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Understanding Embedded - Microprocessors

Embedded microprocessors are specialized computing chips designed to perform specific tasks within an embedded system. Unlike general-purpose microprocessors found in personal computers, embedded microprocessors are tailored for dedicated functions within larger systems, offering optimized performance, efficiency, and reliability. These microprocessors are integral to the operation of countless electronic devices, providing the computational power necessary for controlling processes, handling data, and managing communications.

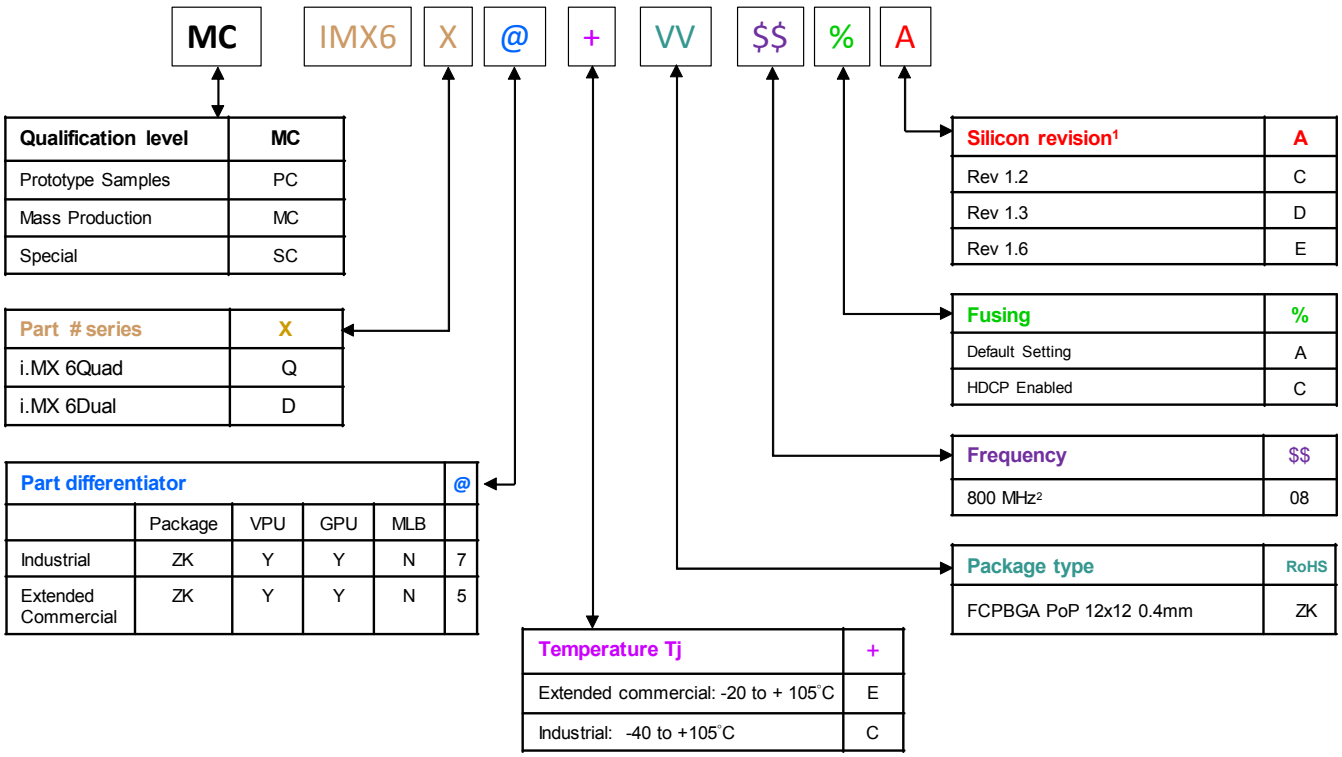
Applications of Embedded - Microprocessors

Embedded microprocessors are utilized across a broad spectrum of applications, making them indispensable in

Details	
Product Status	Active
Core Processor	ARM® Cortex®-A9
Number of Cores/Bus Width	2 Core, 32-Bit
Speed	800MHz
Co-Processors/DSP	Multimedia; NEON™ SIMD
RAM Controllers	LPDDR2, LVDDR3, DDR3
Graphics Acceleration	Yes
Display & Interface Controllers	Keypad, LCD
Ethernet	10/100/1000Mbps (1)
SATA	SATA 3Gbps (1)
USB	USB 2.0 + PHY (4)
Voltage - I/O	1.8V, 2.5V, 2.8V, 3.3V
Operating Temperature	-40°C ~ 105°C (TA)
Security Features	ARM TZ, Boot Security, Cryptography, RTIC, Secure Fusebox, Secure JTAG, Secure Memory, Secure RTC, Tamper Detection
Package / Case	569-LFBGA
Supplier Device Package	569-MAPBGA (12x12)
Purchase URL	https://www.e-xfl.com/product-detail/nxp-semiconductors/mcimx6d7czk08ad

- The i.MX 6Dual/6Quad Applications Processors for Consumer Products data sheet (IMX6DQCPOPEC) covers parts listed with “D (Commercial temp)” or “E (Extended Commercial temp)” and that uses the Package-on-Package.
- The i.MX 6Dual/6Quad Applications Processors for Industrial Products data sheet (IMX6DQIEC) covers parts listed with “C (Industrial temp)”

Ensure that you have the right data sheet for your specific part by checking the temperature grade (junction) field and matching it to the right data sheet. If you have questions, see nxp.com/imx6series or contact your NXP representative.



1. See the nxp.com\imx6series Web page for latest information on the available silicon revision.
2. If a 24 MHz input clock is used (required for USB), the maximum SoC speed is limited to 792 MHz.

Figure 1. Part Number Nomenclature—i.MX 6Dual PoP and 6Quad PoP

1.2 Features

The i.MX 6Dual/6Quad processors are based on ARM Cortex-A9 MPCore platform, which has the following features:

- ARM Cortex-A9 MPCore 4xCPU processor (with TrustZone®)
- The core configuration is symmetric, where each core includes:

3 Modules List

The i.MX 6Dual/6Quad processors contain a variety of digital and analog modules. Table 2 describes these modules in alphabetical order.

