2N3878, 2N3879, 2N5202, 2N6500

File Number **766**

High-Speed, Epitaxial-Collector Silicon N-P-N Planar Transistors

For High-Speed Switching and Linear-Amplifier Applications

Features:

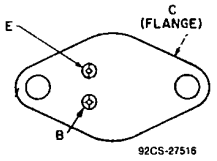
- *Maximum-area-of-operation curves for dc and pulse operation*
- *High substaining voltage*
- *Total saturated transition time less than 1 μs for 2N3879, 2N5202, and 2N6500*

RCA-2N3878, 2N3879, 2N5202, and 2N6500* are epitaxial silicon n-p-n transistors. The 2N3878 is an amplifier type intended for audio-, ultrasonic-, and radio-frequency circuits. Types 2N3879, 2N5202, and 2N6500 are switching transistors intended for use in high-current, high-speed switching circuits.

Typical applications for these transistors include: low-distortion power amplifiers, oscillators, switching regulators, series regulators, converters, and inverters.

*Formerly RCA Dev. Type Nos. TA2509, TA2509A, TA7285, and TA8932, respectively.

TERMINAL DESIGNATIONS



JEDEC TO-213AA

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		2N3878	2N3879	2N5202	2N6500	
*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	120	120	100	120	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:						
With external base-to-emitter resistance (R_{BE}) = 50 Ω.	$V_{CER(sus)}$	65	90	75*	110*	V
With base open.	$V_{CEO(sus)}$	50*	75*	50	90*	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	7	7	6	7	V
*CONTINUOUS COLLECTOR CURRENT	I_C	4	7	4	4	A
PEAK COLLECTOR CURRENT	I_{CM}	10	10	5	5	A
*CONTINUOUS BASE CURRENT	I_B	4	5	2	3	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. 1, 3 and 4				
*TEMPERATURE RANGE:						
Storage & operating (Junction)		−65 to 200				°C
*PIN TEMPERATURE:						
1/32 in. (0.8 mm) from seating plane for 10 s max.		235	235	235	235	°C

* In accordance with JEDEC registration data format JS-6 RDF-2 (2N3878); JS-6 RDF-1 (2N3879, 2N5202, 2N6500).

2N3878, 2N3879, 2N5202, 2N6500

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

	CHARACTERISTIC	SYMBOL	TEST CONDITIONS				LIMITS								UNITS
			VOLTAGE V dc		CURRENT A dc		2N3878		2N3879		2N5202		2N6500		
			V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
*	Collector Cutoff Current: With base-emitter junction reverse-biased	I_{CEV}	100 110 120	−1.5 0 −1.5			− − −	− − 25	− − −	− − 25	− − −	10 − −	− − −	− 5 −	mA
*	With base-emitter junction reverse-biased and T_C = 150°C	I_{CEV}	100 110	−1.5 0			− −	4 −	− −	4 −	− −	10 −	− −	− 10	mA
	With base open	I_{CEO}	40 70			0 0	− −	5* −	− −	5 −	− −	− −	− −	− 5	mA
*	Emitter Cutoff Current	I_{EBO}		−6 −7			− −	− 10	− −	− 10	− −	10 −	− −	− 25	mA
	Collector-to-Emitter Sustaining Voltage With base open	$V_{CEO(sus)}$			0.2	0	50*[a]	−	75*[a]	−	50[a]	−	90*[a]	−	V
	With external base-to-emitter resistance (R_{BE}) = 50 Ω	$V_{CER(sus)}$			0.2	0	65[a]	−	90[a]	−	75[a]	−	110[a]		V
	DC Forward-Current Transfer Ratio	h_{FE}	1.2 2 2 2 5 5		4[b] 0.5[b] 3[b] 4[b] 4[b] 0.5[b]		− 40* − 8* 20* 50*	− 200* − − − 200*	− − − 12* 20 40	− − − 100* 80 −	10* − − − − −	100* − − − − −	− − 15* − − −	− − 60* − − −	
*	Collector-to-Emitter Saturation Voltage	$V_{CE(sat)}$			3[b] 4[b]	0 3 0 4	− −	− 2	− −	− 1.2	− −	− 1.2	− −	1.5 −	V
*	Base-to-Emitter Voltage	V_{BE}	2		4b	−	−	2.5	−	−	−	−	−	−	V
*	Base-to-Emitter Saturation Voltage	$V_{BE(sat)}$			3[b] 4[b]	0.3 0.4	− −	− −	− −	− 2	− −	− 2	− −	2.5 −	V
	Collector-to-Base Output Capacitance (f = 1 MHz, V_{CB} = 10 V)	C_{ob}					−	175*	-	175	−	175	−	175	pF
	Second Breakdown Collector Current With base forward-biased and 1-s nonrepetitive pulse	$I_{S/b}$	40				750	−	500	−	400	−	400	−	mA
*	Magnitude of Common Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio (f = 10 MHz)	$\|h_{fe}\|$	10		0.5		4	−	4	−	6	−	6	−	
*	Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio (f = 1 kHz)	h_{fe}	30		0.1		40	−	−	−	−	−	−	−	
	Thermal Resistance Junction-to-case	$R_{\theta JC}$					−	5	−	5	−	5	−	5	°C/W

