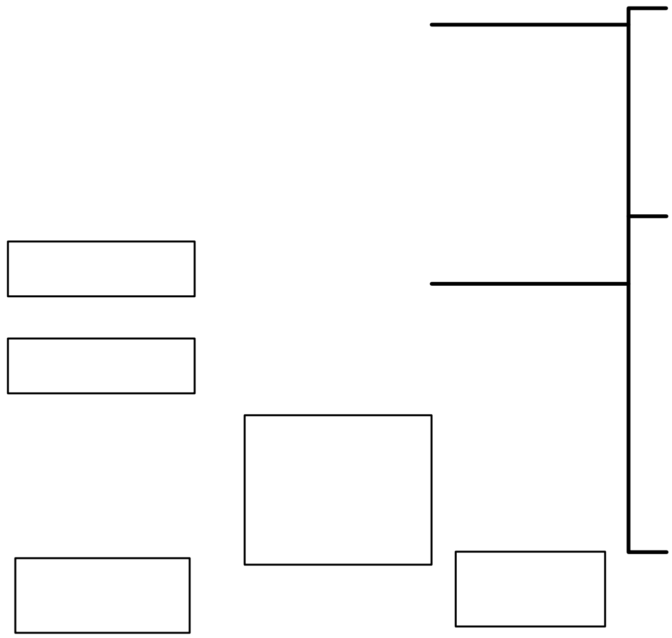
ADM1031

I T
M D PWM F
C



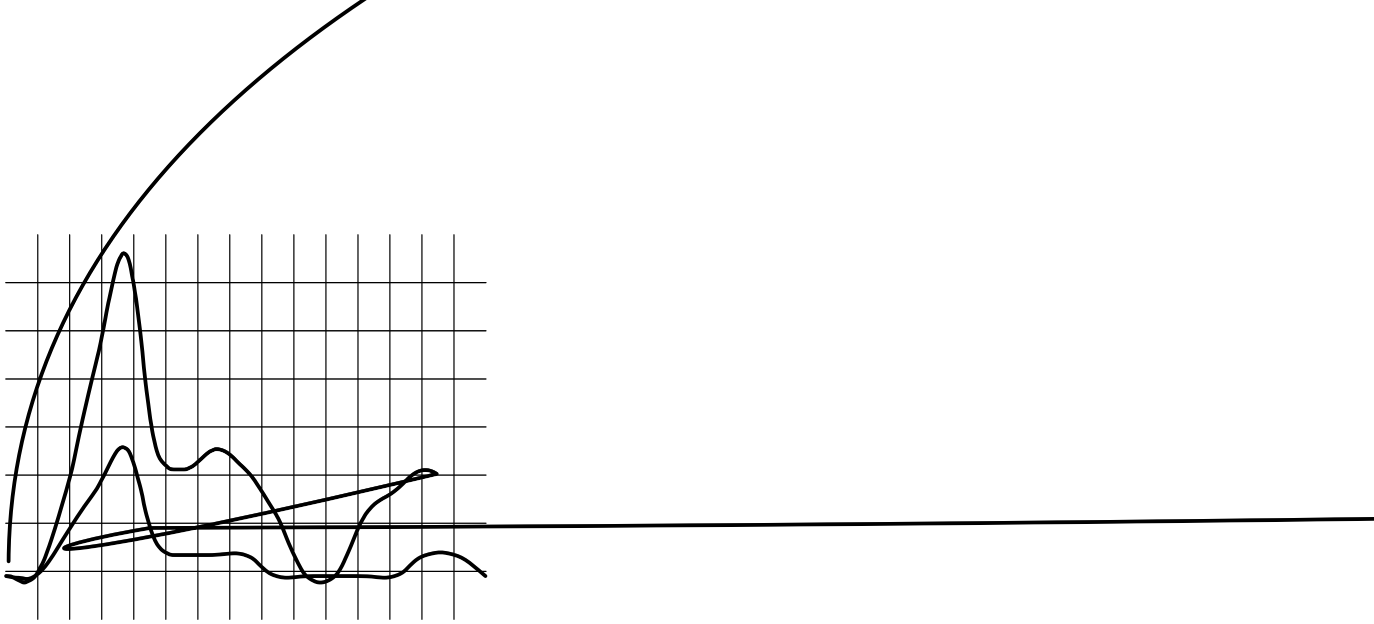
1	PWM_OUT1	Digital Output, Open-Drain. Pulse width modulated output to control fan speed. Requires pullup resistor (10 kΩ typical).
2	TACH1/AIN1	Digital/Analog Input. Fan tachometer input to measure FAN1 fan speed. Can be reprogrammed as an analog input to measure speed of a 2-wire fan via a sense resistor (2 Ω typical).
3	PWM_OUT2	Digital Output, Open-Drain. Pulse width modulated output to control FAN2 fan speed. Requires pullup resistor (10 kΩ typical).
4	TACH2/AIN2	Digital/Analog Input. Fan tachometer input to measure FAN2 fan speed. Can be reprogrammed as an analog input to measure speed of a 2-wire fan via a sense resistor (2 Ω typical).
5	GND	System Ground.
6	VCC	Power. Can be powered by 3.3 V standby power if monitoring in low power states is required.
7	$\overline{\text{THERM}}$	Digital I/O, Open-Drain. An active low thermal overload output that indicates a violation of a temperature set point (overtemperature). Also acts as an input to provide external fan control. When this pin is pulled low by an external signal, a status bit is set, and the fan speed is set to full-on. Requires pullup resistor (10 kΩ).
8	$\overline{\text{FAN\_FAULT}}$	Digital Output, Open-Drain. Can be used to signal a fan fault. Drives second fan to full speed if one fan fails. Requires pullup resistor (typically 10 kΩ).
9	D1–	Analog Input. Connected to cathode of first remote temperature-sensing diode. The temperature-sensing element is either a Pentium III substrate transistor or a general-purpose 2N3904.
10	D1+	Analog Input. Connected to anode of first remote temperature-sensing diode.
11	D2–	Analog Input. Connected to cathode of second remote temperature-sensing diode.
12	D2+	Analog Input. Connected to anode of second remote temperature-sensing diode.
13	ADD	Three-State Logic Input. Sets two lower bits of device SMBus address.
14	$\overline{\text{INT}}$(SMBALERT)	Digital Output, Open-Drain. Can be programmed as an interrupt (SMBus $\overline{\text{ALERT}}$) output for temperature/fan speed interrupts. Requires pullup resistor (10 kΩ typical).
15	SDA	Digital I/O, Serial Bus Bidirectional Data. Open-drain output. Requires pullup resistor (2.2 kΩ typical).
16	SCL	Digital Input, Serial Bus Clock. Requires pullup resistor (2.2 kΩ typical).

