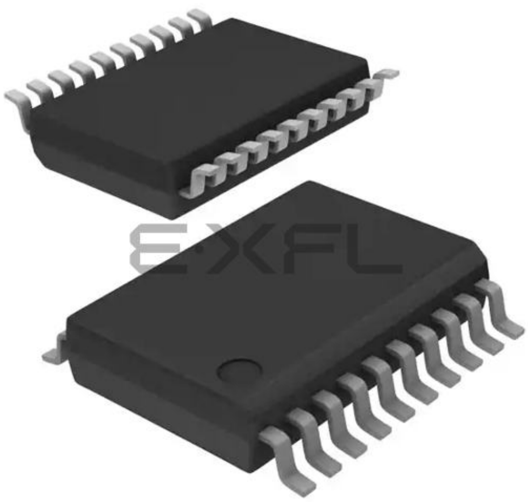

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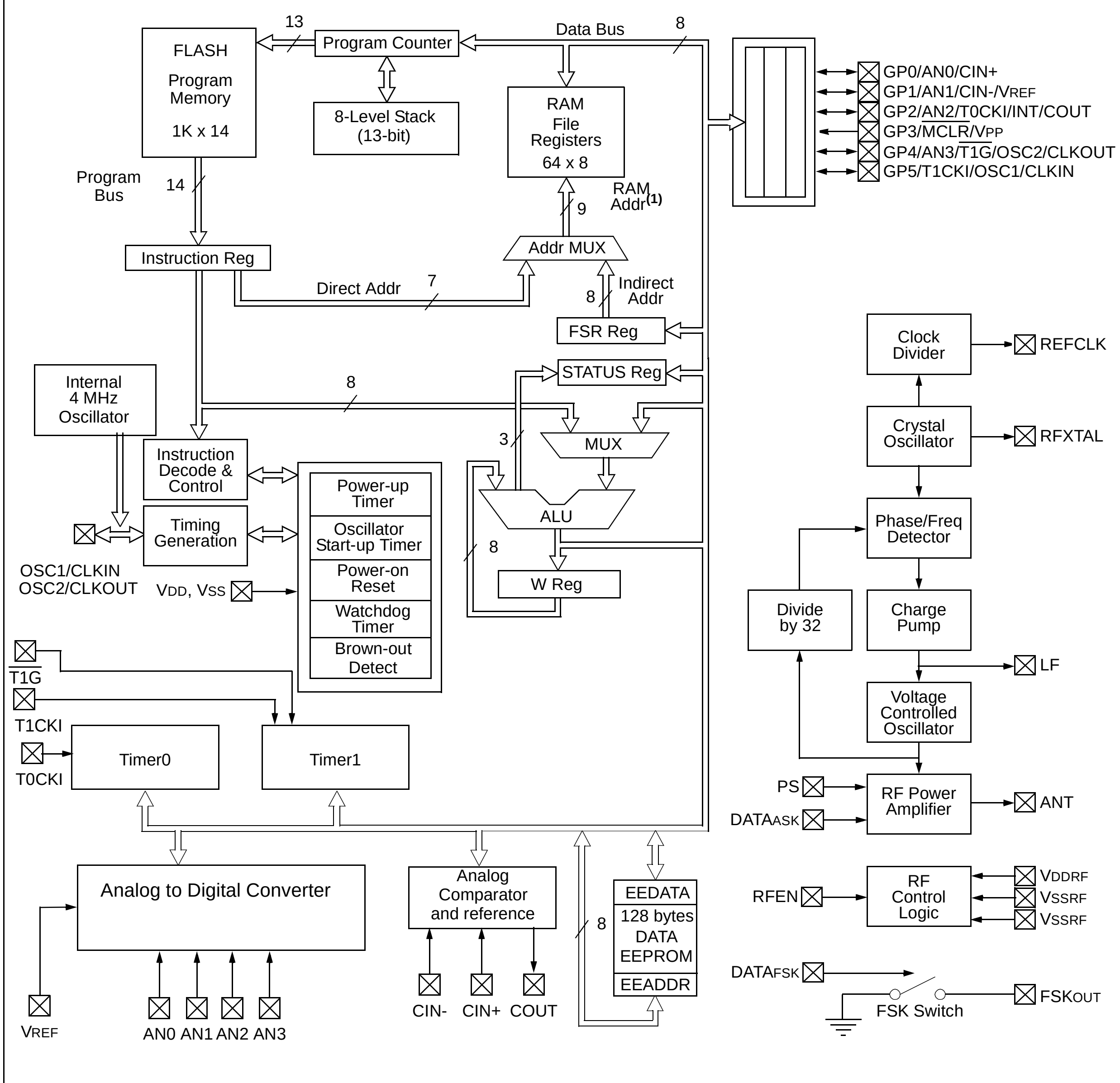
Details	
Product Status	Obsolete
Applications	RKE, Security Systems
Core Processor	PIC
Program Memory Type	FLASH (1.75kB)
Controller Series	rfPIC™
RAM Size	64 x 8
Interface	-
Number of I/O	6
Voltage - Supply	2V ~ 5.5V
Operating Temperature	-40°C ~ 85°C
Mounting Type	Surface Mount
Package / Case	20-SSOP (0.209", 5.30mm Width)
Supplier Device Package	20-SSOP
Purchase URL	https://www.e-xfl.com/product-detail/microchip-technology/rfpic12f675ft-i-ss

1.0 DEVICE OVERVIEW

This document contains device specific information for the rfPIC12F675. Additional information may be found in the *PICmicro™ Mid-Range Reference Manual* (DS33023), which may be obtained from your local Microchip Sales Representative or downloaded from the Microchip web site. The Reference Manual should be considered a complementary document to this Data Sheet, and is highly recommended reading for a better understanding of the device architecture and operation of the peripheral modules.

The rfPIC12F675 comes in a 20-pin SSOP package. Figure 1-1 shows a block diagram of the rfPIC12F675 device. Table 1-1 shows the pinout description.

FIGURE 1-1: rfPIC12F675 BLOCK DIAGRAM



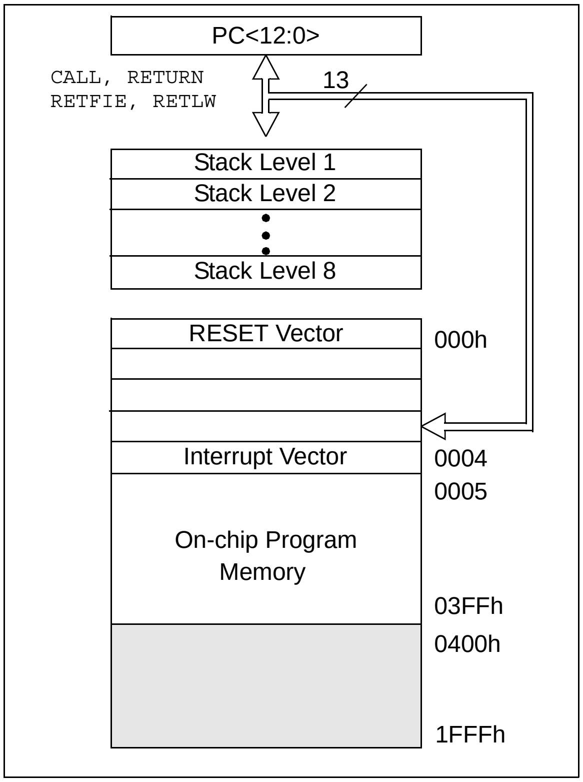
Note 1: Higher order bits are from STATUS register.

2.0 MEMORY ORGANIZATION

2.1 Program Memory Organization

The rfPIC12F675 devices have a 13-bit program counter capable of addressing an 8K x 14 program memory space. Only the first 1K x 14 (0000h - 03FFh) for the rfPIC12F675 devices is physically implemented. Accessing a location above these boundaries will cause a wrap around within the first 1K x 14 space. The RESET vector is at 0000h and the interrupt vector is at 0004h (see Figure 2-1).

