MIC281

Low-Cost Thermal Sensor

Features

- Remote Temperature Measurement Using Embedded Thermal Diodes or Commodity Transistors
- Accurate Remote Sensing: ±3°C max., 0°C to 100°C
- Excellent Noise Rejection
- I^2C and SMBus 2.0-Compatible Serial Interface
- SMBus Timeout to Prevent Bus Lockup
- Voltage Tolerant I/Os
- Low Power Shutdown Mode
- Failsafe Response to Diode Faults
- 3.0V to 3.6V Power Supply Range
- Available in SOT23-6 Package

Applications

- Desktop, Server, and Notebook Computers
- Set-Top Boxes
- Game Consoles
- Appliances

General Description

The MIC281 is a digital thermal sensor capable of measuring the temperature of a remote PN junction. It is optimized for applications favoring low cost and small size. The remote junction may be an inexpensive commodity transistor, e.g., 2N3906, or an embedded thermal diode such as found in Intel Pentium® II/III/IV CPUs, AMD Athlon® CPUs, and Xilinx Virtex® FPGAs.

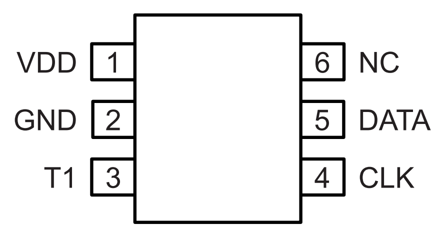
The MIC281 is 100% software and hardware backward compatible with the MIC280 and features the same industry-leading noise performance and small size. The advanced integrating A/D converter and analog front-end reduce errors due to noise for maximum accuracy and minimum guardbanding.

A 2-wire SMBus 2.0-compatible serial interface is provided for host communication. The clock and data pins are 5V-tolerant regardless of the value of V_{DD}. They will not clamp the bus lines low even if the device is powered down.

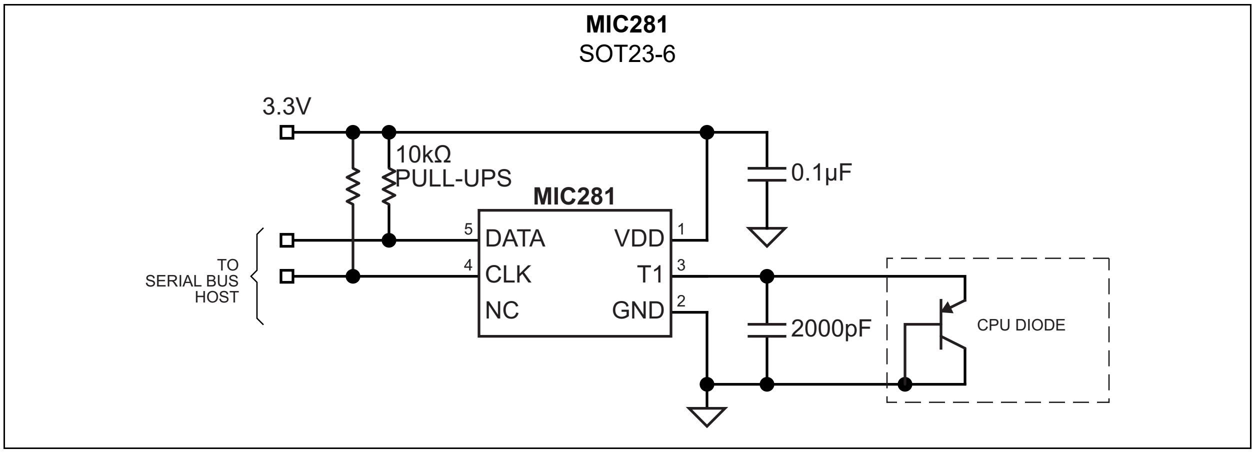
Superior performance, low power, and small size make the MIC281 an excellent choice for cost-sensitive thermal management applications.

Package Type

MIC281
6-Lead SOT23 (M6)
(Top View)



Typical Application Circuit



1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings †

Power Supply Voltage (V_{DD}) .... +3.8V
Voltage on T1 .... –0.3V to V_{DD} + 0.3V
Voltage on CLK, DATA .... –0.3V to +6V
Current on Any Pin .... ±10 mA
Power Dissipation (T_A = +125°C) .... 109 mW
ESD Rating (HBM, Note 1) .... 1.5 kV
ESD Rating (MM, Note 1) 200V

Operating Ratings ‡

Power Supply Voltage (V_{DD}) .... +3.0V to +3.6V

† 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 operational sections of this specification is not intended. Exposure to maximum rating conditions for extended periods may affect device reliability.

‡ Notice: The device is not guaranteed to function outside its operating ratings. Final test on outgoing product is performed at T_A = +25°C.

Note 1: Devices are ESD sensitive. Handling precautions are recommended. Human body model, 1.5 kΩ in series with 100 pF.

