

# 5-A SwitchMax Power Transistors

T-35-19

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

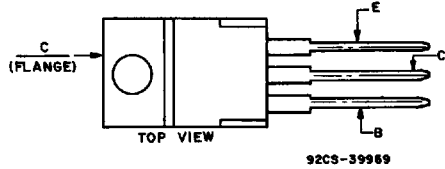
**Features:**

- High-temperature parameters guaranteed
- Fast switching speed
- High voltage ratings:  
V<sub>CEX</sub> = 350 V to 450 V
- Low V<sub>CE</sub>(sat) at I<sub>C</sub> = 5 A
- VERSAWATT package

**Applications:**

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

**TERMINAL DESIGNATIONS**



**JEDEC TO-220AB**

The BUW41, BUW41A, and BUW41B SwitchMax 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 and are also well suited for use in a wide range of inverter or converter circuits, and pulse-width-modulated regulators. These high-voltage, high-speed transistors are 100-per-cent tested for parameters that

are essential to the design of high-power switching circuits. Switching times, including inductive turn-off time, and saturation voltages are guaranteed at 125°C to provide information necessary for worst-case design.

The BUW41, BUW41A and BUW41B series transistors are supplied in JEDEC TO-220AB (VERSAWATT) plastic packages.

POWER TRANSISTORS

**MAXIMUM RATINGS, Absolute-Maximum Values:**

	BUW41	BUW41A	BUW41B	
V <sub>CE</sub> , R <sub>BE</sub> = 100Ω	350	400	450	V
V <sub>CEV</sub>				
V <sub>BE</sub> = -1.5 V	450	550	650	V
V <sub>CEX</sub> (clamped)				
V <sub>BE</sub> = -1.5 V	350	400	450	V
V <sub>CEO</sub>	300	350	400	V
V <sub>EBO</sub>		8		V
I <sub>C</sub> (sat)		5		A
I <sub>C</sub>		8		A
I <sub>CM</sub>		10		A
I <sub>B</sub>		4		A
P <sub>T</sub>				
T <sub>C</sub> up to 25°C		100		W
T <sub>C</sub> above 25°C, derate linearly		0.8		W/°C
T <sub>stg</sub> , T <sub>J</sub>		-65 to 150		°C
T <sub>L</sub>				
At distance ≥ 1/8 in. (3.17 mm) from seating plane for 10 s max.		235		°C

ELECTRICAL CHARACTERISTICS

T-35-19

Characteristic	Test Conditions				Limits					Units
	Voltage V dc		Current A dc		BUW41		BUW41A		BUW41B	
	V <sub>CE</sub>	V <sub>BE</sub>	I <sub>C</sub>	I <sub>B</sub>	Min.	Max.	Min.	Max.	Min.	

T<sub>C</sub> = 25° C

I <sub>CEV</sub>	450	-1.5			—	0.1	—	—	—	—	mA
	550	-1.5			—	—	—	0.1	—	—	
	650	-1.5			—	—	—	—	—	0.1	
I <sub>IEBO</sub>		-8	0		—	2	—	2	—	2	
V <sub>CEO(sus)<sup>b</sup></sub>			0.2 <sup>a</sup>	0	300	—	350	—	400	—	V
h <sub>FE</sub>	3		5 <sup>a</sup>		10	40	10	40	10	40	
V <sub>BE(sat)</sub>			5 <sup>a</sup>	1	—	1.6	—	1.6	—	1.6	V
V <sub>CE(sat)</sub>			5 <sup>a</sup>	1	—	1	—	1	—	1	
			8 <sup>a</sup>	4	—	2	—	2	—	2	
V <sub>CEX<sup>b</sup></sub> (Clamped E <sub>S/b</sub> ) L = 170 μH R <sub>BB</sub> = 5 Ω		-5	5	1 <sup>e</sup>	350	—	400	—	450	—	V
		-5	8	3 <sup>e</sup>	200	—	250	—	300	—	
I <sub>S/b</sub>	25		4		0.5	—	0.5	—	0.5	—	s
h <sub>fe</sub>   f=5 MHz	10		0.2		3	12	3	12	3	12	
f <sub>T</sub>	10		0.2		15	60	15	60	15	60	MHz
C <sub>obo</sub> f=0.1 MHz	10 <sup>c</sup>				50	300	50	300	50	300	pF
t <sub>d<sup>d</sup></sub>			5	1	—	0.1	—	0.1	—	0.1	μs
t <sub>r<sup>d</sup></sub>			5	1	—	0.5	—	0.5	—	0.5	
t <sub>s<sup>d</sup></sub>			5	1 <sup>e</sup>	—	2.5	—	2.5	—	2.5	
t <sub>f<sup>d</sup></sub>			5	1 <sup>e</sup>	—	0.4	—	0.4	—	0.4	
t <sub>c</sub> V <sub>CC</sub> = 125 V, L = 170 μH, R <sub>C</sub> = 25 Ω Collector clamped to V <sub>CEX</sub>			5	1 <sup>e</sup>	—	0.4	—	0.4	—	0.4	

