D64DS5,6,7
D64ES5,6,7

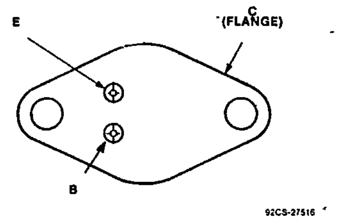
File Number **15.34**

HARRIS SEMICOND SECTOR 27E D ■ 4302271 0020361 5 ■HAS

T-33-29

20-Ampere N-P-N Darlington Power Transistors

TERMINAL DESIGNATIONS

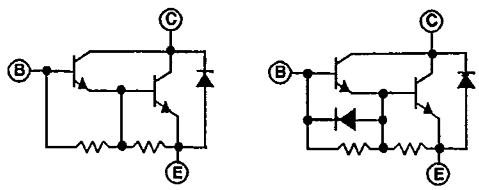


JEDEC TO-204AA

2

Features:
- *High speed $t_s < 3.0$ µsec., $t_r < 1.0$ µsec.*
- *High voltage: 400-500 $V_{CEO(SUS)}$*
- *High gain: h_{FE} 40 minimum @ I_C = 20A*
- *High current: 30 amperes, I_C (Peak)*

The D64DS and D64ES series of silicon n-p-n power Darlington transistors are designed for use in high-speed switching applications. These applications include off-line switching power supplies, PWM ac and dc motor controls, UPS systems, ultrasonic equipment, and other high-frequency power conversion equipment.



D64DS D64ES

DEVICE CIRCUIT

MAXIMUM RATINGS (T_A = 25° C) (unless otherwise specified)

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

D64DS5,6,7
D64ES5,6,7

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ELECTRICAL CHARACTERISTICS (T_C = 25°C) (unless otherwise specified)

CHARACTERISTIC		SYMBOL	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Collector-Emitter Sustaining Voltage (I_C = 0.5A) (V_{clamp} = V_{CEO} Rated)	D64DS5/ES5 D64DS6/ES6 D64DS7/ES7	$V_{CEO(sus)}$	400 450 500	— — —	— — —	Volts
Collector Cutoff Current (V_{CE} = Rated Value, V_{BE} = -1.5V)	T_J = 25°C T_J = 150°C	I_{CEV}	— —	— —	1.0 2.5	mA
Emitter Cutoff Current (V_{EB} = 4.5V, I_C = 0) (V_{EB} = 1.5V, I_C = 0)	D64DS D64ES	I_{EBO}	— —	— —	200 200	mA
SECOND BREAKDOWN						
Second Breakdown with Base Forward Biased		FBSOA	SEE FIGURE 26			
ON CHARACTERISTICS						
DC Current Gain (I_C = 30A, V_{CE} = 5V) (I_C = 20A, V_{CE} = 5V) (I_C = 10A, V_{CE} = 5V)		h_{FE}	20 40 100	35 85 160	— — —	—
Collector-Emitter Saturation Voltage (I_C = 30A, I_B = 3A) (I_C = 20A, I_B = 2A) (I_C = 10A, I_B = 1A)		$V_{CE(sat)}$	— — —	2.1 1.6 1.2	3.5 2.5 1.5	V
Base-Emitter Saturation Voltage (I_C = 30A, I_B = 3A) (I_C = 20A, I_B = 2A) (I_C = 10A, I_B = 1A)		$V_{BE(sat)}$	— — —	2.65 2.3 1.8	4 3 2.5	V

SWITCHING CHARACTERISTICS

Resistive Load				TYP. DS	TYP. ES	MAX. DS	MAX. ES	
Delay Time	V_{CC} = 250V	t_d	—	0.05	0.05	0.5	0.5	μsec
Rise Time	I_C = 20A	t_r	—	0.4	0.4	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

Characteristic		Symbol	Min	Typ	Max	Unit
Power Dissipation		P_D	—	—	125	Watts
Forward Voltage	(I_F = 10A) (I_P = 25A) (I_F = 25A, T_J = 150°C)	V_F V_F V_F	— — —	1.95 2.80 2.75	3.20 4.00 4.00	Volts Volts 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

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D64ES5,6,7

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TYPICAL CHARACTERISTICS

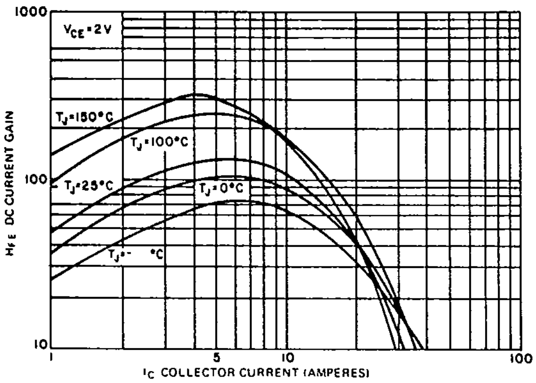

FIGURE 1. DC CURRENT GAIN (V_{CE} = 2V)

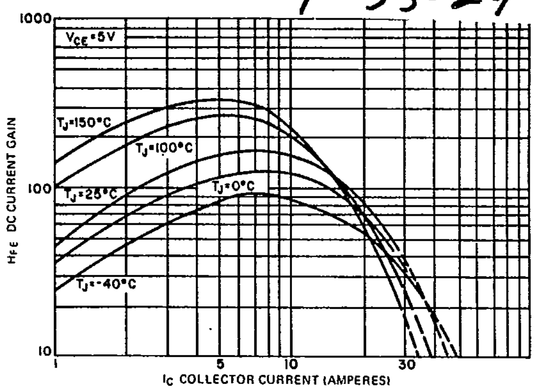

FIGURE 2. DC CURRENT GAIN (V_{CE} = 5V)

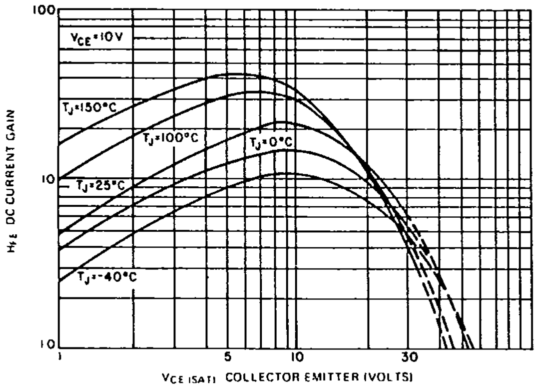

FIGURE 3. DC CURRENT GAIN (V_{CE} = 10V)

