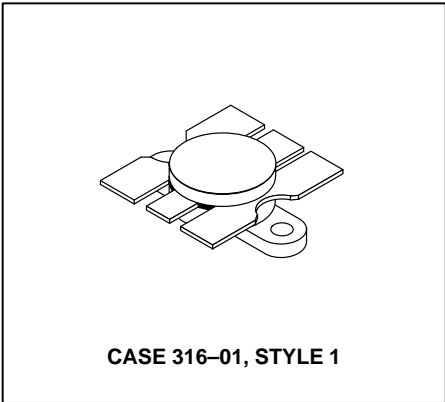


# The RF Line

## NPN Silicon

### RF Power Transistor



Designed for 12.5 Volt UHF large-signal, common emitter, class-C amplifier applications in industrial and commercial FM equipment operating to 520 MHz.

- Specified 12.5 Volt, 512 MHz Characteristics
  - Output Power = 65 Watts
  - Minimum Gain = 4.15 dB
  - Minimum Efficiency = 50%
- Characterized with Series Equivalent Large-Signal Impedance Parameters from 400 to 520 MHz
- Built-In Matching Network for Broadband Operation
- Triple Ion Implanted for More Consistent Characteristics
- Implanted Emitter Ballast Resistors for Improved Ruggedness
- Silicon Nitride Passivated
- Capable of Surviving Load Mismatch Stress at all Phase Angles with 20:1 VSWR @ 15.5 Vdc and 2.0 dB Overdrive

#### MAXIMUM RATINGS

| Rating   | Symbol    | Value        | Unit          |
|--|-----------|--------------|---------------|
| Collector-Emitter Voltage  | $V_{CEO}$ | 16.5         | Vdc           |
| Collector-Emitter Voltage  | $V_{CES}$ | 38           | Vdc           |
| Emitter-Base Voltage   | $V_{EBO}$ | 4.0          | Vdc           |
| Collector Current — Continuous   | $I_C$     | 15           | Adc           |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$     | 175<br>1.0   | Watts<br>W/°C |
| Storage Temperature Range  | $T_{stg}$ | - 65 to +150 | °C            |

#### THERMAL CHARACTERISTICS

| Characteristic                       | Symbol          | Max | Unit |
|--------------------------------------|-----------------|-----|------|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 1.0 | °C/W |

