File Number **34**

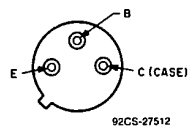
2N1893, 2N2405

Medium-Power Silicon N-P-N Planar Transistors

For Small-Signal Applications
In Industrial and Commercial Equipment

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

TERMINAL DESIGNATIONS



JEDEC TO-205AD

The RCA-2N1893 and 2N2405* are silicon n-p-n planar transistors intended for a variety of small-signal and medium-power applications. They feature exceptionally high collector-to-emitter sustaining voltage, low leakage characteristics, high switching speeds, and high pulse beta (h_{FE}).

RCA-2N2405 is a direct replacement for type 2N1893 for most applications. In addition, the 2N2405 has high voltage ratings, lower saturation voltages, and higher sustaining voltages than the 2N1893.

The 2N1893 and 2N2405 are supplied in the TO-205AD package.

*Formerly Dev. Type TA2235A.

2N2405 Features:
- *Minimum gain-bandwidth product (f_T) of 120 MHz; useful in application from dc to 50 MHz*
- *High sustaining voltage: $V_{CEO}(sus)$ = 90 V min.*
- *Low saturation voltages: $V_{CE}(sat)$ = 0.5 V max. at I_C = 150 mA; $V_{BE}(sat)$ = 1.1 V max. at I_C = 150 mA*

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		2N1893	2N2405	
* COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	120	120	V
* COLLECTOR-TO-EMITTER SUSTAINING VOLTAGE:				
With external base-to-emitter resistance (R_{BE}) ≤ 10 Ω	V_{CER}	100	140	V
With base open	V_{CEO}	80	90	V
* EMITTER-TO-BASE VOLTAGE	V_{EBO}	7	7	V
* COLLECTOR CURRENT	I_C	0.5	1	A
* TRANSISTOR DISSIPATION:	P_T			
At case temperature up to 25°C		3	5	W
At free-air temperatures up to 25°C		0.8	1	W
At temperatures above 25°C		See Figs 1 & 2		
* TEMPERATURE RANGE:				
Storage and operating (Junction)	T_{stg}, T_J	-65 to +200		°C
* LEAD TEMPERATURE (During soldering):				
At distance from seating plane for 10 s max. ≥ 1/16 in. (1.58 mm) for 2N1893 and ≥ 1/32 in. (0.8 mm) for 2N2405	T_L	255		°C

* In accordance with JEDEC registration data format (JS-9 RDF-2).

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

	CHARACTERISTIC	TEST CONDITIONS					LIMITS				UNITS
		VOLTAGE V dc		CURRENT mA dc			2N1893		2N2405		
		V_{CB}	V_{CE}	I_C	I_E	I_B	Min.	Max.	Min.	Max.	
*	I_{CBO}	90			0		–	0.01	–	0.01	μA
	T_C = 150°C	90			0		–	15	–	10	
*	I_{EBO} V_{BE} = –5 V			0			–	0.01	–	0.01	μA
*	$V_{CEO(sus)}$			100[a]		0	–	–	90	–	V
				30[a]		0	80	–	90	–	
*	$V_{CER(sus)}$ R_{BE} = 10 Ω			100[a]			100	–	140	–	V
	R_{BE} = 500 Ω			100[a]			–	–	120	–	
*	$V_{(BR)CBO}$			0.1	0		120	–	120	–	V
*	$V_{(BR)EBO}$			0	0.1		7	–	7	–	V
*	$V_{CE(sat)}$			150[a]		15	–	5	–	0.5	V
				50[a]		5	–	1.5	–	0.2	
*	$V_{BE(sat)}$			150[a]		15	–	1.3	–	1.1	V
				50[a]		5	–	0.9	–	0.9	
*	h_{FE}		10	150[a]			40	120	60	200	
*			10	10[a]			35	–	35	–	
*			10	0.1			20	–	–	–	
*	T_C = 55°C		10	10			20	–	20	–	
*	h_{fe} f = 1 kHz		5	1			30	100	–	–	
*	1 kHz		5	5			–	–	50	275	
*	1 kHz		10	5			45	–	–	–	
*	20 MHz		10	50			2.5	–	6	–	
*	h_{ib}	5		1			20	30	24	34	Ω
	f = 1 kHz	10		5			4	8	4	8	
*	h_{rb}	5		1			–	1.25×10^{-4}	–	3×10^{-4}	
	f = 1 kHz	10		5			–	1.5×10^{-4}	–	3×10^{-4}	
*	h_{ob}	5		1			–	0.5	–	0.5	μmho
	f = 1 kHz	10		5			–	0.5	–	0.5	
*	C_{obo}	10			0		–	15	–	15	pF
*	C_{ib} V_{BE} = –0.5 V			0			–	85	–	80	pF
	NF RG = 500 Ω BW = 15 kHz f = 1 kHz	10		0.3			–	–	–	6	dB
*	$R_{\theta J\text{-}C}$						–	58.3	–	35	°C/W
	$R_{\theta J\text{-}A}$						–	219	–	175	

