2N6609, MJ15004, RCA9116C, RCA9116D, RCA9116E

File Number **1061**

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

Rugged Devices, Broadly Applicable For Industrial and Commerical Use

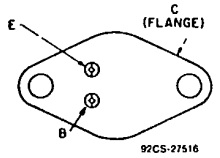
Features:

- *High-dissipation capability*
- *Low saturation voltages*
- *Maximum safe-area-of-operation curves*
- *f_T = 2 MHz*
- *High gain at high current*

Applications:

- *Series and shunt regulators*
- *High-fidelity amplifiers*
- *Power-switching circuits*
- *Solenoid drivers*

TERMINAL DESIGNATIONS



JEDEC TO-204AA

The RCA2N6609, MJ15004, RCA9116C, RCA9116D, and RCA9116E are ballasted epitaxial-base silicon p-n-p transistors featuring high gain at high current. They may be used as complements to the n-p-n types RCA3773, MJ15003, RCA8638C, RCA8638D, and RCA8638E, respectively.

They differ in voltage ratings and in the currents at which the parameters are controlled. All are supplied in the steel JEDEC TO-204AA packages.

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	2N6609	MJ15004	RCA9116C	RCA9116D	RCA9116E	
* V_{CBO}	-160	-140	-140	-120	-100	V
$V_{CEX(SUS)}$ V_{BE} = -1.5 V; R_{BE} = 100 Ω	-160	—	—	—	—	V
$V_{CER(SUS)}$ R_{BE} = 100 Ω	-150	-150	-150	-130	-110	V
* $V_{CEO(SUS)}$	-140	-140	-140	-120	-100	V
* V_{EBO}	-7	-5				V
* I_C	-16	-200				A
* I_B	-4	-5				A
* P_T						
At $T_C \leq 25°C$	150	250	200	200	200	W
At $T_C > 25°C$ Derate Linearly	0.857	1.43	1.14			W/°C
* T_{stg}, T_J	-65 to +200					°C
* T_L At distance ≥ 1/32 in. (0.8 mm) from seating plane for 10 s max.	265	230				°C

* 2N-type in accordance with JEDEC registration data format JS25RDF1, Issue 1.

2N6609, MJ15004, RCA9116C, RCA9116D, RCA9116E

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

	CHARACTERISTIC	TEST CONDITIONS			LIMITS				UNITS
		VOLTAGE V dc		CURRENT A dc	2N6609		MJ15004		
		V_{CE}	V_{BE}	I_C	Min.	Max.	Min.	Max.	
*	I_{CBO}	−160[a]			–	−4	–	–	mA
*		−140[a]			–	−2	–	−1	
	I_{CEX}	−140	1.5		–	–	–	−0.1	
	I_{CEX} T_C = 150°C	−140	1.5		–	–	–	−2	
*	I_{CEV}	−140	1.5		–	−2	–	–	
*	I_{CEV} T_C = 150°C	−140	1.5		–	−10	–	–	
	I_{CEO} I_B = 0	−140			–	–	–	−0.25	
*		−120			–	−10	–	–	
*	I_{EBO}		−7		–	−5	–	–	
*			−5		–	–	–	−0.1	
*	h_{FE}	−4		−8[c]	15	60	–	–	
*		−4		−16[c]	5	–	–	–	
		−2		−5[c]	–	–	25	150	
		−2		−10[c]	–	–	10	–	
	$V_{CEX(sus)}$[b] R_{BE} = 100Ω		1.5	−0.2	−160	–	–	–	V
	$V_{CER(sus)}$[b] $R_{BE} \leq$ 100Ω			−0.2	−150	–	−150	–	
*	$V_{CEO(sus)}$[b]			−0.2	−140	–	−140	–	
	V_{EBO} I_E = −1 mA			0	−7	–	−5[d]	–	
	V_{BE}	−4		−8[c]	–	−2.2	–	–	
		−2		−5[c]	–	–	–	−2	
*	$V_{CE(sat)}$ I_B = −3.2A			−16[c]	–	−4	–	–	
*	= −0.8A			−8[c]	–	−1.4	–	–	
	= −0.5A			−5[c]	–	–	–	−1	
	$I_{S/b}$ t_p = 1 s nonrep.	−100			−1.5	–	−1	–	A
		−50			–	–	−5	–	
*	$\|h_{fe}\|$ f = 0.05	−4		−1	4	–	–	–	
	= 0.5 MHz	−10		−0.5	4	–	4	–	
	f_T				2	–	2	–	MHz
*	h_{fe} f = 1 kHz	−4		−1	40	–	–	–	
	C_{ob} f = 0.1 MHz	−10[a]			–	1000	–	1000	pF
	$R_{\theta JC}$	−10		−10	–	1.17	–	0.7	°C/W

See page 3 for footnotes.