Table 2. i.MX 6Dual/6Quad Modules List

Block Mnemonic	Block Name	Subsystem	Brief Description
512 x 8 Fuse Box	Electrical Fuse Array	Security	Electrical Fuse Array. Enables to setup Boot Modes, Security Levels, Security Keys, and many other system parameters. The i.MX 6Dual/6Quad processors consist of 512x8-bit fuse box accessible through OCOTP_CTRL interface.
APBH-DMA	NAND Flash and BCH ECC DMA Controller	System Control Peripherals	DMA controller used for GPMI2 operation.
ARM	ARM Platform	ARM	The ARM Cortex-A9 platform consists of 4x (four) Cortex-A9 cores version r2p10 and associated sub-blocks, including Level 2 Cache Controller, SCU (Snoop Control Unit), GIC (General Interrupt Controller), private timers, Watchdog, and CoreSight debug modules.
ASRC	Asynchronous Sample Rate Converter	Multimedia Peripherals	The Asynchronous Sample Rate Converter (ASRC) converts the sampling rate of a signal associated to an input clock into a signal associated to a different output clock. The ASRC supports concurrent sample rate conversion of up to 10 channels of about -120dB THD+N. The sample rate conversion of each channel is associated to a pair of incoming and outgoing sampling rates. The ASRC supports up to three sampling rate pairs.
AUDMUX	Digital Audio Mux	Multimedia Peripherals	The AUDMUX is a programmable interconnect for voice, audio, and synchronous data routing between host serial interfaces (for example, SSI1, SSI2, and SSI3) and peripheral serial interfaces (audio and voice codecs). The AUDMUX has seven ports with identical functionality and programming models. A desired connectivity is achieved by configuring two or more AUDMUX ports.
BCH40	Binary-BCH ECC Processor	System Control Peripherals	The BCH40 module provides up to 40-bit ECC error correction for NAND Flash controller (GPMI).
CAAM	Cryptographic Accelerator and Assurance Module	Security	CAAM is a cryptographic accelerator and assurance module. CAAM implements several encryption and hashing functions, a run-time integrity checker, and a Pseudo Random Number Generator (PRNG). The pseudo random number generator is certified by Cryptographic Algorithm Validation Program (CAVP) of National Institute of Standards and Technology (NIST). Its DRBG validation number is 94 and its SHS validation number is 1455. CAAM also implements a Secure Memory mechanism. In i.MX 6Dual/6Quad processors, the security memory provided is 16 KB.
CCM GPC SRC	Clock Control Module, General Power Controller, System Reset Controller	Clocks, Resets, and Power Control	These modules are responsible for clock and reset distribution in the system, and also for the system power management.

Table 8. Maximum Supply Currents

Power Supply	Conditions	Maximum Current		Unit
		Power Virus	CoreMark	
i.MX 6Quad: VDD_ARM_IN + VDD_ARM23_IN	• ARM frequency = 792 MHz • ARM LDOs set to 1.3V • T_j = 105°C	3270	2090	mA
i.MX 6Dual: VDD_ARM_IN	• ARM frequency = 792 MHz • ARM LDOs set to 1.3V • T_j = 105°C	1960	1250	mA
i.MX 6Dual or i.MX 6Quad: VDD_SOC_IN	• GPU frequency = 600 MHz • SOC LDO set to 1.3 V • T_j = 105°C	2370		mA
VDD_HIGH_IN	—	125[1]		mA
VDD_SNVS_IN	—	275[2]		µA
USB_OTG_VBUS/ USB_H1_VBUS (LDO 3P0)	—	25[3]		mA
Primary Interface (IO) Supplies				
NVCC_DRAM	—	(see note[4])		
NVCC_ENET	N=10	Use maximum IO equation[5]		
NVCC_LCD	N=29	Use maximum IO equation[5]		
NVCC_GPIO	N=24	Use maximum IO equation[5]		
NVCC_CSI	N=20	Use maximum IO equation[5]		
NVCC_EIM0	N=19	Use maximum IO equation[5]		
NVCC_EIM1	N=14	Use maximum IO equation[5]		
NVCC_EIM2	N=20	Use maximum IO equation[5]		
NVCC_JTAG	N=6	Use maximum IO equation[5]		
NVCC_RGMII	N=6	Use maximum IO equation[5]		
NVCC_SD1	N=6	Use maximum IO equation[5]		
NVCC_SD2	N=6	Use maximum IO equation[5]		
NVCC_SD3	N=11	Use maximum IO equation[5]		
NVCC_NANDF	N=26	Use maximum IO equation[5]		
NVCC_MIPI	—	25.5		mA
NVCC_LVDS2P5	—	NVCC_LVDS2P5 is connected to VDD_HIGH_CAP at the board level. VDD_HIGH_CAP is capable of handing the current required by NVCC_LVDS2P5.		

Table 11. SATA PHY Current Drain (continued)

Mode	Test Conditions	Supply	Typical Current	Unit
P1: Transmitter idle, Rx powered down, LOS disabled	Single Transceiver	SATA_VP	0.67	mA
		SATA_VPH	0.23	
	Clock Module	SATA_VP	6.9	
		SATA_VPH	6.2	
P2: Powered-down state, only LOS and POR enabled	Single Transceiver	SATA_VP	0.53	mA
		SATA_VPH	0.11	
	Clock Module	SATA_VP	0.036	
		SATA_VPH	0.12	
PDDQ mode[3]	Single Transceiver	SATA_VP	0.13	mA
		SATA_VPH	0.012	
	Clock Module	SATA_VP	0.008	
		SATA_VPH	0.004	

1 Programmed for 1.0 V peak-to-peak Tx level.

2 Programmed for 0.9 V peak-to-peak Tx level with no boost or attenuation.

3 LOW power non-functional.

4.1.9 PCIe 2.0 Maximum Power Consumption

Table 12 provides PCIe PHY currents for certain operating modes.

Table 12. PCIe PHY Current Drain

Mode	Test Conditions	Supply	Max Current	Unit
P0: Normal Operation	5G Operations	PCIE_VP (1.1 V)	40	mA
		PCIE_VPTX (1.1 V)	20	
		PCIE_VPH (2.5 V)	21	
	2.5G Operations	PCIE_VP (1.1 V)	27	
		PCIE_VPTX (1.1 V)	20	
		PCIE_VPH (2.5 V)	20	
P0s: Low Recovery Time Latency, Power Saving State	5G Operations	PCIE_VP (1.1 V)	30	mA
		PCIE_VPTX (1.1 V)	2.4	
		PCIE_VPH (2.5 V)	18	
	2.5G Operations	PCIE_VP (1.1 V)	20	
		PCIE_VPTX (1.1 V)	2.4	
		PCIE_VPH (2.5 V)	18	

Table 19. OSC32K Main Characteristics

Parameter	Min	Typ	Max	Comments
Fosc	—	32.768 kHz	—	This frequency is nominal and determined mainly by the crystal selected. 32.0 K would work as well.
Current consumption	—	4 μA	—	The typical value shown is only for the oscillator, driven by an external crystal. If the internal ring oscillator is used instead of an external crystal, then approximately 25 μA must be added to this value.
Bias resistor	—	14 MΩ	—	This the integrated bias resistor that sets the amplifier into a high gain state. Any leakage through the ESD network, external board leakage, or even a scope probe that is significant relative to this value will debias the amplifier. The debiasing will result in low gain, and will impact the circuit's ability to start up and maintain oscillations.
Target Crystal Properties				
Cload	—	10 pF	—	Usually crystals can be purchased tuned for different Cloads. This Cload value is typically 1/2 of the capacitances realized on the PCB on either side of the quartz. A higher Cload will decrease oscillation margin, but increases current oscillating through the crystal.
ESR	—	50 kΩ	100 kΩ	Equivalent series resistance of the crystal. Choosing a crystal with a higher value will decrease the oscillating margin.

