Document Number: AFT09MS031N
Rev. 1, 8/2012

RoHS

RF Power LDMOS Transistors

High Ruggedness N-Channel Enhancement-Mode Lateral MOSFETs

Designed for mobile two-way radio applications with frequencies from 764 to 941 MHz. The high gain, ruggedness and broadband performance of these devices make them ideal for large-signal, common source amplifier applications in mobile radio equipment.

Narrowband Performance (13.6 Vdc, I_{DQ} = 500 mA, T_A = 25°C, CW)

Frequency (MHz)	G_{ps} (dB)	η_D (%)	P1dB (W)
764	18.0	74.1	32
870	17.2	71.0	31
941	15.7	68.1	31

800 MHz Broadband Performance (13.6 Vdc, I_{DQ} = 100 mA, T_A = 25°C, CW)

Frequency (MHz)	G_{ps} (dB)	η_D (%)	P1dB (W)
760	15.7	62.0	44
820	15.7	63.0	37
870	15.5	61.0	36

Load Mismatch/Ruggedness

Frequency (MHz)	Signal Type	VSWR	P_{in} (W)	Test Voltage	Result
870 (1)	CW	>65:1 at all Phase Angles	1.2 (3 dB Overdrive)	17	No Device Degradation
870 (2)			2.0 (3 dB Overdrive)		

1. Measured in 870 MHz narrowband test circuit.
2. Measured in 760-870 MHz broadband reference circuit.

Features

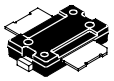
- Characterized for Operation from 764 to 941 MHz
- Unmatched Input and Output Allowing Wide Frequency Range Utilization
- Integrated ESD Protection
- Integrated Stability Enhancements
- Wideband — Full Power Across the Band (764–870 MHz)
- 225°C Capable Plastic Package
- Exceptional Thermal Performance
- High Linearity for: TETRA, SSB, LTE
- Cost-effective Over-molded Plastic Packaging
- In Tape and Reel. R1 Suffix = 500 Units, 24 mm Tape Width, 13 inch Reel.

Typical Applications

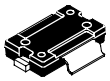
- Output Stage 800 MHz Trunking Band Mobile Radio
- Output Stage 900 MHz Trunking Band Mobile Radio

AFT09MS031NR1
AFT09MS031GNR1

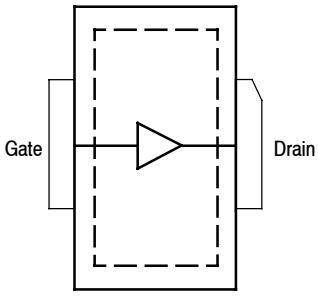
764-941 MHz, 31 W, 13.6 V
WIDEBAND
RF POWER LDMOS TRANSISTORS



TO-270-2
PLASTIC
AFT09MS031NR1



TO-270-2 GULL
PLASTIC
AFT09MS031GNR1



(Top View)

Note: The backside of the package is the source terminal for the transistor.

Figure 1. Pin Connections

freescale Airfast

Table 1. Maximum Ratings

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	-0.5, +40	Vdc
Gate-Source Voltage	V_{GS}	-6.0, +12	Vdc
Operating Voltage	V_{DD}	17, +0	Vdc
Storage Temperature Range	T_{stg}	-65 to +150	°C
Case Operating Temperature Range	T_C	-40 to +150	°C
Operating Junction Temperature Range (1,2)	T_J	-40 to +225	°C
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	317 1.59	W W/°C

Table 2. Thermal Characteristics

Characteristic	Symbol	Value (2,3)	Unit
Thermal Resistance, Junction to Case Case Temperature 81°C, 31 W CW, 13.6 Vdc, I_{DQ} = 500 mA, 870 MHz	$R_{\theta JC}$	0.63	°C/W

Table 3. ESD Protection Characteristics

Test Methodology	Class
Human Body Model (per JESD22-A114)	2, passes 2500 V
Machine Model (per EIA/JESD22-A115)	A, passes 100 V
Charge Device Model (per JESD22-C101)	IV, passes 1200 V

Table 4. Moisture Sensitivity Level

Test Methodology	Rating	Package Peak Temperature	Unit
Per JESD22-A113, IPC/JEDEC J-STD-020	3	260	°C

Table 5. Electrical Characteristics (T_A = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Off Characteristics					
Zero Gate Voltage Drain Leakage Current (V_{DS} = 40 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	2	μAdc
Zero Gate Voltage Drain Leakage Current (V_{DS} = 13.6 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	1	μAdc
Gate-Source Leakage Current (V_{GS} = 5 Vdc, V_{DS} = 0 Vdc)	I_{GSS}	—	—	600	nAdc
On Characteristics					
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 115 μAdc)	$V_{GS(th)}$	1.6	2.1	2.6	Vdc
Drain-Source On-Voltage (V_{GS} = 10 Vdc, I_D = 1.2 Adc)	$V_{DS(on)}$	—	0.1	—	Vdc
Forward Transconductance (V_{GS} = 10 Vdc, I_D = 10 Adc)	g_{fs}	—	7.8	—	S

1. Continuous use at maximum temperature will affect MTTF.
2. MTTF calculator available at http://www.freescale.com/rf. Select Software & Tools/Development Tools/Calculators to access MTTF calculators by product.
3. Refer to AN1955, *Thermal Measurement Methodology of RF Power Amplifiers.* Go to http://www.freescale.com/rf. Select Documentation/Application Notes - AN1955.

(continued)

Table 5. Electrical Characteristics (T_A = 25°C unless otherwise noted) **(continued)**

Characteristic	Symbol	Min	Typ	Max	Unit
Dynamic Characteristics					
Reverse Transfer Capacitance (V_{DS} = 13.6 Vdc ± 30 mV(rms)ac @ 1 MHz, V_{GS} = 0 Vdc)	C_{rss}	—	2.1	—	pF
Output Capacitance (V_{DS} = 13.6 Vdc ± 30 mV(rms)ac @ 1 MHz, V_{GS} = 0 Vdc)	C_{oss}	—	63	—	pF
Input Capacitance (V_{DS} = 13.6 Vdc, V_{GS} = 0 Vdc ± 30 mV(rms)ac @ 1 MHz)	C_{iss}	—	140	—	pF
Functional Tests (1) (In Freescale Narrowband Test Fixture, 50 ohm system) V_{DD} = 13.6 Vdc, I_{DQ} = 500 mA, P_{out} = 31 W, f = 870 MHz					
Common-Source Amplifier Power Gain	G_{ps}	16.0	17.2	18.5	dB
Drain Efficiency	η_D	68.0	71.0	—	%

Load Mismatch/Ruggedness (In Freescale Test Fixture, 50 ohm system, I_{DQ} = 500 mA)

Frequency (MHz)	Signal Type	VSWR	P_{in} (W)	Test Voltage, V_{DD}	Result
870	CW	>65:1 at all Phase Angles	1.2 (3 dB Overdrive)	17	No Device Degradation

1. Measurement made with device in straight lead configuration before any lead forming operation is applied. Lead forming is used for gull wing (GN) parts.

