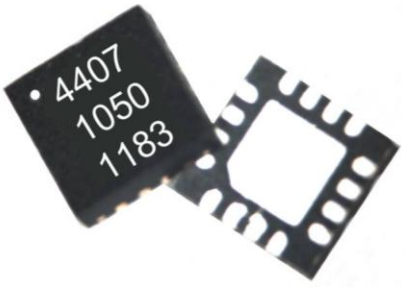
TGC4407-SM

Ka-Band Up-Converter

Applications

- VSAT
- Point-to-Point Radio
- Test Equipments & Sensors

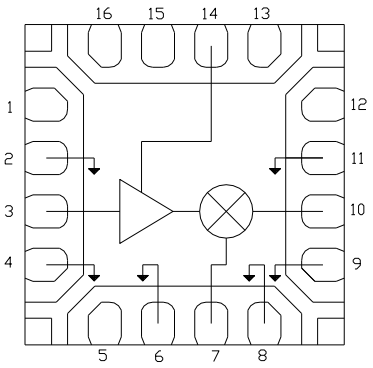


QFN 3x3mm 16L

Product Features

- RF Frequency Range: 21.5 – 32.5 GHz
- Wideband IF Frequency: DC – 7.0 GHz
- Sub-Harmonic Pumped LO Frequency: 11 – 16 GHz
- Integrated LO Amplifier: 0 to 7.5 dBm Input
- Conversion Gain: -9 dB
- Bias: Vd = 5 V, Id = 65 mA, Typical
- Package Dimensions: 3.0 x 3.0 x 0.85 mm

Functional Block Diagram



General Description

The TriQuint TGC4407-SM is a Ka-Band sub-harmonic Up-Converter with integrated LO buffer amplifier. The TGC4407-SM operates from 21.5 to 32.5 GHz and is designed using TriQuint's pHEMT production process.

The TGC4407-SM typically provides 13 dBm of Input TOI at -10dBm input power per tone and a conversion gain of -9 dB.

The TGC4407-SM is available in a low-cost, surface mount 16 lead 3x3 QFN package and is ideally suited for Point-to-Point Radio, and Ka-Band VSAT Ground Terminal.

Lead-free and RoHS compliant.

Evaluation Boards are available upon request.

Pin Configuration

Pin #	Symbol
1, 5, 12, 13, 15, 16	N/C
2, 4, 6, 8, 9, 11	GND
3	LO IN
7	IF IN
10	RF OUT
14	Vd

Ordering Information

Part No.	ECCN	Description
TGC4407-SM	EAR99	Ku-band Up-Converter

Standard T/R size = 500 pieces on a 7" reel.

Specifications

Absolute Maximum Ratings

Parameter	Rating
Drain Voltage,Vd	+7 V
Drain Current, Id	0.175 A
Power Dissipation, Pdiss	1.2 W
RF Input Power, CW, 50Ω,T = 25ºC	+10 dBm
Channel Temperature, Tch	200 °C
Mounting Temperature (30 Seconds)	260 °C
Storage Temperature	-40 to 150 °C

Operation of this device outside the parameter ranges given above may cause permanent damage. These are stress ratings only, and functional operation of the device at these conditions is not implied.

Recommended Operating Conditions

Parameter	Min	Typical	Max	Units
Vd	4	5	6	V
Id		0.065		A
Id_drive (Under RF Drive)		0.076		A
Temperature	-40	25	85	°C

Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions.

Electrical Specifications

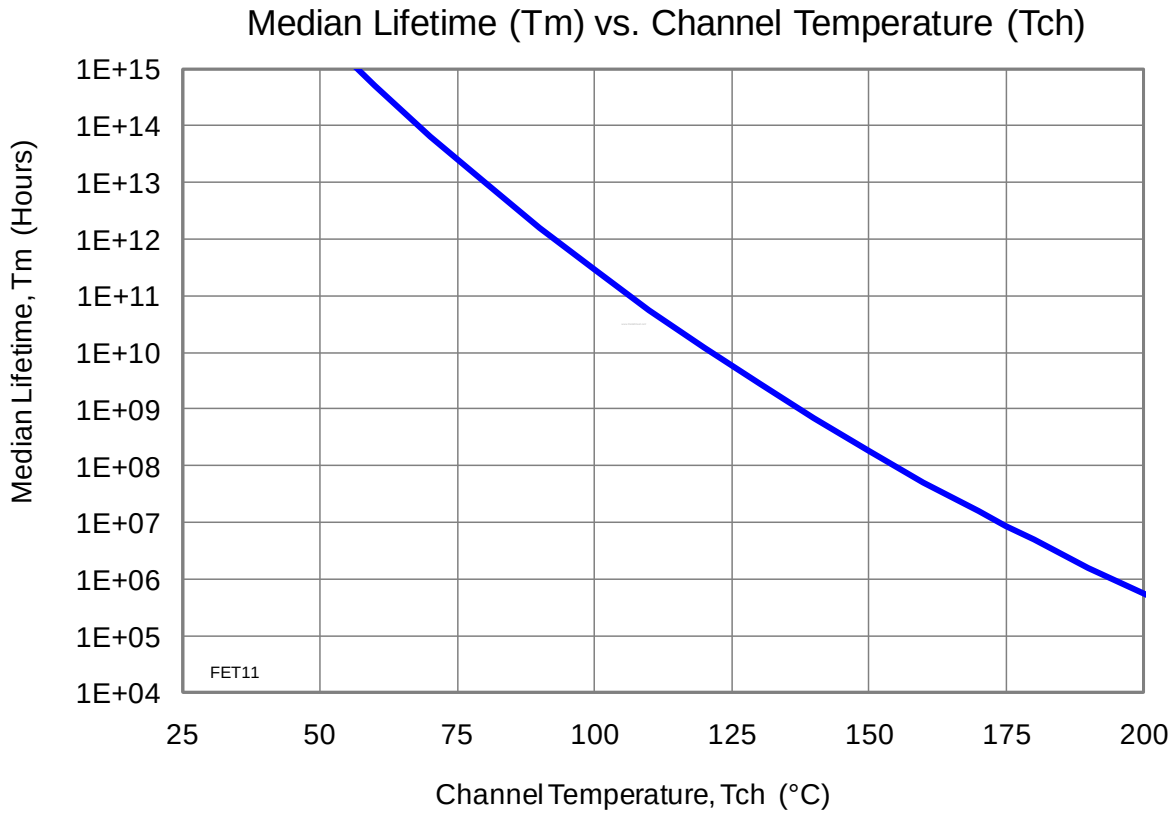
Test conditions unless otherwise noted: 25ºC, Vd = 5 V, Id = 0.065 A Typical.
For: IF = 500 MHz, LSB = 2 x LO – IF (19.5 – 31.5 GHz) and USB = 2 x LO + IF (20.5 – 32.5 GHz).

