

Taken from the Datasheet shown below.

My +Vdd power rail is 5.1V.



# MICROCHIP MCP413X/415X/423X/425X

## 7/8-Bit Single/Dual SPI Digital POT with Volatile Memory

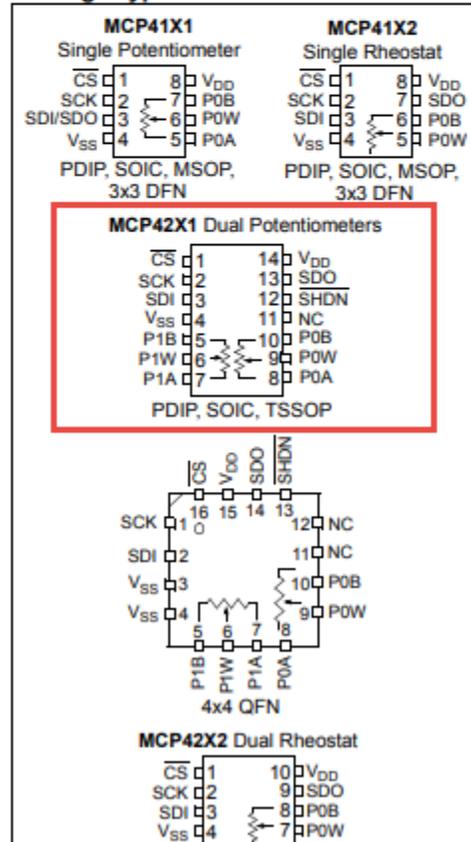
### Features

- Single or Dual Resistor Network options
- Potentiometer or Rheostat configuration options
- Resistor Network Resolution
  - 7-bit: 128 Resistors (129 Steps)
  - 8-bit: 256 Resistors (257 Steps)
- $R_{AB}$  Resistances options of:
  - 5 k $\Omega$
  - 10 k $\Omega$
  - 50 k $\Omega$
  - 100 k $\Omega$
- Zero Scale to Full Scale Wiper operation
- Low Wiper Resistance: 75 $\Omega$  (typ.)
- Low Tempco:
  - Absolute (Rheostat): 50 ppm typical (0°C to 70°C)
  - Ratiometric (Potentiometer): 15 ppm typical
- SPI Serial Interface (10 MHz, modes 0,0 & 1,1)
  - High-Speed Read/Writes to wiper registers
  - SDI/SDO multiplexing (MCP41X1 only)
- Resistor Network Terminal Disconnect Feature via:
  - Shutdown pin ( $\overline{SHDN}$ )
  - Terminal Control (TCON) Register
- Brown-out reset protection (1.5V typical)
- Serial Interface Inactive current (2.5  $\mu$ A typ.)
- High-Voltage Tolerant Digital Inputs: Up to 12.5V
- Supports Split Rail Applications
- Internal weak pull-up on all digital inputs
- Wide Operating Voltage:
  - 2.7V to 5.5V - Device Characteristics Specified
  - 1.8V to 5.5V - Device Operation
- Wide Bandwidth (-3 dB) Operation:
  - 2 MHz (typ.) for 5.0 k $\Omega$  device
- Extended temperature range (-40°C to +125°C)

### Description

The MCP41XX and MCP42XX devices offer a wide range of product offerings using an SPI interface. This family of devices support 7-bit and 8-bit resistor networks, and Potentiometer and Rheostat pinouts.

### Package Types



## Device Features

Device	# of POTS	Wiper Configuration	Control Interface	Memory Type	WiperLock Technology	POR Wiper Setting	Resistance (typical)		# of Steps	V <sub>DD</sub> Operating Range <sup>(2)</sup>
							R <sub>AB</sub> Options (kΩ)	Wiper - R <sub>W</sub> (Ω)		
MCP4131 <sup>(3)</sup>	1	Potentiometer <sup>(1)</sup>	SPI	RAM	No	Mid-Scale	5.0, 10.0, 50.0, 100.0	75	129	1.8V to 5.5V
MCP4132 <sup>(3)</sup>	1	Rheostat	SPI	RAM	No	Mid-Scale	5.0, 10.0, 50.0, 100.0	75	129	1.8V to 5.5V
MCP4141	1	Potentiometer <sup>(1)</sup>	SPI	EE	Yes	NV Wiper	5.0, 10.0, 50.0, 100.0	75	129	2.7V to 5.5V
MCP4142	1	Rheostat	SPI	EE	Yes	NV Wiper	5.0, 10.0, 50.0, 100.0	75	129	2.7V to 5.5V
MCP4151 <sup>(3)</sup>	1	Potentiometer <sup>(1)</sup>	SPI	RAM	No	Mid-Scale	5.0, 10.0, 50.0, 100.0	75	257	1.8V to 5.5V
MCP4152 <sup>(3)</sup>	1	Rheostat	SPI	RAM	No	Mid-Scale	5.0, 10.0, 50.0, 100.0	75	257	1.8V to 5.5V
MCP4161	1	Potentiometer <sup>(1)</sup>	SPI	EE	Yes	NV Wiper	5.0, 10.0, 50.0, 100.0	75	257	2.7V to 5.5V
MCP4162	1	Rheostat	SPI	EE	Yes	NV Wiper	5.0, 10.0, 50.0, 100.0	75	257	2.7V to 5.5V
MCP4231 <sup>(3)</sup>	2	Potentiometer <sup>(1)</sup>	SPI	RAM	No	Mid-Scale	5.0, 10.0, 50.0, 100.0	75	129	1.8V to 5.5V
MCP4232 <sup>(3)</sup>	2	Rheostat	SPI	RAM	No	Mid-Scale	5.0, 10.0, 50.0, 100.0	75	129	1.8V to 5.5V
MCP4241	2	Potentiometer <sup>(1)</sup>	SPI	EE	Yes	NV Wiper	5.0, 10.0, 50.0, 100.0	75	129	2.7V to 5.5V
MCP4242	2	Rheostat	SPI	EE	Yes	NV Wiper	5.0, 10.0, 50.0, 100.0	75	129	2.7V to 5.5V
MCP4251 <sup>(3)</sup>	2	Potentiometer <sup>(1)</sup>	SPI	RAM	No	Mid-Scale	5.0, 10.0, 50.0, 100.0	75	257	1.8V to 5.5V
MCP4252 <sup>(3)</sup>	2	Rheostat	SPI	RAM	No	Mid-Scale	5.0, 10.0, 50.0, 100.0	75	257	1.8V to 5.5V
MCP4261	2	Potentiometer <sup>(1)</sup>	SPI	EE	Yes	NV Wiper	5.0, 10.0, 50.0, 100.0	75	257	2.7V to 5.5V
MCP4262	2	Rheostat	SPI	EE	Yes	NV Wiper	5.0, 10.0, 50.0, 100.0	75	257	2.7V to 5.5V

