

Bipolar Transistor



Description:

A Silicon NPN transistor in a TO-39 case intended for high speed switching applications.



Absolute Maximum Ratings:

Collector-Base Voltage, V_{CB0}	: 75V
Collector-Emitter Voltage, V_{CE0}	: 40V
Emitter-Base Voltage, V_{EB0}	: 6V
Continuous Collector Current, I_C	: 800mA
Total Device Dissipation ($T_C = +25^\circ\text{C}$), P_D	: 1.2W
Derate above 25°C	: 6.85mW/ $^\circ\text{C}$
Total Device Dissipation ($T_A = +25^\circ\text{C}$), P_D	: 400mW
Derate above 25°C	: 2.28mW/ $^\circ\text{C}$
Operating Junction Temperature Range, T_J	: -65°C to $+200^\circ\text{C}$
Storage Temperature Range, T_{stg}	: -65°C to 200°C

Electrical Characteristics: ($T_A = +25^\circ\text{C}$ Unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Max	Unit
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OFF Characteristics

Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\text{mA}, I_B = 0$	40	-	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 10\mu\text{A}, I_E = 0$	75	-	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\mu\text{A}, I_C = 0$	6	-	V
Collector Cut-Off Current	I_{CBO}	$V_{CE} = 60\text{V}, I_E = 0$	-	0.01	μA
		$V_{CE} = 60\text{V}, I_E = 0, T_A = +150^\circ\text{C}$	-	10	μA
	I_{CEX}	$V_{CE} = 60\text{V}, V_{EB(off)} = 3\text{V}$	-	10	μA
Emitter Cut-Off Current	I_{EBO}	$V_{EB} = 3\text{V}, I_C = 0$	-	10	μA
Base Cut-Off Current	I_{BL}	$V_{CE} = 60\text{V}, V_{EB(off)} = 0$	-	20	μA

On Characteristics

DC Current Gain	h_{FE}	$I_C = 0.1\text{mA}, V_{CE} = 10\text{V}$	20	-	-
		$I_C = 1\text{mA}, V_{CE} = 10\text{V}$	25	-	-
		$I_C = 10\text{mA}, V_{CE} = 10\text{V}$	35	-	-
		$I_C = 10\text{mA}, V_{CE} = 10\text{V}, T_A = -55^\circ\text{C}$	15	-	-
		$I_C = 150\text{mA}, V_{CE} = 10\text{V}$ (Note 1)	40	120	-
		$I_C = 150\text{mA}, V_{CE} = 1\text{V}$ (Note 1)	20	-	-
		$I_C = 500\text{mA}, V_{CE} = 10\text{V}$ (Note 1)	25	-	-
Collector-Emitter Saturation Voltage (Note 1)	$V_{CE(sat)}$	$I_C = 150\text{mA}, I_B = 5\text{mA}$	-	0.3	V
		$I_C = 500\text{mA}, I_B = 50\text{mA}$	-	1	V
Base-Emitter Saturation Voltage (Note 1)	$V_{BE(sat)}$	$I_C = 150\text{mA}, I_B = 15\text{mA}$	0.6	1.2	V
		$I_C = 500\text{mA}, I_B = 50\text{mA}$	-	2	V

