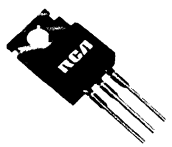
RCA
Solid State
Division

Power Transistors

RCA31/SDH RCA31B/SDH
RCA31A/SDH RCA31C/SDH



JEDEC TO-220 AB H-1535

Hometaxial-Base, Silicon N-P-N VERSAWATT Transistors

For Medium-Power Switching and Amplifier Applications

Features:

- **50 W at 25°C case temperature**
- **Low saturation voltage**
- **Maximum safe-area-of-operation curves**
- **Thermal-cycle ratings curves**

TERMINAL CONNECTIONS

Terminal No. 1 — Base
Terminal No. 2 — Collector
Terminal No. 3 — Emitter
Mounting Flange Terminal No. 4 — Collector

RCA31/SDH, RCA31A/SDH, RCA31B/SDH, and RCA31C/SDH are single-diffused hometaxial-base, silicon n-p-n transistors. These types are essentially hometaxial-base versions of the RCA31, RCA31A, RCA31B, and RCA31C epitaxial-base types, respectively.● They are intended for a wide variety of switching and amplifier applications, such as series and shunt regulators and driver and output stages of high-fidelity amplifiers. These new plastic power-transistors differ from each other in voltage ratings and in the currents at which the parameters are controlled.

● RCA31-series types are described in RCA data bulletin File No. 585.

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		RCA31/SDH	RCA31A/SDH	RCA31B/SDH	RCA31C/SDH	
COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	40	60	80	100	V
COLLECTOR-TO-EMITTER VOLTAGE:						
With base open	V_{CEO}	40	60	80	100	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	5	5	5	5	V
* CONTINUOUS COLLECTOR CURRENT	I_C	4	4	4	2.5	A
CONTINUOUS BASE CURRENT	I_B	1	1	1	1	A
TRANSISTOR DISSIPATION:	P_T					
At case temperatures up to 25°C		36	36	36	50	W
At ambient temperatures up to 25°C		1.8	1.8	1.8	1.8	W
At case temperatures above 25°C		See Fig. 2				
At ambient temperatures above 25°C...Derate linearly		0.0144				W/°C
TEMPERATURE RANGE:						
Storage and Operating (Junction)		−65 to 150				°C
TERMINAL TEMPERATURE (During Soldering):						
At distance 1/8 in. (3.17 mm) from case for 10 s max.		235				°C

*Differs from RCA31 Series.

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

	CHARACTERISTIC	SYMBOL	TEST CONDITIONS					LIMITS				UNITS
			DC VOLTAGE (V)			DC CURRENT (A)		RCA31/SDH		RCA31A/SDH		
			V_{CE}	V_{EB}	V_{BE}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	
	Collector-Cutoff Current: With base open	I_{CEO}	30				0	–	0.3	–	0.3	mA
	With base-emitter junction short-circuited	I_{CES}	40 60		0 0			– –	0.2 –	– –	– 0.2	
	Emitter-Cutoff Current	I_{EBO}		5		0		–	1	–	1	mA
	Collector-to-Emitter Breakdown Voltage: With base open	$V_{BR(CEO)}$				0.03[a]	0	40	–	60	–	V
*	DC Forward-Current Transfer Ratio	h_{FE}	4 4			1[a] 3[a]		25 10	– –	25 10	– –	
	Base-to-Emitter Voltage	V_{BE}	4			3[a]		–	1.8	–	1.8	V
	Collector-to-Emitter Saturation Voltage	$V_{CE(sat)}$				3[a]	0.375	–	1.2	–	1.2	V
	Common-Emitter, Small-Signal, Short, Circuit, Forward-Current Transfer Ratio (f = 1 kHz)	h_{fe}	10			0.5		20	–	20	–	
*	Magnitude of Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio (f = 1 MHz)	$\|h_{fe}\|$	10			0.5		0.8	–	0.8	–	
	Unclamped Inductive Load Energy[b] (L = 20 mH) See Fig. 8		(V_{CC}) 10					–	32	–	32	mJ
*	Saturated Switching Time: (R_L = 30 Ω) See Figs. 10 and 11 Turn-on-time ($t_d + t_r$)	t_{on}	(V_{CC}) 30			1	0.1[c]	2.3 (typ.)	5	2.3 (typ.)	5	μs
*	Turn-off time ($t_s + t_f$)	t_{off}	(V_{CC}) 30			1	0.1[c]	6 (typ.)	15	6 (typ.	15	
*	Thermal Resistance Junction-to-Case	$R_{\theta JC}$						–	3.5	–	3.5	°C/W
	Junction-to-Ambient	$R_{\theta JA}$						–	70	–	70	

*Differs from RCA31 Series.

