Standard Products

ACT4438 Transceiver

for MIL-STD-1553 / 1760 in a Chipscale Package

www.aeroflex.com/AVIONICS

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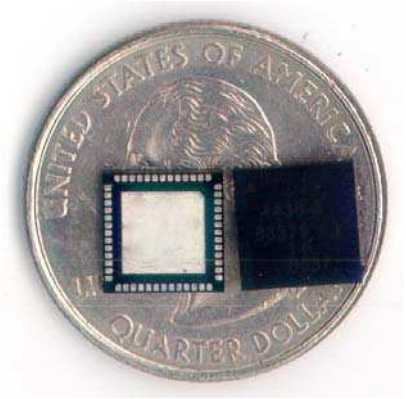
FEATURES

- Transceiver meets MIL-STD-1553 and MIL-STD-1760
- Low power dissipation at full output power
- Single +5V power supply
- Receiver threshold control
- Current Source Transmitter Output
- Bipolar Monolithic Construction
- Aeroflex is a Class H & K MIL-PRF-38534 Manufacturer
- Designed for commercial, industrial and aerospace applications
- Integral heat sink
- Miniature Chipscale Package: QFN, Epad, 52 lead, 8 x 8 mm
  Weight: 0.2g



GENERAL DESCRIPTION

The Aeroflex Plainview Model ACT4438 is a next generation monolithic transceiver which provide full compliance with MIL-STD-1553/1760 and data bus requirements in a 52-lead Epad 8 x 8 mm QFN with the lowest standby power consumption and single power supply operation.

The Model ACT4438 performs the front-end analog function of inputting and outputting data through a transformer to a MIL-STD-1553/1760 data bus with a few external components.

Design of these transceivers reflects particular attention to active filter performance. This results in low bit and word error rate with superior waveform purity and minimal zero crossover distortion. Efficient transmitter electrical and thermal design provides low internal power dissipation and heat rise at high as well as low duty cycles.

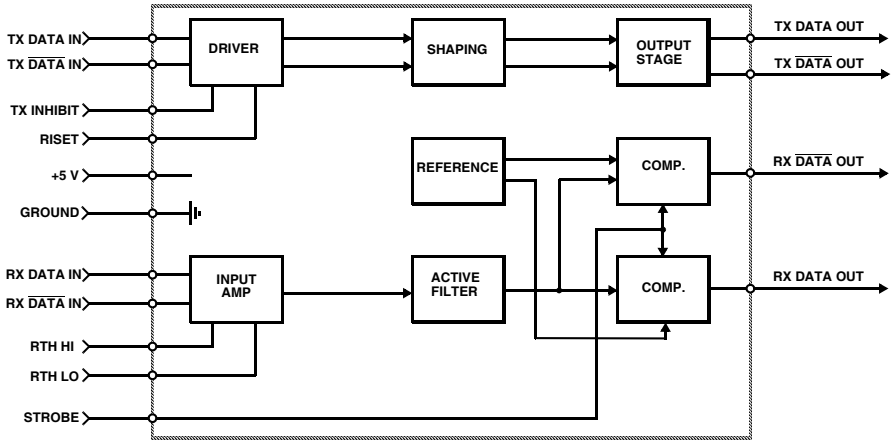
TRANSMITTER

The Transmitter section accepts bi-phase TTL data at the input and when coupled to the data bus with a 1:2.5 transformer, isolated on the data bus side with two 55 Ohm fault isolation resistors for direct stub coupling. The data bus signal produced for RISET = 2.7K Ohm is typically 7.5 Volts nominal P-P at A-A', See Figure 5. When both DATA and $\overline{\text{DATA}}$ inputs are held low, the transmitter output becomes a high impedance and is "removed" from the line. In addition, an overriding "INHIBIT" input provides for the removal of the transmitter output from the line. A logic "1" applied to the "INHIBIT" takes priority over the condition of the data inputs and disables the transmitter (See Transmitter Logic Waveform, Figure 1).

