File Number **1312**

BU323, BU323A

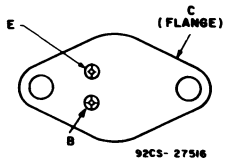
10-Ampere N-P-N Monolithic Darlington Power Transistors

350, 400 Volts, 175 Watts
Gain of 150 at 6 A

Features:
- *Operates from IC without predriver*
- *High voltage breakdown*
- *High reverse second-breakdown capability*

Applications:
- *Power switching*
- *Solenoid drivers*
- *Automotive ignition*
- *Series and shunt regulators*

TERMINAL DESIGNATIONS



JEDEC TO-204AA

The BU323 and BU323A are monolithic n-p-n silicon Darlington transistors designed for automotive electronic power applications..

These devices provide good forward and reverse second-breakdown capability; their high gain makes it possible for them to be driven directly from integrated circuits.

The BU323 and BU323A are supplied in the JEDEC TO-204AA hermetic steel package.

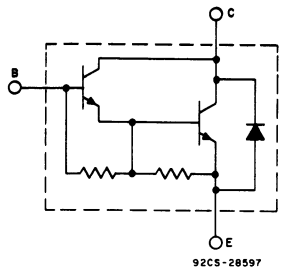


Fig. 1-Schematic diagram for both types.

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	BU323	BU323A	
V_{CBO}	500	600	V
$V_{CER(sus)}$			
R_{BE}=100 Ω	400	475	V
$V_{CEO(sus)}$	350	400	V
V_{EBO}	8	8	V
I_C	10	10	A
I_{CM}	16	16	A
I_B	3	3	A
P_T			
$T_C \leq 25°C$	175	175	W
$T_C > 25°C$	See Fig. 2		
T_{stg}, T_J	-65 to +200		°C
T_L			
At distances ≥ 1/8 in. (3.17 mm) from case for 10 s max.	235		°C

BU323, BU323A

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) 25° C unless otherwise specified*

CHARACTERISTIC	TEST CONDITIONS				LIMITS				UNITS
	VOLTAGE V dc		CURRENT A dc		BU323		BU323A		
	V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	
I_{CER} R_{BE}=100 Ω	400 475				— —	1 —	— —	— 1	mA
I_{EBO}		-6	0		—	40	—	40	
I_{CBO}	500[b] 600[b]				— —	1 —	— —	— 1	
V_{CER}(sus) R_{BE}=100 Ω L=500 μH			4		400	—	475	—	V
V_{CEO}(sus)			0.2[a]	0	350	—	400	—	
h_{FE}	6 6 6		3[a] 6[a] 10[a]		300 150 50	— 2000 —	300 150 50	— 2000 —	
V_{CE}(sat)			3[a] 6[a] 10[a]	0.06[a] 0.12[a] 0.30[a]	— — —	1.5 1.7 2.7	— — —	1.5 1.7 2.7	V
T_C=-40° C			6[a]	0.12[a]	—	2.0	—	2.0	
V_{BE}(sat)			6[a] 10[a]	0.12 0.30	— —	2.2 3	— —	2.2 3	V
T_C=-40° C			6[a]	0.12	—	2.4	—	2.4	
V_{BE}(On)	6		10[a]		—	2.5	—	2.5	
V_F			10[a]		—	3.5	—	3.5	
C_{ob} f=100 kHz	10[b]				—	350	—	350	pF
$I_C^2L/2$ (See Fig. 9)					550	—	550	—	mJ
t_s I_{B1}=I_{B2}	12[c]		6	0.3	—	15	—	15	μs
t_f I_{B1}=I_{B2}	12[c]		6	0.3	—	15	—	15	
$\|h_{fe}\|$ f=1 MHz	5		1		10	—	10	—	
$I_{S/b}$ t=1 s, nonrep.	50				3.5	—	3.5	—	A
$R_{\theta JC}$					—	1	—	1	°C/W

[a]Pulsed: Pulse duration=300 μs, duty factor=1.8%.
[b]V_{CB} value.
[c]V_{CC} value.

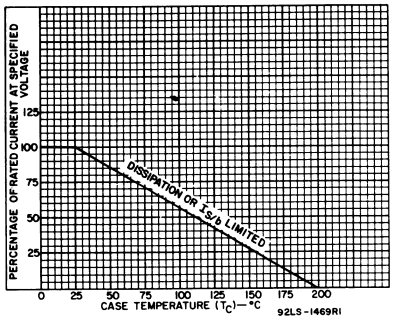


Fig. 2 — Dissipation derating curve for both types.

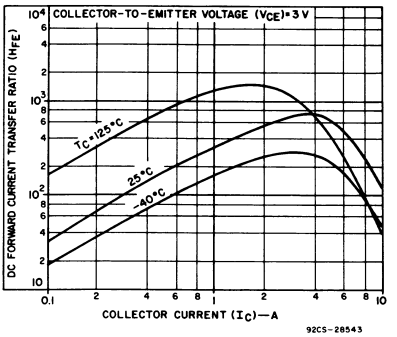


Fig. 3 — Typical DC beta characteristics for both types.

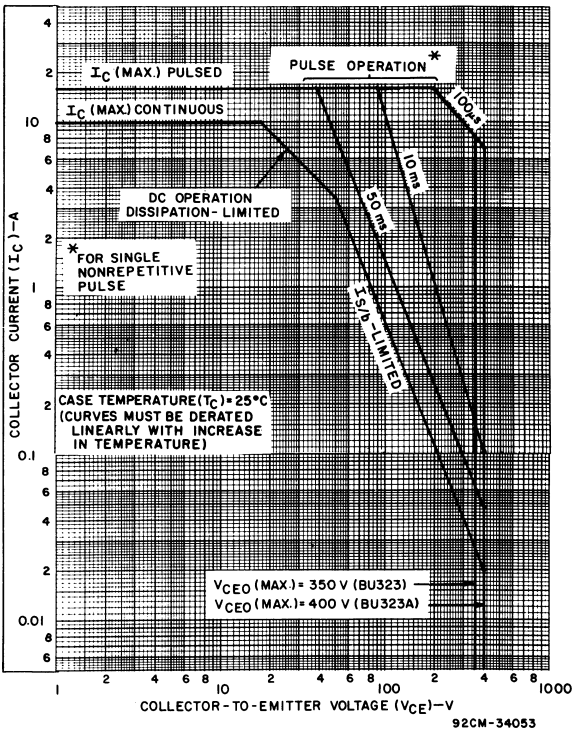


Fig. 4 — Maximum operating areas for both types.

BU323, BU323A

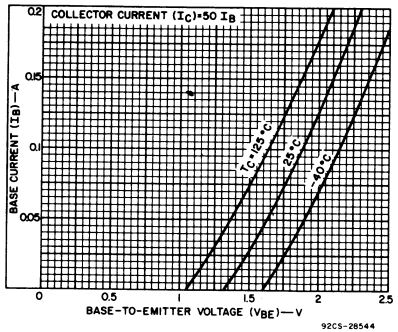


Fig. 5 — Typical input characteristics for both types.

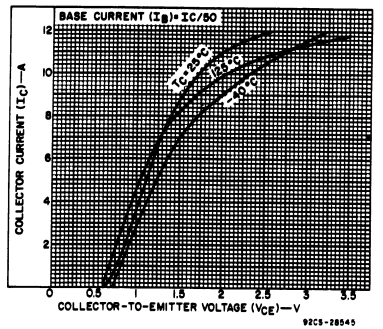


Fig. 6 — Typical output characteristics for both types.