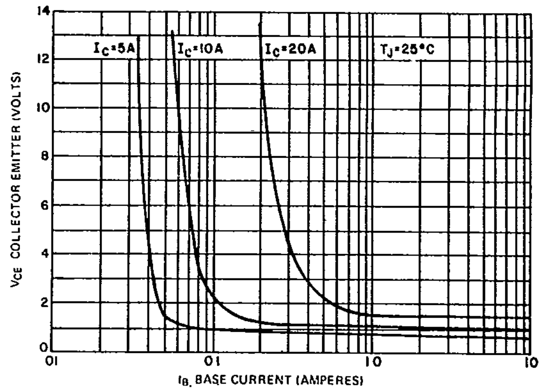

FIGURE 4. COLLECTOR SATURATION REGION

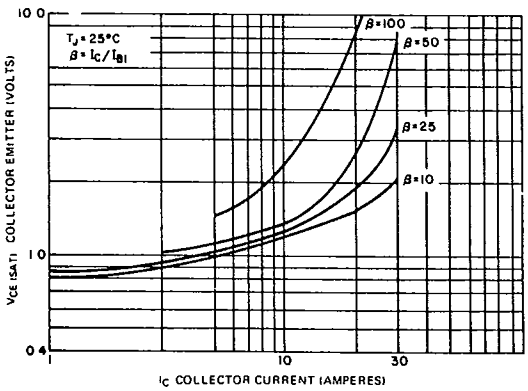

FIGURE 5. $V_{CE(SAT)}$ VS. I_C, T_J = 25°C

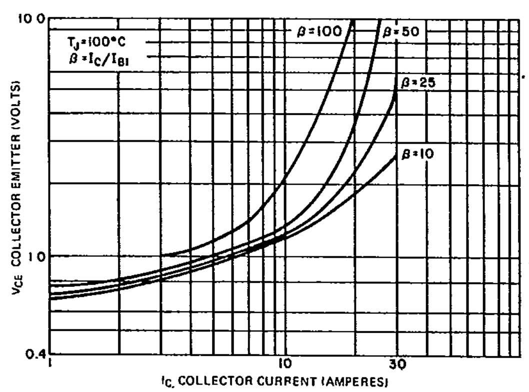

FIGURE 6. $V_{CE(SAT)}$ VS. I_C, T_J = 100°C

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D64ES5,6,7

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TYPICAL CHARACTERISTICS

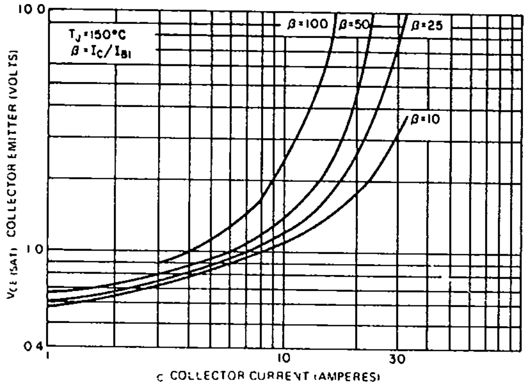

FIGURE 7. $V_{CE(SAT)}$ VS. I_C, T_J = 150°C

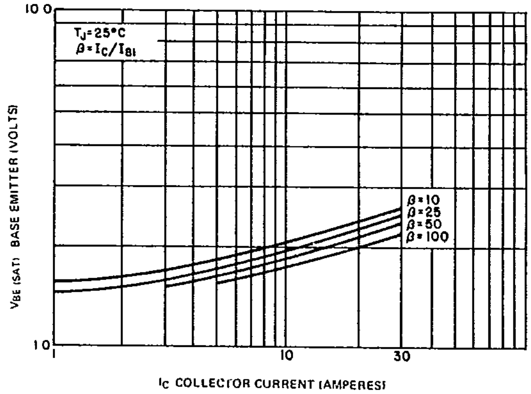

FIGURE 8. $V_{BE(SAT)}$ VS. I_C, T_J = 25°C

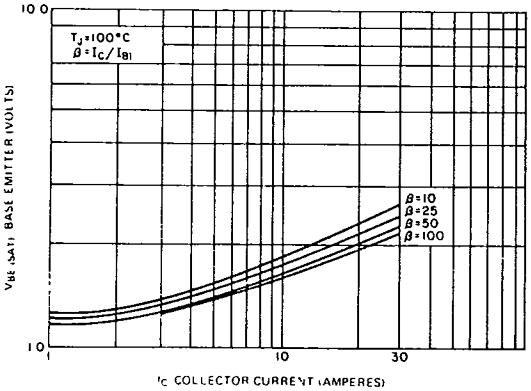

FIGURE 9. $V_{BE(SAT)}$ VS. I_C, T_J = 100°C

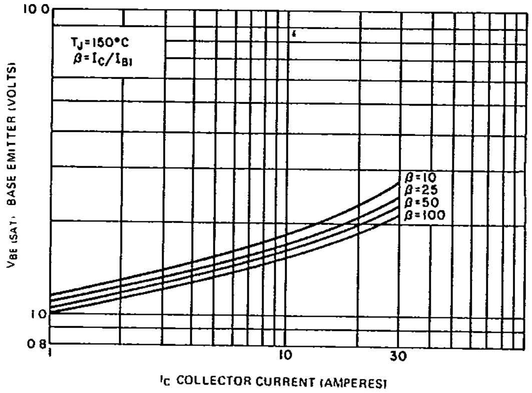

FIGURE 10. $V_{BE(SAT)}$ VS. I_C, T_J = 150°C

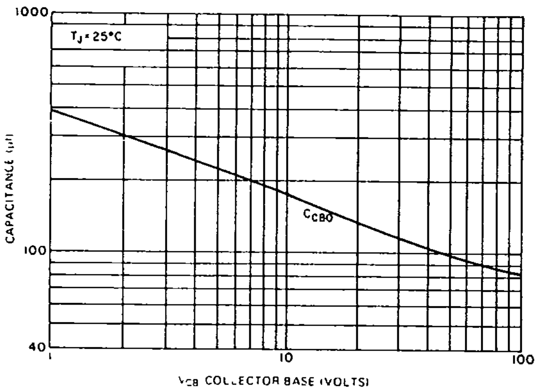

FIGURE 11. CAPACITANCE (C_{CBO})

