



QPL2210D

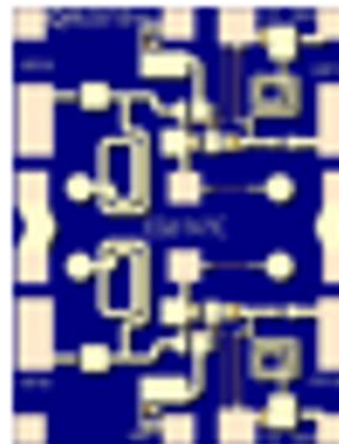
10.5 – 12.7 GHz Dual Channel Low Noise Amplifier

Product Overview

Qorvo's QPL2210D is a dual channel high-performance, low noise MMIC amplifier fabricated on Qorvo's production 90 nm pHEMT process (QPHT09). Covering 10.5 – 12.7 GHz, the QPL2210D provides 17 dB small signal gain and 1.1 dB noise figure. With a compact die size of 1.1 x 1.4 mm, the amplifier can deliver 6 dBm of saturated power, in addition, the device can provide low IMD3 level of -40 dBc at Pout = -8 dBm/tone.

The QPL2210D is matched to 50 ohms with integrated DC blocking caps on both I/O ports for easy handling and simple system integration.

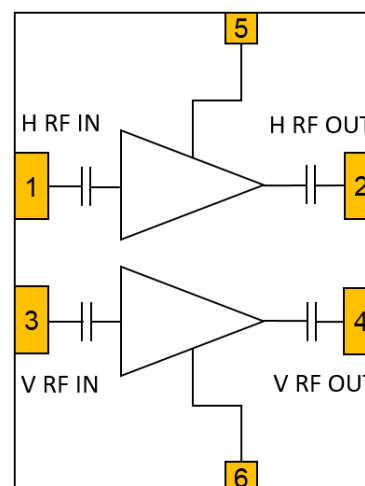
The high performance of the QPL2210D makes it ideal for airborne high density phased array radar applications as well as commercial communication systems.



Key Features

- Frequency Range: 10.5 – 12.7 GHz
- Noise Figure: 1.1 dB (typical)
- Small Signal Gain: 17 dB (typical)
- P1dB: 1 dBm (typical)
- Psat: 6 dBm (typical)
- IMD3: -40 dBc (typical) (Pout = -8 dBm/tone)
- Bias: VD = 2.0 V, IDQ = 8 to 13 mA (self-bias)
- Low power consumptions: 22 mW (typical)
- Die Dimensions: 1.10 x 1.40 x 0.10 mm

Functional Block Diagram



Applications

- Electronic Warfare (EW)
- Commercial and Military Radar
- Communication Systems

Ordering Information

Part No.	Description
QPL2210D	10.5 – 12.7 GHz Low Noise Amplifier
QPL2210DEVB02	QPL2210D Evaluation Board

Absolute Maximum Ratings

Parameter	Rating
Drain Voltage (V_D)	4.5 V
Drain Current	45 mA
RF Input Power (50 Ω , 85 °C)	20 dBm
Channel Temperature, T_{CH}	140 °C
Mounting Temperature (30 seconds)	260 °C
Storage Temperature	-55 to 150 °C

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability.

Recommended Operating Conditions

Parameter	Typ	Units
Drain Voltage	2.0 V	V
Drain Current (quiescent, self-bias)	8 to 13	mA
Gate Voltage (not required)	-	V
Operating Temperature Range	-40 to 85	°C

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

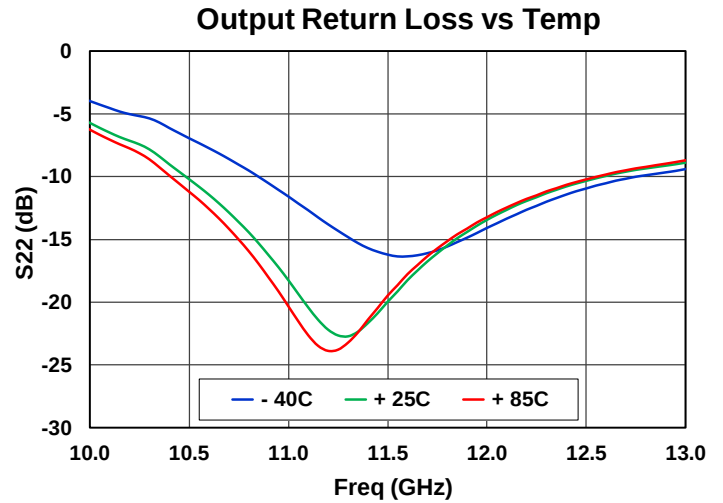
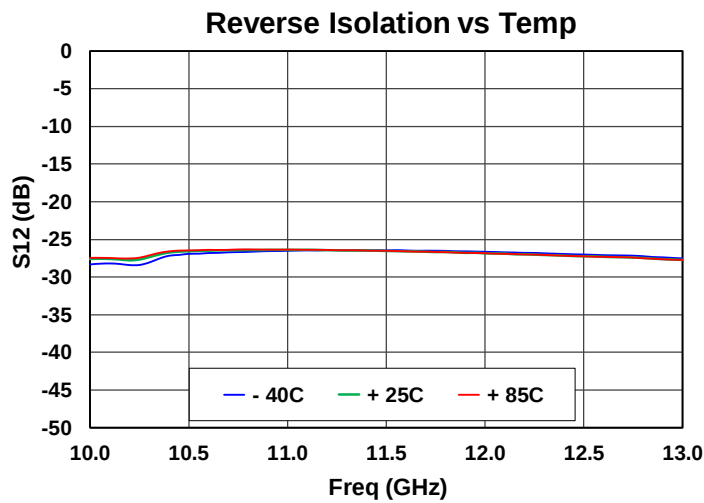
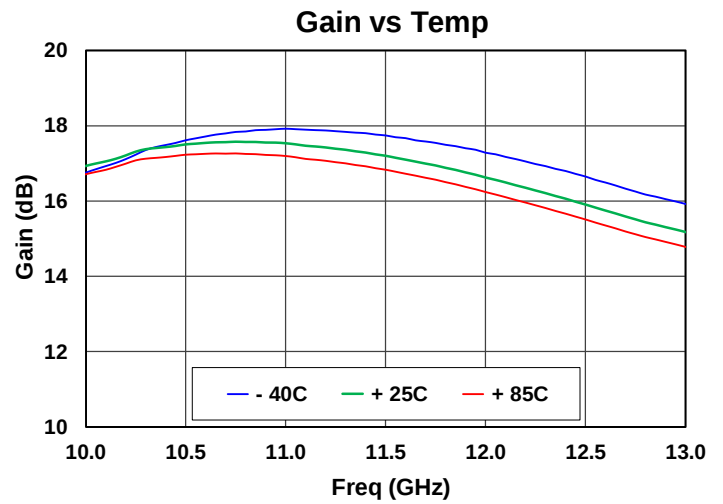
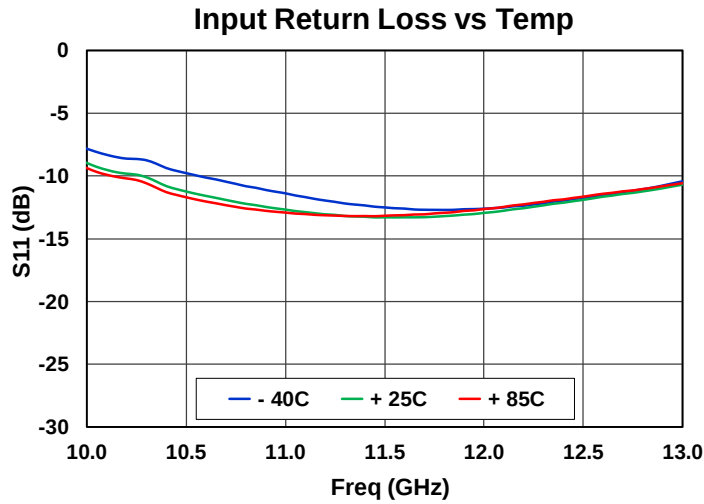
Electrical Specifications

