



# RF Power Field Effect Transistor

## N-Channel Enhancement-Mode Lateral MOSFETs

Designed primarily for pulsed wideband large-signal output and driver applications with frequencies up to 450 MHz. Devices are unmatched and are suitable for use in industrial, medical and scientific applications.

- Typical CW Performance at 220 MHz:  $V_{DD} = 50$  Volts,  $I_{DQ} = 35$  mA,  $P_{out} = 10$  Watts  
     Power Gain — 25 dB  
     Drain Efficiency — 68%
- Capable of Handling 10:1 VSWR, @ 50 Vdc, 210 MHz, 10 Watts CW Output Power

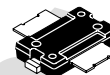
### Features

- Integrated ESD Protection
- Excellent Thermal Stability
- Facilitates Manual Gain Control, ALC and Modulation Techniques
- 225°C Capable Plastic Package
- RoHS Compliant

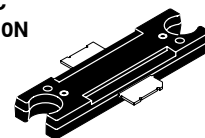
**MRF6V2010N**  
**MRF6V2010NB**

PREPRODUCTION

**10-450 MHz, 10 W, 50 V**  
**LATERAL N-CHANNEL**  
**BROADBAND**  
**RF POWER MOSFETs**



**CASE 1265-08, STYLE 1**  
**TO-270-2**  
**PLASTIC**  
**MRF6V2010N**



**CASE 1337-03, STYLE 1**  
**TO-272-2**  
**PLASTIC**  
**MRF6V2010NB**

**Table 1. Maximum Ratings**

Rating	Symbol	Value	Unit
Drain-Source Voltage	$V_{DSS}$	-0.5, +110	Vdc
Gate-Source Voltage	$V_{GS}$	-0.5, +10	Vdc
Storage Temperature Range	$T_{stg}$	- 65 to +150	°C
Operating Junction Temperature (1,2)	$T_J$	225	°C

**Table 2. Thermal Characteristics**

Characteristic	Symbol	Value (3)	Unit
Thermal Resistance, Junction to Case Case Temperature TBD°C, TBD W CW Case Temperature TBD°C, TBD W CW	$R_{\theta JC}$	TBD TBD	°C/W

**Table 3. ESD Protection Characteristics**

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

1. Continuous use at maximum temperature will affect MTTF.
2. MTTF calculator available at <http://www.freescale.com/rf>. Select Tools/Software/Application Software/Calculators to access the MTTF calculators by product. (Calculator available when part is in production.)
3. Refer to AN1955, *Thermal Measurement Methodology of RF Power Amplifiers*. Go to <http://www.freescale.com/rf>. Select Documentation/Application Notes - AN1955.

This document contains information on a preproduction product. Specifications and information herein are subject to change without notice.

**Table 4. Moisture Sensitivity Level**

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

**Table 5. Electrical Characteristics** ( $T_C = 25^\circ\text{C}$  unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
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**Off Characteristics**

Zero Gate Voltage Drain Leakage Current ( $V_{DS} = 110\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ )	$I_{DSS}$	—	—	10	$\mu\text{Adc}$
Zero Gate Voltage Drain Leakage Current ( $V_{DS} = 50\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ )	$I_{DSS}$	—	—	10	$\mu\text{Adc}$
Drain-Source Breakdown Voltage ( $I_D = 5\text{ mA}$ , $V_{GS} = 0\text{ Vdc}$ )	$BV_{DSS}$	110	—	—	Vdc
Gate-Source Leakage Current ( $V_{GS} = 5\text{ Vdc}$ , $V_{DS} = 0\text{ Vdc}$ )	$I_{GSS}$	—	—	10	$\mu\text{Adc}$

**On Characteristics**

Gate Threshold Voltage ( $V_{DS} = 10\text{ Vdc}$ , $I_D = 28\ \mu\text{Adc}$ )	$V_{GS(th)}$	—	2.4	—	Vdc
Drain-Source On-Voltage ( $V_{GS} = 10\text{ Vdc}$ , $I_D = 70\text{ mAdc}$ )	$V_{DS(on)}$	—	0.3	—	Vdc

