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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	40MHz
Connectivity	-
Peripherals	POR, WDT
Number of I/O	20
Program Memory Size	768B (512 x 12)
Program Memory Type	OTP
EEPROM Size	-
RAM Size	24 x 8
Voltage - Supply (Vcc/Vdd)	2.5V ~ 6.25V
Data Converters	-
Oscillator Type	External
Operating Temperature	0°C ~ 70°C (TA)
Mounting Type	Surface Mount
Package / Case	28-SSOP (0.209", 5.30mm Width)
Supplier Device Package	28-SSOP
Purchase URL	https://www.e-xfl.com/product-detail/microchip-technology/pic16c55-lp-ss

3.0 ARCHITECTURAL OVERVIEW

The high performance of the PIC16C5X family can be attributed to a number of architectural features commonly found in RISC microprocessors. To begin with, the PIC16C5X uses a Harvard architecture in which program and data are accessed on separate buses. This improves bandwidth over traditional von Neumann architecture where program and data are fetched on the same bus. Separating program and data memory further allows instructions to be sized differently than the 8-bit wide data word. Instruction opcodes are 12 bits wide making it possible to have all single word instructions. A 12-bit wide program memory access bus fetches a 12-bit instruction in a single cycle. A two-stage pipeline overlaps fetch and execution of instructions. Consequently, all instructions (33) execute in a single cycle except for program branches.

The PIC16C54/CR54 and PIC16C55 address 512 x 12 of program memory, the PIC16C56/CR56 address 1K x 12 of program memory, and the PIC16C57/CR57 and PIC16C58/CR58 address 2K x 12 of program memory. All program memory is internal.

The PIC16C5X can directly or indirectly address its register files and data memory. All special function registers including the program counter are mapped in the data memory. The PIC16C5X has a highly orthogonal (symmetrical) instruction set that makes it possible to carry out any operation on any register using any addressing mode. This symmetrical nature and lack of ‘special optimal situations’ make programming with the PIC16C5X simple yet efficient. In addition, the learning curve is reduced significantly.

The PIC16C5X device contains an 8-bit ALU and working register. The ALU is a general purpose arithmetic unit. It performs arithmetic and Boolean functions between data in the working register and any register file.

The ALU is 8 bits wide and capable of addition, subtraction, shift and logical operations. Unless otherwise mentioned, arithmetic operations are two's complement in nature. In two-operand instructions, typically one operand is the W (working) register. The other operand is either a file register or an immediate constant. In single operand instructions, the operand is either the W register or a file register.

The W register is an 8-bit working register used for ALU operations. It is not an addressable register.

Depending on the instruction executed, the ALU may affect the values of the Carry (C), Digit Carry (DC), and Zero (Z) bits in the STATUS register. The C and DC bits operate as a borrow and digit borrow out bit, respectively, in subtraction. See the `SUBWF` and `ADDWF` instructions for examples.

A simplified block diagram is shown in Figure 3-1, with the corresponding device pins described in Table 3-1 (for PIC16C54/56/58) and Table 3-2 (for PIC16C55/57).

TABLE 3-1: PINOUT DESCRIPTION - PIC16C54, PIC16CR54, PIC16C56, PIC16CR56, PIC16C58, PIC16CR58

Pin Name	Pin Number			Pin Type	Buffer Type	Description
	DIP	SOIC	SSOP			
RA0	17	17	19	I/O	TTL	Bi-directional I/O port
RA1	18	18	20	I/O	TTL	
RA2	1	1	1	I/O	TTL	
RA3	2	2	2	I/O	TTL	
RB0	6	6	7	I/O	TTL	Bi-directional I/O port
RB1	7	7	8	I/O	TTL	
RB2	8	8	9	I/O	TTL	
RB3	9	9	10	I/O	TTL	
RB4	10	10	11	I/O	TTL	
RB5	11	11	12	I/O	TTL	
RB6	12	12	13	I/O	TTL	
RB7	13	13	14	I/O	TTL	
T0CKI	3	3	3	I	ST	Clock input to Timer0. Must be tied to V_{SS} or V_{DD}, if not in use, to reduce current consumption.
$\overline{MCLR}/V_{PP}$	4	4	4	I	ST	Master clear (RESET) input/programming voltage input. This pin is an active low RESET to the device. Voltage on the $\overline{MCLR}/V_{PP}$ pin must not exceed V_{DD} to avoid unintended entering of Programming mode.
OSC1/CLKIN	16	16	18	I	ST	Oscillator crystal input/external clock source input.
OSC2/CLKOUT	15	15	17	O	—	Oscillator crystal output. Connects to crystal or resonator in crystal Oscillator mode. In RC mode, OSC2 pin outputs CLKOUT, which has 1/4 the frequency of OSC1 and denotes the instruction cycle rate.
V_{DD}	14	14	15,16	P	—	Positive supply for logic and I/O pins.
V_{SS}	5	5	5,6	P	—	Ground reference for logic and I/O pins.

Legend: I = input, O = output, I/O = input/output, P = power, — = Not Used, TTL = TTL input, ST = Schmitt Trigger input

FIGURE 8-3: TIMER0 TIMING: INTERNAL CLOCK/NO PRESCALER

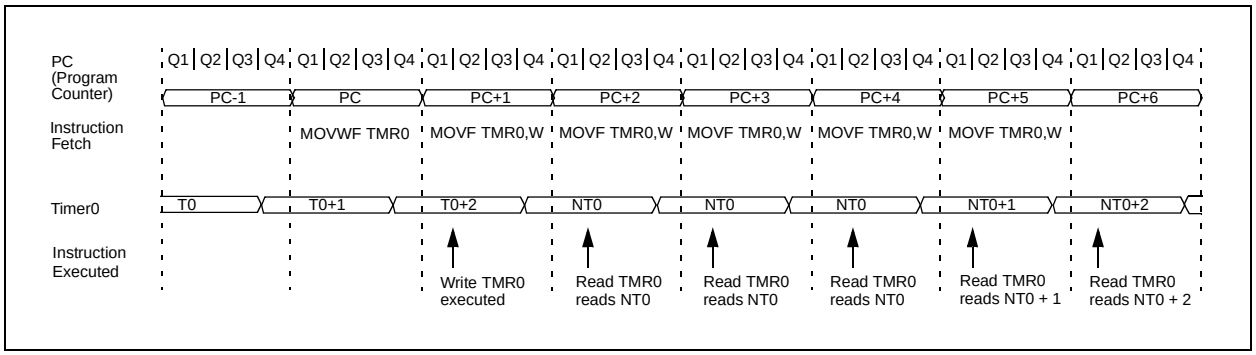


FIGURE 8-4: TIMER0 TIMING: INTERNAL CLOCK/PRESCALER 1:2

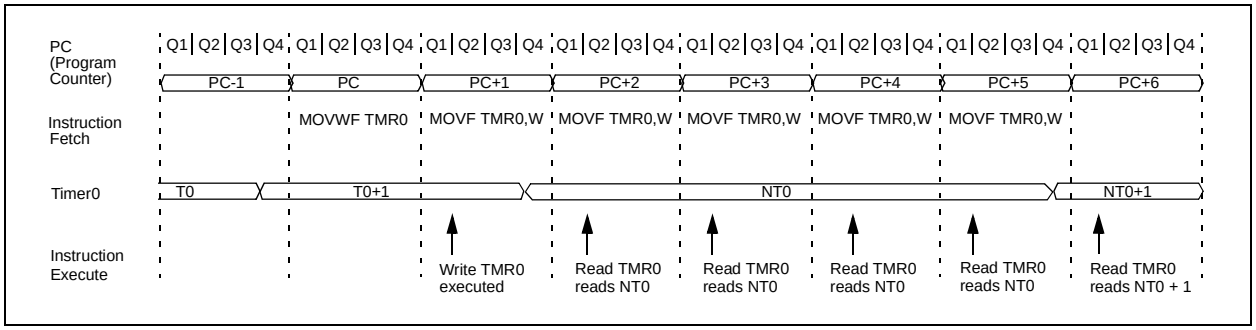


TABLE 8-1: REGISTERS ASSOCIATED WITH TIMER0

Address	Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Value on Power-on Reset	Value on MCLR and WDT Reset
01h	TMR0	Timer0 - 8-bit real-time clock/counter								xxxx xxxx	uuuu uuuu
N/A	OPTION	—	—	T0CS	T0SE	PSA	PS2	PS1	PS0	--11 1111	--11 1111

Legend: x = unknown, u = unchanged, - = unimplemented. Shaded cells not used by Timer0.

