MJE13009

Preferred Device

SWITCHMODE™ Series NPN Silicon Power Transistors

The MJE13009 is designed for high−voltage, high−speed power switching inductive circuits where fall time is critical. They are particularly suited for 115 and 220 V SWITCHMODE applications such as Switching Regulators, Inverters, Motor Controls, Solenoid/Relay drivers and Deflection circuits.

Features

- $V_{CEO(sus)}$ 400 V and 300 V
- Reverse Bias SOA with Inductive Loads @ T_C = 100°C
- Inductive Switching Matrix 3 to 12 Amp, 25 and 100°C t_c @ 8 A, 100°C is 120 ns (Typ)
- 700 V Blocking Capability
- SOA and Switching Applications Information
- Pb−Free Package is Available*

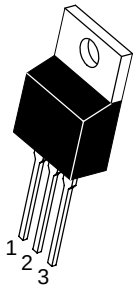
MAXIMUM RATINGS

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_C = 25°C Derate above 25°C	P_D	2 16	W W/°C
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	100 800	W W/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−65 to +150	°C

THERMAL CHARACTERISTICS

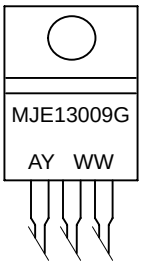
Characteristics	Symbol	Max	Unit
Thermal Resistance, Junction−to−Ambient	$R_{\theta JA}$	62.5	°C/W
Thermal Resistance, Junction−to−Case	$R_{\theta JC}$	1.25	°C/W
Maximum Lead Temperature for Soldering Purposes 1/8″ from Case for 5 Seconds	T_L	275	°C

12 AMPERE
NPN SILICON
POWER TRANSISTOR
400 VOLTS − 100 WATTS



TO−220AB
CASE 221A−09
STYLE 1

MARKING DIAGRAM



A = Assembly Location
Y = Year
WW = Work Week
G = Pb−Free Package

ORDERING INFORMATION

Device	Package	Shipping
MJE13009	TO−220	50 Units / Rail
MJE13009G	TO−220 (Pb−Free)	50 Units / Rail

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS (Note 2)					
Collector−Emitter Sustaining Voltage (I_C = 10 mA, I_B = 0)	$V_{CEO(sus)}$	400	–	–	Vdc
Collector Cutoff Current (V_{CEV} = Rated Value, $V_{BE(off)}$ = 1.5 Vdc) (V_{CEV} = Rated Value, $V_{BE(off)}$ = 1.5 Vdc, T_C = 100°C)	I_{CEV}	 – –	 – –	 1 5	mAdc
Emitter Cutoff Current (V_{EB} = 9 Vdc, I_C = 0)	I_{EBO}	–	–	1	mAdc
SECOND BREAKDOWN					
Second Breakdown Collector Current with base forward biased	$I_{S/b}$	See Figure 1			
Clamped Inductive SOA with Base Reverse Biased	–	See Figure 2			
ON CHARACTERISTICS (Note 2)					
DC Current Gain (I_C = 5 Adc, V_{CE} = 5 Vdc) (I_C = 8 Adc, V_{CE} = 5 Vdc)	h_{FE}	 8 6	 – –	 40 30	
Collector−Emitter Saturation Voltage (I_C = 5 Adc, I_B = 1 Adc) (I_C = 8 Adc, I_B = 1.6 Adc) (I_C = 12 Adc, I_B = 3 Adc) (I_C = 8 Adc, I_B = 1.6 Adc, T_C = 100°C)	$V_{CE(sat)}$	 – – – –	 – – – –	 1 1.5 3 2	Vdc
Base−Emitter Saturation Voltage (I_C = 5 Adc, I_B = 1 Adc) (I_C = 8 Adc, I_B = 1.6 Adc) (I_C = 8 Adc, I_B = 1.6 Adc, T_C = 100°C)	$V_{BE(sat)}$	 – – –	 – – –	 1.2 1.6 1.5	Vdc
DYNAMIC CHARACTERISTICS					
Current−Gain − Bandwidth Product (I_C = 500 mAdc, V_{CE} = 10 Vdc, f = 1 MHz)	f_T	4	–	–	MHz
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 0.1 MHz)	C_{ob}	–	180	–	pF

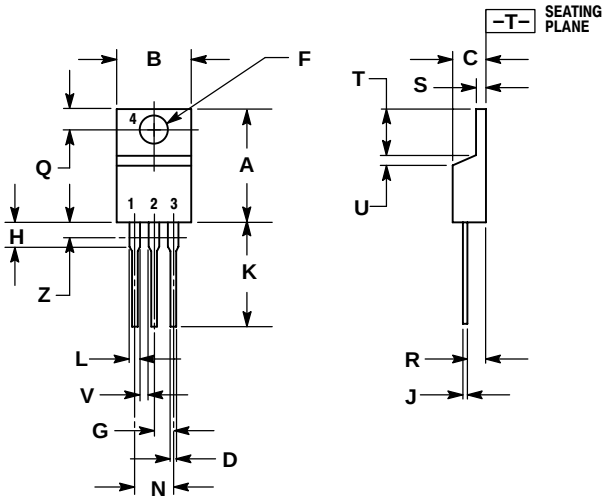
SWITCHING CHARACTERISTICS

Resistive Load (Table 1)						
Delay Time	(V_{CC} = 125 Vdc, I_C = 8 A, I_{B1} = I_{B2} = 1.6 A, t_p = 25 μs, Duty Cycle ≤ 1%)	t_d	–	0.06	0.1	μs
Rise Time		t_r	–	0.45	1	μs
Storage Time		t_s	–	1.3	3	μs
Fall Time		t_f	–	0.2	0.7	μs
Inductive Load, Clamped (Table 1, Figure 13)						
Voltage Storage Time	(I_C = 8 A, V_{clamp} = 300 Vdc, I_{B1} = 1.6 A, $V_{BE(off)}$ = 5 Vdc, T_C = 100°C)	t_{sv}	–	0.92	2.3	μs
Crossover Time		t_c	–	0.12	0.7	μs

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

PACKAGE DIMENSIONS

TO−220AB
CASE 221A−09
ISSUE AA



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.570	0.620	14.48	15.75
B	0.380	0.405	9.66	10.28
C	0.160	0.190	4.07	4.82
D	0.025	0.035	0.64	0.88
F	0.142	0.147	3.61	3.73
G	0.095	0.105	2.42	2.66
H	0.110	0.155	2.80	3.93
J	0.018	0.025	0.46	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.39
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	---	1.15	---
Z	---	0.080	---	2.04

STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR