



TECHNICAL DATA

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	mA
Total Power Dissipation @ $T_A = +25^{\circ}\text{C}$ ⁽¹⁾ @ $T_C = +25^{\circ}\text{C}$ ⁽²⁾	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 $T_C > +25^{\circ}\text{C}$



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 $I_C = 10 \text{ mA}$	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	μA
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	ηA μA
Emitter-Base Cutoff Current $V_{EB} = 3.5 \text{ Vdc}$ $V_{EB} = 5.0 \text{ Vdc}$		I_{EBO}	50 10	ηA μA

ELECTRICAL CHARACTERISTICS (con't)

Characteristics	Symbol	Min.	Max.	Unit
ON CHARACTERISTICS ⁽³⁾				
Forward-Current Transfer Ratio $I_C = 0.1 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}$ 2N2904 2N2905 2N2904A, 2N2904AL 2N2905A, 2N2905AL $I_C = 1.0 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}$ 2N2904 2N2905 2N2904A, 2N2904AL 2N2905A, 2N2905AL $I_C = 10 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}$ 2N2904 2N2905 2N2904A, 2N2904AL 2N2905A, 2N2905AL $I_C = 150 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}$ 2N2904, 2N2904A, L 2N2905, 2N2905A, L $I_C = 500 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}$ 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	175 450 175 450 120 300	
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

DYNAMIC CHARACTERISTICS

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 50 40 100		
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

SWITCHING CHARACTERISTICS

Turn-On Time $V_{CC} = 30 \text{ Vdc}; I_C = 150 \text{ mAdc}; I_{B1} = 15 \text{ mAdc}$	t_{on}		45	ns
Turn-Off Time $V_{CC} = 30 \text{ Vdc}; I_C = 150 \text{ mAdc}; I_{B1} = I_{B2} = 15 \text{ mAdc}$	t_{off}		300	ns

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

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