TABLE 11-1: DEVELOPMENT TOOLS FROM MICROCHIP

		PIC12CXXX	PIC14000	PIC16C5X	PIC16C6X	PIC16CXXX	PIC16F62X	PIC16C7X	PIC16C7XX	PIC16C8X	PIC16F8XX	PIC16C9XX	PIC17C4X	PIC17C7XX	PIC18CXX2	PIC18FXXX	24CXX/ 25CXX/ 93CXX	HCSXXX	MCRFXXX	MCP2510
Software Tools	MPLAB® Integrated Development Environment	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				
	MPLAB® C17 C Compiler												✓	✓						
	MPLAB® C18 C Compiler														✓	✓				
	MPASM™ Assembler/ MPLINK™ Object Linker	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Emulators	MPLAB® ICE In-Circuit Emulator	✓	✓	✓	✓	✓	✓**	✓	✓	✓	✓	✓	✓	✓	✓	✓				
	ICEPIC™ In-Circuit Emulator	✓		✓	✓	✓		✓	✓	✓		✓								
Debugger	MPLAB® ICD In-Circuit Debugger				✓*			✓*			✓					✓				
Programmers	PICSTART® Plus Entry Level Development Programmer	✓	✓	✓	✓	✓	✓**	✓	✓	✓	✓	✓	✓	✓	✓	✓				
	PRO MATE® II Universal Device Programmer	✓	✓	✓	✓	✓	✓**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Demo Boards and Eval Kits	PICDEM™ 1 Demonstration Board			✓		✓		✓†		✓			✓							
	PICDEM™ 2 Demonstration Board				✓†			✓†							✓	✓				
	PICDEM™ 3 Demonstration Board											✓								
	PICDEM™ 14A Demonstration Board		✓																	
	PICDEM™ 17 Demonstration Board													✓						
	KEELOQ® Evaluation Kit																✓		✓	
	KEELOQ® Transponder Kit																✓			
	microID™ Programmer's Kit																	✓		
	125 kHz microID™ Developer's Kit																		✓	
	125 kHz Anticollision microID™ Developer's Kit																		✓	
	13.56 MHz Anticollision microID™ Developer's Kit																		✓	
	MCP2510 CAN Developer's Kit																			✓

* Contact the Microchip Technology Inc. web site at www.microchip.com for information on how to use the MPLAB® ICD In-Circuit Debugger (DV164001) with PIC16C62, 63, 64, 65, 72, 73, 74, 76, 77.

** Contact Microchip Technology Inc. for availability date.

† Development tool is available on select devices.

NOTES:

12.1 DC Characteristics: PIC16C54/55/56/57-RC, XT, 10, HS, LP (Commercial)

PIC16C54/55/56/57-RC, XT, 10, HS, LP (Commercial)			**Standard Operating Conditions (unless otherwise specified)** Operating Temperature 0°C ≤ TA ≤ +70°C for commercial				
Param No.	**Symbol**	**Characteristic/Device**	**Min**	**Typ†**	**Max**	**Units**	**Conditions**
D001	VDD	**Supply Voltage**					
		PIC16C5X-RC	3.0	—	6.25	V	
		PIC16C5X-XT	3.0	—	6.25	V	
		PIC16C5X-10	4.5	—	5.5	V	
		PIC16C5X-HS	4.5	—	5.5	V	
		PIC16C5X-LP	2.5	—	6.25	V	
D002	VDR	**RAM Data Retention Voltage(1)**		1.5*	—	V	Device in SLEEP Mode
D003	VPOR	**VDD Start Voltage** to ensure Power-on Reset		VSS	—	V	See Section 5.1 for details on Power-on Reset
D004	SVDD	**VDD Rise Rate** to ensure Power-on Reset	0.05*	—	—	V/ms	See Section 5.1 for details on Power-on Reset
D010	IDD	**Supply Current(2)**					
		PIC16C5X-RC(3)	—	1.8	3.3	mA	FOSC = 4 MHz, VDD = 5.5V
		PIC16C5X-XT	—	1.8	3.3	mA	FOSC = 4 MHz, VDD = 5.5V
		PIC16C5X-10	—	4.8	10	mA	FOSC = 10 MHz, VDD = 5.5V
		PIC16C5X-HS	—	4.8	10	mA	FOSC = 10 MHz, VDD = 5.5V
		PIC16C5X-HS	—	9.0	20	mA	FOSC = 20 MHz, VDD = 5.5V
		PIC16C5X-LP	—	15	32	µA	FOSC = 32 kHz, VDD = 3.0V, WDT disabled
D020	IPD	**Power-down Current(2)**	—	4.0	12	µA	VDD = 3.0V, WDT enabled
			—	0.6	9	µA	VDD = 3.0V, WDT disabled

* These parameters are characterized but not tested.

† Data in "Typ" column is based on characterization results at 25°C. This data is for design guidance only and is not tested.

Note 1: This is the limit to which VDD can be lowered in SLEEP mode without losing RAM data.

2: The supply current is mainly a function of the operating voltage and frequency. Other factors such as bus loading, oscillator type, bus rate, internal code execution pattern and temperature also have an impact on the current consumption.

a) The test conditions for all IDD measurements in active Operation mode are: OSC1 = external square wave, from rail-to-rail; all I/O pins tristated, pulled to VSS, T0CKI = VDD, $\overline{\text{MCLR}}$ = VDD; WDT enabled/disabled as specified.

b) For standby current measurements, the conditions are the same, except that the device is in SLEEP mode. The power-down current in SLEEP mode does not depend on the oscillator type.

3: Does not include current through REXT. The current through the resistor can be estimated by the formula: IR = VDD/2REXT (mA) with REXT in kΩ.

12.4 DC Characteristics: PIC16C54/55/56/57-RC, XT, 10, HS, LP (Commercial) PIC16C54/55/56/57-RCI, XTI, 10I, HSI, LPI (Industrial)

