RCA
Solid State
Division

Power Transistors

RCS564

JEDEC TO-3

H-1570

300-V, 30-A, 175-W Silicon N-P-N Switching Transistor

For Switching Applications in Industrial and Commercial Equipment

Features:

- **High voltage ratings:** V_{CBO} = 300 V
- **Maximum safe-area-of-operation curves**
- **High dissipation rating: P_T = 175 W**
- **Low saturation voltages**

The RCA-RCS564 is a multiple epitaxial silicon n-p-n power transistor utilizing a multiple-emitter-site structure. Multiple-epitaxial construction maximizes the volt-ampere characteristic of the device and provides fast switching speeds. Multiple-emitter-site design assures uniform current flow throughout the structure, which produces a high $I_{S/b}$ and a large safe-operation area.

The device uses the popular JEDEC TO-3 package.

The exceptional second-breakdown capabilities and high voltage-breakdown ratings of the RCS564 make this transistor especially suitable for off-line inverters, switching regulators, motor controls, and deflection circuit applications.

The high gain and high $E_{S/b}$ energy-handling capability of the RCS564 make it an excellent choice for motor-control applications in which large winding inductances are encountered and high surge currents are required to start the motor.

MAXIMUM RATINGS, *Absolute-Maximum Values:*

COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	300	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:			
With base open	$V_{CEO}(sus)$	200	V
With reverse bias (V_{BE}) = 0 V (with base-emitter shorted)	$V_{CEX}(sus)$	225	V
With external base-to-emitter resistance (R_{BE}) ⩽ 50 Ω	$V_{CER}(sus)$	225	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	6	V
CONTINUOUS COLLECTOR CURRENT	I_C	10	A
PEAK COLLECTOR CURRENT	I_{CM}	30	A
CONTINUOUS BASE CURRENT	I_B	10	A
TRANSISTOR DISSIPATION:	P_T		
At case temperatures up to 25°C and V_{CE} up to 30 V		175	W
At case temperatures up to 25°C and V_{CE} above 30 V		See Figs. 1 and 2.	
At case temperatures above 25°C and V_{CE} above 30 V		See Figs. 1, 2, and 4.	
TEMPERATURE RANGE:			
Storage & Operating (Junction)		−65 to +200	°C
PIN TEMPERATURE (During Soldering):			
At distances ⩾ 1/32 in. (0.8 mm) from case for 10 s max.		230	

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ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C unless otherwise specified*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS VOLTAGE V dc V_{CE}	V_{BE}	CURRENT A dc I_C	I_B	LIMITS RCS564 Min.	Typ.	Max.	UNITS
Collector-Cutoff Current: With base open	I_{CEO}	150			0	–	–	10	mA
With base-emitter junction reverse-biased	I_{CEV}	225	−1.5			–	–	10	mA
With base-emitter junction reverse-biased, and T_C = 125°C	I_{CEV}	225	−1.5			–	–	25	mA
Emitter-Cutoff Current	I_{EBO}		−6			–	–	5	mA
Collector-to-Emitter Sustaining Voltage (see Figs. 11 and 12): With base open	$V_{CEO}(sus)$			0.2		200[b]	–	–	V
With external base-to-emitter resistance (R_{BE}) = 50 Ω	$V_{CER}(sus)$			0.2		225[b]	–	–	V
DC Forward-Current Transfer Ratio	h_{FE}	3		10[a]		5	–	–	
Base-to-Emitter Saturation Voltage	$V_{BE}(sat)$			10[a]	2	–	–	3.2	V
Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$			10[a]		–	–	2.5	V
Magnitude of Common Emitter, Small-Signal, Short-Circuit, Forward Current Transfer Ratio: f = 1 MHz	$\|h_{fe}\|$	10		1		2.5	8	–	
Second-Breakdown Collector Current: t = 1 s, nonrepetitive	$I_{S/b}$[c]	30				5.8	–	–	A
Reverse-Biase Second-Breakdown Energy: R_B = 50 Ω, L = 50 μH	$E_{S/b}$[d]		−4	10		2.5	–	–	mJ
Switching Times (V_{CC} = 200 V):[e] Rise Time	t_r			10	1	–	0.8	2	μs
Storage Time	t_s			10	1	–	1.8	3.5	μs
Fall Time	t_f			10	1	–	0.5	1	μs
Thermal Resistance: Junction-to-Case	$R_{\theta JC}$	10		5	–	–	–	1	°C/W

[a]Pulses; pulse duration ≤ 350 μs, duty factor = 2%.

