RCA Solid State Division

Power Transistors

2N6246 2N6247 2N6248 2N6469 2N6470 2N6471 2N6472

JEDEC TO-3

H-1570

Silicon N-P-N and P-N-P Epitaxial-Base High-Power Transistors

General-Purpose Types for Switching and Linear-Amplifier Applications

Features:

- **High dissipation capability: 125 W at 25°C**
- **Low saturation voltages**
- **Maximum safe-area-of-operation curves**
- **Hermetically sealed JEDEC TO-3 package**
- **High gain at high current**
- **Thermal-cycling rating curve**

RCA-2N6246, 2N6247, 2N6248, and 2N6469▲ are epitaxial-base silicon p-n-p transistors featuring high gain at high current. RCA-2N6470, 2N6471, and 2N6472● are epitaxial-base silicon n-p-n transistors. They may be used as complements to the 2N6469, 2N6246, and 2N6247, respectively. All of these devices have a dissipation capability of 125 watts at case temperatures up to 25°C. They differ in voltage ratings and in the currents at which the parameters are controlled. All are supplied in the JEDEC TO-3 package.

▲ Formerly RCA Dev. Nos. TA7281, TA7280, TA7279, and TA8724, respectively.

● Formerly RCA Dev. Nos. TA8726, TA8443, and TA8442, respectively.

Maximum Ratings, *Absolute-Maximum Values:*

		N-P-N	2N6470	2N6471	2N6472		
		P-N-P	2N6469♦	2N6246♦	2N6247♦	2N6248♦	
*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}		50	70	90	110	V
COLLECTOR-TO-EMITTER VOLTAGE:							
* With external base-to-emitter resistance (R_{BE}) = 100 Ω	V_{CER}		50	70	90	110	V
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		15	15	15	10	A
*CONTINUOUS BASE CURRENT	I_B		5	5	5	5	A
*TRANSISTOR DISSIPATION:	P_T						
At case temperatures up to 25°C			125	125	125	125	W
At case temperatures above 25°C			← See Fig. 3 →				
*TEMPERATURE RANGE:							
Storage & Operating (Junction)			← −65 to +200 →				°C
*PIN TEMPERATURE (During Soldering):							
At distances ≥ 1/32" (0.8 mm) from seating plane for 10 s max.			← +235 →				°C

* In accordance with JEDEC registration data format (JS-6 RDF-2).

♦ For p-n-p devices, voltage and current values are negative.

ELECTRICAL CHARACTERISTICS FOR P-N-P TYPES, *At case temperature (T_C) = 25° C unless otherwise specified*

