Infrared Thermopile Sensor in Chip-Scale Package

Check for Samples: TMP006

FEATURES

- **Complete Solution in 1,6-mm × 1,6-mm Wafer Chip-Scale Package (WCSP) Device (DSBGA)**
- **Digital Output:**
  - **Sensor Voltage: 7 µV/°C**
  - **Local Temperature: –40°C to +125°C**
- **SMBus™-Compatible Interface**
- **Pin-Programable Interface Addressing**
- **Low Supply Current: 240 µA**
- **Low Minimum Supply Voltage: 2.2 V**

APPLICATIONS

- **Notebook Case Temperature**
- **Comfort Index Measurement**
- **Motor Case Temperature**
- **Server Farm Power Management**

DESCRIPTION

The TMP006 is the first in a series of temperature sensors that measure the temperature of an object without the need to make contact with the object. This sensor uses a thermopile to absorb the infrared energy emitted from the object being measured and uses the corresponding change in thermopile voltage to determine the object temperature.

Infrared sensor voltage range is specified from –40°C to +125°C to enable use in a wide range of applications. Low power consumption along with low operating voltage makes the device suitable for battery-powered applications. The low package height of the chip-scale format enables standard high-volume assembly methods, and can be useful where limited spacing to the object being measured is available.

Histogram
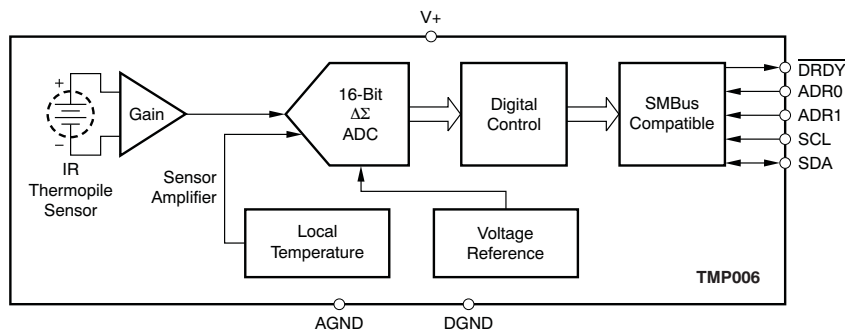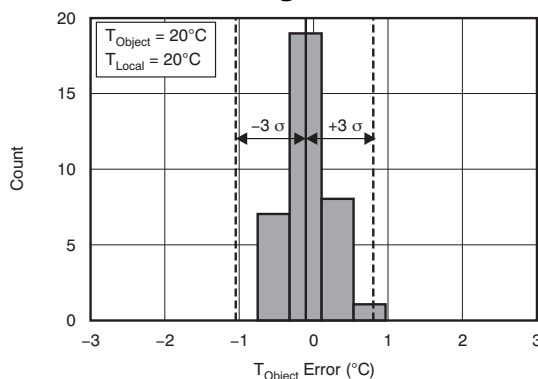
This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

PACKAGE INFORMATION[1]

PRODUCT	PACKAGE	DESCRIPTION	TWO-WIRE ADDRESS	PACKAGE DESIGNATOR
TMP006YZF	WCSP-8	1,6-mm × 1,6-mm WCSP	1000XXX	YZF

(1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or visit the device product folder at www.ti.com.

ABSOLUTE MAXIMUM RATINGS[1]

		TMP006		UNIT
		MIN	MAX	
Supply voltage	V+		7	V
Input voltage	ADR1 pins	−0.5	V_S + 0.5	V
Input voltage	SDA, SCL, $\overline{DRDY}$, ADR0 pins	−0.5	7	V
Input current			10	mA
Operating temperature range		−55	+125	°C
Storage temperature range		−65	+150	°C
Junction temperature ($T_{J\ max}$)			+150	°C
ESD rating:	Human body model (HBM)		2000	V
	Charged device model (CDM)		500	V
	Machine model (MM)		200	V

(1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not supported.

THERMAL INFORMATION

	THERMAL METRIC[1]	TMP006YZF	UNITS
		YZF	
		8 PINS	
θ_{JA}	Junction-to-ambient thermal resistance	123.8	°C/W
θ_{JCtop}	Junction-to-case (top) thermal resistance	69	
θ_{JB}	Junction-to-board thermal resistance	103	
ψ_{JT}	Junction-to-top characterization parameter	4.7	
ψ_{JB}	Junction-to-board characterization parameter	55	
θ_{JCbot}	Junction-to-case (bottom) thermal resistance	n/a	

(1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, SPRA953.

ELECTRICAL CHARACTERISTICS

At T_A = +25°C, V+ = 3.3 V, and conversion time = 1 sec, unless otherwise specified.

