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### Understanding Embedded - FPGAs (Field Programmable Gate Array)

Embedded - FPGAs, or Field Programmable Gate Arrays, are advanced integrated circuits that offer unparalleled flexibility and performance for digital systems. Unlike traditional fixed-function logic devices, FPGAs can be programmed and reprogrammed to execute a wide array of logical operations, enabling customized functionality tailored to specific applications. This reprogrammability allows developers to iterate designs quickly and implement complex functions without the need for custom hardware.

### Applications of Embedded - FPGAs

The versatility of Embedded - FPGAs makes them indispensable in numerous fields. In telecommunications.

#### Details

|                                |                                                                                                                                         |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Product Status                 | Active                                                                                                                                  |
| Number of LABs/CLBs            | 1879                                                                                                                                    |
| Number of Logic Elements/Cells | 24051                                                                                                                                   |
| Total RAM Bits                 | 958464                                                                                                                                  |
| Number of I/O                  | 266                                                                                                                                     |
| Number of Gates                | -                                                                                                                                       |
| Voltage - Supply               | 1.14V ~ 1.26V                                                                                                                           |
| Mounting Type                  | Surface Mount                                                                                                                           |
| Operating Temperature          | -40°C ~ 100°C (TJ)                                                                                                                      |
| Package / Case                 | 484-BBGA                                                                                                                                |
| Supplier Device Package        | 484-FBGA (23x23)                                                                                                                        |
| Purchase URL                   | <a href="https://www.e-xfl.com/product-detail/xilinx/xc6slx25-2fg484i">https://www.e-xfl.com/product-detail/xilinx/xc6slx25-2fg484i</a> |

Table 8: Recommended Operating Conditions for User I/Os Using Differential Signal Standards

| I/O Standard             | V <sub>CCO</sub> for Drivers |        |        |
|--------------------------|------------------------------|--------|--------|
|                          | V, Min                       | V, Nom | V, Max |
| LVDS_33                  | 3.0                          | 3.3    | 3.45   |
| LVDS_25                  | 2.25                         | 2.5    | 2.75   |
| BLVDS_25                 | 2.25                         | 2.5    | 2.75   |
| MINI_LVDS_33             | 3.0                          | 3.3    | 3.45   |
| MINI_LVDS_25             | 2.25                         | 2.5    | 2.75   |
| LVPECL_33 <sup>(1)</sup> | N/A—Inputs Only              |        |        |
| LVPECL_25                | N/A—Inputs Only              |        |        |
| RSDS_33                  | 3.0                          | 3.3    | 3.45   |
| RSDS_25                  | 2.25                         | 2.5    | 2.75   |
| TMDS_33 <sup>(1)</sup>   | 3.14                         | 3.3    | 3.45   |
| PPDS_33                  | 3.0                          | 3.3    | 3.45   |
| PPDS_25                  | 2.25                         | 2.5    | 2.75   |
| DISPLAY_PORT             | 2.3                          | 2.5    | 2.7    |
| DIFF_MOBILE_DDR          | 1.7                          | 1.8    | 1.9    |
| DIFF_HSTL_I              | 1.4                          | 1.5    | 1.6    |
| DIFF_HSTL_II             | 1.4                          | 1.5    | 1.6    |
| DIFF_HSTL_III            | 1.4                          | 1.5    | 1.6    |
| DIFF_HSTL_I_18           | 1.7                          | 1.8    | 1.9    |
| DIFF_HSTL_II_18          | 1.7                          | 1.8    | 1.9    |
| DIFF_HSTL_III_18         | 1.7                          | 1.8    | 1.9    |
| DIFF_SSTL3_I             | 3.0                          | 3.3    | 3.45   |
| DIFF_SSTL3_II            | 3.0                          | 3.3    | 3.45   |
| DIFF_SSTL2_I             | 2.3                          | 2.5    | 2.7    |
| DIFF_SSTL2_II            | 2.3                          | 2.5    | 2.7    |
| DIFF_SSTL18_I            | 1.7                          | 1.8    | 1.9    |
| DIFF_SSTL18_II           | 1.7                          | 1.8    | 1.9    |
| DIFF_SSTL15_II           | 1.425                        | 1.5    | 1.575  |

**Notes:**

1. LVPECL\_33 and TMDS\_33 inputs require V<sub>CCAUX</sub> = 3.3V nominal.

Table 10: Differential I/O Standard DC Input and Output Levels

| I/O Standard                | V <sub>ID</sub> |         | V <sub>ICM</sub> |                     | V <sub>OD</sub> |         | V <sub>OCM</sub>             |                          | V <sub>OH</sub>        | V <sub>OL</sub>        |
|-----------------------------|-----------------|---------|------------------|---------------------|-----------------|---------|------------------------------|--------------------------|------------------------|------------------------|
|                             | mV, Min         | mV, Max | V, Min           | V, Max              | mV, Min         | mV, Max | V, Min                       | V, Max                   | V, Min                 | V, Max                 |
| LVDS_33 <sup>(2)(3)</sup>   | 100             | 600     | 0.3              | 2.35                | 247             | 454     | 1.125                        | 1.375                    | –                      | –                      |
| LVDS_25 <sup>(2)(3)</sup>   | 100             | 600     | 0.3              | 2.35                | 247             | 454     | 1.125                        | 1.375                    | –                      | –                      |
| BLVDS_25 <sup>(2)(3)</sup>  | 100             | –       | 0.3              | 2.35                | 240             | 460     | Typical 50% V <sub>CCO</sub> |                          | –                      | –                      |
| MINI_LVDS_33                | 200             | 600     | 0.3              | 1.95                | 300             | 600     | 1.0                          | 1.4                      | –                      | –                      |
| MINI_LVDS_25                | 200             | 600     | 0.3              | 1.95                | 300             | 600     | 1.0                          | 1.4                      | –                      | –                      |
| LVPECL_33 <sup>(2)(3)</sup> | 100             | 1000    | 0.3              | 2.8 <sup>(1)</sup>  | Inputs only     |         |                              |                          |                        |                        |
| LVPECL_25 <sup>(2)(3)</sup> | 100             | 1000    | 0.3              | 1.95                | Inputs only     |         |                              |                          |                        |                        |
| RSDS_33 <sup>(2)(3)</sup>   | 100             | –       | 0.3              | 1.5                 | 100             | 400     | 1.0                          | 1.4                      | –                      | –                      |
| RSDS_25 <sup>(2)(3)</sup>   | 100             | –       | 0.3              | 1.5                 | 100             | 400     | 1.0                          | 1.4                      | –                      | –                      |
| TMDS_33                     | 150             | 1200    | 2.7              | 3.23 <sup>(1)</sup> | 400             | 800     | V <sub>CCO</sub> – 0.405     | V <sub>CCO</sub> – 0.190 | –                      | –                      |
| PPDS_33 <sup>(2)(3)</sup>   | 100             | 400     | 0.2              | 2.3                 | 100             | 400     | 0.5                          | 1.4                      | –                      | –                      |
| PPDS_25 <sup>(2)(3)</sup>   | 100             | 400     | 0.2              | 2.3                 | 100             | 400     | 0.5                          | 1.4                      | –                      | –                      |
| DISPLAY_PORT                | 190             | 1260    | 0.3              | 2.35                | –               | –       | Typical 50% V <sub>CCO</sub> |                          | –                      | –                      |
| DIFF_MOBILE_DDR             | 100             | –       | 0.78             | 1.02                | –               | –       | –                            | –                        | 90% V <sub>CCO</sub>   | 10% V <sub>CCO</sub>   |
| DIFF_HSTL_I                 | 100             | –       | 0.68             | 0.9                 | –               | –       | –                            | –                        | V <sub>CCO</sub> – 0.4 | 0.4                    |
| DIFF_HSTL_II                | 100             | –       | 0.68             | 0.9                 | –               | –       | –                            | –                        | V <sub>CCO</sub> – 0.4 | 0.4                    |
| DIFF_HSTL_III               | 100             | –       | 0.68             | 0.9                 | –               | –       | –                            | –                        | V <sub>CCO</sub> – 0.4 | 0.4                    |
| DIFF_HSTL_I_18              | 100             | –       | 0.8              | 1.1                 | –               | –       | –                            | –                        | V <sub>CCO</sub> – 0.4 | 0.4                    |
| DIFF_HSTL_II_18             | 100             | –       | 0.8              | 1.1                 | –               | –       | –                            | –                        | V <sub>CCO</sub> – 0.4 | 0.4                    |
| DIFF_HSTL_III_18            | 100             | –       | 0.8              | 1.1                 | –               | –       | –                            | –                        | V <sub>CCO</sub> – 0.4 | 0.4                    |
| DIFF_SSTL3_I                | 100             | –       | 1.0              | 1.9                 | –               | –       | –                            | –                        | V <sub>TT</sub> + 0.6  | V <sub>TT</sub> – 0.6  |
| DIFF_SSTL3_II               | 100             | –       | 1.0              | 1.9                 | –               | –       | –                            | –                        | V <sub>TT</sub> + 0.8  | V <sub>TT</sub> – 0.8  |
| DIFF_SSTL2_I                | 100             | –       | 1.0              | 1.5                 | –               | –       | –                            | –                        | V <sub>TT</sub> + 0.61 | V <sub>TT</sub> – 0.61 |
| DIFF_SSTL2_II               | 100             | –       | 1.0              | 1.5                 | –               | –       | –                            | –                        | V <sub>TT</sub> + 0.81 | V <sub>TT</sub> – 0.81 |
| DIFF_SSTL18_I               | 100             | –       | 0.7              | 1.1                 | –               | –       | –                            | –                        | V <sub>TT</sub> + 0.47 | V <sub>TT</sub> – 0.47 |
| DIFF_SSTL18_II              | 100             | –       | 0.7              | 1.1                 | –               | –       | –                            | –                        | V <sub>TT</sub> + 0.6  | V <sub>TT</sub> – 0.6  |
| DIFF_SSTL15_II              | 100             | –       | 0.55             | 0.95                | –               | –       | –                            | –                        | V <sub>TT</sub> + 0.4  | V <sub>TT</sub> – 0.4  |

**Notes:**

1. LVPECL\_33 and TMDS\_33 maximum V<sub>ICM</sub> is the lower of V (maximum) or V<sub>CCAUX</sub> – (V<sub>ID</sub>/2)
2. When V<sub>CCAUX</sub> = 3.3V, the DCD can be higher than 5% for V<sub>ICM</sub> < 0.7V when using these I/O standards: LVDS\_25, LVDS\_33, BLVDS\_25, LVPECL\_25, LVPECL\_33, RSDS\_25, RSDS\_33, PPDS\_25, and PPDS\_33.
3. The -1L devices require V<sub>CCAUX</sub> = 2.5V when using the LVDS\_25, LVDS\_33, BLVDS\_25, LVPECL\_25, RSDS\_25, RSDS\_33, PPDS\_25, and PPDS\_33 I/O standards on inputs. LVPECL\_33 is not supported in the -1L devices.

## GTP Transceiver DC Input and Output Levels

Table 16 summarizes the DC output specifications of the GTP transceivers in Spartan-6 FPGAs. Figure 1 shows the single-ended output voltage swing. Figure 2 shows the peak-to-peak differential output voltage.

Consult [UG386: Spartan-6 FPGA GTP Transceivers User Guide](#) for further details.

Table 16: GTP Transceiver DC Specifications

| Symbol        | DC Parameter                                              | Conditions                                         | Min                       | Typ              | Max       | Units    |
|---------------|-----------------------------------------------------------|----------------------------------------------------|---------------------------|------------------|-----------|----------|
| $DV_{PPIN}$   | Differential peak-to-peak input voltage                   | External AC coupled                                | 140                       | –                | 2000      | mV       |
| $V_{IN}$      | Absolute input voltage                                    | DC coupled<br>MGTAVTTRX = 1.2V                     | –400                      | –                | MGTAVTTRX | mV       |
| $V_{CMIN}$    | Common mode input voltage                                 | DC coupled<br>MGTAVTTRX = 1.2V                     | –                         | 3/4<br>MGTAVTTRX | –         | mV       |
| $DV_{PPOUT}$  | Differential peak-to-peak output voltage <sup>(1)</sup>   | Transmitter output swing is set to maximum setting | –                         | –                | 1000      | mV       |
| $V_{SEOUT}$   | Single-ended output voltage swing <sup>(1)</sup>          |                                                    | –                         | –                | 500       | mV       |
| $V_{CMOUTDC}$ | Common mode output voltage                                | Equation based                                     | $MGTAVTTTX - V_{SEOUT}/2$ |                  |           | mV       |
| $R_{IN}$      | Differential input resistance                             |                                                    | 80                        | 100              | 130       | $\Omega$ |
| $R_{OUT}$     | Differential output resistance                            |                                                    | 80                        | 100              | 130       | $\Omega$ |
| $T_{OSKEW}$   | Transmitter output skew                                   |                                                    | –                         | –                | 15        | ps       |
| $C_{EXT}$     | Recommended external AC coupling capacitor <sup>(2)</sup> |                                                    | 75                        | 100              | 200       | nF       |

### Notes:

- The output swing and preemphasis levels are programmable using the attributes discussed in [UG386: Spartan-6 FPGA GTP Transceivers User Guide](#) and can result in values lower than reported in this table.
- Other values can be used as appropriate to conform to specific protocols and standards.

