Analog Temperature Sensor – SiS60A

Single-supply voltage-output temperature sensor in bare die form

Rev 1.0
04/04/20

Description

The SiS60A measures temperature over a wide -60°C to 125°C range. The device operates from a single supply and provides a linear voltage output with temperature coefficient of 6.25mV/°C. By design DC offset of +424 mV permits measurement of negative temperature without need for negative supply. Nominal output range is within 49mV (-60°C) and 1205mV (125°C). Output precision is calibrated on-die to ±2% max at 25°C and ±4% max over the full range. 2.7V operation & 125µA max consumption enable logic gate outputs to power this device, which combines intrinsic shutdown capability with simplified integration.

Features:

- Wide temperature range: -60 to +125°C
- Single-supply range: 2.7-10V
- ±1% typical accuracy at 25°C
- ±2% typical accuracy over -60 to +125°C range
- Low supply current: 125µA maximum
- Minimal self-heating: <= 0.1°C in still air
- ESD rated to 2kV HBM

Ordering Information

The following part suffixes apply:

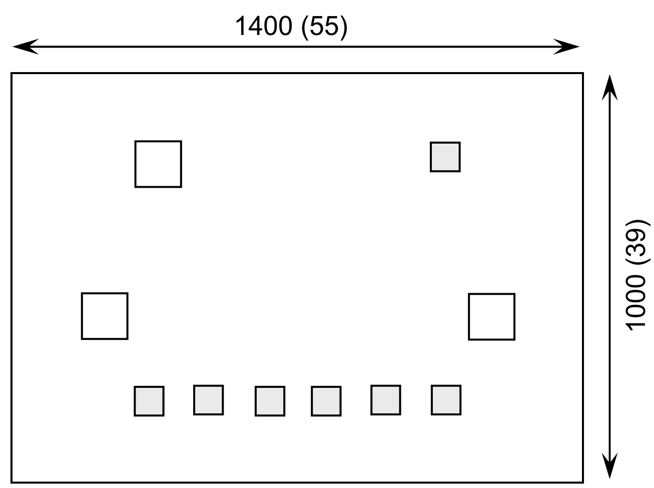
- No suffix - MIL-STD-883 /2010B Visual Inspection
- "**H**" - MIL-STD-883 /2010B Visual Inspection
  + MIL-PRF-38534 Class H LAT
- "**K**" - MIL-STD-883 /2010A Visual Inspection (Space)
  + MIL-PRF-38534 Class K LAT

LAT = Lot Acceptance Test.

For further information on LAT process flows see below.

www.siliconsupplies.com\quality\bare-die-lot-qualification

Die Dimensions in µm (mils)



Supply Formats:

- Default – Die in Waffle Pack (400 per tray capacity)
- Sawn Wafer on Tape – On request
- Unsawn Wafer – On request
- Die Thickness <> 350µm(14 Mils) – On request
- Assembled into Ceramic Package – On request

Mechanical Specification

Die Size (Unsawn)	1400 x 1000 55 x 39	µm mils
Minimum Bond Pad Size	112 x 112 4.4 x 4.4	µm mils
Die Thickness	350 (±20) 13.78 (±0.79)	µm mils
Top Metal Composition	Al 1%Si 1.1µm	
Back Metal Composition	N/A – Bare Si	

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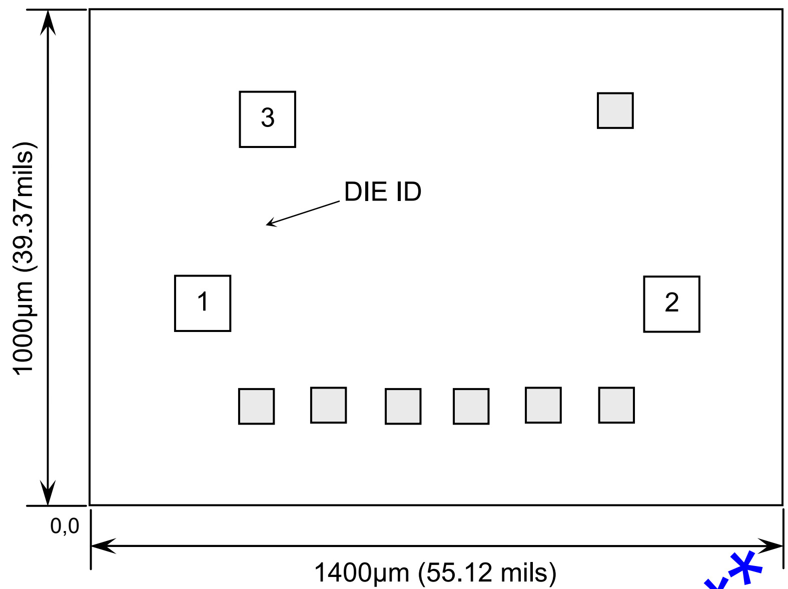
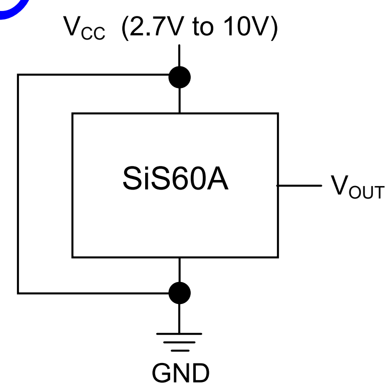
Pad Layout and Functions

