

T-35-19

### 5-A *SwitchMax* II Power Transistors

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

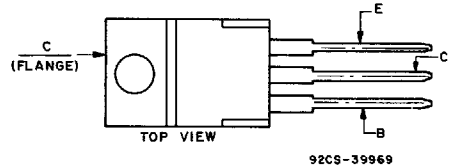
**Features:**

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

**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:**

$V_{CEV}$	.....		
$V_{BE} = -1.5\text{ V}$	.....		
$V_{CEO}$	.....		
$V_{EBO}$	.....		
$I_C(\text{sat})$	.....		
$I_C$	.....		
$I_{CM}$	.....		
$I_B$	.....		
$I_{BM}$	.....		
$P_T$	.....		
@ $T_C = 25^\circ\text{C}$	.....		
@ $T_C = 100^\circ\text{C}$	.....		
$T_C$ above $25^\circ\text{C}$ , derate linearly	.....		
$T_{stg}$	.....		
$T_J$	.....		
TL	.....		
At distance $\geq 1/8"$ in. (3.17 mm) from seating plane for 10 s max	.....		
$R_{\theta JC}$	.....		

	<b>MJE13070</b>	<b>MJE13071</b>	
	650	750	V
	400	450	V
	_____	_____	V
	_____	_____	A
	_____	_____	A
	_____	_____	A
	_____	_____	A
	_____	_____	A
	_____	_____	W
	_____	_____	W
	_____	_____	W/°C
	_____	_____	°C
	_____	_____	°C
	_____	_____	°C/W

**POWER TRANSISTORS**

# MJE13070, MJE13071

HARRIS SEMICONDUCTOR

56E D ■ 4302271 0040892 232 ■ HAS

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

Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS (1)</b>					
Collector-Emitter Sustaining Voltage (I <sub>C</sub> = 100 mA, I <sub>B</sub> = 0)	MJE13070 MJE13071 V <sub>CEO(sus)</sub>	400 450	— —	— —	V <sub>dc</sub>
Collector Cutoff Current (V <sub>CEV</sub> = Rated Value, V <sub>BE(off)</sub> = 1.5 V <sub>dc</sub> ) (V <sub>CEV</sub> = Rated Value, V <sub>BE(off)</sub> = 1.5 V <sub>dc</sub> , T <sub>C</sub> = 100°C)	I <sub>CEV</sub>	— —	— —	0.5 2.5	mAdc
Collector Cutoff Current (V <sub>CE</sub> = Rated V <sub>CEV</sub> , R <sub>BE</sub> = 50 Ω, T <sub>C</sub> = 100°C)	I <sub>CER</sub>	—	—	3.0	mAdc
Emitter Cutoff Current (V <sub>EB</sub> = 6.0 V <sub>dc</sub> , I <sub>C</sub> = 0)	I <sub>EBO</sub>	—	—	1.0	mAdc

## SECOND BREAKDOWN

Second Breakdown Collector Current with Base Forward Biased	I <sub>S/b</sub>	See Figure 1			
Clamped Inductive SOA with Base Reverse Biased	RBSOA	See Figure 2			

## ON CHARACTERISTICS (1)

DC Current Gain (I <sub>C</sub> = 3.0 Adc, V <sub>CE</sub> = 5.0 V <sub>dc</sub> )	h <sub>FE</sub>	8.0	—	—	—
Collector-Emitter Saturation Voltage (I <sub>C</sub> = 3.0 Adc, I <sub>B</sub> = 0.6 Adc) (I <sub>C</sub> = 5.0 Adc, I <sub>B</sub> = 1.0 Adc) (I <sub>C</sub> = 3.0 Adc, I <sub>B</sub> = 0.6 Adc, T <sub>C</sub> = 100°C)	V <sub>CE(sat)</sub>	— — —	0.6 2.0 —	1.0 3.0 2.0	V <sub>dc</sub>
Base-Emitter Saturation Voltage (I <sub>C</sub> = 3.0 Adc, I <sub>B</sub> = 0.6 Adc) (I <sub>C</sub> = 3.0 Adc, I <sub>B</sub> = 0.6 Adc, T <sub>C</sub> = 100°C)	V <sub>BE(sat)</sub>	— —	1.0 —	1.5 1.5	V <sub>dc</sub>

