



# 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  $\mu\text{m}$  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  $P_{\text{IN}}$ .

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

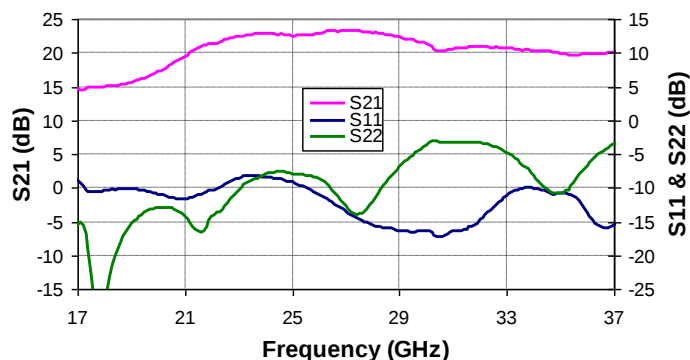
### Product Features

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

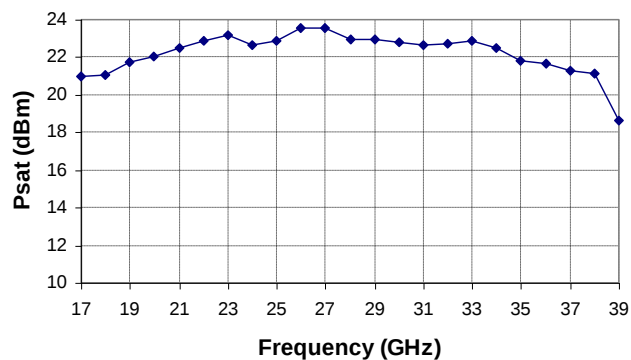


### Measured Performance

Bias at  $V_D = 5\text{ V}$ ,  $I_D = 140\text{ mA}$  and  $V_G = -0.75\text{ V}$  (Typical)



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### 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   |
| $T_S$       | 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

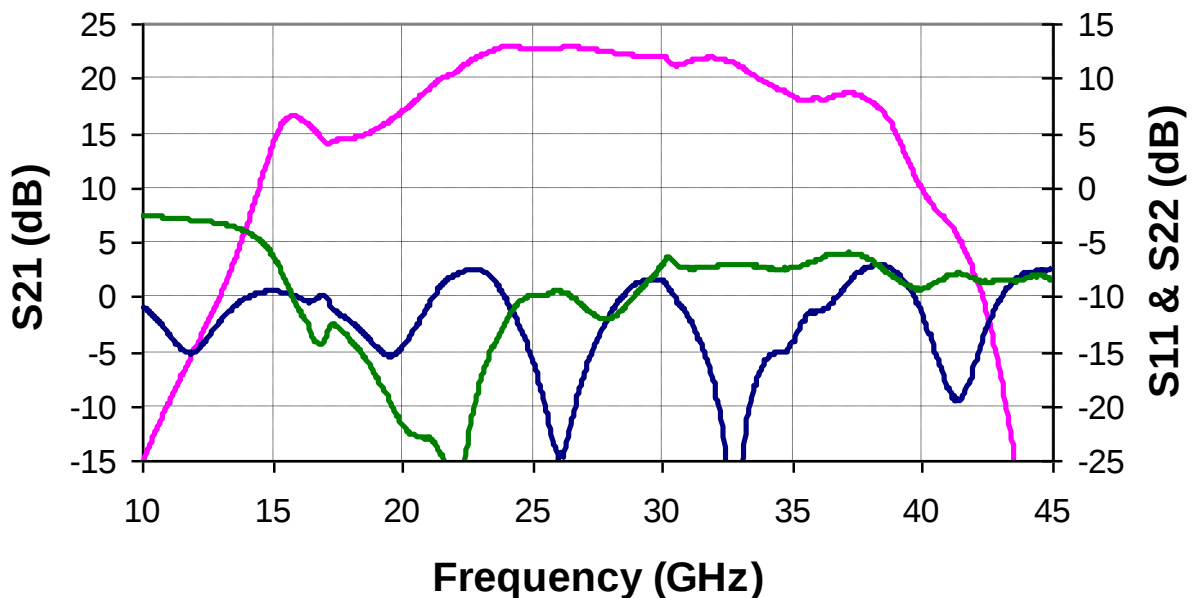
See application pages for amplifier, 2x multiplier and 3x multiplier bias conditions,  $T_A = 25^\circ\text{C}$

Data de-embedded to reference lines

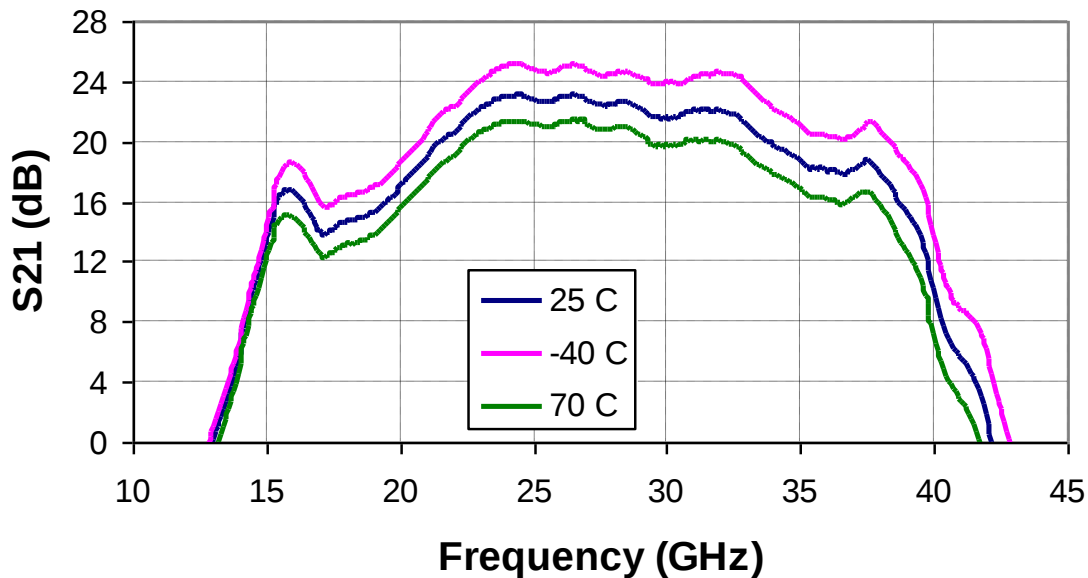
| Parameter                                               | Amplifier | 2x Multiplier | 3x Multiplier | Units |
|---------------------------------------------------------|-----------|---------------|---------------|-------|
| RF Output Frequencies                                   | 17-37     | 22-38         | 23-31         | GHz   |
| S <sub>21</sub> , Small Signal Gain                     | 20        |               |               | dB    |
| S <sub>11</sub> , Input Return Loss                     | 10        |               |               | dB    |
| S <sub>22</sub> , Output Return Loss                    | 5         | 5             | 5             | dB    |
| P <sub>SAT</sub> , Maximum Output Power                 | 22        |               |               | dBm   |
| P <sub>1dB</sub> , Output Power @ 1 dB Gain Compression | 18        |               |               | dBm   |
| IMD <sub>3</sub> @ 11 dBm P <sub>OUT</sub> /Tone        | 30        |               |               | dBc   |
| Output Power @ P <sub>IN</sub> = 9 dBm                  |           | 15            | 15            | dBm   |
| Conversion Gain                                         |           | 9             | 5             | dB    |
| Gain Temperature coefficient                            | -0.04     |               |               | dB/°C |