DC CHARACTERISTICS			Standard Operating Conditions (unless otherwise specified) Operating Temperature 0°C ≤ TA ≤ +70°C for commercial –40°C ≤ TA ≤ +85°C for industrial				
Param No.	**Symbol**	**Characteristic/Device**	**Min**	**Typ†**	**Max**	**Units**	**Conditions**
D030	VIL	**Input Low Voltage**					
		I/O ports	VSS	—	0.2 VDD	V	Pin at hi-impedance
		MCLR (Schmitt Trigger)	VSS	—	0.15 VDD	V	
		T0CKI (Schmitt Trigger)	VSS	—	0.15 VDD	V	
		OSC1 (Schmitt Trigger)	VSS	—	0.15 VDD	V	PIC16C5X-RC only(3)
		OSC1 (Schmitt Trigger)	VSS	—	0.3 VDD	V	PIC16C5X-XT, 10, HS, LP
D040	VIH	**Input High Voltage**					
		I/O ports	0.45 VDD	—	VDD	V	For all VDD(4)
		I/O ports	2.0	—	VDD	V	4.0V < VDD ≤ 5.5V(4)
		I/O ports	0.36 VDD	—	VDD	V	VDD > 5.5V
		MCLR (Schmitt Trigger)	0.85 VDD	—	VDD	V	
		T0CKI (Schmitt Trigger)	0.85 VDD	—	VDD	V	
		OSC1 (Schmitt Trigger)	0.85 VDD	—	VDD	V	PIC16C5X-RC only(3)
		OSC1 (Schmitt Trigger)	0.7 VDD	—	VDD	V	PIC16C5X-XT, 10, HS, LP
D050	VHYS	**Hysteresis of Schmitt Trigger inputs**	0.15 VDD*	—	—	V	
D060	IIL	**Input Leakage Current(1,2)**					**For VDD ≤ 5.5V:**
		I/O ports	–1	0.5	+1	µA	VSS ≤ VPIN ≤ VDD, pin at hi-impedance
		MCLR	–5	—	—	µA	VPIN = VSS + 0.25V
		MCLR	—	0.5	+5	µA	VPIN = VDD
		T0CKI	–3	0.5	+3	µA	VSS ≤ VPIN ≤ VDD
		OSC1	–3	0.5	+3	µA	VSS ≤ VPIN ≤ VDD, PIC16C5X-XT, 10, HS, LP
D080	VOL	**Output Low Voltage**					
		I/O ports	—	—	0.6	V	IOL = 8.7 mA, VDD = 4.5V
		OSC2/CLKOUT	—	—	0.6	V	IOL = 1.6 mA, VDD = 4.5V, PIC16C5X-RC
D090	VOH	**Output High Voltage(2)**					
		I/O ports	VDD – 0.7	—	—	V	IOH = –5.4 mA, VDD = 4.5V
		OSC2/CLKOUT	VDD – 0.7	—	—	V	IOH = –1.0 mA, VDD = 4.5V, PIC16C5X-RC

* These parameters are characterized but not tested.

† Data in the Typical ("Typ") column is based on characterization results at 25°C. This data is for design guidance only and is not tested.

Note 1: The leakage current on the MCLR/VPP pin is strongly dependent on the applied voltage level. The specified levels represent normal operating conditions. Higher leakage current may be measured at different input voltage.

2: Negative current is defined as coming out of the pin.

3: For PIC16C5X-RC devices, the OSC1/CLKIN pin is a Schmitt Trigger input. It is not recommended that the PIC16C5X be driven with external clock in RC mode.

4: The user may use the better of the two specifications.

TABLE 12-1: EXTERNAL CLOCK TIMING REQUIREMENTS - PIC16C54/55/56/57

AC Characteristics		Standard Operating Conditions (unless otherwise specified) Operating Temperature 0°C ≤ TA ≤ +70°C for commercial –40°C ≤ TA ≤ +85°C for industrial –40°C ≤ TA ≤ +125°C for extended					
Param No.	**Symbol**	**Characteristic**	**Min**	**Typ†**	**Max**	**Units**	**Conditions**
1	TOSC	External CLKIN Period(1)	250	—	—	ns	XT OSC mode
			100	—	—	ns	10 MHz mode
			50	—	—	ns	HS OSC mode (Comm/Ind)
			62.5	—	—	ns	HS OSC mode (Ext)
			25	—	—	µs	LP OSC mode
		Oscillator Period(1)	250	—	—	ns	RC OSC mode
			250	—	10,000	ns	XT OSC mode
			100	—	250	ns	10 MHz mode
			50	—	250	ns	HS OSC mode (Comm/Ind)
			62.5	—	250	ns	HS OSC mode (Ext)
			25	—	—	µs	LP OSC mode
2	Tcy	Instruction Cycle Time(2)	—	4/FOSC	—	—	
3	TosL, TosH	Clock in (OSC1) Low or High Time	85*	—	—	ns	XT oscillator
			20*	—	—	ns	HS oscillator
			2.0*	—	—	µs	LP oscillator
4	TosR, TosF	Clock in (OSC1) Rise or Fall Time	—	—	25*	ns	XT oscillator
			—	—	25*	ns	HS oscillator
			—	—	50*	ns	LP oscillator

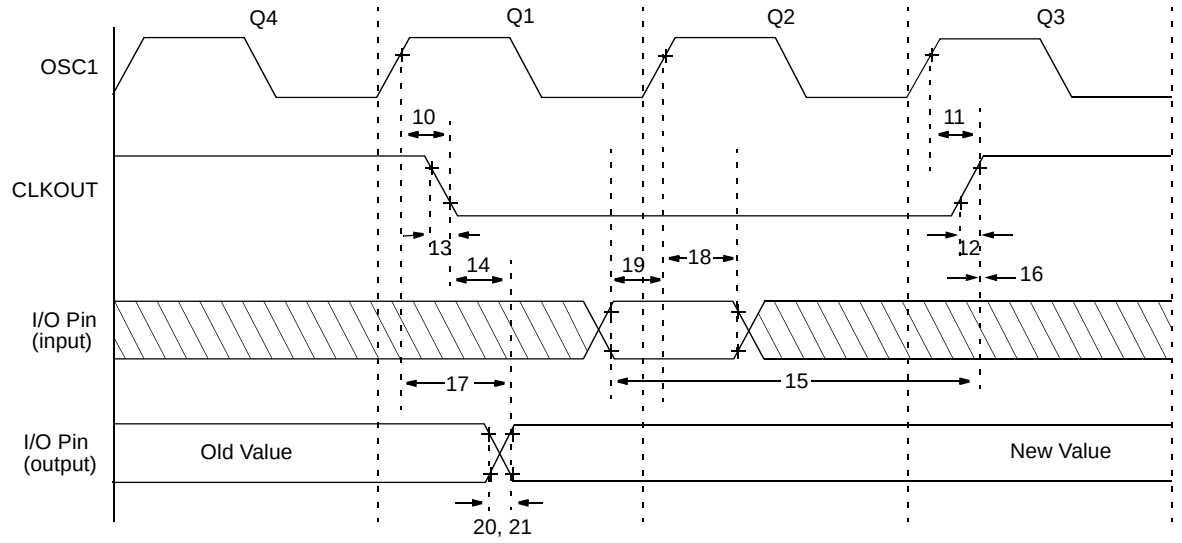
* These parameters are characterized but not tested.

† Data in the Typical ("Typ") column is at 5.0V, 25°C unless otherwise stated. These parameters are for design guidance only and are not tested.

Note 1: All specified values are based on characterization data for that particular oscillator type under standard operating conditions with the device executing code. Exceeding these specified limits may result in an unstable oscillator operation and/or higher than expected current consumption.
When an external clock input is used, the "max" cycle time limit is "DC" (no clock) for all devices.

2: Instruction cycle period (TCY) equals four times the input oscillator time base period.

FIGURE 12-3: CLKOUT AND I/O TIMING - PIC16C54/55/56/57



Note: Please refer to Figure 12-1 for load conditions.

TABLE 12-2: CLKOUT AND I/O TIMING REQUIREMENTS - PIC16C54/55/56/57

AC Characteristics		**Standard Operating Conditions (unless otherwise specified)** Operating Temperature 0°C ≤ TA ≤ +70°C for commercial –40°C ≤ TA ≤ +85°C for industrial –40°C ≤ TA ≤ +125°C for extended				
Param No.	**Symbol**	**Characteristic**	**Min**	**Typ†**	**Max**	**Units**
10	TosH2ckL	OSC1↑ to CLKOUT↓(1)	—	15	30**	ns
11	TosH2ckH	OSC1↑ to CLKOUT↑(1)	—	15	30**	ns
12	TckR	CLKOUT rise time(1)	—	5.0	15**	ns
13	TckF	CLKOUT fall time(1)	—	5.0	15**	ns
14	TckL2ioV	CLKOUT↓ to Port out valid(1)	—	—	40**	ns
15	TioV2ckH	Port in valid before CLKOUT↑(1)	0.25 TCY+30*	—	—	ns
16	TckH2ioI	Port in hold after CLKOUT↑(1)	0*	—	—	ns
17	TosH2ioV	OSC1↑ (Q1 cycle) to Port out valid(2)	—	—	100*	ns
18	TosH2ioI	OSC1↑ (Q2 cycle) to Port input invalid (I/O in hold time)	TBD	—	—	ns
19	TioV2osH	Port input valid to OSC1↑ (I/O in setup time)	TBD	—	—	ns
20	TioR	Port output rise time(2)	—	10	25**	ns
21	TioF	Port output fall time(2)	—	10	25**	ns

* These parameters are characterized but not tested.

