

# AFM912N

## Airfast RF Power LDMOS Transistor

Rev. 0 — November 2022

Data Sheet: Technical Data

Designed for handheld two-way radio applications with frequencies from 136 to 941 MHz. The high gain, ruggedness and wideband performance of this device make it ideal for large-signal, common-source amplifier applications in handheld radio equipment.

### Typical Performance (7.5 Vdc, $T_A = 25^\circ\text{C}$ , CW)

Frequency (MHz)	Gain Compression	$P_{\text{out}}$ (W)	$G_{\text{ps}}$ (dB)	$\eta_D$ (%)
941	P1dB	12.5	13.3	65.2
	P3dB	15.7	11.3	69.5

### Load Mismatch/Ruggedness

Frequency (MHz)	Signal Type	VSWR	$P_{\text{in}}$ (dBm)	Test Voltage	Result
941	CW	> 10:1 at all Phase Angles	32.9 (3 dB Overdrive)	10.0	No Device Degradation

### Features

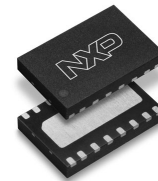
- Characterized for operation from 136 to 941 MHz
- Unmatched input and output allowing wide frequency range utilization
- Device can be used single-ended or in a push-pull configuration
- Integrated ESD protection
- Integrated stability enhancements
- Wideband — full power across each band
- Extreme ruggedness
- High linearity for: TETRA, SSB

### Typical Applications

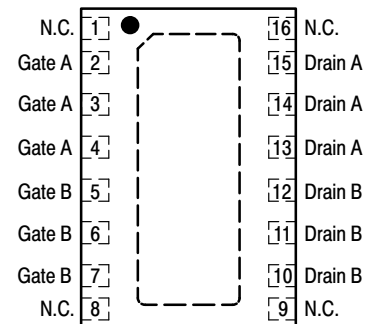
- Output stage VHF band handheld radio
- Output stage UHF band handheld radio
- Output stage for 700–800 MHz handheld radio

## AFM912N

136–941 MHz, 12 W, 7.5 V  
WIDEBAND  
AIRFAST RF POWER LDMOS  
TRANSISTOR



DFN 4 × 6



(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, +30	Vdc
Gate–Source Voltage	$V_{GS}$	-6.0, +12	Vdc
Operating Voltage	$V_{DD}$	0 to 12.5	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)	$T_J$	-40 to +150	°C
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	$P_D$	142 1.14	W W/°C

**Table 2. Thermal Characteristics**

Characteristic	Symbol	Value (2)	Unit
Thermal Resistance, Junction to Case Case Temperature 78°C, 12.6 W CW, 7.5 Vdc, $I_{DQ(A+B)} = 130$ mA, 941 MHz	$R_{\theta JC}$	0.88	°C/W

**Table 3. ESD Protection Characteristics**

Test Methodology	Class
Human Body Model (per JS-001-2017)	Class 1C, passes 1000 V
Charge Device Model (per JS-002-2014)	Class C3, passes 1200 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
<b>Off Characteristics (3)</b>					
Zero Gate Voltage Drain Leakage Current ( $V_{DS} = 30$ Vdc, $V_{GS} = 0$ Vdc)	$I_{DSS}$	—	—	10	$\mu\text{Adc}$
Gate–Source Leakage Current ( $V_{GS} = 5$ Vdc, $V_{DS} = 0$ Vdc)	$I_{GSS}$	—	—	500	nAdc
<b>On Characteristics (3)</b>					
Gate Threshold Voltage ( $V_{DS} = 10$ Vdc, $I_D = 78$ $\mu\text{Adc}$ )	$V_{GS(th)}$	1.7	2.1	2.6	Vdc
Drain–Source On–Voltage ( $V_{GS} = 10$ Vdc, $I_D = 780$ mAdc)	$V_{DS(on)}$	—	0.11	0.15	Vdc
Forward Transconductance ( $V_{DS} = 7.5$ Vdc, $I_D = 4.7$ Adc)	$g_{fs}$	—	4.4	—	S

1. Continuous use at maximum temperature will affect MTTF.

2. Refer to AN1955, *Thermal Measurement Methodology of RF Power Amplifiers*. Go to <http://www.nxp.com/RF> and search for AN1955.