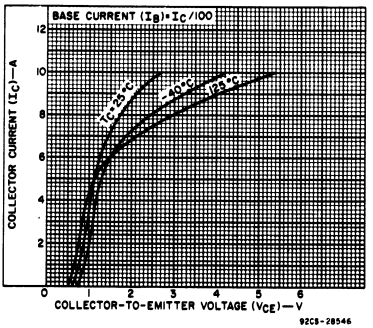


Fig. 7 — Typical output characteristics for both types.

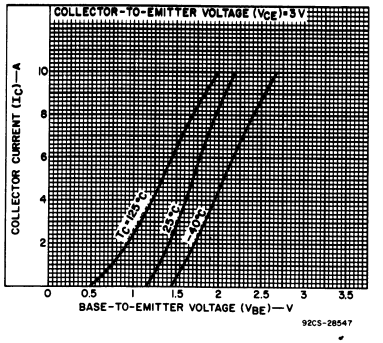


Fig. 8 — Typical transfer characteristics for both types.

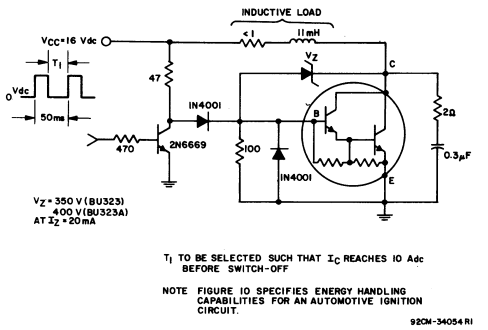
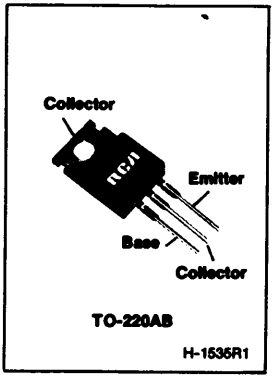


Fig. 9 — Ignition test circuit.

RCA
Solid State
Division

Power Transistors
BUW40
BUW40A
BUW40B

File Number 1308



1-A SwitchMax VERSAWATT Transistors

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

Features:
- *100% High-Temperature Tested for 125° C Parameters*
- *Fast Switching Speed*
- *High Voltage Ratings:*
  V_{CEX}=350 V to 450 V
- *Low V_{CE}(sat) at I_C=1 A*
- *VERSAWATT package*

Applications:
- *Off-Line Power Supplies*
- *High-Voltage Inverters*
- *Switching Regulators*

The RCA-BUW40, BUW40A, and BUW40B 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 use in 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-percent tested for parameters that are essential to the design of industrial high-power switching circuits. Switching times, including inductive turn-off time, and saturation voltages are tested at 125°C, as well as at 25°C, to provide information necessary for worst-case design.

The RCA-BUW40, BUW40A, and BUW40B series transistors are supplied in the JEDEC TO-220AB VERSAWATT plastic package.

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	BUW40	BUW40A	BUW40B	
V_{CER}, R_{BE}=100 Ω	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)		1		A
I_C		1		A
I_{CM}		2		A
I_B		0.6		A
P_T				
T_C up to 25°C		40		W
T_C above 25°C, derate linearly		0.32		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

Silicon N-P-N Power-Switching Transistors

Printed in USA/8-81

ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	TEST CONDITIONS VOLTAGE V dc		CURRENT A dc		LIMITS BUW40		BUW40A		BUW40B		UNITS
	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	−1.5			—	—	—	—	—	0.1	
I_{EBO}		−8	0		—	2	—	2	—	2	
$V_{CEO(sus)}$[b]			0.2[a]	0	300	—	350	—	400	—	V
$V_{CE(sat)}$			1[a]	0.2	—	1.0	—	1.0	—	1.0	
$V_{BE(sat)}$			1[a]	0.2	—	1.2	—	1.2	—	1.2	
h_{FE}	3		0.3[a]		20	100	20	100	20	100	
	3		1[a]		10	50	10	50	10	50	
V_{CEX}[b] (Clamped $E_{S/b}$) L=450 μH, R_{BB}=50 Ω		−5	1	0.1[e]	350	—	400	—	450	—	V
$I_{S/b}$	100		0.4		0.5	—	0.5	—	0.5	—	s
$\|h_{fe}\|$ f=1 MHz	10		0.2		10	50	10	50	10	50	
f_T	10		0.2		10	50	10	50	10	50	MHz
C_{obo} f=0.1 MHz	10[c]				20	60	20	60	20	60	pF
t_d[d]			1	0.2	—	0.05	—	0.05	—	0.05	μs
t_r[d]			1	0.2	—	0.2	—	0.2	—	0.2	
t_s[d]			1	0.2[e]	—	2.5	—	2.5	—	2.5	
t_f[d]			1	0.2[e]	—	0.4	—	0.4	—	0.4	
t_c V_{CC}=200 V, L=450 μH, R_C=200 Ω Collector clamped to V_{CEX}			1	0.2[e]	—	0.4	—	0.4	—	0.4	
T_C=125°C											
I_{CEV}	450	−1.5			—	1	—	—	—	—	mA
	550	−1.5			—	—	—	1	—	—	
	650	−1.5			—	—	—	—	—	1	
$V_{CE(sat)}$			1[a]	0.2	—	2	—	2	—	2	V
t_r[d]			1	0.2	—	0.5	—	0.5	—	0.5	μs
t_s[d]			1	0.2[e]	—	4.5	—	4.5	—	4.5	
t_f[d]			1	0.2[e]	—	1.3	—	1.3	—	1.3	
t_c V_{CC}=200 V, L=450 μH, R_C=200 Ω Collector clamped to V_{CEX}			1	0.2[e]	—	1.3	—	1.3	—	1.3	
$R_{\theta JC}$	20		1		—	3.12	—	3.12	—	3.12	°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} = 200 V, t_p = 20 μs.
[e]$I_{B_1} = -I_{B_2}$.

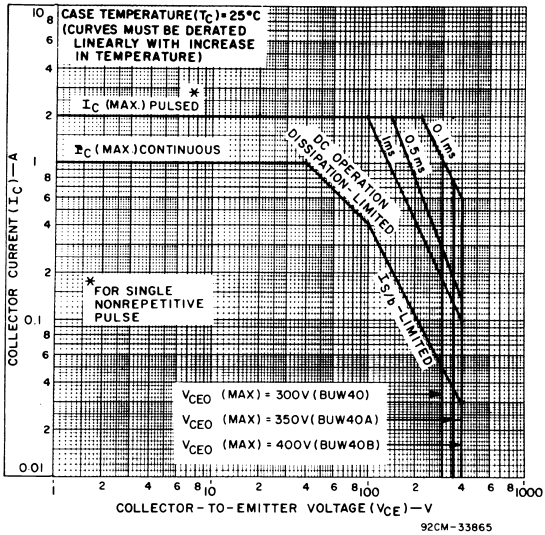


Fig. 1 - Maximum operating areas for all types.

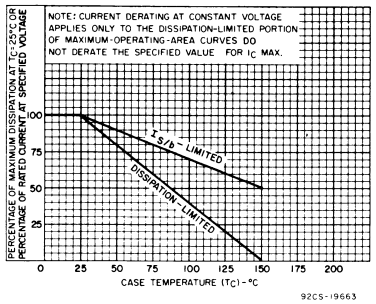


Fig. 2 - Derating curve for all types.

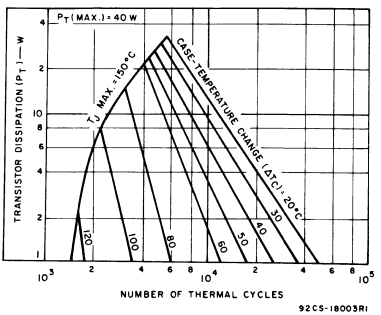


Fig. 3 - Thermal-cycling rating chart for all types.

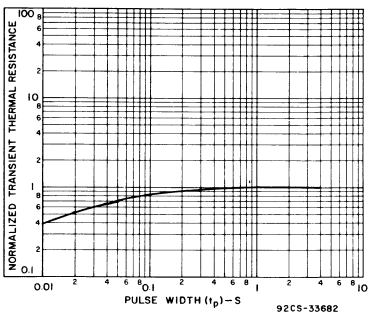


Fig. 4 - Typical thermal-response characteristics for all types.

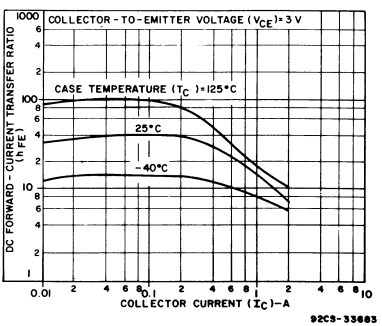


Fig. 5 - Typical dc beta characteristics for all types.

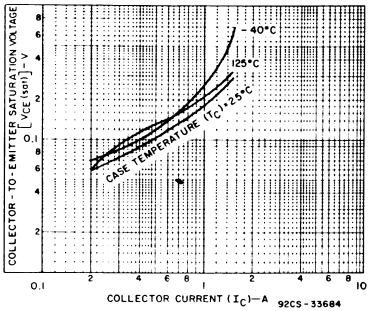


Fig. 6 - Typical collector-to-emitter saturation voltage as a function of collector current for all types.

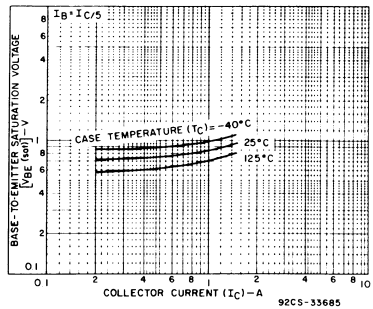


Fig. 7 - Typical base-to-emitter saturation voltage as a function of collector current for all types.

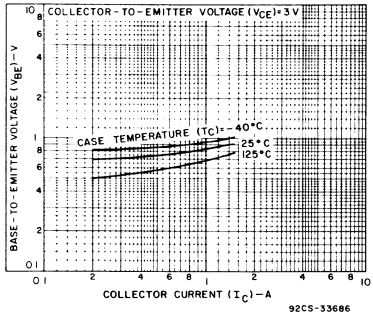


Fig. 8 - Typical base-to-emitter voltage as a function of collector current for all types.

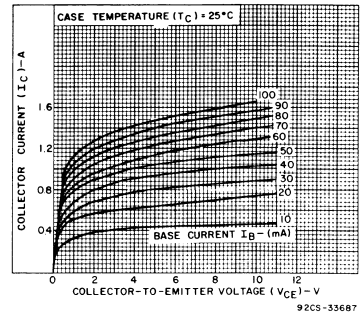


Fig. 9 - Typical output characteristics for all types.

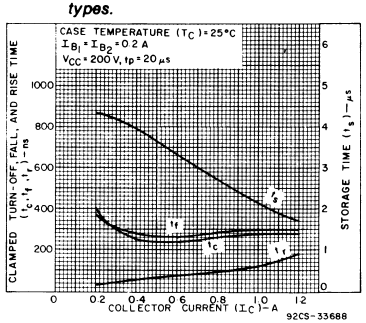


Fig. 10 - Typical saturated switching time characteristics for all types.

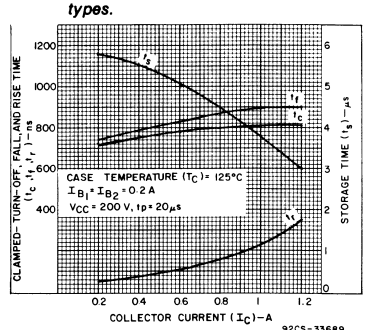


Fig. 11 - Typical saturated-switching-time characteristics as a function of collector current for all types.

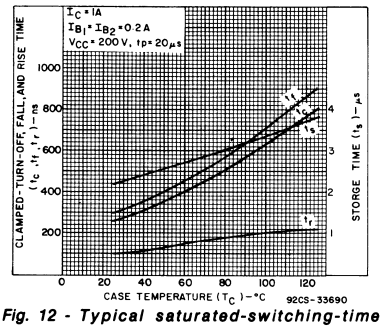


Fig. 12 - Typical saturated-switching-time characteristics as a function of case temperature for all types.

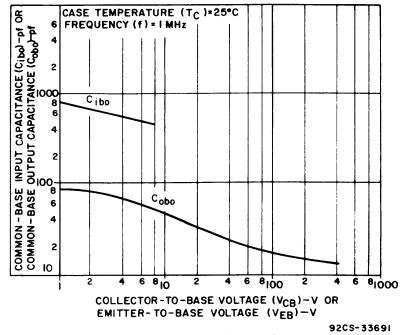


Fig. 13 - Typical common-base input or output capacitance characteristics as a function of collector-to-base voltage or emitter-to-base voltage.

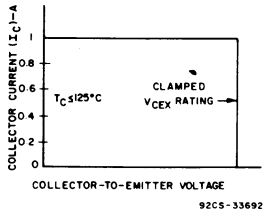


Fig. 14 - Maximum operating conditions for switching between saturation and cutoff.

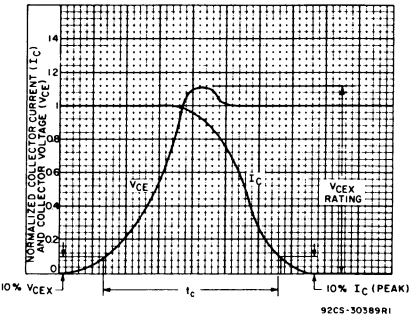


Fig. 15 - Oscilloscope display for measurement of clamped induction switching time (t_c).

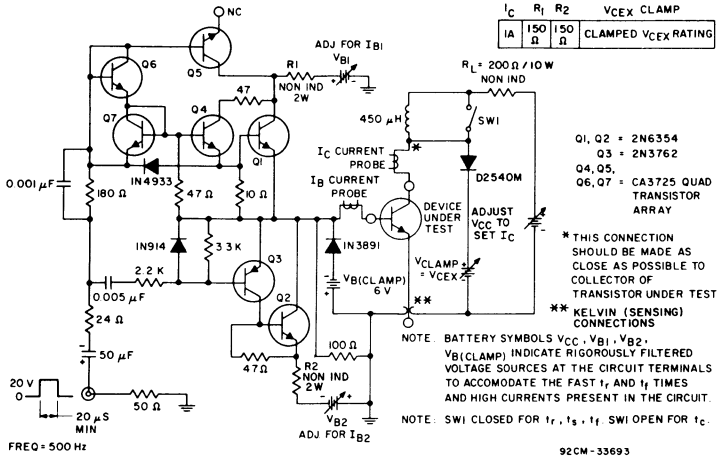


Fig. 16 - Circuit for measuring switching times.

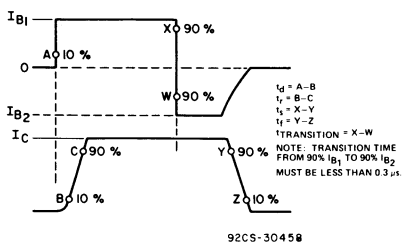


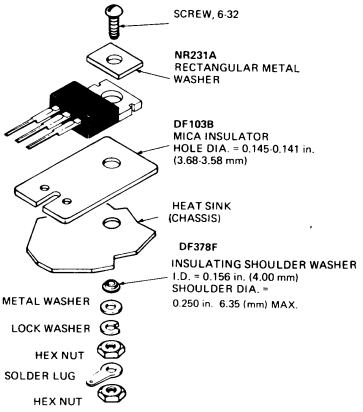
Fig. 17 - Phase relationship between input and output currents showing reference points for specification of switching times.

SYMBOLS

C_{ibo}	common-base input capacitance, collector open
C_{obo}	common-base output capacitance, emitter open
$E_{S/b}$	reverse-bias second-breakdown energy
f_T	gain-bandwidth product
h_{FE}	dc forward-current transfer ratio
$\|h_{fe}\|$	magnitude of common-emitter, small-signal, short-circuit, forward-current transfer ratio
I_B	continuous base current
I_C	continuous collector current
I_{CEV}	collector-cutoff current with specified voltage between base and emitter
I_{CM}	peak collector current
$I_{C(sat)}$	collector current at which h_{FE}, $V_{BE(sat)}$, $V_{CE(sat)}$, and switching speeds are measured

SYMBOLS (Cont'd)

$I_{S/b}$	forward-bias, second-breakdown collector current
P_T	transistor dissipation at specified temperature
R_{BB}	base bias resistor
R_C	collector resistor
$R_{\theta JC}$	thermal resistance, junction-to-case
T_C	case temperature
T_J	operating (junction) temperature
T_L	lead temperature during soldering
T_{stg}	storage temperature
t_c	clamped turn-off switch time of an inductive load (see Fig. 15)
t_d	delay time
t_f	fall time
t_p	pulse duration
t_r	rise time
t_s	storage time
V_{BE}	base-to-emitter voltage
$V_{BE(sat)}$	base-to-emitter saturation voltage
V_{CB}	collector-to-base voltage
V_{CC}	collector supply voltage
V_{CE}	collector-to-emitter voltage
$V_{CE(sat)}$	collector-to-emitter saturation voltage
V_{CEO}	collector-to-emitter voltage, base open
$V_{CEO(sus)}$	collector-to-emitter sustaining voltage, base open
V_{CEV}	collector-to-emitter voltage with specified voltage between base and emitter
V_{CEX}	collector-to-emitter voltage with specified circuit between base and emitter
V_{EB}	emitter-to-base voltage
V_{EBO}	emitter-to-base voltage, collector open
ΔT_C	case temperature change



NOTE: MAXIMUM TORQUE APPLIED TO MOUNTING FLANGE IS 8 in. lb. (0.09 kgf m)

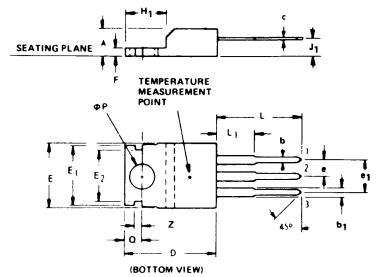
Suggested mounting hardware for JEDEC TO-220AB

TERMINAL CONNECTIONS

Lead No. 1 - Base
Lead No. 2 - Collector
Lead No. 3 - Emitter
Mounting Flange - Collector

When incorporating RCA Solid State Devices in equipment, it is recommended that the designer refer to "Operating Considerations for RCA Solid State Devices", Form No. 1CE-402, available on request from RCA Solid State Division, Box 3200, Somerville, N.J. 08876.

DIMENSIONAL OUTLINE
JEDEC TO-220AB



SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	0.140	0.190	3.56	4.82	–
b	0.020	0.045	0.51	1.14	–
b_1	0.045	0.070	1.14	1.77	–
c	0.015	0.025	0.38	0.63	–
D	0.560	0.625	14.23	15.87	–
E	0.380	0.420	9.66	10.66	1
E_1	0.365	0.385	9.28	9.77	–
E_2	0.300	0.320	7.62	8.12	–
e	0.090	0.110	2.29	2.79	2
e_1	0.190	0.210	4.83	5.33	2
F	0.045	0.055	1.14	1.39	–
H_1	0.230	0.270	5.85	6.85	1
J_1	0.080	0.115	2.04	2.92	–
L	0.500	0.562	12.70	14.27	–
L_1	–	0.250	–	6.35	–
ϕP	0.139	0.147	3.531	3.733	–
Q	0.100	0.120	2.54	3.04	–
Z	0.040	0.060	1.02	1.52	–

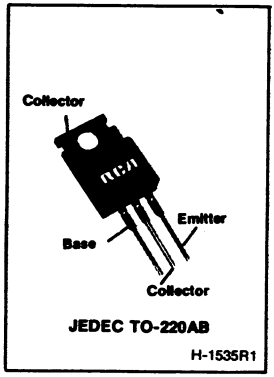
92CS-17991R2

NOTES:
1. Tab contour optional within H_1 and E.
2. Position of lead to be measured 0.250 – 0.255 in. (6.350 – 6.477 mm) from case.

RCA
Solid State
Division

Power Transistors
BUW41 BUW41A BUW41B

File No. 1275



5-A SwitchMax Power Transistors

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

Features:

- *100% High-Temperature Tested for 125° C Parameters*
- *Fast Switching Speed*
- *High Voltage Ratings: V_{CEX} = 350 V to 450 V*
- *Low V_{CE}[sat] at I_C = 5 A*
- *VERSAWATT PACKAGE [Molded Silicone Plastic]*

Applications

- *Off-Line Power Supplies*
- *High-Voltage Inverters*
- *Switching Regulators*

The RCA-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 use in 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 industrial high-power switching circuits. Switching times, including inductive turn-off time, and saturation voltages are tested at 125° C, as well as at 25° C, to provide information necessary for worst-case design.

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

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

Silicon N-P-N Power-Switching Transistors

Printed in USA/12-80

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	—	
$I_{S/b}$	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	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	

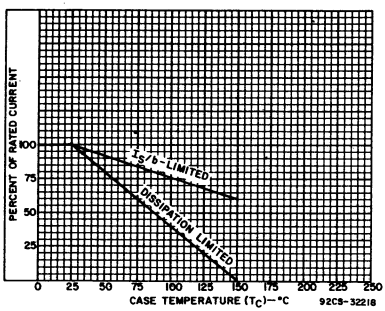


Fig.2 - Dissipation and $I_{S/b}$ derating curves for all types.

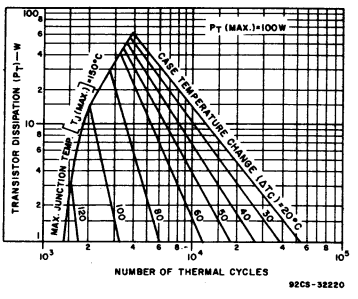


Fig.3 - Thermal-cycling chart for all types.

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_{B_1}= $-I_{B_2}$.

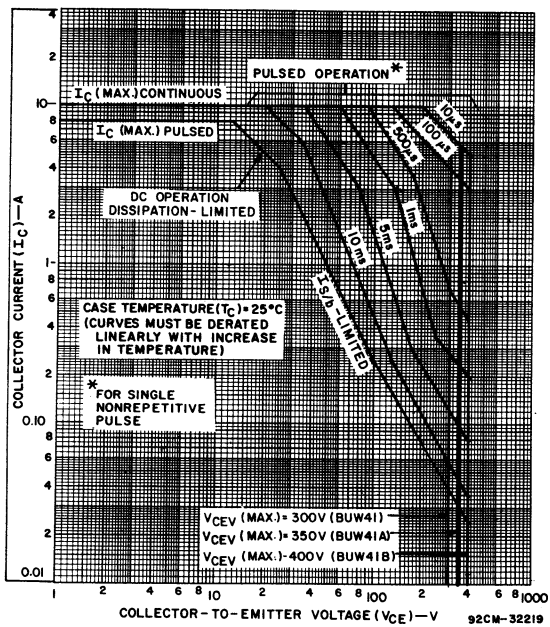


Fig.1 - Maximum operating areas for all types [T_C = 25° C].

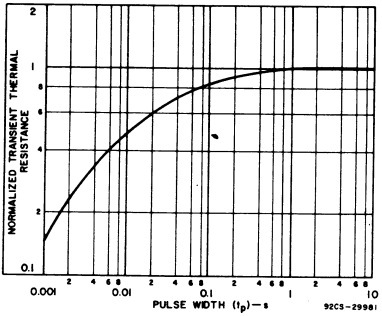


Fig.4 - Typical thermal-response characteristic for all types.

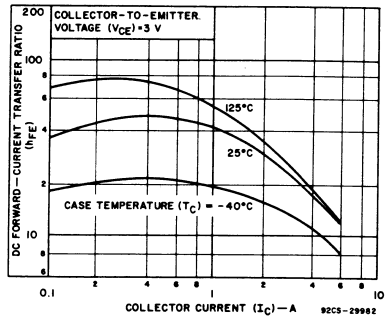


Fig.5 - Typical dc beta characteristics for all types.

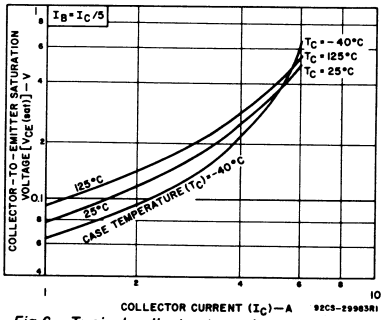


Fig.6 - Typical collector-to-emitter saturation voltage as a function of collector current for all types.

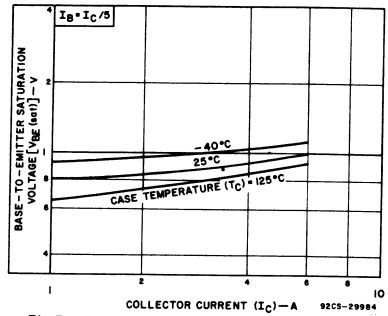


Fig.7 - Typical base-to-emitter saturation voltage as a function of collector current for all types.

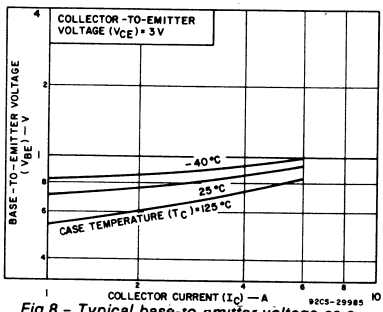


Fig.8 - Typical base-to-emitter voltage as a function of collector current for all types.

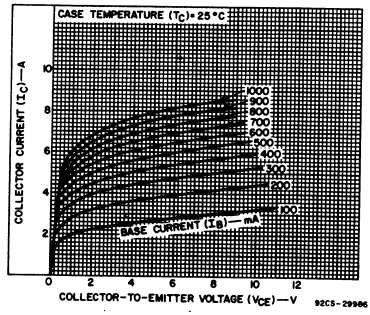


Fig.9 - Typical output characteristics for all types.

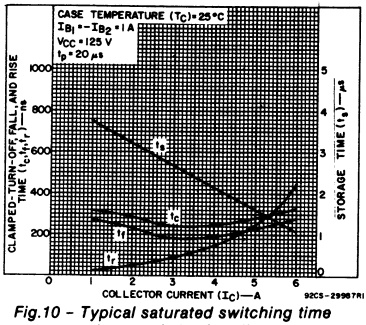


Fig.10 - Typical saturated switching time characteristics for all types.

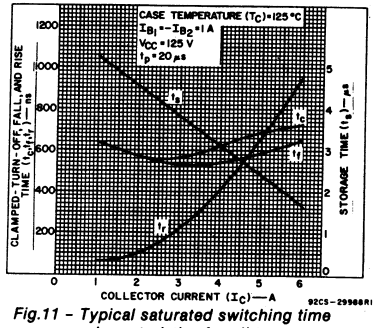


Fig.11 - Typical saturated switching time characteristics for all types.

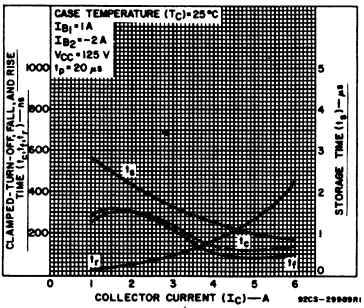


Fig.12 - Typical saturated switching time characteristics for all types.

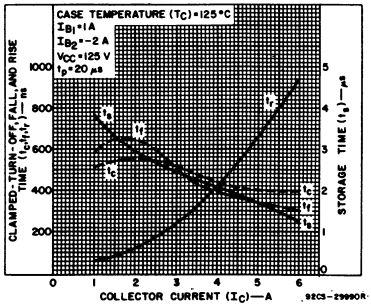


Fig.13 - Typical saturated switching time characteristics for all types.

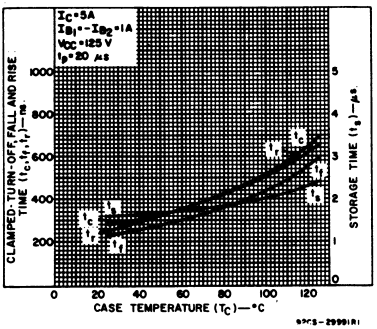


Fig.14 - Typical saturated switching time characteristics as a function of case temperature for all types.

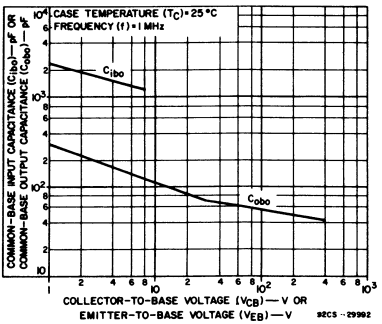


Fig.15 - Typical common-base input or output capacitance characteristics as a function of collector-to-base voltage or emitter-to-base voltage for all types.

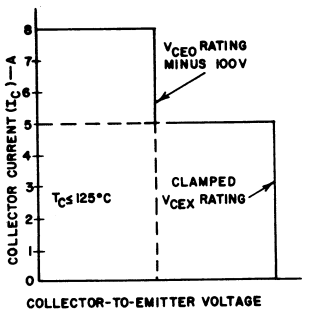


Fig.16 - Maximum operating conditions for switching between saturation and cutoff.

