

2N6077, 2N6078, 2N6079

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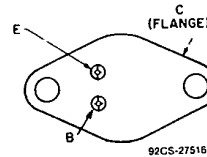
# High-Voltage, High Power Silicon N-P-N Transistors

For Switching and Linear Applications

**Features:**

- Maximum safe-area-of-operation curves
- Low saturation voltages
- High voltage ratings:
  - $V_{CE(sus)} = 300\text{ V [2N6077]}$
  - $= 275\text{ V [2N6078]}$
  - $= 375\text{ V [2N6079]}$
- High dissipation ratings :  $P_T = 45\text{ W}$

**TERMINAL DESIGNATIONS**



JEDEC TO-213AA

RCA-2N6077, 2N6078, and 2N6079 are multiple epitaxial silicon n-p-n transistors. Multiple-epitaxial construction maximizes the voltampere characteristic of the device and provides fast switching speeds.

These devices use the popular JEDEC TO-213AA package; they differ mainly in voltage ratings, leakage-current limits, and  $V_{CE(sat)}$  ratings.

The 2N6077 is characterized for switching applications with load lines in the active region. These applications include sweep circuits and all circuits using the transistor as an active voltage clamp.

Type 2N6078 is characterized for switching applications with the load line extending into the reverse-bias region. Its voltage ratings make this device useful for switching regulators operating directly from a rectified 110-V or 220-V power line. The unit is rated to take surge currents up to 5 A and maintain saturation.

The 2N6079 is characterized for use in inverters operating directly from a rectified 110-V power line. The leakage current is specified at 450 volts; therefore the device can also be used in a series bridge configuration on a 220-V line. The  $V_{EBO}$  rating of 9 volts eases requirements on the drive transformer in inverter applications. Storage time, an important factor in the frequency stability of an inverter, is specified in Fig. 12, which shows variation in storage time with variation in load current from zero to maximum (4 A).

**MAXIMUM RATINGS, Absolute-Maximum Values:**

	2N6077	2N6078	2N6079	
*COLLECTOR-TO-BASE VOLTAGE	300	275	375	V
COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:				
With base open	$V_{CE0(sus)}$ 275	250	350	V
With reverse bias ( $V_{BE}$ ) of -1.5 V	$V_{CEX(sus)}$ 300	275	375	V
With external base-to-emitter resistance ( $R_{BE}) \leq 50\Omega$	$V_{CEB(sus)}$ 300	275	375	V
*EMITTER-TO-BASE VOLTAGE	$V_{EBO}$ 6	6	9	V
*COLLECTOR CURRENT:	$I_C$			
Continuous	7	7	7	A
Peak	10	10	10	A
*CONTINUOUS BASE CURRENT	$I_B$ 4	4	4	A
*TRANSISTOR DISSIPATION:	$P_T$			
At case temperatures up to 25°C and $V_{CE}$ up to 40 V	45	45	45	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, 2, & 3			
*TEMPERATURE RANGE:				
Storage & Operating (Junction)	-65 to +200			°C
*PIN TEMPERATURE (During Soldering):				
At distances $\geq 1/32$ in. (0.8 mm)				
from case for 10 s max.	230			°C

