



MICROCHIP

PIC18F2331/2431/4331/4431

PIC18F2331/2431/4331/4431 Data Sheet Errata

In the Device Data Sheet (DS39616B), the following clarifications and corrections should be noted. Any silicon issues related to the PIC18F2331/2431/4331/4431 will be reported in a separate silicon errata. Please check the Microchip Web site for any existing issues.

Clarifications/Corrections to the Data Sheet:

In the Device Data Sheet (DS39616B), the following clarifications and corrections should be noted.

1. Module: Power-on Reset

The following note has been added to **Section 4.1 "Power-on Reset (POR)"**:

Note: The following decoupling method is recommended:

1. A 1 μ F capacitor should be connected across AVDD and AVSS.
2. A similar capacitor should be connected across VDD and VSS.

2. Module: Watchdog Timer

In Table 22-2: Summary of Watchdog Timer Registers, the WINEN bit (CONFIG2H<5>) should not be shaded.

3. Module: PWM Equations

In **Section 17.5 "PWM Period"**, Equations 17-1, 17-2 and 17-3 should be corrected as shown.

EQUATION 17-1: PWM PERIOD FOR FREE RUNNING MODE

$$TPWM = \frac{(PTPER + 1) \times PTMRPS}{FOSC/4}$$

EQUATION 17-2: PWM PERIOD FOR UP/DOWN COUNTING MODE

$$TPWM = \frac{(2 \times PTPER) \times PTMRPS}{\frac{FOSC}{4}}$$

EQUATION 17-3: PWM RESOLUTION

$$Resolution = \frac{\log\left(\frac{FOSC}{F_{pwm}}\right)}{\log(2)}$$

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4. Module: DC Characteristics

The specifications and parameter numbers for the Brown-out Reset Voltage limits (VBOR, originally parameter D005) in **Section 25.1 “DC Characteristics: Supply Voltage”** of the Device Data Sheet have been changed.

The specifications and parameter numbers have been revised for devices with date codes from 0401xxx to 0420xxx, inclusive.

Specifications and parameter numbers have been revised for specific temperature ranges for date codes from 0421xxx and higher.

The new information is shown in **bold text**.

25.1 DC Characteristics: Supply Voltage

PIC18F2331/2431/4331/4431 (Industrial)

PIC18LF2331/2431/4331/4431 (Industrial, Extended)

PIC18LF2331/2431/4331/4431 (Industrial)			Standard Operating Conditions (unless otherwise stated) Operating temperature $-40^{\circ}\text{C} \leq T_A \leq +85^{\circ}\text{C}$ for industrial				
PIC18F2331/2431/4331/4431 (Industrial, Extended)			Standard Operating Conditions (unless otherwise stated) Operating temperature $-40^{\circ}\text{C} \leq T_A \leq +85^{\circ}\text{C}$ for industrial $-40^{\circ}\text{C} \leq T_A \leq +125^{\circ}\text{C}$ for extended				
Param No.	Symbol	Characteristic	Min	Typ	Max	Units	Conditions
Date Codes from 0401xxx to 0420xxx, inclusive							
D005A	VBOR	Brown-out Reset Voltage					
		PIC18LF2X31/4X31	Industrial Low Voltage (-40°C to $+85^{\circ}\text{C}$)				
		BORV1:BORV0 = 11	N/A	N/A	N/A	V	Reserved
		BORV1:BORV0 = 10	2.45	2.72	2.99	V	
		BORV1:BORV0 = 01	3.80	4.22	4.64	V	
D005B		BORV1:BORV0 = 00	4.09	4.54	4.99	V	
		PIC18F2X31/4X31	Industrial (-40°C to $+85^{\circ}\text{C}$)				
		BORV1:BORV0 = 1x	N/A	N/A	N/A	V	Reserved
		BORV1:BORV0 = 01	3.80	4.22	4.64	V	(Note 2)
D005C		BORV1:BORV0 = 00	4.09	4.54	4.99	V	(Note 2)
		PIC18F2X31/4X31	Extended (-40°C to $+125^{\circ}\text{C}$)				
		BORV1:BORV0 = 1x	N/A	N/A	N/A	V	Reserved
		BORV1:BORV0 = 01	3.80	4.22	4.64	V	(Note 2)
		BORV1:BORV0 = 00	4.09	4.54	4.99	V	(Note 2)

Legend: Shading of rows is to assist in readability of the table.

