RF Power LDMOS Transistors

High Ruggedness N-Channel Enhancement-Mode Lateral MOSFETs

MRF101AN
MRF101BN

PREPRODUCTION

1.8–250 MHz, 100 W CW, 50 V WIDEBAND RF POWER LDMOS TRANSISTORS

These rugged devices are designed for use in high VSWR industrial, scientific and medical applications and HF and VHF communications as well as radio and VHF TV broadcast, aerospace and mobile radio applications. Their design allows for wide frequency range use up to 250 MHz.

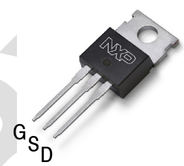
Typical Performance: V_{DD} = 50 Vdc

Frequency (MHz)	Signal Type	P_{out} (W)	G_{ps} (dB)	η_D (%)
40.68	CW	100 CW	26.0	75.1
136–174	CW	85 CW	23.1	72.2
230 (1)	Pulse (100 μsec, 20% Duty Cycle)	115 Peak	21.1	76.7

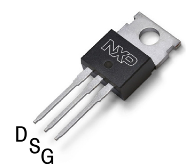
Load Mismatch/Ruggedness

Frequency (MHz)	Signal Type	VSWR	P_{in} (W)	Test Voltage	Result
40.68	CW	> 65:1 at all Phase Angles	0.64 Peak (3 dB Overdrive)	50	No Device Degradation
230	Pulse (100 μsec, 20% Duty Cycle)	> 65:1 at all Phase Angles	1.8 Peak (3 dB Overdrive)	50	No Device Degradation

1. Measured in 230 MHz typical fixture.



TO-220-3L
MRF101AN



TO-220-3L
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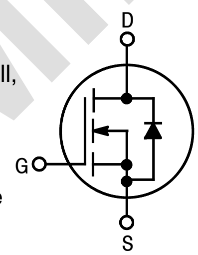
Note: Exposed backside of the package also serves as a source terminal for the transistor.

Features

- Mirror pinout versions (A and B) to simplify use in a push-pull, two-up configuration
- Characterized from 30 to 50 V
- Suitable for linear application
- Integrated ESD protection with greater negative gate-source voltage range for improved Class C operation
- Included in NXP product longevity program with assured supply for a minimum of 15 years after launch



Typical Applications

- Industrial, scientific, medical (ISM)
  – Laser generation
  – Plasma etching
  – Particle accelerators
  – MRI and other medical applications
  – Industrial heating, welding and drying systems
- Broadcast
  – Radio broadcast
  – VHF TV broadcast
- Mobile radio
  – VHF base stations
- HF and VHF communications
- Switch mode power supplies

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

Table 1. Maximum Ratings

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	–0.5, +133	Vdc
Gate-Source Voltage	V_{GS}	–6.0, +10	Vdc
Operating Voltage	V_{DD}	50	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 +175	°C
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	182 0.91	W W/°C

Table 2. Thermal Characteristics

Characteristic	Symbol	Value [2,3]	Unit
Thermal Resistance, Junction to Case CW: Case Temperature 77°C, 150 W CW, 50 Vdc, I_{DQ} = 100 mA, 40.68 MHz	$R_{\theta JC}$	1.1	°C/W
Thermal Impedance, Junction to Case Pulse: Case Temperature 73°C, 113 W Peak, 100 μsec Pulse Width, 20% Duty Cycle, 50 Vdc, I_{DQ} = 100 mA, 230 MHz	$Z_{\theta JC}$	0.37	°C/W

Table 3. ESD Protection Characteristics

Test Methodology	Class
Human Body Model (per JS-001-2017)	1B, passes 1000 V
Charge Device Model (per JS-002-2014)	C3, passes 1200 V

Table 4. Moisture Sensitivity Level

Test Methodology	Rating	Package Peak Temperature	Unit
Per JESD22-A113, IPC/JEDEC J-STD-020	0	260	°C