* In accordance with JEDEC registration data format JS-6 RDF-2 (2N3878); JS-6 RDF-1 (2N3879, 2N5202, 2N6500).

[a] CAUTION: Sustaining voltages $V_{CEO(sus)}$ and $V_{CER(sus)}$ MUST NOT be measured on a curve tracer.

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

2N3878, 2N3879, 2N5202, 2N6500

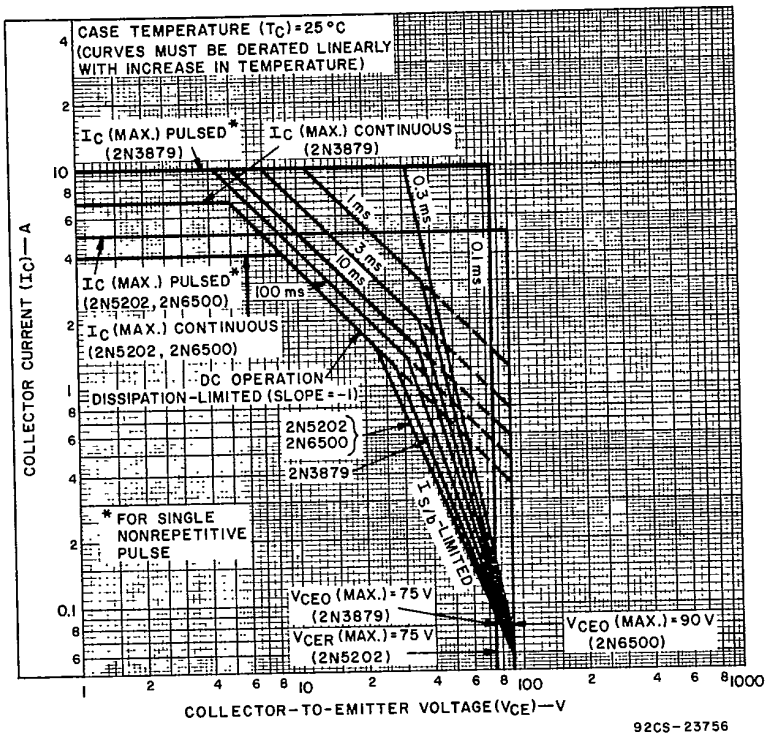


Fig. 1 – Maximum operating areas for 2N3879, 2N5202, and 2N6500.

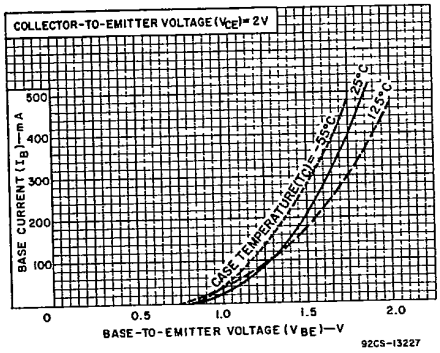


Fig. 2 – Typical input characteristics for all types.

2N3878, 2N3879, 2N5202, 2N6500

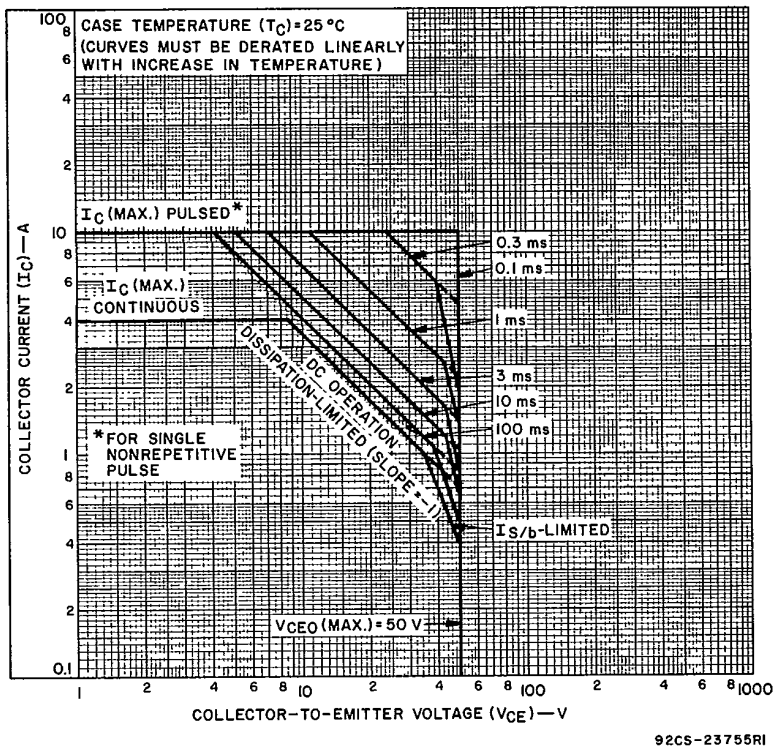


Fig. 3 – Maximum operating areas for 2N3878.

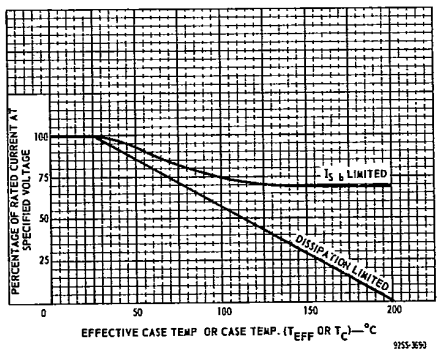


Fig. 4 – Dissipation derating for all types.

2N3878, 2N3879, 2N5202, 2N6500

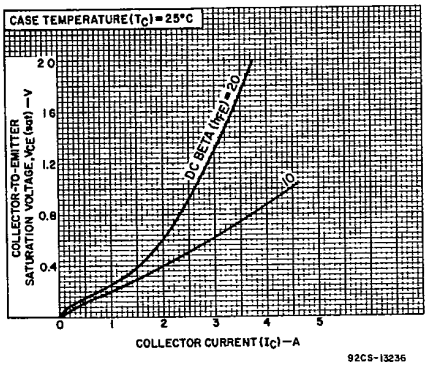


Fig. 5 – Typical saturation-voltage characteristics for 2N3878, and 2N3879.

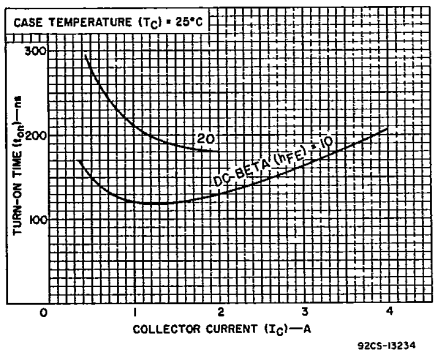


Fig. 6 – Typical turn-on time for 2N3879, 2N5202, and 2N6500.

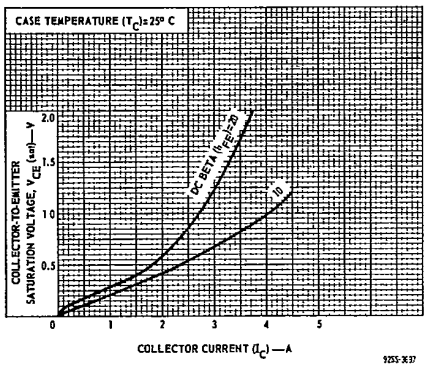


Fig. 7 – Typical saturation-voltage characteristics for 2N5202.

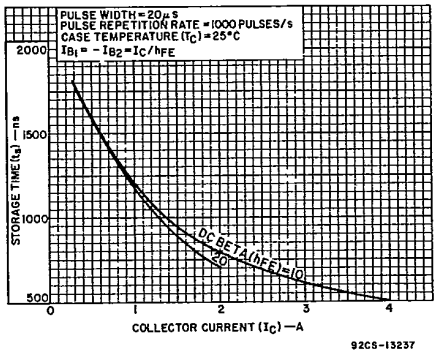


Fig. 8 – Typical storage time for 2N3879, 2N5202, and 2N6500.

