Freescale Semiconductor
Technical Data

Document Number: MRF24300N
Rev. 0, 5/2016

RF Power LDMOS Transistor

N-Channel Enhancement-Mode Lateral MOSFET

This 300 W CW transistor is designed for industrial, scientific, medical (ISM) applications at 2450 MHz. This device is suitable for use in CW, pulse and linear applications. This high gain, high efficiency device is targeted to replace industrial magnetrons and will provide longer life and ease of use.

Typical Performance: In 2400–2500 MHz reference circuit, V_{DD} = 32 Vdc

Frequency (MHz)	Signal Type	P_{in} (W)	G_{ps} (dB)	η_D (%)	P_{out} (W)
2450	CW	15.9	13.1	60.5	320

Load Mismatch/Ruggedness

Frequency (MHz)	Signal Type	VSWR	P_{in} (W)	Test Voltage	Result
2450 (1)	CW	> 5:1 at all Phase Angles	15.0 (2 dB Overdrive)	32	No Device Degradation

1. Measured in 2450 MHz reference circuit.

Features

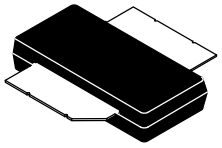
- Characterized with series equivalent large-signal impedance parameters
- Internally matched for ease of use
- Qualified for operation at 32 Vdc
- Integrated ESD protection
- Low thermal resistance

Target Applications

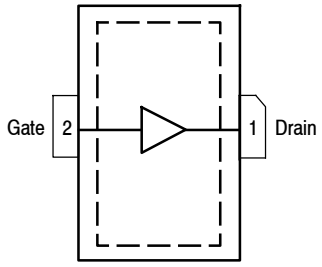
- Industrial heating:
  - Sterilization
  - Pasteurization
- Industrial drying
- Moisture-leveling process
- Curing
- Welding
- Heat sealing
- Microwave ablation
- Renal denervation
- Diathermy

MRF24300N

2450 MHz, 300 W CW, 32 V
RF POWER LDMOS TRANSISTOR



OM-780-2L
PLASTIC



(Top View)

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

Figure 1. Pin Connections

Table 1. Maximum Ratings

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	–0.5, +65	Vdc
Gate-Source Voltage	V_{GS}	–6.0, +10	Vdc
Operating Voltage	V_{DD}	32, +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	833 4.17	W W/°C

Table 2. Thermal Characteristics

Characteristic	Symbol	Value (2,3)	Unit
Thermal Resistance, Junction to Case Case Temperature 89°C, 300 W CW, 32 Vdc, I_{DQ} = 100 mA, 2450 MHz	$R_{\theta JC}$	0.24	°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)	B, passes 250 V
Charge Device Model (per JESD22-C101)	IV, passes 2000 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} = 65 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	10	μAdc
Zero Gate Voltage Drain Leakage Current (V_{DS} = 32 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 = 303 μAdc)	$V_{GS(th)}$	1.6	2.0	2.4	Vdc
Gate Quiescent Voltage (V_{DD} = 32 Vdc, I_D = 100 mAdc, Measured in Functional Test)	$V_{GS(Q)}$	—	2.5	—	Vdc
Drain-Source On-Voltage (V_{GS} = 10 Vdc, I_D = 3.7 Adc)	$V_{DS(on)}$	—	0.15	0.17	Vdc

1. Continuous use at maximum temperature will affect MTTF.
2. MTTF calculator available at http://www.nxp.com/RF/calculators.
3. Refer to AN1955, *Thermal Measurement Methodology of RF Power Amplifiers.* Go to http://www.nxp.com/RF and search for AN1955.