** These parameters are design targets and are not tested. No characterization data available at this time.

† Data in the Typical ("Typ") column is at 5.0V, 25°C unless otherwise stated. These parameters are for design guidance only and are not tested.

Note 1: Measurements are taken in RC Mode where CLKOUT output is 4 x Tosc.

2: Please refer to Figure 12-1 for load conditions.

FIGURE 14-17: TRANSCONDUCTANCE (gm) OF LP OSCILLATOR vs. VDD

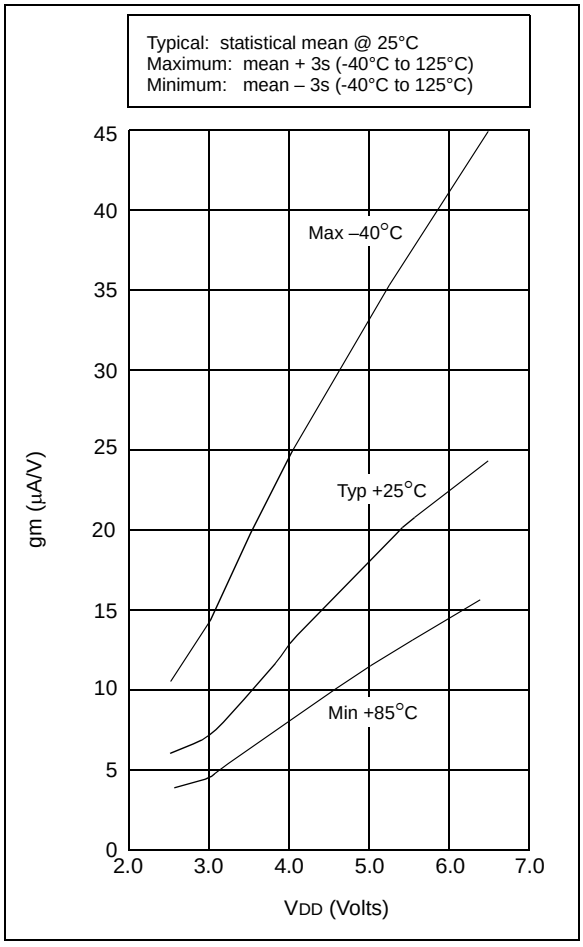


FIGURE 14-18: TRANSCONDUCTANCE (gm) OF XT OSCILLATOR vs. VDD

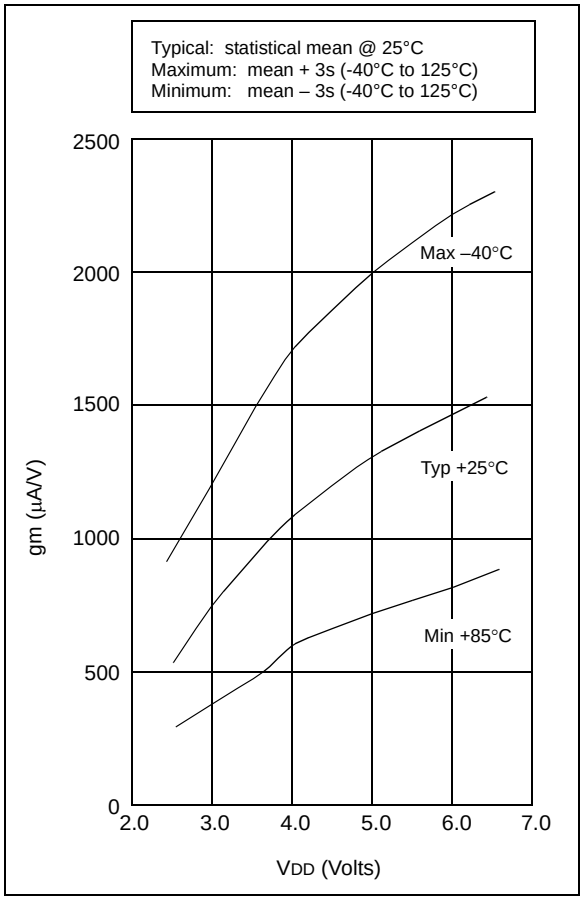


FIGURE 14-19: PORTA, B AND C I_{OH} vs. V_{OH}, V_{DD} = 3 V

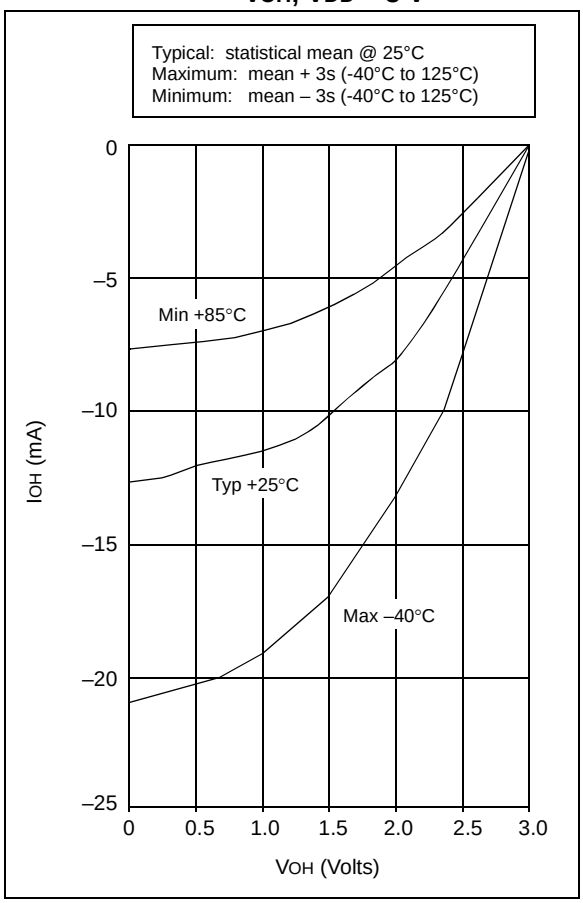


FIGURE 14-20: PORTA, B AND C I_{OH} vs. V_{OH}, V_{DD} = 5 V

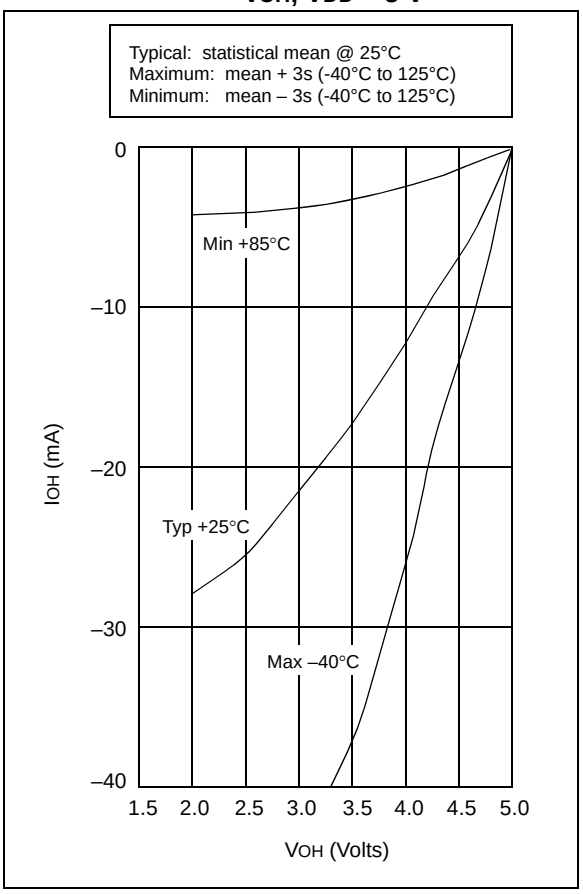


FIGURE 14-21: PORTA, B AND C I_{OL} vs. V_{OL}, V_{DD} = 3 V

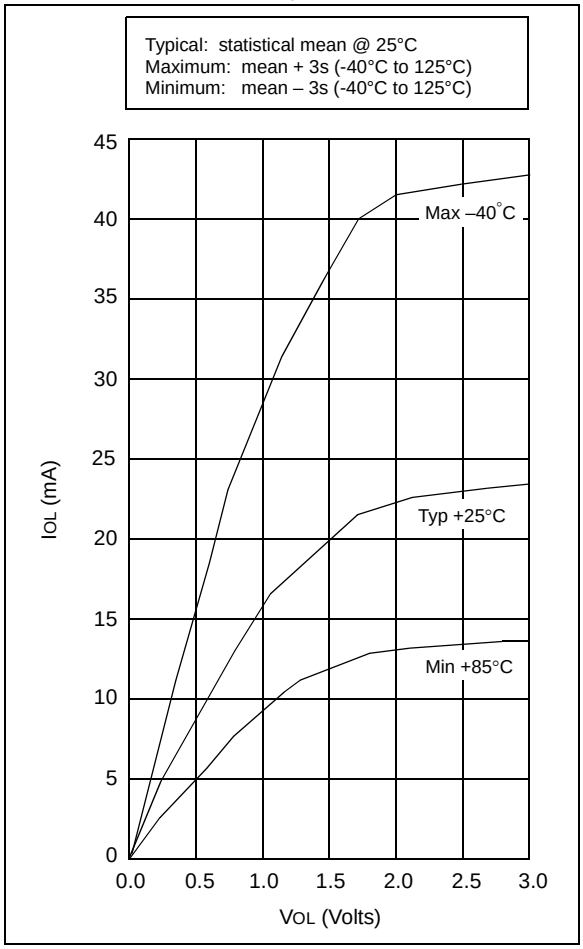
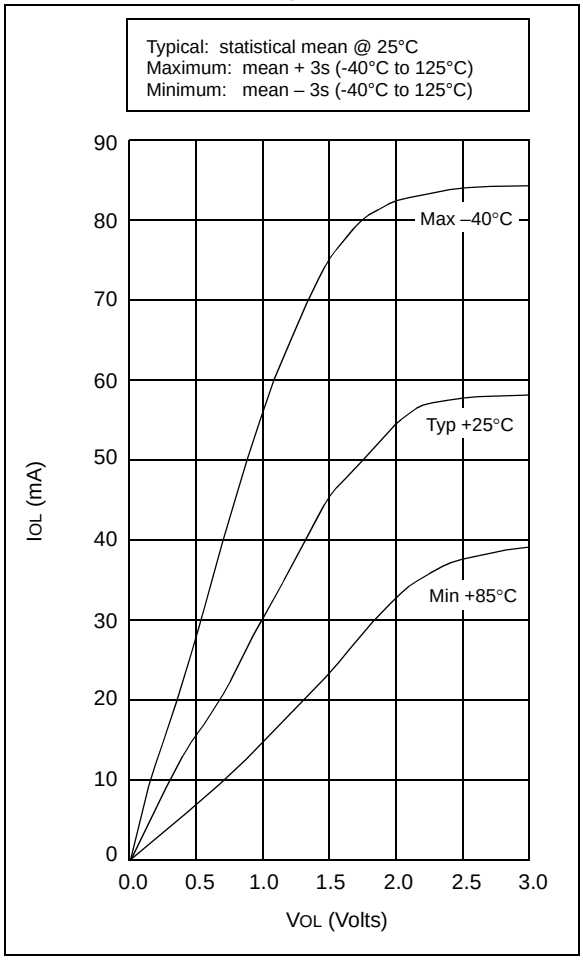


FIGURE 14-22: PORTA, B AND C I_{OL} vs. V_{OL}, V_{DD} = 5 V



15.1 DC Characteristics: PIC16C54A-04, 10, 20 (Commercial)
PIC16C54A-04I, 10I, 20I (Industrial)
PIC16LC54A-04 (Commercial)
PIC16LC54A-04I (Industrial)

PIC16LC54A-04 **PIC16LC54A-04I** (Commercial, Industrial)	**Standard Operating Conditions (unless otherwise specified)** Operating Temperature 0°C ≤ TA ≤ +70°C for commercial –40°C ≤ TA ≤ +85°C for industrial
PIC16C54A-04, 10, 20 **PIC16C54A-04I, 10I, 20I** (Commercial, Industrial)	**Standard Operating Conditions (unless otherwise specified)** Operating Temperature 0°C ≤ TA ≤ +70°C for commercial –40°C ≤ TA ≤ +85°C for industrial

Param No.	Symbol	Characteristic/Device	Min	Typ†	Max	Units	Conditions