[b]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. 11.

[c]$I_{S/b}$ is defined as the current at which second breakdown occurs at a specified collector voltage with the emitter-base junction forward – biased for transistor operation in the active region.

[d]$E_{S/b}$ 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.

[e]$I_{B1} = I_{B2}$ = value shown: see Figs. 13 – 18.

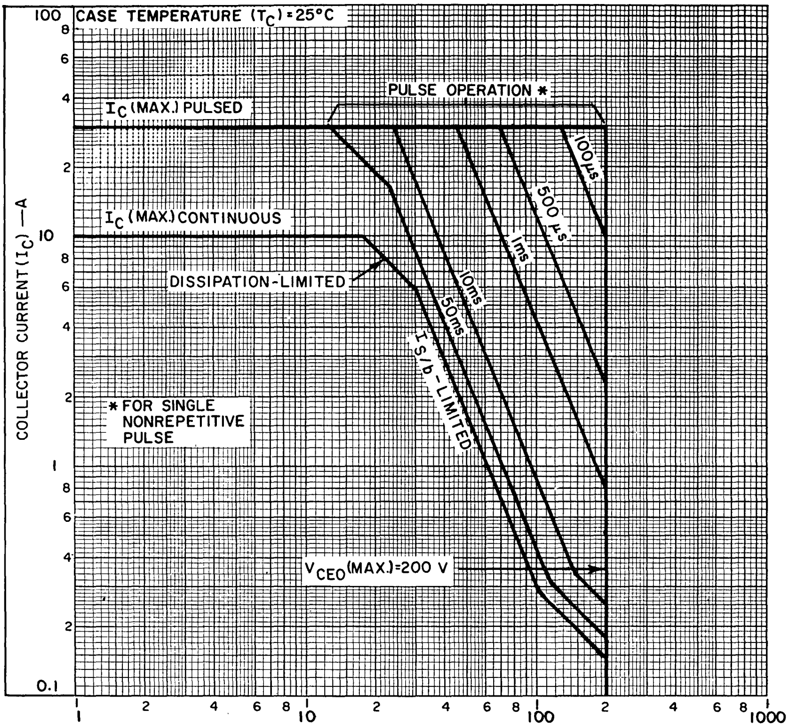


Fig. 1 — Maximum operating areas.

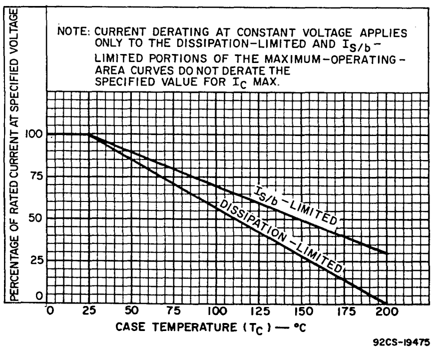


Fig. 2 — Dissipation derating and $I_{S/b}$ derating.

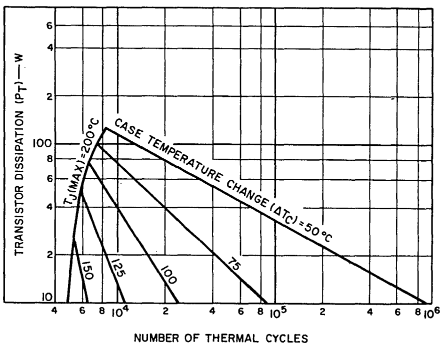


Fig. 3 — Thermal-cycle rating chart.

