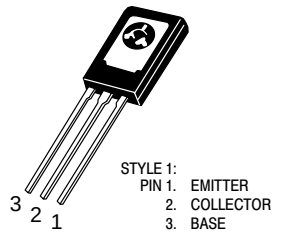
Plastic NPN Silicon High-Voltage Power Transistor

2N5655
2N5657

. . . designed for use in line–operated equipment such as audio output amplifiers; low–current, high–voltage converters; and AC line relays.

- Excellent DC Current Gain –
  h_{FE} = 30–250 @ I_C = 100 mAdc
- Current–Gain – Bandwidth Product –
  f_T = 10 MHz (Min) @ I_C = 50 mAdc

0.5 AMPERE
POWER TRANSISTORS
NPN SILICON
250–350 VOLTS
20 WATTS



CASE 77–09
TO–225AA TYPE

MAXIMUM RATINGS (1)

Rating	Symbol	2N5655	2N5657	Unit
Collector–Emitter Voltage	V_{CEO}	250	350	Vdc
Collector–Base Voltage	V_{CB}	275	375	Vdc
Emitter–Base Voltage	V_{EB}	6.0		Vdc
Collector Current – Continuous Peak	I_C	0.5 1.0		Adc
Base Current	I_B	0.25		Adc
Total Power Dissipation @ T_C = 25°C Derate above 25°C	P_D	20 0.16		Watts W/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	–65 to +150		°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	θ_{JC}	6.25	°C/W

(1) Indicates JEDEC Registered Data.

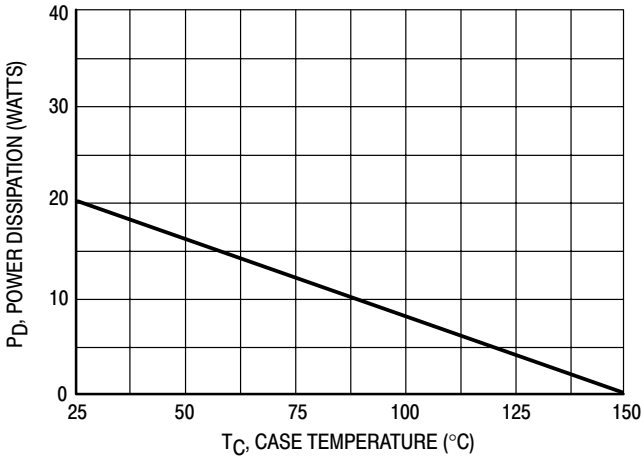


Figure 1. Power Derating

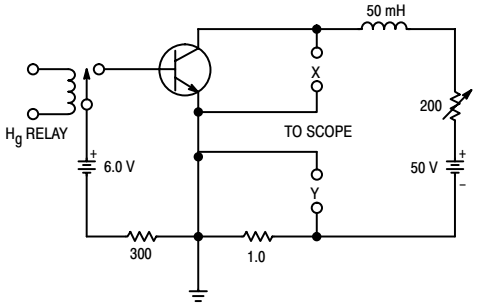


Figure 2. Sustaining Voltage Test Circuit

Safe Area Limits are indicated by Figures 3 and 4. Both limits are applicable and must be observed.

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

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector–Emitter Sustaining Voltage (I_C = 100 mAdc (inductive), L = 50 mH)	2N5655 2N5657	$V_{CEO(sus)}$	250 350	– –	Vdc
Collector–Emitter Breakdown Voltage (I_C = 1.0 mAdc, I_B = 0)	2N5655 2N5657	$V_{(BR)CEO}$	250 350	– –	Vdc
Collector Cutoff Current		I_{CEO}			mAdc
(V_{CE} = 150 Vdc, I_B = 0)	2N5655		–	0.1	
(V_{CE} = 250 Vdc, I_B = 0)	2N5657		–	0.1	
Collector Cutoff Current		I_{CEX}			mAdc
(V_{CE} = 250 Vdc, $V_{EB(off)}$ = 1.5 Vdc)	2N5655		–	0.1	
(V_{CE} = 350 Vdc, $V_{EB(off)}$ = 1.5 Vdc)	2N5657		–	0.1	
(V_{CE} = 150 Vdc, $V_{EB(off)}$ = 1.5 Vdc, T_C = 100°C)	2N5655		–	1.0	
(V_{CE} = 250 Vdc, $V_{EB(off)}$ = 1.5 Vdc, T_C = 100°C)	2N5657		–	1.0	
Collector Cutoff Current		I_{CBO}			μAdc
(V_{CB} = 275 Vdc, I_E = 0)	2N5655		–	10	
(V_{CB} = 375 Vdc, I_E = 0)	2N5657		–	10	
Emitter Cutoff Current (V_{EB} = 6.0 Vdc, I_C = 0)		I_{EBO}	–	10	μAdc
ON CHARACTERISTICS					
DC Current Gain (1)		h_{FE}			–
(I_C = 50 mAdc, V_{CE} = 10 Vdc)			25	–	
(I_C = 100 mAdc, V_{CE} = 10 Vdc)			30	250	
(I_C = 250 mAdc, V_{CE} = 10 Vdc)			15	–	
(I_C = 500 mAdc, V_{CE} = 10 Vdc)			5.0	–	
Collector–Emitter Saturation Voltage (1)		$V_{CE(sat)}$			Vdc
(I_C = 100 mAdc, I_B = 10 mAdc)			–	1.0	
(I_C = 250 mAdc, I_B = 25 mAdc)			–	2.5	
(I_C = 500 mAdc, I_B = 100 mAdc)			–	10	
Base–Emitter Voltage (1) (I_C = 100 mAdc, V_{CE} = 10 Vdc)		V_{BE}	–	1.0	Vdc
DYNAMIC CHARACTERISTICS					
Current–Gain – Bandwidth Product (2) (I_C = 50 mAdc, V_{CE} = 10 Vdc, f = 10 MHz)		f_T	10	–	MHz
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 100 kHz)		C_{ob}	–	25	pF
Small–Signal Current Gain (I_C = 100 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)		h_{fe}	20	–	–

