5.1. Issuing a Measurement Command

The measurement commands instruct the Si7057/8/9 to perform temperature measurements. The procedure to issue any one of these commands is identical. While the measurement is in progress, the option of either clock stretching (Hold Master Mode) or Not Acknowledging read requests (No Hold Master Mode) is available to indicate to the master that the measurement is in progress; the chosen command code determines which mode is used. A checksum byte is returned from the slave for use in checking for transmission errors. The checksum byte will follow the least significant measurement byte. The checksum byte is calculated using a CRC generator polynomial of $x^8 + x^5 + x^4 + 1$, with an initialization of 0xFC.

Table 10. I²C Bit Descriptions

Name	Symbol	Description
START	S	SDA goes low while SCL high.
STOP	P	SDA goes high while SCL high.
Repeated START	Sr	SDA goes low while SCL high. It is allowable to generate a STOP before the repeated start. SDA can transition to high before or after SCL goes high in preparation for generating the START.
READ	R	Read bit = 1
WRITE	W	Write bit = 0
All other bits	—	SDA value must remain high or low during the entire time SCL is high (this is the set up and hold time in Figure 1).

In the I²C sequence diagrams in the following sections, bits produced by the master and slave are color coded as shown:

Sequence to Perform a Measurement and Read Back Result (Hold Mode)

S	Slave Address	W	A	Command Byte 1	A	Command Byte 2	A	Sr	Slave Address

R	A	Clock Stretch During Measurement	Temp MSB	A	Temp LSB	A	Checksum*	NA	P

***Note:** Reading the checksum is optional. If the checksum is not needed, then NA and STOP after the Temp LSB.

Sequence to Perform a Measurement and Read Back Result (No Hold Mode)

S	Slave Address	W	A	Command Byte 1	A	Command Byte 2	A	Sr	Slave Address

R	NA[1]	Sr	Slave Address	R	A	Temp MSB	A	Temp LSB	A	Checksum[2]	NA	P

Notes:

1. Device will NACK the slave address byte until conversion is complete.
2. Reading the checksum is optional. If the checksum is not needed then NA and STOP after the Temp LSB.

The Si7057/8/9 devices are software-compatible with Si7034 relative humidity and temperature sensor. If an ACK is sent to the Si7057/8/9 after the temp checksum, two more data bytes can be read from the Si7057/8/9 along with a second checksum value. The data contained within these two data bytes is undefined, but the 2nd checksum value will be correct for the data that is contained within the two additional data bytes.

5.2. Measuring Temperature

The results of the temperature measurement may be converted to temperature in degrees Celsius (°C) using the following expression:

$$T = -45 + 175 \times \frac{Temp\_Code}{2^{16}}$$

Where:

Temperature (°C) is the measured temperature value in °C

Temp_Code is the 16-bit word returned by the Si7057/8/9

5.3. Firmware Revision

The internal firmware revision can be read with the following I^2C transaction:

S	Slave Address	W	A	0x84	A	0xF1	A	Sr	Slave Address

R	A	FWREV	A	NA	P

The values in this field are encoded as follows: 0x10 = Firmware version 1.0

5.4. Electronic Serial Number

The Si7057/8/9 provides a serial number individualized for each device that can be read via the I^2C serial interface.

Two I^2C commands are required to access the device memory and retrieve the complete serial number. The command sequence, and format of the serial number response is described in the figure below:

Master	Slave

First access:

S	Slave Address	W	ACK	0xFA	ACK	0X0F	ACK	
S	Slave Address	R	ACK					
	SNA_3	ACK	CRC	ACK	SNA_2	ACK	CRC	ACK
	SNA_1	ACK	CRC	ACK	SNA_0	ACK	CRC	NACK	P

2nd Access:

S	Slave Address	W	ACK	0xFC	ACK	0XC9	ACK
S	Slave Address	R	ACK				
	SNB_3	ACK	SNB_2	ACK	CRC	ACK	
	SNB_1	ACK	SNB_0	ACK	CRC	NACK	P

The format of the complete serial number is 64-bits in length, divided into 8 data bytes. The complete serial number sequence is shown below:

SNA_3	SNA_2	SNA_1	SNA_0	SNB_3	SNB_2	SNB_1	SNB_0

The SNB3 field contains the device identification to distinguish between the different Silicon Labs temperature devices. The value of this field maps to the following devices according to this table:

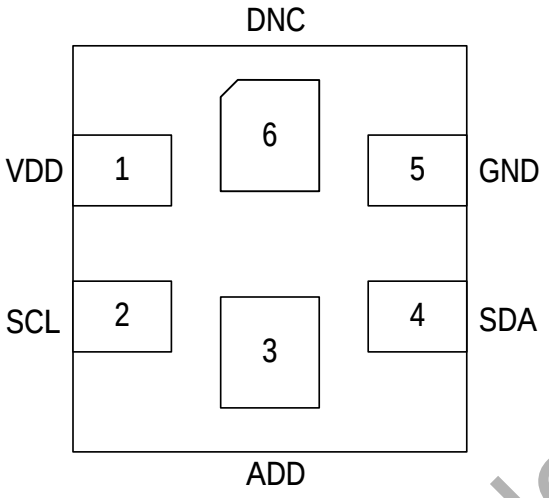
0x00 or 0xFF engineering samples

0x39 = Si7057

0x40 = Si7058

0x41 = Si7059

6. Pin Descriptions: Si7057/8/9 (Top View)



Pin Name	Pin #	Pin Description
VDD	1	Power. This pin is connected to the power supply on the circuit board.
SCL	2	I^2C clock
ADD	3	Tie this pin low for I^2C address 0x71, or tie this pin high for address 0x72.
SDA	4	I^2C data
GND	5	Ground. This pin is connected to ground on the circuit board.
DNC	6	Leave unconnected, or tie to VDD.

7. Ordering Guide

Table 11. Device Ordering Guide

Part Number	Description	Max. Accuracy	Pkg	Packing Format
Si7057-A10-IM	Digital temperature sensor	±0.35 °C	QFN 6	Cut Tape
Si7057-A10-IMR	Digital temperature sensor	±0.35 °C	QFN 6	Tape and Reel
Si7058-A10-IM	Digital temperature sensor	±0.5 °C	QFN 6	Cut Tape
Si7058-A10-IMR	Digital temperature sensor	±0.5 °C	QFN 6	Tape and Reel
Si7059-A10-IM	Digital temperature sensor	±1.0 °C	QFN 6	Cut Tape
Si7059-A10-IMR	Digital temperature sensor	±1.0 °C	QFN 6	Tape and Reel

8. Package Outline

8.1. Package Outline: 2x2 6-pin QFN

Figure 6 illustrates the package details for the Si7057/8/9.

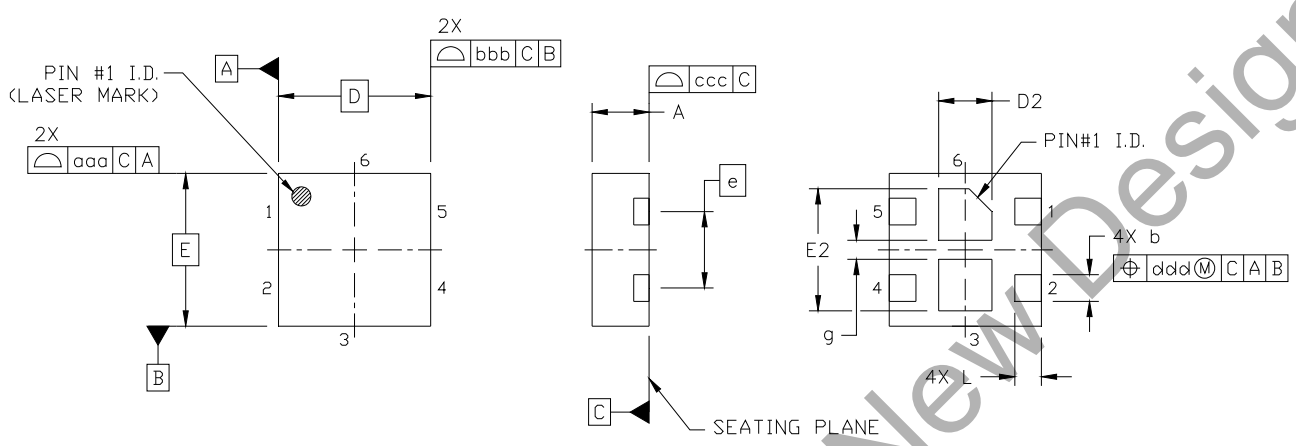


Figure 6. Si7057/8/9 Package Drawing

Table 12. Package Dimensions

Dimension	Min	Nom	Max
A	0.70	0.75	0.80
b	0.30	0.35	0.40
D	2.00 BSC		
E	2.00 BSC		
e	1.00 BSC		
D2	0.60	0.70	0.80
E2	1.50	1.60	1.70
g	0.20	0.25	0.30
L	0.30	0.35	0.40
aaa	0.10		
bbb	0.10		
ccc	0.08		
ddd	0.10		

