



Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!



## Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: [info@chipsmall.com](mailto:info@chipsmall.com) Web: [www.chipsmall.com](http://www.chipsmall.com)

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



# RF Power LDMOS Transistor

## N-Channel Enhancement-Mode Lateral MOSFET

This RF power transistor is designed for applications operating at frequencies between 2700 and 3100 MHz. This device is suitable for use in pulse applications.

**Typical Performance:** In 2700–3100 MHz reference circuit,  $V_{DD} = 32$  Vdc

Frequency (MHz)	Signal Type	$P_{out}$ (W)	$G_{ps}$ (dB)	$\eta_D$ (%)	IRL (dB)
2700–3100 (1)	Pulse (300 $\mu$ sec, 15% Duty Cycle)	150 Peak	17.2	49.0	–6

### Load Mismatch/Ruggedness

Frequency (MHz)	Signal Type	VSWR	$P_{in}$ (W)	Test Voltage	Result
3100 (2)	Pulse (300 $\mu$ sec, 15% Duty Cycle)	10:1 at all Phase Angles	6.8 Peak (3 dB Overdrive)	32	No Device Degradation

1. The values shown are the center band performance numbers across the indicated frequency range.
2. Measured in 3100 MHz narrowband production test fixture.

### Features

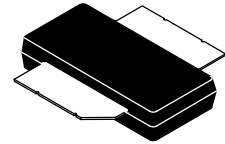
- Characterized with series equivalent large-signal impedance parameters
- Internally matched for ease of use
- Qualified up to a maximum of 32 V<sub>DD</sub> operation
- Integrated ESD protection
- Greater negative gate-source voltage range for improved Class C operation
- Recommended driver: AFIC31025N (25 W)
- Included in NXP product longevity program with assured supply for a minimum of 15 years after launch

### Typical Applications

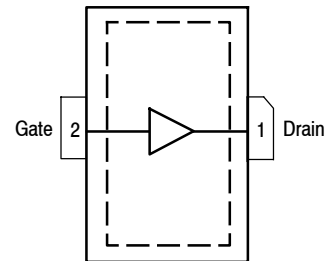
- Commercial S-Band radar systems
- Maritime radar
- Weather radar

**AFT31150N**

**2700–3100 MHz, 150 W PEAK, 32 V  
AIRFAST 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	$V_{DS}$	-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 @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	741 3.7	W W/°C

**Table 2. Thermal Characteristics**

Characteristic	Symbol	Value (2,3)	Unit
Thermal Impedance, Junction to Case Pulse: Case Temperature $76^\circ\text{C}$ , 160 W Peak, 300 $\mu\text{sec}$ Pulse Width, 15% Duty Cycle, 32 Vdc, $I_{DQ} = 100\text{ mA}$ , 3100 MHz	$Z_{\theta JC}$	0.042	°C/W

**Table 3. ESD Protection Characteristics**

Test Methodology	Class
Human Body Model (per JESD22-A114)	2, passes 2500 V
Charge Device Model (per JESD22-C101)	C3, 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** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
----------------	--------	-----	-----	-----	------

**Off Characteristics**

Gate-Source Leakage Current ( $V_{GS} = 5\text{ Vdc}$ , $V_{DS} = 0\text{ Vdc}$ )	$I_{GSS}$	—	—	1	$\mu\text{Adc}$
Drain-Source Breakdown Voltage ( $V_{GS} = 0\text{ Vdc}$ , $I_D = 10\text{ }\mu\text{Adc}$ )	$V_{(BR)DSS}$	65	—	—	Vdc
Zero Gate Voltage Drain Leakage Current ( $V_{DS} = 32\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ )	$I_{DSS}$	—	—	1	$\mu\text{Adc}$
Zero Gate Voltage Drain Leakage Current ( $V_{DS} = 65\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ )	$I_{DSS}$	—	—	10	$\mu\text{Adc}$

**On Characteristics**

Gate Threshold Voltage ( $V_{DS} = 10\text{ Vdc}$ , $I_D = 180\text{ }\mu\text{Adc}$ )	$V_{GS(th)}$	0.8	1.2	1.6	Vdc
Gate Quiescent Voltage ( $V_{DD} = 32\text{ Vdc}$ , $I_D = 100\text{ mAdc}$ , Measured in Functional Test)	$V_{GS(Q)}$	1.1	1.6	2.1	Vdc
Drain-Source On-Voltage ( $V_{GS} = 10\text{ Vdc}$ , $I_D = 1.8\text{ Adc}$ )	$V_{DS(on)}$	0.1	0.15	0.3	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** ( $T_A = 25^\circ\text{C}$  unless otherwise noted) (continued)

Characteristic	Symbol	Min	Typ	Max	Unit
<b>Functional Tests</b> <sup>(1)</sup> (In NXP Production Test Fixture, 50 ohm system) $V_{DD} = 32\text{ Vdc}$ , $I_{DQ} = 100\text{ mA}$ , $P_{out} = 160\text{ W Peak}$ (24 W Avg.), $f = 3100\text{ MHz}$ , 300 $\mu\text{sec}$ Pulse Width, 15% Duty Cycle					
Power Gain	$G_{ps}$	15.0	17.0	19.0	dB
Drain Efficiency	$\eta_D$	46.5	50.0	—	%
Input Return Loss	IRL	—	-19	-9	dB

