HIGH SPEED
NPN POWER DARLINGTON TRANSISTORS

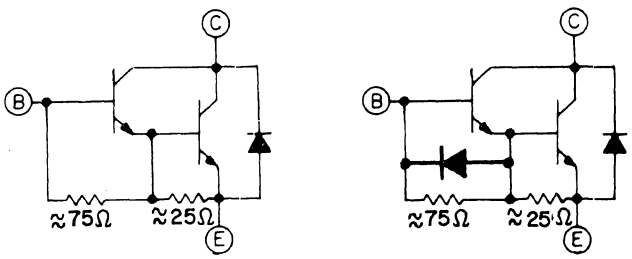
D64DS5,6,7
D64ES5,6,7

400-500 VOLTS
20 AMP, 125 WATTS

These devices are designed for use in high-speed switching applications, such as off-line switching power supplies PWM DC and AC motor control, UPS, ultrasonic equipment and other high frequency power conversion equipment.

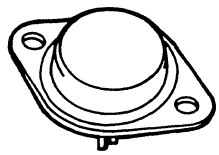
Features:

- High Speed: $t_s < 3.0\ \mu sec.$, $t_f < 1.0\ \mu sec.$
- High Voltage: 400-500 $V_{CEO(SUS)}$
- High Gain: h_{FE} 40 Minimum @ I_C = 20A
- High Current: 30 Amperes, I_C (Peak)



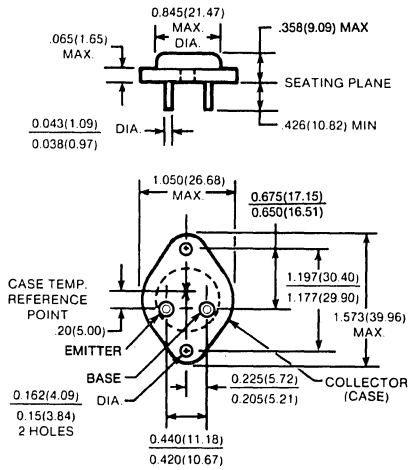
D64DS **D64ES**

DEVICE CIRCUIT



CASE STYLE TO-204AA (TO-3)

DIMENSIONS ARE IN INCHES AND (MILLIMETERS)



maximum ratings (T_C = 25°C) (unless otherwise noted)

RATING	SYMBOL	D64DS5/ES5	D64DS6/ES6	D64DS7/ES7	UNITS
Collector-Emitter Voltage	V_{CEV}	500	600	700	Volts
Collector-Emitter Voltage	V_{CEO}	400	450	500	Volts
Emitter Base Voltage D64DS D64ES	V_{EBO}	8 5	8 5	8 5	Volts
Collector Current — Continuous Peak (Repetitive) Peak (Non-Repetitive)	I_C I_{CM} I_{CSM}	20 30 50	20 30 50	20 30 50	A
Base Current — Continuous Peak (Non-Repetitive)	I_B I_{BM}	5 10	5 10	5 10	A
Total Power Dissipation @ T_C = 25°C	P_D	125	125	125	Watts
Operating and Storage Junction Temperature Range	T_J, T_{STG}	-65 to +150	-65 to +150	-65 to +150	°C

thermal characteristics

Thermal Resistance, Junction to Case	$R_{\theta JC}$	1	1	1	°C/W
Maximum Lead Temperature for Soldering Purposes: ⅛" from Case for 5 Seconds	T_L	300	300	300	°C

electrical characteristics (T_C = 25°C) (unless otherwise specified)

CHARACTERISTIC		SYMBOL	MIN	TYP	MAX	UNIT
off characteristics						
Collector-Emitter Sustaining Voltage (I_C = .5A, V_{clamp} = V_{CEO} Rated)	D64DS5/ES5	$V_{CEO(sus)}$	400	—	—	Volts
	D64DS6/ES6		450	—	—	
	D64DS7/ES7		500	—	—	
Collector Cutoff Current (V_{CE} = Rated Value, V_{BE} = -1.5V)	T_J = 25°C	I_{CEV}	—	—	1.0	mA
	T_J = 150°C		—	—	2.5	
Emitter Cutoff Current		I_{EBO}				
(V_{EB} = 4.5V, I_C = 0)	D64DS		—	—	200	mA
(V_{EB} = 1.5V, I_C = 0)	D64ES		—	—	200	
second breakdown						
Second Breakdown with Base Forward Biased		FBSOA	SEE FIGURE 26			
on characteristics						
DC Current Gain		h_{FE}				
(I_C = 30A, V_{CE} = 5V)			20	35	—	—
(I_C = 20A, V_{CE} = 5V)			40	85	—	
(I_C = 10A, V_{CE} = 5V)			100	160	—	
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$				
(I_C = 30A, I_B = 3A)			—	2.1	3.5	V
(I_C = 20A, I_B = 2A)			—	1.6	2.5	
(I_C = 10A, I_B = 1A)			—	1.2	1.5	
Base-Emitter Saturation Voltage		$V_{BE(sat)}$				
(I_C = 30A, I_B = 3A)			—	2.65	4	V
(I_C = 20A, I_B = 2A)			—	2.3	3	
(I_C = 10A, I_B = 1A)			—	1.8	2.5	

switching characteristics

Resistive Load				TYP. DS	TYP. ES	MAX. DS	MAX. ES	
Delay Time	V_{CC} = 250V	t_d	—	.05	.05	.5	.5	μs
Rise Time	I_C = 20A	t_r	—	.4	.4	1	1	
Storage Time	I_{B1} = 1A, I_{B2} = 2A	t_s	—	2.2	1.8	5	3	
Fall Time	t_p = 50 μsec	t_f	—	1.6	.45	3	1	

emitter-collector diode characteristics

Power Dissipation (I_{B1} = 0)		P_D	—	—	125	Watts
Forward Voltage	(I_F = 10A)	V_F	—	1.95	3.20	Volts
	(I_P = 25A)	V_F	—	2.80	4.00	Volts
	(I_F = 25A, T_J = 150°C)	V_F	—	2.75	4.00	Volts
Reverse Recovery Time (I_F = 25A, $di/_{dt}$ = 15A/μsec, R_{B1E} = .25Ω)		T_{rr}	—	3.85	10	μsec
Forward Turn-On Time (I_F = 25A, $di/_{dt}$ = 50A/μsec)		T_{ON}	—	0.42	1.0	μsec
Single Cycle Surge Current (60Hz)		I_{FSM}	—	—	50	Amps
Thermal Resistance		$R_{\theta JC}$	—	—	1.0	°C/Watt

TYPICAL CHARACTERISTICS

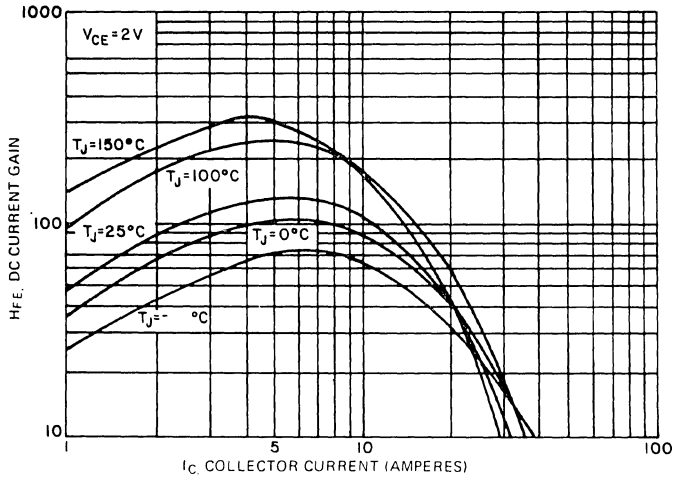


FIGURE 1. DC CURRENT GAIN (V_{CE} = 2V)

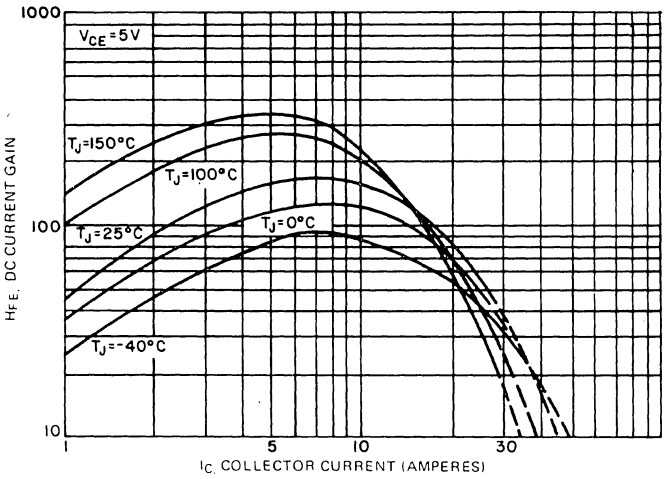


FIGURE 2. DC CURRENT GAIN (V_{CE} = 5V)

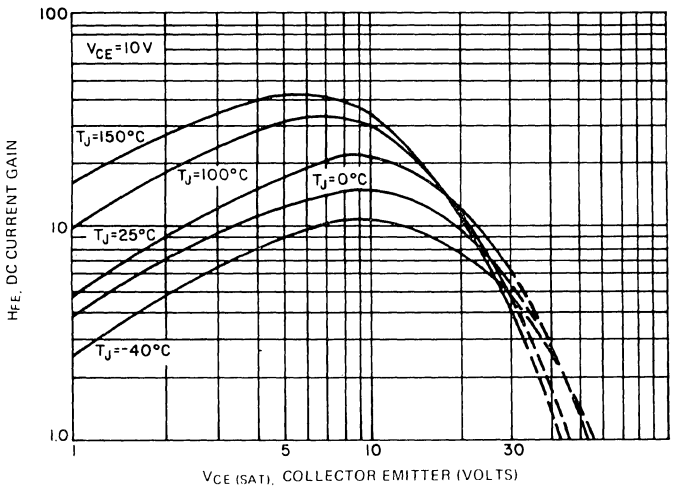


FIGURE 3. DC CURRENT GAIN (V_{CE} = 10V)

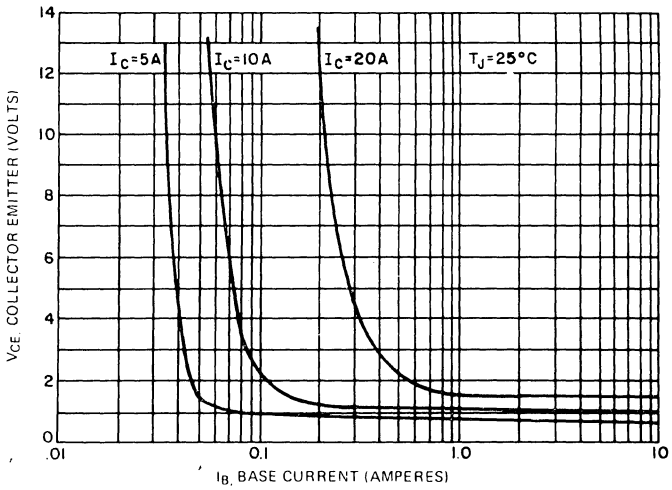


FIGURE 4. COLLECTOR SATURATION REGION

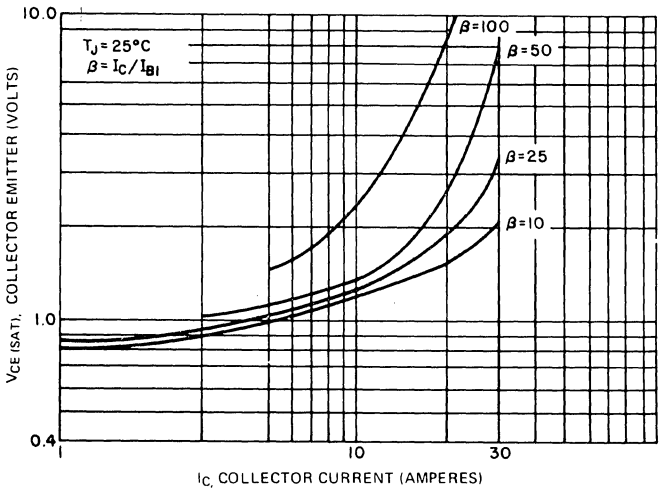


FIGURE 5. $V_{CE(SAT)}$ VS. I_C, T_J = 25°C

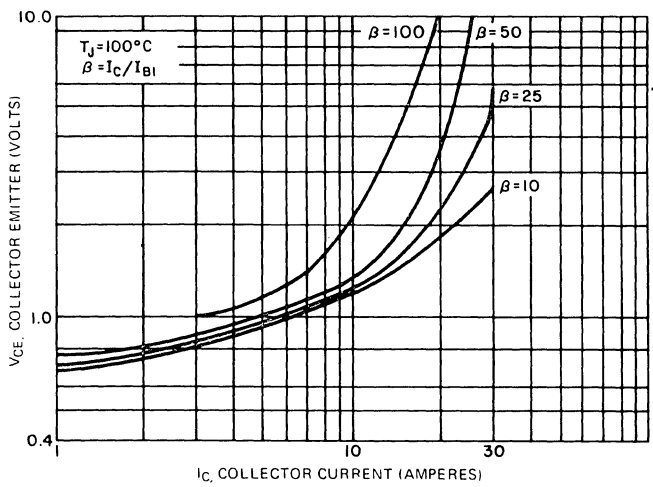


FIGURE 6. $V_{CE(SAT)}$ VS. I_C, T_J = 100°C

TYPICAL CHARACTERISTICS

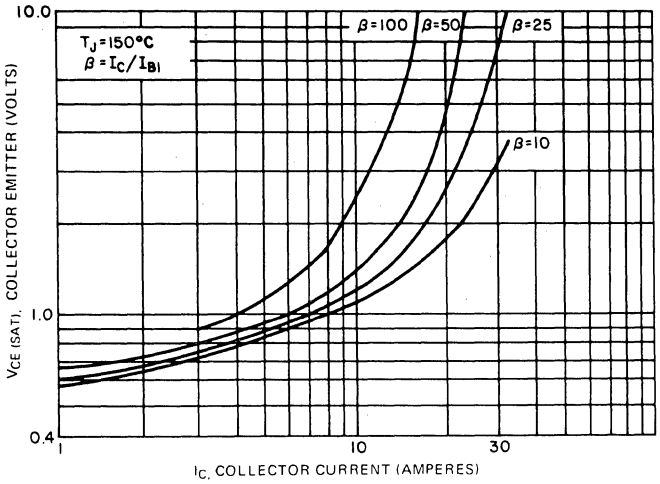


FIGURE 7. $V_{CE(SAT)}$ VS. I_C, T_J = 150°C

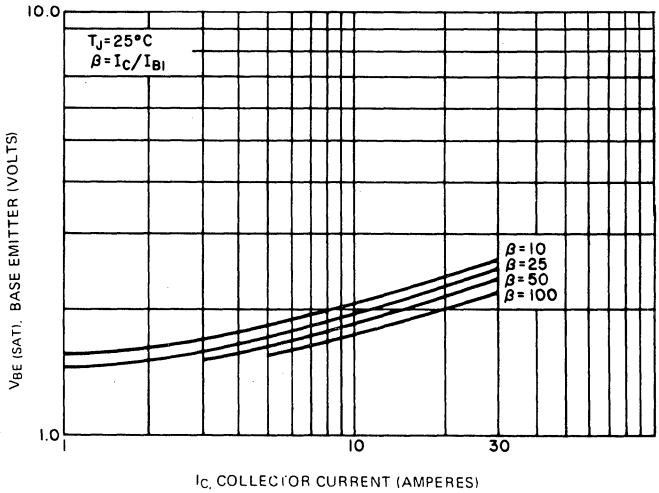


FIGURE 8. $V_{BE(SAT)}$ VS. I_C, T_J = 25°C

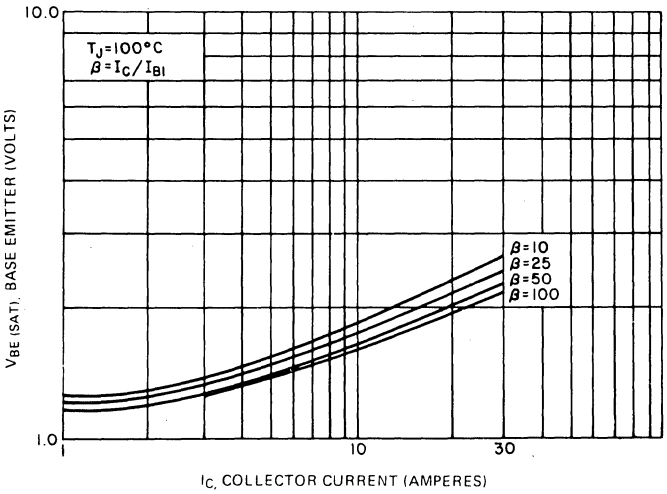


FIGURE 9. $V_{BE(SAT)}$ VS. I_C, T_J = 100°C

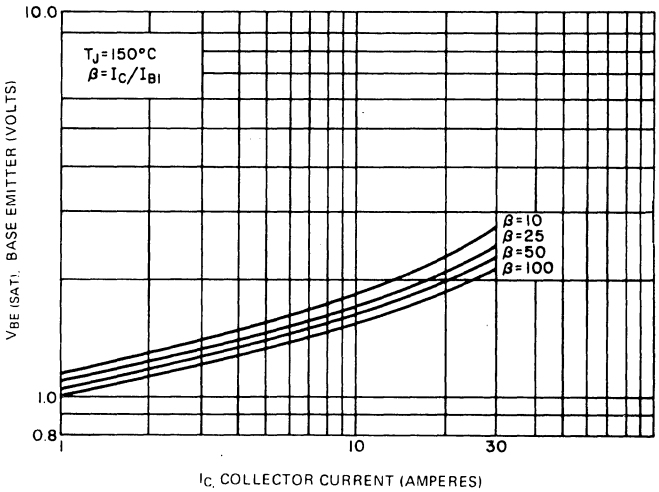


FIGURE 10. $V_{BE(SAT)}$ VS. I_C, T_J = 150°C

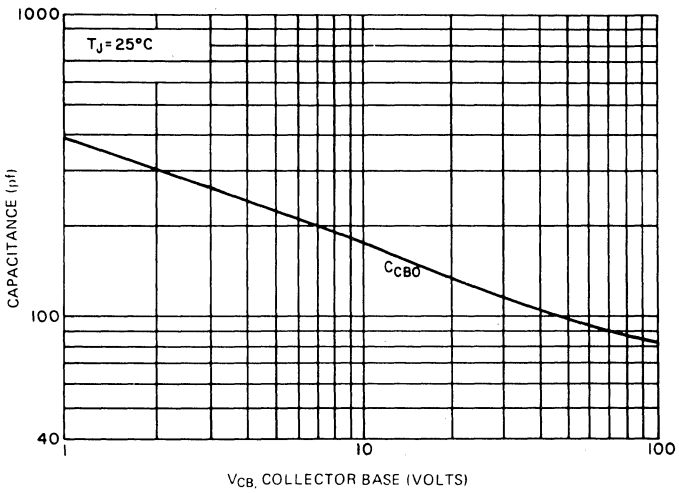


FIGURE 11. CAPACITANCE (C_{CBO})

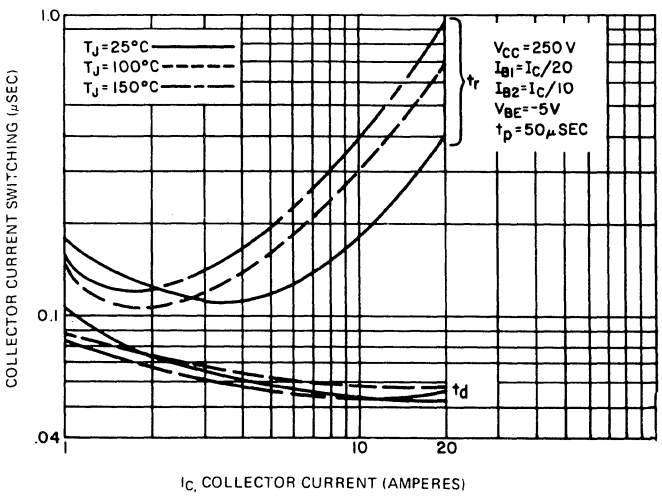


FIGURE 12. TURN-ON TIME (RESISTIVE LOAD) (D64DS ONLY)

TYPICAL CHARACTERISTICS

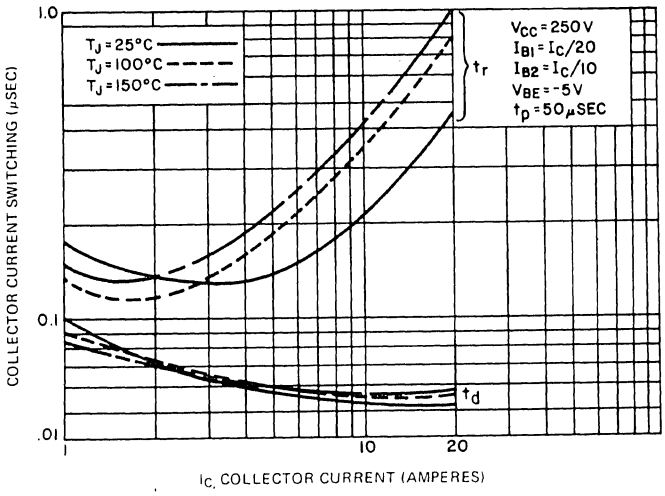


FIGURE 13. TURN-ON TIME (RESISTIVE) (D64ES ONLY)

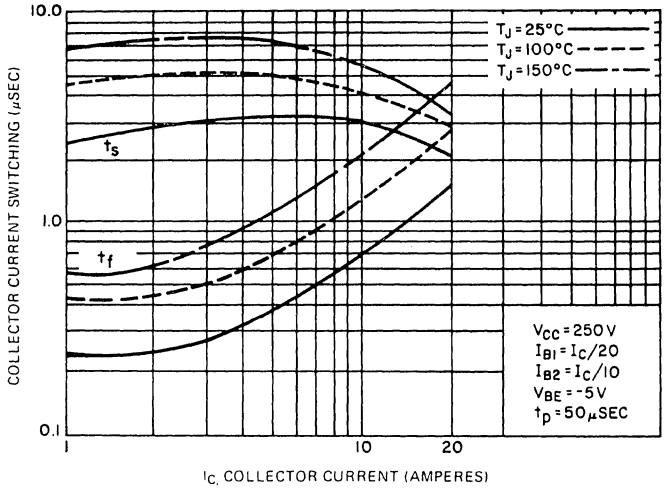


FIGURE 14. TURN-OFF TIME (RESISTIVE) (D64DS ONLY)

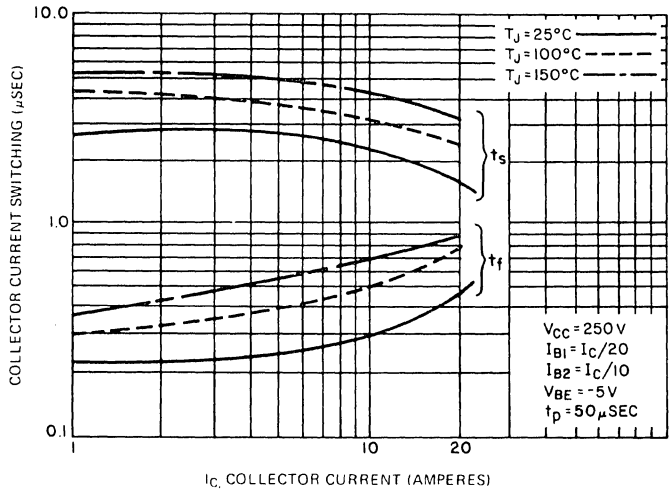


FIGURE 15. TURN-OFF TIME (RESISTIVE) (D64ES ONLY)

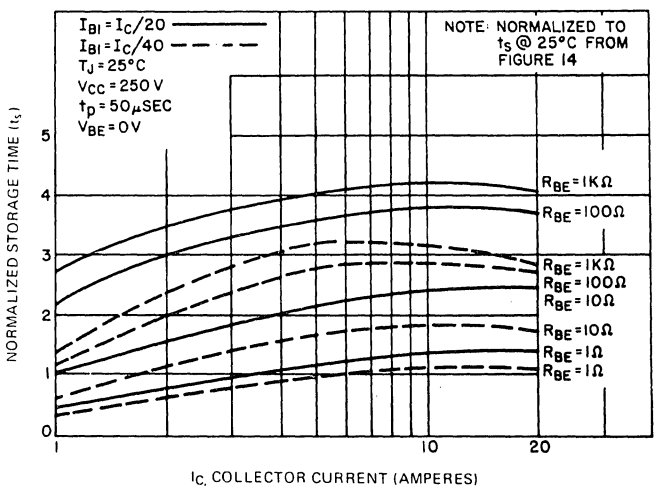


FIGURE 16. NORMALIZED RESISTIVE SWITCHING STORAGE TIME (R_{BE} VARIATIONS) VS. COLLECTOR CURRENT (D64DS ONLY)

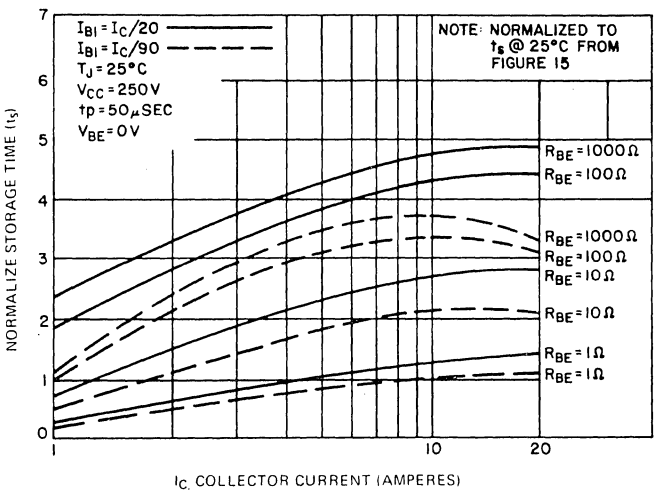


FIGURE 17. NORMALIZED RESISTIVE SWITCHING STORAGE TIME (R_{BE} VARIATIONS) VS. COLLECTOR CURRENT (D64ES ONLY)

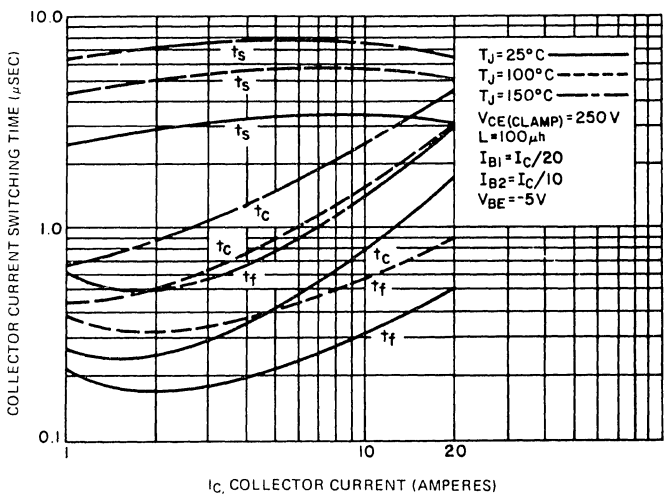


FIGURE 18. CLAMPED INDUCTIVE TURN-OFF TIME (D64DS ONLY)

TYPICAL CHARACTERISTICS

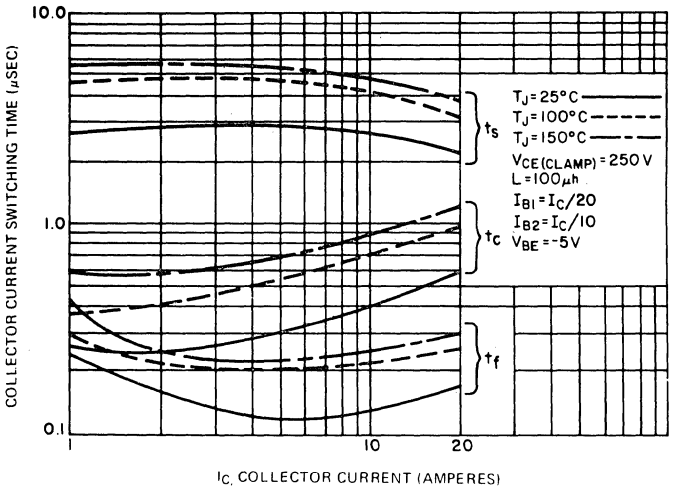


FIGURE 19. CLAMPED INDUCTIVE TURN-OFF TIME (D64ES ONLY)

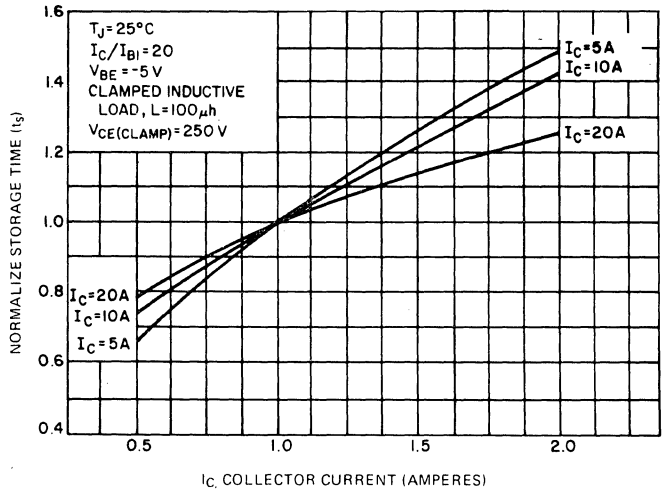


FIGURE 20. STORAGE TIME VARIATION WITH I_{B2} (D64DS ONLY)

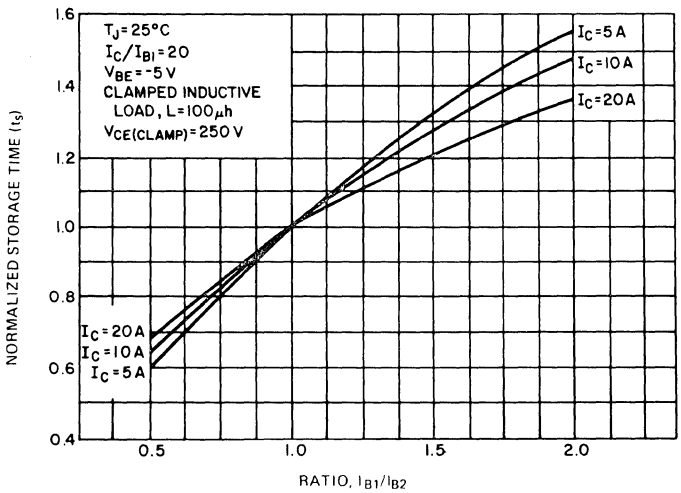


FIGURE 21. STORAGE TIME VARIATION WITH I_{B2} (D64ES ONLY)

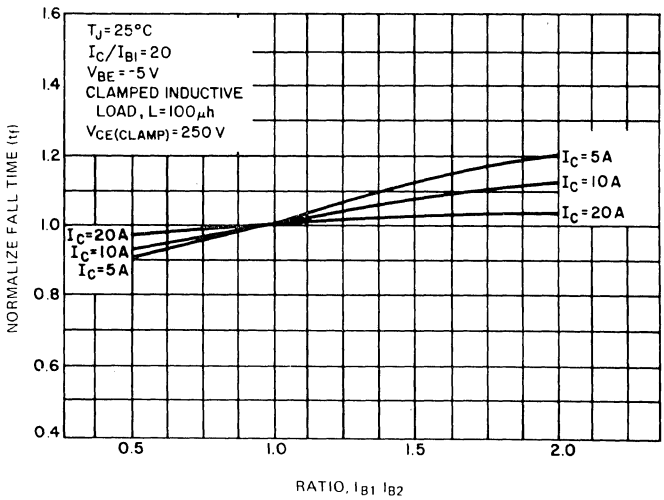


FIGURE 22. FALL TIME VARIATION WITH I_{B2} (D64DS ONLY)

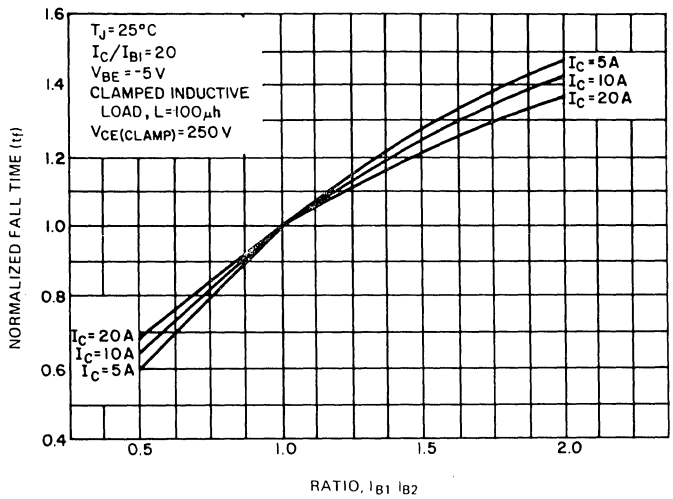


FIGURE 23. FALL TIME VARIATION WITH I_{B2} (D64ES ONLY)

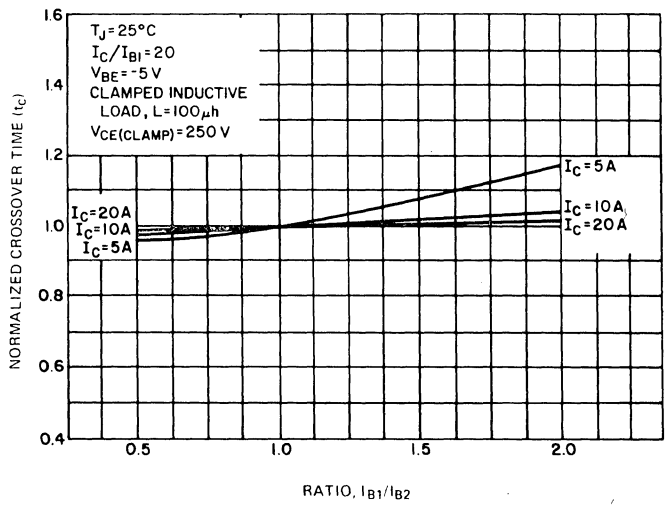


FIGURE 24. CROSS-OVER TIME VARIATION WITH I_{B2} (D64DS ONLY)

TYPICAL CHARACTERISTICS

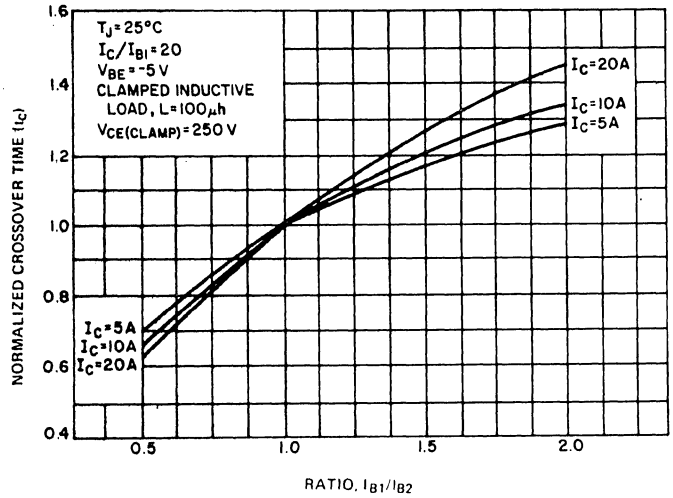


FIGURE 25. CROSS-OVER TIME VARIATION WITH I_{B2} (D64ES ONLY)

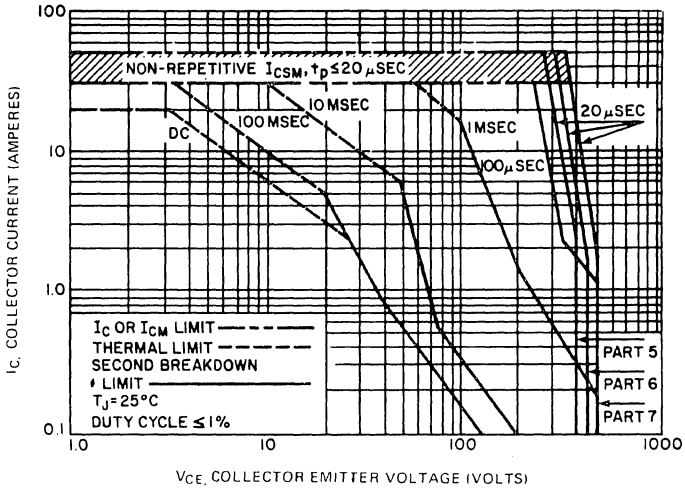


FIGURE 26. FORWARD BIAS SAFE OPERATING AREA

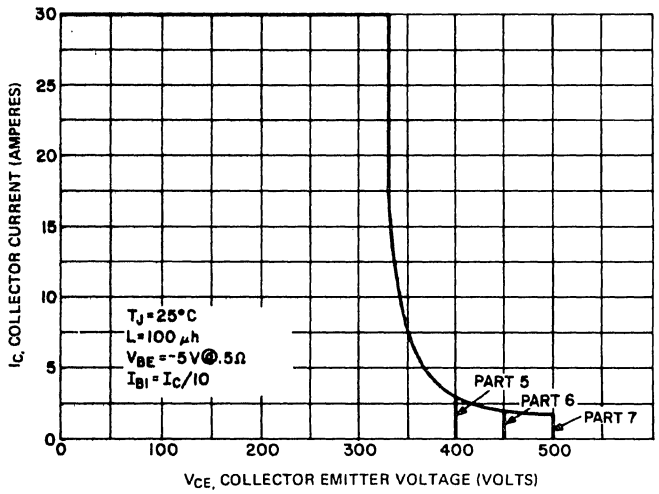


FIGURE 27. REVERSE BIAS SAFE OPERATING AREA

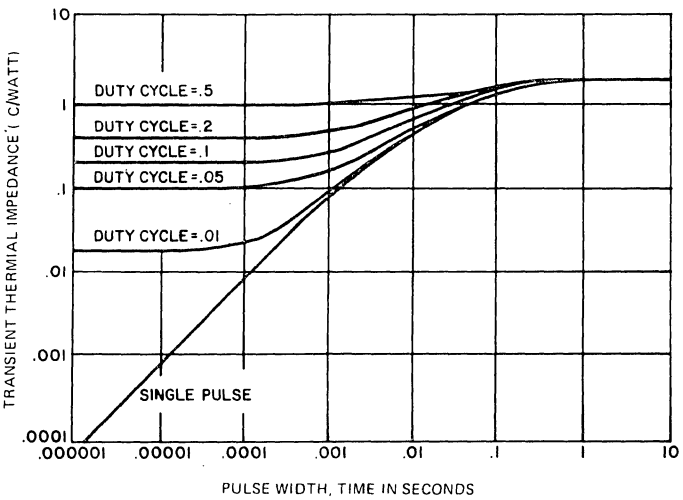


FIGURE 28. TRANSIENT THERMAL RESPONSE

DIODE CHARACTERISTICS

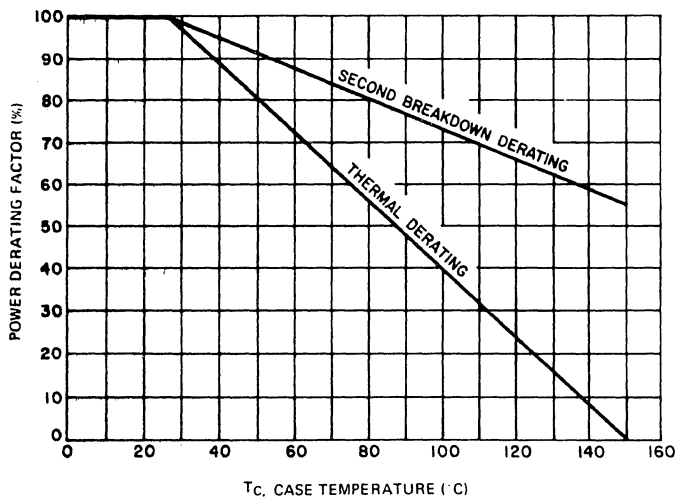


FIGURE 29. POWER DERATING

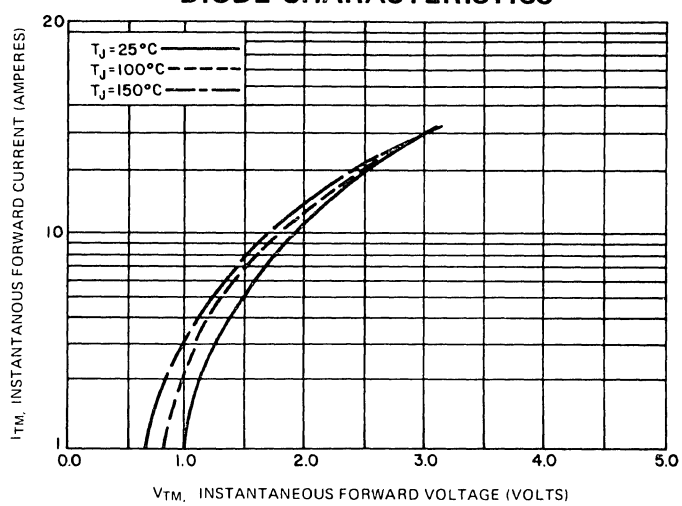


FIGURE 30. FORWARD CHARACTERISTICS

TYPICAL CHARACTERISTICS

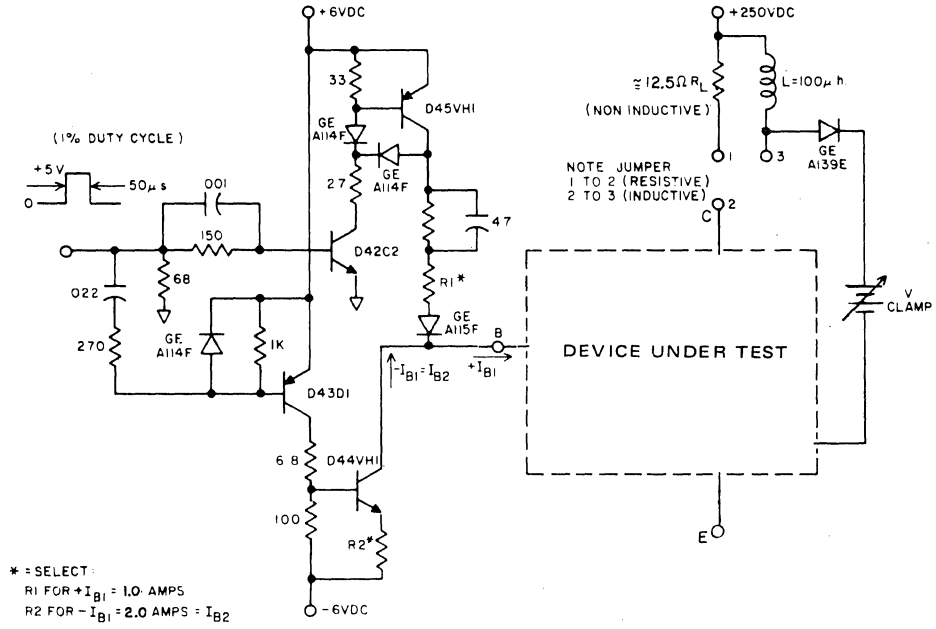


FIGURE 31. SWITCHING TIME TEST CIRCUIT