## DYNAMIC CHARACTERISTICS

Output Capacitance (V <sub>CB</sub> = 10 V <sub>dc</sub> , I <sub>E</sub> = 0, f <sub>test</sub> = 1.0 kHz)	C <sub>ob</sub>	—	—	250	pF
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## SWITCHING CHARACTERISTICS

Resistive Load						
Delay Time	(V <sub>CC</sub> = 250 V <sub>dc</sub> , I <sub>C</sub> = 3.0 Adc, I <sub>B1</sub> = 0.4 Adc, t <sub>p</sub> = 30 μs, Duty Cycle ≤ 2%, V <sub>BE(off)</sub> = 5.0 V <sub>dc</sub> )	t <sub>d</sub>	—	0.03	0.05	μs
Rise Time		t <sub>r</sub>	—	0.08	0.40	
Storage Time		t <sub>s</sub>	—	0.33	1.50	
Fall Time		t <sub>f</sub>	—	0.10	0.50	

## Inductive Load, Clamped

Storage Time	(I <sub>C(pk)</sub> = 3.0 A, I <sub>B1</sub> = 0.4 Adc, V <sub>BE(off)</sub> = 5.0 V <sub>dc</sub> )	(T <sub>J</sub> = 100°C)	t <sub>sv</sub>	—	0.70	2.0	μs
Crossover Time			t <sub>c</sub>	—	0.08	0.50	
Fall Time	(T <sub>J</sub> = 25°C)	t <sub>fi</sub>	—	0.05	0.30		
Storage Time		t <sub>sv</sub>	—	0.40	—		
Crossover Time		t <sub>c</sub>	—	0.05	—		
Fall Time		t <sub>fi</sub>	—	0.03	—		

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

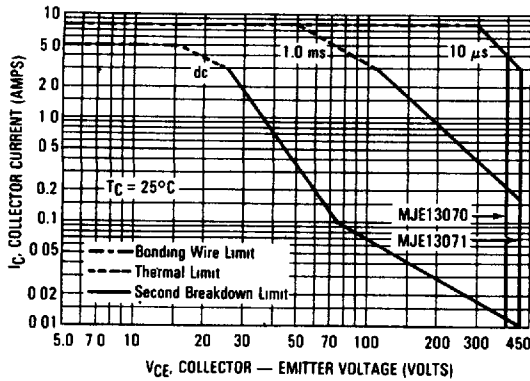


Fig. 1 — Maximum forward-bias safe-operating-areas for both types.

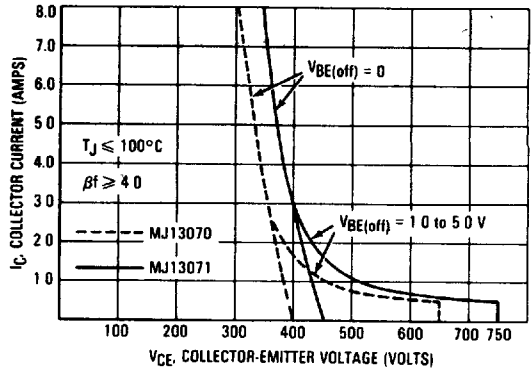


Fig. 2 — Maximum reverse-bias safe-operating-areas for both types.

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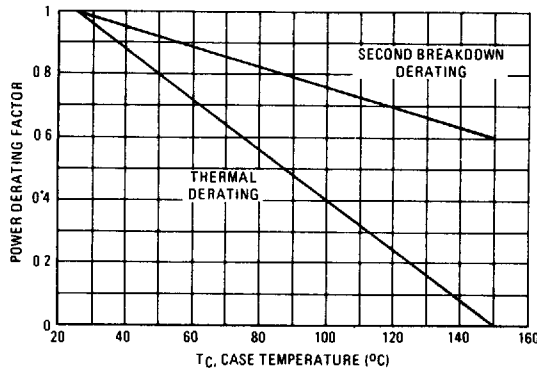


Fig. 3 — Dissipation and  $I_{sdb}$  derating curves for both types.

POWER TRANSISTORS