

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.

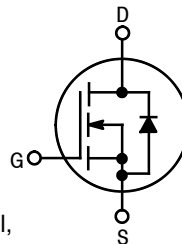
Typical Performance: $V_{DD} = 50$ Vdc

| 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 μ sec, 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 μ sec, 20% Duty Cycle) | > 65:1 at all Phase Angles | 2 Peak (3 dB Overdrive) | 50 | No Device Degradation |
| 230 | Pulse (100 μ sec, 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

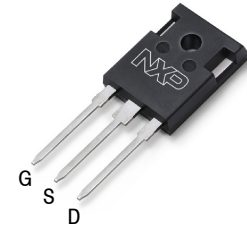
- Mirror pinout versions (A and B) to simplify use in a push-pull, two-up configuration
- Characterized from 30 to 50 V
- Suitable for linear application
- Integrated ESD protection with greater negative gate-source voltage range for improved Class C operation
- Included in NXP product longevity program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

Typical Applications

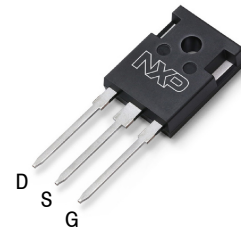
- Industrial, scientific, medical (ISM)
 - Laser generation
 - Plasma etching
 - Particle accelerators
 - MRI and other medical applications
 - Industrial heating, welding and drying systems
- Radio and VHF TV broadcast
- HF and VHF communications
- Switch mode power supplies

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.

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 @ $T_C = 25^\circ\text{C}$ 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 ($T_A = 25^\circ\text{C}$ 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 ($T_A = 25^\circ\text{C}$ unless otherwise noted) (continued)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|--|-----------|-----|------|-----|------|
| Dynamic Characteristics | | | | | |
| Reverse Transfer Capacitance ($V_{DS} = 50 \text{ Vdc} \pm 30 \text{ mV(rms)ac}$ @ 1 MHz, $V_{GS} = 0 \text{ Vdc}$) | C_{rss} | — | 2.31 | — | pF |
| Output Capacitance ($V_{DS} = 50 \text{ Vdc} \pm 30 \text{ mV(rms)ac}$ @ 1 MHz, $V_{GS} = 0 \text{ Vdc}$) | C_{oss} | — | 104 | — | pF |
| Input Capacitance ($V_{DS} = 50 \text{ Vdc}$, $V_{GS} = 0 \text{ Vdc} \pm 30 \text{ mV(rms)ac}$ @ 1 MHz) | C_{iss} | — | 403 | — | pF |

Typical Performance — 230 MHz (In NXP 230 MHz Fixture, 50 ohm system) $V_{DD} = 50 \text{ Vdc}$, $I_{DQ} = 100 \text{ mA}$, $P_{in} = 3 \text{ W}$, $f = 230 \text{ MHz}$, 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) $I_{DQ} = 100 \text{ mA}$

| 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

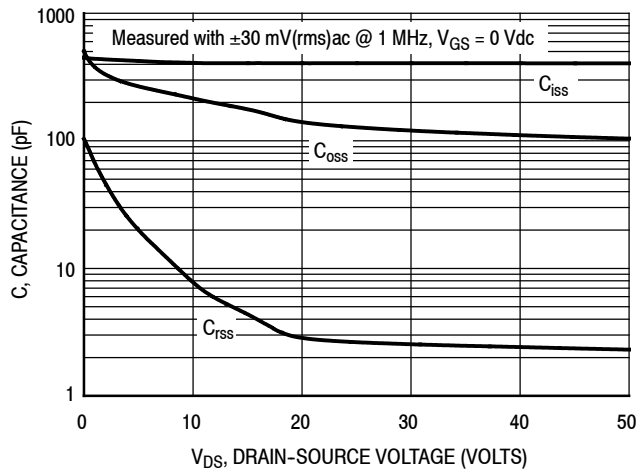
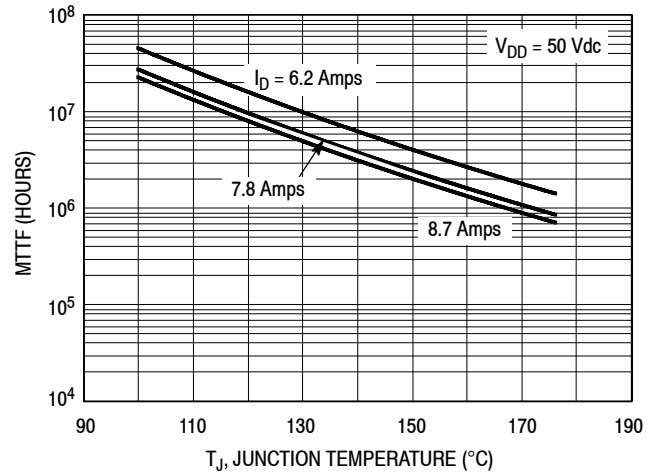


Figure 1. Capacitance versus Drain-Source Voltage



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

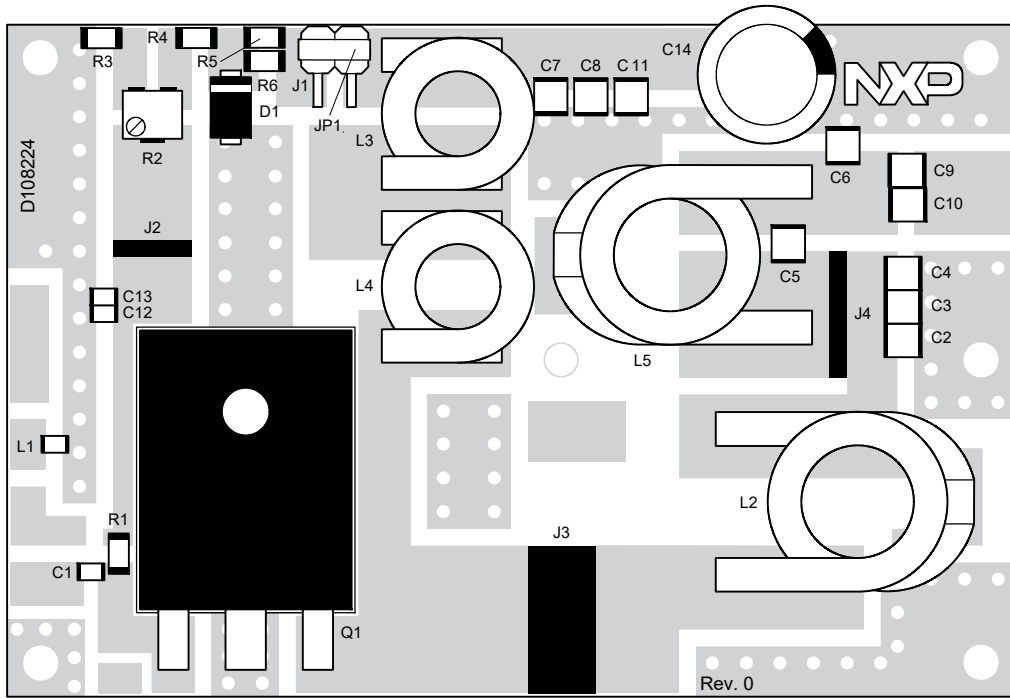
13.56 MHz REFERENCE CIRCUIT (MRF300AN)

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" x 3" (5.1 cm x 7.6 cm)



aaa-034124

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 μ F Chip Capacitor | GRM32EC72A106KE05L | Murata |
| C12 | 10 nF Chip Capacitor | GRM21BR72A103KA01B | Murata |
| C13 | 1 μ F Chip Capacitor | GJ821BR71H105KA12L | Murata |
| C14 | 220 μ F, 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 k Ω Multi-turn Cermet Trimming Potentiometer | 3224W-1-502E | Bourns |
| R3 | 12 k Ω , 1/4 W Chip Resistor | CRCW120612K0FNEA | Vishay |
| R4 | 27 k Ω , 1/4 W Chip Resistor | CRCW120627K0FKEA | Vishay |
| R5, R6 | 20 k Ω , 1/4 W Chip Resistor | CRCW120620K0FKEA | Vishay |
| PCB | FR4 0.087", $\epsilon_r = 4.8$, 2 oz. Copper | D108224 | MTL |

