Document Number: MRFG35020A
Rev. 1, 12/2008

RoHS

Gallium Arsenide PHEMT

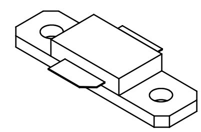
RF Power Field Effect Transistor

MRFG35020AR1

Designed for WiMAX and WLL base station applications that have a 200 MHz BW requirement in the 2300-3800 MHz frequency range. Suitable for TDMA and CDMA amplifier applications. To be used in Class AB applications.

- Typical WiMAX Performance: V_{DD} = 12 Volts, I_{DQ} = 300 mA, P_{out} = 2 Watts Avg., f = 3500 MHz, 802.16d, 64 QAM $^3/_4$, 4 bursts, 7 MHz Channel Bandwidth, Input Signal PAR = 9.5 dB @ 0.01% Probability on CCDF.
  - Power Gain — 11.5 dB
  - Drain Efficiency — 22%
  - RCE — -33 dB
  - Meets ETSI Type G Mask
- 20 Watts P1dB @ 3500 MHz, CW

**3.5 GHz, 20 W, 12 V
WiMAX
POWER FET
GaAs PHEMT**



**CASE 360E-01, STYLE 2
NI-360 SHORT LEAD**

Features

- Supports up to 28 MHz Bandwidth OFDM Signals
- Internally Input Matched for Ease of Use
- High Gain, High Efficiency and High Linearity
- Excellent Thermal Stability
- RoHS Compliant
- In Tape and Reel. R1 Suffix = 500 Units per 32 mm, 13 inch Reel.

Table 1. Maximum Ratings

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	15	Vdc
Gate-Source Voltage	V_{GS}	-5	Vdc
RF Input Power	P_{in}	34	dBm
Storage Temperature Range	T_{stg}	-40 to +150	°C
Channel Temperature (1)	T_{ch}	175	°C

Table 2. Thermal Characteristics

Characteristic	Symbol	Value (2)	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	2.7	°C/W

1. For reliable operation, the operating channel temperature should not exceed 150°C. Exceeding 150°C channel operating temperature may result in device performance degradation.
2. Refer to AN1955, *Thermal Measurement Methodology of RF Power Amplifiers.* Go to http://www.freescale.com/rf. Select Documentation/Application Notes - AN1955.

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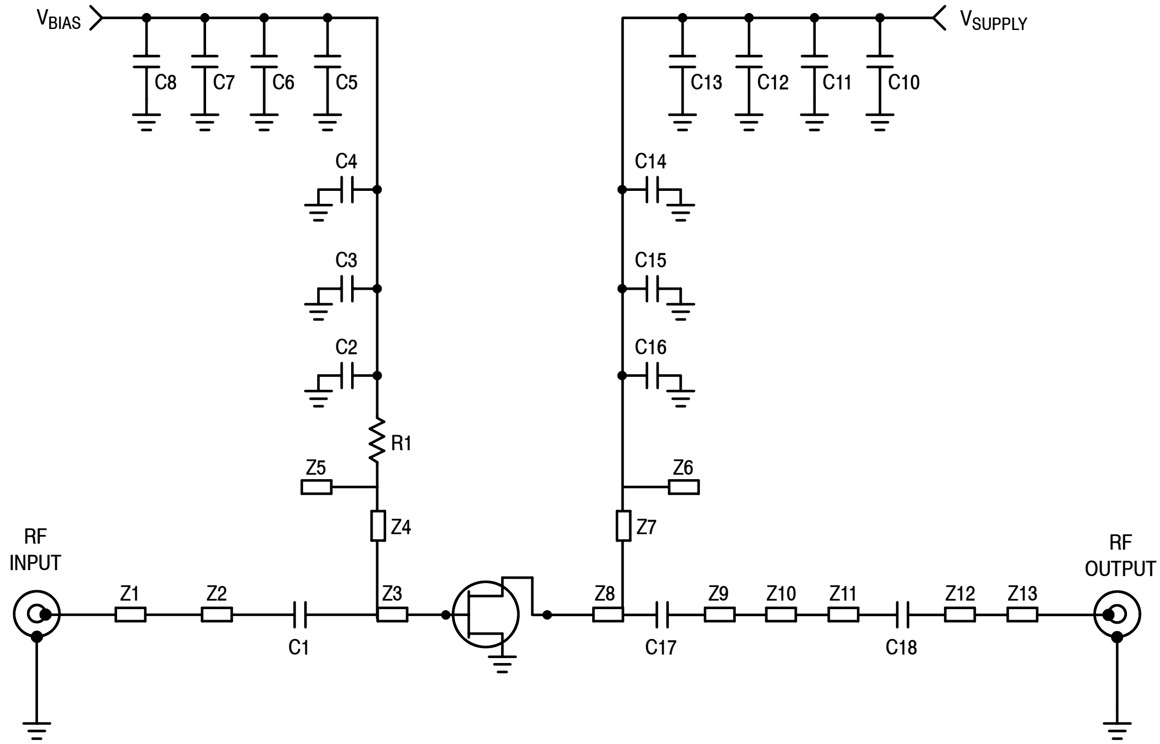
Table 3. ESD Protection Characteristics