PARAMETER		TEST CONDITIONS	TMP006 MIN	TMP006 TYP	TMP006 MAX	UNIT
OUTPUT ERROR						
Ambient temperature sensor		T_A = 0°C to +60°C, V+ = 2.2 V to 5.5 V		±0.5	±1	°C
Ambient temperature sensor		T_A = −40°C to +125°C, V+ = 2.2 V to 5.5 V		±0.5	±1.5	°C
Power-supply rejection ratio	PSRR			0.1		°C/V
Sensor voltage		T_{Object} = +40°C to +60°C, T_A = 0°C to +60°C		7		µV/°C
Calculate object temperature[1]		T_A = +20°C to +60°C, $T_{Object} - T_A$ = −10°C to +30°C		±1	±3	°C
Field of view		50% responsivity		90		Degrees
TEMPERATURE MEASUREMENT						
Conversion time		CR2 = 0, CR1 = 0, CR0 = 0		0.25		Seconds
Conversion time		CR2 = 0, CR1 = 0, CR0 = 1		0.5		Seconds
Conversion time		CR2 = 0, CR1 = 1, CR0 = 0		1		Seconds
Conversion time		CR2 = 0, CR1 = 1, CR0 = 1		2		Seconds
Conversion time		CR2 = 1, CR1 = 0, CR0 = 0		4		Seconds
Resolution						
Local temperature sensor				0.03125		°C
Thermopile sensor resolution				156.25		nV
SMBus COMPATIBLE INTERFACE						
Logic input high voltage (SCL, SDA)	V_{IH}		2.1			V
Logic input low voltage (SCL, SDA)	V_{IL}				0.8	V
Hysteresis				100		mV
Output low voltage (SDA)	V_{OL}	I_{OUT} = 6 mA		0.15	0.4	V
Output low sink current (SDA)			6			mA
Logic input current		Forced to 0.4 V	−1		+1	µA
Input capacitance (SCL, SDA, A0, A1)				3		pF
Clock frequency			0.001		3.4	MHz
Interface timeout			25	30	35	ms
DIGITAL OUTPUTS						
Output low voltage ($\overline{DRDY}$ pin)	V_{OL}	I_{OUT} = 4 mA		0.15	0.4	V
High-level output leakage current	I_{OH}	V_{OUT} = V_{DD}		0.1	1	µA
Output low sink current ($\overline{DRDY}$)		Forced to 0.4 V	4			mA
POWER SUPPLY						
Power-on reset	V+	T = −40°C to +125°C		1.6		V
Specified voltage range	V+	T = −40°C to +125°C	2.2		5.5	V
Quiescent current	I_Q	Continuous conversion; see Table 9		240	325	µA
Quiescent current	I_Q	Serial bus inactive, shutdown mode		0.5	1.0	µA
Quiescent current	I_Q	Serial bus active, f_S = 400 kHz, shutdown mode		90		µA
TEMPERATURE RANGE						
Specified range			−40		+125	°C
Storage range			−65		+150	°C

(1) This parameter is tested in a fully-settled setup with no transients, in front of an ideal black body, with specified layout constraints, and after system calibration.

TMP006

PIN CONFIGURATION
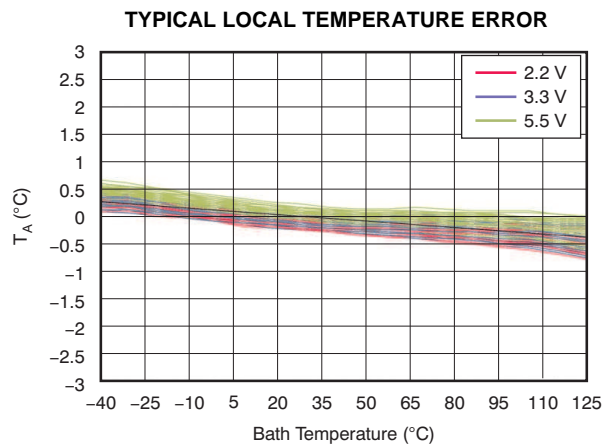
YZF PACKAGE
WCSP-8
(Top View, Not to Scale)
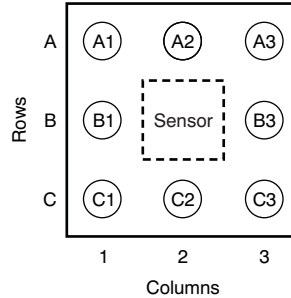
PIN DESCRIPTIONS

PIN	NAME	DESCRIPTION
A1	DGND	Digital ground
A2	AGND	Analog ground
A3	V+	Positive supply (2.2 V to 5.5 V)
B1	ADR1	Address select pin
B3	SCL	Serial clock line for SMBus, open-drain; requires a pull-up resistor to V+
C1	ADR0	Address select pin
C2	$\overline{\text{DRDY}}$	Data ready, active low, open-drain; requires a pull-up resistor to V+
C3	SDA	Serial data line for SMBus, open-drain; requires a pull-up resistor to V+

Product Folder Link(s): *TMP006*

TYPICAL CHARACTERISTICS

At T_A = +25°C and V_S = 3.3 V, unless otherwise noted.