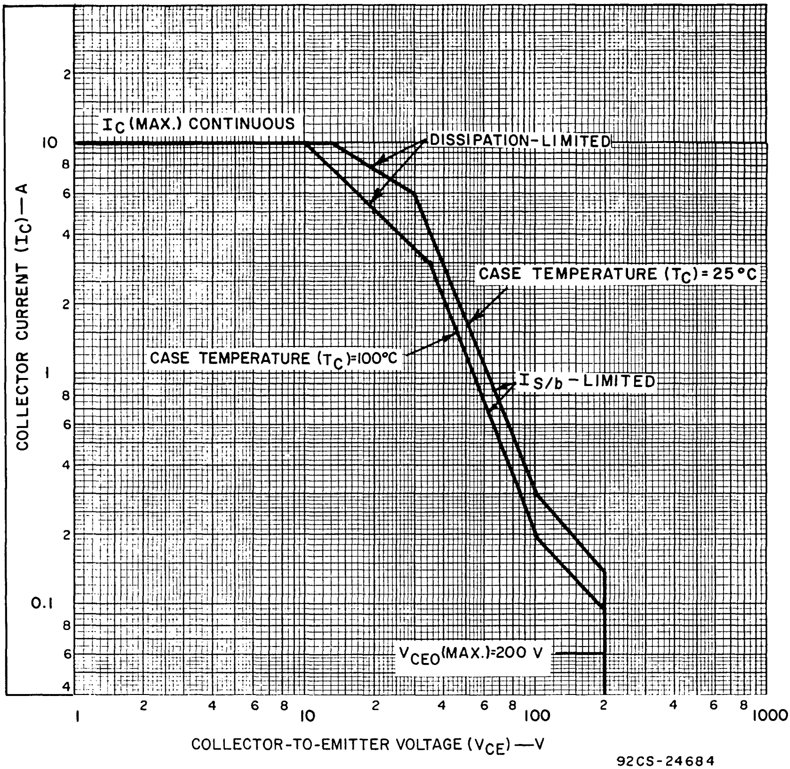


Fig. 4 — Maximum operating areas for dc operation at T_C = 25°C and 100°C.

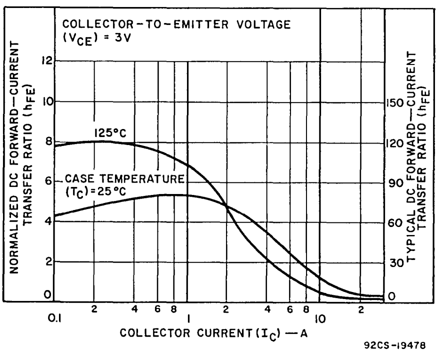


Fig. 5 — Typical normalized dc beta characteristics.

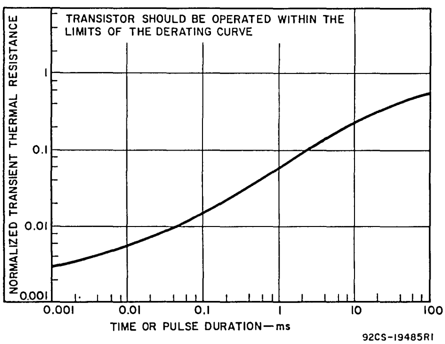


Fig. 6 — Typical thermal response characteristic.

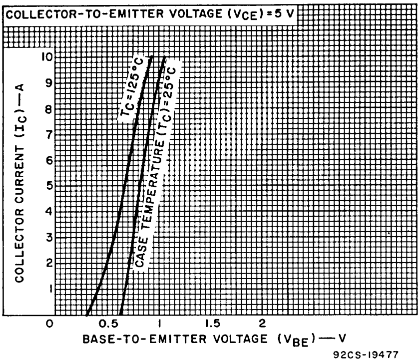


Fig. 7 — Typical transfer characteristics.

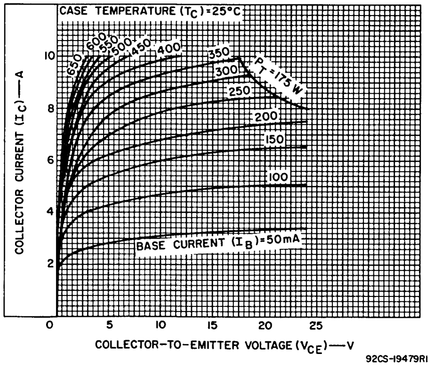


Fig. 8 — Typical output characteristics.

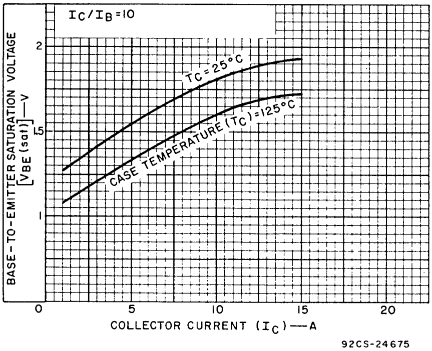


Fig. 9 — Typical base-to-emitter saturation voltage characteristics.

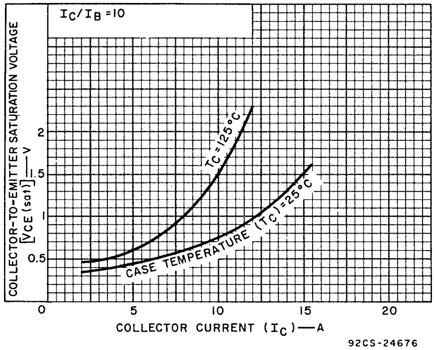


Fig. 10 — Typical collector-to-emitter saturation voltage characteristics.

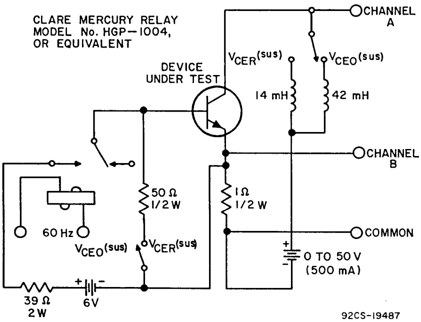
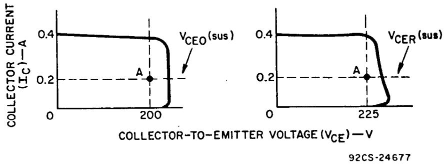


Fig. 11 — Circuit used to measure sustaining voltages V_{CEO}(sus) and V_{CER}(sus).



The sustaining voltages V_{CEO}(sus) and V_{CER}(sus) are acceptable when the traces fall to the right of point "A".

Fig. 12 — Oscilloscope display for measurement of sustaining voltages. (Test circuit shown in Fig. 11).

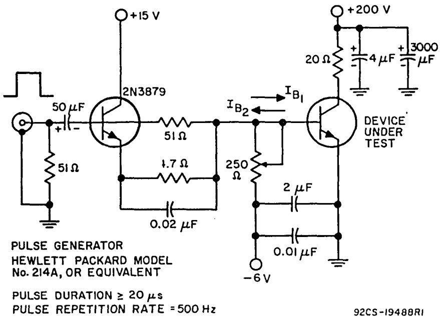


Fig. 13 — Circuit used to measure switching times.

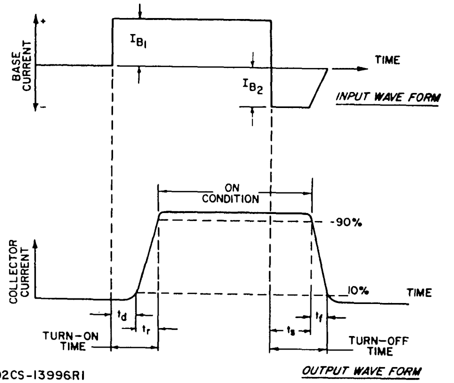


Fig. 14 — Phase relationship between input and output currents showing reference points for specification of switching times. (Test circuit shown in Fig. 13).

