MAX1617

SMBus Temperature Sensor with Internal and External Diode Input

The MAX1617 is a serially programmable temperature sensor optimized for monitoring modern high performance CPUs with on–board, integrated temperature sensing diodes. Temperature data is converted from the CPU's diode outputs and made available as an 8–bit digital word.

Communication with the MAX1617 is accomplished via the standard System Management Bus (SMBus) commonly used in modern computer systems. This permits reading the current internal/external temperature, programming the threshold setpoints, and configuring the device. Additionally, an interrupt is generated on the ALERT pin when temperature moves outside the preset threshold windows in either direction.

A Standby command may be sent via the SMBus by signaling the STBY input to activate the low–power Standby mode. Registers can be accessed while in Standby mode. Address selection inputs allow up to nine MAX1617s to share the same 2–wire SMBus for multi–zone monitoring.

All registers can be read by the host, and both polled and interrupt driven systems are easily accommodated. Small size, low installed cost, and ease of use make the MAX1617 an ideal choice for implementing sophisticated system management schemes, such as ACPI.

Features

- Includes Internal *and* External Sensing Capability
- Outputs Temperature As 8–Bit Digital Word
- Solid State Temperature Sensing; 1°C Resolution
- 3.0 — 5.5V Operating Range
- Independent Internal and External Threshold Set–Points With ALERT Interrupt Output
- SMBus 2–Wire Serial Interface
- Up To 9 MAX1617s May Share the Same Bus
- Low Standby Power Mode
- Low Power: 70 µA (max) Operating, 10 µA (max) Standby Mode
- 16–Pin Plastic QSOP Package
- Operating Temperature Range: –55°C to +125°C

Typical Applications

- Thermal Protection For Intel "Deschutes" Pentium II™ and Other High Performance CPUs with Integrated On–Board Diode - No Sensor Mounting Problems!
- Accurate Temperature Sensing From Any Silicon Junction Diode
- Thermal Management in Electronic Systems: Computers, Network Equipment, Power Supplies

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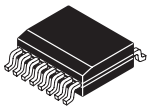
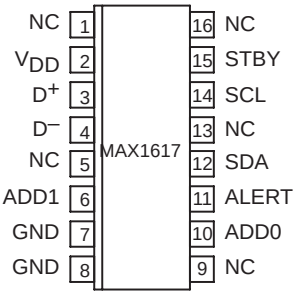


16–Pin QSOP
DB SUFFIX
CASE TBD
PRELIMINARY INFORMATION

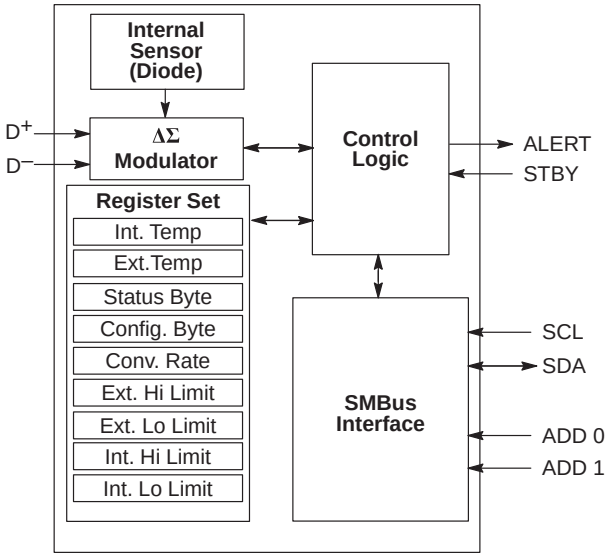
PIN CONFIGURATION
(Top View)



ORDERING INFORMATION

Device	Package	Shipping
MAX1617DBR2	16–Pin QSOP	2500 Tape/Reel

FUNCTIONAL BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS*

Symbol	Parameter	Value	Unit
V_{DD}	Power Supply Voltage	6.0	V
	Voltage on Any Pin	(GND – 0.3 V) to (V_{DD} + 0.3 V)	V
T_A	Operating Temperature Range	–55 to +125	°C
T_{stg}	Storage Temperature Range	–65 to +150	°C
	SMBus Input/Output Current	–1 to +50	mA
	D^- Input Current	±1	mA
P_D	Maximum Power Dissipation	330	mW

* Maximum Ratings are those values beyond which damage to the device may occur.

PIN DESCRIPTION

Pin No.	Symbol	Type	Description
2	V_{DD}	Power	Power Supply Input
3	D^+	Bi–Directional	Current Source and A/D Positive Input
4	D^-	Bi–Directional	Current Sink and A/D Negative Input
6, 10	ADD[1:0]	Input	Address Select Pins (See Address Decode Table)
7, 8	GND	Power	System Ground
11	ALERT	Output	SMBus Interrupt (SMBALERT) or Comparator Output
12	SDA	Bi–Directional	SMBus Serial Data
14	SCL	Input	SMBus Serial Clock
15	STBY	Input	Standby Enable
1, 5, 9, 13, 16	NC	—	Not Connected

PIN DESCRIPTION

SCL

Input. SMBus serial clock. Clocks data into and out of the MAX1617.

