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### What is "[Embedded - Microcontrollers](#)"?

"[Embedded - Microcontrollers](#)" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable input/output peripherals. They are called "embedded" because they are embedded within electronic devices to control various functions, rather than serving as standalone computers. Microcontrollers are crucial in modern electronics, providing the intelligence and control needed for a wide range of applications.

### Applications of "[Embedded - Microcontrollers](#)"

#### Details

|                            |                                                                                                                                                                       |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product Status             | Active                                                                                                                                                                |
| Core Processor             | PIC                                                                                                                                                                   |
| Core Size                  | 8-Bit                                                                                                                                                                 |
| Speed                      | 48MHz                                                                                                                                                                 |
| Connectivity               | I <sup>2</sup> C, SPI, UART/USART, USB                                                                                                                                |
| Peripherals                | Brown-out Detect/Reset, POR, PWM, WDT                                                                                                                                 |
| Number of I/O              | 22                                                                                                                                                                    |
| Program Memory Size        | 16KB (8K x 16)                                                                                                                                                        |
| Program Memory Type        | FLASH                                                                                                                                                                 |
| EEPROM Size                | 256 x 8                                                                                                                                                               |
| RAM Size                   | 2K x 8                                                                                                                                                                |
| Voltage - Supply (Vcc/Vdd) | 2.3V ~ 5.5V                                                                                                                                                           |
| Data Converters            | A/D 14x10b                                                                                                                                                            |
| Oscillator Type            | Internal                                                                                                                                                              |
| Operating Temperature      | -40°C ~ 85°C (TA)                                                                                                                                                     |
| Mounting Type              | Surface Mount                                                                                                                                                         |
| Package / Case             | 28-SSOP (0.209", 5.30mm Width)                                                                                                                                        |
| Supplier Device Package    | 28-SSOP                                                                                                                                                               |
| Purchase URL               | <a href="https://www.e-xfl.com/product-detail/microchip-technology/pic18f24k50t-i-ss">https://www.e-xfl.com/product-detail/microchip-technology/pic18f24k50t-i-ss</a> |

# PIC18(L)F2X/45K50

## PIC18(L)F2X/45K50 USB Flash MCU Product Brief

### Universal Serial Bus Features:

- USB V2.0 Compliant
- Crystal-less Full Speed (12 Mb/s) and Low-Speed Operation (1.5 Mb/s)
- Supports Control, Interrupt, Isochronous and Bulk Transfers
- Supports up to 32 Endpoints (16 Bidirectional)
- 1 Kbyte Dual Access RAM for USB
- On-Chip USB Transceiver

### Flexible Oscillator Structure:

- 3x and 4x PLL Clock Multipliers
- Two External Clock modes, Up to 48 MHz (12 MIPS)
- Internal 31 kHz Oscillator
- Internal Oscillator, 31 kHz to 16 MHz
  - Factory calibrated to  $\pm 1\%$
  - Self-tune to  $\pm 0.20\%$  max. from USB or secondary oscillator
- Secondary Oscillator using Timer1 @ 32 kHz
- Fail-Safe Clock Monitor:
  - Allows for safe shutdown if any clock stops

### Peripheral Highlights:

- Up to 33 I/O Pins plus 3 Input-Only Pins:
  - High-current Sink/Source 25 mA/25 mA
  - Three programmable external interrupts
  - 11 programmable Interrupt-on-Change
  - 9 programmable weak pull-ups
  - Programmable slew rate
- SR Latch
- Enhanced Capture/Compare/PWM (ECCP) module:
  - One, two or four PWM outputs
  - Selectable polarity
  - Programmable dead time
  - Auto-shutdown and auto-restart
  - Pulse steering control
- Capture/Compare/PWM (CCP) module
- Master Synchronous Serial Port (MSSP) module Supporting 3-Wire SPI (all 4 modes) and I<sup>2</sup>C™ Master and Slave modes
- Two Analog Comparators with Input Multiplexing
- 10-Bit Analog-to-Digital (A/D) Converter module:
  - Up to 25 input channels
  - Auto-acquisition capability
  - Conversion available during Sleep
- Digital-to-Analog Converter (DAC) module:
  - Fixed Voltage Reference (FVR) with 1.024V, 2.048V and 4.096V output levels
  - 5-bit rail-to-rail resistive DAC with positive and negative reference selection

