RCA
Solid State
Division

Power Transistors

2N6211, 2N6212
2N6213, 2N6214

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:**
  $V_{CEO}(sus)$ = −400 V max. (2N6214)
  = −350 V max. (2N6213)
  = −300 V max. (2N6212)
  = −225 V max. (2N6211)
- **Large safe-operating area**
- **Complements to 2N3585 transistor family**
- **Thermal-cycling rating**

RCA types 2N6211, 2N6212, 2N6213, and 2N6214● are epitaxial silicon p-n-p 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.

● Formerly RCA Dev. Nos. TA7719, TA7410, TA8330, and TA8331, respectively.

Applications:

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

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		2N6211	2N6212	2N6213	2N6214	
*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	−275	−350	−400	−450	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:						
With base open	$V_{CEO}(sus)$	−225	−300	−350	−400	V
With external base-to-emitter resistance (R_{BE}) = 50 Ω	$V_{CER}(sus)$	−250	−325	−375	−425	V
* With base-emitter junction reverse-biased (V_{BE} = 1.5 V)	$V_{CEX}(sus)$	−275	−350	−400	−450	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	−6	−6	−6	−6	V
*COLLECTOR CURRENT (Continuous)	I_C	−2	−2	−2	−2	A
*BASE CURRENT (Continuous)	I_B	−1	−1	−1	−1	A
TRANSISTOR DISSIPATION:	P_T					
* At case temperatures up to 100°C and V_{CE} up to 50 V		20	20	20	20	W
At case temperatures up to 25°C and V_{CE} up to 40 V		35	35	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 & 6.				
*TEMPERATURE RANGE:						
Storage & Operating (Junction)		←	−65 to 200		→	°C
*LEAD TEMPERATURE (During Soldering):						
At distance ≥ 1/32 in. (0.8 mm) from case for 10s max.		←	230		→	°C

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

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

CHARACTERISTIC	SYMBOL	TEST CONDITIONS				LIMITS								UNITS
		Voltage V dc		Current A dc		2N6211		2N6212		2N6213		2N6214		
		V_{CE}	V_{BE}	I_C	I_B	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Collector-Cutoff Current: With base open	I_{CEO}	−150			0	–	−5	–	−5	–	−5	–	−5	mA
With base-emitter junction reverse-biased	I_{CEV}	−250	1.5			–	−0.5	–	–	–	–	–	–	
		−315	1.5			–	–	–	−0.5	–	–	–	–	
		−360	1.5			–	–	–	–	–	−0.5	–	–	
		−410	1.5			–	–	–	–	–	–	–	−1	
With base-emitter junction reverse biased and T_C = 100°C		−250	1.5			–	−5	–	–	–	–	–	–	
		−315	1.5			–	–	–	−5	–	–	–	–	
		−360	1.5			–	–	–	–	–	−5	–	–	
		−410	1.5			–	–	–	–	–	–	–	−10	
Emitter-Cutoff Current	I_{EBO}		6	0		–	−1	–	−0.5	–	−0.5	–	−0.5	mA
DC Forward-Current Transfer Ratio	h_{FE}	−2.8		−1[a]		10	100	–	–	–	–	–	–	
		−3.2		−1[a]		–	–	10	100	–	–	–	–	
		−4		−1[a]		–	–	–	–	10	100	–	–	
		−5		−1[a]		–	–	–	–	–	–	10	100	
Collector-to-Emitter Sustaining Voltage: With base open	$V_{CEO(sus)}$			−0.2[a]	0	−225	–	−300	–	−350	–	−400	–	V
With external base-to-emitter resistance (R_{BE}) = 50 Ω	$V_{CER(sus)}$			−0.2[a]		−250	–	−325	–	−375	–	−425	–	
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	–	−350	–	−400	–	−450	–	
Emitter-to-Base Voltage	V_{EBO}				0.5 mA	–	–	−6	–	−6	–	−6	–	V
					1 mA	−6				–	–	–	–	
Emitter-to-Base Saturation Voltage	$V_{BE(sat)}$			−1[a]	−0.125	–	−1.4	–	−1.4	–	−1.4	–	−1.4	V
Collector-to-Emitter Saturation Voltage	$V_{CE(sat)}$			−1[a]	−0.125	–	−1.4	–	−1.6	–	−2	–	−2.5	V
Output Capacitance (f = 1 MHz)	C_{obo}	−10 (V_{CB})				–	220	–	220	–	220	–	220	pF
Second-Breakdown Collector Current (Base forward-biased)	$I_{S/b}$	−40				−0.875	–	−0.875	–	−0.875	–	−0.875	–	A
Magnitude of Common-Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio (f = 5 MHz)	$\lvert h_{fe} \rvert$	−10		−0.2		4	–	4	–	4	–	4	–	
Saturated Switching Times: Rise time	t_r	V_{CC} = −200 V		−1	I_{B1} & I_{B2} −0.125	–	0.6	–	0.6	–	0.6	–	0.6	μs
Storage time	t_s	V_{CC} = −200 V		−1	I_{B1} & I_{B2} −0.125	–	2.5	–	2.5	–	2.5	–	2.5	
Fall time	t_f	V_{CC} = −200 V		−1	I_{B1} & I_{B2} −0.125	–	0.6	–	0.6	–	0.6	–	0.6	
Thermal Resistance (Junction-to-case)	$R_{\theta JC}$	−10		−1		–	5	–	5	–	5	–	5	°C/W