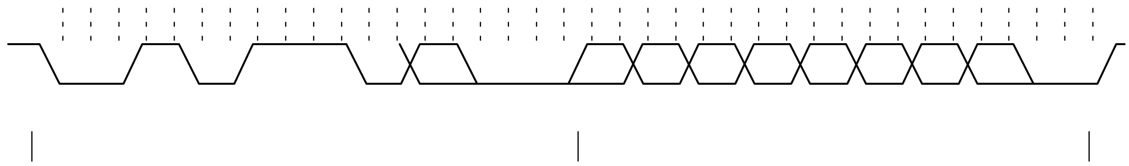
(T_A = T_{MIN} to T_{MAX}, V_{CC} = V_{MIN} to V_{MAX}, unless otherwise noted.) (Note 1)

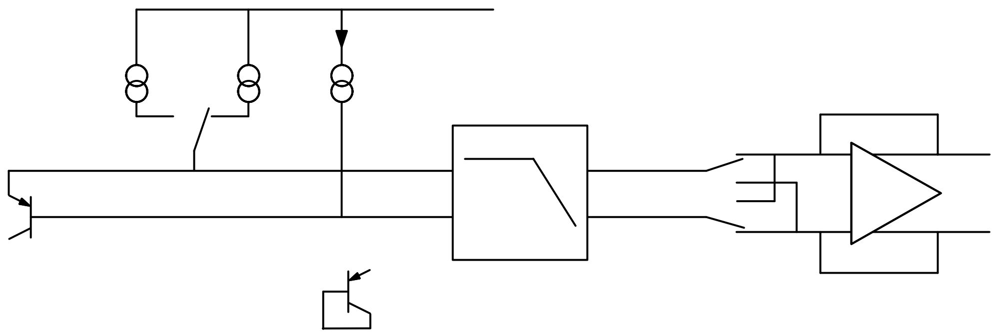
Supply Voltage, V_{CC}		3.0	3.3	3.6	V
Supply Current, I_{CC}	Interface inactive, ADC active Standby mode	– –	1.4 32	3.0 50	mA μA
Local Sensor Accuracy		–	1.0	3.0	C
Resolution		–	0.25	–	C
Remote Diode1 Sensor Accuracy	60 C T_D 100 C	–	0.5	1.0	C
Remote Diode2 Sensor Accuracy	60 C T_D 100 C	–	0.5	1.75	C
Resolution		–	0.125	–	C
Remote Sensor Source Current	High level Low level	– –	180 11	– –	μA
Output Low Voltage, V_{OL}	I_{OUT} = –6.0 mA; V_{CC} = 3.0 V	–	–	0.4	V
High-Level Output Leakage Current, I_{OH}	V_{OUT} = V_{CC}; V_{CC} = 3.0 V	–	0.1	1.0	μA

(T_A = T_{MIN} to T_{MAX}, V_{CC} = V_{MIN} to V_{MAX}, unless otherwise noted.) (Note 1)

Output Low Voltage, V_{OL}	I_{OUT} = –6.0 mA; V_{CC} = 3.0 V	–	–	0.4	V







Δ

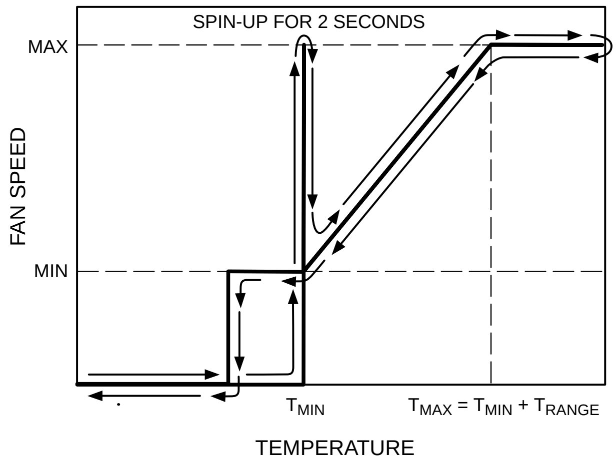
Δ

μ

μ

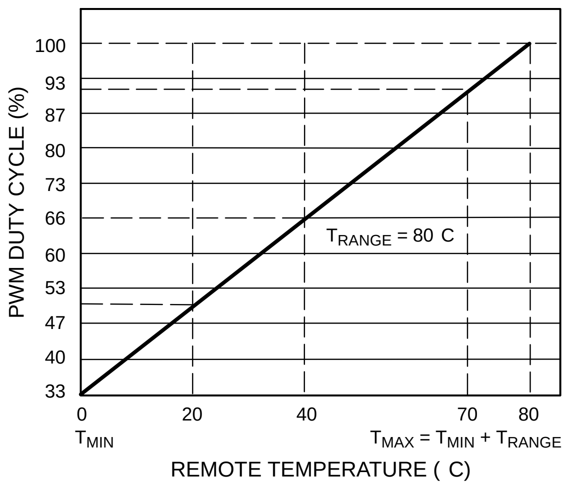
μ

μ



SPIN-UP FOR 2 SECONDS
MAX
MIN
FAN SPEED
TMIN
TMAX = TMIN + TRANGE
TEMPERATURE

000	200 ms
001	400 ms
010	600 ms
011	800 ms
100	1 sec
101	2 sec (Default)
110	4 sec
111	8 sec