Note 1: This is the limit to which VDD can be lowered in Sleep mode, or during a device Reset, without losing RAM data.

Note 2: When BOR is on and BORV<1:0> = 0x, the device will operate correctly at 40 MHz for any VDD at which the BOR allows execution.

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25.1 DC Characteristics: Supply Voltage

PIC18F2331/2431/4331/4431 (Industrial)

PIC18LF2331/2431/4331/4431 (Industrial, Extended)

PIC18LF2331/2431/4331/4431 (Industrial)			Standard Operating Conditions (unless otherwise stated) Operating temperature $-40^{\circ}\text{C} \leq T_A \leq +85^{\circ}\text{C}$ for industrial				
PIC18F2331/2431/4331/4431 (Industrial, Extended)			Standard Operating Conditions (unless otherwise stated) Operating temperature $-40^{\circ}\text{C} \leq T_A \leq +85^{\circ}\text{C}$ for industrial $-40^{\circ}\text{C} \leq T_A \leq +125^{\circ}\text{C}$ for extended				
Param No.	Symbol	Characteristic	Min	Typ	Max	Units	Conditions
Date Codes from 0421xxx and higher							
D005D	V _{BOR}	Brown-out Reset Voltage					
		PIC18F2X31/4X31	Industrial Low Voltage (-10°C to $+85^{\circ}\text{C}$)				
		BORV1:BORV0 = 11	N/A	N/A	N/A	V	Reserved
		BORV1:BORV0 = 10	2.50	2.72	2.94	V	
		BORV1:BORV0 = 01	3.88	4.22	4.56	V	
D005F		PIC18F2X31/4X31	Industrial Low Voltage (-40°C to -10°C)				
		BORV1:BORV0 = 11	N/A	N/A	N/A	V	Reserved
		BORV1:BORV0 = 10	2.34	2.72	3.10	V	
		BORV1:BORV0 = 01	3.63	4.22	4.81	V	
		BORV1:BORV0 = 00	3.90	4.54	5.18	V	
D005G		PIC18F2X31/4X31	Industrial (-10°C to $+85^{\circ}\text{C}$)				
		BORV1:BORV0 = 1x	N/A	N/A	N/A	V	Reserved
		BORV1:BORV0 = 01	3.88	4.22	4.56	V	(Note 2)
		BORV1:BORV0 = 00	4.18	4.54	4.90	V	(Note 2)
D005H		PIC18F2X31/4X31	Industrial (-40°C to -10°C)				
		BORV1:BORV0 = 1x	N/A	N/A	N/A	V	Reserved
		BORV1:BORV0 = 01	N/A	N/A	N/A	V	Reserved
		BORV1:BORV0 = 00	3.90	4.54	5.18	V	(Note 2)
D005J		PIC18F2X31/4X31	Extended (-10°C to $+85^{\circ}\text{C}$)				
		BORV1:BORV0 = 1x	N/A	N/A	N/A	V	Reserved
		BORV1:BORV0 = 01	3.88	4.22	4.56	V	(Note 2)
		BORV1:BORV0 = 00	4.18	4.54	4.90	V	(Note 2)
D005K		PIC18F2X31/4X31	Extended (-40°C to -10°C , $+85^{\circ}\text{C}$ to $+125^{\circ}\text{C}$)				
		BORV1:BORV0 = 1x	N/A	N/A	N/A	V	Reserved
		BORV1:BORV0 = 01	N/A	N/A	N/A	V	Reserved
		BORV1:BORV0 = 00	3.90	4.54	5.18	V	(Note 2)

Legend: Shading of rows is to assist in readability of the table.

Note 1: This is the limit to which V_{DD} can be lowered in Sleep mode, or during a device Reset, without losing RAM data.

2: When BOR is on and BORV<1:0> = 0x, the device will operate correctly at 40 MHz for any V_{DD} at which the BOR allows execution.

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5. Module: LVD Characteristics

The specifications and parameter numbers for the Low-Voltage Detect thresholds (VLVD, originally parameter D420) in Table 25-2 of the Device Data Sheet have been changed.

The specifications and parameter numbers have been revised for devices with date codes from 0401xxx to 0420xxx, inclusive.

Specifications and parameter numbers have been revised for specific temperature ranges for date codes from 0421xxx and higher.

The new information is shown in **bold text**.

TABLE 25-2: LOW-VOLTAGE DETECT CHARACTERISTICS

PIC18LF2331/2431/4331/4431 (Industrial)				Standard Operating Conditions (unless otherwise stated) Operating temperature $-40^{\circ}\text{C} \leq T_A \leq +85^{\circ}\text{C}$ for industrial				
PIC18F2331/2431/4331/4431 (Industrial, Extended)				Standard Operating Conditions (unless otherwise stated) Operating temperature $-40^{\circ}\text{C} \leq T_A \leq +85^{\circ}\text{C}$ for industrial $-40^{\circ}\text{C} \leq T_A \leq +125^{\circ}\text{C}$ for extended				
Param No.	Symbol	Characteristic		Min	Typ†	Max	Units	Conditions
Date Codes from 0401xxx to 0420xxx, inclusive								
D420A	VLVD	LVD Voltage on VDD Transition High-to-Low		Industrial Low Voltage (-40°C to $+85^{\circ}\text{C}$)				
		PIC18LF2X31/4X31	LVDL<3:0> = 0000	N/A	N/A	N/A	V	Reserved
			LVDL<3:0> = 0001	N/A	N/A	N/A	V	Reserved
			LVDL<3:0> = 0010	2.08	2.26	2.44	V	
			LVDL<3:0> = 0011	2.26	2.45	2.65	V	
			LVDL<3:0> = 0100	2.35	2.55	2.76	V	
			LVDL<3:0> = 0101	2.55	2.77	2.99	V	
			LVDL<3:0> = 0110	2.64	2.87	3.10	V	
			LVDL<3:0> = 0111	2.82	3.07	3.31	V	
			LVDL<3:0> = 1000	3.09	3.36	3.63	V	
			LVDL<3:0> = 1001	3.29	3.57	3.86	V	
			LVDL<3:0> = 1010	3.38	3.67	3.96	V	
			LVDL<3:0> = 1011	3.56	3.87	4.18	V	
			LVDL<3:0> = 1100	3.75	4.07	4.40	V	
			LVDL<3:0> = 1101	3.93	4.28	4.62	V	
			LVDL<3:0> = 1110	4.23	4.60	4.96	V	
D420B		LVD Voltage on VDD Transition High-to-Low		Industrial (-40°C to $+85^{\circ}\text{C}$)				
		PIC18F2X31/4X31	LVDL<3:0> = 1011	3.56	3.87	4.18	V	
	LVDL<3:0> = 1100		3.75	4.07	4.40	V		
	LVDL<3:0> = 1101		3.93	4.28	4.62	V		
	LVDL<3:0> = 1110		4.23	4.60	4.96	V		
D420C		LVD Voltage on VDD Transition High-to-Low		Extended (-40°C to $+125^{\circ}\text{C}$)				
		PIC18F2X31/4X31	LVDL<3:0> = 1011	3.41	3.87	4.33	V	
	LVDL<3:0> = 1100		3.58	4.07	4.56	V		
	LVDL<3:0> = 1101		3.77	4.28	4.79	V		
	LVDL<3:0> = 1110		4.04	4.60	5.15	V		

Legend: Shading of rows is to assist in readability of the table.

† Production tested at TAMB = 25°C. Specifications over temperature limits ensured by characterization.

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TABLE 25-2: LOW-VOLTAGE DETECT CHARACTERISTICS (CONTINUED)

