MOTOROLA
**SEMICONDUCTOR**
TECHNICAL DATA

# 2N5160

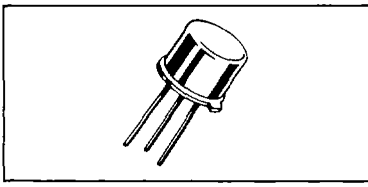
## The RF Line

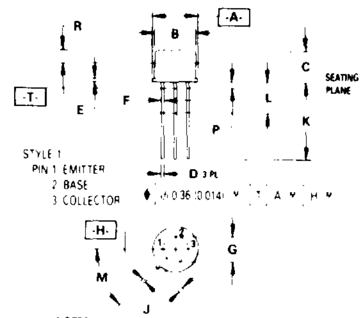
### PNP SILICON RF POWER TRANSISTOR

. . . designed for amplifier, frequency multiplier or oscillator applications in military and industrial equipment. Suitable for use as Class A, B, or C output driver, or pre-driver stages in VHF and UHF.

- High Power Gain — $G_{PE}$ = 8.0 dB (Min) @ f = 400 MHz, 14.5 db (Typ) @ 175 MHz — No Emitter Tuning
- Power Output — $P_{out}$ = 1.0 Watt (Min @ f = 400 MHz
  = 1.5 Watt (Typ) @ f = 175 MHz
- Resists Burnout When Load is Shorted or Opened
- Designed for Use in Complementary Circuits with 2N3866
- MIL-S-19500 Processed Versions Available as MRF5160HX, MRF5160HXV

**$I_C$ = −400 mA**
**POWER TRANSISTOR**
**PNP SILICON**






NOTES
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M 1982
2. CONTROLLING DIMENSION INCH
3. DIMENSION J MEASURED FROM DIMENSION A MAXIMUM
4. DIMENSION B SHALL NOT VARY MORE THAN 0.25 (0.010) IN ZONE R. THIS ZONE CONTROLLED FOR AUTOMATIC HANDLING
5. DIMENSION F APPLIES BETWEEN DIMENSION P AND L. DIMENSION D APPLIES BETWEEN DIMENSION L AND K MINIMUM. LEAD DIAMETER IS UNCONTROLLED IN DIMENSION P AND BEYOND DIMENSION K MINIMUM

| DIM | MILLIMETERS MIN | MILLIMETERS MAX | INCHES MIN | INCHES MAX |
|---|---|---|---|---|
| A | 8.51 | 9.39 | 0.335 | 0.370 |
| B | 7.75 | 8.50 | 0.305 | 0.335 |
| C | 6.10 | 6.60 | 0.240 | 0.260 |
| D | 0.41 | 0.53 | 0.016 | 0.021 |
| E | 0.23 | 1.04 | 0.009 | 0.041 |
| F | 0.41 | 0.48 | 0.016 | 0.019 |
| G | 5.08 BSC | | 0.200 BSC | |
| H | 0.72 | 0.86 | 0.028 | 0.034 |
| J | 0.74 | 1.14 | 0.029 | 0.045 |
| K | 12.70 | 19.05 | 0.500 | 0.750 |
| L | 6.35 | | 0.250 | – |
| M | 45° BSC | | 45° BSC | |
| P | — | 1.27 | — | 0.050 |
| R | 2.54 | — | 0.100 | – |

**CASE 79-04**
**TO-205AD**
**(TO-39)**

### *MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Collector-Emitter Voltage | $V_{CEO}$ | −40 | Vdc |
| Collector-Base Voltage | $V_{CB}$ | 60 | Vdc |
| Emitter-Base Voltage | $V_{EB}$ | 4.0 | Vdc |
| Collector Current | $I_C$ | 0.4 | Adc |
| Total Device Dissipation @ $T_C$ = 25°C<br>Derate above 25°C | $P_D$ | 5.0<br>28.6 | Watts<br>mW/°C |
| Operating and Storage Junction Temperature Range | $T_J$, $T_{stg}$ | −65 to +200 | °C |

*Indicates JEDEC Registered Data.

***ELECTRICAL CHARACTERISTICS** ($T_A$ = 25°C unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Collector-Emitter Sustaining Voltage ($I_C$ = 5.0 mAdc, $I_B$ = 0) | $V_{CEO(sus)}$ | 40 | — | — | Vdc |
| Emitter-Base Breakdown Voltage ($I_E$ = −0.1 mAdc, $I_C$ = 0) | $V_{(BR)EBO(sus)}$ | −4.0 | — | — | Vdc |
| Collector Cutoff Current ($V_{CE}$ = −28 Vdc, $I_B$ = 0) | $I_{CEO}$ | — | — | −20 | μAdc |
| Collector Cutoff Current ($V_{CE}$ = −60 Vdc, $V_{BE}$ = 0) | $I_{CES}$ | — | — | −0.1 | mAdc |
| Collector Cutoff Current ($V_{CB}$ = 28 Vdc, $I_E$ = 0) | $I_{CBO}$ | — | — | −1.0 | μAdc |
| **ON CHARACTERISTICS** | | | | | |
| DC Current Gain ($I_C$ = −50 mAdc, $V_{CE}$ = −5.0 Vdc) | $h_{FE}$ | 10 | — | — | — |
| **DYNAMIC CHARACTERISTICS** | | | | | |
| Current-Gain — Bandwidth Product ($I_C$ = 50 mAdc, $V_{CE}$ = 15 Vdc, f = 200 MHz) | $f_T$ | 500 | 900 | — | MHz |
| Collector-Base Capacitance ($V_{CB}$ = −28 Vdc, $I_E$ = 0, f = 0.1 to 1.0 MHz) | $C_{cb}$ | — | 2.5 | 4.0 | pF |
| **FUNCTIONAL TESTS** | | | | | |
| Common-Emitter Amplifier Power Gain<br>($V_{CE}$ = 28 Vdc, $P_{in}$ = 0.16 Watt, f = 400 MHz)<br>($V_{CE}$ = −28 Vdc, $P_{in}$ = 50 mW, f = 175 MHz) | $G_{PE}$ | <br>8.0<br>— | <br>8.8<br>14.5 | <br>—<br>— | dB |
| Power Output<br>($V_{CE}$ = 28 Vdc, $P_{in}$ = 0.16 Watt, f = 400 MHz)<br>($V_{CE}$ = −28 Vdc, $P_{in}$ = 50 mW, f = 175 MHz) | $P_{out}$ | <br>1.0<br>— | <br>1.2<br>1.4 | <br>—<br>— | Watt |
| Collector Efficiency ($V_{CE}$ = 28 Vdc, $P_{in}$ = 0.16 Watt, f = 400 MHz) | η | 45 | 55 | — | % |

*Indicates JEDEC Registered Data.