*Indicates JEDEC Registered Data for 2N5655 Series.

(1) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

(2) f_T is defined as the frequency at which $|h_{fe}|$ extrapolates to unity.

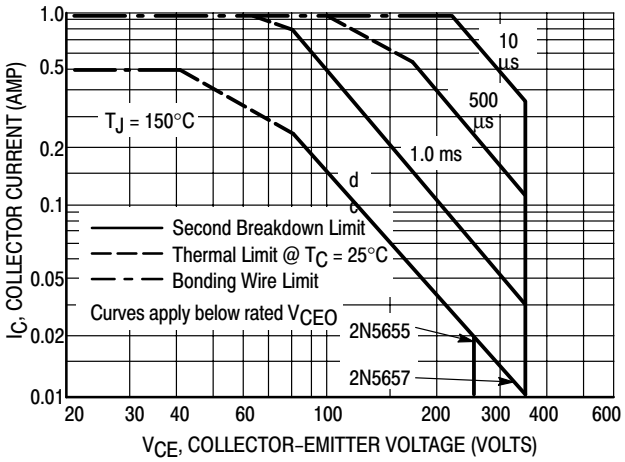


Figure 3. Active–Region Safe Operating Area

There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate $I_C - V_{CE}$ limits of the transistor that must be observed for reliable operation; i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figure 3 is based on $T_{J(pk)}$ = 150°C; T_C is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)}$ ≤ 150°C. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

