TYPES 2N3583, 2N3584, 2N3585, 2N4240
N-P-N SILICON POWER TRANSISTORS

TYPES 2N3583, 2N3584, 2N3585, 2N4240
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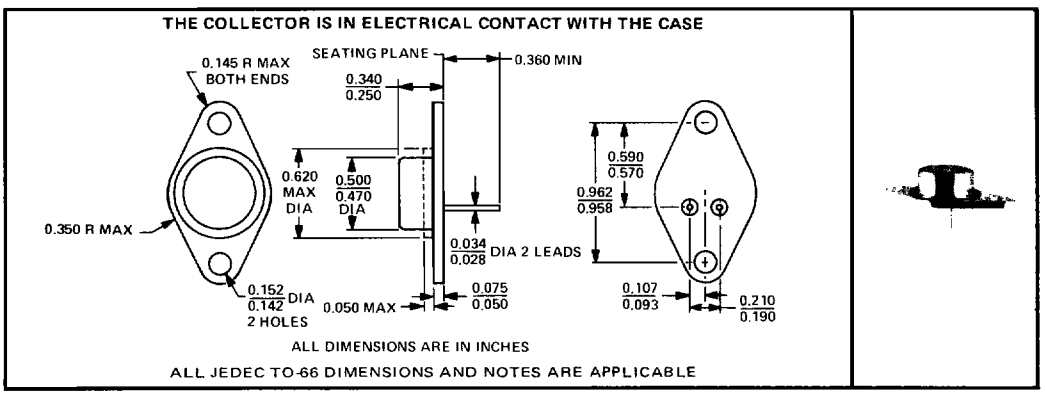
5

HIGH-VOLTAGE POWER TRANSISTORS
DESIGNED FOR INDUSTRIAL AND MILITARY APPLICATIONS

- Min $V_{(BR)CEO}$ of 300 V (2N3585, 2N4240)
- Typ $V_{CE(sat)}$ of 0.25 V at I_B = 125 mA, I_C = 1 A
- Typ t_{on} of 0.2 μs, at 750 mA, 200 V (2N4240)
- Min f_T of 15 MHz at 10 V, 200 mA (2N4240)
- 35 W at 25°C Case Temperature

***mechanical data**



absolute maximum ratings at 25°C case temperature (unless otherwise noted)

	2N3583	2N3584	2N3585	2N4240
Collector-Base Voltage	250 V*	375 V*	500 V*	500 V*
Collector-Emitter Voltage (See Note 1)	175 V*	250 V*	300 V*	300 V*
Emitter-Base Voltage	6 V*			
Continuous Collector Current	1 A*	2 A*	2 A*	2 A*
Peak Collector Current (See Note 2)	5 A*	5 A*	5 A*	5 A*
Continuous Base Current	1 A*			
Safe Operating Area at 100°C Case Temperature	See Figure 5			
Continuous Device Dissipation at (or below) 25°C Case Temperature (See Note 3)	35 W*			
Continuous Device Dissipation at 100°C Case Temperature (See Note 3)	20 W*			
Continuous Device Dissipation at (or below) 25°C Free-Air Temperature (See Note 4)	2 W			
Operating Collector Junction Temperature Range	−65°C to 200°C*			
Storage Temperature Range	−65°C to 200°C*			
Terminal Temperature 1/32 Inch from Case for 10 Seconds	235°C*			

NOTES: 1. This value applies when the base-emitter diode is open-circuited.
2. This value applies for $t_w \leq 0.3$ ms, duty cycle $\leq 10\%$.
3. Derate linearly to 200°C case temperature at the rate of 0.2 W/°C.
4. Derate linearly to 200°C free-air temperature at the rate of 11.4 mW/°C.

*JEDEC registered data. This data sheet contains all applicable registered data in effect at the time of publication.

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TYPES 2N3583, 2N3584, 2N3585, 2N4240
N-P-N SILICON POWER TRANSISTORS

*electrical characteristics at 25°C case temperature (unless otherwise noted)

