NXP Semiconductors
Technical Data

Document Number: MRF300AN
Rev. 2, 06/2019

RoHS

RF Power LDMOS Transistors

High Ruggedness N-Channel Enhancement-Mode Lateral MOSFETs

These devices are designed for use in HF and VHF communications, industrial, scientific and medical (ISM) and broadcast and aerospace applications. The devices are extremely rugged and exhibit high performance up to 250 MHz.

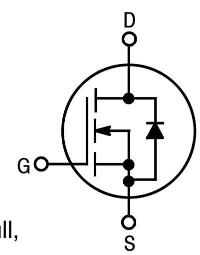
Typical Performance: V_{DD} = 50 Vdc

Frequency (MHz)	Signal Type	P_{out} (W)	G_{ps} (dB)	η_D (%)
13.56 (1)	CW	320 CW	28.1	79.7
27 (2)		330 CW	27.4	80.0
40.68 (3)		330 CW	28.2	79.0
50 (4)		320 CW	27.3	73.0
81.36 (5)		325 CW	25.1	77.5
144 (6)		320 CW	23.0	73.0
230 (7)	Pulse (100 μsec, 20% Duty Cycle)	330 Peak	20.4	75.5

Load Mismatch/Ruggedness

Frequency (MHz)	Signal Type	VSWR	P_{in} (W)	Test Voltage	Result
40.68	Pulse (100 μsec, 20% Duty Cycle)	> 65:1 at all Phase Angles	2 Peak (3 dB Overdrive)	50	No Device Degradation
230	Pulse (100 μsec, 20% Duty Cycle)	> 65:1 at all Phase Angles	6 Peak (3 dB Overdrive)	50	No Device Degradation

1. Measured in 13.56 MHz reference circuit (page 5).
2. Measured in 27 MHz reference circuit (page 10).
3. Measured in 40.68 MHz reference circuit (page 15).
4. Measured in 50 MHz reference circuit (page 20).
5. Measured in 81.36 MHz reference circuit (page 25).
6. Measured in 144 MHz reference circuit (page 30).
7. Measured in 230 MHz fixture (page 35).



Features

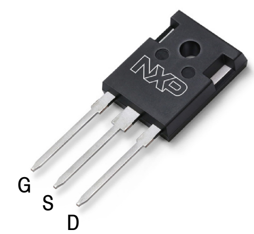
- Mirror pinout versions (A and B) to simplify use in a push-pull, two-up configuration
- Characterized from 30 to 50 V
- Suitable for linear application
- Integrated ESD protection with greater negative gate-source voltage range for improved Class C operation
- Included in NXP product longevity program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

Typical Applications

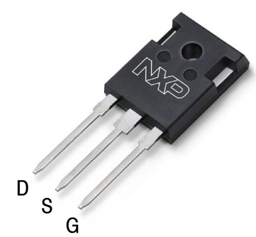
- Industrial, scientific, medical (ISM)
  - Laser generation
  - Plasma etching
  - Particle accelerators
  - MRI and other medical applications
  - Industrial heating, welding and drying systems
- Radio and VHF TV broadcast
- HF and VHF communications
- Switch mode power supplies

MRF300AN
MRF300BN

1.8–250 MHz, 300 W CW, 50 V WIDEBAND RF POWER LDMOS TRANSISTORS



TO-247-3
MRF300AN



TO-247-3
MRF300BN

Backside

Note: Exposed backside of the package also serves as a source terminal for the transistor.

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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	272 1.82	W W/°C

Table 2. Thermal Characteristics

Characteristic	Symbol	Value [2,3]	Unit
Thermal Resistance, Junction to Case CW: Case Temperature 76°C, 300 W CW, 50 Vdc, I_{DQ} = 50 mA, 40.68 MHz	$R_{\theta JC}$	0.55	°C/W
Thermal Impedance, Junction to Case Pulse: Case Temperature 74°C, 300 W Peak, 100 μsec Pulse Width, 20% Duty Cycle, 50 Vdc, I_{DQ} = 100 mA, 230 MHz	$Z_{\theta JC}$	0.13	°C/W

Table 3. ESD Protection Characteristics

Test Methodology	Class
Human Body Model (per JS-001-2017)	2, passes 2500 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	225 [4]	°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 = 840 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)	$V_{DS(on)}$	—	0.16	—	Vdc
Forward Transconductance (V_{DS} = 10 Vdc, I_D = 30 Adc)	g_{fs}	—	28	—	S

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.
4. Peak temperature during reflow process must not exceed 225°C.

(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}	—	2.31	—	pF
Output Capacitance (V_{DS} = 50 Vdc ± 30 mV(rms)ac @ 1 MHz, V_{GS} = 0 Vdc)	C_{oss}	—	104	—	pF
Input Capacitance (V_{DS} = 50 Vdc, V_{GS} = 0 Vdc ± 30 mV(rms)ac @ 1 MHz)	C_{iss}	—	403	—	pF
Typical Performance — 230 MHz (In NXP 230 MHz Fixture, 50 ohm system) V_{DD} = 50 Vdc, I_{DQ} = 100 mA, P_{in} = 3 W, f = 230 MHz, 100 μsec Pulse Width, 20% Duty Cycle					
Common-Source Amplifier Output Power	P_{out}	—	330	—	W
Drain Efficiency	η_D	—	75.5	—	%
Input Return Loss	IRL	—	–21	—	dB

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	6 Peak (3 dB Overdrive)	50	No Device Degradation

Table 7. Ordering Information — Device

Device	Shipping Information	Package
MRF300AN	MPQ = 240 devices (30 devices per tube, 8 tubes per box)	TO-247-3L (Pin 1: Gate, Pin 2: Source, Pin 3: Drain)
MRF300BN		TO-247-3L (Pin 1: Drain, Pin 2: Source, Pin 3: Gate)

Table 8. Ordering Information — Reference Circuits

Order Number	Description
MRF300AN-13MHZ	MRF300AN 13.56 MHz Reference Circuit
MRF300AN-27MHZ	MRF300AN 27 MHz Reference Circuit
MRF300AN-40MHZ	MRF300AN 40.68 MHz Reference Circuit
MRF300AN-50MHZ	MRF300AN 50 MHz Reference Circuit
MRF300AN-81MHZ	MRF300AN 81.36 MHz Reference Circuit
MRF300AN-144MHZ	MRF300AN 144 MHz Reference Circuit
MRF300AN-230MHZ	MRF300AN 230 MHz Test Fixture

TYPICAL CHARACTERISTICS

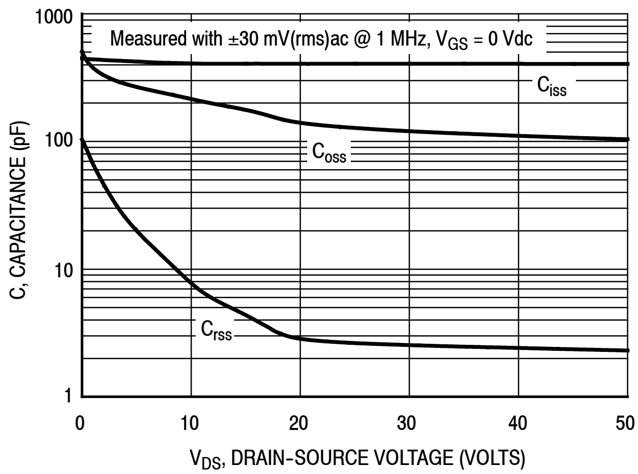
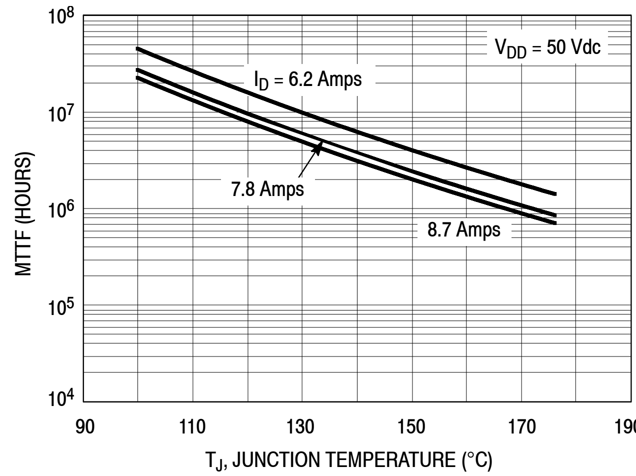


Figure 1. Capacitance versus Drain-Source Voltage



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

13.56 MHz REFERENCE CIRCUIT (MRF300AN)

Table 9. 13.56 MHz Performance (In NXP Reference Circuit, 50 ohm system)
V_{DD} = 50 Vdc, I_{DQ} = 100 mA, P_{in} = 0.5 W, CW

Frequency (MHz)	P_{out} (W)	G_{ps} (dB)	η_D (%)
13.56	320	28.1	79.7

13.56 MHz REFERENCE CIRCUIT (MRF300AN) — 2″ × 3″ (5.1 cm × 7.6 cm)

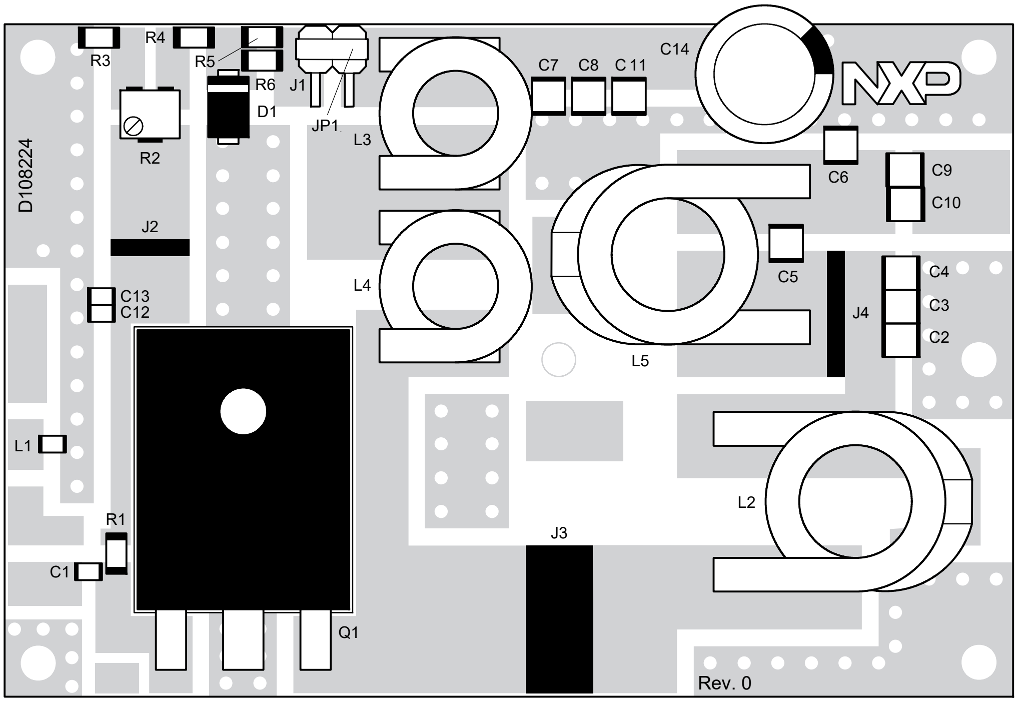


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Figure 3. MRF300AN 13.56 MHz Reference Circuit Component Layout

