

## 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>

### Qualified Level

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

### MAXIMUM RATINGS

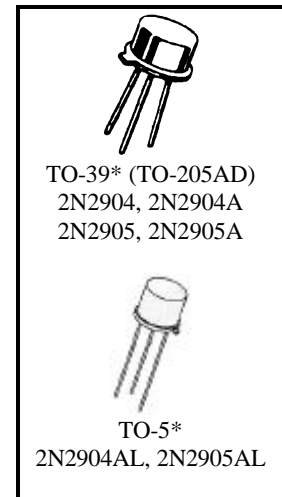
Ratings	Symbol	2N2904 2N2905	2N2904A, L 2N2905A, L	Unit
Collector-Emitter Voltage	$V_{CEO}$	40	60	Vdc
Collector-Base Voltage	$V_{CBO}$	60		Vdc
Emitter-Base Voltage	$V_{EBO}$	5.0		Vdc
Collector Current	$I_C$	600		mAdc
Total Power Dissipation @ $T_A = +25^{\circ}\text{C}$ <sup>(1)</sup> @ $T_C = +25^{\circ}\text{C}$ <sup>(2)</sup>	$P_T$	0.6		W
		3.0		W
Operating & Storage Junction Temp. Range	$T_J, T_{stg}$	-65 to +200		$^{\circ}\text{C}$

### THERMAL CHARACTERISTICS

Characteristics	Symbol	Max.	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	0.29	$^{\circ}\text{C}/\text{mW}$

1) Derate linearly 3.43 W/ $^{\circ}\text{C}$  for  $T_A > +25^{\circ}\text{C}$

2) Derate linearly 17.2 W/ $^{\circ}\text{C}$  for  $T_C > +25^{\circ}\text{C}$



\*See appendix A for package outline

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

Characteristics	Symbol	Min.	Max.	Unit
-----------------	--------	------	------	------

### OFF CHARACTERISTICS

Collector-Emitter Breakdown Voltage $I_C = 10 \text{ mAdc}$	2N2904, 2N2905 2N2904A, L, 2N2905A, L	$V_{(BR)CEO}$	40 60	Vdc
Collector-Emitter Cutoff Voltage $V_{CE} = 40 \text{ Vdc}$ $V_{CE} = 60 \text{ Vdc}$	2N2904, 2N2905 2N2904A, L, 2N2905A, L	$I_{CES}$	1.0 1.0	$\mu\text{Adc}$
Collector-Base Cutoff Current $V_{CB} = 50 \text{ Vdc}$ $V_{CB} = 60 \text{ Vdc}$	2N2904, 2N2905 2N2904A, L, 2N2905A, L All Types	$I_{CBO}$	20 10 10	$\eta\text{Adc}$ $\mu\text{Adc}$
Emitter-Base Cutoff Current $V_{EB} = 3.5 \text{ Vdc}$ $V_{EB} = 5.0 \text{ Vdc}$		$I_{EBO}$	50 10	$\eta\text{Adc}$ $\mu\text{Adc}$

**ELECTRICAL CHARACTERISTICS (con't)**

Characteristics	Symbol	Min.	Max.	Unit
<b>ON CHARACTERISTICS <sup>(3)</sup></b>				
Forward-Current Transfer Ratio I <sub>C</sub> = 0.1 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub>				
2N2904		20		
2N2905		35		
2N2904A, 2N2904AL		40		
2N2905A, 2N2905AL		75		
I <sub>C</sub> = 1.0 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub>				
2N2904		25	175	
2N2905		50	450	
2N2904A, 2N2904AL		40	175	
2N2905A, 2N2905AL		100	450	
I <sub>C</sub> = 10 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub>	h <sub>FE</sub>			
2N2904		35		
2N2905		75		
2N2904A, 2N2904AL		40		
2N2905A, 2N2905AL		100		
I <sub>C</sub> = 150 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub>				
2N2904, 2N2904A, L		40	120	
2N2905, 2N2905A, L		100	300	
I <sub>C</sub> = 500 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub>				
2N2904		20		
2N2905		30		
2N2904A, 2N2904AL		40		
2N2905A, 2N2905AL		50		
Collector-Emitter Saturation Voltage I <sub>C</sub> = 150 mA <sub>dc</sub> , I <sub>B</sub> = 15 mA <sub>dc</sub> I <sub>C</sub> = 500 mA <sub>dc</sub> , I <sub>B</sub> = 50 mA <sub>dc</sub>	V <sub>CE(sat)</sub>		0.4 1.6	V <sub>dc</sub>
Base-Emitter Voltage I <sub>C</sub> = 150 mA <sub>dc</sub> , I <sub>B</sub> = 15 mA <sub>dc</sub> I <sub>C</sub> = 500 mA <sub>dc</sub> , I <sub>B</sub> = 50 mA <sub>dc</sub>	V <sub>BE(sat)</sub>		1.3 2.6	V <sub>dc</sub>

**DYNAMIC CHARACTERISTICS**

Small-Signal Cutoff Frequency I <sub>C</sub> = 1.0 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> , f = 1.0 kHz				
2N2904	h <sub>fe</sub>	25		
2N2905		50		
2N2904A, 2N2905A		40		
2N2904AL, 2N2905AL		100		
Small-Signal Cutoff Frequency, Magnitude I <sub>C</sub> = 50 mA <sub>dc</sub> , V <sub>CE</sub> = 20 V <sub>dc</sub> , f = 100 MHz	h <sub>fe</sub>	2.0		
Output Capacitance V <sub>CB</sub> = 10 V <sub>dc</sub> , I <sub>E</sub> = 0, 100 kHz ≤ f ≤ 1.0 MHz	C <sub>obo</sub>		8.0	pF
Input Capacitance V <sub>EB</sub> = 2.0 V <sub>dc</sub> , I <sub>C</sub> = 0, 100 kHz ≤ f ≤ 1.0 MHz	C <sub>ibo</sub>		30	pF

**SWITCHING CHARACTERISTICS**

Turn-On Time V <sub>CC</sub> = 30 V <sub>dc</sub> ; I <sub>C</sub> = 150 mA <sub>dc</sub> ; I <sub>B1</sub> = 15 mA <sub>dc</sub>	t <sub>on</sub>		45	ns
Turn-Off Time V <sub>CC</sub> = 30 V <sub>dc</sub> ; I <sub>C</sub> = 150 mA <sub>dc</sub> ; I <sub>B1</sub> = I <sub>B2</sub> = 15 mA <sub>dc</sub>	t <sub>off</sub>		300	ns

(3) Pulse Test: Pulse Width = 300μs, Duty Cycle ≤ 2.0%.