- High/Low-Voltage Detect module
- Charge Time Measurement Unit (CTMU):
  - Supports capacitive touch sensing for touch screens and capacitive switches
- Enhanced USART module:
  - Supports RS-485, RS-232 and LIN/J2602
  - Auto-wake-up on Start bit
  - Auto-Baud Detect

### Extreme Low-Power Management with XLP:

- Sleep mode: 20 nA, typical
- Watchdog Timer: 300 nA, typical
- Timer1 Oscillator: 800 nA @ 32 kHz
- Peripheral Module Disable

### Special Microcontroller Features:

- Low-Power, High-Speed CMOS Flash Technology
- C Compiler Optimized Architecture for Re-Entrant Code
- Power Management Features:
  - Run: CPU on, peripherals on, SRAM on
  - Idle: CPU off, peripherals on, SRAM on
  - Sleep: CPU off, peripherals off, SRAM on
- Priority Levels for Interrupts
- Self-Programmable under Software Control
- 8 x 8 Single-Cycle Hardware Multiplier
- Extended Watchdog Timer (WDT):
  - Programmable period from 4 ms to 131s
- Single-Supply In-Circuit Serial Programming™ (ICSP™) via Two Pins
- In-Circuit Debug (ICD) with Three Breakpoints via Two Pins
- Optional dedicated ICD/ICSP Port (44-Pin TQFP Package Only)
- Wide Operating Voltage Range:
  - F devices: 2.3V to 5.5V
  - LF devices: 1.8V to 3.6V
- Flash Program Memory of 10,000 Erase/Write Cycles Minimum and 20-year Data Retention

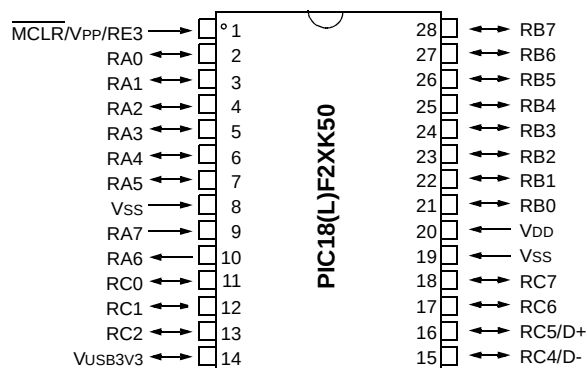
# PIC18(L)F2X/45K50

## PIC18(L)F2X/45K50 Family Types

| Device         | Program Memory |                          | Data Memory  |                     | Pins  | I/O | 10-bit A/D channels | Comparators | CCP/ ECCP | BOR/LVD | CTMU | MSSP | EUSART | Timers 8-bit/16-bit | USB 2.0 |
|----------------|----------------|--------------------------|--------------|---------------------|-------|-----|---------------------|-------------|-----------|---------|------|------|--------|---------------------|---------|
|                | Flash (bytes)  | Single Word Instructions | SRAM (bytes) | Data EEPROM (bytes) |       |     |                     |             |           |         |      |      |        |                     |         |
| PIC18(L)F45K50 | 32K            | 16384                    | 2048         | 256                 | 40/44 | 36  | 25-ch               | 2           | 1/1       | Yes     | Yes  | 1    | 1      | 2/2                 | Yes     |
| PIC18(L)F25K50 | 32K            | 16384                    | 2048         | 256                 | 28    | 25  | 14-ch               | 2           | 1/1       | Yes     | Yes  | 1    | 1      | 2/2                 | Yes     |
| PIC18(L)F24K50 | 16K            | 8192                     | 2048         | 256                 | 28    | 25  | 14-ch               | 2           | 1/1       | Yes     | Yes  | 1    | 1      | 2/2                 | Yes     |

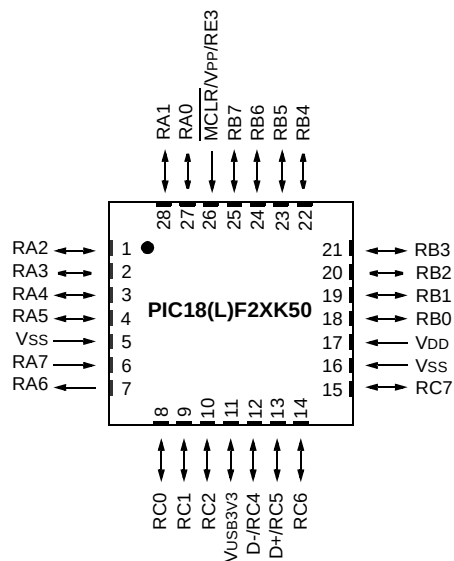
**FIGURE 1: 28-PIN PDIP, SOIC, SSOP DIAGRAM FOR PIC18(L)F2XK50**