TABLE 1-1: ELECTRICAL CHARACTERISTICS

Electrical Characteristics: V_{DD} = 3.3V; T_A = +25°C, unless noted. **Bold** values indicate $T_{MIN} \le T_A \le T_{MAX}$, unless noted. Note 1

Parameters	Symbol	Min.	Typ.	Max.	Units	Conditions
Power Supply						
Supply Current	I_{DD}	—	0.23	**0.4**	mA	T1 open; CLK = DATA = High; Normal mode
		—	9	—	µA	Shutdown mode; T1 open; Note 2; CLK = 100 kHz
		—	6	—	µA	Shutdown mode; T1 open; CLK = DATA = High
Power-on Reset Time, Note 2	t_{POR}	—	200	—	µs	$V_{DD} > V_{POR}$
Power-on Reset Voltage	V_{POR}	—	2.65	**2.95**	V	All registers reset to default values; A/D conversions initiated
Power-on Reset Hysteresis Voltage, Note 2	V_{HYST}	—	300	—	mV	—
Temperature-to-Digital Converter Characteristics						
Accuracy, Note 2, Note 3, Note 4	—	—	**±1**	**±3**	°C	$0°C \le T_D \le 100°C$, $0°C < T_A < 85°C$; $3.15V < V_{DD} < 3.45V$
		—	**±2**	**±5**	°C	$–40°C \le T_D \le 125°C$, $0°C < T_A < 85°C$; $3.15V < V_{DD} < 3.45V$
Conversion Time, Note 2	t_{CONV}	—	200	**240**	ms	—
Remote Temperature Input, T1						
Current into External Diode, Note 2	I_F	—	192	**400**	µA	T1 forced to 1.0V, high level
		7	12	—		Low level
Serial Data I/O Pin, DATA						
Low Output Voltage, Note 5	V_{OL}	—	—	**0.3**	V	I_{OL} = 3 mA
		—	—	**0.5**		I_{OL} = 6 mA
Low Input Voltage	V_{IL}	—	—	**0.8**	V	$3V \le V_{DD} \le 3.6V$
High Input Voltage	V_{IH}	**2.1**	—	**5.5**	V	$3V \le V_{DD} \le 3.6V$
Input Capacitance	C_{IN}	—	10	—	pF	Note 2
Input Current	I_{LEAK}	—	—	**±1**	µA	—
Serial Clock Input, CLK						
Low Input Voltage	V_{IL}	—	—	**0.8**	V	$3V \le V_{DD} \le 3.6V$
High Input Voltage	V_{IH}	**2.1**	—	**5.5**	V	$3V \le V_{DD} \le 3.6V$
Input Capacitance	C_{IN}	—	10	—	pF	Note 2
Input Current	I_{LEAK}	—	—	**±1**	µA	—
Serial Interface Timing						
CLK (Clock) Period	t_1	**2.5**	—	—	µs	—
Data-In Set-Up Time to CLK High	t_2	**100**	—	—	ns	—

TABLE 1-1: ELECTRICAL CHARACTERISTICS (CONTINUED)

Electrical Characteristics: V_{DD} = 3.3V; T_A = +25°C, unless noted. **Bold** values indicate $T_{MIN} \le T_A \le T_{MAX}$, unless noted. Note 1

Parameters	Symbol	Min.	Typ.	Max.	Units	Conditions
Data-Out Stable after CLK Low	t_3	**300**	—	—	ns	—
Data-Low Set-Up Time to CLK Low	t_4	**100**	—	—	ns	Start Condition
Data-High Hold Time after CLK High	t_5	**100**	—	—	ns	Stop Condition
Bus Timeout	t_{TO}	**25**	30	**35**	ms	—

Note 1: The device is not guaranteed to function outside its operating ratings. Final test on outgoing product is performed at T_A = +25°C. Specification for packaged product only.

2: Guaranteed by design over the operating temperature range. Not 100% production tested.

3: Accuracy specification does not include quantization noise, which may be up to ±1/2 LSB.

4: T_D is the temperature of the remote diode junction. Testing is performed using a single unit of one of the transistors listed in Table 5-1.

5: Current into the DATA pin will result in self-heating of the device. Sink current should be minimized for best accuracy.

TEMPERATURE SPECIFICATIONS

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
Temperature Ranges						
Storage Temperature	T_S	–65	—	+150	°C	—
Ambient Temperature Range	T_A	–55	—	+125	°C	—
Lead Temperature Soldering	—	—	—	+220 ±5	°C	Vapor Phase, 60 sec.
		—	—	+235 ±5	°C	Infrared, 15 sec.
Package Thermal Resistances						
SOT23-6	θ_{JA}	—	230	—	°C/W	—

Note 1: The maximum allowable power dissipation is a function of ambient temperature, the maximum allowable junction temperature and the thermal resistance from junction to air (i.e., T_A, T_J, θ_{JA}). Exceeding the maximum allowable power dissipation will cause the device operating junction temperature to exceed the maximum +150°C rating. Sustained junction temperatures above +150°C can impact the device reliability.

2.0 TYPICAL PERFORMANCE CURVES

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.

V_{DD} = 3.3V; T_A = 25˚C, unless otherwise noted.