TYPICAL CHARACTERISTICS

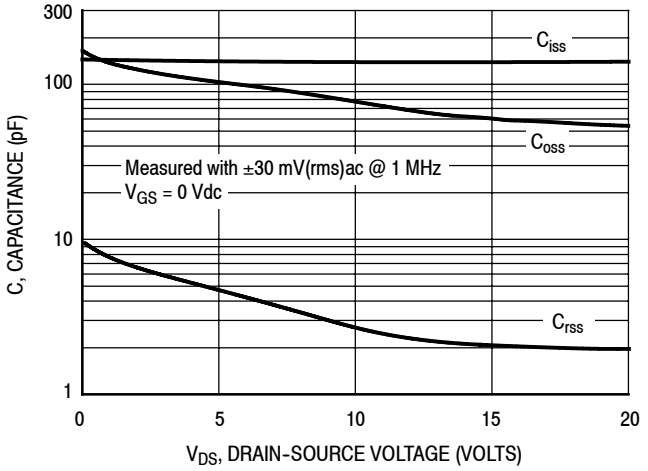
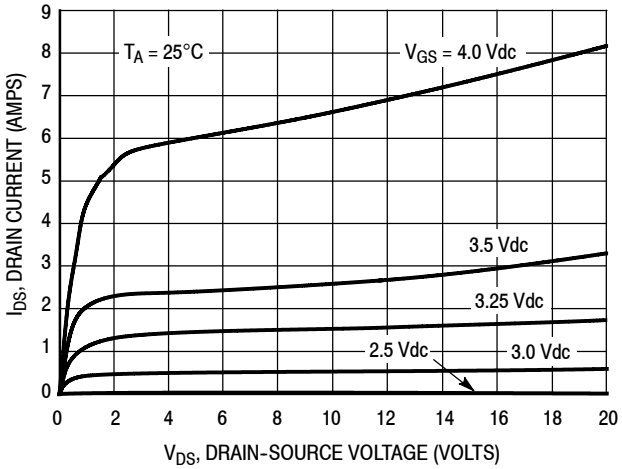
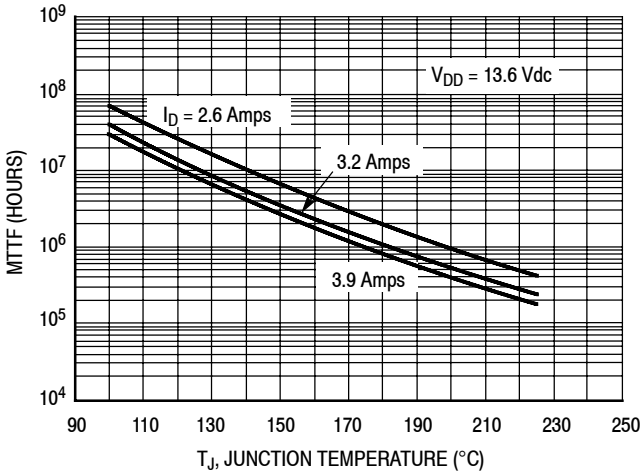


Figure 2. Capacitance versus Drain-Source Voltage



Note: Measured with both sides of the transistor tied together.

Figure 3. Drain Current versus Drain-Source Voltage



Note: MTTF value represents the total cumulative operating time under indicated test conditions.

MTTF calculator available at http:/www.freescale.com/rf. Select Software & Tools/Development Tools/Calculators to access MTTF calculators by product.

Figure 4. MTTF versus Junction Temperature - CW

870 MHz NARROWBAND PRODUCTION TEST FIXTURE

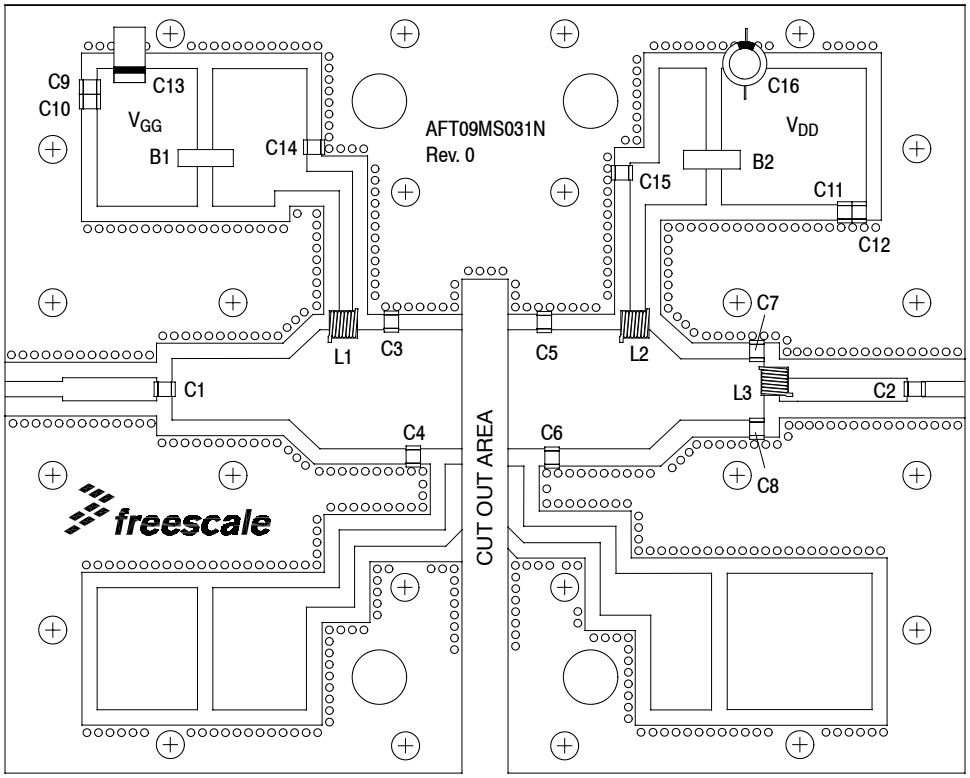


Figure 5. AFT09MS031NR1 Narrowband Test Circuit Component Layout — 870 MHz

Table 6. AFT09MS031NR1 Narrowband Test Circuit Component Designations and Values — 870 MHz

Part	Description	Part Number	Manufacturer
B1, B2	RF Beads, Long	2743021447	Fair-Rite
C1	3.9 pF Chip Capacitor	ATC100B3R9CT500XT	ATC
C2, C14, C15	56 pF Chip Capacitors	ATC100B560CT500XT	ATC
C3, C4, C5, C6	10 pF Chip Capacitors	ATC100B100JT500XT	ATC
C7, C8	3.6 pF Chip Capacitors	ATC100B3R6CT500XT	ATC
C9	2.5 μF Chip Capacitor	GRM31CR71H225KA88L	Murata
C10, C11	0.1 μF Chip Capacitors	C1206C104K1RAC-TU	Kemet
C12	10,000 pF Chip Capacitor	ATC200B103KT50XT	ATC
C13	22 μF, 25 V Tantalum Capacitor	TPSD226M025R0200	AVX
C16	330 μF, 35 V Electrolytic Capacitor	MCGPR35V337M10X16-RH	Multicomp
L1	8.0 nH Inductor	A03TKLC	Coilcraft
L2	18.5 nH Inductor	A05TKLC	Coilcraft
L3	5.0 nH Inductor	A02TKLC	Coilcraft
PCB	0.030″, ε_r = 3.5	RO4350B	Rogers