PARAMETER		TEST CONDITIONS		2N3583		2N3584		2N3585		2N4240		UNIT
				MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	I_C = 200 mA, I_B = 0,	See Note 5	175		250		300		300		V
I_{CEO}	Collector Cutoff Current	V_{CE} = 150 V, I_B = 0			10							mA
I_{CEV}	Collector Cutoff Current	V_{CE} = 225 V, V_{BE} = −1.5 V			1							mA
		V_{CE} = 340 V, V_{BE} = −1.5 V					1					
		V_{CE} = 450 V, V_{BE} = −1.5 V							1		2	
		V_{CE} = 225 V, V_{BE} = −1.5 V, T_C = 150°C			3							
		V_{CE} = 300 V, V_{BE} = −1.5 V, T_C = 150°C					3		3		5	
I_{EBO}	Emitter Cutoff Current	V_{EB} = 6 V, I_C = 0			5		0.5		0.5		0.5	mA
h_{FE}	Static Forward Current Transfer Ratio	V_{CE} = 10 V, I_C = 0.5 A	See Notes 5 and 6	40	200							
		V_{CE} = 10 V, I_C = 1 A		10								
		V_{CE} = 2 V, I_C = 1 A				8	80	8	80			
		V_{CE} = 2 V, I_C = 0.75 A								10	100	
V_{BE}	Base-Emitter Voltage	I_B = 75 mA, I_C = 0.75 A	See Notes 5 and 6								1.8	V
		I_B = 0.1 A, I_C = 1 A					1.4		1.4			
		V_{CE} = 10 V, I_C = 1 A			1.4							
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_B = 75 mA, I_C = 0.75 A	See Notes 5 and 6								1	V
		I_B = 125 mA, I_C = 1 A			5		0.75		0.75			
h_{fe}	Small-Signal Common-Emitter Forward Current Transfer Ratio	V_{CE} = 30 V, I_C = 0.1 A,	f = 1 kHz	25	350							
$\|h_{fe}\|$	Small-Signal Common-Emitter Forward Current Transfer Ratio	V_{CE} = 10 V, I_C = 0.2 A,	f = 5 MHz	2		2		2		3		

NOTES: 5. These parameters must be measured using pulse techniques. t_w = 300 μs, duty cycle ≤ 2%.

6. *These parameters are measured with voltage-sensing contacts separate from the current-carrying contacts and located within 0.125 inch from the device body.*

*JEDEC registered data

thermal characteristics

PARAMETER		MAX	UNIT
$R_{\theta JC}$	Junction-to-Case Thermal Resistance	5	°C/W
$R_{\theta JA}$	Junction-to-Free-Air Thermal Resistance	87.5	

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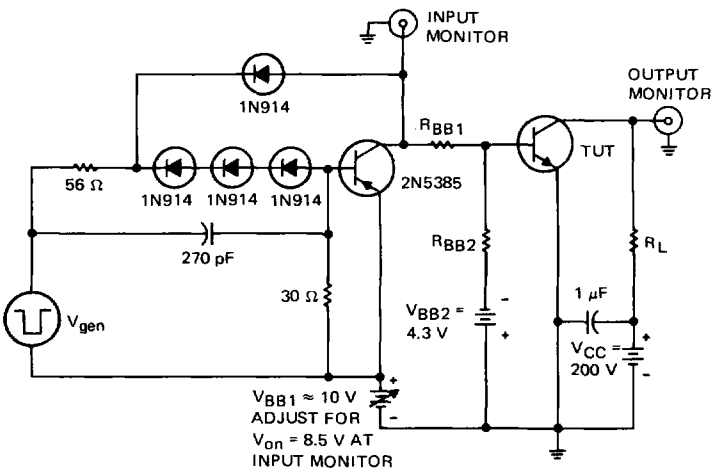
*switching characteristics at 25°C case temperature

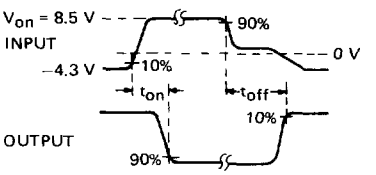
PARAMETER		TEST CONDITIONS‡			2N3584 2N3585		2N4240		UNIT
					TYP	MAX	TYP	MAX	
t_r	Rise Time	I_C = 1 A, $V_{BE(off)}$ = −4.3 V,	$I_{B(1)}$ = 100 mA, R_L = 200 Ω,	$I_{B(2)}$ = −100 mA, See Figure 1	1	3			μs
t_s	Storage Time				1.5	4			
t_f	Fall Time				1	3			
t_r	Rise Time	I_C = 0.75 A, $V_{BE(off)}$ = −4.3 V,	$I_{B(1)}$ = 75 mA, R_L = 267 Ω,	$I_{B(2)}$ = −75 mA, See Figure 1			0.15	0.5	μs
t_s	Storage Time						2.5	6	
t_f	Fall Time						0.5	3	

‡Voltage and current values shown are nominal; exact values vary slightly with transistor parameters.
*JEDEC registered data

