EC1089

InGaP HBT Gain Block

The Communications Edge ™

Product Information

Product Features

- 10 – 2500 MHz
- +24 dBm P1dB
- +41 dBm OIP3
- 15.5 dB Gain at 900 MHz
- 12.2 dB Gain at 1900 MHz
- Available in SOT-89 and lead-free / green SOT-89 Package Styles
- Internally matched to 50 Ω

Applications

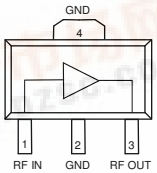
- Mobile Infrastructure
- Final stage amplifiers for Repeaters
- Defense / Homeland Security

Product Description

The EC1089 is a high dynamic range driver amplifier in a low-cost surface mount package. The InGaP/GaAs HBT is able to achieve high performance across a broad range with +41 dBm OIP3 and +24 dBm of compressed 1dB power. It is housed in an industry standard SOT-89 SMT package. The EC1089 is also available in a lead-free/green/RoHS-compliant SOT-89 package. All devices are 100% RF and DC tested.

The EC1089 is targeted for use as a driver amplifier in wireless infrastructure where high linearity and medium power is required. An internal active bias allows the EC1089 to maintain high linearity over temperature and operate directly off a single +5 V supply. This combination makes the device an excellent candidate for transceiver line cards in current and next generation multi-carrier 3G base stations.

Functional Diagram



EC1089B / EC1089B-G

Specifications (1)

Parameters	Units	Min	Typ	Max
Operational Bandwidth	MHz	10		2500
Test Frequency	MHz		1900	
Gain	dB	10.5	12.2	
Input Return Loss	dB		15	
Output Return Loss	dB		10	
Output P1dB	dBm		+23.5	
Output IP3 (2)	dBm	+40	+41	
IS-95A Channel Power @ -45 dBc ACPR	dBm		+17	
Noise Figure	dB		5.9	
Test Frequency	MHz		2140	
Gain	dB		11.5	
Output P1dB	dBm		+23.5	
Output IP3 (2)	dBm		+40	
Operating Current Range	mA	140	160	175
Device Voltage	V		+5	

1. Test conditions unless otherwise noted: 25° C, Supply Voltage = +5 V, , in tuned application circuit.
2. 3OIP measured with two tones at an output power of +11 dBm/tone separated by 1 MHz. The suppression on the largest IM3 product is used to calculate the 3OIP using a 2:1 rule.

Typical Performance (3)

Parameters	Units	Typical		
Frequency	MHz	900	1900	2140
S21 - Gain	dB	15.5	12.2	11.5
S11 - Input R.L.	dB	-14	-15	-15
S22 - Output R.L.	dB	-10	-10	-10
Output P1dB	dBm	+24	+23.5	+23.5
Output IP3	dBm	+40	+41	+40
Noise Figure	dB	5.1	5.9	5.4
Supply Bias		+5 V @ 160 mA		

3. Typical parameters reflect performance in a tuned application circuit: Supply Voltage = +5 V, I = 160 mA, +25° C

Absolute Maximum Rating

Parameter	Rating
Operating Case Temperature	-40 to +85 °C
Storage Temperature	-65 to +150 °C
RF Input Power (continuous)	+18 dBm
Device Voltage	+6 V
Device Current	220 mA
Junction Temperature	+250 °C

Operation of this device above any of these parameters may cause permanent damage.

Ordering Information

Part No.	Description
EC1089B	InGaP HBT Gain Block (leaded SOT-89 Pkg)
EC1089B-G	InGaP HBT Gain Block (lead-free/green/RoHS-compliant SOT-89 Pkg)
EC1089B-PCB900	900 MHz Evaluation Board
EC1089B-PCB1900	1900 MHz Evaluation Board
EC1089B-PCB2140	2140 MHz Evaluation Board

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¼ Watt, High Linearity InGaP HBT Amplifier