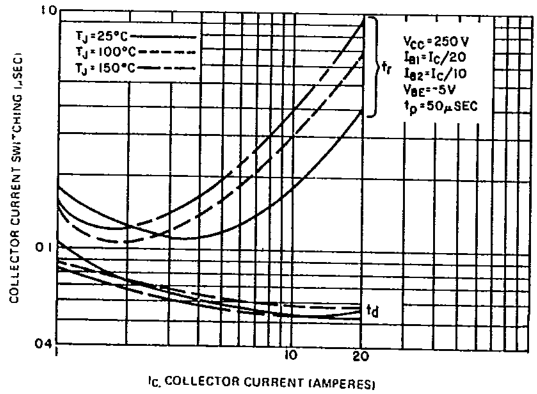

FIGURE 12. TURN-ON TIME (RESISTIVE LOAD) (D64DS ONLY)

TYPICAL CHARACTERISTICS

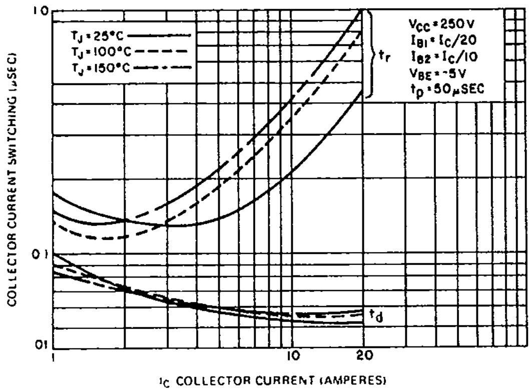

FIGURE 13. TURN-ON TIME (RESISTIVE) (D64ES ONLY)

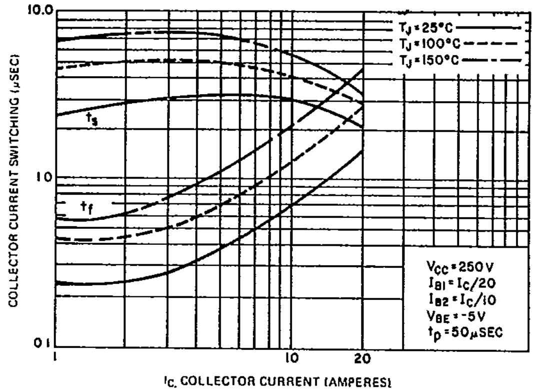

FIGURE 14. TURN-OFF TIME (RESISTIVE) (D64DS ONLY)

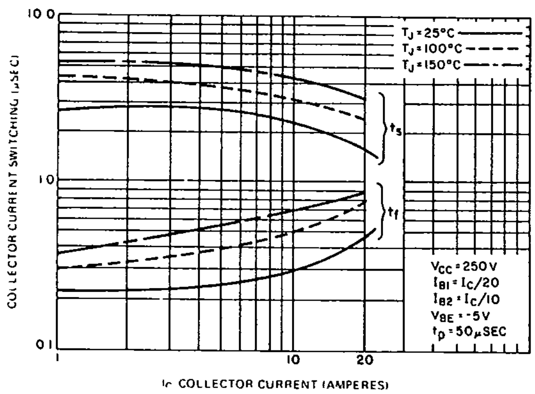

FIGURE 15. TURN-OFF TIME (RESISTIVE) (D64ES ONLY)

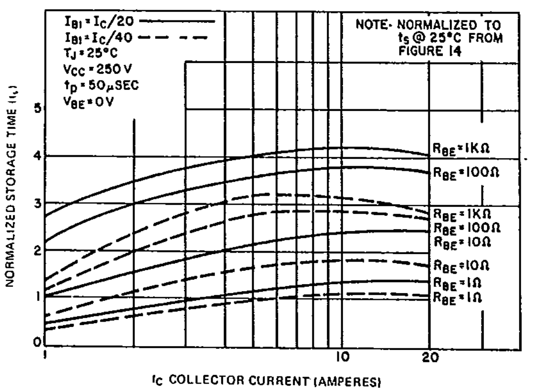

FIGURE 16. NORMALIZED RESISTIVE SWITCHING STORAGE TIME (R_{BE} VARIATIONS) VS. COLLECTOR CURRENT (D64DS ONLY)

