PIC16F76/77 → PIC16CR76/77 Migration

DEVICE MIGRATIONS

This document is intended to describe the differences that are present when migrating from one device to the next. Table 1 and Table 2 list the differences in the electrical specifications.

Note 1: This device has been designed to perform to the parameters of its data sheet. It has been tested to an electrical specification designed to determine its conformance with these parameters. Due to process differences in the manufacture of this device, this device may have different performance characteristics than its earlier version. These differences may cause this device to perform differently in your application than the earlier version of this device.

2: The user should verify that the device oscillator starts and performs as expected. Adjusting the loading capacitor values and/or the Oscillator mode may be required.

Oscillator Differences

The functionality of the RC oscillator in both the PIC16F7X family and the PIC16CR7X family was designed to be equivalent, however, due to process variation and continuous improvement, the Frequency vs. VDD charts in Section 16 of the PIC16F7X may not represent current production devices. For a comparison of the PIC16F7X and the PIC16CR7X devices, please consult Figure 16-7 through Figure 16-9 in the PIC16CR7X Data Sheet (DS21993).

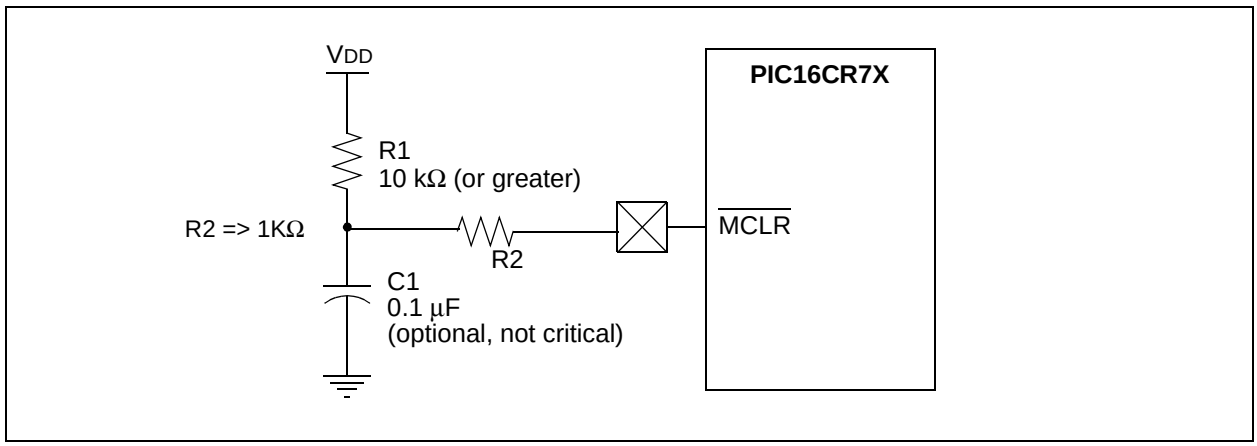
RA4 Functionality

The RA4 pin on the PIC16CR7X family of devices should never be taken higher than 5.5 volts. The RA4 pin retains the Open Drain configuration of the Flash device.

$\overline{\text{MCLR}}$ Functionality

The ESD protection that is present on the Flash PIC16F7X devices is also present on the PIC16CR7S ROM family. For this reason, Microchip recommends that the $\overline{\text{MCLR}}$ pin not be tied directly to VDD. The use of an RC network, as shown in Figure 1, is suggested. This pin should never be taken above 5.5 volts.

FIGURE 1: RECOMMENDED $\overline{\text{MCLR}}$ CIRCUIT



Electrical Characteristics Differences

TABLE 1: PIC16F76/77 → PIC16CR76/77 ELECTRICAL CHARACTERISTICS DIFFERENCES

Characteristic	PIC16F7X Data Sheet	PIC16CR7X Data Sheet	Units
Voltage on V_{DD} with respect to Vss	-0.3 to 6.5	-0.3 to 5.5	V
Voltage on $\overline{MCLR}$ with respect to Vss (Note 1)	0 to 13.5	0 to 5.5	V
Voltage on RA4 with respect to Vss	0 to 12	0 to 5.5	V

Note 1: It is not recommended to tie the $\overline{MCLR}$ pin directly to V_{DD} (see Figure 1 in this document or Figure 12-5 in the PIC16CR7X Data Sheet (DS21993) for the recommended $\overline{MCLR}$ circuit).