4.6 I/O DC Parameters

This section includes the DC parameters of the following I/O types:

- General Purpose I/O (GPIO)
- Double Data Rate I/O (DDR) for LPDDR2
- LVDS I/O

NOTE

The term ‘OVDD’ in this section refers to the associated supply rail of an input or output.

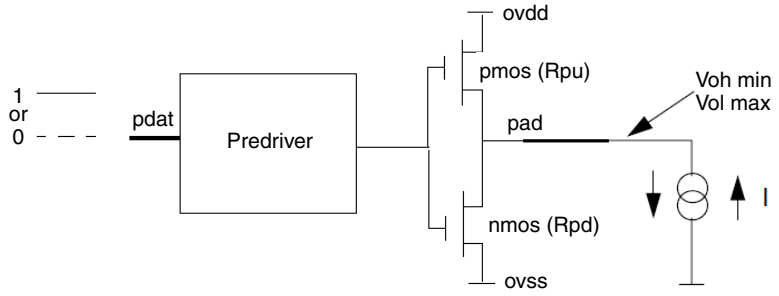


Figure 3. Circuit for Parameters Voh and Vol for I/O Cells

Table 36. EIM Asynchronous Timing Parameters Relative to Chip Select[1, 2] (continued)

Ref No.	Parameter	Determination by Synchronous measured parameters	Min	Max	Unit
WE40	EIM_LBA_B Invalid to EIM_CSx_B Invalid (ADVL is asserted)	WE7-WE15-CSN×t	-3.5-CSN×t	3.5-CSN×t	ns
WE40A (muxed A/D)	EIM_CSx_B Valid to EIM_LBA_B Invalid	WE14-WE6+(ADVN+ADVA+1-CSA)×t	-3.5+(ADVN+ADVA+1-CSA)×t	3.5+(ADVN+ADVA+1-CSA)×t	ns
WE41	EIM_CSx_B Valid to Output Data Valid	WE16-WE6-WCSA×t	-3.5-WCSA×t	3.5-WCSA×t	ns
WE41A (muxed A/D)	EIM_CSx_B Valid to Output Data Valid	WE16-WE6+(WADVN+WADVA+ADH+1-WCSA)×t	-3.5+(WADVN+WADVA+ADH+1-WCSA)×t	3.5+(WADVN+WADVA+ADH+1-WCSA)×t	ns
WE42	Output Data Invalid to EIM_CSx_B Invalid	WE17-WE7-CSN×t	-3.5-CSN×t	3.5-CSN×t	ns
MAXCO	Output maximum delay from internal driving EIM_ADDRxx/control flip-flops to chip outputs.	10	—	10	ns
MAXCSO	Output maximum delay from internal chip selects driving flip-flops to EIM_CSx_B out.	10	—	10	ns
MAXDI	EIM_DATAxx MAXIMUM delay from chip input data to its internal flip-flop	5	—	5	ns
WE43	Input Data Valid to EIM_CSx_B Invalid	MAXCO-MAXCSO+MAXDI	MAXCO-MAXCSO+MAXDI	—	ns
WE44	EIM_CSx_B Invalid to Input Data Invalid	0	0	—	ns
WE45	EIM_CSx_B Valid to EIM_EBx_B Valid (Write access)	WE12-WE6+(WBEA-WCSA)×t	-3.5+(WBEA-WCSA)×t	3.5+(WBEA-WCSA)×t	ns
WE46	EIM_EBx_B Invalid to EIM_CSx_B Invalid (Write access)	WE7-WE13+(WBEN-WCSN)×t	-3.5+(WBEN-WCSN)×t	3.5+(WBEN-WCSN)×t	ns
MAXDTI	Maximum delay from EIM_DTACK_B input to its internal flip-flop + 2 cycles for synchronization	10	—	10	ns
WE47	EIM_DTACK_B Active to EIM_CSx_B Invalid	MAXCO-MAXCSO+MAXDTI	MAXCO-MAXCSO+MAXDTI	—	ns
WE48	EIM_CSx_B Invalid to EIM_DTACK_B invalid	0	0	—	ns

1 For more information on configuration parameters mentioned in this table, see the i.MX 6Dual/6Quad reference manual (IMX6DQRM).