Test Methodology	Class
Human Body Model (per JESD22-A114)	2 (Minimum)
Machine Model (per EIA/JESD22-A115)	A (Minimum)
Charge Device Model (per JESD22-C101)	IV (Minimum)

Table 4. Electrical Characteristics (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
DC Characteristics					
Off State Drain Current (V_{DS} = 3.5 Vdc, V_{GS} = -2.2 Vdc)	I_{DSO}	—	10	425	μAdc
Off State Current (V_{DS} = 28.5 Vdc, V_{GS} = -2.5 Vdc)	I_{DSX}	—	2	42.5	mAdc
Gate-Source Cut-off Voltage (V_{DS} = 3.5 Vdc, I_{DS} = 42.5 mA)	$V_{GS(th)}$	-1.2	-0.95	-0.7	Vdc
Functional Tests (In Freescale Test Fixture, 50 ohm system) (1) V_{DD} = 12 Vdc, I_{DQ} = 300 mA, P_{out} = 2 W Avg., f = 3500 MHz, Single-Carrier W-CDMA, 3.84 MHz Channel Bandwidth Carrier. ACPR measured in 3.84 MHz Channel Bandwidth @ ±5 MHz Offset. PAR = 8.5 dB @ 0.01% Probability on CCDF.					
Power Gain	G_{ps}	9.5	11.5	—	dB
Drain Efficiency	η_D	18	22	—	%
Adjacent Channel Power Ratio	ACPR	—	-43	-39	dBc
Typical RF Performance (In Freescale Test Fixture, 50 ohm system) V_{DD} = 12 Vdc, I_{DQ} = 300 mA, f = 3500 MHz					
Output Power, 1 dB Compression Point, CW	P1dB	—	20	—	W

1. Measurements made with device in test fixture.



Z1	0.021″ x 0.728″ Microstrip	Z8	0.375″ x 0.172″ Microstrip
Z2	0.045″ x 0.522″ Microstrip	Z9	0.074″ x 0.068″ Microstrip
Z3	0.200″ x 0.215″ Microstrip	Z10	0.030″ x 0.347″ Microstrip
Z4	0.150″ x 0.522″ Microstrip	Z11, Z12	0.040″ x 0.050″ Microstrip
Z5, Z6	0.279″ x 90° Microstrip Radial Stub	Z13	0.021″ x 0.713″ Microstrip
Z7	0.060″ x 0.420″ Microstrip	PCB	Rogers 4350, 0.010″, ε_r = 3.5