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

2N6077, 2N6078, 2N6079

ELECTRICAL CHARACTERISTICS, Case Temperature (T<sub>C</sub>) = 25°C

Characteristic	Symbol	Test Conditions						Limits									Units
		DC Collector Voltage (V)		DC Emitter Voltage (V)		DC Current (A)		Type 2N6077			Type 2N6078			Type 2N6079			
		V <sub>CE</sub>	V <sub>CB</sub>	V <sub>BE</sub>	I <sub>C</sub>	I <sub>B</sub>	I <sub>E</sub>	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
Collector-Cutoff Current: With base open	I <sub>CEO</sub>	250				0			2								mA
With base-emitter junction reverse biased	I <sub>CEV</sub>	250 450 <sup>a</sup>		-1.5 -1.5					5		0.05					0.5	mA
With base-emitter junction reverse biased	I <sub>CEV</sub> T <sub>C</sub> = 125°C	250 450		-1.5 -1.5					8		0.2					5	mA
Emitter-Cutoff Current	I <sub>EBO</sub>			-6 -9	0 0				1		1					1	mA
Collector-to-Emitter Sustaining Voltage (see Figs. 15 & 16) With base open	V <sub>CEQ(sus)</sub> <sup>b</sup>				0.2		275 <sup>b</sup>				250 <sup>b</sup>			350 <sup>b</sup>			V
With external base-to-emitter resistance (R <sub>BE</sub> ) = 50 Ω	V <sub>CER(sus)</sub> <sup>b</sup>				0.2		300 <sup>b</sup>				275 <sup>b</sup>			375 <sup>b</sup>			V
Emitter-to-Base Voltage	V <sub>EBO</sub>					0.001	6			6			9				V
DC Forward-Current Transfer Ratio	h <sub>FE</sub>	1			1.2		12	28	70	12	28	70	12	28	50		
Base-to-Emitter Saturation Voltage	V <sub>BE(sat)</sub> <sup>a</sup>				1.2 3 4 5	0.2 0.6 0.8 1		1.0 1.2	1.6 1.9		1.0 1.6			1.0 1.3	1.6 2	1.6 2	V
Collector-to-Emitter Saturation Voltage	V <sub>CE(sat)</sub> <sup>a</sup>				1.2 3 4 5	0.2 0.6 0.8 1		0.15 0.25	0.5 1		0.15 0.5			0.15 0.5 3	0.5 3	0.5 3	V
Output Capacitance (At 1 MHz)	C <sub>obo</sub>		10				0		150		150			150		150	pF
Magnitude of Common Emitter, Small-Signal, Short-Circuit, Forward-Current Transfer Ratio (f = 1 MHz)	h <sub>fe</sub>	10			0.2		1	7		1	7		1	7			
Second Breakdown Collector Current (With base forward biased) Pulse duration (non-repetitive) = 1 s	I <sub>S/B</sub> <sup>c</sup>	50					0.9			0.9			0.9				A
Second Breakdown <sup>e</sup> Energy (With base reverse biased) R <sub>B</sub> = 50 Ω, L = 100 μH	E <sub>S/B</sub> <sup>d</sup>			-4	3		0.45			0.45			0.45				mJ
Switching Times: Delay (See Figs. 10, 17, & 18)	t <sub>d</sub>	V <sub>CC</sub> = 250 V			1.2	0.2 <sup>a</sup>		0.02			0.02			0.02			μs
Rise (See Figs. 13, 17, & 18)	t <sub>r</sub>	V <sub>CC</sub> = 250 V			1.2	0.2 <sup>a</sup>		0.3	0.75		0.3	0.75		0.3	0.75		
Storage (See Figs. 11, 12, 17E & 18)	t <sub>s</sub>	V <sub>CC</sub> = 250 V			1.2	0.2 <sup>a</sup>		2.8	5		2.8	5		2.8	5		
(See Figs. 14, 17, & 18)	t <sub>f</sub>	V <sub>CC</sub> = 250 V			1.2	0.2 <sup>a</sup>		0.3	0.75		0.3	0.75		0.3	0.75		
Thermal Resistance (Junction-to-Case)	θ <sub>J-C</sub>	20			2.5				3.9		3.9			3.9			°C/W

<sup>a</sup> Pulsed; pulse duration ≤ 350 μs, Duty factor = 2%.

<sup>b</sup> CAUTION: The sustaining voltages V<sub>CEQ(sus)</sub> and V<sub>CER(sus)</sub>, MUST NOT be measured on a curve tracer. These sustaining voltages should be measured by means of the test circuit shown in Fig. 15.

<sup>c</sup> I<sub>S/B</sub> is defined as the current at which second breakdown occurs at a specified collector voltage with the emitter-base junction forward biased for transistor operation in the active region.

<sup>d</sup> E<sub>S/B</sub> is defined as the energy at which second breakdown occurs under specified reverse bias conditions. E<sub>S/B</sub> = 1/2 LI<sup>2</sup> where L is a series load or leakage inductance, and I is the peak collector current.

<sup>e</sup> |B<sub>1</sub>| = |B<sub>2</sub>| = value shown.

