SOLID STATE INC.
46 FARRAND STREET
BLOOMFIELD, NEW JERSEY 07003
www.solidstateinc.com

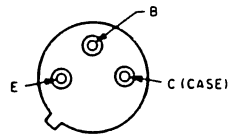
2N1893, 2N2405

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



TO-39
Metal Can Package

The 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}).

The 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.

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

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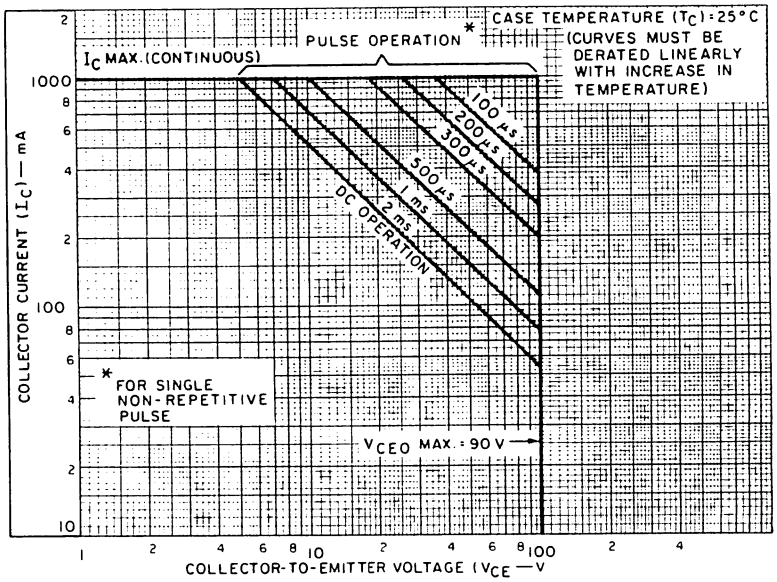

Fig. 1 — Maximum operating areas for type 2N2405.

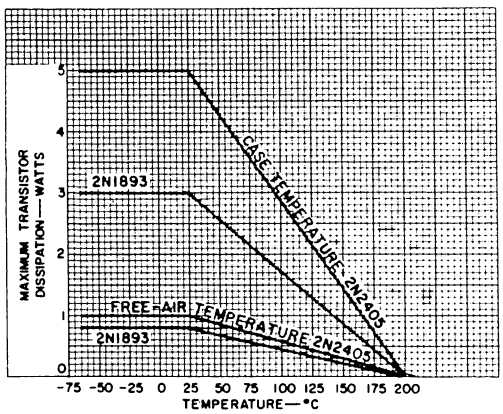

Fig. 2 — Dissipation derating curves for types 2N1893, and 2N2405.

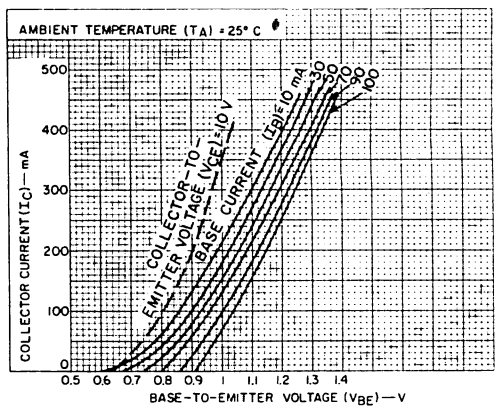

Fig. 3 — Typical transfer characteristics for types 2N1893 and 2N2405.

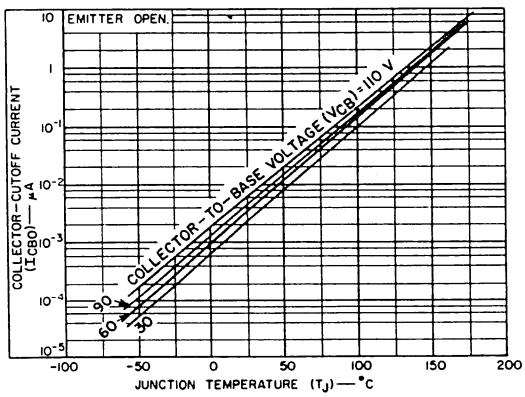

Fig. 4 — Typical cutoff characteristics for types 2N1893 and 2N2405.