	IPD	**Power-down Current(2)**					
D006		PIC16LC5X	—	2.5	12	µA	VDD = 2.5V, WDT enabled, Commercial
			—	0.25	4.0	µA	VDD = 2.5V, WDT disabled, Commercial
			—	2.5	14	µA	VDD = 2.5V, WDT enabled, Industrial
			—	0.25	5.0	µA	VDD = 2.5V, WDT disabled, Industrial
D006A		PIC16C5X	—	4.0	12	µA	VDD = 3.0V, WDT enabled, Commercial
			—	0.25	4.0	µA	VDD = 3.0V, WDT disabled, Commercial
			—	5.0	14	µA	VDD = 3.0V, WDT enabled, Industrial
			—	0.3	5.0	µA	VDD = 3.0V, WDT disabled, Industrial

Legend: Rows with standard voltage device data only are shaded for improved readability.

* These parameters are characterized but not tested.

† Data in "Typ" column is based on characterization results at 25°C. This data is for design guidance only and is not tested.

Note 1: This is the limit to which VDD can be lowered in SLEEP mode without losing RAM data.

2: The supply current is mainly a function of the operating voltage and frequency. Other factors such as bus loading, oscillator type, bus rate, internal code execution pattern and temperature also have an impact on the current consumption.

a) The test conditions for all IDD measurements in active Operation mode are: OSC1 = external square wave, from rail-to-rail; all I/O pins tristated, pulled to VSS, T0CKI = VDD, $\overline{MCLR}$ = VDD; WDT enabled/disabled as specified.

b) For standby current measurements, the conditions are the same, except that the device is in SLEEP mode. The power-down current in SLEEP mode does not depend on the oscillator type.

3: Does not include current through REXT. The current through the resistor can be estimated by the formula: IR = VDD/2REXT (mA) with REXT in kΩ.