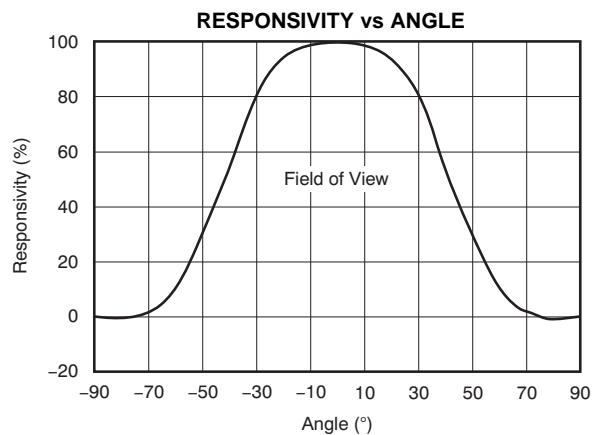**TYPICAL LOCAL TEMPERATURE ERROR**

Figure 1.

**TYPICAL OBJECT TEMPERATURE ERROR**

Figure 2.

RESPONSIVITY vs ANGLE
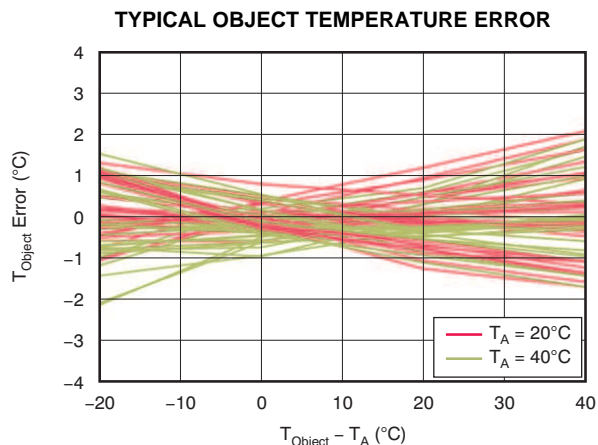
Figure 3.

OVERVIEW

The TMP006 is a digital temperature sensor that is optimal for thermal management and thermal protection applications where remote non-contact sensing is desired. The TMP006 is two-wire and SMBus interface compatible, and is specified over the ambient temperature range of −40°C to +125°C. The TMP006 measures object temperatures over a temperature range of −40°C to +125°C. The TMP006 contains registers for holding configuration information, temperature measurement results, and sensor voltage measurement. Ambient temperature and sensor voltage measurements are used to calculate the object temperature. Refer to the *TMP006 User Guide* (SBOU107) for more details.

The SCL and SDA interface pins require pull-up resistors (10 kΩ, typical) as part of the communication bus, while $\overline{DRDY}$ is an open-drain output that must also use a pull-up resistor. $\overline{DRDY}$ may be shared with other devices if desired for a wired-OR implementation. A 0.01-µF power-supply bypass capacitor is recommended, as shown in Figure 4.
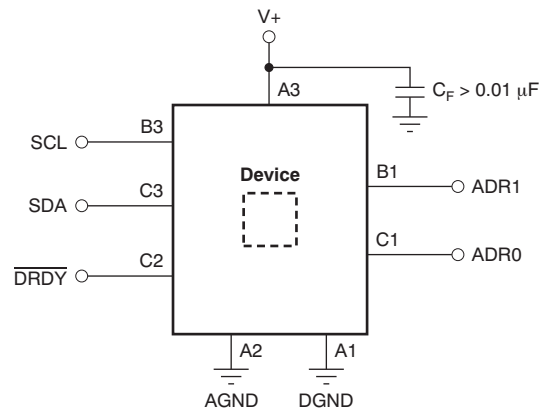
Figure 4. Typical Connection Diagram

The TMP006 provides both local temperature and thermopile sensor voltage outputs in a WCSP. The local temperature sensor in the TMP006 is integrated on-chip; the thermal path runs through the WCSP solder balls. The low thermal resistance of the solder balls provides the thermal path to maintain the chip at the temperature of the local environment.