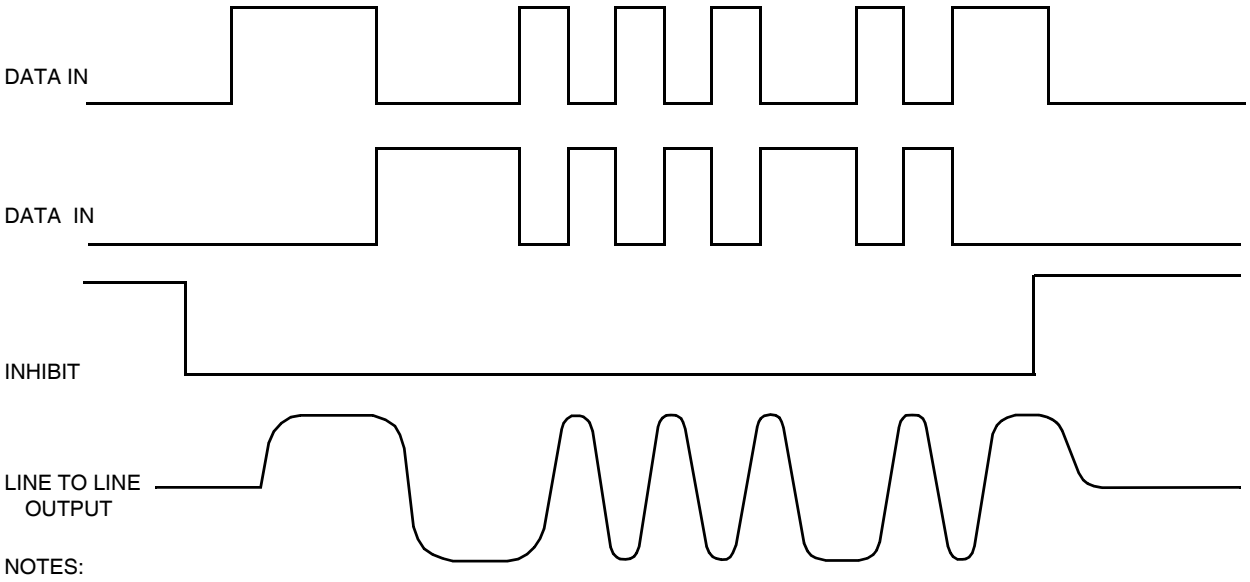
The transceiver utilizes an active filter to suppress harmonics above 1MHz. The Transmitter may be safely operated at 100% duty cycle for an indefinite period into a short circuited 1553 bus.

RECEIVER

The Receiver section accepts bi-phase differential data at the input and produces two TTL signals at the output. The outputs are DATA and $\overline{\text{DATA}}$, and represent positive and negative excursions of the input beyond a pre-determined threshold (See Receiver Logic Waveform, Figure 2). The externally set (R_{TH}) thresholds will detect data bus signals exceeding 1.150 Volts P-P and reject signals less than 0.6 volts P-P when used with a 1:2.5 turns ratio transformer. (See Figure 5 for transformer data and typical connection).



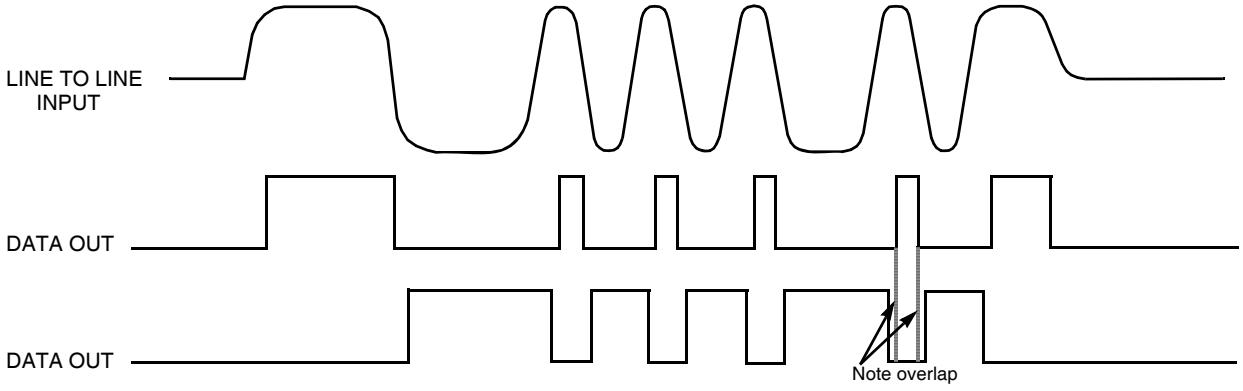
BLOCK DIAGRAM (WITHOUT TRANSFORMER)



NOTES:

1. DATA and $\overline{\text{DATA}}$ inputs must be complementary waveforms or 50% duty cycle average, with no delays between them.
2. DATA and $\overline{\text{DATA}}$ must be in the same state during off time (both high or low).

