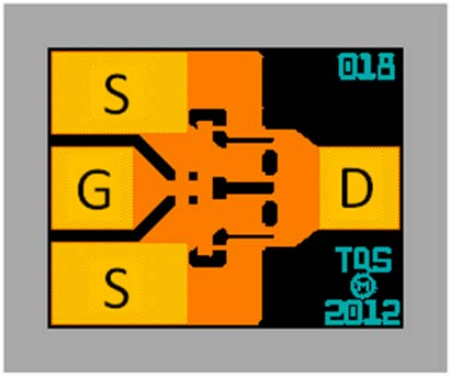
# TGF2018

***180 um Discrete GaAs pHEMT***

## Applications

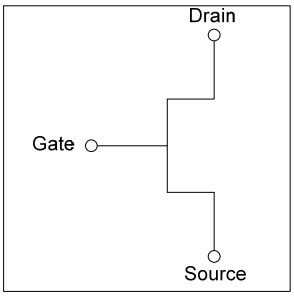
- Defense & Aerospace
- High-Reliability
- Test and Measurement
- Commercial
- Broadband Wireless




## Product Features

- Frequency Range: DC - 20 GHz
- 22 dBm Typical Output Power - P1dB
- 14 dB Typical Gain at 12 GHz
- 55% Typical PAE at 12 GHz
- 1 dB Typical NF at 12 GHz
- No Vias
- Technology: 0.25 um GaAs pHEMT
- Chip Dimensions: 0.41 x 0.34 x 0.10 mm

## Functional Block Diagram




## General Description

The TriQuint TGF2018 is a discrete 180 micron pHEMT which operates from DC to 20 GHz. The TGF2018 is fabricated using TriQuint's proven standard 0.25 um power pHEMT production process. This process features advanced techniques to optimize microwave power and efficiency at high drain bias operating conditions.

The TGF2018 typically provides 22 dBm of output power at P1dB with gain of 14 dB and 55% power-added efficiency at 1 dB compression. This performance makes the TGF2018 appropriate for high efficiency applications. The protective overcoat layer with silicon nitride provides a level of environmental robustness and scratch protection.

The TGF2018 is lead-free and RoHS compliant.

## Pad Configuration

| Pad Dimensions | Terminals |
|---|---|
| G (71um X 71um) | Gate |
| D (71um X 71um) | Drain |
| S (121um X 71um) | Source |

## Ordering Information

| Part | ECCN | Description |
|---|---|---|
| TGF2018 | EAR99 | 180 um GaAs pHEMT |


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## Absolute Maximum Ratings

| Symbol | Parameter | Absolute | Continuous | Units |
|---|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage[2] | 12 | 8 | V |
| $V_{GS}$ | Gate- Source Voltage | -7 | -3 | V |
| $I_{DS}$ | Drain Current[2] | $I_{DSS}$ | $I_{DSS}$ | mA |
| $I_{G,F}$ | Forward Gate Current | 9 | 1.5 | mA |
| $T_{CH}$ | Channel Temperature[3] | 175 [4] | 150 [5] | °C |
| $T_{STG}$ | Storage Temperature | -65 to 150 | -65 to 150 | °C |
| $P_{IN}$ | Input Continuous Wave Power[2] | 16 | at 3 dB Compression | dBm |
| $P_{TOT}$ | Total Power Dissipation | 0.96 | 0.64 | W |

Notes:
1. These ratings represent the maximum operable values for this device. Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device and/or affect device lifetime. These are stress ratings only, and functional operation of the device at these conditions is not implied.
2. Combinations of supply voltage, supply current, input power, and output power shall not exceed the maximum total power dissipation listed in the table.
3. Junction operating temperature will directly affect the device median time to failure. For maximum life, it is recommended that junction temperatures be maintained at the lowest possible levels.
4. When operated at this channel temperature, the median life is 1.0E+5 hours.
5. When operated at this channel temperature, the median life is 1.0E+6 hours.

## Electrical Characteristics

Test conditions unless otherwise noted: Temperature = 25°C.