The top side of the WCSP must face the object that is being measured with an unobstructed view in order to accurately measure the temperature. Refer to the user guide *TMP006 Layout and Assembly Guidelines* (SBOU108) for more details.

The TMP006 initially starts up with typical settings consisting of a conversion rate of 1 conversion per second (as specified in the Electrical Characteristics). The internal structure of the digital interface is shown in Figure 5.
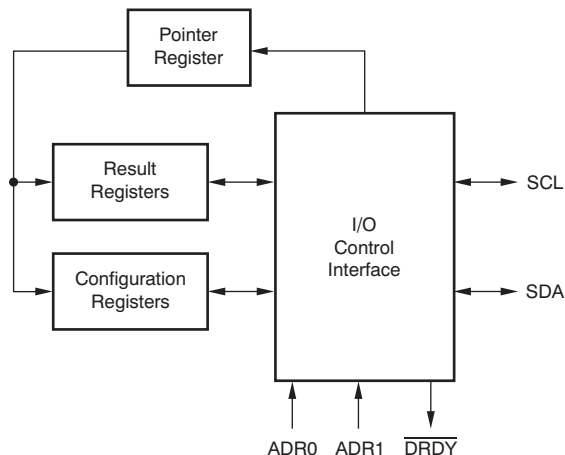
Figure 5. Internal Structure

SERIAL BUS ADDRESS

To communicate with the TMP006, the master must first address slave devices via a slave address byte. The slave address byte consists of seven address bits and a direction bit that indicates the intent to execute a read or write operation.

The TMP006 features two address pins to allow up to eight devices to be addressed on a single bus. Table 1 describes the pin logic levels used to properly connect up to eight devices. The state of the ADR0 and ADR1 pins is sampled on every bus communication and should be set before any activity on the interface occurs. The address pin is read at the start of each communication event.

Table 1. TMP006 Address Pins and Slave Addresses

ADR1	ADR0	SMBus Address
0	0	1000000
0	1	1000001
0	SDA	1000010
0	SCL	1000011
1	0	1000100
1	1	1000101
1	SDA	1000110
1	SCL	1000111

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INTERNAL REGISTERS

The TMP006 contains data registers that hold configuration information, temperature measurement results, and status information.

Table 2. Register Map[1]

POINTER (HEX)	REGISTER	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
00h	V_{OBJECT}	**V15**	**V14**	**V13**	**V12**	**V11**	**V10**	**V9**	**V8**	**V7**	**V6**	**V5**	**V4**	**V3**	**V2**	**V1**	**V0**
01h	$T_{AMBIENT}$	**T13**	**T12**	**T11**	**T10**	**T9**	**T8**	**T7**	**T6**	**T5**	**T4**	**T3**	**T2**	**T1**	**T0**	**0**	**0**
02h	Configuration	RST	MOD3	MOD2	MOD1	CR3	CR2	CR1	EN	$\overline{DRDY}$	0	0	0	0	0	0	0
FEh	Manufacturer ID	**ID15**	**ID14**	**ID13**	**ID12**	**ID11**	**ID10**	**ID9**	**ID8**	**ID7**	**ID6**	**ID5**	**ID4**	**ID3**	**ID2**	**ID1**	**ID0**
FFh	Device ID	**ID15**	**ID14**	**ID13**	**ID12**	**ID11**	**ID10**	**ID9**	**ID8**	**ID7**	**ID6**	**ID5**	**ID4**	**ID3**	**ID2**	**ID1**	**ID0**

(1)   Registers in **bold** are read-only.

POINTER REGISTER

The TMP006 has an 8-bit pointer used to address a given data register, as shown in Table 3. The pointer identifies which of the data registers should respond to a read or write command on the two-wire bus. This register is set with every write command. A write command must be issued to set the proper value in the pointer before executing a read command. The power-on reset (POR) value of the pointer is 00h; this value selects the thermopile sensor voltage, V_{OBJECT}.

Table 3. Pointer Register (Write-Only)

Register	P7	P6	P5	P4	P3	P2	P1	P0
Reset value	0	0	0	0	0	0	0	0

SENSOR VOLTAGE REGISTER (V_{OBJECT})

The Sensor Voltage Register is a 16-bit result register in binary twos complement format. One least significant bit (LSB) is 156.25 nV. The full-scale value is a ±5.12 mV signal. Data from this register (Table 4) are used in conjunction with data from the Temperature Register to calculate the object temperature. Table 4 summarizes the Sensor Voltage Register. The equation for the resultant object temperature is discussed in the *TMP006 User Guide* (SBOU107).