15.4 DC Characteristics: PIC16C54A-04, 10, 20, PIC16LC54A-04, PIC16LV54A-02 (Commercial) PIC16C54A-04I, 10I, 20I, PIC16LC54A-04I, PIC16LV54A-02I (Industrial) PIC16C54A-04E, 10E, 20E, PIC16LC54A-04E (Extended)

DC CHARACTERISTICS			Standard Operating Conditions (unless otherwise specified) Operating Temperature 0°C ≤ TA ≤ +70°C for commercial –40°C ≤ TA ≤ +85°C for industrial –20°C ≤ TA ≤ +85°C for industrial-PIC16LV54A-02I –40°C ≤ TA ≤ +125°C for extended				
Param No.	**Symbol**	**Characteristic**	**Min**	**Typ†**	**Max**	**Units**	**Conditions**
D030	VIL	**Input Low Voltage**					
		I/O ports	VSS	—	0.2 VDD	V	Pin at hi-impedance
		MCLR (Schmitt Trigger)	VSS	—	0.15 VDD	V	
		T0CKI (Schmitt Trigger)	VSS	—	0.15 VDD	V	
		OSC1 (Schmitt Trigger)	VSS	—	0.15 VDD	V	RC mode only(3)
		OSC1	VSS	—	0.3 VDD		XT, HS and LP modes
D040	VIH	**Input High Voltage**					
		I/O ports	0.2 VDD + 1	—	VDD	V	For all VDD(4)
		I/O ports	2.0	—	VDD	V	4.0V < VDD ≤ 5.5V(4)
		MCLR (Schmitt Trigger)	0.85 VDD	—	VDD	V	
		T0CKI (Schmitt Trigger)	0.85 VDD	—	VDD	V	
		OSC1 (Schmitt Trigger)	0.85 VDD	—	VDD	V	RC mode only(3)
		OSC1	0.7 VDD	—	VDD	V	XT, HS and LP modes
D050	VHYS	**Hysteresis of Schmitt Trigger inputs**	0.15 VDD*	—	—	V	
D060	IIL	**Input Leakage Current(1,2)**					**For VDD ≤ 5.5V:**
		I/O ports	-1.0	0.5	+1.0	µA	VSS ≤ VPIN ≤ VDD, pin at hi-impedance
		MCLR	-5.0	—	+5.0	µA	VPIN = VSS +0.25V
		MCLR	—	0.5	+3.0	µA	VPIN = VDD
		T0CKI	-3.0	0.5	+3.0	µA	VSS ≤ VPIN ≤ VDD
		OSC1	-3.0	0.5	—	µA	VSS ≤ VPIN ≤ VDD, XT, HS and LP modes
D080	VOL	**Output Low Voltage**					
		I/O ports	—	—	0.6	V	IOL = 8.7 mA, VDD = 4.5V
		OSC2/CLKOUT	—	—	0.6	V	IOL = 1.6 mA, VDD = 4.5V, RC mode only
	VOH	**Output High Voltage(2)**					
		I/O ports	VDD - 0.7	—	—	V	IOH = -5.4 mA, VDD = 4.5V
		OSC2/CLKOUT	VDD - 0.7	—	—	V	IOH = -1.0 mA, VDD = 4.5V, RC mode only

* These parameters are characterized but not tested.

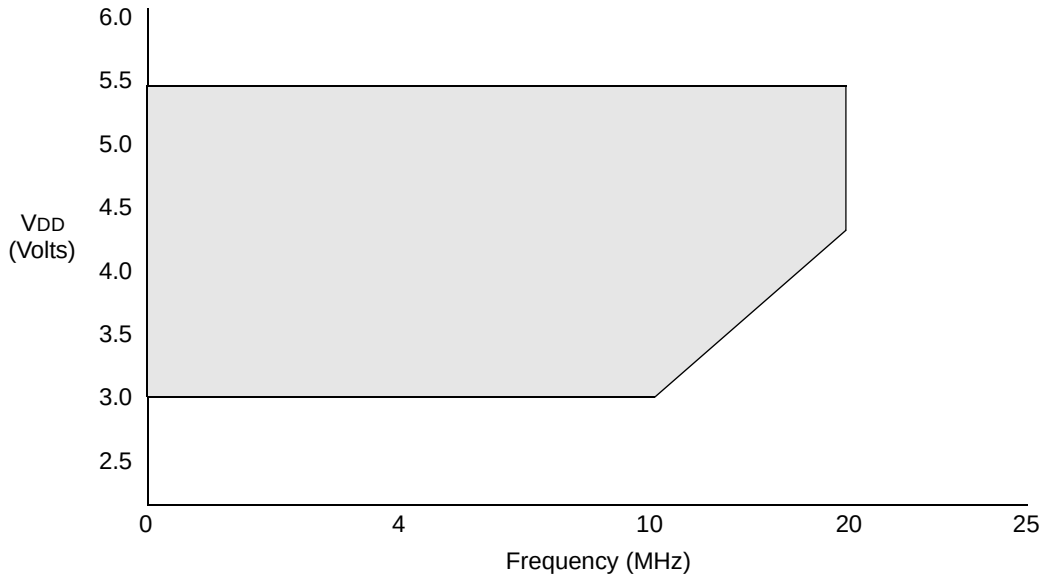
† Data in the Typical ("Typ") column is based on characterization results at 25°C. This data is for design guidance only and is not tested.

Note 1: The leakage current on the MCLR/VPP pin is strongly dependent on the applied voltage level. The specified levels represent normal operating conditions. Higher leakage current may be measured at different input voltage.

2: Negative current is defined as coming out of the pin.

3: For the RC mode, the OSC1/CLKIN pin is a Schmitt Trigger input. It is not recommended that the PIC16C5X be driven with external clock in RC mode.

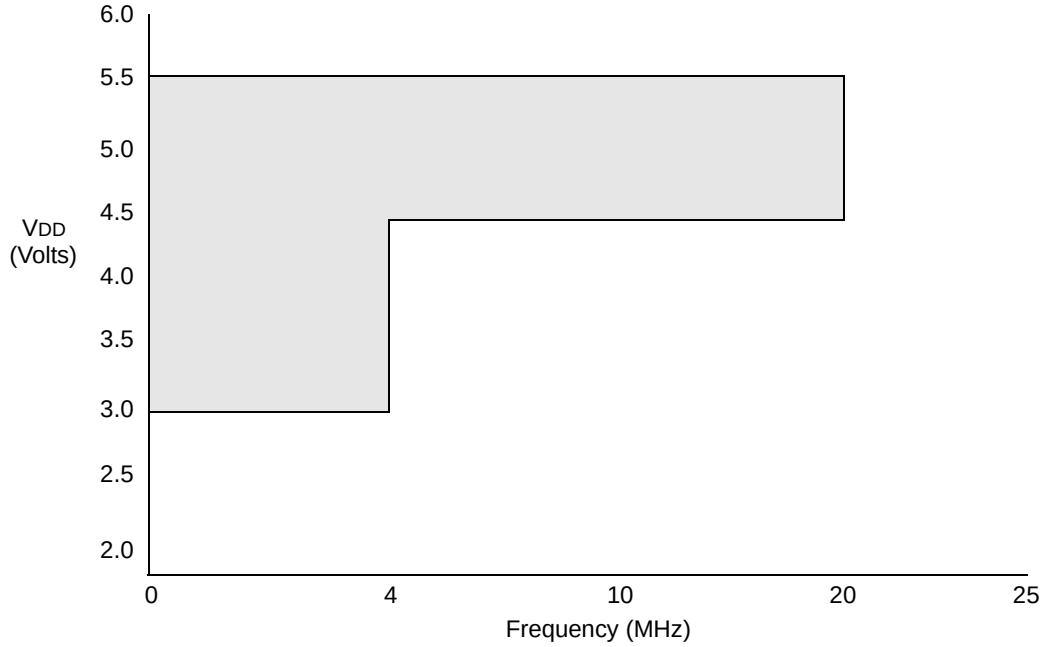
FIGURE 17-1: PIC16C54C/55A/56A/57C/58B-04, 20 VOLTAGE-FREQUENCY GRAPH, 0°C ≤ T_A ≤ +70°C (COMMERCIAL TEMPS)



Note 1: The shaded region indicates the permissible combinations of voltage and frequency.

