Replaced by MRF9045NR1/NBR1. There are no form, fit or function changes with this part replacement. N suffix added to part number to indicate transition to lead-free terminations.

MRF9045MR1
MRF9045MBR1

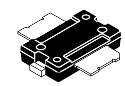
RF Power Field Effect Transistors

N-Channel Enhancement-Mode Lateral MOSFETs

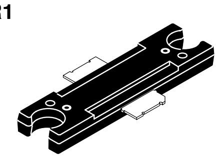
Designed for broadband commercial and industrial applications with frequencies up to 1000 MHz. The high gain and broadband performance of these devices make them ideal for large-signal, common-source amplifier applications in 28 volt base station equipment.

- Typical Performance at 945 MHz, 28 Volts
  Output Power — 45 Watts PEP
  Power Gain — 19 dB
  Efficiency — 41% (Two Tones)
  IMD — -31 dBc
- Integrated ESD Protection
- Guaranteed Ruggedness @ Load VSWR = 5:1, @ 28 Vdc, 945 MHz, 45 Watts CW Output Power
- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Dual-Lead Boltdown Plastic Package Can Also Be Used As Surface Mount.
- 200°C Capable Plastic Package
- TO-272 Available in Tape and Reel. R1 Suffix = 500 Units per 44 mm, 13 inch Reel.
- TO-270 Available in Tape and Reel. R1 Suffix = 500 Units per 24 mm, 13 inch Reel.

945 MHz, 45 W, 28 V
LATERAL N-CHANNEL
BROADBAND
RF POWER MOSFETs



CASE 1265-08, STYLE 1
TO-270
PLASTIC
MRF9045MR1



CASE 1337-03, STYLE 1
TO-272 DUAL LEAD
PLASTIC
MRF9045MBR1

Table 1. Maximum Ratings

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	- 0.5, +65	Vdc
Gate-Source Voltage	V_{GS}	- 0.5, + 15	Vdc
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	177 1.18	W W/°C
Storage Temperature Range	T_{stg}	- 65 to +150	°C
Operating Junction Temperature	T_J	200	°C

Table 2. Thermal Characteristics

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.85	°C/W

Table 3. ESD Protection Characteristics

Test Conditions	Class
Human Body Model	1 (Minimum)
Machine Model	M2 (Minimum)

Table 4. Moisture Sensitivity Level

Test Methodology	Rating	Package Peak Temperature	Unit
Per JESD 22-A113, IPC/JEDEC J-STD-020	3	260	°C

NOTE - **CAUTION** - MOS devices are susceptible to damage from electrostatic charge. Reasonable precautions in handling and packaging MOS devices should be observed.