FIGURE 2-1: PROGRAM MEMORY MAP AND STACK FOR THE rfPIC12F675



2.2 Data Memory Organization

The data memory (see Figure 2-2) is partitioned into two banks, which contain the General Purpose registers and the Special Function registers. The Special Function registers are located in the first 32 locations of each bank. Register locations 20h-5Fh are General Purpose registers, implemented as static RAM and are mapped across both banks. All other RAM is unimplemented and returns ‘0’ when read. RP0 (STATUS<5>) is the bank select bit.

- RP0 = 0 Bank 0 is selected
- RP0 = 1 Bank 1 is selected

Note:	The IRP and RP1 bits STATUS<7:6> are reserved and should always be maintained as ‘0’s.

2.2.1 GENERAL PURPOSE REGISTER FILE

The register file is organized as 64 x 8 in the rfPIC12F675 devices. Each register is accessed, either directly or indirectly, through the File Select Register FSR (see Section 2.4).

TABLE 2-1: SPECIAL FUNCTION REGISTERS SUMMARY (CONTINUED)

Address	Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Value on POR, BOD	Page
Bank 1											
80h	INDF(1)	Addressing this Location uses Contents of FSR to Address Data Memory								0000 0000	16,63
81h	OPTION_REG	$\overline{\text{GPPU}}$	INTEDG	T0CS	T0SE	PSA	PS2	PS1	PS0	1111 1111	10,26
82h	PCL	Program Counter's (PC) Least Significant Byte								0000 0000	15
83h	STATUS	IRP(2)	RP1(2)	RP0	$\overline{\text{TO}}$	$\overline{\text{PD}}$	Z	DC	C	0001 1xxx	9
84h	FSR	Indirect Data Memory Address Pointer								xxxx xxxx	16
85h	TRISIO	—	—	TRISIO5	TRISIO4	TRISIO3	TRISIO2	TRISIO1	TRISIO0	--11 1111	17
86h	—	Unimplemented								—	—
87h	—	Unimplemented								—	—
88h	—	Unimplemented								—	—
89h	—	Unimplemented								—	—
8Ah	PCLATH	—	—	—	Write Buffer for Upper 5 bits of Program Counter					---0 0000	15
8Bh	INTCON	GIE	PEIE	T0IE	INTE	GPIE	T0IF	INTF	GPIF	0000 0000	11
8Ch	PIE1	EEIE	ADIE	—	—	CMIE	—	—	TMR1IE	00-- 0--0	12
8Dh	—	Unimplemented								—	—
8Eh	PCON	—	—	—	—	—	—	$\overline{\text{POR}}$	$\overline{\text{BOD}}$	---- --0x	14
8Fh	—	Unimplemented								—	—
90h	OSCCAL	CAL5	CAL4	CAL3	CAL2	CAL1	CAL0	—	—	1000 00--	14
91h	—	Unimplemented								—	—
92h	—	Unimplemented								—	—
93h	—	Unimplemented								—	—
94h	—	Unimplemented								—	—
95h	WPU	—	—	WPU5	WPU4	—	WPU2	WPU1	WPU0	--11 -111	18
96h	IOC	—	—	IOC5	IOC4	IOC3	IOC2	IOC1	IOC0	--00 0000	19
97h	—	Unimplemented								—	—
98h	—	Unimplemented								—	—
99h	VRCON	VREN	—	VRR	—	VR3	VR2	VR1	VR0	0-0- 0000	38
9Ah	EEDATA	Data EEPROM Data Register								0000 0000	45
9Bh	EEADR	—	Data EEPROM Address Register							-000 0000	45
9Ch	EECON1	—	—	—	—	WRERR	WREN	WR	RD	---- x000	46
9Dh	EECON2(1)	EEPROM Control Register 2								---- ----	46
9Eh	ADRESL	Least Significant 2 bits of the Left Shifted A/D Result of 8 bits or the Right Shifted Result								xxxx xxxx	40
9Fh	ANSEL	—	ADCS2	ADCS1	ADCS0	ANS3	ANS2	ANS1	ANS0	-000 1111	42,63

Legend: — = unimplemented locations read as ‘0’, u = unchanged, x = unknown, q = value depends on condition, shaded = unimplemented

Note 1: This is not a physical register.

2: These bits are reserved and should always be maintained as ‘0’.

2.2.2.6 PCON Register

The Power Control (PCON) register contains flag bits to differentiate between a:

- Power-on Reset (POR)
- Brown-out Detect (BOD)
- Watchdog Timer Reset (WDT)
- External $\overline{\text{MCLR}}$ Reset

The PCON Register bits are shown in Register 2-6.

REGISTER 2-6: PCON — POWER CONTROL REGISTER (ADDRESS: 8Eh)

U-0	U-0	U-0	U-0	U-0	U-0	R/W-0	R/W-x
—	—	—	—	—	—	$\overline{\text{POR}}$	$\overline{\text{BOD}}$
bit 7							bit 0

bit 7-2 **Unimplemented:** Read as '0'

bit 1 **$\overline{\text{POR}}$:** Power-on Reset STATUS bit
1 = No Power-on Reset occurred
0 = A Power-on Reset occurred (must be set in software after a Power-on Reset occurs)

bit 0 **$\overline{\text{BOD}}$:** Brown-out Detect STATUS bit
1 = No Brown-out Detect occurred
0 = A Brown-out Detect occurred (must be set in software after a Brown-out Detect occurs)

Legend:			
R = Readable bit	W = Writable bit	U = Unimplemented bit, read as ‘0’	
- n = Value at POR	’1’ = Bit is set	’0’ = Bit is cleared	x = Bit is unknown

2.2.2.7 OSCCAL Register

The Oscillator Calibration register (OSCCAL) is used to calibrate the internal 4 MHz oscillator. It contains 6 bits to adjust the frequency up or down to achieve 4 MHz.

The OSCCAL register bits are shown in Register 2-7.

REGISTER 2-7: OSCCAL — OSCILLATOR CALIBRATION REGISTER (ADDRESS: 90h)

R/W-1	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0	U-0	U-0
CAL5	CAL4	CAL3	CAL2	CAL1	CAL0	—	—
bit 7							bit 0

bit 7-2 **CAL5:CAL0:** 6-bit Signed Oscillator Calibration bits
111111 = Maximum frequency
100000 = Center frequency
000000 = Minimum frequency

bit 1-0 **Unimplemented:** Read as '0'

Legend:			
R = Readable bit	W = Writable bit	U = Unimplemented bit, read as ‘0’	
- n = Value at POR	’1’ = Bit is set	’0’ = Bit is cleared	x = Bit is unknown

3.0 GPIO PORT

There are as many as six general purpose I/O pins available. Depending on which peripherals are enabled, some or all of the pins may not be available as general purpose I/O. In general, when a peripheral is enabled, the associated pin may not be used as a general purpose I/O pin.

> **Note:** Additional information on I/O ports may be found in the *PIC Mid-Range Reference Manual* (DS33023)

3.1 GPIO and the TRISIO Registers

GPIO is an 6-bit wide, bi-directional port. The corresponding data direction register is TRISIO. Setting a TRISIO bit (= 1) will make the corresponding GPIO pin an input (i.e., put the corresponding output driver in a Hi-impedance mode). Clearing a TRISIO bit (= 0) will make the corresponding GPIO pin an output (i.e., put the contents of the output latch on the selected pin). The exception is GP3, which is input only and its TRISIO bit will always read as ‘1’. Example 3-1 shows how to initialize GPIO.

Reading the GPIO register reads the status of the pins, whereas writing to it will write to the port latch. All write operations are read-modify-write operations. Therefore, a write to a port implies that the port pins are read, this value is modified, and then written to the port data latch. GP3 reads ‘0’ when MCLREN = 1.

