2N414A–2N487

TYPE	MATERIAL	POLARITY	REPLACEMENT	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 (min)	(max)	Units	$V_{CE(SAT)}$ @ I_C (volts)	Units	h_{f-}	Subscript	f_-	Subscript
2N414A	G	P			RFA	150M	A	85	30	15	0									
2N414B	G	P			RFA	0.2W	A	100	30	24	V						40	E	4.0M	B
2N414C	G	P			RFA	0.2W	A	100	30	24	V						40	E	4.0M	B
2N415	G	P			RFA	150M	A	85	30	10	0									
2N415A	G	P			RRA	150M	A	85	30	10	0									
2N416	G	P			RFA	150M	A	85	30	12	0									
2N417	G	P			RFA	150M	A	85	30	10	0									
2N418	G	P	2N1537	7-60	PMS	25W	C	100	100	75	R	40		4.0A	2.0	4.0A				
2N419	G	P			LPA	35W	C	95	25	20	0	50	350	0.5A	0.8	1.5A	25	E	3.0K	E
2N420	G	P	2N1535	7-60	PMS	25W	C	100	65	40	R	40		4.0A	2.0	4.0A				
2N420A	G	P	2N1537	7-60	PMS	25W	C	100	90	65	R	40		4.0A	2.0	4.0A				
2N422	G	P	2N651	6-20	LNA	150M	A	85	35	20	0									
2N422A	G	P			LNA	175M	A	100	35	20	0						30	E	1.5M	B
2N424	S	N	2N3446	7-111	LPA	85W	C	200		80	R	12	60	1.0A						
2N424A	S	N			LPA	85W	C	200		80	R	12	60	1.0A	0.75	1.0A			1.0M	T
2N425	G	P			MSA	175M	A	85	30	20	0	20	40		0.32	100M			2.5M	B
2N426	G	P			MSA	175M	A	85	30	10	0	30	60		0.32	100M			3.0M	B
2N427	G	P			MSA	175M	A	85	30	15	0	40	80		0.32	150M			5.0M	B
2N428	G	P			MSA	175M	A	85	30	12	0	60			0.32	200M			10M	B
2N428A	G	P			MSS	0.15W	A	100	30	18	0	80			0.32	0.2A			10M	B
2N438	G	N			MSS	0.1W	A	85	30	25	0	20		50M					2.5M	B
2N438A	G	N			MSS	0.15W	A	85	30	25	0	20		50M					2.5M	B
2N439	G	N			MSS	0.1W	A	85	30	20	0	30		50M					5.0M	B
2N439A	G	N			MSS	0.15W	A	85	30	20	0	30		50M					5.0M	B
2N440	G	N			MSS	0.1W	A	85	30	15	0	40		50M					10M	B
2N440A	G	N			MSS	0.15W	A	85	30	15	0	40		50M		50M			10M	B
2N441	G	P		7-36	LPA	50W	C	95	40	40	S	20	40	5.0A						
2N442	G	P		7-36	LPA	50W	C	95	50	45	S	20	40	5.0A						
2N443	G	P		7-36	LPA	50W	C	95	60	50	S	20	40	5.0A	1.0	12A				
2N444	G	N			AFA	100M	A	85	15	15	0								0.5M	B
2N444A	G	N			AFA	150M	A	100	40	25	0	20	40	20M			15	E	0.5M	B
2N445	G	N			AFA	100M	A	85	15	12	0								0.5M	B
2N445A	G	N			AFA	150M	A	100	30	18	0	40	160	20M			35	E	2.0M	B
2N446	G	N			MSA	100M	A	85	15	10	0								5.0M	B
2N446A	G	N			MSA	150M	A	100	30	15	0	60	250	20M			60	E	5.0M	B
2N447	G	N			MSA	100M	A	85	15	6.0	0								5.0M	B
2N447A	G	N			MSA	150M	A	100	30	12	0	80	300	20M			85	E	9.0M	B
2N447B	G	N			MSA	150M	A	100	25	12	0	80	300	20M			150	E	9.0M	B
2N448	G	N			RFC	65M	A	85	15	15	0	8.0	51	1.0M						
2N449	G	N			RFC	65M	A	85	15	15	0	34		1.0M						
2N450	G	P			HSA	150M	A	85	20	12	0	30		10M	0.2	10M			5.0M	B
2N456	G	P	2N456A	7-39	LPA	50W	C	95	40	40	X				1.0	5.0A				