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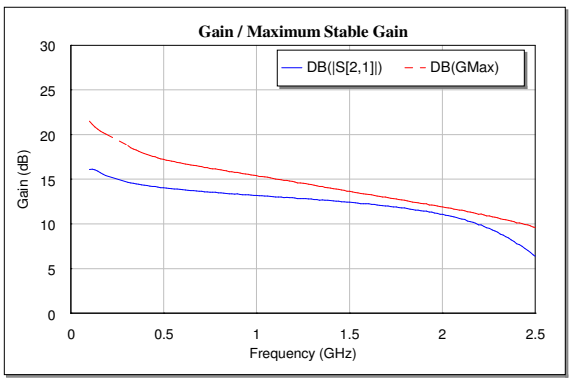
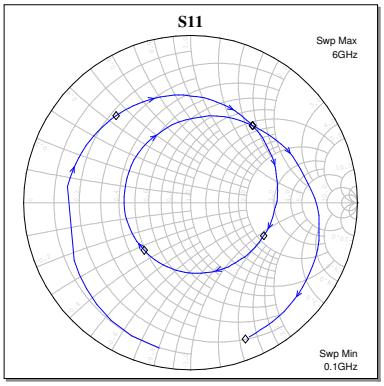
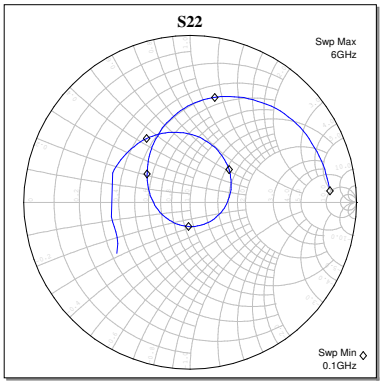
Product Information

Typical Device Data

S-Parameters (V_{DS} = +5 V, I_{cc} = 160 mA, T = 25°C, unmatched 50 ohm system)







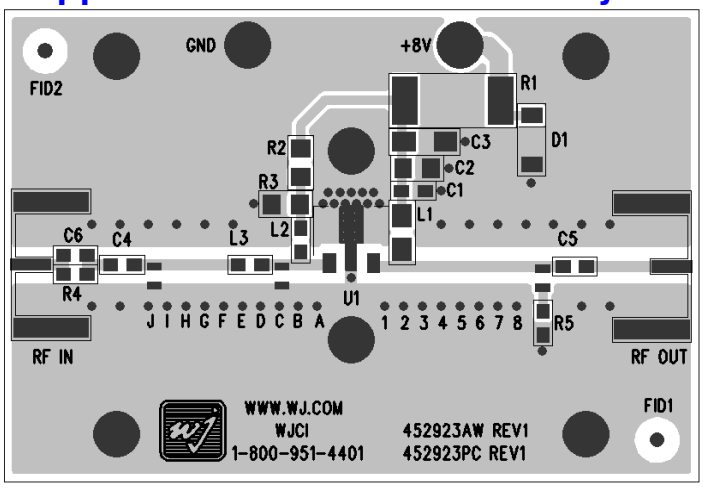
Notes:
The gain for the unmatched device in 50 ohm system is shown as the trace in black color. For a tuned circuit for a particular frequency, it is expected that actual gain will be higher, up to the maximum stable gain. The maximum stable gain is shown in the dashed red line. The return loss plots are shown from 50 – 3000 MHz, with markers placed at 0.5 – 3.0 GHz in 0.5 GHz increments.

S-Parameters (V_{DS} = +5 V, I_{DS} = 160 mA, T = 25°C, unmatched 50 ohm system, calibrated to device leads)