The TRISIO register controls the direction of the GP pins, even when they are being used as analog inputs. The user must ensure the bits in the TRISIO register are maintained set when using them as analog inputs. I/O pins configured as analog inputs always read ‘0’.

> **Note:** The ANSEL (9Fh) and CMCON (19h) registers (9Fh) must be initialized to configure an analog channel as a digital input. Pins configured as analog inputs will read ‘0’.

EXAMPLE 3-1: INITIALIZING GPIO

```
bcf     STATUS,RP0      ;Bank 0
clrf    GPIO            ;Init GPIO
movlw   07h             ;Set GP<2:0> to
movwf   CMCON           ;digital IO
bsf     STATUS,RP0      ;Bank 1
clrf    ANSEL           ;Digital I/O
movlw   0Ch             ;Set GP<3:2> as inputs
movwf   TRISIO          ;and set GP<5:4,1:0>
                        ;as outputs
```

3.2 Additional Pin Functions

Every GPIO pin on the rfPIC12F675 has an interrupt-on-change option and every GPIO pin, except GP3, has a weak pull-up option. The next two sections describe these functions.

3.2.1 WEAK PULL-UP

Each of the GPIO pins, except GP3, has an individually configurable weak internal pull-up. Control bits WPUx enable or disable each pull-up. Refer to Register 3-3. Each weak pull-up is automatically turned off when the port pin is configured as an output. The pull-ups are disabled on a Power-on Reset by the $\overline{\text{GPPU}}$ bit (OPTION<7>).

REGISTER 3-1: GPIO — GPIO REGISTER (ADDRESS: 05h)

U-0	U-0	R/W-x	R/W-x	R/W-x	R/W-x	R/W-x	R/W-x
—	—	GPIO5	GPIO4	GPIO3	GPIO2	GPIO1	GPIO0
bit 7							bit 0

bit 7-6: **Unimplemented**: Read as ’0’

bit 5-0: **GPIO<5:0>**: General Purpose I/O pin.
1 = Port pin is >V_{IH}
0 = Port pin is <V_{IL}

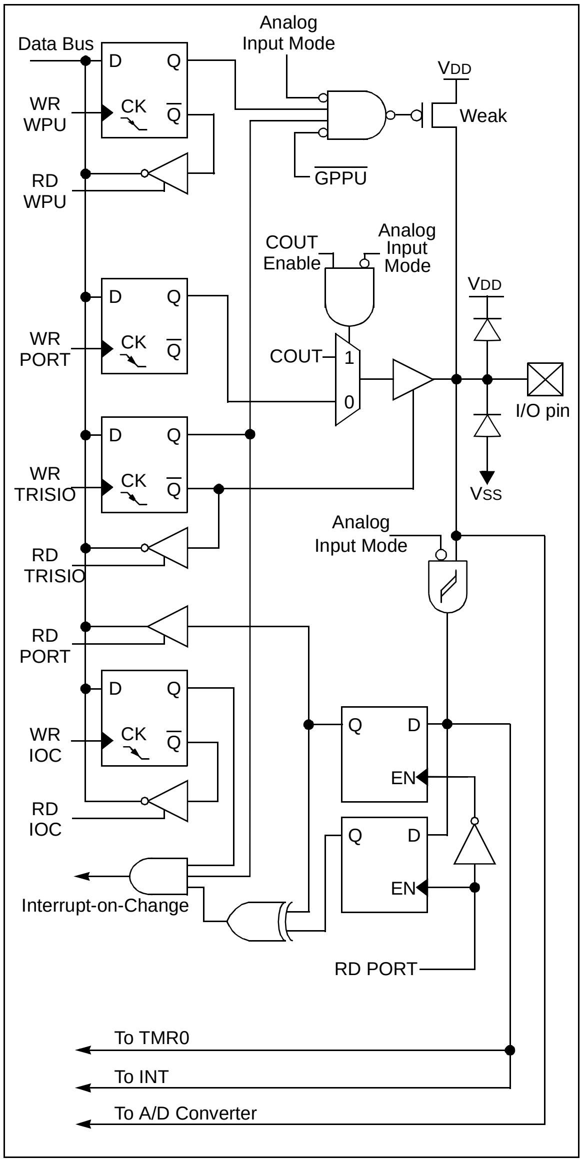
Legend:			
R = Readable bit	W = Writable bit	U = Unimplemented bit, read as ‘0’	
- n = Value at POR	’1’ = Bit is set	’0’ = Bit is cleared	x = Bit is unknown

3.3.3 GP2/AN2/T0CKI/INT/COUT

Figure 3-2 shows the diagram for this pin. The GP2 pin is configurable to function as one of the following:

- a general purpose I/O
- an analog input for the A/D
- the clock input for TMR0
- an external edge triggered interrupt
- a digital output from the comparator

FIGURE 3-2: BLOCK DIAGRAM OF GP2

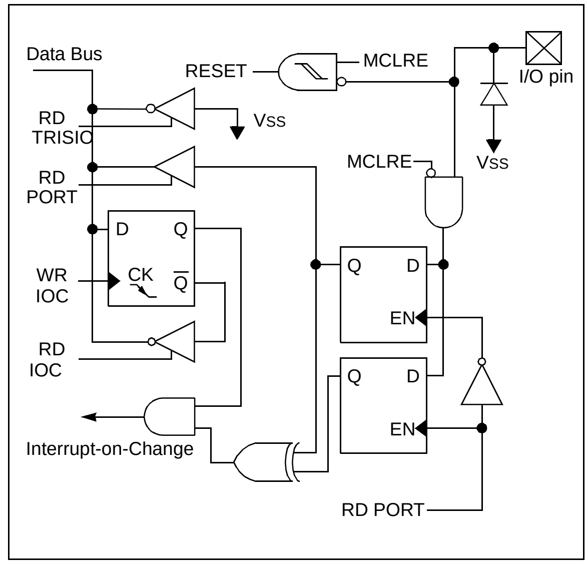


3.3.4 GP3/$\overline{\text{MCLR}}$/VPP

Figure 3-3 shows the diagram for this pin. The GP3 pin is configurable to function as one of the following:

- a general purpose input
- as Master Clear Reset

FIGURE 3-3: BLOCK DIAGRAM OF GP3



7.2 A/D Acquisition Requirements

For the A/D converter to meet its specified accuracy, the charge holding capacitor (CHOLD) must be allowed to fully charge to the input channel voltage level. The analog input model is shown in Figure 7-3. The source impedance (RS) and the internal sampling switch (RSS) impedance directly affect the time required to charge the capacitor CHOLD. The sampling switch (RSS) impedance varies over the device voltage (VDD), see Figure 7-3. **The maximum recommended impedance for analog sources is 10 kΩ.** As the impedance is decreased, the acquisition time may be decreased. After the analog input channel is selected (changed), this acquisition must be done before the conversion can be started.

To calculate the minimum acquisition time, Equation 7-1 may be used. This equation assumes that 1/2 LSb error is used (1024 steps for the A/D). The 1/2 LSb error is the maximum error allowed for the A/D to meet its specified resolution.

To calculate the minimum acquisition time, TACQ, see the *PIC Mid-Range Reference Manual* (DS33023).

