2N3583-2N3585, 2N4240

File Number **138**

High-Voltage Silicon N-P-N Transistors

For High-Speed Switching and Linear-Amplifier Applications

Features:

- *Freedom from second breakdown*
- *Economy types for ac/dc circuits*
- *Fast turn-on time at high collector current*

RCA-2N3583•, 2N3584•, 2N3585•, and 2N4240•, are silicon n-p-n transistors with high breakdown voltages and fast switching speeds.

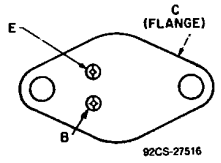
Typical applications for these transistors include high-voltage operational amplifiers, high-voltage switches, switching regulators, converters, inverters, deflection and hi-fi amplifiers.

These transistors are also intended for a wide varitey of applications in ac/dc commercial equipment.

All types utilize the JEDEC TO-213AA package.

•Formerly Dev. Nos. TA2510, TA2511, TA2512, and TA2871 respectively.

TERMINAL DESIGNATIONS



JEDEC TO-213AA

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	2N3583	2N3584	2N3585 2N4240	
* COLLECTOR-TO-BASE VOLTAGE, V_{CBO}	250	375	500	V
* COLLECTOR-TO-EMITTER VOLTAGE, Sustaining, $V_{CEO(sus)}$	175	250	300	V
* EMITTER-TO-BASE VOLTAGE, V_{EBO}	6	6	6	V
* CONTINUOUS COLLECTOR CURRENT, I_C	1	2	2	A
* PEAK COLLECTOR CURRENT	5	5	5	A
* CONTINUOUS BASE CURRENT, I_B	1	1	1	A
* TRANSISTOR DISSIPATION, P_T				
At Case Temperature (T_C) = 25°C	35	35	35	W
At Case Temperatures Above 25°C	Derate Linearly at 0.2			W/°C
For Other Conditions	Derate Linearly to 200			°C
* TEMPERATURE RANGE:				
Storage and Operating (Junction)	-65 to +200			°C
* PIN TEMPERATURE:				
At distance 1/16 in. (1.58 mm) from seating plane for 10 s. max.	235	235	235	°C

* In accordance with JEDEC registration data format JS-6 RDF-2 (2N3583), JS-6 RDF-1 (2N3584, 2N3585, 2N4240).

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ELECTRICAL CHARACTERISTICS *at Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS: VOLTAGE V dc V_{CB}	V_{CE}	V_{EB}	V_{BE}	CURRENT mA dc I_C	I_E	I_B	2N3583 MIN.	2N3583 MAX.	2N3584 MIN.	2N3584 MAX.	2N3585 MIN.	2N3585 MAX.	2N4240 MIN.	2N4240 MAX.	UNITS
• Collector-Cutoff Current	I_{CEO}		150					0	–	10	–	5	–	5	–	5	mA
			225		−1.5				–	1.0	–	–	–	–	–	–	
• Collector-Cutoff Current	I_{CEX}		340		−1.5				–	–	–	1.0	–	–	–	–	mA
			450		−1.5				–	–	–	–	–	1.0	–	2.0	
			225		−1.5				–	3	–	–	–	–	–	–	
At T_C = 150°C	I_{CEX}		300		−1.5				–	–	–	3	–	3	–	5.0	mA
• Emitter-Cutoff Current	I_{EBO}			6	−6	0			–	5.0	–	0.5	–	0.5	–	0.5	mA
			2			750[a]			–	–	–	–	–	–	10	100	
			2			1 A[a]			–	–	8	80	8	80	–	–	
• DC Forward-Current Transfer Ratio	h_{FE}		10			100[a]			40	–	40	–	40	–	40	–	
			10			500[a]			40	200	–	–	–	–	–	–	
			10			750[a]			–	–	–	–	–	–	30	150	
			10			1 A[a]			10	–	25	100	25	100	–	–	
Collector-to-Emitter Sustaining Voltage:																	
• With base open	$V_{CEO(sus)}$					200		0	175●	–	250●	–	300●	–	300●	–	V
With external base-to-emitter resistance (R_{BE}) = 50Ω	I_{CER}		250						–	1.0	–	–	–	–	–	–	
			300						–	–	–	1.0	–	–	–	–	mA
			400						–	–	–	–	–	1.0	–	1.0	
• Base-to-Emitter Saturation Voltage	$V_{BE(sat)}$					750[a]		75	–	–	–	–	–	–	–	1.8	V
						1 A[a]		100	–	1.4	–	1.4	–	1.4	–	–	
• Collector-to-Emitter Saturation Voltage	$V_{CE(sat)}$					750[a]		75	–	–	–	–	–	–	–	1.0	V
						1 A[a]		125	–	5	–	0.75	–	0.75	–	–	
Small-Signal Forward Current Transfer Ratio f = 5 MHz	h_{fe}		10			200			3	–	3	–	3	–	3	–	
• f = 1 kHz			30			100			25	350	–	–	–	–	–	–	
• Magnitude of Common-Emitter, Small-Signal, Short-Circuit, Forward Current Transfer Ratio f = 5 MHz	$\lvert h_{fe} \rvert$		10			200			2	–	2	–	2	–	3	–	
Output Capacitance: V_{CB} = 10 V, f = 1 MHz	C_{obo}	10					0		–	120	–	120	–	120	–	120	pF
Second-Breakdown Collector Current with base forward-biased** (See Figs 1 & 2)	$I_{S/b}$		100						350	–	350	–	350	–	350	–	mA
• Saturated Switching Time (V_{CC} = 200 V): Rise Time	t_r	$\left(\frac{V_{CC}}{200}\right)$				1 A		100	–	–	–	3	–	3	–	–	
						750		75	–	–	–	–	–	–	–	0.5	
Storage Time	t_s	$\left(\frac{V_{CC}}{200}\right)$				1 A		100	–	–	–	4	–	4	–	–	μs
						750		75	–	–	–	–	–	–	–	6	
Fall Time	t_f	$\left(\frac{V_{CC}}{200}\right)$				750		75	–	–	–	–	–	–	–	3	
						1 A		100	–	–	–	3	–	3	–	–	
Thermal Resistance: Junction-to-Case	$R_{\theta JC}$								–	5	–	5	–	5	–	5	
Junction-to-Ambient	$R_{\theta JA}$								–	70	–	70	–	70	–	70	°C/W