PWM DUTY CYCLE (%)
100
93
87
80
73
66
60
53
47
40
33
TRANGE = 80 C
0
20
40
70
80
TMIN
TMAX = TMIN + TRANGE
REMOTE TEMPERATURE (C)

$$T_{MAX} = T_{MIN} + ((\text{Max DC} - \text{Min DC}) \times T_{RANGE}/10)$$
$$T_{MAX} = 0 + ((100\%\ \text{DC} - 53\%\ \text{DC}) \times 40/10) \quad \text{(eq. 3)}$$
$$T_{MAX} = 0 + ((15 - 8) \times 4) = 28$$

o

T_{MIN}
Min DC

$$T_{MAX} = T_{MIN} + ((\text{Max DC} - \text{Min DC}) \times T_{RANGE}/10)$$
$$T_{MAX} = 0 + ((100\%\ \text{DC} - 73\%\ \text{DC}) \times 40/10) \quad \text{(eq. 4)}$$
$$T_{MAX} = 0 + ((15 - 11) \times 4) = 16$$

o

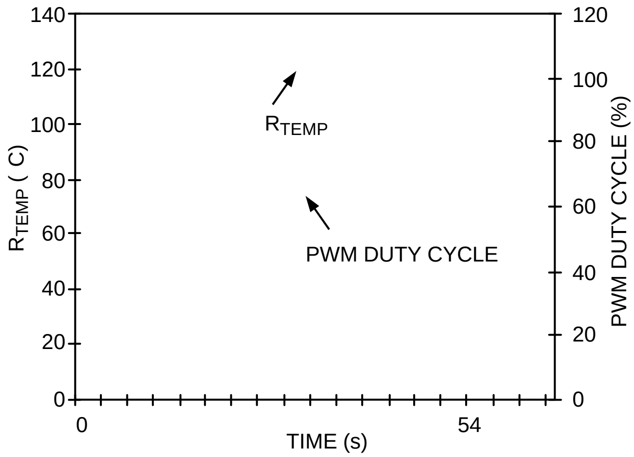
T_{MIN}
Min DC

$$T_{MAX} = T_{MIN} + ((\text{Max DC} - \text{Min DC}) \times T_{RANGE}/10)$$
$$T_{MAX} = 0 + ((100\%\ \text{DC} - 33\%\ \text{DC}) \times 40/10) \quad \text{(eq. 5)}$$
$$T_{MAX} = 0 + ((15 - 5) \times 4) = 40$$

o

$$T_{MAX} = T_{MIN} + ((\text{Max DC} - \text{Min DC}) \times T_{RANGE}/10)$$
$$T_{MAX} = T_{MIN} + ((15 - 5) \times T_{RANGE}/10)$$
$$T_{MAX} = T_{MIN} + (10 \times T_{RANGE}/10) \quad \text{(eq. 6)}$$
$$= \quad +$$

×


140
120
100
80
60
40
20
0
R_TEMP (C)
R_TEMP
PWM DUTY CYCLE
0
54
TIME (s)
120
100
80
60
40
20
0
PWM DUTY CYCLE (%)

$$Count = (f \times 60)/R \times N \quad \text{(eq. 7)}$$

f
R
N

$$Count = (f \times 60)/R \times N$$
$$R = (f \times 60)/Count \times N$$
$$R = (11250 \times 60)/255 \times 2 \quad \text{(eq. 8)}$$
$$R = (675000)/510$$
$$R = 1324 \text{ RPM, fan fail detect speed.}$$

$$Count = (f \times 60)/R \times N \quad \text{(eq. 9)}$$

f
R
N

$$\text{Fan RPM} = (f \times 60)/\text{Count} \times N \qquad \text{(eq. 14)}$$

$$\text{Fan RPM} = (f \times 60)/(\text{Count} \times N \times 1.5) \qquad \text{(eq. 15)}$$

$$\text{Fan RPM} = (f \times 60)/(\text{Count} \times N \times 2) \qquad \text{(eq. 16)}$$

Value Registers	0x08–0x1E	See Table 17.
Device ID Register	0x3D	This location contains the device identification number. Since this device is the ADM1031, this register contains 0x31. This register is read only.
Company ID $\overline{\text{THERM}}$	0x3E	This location contains the company identification number (0x41). This register is read only.
Behavior/Revision	0x3F	This location contains the revision number of the device. The lower four bits reflect device revisions [3:0]. Bit 7 of this register is the $\overline{\text{THERM}}$-to-fan enable bit. See Table 30.
Configuration Register 1	0x00	See Table 18. (Power-On Value = 1001 0000)
Configuration Register 2	0x01	See Table 19. (Power-On Value = 0111 1111)