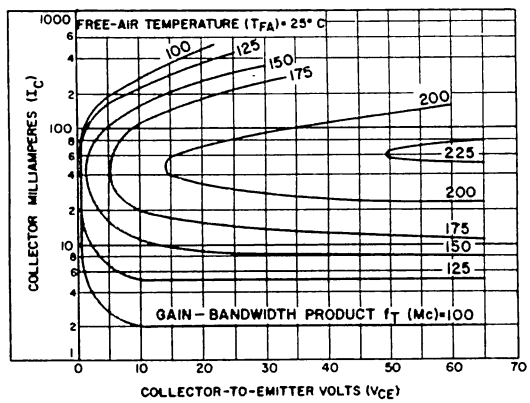

Fig. 5 — Typical gain bandwidth product characteristics for types 2N1893 and 2N2405.

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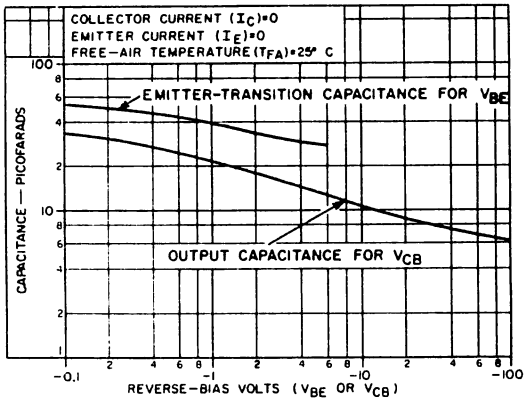

Fig. 6 – Typical capacitance characteristics for types 2N1893 and 2N2405.

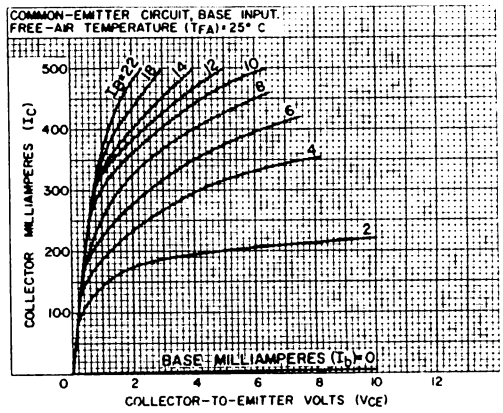

Fig. 7 – Typical collector characteristics at 25°C for type 2N2405.

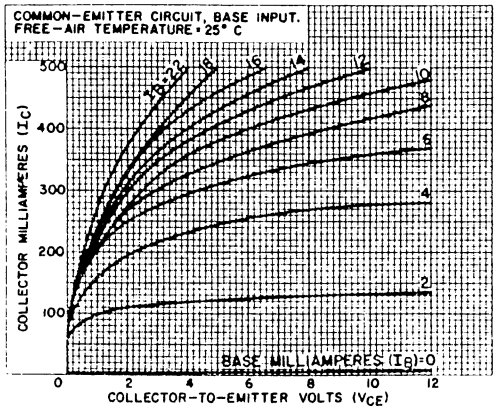

Fig. 8 – Typical collector characteristics at 25°C for type 2N1893.

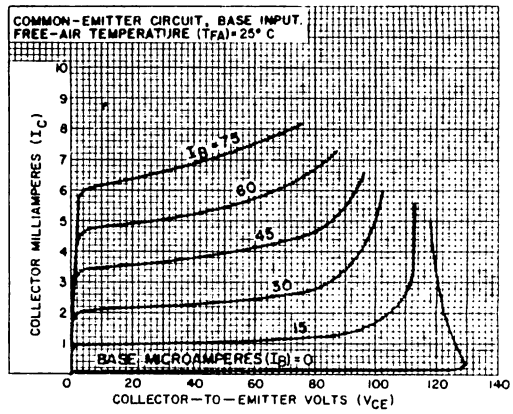

Fig. 9 – Typical collector characteristics at 25°C for type 2N2405.