13.56 MHz REFERENCE CIRCUIT (MRF300AN)

Table 10. MRF300AN Reference Circuit Component Designations and Values — 13.56 MHz

Part	Description	Part Number	Manufacturer
C1	1 nF Chip Capacitor	GRM2165C2A102JA01D	Murata
C2, C3, C4	430 pF Chip Capacitor	800B431JT200XT	ATC
C5	75 pF Chip Capacitor	800B750JT500XT	ATC
C6	330 pF Chip Capacitor	800B331JT200XT	ATC
C7, C8, C9, C10	6.8 nF Chip Capacitor	GRM32QR73A682KW01L	Murata
C11	10 μF Chip Capacitor	GRM32EC72A106KE05L	Murata
C12	10 nF Chip Capacitor	GRM21BR72A103KA01B	Murata
C13	1 μF Chip Capacitor	GJ821BR71H105KA12L	Murata
C14	220 μF, 100 V Electrolytic Capacitor	MCGPR100V227M16X26	Multicomp
D1	8.2 V Zener Diode	SMAJ4738A–TP	Micro Commercial Components
J1	Right Angle Breakaway Headers (2 Pins)	9-146305-0	TE Connectivity
J2, J3, J4	Jumper	Copper Foil	
JP1	Shunt (J1)	382811-8	TE Connectivity
L1	390 nH Chip Inductor	0805CS-391XJLC	ATC
L2	33 nF Air Core Inductor	2014VS-33NMEB	Coilcraft
L3, L4	140 nH Air Core Inductor	1010VS-141ME	Coilcraft
L5	250 nH Air Core Inductor	2014VS-251NMEB	Coilcraft
Q1	RF Power LDMOS Transistor	MRF300AN	NXP
R1	33 Ω, 1/8 W Chip Resistor	CRCW080533R0FKEA	KOA Speer
R2	5.0 kΩ Multi-turn Cermet Trimming Potentiometer	3224W-1-502E	Bourns
R3	12 kΩ, 1/4 W Chip Resistor	CRCW120612K0FNEA	Vishay
R4	27 kΩ, 1/4 W Chip Resistor	CRCW120627K0FKEA	Vishay
R5, R6	20 kΩ, 1/4 W Chip Resistor	CRCW120620K0FKEA	Vishay
PCB	FR4 0.087″, ε_r = 4.8, 2 oz. Copper	D108224	MTL

TYPICAL CHARACTERISTICS — 13.56 MHz REFERENCE CIRCUIT (MRF300AN)

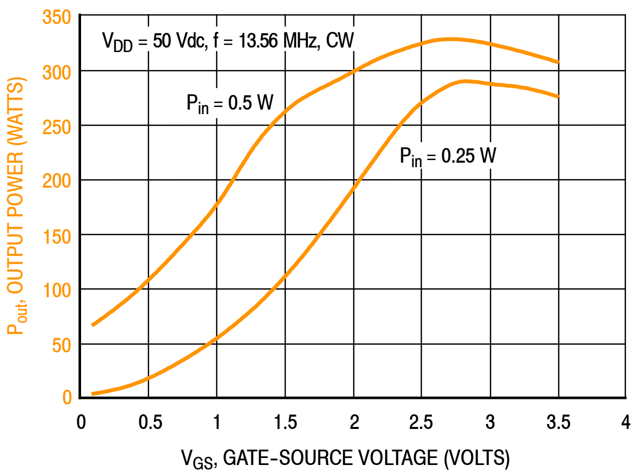
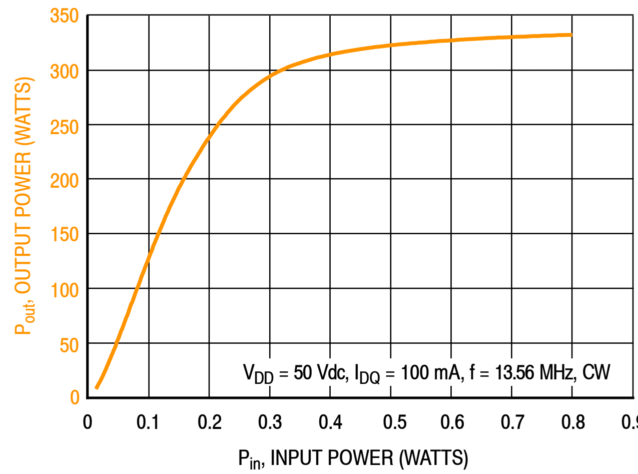


Figure 4. CW Output Power versus Gate-Source Voltage at a Constant Input Power



f (MHz)	P1dB (W)	P3dB (W)
13.56	285	322

Figure 5. CW Output Power versus Input Power

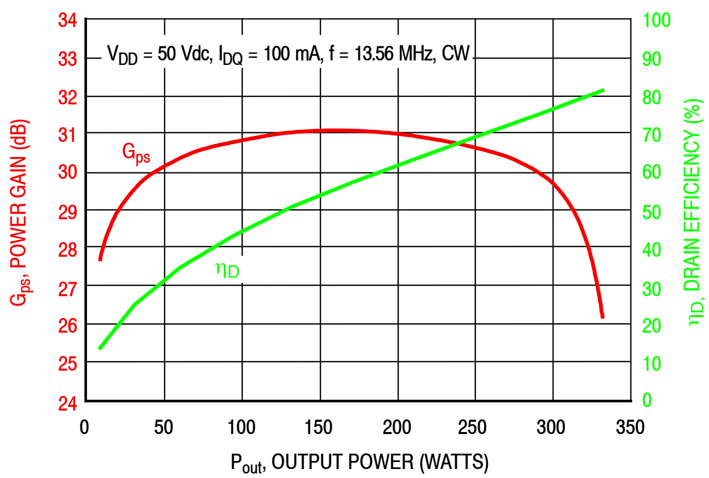


Figure 6. Power Gain and Drain Efficiency versus CW Output Power

13.56 MHz REFERENCE CIRCUIT (MRF300AN)

f (MHz)	Z_{source} (Ω)	Z_{load} (Ω)
13.56	12.0 + j5.2	5.1 – j1.0

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

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

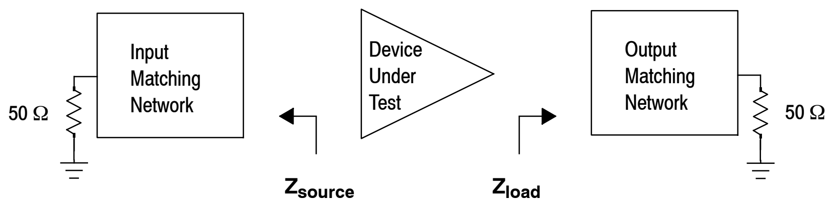


Figure 7. Series Equivalent Source and Load Impedance — 13.56 MHz

27 MHz REFERENCE CIRCUIT (MRF300AN)

Table 11. 27 MHz Performance (In NXP Reference Circuit, 50 ohm system)
V_{DD} = 50 Vdc, I_{DQ} = 100 mA, P_{in} = 0.6 W, CW

Frequency (MHz)	P_{out} (W)	G_{ps} (dB)	η_D (%)
27	330	27.4	80.0

27 MHz REFERENCE CIRCUIT (MRF300AN) — 2″ × 3″ (5.1 cm × 7.6 cm)

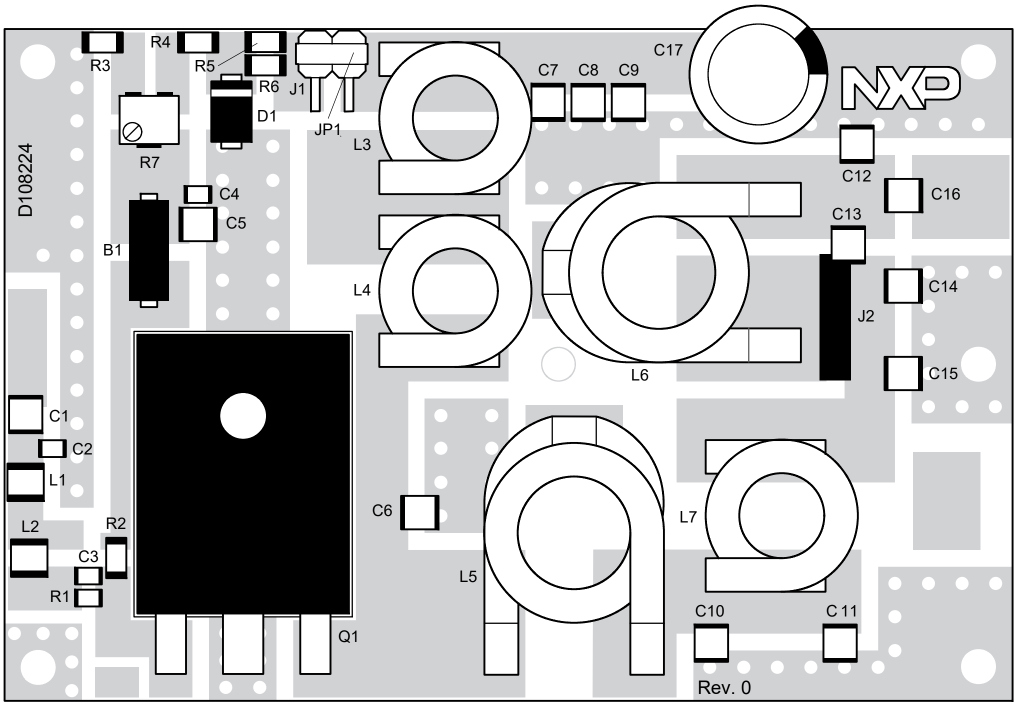


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Figure 8. MRF300AN 27 MHz Reference Circuit Component Layout

27 MHz REFERENCE CIRCUIT (MRF300AN)

Table 12. MRF300AN Reference Circuit Component Designations and Values — 27 MHz

Part	Description	Part Number	Manufacturer
B1	Long Ferrite Bead	2743021447	Fair-Rite
C1, C5, C7, C16	39,000 pF Chip Capacitor	200B393KT50XT	ATC
C2	120 pF Chip Capacitor	GQM2195C2E121GB12D	Murata
C3	200 pF Chip Capacitor	GQM2195C2A201GB12D	Murata
C4	1 μF Chip Capacitor	GRM31CR72A105KA01L	Murata
C6	27 pF Chip Capacitor	100B270JT500XT	ATC
C8	0.1 μF Chip Capacitor	GRM32NR72A104KA01B	Murata
C9	10 μF Chip Capacitor	GRM32ER61H106KA12L	Murata
C10	220 pF Chip Capacitor	100B221JT200XT	ATC
C11	120 pF Chip Capacitor	100B121JT300XT	ATC
C12	30 pF Chip Capacitor	100B300JT500XT	ATC
C13, C14	56 pF Chip Capacitor	100B560CT500XT	ATC
C15	200 pF Chip Capacitor	100B201JT300XT	ATC
C17	220 μF, 63 V Electrolytic Capacitor	EEU-FC1J221	Panasonic-ECG
D1	8.2 V Zener Diode	SMAJ4738A-TP	Micro Commercial Components
J1	Right Angle Breakaway Headers (2 Pins)	9-146305-0	TE Connectivity
J2	Jumper	Copper Foil	
JP1	Shunt (J1)	382811-8	TE Connectivity
L1, L2	180 nH Chip Inductor	1008CS-181XJLB	Coilcraft
L3, L4	110 nH Air Core Inductor	1212VS-111MEB	Coilcraft
L5	33 nH Air Core Inductor	2014VS-33NMEB	Coilcraft
L6	155 nH Air Core Inductor	2014VS-151MEB	Coilcraft
L7	90 nH Air Core Inductor	1212VS-90NME	Coilcraft
Q1	RF Power LDMOS Transistor	MRF300AN	NXP
R1	51 Ω, 1/4 W Chip Resistor	CRCW120651R0FKEA	Vishay
R2	100 Ω, 1/4 W Chip Resistor	CRCW1206100RFKEA	Vishay
R3	12 kΩ, 1/4 W Chip Resistor	CRCW120612K0JNEA	Vishay
R4	27 kΩ, 1/4 W Chip Resistor	CRCW120627K0FKEA	Vishay
R5, R6	20 kΩ, 1/4 W Chip Resistor	CRCW120620K0FKEA	Vishay
R7	5.0 kΩ Multi-turn Cermet Trimmer Potentiometer	3224W-1-502E	Bourns
PCB	FR4 0.087″, ε_r = 4.8, 2 oz. Copper	D108224	MTL

