RCA
Solid State
Division

Power Transistors
2N3583-2N3585
2N4240, 40374

JEDEC TO-66 H-1340

JEDEC TO-66
With Integral Heat Radiator H-1470A

High-Voltage Silicon N-P-N Transistors

For High-Speed Switching and
Linear-Amplifier Applications

Features

- 100-percent tested to assure freedom from second breakdown in both forward- and reverse-bias conditions when operated within specified limits
- JEDEC TO-66 package for 2N3583, 2N3584, 2N3585, and 2N4240
- JEDEC TO-66 package with heat radiator for 40374
- Economy types for ac/dc circuits
- Fast turn-on time at high collector current

RCA-2N3583,• 2N3584,• 2N3585,• 2N4240,• and 40374 are silicon n-p-n transistors with high breakdown voltages and fast switching speeds.

Type 40374 is a 2N3583 with a factory-attached heat radiator to increase the free-air dissipation rating. This device is intended for those applications which require a power transistor for mounting on a printed-circuit board. Tabs are provided on the underside of the radiator for mounting purposes and making electrical connection to the collector.

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 variety of applications in ac/dc commercial equipment.

Heat-radiator versions of types 2N3584, 2N3585, and 2N4240 can also be supplied on special order.

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

MAXIMUM RATINGS, *Absolute-maximum values:*

		2N3583	2N3584	2N3585 2N4240	40374	
*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	250	375	500	250	V
*COLLECTOR-TO-EMITTER VOLTAGE, sustaining	$V_{CEO(sus)}$	175	250	300	175	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	6	6	6	6	V
*CONTINUOUS COLLECTOR CURRENT	I_C	1	2	2	2	A
*PEAK COLLECTOR CURRENT		5	5	5	5	A
*CONTINUOUS BASE CURRENT	I_B	1	1	1	1	A
*TRANSISTOR DISSIPATION	P_T					
At case temperature (T_C) = 25°C		35	35	35	35	W
At case temperatures above 25°C		Derate linearly at 0.2 W/°C				
For other conditions		See Figs. 7, 8, 9, 21, 22, & 23				
*TEMPERATURE RANGE:						
Storage & Operating (Junction)		← –65 to 200 →				°C
*PIN TEMPERATURE:						
1/16 in. (1.58 mm) from seating plane for 10 s max.		235	235	235	235	°C

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

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

	CHARACTERISTIC	SYMBOL	TEST CONDITIONS: VOLTAGE V dc		TEST CONDITIONS: CURRENT mA dc			LIMITS: 2N3583 40374		2N3584		2N3585		2N4240		UNITS
			V_{CE}	V_{BE}	I_C	I_E	I_B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
*	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	
	At T_C = 150°C	I_{CEX}	225	−1.5				–	3	–	–	–	–	–	–	mA
			300	−1.5				–	–	–	3	–	3	–	5.0	
*	Emitter-Cutoff Current	I_{EBO}		−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		750[a]			40	200	–	–	–	–	–	–	
			10		1 A[a]			–	–	–	–	–	–	30	150	
			10		1 A			10	–	25	100	25	100	–	–	
	Collector-to-Emitter Sustaining Voltage: (See Figs. 1, 2, & 12)															
*	With base open	$V_{CEO(sus)}$			200		0	175[e]	–	250[e]	–	300[e]	–	300[e]	–	V
	With external base-to-emitter resistance (R_{BE}) = 50Ω	$V_{CER(sus)}$			200			250[e]	–	300[e]	–	400[e]	–	400[e]	–	
*	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}				0		–	120	–	120	–	120	–	120	pF
	Second-Breakdown Collector Current with base forward-biased** (See Figs. 22 & 23)	$I_{S/b}$	100					350	–	350	–	350	–	350	–	mA
	Second-Breakdown Energy with base reverse-biased R_{BE} = 20Ω, L = 100 μH	$E_{S/b}$[†]		→				50	–	200	–	200	–	50	–	μJ
*	Saturated Switching Time (V_{CC} = 200 V):															
	Rise Time (See Figs. 13, 16, 17, & 18)	t_r			1 A		100	–	–	–	3	–	3	–	–	
					750		75	–	–	–	–	–	–	–	0.5	
	Storage Time (See Figs. 14, 16, 17, & 18)	t_s			1 A		100	–	–	–	4	–	4	–	–	μs
					750		75	–	–	–	–	–	–	–	6	
	Fall Time (See Figs. 15, 16, 17, & 18)	t_f			750		75	–	–	–	–	–	–	–	3	
					1 A		100	–	–	–	3	–	3	–	–	