SDA

Bi–directional. Serial data is transferred on the SMBus in both directions using this pin.

ADD1, ADD0

Inputs. Sets the 7–bit SMBus address. These pins are “tri–state,” and the SMBus addresses are specified in the Address Decode Table below.

(**NOTE:** The tri–state scheme allows up to nine MAX1617s on a single bus. A match between the MAX1617’s address and the address specified in the serial bit stream must be made to initiate communication. Many SMBus–compatible devices with other addresses may share the same 2–wire bus. These pins are only active at power–on reset, and will latch into the appropriate states.

ALERT

Output, Open Collector, Active Low. The ALERT output corresponds to the general SMBALERT signal and indicates an interrupt event. The MAX1617 will respond to the standard SMBus Alert Response Address when ALERT is asserted. Normally, the ALERT output will be asserted when any of the following occurs:

INT_TEMP equal to or exceeds INT_HLIM
INT_TEMP falls below INT_LLIM
EXT_TEMP equal to or exceeds EXT_HLIM
EXT_TEMP falls below EXT_LLIM
External Diode “Open”

The operation of the ALERT output is controlled by the MASK1 bit in the CONFIG register. If the MASK1 bit is set to “1,” no interrupts will be generated on ALERT. The ALERT output is cleared and re–armed by the Alert Response Address (ARA). This output may be WIRE–ORed with similar outputs from other SMBus devices. If the alarm condition persists after the ARA, the ALERT output will be immediately re–asserted.

(**NOTE:** A pull–up resistor is necessary on ALERT since it is an open–drain output. Current sourced from the pull–up resistor causes power dissipation and may cause internal heating of the MAX1617. To avoid affecting the accuracy of internal temperature readings, the pull–up resistors should be made as large as possible.)

STBY

Input. The activation of Standby mode may be achieved using either the STBY pin or the CHIP STOP bit (CONFIG register). If STBY is pulled low, the MAX1617 unconditionally enters its low–power Standby mode. The temperature–to–digital conversion process is halted, but ALERT remains functional. The MAX1617’s bus interface remains active, and all registers may be read from and written to normally. The INT_TEMP and EXT_TEMP registers will contain whatever data was valid at the time of Standby. (Transitions on SDA or SCL due to external bus activity may increase the Standby power consumption.)

D^+

Bi–directional. this pin connects to the anode of the external diode and is the positive A/D input. Current is injected into the external diode from the MAX1617, and the temperature proportional V_{BE} is measured and converted to digital temperature data.

D^-

Bi–directional. This pin connects to the cathode of the external diode. Current is sunk from the external diode into the MAX1617 through this pin. It also is the negative input terminal to the MAX1617’s A/D converter. This node is kept at approximately 0.7V above GROUND.

V_{DD}

Input. Power supply input. See electrical specifications.

GND

Input. Ground return for all MAX1617 functions.

DC ELECTRICAL CHARACTERISTICS (V_{DD} = 3.3 V, –55°C ≤ T_A ≤ 125°C, unless otherwise noted.)