**TYPICAL CHARACTERISTICS — 13.56 MHz
REFERENCE CIRCUIT (MRF300AN)**

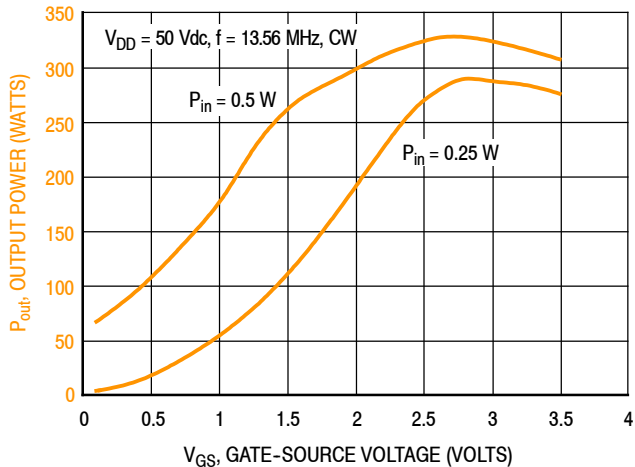
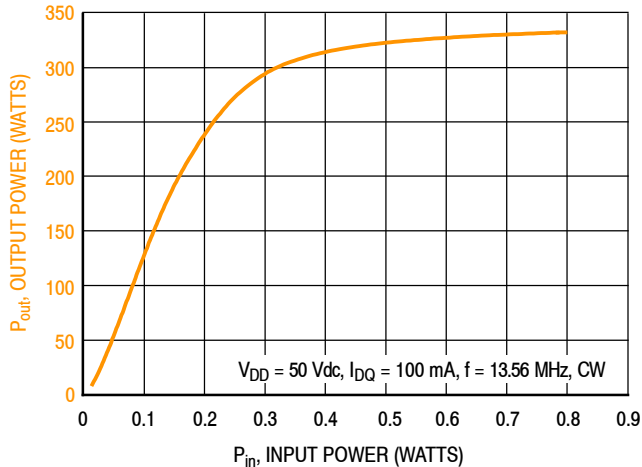


Figure 4. CW Output Power versus Gate-Source Voltage at a Constant Input Power



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

Figure 5. CW Output Power versus Input Power

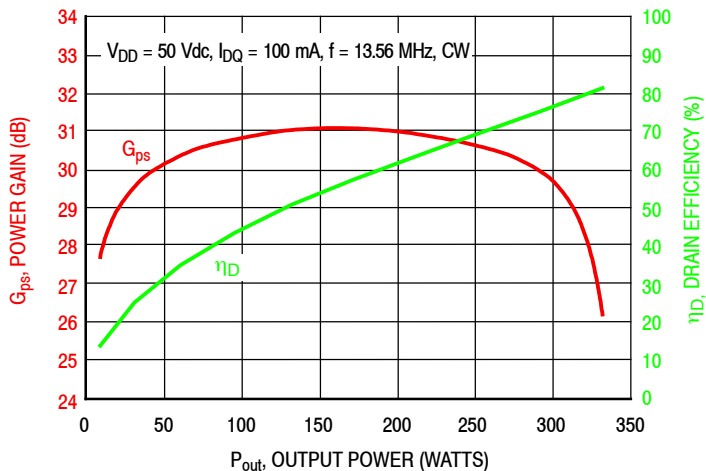


Figure 6. Power Gain and Drain Efficiency versus CW Output Power

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.

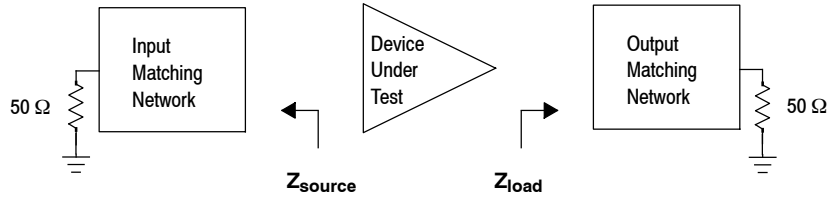


Figure 7. Series Equivalent Source and Load Impedance — 13.56 MHz

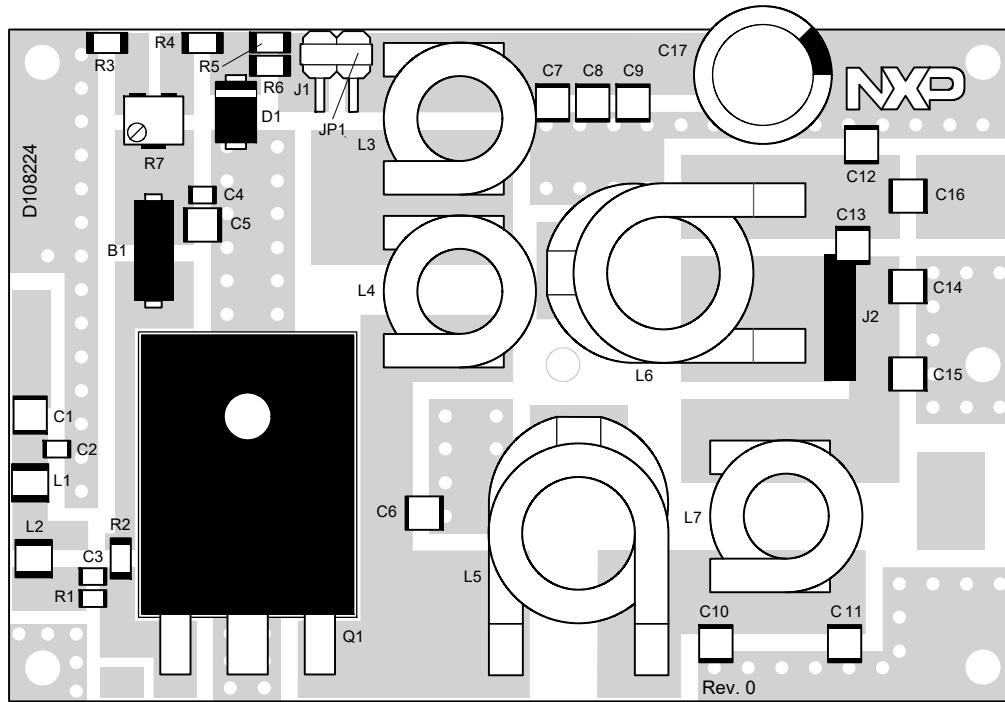
27 MHz REFERENCE CIRCUIT (MRF300AN)

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" x 3" (5.1 cm x 7.6 cm)



aaa-034170

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 μ F Chip Capacitor | GRM31CR72A105KA01L | Murata |
| C6 | 27 pF Chip Capacitor | 100B270JT500XT | ATC |
| C8 | 0.1 μ F Chip Capacitor | GRM32NR72A104KA01B | Murata |
| C9 | 10 μ F 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 μ F, 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 k Ω , 1/4 W Chip Resistor | CRCW120612K0JNEA | Vishay |
| R4 | 27 k Ω , 1/4 W Chip Resistor | CRCW120627K0FKEA | Vishay |
| R5, R6 | 20 k Ω , 1/4 W Chip Resistor | CRCW120620K0FKEA | Vishay |
| R7 | 5.0 k Ω Multi-turn Cermet Trimmer Potentiometer | 3224W-1-502E | Bourns |
| PCB | FR4 0.087", $\epsilon_r = 4.8$, 2 oz. Copper | D108224 | MTL |

TYPICAL CHARACTERISTICS — 27 MHz
REFERENCE CIRCUIT (MRF300AN)

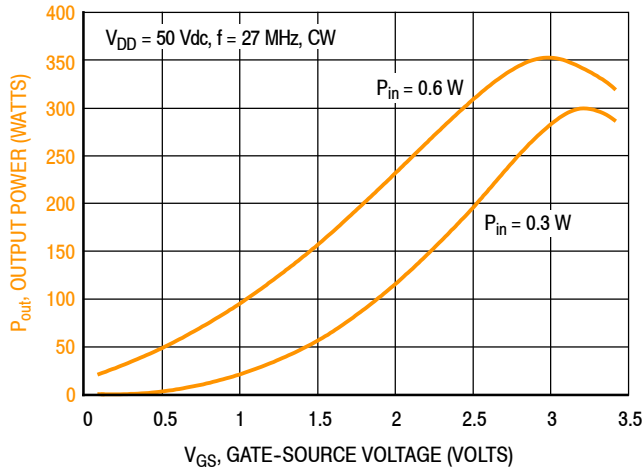
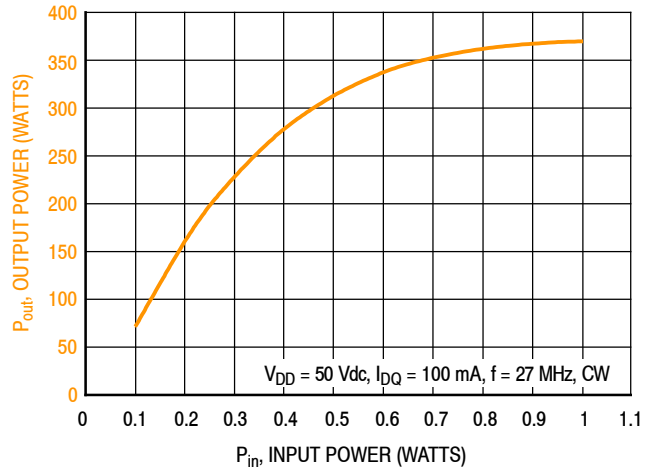