FIGURE 1 – TRANSMITTER LOGIC WAVEFORMS



NOTE: Waveforms shown are for normally low devices.

FIGURE 2 – RECEIVER LOGIC WAVEFORMS

ABSOLUTE MAXIMUM RATINGS

Operating Case Temperature	-40°C to +85°C
Storage Case Temperature	-65°C to +150°C
Maximum Die Junction Temperature	+125°C
Positive Power Supply Voltage	-0.3 V to +7.0 V
Receiver Differential Input	±10 V
Receiver Input Voltage (Common Mode)	±5 V
Driver Peak Output Current	650 mA
Total Package Power Dissipation over the full operating case temperature rise at 100% duty cycle	2.2 Watt
$Ø_{JC}$	1°C/W
$Ø_{JA}$	33°C/W
Maximum Junction Temperature Rise over Case (Junction to Case)	2.2°C
Maximum Junction Temperature Rise over Ambient (Junction to Ambient)	72.6°C

ELECTRICAL CHARACTERISTICS – DRIVER SECTION
INPUT CHARACTERISTICS, TX DATA IN OR TX $\overline{\text{DATA}}$ IN

Parameter	Condition	Symbol	Min	Typ	Max	Unit
"0" Input Current	V_{IN} = 0.4V	I_{ILD}	-	-0.2	-0.4	mA
"1" Input Current	V_{IN} = 2.7V	I_{IHD}	-	1	40	µA
"0" Input Voltage		V_{ILD}	-	-	0.7	V
"1" Input Voltage		V_{IHD}	2.0	-	-	V

INHIBIT CHARACTERISTICS

"0" Input Current	V_{IN} = 0.4V	I_{ILI}	-	-0.2	-0.4	mA
"1" Input Current	V_{IN} = 2.7V	I_{IHI}	-	1.0	40	µA
"0" Input Voltage		V_{ILI}	-	-	0.7	V
"1" Input Voltage		V_{IHI}	2	-	-	V
Delay from TX inhibit, (0→1) to inhibited output		t_{DXOFF}	-	150	300	nS
Delay from TX inhibit, (1→0) to active output		t_{DXON}	-	150	300	nS
Differential Output Noise, inhibit mode		V_{NOI}	-	2	10	mV p-p
Differential Output Impedance (inhibited)	Note 1	Z_{OI}	2K	-	-	Ω

OUTPUT CHARACTERISTICS

Differential output level at point A-A' on Figure 5	Z_O = 78Ω	V_O	6.5	7.5	9.0	V p-p
Rise and Fall Times at point A-A' on Figure 5 (10% to 90% of p-p output)		t_r	100	200	300	nS
Output Offset at point A-A' on Figure 5, 2.5 µS after midpoint crossing of the parity bit of the last word of a 660 µS message	Z_O = 78Ω	V_{OS}	-	-	±90	mV peak
Delay from 50% point of TX DATA or TX $\overline{\text{DATA}}$ input to zero crossing of differential signal		t_{DTX}	-	100	300	nS

Note 1. Power ON/OFF, measured from 75KHz to 1MHz at Point A-A. See Figure 5.

ELECTRICAL CHARACTERISTICS – RECEIVER SECTION

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Differential Voltage Range		V_{IDR}	-	-	20	V peak
Common Mode Rejection Ratio		CMRR	45	-	-	dB

STROBE CHARACTERISTICS (LOGIC "0" INHIBITS OUTPUT) If not used, a 1K pullup to 5V is recommended

"0" Input Current	V_S = 0.4V	I_{IL}	-	-0.2	-0.4	mA
"1" Input Current	V_S = 2.7V	I_{IH}	-	1	+40	µA
"0" Input Voltage		V_{IL}	-	-	0.7	V
"1" Input Voltage		V_{IH}	2.0	-	-	V
Strobe Delay (turn-on)		$t_{SD(ON)}$	-	90	200	nS
Strobe Delay (turn-off)		$t_{SD(OFF)}$	-	90	200	nS

THRESHOLD CHARACTERISTICS (SINEWAVE INPUT)