		—	
0	MONITOR	R/W	Setting this bit to a “1” enables monitoring of temperature and enables measurement of the fan tach signals. (Powerup Default = 0)
1	$\overline{\text{INT}}$ Enable	R/W	Setting this bit to a “1” enables the $\overline{\text{INT}}$ output. 1 = Enabled 0 = Disabled (Powerup Default = 0)
2	TACH/AIN	R/W	Clearing this bit to “0” selects digital fan speed measurement via the TACH pins. Setting this bit to “1” configures the TACH pins as analog inputs that can measure the speed of 2-wire fans via a sense resistor. (Powerup Default = 0)
3	PWM Invert	R/W	Setting this bit to “1” inverts the PWM signal on the output pins. (Powerup Default = 0)
4	$\overline{\text{FAN\_FAULT}}$ Enable	R/W	Logic 1 enables $\overline{\text{FAN\_FAULT}}$ pin; Logic 0 disables $\overline{\text{FAN\_FAULT}}$ output. (Powerup Default = 1)
6–5	PWM Mode	R/W	These two bits control the behavior of the fans in auto fan speed control mode. 00 = Remote Temp 1 controls Fan 1; Remote Temp 2 controls Fan 2. 01 = Remote Temp 1 controls Fan 1 and Fan 2. 10 = Remote Temp 2 controls Fan 1 and Fan 2. 11 = Max of Local Temp and Remote Temp 1 and 2 drives Fans 1 and 2. These two bits have the following effect in software control mode. 00 = Program PWM duty cycles for Fans 1 and 2. 11 = Program RPM Speeds for Fans 1 and 2.
7	Auto/SW Ctrl	R/W	Logic 1 selects automatic fan speed control; Logic 0 selects SW control. (Powerup Default = 1). When under software control, PWM duty cycle or RPM values can be programmed for each fan.

		—	
0	PWM 1 En	R/W	Enables Fan 1 PWM output when this bit is a “1.”
1	PWM 2 En	R/W	Enables Fan 2 PWM output when this bit is a “1.”
2	TACH 1 En	R/W	Enables Tach 1 input when set to “1.”
3	TACH 2 En	R/W	Enables Tach 2 input when set to “1.”
4	Loc Temp En	R/W	Enables Interrupts on local temperature channel when set to “1.”
5	Remote 1 Temp En	R/W	Interrupts on Remote 1 Channel when set to “1.” Default is normally enabled, except when a diode fault is detected on powerup.
6	Remote 2 Temp En	R/W	Enables Interrupts on Remote 2 Channel when set to “1.” Default is normally enabled, except when a diode fault is detected on powerup.
7	SW Reset	R/W	When set to “1,” resets the device. Self-clears. Powerup Default = 0.

0	Alarm 1 Speed	R	This bit is set to “1” when fan is running at alarm speed. Once read, this bit is not reasserted on next monitoring cycle, even if the fan is still running at alarm speed.
1	Fan 1 Fault	R	This bit is set to “1” if Fan 1 becomes stuck or is running under speed.
2	Remote 1 High	R	“1” indicates Remote 1 high temperature limit has been exceeded. If the temperature is still outside the Remote 1 Temp High Limit, this bit reasserts on next monitoring cycle.
3	Remote 1 Low	R	“1” indicates Remote 1 low temperature limit exceeded (below). If the temperature is still outside the Remote 1 Temp Low Limit, this bit reasserts on next monitoring cycle.
4	Remote 1 $\overline{\text{THERM}}$		

[redacted]

		—	
<2:0>	Fan 1 Spin-Up	R/W	These bits contain the fan spin-up time to allow Fan 1 to overcome its own inertia. 000 = 200 ms 001 = 400 ms 010 = 600 ms 011 = 800 ms 100 = 1 sec 101 = 2 sec (Default) 110 = 4 sec 111 = 8 sec
<5:3>	PWM 1 Frequency		

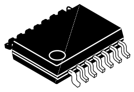
		—	
<7>	Spin-Up Disable	R/W	When set to 1, disables fan spin-up.
<6:5>	Ramp Rate	R/W	These bits set the ramp rate. (Default = 31 Hz) 00 = 1 01 = 2 10 = 4 (Default) 11 = 8
<4:2>			