### 28-PIN PDIP (300 MIL), SOIC, SSOP

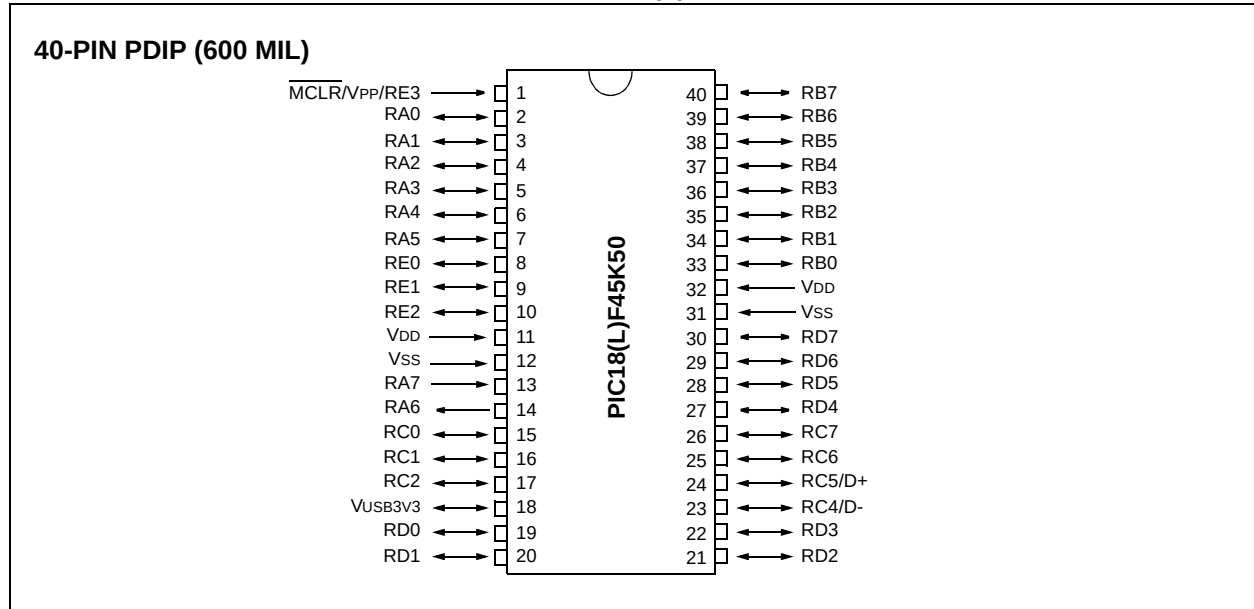


**FIGURE 2: 28-PIN QFN DIAGRAM FOR PIC18(L)F2XK50**

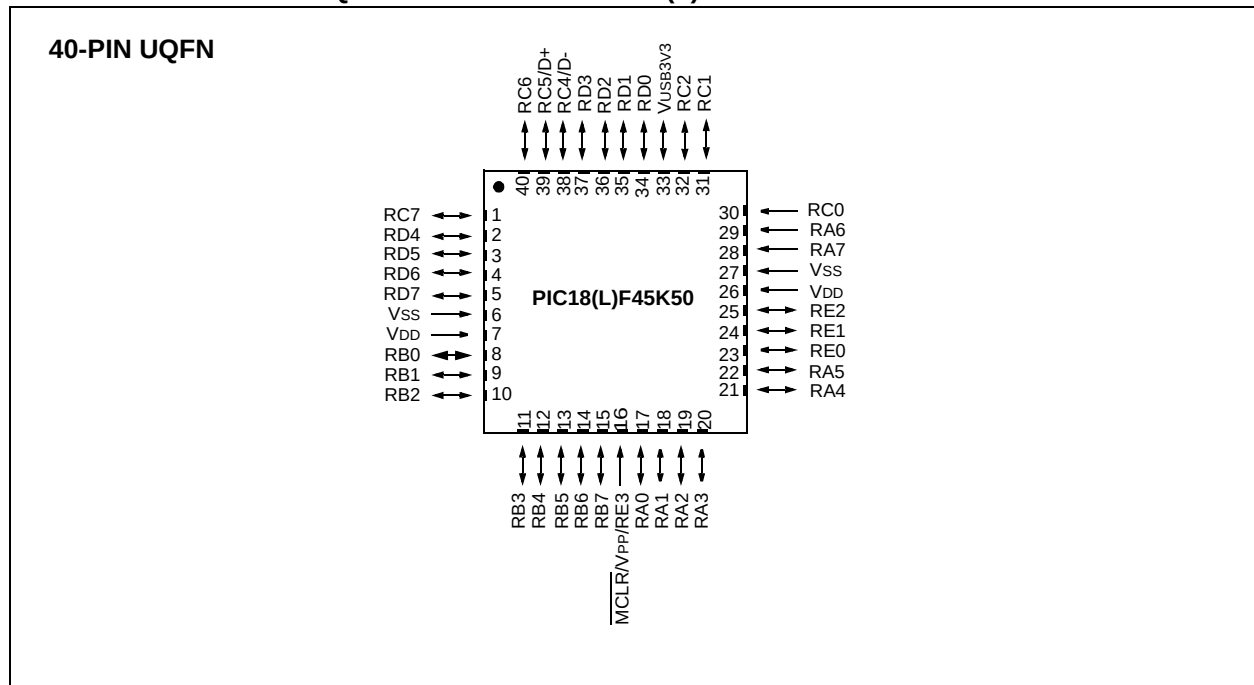
### 28-PIN QFN



**FIGURE 3: 40-PIN PDIP DIAGRAM FOR PIC18(L)F45K50**

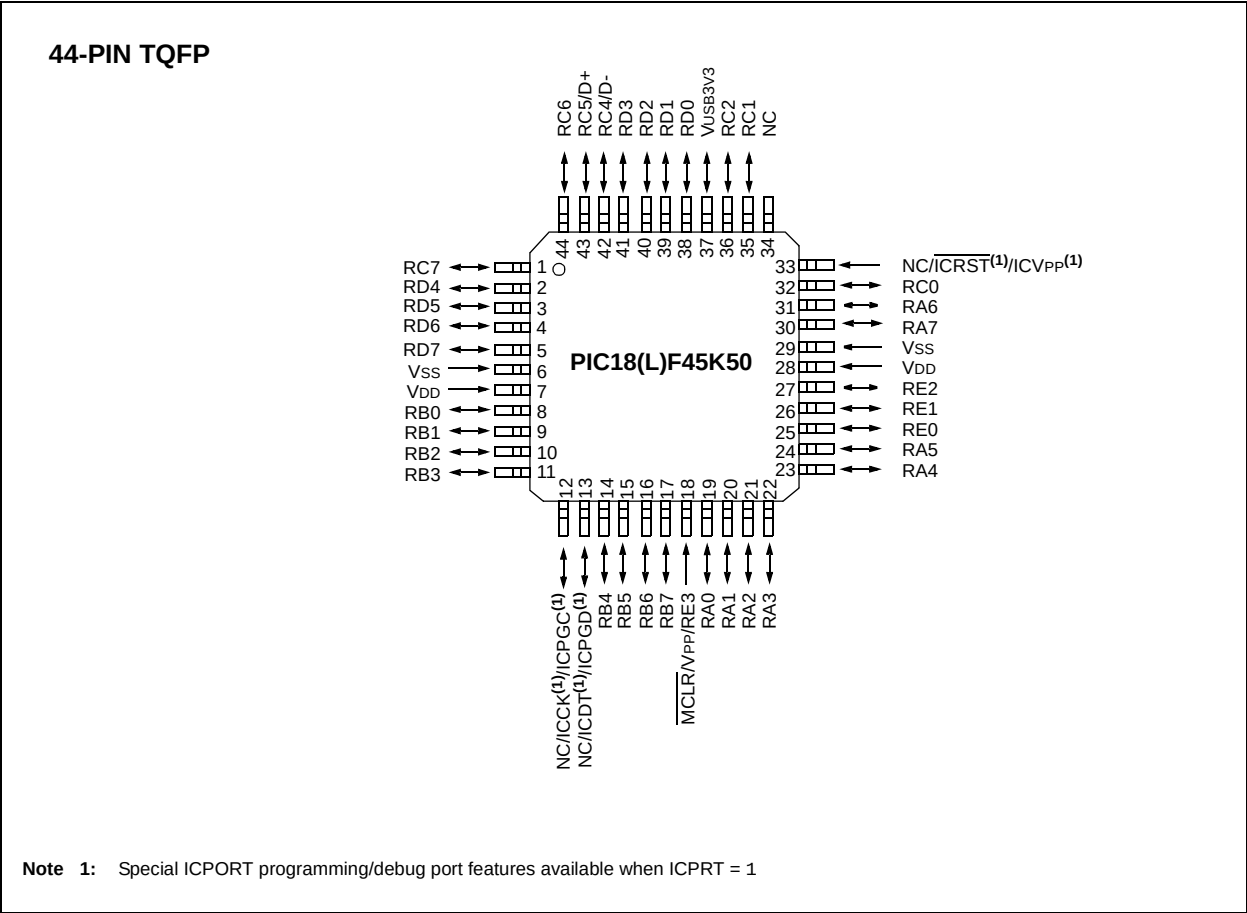


**FIGURE 4: 40-PIN UQFN DIAGRAM FOR PIC18(L)F45K50**



# PIC18(L)F2X/45K50

FIGURE 5: 44-PIN TQFP DIAGRAM FOR PIC18(L)F45K50



**TABLE 1: PIC18(L)F2X/45K50 PIN SUMMARY**

| I/O | 28-Pin PDIP/SSOP | 28-Pin QFN | 40-Pin PDIP | 40-Pin UQFN | 44-Pin TQFP | Analog | Comparator | CTMU  | SR Latch | Reference       | USB | (E)CCP              | EUSART | MSSP       | Timers                      | Interrupts | Pull-up | Basic        | ICD |
|-----|------------------|------------|-------------|-------------|-------------|--------|------------|-------|----------|-----------------|-----|---------------------|--------|------------|-----------------------------|------------|---------|--------------|-----|
| RA0 | 2                | 27         | 2           | 17          | 19          | AN0    | C12IN0-    |       |          |                 |     |                     |        |            |                             |            |         |              |     |
| RA1 | 3                | 28         | 3           | 18          | 20          | AN1    | C12IN1-    | CTCMP |          |                 |     |                     |        |            |                             |            |         |              |     |
| RA2 | 4                | 1          | 4           | 19          | 21          | AN2    | C2IN+      |       |          | VREF-<br>DACOUT |     |                     |        |            |                             |            |         |              |     |