Notes:
1. All dimensions shown are in millimeters (mm).
2. Dimensioning and Tolerancing per ANSI Y14.5M-1994.

9. PCB Land Pattern and Solder Mask Design

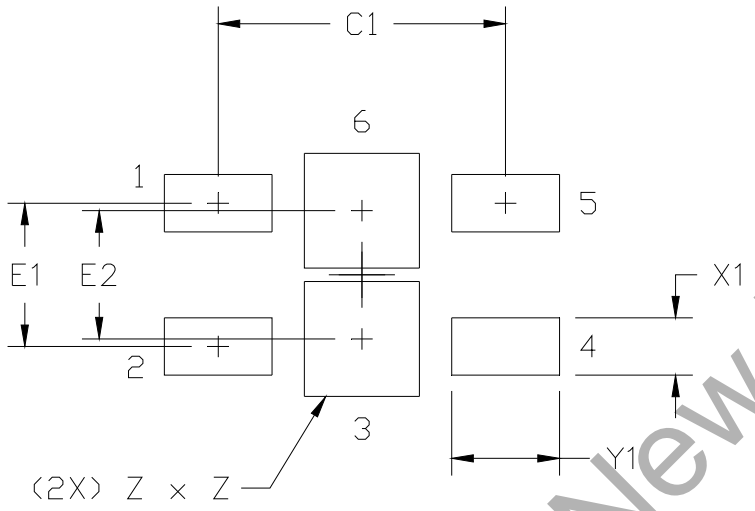


Figure 7. PCB Land Pattern Dimensions

Table 13. PCB Land Pattern Dimensions

Symbol	mm
C1	2.00
E1	1.00
E2	0.90
X1	0.40
Y1	0.75
Z	0.80

Notes:

General

1. All dimensions shown are in millimeters (mm).
2. This Land Pattern Design is based on the IPC-7351 guidelines.
3. All dimensions shown are at Maximum Material Condition (MMC). Least Material Condition (LMC) is calculated based on a Fabrication Allowance of 0.05 mm.

Solder Mask Design

4. All metal pads are to be non-solder mask defined (NSMD). Clearance between the solder mask and the metal pad is to be 60 µm minimum, all the way around the pad.

Stencil Design

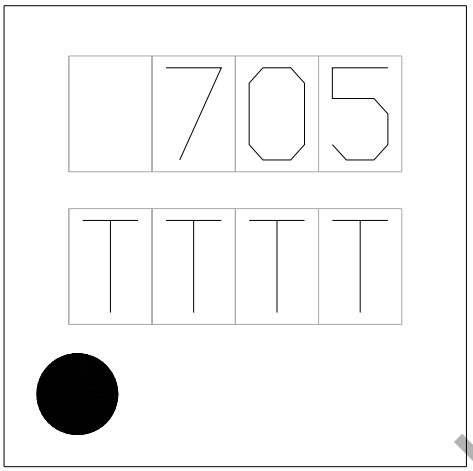
5. A stainless steel, laser-cut and electropolished stencil with trapezoidal walls should be used to assure good solder paste release.
6. The stencil thickness should be 0.125 mm (5 mils).
7. The ratio of stencil aperture to land pad size should be 1:1 for all pads.

Card Assembly

8. A No-Clean, Type-3 solder paste is recommended.
9. The recommended card reflow profile is per the JEDEC/IPC J-STD-020 specification for Small Body Components.

