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 = 0.5µs (Max.)
- High current - I_C (max.) = 30A
- Low saturation - V_{CE} (sat) = 2.5V (max.) at I_C = 20A
- 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 I_{CM}	20 30	
Base Current-Continuous	P_B	5	
Total Power Dissipation at T_C = 25°C Derate above 25°C	P_D	140 0.8	W W/°C
Operating and Storage Junction Temperature Range	T_J, T_{Stg}	-65 to +200	°C

Thermal Characteristics

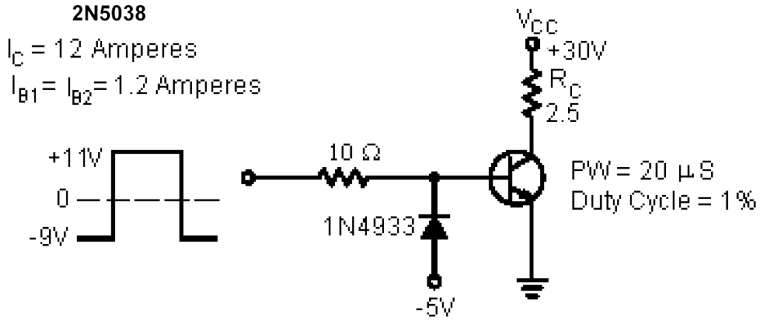
Characteristic	Symbol	Max.	Unit
Thermal Resistance Junction to Case	$R_{\theta JC}$	1.25	°C/W

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 ≤10ms, duty cycle ≤50%

Transistor, NPN
TO-3

Switching Time Test Circuit



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

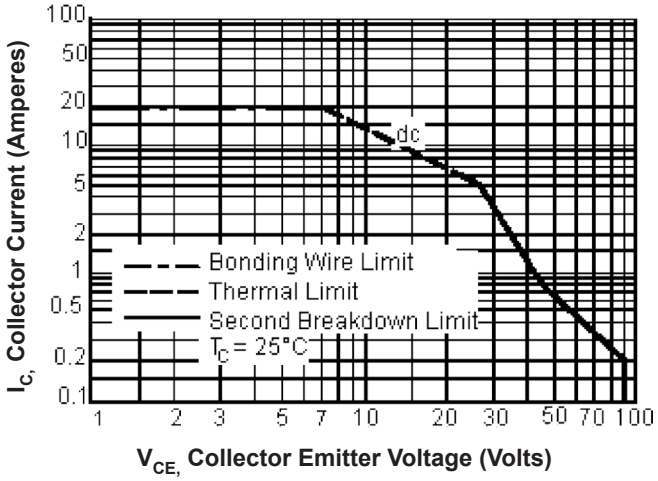
Characteristic	Symbol	Min.	Max.	Unit
Off Characteristics				
Collector-Emitter Sustaining Voltage (Note 4) (I_C = 200mA DC, I_B = 0)	$V_{CEO\ (sus)}$	90	-	V DC
Collector Cut off Current (V_{CE} = 140V DC, $V_{BE\ (off)}$ = 1.5V) (V_{CE} = 100V DC, $V_{BE\ (off)}$ = 1.5V DC, T_C = 150°C)	I_{CEX}	-	50 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)	$\lvert h_{fe} \rvert$	12	-	-
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:

3. Indicates JEDEC Registered Data.
4. Pulse Test: Pulse Width ≤300µs, Duty Cycle ≤2%

Transistor, NPN
TO-3

Active-Region Safe Operating Area

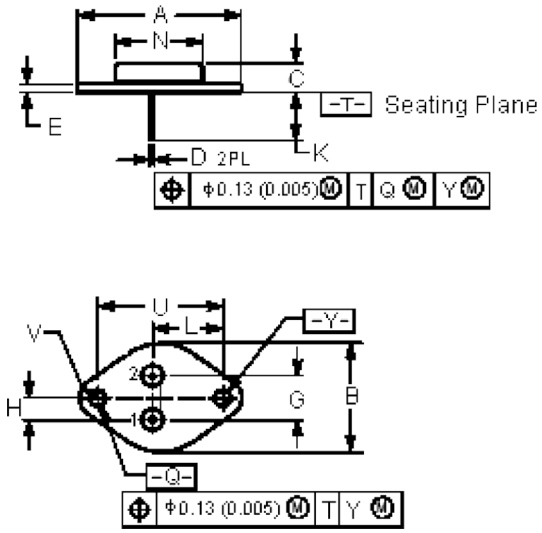


There are two limitation on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate I_C-V_{CE} limits of the transistor that must be observed for reliable operation i.e., the transistor must not be subjected to greater dissipation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

(TO-3)



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