*In accordance with JEDEC registration data format JS-6 RDF-2 (2N3583), JS-6 RDF-1 (2N3584, 2N3585, 2N4240)

● **CAUTION:** The sustaining voltages V_{CEO} (sus) **MUST NOT** be measured on a curve tracer.

** Specified value of $I_{S/b}$ for given value of V_{CE} as base voltage is increased from zero in a positive direction.

[a] Pulsed, pulse duration = 300 μs; duty factor ≤ 2%.

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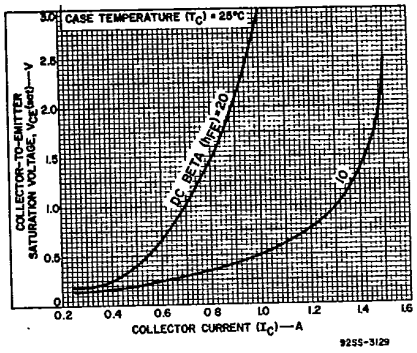

Fig. 3 - Typical collector-to-emitter saturation voltage vs. current for types 2N3584 and 2N3585.

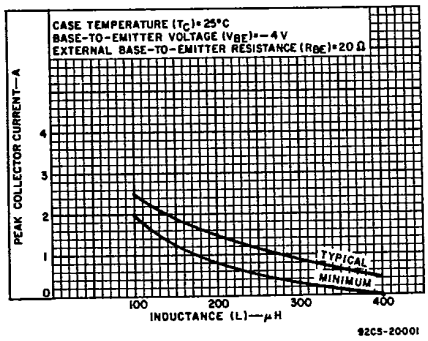

Fig. 4 - Reverse-bias second breakdown characteristics for types 2N3584 and 2N3585.

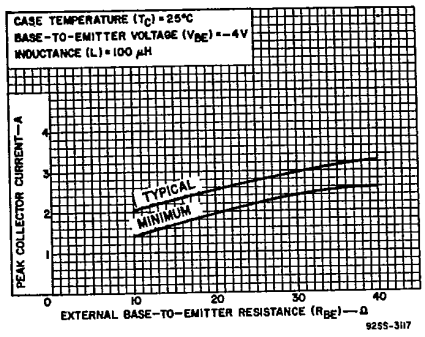

Fig. 5 - Reverse-bias second breakdown characteristics for types 2N3584 and 2N3585.