	CHARACTERISTIC	SYMBOL	TEST CONDITIONS			LIMITS								UNITS
			V dc	A dc		2N6469		2N6246		2N6247		2N6248		
			V_{CE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
	Collector-Cutoff Current: With external base-emitter resistance (R_{BE}) = 100Ω	I_{CER}	-35			–	-200	–	–	–	–	–	–	μA
			-55			–	–	–	-200	–	–	–	–	
			-75			–	–	–	–	–	-200	–	–	
*			-95			–	–	–	–	–	–	–	-200	
	V_{BE} = 1.5 V	I_{CEX}	-45			–	-200	–	–	–	–	–	–	μA
			-65			–	–	–	-200	–	–	–	–	
			-85			–	–	–	–	–	-200	–	–	
			-100			–	–	–	–	–	–	–	-200	
*	At T_C = 150°C V_{BE} = 1.5 V		-45			–	-5	–	–	–	–	–	–	mA
			-55			–	–	–	-5	–	–	–	–	
			-70			–	–	–	–	–	-5	–	–	
			-90			–	–	–	–	–	–	–	-5	
*	With base open	I_{CEO}	-20		0	–	-1	–	–	–	–	–	–	mA
			-30		0	–	–	–	-1	–	–	–	–	
			-40		0	–	–	–	–	–	-1	–	–	
			-50		0	–	–	–	–	–	–	–	-1	
*	Emitter-Cutoff Current, V_{BE} = 5 V	I_{EBO}			0	–	-5	–	-5	–	-1	–	-1	mA
*	DC Forward-Current Transfer Ratio	h_{FE}	-4	-5[a]		20	150	–	–	–	–	20	100	
			-4	-7[a]		–	–	20	100	–	–	–	–	
			-4	-6[a]		–	–	–	–	20	100	–	–	
			-4	-10[a]		–	–	–	–	–	–	5	–	
			-4	-15[a]		5	–	5	–	5	–	–	–	
	Collector-to-Emitter Sustaining Voltage	$V_{CEO(sus)}$		-0.2	0	-40[b]	–	-60[b]	–	-80[b]	–	-100[b]	–	V
*	With base open													
	With external base-emitter resistance (R_{BE}) = 100Ω	$V_{CER(sus)}$		-0.2		-45[b]	–	-65[b]	–	-85[b]	–	-105[b]	–	
*	Base-to-Emitter Voltage	V_{BE}	-4	-15[a]		–	-3.5	–	–	–	–	–	–	V
			-4	-7[a]		–	–	–	-2	–	–	–	–	
			-4	-6[a]		–	–	–	–	–	-1.8	–	–	
			-4	-5[a]		–	–	–	–	–	–	–	-1.8	
*	Collector-to-Emitter Saturation Voltage	$V_{CE(sat)}$		-5[a]	-0.5	–	-1.3	–	–	–	–	–	-1.3	V
				-7[a]	-0.7	–	–	–	-1.3	–	–	–	–	
				-6[a]	-0.6	–	–	–	–	–	-1.3	–	–	
				-15[a]	-5	–	-3.5	–	–	–	–	–	–	
				-15[a]	-3	–	–	–	-2.5	–	–	–	–	
				-15[a]	-4	–	–	–	–	–	-3.5	–	–	
				-10[a]	-2	–	–	–	–	–	–	–	-3.5	
*	Magnitude of Common-Emitter Small-Signal Short-Circuit Forward-Current Transfer Ratio (f = 2 MHz)	$\lvert h_{fe} \rvert$	-4	-1		5	–	5	–	5	–	5	–	
*	Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio (f = 1 kHz)	h_{fe}	-4	-1		25	–	25	–	25	–	25	–	
	Thermal Resistance (Junction-to-case)	$R_{\theta JC}$				–	1.4	–	1.4	–	1.4	–	1.4	°C/W

* In accordance with JEDEC registration data format (JS-6 RDF-2).

[a] Pulsed; pulse duration = 300 μs, duty factor = 1.8%.

[b] *CAUTION: Sustaining voltages $V_{CEO(sus)}$, $V_{CER(sus)}$, and $V_{CEX(sus)}$ MUST NOT be measured on a curve tracer, (See Fig. 22)*

ELECTRICAL CHARACTERISTICS FOR N-P-N TYPES, *At case temperature (T_C) = 25° C unless otherwise specified*

	CHARACTERISTIC	SYMBOL	TEST CONDITIONS			LIMITS						UNITS
			V dc	A dc		2N6470		2N6471		2N6472		
			V_{CE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	
	Collector-Cutoff Current:											
	With external base-emitter resistance (R_{BE}) = 100Ω	I_{CER}	35 55 75			– – –	500	– – –	– 500 –	– – –	– – 500	μA
*	V_{BE} = −1.5 V	I_{CEX}	45 65 85			– – –	500 – –	– – –	– 500 –	– – –	– – 500	μA
*	At T_C = 150°C V_{BE} = −1.5 V	I_{CEX}	40 60 80			– – –	5 – –	– – –	– 5 –	– – –	– – 5	mA
*	With base open	I_{CEO}	20 30 40		0 0 0	– – –	1 – –	– – –	– 1 –	– – –	– – 1	mA
*	Emitter-Cutoff Current; V_{BE} = −5 V	I_{EBO}		0		–	1	–	1	–	1	mA
*	DC Forward-Current Transfer Ratio	h_{FE}	4 4	5[a] 15[a]		20 5	150 –	20 5	150 –	20 5	150 –	
*	Collector-to-Emitter Sustaining Voltage With base open	$V_{CEO(sus)}$		0.2	0	40[b]		60[b]	–	80[b]	–	V
	With external base-emitter resistance (R_{BE}) = 100Ω	$V_{CER(sus)}$		0.2		45[b]		65[b]	–	85[b]	–	
*	Base-to-Emitter Voltage	V_{BE}	4 4	5[a] 15[a]		– –	1.3 3.5	– –	1.3 3.5	– –	1.3 3.5	V
*	Collector-to-Emitter Saturation Voltage	$V_{CE(sat)}$		5[a] 15[a]	0.5 5		1.3 3.5	–	1.3 3.5	– –	1.3 3.5	V
*	Magnitude of Common-Emitter Small-Signal Short-Circuit Forward-Current Transfer Ratio: (f = 1 MHz)	$\lvert h_{fe} \rvert$	4	1		5		5	–	5	–	
*	Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio (f = 1 kHz)	h_{fe}	4	1		25		25	–	25	–	
	Thermal Resistance: (Junction-to-case)	$R_{\theta JC}$				–	1.4	–	1.4	–	1.4	°C/W