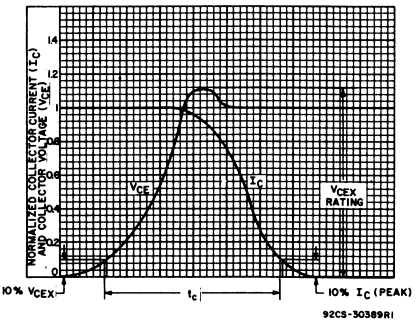


Fig.17 - Oscilloscope display for measurement of clamped induction switching time (t_c).

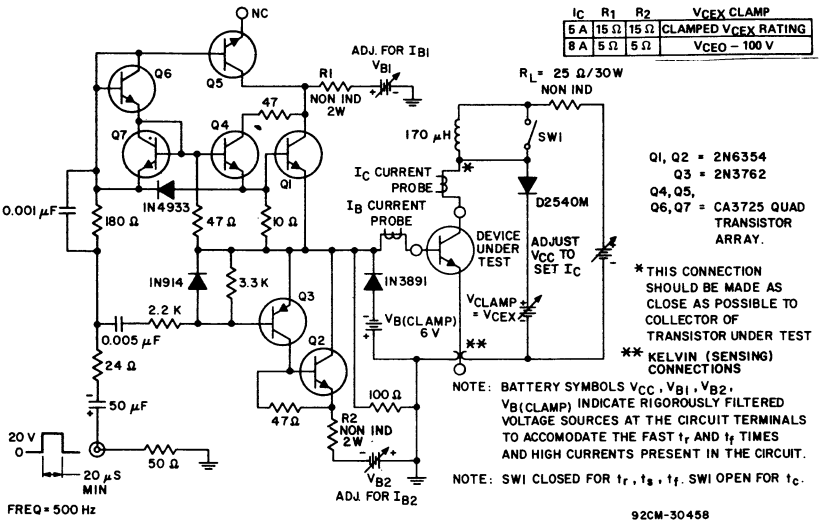


Fig.18 - Circuit for measuring switching times.

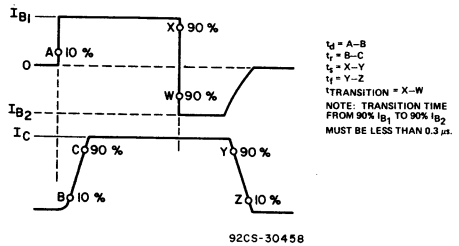


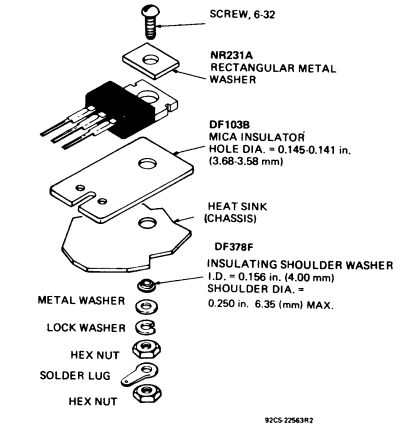
Fig.19 - Phase relationship between input and output currents showing reference points for specification of switching times.

SYMBOLS

C_{ibo}	common-base input capacitance, collector open
C_{obo}	common-base output capacitance, emitter open
$E_{S/b}$	reverse-bias second-breakdown energy
f_T	gain bandwidth product
h_{FE}	dc forward-current transfer ratio
$\|h_{fe}\|$	magnitude of common-emitter, small-signal, short-circuit, forward-current transfer ratio
I_B	continuous base current
I_C	continuous collector current
I_{CEV}	collector-cutoff current with specified resistance between base and emitter
I_{CM}	peak collector current
$I_{C(sat)}$	collector current at which h_{FE}, $V_{BE(sat)}$, and switching speeds are measured
$I_{S/b}$	forward-bias, second-breakdown collector current
P_T	transistor dissipation at specified temperature
R_{BB}	base bias resistor
R_C	collector resistor
$R_{\theta JC}$	thermal resistance, junction to case

SYMBOLS Continued

T_C	case temperature
T_j	operating (junction) temperature
T_L	lead temperature during soldering
T_{stg}	storage temperature
t_c	clamped turn-off switch time of an inductive load (see Fig.18)
t_d	delay time
t_f	fall time
t_p	pulse duration
t_r	rise time
t_s	storage time
V_{BE}	base-to-emitter voltage
$V_{BE}(sat)$	base-to-emitter saturation voltage
V_{CB}	collector-to-base voltage
V_{CC}	collector supply voltage
V_{CE}	collector-to-emitter voltage
$V_{CE}(sat)$	collector-to-emitter saturation voltage
V_{CEO}	collector-to-emitter voltage base open
$V_{CEO}(sus)$	collector-to-emitter sustaining voltage, base open
V_{CEV}	collector-to-emitter voltage with specified voltage between base and emitter
V_{CEX}	collector-to-emitter voltage with specified circuit between base and emitter
V_{EB}	emitter-to-base voltage
V_{EBO}	emitter-to-base voltage, collector open
ΔT_C	case temperature change

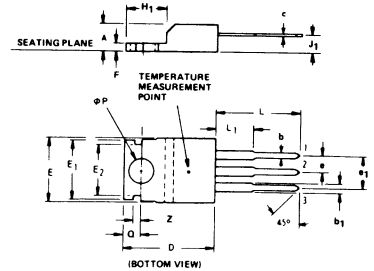


NOTE: MAXIMUM TORQUE APPLIED TO MOUNTING FLANGE IS 8 in.-lb. (0.09 kgf·m)

Suggested mounting hardware for use with JEDEC TO-220AB package.

When incorporating RCA Solid State Devices in equipment, it is recommended that the designer refer to "Operating Considerations for RCA Solid State Devices", Form No. 1CE-402, available on request from RCA Solid State Division, Box 3200, Somerville, N.J. 08876.

DIMENSIONAL OUTLINE
JEDEC TO-220AB



SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
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E	0.380	0.420	9.66	10.66	1
E_1	0.365	0.385	9.28	9.77	–
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e	0.090	0.110	2.29	2.79	2
e_1	0.190	0.210	4.83	5.33	2
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J_1	0.080	0.115	2.04	2.92	–
L	0.500	0.562	12.70	14.27	–
L_1	–	0.250	–	6.35	–
φP	0.139	0.147	3.531	3.733	–
Q	0.100	0.120	2.54	3.04	–
Z	0.040	0.060	1.02	1.52	–

NOTES: 92CS-17991R2

1. Tab contour optional within H_1 and E.
2. Position of lead to be measured 0.250 – 0.255 in. (6.350 – 6.477 mm) from case.

TERMINAL CONNECTIONS

Lead No. 1 — Base
Lead No. 2 — Collector
Lead No. 3 — Emitter
Mounting Flange — Collector

File Number **1199**

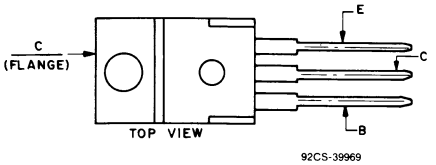
BUW64A, BUW64B, BUW64C

High-Current, Silicon N-P-N VERSAWATT Transistors

Switching Applications

Features:
- *Fast switching speed at temperatures up to 125° C*
- *Low $V_{CE}(sat)$*
- *VERSAWATT plastic package*

TERMINAL DESIGNATIONS



JEDEC TO-220AB

RCA-BUW64A, BUW64B, and BUW64C are epitaxial-base silicon n-p-n power transistors which feature fast switching speeds, low saturation voltages, and high safe-operating-area (SOA) ratings. They are specially designed for converters, inverters, pulse-width-modulated regulators and a variety of power switching circuits.