2N6609, MJ15004, RCA9116C, RCA9116D, RCA9116E

ELECTRICAL CHARACTERISTICS, *at Case Temperature (T_C) = 25°C*
Unless Otherwise Specified (Cont'd)

CHARACTERISTIC	TEST CONDITIONS			LIMITS						UNITS
	VOLTAGE V dc		CURRENT A dc	RCA9116C		RCA9116D		RCA9116E		
	V_{CE}	V_{BE}	I_C	Min.	Max.	Min.	Max.	Min.	Max.	
I_{CBO}	−140[a]			–	−1	–	–	–	–	mA
	−120[a]			–	–	–	−1	–	–	
	−100[a]			–	–	–	–	–	−1	
I_{CEX}	−140	1.5		–	−1	–	–	–	–	
	−120	1.5		–	–	–	−1	–	–	
I_{CEX} T_C = 150°C	−140	1.5		–	−5	–	–	–	–	
	−120	1.5		–	–	–	−5	–	–	
I_{CEO} I_B = 0	−70			–	−1	–	–	–	–	
	−60			–	–	–	−1	–	–	
I_{EBO}		−5		–	−1	–	−1	–	−1	
h_{FE}	−2		−5[c]	25	150	25	150	–	–	
	−2		−7.5[c]	–	–	–	–	10	100	
	−2		−10[c]	10	–	10	–	–	–	
$V_{CER(sus)}$[b] $R_{BE} \leq 100\Omega$			−0.2	−150	–	−130	–	−110	–	V
$V_{CEO(sus)}$[b]			−0.2	−140	–	−120	–	−100	–	
V_{EBO} I_E = −1 mA			0	−5	–	−5	–	−5	–	
V_{BE}	−2		−7.5[c]	–	–	–	–	–	−3	
	−2		−5[c]	–	−2	–	−2	–	–	
$V_{CE(sat)}$ I_B = −0.75A			−7.5[c]	–	–	–	–	–	−1.5	
= −0.5A			−5[c]	–	−1	–	−1	–	–	
$I_{S/b}$ t_p = 1 s nonrep.	−35			−5.71	–	−5.71	–	–	–	A
	−25			–	–	–	–	−8	–	
$\|h_{fe}\|$ f = 0.5 MHz	−10		−0.5	4	–	4	–	4	–	
f_T				2	–	2	–	2	–	MHz
C_{ob} f = 0.1 MHz	−10[a]			–	1000	–	1000	–	1000	pF
$R_{\theta JC}$	−10		−10	–	0.875	–	0.875	–	0.875	°C/W

* 2N-types in accordance with JEDEC registration data format JS25 RDF1, Issue 1.

[a] V_{CB}

[b] **CAUTION:** Sustaining voltages V_{CEX}(sus), V_{CER}(sus), and V_{CEO}(sus) *MUST NOT* be measured on a curve tracer. See Figs. 8 and 9.

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

[d] Measured at I_E = −0.1 mA.

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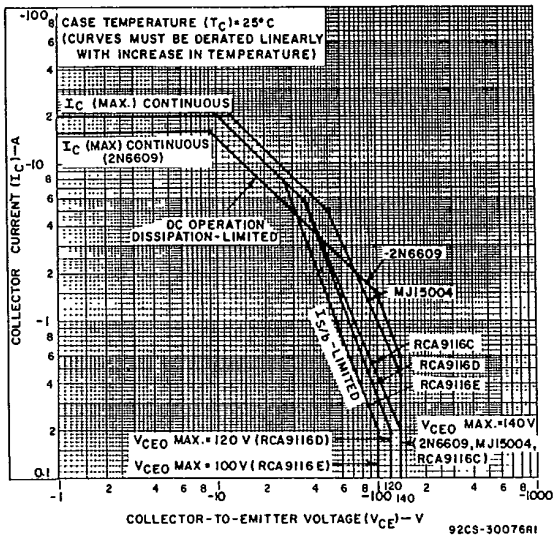

Fig. 1 - Maximum operating areas for all types.

