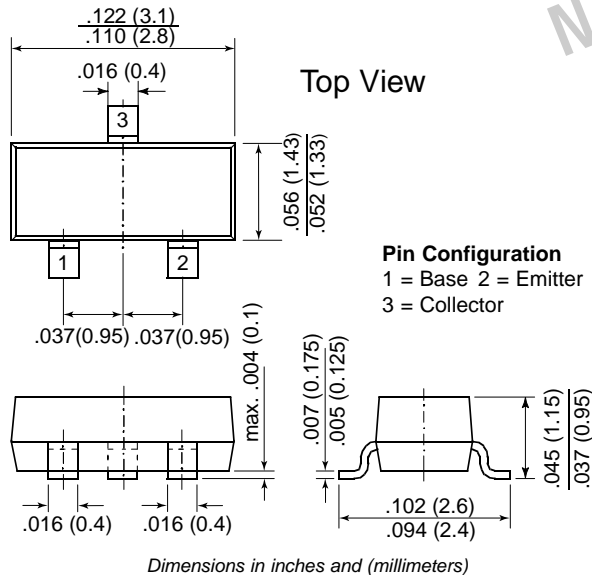


Small Signal Transistor (NPN)

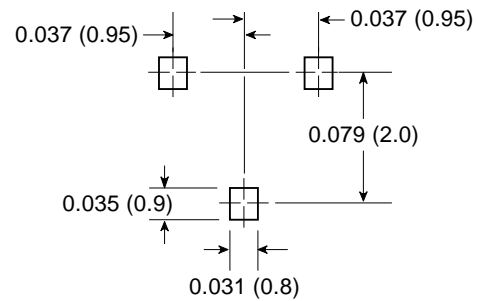


TO-236AB (SOT-23)



New Product

Mounting Pad Layout



Mechanical Data

Case: SOT-23 Plastic Package

Weight: approx. 0.008g

Marking Code: 1P

Packaging Codes/Options:

E8/10K per 13" reel (8mm tape)

E9/3K per 7" reel (8mm tape)

Features

- NPN Silicon Epitaxial Planar Transistor for switching and amplifier applications.
- This transistor is also available in the TO-92 case with the type designation MPS2222A.

Maximum Ratings & Thermal Characteristics Ratings at 25°C ambient temperature unless otherwise specified.

| Parameters | Symbols | Value | Units |
|--|------------------|--------------|-------------|
| Collector-Base Voltage | V _{CB0} | 75 | V |
| Collector-Emitter Voltage | V _{CEO} | 40 | V |
| Emitter-Base Voltage | V _{EB0} | 6.0 | V |
| Collector Current | I _C | 600 | mA |
| Power Dissipation | P _{tot} | 225 1.8 | mW mW/°C |
| Power Dissipation | P _{tot} | 300 2.4 | mW mW/°C |
| Thermal Resistance Junction to Ambient Air | R _{θJA} | 556 417 | °C/W |
| Junction Temperature | T _j | 150 | °C |
| Storage Temperature Range | T _s | - 55 to +150 | °C |

Notes: (1) FR-5 = 1.0 x 0.75 x 0.062 in.

(2) Alumina = 0.4 x 0.3 x 0.024 in. 99.5% alumina.

Small Signal Transistor (NPN)

Electrical Characteristics (T_J = 25°C unless otherwise noted)

