# High Speed Switching Transistor

RoHS Compliant

## Features

- NPN Silicon Planar Switching Transistor
- Fast switching devices exhibiting short turn-off and low saturation voltage characteristics
- Switching and Linear application DC and VHF Amplifier applications

## Specification Table

| $V_{CEO}$ Max. (V) | $I_C$ Max. (A) | $V_{CE}$(sat) Max. (V) at $I_C$ = 150mA | $t_{off}$ Max. (ns) at $I_C$ = 150mA | $h_{FE}$ Min. at $I_C$ = 150mA | $P_{tot}$ at 25°C (mW) | Package and Pin Out |
|---|---|---|---|---|---|---|
| 40 | 0.8 | 0.3 | 60 | 100 | 500 | TO-18 |

## Absolute Maximum Ratings

| Parameter | Symbol | Rating | Unit |
|---|---|---|---|
| Collector - Emitter Voltage | $V_{CEO}$ | 40 | V |
| Collector - Base Voltage | $V_{CBO}$ | 75 | |
| Emitter - Base Voltage | $V_{EBO}$ | 6 | |
| Collector Current Continuous | $I_C$ | 800 | mA |
| Power Dissipation at $T_A$ = 25°C<br>Derate above 25°C | $P_D$ | 500<br>2.28 | mW<br>mW / °C |
| Power Dissipation at $T_C$ = 25°C<br>Derate above 25°C | $P_D$ | 1.2<br>6.85 | W<br>mW / °C |
| Operating and Storage Junction Temperature Range | $T_J$, Tstg | -65 to +200 | °C |

## Electrical Characteristics ($T_A$ = 25°C unless otherwise specified)

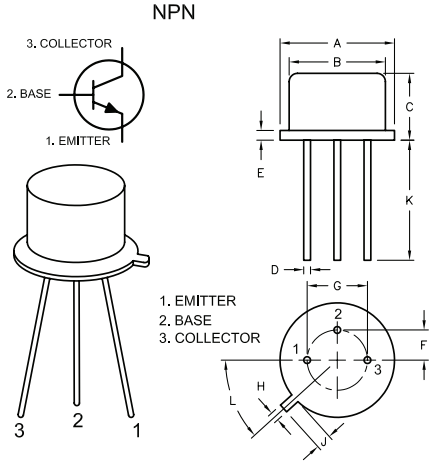
| Parameter | Symbol | Test Condition | Value | | |
|---|---|---|---|---|---|
| | | | Minimum | Maximum | Unit |
| Collector - Emitter Voltage | $V_{CEO}$ | $I_C$ = 10mA, $I_B$ = 0 | 40 | - | V |
| Collector - Base Voltage | $V_{CBO}$ | $I_C$ = 10µA, $I_E$ = 0 | 75 | - | |
| Emitter - Base Voltage | $V_{EBO}$ | $I_E$ = 10µA, $I_C$ = 0 | 6 | - | |
| Collector - Cut off Current | $I_{CBO}$<br><br>$I_{CEX}$ | $V_{CB}$ = 60V, $I_E$ = 0<br>$T_A$ = 150°C<br>$V_{CB}$ = 60V, $I_E$ = 0<br>$V_{CE}$ = 60V, $V_{EB}$ = 3V | - | 10<br><br>10<br>10 | nA<br><br>µA<br>nA |
| Emitter - Cut off Current | $I_{EBO}$ | $V_{EB}$ = 3V, $I_C$ = 0 | - | 10 | nA |
| Base - Cut off Current | $I_{BL}$ | $V_{CE}$ = 60V, $V_{EB}$ = 3V | - | 20 | |
| Collector Emit >35 ter Saturation Voltage | *$V_{CE}$ (Sat) | $I_C$ = 150mA, $I_B$ = 15mA | - | 0.3 | V |
| | | $I_C$ = 500mA, $I_B$ = 50mA | - | 1 | |
| Base Emitter Saturation Voltage | *$V_{BE}$ (Sat) | $I_C$ = 150mA, $I_B$ = 15mA | - | 0.6 to 1.2 | |
| | | $I_C$ = 500mA, $I_B$ = 50mA | - | 2 | |