PIC18LF2331/2431/4331/4431 (Industrial)				Standard Operating Conditions (unless otherwise stated) Operating temperature -40°C ≤ TA ≤ +85°C for industrial				
PIC18F2331/2431/4331/4431 (Industrial, Extended)				Standard Operating Conditions (unless otherwise stated) Operating temperature -40°C ≤ TA ≤ +85°C for industrial -40°C ≤ TA ≤ +125°C for extended				
Param No.	Symbol	Characteristic		Min	Typ†	Max	Units	Conditions
Date Codes from 0421xxx and higher								
D420D	VLVD	LVD Voltage on VDD Transition High-to-Low		Industrial Low Voltage (-10°C to +85°C)				
		PIC18LF2X31/4X31	LVDL<3:0> = 0000	N/A	N/A	N/A	V	Reserved
			LVDL<3:0> = 0001	N/A	N/A	N/A	V	Reserved
			LVDL<3:0> = 0010	2.08	2.26	2.44	V	
			LVDL<3:0> = 0011	2.26	2.45	2.65	V	
			LVDL<3:0> = 0100	2.35	2.55	2.76	V	
			LVDL<3:0> = 0101	2.55	2.77	2.99	V	
			LVDL<3:0> = 0110	2.64	2.87	3.10	V	
			LVDL<3:0> = 0111	2.82	3.07	3.31	V	
			LVDL<3:0> = 1000	3.09	3.36	3.63	V	
			LVDL<3:0> = 1001	3.29	3.57	3.86	V	
			LVDL<3:0> = 1010	3.38	3.67	3.96	V	
			LVDL<3:0> = 1011	3.56	3.87	4.18	V	
			LVDL<3:0> = 1100	3.75	4.07	4.40	V	
			LVDL<3:0> = 1101	3.93	4.28	4.62	V	
			LVDL<3:0> = 1110	4.23	4.60	4.96	V	
D420F		LVD Voltage on VDD Transition High-to-Low		Industrial Low Voltage (-40°C to -10°C)				
		PIC18LF2X31/4X31	LVDL<3:0> = 0000	N/A	N/A	N/A	V	Reserved
			LVDL<3:0> = 0001	N/A	N/A	N/A	V	Reserved
			LVDL<3:0> = 0010	1.99	2.26	2.53	V	
			LVDL<3:0> = 0011	2.16	2.45	2.75	V	
			LVDL<3:0> = 0100	2.25	2.55	2.86	V	
			LVDL<3:0> = 0101	2.43	2.77	3.10	V	
			LVDL<3:0> = 0110	2.53	2.87	3.21	V	
			LVDL<3:0> = 0111	2.70	3.07	3.43	V	
			LVDL<3:0> = 1000	2.96	3.36	3.77	V	
			LVDL<3:0> = 1001	3.14	3.57	4.00	V	
			LVDL<3:0> = 1010	3.23	3.67	4.11	V	
			LVDL<3:0> = 1011	3.41	3.87	4.34	V	
			LVDL<3:0> = 1100	3.58	4.07	4.56	V	
			LVDL<3:0> = 1101	3.76	4.28	4.79	V	
			LVDL<3:0> = 1110	4.04	4.60	5.15	V	

Legend: Shading of rows is to assist in readability of the table.

† Production tested at $T_{\text{AMB}} = 25^{\circ}\text{C}$. Specifications over temperature limits ensured by characterization.

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TABLE 25-2: LOW-VOLTAGE DETECT CHARACTERISTICS (CONTINUED)

PIC18LF2331/2431/4331/4431 (Industrial)				Standard Operating Conditions (unless otherwise stated) Operating temperature $-40^{\circ}\text{C} \leq T_A \leq +85^{\circ}\text{C}$ for industrial				
PIC18F2331/2431/4331/4431 (Industrial, Extended)				Standard Operating Conditions (unless otherwise stated) Operating temperature $-40^{\circ}\text{C} \leq T_A \leq +85^{\circ}\text{C}$ for industrial $-40^{\circ}\text{C} \leq T_A \leq +125^{\circ}\text{C}$ for extended				
Param No.	Symbol	Characteristic		Min	Typ†	Max	Units	Conditions
Date Codes from 0421xxx and higher								
D420G	VLVD	LVD Voltage on VDD Transition High-to-Low		Industrial (-10°C to $+85^{\circ}\text{C}$)				
		PIC18F2X31/4X31	LVDL<3:0> = 1101	3.93	4.28	4.62	V	
			LVDL<3:0> = 1110	4.23	4.60	4.96	V	
D420H		LVD Voltage on VDD Transition High-to-Low		Industrial (-40°C to -10°C)				
		PIC18F2X31/4X31	LVDL<3:0> = 1101	3.76	4.28	4.79	V	Reserved
			LVDL<3:0> = 1110	4.04	4.60	5.15	V	
D420J		LVD Voltage on VDD Transition High-to-Low		Extended (-10°C to $+85^{\circ}\text{C}$)				
		PIC18F2X31/4X31	LVDL<3:0> = 1101	3.94	4.28	4.62	V	
			LVDL<3:0> = 1110	4.23	4.60	4.96	V	
D420K		LVD Voltage on VDD Transition High-to-Low		Extended (-40°C to -10°C , $+85^{\circ}\text{C}$ to $+125^{\circ}\text{C}$)				
		PIC18F2X31/4X31	LVDL<3:0> = 1101	3.77	4.28	4.79	V	Reserved
			LVDL<3:0> = 1110	4.05	4.60	5.15	V	

Legend: Shading of rows is to assist in readability of the table.