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

[b]Based upon ability of device to perform in circuit shown in Fig. 8.

[c]$I_{B_1} = I_{B_2}$ = value shown.

ELECTRICAL CHARACTERISTICS, *At Case Temperature (T_C) = 25°C* (cont'd)

	CHARACTERISTIC	SYMBOL	TEST CONDITIONS					LIMITS				UNITS
			DC VOLTAGE (V)			DC CURRENT (A)		RCA31B/SDH		RCA31C/SDH		
			V_{CE}	V_{EB}	V_{BE}	I_C	I_B	MIN.	MAX.	MIN.	MAX.	
	Collector-Cutoff Current: With base open	I_{CEO}	60				0	–	0.3	–	0.3	mA
	With base-emitter junction short-circuited	I_{CES}	80 100		0 0			– –	0.2 –	– –	– 0.2	
	Emitter-Cutoff Current	I_{EBO}		5		0		–	1	–	1	mA
	Collector-to-Emitter Breakdown Voltage: With base open	$V_{BR(CEO)}$				0.03[a]	0	80	–	100	–	V
*	DC Forward-Current Transfer Ratio	h_{FE}	4 4			1[a] 3[a]		25 10	– –	25 10	– –	
	Base-to-Emitter Voltage	V_{BE}	4			3[a]		–	1.8	–	1.8	V
	Collector-to-Emitter Saturation Voltage	$V_{CE(sat)}$				3[a]	0.375	–	1.2	–	1.2	V
	Common-Emitter, Small-Signal, Short, Circuit, Forward-Current Transfer Ratio (f = 1 kHz)	h_{fe}	10			0.5		20	–	20	–	
*	Magnitude of Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio (f = 1 MHz)	$\|h_{fe}\|$	10			0.5		0.8	–	0.8	–	
	Unclamped Inductive Load Energy[b] (L = 20 mH) See Fig. 8		(V_{CC}) 10					–	32	–	32	mJ
*	Saturated Switching Time: (R_L = 30 Ω) See Figs. 10 and 11 Turn-on-time ($t_d + t_r$)	t_{on}	(V_{CC}) 30			1	0.1[c]	2.3 (typ.)	5	2.3 (typ.)	5	μs
*	Turn-off time ($t_s + t_f$)	t_{off}	(V_{CC}) 30			1	0.1[c]	6 (typ.)	15	6 (typ.	15	
*	Thermal Resistance Junction-to-Case	$R_{\theta JC}$						–	3.5	–	2.5	°C/W
	Junction-to-Ambient	$R_{\theta JA}$						–	70	–	70	

*Differs from RCA31 Series.

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

[b]Based upon ability of device to perform in circuit shown in Fig. 8.

[c]$I_{B_1} = I_{B_2}$ = value shown.