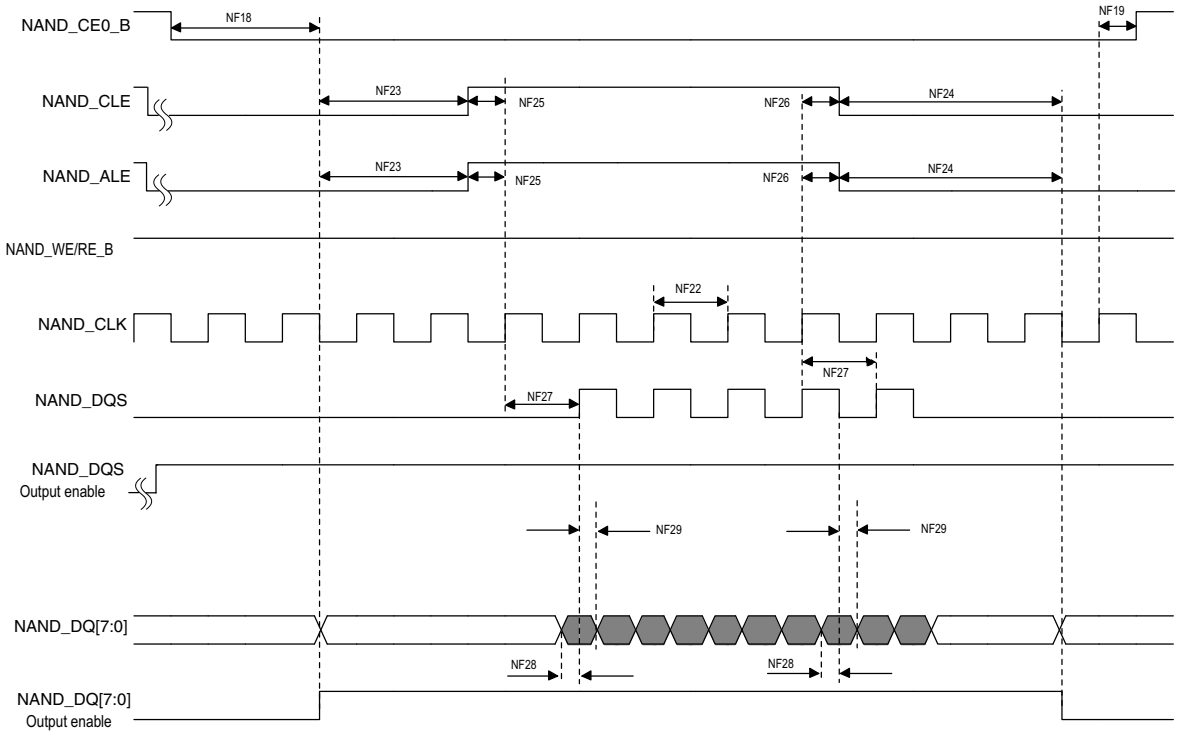


Figure 28. Source Synchronous Mode Data Write Timing Diagram

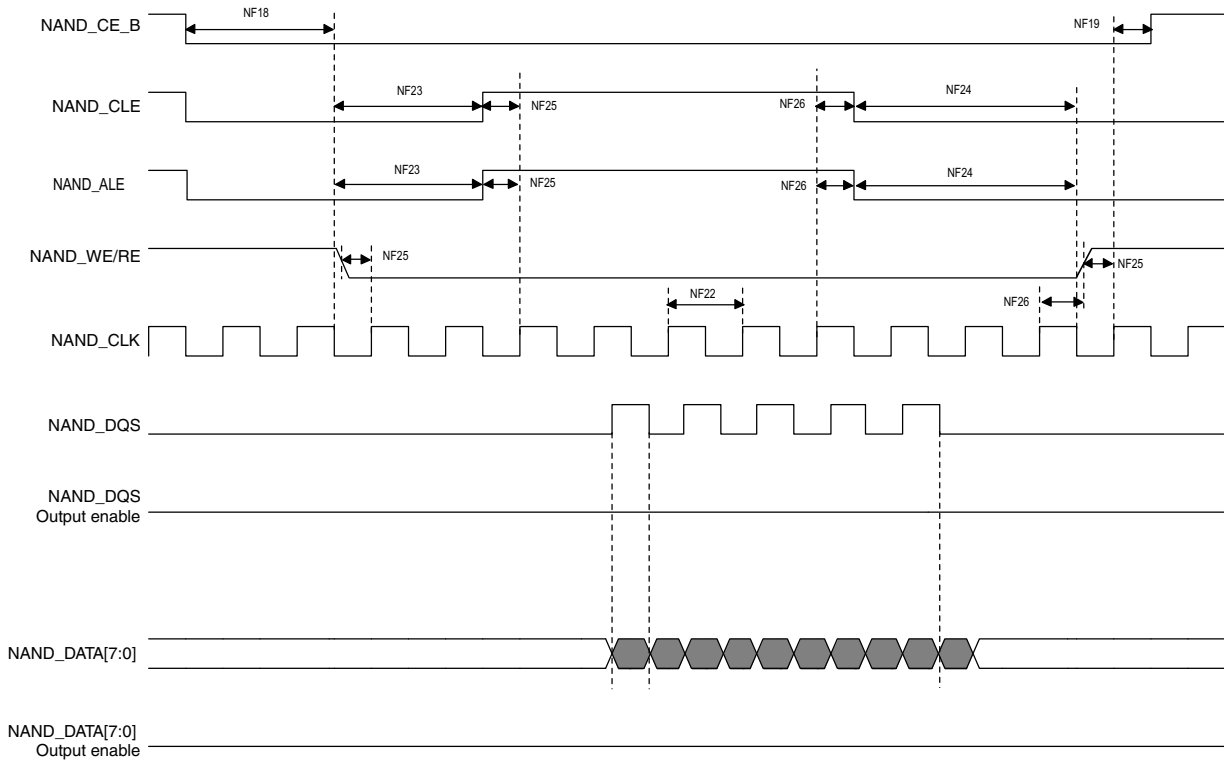


Figure 29. Source Synchronous Mode Data Read Timing Diagram

4.12.5.3 RGMII Signal Switching Specifications

The following timing specifications meet the requirements for RGMII interfaces for a range of transceiver devices.

Table 52. RGMII Signal Switching Specifications[1]

Symbol	Description	Min	Max	Unit
T_{cyc}[2]	Clock cycle duration	7.2	8.8	ns
T_{skewT}[3]	Data to clock output skew at transmitter	-100	900	ps
T_{skewR}[3]	Data to clock input skew at receiver	1	2.6	ns
Duty_G[4]	Duty cycle for Gigabit	45	55	%
Duty_T[4]	Duty cycle for 10/100T	40	60	%
Tr/Tf	Rise/fall time (20–80%)	—	0.75	ns

1 The timings assume the following configuration:
DDR_SEL = (11)b
DSE (drive-strength) = (111)b

2 For 10 Mbps and 100 Mbps, T_{cyc} will scale to 400 ns ±40 ns and 40 ns ±4 ns respectively.

3 For all versions of RGMII prior to 2.0; This implies that PC board design will require clocks to be routed such that an additional delay of greater than 1.2 ns and less than 1.7 ns will be added to the associated clock signal. For 10/100, the max value is unspecified.

4 Duty cycle may be stretched/shrunk during speed changes or while transitioning to a received packet's clock domain as long as minimum duty cycle is not violated and stretching occurs for no more than three Tcyc of the lowest speed transitioned between.

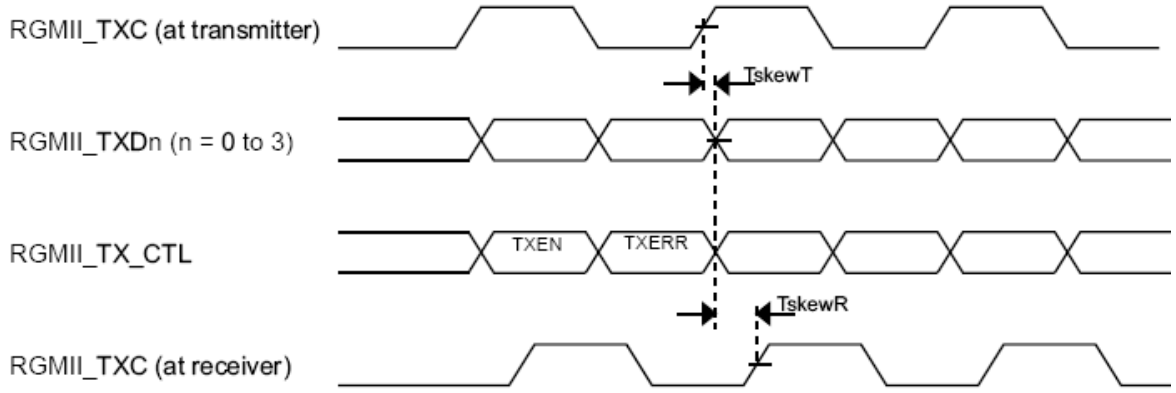


Figure 45. RGMII Transmit Signal Timing Diagram Original

Table 58. Video Signal Cross-Reference (continued)