2N456A	G	P		7-39	LPA	150W	C		40	40	0	30	90	5.0A	0.5	5.0A			4.0K	E
2N456B	G	P	2N1553	7-67	LPA	150W	C	100	40	30	0	30	90	5.0A	0.5	5.0A			200K	T
2N457	G	P	2N457A	7-39	LPA	50W		95	60	60	X				1.0	5.0A				
2N457A	G	P		7-39	LPA	150W	C		60	60	0	30	90	5.0A	0.5	5.0A			4.0K	E
2N457B	G	P	2N1553	7-67	LPA	150W	C	100	60	40	0	30	90	5.0A	0.5	5.0A			200K	T
2N458	G	P	2N458A	7-39	LPA	50W		95	80	80	X				1.0	5.0A				
2N458A	G	P		7-39	LPA	150W	C		80	80	0	30	90	5.0A	0.5	5.0A			4.0K	E
2N458B	G	P	2N1555	7-67	LPA	150W	C	100	80	45	0	30	90	5.0A	0.5	5.0A			200K	T
2N459	G	P		7-35	PMS	50W	C	100	60			20	70	2.0A	1.0	2.0A			5.0K	E
2N459A	G	P		7-35	PMS	106W	C	110	105	60	0	40	70	2.0A	0.3	2.0A			5.0K	E
2N460	G	P		6-14	AFA	0.2W	A	100	45			16	32							
2N461	G	P		6-14	AFA	0.2W	A	100	45			32	100							
2N462	G	P			BMS	150M	A	75	40			20		200M					500K	B
2N463	G	P	2N1551	7-67	LPA	37.5W	C	100	60	60		20	60	2.0A					4.0K	E
2N464	G	P		6-15	AFA	150M	A	85	45	40	0									
2N465	G	P		6-15	AFA	150M	A	85	45	30	0									
2N466	G	P		6-15	AFA	150M	A	85	35	20	0									
2N467	G	P		6-15	AFA	150M	A	85	35	15	0									
2N469	G	P			SPP	50M	A	75	6.0			10		1.0M						
2N469A	G	P			SPP	50M	A	85	20	15	R						30	E		
2N470	S	N			RFA	0.2W	A	200	15	15	0				1.5	5.0M	10	E	8.0M	T
2N471	S	N			AFA	0.2W	A	200	30	30	0				1.5	5.0M	10	E	8.0M	T
2N471A	S	N			AFA	0.2W	A	200	30	30	0				1.0	5.0M	10	E	8.0M	T
2N472	S	N			RFA	0.2W	A	200	45	45	0				1.5	5.0M	10	E	8.0M	T
2N472A	S	N			AFA	0.2W	A	200	45	45	0				1.0	5.0M	10	E	8.0M	T
2N473	S	N			AFA	0.2W	A	200	15	15	0				1.5	5.0M	20	E	8.0M	T
2N474	S	N			AFA	0.2W	A	200	30	30	0				1.5	5.0M	20	E	8.0M	T
2N474A	S	N			AFA	0.2W	A	200	30	30	0	10			1.0	5.0M	20	E	8.0M	T
2N475	S	N			AFA	0.2W	A	200	45	45	0				1.5	5.0M	20	E	8.0M	T
2N475A	S	N			AFA	0.2W	A	200	45	45	0	10			1.0	5.0M	20	E	8.0M	T
2N476	S	N			AFA	0.2W	A	200	15	15	0				1.5	5.0M	30	E	12M	T
2N477	S	N			AFA	0.2W	A	200	30	30	0				1.5	5.0M	30	E	12M	T
2N478	S	N			RFA	0.2W	A	200	15	15	0				1.5	5.0M	40	E	20M	T
2N479	S	N			RFA	0.2W	A	200	30	30	0				1.5	5.0M	40	E	20M	T
2N479A	S	N			AFA	0.2W	A	200	30	30	0	10			1.0	5.0M	40	E	20M	T
2N480	S	N			RFA	0.2W	A	200	45	45	0				1.5	5.0M	40	E	20M	T
2N480A	S	N			AFA	0.2W	A	200	45	45	0	10			1.0	5.0M	40	E	20M	T
2N481	G	P			RFA	150M	A	85	12	12	0									
2N482	G	P			RFA	150M	A	85	12	12	0									
2N483	G	P			RFA	150M	A	85	12	12	0									
2N484	G	P			RFA	150M	A	85	12	12	0									
2N485	G	P			RFA	150M	A	85	12	12	0									
2N486	G	P			RFA	150M	A	85	12	12	0									
2N487	G	P			AFC	100M	A	85	18	18	R	20		1.0M			10	E	10M	T