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

Characteristic	Symbol	Min	Typ	Max	Unit
Off Characteristics					
Gate-Source Leakage Current (V_{GS} = 5 Vdc, V_{DS} = 0 Vdc)	I_{GSS}	—	—	1	μAdc
Drain-Source Breakdown Voltage (V_{GS} = 0 Vdc, I_D = 50 mAdc)	$V_{(BR)DSS}$	133	—	—	Vdc
Zero Gate Voltage Drain Leakage Current (V_{DS} = 100 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	10	μAdc
On Characteristics					
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 290 μAdc)	$V_{GS(th)}$	1.7	2.2	2.7	Vdc
Gate Quiescent Voltage (V_{DS} = 50 Vdc, I_D = 100 mAdc)	$V_{GS(Q)}$	—	2.5	—	Vdc
Drain-Source On-Voltage (V_{GS} = 10 Vdc, I_D = 1 Adc)	$V_{DS(on)}$	—	0.45	—	Vdc
Forward Transconductance (V_{DS} = 10 Vdc, I_D = 8.8 Adc)	g_{fs}	—	7.1	—	S

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

(continued)

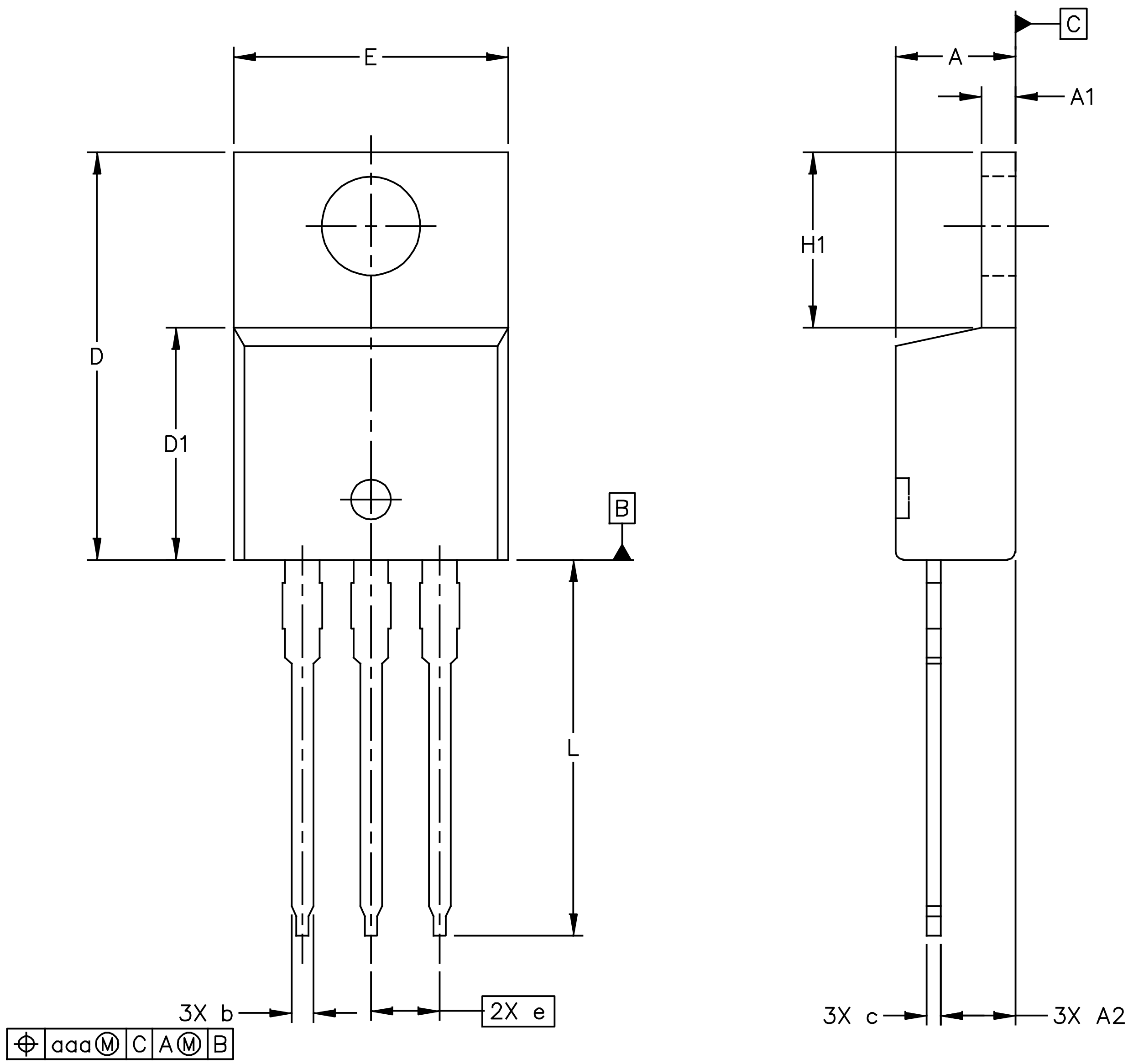
Table 5. Electrical Characteristics (T_A = 25°C unless otherwise noted) **(continued)**