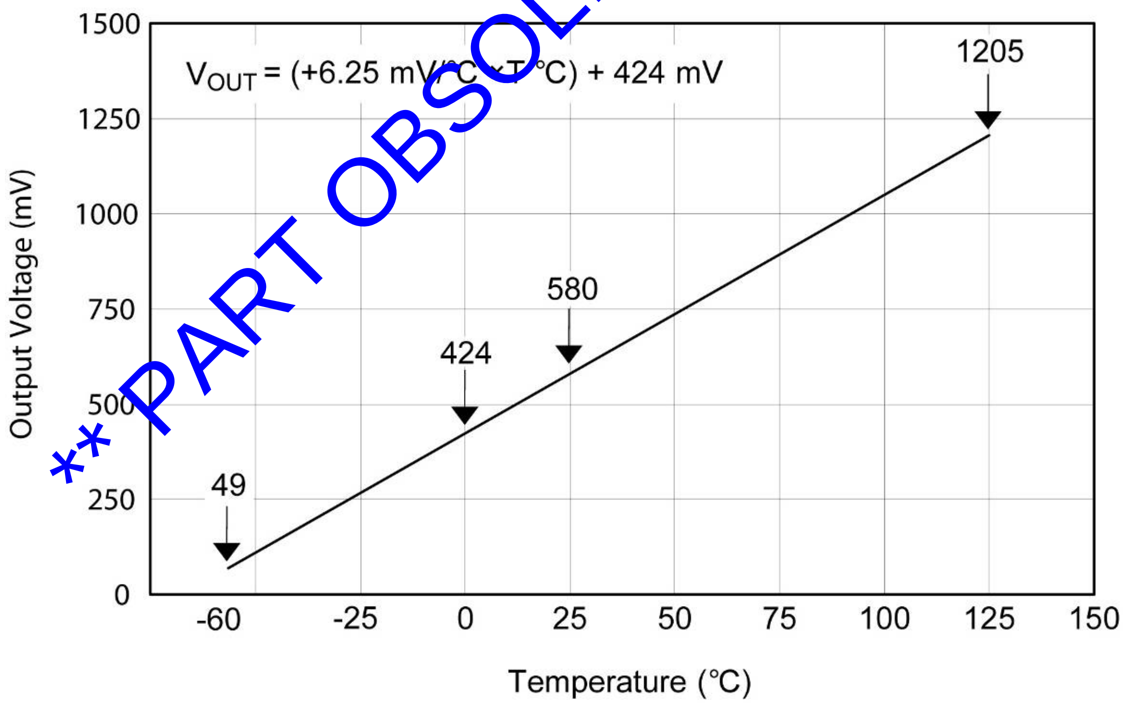


PAD	FUNCTION	COORDINATES (µm)	
		X	Y
1	V_{CC}	174.5	350
2	V_{OUT}	1124	350
3	GND	300	724
CONNECT CHIP BACK TO GND			

Simplified Schematic



Output Voltage versus Temperature



Absolute Maximum Ratings[1]

PARAMETER	SYMBOL	VALUE	UNIT
DC Supply Voltage Range	V_{CC}	-0.2 to +12	V
Output Voltage	V_{OUT}	-0.6 to V_{CC} +0.6	V
Load Current	I_{LOAD}	10	mA
Input Current (Any pin)	I_{IN}	5	mA
Storage Temperature	T_{STG}	-65 to +150	°C
Operating Junction Temperature	T_J	-60 to +125	°C
Thermal Resistance[2]	$R_{\theta JA}$	162	°C/W
Electrostatic Discharge (HBM)	V_{ESD}	2	kV

1. Operation above the absolute maximum rating may cause device failure. Operation at the absolute maximum ratings, for extended periods, may reduce device reliability. **2.** Die assembled in TO-92 package in still air.

