

2N1613, 2N2102

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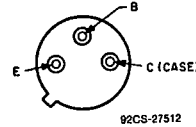
Medium-Power Silicon
N-P-N Planar Transistors

For Small-Signal Applications
In Industrial and Commercial Equipment

2N2102 Features:

- Gain bandwidth product (f_T) = 120 MHz (typ.);
useful in applications from dc to 20 MHz
- High breakdown voltage:
 $V_{I\text{B}(\text{CEO})} = 120 \text{ V min. at } I_C = 0.1 \text{ mA}$
- Low saturation voltages:
 $V_{\text{CE}(\text{sat})} = 0.5 \text{ V max. at } I_C = 150 \text{ mA}$
 $V_{\text{BE}(\text{sat})} = 1.1 \text{ V max. at } I_C = 150 \text{ mA}$
- Beta (h_{FE}) controlled over 5 decades of I_C

TERMINAL DESIGNATIONS



JEDEC TO-205AD

The RCA-2N1613 and 2N2102 are silicon n-p-n planar transistors intended for a wide variety of small-signal and medium-power applications in military and industrial equipment. They feature exceptionally low noise, low leakage, high switching speed, and high pulsed beta.

RCA-2N2102 is a direct replacement for the 2N1613. In addition, because of its junction design, the 2N2102 has higher breakdown-voltage ratings, higher dissipation ratings, lower saturation voltages, higher sustaining voltages, and lower output capacitance.

These transistors are supplied in the JEDEC TO-205AD hermetic package.

Features for Both Types:

- For operation at junction temperature up to 200°C
- Planar construction for low noise and low leakage
- Low output capacitance

MAXIMUM RATINGS, Absolute-Maximum Values:

	2N2102	2N1613	
* V_{CBO}	120	75	V
* $V_{\text{CE}(\text{SUS})}$ $R_{\text{BE}} = 10 \Omega$	80	50	V
* $V_{\text{CEO}(\text{SUS})}$	65	—	V
* V_{EBO}	7	7	V
* I_C	1*	1	A
* P_T :			
At $T_C \leq 25^\circ\text{C}$	5	3	W
At $T_A \leq 25^\circ\text{C}$	1	0.8	W
At $T_C > 25^\circ\text{C}$	2.86	17.1	mW/°C
At $T_A > 25^\circ\text{C}$	5.7	4.57	mW/°C
* T_J, T_{stg}	-65 to +200		°C
* T_L (During soldering): At distance $\geq 1/16$ in. (1.58 mm) from seating plane for 10 s max.	300		°C

* In accordance with JEDEC registration data format.

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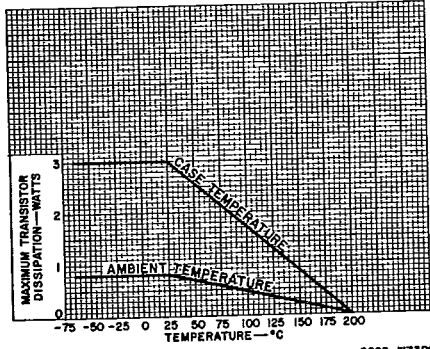
ELECTRICAL CHARACTERISTICS, At Case Temperature (T_C) = 25°C unless otherwise specified

CHARACTERISTIC	TEST CONDITIONS				LIMITS				UNITS
	Voltage V dc		Current mA dc		2N1613		2N2102		
	V_{CB}	V_{CE}	I_C	I_B	Min.	Max.	Min.	Max.	
* I_{CBO} At $T_C=150^\circ C$	60				-	0.01	-	0.002	μA
* I_{EBO} $V_{EB}=5 V$			0		-	0.01	-	0.002	μA
* h_{FE}		10	0.01		-	-	10	-	
		10	0.1		20	-	20	-	
		10	10 ^a		35	-	35	-	
		10	150 ^a		40	120	40	120	
		10	500 ^a		20	-	25	-	
At $T_C=-55^\circ C$		10	10 ^a		20	-	20	-	
* V_{RT} $V_{EB}=1.5 V, I_E=0$					-	-	120	-	V
* $V_{(BR)CBO}$ $I_E=0$			0.1		75	-	120	-	V
* $V_{(BR)EBO}$ $I_E=0.1 mA$			0		7	-	7	-	V
* $V_{CEO(sus)}$			100 ^a	0	-	-	65	-	V
* $V_{CER(sus)}$ $R_{BE}=10 \Omega$			100 ^a		50	-	80	-	V
* $V_{BE(sat)}$			150 ^a	15	-	1.3	-	1.1	V
* $V_{CE(sat)}$			150 ^a	15	-	1.5	-	0.5	V
* h_{fe} $f=1 kHz$		5	1		30	100	30	100	
		10	5		35	150	35	150	
* $ h_{fe} $ $f=20 MHz$		10	50		3	-	3	-	
* h_{ib} $f=1 kHz$	5		1		24	34	24	34	Ω
	10		5		4	8	4	8	
* h_{rb} $f=1 kHz$	5		1		-	3×10^{-4}	-	3×10^{-4}	
	10		1		-	3×10^{-4}	-	-	
	10		5		-	-	-	3×10^{-4}	
* h_{ob} $f=1 kHz$	5		1		0.05	0.5	0.01	0.5	μmho
	10		5		0.05	0.5	0.01	1	
* C_{ob} $I_E=0$	10				-	25	-	15	pF
* C_{ib} $V_{EB}=0.5 V$			0		-	80	-	80	pF
* NF BW=1 Hz Ref.sig.freq.=1 kHz $R_G=510 \Omega$ (2N1613) $Z_G=1000 \Omega$ (2N2102)	10		0.3		-	12	-	6	dB
* $t_d + t_r + t_f^b$					-	30	-	30	ns
$R_{\theta JC}$					-	58.3	-	35	$^\circ C/W$
$R_{\theta JA}$					-	219	-	175	