† Production tested at $T_{\text{AMB}} = 25^{\circ}\text{C}$. Specifications over temperature limits ensured by characterization.

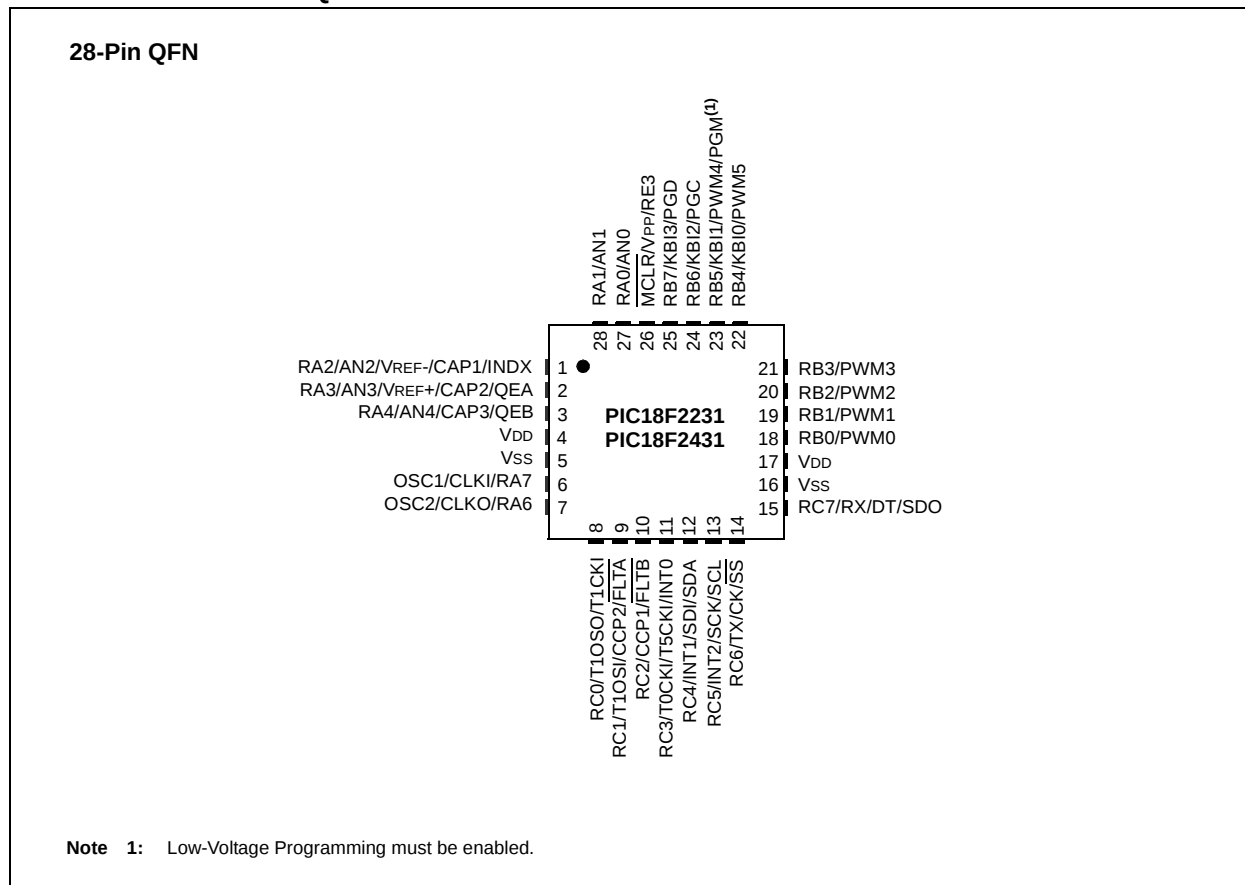
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6. Module: 28-Pin QFN Diagram

A 28-pin QFN package has been introduced for the PIC18F2331 and PIC18F2431 devices. The Device Data Sheet has been updated as follows:

- The **Pin Diagram** section (page 3) has been updated to include the new 28-pin QFN package.

FIGURE 1: 28-PIN QFN DIAGRAM



- The Packages information in Table 1-1 (page 9) and Table B-1 (page 379) has been updated to include a reference to the 28-pin QFN. The new text is shown in **bold**.