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°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
						h_{FE} @ V_{CE} & I_C				$f_{\alpha b}$	
	P_D mW	T_J °C	V_{CBO} volts	V_{CER} (R = 10 k) volts	I_C mA	min	max	volts	mA	typ MHz	
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 2N526A ①
2N527	225	100	—	30	500	72	121	1	20	1.5 ⑤	2N527A ①
2N650	200	100	45	30	500	30	70	6	1	1.5	2N650A ① USN 2N650A
2N651	200	100	45	30	500	50	120	6	1	2.0	2N651A ① USN 2N651A
2N652	200	100	45	30	500	100	225	6	1	2.5	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	

2N464 thru 2N467
2N465 USA/JAN
2N466 JAN
2N467 USA/JAN

V_{CB} = 45 V
h_{fe} - to 112 (min)
$f_{\alpha b}$ - to 1.2 MHz (typ)

CASE 31
(TO-5)
All leads isolated

PNP germanium transistor for general purpose applications in the audio-frequency range.

MAXIMUM RATINGS

Rating	Symbol	2N464	2N465	2N466	2N467	Unit
Collector-Base Voltage	V_{CB}	45	45	35	35	Volts
Collector-Emitter Voltage	V_{CE}	40	30	20	15	Volts
Emitter-Base Voltage	V_{EB}	← 12 →				Volts
DC Collector Current	I_C	← 500 →				mA
Max. Junction & Storage Temperature	T_J and T_{stg}	← 100 →				°C
Collector Dissipation in Free Air	P_D	← 200 →				mW
Derate above 25°C		← 2.67 →				mW/°C
Thermal Resistance, Junction to Air	θ_{JA}	← 0.375 →				°C/mW

