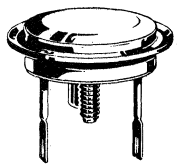
2N3311 thru 2N3316 (GERMANIUM)



PNP germanium power transistors for high-power applications.

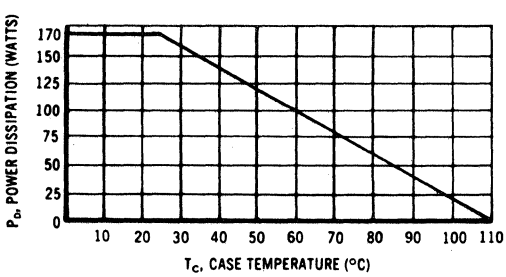
CASE 5
(TO-36)

Collector connected to case

MAXIMUM RATINGS

Rating	Symbol	2N3311 2N3314	2N3312 2N3315	2N3313 2N3316	Unit
Collector-Base Voltage	V_{CB}	30	45	60	Volts
Collector-Emitter Voltage	V_{CES}	30	45	60	Volts
Collector-Emitter Voltage	V_{CEO}	20	30	40	Volts
Emitter-Base Voltage	V_{EB}	20	25	30	Volts
Collector Current (Continuous)	I_C	5.0			Amp
Power Dissipation at $T_C = 25^oC$	P_D	170			Watts
Junction Temperature Range	T_J	-65 to +110			^oC
Thermal Resistance	θ_{JC}	0.5			°C/W

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 170 Watts at case temperatures of 25°C and is 0 Watts at 110°C with a linear relation between the two temperatures such that:

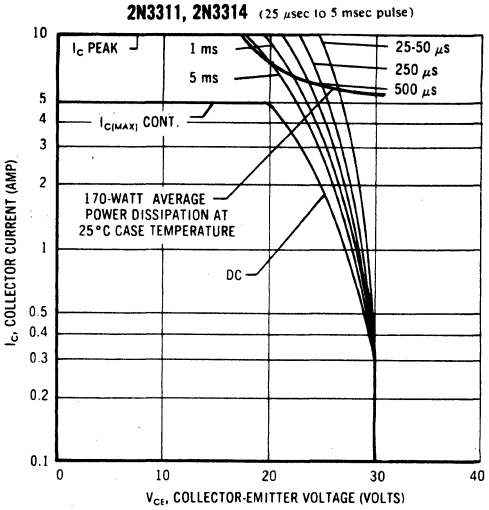
$$\text{allowable } P_D = \frac{110^o - Tc}{0.5}$$

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

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage* (I_C = 500 mAdc, I_B = 0)	2N3311, 2N3314	BV_{CEO}*	20	-	Vdc
	2N3312, 2N3315		30	-	
	2N3313, 2N3316		40	-	
Collector-Emitter Breakdown Voltage* (I_C = 300 mAdc, V_{BE} = 0)	2N3311, 2N3314	BV_{CES}*	30	-	Vdc
	2N3312, 2N3315		45	-	
	2N3313, 2N3316		60	-	
Collector Cutoff Current (V_{CE} = 10 Vdc, I_B = 0)	2N3311, 2N3314	I_{CEO}	-	200	mAdc
(V_{CE} = 15 Vdc, I_B = 0)	2N3312, 2N3315		-	200	
(V_{CE} = 20 Vdc, I_B = 0)	2N3313, 2N3316		-	200	
Collector Cutoff Current (V_{CE} = 25 Vdc, V_{BE} = 1.0 Vdc, T_C = 100°C)	2N3311, 2N3314	I_{CEX}	-	35	mAdc
(V_{CE} = 40 Vdc, V_{BE} = 1.0 Vdc, T_C = 100°C)	2N3312, 2N3315		-	35	
(V_{CE} = 55 Vdc, V_{BE} = 1.0 Vdc, T_C = 100°C)	2N3313, 2N3316		-	35	
Collector-Base Cutoff Current (V_{CB} = $V_{CB\ max}$)		I_{CBO}	-	5.0	mAdc
(V_{CB} = 2.0 Vdc, I_E = 0)			-	0.3	
Emitter-Base Cutoff Current (V_{BE} = $V_{BE\ max}$, I_C = 0)		I_{EBO}	-	4.0	mAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 500 mAdc, V_{CB} = 2.0 Vdc)	2N3311 thru 2N3313	h_{FE}	-	150	-
	2N3314 thru 2N3316		-	250	
(I_C = 3.0 Adc, V_{CB} = 2.0 Vdc)	2N3311 thru 2N3313		60	120	
	2N3314 thru 2N3316		100	200	
Collector-Emitter Saturation Voltage (I_C = 3.0 Adc, I_B = 300 mAdc)		$V_{CE(sat)}$	-	0.1	Vdc
Base-Emitter Voltage (I_C = 3.0 Adc, V_{CE} = 2.0 Vdc)	2N3311 thru 2N3313	$V_{BE(on)}$	-	0.6	Vdc
	2N3314 thru 2N3316		-	0.5	
DYNAMIC CHARACTERISTICS					
Common Emitter Cutoff Frequency (I_C = 3.0 Adc, V_{CE} = 2.0 Vdc)		$f_{\alpha e}$	1.0	-	kHz
Small Signal Current Gain (I_C = 3.0 Adc, V_{CE} = 2.0 Vdc, f = 0.5 kHz)	2N3311 thru 2N3313	h_{fe}	30	90	-
	2N3314 thru 2N3316		40	120	