EQUATION 7-1: ACQUISITION TIME

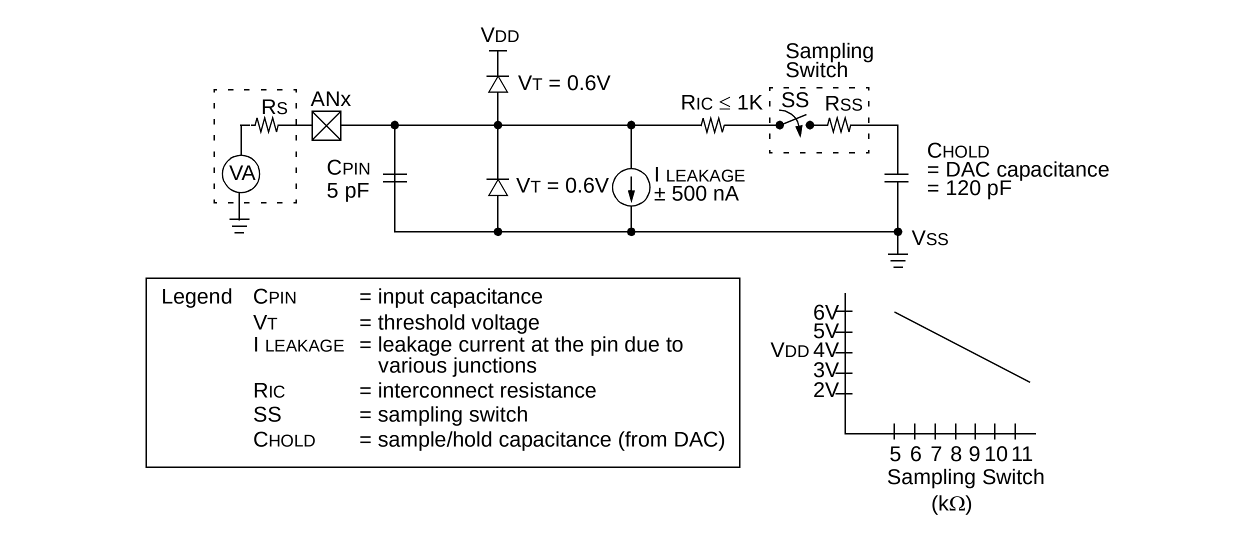
$$
\begin{aligned}
T_{ACQ} &= \text{Amplifier Settling Time} + \\
&\quad \text{Hold Capacitor Charging Time} + \\
&\quad \text{Temperature Coefficient} \\
&= T_{AMP} + T_C + T_{COFF} \\
&= 2\mu s + T_C + [(\text{Temperature} - 25°C)(0.05\mu s/°C)] \\
T_C &= C_{HOLD}\,(R_{IC} + R_{SS} + R_S)\ \ln(1/2047) \\
&= -\,120pF\,(1k\Omega + 7k\Omega + 10k\Omega)\ \ln(0.0004885) \\
&= 16.47\mu s \\
T_{ACQ} &= 2\mu s + 16.47\mu s + [(50°C - 25°C)(0.05\mu s/°C) \\
&= 19.72\mu s
\end{aligned}
$$

Note 1: The reference voltage (VREF) has no effect on the equation, since it cancels itself out.

2: The charge holding capacitor (CHOLD) is not discharged after each conversion.

3: The maximum recommended impedance for analog sources is 10 kΩ. This is required to meet the pin leakage specification.

FIGURE 7-3: ANALOG INPUT MODEL



8.1 EEADR

The EEADR register can address up to a maximum of 128 bytes of data EEPROM. Only seven of the eight bits in the register (EEADR<6:0>) are required. The MSb (bit 7) is ignored.

The upper bit should always be '0' to remain upward compatible with devices that have more data EEPROM memory.

8.2 EECON1 AND EECON2 REGISTERS

EECON1 is the control register with four low order bits physically implemented. The upper four bits are non-implemented and read as '0's.

Control bits RD and WR initiate read and write, respectively. These bits cannot be cleared, only set, in software. They are cleared in hardware at completion of the read or write operation. The inability to clear the WR bit in software prevents the accidental, premature termination of a write operation.

The WREN bit, when set, will allow a write operation. On power-up, the WREN bit is clear. The WRERR bit is set when a write operation is interrupted by a $\overline{\text{MCLR}}$ Reset, or a WDT Time-out Reset during normal operation. In these situations, following RESET, the user can check the WRERR bit, clear it, and rewrite the location. The data and address will be cleared, therefore, the EEDATA and EEADR registers will need to be re-initialized.

Interrupt flag bit EEIF in the PIR1 register is set when write is complete. This bit must be cleared in software.

EECON2 is not a physical register. Reading EECON2 will read all '0's. The EECON2 register is used exclusively in the Data EEPROM write sequence.

REGISTER 8-3: EECON1 — EEPROM CONTROL REGISTER (ADDRESS: 9Ch)

U-0	U-0	U-0	U-0	R/W-x	R/W-0	R/S-0	R/S-0
—	—	—	—	WRERR	WREN	WR	RD

bit 7 bit 0

bit 7-4 **Unimplemented:** Read as '0'

bit 3 **WRERR:** EEPROM Error Flag bit
1 = A write operation is prematurely terminated (any $\overline{\text{MCLR}}$ Reset, any WDT Reset during normal operation or BOD detect)
0 = The write operation completed

bit 2 **WREN:** EEPROM Write Enable bit
1 = Allows write cycles
0 = Inhibits write to the data EEPROM

bit 1 **WR**: Write Control bit
1 = Initiates a write cycle (The bit is cleared by hardware once write is complete. The WR bit can only be set, not cleared, in software.)
0 = Write cycle to the data EEPROM is complete

bit 0 **RD**: Read Control bit
1 = Initiates an EEPROM read (Read takes one cycle. RD is cleared in hardware. The RD bit can only be set, not cleared, in software.)
0 = Does not initiate an EEPROM read

Legend:			
S = Bit can only be set			
R = Readable bit	W = Writable bit	U = Unimplemented bit, read as '0'	
- n = Value at POR	'1' = Bit is set	'0' = Bit is cleared	x = Bit is unknown

TABLE 10-8: SUMMARY OF INTERRUPT REGISTERS

Address	Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Value on POR, BOD	Value on all other RESETS
0Bh, 8Bh	INTCON	GIE	PEIE	T0IE	INTE	GPIE	T0IF	INTF	GPIF	0000 0000	0000 000u
0Ch	PIR1	EEIF	ADIF	—	—	CMIF	—	—	TMR1IF	00-- 0--0	00-- 0--0
8Ch	PIE1	EEIE	ADIE	—	—	CMIE	—	—	TMR1IE	00-- 0--0	00-- 0--0

Legend: x = unknown, u = unchanged, - = unimplemented read as '0', q = value depends upon condition.
Shaded cells are not used by the Interrupt module.

10.5 Context Saving During Interrupts

During an interrupt, only the return PC value is saved on the stack. Typically, users may wish to save key registers during an interrupt, (e.g., W register and STATUS register). This must be implemented in software.

Example 10-2 stores and restores the STATUS and W registers. The user register, W_TEMP, must be defined in both banks and must be defined at the same offset from the bank base address (i.e., W_TEMP is defined at 0x20 in Bank 0 and it must also be defined at 0xA0 in Bank 1). The user register, STATUS_TEMP, must be defined in Bank 0. The Example 10-2:

- Stores the W register
- Stores the STATUS register in Bank 0
- Executes the ISR code
- Restores the STATUS (and bank select bit register)
- Restores the W register

EXAMPLE 10-2: SAVING THE STATUS AND W REGISTERS IN RAM

```
MOVWF  W_TEMP        ;copy W to temp register,
                      could be in either bank
SWAPF  STATUS,W      ;swap status to be saved into W
BCF    STATUS,RP0    ;change to bank 0 regardless of
                      current bank
MOVWF  STATUS_TEMP   ;save status to bank 0 register
    :
    :(ISR)
    :
SWAPF  STATUS_TEMP,W;swap STATUS_TEMP register into
                      W, sets bank to original state
MOVWF  STATUS        ;move W into STATUS register
SWAPF  W_TEMP,F      ;swap W_TEMP
SWAPF  W_TEMP,W      ;swap W_TEMP into W
```

10.6 Watchdog Timer (WDT)

The Watchdog Timer is a free running, on-chip RC oscillator, which requires no external components. This RC oscillator is separate from the external RC oscillator of the CLKIN pin and INTOSC. That means that the WDT will run, even if the clock on the OSC1 and OSC2 pins of the device has been stopped (for example, by execution of a `SLEEP` instruction). During normal operation, a WDT time-out generates a device RESET. If the device is in SLEEP mode, a WDT time-out causes the device to wake-up and continue with normal operation. The WDT can be permanently disabled by programming the configuration bit WDTE as clear (Section 10.1).

