RCA
Solid State
Division

Power Transistors
RCS559
RCS560

JEDEC TO-66

H-1340

High-Voltage Medium-Power Silicon P-N-P Transistors

For Switching and Amplifier Applications
In Military, Industrial, and Commercial Equipment

Features:

- **High voltage ratings:**
  $V_{CEO}(sus)$ = −200 V max. (RCS560)
  = −225 V max. (RCS559)
- **Large safe-operating area**
- **Complements to 2N3583 transistor family***
- **Thermal-cycling rating**

The RCA-RCS559 and RCS560 are double-epitaxial silicon n-p-n transistors with high breakdown-voltage ratings and fast switching speeds. They are supplied in the popular JEDEC TO-66 package; they differ in breakdown-voltage ratings and leakage-current values.

*Data for the 2N3583 transistor family are supplied in bulletin File No. 138.

Applications:

- **Power-Switching Circuits**
- **Switching Regulators**
- **Converters**
- **Inverters**
- **High-Fidelity Amplifiers**

TERMINAL CONNECTIONS

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

MAXIMUM RATINGS, *Absolute-Maximum Values:*		**RCS559**	**RCS560**	
COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	−275	−250	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:				
With base open	$V_{CEO}(sus)$	−225	−200	V
With external base-to-emitter resistance (R_{BE}) = 50 Ω	$V_{CER}(sus)$	−250	−225	V
With base-emitter junction reverse-biased (V_{BE} = 1.5 V)	$V_{CEX}(sus)$	−275	−250	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	−6	−6	V
COLLECTOR CURRENT (Continuous)	I_C	−2	−2	A
BASE CURRENT (Continuous)	I_B	−1	−1	A
TRANSISTOR DISSIPATION:				
At case temperatures up to 100°C and V_{CE} up to 50 V		20	20	W
At case temperatures up to 25°C and V_{CE} up to 40 V		35	35	W
At case temperatures up to 25°C and V_{CE} above 40 V		See Fig. 1		
At case temperatures above 25°C and V_{CE} above 40 V		See Figs. 1 and 2		
TEMPERATURE RANGE:				
Storage & Operating (Junction)		−65 to 200		°C
LEAD TEMPERATURE (During Soldering):				
At distance ≥ 1/32 in. (0.8 mm) from case for 10 s max.		230		°C

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

CHARACTERISTIC	SYMBOL	TEST CONDITIONS					LIMITS				UNITS
		Voltage V dc		Current A dc			RCS559		RCS560		
		V_{CE}	V_{BE}	I_C	I_E	I_B	Min.	Max.	Min.	Max.	
Collector-Cutoff Current: With base open	I_{CEO}	−150				0	–	−5	–	−10	mA
With base-emitter junction reverse-biased	I_{CEV}	−250	1.5				–	−0.5	–	–	mA
		−225	1.5				–	–	–	−1	mA
With base-emitter junction reverse biased and T_C = 100°C	I_{CEV}	−250	1.5				–	−5	–	–	mA
		−225	1.5				–	–	–	−10	mA
Emitter-Cutoff Current	I_{EBO}		6	0			–	−1	–	–	mA
			4	0			–	–	–	−1	mA
DC Forward-Current Transfer Ratio	h_{FE}	−3		−0.75[a]			10	100	7.5	–	
Collector-to-Emitter Sustaining Voltage: With base open	$V_{CEO(sus)}$			−0.2[a]		0	−225[c]	–	−200[c]		V
With external base-to-emitter resistance (R_{BE}) = 50 Ω	$V_{CER(sus)}$			−0.2[a]			−250[c]	–	−225[c]	–	V
With base-emitter junction reverse-biased and external base-to-emitter resistance (R_{BE}) = 50 Ω	$V_{CEX(sus)}$		1.5	−0.2[a]			−275[c]	–	−250[c]	–	V
Emitter-to-Base Saturation Voltage	$V_{BE(sat)}$			−0.75[a]		−0.075	–	−1.4	–	−1.4	V
Collector-to-Emitter Saturation Voltage	$V_{CE(sat)}$			−0.75[a]		−0.075	–	−1.5	–	−2	V
Output Capacitance: V_{CB} = −10 V, f = 1 MHz	C_{obo}				0		–	220	–	220	pF
Forward-Bias, Second-Breakdown Collector Current: t = 1 s, nonrepetitive	$I_{S/b}$	−40					−0.875	–	−0.875	–	A
Magnitude of Common-Emitter, Small-Signal, Short-Circuit, Forward Current Transfer Ratio: f = 5 MHz	$\|h_{fe}\|$	−10		−0.2			4	–	4	–	
Saturated Switching Times (V_{CC} = −200 V): Rise time	t_r			−1		−0.125[b]	–	0.6	–	0.6	μs
Storage time	t_s			−1		−0.125[b]	–	2.5	–	2.5	μs
Fall time	t_f			−1		−0.125[b]	–	0.6	–	0.6	μs
Thermal Resistance: Junction-to-case	$R_{\theta JC}$	−10		−1			–	5	–	5	°C/W

