

TYPE	MATERIAL	POLARITY	REPLACE- MENT	PAGE NUMBER	USE	MAXIMUM RATINGS					ELECTRICAL CHARACTERISTICS											
						P _D @ 25°C	Ref Point	T _J °C	V _{CB} (volts)	V _{CE—} (volts)	Subscript	h _{FE} @ I _C		V _{CE(SAT)} @ I _C		h _{FE}	Subscript	f _m Units	Subscript			
												(min)	(max)	Units	(volts)					Units		
2N1136B	G	P	2N1543	7-64	LPA			100	100	75	R	50	100	3.0A	1.0	3.0A					4.0K	F
2N1137	G	P	2N1544	7-64	LPA			100	60	25	O	75	150	3.0A	1.0	3.0A						
2N1137A	G	P	2N1547	7-64	LPA			100	90	55	O	75	150	3.0A	1.0	3.0A						
2N1137B	G	P	2N1548	7-64	LPA			100	100	65	O	75	150	3.0A	1.0	3.0A						
2N1138	G	P	2N1545	7-64	LPA			100	60	25	O	100	200	3.0A	1.0	3.0A						
2N1138A	G	P	2N1547	7-64	LPA			100	90	55	O	100	200	3.0A	1.0	3.0A						
2N1138B	G	P	2N1548	7-64	LPA			100	100	65	O	100	200	3.0A	1.0	3.0A						
2N1139	S	N	2N835	8-54	HSS	6.6M	A	175	15	15	O	20	200	10M	0.7	10M					100M	T
2N1141	G	P		9-19	RFA	750M	C	100	35			10		10M	2.0	50M						
2N1141A	G	P			RFA	750M	C	160	35	25	S	15		10M	2.0	50M	0.94	B			500M	T
2N1142	G	P		9-19	RFA	750M	C	100	30			10		10M	2.0	50M	0.98	B			600M	T
2N1142A	G	P			RFA	750M	C	100	30	25	S	15		10*	2.0	50M	0.94	B			400M	T
2N1143	G	P		9-19	RFA	750M	C	100	25			10		10M	2.0	50M	0.98	B			480M	T
2N1143A	G	P			RFA	750M	C	100	30	25	S	15		10M	2.0	50M	0.94	B			400M	T
2N1144	G	P	2N321	6-6	APC	175M	A	85	16	16	R	34	90	20M							1.0M	B
2N1145	G	P	2N1414	6-33	APC	175M	A	85	16	16	R	25	90	20M							1.0M	B
2N1146	G	P			PMS	87W	C	95	40	20	O	60	150	5.0A	1.0	15A					0.15M	E
2N1146A	G	P			PMS	87W	C	95	60	30	O	60	150	5.0A	1.0	15A					0.15M	E
2N1146B	G	P			PMS	87W	C	95	80	40	O	60	150	5.0A	1.0	15A					0.15M	E
2N1146C	G	P			PMS	87W	C	95	100	50	O	60	150	5.0A	1.0	15A					0.15M	E
2N1147	G	P			PMS	87W	C	95	40	20	O	60	150	5.0A	1.0	15A					0.15M	E
2N1147A	G	P			PMS	87W	C	95	60	30	O	60	150	5.0A	1.0	15A					0.15M	E
2N1147B	G	P			PMS	87W	C	95	80	45	O	60	150	5.0A	1.0	15A					0.15M	E
2N1147C	G	P			PMS	87W	C	95	100	50	O	60	150	5.0A	1.0	15A					0.15M	E
2N1149	S	N			AFA	150M	A	175	45			9.0	20	25M			0.9	B			4.0M	B
2N1150	S	N			AFA	150M	A	175	45			18	40	25M			0.948	B			5.0M	B
2N1151	S	N			AFA	150M	A	175	45			18	90	25M			0.948	B			8.0M	B
2N1152	S	N			AFA	150M	A	175	45			36	90	25M			0.973	B			6.0M	B
2N1153	S	N			AFA	150M	A	175	45			76	333	25M			0.987	B			7.0M	B
2N1154	S	N			AFA	750M	C	150	50			9.0		50M			0.9	B				
2N1155	S	N			AFA	750M	C	150	80			9.0		50M			0.9	B				
2N1156	S	N			AFA	750M	C	150	120			9.0		40M			0.9	B				