* In accordance with JEDEC registration data format (JS-6 RDF-2).

[a] Pulsed; pulse duration = 300 μs, duty factor 1.8%.

[b] *CAUTION: Sustaining voltages $V_{CEO}(sus)$, $V_{CER}(sus)$, and $V_{CEX}(sus)$ MUST NOT be measured on a curve tracer. (See Fig. 22.)*

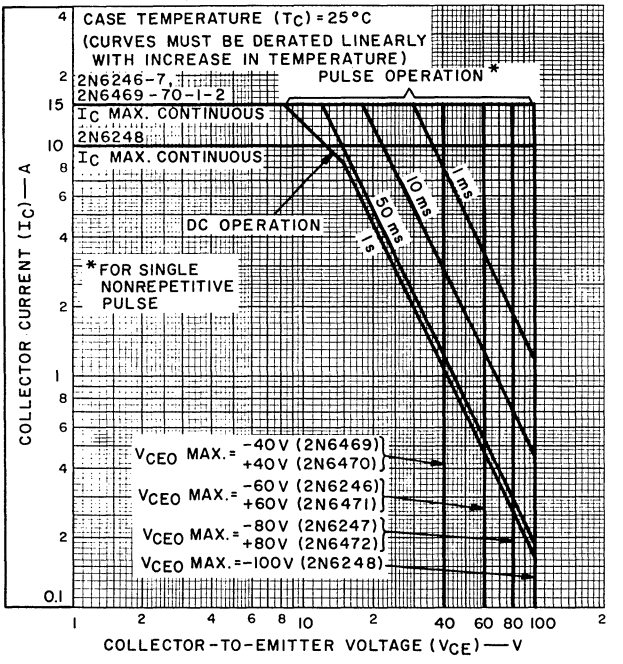


Fig.1 – Maximum operating areas for all types.

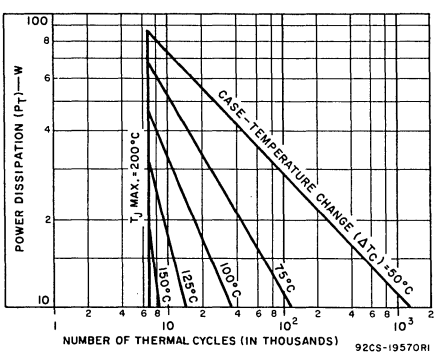


Fig.2 – Thermal-cycling rating chart for all types.

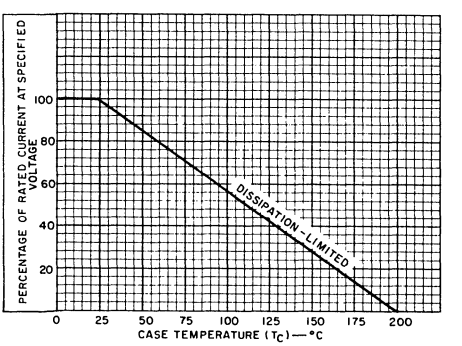


Fig.3 – Current derating for all types.