[a]Pulsed: Pulse duration = 300 μs; duty factor ≤ 2%.

[b]$I_{B1} = I_{B2}$

[c]Sustaining voltages, V_{CEO}(sus), V_{CER}(sus), and V_{CEX}(sus), MUST NOT be measured on a curve tracer. They should be tested by using the circuit in Fig. 4.

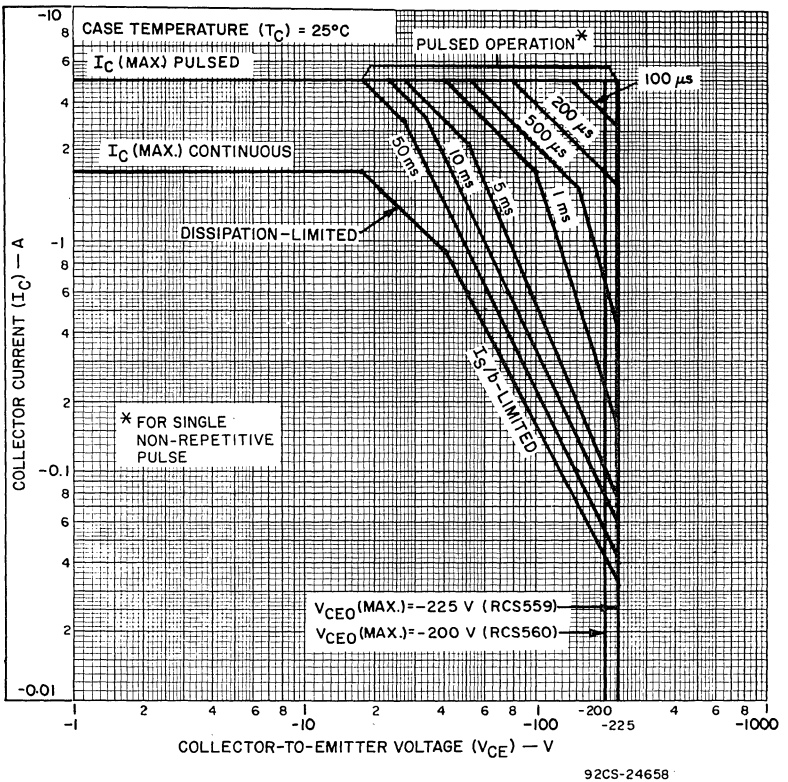

Fig. 1 — Maximum operating areas for both types.

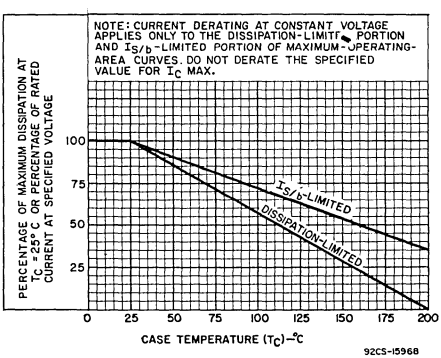

Fig. 2 — Derating curves for both types.