**Dynamic Characteristics**

Reverse Transfer Capacitance ( $V_{DS} = 50\text{ Vdc} \pm 30\text{ mV(rms)ac}$ @ 1 MHz, $V_{GS} = 0\text{ Vdc}$ )	$C_{rss}$	—	0.27	—	pF
Output Capacitance ( $V_{DS} = 50\text{ Vdc} \pm 30\text{ mV(rms)ac}$ @ 1 MHz, $V_{GS} = 0\text{ Vdc}$ )	$C_{oss}$	—	6.6	—	pF
Input Capacitance ( $V_{DS} = 50\text{ Vdc} \pm 30\text{ mV(rms)ac}$ @ 1 MHz, $V_{GS} = 0\text{ Vdc}$ )	$C_{iss}$	—	15	—	pF

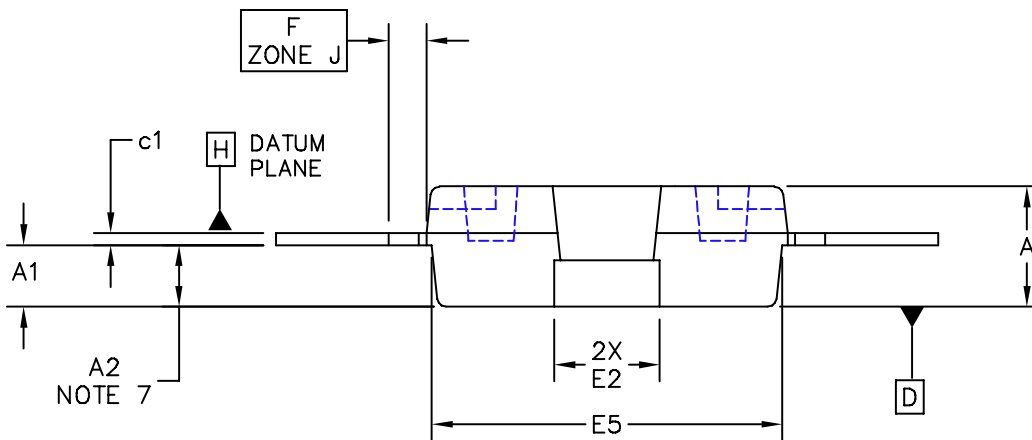
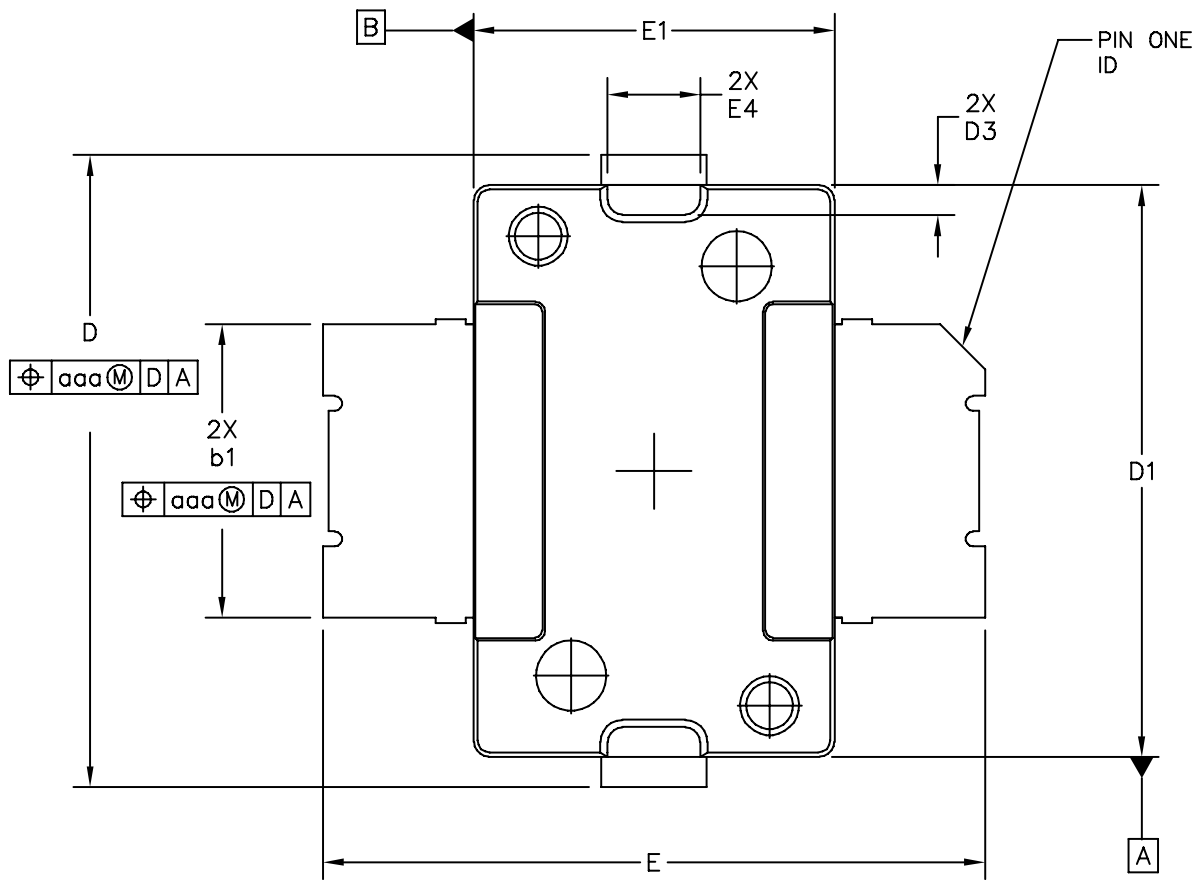
**Functional Tests** (In Freescale Test Fixture, 50 ohm system)  $V_{DD} = 50\text{ Vdc}$ ,  $I_{DQ} = 35\text{ mA}$ ,  $P_{out} = 10\text{ W}$ ,  $f = 220\text{ MHz}$ , CW