i.MX 6Dual/6Quad	LCD							Comment[1,2]
Port Name (x = 0, 1)	RGB, Signal Name (General)	RGB/TV Signal Allocation (Example)						
		16-bit RGB	18-bit RGB	24 Bit RGB	8-bit YCrCb[3]	16-bit YCrCb	20-bit YCrCb	
IPUx_DISPx_DAT05	DAT[5]	G[0]	B[5]	B[5]	Y/C[5]	C[5]	C[5]	—
IPUx_DISPx_DAT06	DAT[6]	G[1]	G[0]	B[6]	Y/C[6]	C[6]	C[6]	—
IPUx_DISPx_DAT07	DAT[7]	G[2]	G[1]	B[7]	Y/C[7]	C[7]	C[7]	—
IPUx_DISPx_DAT08	DAT[8]	G[3]	G[2]	G[0]	—	Y[0]	C[8]	—
IPUx_DISPx_DAT09	DAT[9]	G[4]	G[3]	G[1]	—	Y[1]	C[9]	—
IPUx_DISPx_DAT10	DAT[10]	G[5]	G[4]	G[2]	—	Y[2]	Y[0]	—
IPUx_DISPx_DAT11	DAT[11]	R[0]	G[5]	G[3]	—	Y[3]	Y[1]	—
IPUx_DISPx_DAT12	DAT[12]	R[1]	R[0]	G[4]	—	Y[4]	Y[2]	—
IPUx_DISPx_DAT13	DAT[13]	R[2]	R[1]	G[5]	—	Y[5]	Y[3]	—
IPUx_DISPx_DAT14	DAT[14]	R[3]	R[2]	G[6]	—	Y[6]	Y[4]	—
IPUx_DISPx_DAT15	DAT[15]	R[4]	R[3]	G[7]	—	Y[7]	Y[5]	—
IPUx_DISPx_DAT16	DAT[16]	—	R[4]	R[0]	—	—	Y[6]	—
IPUx_DISPx_DAT17	DAT[17]	—	R[5]	R[1]	—	—	Y[7]	—
IPUx_DISPx_DAT18	DAT[18]	—	—	R[2]	—	—	Y[8]	—
IPUx_DISPx_DAT19	DAT[19]	—	—	R[3]	—	—	Y[9]	—
IPUx_DISPx_DAT20	DAT[20]	—	—	R[4]	—	—	—	—
IPUx_DISPx_DAT21	DAT[21]	—	—	R[5]	—	—	—	—
IPUx_DISPx_DAT22	DAT[22]	—	—	R[6]	—	—	—	—
IPUx_DISPx_DAT23	DAT[23]	—	—	R[7]	—	—	—	—
IPUx_DIx_DISP_CLK	PixCLK							—
IPUx_DIx_PIN01	—							May be required for anti-tearing
IPUx_DIx_PIN02	HSYNC							—
IPUx_DIx_PIN03	VSYNC							VSYNC out

Table 59 shows timing characteristics of signals presented in Figure 61 and Figure 62.

Table 59. Synchronous Display Interface Timing Characteristics (Pixel Level)

ID	Parameter	Symbol	Value	Description	Unit
IP5	Display interface clock period	Tdicp	(see[1])	Display interface clock IPP_DISP_CLK	ns
IP6	Display pixel clock period	Tdpcp	DISP_CLK_PER_PIXEL × Tdicp	Time of translation of one pixel to display, DISP_CLK_PER_PIXEL—number of pixel components in one pixel (1.***n***). The DISP_CLK_PER_PIXEL is virtual parameter to define display pixel clock period. The DISP_CLK_PER_PIXEL is received by DC/DI one access division to ***n*** components.	ns
IP7	Screen width time	Tsw	(SCREEN_WIDTH) × Tdicp	SCREEN_WIDTH—screen width in, interface clocks. horizontal blanking included. The SCREEN_WIDTH should be built by suitable DI's counter[2].	ns
IP8	HSYNC width time	Thsw	(HSYNC_WIDTH)	HSYNC_WIDTH—Hsync width in DI_CLK with 0.5 DI_CLK resolution. Defined by DI's counter.	ns
IP9	Horizontal blank interval 1	Thbi1	BGXP × Tdicp	BGXP—width of a horizontal blanking before a first active data in a line (in interface clocks). The BGXP should be built by suitable DI's counter.	ns
IP10	Horizontal blank interval 2	Thbi2	(SCREEN_WIDTH – BGXP – FW) × Tdicp	Width a horizontal blanking after a last active data in a line (in interface clocks) FW—with of active line in interface clocks. The FW should be built by suitable DI's counter.	ns
IP12	Screen height	Tsh	(SCREEN_HEIGHT) × Tsw	SCREEN_HEIGHT— screen height in lines with blanking. The SCREEN_HEIGHT is a distance between 2 VSYNCs. The SCREEN_HEIGHT should be built by suitable DI's counter.	ns
IP13	VSYNC width	Tvsw	VSYNC_WIDTH	VSYNC_WIDTH—Vsync width in DI_CLK with 0.5 DI_CLK resolution. Defined by DI's counter.	ns
IP14	Vertical blank interval 1	Tvbi1	BGYP × Tsw	BGYP—width of first Vertical blanking interval in line. The BGYP should be built by suitable DI's counter.	ns
IP15	Vertical blank interval 2	Tvbi2	(SCREEN_HEIGHT – BGYP – FH) × Tsw	Width of second vertical blanking interval in line. The FH should be built by suitable DI's counter.	ns

Figure 63 depicts the synchronous display interface timing for access level. The DISP_CLK_DOWN and DISP_CLK_UP parameters are register-controlled. Table 60 lists the synchronous display interface timing characteristics.

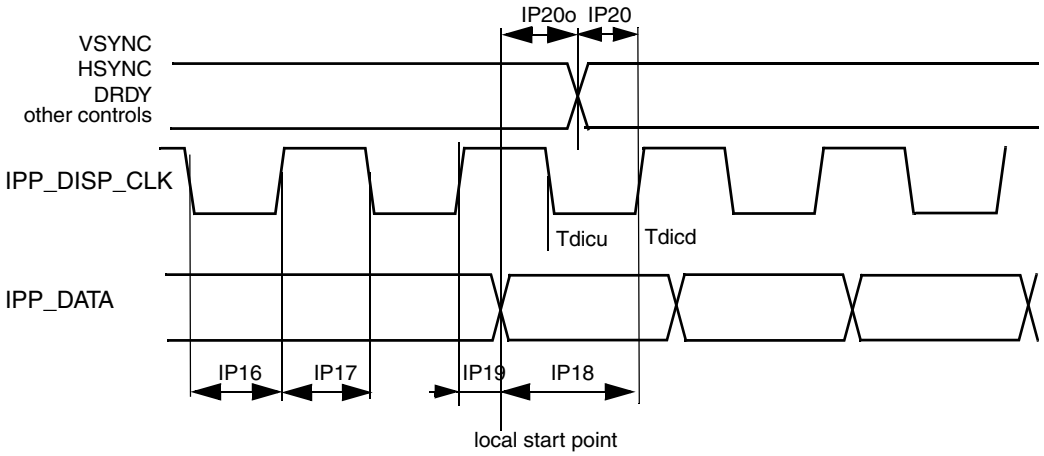


Figure 63. Synchronous Display Interface Timing Diagram—Access Level

Table 60. Synchronous Display Interface Timing Characteristics (Access Level)