The BUW64A, BUW64B, and BUW64C transistors are supplied in the JEDEC TO-220AB (RCA VERSAWATT) plastic packages.

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	BUW64A	BUW64B	BUW64C	
V_{CEV}				
V_{BE} = -1.5 V	140	160	180	V
V_{CEO}	90	110	130	V
V_{EBO}		7		V
I_C(sat)	5	5	4	A
I_C		7		A
I_{CM}		10		A
I_B		5		A
P_T				
T_C up to 25° C		50		W
T_C above 25° C ... Derate Linearly		0.4		W/° C
T_{stg}, T_J		-65 to 150		°C
T_L				
At distance ≥ 1/8 in. (3.16 mm) from seating plane for 10 s max.		235		°C

BUW64A, BUW64B, BUW64C

ELECTRICAL CHARACTERISTICS, at Case Temperature T_C = 25°C Unless Otherwise Specified

CHARACTERISTIC	TEST CONDITIONS				LIMITS						UNITS
	VOLTAGE V dc		CURRENT A dc		BUW64A		BUW64B		BUW64C		
	V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	
I_{CEV}	140	−1.5			–	100	–	–	–	–	μA
	160	−1.5			–	–	–	100	–	–	
	180	−1.5			–	–	–	–	–	100	
T_C = 125°C	140	−1.5			–	1	–	–	–	–	mA
	160	−1.5			–	–	–	1	–	–	
	180	−1.5			–	–	–	–	–	1	
I_{EBO}		−7	0		–	100	–	100	–	100	μA
V_{CEO}(sus)[b]			0.01[a]	0	90	–	110	–	130	–	V
h_{FE}	2		0.2[a]		30	–	30	–	30	–	
	2		4[a]		–	–	–	–	20	–	
	2		5[a]		20	–	20	–	–	–	
V_{BE}(sat)			4[a]	0.4	–	–	–	–	–	1.4	V
			5[a]	0.5	–	1.5	–	1.5	–	–	
V_{CE}(sat)			4[a]	0.4	–	–	–	–	–	0.7	
			5[a]	0.5	–	0.8	–	0.8	–	–	
			7[a]	0.7	–	1.5	–	1.5	–	1.5	
$I_{S/b}$	20		2.5		1	–	1	–	1	–	s
$\lvert h_{fe} \rvert$ f = 5 MHz	10		0.5		10	40	10	40	10	40	
f_T	10		0.5		50	200	50	200	50	200	MHz
C_{obo} f = 0.1 MHz	10[c]				50	150	50	150	50	150	pF
t_d[d]		−4	4	0.4	–	–	–	–	–	0.1	μs
			5	0.5	–	0.1	–	0.1	–	–	
t_r[d]		−4	4	0.4	–	–	–	–	–	0.25	
			5	0.5	–	0.25	–	0.25	–	–	
t_s[d]		−4	4	0.4[e]	–	–	–	–	–	1	
			5	0.5[e]	–	1	–	1	–	–	
t_f[d]		−4	4	0.4[e]	–	–	–	–	–	0.5	
			5	0.5[e]	–	0.5	–	0.5	–	–	
$R_{\theta JC}$	4		5		–	2.5	–	2.5	–	2.5	°C/W

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

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

[c] V_{CB} value.

[d] V_{CC} = 70 V, t_p = 20 μs

[e] $I_{B_1} = -I_{B_2}$.

BUW64A, BUW64B, BUW64C

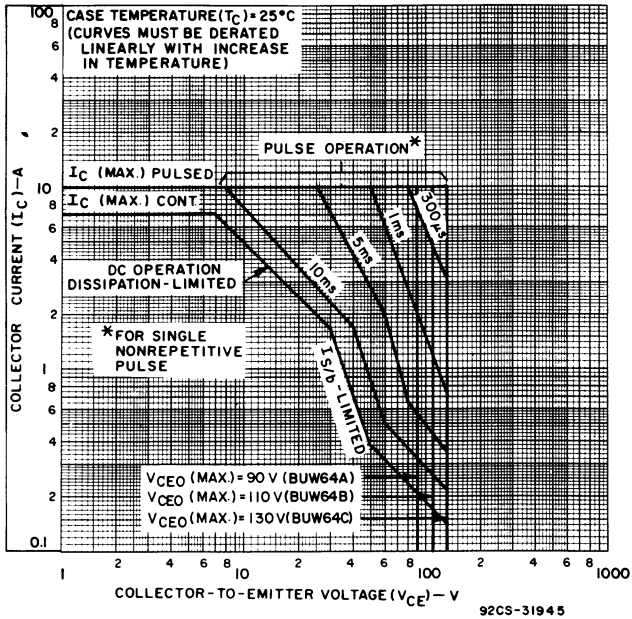


Fig. 1 – Maximum operating areas for all types (T_C = 25°C).

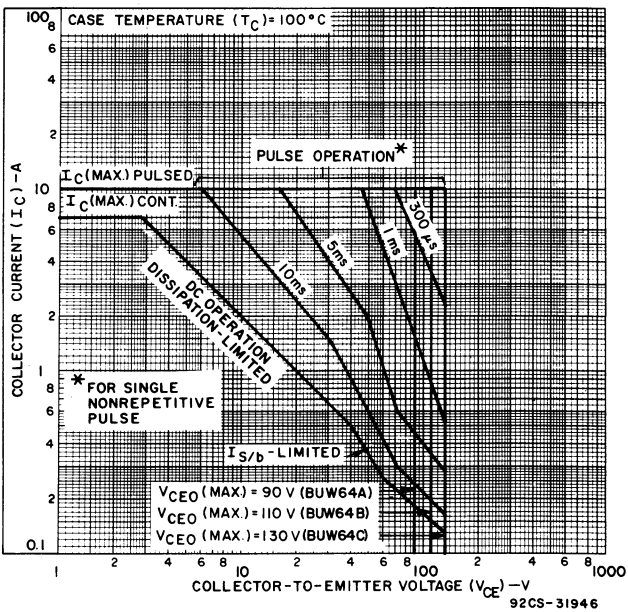


Fig. 2 – Maximum operating areas for all types (T_C = 100°C).

BUW64A, BUW64B, BUW64C

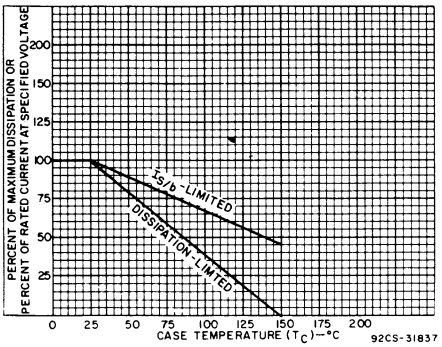


Fig. 3 — Dissipation and $I_{S/b}$ derating curves for all types.

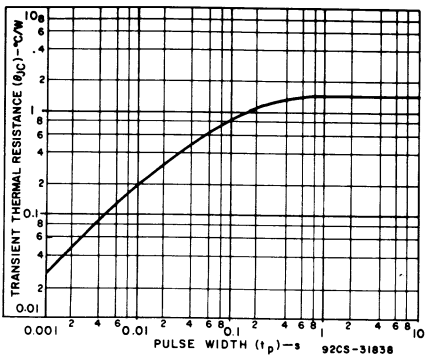


Fig. 4 — Typical thermal-response characteristic for all types.

