PIC18F66K80 FAMILY

28/40/44/64-Pin, High-Temperature, Enhanced Flash Microcontrollers with ECAN™ and nanoWatt XLP Technology

High-Temperature Features:

- Ambient Temperature Range of -40°C to +150°C

Power-Managed Modes:

- Run: CPU on, Peripherals on
- Idle: CPU off, Peripherals on
- Sleep: CPU off, Peripherals off
- Two-Speed Oscillator Start-up
- Fail-Safe Clock Monitor (FSCM)
- Power-Saving Peripheral Module Disable (PMD)
- Ultra Low-Power Wake-up
- Fast Wake-up, 1 µs, Typical
- Low-Power WDT, 300 nA, Typical
- Run mode Currents Down to Very Low 3.8 µA, Typical
- Idle mode Currents Down to Very Low 880 nA, Typical
- Sleep mode Currents Down to Very Low 13 nA, Typical

ECAN Bus Module Features:

- Conforms to CAN 2.0B Active Specification
- Three Operating modes:
  - Legacy mode (full backward compatibility with existing PIC18CXX8/FXX8 CAN modules)
  - Enhanced mode
  - FIFO mode or programmable TX/RX buffers
- Message Bit Rates up to 1 Mbps
- DeviceNet™ Data Byte Filter Support

ECAN Bus Module Features (Continued):

- Six Programmable Receive/Transmit Buffers
- Three Dedicated Transmit Buffers with Prioritization
- Two Dedicated Receive Buffers
- 16 Full, 29-Bit Acceptance Filters with Dynamic Association
- Three Full, 29-Bit Acceptance Masks
- Automatic Remote Frame Handling
- Advanced Error Management Features

Special Microcontroller Features:

- On-Chip 3.3V Regulator
- Operating Speed up to 64 MHz
- 3.6 Kbytes of General Purpose Registers (SRAM)
- Three Internal Oscillators:
  - LF-INTOSC (31 kHz)
  - MF-INTOSC (500 kHz)
  - HF-INTOSC (16 MHz)
- Priority Levels for Interrupts
- 8 x 8 Single-Cycle Hardware Multiplier
- Extended Watchdog Timer (WDT):
  - Programmable period from 4 ms to 4,194s
- In-Circuit Serial Programming™ (ICSP™) via Two Pins
- In-Circuit Debug via Two Pins
- Programmable BOR
- Programmable LVD

TABLE 1: DEVICE COMPARISON

Device	Program Memory	Data Memory (Bytes)	Data EE (Bytes)	Pins	I/O	CTMU	12-Bit A/D Channels	CCP/ ECCP	Timers 8-Bit/16-Bit	EUSART	Comparators	ECAN™	MSSP	BORMV/LVD	DSM
PIC18F25K80	32 Bytes	3,648	1,024	28	24	1	8-ch	4/1	2/3	2	2	1	1	Yes	No
PIC18F26K80	64 Bytes	3,648	1,024	28	24	1	8-ch	4/1	2/3	2	2	1	1	Yes	No
PIC18F45K80	32 Bytes	3,648	1,024	40/44	35	1	11-ch	4/1	2/3	2	2	1	1	Yes	No
PIC18F46K80	64 Bytes	3,648	1,024	40/44	35	1	11-ch	4/1	2/3	2	2	1	1	Yes	No
PIC18F65K80	32 Bytes	3,648	1,024	64	54	1	11-ch	4/1	2/3	2	2	1	1	Yes	Yes
PIC18F66K80	64 Bytes	3,648	1,024	64	54	1	11-ch	4/1	2/3	2	2	1	1	Yes	Yes

Peripheral Highlights:

- Five CCP/ECCP modules:
  - Four Capture/Compare/PWM (CCP) modules
  - One Enhanced Capture/Compare/PWM (ECCP) module
- Five 8/16-Bit Timer/Counter modules:
  - Timer0: 8/16-bit timer/counter with 8-bit programmable prescaler
  - Timer1, Timer3: 16-bit timer/counter
  - Timer2, Timer4: 8-bit timer/counter
- Two Analog Comparators
- Configurable Reference Clock Output
- Charge Time Measurement Unit (CTMU):
  - Capacitance measurement
  - Time measurement with 1 ns typical resolution
  - Integrated voltage reference
- Up to Four External Interrupts
- One Master Synchronous Serial Port (MSSP) module:
  - 3/4-wire SPI (supports all four SPI modes)
  - I^2C™ Master and Slave modes
- Two Enhanced Addressable USART modules:
  - LIN/J2602 support
  - Auto-Baud Detect (ABD)
- 12-Bit A/D Converter with up to 11 Channels:
  - Auto-acquisition and Sleep operation
  - Differential Input mode of operation
- Data Signal Modulator module:
  - Select modulator and carrier sources from various module outputs
- Integrated Voltage Reference

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1.0 DEVICE OVERVIEW

This document contains device-specific information for the following devices, operating in an ambient temperature range between -40°C and +150°C:

- PIC18F25K80
- PIC18F26K80
- PIC18F45K80
- PIC18F46K80
- PIC18F65K80
- PIC18F66K80

Note: This data sheet documents only the devices' features and specifications that are in addition to the features and specifications of the non-specialty PIC18F66K80 devices. For information on the features and specifications shared by this document's high-temperature devices and the non-specialty devices, see the *"PIC18F66K80 Family Data Sheet"* (DS39977).

This family of devices offers the advantages of all PIC18 microcontrollers; namely, high computational performance at an economical price. In addition to these features, the PIC18F66K80 family introduces design enhancements that make these microcontrollers a logical choice for many high-performance, power-sensitive applications.

The primary differentiating features and specifications of the high-temperature PIC18F66K80 family devices are:

- Above +125°C, writes are not allowed for Flash program memory
- All AC timing specifications are increased by 15%

  This derating factor includes parameters, such as TPWRT
- Maximum HS frequency of operation is 64 MHz

Note: The test duration for AEC-Q100 reliability testing for devices operating at +150°C is 1,000 hours. Any design operating at +125°C to +150°C for longer than that period is not warranted without prior written approval from Microchip Technology Inc.

NOTES:

2.0 SPECIAL FEATURES OF THE CPU

Note: For additional details on the Configuration bits, refer to **Section 28.1 "Configuration Bits"** in the *"PIC18F66K80 Family Data Sheet"* (DS39977). Device ID information presented in this section is for the high-temperature PIC18F66K80 family devices only.

2.1 Device ID Registers

The Device ID registers are read-only registers. They identify the device type and revision for device programmers and can be read by firmware using table reads.

TABLE 2-1: DEVICE IDs

File Name		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Default/ Unprogrammed Value
3FFFFEh	DEVID1(1)	DEV2	DEV1	DEV0	REV4	REV3	REV2	REV1	REV0	xxxx xxxx
3FFFFFh	DEVID2(1)	DEV10	DEV9	DEV8	DEV7	DEV6	DEV5	DEV4	DEV3	xxxx xxxx

Legend: x = unknown; u = unchanged,;— = unimplemented.

Note 1: See Register 2-1 and Register 2-2 for DEVIDx values. DEVIDx registers are read-only and cannot be programmed by the user.

REGISTER 2-1: DEVID1: DEVICE ID REGISTER 1

R	R	R	R	R	R	R	R
DEV2(1)	DEV1(1)	DEV0(1)	REV4	REV3	REV2	REV1	REV0
bit 7							bit 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

bit 7-5 **DEV<2:0>:** Device ID bits(1)
111 = PIC18F66K80
100 = PIC18F25K80
011 = PIC18F45K80
010 = PIC18F65K80
001 = PIC18F26K80
000 = PIC18F46K80

bit 4-0 **REV<4:0>:** Revision ID bits
These bits are used to indicate the device revision.

Note 1: These DEV<2:0> values may be shared with other devices. The specific device is always identified by using the entire DEV<10:0> bit sequence.

