2N108–1N184

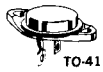
TYPE	MATERIAL	POLARITY	REPLACEMENT	PAGE NUMBER	USE	MAXIMUM RATINGS						ELECTRICAL CHARACTERISTICS								
						P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	h_{FE} @ I_C (min)	(max)	Units	$V_{CE(SAT)}$ @ I_C (volts)	Units	h_{f-}	Subscript	f_- Units	Subscript
2N108	G	P			AFA	50M	A													
2N109	G	P	2N1192	6-30	AFC	165M	A	71	35	25	O	65	115	50M	0.15	50M	50	E		
2N110	G	P			MSS	0.2W	A	85	50						2.5	18M				
2N111	G	P			RFA	150M	A	85	30	15	O	15		1.0M						
2N111A	G	P			RFA	150M	A	85	30	15	O	15		1.0M						
2N112	G	P			RFA	150M	A	85	30	15	O	15		1.0M						
2N112A	G	P			RFA	150M	A	85	30	15	O	15		1.0M						
2N113	G	P			RFA	96M	A	85	10											
2N114	G	P			RFA	96M	A	85	10											
2N115	G	P			PMS	50W	C	75	32	32	R		110	30M						
2N117	S	N			HSA	150M	C	150	30								0.9	B	1.0M	B
2N118	S	N			HSA	150M	C	150	30								0.95	B	2.0M	B
2N118A	S	N			HSA	150M	C	150	45											
2N119	S	N			HSA	150M	C	150	30								0.974	B	2.0M	B
2N120	S	N			RFA	150M	C	175	45			76	333				0.987	B		
2N122	S	N			LPA	8.75W	C	150	120			3.0		100M						
2N123	G	P			HSA	50M	J	85	20	15	O						0.98	B	5.0M	B
2N124	G	N			MSS	50M	A	75	10			12	24	5.0M	0.3	5.0M			0.3M	B
2N125	G	N			MSS	50M	A	75	10			24	48	5.0M	0.3	5.0M			5.0M	B
2N126	G	N			MSS	50M	A	75	10			48	100	5.0M	0.3	5.0M			5.0M	B
2N127	G	N			MSS	50M	A	75	10			100	200	5.0M	0.3	5.0M			5.0M	B
2N128	G	P			RFA	30M	A	85	10	4.5	U						19	E	45M	M
2N129	G	P			RFA	30M	A	85	10	4.5	U						11.5	E	30M	M
2N130	G	P	2N1191	6-30	AFA	85M	A	85	44											
2N130A	G	P	2N650	6-20	AFA	100M	A	85	45	40	O						14	E		
2N131	G	P	2N1192	6-30	AFA	85M	A	85	30											
2N131A	G	P	2N651	6-20	AFA	100M	A	85	45	30	O						27	E		
2N132	G	P	2N1192	6-30	AFA	85M	A	85	24											
2N132A	G	P	2N651	6-20	AFA	100M	A	85	35	20	O									
2N133	G	P	2N1192	6-30	AFA	85M	A	85	30											
2N133A	G	P	2N651	6-20	LNA	100M	A	85	35	20	O									
2N135	G	P			RFA	100M	A	85	20	12	R						20	E	4.5M	B
2N136	G	P			RFA	100M	A	85	20	12	R						40	E	6.5M	B
2N137	G	P			RFA	100M	A	85	10	6.0	R						60	E	10M	B
2N138	G	P			AFA	50M	A	50	24											
2N138A	G	P			AFA	150M	A	85	45	30	O	10		50M						
2N138B	G	P			AFA	100M	A	85	45											
2N139	G	P			AFC	80M	A	70	16											
2N140	G	P			AFC	80M	A	70	16											
2N141	G	P			LPA	1.5W	A	25	60	30										
