

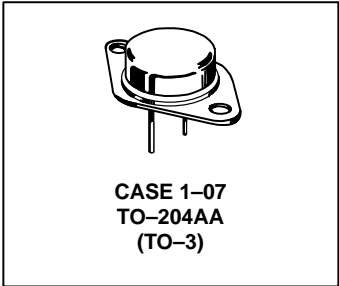
NPN Silicon Transistors

... 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.

- High Speed – $t_f = 0.5 \mu\text{s}$ (Max)
- High Current – $I_{C(\text{max})} = 30$ Amps
- Low Saturation – $V_{CE(\text{sat})} = 2.5$ V (Max) @ $I_C = 20$ Amps

2N5038

**20 AMPERE
NPN SILICON
POWER TRANSISTOR
90 VOLTS
140 WATTS**



***MAXIMUM RATINGS**

Rating	Symbol	Value	Unit
Collector–Base Voltage	V_{CB0}	150	Vdc
Collector–Emitter Voltage	V_{CEV}	150	Vdc
Emitter–Base Voltage	V_{EB0}	7	Vdc
Collector Current – Continuous Peak (1)	I_C I_{CM}	20 30	Adc
Base Current – Continuous	I_B	5	Adc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	140 0.8	Watts 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	$^\circ\text{C/W}$

*Indicates JEDEC Registered Data.

(1) Pulse Test: Pulse Width ≤ 10 ms, Duty Cycle $\leq 50\%$.

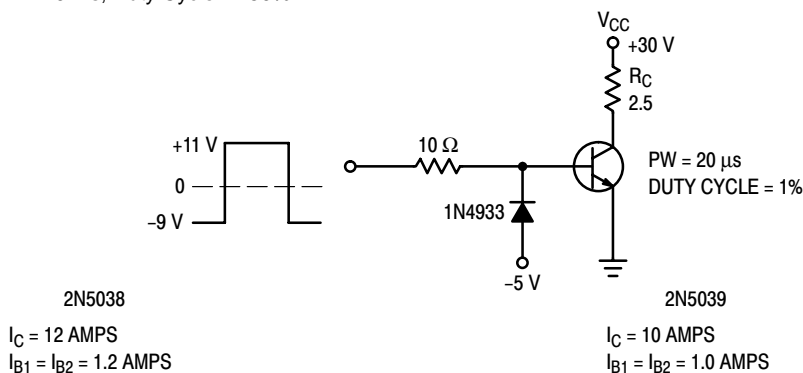


Figure 1. Switching Time Test Circuit

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*ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector–Emitter Sustaining Voltage (2) ($I_C = 200 \text{ mAdc}$, $I_B = 0$)	$V_{CEO(sus)}$	90	–	Vdc
Collector Cutoff Current ($V_{CE} = 140 \text{ Vdc}$, $V_{BE(off)} = 1.5 \text{ V}$) ($V_{CE} = 100 \text{ Vdc}$, $V_{BE(off)} = 1.5 \text{ Vdc}$, $T_C = 150^\circ\text{C}$)	I_{CEX}	– –	50 10	mAdc
Emitter Cutoff Current ($V_{EB} = 5 \text{ Vdc}$, $I_C = 0$) ($V_{EB} = 7 \text{ Vdc}$, $I_C = 0$)	I_{EBO}	– –	5 50	mAdc

ON CHARACTERISTICS (2)

DC Current Gain ($I_C = 12 \text{ Adc}$, $V_{CE} = 5 \text{ Vdc}$)	h_{FE}	20	100	–
Collector–Emitter Saturation Voltage ($I_C = 20 \text{ Adc}$, $I_B = 5 \text{ Adc}$)	$V_{CE(sat)}$	–	2.5	Vdc
Base–Emitter Saturation Voltage ($I_C = 20 \text{ Adc}$, $I_B = 5 \text{ Adc}$)	$V_{BE(sat)}$	–	3.3	Vdc

DYNAMIC CHARACTERISTICS

Magnitude of Common–Emitter Small–Signal Short–Circuit Forward Current Transfer Ratio ($I_C = 2 \text{ Adc}$, $V_{CE} = 10 \text{ Vdc}$, $f = 5 \text{ MHz}$)	$ h_{fe} $	12	–	–
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SWITCHING CHARACTERISTICS

RESISTIVE LOAD					
Rise Time	($V_{CC} = 30 \text{ Vdc}$) ($I_C = 12 \text{ Adc}$, $I_{B1} = I_{B2} = 1.2 \text{ Adc}$)	t_r	–	0.5	μs
Storage Time		t_s	–	1.5	μs

*Indicates JEDEC Registered Data.

(2) Pulse Test: Pulse Width $\leq 300 \mu\text{s}$, Duty Cycle $\leq 2\%$.

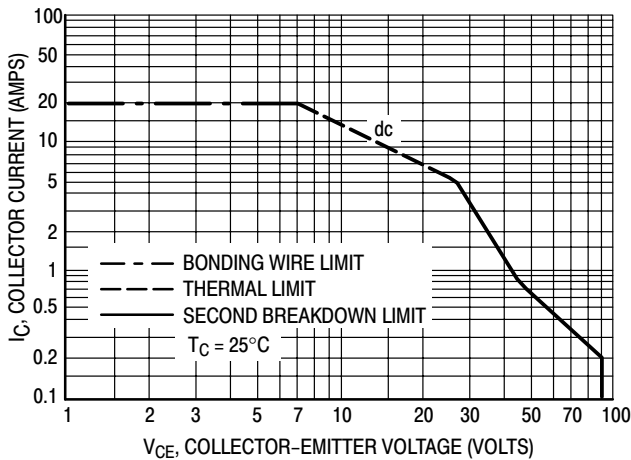


Figure 2. Forward Bias Safe Operating Area

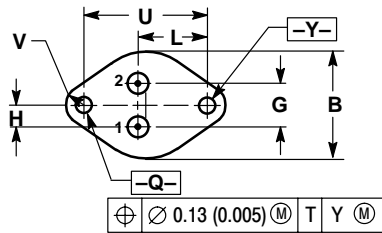
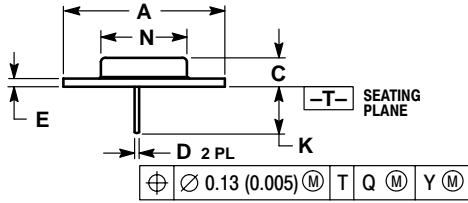
There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate $I_C - V_{CE}$ limits of the transistor that must be observed for reliable operation; i.e., the transistor must not be subjected to greater dissipation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

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PACKAGE DIMENSIONS

CASE 1-07 TO-204AA (TO-3) ISSUE Z



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.
 3. ALL RULES AND NOTES ASSOCIATED WITH REFERENCED TO-204AA OUTLINE SHALL APPLY.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	1.550 REF		39.37 REF	
B	---	1.050	---	26.67
C	0.250	0.335	6.35	8.51
D	0.038	0.043	0.97	1.09
E	0.055	0.070	1.40	1.77
G	0.430 BSC		10.92 BSC	
H	0.215 BSC		5.46 BSC	
K	0.440	0.480	11.18	12.19
L	0.665 BSC		16.89 BSC	
N	---	0.830	---	21.08
Q	0.151	0.165	3.84	4.19
U	1.187 BSC		30.15 BSC	
V	0.131	0.188	3.33	4.77

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