REGISTER 2-2: DEVID2: DEVICE ID REGISTER 2

R	R	R	R	R	R	R	R
DEV10(1)	DEV9(1)	DEV8(1)	DEV7(1)	DEV6(1)	DEV5(1)	DEV4(1)	DEV3(1)
bit 7							bit 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

bit 7-0 **DEV<10:3>:** Device ID bits(1)
0110 0000 = PIC18F66K80
0110 0001 = PIC18F46K80, PIC18F26K80, PIC18F65K80, PIC18F45K80, PIC18F25K80

Note 1: These DEV<10:3> values may be shared with other devices. The specific device is always identified by using the entire DEV<10:0> bit sequence.

3.0 ELECTRICAL CHARACTERISTICS

Note: Other than some basic data, this section documents only the high-temperature PIC18F66K80 family devices' specifications that differ from those of the non-specialty PIC18F66K80 family devices. For detailed information on the electrical specifications shared by the high-temperature and non-specialty devices, see the *"PIC18F66K80 Family Data Sheet"* (DS39977).

Unless otherwise noted, this section's parameters assume a minimum voltage of 4.0V.

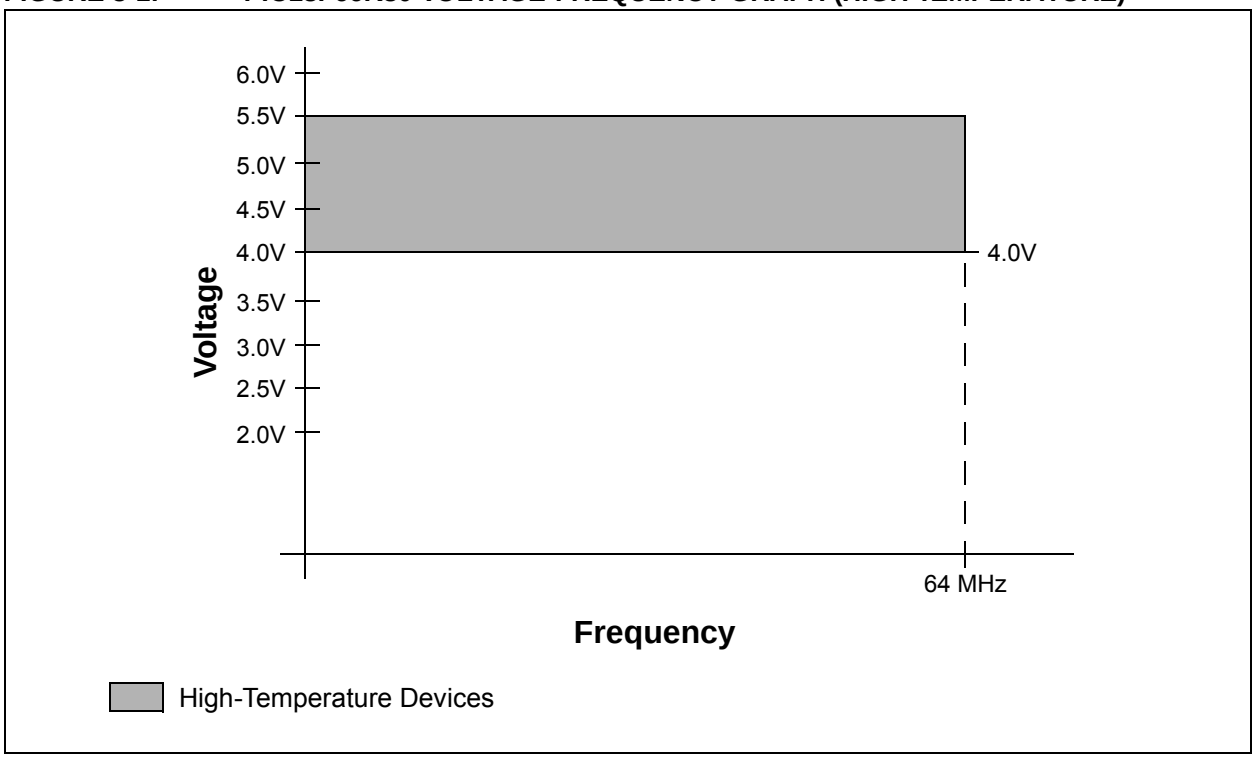
3.1 Absolute Maximum Ratings(†)