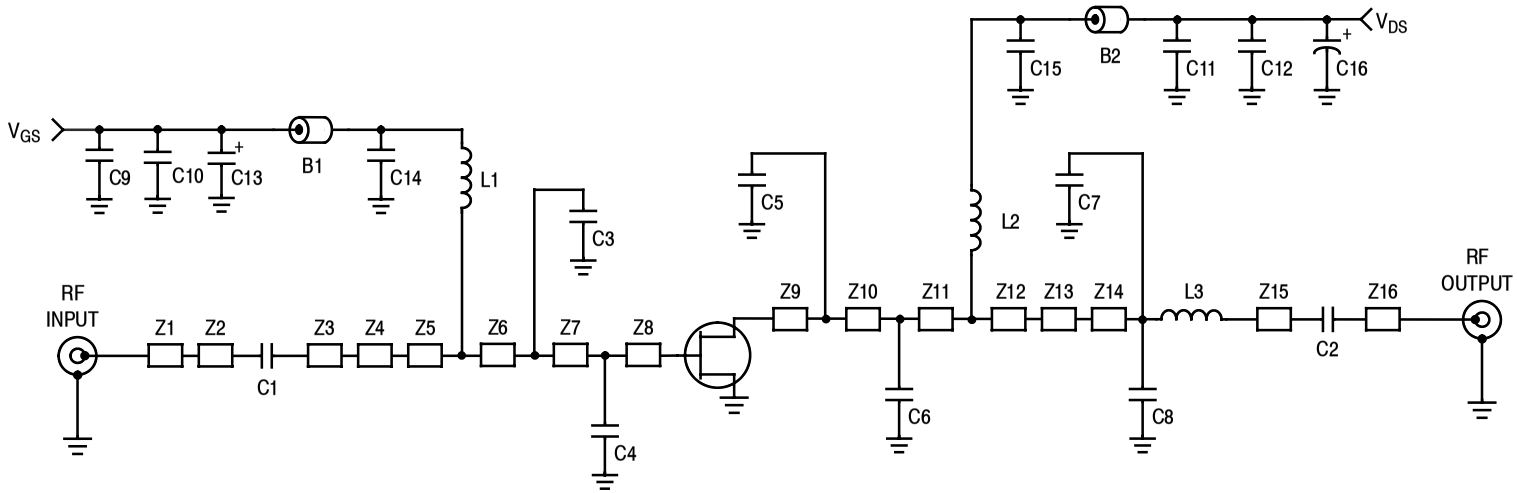


Figure 6. AFT09MS031NR1 Narrowband Test Circuit Schematic — 870 MHz

Table 7. AFT09MS031NR1 Narrowband Test Circuit Microstrips — 870 MHz

Microstrip	Description
Z1	0.280″ × 0.080″ Microstrip
Z2	0.490″ × 0.120″ Microstrip
Z3	0.610″ × 0.320″ Microstrip
Z4	0.320″ × 0.155″ × 0.620″ Microstrip Taper
Z5	0.139″ × 0.620″ Microstrip
Z6	0.225″ × 0.620″ Microstrip
Z7	0.121″ × 0.620″ Microstrip
Z8	0.254″ × 0.620″ Microstrip

Microstrip	Description
Z9	0.190″ × 0.080″ Microstrip
Z10	0.040″ × 0.080″ Microstrip
Z11	0.454″ × 0.520″ Microstrip
Z12	0.054″ × 0.520″ Microstrip
Z13	0.620″ × 0.420″ × 0.620″ Microstrip Taper
Z14	0.433″ × 0.420″ Microstrip
Z15	0.665″ × 0.420″ Microstrip
Z16	0.200″ × 0.420″ Microstrip

TYPICAL CHARACTERISTICS — 870 MHz

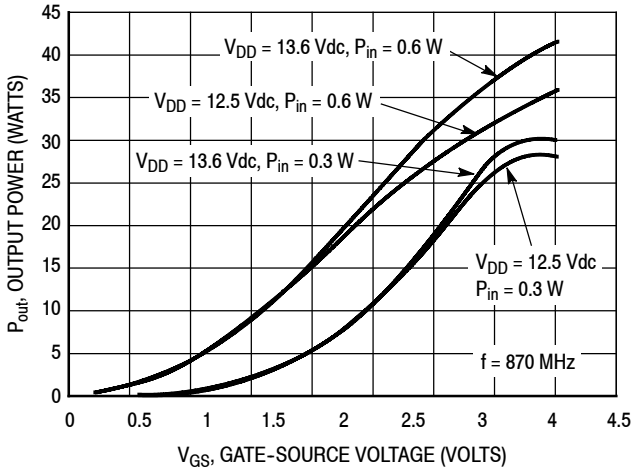


Figure 7. CW Output Power versus Gate-Source Voltage

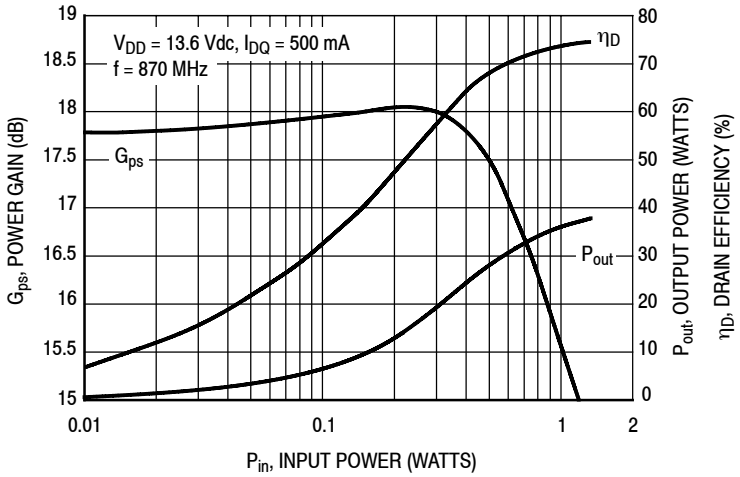


Figure 8. Power Gain, CW Output Power and Drain Efficiency versus Input Power

V_{DD} = 13.6 Vdc, I_{DQ} = 500 mA, P_{out} = 31 W Avg.

f MHz	Z_{source} Ω	Z_{load} Ω
870	0.28 - j0.71	0.98 - j0.52

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

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

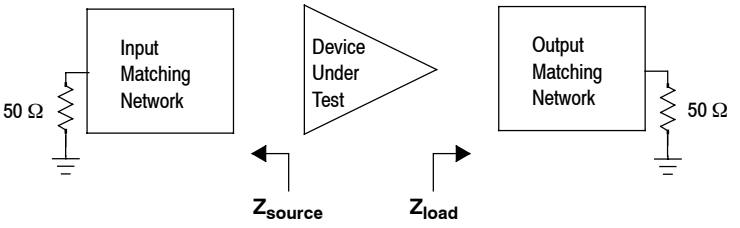


Figure 9. Narrowband Series Equivalent Source and Load Impedance — 870 MHz

Table 8. 760–870 MHz Broadband Performance (In Freescale Reference Circuit, 50 ohm system)
V_{DD} = 13.6 Volts, I_{DQ} = 100 mA, T_A = 25°C, CW

Frequency (MHz)	G_{ps} (dB)	η_D (%)	P1dB (W)
760	15.7	62.0	44
820	15.7	63.0	37
870	15.5	61.0	36

Table 9. Load Mismatch/Ruggedness (In Freescale Reference Circuit)

Frequency (MHz)	Signal Type	VSWR	P_{in} (W)	Test Voltage, V_{DD}	Result
870	CW	>65:1 at all Phase Angles	2.0 (3 dB Overdrive)	17	No Device Degradation

760–870 MHz BROADBAND REFERENCE CIRCUIT

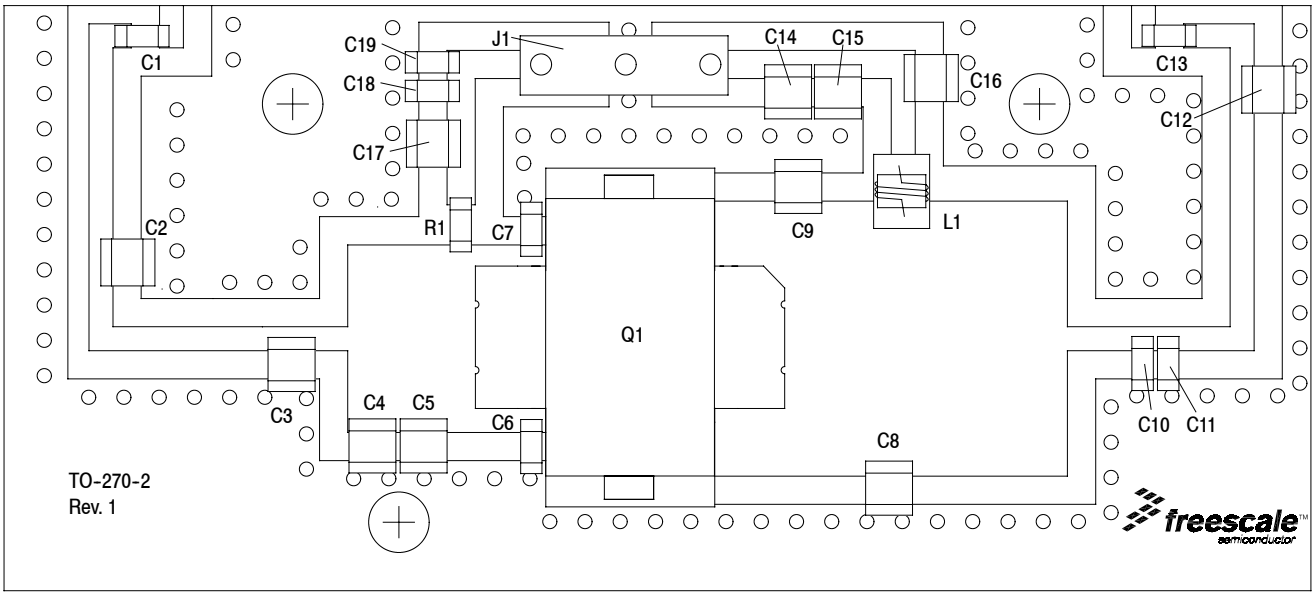


Figure 10. AFT09MS031NR1 Broadband Reference Circuit Component Layout — 760–870 MHz

Table 10. AFT09MS031NR1 Broadband Reference Circuit Component Designations and Values — 760–870 MHz

Part	Description	Part Number	Manufacturer
C1, C10, C11, C12	5.6 pF Chip Capacitors	ATC600F5R6BT250XT	ATC
C2	6.8 pF Chip Capacitor	ATC600F6R8BT250XT	ATC
C3	8.2 pF Chip Capacitor	ATC600F8R2BT250XT	ATC
C4	12 pF Chip Capacitor	ATC600F120JT250XT	ATC
C5	10 pF Chip Capacitor	ATC600F100JT250XT	ATC
C6, C7	30 pF Chip Capacitors	ATC600F300JT250XT	ATC
C8, C9	22 pF Chip Capacitors	ATC600F220JT250XT	ATC
C13, C16, C17	240 pF Chip Capacitors	ATC600F241JT250XT	ATC
C14, C19	10 μF Chip Capacitors	GRM31CR61H106KA12L	Murata
C15, C18	1 μF Chip Capacitors	GRM21BR71H105KA12L	Murata
J1	3 Pin Connector	AMP-9-146305-0	TE Connectivity
L1	6.9 nH Inductor	0807SQ6N9	Coilcraft
Q1	RF Power LDMOS Transistor	AFT09MS031NR1	Freescale
R1	62 Ω Chip Resistor	RG2012N-620-B-T1	Susumu
PCB	0.020″, ε_r = 4.8	S1000-2	Shengyi

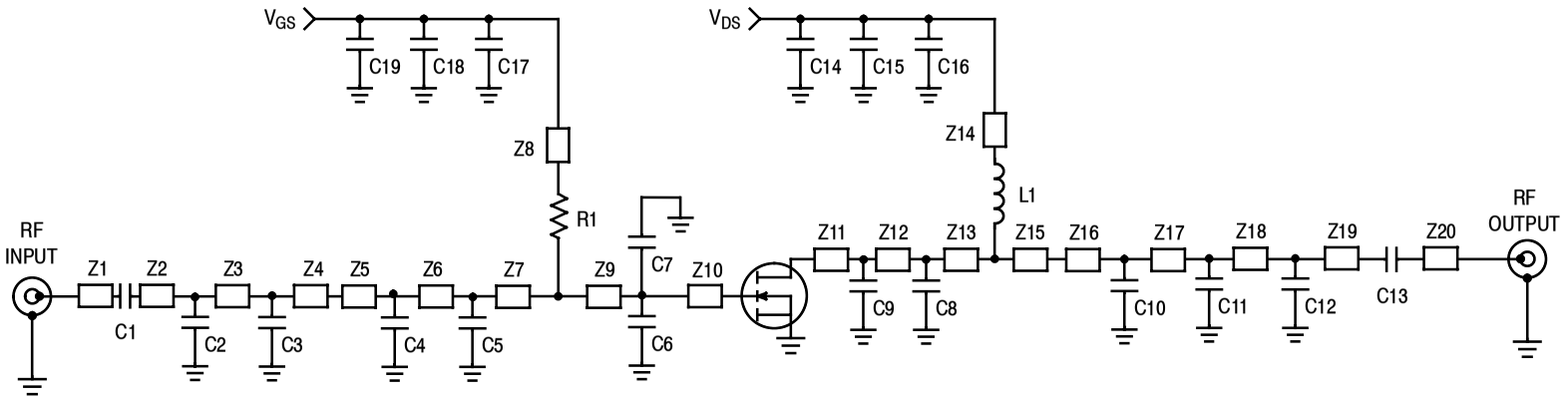


Figure 11. AFT09MS031NR1 Broadband Reference Circuit Schematic — 760-870 MHz

Table 11. AFT09MS031NR1 Broadband Reference Circuit Microstrips — 760-870 MHz

Microstrip	Description
Z1, Z20	0.034″ × 0.060″ Microstrip
Z2*	0.034″ × 0.380″ Microstrip
Z3*	0.034″ × 0.215″ Microstrip
Z4	0.034″ × 0.054″ Microstrip
Z5, Z6	0.266″ × 0.025″ Microstrip
Z7, Z9	0.266″ × 0.080″ Microstrip
Z8	0.034″ × 0.050″ Microstrip
Z10	0.266″ × 0.015″ Microstrip

Microstrip	Description
Z11, Z12	0.390″ × 0.120″ Microstrip
Z13	0.390″ × 0.080″ Microstrip
Z14	0.034″ × 0.100″ Microstrip
Z15	0.390″ × 0.200″ Microstrip
Z16	0.034″ × 0.110″ Microstrip
Z17	0.034″ × 0.010″ Microstrip
Z18*	0.034″ × 0.190″ Microstrip
Z19*	0.034″ × 0.110″ Microstrip

* Line length includes microstrip bends

TYPICAL CHARACTERISTICS — 760–860 MHz BROADBAND REFERENCE CIRCUIT

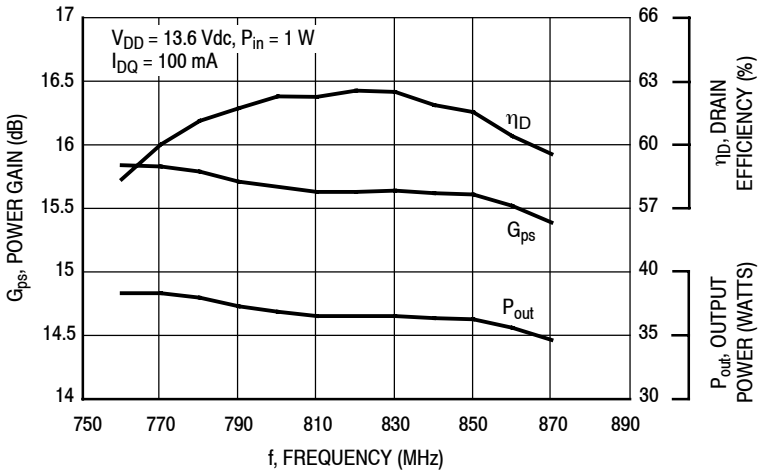


Figure 12. Power Gain, CW Output Power and Drain Efficiency versus Frequency at a Constant Input Power

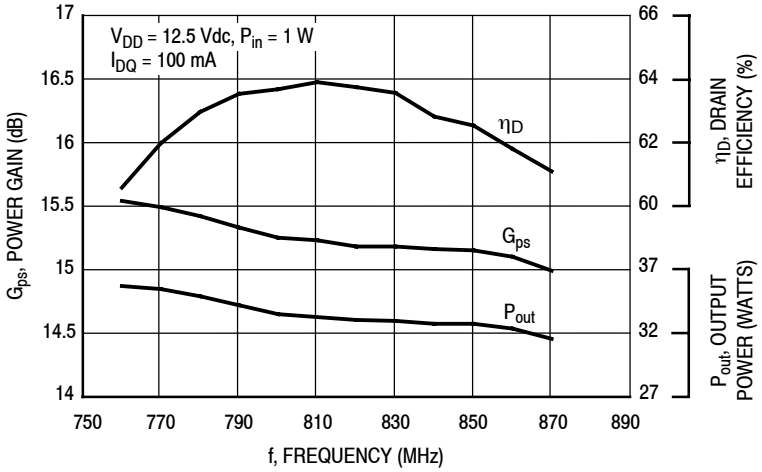


Figure 13. Power Gain, CW Output Power and Drain Efficiency versus Frequency at a Constant Input Power