2N142	G	N			LPA	1.5W	A	25	60	30										
2N143	G	P			LPA	1.0W	A	25	60	30										
2N144	G	N			LPA	1.0W	A	25	60	30										
2N145	G	N			RFA	65M	A	75		20	U									
2N146	G	N			RFA	65M	A	75		20	U									
2N147	G	N			RFA	65M	A	75		20	U									
2N148	G	N			RFA	65M	A	75		16	U									
2N148A	G	N			RFA	65M	A	75		32	U									
2N149	G	N			RFA	65M	A	75		16	U									
2N149A	G	N			RFA	65M	A	75		32	U									
2N150	G	N			RFA	65M	A	75		16	U									
2N150A	G	N			RFA	65M	A	75		32	U									
2N155	G	P	2N176	7-20	LPA	1.5W	A	85	30			24		0.5A	0.65	0.5A				
2N156	G	P	2N176	7-20	LPA	1.5W	A	85	30			24		0.5A	0.6	1.0A			145K	B
2N157	G	P	2N1531	7-60	LPA	1.5W	A	85	60			20		0.5A					100K	B
2N157A	G	P	2N1532	7-60	LPA	1.5W	A	85	90			20		0.5A					100K	B
2N158	G	P	2N2139	7-78	LPA	1.5W	A	85	60			21		0.5A	0.75	1.0A			145K	B
2N158A	G	P	2N2141	7-78	LPA	1.5W	A	95	80	60	O	21		0.5A	0.75	1.0A			4.0K	E
2N159																				
2N160	S	N			AFA	0.15W	A		40			9.0	19							
2N160A	S	N			AFA	0.15W	A		40			9.0	19							
2N161	S	N			AFA	0.15W	A		40			19	39							
2N161A	S	N			AFA	0.15W	A		40			19	39							
2N162	S	N			AFA	0.15W	A		40			19	199							
2N162A	S	N			AFA	0.15W	A		40			19	199							
2N163	S	N			AFA	0.15W	A		40			39	199							
2N163A	S	N			AFA	0.15W	A		40			39	199							
2N166	G	N			RFC	25M	A	50		6.0	O									
2N167	G	N			HSA	75M	A	85	30	30	O						0.952	B	5.0M	B
2N167A	G	N			HSA	75M	A	85	30	30	O	17	90	8.0M			0.952	B	5.0M	B
2N168	G	N			RFC	55M	A	75	15	15	O						20	E		
2N168A	G	N			RFC	65M	A	85	15	15	O						20	E		
2N169	G	N			RFC	65M	A	85	15	15	O						30	E		
2N169A	G	N			AFC	65M	A	85	25	25	O						30	E		
2N170	G	N			RFC	25M	A	50		6.0	O									
2N172	G	N			RFA	65M	A	75		16	U									
2N173	G	P		7-25	LPA	10W	C	95	60	50	S	35	70	5.0A	1.0	12A				
2N174	G	P		7-17	PMS	100W	C	95	80	70	S	25	50	5.0A	0.9	12A				
2N174A	G	P			PMS	100W	C	95	80	70	S	40	80	1.2A	0.7	12A			100K	B
2N175	G	P	2N1192	6-30	AFC	50M	A	71	10											
2N176	G	P		7-20	AFC	90W	C	80	40	30	R	25		0.5A	0.4	3.0A			4.0K	E
2N178	G	P		7-22	AFA	40W	C	90	30	30	R	15	45	0.5A	0.6	3.0A			5.0K	E
2N179	G	P	2N176	7-20	AFA															
2N180	G	P	2N1192	6-30	AFA	0.15W	A	75	30											
2N181	G	P	2N1192	6-30	AFA	0.25W	A	75	30											
2N182	G	N			MSS	0.1W	A	75	25											
2N183	G	N			MSS	0.1W	A	75	25											
2N184	G	N			MSS	0.1W	A	75	25											