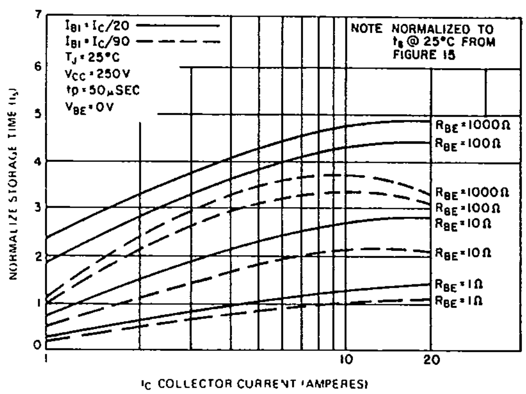

FIGURE 17. NORMALIZED RESISTIVE SWITCHING STORAGE TIME (R_{BE} VARIATIONS) VS. COLLECTOR CURRENT (D64ES ONLY)

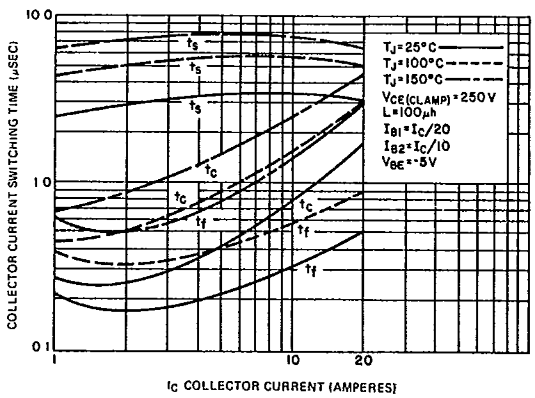

FIGURE 18. CLAMPED INDUCTIVE TURN-OFF TIME (D64DS ONLY)

D64DS5,6,7
D64ES5,6,7

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TYPICAL CHARACTERISTICS

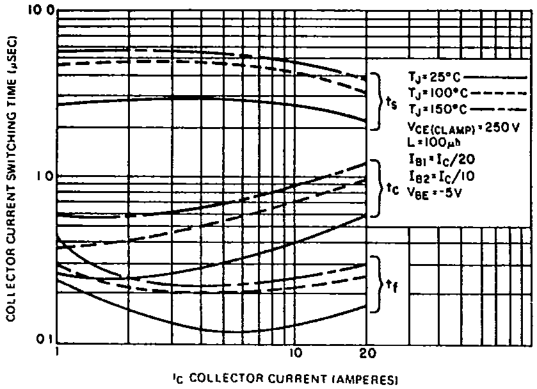

FIGURE 19. CLAMPED INDUCTIVE TURN-OFF TIME (D64ES ONLY)

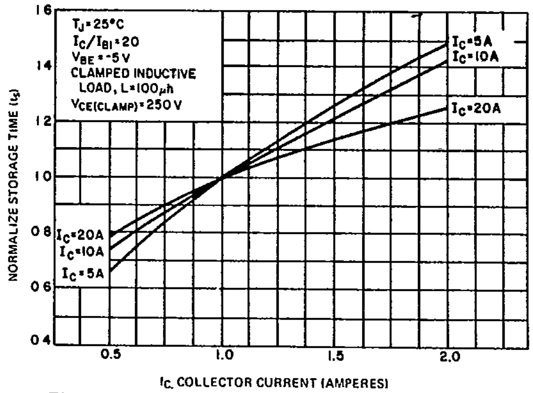

FIGURE 20. STORAGE TIME VARIATION WITH I_{B2} (D64DS ONLY)

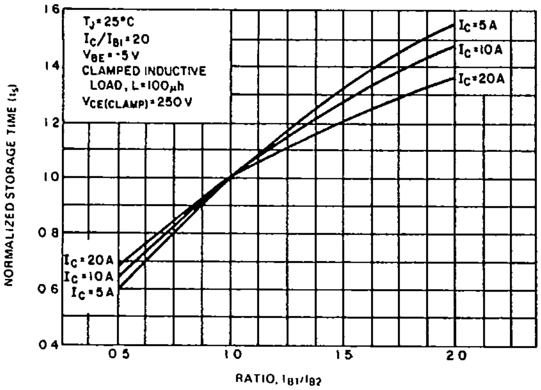

FIGURE 21. STORAGE TIME VARIATION WITH I_{B2} (D64ES ONLY)