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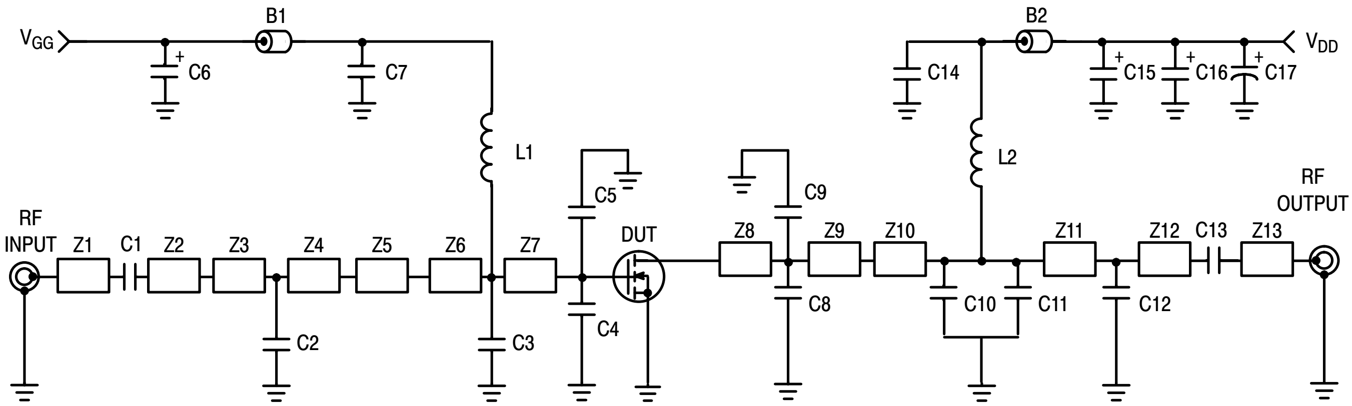
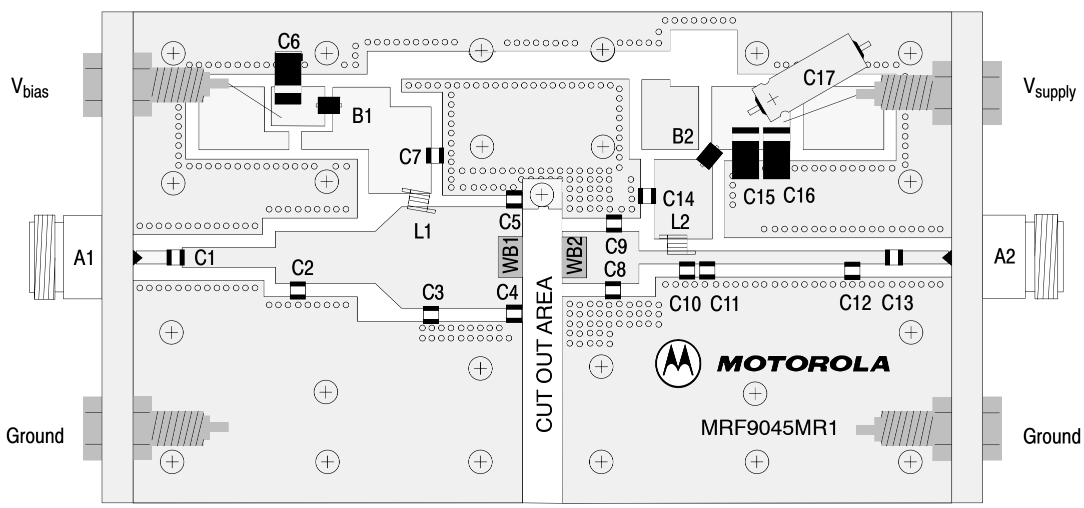
Table 5. Electrical Characteristics (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Off Characteristics					
Zero Gate Voltage Drain Leakage Current (V_{DS} = 65 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	10	μAdc
Zero Gate Voltage Drain Leakage Current (V_{DS} = 28 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	1	μAdc
Gate-Source Leakage Current (V_{GS} = 5 Vdc, V_{DS} = 0 Vdc)	I_{GSS}	—	—	1	μAdc
On Characteristics					
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 150 μAdc)	$V_{GS(th)}$	2	2.8	4	Vdc
Gate Quiescent Voltage (V_{DS} = 28 Vdc, I_D = 350 mAdc)	$V_{GS(Q)}$	3	3.7	5	Vdc
Drain-Source On-Voltage (V_{GS} = 10 Vdc, I_D = 1 Adc)	$V_{DS(on)}$	—	0.22	0.4	Vdc
Forward Transconductance (V_{DS} = 10 Vdc, I_D = 3 Adc)	g_{fs}	—	4	—	S
Dynamic Characteristics					
Input Capacitance (V_{DS} = 28 Vdc ± 30 mV(rms)ac @ 1 MHz, V_{GS} = 0 Vdc)	C_{iss}	—	70	—	pF
Output Capacitance (V_{DS} = 28 Vdc ± 30 mV(rms)ac @ 1 MHz, V_{GS} = 0 Vdc)	C_{oss}	—	38	—	pF
Reverse Transfer Capacitance (V_{DS} = 28 Vdc ± 30 mV(rms)ac @ 1 MHz, V_{GS} = 0 Vdc)	C_{rss}	—	1.7	—	pF
Functional Tests (In Freescale Test Fixture, 50 ohm system)					
Two-Tone Common-Source Amplifier Power Gain (V_{DD} = 28 Vdc, P_{out} = 45 W PEP, I_{DQ} = 350 mA, f1 = 945.0 MHz, f2 = 945.1 MHz)	G_{ps}	17	19	—	dB
Two-Tone Drain Efficiency (V_{DD} = 28 Vdc, P_{out} = 45 W PEP, I_{DQ} = 350 mA, f1 = 945.0 MHz, f2 = 945.1 MHz)	η	38	41	—	%
3rd Order Intermodulation Distortion (V_{DD} = 28 Vdc, P_{out} = 45 W PEP, I_{DQ} = 350 mA, f1 = 945.0 MHz, f2 = 945.1 MHz)	IMD	—	-31	-28	dBc
Input Return Loss (V_{DD} = 28 Vdc, P_{out} = 45 W PEP, I_{DQ} = 350 mA, f1 = 945.0 MHz, f2 = 945.1 MHz)	IRL	—	-14	-9	dB
Two-Tone Common-Source Amplifier Power Gain (V_{DD} = 28 Vdc, P_{out} = 45 W PEP, I_{DQ} = 350 mA, f1 = 930.0 MHz, f2 = 930.1 MHz and f1 = 960.0 MHz, f2 = 960.1 MHz)	G_{ps}	—	19	—	dB
Two-Tone Drain Efficiency (V_{DD} = 28 Vdc, P_{out} = 45 W PEP, I_{DQ} = 350 mA, f1 = 930.0 MHz, f2 = 930.1 MHz and f1 = 960.0 MHz, f2 = 960.1 MHz)	η	—	41	—	%
3rd Order Intermodulation Distortion (V_{DD} = 28 Vdc, P_{out} = 45 W PEP, I_{DQ} = 350 mA, f1 = 930.0 MHz, f2 = 930.1 MHz and f1 = 960.0 MHz, f2 = 960.1 MHz)	IMD	—	-31	—	dBc
Input Return Loss (V_{DD} = 28 Vdc, P_{out} = 45 W PEP, I_{DQ} = 350 mA, f1 = 930.0 MHz, f2 = 930.1 MHz and f1 = 960.0 MHz, f2 = 960.1 MHz)	IRL	—	-13	—	dB



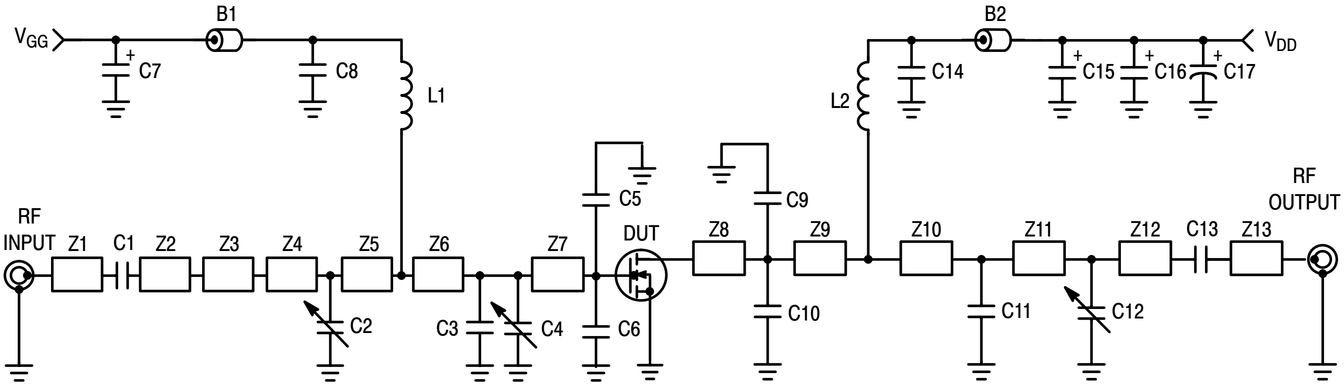
B1, B2	Short Ferrite Beads, Surface Mount
C1, C7, C13, C14	47 pF Chip Capacitors
C2, C8	2.7 pF Chip Capacitors
C3	3.9 pF Chip Capacitor
C4, C5, C8, C9	10 pF Chip Capacitors
C6, C15, C16	10 μF, 35 V Tantalum Surface Mount Capacitors
C10	2.2 pF Chip Capacitor
C11	4.7 pF Chip Capacitor
C12	1.2 pF Chip Capacitor
C17	220 μF, 50 V Electrolytic Capacitor
L1, L2	12.5 nH Inductors
Z1	0.20″ x 0.08″ Microstrip
Z2	0.57″ x 0.12″ Microstrip
Z3	0.14″ x 0.32″ Microstrip
Z4	0.47″ x 0.32″ Microstrip
Z5	0.16″ x 0.32″ x 0.62″ Taper
Z6	0.18″ x 0.62″ Microstrip
Z7	0.56″ x 0.62″ Microstrip
Z8	0.33″ x 0.32″ Microstrip
Z9	0.14″ x 0.32″ Microstrip
Z10	0.36″ x 0.08″ Microstrip
Z11	1.01″ x 0.08″ Microstrip
Z12	0.15″ x 0.08″ Microstrip
Z13	0.29″ x 0.08″ Microstrip