2N1157	G	P	MP501	7-210	PMS	187W	J	100	60	45	O	38	84	10A	0.8	40A					75K	T
2N1157A	G	P	MP502	7-210	PMS	187W	J	100	80	50	O	38	84	10A	0.8	40A					75K	T
2N1158	G	P	2N1143	9-19	RFA	60M	A	100	20	20	S											
2N1158A	G	P	2N1142	9-19	RFA	75M	A	100	20	20	S											
2N1159	G	P	2N3616	7-118	PMS	35W	C	95	80	60	O	30	75	3.0A	1.0	3.0A						
2N1160	G	P	2N3616	7-118	PMS	35W	C	95	80	60	O	20	50	5.0A	1.0	5.0A						
2N1162	G	P		7-53	PMS	90W	C	100	50	35	S	15	65	25A	0.8	25A						
2N1162A	G	P		7-53	PMS	90W	C	100	50	35	S	15	65	25A	0.8	25A					1.0K	E
2N1163	G	P		7-53	PMS	90W	C	100	50	35	S	15	65	25A	0.8	25A					3.0K	E
2N1163A	G	P		7-53	PMS	90W	C	100	50	35	S	15	65	25A	0.8	25A					1.0K	E
2N1164	G	P		7-53	PMS	90W	C	100	80	60	S	15	65	25A	0.8	25A					3.0K	E
2N1164A	G	P		7-53	PMS	90W	C	100	80	60	S	15	65	25A	0.8	25A					3.0K	E
2N1165	G	P		7-53	PMS	90W	C	100	80	60	S	15	65	25A	0.8	25A					1.0K	E
2N1165A	G	P		7-53	PMS	90W	C	100	80	60	S	15	65	25A	0.8	25A					1.0K	E
2N1166	G	P		7-53	PMS	90W	C	100	100	75	S	15	65	25A	0.8	25A					3.0K	E
2N1166A	G	P		7-53	PMS	90W	C	100	100	75	S	15	65	25A	0.8	25A					3.0K	E
2N1167	G	P		7-53	PMS	90W	C	100	100	75	S	15	65	25A	0.8	25A					1.0K	E
2N1167A	G	P		7-53	PMS	90W	C	100	100	75	S	15	65	25A	0.8	25A					3.0K	E
2N1168	G	P	2N3614	7-118	LPA	45W	C	95	50	30	O											
2N1169	G	P			BMS	120M	A	71	40	20	O	20		200M	0.3	200M					4.5M	B
2N1170	G	N			BMS	120M	A	71	40	20	O	20		200M	0.3	200M					4.5M	B
2N1171	G	P			MMS	170M	A	85	30	12	O	30		30M							10M	B
2N1172	G	P	2N2137	7-78	PMS	95	40	30	100	100M		30	90	100M								
2N1173	G	N			MSS	0.25W	A	100	35	20	O	50	200	10M	0.075	10M						
2N1174	G	P			MSS	0.25W	A	100	35	20	O	50	200	10M	0.075	10M						
2N1175	G	P		6-33	AFA	200M	A	85	35	25	R	70	140	20M							1.5M	B
2N1176	G	P	2N1189	6-28	AFA	0.3W	C	85	10	10	R				0.3	0.1A						
2N1177	G	P	2N2957	8-173	RFA	80M	A	71	30													
2N1178	G	P	2N2955	8-173	RFA	80M	A	71	30													
2N1179	G	P	2N2956	8-173	RFA	80M	A	71	30													
2N1180	G	P	2N2956	8-173	RFA	80M	A	71	30													
2N1182	G	P	2N2140	7-78	PMS	106W	C	100	50	60	O	30	85	0.5A	0.9	2.0A					5.0K	E
2N1183	G	P	2N2140	7-78	PMS	7.5W	C	100	45	20	O	20	60	400M	0.5	400M					500K	B
2N1183A	G	P	2N2140	7-78	PMS	7.5W	C	100	60	30	O	20	60	400M	0.5	400M					500K	B
2N1183B	G	P	2N2141	7-78	PMS	7.5W	C	100	80	40	O	20	60	400M	0.5	400M					500K	B
2N1184	G	P	2N2144	7-78	PMS	7.5W	C	100	45	20	O	40	120	400M	0.5	400M					500K	B