3. Each side of device measured separately.

(continued)

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

Characteristic	Symbol	Min	Typ	Max	Unit
<b>Dynamic Characteristics</b> <sup>(1)</sup>					
Reverse Transfer Capacitance ( $V_{DS} = 7.5\text{ Vdc} \pm 30\text{ mV(rms)ac}$ @ 1 MHz, $V_{GS} = 0\text{ Vdc}$ )	$C_{rss}$	—	1.7	—	pF
Output Capacitance ( $V_{DS} = 7.5\text{ Vdc} \pm 30\text{ mV(rms)ac}$ @ 1 MHz, $V_{GS} = 0\text{ Vdc}$ )	$C_{oss}$	—	39.8	—	pF
Input Capacitance ( $V_{DS} = 7.5\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc} \pm 30\text{ mV(rms)ac}$ @ 1 MHz)	$C_{iss}$	—	68.9	—	pF

**Typical Performance** (In NXP Test Fixture, 50 ohm system)  $V_{DD} = 7.5\text{ Vdc}$ ,  $I_{DQ(A+B)} = 130\text{ mA}$ ,  $P_{out} = 12\text{ W}$ ,  $f = 941\text{ MHz}$

Power Gain	$G_{ps}$	—	13.3	—	dB
Drain Efficiency	$\eta_D$	—	65.2	—	%
Input Return Loss	IRL	—	-17	—	dB

**Load Mismatch/Ruggedness** (In NXP Test Fixture, 50 ohm system)  $I_{DQ(A+B)} = 130\text{ mA}$

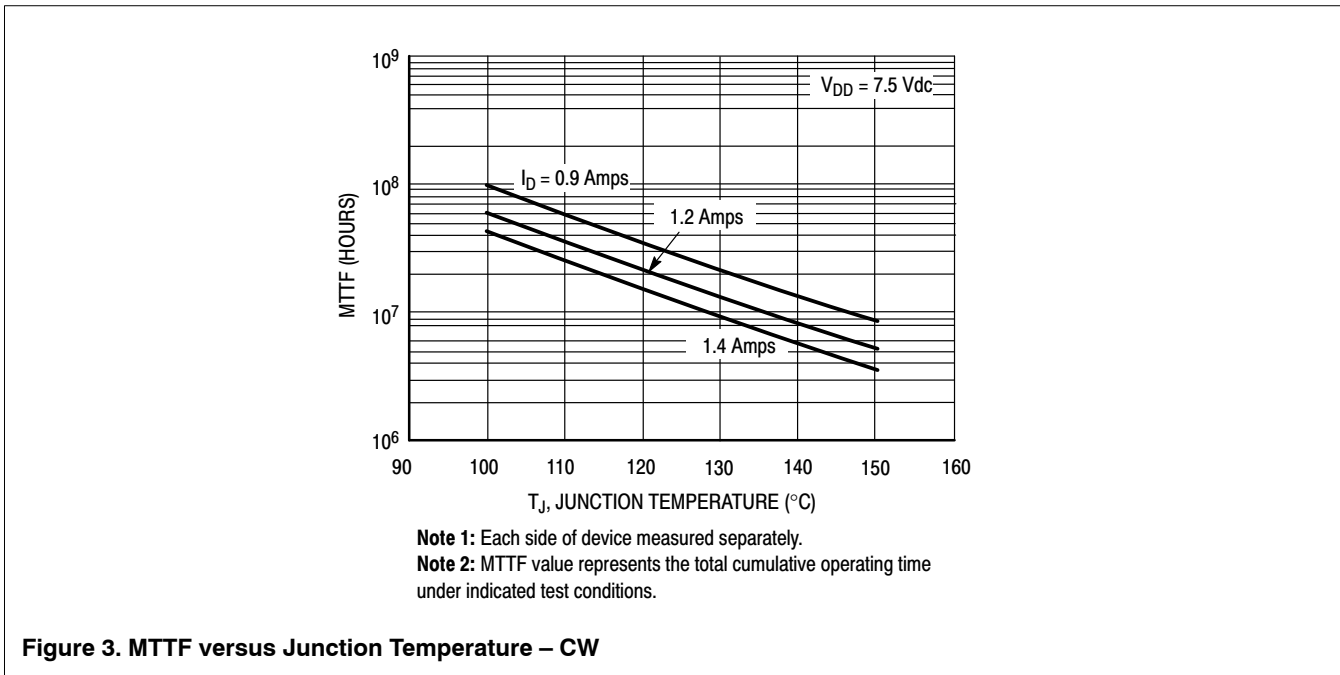
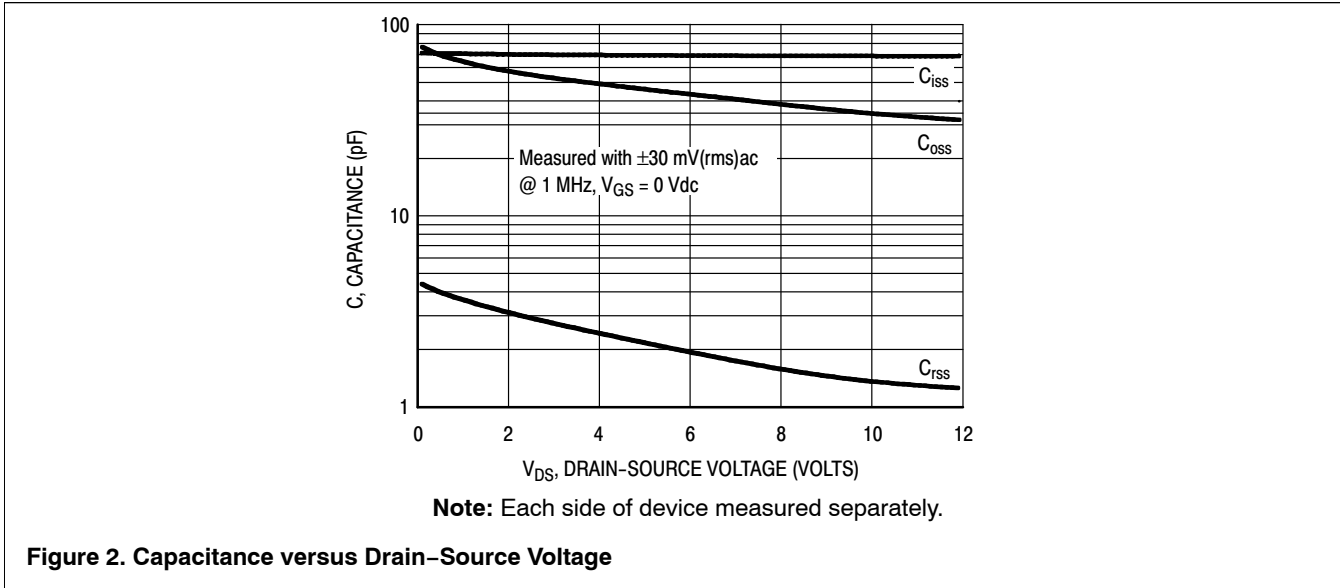
Frequency (MHz)	Signal Type	VSWR	$P_{in}$ (dBm)	Test Voltage, $V_{DD}$	Result
941	CW	> 10:1 at all Phase Angles	32.9 (3 dB Overdrive)	10.0	No Device Degradation