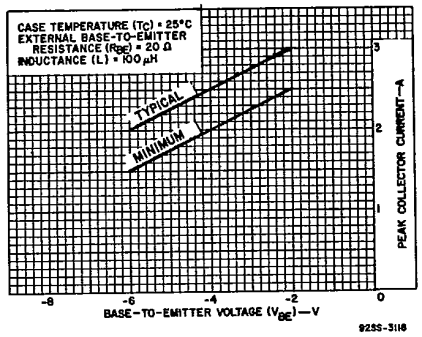

Fig. 6 - Reverse-bias second breakdown characteristics for types 2N3584 and 2N3585.

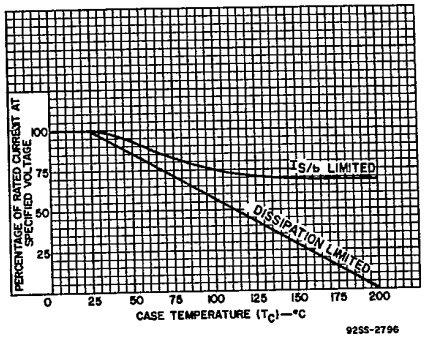

Fig. 7 - Dissipation derating curves for all types.

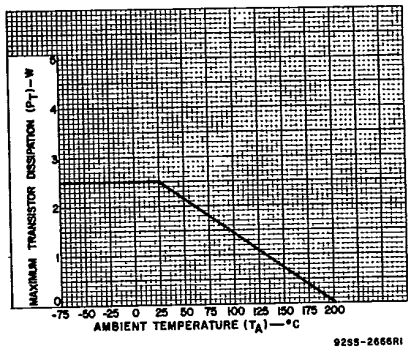

Fig. 8 - Dissipation derating curve for types 2N3583, 2N3584, 2N3585, and 2N4240.

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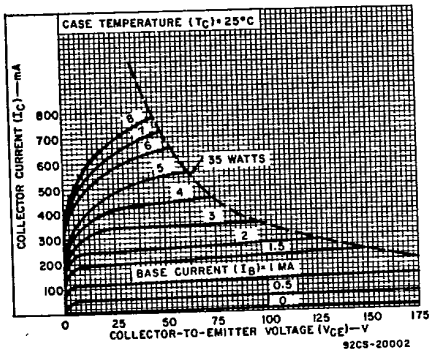

Fig. 9 - Typical output characteristics for type 2N3583.

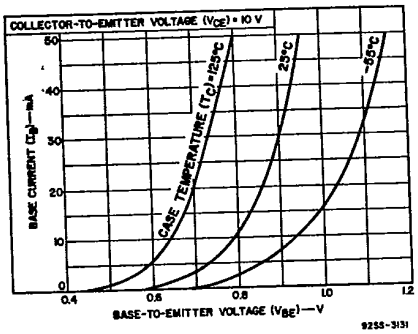

Fig. 10 - Typical input characteristics for all types.

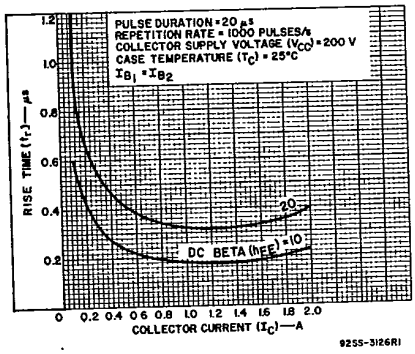

Fig. 11 - Typical rise time vs. collector current for types 2N3584 and 2N3585.

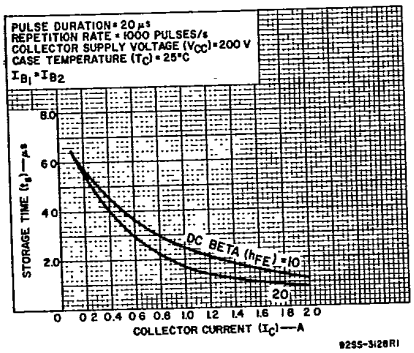

Fig. 12 - Typical storage time vs. collector current for types 2N3584 and 2N3585.

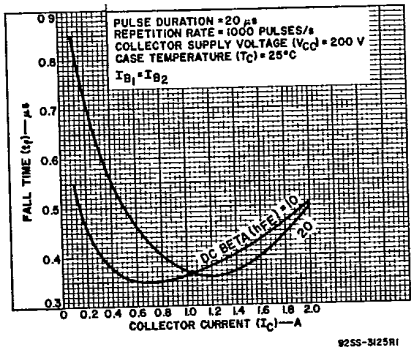

Fig. 13 - Typical fall time vs. collector current for types 2N3584 and 2N3585.