(continued)

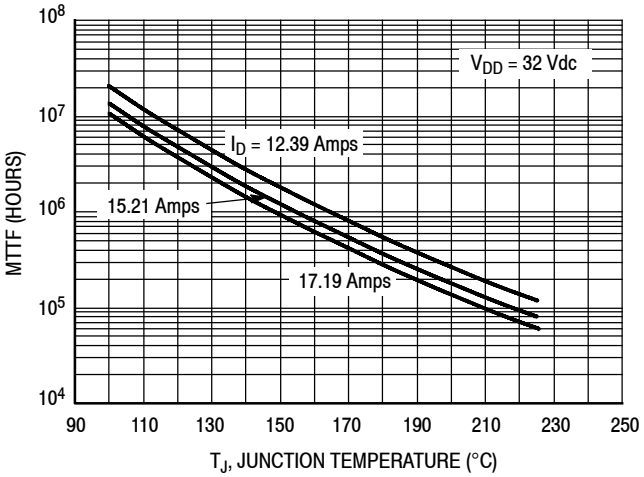
Table 5. Electrical Characteristics (T_A = 25°C unless otherwise noted) **(continued)**

Characteristic	Symbol	Min	Typ	Max	Unit
Functional Tests (In Freescale Production Test Fixture, 50 ohm system) V_{DD} = 32 Vdc, I_{DQ} = 100 mA, P_{in} = 10 W Peak (1 W Avg.), f = 2450 MHz, 100 μsec Pulse Width, 10% Duty Cycle					
Output Power	P_{out}	260	291	330	W
Drain Efficiency	η_D	52.0	56.9	—	%
Input Return Loss	IRL	—	–18	–9	dB

Table 6. Ordering Information

Device	Tape and Reel Information	Package
MRF24300NR3	R3 Suffix = 250 Units, 32 mm Tape Width, 13-inch Reel	OM-780-2L

TYPICAL CHARACTERISTICS



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

MTTF calculator available at http:/www.nxp.com/RF/calculators.

Figure 2. MTTF versus Junction Temperature – CW

2400–2500 MHz REFERENCE CIRCUIT — 2″ × 3″ (5.1 cm × 7.6 cm)

Table 7. 2450 MHz Performance (In Freescale 2400–2500 MHz Reference Circuit, 50 ohm system)
V_{DD} = 32 Vdc, I_{DQ} = 100 mA, T_A = 25°C

Frequency (MHz)	Signal Type	P_{in} (W)	G_{ps} (dB)	η_D (%)	P_{out} (W)
2450	CW	15.9	13.1	60.5	320

Table 8. Load Mismatch/Ruggedness (In Freescale Reference Circuit)

Frequency (MHz)	Signal Type	VSWR	P_{in} (W)	Test Voltage, V_{DD}	Result
2450	CW	> 5:1 at all Phase Angles	15.0 (2 dB Overdrive)	32	No Device Degradation

2400–2500 MHz REFERENCE CIRCUIT — 2″ × 3″ (5.1 cm × 7.6 cm)

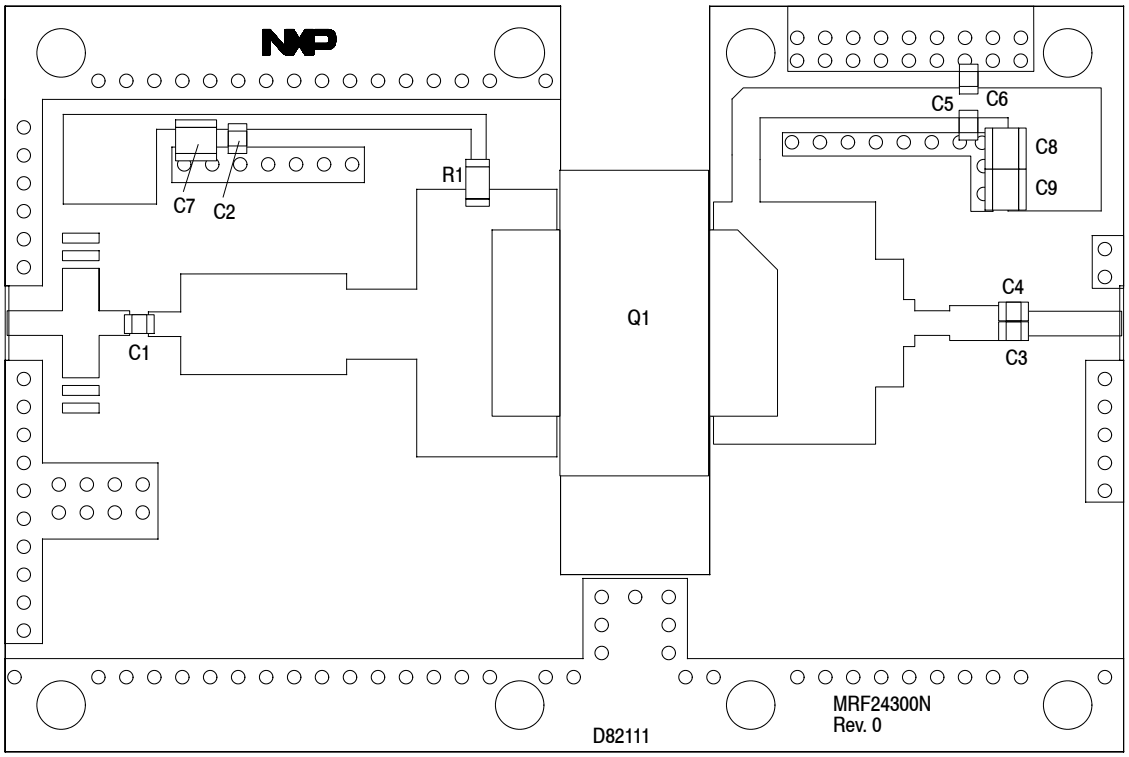


Figure 3. MRF24300N Reference Circuit Component Layout — 2400–2500 MHz

Table 9. MRF24300N Reference Circuit Component Designations and Values — 2400–2500 MHz

Part	Description	Part Number	Manufacturer
C1, C2, C3, C4, C5, C6	27 pF Chip Capacitors	ATC600F270JT250XT	ATC
C7, C8, C9	10 μF Chip Capacitors	GRM32ER61H106KA12L	Murata
Q1	RF Power LDMOS Transistor	MRF24300N	NXP
R1	10 Ω, 1/4 W Chip Resistor	CRCW120610R0JNEA	Vishay
PCB	Rogers RT6035HTC, 0.030″, ε_r = 3.5	D82111	MTL

