QPD2731

2.5 – 2.7 GHz, 110 W / 220 W, 48 V, Asymmetric Doherty

Product Description

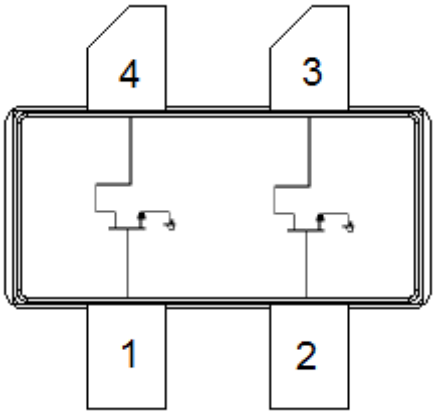
The QPD2731 is an asymmetric Doherty power device composed of pre-matched, discrete GaN on SiC HEMTs. The device operates from 2.5 to 2.7 GHz.

QPD2731 can deliver P_{AVG} of 50 W at +48 V operation.

ROHS compliant.

4 Lead NI780 Package

Functional Block Diagram



Product Features

- Operating Frequency Range: 2.5 – 2.7 GHz
- Peak Doherty Output Power: 55.0dBm (316 W)
- Doherty Drain Efficiency: 60.0% (47.5dBm)
- Doherty Gain: 16.0 dB
- 4-lead, earless, ceramic flange NI780 package

Applications

- W-CDMA / LTE
- Macrocell Base Station
- Asymmetric Doherty Applications

Ordering Information

Part No.	ECCN	Description
QPD2731	5A991.b	36 W (110 / 220), 2.6 GHz, GaN Doherty
QPD2731EVB1.0	EAR99	2.6 GHz Doherty Evaluation Board

Absolute Maximum Ratings

Parameter	Value / Range
Gate Current (I_{G1})	-17 to 17mA
Gate Current (I_{G2})	-34 to 34mA
Drain Voltage (V_D)	+55 V
Peak RF Input Power	43 dBm
VSWR Mismatch, P1dB Pulse (10 % duty cycle, 100 µ width), T = 25 °C	10:1
Storage Temperature	−65 to +150°C

Operation of this device outside the parameter ranges given above may cause permanent damage.

Recommended Operating

Parameter	Min	Typ	Max	Units
Operating Temperature	−40	–	–	°C
Gate Voltage (V_{G1})	–	−2.7	–	V
Gate Voltage (V_{G2})	–	−5.0	–	V
Drain Voltage (V_{D1}, V_{D2})	–	48	–	V
Quiescent Current (I_{DQ1})	–	220	800	mA
T_{CH} for >10^6 hours MTTF	–	–	250	°C

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

RF Characterization – Doherty Specifications

Parameter	Conditions	Min	Typ	Max	Units
Frequency Range		2500	–	2700	MHz
Quiescent Current		–	220	–	mA
Drain Efficiency	P_{AVG} = 45.6dBm		57.1	-	%
Doherty Gain	P_{AVG} = 45.6dBm	–	16.3	–	dB
Peak Power	P3dB	–	55.0	–	dBm
Drain Efficiency	P_{AVG} = 47.5dBm		60.0		%