*To avoid excessive heating of the collector junction, perform these tests with an oscilloscope.

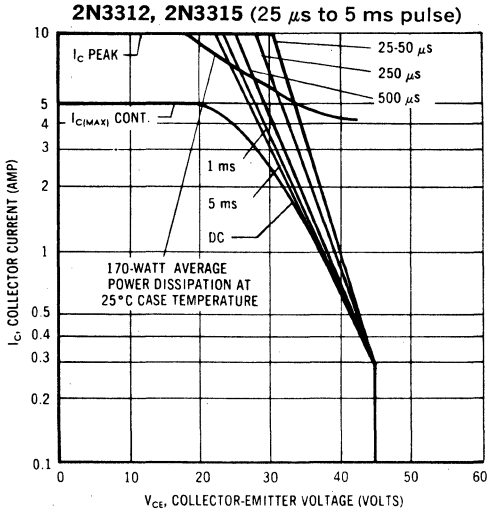
2N3311, 2N3314 (25 μsec to 5 msec pulse)



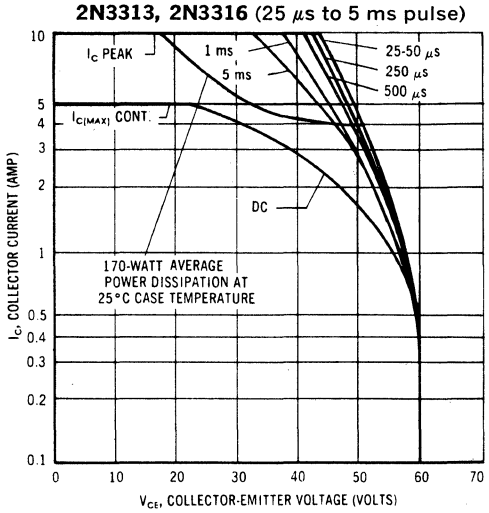
SAFE OPERATING AREA

The Safe Operating Area Curves indicate the I_C-V_{CE} limits below which the devices will not go into secondary breakdown. As the safe operating areas shown are independent of temperature and duty cycle, these curves can be used as long as the average power derating curve is also taken into consideration to insure operation below the maximum junction temperature.

2N3312, 2N3315 (25 μs to 5 ms pulse)

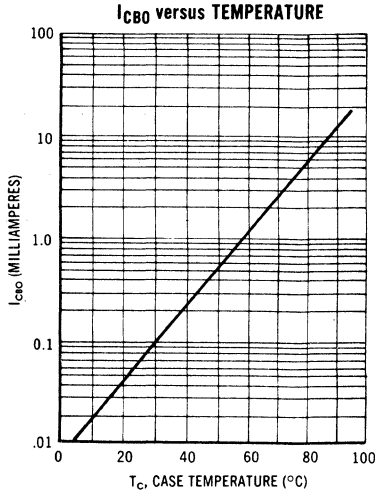


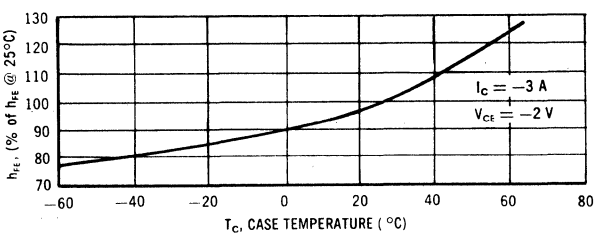
2N3313, 2N3316 (25 μs to 5 ms pulse)



TEMPERATURE CHARACTERISTICS

I_{CBO} versus TEMPERATURE





DC TRANSCONDUCTANCE versus CASE TEMPERATURE