2: The maximum rated speed of the part limits the permissible combinations of voltage and frequency. Please reference the Product Identification System section for the maximum rated speed of the parts.

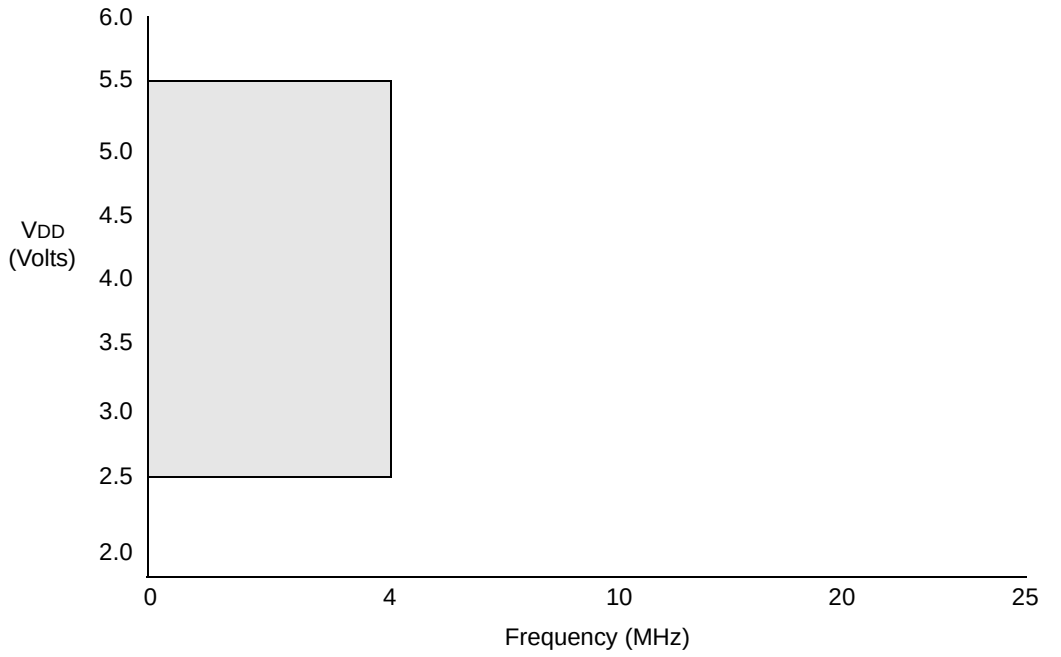
FIGURE 17-2: PIC16C54C/55A/56A/57C/58B-04, 20 VOLTAGE-FREQUENCY GRAPH, -40°C ≤ T_A < 0°C, +70°C < T_A ≤ +125°C (OUTSIDE OF COMMERCIAL TEMPS)



Note 1: The shaded region indicates the permissible combinations of voltage and frequency.

2: The maximum rated speed of the part limits the permissible combinations of voltage and frequency. Please reference the Product Identification System section for the maximum rated speed of the parts.

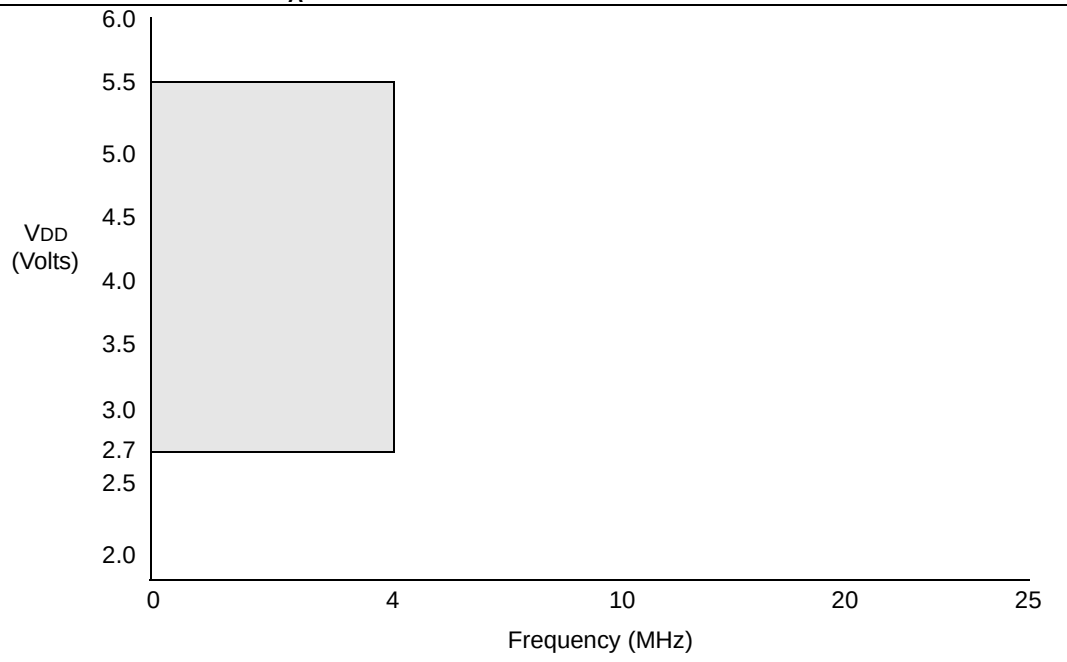
FIGURE 17-3: PIC16LC54C/55A/56A/57C/58B VOLTAGE-FREQUENCY GRAPH, $0°C \leq T_A \leq +85°C$



Note 1: The shaded region indicates the permissible combinations of voltage and frequency.

2: The maximum rated speed of the part limits the permissible combinations of voltage and frequency. Please reference the Product Identification System section for the maximum rated speed of the parts.

FIGURE 17-4: PIC16LC54C/55A/56A/57C/58B VOLTAGE-FREQUENCY GRAPH, $-40°C \leq T_A \leq 0°C$



Note 1: The shaded region indicates the permissible combinations of voltage and frequency.

2: The maximum rated speed of the part limits the permissible combinations of voltage and frequency. Please reference the Product Identification System section for the maximum rated speed of the parts.