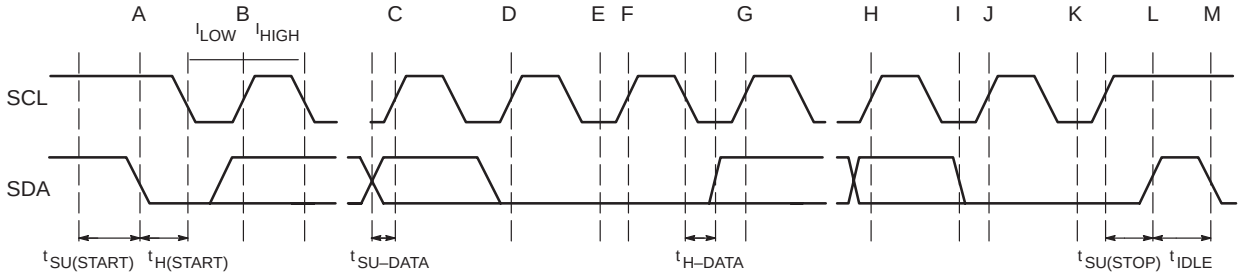
Symbol	Characteristic	Min	Typ	Max	Unit
Power Supply					
V_{DD}	Power Supply Voltage	3.0	—	5.5	V
$V_{UV–LOCK}$	V_{DD} Undervoltage Lockout Threshold	2.4	2.80	2.95	V
V_{POR}	Power–On Reset Threshold (V_{DD} Falling Edge)	1.0	1.7	2.3	V
I_{DD}	Operating Current 0.25 Conv./Sec Rate SMBus Inactive (1)	—	—	70	μA
I_{DD}	Operating Current 2 Conv./Sec Rate SMBus Inactive (1)	—	—	180	μA
$I_{DD–STANDBY}$	Standby Supply Current (SMBus Active)	—	—	100	μA
$I_{DD–STANDBY}$	Standby Supply Current (SMBus Inactive)	—	—	10	μA
$I_{ADD–BIAS}$	ADD[1:0] Bias Current (Power–Up Only)	—	160	—	μA
ALERT Output					
V_{OL}	Output Low Voltage (I_{OL} = 1.0 mA) (3)	—	—	0.4	V
ADD[1:0] Inputs					
V_{IL}	Logic Input Low	—	—	V_{DD} x 0.3	V
V_{IH}	Logic Input High	V_{DD} x 0.7	—	—	V
STBY Input					
V_{IL}	Logic Input Low	—	—	V_{DD} x 0.3	V
V_{IH}	Logic Input High	V_{DD} x 0.7	—	—	V
Temp–to–Bits Converter					
T_{RES}	Basic Temperature Resolution	—	1.0	—	°C
T_{IERR}	Internal Diode Temperature +60°C ≤ T_A ≤ +100°C 0°C ≤ T_A ≤ +125°C –55°C ≤ T_A ≤ 0°C	 –2 –3 —	 — — ±3	 +2 +3 —	°C
T_{EERR}	External Diode Temperature +60°C ≤ T_A ≤ +100°C 0°C ≤ T_A ≤ +125°C –55°C ≤ T_A ≤ 0°C	 –3 –5 —	 — — ±5	 +3 +5 —	°C
$I_{DIODE–HIGH}$	External Diode High Source Current $(D^+) – (D^–)$ ~ 0.65 V	—	100	—	μA
$I_{DIODE–LOW}$	External Diode Low Source Current $(D^+) – (D^–)$ ~ 0.65 V	—	10	—	μA
$V_{D–SOURCE}$	Source Voltage	—	0.7	—	V
t_{CONV}	Conversion Time From CHIP STOP to Conv. Complete (2)	54	83	112	msec
ΔCR	Conversion Rate Accuracy (See Conversion Rate Register Desc.)	–35	—	+35	%
2–Wire SMBus Interface					
V_{IH}	Logic Input High	2.2	—	—	V
V_{IL}	Logic Input Low	—	—	0.8	V
V_{OL}	SDA Output Low I_{OL} = 2 mA (3) I_{OL} = 4 mA (3)	 — —	 — —	 0.4 0.6	V
C_{IN}	Input Capacitance SDA, SCL	—	5.0	—	pF
I_{LEAK}	I/O Leakage	–1.0	0.1	1.0	μA

1. Operating current is an average value (including external diode injection pulse current) integrated over multiple conversion cycles. Transient current may exceed this specification.
2. For true recurring conversion time see Conversion Rate register description.
3. Output current should be minimized for best temperature accuracy. Power dissipation within the MAX1617 will cause self–heating and temperature drift error.

SMBus PORT AC TIMING (V_{DD} = 3.3 V, –55°C ≤ (T_A = T_J) ≤ 125°C; C_L = 80 pF, unless otherwise noted.)

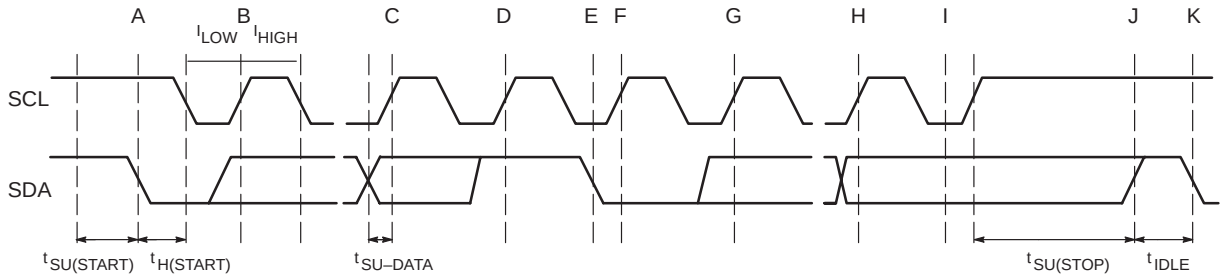
Symbol	Characteristic	Min	Typ	Max	Unit
f_{SMB}	SMBus Clock Frequency	10	—	100	kHz
t_{LOW}	Low Clock Period (10% to 10%)	4.7	—	—	μsec
t_{HIGH}	High Clock Period (90% to 90%)	4	—	—	μsec
t_R	SMBus Rise Time (10% to 90%)	—	—	1,000	nsec
t_F	SMBus Fall Time (90% to 10%)	—	—	300	nsec
$t_{SU(START)}$	Start Condition Setup Time (90% SCL to 10% SDA) (for Repeated Start Condition)	4	—	—	μsec
$t_{H(START)}$	Start Condition Hold Time	4	—	—	μsec
$t_{SU–DATA}$	Data in Setup Time	1,000	—	—	nsec
$t_{H–DATA}$	Data in Hold Time	1,250	—	—	nsec
$t_{SU(STOP)}$	Stop Condition Setup Time	4	—	—	μsec
t_{IDLE}	Bus Free Time Prior to New Transition	4.7	—	—	μsec