**Table 6. Load Mismatch/Ruggedness** (In NXP Production Test Fixture, 50 ohm system)  $I_{DQ} = 100\text{ mA}$ 

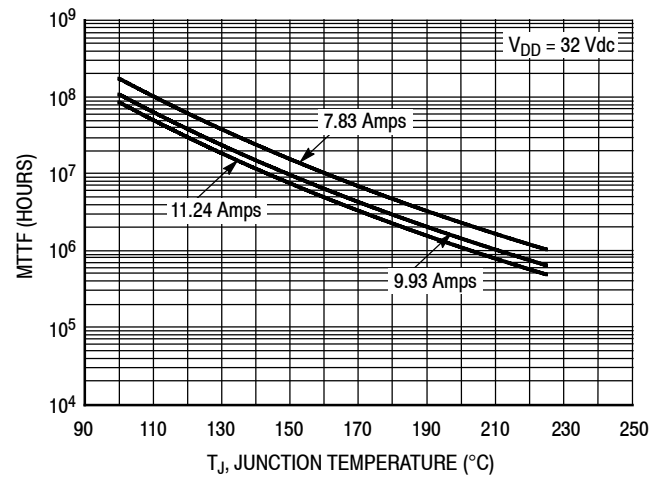
Frequency (MHz)	Signal Type	VSWR	$P_{in}$ (W)	Test Voltage, $V_{DD}$	Result
3100	Pulse (300 $\mu\text{sec}$ , 15% Duty Cycle)	10:1 at all Phase Angles	6.8 Peak (3 dB Overdrive)	32	No Device Degradation

**Table 7. Ordering Information**

Device	Tape and Reel Information	Package
AFT31150NR5	R5 Suffix = 50 Units, 32 mm Tape Width, 13-inch Reel	OM-780-2L

1. Part internally matched both on input and output.

## 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 – Pulse**

## 2700–3100 MHz REFERENCE CIRCUIT – 2.0" × 3.0" (5.1 cm × 7.6 cm)

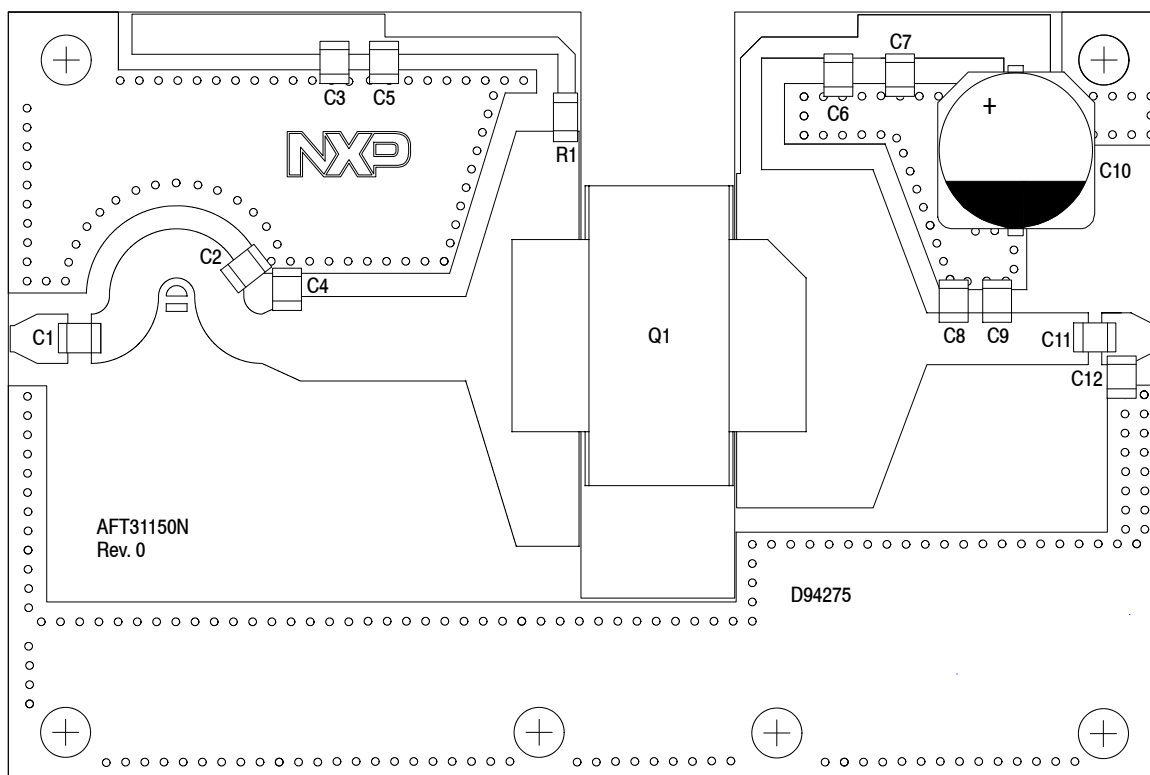
**Table 8. 2700–3100 MHz Performance** (In NXP Reference Circuit, 50 ohm system)

$P_{out} = 150\text{ W}$ ,  $V_{DD} = 32\text{ Vdc}$ ,  $I_{DQ} = 100\text{ mA}$

Frequency (MHz)	Signal Type	$P_{in}$ (W)	$G_{ps}$ (dB)	$\eta_D$ (%)	IRL (dB)
2700	Pulse (300 $\mu$ sec, 15% Duty Cycle)	3.1	16.9	53.0	–6
2900		2.9	17.2	49.0	–6
3100		3.0	17.0	47.0	–9