Recommended Operating Conditions

PARAMETER	SYMBOL	MIN	MAX	UNITS
DC Supply Voltage	V_{CC}	2.7	10	V
Load Current	I_{LOAD}	-	1	µA
Operating Temperature	T_A	-60	+125	°C

DC Electrical Characteristics (V_{CC} =3V, I_{LOAD} = 1µA , T_J = T_A = 25°C unless otherwise specified)

PARAMETER	SYMBOL	CONDITIONS	LIMITS			UNITS
			MIN	TYP	MAX	
Accuracy	ΔT_1	$T_A = T_J$ = 25°C	-2	±1	+2	°C
		$T_A = T_J$ = Full Range	-4	±2	+4	
Output Voltage	V_{OUT}	0°C	-	424	-	mV
Non-linearity	-	-	-0.8	-	+0.8	°C
Sensor Gain		$T_A = T_J$ = Full Range	6.00	6.25	6.50	mV/°C
Output Impedance	R_{OUT}	$T_A = T_J$ = Full Range	-	-	800	Ω
Line Regulation	ΔV_{OUT}	3V ≤ +V_{CC} ≤ 10V, $T_A = T_J$ = Full Range	-0.3	-	0.3	mV/V
		2.7V ≤ +V_{CC} ≤ 3.3V, $T_A = T_J$ = Full Range	-3	-	3	mV
Quiescent Current	I_{CC}	2.7V ≤ +V_{CC} ≤ 10 V, $T_A = T_J$ = 25°C	-	82	110	µA
		2.7V ≤ +V_{CC} ≤ 10 V, $T_A = T_J$ = Full Range	-	-	125	
Quiescent Current Change	ΔI_{CC}	2.7V ≤ +V_{CC} ≤ 10 V	-	5	-	µA
Temperature coefficient of Quiescent current	-	-	-	0.2	-	µA/°C
Long-term stability	-	$T_J = T_{MAX}$ = 125°C for 1000 hours	-	±0.2	-	°C

Typical Characteristics (V_{CC} =3V, I_{LOAD} = 1μA , T_J = T_A = 25°C unless otherwise specified)

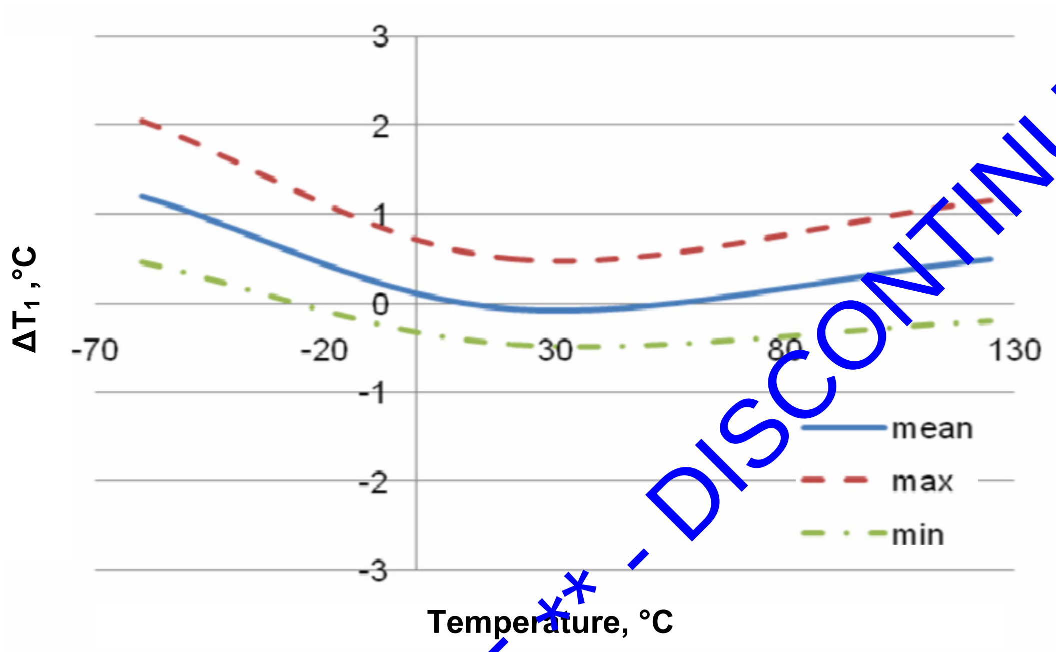
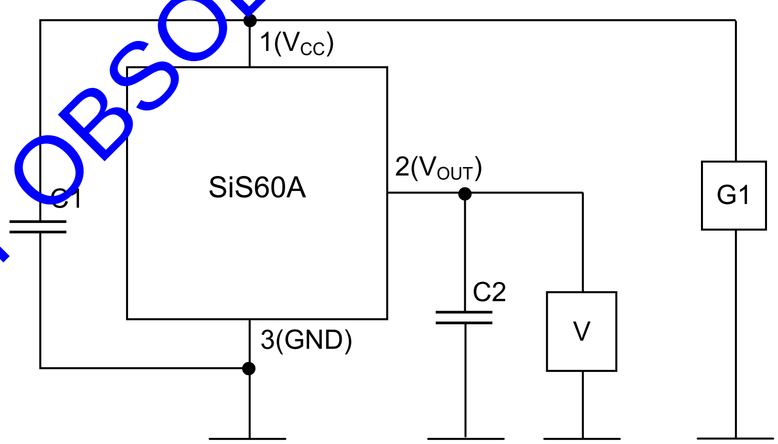