Freq (MHz)	S11 (dB)	S11 (ang)	S21 (dB)	S21 (ang)	S12 (dB)	S12 (ang)	S22 (dB)	S22 (ang)
50	-3.61	-169.14	23.08	149.67	-30.46	17.14	-7.74	-128.38
100	-3.31	-173.35	21.93	148.90	-29.57	14.05	-7.80	-143.29
200	-2.62	179.12	19.02	146.43	-27.97	9.40	-6.40	-169.43
400	-2.62	173.23	17.74	136.11	-27.96	10.86	-6.33	-179.95
600	-2.54	168.30	16.69	123.77	-27.96	10.86	-6.09	173.78
800	-2.39	163.31	15.62	111.53	-27.96	10.62	-5.86	168.37
1000	-2.27	158.06	14.57	101.13	-26.02	9.88	-5.68	163.12
1200	-2.21	152.89	13.55	91.40	-26.02	8.87	-5.58	157.73
1400	-2.16	147.55	12.54	82.69	-26.02	7.57	-5.37	152.46
1600	-2.05	142.54	11.65	74.35	-26.02	5.95	-5.20	147.09
1800	-1.99	137.85	10.70	66.99	-25.08	4.22	-5.20	141.71
2000	-1.84	133.47	9.91	59.96	-24.44	2.37	-5.05	136.43
2200	-1.68	129.41	9.13	53.84	-24.44	0.24	-5.01	131.29
2400	-1.46	125.20	8.46	47.68	-24.44	-2.39	-4.89	126.16
2600	-1.33	120.48	7.85	41.30	-23.27	-5.53	-4.88	121.19
2800	-1.20	115.03	7.22	34.74	-23.10	-9.13	-4.73	116.28
3000	-1.17	109.05	6.62	27.78	-23.10	-12.86	-4.66	111.40

Device S-parameters are available for download off of the website at: http://www.wj.com

Application Circuit PC Board Layout



Circuit Board Material: .014" Getek, 4 layers (other layers added for rigidity), .062" total thickness, 1 oz copper
Microstrip line details: width = .026", spacing = .026"

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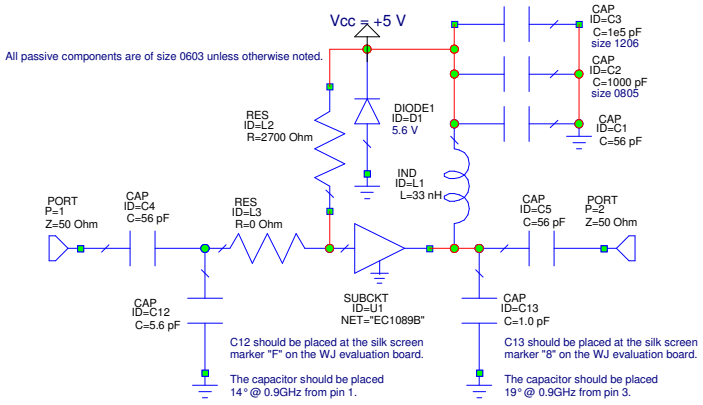
900 MHz Application Circuit (EC1089B-PCB900)

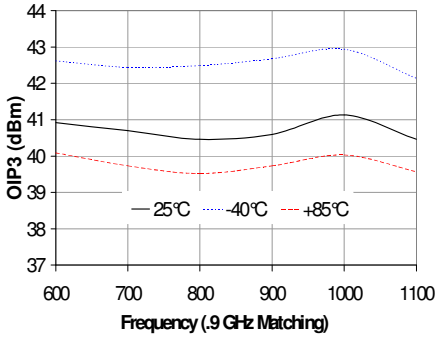
Typical RF Performance

Frequency	900 MHz
S21 – Gain	15.5 dB
S11 – Input Return Loss	-15dB
S22 – Output Return Loss	-10 dB
Output IP3 (+11 dBm / tone, 1 MHz spacing)	+40 dBm
Output P1dB	+24 dBm
Noise Figure	5.1 dB
Supply Voltage	+5 V
Supply Current	160 mA

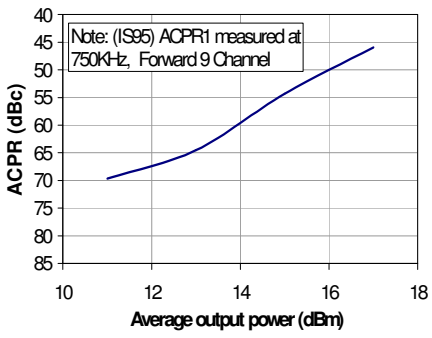
Measured parameters were taken at 25 °C.