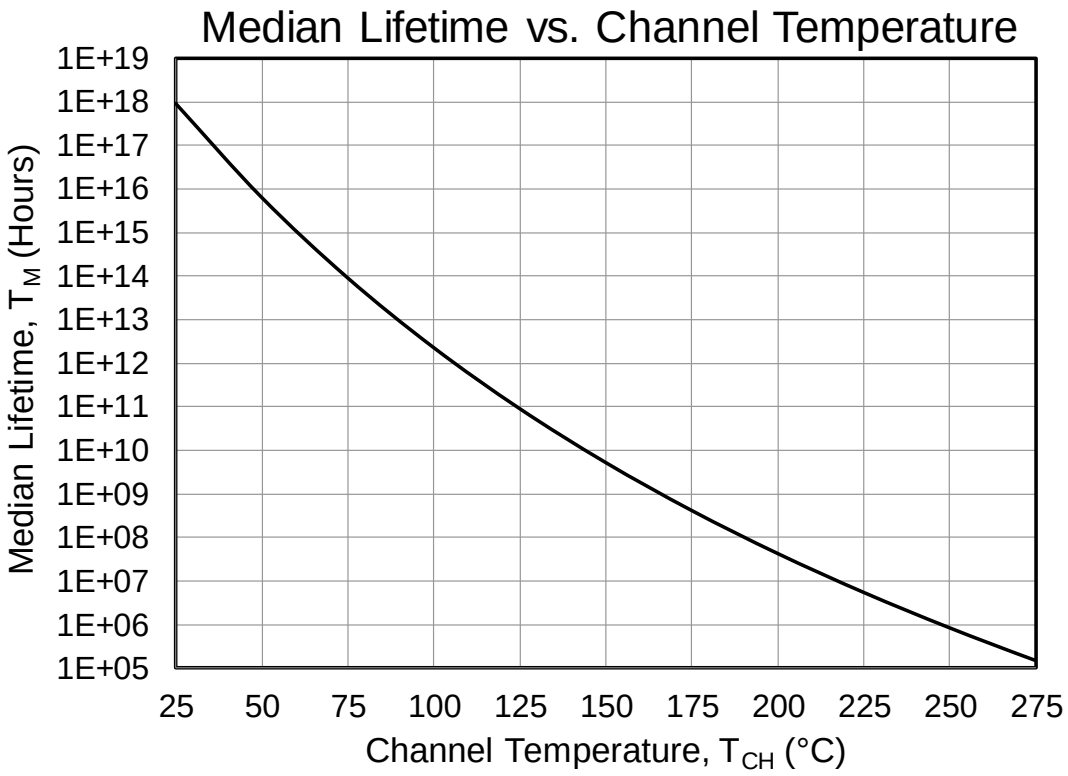
Test conditions unless otherwise noted: V_{G2} = −5.0V, V_{D1} = V_{D2} = +48 V, I_{DQ1} = 220 mA, T = 25°C, Frequency = 2605 MHz, 1C WCDMA signal, Input PAR = 10 dB at 0.01% CCDF

Thermal and Reliability Information

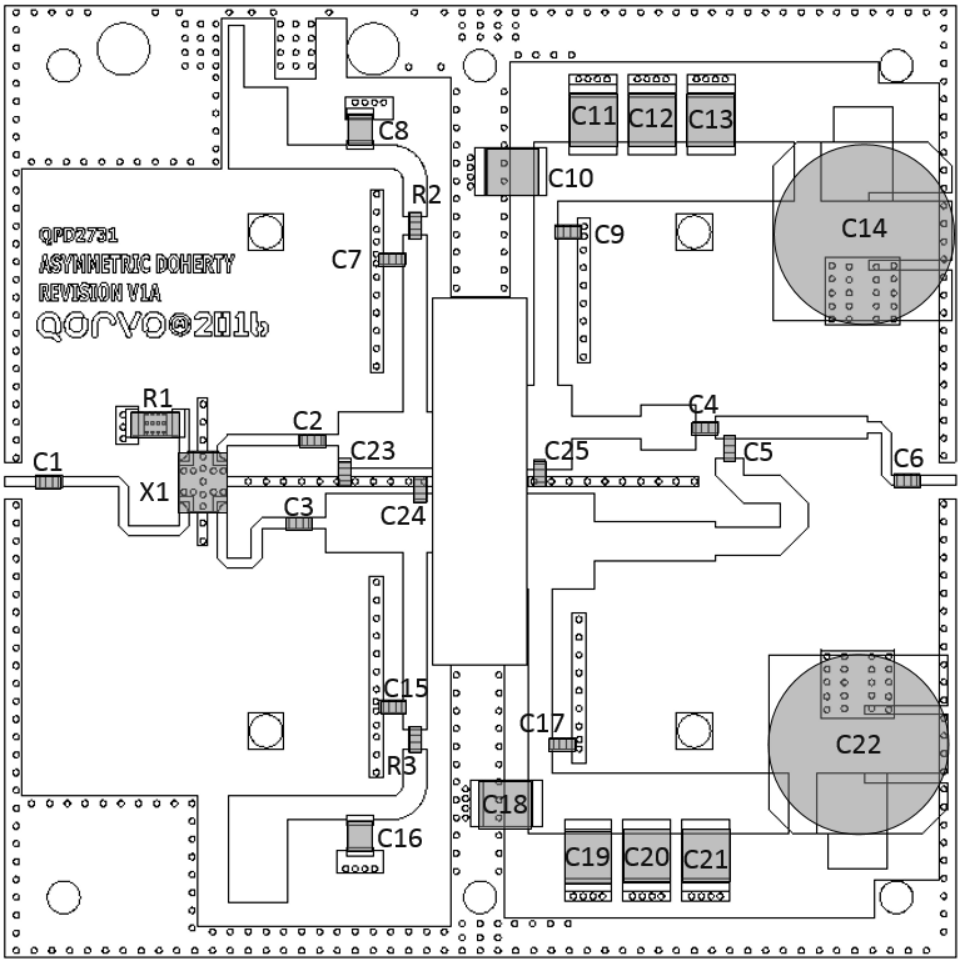
Parameter	Test Conditions	Value	Units
Carrier Amplifier Thermal Resistance at Average Power (θ_{JC})	T_{CASE} = 85°C, T_{CH} = 131°C, CW: P_{DISS} = 20.0 W, P_{OUT} = 28.8 W	2.29	°C/W

Notes:
1. Thermal resistance measured to package backside.
2. Based on expected carrier amplifier efficiency of Doherty.
3. P_{OUT} assumes 20% peaking amplifier contribution of total average Doherty rated power.

