



SGM451L

$\pm 1^{\circ}\text{C}$ Local and Remote Temperature Sensor with η -Factor, Offset Correction, Series-Resistance Cancellation, and Programmable Digital Filter

GENERAL DESCRIPTION

The SGM451L is a high-accuracy, low-power temperature sensor which integrates local and remote temperature channels. The remote sensor which is connected to the SGM451L is made by discrete transistors or diodes, which would be the integrated inside the MCU and FPGA. The SGM451L is a 12-bit device with a resolution of only 0.0625°C . This device can measure the temperature of the local and remote diode sensors with an accuracy of $\pm 0.25^{\circ}\text{C}$ (TYP).

Communication with the SGM451L is accomplished via the two-wire serial interface which is compatible with the SMBus communication protocol. Through this interface the SGM451L internal registers may be accessed.

There are many advantages of SGM451L, such as cancelling the series resistance, calibrating the offset, changing the cutoff frequency of the digital filter, changing the limitation of temperature and non-ideality factor with programming. The above factors are significant to improve the accuracy of the SGM451L.

The SGM451L is suitable for high precision temperature measurements in multiple locations in application system. The wide supply voltage range from 1.6V to 5.5V makes the SGM451L possible to use in a wide range of applications, including low power devices. The device operates over a wide temperature range of -40°C to $+125^{\circ}\text{C}$.

FEATURES

- **Temperature Accuracy**
 - Local Diode Sensor: $\pm 0.25^{\circ}\text{C}$ (TYP)
 - Remote Diode Sensor: $\pm 0.25^{\circ}\text{C}$ (TYP)
- **Local and Remote Channels Resolution: 0.0625°C**
- **Supply and Logic Voltage Range: 1.6V to 5.5V**
- **Support 1.8V I²C Bus Voltage at 3.3V Power Supply**
- **Operating Current: $4\mu\text{A}$ (TYP)**
- **Shutdown Current: $0.3\mu\text{A}$ (TYP)**
- **Cancelling the Series Resistor**
- **η -Factor**
- **Calibrating the Offset**
- **Programmable Digital Filter**
- **Diode Fault Detection**
- **Two-Wire and SMBus Serial Interface**
- **Available in a Green TDFN-2 \times 2-8BL Package**

APPLICATIONS

CPU, GPU, DSP and FPGA Computing System
Smart Phones and Computers
Servers and Desktops
Storage Area Networks (SANs)
Telecom Equipment

TYPICAL APPLICATION

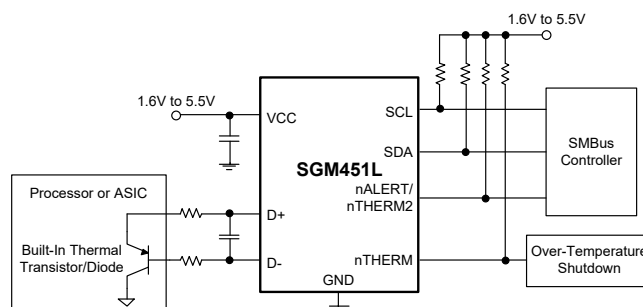


Figure 1. Typical Application Circuit

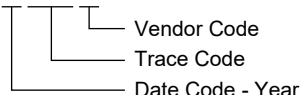
PACKAGE/ORDERING INFORMATION

| MODEL | PACKAGE DESCRIPTION | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE MARKING | PACKING OPTION |
|---------|---------------------|-----------------------------|------------------|-----------------|---------------------|
| SGM451L | TDFN-2×2-8BL | -40°C to +125°C | SGM451LXTEA8G/TR | 451L XXXX | Tape and Reel, 3000 |

MARKING INFORMATION

NOTE: XXXX = Date Code, Trace Code and Vendor Code.

XXXX



Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

ABSOLUTE MAXIMUM RATINGS

| | |
|---------------------------------------|--------------------------|
| Power Supply, V_{CC} | -0.3V to 6.5V |
| Input Voltage | |
| nTHERM, nALERT/nTHERM2, SDA and SCL | -0.3V to 6.5V |
| D+ Only | -0.3V to $V_{CC} + 0.3V$ |
| D- Only | -0.3V to 0.3V |
| Input Current | 10mA |
| Package Thermal Resistance | |
| TDFN-2×2-8BL, θ_{JA} | 129.9°C/W |
| TDFN-2×2-8BL, θ_{JB} | 54.2°C/W |
| TDFN-2×2-8BL, θ_{JC} | 73.7°C/W |
| Junction Temperature | +150°C |
| Storage Temperature Range | -65°C to +150°C |
| Lead Temperature (Soldering, 10s) | +260°C |
| ESD Susceptibility ^{(1) (2)} | |
| HBM | ±4000V |
| CDM | ±1000V |

NOTES:

- For human body model (HBM), all pins comply with ANSI/ESDA/JEDEC JS-001 specifications.
- For charged device model (CDM), all pins comply with ANSI/ESDA/JEDEC JS-002 specifications.

