5-A *SwitchMax* Power Transistors

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

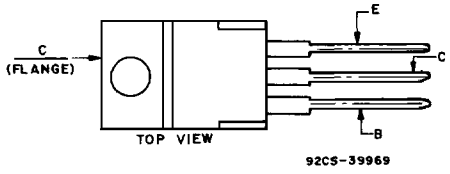
Features:

- *High-temperature parameters guaranteed*
- *Fast switching speed*
- *High voltage ratings:* V_{CEX} *= 350 V to 450 V*
- *Low* V_{CE} *(sat) at* I_C *= 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.

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	BUW41	BUW41A	BUW41B	
V_{CER}, R_{BE} = 100Ω	350	400	450	V
V_{CEV}				
V_{BE} = −1.5 V	450	550	650	V
V_{CEX} (clamped)				
V_{BE} = −1.5 V	350	400	450	V
V_{CEO}	300	350	400	V
V_{EBO}		8		V
I_C(sat)		5		A
I_C		8		A
I_{CM}		10		A
I_B		4		A
P_T				
T_C up to 25°C		100		W
T_C above 25°C, derate linearly		0.8		W/°C
T_{stg}, T_J		−65 to 150		°C
T_L				
At distance ≥ 1/8 in. (3.17 mm) from seating plane for 10 s max.		235		°C

ELECTRICAL CHARACTERISTICS

Characteristic	Test Conditions				Limits						Units
	Voltage V dc		Current A dc		BUW41		BUW41A		BUW41B		
	V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	
T_C = 25° C											
I_{CEV}	450	—1.5			—	0.1	—	—	—	—	mA
	550	—1.5			—	—	—	0.1	—	—	
	650	—.5			—	—	—	—	—	0.1	
I_{IEBO}		—8	0		—	2	—	2	—	2	
$V_{CEO}(sus)$[b]			0.2[a]	0	300	—	350	—	400	—	V
h_{FE}	3		5[a]		10	40	10	40	10	40	
$V_{BE}(sat)$			5[a]	1	—	1.6	—	1.6	—	1.6	V
$V_{CE}(sat)$			5[a]	1	—	1	—	1	—	1	
			8[a]	4	—	2	—	2	—	2	
V_{CEX}[b] (Clamped $E_{S/b}$) L = 170 μH		—5	5	1[e]	350	—	400	—	450	—	
R_{BB} = 5 Ω		—5	8	3[e]	200	—	250	—	300	—	
$t_{S/b}$	25		4		0.5	—	0.5	—	0.5	—	s
$\|h_{fe}\|$ f=5 MHz	10		0.2		3	12	3	12	3	12	
f_T	10		0.2		15	60	15	60	15	60	MHz
C_{obo} f=0.1 MHz	10[c]				50	300	50	300	50	300	pF
t_d[d]			5	1	—	0.1	—	0.1	—	0.1	μs
t_r[d]			5	1	—	0.5	—	0.5	—	0.5	
t_s[d]			5	1[e]	—	2.5	—	2.5	—	2.5	
t_f[d]			5	1[e]		0.4	—	0.4	—	0.4	
t_c V_{CC}=125 V, L=170 μH, R_C = 25 Ω Collector clamped to V_{CEX}			5	1[e]	—	0.4	—	0.4	—	0.4	

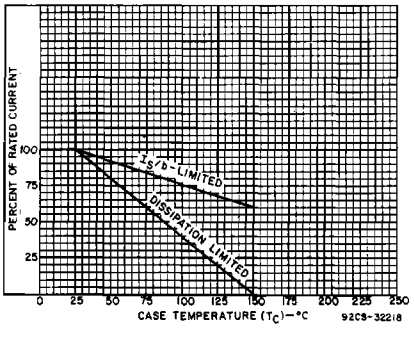


Fig. 1 — Dissipation and $I_{S/b}$ derating curves for all types.

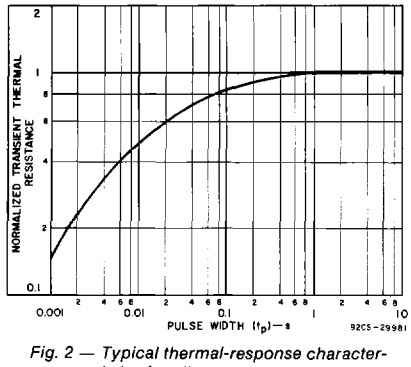


Fig. 2 — Typical thermal-response characteristics for all types.