| RA3 | 5                | 2          | 5           | 20          | 22          | AN3    | C1IN+      |       |          | VREF+           |     |                     |        |            |                             |            |         |              |     |
| RA4 | 6                | 3          | 6           | 21          | 23          |        | C1OUT      |       | SRQ      |                 |     |                     |        |            | T0CKI                       |            |         |              |     |
| RA5 | 7                | 4          | 7           | 22          | 24          | AN4    | C2OUT      |       | SRNQ     | LVDIN           |     |                     |        | SS         |                             |            |         |              |     |
| RA6 | 10               | 7          | 14          | 29          | 31          |        |            |       |          |                 |     |                     |        |            |                             |            |         | OSC2<br>CLKO |     |
| RA7 | 9                | 6          | 13          | 28          | 30          |        |            |       |          |                 |     |                     |        |            |                             |            |         | OSC1<br>CLKI |     |
| RB0 | 21               | 18         | 33          | 8           | 8           | AN12   |            |       | SRI      |                 |     | FLT0                |        | SDI<br>SDA |                             | INT0       | Y       |              |     |
| RB1 | 22               | 19         | 34          | 9           | 9           | AN10   | C12IN3-    |       |          |                 |     | P1C <sup>(5)</sup>  |        | SCK<br>SCL |                             | INT1       | Y       |              |     |
| RB2 | 23               | 20         | 35          | 10          | 10          | AN8    |            | CTED1 |          |                 |     | P1B <sup>(5)</sup>  |        |            |                             | INT2       | Y       |              |     |
| RB3 | 24               | 21         | 36          | 11          | 11          | AN9    | C12IN2-    | CTED2 |          |                 |     | CCP2 <sup>(1)</sup> |        | SDO        |                             |            | Y       |              |     |
| RB4 | 25               | 22         | 37          | 12          | 14          | AN11   |            |       |          |                 |     | P1D <sup>(5)</sup>  |        |            |                             | IOCB4      | Y       |              |     |
| RB5 | 26               | 23         | 38          | 13          | 15          | AN13   |            |       |          |                 |     |                     |        |            | T1G<br>T3CKI <sup>(2)</sup> | IOCB5      | Y       |              |     |
| RB6 | 27               | 24         | 39          | 14          | 16          |        |            |       |          |                 |     |                     |        |            |                             | IOCB6      | Y       | PGC          |     |
| RB7 | 28               | 25         | 40          | 15          | 17          |        |            |       |          |                 |     |                     |        |            |                             | IOCB7      | Y       | PGD          |     |