TYPICAL CHARACTERISTICS — 27 MHz REFERENCE CIRCUIT (MRF300AN)

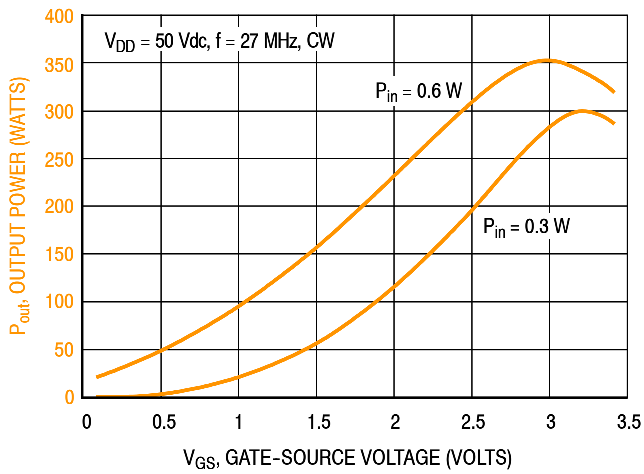
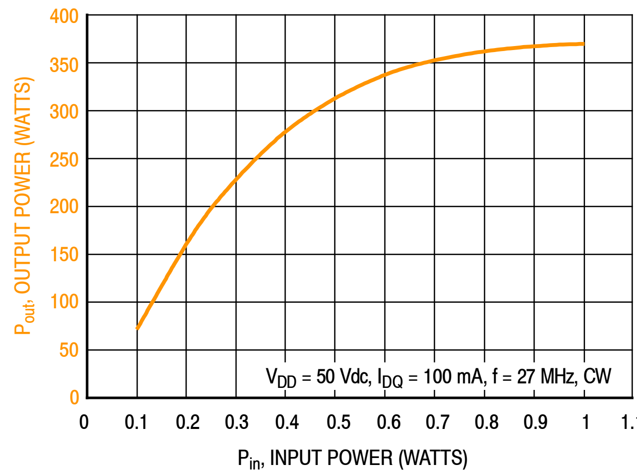


Figure 9. CW Output Power versus Gate-Source Voltage at a Constant Input Power



f (MHz)	P1dB (W)	P3dB (W)
27	310	365

Figure 10. CW Output Power versus Input Power

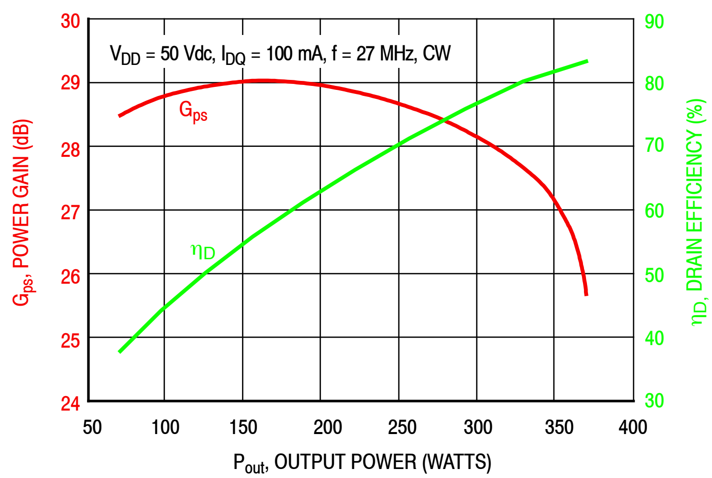


Figure 11. Power Gain and Drain Efficiency versus CW Output Power

27 MHz REFERENCE CIRCUIT (MRF300AN)

f (MHz)	Z_{source} (Ω)	Z_{load} (Ω)
27	32.13 + j11.22	4.47 + j0.45

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

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

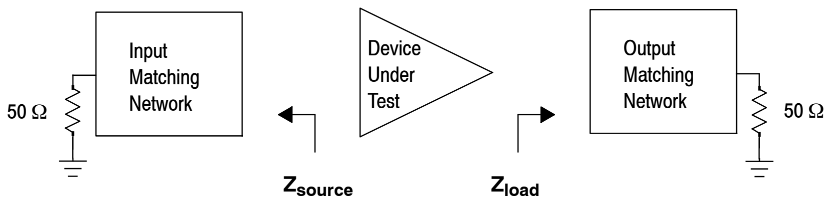


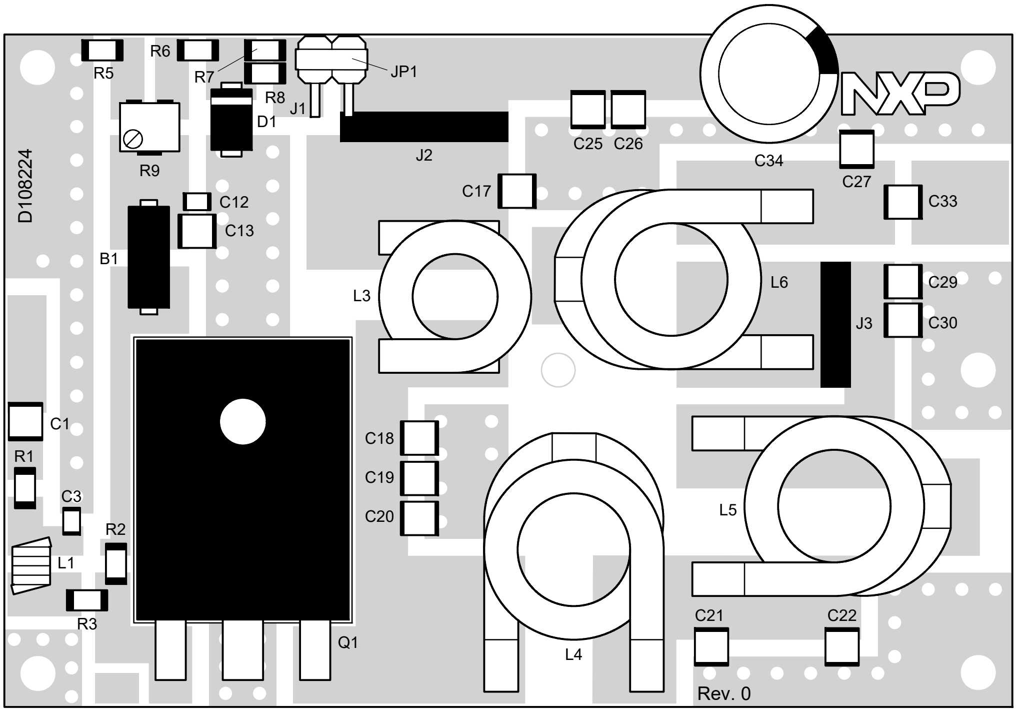
Figure 12. Series Equivalent Source and Load Impedance — 27 MHz

40.68 MHz REFERENCE CIRCUIT (MRF300AN)

Table 13. 40.68 MHz Performance (In NXP Reference Circuit, 50 ohm system)
V_{DD} = 50 Vdc, I_{DQ} = 100 mA, P_{in} = 0.5 W, CW

Frequency (MHz)	P_{out} (W)	G_{ps} (dB)	η_D (%)
40.68	330	28.2	79.0

40.68 MHz REFERENCE CIRCUIT (MRF300AN) — 2″ × 3″ (5.1 cm × 7.6 cm)



Note: Component numbers C2, C4–C11, C14–C16, C23, C24, C28, C31, C32, L2 and R4 are not used.

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Figure 13. MRF300AN 40.68 MHz Reference Circuit Component Layout

40.68 MHz REFERENCE CIRCUIT (MRF300AN)

Table 14. MRF300AN Reference Circuit Component Designations and Values — 40.68 MHz

Part	Description	Part Number	Manufacturer
B1	Long Ferrite Bead	2743021447	Fair-Rite
C1, C13, C17	22,000 pF Chip Capacitor	ATC200B223KT50XT	ATC
C3	200 pF Chip Capacitor	GQM2195C2A201GB12D	Murata
C12	1 μF Chip Capacitor	GRM31CR72A105KA01L	Murata
C18, C19, C20	68 pF Chip Capacitor	ATC100B680JT500XT	ATC
C21	200 pF Chip Capacitor	ATC100B201JT300XT	ATC
C22	220 pF Chip Capacitor	ATC100B221JT200XT	ATC
C25	0.1 μF Chip Capacitor	GRM32NR72A104KA01B	Murata
C26	10 μF Chip Capacitor	GRM32ER61H106KA12L	Murata
C27	56 pF Chip Capacitor	ATC100B560CT500XT	ATC
C29	75 pF Chip Capacitor	ATC100B750JT500XT	ATC
C30	91 pF Chip Capacitor	ATC100B910JT500XT	ATC
C33	5100 pF Chip Capacitor	ATC700B512KT50XT	ATC
C34	220 μF, 63 V Electrolytic Capacitor	EEU-FC1J221	Panasonic
D1	8.2 V Zener Diode	SMAJ4738A-TP	Micro Commercial Components
J1	Right Angle Breakaway Headers (2 Pins)	9-146305-0	TE Connectivity
J2, J3	Jumper	Copper Foil	
JP1	Shunt (J1)	382811-8	TE Connectivity
L1	120 nH Chip Inductor	1008CS-121XJLB	Coilcraft
L3	117 nH Air Core Inductor	1212VS-111MEB	Coilcraft
L4	33 nH Air Core Inductor	2014VS-33NMEB	Coilcraft
L5	108 nH Air Core Inductor	2014VS-111MEB	Coilcraft
L6	155 nH Air Core Inductor	2014VS-151MEB	Coilcraft
Q1	RF Power LDMOS Transistor	MRF300AN	NXP
R1, R3	0 Ω, 1/4 W Chip Resistor	CRCW12060000Z0EA	Vishay
R2	100 Ω, 1/4 W Chip Resistor	CRCW1206100RFKEA	Vishay
R5	12 kΩ, 1/4 W Chip Resistor	CRCW120612K0FKEA	Vishay
R6	27 kΩ, 1/4 W Chip Resistor	CRCW120627K0FKEA	Vishay
R7, R8	20 kΩ, 1/4 W Chip Resistor	CRCW120620K0FKEA	Vishay
R9	5.0 kΩ Multi-turn Cermet Trimmer Potentiometer	3224W-1-502E	Bourns
PCB	FR4 0.087″, ε_r = 4.8, 2 oz. Copper	D108224	MTL

TYPICAL CHARACTERISTICS — 40.68 MHz REFERENCE CIRCUIT (MRF300AN)