Figure 1. MRFG35020A Test Circuit Schematic

Table 5. MRFG35020A Test Circuit Component Designations and Values

Part	Description	Part Number	Manufacturer
C1	3.9 pF Chip Capacitor	08051J3R9BBS	AVX
C2, C16	10 pF Chip Capacitors	ATC100A100JT150XT	ATC
C3, C15	100 pF Chip Capacitors	ATC100A101JT150XT	ATC
C4, C14	100 pF Chip Capacitors	ATC100B101JT500XT	ATC
C5, C13	1000 pF Chip Capacitors	ATC100B102JT50XT	ATC
C6, C12	0.01 μF Chip Capacitors	ATC200B103KT50XT	ATC
C7, C11	39K pF Chip Capacitors	ATC200B393KT50XT	ATC
C8, C10	10 μF Chip Capacitors	GRM55DR61H106KA88B	Murata
C9	None		
C17	1.8 pF Chip Capacitors	08051J1R8BBS	AVX
C18	1.5 pF Chip Capacitor	08051J1R5BBS	AVX
R1	6.2 Ω, 1/4 W Chip Resistor	CRCW12066R20FKEA	Vishay

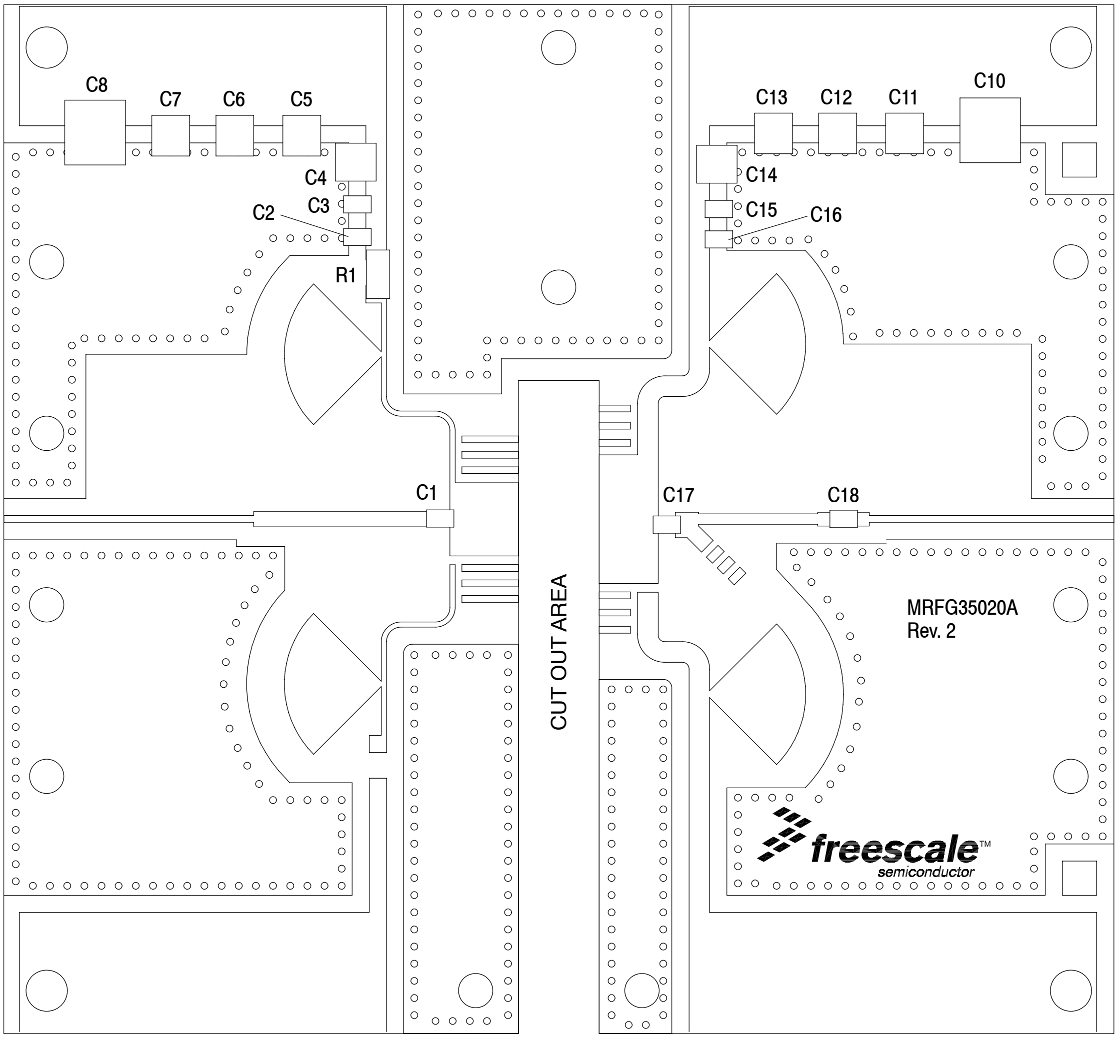


Figure 2. MRFG35020A Test Circuit Component Layout

TYPICAL CHARACTERISTICS

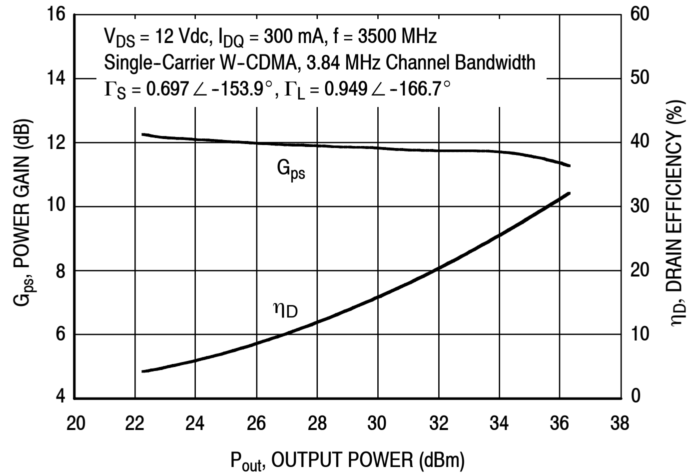


Figure 3. Single-Channel W-CDMA Power Gain and Drain Efficiency versus Output Power

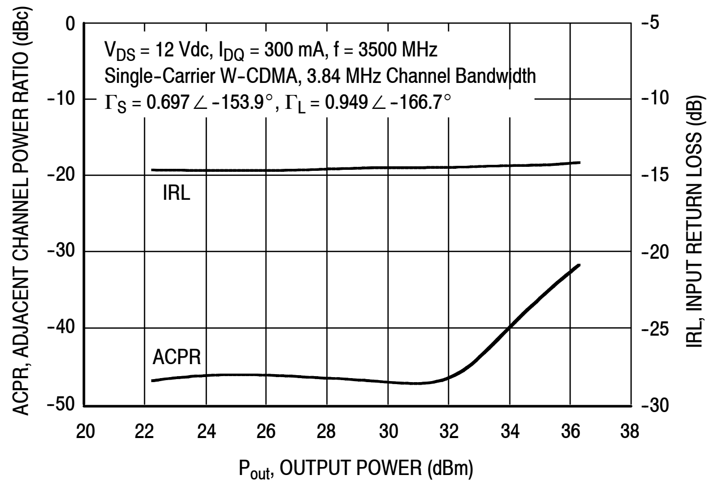


Figure 4. Single-Channel W-CDMA Adjacent Channel Power Ratio and IRL versus Output Power

NOTE: All data is referenced to package lead interface. Γ_S and Γ_L are the impedances presented to the DUT. All data is generated from load pull, not from the test circuit shown.