ELECTRICAL CHARACTERISTICS Continued

Characteristic	Test Conditions				Limits						Units
	Voltage V dc		Current A dc		BUW41		BUW41A		BUW41B		
	V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	
T_C = 125° C											
I_{CEV}	450	−1.5			—	1	—	—	—	—	mA
	550	−1.5			—	—	—	1	—	—	
	650	−1.5			—	—	—	—	—	1	
V_{CE}(sat)			5[a]	1	—	2	—	2	—	2	V
t_r[d]			5	1	—	0.8	—	0.8	—	0.8	μs
t_s[d]			5	1[e]	—	4	—	4	—	4	
t_f[d]			5	1[e]	—	0.8	—	0.8	—	0.8	
t_c V_{CC}= 125 V, L=170 μH, R_C = 25 Ω Collector clamped to V_{CEX}			5	1[e]	—	0.8	—	0.8	—	0.8	
$R_{\theta JC}$					—	1.25	—	1.25	—	1.25	°C/W
$R_{\theta JA}$					—	70	—	70	—	70	°C/W

[a]Pulsed: pulse duration = 300 μs, duty factor ≤2%.

[b]CAUTION: The sustaining voltage V_{CEO}(sus) and V_{CEX} MUST NOT be measured on a curve tracer.

[c]V_{CB} value.

[d]V_{CC}=125 V, t_p=20 μs.

[e]I_{B1} = $-I_{B2}$.

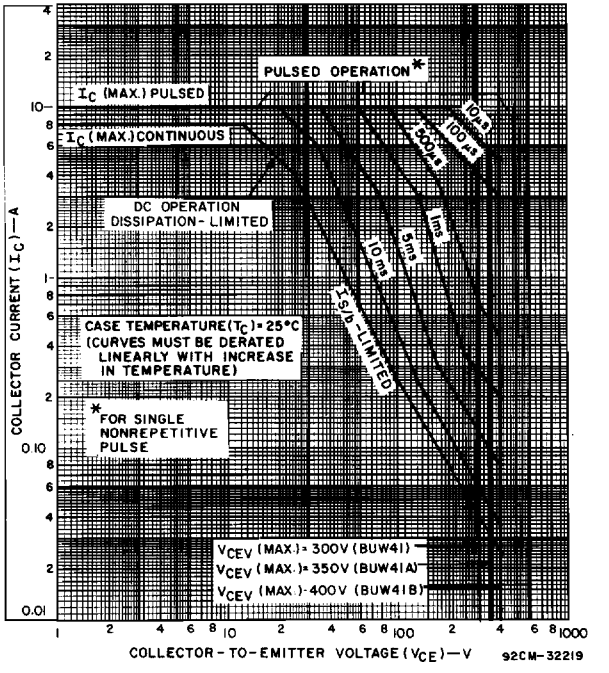


Fig. 3 — Maximum operating areas for all types [T_C = 25° C].

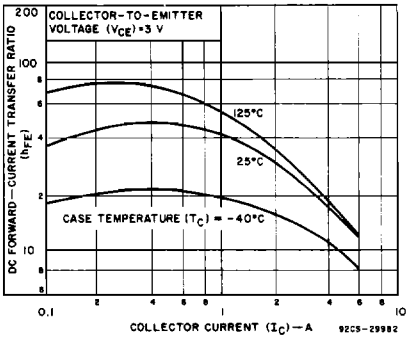


Fig. 4 — Typical dc beta characteristics for all types.

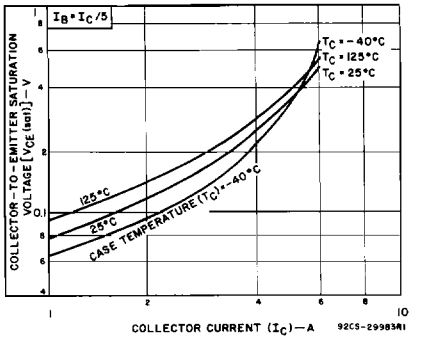


Fig. 5 — Typical collector-to-emitter saturation voltage as a function of collector current for all types.