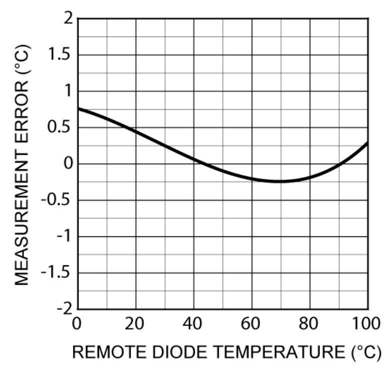


FIGURE 2-1: *Remote Temperature Measurement Error.*

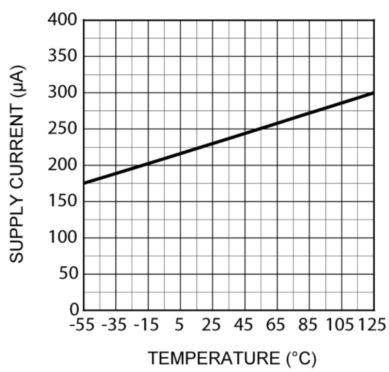


FIGURE 2-2: *Supply Current vs. Temperature for V_{DD} = 3.3V.*

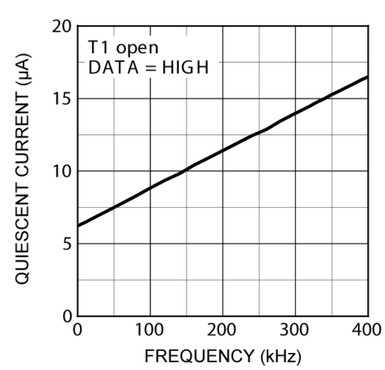


FIGURE 2-3: *Quiescent Current vs. Clock Frequency in Shutdown Mode.*

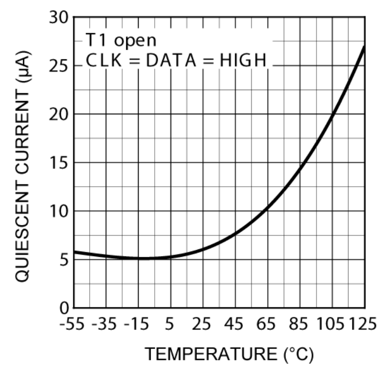


FIGURE 2-4: *Quiescent Current vs. Temperature in Shutdown Mode.*

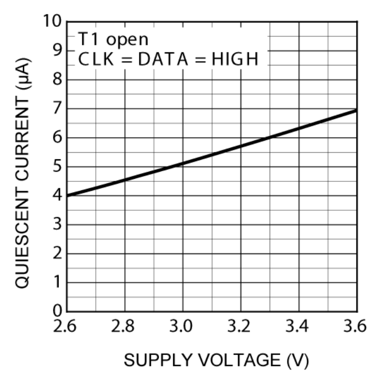


FIGURE 2-5: *Quiescent Current vs. Supply Voltage in Shutdown Mode.*

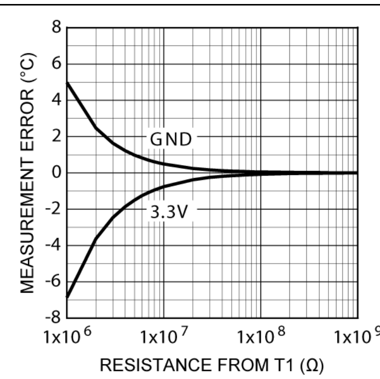


FIGURE 2-6: *Measurement Error vs. PCB Leakage to +3.3V/GND.*

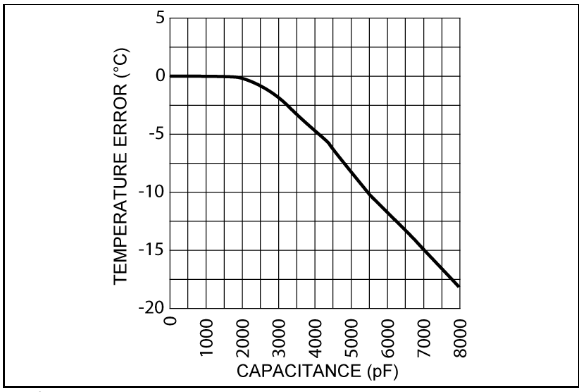


FIGURE 2-7: Remote Temperature Error vs.Capacitance on T1.

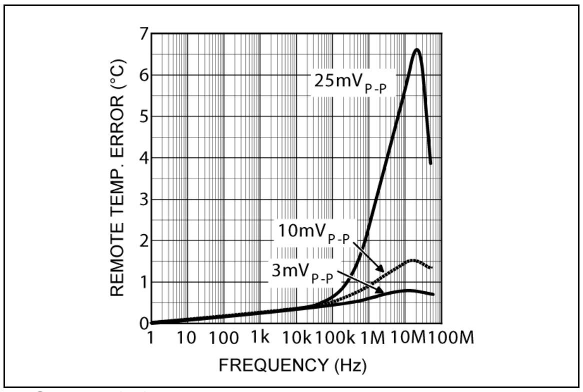


FIGURE 2-8: Error Due to Noise on the Base of Remote Transistor.