Figure 1. MRF9045MR1(MBR1) 930-960 MHz Broadband Test Circuit Schematic



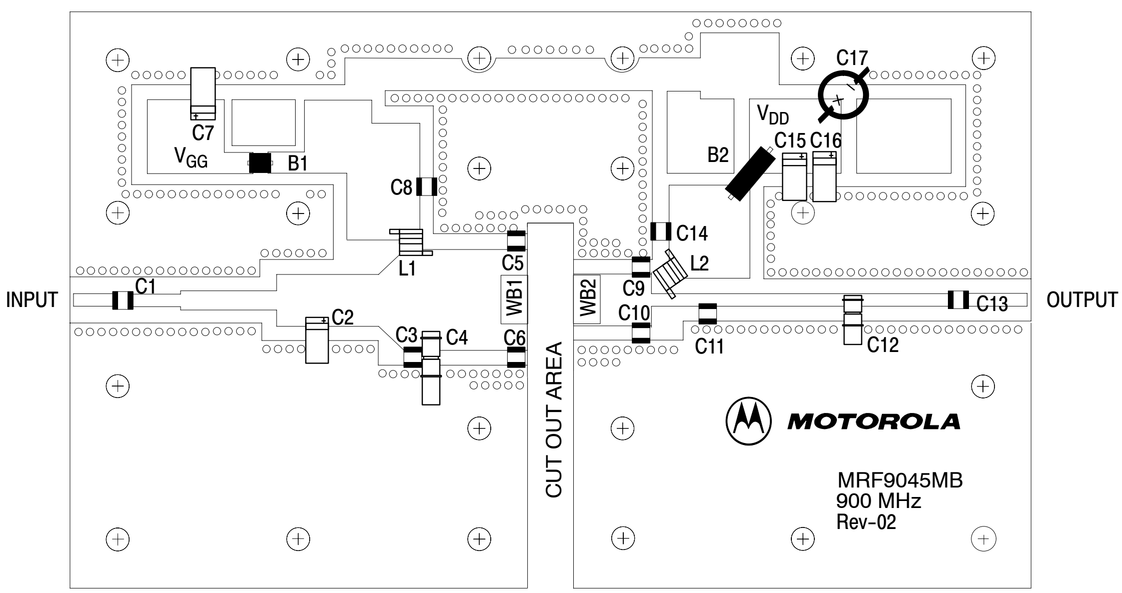
Freescale has begun the transition of marking Printed Circuit Boards (PCBs) with the Freescale Semiconductor signature/logo. PCBs may have either Motorola or Freescale markings during the transition period. These changes will have no impact on form, fit or function of the current product.

Figure 2. MRF9045MR1(MBR1) 930-960 MHz Broadband Test Circuit Component Layout



B1	Short Ferrite Bead	Z1	0.260″ x 0.060″ Microstrip
B2	Long Ferrite Bead	Z2	0.240″ x 0.060″ Microstrip
C1, C8, C13, C14	47 pF Chip Capacitors	Z3	0.500″ x 0.100″ Microstrip
C2	0.4-2.5 pF Variable Capacitor, Johanson Gigatrim	Z4	0.215″ x 0.270″ Microstrip
C3	3.6 pF Chip Capacitor	Z5	0.315″ x 0.270″ Microstrip
C4	0.8-8.0 pF Variable Capacitor, Johanson Gigatrim	Z6	0.160″ x 0.270″ x 0.520″ Taper
C5, C6, C9, C10	10 pF Chip Capacitors	Z7	0.285″ x 0.520″ Microstrip
C7, C15, C16	10 μF, 35 V Tantalum Chip Capacitors	Z8	0.140″ x 0.270″ Microstrip
C11	7.5 pF Chip Capacitor	Z9	0.450″ x 0.270″ Microstrip
C12	0.6-4.5 pF Variable Capacitor, Johanson Gigatrim	Z10	0.250″ x 0.060″ Microstrip
C17	220 μF Electrolytic Chip Capacitor	Z11	0.720″ x 0.060″ Microstrip
L1, L2	12.5 nH Surface Mount Inductors	Z12	0.490″ x 0.060″ Microstrip
WB1, WB2	10 mil Brass Wear Blocks	Z13	0.290″ x 0.060″ Microstrip
		Board	Taconic RF-35-0300, ε_r = 3.5

Figure 3. MRF9045MR1(MBR1) 930-960 MHz Broadband Test Circuit Schematic



Freescale has begun the transition of marking Printed Circuit Boards (PCBs) with the Freescale Semiconductor signature/logo. PCBs may have either Motorola or Freescale markings during the transition period. These changes will have no impact on form, fit or function of the current product.

Figure 4. MRF9045MR1(MBR1) 930-960 MHz Broadband Test Circuit Component Layout

TYPICAL CHARACTERISTICS

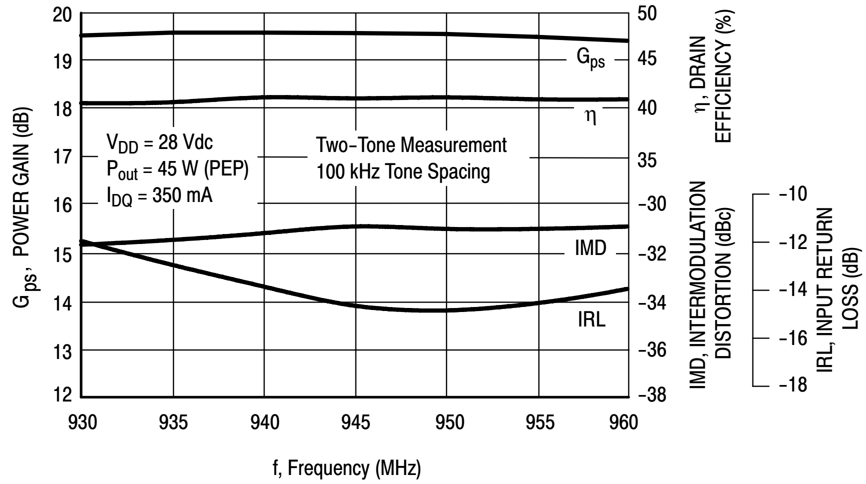


Figure 5. Class AB Broadband Circuit Performance

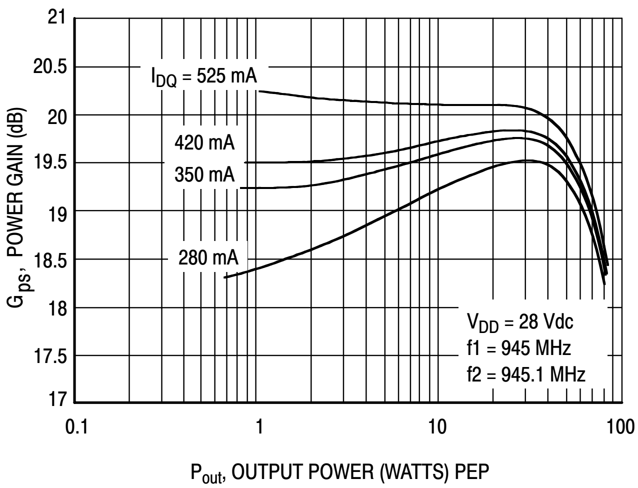


Figure 6. Power Gain versus Output Power

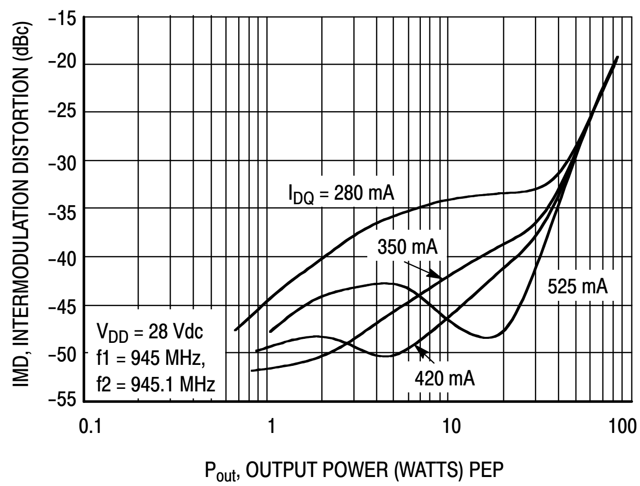


Figure 7. Intermodulation Distortion versus Output Power

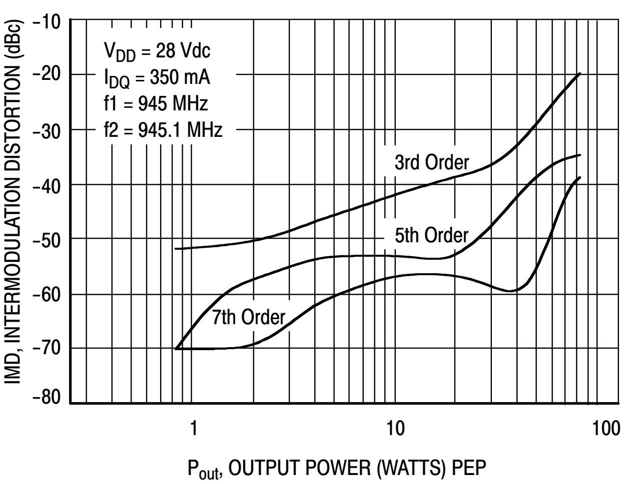


Figure 8. Intermodulation Distortion Products versus Output Power

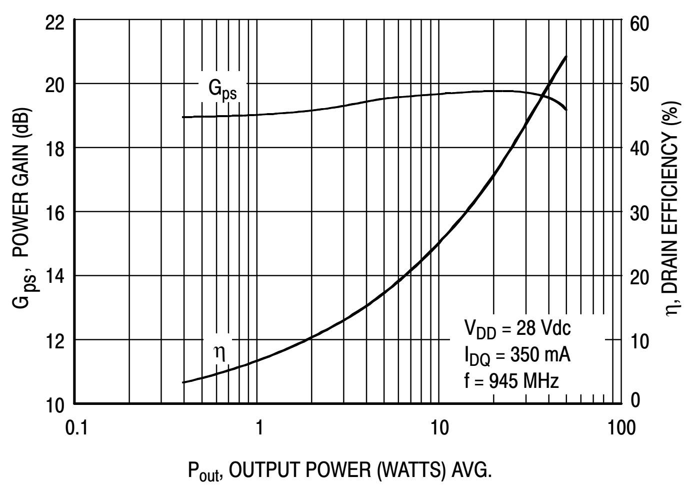


Figure 9. Power Gain and Efficiency versus Output Power

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TYPICAL CHARACTERISTICS

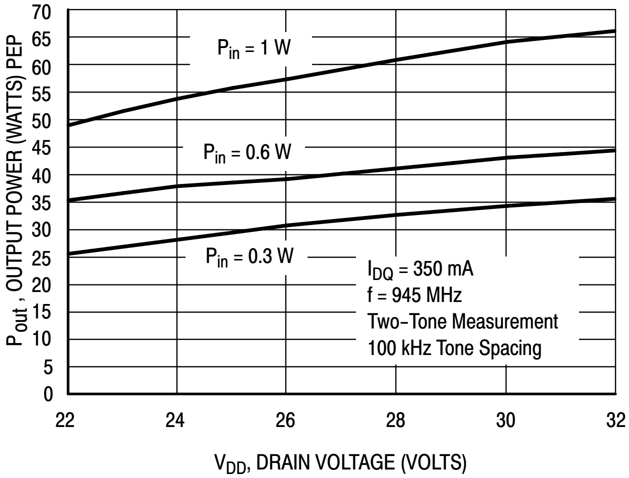


Figure 10. Output Voltage versus Supply Voltage (MRF9045MR1)