OIP3 vs. Frequency



Average CDMA ACPR

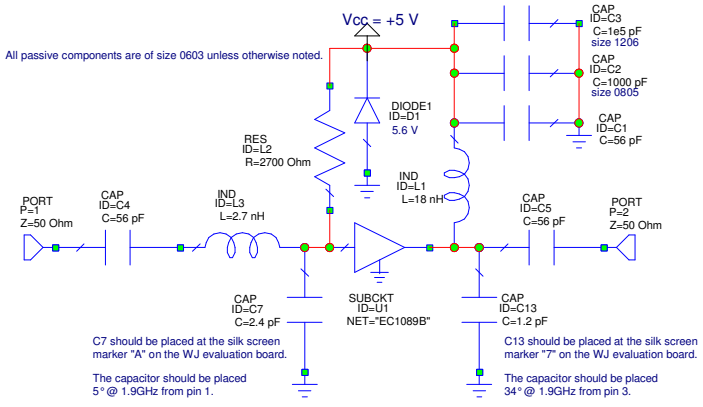


1900 MHz Application Circuit (EC1089B-PCB1900)

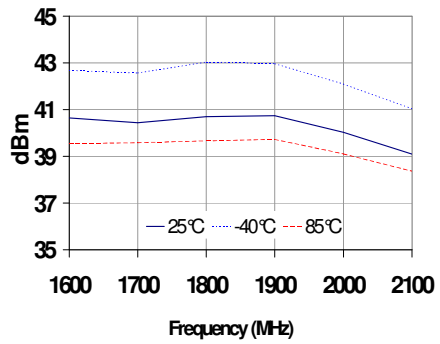
Typical RF Performance

Frequency	1900 MHz
S21 – Gain	12.2 dB
S11 – Input Return Loss	-15 dB
S22 – Output Return Loss	-10 dB
Output IP3 (+11 dBm / tone, 1 MHz spacing)	+41 dBm
Output P1dB	+23 dBm
Noise Figure	5.9 dB
Supply Voltage	+5 V
Supply Current	160 mA

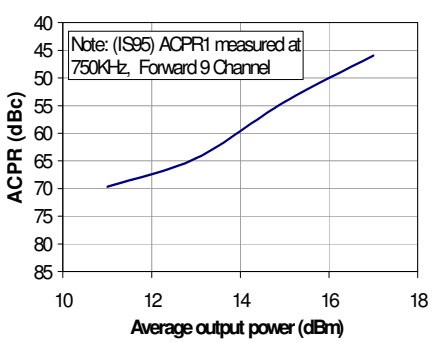
Measured parameters were taken at 25 °C.



OIP3 vs. Temperature vs. Frequency



Average CDMA ACPR

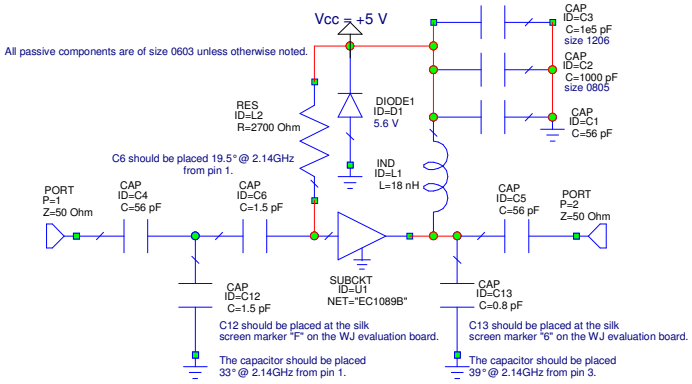


2140 MHz Application Circuit (EC1089B-PCB2140)

Typical RF Performance

Frequency	2140 MHz
S21 – Gain	11.5 dB
S11 – Input Return Loss	-15 dB
S22 – Output Return Loss	-10 dB
Output IP3 (+10 dBm / tone, 1 MHz spacing)	+40 dBm
Output P1dB	+23 dBm
Noise Figure	5.4 dB
Supply Voltage	+5 V
Supply Current	160 mA

Measured parameters were taken at 25 °C.



