

2N6211, 2N6212, 2N6213, 2N6214

File Number 507

**High-Voltage Medium-Power Silicon P-N-P Transistors**

For Switching and Amplifier Applications in Military, Industrial, and Commercial Equipment

**Features:**

- High voltage ratings:
  - $V_{CE0(sus)}$  = -400 V max. (2N6214)
  - = -350 V max. (2N6213)
  - = -300 V max. (2N6212)
  - = -225 V max. (2N6211)

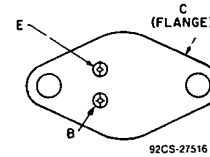
**Applications:**

- Power-Switching circuits
- Switching regulators
- Converters
- Inverters
- High-Fidelity amplifiers

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-213AA package; they differ in breakdown-voltage ratings and leakage current values.

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

**TERMINAL DESIGNATIONS**



JEDEC TO-213AA

**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, $V_{CE0(sus)}$ .....	-225	-300	-350	-400	V
With external base-to-emitter resistance					
( $R_{BE}$ ) = 50 $\Omega$ , $V_{CE0(sus)}$ .....	-250	-325	-375	-425	V
* With base-emitter junction reverse-biased					
( $V_{BE} = 1.5$ V), $V_{CE0(sus)}$ .....	-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 & 3.				
* TEMPERATURE RANGE:					
Storage & Operating (Junction) .....	-65 to +200				°C
* LEAD TEMPERATURE (During Soldering):					
At distance $\geq 1/32$ in. (0.8 mm) from					
case for 10 s max. ....	230				°C

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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 <sub>CE</sub>	V <sub>BE</sub>	I <sub>C</sub>	I <sub>E</sub>	I <sub>B</sub>	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.															
Collector-Cutoff Current: With base open	I <sub>CEO</sub>	-150				0	-	-5	-	-5	-	-5	-	-5	mA														
With base-emitter junction reverse-biased	I <sub>CEV</sub>	-250	1.5				-	-0.5	-	-	-	-	-	-															
		-315	1.5				-	-	-	-0.5	-	-	-	-															
		-360	1.5				-	-	-	-	-	-0.5	-	-															
With base emitter junction reverse biased and T <sub>C</sub> = 100°C		-410	1.5				-	-	-	-	-	-	-1																
		-250	1.5				-	-5	-	-	-	-	-	-															
		-315	1.5				-	-	-	-5	-	-	-	-															
		-360	1.5				-	-	-	-	-5	-	-	-															
		-410	1.5				-	-	-	-	-	-	-10	-															
Emitter-Cutoff Current	I <sub>EBO</sub>		6	0			-	-1	-	-0.5	-	-0.5	-	-0.5	mA														
DC Forward Current Transfer Ratio	h <sub>FE</sub>	-2.8		-1 <sup>a</sup>			10	100	-	-	-	-	-	-															
		-3.2		-1 <sup>a</sup>			-	-	10	100	-	-	-	-															
		-4		-1 <sup>a</sup>			-	-	-	-	10	100	-	-															
		-5		-1 <sup>a</sup>			-	-	-	-	-	-	10	100															
Collector-to-Emitter Sustaining Voltage: With base open	V <sub>CEO(sus)</sub>			-0.2 <sup>a</sup>		0	-225	-	-300	-	-350	-	-400	-	V														
With external base-to-emitter resistance (R <sub>BE</sub> ) = 50 Ω	V <sub>CER(sus)</sub>			-0.2			-250	-	-325	-	-375	-	-425	-															
With base emitter junction reverse-biased and external base-to emitter resistance (R <sub>BE</sub> ) = 50 Ω	V <sub>CEX(sus)</sub>		1.5	-0.2			-275	-	-350	-	-400	-	-450	-															
Emitter-to-Base Voltage	V <sub>EBO</sub>					0.5 mA 1 mA	-	-	-6	-	-6	-	-6	-	V														
Emitter-to-Base Saturation Voltage	V <sub>BE(sat)</sub>			-1 <sup>a</sup>		-0.125	-	1.4	-	-1.4	-	-1.4	-	-1.4	V														
Collector-to-Emitter Saturation Voltage	V <sub>CE(sat)</sub>			-1 <sup>a</sup>		-0.125	-	-1.4	-	-1.6	-	-2	-	-2.5	V														
Output Capacitance (f = 1 MHz)	C <sub>obo</sub>	-10 (V <sub>CB</sub> )			0		-	220	-	220	-	220	-	220	pF														
Second-Breakdown Collector Current (Base forward-biased)	I <sub>S/b</sub>	-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)	h <sub>fe</sub>	-10		-0.2			4	-	4	-	4	-	4	-															
Saturated Switching Times:	t <sub>r</sub>	V <sub>CC</sub> = -200 V		-1	I <sub>B1</sub> & I <sub>B2</sub> -0.125		-	0.6	-	0.6	-	0.6	-	0.6															
																Storage time	t <sub>s</sub>	V <sub>CC</sub> = -200 V		-1	I <sub>B1</sub> & I <sub>B2</sub> -0.125		-	2.5	-	2.5	-	2.5	
Thermal Resistance (Junction-to case)	R <sub>θJC</sub>	-10		-1			-	5	-	5	-	5	-	5	°C/W														