**Note 1:** Floating either terminal (A or B) allows the device to be used as a Rheostat (variable resistor).

**2:** Analog characteristics only tested from 2.7V to 5.5V unless otherwise noted.

## MCP413X/415X/423X/425X

### AC/DC CHARACTERISTICS (CONTINUED)

DC Characteristics		Standard Operating Conditions (unless otherwise specified)					
		Operating Temperature $-40^{\circ}\text{C} \leq T_A \leq +125^{\circ}\text{C}$ (extended)					
		All parameters apply across the specified operating ranges unless noted.					
		V <sub>DD</sub> = +2.7V to 5.5V, 5 kΩ, 10 kΩ, 50 kΩ, 100 kΩ devices.					
		Typical specifications represent values for V <sub>DD</sub> = 5.5V, T <sub>A</sub> = +25°C.					
Parameters	Sym	Min	Typ	Max	Units	Conditions	
<b>Digital Inputs/Outputs (CS, SDI, SDO, SCK, SHDN)</b>							
Schmitt Trigger High Input Threshold	V <sub>IH</sub>	0.45 V <sub>DD</sub>	—	—	V	2.7V ≤ V <sub>DD</sub> ≤ 5.5V (Allows 2.7V Digital V <sub>DD</sub> with 5V Analog V <sub>DD</sub> )	
		0.5 V <sub>DD</sub>	—	—	V	1.8V ≤ V <sub>DD</sub> ≤ 2.7V	
Schmitt Trigger Low Input Threshold	V <sub>IL</sub>	—	—	0.2V <sub>DD</sub>	V		
Hysteresis of Schmitt Trigger Inputs	V <sub>HYS</sub>	—	0.1V <sub>DD</sub>	—	V		
High Voltage Limit	V <sub>MAX</sub>	—	—	12.5 <sup>(6)</sup>	V	Pin can tolerate V <sub>MAX</sub> or less.	
Output Low Voltage (SDO)	V <sub>OL</sub>	V <sub>SS</sub>	—	0.3V <sub>DD</sub>	V	I <sub>OL</sub> = 5 mA, V <sub>DD</sub> = 5.5V	
		V <sub>SS</sub>	—	0.3V <sub>DD</sub>	V	I <sub>OL</sub> = 1 mA, V <sub>DD</sub> = 1.8V	
Output High Voltage (SDO)	V <sub>OH</sub>	0.7V <sub>DD</sub>	—	V <sub>DD</sub>	V	I <sub>OH</sub> = -2.5 mA, V <sub>DD</sub> = 5.5V	
		0.7V <sub>DD</sub>	—	V <sub>DD</sub>	V	I <sub>OL</sub> = -1 mA, V <sub>DD</sub> = 1.8V	

**TABLE 1-2: SPI REQUIREMENTS (MODE = 00)**

#	Characteristic	Symbol	Min	Max	Units	Conditions
	SCK Input Frequency	F <sub>SCK</sub>	—	10	MHz	V <sub>DD</sub> = 2.7V to 5.5V
			—	1	MHz	V <sub>DD</sub> = 1.8V to 2.7V
70	CS Active (V <sub>IL</sub> or V <sub>IHH</sub> ) to SCK↑ input	TcsA2scH	60	—	ns	
71	SCK input high time	TscH	45	—	ns	V <sub>DD</sub> = 2.7V to 5.5V
			500	—	ns	V <sub>DD</sub> = 1.8V to 2.7V
72	SCK input low time	TscL	45	—	ns	V <sub>DD</sub> = 2.7V to 5.5V
			500	—	ns	V <sub>DD</sub> = 1.8V to 2.7V