Median Lifetime



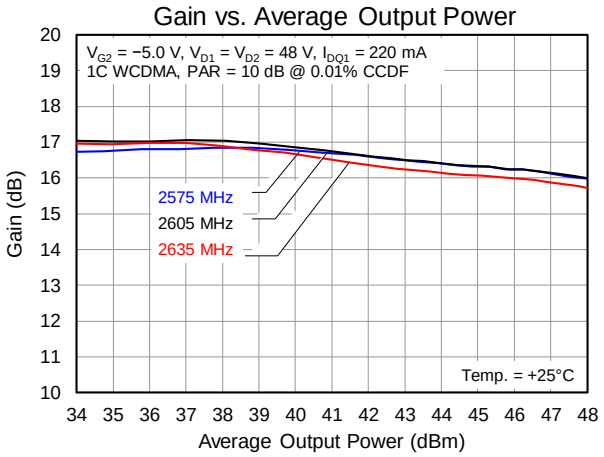
Doherty Evaluation Board Layout

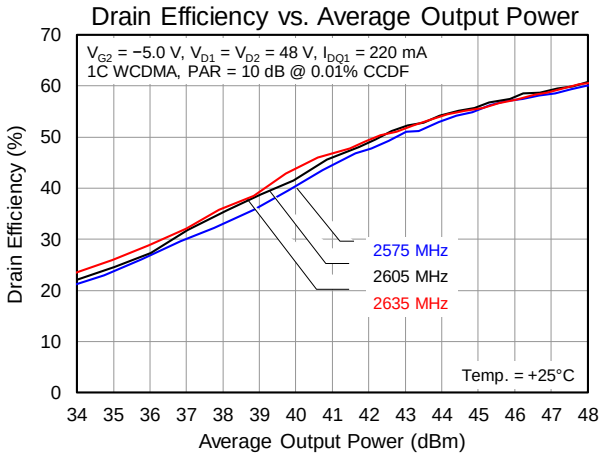


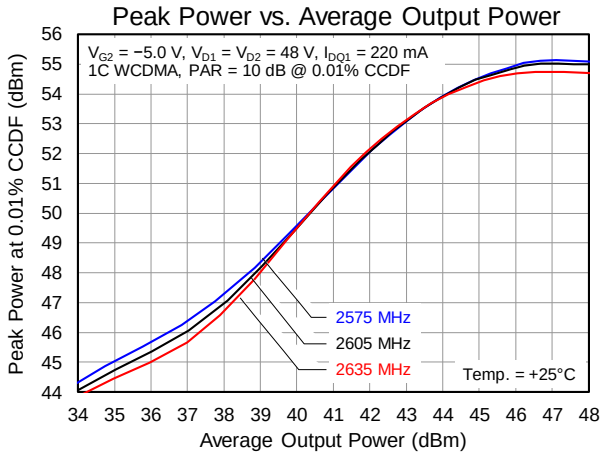
Bill of Materials

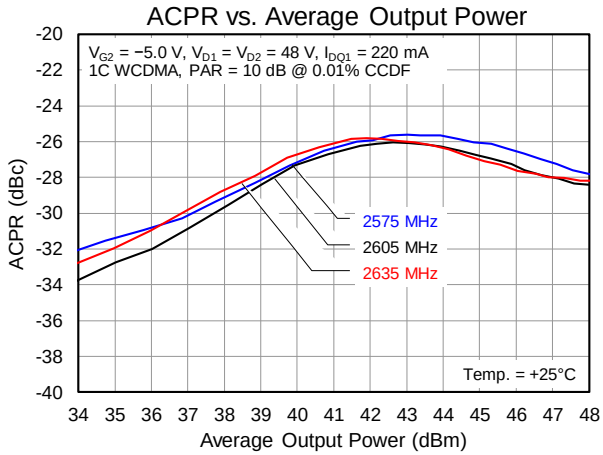
Reference Des.	Value	Description	Manuf.	Part Number
C23	0.2pF	Capacitor, 0.2pF	ATC	ATC600F0R2AT250XT
C25	0.7pF	Capacitor, 0.7pF	ATC	ATC600F0R7AT250XT
C24	1.0pF	Capacitor, 1.0pF	ATC	ATC600F1R0AT250XT
C7, C9, C15, C17	4.7pF	Capacitor, 4.7pF	ATC	ATC600F4R7BT250XT
C1, C2, C3, C4, C5, C6	20pF	Capacitor, 20.0pF	ATC	ATC600F200GT250XT
C8, C16	10uF	Capacitor, Ceramic, 10uF	TDK	C3225X7R1C106K200AB
C10, C11, C12, C13, C18, C19, C20, C21	10 µF	Capacitor, Ceramic, 10uF, 100V	TDK	CKG57KX7S2A106K335J
C14, C22	220 µF	Capacitor, 220µF, Electrolytic, 100V	Nichicon	UCD2A221MNQ1MS
R1	50 Ω	Resistor, 50 Ω, 10 W	ATC	CS12010T0050JTR
R2, R3	10 Ω	Resistor, 10Ω, 1/8W	Panasonic	ERJ-6GEYJ100V
X1	–	Coupler, 2dB, 90°	Anaren	X3C25P1-02S

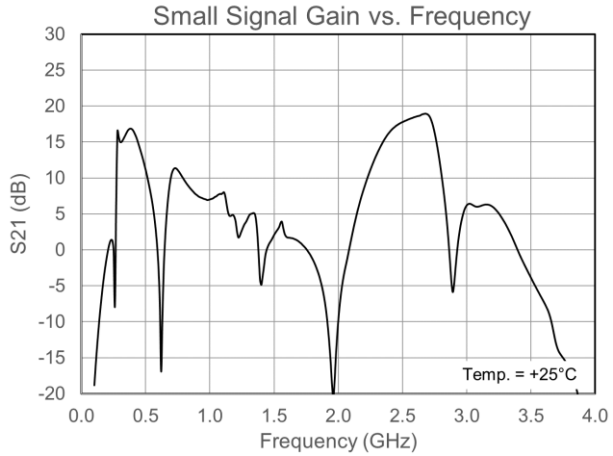
Doherty Performance Plots

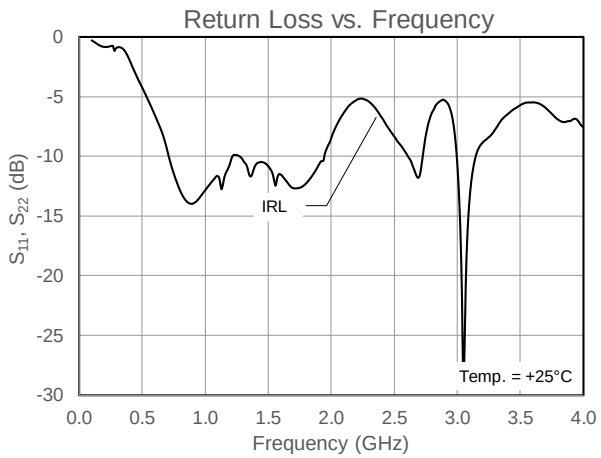