Figure 9. CW Output Power versus Gate-Source Voltage at a Constant Input Power



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

Figure 10. CW Output Power versus Input Power

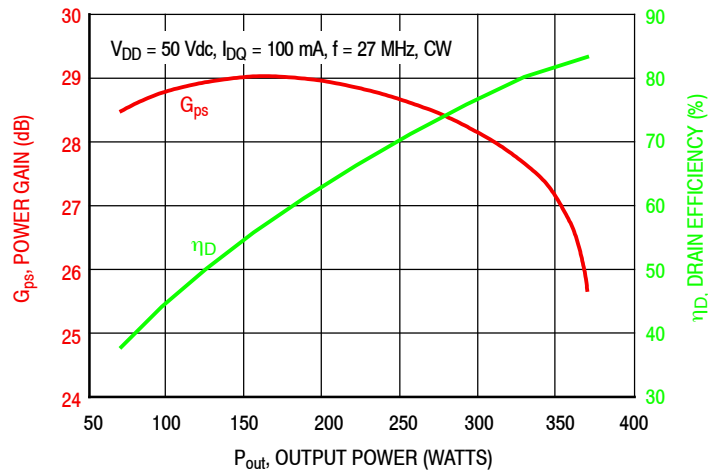


Figure 11. Power Gain and Drain Efficiency versus CW Output Power

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.

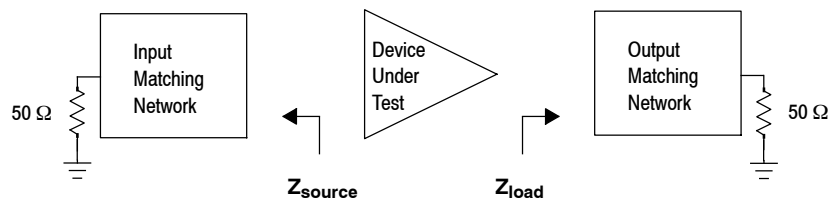


Figure 12. Series Equivalent Source and Load Impedance — 27 MHz

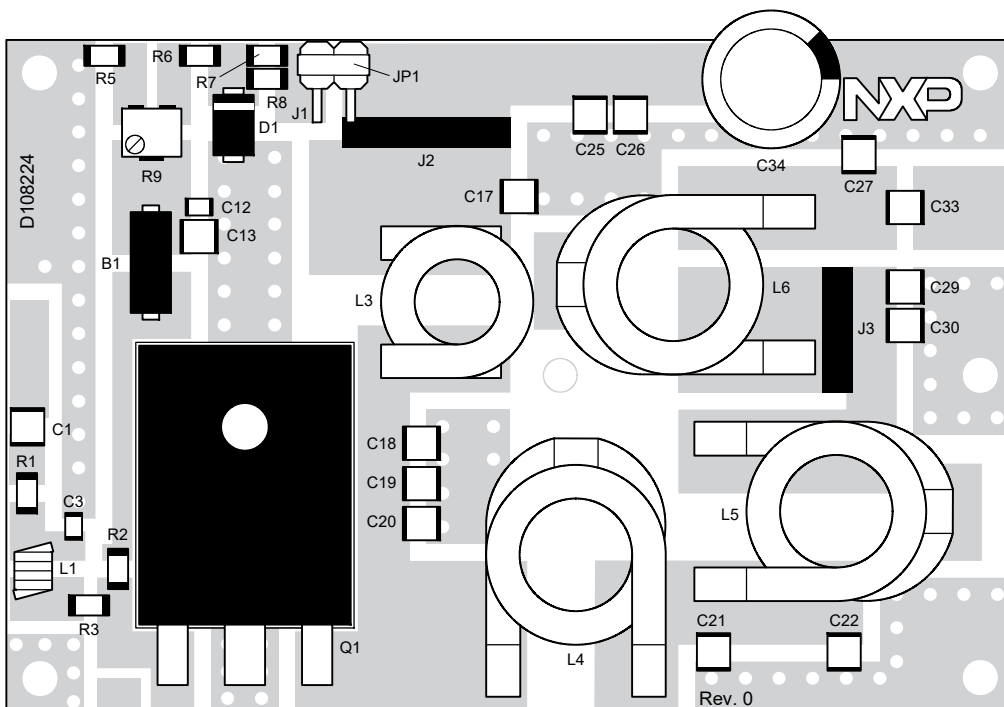
40.68 MHz REFERENCE CIRCUIT (MRF300AN)

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" x 3" (5.1 cm x 7.6 cm)



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

aaa-030512

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 μ F 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 μ F Chip Capacitor | GRM32NR72A104KA01B | Murata |
| C26 | 10 μ F 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 μ F, 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 k Ω , 1/4 W Chip Resistor | CRCW120612K0FKEA | Vishay |
| R6 | 27 k Ω , 1/4 W Chip Resistor | CRCW120627K0FKEA | Vishay |
| R7, R8 | 20 k Ω , 1/4 W Chip Resistor | CRCW120620K0FKEA | Vishay |
| R9 | 5.0 k Ω Multi-turn Cermet Trimmer Potentiometer | 3224W-1-502E | Bourns |
| PCB | FR4 0.087", $\epsilon_r = 4.8$, 2 oz. Copper | D108224 | MTL |

**TYPICAL CHARACTERISTICS — 40.68 MHz
REFERENCE CIRCUIT (MRF300AN)**

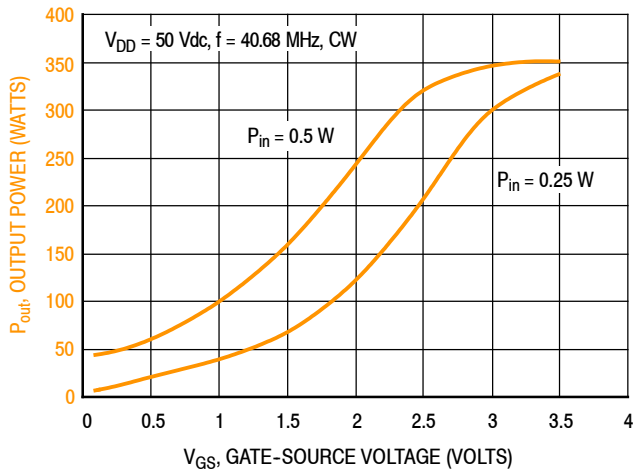
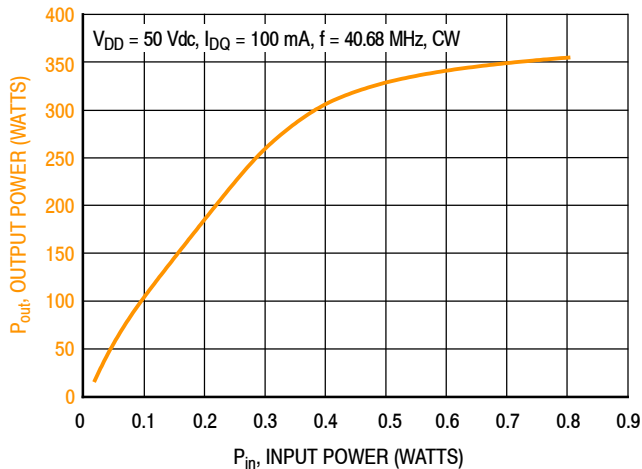


Figure 14. CW Output Power versus Gate-Source Voltage at a Constant Input Power



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

Figure 15. CW Output Power versus Input Power

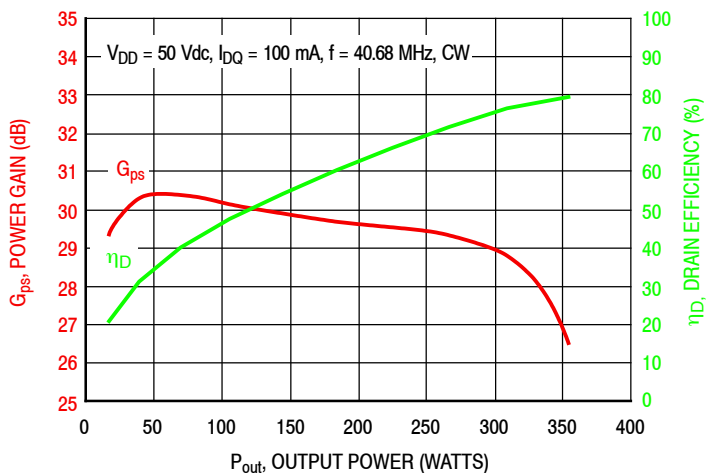


Figure 16. Power Gain and Drain Efficiency versus CW Output Power

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.