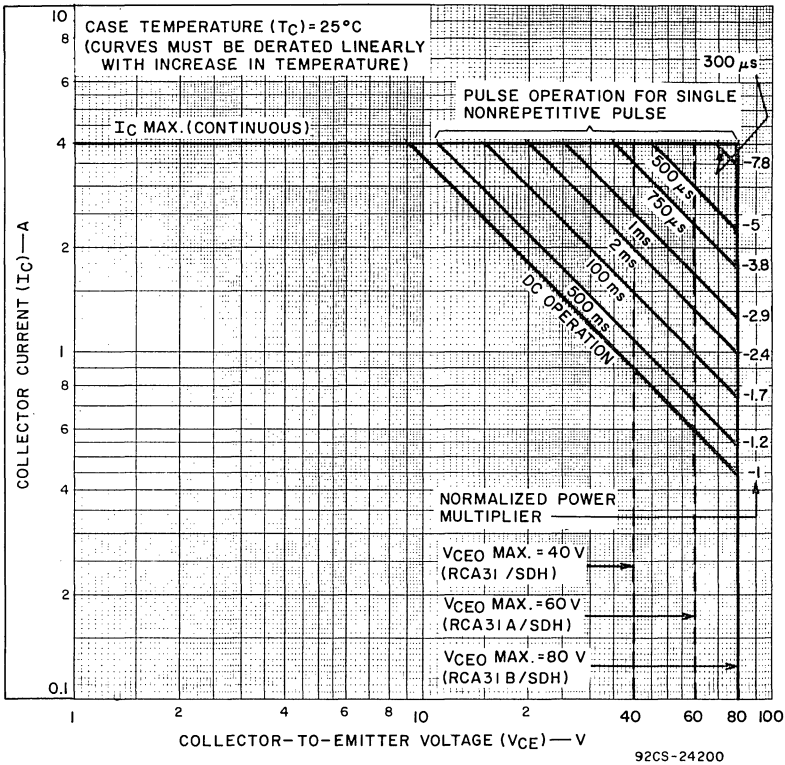


Fig. 1 – Mounting operating areas for RCA31/SDH, RCA31A/SDH, and RCA31B/SDH.

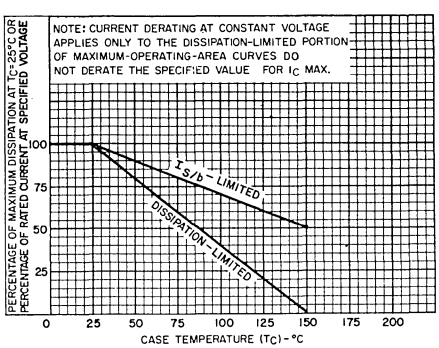


Fig. 2 – Dissipation and $I_{S/b}$ derating curves for all types.

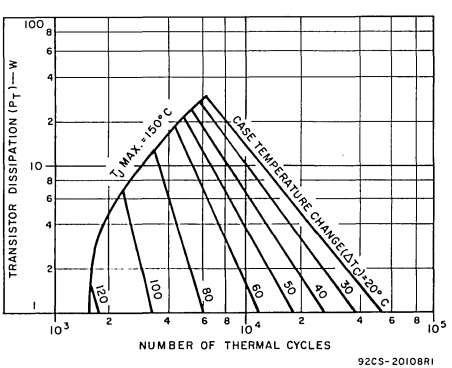


Fig. 3 – Thermal-cycling rating chart for RCA31/SDH, RCA31A/SDH, and RCA31B/SDH.

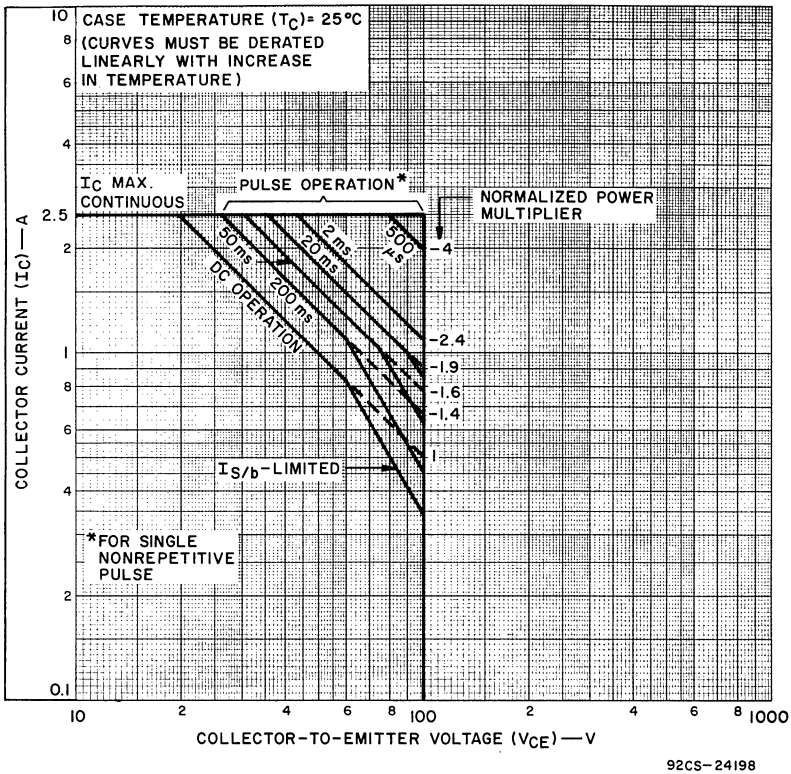


Fig. 4 – Maximum operating areas for RCA31C/SDH.

