

Product Overview

The Qorvo QPD2040D is a discrete 400 micron pHEMT which operates from DC to 20 GHz. The QPD2040D is fabricated using Qorvo'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 QPD2040D typically provides 26 dBm of output power at P_{1dB} with gain of 13 dB and 55% power-added efficiency at 1 dB compression. This performance makes the QPD2040D appropriate for high efficiency applications. The protective overcoat layer with silicon nitride provides a level of environmental robustness and scratch protection.

The QPD2040D is lead-free and RoHS compliant.



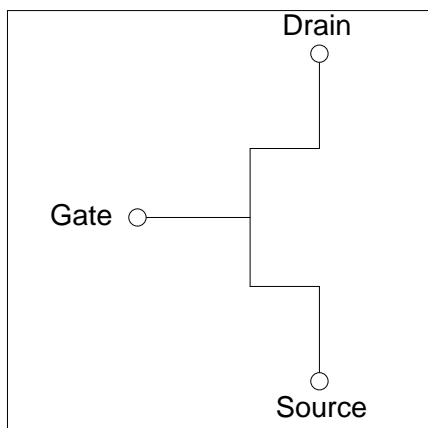
Key Features

- Frequency: DC – 20 GHz
- Output Power (P_{1dB})¹: 26 dBm
- Typical Gain¹: 13 dB
- Typical PAE_{1dB}¹: 55%
- Noise Figure¹: 1.1 dB
- No Vias
- Technology: 0.25 um GaAs pHEMT
- Chip Dimensions: 0.41 x 0.34 x 0.10 mm

Notes:

1. @ 12 GHz

Functional Block Diagram



Pad Dimensions	Terminal
71 um x 71 um	Gate
71 um x 71 um	Drain
121 um x 71 um	Source

Applications

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

Ordering Information

Part Number	Description
QPD2040D	400 um GaAs pHEMT

Absolute Maximum Ratings¹

Parameter	Absolute	Continuous	Units
Drain-Source Voltage (V_{DS}) ⁽²⁾	12	8	V
Gate-Source Voltage (V_{GS})	-7	-3	V
Drain Current (I_{DS}) ⁽²⁾	I_{DSS}	I_{DSS}	mA
Forward Gate Current ($I_{G,F}$)	20	3	W
Channel Temperature (T_{CH}) ⁽³⁾	175 ⁽⁴⁾	150 ⁽⁵⁾	°C
Storage Temperature (T_{STG})	-65 to 150	-65 to 150	°C
RF Input Power (P_{IN}) ⁽²⁾	21	At 3dB Compression	dBm
Power Dissipation (P_{TOT})	2.1	14	W

Notes:

- 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.
- Combinations of supply voltage, supply current, input power, and output power shall not exceed the maximum total power dissipation listed in the table.
- 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.
- When operated at this channel temperature, the median life is 1.0E+5 hours.
- When operated at this channel temperature, the median life is 1.0E+6 hours.

Electrical Characteristics¹

Parameters	Conditions	Typical Values	Units
Output Power at 1dB Compression (P_{1dB})	Freq = 12 GHz	24	dBm
Gain at P1dB (G_{1dB})	$V_{DS} = 8$ V	14	dB
PAE at P1dB (PAE)	$I_{DS} = 50\% I_{DSS}$	58	%
50 OHM Noise Figure (NF)	$V_{DS} = 2$ V, $I_{DS} = 19$ mA	1.1	dB
Saturated Drain Current (I_{DSS})	$V_{DS} = 2$ V, $V_{GS} = 0$ V	129 ⁽²⁾	mA
Transconductance (G_m)	$V_{DS} = 2$ V, $I_{DS} = 50\% I_{DSS}$	155	mS
Pinch-Off Voltage (V_P)	$V_{DS} = 2$ V, $I_{DS} = 0.20$ mA	-1.0	V
Gate-Drain Breakdown Voltage (BV_{GD})	$I_G = 0.4$ mA, source open	-15	V
Gate-Source Breakdown Voltage (BV_{GS})	$I_G = 0.4$ mA, drain open	-15	V
Thermal Resistance (R_{TH}) ⁽³⁾	AuSn eutectic attach	60	°C/W

Notes:

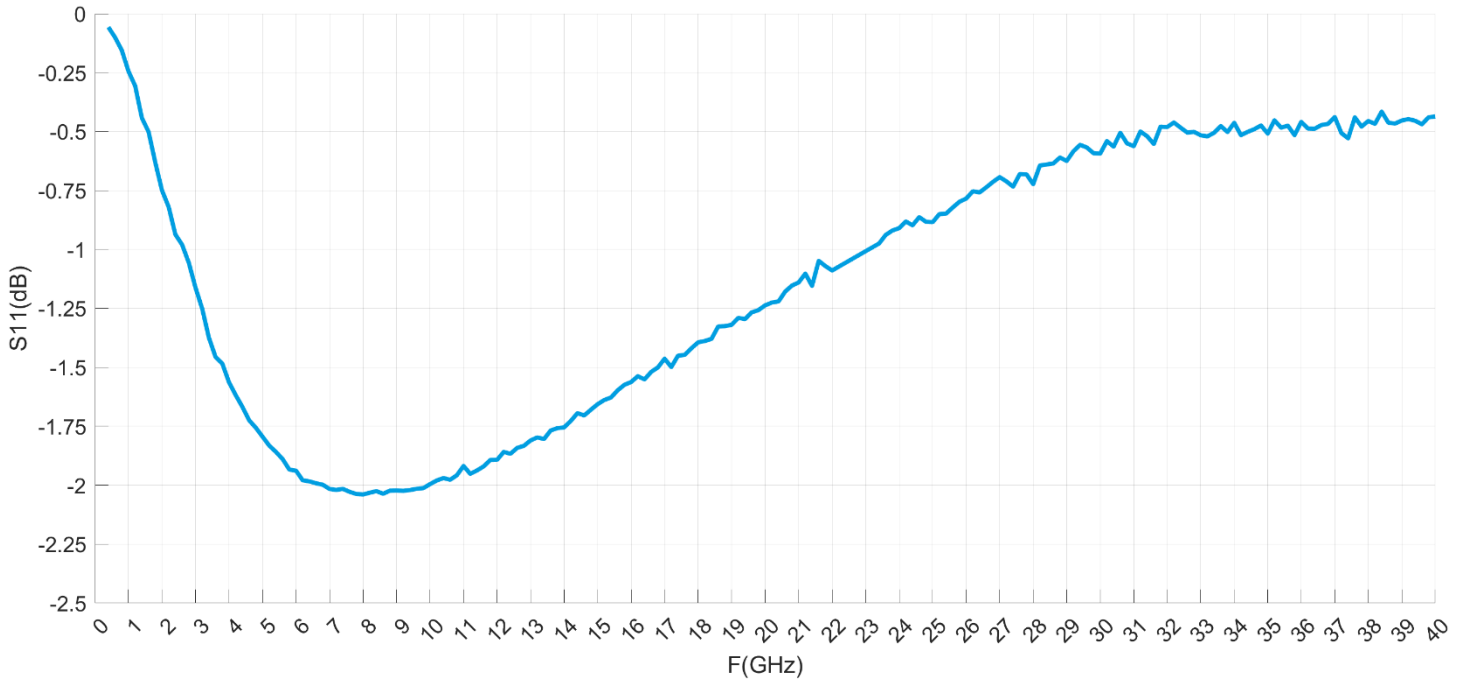
- Test conditions unless otherwise noted: $T_A = +25$ °C
- Typical Standard Deviation of 2 mA (1 σ).
- Based on IR Scan.

S-Parameters¹

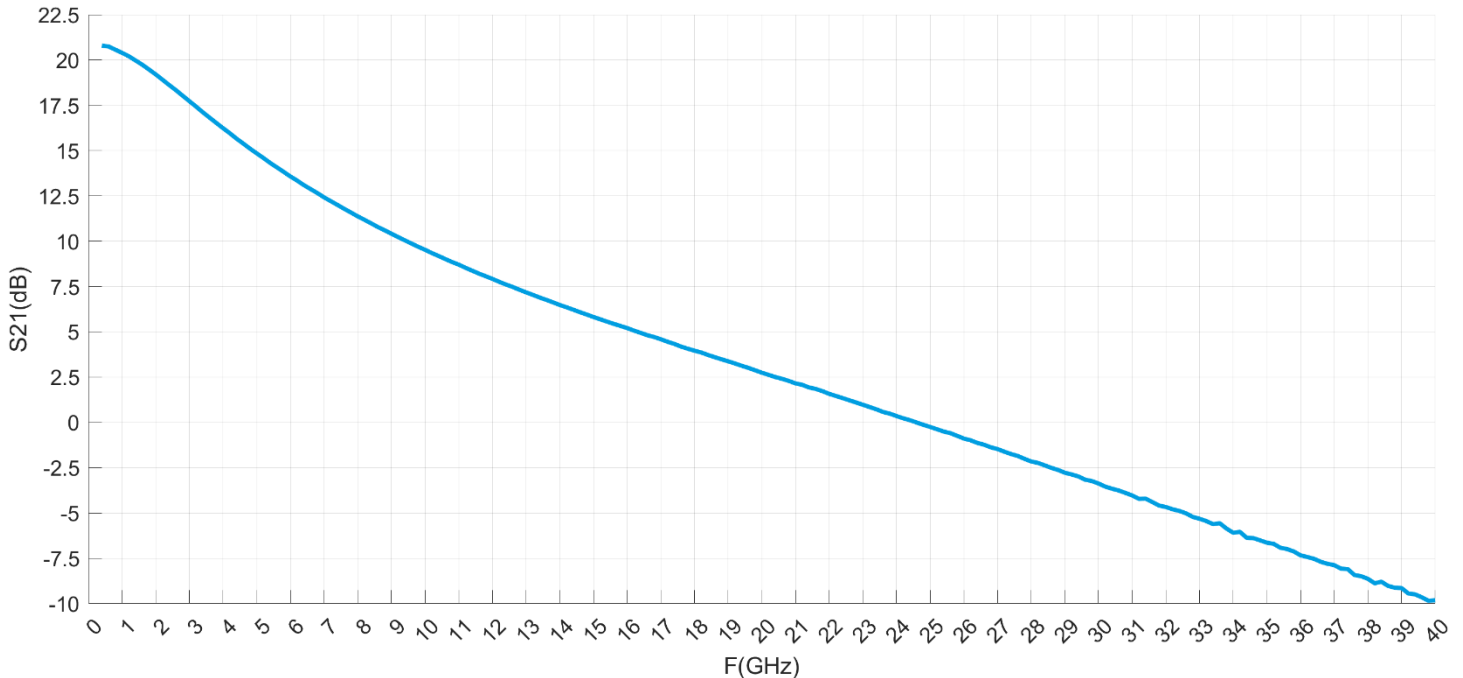
Notes:

1. S-Parameter data was measured by Modelithics with bonding wires at $V_D = 8$ V, $I_{DQ} = 32$ mA, and $T_A = 25$ °C. Please review Modelithics's QPD2040D model datasheet for more information on configurations of bonding wires.

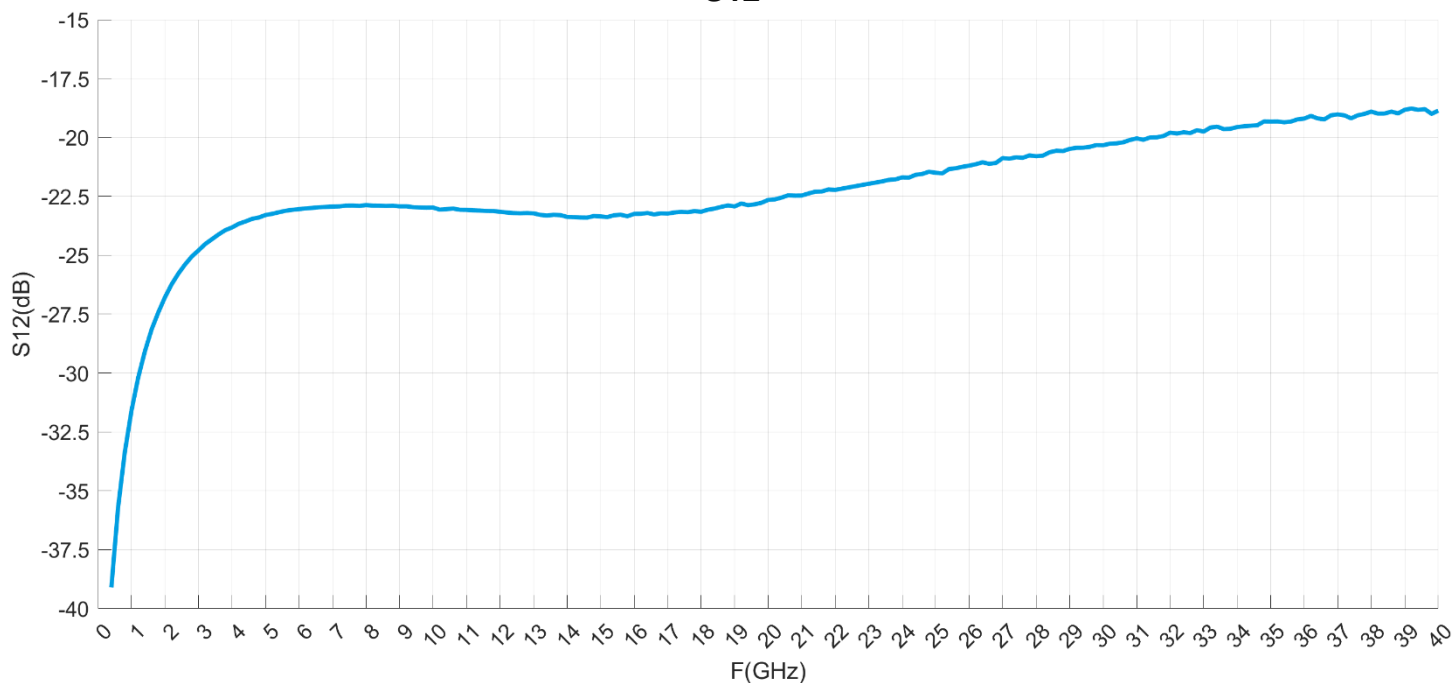
S11



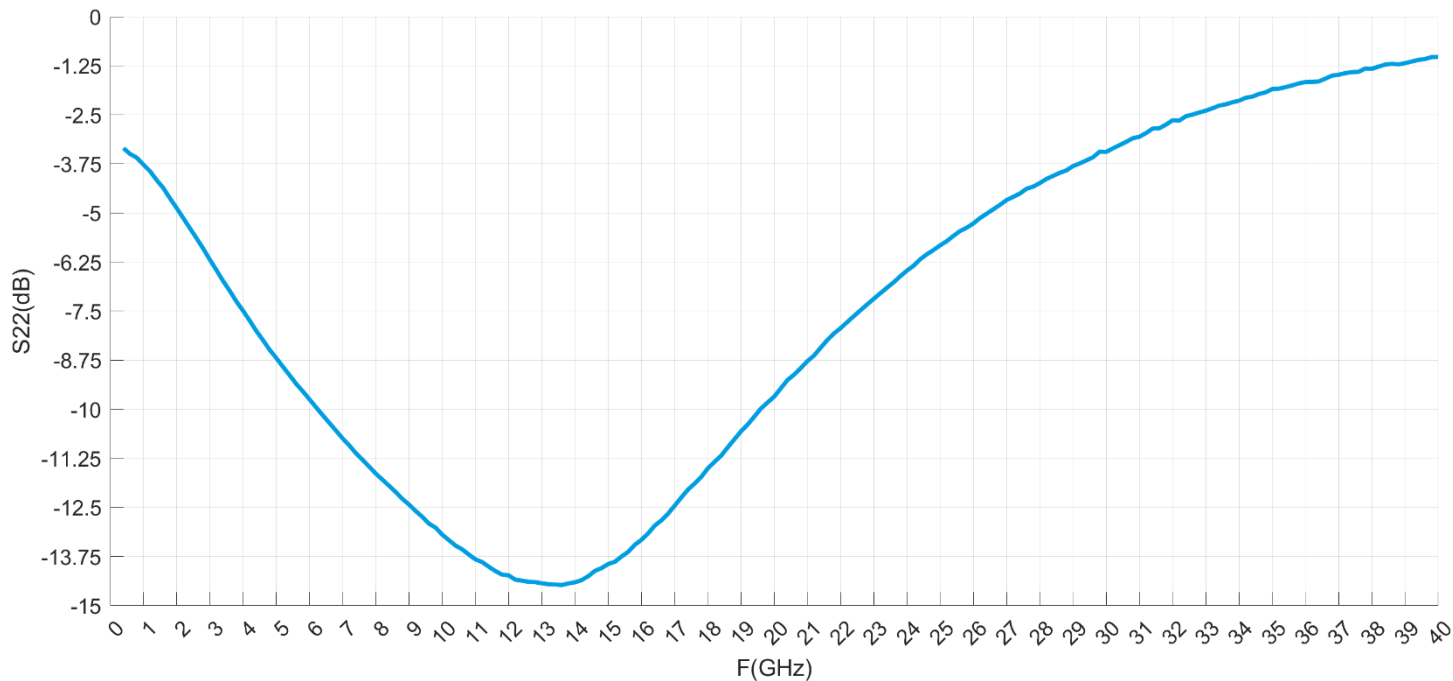
S21



S12



S22

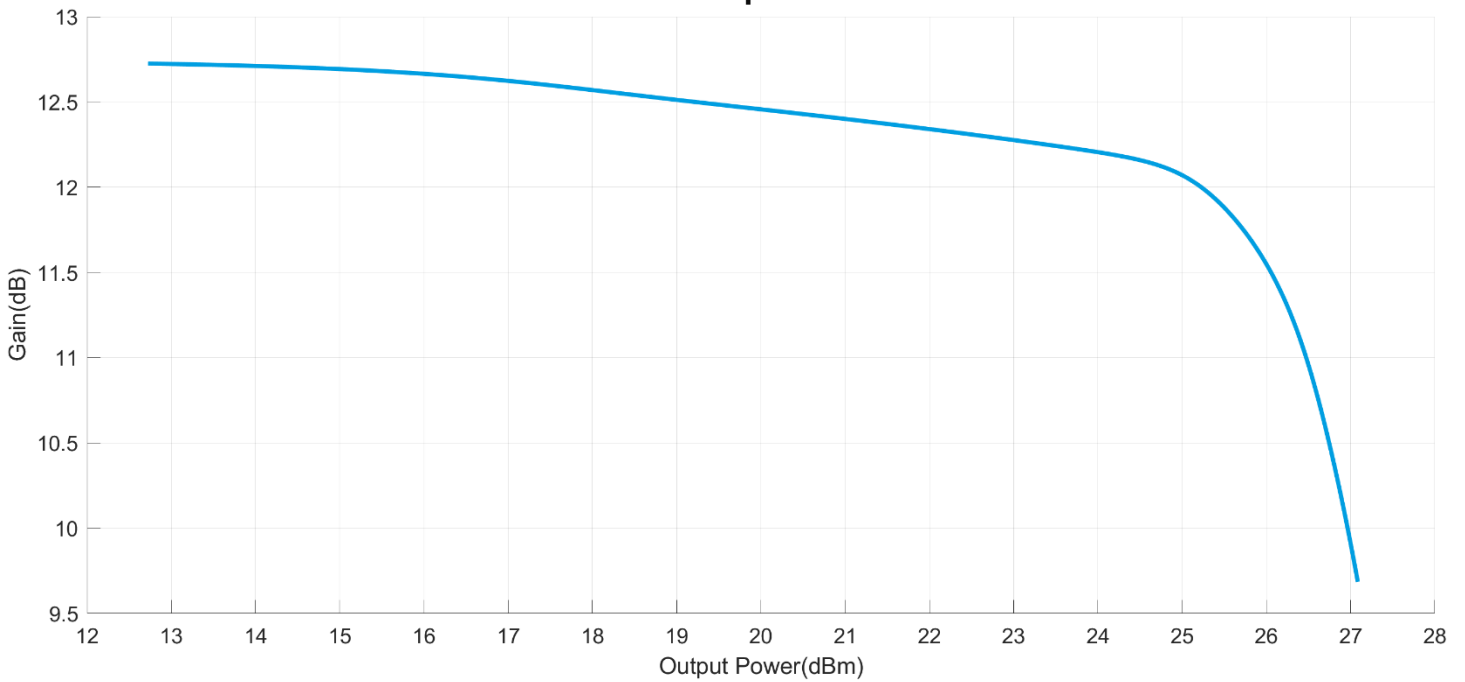


Performance Plots – Power Tuned @ 12 GHz¹

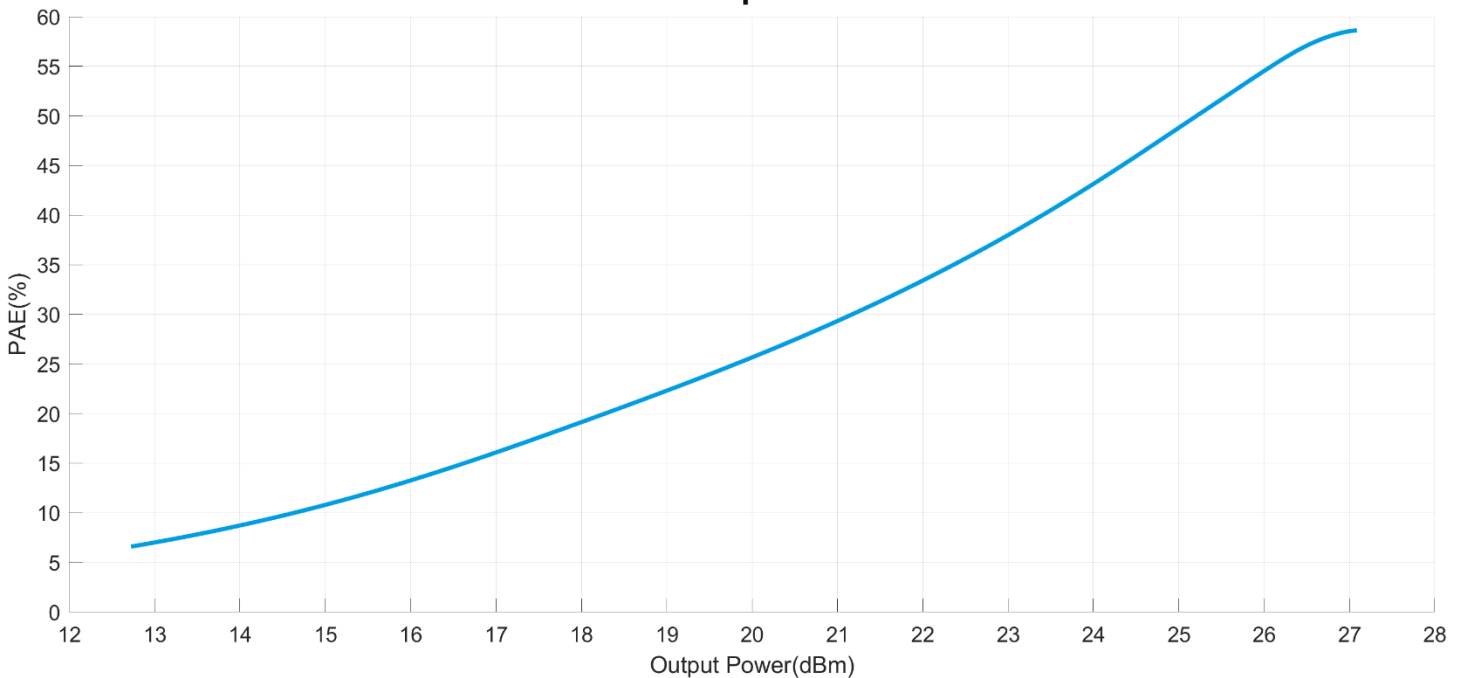
Notes:

1. Performance Plots are simulated result using Modelithics's QPD2040D model with $V_D = 8$ V, $I_{DQ} = 32$ mA, $BW_{removal} = 0$. Please visit Modelithics for Measurement vs. Model Data and more information.

