

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

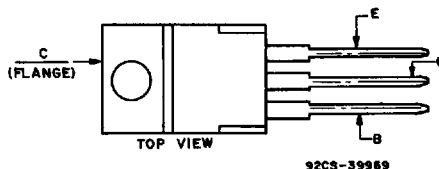
Features:

- High-temperature parameters guaranteed
- Fast switching speed
- High voltage ratings:
 $V_{CEX} = 350 \text{ V to } 450 \text{ V}$
- Low $V_{CE(sat)}$ at $I_C = 5 \text{ A}$
- 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	
$V_{CER}, R_{BE} = 100\Omega$	350	400	450	V
V_{CEV}				
$V_{BE} = -1.5 \text{ V}$	450	550	650	V
V_{CEX} (clamped) $V_{BE} = -1.5 \text{ V}$	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 $\geq 1/8 \text{ in. (3.17 mm)}$ 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 _{CE}	V _{BE}	I _C	I _B	Min.	Max.	Min.	Max.	Min.	Max.	

T_C = 25° C

I _{CEV}	450 550 650	-1.5 -1.5 -1.5			— — —	0.1 — —	— — —	0.1 — —	— — 0.1	— — —	mA
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 _{CE(sat)}			5 ^a 8 ^a	1 4	— —	1 2	— —	1 2	— —	1 2	V
V _{CEX} ^b (Clamped E _{S/b}) L = 170 μH R _{BB} = 5 Ω		-5 -5	5 8	1 ^e 3 ^e	350 200	— —	400 250	— —	450 300	— —	
I _{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	
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	μs

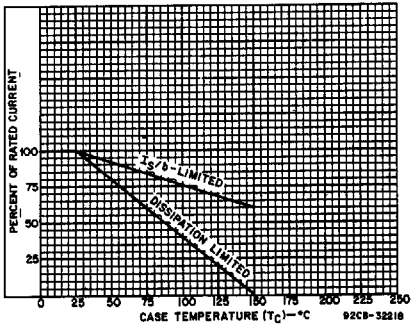


Fig. 1 — Dissipation and I_{S/b} derating curves for all types.

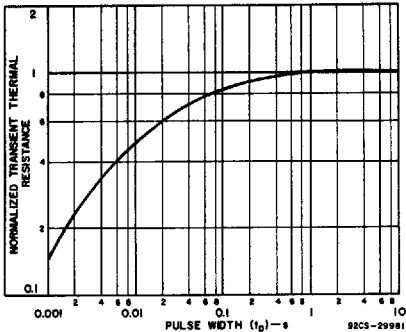


Fig. 2 — Typical thermal-response characteristics for all types.

HARRIS SEMICONDUCTOR

ELECTRICAL CHARACTERISTICS Continued

T-35-19

T-35-1

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.	

 $T_C = 125^\circ\text{C}$

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 ^e	—	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 _{θJC}					—	1.25	—	1.25	—	1.25	$^\circ\text{C/W}$
R _{θJA}					—	70	—	70	—	70	$^\circ\text{C/W}$

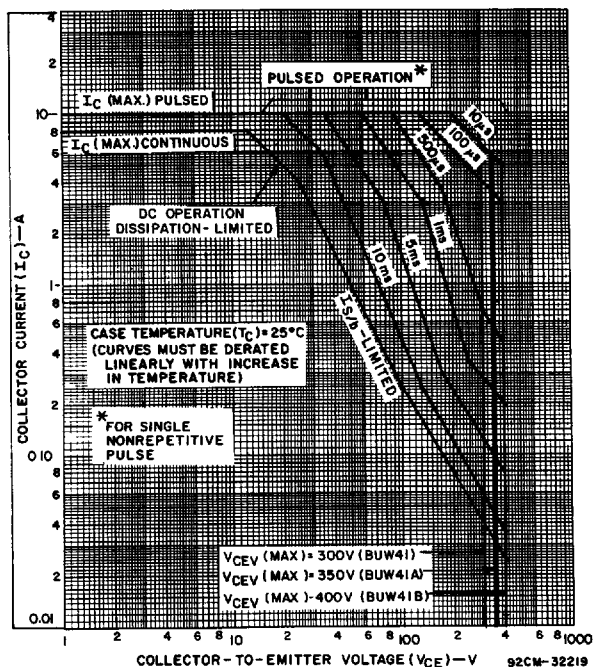
^aPulsed: pulse duration = 300 μs , duty factor $\leq 2\%$.

^cV_{CB} value.

^bCAUTION: The sustaining voltage V_{CEO(sus)} and

^dV_{CC}=125 V, t_p=20 μs .

V_{CEX} MUST NOT be measured on a curve tracer.

^eI_{B1} = -I_{B2}.