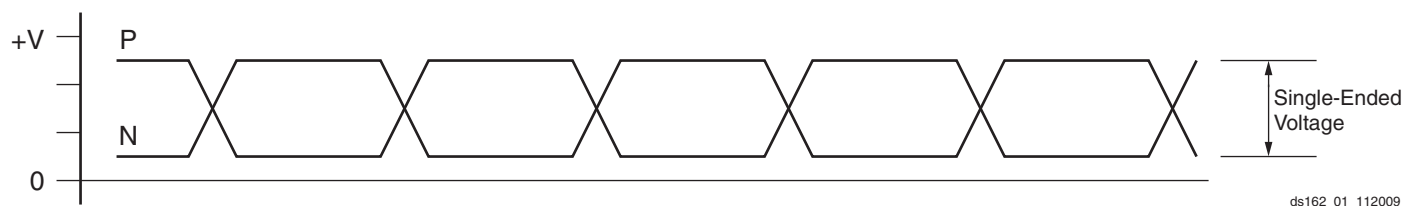


Figure 1: Single-Ended Peak-to-Peak Voltage

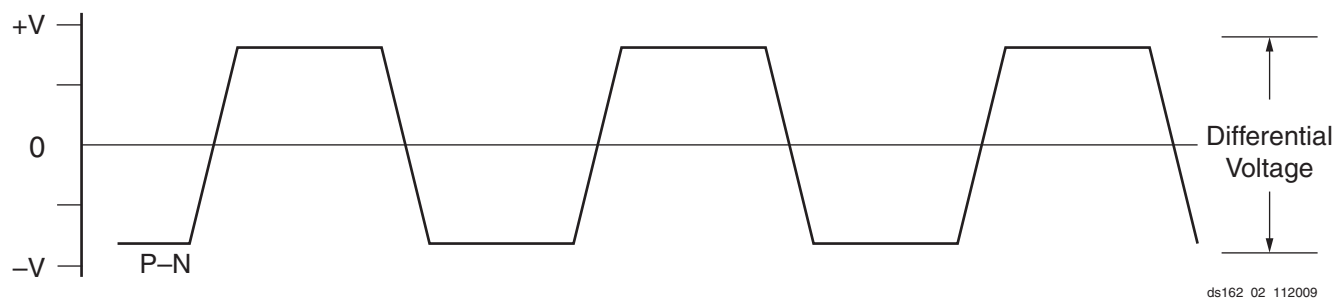


Figure 2: Differential Peak-to-Peak Voltage

Table 17 summarizes the DC specifications of the clock input of the GTP transceiver. Consult [UG386: Spartan-6 FPGA GTP Transceivers User Guide](#) for further details.

Table 17: GTP Transceiver Clock DC Input Level Specification

| Symbol      | DC Parameter                            | Min | Typ | Max  | Units    |
|-------------|-----------------------------------------|-----|-----|------|----------|
| $V_{IDIFF}$ | Differential peak-to-peak input voltage | 200 | 800 | 2000 | mV       |
| $R_{IN}$    | Differential input resistance           | 80  | 100 | 120  | $\Omega$ |
| $C_{EXT}$   | Required external AC coupling capacitor | –   | 100 | –    | nF       |

## GTP Transceiver Switching Characteristics

Consult [UG386](#): *Spartan-6 FPGA GTP Transceivers User Guide* for further information.

Table 18: GTP Transceiver Performance

| Symbol          | Description                                               | Speed Grade  |              |              |     | Units |
|-----------------|-----------------------------------------------------------|--------------|--------------|--------------|-----|-------|
|                 |                                                           | -3           | -3N          | -2           | -1L |       |
| $F_{GTPMAX}$    | Maximum GTP transceiver data rate                         | 3.2          | 3.2          | 2.7          | N/A | Gb/s  |
| $F_{GTPRANGE1}$ | GTP transceiver data rate range when PLL_TXDIVSEL_OUT = 1 | 1.88 to 3.2  | 1.88 to 3.2  | 1.88 to 2.7  | N/A | Gb/s  |
| $F_{GTPRANGE2}$ | GTP transceiver data rate range when PLL_TXDIVSEL_OUT = 2 | 0.94 to 1.62 | 0.94 to 1.62 | 0.94 to 1.62 | N/A | Gb/s  |
| $F_{GTPRANGE3}$ | GTP transceiver data rate range when PLL_TXDIVSEL_OUT = 4 | 0.6 to 0.81  | 0.6 to 0.81  | 0.6 to 0.81  | N/A | Gb/s  |
| $F_{GPLLMAX}$   | Maximum PLL frequency                                     | 1.62         | 1.62         | 1.62         | N/A | GHz   |
| $F_{GPLLMIN}$   | Minimum PLL frequency                                     | 0.94         | 0.94         | 0.94         | N/A | GHz   |

Table 19: GTP Transceiver Dynamic Reconfiguration Port (DRP) Switching Characteristics

| Symbol         | Description                                        | Speed Grade |     |     |     | Units |
|----------------|----------------------------------------------------|-------------|-----|-----|-----|-------|
|                |                                                    | -3          | -3N | -2  | -1L |       |
| $F_{GTPDRCLK}$ | GTP transceiver DCLK (DRP clock) maximum frequency | 125         | 125 | 100 | N/A | MHz   |

Table 20: GTP Transceiver Reference Clock Switching Characteristics

| Symbol      | Description                               | Conditions                                               | All LXT Speed Grades |     |     | Units   |
|-------------|-------------------------------------------|----------------------------------------------------------|----------------------|-----|-----|---------|
|             |                                           |                                                          | Min                  | Typ | Max |         |
| $F_{GCLK}$  | Reference clock frequency range           |                                                          | 60                   | –   | 160 | MHz     |
| $T_{RCLK}$  | Reference clock rise time                 | 20% – 80%                                                | –                    | 200 | –   | ps      |
| $T_{FCLK}$  | Reference clock fall time                 | 80% – 20%                                                | –                    | 200 | –   | ps      |
| $T_{DCREF}$ | Reference clock duty cycle                | Transceiver PLL only                                     | 45                   | 50  | 55  | %       |
| $T_{LOCK}$  | Clock recovery frequency acquisition time | Initial PLL lock                                         | –                    | –   | 1   | ms      |
| $T_{PHASE}$ | Clock recovery phase acquisition time     | Lock to data after PLL has locked to the reference clock | –                    | –   | 200 | $\mu$ s |

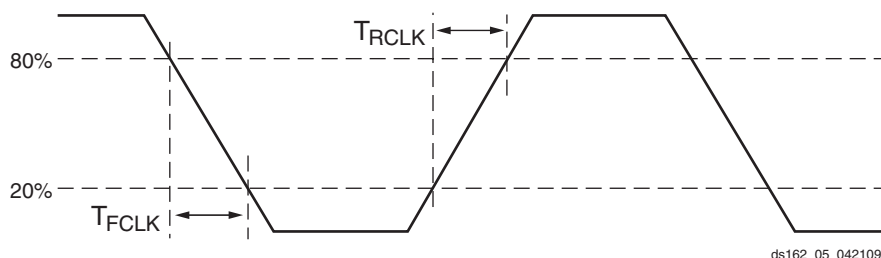


Figure 3: Reference Clock Timing Parameters

Table 28: IOB Switching Characteristics for the Commercial (XC) Spartan-6 Devices (Cont'd)

| I/O Standard              | T <sub>IOPI</sub> |      |      |                    | T <sub>IOOP</sub> |      |      |                    | T <sub>IOTP</sub> |      |      |                    | Units |
|---------------------------|-------------------|------|------|--------------------|-------------------|------|------|--------------------|-------------------|------|------|--------------------|-------|
|                           | Speed Grade       |      |      |                    | Speed Grade       |      |      |                    | Speed Grade       |      |      |                    |       |
|                           | -3                | -3N  | -2   | -1L <sup>(1)</sup> | -3                | -3N  | -2   | -1L <sup>(1)</sup> | -3                | -3N  | -2   | -1L <sup>(1)</sup> |       |
| LVC MOS33, Fast, 8 mA     | 1.34              | 1.46 | 1.59 | 1.82               | 2.07              | 2.21 | 2.41 | 3.03               | 2.07              | 2.21 | 2.41 | 3.03               | ns    |
| LVC MOS33, Fast, 12 mA    | 1.34              | 1.46 | 1.59 | 1.82               | 1.65              | 1.79 | 1.99 | 2.62               | 1.65              | 1.79 | 1.99 | 2.62               | ns    |
| LVC MOS33, Fast, 16 mA    | 1.34              | 1.46 | 1.59 | 1.82               | 1.65              | 1.79 | 1.99 | 2.62               | 1.65              | 1.79 | 1.99 | 2.62               | ns    |
| LVC MOS33, Fast, 24 mA    | 1.34              | 1.46 | 1.59 | 1.82               | 1.65              | 1.79 | 1.99 | 2.62               | 1.65              | 1.79 | 1.99 | 2.62               | ns    |
| LVC MOS25, QUIETIO, 2 mA  | 0.82              | 0.94 | 1.07 | 1.31               | 4.81              | 4.95 | 5.15 | 5.79               | 4.81              | 4.95 | 5.15 | 5.79               | ns    |
| LVC MOS25, QUIETIO, 4 mA  | 0.82              | 0.94 | 1.07 | 1.31               | 3.70              | 3.84 | 4.04 | 4.66               | 3.70              | 3.84 | 4.04 | 4.66               | ns    |
| LVC MOS25, QUIETIO, 6 mA  | 0.82              | 0.94 | 1.07 | 1.31               | 3.46              | 3.60 | 3.80 | 4.38               | 3.46              | 3.60 | 3.80 | 4.38               | ns    |
| LVC MOS25, QUIETIO, 8 mA  | 0.82              | 0.94 | 1.07 | 1.31               | 3.20              | 3.34 | 3.54 | 4.12               | 3.20              | 3.34 | 3.54 | 4.12               | ns    |
| LVC MOS25, QUIETIO, 12 mA | 0.82              | 0.94 | 1.07 | 1.31               | 2.83              | 2.97 | 3.17 | 3.75               | 2.83              | 2.97 | 3.17 | 3.75               | ns    |
| LVC MOS25, QUIETIO, 16 mA | 0.82              | 0.94 | 1.07 | 1.31               | 2.64              | 2.78 | 2.98 | 3.64               | 2.64              | 2.78 | 2.98 | 3.64               | ns    |
| LVC MOS25, QUIETIO, 24 mA | 0.82              | 0.94 | 1.07 | 1.31               | 2.45              | 2.59 | 2.79 | 3.42               | 2.45              | 2.59 | 2.79 | 3.42               | ns    |
| LVC MOS25, Slow, 2 mA     | 0.82              | 0.94 | 1.07 | 1.31               | 3.78              | 3.92 | 4.12 | 4.76               | 3.78              | 3.92 | 4.12 | 4.76               | ns    |
| LVC MOS25, Slow, 4 mA     | 0.82              | 0.94 | 1.07 | 1.31               | 2.79              | 2.93 | 3.13 | 3.73               | 2.79              | 2.93 | 3.13 | 3.73               | ns    |
| LVC MOS25, Slow, 6 mA     | 0.82              | 0.94 | 1.07 | 1.31               | 2.73              | 2.87 | 3.07 | 3.66               | 2.73              | 2.87 | 3.07 | 3.66               | ns    |
| LVC MOS25, Slow, 8 mA     | 0.82              | 0.94 | 1.07 | 1.31               | 2.48              | 2.62 | 2.82 | 3.42               | 2.48              | 2.62 | 2.82 | 3.42               | ns    |
| LVC MOS25, Slow, 12 mA    | 0.82              | 0.94 | 1.07 | 1.31               | 2.01              | 2.15 | 2.35 | 2.95               | 2.01              | 2.15 | 2.35 | 2.95               | ns    |
| LVC MOS25, Slow, 16 mA    | 0.82              | 0.94 | 1.07 | 1.31               | 2.01              | 2.15 | 2.35 | 2.95               | 2.01              | 2.15 | 2.35 | 2.95               | ns    |
| LVC MOS25, Slow, 24 mA    | 0.82              | 0.94 | 1.07 | 1.31               | 2.01              | 2.15 | 2.35 | 2.94               | 2.01              | 2.15 | 2.35 | 2.94               | ns    |
| LVC MOS25, Fast, 2 mA     | 0.82              | 0.94 | 1.07 | 1.31               | 3.35              | 3.49 | 3.69 | 4.31               | 3.35              | 3.49 | 3.69 | 4.31               | ns    |
| LVC MOS25, Fast, 4 mA     | 0.82              | 0.94 | 1.07 | 1.31               | 2.25              | 2.39 | 2.59 | 3.22               | 2.25              | 2.39 | 2.59 | 3.22               | ns    |
| LVC MOS25, Fast, 6 mA     | 0.82              | 0.94 | 1.07 | 1.31               | 2.09              | 2.23 | 2.43 | 3.05               | 2.09              | 2.23 | 2.43 | 3.05               | ns    |
| LVC MOS25, Fast, 8 mA     | 0.82              | 0.94 | 1.07 | 1.31               | 2.02              | 2.16 | 2.36 | 2.98               | 2.02              | 2.16 | 2.36 | 2.98               | ns    |
| LVC MOS25, Fast, 12 mA    | 0.82              | 0.94 | 1.07 | 1.31               | 1.56              | 1.70 | 1.90 | 2.52               | 1.56              | 1.70 | 1.90 | 2.52               | ns    |
| LVC MOS25, Fast, 16 mA    | 0.82              | 0.94 | 1.07 | 1.31               | 1.56              | 1.70 | 1.90 | 2.52               | 1.56              | 1.70 | 1.90 | 2.52               | ns    |
| LVC MOS25, Fast, 24 mA    | 0.82              | 0.94 | 1.07 | 1.31               | 1.56              | 1.70 | 1.90 | 2.52               | 1.56              | 1.70 | 1.90 | 2.52               | ns    |
| LVC MOS18, QUIETIO, 2 mA  | 1.18              | 1.30 | 1.43 | 2.04               | 5.92              | 6.06 | 6.26 | 6.80               | 5.92              | 6.06 | 6.26 | 6.80               | ns    |
| LVC MOS18, QUIETIO, 4 mA  | 1.18              | 1.30 | 1.43 | 2.04               | 4.74              | 4.88 | 5.08 | 5.63               | 4.74              | 4.88 | 5.08 | 5.63               | ns    |
| LVC MOS18, QUIETIO, 6 mA  | 1.18              | 1.30 | 1.43 | 2.04               | 4.05              | 4.19 | 4.39 | 4.96               | 4.05              | 4.19 | 4.39 | 4.96               | ns    |
| LVC MOS18, QUIETIO, 8 mA  | 1.18              | 1.30 | 1.43 | 2.04               | 3.71              | 3.85 | 4.05 | 4.63               | 3.71              | 3.85 | 4.05 | 4.63               | ns    |
| LVC MOS18, QUIETIO, 12 mA | 1.18              | 1.30 | 1.43 | 2.04               | 3.35              | 3.49 | 3.69 | 4.27               | 3.35              | 3.49 | 3.69 | 4.27               | ns    |
| LVC MOS18, QUIETIO, 16 mA | 1.18              | 1.30 | 1.43 | 2.04               | 3.20              | 3.34 | 3.54 | 4.14               | 3.20              | 3.34 | 3.54 | 4.14               | ns    |
| LVC MOS18, QUIETIO, 24 mA | 1.18              | 1.30 | 1.43 | 2.04               | 2.96              | 3.10 | 3.30 | 3.98               | 2.96              | 3.10 | 3.30 | 3.98               | ns    |
| LVC MOS18, Slow, 2 mA     | 1.18              | 1.30 | 1.43 | 2.04               | 4.62              | 4.76 | 4.96 | 5.54               | 4.62              | 4.76 | 4.96 | 5.54               | ns    |
| LVC MOS18, Slow, 4 mA     | 1.18              | 1.30 | 1.43 | 2.04               | 3.69              | 3.83 | 4.03 | 4.60               | 3.69              | 3.83 | 4.03 | 4.60               | ns    |
| LVC MOS18, Slow, 6 mA     | 1.18              | 1.30 | 1.43 | 2.04               | 3.00              | 3.14 | 3.34 | 3.94               | 3.00              | 3.14 | 3.34 | 3.94               | ns    |
| LVC MOS18, Slow, 8 mA     | 1.18              | 1.30 | 1.43 | 2.04               | 2.19              | 2.33 | 2.53 | 3.17               | 2.19              | 2.33 | 2.53 | 3.17               | ns    |
| LVC MOS18, Slow, 12 mA    | 1.18              | 1.30 | 1.43 | 2.04               | 1.99              | 2.13 | 2.33 | 2.95               | 1.99              | 2.13 | 2.33 | 2.95               | ns    |
| LVC MOS18, Slow, 16 mA    | 1.18              | 1.30 | 1.43 | 2.04               | 1.99              | 2.13 | 2.33 | 2.95               | 1.99              | 2.13 | 2.33 | 2.95               | ns    |

