GaN Transistor 28 V, 60 W DC - 6 GHz

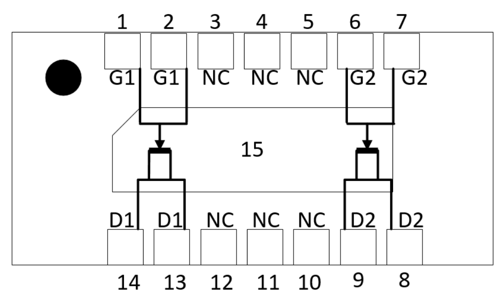
Features
- Unmatched, Ideal for Pulsed Operation
- Suitable for Linear & Saturated Applications
- CW & Pulsed Operation: 60 W Output Power
- 28 V Operation

3 x 6 mm DFN

Applications
- 2-Way Private Radio
- Broadband Amplifiers
- Cellular Infrastructure
- Test Instrumentation
- Class A, AB, Linear amplifiers suitable for OFDM, W-CDMA, EDGE, CDMA waveforms

Description
The MAPC-A3025 is a 60W packaged, unmatched transistor utilizing high power GaN on SiC production process. The device is suitable for pulsed operation with output power levels of 60W (47.8 dBm) in a DFN Package.

Functional Schematic



Typical RF Performance:
- Measured at pulsed[2] @P_{SAT} defined at P_{IN} = 34dBm. V_{DS} = 28 V, I_{DQ} = 400 mA, T_C = 25°C

Frequency (GHz)	Output Power (dBm)	Gain (dB)	η_D (%)
2.60	47.8	13.8	77.0
2.65	47.5	13.7	77.0
2.70	47.2	13.3	76.0

Pin Configuration[1]

Pin #	Pin Name	Function
1,2	G1	RF Input / Gate 1
13,14	D1	RF Output / Drain 1
6,7	G2	RF Input / Gate 2
8,9	D2	RF Output / Drain 2
3,4,5,10,11, 12,15	NC	Ground / Source

1. The exposed pad centered on the package bottom must be connected to RF and DC ground.

Ordering Information

Part Number	Package
MAPC-A3025-AD000	Bulk Quantity
MAPC-A3025-SBPPR	Sample Board
MAPC-A3025-ADTR1	Tape and Reel

* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

RF Electrical Characteristics: T_C = 25°C, V_{DS} = 28 V, I_{DQ} = 400 mA
Note: Performance in MACOM Evaluation Test Fixture, 50 Ω system

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Power Gain	Pulsed[2], 2.6 GHz, P_{IN} = 34 dBm	G_{SAT}	—	13.8	—	dB
Saturated Drain Efficiency	Pulsed[2], 2.6 GHz, P_{IN} = 34 dBm	η_{SAT}	—	77.0	—	%
Saturated Output Power	Pulsed[2], 2.6 GHz, P_{IN} = 34 dBm	P_{SAT}	—	47.8	—	dBm
Ruggedness: Output Mismatch	All phase angles	Ψ	VSWR = 10:1; No Damage			

RF Electrical Specifications: T_A = 25°C, V_{DS} = 28 V, I_{DQ} = 400 mA
Note: Performance in MACOM Production Test Fixture, 50 Ω system

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Power Gain	Pulsed[2], 2.6 GHz, P_{IN} = 34 dBm	G_{SAT}	13.4	13.7	—	dB
Saturated Drain Efficiency	Pulsed[2], 2.6 GHz, P_{IN} = 34 dBm	η_{SAT}	65	74	—	%
Saturated Output Power	Pulsed[2], 2.6 GHz, P_{IN} = 34 dBm	P_{SAT}	47.4	47.7	—	dBm

2. Pulse details: 100 μs pulse width, 10% Duty Cycle.

DC Electrical Characteristics T_A = 25°C

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Drain-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 10 V	I_{DLK}	-	-	2	mA
Gate-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 10 V	I_{GLK}	-2	-	-	mA
Gate Threshold Voltage	V_{DS} = 28 V, I_D = 14.4 mA	V_T	-3.6	-3.1	-2.4	V
Gate Quiescent Voltage	V_{DS} = 28 V, I_D = 300 mA	V_{GSQ}	-	-2.4	-	V

Absolute Maximum Ratings [3,4,5,6]

Parameter	Absolute Maximum
Drain Source Voltage, V_{DS}	28 V
Gate Source Voltage, V_{GS}	-10 to 2 V
Gate Current, I_G	14 mA
Storage Temperature Range	-65°C to +150°C
Case Operating Temperature Range	-40°C to +85°C
Channel Operating Temperature Range, T_{CH}	-40°C to +225°C

3. Exceeding any one or combination of these limits may cause permanent damage to this device.
4. MACOM does not recommend sustained operation above maximum operating conditions.
5. Operating at drain source voltage V_{DS} < 28 V will ensure MTTF > 2 x 10^6 hours.
6. Operating at nominal conditions with T_{CH} ≤ 225°C will ensure MTTF > 2 x 10^6 hours.

Thermal Characteristics

Parameter	Test Conditions	Symbol	Typical	Units
Thermal Resistance using Finite Element Analysis	V_{DS} = 28 V, P_{DISS} = 43.2 W T_C = 85°C, T_{CH} = 225°C	R_θ(FEA)	1.83	°C/W
Thermal Resistance using Finite Element Analysis (per side)	V_{DS} = 28 V, P_{DISS} = 21.6 W T_C = 85°C, T_{CH} = 225°C	R_θ(FEA)	3.65	°C/W

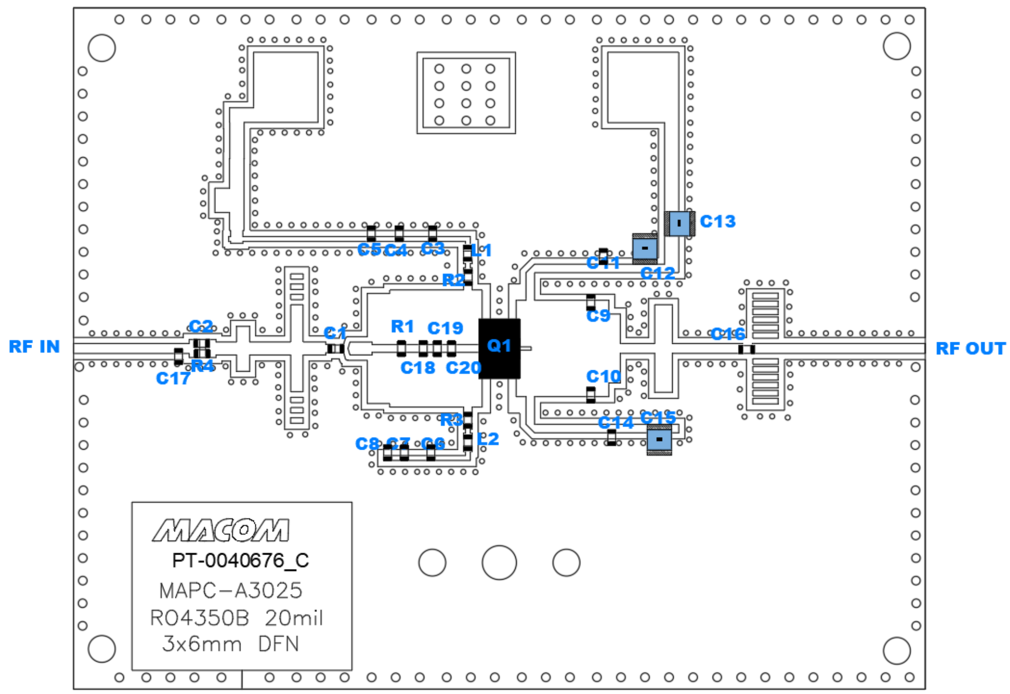
Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

Gallium Nitride Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these HBM Class 1C and CDM Class C3 devices.