TYPICAL CHARACTERISTICS — 2400–2500 MHz REFERENCE CIRCUIT

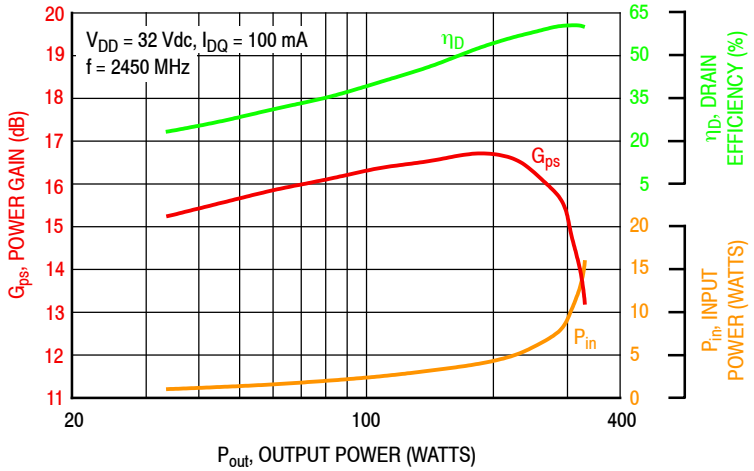


Figure 4. Power Gain, Drain Efficiency and Input Power versus Output Power

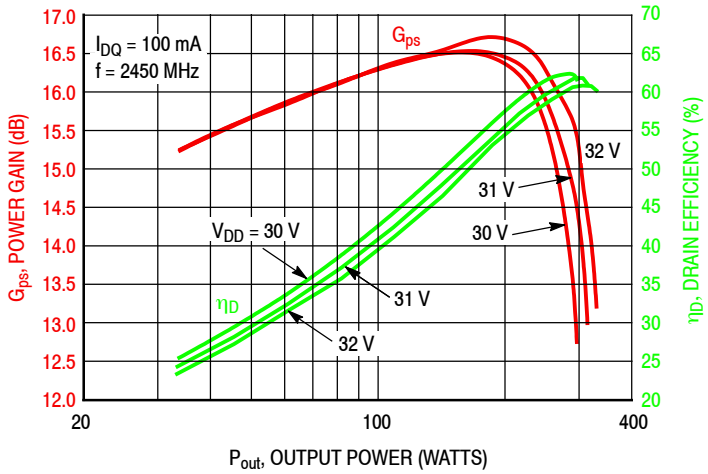


Figure 5. Power Gain and Drain Efficiency versus Output Power and Supply Voltage

2450 MHz NARROWBAND PRODUCTION TEST FIXTURE — 3″ × 5″ (7.6 cm × 12.7 cm)

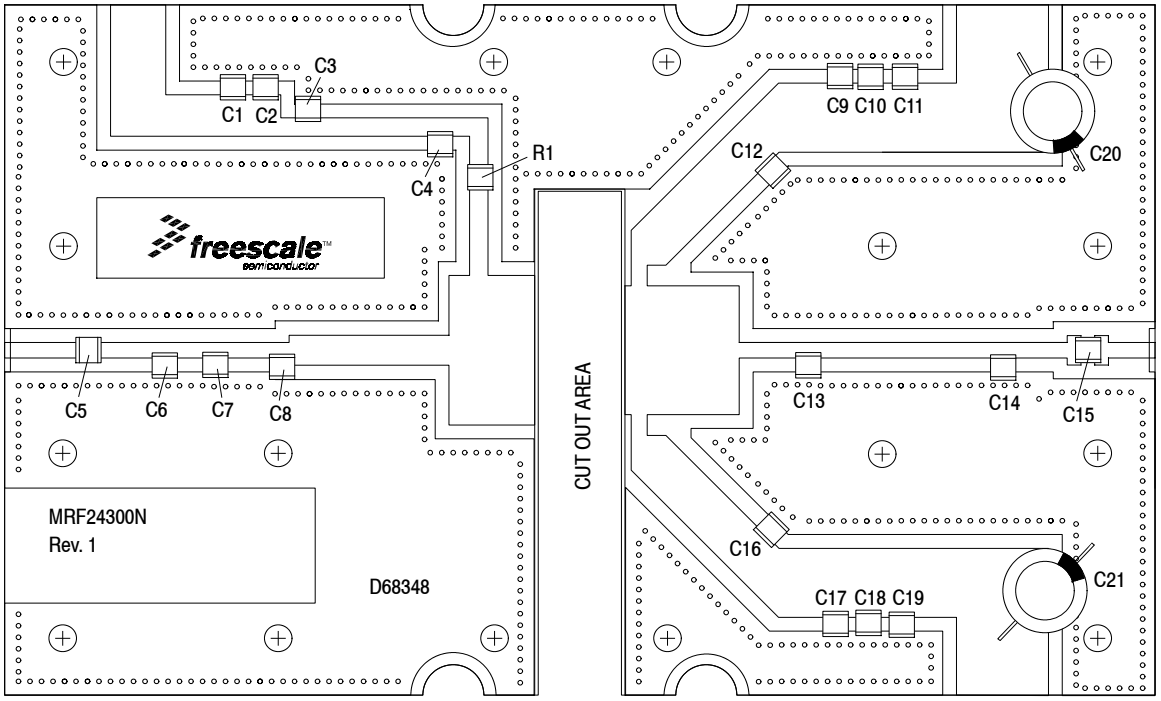
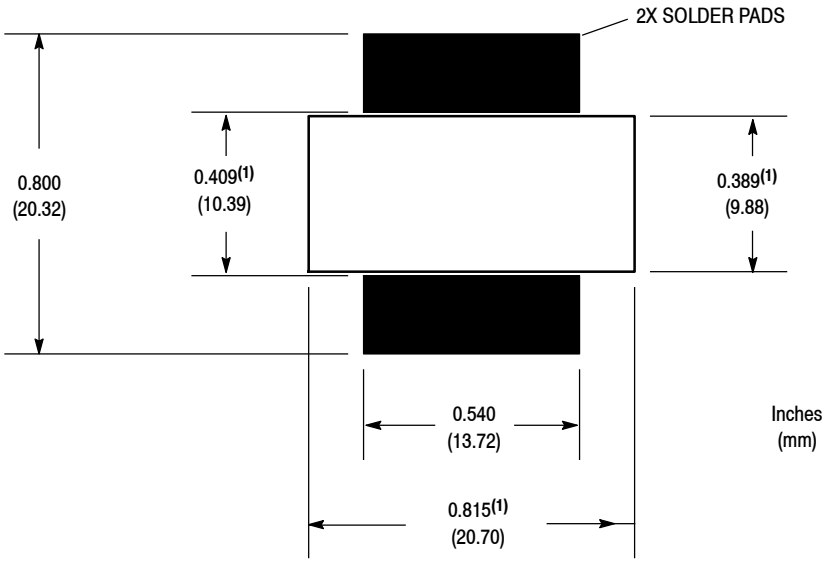