10.6.1 WDT PERIOD

The WDT has a nominal time-out period of 18 ms, (with no prescaler). The time-out periods vary with temperature, V_{DD} and process variations from part to part (see DC specs). If longer time-out periods are desired, a prescaler with a division ratio of up to 1:128 can be assigned to the WDT under software control by writing to the OPTION register. Thus, time-out periods up to 2.3 seconds can be realized.

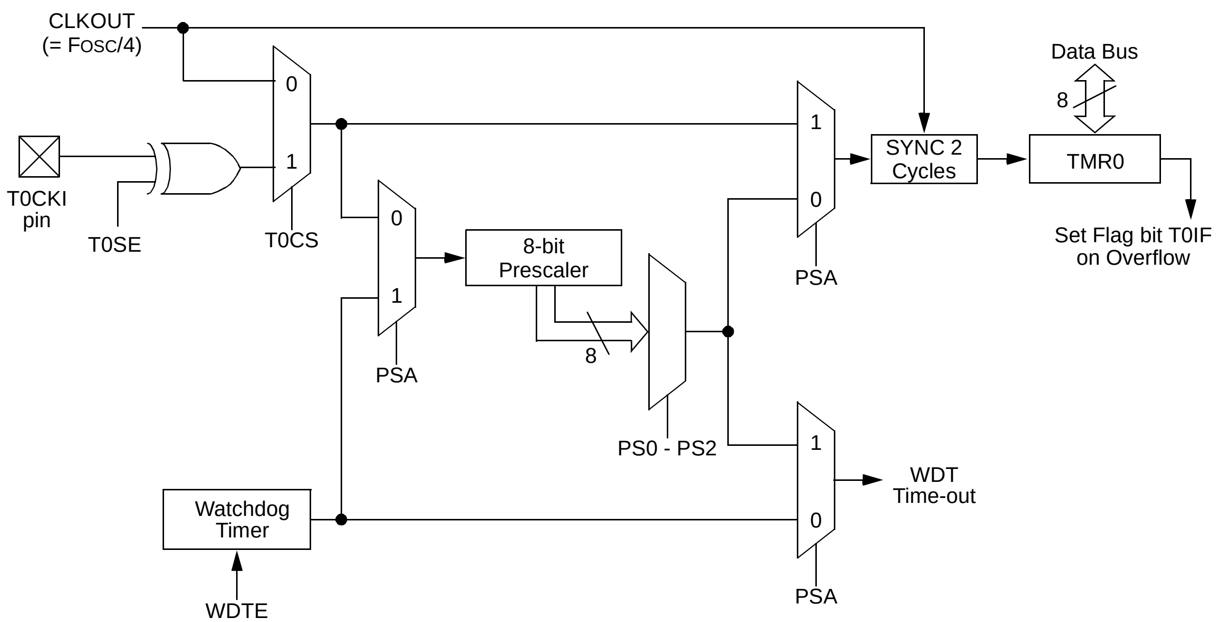
The `CLRWDT` and `SLEEP` instructions clear the WDT and the prescaler, if assigned to the WDT, and prevent it from timing out and generating a device RESET.

The $\overline{TO}$ bit in the STATUS register will be cleared upon a Watchdog Timer time-out.

10.6.2 WDT PROGRAMMING CONSIDERATIONS

It should also be taken in account that under worst case conditions (i.e., V_{DD} = Min., Temperature = Max., Max. WDT prescaler) it may take several seconds before a WDT time-out occurs.

FIGURE 10-12: WATCHDOG TIMER BLOCK DIAGRAM



Note 1: T0SE, T0CS, PSA, PS0-PS2 are bits in the Option register.

TABLE 10-9: SUMMARY OF WATCHDOG TIMER REGISTERS

Address	Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Value on POR, BOD	Value on all other RESETS
81h	OPTION_REG	$\overline{\text{GPPU}}$	INTEDG	T0CS	T0SE	PSA	PS2	PS1	PS0	1111 1111	1111 1111
2007h	Config. bits	$\overline{\text{CP}}$	BODEN	MCLRE	$\overline{\text{PWRTE}}$	WDTE	F0SC2	F0SC1	F0SC0	uuuu uuuu	uuuu uuuu

Legend: u = Unchanged, shaded cells are not used by the Watchdog Timer.

10.7 ID Locations

Four memory locations (2000h-2003h) are designated as ID locations where the user can store checksum or other code identification numbers. These locations are not accessible during normal execution but are readable and writable during Program/Verify. Only the Least Significant 7 bits of the ID locations are used.

10.8 Code Protection

If the code protection bit(s) have not been programmed, the on-chip program memory can be read out for verification purposes.

> **Note:** The entire data EEPROM and FLASH program memory will be erased when the code protection is turned off. The INTOSC calibration data is also erased. See rfPIC12F675 Programming Specification for more information.

DECFSZ	Decrement f, Skip if 0
Syntax:	[*label*] DECFSZ f,d
Operands:	$0 \leq f \leq 127$ $d \in [0,1]$
Operation:	(f) - 1 → (destination); skip if result = 0
Status Affected:	None
Description:	The contents of register 'f' are decremented. If 'd' is 0, the result is placed in the W register. If 'd' is 1, the result is placed back in register 'f'. If the result is 1, the next instruction is executed. If the result is 0, then a `NOP` is executed instead, making it a 2TCY instruction.

GOTO	Unconditional Branch
Syntax:	[*label*] GOTO k
Operands:	$0 \leq k \leq 2047$
Operation:	k → PC<10:0> PCLATH<4:3> → PC<12:11>
Status Affected:	None
Description:	`GOTO` is an unconditional branch. The eleven-bit immediate value is loaded into PC bits <10:0>. The upper bits of PC are loaded from PCLATH<4:3>. `GOTO` is a two-cycle instruction.

INCF	Increment f
Syntax:	[*label*] INCF f,d
Operands:	$0 \leq f \leq 127$ $d \in [0,1]$
Operation:	(f) + 1 → (destination)
Status Affected:	Z
Description:	The contents of register 'f' are incremented. If 'd' is 0, the result is placed in the W register. If 'd' is 1, the result is placed back in register 'f'.

INCFSZ	Increment f, Skip if 0
Syntax:	[*label*] INCFSZ f,d
Operands:	$0 \leq f \leq 127$ $d \in [0,1]$
Operation:	(f) + 1 → (destination), skip if result = 0
Status Affected:	None
Description:	The contents of register 'f' are incremented. If 'd' is 0, the result is placed in the W register. If 'd' is 1, the result is placed back in register 'f'. If the result is 1, the next instruction is executed. If the result is 0, a `NOP` is executed instead, making it a 2TCY instruction.

IORLW	Inclusive OR Literal with W
Syntax:	[*label*] IORLW k
Operands:	$0 \leq k \leq 255$
Operation:	(W) .OR. k → (W)
Status Affected:	Z
Description:	The contents of the W register are OR'ed with the eight-bit literal 'k'. The result is placed in the W register.

IORWF	Inclusive OR W with f
Syntax:	[*label*] IORWF f,d
Operands:	$0 \leq f \leq 127$ $d \in [0,1]$
Operation:	(W) .OR. (f) → (destination)
Status Affected:	Z
Description:	Inclusive OR the W register with register 'f'. If 'd' is 0, the result is placed in the W register. If 'd' is 1, the result is placed back in register 'f'.