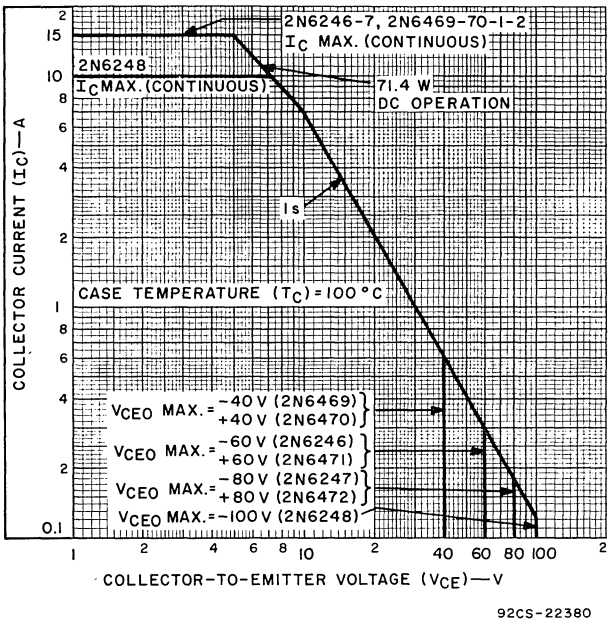


Fig.4 — Maximum operating areas for all types.

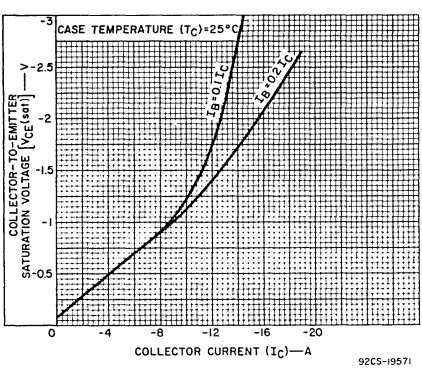


Fig.5 — Typical collector-to-emitter saturation-voltage characteristics for 2N6246, 2N6247, 2N6248, and 2N6469.

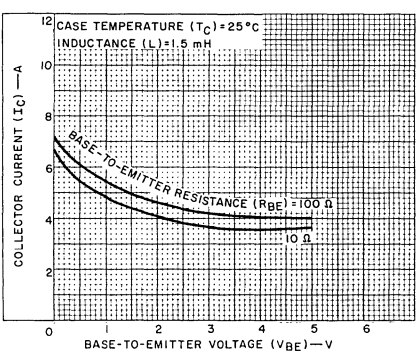


Fig.6 — Minimum reverse-bias second-breakdown characteristics for all types. (Values for p-n-p types are negative).

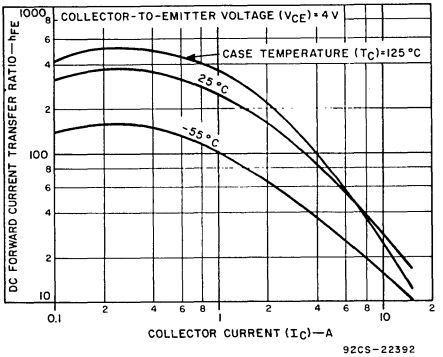


Fig.7 — Typical dc beta characteristics for 2N6470, 2N6471, and 2N6472.

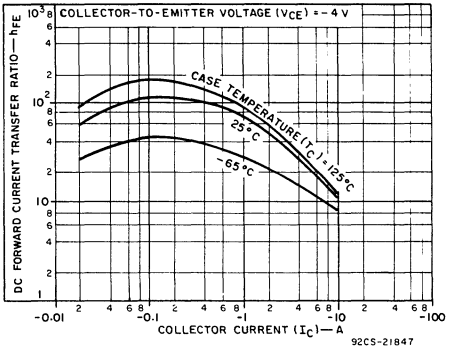


Fig.8 — Typical dc beta characteristics for 2N6248.