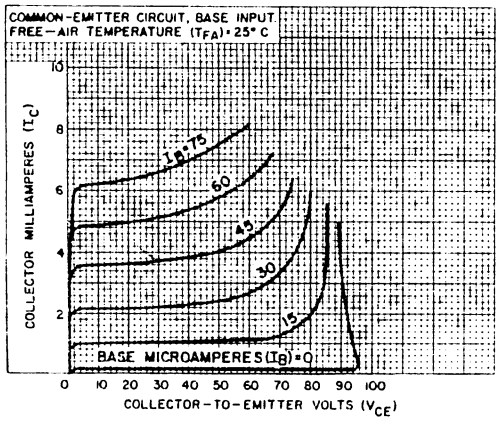

Fig. 10 – Typical collector characteristics at 25°C for type 2N1893.

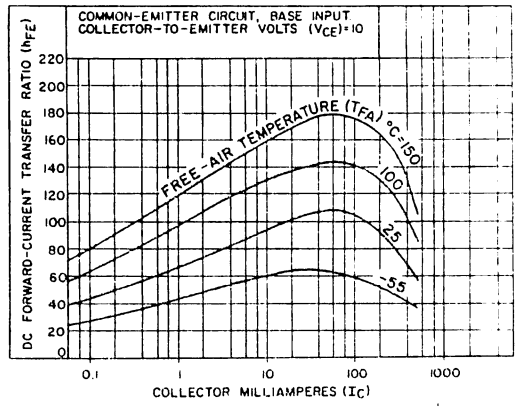

Fig. 11 – Typical dc-beta characteristics for types 2N1893 and 2N2405.

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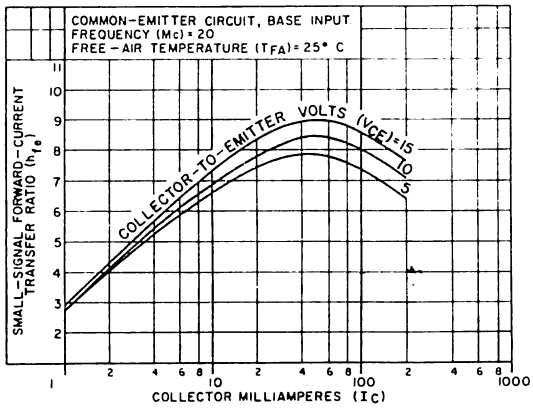

Fig. 12 – Typical small-signal beta characteristics for types 2N1893 and 2N2405.

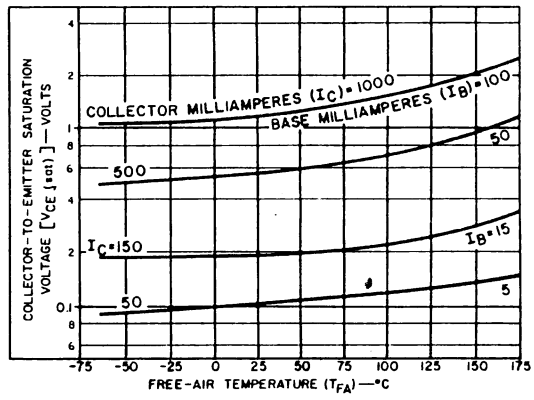

Fig. 13 – Typical saturation characteristics for types 2N1893 and 2N2405.

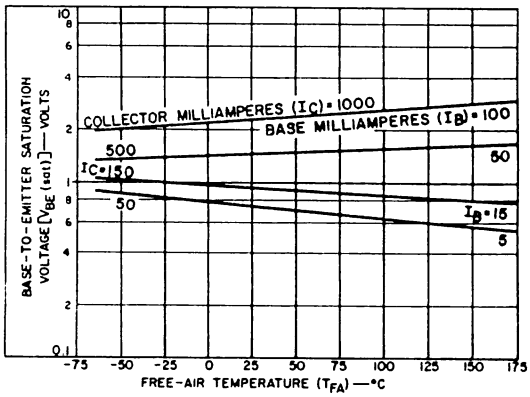

Fig. 14 – Typical saturation characteristics for types 2N2405 and 2N1893.