MOVF	Move f
Syntax:	[*label*] MOVF f,d
Operands:	$0 \le f \le 127$ $d \in [0,1]$
Operation:	(f) $\rightarrow$ (destination)
Status Affected:	Z
Description:	The contents of register f are moved to a destination dependant upon the status of d. If d = 0, destination is W register. If d = 1, the destination is file register f itself. d = 1 is useful to test a file register, since status flag Z is affected.

MOVLW	Move Literal to W
Syntax:	[*label*] MOVLW k
Operands:	$0 \le k \le 255$
Operation:	k $\rightarrow$ (W)
Status Affected:	None
Description:	The eight-bit literal 'k' is loaded into W register. The don't cares will assemble as 0's.

MOVWF	Move W to f
Syntax:	[*label*] MOVWF f
Operands:	$0 \le f \le 127$
Operation:	(W) $\rightarrow$ (f)
Status Affected:	None
Description:	Move data from W register to register 'f'.

NOP	No Operation
Syntax:	[*label*] NOP
Operands:	None
Operation:	No operation
Status Affected:	None
Description:	No operation.

RETFIE	Return from Interrupt
Syntax:	[*label*] RETFIE
Operands:	None
Operation:	TOS $\rightarrow$ PC, 1 $\rightarrow$ GIE
Status Affected:	None

RETLW	Return with Literal in W
Syntax:	[*label*] RETLW k
Operands:	$0 \le k \le 255$
Operation:	k $\rightarrow$ (W); TOS $\rightarrow$ PC
Status Affected:	None
Description:	The W register is loaded with the eight-bit literal 'k'. The program counter is loaded from the top of the stack (the return address). This is a two-cycle instruction.

13.5 DC Characteristics: rfPIC12F675-E (Extended)

		Standard Operating Conditions (unless otherwise stated) Operating temperature -40°C ≤ T_A ≤ +125°C for extended					
Param No.	**Device Characteristics**	**Min**	**Typ†**	**Max**	**Units**	**Conditions: V_{DD}**	**Conditions: Note**
D020E	**Power-down Current (I_{PD})(3)**	—	0.0011	3.5	μA	2.0	WDT, BOD, Comparators, V_{REF}, and T1OSC disabled
		—	0.0012	4.0	μA	3.0	
		—	0.0022	8.0	μA	5.0	
D021E		—	0.3	6.0	μA	2.0	WDT Current(1)
		—	1.8	9.0	μA	3.0	
		—	8.4	20	μA	5.0	
D022E		—	58	70	μA	3.0	BOD Current(1)
		—	109	130	μA	5.0	
D023E		—	3.3	10	μA	2.0	Comparator Current(1)
		—	6.1	13	μA	3.0	
		—	11.5	24	μA	5.0	
D024E		—	58	70	μA	2.0	CV_{REF} Current(1)
		—	85	100	μA	3.0	
		—	138	165	μA	5.0	
D025E		—	4.0	10	μA	2.0	T1 OSC Current(1)
		—	4.6	12	μA	3.0	
		—	6.0	20	μA	5.0	
D026E		—	0.0012	6.0	μA	3.0	A/D Current(1)
		—	0.0022	8.5	μA	5.0	
D027E	Power-down RF Current (I_{PDRF})(3)	—	0.050	TBD	μA	3.0	RF Transmitter, RFEN=V_{SSRF}

† Data in ‘Typ’ column is at 5.0V, 25°C unless otherwise stated. These parameters are for design guidance only and are not tested.

Note 1: The peripheral current is the sum of the base I_{DD} or I_{PD} and the additional current consumed when this peripheral is enabled. The peripheral Δ current can be determined by subtracting the base I_{DD} or I_{PD} current from this limit. Max values should be used when calculating total current consumption.

2: The power-down current in SLEEP mode does not depend on the oscillator type. Power-down current is measured with the part in SLEEP mode, with all I/O pins in hi-impedance state and tied to V_{DD}.

3: Total device current is the sum of I_{PD} from V_{DD} and I_{PDRF} from V_{DDRF}.

13.12 AC CHARACTERISTICS: rfPIC12F675 (INDUSTRIAL, EXTENDED)

FIGURE 13-5: EXTERNAL CLOCK TIMING

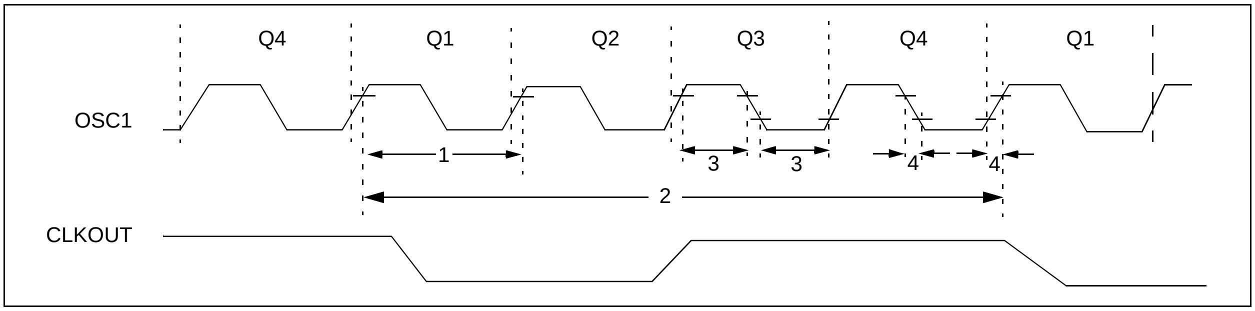


TABLE 13-1: EXTERNAL CLOCK TIMING REQUIREMENTS

Param No.	Sym	Characteristic	Min	Typ†	Max	Units	Conditions
	FOSC	External CLKIN Frequency(1)	DC	—	37	kHz	LP Osc mode
			DC	—	4	MHz	XT mode
			DC	—	20	MHz	HS mode
			DC	—	20	MHz	EC mode
		Oscillator Frequency(1)	5	—	37	kHz	LP Osc mode
			—	4	—	MHz	INTOSC mode
			DC	—	4	MHz	RC Osc mode
			0.1	—	4	MHz	XT Osc mode
			1	—	20	MHz	HS Osc mode
1	TOSC	External CLKIN Period(1)	27	—	∞	μs	LP Osc mode
			50	—	∞	ns	HS Osc mode
			50	—	∞	ns	EC Osc mode
			250	—	∞	ns	XT Osc mode
		Oscillator Period(1)	27		200	μs	LP Osc mode
			—	250	—	ns	INTOSC mode
			250	—	—	ns	RC Osc mode
			250	—	10,000	ns	XT Osc mode
			50	—	1,000	ns	HS Osc mode
2	TCY	Instruction Cycle Time(1)	200	TCY	DC	ns	TCY = 4/FOSC
3	TosL, TosH	External CLKIN (OSC1) High External CLKIN Low	2*	—	—	μs	LP oscillator, TOSC L/H duty cycle
			20*	—	—	ns	HS oscillator, TOSC L/H duty cycle
			100 *	—	—	ns	XT oscillator, TOSC L/H duty cycle
4	TosR, TosF	External CLKIN Rise External CLKIN Fall	—	—	50*	ns	LP oscillator
			—	—	25*	ns	XT oscillator
			—	—	15*	ns	HS oscillator

* These parameters are characterized but not tested.

† Data in 'Typ' column is at 5V, 25°C unless otherwise stated. These parameters are for design guidance only and are not tested.

Note 1: Instruction cycle period (TCY) equals four times the input oscillator time-base period. 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. All devices are tested to operate at 'min' values with an external clock applied to OSC1 pin. When an external clock input is used, the 'max' cycle time limit is 'DC' (no clock) for all devices.