RECOMMENDED OPERATING CONDITIONS

| | |
|-----------------------------|-----------------|
| Supply Voltage Range | 1.6V to 5.5V |
| Operating Temperature Range | -40°C to +125°C |

OVERSTRESS CAUTION

Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

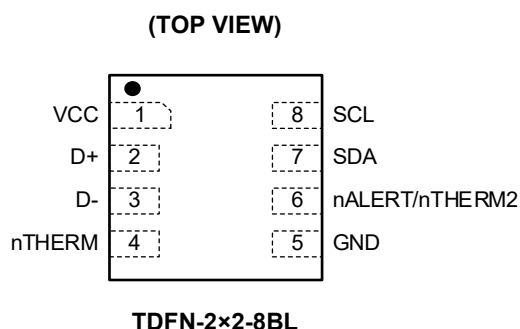
ESD SENSITIVITY CAUTION

This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because even small parametric changes could cause the device not to meet the published specifications.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

PIN CONFIGURATION



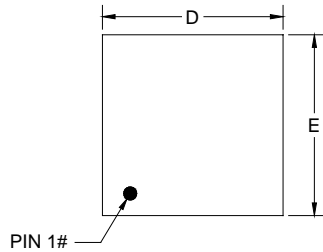
PIN DESCRIPTION

| PIN | NAME | TYPE | DESCRIPTION |
|-----|----------------|------|---|
| 1 | VCC | P | 1.6V to 5.5V Power Supply Pin. |
| 2 | D+ | AI | Positive Side Connected to Remote Temperature Sensor. |
| 3 | D- | AI | Negative Side Connected to Remote Temperature Sensor. |
| 4 | nTHERM | DO | Thermal Shutdown or Fan-Control Open-Drain Output Pin. An external pull-up resistor to voltage between 1.6V and 5.5V is required. |
| 5 | GND | G | Ground. |
| 6 | nALERT/nTHERM2 | DO | Interrupt or SMBus Alert Output Pin. It can be used as another nTHERM open-drain output. An external pull-up resistor to voltage between 1.6V and 5.5V is required. |
| 7 | SDA | I/O | Data Input/Output Pin. Open-drain. An external pull-up resistor to voltage between 1.6V and 5.5V is required. |
| 8 | SCL | DI | Clock Input Pin for SMBus. If it is driven by open-drain output, an external pull-up resistor to voltage between 1.6V and 5.5V is required. |

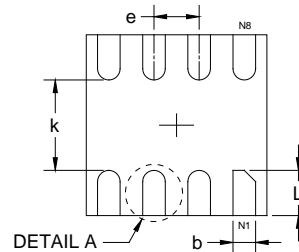
NOTE: AI = analog input, DI = digital input, DO = digital output, I/O = input/output, G = ground, P = power.

PACKAGE OUTLINE DIMENSIONS

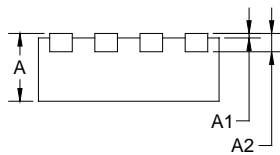
TDFN-2x2-8BL



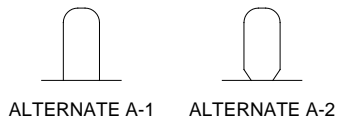
TOP VIEW



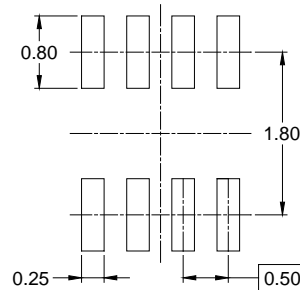
BOTTOM VIEW



SIDE VIEW



DETAIL A
ALTERNATE TERMINAL
CONSTRUCTION



RECOMMENDED LAND PATTERN (Unit: mm)

| Symbol | Dimensions In Millimeters | | |
|--------|---------------------------|-------|-------|
| | MIN | MOD | MAX |
| A | 0.700 | 0.750 | 0.800 |
| A1 | 0.000 | 0.020 | 0.050 |
| A2 | 0.203 REF | | |
| D | 2.000 BSC | | |
| E | 2.000 BSC | | |
| b | 0.200 | 0.250 | 0.300 |
| e | 0.500 BSC | | |
| L | 0.450 | 0.500 | 0.550 |
| k | 1.000 REF | | |

NOTE: This drawing is subject to change without notice.

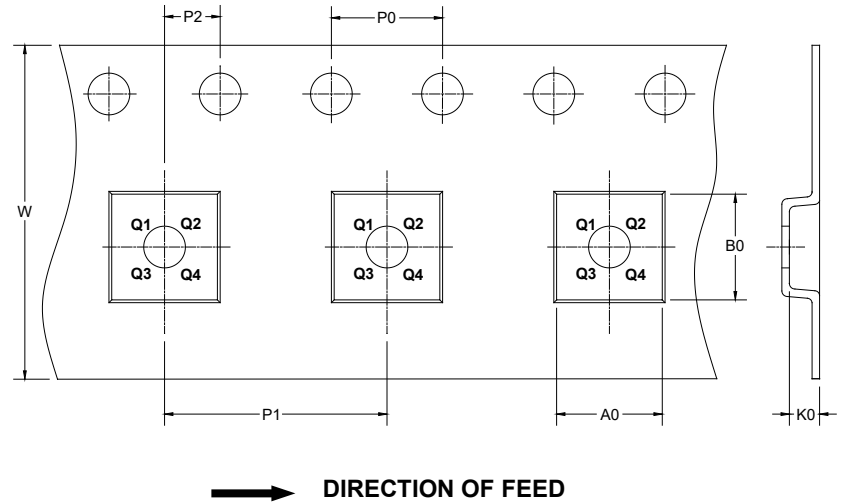
PACKAGE INFORMATION

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

| Package Type | Reel Diameter | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P0 (mm) | P1 (mm) | P2 (mm) | W (mm) | Pin1 Quadrant |
|--------------|---------------|--------------------|---------|---------|---------|---------|---------|---------|--------|---------------|
| TDFN-2×2-8BL | 7" | 9.5 | 2.30 | 2.30 | 1.10 | 4.0 | 4.0 | 2.0 | 8.0 | Q1 |

DD00001

PACKAGE INFORMATION

CARTON BOX DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF CARTON BOX

| Reel Type | Length (mm) | Width (mm) | Height (mm) | Pizza/Carton |
|-------------|-------------|------------|-------------|--------------|
| 7" (Option) | 368 | 227 | 224 | 8 |
| 7" | 442 | 410 | 224 | 18 |

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