| Parameter | Symbol | Test Condition | Min | Typ | Max | Unit |
|---|----------------------|--|------|-----|------|------|
| DC Current Gain | h _{FE} | V _{CE} = 10 V, I _C = 0.1 mA | 35 | — | — | — |
| | | V _{CE} = 10 V, I _C = 1 mA | 50 | — | — | |
| | | V _{CE} = 10 V, I _C = 10 mA | 75 | — | — | |
| | | V _{CE} = 10 V, I _C = 10 mA T _A = -55°C | 35 | — | — | |
| | | V _{CE} = 10 V, I _C = 150 mA ⁽¹⁾ | 100 | — | 300 | |
| | | V _{CE} = 10 V, I _C = 500 mA ⁽¹⁾ | 40 | — | — | |
| V _{CE} = 1.0 V, I _C = 150 mA ⁽¹⁾ | 50 | — | — | | | |
| Collector-Base Breakdown Voltage | V _{(BR)CBO} | I _C = 10 μA, I _E = 0 | 75 | — | — | V |
| Collector-Emitter Breakdown Voltage ⁽¹⁾ | V _{(BR)CEO} | I _C = 10 mA, I _B = 0 | 40 | — | — | V |
| Emitter-Base Breakdown Voltage | V _{(BR)EBO} | I _C = 10 μA, I _C = 0 | 6.0 | — | — | V |
| Collector-Emitter Saturation Voltage ⁽¹⁾ | V _{CEsat} | I _C = 150 mA, I _B = 15 mA | — | — | 0.3 | V |
| | | I _C = 500 mA, I _B = 50 mA | — | — | 1.0 | |
| Base-Emitter Saturation Voltage ⁽¹⁾ | V _{BEsat} | I _C = 150 mA, I _B = 15 mA | 0.6 | — | 1.2 | V |
| | | I _C = 500 mA, I _B = 50 mA | — | — | 2.0 | |
| Collector Cut-off Current | I _{CEx} | V _{EB} = 3 V, V _{CE} = 60 V | — | — | 10 | nA |
| Collector Cut-off Current | I _{CBO} | V _{CB} = 60 V, I _E = 0 | — | — | 10 | nA |
| | | V _{CB} = 50 V, I _E = 0 V T _A = 125°C | — | — | 10 | μA |
| Base Cut-off Current | I _{BL} | V _{EB} = 3 V, V _{CE} = 60 V | — | — | 20 | nA |
| Emitter Cut-off Current | I _{EBO} | V _{EB} = 3 V _{DC} , I _C = 0 | — | — | 100 | nA |
| Current Gain-Bandwidth Product | f _T | V _{CE} = 20 V, I _C = 20 mA f = 100 MHz | 300 | — | — | MHz |
| Output Capacitance | C _{obo} | V _{CB} = 10 V, f = 1 MHz, I _E = 0 | — | — | 8 | pF |
| Input Capacitance | C _{ibo} | V _{EB} = 0.5 V, f = 1 MHz, I _C = 0 | — | — | 25 | pF |
| Noise Figure | NF | V _{CE} = 10 V, I _C = 100 μA, R _S = 1 kΩ, f = 1 kHz | — | — | 4.0 | dB |
| Input Impedance | h _{ie} | V _{CE} = 10 V, I _C = 1 mA f = 1 kHz | 2 | — | 8.0 | kΩ |
| | | V _{CE} = 10 V, I _C = 10 mA f = 1 kHz | 0.25 | — | 1.25 | |
| Small Signal Current Gain | h _{fe} | V _{CE} = 10 V, I _C = 1 mA, f = 1 kHz | 50 | — | 300 | — |
| | | V _{CE} = 10 V, I _C = 10 mA, f = 1 kHz | 75 | — | 375 | |
| Voltage Feedback Ratio | h _{re} | V _{CE} = 10 V, I _C = 1 mA, f = 1 kHz | 50 | — | 300 | — |
| | | | 75 | — | 375 | |
| Output Admittance | h _{oe} | V _{CE} = 10 V, I _C = 1 mA, f = 1 kHz | 5.0 | — | 35 | μS |
| | | V _{CE} = 10 V, I _C = 10 mA, f = 1 kHz | 25 | — | 200 | |

Note:

(1) Pulse Test: Pulse width ≤ 300 μs - Duty cycle ≤ 2%

Small Signal Transistors (NPN)

Electrical Characteristics ($T_J = 25^\circ\text{C}$ unless otherwise noted)

| Parameter | Symbol | Test Condition | Min | Typ | Max | Unit |
|------------------------------|------------|--|-----|-----|-----|------|
| Collector Base Time Constant | $r_b' C_C$ | $I_E = 20 \text{ mA}, V_{CB} = 20 \text{ V}, f = 31.8 \text{ MHz}$ | — | — | 150 | ps |
| Delay Time (see fig. 1) | t_d | $I_{B1} = 15 \text{ mA}, I_C = 150 \text{ mA}, V_{CC} = 30\text{V}, V_{BE} = -0.5 \text{ V}$ | — | — | 10 | ns |
| Rise Time (see fig. 1) | t_r | $I_{B1} = 15 \text{ mA}, I_C = 150 \text{ mA}, V_{CC} = 30\text{V}, V_{BE} = -0.5 \text{ V}$ | — | — | 25 | ns |
| Storage Time (see fig. 2) | t_s | $I_{B1} = I_{B2} = 15 \text{ mA}, I_C = 150 \text{ mA}, V_{CC} = 30\text{V}$ | — | — | 225 | ns |
| Fall Time (see fig. 2) | t_f | $I_{B1} = I_{B2} = 15 \text{ mA}, I_C = 150 \text{ mA}, V_{CC} = 30\text{V}$ | — | — | 60 | ns |

Switching Time Equivalent Test Circuit

Figure 1. Turn-ON Time

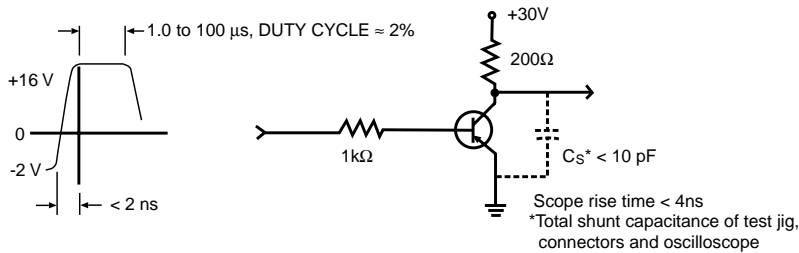


Figure 2. Turn-OFF Time

