MJE16002, MJE16004

File Number **1842**

5-A SwitchMax II Power Transistors

High-Voltage N-P-N Types for Off-Line Power Supplies and Other High-Voltage Switching Applications

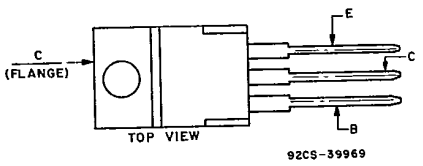
Features:

- *Fast switching speed*
- *High-voltage ratings:* V_{CEV} = 850 V
- *Low V_{CE}(sat) at I_c = 3A*

Applications:

- *Off-line power supplies*
- *High-voltage inverters*
- *Switching regulators*

TERMINAL DESIGNATIONS



JEDEC TO-220AB

The RCA MJE16002 and MJE16004 SwitchMax II series of silicon n-p-n power transistors feature high-voltage capability, fast switching speeds, and low saturation voltages, together with high safe-operating-area (SOA) ratings. They are specially designed for off-line power supplies, converter circuits, and pulse-width-modulated regulators. These high-voltage, high-speed transistors are tested for parameters that are essential to the design of high-power switching circuits. Switching times, including inductive turn-off time, saturation voltages are specified at 100°C to provide information necessary for worst-case design.

These transistors are supplied in the JEDEC TO-220AB (VERSAWATT) plastic package.

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	MJE16002 MJE16004	
V_{CEV}	850	V
V_{BE} = −1.5 V	450	V
V_{CEO}	6	V
V_{EBO}	3	A
I_C(sat)	5	A
I_C	10	A
I_{CM}	4	A
I_B	8	A
I_{BM}		
P_T	80	W
@ T_C = 25°C	32	W
@ T_C = 100°C	0.64	W/°C
T_C above 25°C, derate linearly	−65 to +150	°C
T_{stg} T_J		
TL		
At distance ≥ 1/8" in. (3.17 mm) from seating plane for 10 s max	235	°C
$R_{\theta JC}$	1.56	°C/W

MJE16002, MJE16004

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

Characteristic		Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS (1)						
Collector-Emitter Sustaining Voltage (I_C = 100 mA, I_B = 0)		$V_{CEO(sus)}$	450	—	—	Vdc
Collector Cutoff Current (V_{CEV} = 850 Vdc, $V_{BE(off)}$ = 1.5 Vdc)		I_{CEV}	—	—	0.25	mAdc
(V_{CEV} = 850 Vdc, $V_{BE(off)}$ = 1.5 Vdc, T_C = 100°C)			—	—	1.5	
Collector Cutoff Current (V_{CE} = 850 Vdc, R_{BE} = 50 Ω, T_C = 100°C)		I_{CER}	—	—	2.5	mAdc
Emitter Cutoff Current (V_{EB} = 6.0 Vdc, I_C = 0)		I_{EBO}	—	—	1.0	mAdc
SECOND BREAKDOWN						
Second Breakdown Collector Current with Base Forward Biased		$I_{S/b}$		See Figure 1		
Clamped Inductive SOA with Base Reverse Biased		RBSOA		See Figure 2		
ON CHARACTERISTICS (1)						
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$				Vdc
(I_C = 1.5 Adc, I_B = 0.2 Adc)	MJE16002		—	0.5	1.0	
(I_C = 1.5 Adc, I_B = 0.15 Adc)	MJE16004		—	0.5	1.0	
(I_C = 3.0 Adc, I_B = 0.4 Adc)	MJE16002		—	1.2	2.5	
(I_C = 3.0 Adc, I_B = 0.3 Adc)	MJE16004		—	1.2	2.5	
(I_C = 3.0 Adc, I_B = 0.4 Adc, T_C = 100°C)	MJE16002		—	—	2.5	
(I_C = 3.0 Adc, I_B = 0.3 Adc, T_C = 100°C)	MJE16004		—	—	2.5	
Base-Emitter Saturation Voltage		$V_{BE(sat)}$				Vdc
(I_C = 3.0 Adc, I_B = 0.4 Adc)	MJE16002		—	1.0	1.5	
(I_C = 3.0 Adc, I_B = 0.3 Adc)	MJE16004		—	1.0	1.5	
(I_C = 3.0 Adc, I_B = 0.4 Adc, T_C = 100°C)	MJE16002		—	—	1.5	
(I_C = 3.0 Adc, I_B = 0.3 Adc, T_C = 100°C)	MJE16004		—	—	1.5	
DC Current Gain (I_C = 5.0 Adc, V_{CE} = 5.0 Vdc)	MJE16002	h_{FE}	5.0	—	—	—
	MJE16004		7.0	—	—	
DYNAMIC CHARACTERISTICS						
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f_{test} = 1.0 kHz)		C_{ob}	—	—	200	pF
SWITCHING CHARACTERISTICS						
Resistive Load	**MJE16002**					
Delay Time	(I_C = 3.0 Adc, V_{CC} = 250 Vdc, I_{B1} = 0.4 Adc, PW = 30 μs, Duty Cycle ≤2.0%)	(I_{B2} = 0.8 Adc, R_{B2} = 8.0 Ω)	t_d	—	40	100	ns
Rise Time			t_r	—	80	300	
Storage Time			t_s	—	900	3000	
Fall Time			t_f	—	20	300	
Storage Time		($V_{BE(off)}$ = 5.0 Vdc)	t_s	—	330	—	
Fall Time			t_f	—	100	—	
Resistive Load	**MJE16004**						
Delay Time	(I_C = 3.0 Adc, V_{CC} = 250 Vdc, I_{B1} = 0.3 Adc, PW = 30 μs, Duty Cycle ≤2.0%)	(I_{B2} = 0.6 Adc, R_{B2} = 8.0 Ω)	t_d	—	40	100	ns
Rise Time			t_r	—	110	300	
Storage Time			t_s	—	750	2700	
Fall Time			t_f	—	150	350	
Storage Time		($V_{BE(off)}$ = 5.0 Vdc)	t_s	—	270	—	
Fall Time			t_f	—	90	—	

