

GERMANIUM MILLIWATT TRANSISTORS

This line of low-frequency, low-power transistors consists of a wide selection of highly reliable germanium PNP devices designed for general purpose switching, amplifier, and control applications.

The line is generally characterized by devices having a power rating to 225 mW, a maximum operating temperature range from -65°C to $+100^{\circ}\text{C}$, and a typical cutoff frequency ($f_{\alpha b}$) to 8 MHz.

QUICK SELECTION GUIDE — FOR AMPLIFIER / OSCILLATOR AND SWITCHING APPLICATIONS TO 20 KILOCYCLES

The following transistors merit first consideration within the specified gain-voltage groups. All of the specified devices have collector power dissipation ratings (P_D) of 150-225 mW, and a maximum operating junction temperature of 100°C .

MINIMUM DC CURRENT GAIN (h_{FE})	TRANSISTOR VOLTAGE RATING; V_{CER} (R = 10 k)			
	12-24	25-39	40-49	50-60
20	—	2N524	MA910 ③	2N2042
30	2N322	2N525 2N1191 ①	2N1924 2N1186	—
40	2N323 2N1008 ① ②	2N526 2N1192 ①	2N1008A ① ② 2N1925	2N1008B ① ② 2N2043
60	2N324 2N1705	2N527 2N1175	2N1926	—
90	2N467 2N508 MA1706	2N1193 ① 2N2171 2N3427	2N1188	—
130	MA1707	2N3428	—	—
180	MA1708	2N1194 ① MA1702	—	—

① Small Signal Current Gain h_{fe} ② V_{CEO} ③ V_{CES}

NUMERICAL-ALPHABETICAL LISTING (continued)

Type	MAXIMUM RATINGS					ELECTRICAL CHARACTERISTICS					MILITARY and Hi-Rel Type
	Pd mW	T _J °C	V _{CB0} volts	V _{CEr} (R = 10k) volts	I _c mA	h _{FE} @ V _{CE} & I _c				f _{αb} typ MHz	
						min	max	volts	mA		
2N1193	200	100	40	25	200	100	250	6	1	2.5	
2N1194	200	100	40	25	200	190	500	6	1	3.0	
2N1408	150	100	50	50 ④	200	10	—	1	1 ③	—	
2N1413	225	100	35	25	500	23	65	1	20	0.8 ⑤	
2N1415	225	100	—	25	500	53	—	1	20	1.3 ⑤	
2N1705	200	100	18	12	400	70 h _{FE}	150	6	1	4 5	
2N1706	200	100	25	18	400	50 h _{FE}	150	5	10	3 5	
2N1707	200	100	30	25	400	30 h _{FE}	150	5	10	3 5	
2N1924	225	100	—	40	500	34	65	1	20	1.0 ⑤	
2N1925	225	100	—	40	500	53	90	1	20	1.3 ⑤	
2N1926	225	100	—	40	500	72	121	1	20	1.5 ⑤	
2N2042	200	100	105	55	200	20	50	0.35	5	0.5 ⑤	2N2042A ①
2N2043	200	100	105	55	200	40	100	0.35	5	0.75 ⑤	2N2043A ①
2N2171	225	100	50	25	400	110	250	1.0	20	7.5	
2N3427	200	100	45	30	500	100	350	1	100	6.0	
2N3428	200	100	45	30	500	150	400	1	100	8.0	
MA112	175	85	15	—	200	30 h _{FE}	70	6	1	—	
MA113	175	85	15	—	200	50 h _{FE}	125	6	1	—	
MA114	175	85	15	—	200	100 h _{FE}	250	6	1	—	
MA115	175	85	15	—	200	30 h _{FE}	125	6	1	—	
MA116	175	85	15	—	200	50 h _{FE}	250	6	1	—	
MA117	175	85	15	—	200	30 h _{FE}	250	6	1	—	
MA286	175	85	10	—	200	14 h _{FE}	40	6	1	—	
MA287	175	85	10	—	200	30 h _{FE}	250	6	1	—	
MA288	175	85	10	—	200	180 h _{FE}	—	6	1	—	
MA881	200	100	60	60 ④	500	30	—	1	10	0.75 ⑤	
MA882	200	100	60	60 ④	500	40	—	1	10	1.0 ⑤	
MA883	200	100	60	60 ④	500	75	—	1	10	1.25 ⑤	
MA884	200	100	60	60 ④	500	125	—	1	10	1.75 ⑤	
MA885	200	100	50	50 ④	500	15 h _{FE}	40	6	1	0.75 ⑤	
MA886	200	100	50	50 ④	500	30 h _{FE}	70	6	1	0.75 ⑤	
MA887	200	100	50	50 ④	500	50 h _{FE}	120	6	1	1.25 ⑤	
MA888	200	100	50	50 ④	500	100 h _{FE}	225	6	1	0.5 ⑤	
MA889	200	100	50	50 ④	500	190 h _{FE}	400	6	1	—	
MA909	150	100	75	35 ④	200	20	—	0.35	5	—	
MA910	150	100	90	45 ④	200	20	—	0.35	5	—	
MA1702	200	100	45	30	500	200	—	1	100	7.0 min	
MA1703	200	100	25	25	500	100	350	1	100	3.0 min	
MA1704	200	100	25	25	500	150	400	1	100	5.0 min	
MA1705	200	100	25	25	500	200	—	1	100	6.0 min	
MA1706	200	100	15	15	500	100	350	1	100	3.0 min	
MA1707	200	100	15	15	500	150	400	1	100	4.0 min	
MA1708	200	100	15	15	500	200	—	1	100	5.0 min	