ID	Parameter	Symbol	Min	Typ[1]	Max	Unit
IP16	Display interface clock low time	Tckl	Tdicd-Tdicu-1.24	Tdicd[2]-Tdicu[3]	Tdicd-Tdicu+1.24	ns
IP17	Display interface clock high time	Tckh	Tdicp-Tdicd+Tdicu-1.24	Tdicp-Tdicd+Tdicu	Tdicp-Tdicd+Tdicu+1.2	ns
IP18	Data setup time	Tdsu	Tdicd-1.24	Tdicu	—	ns
IP19	Data holdup time	Tdhd	Tdicp-Tdicd-1.24	Tdicp-Tdicu	—	ns
IP20o	Control signals offset times (defined for each pin)	Tocsu	Tocsu-1.24	Tocsu	Tocsu+1.24	ns
IP20	Control signals setup time to display interface clock (defined for each pin)	Tcsu	Tdicd-1.24-Tocsu%Tdicp	Tdicu	—	ns

[1]The exact conditions have not been finalized, but will likely match the current customer requirement for their specific display. These conditions may be chip specific.

[2] Display interface clock down time

$$\mathrm{Tdicd} = \frac{1}{2}\left(\mathrm{T_{diclk}} \times \mathrm{ceil}\left[\frac{2 \times \mathrm{DISP\_CLK\_DOWN}}{\mathrm{DI\_CLK\_PERIOD}}\right]\right)$$

[3] Display interface clock up time where CEIL(X) rounds the elements of X to the nearest integers towards infinity.

$$\mathrm{Tdicu} = \frac{1}{2}\left(\mathrm{T_{diclk}} \times \mathrm{ceil}\left[\frac{2 \times \mathrm{DISP\_CLK\_UP}}{\mathrm{DI\_CLK\_PERIOD}}\right]\right)$$

Table 62. Electrical and Timing Information (continued)

Symbol	Parameters	Test Conditions	Min	Typ	Max	Unit
HS Line Drivers DC Specifications						
$\|V_{OD}\|$	HS Transmit Differential output voltage magnitude	80 Ω<= RL< = 125 Ω	140	200	270	mV
$\Delta\|V_{OD}\|$	Change in Differential output voltage magnitude between logic states	80 Ω<= RL< = 125 Ω	—	—	10	mV
V_{CMTX}	Steady-state common-mode output voltage.	80 Ω<= RL< = 125 Ω	150	200	250	mV
$\Delta V_{CMTX}(1,0)$	Changes in steady-state common-mode output voltage between logic states	80 Ω<= RL< = 125 Ω	—	—	5	mV
V_{OHHS}	HS output high voltage	80 Ω<= RL< = 125 Ω	—	—	360	mV
Z_{OS}	Single-ended output impedance.	—	40	50	62.5	Ω
ΔZ_{OS}	Single-ended output impedance mismatch.	—	—	—	10	%
LP Line Drivers DC Specifications						
V_{OL}	Output low-level SE voltage	—	-50		50	mV
V_{OH}	Output high-level SE voltage	—	1.1	1.2	1.3	V
Z_{OLP}	Single-ended output impedance.	—	110	—	—	Ω
$\Delta Z_{OLP(01-10)}$	Single-ended output impedance mismatch driving opposite level	—	—	—	20	%
$\Delta Z_{OLP(0-11)}$	Single-ended output impedance mismatch driving same level	—	—	—	5	%
HS Line Receiver DC Specifications						
V_{IDTH}	Differential input high voltage threshold	—	—	—	70	mV
V_{IDTL}	Differential input low voltage threshold	—	-70	—	—	mV
V_{IHHS}	Single ended input high voltage	—	—	—	460	mV
V_{ILHS}	Single ended input low voltage	—	-40	—	—	mV
V_{CMRXDC}	Input common mode voltage	—	70	—	330	mV
Z_{ID}	Differential input impedance	—	80	—	125	Ω

Table 63. Electrical and Timing Information (continued)

Symbol	Parameters	Test Conditions	Min	Typ	Max	Unit
t_{CDC}	DDR CLK duty cycle	$t_{CDC} = t_{CPH} / P_{DDRCLK}$	—	50	—	%
t_{CPH}	DDR CLK high time	—	—	1	—	UI
t_{CPL}	DDR CLK low time	—	—	1	—	UI
—	DDR CLK / DATA Jitter	—	—	75	—	ps pk-pk
$t_{SKEW[PN]}$	Intra-Pair (Pulse) skew	—	—	0.075	—	UI
$t_{SKEW[TX]}$	Data to Clock Skew	—	0.350	—	0.650	UI
t_r	Differential output signal rise time	20% to 80%, RL = 50 Ω	150	—	0.3UI	ps
t_f	Differential output signal fall time	20% to 80%, RL = 50 Ω	150	—	0.3UI	ps
$\Delta V_{CMTX(HF)}$	Common level variation above 450 MHz	80 Ω<= RL< = 125 Ω	—	—	15	mV_{rms}
$\Delta V_{CMTX(LF)}$	Common level variation between 50 MHz and 450 MHz	80 Ω<= RL< = 125 Ω	—	—	25	mV_p
LP Line Drivers AC Specifications						
t_{rlp}, t_{flp}	Single ended output rise/fall time	15% to 85%, C_L<70 pF	—	—	25	ns
t_{reo}	—	30% to 85%, C_L<70 pF	—	—	35	ns
$\delta V/\delta t_{SR}$	Signal slew rate	15% to 85%, C_L<70 pF	—	—	120	mV/ns
C_L	Load capacitance	—	0	—	70	pF
HS Line Receiver AC Specifications						
$t_{SETUP[RX]}$	Data to Clock Receiver Setup time	—	0.15	—	—	UI
$t_{HOLD[RX]}$	Clock to Data Receiver Hold time	—	0.15	—	—	UI
$\Delta V_{CMRX(HF)}$	Common mode interference beyond 450 MHz	—	—	—	200	mVpp
$\Delta V_{CMRX(LF)}$	Common mode interference between 50 MHz and 450 MHz	—	-50	—	50	mVpp
C_{CM}	Common mode termination	—	—	—	60	pF
LP Line Receiver AC Specifications						
e_{SPIKE}	Input pulse rejection	—	—	—	300	Vps
T_{MIN}	Minimum pulse response	—	50	—	—	ns
V_{INT}	Pk-to-Pk interference voltage	—	—	—	400	mV
f_{INT}	Interference frequency	—	450	—	—	MHz
Model Parameters used for Driver Load switching performance evaluation						
C_{PAD}	Equivalent Single ended I/O PAD capacitance.	—	—	—	1	pF
C_{PIN}	Equivalent Single ended Package + PCB capacitance.	—	—	—	2	pF