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| P1dB | Output Power at 1dB Compression | Freq = 12 GHz<br>$V_{DS}$ = 8 V<br>$I_{DS}$ = 50% $I_{DSS}$ | | 22 | | dBm |
| G1dB | Gain at P1dB | | | 14 | | dB |
| PAE | PAE at P1dB | | | 55 | | % |
| NF | 50 ohm Noise Figure | $V_{DS}$ = 2 V, $I_{DS}$ = 19 mA | | 1 | | dB |
| $I_{DSS}$ | Saturated Drain Current | $V_{DS}$ = 2 V, $V_{GS}$ = 0 V | 36 | 58[1] | 80 | mA |
| Gm | Transconductance | $V_{DS}$ = 2 V, $I_{DS}$ = 50% $I_{DSS}$ | | 70 | | mS |
| $V_P$ | Pinch-Off Voltage | $V_{DS}$ = 2 V, $I_{DS}$ = 0.18 mA | -1.5 | -1.0 | -0.5 | V |
| $BV_{GD}$ | Gate-Drain Breakdown Voltage | $I_G$ = 0.18 mA, source open | | -15 | -12 | V |
| $BV_{GS}$ | Gate-Source Breakdown Voltage | $I_G$ = 0.18 mA, drain open | | -15 | | V |
| $R_{TH}$ | Thermal Resistance[2] | AuSn eutectic attach | | 88 | | °C/W |

Notes:
1. Typical Standard Deviation of 2 mA (1 σ).
2. Based on IR Scan


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## S-Parameters

Test Conditions: $V_{DS}$=+8 V (typ.), $I_{DS}$=50% $I_{DSS}$, Temp=+25°C, 50Ω system

| Freq (GHz) | S11 (mag) | S11 (ang) | S21 (mag) | S21 (ang) | S12 (mag) | S12 (ang) | S22 (mag) | S22 (ang) |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.99 | -18.1 | 5.99 | 166.0 | 0.015 | 77.5 | 0.81 | -6.7 |
| 2 | 0.97 | -36.0 | 5.84 | 153.9 | 0.029 | 68.2 | 0.80 | -13.3 |
| 3 | 0.95 | -53.8 | 5.62 | 141.9 | 0.042 | 58.6 | 0.77 | -19.2 |
| 4 | 0.92 | -71.3 | 5.36 | 130.0 | 0.053 | 49.1 | 0.74 | -24.9 |
| 5 | 0.89 | -88.0 | 5.06 | 118.7 | 0.062 | 40.2 | 0.71 | -30.5 |
| 6 | 0.86 | -103.9 | 4.73 | 108.0 | 0.069 | 31.8 | 0.67 | -35.6 |
| 7 | 0.84 | -119.1 | 4.41 | 97.9 | 0.075 | 24.2 | 0.64 | -40.1 |
| 8 | 0.82 | -133.8 | 4.09 | 88.4 | 0.079 | 17.1 | 0.61 | -43.7 |
| 9 | 0.81 | -147.6 | 3.78 | 79.3 | 0.081 | 10.4 | 0.58 | -47.4 |
| 10 | 0.80 | -160.3 | 3.48 | 70.7 | 0.082 | 4.0 | 0.55 | -50.8 |
| 11 | 0.79 | -171.7 | 3.20 | 62.6 | 0.082 | -1.5 | 0.53 | -54.5 |
| 12 | 0.79 | 178.0 | 2.96 | 55.1 | 0.082 | -6.7 | 0.51 | -58.0 |
| 13 | 0.80 | 168.4 | 2.74 | 47.8 | 0.082 | -11.5 | 0.50 | -61.9 |
| 14 | 0.80 | 159.9 | 2.55 | 40.8 | 0.080 | -16.2 | 0.49 | -65.9 |
| 15 | 0.81 | 152.1 | 2.37 | 34.4 | 0.079 | -19.8 | 0.48 | -69.4 |
| 16 | 0.82 | 144.8 | 2.22 | 28.4 | 0.077 | -23.0 | 0.47 | -72.0 |
| 17 | 0.83 | 138.1 | 2.07 | 22.2 | 0.076 | -26.3 | 0.47 | -76.3 |
| 18 | 0.83 | 132.0 | 1.93 | 16.2 | 0.074 | -29.8 | 0.46 | -81.2 |
| 19 | 0.83 | 126.4 | 1.79 | 10.7 | 0.071 | -32.7 | 0.45 | -85.9 |
| 20 | 0.84 | 121.9 | 1.70 | 5.3 | 0.069 | -34.4 | 0.46 | -91.0 |
| 21 | 0.86 | 116.9 | 1.60 | -0.1 | 0.068 | -36.7 | 0.45 | -95.7 |
| 22 | 0.87 | 112.5 | 1.51 | -5.5 | 0.066 | -39.0 | 0.46 | -100.8 |
| 23 | 0.87 | 108.4 | 1.42 | -10.7 | 0.064 | -41.3 | 0.46 | -105.7 |
| 24 | 0.88 | 104.5 | 1.34 | -15.7 | 0.062 | -42.6 | 0.46 | -111.5 |
| 25 | 0.88 | 100.9 | 1.27 | -20.7 | 0.060 | -43.7 | 0.47 | -116.2 |
| 26 | 0.89 | 97.5 | 1.20 | -25.7 | 0.059 | -45.0 | 0.47 | -121.6 |