Table 28: IOB Switching Characteristics for the Commercial (XC) Spartan-6 Devices (Cont'd)

| I/O Standard                    | T <sub>IOPI</sub> |      |      |                    | T <sub>IOOP</sub> |      |      |                    | T <sub>IOTP</sub> |      |      |                    | Units |
|---------------------------------|-------------------|------|------|--------------------|-------------------|------|------|--------------------|-------------------|------|------|--------------------|-------|
|                                 | Speed Grade       |      |      |                    | Speed Grade       |      |      |                    | Speed Grade       |      |      |                    |       |
|                                 | -3                | -3N  | -2   | -1L <sup>(1)</sup> | -3                | -3N  | -2   | -1L <sup>(1)</sup> | -3                | -3N  | -2   | -1L <sup>(1)</sup> |       |
| LVC MOS12, Fast, 2 mA           | 0.91              | 1.03 | 1.16 | 1.51               | 3.46              | 3.60 | 3.80 | 4.44               | 3.46              | 3.60 | 3.80 | 4.44               | ns    |
| LVC MOS12, Fast, 4 mA           | 0.91              | 1.03 | 1.16 | 1.51               | 2.35              | 2.49 | 2.69 | 3.30               | 2.35              | 2.49 | 2.69 | 3.30               | ns    |
| LVC MOS12, Fast, 6 mA           | 0.91              | 1.03 | 1.16 | 1.51               | 1.79              | 1.93 | 2.13 | 2.75               | 1.79              | 1.93 | 2.13 | 2.75               | ns    |
| LVC MOS12, Fast, 8 mA           | 0.91              | 1.03 | 1.16 | 1.51               | 1.68              | 1.82 | 2.02 | 2.64               | 1.68              | 1.82 | 2.02 | 2.64               | ns    |
| LVC MOS12, Fast, 12 mA          | 0.91              | 1.03 | 1.16 | 1.51               | 1.66              | 1.80 | 2.00 | 2.62               | 1.66              | 1.80 | 2.00 | 2.62               | ns    |
| LVC MOS12_JEDEC, QUIETIO, 2 mA  | 1.50              | 1.62 | 1.75 | 1.88               | 6.39              | 6.53 | 6.73 | 7.31               | 6.39              | 6.53 | 6.73 | 7.31               | ns    |
| LVC MOS12_JEDEC, QUIETIO, 4 mA  | 1.50              | 1.62 | 1.75 | 1.88               | 4.98              | 5.12 | 5.32 | 5.88               | 4.98              | 5.12 | 5.32 | 5.88               | ns    |
| LVC MOS12_JEDEC, QUIETIO, 6 mA  | 1.50              | 1.62 | 1.75 | 1.88               | 4.67              | 4.81 | 5.01 | 5.54               | 4.67              | 4.81 | 5.01 | 5.54               | ns    |
| LVC MOS12_JEDEC, QUIETIO, 8 mA  | 1.50              | 1.62 | 1.75 | 1.88               | 4.23              | 4.37 | 4.57 | 5.22               | 4.23              | 4.37 | 4.57 | 5.22               | ns    |
| LVC MOS12_JEDEC, QUIETIO, 12 mA | 1.50              | 1.62 | 1.75 | 1.88               | 3.99              | 4.13 | 4.33 | 4.94               | 3.99              | 4.13 | 4.33 | 4.94               | ns    |
| LVC MOS12_JEDEC, Slow, 2 mA     | 1.50              | 1.62 | 1.75 | 1.88               | 5.00              | 5.14 | 5.34 | 5.90               | 5.00              | 5.14 | 5.34 | 5.90               | ns    |
| LVC MOS12_JEDEC, Slow, 4 mA     | 1.50              | 1.62 | 1.75 | 1.88               | 2.85              | 2.99 | 3.19 | 3.80               | 2.85              | 2.99 | 3.19 | 3.80               | ns    |
| LVC MOS12_JEDEC, Slow, 6 mA     | 1.50              | 1.62 | 1.75 | 1.88               | 2.76              | 2.90 | 3.10 | 3.72               | 2.76              | 2.90 | 3.10 | 3.72               | ns    |
| LVC MOS12_JEDEC, Slow, 8 mA     | 1.50              | 1.62 | 1.75 | 1.88               | 2.35              | 2.49 | 2.69 | 3.30               | 2.35              | 2.49 | 2.69 | 3.30               | ns    |
| LVC MOS12_JEDEC, Slow, 12 mA    | 1.50              | 1.62 | 1.75 | 1.88               | 2.09              | 2.23 | 2.43 | 3.05               | 2.09              | 2.23 | 2.43 | 3.05               | ns    |
| LVC MOS12_JEDEC, Fast, 2 mA     | 1.50              | 1.62 | 1.75 | 1.88               | 3.46              | 3.60 | 3.80 | 4.42               | 3.46              | 3.60 | 3.80 | 4.42               | ns    |
| LVC MOS12_JEDEC, Fast, 4 mA     | 1.50              | 1.62 | 1.75 | 1.88               | 2.35              | 2.49 | 2.69 | 3.31               | 2.35              | 2.49 | 2.69 | 3.31               | ns    |
| LVC MOS12_JEDEC, Fast, 6 mA     | 1.50              | 1.62 | 1.75 | 1.88               | 1.79              | 1.93 | 2.13 | 2.76               | 1.79              | 1.93 | 2.13 | 2.76               | ns    |
| LVC MOS12_JEDEC, Fast, 8 mA     | 1.50              | 1.62 | 1.75 | 1.88               | 1.69              | 1.83 | 2.03 | 2.65               | 1.69              | 1.83 | 2.03 | 2.65               | ns    |
| LVC MOS12_JEDEC, Fast, 12 mA    | 1.50              | 1.62 | 1.75 | 1.88               | 1.66              | 1.80 | 2.00 | 2.62               | 1.66              | 1.80 | 2.00 | 2.62               | ns    |

**Notes:**

1. The -1L values listed in this table are also applicable to the Spartan-6Q devices.
2. Devices with a -1L speed grade do not support Xilinx PCI IP.

Table 29: IOB Switching Characteristics for the Automotive XA Spartan-6 and the Spartan-6Q Devices<sup>(1)</sup> (Cont'd)

| I/O Standard              | T <sub>IOPI</sub> |      | T <sub>IOOP</sub> |      | T <sub>IOTP</sub> |      | Units |
|---------------------------|-------------------|------|-------------------|------|-------------------|------|-------|
|                           | Speed Grade       |      | Speed Grade       |      | Speed Grade       |      |       |
|                           | -3                | -2   | -3                | -2   | -3                | -2   |       |
| DIFF_SSTL3_I              | 1.26              | 1.44 | 1.95              | 2.15 | 1.95              | 2.15 | ns    |
| DIFF_SSTL3_II             | 1.26              | 1.44 | 1.94              | 2.14 | 1.94              | 2.14 | ns    |
| DIFF_SSTL2_I              | 1.09              | 1.27 | 1.94              | 2.14 | 1.94              | 2.14 | ns    |
| DIFF_SSTL2_II             | 1.09              | 1.27 | 1.90              | 2.10 | 1.90              | 2.10 | ns    |
| DIFF_SSTL18_I             | 1.04              | 1.22 | 1.86              | 2.06 | 1.86              | 2.06 | ns    |
| DIFF_SSTL18_II            | 1.05              | 1.23 | 1.82              | 2.02 | 1.82              | 2.02 | ns    |
| DIFF_SSTL15_II            | 1.01              | 1.19 | 1.81              | 2.01 | 1.81              | 2.01 | ns    |
| DIFF_MOBILE_DDR           | 1.04              | 1.22 | 1.89              | 2.09 | 1.89              | 2.09 | ns    |
| LVTTL, QUIETIO, 2 mA      | 1.42              | 1.60 | 5.64              | 5.84 | 5.64              | 5.84 | ns    |
| LVTTL, QUIETIO, 4 mA      | 1.42              | 1.60 | 4.46              | 4.66 | 4.46              | 4.66 | ns    |
| LVTTL, QUIETIO, 6 mA      | 1.42              | 1.60 | 3.92              | 4.12 | 3.92              | 4.12 | ns    |
| LVTTL, QUIETIO, 8 mA      | 1.42              | 1.60 | 3.37              | 3.57 | 3.37              | 3.57 | ns    |
| LVTTL, QUIETIO, 12 mA     | 1.42              | 1.60 | 3.42              | 3.62 | 3.42              | 3.62 | ns    |
| LVTTL, QUIETIO, 16 mA     | 1.42              | 1.60 | 3.09              | 3.29 | 3.09              | 3.29 | ns    |
| LVTTL, QUIETIO, 24 mA     | 1.42              | 1.60 | 2.83              | 3.03 | 2.83              | 3.03 | ns    |
| LVTTL, Slow, 2 mA         | 1.42              | 1.60 | 4.58              | 4.78 | 4.58              | 4.78 | ns    |
| LVTTL, Slow, 4 mA         | 1.42              | 1.60 | 3.38              | 3.58 | 3.38              | 3.58 | ns    |
| LVTTL, Slow, 6 mA         | 1.42              | 1.60 | 2.95              | 3.15 | 2.95              | 3.15 | ns    |
| LVTTL, Slow, 8 mA         | 1.42              | 1.60 | 2.73              | 2.93 | 2.73              | 2.93 | ns    |
| LVTTL, Slow, 12 mA        | 1.42              | 1.60 | 2.72              | 2.92 | 2.72              | 2.92 | ns    |
| LVTTL, Slow, 16 mA        | 1.42              | 1.60 | 2.53              | 2.73 | 2.53              | 2.73 | ns    |
| LVTTL, Slow, 24 mA        | 1.42              | 1.60 | 2.42              | 2.62 | 2.42              | 2.62 | ns    |
| LVTTL, Fast, 2 mA         | 1.42              | 1.60 | 4.04              | 4.24 | 4.04              | 4.24 | ns    |
| LVTTL, Fast, 4 mA         | 1.42              | 1.60 | 2.66              | 2.86 | 2.66              | 2.86 | ns    |
| LVTTL, Fast, 6 mA         | 1.42              | 1.60 | 2.58              | 2.78 | 2.58              | 2.78 | ns    |
| LVTTL, Fast, 8 mA         | 1.42              | 1.60 | 2.46              | 2.66 | 2.46              | 2.66 | ns    |
| LVTTL, Fast, 12 mA        | 1.42              | 1.60 | 1.97              | 2.17 | 1.97              | 2.17 | ns    |
| LVTTL, Fast, 16 mA        | 1.42              | 1.60 | 1.97              | 2.17 | 1.97              | 2.17 | ns    |
| LVTTL, Fast, 24 mA        | 1.42              | 1.60 | 1.97              | 2.17 | 1.97              | 2.17 | ns    |
| LVC MOS33, QUIETIO, 2 mA  | 1.41              | 1.59 | 5.65              | 5.85 | 5.65              | 5.85 | ns    |
| LVC MOS33, QUIETIO, 4 mA  | 1.41              | 1.59 | 4.20              | 4.40 | 4.20              | 4.40 | ns    |
| LVC MOS33, QUIETIO, 6 mA  | 1.41              | 1.59 | 3.65              | 3.85 | 3.65              | 3.85 | ns    |
| LVC MOS33, QUIETIO, 8 mA  | 1.41              | 1.59 | 3.51              | 3.71 | 3.51              | 3.71 | ns    |
| LVC MOS33, QUIETIO, 12 mA | 1.41              | 1.59 | 3.09              | 3.29 | 3.09              | 3.29 | ns    |
| LVC MOS33, QUIETIO, 16 mA | 1.41              | 1.59 | 2.91              | 3.11 | 2.91              | 3.11 | ns    |
| LVC MOS33, QUIETIO, 24 mA | 1.41              | 1.59 | 2.73              | 2.93 | 2.73              | 2.93 | ns    |
| LVC MOS33, Slow, 2 mA     | 1.41              | 1.59 | 4.59              | 4.79 | 4.59              | 4.79 | ns    |
| LVC MOS33, Slow, 4 mA     | 1.41              | 1.59 | 3.14              | 3.34 | 3.14              | 3.34 | ns    |

Table 32: Output Delay Measurement Methodology (Cont'd)

| Description                                              | I/O Standard Attribute     | $R_{REF}$ ( $\Omega$ ) | $C_{REF}^{(1)}$ (pF) | $V_{MEAS}$ (V)   | $V_{REF}$ (V) |
|----------------------------------------------------------|----------------------------|------------------------|----------------------|------------------|---------------|
| SSTL, Class II, 2.5V                                     | SSTL2_II                   | 25                     | 0                    | $V_{REF}$        | 1.25          |
| SSTL, Class II, 1.5V                                     | SSTL15_II                  | 25                     | 0                    | $V_{REF}$        | 0.75          |
| LVDS (Low-Voltage Differential Signaling), 2.5V & 3.3V   | LVDS_25, LVDS_33           | 100                    | 0                    | 0 <sup>(3)</sup> | —             |
| BLVDS (Bus LVDS), 2.5V                                   | BLVDS_25                   | Note 4                 | 0                    | 0 <sup>(3)</sup> | —             |
| Mini-LVDS, 2.5V & 3.3V                                   | MINI_LVDS_25, MINI_LVDS_33 | 100                    | 0                    | 0 <sup>(3)</sup> | —             |
| RSDS (Reduced Swing Differential Signaling), 2.5V & 3.3V | RSDS_25, RSDS_33           | 100                    | 0                    | 0 <sup>(3)</sup> | —             |
| TMDS (Transition Minimized Differential Signaling), 3.3V | TMDS_33                    | Note 5                 | 0                    | 0 <sup>(3)</sup> | —             |
| PPDS (Point-to-Point Differential Signaling, 2.5V & 3.3V | PPDS_25, PPDS_33           | 100                    | 0                    | 0 <sup>(3)</sup> | —             |

**Notes:**

1.  $C_{REF}$  is the capacitance of the probe, nominally 0 pF.
2. Per PCI specifications.
3. The value given is the differential output voltage.
4. See the *BLVDS Output Termination* section in [UG381](#), *Spartan-6 FPGA SelectIO Resources User Guide*.
5. See the *TMDS\_33 Termination* section in [UG381](#), *Spartan-6 FPGA SelectIO Resources User Guide*.

## Simultaneously Switching Outputs

Due to package electrical parasitics, a given package supports a limited number of simultaneous switching outputs (SSOs) when using fast, high-drive outputs. [Table 33](#) and [Table 34](#) provide guidelines for the recommended maximum allowable number of SSOs. These guidelines describe the maximum number of user I/O pins of an output signal standard that should simultaneously switch in the same direction, while maintaining a safe level of switching noise for that particular signal standard. Meeting these guidelines for the stated test conditions ensures that the FPGA operates free from the adverse effects of GND and power bounce.

For each device/package combination, [Table 33](#) provides the number of equivalent  $V_{CCO}$ /GND pairs per bank. For each output signal standard and drive strength, [Table 34](#) recommends the maximum number of SSOs, switching in the same direction, allowed per  $V_{CCO}$ /GND pair within an I/O bank. The guidelines are categorized by package style, slew rate, and output drive current. The number of SSOs are also specified by I/O bank. Multiply the appropriate numbers from each table to calculate the maximum number of SSOs allowed within an I/O bank. The guidelines assume that all pins within a bank use the same I/O standard. Exceeding these SSO guidelines can result in increased power or GND bounce, degraded signal integrity, or increased system jitter. For a given I/O standard, if the SSO limit per pair in [Table 34](#) is greater than the maximum I/O per pair in [Table 33](#), then there is no SSO limit for the exclusive use of that I/O standard.

The recommended maximum SSO values assume that the FPGA is soldered on a printed circuit board and that the board uses sound design practices. Due to the additional inductance introduced by the socket, the SSO values do not apply for FPGAs mounted in sockets. The SSO values assume that the  $V_{CCAUX}$  is powered at 3.3V. Setting  $V_{CCAUX}$  to 2.5V provides better SSO characteristics. For more detail, see [UG381](#): *Spartan-6 FPGA SelectIO Resources User Guide*.

Table 34: SSO Limit per V<sub>CCO</sub>/GND Pair (Cont'd)

| V <sub>CCO</sub> | I/O Standard                   | Drive | Slew    | SSO Limit per V <sub>CCO</sub> /GND Pair                       |          |                                                                       |              |    |
|------------------|--------------------------------|-------|---------|----------------------------------------------------------------|----------|-----------------------------------------------------------------------|--------------|----|
|                  |                                |       |         | All TQG144, CPG196, CSG225, FT(G)256, and LX devices in CSG324 |          | All CS(G)484, FG(G)484, FG(G)676, FG(G)900, and LXT devices in CSG324 |              |    |
|                  |                                |       |         | Bank 0/2                                                       | Bank 1/3 | Bank 0/2                                                              | Bank 1/3/4/5 |    |
| 1.8V             | LVCMOS18, LVCMOS18_JEDEC       | 2     | Fast    | 39                                                             | 46       | 39                                                                    | 47           |    |
|                  |                                |       | Slow    | 65                                                             | 75       | 65                                                                    | 74           |    |
|                  |                                |       | QuietIO | 80                                                             | 80       | 80                                                                    | 85           |    |
|                  |                                | 4     | Fast    | 22                                                             | 25       | 22                                                                    | 25           |    |
|                  |                                |       | Slow    | 38                                                             | 36       | 38                                                                    | 29           |    |
|                  |                                |       | QuietIO | 45                                                             | 40       | 45                                                                    | 35           |    |
|                  |                                | 6     | Fast    | 16                                                             | 18       | 16                                                                    | 17           |    |
|                  |                                |       | Slow    | 27                                                             | 25       | 27                                                                    | 19           |    |
|                  |                                |       | QuietIO | 30                                                             | 28       | 30                                                                    | 23           |    |
|                  |                                | 8     | Fast    | 13                                                             | 15       | 13                                                                    | 14           |    |
|                  |                                |       | Slow    | 16                                                             | 18       | 16                                                                    | 16           |    |
|                  |                                |       | QuietIO | 25                                                             | 22       | 25                                                                    | 18           |    |
|                  |                                | 12    | Fast    | 5                                                              | 7        | 5                                                                     | 5            |    |
|                  |                                |       | Slow    | 7                                                              | 8        | 7                                                                     | 6            |    |
|                  |                                |       | QuietIO | 11                                                             | 10       | 11                                                                    | 8            |    |
|                  |                                | 16    | Fast    | 4                                                              | 5        | 4                                                                     | 4            |    |
|                  |                                |       | Slow    | 7                                                              | 8        | 7                                                                     | 5            |    |
|                  |                                |       | QuietIO | 11                                                             | 10       | 11                                                                    | 8            |    |
|                  |                                | 24    | Fast    | N/A                                                            | 5        | N/A                                                                   | 3            |    |
|                  |                                |       | Slow    | N/A                                                            | 8        | N/A                                                                   | 8            |    |
|                  |                                |       | QuietIO | N/A                                                            | 10       | N/A                                                                   | 8            |    |
|                  | HSTL_I_18                      |       |         |                                                                | 9        | 10                                                                    | 9            | 9  |
|                  | HSTL_II_18                     |       |         |                                                                | N/A      | 5                                                                     | N/A          | 6  |
|                  | HSTL_III_18                    |       |         |                                                                | 9        | 10                                                                    | 9            | 11 |
|                  | DIFF_HSTL_I_18                 |       |         |                                                                | 27       | 30                                                                    | 27           | 27 |
|                  | DIFF_HSTL_II_18                |       |         |                                                                | N/A      | 15                                                                    | N/A          | 18 |
|                  | DIFF_HSTL_III_18               |       |         |                                                                | 27       | 30                                                                    | 27           | 33 |
|                  | MOBILE_DDR <sup>(3)</sup>      |       |         |                                                                | 12       | 14                                                                    | 12           | 14 |
|                  | DIFF_MOBILE_DDR <sup>(3)</sup> |       |         |                                                                | 36       | 42                                                                    | 36           | 42 |
|                  | SSTL_18_I <sup>(3)</sup>       |       |         |                                                                | 9        | 10                                                                    | 9            | 10 |
|                  | SSTL_18_II <sup>(3)</sup>      |       |         |                                                                | N/A      | 5                                                                     | N/A          | 4  |
|                  | DIFF_SSTL_18_I <sup>(3)</sup>  |       |         |                                                                | 27       | 30                                                                    | 27           | 30 |
|                  | DIFF_SSTL_18_II <sup>(3)</sup> |       |         |                                                                | N/A      | 15                                                                    | N/A          | 12 |

## CLB Distributed RAM Switching Characteristics (SLICEM Only)

Table 41: CLB Distributed RAM Switching Characteristics (SLICEM Only)

| Symbol                                      | Description                                      | Speed Grade    |                |                |                | Units   |
|---------------------------------------------|--------------------------------------------------|----------------|----------------|----------------|----------------|---------|
|                                             |                                                  | -3             | -3N            | -2             | -1L            |         |
| Sequential Delays                           |                                                  |                |                |                |                |         |
| T <sub>SHCKO</sub>                          | Clock to A – D outputs                           | 1.26           | 1.55           | 1.55           | 2.35           | ns, Max |
|                                             | Clock to A – D outputs (direct output path)      | 0.96           | 1.20           | 1.20           | 1.87           | ns, Max |
| Setup and Hold Times Before/After Clock CLK |                                                  |                |                |                |                |         |
| T <sub>DS</sub> /T <sub>DH</sub>            | AX – DX or AI – DI inputs to CLK                 | 0.59/<br>0.17  | 0.73/<br>0.22  | 0.73/<br>0.22  | 1.17/<br>0.33  | ns, Min |
| T <sub>AS</sub> /T <sub>AH</sub>            | Address An inputs to clock for XC devices        | 0.28/<br>0.35  | 0.32/<br>0.42  | 0.32/<br>0.42  | 0.26/<br>0.71  | ns, Min |
|                                             | Address An inputs to clock for XA and XQ devices | 0.28/<br>0.51  | N/A            | 0.32/<br>0.51  | 0.26/<br>0.71  | ns, Min |
| T <sub>WS</sub> /T <sub>WH</sub>            | WE input to clock                                | 0.31/<br>–0.08 | 0.37/<br>–0.08 | 0.37/<br>–0.08 | 0.59/<br>–0.27 | ns, Min |
| T <sub>CECK</sub> /T <sub>CKCE</sub>        | CE input to CLK                                  | 0.31/<br>–0.08 | 0.37/<br>–0.08 | 0.37/<br>–0.08 | 0.59/<br>–0.27 | ns, Min |