TYPICAL CHARACTERISTICS — 760–870 MHz BROADBAND REFERENCE CIRCUIT

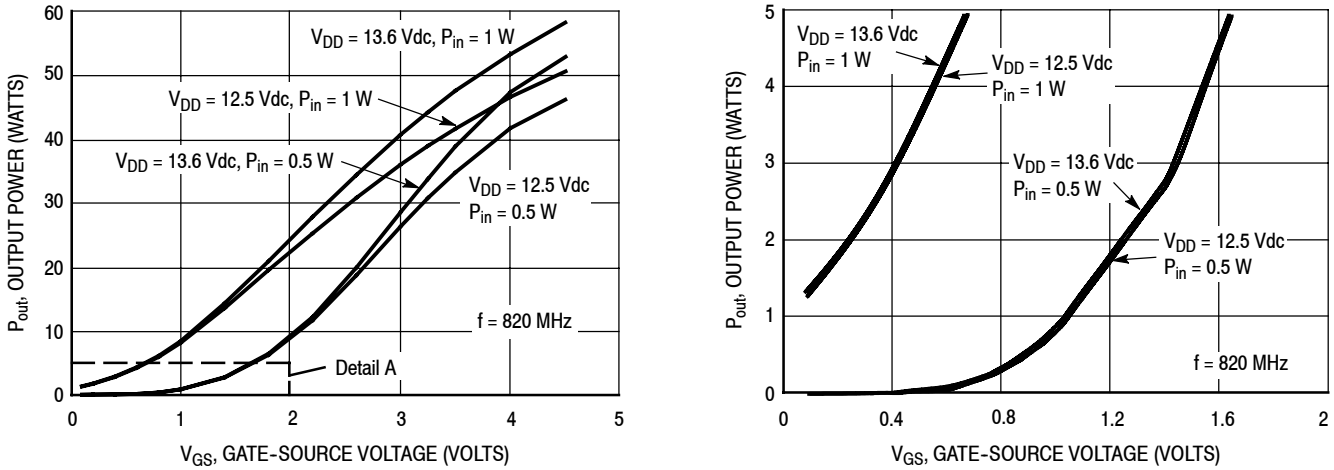


Figure 14. CW Output Power versus Gate-Source Voltage

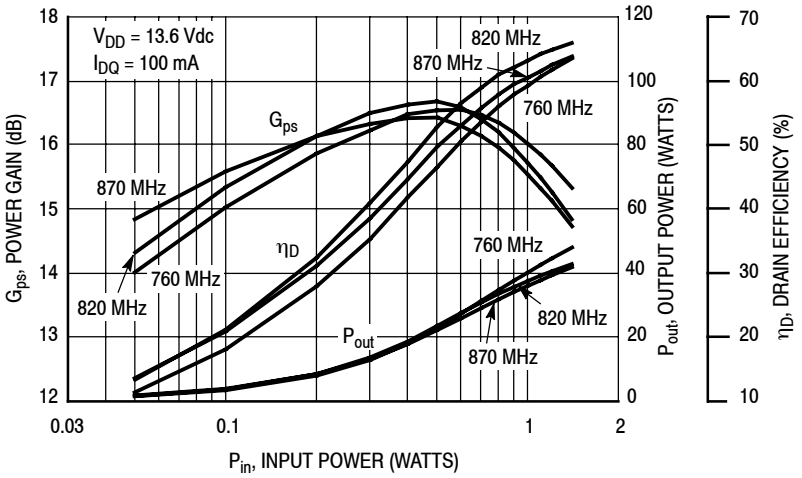
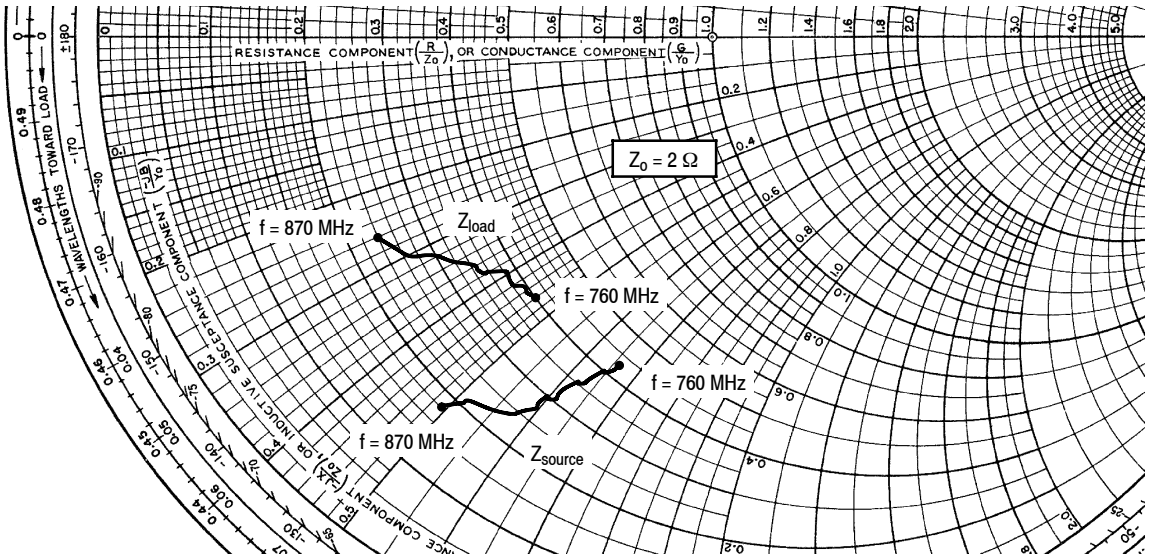


Figure 15. Power Gain, CW Output Power and Drain Efficiency versus Input Power and Frequency



V_{DD} = 13.6 Vdc, I_{DQ} = 100 mA, P_{out} = 31 W Avg.

f MHz	Z_{source} Ω	Z_{load} Ω
760	0.85 – j1.31	0.80 – j0.92
770	0.80 – j1.30	0.78 – j0.88
780	0.75 – j1.28	0.78 – j0.85
790	0.69 – j1.26	0.76 – j0.81
800	0.65 – j1.24	0.76 – j0.78
810	0.59 – j1.21	0.72 – j0.75
820	0.55 – j1.18	0.70 – j0.73
830	0.51 – j1.15	0.67 – j0.70
840	0.46 – j1.11	0.62 – j0.66
850	0.42 – j1.01	0.57 – j0.62
860	0.39 – j1.02	0.52 – j0.57
870	0.36 – j0.97	0.48 – j0.52