① Hi-Rel ② I_E ③ I_B ④ V_{CEs} ⑤ Minimum ⑥ V_{CE0} ⑦ R_{BE} = 1 K

2N1924 thru 2N1926

$V_{CB} = 60 \text{ V}$
 $h_{FE} - \text{to } 72 \text{ (min)}$
 $f_{\alpha_b} - \text{to } 1.5 \text{ MHz (min)}$



CASE 31
(TO-5)

Base connected to case

PNP germanium transistors for general purpose, low-frequency applications. Characteristics curves similar to 2N524-2N527 series.

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Base Voltage	V_{CB}	60	Vdc
Collector-Emitter Voltage	V_{CEO}	40	Vdc
Emitter-Base Voltage	V_{EB}	25	Vdc
Collector Current	I_C	500	mAdc
Junction and Storage Temperature	T_J & T_{stg}	-65 to +100	°C
Power Dissipation at 25°C Free Air	P_D	225	mW

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

Characteristics	Symbol	Min	Max	Unit
Collector Cutoff Current $V_{CB} = -45 \text{ Vdc}, I_E = 0$	I_{CBO}	—	10	μAdc
Emitter Cutoff Current $V_{EB} = -25 \text{ Vdc}, I_C = 0$	I_{EBO}	—	10	μAdc
Collector-Base Voltage $I_C = 200 \mu\text{Adc}, I_E = 0$	V_{CBO}	60	—	Vdc
Collector-Emitter Voltage $I_C = 50 \mu\text{Adc}, V_{BE} = +1.5 \text{ Vdc}, R_{BE} = 10 \text{ K}$	V_{CEX}	50	—	Vdc
Collector-Emitter Voltage $I_C = 0.6 \text{ mAdc}, R_{BE} = 10 \text{ K}$	V_{CER}	40	—	Vdc
Punch-Thru Voltage ($V_{EB} = 1 \text{ Vdc}, VTVM Z \geq 1 \text{ Megohm}$)	V_{pt}	50	—	Vdc

2N1924 thru 2N1926 (continued)

ELECTRICAL CHARACTERISTICS (continued)

Characteristics	Symbol	Min	Max	Unit
DC Current Gain $I_C = 20 \text{ mAdc}, V_{CE} = -1 \text{ Vdc}$ 2N1924 2N1925 2N1926	h_{FE}	34 53 72	65 90 121	—
DC Current Gain $I_C = 100 \text{ mAdc}, V_{CE} = -1 \text{ Vdc}$ 2N1924 2N1925 2N1926	h_{FE}	30 47 65	— — —	—
Collector-Emitter Saturation Voltage $I_B = 1.33 \text{ mAdc}, I_C = 20 \text{ mAdc}$ 2N1924 $I_B = 1.0 \text{ mAdc}, I_C = 20 \text{ mAdc}$ 2N1925 $I_B = 0.67 \text{ mAdc}, I_C = 20 \text{ mAdc}$ 2N1926	$V_{CE(SAT)}$	50 55 60	110 110 110	mVdc
Base Input Voltage $V_{CE} = -1 \text{ Vdc}, I_C = 20 \text{ mAdc}$ 2N1924 2N1925 2N1926	V_{BE}	200 190 180	300 290 280	mVdc
Output Capacitance; Input AC Open Circuit $V_{CB} = -5 \text{ Vdc}, I_E = 1 \text{ mAdc}, f = 1 \text{ MHz}$	C_{ob}	—	30	pF
Frequency Cutoff $V_{CB} = -5 \text{ Vdc}, I_E = 1 \text{ mAdc}$ 2N1924 2N1925 2N1926	f_{ob}	1.0 1.3 1.5	— — —	MHz
Small-Signal Short-Circuit Forward-Transfer Current Ratio $V_{CE} = -5 \text{ Vdc}, I_E = 1 \text{ mAdc}, f = 1 \text{ kHz}$ 2N1924 2N1925 2N1926	h_{fe}	30 44 60	64 88 120	—
Small-Signal Open Circuit Output Admittance $V_{CE} = -5 \text{ Vdc}, I_E = 1 \text{ mAdc}, f = 1 \text{ kHz}$ 2N1924 2N1925 2N1926	h_{oe}	15 20 25	60 65 70	μmho
Small-Signal Open-Circuit Reverse-Transfer Voltage Ratio $V_{CE} = -5 \text{ Vdc}, I_E = 1 \text{ mAdc}, f = 1 \text{ kHz}$ 2N1924 2N1925 2N1926	h_{re}	2 3 4	8 9 10	$\times 10^{-4}$
Small-Signal Short-Circuit Input Impedance $V_{CE} = -5 \text{ Vdc}, I_E = 1 \text{ mAdc}, f = 1 \text{ kHz}$ 2N1924 2N1925 2N1926	h_{ie}	700 1200 1500	2200 3200 4200	ohms