Power Gain	$G_{ps}$	—	25	—	dB
Drain Efficiency	$\eta_D$	—	68	—	%
Input Return Loss	IRL	—	-20	—	dB
$P_{out}$ @ 1 dB Compression Point, CW ( $f = 220\text{ MHz}$ )	P1dB	—	11	—	W

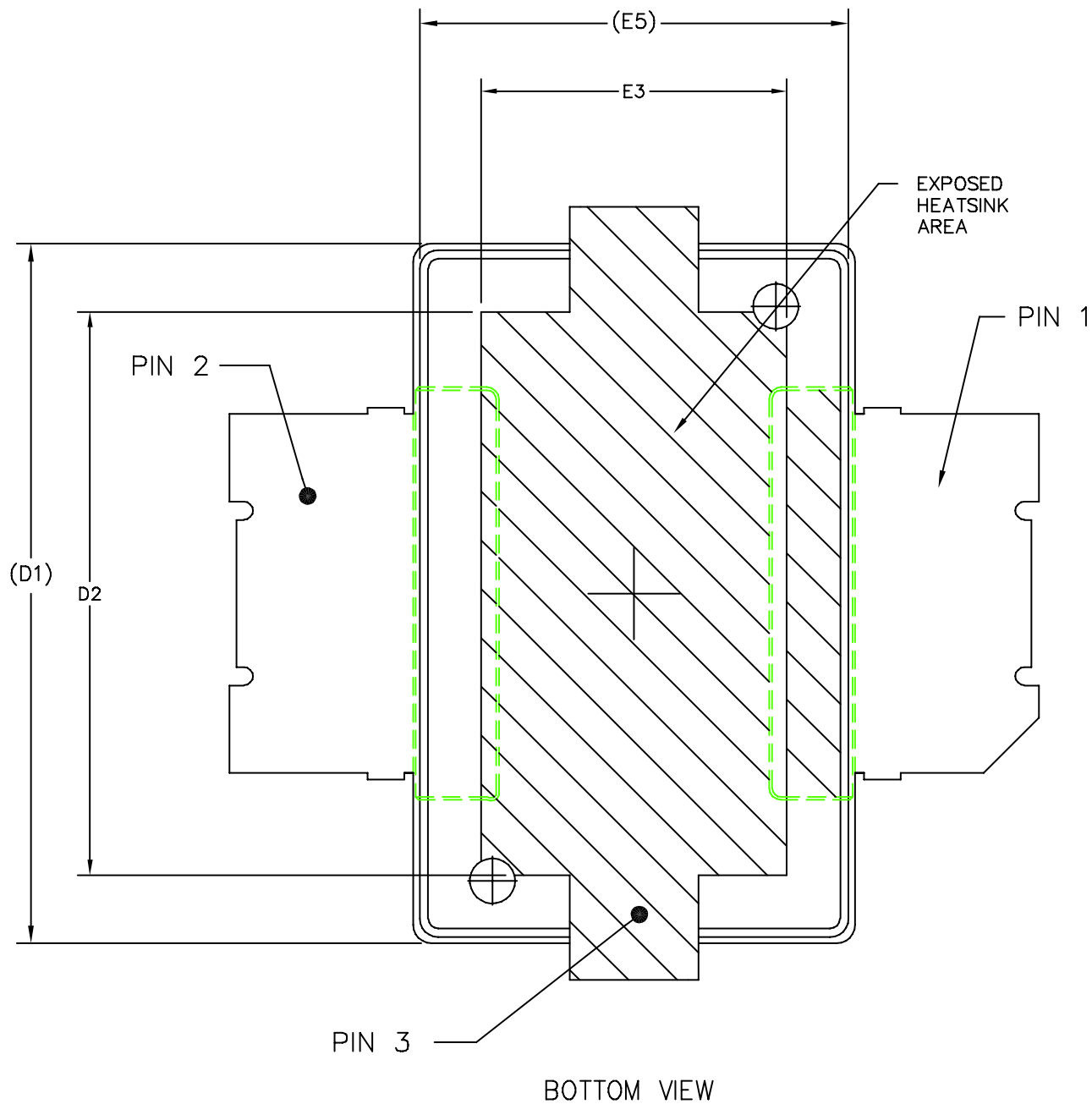


ATTENTION: The MRF6V2010N and MRF6V2010NB are high power devices and special considerations must be followed in board design and mounting. Incorrect mounting can lead to internal temperatures which exceed the maximum allowable operating junction temperature. Refer to Freescale Application Note AN3263 (for bolt down mounting) or AN1907 (for solder reflow mounting) **PRIOR TO STARTING SYSTEM DESIGN** to ensure proper mounting of these devices.

**PACKAGE DIMENSIONS**



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<p>TITLE: <b>TO-270 SURFACE MOUNT</b></p>	<p>DOCUMENT NO: 98ASH98117A</p>	<p>REV: J</p>	
	<p>CASE NUMBER: 1265-08</p>	<p>01 APR 2005</p>	
	<p>STANDARD: NON-JEDEC</p>		