Ambient temperature under bias ..... +150°C
Maximum current out of VSS pin ..... 60 mA
Maximum current into VDD pin ..... 60 mA
Maximum output current sunk by any I/O pin(1) ..... 1 mA
Maximum output current sourced by any I/O pin(1) ..... 1 mA
Maximum current sunk by all ports combined(1) ..... 10 mA
Maximum current sourced by all ports combined(1) ..... 10 mA

Note 1: Maximum allowable current is a function of device maximum power dissipation (see **Section 31.0 "Electrical Characteristics"** in the *"PIC18F66K80 Family Data Sheet"*.

† **NOTICE:** Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operation listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

FIGURE 3-1: PIC18F66K80 VOLTAGE-FREQUENCY GRAPH (HIGH TEMPERATURE)



3.2 DC Characteristics: Supply Voltage (High Temperature)

PIC18F66K80 Family (High Temperature)			Standard Operating Conditions (unless otherwise stated) Operating temperature +125°C ≤ TA ≤ +150°C for high temperature				
Param No.	**Symbol**	**Characteristic**	**Min**	**Typ**	**Max**	**Units**	**Conditions**
D001	VDD	Supply Voltage	4.0	—	5.5	V	For F devices

3.3 DC Characteristics: Power Down and Supply Current (High Temperature)

PIC18F66K80 Family (High Temperature)		Standard Operating Conditions (unless otherwise stated) Operating temperature +125°C ≤ TA ≤ +150°C for high temperature				
Param No.	**Device**	**Typ**	**Max**	**Units**	**Conditions**	
	PIC18FXXK80	**Power-Down Current (IPD)(1)**				
		10	28	µA	+150°C	VDD = 5V, Sleep mode
		Module Differential Currents				
		12	29	µA	+150°C	VDD = 5V, Watchdog Timer Current: ΔIWDT
		12	28	µA	+150°C	VDD = 5V, A/D Current: ΔIAD
		12	28	µA	+150°C	VDD = 5V, High/Low-Voltage Detect: ΔIHLVD
		Supply Current (IDD)(2,3)				
		10	32	mA	+150°C	VDD = 5V, FOSC = 64 MHz (PRI_RUN mode)
		—	8	mA	+150°C	VDD = 5V, FOSC = 4 MHz (PRI_RUN mode)
		—	3	mA	+150°C	VDD = 5V, FOSC = 1 MHz (PRI_RUN mode)
		—	8	mA	+150°C	VDD = 5V, FOSC = 64 MHz (PRI_IDLE mode)
		—	1.8	mA	+150°C	VDD = 5V, FOSC = 4 MHz (PRI_IDLE mode)
		—	1	mA	+150°C	VDD = 5V, FOSC = 1 MHz (PRI_IDLE mode)
		—	28	mA	+150°C	VDD = 5V, FOSC = 64 MHz (PRI_RUN mode, 16 MHz w/PLL)
		—	8	mA	+150°C	VDD = 5V, FOSC = 16 MHz (PRI_RUN mode, 4 MHz w/PLL)

Note 1: 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 a high-impedance state and tied to VDD or VSS, and all features that add delta current are disabled (such as WDT, secondary oscillator, BOR, etc.).

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

3: The test conditions for all IDD measurements in active operation mode are: OSC1 = External square wave, from rail-to-rail; all I/O pins tri-stated, pulled to VDD; $\overline{MCLR}$ = VDD; WDT is enabled/disabled as specified.