Table 4. Sensor Voltage Register (Read-Only)

| POINTER (HEX)	REGISTER	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
00h	V_{OBJECT}	V15	V14	V13	V12	V11	V10	V9	V8	V7	V6	V5	V4	V3	V2	V1	V0
	Reset value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Product Folder Link(s): *TMP006*

SENSOR VOLTAGE FORMAT

The TMP006 provides 16 bits of data in binary twos complement format. The positive full-scale input produces an output code of 7FFFh and the negative full-scale input produces an output code of 8000h. The output clips at these codes for signals that exceed full-scale. Table 5 summarizes the ideal output codes for different input signals. Figure 6 illustrates code transitions versus input voltage. Full-scale is a 5.12 mV signal. The LSB size is 156.25 nV.

Table 5. Input Signal versus Ideal Output Code[1]

SENSOR SIGNAL	OUTPUT CODE
FS $(2^{15} - 1)/2^{15}$ (5.12 mV)	7FFFh
+FS/2^{15} (156.25 nV)	0001h
0	0
−FS/2^{15} (−156.25 nV)	FFFFh
−FS (−5.12 mV)	8000h

(1) FS = Full-scale value.
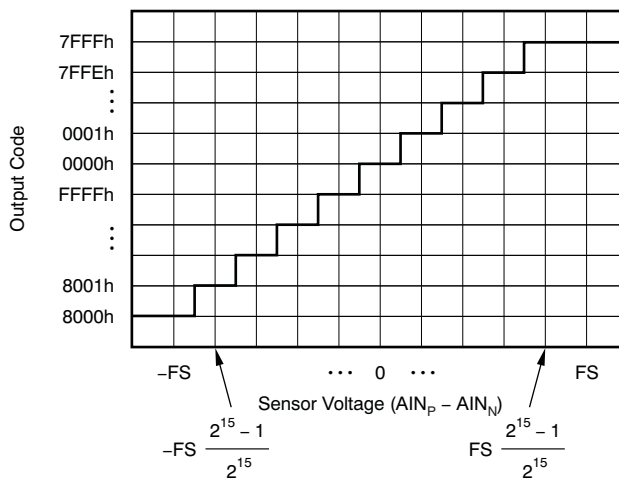
Figure 6. Code Transition Diagram

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TEMPERATURE REGISTER (T$_{AMBIENT}$)

The Temperature Register of the TMP006 is configured as a 14-bit, read-only register (as shown in Table 6) that stores the result of the most recent conversion for the local die temperature, T$_{AMBIENT}$. Following power-up or a software reset, the Temperature Register reads 0°C (0000h) until the first conversion is complete.

Table 6. Temperature Registers (Read Only)

POINTER (HEX)	REGISTER	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
01h	T$_{AMBIENT}$	T13	T12	T11	T10	T9	T8	T7	T6	T5	T4	T3	T2	T1	T0	0	0
	Reset value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TEMPERATURE FORMAT

The Temperature Register data format of the TMP006 is reported in a binary twos complement signed integer format, as Table 7 shows, with 1 LSB = 1/32°C = 0.03125.

Table 7. Temperature Data Format

TEMPERATURE (°C)	DIGITAL OUTPUT (BINARY)	SHIFTED HEX
150	0100 1011 0000 0000	12CO
125	0011 1110 1000 0000	0FA0
100	0011 0010 0000 0000	0C80
80	0010 1000 0000 0000	0A00
75	0010 0101 1000 0000	0960
50	0001 1001 0000 0000	0640
25	0000 1100 1000 0000	0320
0.03125	0000 0000 0000 0100	0001
0	0000 0000 0000 0000	0000
−0.03125	1111 1111 1111 1100	FFFC
−0.0625	1111 1111 1111 1000	FFF8
−25	1111 0011 0111 0000	F370
−40	1110 1011 1111 1100	EBFC
−55	1110 0100 0111 1100	E47C

Converting the integer temperature result of the TMP006 to physical temperature is done by right-shifting the last two LSBs followed by a divide-by-32 of T$_{REG}$ to obtain the physical temperature result in degrees Celsius. T$_{REG}$ is the 14-bit signed integer contained in the corresponding register. The sign of the temperature is the same as the sign of the integer read form the TMP006. In twos complement notation, the MSB is the sign bit. If the MSB is '1', the integer is negative and the absolute value can be obtained by inverting all bits and adding '1'. An alternative method of calculating the absolute value of negative integers is abs(i) = i xor FFFFh + 1.

Product Folder Link(s): *TMP006*

CONFIGURATION REGISTER

Table 8 describes the Configuration Register. This register determines the operational modes, conversion rate, DRDY control, initiates a single conversion, performs a software reset, or puts the device into shutdown mode. This register is read/write, and the pointer address is 02h.