**Table 6. Ordering Information**

Device	Tape and Reel Information	Package
AFM912NT1	T1 Suffix = 1,000 Units, 16 mm Tape Width, 7-inch Reel	DFN 4 × 6

1. Each side of device measured separately.

## Typical Characteristics



### 941 MHz Test Fixture — 3" × 5" (7.8 cm × 12.7 cm)

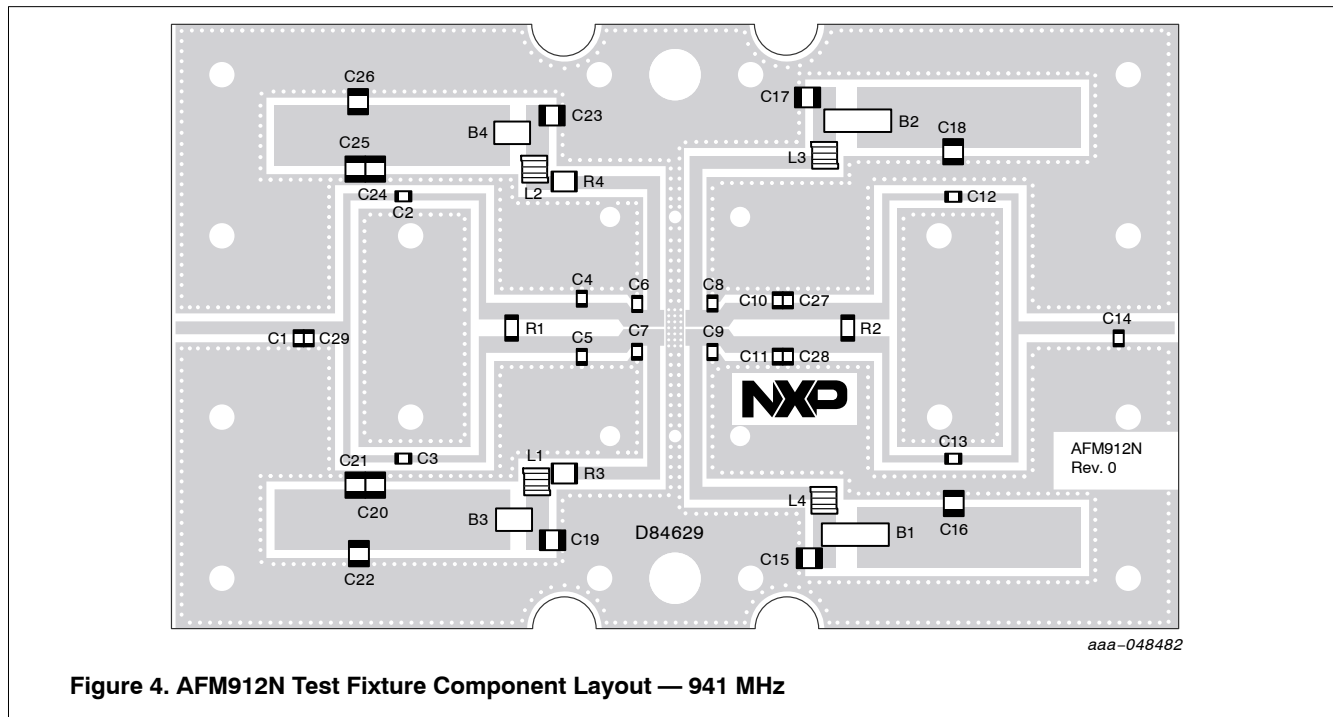


Figure 4. AFM912N Test Fixture Component Layout — 941 MHz

Table 7. AFM912N Test Fixture Component Designations and Values — 941 MHz

Part	Description	Part Number	Manufacturer
B1, B2	Long RF Bead	2743021447	Fair-Rite
B3, B4	Short RF Bead	2743019447	Fair-Rite
C1	2 pF Chip Capacitor	600F2R0BT250XT	ATC
C2, C3	8.2 pF Chip Capacitor	600F8R2BT250XT	ATC
C4, C5	6.8 pF Chip Capacitor	600F6R8BT250XT	ATC
C6, C7, C8, C9	9.1 pF Chip Capacitor	600F9R1BT250XT	ATC
C10, C11	5.6 pF Chip Capacitor	600F5R6BT250XT	ATC
C12, C13	150 pF Chip Capacitor	600F151JT250XT	ATC
C14	3 pF Chip Capacitor	600F3R0BT250XT	ATC
C15, C17, C19, C23	1 μF Chip Capacitor	GRM32CR72A105KA35L	Murata
C16, C18, C22, C26	10 μF Chip Capacitor	C3225X7S1H106M250AB	TDK
C20, C21, C24, C25	0.1 μF Chip Capacitor	GRM32MR71H104JA01L	Murata
C27, C28	0.2 pF Chip Capacitor	600F0R2BT250XT	ATC
C29	5.1 pF Chip Capacitor	600F5R1BT250XT	ATC
L1, L2	8 nH Inductor, 3 Turns	A03TKLC	Coilcraft
L3, L4	5 nH Inductor, 2 Turns	A02TJLC	Coilcraft
R1, R2	100 Ω, 1/4 W Chip Resistor	CRCW1206100RFKEA	Vishay
R3, R4	3.3 Ω, 1/2 W Chip Resistor	ERJ-14YJ3R3U	Panasonic
PCB	Rogers RO4350B, 0.030", ε <sub>r</sub> = 3.66	D84629	MTL