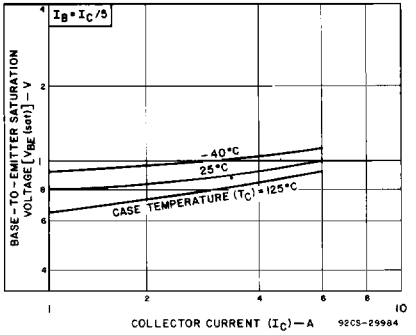


Fig. 6 — Typical base-to-emitter saturation voltage as a function of collector current for all types.

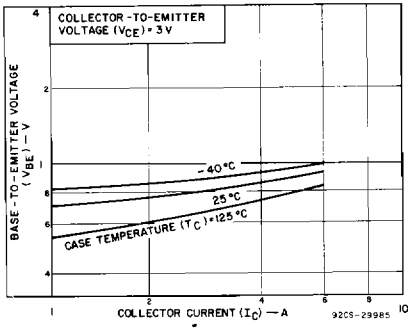


Fig. 7 — Typical base-to-emitter voltage as a function of collector current for all types.

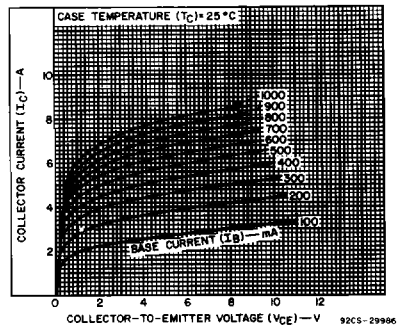


Fig. 8 — Typical output characteristics for all types.

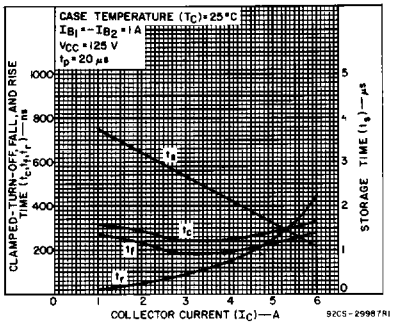


Fig. 9 — Typical saturated-switching-time characteristics for all types.

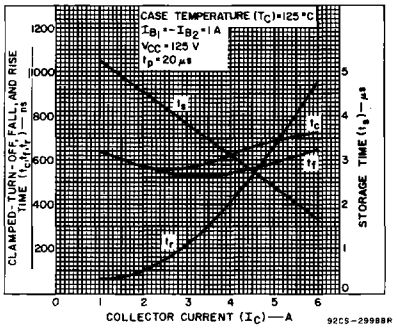


Fig. 10 — Typical saturated-switching-time characteristics as a function of collector current for all types.

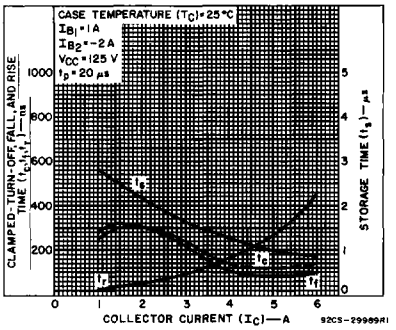


Fig. 11 — Typical saturated-switching-time characteristics for all types.

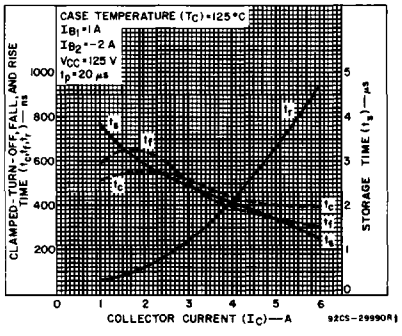


Fig. 12 — Typical saturated-switching-time characteristics for all types.

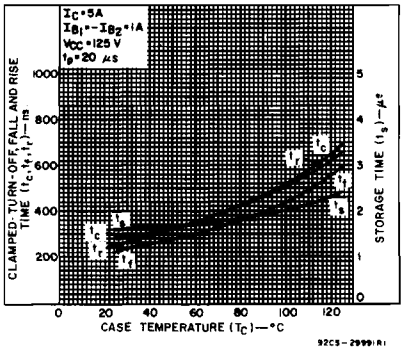


Fig. 13 — Typical saturated-switching-time characteristics as a function of case temperature for all types.