TABLE 1:

Features	PIC18F2331	PIC18F2431	PIC18F4331	PIC18F4431
Packages	28-pin SDIP 28-pin SOIC 28-pin QFN	28-pin SDIP 28-pin SOIC 28-pin QFN	40-pin DIP 44-pin TQFP 44-pin QFN	40-pin DIP 44-pin TQFP 44-pin QFN

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- A new column with pin number information for the 28-pin QFN package has been added to Table 1-2 (pages 12-14). New information is shown in **bold** text.

TABLE 1-2: PIC18F2331/2431 PINOUT I/O DESCRIPTIONS

Pin Name	Pin Number		Pin Type	Buffer Type	Description
	DIP, SOIC	QFN			
MCLR/VPP/RE3 MCLR	1	26	I	ST	Master Clear (input) or programming voltage (input). Master Clear (Reset) input. This pin is an active-low Reset to the device.
VPP RE3			P I	ST	High-voltage ICSP programming enable pin. Digital input. Available only when MCLR is disabled.
OSC1/CLKI/RA7 OSC1	9	6	I	ST	Oscillator crystal or external clock input. Oscillator crystal input or external clock source input. ST buffer when configured in RC mode, CMOS otherwise.
CLKI			I	CMOS	External clock source input. Always associated with pin function OSC1. (See related OSC1/CLKI, OSC2/CLKO pins.)
RA7			I/O	TTL	General purpose I/O pin.
OSC2/CLKO/RA6 OSC2	10	7	O	—	Oscillator crystal or clock output. Oscillator crystal output. Connects to crystal or resonator in Crystal Oscillator mode.
CLKO			O	—	In RC mode, OSC2 pin outputs CLKO, which has 1/4 the frequency of OSC1 and denotes the instruction cycle rate.
RA6			I/O	TTL	General purpose I/O pin.
RA0/AN0 RA0 AN0	2	27	I/O I	TTL Analog	PORTA is a bidirectional I/O port. Digital I/O. Analog input 0.
RA1/AN1 RA1 AN1	3	28	I/O I	TTL Analog	Digital I/O. Analog input 1.
RA2/AN2/VREF-/CAP1/INDX RA2 AN2 VREF- CAP1 INDX	4	1	I/O I I I I	TTL Analog Analog ST ST	Digital I/O. Analog input 2. A/D reference voltage (Low) input. Input capture pin 1. Quadrature Encoder Interface index input pin.
RA3/AN3/VREF+/CAP2/QEA RA3 AN3 VREF+ CAP2 QEA	5	2	I/O I I I I	TTL Analog Analog ST ST	Digital I/O. Analog input 3. A/D reference voltage (High) input. Input capture pin 2. Quadrature Encoder Interface channel A input pin.
RA4/AN4/CAP3/QEB RA4 AN4 CAP3 QEB	6	3	I/O I I I	TTL Analog ST ST	Digital I/O. Analog input 4. Input capture pin 3. Quadrature Encoder Interface channel B input pin.

Legend: TTL = TTL compatible input CMOS = CMOS compatible input or output
ST = Schmitt Trigger input with CMOS levels I = Input
O = Output P = Power
OD = Open-Drain (no diode to VDD)

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TABLE 1-2: PIC18F2331/2431 PINOUT I/O DESCRIPTIONS (CONTINUED)

Pin Name	Pin Number		Pin Type	Buffer Type	Description
	DIP, SOIC	QFN			
RB0/PWM0	21	18	I/O	TTL	PORTB is a bidirectional I/O port. PORTB can be software programmed for internal weak pull-ups on all inputs. Digital I/O. PWM output 0.
RB0 PWM0			O	TTL	
RB1/PWM1	22	19	I/O	TTL	Digital I/O. PWM output 1.
RB1 PWM1			O	TTL	
RB2/PWM2	23	20	I/O	TTL	Digital I/O. PWM output 2.
RB2 PWM2			O	TTL	
RB3/PWM3	24	21	I/O	TTL	Digital I/O. PWM output 3.
RB3 PWM3			O	TTL	
RB4/KBI0/PWM5	25	22	I/O	TTL	Digital I/O. Interrupt-on-change pin. PWM output 5.
RB4 KBI0			I	TTL	
PWM5			O	TTL	
RB5/KBI1/PWM4/PGM	26	23	I/O	TTL	Digital I/O. Interrupt-on-change pin. PWM output 4. Low-Voltage ICSP™ Programming entry pin.
RB5 KBI1			I	TTL	
PWM4			O	TTL	
PGM			I/O	ST	
RB6/KBI2/PGC	27	24	I/O	TTL	Digital I/O. Interrupt-on-change pin. In-Circuit Debugger and ICSP programming clock pin.
RB6 KBI2			I	TTL	
PGC			I/O	ST	
RB7/KBI3/PGD	28	25	I/O	TTL	Digital I/O. Interrupt-on-change pin. In-Circuit Debugger and ICSP programming data pin.
RB7 KBI3			I	TTL	
PGD			I/O	ST	