Parameter	IF = 500 MHz, LO = 0 dBm, Vd = 5 V, Id = 0.065 A.			Units
	Min	Typical	Max.	
RF Frequency Range	21.5		32.5	GHz
LO Frequency Range	11		16	GHz
IF Frequency Range	DC		7	GHz
Conversion Gain		-9		dB
Noise Figure		9		dB
2LO-to-RF Isolation		35		dB
Input IP3		13		dBm
Input 1dB Compression		4		dBm
Supply Current		65		mA

Specifications (cont.)

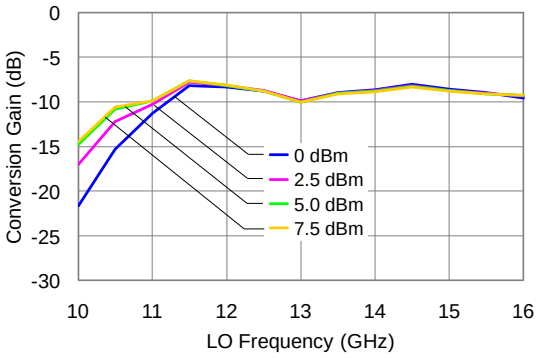
Thermal and Reliability Information

Parameter	Condition	Rating
Thermal Resistance, θ_{JC}, measured to back of package	Tbase = 85 °C	θ_{JC} = 47 °C/W
Channel Temperature (Tch), and Median Lifetime (Tm)	Tbase = 85 °C, Vd = 5 V, Id = 65 mA, Pdiss = 0.325 W	Tch = 100 °C Tm = 2.9 E+11 Hours
Channel Temperature (Tch), and Median Lifetime (Tm) Under RF Drive	Tbase = 85 °C, Vd = 5 V, Id = 76 mA, Pin = 7 dBm, Pdiss = 0.38 W	Tch = 103 °C Tm = 2.2 E+11 Hours

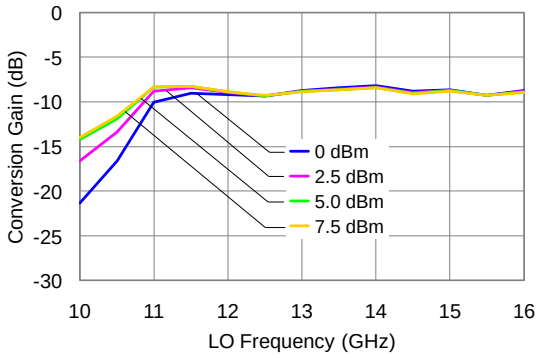


Typical Performance

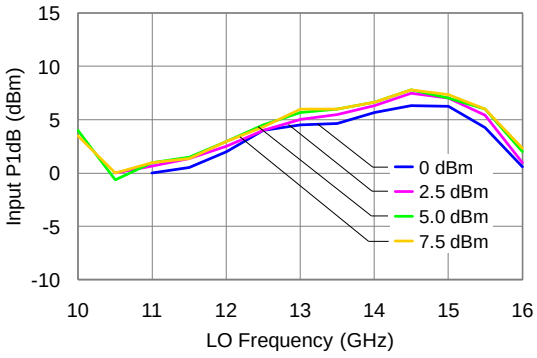
Conversion Gain vs. LO Drive
Vd = 5 V, IF = 500 MHz, LSB, 25 °C



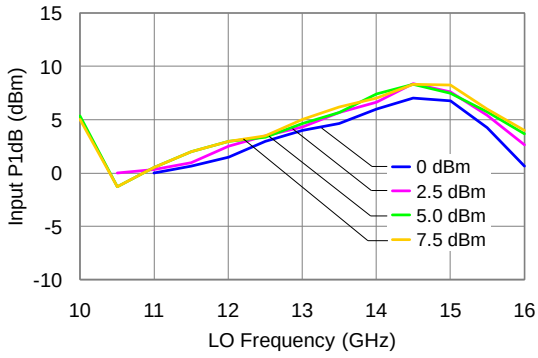
Conversion Gain vs. LO Drive
Vd = 5 V, IF = 500 MHz, USB, 25 °C



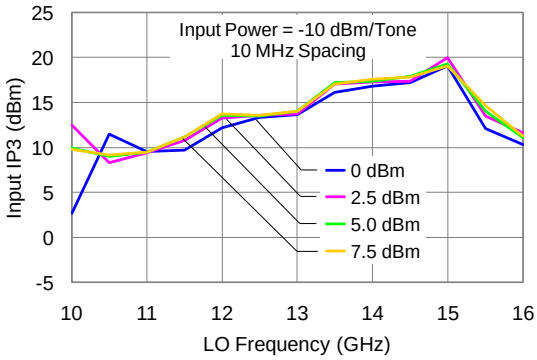
Input P1dB vs. LO Drive
Vd = 5 V, IF = 500 MHz, LSB, 25 °C



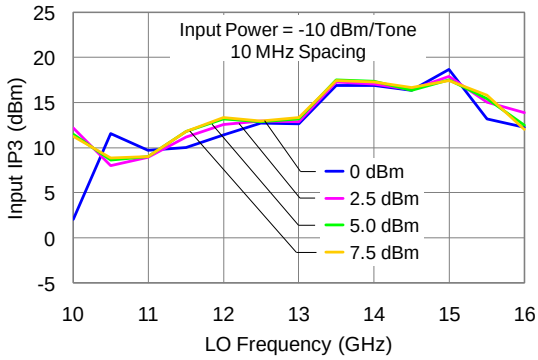
Input P1dB vs. LO Drive
Vd = 5 V, IF = 500 MHz, USB, 25 °C



Input IP3 vs. LO Drive
Vd = 5 V, IF = 500 MHz, LSB, 25 °C

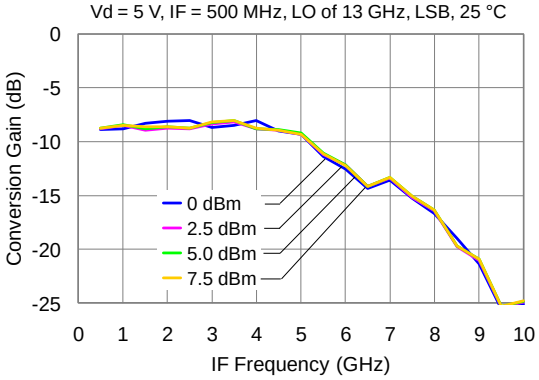


Input IP3 vs. LO Drive
Vd = 5 V, IF = 500 MHz, USB, 25 °C

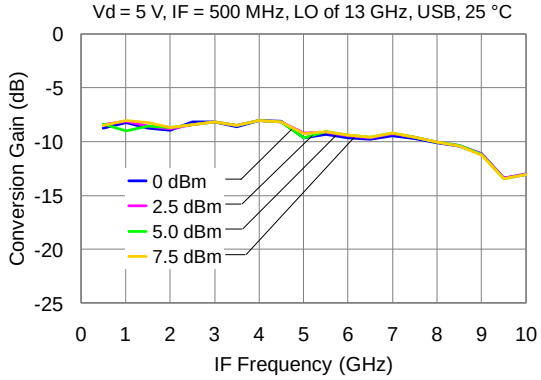


Typical Performance (cont.)

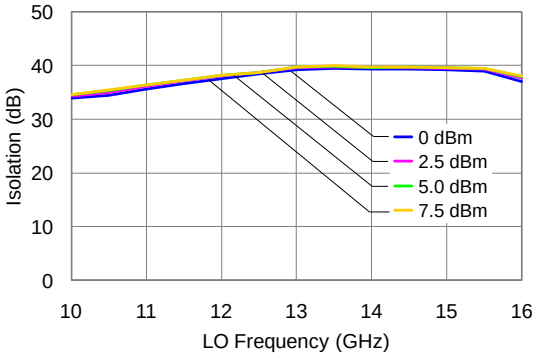
IF Bandwidth vs. LO Drive
Vd = 5 V, IF = 500 MHz, LO of 13 GHz, LSB, 25 °C



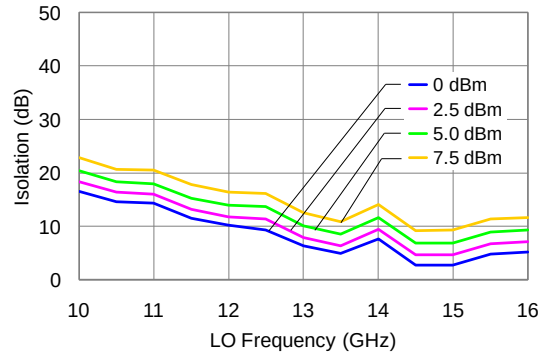
IF Bandwidth vs. LO Drive
Vd = 5 V, IF = 500 MHz, LO of 13 GHz, USB, 25 °C



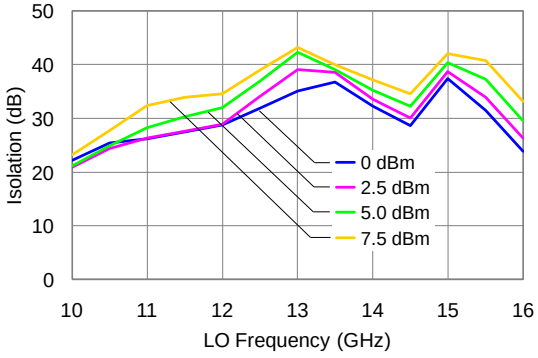
IF to RF Isolation vs. LO Drive
Vd = 5 V, IF = 500 MHz, 25 °C



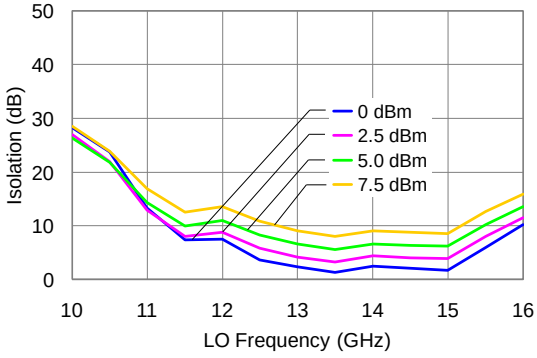
LO to RF Isolation vs. LO Drive
Vd = 5 V, 25 °C



2LO to RF Isolation vs. LO Drive
Vd = 5 V, 25 °C

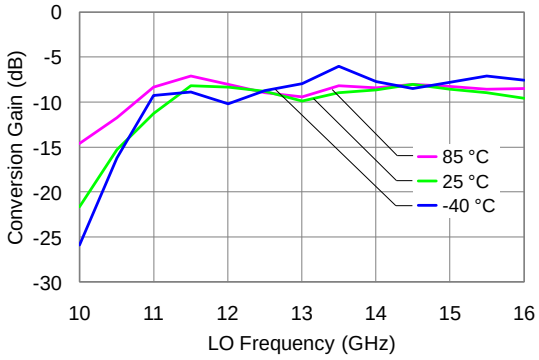


3LO to RF Isolation vs. LO Drive
Vd = 5 V, 25 °C

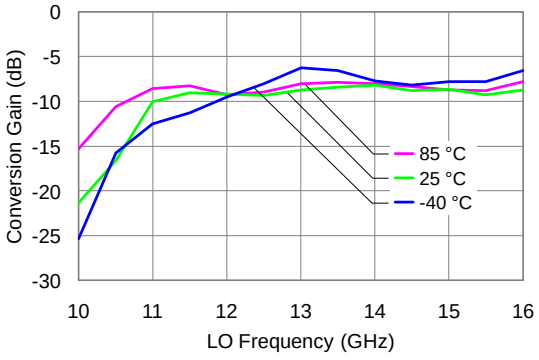


Typical Performance (cont.)

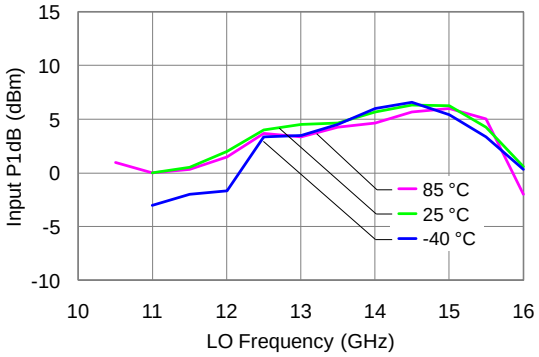
Conversion Gain vs. Temperature
Vd = 5 V, IF = 500 MHz, LO = 0 dBm, LSB



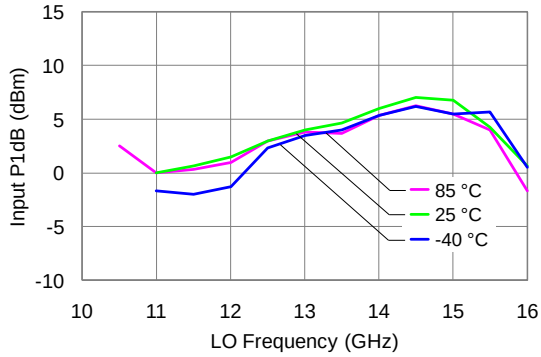
Conversion Gain vs. Temperature
Vd = 5 V, IF = 500 MHz, LO = 0 dBm, USB



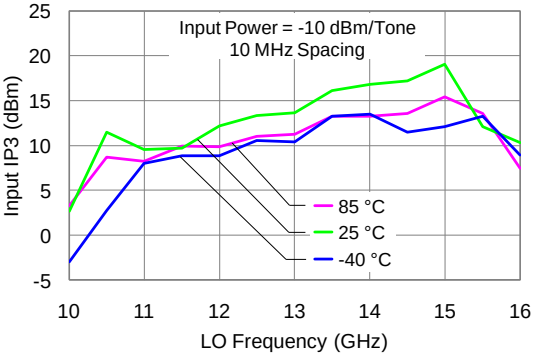
Input P1dB vs. Temperature
Vd = 5 V, IF = 500 MHz, LO = 0 dBm, LSB



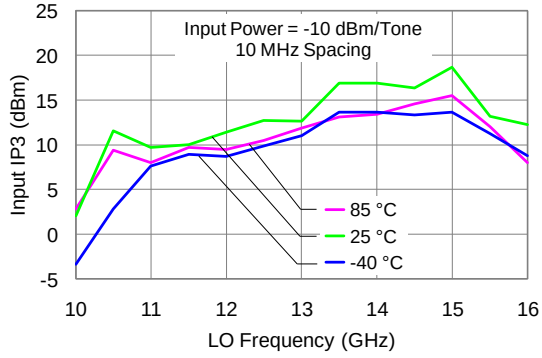
Input P1dB vs. Temperature
Vd = 5 V, IF = 500 MHz, LO = 0 dBm, USB



Input IP3 vs. Temperature
Vd = 5 V, IF = 500 MHz, LO = 0 dBm, LSB

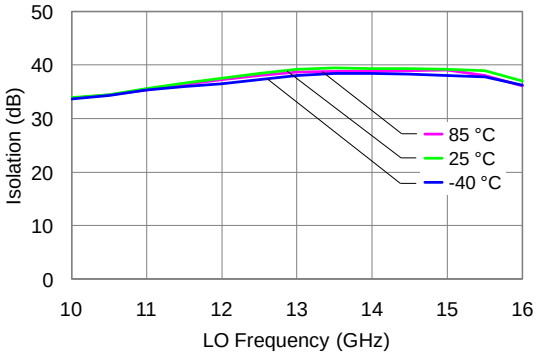


Input IP3 vs. Temperature
Vd = 5 V, IF = 500 MHz, LO = 0 dBm, USB

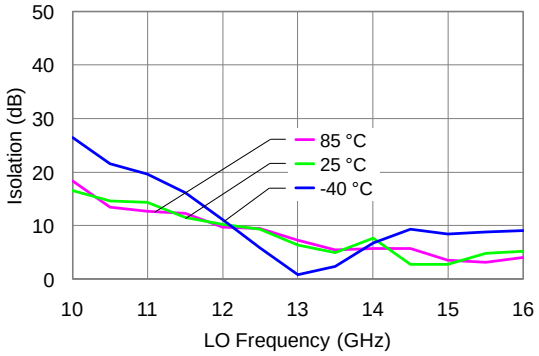


Typical Performance (cont.)

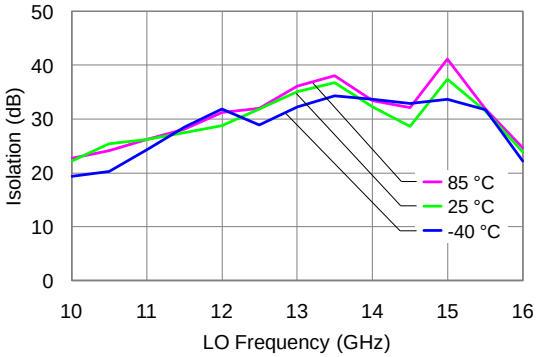
IF to RF Isolation vs. Temperature
Vd = 5 V, IF = 500 MHz, LO = 0 dBm



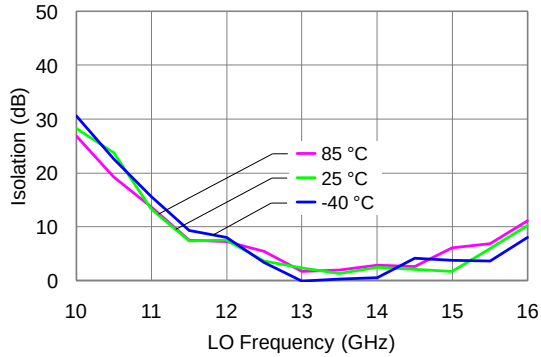
LO to RF Isolation vs. Temperature
Vd = 5 V, LO = 0 dBm



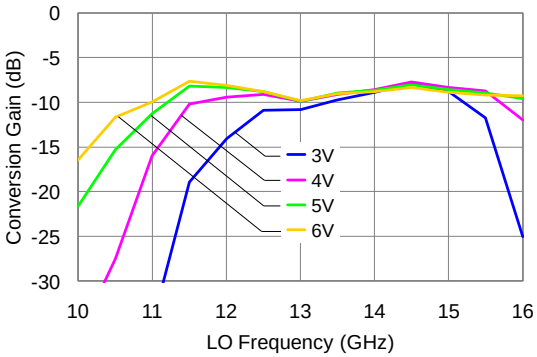
2LO to RF Isolation vs. Temperature
Vd = 5 V, LO = 0 dBm



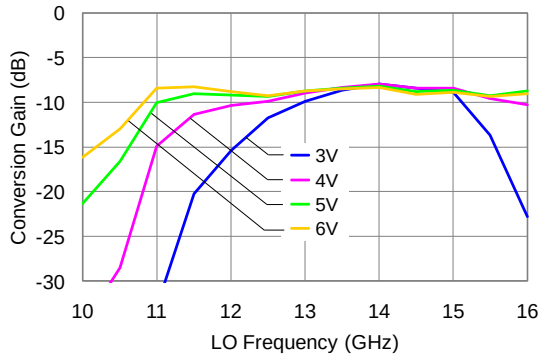
3LO to RF Isolation vs. Temperature
Vd = 5 V, LO = 0 dBm



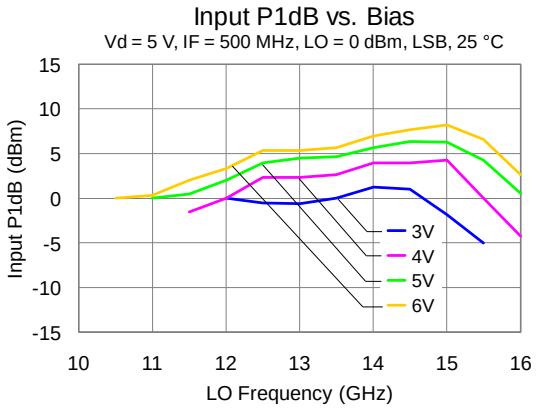
Conversion Gain vs. Bias
Vd = 5 V, IF = 500 MHz, LO = 0 dBm, LSB, 25 °C

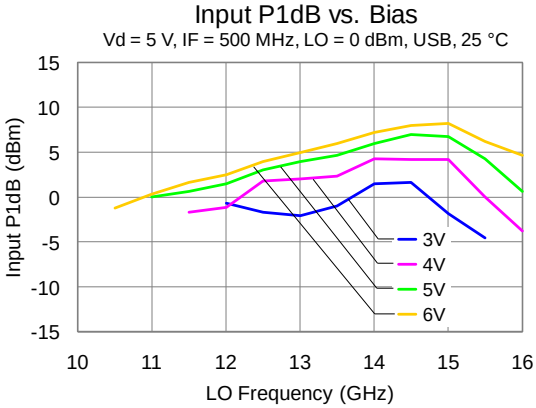


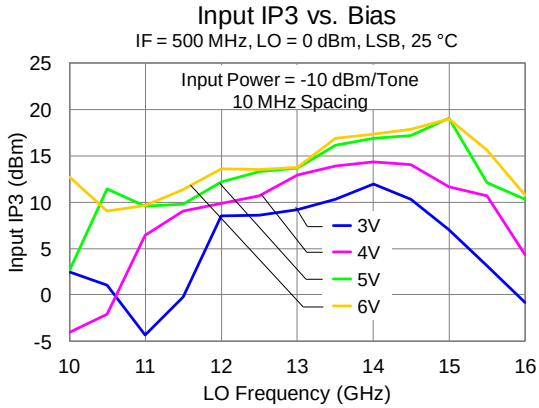
Conversion Gain vs. Bias
Vd = 5 V, IF = 500 MHz, LO = 0 dBm, USB, 25 °C

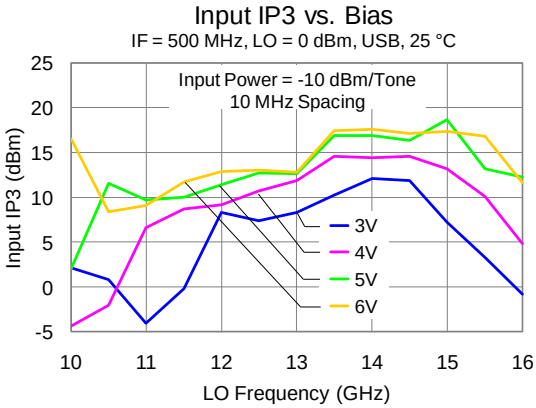


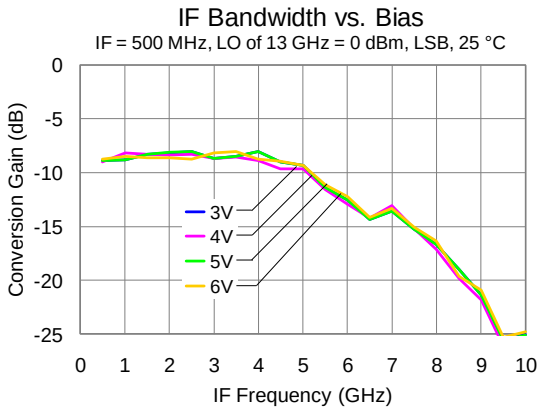
Typical Performance (cont.)

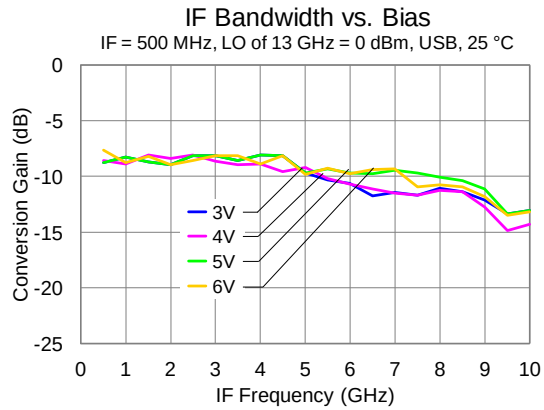




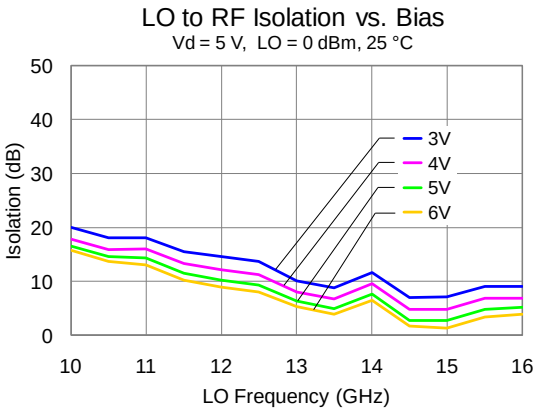


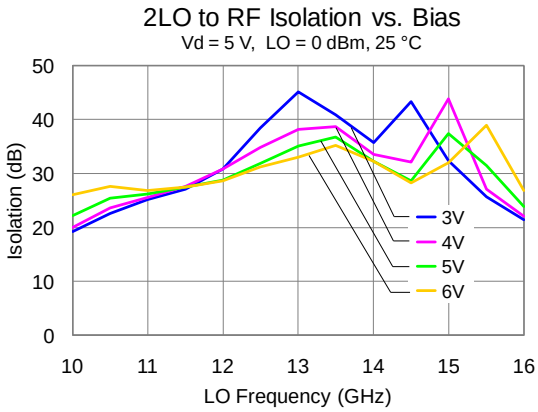


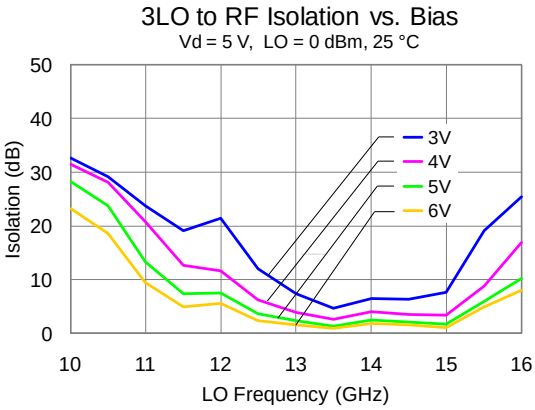




Typical Performance (cont.)





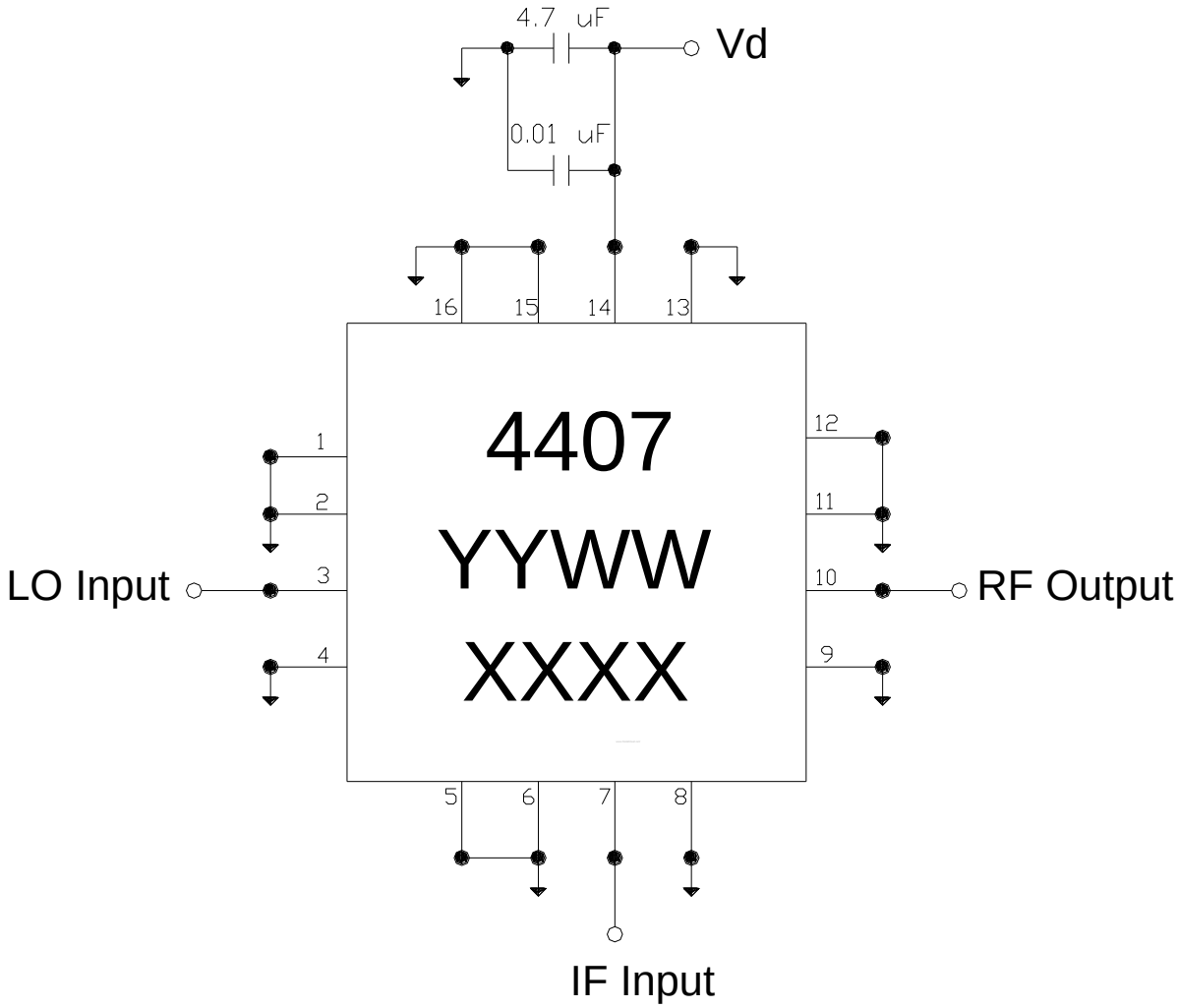


M x N Spurious Outputs

LO at 13 GHz and 0 dBm; IF at 1 GHz and -10 dBm; Vd = 5 V; 25 °C; All values are in dBc from USB.

	nLO			
mRF	3	2	1	0
-2	-32	-39	-53	-59
-1	-35	-1	-40	-24
0	18	-16	12	
1	-35	0	-35	
2	-29	-43	-42	
3		-49	-75	

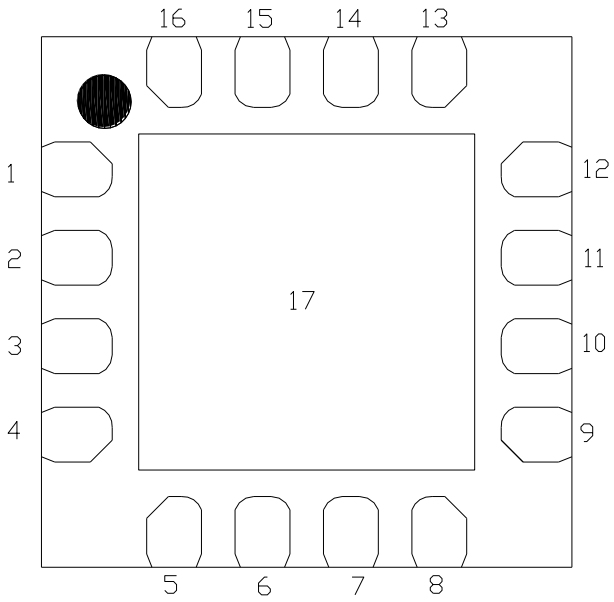
Application Circuit



Bias-up Procedure	Bias-down Procedure
Set Vd to desired voltage within specified limits	Turn off RF supply
Apply RF signals to LO and RF Inputs	Reduce Vd to 0 V

The TGC4407-SM will be marked with the "4407" designator and a lot code marked below the part designator. The "YY" represents the last two digits of the year the part was manufactured, the "WW" is the work week, and the "XXXX" is an auto-generated number.

Pin Description

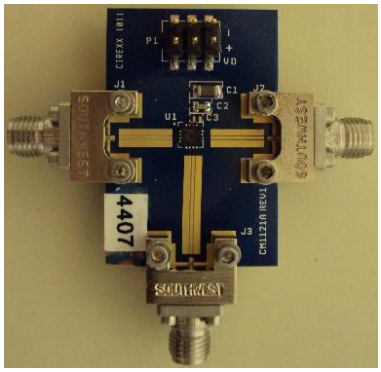


Pin	Symbol	Description
1, 5, 12, 13, 15, 16	N/C	No internal connection; must be grounded on PCB.
2, 4, 6, 8, 9, 11	GND	Internal Grounding; must be grounded on PCB.
3	LO IN	Local Oscillator Input, matched to 50 ohms, AC Coupled.
7	IF IN	IF Input matched to 50 ohms, DC Coupled.
10	RF OUT	RF Output matched to 50 ohms, AC Coupled.
14	Vd	Drain voltage. Bias network is required; see Application Circuit on page 10 as an example.
17	GND	Backside Paddle. Multiple vias should be employed to minimize inductance and thermal resistance; see Mounting Configuration on page 14 for suggested footprint.

Applications Information

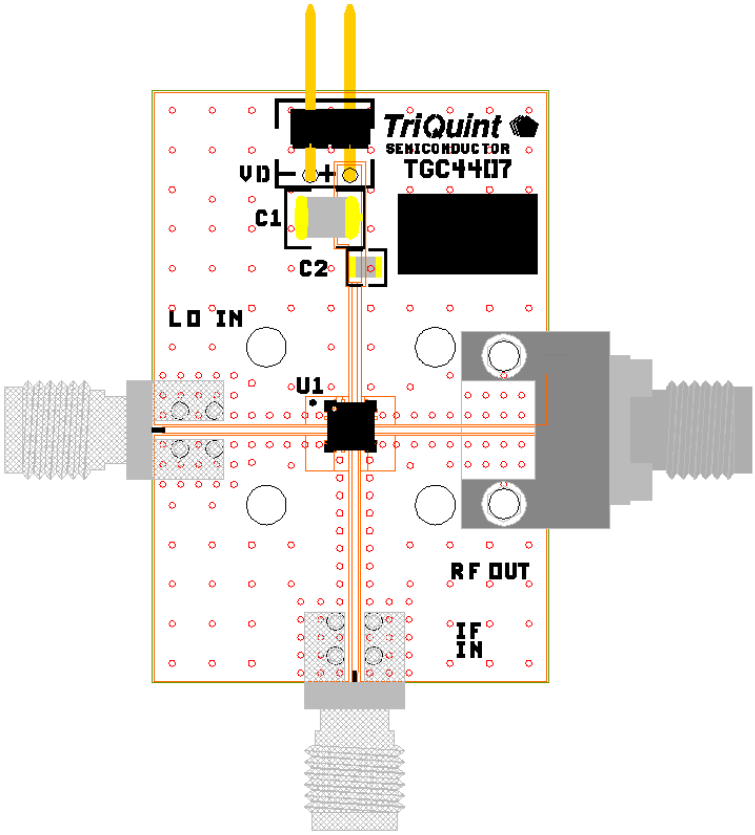
PC Board Layout

Top RF layer is 0.008" thick Rogers RO4003, ϵ_r = 3.38, with 0.062" FR4 stiffener. Metal layers are 1-oz copper. The 50 Ω transmission line is a Grounded Coplanar Waveguide Interface.



The pad pattern shown has been developed and tested for optimized assembly at TriQuint Semiconductor. The PCB land pattern has been developed to accommodate lead and package tolerances. Since surface mount processes vary from company to company, careful process development is recommended.

For further technical information, refer to the TGC4407-SM Product Information page.



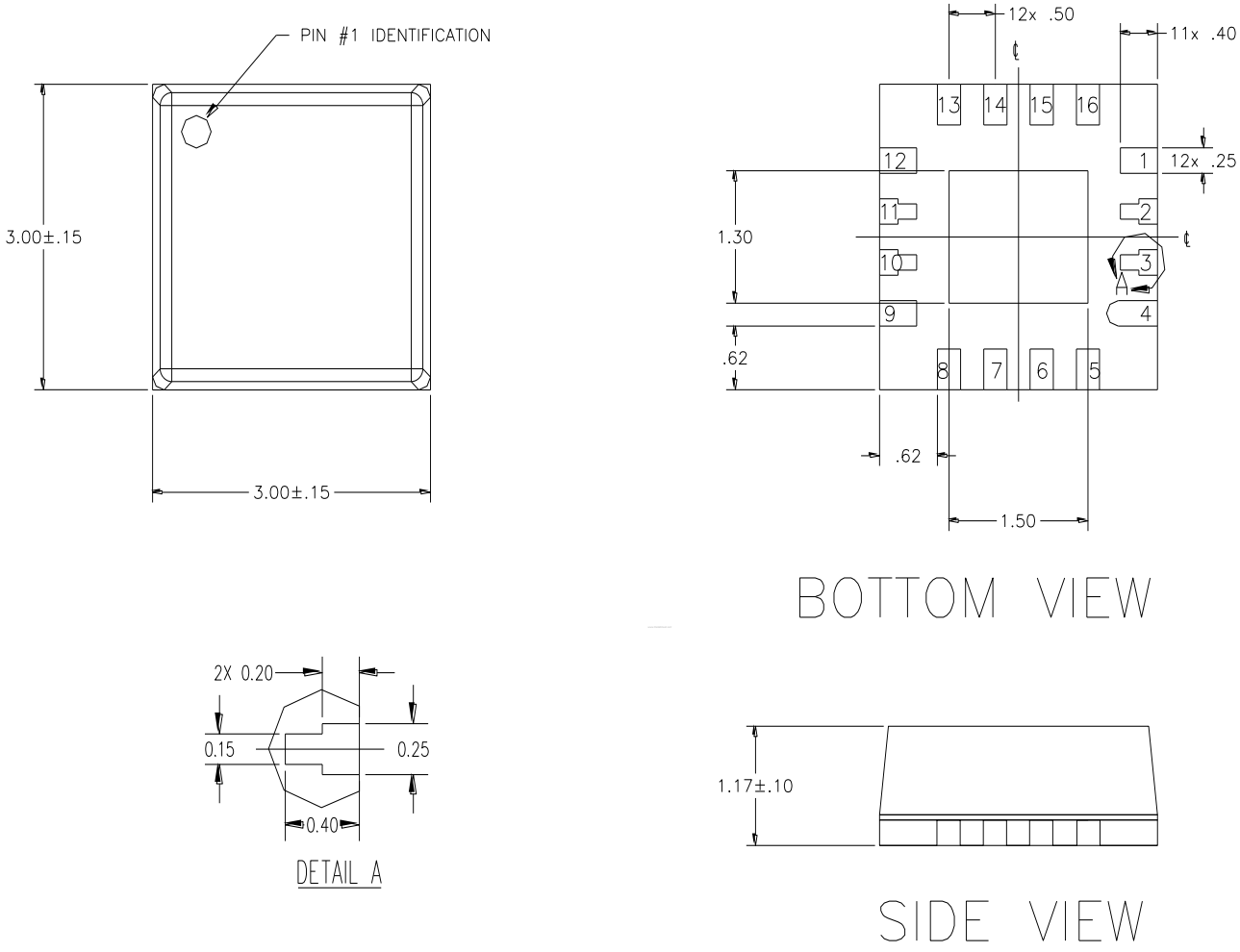
Bill of Material

Ref Des	Value	Description	Manufacturer	Part Number
C1	4.7 µF	Cap, 1206, 20V, 5%, X7R	various	
C2	0.01 µF	Cap, 0603, 25V, 5%, X5R	various	

Mechanical Information

Package Information and Dimensions

All dimensions are in millimeters.



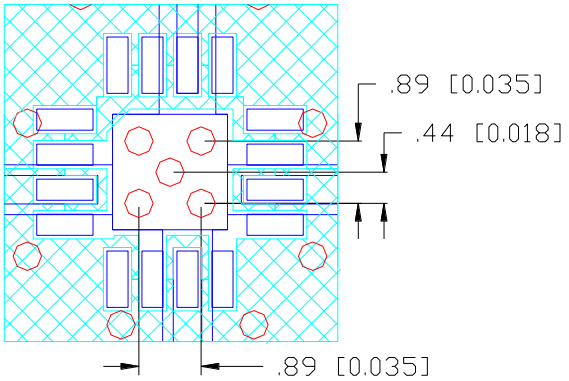
This package is lead-free/RoHS-compliant with a copper alloy base (CDA194), and the plating material on the leads is 100% matte Sn. It is compatible with both lead-free (maximum 260 °C reflow temperature) and tin-lead (maximum 245 °C reflow temperature) soldering processes.

Mechanical Information (cont.)

Mounting Configuration

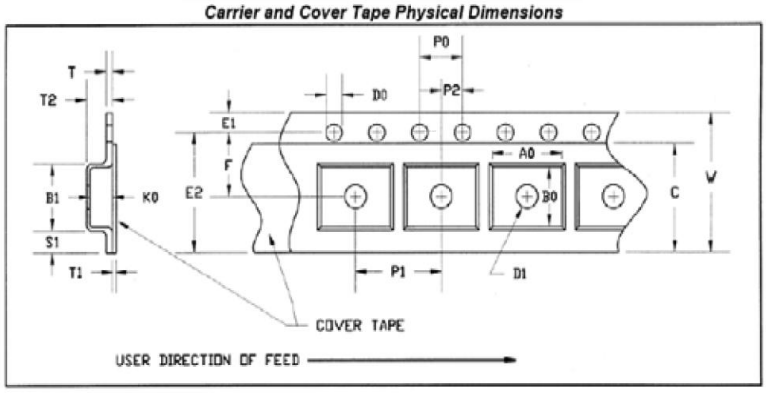
All dimensions are in millimeters (inches).

Notes:
1. Ground vias are critical for the proper performance of this device. Vias have a final plated thru diameter of .40 mm (.016").



Tape and Reel Information

Tape and reel specifications for this part are also available on the TriQuint website in the "Application Notes" section.
Standard T/R size = 500 pieces on a 7 x 0.5" reel.



CARRIER AND COVER TAPE DIMENSIONS

Part	Feature	Symbol	Size (in)	Size (mm)
Cavity	Length	A0	0.134	3.4
	Width	B0	0.126	3.2
	Depth	K0	0.055	1.4
	Pitch	P1	0.315	8.0
Distance Between Centerline	Cavity to Perforation Length Direction	P2	0.079	2.0
	Cavity to Perforation Width Direction	F	0.217	5.5
Cover Tape	Width	C	0.374	9.5
Carrier Tape	Width	W	0.472	12.0

Product Compliance Information

ESD Information

Caution! ESD-Sensitive Device

ESD Rating:	Class 0
Value:	≥ 200 V and < 250 V
Test:	Human Body Model (HBM)
Standard:	JEDEC Standard JESD22-A114

MSL Rating

Level MSL1 at +260 °C convection reflow
The part is rated Moisture Sensitivity Level MSL1 at 260°C per JEDEC standard IPC/JEDEC J-STD-020.

ECCN

US Department of Commerce EAR99

Solderability

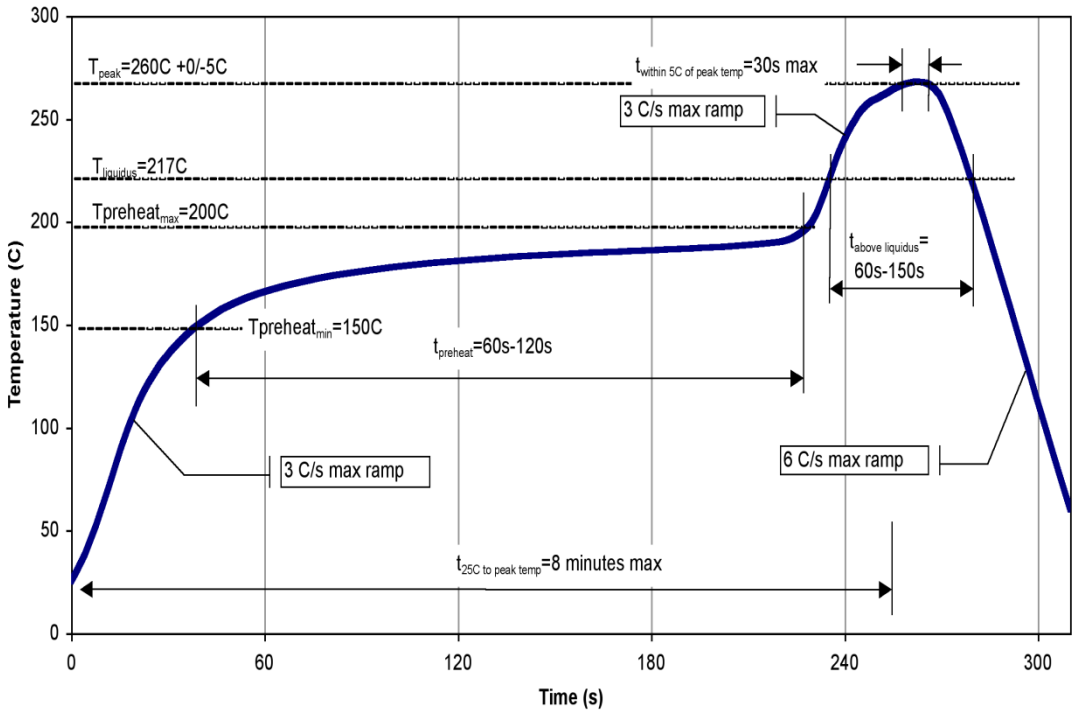
Compatible with the latest version of J-STD-020, Lead free solder, 260°C

This part is compliant with EU 2002/95/EC RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment).

This product also has the following attributes:

- Lead Free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A ($C_{15}H_{12}Br_40_2$) Free
- PFOS Free
- SVHC Free

Recommended Soldering Temperature Profile



Contact Information

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