ELECTRICAL CHARACTERISTICS *at Case Temperature (T_C) = 25°C Unless Otherwise Specified (Con't.)*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS					LIMITS								UNITS
		VOLTAGE V dc		CURRENT mA dc			2N3583 40374		2N3584		2N3585		2N4240		
		V_{CE}	V_{BE}	I_C	I_E	I_B	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
Thermal Resistance: Junction-to-Case	$R_{\theta JC}$						5(Max.) 2N3583		–	5	–	5	–	5	°C/W
Junction-to-Ambient	$R_{\theta JA}$						70 (Max.) 2N3583		–	70	–	70	–	70	°C/W
							30 (Max.) 40374		–	–	–	–	–	–	

*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) and V_{CER}(sus) **MUST NOT** be measured on a curve tracer. These sustaining voltages should be measured by means of the test circuit shown in Fig. 1.

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

†$E_{S/b}$ is defined as the energy at which second breakdown occurs under specified reverse bias conditions. $E_{S/b} = 1/2\ LI^2$, where L is a series load or leakage inductance and I is the peak collector current from Figs. 3, 4, and 5.

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

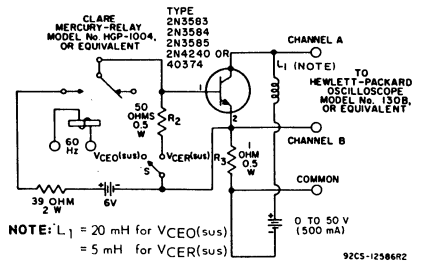

Fig. 1—Circuit used to measure sustaining voltages V_{CEO}(sus) and V_{CER}(sus) for all types.

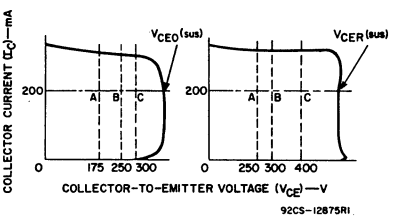

Fig. 2—Oscilloscope display for measurement of sustaining voltages (test circuit shown in Fig. 1).

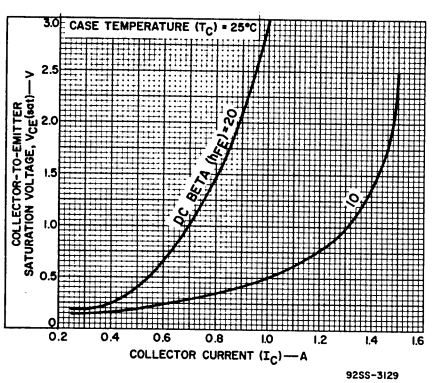

Fig. 3—Typical collector-to-emitter saturation voltage vs. current for types 2N3584 and 2N3585.

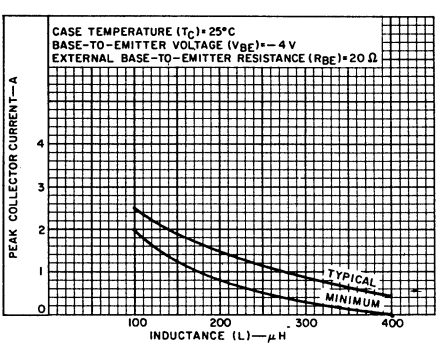

Fig. 4—Reverse-bias second breakdown characteristics for types 2N3584 and 2N3585.

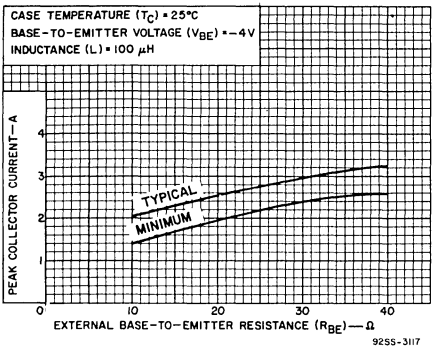

Fig. 5—Reverse-bias second breakdown characteristics for types 2N3584 and 2N3585.