Legend: TTL = TTL compatible input CMOS = CMOS compatible input or output
ST = Schmitt Trigger input with CMOS levels I = Input
O = Output P = Power
OD = Open-Drain (no diode to VDD)

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TABLE 1-2: PIC18F2331/2431 PINOUT I/O DESCRIPTIONS (CONTINUED)

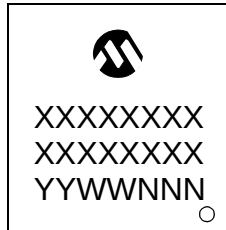
Pin Name	Pin Number		Pin Type	Buffer Type	Description
	DIP, SOIC	QFN			
RC0/T1OSO/T1CKI RC0 T1OSO T1CKI	11	8	I/O O I	ST — ST	PORTC is a bidirectional I/O port. Digital I/O. Timer1 oscillator output. Timer1 external clock input.
RC1/T1OSI/CCP2/FLTA RC1 T1OSI CCP2 FLTA	12	9	I/O I I/O I	ST CMOS ST ST	Digital I/O. Timer1 oscillator input. Capture 2 input, Compare 2 output, PWM 2 output. Fault interrupt input pin.
RC2/CCP1/FLTB RC2 CCP1 FLTB	13	10	I/O I/O I	ST ST ST	Digital I/O. Capture 1 input/Compare 1 output/PWM 1 output. Fault interrupt input pin.
RC3/T0CKI/T5CKI/INT0 RC3 T0CKI T5CKI INT0	14	11	I/O I I I	ST ST ST ST	Digital I/O. Timer0 alternate clock input. Timer5 alternate clock input. External interrupt 0.
RC4/INT1/SDI/SDA RC4 INT1 SDI SDA	15	12	I/O I I I/O	ST ST ST ST	Digital I/O. External interrupt 1. SPI™ data in. I²C™ data I/O.
RC5/INT2/SCK/SCL RC5 INT2 SCK SCL	16	13	I/O I I/O I/O	ST ST ST ST	Digital I/O. External interrupt 2. Synchronous serial clock input/output for SPI mode. Synchronous serial clock input/output for I²C mode.
RC6/TX/CK/SS RC6 TX CK SS	17	14	I/O O I/O I	ST — ST TTL	Digital I/O. USART asynchronous transmit. USART synchronous clock (see related RX/DT). SPI slave select input.
RC7/RX/DT/SDO RC7 RX DT SDO	18	15	I/O I I/O O	ST ST ST —	Digital I/O. USART asynchronous receive. USART synchronous data (see related TX/CK). SPI data out.
Vss	8, 19	5, 16	P	—	Ground reference for logic and I/O pins.
VDD	7, 20	4, 17	P	—	Positive supply for logic and I/O pins.

Legend: TTL = TTL compatible input
ST = Schmitt Trigger input with CMOS levels
O = Output
OD = Open-Drain (no diode to VDD)
CMOS = CMOS compatible input or output
I = Input
P = Power

- 28-pin QFN details have been added to **Section 27.1 “Package Marking Information”** (page 373).

27.1 Package Marking Information

28-Lead QFN



Example



Legend:	XX...X	Customer-specific information
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week '01')
	NNN	Alphanumeric traceability code
	(e3)	Pb-free JEDEC designator for Matte Tin (Sn)
	*	This package is Pb-free. The Pb-free JEDEC designator (e3) can be found on the outer packaging for this package.