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¼ Watt, High Linearity InGaP HBT Amplifier

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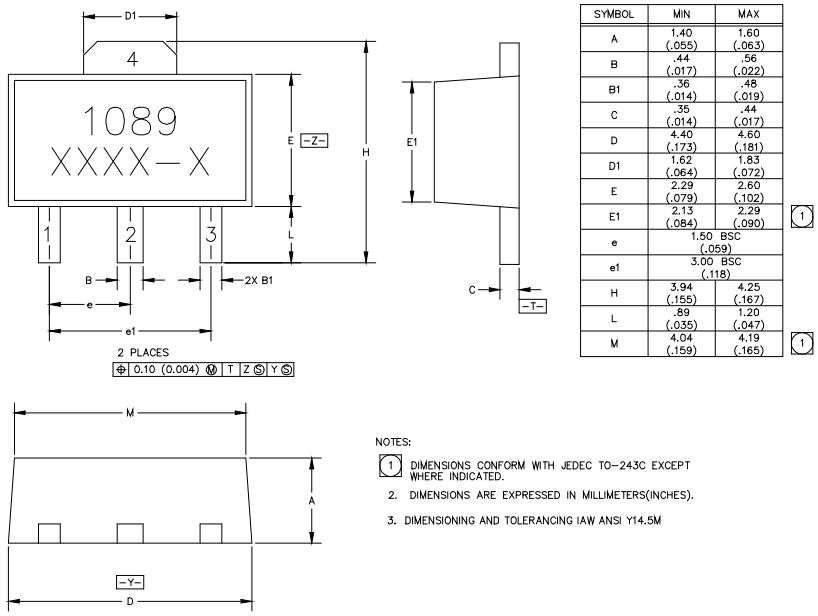
Product Information

EC1089B (SOT-89 Package) Mechanical Information

This package may contain lead-bearing materials. The plating material on the leads is SnPb.

Outline Drawing

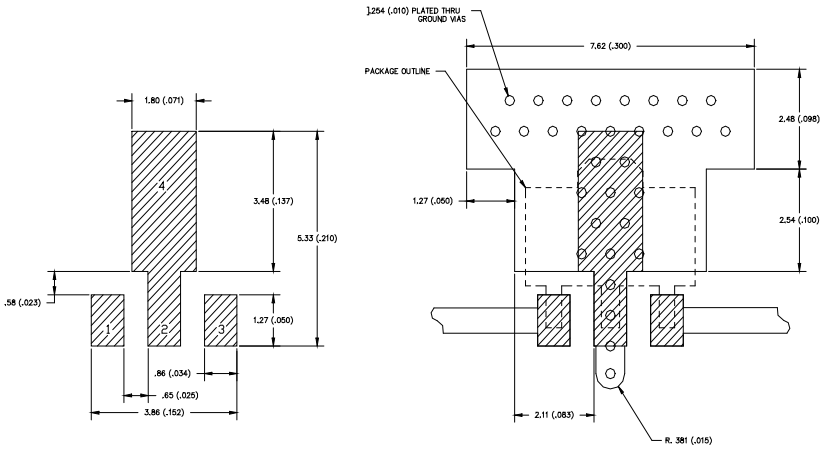


SYMBOL	MIN	MAX
A	1.40 (.055)	1.60 (.063)
B	.44 (.017)	.56 (.022)
B1	.36 (.014)	.48 (.019)
C	.35 (.014)	.44 (.017)
D	4.40 (.173)	4.60 (.181)
D1	1.62 (.064)	1.83 (.072)
E	2.29 (.079)	2.60 (.102)
E1	2.13 (.084)	2.29 (.090) (1)
e	1.50 BSC (.059)	
e1	3.00 BSC (.118)	
H	3.94 (.155)	4.25 (.167)
L	.89 (.035)	1.20 (.047)
M	4.04 (.159)	4.19 (.165) (1)

NOTES:

1. DIMENSIONS CONFORM WITH JEDEC TO-243C EXCEPT WHERE INDICATED.
2. DIMENSIONS ARE EXPRESSED IN MILLIMETERS(INCHES).
3. DIMENSIONING AND TOLERANCING IAW ANSI Y14.5M

