5-A *SwitchMax* II Power Transistors

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

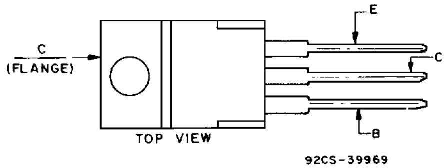
Features:

- *Fast switching speed*
- *High-voltage ratings:* *V_{CEV} = 650 V to 750 V*
- *Low $V_{CE}(sat)$ at I_c = 5A*

Applications:

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

TERMINAL DESIGNATIONS



JEDEC TO-220AB

The MJE13070 and MJE13071 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:*

<table>
<tr><th></th><th>MJE13070</th><th>MJE13071</th><th></th></tr>
<tr><td>V_{CEV}</td><td></td><td></td><td></td></tr>
<tr><td>V_{BE} = -1.5 V</td><td>650</td><td>750</td><td>V</td></tr>
<tr><td>V_{CEO}</td><td>400</td><td>450</td><td>V</td></tr>
<tr><td>V_{EBO}</td><td colspan="2">6</td><td>V</td></tr>
<tr><td>$I_C(sat)$</td><td colspan="2">5</td><td>A</td></tr>
<tr><td>I_C</td><td colspan="2">5</td><td>A</td></tr>
<tr><td>I_{CM}</td><td colspan="2">8</td><td>A</td></tr>
<tr><td>I_B</td><td colspan="2">2</td><td>A</td></tr>
<tr><td>I_{BM}</td><td colspan="2">4</td><td>A</td></tr>
<tr><td>P_T</td><td></td><td></td><td></td></tr>
<tr><td>@ T_C = 25°C</td><td colspan="2">80</td><td>W</td></tr>
<tr><td>@ T_C = 100°C</td><td colspan="2">32</td><td>W</td></tr>
<tr><td>T_C above 25°C, derate linearly</td><td colspan="2">0.64</td><td>W/°C</td></tr>
<tr><td>T_{stg}, T_J</td><td colspan="2">-65 to +150</td><td>°C</td></tr>
<tr><td>TL</td><td></td><td></td><td></td></tr>
<tr><td>At distance ≥ 1/8" in. (3.17 mm) from seating plane for 10 s max</td><td colspan="2">235</td><td>°C</td></tr>
<tr><td>$R_{\theta JC}$</td><td colspan="2">1.56</td><td>°C/W</td></tr>
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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) MJE13070	$V_{CEO(sus)}$	400	—	—	Vdc
MJE13071		450	—	—	
Collector Cutoff Current (V_{CEV} = Rated Value, $V_{BE(off)}$ = 1.5 Vdc)	I_{CEV}	—	—	0.5	mAdc
(V_{CEV} = Rated Value, $V_{BE(off)}$ = 1.5 Vdc, T_C = 100°C)		—	—	2.5	
Collector Cutoff Current (V_{CE} = Rated V_{CEV}, R_{BE} = 50 Ω, T_C = 100°C)	I_{CER}	—	—	3.0	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)					
DC Current Gain (I_C = 3.0 Adc, V_{CE} = 5.0 Vdc)	h_{FE}	8.0	—	—	—
Collector-Emitter Saturation Voltage (I_C = 3.0 Adc, I_B = 0.6 Adc)	$V_{CE(sat)}$	—	0.6	1.0	Vdc
(I_C = 5.0 Adc, I_B = 1.0 Adc)		—	2.0	3.0	
(I_C = 3.0 Adc, I_B = 0.6 Adc, T_C = 100°C)		—	—	2.0	
Base-Emitter Saturation Voltage (I_C = 3.0 Adc, I_B = 0.6 Adc)	$V_{BE(sat)}$	—	1.0	1.5	Vdc
(I_C = 3.0 Adc, I_B = 0.6 Adc, T_C = 100°C)		—	—	1.5	
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f_{test} = 1.0 kHz)	C_{ob}	—	—	250	pF
SWITCHING CHARACTERISTICS					
Resistive Load (V_{CC} = 250 Vdc, I_C = 3.0 Adc, I_{B1} = 0.4 Adc, t_p = 30 μs, Duty Cycle ≤ 2%, $V_{BE(off)}$ = 5.0 Vdc)					
Delay Time	t_d	—	0.03	0.05	μs
Rise Time	t_r	—	0.08	0.40	
Storage Time	t_s	—	0.33	1.50	
Fall Time	t_f	—	0.10	0.50	
Inductive Load, Clamped ($I_{C(pk)}$ = 3.0 A, I_{B1} = 0.4 Adc, $V_{BE(off)}$ = 5.0 Vdc, $V_{CE(pk)}$ = 250 V)					
Storage Time (T_J = 100°C)	t_{sv}	—	0.70	2.0	μs
Crossover Time (T_J = 100°C)	t_c	—	0.08	0.50	
Fall Time (T_J = 100°C)	t_{fi}	—	0.05	0.30	
Storage Time (T_J = 25°C)	t_{sv}	—	0.40	—	
Crossover Time (T_J = 25°C)	t_c	—	0.05	—	
Fall Time (T_J = 25°C)	t_{fi}	—	0.03	—	

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

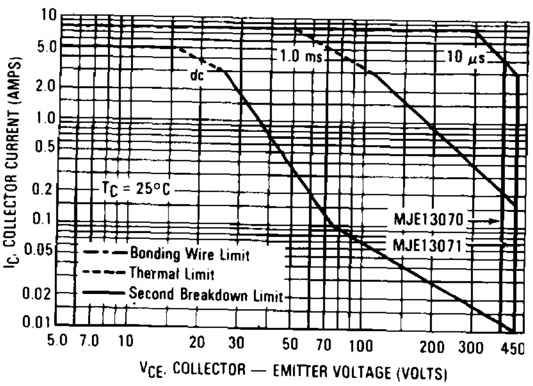

Fig. 1 — Maximum forward-bias safe-operating-areas for both types.

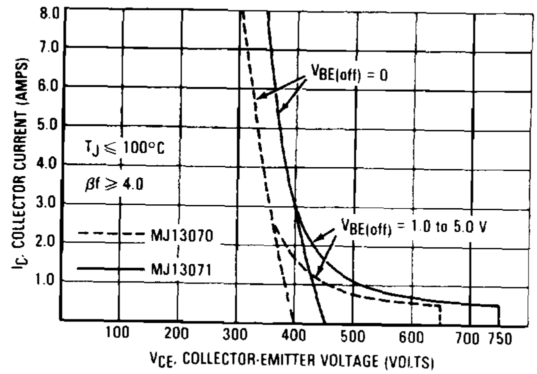

Fig. 2 — Maximum reverse-bias safe-operating-areas for both types.

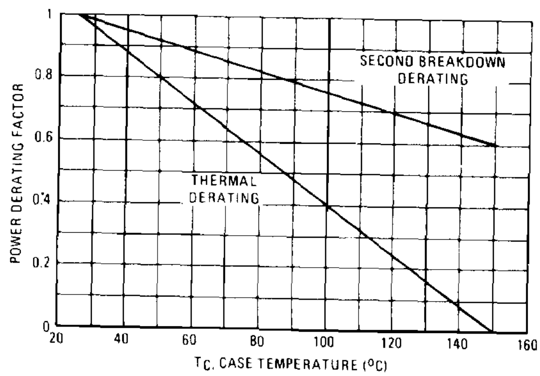

Fig. 3 — Dissipation and $I_{s/b}$ derating curves for both types.

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POWER TRANSISTORS