* In accordance with JEDEC registration data format.

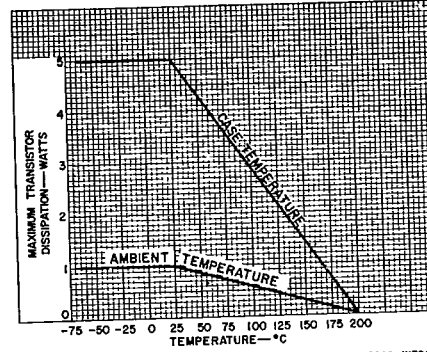
^a Pulsed, pulse duration=300 μs , duty factor=1.8% (2N2102) \leq 2% (2N1613). ^b See Fig. 14.

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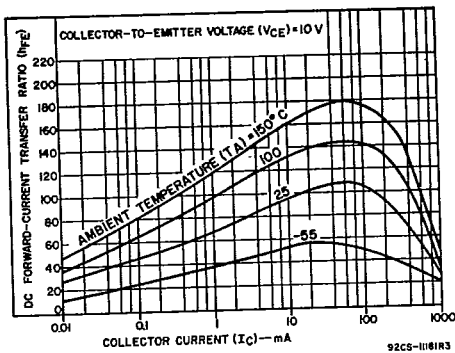
92CS-W73R2

Fig. 1 - Rating chart for 2N1613.



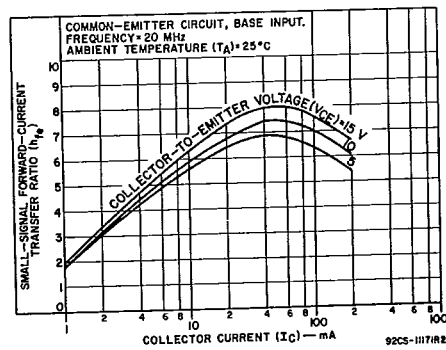
92CS-11172R2

Fig. 2 - Rating chart for 2N2102.



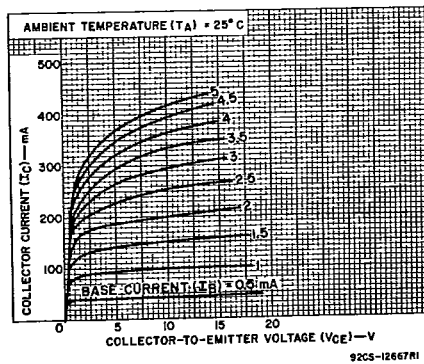
92CS-11181R3

Fig. 3 - Typical dc beta characteristics for both types.



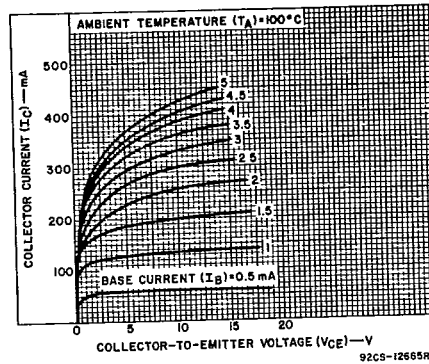
92CS-11171R2

Fig. 4 - Typical small-signal beta characteristics for both types.



92CS-12667R1

Fig. 5 - Typical output characteristics for both types.



92CS-12665R1

Fig. 6 - Typical output characteristics for both types at $T_A = 100^\circ\text{C}$.

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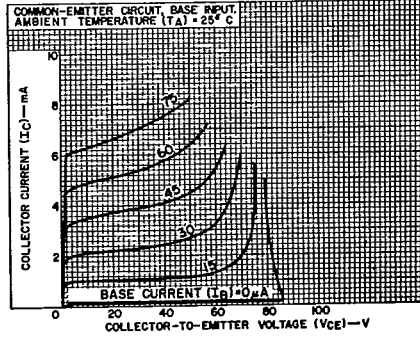


Fig. 7 - Typical high-current output characteristics for both types.