## CLB Shift Register Switching Characteristics (SLICEM Only)

Table 42: CLB Shift Register Switching Characteristics

| Symbol                                      | Description                                 | Speed Grade    |                |                |                | Units   |
|---------------------------------------------|---------------------------------------------|----------------|----------------|----------------|----------------|---------|
|                                             |                                             | -3             | -3N            | -2             | -1L            |         |
| Sequential Delays                           |                                             |                |                |                |                |         |
| T <sub>REG</sub>                            | Clock to A – D outputs                      | 1.35           | 1.78           | 1.78           | 2.74           | ns, Max |
|                                             | Clock to A – D outputs (direct output path) | 1.24           | 1.65           | 1.65           | 2.48           | ns, Max |
| Setup and Hold Times Before/After Clock CLK |                                             |                |                |                |                |         |
| T <sub>WS</sub> /T <sub>WH</sub>            | WE input to CLK                             | 0.20/<br>–0.07 | 0.24/<br>–0.07 | 0.24/<br>–0.07 | 0.29/<br>–0.27 | ns, Min |
| T <sub>CECK</sub> /T <sub>CKCE</sub>        | CE input to CLK for XC devices              | 0.30/<br>0.30  | 0.30/<br>0.38  | 0.30/<br>0.38  | 0.82/<br>–0.41 | ns, Min |
|                                             | CE input to CLK for XA and XQ devices       | 0.32/<br>0.30  | N/A            | 0.40/<br>0.38  | 0.82/<br>–0.41 | ns, Min |
| T <sub>DS</sub> /T <sub>DH</sub>            | AX – DX or AI – DI inputs to CLK            | 0.07/<br>0.11  | 0.09/<br>0.14  | 0.09/<br>0.14  | 0.11/<br>0.23  | ns, Min |

# Configuration Switching Characteristics

Table 47: Configuration Switching Characteristics<sup>(1)</sup>

| Symbol                                     | Description                                                                                                                     | Speed Grade |          |          |          | Units       |
|--------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-------------|----------|----------|----------|-------------|
|                                            |                                                                                                                                 | -3          | -3N      | -2       | -1L      |             |
| Power-up Timing Characteristics            |                                                                                                                                 |             |          |          |          |             |
| T <sub>PL</sub> <sup>(2)</sup>             | PROGRAM_B Latency                                                                                                               | 4           | 4        | 4        | 5        | ms, Max     |
| T <sub>POR</sub> <sup>(2)</sup>            | Power-on reset (50 ms ramp time) <sup>(3)</sup>                                                                                 | 5/30        | 5/34     | 5/40     | 5/40     | ms, Min/Max |
|                                            | Power-on reset (10 ms ramp time)                                                                                                | 5/25        | 5/29     | 5/35     | 5/40     | ms, Min/Max |
| T <sub>PROGRAM</sub>                       | PROGRAM_B Pulse Width                                                                                                           | 500         | 500      | 500      | 500      | ns, Min     |
| Slave Serial Mode Programming Switching    |                                                                                                                                 |             |          |          |          |             |
| T <sub>DCCK</sub> /T <sub>CCKD</sub>       | DIN Setup/Hold, slave mode                                                                                                      | 6.0/1.0     | 6.0/1.0  | 6.0/1.0  | 8.0/2.0  | ns, Min     |
| T <sub>CCO</sub>                           | CCLK to DOUT                                                                                                                    | 12          | 12       | 12       | 17       | ns, Max     |
| F <sub>SCCK</sub>                          | Slave mode external CCLK                                                                                                        | 80          | 80       | 80       | 50       | MHz, Max    |
| Slave SelectMAP Mode Programming Switching |                                                                                                                                 |             |          |          |          |             |
| T <sub>SMDCK</sub> /T <sub>SMCCKD</sub>    | SelectMAP Data Setup/Hold                                                                                                       | 6.0/1.0     | 6.0/1.0  | 6.0/1.0  | 8.0/2.0  | ns, Min     |
| T <sub>SMCSCCK</sub> /T <sub>SMCCKCS</sub> | CSI_B Setup/Hold                                                                                                                | 7.0/0.0     | 7.0/0.0  | 7.0/0.0  | 9.0/2.0  | ns, Min     |
| T <sub>SMWCCK</sub> /T <sub>SMCCKW</sub>   | RDWR_B Setup/Hold                                                                                                               | 17.0/1.0    | 17.0/1.0 | 17.0/1.0 | 27.0/2.0 | ns, Min     |
| T <sub>SMCKCSO</sub>                       | CSO_B clock to out                                                                                                              | 16          | 16       | 16       | 26       | ns, Max     |
| T <sub>SMCO</sub>                          | CCLK to DATA out in readback                                                                                                    | 13          | 13       | 13       | 25       | ns, Max     |
| T <sub>SMCKBY</sub>                        | CCLK to BUSY out in readback                                                                                                    | 12          | 12       | 12       | 17       | ns, Max     |
| F <sub>SMCK</sub>                          | Maximum CCLK frequency (LX4, LX9, LX16, LX25, LX25T, LX45, LX45T, LX75, and LX75T only)                                         | 50          | 50       | 50       | 25       | MHz, Max    |
|                                            | Maximum CCLK frequency (LX100 and LX100T in x8 mode, LX150, and LX150T only)                                                    | 40          | 40       | 40       | 20       | MHz, Max    |
|                                            | Maximum CCLK frequency (LX100 and LX100T in x16 mode only)                                                                      | 35          | 35       | 35       | 20       | MHz, Max    |
| F <sub>RBCK</sub>                          | Maximum Readback CCLK frequency, including block RAM (LX4, LX9, LX16, LX25, LX25T, LX45, LX45T, LX75, and LX75T only)           | 20          | 20       | 20       | 4        | MHz, Max    |
|                                            | Maximum Readback CCLK frequency, ignoring block RAM (POST_CRC) (LX4, LX9, LX16, LX25, LX25T, LX45, LX45T, LX75, and LX75T only) | 50          | 50       | 50       | 30       | MHz, Max    |
|                                            | Maximum Readback CCLK frequency, including block RAM (LX100, LX100T, LX150, and LX150T only)                                    | 12          | 12       | 12       | 4        | MHz, Max    |
|                                            | Maximum Readback CCLK frequency, ignoring block RAM (POST_CRC) (LX100, LX100T, LX150, and LX150T only)                          | 35          | 35       | 35       | 20       | MHz, Max    |
| Boundary-Scan Port Timing Specifications   |                                                                                                                                 |             |          |          |          |             |
| T <sub>TAPTCK</sub>                        | TMS and TDI Setup time before TCK                                                                                               | 10          | 10       | 10       | 17       | ns, Min     |
| T <sub>TCKTAP</sub>                        | TMS and TDI Hold time after TCK                                                                                                 | 5.5         | 5.5      | 5.5      | 5.5      | ns, Min     |
| T <sub>TCKTDO</sub>                        | TCK falling edge to TDO output valid                                                                                            | 6.5         | 6.5      | 6.5      | 8        | ns, Max     |
| T <sub>TCKH</sub>                          | TCK clock minimum High time                                                                                                     | 12          | 12       | 12       | 21       | ns, Min     |
| T <sub>TCKL</sub>                          | TCK clock minimum Low time                                                                                                      | 12          | 12       | 12       | 21       | ns, Min     |
| F <sub>TCK</sub>                           | Maximum configuration TCK clock frequency                                                                                       | 33          | 33       | 33       | 18       | MHz, Max    |
| F <sub>TCKB</sub>                          | Maximum boundary-scan TCK clock frequency                                                                                       | 33          | 33       | 33       | 18       | MHz, Max    |
| F <sub>TCKAES</sub>                        | Maximum AES key TCK clock frequency                                                                                             | 2           | 2        | 2        | 2        | MHz, Max    |

## Spartan-6 Device Pin-to-Pin Output Parameter Guidelines

All devices are 100% functionally tested. The representative values for typical pin locations and normal clock loading are listed in Table 63 through Table 69. Values are expressed in nanoseconds unless otherwise noted.

Table 63: Global Clock Input to Output Delay Without DCM or PLL

| Symbol                                                                                                              | Description                                      | Device     | Speed Grade |      |      |       | Units |
|---------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|------------|-------------|------|------|-------|-------|
|                                                                                                                     |                                                  |            | -3          | -3N  | -2   | -1L   |       |
| LVCMOS25 Global Clock Input to Output Delay using Output Flip-Flop, 12mA, Fast Slew Rate, <i>without</i> DCM or PLL |                                                  |            |             |      |      |       |       |
| T <sub>ICKOF</sub>                                                                                                  | Global Clock and OUTFF <i>without</i> DCM or PLL | XC6SLX4    | 6.12        | N/A  | 7.68 | 9.41  | ns    |
|                                                                                                                     |                                                  | XC6SLX9    | 6.12        | 6.51 | 7.68 | 9.41  | ns    |
|                                                                                                                     |                                                  | XC6SLX16   | 5.98        | 6.42 | 7.48 | 9.10  | ns    |
|                                                                                                                     |                                                  | XC6SLX25   | 6.20        | 6.69 | 7.84 | 9.44  | ns    |
|                                                                                                                     |                                                  | XC6SLX25T  | 6.20        | 6.69 | 7.84 | N/A   | ns    |
|                                                                                                                     |                                                  | XC6SLX45   | 6.37        | 6.88 | 8.10 | 9.61  | ns    |
|                                                                                                                     |                                                  | XC6SLX45T  | 6.37        | 6.88 | 8.10 | N/A   | ns    |
|                                                                                                                     |                                                  | XC6SLX75   | 6.39        | 6.99 | 8.16 | 10.18 | ns    |
|                                                                                                                     |                                                  | XC6SLX75T  | 6.39        | 6.99 | 8.16 | N/A   | ns    |
|                                                                                                                     |                                                  | XC6SLX100  | 6.59        | 7.18 | 8.41 | 10.31 | ns    |
|                                                                                                                     |                                                  | XC6SLX100T | 6.59        | 7.18 | 8.41 | N/A   | ns    |
|                                                                                                                     |                                                  | XC6SLX150  | 6.98        | 7.68 | 8.80 | 10.62 | ns    |
|                                                                                                                     |                                                  | XC6SLX150T | 6.98        | 7.68 | 8.80 | N/A   | ns    |
|                                                                                                                     |                                                  | XA6SLX4    | 6.44        | N/A  | 7.68 | N/A   | ns    |
|                                                                                                                     |                                                  | XA6SLX9    | 6.44        | N/A  | 7.68 | N/A   | ns    |
|                                                                                                                     |                                                  | XA6SLX16   | 6.30        | N/A  | 7.48 | N/A   | ns    |
|                                                                                                                     |                                                  | XA6SLX25   | 6.52        | N/A  | 7.84 | N/A   | ns    |
|                                                                                                                     |                                                  | XA6SLX25T  | 6.52        | N/A  | 7.84 | N/A   | ns    |
|                                                                                                                     |                                                  | XA6SLX45   | 6.69        | N/A  | 8.12 | N/A   | ns    |
|                                                                                                                     |                                                  | XA6SLX45T  | 6.69        | N/A  | 8.12 | N/A   | ns    |
|                                                                                                                     |                                                  | XA6SLX75   | 6.89        | N/A  | 8.16 | N/A   | ns    |
|                                                                                                                     |                                                  | XA6SLX75T  | 6.89        | N/A  | 8.16 | N/A   | ns    |
|                                                                                                                     |                                                  | XA6SLX100  | N/A         | N/A  | 8.36 | N/A   | ns    |
|                                                                                                                     |                                                  | XQ6SLX75   | N/A         | N/A  | 8.16 | 10.18 | ns    |
|                                                                                                                     |                                                  | XQ6SLX75T  | 6.89        | N/A  | 8.16 | N/A   | ns    |
|                                                                                                                     |                                                  | XQ6SLX150  | N/A         | N/A  | 8.80 | 10.62 | ns    |
|                                                                                                                     |                                                  | XQ6SLX150T | 7.61        | N/A  | 8.80 | N/A   | ns    |

### Notes:

- Listed above are representative values where one global clock input drives one vertical clock line in each accessible column, and where all accessible IOB and CLB flip-flops are clocked by the global clock net.

