

## NPN SILICON POWER 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.

### FEATURES:

- \* High Speed  $-t_f = 0.5 \mu s$  (Max)
- \* Low  $V_{CE(SAT)} \leq 2.5 V$  @  $I_C = 20A$

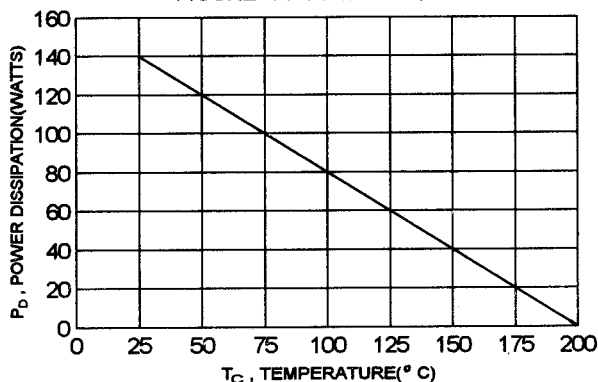
### MAXIMUM RATINGS

Characteristic	Symbol	2N5038	2N5039	Unit
Collector-Emitter Voltage	$V_{CEO}$	90	75	V
Collector-Base Voltage	$V_{CBO}$	150	120	V
Collector-Emitter Voltage	$V_{CEV}$	150	120	V
Emitter-Base Voltage	$V_{EBO}$	7		V
Collector Current-Continuous - Peak	$I_C$	20 30		A
Base Current	$I_B$	5		A
Total Power Dissipation @ $T_C = 25^\circ C$ Derate above $25^\circ C$	$P_D$	140 0.8		W W/ $^\circ C$
Operating and Storage Junction Temperature Range	$T_J, T_{STG}$	- 65 to +200		$^\circ C$

### THERMAL CHARACTERISTICS

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

FIGURE -1 POWER DERATING

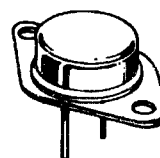


### NPN

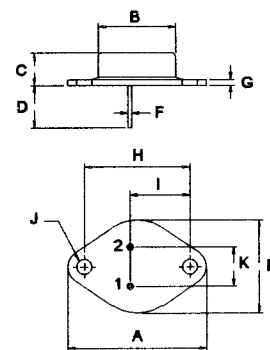
2N5038

2N5039

20 AMPERE  
NPN SILICON  
POWER TRANSISTORS  
75 - 90 VOLTS  
140 WATTS



TO-3



PIN 1.BASE  
2.EMITTER  
COLLECTOR(CASE)

DIM	MILLIMETERS	
	MIN	MAX
A	38.75	39.96
B	19.28	22.23
C	7.96	9.28
D	11.18	12.19
E	25.20	26.67
F	0.92	1.09
G	1.38	1.62
H	29.90	30.40
I	16.64	17.30
J	3.88	4.36
K	10.67	11.18

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

Characteristic	Symbol	Min	Max	Unit
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**OFF CHARACTERISTICS**

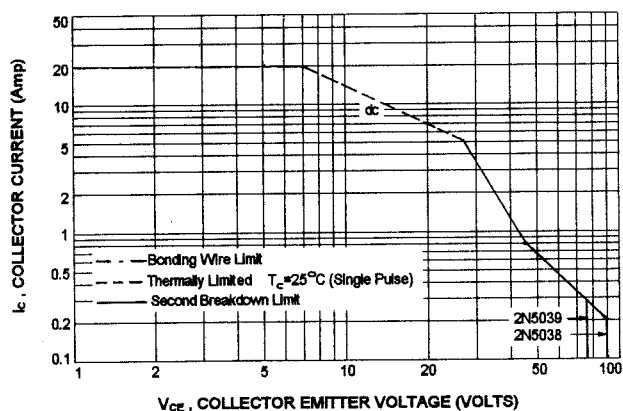
Collector - Emitter Sustaining Voltage (1) ( $I_C = 200\text{ mA}$ , $I_B = 0$ )	2N5038 2N5039	$V_{CEO(sus)}$	90 75	V
Collector Cutoff Current ( $V_{CE} = 140\text{ V}$ , $V_{BE(off)} = 1.5\text{ V}$ ) ( $V_{CE} = 110\text{ V}$ , $V_{BE(off)} = 1.5\text{ V}$ ) ( $V_{CE} = 100\text{ V}$ , $V_{BE(off)} = 1.5\text{ V}$ , $T_c = 150^\circ\text{C}$ ) ( $V_{CE} = 85\text{ V}$ , $V_{BE(off)} = 1.5\text{ V}$ , $T_c = 150^\circ\text{C}$ )	2N5038 2N5039 2N5038 2N5039	$I_{CEX}$	50 50 10 10	mA
Emitter Cutoff Current ( $V_{EB} = 5.0\text{ V}$ , $I_C = 0$ ) ( $V_{EB} = 7.0\text{ V}$ , $I_C = 0$ )	2N5038 2N5039 Both	$I_{EBO}$	5 15 50	mA

**ON CHARACTERISTICS (1)**

DC Current Gain ( $I_C = 12\text{ A}$ , $V_{CE} = 5.0\text{ V}$ ) ( $I_C = 10\text{ A}$ , $V_{CE} = 5.0\text{ V}$ )	2N5038 2N5039	$h_{FE}$	20 20	100 100
Collector - Emitter Saturation Voltage ( $I_C = 20\text{ A}$ , $I_B = 5.0\text{ A}$ )		$V_{CE(sat)}$		2.5
Base - Emitter Saturation Voltage ( $I_C = 20\text{ A}$ , $I_B = 5.0\text{ A}$ )		$V_{BE(sat)}$		3.3

**SWITCHING CHARACTERISTICS**

Rise Time	$V_{CC} = 30\text{ V}$ ( $I_C = 12\text{ A}$ , $I_{B1} = -I_{B2} = 1.2\text{ A}$ )	2N5038	$t_r$	0.5	us
Storage Time	( $I_C = 10\text{ A}$ , $I_{B1} = -I_{B2} = 1.0\text{ A}$ )	2N5039	$t_s$	1.5	us
Fall Time			$t_f$	0.5	us

(1) Pulse Test: Pulse width  $\leq 300\text{ us}$ , Duty Cycle  $\leq 2.0\%$ **ACTIVE REGION SAFE OPERATING AREA (SOA)**

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.

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