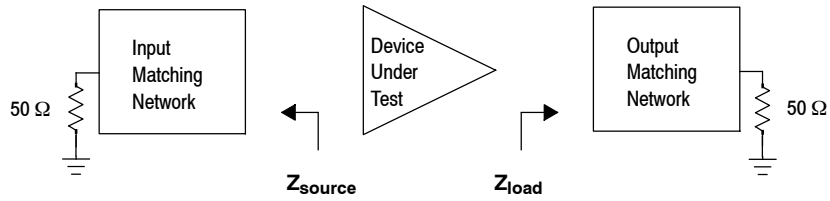


Figure 17. Series Equivalent Source and Load Impedance — 40.68 MHz

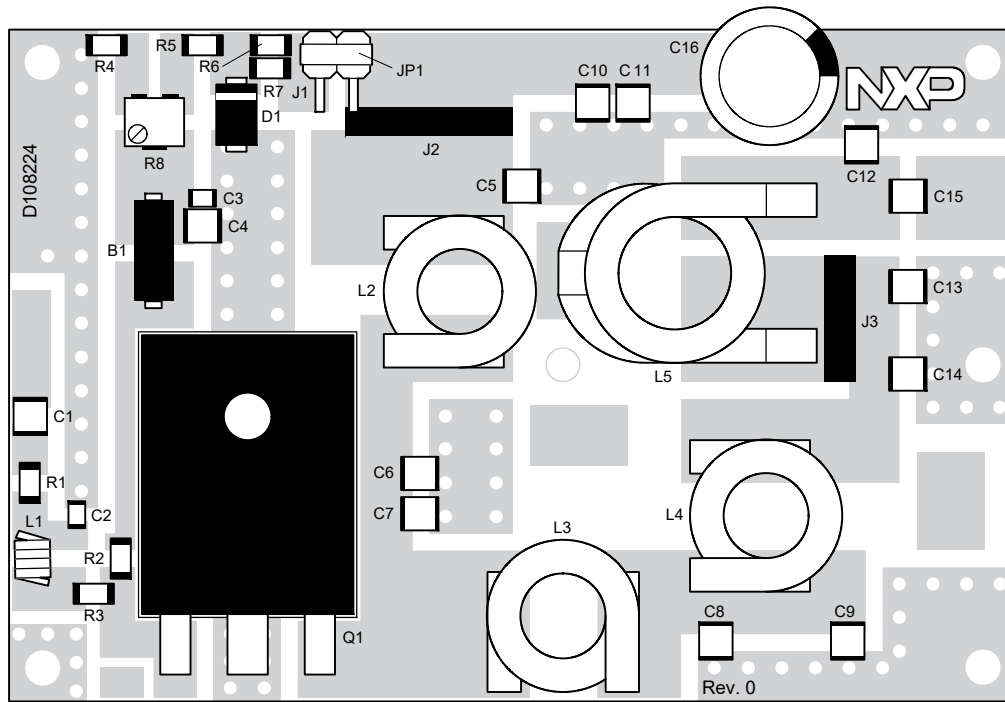
50 MHz REFERENCE CIRCUIT (MRF300AN)

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" x 3" (5.1 cm x 7.6 cm)



aaa-034173

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 μ F 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 μ F Chip Capacitor | 12101C104KAT4A | AVX |
| C11 | 10 μ F Chip Capacitor | GRM32ER61H106KA12L | Murata |
| C12 | 82 pF Chip Capacitor | 100B820JT500XT | ATC |
| C14 | 110 pF Chip Capacitor | 100B111JT300XT | ATC |
| C16 | 220 μ F, 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 k Ω , 1/4 W Chip Resistor | CRCW120612K0FNEA | Vishay |
| R5 | 27 k Ω , 1/4 W Chip Resistor | CRCW120627K0FKEA | Vishay |
| R6, R7 | 20 k Ω , 1/4 W Chip Resistor | CRCW120620K0FKEA | Vishay |
| R8 | 5.0 k Ω Multi-turn Cermet Trimmer Potentiometer | 3224W-1-502E | Bourns |
| PCB | FR4 0.087", $\epsilon_r = 4.8$, 2 oz. Copper | D108224 | MTL |

**TYPICAL CHARACTERISTICS — 50 MHz
REFERENCE CIRCUIT (MRF300AN)**

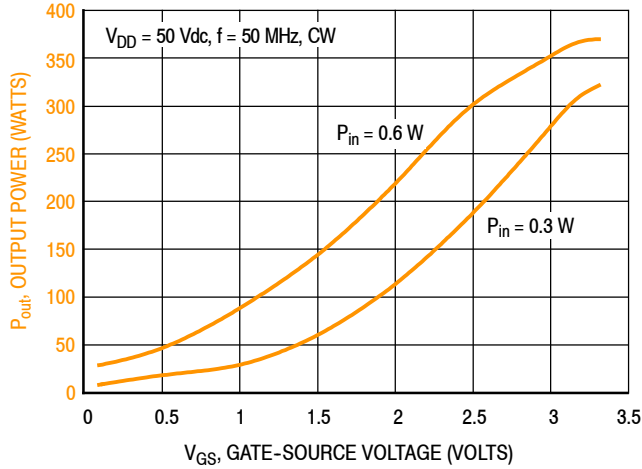
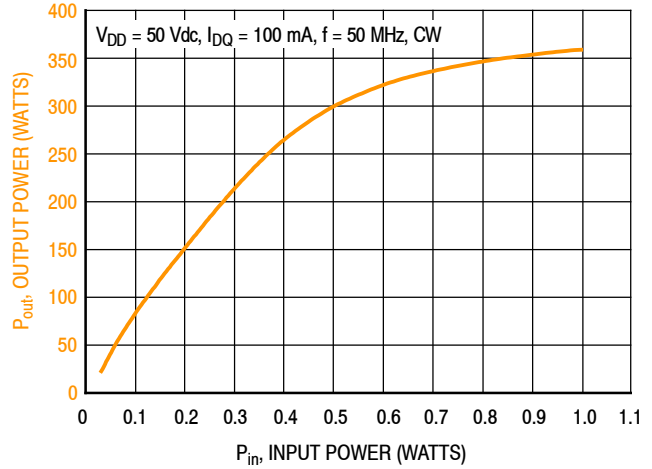


Figure 19. CW Output Power versus Gate-Source Voltage at a Constant Input Power



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

Figure 20. CW Output Power versus Input Power

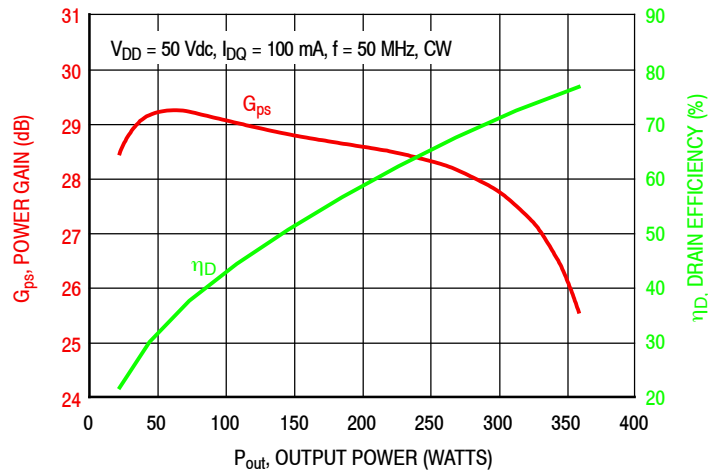


Figure 21. Power Gain and Drain Efficiency versus CW Output Power

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.