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

2N6077, 2N6078, 2N6079

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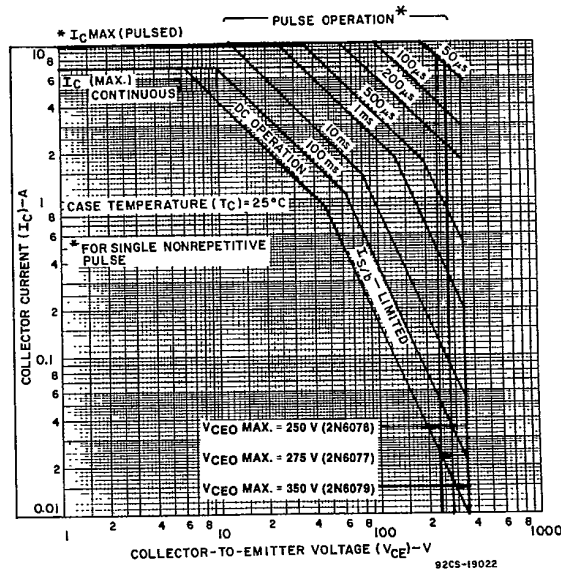


Fig.1—Maximum operating areas for all types.

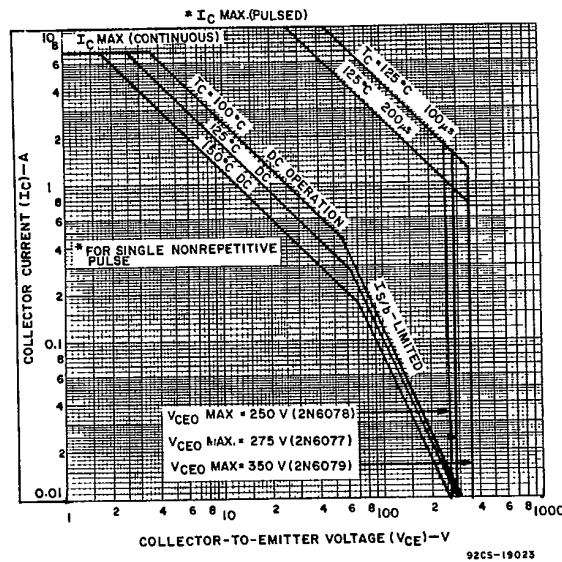


Fig.2—Maximum operating areas for all types.

2N6077, 2N6078, 2N6079

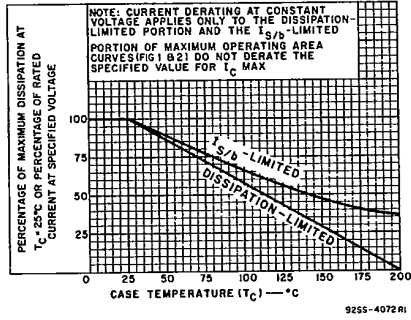


Fig. 3—Derating curve for all types.

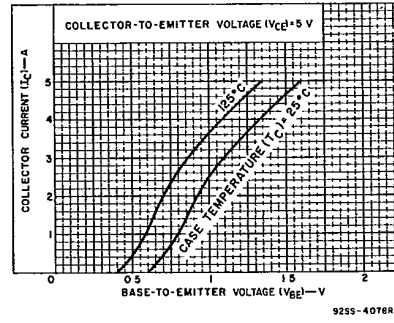


Fig. 4—Typical transfer characteristics for all types.

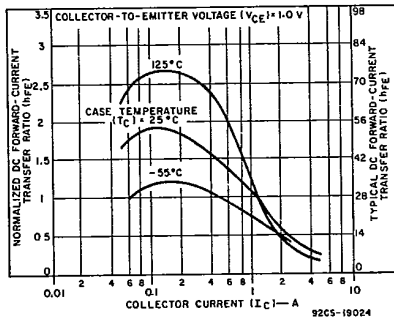


Fig. 5—Typical normalized dc beta characteristics for all types.

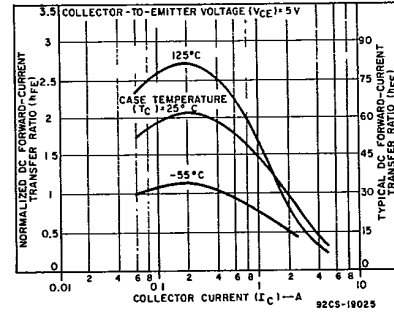


Fig. 6—Typical normalized dc beta characteristics for all types.

