

## PNP SWITCHING SILICON TRANSISTOR

Qualified per MIL-PRF-19500/290

### DEVICES

<b>2N2904</b>	<b>2N2905</b>
<b>2N2904A</b>	<b>2N2905A</b>
<b>2N2904AL</b>	<b>2N2905AL</b>

**LEVELS**  
**JAN**  
**JANTX**  
**JANTXV**  
**JANS**

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

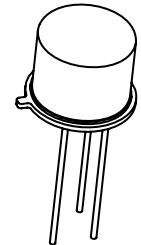
Parameters / Test Conditions	Symbol	2N2904 2N2905	2N2904A, L 2N2905A, L	Unit
Collector-Emitter Voltage	$V_{CEO}$	40	60	Vdc
Collector-Base Voltage	$V_{CBO}$	60		Vdc
Emitter-Base Voltage	$V_{EBO}$	5.0		Vdc
Collector Current	$I_C$	600		mAdc
Total Power Dissipation @ $T_A = +25^\circ\text{C}$ (1) @ $T_C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

### NOTES:

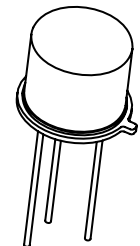
- 1/ Derate linearly 3.43W/°C for  $T_A > +25^\circ\text{C}$
- 2/ Derate linearly 17.2W/°C for  $T_C > +25^\circ\text{C}$

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

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
<b>OFF CHARACTERISTICS</b>				
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	$\mu\text{Adc}$
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	$\eta\text{Adc}$ $\eta\text{Adc}$ $\mu\text{Adc}$
Emitter-Base Cutoff Current $V_{EB} = 3.5\text{Vdc}$ $V_{EB} = 5.0\text{Vdc}$	$I_{EBO}$		50 10	$\eta\text{Adc}$ $\mu\text{Adc}$



**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
<b>ON CHARACTERISTICS <sup>(3)</sup></b>				
Forward-Current Transfer Ratio $I_C = 0.1\text{mA}$ , $V_{CE} = 10\text{Vdc}$				
2N2904		20		
2N2905		35		
2N2904A, 2N2904AL		40		
2N2905A, 2N2905AL		75		
$I_C = 1.0\text{mA}$ , $V_{CE} = 10\text{Vdc}$				
2N2904		25	175	
2N2905		50	450	
2N2904A, 2N2904AL		40	175	
2N2905A, 2N2905AL		100	450	
$I_C = 10\text{mA}$ , $V_{CE} = 10\text{Vdc}$				
2N2904	$h_{FE}$	35		
2N2905		75		
2N2904A, 2N2904AL		40		
2N2905A, 2N2905AL		100		
$I_C = 150\text{mA}$ , $V_{CE} = 10\text{Vdc}$				
2N2904, 2N2904A / AL		40	120	
2N2905, 2N2905A / AL		100	300	
$I_C = 500\text{mA}$ , $V_{CE} = 10\text{Vdc}$				
2N2904		20		
2N2905		30		
2N2904A, 2N2904AL		40		
2N2905A, 2N2905AL		50		
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

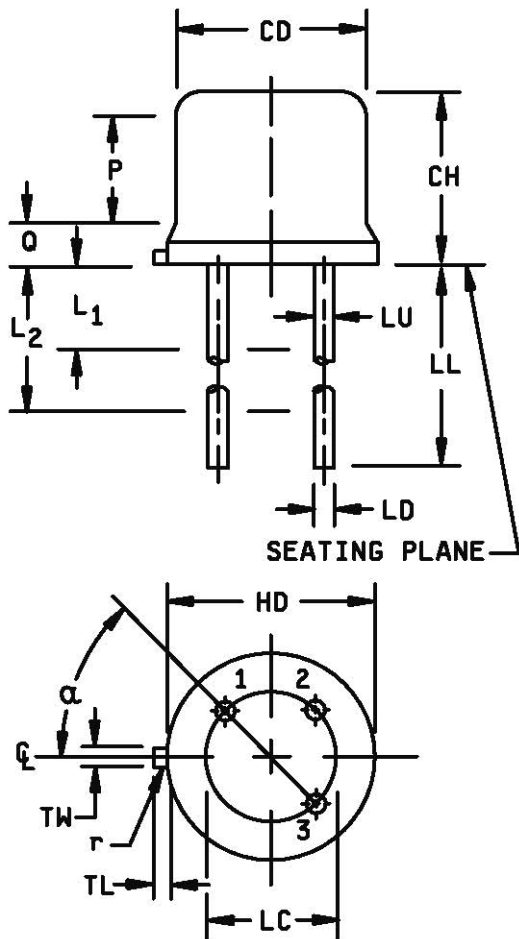
Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Small-Signal Short-Circuit Forward-Current Transfer Ratio $I_C = 1.0\text{mA}$ , $V_{CE} = 10\text{Vdc}$ , $f = 1.0\text{kHz}$ 2N2904 2N2905 2N2904A, 2N2905A 2N2904AL, 2N2905AL	$h_{fe}$		25 50 40 100	
Small-Signal Short-Circuit Forward-Current Transfer 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 $\mu$ 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 <sub>1</sub>		.050		1.27	7, 8
L <sub>2</sub>	.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
$\alpha$	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 L<sub>1</sub> and L<sub>2</sub>. Dimension LD applies between L<sub>2</sub> and L minimum. Diameter is uncontrolled in L<sub>1</sub> 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  $\phi x$  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)