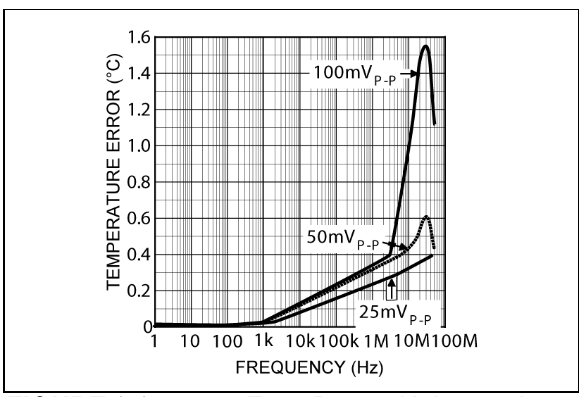


FIGURE 2-9: Error Due to Noise on the Collector of Remote Transistor.

Timing Diagram

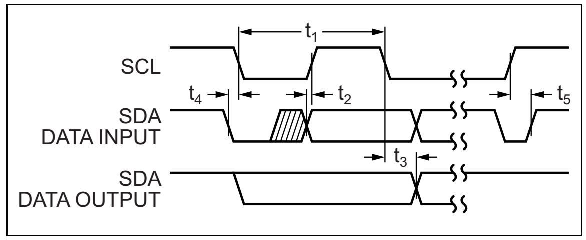


FIGURE 2-10: Serial Interface Timing.

3.0 PIN DESCRIPTIONS

The descriptions of the pins are listed in Table 3-1.

TABLE 3-1: PIN FUNCTION TABLE

Pin Number	Symbol	Description
1	VDD	Analog input: Power supply input to the IC.
2	GND	Ground return for all IC functions.
3	T1	Analog input: Connection to remote diode junction.
4	CLK	Digital input: Serial bit clock input.
5	DATA	Digital input/output: Open-drain. Serial data input/output.
6	NC	No connection: Must be left unconnected.

4.0 FUNCTIONAL DESCRIPTION

4.1 Serial Port Operation

The MIC281 uses standard SMBus Write_Byte and Read_Byte operations for communication with its host. The SMBus Write_Byte operation involves sending the device's client address (with the R/W bit low to signal a write operation), followed by a command byte and the data byte. The SMBus Read_Byte operation is a composite write and read operation: the host first sends the device's client address followed by the command byte, as in a write operation. A new start bit must then be sent to the MIC281, followed by a repeat of the client address with the R/W bit (LSB) set to the high (read) state. The data to be read from the part may then be clocked out. These protocols are shown in Figure 4-1 and Figure 4-2.

The Command byte is eight bits (one byte) wide. This byte carries the address of the MIC281 register to be operated upon. The command byte values corresponding to the various MIC281 registers are shown in Table 4-1. Other command byte values are reserved, and should not be used.

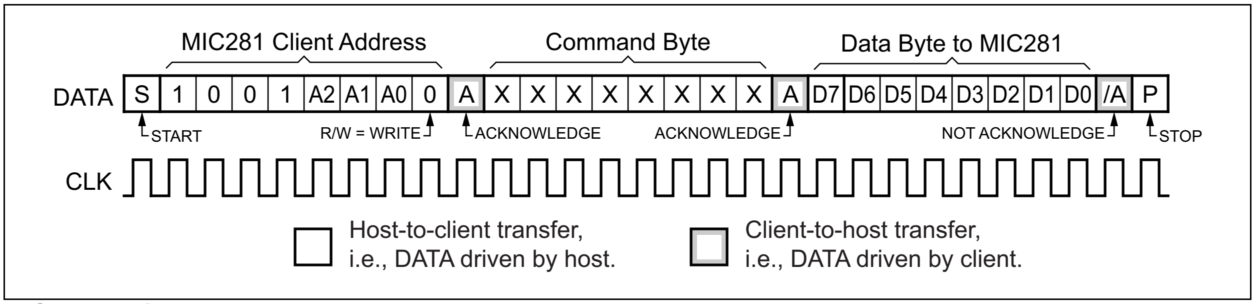


FIGURE 4-1: *Write_Byte Protocol.*

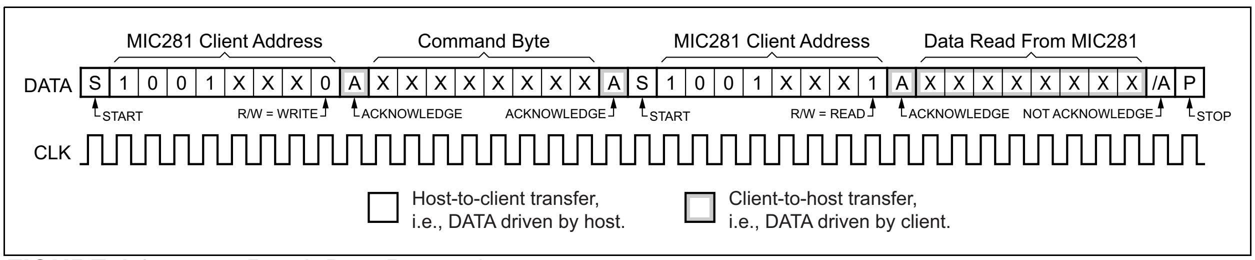


FIGURE 4-2: *Read_Byte Protocol.*

TABLE 4-1: MIC281 REGISTER ADDRESSES

Target Register		Command Byte Value		Power-On Default
Label	**Description**	**Read**	**Write**	
TEMP	Remote temperature result	01_h	N/A	00_h (0°C)
CONFIG	Configuration	03_h	03_h	80_h
MFG_ID	Manufacturer identification	FE_h	N/A	$2A_h$
DEV_ID	Device and revision identification	FF_h	N/A	$0x_h$ (Note 1)

Note 1: The lower nibble contains the die revision level (e.g., Rev. 0 = 00h).