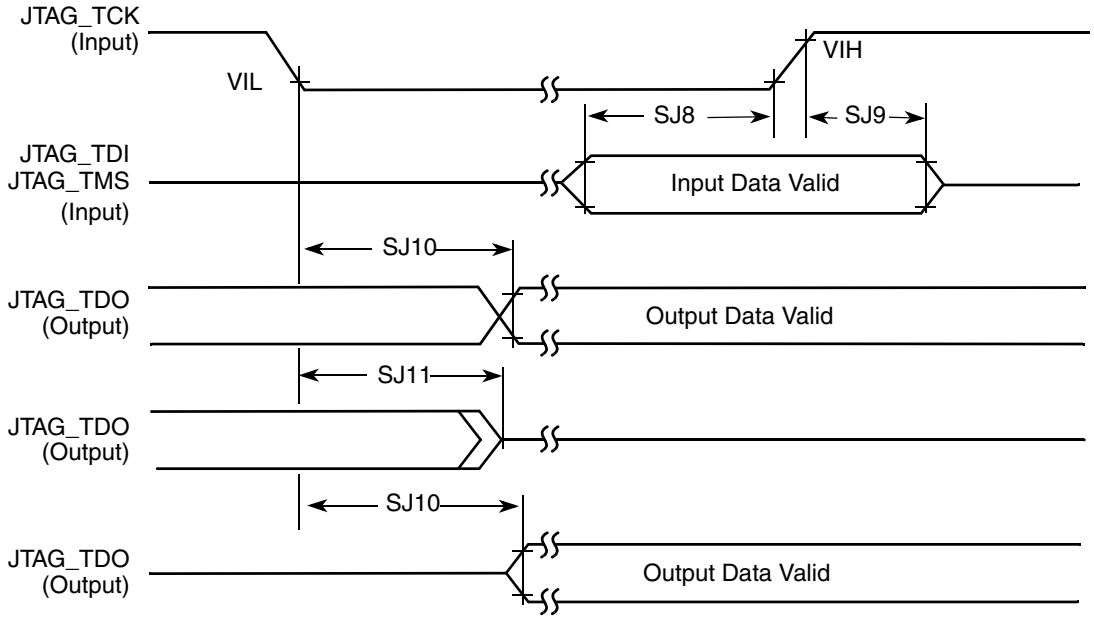


Figure 82. Test Access Port Timing Diagram

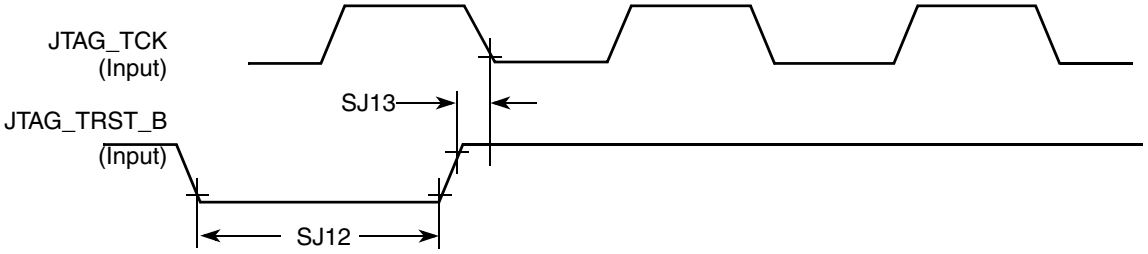


Figure 83. JTAG_TRST_B Timing Diagram

Table 68. JTAG Timing

ID	Parameter[1,2]	All Frequencies		Unit
		Min	Max	
SJ0	JTAG_TCK frequency of operation $1/(3xT_{DC})$[1]	0.001	22	MHz
SJ1	JTAG_TCK cycle time in crystal mode	45	—	ns
SJ2	JTAG_TCK clock pulse width measured at V_M[2]	22.5	—	ns
SJ3	JTAG_TCK rise and fall times	—	3	ns
SJ4	Boundary scan input data set-up time	5	—	ns
SJ5	Boundary scan input data hold time	24	—	ns
SJ6	JTAG_TCK low to output data valid	—	40	ns
SJ7	JTAG_TCK low to output high impedance	—	40	ns
SJ8	JTAG_TMS, JTAG_TDI data set-up time	5	—	ns

6 Package Information and Contact Assignments

This section includes the contact assignment information and mechanical package drawing.

6.1 Signal Naming Convention

The signal names of the i.MX6 series of products are standardized to align the signal names within the family and across the documentation. Benefits of this standardization are as follows:

- Signal names are unique within the scope of an SoC and within the series of products
- Searches will return all occurrences of the named signal
- Signal names are consistent between i.MX 6 series products implementing the same modules
- The module instance is incorporated into the signal name

This standardization applies only to signal names. The ball names are preserved to prevent the need to change schematics, BSDL models, IBIS models, and so on.

Throughout this document, the signal names are used except where referenced as a ball name (such as the Functional Contact Assignments table, Ball Map table, and so on). A master list of signal names is in the document, *IMX 6 Series Standardized Signal Name Map* (EB792). This list can be used to map the signal names used in older documentation to the standardized naming conventions.

6.2 12 x 12 mm Package on Package (PoP) Information

This section contains the outline drawing, signal assignment map, ground/power reference ID (by ball grid location) for the 12 x 12 mm, 0.4 mm pitch PoP package.

Table 87. PoP 12 x 12 mm, 0.4 mm Pitch Top Ball Map (continued)

Y	W	V	U	T	R	P	N
POP_VDDQ	DRAM_D5P0	DRAM_D4P0	POP_VDDQ	POP_VDD2__5	POP_VDD1__4	GND	DRAM_D1P0
DRAM_D3P0	DRAM_D6P0	GND	DRAM_D0P0	POP_VDD2__5	DRAM_VREF	GND	POP_VDD1__4
DRAM_CS0P0	DRAM_CA4P0	GND	DRAM_VREF	POP_VDDCA	GND	POP_VDD2__4	DRAM_D29P1
DRAM_CKE1P0	DRAM_CS1P0	DRAM_CA3P0	DRAM_CA2P0	DRAM_CA1P0	DRAM_CA0P0	POP_VDD1__5	DRAM_D25P1

Table 87. PoP 12 x 12 mm, 0.4 mm Pitch Top Ball Map (continued)

AG	AF	AE	AD	AC	AB	AA
DRAM_D10P0	DRAM_D14P0	DRAM_D12P0	DRAM_DQS1P0_B	POP_VDDQ	DRAM_DM0P0	DRAM_DQS0P0
DRAM_D13P0	POP_VDDQ	GND	DRAM_DQS1P0	DRAM_DM1P0	GND	DRAM_DQS0P0_B
POP_VDD2__8	GND	DRAM_CA8P0	DRAM_CA7P0	POP_VDDCA	DRAM_CLKP0	GND
POP_ZQP0	DRAM_CA9P0	POP_VDDCA	DRAM_CA6P0	DRAM_CA5P0	DRAM_CLKP0_B	DRAM_CKE0P0

Table 88. PoP 12 x 12 mm, 0.4 mm Pitch Bottom Ball Map (continued)