#### ELECTRICAL CHARACTERISTICS ( $T_C = 25^\circ\text{C}$ unless otherwise noted.)

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

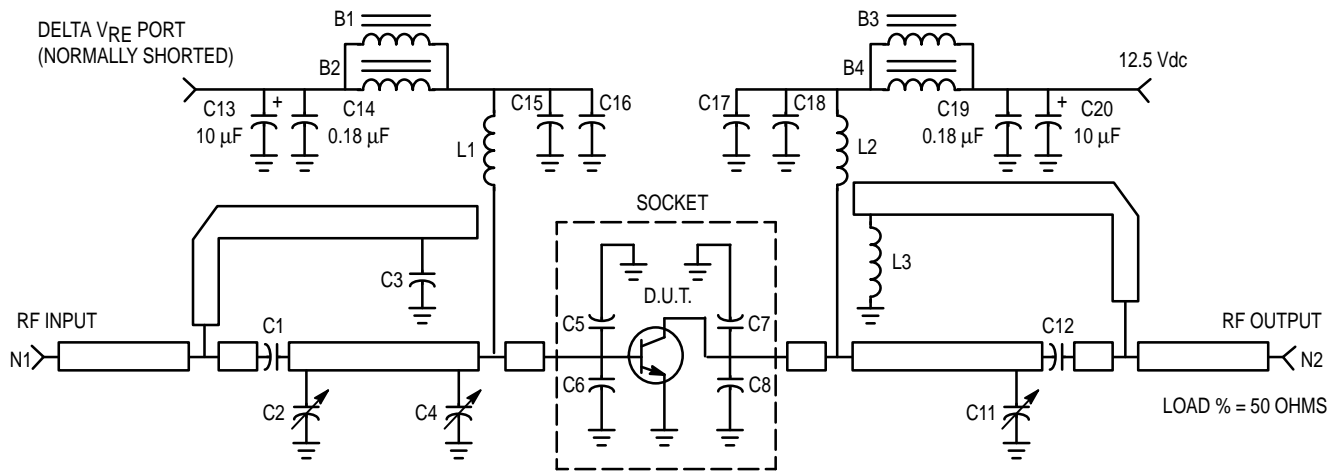
#### OFF CHARACTERISTICS

|   |               |      |     |    |      |
|---|---------------|------|-----|----|------|
| Collector-Emitter Breakdown Voltage<br>( $I_C = 50 \text{ mAdc}$ , $I_B = 0$ )                      | $V_{(BR)CEO}$ | 16.5 | 29  | —  | Vdc  |
| Collector-Emitter Breakdown Voltage<br>( $I_C = 50 \text{ mAdc}$ , $V_{BE} = 0$ )                   | $V_{(BR)CES}$ | 38   | 45  | —  | Vdc  |
| Emitter-Base Breakdown Voltage<br>( $I_E = 10 \text{ mAdc}$ , $I_C = 0$ )                           | $V_{(BR)EBO}$ | 4.0  | 4.6 | —  | Vdc  |
| Collector Cutoff Current<br>( $V_{CE} = 15 \text{ Vdc}$ , $V_{BE} = 0$ , $T_C = 25^\circ\text{C}$ ) | $I_{CES}$     | —    | 0.1 | 10 | mAdc |

(continued)

**ELECTRICAL CHARACTERISTICS — continued** ( $T_C = 25^\circ\text{C}$  unless otherwise noted.)

| Characteristic   | Symbol    | Min                            | Typ | Max | Unit |
|--|-----------|--------------------------------|-----|-----|------|
| <b>ON CHARACTERISTICS</b>  |           |                                |     |     |      |
| DC Current Gain<br>( $I_C = 10 \text{ Adc}$ , $V_{CE} = 5.0 \text{ Vdc}$ )   | $h_{FE}$  | 40                             | 85  | 120 | —    |
| <b>DYNAMIC CHARACTERISTICS</b>   |           |                                |     |     |      |
| Output Capacitance<br>( $V_{CB} = 12.5 \text{ Vdc}$ , $I_E = 0$ , $f = 1.0 \text{ MHz}$ )  | $C_{ob}$  | —                              | 170 | 220 | pF   |
| <b>FUNCTIONAL TESTS</b> (In Motorola Test Fixture. See Figure 1.)  |           |                                |     |     |      |
| Output Power<br>( $V_{CC} = 12.5 \text{ Vdc}$ , $P_{in} = 25 \text{ W}$ , $f = 470 \text{ \& } 512 \text{ MHz}$ )                        | $P_{out}$ | 65                             | —   | —   | W    |
| Collector Efficiency<br>( $V_{CC} = 12.5 \text{ Vdc}$ , $P_{out} = 65 \text{ W}$ , $f = 470 \text{ \& } 512 \text{ MHz}$ )               | $\eta$    | 50                             | 60  | —   | %    |
| Output Mismatch Stress<br>( $V_{CC} = 15.5 \text{ Vdc}$ , $P_{in} = 32 \text{ W}$ , $f = 512 \text{ MHz}$ , VSWR 20:1, All Phase Angles) | $\psi$    | No Degradation in Output Power |     |     |      |



- B1–B4 — Long Bead, Fair Rite (2743019446)
- C1 — 56 pF, Chip Capacitor, Murata Erie
- C2 — 1–20 pF Trimmer, Johanson–JMC 5501 PG26J200
- C3 — 39 pF, Chip Capacitor, Murata Erie
- C4 — 1–20 pF Trimmer, Johanson–JMC 5501
- C5 — 33 pF, Miniature Clamped Mica, SAHA
- C6 — 33 pF, Miniature Clamped Mica, SAHA
- C7 — 33 pF, Miniature Clamped Mica, SAHA
- C8 — 27 pF, Miniature Clamped Mica, SAHA
- C11 — 1–20 pF Trimmer, Johanson–JMC 5501 PG26J200
- C12 — 110 pF, Chip Capacitor, Murata Erie
- C13 — 10  $\mu\text{F}$ , 50 V Electrolytic, Panasonic–ECEV1HV100R
- C14 — 0.18  $\mu\text{F}$  Chip Capacitor
- C15 — 130 pF, Chip Capacitor, Murata Erie

- C16 — 130 pF, Chip Capacitor, Murata Erie
- C17 — 130 pF, Chip Capacitor, Murata Erie
- C18 — 130 pF, Chip Capacitor, Murata Erie
- C19 — 0.18  $\mu\text{F}$  Chip Capacitor
- C20 — 10  $\mu\text{F}$ , 50 V Electrolytic, Panasonic–ECEV1HV100R
- Board — 1/16" Glass Teflon,  $\epsilon_r = 2.55$ , Keene (GX–0600–55–22)
- L1, L2 — 5 Turns, 20 AWG, ID 0.126"
- L3 — 2 Turns, 26 AWG, ID 0.073"
- N1, N2 — Type N Flange, Omni Spectra (3052–1648–10)

- Murata Erie Chip Capacitors — GRH710COGxxxx100VBE
- SAHA Mini Clamped Mica Capacitors — 3HS0006–xx