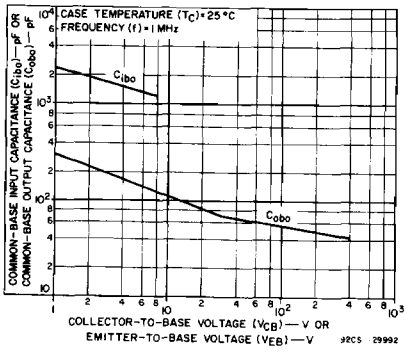


Fig. 14 — Typical common-base input or output capacitance characteristics as a function of collector-to-base voltage or emitter-to-base voltage for all types.

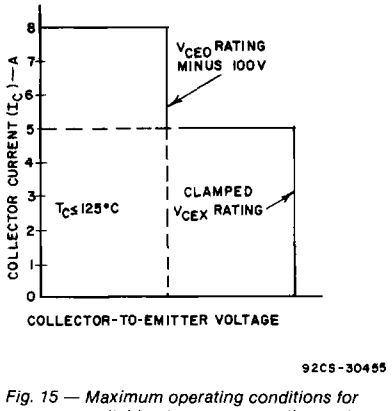


Fig. 15 — Maximum operating conditions for switching between saturation and cutoff.

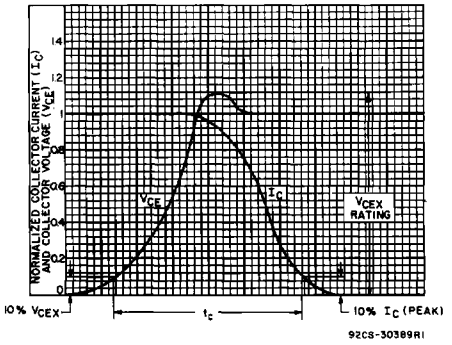


Fig. 16 — Oscilloscope display for measurement of clamped induction switching time (t_c).

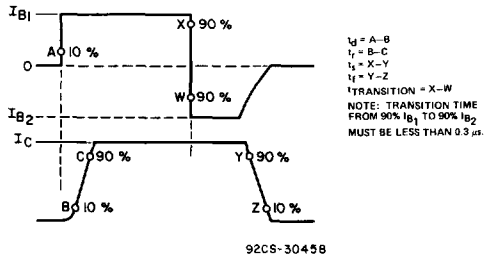


Fig. 17 — Phase relationship between input and output currents showing reference points for specification of switching times.

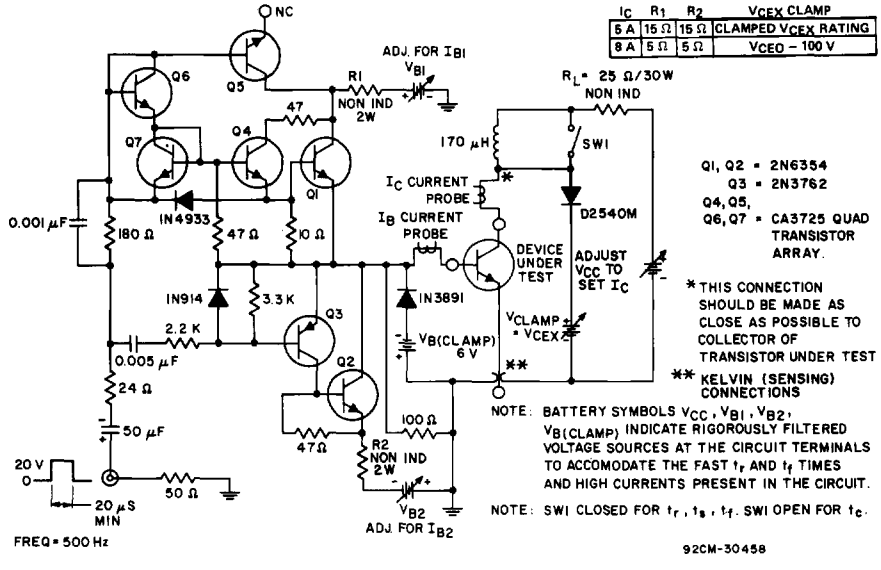


Fig. 18 — Circuit for measuring switching times.