TABLE 13-11: rfPIC12F675K RF TRANSMITTER SPECIFICATIONS (315 MHz)

RF Transmitter Specifications		**Standard Operating Conditions** TA = +23°C (unless otherwise stated) VDDRF = 3.0V (unless otherwise stated) FC = 315 MHz (unless otherwise stated)				
Sym	**Characteristics**	**Min**	**Typ**	**Max**	**Units**	**Comments**
FC	VCO Frequency	290	—	350	MHz	32 x FRFXTAL
FXTAL	Crystal Frequency	9.06	—	10.94	MHz	Fundamental mode
FREF	Reference Frequency	2.265	—	2.735	MHz	FRFXTAL / 4
CL	Load Capacitance	10	—	15	pF	
CO	Static Capacitance	—	—	7	pF	
RS	Series Resistance	—	—	70	Ω	
ASPUR	Spurious response	—	—	-10	dB	For FSK operation
ΔFVDD	Frequency Stability vs VDDRF	—	—	±3	ppm	
ΔFTA	Frequency Stability vs Temp	—	—	±10	ppm	Crystal temp constant
ΔF	FSK Deviation	±5	—	±80	kHz	Depends on crystal parameters
RFSK	FSK Data Rate	—	—	40	Kbit/s	NRZ
RASK	ASK Data Rate	—	—	40	Kbit/s	NRZ
TON	RFEN High to Transmit	—	1.2	1.5	ms	
POFF	RF Output Power in Step 0	—	—	-70	dBm	RFEN=1
P1	RF Output Power in Step 1	—	-12	—	dBm	RFEN=1
P2	RF Output Power in Step 2	—	-4	—	dBm	RFEN=1
P3	RF Output Power in Step 3	—	2	—	dBm	RFEN=1
P4	RF Output Power in Step 4	—	4	—	dBm	RFEN=1, VDDRF=2.0V
		—	7.5	—	dBm	RFEN=1, VDDRF=3.0V
		—	8.5	9.5	dBm	RFEN=1, VDDRF=4.0V
		—	9.0	10.5	dBm	RFEN=1, VDDRF=5.0V
L(FM)	Phase Noise	—	-86	—	dBc/Hz	200 kHz offset
PSPUR	Spurious Emissions	—	—	-54	dBm	47 MHz < f < 74 MHz 87.5 MHz < f < 118 MHz 174 MHz < f < 230 MHz 470 MHz < f < 862 MHz RBW = 100 kHz
		—	—	-36	dBm	f < 1 GHz RBW = 100 kHz
		—	—	-30	dBm	f > 1 GHz RBW = 1 MHz

14.0 DC AND AC CHARACTERISTICS GRAPHS AND TABLES

The graphs and tables provided in this section are for **design guidance** and are **not tested**.

In some graphs or tables, the data presented are **outside specified operating range** (i.e., outside specified VDD range). This is for **information only** and devices are ensured to operate properly only within the specified range.

The data presented in this section is a **statistical summary** of data collected on units from different lots over a period of time and matrix samples. 'Typical' represents the mean of the distribution at 25°C. 'Max' or 'min' represents (mean + 3σ) or (mean - 3σ) respectively, where σ is standard deviation, over the whole temperature range.

FIGURE 14-1: TYPICAL IPD vs. VDD OVER TEMP (-40°C TO +25°C)

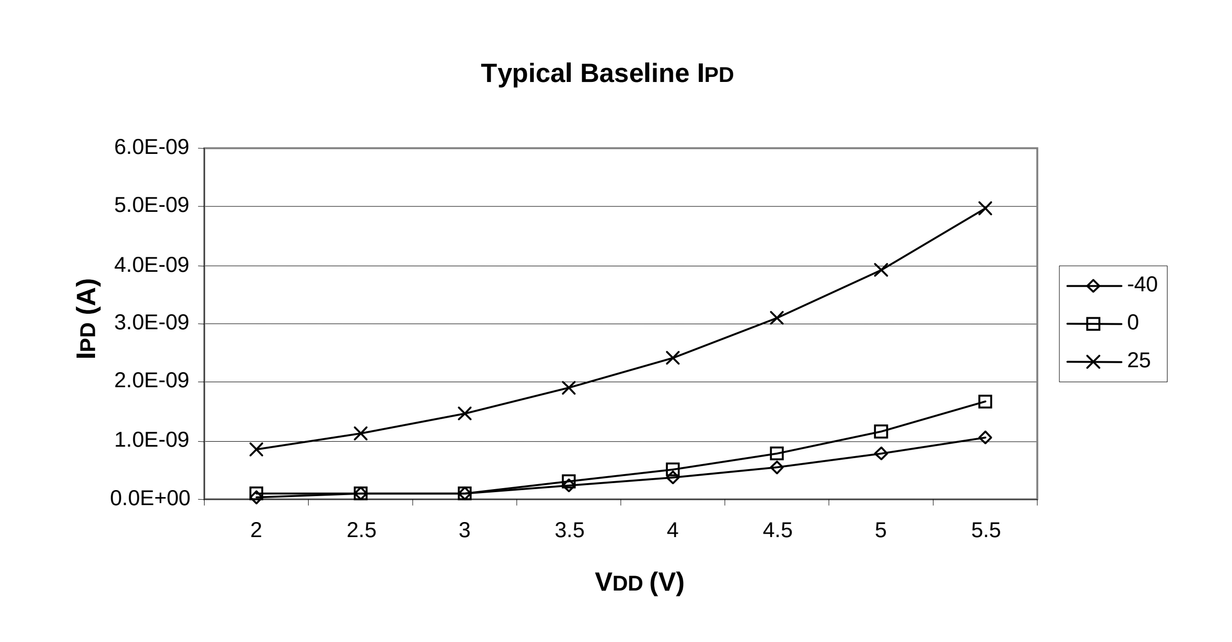


FIGURE 14-2: TYPICAL IPD vs. VDD OVER TEMP (+85°C)

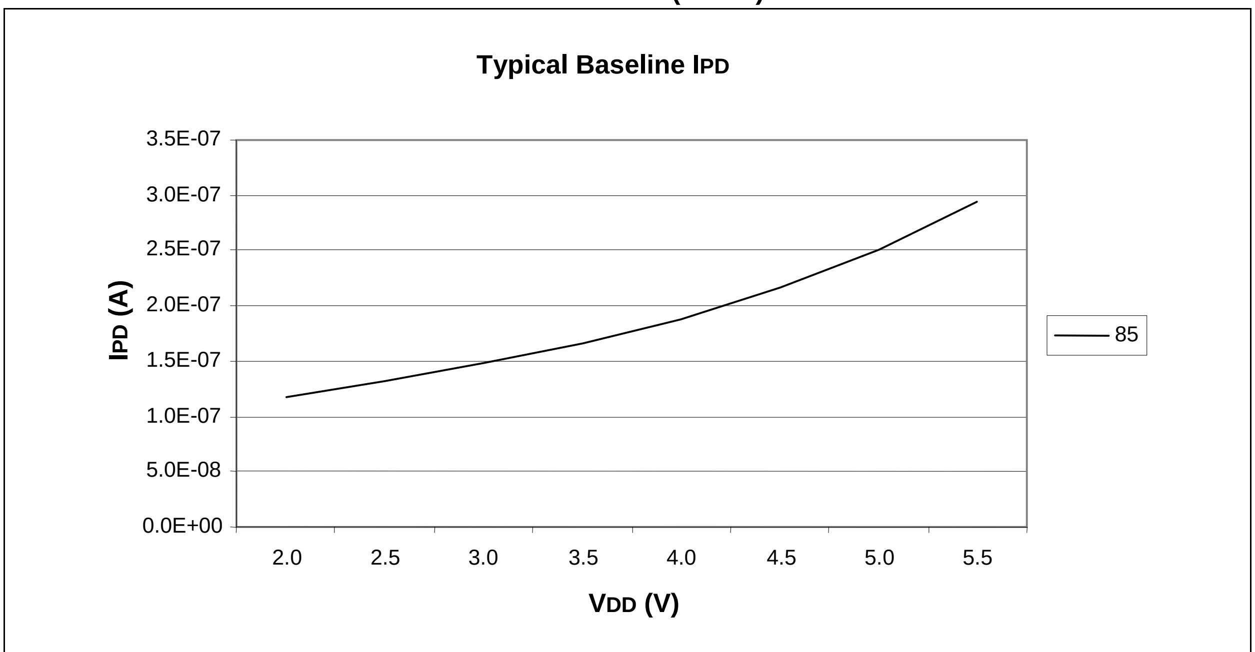


FIGURE 14-7: TYPICAL I_{PD} WITH BOD ENABLED vs. V_{DD} OVER TEMP (-40°C TO +125°C)