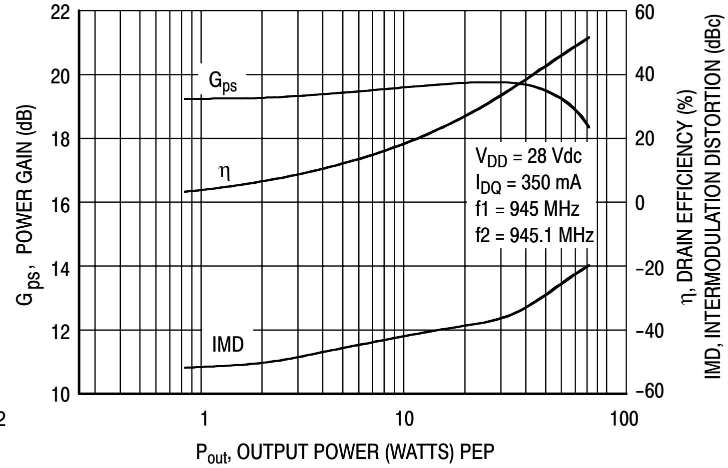
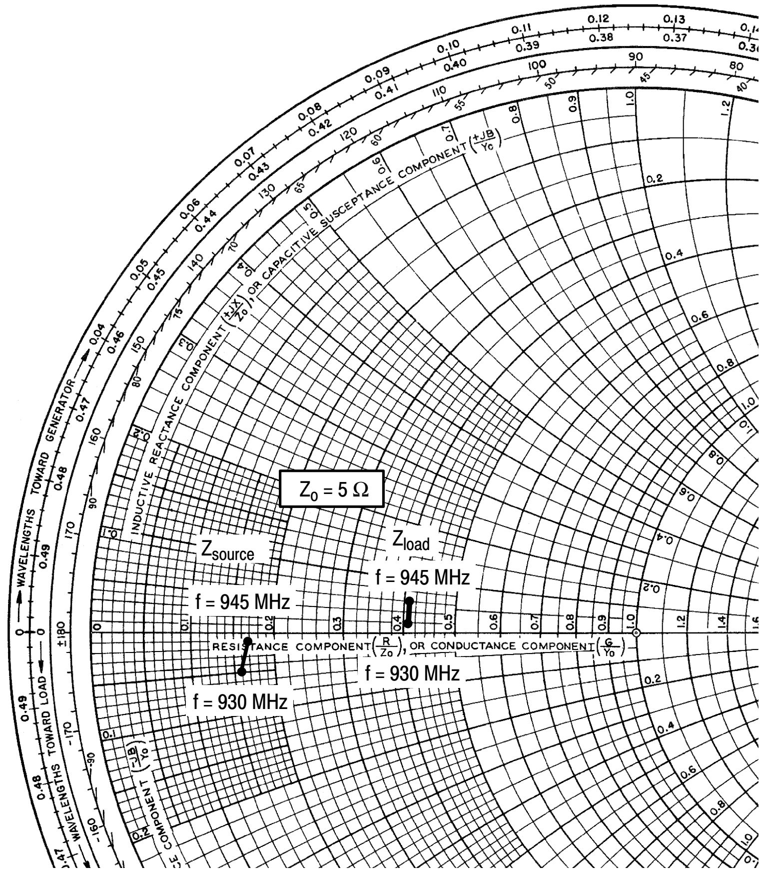


Figure 11. Power Gain, Efficiency and IMD versus Output Power (MRF9045MBR1)



V_{DD} = 28 V, I_{DQ} = 350 mA, P_{out} = 45 W (PEP)

f MHz	Z_{source} Ω	Z_{load} Ω
930	0.81 - j0.25	2.03 + j0.09
945	0.85 - j0.05	2.03 + j0.28

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

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

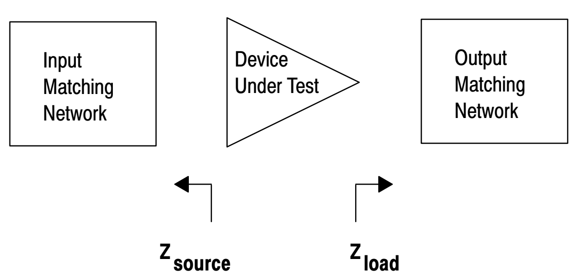
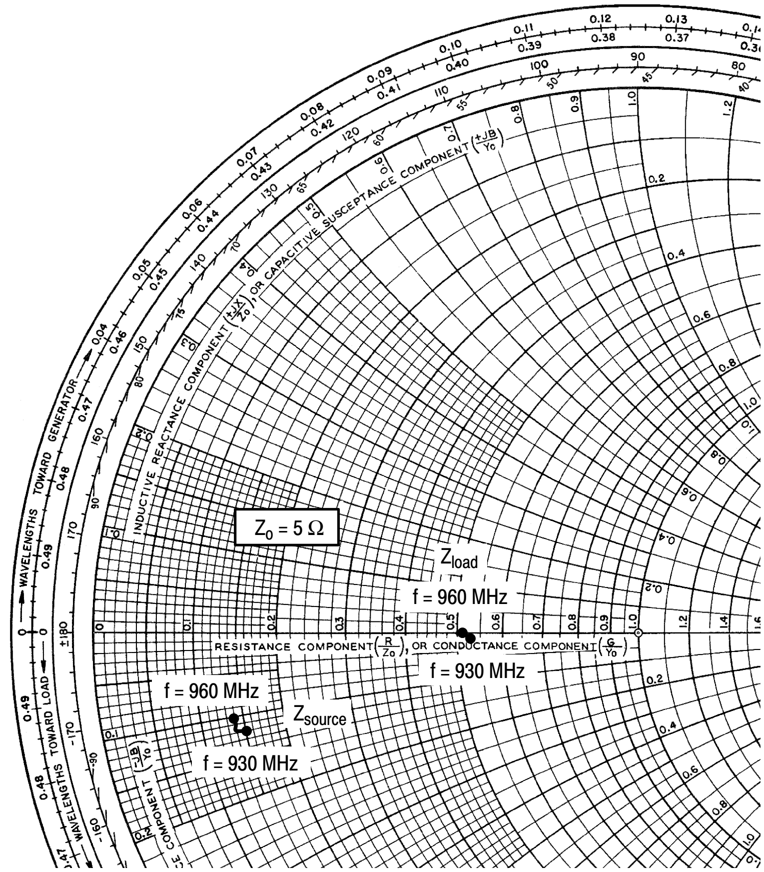