SMBUS Write Timing Diagram



A = Start Condition
B = MSB of Address Clocked into Slave
C = LSB of Address Clocked into Slave
D = R/$\overline{W}$ Bit Clocked into Slave
E = Slave Pulls SDA Line Low
F = Acknowledge Bit Clocked into Master
G = MSB of Data Clocked into Slave
H = LSB of Data Clocked into Slave
I = Slave Pulls SDA Line Low
J = Acknowledge Clocked into Master
K = Acknowledge Clock Pulse
L = Stop Condition, Data Executed by Slave
M = New Start Condition

SMBUS Read Timing Diagram



A = Start Condition
B = MSB of Address Clocked into Slave
C = LSB of Address Clocked into Slave
D = R/$\overline{W}$ Bit Clocked into Slave
E = Slave Pulls SDA Line Low
F = Acknowledge Bit Clocked into Master
G = MSB of Data Clocked into Master
H = LSB of Data Clocked into Master
I = Acknowledge Clock Pulse
J = Stop Condition
K = New Start Condition

DETAILED OPERATING DESCRIPTION

The MAX1617 acquires and converts temperature information from two separate sources, both silicon junction diodes, with a basic accuracy of ±1°C. One is located on the MAX1617 die; the other is connected externally. The external diode may be located on another IC die. The analog–to–digital converter on the MAX1617 alternately converts temperature data from the two sensors and stores them separately in internal registers.

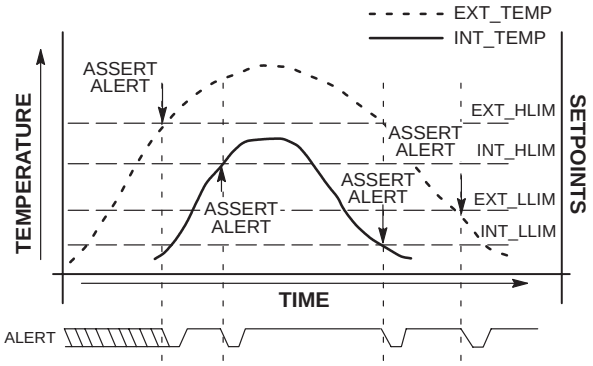
The system interface is a slave SMBus port with an ALERT (SMBALERT) interrupt output. The interrupt is triggered when one or more of four preset temperature thresholds are tripped (see Figure 1). These four thresholds are user–programmable via the SMBus port. Additionally, the temperature data can be read at any time through the SMBus port. Nine SMBus addresses are programmable for the MAX1617, which allows for a multi–sensor configuration. Also, there is low–power Standby mode where temperature acquisition is suspended.

STANDBY MODE

The MAX1617 allows the host to put it into a low power (I_{DD} = 10 μA, max) Standby mode. In this mode, the A/D converter is halted, and the temperature data registers are frozen. The SMBus port operates normally. Standby mode can be enabled with either the STBY input pin or the CHIP STOP bit in the CONFIG register. The following table summarizes this operation.

Standby Mode Operation

STBY	Chip Stop Bit	One Shot?	Operating Mode
0	Don't Care	Don't Care	Standby
1	0	Don't Care	Normal
1	1	No	Standby
1	1	Yes	Normal (1 Conversion Only, then Standby)



Note: This diagram implies that the appropriate setpoint is moved, temporarily, after each ALERT event to suppress re–assertion of ALERT immediately after the ARA/de–assertion.