Includes 1 bond wire on Gate, 1 bond wire on Drain, and 3 bond wires on each Source pad.


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## Noise Parameters

$V_{DS}$ = 2 V, $I_{DS}$ = 28 mA, Temperature = 25°C

| Frequency | NFmin | Rn/50 | Gamma | |
|---|---|---|---|---|
| GHz | dB | Ω | Mag. | Angle |
| 2 | 0.57 | 0.291 | 0.71 | 17.58 |
| 3 | 0.62 | 0.283 | 0.68 | 23.87 |
| 4 | 0.61 | 0.275 | 0.65 | 32.18 |
| 5 | 0.64 | 0.265 | 0.62 | 41.66 |
| 6 | 0.70 | 0.249 | 0.59 | 51.44 |
| 7 | 0.78 | 0.230 | 0.56 | 61.44 |
| 8 | 0.85 | 0.210 | 0.54 | 71.62 |
| 9 | 0.93 | 0.192 | 0.52 | 81.92 |
| 10 | 1.00 | 0.173 | 0.50 | 92.27 |
| 11 | 1.08 | 0.155 | 0.48 | 102.61 |
| 12 | 1.17 | 0.138 | 0.47 | 112.89 |
| 13 | 1.24 | 0.123 | 0.46 | 123.06 |
| 14 | 1.32 | 0.111 | 0.46 | 133.04 |
| 15 | 1.38 | 0.100 | 0.45 | 142.78 |
| 16 | 1.46 | 0.092 | 0.45 | 152.22 |
| 17 | 1.52 | 0.085 | 0.45 | 161.31 |
| 18 | 1.60 | 0.082 | 0.46 | 169.98 |
| 19 | 1.67 | 0.081 | 0.47 | 178.18 |
| 20 | 1.73 | 0.083 | 0.48 | -174.16 |
| 21 | 1.82 | 0.090 | 0.49 | -167.09 |
| 22 | 1.92 | 0.102 | 0.51 | -160.67 |
| 23 | 2.01 | 0.116 | 0.53 | -154.96 |
| 24 | 2.06 | 0.132 | 0.55 | -150.02 |
| 25 | 2.09 | 0.144 | 0.57 | -146.14 |
| 26 | 2.15 | 0.155 | 0.59 | -143.51 |