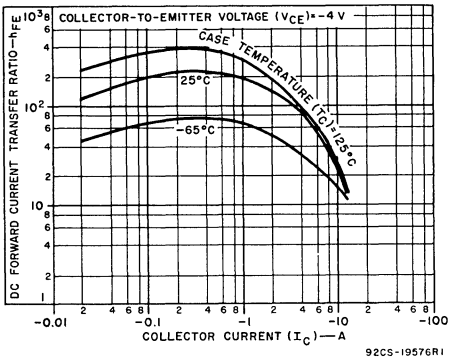


Fig.9 — Typical dc beta characteristics for 2N6246, 2N6247, and 2N6469.

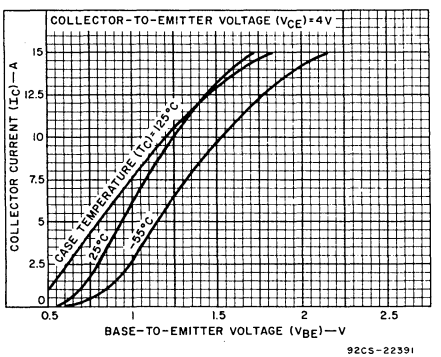


Fig.10 — Typical transfer characteristics for 2N6470, 2N6471, and 2N6472.

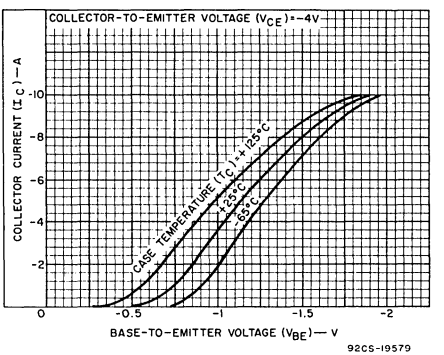


Fig.11 — Typical transfer characteristics for 2N6246, 2N6247, 2N6248, and 2N6469.

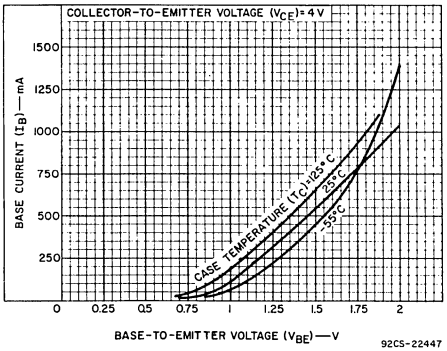


Fig.12 – Typical input characteristics for 2N6470, 2N6471, and 2N6472.

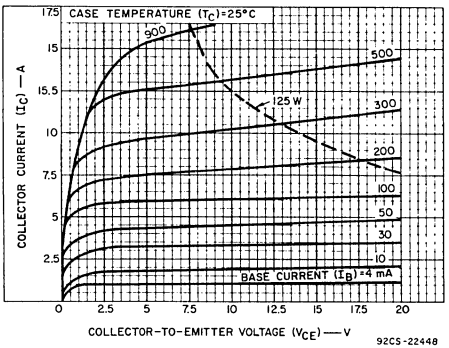


Fig.13 – Typical output characteristics for 2N6470, 2N6471, and 2N6472.

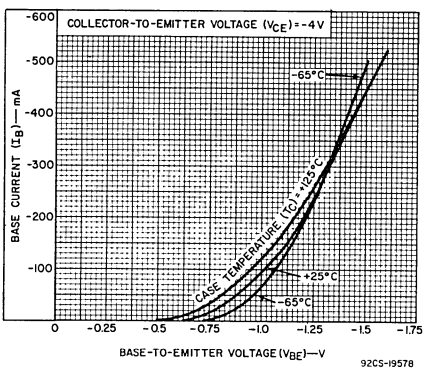


Fig.14 – Typical input characteristics for 2N6248.

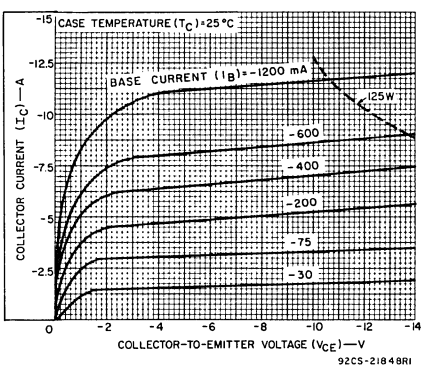


Fig.15 – Typical output characteristics for 2N6248.