Test conditions unless otherwise noted: $V_D = +2.0$ V, $I_{DQ} = 8$ to 13 mA, Temp. = +25 °C. Data de-embedded to MMIC bond wires.

Parameter	Min	Typ	Max	Units
Operating Frequency	10.5		12.7	GHz
Small Signal Gain		17		dB
Noise Figure		1.1		dB
Power at 1-dB Compression		1		dBm
Power at Saturation		6		dBm
Input Return Loss		11.0		dB
Output Return Loss		12.0		dB
3 RD Order Intermodulation Level ($P_{out} = -8$ dBm / Tone)		-40		dBc
Output TOI ($P_{in} = -25$ dBm / tone)		12.0		dBm
Gain (S21) Temperature Coefficient		-0.008		dB/°C

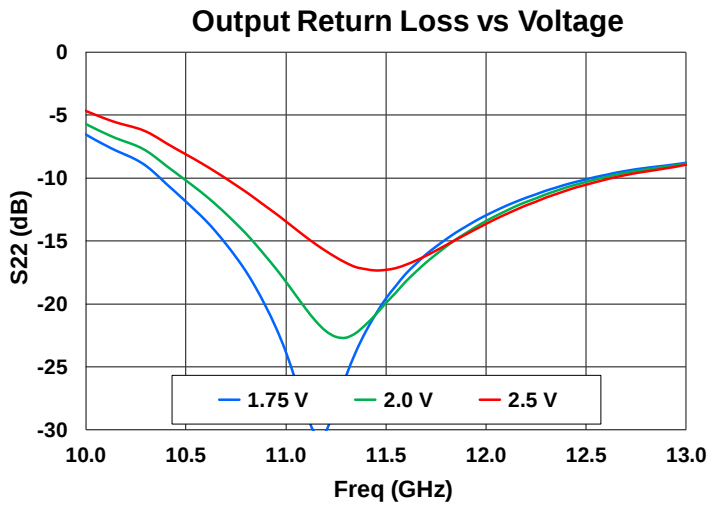
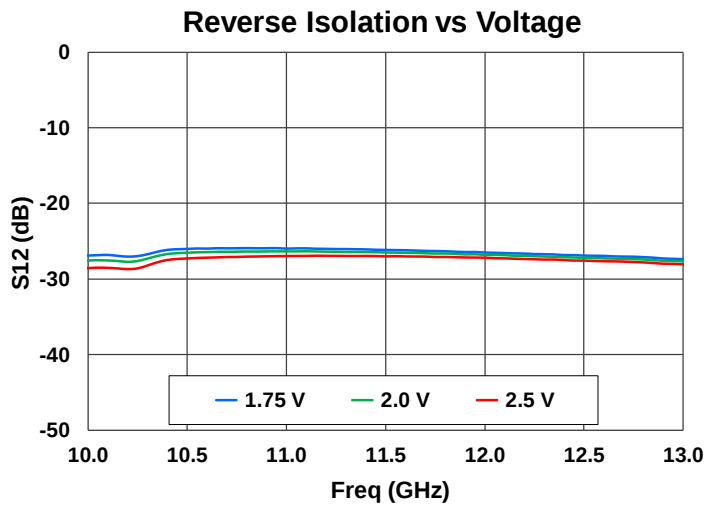
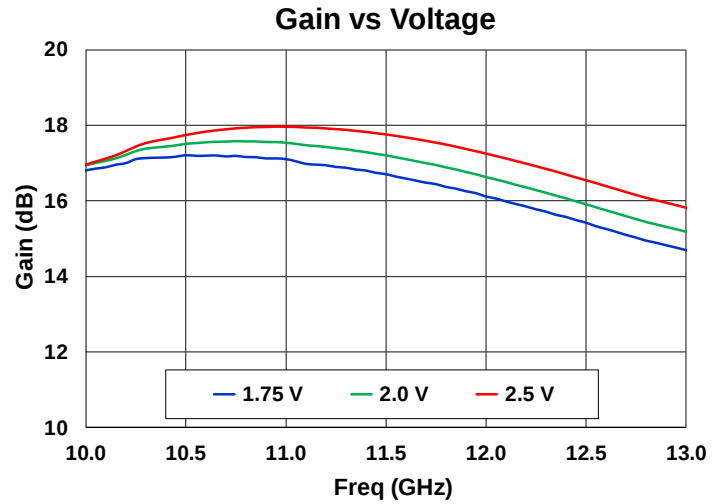
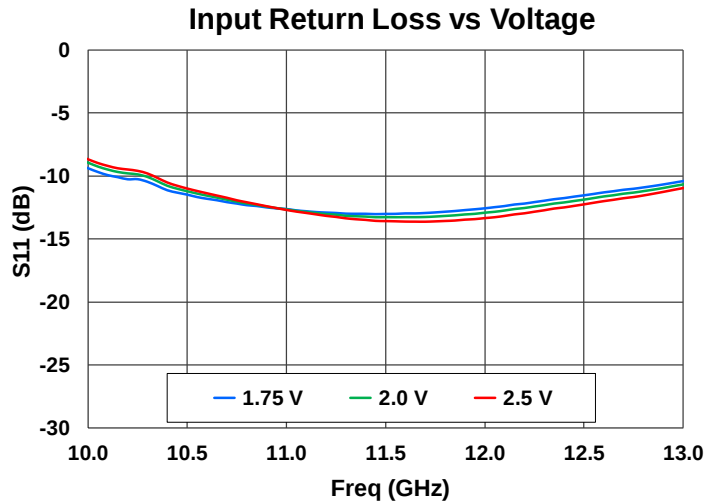
Performance Plots – Small Signal

Test conditions unless otherwise noted: $V_D = +2.0$ V, $I_{DQ} = 8$ to 13 mA, Temp. = +25 °C



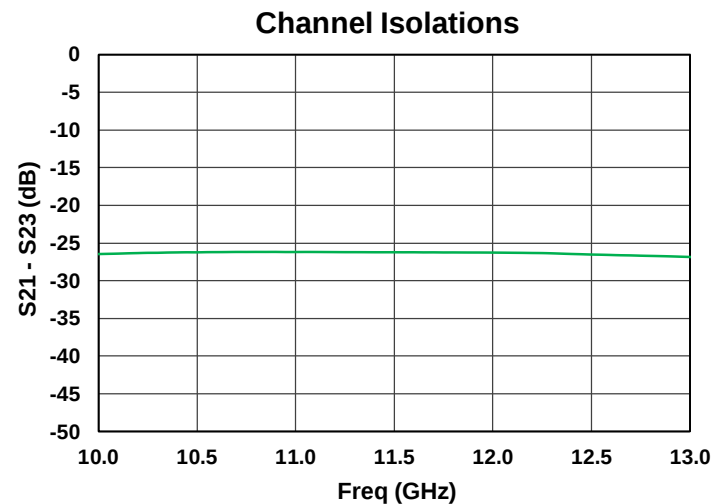
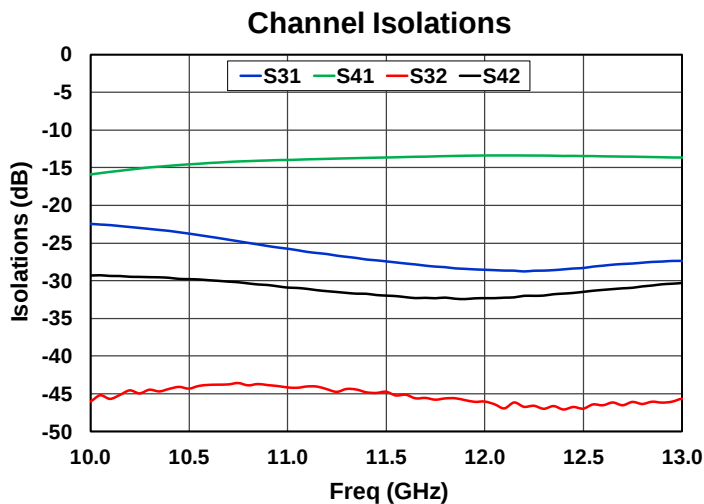
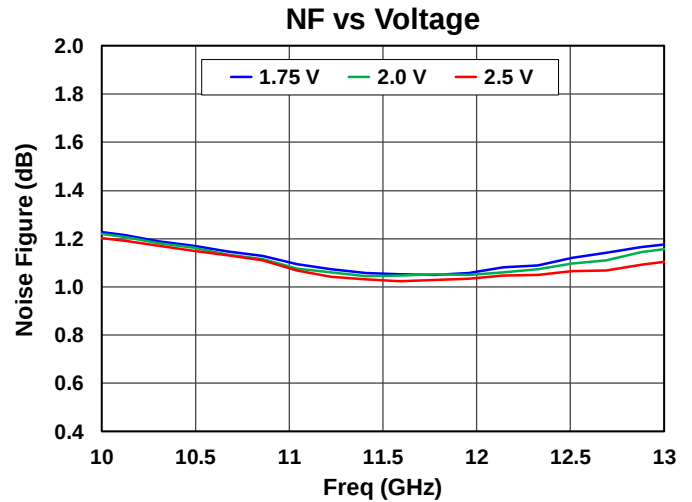
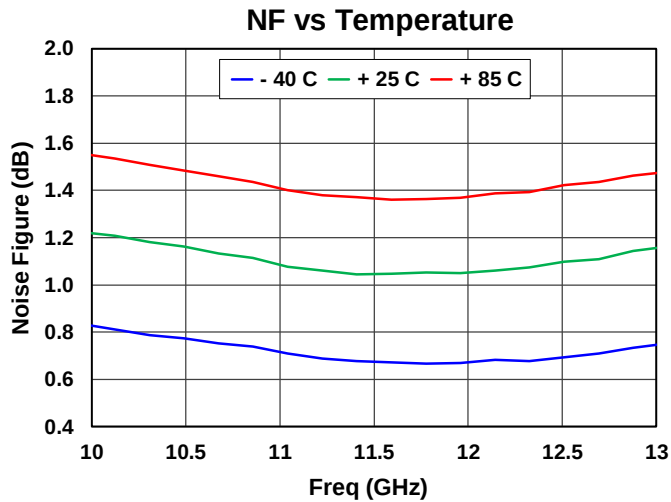
Performance Plots – Small Signal

Test conditions unless otherwise noted: $V_D = +2.0\text{ V}$, $I_{DQ} = 8\text{ to }13\text{ mA}$, Temp. = $+25\text{ }^\circ\text{C}$



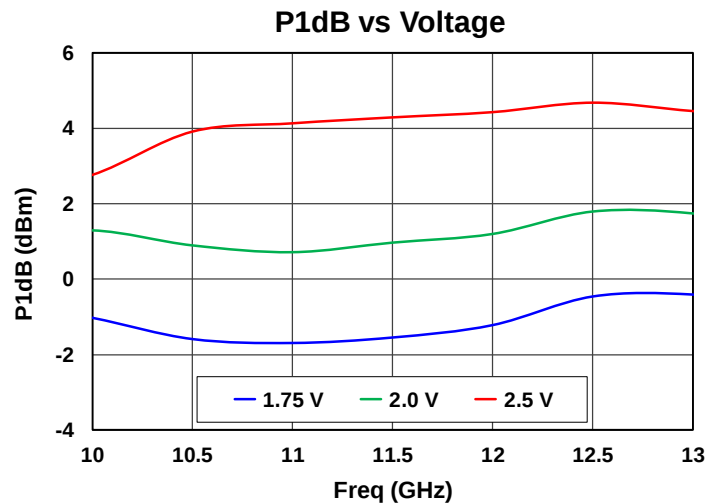
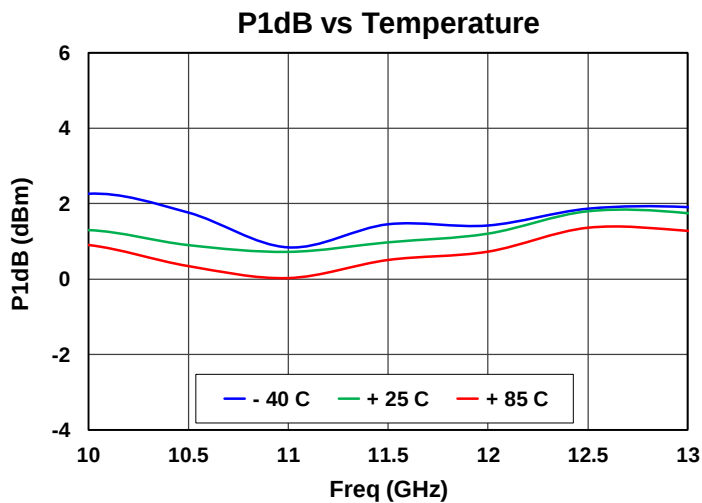
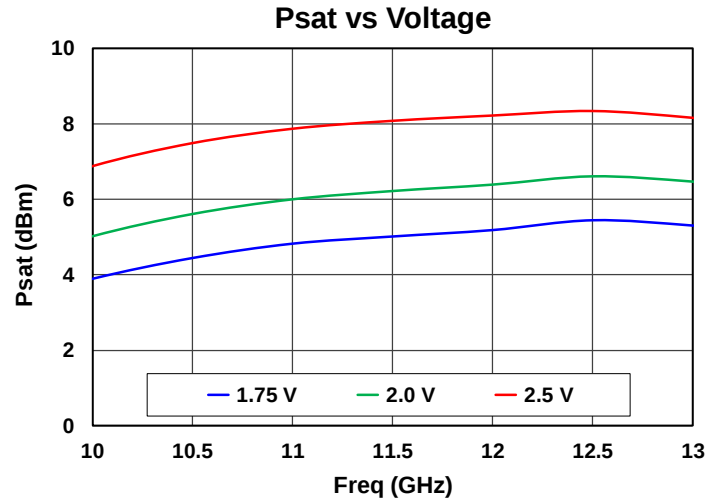
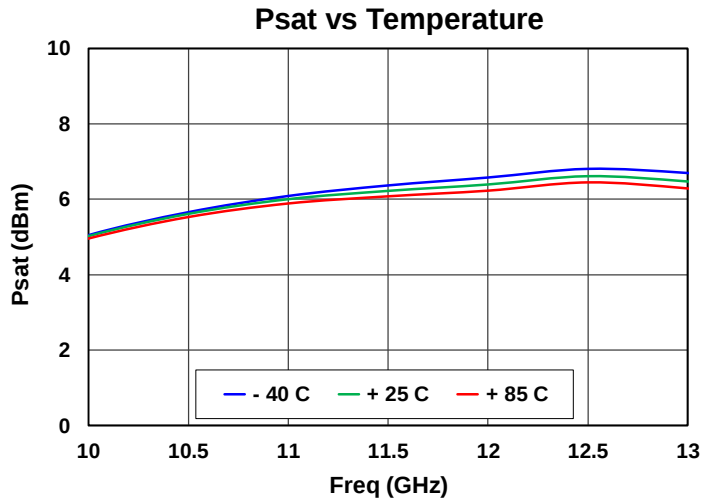
Performance Plots – Noise Figure and Channel Isolations

Test conditions unless otherwise noted: $V_D = +2.0$ V, $I_{DQ} = 8$ to 13 mA, Temp. = +25 °C
Isolation tests: Port 1 – H RFIN, 2 – H RFOUT, 3 – V RFIN, 4 – V RFOUT



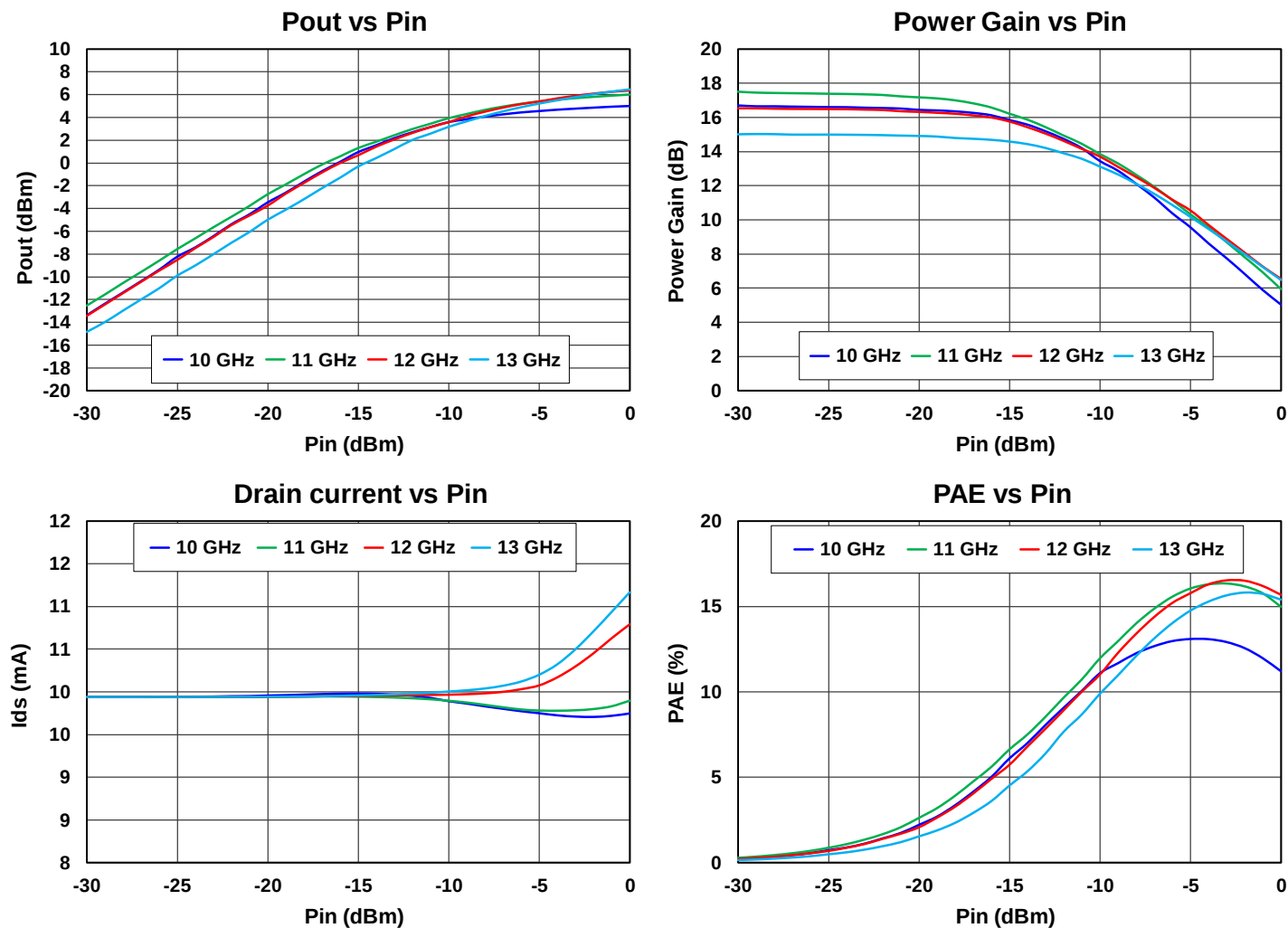
Performance Plots – Large Signal

Test conditions unless otherwise noted: $V_D = +2.0\text{ V}$, $I_{DQ} = 8\text{ to }13\text{ mA}$, Temp. = $+25\text{ }^\circ\text{C}$



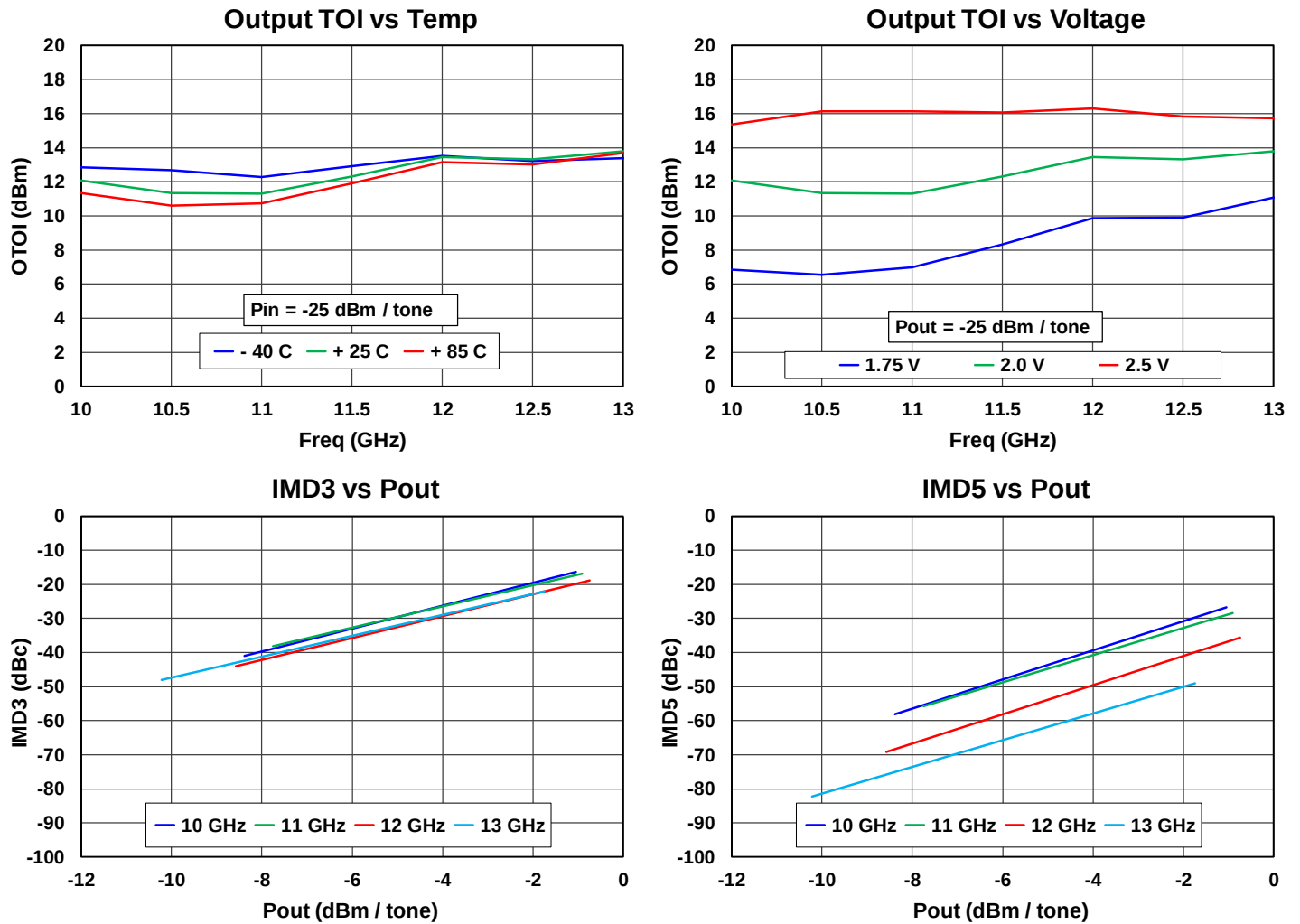
Performance Plots – Large Signal

Test conditions unless otherwise noted: $V_D = +2.0$ V, $I_{DQ} = 8$ to 13 mA, Temp. = +25 °C

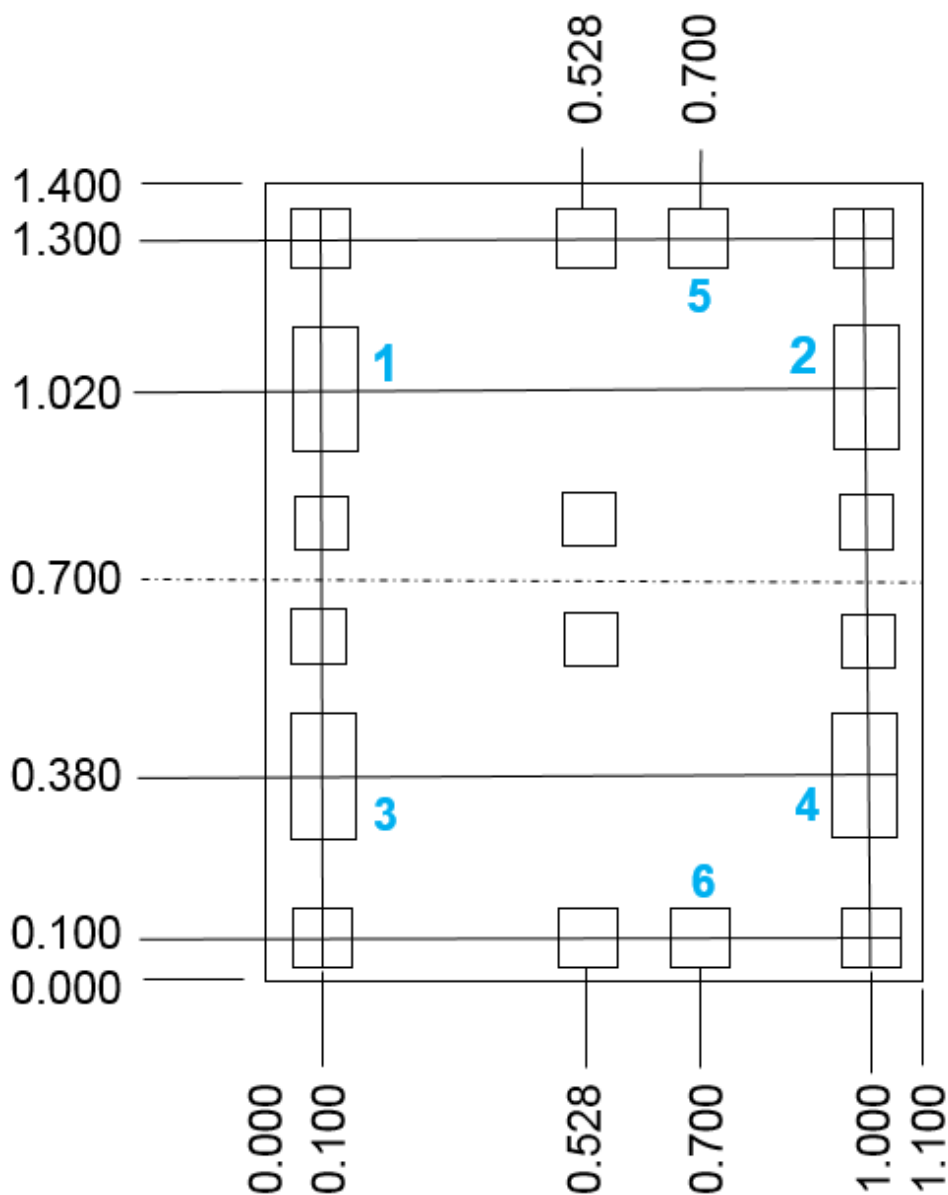


Performance Plots – Linearity

Test conditions unless otherwise noted: $V_D = +2.0\text{ V}$, $I_{DQ} = 8\text{ to }13\text{ mA}$, Tone spacing = 11 MHz, Temp. = + 25 °C



Mechanical Drawing and Bond Pad Description



Dimensions in mm

Pad No.	Label	Description
1	H RF Input	Channel H RF Input, Matched to 50 ohms, DC blocked
2	H RF Output	Channel H RF Output, Matched to 50 ohms, DC blocked
3	V RF Input	Channel V RF Input, Matched to 50 ohms, DC blocked
4	V RF Output	Channel V RF Output, Matched to 50 ohms, DC blocked
5	HVD	Channel H VD
6	RVD	Channel R VD

Assembly Notes

Component placement and adhesive attachment assembly notes:

- Vacuum pencils and/or vacuum collets are the preferred method of pick up.
- Air bridges must be avoided during placement.
- The force impact is critical during auto placement.
- Organic attachment (i.e., conductive epoxy) can be used in low-power applications.
- Curing should be done in a convection oven; proper exhaust is a safety concern.

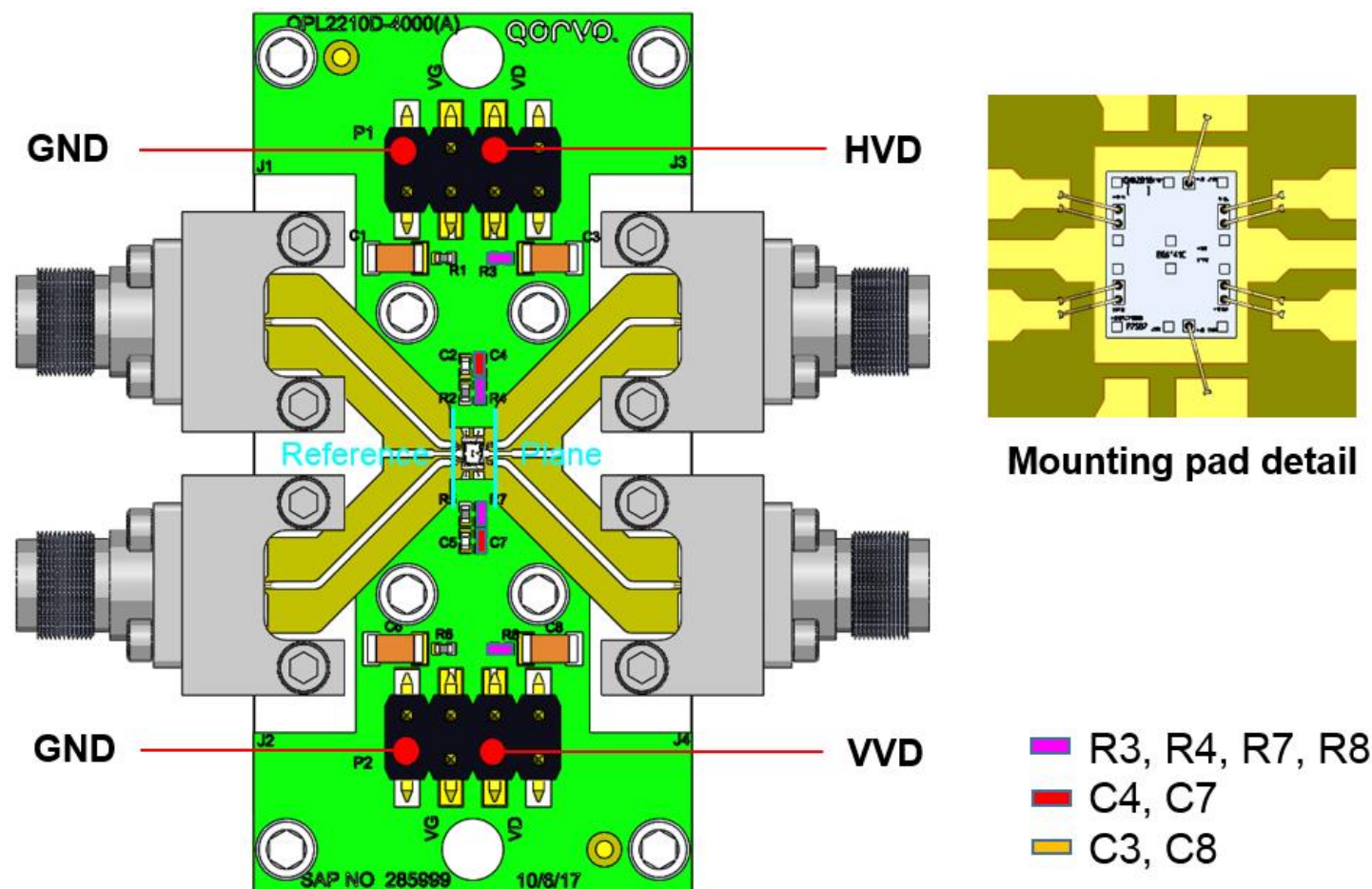
Reflow process assembly notes:

- Use AuSn (80/20) solder and limit exposure to temperatures above 300°C to 3-4 minutes, maximum.
- Conductive epoxy die attach is recommended for PCB mounting.
- Bonding pads plating: Au.
- An alloy station or conveyor furnace with reducing atmosphere should be used.
- Do not use any kind of flux.
- Coefficient of thermal expansion matching is critical for long-term reliability.
- Devices must be stored in a dry nitrogen atmosphere.

Interconnect process assembly notes:

- Thermosonic ball bonding is the preferred interconnect technique.
- Force, time, and ultrasonics are critical parameters.
- Aluminum wire should not be used.
- Devices with small pad sizes should be bonded with 0.0007-inch wire.

Evaluation Board and BOM

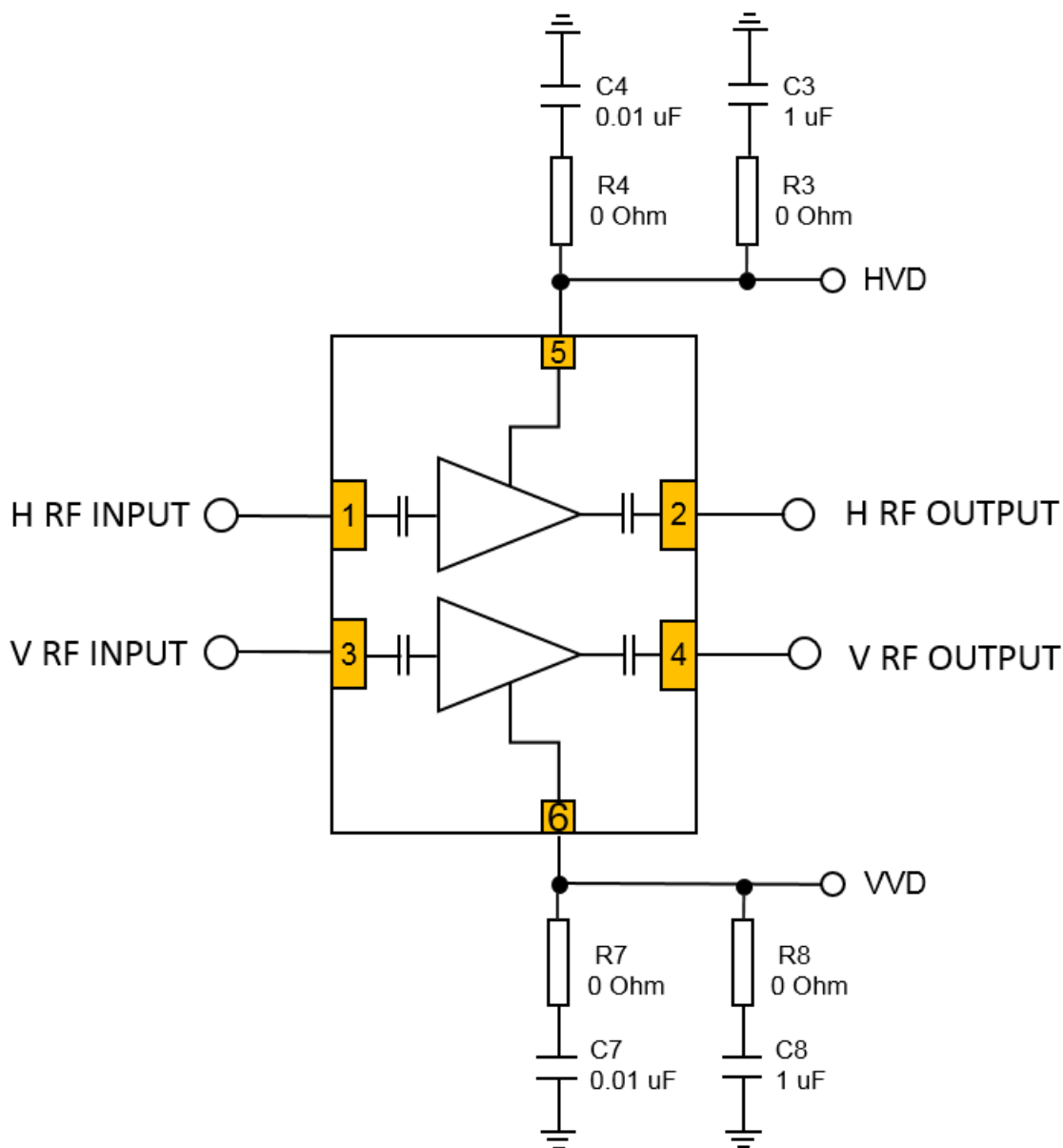


RF Layer is 0.008" thick Rogers Corp. RO4003C ($\epsilon_r = 3.35$). Metal layers are 0.5 oz. copper. The microstrip line at the connector interface is optimized for the Southwest Microwave end launch connector 1092-01A-5.

Bill of Material – Evaluation Board

Ref. Des.	Value	Description	Manuf.	Part Number
R3, R4, R7, R8	0 Ohm	Res 0 Ohm, 5%, 1/10 W, 0402	Various	
C3, C8	1.0 uF	CAP 1.0UF, +/-10%, 16V, 1206, X7R ROHS	Various	
C4, C7	0.01 uF	CAP 0.01uF, 10%, 16V, 0402, X7R ROHS	Various	
RF IN, RF OUT	2.92 mm	2.92 MM END LAUNCH CONNECTOR	Southwest Microwave	1092-01A-5

Application Circuit and Biasing Sequence



Bias-up Procedure

1. Set I_D limit to 45 mA
2. Set $V_D +2.0$ V (device is self – bias, drain current will be between 8 to 13 mA)
3. Apply RF signal

Bias-down Procedure

1. Turn off RF signal
2. Set V_D to 0V
3. Turn off V_D supply

Thermal and Reliability Information

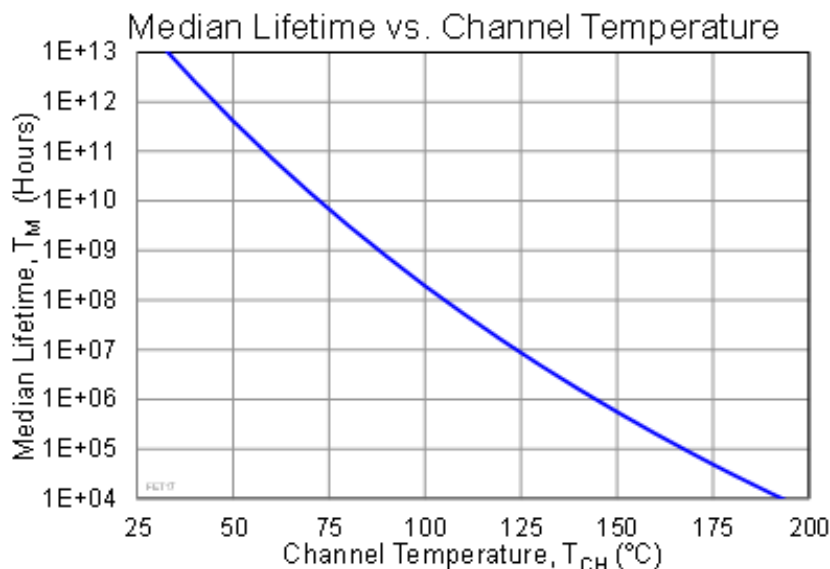
Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) ⁽¹⁾	$T_{base} = 85^{\circ}\text{C}$, $V_D = 2.0\text{ V}$, $I_{DQ} = 11\text{ mA}$ Quiescent/Small Signal operation, $P_{DISS} = 0.022\text{ W}$	145.5	$^{\circ}\text{C/W}$
Channel Temperature, T_{CH} (Under RF)		88.2	$^{\circ}\text{C}$
Median Lifetime (T_M)		9.8E08	Hrs

Notes:

1. Die mounted to 40 mil CuMo carrier plate with AuSn eutectic. Thermal resistance measured at back of carrier plate.

Median Lifetime

Test Conditions: $V_D = +4\text{ V}$
Failure Criteria is 10% reduction in I_{D_MAX}



Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	1A	ESDA / JEDEC JS-001-2012
ESD – Charge Device Model (CDM)	TBD	ANSI/ESD/JEDEC JS-002
MSL – Moisture Sensitivity Level	TBD	IPC/JEDEC J-STD-020



Caution!
ESD-Sensitive Device

RoHS Compliance

This part is compliant with 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment) as amended by Directive 2015/863/EU.

This product also has the following attributes:

- Lead Free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A (C₁₅H₁₂Br₄O₂) Free
- PFOS Free
- SVHC Free

Contact Information

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