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

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

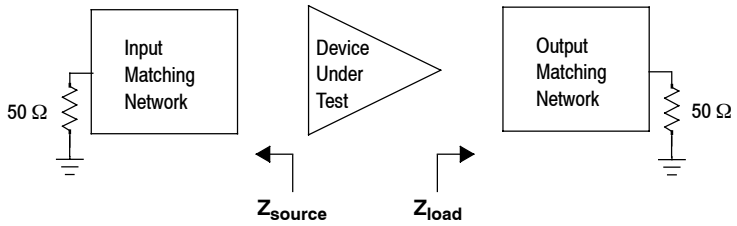
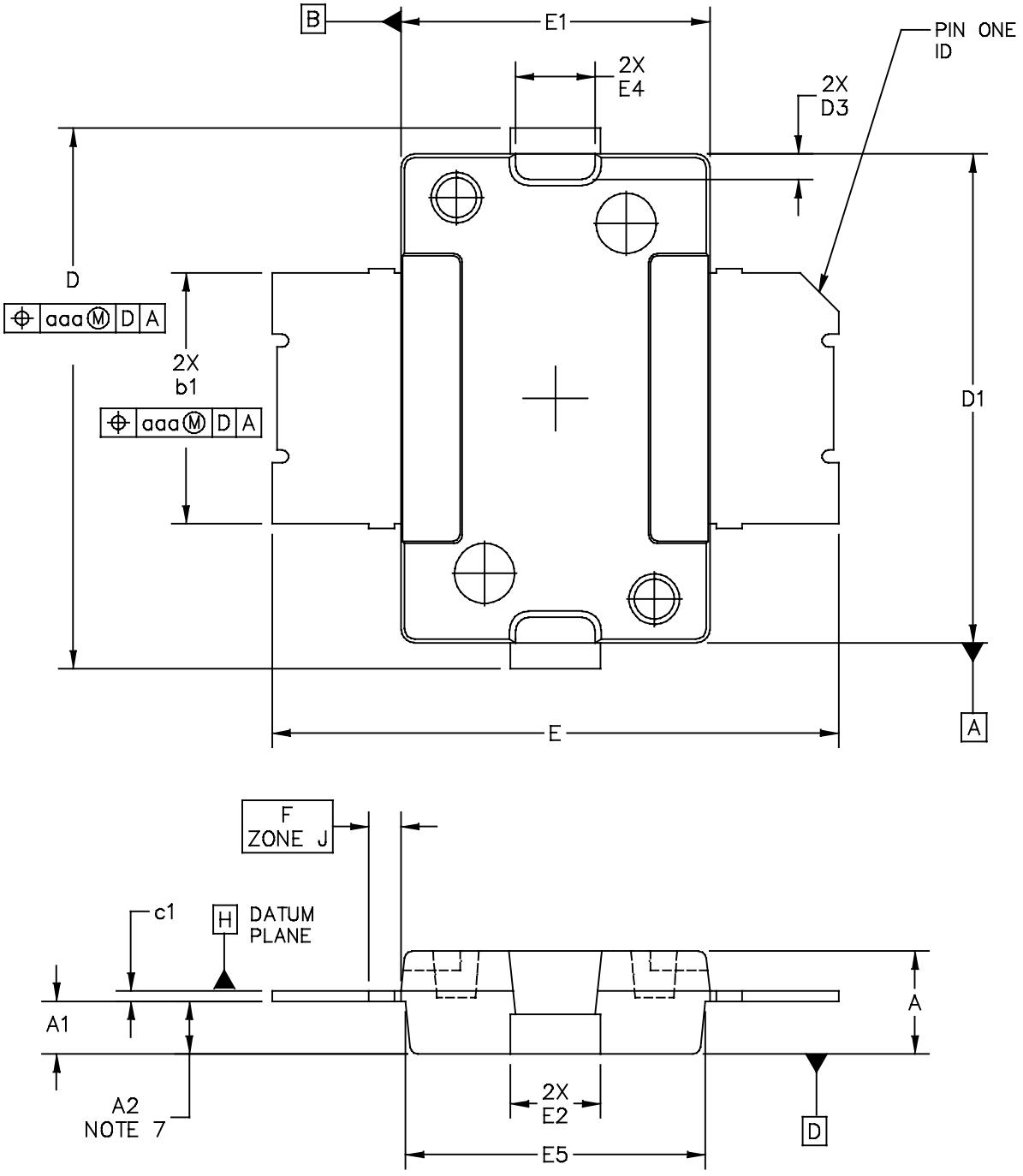


Figure 14. Broadband Series Equivalent Source and Load Impedance — 760–870 MHz

PACKAGE DIMENSIONS



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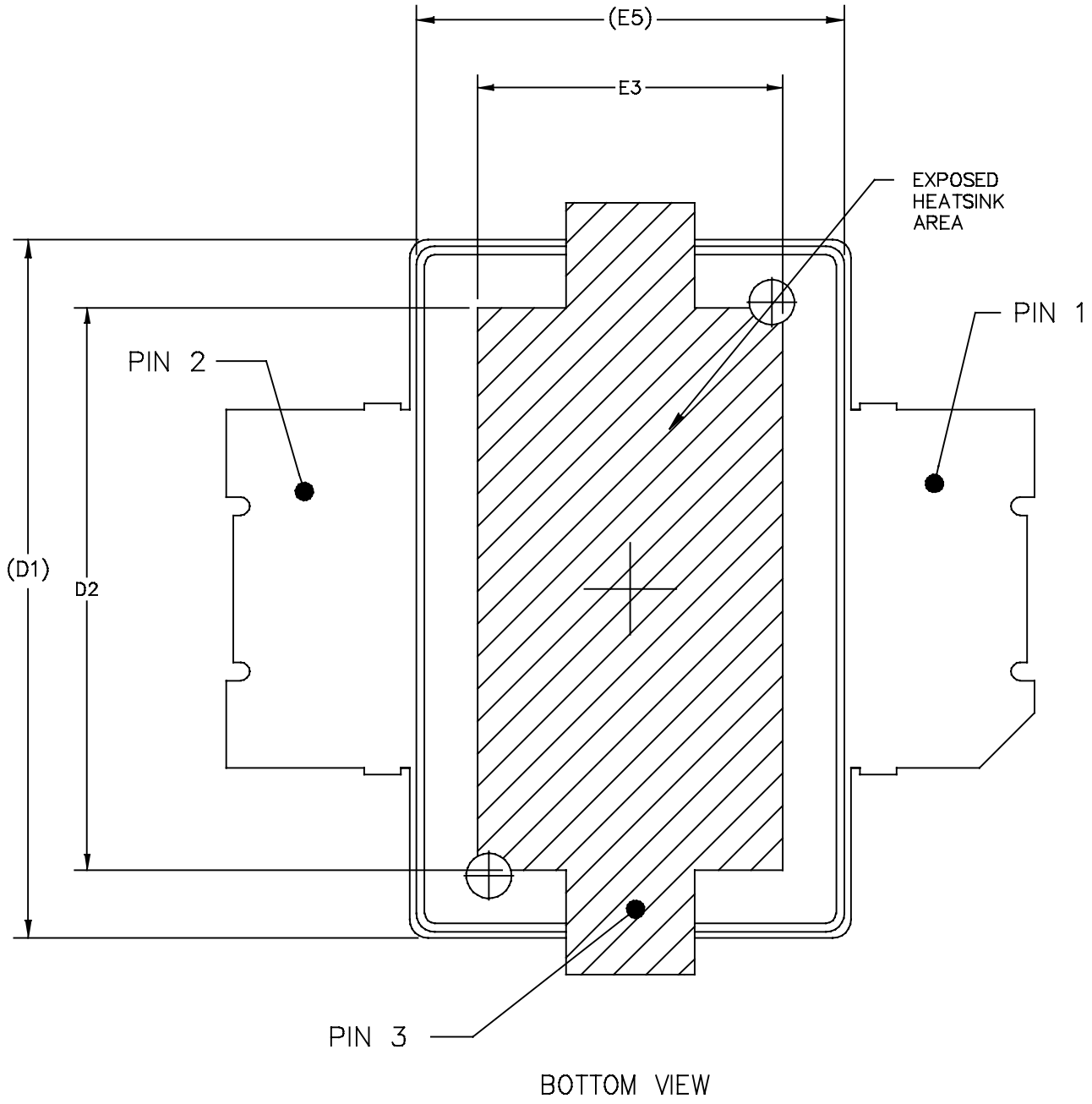
TITLE: TO-270 SURFACE MOUNT	DOCUMENT NO: 98ASH98117A	REV: K
	CASE NUMBER: 1265-09	29 JUN 2007
	STANDARD: JEDEC TO-270 AA	



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TITLE: TO−270 SURFACE MOUNT	DOCUMENT NO: 98ASH98117A	REV: K
	CASE NUMBER: 1265−09	29 JUN 2007
	STANDARD: JEDEC TO−270 AA	

NOTES:
1. CONTROLLING DIMENSION: INCH

2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M–1994.