# 2700–3100 MHz REFERENCE CIRCUIT — 2.0" × 3.0" (5.1 cm × 7.6 cm)

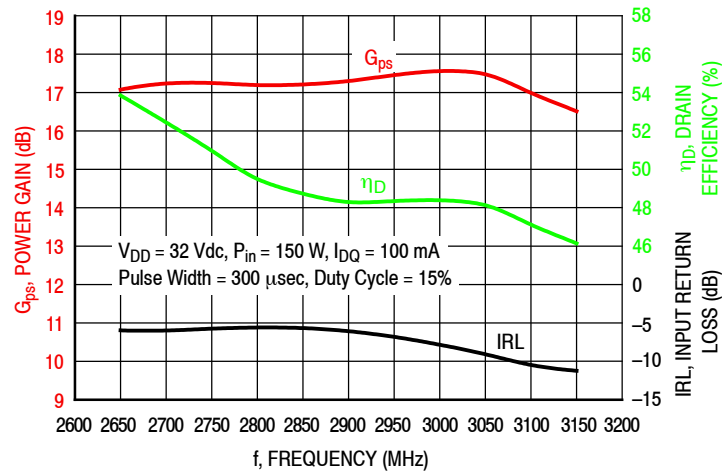


**Figure 3. AFT31150N Reference Circuit Component Layout – 2700–3100 MHz**

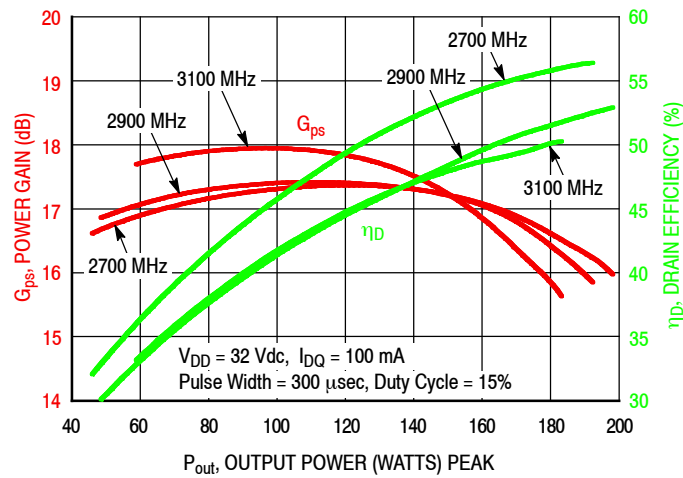
**Table 9. AFT31150N Reference Circuit Component Designations and Values – 2700–3100 MHz**

Part	Description	Part Number	Manufacturer
C1	3.6 pF Chip Capacitor	ATC800B3R6CT500XT	ATC
C2	0.8 pF Chip Capacitor	ATC800B0R8BT500XT	ATC
C3, C7	2.2 $\mu$ F Chip Capacitor	C3225X7R2A225K230AB	TDK
C4	0.6 pF Chip Capacitor	ATC800B0R6BT500XT	ATC
C5, C6	3.3 pF Chip Capacitor	ATC800B3R3CT500XT	ATC
C8	0.7 pF Chip Capacitor	ATC800B0R7BT500XT	ATC
C9	0.4 pF Chip Capacitor	ATC800B0R4BT500XT	ATC
C10	220 $\mu$ F, 50 V Electrolytic Capacitor	MVY50V221MJ10TP	United Chem
C11	4.3 pF Chip Capacitor	ATC800B4R3CT500XT	ATC
C12	0.1 pF Chip Capacitor	ATC800B0R1BT500XT	ATC
Q1	RF High Power LDMOS Transistor	AFT31150N	NXP
R1	10 $\Omega$ , 1/4 W Chip Resistor	CRCW120610R0JNEA	Vishay
PCB	Rogers RT6035HTC, 0.030", $\epsilon_r = 3.5$	D94275	MTL

# **TYPICAL CHARACTERISTICS – 2700–3100 MHz REFERENCE CIRCUIT**



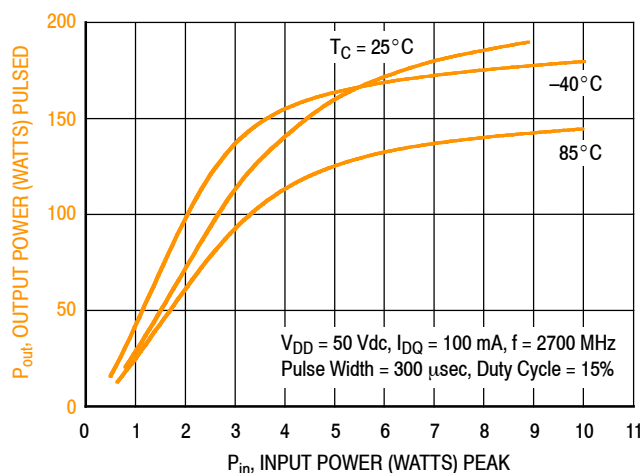
**Figure 4. Power Gain, Drain Efficiency and IRL versus Frequency at a Constant Output Power**



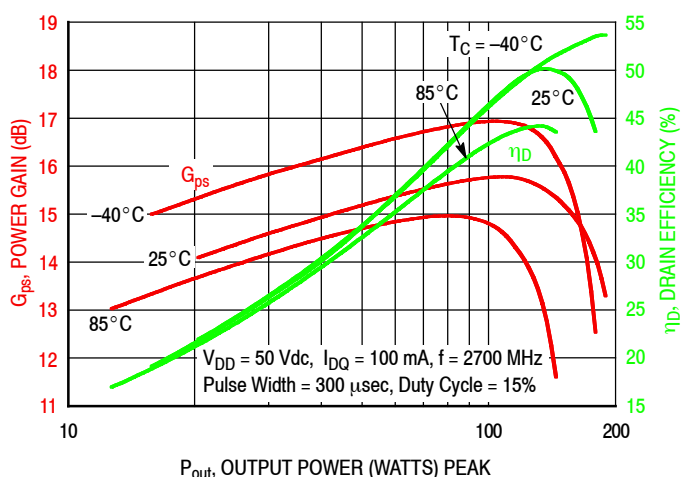
**Figure 5. Power Gain and Drain Efficiency versus Output Power**