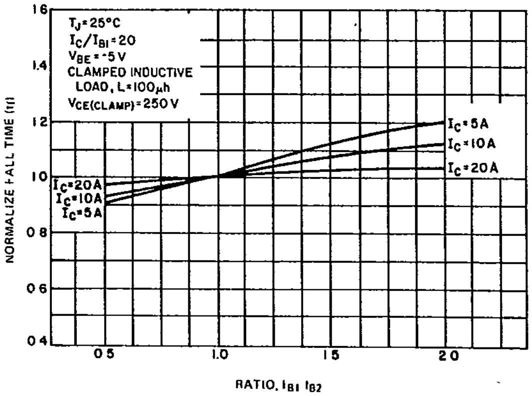

FIGURE 22. FALL TIME VARIATION WITH I_{B2} (D64DS ONLY)

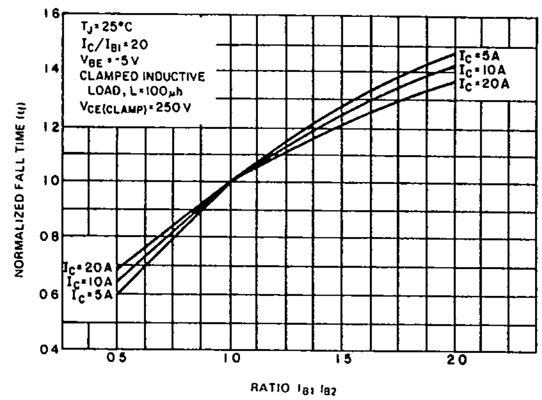

FIGURE 23. FALL TIME VARIATION WITH I_{B2} (D64ES ONLY)

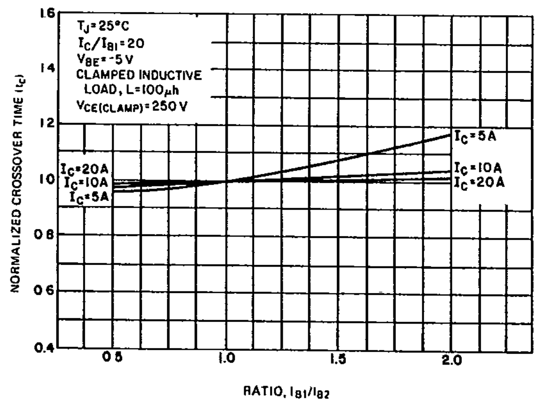

FIGURE 24. CROSS-OVER TIME VARIATION WITH I_{B2} (D64DS ONLY)

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D64DS5,6,7
D64ES5,6,7

TYPICAL CHARACTERISTICS

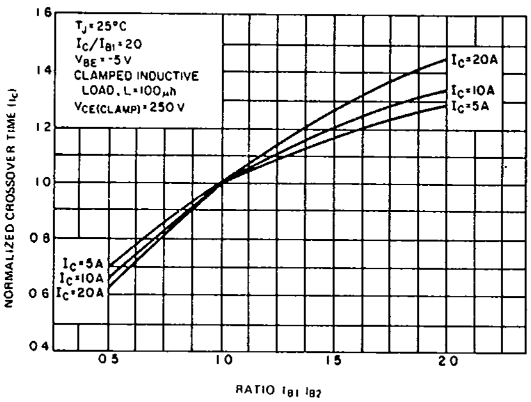

FIGURE 25. CROSS-OVER TIME VARIATION WITH I_{B2} (D64ES ONLY)