[a] Pulsed. Pulse duration = 300 μsec max.; duty factor ≤ 2%.
* In accordance with JEDEC registration data format (JS-9 RDF-2).

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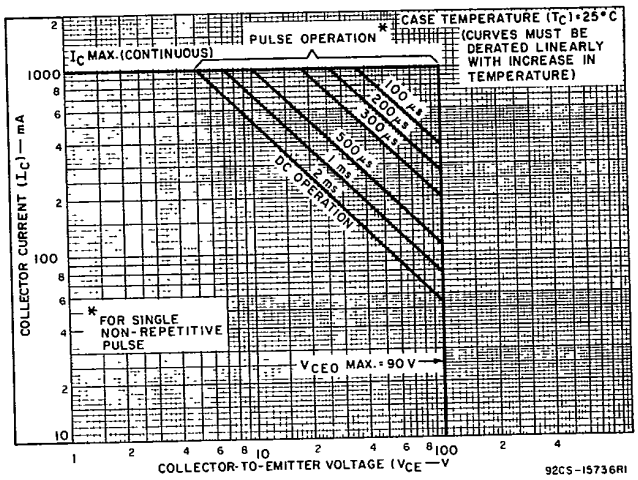

Fig. 1 – Maximum operating areas for type 2N2405.

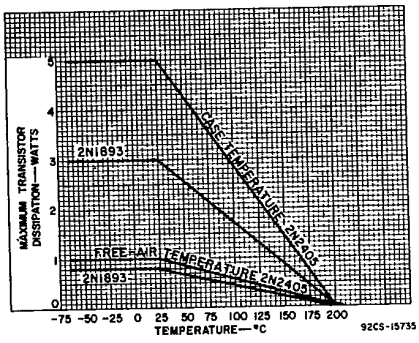

Fig. 2 – Dissipation derating curves for types 2N1893, and 2N2405.

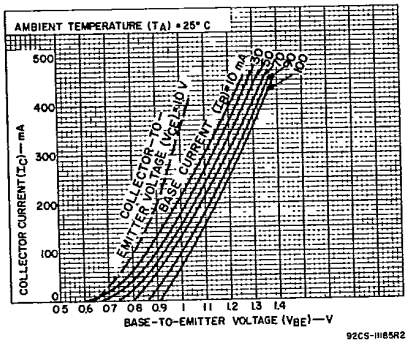

Fig. 3 – Typical transfer characteristics for types 2N1893 and 2N2405.

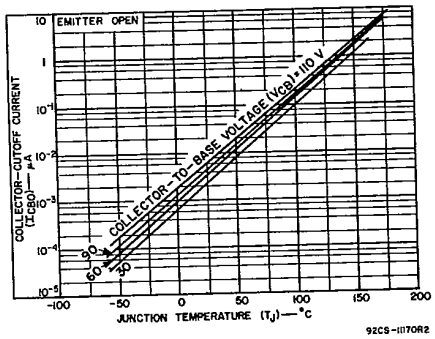

Fig. 4 – Typical cutoff characteristics for types 2N1893 and 2N2405.