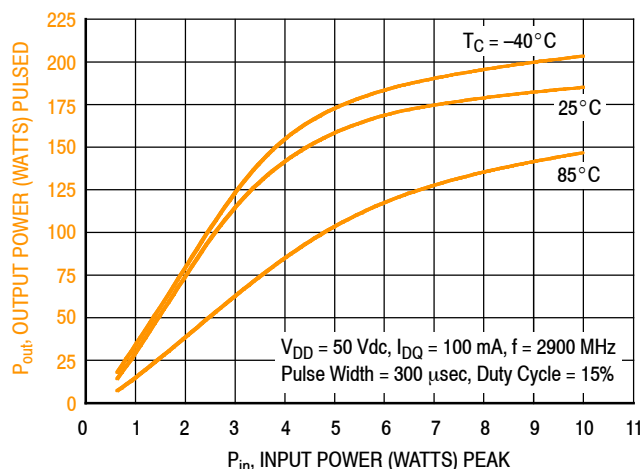
## TYPICAL CHARACTERISTICS – 2700–3100 MHz REFERENCE CIRCUIT



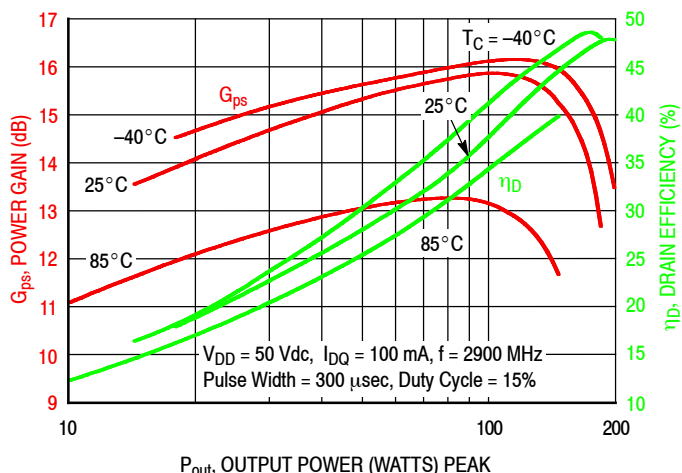
**Figure 6. Output Power versus Input Power versus Temperature – 2700 MHz**



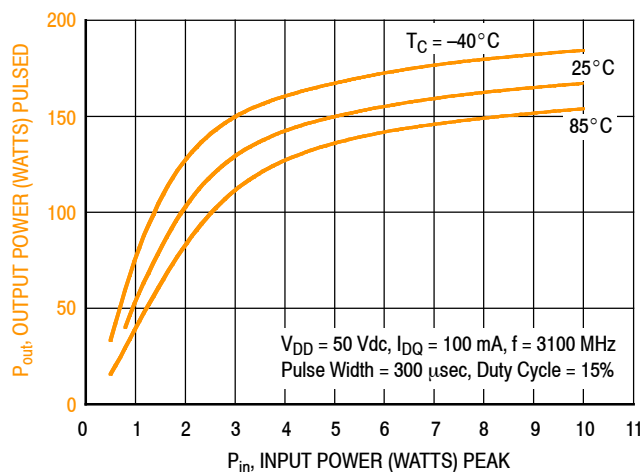
**Figure 7. Power Gain and Drain Efficiency versus Output Power – 2700 MHz**



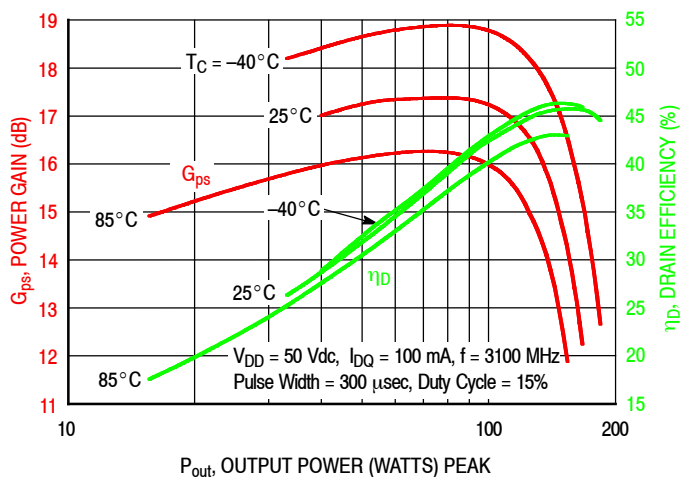
**Figure 8. Output Power versus Input Power versus Temperature – 2900 MHz**