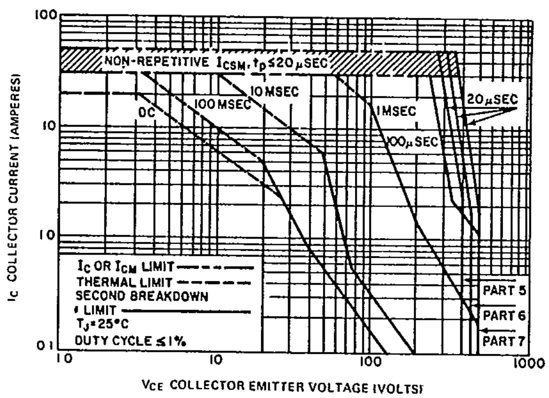

FIGURE 26. FORWARD BIAS SAFE OPERATING AREA

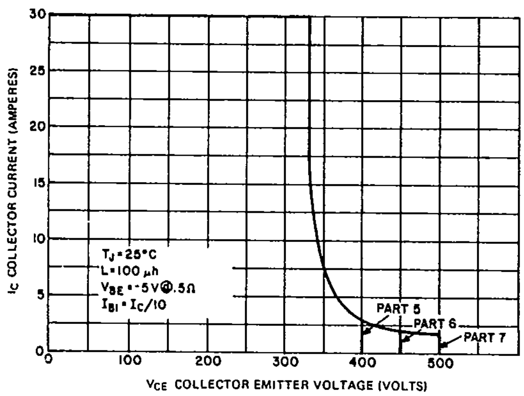

FIGURE 27. REVERSE BIAS SAFE OPERATING AREA

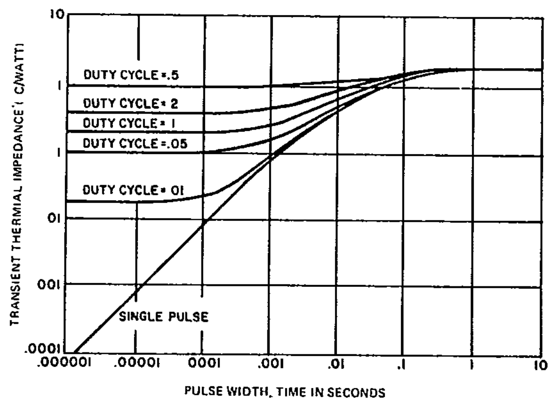

FIGURE 28. TRANSIENT THERMAL RESPONSE

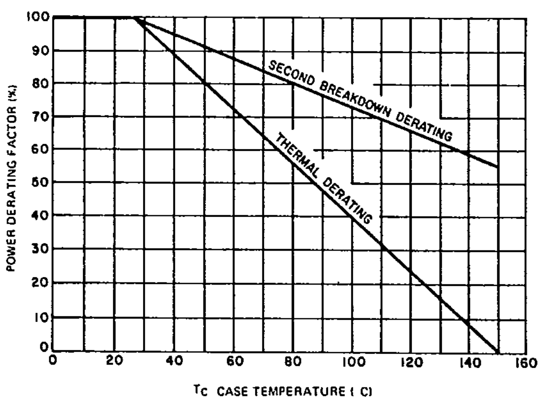

FIGURE 29. POWER DERATING

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D64DS5,6,7
D64ES5,6,7

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TYPICAL CHARACTERISTICS

HARRIS SEMICOND SECTOR 27E D ■ 4302271 0020368 8 ■HAS

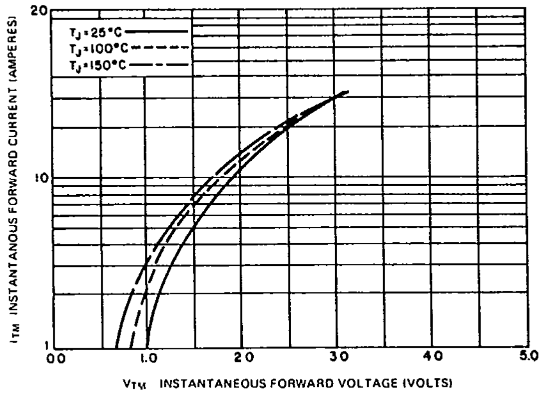

FIGURE 30. DIODE CHARACTERISTICS

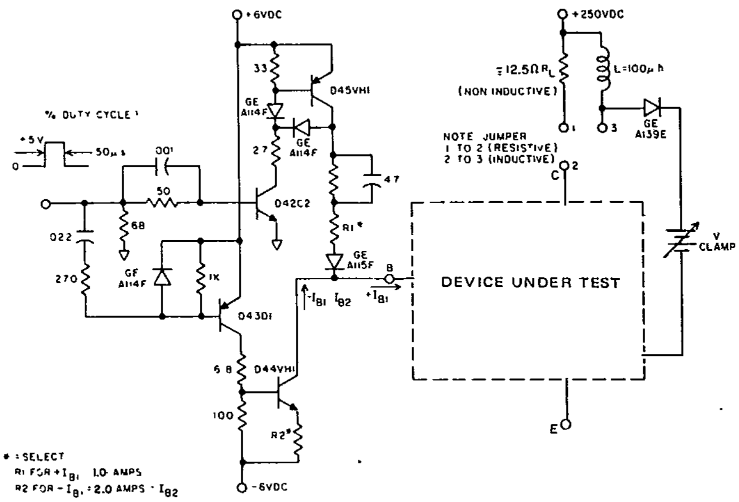

FIGURE 31. SWITCHING TIME TEST CIRCUIT