Figure 6. MRF24300N Narrowband Test Circuit Component Layout — 2450 MHz

Table 10. MRF24300N Narrowband Test Circuit Component Designations and Values — 2450 MHz

Part	Description	Part Number	Manufacturer
C1, C11, C19	10 μF Chip Capacitors	C5750X7S2A106M230KB	TDK
C2, C10, C18	1 μF Chip Capacitors	C3225JB2A105K200AA	TDK
C3, C9, C17	0.1 μF Chip Capacitors	C1206C104K1RAC-TU	Kemet
C4	5.6 pF Chip Capacitor	ATC100B5R6CT500XT	ATC
C5, C15	8.2 pF Chip Capacitors	ATC100B8R2CT500XT	ATC
C6	2.7 pF Chip Capacitor	ATC100B2R7BT500XT	ATC
C7, C12, C16	3.6 pF Chip Capacitors	ATC100B3R6CT500XT	ATC
C8	2.2 pF Chip Capacitor	ATC100B2R2JT500XT	ATC
C13	0.3 pF Chip Capacitor	ATC100B0R3BT500XT	ATC
C14	1.0 pF Chip Capacitor	ATC100B1R0BT500XT	ATC
C20, C21	220 μF, 100 V Electrolytic Capacitors	MCGPR100V227M16X26-RH	Multicomp
R1	5.9 Ω, 1/4 W Chip Resistor	CRCW12065R90FKEA	Vishay
PCB	Taconic RF35, 0.030″, ε_r = 3.5	D68348	MTL