GERMANIUM POWER TRANSISTOR SELECTOR GUIDE (continued)

10-AMP — HIGH-VOLTAGE LOW-SATURATION SWITCH

$P_D = 85$ W
$f_T = 0.7$ MHz
*$P_D = 56$ W
*$f_T = 1.0$ MHz


TO-3


TO-41†①

h_{FE} $I_C = 3$ A, $V_{CE} = 2$ V	V_{CEO}	80 V	120 V	160 V	V_{CES}	
	V_{CB}	80 V	120 V	160 V	200 V	320 V
20-50 20 min *		2N2526	2N2527	2N2528	MP3730*	MP3731*

15-AMP — GENERAL PURPOSE SWITCH AND AMPLIFIER

$P_D = 170$ W
$f_T = 0.3$ MHz


TO-36

h_{FE} $I_C = 5$ A, $V_{CE} = 2$ V	V_{CES}	40 V	50 V	70 V	80 V	
	V_{CB}	40 V	50 V	70 V	80 V	
20-40		2N2078	2N2077	2N2076	2N2075	
35-70		2N2082	2N2081	2N2080	2N2079	

15-AMP — GENERAL PURPOSE SWITCH AND AMPLIFIER

$P_D = 150$ W
$f_T = 0.3$ MHz


TO-36

h_{FE} $I_C = 5$ A, $V_{CE} = 2$ V	V_{CES}	40 V	45 V	50 V	70 V	80 V
	V_{CB}	40 V	50 V	60 V	80 V	100 V
20-40		2N441	2N442	2N443		
25-50					2N174	2N1100
35-70		2N277	2N278	2N173	2N1099	

15-AMP — HIGH-FREQUENCY SWITCH AND AMPLIFIER

$P_D = 106$ W


TO-3

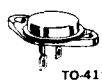

TO-41†①

h_{FE} $I_C = 10$ A, $V_{CE} = 2$ V	V_{CES}	30 V	45 V	60 V	75 V	
	V_{CB}	40 V	60 V	80 V	100 V	
10-30 $f_T = 0.55$ MHz		2N1549	2N1550	2N1551	2N1552	
30-60 $f_T = 0.4$ MHz		2N1553	2N1554	2N1555	2N1556	
50-100 $f_T = 0.4$ MHz		2N1557	2N1558	2N1559	2N1560	

20-AMP — HIGH-SPEED SWITCH

$P_D = 85$ W
$f_T = 18$ MHz

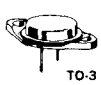

TO-3

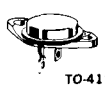

TO-41†①

h_{FE} $I_C = 10$ A, $V_{CE} = 2$ V	V_{CEO}	50 V		75 V		100 V
	V_{CB}	80 V		120 V		140 V
25-100		2N2832		2N2833		2N2834

25-AMP — HIGH DC GAIN SWITCH

$P_D = 106$ W
$f_T = 0.4$ MHz


TO-3


TO-41†②

h_{FE} $I_C = 25$ A, $V_{CE} = 1$ V	V_{CES}	35 V		60 V		75 V
	V_{CB}	50 V		80 V		100 V
15-65		2N1162		2N1164		2N1166
		2N1163†		2N1165†		2N1167†

25-AMP — HIGH DC GAIN LOW-SATURATION SWITCH

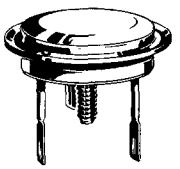
$P_D = 75$ W
$f_T = 10$ MHz


CASE 8

h_{FE} $I_C = 5$ A, $V_{CE} = 2$ V	$V_{CE(sat)}$ $I_C = 25$ A, $I_B = 2.5$ A			0.5 V		
	V_{CB}			15 V		
200-800				2N2912		

2N277 (GERMANIUM)
2N278
2N173
2N1099

V_{CB} = 40-80V
I_E = 15A
P_D = 170 W



CASE 5
(TO-36)

PNP germanium power transistors for general purpose power amplifier and switching applications. Power and temperature ratings exceed EIA registration.