(1) Pulse Test PW - 300 μs, Duty Cycle ≤2%.

MJE16002, MJE16004

SWITCHING CHARACTERISTICS (continued)

Characteristics			Symbol	Min	Typ	Max	Unit
Inductive Load	**MJE16002**						
Storage Time	(I_C = 3.0 Adc, I_{B1} = 0.4 Adc, $V_{BE(off)}$ = 5.0 Vdc, $V_{CE(pk)}$ = 400 Vdc)	(T_J = 100°C)	t_{sv}	—	660	1600	ns
Fall Time			t_{fi}	—	50	200	
Crossover Time			t_c	—	80	250	
Storage Time		(T_J = 150°C)	t_{sv}	—	690	—	
Fall Time			t_{fi}	—	50	—	
Crossover Time			t_c	—	90	—	
Inductive Load	**MJE16004**						
Storage Time	(I_C = 3.0 Adc, I_{B1} = 0.3 Adc, $V_{BE(off)}$ = 5.0 Vdc, $V_{CE(pk)}$ = 400 Vdc)	(T_J = 100°C)	t_{sv}	—	530	1300	ns
Fall Time			t_{fi}	—	40	150	
Crossover Time			t_c	—	80	200	
Storage Time		(T_J = 150°C)	t_{sv}	—	600	—	
Fall Time			t_{fi}	—	40	—	
Crossover Time			t_c	—	80	—	

(1) Pulse Test: PW - 300 μs, Duty Cycle ≤2%.

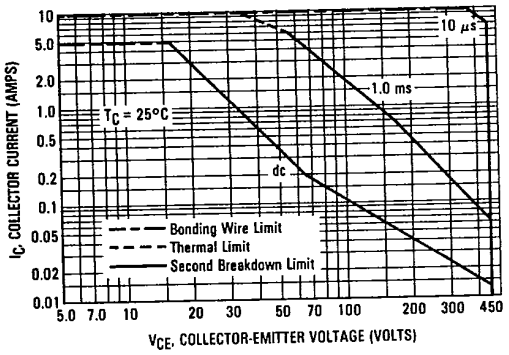


Fig. 1 — Maximum forward-bias safe-operating-areas for both types.

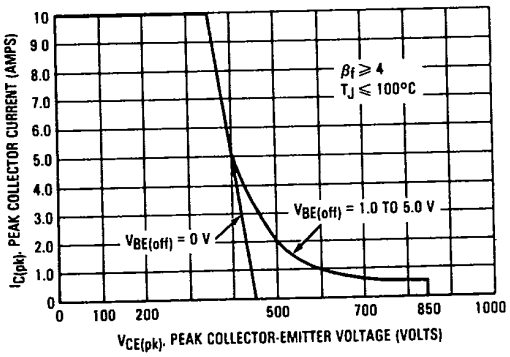


Fig. 2 — Maximum reverse-bias safe-operating-areas for both types.

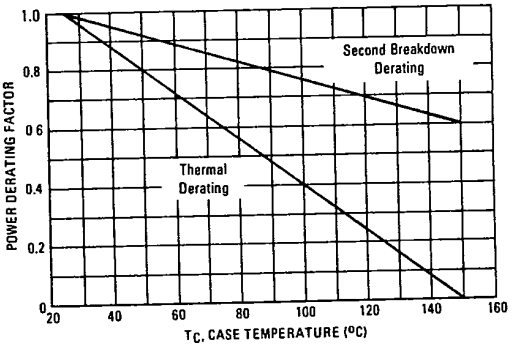


Fig. 3 — Dissipation and $I_{s/b}$ derating curves for both types.