Table 8. Configuration Register (Read/Write)

POINTER (HEX)	REGISTER	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
02h	Configuration	RST	MOD2	MOD1	MOD0	CR2	CR1	CR0	EN	$\overline{DRDY}$	0	0	0	0	0	0	0
	Reset value	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0

Bit [15]　　　**RST: Software reset bit**

0 = Normal operation, this bit self clears
1 = Software reset

Bits [14:12]　　**MOD[2:0]: Mode of operation**

000 = Power-down
111 = Sensor and ambient continuous conversion (MOD)

Bits [11:9]　　**CR[2:0]: ADC conversion rate**

See Table 9.

Bit [8]　　　**EN: $\overline{DRDY}$ enable bit**

0 = $\overline{DRDY}$ pin disabled
1 = $\overline{DRDY}$ pin enabled

Bit [7]　　　**$\overline{DRDY}$: Data ready bit**

0 = Conversion in progress
1 = Object voltage and ambient temperature results are ready to read. A temperature or sensor voltage read or a write to the Configuration Register is required to clear the condition.

Bits [6:0]　　**Unused [6:0]**

The TMP006 can operate in two modes: continuous and shutdown. A software reset function is also available. Selecting the desired operating mode is done by writing to the Configuration Register conversion mode select bits MOD[2:0]. The duration of the analog-to-digital (A/D) conversion is determined by the conversion rate bits CR[2:0] and is listed in Table 9. Continuous mode, on the other hand, performs an A/D conversion followed by a low-power delay in order to reduce the average power consumption. Multiple options for the conversion time and delay time are available in order to select the desired power and noise performance. Initiating power-down has an immediate effect; it aborts the current conversion and puts the device into a low-power shutdown mode. RST, or software reset, is also immediate and initializes all memory locations with the respective reset values.

Table 9. Conversion Rate

CR2	CR1	CR0	CONVERSION RATE (conv/sec)	TOTAL NUMBER OF AVERAGED SAMPLES	AVERAGE I_Q (µA)	PEAK-PEAK NOISE OF THE T_{Object} RESULT (°C)
0	0	0	4	1	240	0.5
0	0	1	2	2	240	0.35
0	1	0	1	4	240	0.25 (default)
0	1	1	0.5	8	240	0.18
1	0	0	0.25	16	240	0.125

Product Folder Link(s): TMP006

MANUFACTURER AND DEVICE ID REGISTERS

The TMP006 has two registers for identification: manufacturer ID (pointer address FEh) and device ID (pointer address FFh). The manufacturer ID reads 5449h and the device ID is 0067h. Table 10 summarizes these two values.

Table 10. Manufacturer and Device ID (Read-Only)

POINTER (HEX)	REGISTER	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
FEh	Manufacturer ID	ID15	ID14	ID13	ID12	ID11	ID10	ID9	ID8	ID7	ID6	ID5	ID4	ID3	ID2	ID1	ID0
	Reset value	0	1	0	1	0	1	0	0	0	1	0	0	1	0	0	1
FFh	Device ID	ID15	ID14	ID13	ID12	ID11	ID10	ID9	ID8	ID7	ID6	ID5	ID4	ID3	ID2	ID1	ID0
	Reset value	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	1

SERIAL INTERFACE

The TMP006 operates only as a slave device on either the two-wire bus or the SMBus interface. Connections to either bus are made via the open-drain I/O lines, SDA, and SCL. The SDA and SCL pins feature integrated spike-suppression filters and Schmitt triggers to minimize the effects of input spikes and bus noise. The TMP006 supports the transmission protocol for fast (1 kHz to 400 kHz) and high-speed (1 kHz to 3.4 MHz) modes. All data bytes are transmitted MSB first.

SERIAL BUS ADDRESS

To communicate with the TMP006, the master must first address slave devices via a slave address byte. The slave address byte consists of seven address bits, and a direction bit that indicate the intent to execute a read or write operation.

READ/WRITE OPERATIONS

Accessing a particular register on the TMP006 is accomplished by writing the appropriate value to the Pointer Register. The pointer value is the first byte transferred after the slave address byte with the R/W bit low. Every write operation to the TMP006 requires a value for the pointer (see Figure 7). When reading from the TMP006, the last value stored in the pointer by a write operation is used to determine which register is read by a read operation. To change the register pointer for a read operation, a new value must be written to the pointer. This transaction is accomplished by issuing a slave address byte with the R/W bit low, followed by the pointer byte. No additional data are required. The master can then generate a START condition and send the slave address byte with the R/W bit high to initiate the read command. If repeated reads from the same register are desired, it is not necessary to continually send the pointer bytes because the TMP006 retains the pointer value until it is changed by the next write operation. Note that register bytes are sent MSB first, followed by the LSB.