TYPICAL CHARACTERISTICS

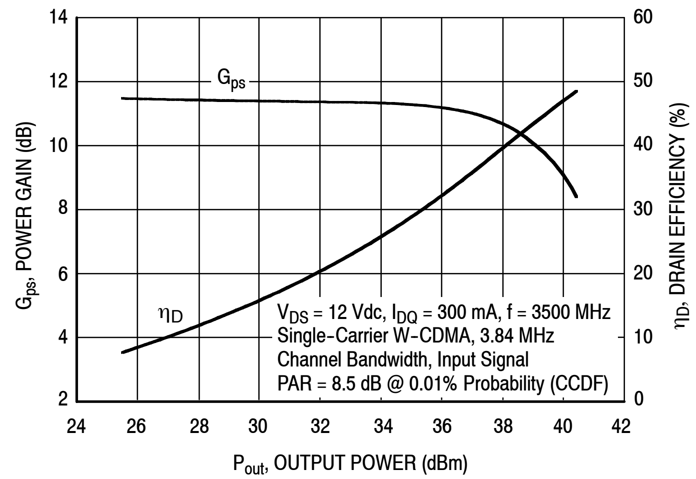


Figure 5. Single-Channel W-CDMA Power Gain and Drain Efficiency versus Output Power

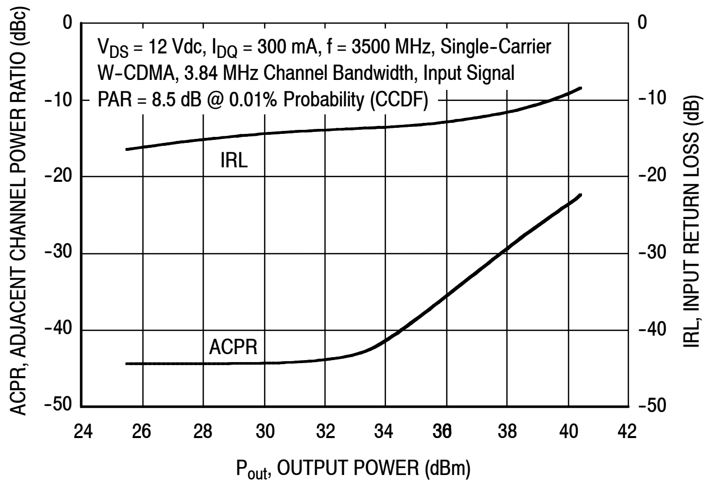


Figure 6. Single-Channel W-CDMA Adjacent Channel Power Ratio and IRL versus Output Power

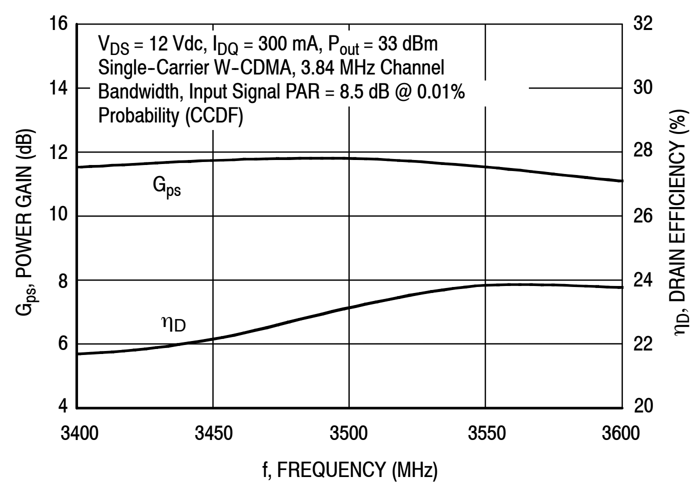


Figure 7. Single-Channel W-CDMA Power Gain and Drain Efficiency versus Frequency

NOTE: Data is generated from the test circuit shown.

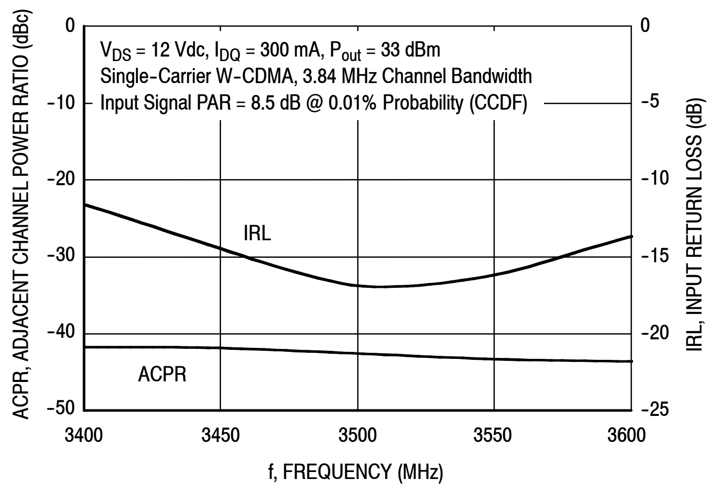


Figure 8. Single-Channel W-CDMA Adjacent Channel Power Ratio and IRL versus Frequency