4.2 Client Address

The MIC281 will only respond to its own unique client address. A match between the MIC281's address and the address specified in the serial bit stream must be made to initiate communication. The MIC281's client address is fixed at the time of manufacture. Eight different client addresses are available as determined by the part number. See Table 4-2 and the Product Identification System.

TABLE 4-2: MIC281 CLIENT ADDRESSES

Part Number	Client Address
MIC281-0YM6	$1001\ 000_b = 90_h$
MIC281-1YM6	$1001\ 001_b = 92_h$
MIC281-2YM6	$1001\ 010_b = 94_h$
MIC281-3YM6	$1001\ 011_b = 96_h$
MIC281-4YM6	$1001\ 100_b = 98_h$
MIC281-5YM6	$1001\ 101_b = 9A_h$
MIC281-6YM6	$1001\ 110_b = 9C_h$
MIC281-7YM6	$1001\ 111_b = 9E_h$

4.3 Temperature Data Format

The least-significant bit of the temperature register represents one degree Centigrade. The values are in a two's complement format, wherein the most significant bit (D7) represents the sign: zero for positive temperatures and one for negative temperatures. Table 4-3 shows examples of the data format used by the MIC281 for temperatures.

TABLE 4-3: DIGITAL TEMPERATURE FORMAT

Temperature	Binary	Hex
+127°C	0111 1111	7F
+125°C	0111 1101	7D
+25°C	0001 1001	19
+1°C	0000 0001	01
0°C	0000 0000	00
–1°C	1111 1111	FF
–25°C	1110 0111	E7
–125°C	1000 0011	83
–128°C	1000 0000	80

4.4 Diode Faults

The MIC281 is designed to respond in a failsafe manner to diode faults. If an internal or external fault occurs in the temperature sensing circuitry, such as T1 being open or shorted to VDD or GND, the temperature result will be reported as the maximum full-scale value of +127°C. Note that diode faults will not be detected until the first A/D conversion cycle is completed following power-up or exiting shutdown mode.

4.5 Shutdown Mode

Setting the shutdown bit in the configuration register will cause the MIC281 to cease operation. The A/D converter will stop and power consumption will drop to the I_{SHDN} level. No registers will be affected by entering shutdown mode. The last temperature reading will persist in the TEMP register.

4.6 Detailed Register Descriptions

4.6.1 REMOTE TEMPERATURE RESET (TEMP) 8-BITS, READ ONLY

TABLE 4-4: REMOTE TEMPERATURE RESET

Local Temperature Result Register							
D[7] read-only	D[6] read-only	D[5] read-only	D[4] read-only	D[3] read-only	D[2] read-only	D[1] read-only	D[0] read-only
Temperature data from ADC.							
Bit		**Function**				**Operation**	
D[7:0]		Measured temperature data for the remote zone.				Read only.	

Power-up default value: 0000 0000_b = 00_h = (0°C) (Note 1)

Read command byte: 0000 0001_b = 01_h

Each LSB represents one degree centigrade. The values are in a twos complement binary format such that 0°C is reported as 0000 0000_b. See the Temperature Data Format section for more details.

Note 1: TEMP will contain measured temperature data after the completion of one conversion.

4.6.2 CONFIGURATION REGISTER (CONFIG) 8-BITS, READ/WRITE

TABLE 4-5: CONFIGURATION REGISTER

Configuration Register							
D[7] reserved	D[6] reserved	D[5] reserved	D[4] reserved	D[3] reserved	D[2] reserved	D[1] reserved	D[0] write-only
Reserved	Shutdown (SHDN)	Reserved					
Bit		**Function**			**Operation (Note 2)**		
D7		Reserved			Always writes as zero; reads undefined		
D6		Shutdown bit			0 = normal operation; 1 = shutdown		
D[5:0]		Reserved			Always writes as zero; reads undefined		

2: Any write to CONFIG will result in any A/D conversion in progress being aborted and the result discarded. The A/D will begin a new conversion sequence once the write operation is complete.

Power-up default value: x0xx $xxxx_b$ (not in shutdown mode)

Command byte: 0000 0011_b = 03_h

4.6.3 MANUFACTURER ID REGISTER (MFG_ID) 8-BITS, READ ONLY

TABLE 4-6: MANUFACTURER ID REGISTER

Manufacturer ID Register							
D[7] read-only	D[6] read-only	D[5] read-only	D[4] read-only	D[3] read-only	D[2] read-only	D[1] read-only	D[0] read-only
0	0	1	0	1	0	1	0
Bit		**Function**				**Operation**	
D[7:0]		Identifies Microchip Technology Inc. as the manufacturer of the device.				Read only. Always returns $2A_h$	

Power-up default value: 0010 1010_b = $2A_h$

Read command byte: 1111 1110_b = FE_h

4.6.4 DIE REVISION REGISTER (DIE_REV) 8-BITS, READ ONLY

TABLE 4-7: DIE REVISION REGISTER

Die Revision Register							
D[7] read-only	D[6] read-only	D[5] read-only	D[4] read-only	D[3] read-only	D[2] read-only	D[1] read-only	D[0] read-only
MIC281 die revision number							
Bit		**Function**				**Operation**	
D[7:0]		Identifies the device revision number.				Read only.	