BOTTOM VIEW

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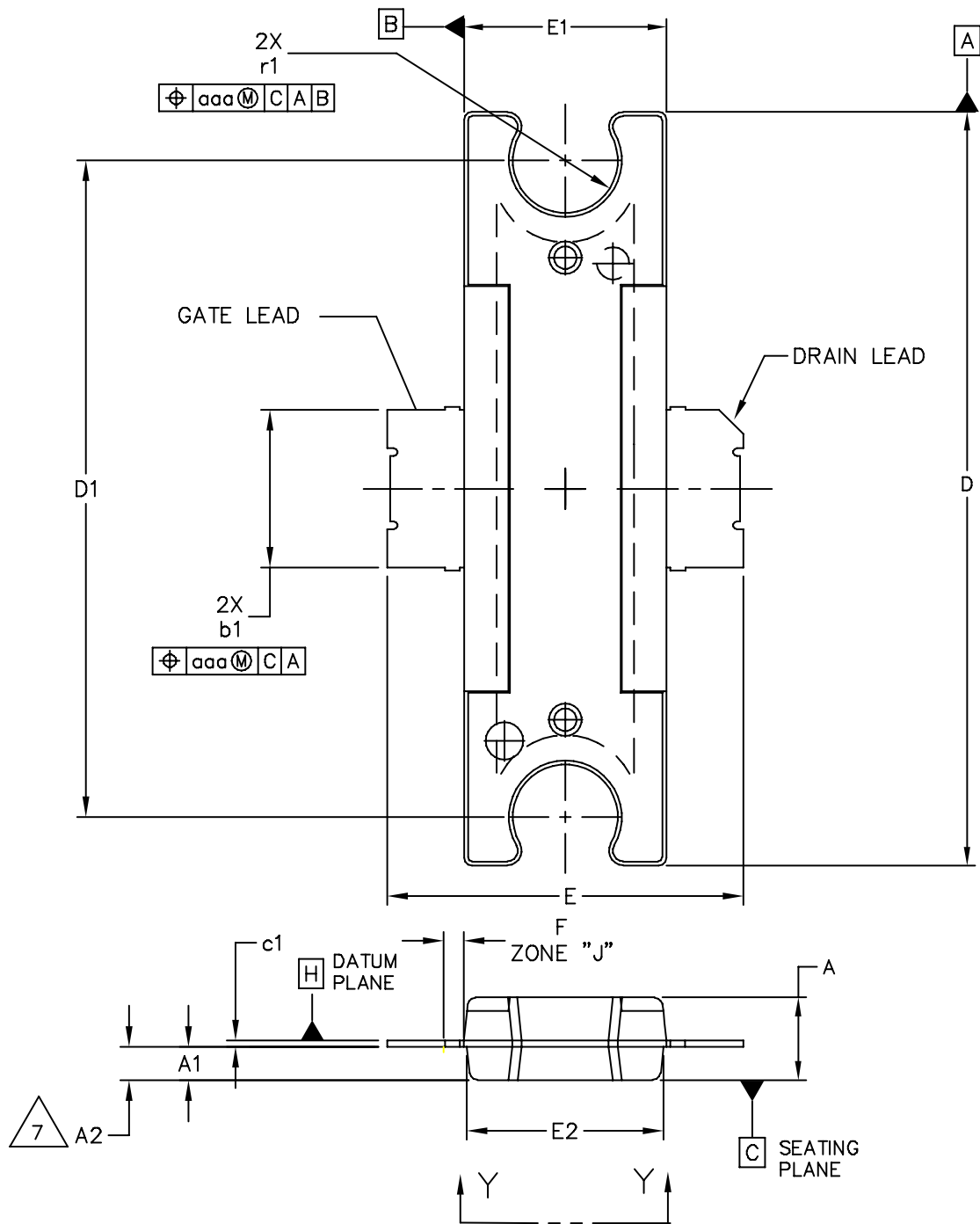
## NOTES:

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-.