Figure 12. Series Equivalent Source and Load Impedance (MRF9045MR1)



V_{DD} = 28 V, I_{DQ} = 350 mA, P_{out} = 45 W (PEP)

f MHz	Z_{source} Ω	Z_{load} Ω
930	0.75 - j0.6	2.65 - j0.05
945	0.72 - j0.6	2.60 - j0.05
960	0.70 - j0.5	2.55 - j0.02

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

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

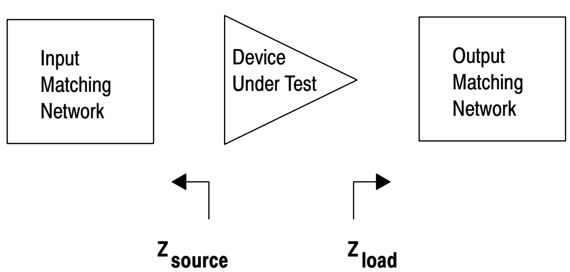


Figure 13. Series Equivalent Source and Load Impedance (MRF9045MBR1)

NOTES

NOTES

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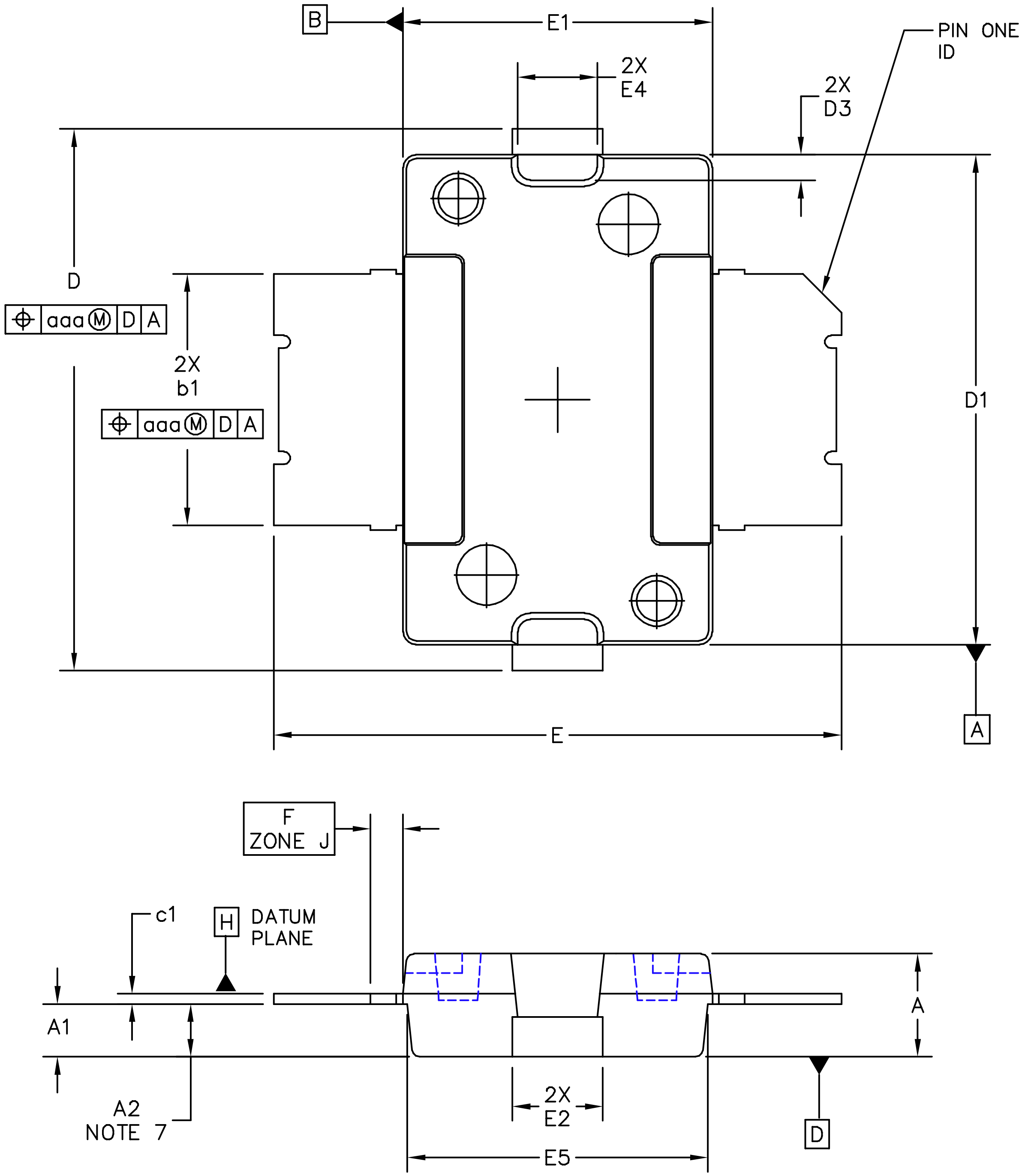
PACKAGE DIMENSIONS