**Figure 9. Power Gain and Drain Efficiency versus Output Power – 2900 MHz**

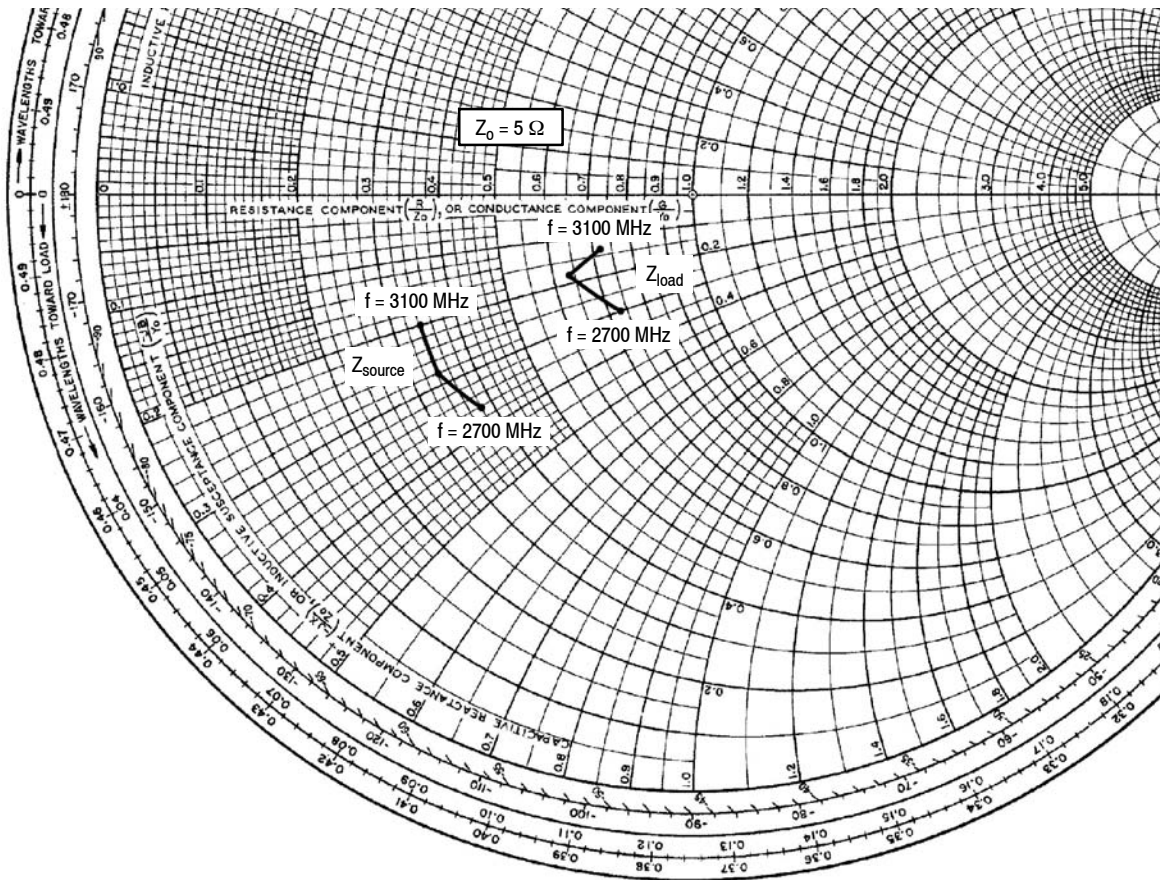


**Figure 10. Output Power versus Input Power versus Temperature – 3100 MHz**



**Figure 11. Power Gain and Drain Efficiency versus Output Power – 3100 MHz**

## 2700–3100 MHz REFERENCE CIRCUIT



f MHz	$Z_{\text{source}}$ $\Omega$	$Z_{\text{load}}$ $\Omega$
2700	$1.9 - j1.8$	$3.7 - j1.5$
2900	$1.7 - j1.4$	$3.2 - j0.9$
3100	$1.7 - j1.0$	$3.6 - j0.7$

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

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

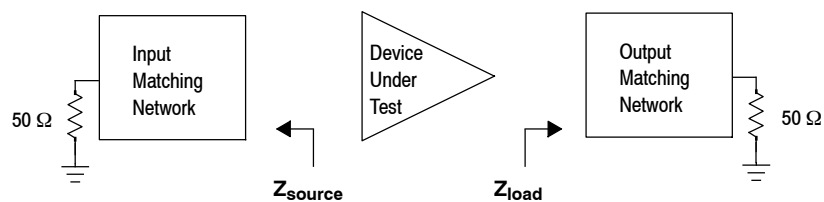
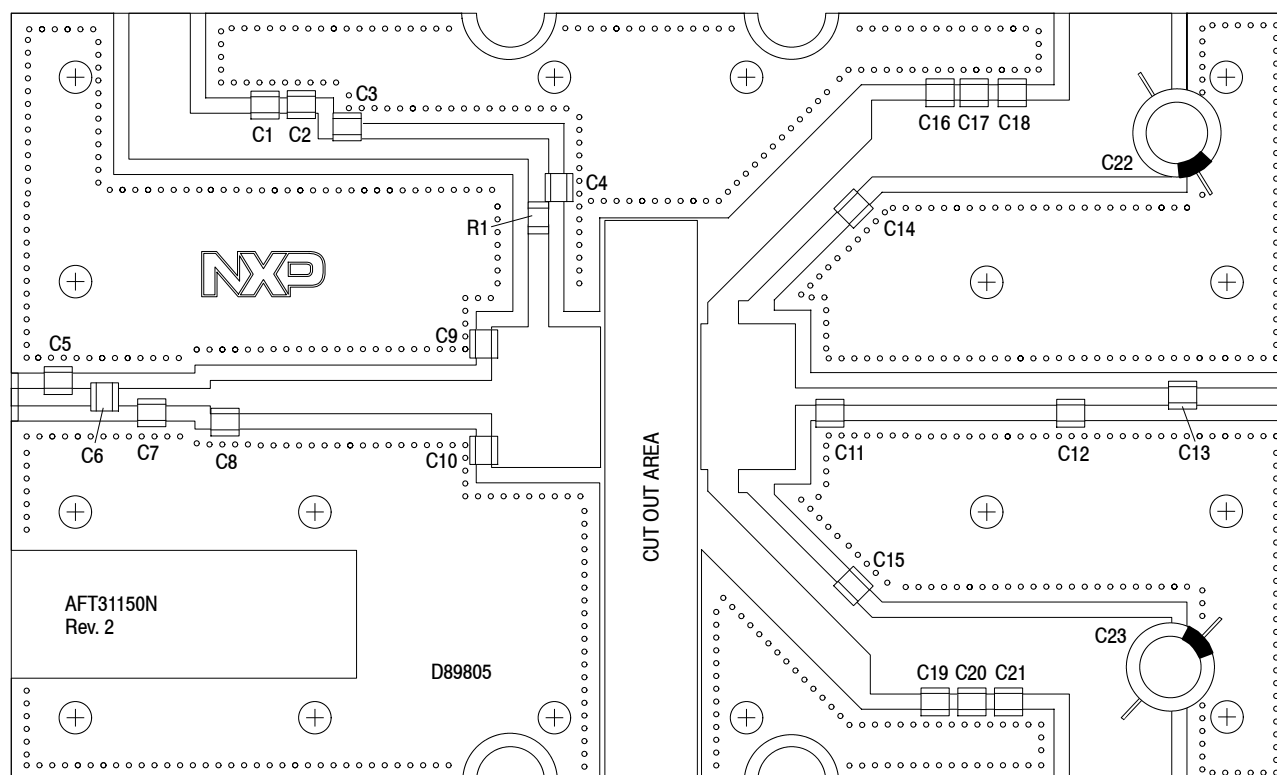


