

PNP SWITCHING SILICON TRANSISTOR

Qualified per MIL-PRF-19500/290

Devices

2N2904
2N2904A
2N2904AL

2N2905
2N2905A
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 @ $T_A = +25^{\circ}\text{C}$ ⁽¹⁾ @ $T_C = +25^{\circ}\text{C}$ ⁽²⁾	P_T	0.6 3.0		W 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 $T_C > +25^{\circ}\text{C}$



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



TO-5*
2N2904AL, 2N2905AL

*See appendix A for package outline

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

Characteristics	Symbol	Min.	Max.	Unit
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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	μAdc
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	ηAdc μAdc
Emitter-Base Cutoff Current $V_{EB} = 3.5 \text{ Vdc}$ $V_{EB} = 5.0 \text{ Vdc}$		I_{EBO}	50 10	ηAdc μAdc

ELECTRICAL CHARACTERISTICS (con't)

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

DYNAMIC CHARACTERISTICS

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

SWITCHING CHARACTERISTICS

Turn-On Time V _{CC} = 30 V _{dc} ; I _C = 150 mA _{dc} ; I _{B1} = 15 mA _{dc}	t _{on}		45	ns
Turn-Off Time V _{CC} = 30 V _{dc} ; I _C = 150 mA _{dc} ; I _{B1} = I _{B2} = 15 mA _{dc}	t _{off}		300	ns

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