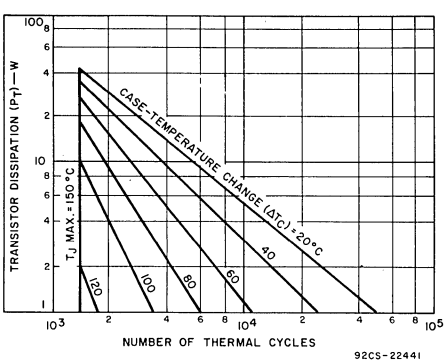


Fig. 5 – Thermal-cycling rating chart for RCA31C/SDH.

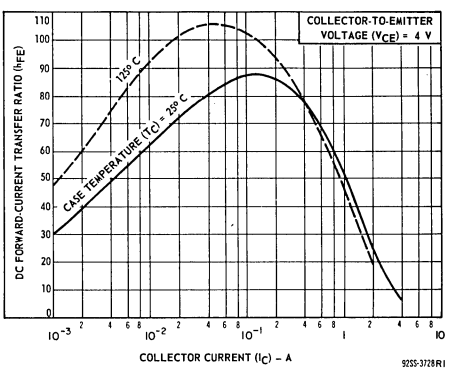


Fig. 6 – Typical dc beta characteristics for RCA31/SDH, RCA31A/SDH, and RCA31B/SDH.

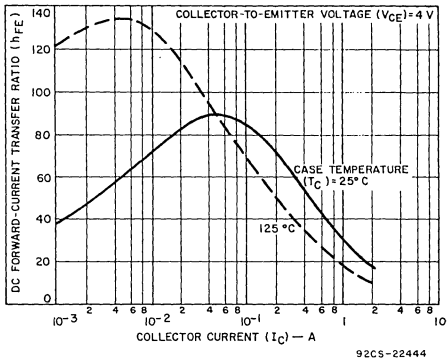
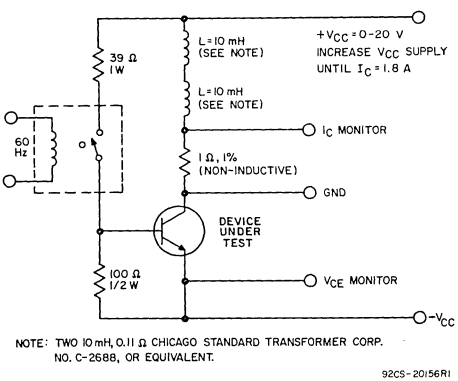


Fig. 7 — Typical dc beta characteristics for RCA31C/SDH.



NOTE: TWO 10 mH, 0.11 Ω CHICAGO STANDARD TRANSFORMER CORP. NO. C-2688, OR EQUIVALENT.

Fig. 8 — Circuit for measuring inductive-load switching for all types.

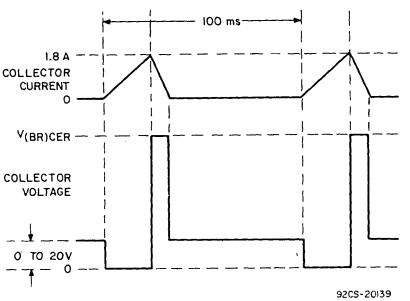
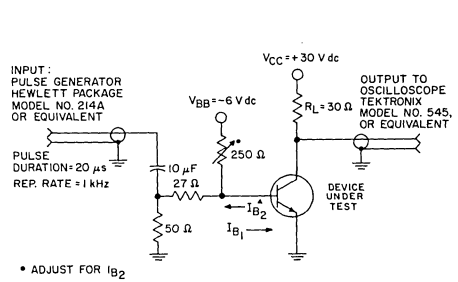


Fig. 9 — Inductive-load voltage and current waveforms (test circuit shown in Fig. 8).



• ADJUST FOR I_{B_2}

▲ I_{B_1} AND I_{B_2} MEASURED WITH TEKTRONIX CURRENT PROBE P6019 AND TYPE 134 AMPLIFIER, OR EQUIVALENT

Fig. 10 — Circuit used to measure switching times for all types.

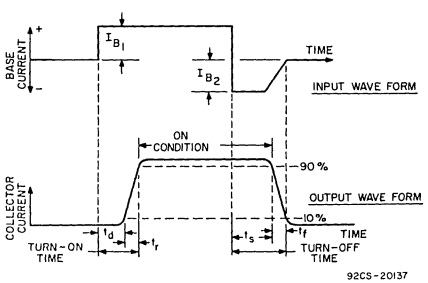


Fig. 11 — Phase relationship between input current and output voltage showing reference points for specification of switching times (test circuit shown in Fig. 10).