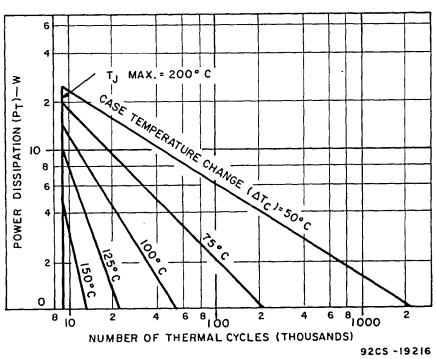

Fig. 3 — Thermal-cycling rating chart for both types.

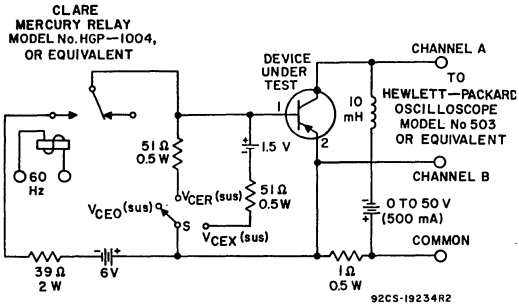

Fig. 4 — Circuit used to measure sustaining voltages $V_{CEO}(sus)$, $V_{CER}(sus)$ and $V_{CEX}(sus)$ for both types.

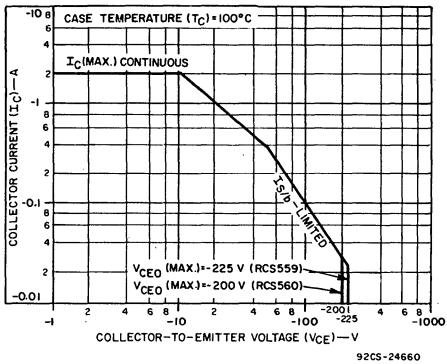

Fig. 5 — Maximum operating areas at $T_C = 100°C$ for both types.

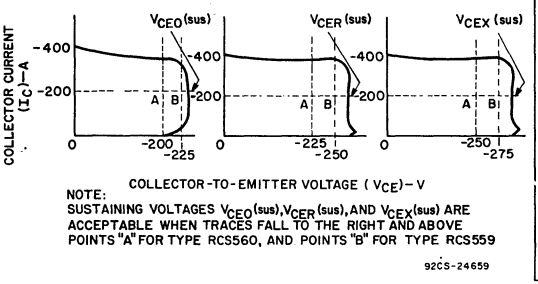

Fig. 6 — Oscilloscope display for measurement of sustaining voltages (test circuit shown in Fig. 4).

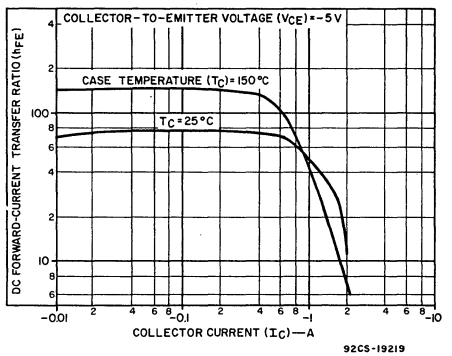

Fig. 7 — Typical dc beta characteristic for both types.

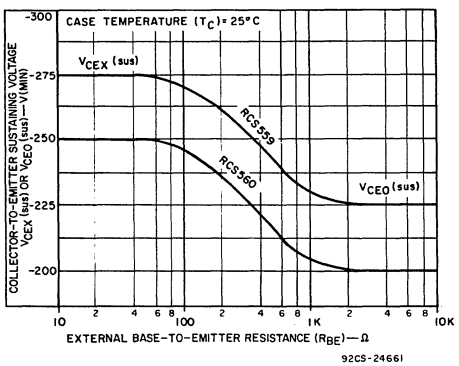

Fig. 8 — Collector-to-emitter sustaining voltage characteristics for both types.

