

## PNP SWITCHING SILICON TRANSISTOR

Qualified per MIL-PRF-19500/290

### Devices

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

### Qualified Level

JAN  
JANTX  
JANTXV  
JANS

### MAXIMUM RATINGS

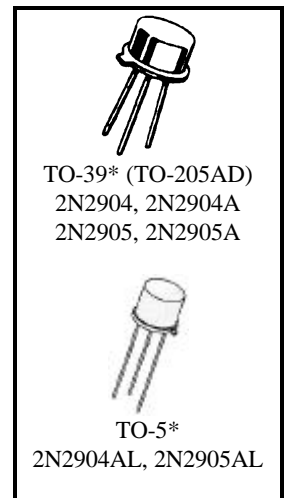
Ratings	Symbol	2N2904 2N2905	2N2904A, L 2N2905A, L	Unit
Collector-Emitter Voltage	$V_{CEO}$	40	60	Vdc
Collector-Base Voltage	$V_{CBO}$		60	Vdc
Emitter-Base Voltage	$V_{EBO}$		5.0	Vdc
Collector Current	$I_C$		600	mAdc
Total Power Dissipation @ $T_A = +25^{\circ}\text{C}$ <sup>(1)</sup> @ $T_C = +25^{\circ}\text{C}$ <sup>(2)</sup>	$P_T$		0.6 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
<b>OFF CHARACTERISTICS</b>				
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	$\eta\text{Adc}$ $\mu\text{Adc}$

2N2904, 2N2904A, 2N2904AL, 2N2905, 2N2905A, 2N2905AL JAN SERIES

**ELECTRICAL CHARACTERISTICS (con't)**

Characteristics	Symbol	Min.	Max.	Unit	
<b>ON CHARACTERISTICS</b> <sup>(3)</sup>					
Forward-Current Transfer Ratio $I_C = 0.1 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}$ 2N2904 2N2905 2N2904A, 2N2904AL 2N2905A, 2N2905AL	$h_{FE}$	20			
$I_C = 1.0 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}$ 2N2904 2N2905 2N2904A, 2N2904AL 2N2905A, 2N2905AL		25	175		
$I_C = 10 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}$ 2N2904 2N2905 2N2904A, 2N2904AL 2N2905A, 2N2905AL		35	450		
$I_C = 150 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}$ 2N2904, 2N2904A, L 2N2905, 2N2905A, L		40	175		
$I_C = 500 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}$ 2N2904 2N2905 2N2904A, 2N2904AL 2N2905A, 2N2905AL		75	450		
Collector-Emitter Saturation Voltage $I_C = 150 \text{ mAdc}, I_B = 15 \text{ mAdc}$ $I_C = 500 \text{ mAdc}, I_B = 50 \text{ mAdc}$		$V_{CE(sat)}$		0.4 1.6	Vdc
Base-Emitter Voltage $I_C = 150 \text{ mAdc}, I_B = 15 \text{ mAdc}$ $I_C = 500 \text{ mAdc}, I_B = 50 \text{ mAdc}$		$V_{BE(sat)}$		1.3 2.6	Vdc
<b>DYNAMIC CHARACTERISTICS</b>					
Small-Signal Cutoff Frequency $I_C = 1.0 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}, f = 1.0 \text{ kHz}$ 2N2904 2N2905 2N2904A, 2N2905A 2N2904AL, 2N2905AL		$h_{fe}$	25		
Small-Signal Cutoff Frequency, Magnitude $I_C = 50 \text{ mAdc}, V_{CE} = 20 \text{ Vdc}, f = 100 \text{ MHz}$		$ 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
<b>SWITCHING CHARACTERISTICS</b>					
Turn-On Time $V_{CC} = 30 \text{ Vdc}; I_C = 150 \text{ mAdc}; I_{B1} = 15 \text{ mAdc}$	$t_{on}$		45	$\eta s$	
Turn-Off Time $V_{CC} = 30 \text{ Vdc}; I_C = 150 \text{ mAdc}; I_{B1} = I_{B2} = 15 \text{ mAdc}$	$t_{off}$		300	$\eta s$	

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