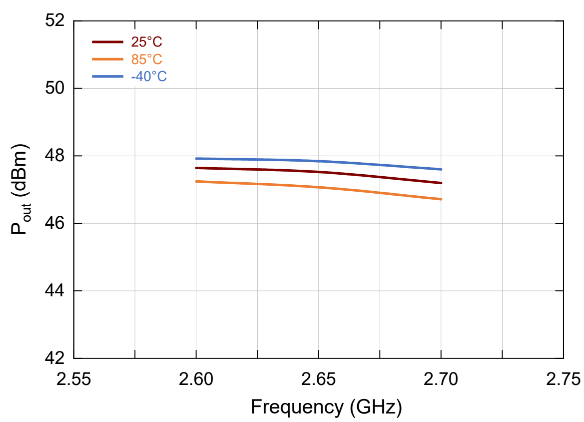
Evaluation Board and Recommended Tuning Solution 2.6 - 2.7GHz



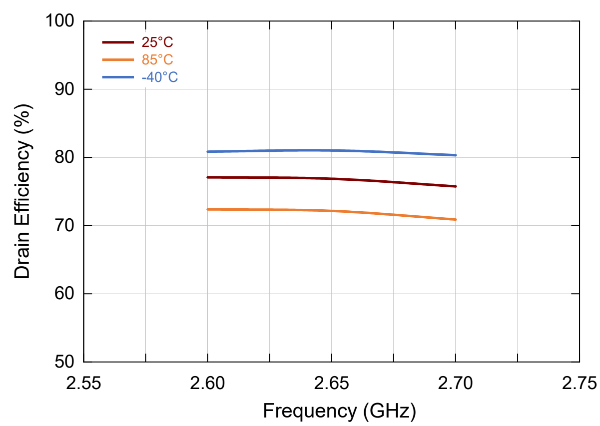
Reference Designator	Value	Tolerance	Manufacturer	Part Number
C1	27 pF	±5%	Johanson	QSCT251Q270J1GV001E
R1	100 Ω	±5%	Vishay	CRCW12100000Z0EAHP
R2,R3	10 Ω	±1%	Yageo	RC0603FR-0710KL
C2	2.4 pF	±0.1pF	Johanson	QSCT251Q2R4B1GV001E
R4	150 Ω	±5%	Yageo	RC0603JR-13150RL
L1, L2	22 nH	±5%	Coilcraft	0201HL-22NXJRW
C3, C6	27 pF	±5%	Johanson	QSCT251Q270J1GV001E
C7, C4, C12, C15	1000 pF	±10%	Murata	GRM21AR72E102KW01D
C5, C8, C13, C16	2.2 µF	±20%	Murata	GRM21BD72A225ME01K
C9, C10	0.6 pF	±0.05pF	Johanson	QSCT251Q0R6A1GV001E
C11, C14	20 pF	±5%	Johanson	QSCT251Q200J1GV001E
C17	15 pF	±5%	Johanson	QSCT251Q150J1GV001E
C18, C19, C20	1 pF	±0.1pF	Johanson	QSCT251Q1R0B1GV001E

Typical Performance Curves as Measured in the 2.6 - 2.7 GHz Evaluation Board: Pulsed[2], V_{DS} = 28 V, I_{DQ} = 400 mA, Pin = 34dBm, T_C = 25°C (Unless Otherwise Noted)

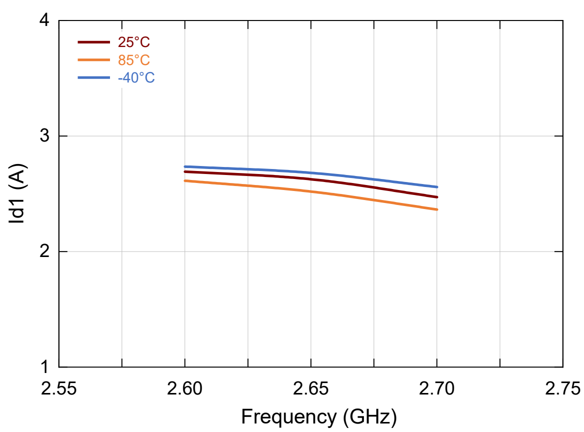
Output Power vs. Temperature and Frequency



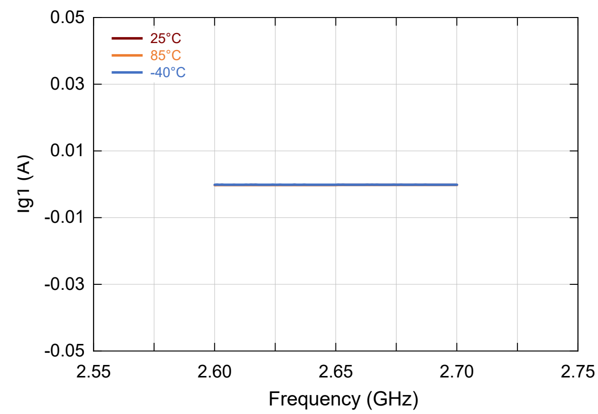
Drain Efficiency vs. Temperature and Frequency



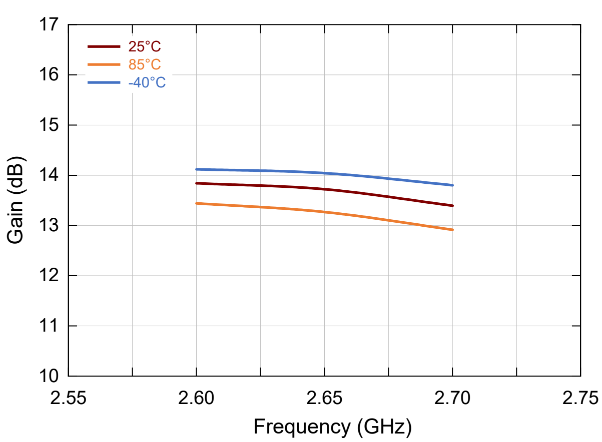
Drain Current vs. Temperature and Frequency



Gate Current vs. Temperature and Frequency

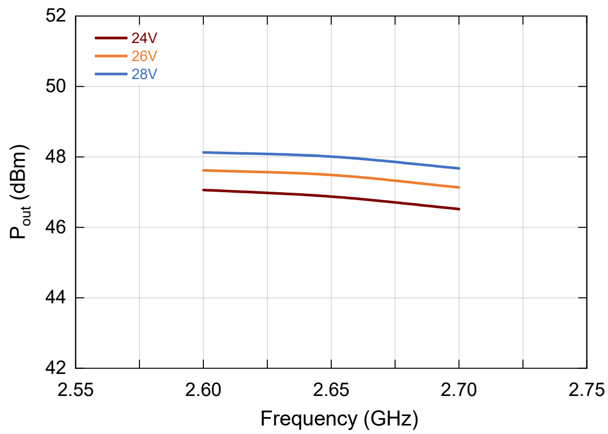


Large Signal Gain vs. Temperature and Frequency

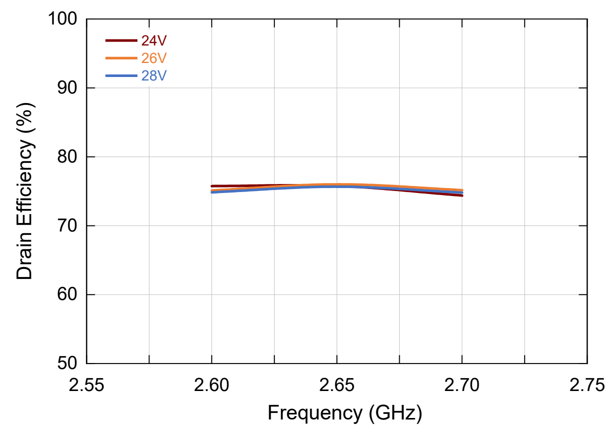


Typical Performance Curves as Measured in the 2.6 - 2.7 GHz Evaluation Board: Pulsed[2] , V_{DS} = 28 V, I_{DQ} = 400 mA, Pin = 3dBm, T_C = 25°C (Unless Otherwise Noted)

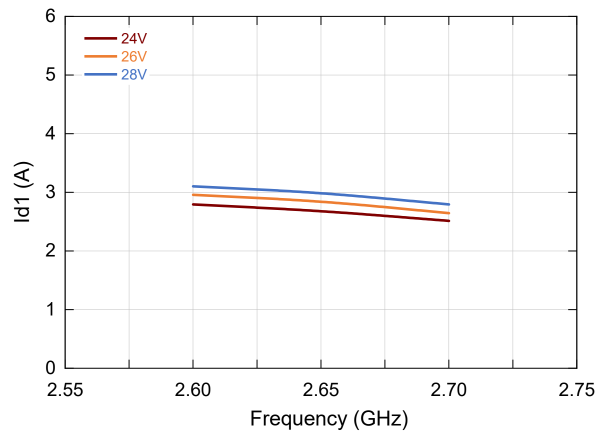
Output Power vs. V_{DS} and Frequency



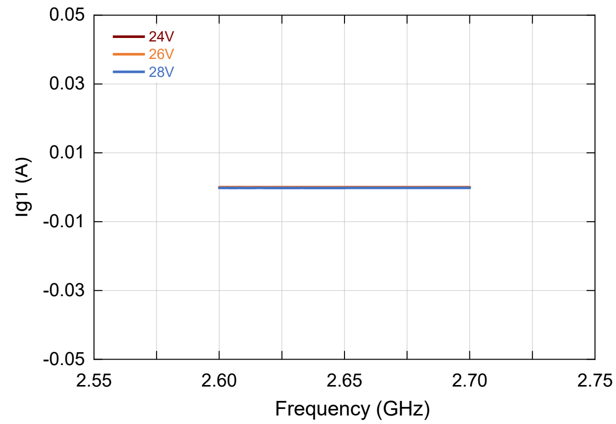
Drain Efficiency vs. V_{DS} and Frequency



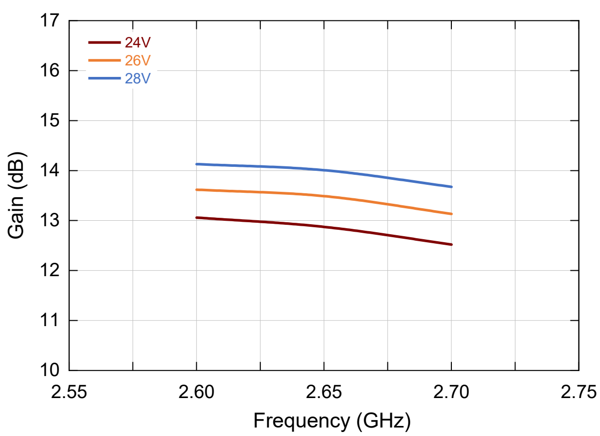
Drain Current vs. V_{DS} and Frequency



Gate Current vs. V_{DS} and Frequency

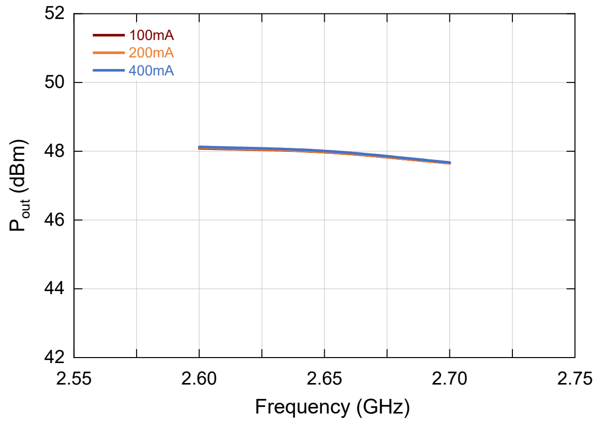


Large Signal Gain vs. V_{DS} and Frequency

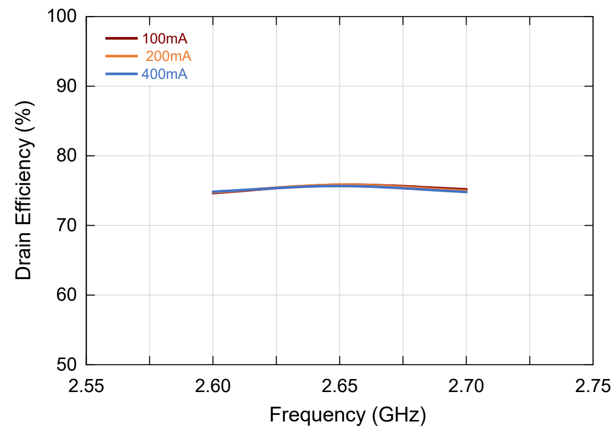


Typical Performance Curves as Measured in the 2.6 - 2.7 GHz Evaluation Board: Pulsed[2] , V_{DS} = 28 V, I_{DQ} = 400 mA, Pin = 34dBm, T_C = 25°C (Unless Otherwise Noted)