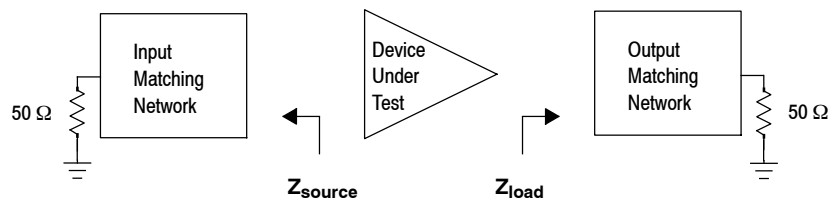


Figure 22. Series Equivalent Source and Load Impedance — 50 MHz

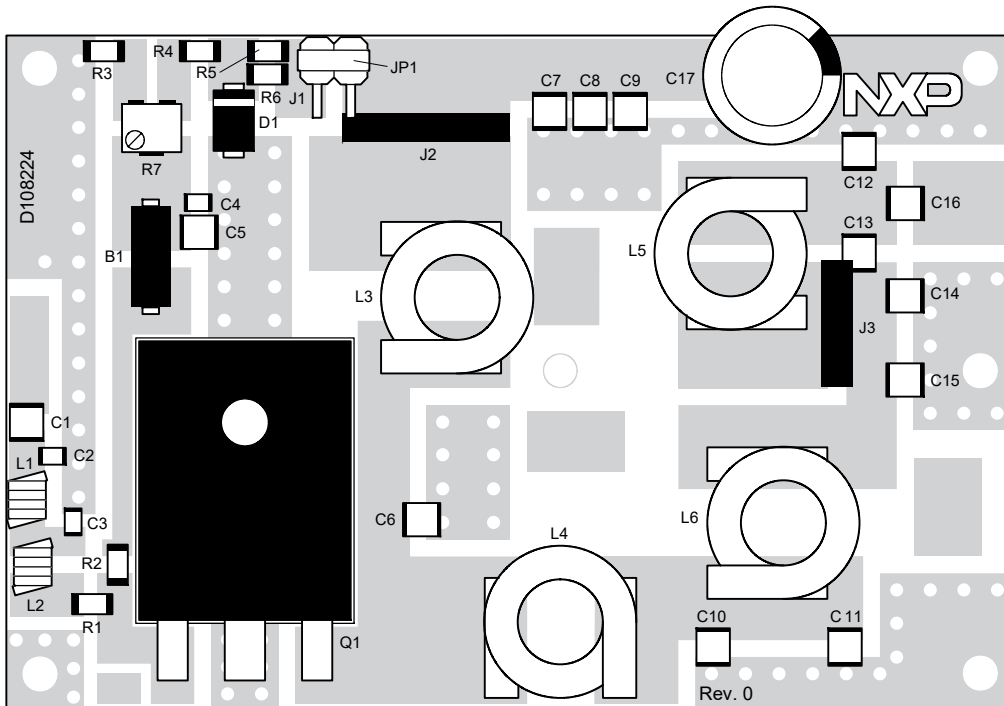
81.36 MHz REFERENCE CIRCUIT (MRF300AN)

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" x 3" (5.1 cm x 7.6 cm)



aaa-034174

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 μ F Chip Capacitor | GRM31CR72A105KA01L | Murata |
| C6 | 30 pF Chip Capacitor | 100B300JT500XT | ATC |
| C8 | 0.1 μ F Chip Capacitor | GRM32NR72A104KA01B | Murata |
| C9 | 10 μ F 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 μ F, 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 k Ω , 1/4 W Chip Resistor | CRCW120612K0JNEA | Vishay |
| R4 | 27 k Ω , 1/4 W Chip Resistor | CRCW120627K0FKEA | Vishay |
| R5, R6 | 20 k Ω , 1/4 W Chip Resistor | CRCW120620K0FKEA | Vishay |
| R7 | 5.0 k Ω Multi-turn Cermet Trimmer Potentiometer | 3224W-1-502E | Bourns |
| PCB | FR4 0.087", $\epsilon_r = 4.8$, 2 oz. Copper | D108224 | MTL |

**TYPICAL CHARACTERISTICS — 81.36 MHz
REFERENCE CIRCUIT (MRF300AN)**

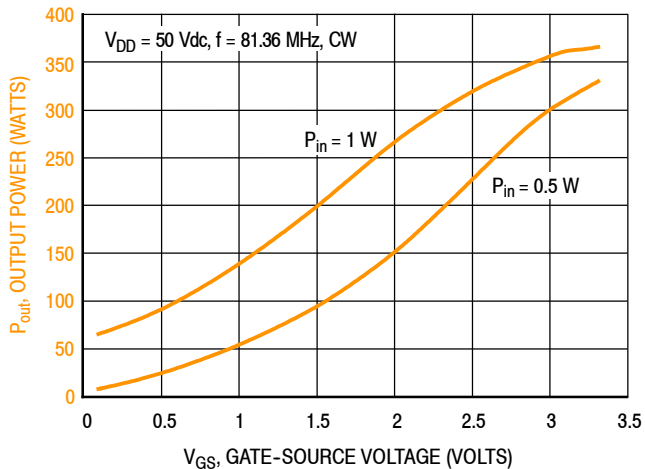
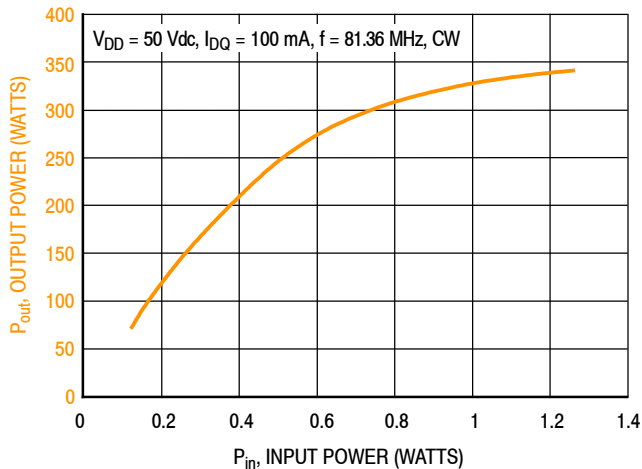


Figure 24. CW Output Power versus Gate-Source Voltage at a Constant Input Power



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

Figure 25. CW Output Power versus Input Power

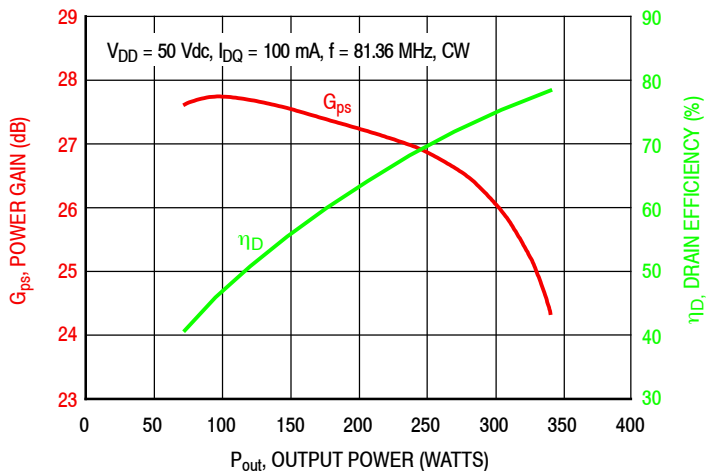


Figure 26. Power Gain and Drain Efficiency versus CW Output Power

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.