Input Threshold Voltage (Referred to the bus)	100KHz-1MHz	V_{TH}	0.60	0.8	1.15	V p-p

OUTPUT CHARACTERISTICS, RX DATA AND RX $\overline{\text{DATA}}$

"1" State	I_{OH} = -0.4mA	V_{OH}	2.5	3.7	-	V
"0" State	I_{OL} = 4mA	V_{OL}	-	0.3	0.5	V
Delay, (average)from differential input zero crossings to RX DATA and RX $\overline{\text{DATA}}$ output 50% points		t_{DRX}	-	330	450	nS

POWER DATA

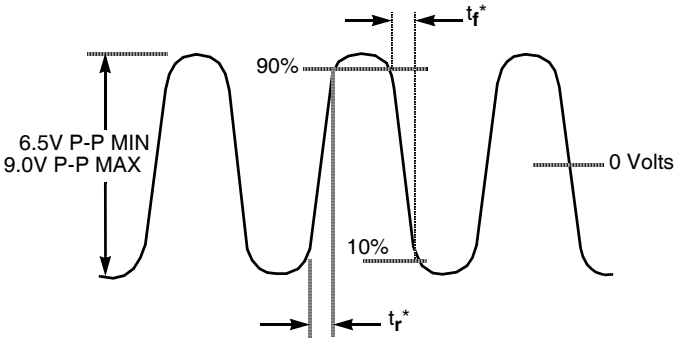
MAXIMUM CURRENTS, (+5V) For RISET = 2.7KΩ

Duty Cycle	Typ	Max
Transmitter Standby	20 mA	30 mA
25% duty cycle	155 mA	185 mA
50% duty cycle	264 mA	335 mA
100% duty cycle	600 mA	650 mA

POWER SUPPLY VOLTAGE

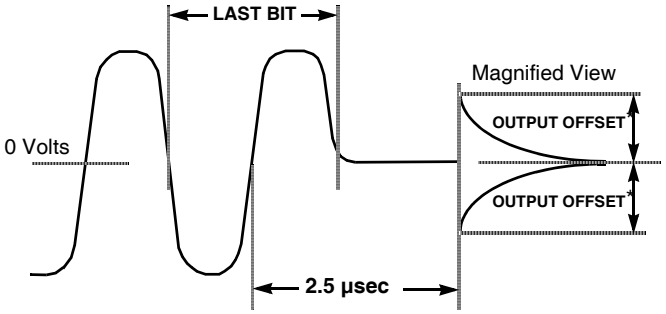
+V	4.75 to 5.5 Volts

Note 2. +V = 5 Volts ±0.1 V, for all measurements unless otherwise specified.
Note 3. Specifications apply over the case temperature range of -40°C to +85°C unless otherwise specfied.
Note 4. All typical values are measured at +25°C.



* Rise and fall times measured at point A-A' in Fig 5

FIGURE 3 – TRANSMITTER (TX) OUTPUT WAVEFORM



*Offset measured at point A-A' in Fig 5

FIGURE 4 – TRANSMITTER (TX) OUTPUT OFFSET

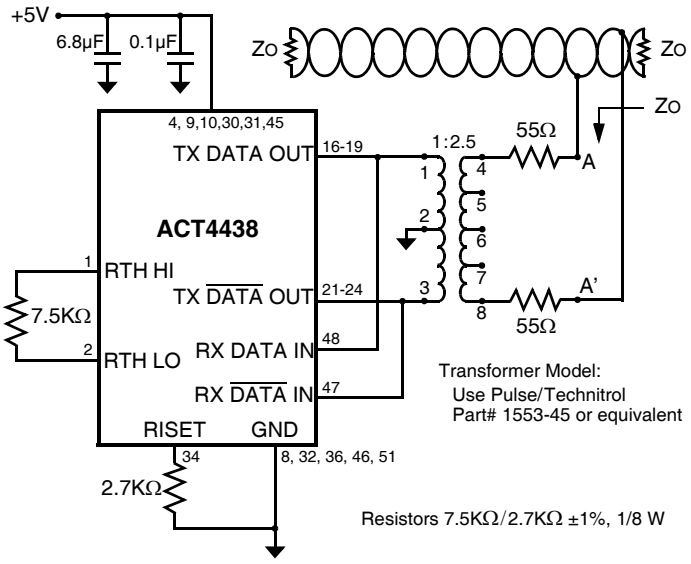
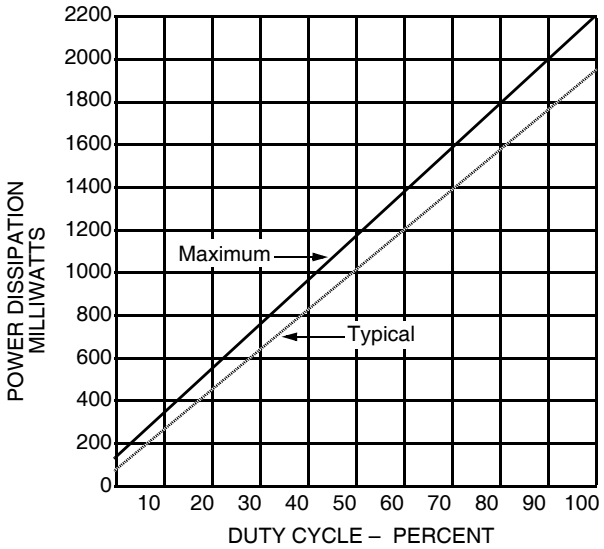