Test conditions unless otherwise noted: V_{G2} = −5.00 V, V_{D1} = V_{D2} = +48 V, I_{DQ1} = 220 mA, T = 25°C, Frequency = 2605 MHz, 1C WCDMA signal, Input PAR = 10.0 dB at 0.01% CCDF

Carrier Amplifier – Power Matched Load Impedances

Frequency (MHz)	Source Impedance	Load Impedance	Gain @ P3dB (dB)	P3dB (dBm)	Drain Efficiency (%)
2500	5.49 – j8.71	18.88 + j2.58	16.5	51.1	65.2
2575	6.68 – j7.36	14.44 + j4.37	17.1	51.0	63.1
2600	6.37 – j7.32	15.55 + j7.60	16.6	51.1	61.3
2635	7.40 – j6.76	15.02 + j4.29	17.7	51.0	69.3
2700	4.44 – j5.88	10.20 + j7.54	16.6	51.1	60.4

Test conditions unless otherwise noted: V_{D1} = +48 V, I_{DQ1} = 210 mA, T = 25°C, Pulsed (10% duty cycle, 100 µs width)

Carrier Amplifier – Efficiency Matched Load Impedances

Frequency (MHz)	Source Impedance	Load Impedance	Gain @ P3dB (dB)	P3dB (dBm)	Drain Efficiency (%)
2500	5.49 – j8.71	13.13 – j10.46	18.5	49.6	80.5
2575	6.68 – j7.36	15.03 – j9.01	19.3	49.3	75.7
2600	6.37 – j7.32	15.61 – j7.50	19.4	49.4	76.9
2635	7.40 – j6.76	19.85 – j8.37	19.2	49.2	77.3
2700	4.44 – j5.88	21.27 – j3.10	19.4	49.4	77.4