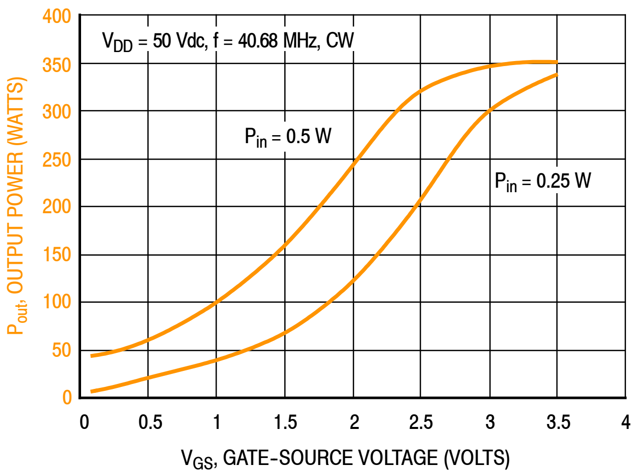
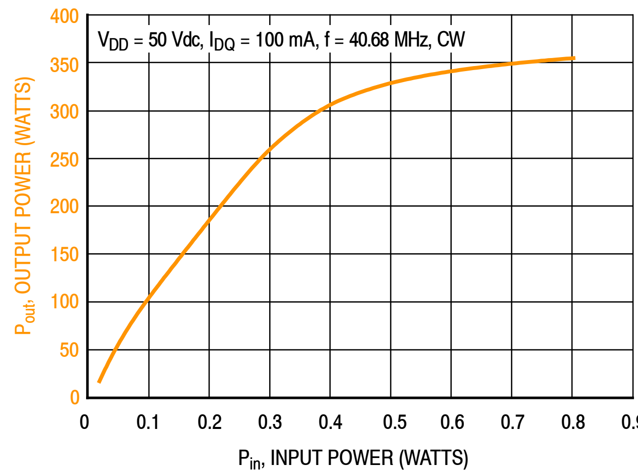


Figure 14. CW Output Power versus Gate-Source Voltage at a Constant Input Power



f (MHz)	P1dB (W)	P3dB (W)
40.68	250	340

Figure 15. CW Output Power versus Input Power

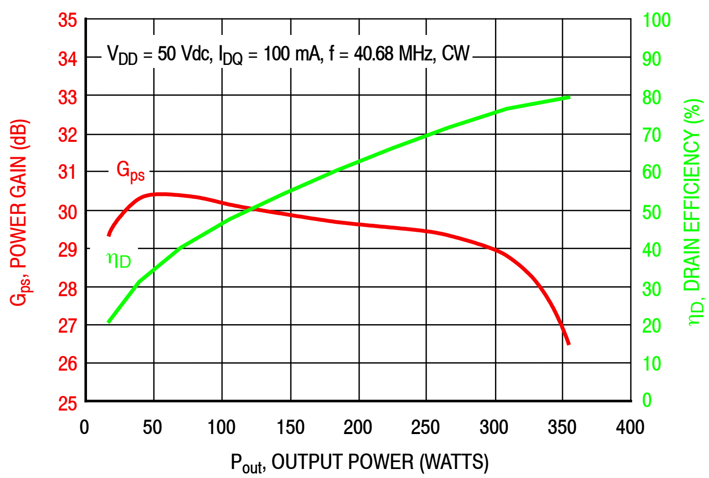


Figure 16. Power Gain and Drain Efficiency versus CW Output Power

40.68 MHz REFERENCE CIRCUIT (MRF300AN)

f (MHz)	Z_{source} (Ω)	Z_{load} (Ω)
40.68	7.83 + j13.51	5.34 + j1.03

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

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

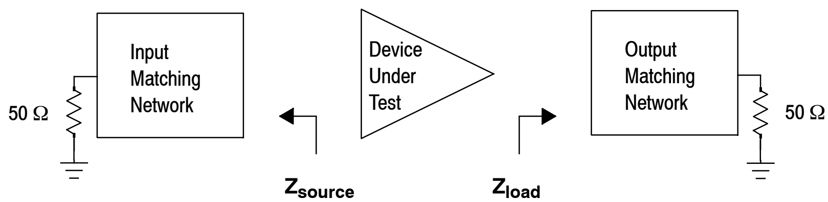


Figure 17. Series Equivalent Source and Load Impedance — 40.68 MHz

50 MHz REFERENCE CIRCUIT (MRF300AN)

Table 15. 50 MHz Performance (In NXP Reference Circuit, 50 ohm system)
V_{DD} = 50 Vdc, I_{DQ} = 100 mA, P_{in} = 0.6 W, CW

Frequency (MHz)	P_{out} (W)	G_{ps} (dB)	η_D (%)
50	320	27.3	73.0

50 MHz REFERENCE CIRCUIT (MRF300AN) — 2″ × 3″ (5.1 cm × 7.6 cm)

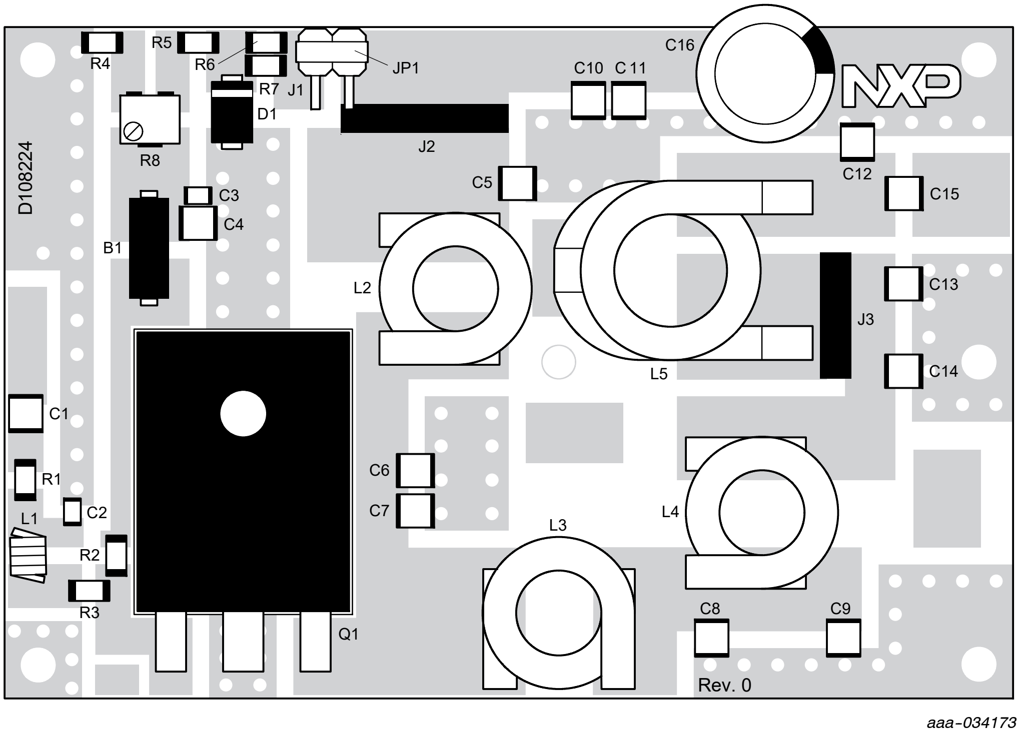


Figure 18. MRF300AN 50 MHz Reference Circuit Component Layout

50 MHz REFERENCE CIRCUIT (MRF300AN)

Table 16. MRF300AN Reference Circuit Component Designations and Values — 50 MHz

Part	Description	Part Number	Manufacturer
B1	Long Ferrite Bead	2743021447	Fair-Rite
C1, C4, C5, C15	10,000 pF Chip Capacitor	200B103KT50XT	ATC
C2	180 pF Chip Capacitor	GQM2195C2A181GB12D	Murata
C3	1 μF Chip Capacitor	GRM31CR72A105KA01L	Murata
C6	56 pF Chip Capacitor	100B560CT500XT	ATC
C7, C13	68 pF Chip Capacitor	100B680JT500XT	ATC
C8, C9	180 pF Chip Capacitor	100B181JT300XT	ATC
C10	0.1 μF Chip Capacitor	12101C104KAT4A	AVX
C11	10 μF Chip Capacitor	GRM32ER61H106KA12L	Murata
C12	82 pF Chip Capacitor	100B820JT500XT	ATC
C14	110 pF Chip Capacitor	100B111JT300XT	ATC
C16	220 μF, 63 V Electrolytic Capacitor	EEU-FC1J221	Panasonic
D1	8.2 V Zener Diode	SMAJ4738A–TP	Micro Commercial Components
J1	Right Angle Breakaway Headers (2 Pins)	9-146305-0	TE Connectivity
J2, J3	Jumper	Copper Foil	
JP1	Shunt (J1)	382811-8	TE Connectivity
L1	82 nH Air Core Inductor	1812SMS-82NJLC	Coilcraft
L2	110 nH Air Core Inductor	1212VS-111MEB	Coilcraft
L3	22 nH Air Core Inductor	1212VS-22NME	Coilcraft
L4	90 nH Air Core Inductor	1212VS-90NME	Coilcraft
L5	150 nH Air Core Inductor	2014VS-151MEB	Coilcraft
Q1	RF Power LDMOS Transistor	MRF300AN	NXP
R1, R3	0 Ω, 1/4 W Chip Resistor	CRCW12060000Z0EA	Vishay
R2	100 Ω, 1/4 W Chip Resistor	CRCW1206100RFKEA	Vishay
R4	12 kΩ, 1/4 W Chip Resistor	CRCW120612K0FNEA	Vishay
R5	27 kΩ, 1/4 W Chip Resistor	CRCW120627K0FKEA	Vishay
R6, R7	20 kΩ, 1/4 W Chip Resistor	CRCW120620K0FKEA	Vishay
R8	5.0 kΩ Multi-turn Cermet Trimmer Potentiometer	3224W-1-502E	Bourns
PCB	FR4 0.087″, ε_r = 4.8, 2 oz. Copper	D108224	MTL

TYPICAL CHARACTERISTICS — 50 MHz REFERENCE CIRCUIT (MRF300AN)

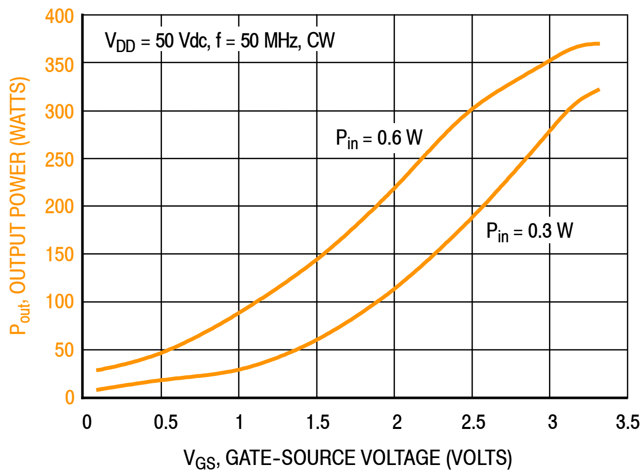
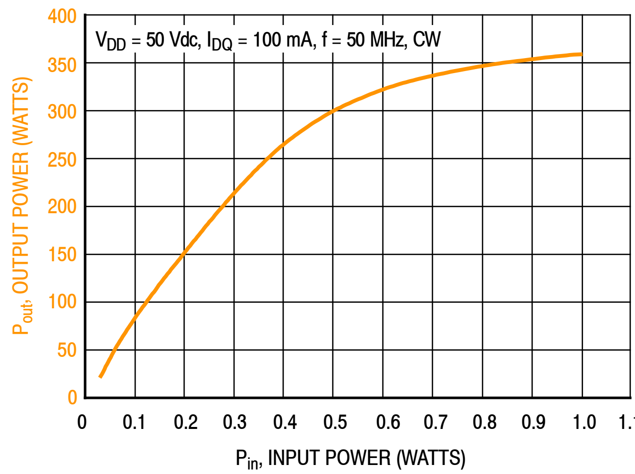