TABLE 2: PIC16F76/77 → PIC16CR76/77 DC CHARACTERISTICS DIFFERENCES

Param No.	Sym	Characteristic	PIC16F7X Data Sheet				Conditions	PIC16CR7X Data Sheet				Conditions
			Min	Typ†	Max	Units		Min	Typ†	Max	Units	
D005	BVDD	**Brown-out Reset Voltage**	3.65	4.0	4.35	V	BOREN bit in Configuration Word enabled	**TBD**	**TBD**	**TBD**	V	Currently being characterized
D010	IDD	**Supply Current (Notes 3, 5)**	—	0.9	4	mA	XT, RC osc configuration FOSC = 4 MHz, VDD = 5.5V, **(Note 5)**	—	1.1	4	mA	XT, RC osc configuration FOSC = 4 MHz, VDD = 5.5V, **(Note 5)**
D013			—	5.2	15	mA	HS osc configuration FOSC = 20 MHz, VDD = 5.5V	—	6.3	15	mA	HS osc configuration FOSC = 20 MHz, VDD = 5.5V
D015*	ΔIBOR	**Brown-out Reset Current (Note 6)**	—	25	200	µA	BOR enabled, VDD = 5.0V	—	30	200	µA	
D020	IPD	**Power-down Reset Current (Note 4, 7)**	—	5.0	42	µA	VDD = 4.0V, WDT enabled, -40°C to +85°C	—	TBD	42	µA	Currently being characterized, however, expected to be the same or lower than the PIC16F7X family
D021x			—	0.1	19	µA	VDD = 4.0V, WDT disabled, -40°C to +85°C	—	TBD	19	µA	
D021B			—	1.5	42	µA	VDD = 4.0V, WDT disabled, -40°C to +125°C	—	TBD	42	µA	
D150*	VOD	**Open Drain High Voltage**	—	—	12	V	RA4 pin	—	—	5.5	V	RA4 pin

* These parameters are characterized but not tested.

† 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: For RC osc configuration, the OSC1/CLKIN pin is a Schmitt Trigger input. It is not recommended that the PIC16CR76/77 be driven with external clock in RC mode.

2: When BOR is enabled, the device will operate correctly until the VBOR voltage trip point is reached.

3: The supply current is mainly a function of the operating voltage and frequency. Other factors, such as I/O pin loading and switching rate, oscillator type, internal code execution pattern and temperature also have an impact on the current consumption.
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.
MCLR = VDD; WDT enabled/disabled as specified.

4: Timer1 oscillator (when enabled) adds approximately 20 µA to the specification. This value is from characterization and is for design guidance only. This is not tested.

5: For RC osc configuration, current through REXT is not included. The current through the resistor can be estimated by the formula Ir = VDD/2REXT (mA) with REXT in kΩ.

6: The Δ current is the additional current consumed when this peripheral is enabled. This current should be added to the base IDD or IPD measurement.

7: 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 high-impedance state and pulled to VDD and VSS.

RC Oscillator Comparison

Note: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only. The performance characteristics listed herein are not tested or guaranteed. In some graphs or tables, the data presented may be outside the specified operating range (e.g., outside specified power supply range) and therefore, outside the warranted range. The Oscillator frequency is strongly influenced by VDD and Temperature Check the RC oscillator frequency across the applications expected temperature and voltage range.

FIGURE 2: AVERAGE FOSC vs. VDD FOR VARIOUS VALUES OF R (RC MODE, C = 20 pF, 25°C)