3. DATUM PLANE –H– IS LOCATED AT TOP OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT THE TOP OF THE PARTING LINE.

4. DIMENSIONS "D1" AND "E1" DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS .006 PER SIDE. DIMENSIONS "D1 AND "E1" DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE –H–.

5. DIMENSION "b1" DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE .005 TOTAL IN EXCESS OF THE "b1" DIMENSION AT MAXIMUM MATERIAL CONDITION.

6. DATUMS –A– AND –B– TO BE DETERMINED AT DATUM PLANE –H–.

7. DIMENSION "A2" APPLIES WITHIN ZONE "J" ONLY.

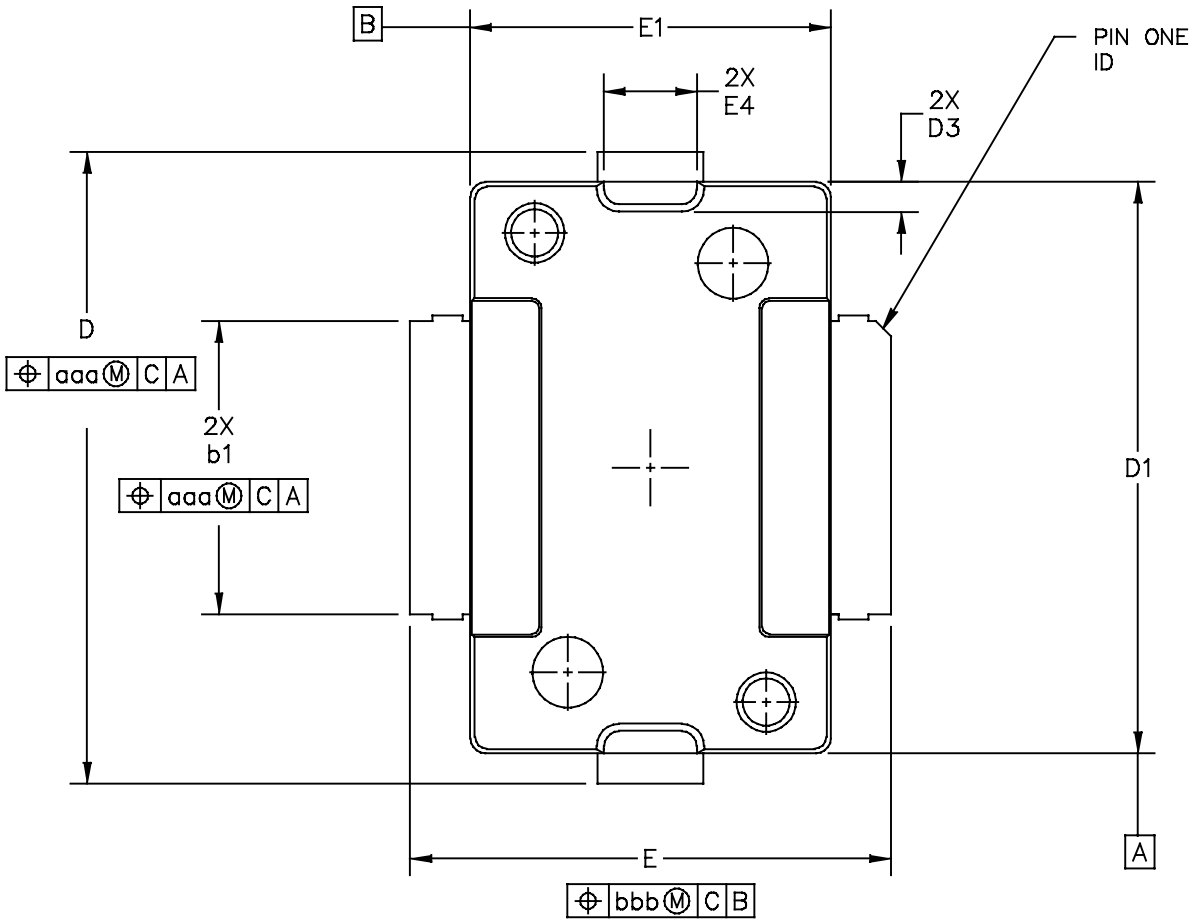
8. DIMENSIONS "D" AND "E2" DO NOT INCLUDE MOLD PROTRUSION. OVERALL LENGTH INCLUDING MOLD PROTRUSION SHOULD NOT EXCEED 0.430 INCH FOR DIMENSION "D" AND 0.080 INCH FOR DIMENSION "E2". DIMENSIONS "D" AND "E2" DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE –D–.

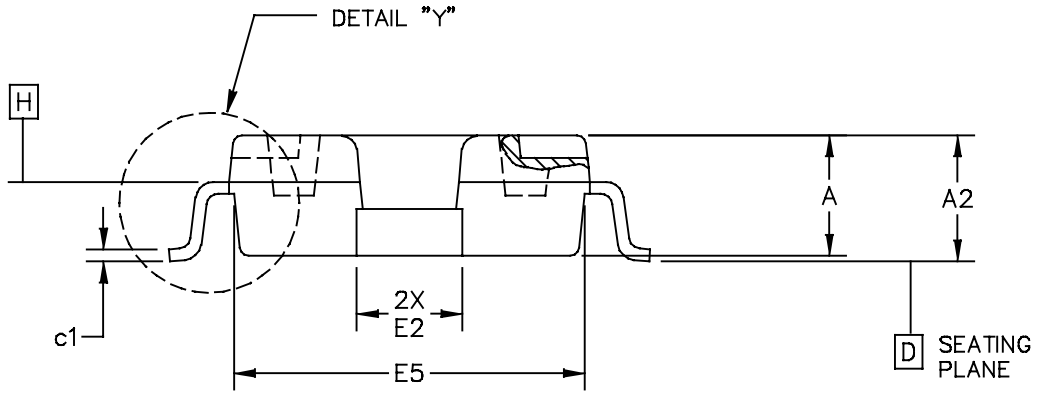
STYLE 1:
PIN 1 – DRAIN
PIN 2 – GATE
PIN 3 – SOURCE

DIM	INCH MIN	INCH MAX	MILLIMETER MIN	MILLIMETER MAX	DIM	INCH MIN	INCH MAX	MILLIMETER MIN	MILLIMETER MAX
A	.078	.082	1.98	2.08	F	.025 BSC		0.64 BSC	
A1	.039	.043	0.99	1.09	b1	.193	.199	4.90	5.06
A2	.040	.042	1.02	1.07	c1	.007	.011	0.18	0.28
D	.416	.424	10.57	10.77	aaa	.004		0.10	
D1	.378	.382	9.60	9.70					
D2	.290	----	7.37	----					
D3	.016	.024	0.41	0.61					
E	.436	.444	11.07	11.28					
E1	.238	.242	6.04	6.15					
E2	.066	.074	1.68	1.88					
E3	.150	----	3.81	----					
E4	.058	.066	1.47	1.68					
E5	.231	.235	5.87	5.97					