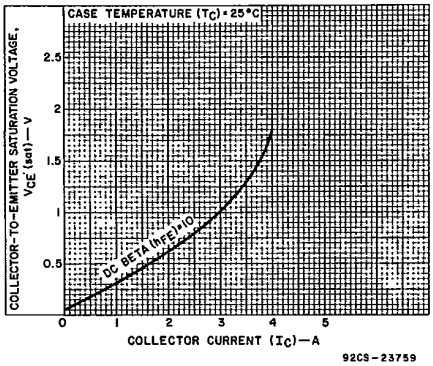


Fig. 9 – Typical saturation-voltage characteristics for 2N6500.

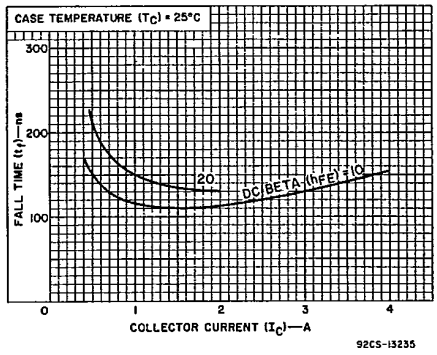


Fig. 10 – Typical fall time for 2N3879, 2N5202, and 2N6500.

2N3878, 2N3879, 2N5202, 2N6500

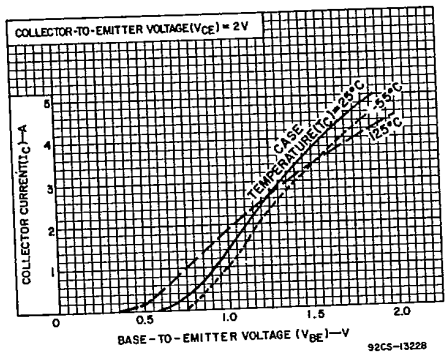


Fig.11 – Typical transfer characteristics for all types.

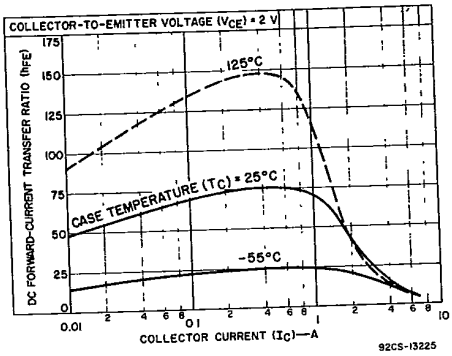


Fig.12 – Typical dc beta characteristics for 2N3878 and 2N3879.

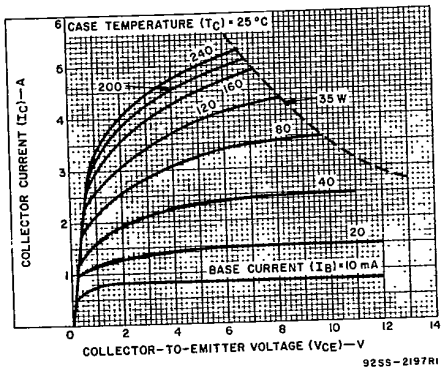


Fig.13 – Typical output characteristics for 2N3878, 2N3879 and 2N5202.

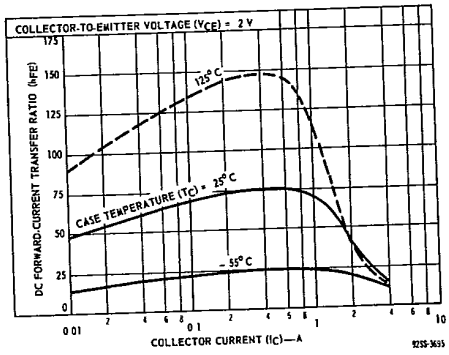


Fig.14 – Typical dc beta characteristics for 2N5202.

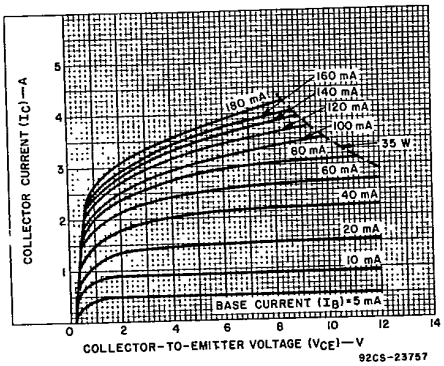


Fig.15 – Typical output characteristics for 2N6500.

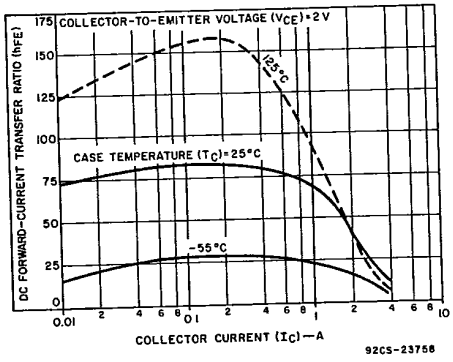


Fig.16 – Typical dc beta characteristics for 2N6500.

2N3878, 2N3879, 2N5202, 2N6500

TRANSITION AND STORAGE-TIME CHARACTERISTICS FOR SWITCHING TYPES, *At Case Temperature (T_C) = 25°C:*

CHARACTERISTIC	SYMBOL	TEST CONDITIONS			LIMITS						UNITS
		VOLTAGE V dc	CURRENT A dc		2N3879		2N5202		2N6500		
		V_{CC}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	
Saturated Switching Time	t_d	30	3	0.3[a]	–	–	–	–	–	40	ns
		30	4	0.4[a]	–	40	–	–	–	–	
Delay time		30	4	0.8[a]	–	–	–	40	–	–	
* Rise time	t_r	30	3	0.3[a]	–	–	–	–	–	400	
		30	4	0.4[a]	–	400	–	–	–	–	
		30	4	0.8[a]	–	–	–	400	–	–	
* Storage time	t_s	30	3	0.3[a]	–	–	–	–	–	1000	
		30	4	0.4[a]	–	800	–	–	–	–	
		30	4	0.8[a]	–	–	–	1200	–	–	
* Fall time	t_f	30	3	0.3[a]	–	–	–	–	–	500	
		30	4	0.4[a]	–	400	–	–	–	–	
		30	4	0.8[a]	–	–	–	400	–	–	

* In accordance with JEDEC registration data format (JS-6, RDF-1)

[a] $I_{B_1} = I_{B_2}$

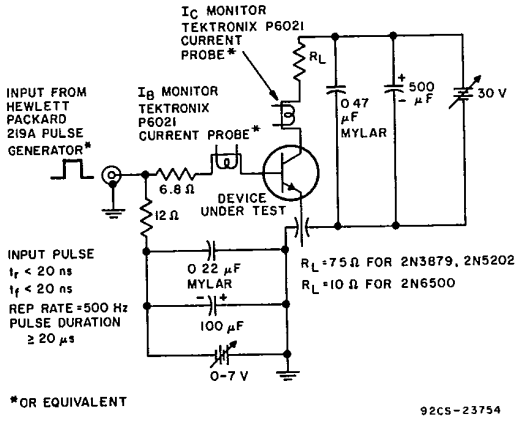


Fig. 17 - Circuit used to measure switching times for 2N3879, 2N5202, and 2N6500.

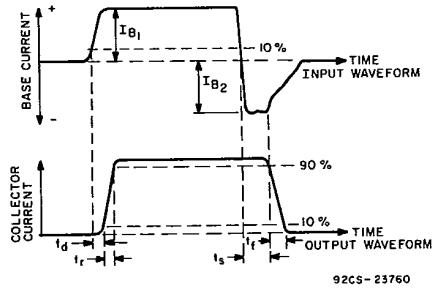


Fig. 18 - Oscilloscope display for measurement of switching times. (Circuit shown in Fig.1).

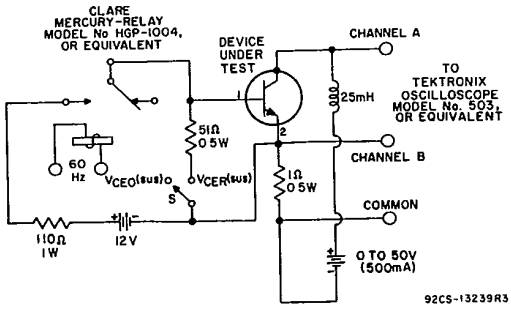
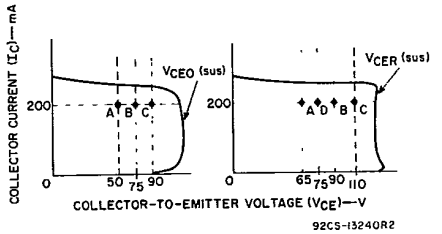


Fig. 19 - Circuit used to measure sustaining voltages, V_{CEO}(sus) and V_{CER}(sus) for all types.



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 2N3878, 40375, and 2N5202; point "B" for type 2N3879; and point "C" for type 2N6500. The sustaining voltage V_{CER}(sus) is acceptable when the trace falls to the right and above point "D" for type 2N5202.

Fig. 20 - Oscilloscope display for measurement of sustaining voltages.