Note (Figs. 5 & 6): To estimate min., max.  $h_{FE}$  at any current and temperature, read normalized dc forward-current transfer ratio and multiply by min., max. specifications given in Electrical Characteristics Chart (p. 2).

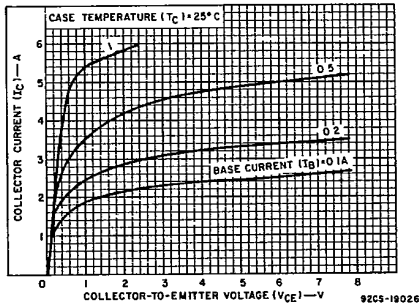


Fig. 7—Typical output characteristics for all types.

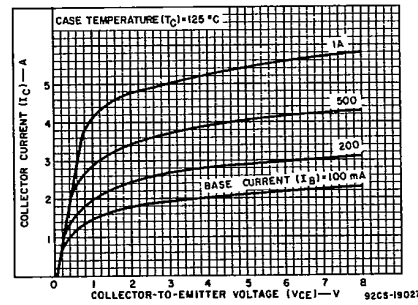


Fig. 8—Typical output characteristics for all types.

High-Voltage Power Transistors

2N6077, 2N6078, 2N6079

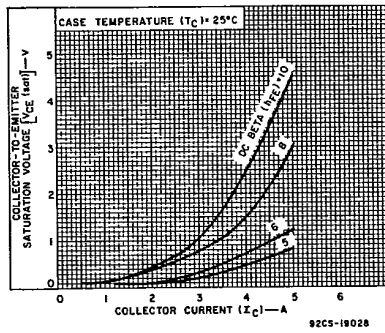


Fig. 9—Typical saturation voltage characteristics for all types.

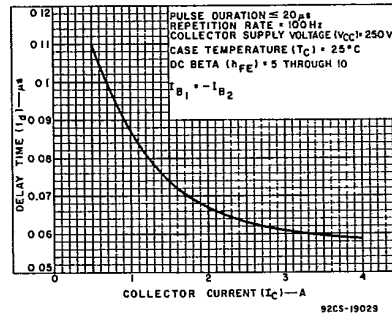


Fig. 10—Typical delay-time characteristic for all types.

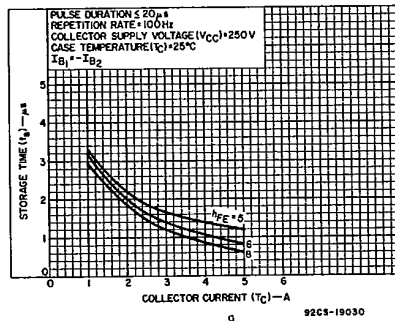


Fig. 11—Typical storage-time characteristic for all types (with constant forced gain).

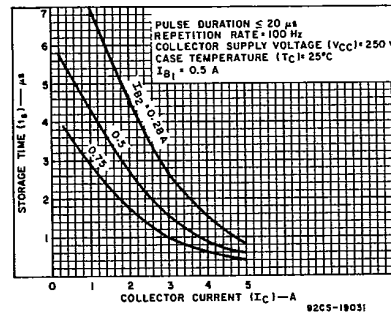


Fig. 12—Typical storage-time characteristic for all types (with constant-base drives).

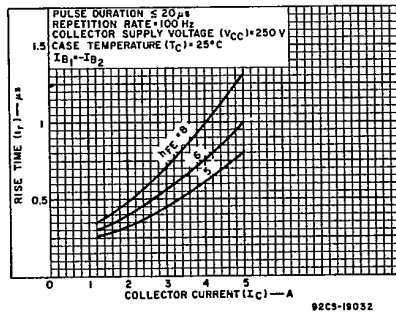


Fig. 13—Typical rise-time characteristic for all types.

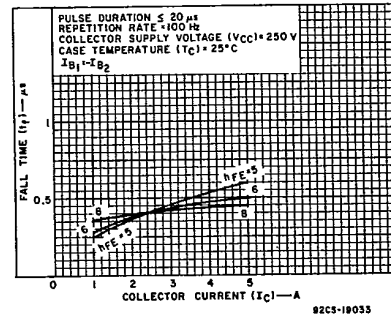


Fig. 14—Typical fall-time characteristic for all types.