Small-Signal Characteristics

Current Gain-Bandwidth Product (Note 2)	f_T	$I_C = 20\text{mA}, V_{CE} = 20\text{V}, f = 100\text{MHz}, (\text{Note } 2)$	250	-	MHz
Output Capacitance	C_{obo}	$V_{CB} = 10\text{V}, I_E = 0, f = 100\text{kHz}$	-	8	pF
Input Capacitance	C_{ibo}	$V_{EB} = 0.5\text{V}, I_C = 0, f = 10\text{kHz}$	-	25	pF
Input Impedance	h_{ie}	$I_C = 1\text{mA}, V_{CE} = 10\text{V}, f = 1\text{kHz}$	1	3.5	k Ω
		$I_C = 10\text{mA}, V_{CE} = 10\text{V}, f = 1\text{kHz}$	0.2	1	k Ω
Voltage Feedback Ratio	H_{re}	$I_C = 1\text{mA}, V_{CE} = 10\text{V}, f = 1\text{kHz}$		5	$\times 10^{-4}$
		$I_C = 10\text{mA}, V_{CE} = 10\text{V}, f = 1\text{kHz}$	-	2.5	$\times 10^{-4}$
Output Admittance	h_{oe}	$I_C = 1\text{mA}, V_{CE} = 10\text{V}, f = 1\text{kHz}$	3	15	μhos
		$I_C = 10\text{mA}, V_{CE} = 10\text{V}, f = 1\text{kHz}$	10	100	μhos
Collector-Base Time Constant	$r_b'C_C$	$I_C = 20\text{mA}, V_{CB} = 20\text{V}, f = 31.8\text{MHz}$	5	150	ps
Noise Figure	NF	$I_C = 100\mu\text{A}, V_{CE} = 10\text{V}, R_s = 1\text{k}\Omega, f = 1\text{kHz}$	-	4	dB
Real Part of Common-Emitter High Frequency input Impedance	$\text{Re}(h_{ie})$	$I_C = 20\text{mA}, V_{CE} = 20\text{V}, f = 300\text{MHz}$	-	60	Ω

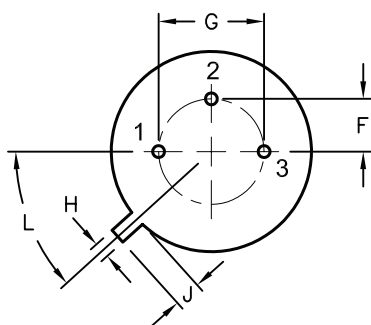
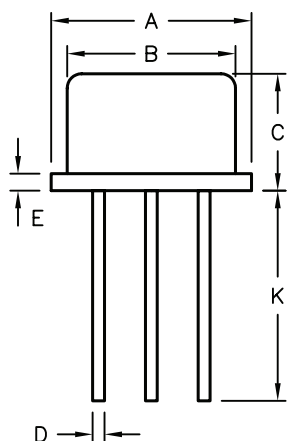
Switching Characteristics

Delay Time	t_d	$V_{CC} = 30\text{V}, I_C = 150\text{mA}, V_{CE(\text{OFF})} = 0.5\text{V}, I_{B1} = 15\text{mA}$	-	10	ns
Rise Time	t_r		-	25	ns
Storage Time	t_s	$V_{CC} = 30\text{V}, I_C = 150\text{mA}, I_{B1} = I_{B2} = 15\text{mA}$	-	225	ns
Fall Time	t_f		-	60	ns
Active Region Time Constant	T_A	$I_C = 150\text{mA}, V_{CE} = 30\text{V}$	-	2.5	ns

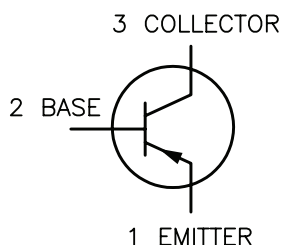
Notes

1. Pulse Test: Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2\%$.
2. f_T is defined as the frequency at which $|h_{fe}|$ extrapolates to unity.

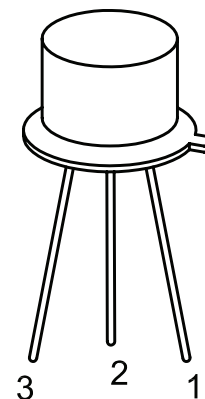
Bipolar Transistor



NPN



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



Dim	Min	Max
A	8.5	9.39
B	7.74	8.5
C	6.09	6.6
D	0.4	0.53
E	-	0.88
F	2.41	2.66
G	4.82	5.33
H	0.71	0.83
J	0.73	0.86
K	12.7	-
L	42°	48°

Dimensions : Millimetres

Part Number Table

Description	Part Number
Bipolar Transistor	2N2218A

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