Power-up default value: $[\text{device revision number}]_h$

Read command byte: $1111\ 1111_b = FF_h$

5.0 APPLICATION INFORMATION

5.1 Remote Diode Section

Most small-signal PNP transistors with characteristics similar to the JEDEC 2N3906 will perform well as remote temperature sensors. Table 5-1 lists several examples of such parts that Microchip has tested for use with the MIC281. Other transistors equivalent to these should also work well.

TABLE 5-1: TRANSISTORS SUITABLE FOR USE AS REMOTE DIODES

Vendor	Part Number	Package
Fairchild Semiconductor	MMBT3906	SOT23
On Semiconductor	MMBT3906L	SOT23
Philips Semiconductor	SMBT3906	SOT23
Samsung Semiconductor	KST3906-TF	SOT23

5.2 Minimizing Errors

5.2.1 SELF-HEATING

One concern when using a part with the temperature accuracy and resolution of the MIC281 is to avoid errors induced by self-heating (V_{DD} × I_{DD}) + (V_{OL} × I_{OL}). In order to understand what level of error this might represent, and how to reduce that error, the dissipation in the MIC281 must be calculated and its effects reduced to a temperature offset. The worst-case operating condition for the MIC281 is when V_{DD} = 3.6V.The maximum power dissipated in the part is given in the following equation:

EQUATION 5-1:

$$P_D = (I_{DD} \times V_{DD}) + (I_{OL(DATA)} \times V_{OL(DATA)})$$

$$P_D = (0.4mA \times 3.6V) + (6mA \times 0.5V)$$

$$P_D = 4.44mW$$

The $R_{\theta JA}$ of the SOT23-6 package is 230°C/W, therefore the theoretical maximum self-heating is:

EQUATION 5-2:

$$4.44mW \times 230°C/W = 1.02°C$$

In most applications, the DATA pin will have a duty cycle of substantially below 25% in the low state. These considerations, combined with more typical device and application parameters, give a better system-level view of device self-heating. This is illustrated by the next equation. In any application, the best approach is to verify performance against calculation in the final application environment. This is especially true when dealing with systems for which some temperature data may be poorly defined or unobtainable except by empirical means.

EQUATION 5-3:

$$P_D = (I_{DD} \times V_{DD}) + (I_{OL(DATA)} \times V_{OL(DATA)})$$

$$P_D = (0.23mA \times 3.3V) + (25\% \times 1.5mA \times 0.15V)$$

$$P_D = 0.815mW$$

The $R_{\theta JA}$ of the SOT23-6 package is 230°C/W, therefore the typical self-heating is:

EQUATION 5-4:

$$0.815mW \times 230°C/W = 0.188°C$$

5.2.2 SERIES RESISTANCE

The operation of the MIC281 depends upon sensing the V_{CB-E} of a diode-connected PNP transistor (diode) at two different current levels. For remote temperature measurements, this is done using an external diode connected between T1 and ground. Because this technique relies upon measuring the relatively small voltage difference resulting from two levels of current through the external diode, any resistance in series with the external diode will cause an error in the temperature reading from the MIC281. A good rule of thumb is that for each ohm in series with the external transistor, there will be a 0.9°C error in the MIC281's temperature measurement. It is not difficult to keep the series resistance well below an ohm (typically <0.1Ω), so this will rarely be an issue.

5.3 Filter Capacitor Selection

It is usually desirable to employ a filter capacitor between the T1 and GND pins of the MIC281. The use of this capacitor is recommended in environments with a lot of high frequency noise (such as digital switching noise), or if long traces or wires are used to connect to the remote diode. The recommended total capacitance from the T1 pin to GND is 2200 pF. If the remote diode is to be at a distance of more than six-to-twelve inches from the MIC281, using twisted pair wiring or shielded microphone cable for the connections to the diode can significantly reduce noise pickup. If using a long run of shielded cable, remember to subtract the cable's conductor-to-shield capacitance from the 2200 pF total capacitance.

5.4 Layout Considerations

The following guidelines should be kept in mind when designing and laying out circuits using the MIC281.