**Figure 1. 512 MHz Test Circuit**

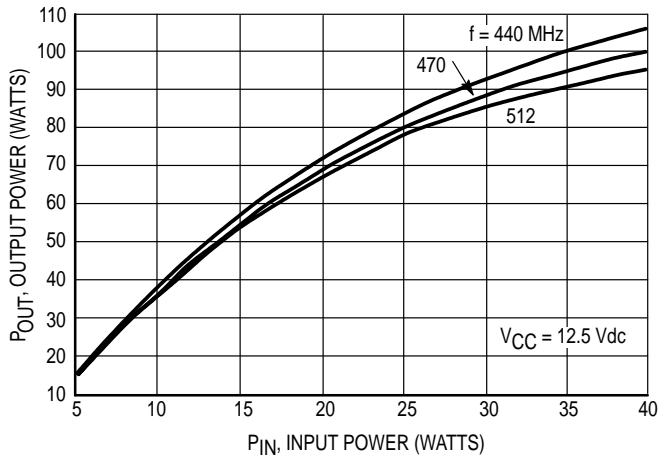


Figure 2. Output Power versus Input Power

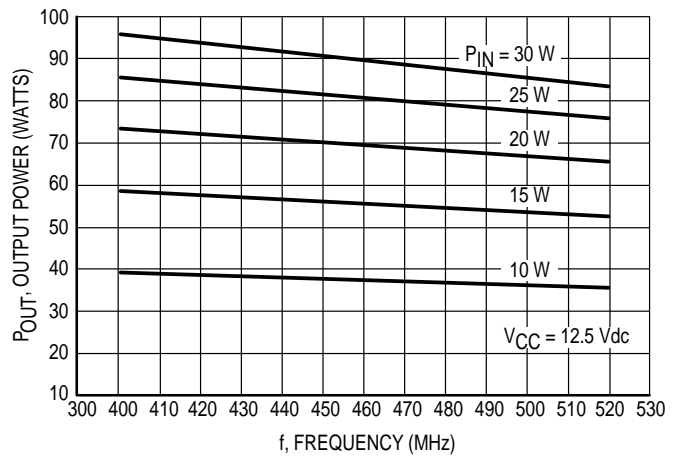


Figure 3. Output Power versus Frequency

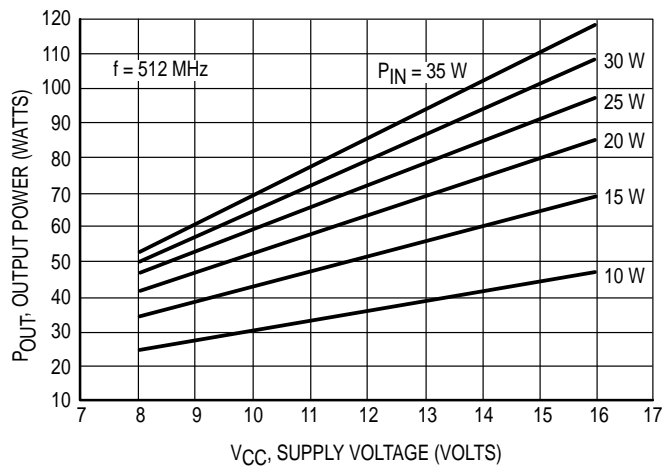
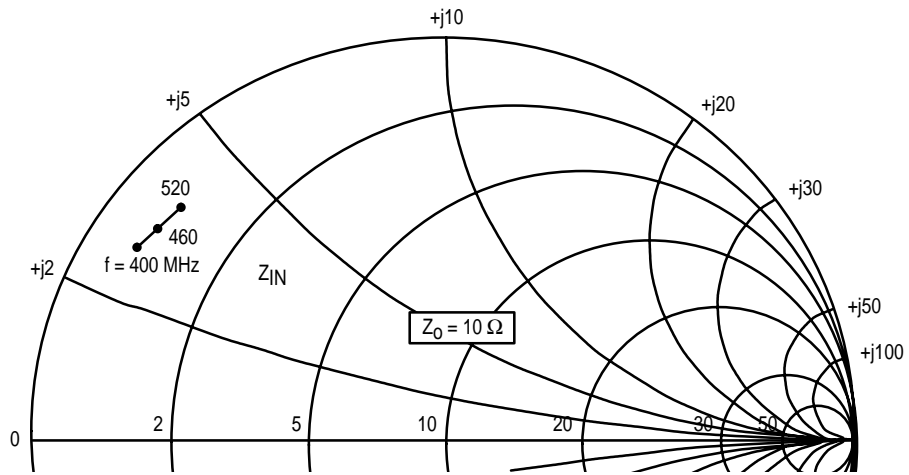
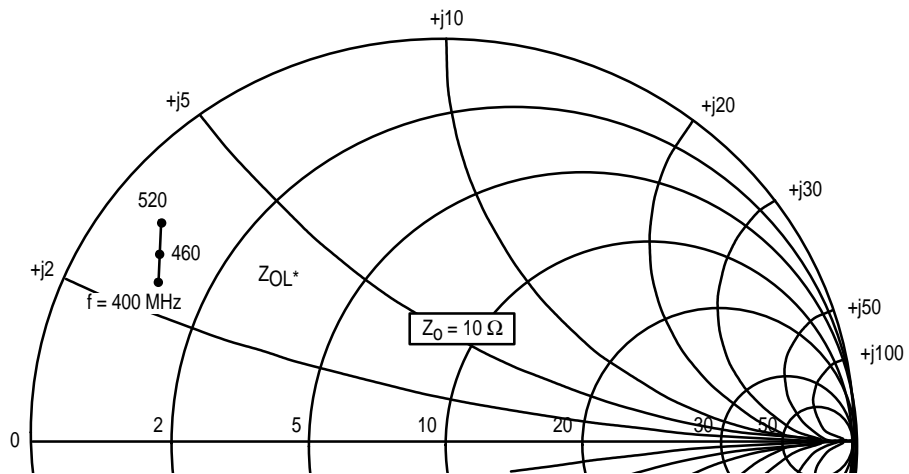