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	—	—

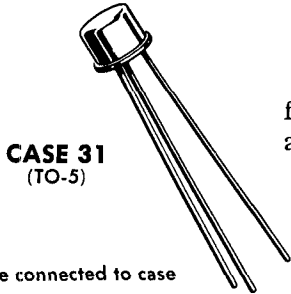
① Small Signal Current Gain h_{fe} ② V_{CEO} ③ V_{CES}

COMPLETE NUMERICAL-ALPHABETICAL LISTING

Type	MAXIMUM RATINGS					ELECTRICAL CHARACTERISTICS					MILITARY and Hi-Rel Type
	P _D mW	T _J °C	V _{CSO} volts	V _{CEB} (R = 10 k) volts	I _C mA	h _{FE} @ V _{CE} & I _C				f _{αB} typ MHz	
						min	max	volts	mA		
2N319	225	100	—	20	500	25	42	1	20	1.0 ⑤	
2N320	225	100	—	20	500	34	65	1	20	1.5 ⑤	
2N321	225	100	—	20	500	53	121	1	20	2.0 ⑤	
2N322	225	100	—	18	500	34	65	1	20	1.0 ⑤	
2N323	225	100	—	18	500	53	121	1	20	1.5 ⑤	
2N324	225	100	—	18	500	72	198	1	20	2.0 ⑤	
2N331	200	100	30	V _{EB} = 12	200	30	70	6	1	1.5	JAN 2N331
2N381	225	100	50	25	400	35	65	1	20	3	
2N382	225	100	50	25	400	60	95	1	20	4	
2N383	225	100	50	25	400	75	120	1	20	5	
2N398	50	85	105	V _{pt} = 105	100	20	—	0.35	5	1.0	USN 2N398
2N398A	150	100	105	V _{pt} = 105	200	20	—	0.35	5	1.0	
2N460	225	100	45	35 ⑦	400	31	200	6	1 ②	4	
2N461	225	100	45	35 ⑦	400	0.94 h _b	0.972	6	1 ②	1.2	USAF 2N461
2N464	200	100	45	40	100	14	—	6	1	1.0	
2N465	200	100	45	30	100	27	—	6	1	1.5	USA 2N465
2N466	200	100	35	20	100	56	—	6	1	2.0	JAN 2N466
2N467	200	100	35	15	100	112	—	6	1	2.5	USA 2N467
2N508	225	100	—	18	500	99	198	1	20	2.5 ⑤	
2N524	225	100	—	30	500	25	42	1	20	0.8 ⑤	2N524A ①
2N525	225	100	—	30	500	34	65	1	20	1.0 ⑤	2N525A ①
2N526	225	100	—	30	500	53	90	1	20	1.3 ⑤	JAN 2N526
2N527	225	100	—	30	500	72	121	1	20	1.5 ⑤	2N526A ①
2N650	200	100	45	30	500	30	70	6	1	1.5	2N527A ①
											2N650A ①
2N651	200	100	45	30	500	50	120	6	1	2.0	USN 2N650A
											2N651A ①
2N652	200	100	45	30	500	100	225	6	1	2.5	USN 2N651A
											2N652A ①
											USN 2N652A
2N653	200	100	30	25	250	30	70	6	1	1.5	
2N654	200	100	30	25	250	50	125	6	1	2.0	
2N655	200	100	30	25	250	100	250	6	1	2.5	
2N1008	200	100	20	20 ⑥	300	40 h _{FE}	150	5	10	—	
2N1008A	200	100	40	40 ⑥	300	40 h _{FE}	150	5	10	—	
2N1008B	200	100	60	60 ⑥	300	40 h _{FE}	150	5	10	—	
2N1175	225	100	—	25	500	70	140	1	20	1.5 ⑤	
2N1185	200	100	45	30	500	190	400	6	1	3.0	
2N1186	200	100	60	45	500	30	70	6	1	1.5	
2N1187	200	100	60	45	500	50	120	6	1	2.0	
2N1188	200	100	60	45	500	100	225	6	1	2.5	
2N1189	200	100	45	30	500	60	—	1	10 ②	3.5	
2N1190	200	100	45	30	500	100	—	1	10 ②	4.5	
2N1191	200	100	40	25	200	30	70	6	1	1.5	
2N1192	200	100	40	25	200	50	125	6	1	2.0	