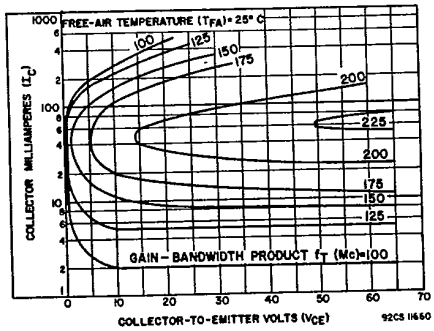

Fig. 5 – Typical gain bandwidth product characteristics for types 2N1893 and 2N2405.

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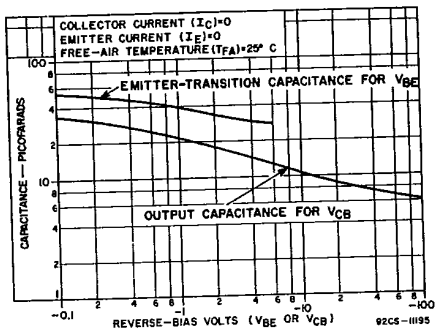

Fig. 6 — Typical capacitance characteristics for types 2N1893 and 2N2405.

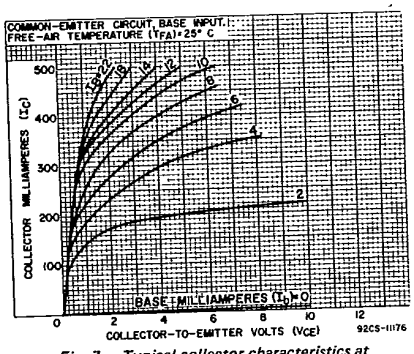

Fig. 7 — Typical collector characteristics at 25° C for type 2N2405.

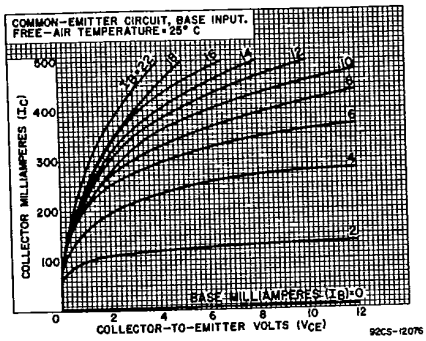

Fig. 8 — Typical collector characteristics at 25° C for type 2N1893.

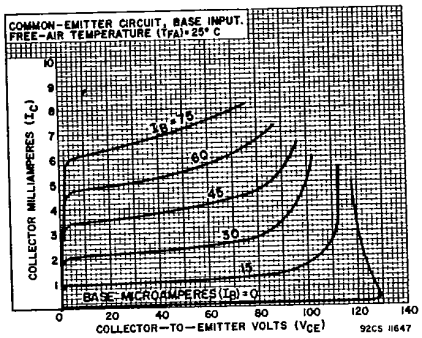

Fig. 9 — Typical collector characteristics at 25° C for type 2N2405.

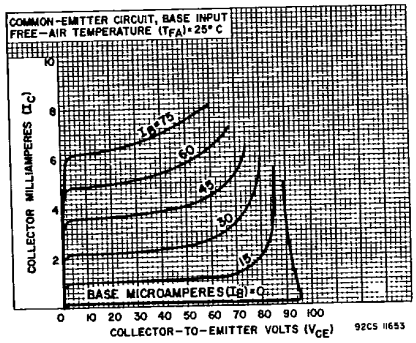

Fig. 10 — Typical collector characteristics at 25° C for type 2N1893.