Test conditions unless otherwise noted: V_{D1} = +48 V, I_{DQ1} = 210 mA, T = 25°C, Pulsed (10% duty cycle, 100 µs width)

Peaking Amplifier – Power Matched Load Impedances

Frequency (MHz)	Source Impedance	Load Impedance	Gain @ P3dB (dB)	P3dB (dBm)	Drain Efficiency (%)
2500	2.66 – j7.03	8.14 – j5.81	17.8	53.7	65.3
2575	4.23 – j7.85	9.46 – j2.58	18.0	53.4	59.8
2600	3.90 – j5.79	9.46 – j2.58	18.0	53.4	59.9
2635	4.78 – j5.90	8.04 – j1.63	18.3	53.4	65.0
2700	4.56 – j4.36	9.88 – j1.55	18.1	53.5	61.1

Test conditions unless otherwise noted: V_{D2} = +48 V, I_{DQ2} = 410 mA, T = 25°C, Pulsed (10% duty cycle, 100 µs width)

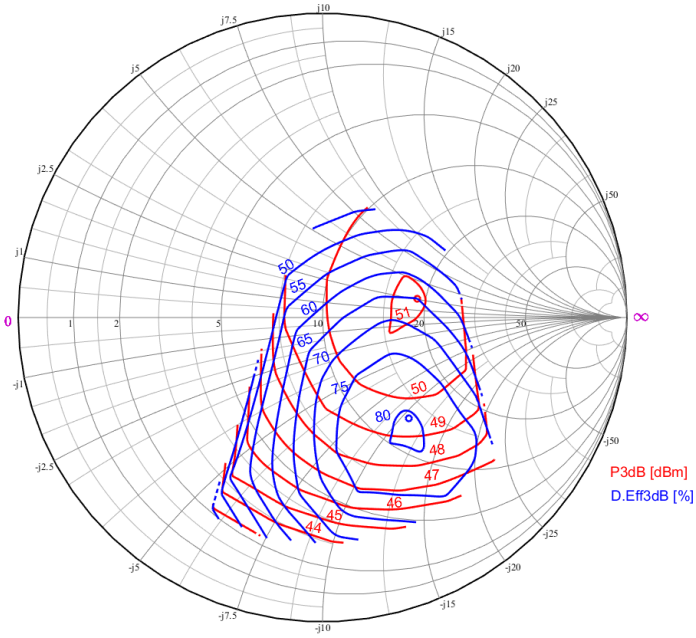
Peaking Amplifier – Efficiency Matched Load Impedances

Frequency (MHz)	Source Impedance	Load Impedance	Gain @ P3dB (dB)	P3dB (dBm)	Drain Efficiency (%)
2500	2.66 – j7.03	3.17 – j7.23	20.2	51.7	79.0
2575	4.23 – j7.85	4.46 – j6.85	21.3	51.4	73.4
2600	3.90 – j5.79	4.46 – j6.85	21.5	51.3	73.9
2635	4.78 – j5.90	5.07 – j6.85	21.5	51.5	73.2
2700	4.56 – j4.36	4.01 – j7.91	22.3	49.5	78.9

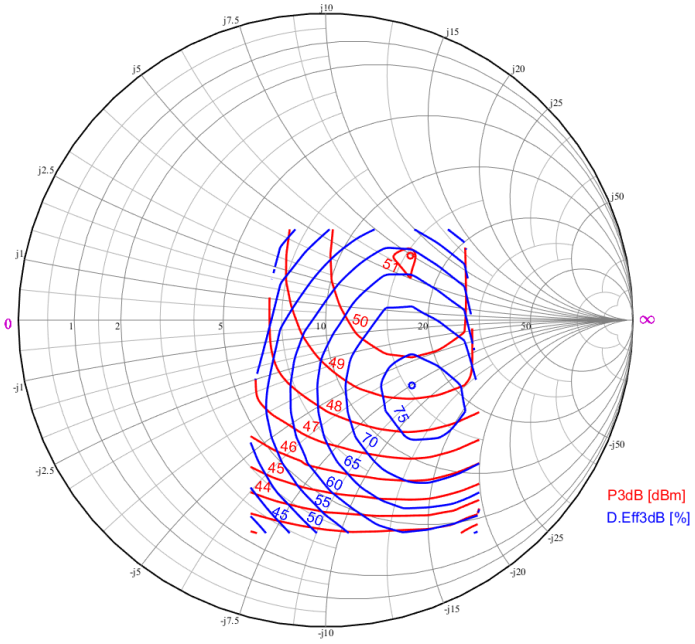
Test conditions unless otherwise noted: V_{D2} = +48 V, I_{DQ2} = 410 mA, T = 25°C, Pulsed (10% duty cycle, 100 µs width)