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE WAVEFORMS

CIRCUIT CONDITIONS

NOMINAL I_C	R_{BB1}	R_{BB2}	R_L
1 A	37 Ω	53 Ω	200 Ω
0.75 A	50 Ω	70 Ω	267 Ω

NOTES: A. V_{gen} is a −30-V pulse (from 0 V) into a 50-Ω termination.
B. The V_{gen} waveform is supplied by a generator with following characteristics: $t_r \leq 15$ ns, $t_f \leq 15$ ns, Z_{out} = 50 Ω, t_w = 20 μs, duty cycle ≤ 2%.
C. Waveforms are monitored on an oscilloscope with the following characteristics: $t_r \leq 15$ ns, $R_{in} \geq 10$ MΩ, $C_{in} \leq 11.5$ pF.
D. Resistors must be noninductive types.
E. The d-c power supplies may require additional bypassing in order to minimize ringing.

FIGURE 1

TYPICAL CHARACTERISTICS

2N3583
STATIC FORWARD CURRENT TRANSFER RATIO vs COLLECTOR CURRENT

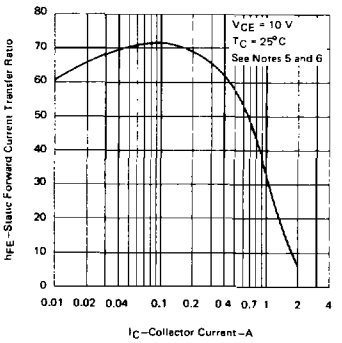


FIGURE 2

BASE-EMITTER VOLTAGE vs COLLECTOR CURRENT

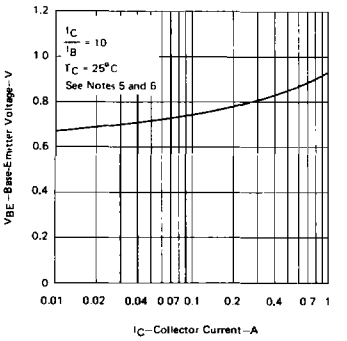


FIGURE 3

COLLECTOR-EMITTER SATURATION VOLTAGE vs COLLECTOR CURRENT

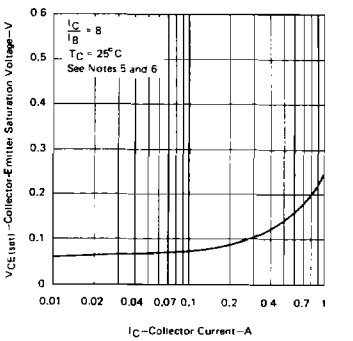


FIGURE 4

NOTES: 5. These parameters must be measured using pulse techniques. t_w = 300 μs, duty cycle ≤ 2%.
6. These parameters are measured with voltage-sensing contacts separate from the current-carrying contacts and located within 0.125 inch from the device body.

MAXIMUM SAFE OPERATING AREA

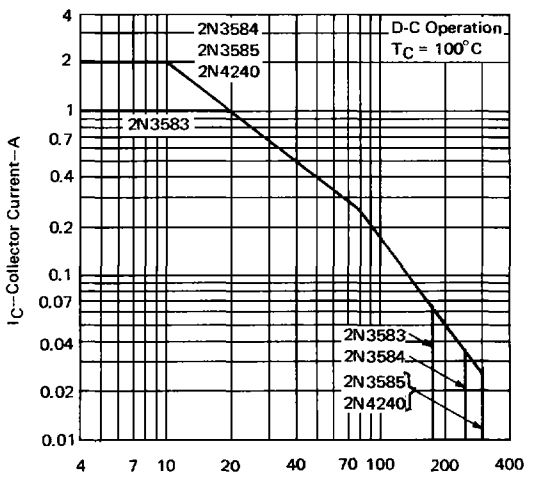


FIGURE 5

THERMAL INFORMATION

DISSIPATION DERATING CURVE

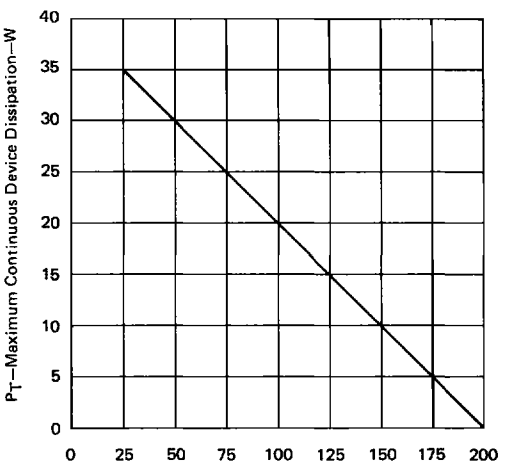


FIGURE 6

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