*In accordance with JEDEC registration data format JS-6 RDF-1.

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

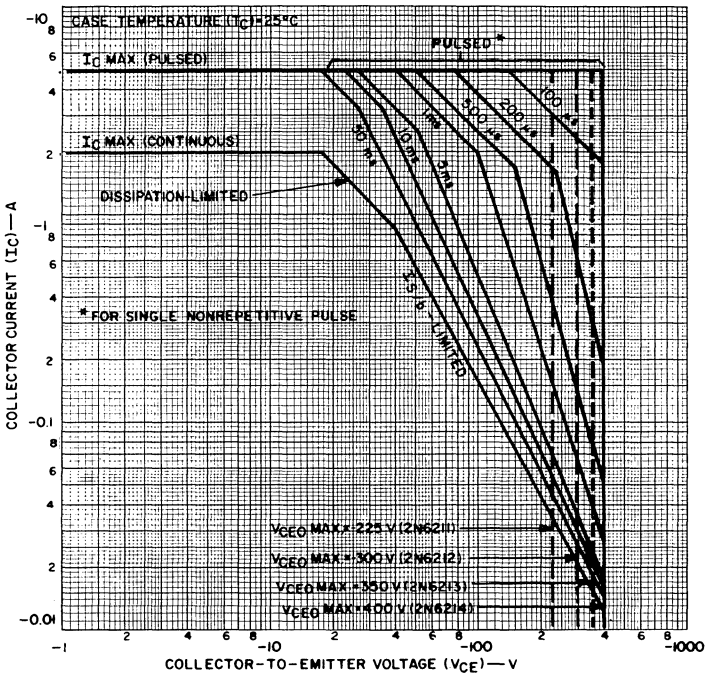

Fig. 1—Maximum operating areas for all types.

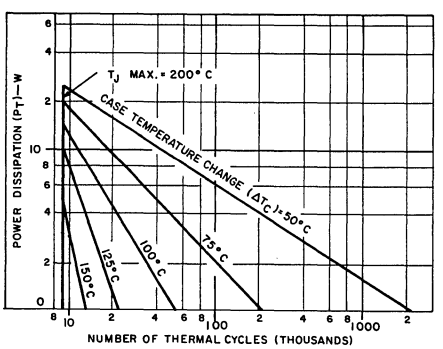

Fig. 2—Thermal-cycling rating chart for all types.