## Electrical Characteristics ($T_A$ = 25°C unless otherwise specified)

| Parameter | Symbol | Test Condition | Rating | Unit |
|---|---|---|---|---|
| DC Current Gain | $h_{FE}$ | $I_C$ = 0.1mA, $V_{CE}$ = 10V<br>$I_C$ = 1mA, $V_{CE}$ = 10V<br>$I_C$ = 10 mA, $V_{CE}$ = 10V<br>$T_A$ = 55°C<br>$I_C$ = 10mA, $V_{CE}$ = 10V<br>$I_C$ = 150mA, $V_{CE}$ = 10V<br>$I_C$ = 150mA, $V_{CE}$ = 1V<br>$I_C$ = 500mA, $V_{CE}$ = 10V | >35<br>>50<br>>75<br><br>>35<br>100 to 300<br>>50<br>>40 | - |
| **Dynamic Characteristics** | | | | |
| | | ALL F = 1kHz | | |
| Small Signal Current Gain | $h_{FE}$ | $I_C$ = 1mA, $V_{CE}$ = 10V<br>$I_C$ = 10mA, $V_{CE}$ = 10V | 50 to 300<br>75 to 375 | - |
| Input Impedance | $h_{IE}$ | $I_C$ = 1mA, $V_{CE}$ = 10V<br>$I_C$ = 10mA, $V_{CE}$ = 10V | 2 to 8<br>0.25 to 1.25 | kΩ |
| Voltage Feedback Ratio | $h_{RE}$ | $I_C$ = 1mA, $V_{CE}$ = 10V<br>$I_C$ = 10mA, $V_{CE}$ = 10V | <8<br><4 | x10-4 |
| Output Admittance | $h_{OE}$ | $I_C$ = 1mA, $V_{CE}$ = 10V<br>$I_C$ = 10mA, $V_{CE}$ = 10V | 5 to 35<br>25 to 200 | umhos |
| Collector Base Time Constant | rb'Cc | $I_E$ = 20mA, $V_{CB}$ = 20V<br>f = 31.8MHz | <150 | ps |
| **Dynamic Characteristics** | | | | |
| Real Part Common - Emitter High Frequency | Re (hie) | $I_C$ = 20mA, $V_{CE}$ = 20V | <60 | Ω |
| Input Impedance | - | f = 300MHz | - | - |
| Noise Figure | $N_F$ | Ic = 100µA, $V_{CE}$ = 10V<br>Rs = 1kΩ, f = 1kHz | <4 | dB |
| Transistors Frequency | $f_t$ | $I_C$ = 20mA, $V_{CE}$ = 20V<br>f = 100MHz | >300 | MHz |
| Output Capacitance | $C_{ob}$ | $V_{CB}$ = 10V, $I_E$ = 0<br>f = 100kHz | <8 | pF |
| Input Capacitance | $C_{ib}$ | $V_{EB}$ = 0.5V, $I_C$ = 0<br>f = 100kHz | <25 | |
| **Switching Time** | | | | |
| Delay Time<br>Rise Time | $t_d$<br>$t_r$ | $I_C$ = 150mA, $I_{B1}$ = 15mA<br>$V_{CC}$ = 30V, $V_{BE}$ = 0.5V | <10<br><25 | ns |
| Storage Time<br>Fall Time | $t_s$<br>$t_f$ | $I_C$ = 150mA, $I_{B1}$ =<br>$I_{B2}$ = 15mA, $V_{CC}$ = 30V | <225<br><60 | |

*Pulse Condition: Pulse Width = 300µs, Duty Cycle = 2%

## TO-18 Metal Can Package




| Dimensions | Minimum | Maximum |
|---|---|---|
| A | 5.24 | 5.84 |
| B | 4.52 | 4.97 |
| C | 4.31 | 5.33 |
| D | 0.4 | 0.53 |
| E | - | 0.76 |
| F | - | 1.27 |
| G | - | 2.97 |
| H | 0.91 | 1.17 |
| J | 0.71 | 1.21 |
| K | 12.7 | - |
| L | 45° | |

Dimensions : Millimetres

| Material content declaration of TO-18<br>1pc weight: 0.3092gm | | | | |
|---|---|---|---|---|
| **Components** | **Substance make up of Material** | **Chemical Composition** | **CAS Number** | **Amount of substances (gm)** |
| Header/cap | KOVAR, CRS1010 | Fe<br>Ni 29<br>Co 18<br>Glass | 7439-89-6<br>7440-02-0<br>7440-48-4 | 0.2889gm |
| Chip | Silicon | Si | 7440-21-3 | 0.0031gm |
| Bonding Wire | Aluminium (Al) | Al | 7429-90-05 | 0.00089gm |
| Tin Plating | Pure Tin | Sn | 7440-31-5 | 0.0074gm |

## Part Number Table

| Description | Part Number |
|---|---|
| Bipolar (BJT) Single Transistor, NPN, 40V, 300MHz, 1.2W, 800mA | 2N2222A |