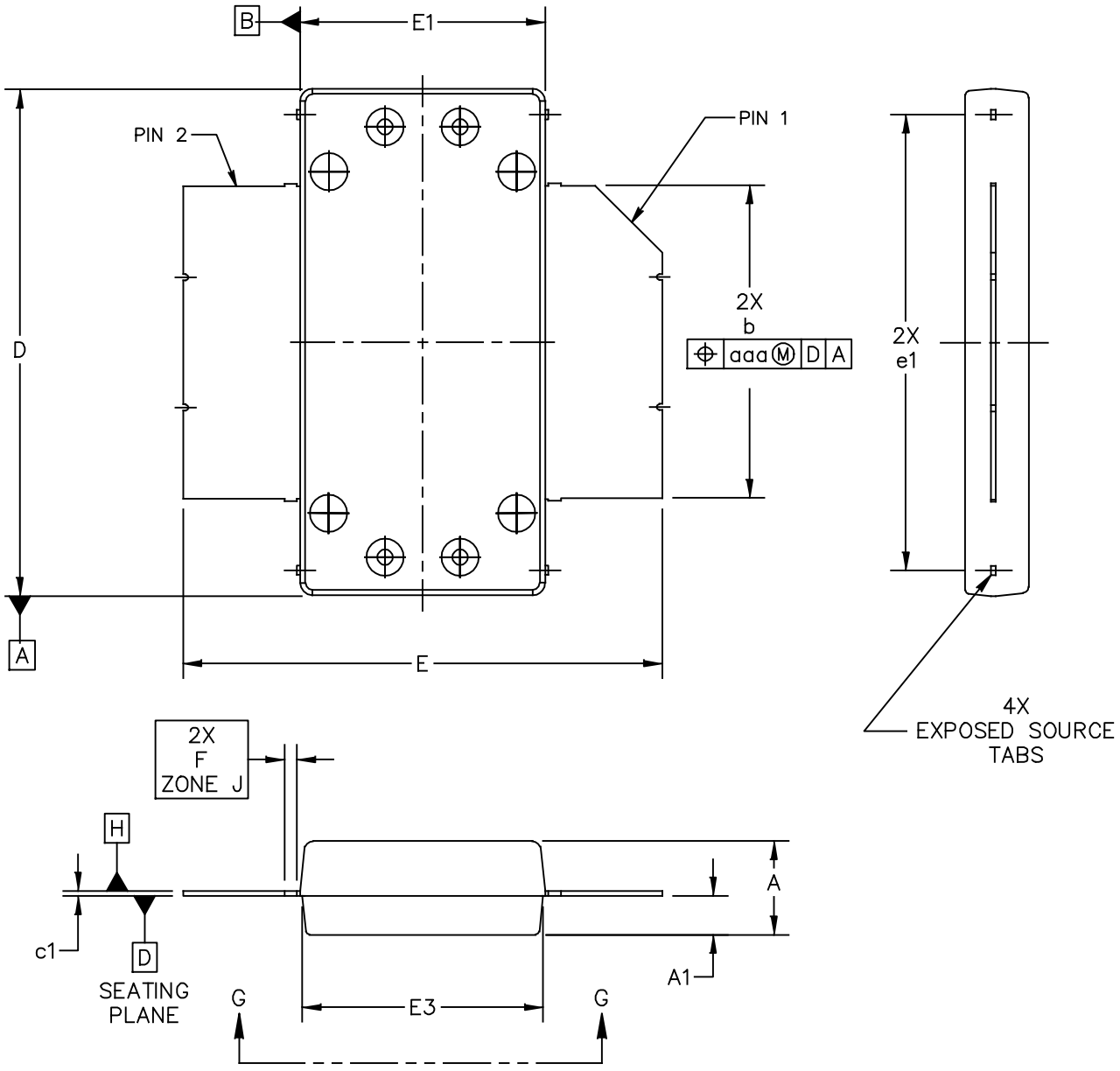


1. Slot dimensions are minimum dimensions and exclude milling tolerances

Figure 7. PCB Pad Layout for OM-780-2L

Figure 8. Product Marking

PACKAGE DIMENSIONS



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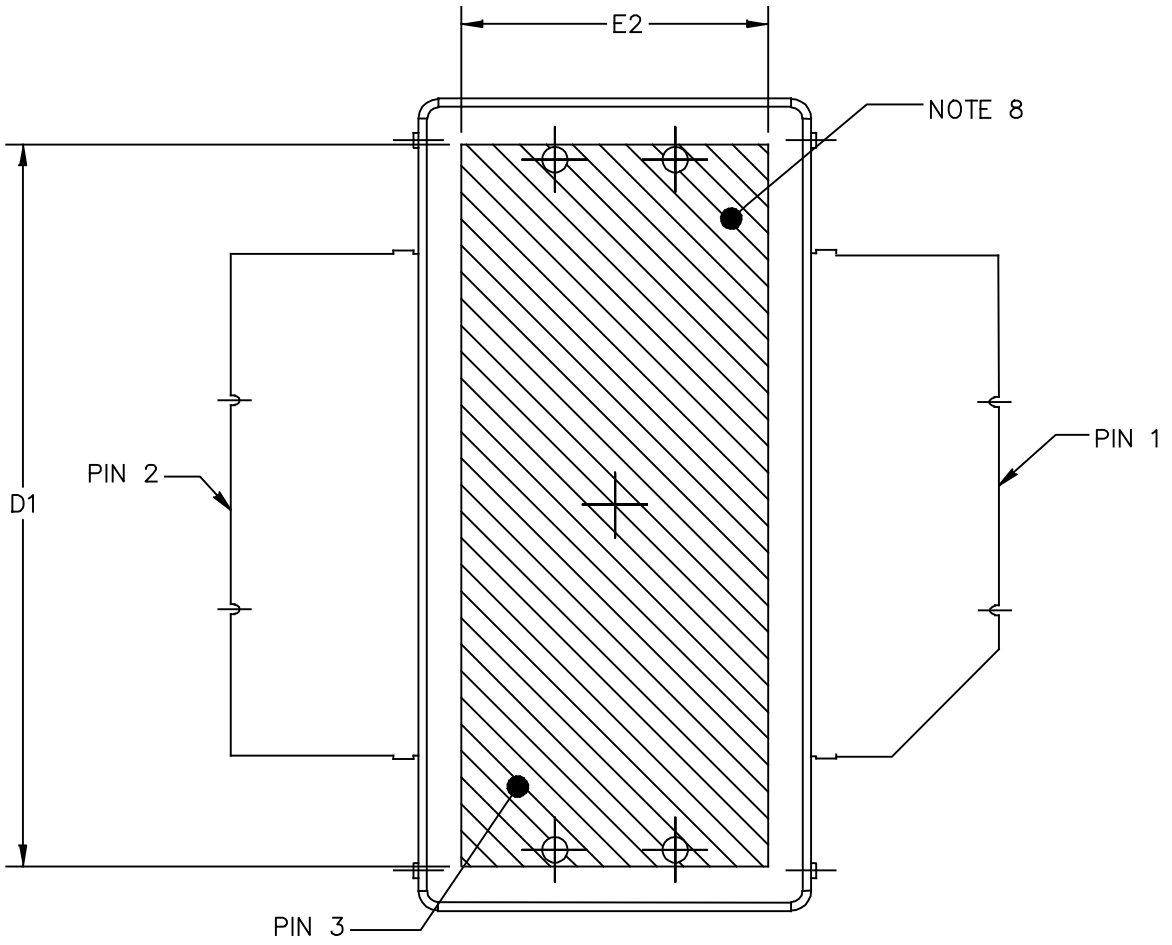

BOTTOM VIEW
VIEW G–G

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	STANDARD: NON–JEDEC	
	SOT1693–1	22 JAN 2016

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

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

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

7. DIMENSION A1 APPLIES WITHIN ZONE "J" ONLY

8. HATCHING REPRESENTS THE EXPOSED AREA OF THE HEAT SLUG. THE DIMENSIONS D1 AND E2 REPRESENT THE VALUES BETWEEN THE TWO OPPOSITE POINTS ALONG THE EDGES OF EXPOSED AREA OF HEAT SLUG.

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	0.148	.152	3.76	3.86	b	.497	.503	12.62	12.78
A1	.059	.065	1.50	1.65	c1	.007	.011	0.18	0.28
D	.808	.812	20.52	20.62	e1	.721	.729	18.31	18.52
D1	.720	----	18.29	----					
E	.762	.770	19.36	19.56	aaa	.004		0.10	
E1	.390	.394	9.91	10.01					
E2	.306	----	7.77	----					
E3	.383	.387	9.73	9.83					
F	.025 BSC		0.635 BSC						

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STRAIGHT LEAD

DOCUMENT NO: 98ASA10831D REV: C
STANDARD: NON–JEDEC
SOT1693–1 22 JAN 2016

PRODUCT DOCUMENTATION, SOFTWARE AND TOOLS

Refer to the following resources to aid your design process.

Application Notes

- AN1907: Solder Reflow Attach Method for High Power RF Devices in Plastic Packages
- AN1955: Thermal Measurement Methodology of RF Power Amplifiers

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

To Download Resources Specific to a Given Part Number:

1. Go to http://www.nxp.com/RF
2. Search by part number
3. Click part number link
4. Choose the desired resource from the drop down menu

REVISION HISTORY

The following table summarizes revisions to this document.

Revision	Date	Description
0	May 2016	• Initial Release of Data Sheet

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