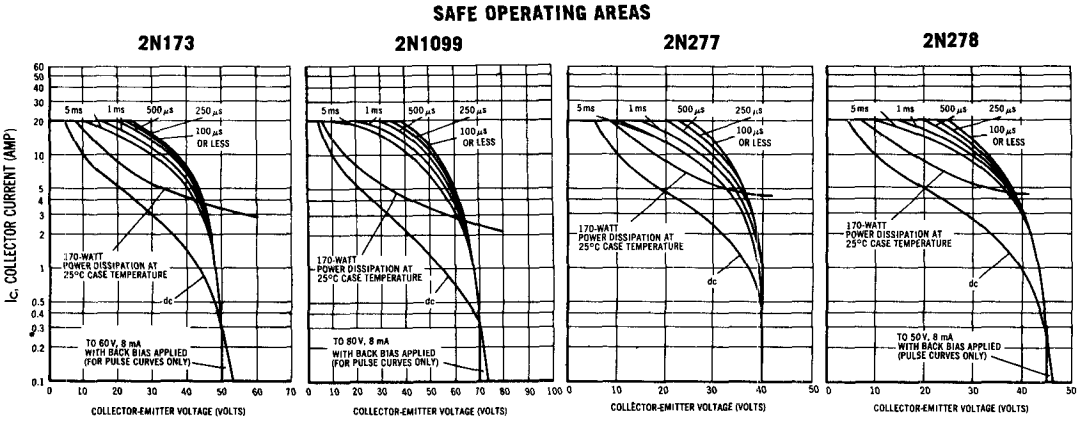
MAXIMUM RATINGS

Rating	Symbol	2N277	2N278	2N173	2N1099	Unit
Collector-Base Voltage	V_{CB}	40	50	60	80	Vdc
Emitter-Base Voltage	V_{EB}	20	30	40	40	Vdc
Emitter Current-Continuous	I_E	15				Adc
Base Current	I_B	4				Adc
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	170 2				Watts W/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to +110				°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	θ_{JC}	0.5	°C/W

SAFE OPERATING AREAS



The Safe Operating Area Curves indicate I_C — V_{CE} limits below which the device will not go into secondary breakdown. Collector load lines for specific circuits must fall within the applicable Safe Area to avoid causing a collector-emitter short. (Duty cycle of the excursions make no significant change in these safe areas.) To insure operation below the maximum T_J, the power-temperature derating curve must be observed for both steady state and pulse power conditions.

2N277, 2N278, 2N173, 2N1099 (continued)

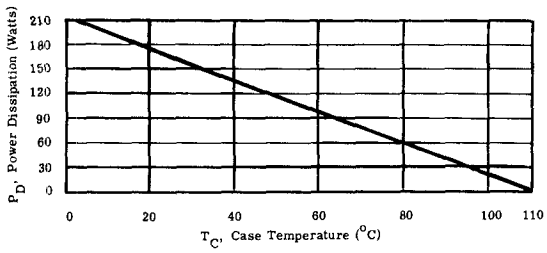
ELECTRICAL CHARACTERISTICS (At 25°C unless otherwise noted)

Characteristic		Symbol	Minimum	Typical	Maximum	Unit
Collector-Base Cutoff Current V_{CBO} = 2 V		I_{CBO}	—	100	—	μA
Collector-Base Cutoff Current		I_{CB}				mA
V_{EB} = 1.5 V, V_{CB} = 40 V	2N277		—	2	8	
50	2N278		—	2	8	
60	2N173		—	2	8	
80	2N1099		—	2	8	
Emitter-Base Cutoff Current		I_{EBO}				mA
V_{EBO} = 20 V	2N277		—	1	8	
30	2N278		—	1	8	
40	2N173		—	1	8	
40	2N1099		—	1	8	
Collector-Base Cutoff Current		I_{CBO}				mA
V_{CBO} = 40 V, 71°C	2N277		—	—	15	
50	2N278		—	—	15	
60	2N173		—	—	15	
80	2N1099		—	—	15	
Collector-Emitter Voltage		BV_{CES}*				Vdc
I_C = 300 mA, V_{EB} = 0	2N277		40	—	—	
	2N278		45	—	—	
	2N173		50	—	—	
	2N1099		70	—	—	
Collector-Emitter Voltage		BV_{CEO}*				Vdc
I_C = 1 Amp, I_B = 0	2N277		25	—	—	
	2N278		30	—	—	
	2N173		45	—	—	
	2N1099		55	—	—	
Floating Potential		V_{fl}				volt
I_E = 0, V_{CB} = 40 V	2N277		—	0.15	1.0	
50	2N278		—	0.15	1.0	
60	2N173		—	0.15	1.0	
80	2N1099		—	0.15	1.0	
Current Gain		h_{FE}				—
I_C = 5 Amp, V_{CB} = 2 V			35	—	70	
I_C = 12 Amp, V_{CB} = 2 V			—	25	—	
Base-Emitter Voltage		V_{BE}				Vdc
I_C = 5 Amp, V_{CB} = 2 V	2N277		—	0.65	—	
	2N278		—	0.65	—	
	2N173		—	0.65	—	
	2N1099		—	0.65	0.9	
Saturation Voltage		$V_{CE(SAT)}$				Vdc
I_C = 12 Amp, I_B = 2 Amp	2N277		—	0.3	—	
	2N278		—	0.3	1.0	
	2N173		—	0.3	1.0	
	2N1099		—	0.3	0.7	
Common-Emitter Current Amplification Cutoff Frequency I_C = 5 Amp, V_{CE} = 6 V		$f_{\alpha e}$	0.3	10	—	kHz
Rise Time "on" I_C = 12 Adc, I_B = 2 Adc, V_{CE} = 12 V		t_r	—	15	—	μs
Fall Time "off" I_C = 0, V_{EB} = 6 V, R_{EB} = 10 Ohms		t_f	—	15	—	μs