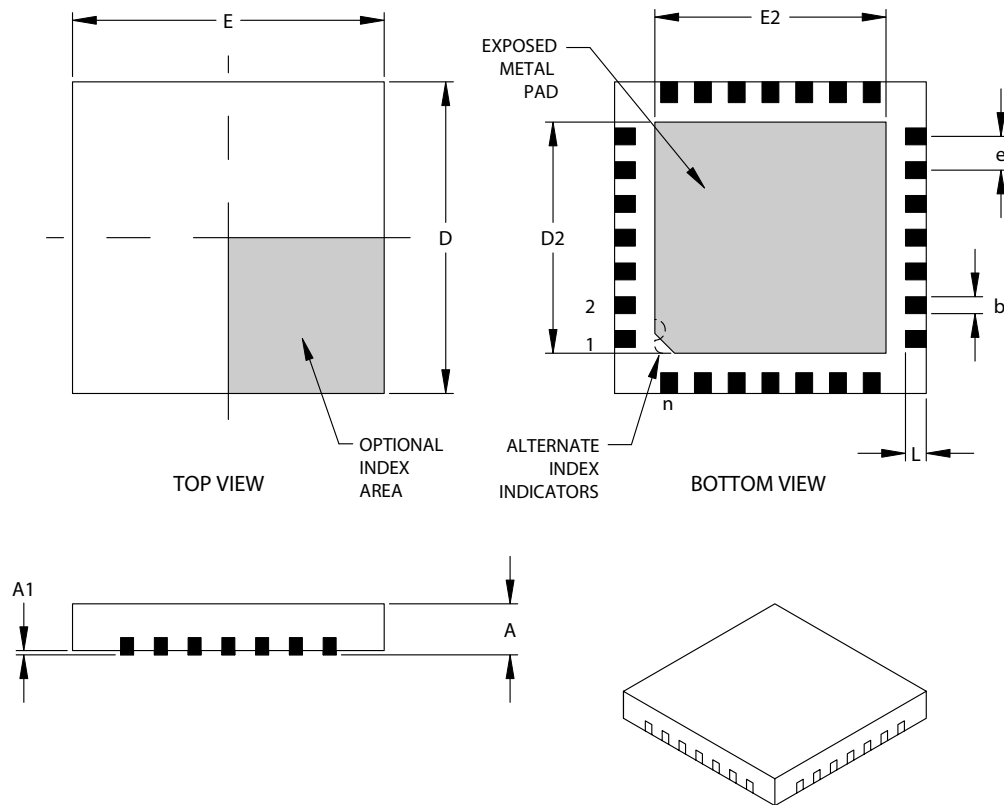
Note: In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for customer-specific information.

- * Standard PICmicro device marking consists of Microchip part number, year code, week code, and traceability code. For PICmicro device marking beyond this, certain price adders apply. Please check with your Microchip Sales Office. For QTP devices, any special marking adders are included in QTP price.

PIC18F2331/2431/4331/4431

- 28-pin QFN packaging details have been added to Section 27.2 "Package Details" (page 374).

28-Lead Plastic Quad Flat No Lead Package (MM) 6x6x0.9 mm Body (QFN-S) – With 0.40 mm Contact Length (Saw Singulated)



Units		INCHES			MILLIMETERS*		
Dimension Limits		MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n	28			28		
Pitch	e	.026 BSC			0.65 BSC		
Overall Height	A	.031	.035	.039	0.80	0.90	1.00
Standoff	A1	.000	.001	.002	0.00	0.02	0.05
Overall Width	E	.232	.236	.240	5.90	6.00	6.10
Exposed Pad Width	E2	.169	.175	.177	4.30	4.45	4.50
Overall Length	D	.232	.236	.240	5.90	6.00	6.10
Exposed Pad Length	D2	.169	.175	.177	4.30	4.45	4.50
Lead Width	b	.013	.015	.017	0.33	0.38	0.43
Lead Length	L	.012	.016	.020	0.30	0.40	0.50

*Controlling Parameter

Notes:

JEDEC equivalent: MO-220

Drawing No. C04-124

Revised 05/24/04

REVISION HISTORY

Rev A Document (06/2005)

First revision of this document. Data Sheet Clarification issues 1 (Power-on Reset), 2 (Watchdog Timer), 3 (PWM Equations), 4 (DC Characteristics), 5 (LVD Characteristics), and 6 (28-Pin QFN Diagram).

PIC18F2331/2431/4331/4431

NOTES:

Note the following details of the code protection feature on Microchip devices:

- Microchip products meet the specification contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.
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- Microchip is willing to work with the customer who is concerned about the integrity of their code.
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