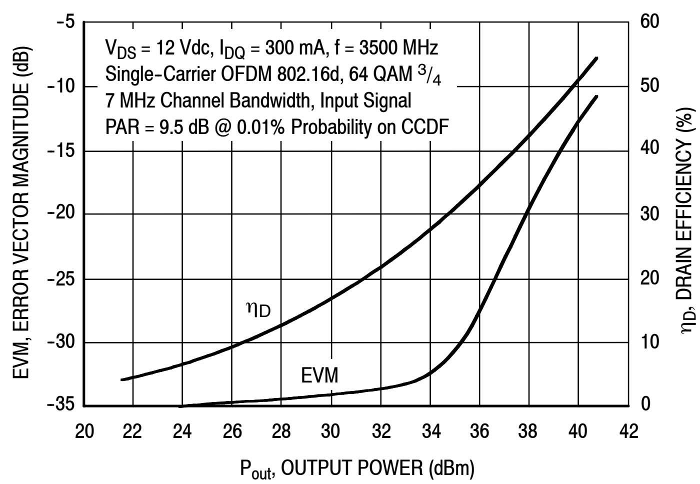
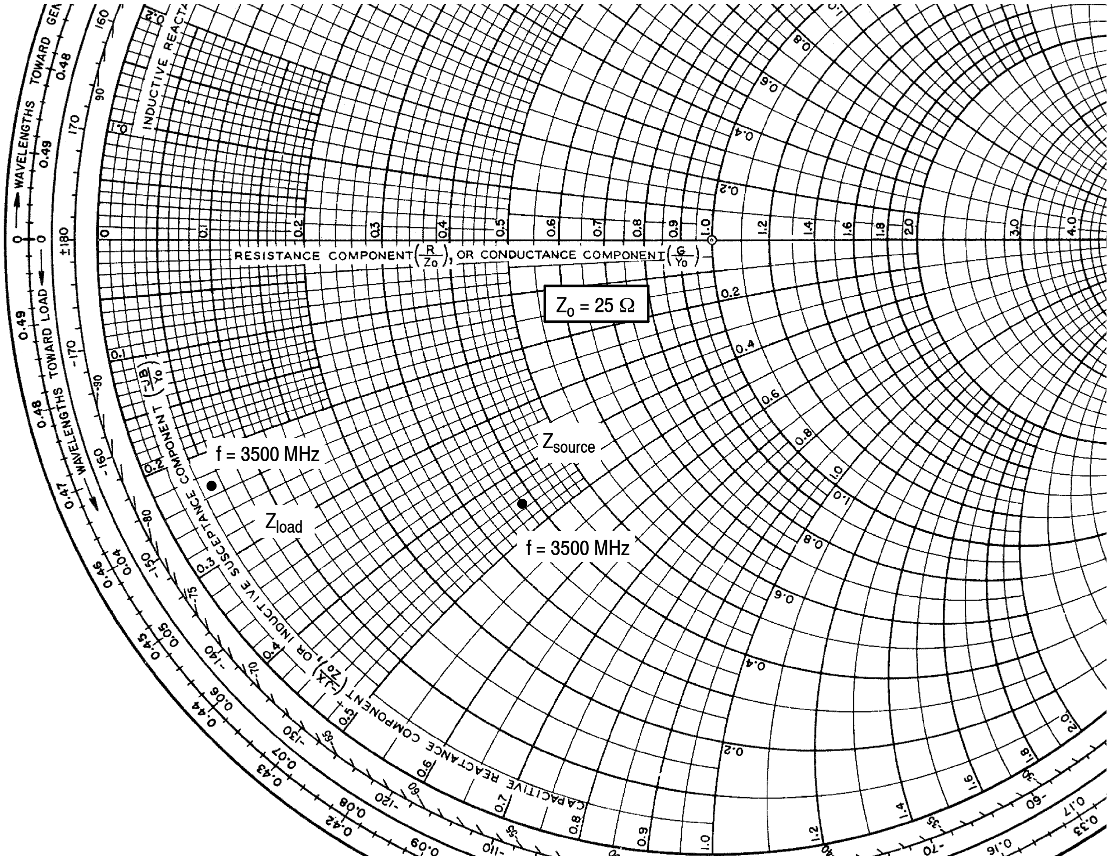