Table 64: Global Clock Input to Output Delay With DCM in System-Synchronous Mode

| Symbol                                                                                                                                | Description                            | Device     | Speed Grade |      |      |      | Units |
|---------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|------------|-------------|------|------|------|-------|
|                                                                                                                                       |                                        |            | -3          | -3N  | -2   | -1L  |       |
| LVCMOS25 Global Clock Input to Output Delay using Output Flip-Flop, 12mA, Fast Slew Rate, <i>with</i> DCM in System-Synchronous Mode. |                                        |            |             |      |      |      |       |
| T <sub>ICKOFDCM</sub>                                                                                                                 | Global Clock and OUTFF <i>with</i> DCM | XC6SLX4    | 4.23        | N/A  | 6.11 | 6.60 | ns    |
|                                                                                                                                       |                                        | XC6SLX9    | 4.23        | 5.17 | 6.11 | 6.60 | ns    |
|                                                                                                                                       |                                        | XC6SLX16   | 4.28        | 4.57 | 5.34 | 6.36 | ns    |
|                                                                                                                                       |                                        | XC6SLX25   | 3.95        | 4.18 | 4.59 | 6.91 | ns    |
|                                                                                                                                       |                                        | XC6SLX25T  | 3.95        | 4.18 | 4.59 | N/A  | ns    |
|                                                                                                                                       |                                        | XC6SLX45   | 4.37        | 4.70 | 5.50 | 6.85 | ns    |
|                                                                                                                                       |                                        | XC6SLX45T  | 4.37        | 4.70 | 5.50 | N/A  | ns    |
|                                                                                                                                       |                                        | XC6SLX75   | 3.90        | 4.23 | 4.77 | 6.31 | ns    |
|                                                                                                                                       |                                        | XC6SLX75T  | 3.90        | 4.23 | 4.77 | N/A  | ns    |
|                                                                                                                                       |                                        | XC6SLX100  | 3.86        | 4.16 | 4.66 | 7.25 | ns    |
|                                                                                                                                       |                                        | XC6SLX100T | 3.90        | 4.16 | 4.66 | N/A  | ns    |
|                                                                                                                                       |                                        | XC6SLX150  | 4.03        | 4.33 | 4.83 | 6.63 | ns    |
|                                                                                                                                       |                                        | XC6SLX150T | 4.03        | 4.33 | 4.83 | N/A  | ns    |
|                                                                                                                                       |                                        | XA6SLX4    | 4.55        | N/A  | 6.11 | N/A  | ns    |
|                                                                                                                                       |                                        | XA6SLX9    | 4.55        | N/A  | 6.11 | N/A  | ns    |
|                                                                                                                                       |                                        | XA6SLX16   | 4.62        | N/A  | 5.33 | N/A  | ns    |
|                                                                                                                                       |                                        | XA6SLX25   | 4.27        | N/A  | 4.59 | N/A  | ns    |
|                                                                                                                                       |                                        | XA6SLX25T  | 4.27        | N/A  | 4.69 | N/A  | ns    |
|                                                                                                                                       |                                        | XA6SLX45   | 4.69        | N/A  | 5.50 | N/A  | ns    |
|                                                                                                                                       |                                        | XA6SLX45T  | 4.69        | N/A  | 5.50 | N/A  | ns    |
|                                                                                                                                       |                                        | XA6SLX75   | 4.22        | N/A  | 4.77 | N/A  | ns    |
|                                                                                                                                       |                                        | XA6SLX75T  | 4.22        | N/A  | 4.77 | N/A  | ns    |
|                                                                                                                                       |                                        | XA6SLX100  | N/A         | N/A  | 5.34 | N/A  | ns    |
|                                                                                                                                       |                                        | XQ6SLX75   | N/A         | N/A  | 4.77 | 6.31 | ns    |
|                                                                                                                                       |                                        | XQ6SLX75T  | 4.22        | N/A  | 4.77 | N/A  | ns    |
|                                                                                                                                       |                                        | XQ6SLX150  | N/A         | N/A  | 4.96 | 6.63 | ns    |
|                                                                                                                                       |                                        | XQ6SLX150T | 4.62        | N/A  | 4.96 | N/A  | ns    |

**Notes:**

1. Listed above are representative values where one global clock input drives one vertical clock line in each accessible column, and where all accessible IOB and CLB flip-flops are clocked by the global clock net.
2. DCM output jitter is already included in the timing calculation.

Table 65: Global Clock Input to Output Delay With DCM in Source-Synchronous Mode

| Symbol                                                                                                                                | Description                            | Device     | Speed Grade |      |      |      | Units |
|---------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|------------|-------------|------|------|------|-------|
|                                                                                                                                       |                                        |            | -3          | -3N  | -2   | -1L  |       |
| LVCMOS25 Global Clock Input to Output Delay using Output Flip-Flop, 12mA, Fast Slew Rate, <i>with</i> DCM in Source-Synchronous Mode. |                                        |            |             |      |      |      |       |
| T <sub>ICKOFDCM_0</sub>                                                                                                               | Global Clock and OUTFF <i>with</i> DCM | XC6SLX4    | 5.03        | N/A  | 7.21 | 8.05 | ns    |
|                                                                                                                                       |                                        | XC6SLX9    | 5.03        | 6.13 | 7.21 | 8.05 | ns    |
|                                                                                                                                       |                                        | XC6SLX16   | 5.08        | 5.51 | 6.44 | 7.96 | ns    |
|                                                                                                                                       |                                        | XC6SLX25   | 4.81        | 5.13 | 5.69 | 7.94 | ns    |
|                                                                                                                                       |                                        | XC6SLX25T  | 4.81        | 5.13 | 5.69 | N/A  | ns    |
|                                                                                                                                       |                                        | XC6SLX45   | 5.26        | 5.69 | 6.63 | 7.92 | ns    |
|                                                                                                                                       |                                        | XC6SLX45T  | 5.26        | 5.69 | 6.63 | N/A  | ns    |
|                                                                                                                                       |                                        | XC6SLX75   | 4.77        | 5.18 | 5.88 | 7.95 | ns    |
|                                                                                                                                       |                                        | XC6SLX75T  | 4.77        | 5.18 | 5.88 | N/A  | ns    |
|                                                                                                                                       |                                        | XC6SLX100  | 4.72        | 5.11 | 5.76 | 8.59 | ns    |
|                                                                                                                                       |                                        | XC6SLX100T | 4.76        | 5.11 | 5.76 | N/A  | ns    |
|                                                                                                                                       |                                        | XC6SLX150  | 4.90        | 5.30 | 5.93 | 7.93 | ns    |
|                                                                                                                                       |                                        | XC6SLX150T | 4.90        | 5.30 | 5.93 | N/A  | ns    |
|                                                                                                                                       |                                        | XA6SLX4    | 5.35        | N/A  | 7.21 | N/A  | ns    |
|                                                                                                                                       |                                        | XA6SLX9    | 5.35        | N/A  | 7.21 | N/A  | ns    |
|                                                                                                                                       |                                        | XA6SLX16   | 5.42        | N/A  | 6.44 | N/A  | ns    |
|                                                                                                                                       |                                        | XA6SLX25   | 5.13        | N/A  | 5.69 | N/A  | ns    |
|                                                                                                                                       |                                        | XA6SLX25T  | 5.13        | N/A  | 5.79 | N/A  | ns    |
|                                                                                                                                       |                                        | XA6SLX45   | 5.58        | N/A  | 6.63 | N/A  | ns    |
|                                                                                                                                       |                                        | XA6SLX45T  | 5.58        | N/A  | 6.63 | N/A  | ns    |
|                                                                                                                                       |                                        | XA6SLX75   | 5.09        | N/A  | 5.87 | N/A  | ns    |
|                                                                                                                                       |                                        | XA6SLX75T  | 5.09        | N/A  | 5.87 | N/A  | ns    |
|                                                                                                                                       |                                        | XA6SLX100  | N/A         | N/A  | 6.44 | N/A  | ns    |
|                                                                                                                                       |                                        | XQ6SLX75   | N/A         | N/A  | 5.87 | 7.95 | ns    |
|                                                                                                                                       |                                        | XQ6SLX75T  | 5.09        | N/A  | 5.87 | N/A  | ns    |
|                                                                                                                                       |                                        | XQ6SLX150  | N/A         | N/A  | 6.06 | 7.93 | ns    |
|                                                                                                                                       |                                        | XQ6SLX150T | 5.50        | N/A  | 6.06 | N/A  | ns    |

**Notes:**

- Listed above are representative values where one global clock input drives one vertical clock line in each accessible column, and where all accessible IOB and CLB flip-flops are clocked by the global clock net.
- DCM output jitter is already included in the timing calculation.

Table 66: Global Clock Input to Output Delay With PLL in System-Synchronous Mode

| Symbol                                                                                                                                | Description                            | Device     | Speed Grade |      |      |      | Units |
|---------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|------------|-------------|------|------|------|-------|
|                                                                                                                                       |                                        |            | -3          | -3N  | -2   | -1L  |       |
| LVCMOS25 Global Clock Input to Output Delay using Output Flip-Flop, 12mA, Fast Slew Rate, <i>with</i> PLL in System-Synchronous Mode. |                                        |            |             |      |      |      |       |
| T <sub>ICKOFFPLL</sub>                                                                                                                | Global Clock and OUTFF <i>with</i> PLL | XC6SLX4    | 4.57        | N/A  | 6.25 | 7.34 | ns    |
|                                                                                                                                       |                                        | XC6SLX9    | 4.57        | 5.25 | 6.25 | 7.34 | ns    |
|                                                                                                                                       |                                        | XC6SLX16   | 4.41        | 4.64 | 5.39 | 6.92 | ns    |
|                                                                                                                                       |                                        | XC6SLX25   | 4.03        | 4.32 | 4.91 | 7.64 | ns    |
|                                                                                                                                       |                                        | XC6SLX25T  | 4.03        | 4.32 | 4.91 | N/A  | ns    |
|                                                                                                                                       |                                        | XC6SLX45   | 4.63        | 4.96 | 5.75 | 7.36 | ns    |
|                                                                                                                                       |                                        | XC6SLX45T  | 4.63        | 4.96 | 5.75 | N/A  | ns    |
|                                                                                                                                       |                                        | XC6SLX75   | 4.01        | 4.30 | 4.88 | 7.15 | ns    |
|                                                                                                                                       |                                        | XC6SLX75T  | 4.01        | 4.30 | 4.88 | N/A  | ns    |
|                                                                                                                                       |                                        | XC6SLX100  | 4.02        | 4.33 | 4.90 | 7.37 | ns    |
|                                                                                                                                       |                                        | XC6SLX100T | 4.06        | 4.33 | 4.90 | N/A  | ns    |
|                                                                                                                                       |                                        | XC6SLX150  | 3.65        | 3.98 | 4.58 | 6.94 | ns    |
|                                                                                                                                       |                                        | XC6SLX150T | 3.65        | 3.98 | 4.58 | N/A  | ns    |
|                                                                                                                                       |                                        | XA6SLX4    | 4.88        | N/A  | 6.13 | N/A  | ns    |
|                                                                                                                                       |                                        | XA6SLX9    | 4.88        | N/A  | 6.13 | N/A  | ns    |
|                                                                                                                                       |                                        | XA6SLX16   | 4.74        | N/A  | 5.27 | N/A  | ns    |
|                                                                                                                                       |                                        | XA6SLX25   | 4.43        | N/A  | 4.78 | N/A  | ns    |
|                                                                                                                                       |                                        | XA6SLX25T  | 4.43        | N/A  | 4.88 | N/A  | ns    |
|                                                                                                                                       |                                        | XA6SLX45   | 4.94        | N/A  | 5.62 | N/A  | ns    |
|                                                                                                                                       |                                        | XA6SLX45T  | 4.94        | N/A  | 5.62 | N/A  | ns    |
|                                                                                                                                       |                                        | XA6SLX75   | 4.32        | N/A  | 4.77 | N/A  | ns    |
|                                                                                                                                       |                                        | XA6SLX75T  | 4.32        | N/A  | 4.77 | N/A  | ns    |
|                                                                                                                                       |                                        | XA6SLX100  | N/A         | N/A  | 5.41 | N/A  | ns    |
|                                                                                                                                       |                                        | XQ6SLX75   | N/A         | N/A  | 4.77 | 7.15 | ns    |
|                                                                                                                                       |                                        | XQ6SLX75T  | 4.32        | N/A  | 4.77 | N/A  | ns    |
|                                                                                                                                       |                                        | XQ6SLX150  | N/A         | N/A  | 4.60 | 6.94 | ns    |
|                                                                                                                                       |                                        | XQ6SLX150T | 4.35        | N/A  | 4.60 | N/A  | ns    |

**Notes:**

1. Listed above are representative values where one global clock input drives one vertical clock line in each accessible column, and where all accessible IOB and CLB flip-flops are clocked by the global clock net.
2. PLL output jitter is included in the timing calculation.