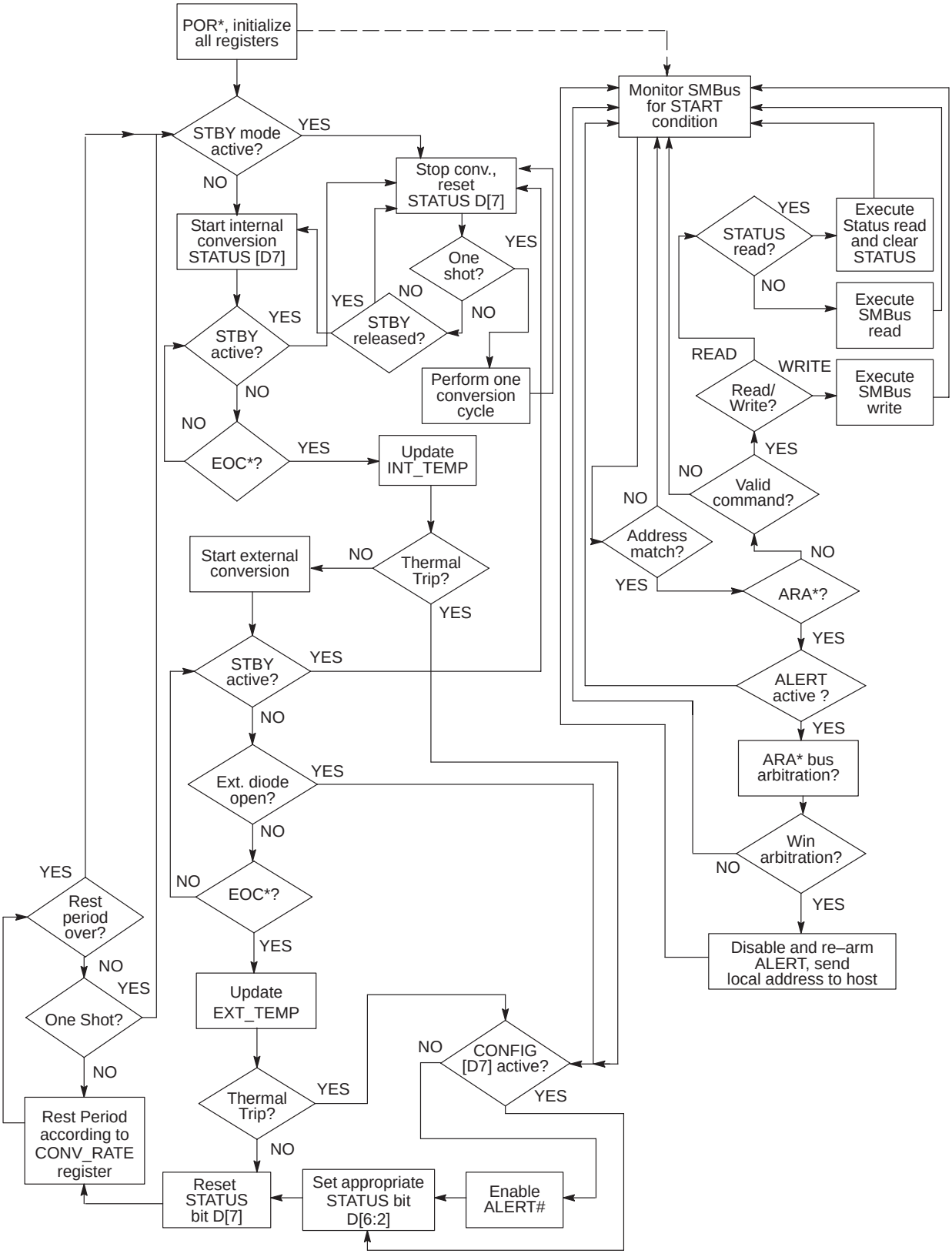
Figure 1. Temperature vs. Setpoint Event Generation

SMBus SLAVE ADDRESS

The two pins ADD1 and ADD0 are tri–state input pins which determine the 7–bit SMBus slave address of the MAX1617. The address is latched during POR.

Address Decode Table

ADD0	ADD1	SMBus Address
0	0	0011 000
0	open (3–state)	0011 001
0	1	0011 010
open (3–state)	0	0101 001
open (3–state)	open (3–state)	0101 010
open (3–state)	1	0101 011
1	0	1001 100
1	open (3–state)	1001 101
1	1	1001 110



* POR = Power On Reset; ARA = Alert Response Address; EOC = End Of Conversion

Figure 2. MAX1617 Functional Description Flowchart

Serial Port Operation

The Serial Clock input (SCL) and bi–directional data port (SDA) form a 2–wire bi–directional serial port for programming and interrogating the MAX1617. The following conventions are used in this bus architecture. (See SMBus Write/Read Timing Diagram.)

All transfers take place under control of a host, usually a CPU or microcontroller, acting as the Master, which provides the clock signal for all transfers. The MAX1617 *always* operates as a slave. The serial protocol is illustrated in Figure 3. All data transfers have two phases; all bytes are transferred MSB first. Accesses are initiated by a start condition (START), followed by a device address byte and one or more data bytes. The device address byte includes a Read/Write selection bit. Each access must be terminated by a Stop Condition (STOP). A convention called *Acknowledge* (ACK) confirms receipt of each byte. Note that SDA can change only during periods when SCL is LOW (SDA changes while SCL is High are reserved for Start and Stop conditions.)