MECHANICAL OUTLINE	PRINT VERSION NOT TO SCALE

TITLE:	DOCUMENT NO: 98ASH98117A	REV: K
TO–270 SURFACE MOUNT	CASE NUMBER: 1265–09	29 JUN 2007
	STANDARD: JEDEC TO–270 AA	





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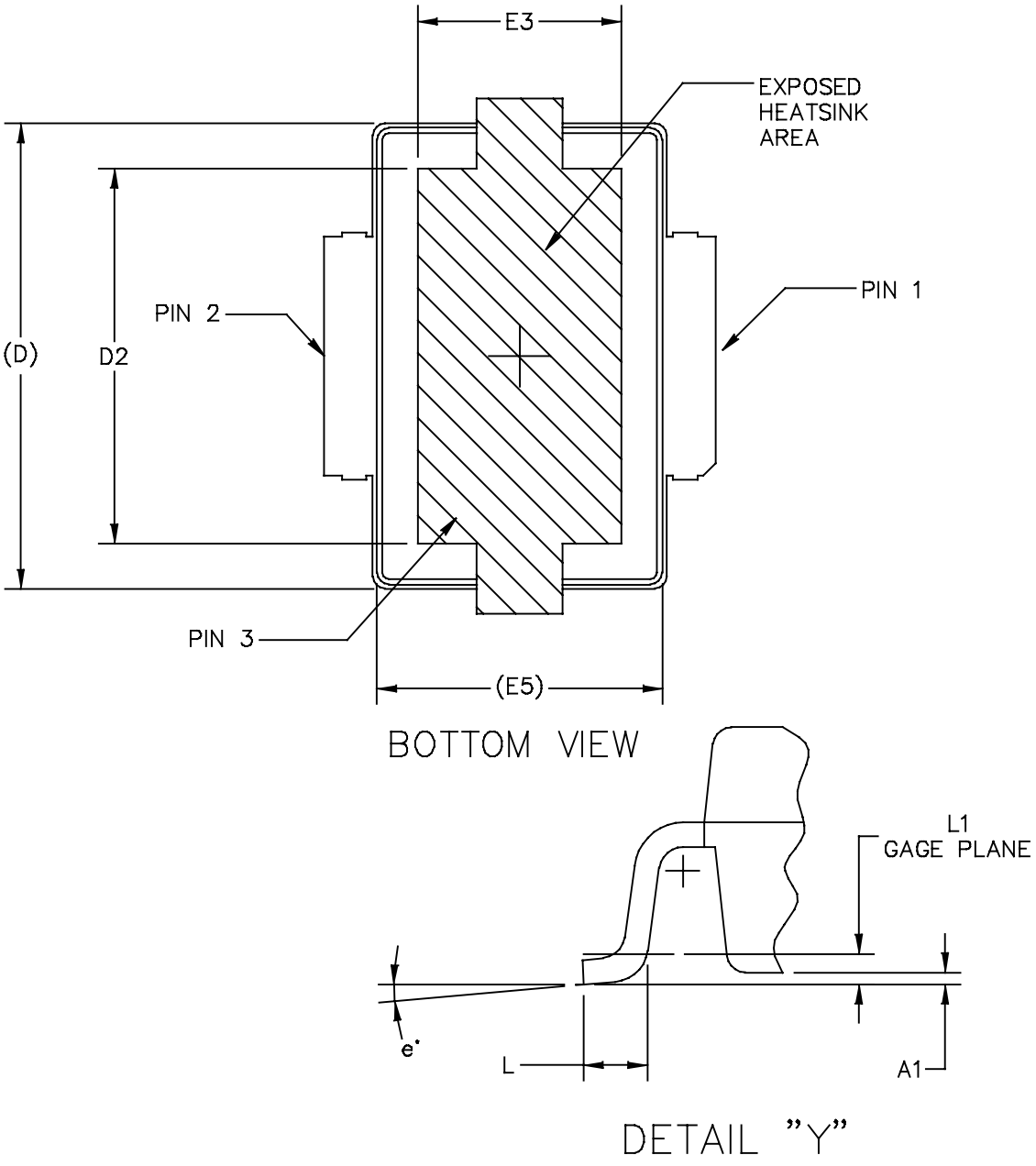
TITLE: TO−270 GULL WING	DOCUMENT NO: 98ASA99301D	REV: C
	CASE NUMBER: 1265A−03	02 JUL 2007
	STANDARD: JEDEC TO−270 BA	



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TITLE: TO-270 GULL WING	DOCUMENT NO: 98ASA99301D	REV: C
	CASE NUMBER: 1265A-03	02 JUL 2007
	STANDARD: JEDEC TO-270 BA	

NOTES:
1. CONTROLLING DIMENSION: INCH

2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M–1994.

3. DATUM PLANE –H– IS LOCATED AT TOP OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT THE TOP OF THE PARTING LINE.

4. DIMENSIONS "D1" AND "E1" DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS .006 PER SIDE. DIMENSIONS "D1 AND "E1" DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE –H–.

5. DIMENSION b1 DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE .005 TOTAL IN EXCESS OF THE b1 DIMENSION AT MAXIMUM MATERIAL CONDITION.

6. DATUMS –A– AND –B– TO BE DETERMINED AT DATUM PLANE –H–.

7. DIMENSIONS "D" AND "E2" DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS .003 PER SIDE. DIMENSIONS "D AND "E2" DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE –D–.

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

DIM	INCH MIN	INCH MAX	MILLIMETER MIN	MILLIMETER MAX	DIM	INCH MIN	INCH MAX	MILLIMETER MIN	MILLIMETER MAX
A	.078	.082	1.98	2.08	L	.018	.024	0.46	0.61
A1	.001	.004	0.02	0.10	L1	.01 BSC		0.25 BSC	
A2	.077	.088	1.96	2.24	b1	.193	.199	4.90	5.06
D	.416	.424	10.57	10.77	c1	.007	.011	0.18	0.28
D1	.378	.382	9.60	9.70	e	2°	8°	2°	8°
D2	.290	–	7.37	–	aaa	.004		0.10	
D3	.016	.024	0.41	0.61					
E	.316	.324	8.03	8.23					
E1	.238	.242	6.04	6.15					
E2	.066	.074	1.68	1.88					
E3	.150	–	3.81	–					
E4	.058	.066	1.47	1.68					
E5	.231	.235	5.87	5.97					

MECHANICAL OUTLINE	PRINT VERSION NOT TO SCALE

TITLE:	DOCUMENT NO: 98ASA99301D	REV: C
TO–270 GULL WING	CASE NUMBER: 1265A–03	02 JUL 2007
	STANDARD: JEDEC TO–270 BA	

PRODUCT DOCUMENTATION, SOFTWARE AND TOOLS

Refer to the following documents, software and tools to aid your design process.

Application Notes

- AN1907: Solder Reflow Attach Method for High Power RF Devices in Over-Molded Plastic Packages
- AN1955: Thermal Measurement Methodology of RF Power Amplifiers
- AN3263: Bolt Down Mounting Method for High Power RF Transistors and RFICs in Over-Molded Plastic Packages
- AN3789: Clamping of High Power RF Transistors and RFICs in Over-Molded Plastic Packages

Engineering Bulletins

- EB212: Using Data Sheet Impedances for RF LDMOS Devices

Software

- Electromigration MTTF Calculator
- RF High Power Model
- .s2p File

Development Tools

- Printed Circuit Boards

For Software and Tools, do a Part Number search at http://www.freescale.com, and select the “Part Number” link. Go to the Software & Tools tab on the part’s Product Summary page to download the respective tool.

REVISION HISTORY

The following table summarizes revisions to this document.

Revision	Date	Description
0	May 2012	• Initial Release of Data Sheet
1	Aug. 2012	• Load Mismatch/Ruggedness tables: changed output power to input power to clarify the conditions used during test, p. 1, 8 • Fig. 10, Broadband Reference Circuit Component Layout — 760-870 MHz: added C18 and C19; replaced L1 with R1 and L2 with L1, p. 9 • Table 10, Broadband Reference Circuit Component Designations and Values — 760-870 MHz: changed C14 description from 0.10 μF to 10 μF and part number from GRM21BR71H104KA01B to GRM31CR61H106KA12L; changed C15 description from 0.01 μF to 1 μF and part number from GRM21BR72A103KA01B to GRM21BR71H105KA12L; changed C17 description from 22 pF to 240 pF and part number from ATC100A220JT150XT to ATC600F241JT250XT; added C18 and C19; replaced L1 with R1 and L2 with L1, p. 9 • Fig. 11, Broadband Reference Circuit Schematic — 760-870 MHz: added C18 and C19; replaced L1 with R1 and L2 with L1, p. 10 Modifications to Fig. 10, Table 10 and Fig. 11 will improve stability of the test circuit and improve performance under a modulated signal, p. 9, 10

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