FIGURE 18-10: V_{TH} (INPUT THRESHOLD TRIP POINT VOLTAGE) OF OSC1 INPUT (IN XT, HS AND LP MODES) vs. V_{DD}

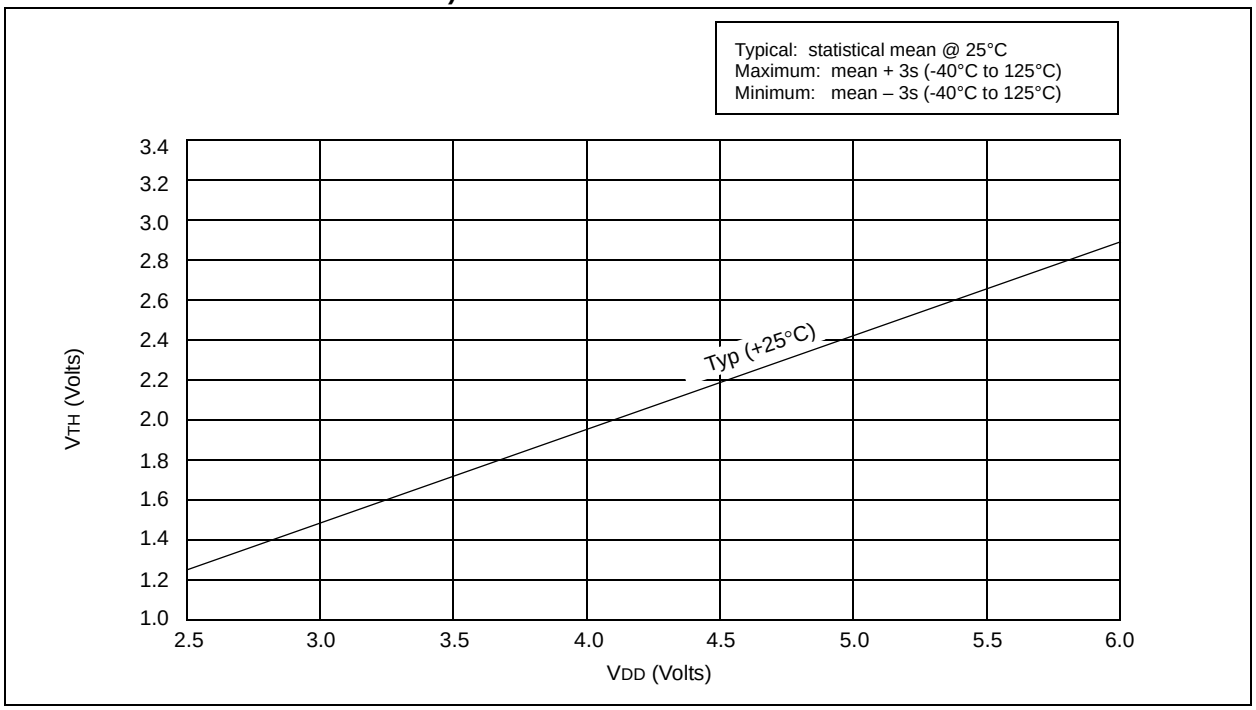


FIGURE 18-11: TYPICAL I_{DD} vs. FREQUENCY (WDT DISABLED, RC MODE @ 20 pF, 25°C)

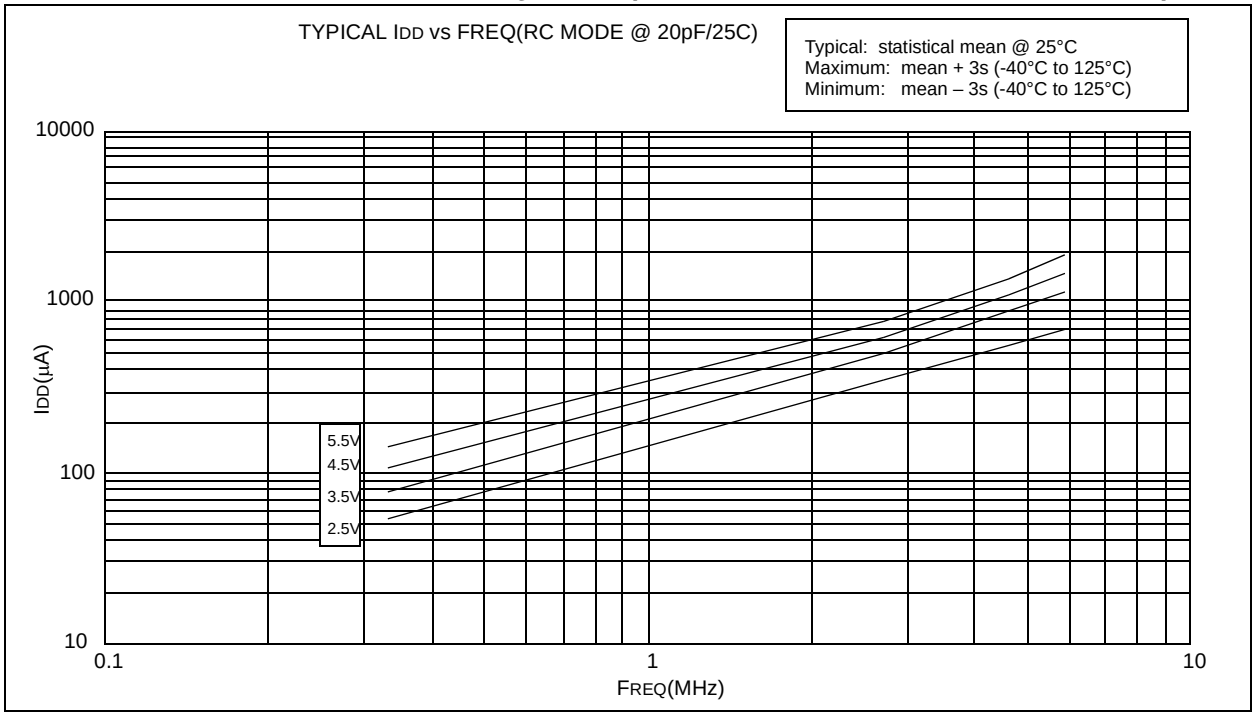
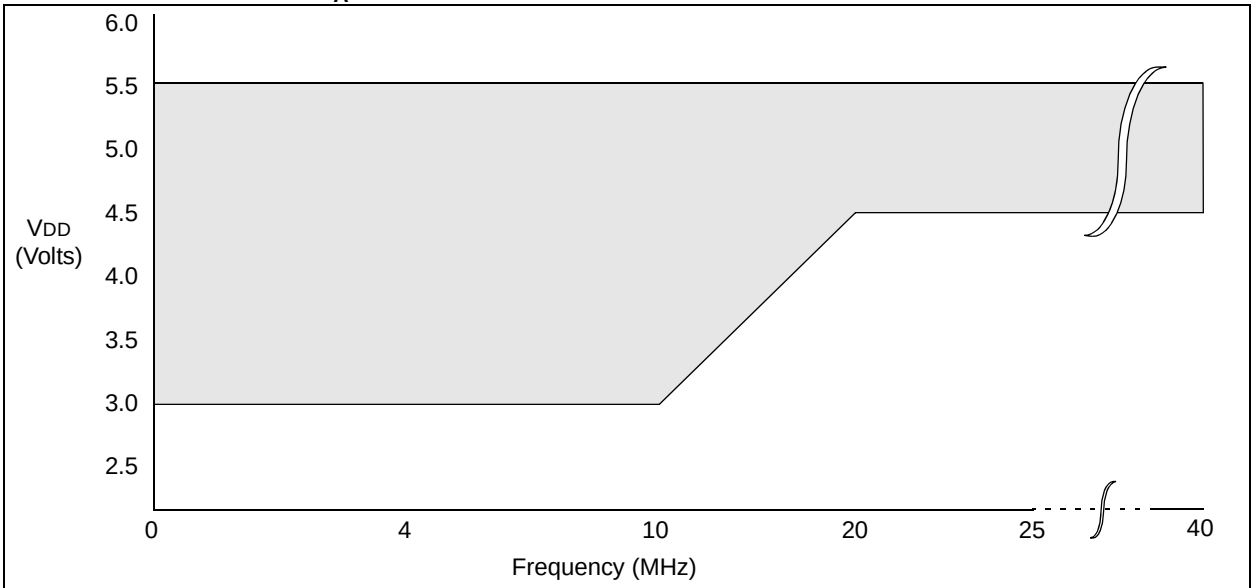


FIGURE 19-1: PIC16C54C/C55A/C56A/C57C/C58B-40 VOLTAGE-FREQUENCY GRAPH, $0°C \leq T_A \leq +70°C$



Note 1: The shaded region indicates the permissible combinations of voltage and frequency.

2: The maximum rated speed of the part limits the permissible combinations of voltage and frequency. Please reference the Product Identification System section for the maximum rated speed of the parts.

3: Operation between 20 to 40 MHz requires the following:

- VDD between 4.5V. and 5.5V
- OSC1 externally driven
- OSC2 not connected
- HS mode
- Commercial temperatures

Devices qualified for 40 MHz operation have -40 designation (ex: PIC16C54C-40/P).

4: For operation between DC and 20 MHz, see Section 17.1.

NOTES:

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