2N1413 thru **2N1415**
2N1175

$BV_{CB} = 35 \text{ V}$
 $h_{FE} - \text{to } 62 \text{ (min)}$
 $f_{\alpha_b} - \text{to } 1.5 \text{ MHz (min)}$



PNP germanium transistor for general purpose low-frequency amplifier and switching applications. Characteristic curves similar to 2N524-2N527 series.

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Base Voltage	V_{CB}	35	Vdc
Collector-Emitter Voltage	V_{CEO}	25	Vdc
Emitter-Base Voltage	V_{EB}	10	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

2N1413 thru 2N1415, 2N1175 (continued)

ELECTRICAL CHARACTERISTICS (T_c = 25°C unless otherwise noted)

Characteristics	Symbol	Min	Max	Unit
Collector Cutoff Current V _{CB} = 30 Vdc, I _E = 0	I _{CBO}	—	12	μAdc
Emitter Cutoff Current V _{EB} = 10 Vdc, I _C = 0	I _{EBO}	—	10	μAdc
Collector-Emitter Voltage I _C = 0.6 mAdc, R _{BE} = 10 K	BV _{CER}	25	—	Vdc
Punch-Thru Voltage	V _{pt}	25	—	Vdc
DC Current Gain I _C = 20 mAdc, V _{CE} = 1 Vdc	h _{FE}			
2N1413		25	42	—
2N1414		34	65	
2N1415		53	90	
2N1175		70	140	
DC Current Gain I _C = 100 mAdc, V _{CE} = 1 Vdc	h _{FE}			
2N1413		23	—	—
2N1414		30	—	
2N1415		47	—	
2N1175		62	—	
Base Input Voltage V _{CE} = 1 Vdc, I _C = 20 mAdc	V _{BE}			
2N1175		—	260	mVdc
Output Capacitance; Input AC Open Circuit V _{CB} = 5 Vdc, I _E = 1 mAdc, f = 1 MHz	C _{ob}	—	40	pF
Frequency Cutoff V _{CE} = 5 Vdc, I _E = 1 mAdc	f _{ab}			
2N1413		0.8	—	MHz
2N1414		1.0	—	
2N1415		1.3	—	
2N1175		1.5	—	
Small-Signal Short-Circuit Forward-Transfer Current Ratio V _{CE} = 5 Vdc, I _E = 1 mAdc, f = 1 kHz	h _{fe}			
2N1413		20	41	—
2N1414		30	64	
2N1415		44	88	
2N1175		60	120	
Small-Signal Open Circuit Output Admittance V _{CB} = 5 Vdc, I _E = 1 mAdc, f = 1 kHz	h _{ob}			
2N1413		0.10	1.3	μmh
2N1414		0.10	1.2	
2N1415		0.10	1.0	
2N1175		0.10	0.9	
Small-Signal Open-Circuit Reverse-Transfer Voltate Ratio V _{CB} = 5 Vdc, I _E = 1 mAdc, f = 1 kHz	h _{rb}			
2N1413		1.0	10	X10 ⁻⁴
2N1414		1.0	11	
2N1415		1.0	12	
2N1175		1.0	14	
Small-Signal Short-Circuit Input Impedance V _{CB} = 5 Vdc, I _E = 1 mAdc, f = 1 kHz	h _{ib}			
2N1413		26	36	ohms
2N1414		26	35	
2N1415		26	33	
2N1175		26	31	