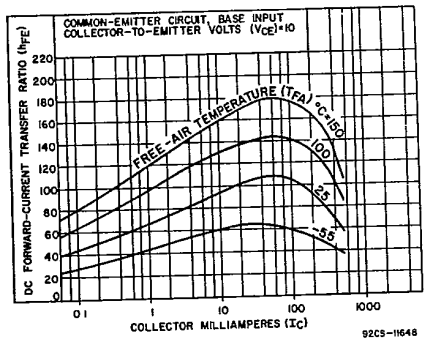

Fig. 11 — Typical dc-beta characteristics for types 2N1893 and 2N2405.

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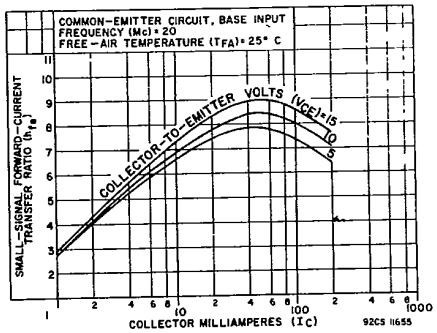

Fig. 12 – Typical small-signal beta characteristics for types 2N1893 and 2N2405.

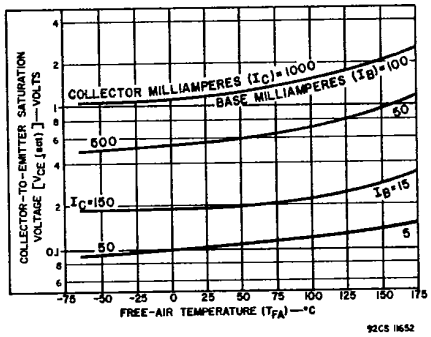

Fig. 13 – Typical saturation characteristics for types 2N1893 and 2N2405.

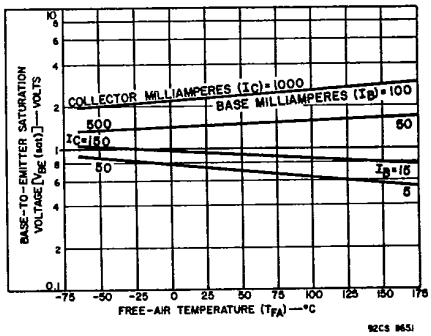

Fig. 14 – Typical saturation characteristics for types 2N2405 and 2N1893.

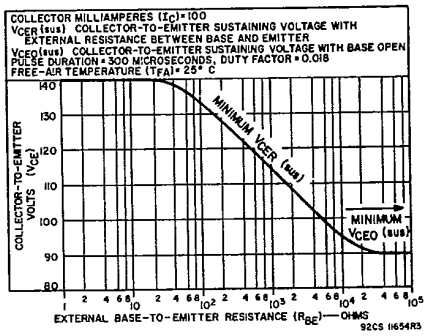

Fig. 15 – Sustaining voltage characteristic for type 2N2405.

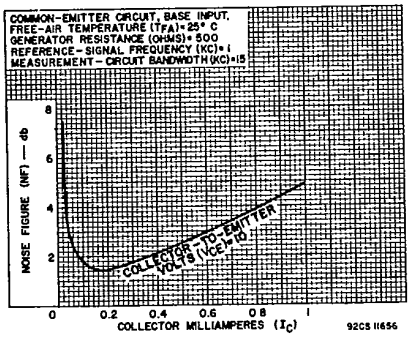

Fig. 16 – Typical wide-band noise characteristic for type 2N2405.

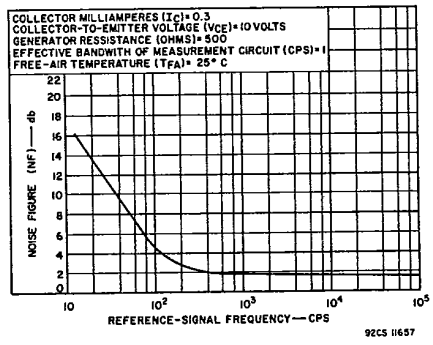

Fig. 17 – Typical narrow-band noise characteristic for type 2N2405.