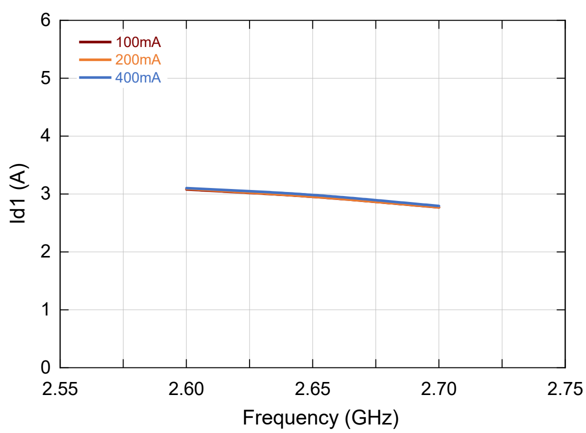
Output Power vs. I_{DQ} and Frequency



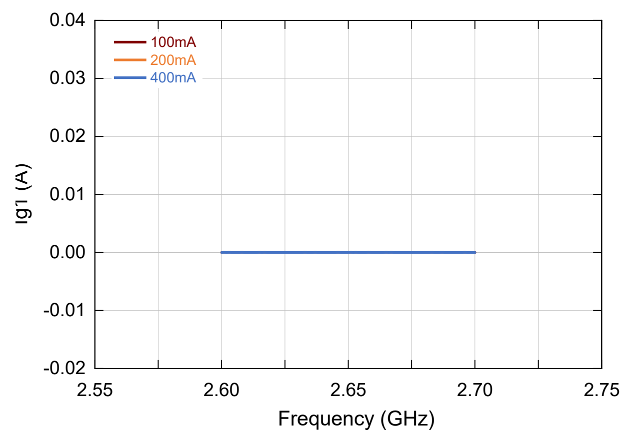
Drain Efficiency vs. I_{DQ} and Frequency



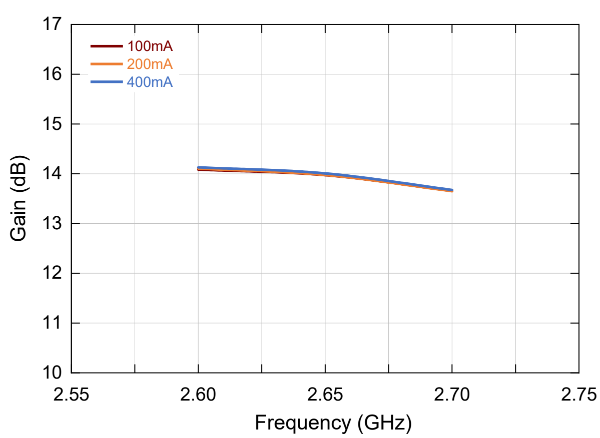
Drain Current vs. I_{DQ} and Frequency



Gate Current vs. I_{DQ} and Frequency

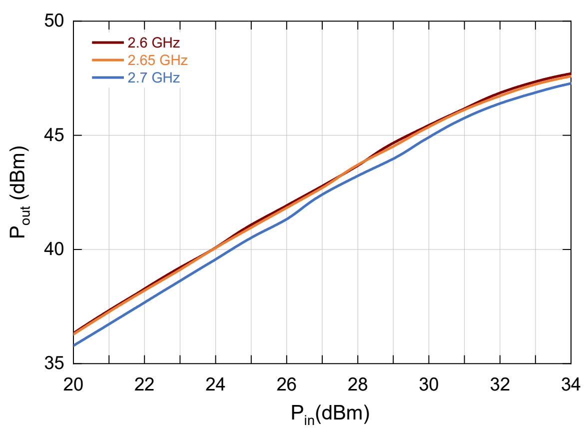


Large Signal Gain vs. I_{DQ} and Frequency

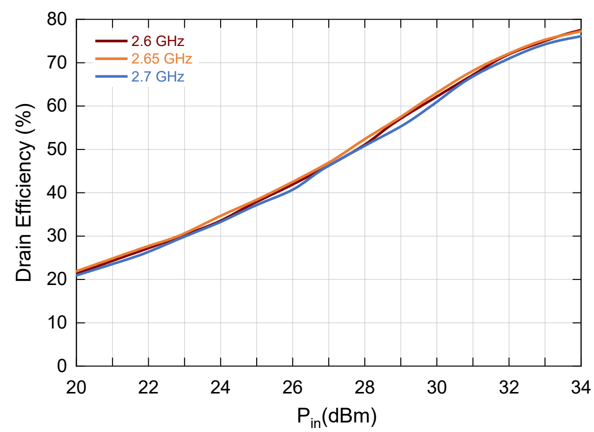


Typical Performance Curves as Measured in the 2.6 - 2.7 GHz Evaluation Board: Pulsed[2], V_{DS} = 28 V, I_{DQ} = 400 mA, T_C = 25°C (Unless Otherwise Noted)

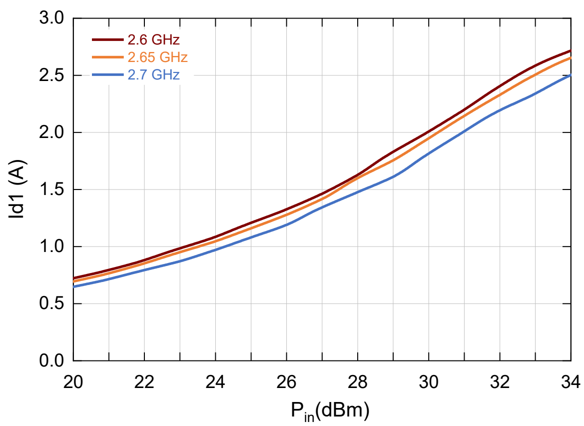
Output Power vs. Frequency and P_{IN}



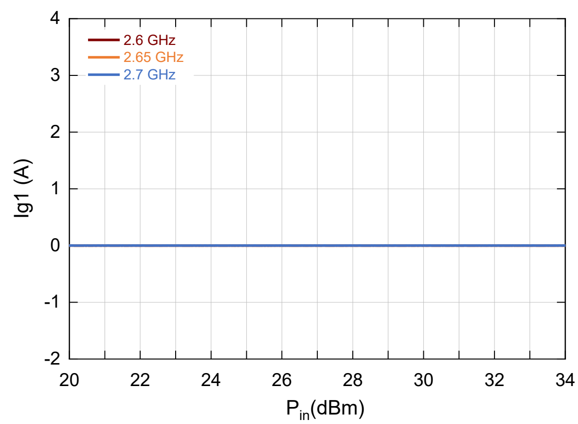
Drain Efficiency vs. Frequency and P_{IN}