MAX1617 Serial Bus Conventions

Term	Explanation
Transmitter	The device sending data to the bus.
Receiver	The device receiving data from the bus.
Master	The device which controls the bus: initiating transfers (START), generating the clock, and terminating transfers (STOP).
Slave	The device addressed by the master.
Start	A unique condition signaling the beginning of a transfer indicated by SDA falling (High — Low) while SCL is high.
Stop	A unique condition signaling the end of a transfer indicated by SDA rising (Low — High) while SCL is high.
ACK	A receiver acknowledges the receipt of each byte with this unique condition. The receiver drives SDA low during SCL high of the ACK clock–pulse. The Master provides the clock pulse for the ACK cycle.
Busy	Communication is not possible because the bus is in use.
NOT Busy	When the bus is idle, both SDA and SCL will remain high.
Data Valid	The state of SDA must remain stable during the High period of SCL in order for a data bit to be considered valid. SDA only changes state while SCL is low during normal data transfers (see Start and Stop conditions).

Start Condition (START)

The MAX1617 continuously monitors the SDA and SCL lines for a start condition (a High to Low transition of SDA while SCL is High), and will not respond until this condition is met. (See SMBus Write/Read Timing Diagram.)

Address Byte

Immediately following the Start Condition, the host must transmit the address byte to the MAX1617. The states of ADD1 and ADD0 during power–up determine the 7–bit SMBus address for the MAX1617. The 7–bit address transmitted in the serial bit stream must match for the MAX1617 to respond with an Acknowledge (indicating the MAX1617 is on the bus and ready to accept data). The eighth bit in the Address Byte is a Read–Write Bit. This bit is 1 for a read operation or 0 for a write operation.

Acknowledge (ACK)

Acknowledge (ACK) provides a positive handshake between the host and the MAX1617. The host releases SDA after transmitting eight bits, then generates a ninth clock cycle to allow the MAX1617 to pull the SDA line Low to acknowledge that it successfully received the previous eight bits of data or address.

Data Byte

After a successful ACK of the address byte, the host must transmit the data byte to be written or clock out the data to be read. (See the appropriate timing diagrams.) ACK will be generated after a successful write of a data byte into the MAX1617.

Stop Condition (STOP)

Communications must be terminated by a stop condition (a Low to High transition of SDA while SCL is High). The Stop Condition must be communicated by the transmitter to the MAX1617. (See SMBus Write/Read Timing Diagram.)

Write Byte Format

S	ADDRESS	WR	ACK	COMMAND	ACK	DATA	ACK	P
	7 Bits			8 Bits		8 Bits		

Slave Address

Command Byte: selects which register you writing to.

Data Byte: data goes into the register set by the command byte.

Read Byte Format

S	ADDRESS	WR	ACK	COMMAND	ACK	S	ADDRESS	RD	ACK	DATA	NACK	P
	7 Bits			8 Bits			7 Bits			8 Bits		

Slave Address

Command Byte: selects which register you reading from.

Slave Address: repeated due to change in data–flow direction.

Data Byte: reads from the register set by the command byte.

Send Byte Format

S	ADDRESS	WR	ACK	COMMAND	ACK	P
	7 Bits			8 Bits		

Command Byte: sends command with no data, usually used for one–shot command.

Receive Byte Format

S	ADDRESS	RD	ACK	DATA	NACK	P
	7 Bits			8 Bits		

Data Byte: reads data from the register commanded by the last Read Byte.

S = Start Condition
P = Stop Condition
Shaded = Slave Transmission

Figure 3. SMBus Protocols

REGISTER SET AND PROGRAMMER'S MODEL

MAX1617 Command Set

The MAX1617 supports four SMBus command protocols. These are READ_BYTE, WRITE_BYTE, SEND_BYTE, and RECEIVE_BYTE. See System Management Bus Specification Rev. 1.0 for details.

Command Byte Description

Command	Code	Function
RIT	00h	Read Internal Temp (INT_TEMP)
RET	01h	Read External Temp (EXT_TEMP)
RS	02h	Read Status Byte (STATUS)
RC	03h	Read Configuration Byte (CONFIG)
RCR	04h	Read Conversion Rate Byte (CONV_RATE)
RIHL	05h	Read Internal High Limit (INT_HLIM)
RILL	06h	Read Internal Low Limit (INT_LLIM)
REHL	07h	Read External High Limit (EXT_HLIM)
RELL	08h	Read External Low Limit (EXT_LLIM)
WC	09h	Write Configuration Byte (CONFIG)
WCR	0Ah	Write Conversion Rate Byt3 (CONV_RATE)
WIHL	0Bh	Write Internal High Limit (INT_HLIM)
WILL	0Ch	Write Internal Low Limit (INT_LLIM)
WEHL	0Dh	Write External High Limit (EXT_HLIM)
WELL	0Eh	Write External Low Limit (EXT_LLIM)
OSHT	0Fh	One Shot Temp Measurement
RMID	FEh	Read Manufacturer ID (MFR_ID)
RMREV	FFh	Read Manufacturer Revision Number (MFR_REV)