## Typical Characteristics — 941 MHz Test Fixture

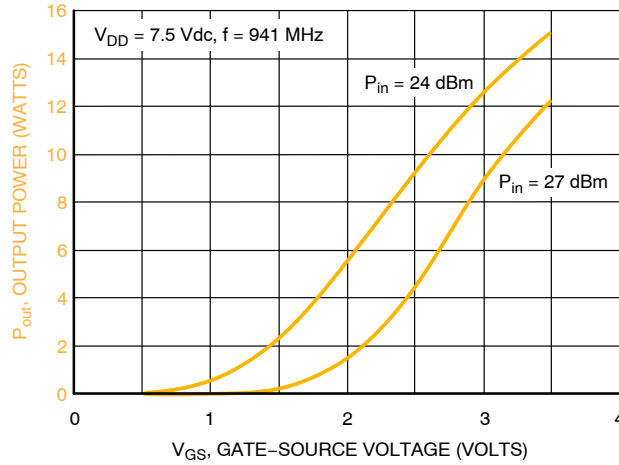


Figure 5. Output Power versus Gate-Source Voltage

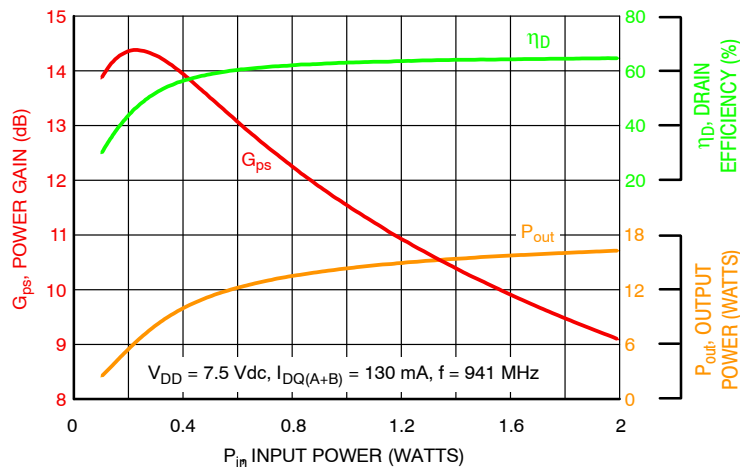


Figure 6. Power Gain, Drain Efficiency and Output Power versus Input Power

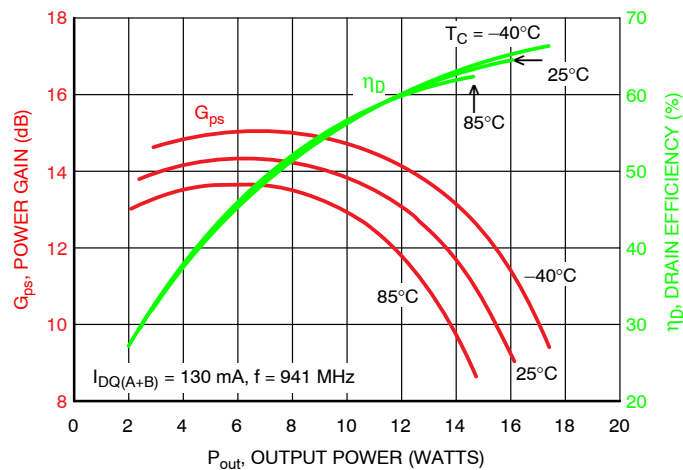


Figure 7. Power Gain and Drain Efficiency versus Output Power over Temperature

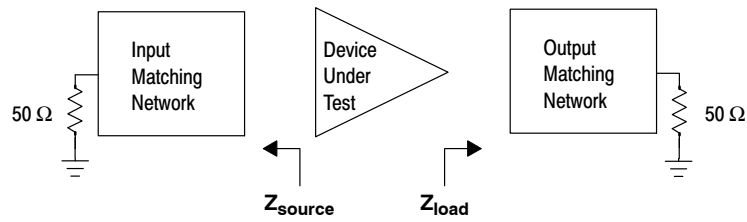
## 941 MHz Test Fixture

f (MHz)	$Z_{\text{source}}^{(1)}$ ( $\Omega$ )	$Z_{\text{load}}^{(1)}$ ( $\Omega$ )
941	$0.4 - j1.7$	$0.9 - j1.2$

1. Simulated data.

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

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



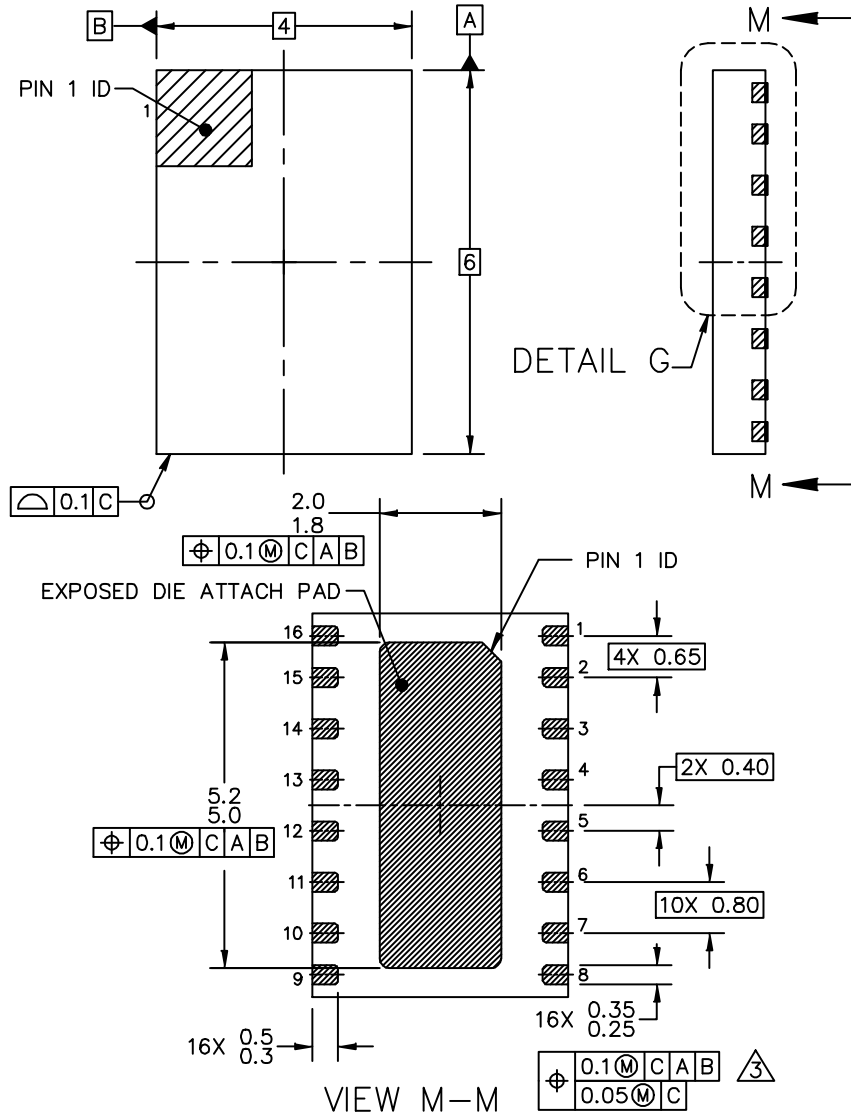
**Figure 8. Series Equivalent Source and Load Impedance — 941 MHz**



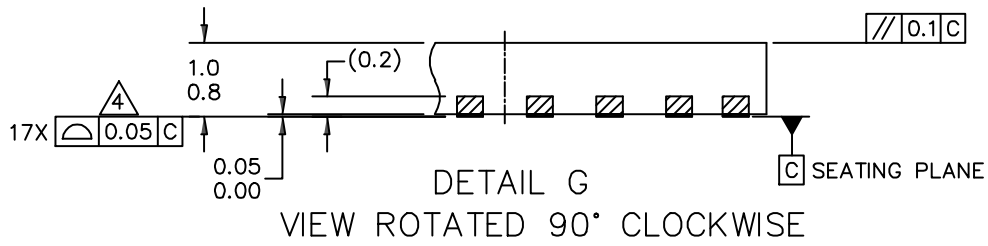
**Figure 9. Product Marking**



# Package Information



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TITLE: DFN, THERMALLY ENHANCED 4 X 6 X 0.9, 0.8 & 0.65 PITCH, 16 TERMINAL	DOCUMENT NO: 98ASA00868D	REV: B
	STANDARD: NON-JEDEC	
	SOT1862-1	27 JUL 2016



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NOTES:

1. DIMENSIONING & TOLERANCING CONFIRM TO ASME Y14.5M-1994.
2. ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.
3. THIS DIMENSION APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.25 MM AND 0.30 MM FROM TERMINAL TIP.
4. COPLANARITY APPLIES TO THE EXPOSED HEAT SLUG AS WELL AS THE TERMINALS.

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## 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

### Development Tools

- Printed Circuit Boards

## Revision History

The following table summarizes revisions to this document.

Revision	Date	Description
0	Nov. 2022	<ul style="list-style-type: none"><li>• Initial release of data sheet</li></ul>