Drain Current vs. Frequency and P_{IN}



Gate Current vs. Frequency and P_{IN}



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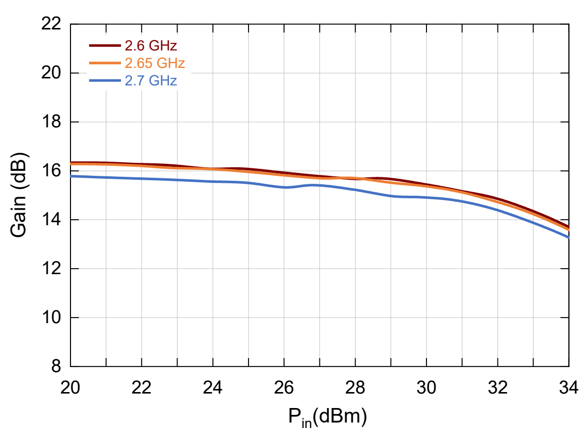
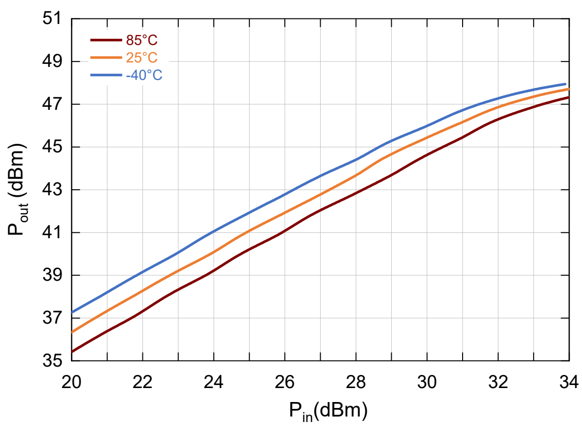
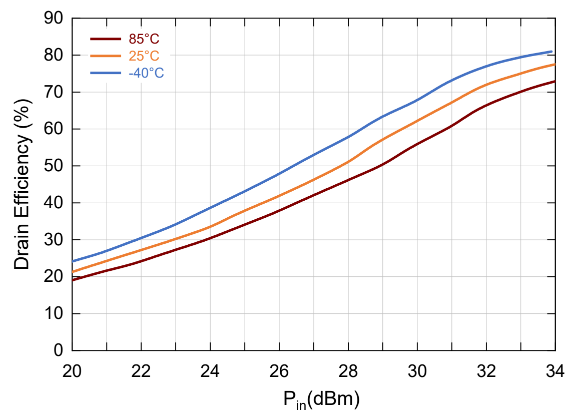


Typical Performance Curves as Measured in the 2.6 - 2.7 GHz Evaluation Board: Pulsed[2], V_{DS} = 28 V, I_{DQ} = 400 mA, Frequency = 2.6GHz (Unless Otherwise Noted)

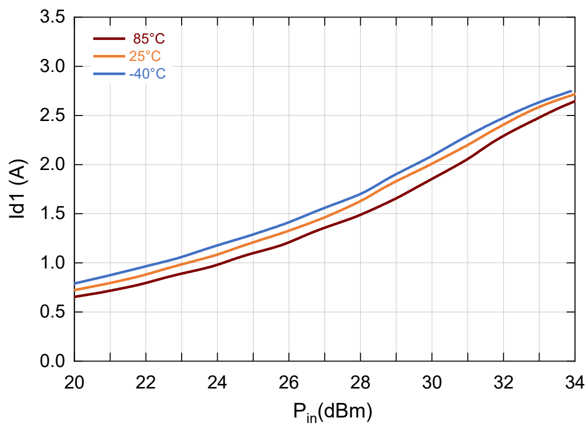
Output Power vs. Temperature and P_{IN}



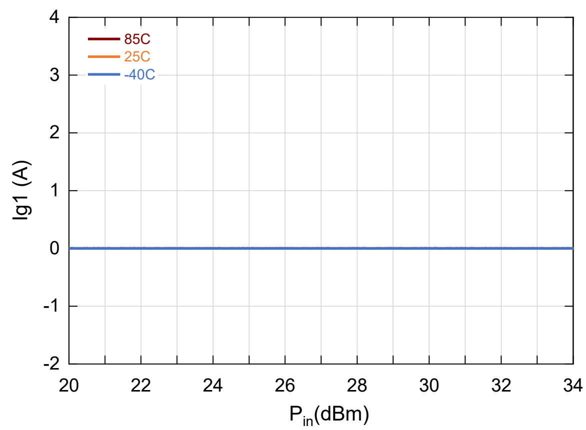
Drain Efficiency vs. Temperature and P_{IN}



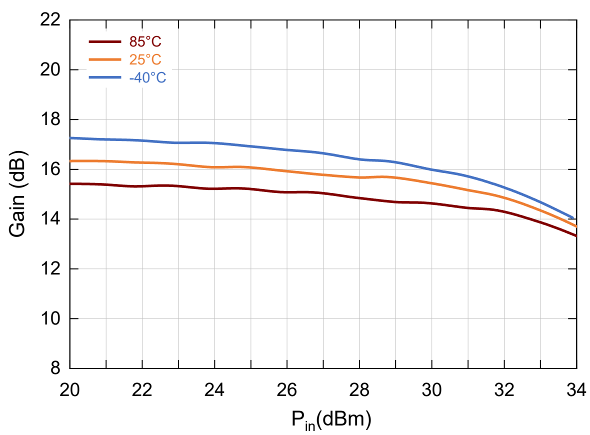
Drain Current vs. Temperature and P_{IN}



Gate Current vs. Temperature and P_{IN}

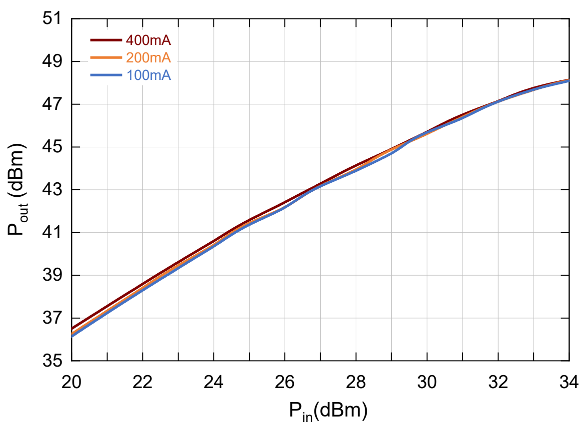


Large Signal Gain vs. Temperature and P_{IN}

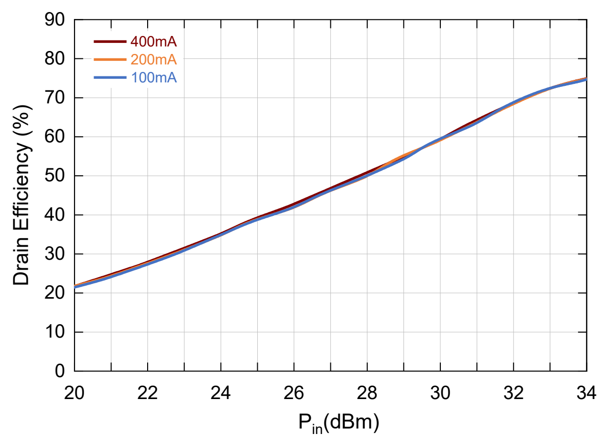


Typical Performance Curves as Measured in the 2.6 - 2.7 GHz Evaluation Board: Pulsed[2] , V_{DS} = 28 V, I_{DQ} = 400 mA, Frequency = 2.6GHz (Unless Otherwise Noted)