FIGURE 1. Temperature measurement accuracy

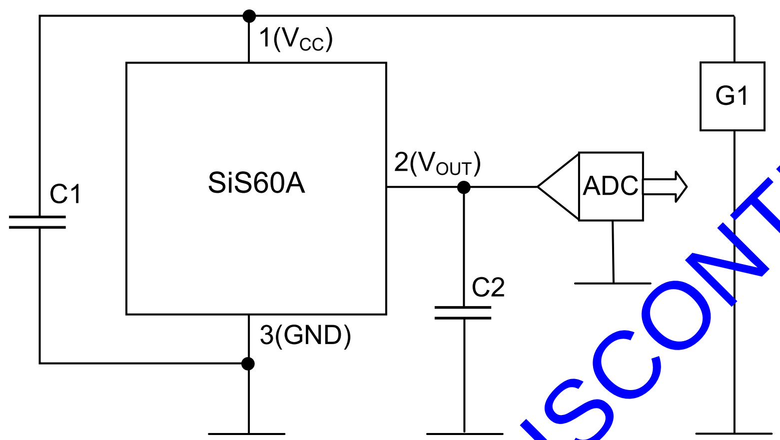
Typical Applications



C1 – 0.1μF ± 20% capacitor – Optional by-pass filter for noisy environments
C2 – 1μF ± 20% capacitor – Optional 199-Hz low-pass filter for noisy environments
G1 – DC supply 2.7V - 10V
V - Voltmeter

FIGURE 2. Output with noise reduction circuit

Typical Applications continued



C1 – 0.1µF ± 20% capacitor – Optional by-pass filter for noisy environments
C2 – 1µF ± 20% capacitor – Optional 199-Hz low-pass filter for noisy environments
G1 – DC supply 2.7V - 10V
ADC – Analog to Digital Converter

FIGURE 3. Output to ADC with noise reduction circuit

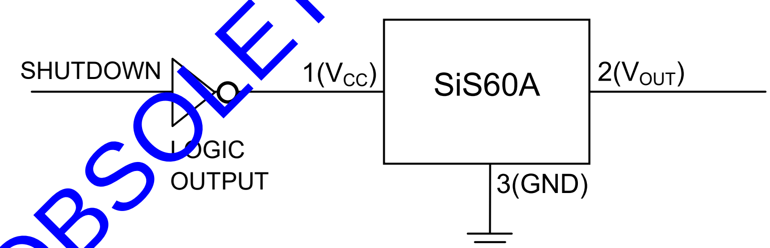


FIGURE 6. Logic device drive with intrinsic shutdown

Formulae

Linear Transfer Function

$V_{OUT} = (6.25mV/°C \times T°C) + 424mV$

Where:
- T = Temperature
- V_{OUT} = SiS60A output voltage.

Die Self-Heating Calculation

$T_J = T_A + R_{\theta JA} [(V_{CC}\ I_{CC}) + (V_{CC} - V_{OUT})\ I_{LOAD}]$

Where:
- I_{CC} = SiS60A quiescent current
- I_{LOAD} = The load current on the SiS60A output

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Block Diagram