

Transistor, NPN TO-3



Description:

Fast switching speeds and high current capacity ideally suit these parts for use in switching regulators, inverters, wide-band amplifiers and power oscillators in industrial and commercial applications

Features:

- High speed - $t_f = 0.5\mu\text{s}$ (Max.)
- High current - I_C (max.) = 30A
- Low saturation - $V_{CE}(\text{sat}) = 2.5\text{V}$ (max.) at $I_C = 20\text{A}$
- Pb-free package

Maximum Ratings

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	90	V DC
Collector-Base Voltage	V_{CBO}	150	
Collector-Emitter Voltage	V_{CEV}		
Emitter-Base Voltage	V_{EBO}	7	A DC
Collector Current-Continuous -Peak (Note 2)	I_C	20	
	I_{CM}	30	
Base Current-Continuous	P_B	5	
Total Power Dissipation at $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	140	W
		0.8	W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	T_J, T_{Stg}	-65 to +200	$^\circ\text{C}$

Thermal Characteristics

Characteristic	Symbol	Max.	Unit
Thermal Resistance Junction to Case	$R_{\theta JC}$	1.25	$^\circ\text{C}/\text{W}$

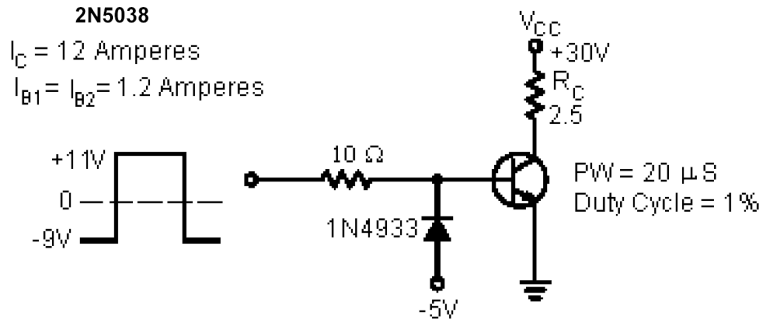
Stresses exceeding maximum ratings may damage the device. Maximum ratings are stress ratings only. Functional operation above the recommended operating conditions is not implied. Extended exposure to stresses above the recommended operating conditions may affect device reliability

1. Indicates JEDEC registered data
2. Pulse test: pulse width $\leq 10\text{ms}$, duty cycle $\leq 50\%$

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Switching Time Test Circuit



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

Characteristic	Symbol	Min.	Max.	Unit
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Off Characteristics

Collector-Emitter Sustaining Voltage (Note 4) ($I_C = 200mA$ DC, $I_B = 0$)	$V_{CEO(sus)}$	90	-	V DC
Collector Cut off Current ($V_{CE} = 140V$ DC, $V_{BE(off)} = 1.5V$) ($V_{CE} = 100V$ DC, $V_{BE(off)} = 1.5V$ DC, $T_C = 150^\circ C$)	I_{CEX}	-	50 10	mA DC
Emitter Cut off Current ($V_{EB} = 5V$ DC, $I_C = 0$) ($V_{EB} = 7V$ DC, $I_C = 0$)	I_{EBO}	-	5 50	

On Characteristics (Note 4)

DC Current Gain ($I_C = 12A$ DC, $V_{CE} = 5V$ DC)	h_{FE}	20	100	-
Collector-Emitter Saturation Voltage ($I_C = 20A$ DC, $I_B = 5A$ DC)	$V_{CE(sat)}$	-	2.5	V DC
Base-Emitter Saturation Voltage ($I_C = 20A$ DC, $I_B = 5A$ DC)	$V_{BE(sat)}$	-	3.3	

Dynamic Characteristics

Magnitude of Common-Emitter Small-Signal Short-Circuit Forward Current Transfer Ratio ($I_C = 2A$ DC, $V_{CE} = 10V$ DC, $f = 5MHz$)	$ h_{fe} $	12	-	-
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Switching Characteristics

Resistive Load					
Rise Time	$(V_{CC} = 30V$ DC) $(I_C = 12A$ DC, $I_{B1} = I_{B2} = 1.2A$ DC)	t_r	-	0.5	μs
Storage Time		t_s	-	1.5	

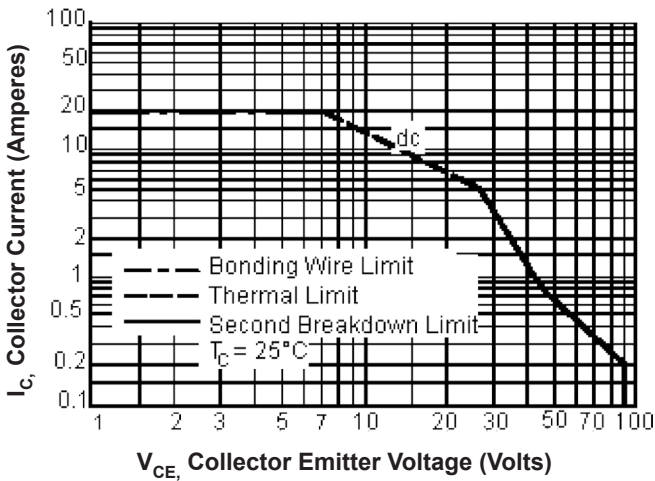
Note:

- Indicates JEDEC Registered Data.
- Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$

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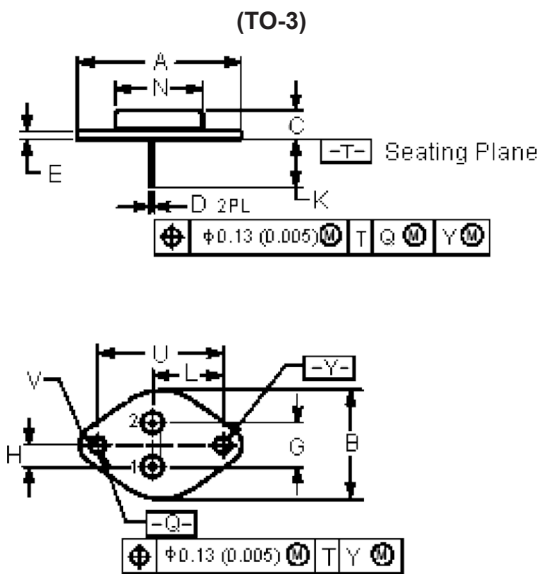
Active-Region Safe Operating Area



There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate I_C - V_{CE} limits of the transistor that must be observed for reliable operation i.e., the transistor must not be subjected to greater dissipation than curves indicate.

Second breakdown pulse limits are valid for duty cycles to 10%. At high case temperatures, thermal limitations may reduce the power that can be handled to values less than the limitations imposed by second breakdown.

Dimensions



Dimensions	Min.	Max.
A	1.55 (39.37)	Reference
B	-	1.05 (26.67)
C	0.25 (6.35)	0.335 (8.51)
D	0.038 (0.97)	0.043 (1.09)
E	0.055 (1.4)	0.07 (1.77)
G	0.43 (10.92)	BSC
H	0.215 (5.46)	BSC
K	0.44 (11.18)	0.48 (12.19)
L	0.665 (16.89)	BSC
N	-	0.83 (21.08)
Q	0.151 (3.84)	0.165 (4.19)
U	1.187 (30.15)	BSC
V	0.131 (3.33)	0.188 (4.77)

Dimensions : Inches (Millimetres)

Pin Configuration:

- Pin 1. Base
- 2. Emitter
- Collector (Case)

Part Number Table

Description	Part Number
Transistor, NPN, TO-3	2N5038

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