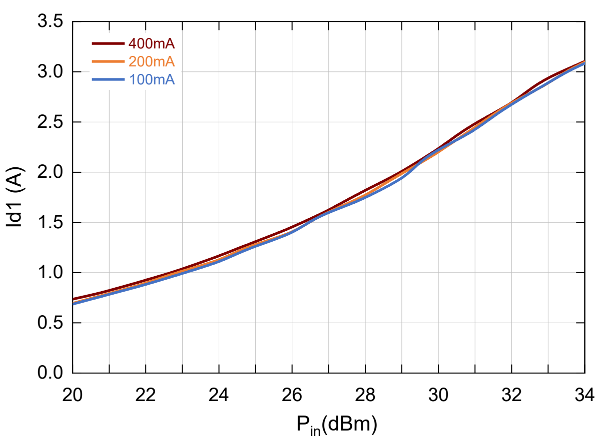
Output Power vs. I_{DQ} and P_{IN}



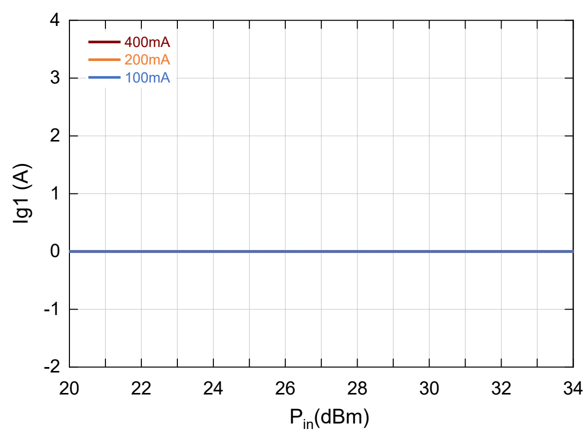
Drain Efficiency vs. I_{DQ} and P_{IN}



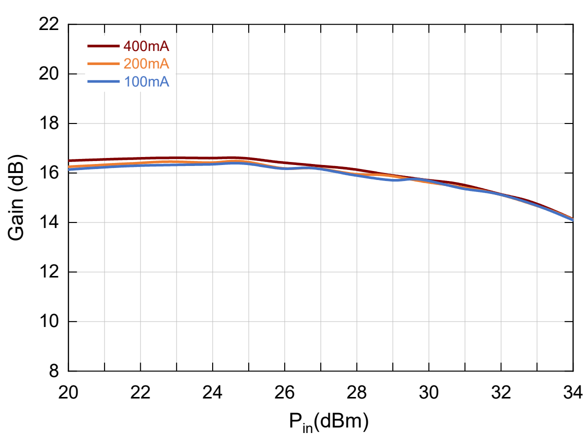
Drain Current vs. I_{DQ} and P_{IN}



Gate Current vs. I_{DQ} and P_{IN}

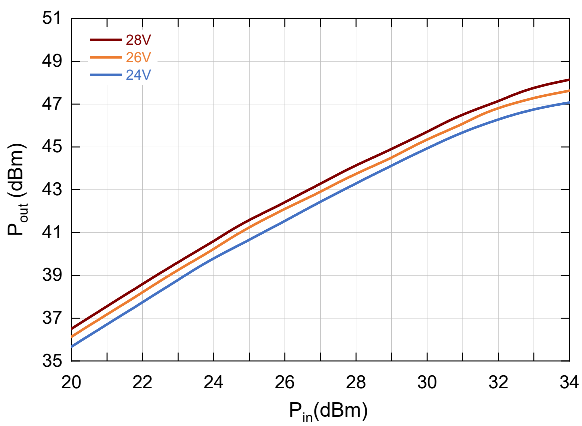


Large Signal Gain vs. I_{DQ} and P_{IN}

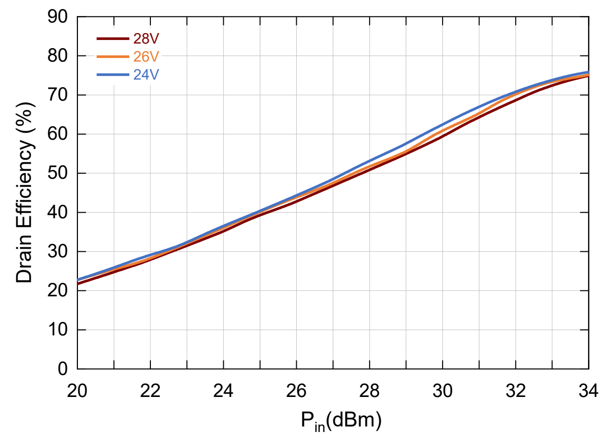


Typical Performance Curves as Measured in the 2.6 - 2.7 GHz Evaluation Board: Pulsed[2], V_{DS} = 28 V, I_{DQ} = 400 mA, Frequency = 2.6GHz (Unless Otherwise Noted)