Figure 9. Single-Channel OFDM Error Vector Magnitude and Drain Efficiency versus Output Power

NOTE: Data is generated from the test circuit shown.



V_{DD} = 12 Vdc, I_{DQ} = 300 mA, P_{out} = 2 W Avg.

f MHz	Z_{source} Ω	Z_{load} Ω
3500	9.4 – j11.2	1.3 – j5.8

Z_{source} = Test circuit impedance as measured from gate to ground.

Z_{load} = Test circuit impedance as measured from drain to ground.

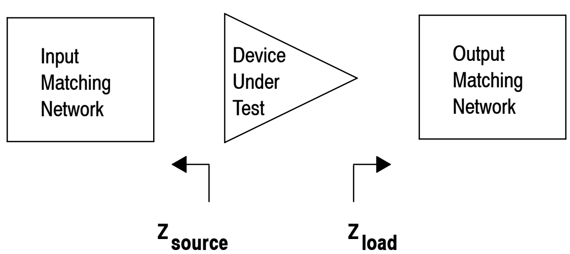
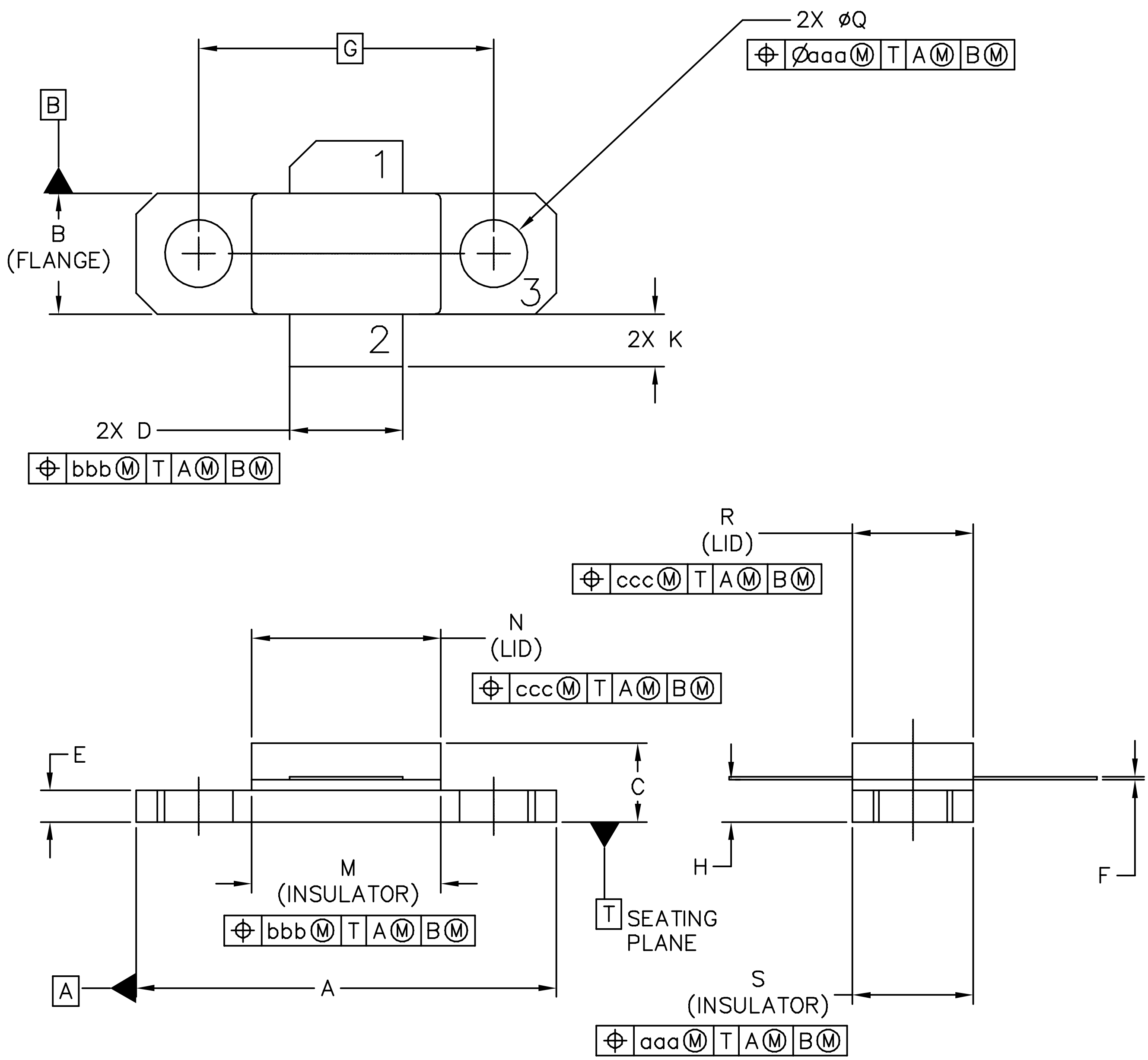