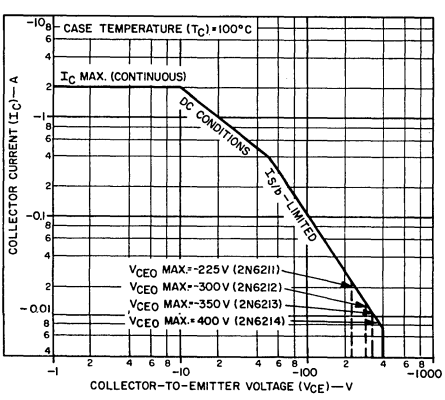

Fig. 3—Maximum operating areas for all types.

TERMINAL CONNECTIONS

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

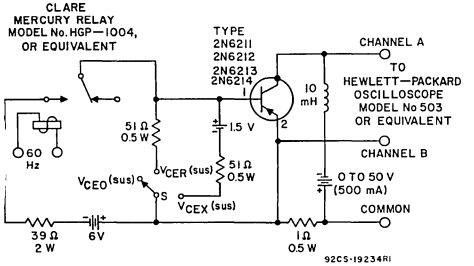

Fig. 4—Circuit used to measure sustaining voltages $V_{CEO}(sus)$, $V_{CER}(sus)$ and $V_{CEX}(sus)$ for all types.

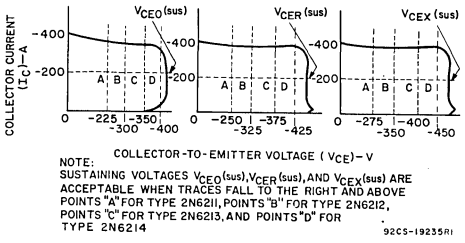

Fig. 5—Oscilloscope display for measurement of sustaining voltages (test circuit shown in Fig 4).

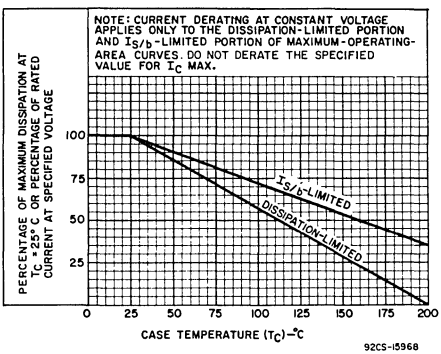

Fig. 6—Derating curves for all types.

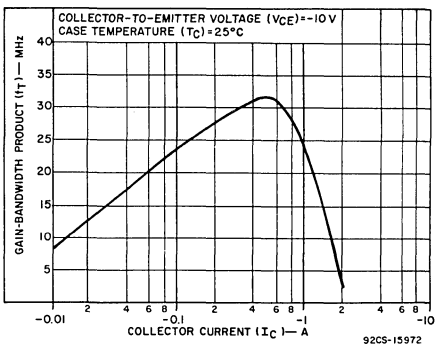

Fig. 7—Typical gain-bandwidth product for all types.

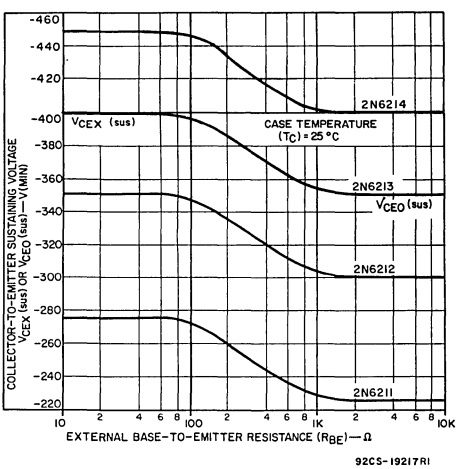

Fig. 8—Collector-to-emitter sustaining-voltage characteristics for all types.