\*In accordance with JEDEC registration data format JS 6 RDF-1.  
<sup>a</sup>Pulsed: Pulse duration = 300 μs; duty factor ≤ 2%.

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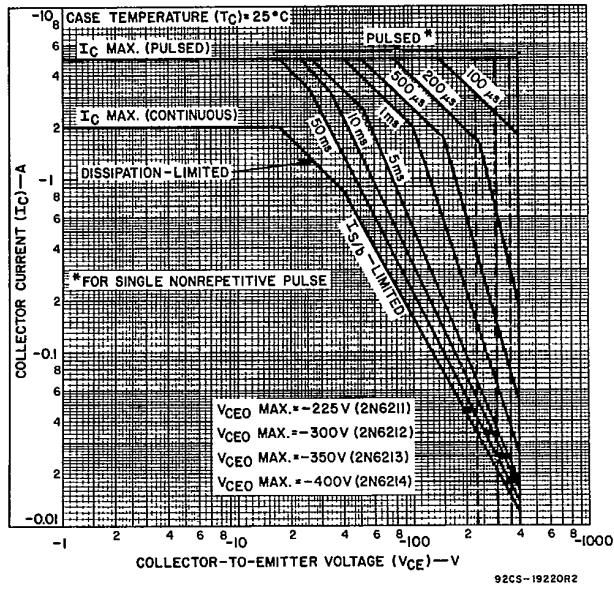


Fig. 1 - Maximum operating areas for all types.

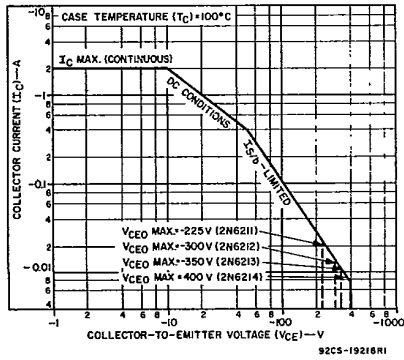


Fig. 2 - Maximum operating areas for all types.

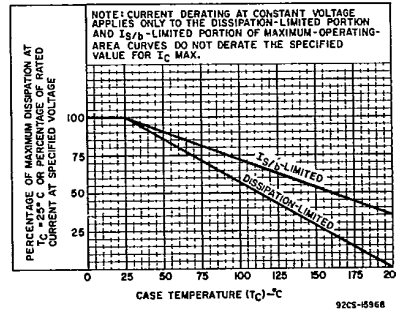


Fig. 3 - Derating curves for all types.

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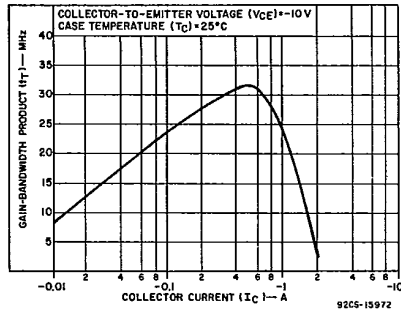


Fig. 4 - Typical gain-bandwidth product for all types.

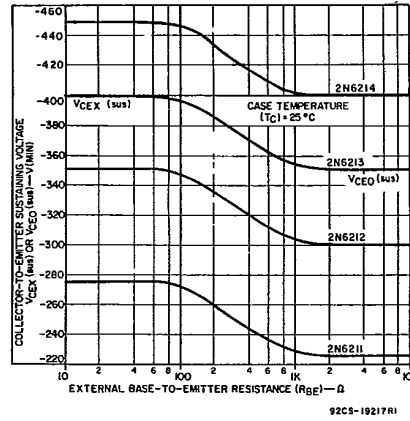


Fig. 5 - Collector-to-emitter sustaining-voltage characteristics for all types.

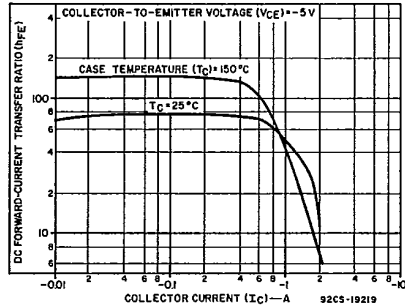


Fig. 6 - Typical dc beta characteristic for all types.