* To avoid excessive heating of the collector junction, perform these tests with the sweep method.

2N277, 2N278, 2N173, 2N1099 (continued)

POWER-TEMPERATURE DERATING CURVE

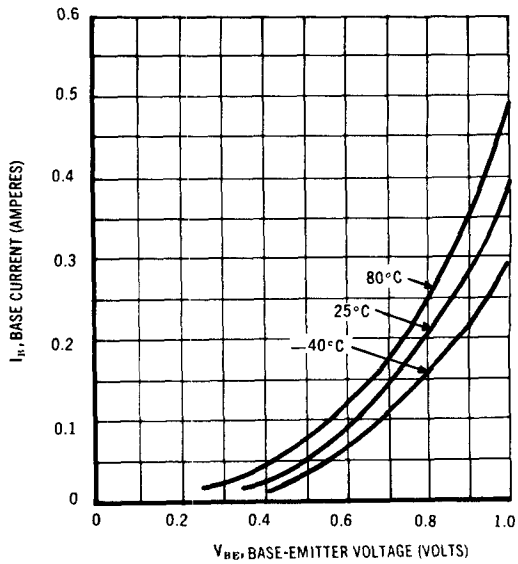


The maximum continuous power is related to maximum junction temperature by the thermal resistance factor.

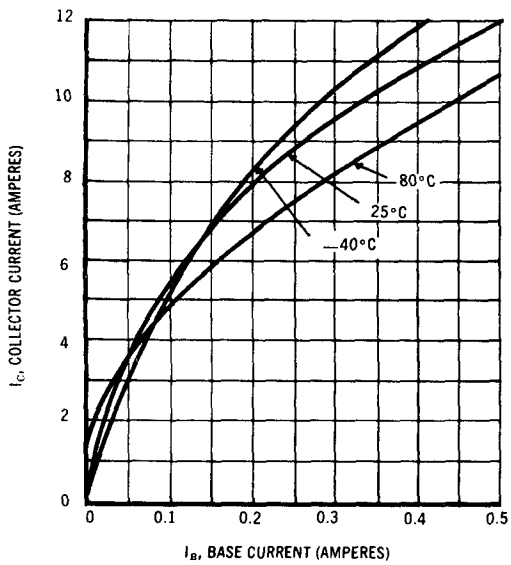
This curve has a value of 150 Watts at case temperatures of 25°C and is 0 Watts at 110°C with a linear relation between the two temperatures such that:

$$\text{allowable } P_D = \frac{110° - T_C}{0.5}$$

INPUT CHARACTERISTICS



CURRENT TRANSFER CHARACTERISTICS



TRANSCONDUCTANCE CHARACTERISTICS