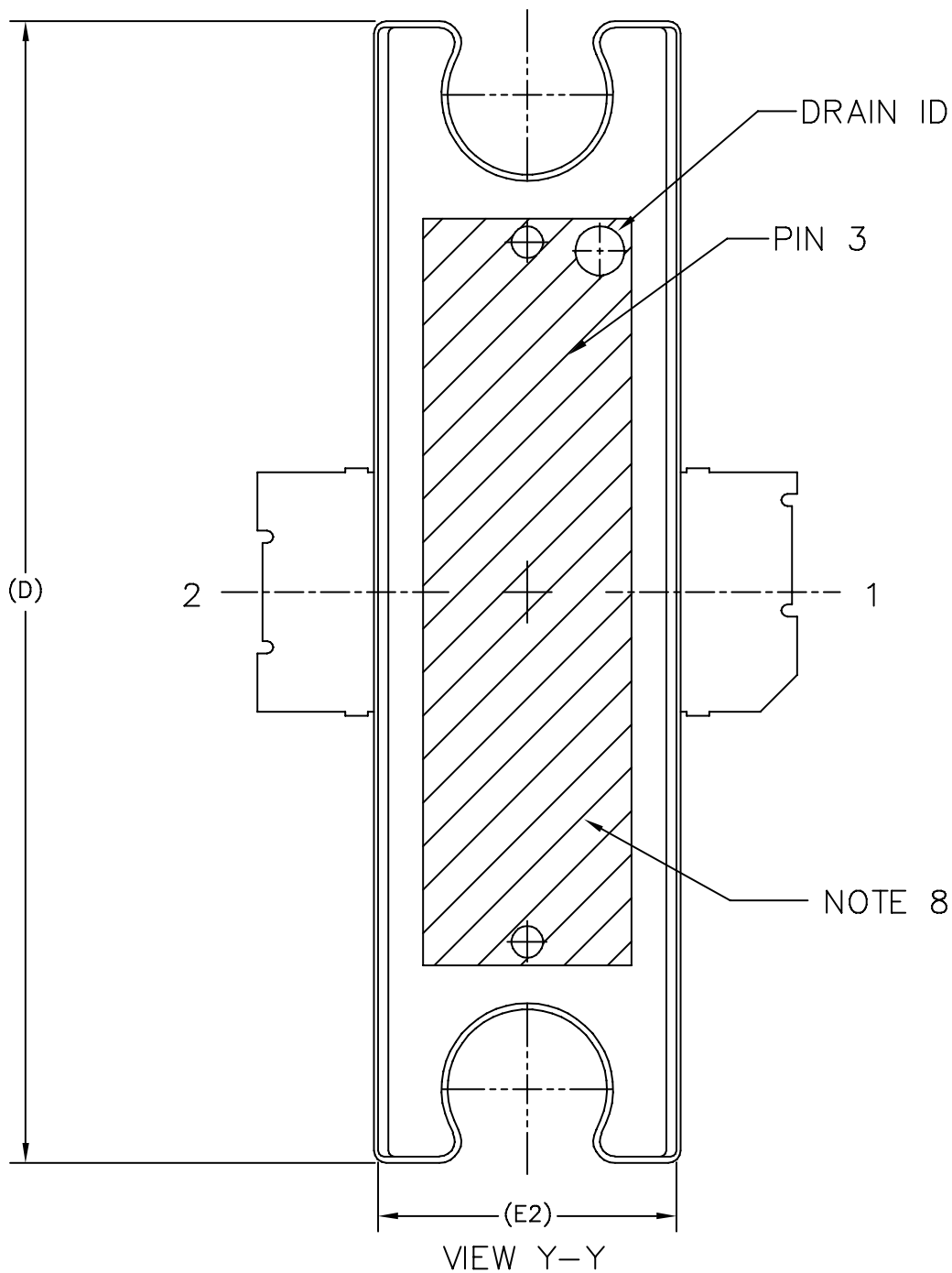
## STYLE 1:

PIN 1 - DRAIN  
 PIN 2 - GATE  
 PIN 3 - SOURCE

DIM	INCH		MILLIMETER		DIM	INCH		MILLIMETER	
	MIN	MAX	MIN	MAX		MIN	MAX	MIN	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					
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	CASE NUMBER: 1337-03			21 MAR 2005	
	STANDARD: NON-JEDEC				



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## NOTES:

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5. DIMENSIONS "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. HATCHING REPRESENTS THE EXPOSED AREA OF THE HEAT SLUG.

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

DIM	INCH		MILLIMETER		DIM	INCH		MILLIMETER	
	MIN	MAX	MIN	MAX		MIN	MAX	MIN	MAX
A	.100	.104	2.54	2.64	b1	.193	.199	4.90	5.05
A1	.039	.043	0.99	1.09	c1	.007	.011	.18	.28
A2	.040	.042	1.02	1.07	r1	.063	.068	1.60	1.73
D	.928	.932	23.57	23.67	aaa	.004		.10	
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						
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