

2N2415 (GERMANIUM)

2N2416

GERMANIUM ULTRA-HIGH-FREQUENCY TRANSISTORS

... for very low-noise, high-gain amplifiers, oscillators, mixers, and frequency multipliers.

- High Maximum Frequency of Oscillation
 $f_{max} = 2000$ MHz typ
- Low Noise Figure
 $NF = 3.0$ dB max at 200 MHz (2N2415)
- High Maximum Available Gain
 $MAG = 14$ dB typ at 500 MHz for 2N2415
 $MAG = 12.5$ dB typ at 500 MHz for 2N2416
- High Breakdown Voltages
 $BV_{ceo} = 25$ Volts typ
 $BV_{cbo} = 15$ Volts typ
- Low Output Capacitance
 $C_{ob} = 0.9$ pF typ

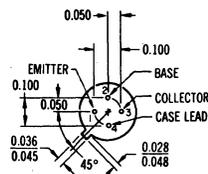
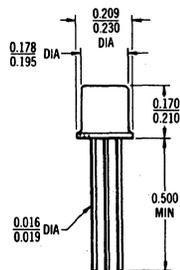
MAXIMUM RATINGS*

| Rating | Symbol | Value | Unit |
|--|----------------|-------------|----------------------------|
| Collector-Emitter Voltage | V_{CEO} | 10 | Vdc |
| Collector-Base Voltage | V_{CB} | 15 | Vdc |
| Emitter-Base Voltage | V_{EB} | 0.3 | Vdc |
| Collector Current | I_C | 20 | mAdc |
| Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C | P_D | 75 1.0 | mW mW/ $^\circ\text{C}$ |
| Operating and Storage Junction Temperature Range | T_J, T_{stg} | -65 to +100 | $^\circ\text{C}$ |

* The maximum rating is that value above which device operation may be impaired from the viewpoint of life or performance.

AMPLIFIER TRANSISTORS

GERMANIUM PNP EPITAXIAL MESA DIFFUSED BASE



TO-72 PACKAGE
CASE 20

2N2415, 2N2416 (continued)

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|------------|-----|-----|-----|-----------------|
| OFF CHARACTERISTICS | | | | | |
| Collector-Emitter Breakdown Voltage ⁽¹⁾ ($I_C = 2.0\text{ mAdc}$, $I_E = 0$) | BV_{CEO} | 10 | 15 | - | Vdc |
| Collector-Base Breakdown Voltage ($I_C = 100\text{ }\mu\text{Adc}$, $I_E = 0$) | BV_{CBO} | 15 | 25 | - | Vdc |
| Collector Cutoff Current ($V_{CB} = 10\text{ Vdc}$, $I_E = 0$) | I_{CBO} | - | 1.0 | 5.0 | μAdc |
| Emitter Cutoff Current ($V_{BE} = 0.3\text{ Vdc}$, $I_C = 0$) | I_{EBO} | - | - | 100 | μAdc |

ON CHARACTERISTICS

| | | | | | | |
|--|------------------|----------|-----------|--------|------------|---|
| DC Current Gain ($I_C = 2.0\text{ mAdc}$, $V_{CE} = 6.0\text{ Vdc}$) | 2N2415 2N2416 | h_{FE} | 10 8.0 | - - | 200 200 | - |
|--|------------------|----------|-----------|--------|------------|---|

DYNAMIC CHARACTERISTICS

| | | | | | | |
|---|------------------|-----------------|------------|------------|------------|-----|
| Current-Gain-Bandwidth Product ($I_C = 2.0\text{ mAdc}$, $V_{CE} = 6.0\text{ Vdc}$, $f = 200\text{ MHz}$) | 2N2415 2N2416 | f_T | 500 400 | - - | - - | MHz |
| Output Capacitance ($V_{CB} = 6.0\text{ Vdc}$, $I_E = 0$, $f = 1.0\text{ MHz}$) | | C_{ob} | - | 0.9 | 2.0 | pF |
| Small-Signal Current Gain ($I_C = 2.0\text{ mAdc}$, $V_{CE} = 6.0\text{ Vdc}$, $f = 1.0\text{ kHz}$) | 2N2415 2N2416 | h_{fe} | 15 10 | - - | 300 300 | - |
| Collector-Base Time Constant** ($I_E = 2.0\text{ mAdc}$, $V_{CB} = 6.0\text{ Vdc}$, $f = 79.8\text{ MHz}$) | 2N2415 2N2416 | $r_b' C_c^{**}$ | - - | - - | 8.0 10 | ps |
| Noise Figure ($V_{CB} = 6.0\text{ Vdc}$, $I_E = 1.5\text{ mAdc}$, $R_S = 75\text{ ohms}$, $f = 200\text{ MHz}$) | 2N2415 2N2416 | NF | - - | 2.4 3.4 | 3.0 4.0 | dB |

FUNCTIONAL TESTS

| | | | | | | |
|---|------------------|------|--------|------------|--------|----|
| Maximum Available Gain# ($V_{CB} = 6.0\text{ Vdc}$, $I_E = 2.0\text{ mAdc}$, $f = 500\text{ MHz}$) | 2N2415 2N2416 | MAG# | - - | 14 12.5 | - - | dB |
|---|------------------|------|--------|------------|--------|----|

(1) Pulse Test: Pulse Width $\leq 300\text{ }\mu\text{s}$, Duty Cycle $\leq 2.0\%$.

** Direct Collector-Emitter header capacitance balanced out to give true device capability.

MAG calculated from f_{max} as determined from actual amplifier circuits.

TYPICAL MAG and NOISE FIGURE versus FREQUENCY