FIGURE 5 – TYPICAL TRANSFORMER CONNECTION DIRECT STUB



Note: Vcc = 5 Volts, V_{bus} (pt A-A') at 7.5 Volts P-P, Z_O = 78Ω

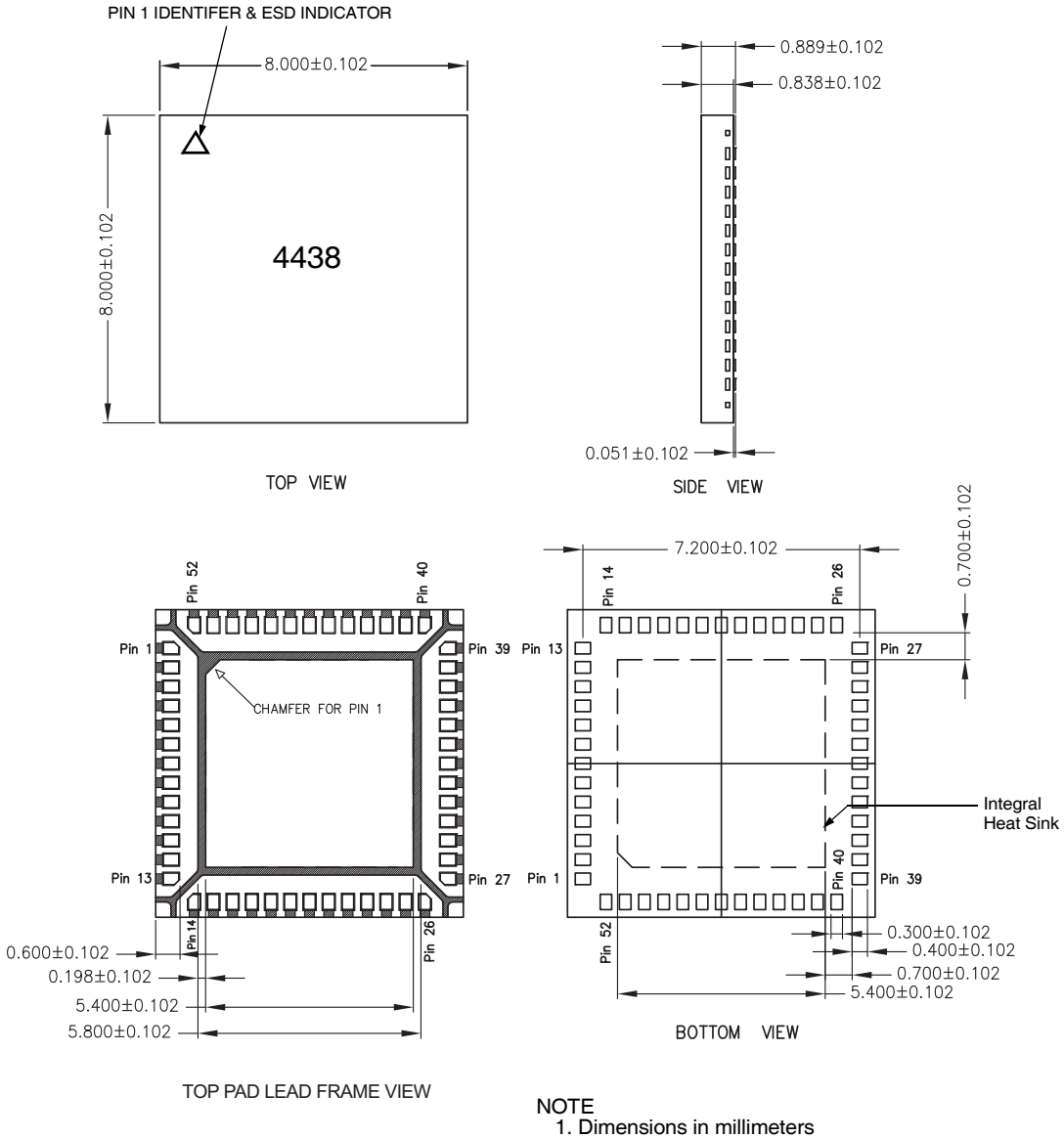
FIGURE 6 – POWER DISSIPATION VS. DUTY CYCLE