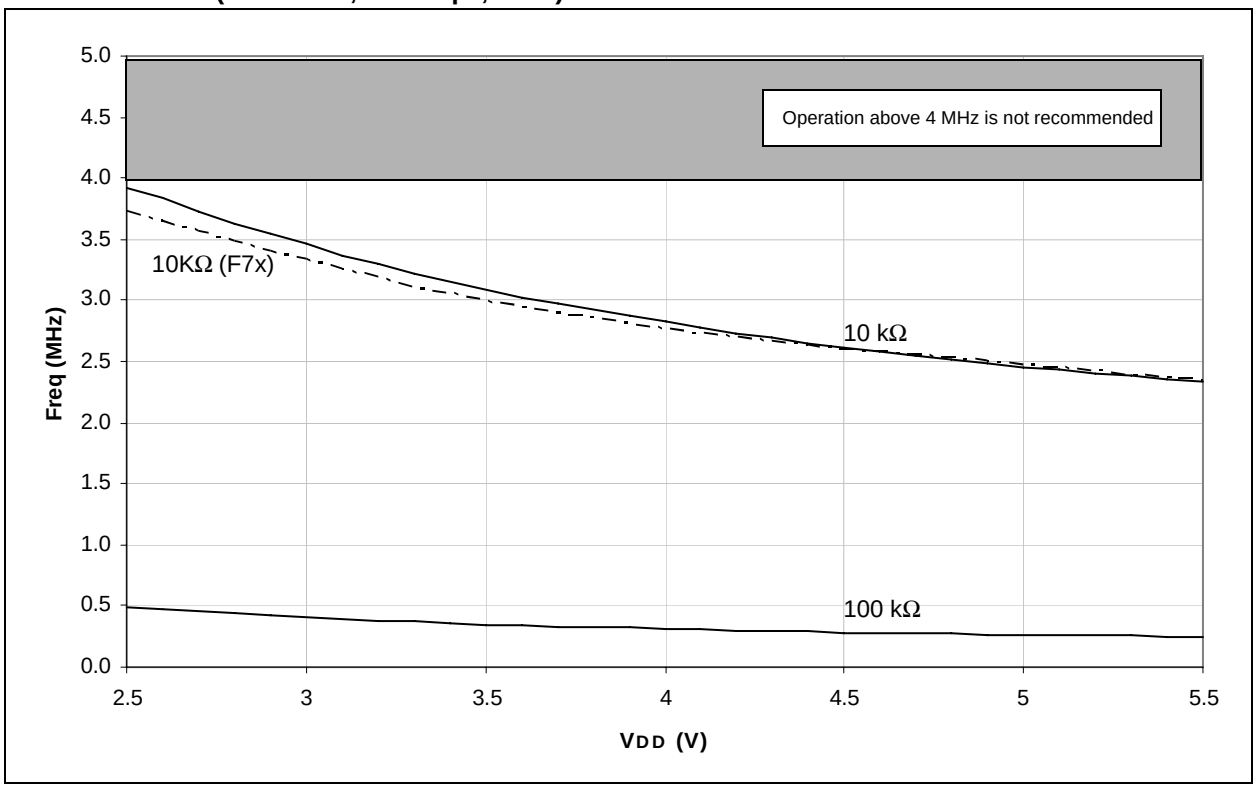


FIGURE 3: AVERAGE FOSC vs. VDD FOR VARIOUS VALUES OF R (RC MODE, C = 100 pF, 25°C)