<table>
<tr><td></td><td></td><td>—</td><td></td></tr>
<tr><td><7:3></td><td>Remote 1 Temp T_{MIN}</td><td>R/W</td><td>Contains the minimum temperature value for automatic fan speed control based on local temperature readings. T_{MIN} can be programmed to positive values only in 4 C increments. Default is 32 C.
00000 = 0 C
00001 = 4 C
00010 = 8 C
00011 = 12 C
|
|
01100 = 48 C
|
|
|
11110 = 120 C
11111 = 124 C</td></tr>
<tr><td><2:0></td><td>Remote 1 Temp T_{RANGE}</td><td>R/W</td><td>This nibble contains the temperature range value for automatic fan speed control based on the Remote 1 Temp Readings.
000 = 5 C
001 = 10 C (Default)
010 = 20 C
011 = 40 C
100 = 80 C</td></tr>
</table>

<table>
<tr><td></td><td></td><td>—</td><td></td></tr>
<tr><td><7:3></td><td>Remote 2 Temp T_{MIN}</td><td>R/W</td><td>Contains the minimum temperature value for automatic fan speed control based on Remote 2 Temperature Readings. T_{MIN} can be programmed to positive values only in 4 C increments. Default is 32 C.
00000 = 0 C
00001 = 4 C
00010 = 8 C
00011 = 12 C
|
|
01100 = 48 C (Default)
|
|
11110 = 120 C
11111 = 124 C</td></tr>
<tr><td><2:0></td><td>Remote 2 Temp T_{RANGE}</td><td>R/W</td><td>This nibble contains the temperature range value for automatic fan speed control based on the Remote 2 Temp Readings.
000 = 5 C
001 = 10 C (Default)
010 = 20 C
011 = 40 C
100 = 80 C</td></tr>
</table>

$\overline{\text{THERM}}$

<table>
<tr><td></td><td></td><td>—</td><td></td></tr>
<tr><td><7></td><td>$\overline{\text{THERM}}$-to-Fan En</td><td>R/W</td><td>Setting this bit to 1, enables the fan to run full-speed when $\overline{\text{THERM}}$ is asserted low. This allows the system to be run in performance mode. Clearing this bit to 0 disables the fan from running full-speed whenever $\overline{\text{THERM}}$ is asserted low. This allows the system to run in silent mode. (Power-On Default = 1).</td></tr>
<tr><td><3:0></td><td>Revision</td><td>R</td><td>This nibble contains the revision number for the ADM1031.</td></tr>
</table>

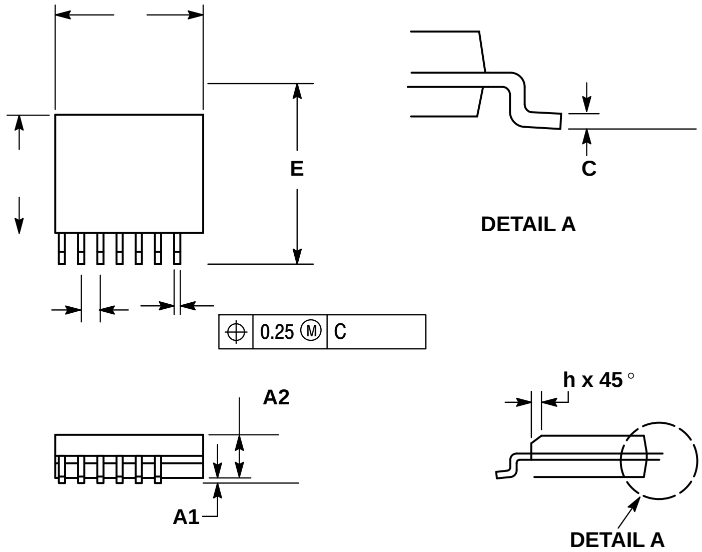


SCALE 2:1

QSOP16
CASE 492−01
ISSUE A

DATE 23 MAR 2011

NOTES:



	INCHES		
DIM	MIN	MA	
A	0.053	0.069	
A1	0.004	0.010	
	0.008	0.012	
ı	0.007	0.010	
	0.025 BSC		
	0.009	0.020	
L	0.016	0.050	
M	0	8	