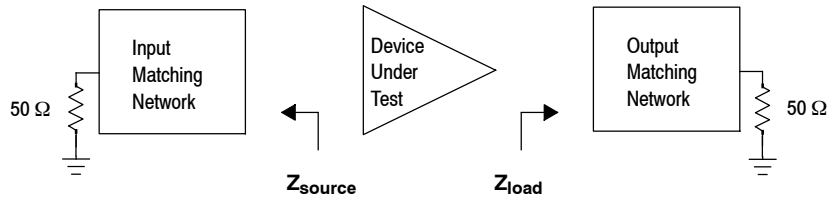


Figure 27. Series Equivalent Source and Load Impedance — 81.36 MHz

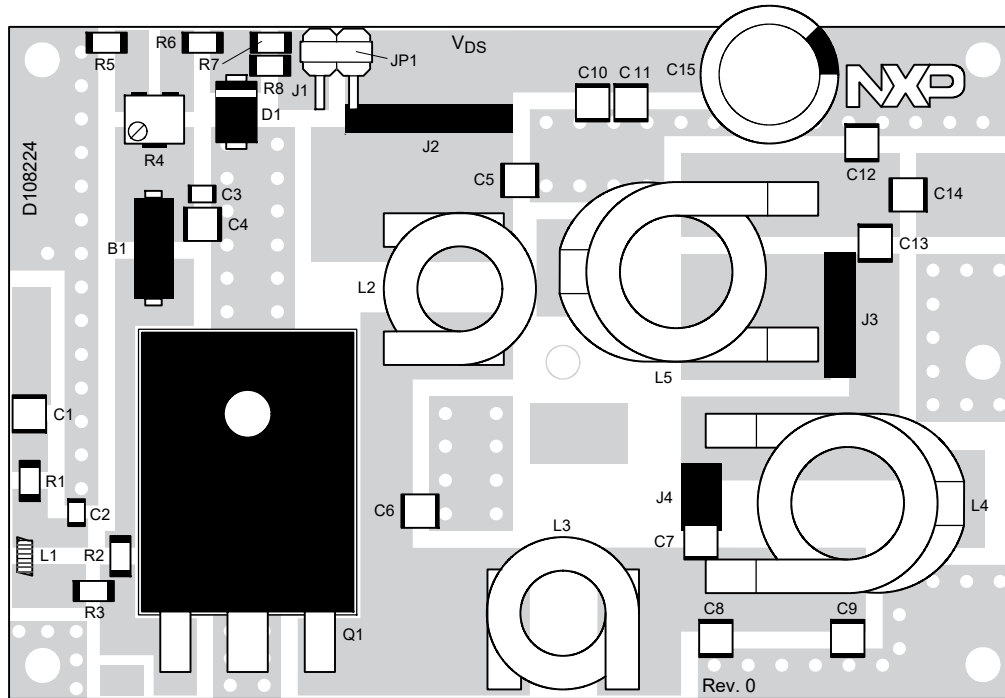
144 MHz REFERENCE CIRCUIT (MRF300AN)

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" x 3" (5.1 cm x 7.6 cm)



aaa-034175

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 μ F 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 μ F Chip Capacitor | GRM32NR72A104KA01B | Murata |
| C11 | 10 μ F Chip Capacitor | GRM32ER61H106KA12L | Murata |
| C12 | 33 pF Chip Capacitor | 100B330JT500XT | ATC |
| C13 | 3.9 pF Chip Capacitor | 100B3R9CT500XT | ATC |
| C15 | 220 μ F, 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 k Ω Multi-turn Cermet Trimmer Potentiometer | 3224W-1-502E | Bourns |
| R5 | 12 k Ω , 1/4 W Chip Resistor | CRCW120612K0JNEA | Vishay |
| R6 | 27 k Ω , 1/4 W Chip Resistor | CRCW120627K0JNEA | Vishay |
| R7, R8 | 20 k Ω , 1/4 W Chip Resistor | CRCW120620K0JNEA | Vishay |
| PCB | FR4 0.087", $\epsilon_r = 4.8$, 2 oz. Copper | D108224 | MTL |

**TYPICAL CHARACTERISTICS — 144 MHz
REFERENCE CIRCUIT (MRF300AN)**

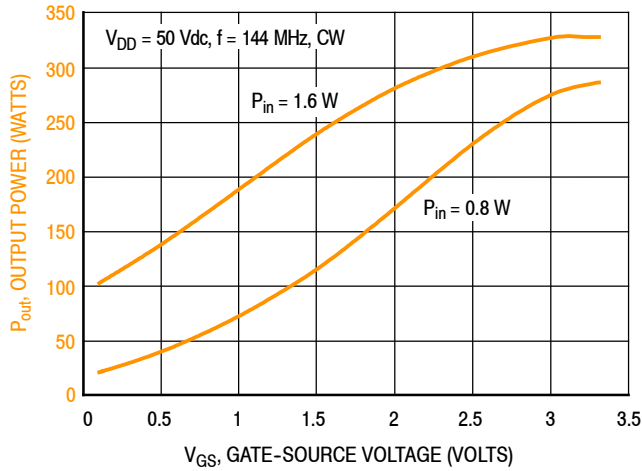
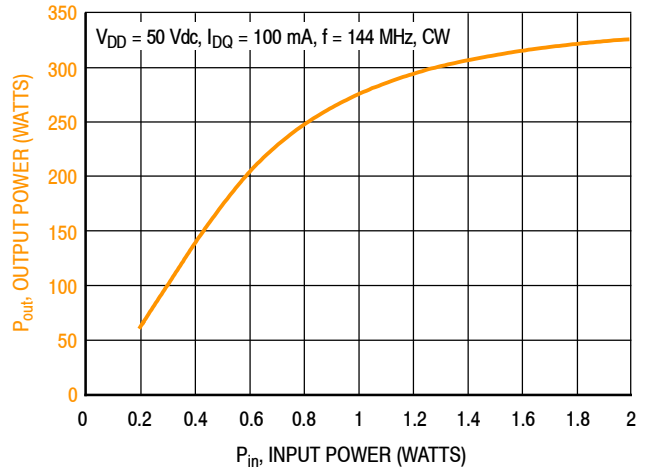


Figure 29. CW Output Power versus Gate-Source Voltage at a Constant Input Power



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

Figure 30. CW Output Power versus Input Power

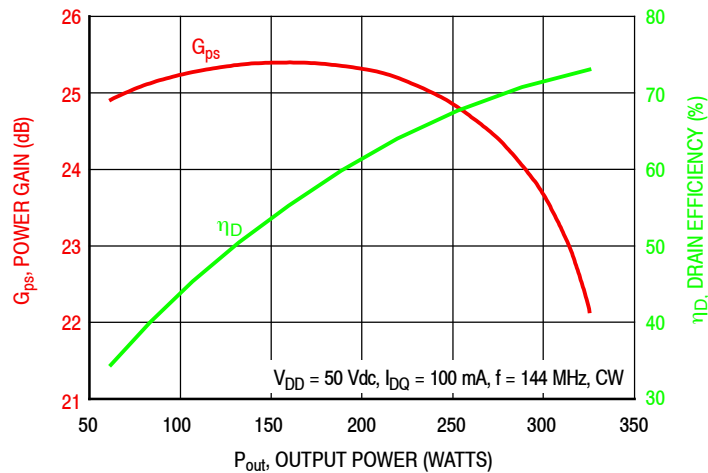


Figure 31. Power Gain and Drain Efficiency versus CW Output Power

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.

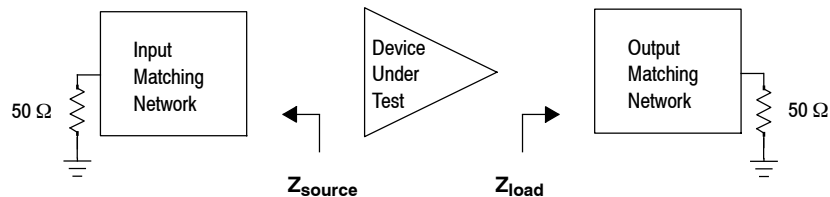
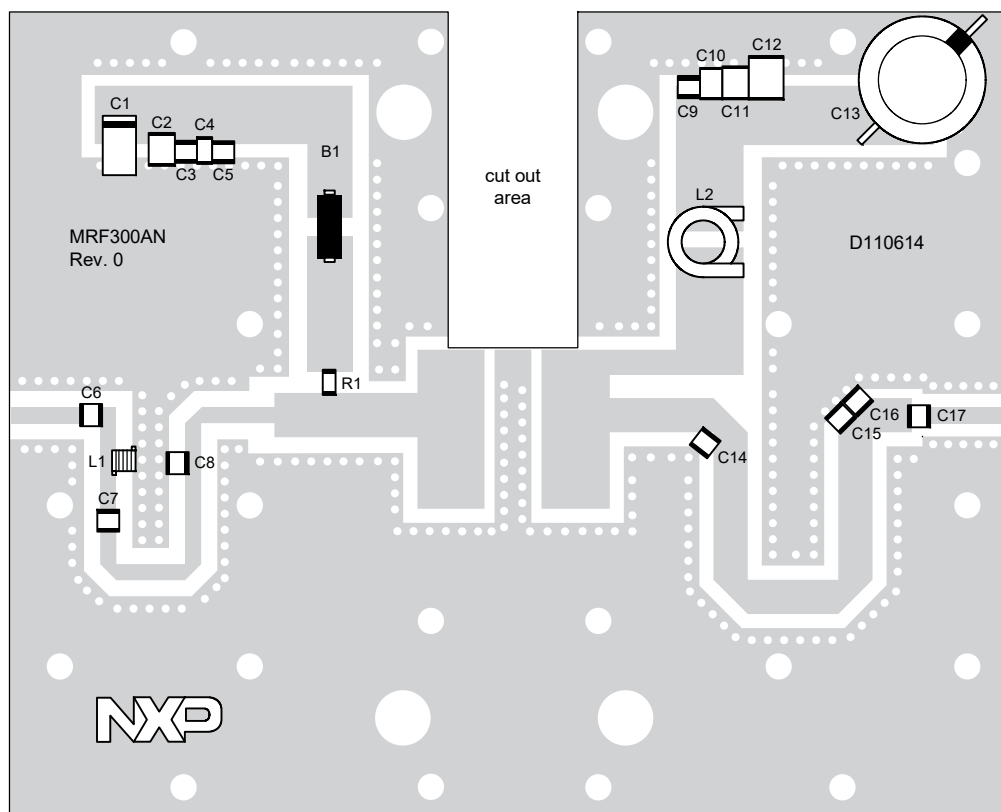