Figure 4. Output Power versus Supply Voltage



$V_{CC} = 12.5 \text{ V}$   $P_0 = 70 \text{ W}$

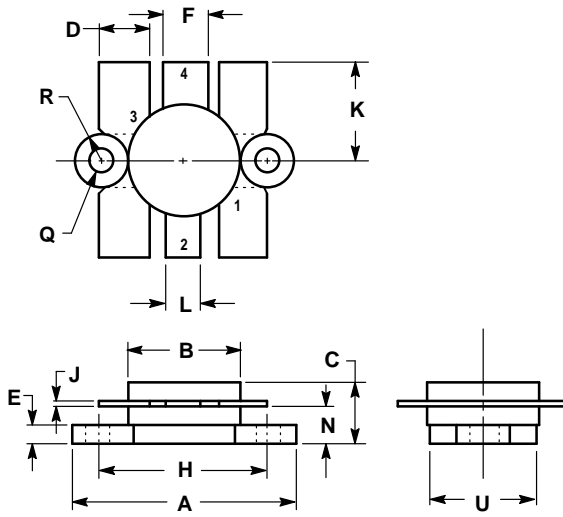
| f<br>MHz | $Z_{IN}$<br>OHMS | $Z_{OL}^*$<br>OHMS |
|----------|------------------|--------------------|
| 400      | $0.62 + j2.8$    | $1.20 + j2.5$      |
| 440      | $0.72 + j3.1$    | $1.10 + j2.8$      |
| 480      | $0.81 + j3.3$    | $0.94 + j3.1$      |
| 520      | $0.90 + j3.6$    | $0.80 + j3.4$      |



$Z_{OL}^*$  = Conjugate of optimum load impedance into which the device operates at a given output power, voltage and frequency.

**Figure 5. Series Equivalent Input and Output Impedances**

# PACKAGE DIMENSIONS




NOTES:  
1. FLANGE IS ISOLATED IN ALL STYLES.

| DIM | INCHES |       | MILLIMETERS |       |
|-----|--------|-------|-------------|-------|
|     | MIN    | MAX   | MIN         | MAX   |
| A   | 24.38  | 25.14 | 0.960       | 0.990 |
| B   | 12.45  | 12.95 | 0.490       | 0.510 |
| C   | 5.97   | 7.62  | 0.235       | 0.300 |
| D   | 5.33   | 5.58  | 0.210       | 0.220 |
| E   | 2.16   | 3.04  | 0.085       | 0.120 |
| F   | 5.08   | 5.33  | 0.200       | 0.210 |
| H   | 18.29  | 18.54 | 0.720       | 0.730 |
| J   | 0.10   | 0.15  | 0.004       | 0.006 |
| K   | 10.29  | 11.17 | 0.405       | 0.440 |
| L   | 3.81   | 4.06  | 0.150       | 0.160 |
| N   | 3.81   | 4.31  | 0.150       | 0.170 |
| Q   | 2.92   | 3.30  | 0.115       | 0.130 |
| R   | 3.05   | 3.30  | 0.120       | 0.130 |
| U   | 11.94  | 12.57 | 0.470       | 0.495 |

STYLE 1:  
PIN 1. EMITTER  
2. COLLECTOR  
3. EMITTER  
4. BASE

**CASE 316-01  
ISSUE D**

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