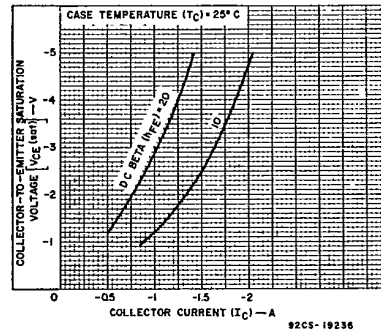


Fig. 7 - Typical saturation-voltage characteristics for all types.

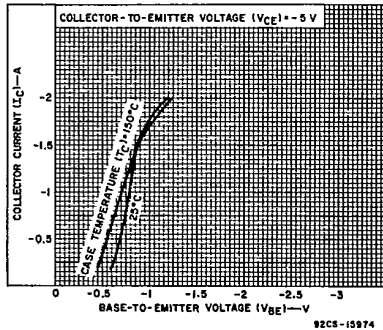


Fig. 8 - Typical transfer characteristics for all types.

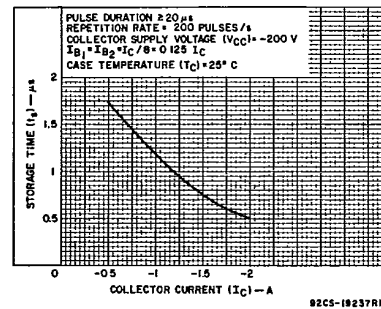


Fig. 9 - Typical storage-time characteristics for all types.

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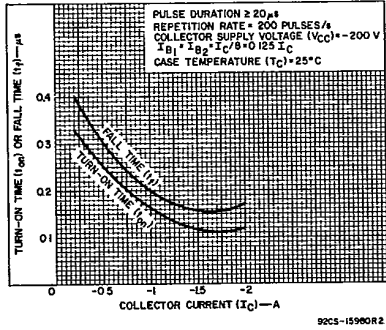


Fig. 10 - Typical turn-on time and fall-time characteristics for all types.

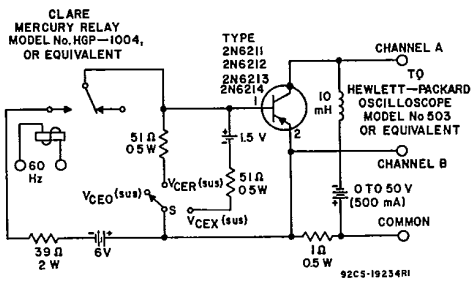
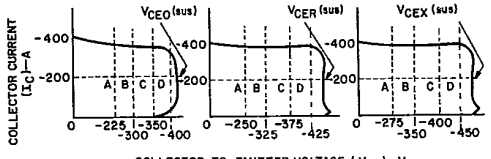


Fig. 11 - Circuit used to measure sustaining voltages  $V_{CE0}(sus)$ ,  $V_{CER}(sus)$  and  $V_{CEX}(sus)$  for all types.



NOTE: COLLECTOR-TO-EMITTER VOLTAGE ( $V_{CE}$ )-V  
 SUSTAINING VOLTAGES  $V_{CE0}(sus)$ ,  $V_{CER}(sus)$ , AND  $V_{CEX}(sus)$  ARE ACCEPTABLE WHEN TRACES FALL TO THE RIGHT AND ABOVE POINTS "A" FOR TYPE 2N6211, POINTS "B" FOR TYPE 2N6212, POINTS "C" FOR TYPE 2N6213, AND POINTS "D" FOR TYPE 2N6214

Fig. 12 - Oscilloscope display for measurement of sustaining voltages.

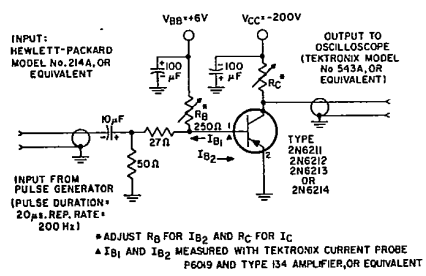


Fig. 13 - Circuit used to measure saturated switching times for all types.

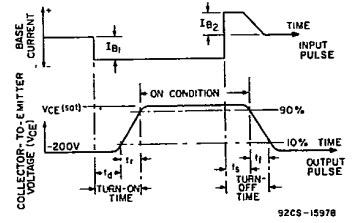


Fig. 14 - Phase relationship between input current and output voltage showing reference points for specification of switching times.