Product Folder Link(s): *TMP006*

TIMING DIAGRAMS

The TMP006 is two-wire and SMBus-compatible. Figure 7 and Figure 8 illustrate the timing for the various operations on the TMP006. Parameters for Figure 7 are defined in Table 11. Bus definitions are given below.

Table 11. Timing Diagram Definitions

PARAMETER	TEST CONDITIONS	FAST MODE		HIGH-SPEED MODE		UNIT
		MIN	MAX	MIN	MAX	
f_{SCL}	SCL operating frequency, $V_S > 1.7$ V	0.001	0.4	0.001	3.4	MHz
f_{SCL}	SCL operating frequency, $V_S < 1.7$ V	0.001	0.4	0.001	2.75	MHz
t_{BUF}	Bus free time between STOP and START condition	600		160		ns
t_{HDSTA}	Hold time after repeated START condition. After this period, the first clock is generated.	100		100		ns
t_{SUSTA}	Repeated START condition setup time	100		100		ns
t_{SUSTO}	STOP condition setup time	100		100		ns
t_{HDDAT}	Data hold time	0[1]		0[2]		ns
t_{SUDAT}	Data setup time	100		10		ns
t_{LOW}	SCL clock low period, $V_S > 1.7$ V	1300		160		ns
t_{LOW}	SCL clock low period, $V_S < 1.7$ V	1300		200		ns
t_{HIGH}	SCL clock high period	600		60		ns
t_F	Clock/data fall time		300			ns
t_R	Clock/data rise time		300		160	ns
t_R	Clock/data rise time for SCLK ≤ 100 kHz		1000			ns

(1) For cases with fall time of SCL less than 20 ns and/or the rise or fall time of SDA less than 20 ns, the hold time should be greater than 20 ns.

(2) For cases with a fall time of SCL less than 10 ns and/or the rise or fall time of SDA less than 10 ns, the hold time should be greater than 10 ns.

**Bus Idle:** Both SDA and SCL lines remain high.

Start Data Transfer: A change in the state of the SDA line from high to low while the SCL line is high defines a START condition. Each data transfer is initiated with a START condition.

Stop Data Transfer: A change in the state of the SDA line from low to high while the SCL line is high defines a STOP condition. Each data transfer terminates with a STOP or a repeated START condition.

Data Transfer: The number of data bytes transferred between a START and a STOP condition is not limited and is determined by the master device. The receiver acknowledges the transfer of data.

Acknowledge: Each receiving device, when addressed, is obliged to generate an Acknowledge bit. A device that acknowledges must pull down the SDA line during the Acknowledge clock pulse in such a way that the SDA line is stable low during the high period of the Acknowledge clock pulse. Setup and hold times must be taken into account. On a master receive, data transfer termination can be signaled by the master generating a Not-Acknowledge on the last byte that has been transmitted by the slave.

In order for the two-wire bus to operate at frequencies above 400 kHz, the master device must issue a High-speed mode (Hs-mode) master code (0000100X) as the first byte after a START condition to switch the bus to high-speed operation. The TMP006 does not acknowledge this byte, but switches the input filters on SDA and SCL and the output filter on SDA to operate in Hs-mode, allowing transfers at up to 3.4 MHz. After the Hs-mode master code has been issued, the master transmits a two-wire slave address to initiate a data transfer operation. The bus continues to operate in Hs-mode until a STOP condition occurs on the bus. Upon receiving the STOP condition, the TMP006 switches the input and output filter back to fast-mode operation.
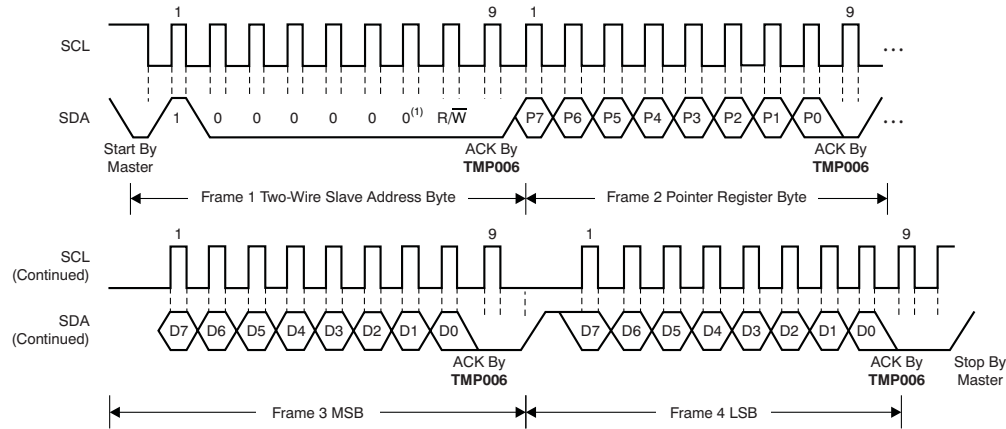
(1) Slave address 1000000 shown. Slave address changes for the TMP006 depend on the ADR1 and ADR0 pin connection. See Package Information for more details.