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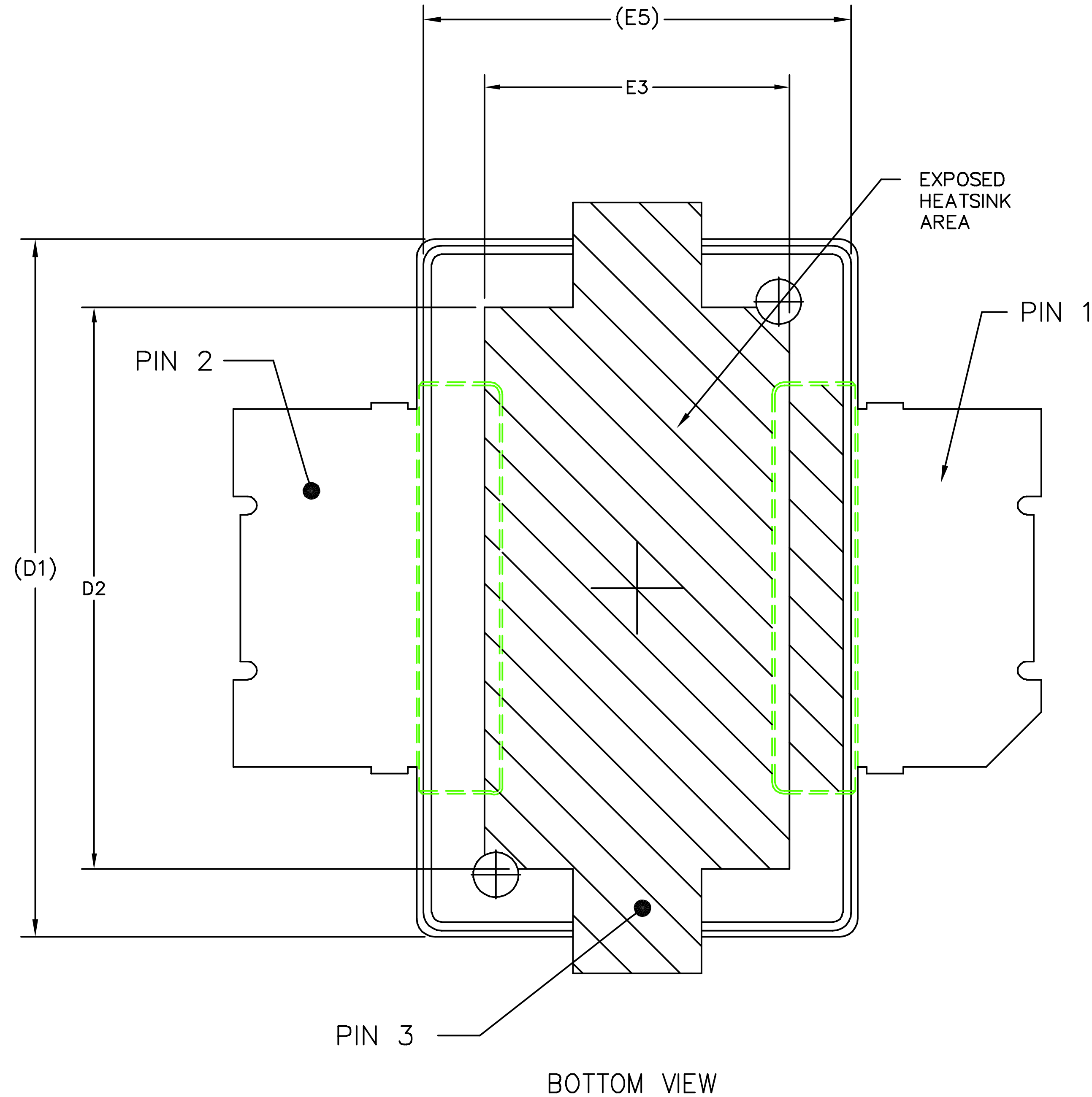
TITLE: TO−270 SURFACE MOUNT	DOCUMENT NO: 98ASH98117A		REV: J
	CASE NUMBER: 1265−08		01 APR 2005
	STANDARD: NON−JEDEC		



	MECHANICAL OUTLINE	PRINT VERSION NOT TO SCALE
TITLE: TO-270 SURFACE MOUNT	DOCUMENT NO: 98ASH98117A	REV: J
	CASE NUMBER: 1265-08	01 APR 2005
	STANDARD: NON-JEDEC	

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.

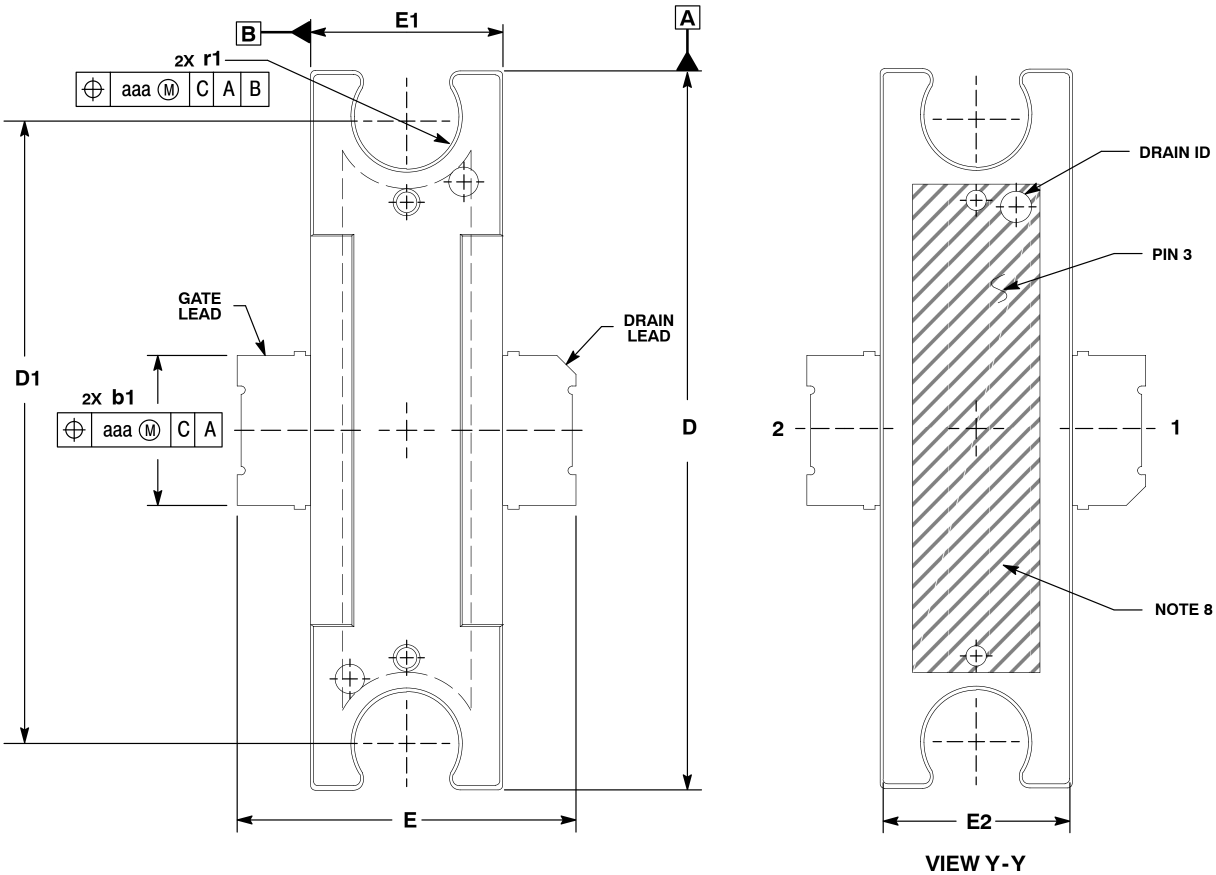
8. DIMENSIONS "D" AND "E2" DO NOT INCLUDE MOLD PROTRUSION. OVERALL LENGTH INCLUDING MOLD PROTRUSION SHOULD NOT EXCEED 0.430 INCH FOR DIMENSION "D" AND 0.080 INCH FOR DIMENSION "E2". DIMENSIONS "D" AND "E2" DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE –D–.

