TGA4030-SM

17–37 GHz GaAs MPA/Multiplier

General Description

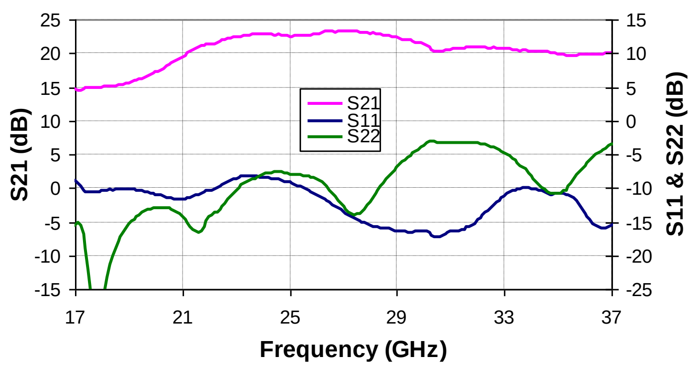
The Qorvo TGA4030-SM is a Medium Power Amplifier and Multiplier for wide band 17–37 GHz applications. The part is designed using Qorvo's 0.15 um power pHEMT process.

The TGA4030-SM provides a nominal 20 dB small signal gain with 22 dBm maximum output power. For 2x and 3x Multiplier Function, TGA4030-SM provides 15 dBm typical output power @ 9 dBm P_{IN}.

This part is ideally suited for applications such as Point-to-Point Radio, EW, instrumentation and frequency multipliers.

Measured Performance

Bias at V_D = 5 V, I_D = 140 mA and V_G = -0.75 V (Typical)



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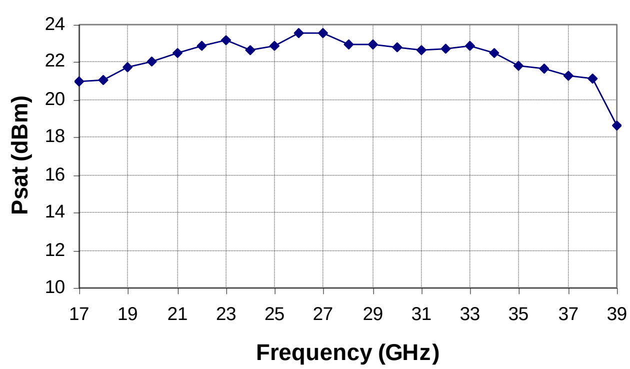


Product Features

- RF Output Frequency Range: 17-37 GHz
- 20 dB Nominal Gain
- 22 dBm Nominal Output Maximum Power
- 2x and 3x Multiplier Function
- Bias: V_D = 5 V, I_D = 140 mA
- Package Dimensions: 3.0 x 3.0 x 0.85 mm

Applications

- Point-to-Point Radio
- EW
- Instrumentation
- Frequency Multiplier

Ordering Information

Part	Description
TGA4030-SM	Amplifier, Waffle Pack, Qty 100
TGA4030-SMEVB	TGA4030-SM Evaluation Board, Qty 1

Absolute Maximum Ratings

Symbol	Parameter	Value/Range	Notes
V_D-V_G	Drain to Gate Voltage	8	V
V_D	Drain Supply Voltage Range	6	V
V_G	Gate Supply Voltage Range	-3 – 0	V
I_D	Drain Current	400	mA
I_G	Gate Current	1.38	mA
P_{IN}	Input Continuous Wave Power	20	dBm
Ts	Storage Temperature	-55 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. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability.

Recommended Operating Conditions

See application pages for amplifier, 2x multiplier and 3x multiplier bias conditions

Symbol	Parameter	Value/Range, Amp	Value/Range, x2 Multi	Value/Range, x3 Multi	Units
V_D	Drain Voltage	5	5	5	V
I_D	Drain Current	140	120	160	mA
V_G	Gate Voltage (Typ)	-0.75	-0.75	-0.75	V
V_{D1}	Drain Voltage	5	5	1	V
V_{G1}	Gate Voltage	same as V_G	-1.1	same as V_G	V

RF Characterization Table

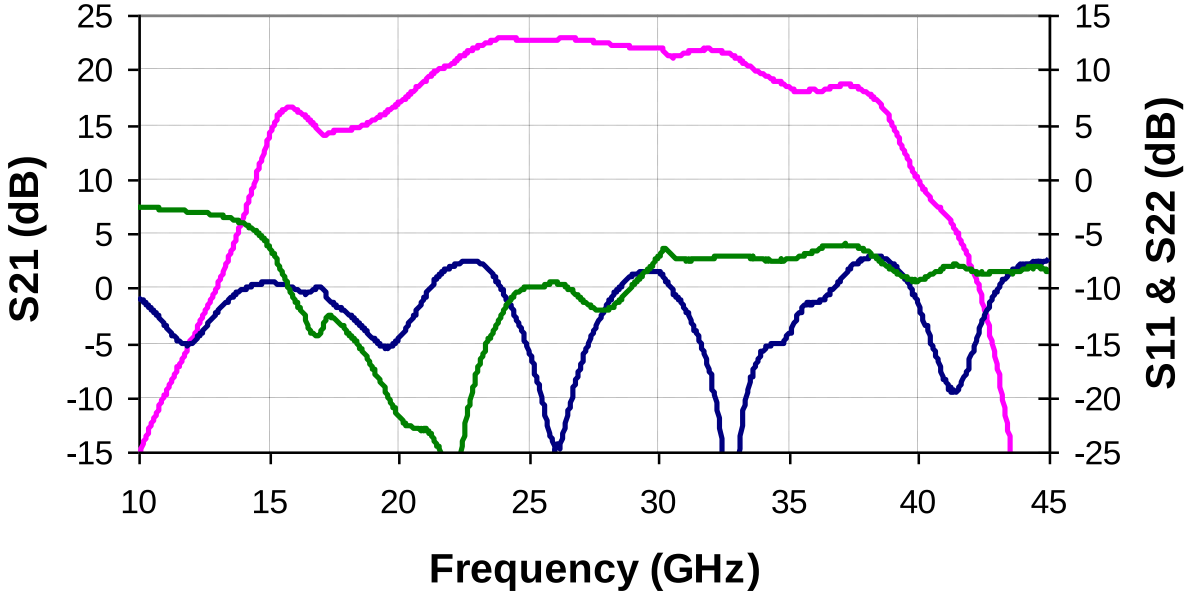
See application pages for amplifier, 2x multiplier and 3x multiplier bias conditions, T_A= 25 °C

Data de-embedded to reference lines

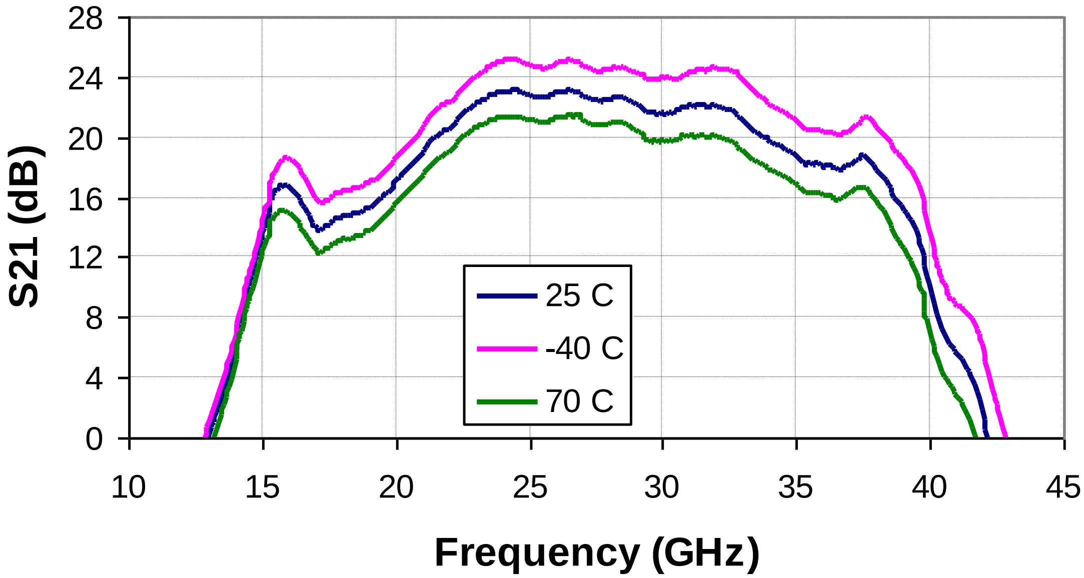
Parameter	Amplifier	2x Multiplier	3x Multiplier	Units
RF Output Frequencies	17-37	22-38	23-31	GHz
S21, Small Signal Gain	20			dB
S11, Input Return Loss	10			dB
S22, Output Return Loss	5	5	5	dB
P_{SAT}, Maximum Output Power	22			dBm
P1dB, Output Power @ 1 dB Gain Compression	18			dBm
IMD3@ 11 dBm P_{OUT}/Tone	30			dBc
Output Power @ P_{IN} = 9 dBm		15	15	dBm
Conversion Gain		9	5	dB
Gain Temperature coefficient	-0.04			dB/°C

Measured Data, Amplifier

Bias Conditions: V_D = 5 V, I_{DQ} = 140 mA, V_G = -0.75 V (Typical), 25 °C



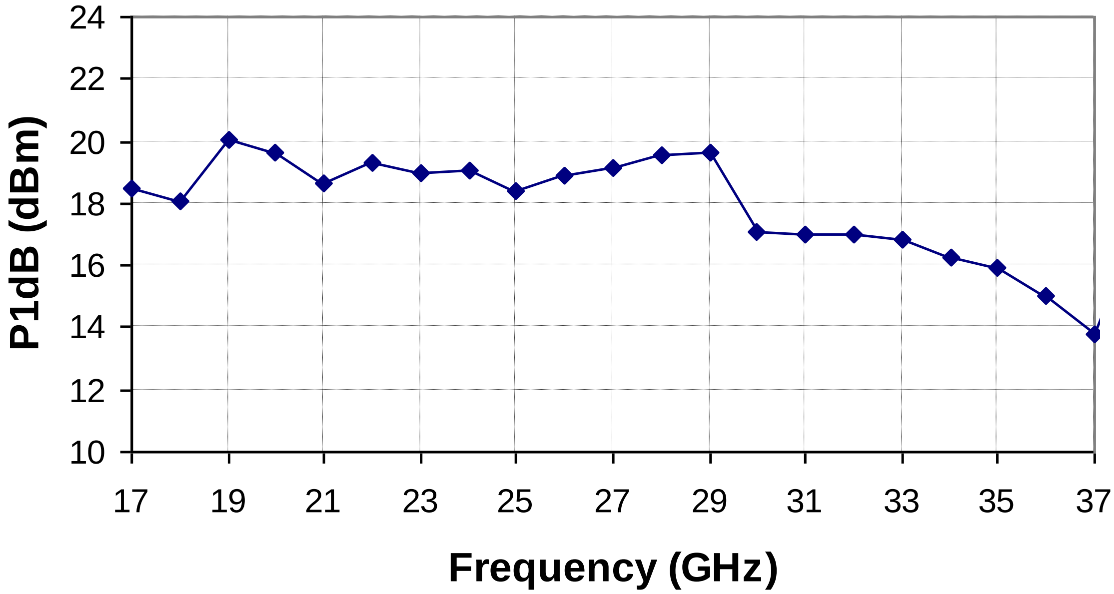
This is device s-parameter

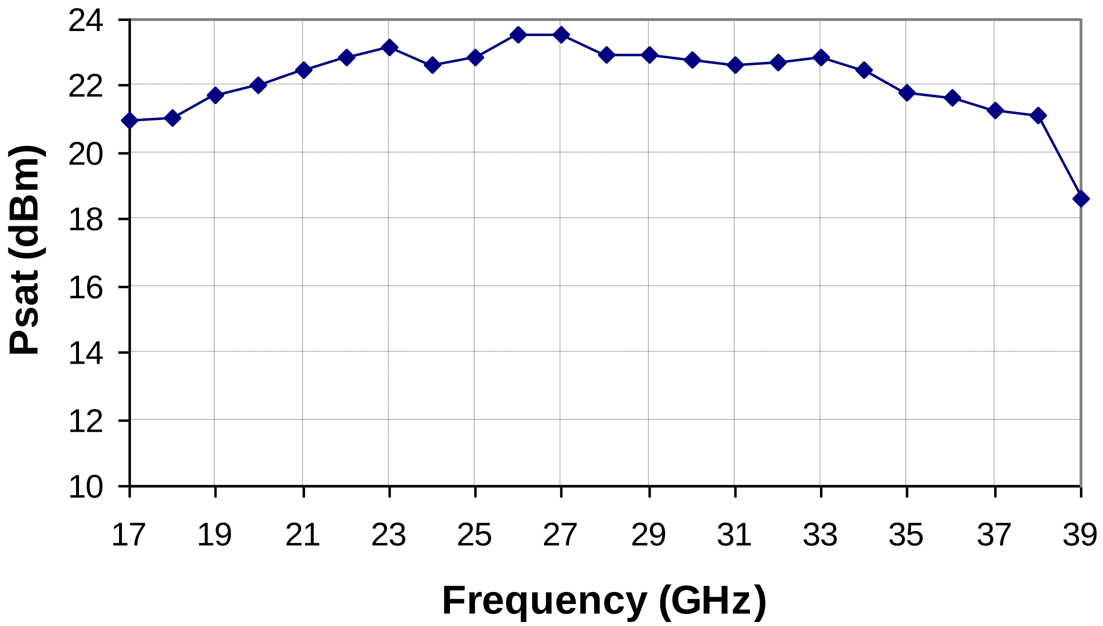


This is evaluation board s-parameter

Measured Data, Amplifier

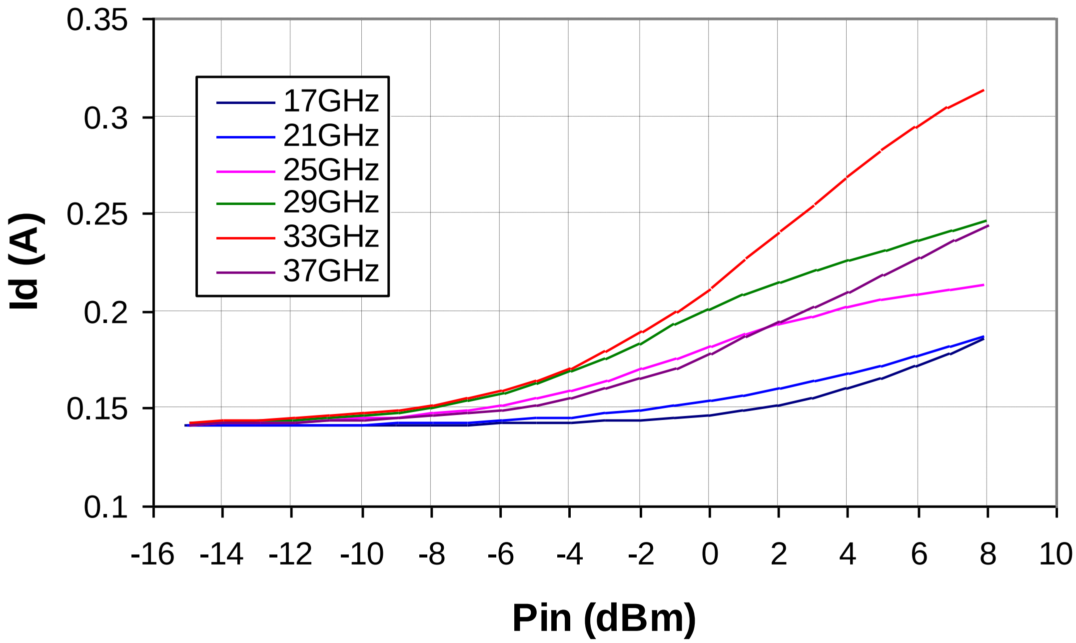
Bias Conditions: V_D = 5 V, I_{DQ} = 140 mA, V_G = -0.75 V (Typical), 25 °C

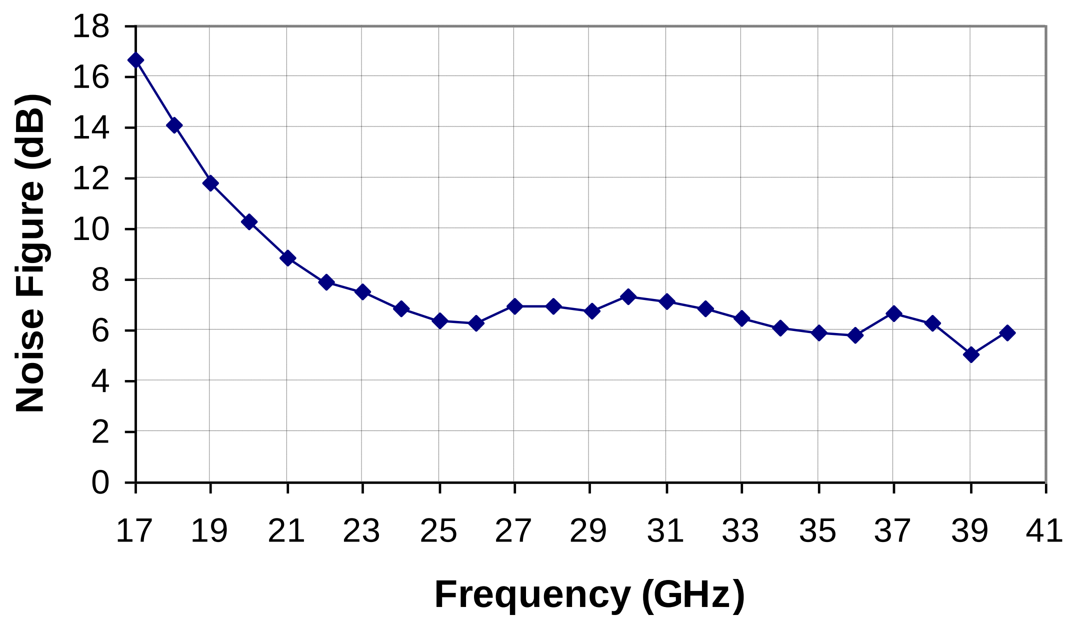




Measured Data, Amplifier

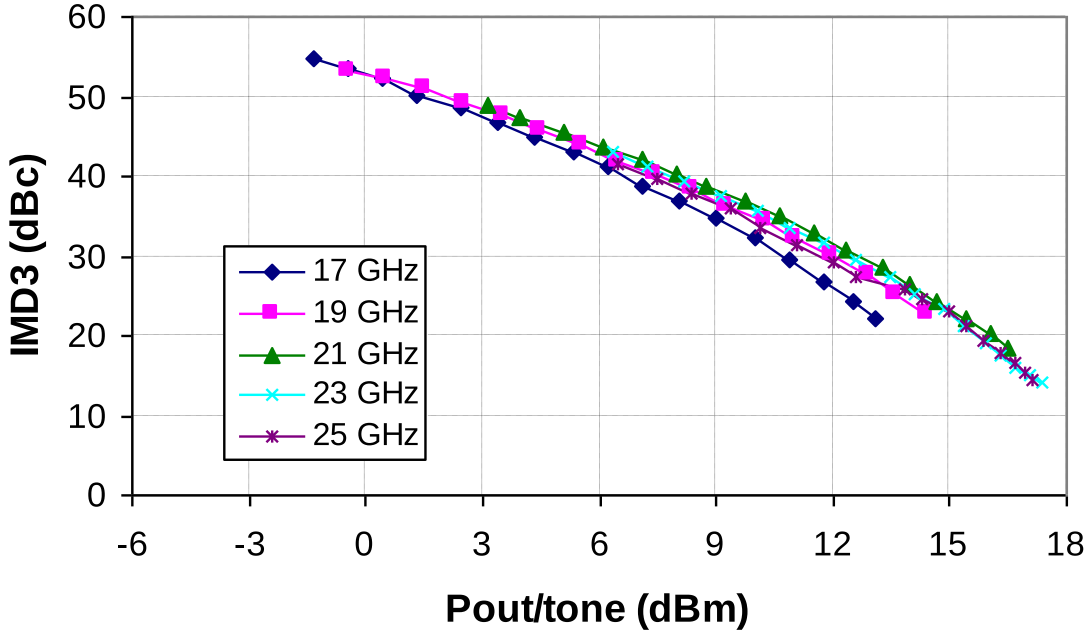
Bias Conditions: V_D = 5 V, I_{DQ} = 140 mA, V_G = -0.75 V (Typical), 25 °C

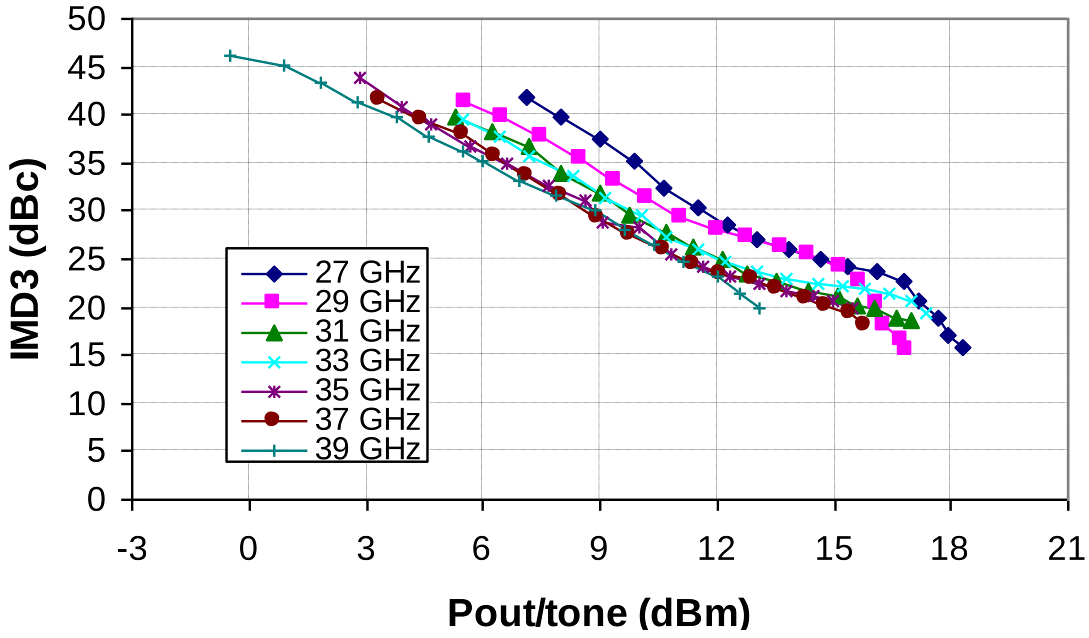




Measured Data, Amplifier

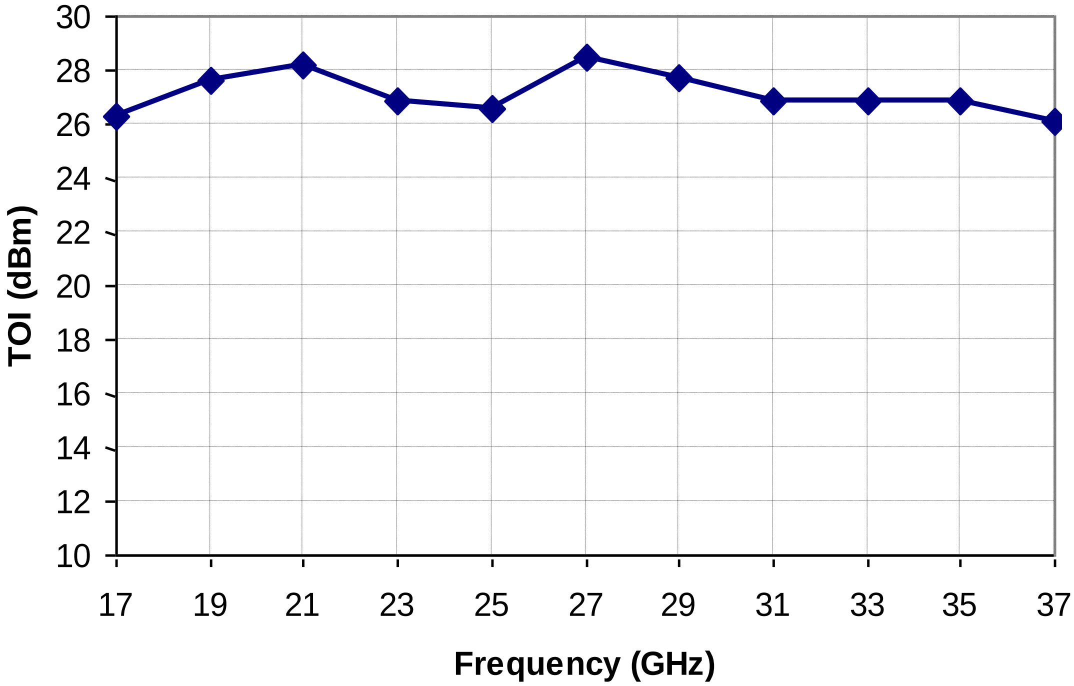
Bias Conditions: V_D = 5 V, I_{DQ} = 140 mA, V_G = -0.75 V (Typical), 25 °C





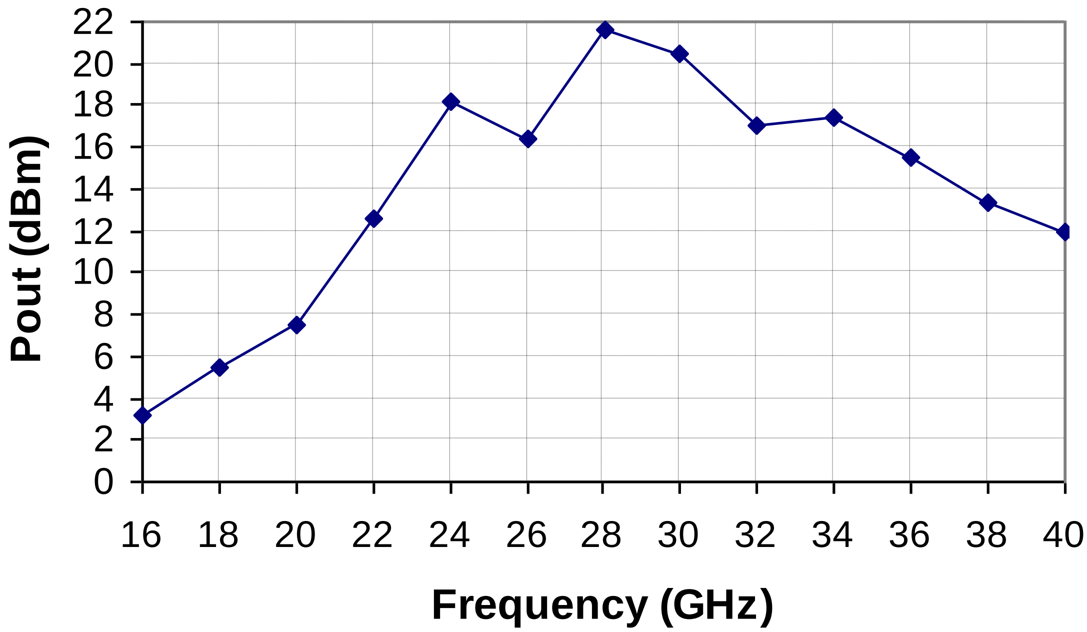
Measured Data, Amplifier

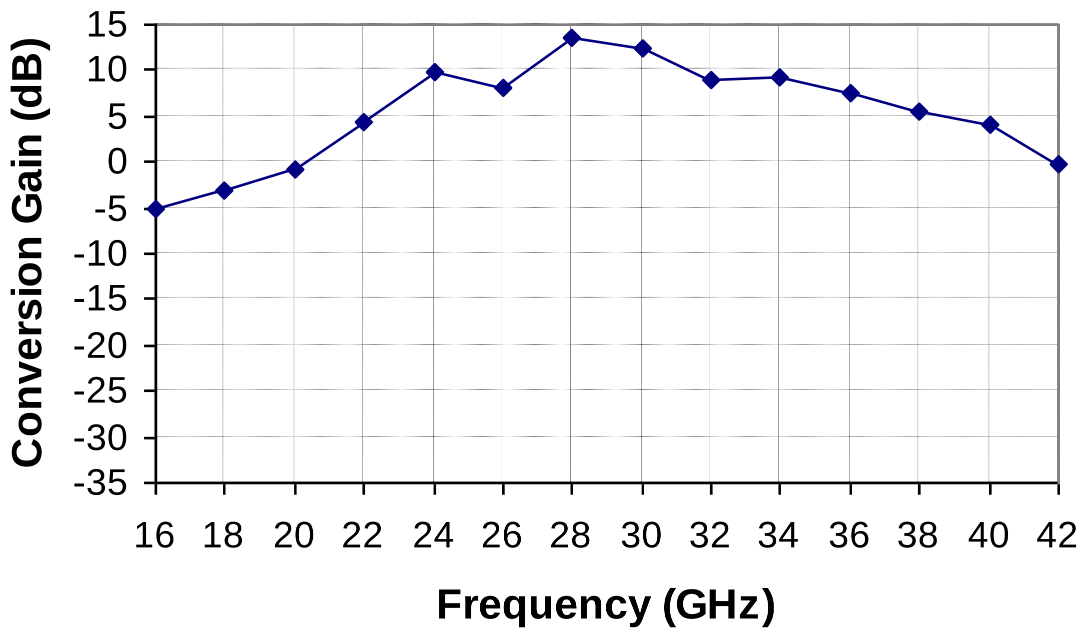
Bias Conditions: V_D = 5 V, I_{DQ} = 140 mA, V_G = -0.75 V (Typical), 25 °C



Measured Data, 2X Multiplier

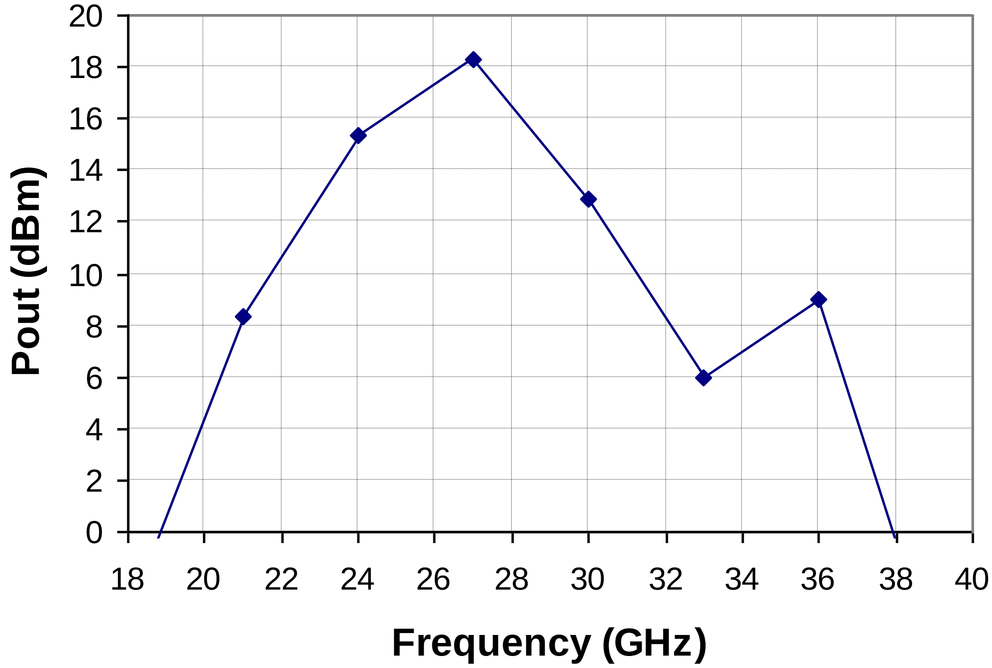
Bias Conditions: V_D = 5 V, I_{DQ} = 120 mA, V_{G1} = -1.1 V, P_{IN} = 9 dBm, 25 °C

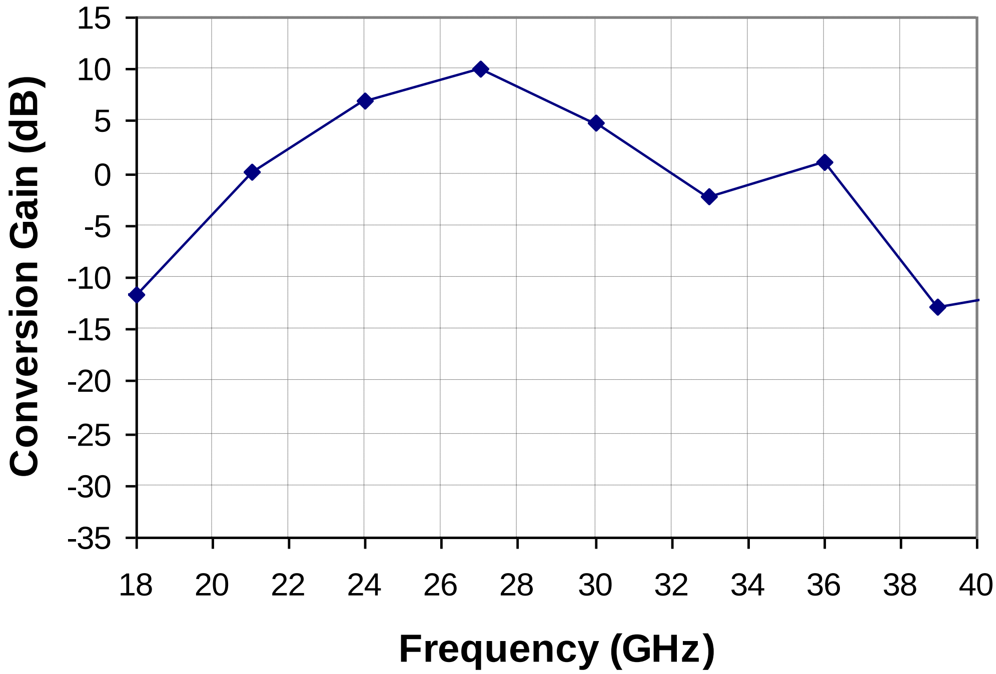




Measured Data, 3X Multiplier

Bias Conditions: V_D = 5 V, V_{D1} = 1 V, I_{DQ} = 160 mA, P_{IN} = 9 dBm, 25 °C



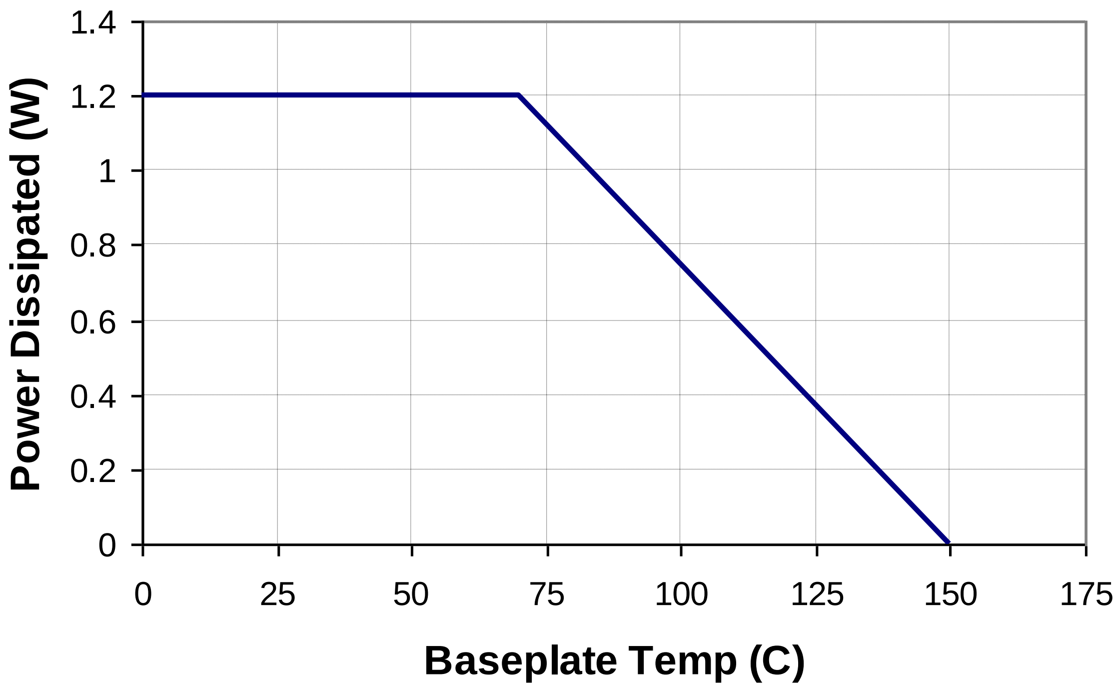


Power Dissipation and Thermal Properties

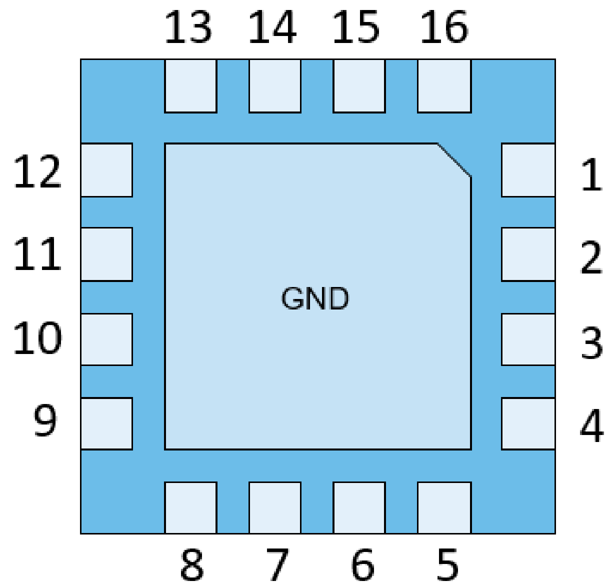
Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC})	Under RF Drive P_D = 1.2 W $T_{BASEPLATE}$ = 70 °C	66.7	°C/W
Channel Temperature (T_{CH})(2)		150	°C
Median Lifetime (T_M)(1)		1.0 E + 6	Hrs
Thermal Resistance (θ_{JC})	Quiescent, Small Signal V_D = 5 V, I_D = 140 mA, P_D = 0.7 W $T_{BASEPLATE}$ = 70 °C	65.7	°C/W
Channel Temperature (T_{CH}) (2)		116	°C
Median Lifetime (T_M)(1)		2.4 E+7 Hrs	Hrs

Notes:

1. For a median life, Tm, of 1 E+6 hours, power dissipation is limited to $P_D(max) = (T_{CHANNEL}\ °C – T_{BASE}\ °C)/\theta jc$
2. Channel operating temperature will directly affect the device median time to failure (MTTF). For maximum life, it is recommended that channel temperatures be maintained at the lowest possible levels.

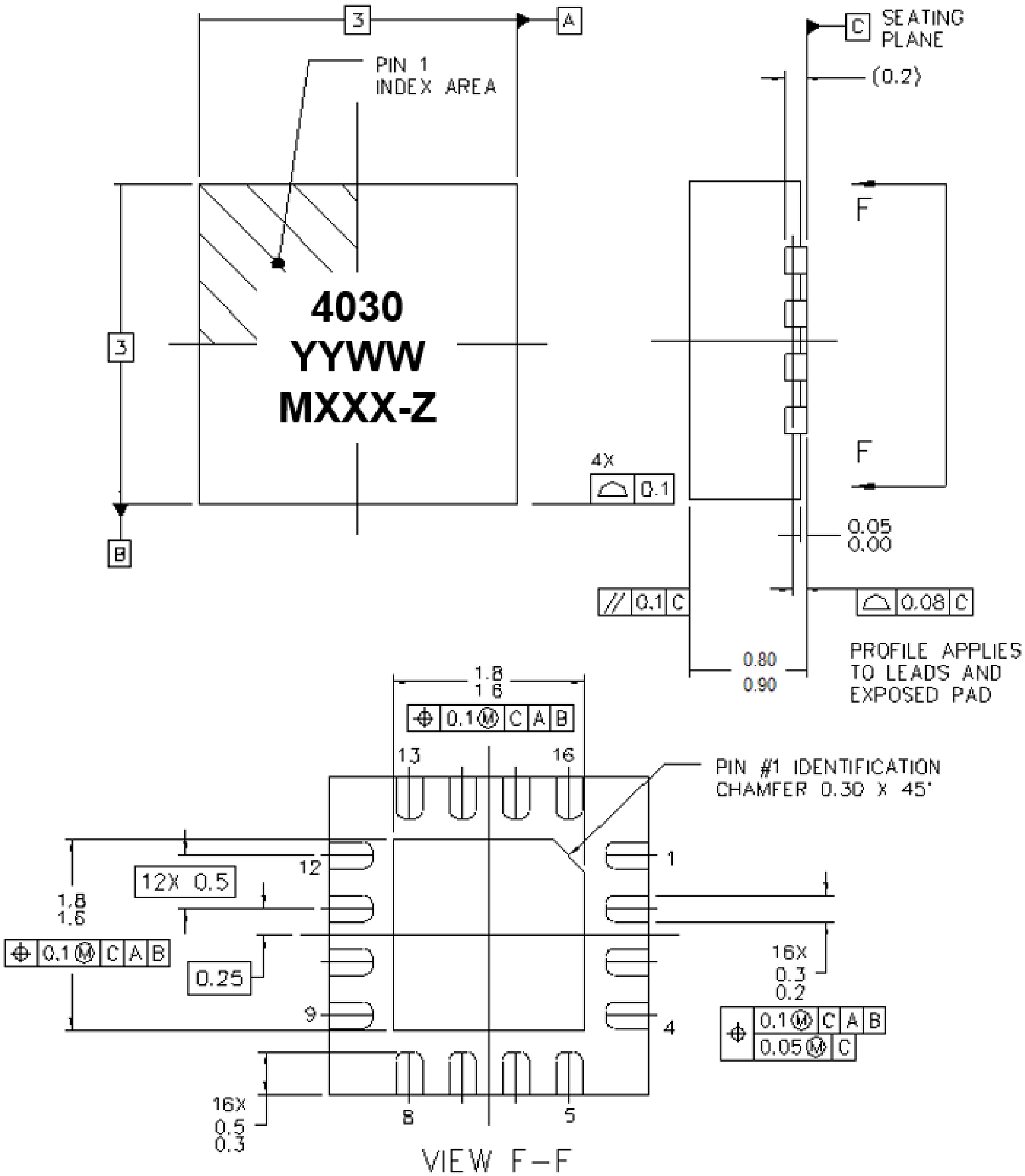


Mechanical Drawing & Pad Description



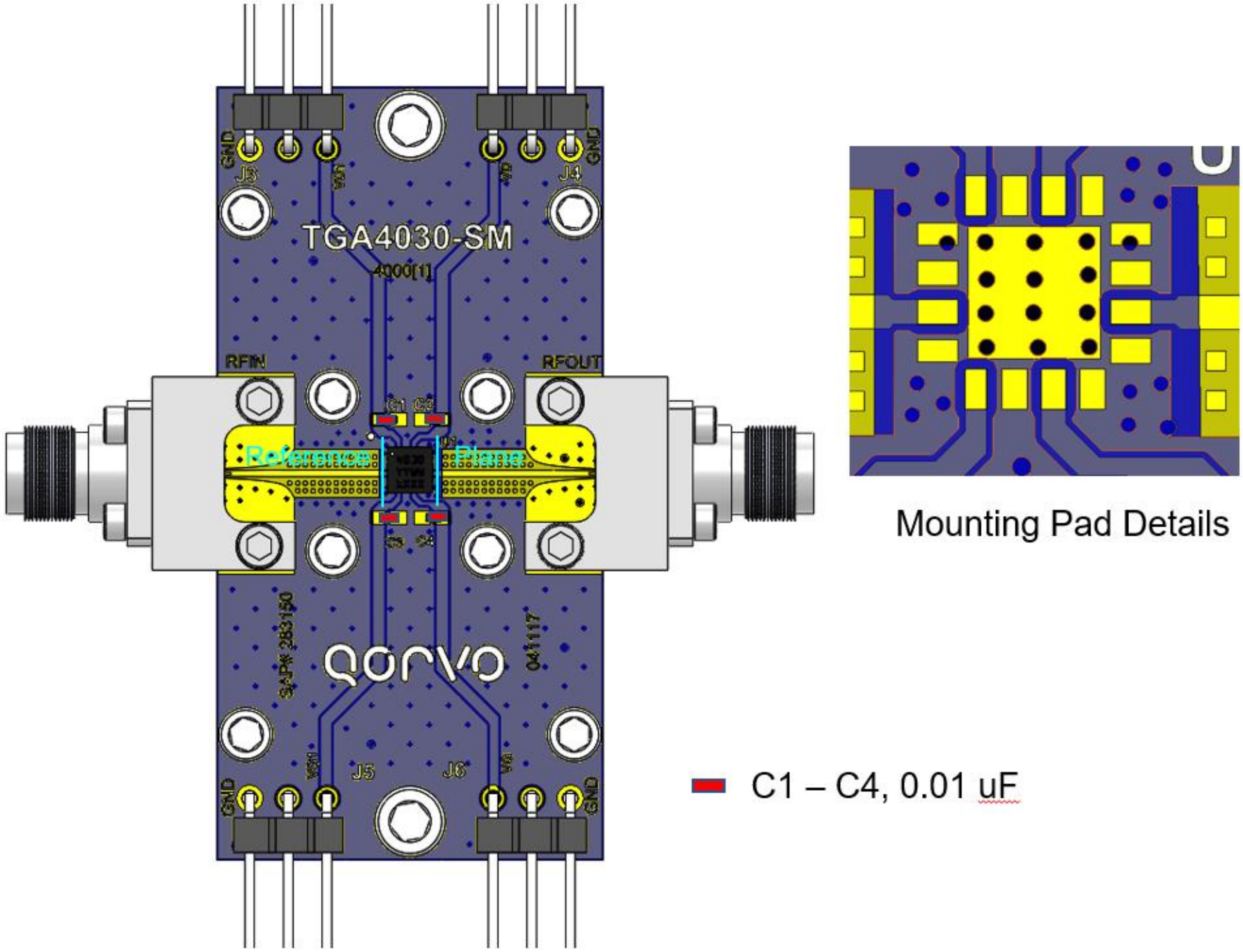
Pin Number	Label	Description
1, 2, 4, 9, 11, 12 (slug)	GND	Ground
3	RF Input	Matched to 50 ohms, DC blocked
5	VG1	Stage 1 Gate Voltage
7	VG	Other Stages Gate Voltage
10	RF Output	Matched to 50 ohms, DC blocked
14	VD	Other Stages Drain Voltage
16	VD1	Stage 1 Drain Voltage
6, 8, 13, 15	N/C	No internal connection. Recommend to GND at the PCB level

Mechanical Drawing



Dimensions in mm, package is mold encapsulated with Tin plated lead finish
Part Marking: 4030 = Part Number, YY = Part Assembly Year
WW = Part Assembly Week, MXXX-Z = Batch ID

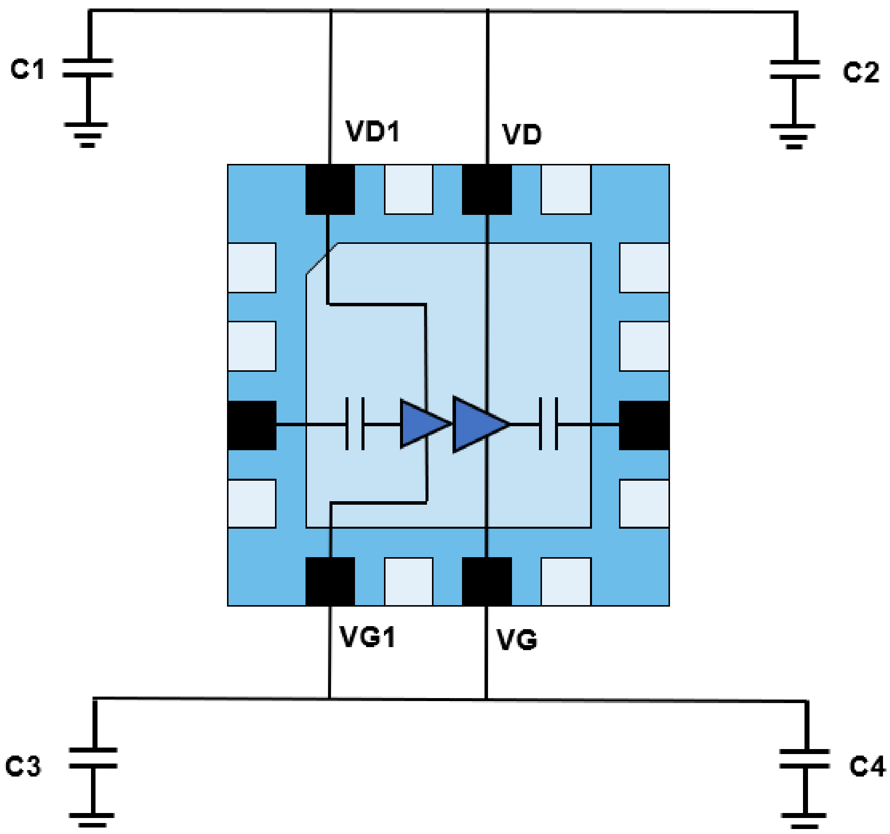
Evaluation Board



Notes:

1. C1 – C4 0402 0.01 uF capacitors
2. Board material is 8 mil ROGERS RO4003

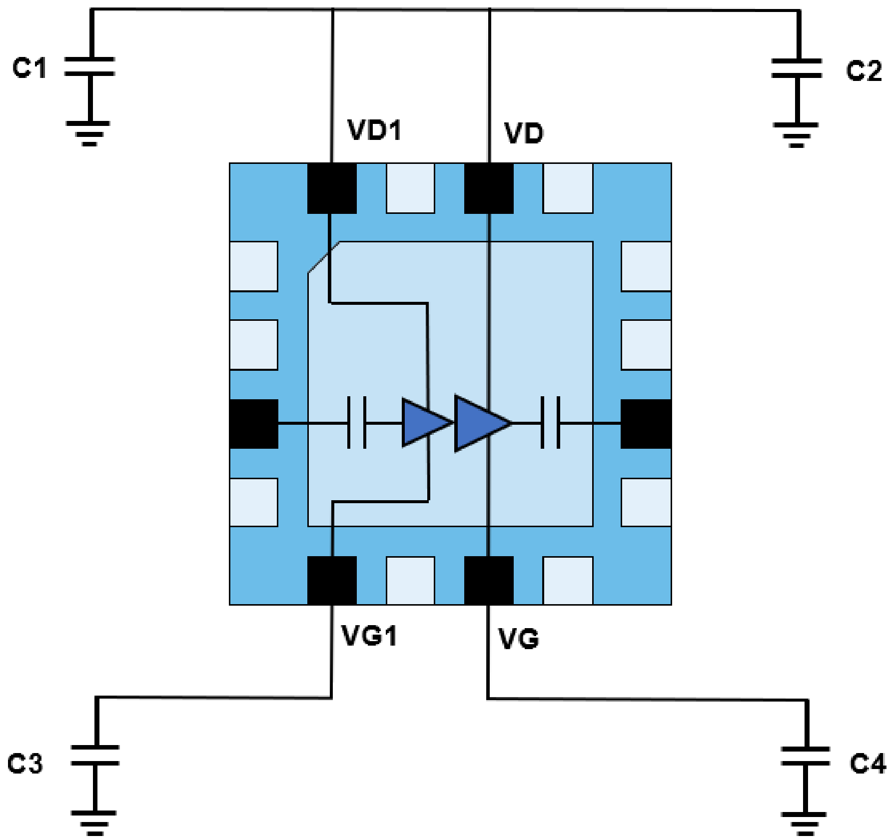
Application Circuit, Device as Amplifier



Bias-up Procedure
1. Set I_D limit to 400 mA, I_G limit to 2 mA
2. Set V_G to −1.5 V
3. Set V_D +5 V
4. Adjust V_G more positive until I_{DQ} = 140 mA
5. Apply RF signal

Bias-down Procedure
1. Turn off RF signal
2. Reduce V_G to −1.5 V. Ensure I_{DQ} ~ 0 mA
3. Set V_D to 0 V
4. Turn off V_D supply
5. Turn off V_G supply

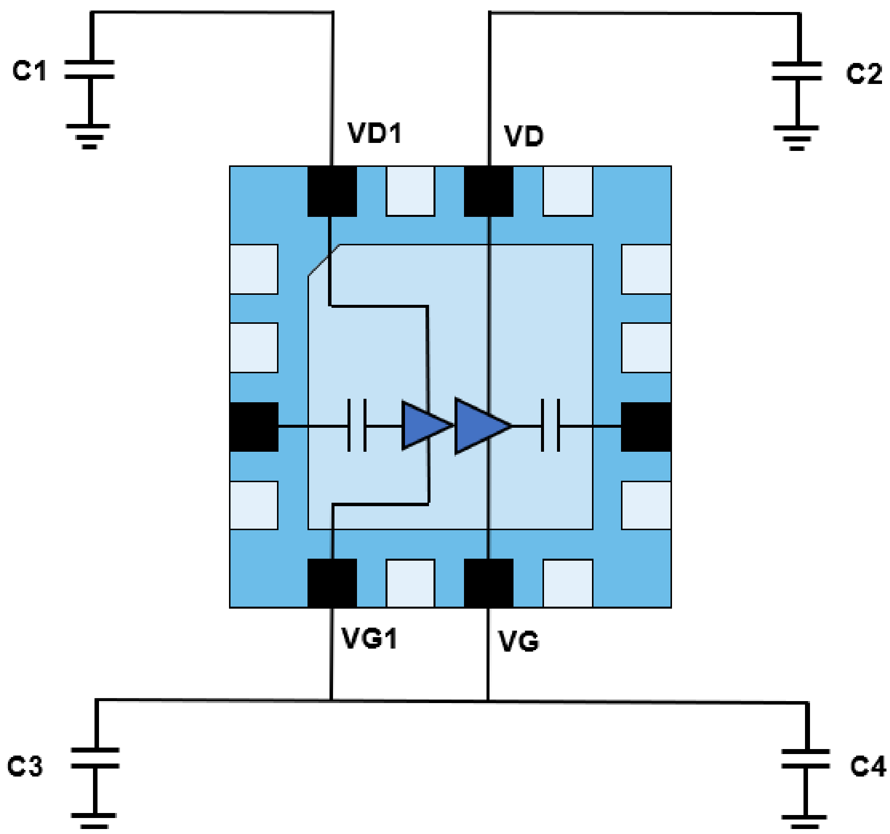
Application Circuit, Device as x2 Multiplier



Bias-up Procedure
1. Set I_D limit to 400 mA, I_G and I_{G1} limit to 2 mA each.
2. Set V_G to −1.5 V, Set V_{G1} = -1.1 V (fixed)
3. Set V_D +5 V
4. Adjust V_G more positive until I_{DQ} = 120 mA
5. Apply RF signal

Bias-down Procedure
1. Turn off RF signal
2. Reduce V_G to −1.5 V. Ensure I_{DQ} ~ 0 mA
3. Set V_D to 0 V
4. Turn off V_D supply
5. Turn off V_G and V_{G1} supply

Application Circuit, Device as x3 Multiplier



Bias-up Procedure	Bias-down Procedure
1. Set I_D limit to 400 mA, Set I_{D1} Limit to 50 mA, I_G limit to 2 mA	1. Turn off RF signal
2. Set V_G to −1.5 V	2. Reduce V_G to −1.5 V. Ensure I_{DQ} ~ 0 mA
3. Set V_D = +5 V, Set V_{D1} = +1 V	3. Set V_{D1} and V_D to 0 V
4. Adjust V_G more positive until I_{D1} + I_D = 160 mA	4. Turn off V_{D1} and V_D supply
5. Apply RF signal	5. Turn off V_G supply

Recommended Surface Mount Package Assembly

Clean the board with acetone. Rinse with alcohol. Allow the circuit to fully dry.

Qorvo recommends using a conductive solder paste for attachment. Follow solder paste and reflow oven vendors' recommendations when developing a solder reflow profile.

Hand soldering is not recommended. Solder paste can be applied using a stencil printer or dot placement. The volume of solder paste depends on PCB and component layout and should be well controlled to ensure consistent mechanical and electrical performance

Typical Soldier Reflow Profiles

Reflow Profiles	SnPb	Pb Free
Ramp-up rate	3 °C/sec	3 °C/sec
Activation Time and Temperture	60-120 sec @ 140-160 °C	60-180 sec @ 150-200 °C
Time above Melting point	60-150 sec	60-150 sec
Max Peak Temperature	240 °C	260 °C
Time within 5 ºC of Peak Temperature	10-20 sec	10-20 sec
Ramp-down Rate	4-6 °C/sec	4-6 °C/sec

Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	0B	ESDA / JEDEC JS-001-2017
ESD – Charged Device Model (CDM)	C3	ESDA / JEDEC JS-002-2014
MSL – Moisture Sensitivity Level	3	JEDEC standard IPC/JEDEC J-STD-020

Caution!
ESD-Sensitive Device

RoHS Compliance

This product is compliant with the 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 ($C_{15}H_{12}Br_{4}0_{2}$) Free
- PFOS Free
- SVHC Free

Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations.

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Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

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