Carrier Amplifier Load Pull Plots

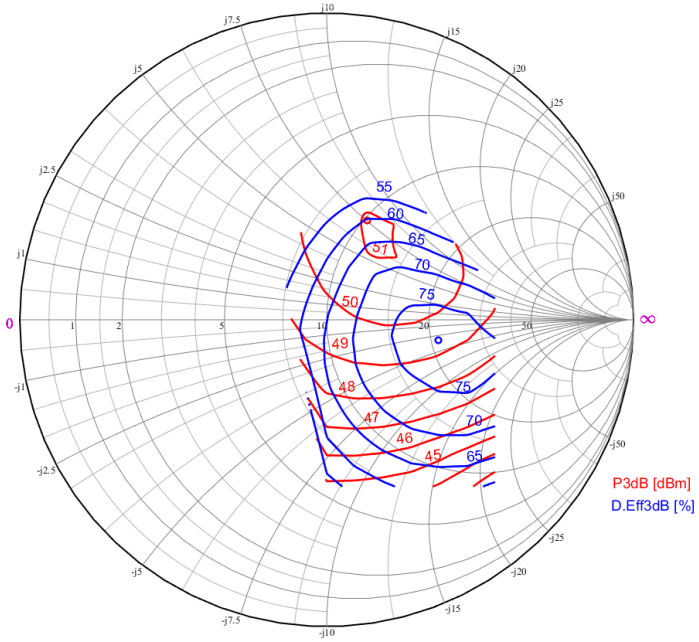
Load Pull at 2.500GHz



Load Pull at 2.600GHz



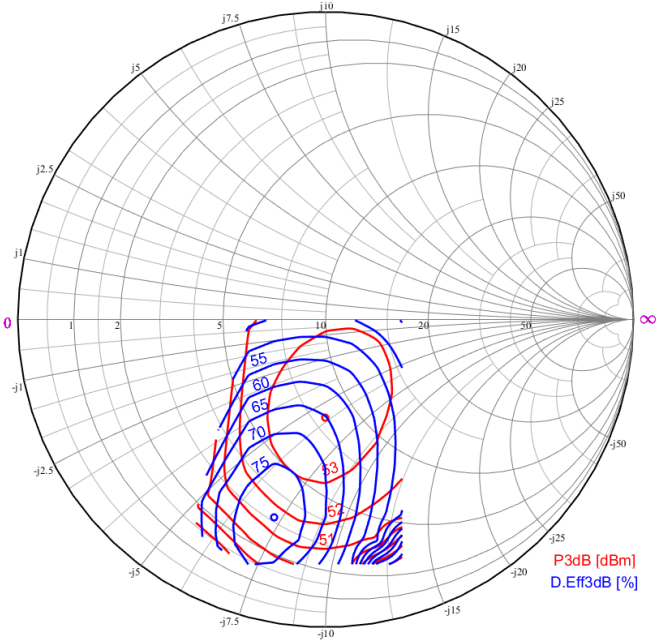
Load Pull at 2.700GHz



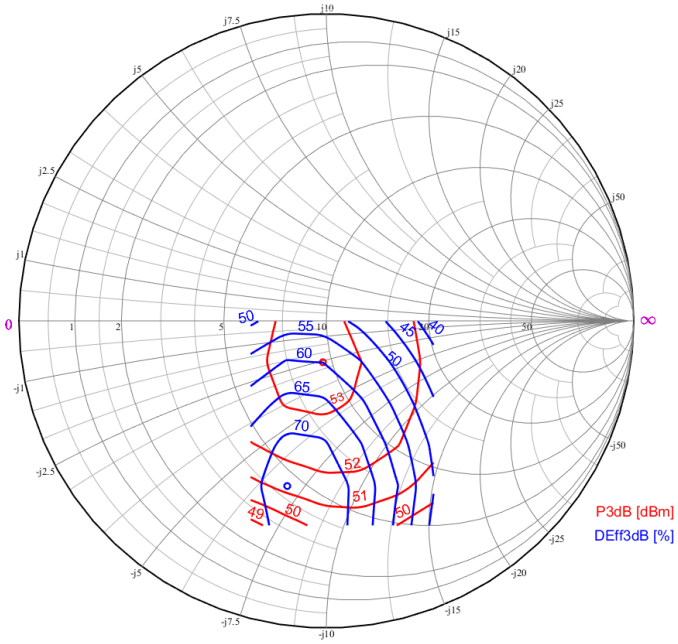
Test conditions unless otherwise noted: V_{D1} = +48 V, I_{DQ1} = 210 mA, T = 25°C, Pulsed (10% duty cycle, 100 µs width)