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

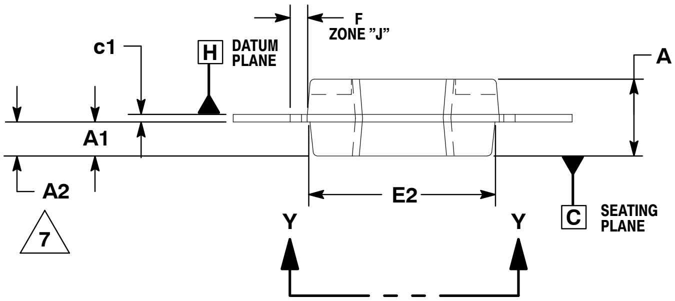
DIM	INCH MIN	INCH MAX	MILLIMETER MIN	MILLIMETER MAX	DIM	INCH MIN	INCH MAX	MILLIMETER MIN	MILLIMETER MAX
A	.078	.082	1.98	2.08	F	.025 BSC		0.64 BSC	
A1	.039	.043	0.99	1.09	b1	.193	.199	4.90	5.06
A2	.040	.042	1.02	1.07	c1	.007	.011	0.18	0.28
D	.416	.424	10.57	10.77	aaa	.004		0.10	
D1	.378	.382	9.60	9.70					
D2	.290	.320	7.37	8.13					
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	.180	3.81	4.57					
E4	.058	.066	1.47	1.68					
E5	.231	.235	5.87	5.97					

MECHANICAL OUTLINE | PRINT VERSION NOT TO SCALE

TITLE: TO–270 SURFACE MOUNT	DOCUMENT NO: 98ASH98117A	REV: J
	CASE NUMBER: 1265–08	01 APR 2005
	STANDARD: NON–JEDEC	



VIEW Y-Y



NOTES:
1. CONTROLLING DIMENSION: INCH.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
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6. DATUMS -A- AND -B- TO BE DETERMINED AT DATUM PLANE -H-.
7. DIMENSION A2 APPLIES WITHIN ZONE "J" ONLY.
8. CROSSHATCHING REPRESENTS THE EXPOSED AREA OF THE HEAT SLUG.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	.100	.104	2.54	2.64
A1	.039	.043	0.99	1.09
A2	.040	.042	1.02	1.07
D	.928	.932	23.57	23.67
D1	.810 BSC		20.57 BSC	
E	.438	.442	11.12	11.23
E1	.248	.252	6.30	6.40
E2	.241	.245	6.12	6.22
F	.025 BSC		0.64 BSC	
b1	.193	.199	4.90	5.05
c1	.007	.011	.18	.28
r1	.063	.068	1.60	1.73
aaa	.004		.10	

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

CASE 1337-03
ISSUE C
TO-272 DUAL LEAD PLASTIC
MRF9045MBR1

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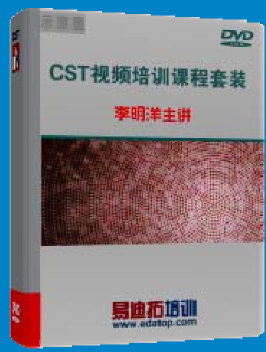
MRF9045MR1
Rev. 9, 5/2006

CST 学习培训课程套装



该培训套装由易迪拓培训联合微波 EDA 网共同推出，是最全面、系统、专业的 CST 微波工作室培训课程套装，所有课程都由经验丰富的专家授课，视频教学，可以帮助您从零开始，全面系统地学习 CST 微波工作的各项功能及其在微波射频、天线设计等领域的设计应用。且购买该套装，还可超值赠送 3 个月免费学习答疑…

课程网址：http://www.edatop.com/peixun/cst/24.html

HFSS 天线设计培训课程套装

套装包含 6 门视频课程和 1 本图书，课程从基础讲起，内容由浅入深，理论介绍和实际操作讲解相结合，全面系统的讲解了 HFSS 天线设计的全过程。是国内最全面、最专业的 HFSS 天线设计课程，可以帮助您快速学习掌握如何使用 HFSS 设计天线，让天线设计不再难…

课程网址：http://www.edatop.com/peixun/hfss/122.html

13.56MHz NFC/RFID 线圈天线设计培训课程套装

套装包含 4 门视频培训课程，培训将 13.56MHz 线圈天线设计原理和仿真设计实践相结合，全面系统地讲解了 13.56MHz 线圈天线的工作原理、设计方法、设计考量以及使用 HFSS 和 CST 仿真分析线圈天线的具体操作，同时还介绍了 13.56MHz 线圈天线匹配电路的设计和调试。通过该套课程的学习，可以帮助您快速学习掌握 13.56MHz 线圈天线及其匹配电路的原理、设计和调试…

详情浏览：http://www.edatop.com/peixun/antenna/116.html

我们的课程优势：

※ 成立于 2004 年，10 多年丰富的行业经验，

※ 一直致力并专注于微波射频和天线设计工程师的培养，更了解该行业对人才的要求

※ 经验丰富的一线资深工程师讲授，结合实际工程案例，直观、实用、易学

联系我们：

※ 易迪拓培训官网：http://www.edatop.com

※ 微波 EDA 网：http://www.mweda.com

※ 官方淘宝店：http://shop36920890.taobao.com