Figure 32. Series Equivalent Source and Load Impedance — 144 MHz

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



aaa-030511

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 μ F, 16 V Tantalum Capacitor | T491D476K016AT | Kemet |
| C2 | 2.2 μ F Chip Capacitor | C3225X7R1H225K250AB | TDK |
| C3 | 10 nF Chip Capacitor | C1210C103J5GACTU | Kemet |
| C4 | 0.1 μ F 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 μ F Chip Capacitor | C1812104K1RACTU | Kemet |
| C11 | 2.2 μ F Chip Capacitor | C3225X7R2A225K230AB | TDK |
| C12 | 2.2 μ F Chip Capacitor | HMK432B7225KM-T | Taiyo Yuden |
| C13 | 220 μ F, 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", $\epsilon_r = 2.55$, 2 oz. Copper | D110614 | MTL |

MRF300AN MRF300BN

**TYPICAL CHARACTERISTICS — 230 MHz, $T_C = 25^\circ\text{C}$
FIXTURE (MRF300AN)**

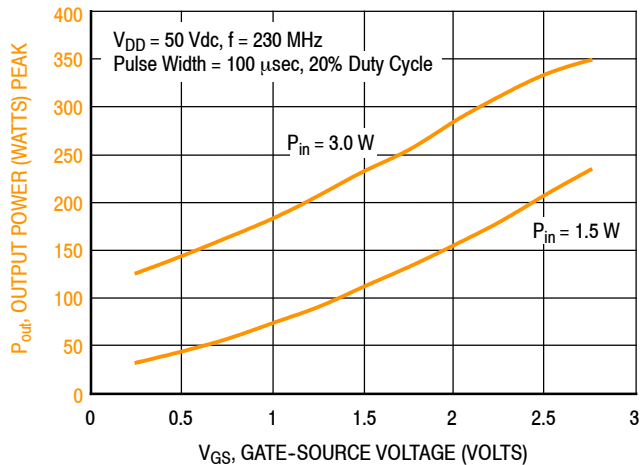
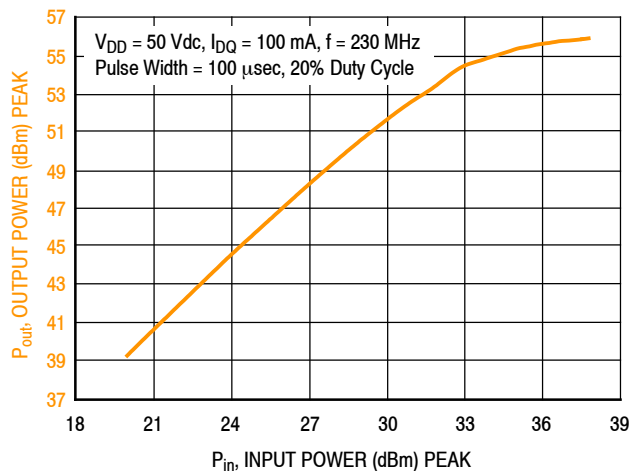


Figure 34. Output Power versus Gate-Source Voltage at a Constant Input Power



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

Figure 35. Output Power versus Input Power

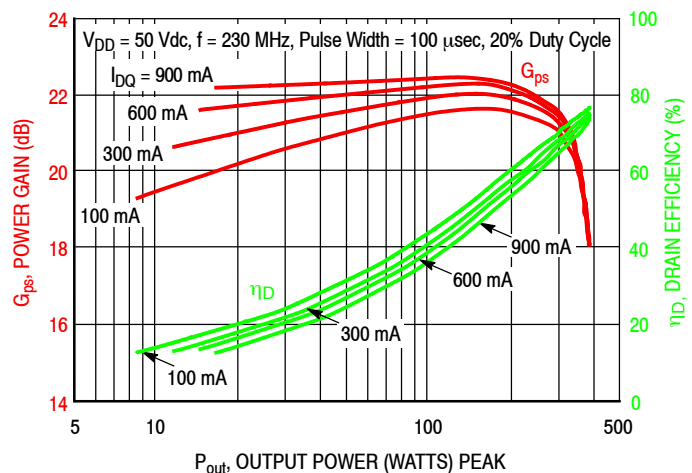


Figure 36. Power Gain and Drain Efficiency versus Output Power and Quiescent Current

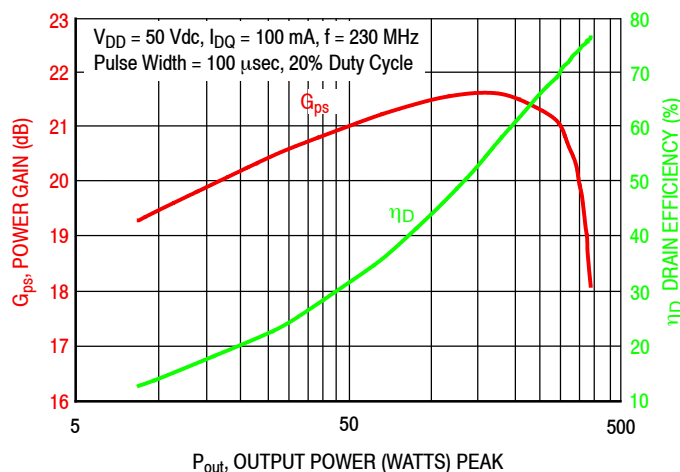


Figure 37. Power Gain and Drain Efficiency versus Output Power

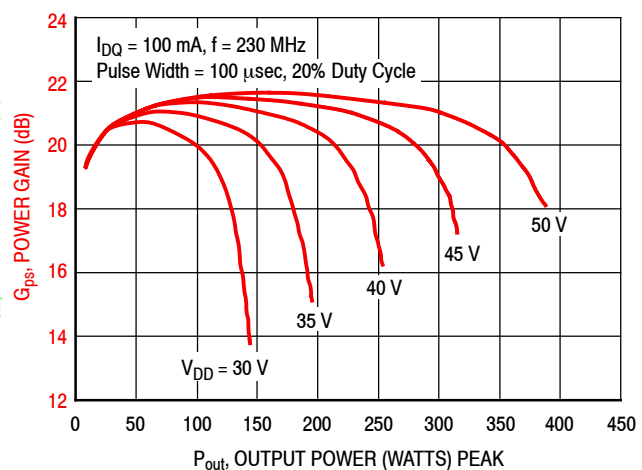


Figure 38. Power Gain versus Output Power and Drain-Source Voltage

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.

