

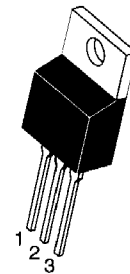
## MJE13009

# SWITCHMODE Series NPN Silicon Power Transistors

### Features

- $V_{CEO(sus)}$  400 V and 300 V
- Reverse Bias SOA with Inductive Loads @  $T_C = 100^\circ\text{C}$
- Inductive Switching Matrix 3 to 12 Amp, 25 and  $100^\circ\text{C}$   $t_c$  @ 8 A,  $100^\circ\text{C}$  is 120 ns (Typ)
- 700 V Blocking Capability
- SOA and Switching Applications Information
- These Devices are Pb-Free and are RoHS Compliant\*

**12 AMPERE  
NPN SILICON  
POWER TRANSISTOR  
400 VOLTS – 100 WATTS**



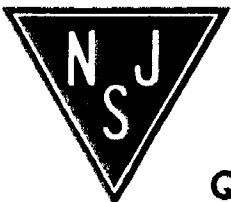
TO-220AB

### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CEO(sus)}$	400	Vdc
Collector-Emitter Voltage	$V_{CEV}$	700	Vdc
Emitter-Base Voltage	$V_{EBO}$	9	Vdc
Collector Current – Continuous – Peak (Note 1)	$I_C$ $I_{CM}$	12 24	Adc
Base Current – Continuous – Peak (Note 1)	$I_B$ $I_{BM}$	6 12	Adc
Emitter Current – Continuous – Peak (Note 1)	$I_E$ $I_{EM}$	18 36	Adc
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	2 0.016	W W/ $^\circ\text{C}$
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	100 0.8	W W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-65 to +150	$^\circ\text{C}$

### THERMAL CHARACTERISTICS

Characteristics	Symbol	Max	Unit
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	62.5	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	1.25	$^\circ\text{C}/\text{W}$
Maximum Lead Temperature for Soldering Purposes 1/8" from Case for 5 Seconds	$T_L$	275	$^\circ\text{C}$



NJ Semi-Conductors reserves the right to change test conditions, parameter limits and package dimensions without notice. Information furnished by NJ Semi-Conductors is believed to be both accurate and reliable at the time of going to press. However, NJ Semi-Conductors assumes no responsibility for any errors or omissions discovered in its use. NJ Semi-Conductors encourages customers to verify that datasheets are current before placing orders.

**Quality Semi-Conductors**

## MJE13009

### ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
----------------	--------	-----	-----	-----	------

#### OFF CHARACTERISTICS (Note 2)

Collector-Emitter Sustaining Voltage (I <sub>C</sub> = 10 mA, I <sub>B</sub> = 0)	V <sub>CEO(sus)</sub>	400	-	-	Vdc
Collector Cutoff Current (V <sub>CEV</sub> = Rated Value, V <sub>BE(off)</sub> = 1.5 Vdc) (V <sub>CEV</sub> = Rated Value, V <sub>BE(off)</sub> = 1.5 Vdc, T <sub>C</sub> = 100°C)	I <sub>CEV</sub>	-	-	1 5	mAdc
Emitter Cutoff Current (V <sub>EB</sub> = 9 Vdc, I <sub>C</sub> = 0)	I <sub>EBO</sub>	-	-	1	mAdc

#### SECOND BREAKDOWN

Second Breakdown Collector Current with base forward biased Clamped Inductive SOA with Base Reverse Biased	I <sub>S/b</sub> -	See Figure 1 See Figure 2			
---	-----------------------	------------------------------	--	--	--

#### ON CHARACTERISTICS (Note 2)

DC Current Gain (I <sub>C</sub> = 5 Adc, V <sub>CE</sub> = 5 Vdc) (I <sub>C</sub> = 8 Adc, V <sub>CE</sub> = 5 Vdc)	h <sub>FE</sub>	8 6	-	40 30	
Collector-Emitter Saturation Voltage (I <sub>C</sub> = 5 Adc, I <sub>B</sub> = 1 Adc) (I <sub>C</sub> = 8 Adc, I <sub>B</sub> = 1.6 Adc) (I <sub>C</sub> = 12 Adc, I <sub>B</sub> = 3 Adc) (I <sub>C</sub> = 8 Adc, I <sub>B</sub> = 1.6 Adc, T <sub>C</sub> = 100°C)	V <sub>CE(sat)</sub>	-	-	1 1.5 3 2	Vdc
Base-Emitter Saturation Voltage (I <sub>C</sub> = 5 Adc, I <sub>B</sub> = 1 Adc) (I <sub>C</sub> = 8 Adc, I <sub>B</sub> = 1.6 Adc) (I <sub>C</sub> = 8 Adc, I <sub>B</sub> = 1.6 Adc, T <sub>C</sub> = 100°C)	V <sub>BE(sat)</sub>	-	-	1.2 1.6 1.5	Vdc

#### DYNAMIC CHARACTERISTICS

Current-Gain – Bandwidth Product (I <sub>C</sub> = 500 mAdc, V <sub>CE</sub> = 10 Vdc, f = 1 MHz)	f <sub>T</sub>	4	-	-	MHz
Output Capacitance (V <sub>CB</sub> = 10 Vdc, I <sub>E</sub> = 0, f = 0.1 MHz)	C <sub>ob</sub>	-	180	-	pF

#### SWITCHING CHARACTERISTICS

Resistive Load (Table 1)						
Delay Time	(V <sub>CC</sub> = 125 Vdc, I <sub>C</sub> = 8 A, I <sub>B1</sub> = I <sub>B2</sub> = 1.6 A, t <sub>p</sub> = 25 μs, Duty Cycle ≤ 1%)	t <sub>d</sub>	-	0.06	0.1	μs
Rise Time		t <sub>r</sub>	-	0.45	1	μs
Storage Time		t <sub>s</sub>	-	1.3	3	μs
Fall Time		t <sub>f</sub>	-	0.2	0.7	μs
Inductive Load, Clamped (Table 1, Figure 13)						
Voltage Storage Time	(I <sub>C</sub> = 8 A, V <sub>clamp</sub> = 300 Vdc, I <sub>B1</sub> = 1.6 A, V <sub>BE(off)</sub> = 5 Vdc, T <sub>C</sub> = 100°C)	t <sub>sv</sub>	-	0.92	2.3	μs
Crossover Time		t <sub>c</sub>	-	0.12	0.7	μs

2. Pulse Test: Pulse Width = 300 μs, Duty Cycle = 2%.