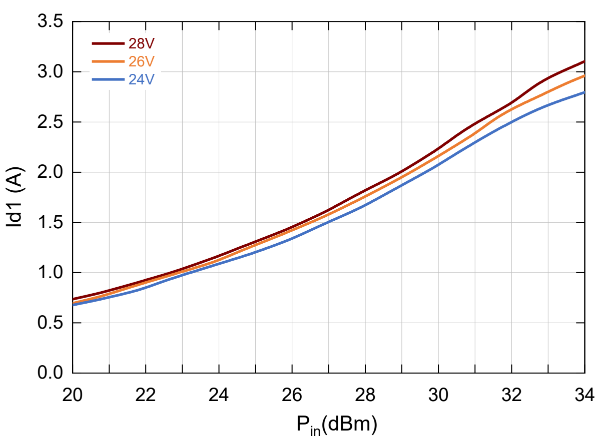
Output Power vs. V_{DS} and P_{IN}



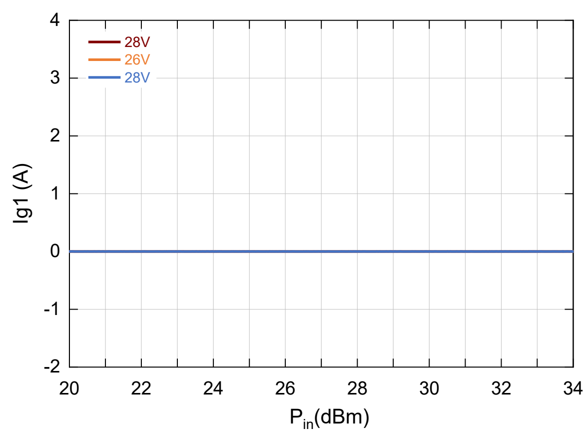
Drain Efficiency vs. V_{DS} and P_{IN}



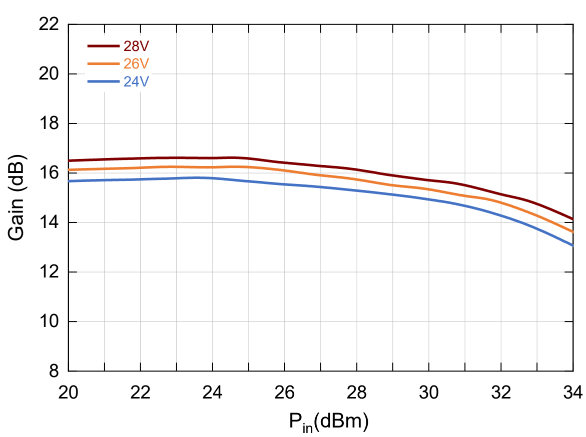
Drain Current vs. V_{DS} and P_{IN}



Gate Current vs. V_{DS} and P_{IN}

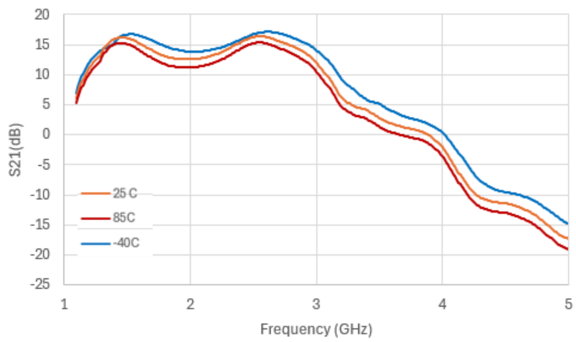


Large Signal Gain vs. V_{DS} and P_{IN}

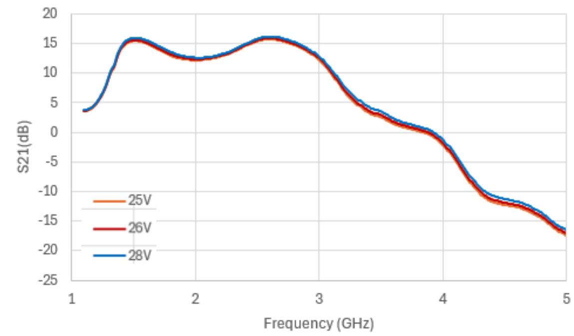


Typical Performance Curves as Measured in the 2.6 - 2.7 GHz Evaluation Board: Pulsed[2], V_{DS} = 28 V, I_{DQ} = 400 mA, T_C= 25°C (Unless Otherwise Noted)

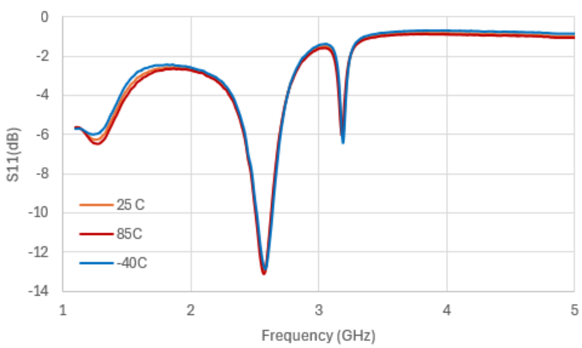
S_{21} over Temperature vs. Frequency @ 28V



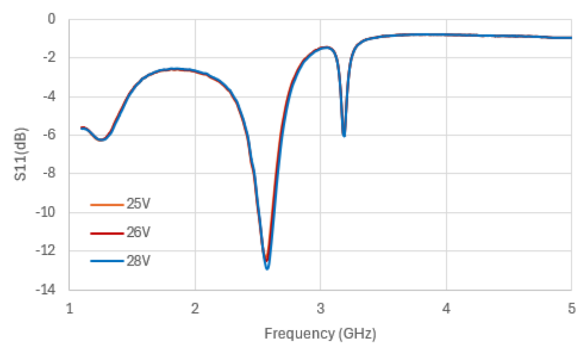
S_{21} over Voltage vs. Frequency @ 25C



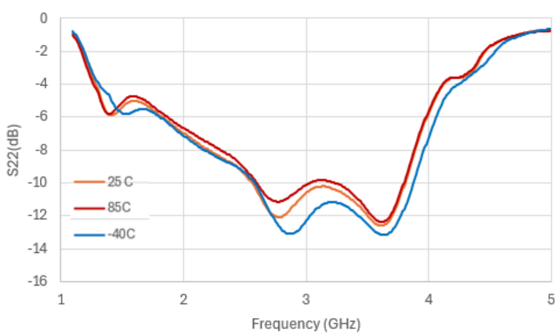
S_{11} over Temperature vs. Frequency @ 28V



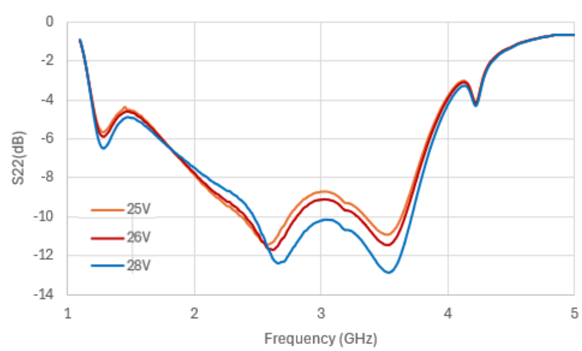
S_{11} over Voltage vs. Frequency @ 25C



S_{22} over Temperature vs. Frequency @ 28V

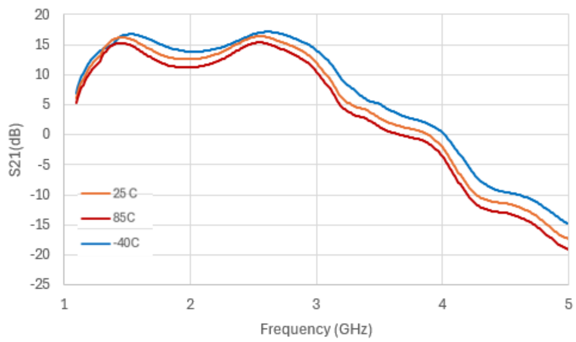


S_{22} over Voltage vs. Frequency @ 25C

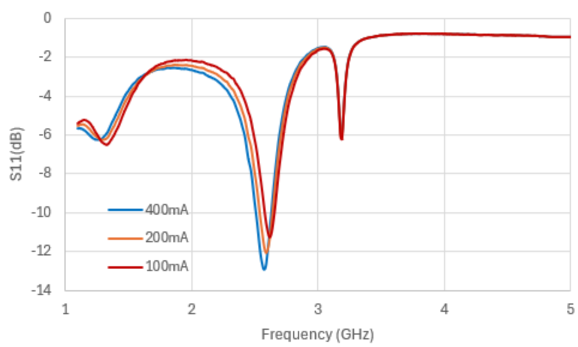


Typical Performance Curves as Measured in the 2.6 - 2.7 GHz Evaluation Board: Pulsed[2], V_{DS} = 28 V, I_{DQ} = 400 mA, T_C= 25°C (Unless Otherwise Noted)

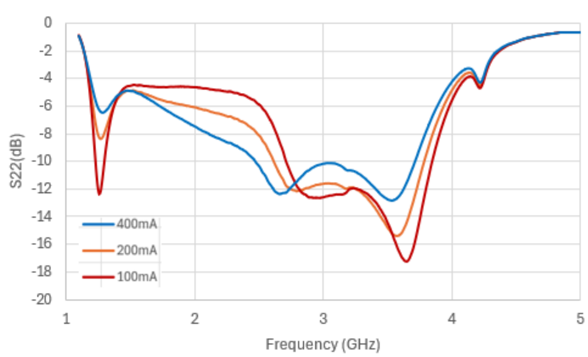
S_{21} over Quiescent Drain Current vs. Frequency