Figure 12. Series Equivalent Source and Load Impedance – 2700–3100 MHz

# 3100 MHz NARROWBAND PRODUCTION TEST FIXTURE – 3.0" x 5.0" (7.6 cm x 12.7 cm)



**Figure 13. AFT31150N Narrowband Test Circuit Component Layout – 3100 MHz**

**Table 10. AFT31150N Narrowband Test Circuit Component Designations and Values – 3100 MHz**

Part	Description	Part Number	Manufacturer
C1, C18, C21	10 $\mu$ F Chip Capacitor	C5750X7S2A106M	TDK
C2, C17, C20	1 $\mu$ F Chip Capacitor	C3225JB2A105K200AA	TDK
C3, C16, C19	0.1 $\mu$ F Chip Capacitor	C1206C104K1RACTU	Kemet
C4	3.3 pF Chip Capacitor	ATC100B3R3CT500XT	ATC
C5, C8, C9, C10	0.2 pF Chip Capacitor	ATC100B0R2BT500XT	ATC
C6, C13	4.3 pF Chip Capacitor	ATC100B4R3CT500XT	ATC
C7	1.0 pF Chip Capacitor	ATC100B1R0BT500XT	ATC
C11	0.3 pF Chip Capacitor	ATC100B0R3BT500XT	ATC
C12	0.8 pF Chip Capacitor	ATC100B0R8BT500XT	ATC
C14, C15	2.2 pF Chip Capacitor	ATC100B2R2BT500XT	ATC
C22, C23	220 $\mu$ F, 100 V Electrolytic Capacitor	MCGPR100V227M16X26-RH	Multicomp
R1	20 $\Omega$ , 1/4 W Chip Resistor	CRCW120620R0FKEA	Vishay
PCB	Taconic RF35, 0.030", $\epsilon_r = 3.5$	D89805	MTL

