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N-P-N TYPES 2N1302, 2N1304, 2N1306, AND 2N1308 ALLOY-JUNCTION GERMANIUM TRANSISTORS

High-Frequency Transistors for Computer and Switching Applications

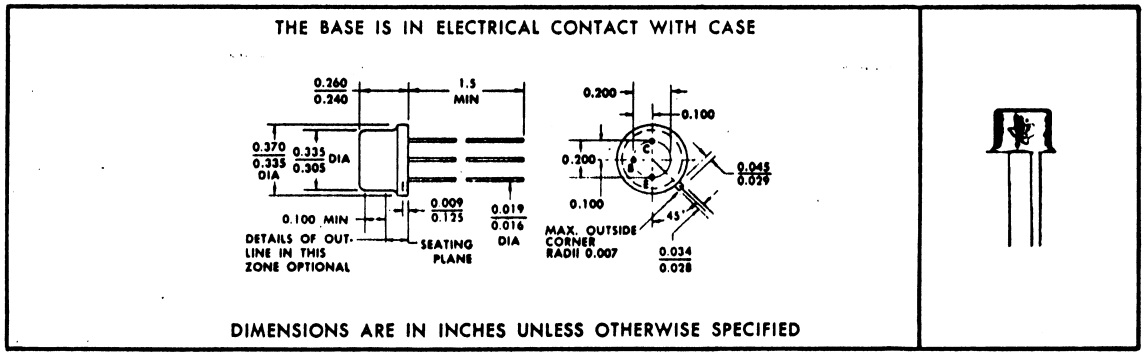
environmental tests

To ensure maximum integrity, stability, and long life, finished devices are subjected to the following tests and conditions prior to thorough testing for rigid adherence to specified characteristics.

- All devices receive a 100°C stabilization bake for 100 hours.
- The hermetic seal for all devices is verified by helium leak testing.
- Production samples are life tested at regularly scheduled periods to ensure maximum reliability under extreme operating conditions.
- Continuous Quality Control checks on in-process assembly are maintained.

*mechanical data

The transistors are in a JEDEC TO-5 hermetically sealed welded package with glass to metal seal between case and leads. Approximate weight is one gram.



*absolute maximum ratings at 25°C free-air temperature (unless otherwise noted)

	2N1302, 2N1304 2N1306, 2N1308	2N1303, 2N1305, 2N1307, 2N1309
Collector-Base Voltage	25 v	30 v
Emitter-Base Voltage	25 v	
Collector Current	300 ma	
Total Device Dissipation at (or below) 25°C Free-Air Temperature	150 mw	
Operating Collector Junction Temperature	85°C	
Storage Temperature Range	−65°C to 100°C	

Quality Semi-Conductors

TYPES 2N1302, 2N1304, 2N1306, AND 2N1308
N-P-N ALLOY-JUNCTION GERMANIUM TRANSISTORS

electrical characteristics at 25°C free-air temperature

PARAMETER		TEST CONDITIONS	2N1302			2N1304			2N1306			2N1308			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
BV_{CBO}	Collector-Base Breakdown Voltage	$I_C = 100\ \mu a$, $I_E = 0$	25	—	—	25	—	—	25	—	—	25	—	—	v
BV_{EBO}	Emitter-Base Breakdown Voltage	$I_E = 100\ \mu a$, $I_C = 0$	25	—	—	25	—	—	25	—	—	25	—	—	v
*V_{PT}	Punch Through Voltage†	$V_{EBfl} = 1$ v	25	—	—	20	—	—	15	—	—	15	—	—	v
*I_{CBO}	Collector Cutoff Current	$V_{CB} = 25$ v, $I_E = 0$	—	3	6	—	3	6	—	3	6	—	3	6	μa
*I_{EBO}	Emitter Cutoff Current	$V_{EB} = 25$ v, $I_C = 0$	—	2	6	—	2	6	—	2	6	—	2	6	μa
*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	100	—	15	110	—	20	125	—	20	140	—	—
*V_{BE}	Base-Emitter Voltage	$I_B = 0.5$ ma, $I_C = 10$ ma	0.15	0.22	0.40	0.15	0.22	0.35	0.15	0.22	0.35	0.15	0.22	0.35	v
*$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_B = 0.5$ ma, $I_C = 10$ ma	—	0.07	0.20	—	—	—	—	—	—	—	—	—	v
		$I_B = 0.25$ ma, $I_C = 10$ ma	—	—	—	—	0.07	0.20	—	—	—	—	—	—	v
		$I_B = 0.17$ ma, $I_C = 10$ ma	—	—	—	—	—	—	—	0.07	0.20	—	—	—	v
		$I_B = 0.13$ ma, $I_C = 10$ ma	—	—	—	—	—	—	—	—	—	—	0.07	0.20	v
h_{ib}	Small-Signal Common-Base Input Impedance	$V_{CB} = 5$ v, $I_E = -1$ ma, $f = 1$ kc	—	28	—	—	28	—	—	28	—	—	28	—	ohm
h_{rb}	Small-Signal Common-Base Reverse Voltage Transfer Ratio	$V_{CB} = 5$ v, $I_E = -1$ ma, $f = 1$ kc	—	5×10^{-4}	—	—	5×10^{-4}	—	—	5×10^{-4}	—	—	5×10^{-4}	—	—
h_{ob}	Small-Signal Common-Base Output Admittance	$V_{CB} = 5$ v, $I_E = -1$ ma, $f = 1$ kc	—	0.34	—	—	0.34	—	—	0.34	—	—	0.34	—	μmho
h_{fe}	Small-Signal Common-Emitter Forward Current Transfer Ratio	$V_{CE} = 5$ v, $I_C = 1$ ma, $f = 1$ kc	—	105	—	—	120	—	—	135	—	—	170	—	—
*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	—	14	20	—	14	20	—	14	20	—	14	20	pf
C_{ib}	Common-Base Open-Circuit Input Capacitance	$V_{EB} = 5$ v, $I_C = 0$, $f = 1$ mc	—	13	—	—	13	—	—	13	—	—	13	—	pf

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

switching characteristics at 25°C free-air temperature

PARAMETER		TEST CONDITIONS††	2N1302			2N1304			2N1306			2N1308			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
t_d	Delay Time	$I_C = 10$ ma, $I_{B(1)} = 1.3$ ma, $I_{B(2)} = -0.7$ ma, $V_{BE(off)} = -0.8$ v, $R_L = 1\ k\Omega$ (See Fig. 1)	—	0.07	—	—	0.07	—	—	0.06	—	—	0.06	—	μsec
t_r	Rise Time		—	0.20	—	—	0.20	—	—	0.18	—	—	0.15	—	μsec
t_s	Storage Time		—	0.70	—	—	0.70	—	—	0.64	—	—	0.64	—	μsec
t_f	Fall Time		—	0.40	—	—	0.40	—	—	0.36	—	—	0.34	—	μsec
Q_{sb}	Stored Base Charge	$I_{B(1)} = 1$ ma, $I_C = 10$ ma (See Fig. 2)	—	800	—	—	760	—	—	720	—	—	680	—	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	2N1302			2N1304			2N1306			2N1308			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
NF	Spot Noise Figure	$V_{CB} = 5$ v, $I_E = -1$ ma, $f = 1$ kc, $R_G = 1\ k\Omega$	—	4	—	—	4	—	—	3	—	—	3	—	db