**FIGURE 1 — 400-MHz TEST CIRCUIT**

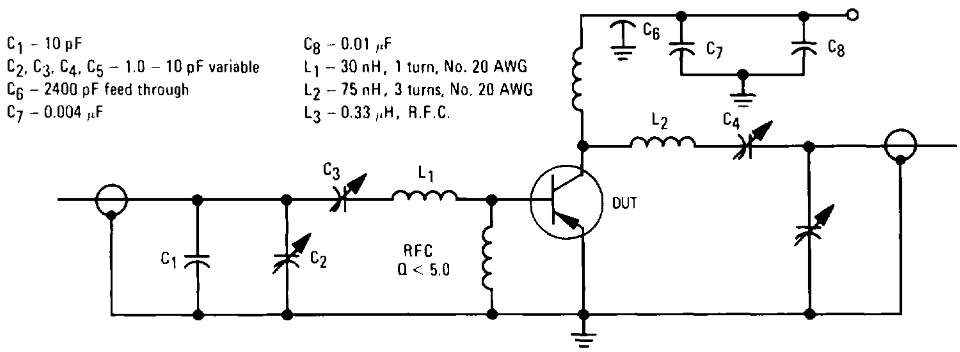


**FIGURE 2 — POWER OUTPUT versus FREQUENCY**

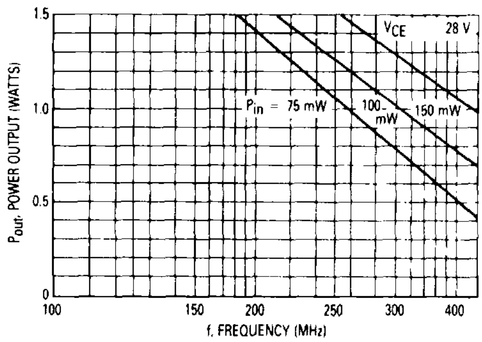



**FIGURE 3 — POWER OUTPUT versus POWER INPUT**

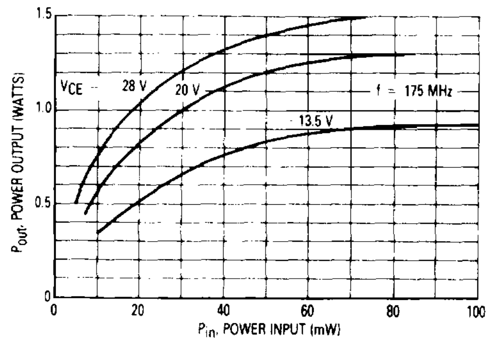



**FIGURE 4 — PARALLEL INPUT IMPEDANCE versus FREQUENCY**

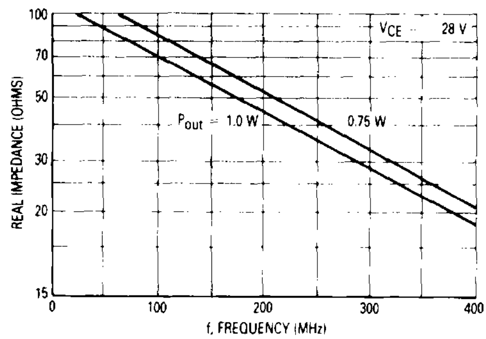



**FIGURE 5 — PARALLEL INPUT IMPEDANCE versus FREQUENCY**

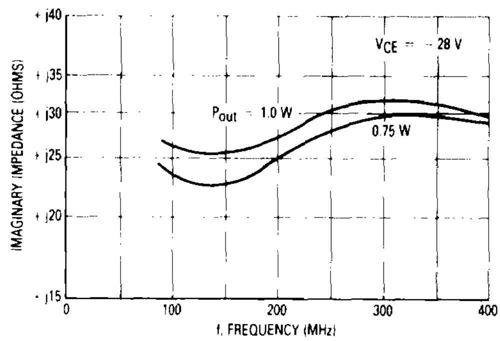



**FIGURE 6 — PARALLEL OUTPUT CAPACITANCE versus FREQUENCY**

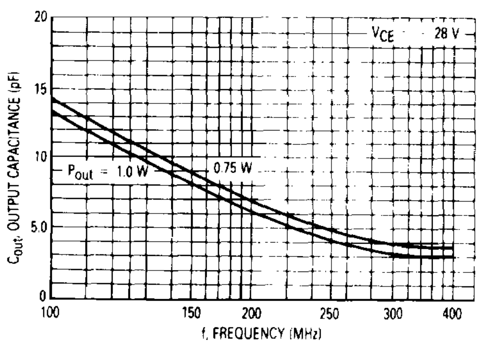



**FIGURE 7 — CURRENT-GAIN — BANDWIDTH PRODUCT versus COLLECTOR CURRENT**

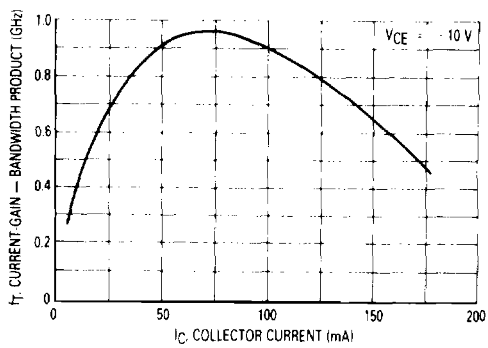


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FIGURE 8 – 2N5160 300-MHz COMPLEMENTARY POWER OUTPUT CIRCUIT

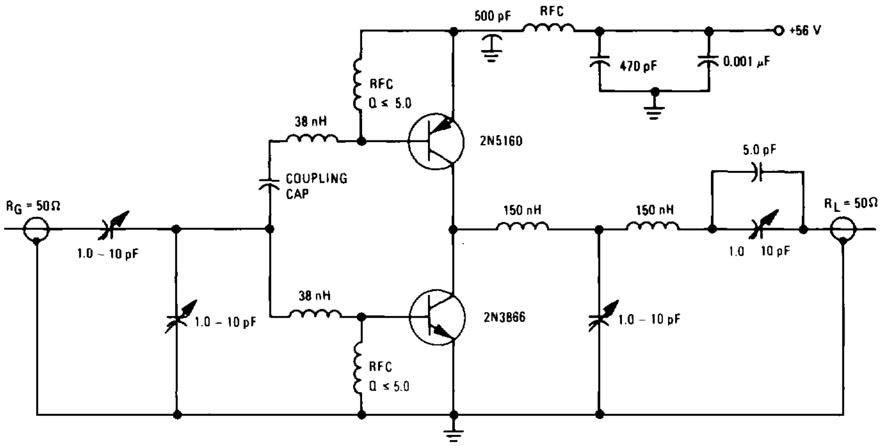


FIGURE 9 – COMPLEMENTARY CIRCUIT – POWER OUTPUT versus POWER INPUT