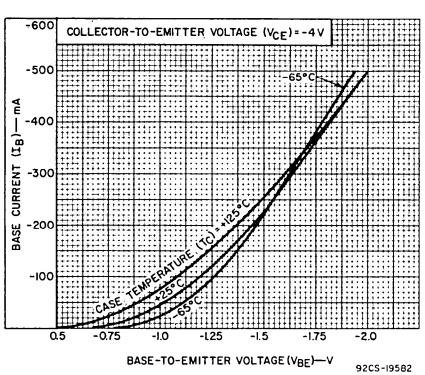


Fig.16 – Typical input characteristics for 2N6246, 2N6247, and 2N6469.

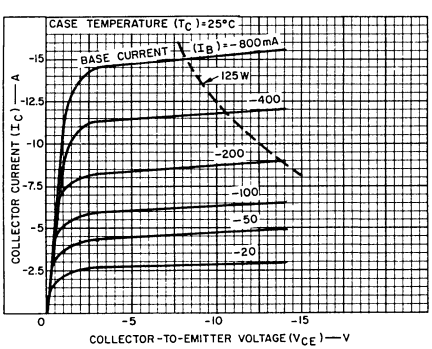


Fig.17 – Typical output characteristics for 2N6246, 2N6247, and 2N6469.

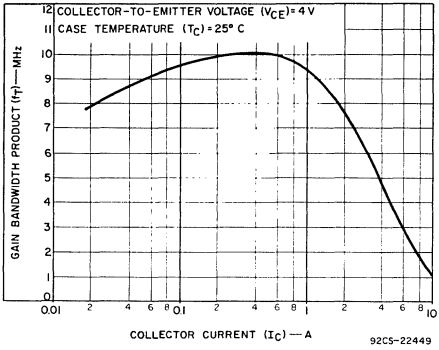


Fig.18 — Typical gain-bandwidth product vs. collector current for 2N6470, 2N6471, and 2N6472.

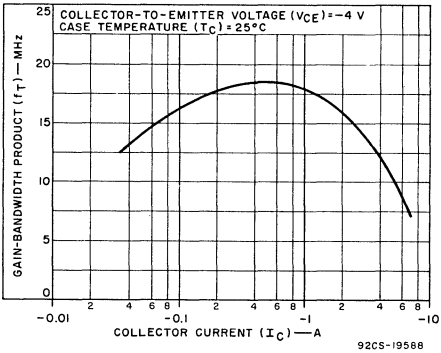


Fig.19 — Typical gain-bandwidth product vs. collector current for 2N6246, 2N6247, 2N6248, and 2N6469.

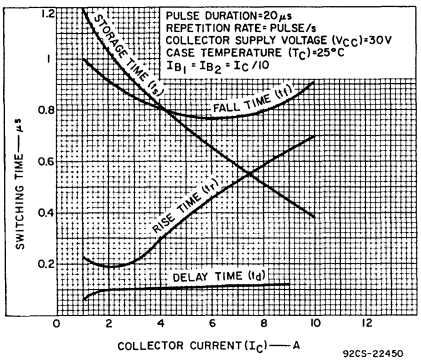


Fig.20 — Typical saturated switching characteristics for 2N6470, 2N6471, and 2N6472.

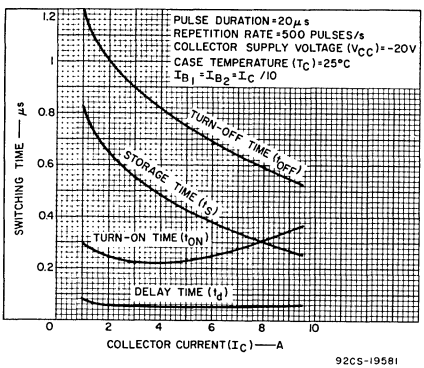
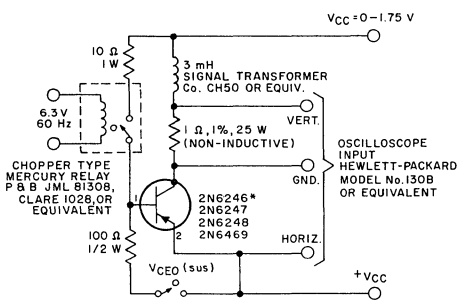
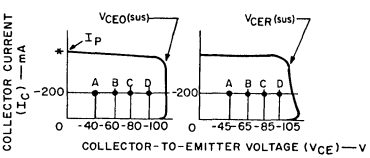


Fig.21 — Typical saturated switching characteristics for 2N6246, 2N6247, 2N6248, and 2N6469.