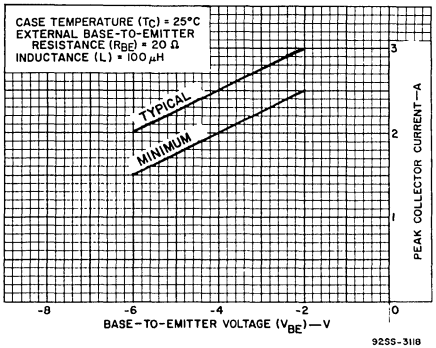

Fig. 6—Reverse-bias second breakdown characteristics for types 2N3584 and 2N3585.

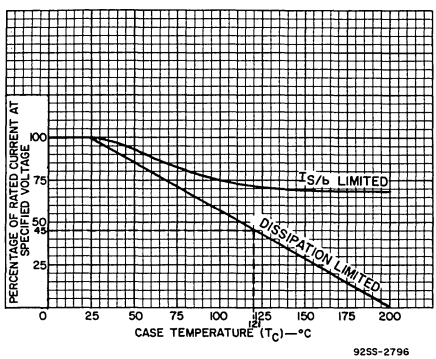

Fig.7—Dissipation derating curves for all types.

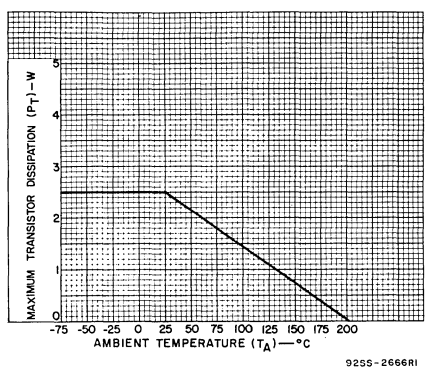

Fig. 8—Dissipation derating curve for types 2N3583, 2N3584, 2N3585, and 2N4240.

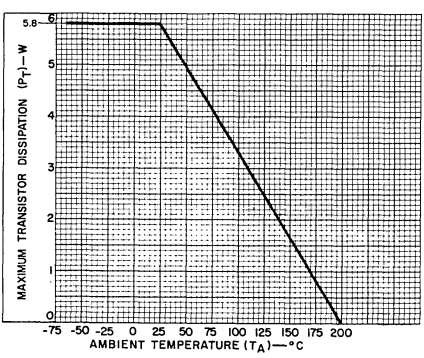

Fig. 9—Dissipation derating curve for type 40374.

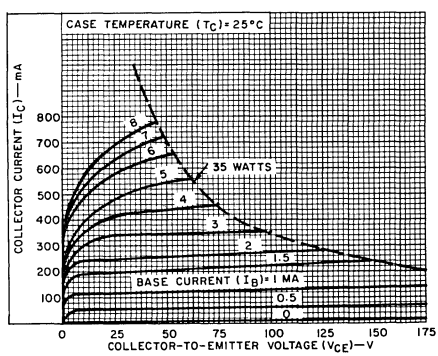

Fig. 10—Typical output characteristics for types 2N3583 and 40374.

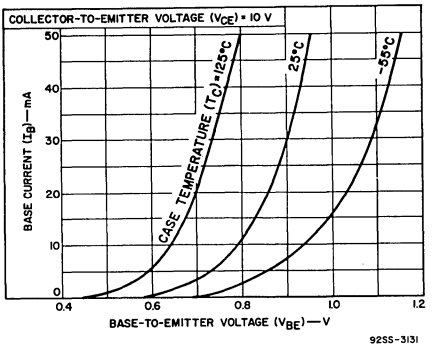

Fig. 11—Typical input characteristics for all types.

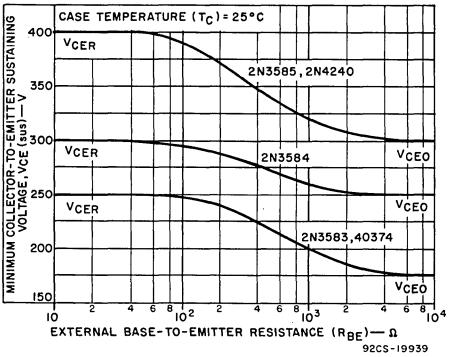

Fig. 12—Sustaining voltage vs. base-to-emitter resistance for all types.