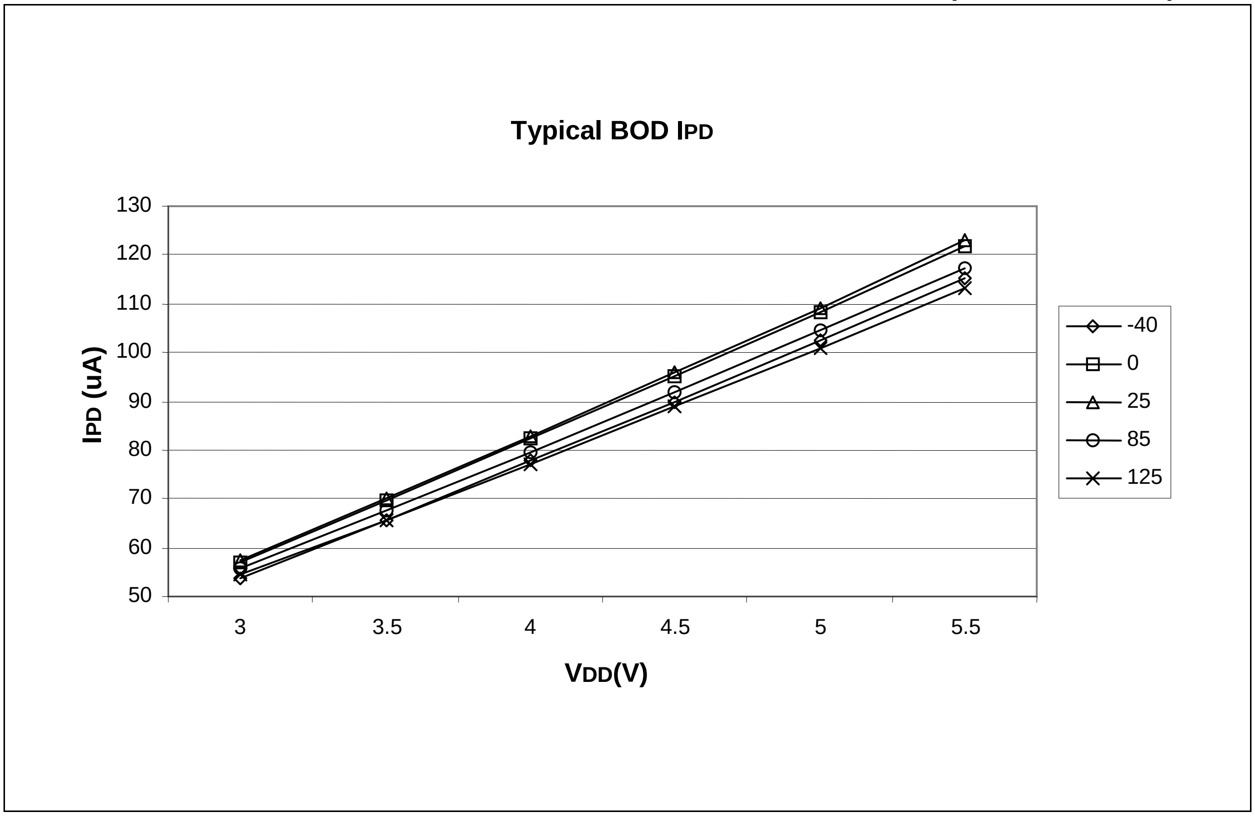
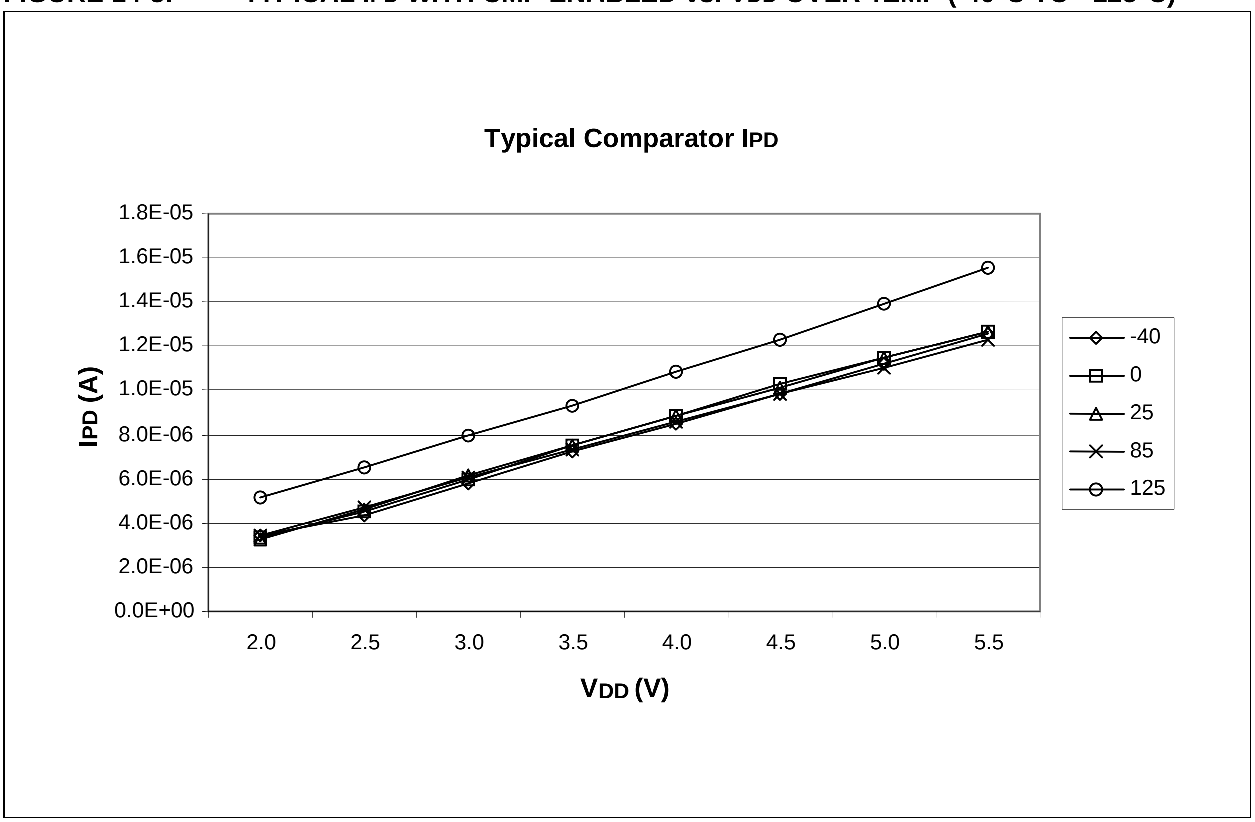


FIGURE 14-8: TYPICAL I_{PD} WITH CMP ENABLED vs. V_{DD} OVER TEMP (-40°C TO +125°C)



NOTES:

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Printed on recycled paper.

ISBN: 9781620769683

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