**Note 1:** Alternate CCP2 pin location based on Configuration bit.**Note 2:** Alternate T3CKI pin location based on Configuration bits.**Note 3:** Pins are enabled when ICPRT = 1, otherwise, they are disabled.**Note 4:** Location on 40/44-Pin parts (PIC18(L)F45K50). Function not on this pin on 28-Pin parts (PIC18(L)F2XK50).**Note 5:** Location on 28-Pin parts (PIC18(L)F2XK50). Function not on this pin on 40/44-Pin parts (PIC18(L)F45K50).**Note 6:** Alternate SDO pin location based on Configuration bits.**Note 7:** RE3, RC4 and RC5 can be used for digital input only (no output functionality).

**TABLE 1: PIC18(L)F2X/45K50 PIN SUMMARY**

| I/O                | 28-Pin PDIP/SOIC/SSOP | 28-Pin QFN | 40-Pin PDIP | 40-Pin UQFN | 44-Pin TQFP | Analog | Comparator | CTMU  | SR Latch | Reference | USB     | (E)CCP             | EUSART   | MSSP               | Timers                         | Interrupts | Pull-up | Basic   | ICD |
|--------------------|-----------------------|------------|-------------|-------------|-------------|--------|------------|-------|----------|-----------|---------|--------------------|----------|--------------------|--------------------------------|------------|---------|---------|-----|
| RC0                | 11                    | 8          | 15          | 30          | 32          |        |            |       |          |           |         |                    |          |                    | SOSCO<br>T1CKI<br>T3CKI<br>T3G | IOCC0      |         |         |     |
| RC1                | 12                    | 9          | 16          | 31          | 35          |        |            |       |          |           |         | CCP2               |          |                    | SOSCI                          | IOCC1      |         |         |     |
| RC2                | 13                    | 10         | 17          | 32          | 36          | AN14   |            | CTPLS |          |           |         | CCP1<br>P1A        |          |                    |                                | IOCC2      |         |         |     |
| —                  | 14                    | 11         | 18          | 33          | 37          | —      |            |       |          |           | VUSB3V3 |                    |          |                    |                                |            |         | VDDCORE |     |
| RC4 <sup>(7)</sup> | 15                    | 12         | 23          | 38          | 42          | —      |            |       |          |           | D-      |                    |          |                    |                                | IOCC4      |         |         |     |
| RC5 <sup>(7)</sup> | 16                    | 13         | 24          | 39          | 43          | —      |            |       |          |           | D+      |                    |          |                    |                                | IOCC5      |         |         |     |
| RC6                | 17                    | 14         | 25          | 40          | 44          | AN18   |            |       |          |           |         |                    | TX<br>CK |                    |                                | IOCC6      |         |         |     |
| RC7                | 18                    | 15         | 26          | 1           | 1           | AN19   |            |       |          |           |         |                    | RX<br>DT | SDO <sup>(6)</sup> |                                | IOCC7      |         |         |     |
| RD0                | —                     | —          | 19          | 34          | 38          | AN20   |            |       |          |           |         |                    |          |                    |                                |            |         |         |     |
| RD1                | —                     | —          | 20          | 35          | 39          | AN21   |            |       |          |           |         |                    |          |                    |                                |            |         |         |     |
| RD2                | —                     | —          | 21          | 36          | 40          | AN22   |            |       |          |           |         |                    |          |                    |                                |            |         |         |     |
| RD3                | —                     | —          | 22          | 37          | 41          | AN23   |            |       |          |           |         |                    |          |                    |                                |            |         |         |     |
| RD4                | —                     | —          | 27          | 2           | 2           | AN24   |            |       |          |           |         |                    |          |                    |                                |            |         |         |     |
| RD5                | —                     | —          | 28          | 3           | 3           | AN25   |            |       |          |           |         | P1B <sup>(4)</sup> |          |                    |                                |            |         |         |     |
| RD6                | —                     | —          | 29          | 4           | 4           | AN26   |            |       |          |           |         | P1C <sup>(4)</sup> |          |                    |                                |            |         |         |     |
| RD7                | —                     | —          | 30          | 5           | 5           | AN27   |            |       |          |           |         | P1D <sup>(4)</sup> |          |                    |                                |            |         |         |     |
| RE0                | —                     | —          | 8           | 23          | 25          | AN5    |            |       |          |           |         |                    |          |                    |                                |            |         |         |     |