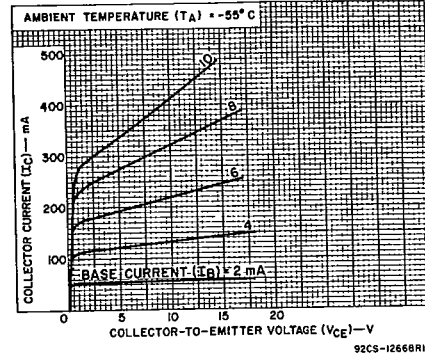


Fig. 8 - Typical output characteristics for both types at $T_A = -55^\circ\text{C}$.

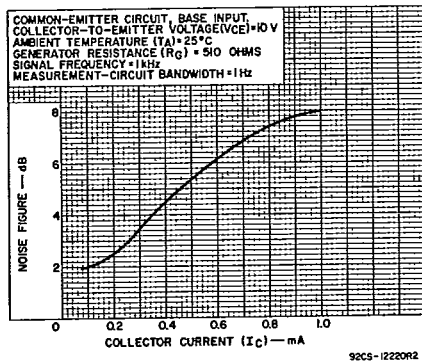


Fig. 9 - Typical noise figure characteristics for both types.

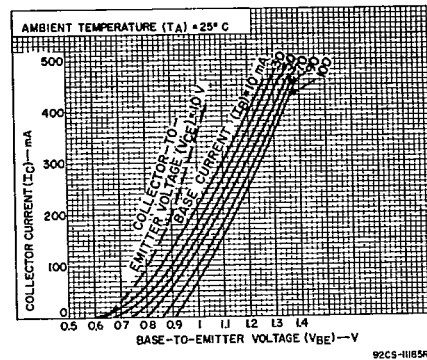


Fig. 10 - Typical transfer characteristics for both types.

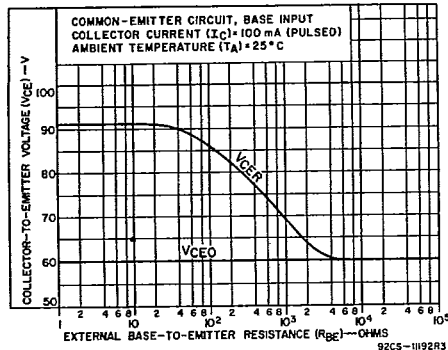


Fig. 11 - Typical sustaining voltage vs. base-to-emitter resistance for 2N1613.

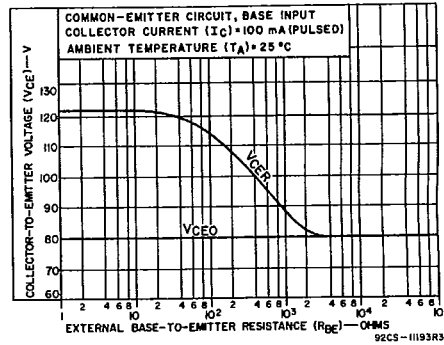


Fig. 12 - Typical sustaining voltage vs. base-to-emitter resistance for 2N2102.

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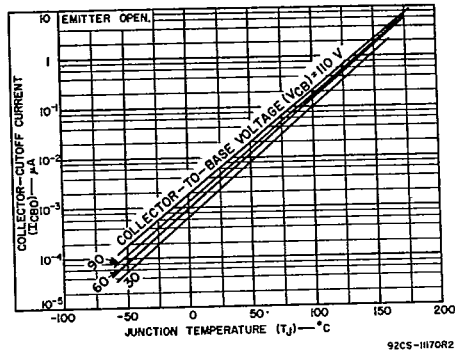


Fig. 13 - Typical leakage characteristics for both types.

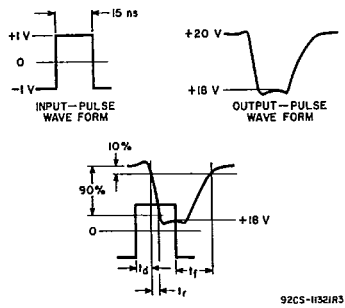
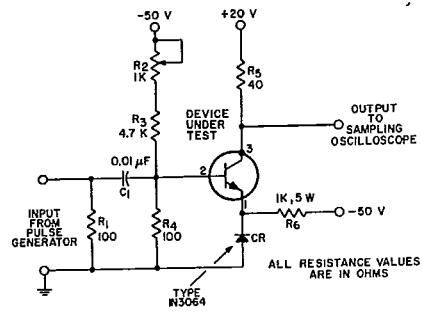


Fig. 14 - Circuit for measurement of switching time, and associated waveforms.