Land Pattern

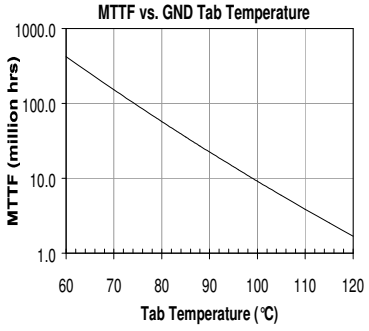


Thermal Specifications

Parameter	Rating
Operating Case Temperature	-40 to +85° C
Thermal Resistance (1)	149° C / W
Junction Temperature (2)	204° C

Notes:

1. The thermal resistance is referenced from the junction-to-case at a case temperature of 85° C.
2. This corresponds to the typical biasing condition of +5V, 160 mA at an 85° C case temperature. A minimum MTTF of 1 million hours is achieved for junction temperatures below 247° C.



Product Marking

The component will be marked with an "1089" designator with an alphanumeric lot code on the top surface of the package.

Tape and reel specifications for this part are located on the website in the "Application Notes" section.

MSL / ESD Rating

Caution! ESD sensitive device.

ESD Rating: Class 1A
Value: Passes between 250 and 500V
Test: Human Body Model (HBM)
Standard: JEDEC Standard JESD22-A114

MSL Rating: Level 3 at +235° C convection reflow
Standard: JEDEC Standard J-STD-020

Mounting Config. Notes

1. Ground / thermal vias are critical for the proper performance of this device. Vias should use a .35mm (#80 / .0135") diameter drill and have a final plated thru diameter of .25 mm (.010").
2. Add as much copper as possible to inner and outer layers near the part to ensure optimal thermal performance.
3. Mounting screws can be added near the part to fasten the board to a heatsink. Ensure that the ground / thermal via region contacts the heatsink.
4. Do not put solder mask on the backside of the PC board in the region where the board contacts the heatsink.
5. RF trace width depends upon the PC board material and construction.
6. Use 1 oz. Copper minimum.
7. All dimensions are in millimeters (inches). Angles are in degrees.

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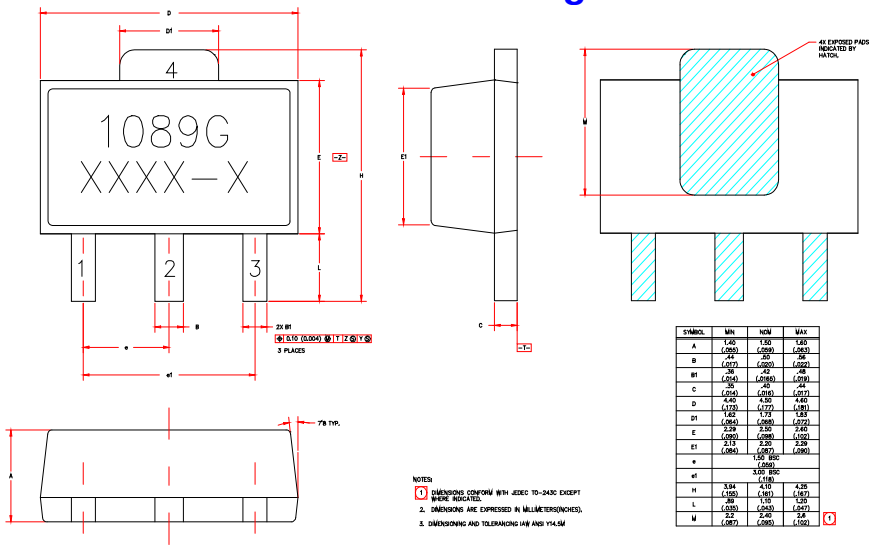
EC1089B-G (Green / Lead-free SOT-89 Package) Mechanical Information