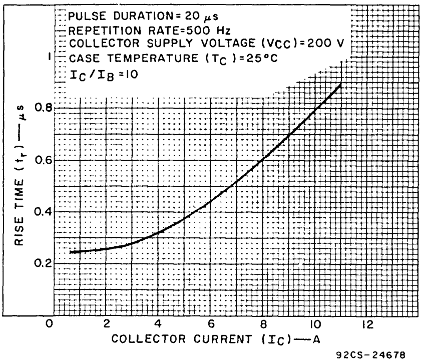


Fig. 15 — Typical rise-time characteristic.

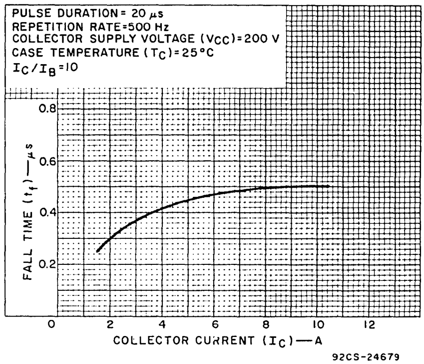


Fig. 16 — Typical fall-time characteristic.

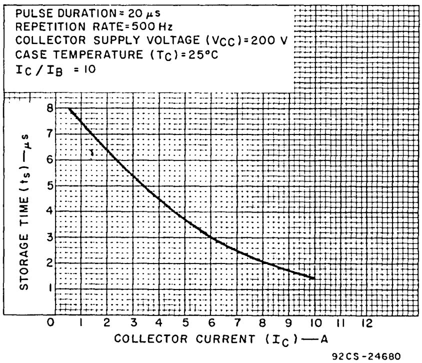


Fig. 17 — Typical storage-time characteristics for all types (with constant forced gain).

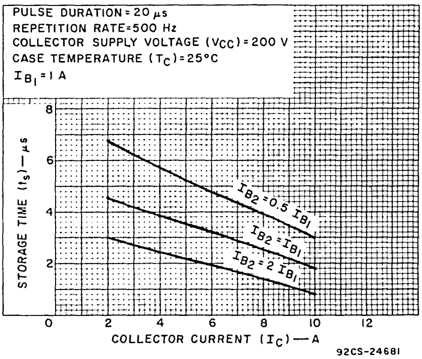


Fig. 18 — Typical storage-time characteristics for all types (with constant base drive).

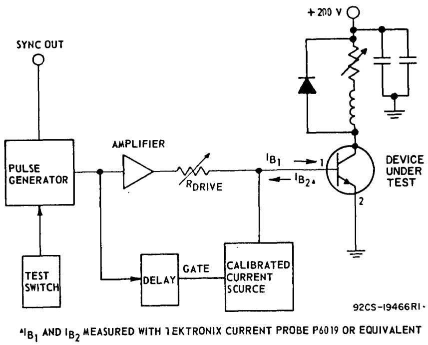


Fig. 19 — Circuit used to measure inductive-load switching times.

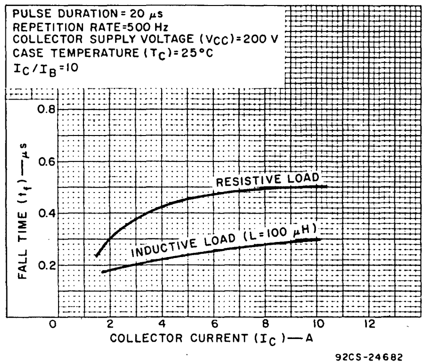


Fig. 20 — Typical inductive- and resistive-load fall-time characteristics.

TERMINAL CONNECTIONS

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