## Measured Data, Amplifier

Bias Conditions:  $V_D = 5\text{ V}$ ,  $I_{DQ} = 140\text{ mA}$ ,  $V_G = -0.75\text{ V}$  (Typical),  $25\text{ }^\circ\text{C}$



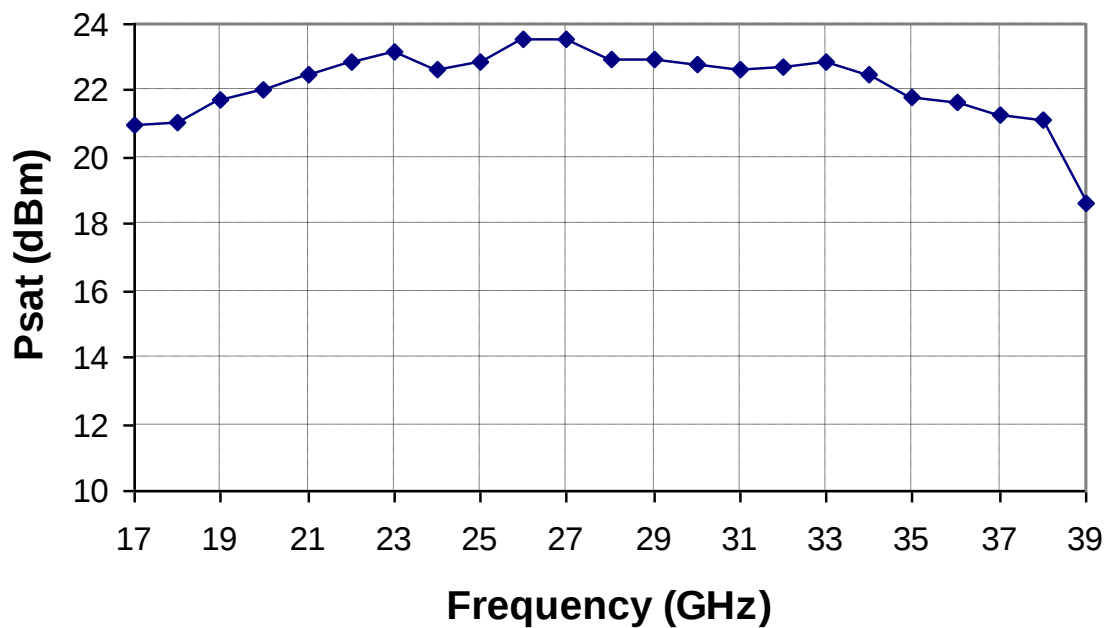
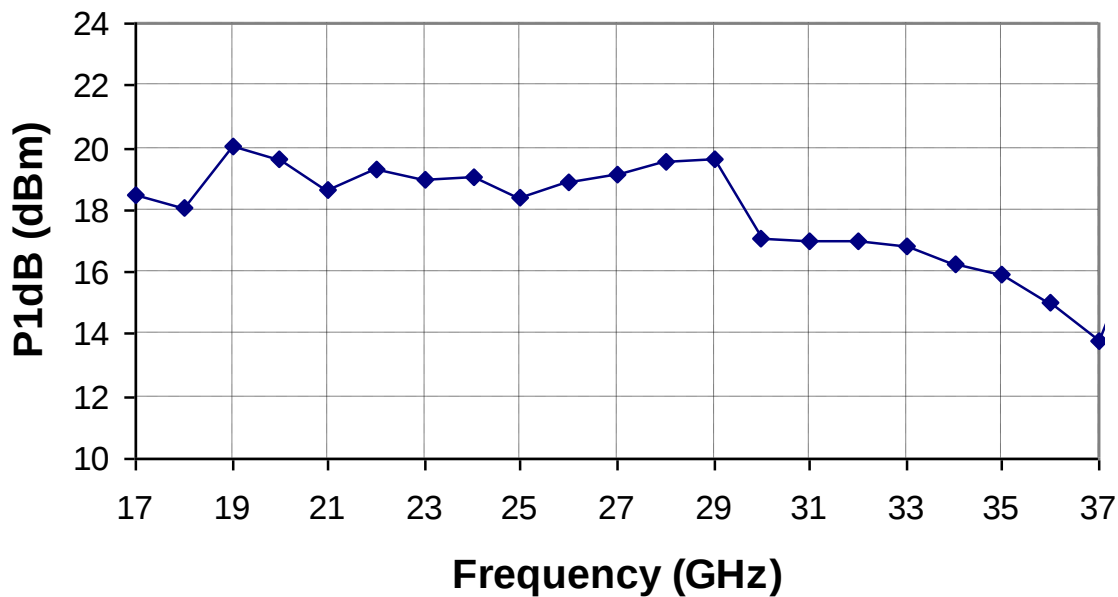
This is device s-parameter



This is evaluation board s-parameter

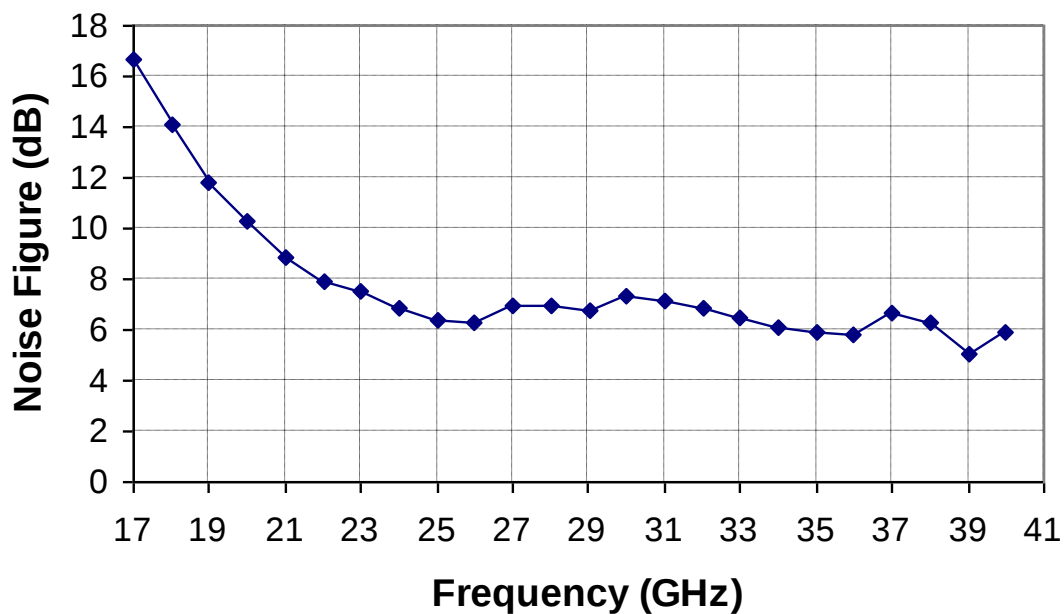
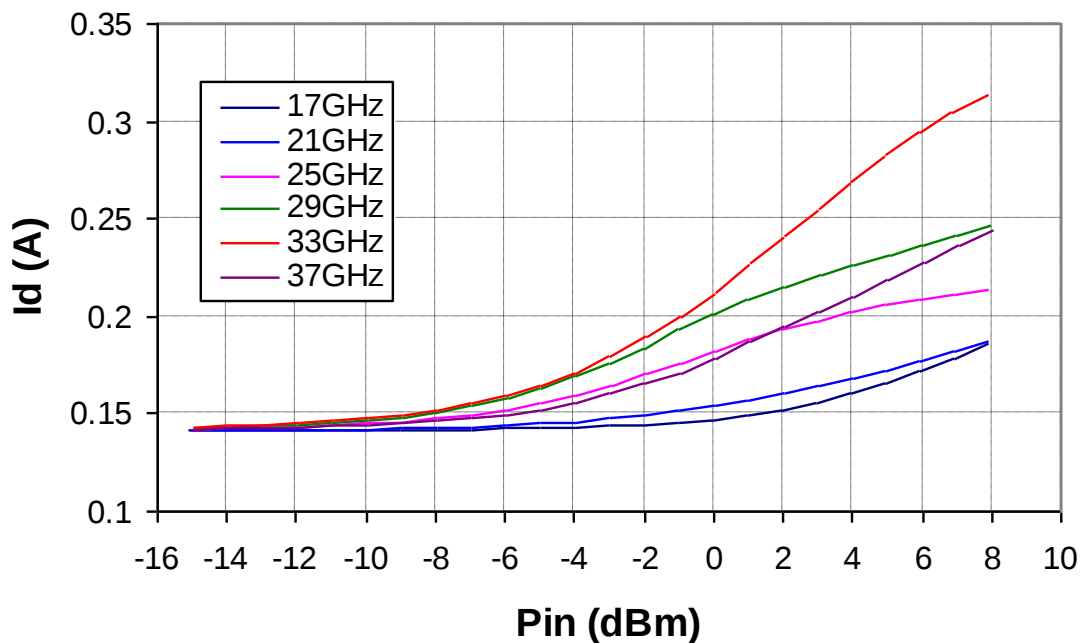
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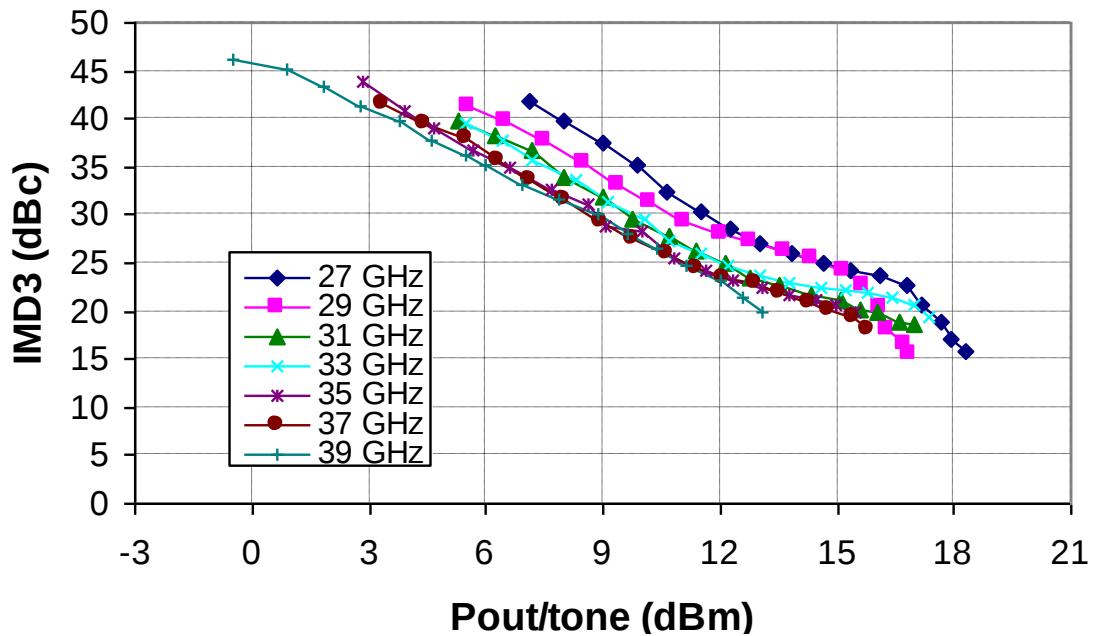
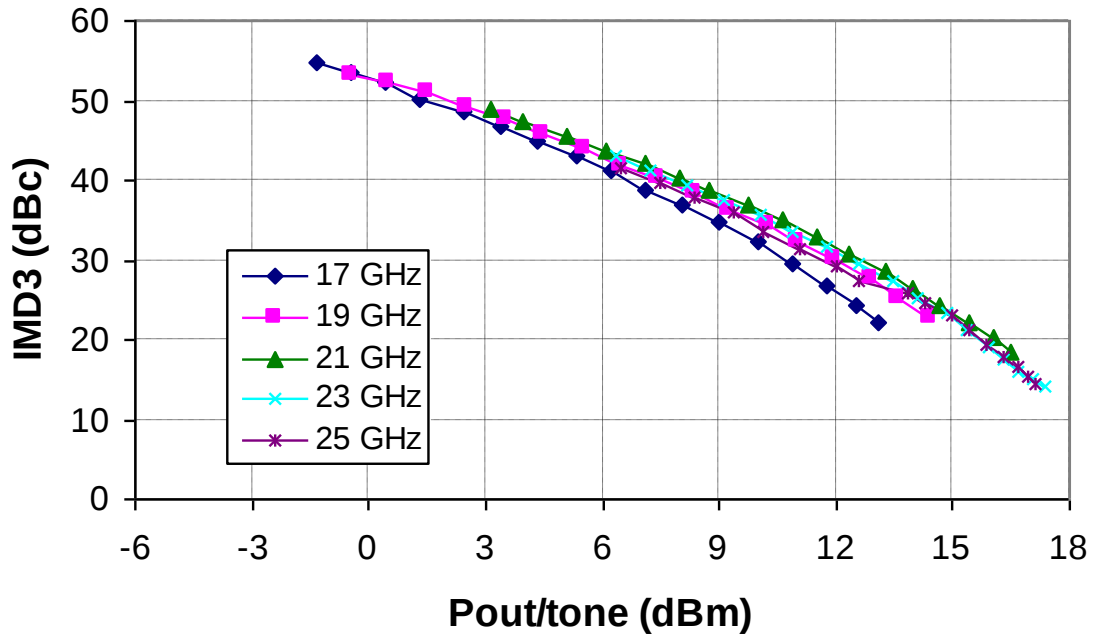
## Measured Data, Amplifier

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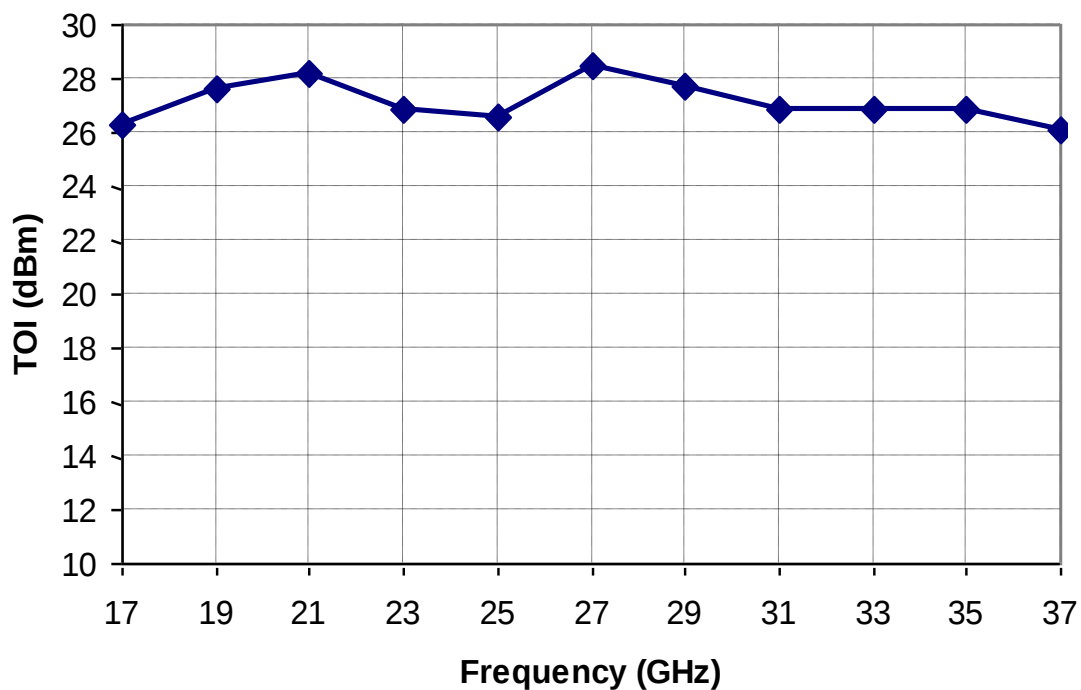
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Bias Conditions:  $V_D = 5$  V,  $I_{DQ} = 140$  mA,  $V_G = -0.75$  V (Typical), 25 °C



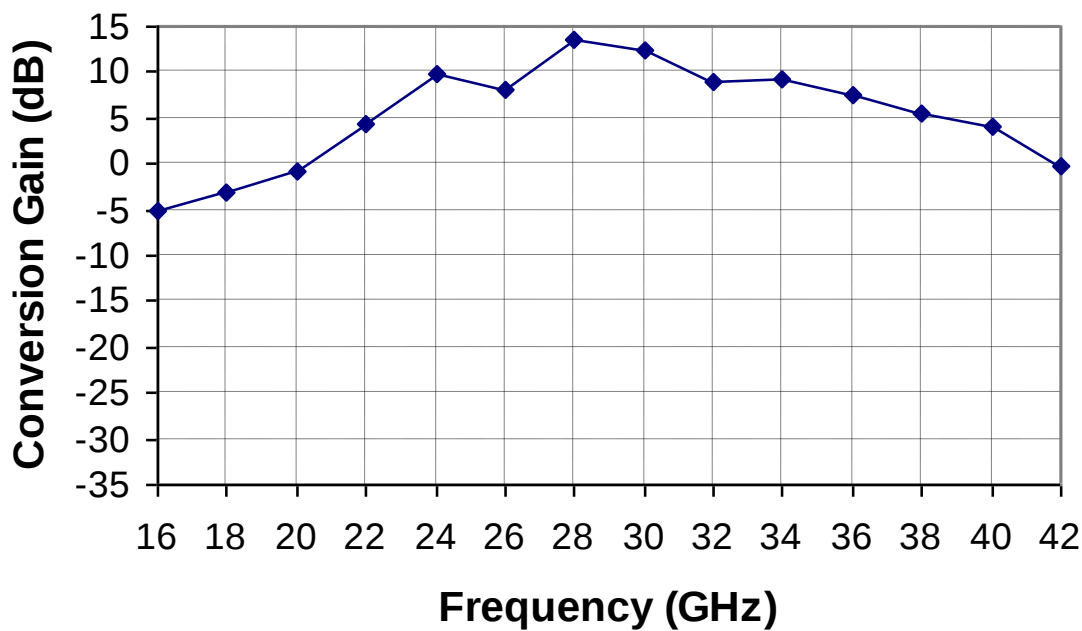
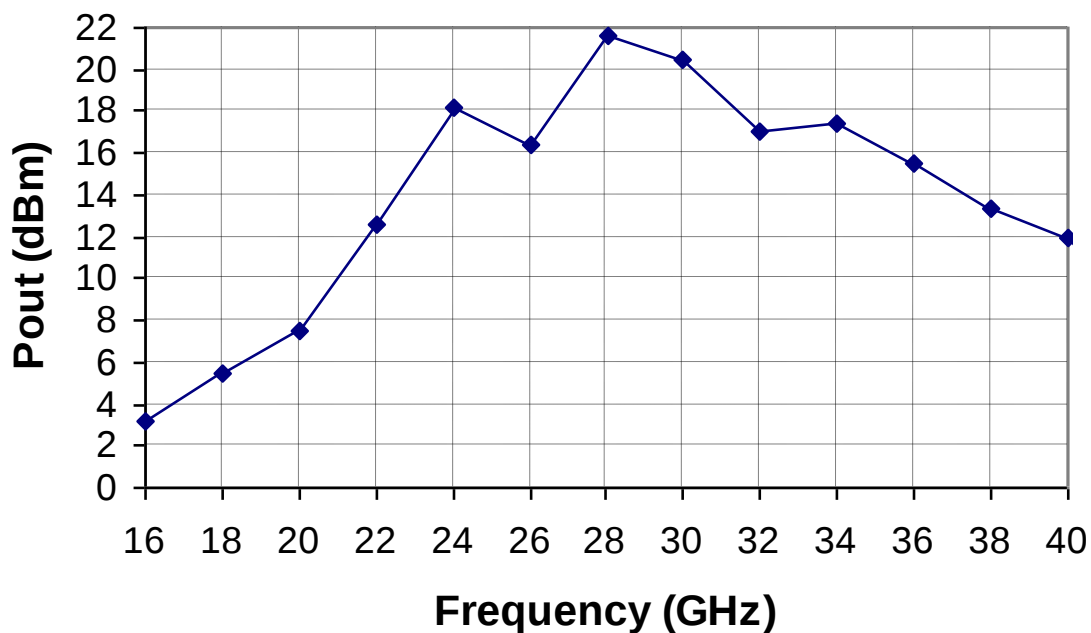
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Bias Conditions:  $V_D = 5\text{ V}$ ,  $I_{DQ} = 140\text{ mA}$ ,  $V_G = -0.75\text{ V}$  (Typical),  $25\text{ }^\circ\text{C}$



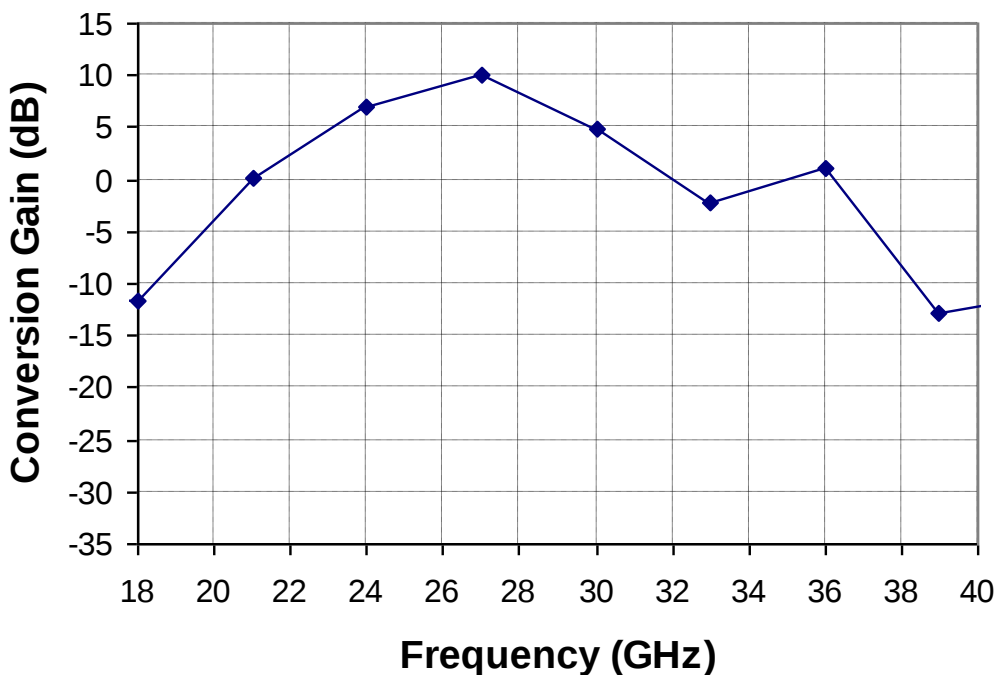
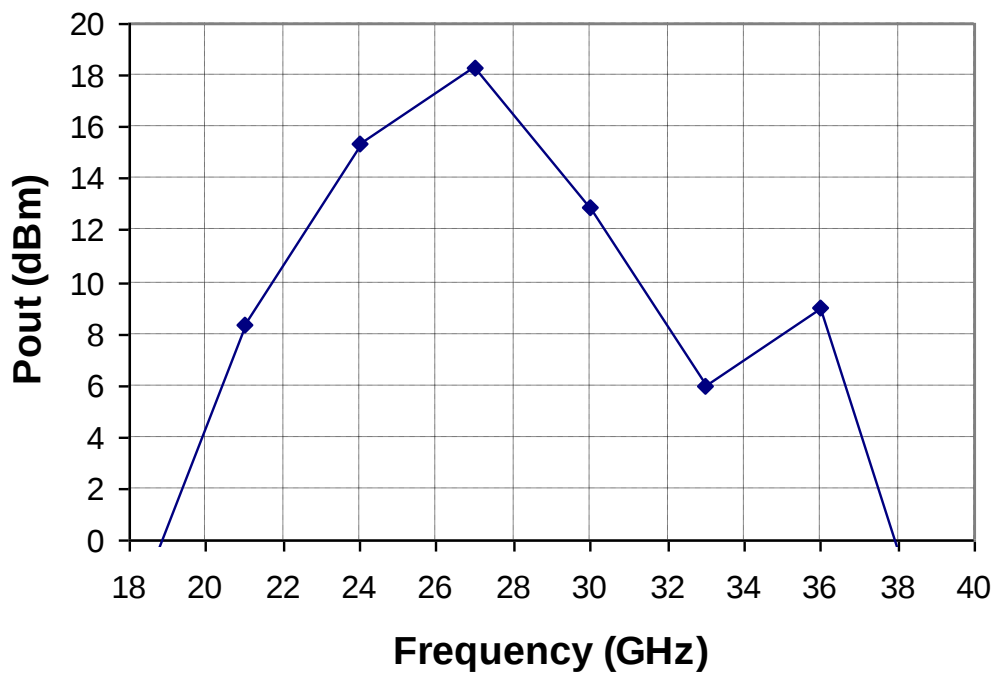
## Measured Data, 2X Multiplier

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



## Measured Data, 3X Multiplier

Bias Conditions:  $V_D = 5\text{ V}$ ,  $V_{D1} = 1\text{ V}$ ,  $I_{DQ} = 160\text{ mA}$ ,  $P_{IN} = 9\text{ dBm}$ ,  $25\text{ }^\circ\text{C}$

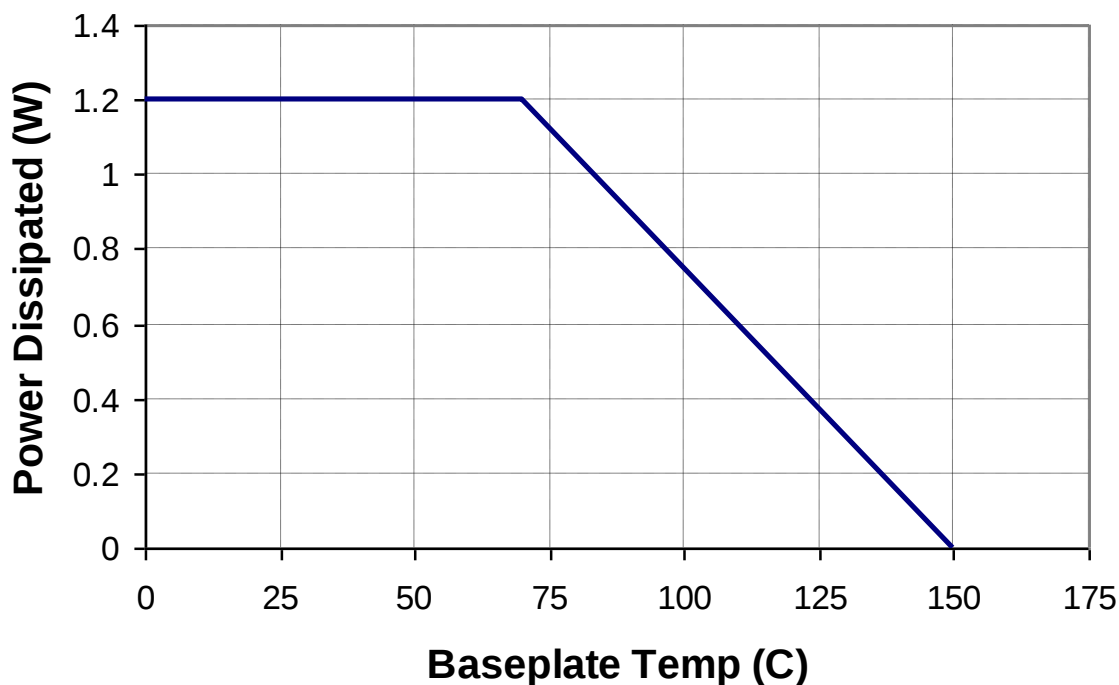


## Power Dissipation and Thermal Properties

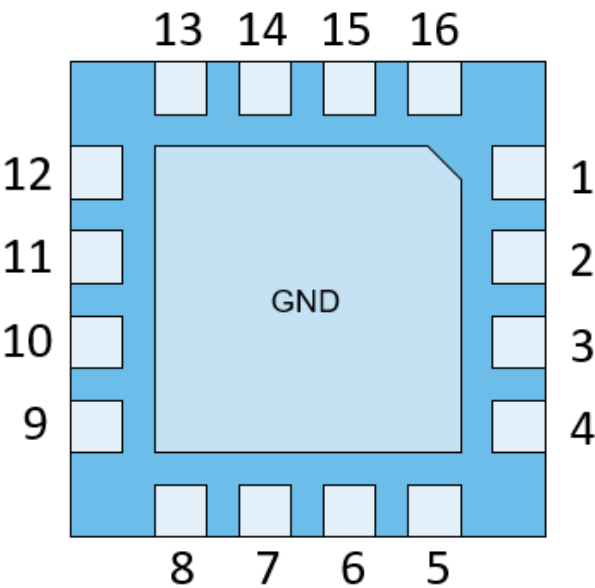
| Parameter                                       | Test Conditions                                                   | Value       | Units |
|-------------------------------------------------|-------------------------------------------------------------------|-------------|-------|
| Thermal Resistance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

**Notes:**

- For a median life,  $T_M$ , of 1 E+6 hours, power dissipation is limited to  
 $P_{D(max)} = (T_{CHANNEL}\text{ °C} - T_{BASE}\text{ °C})/\theta_{JC}$
- 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.

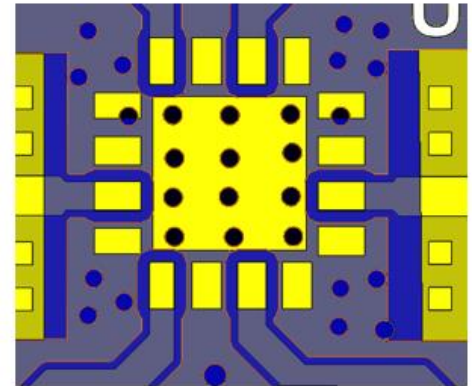
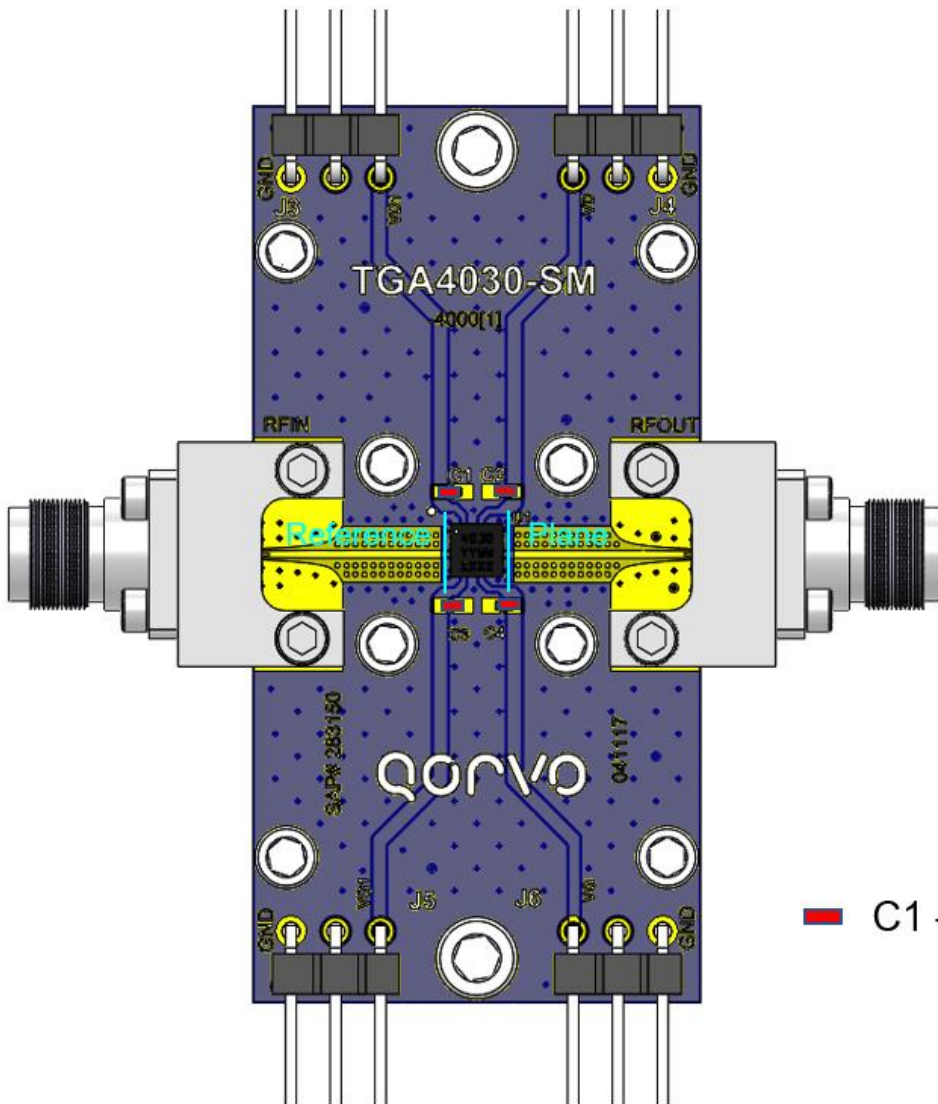


Mechanical Drawing & Pad Description



| 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 |

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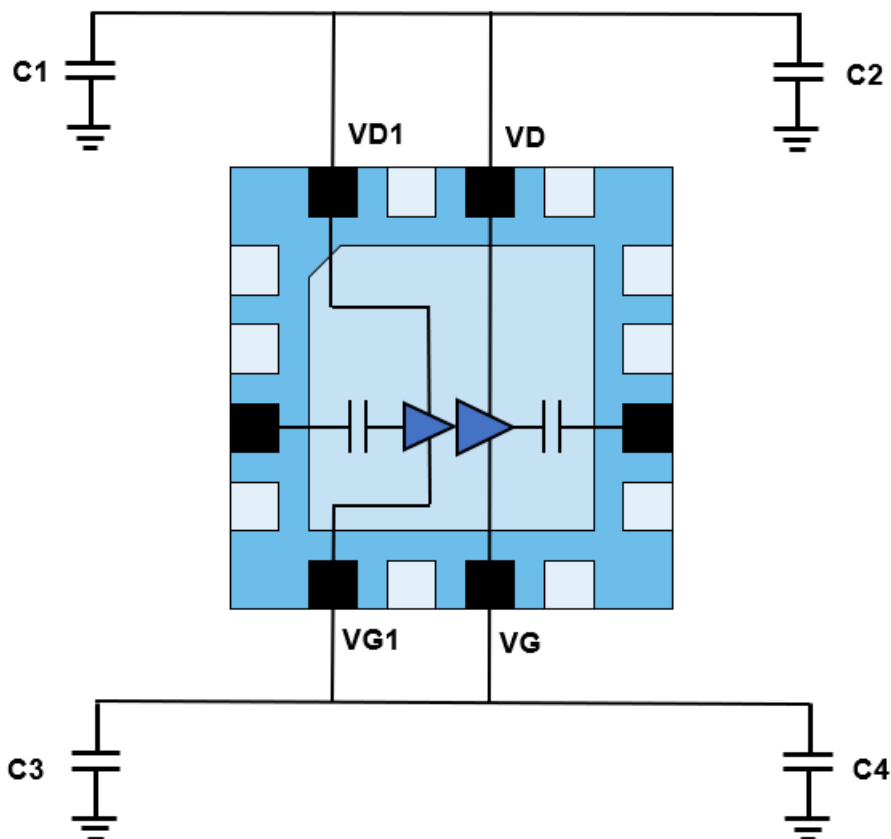
Mounting Pad Details

■ C1 – C4, 0.01  $\mu$ F

Notes:

1. C1 – C4 0402 0.01  $\mu$ F capacitors
2. Board material is 8 mil ROGERS RO4003

Application Circuit, Device as Amplifier



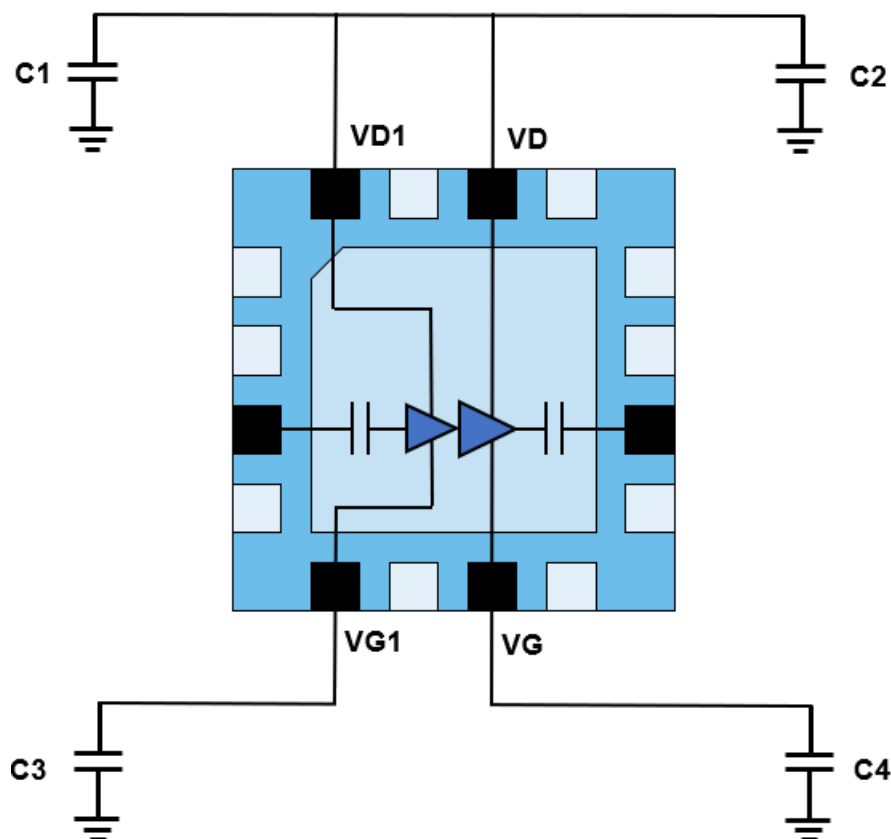
**Bias-up Procedure**

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  $I_{DQ} \sim 0$  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



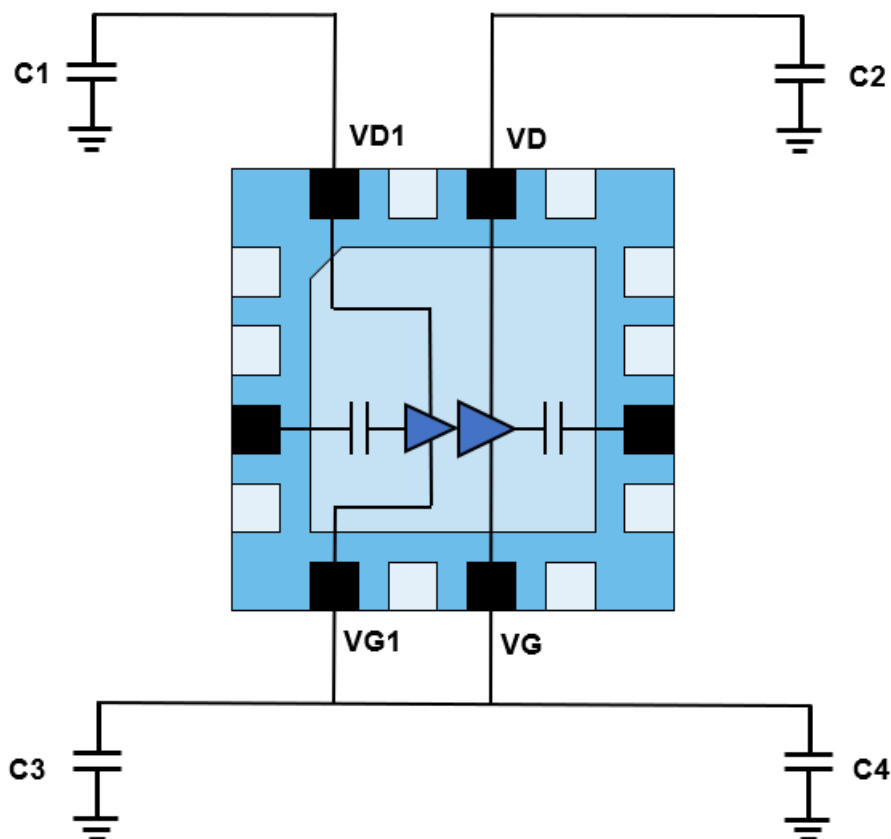
**Bias-up Procedure**

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  $I_{DQ} \sim 0$  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**

1. Set  $I_D$  limit to 400 mA, Set  $I_{D1}$  Limit to 50 mA,  $I_G$  limit to 2 mA
2. Set  $V_G$  to  $-1.5$  V
3. Set  $V_D = +5$  V, Set  $V_{D1} = +1$  V
4. Adjust  $V_G$  more positive until  $I_{D1} + I_D = 160$  mA
5. Apply RF signal

**Bias-down Procedure**

1. Turn off RF signal
2. Reduce  $V_G$  to  $-1.5$  V. Ensure  $I_{DQ} \sim 0$  mA
3. Set  $V_{D1}$  and  $V_D$  to 0 V
4. Turn off  $V_{D1}$  and  $V_D$  supply
5. Turn off  $V_G$  supply



# TGA4030-SM

## 17–37 GHz GaAs MPA/Multiplier

### 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 Solder Reflow Profiles

| Reflow Profiles                      | SnPb                    | Pb Free                 |
|--------------------------------------|-------------------------|-------------------------|
| Ramp-up rate                         | 3 °C/sec                | 3 °C/sec                |
| Activation Time and Temperature      | 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 °C 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<sub>15</sub>H<sub>12</sub>Br<sub>4</sub>O<sub>2</sub>) Free
- PFOS Free
- SVHC Free

### Contact Information

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

Web: [www.qorvo.com](http://www.qorvo.com)

Tel: 1-844-890-8163

Email: [customer.support@qorvo.com](mailto:customer.support@qorvo.com)

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