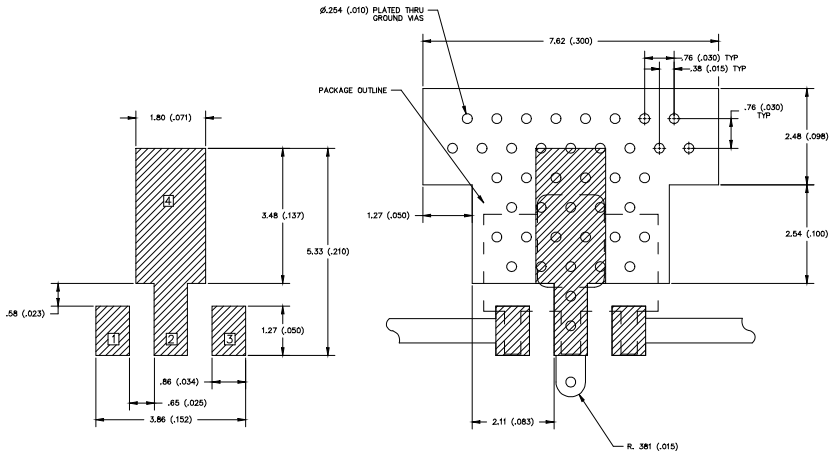
This package is lead-free/Green/RoHS-compliant. It is compatible with both lead-free (maximum 260°C reflow temperature) and leaded (maximum 245°C reflow temperature) soldering processes. The plating material on the leads is NiPdAu.

Outline Drawing



SYMBOL	MIN.	NOM	MAX
A	1.40 (.055)	1.50 (.059)	1.60 (.063)
B	.44 (.017)	.50 (.020)	.56 (.022)
B1	.36 (.014)	.42 (.0165)	.48 (.019)
C	.35 (.014)	.40 (.016)	.44 (.017)
D	4.40 (.173)	4.50 (.177)	4.60 (.181)
D1	1.62 (.064)	1.73 (.068)	1.83 (.072)
E	2.29 (.090)	2.50 (.098)	2.60 (.102)
E1	2.13 (.084)	2.20 (.087)	2.29 (.090)
e		1.50 BSC (.059)	
e1		3.00 BSC (.118)	
H	3.94 (.155)	4.10 (.161)	4.25 (.167)
L	.89 (.035)	1.10 (.043)	1.20 (.047)
M	2.2 (.087)	2.40 (.095)	2.6 (.102)

Land Pattern

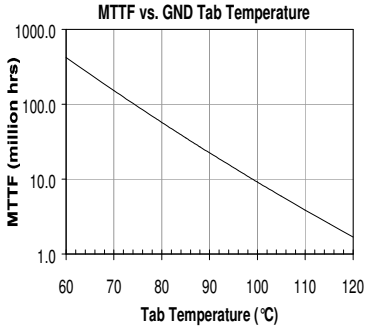


Thermal Specifications

Parameter	Rating
Operating Case Temperature	-40 to +85° C
Thermal Resistance (1)	149° C / W
Junction Temperature (2)	204° C

Notes:

1. The thermal resistance is referenced from the junction-to-case at a case temperature of 85° C.
2. This corresponds to the typical biasing condition of +5V, 160 mA at an 85° C case temperature. A minimum MTTF of 1 million hours is achieved for junction temperatures below 247° C.



Product Marking

The component will be marked with an "1089G" designator with an alphanumeric lot code on the top surface of the package.

Tape and reel specifications for this part are located on the website in the "Application Notes" section.

MSL / ESD Rating

Caution! ESD sensitive device.

ESD Rating: Class 1A
Value: Passes between 250 and 500V
Test: Human Body Model (HBM)
Standard: JEDEC Standard JESD22-A114

MSL Rating: Level 3 at +260° C convection reflow
Standard: JEDEC Standard J-STD-020

Mounting Config. Notes

1. Ground / thermal vias are critical for the proper performance of this device. Vias should use a .35mm (#80 / .0135") diameter drill and have a final plated thru diameter of .25 mm (.010").
2. Add as much copper as possible to inner and outer layers near the part to ensure optimal thermal performance.
3. Mounting screws can be added near the part to fasten the board to a heatsink. Ensure that the ground / thermal via region contacts the heatsink.
4. Do not put solder mask on the backside of the PC board in the region where the board contacts the heatsink.
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6. Use 1 oz. Copper minimum.
7. All dimensions are in millimeters (inches). Angles are in degrees.