Peaking Amplifier Load Pull Plots

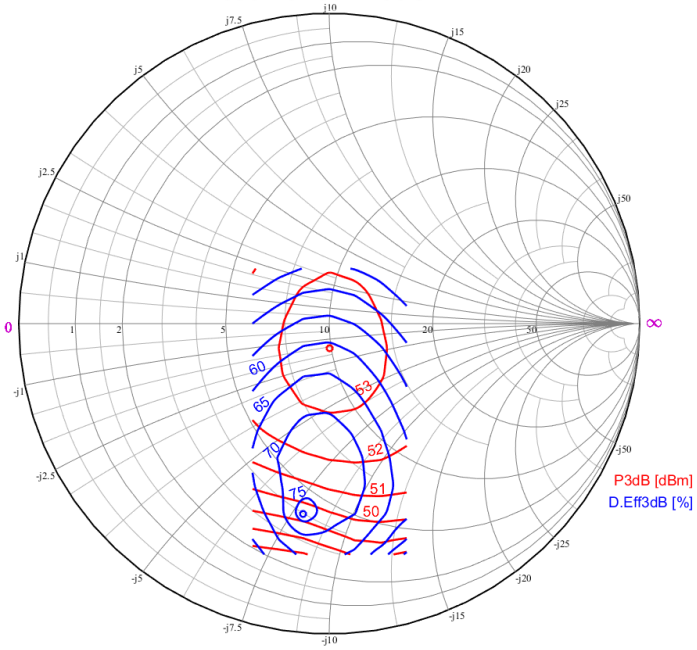
Load Pull at 2.500GHz



Load Pull at 2.600GHz

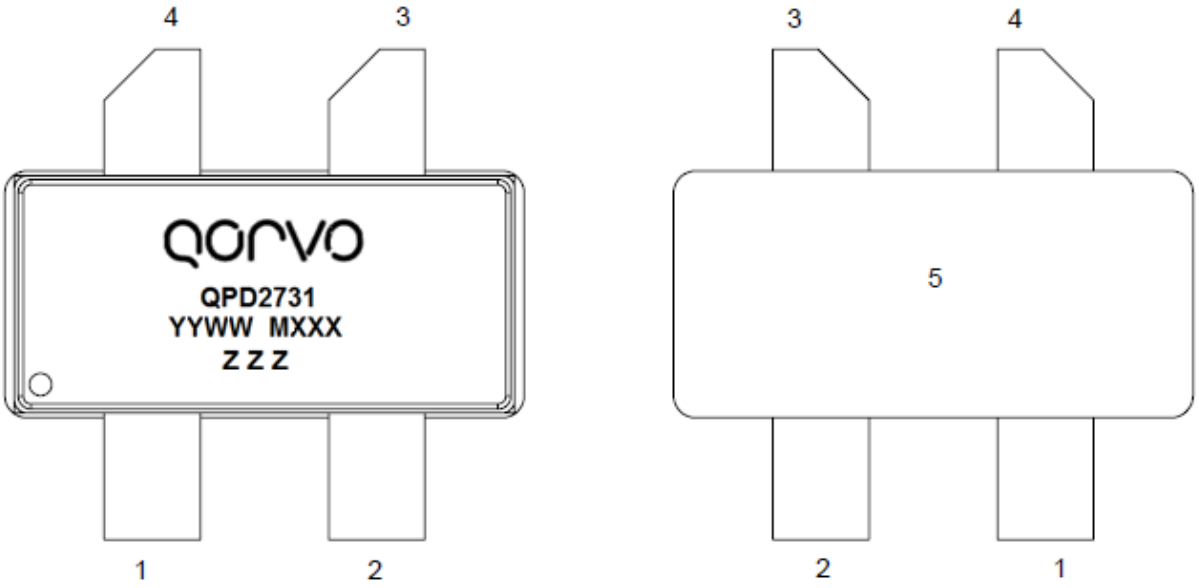


Load Pull at 2.700GHz



Test conditions unless otherwise noted: V_{D2} = +48 V, I_{DQ2} = 410 mA, T = 25°C, Pulsed (10% duty cycle, 100 µs width)