Gain vs. Output Power



PAE vs. Output Power

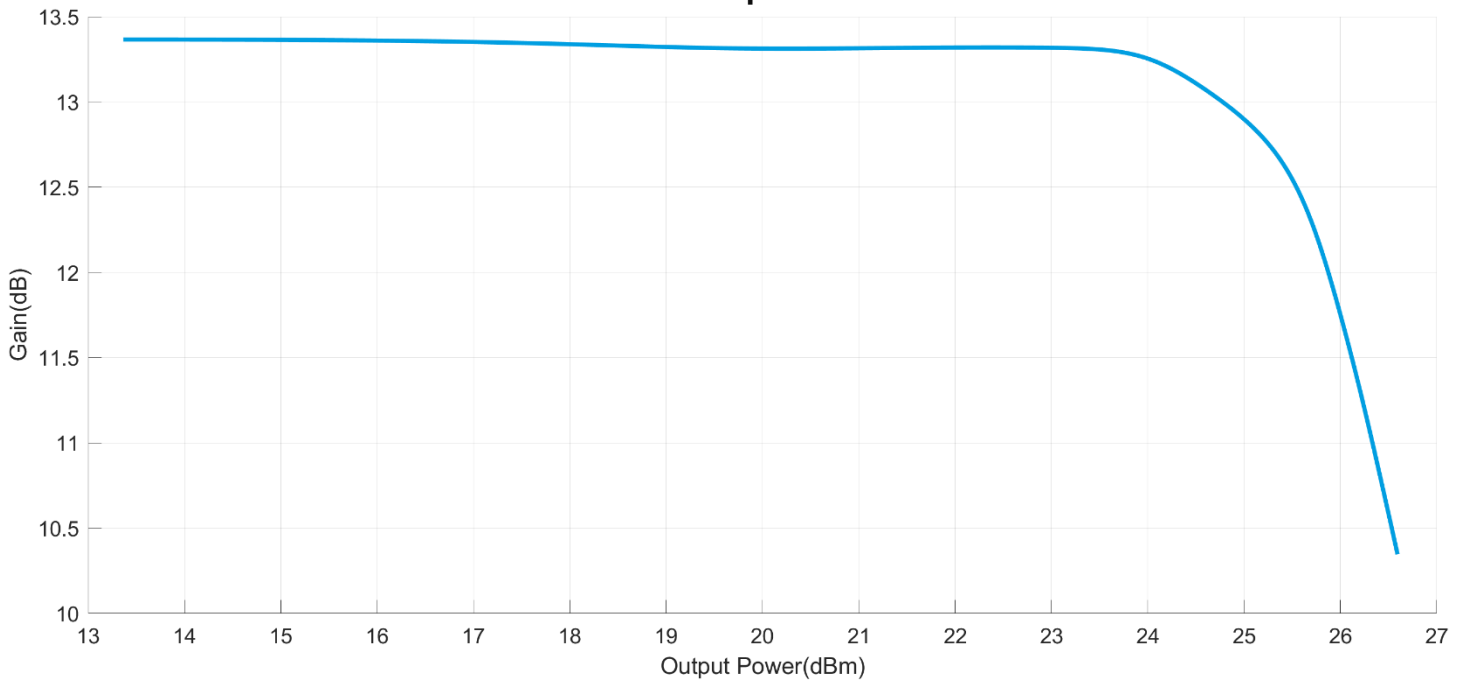


Performance Plots – Efficiency Tuned @ 12 GHz¹

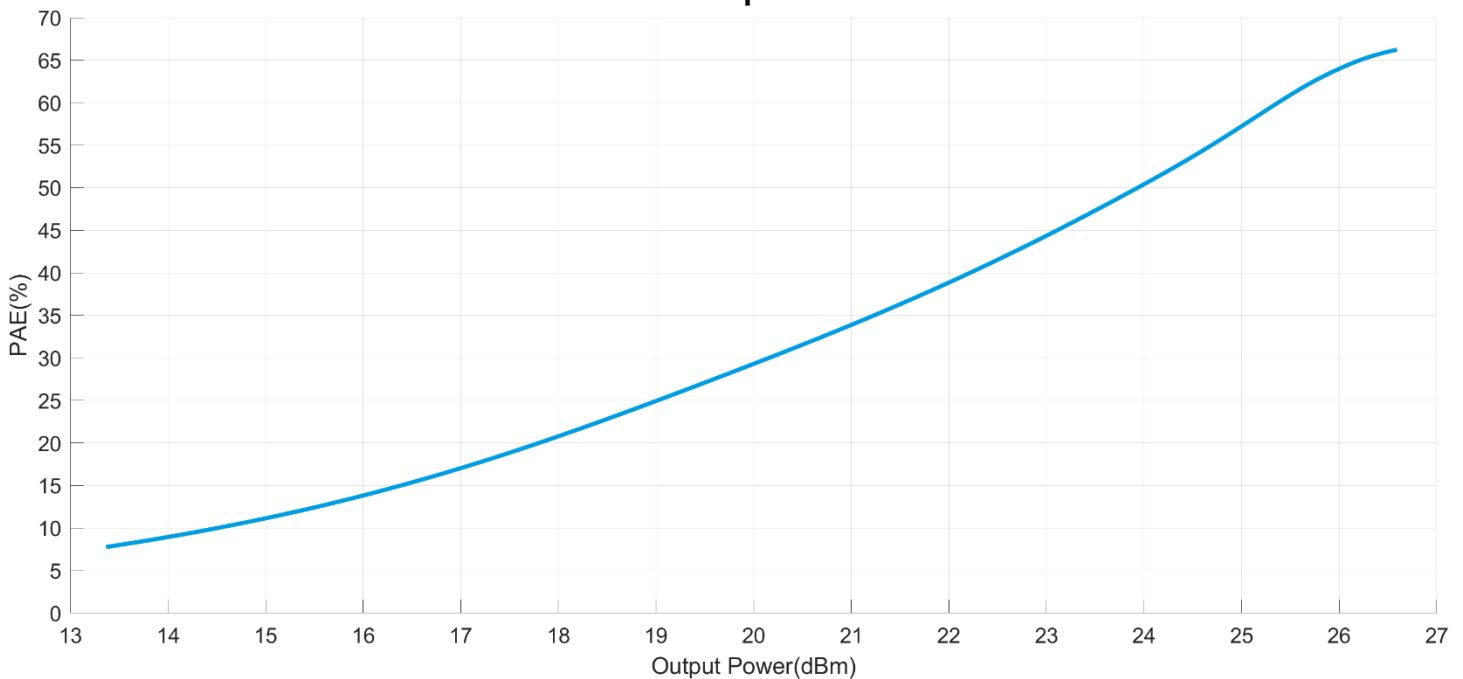
Notes:

1. Performance Plots are simulated result using Modelithics's QPD2040D model with $V_D = 8$ V, $I_{DQ} = 32$ mA, $BW_{removal} = 0$. Please visit Modelithics for Measurement vs. Model Data and more information.

