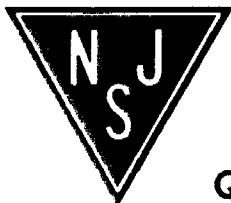


## TYPES 2N1303, 2N1305, 2N1307, AND 2N1309 P-N-P ALLOY-JUNCTION GERMANIUM TRANSISTORS

electrical characteristics at 25°C free-air temperature

PARAMETER	TEST CONDITIONS	2N1303			2N1305			2N1307			2N1309			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
$V_{CB0}$ Collector-Base Breakdown Voltage	$I_C = -100 \mu A, I_E = 0$	-30	—	—	-30	—	—	-30	—	—	-30	—	—	v
$V_{EB0}$ Emitter-Base Breakdown Voltage	$I_E = -100 \mu A, I_C = 0$	-25	—	—	-25	—	—	-25	—	—	-25	—	—	v
$V_{PT}$ Punch Through Voltage†	$V_{EBI} = -1 v$	-25	—	—	-20	—	—	-15	—	—	-15	—	—	v
$I_{C0}$ Collector Cutoff Current	$V_{CB} = -25 v, I_E = 0$	—	-2	-6	—	-2	-6	—	-2	-6	—	-2	-6	$\mu A$
$I_{E0}$ Emitter Cutoff Current	$V_{EB} = -25 v, I_C = 0$	—	-1.5	-6	—	-1.5	-6	—	-1.5	-6	—	-1.5	-6	$\mu A$
$h_{FE}$ Static Forward Current Transfer Ratio	$V_{CE} = -1 v, I_C = -10 ma$	20	100	—	40	115	200	60	130	300	80	160	—	—
	$V_{CE} = -0.35 v, I_C = -200 ma$	10	45	—	15	55	—	20	65	—	20	75	—	—
$V_{BE}$ Base-Emitter Voltage	$I_B = -0.5 ma, I_C = -10 ma$	-0.15	-0.25	-0.40	-0.15	-0.25	-0.35	-0.15	-0.25	-0.35	-0.15	-0.25	-0.35	v
$V_{CE(sat)}$ Collector-Emitter Saturation Voltage	$I_B = -0.5 ma, I_C = -10 ma$	—	-0.08	-0.20	—	—	—	—	—	—	—	—	—	v
	$I_B = -0.25 ma, I_C = -10 ma$	—	—	—	—	-0.08	-0.20	—	—	—	—	—	—	v
	$I_B = -0.17 ma, I_C = -10 ma$	—	—	—	—	—	—	—	-0.08	-0.20	—	—	—	v
	$I_B = -0.13 ma, I_C = -10 ma$	—	—	—	—	—	—	—	—	—	—	-0.08	-0.20	v
$h_{ib}$ Small-Signal Common-Base Input Impedance	$V_{CB} = -5 v, I_E = 1 ma, f = 1 kc$	—	29	—	—	29	—	—	29	—	—	29	—	ohm
$h_{rb}$ Small-Signal Common-Base Reverse Voltage Transfer Ratio	$V_{CB} = -5 v, I_E = 1 ma, f = 1 kc$	—	$7 \times 10^{-4}$	—	—	$7 \times 10^{-4}$	—	—	$7 \times 10^{-4}$	—	—	$7 \times 10^{-4}$	—	—
$h_{ob}$ Small-Signal Common-Base Output Admittance	$V_{CB} = -5 v, I_E = 1 ma, f = 1 kc$	—	0.40	—	—	0.40	—	—	0.40	—	—	0.40	—	$\mu mho$
$h_{fe}$ Small-Signal Common-Emitter Forward Current Transfer Ratio	$V_{CE} = -5 v, I_C = -1 ma, f = 1 kc$	—	115	—	—	130	—	—	150	—	—	190	—	—
$f_{hfb}$ Common-Base Alpha-Cutoff Frequency	$V_{CB} = -5 v, I_E = 1 ma$	3	12	—	5	14	—	10	16	—	15	20	—	mc
$C_{ob}$ Common-Base Open-Circuit Output Capacitance	$V_{CB} = -5 v, I_E = 0, f = 1 mc$	—	10	20	—	10	20	—	10	20	—	10	20	pf
$C_{ib}$ Common-Base Open-Circuit Input Capacitance	$V_{EB} = -5 v, I_C = 0, f = 1 mc$	—	9	—	—	9	—	—	9	—	—	9	—	pf

† $V_{PT}$  is determined by measuring the emitter-base floating potential  $V_{EBI}$ . The collector-base voltage,  $V_{CB}$ , is increased until  $V_{EBI} = -1$  volt; this value of  $V_{CB} = (V_{PT} - 1 v)$ .



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Quality Semi-Conductors

**switching characteristics at 25°C free-air temperature**

PARAMETER	TEST CONDITIONS††	2N1303			2N1305			2N1307			2N1309			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
$t_d$ Delay Time	$I_C = -10 \text{ ma}$ , $I_{B(1)} = -1.3 \text{ ma}$ $I_{B(2)} = 0.7 \text{ ma}$ , $V_{BE(off)} = 0.8 \text{ v}$ $R_L = 1 \text{ k } \Omega$ (See Fig. 1)	—	0.06	—	—	0.06	—	—	0.06	—	—	0.05	—	$\mu\text{sec}$
$t_r$ Rise Time		—	0.18	—	—	0.18	—	—	0.14	—	—	0.14	—	$\mu\text{sec}$
$t_s$ Storage Time		—	0.80	—	—	0.80	—	—	0.78	—	—	0.76	—	$\mu\text{sec}$
$t_f$ Fall Time		—	0.38	—	—	0.38	—	—	0.36	—	—	0.30	—	$\mu\text{sec}$
$Q_{sb}$ Stored Base Charge	$I_{B(1)} = -1 \text{ ma}$ , $I_C = -10 \text{ ma}$ (See Fig. 2)	—	960	—	—	920	—	—	880	—	—	800	—	pcb

††Voltage and current values shown are nominal, exact values vary slightly with device parameters.

**operating characteristics at 25°C free-air temperature**

PARAMETER	TEST CONDITIONS	2N1303			2N1305			2N1307			2N1309			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
NF Spot Noise Figure	$V_{CB} = -5 \text{ v}$ $I_B = 1 \text{ ma}$ $f = 1 \text{ kc}$ , $R_{\theta} = 1 \text{ k } \Omega$	—	4	—	—	4	—	—	3	—	—	3	—	dB