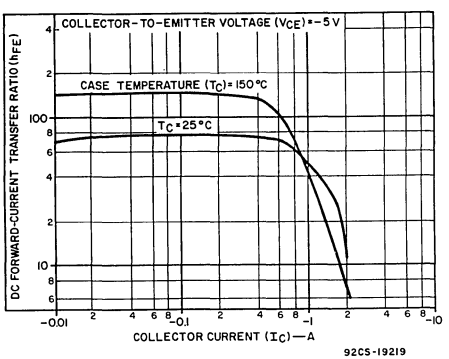

Fig. 9—Typical dc beta characteristic for all types.

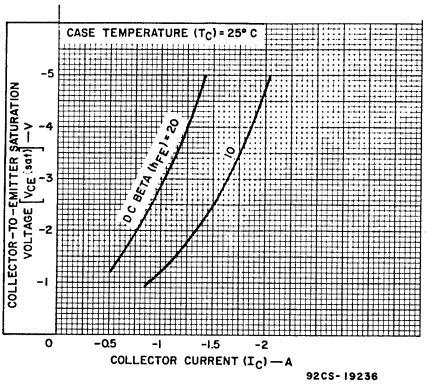

Fig. 10—Typical saturation-voltage characteristics for all types.

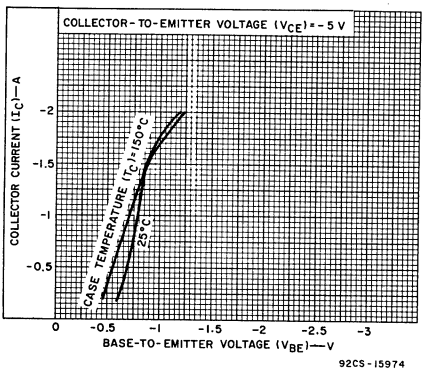

Fig. 11—Typical transfer characteristics for all types.

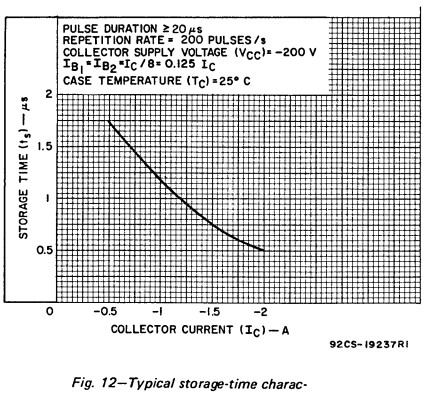

Fig. 12—Typical storage-time characteristic for all types.

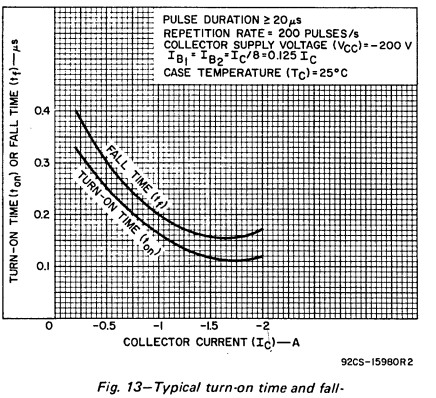

Fig. 13—Typical turn-on time and fall-time characteristics for all types.

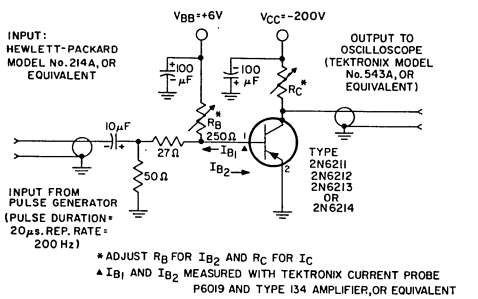

Fig. 14—Circuit used to measure saturated switching times for all types.

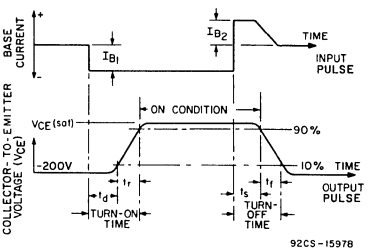

Fig. 15—Phase relationship between input current and output voltage showing reference points for specification of switching times. (Test circuit shown in Fig. 14).