Figure 19. CW Output Power versus Gate-Source Voltage at a Constant Input Power



f (MHz)	P1dB (W)	P3dB (W)
50	260	340

Figure 20. CW Output Power versus Input Power

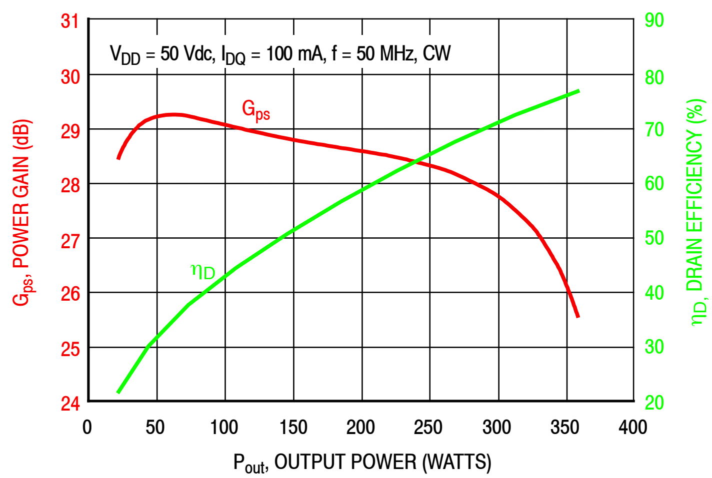


Figure 21. Power Gain and Drain Efficiency versus CW Output Power

50 MHz REFERENCE CIRCUIT (MRF300AN)

f (MHz)	Z_{source} (Ω)	Z_{load} (Ω)
50	6.44 + j12.27	5.05 + j1.36

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

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

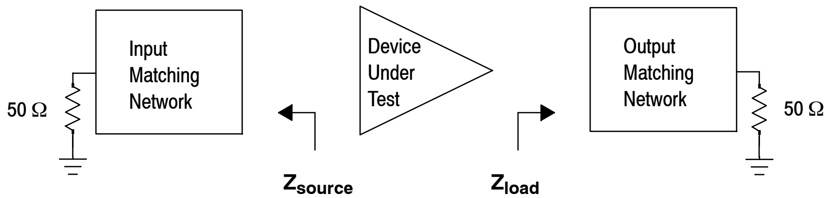


Figure 22. Series Equivalent Source and Load Impedance — 50 MHz

81.36 MHz REFERENCE CIRCUIT (MRF300AN)

Table 17. 81.36 MHz Performance (In NXP Reference Circuit, 50 ohm system)
V_{DD} = 50 Vdc, I_{DQ} = 100 mA, P_{in} = 1 W, CW

Frequency (MHz)	P_{out} (W)	G_{ps} (dB)	η_D (%)
81.36	325	25.1	77.5

81.36 MHz REFERENCE CIRCUIT (MRF300AN) — 2″ × 3″ (5.1 cm × 7.6 cm)

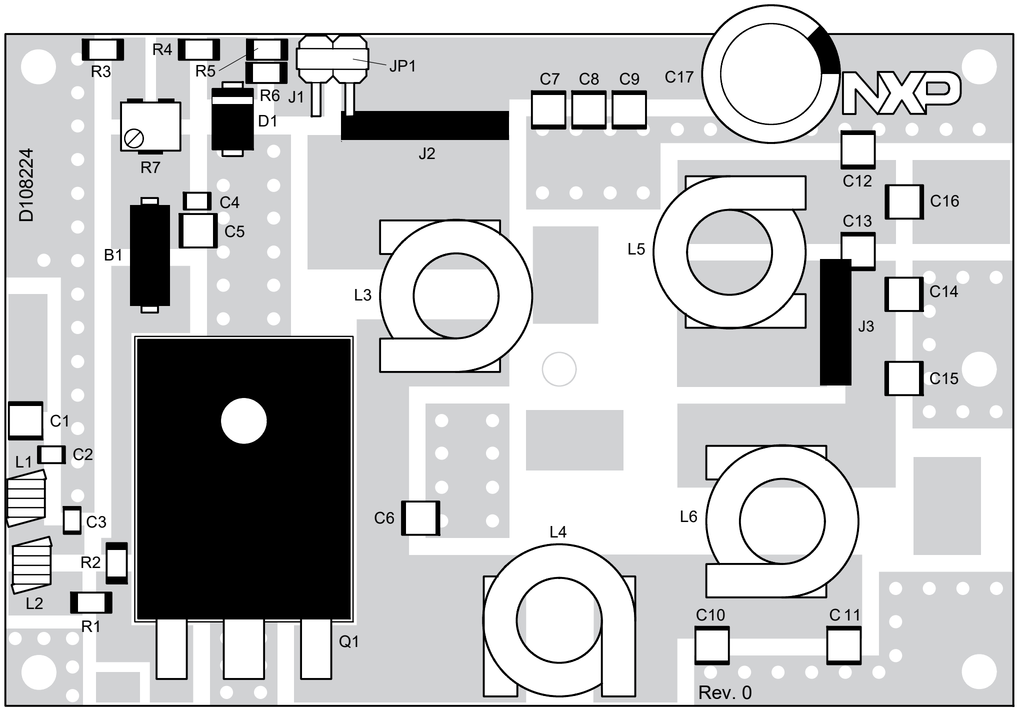


Figure 23. MRF300AN 81.36 MHz Reference Circuit Component Layout

81.36 MHz REFERENCE CIRCUIT (MRF300AN)

Table 18. MRF300AN Reference Circuit Component Designations and Values — 81.36 MHz

Part	Description	Part Number	Manufacturer
B1	Long Ferrite Bead	2743021447	Fair-Rite
C1, C5, C7, C16	4,700 pF Chip Capacitor	700B472KT50XT	ATC
C2	120 pF Chip Capacitor	GQM2195C2E121GB12D	Murata
C3	47 pF Chip Capacitor	GQM2195C2E470GB12D	Murata
C4	1 μF Chip Capacitor	GRM31CR72A105KA01L	Murata
C6	30 pF Chip Capacitor	100B300JT500XT	ATC
C8	0.1 μF Chip Capacitor	GRM32NR72A104KA01B	Murata
C9	10 μF Chip Capacitor	GRM32ER61H106KA12L	Murata
C10	91 pF Chip Capacitor	100B910JT500XT	ATC
C11	82 pF Chip Capacitor	100B820JT500XT	ATC
C12	51 pF Chip Capacitor	100B510GT500XT	ATC
C13	22 pF Chip Capacitor	100B220JT500XT	ATC
C14	12 pF Chip Capacitor	100B120JT500XT	ATC
C15	33 pF Chip Capacitor	100B330JT500XT	ATC
C17	220 μF, 63 V Electrolytic Capacitor	EEU-FC1J221	Panasonic
D1	8.2 V Zener Diode	SMAJ4738A-TP	Micro Commercial Components
J1	Right Angle Breakaway Headers (2 Pins)	9-146305-0	TE Connectivity
J2, J3	Jumper	Copper Foil	
JP1	Shunt (J1)	382811-8	TE Connectivity
L1	12.3 nH Square Air Core Inductor	0806SQ-12NJL	Coilcraft
L2	19 nH Square Air Core Inductor	0806SQ-19NJL	Coilcraft
L3	117 nH Air Core Inductor	1212VS-111MEB	Coilcraft
L4	22 nH Air Core Inductor	1212VS-22NMEB	Coilcraft
L5, L6	42 nH Air Core Inductor	1212VS-42NMEB	Coilcraft
Q1	RF Power LDMOS Transistor	MRF300AN	NXP
R1	0 Ω, 1/4 W Chip Resistor	CRCW12060000Z0EA	Vishay
R2	100 Ω, 1/4 W Chip Resistor	CRCW1206100RFKEA	Vishay
R3	12 kΩ, 1/4 W Chip Resistor	CRCW120612K0JNEA	Vishay
R4	27 kΩ, 1/4 W Chip Resistor	CRCW120627K0FKEA	Vishay
R5, R6	20 kΩ, 1/4 W Chip Resistor	CRCW120620K0FKEA	Vishay
R7	5.0 kΩ Multi-turn Cermet Trimmer Potentiometer	3224W-1-502E	Bourns
PCB	FR4 0.087″, ε_r = 4.8, 2 oz. Copper	D108224	MTL

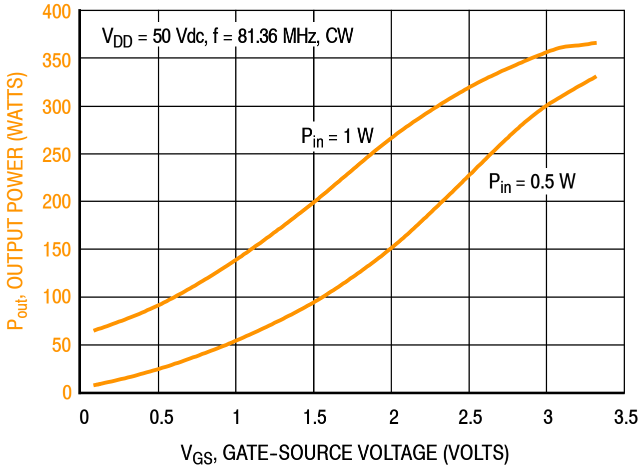
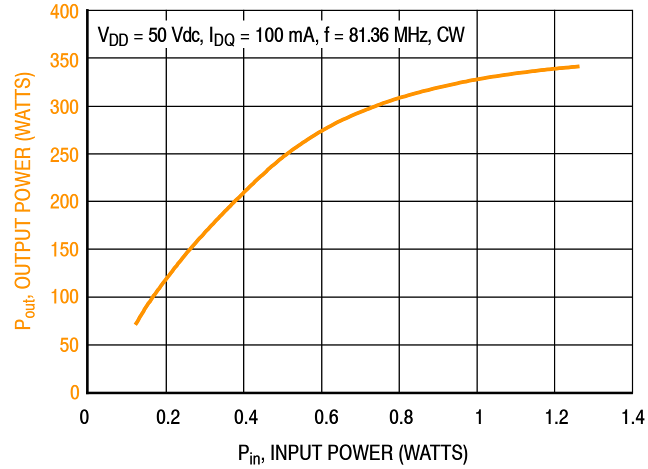