Characteristic	Symbol	Min	Typ	Max	Unit
Dynamic Characteristics					
Reverse Transfer Capacitance (V_{DS} = 50 Vdc ± 30 mV(rms)ac @ 1 MHz, V_{GS} = 0 Vdc)	C_{rss}	—	0.96	—	pF
Output Capacitance (V_{DS} = 50 Vdc ± 30 mV(rms)ac @ 1 MHz, V_{GS} = 0 Vdc)	C_{oss}	—	43.4	—	pF
Input Capacitance (V_{DS} = 50 Vdc, V_{GS} = 0 Vdc ± 30 mV(rms)ac @ 1 MHz)	C_{iss}	—	149	—	pF
Typical Performance – 230 MHz (In NXP 230 MHz Fixture, 50 ohm system) V_{DD} = 50 Vdc, I_{DQ} = 100 mA, P_{in} = 0.9 W, f = 230 MHz, 100 μsec Pulse Width, 20% Duty Cycle					
Common-Source Amplifier Output Power	P_{out}	—	115	—	W
Power Gain	G_{ps}	—	21.1	—	dB
Drain Efficiency	η_D	—	76.7	—	%

Table 6. Load Mismatch/Ruggedness (In NXP 230 MHz Fixture, 50 ohm system) I_{DQ} = 100 mA

Frequency (MHz)	Signal Type	VSWR	P_{in} (W)	Test Voltage, V_{DD}	Result
230	Pulse (100 μsec, 20% Duty Cycle)	> 65:1 at all Phase Angles	1.8 Peak (3 dB Overdrive)	50	No Device Degradation