Fig. 3 — Maximum operating areas for all types [$T_C = 25^\circ\text{C}$].

HARRIS SEMICOND SECTOR

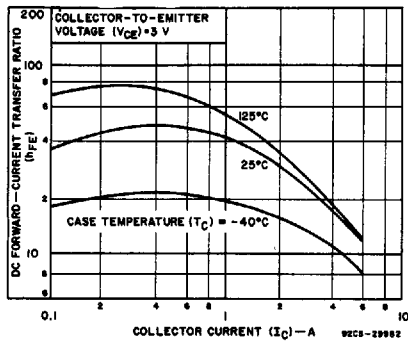


Fig. 4 — Typical dc beta characteristics for all types.

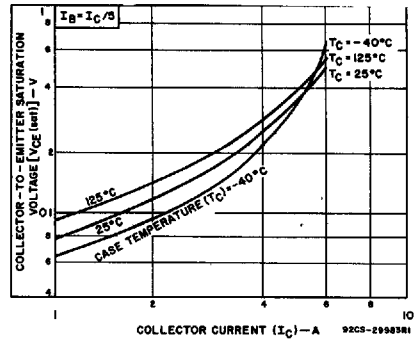


Fig. 5 — Typical collector-to-emitter saturation voltage as a function of collector current for all types.

T-35-19

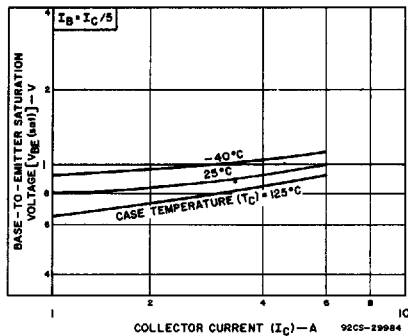


Fig. 6 — Typical base-to-emitter saturation voltage as a function of collector current for all types.

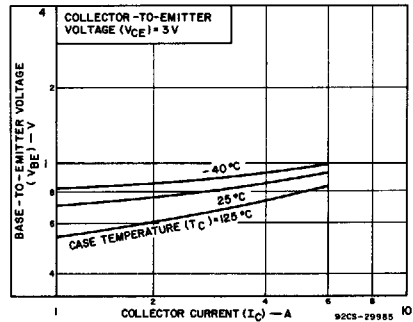


Fig. 7 — Typical base-to-emitter voltage as a function of collector current for all types.

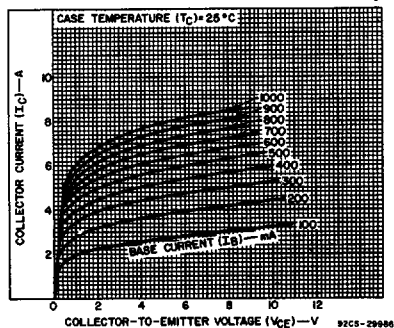


Fig. 8 — Typical output characteristics for all types.

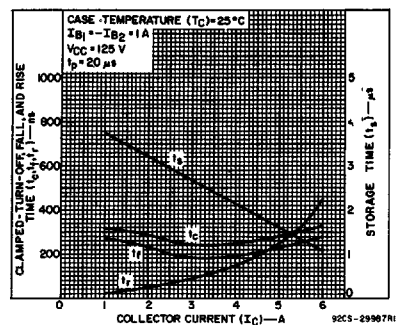


Fig. 9 — Typical saturated-switching-time characteristics for all types.

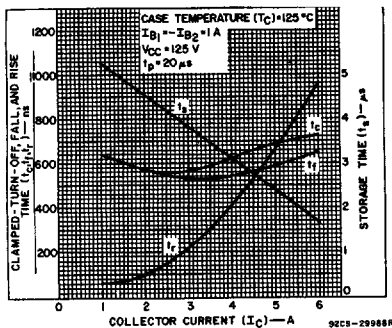


Fig. 10 — Typical saturated-switching-time characteristics as a function of collector current for all types.

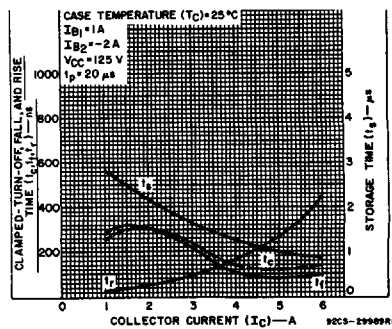


Fig. 11 — Typical saturated-switching-time characteristics for all types.

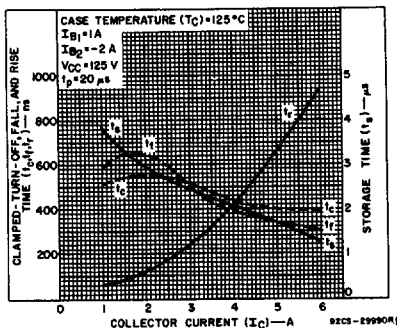


Fig. 12 — Typical saturated-switching-time characteristics for all types.