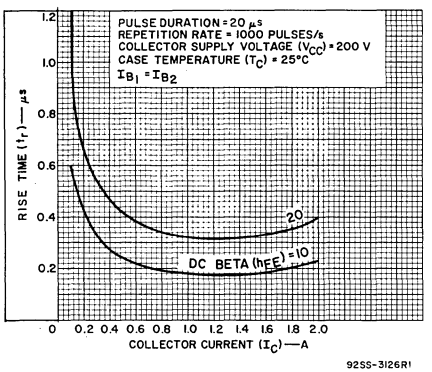

Fig. 13—Typical rise time vs. collector current for types 2N3584 and 2N3585.

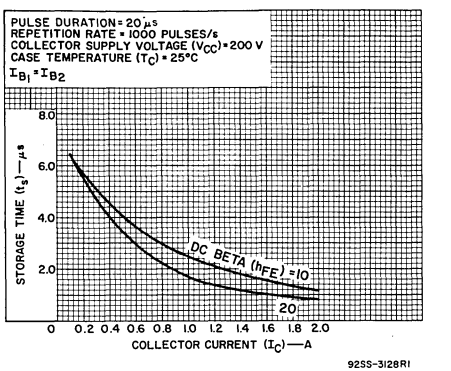

Fig. 14—Typical storage time vs. collector current for types 2N3584 and 2N3585.

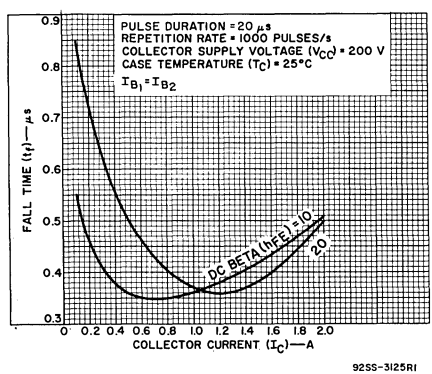

Fig. 15—Typical fall time vs. collector current for types 2N3584 and 2N3585.

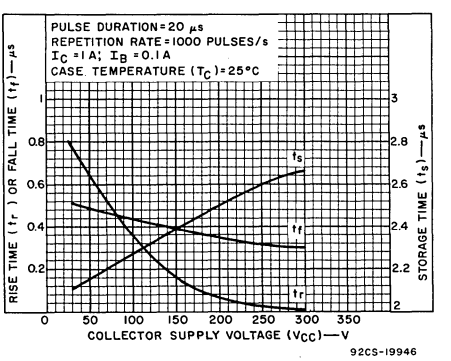

Fig. 16—Typical rise time, fall time, and storage time vs, collector supply voltage for types 2N3584 and 2N3585.

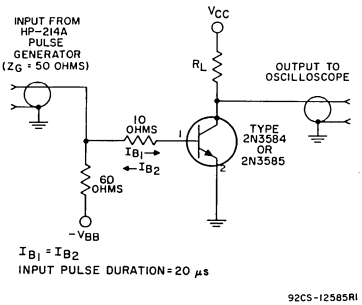

Fig.17—Circuit used to measure switching time for types 2N3584 and 2N3585.

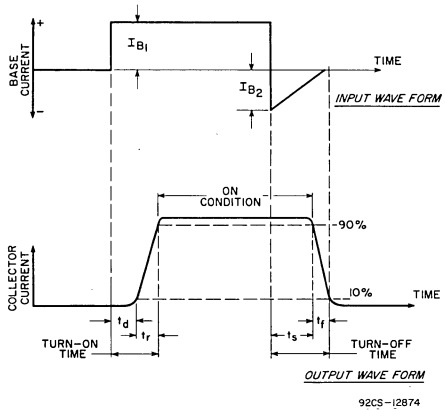

Fig.18—Phase relationship between input and output currents, showing reference points for specification of switching times (test circuit shown in Fig.17).