NOTE: Proper device operation is NOT guaranteed if undefined locations (10h to FDh) are addressed. In case of erroneous SMBus operation (RECEIVE_BYTE command issued immediately after WRITE_BYTE command) the MAX1617 will ACKnowledge the address and return 1111 1111b to signify an error. Under no condition will it implement an SMBus "timeout."

Configuration Register (Config), 8–Bits, Read/Write

Configuration Register (Config)

D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]
Mask1	Chip Stop	Reserved					

Bit	POR State	Function	Operation
D[7]	0	Interrupt Mask (see text)	1 = mask ALERT 0 = don't mask ALERT
D[6]	0	Standby switch	1 = standby, 0 = normal
D[5]—D[0]	0	Reserved — Always returns zero when read.	N/A

A/D Conversion Rate Register (CONV_RATE), 8–Bits, Read/Write

A/D Conversion Rate Register (CONV_RATE)

D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]
Reserved					MSB	X	LSB

Bit	POR State	Function	Operation
D[7:3]	0	Reserved — Always returns zero when read.	N/A
D[2:0]	010b	Conversion rate bits.	See below.

A/D Conversion Rate Selection

D2	D1	D0	Conversion Rate Samples/sec
0	0	0	0.0625
0	0	1	0.125
0	1	0	0.25
0	1	1	0.5
1	0	0	1.0
1	0	1	2.0
1	1	0	4.0
1	1	1	8.0

NOTE: Conversion rate denotes actual sampling of both internal *and* external sensors.

Temperature Registers, 8–Bits, Read–Only (INT_TEMP, EXT_TEMP)

The binary value (2's complement format) in these two registers represents temperature of the internal and external sensors following a conversion cycle. The registers are automatically updated in an alternating manner.

Internal Temperature Register (INT_TEMP)

D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]
MSB	x	x	x	x	x	x	LSB

External Temperature Register (EXT_TEMP)

D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]
MSB	x	x	x	x	x	x	LSB

In the two temperature data and four threshold setpoint registers, each unit value represents one degree (Celsius). The value is in 2's–complement binary format such that a reading of 00000000b corresponds to 0°C. Examples of this temperature–to–binary value relationship are shown in the following table.

Temperature–to–Digital Value Conversion (INT_TEMP, EXT_TEMP, INT_HLIM, INT_LLIM,EXT_HLIM, EXT_LLIM)

Actual Temperature	Rounded Temperature	Binary Value	Hex Value
+130.00°C	+127°C	01111111	7F
+127.00°C	+127°C	01111111	7F
+126.50°C	+127°C	01111111	7F
+25.25°C	+25°C	00011001	19
+0.50°C	+1°C	00000001	01
+0.25°C	0°C	00000000	00
0.00°C	0°C	00000000	00
—0.25°C	0°C	00000000	00
—0.50°C	0°C	00000000	00
—0.75°C	—1°C	11111111	FF
—1.00°C	—1°C	11111111	FF
—25.00°C	—25°C	11100111	E7
—25.25°C	—25°C	11100110	E7
—54.75°C	—55°C	11001001	C9
—55.00°C	—55°C	11001001	C9
—65.00°C	—65°C	10111111	BF

Temperature Threshold Setpoint Registers, 8–Bits, Read–Write (INT_HLIM, INT_LLIM, EXT_HLIM, EXT_LLIM)

These registers store the values of the upper and lower temperature setpoints for event detection. The value is in 2's–complement binary. INT_HLIM and INT_LLIM are compared with the INT_TEMP value, and EXT_HLIM and EXT_LLIM are compared with EXT_TEMP. These registers may be written at any time.

Internal High Limit Setpoint Register (INT_HLIM)

D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]
MSB	x	x	x	x	x	x	LSB

Internal Low Limit Setpoint Register (INT_LLIM)

D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]
MSB	x	x	x	x	x	x	LS

External High Limit Setpoint Register (EXT_HLIM)

D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]
MSB	x	x	x	x	x	x	LSB

External Low Limit Setpoint Register (EXT_LLIM)

D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]
MSB	x	x	x	x	x	x	LSB

NOTE: POR states:

INT_HLIM	01111111b	+127°C
INT_LLIM	11001001b	—55°C
EXT_HLIM	01111111b	+127°C
EXT_LLIM	11001001b	—55°C

Status Register (Status)

D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]
Busy	Flag1	Flag2	Flag3	Flag4	Flag5	Flag6	Re-served

Bit(s)	POR State	Function	Operation*
D[7]	0	Signal A/D converter is busy.	1 = A/D busy, 0 = A/D idle
D[6]	0	Interrupt flag for INT_HLIM event	1 = interrupt occurred, 0 = none
D[5]	0	Interrupt flag for INT_LLIM event	1 = interrupt occurred, 0 = none
D[4]	0	Interrupt flag for EXT_HLIM event	1 = interrupt occurred, 0 = none
D[3]	0	Interrupt flag for EXT_LLIM event	1 = interrupt occurred, 0 = none
D[2]	0	External diode “fault” flag	1 = external diode fault 0 = external diode OK
D[1:0]	0	Reserved — Always returns zero.	N/A

NOTE: All status bits are cleared after a read operation is performed on STATUS. The EXT_TEMP register will read +127°C if an external diode “open” is detected.

Manufacturer’s Identification Register (MFR_ID), 8–Bits, Read Only:

Manufacturer’s Identification Register (MFR_ID)

D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]
MSB	X	X	X	X	X	X	LSB

Manufacturer’s Revision Register (MFR_REV), 8–Bits, Read Only:

Manufacturer’s Revision Register (MFR_REV)

D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]
MSB	X	X	X	X	X	X	LSB

Register Set Summary:

The MAX1617’s register set is summarized in the following table. All registers are 8–bits wide.

Name	Description	POR State	Read	Write
INT_TEMP	Internal sensor temperature (2’s complement)	0000 0000b*	√	
EXT_TEMP	External sensor temperature (2’s complement)	0000 0000b*	√	
STATUS	STATUS register	0000 0000b	√	
CONFIG	CONFIG register	0000 0000b	√	√
CONV_RATE	A/D conversion rate register	0000 0010b	√	√
INT_HLIM	Internal high limit (2’s complement)	0111 1111b	√	√
INT_LLIM	Internal low limit (2’s complement)	1100 1001b	√	√
EXT_HLIM	External high limit (2’s complement)	0111 1111b	√	√
EXT_LLIM	External low limit (2’s complement)	1100 1001b	√	√
MFR_ID	ASCII for letter “T”	0101 0100b	√	
MFR_REV	Serial device revision #	**	√	
CRITICAL	CRITICAL limit (2’s complement)	N/A		√***

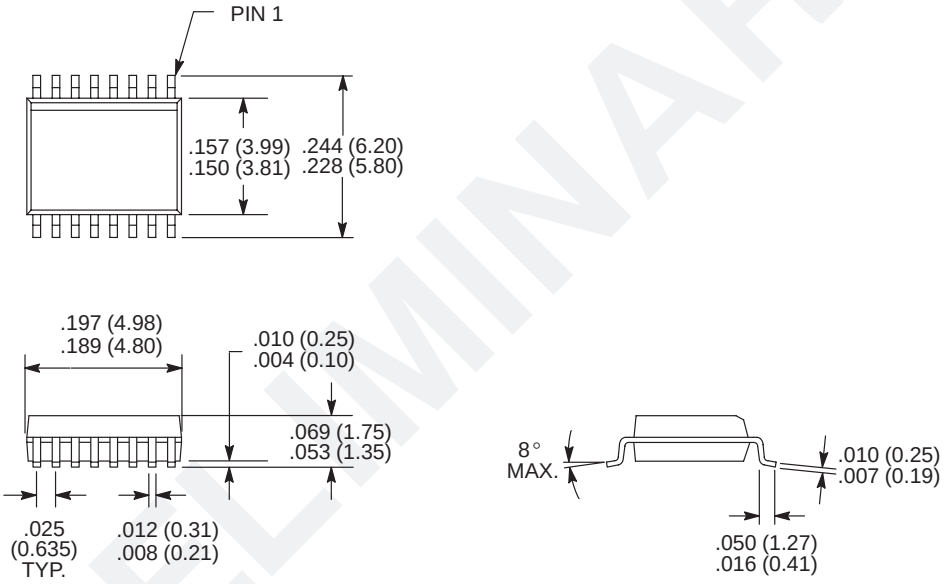
***NOTE:** The INT_TEMP and EXT_TEMP register immediately will be updated by the A/D converter after POR. If STBY is low at power–up, INT_TEMP and EXT_TEMP will remain in POR state (0000 0000b).

**MFR_REV will sequence 01h, 02h, 03h, etc. by mask changes.

***CRITICAL only can be written via the CRIT[1:0] pins. It cannot be accessed through the SMBus port.

PACKAGE DIMENSIONS

16–Pin QSOP
PLASTIC PACKAGE
CASE TBD
ISSUE TBD



Dimensions: inches (mm)

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