*FOR N-P-N TYPES 2N6470, 2N6471, AND 2N6472, REVERSE POLARITY OF V_{CC}.

Fig.22 — Circuit used to measure sustaining voltages $V_{CEO(sus)}$, $V_{CER(sus)}$, and $V_{CEX(sus)}$ for all types.



*PULSE CURRENT (I_P) RANGE = 0.6−0.8 A

THE SUSTAINING VOLTAGES $V_{CEO(sus)}$, AND $V_{CER(sus)}$, ARE ACCEPTABLE WHEN THE TRACES FALL TO THE RIGHT AND ABOVE POINT "A" FOR TYPES 2N6469 AND 2N6470; POINT "B" FOR 2N6246 and 2N6471; POINT "C" FOR 2N6247 AND 2N6472; AND POINT "D" FOR 2N6248. VALUES FOR N-P-N TYPES ARE POSITIVE.

92CS-24702

Fig.23 — Oscilloscope display for measurement of sustaining voltages (test circuit shown in Fig.22.)

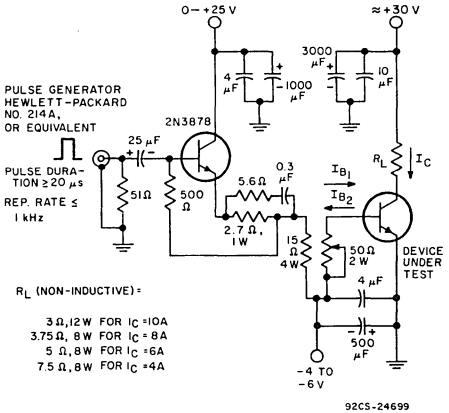


Fig.24 – Circuit used to measure switching times for 2N6470, 2N6471, and 2N6472.

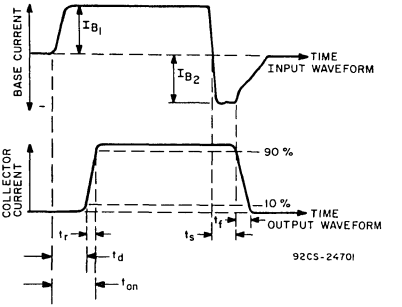


Fig.25 – Phase relationship between input and output currents showing reference points for specification of switching times. (Test circuit shown in Fig.24.)

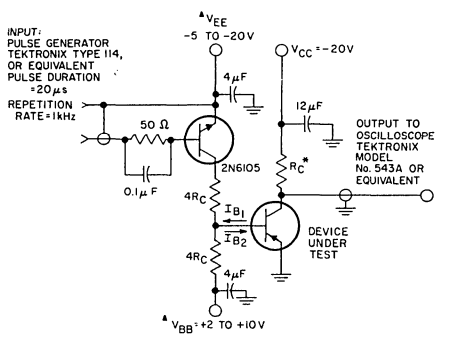


Fig.26 – Circuit used to measure switching times for 2N6246, 2N6247, 2N6248, and 2N6469.

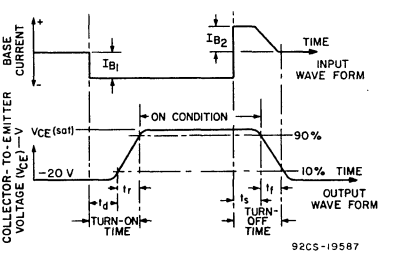


Fig.27 – Oscilloscope display for measurement of switching times.

TERMINAL CONNECTIONS

Pin 1 – Base

Pin 2 – Emitter

Case – Collector

Mounting Flange – Collector