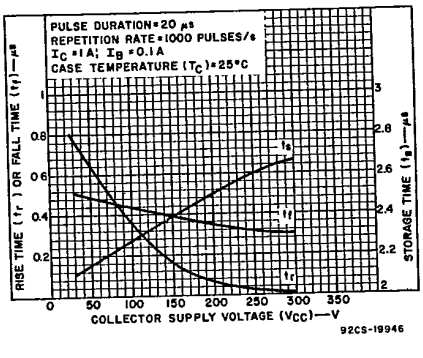

Fig. 14 - Typical rise time, fall time, and storage time vs. collector supply voltage for types 2N3584 and 2N3585.

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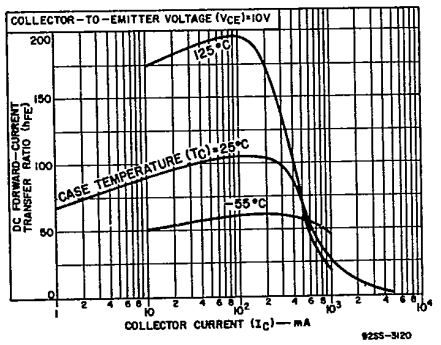


Fig. 15 - Typical dc beta vs. collector current for types 2N3583, and 2N4240.

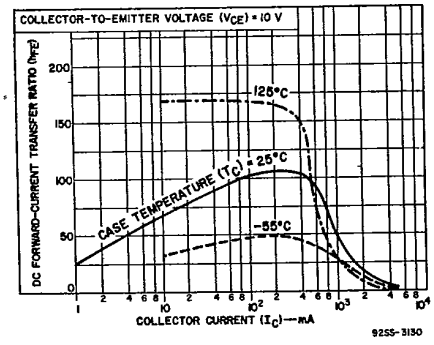


Fig. 16 - Typical dc beta vs. collector current for types 2N3584 and 2N3585.

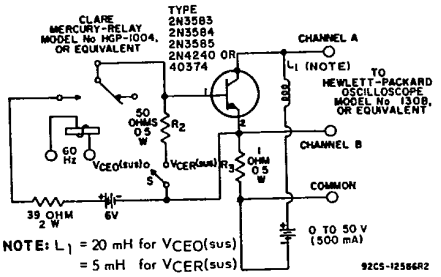
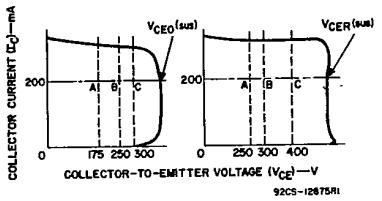


Fig. 17 - Circuit used to measure sustaining voltages $V_{CEO}(sus)$ and $V_{CER}(sus)$ for all types.



NOTE: The sustaining voltages $V_{CEO}(sus)$ and $V_{CER}(sus)$ are acceptable when the trace falls to the right and above point "A" for types 2N3583 and 40374, point "B" for type 2N3584, and point "C" for types 2N3585 and 2N4240.

Fig. 18 - Oscilloscope display for measurement of sustaining voltages.

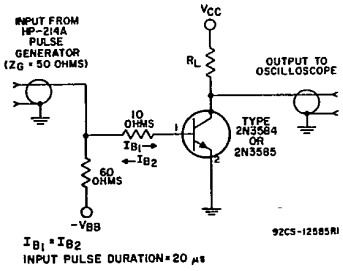


Fig. 19 - Circuit used to measure switching times for types 2N3584 and 2N3585.

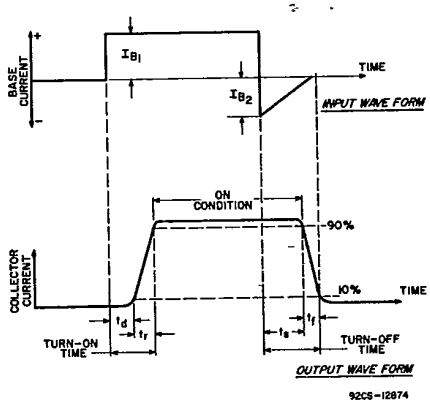


Fig. 20 - Phase relationship between input and output currents, showing reference points for specification of switching times.