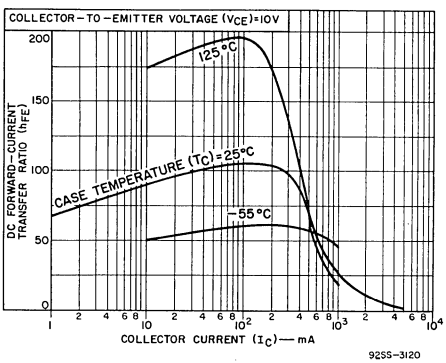

Fig.19—Typical dc beta vs. collector current for types 2N3583, 2N4240, and 40374.

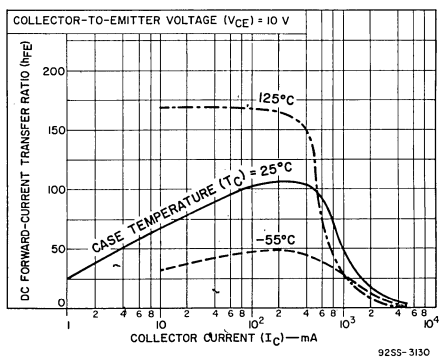

Fig.20—Typical dc beta vs. collector current for types 2N3584 and 2N3585.

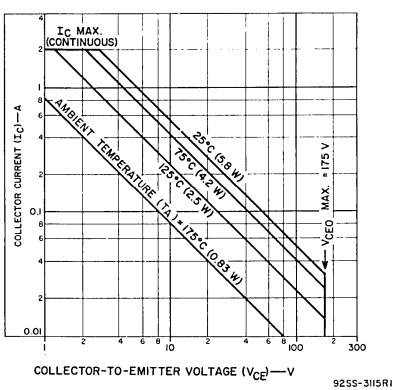

Fig.21—Maximum operating areas for type 40374.

TERMINAL CONNECTIONS FOR TYPES 2N3583, 2N3584, 2N3585, AND 2N4240

Pin 1 - Base
Pin 2 - Emitter
Case, Mounting Flange - Collector

TERMINAL CONNECTIONS FOR TYPE 40374

Pin 1 - Base
Pin 2 - Emitter
Heat-Radiator - Collector

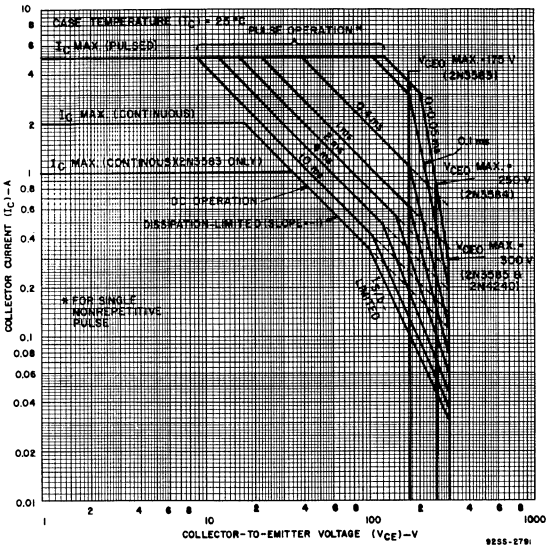

Fig. 22—Maximum operating areas for types 2N3583, 2N3584, 2N3585, and 2N4240 (dc conditions).

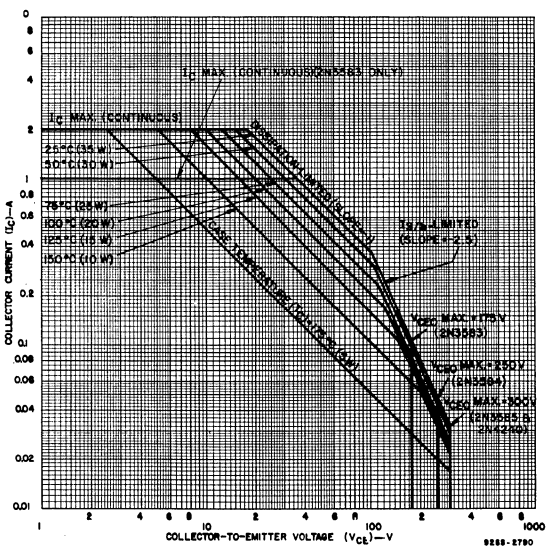

Fig. 23—Maximum operating areas for types 2N3583, 2N3584, 2N3585, and 2N4240 (pulse conditions).