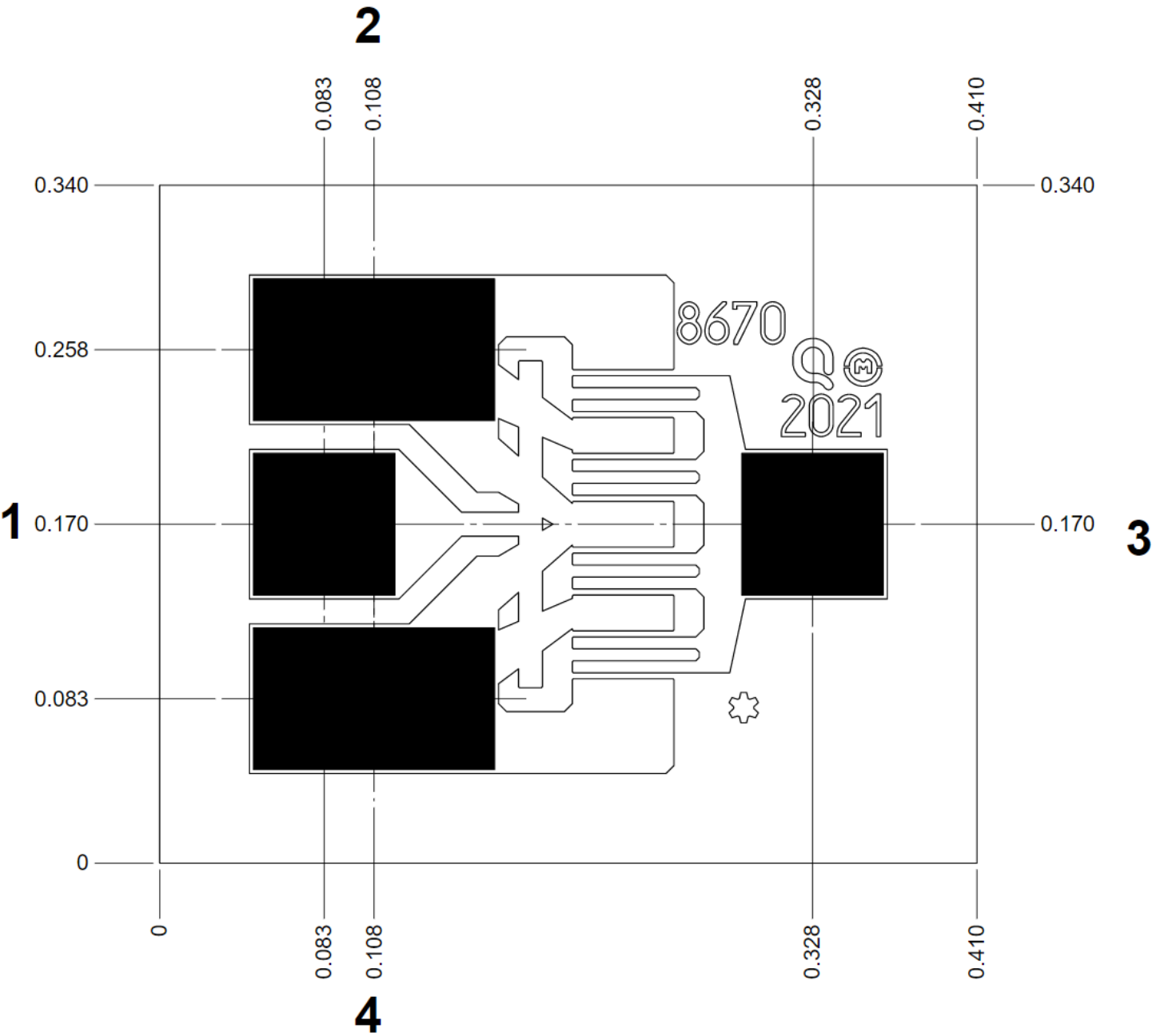
Gain vs. Output Power



PAE vs. Output Power



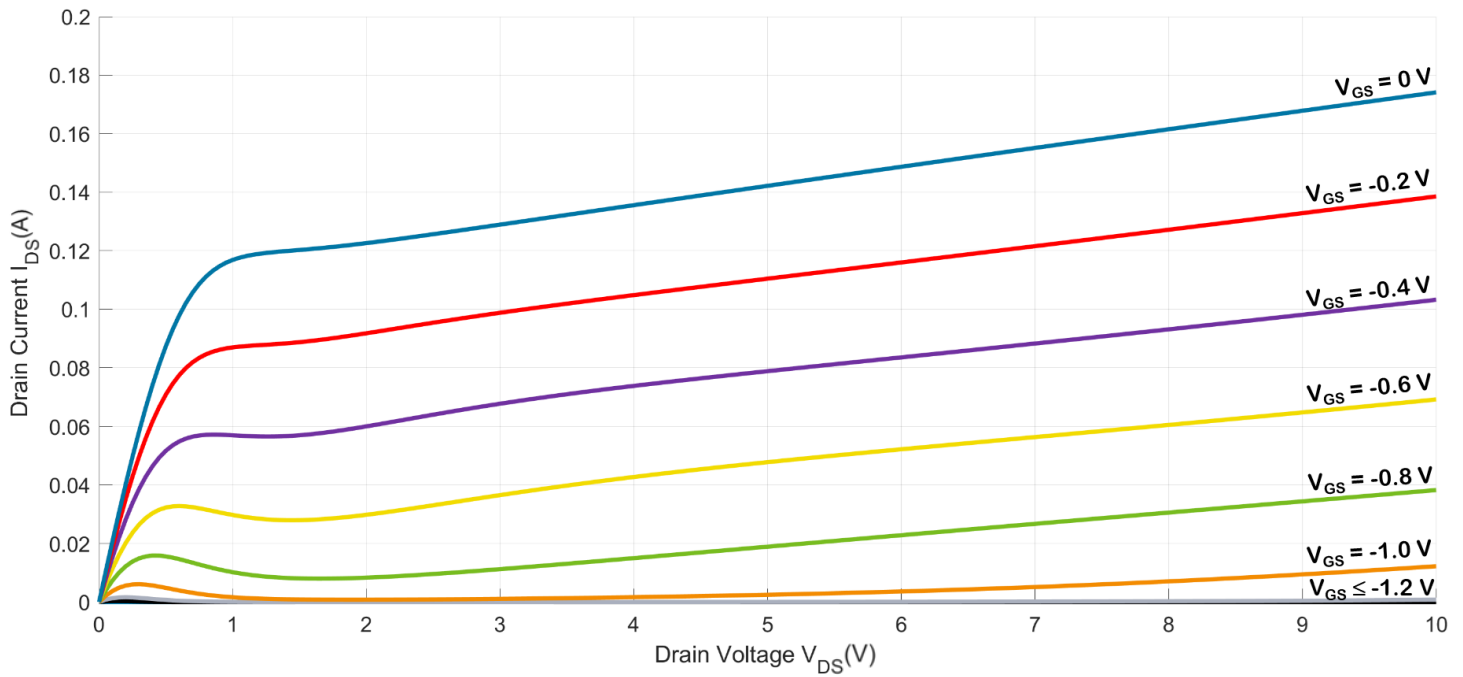
Die Dimensions¹



[E1]		
PIN	X	Y
1	0.071	0.071
2	0.121	0.071
3	0.071	0.071
4	0.121	0.071

Notes:
1. All units are in mm.

DC Characteristics¹



Notes:

1. The I-V plot shown above was simulated data using Modelithics's model with Model self_heat = 0. Please visit Modelithics for Measurement vs. Model Data and more information.

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.

Handling Precautions

GaAs devices are susceptible to damage for electrostatic discharge. Proper precautions should be observed during handling, assembly, and test.



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

Not HAST compliant.

Contact Information

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

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Email: customer.support@qorvo.com

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