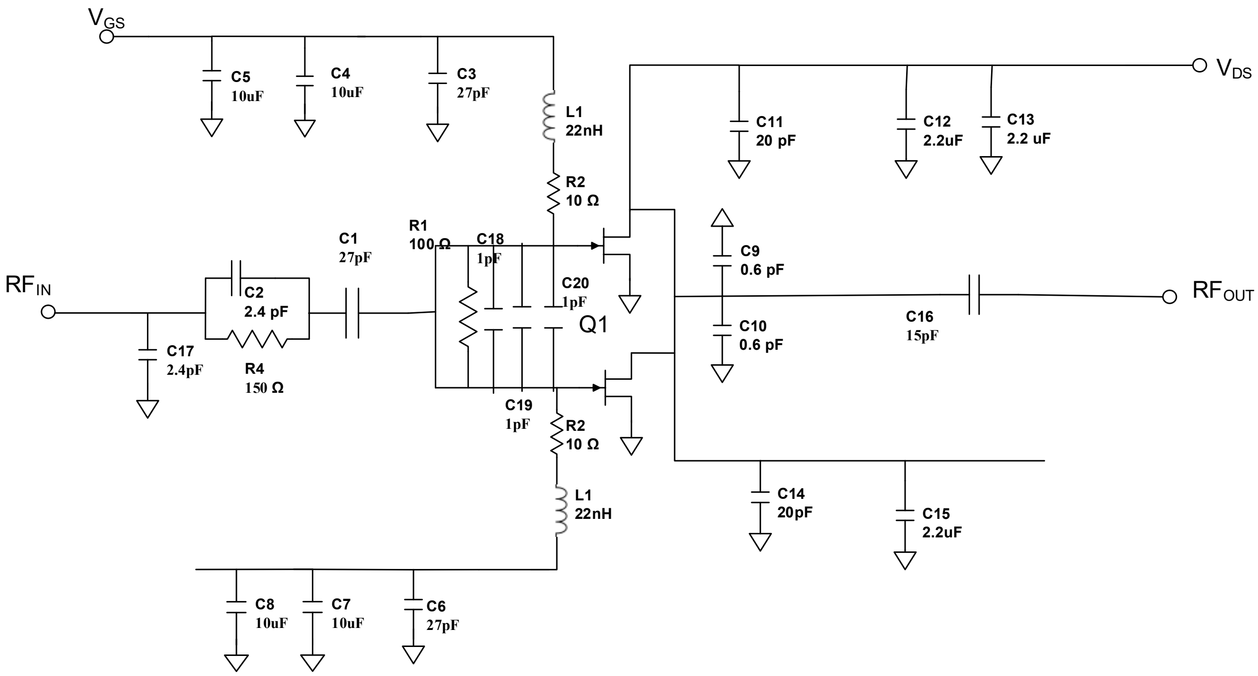
S_{11} over Quiescent Drain Current vs. Frequency



S_{22} over Quiescent Drain Current vs. Frequency



Evaluation Test Fixture and Recommended Tuning Solution 2.6 - 2.7 GHz



Description

Parts measured on evaluation board (20 mil thick RO4350B). Matching is provided using a combination of lumped elements and transmission lines as shown in the simplified schematic above. Recommended tuning solution component placement, transmission lines, and details are shown on the next page.

Bias Sequencing

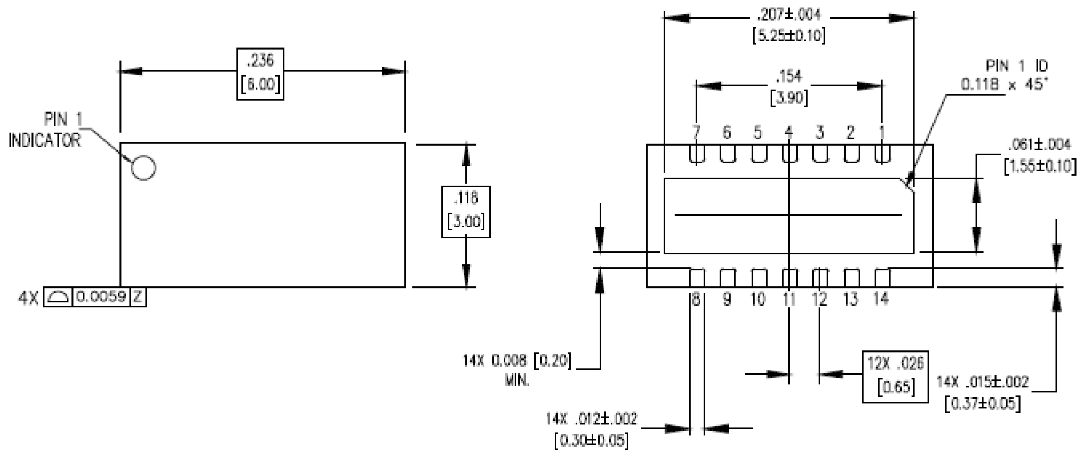
Turning the device ON

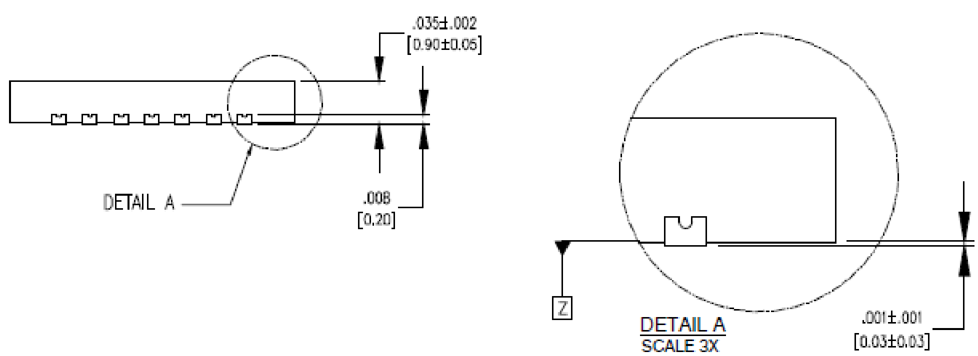
1. Set V_{GS} to pinch-off (V_P).
2. Turn on V_{DS} to nominal voltage (50 V).
3. Increase V_{GS} until I_{DS} current is reached.
4. Apply RF power to desired level.

Turning the device OFF

1. Turn the RF power OFF.
2. Decrease V_{GS} down to V_P pinch-off.
3. Decrease V_{DS} down to 0 V.
4. Turn off V_{GS}.

Lead-Free 3 x 6 mm 14-Lead DFN†





NOTES:
1. ALL DIMENSIONS SHOWN AS in[mm]. CONTROLLING DIMENSIONS ARE IN in. CONVERTED mm DIMENSIONS ARE NOT NECESSARILY EXACT.
2. EXPOSED LEADS: NiPdAu.

† Reference Application Note S2083 for lead-free solder reflow recommendations. Meets JEDEC moisture sensitivity level 1 requirements . Plating is Ni/Pd/Au.