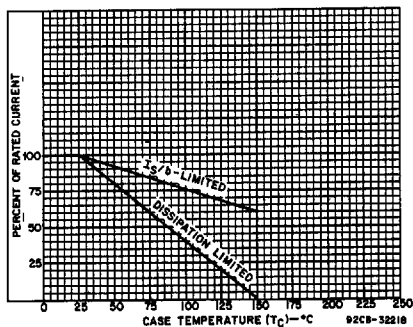


Fig. 1 — Dissipation and I<sub>S/b</sub> derating curves for all types.

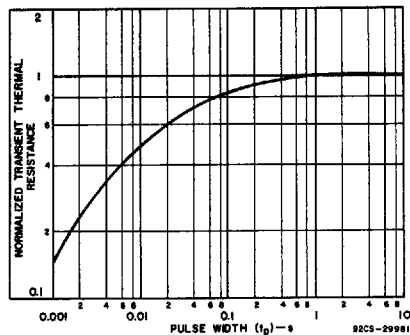


Fig. 2 — Typical thermal-response characteristics for all types.

HARRIS SEMICOND SECTOR

ELECTRICAL CHARACTERISTICS Continued

T-35-19

Characteristic	Test Conditions				Limits						Units
	Voltage V dc		Current A dc		BUW41		BUW41A		BUW41B		
	V <sub>CE</sub>	V <sub>BE</sub>	I <sub>C</sub>	I <sub>B</sub>	Min.	Max.	Min.	Max.	Min.	Max.	

T<sub>C</sub> = 125° C

I <sub>CEV</sub>	450	-1.5			-	1	-	-	-	-	mA
	550	-1.5			-	-	-	1	-	-	
	650	-1.5			-	-	-	-	-	1	
V <sub>CE(sat)</sub>			5 <sup>a</sup>	1	-	2	-	2	-	2	V
t <sub>r</sub> <sup>d</sup>			5	1 <sup>e</sup>	-	0.8	-	0.8	-	0.8	μs
t <sub>s</sub> <sup>d</sup>			5	1 <sup>e</sup>	-	4	-	4	-	4	
t <sub>f</sub> <sup>d</sup>			5	1 <sup>e</sup>	-	0.8	-	0.8	-	0.8	
t <sub>c</sub> V <sub>CC</sub> = 125 V, L = 170 μH, R <sub>C</sub> = 25 Ω Collector clamped to V <sub>CEX</sub>			5	1 <sup>e</sup>	-	0.8	-	0.8	-	0.8	

R <sub>θJC</sub>					-	1.25	-	1.25	-	1.25	°C/W
R <sub>θJA</sub>					-	70	-	70	-	70	°C/W

<sup>a</sup>Pulsed: pulse duration = 300 μs, duty factor ≤ 2%.

<sup>b</sup>CAUTION: The sustaining voltage V<sub>CEO(sus)</sub> and V<sub>CEX</sub> MUST NOT be measured on a curve tracer.

<sup>c</sup>V<sub>CB</sub> value.

<sup>d</sup>V<sub>CC</sub> = 125 V, t<sub>p</sub> = 20 μs.

<sup>e</sup>I<sub>B1</sub> = -I<sub>B2</sub>.

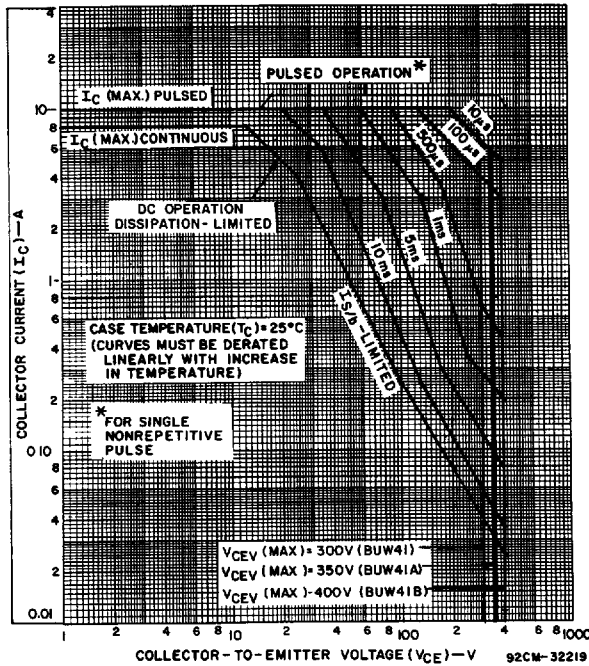


Fig. 3 — Maximum operating areas for all types [T<sub>C</sub> = 25° C].

HARRIS SEMICOND SECTOR

POWER TRANSISTORS

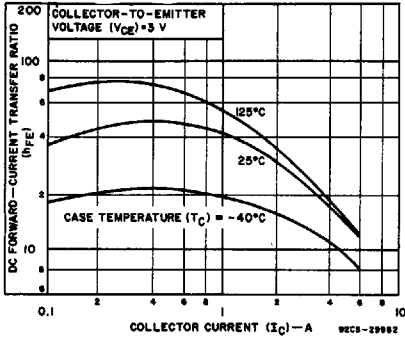


Fig. 4 — Typical dc beta characteristics for all types.

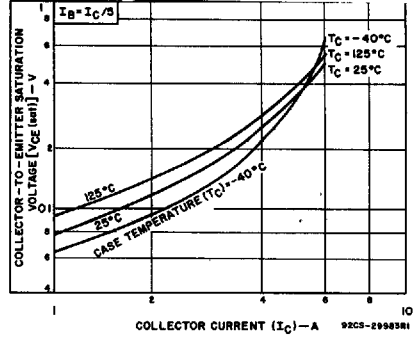


Fig. 5 — Typical collector-to-emitter saturation voltage as a function of collector current for all types.

T-35-19

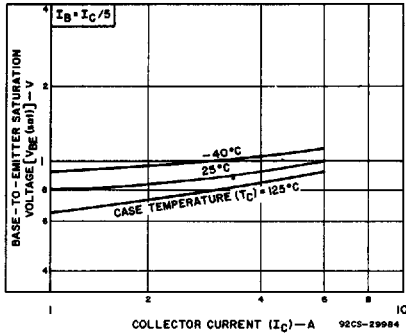


Fig. 6 — Typical base-to-emitter saturation voltage as a function of collector current for all types.

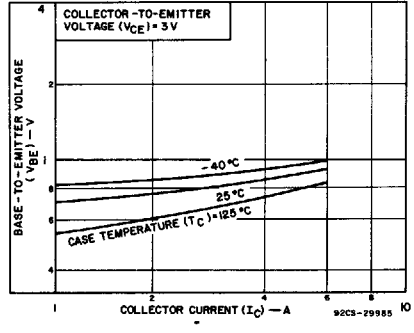


Fig. 7 — Typical base-to-emitter voltage as a function of collector current for all types.

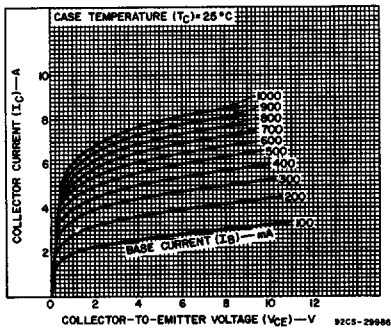


Fig. 8 — Typical output characteristics for all types.

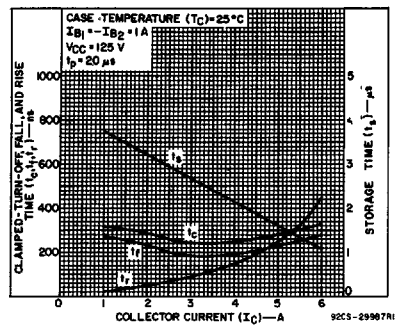


Fig. 9 — Typical saturated-switching-time characteristics for all types.

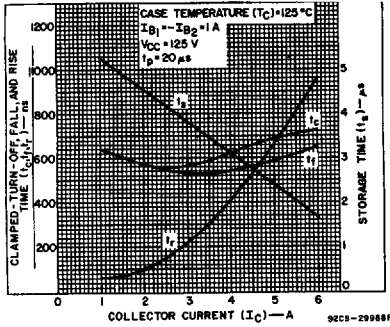


Fig. 10 — Typical saturated-switching-time characteristics as a function of collector current for all types.

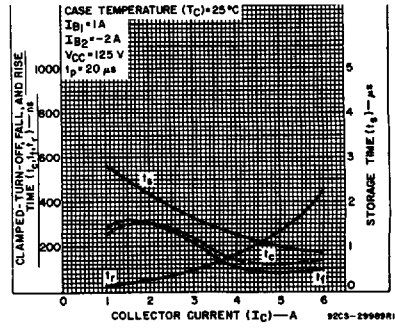


Fig. 11 — Typical saturated-switching-time characteristics for all types.

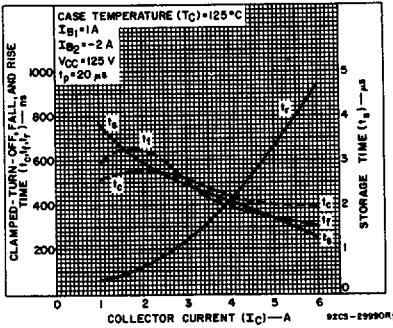


Fig. 12 — Typical saturated-switching-time characteristics for all types.

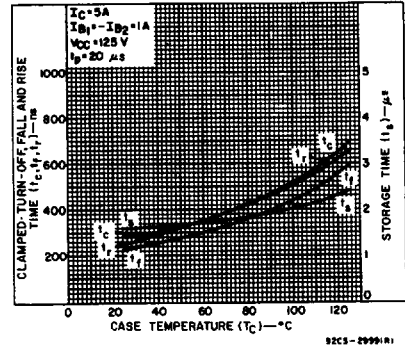


Fig. 13 — Typical saturated-switching-time characteristics as a function of case temperature for all types.

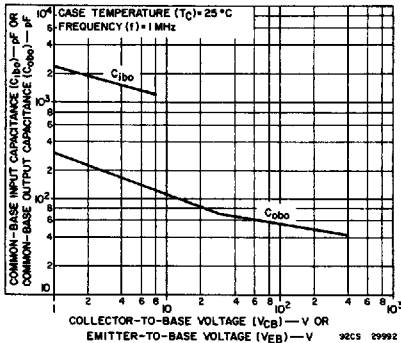


Fig. 14 — Typical common-base input or output capacitance characteristics as a function of collector-to-base voltage or emitter-to-base voltage for all types.

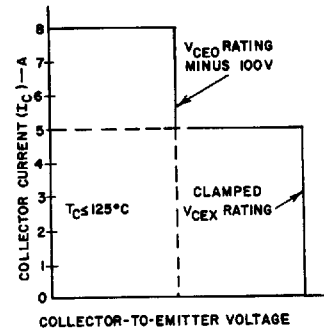


Fig. 15 — Maximum operating conditions for switching between saturation and cutoff.

POWER TRANSISTORS

92CS-30485

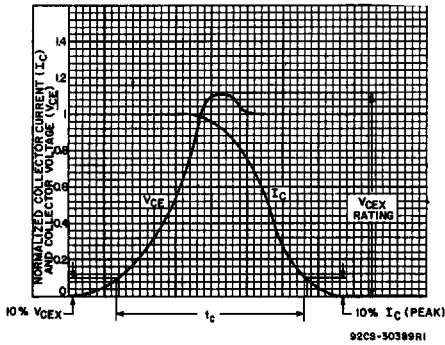


Fig. 16 — Oscilloscope display for measurement of clamped induction switching time ( $t_c$ ).

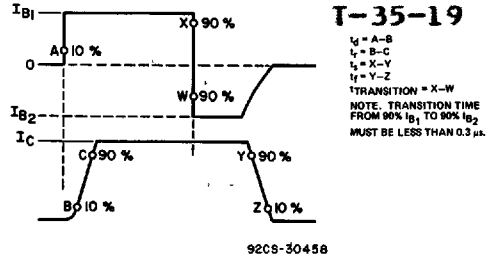


Fig. 17 — Phase relationship between input and output currents showing reference points for specification of switching times.

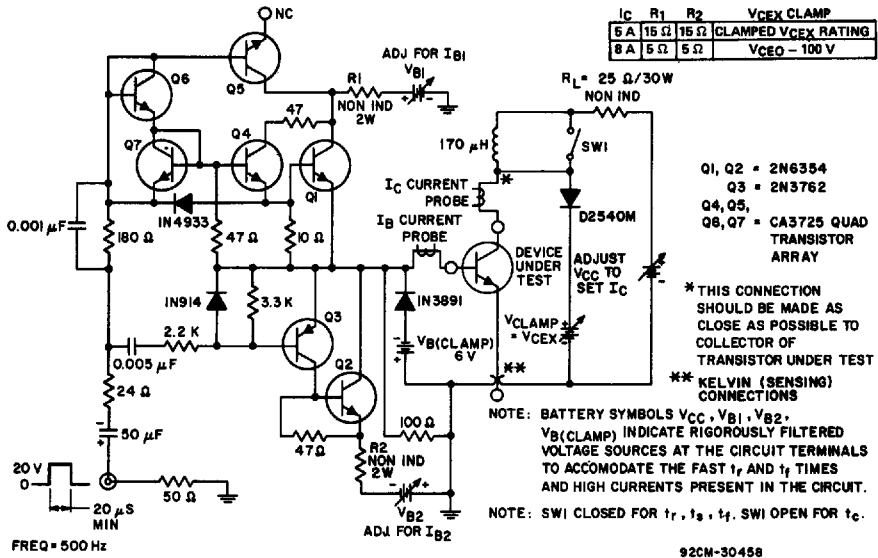


Fig. 18 — Circuit for measuring switching times.