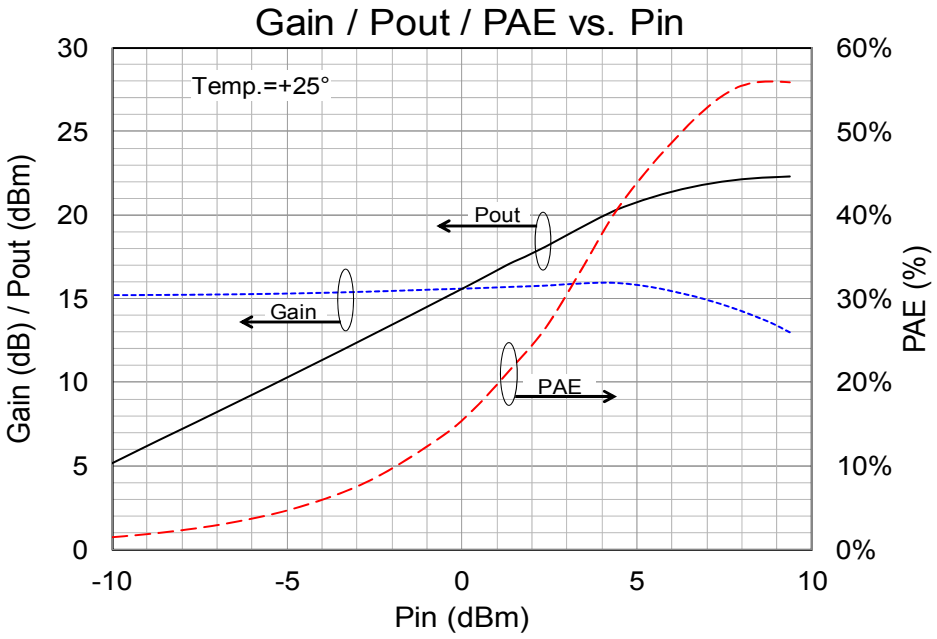
$V_{DS}$ = 2 V, $I_{DS}$ = 14 mA, Temperature = 25°C

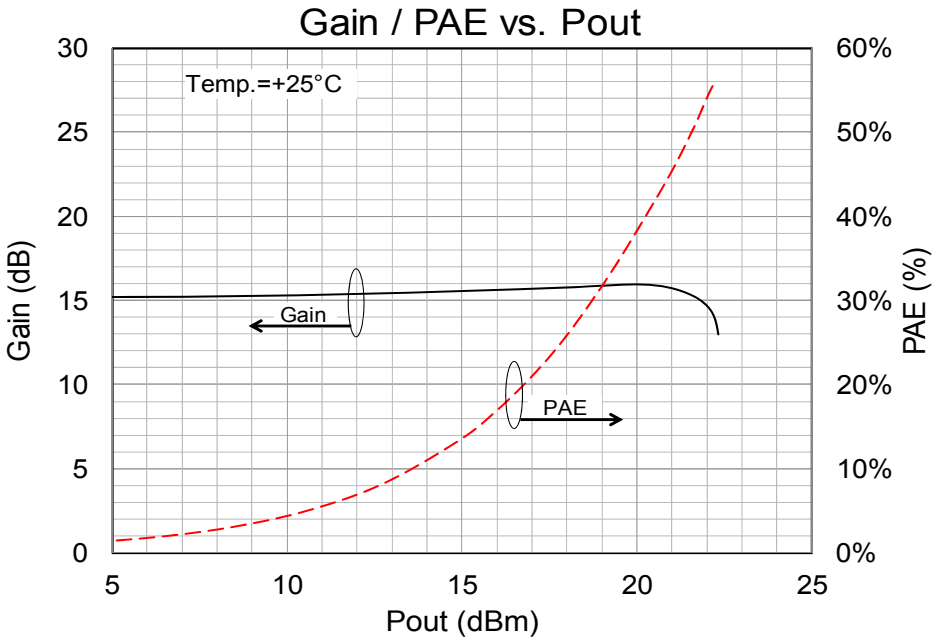
| Frequency | NFmin | Rn/50 | Gamma | |
|---|---|---|---|---|
| GHz | dB | Ω | Mag. | Angle |
| 2 | 0.48 | 0.257 | 0.75 | 16.41 |
| 3 | 0.50 | 0.251 | 0.73 | 21.69 |
| 4 | 0.49 | 0.243 | 0.70 | 28.68 |
| 5 | 0.51 | 0.236 | 0.67 | 36.7 |
| 6 | 0.55 | 0.223 | 0.64 | 45.03 |
| 7 | 0.59 | 0.209 | 0.62 | 53.61 |
| 8 | 0.64 | 0.194 | 0.59 | 62.42 |
| 9 | 0.68 | 0.179 | 0.57 | 71.41 |
| 10 | 0.74 | 0.164 | 0.55 | 80.53 |
| 11 | 0.80 | 0.148 | 0.53 | 89.74 |
| 12 | 0.85 | 0.136 | 0.52 | 99.01 |
| 13 | 0.90 | 0.121 | 0.50 | 108.29 |
| 14 | 0.95 | 0.108 | 0.49 | 117.54 |
| 15 | 0.99 | 0.096 | 0.48 | 126.71 |
| 16 | 1.04 | 0.086 | 0.47 | 135.77 |
| 17 | 10.9 | 0.077 | 0.46 | 144.67 |
| 18 | 1.14 | 0.071 | 0.46 | 153.37 |
| 19 | 1.17 | 0.066 | 0.46 | 161.83 |
| 20 | 1.18 | 0.064 | 0.45 | 170.00 |
| 21 | 1.25 | 0.066 | 0.45 | 177.85 |
| 22 | 1.34 | 0.073 | 0.46 | -174.66 |
| 23 | 1.43 | 0.072 | 0.46 | -167.58 |
| 24 | 1.46 | 0.093 | 0.47 | -160.96 |
| 25 | 1.50 | 0.103 | 0.48 | -155.33 |
| 26 | 1.54 | 0.111 | 0.48 | -151.18 |