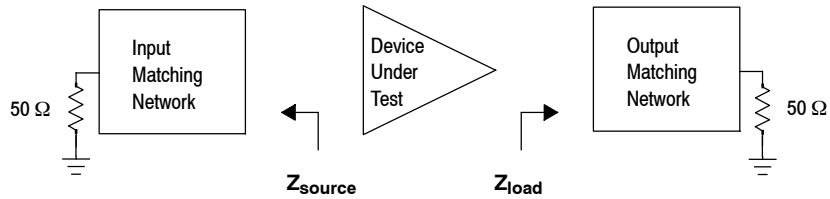
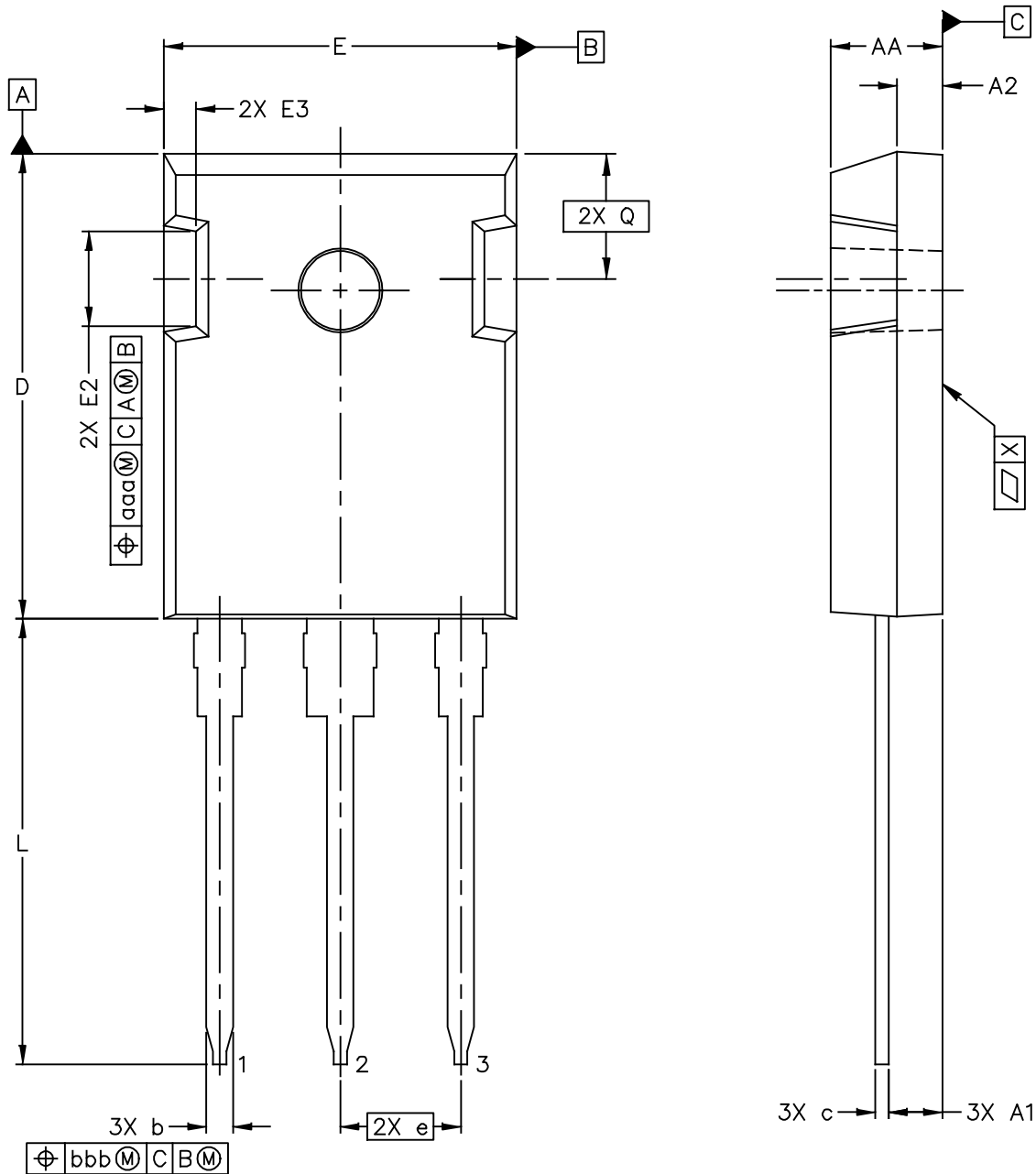


Figure 39. Series Equivalent Source and Load Impedance — 230 MHz

PACKAGE DIMENSIONS

TO-247-3

SOT1930-1

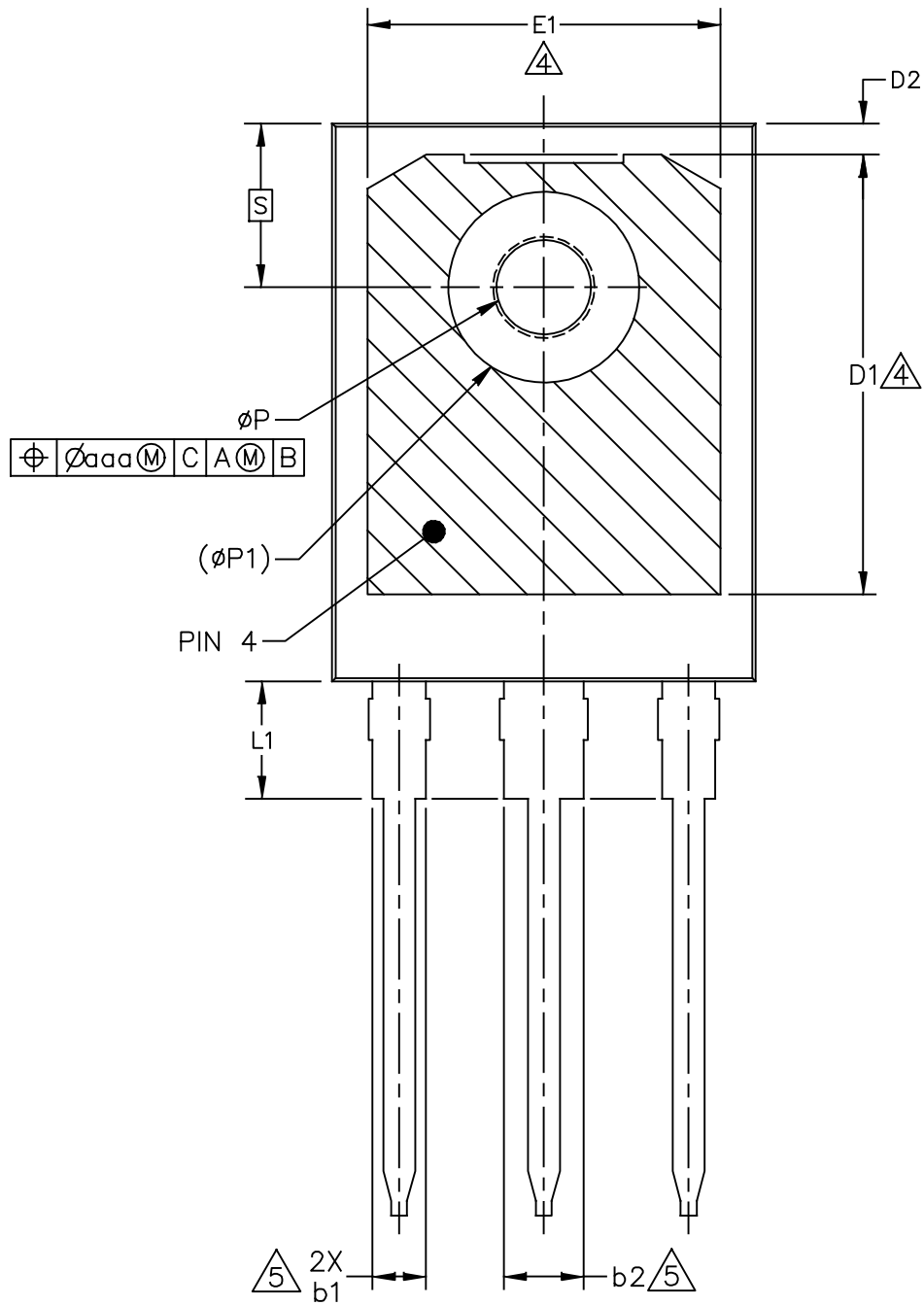


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DATE: 13 FEB 2019

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

MRF300AN MRF300BN





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DATE: 13 FEB 2019

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

MRF300AN MRF300BN

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. ϕ P TO HAVE MAXIMUM DRAFT ANGLE 1.5°.

| DIM | INCH | | MILLIMETER | | DIM | INCH | | MILLIMETER | |
|-----|------|------|------------|-------|-----|----------|------|------------|-------|
| | MIN | MAX | MIN | MAX | | MIN | MAX | MIN | 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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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

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 2018 | <ul style="list-style-type: none">• Initial release of data sheet |
| 1 | Jan. 2019 | <ul style="list-style-type: none">• 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 | <ul style="list-style-type: none">• 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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