1. Place the MIC281 as close to the remote diode as possible, while taking care to avoid severe noise sources such as high frequency power transformers, CRTs, memory and data busses, and the like.
2. Because any conductance from the various voltages on the PC board and the T1 line can induce serious errors, it is good practice to guard the remote diode's emitter trace with a pair of ground traces. These ground traces should be returned to the MIC281's own ground pin. They should not be grounded at any other part of their run. However, it is highly desirable to use these guard traces to carry the diode's own ground return back to the ground pin of the MIC281, thereby providing a Kelvin connection for the base of the diode. See Figure 5-1.
3. When using the MIC281 to sense the temperature of a processor or other device which has an integral thermal diode, e.g., Intel's Pentium III, connect the emitter and base of the remote sensor to the MIC281 using the guard traces and Kelvin return shown in Figure 5-1. The collector of the remote diode is typically inaccessible to the user on these devices.
4. Due to the small currents involved in the measurement of the remote diode's ΔV_{BE}, it is important to adequately clean the PC board after soldering to prevent current leakage. This is most likely to show up as an issue in situations where water-soluble soldering fluxes are used.
5. In general, wider traces for the ground and T1 lines will help reduce susceptibility to radiated noise (wider traces are less inductive). Use trace widths and spacing of 10 mm wherever possible and provide a ground plane under the MIC281 and under the connections from the MIC281 to the remote diode. This will help guard against stray noise pickup.
6. Always place a good quality power supply bypass capacitor directly adjacent to, or underneath, the MIC281. This should be a 0.1 µF ceramic capacitor. Surface-mount parts provide the best bypassing because of their low inductance.

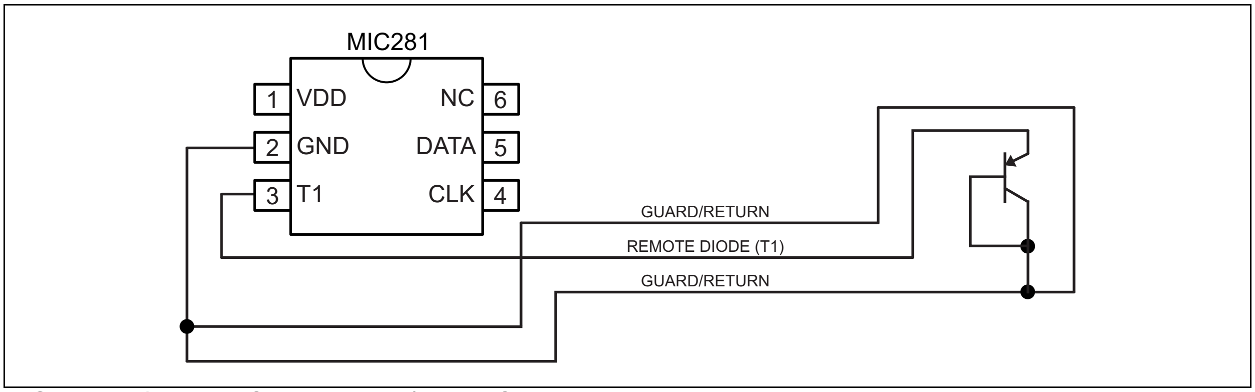
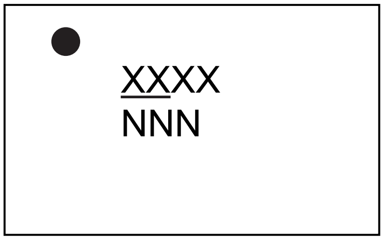


FIGURE 5-1: *Guard Traces/Kelvin Ground Returns.*

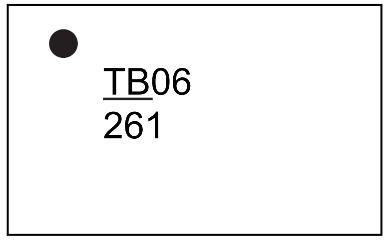
6.0 PACKAGING INFORMATION

6.1 Package Marking Information

6-Pin SOT23*



Example



Part Number	Marking
MIC281-0YM6-TR	TB00
MIC281-1YM6-TR	TB01
MIC281-2YM6-TR	TB02
MIC281-3YM6-TR	TB03
MIC281-4YM6-TR	TB04
MIC281-5YM6-TR	TB05
MIC281-6YM6-TR	TB06
MIC281-7YM6-TR	TB07

Legend:

XX...X	Product code or customer-specific information
Y	Year code (last digit of calendar year)
YY	Year code (last 2 digits of calendar year)
WW	Week code (week of January 1 is week ‘01’)
NNN	Alphanumeric traceability code
(e3)	Pb-free JEDEC® designator for Matte Tin (Sn)
*	This package is Pb-free. The Pb-free JEDEC designator ((e3)) can be found on the outer packaging for this package.

●, ▲, ▼ Pin one index is identified by a dot, delta up, or delta down (triangle mark).