Figure 7. Two-Wire Timing Diagram for Write Word Format
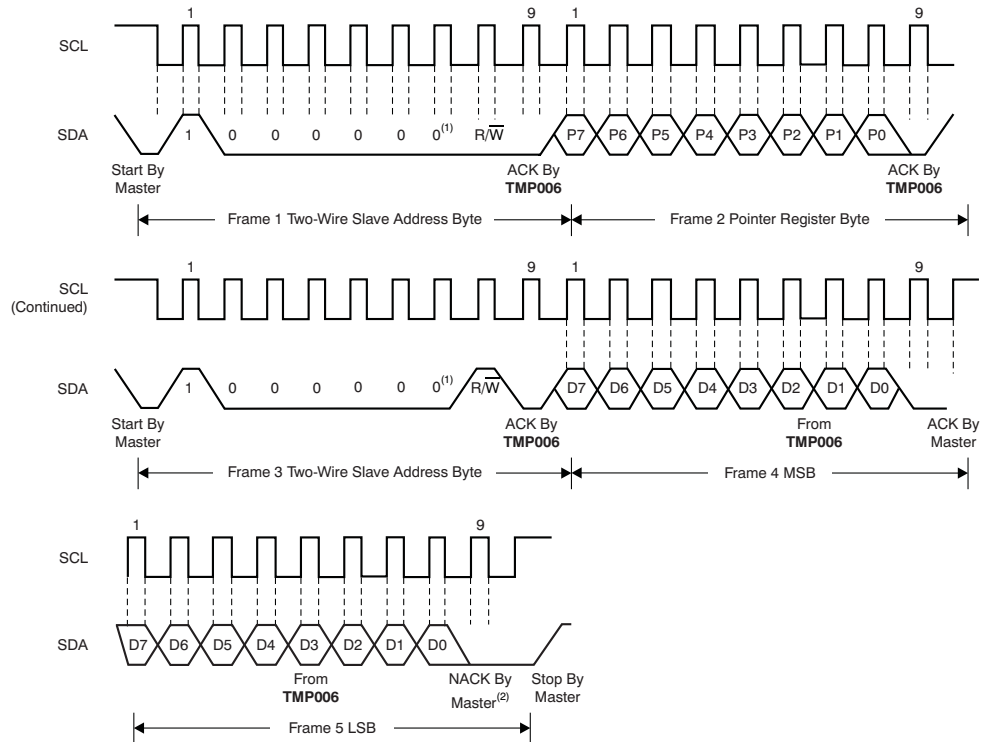
(1) Slave address 1000000 shown.

(2) Master must leave SDA high to terminate a two-byte read operation.

Figure 8. Two-Wire Timing Diagram for Two-Byte Read Format

REVISION HISTORY

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

PACKAGING INFORMATION

Orderable Device	Status [1]	Package Type	Package Drawing	Pins	Package Qty	Eco Plan [2]	Lead/ Ball Finish	MSL Peak Temp [3]	Samples (Requires Login)
TMP006AIYZFR	ACTIVE	DSBGA	YZF	8	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-2-260C-1 YEAR	
TMP006AIYZFT	ACTIVE	DSBGA	YZF	8	250	Green (RoHS & no Sb/Br)	SNAGCU	Level-2-260C-1 YEAR	

[1] The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

[2] Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

[3] MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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PACKAGE MATERIALS INFORMATION

TAPE AND REEL INFORMATION

REEL DIMENSIONS

TAPE DIMENSIONS

A0	Dimension designed to accommodate the component width	
B0	Dimension designed to accommodate the component length	
K0	Dimension designed to accommodate the component thickness	
W	Overall width of the carrier tape	
P1	Pitch between successive cavity centers	

TAPE AND REEL INFORMATION

*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TMP006AIYZFR	DSBGA	YZF	8	3000	180.0	8.4	1.65	1.65	0.81	4.0	8.0	Q1
TMP006AIYZFT	DSBGA	YZF	8	250	180.0	8.4	1.65	1.65	0.81	4.0	8.0	Q1

TAPE AND REEL BOX DIMENSIONS

*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TMP006AIYZFR	DSBGA	YZF	8	3000	210.0	185.0	35.0
TMP006AIYZFT	DSBGA	YZF	8	250	210.0	185.0	35.0

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