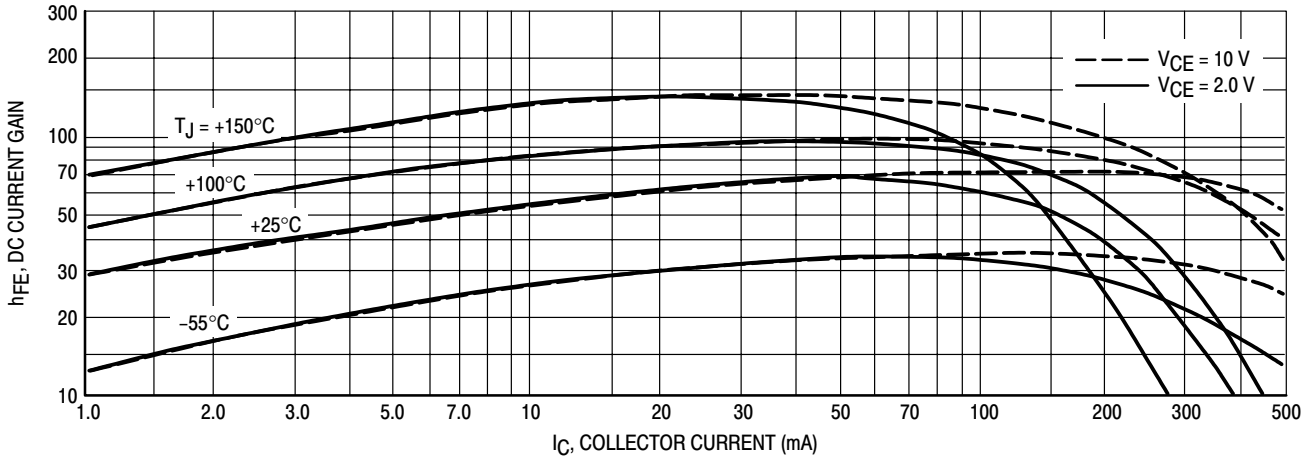


Figure 4. Current Gain

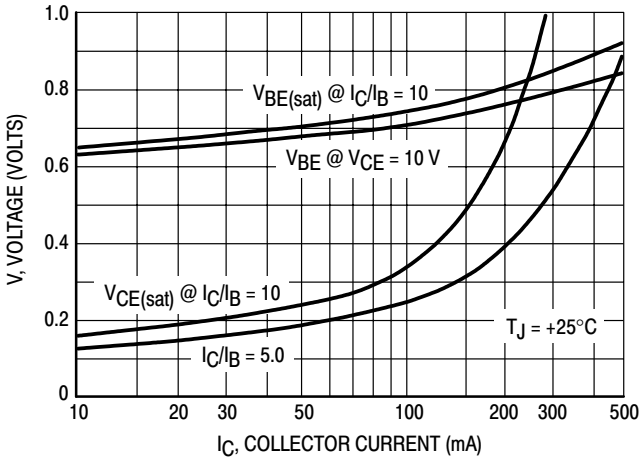


Figure 5. “On” Voltages

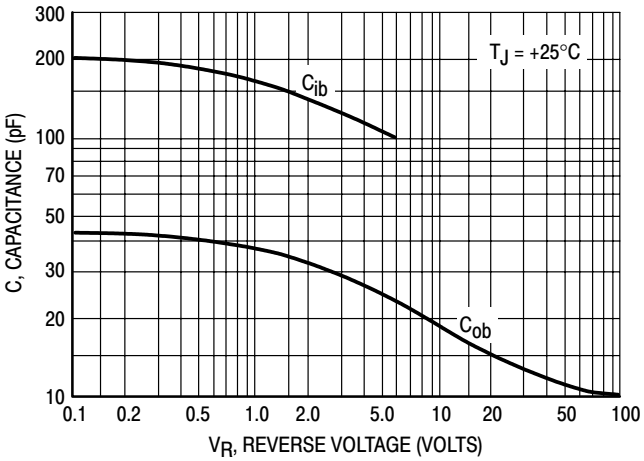


Figure 6. Capacitance

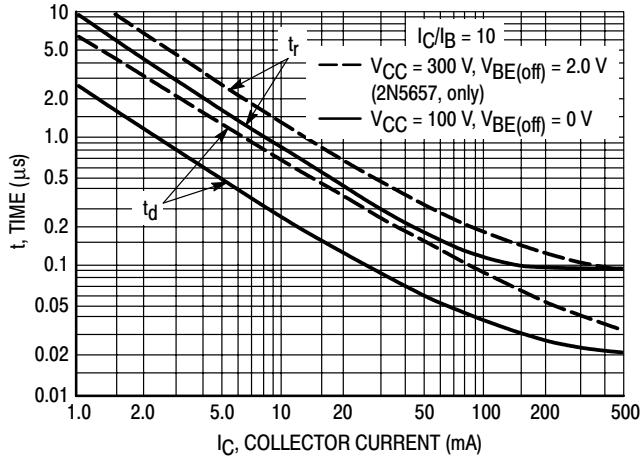


Figure 7. Turn−On Time

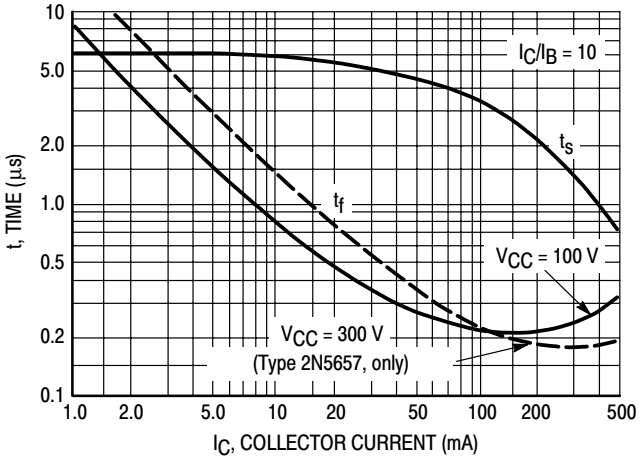
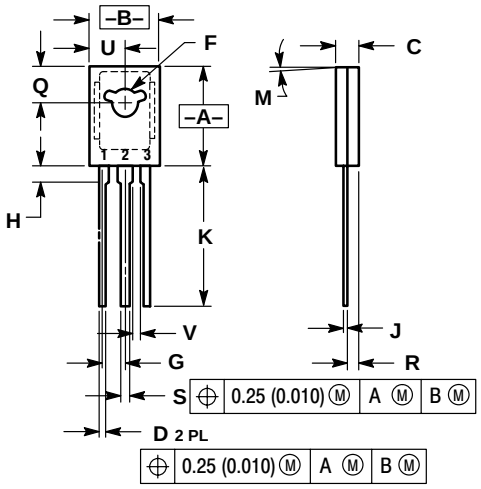


Figure 8. Turn−Off Time

PACKAGE DIMENSIONS

TO–225AA
CASE 77–09
ISSUE W



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.425	0.435	10.80	11.04
B	0.295	0.305	7.50	7.74
C	0.095	0.105	2.42	2.66
D	0.020	0.026	0.51	0.66
F	0.115	0.130	2.93	3.30
G	0.094 BSC		2.39 BSC	
H	0.050	0.095	1.27	2.41
J	0.015	0.025	0.39	0.63
K	0.575	0.655	14.61	16.63
M	5° TYP		5° TYP	
Q	0.148	0.158	3.76	4.01
R	0.045	0.065	1.15	1.65
S	0.025	0.035	0.64	0.88
U	0.145	0.155	3.69	3.93
V	0.040	---	1.02	---

STYLE 1:
PIN 1. EMITTER
2. COLLECTOR
3. BASE

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