## TYPICAL CHARACTERISTICS

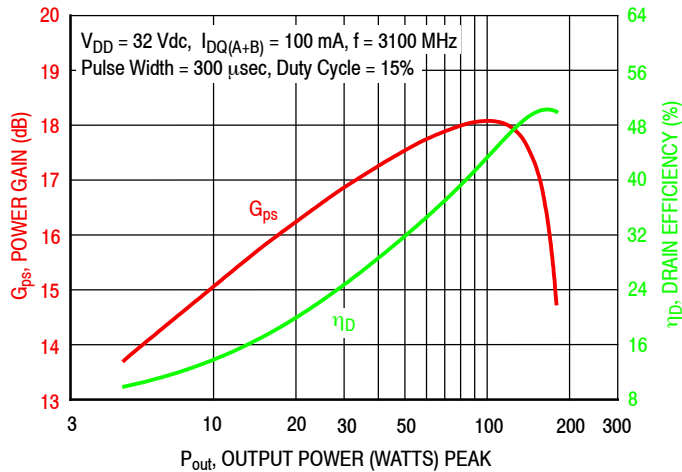


Figure 14. Power Gain and Drain Efficiency versus Output Power

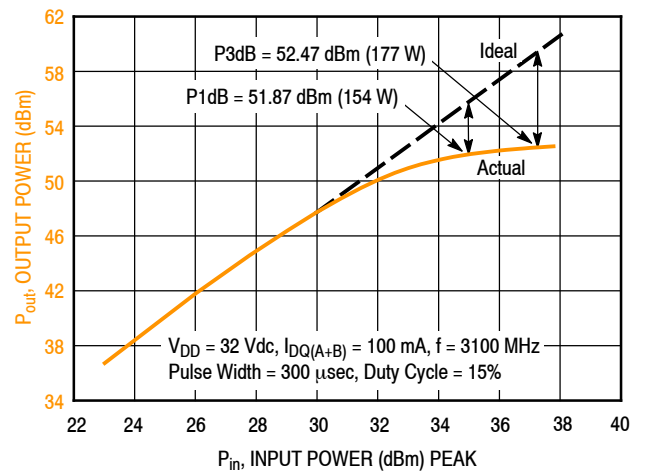


Figure 15. Output Power versus Input Power

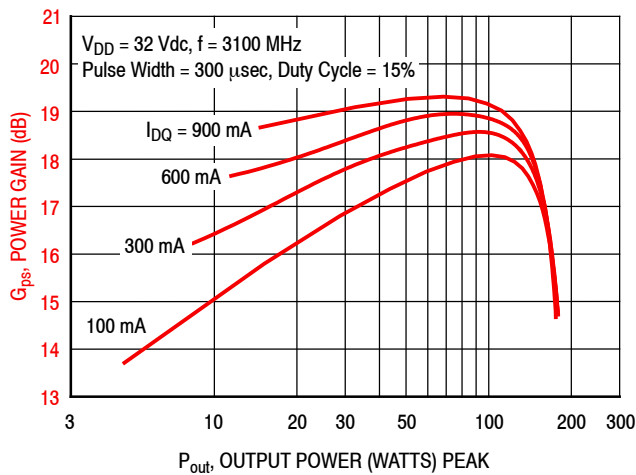


Figure 16. Power Gain versus Output Power

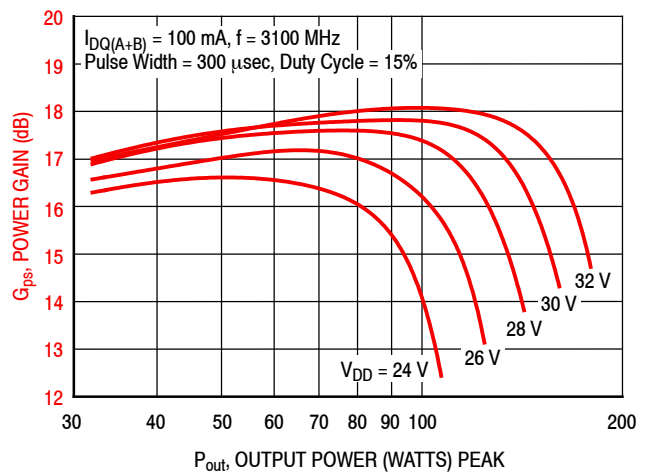


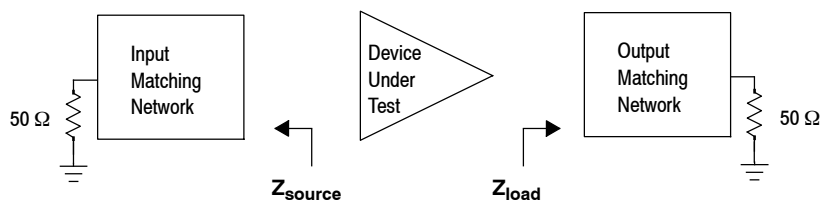
Figure 17. Power Gain versus Output Power and Drain Voltage

## 3100 MHz NARROWBAND PRODUCTION TEST FIXTURE

f MHz	$Z_{\text{source}}$ $\Omega$	$Z_{\text{load}}$ $\Omega$
3100	$9.5 - j5.3$	$5.5 + j1.2$

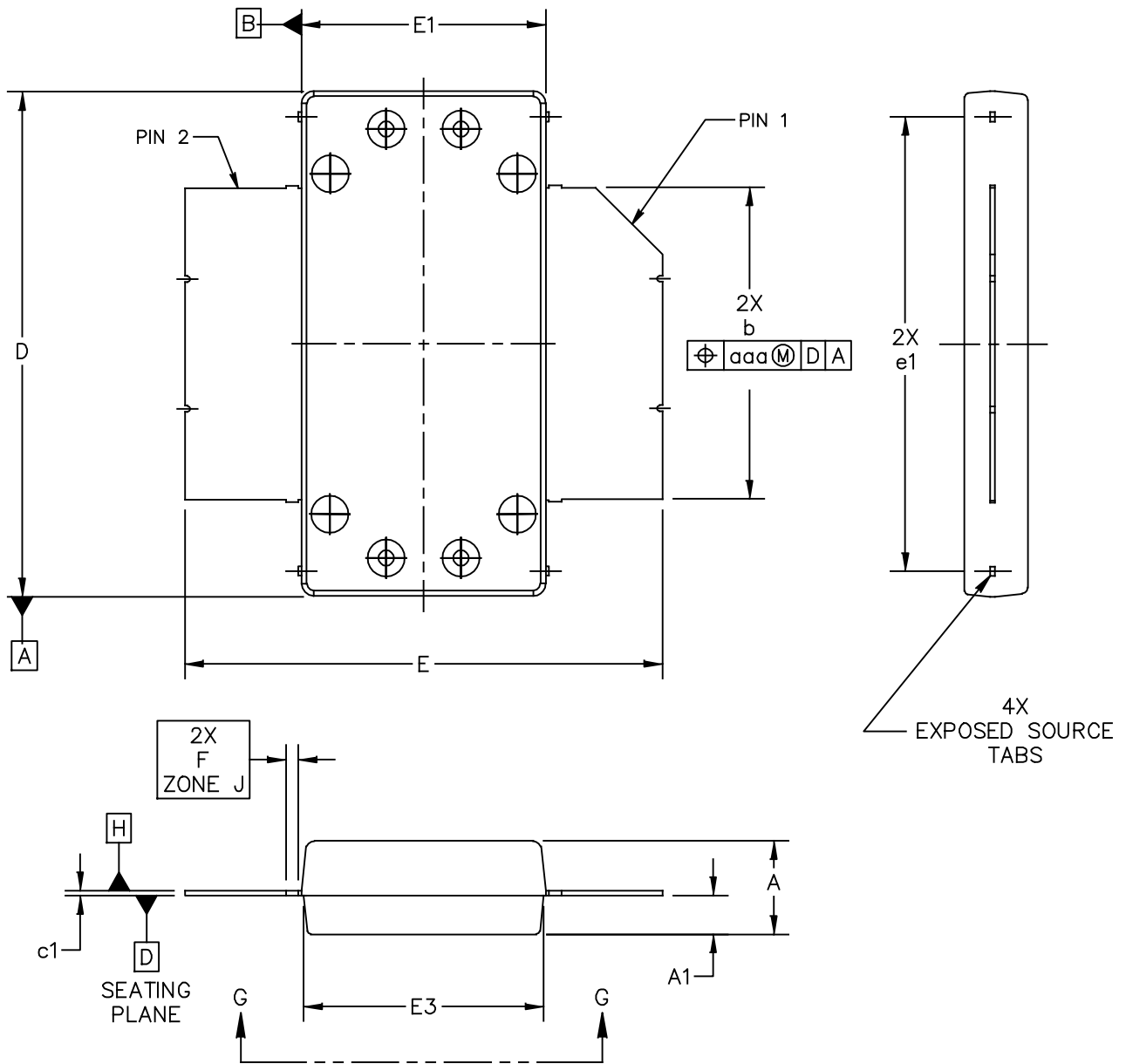
$Z_{\text{source}}$  = Test circuit impedance as measured from gate to ground.