Figure 24. CW Output Power versus Gate-Source Voltage at a Constant Input Power



f (MHz)	P1dB (W)	P3dB (W)
81.36	260	335

Figure 25. CW Output Power versus Input Power

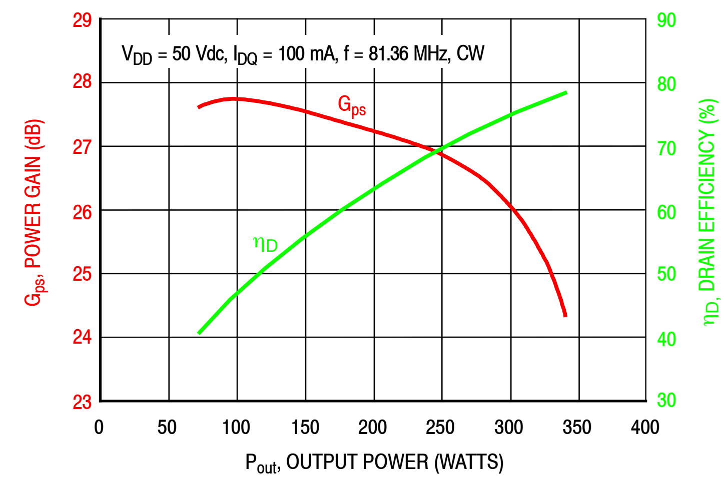


Figure 26. Power Gain and Drain Efficiency versus CW Output Power

81.36 MHz REFERENCE CIRCUIT (MRF300AN)

f (MHz)	Z_{source} (Ω)	Z_{load} (Ω)
81.36	3.86 + j7.90	4.45 + j3.53

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

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

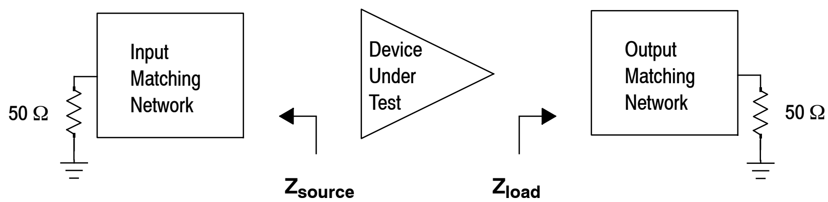


Figure 27. Series Equivalent Source and Load Impedance — 81.36 MHz

144 MHz REFERENCE CIRCUIT (MRF300AN)

Table 19. 144 MHz Performance (In NXP Reference Circuit, 50 ohm system)
V_{DD} = 50 Vdc, I_{DQ} = 100 mA, P_{in} = 1.6 W, CW

Frequency (MHz)	P_{out} (W)	G_{ps} (dB)	η_D (%)
144	320	23.0	73.0

144 MHz REFERENCE CIRCUIT (MRF300AN) — 2″ × 3″ (5.1 cm × 7.6 cm)

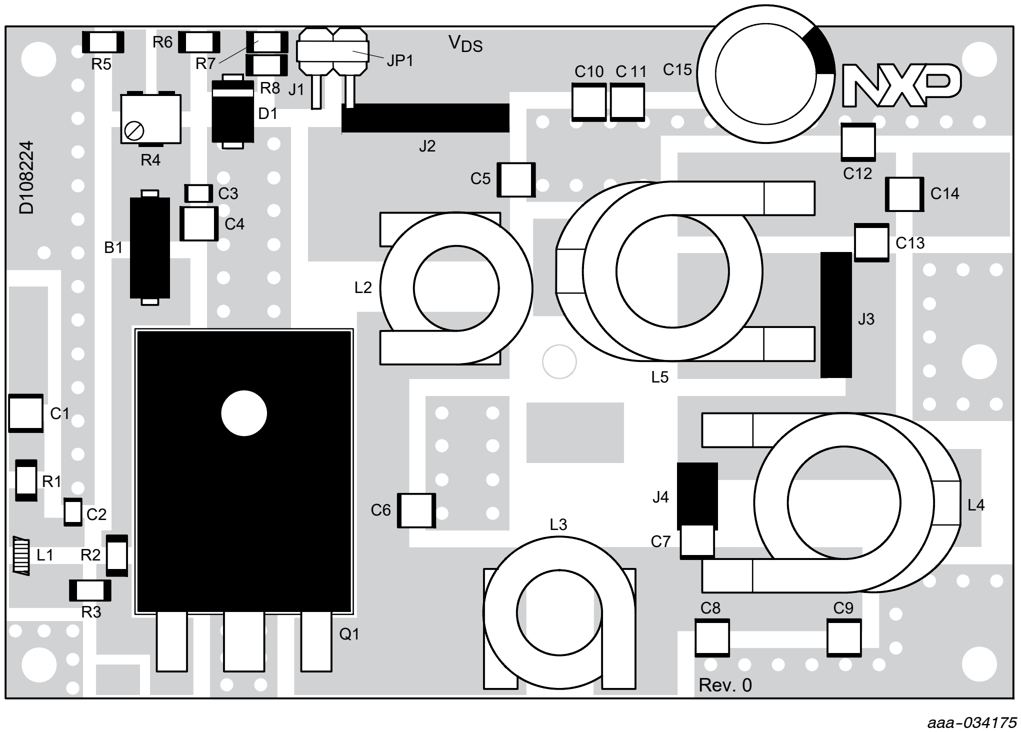


Figure 28. MRF300AN 144 MHz Reference Circuit Component Layout

144 MHz REFERENCE CIRCUIT (MRF300AN)

Table 20. MRF300AN Reference Circuit Component Designations and Values — 144 MHz

Part	Description	Part Number	Manufacturer
B1	Long Ferrite Bead	2743021447	Fair-Rite
C1, C4, C5, C14	1,000 pF Chip Capacitor	100B102JT50XT	ATC
C2	120 pF Chip Capacitor	GQM2195C2A121GB12D	Murata
C3	1 μF Chip Capacitor	GRM31CR72A105KA01L	Murata
C6, C8	30 pF Chip Capacitor	100B300JT500XT	ATC
C7	5.6 pF Chip Capacitor	100B5R6CT500XT	ATC
C9	24 pF Chip Capacitor	100B240JT500XT	ATC
C10	0.1 μF Chip Capacitor	GRM32NR72A104KA01B	Murata
C11	10 μF Chip Capacitor	GRM32ER61H106KA12L	Murata
C12	33 pF Chip Capacitor	100B330JT500XT	ATC
C13	3.9 pF Chip Capacitor	100B3R9CT500XT	ATC
C15	220 μF, 63 V Electrolytic Capacitor	EEU-FC1J221	Panasonic
D1	8.2 V Zener Diode	SMAJ4738A−TP	Micro Commercial Components
J1	Right Angle Breakaway Headers (2 Pins)	9-146305-0	TE Connectivity
J2, J3, J4	Jumper	Copper Foil	
JP1	Shunt (J1)	382811-8	TE Connectivity
L1	7.15 nH Air Core Inductor	1606-7JLC	Coilcraft
L2	110 nH Air Core Inductor	1212VS-111MEB	Coilcraft
L3	22 nH Air Core Inductor	1212VS-22NME	Coilcraft
L4, L5	33 nH Air Core Inductor	2014VS-33NME	Coilcraft
Q1	RF Power LDMOS Transistor	MRF300AN	NXP
R1, R3	0 Ω, 1/4 W Chip Resistor	CRCW12060000Z0EA	Vishay
R2	100 Ω, 1/4 W Chip Resistor	CRCW1206100RFKEA	Vishay
R4	5.0 kΩ Multi-turn Cermet Trimmer Potentiometer	3224W-1-502E	Bourns
R5	12 kΩ, 1/4 W Chip Resistor	CRCW120612K0JNEA	Vishay
R6	27 kΩ, 1/4 W Chip Resistor	CRCW120627K0JNEA	Vishay
R7, R8	20 kΩ, 1/4 W Chip Resistor	CRCW120620K0JNEA	Vishay
PCB	FR4 0.087″, ε_r = 4.8, 2 oz. Copper	D108224	MTL

TYPICAL CHARACTERISTICS — 144 MHz REFERENCE CIRCUIT (MRF300AN)

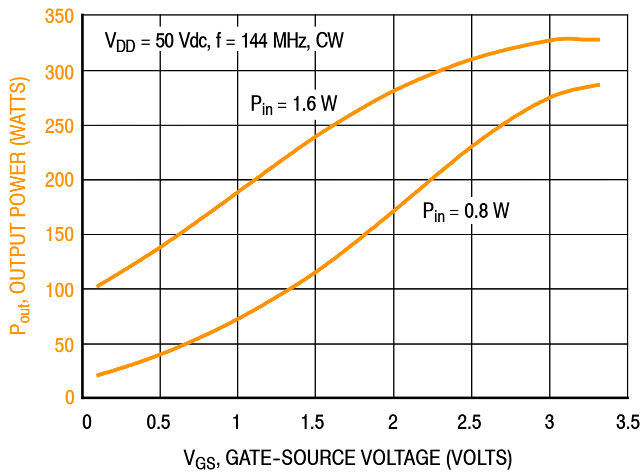
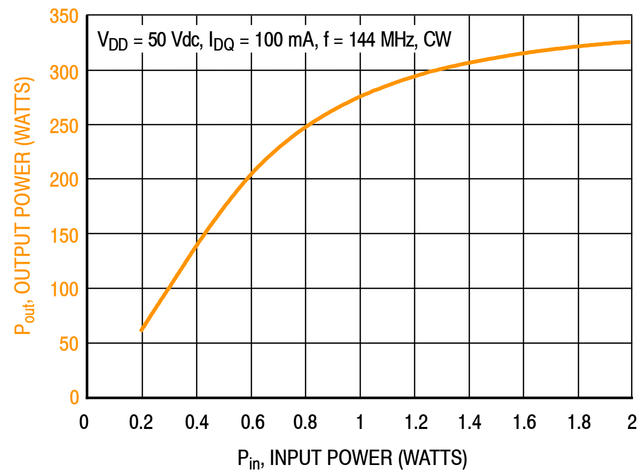