PACKAGE PIN OUT DESCRIPTION - ACT4438

Pin #	Function	Pin #	Function	Pin #	Function	Pin #	Function	Pin #	Function
1	RTH HI	12	NC	23	TX $\overline{\text{DATA}}$ OUT *	34	RISET	45	VCC
2	RTH LO	13	NC	24	TX $\overline{\text{DATA}}$ OUT *	35	NC	46	GND
3	NC	14	NC	25	NC	36	GND	47	RX $\overline{\text{DATA}}$ IN
4	VCC	15	NC	26	NC	37	RX $\overline{\text{DATA}}$ OUT	48	RX DATA IN
5	TX DATA IN	16	TX DATA OUT *	27	NC	38	RX STROBE	49	NC
6	TX $\overline{\text{DATA}}$ IN	17	TX DATA OUT *	28	NC	39	RX DATA OUT	50	NC
7	TX INHIBIT IN	18	TX DATA OUT *	29	NC	40	NC	51	GND
8	GND	19	TX DATA OUT *	30	VCC *	41	NC	52	NC
9	VCC *	20	NC	31	VCC *	42	NC		
10	VCC *	21	TX $\overline{\text{DATA}}$ OUT *	32	GND	43	NC		
11	NC	22	TX $\overline{\text{DATA}}$ OUT *	33	NC	44	NC		

* High current lines

PACKAGE DESCRIPTION



NOTE
1. Dimensions in millimeters

CONFIGURATIONS AND ORDERING INFORMATION

Model No.	Screening Level	Receiver and Transmitter Data Levels (See Figure 1)	Case
ACT4438-3	Industrial Temperature -40°C to +85°C	Normally Low	Epad, 52 lead, 8 x 8 mm, QFN

THE FOLLOWING ARE SOME GUIDELINES FOR THE BOARD LAYOUT OF THE ACT4438

The ACT4438 is a fairly high current device with power supply input currents about 600ma and transmitter output currents in the 500ma region. Therefore, referring to Figure 5 of the data sheet;

1. The 5V power input lands, pins 9, 10, 30 and 31, should be as wide as possible if they are significantly far away from the power source. If you have to via up from below use multiple vias to minimize via interconnect resistance. The land resistance should be made as small as possible so that there will not be a signifcant voltage drop.
2. The transmitter output, pins 16-19 and 21-24 that go to the transformer primary, should run directly to the transformer, do not use vias to connect. They also should be symmetrical and be as wide as possible to minimize trace resistance. The center-tap of the primary transformer will also carry the transmitter output currents and should run directly to a ground plane using multiple vias to minimize the via interconnect resistance.
3. The transmitter output voltage level is set by the 2.7K resistor connected to pin 34. This is a very sensitive node. Therefore keep this node as short as possible and do not allow any other signal trace to cross under it.
4. In general keep output lines away from input lines such as the receiver output lines pins 47 and 48, which have high level (0V to 4V) fast switching edges.
5. The Receiver threshold level set by the 7.5K resistor connected to pins 1 and 2 are also sensitive nodes and should also be kept as short as possible without allowing any other signal trace to cross under them.
6. This package has a heatsink on the bottom side which is on the same plane as the package pins. This heatsink should also be soldered reflowed to a pad, the same size as the heatsink, which contains multiple vias connecting the heatsink pad to a ground plane layer. This will remove heat from the die and fan it out across the ground plane.

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