Table 71: Global Clock Setup and Hold Without DCM or PLL (Default Delay)

| Symbol                                                                                                | Description                                                                         | Device     | Speed Grade |           |           |           | Units |
|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|------------|-------------|-----------|-----------|-----------|-------|
|                                                                                                       |                                                                                     |            | -3          | -3N       | -2        | -1L       |       |
| Input Setup and Hold Time Relative to Global Clock Input Signal for LVCMOS25 Standard. <sup>(1)</sup> |                                                                                     |            |             |           |           |           |       |
| T <sub>PSFD</sub> / T <sub>PHFD</sub>                                                                 | Default Delay <sup>(2)</sup> Global Clock and IFF <sup>(3)</sup> without DCM or PLL | XC6SLX4    | 0.66/1.17   | N/A       | 1.05/0.79 | 2.09/1.05 | ns    |
|                                                                                                       |                                                                                     | XC6SLX9    | 0.66/1.17   | 0.75/1.17 | 1.05/1.17 | 2.09/1.05 | ns    |
|                                                                                                       |                                                                                     | XC6SLX16   | 0.87/1.16   | 0.93/1.16 | 0.96/1.16 | 1.86/1.06 | ns    |
|                                                                                                       |                                                                                     | XC6SLX25   | 0.68/0.77   | 0.81/0.81 | 0.87/0.82 | 2.21/1.33 | ns    |
|                                                                                                       |                                                                                     | XC6SLX25T  | 0.68/0.77   | 0.81/0.81 | 0.87/0.82 | N/A       | ns    |
|                                                                                                       |                                                                                     | XC6SLX45   | 0.40/1.05   | 0.42/1.17 | 0.64/1.20 | 1.61/1.67 | ns    |
|                                                                                                       |                                                                                     | XC6SLX45T  | 0.40/1.05   | 0.42/1.17 | 0.64/1.20 | N/A       | ns    |
|                                                                                                       |                                                                                     | XC6SLX75   | 0.41/1.11   | 0.41/1.13 | 0.80/1.14 | 1.23/1.82 | ns    |
|                                                                                                       |                                                                                     | XC6SLX75T  | 0.41/1.11   | 0.41/1.13 | 0.80/1.14 | N/A       | ns    |
|                                                                                                       |                                                                                     | XC6SLX100  | 0.39/1.12   | 0.39/1.23 | 0.39/1.28 | 1.13/1.94 | ns    |
|                                                                                                       |                                                                                     | XC6SLX100T | 0.39/1.12   | 0.39/1.23 | 0.39/1.28 | N/A       | ns    |
|                                                                                                       |                                                                                     | XC6SLX150  | 0.23/1.54   | 0.23/1.62 | 0.23/1.62 | 1.14/2.05 | ns    |
|                                                                                                       |                                                                                     | XC6SLX150T | 0.23/1.54   | 0.23/1.62 | 0.23/1.62 | N/A       | ns    |
|                                                                                                       |                                                                                     | XA6SLX4    | 0.73/1.18   | N/A       | 1.05/0.80 | N/A       | ns    |
|                                                                                                       |                                                                                     | XA6SLX9    | 0.73/1.18   | N/A       | 1.05/0.80 | N/A       | ns    |
|                                                                                                       |                                                                                     | XA6SLX16   | 0.90/1.20   | N/A       | 0.96/0.75 | N/A       | ns    |
|                                                                                                       |                                                                                     | XA6SLX25   | 0.70/0.81   | N/A       | 0.87/0.91 | N/A       | ns    |
|                                                                                                       |                                                                                     | XA6SLX25T  | 0.76/0.81   | N/A       | 1.03/0.91 | N/A       | ns    |
|                                                                                                       |                                                                                     | XA6SLX45   | 0.40/1.06   | N/A       | 0.64/1.20 | N/A       | ns    |
|                                                                                                       |                                                                                     | XA6SLX45T  | 0.40/1.06   | N/A       | 0.64/1.20 | N/A       | ns    |
|                                                                                                       |                                                                                     | XA6SLX75   | 0.41/1.24   | N/A       | 0.80/1.18 | N/A       | ns    |
|                                                                                                       |                                                                                     | XA6SLX75T  | 0.41/1.24   | N/A       | 0.80/1.18 | N/A       | ns    |
|                                                                                                       |                                                                                     | XA6SLX100  | N/A         | N/A       | 0.86/1.55 | N/A       | ns    |
|                                                                                                       |                                                                                     | XQ6SLX75   | N/A         | N/A       | 0.80/1.18 | 1.23/1.82 | ns    |
|                                                                                                       |                                                                                     | XQ6SLX75T  | 0.41/1.24   | N/A       | 0.80/1.18 | N/A       | ns    |
|                                                                                                       |                                                                                     | XQ6SLX150  | N/A         | N/A       | 0.28/1.57 | 1.14/2.05 | ns    |
|                                                                                                       |                                                                                     | XQ6SLX150T | 0.28/1.78   | N/A       | 0.28/1.57 | N/A       | ns    |

**Notes:**

- Setup and Hold times are measured over worst case conditions (process, voltage, temperature). Setup time is measured relative to the Global Clock input signal using the slowest process, highest temperature, and lowest voltage. Hold time is measured relative to the Global Clock input signal using the fastest process, lowest temperature, and highest voltage.
- Default delay uses IODELAY2 tap 0.
- IFF = Input Flip-Flop or Latch.

Table 79: Package Skew (Cont'd)

| Symbol               | Description                 | Device | Package <sup>(2)</sup> | Value | Units |
|----------------------|-----------------------------|--------|------------------------|-------|-------|
| T <sub>PKGSKEW</sub> | Package Skew <sup>(1)</sup> | LX45   | CSG324                 | 70    | ps    |
|                      |                             |        | CS(G)484               | 99    | ps    |
|                      |                             |        | FG(G)484               | 109   | ps    |
|                      |                             |        | FG(G)676               | 138   | ps    |
|                      |                             | LX45T  | CSG324                 | 75    | ps    |
|                      |                             |        | CS(G)484               | 100   | ps    |
|                      |                             |        | FG(G)484               | 95    | ps    |
|                      |                             | LX75   | CS(G)484               | 101   | ps    |
|                      |                             |        | FG(G)484               | 107   | ps    |
|                      |                             |        | FG(G)676               | 161   | ps    |
|                      |                             | LX75T  | CS(G)484               | 107   | ps    |
|                      |                             |        | FG(G)484               | 110   | ps    |
|                      |                             |        | FG(G)676               | 134   | ps    |
|                      |                             | LX100  | CS(G)484               | 95    | ps    |
|                      |                             |        | FG(G)484               | 155   | ps    |
|                      |                             |        | FG(G)676               | 144   | ps    |
|                      |                             | LX100T | CS(G)484               | 88    | ps    |
|                      |                             |        | FG(G)484               | 111   | ps    |
|                      |                             |        | FG(G)676               | 147   | ps    |
|                      |                             |        | FG(G)900               | 134   | ps    |
|                      |                             | LX150  | CS(G)484               | 84    | ps    |
|                      |                             |        | FG(G)484               | 103   | ps    |
|                      |                             |        | FG(G)676               | 115   | ps    |
|                      |                             |        | FG(G)900               | 121   | ps    |
|                      |                             | LX150T | CS(G)484               | 83    | ps    |
|                      |                             |        | FG(G)484               | 88    | ps    |
|                      |                             |        | FG(G)676               | 141   | ps    |
|                      |                             |        | FG(G)900               | 120   | ps    |

**Notes:**

- These values represent the worst-case skew between any two SelectIO resources in the package: shortest delay to longest delay from Pad to Ball.
- Some of the devices are available in both Pb and Pb-free (additional G) packages as standard ordering options. See [DS160: Spartan-6 Family Overview](#) for more information.

Table 80: Sample Window

| Symbol                   | Description                                                 | Device <sup>(1)</sup> | Speed Grade |     |     |     | Units |
|--------------------------|-------------------------------------------------------------|-----------------------|-------------|-----|-----|-----|-------|
|                          |                                                             |                       | -3          | -3N | -2  | -1L |       |
| T <sub>SAMP</sub>        | Sampling Error at Receiver Pins <sup>(2)</sup>              | All                   | 510         | 510 | 530 | 740 | ps    |
| T <sub>SAMP_BUFIO2</sub> | Sampling Error at Receiver Pins using BUFIO2 <sup>(3)</sup> | All                   | 430         | 430 | 450 | 590 | ps    |

**Notes:**

- LXT devices are not available with a -1L speed grade.
- This parameter indicates the total sampling error of Spartan-6 FPGA DDR input registers, measured across voltage, temperature, and process. The characterization methodology uses the DCM to capture the DDR input registers' edges of operation. These measurements include:
  - CLK0 DCM jitter
  - DCM accuracy (phase offset)
  - DCM phase shift resolution
These measurements do not include package or clock tree skew.
- This parameter indicates the total sampling error of Spartan-6 FPGA DDR input registers, measured across voltage, temperature, and process. The characterization methodology uses the BUFIO2 clock network and IODELAY2 to capture the DDR input registers' edges of operation. These measurements do not include package or clock tree skew.

Table 81: Source-Synchronous Pin-to-Pin Setup/Hold and Clock-to-Out Using BUFIO2 (Cont'd)

| Symbol                               | Description                         | Device     | Speed Grade |      |      |      | Units |
|--------------------------------------|-------------------------------------|------------|-------------|------|------|------|-------|
|                                      |                                     |            | -3          | -3N  | -2   | -1L  |       |
| Pin-to-Pin Clock-to-Out Using BUFIO2 |                                     |            |             |      |      |      |       |
| T <sub>ICKO</sub> FCS                | OFF clock-to-out using BUFIO2 clock | XC6SLX4    | 5.51        | N/A  | 6.95 | 8.45 | ns    |
|                                      |                                     | XC6SLX9    | 5.51        | 5.89 | 6.95 | 8.45 | ns    |
|                                      |                                     | XC6SLX16   | 5.31        | 5.70 | 6.67 | 8.21 | ns    |
|                                      |                                     | XC6SLX25   | 5.53        | 6.00 | 7.02 | 8.72 | ns    |
|                                      |                                     | XC6SLX25T  | 5.53        | 6.00 | 7.02 | N/A  | ns    |
|                                      |                                     | XC6SLX45   | 5.76        | 6.18 | 7.22 | 8.77 | ns    |
|                                      |                                     | XC6SLX45T  | 5.76        | 6.18 | 7.22 | N/A  | ns    |
|                                      |                                     | XC6SLX75   | 5.94        | 6.46 | 7.57 | 9.72 | ns    |
|                                      |                                     | XC6SLX75T  | 5.94        | 6.46 | 7.57 | N/A  | ns    |
|                                      |                                     | XC6SLX100  | 6.09        | 6.53 | 7.60 | 9.66 | ns    |
|                                      |                                     | XC6SLX100T | 6.09        | 6.53 | 7.60 | N/A  | ns    |
|                                      |                                     | XC6SLX150  | 6.29        | 6.69 | 7.81 | 9.94 | ns    |
|                                      |                                     | XC6SLX150T | 6.29        | 6.69 | 7.81 | N/A  | ns    |
|                                      |                                     | XA6SLX4    | 5.83        | N/A  | 6.95 | N/A  | ns    |
|                                      |                                     | XA6SLX9    | 5.83        | N/A  | 6.95 | N/A  | ns    |
|                                      |                                     | XA6SLX16   | 5.65        | N/A  | 6.68 | N/A  | ns    |
|                                      |                                     | XA6SLX25   | 5.85        | N/A  | 7.03 | N/A  | ns    |
|                                      |                                     | XA6SLX25T  | 5.85        | N/A  | 7.03 | N/A  | ns    |
|                                      |                                     | XA6SLX45   | 6.07        | N/A  | 7.25 | N/A  | ns    |
|                                      |                                     | XA6SLX45T  | 6.07        | N/A  | 7.25 | N/A  | ns    |
|                                      |                                     | XA6SLX75   | 6.26        | N/A  | 7.57 | N/A  | ns    |
|                                      |                                     | XA6SLX75T  | 6.26        | N/A  | 7.57 | N/A  | ns    |
|                                      |                                     | XA6SLX100  | N/A         | N/A  | 7.48 | N/A  | ns    |
|                                      |                                     | XQ6SLX75   | N/A         | N/A  | 7.57 | 9.72 | ns    |
|                                      |                                     | XQ6SLX75T  | 6.26        | N/A  | 7.57 | N/A  | ns    |
|                                      |                                     | XQ6SLX150  | N/A         | N/A  | 7.81 | 9.94 | ns    |
|                                      |                                     | XQ6SLX150T | 6.62        | N/A  | 7.81 | N/A  | ns    |

## Revision History

The following table shows the revision history for this document.