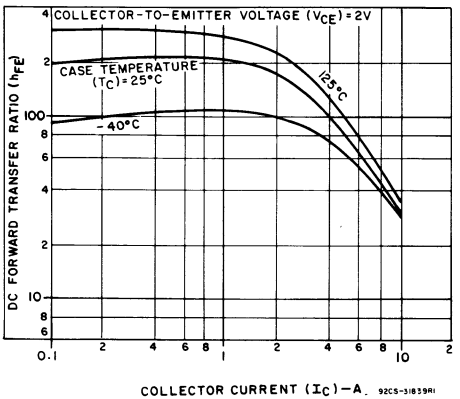


Fig. 5 — Typical dc beta characteristics for all types.

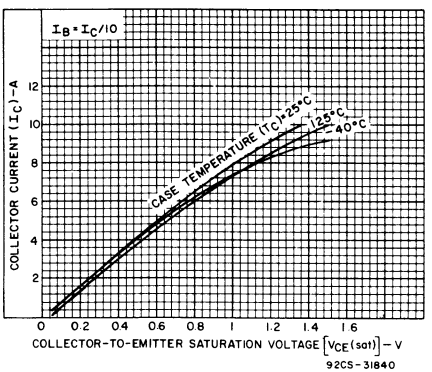


Fig. 6 — Typical collector-to-emitter saturation voltage characteristics for all types.

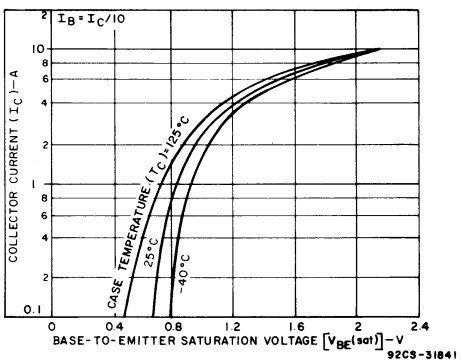


Fig. 7 — Typical base-to-emitter saturation voltage characteristic for all types.

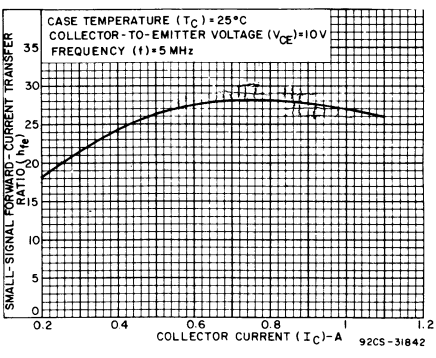


Fig. 8 — Typical small-signal forward-current transfer ratio characteristic for all types (f = 5 MHz).

BUW64A, BUW64B, BUW64C

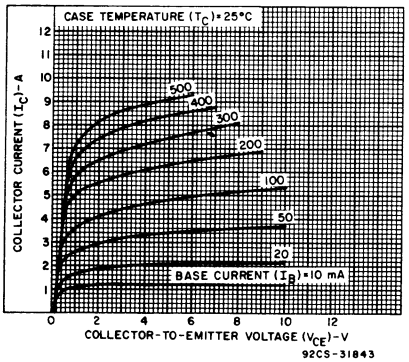


Fig. 9 — Typical output characteristics for all types.

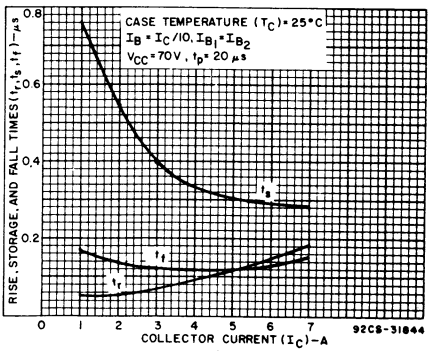


Fig. 10 — Typical saturated-switching-time characteristics as a function of collector current for all types (T_C = 25°C).

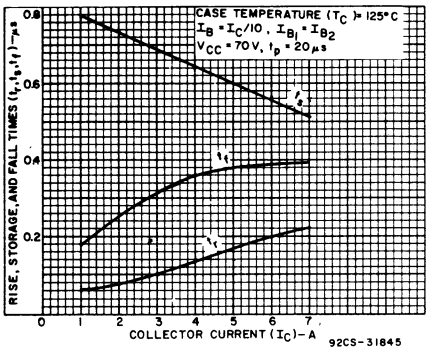


Fig. 11 — Typical saturated-switching-time characteristics as a function of collector current for all types (T_C = 125°C).

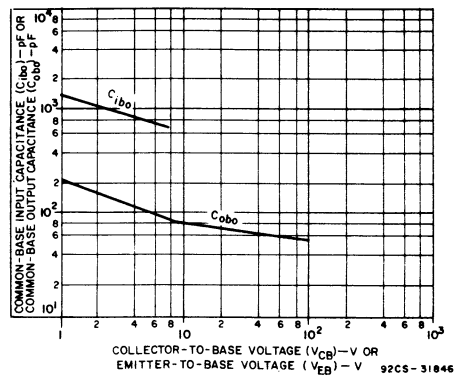


Fig. 12 — Typical common-base input (C_{ibo}) or output (C_{obo}) capacitance characteristic for all types.

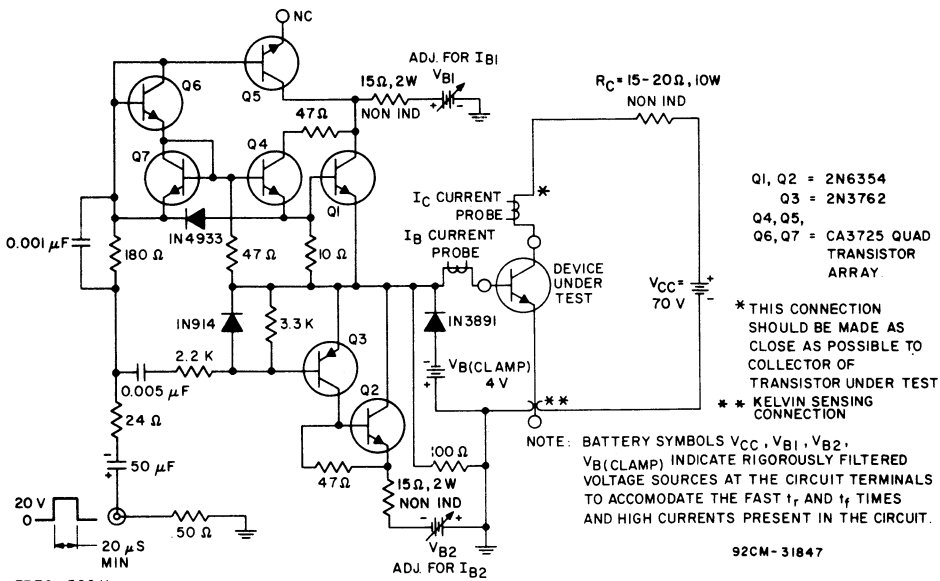
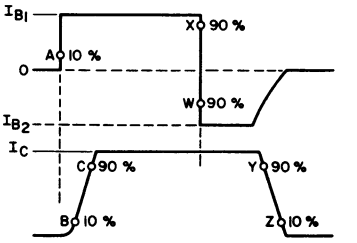


Fig. 13 — Circuit for measuring switching times.

BUW64A, BUW64B, BUW64C



t_d = A–B t_s = X–Y
t_r = B–C t_f = Y–Z
$t_{transition}$ = X–W
NOTE: TRANSITION TIME FROM 90% I_{B_1} TO 90% I_{B_2} MUST BE LESS THAN 0.5 μs.

Fig. 14 — Phase relationship between input and output currents showing reference points for specification of switching times.