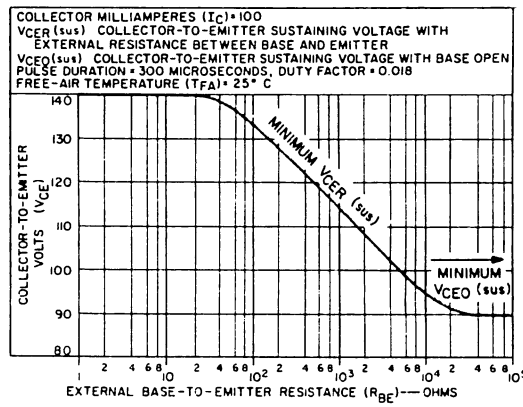

Fig. 15 – Sustaining voltage characteristic for type 2N2405.

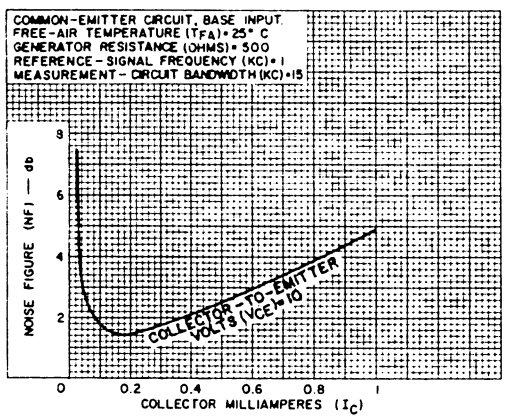

Fig. 16 – Typical wide-band noise characteristic for type 2N2405.

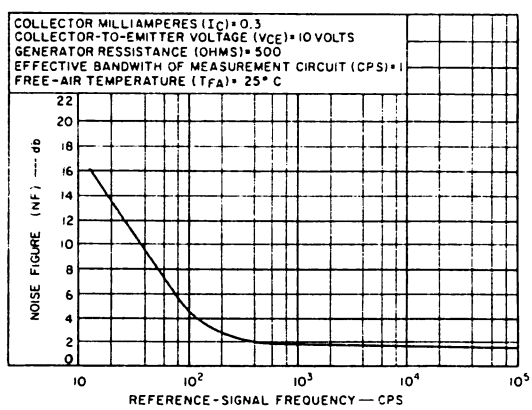

Fig. 17 – Typical narrow-band noise characteristic for type 2N2405.

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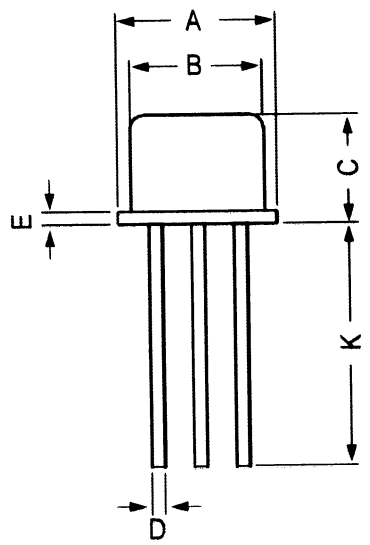
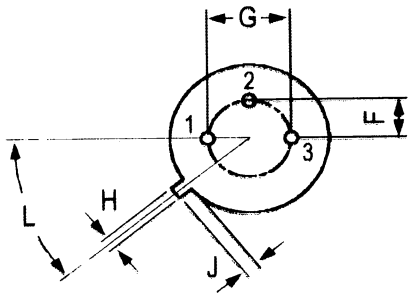
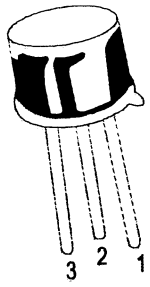


All dimensions are in mm

DIM	MIN	MAX
A	8.50	9.39
B	7.74	8.50
C	6.09	6.60
D	0.40	0.53
E	—	0.88
F	2.41	2.66
G	4.82	5.33
H	0.71	0.86
J	0.73	1.02
K	12.70	—
L	42 DEG	48 DEG





PIN CONFIGURATION
1. EMITTER
2. BASE
3. COLLECTOR