| Date     | Version | Description of Revisions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 06/24/09 | 1.0     | Initial Xilinx release.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 08/26/09 | 1.1     | Added $V_{FS}$ to <a href="#">Table 1</a> and <a href="#">Table 2</a> . Added $R_{FUSE}$ to <a href="#">Table 2</a> . Added XC6SLX75 and XC6SLX75T to $V_{BATT}$ and $I_{BATT}$ in <a href="#">Table 1</a> , <a href="#">Table 2</a> , and <a href="#">Table 4</a> . Corrected the quiescent supply current for the XC6SLX4 in <a href="#">Table 5</a> . Updated <a href="#">Table 11</a> . Removed $DV_{PPIN}$ from <a href="#">Figure 2</a> . Removed $F_{PCIECORE}$ from <a href="#">Table 24</a> and added values to $F_{PCIEUSER}$ . Added more networking applications to <a href="#">Table 25</a> . Updated values for $T_{SUSPENDLOW\_AWAKE}$ , $T_{SUSPEND\_ENABLE}$ , and $T_{SCP\_AWAKE}$ in <a href="#">Table 46</a> . Numerous changes to <a href="#">Table 47</a> , <a href="#">page 54</a> including the addition of new values to various specifications, revising the $T_{SMCKCSO}$ description, and changing the units of $T_{POR}$ . Also, removed <i>Dynamic Reconfiguration Port (DRP) for DCM and PLL Before and After DCLK</i> section from <a href="#">Table 47</a> and updated all the notes. In <a href="#">Table 52</a> , added to $F_{INMAX}$ , revised $F_{OUTMAX}$ , and removed PLL Maximum Output Frequency for BUFIO2. Revised values for DCM_DELAY_STEP in <a href="#">Table 54</a> . Updated CLKIN_FREQ_FX values in <a href="#">Table 55</a> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 01/04/10 | 1.2     | Added -4 speed grade to entire document. Updated speed specification of -4, -3, -2 speed grades to version 1.03. Added -1L speed grade numbers per speed specification 1.00. Updated $T_{SOL}$ in <a href="#">Table 1</a> . Added -1L rows for LVCMOS12, LVCMOS15, and LVCMOS18 in <a href="#">Table 9</a> . Revised much of the detail in <a href="#">GTP Transceiver Specifications</a> in <a href="#">Table 12</a> through <a href="#">Table 23</a> . Added -2 data to <a href="#">Table 25</a> . Updated $F_{MAX}$ in <a href="#">Table 44</a> . Updated descriptions for $T_{DNACKL}$ and $T_{DNACKH}$ in <a href="#">Table 45</a> and revised values for all parameters. Removed $T_{INITADDR}$ from <a href="#">Table 47</a> and added new data. Updated values in <a href="#">Table 48</a> through <a href="#">Table 62</a> . Added <a href="#">Table 51</a> (BUFPLL) and <a href="#">Table 57</a> (DCM_CLKGEN). Removed $T_{LOCKMAX}$ note from <a href="#">Table 52</a> . Updated note 3 in <a href="#">Table 53</a> . In <a href="#">Table 79</a> : removed XC6SLX75CSG324 and XC6SLX75TCSG324; added XC6SLX75FG(G)484 and XC6SLX75FG(G)484.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 02/22/10 | 1.3     | Production release of XC6SLX16 -2 speed grade devices. The changes to <a href="#">Table 26</a> and <a href="#">Table 27</a> includes updating this data sheet to the data in ISE v11.5 software with speed specification v1.06. Updated maximum of $V_{IN}$ and $V_{TS}$ and note 2 in <a href="#">Table 1</a> . In <a href="#">Table 2</a> , changed $V_{IN}$ , added $I_{IN}$ and note 5, revised notes 1, 6, and 7, and added note 8 to $R_{FUSE}$ . In <a href="#">Table 4</a> , removed previous note 1 and added data to $I_{RPU}$ , $I_{RPD}$ , and $I_{BATT}$ , changed $C_{IN}$ , added $R_{DT}$ and $R_{IN\_TERM}$ , and added note 2 and 3. Updated $V_{CCO2}$ in <a href="#">Table 6</a> . Added <a href="#">Table 7</a> and <a href="#">Table 8</a> . Removed PCI66_3 from <a href="#">Table 9</a> . Updated PCI33_3 and I2C in <a href="#">Table 9</a> . Updated the description of <a href="#">Table 11</a> . Completely updated <a href="#">Table 25</a> . Updated <a href="#">Table 28</a> including adding values for PCI33_3. Updated $V_{REF}$ value for HSTL_III_18 in <a href="#">Table 31</a> . Updates missing $V_{REF}$ values in <a href="#">Table 32</a> . Added <a href="#">Simultaneously Switching Outputs</a> , <a href="#">page 36</a> . Removed $T_{GSRQ}$ and $T_{RPW}$ from <a href="#">Table 35</a> and <a href="#">Table 36</a> . Also removed $T_{DOQ}$ from <a href="#">Table 36</a> . Removed $T_{ISDO\_DO}$ and note 1 from <a href="#">Table 37</a> . Removed $T_{OSCK\_S}$ and combinatorial section from <a href="#">Table 38</a> . In <a href="#">Table 39</a> , removed $T_{IODDO\_T}$ and added new tap parameters and note 2. In <a href="#">Table 40</a> , <a href="#">Table 41</a> , and <a href="#">Table 42</a> , made typographical edits and removed notes. Removed clock CLK section in <a href="#">Table 41</a> . Removed clock CLK section and $T_{REG\_MUX}$ and $T_{REG\_M31}$ in <a href="#">Table 42</a> . Added block RAM $F_{MAX}$ values to <a href="#">Table 43</a> . Updated values and added note 2 to <a href="#">Table 45</a> . Added values to <a href="#">Table 46</a> and removed note 1. Numerous changes to <a href="#">Table 47</a> . Completely updated <a href="#">Table 57</a> . Revised data in <a href="#">Table 62</a> . Removed note 3 from <a href="#">Table 71</a> . Added values to <a href="#">Table 79</a> . Added data to <a href="#">Table 80</a> and <a href="#">Table 81</a> . |
| 03/10/10 | 1.4     | Production release of XC6SLX45 -2 speed grade devices, which includes changes to <a href="#">Table 26</a> and <a href="#">Table 27</a> updating this data sheet to the data in ISE v11.5 software with speed specification v1.07. Fixed $R_{IN\_TERM}$ description in <a href="#">Table 4</a> . Added PCI66_3 to <a href="#">Table 7</a> and replaced note 1. Corrected note 1 and the V, Max for TMDS_33 in <a href="#">Table 8</a> . In <a href="#">Table 10</a> , added note 1 to LVPECL_33 and TMDS_33. Also updated specifications for TMDS_33. Updated the <a href="#">GTP Transceiver Specifications</a> section including adding values to <a href="#">Table 16</a> , <a href="#">Table 17</a> , and <a href="#">Table 20</a> through <a href="#">Table 23</a> . Added PCI66_3 back into <a href="#">Table 9</a> , <a href="#">Table 28</a> , <a href="#">Table 31</a> , <a href="#">Table 32</a> , and <a href="#">Table 34</a> . Updated note 3 on <a href="#">Table 32</a> . In <a href="#">Table 34</a> , corrected some typographical errors and fixed SSO limits for bank1/3 in FG(G)484 package. Corrected $T_{OSCK\_OCE}$ in <a href="#">Table 38</a> . In <a href="#">Table 57</a> , updated CLKFX_FREEZE_VAR and CLKFX_FREEZE_TEMP_SLOPE and added typical values to $T_{CENTER\_LOW\_SPREAD}$ and $T_{CENTER\_HIGH\_SPREAD}$ . Updated and added values to <a href="#">Table 63</a> through <a href="#">Table 78</a> , and <a href="#">Table 81</a> . In <a href="#">Table 79</a> , revised the XC6SLX16-CSG324 and the XC6SLX45-CSG484 and FG(G)484 values.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

| Date     | Version | Description of Revisions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 06/14/10 | 1.5     | <p>In <a href="#">Table 2</a>, added note 5 and added temperature range to <math>V_{FS}</math> and <math>R_{FUSE}</math>. Removed speed grade delineation, revised <math>I_{RPD}</math> description, and updated note 2 in <a href="#">Table 4</a>. Added note 2 to <a href="#">Table 7</a>. Added <math>DIFF\_MOBILE\_DDR</math> to <a href="#">Table 8</a> and <a href="#">Table 10</a>. Added note 4 to <a href="#">Table 15</a>. Changed minimum <math>DV_{PPIN}</math> in <a href="#">Table 16</a>. Updated <math>F_{GTPDRCLK}</math> in <a href="#">Table 19</a>. Increased maximum <math>T_{LLSKEW}</math> in <a href="#">Table 22</a>. Updated descriptions and added data to <a href="#">Table 23</a>. Removed note 1 and added new data to the Networking Applications section in <a href="#">Table 25</a>. Updated <a href="#">Table 26</a> and <a href="#">Table 27</a> to the data in ISE v12.1 software with speed specification v1.08. In <a href="#">Table 28</a>, added <math>DIFF\_MOBILE\_DDR</math> and updated -4 speed grade data. Updated the maximum I/O pairs per bank in <a href="#">Table 33</a>. Updated note 2 on <a href="#">Table 39</a>. Revised the <math>F_{MAX}</math> in <a href="#">Table 44</a>. In <a href="#">Table 47</a>, updated description for <math>T_{SMCKCSO}</math>, revised values for <math>T_{POR}</math> and added Min value, added <math>T_{BPIICCK}</math> and <math>T_{SPIICCK}</math>. Also in <a href="#">Table 47</a>, added device dependencies to <math>F_{SMCKCK}</math> and <math>F_{RBCKCK}</math>. Updated and added data to <a href="#">Table 63</a> through <a href="#">Table 78</a>, and <a href="#">Table 81</a>. In <a href="#">Table 79</a>, added data on the XC6SLX45-FG(G)676 and revised the XC6SLX45T and XC6SLX150T values.</p> <p>The following changes to this specification are addressed in the product change notice <a href="#">XC6SLX45-FG(G)676</a>, <a href="#">MCB Performance and JTAG Revision Code for Spartan-6 LX16 and LX45 FPGAs</a>. In <a href="#">Table 2</a>, revised the <math>V_{CCINT}</math> to add the memory controller block extended performance specifications. In <a href="#">Table 25</a>, changed the standard specifications and added extended performance specifications for the memory controller block and note 2. Added note 4 and updated values in <a href="#">Table 34</a>.</p> |
| 06/24/10 | 1.6     | <p>Production release of XC6SLX45T (-2 and -3 speed grades), XC6SLX16 and XC6SLX45 (-3 speed grade) devices which includes changes to <a href="#">Table 26</a> and <a href="#">Table 27</a> (ISE v12.1 software with speed specification v1.08).</p> <p>Added the -3N speed grade, which designates Spartan-6 devices that do not support MCB functionality. This includes changes to <a href="#">Table 2</a> (note 2), <a href="#">Table 25</a> (note 4), and <a href="#">Switching Characteristics</a> (<a href="#">Table 26</a>).</p> <p>Updated <a href="#">Simultaneously Switching Outputs</a> discussion. Added -3 speed grade values for <math>T_{TAP}</math> and <math>F_{MINCAL}</math> values in <a href="#">Table 39</a>. In <a href="#">Table 40</a>, updated <math>T_{RPW}</math> (-2 and -3 speed grade) values and <math>F_{TOG}</math> (-3 speed grade) values. In <a href="#">Table 48</a>, updated <math>T_{GIO}</math> (-2 and -3 speed grade) values. Updated -3 values in spread spectrum section of <a href="#">Table 57</a>.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 07/16/10 | 1.7     | <p>Production release of specific devices listed in <a href="#">Table 26</a> and <a href="#">Table 27</a> using ISE v12.2 software with speed specification v1.11. Added note 4 advising designers of the patch which contains v1.11. Also updated the -1L speed specification to v1.04. Updated numerous -4 and -1L values. Added -4 <math>T_{TAP}</math> values and <math>F_{MINCAL}</math> to <a href="#">Table 39</a>. Revised <math>T_{CINCK}/T_{CKCIN}</math> in <a href="#">Table 40</a>. In <a href="#">Table 41</a>, revised <math>T_{SHCKO}</math>. In <a href="#">Table 42</a>, revised <math>T_{REQ}</math>. Added new -1L values to <a href="#">Table 47</a>. Added and updated values in <a href="#">Table 79</a>.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 07/26/10 | 1.8     | <p>Production release of XC6SLX25, XC6SLX25T, XC6SLX100 and XC6SLX100T in the specific speed grades listed in <a href="#">Table 26</a> and <a href="#">Table 27</a> using ISE v12.2 software with speed specification v1.11. Added note 7 to <a href="#">Table 2</a> and moved <math>V_{FS}</math> and <math>R_{FUSE}</math> to a new <a href="#">Table 3</a>. Added <math>I_{HS}</math> and note 4 to <a href="#">Table 4</a>. Added note 1 to <a href="#">Table 28</a>. Added and updated SSO limits per <math>V_{CCO}/GND</math> pairs in <a href="#">Table 34</a>. Added note 3 to <a href="#">Table 47</a>. In <a href="#">Table 54</a>, removed -1L specifications for <math>CLKOUT\_PER\_JITT\_DV1/2</math> and revised <math>CLKIN\_CLKFB\_PHASE</math> and <math>CLKOUT\_PHASE\_DLL</math> values. Updated note 3 in both <a href="#">Table 56</a> and <a href="#">Table 57</a>.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 08/23/10 | 1.9     | <p>Updated values for <math>F_{GTPRANGE1}</math>, <math>F_{GTPRANGE2}</math>, and <math>F_{GPLLMIN}</math> in <a href="#">Table 18</a>. Revised -3 and -4 values in <a href="#">Table 21</a>. Removed the -1L speed grade readback support restriction and note 3 in <a href="#">Table 47</a>.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 11/05/10 | 1.10    | <p>Production release of XC6SLX4 and XC6SLX9 in the specific speed grades listed in <a href="#">Table 26</a> and <a href="#">Table 27</a> using ISE v12.3 software with speed specification v1.12 for the -2 speed grade available in the 12.3 <i>Speed Files Patch</i>. Added note 3 advising designers of the patch which contains v1.12.</p> <p>In <a href="#">Table 2</a>, added note 4. In <a href="#">Table 4</a>, added note 2. In <a href="#">Table 10</a>, added notes 2 and 3. In <a href="#">Table 44</a>, added note 2. In <a href="#">Table 47</a>, updated symbol for <math>T_{SMWCKCK}/T_{SMCKCKW}</math>, changed -1L values for <math>T_{USERCCLKH}</math> and <math>T_{USERCCLKL}</math>, and added and revised the modes for <math>F_{MCKCK}</math> and <math>F_{SMCKCK}</math>. In <a href="#">Table 53</a>, redefined and expanded description for <math>CLKIN\_FREQ\_DLL</math> and rewrote note 3. Updated title of <a href="#">Table 58</a>. Also in <a href="#">Table 78</a>, revised <math>T_{DCD\_CLK}</math> for XC6SLX150 and XC6SLX150T. Changed description of <math>T_{PSFD}/T_{PHFD}</math> in <a href="#">Table 71</a>.</p> <p>For the -1L speed grade, updated data sheet to ISE 12.3 software with speed specification v1.05 which revised the values in the following tables: <a href="#">Table 25</a>, <a href="#">Table 28</a>, <a href="#">Table 35</a>, <a href="#">Table 36</a>, <a href="#">Table 37</a>, <a href="#">Table 40</a> through <a href="#">Table 43</a>, <a href="#">Table 48</a> through <a href="#">Table 56</a>, <a href="#">Table 62</a> through <a href="#">Table 78</a>, <a href="#">Table 80</a>, and <a href="#">Table 81</a>. Updated <a href="#">Notice of Disclaimer</a>.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |