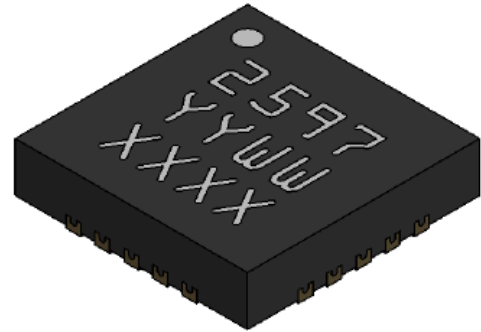


### Product Description

Qorvo's TGA2597-SM is a packaged driver amplifier fabricated on Qorvo's QGaN25 0.25um GaN on SiC production process. The TGA2597-SM operates from 2.0 to 6.0GHz and provides 32 dBm of output power with 14 dB of large signal gain and 31 % power-added efficiency.

Using GaN MMIC technology and plastic packaging, the TGA2597-SM provides a low cost driver solution that provides the added benefit of operating on the same voltage rail as the corresponding GaN HPA. It can also serve as the output power amplifier in lower power architectures.

The TGA2597-SM is offered in a 4x4 mm plastic overmold QFN. It is internally matched to 50 ohms and includes integrated DC blocking caps on both RF ports allowing for simple system integration.



### Product Features

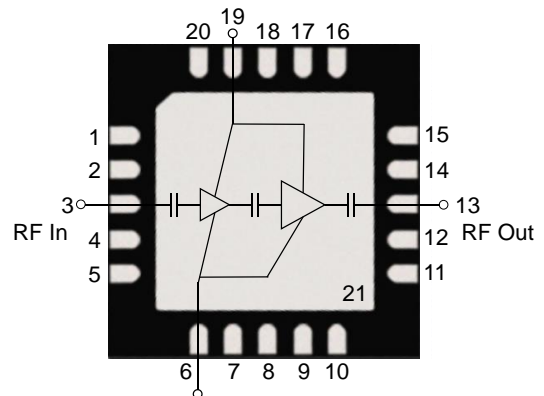
- Frequency Range: 2 – 6 GHz
- Small Signal Gain: > 24 dB
- Power: > 32 dBm
- PAE: > 31 %
- IM3: < -24 dBc
- Bias:  $V_D = 25\text{ V}$ ,  $I_{DQ} = 40\text{ mA}$
- Package Dimensions: 4.0 x 4.0 x 0.85 mm

*Performance is typical across frequency. Please reference electrical specification table and data plots for more details*

### Applications

- Commercial & Military Radar
- Communications
- Electronic Warfare (EW)

### Functional Block Diagram



### Ordering Information

| Part No.      | Description                           |
|---------------|---------------------------------------|
| TGA2597-SM    | Driver Amplifier, Waffle Pack, Qty 50 |
| TGA2597-SMTR7 | Tape and Reel, 7", Qty 500            |
| TGA2597-SMEVB | TGA2597-SM Evaluation Board, Qty 1    |



# TGA2597-SM

## 2 – 6 GHz GaN Driver Amplifier

### Recommended Operating Conditions

| Parameter                                       | Min | Typ                   | Max | Units |
|---|-----|-----------------------|-----|-------|
| Drain Voltage ( $V_D$ )                         |     | 25                    |     | V     |
| Drain Current ( $I_{DQ}$ )                      |     | 40                    |     | mA    |
| Drain Current Under RF Drive ( $I_{D\_DRIVE}$ ) |     | See Performance Plots |     | mA    |
| Gate Voltage ( $V_G$ )                          |     | -2.5                  |     | V     |
| Gate Current Under RF Drive ( $I_{G\_DRIVE}$ )  |     | See Performance Plots |     | mA    |
| Temperature ( $T_{BASE}$ )                      | -40 |                       | +85 | °C    |

Electrical performance is measured under conditions noted in the electrical specifications table. Specifications are not guaranteed over all recommended operating conditions.

### Electrical Specifications

| Parameter                            | Conditions                                      | Min    | Typ    | Max | Units |
|--------------------------------------|---|--------|--------|-----|-------|
| Operational Frequency Range          |   | 2      |        | 6   | GHz   |
| Output Power                         | $P_{IN} = 18$ dBm                               |        | > 32   |     | dBm   |
| Power Added Efficiency               | $P_{IN} = 18$ dBm                               |        | > 31   |     | %     |
| Small Signal Gain                    |   |        | > 24   |     | dB    |
| Input Return Loss                    |   |        | 20     |     | dB    |
| Output Return Loss                   |   |        | > 5    |     | dB    |
| IM3                                  | $P_{OUT}/Tone \leq 24$ dBm, $\Delta f = 10$ MHz |        | < -24  |     | dBc   |
| Gate Leakage                         | $V_D = +10$ V, $V_G = -3.7$ V                   | -0.924 | -0.05  |     | mA    |
| Gain Temperature Coefficient         |   |        | -0.050 |     | dB/°C |
| Output Power Temperature Coefficient |   |        | -0.009 |     | dB/°C |

Test conditions unless otherwise noted:  $T_{BASE} = +25$  °C,  $V_D = 25$  V,  $V_G = -2.5$  V, CW

### Absolute Maximum Ratings

| Parameter                                    | Range / Value | Units |
|--|---------------|-------|
| Drain Voltage ( $V_D$ )                      | +40           | V     |
| Gate Voltage ( $V_G$ )                       | -5 to 0       | V     |
| Drain Current ( $I_D$ )                      | 400           | mA    |
| Gate Current ( $I_G$ )                       | 10            | mA    |
| Power Dissipation, 85 °C ( $P_{DISS}$ )      | 5.4           | W     |
| RF Input Power, CW, 50 $\Omega$ <sup>1</sup> | 24            | dBm   |
| RF Input Power, CW, VSWR 3:1 <sup>1</sup>    | 24            | dBm   |
| Channel Temperature ( $T_{CH}$ )             | +275          | °C    |
| Mounting Temperature<br>(30 seconds maximum) | +260          | °C    |
| 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 may reduce device reliability.

(1)  $V_D = 25V$ ,  $I_{DQ} = 40mA$ ,  $T_B = 85\text{ °C}$

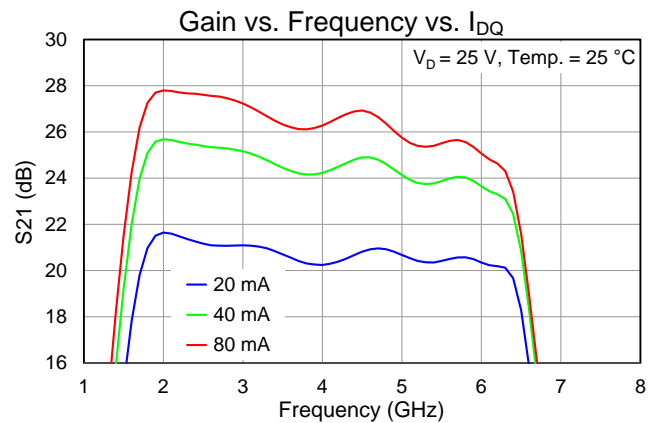
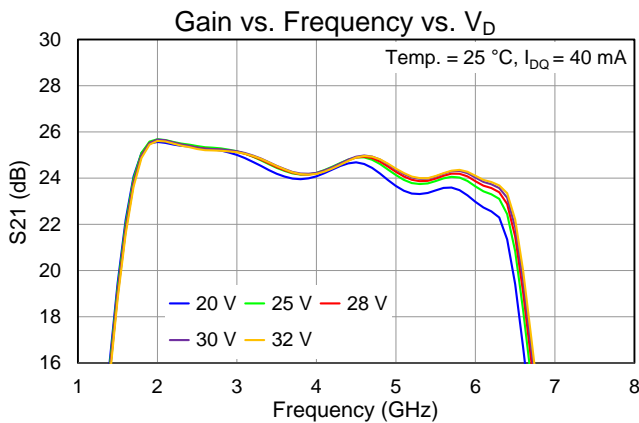
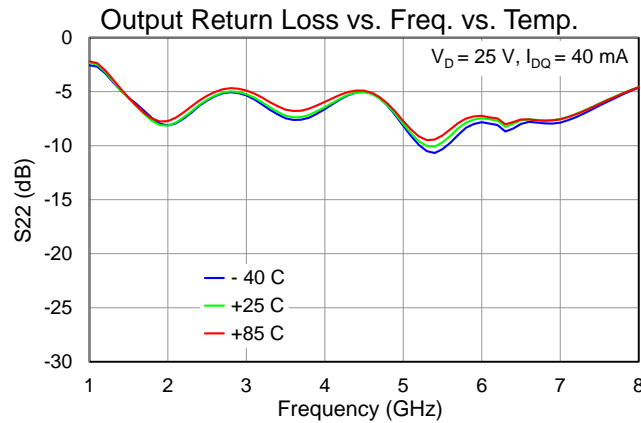
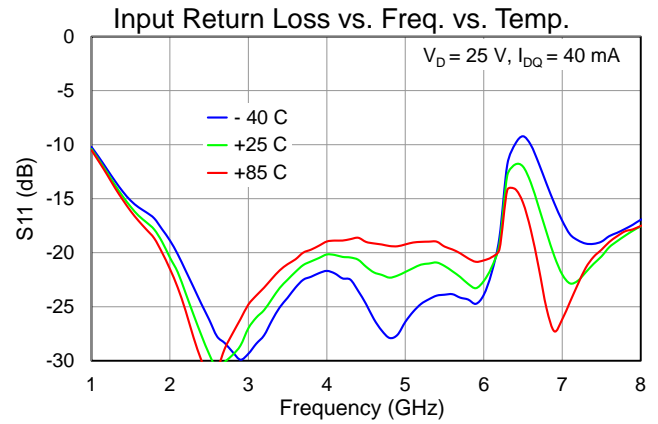
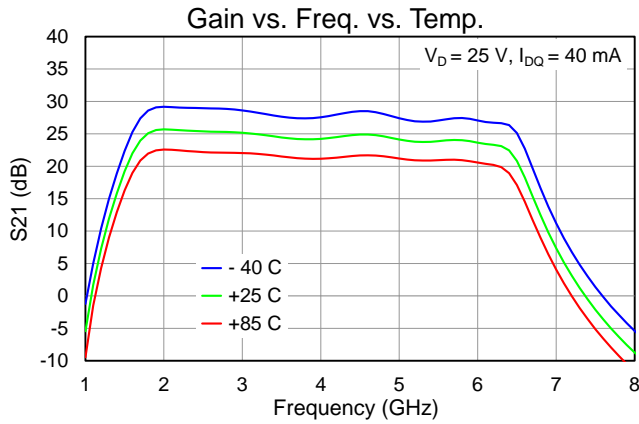
### Thermal and Reliability Information

| Parameter   | Values | Units | Conditions   |
|---|--------|-------|--|
| Thermal Resistance ( $\theta_{JC}$ ) <sup>(1,2,3)</sup> | 16.52  | °C/W  | $T_{BASE} = +85\text{ °C}$ , $V_D = 25\text{ V}$ , $I_{DQ} = 40\text{ mA}$ ,<br>$I_{D\_DRIVE} = 206\text{ mA}$ , $P_{IN} = 18\text{ dBm}$ , $P_{OUT} = 31.8\text{ dBm}$ ,<br>$P_{DISS} = 3.7\text{ W}$ |
| Channel Temperature ( $T_{CH}$ )                        | 146.14 | °C    |  |

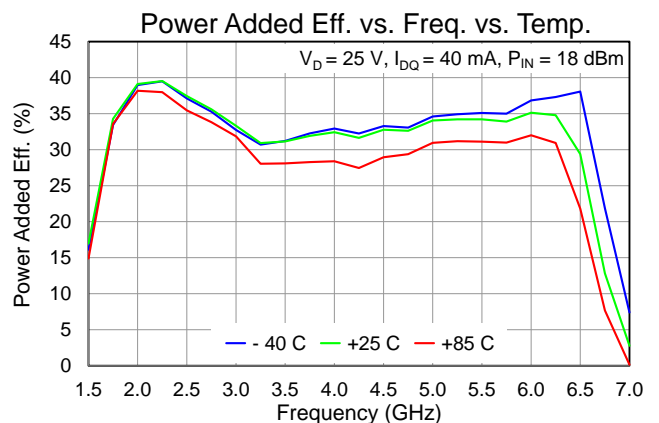
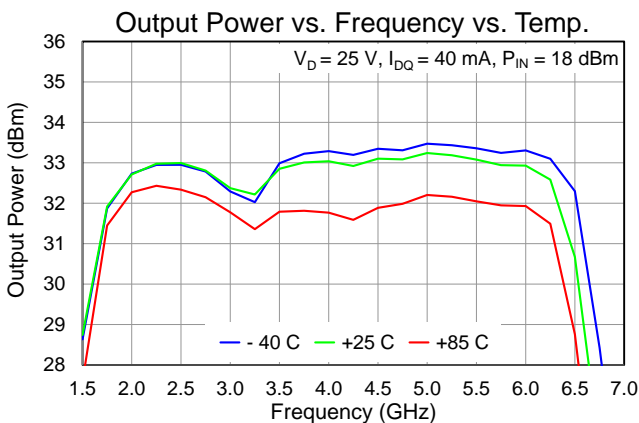
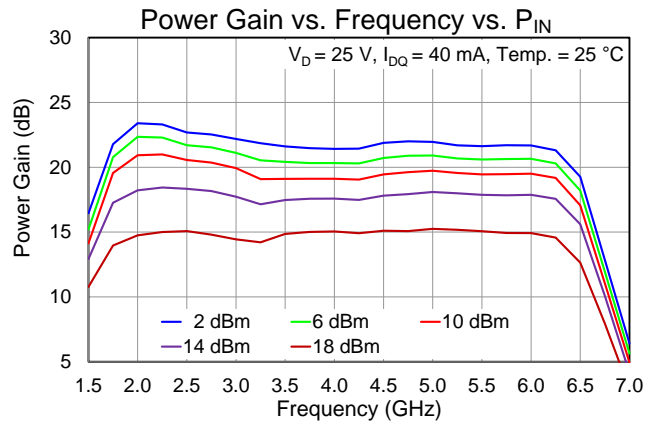
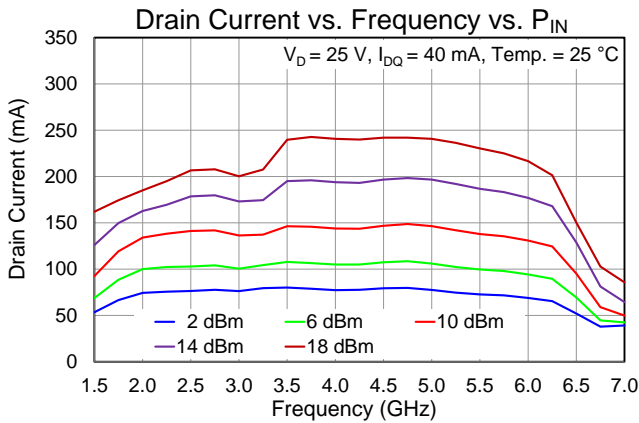
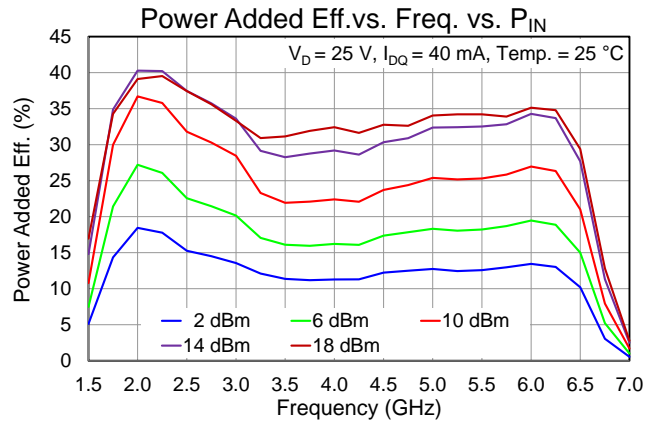
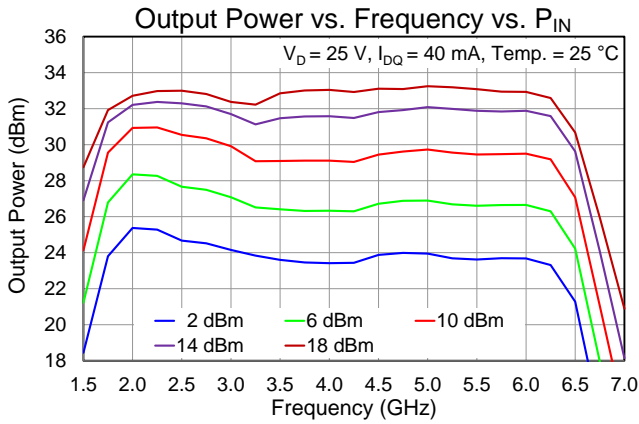
Notes:

1. Thermal resistance is measured to package backside
2. Base or ambient temperature is 85 °C
3. Refer to the following document: [GaN Device Channel Temperature, Thermal Resistance, and Reliability Estimates](#)

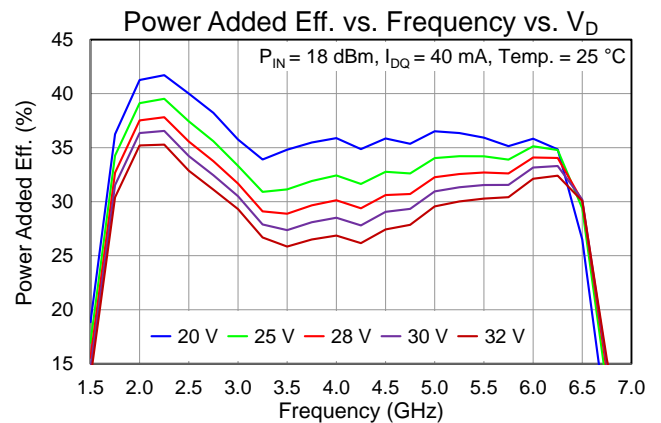
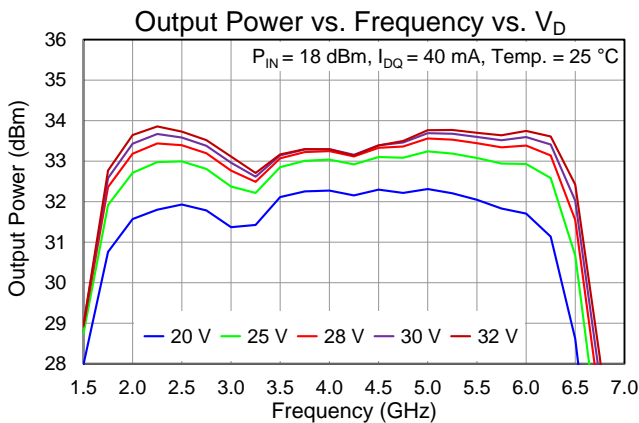
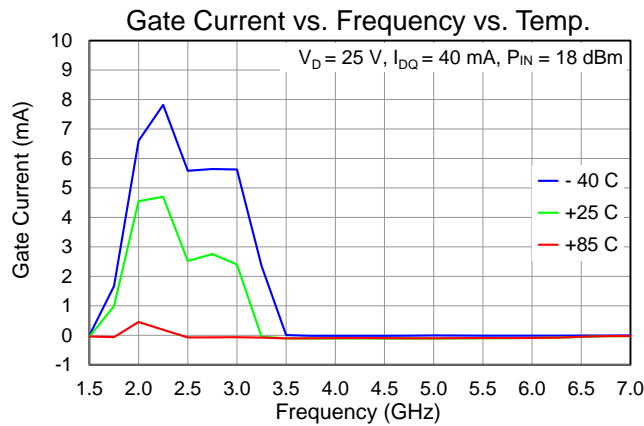
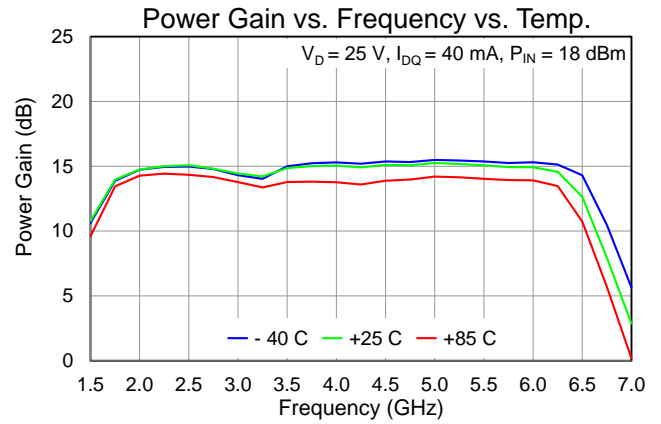
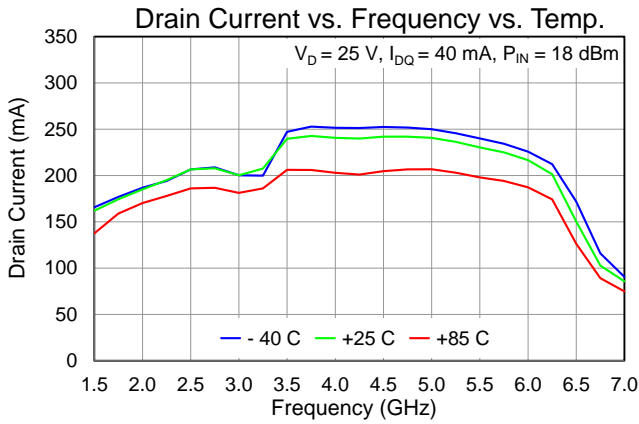
### Performance Plots – Small Signal



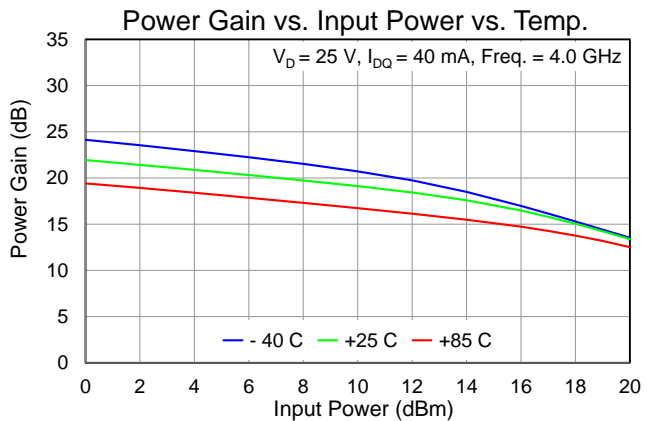
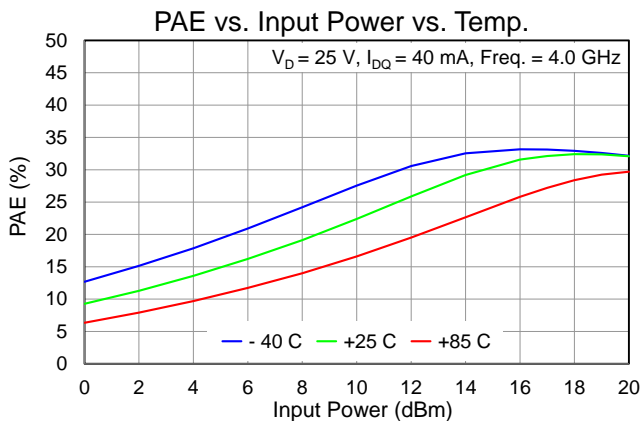
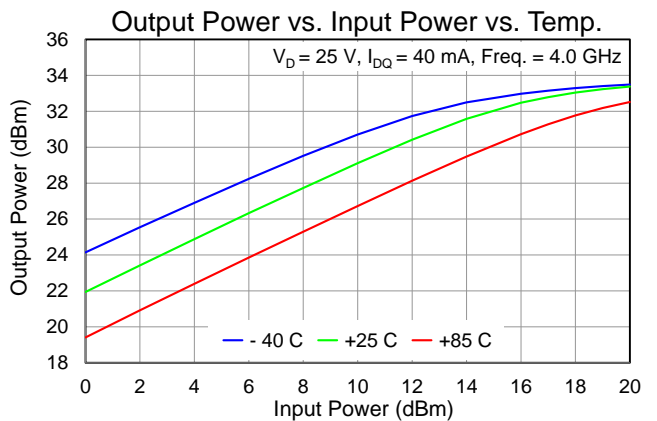
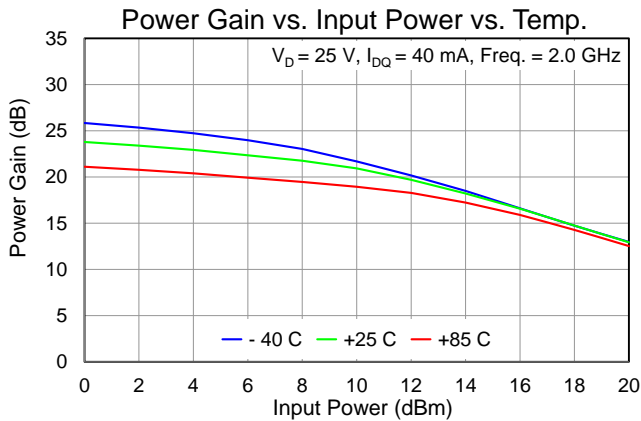
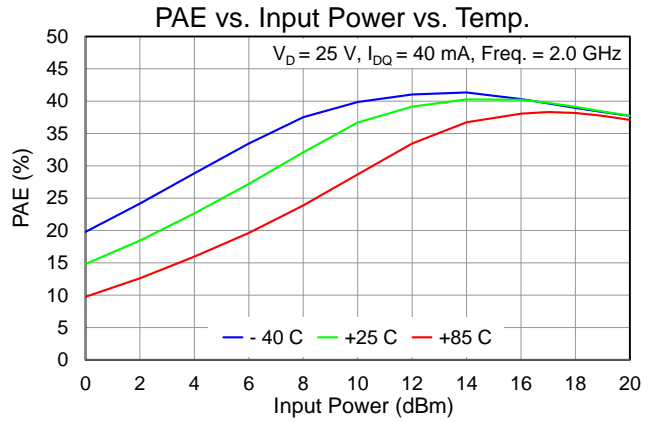
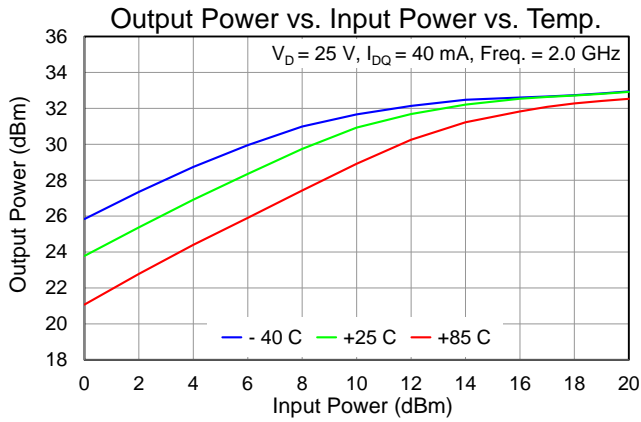
### Performance Plots – Large Signal



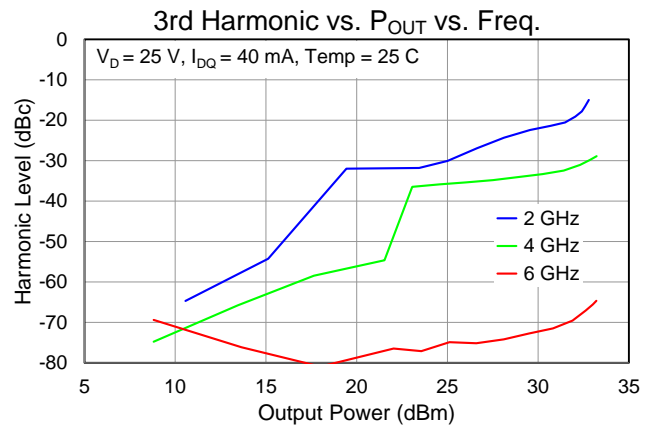
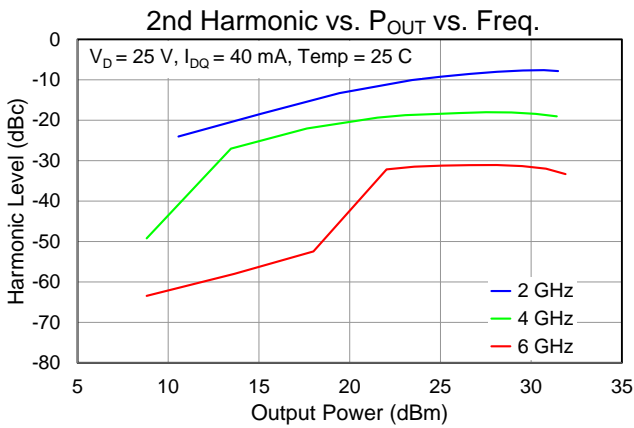
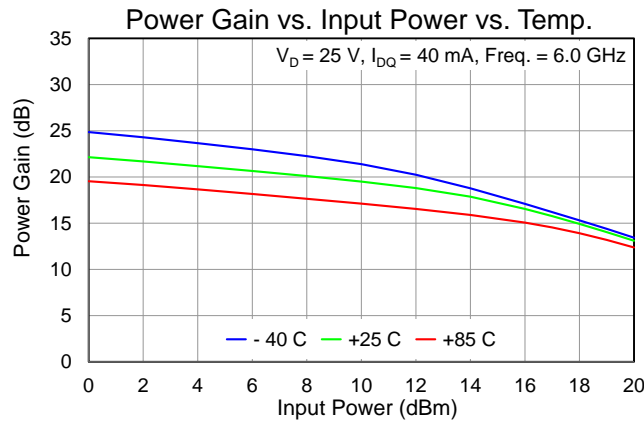
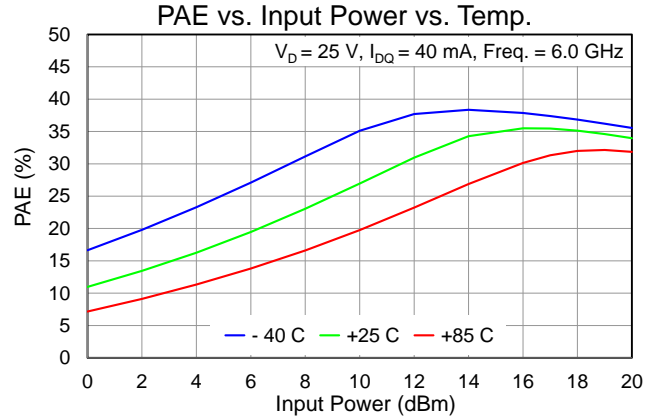
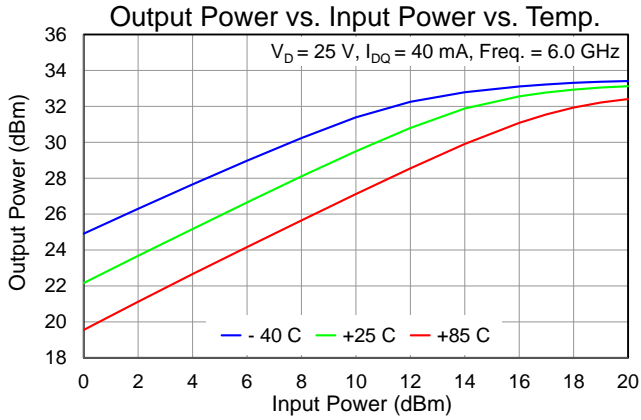
### Performance Plots – Large Signal



### Performance Plots – Large Signal

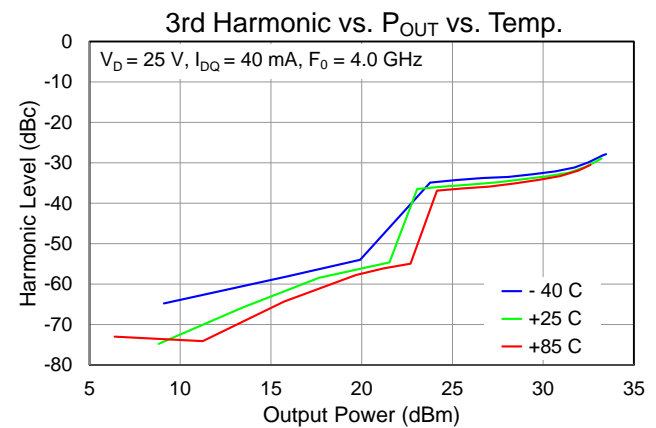
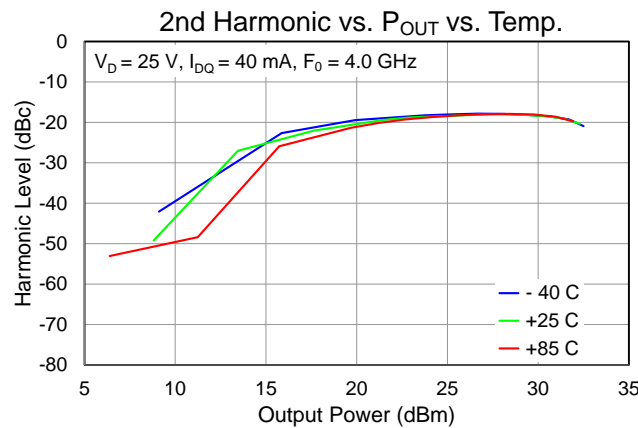
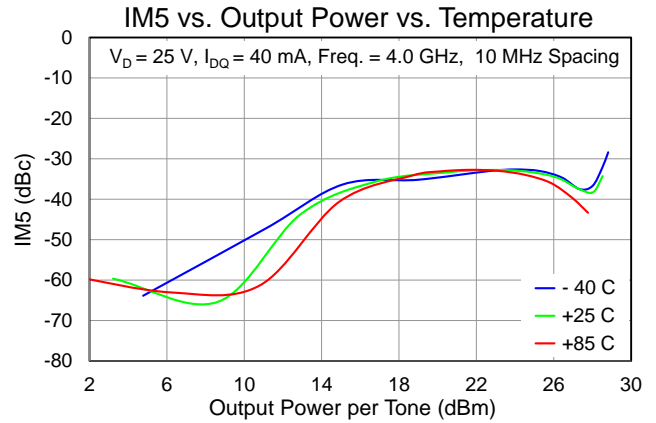
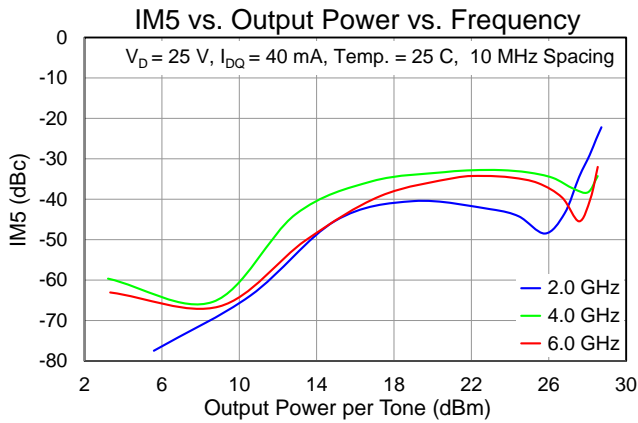
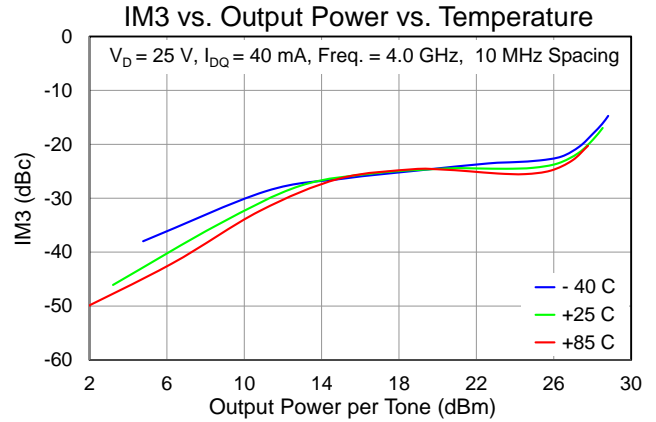
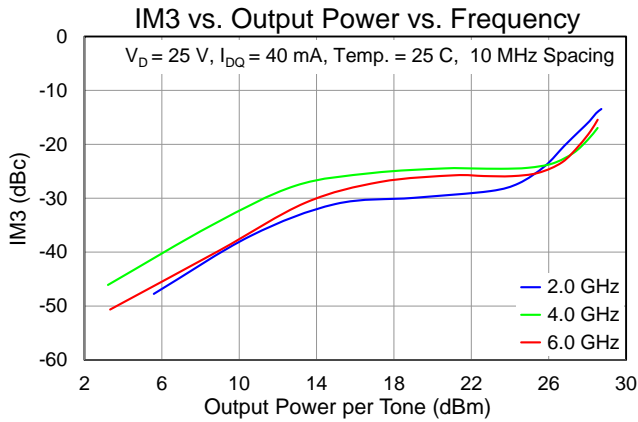


### Performance Plots – Large Signal

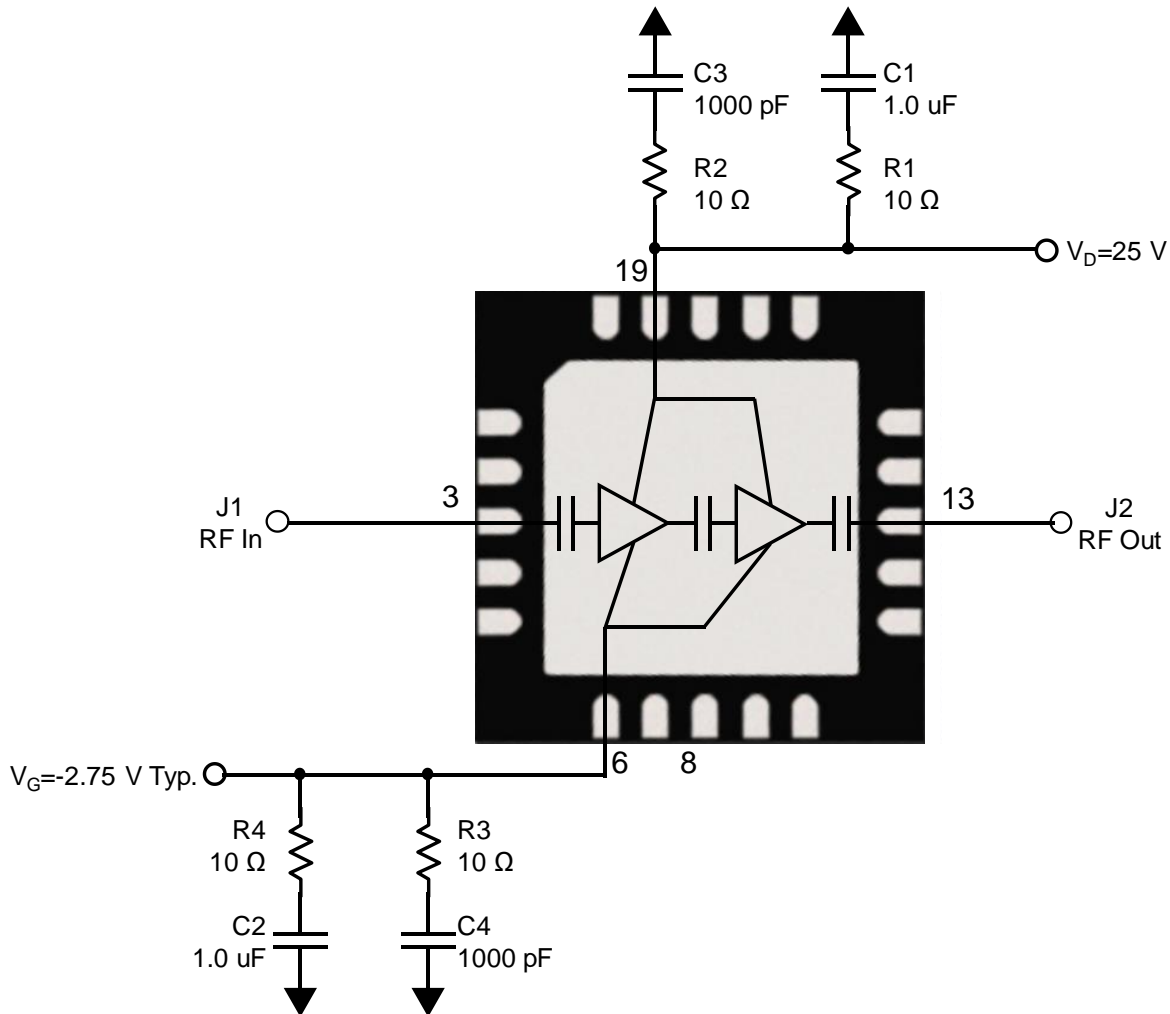




### Performance Plots – Linearity & Harmonic



### Application Circuit



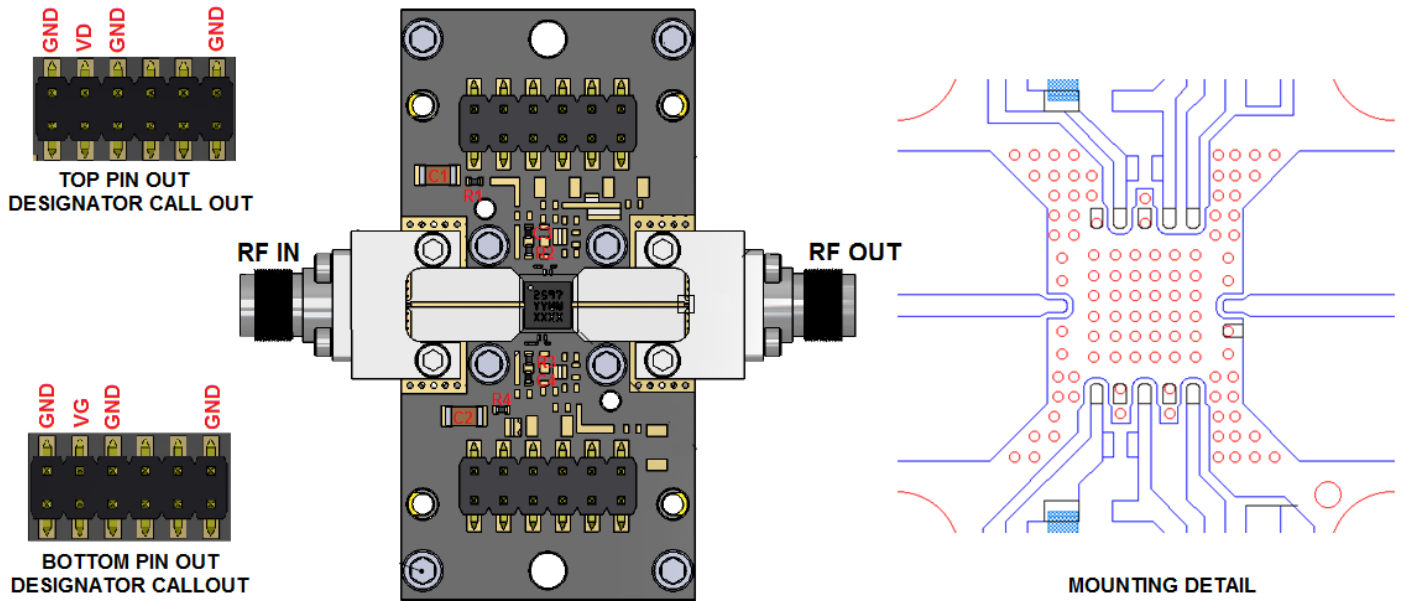
### Bias Up Procedure

1. Set  $I_D$  limit to 400 mA,  $I_G$  limit to 4.5 mA
2. Set  $V_G$  to -5.0V
3. Set  $V_D$  +25V
4. Adjust  $V_G$  more positive until  $I_{DQ} = 40$  mA.
5. Apply RF signal

### Bias Down Procedure

1. Turn off RF signal
2. Set  $V_G$  to -5.0V. Ensure  $I_{DQ} \sim 0$ mA
3. Set  $V_D$  to 0V
4. Turn off  $V_D$  supply
5. Turn off  $V_G$  supply

### Evaluation Board Layout



RF Layer is 0.008" thick Rogers Corp. RO4003C,  $\epsilon_r = 3.38$ . 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.

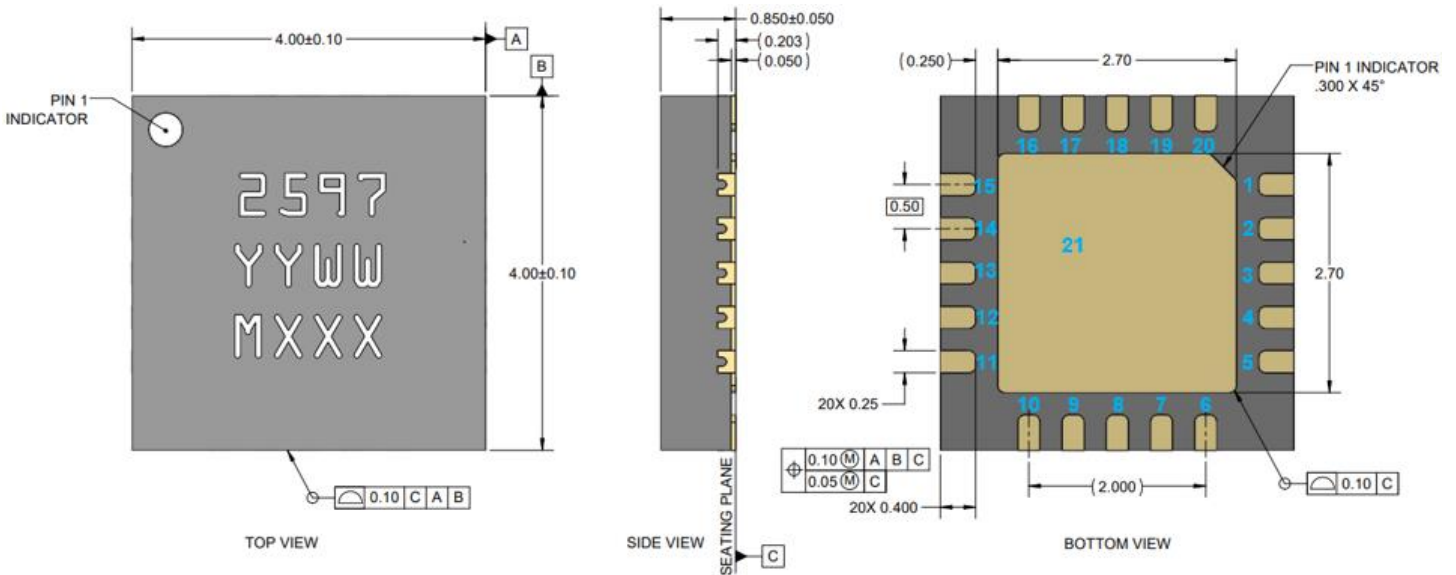
The pad pattern shown has been developed and tested for optimized assembly at Qorvo. The PCB land pattern has been developed to accommodate lead tolerances. Since processes vary from company to company, careful process development is recommended.

Multiple vias should be employed under the package center paddle to minimize inductance resistance.

### Bill of Materials

| Reference Des. | Value                | Description   | Manuf.  | Part Number |
|----------------|----------------------|---------------|---------|-------------|
| C1, C2         | 1 uF, 50 V, 20 %     | CAP X5R 1206  | Various | –           |
| C3, C4         | 1000 pF, 100 V, 10 % | CAP X7R 0402  | Various | –           |
| R1 – R4        | 10 Ohm, 1 %, 1/16 W  | RES 0402 case | Various | –           |

### Mechanical Information, Pin Configuration and Description



Dimensions in mm, package is mold encapsulated with gold plated leads

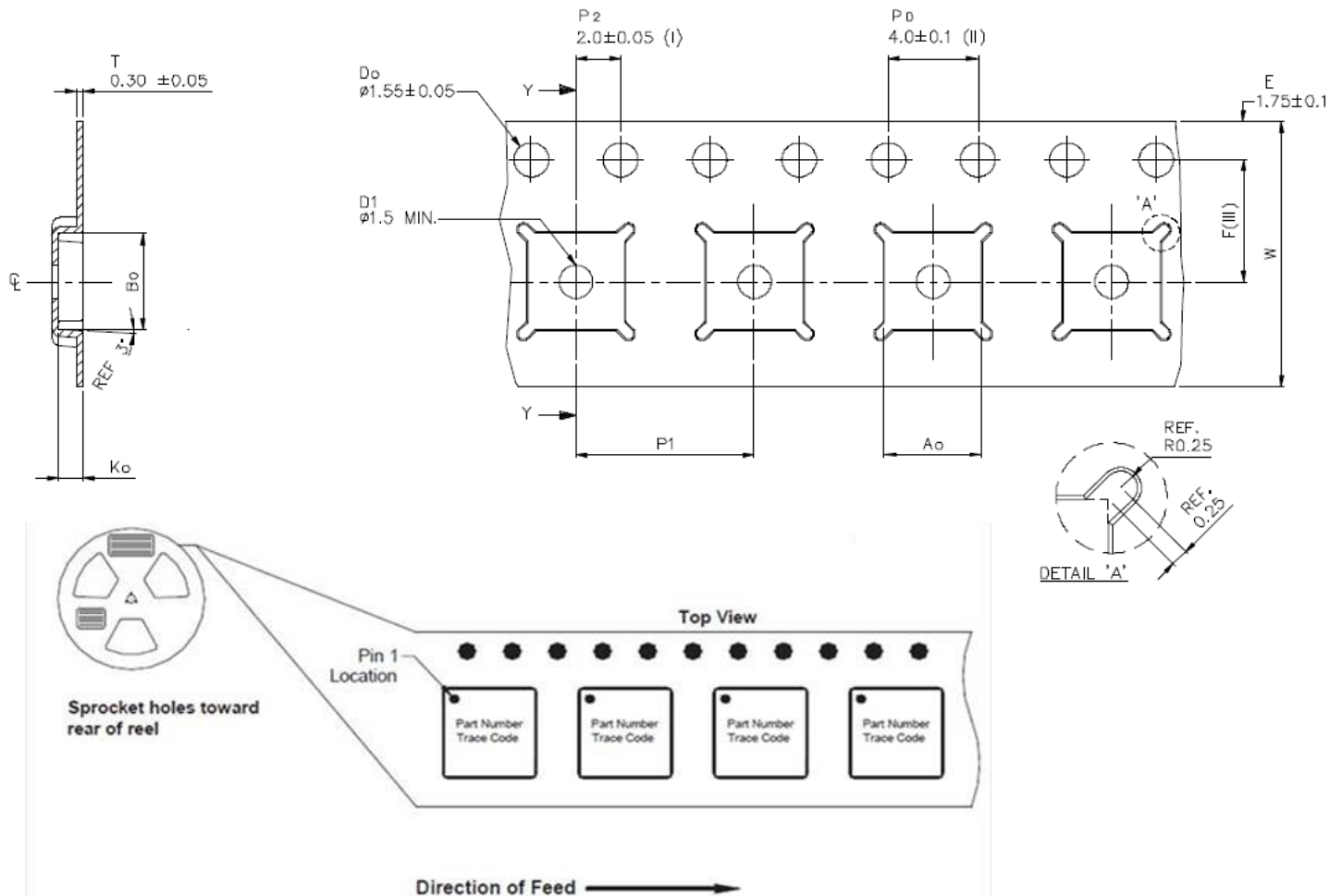
Part Marking: 2597: Part Number, YY = Part Assembly Year, WW = Part Assembly Week, MXXX = Batch ID

| Pin No.                   | Label          | Description   |
|---------------------------|----------------|---|
| 1-2, 4-5, 7-12, 14-18, 20 | GND            | Connected to ground paddle (21); recommend grounding on PCB for improved package isolation.   |
| 3                         | RF Input       | RF input, matched to 50 Ω, DC blocked   |
| 6                         | V <sub>G</sub> | Gate voltage. Bias network required   |
| 13                        | RF Output      | RF output, matched to 50 Ω, DC blocked  |
| 19                        | V <sub>D</sub> | Drain voltage. Bias network required.   |
| 21                        | Slug (GND)     | Backside paddle. Multiple vias should be employed to minimize inductance and thermal resistance. Copper-filled vias recommended for best thermal performance. |

### Tape and Reel Information

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

| Material |                 | Cavity (mm) |            |            |            | Distance Between Centerline (mm) |                     | Carrier Tape (mm) | Cover Carrier (mm) |
|----------|-----------------|-------------|------------|------------|------------|----------------------------------|---------------------|-------------------|--------------------|
| Vendor   | Vendor P/N      | Length (A0) | Width (B0) | Depth (K0) | Pitch (P1) | Length direction (P2)            | Width Direction (F) | Width (W)         | Width (W)          |
| C-Pack   | QFN0400 X 0400D | 4.35        | 4.35       | 1.1        | 8.0        | 2.00                             | 5.50                | 12.0              | 9.20               |



## Solderability

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

## Recommended Soldering Temperature Profile