3.4 DC Characteristics: PIC18F66K80 Family (High Temperature)

PIC18F66K80 Family (High Temperature)			Standard Operating Conditions (unless otherwise stated) Operating temperature +125°C ≤ TA ≤ +150°C for high temperature				
Param No.	**Symbol**	**Characteristic**	**Min**	**Typ**	**Max**	**Units**	**Conditions**
D031	VIL	I/O Ports with Schmitt Trigger Buffer	VSS	—	0.25 VDD	V	VDD = 5.0V
D032	VIL	$\overline{\text{MCLR}}$	VSS	—	0.25 VDD	V	VDD = 5.0V
D041	VIH	I/O Ports with Schmitt Trigger Buffer	0.85 VDD	—	VDD	V	VDD = 5.0V
D042	VIH	$\overline{\text{MCLR}}$, OSC1 (EC mode)	0.85 VDD	—	VDD	V	VDD = 5.0V
D060	IIL	Input Leakage Current I/O Ports	—	—	±2	µA	VSS ≤ VPIN ≤ VDD, Pin at high-impedance

3.5 DC Characteristics: Memory Programming Requirements

PIC18F66K80 Family (High Temperature)			Standard Operating Conditions (unless otherwise stated) Operating temperature +125°C ≤ TA ≤ +150°C for high temperature				
Param No.	**Symbol**	**Characteristic**	**Min**	**Typ**	**Max**	**Units**	**Conditions**
D120	ED	Data EEPROM Memory Byte Endurance	50K	—	—	E/W	+125°C to +150°C
D121	VDRW	VDD for Read/Write	4.0	—	5.5	V	Using EECON to read/write PIC18FXXKXX devices
D123	VRETD	Characteristic Retention	1	—	—	Year	Provided no other specifications are violated

3.6 AC Characteristics Internal RC Accuracy (INTOSC)

PIC18F66K80 Family (High Temperature)	Standard Operating Conditions (unless otherwise stated) Operating temperature -40°C ≤ TA ≤ +150°C				
Param No.	**Min**	**Typ**	**Max**	**Units**	**Conditions**
INTOSC Accuracy @ Freq = 16 MHz, 8 MHz, 4 MHz, 2 MHz, 1 MHz, 500 kHz, 250 kHz(1)					
OA1	-20	—	±20	%	+125°C to +150°C, VDD = 4.0-5.5V
OA2 LF_INTOSC Accuracy @ 31 kHz					
OA2	-25	—	±25	%	VDD = 4.0-5.5V

Note 1: Frequency is calibrated at +25°C. The OSCTUNE register can be used to compensate for temperature drift.

TABLE 3-1: DC CHARACTERISTICS: HIGH/LOW-VOLTAGE DETECT CHARACTERISTICS

PIC18F66K80 Family (High Temperature)		Standard Operating Conditions (unless otherwise stated) Operating temperature -40°C ≤ TA ≤ +150°C				
Param No.	**Characteristic**		**Min**	**Typ**	**Max**	**Units**
D420	HLVD Voltage on VDD, Transition High-to-Low	HLVDL<3:0> = 1101	4.00	4.44	4.88	V
		HLVDL<3:0> = 1110	4.28	4.75	5.23	V

APPENDIX A: REVISION HISTORY

Revision A (February 2012)

Original mini data sheet for the high-temperature devices in the PIC18F66K80 family.

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PART NO.	X	/XX	XXX
Device	Temperature Range	Package	Pattern

Device[1,2]	PIC18F25K80/26K80, PIC18F45K80/46K80, PIC18F65K80/66K80, PIC18F25K80/26K80T, PIC18F45K80/46K80T, PIC18F65K80/66K80T VDD range 4.0V to 5.5V	
Temperature Range	I = -40°C to +85°C	(Industrial)
	E = -40°C to +125°C	(Extended)
	H = -40°C to +150°C	(High Temperature)
Package	PT = TQFP Thin Quad Flatpack MR = QFN Plastic Quad Flat, No Lead Package SS = SSOP Plastic Shrink Small Outline MM = QFN Plastic Quad Flat, No Lead Package ML = QFN Plastic Quad Flat, No Lead Package	
Pattern	QTP, SQTP, Code or Special Requirements (blank otherwise)	

Examples:

a) PIC18F46K80T-H/PT = High Temperature, TQFP package in tape and reel configuration

Note 1: F = Standard Voltage Range
2: LF = Wide Voltage Range
3: T = In Tape and Reel PLCC, and TQFP packages only

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