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



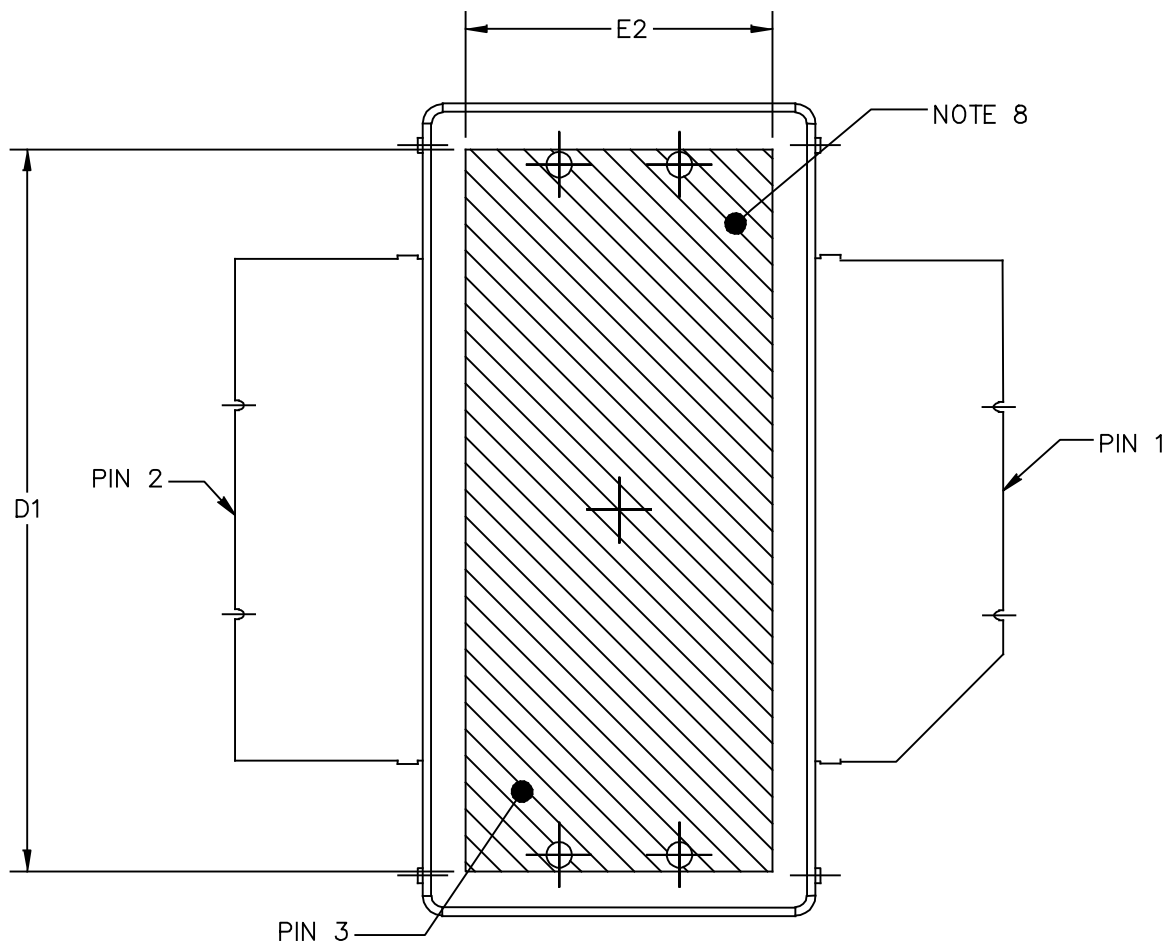
**Figure 18. Series Equivalent Source and Load Impedance – 3100 MHz**

# PACKAGE DIMENSIONS



© NXP SEMICONDUCTORS N.V. ALL RIGHTS RESERVED	MECHANICAL OUTLINE	PRINT VERSION NOT TO SCALE
TITLE:  OM780-2 STRAIGHT LEAD	DOCUMENT NO: 98ASA10831D REV: C	
	STANDARD: NON-JEDEC	
	SOT1693-1	22 JAN 2016

AFT31150N



BOTTOM VIEW  
VIEW G-G

© NXP SEMICONDUCTORS N.V. ALL RIGHTS RESERVED	MECHANICAL OUTLINE	PRINT VERSION NOT TO SCALE
TITLE: OM780-2 STRAIGHT LEAD	DOCUMENT NO: 98ASA10831D REV: C	
	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

INCH			MILLIMETER		INCH			MILLIMETER	
DIM	MIN	MAX	MIN	MAX	DIM	MIN	MAX	MIN	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	----	aaa	.004		0.10	
E	.762	.770	19.36	19.56					
E1	.390	.394	9.91	10.01					
E2	.306	----	7.77	----					
E3	.383	.387	9.73	9.83					
F	.025 BSC		0.635 BSC						
© NXP SEMICONDUCTORS N.V. ALL RIGHTS RESERVED				MECHANICAL OUTLINE			PRINT VERSION NOT TO SCALE		
TITLE:  OM780-2 STRAIGHT LEAD					DOCUMENT NO: 98ASA10831D                      REV: C				
					STANDARD: NON-JEDEC				
					SOT1693-1				

## 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 Over-Molded 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 2017	<ul style="list-style-type: none"><li>• Initial release of data sheet</li></ul>

### ***How to Reach Us:***

**Home Page:**  
nxp.com

**Web Support:**  
nxp.com/support

Information in this document is provided solely to enable system and software implementers to use NXP products. There are no express or implied copyright licenses granted hereunder to design or fabricate any integrated circuits based on the information in this document. NXP reserves the right to make changes without further notice to any products herein.

NXP makes no warranty, representation, or guarantee regarding the suitability of its products for any particular purpose, nor does NXP assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters that may be provided in NXP data sheets and/or specifications can and do vary in different applications, and actual performance may vary over time. All operating parameters, including "typicals," must be validated for each customer application by customer's technical experts. NXP does not convey any license under its patent rights nor the rights of others. NXP sells products pursuant to standard terms and conditions of sale, which can be found at the following address: [nxp.com/SalesTermsandConditions](http://nxp.com/SalesTermsandConditions).

NXP, the NXP logo, and Airfast are trademarks of NXP B.V. All other product or service names are the property of their respective owners.

© 2017 NXP B.V.