AA	Y	W	V	U	T	R	P
CSI0_VSYNC	CSI0_DAT6	CSI0_DAT9	CSI0_DAT11	CSI0_DAT17	CSI0_DAT18	HDMI_HPD	HDMI_D2M
CSI0_MCLK	CSI0_DAT7	CSI0_DAT8	CSI0_DAT15	CSI0_DAT14	CSI0_DAT16	HDMI_DDCCEC	HDMI_D2P
GPIO_18	POP_VDDQ	CSI0_DAT10	CSI0_DAT12	POP_VDDQ	POP_VDD2__5	CSI0_DAT19	POP_VDD1__4
GPIO_1	GPIO_4	GPIO_2	CSI0_DATA_EN	CSI0_DAT4	CSI0_DAT13	VDDSOC_CAP	HDMI_REF
NVCC_LVDS2P5	KEY_COL1	NVCC_GPIO	GPIO_8	CSI0_DAT5	NVCC_CSI	VDDSOC_CAP	VDD_CACHE_CAP
	VDDSOC_CAP	VDDSOC_CAP	GND	GND	VDDARM23_CAP	VDDARM23_CAP	VDDARM23_CAP
	VDDSOC_CAP	VDDSOC_CAP	GND	GND	VDDARM23_CAP	VDDARM23_CAP	VDDARM23_CAP
	VDDSOC_CAP	VDDSOC_CAP	GND	GND	VDDARM23_CAP	VDDARM23_CAP	VDDARM23_CAP
	GND	GND	GND	GND	VDDARM23_CAP	VDDARM23_CAP	VDDARM23_CAP
	GND	GND	GND	GND	GND	GND	GND
	VDDSOC_CAP	VDDSOC_CAP	GND	GND	VDDARM_CAP	VDDARM_CAP	VDDARM_CAP
	VDDSOC_CAP	VDDSOC_CAP	GND	GND	VDDARM_CAP	VDDARM_CAP	VDDARM_CAP
	GND	GND	GND	GND	VDDARM_CAP	VDDARM_CAP	VDDARM_CAP
	GND	GND	GND	GND	VDDARM_CAP	VDDARM_CAP	VDDARM_CAP
	VDDSOC_IN	VDDSOC_IN	VDDPU_CAP	VDDPU_CAP	GND	GND	VDDPU_CAP
	VDDSOC_IN	VDDSOC_IN	VDDPU_CAP	VDDPU_CAP	GND	GND	VDDPU_CAP
NVCC_DRAM	NVCC_DRAM	NVCC_ENET	DISP0_DAT3	DISP0_DAT6	NVCC_LCD	EIM_DA13	NVCC_EIM2
DISP0_DAT19	DISP0_DAT22	DI0_PIN3	DISP0_DAT4	DI0_PIN4	EIM_DA6	EIM_DA7	EIM_EB1
EIM_BCLK	EIM_DA12	EIM_DA4	EIM_DA1	EIM_RW	POP_VDDCA	POP_VDD1__5	POP_VDD2__4
EIM_DA15	EIM_DA10	EIM_DA5	EIM_DA0	EIM_CS1	EIM_OE	EIM_A19	EIM_A22
DRAM_CKE0P0	DRAM_CKE1P0	EIM_DA2	EIM_LBA	EIM_CS0	EIM_A16	EIM_A20	EIM_A21

Table 88. PoP 12 x 12 mm, 0.4 mm Pitch Bottom Ball Map (continued)

AJ	AH	AG	AF	AE	AD	AC	AB
GND	LVDS0_TX1_P	LVDS0_TX0_P	KEY_COL4	GPIO_3	CSI0_PIXCLK	GPIO_7	GPIO_19
GND	LVDS0_TX1_N	LVDS0_TX0_N	KEY_ROW2	GPIO_0	GPIO_9	GPIO_17	GPIO_16
LVDS0_TX2_P	LVDS0_TX2_N	POP_VDD1__6	POP_VDDQ	KEY_ROW3	KEY_ROW1	POP_VDDQ	GPIO_5
LVDS0_CLK_P	LVDS0_CLK_N	POP_VDD2__6					
LVDS0_TX3_P	LVDS0_TX3_N	GND					
LVDS1_TX0_N	LVDS1_TX0_P	POP_VDDQ			KEY_COL3	GPIO_6	KEY_COL0
LVDS1_TX1_P	LVDS1_TX1_N	GND			KEY_COL2	KEY_ROW4	KEY_ROW0
LVDS1_CLK_N	LVDS1_CLK_P	GND			NVCC_DRAM	NVCC_DRAM	
LVDS1_TX2_N	LVDS1_TX2_P	POP_VDDQ			NVCC_DRAM	NVCC_DRAM	
LVDS1_TX3_N	LVDS1_TX3_P	DRAM_VREF			NVCC_DRAM	NVCC_DRAM	
GND	GND	GND			NVCC_DRAM	NVCC_DRAM	
GND	GND	POP_VDDQ			NVCC_DRAM	NVCC_DRAM	
GND	GND	GND			NVCC_DRAM	NVCC_DRAM	
GND	GND	NVCC_LVDS2P5			NVCC_DRAM	NVCC_DRAM	
GND	GND	POP_VDD2__7			NVCC_DRAM	NVCC_DRAM	
GND	GND	POP_VDD1__7			NVCC_DRAM	NVCC_DRAM	
GND	GND	POP_ZQP1			NVCC_DRAM	NVCC_DRAM	
GND	GND	NVCC_LVDS2P5			NVCC_DRAM	NVCC_DRAM	
ZQPAD	GND	POP_VDDCA			NVCC_DRAM	NVCC_DRAM	
GND	ENET_RXD1	NVCC_LVDS2P5			NVCC_DRAM	NVCC_DRAM	
ENET_MDC	ENET_REF_CLK	ENET_TXD1			NVCC_DRAM	NVCC_DRAM	
ENET_MDIO	ENET_RXD0	POP_VDDCA			ENET_RX_ER	NVCC_DRAM	
DRAM_CKE1P1	DRAM_CKE0P1	ENET_CRS_DV			ENET_TXD0	NVCC_DRAM	NVCC_DRAM
DISP0_DAT23	DISP0_DAT18	ENET_TX_EN			DISP0_DAT20	DISP0_DAT21	DISP0_DAT16
DISP0_DAT13	DISP0_DAT15	POP_VDDCA					
DISP0_DAT8	DISP0_DAT10	POP_VDD1__8					
DISP0_DAT11	DISP0_DAT5	POP_VDD2__8	POP_ZQP0	POP_VDDCA	DISP0_DAT1	POP_VDDCA	DISP0_DAT2
DISP0_DAT14	DISP0_DAT17	DISP0_DAT9	DISP0_DAT12	DISP0_DAT7	DI0_PIN15	EIM_DA14	EIM_DA8
GND	DISP0_DAT0	EIM_WAIT	DI0_DISP_CLK	EIM_DA11	DI0_PIN2	EIM_DA9	EIM_DA3

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