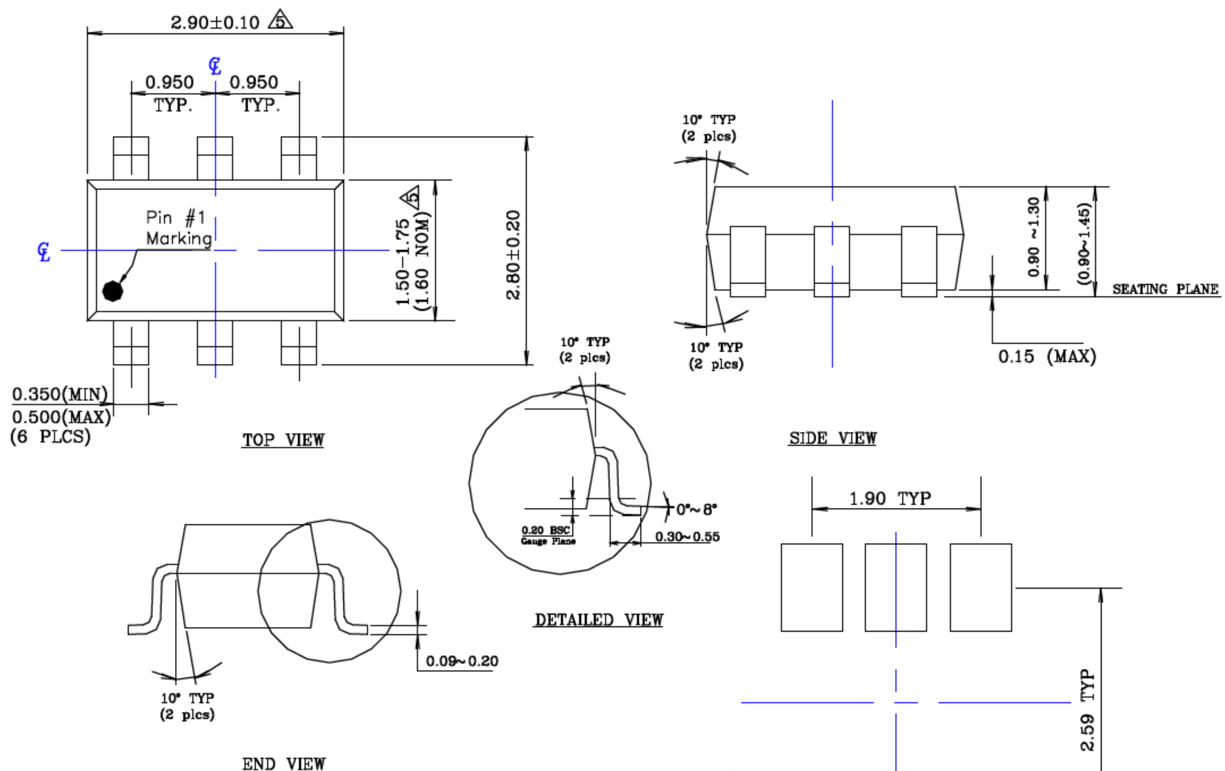
Note: In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for customer-specific information. Package may or may not include the corporate logo.

Underbar (_) and/or Overbar (‾) symbol may not be to scale.

6-Lead SOT23 Package Outline and Recommended Land Pattern

TITLE
6 LEAD SOT23 PACKAGE OUTLINE & RECOMMENDED LAND PATTERN

DRAWING #	SOT23-6LD-PL-1	**UNIT**	MM



NOTE:

1. Dimensions and tolerances are as per ANSI Y14.5M, 1982.
2. Package surface to be mirror finish.
3. Die is facing up for mold. Die is facing down for trim/form, ie. reverse trim/form.
4. The footlength measuring is based on the gauge plane method.
5. (△) Dimension are exclusive of mold flash & gate burr.

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging.

NOTES:

APPENDIX A: REVISION HISTORY

Revision A (December 2020)

- Converted Micrel data sheet MIC281 to Microchip data sheet DS20006468A.
- Minor grammatical corrections throughout.

NOTES:

PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, contact your local Microchip representative or sales office.

PART NO.	-X	X	XX	-XX
Device	Client Address	Ambient Temp. Range	Package	Media Type

Device:	MIC281:		Low-Cost Thermal Sensor
Client Address:	0	=	1001 $000x_b$
	1	=	1001 $001x_b$
	2	=	1001 $010x_b$
	3	=	1001 $011x_b$
	4	=	1001 $100x_b$
	5	=	1001 $101x_b$
	6	=	1001 $110x_b$
	7	=	1001 $111x_b$
Ambient Temperature Range:	Y	=	–55°C to +125°C
Package:	M6	=	6-Lead SOT23
Media Type	TR	=	3,000/Reel

Examples:

a) MIC281-0YM6-TR: Low-Cost Thermal Sensor, 1001 $000x_b$ Client Address, –55°C to +125°C Ambient Temperature Range, 6-Lead SOT23, 3,000/Reel

b) MIC281-2YM6-TR: Low-Cost Thermal Sensor, 1001 $001x_b$ Client Address, –55°C to +125°C Ambient Temperature Range, 6-Lead SOT23, 3,000/Reel

c) MIC281-5YM6-TR: Low-Cost Thermal Sensor, 1001 $101x_b$ Client Address, –55°C to +125°C Ambient Temperature Range, 6-Lead SOT23, 3,000/Reel

d) MIC281-7YM6-TR: Low-Cost Thermal Sensor, 1001 $111x_b$ Client Address, –55°C to +125°C Ambient Temperature Range, 6-Lead SOT23, 3,000/Reel

Note 1: Tape and Reel identifier only appears in the catalog part number description. This identifier is used for ordering purposes and is not printed on the device package. Check with your Microchip Sales Office for package availability with the Tape and Reel option.

NOTES:

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