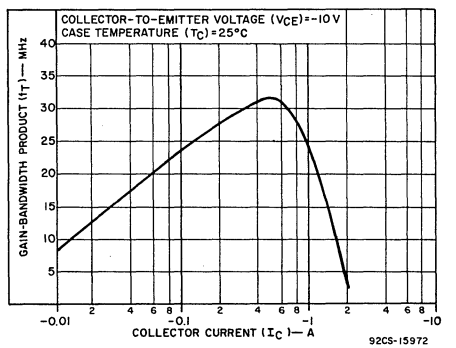

Fig. 9 — Typical gain-bandwidth product for types.

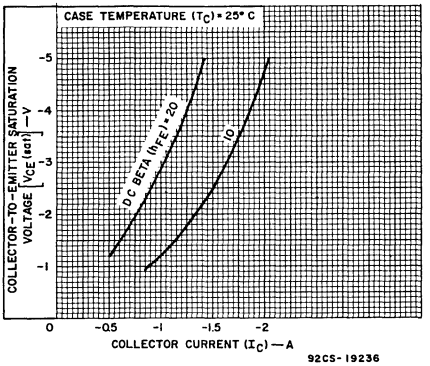

Fig. 10 — Typical saturation-voltage characteristics for both types.

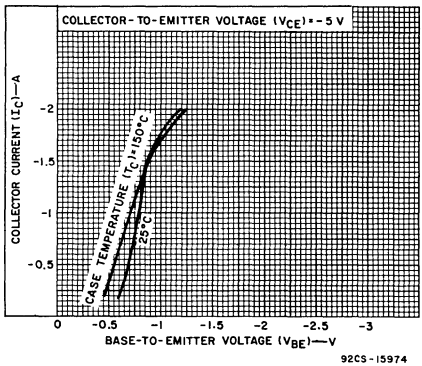

Fig. 11 — Typical transfer characteristics for both types.

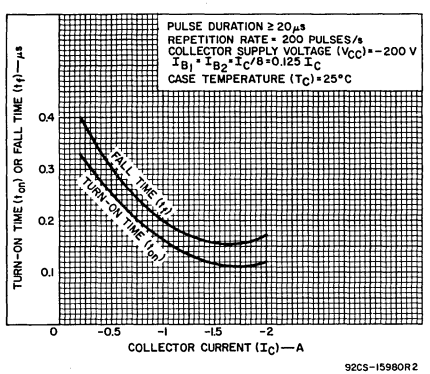

Fig. 12 — Typical turn-on time and fall-time characteristics for both types.

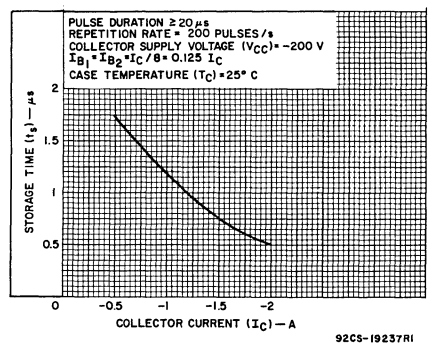

Fig. 13 — Typical storage-time characteristics for both types.

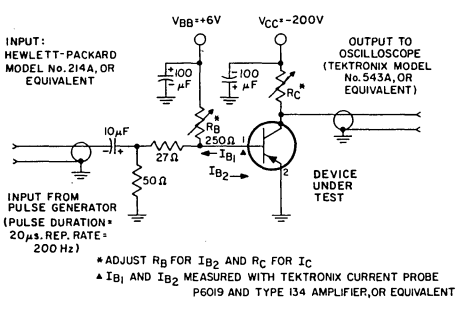

Fig. 14 — Circuit used to measure saturated switching times for both types.

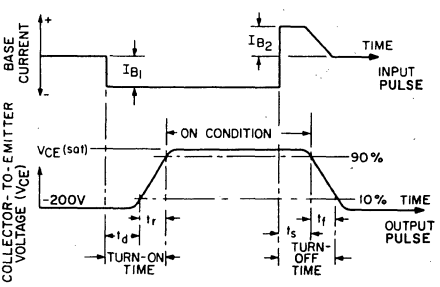

Fig. 15 — Phase relationship between input current and output voltage showing reference points for specification of switching times. (Test circuit shown in Fig. 14).