**Note 1:** Alternate CCP2 pin location based on Configuration bit.**Note 2:** Alternate T3CKI pin location based on Configuration bits.**Note 3:** Pins are enabled when ICPRT = 1, otherwise, they are disabled.**Note 4:** Location on 40/44-Pin parts (PIC18(L)F45K50). Function not on this pin on 28-Pin parts (PIC18(L)F2XK50).**Note 5:** Location on 28-Pin parts (PIC18(L)F2XK50). Function not on this pin on 40/44-Pin parts (PIC18(L)F45K50).**Note 6:** Alternate SDO pin location based on Configuration bits.**Note 7:** RE3, RC4 and RC5 can be used for digital input only (no output functionality).

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|--------------------|-----------------------|------------|-------------|-------------|-------------------|--------|------------|------|----------|-----------|-----|--------|--------|------|--------|------------|---------|---------------------------------------------|----------------------|
| RE1                | —                     | —          | 9           | 24          | 26                | AN6    |            |      |          |           |     |        |        |      |        |            |         |                                             |                      |
| RE2                | —                     | —          | 10          | 25          | 27                | AN7    |            |      |          |           |     |        |        |      |        |            |         |                                             |                      |
| RE3 <sup>(7)</sup> | 1                     | 26         | 1           | 16          | 18                | —      |            |      |          |           |     |        |        |      |        |            | Y       | $\overline{\text{MCLR}}$<br>V <sub>PP</sub> |                      |
|                    | 20                    | 17         | 11,<br>32   | 7,<br>26    | 7,<br>28          |        |            |      |          |           |     |        |        |      |        |            |         | V <sub>DD</sub>                             |                      |
|                    | 8,<br>19              | 5,<br>16   | 12,<br>31   | 6,<br>27    | 6,<br>29          |        |            |      |          |           |     |        |        |      |        |            |         | V <sub>SS</sub>                             |                      |
|                    |                       |            | —           | —           | 12 <sup>(3)</sup> |        |            |      |          |           |     |        |        |      |        |            |         | ICPGC <sup>(3)</sup>                        | ICCK <sup>(3)</sup>  |
|                    |                       |            | —           | —           | 13 <sup>(3)</sup> |        |            |      |          |           |     |        |        |      |        |            |         | ICPGD <sup>(3)</sup>                        | ICDT <sup>(3)</sup>  |
|                    |                       |            | —           | —           | 33 <sup>(3)</sup> |        |            |      |          |           |     |        |        |      |        |            |         | ICV <sub>PP</sub> <sup>(3)</sup>            | ICRST <sup>(3)</sup> |

- Note 1:** Alternate CCP2 pin location based on Configuration bit.  
**2:** Alternate T3CKI pin location based on Configuration bits.  
**3:** Pins are enabled when ICPRT = 1, otherwise, they are disabled.  
**4:** Location on 40/44-Pin parts (PIC18(L)F45K50). Function not on this pin on 28-Pin parts (PIC18(L)F2XK50).  
**5:** Location on 28-Pin parts (PIC18(L)F2XK50). Function not on this pin on 40/44-Pin parts (PIC18(L)F45K50).  
**6:** Alternate SDO pin location based on Configuration bits.  
**7:** RE3, RC4 and RC5 can be used for digital input only (no output functionality).



# PIC18(L)F2X/45K50

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NOTES:

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#### Japan - Yokohama

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#### Korea - Daegu

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