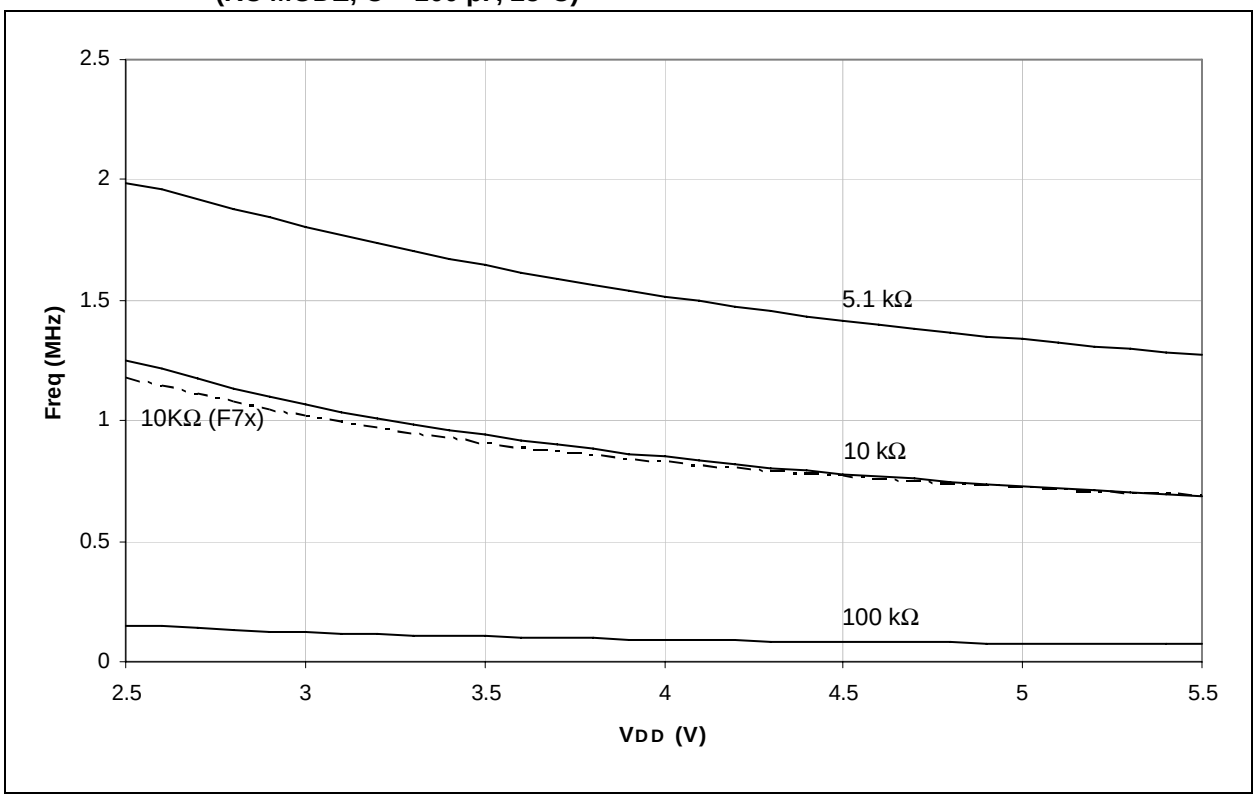
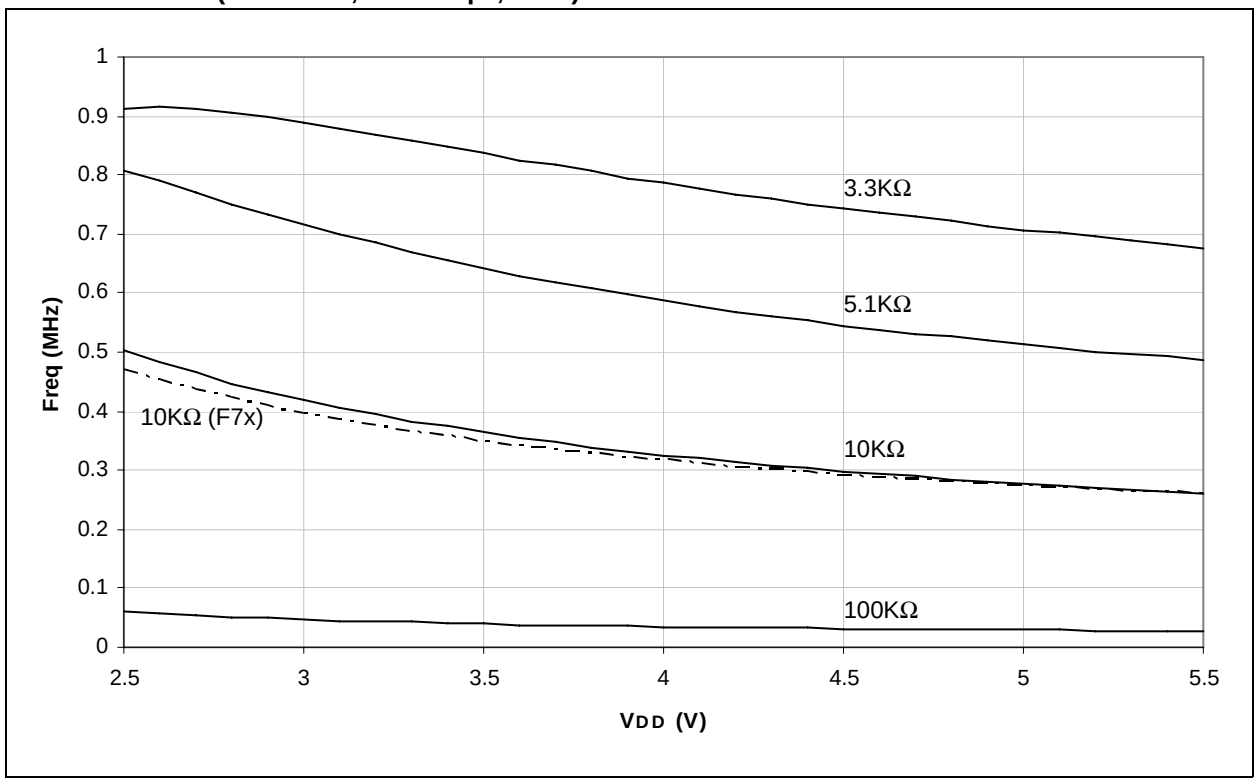


FIGURE 4: AVERAGE FOSC vs. VDD FOR VARIOUS VALUES OF R (RC MODE, C = 300 pF, 25°C)



NOTES:

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

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- 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.
- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.
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02/16/06