

PNP SWITCHING SILICON TRANSISTOR

Qualified per MIL-PRF-19500/290

DEVICES

2N2904	2N2905
2N2904A	2N2905A
2N2904AL	2N2905AL

LEVELS

JAN
JANTX
JANTXV
JANS

ABSOLUTE MAXIMUM RATINGS ($T_C = +25^\circ\text{C}$ unless otherwise noted)

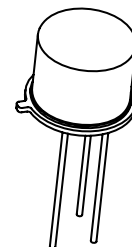
Parameters / Test Conditions	Symbol	2N2904 2N2905	2N2904A, L 2N2905A, L	Unit
Collector-Emitter Voltage	V_{CEO}	40	60	Vdc
Collector-Base Voltage	V_{CBO}	60		Vdc
Emitter-Base Voltage	V_{EBO}	5.0		Vdc
Collector Current	I_C	600		mAdc
Total Power Dissipation @ $T_A = +25^\circ\text{C}$ ⁽¹⁾ @ $T_C = +25^\circ\text{C}$ ⁽²⁾	P_T	0.8 3.0		W/ $^\circ\text{C}$
Operating & Storage Junction Temperature Range	T_J, T_{stg}	-65 to +200		$^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient	$R_{\theta JC}$	50		$^\circ\text{C/W}$

NOTES:

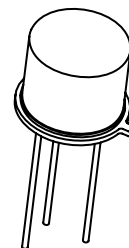
- 1/ Derate linearly 3.43W/ $^\circ\text{C}$ for $T_A > +25^\circ\text{C}$
2/ Derate linearly 17.2W/ $^\circ\text{C}$ for $T_C > +25^\circ\text{C}$

ELECTRICAL CHARACTERISTICS ($T_A = +25^\circ\text{C}$, unless otherwise noted)

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
OFF CHARACTERISTICS				
Collector-Emitter Breakdown Current $I_C = 10\text{mAdc}$ 2N2904, 2N2905 2N2904A, 2N2905A / AL	$V_{(BR)CEO}$	40 60		Vdc
Collector-Emitter Cutoff Voltage $V_{CE} = 40\text{Vdc}$ 2N2904, 2N2905 $V_{CE} = 60\text{Vdc}$ 2N2904A, 2N2905A / AL	I_{CES}		1.0	μAdc
Collector-Base Cutoff Current $V_{CB} = 50\text{Vdc}$ 2N2904, 2N2905 2N2904A, 2N2905A / AL $V_{CB} = 60\text{Vdc}$ All Types	I_{CBO}		20 10 10	ηAdc ηAdc μAdc
Emitter-Base Cutoff Current $V_{EB} = 3.5\text{Vdc}$ $V_{EB} = 5.0\text{Vdc}$	I_{EBO}		50 10	ηAdc μAdc



TO-39 (TO-205AD)
2N2904, 2N2904A
2N2905, 2N2905A



TO-5
2N2904AL, 2N2905AL

ELECTRICAL CHARACTERISTICS ($T_A = +25^\circ\text{C}$, unless otherwise noted) (CONT.)

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
ON CHARACTERISTICS ⁽³⁾				
Forward-Current Transfer Ratio $I_C = 0.1\text{mA}$, $V_{CE} = 10\text{Vdc}$ 2N2904 2N2905 2N2904A, 2N2904AL 2N2905A, 2N2905AL $I_C = 1.0\text{mA}$, $V_{CE} = 10\text{Vdc}$ 2N2904 2N2905 2N2904A, 2N2904AL 2N2905A, 2N2905AL $I_C = 10\text{mA}$, $V_{CE} = 10\text{Vdc}$ 2N2904 2N2905 2N2904A, 2N2904AL 2N2905A, 2N2905AL $I_C = 150\text{mA}$, $V_{CE} = 10\text{Vdc}$ 2N2904, 2N2904A / AL 2N2905, 2N2905A / AL $I_C = 500\text{mA}$, $V_{CE} = 10\text{Vdc}$ 2N2904 2N2905 2N2904A, 2N2904AL 2N2905A, 2N2905AL	h_{FE}	20 35 40 75 25 50 40 100 35 75 40 100 40 100 20 30 40 50	175 450 175 450	
Collector-Emitter Saturation Voltage $I_C = 150\text{mA}$, $I_B = 15\text{mA}$ $I_C = 500\text{mA}$, $I_B = 50\text{mA}$	$V_{CE(sat)}$		0.4 1.6	Vdc
Base-Emitter Saturation Voltage $I_C = 150\text{mA}$, $I_B = 15\text{mA}$ $I_C = 500\text{mA}$, $I_B = 50\text{mA}$	$V_{BE(sat)}$		1.3 2.6	Vdc