Figure 29. CW Output Power versus Gate-Source Voltage at a Constant Input Power



f (MHz)	P1dB (W)	P3dB (W)
144	275	320

Figure 30. CW Output Power versus Input Power

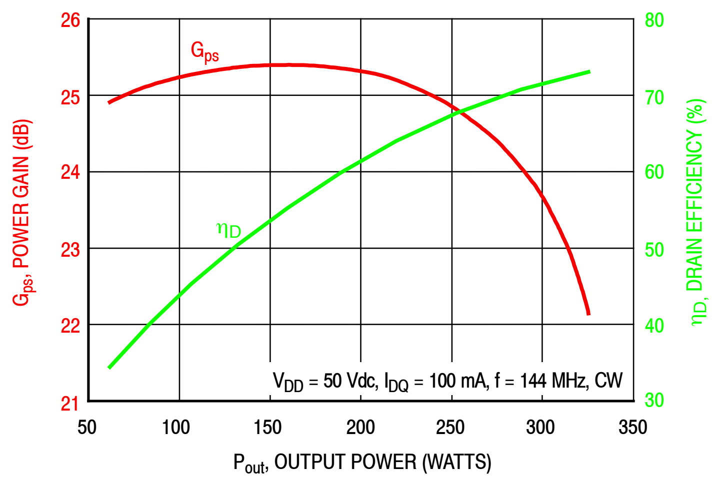


Figure 31. Power Gain and Drain Efficiency versus CW Output Power

144 MHz REFERENCE CIRCUIT (MRF300AN)

f (MHz)	Z_{source} (Ω)	Z_{load} (Ω)
144	1.62 + j6.44	4.32 + j2.06

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

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

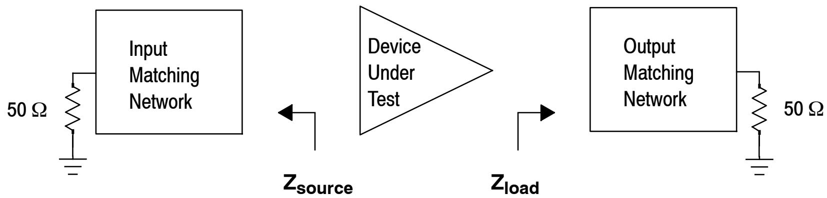


Figure 32. Series Equivalent Source and Load Impedance — 144 MHz

230 MHz FIXTURE (MRF300AN) — 4″ × 5″ (10.2 cm × 12.7 cm)

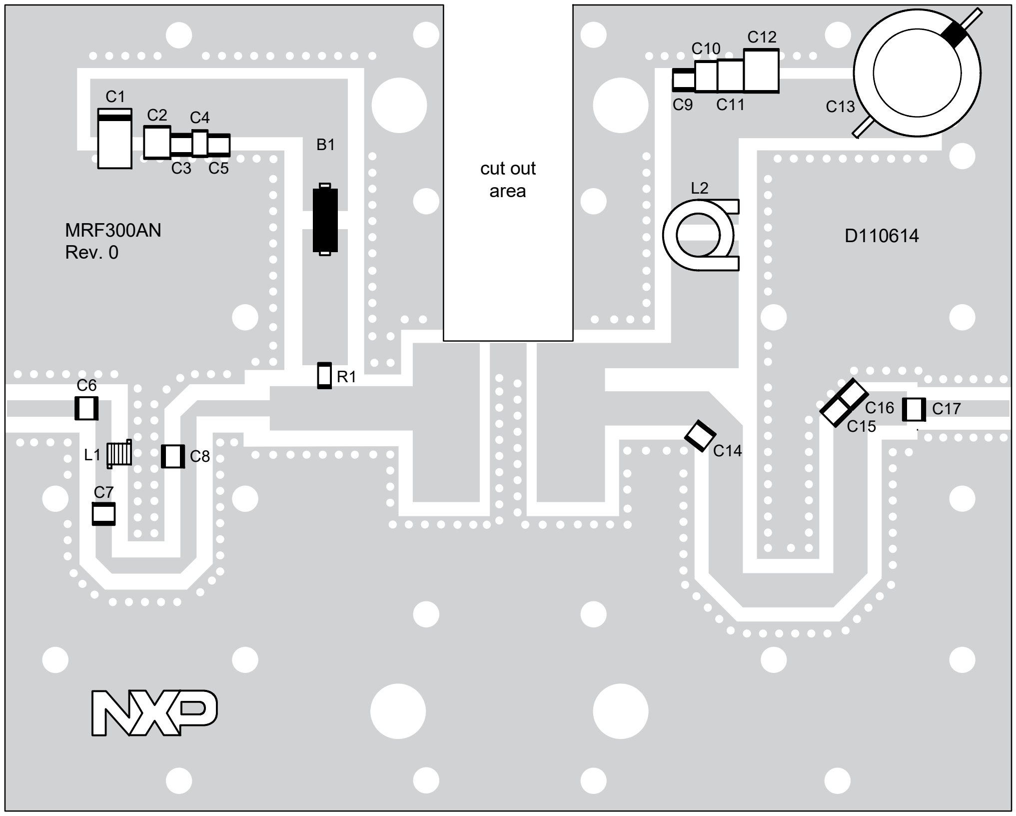


Figure 33. MRF300AN Fixture Component Layout — 230 MHz

Table 21. MRF300AN Fixture Component Designations and Values — 230 MHz

Part	Description	Part Number	Manufacturer
B1	Long Ferrite Bead	2743021447	Fair-Rite
C1	47 μF, 16 V Tantalum Capacitor	T491D476K016AT	Kemet
C2	2.2 μF Chip Capacitor	C3225X7R1H225K250AB	TDK
C3	10 nF Chip Capacitor	C1210C103J5GACTU	Kemet
C4	0.1 μF Chip Capacitor	GRM319R72A104KA01D	Murata
C5, C9	1000 pF Chip Capacitor	ATC800B102JT50XT	ATC
C6, C7	18 pF Chip Capacitor	ATC100B180JT500XT	ATC
C8, C14	56 pF Chip Capacitor	ATC100B560CT500XT	ATC
C10	0.1 μF Chip Capacitor	C1812104K1RACTU	Kemet
C11	2.2 μF Chip Capacitor	C3225X7R2A225K230AB	TDK
C12	2.2 μF Chip Capacitor	HMK432B7225KM-T	Taiyo Yuden
C13	220 μF, 100 V Electrolytic Capacitor	MCGPR100V227M16X26	Multicomp
C15	1.2 pF Chip Capacitor	ATC100B1R2BT500XT	ATC
C16	24 pF Chip Capacitor	ATC100B240JT500XT	ATC
C17	470 pF Chip Capacitor	ATC800B471JT200XT	ATC
L1	47 nH Air Core Inductor	1812SMS-47NJLC	Coilcraft
L2	146 nH Air Core Inductor	1010VS-141NME	Coilcraft
R1	470 Ω, 1/4 W Chip Resistor	CRCW1206470RFKEA	Vishay
PCB	Rogers AD255C 0.030″, ε_r = 2.55, 2 oz. Copper	D110614	MTL

TYPICAL CHARACTERISTICS — 230 MHz, T_C = 25°C FIXTURE (MRF300AN)

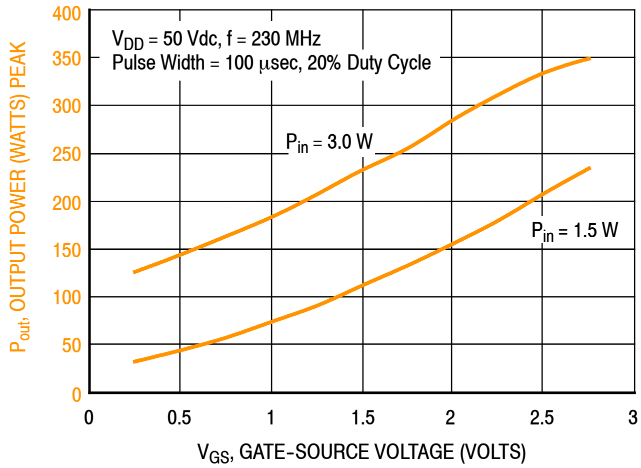
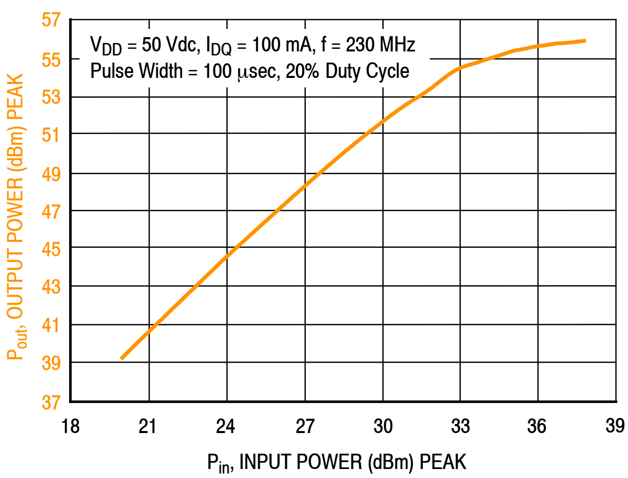


Figure 34. Output Power versus Gate-Source Voltage at a Constant Input Power



f (MHz)	P1dB (W)	P3dB (W)
230	334	382

Figure 35. Output Power versus Input Power

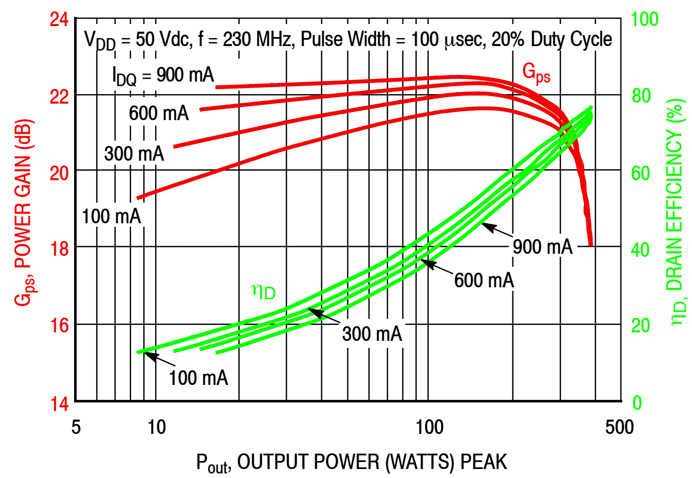


Figure 36. Power Gain and Drain Efficiency versus Output Power and Quiescent Current