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

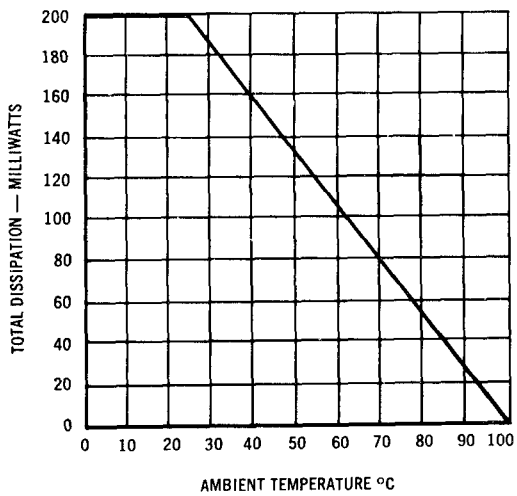
Characteristic		Symbol	Min	Typ	Max	Unit
Collector-Emitter Breakdown Voltage (I_C = 0.6 mAdc, R_{BE} = 10 K ohms)	2N464	BV_{CER}	40	–	–	Vdc
	2N465		30	–	–	
	2N466		20	–	–	
	2N467		15	–	–	
Collector-Base Cutoff Current (V_{CB} = 20 Vdc)		I_{CBO}	–	6	15	μAdc
Small Signal Current Gain Cutoff Frequency (V_{CB} = 6 Vdc, I_E = 1 mAdc)	2N464	$f_{\alpha b}$	–	0.7	–	MHz
	2N465		–	0.8	–	
	2N466		–	1.0	–	
	2N467		–	1.2	–	
Small Signal Current Gain (V_{CE} = 6 Vdc, I_E = 1.0 mAdc, f = 1 kHz)	2N464	h_{fe}	14	26	–	–
	2N465		27	45	–	
	2N466		56	90	–	
	2N467		112	180	–	

2N464 thru 2N467 (continued)

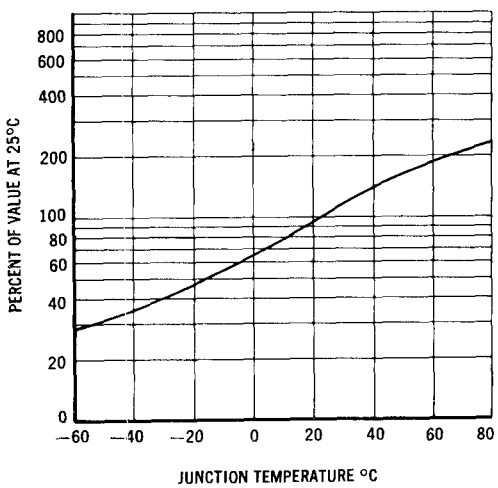
ELECTRICAL CHARACTERISTICS (continued)

Characteristic		Symbol	Min	Typ	Max	Unit
Small Signal Input Impedance (V_{CE} = 6 Vdc, I_E = 1.0 mAdc, f = 1 kHz)	2N464	h_{ie}	–	900	–	Ohms
	2N465		–	1400	–	
	2N466		–	3000	–	
	2N467		–	5500	–	
Small Signal Power Gain (V_{CE} = 6 Vdc, I_E = 1.0 mAdc, f = 1 kHz, matched)	2N464	G_e	–	40	–	dB
	2N465		–	42	–	
	2N466		–	44	–	
	2N467		–	45	–	
Noise Figure (V_{CE} = 2.5 Vdc, I_E = 0.5 mAdc, f = 1 kHz, R_S = 10 Kohms, Δf = 1 Hz		NF	–	–	22	dB

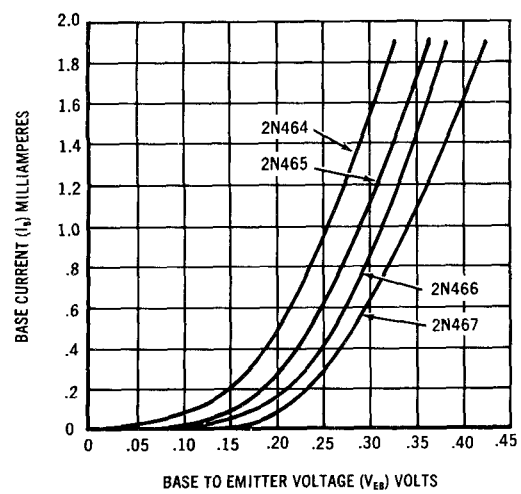
POWER-TEMPERATURE DERATING CURVE



SMALL SIGNAL CURRENT GAIN versus TEMPERATURE



Input Current versus Emitter-Drive Voltage



Small Signal Current Gain versus Collector Current

(common emitter 1 kHz)