DYNAMIC CHARACTERISTICS

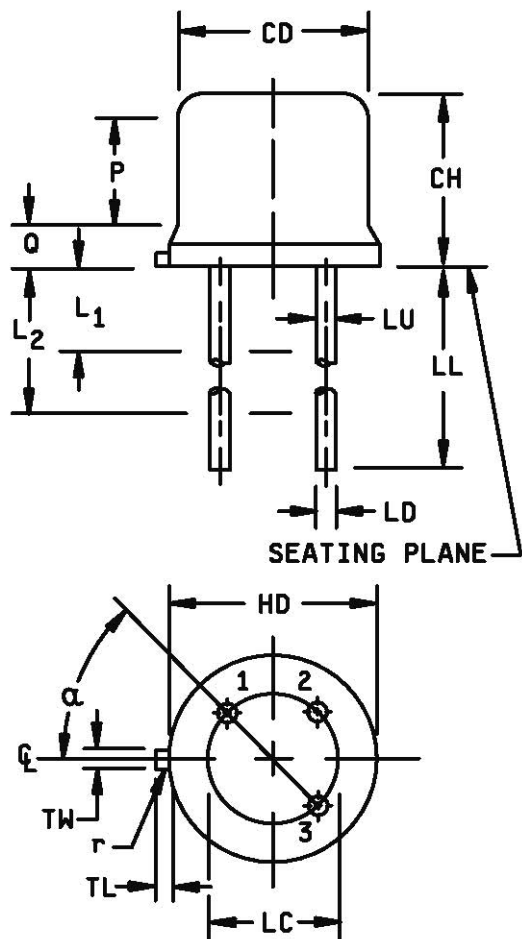
Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Small-Signal Short-Circuit Forward-Current Transfer Ratio $I_C = 1.0\text{mA}$, $V_{CE} = 10\text{Vdc}$, $f = 1.0\text{kHz}$ 2N2904 2N2905 2N2904A, 2N2905A 2N2904AL, 2N2905AL	h_{fe}		25 50 40 100	
Small-Signal Short-Circuit Forward-Current Transfer Ratio $I_C = 50\text{mA}$, $V_{CE} = 20\text{Vdc}$, $f = 100\text{MHz}$	$ h_{fe} $		2.0	
Output Capacitance $V_{CB} = 10\text{Vdc}$, $I_E = 0$, $100\text{kHz} \leq f \leq 1.0\text{MHz}$	C_{obo}		8.0	pF
Input Capacitance $V_{EB} = 2.0\text{Vdc}$, $I_C = 0$, $100\text{kHz} \leq f \leq 1.0\text{MHz}$	C_{ibo}		30	pF

SWITCHING CHARACTERISTICS

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Turn-On Time $V_{CC} = 30\text{Vdc}$, $I_C = 150\text{mA}$, $I_{B1} = 15\text{mA}$	t_{on}		45	ns
Turn-Off Time $V_{CC} = 30\text{Vdc}$, $I_C = 150\text{mA}$, $I_{B1} = I_{B2} = 15\text{mA}$	t_{off}		300	ns

(3) Pulse Test: Pulse Width = 300 μ s, Duty Cycle $\leq$ 2.0%

PACKAGE DIMENSIONS



Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.305	.335	7.75	8.51	
CH	.240	.260	6.10	6.60	
HD	.335	.370	8.51	9.40	
LC	.200 TP		5.08 TP		6
LD	.016	.021	0.41	0.53	7, 8
LL	.500	.750	12.70	19.05	7, 8, 12
LU	.016	.019	0.41	0.48	7, 8
L ₁		.050		1.27	7, 8
L ₂	.250		6.35		7, 8
P	.100		2.54		
Q		.050		1.27	5
TL	.029	.045	0.74	1.14	4
TW	.028	.034	0.71	0.86	3
r		.010		0.25	10
α	45° TP		45° TP		6

NOTES:

1. Dimension are in inches.
2. Millimeters are given for general information only.
3. Beyond r (radius) maximum, TW shall be held for a minimum length of .011 inch (0.28 mm).
4. Dimension TL measured from maximum HD.
5. Body contour optional within zone defined by HD, CD, and Q.
6. Leads at gauge plane .054 +.001, -.000 inch (1.37 +0.03, -0.00 mm) below seating plane shall be within .007 inch (0.18 mm) radius of true position (TP) at maximum material condition (MMC) relative to tab at MMC. The device may be measured by direct methods.
7. Dimension LU applies between L₁ and L₂. Dimension LD applies between L₂ and L minimum. Diameter is uncontrolled in L₁ and beyond LL minimum.
8. All three leads.
9. The collector shall be internally connected to the case.
10. Dimension r (radius) applies to both inside corners of tab.
11. In accordance with ASME Y14.5M, diameters are equivalent to øx symbology.
12. For "L" suffix devices, dimension LL is 1.50 (38.10 mm) minimum, 1.75 (44.45 mm) maximum.
13. Lead 1 = emitter, lead 2 = base, lead 3 = collector.

FIGURE 1. Physical dimensions (similar to TO-39)