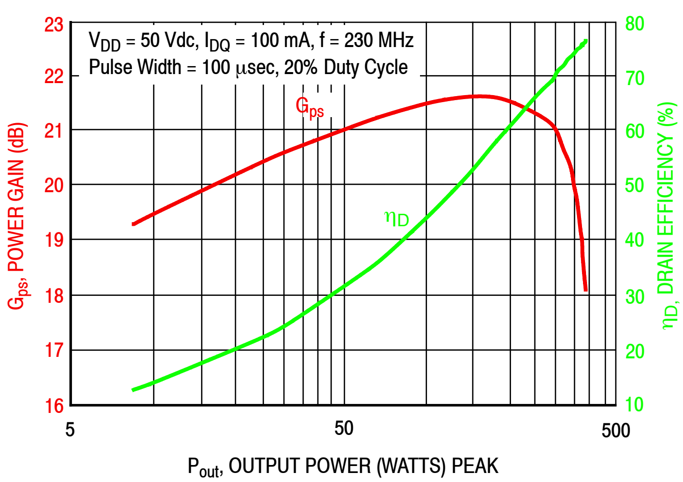


Figure 37. Power Gain and Drain Efficiency versus Output Power

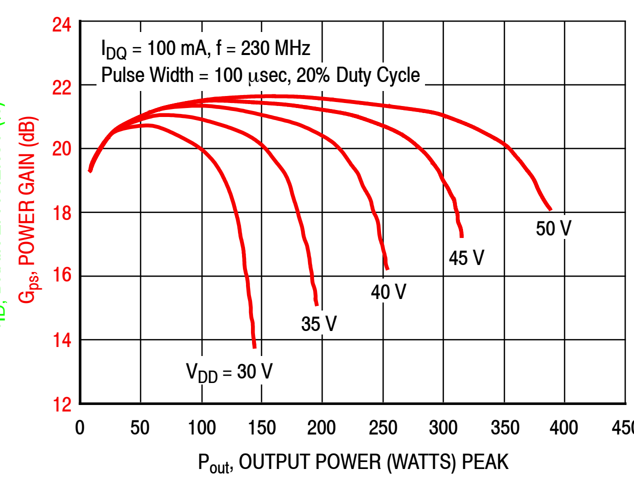


Figure 38. Power Gain versus Output Power and Drain-Source Voltage

230 MHz FIXTURE (MRF300AN)

f (MHz)	Z_{source} (Ω)	Z_{load} (Ω)
230	1.77 + j1.90	2.50 + j0.78

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

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

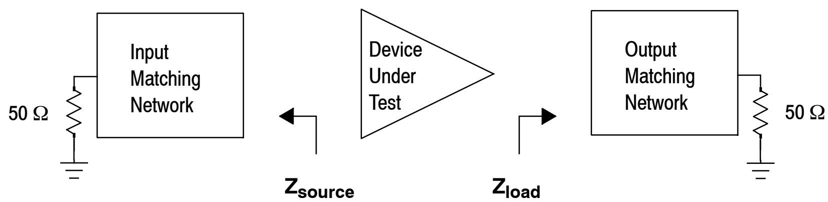
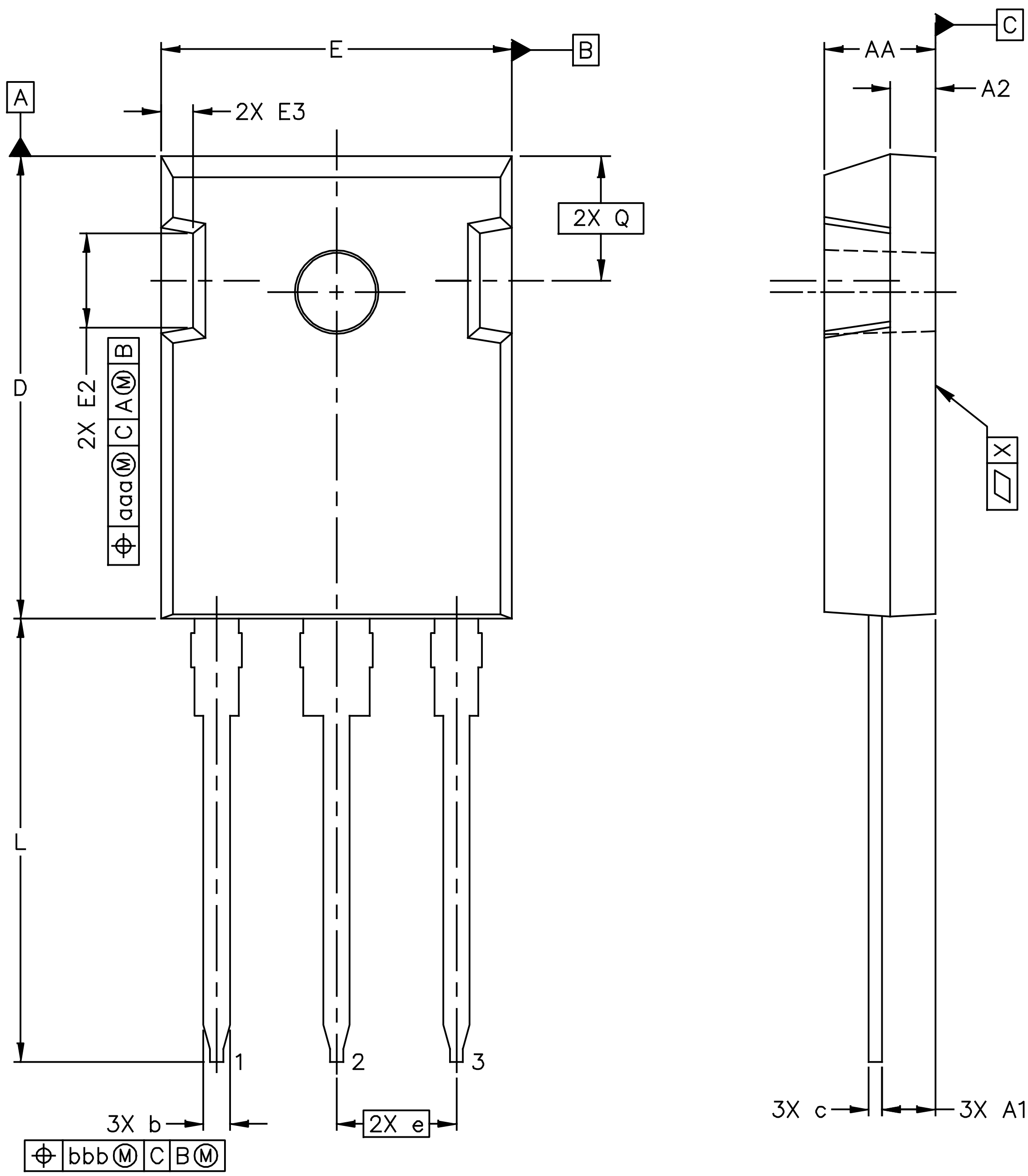


Figure 39. Series Equivalent Source and Load Impedance — 230 MHz

PACKAGE DIMENSIONS

TO–247–3

SOT1930–1



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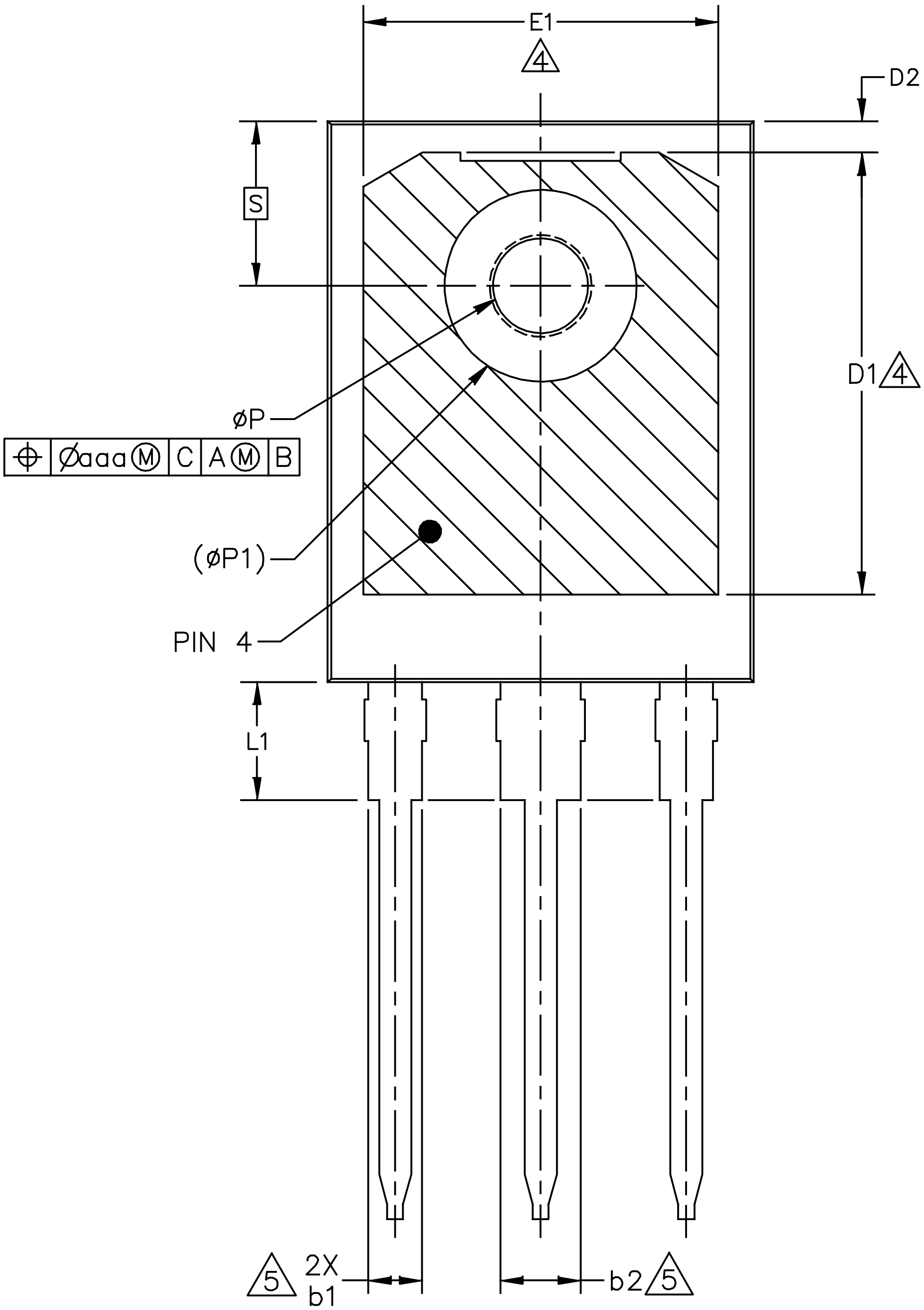
MECHANICAL OUTLINE PRINT VERSION NOT TO SCALE	STANDARD:	DRAWING NUMBER:	REVISION:	PAGE:
	NON JEDEC	98ASA01082D	A	1 OF 3



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MECHANICAL OUTLINE PRINT VERSION NOT TO SCALE	STANDARD: NON JEDEC	DRAWING NUMBER: 98ASA01082D	REVISION: A	PAGE: 2

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 D1 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 & b2 DO NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.15 MM (.006 INCH) PER SIDE IN EXCESS OF THE DIMENSIONS b1 & b2 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)

7. ø P TO HAVE MAXIMUM DRAFT ANGLE 1.5°.

DIM	INCH MIN	INCH MAX	MILLIMETER MIN	MILLIMETER MAX	DIM	INCH MIN	INCH MAX	MILLIMETER MIN	MILLIMETER MAX
AA	.190	.205	4.83	5.21	E3	.039	.102	0.99	2.60
A1	.090	.100	2.29	2.54	e	.214 BSC		5.44 BSC	
A2	.075	.085	1.90	2.16	L	.780	.800	19.80	20.32
b	.042	.052	1.07	1.33	L1	−−−	.173	−−−	4.40
b1	.075	.095	1.91	2.41	P	.138	.146	3.50	3.71
b2	.113	.133	2.87	3.38	P1	−−−	.291	−−−	7.40
c	.022	.027	0.55	0.69	Q	.228 BSC		5.79 BSC	
D	.819	.831	20.80	21.11	S	.242 BSC		6.15 BSC	
D1	.515	−−−	13.08	−−−	X	−−−	.004	−−−	0.01
D2	.020	−−−	0.51	−−−	aaa	.025		0.64	
E	.618	.635	15.70	16.13	bbb	.010		0.25	
E1	.487	−−−	12.37	−−−					
E2	.145	.201	3.68	5.11					

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MECHANICAL OUTLINE PRINT VERSION NOT TO SCALE	STANDARD: NON JEDEC	DRAWING NUMBER: 98ASA01082D	REVISION: A	PAGE: 3

PRODUCT DOCUMENTATION, SOFTWARE AND TOOLS

Refer to the following resources to aid your design process.

Application Notes

- 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

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REVISION HISTORY

The following table summarizes revisions to this document.

Revision	Date	Description
0	May 2018	• Initial release of data sheet
1	Jan. 2019	• Typical Performance table: added 13.56, 50 and 144 MHz reference circuits and updated 81.36 MHz data, p. 1 • Package photos: added backside photo, p. 1 • Table 4, Moisture Sensitivity Level: added footnote "Peak temperature during reflow process must not exceed 225°C." Updated table, p. 2. • Fig. 1, Capacitance versus Drain-Source Voltage: removed note as not applicable to graph, p. 4 • Table 8, 40.68 MHz Performance table; Fig. 5, CW Output Power versus Input Power; and Fig. 6, Power Gain and Drain Efficiency versus CW Output Power: corrected bias value to 100 mA to reflect actual measurement used in data sheet, pp. 5, 8 • Package Outline Drawing: TO-247-3 package outline updated to Rev. A, pp. 13–15 • General updates made to align data sheet to current standard
2	June 2019	• Typical Performance table: updated values for 27 MHz, 50 MHz, 81.36 MHz and 144 MHz reference circuits, p. 1 • Added 13.56 MHz reference circuit, pp. 5–9 • Added 27 MHz reference circuit, pp. 10–14 • Added 50 MHz reference circuit, pp. 20–24 • Added 81.36 MHz reference circuit, pp. 25–29 • Added 144 MHz reference circuit, pp. 30–34

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