

## NPN POWER SILICON TRANSISTOR

Qualified per MIL-PRF-19500/534

### DEVICES

**2N5002    2N5004**

### LEVELS

**JAN  
 JANTX  
 JANTXV  
 JANS**

### ABSOLUTE MAXIMUM RATINGS ( $T_C = +25^\circ\text{C}$ unless otherwise noted)

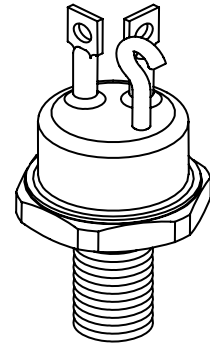
Parameters / Test Conditions	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CEO}$	80	V
Collector-Base Voltage	$V_{CBO}$	100	V
Emitter-Base Voltage	$V_{EBO}$	5.5	V
Collector Current	$I_C^{(3)}$	5.0 10	A
Total Power Dissipation @ $T_A = +25^\circ\text{C}^{(1)}$ @ $T_C = +25^\circ\text{C}^{(2)}$	$P_T$	2.0 58	W
Operating & Storage Junction Temperature Range	$T_J, T_{stg}$	-65 to +200	$^\circ\text{C}$
Thermal Resistance, Junction-to Case	$R_{\theta JC}$	3.0	$^\circ\text{C/W}$
Thermal Resistance, Junction-to Ambient	$R_{\theta JA}$	88	$^\circ\text{C/W}$

**Note:**

- 1) Derate linearly 11.4 mW/ $^\circ\text{C}$  for  $T_A > +25^\circ\text{C}$
- 2) Derate linearly 331 mW/ $^\circ\text{C}$  for  $T_C > +25^\circ\text{C}$
- 3) This value applies for  $P_W \leq 8.3$  ms, duty cycle  $\leq 1\%$

### ELECTRICAL CHARACTERISTICS ( $T_A = +25^\circ\text{C}$ , unless otherwise noted)

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
<b>OFF CHARACTERISTICS</b>				
Collector-Emitter Breakdown Voltage $I_C = 100\text{mA dc}$	$V_{(BR)CEO}$	80		Vdc
Collector-Emitter Cutoff Current $V_{CE} = 40\text{Vdc}, I_B = 0$	$I_{CEO}$		50	$\mu\text{A dc}$
Collector-Emitter Cutoff Current $V_{CE} = 60\text{Vdc}, V_{BE} = 0\text{Vdc}$ $V_{CE} = 100\text{Vdc}, V_{BE} = 0\text{Vdc}$	$I_{CES}$		1.0 1.0	$\mu\text{A dc}$ mA dc
Emitter-Base Cutoff Current $V_{BE} = 4.0\text{Vdc}, I_C = 0$ $V_{BE} = 5.5\text{Vdc}, I_C = 0$	$I_{EBO}$		1.0 1.0	mA dc



**TO-59**

## NPN POWER SILICON TRANSISTOR

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### DYNAMIC CHARACTERISTICS

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Forward-Current Transfer Ratio $I_C = 50\text{mA}$ , $V_{CE} = 5.0\text{Vdc}$ $I_C = 2.5\text{A}$ , $V_{CE} = 5.0\text{Vdc}$ $I_C = 5.0\text{A}$ , $V_{CE} = 5.0\text{Vdc}$	$h_{FE}$	20	---	
2N5002		30	90	
		20	---	
$I_C = 50\text{mA}$ , $V_{CE} = 5.0\text{Vdc}$ $I_C = 2.5\text{A}$ , $V_{CE} = 5.0\text{Vdc}$ $I_C = 5.0\text{A}$ , $V_{CE} = 5.0\text{Vdc}$	2N5004	50	---	
		70	200	
		40	---	
Base-Emitter Voltage Non-Saturated $V_{CE} = 5.0\text{Vdc}$ , $I_C = 2.5\text{A}$	$V_{BE}$		1.45	Vdc
Collector-Emitter Saturation Voltage $I_C = 2.5\text{A}$ , $I_B = 250\text{mA}$ $I_C = 5.0\text{A}$ , $I_B = 500\text{mA}$	$V_{CE(sat)}$		0.75 1.5	Vdc
Base-Emitter Saturation Voltage $I_C = 2.5\text{A}$ , $I_B = 250\text{mA}$ $I_C = 5.0\text{A}$ , $I_B = 500\text{mA}$	$V_{BE(sat)}$		1.45 2.2	Vdc

### DYNAMIC CHARACTERISTICS

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Magnitude of Common Emitter Small-Signal Short-Circuit Forward Current Transfer Ratio $I_C = 500\text{mA}$ , $V_{CE} = 5.0\text{Vdc}$ , $f = 10\text{MHz}$	$ h_{fe} $	6.0		
2N5002 2N5004		7.0		
Output Capacitance $V_{CB} = 10\text{Vdc}$	$C_{obo}$		250	pF

### SWITCHING CHARACTERISTICS

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Turn-On Time $I_C = 5\text{A}$ ; $I_{B1} = 500\text{mA}$	$t_{on}$		0.5	$\mu\text{s}$
Storage Time $I_{B2} = -500\text{mA}$	$t_s$		1.4	$\mu\text{s}$
Fall Time $V_{BE(OFF)} = 3.7\text{Vdc}$	$t_f$		0.5	$\mu\text{s}$
Turn-Off Time $R_L = 6\Omega$	$t_{off}$		1.5	$\mu\text{s}$

### SAFE OPERATING AREA

<p><b>DC Tests</b>  <math>T_C = +25^\circ\text{C}</math>, <math>V_{CE} = 0</math>, <math>t_p = 1\text{s}</math>, 1 Cycle</p> <p><b>Test 1</b>  <math>V_{CE} = 12\text{Vdc}</math>, <math>I_C = 5.0\text{A}</math></p> <p><b>Test 2</b>  <math>V_{CE} = 32\text{Vdc}</math>, <math>I_C = 1.7\text{A}</math></p> <p><b>Test 3</b>  <math>V_{CE} = 80\text{Vdc}</math>, <math>I_C = 100\text{mA}</math></p>
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