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## RF Tuned Data at 12 GHz

Bias conditions unless otherwise noted: $V_D$ = 8 V, $I_{DQ}$ = 50% $I_{DSS}$, F = 12 GHz

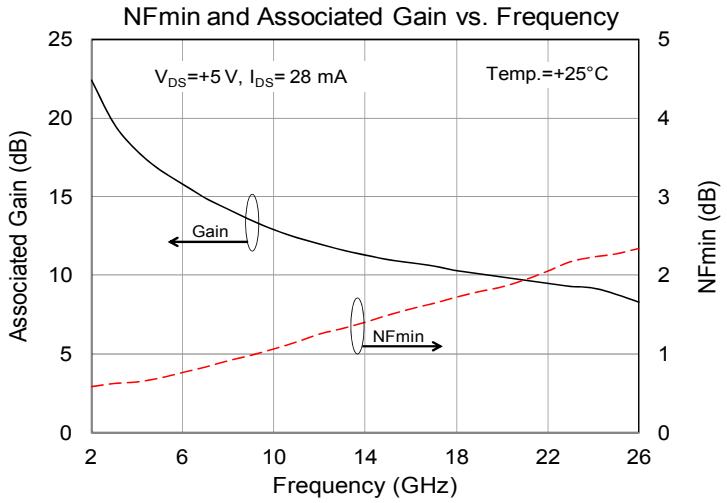


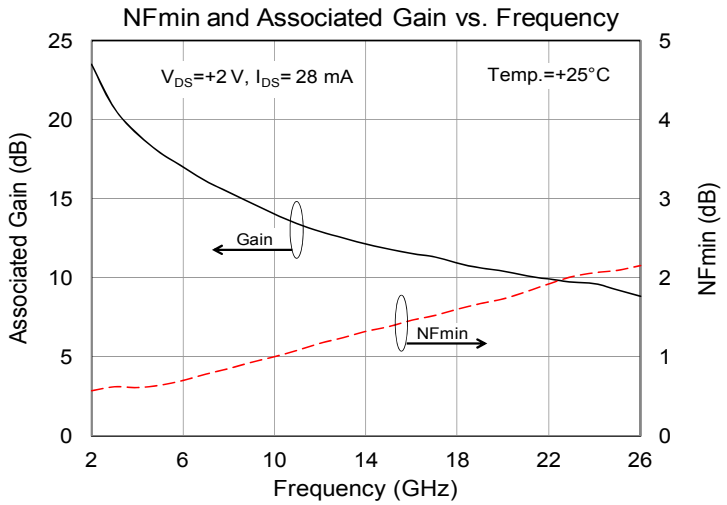



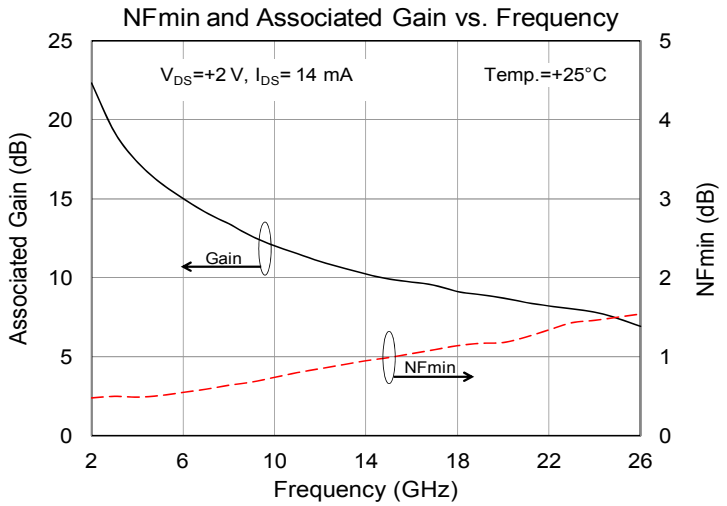


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## Typical Performance – Various Bias Conditions



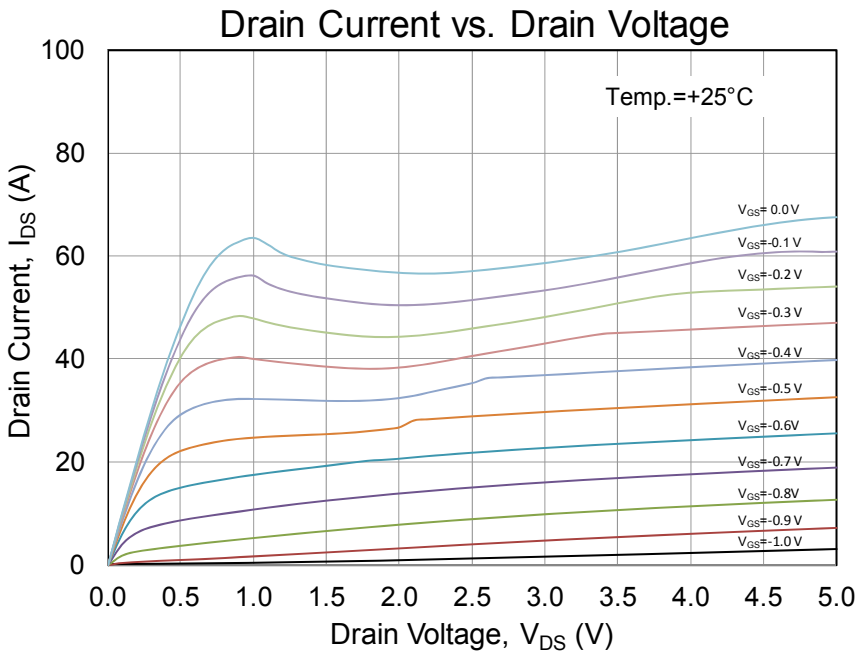





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## DC Characteristics




## 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. 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:

- Recommend Eutectic die attach with AuSn (80/20) solder and limit exposure to temperatures above 300°C to 30 seconds, maximum.
- 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:

- Either Thermo-compression Wedge Bonding or Thermosonic Ball Bonding can be used to bond onto the die.
- Force, time, and ultrasonics are critical bonding parameters.
- Aluminum wire should not be used.
- Devices with small pad sizes should be bonded with 0.0008-inch wire.


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## Product Compliance Information

### ESD Sensitivity



Caution! ESD-Sensitive Device

GaAs devices are susceptible to damage from Electrostatic Discharge. Proper precautions should be observed during handling, assembly and test.

Not HAST compliant.

### RoHs Compliance

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

## Contact Information

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