PACKAGE DIMENSIONS



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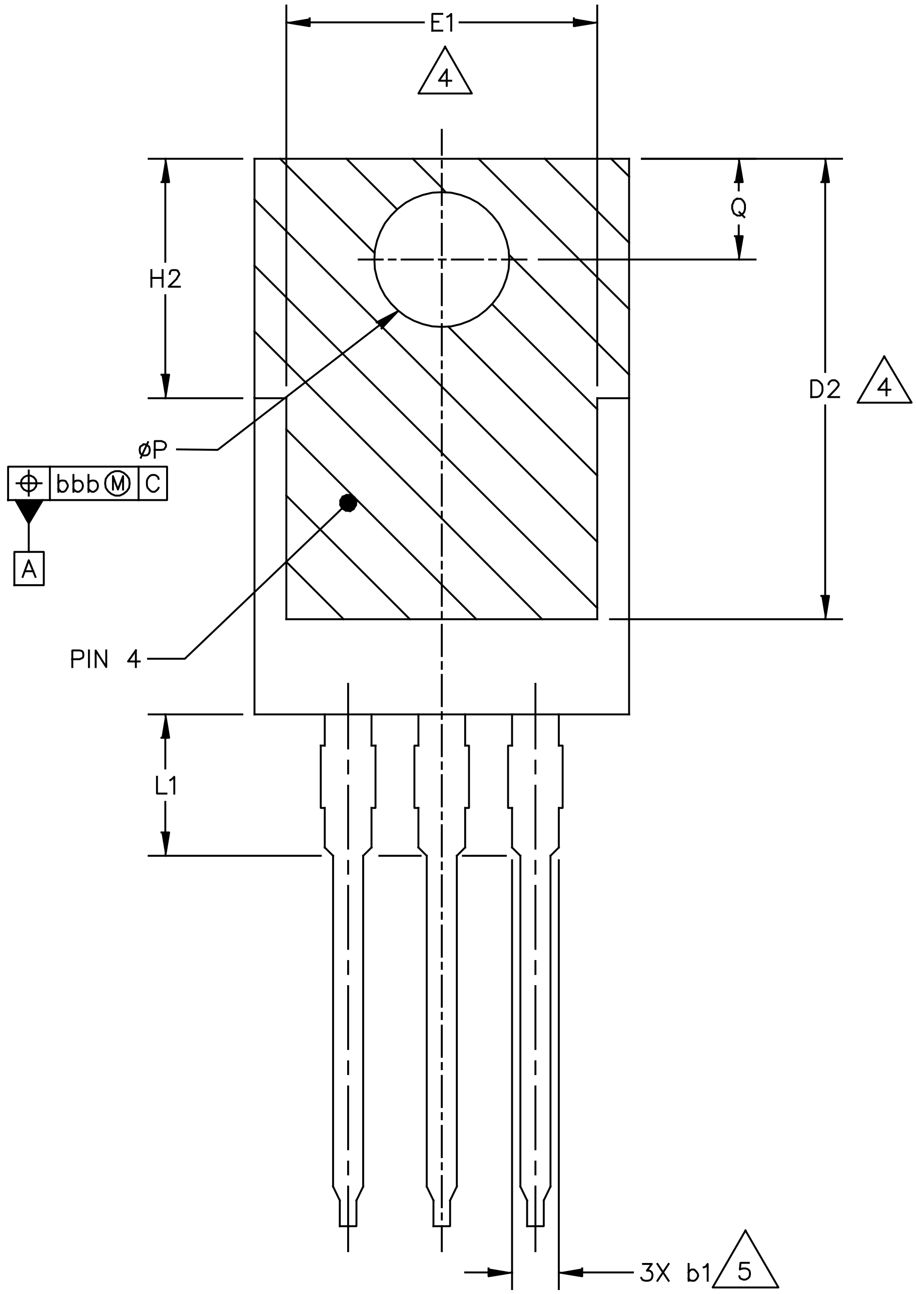

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NOTES:

1. CONTROLLING DIMENSION: MILLIMETER, ANGLES ARE IN DEGREES.

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

3. DIMENSION D AND E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.13 MM (.005 INCH) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREME OF THE PLASTIC BODY.

4. HATCHING REPRESENTS THE EXPOSED AREA OF THE THERMAL PAD (PIN 4). DIMENSIONS D2 AND E1 REPRESENT THE VALUES BETWEEN THE TWO OPPOSITE POINTS ALONG THE EDGES OF THE EXPOSED AREA OF THE THERMAL PAD. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSION D1 AND E1.

5. DIMENSIONS b1 DO NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.15 MM (.006 INCH) PER SIDE IN EXCESS OF THE DIMENSIONS b1 AT MAXIMUM MATERIAL CONDITION.

6. EJECTOR MARKS ON TOP SURFACE ARE PERMITTED AND IT IS SUPPLIER OPTION. THE MAXIMUM DEPTH OF EJECTOR MARK IS 0.25 MM (.010 INCH)

	INCH		MILLIMETER			INCH		MILLIMETER	
DIM	MIN	MAX	MIN	MAX	DIM	MIN	MAX	MIN	MAX
A	.167	.190	4.25	4.83	E1	.303	---	7.70	---
A1	.047	.053	1.20	1.34	e	.10 BSC		2.54 BSC	
A2	.098	.115	2.50	2.92	H1	.240	.264	6.10	6.70
b	.028	.038	0.71	0.97	H2	.240	.264	6.10	6.70
b1	.045	.070	1.14	1.78	L	.500	.567	12.70	14.40
c	.014	.024	0.356	0.61	L1	.144	.159	3.65	4.05
D	.564	.624	14.32	15.86	P	.142	.155	3.60	3.95
D1	.330	---	8.39	---	Q	.100	.119	2.54	3.04
D2	.480	.504	12.20	12.80	aaa	.014		0.35	
E	.392	.412	9.96	10.47	bbb	.014		0.35	

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