10. Top Marking

10.1. Si7057/8/9 Top Marking



10.2. Top Marking Explanation

Mark Method:	Laser
Font Size:	0.40 mm
Line 1 Marking:	705 = Device Code
Line 2 Marking:	TTTT = Manufacturing Trace Code Digits 1–4
Line 3 Marking:	Circle = 0.35 mm Diameter

11. Additional Reference Resources

- AN607: Si70xx Humidity and Temperature Sensor Designer’s Guide
- AN1026: Si70xx Temperature Sensor Designer's Guide

Document Change List

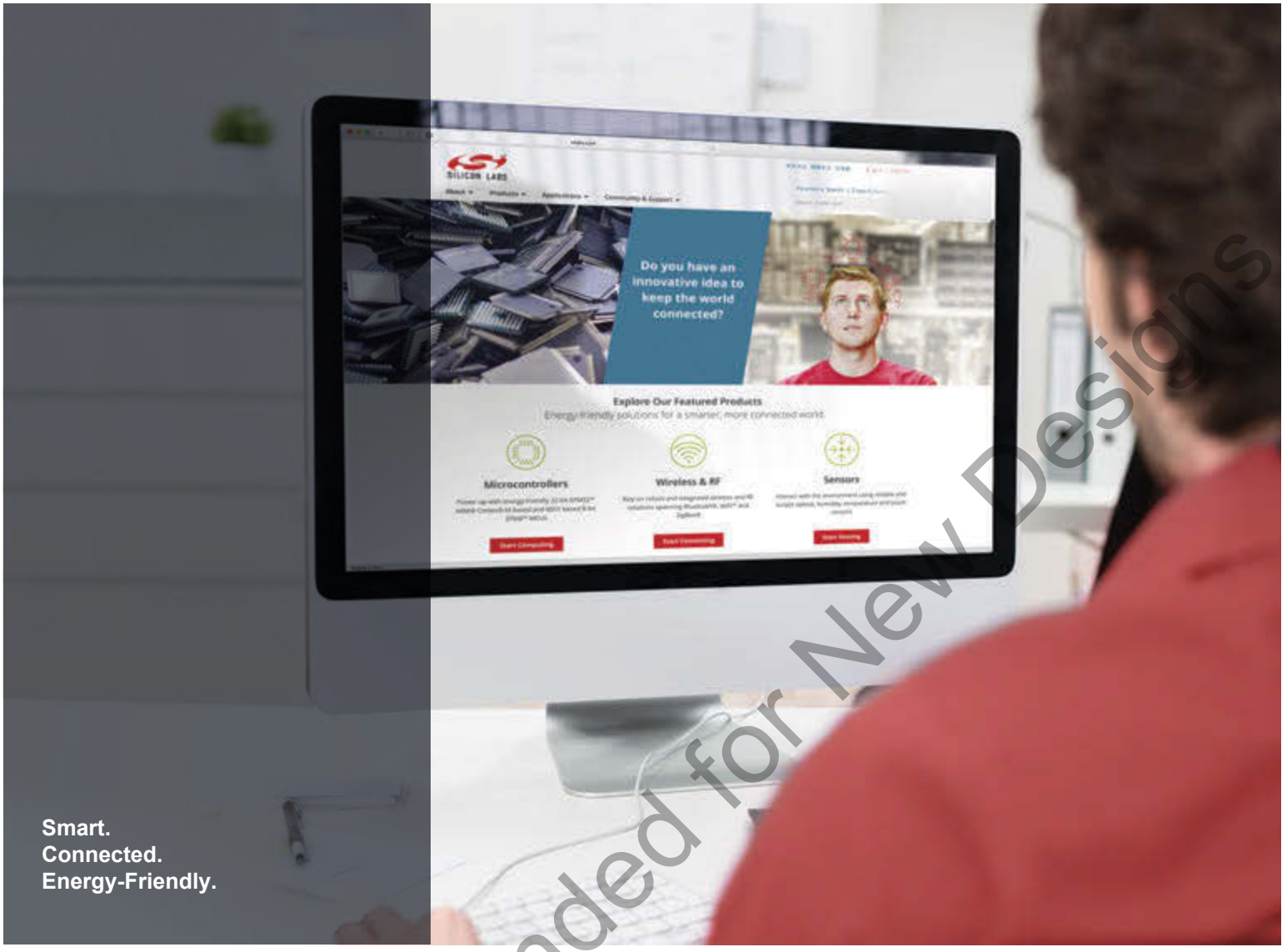
Revision 0.9 to Revision 1.0

- Clarified Features list on page 1.

Revision 1.0 to Revision 1.1

April 18, 2017

- Changed Si7057 max inaccuracy spec to 0.35 °C (was 0.2 °C).
- Updated Figure 2 and Figure 3.



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