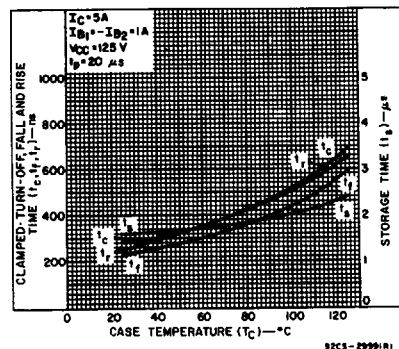


Fig. 13 — Typical saturated-switching-time characteristics as a function of case temperature for all types.

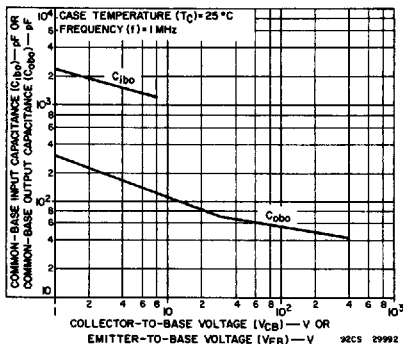


Fig. 14 — Typical common-base input or output capacitance characteristics as a function of collector-to-base voltage or emitter-to-base voltage for all types.

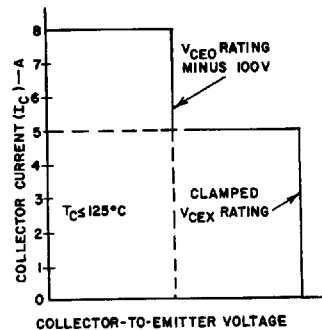


Fig. 15 — Maximum operating conditions for switching between saturation and cutoff.

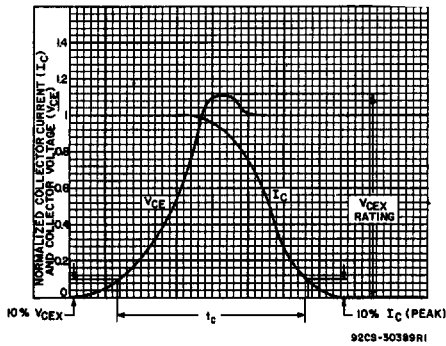


Fig. 16 — Oscilloscope display for measurement of clamped induction switching time (t_c).

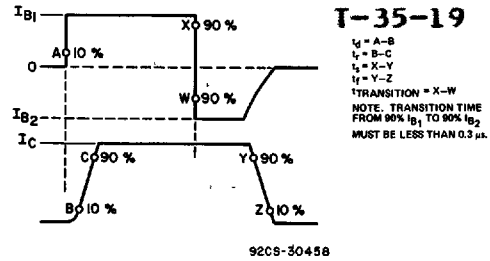


Fig. 17 — Phase relationship between input and output currents showing reference points for specification of switching times.

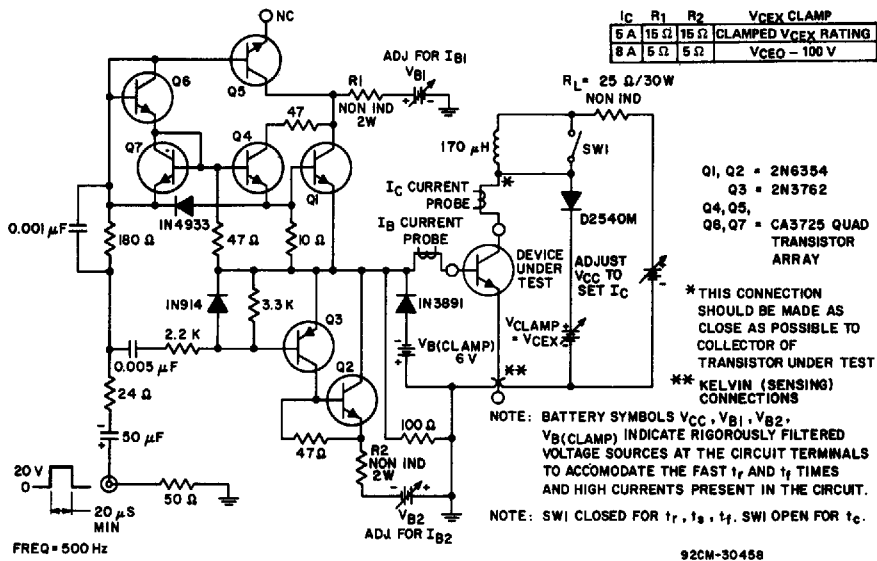


Fig. 18 — Circuit for measuring switching times.