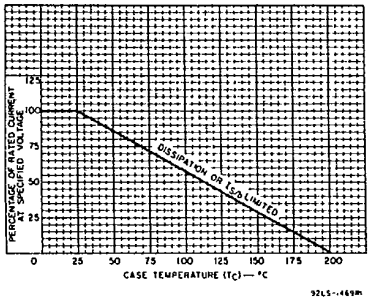

Fig. 2 - Current derating curve for all types.

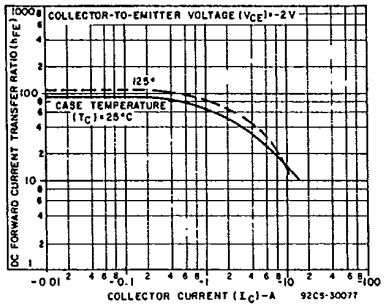

Fig. 3 - Typical dc beta characteristics as a function of collector current for all types.

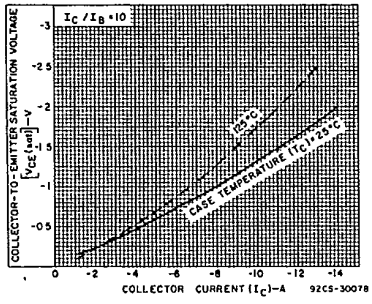

Fig. 4 - Typical saturation voltage characteristics for all types.

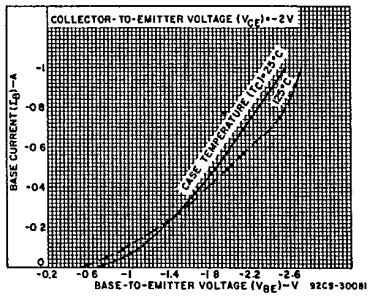

Fig. 5 - Typical input characteristics for all types.

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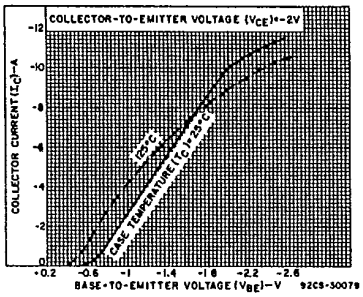

Fig. 6 - Typical transfer characteristics for all types.

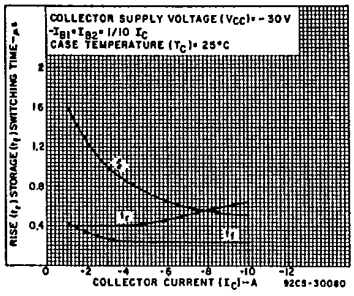

Fig. 7 - Typical saturated-switching times for all types.

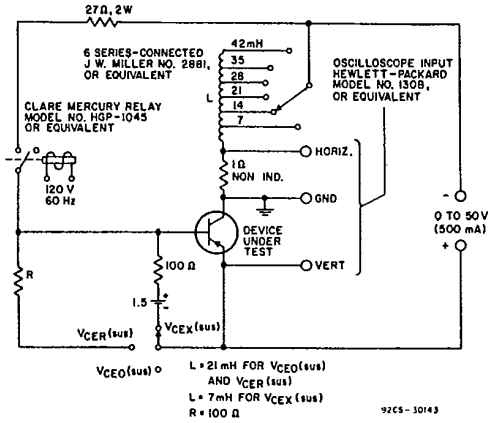

Fig. 8 - Circuit used to measure sustaining voltages $V_{CEO}(sus)$, $V_{CER}(sus)$, and $V_{CEX}(sus)$ for all types.

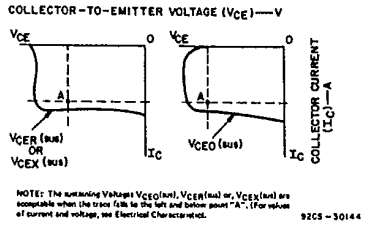

Fig. 9 - Oscilloscope display for measurement of sustaining voltages. (Test circuit shown in Fig. 8).

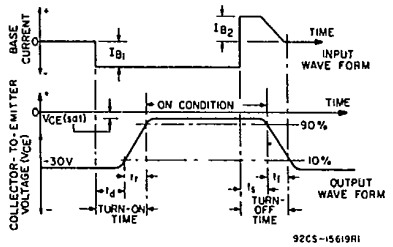

Fig. 10 - Oscilloscope display for measurement of switching times for all types.