Figure 10. Series Equivalent Source and Load Impedance

PACKAGE DIMENSIONS



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TITLE: NI–360 SHORT LEAD	DOCUMENT NO: 98ASA10715D		REV: A
	CASE NUMBER: 360E–01		03 APR 2006
	STANDARD: NON–JEDEC		

NOTES:

1. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M−1994.

2. CONTROLLING DIMENSION: INCH

3. DIMENSION H IS MEASURED .030 AWAY FROM PACKAGE BODY

STYLE 1:
PIN 1 − DRAIN
2 − GATE
3 − SOURCE

STYLE 2:
PIN 1 − GATE
2 − DRAIN
3 − SOURCE

DIM	INCH MIN	INCH MAX	MILLIMETER MIN	MILLIMETER MAX	DIM	INCH MIN	INCH MAX	MILLIMETER MIN	MILLIMETER MAX
A	.795	.805	20.19	20.45	N	.357	.363	9.07	9.22
B	.225	.235	5.72	5.97	Q	.125	.135	3.18	3.43
C	.125	.175	3.18	4.45	R	.227	.233	5.77	5.92
D	.210	.220	5.33	5.59	S	.225	.235	5.72	5.97
E	.055	.065	1.40	1.65					
F	.004	.006	0.10	0.15	aaa	.005		0.13	
G	.562 BSC		14.28 BSC		bbb	.010		0.25	
H	.077	.087	1.96	2.21	ccc	.015		0.38	
K	.085	.115	2.16	2.92					
M	.355	.365	9.02	9.27					

MECHANICAL OUTLINE

PRINT VERSION NOT TO SCALE

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PRODUCT DOCUMENTATION

Refer to the following documents to aid your design process.

Application Notes

- AN1955: Thermal Measurement Methodology of RF Power Amplifiers

REVISION HISTORY

The following table summarizes revisions to this document.

Revision	Date	Description
0	Jan. 2008	• Initial Release of Data Sheet
1	Dec. 2008	• Changed Storage Temperature Range in Max Ratings table from -65 to +175 to -65 to +150 for standardization across products, p. 1 • Removed "Operating Case Temperature Range" from Maximum Ratings table so that the maximum channel temperature rating is the limiting thermal design criteria and not the case temperature range, p. 1

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