Pin Configuration

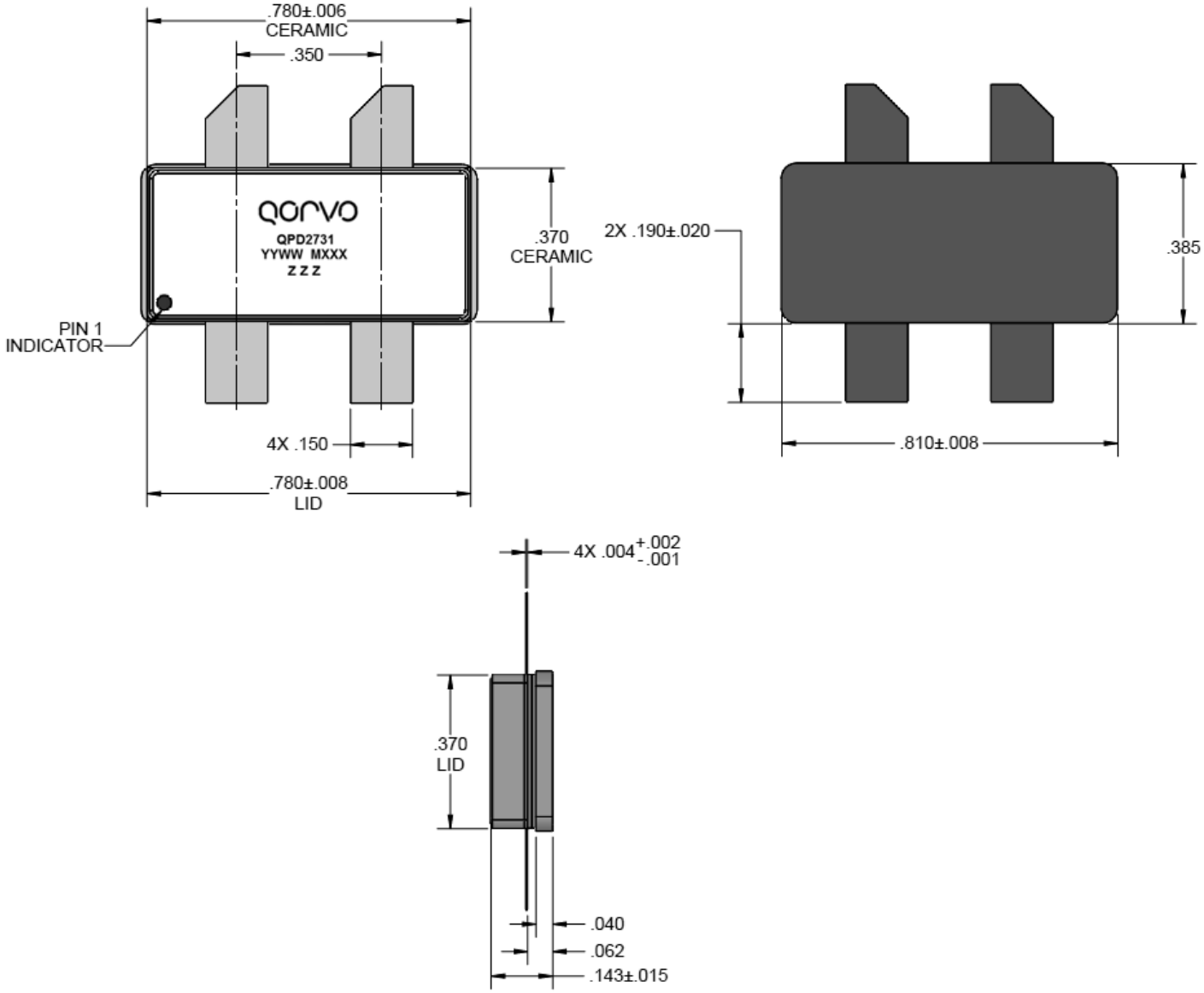


Pin Description

Pin No.	Label	Description
1	RF IN 1, V_{G1}	Carrier Amplifier RF Input, Gate Bias
2	RF IN 2, V_{G2}	Peaking Amplifier RF Input, Gate Bias
3	RF OUT 2, V_{D2}	Peaking Amplifier RF Output, Drain Bias
4	RF OUT 1, V_{D1}	Carrier Amplifier RF Output, Drain Bias
5 (Backside Paddle)	RF/DC GND	RF/DC Ground

Package Marking and Dimensions

Marking: Qorvo Logo
Part Number and Package Version – QPD2731
Date Code – YYWW
Production Lot Number – MXXX
Serial Number – ZZZ



Notes:
1. All dimensions are in inches. Angles are in degrees.
2. Exposed metallization is NiAu plated.