

# Plastic NPN Silicon High-Voltage Power Transistor

... 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

## MAXIMUM RATINGS (1)

Rating	Symbol	2N5655	2N5656	2N5657	Unit
Collector-Emitter Voltage	$V_{CEO}$	250	300	350	Vdc
Collector-Base Voltage	$V_{CB}$	275	325	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 @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	20 0.16			Watts W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-65 to +150			$^\circ\text{C}$

## THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$\theta_{JC}$	6.25	$^\circ\text{C/W}$

(1) Indicates JEDEC Registered Data.

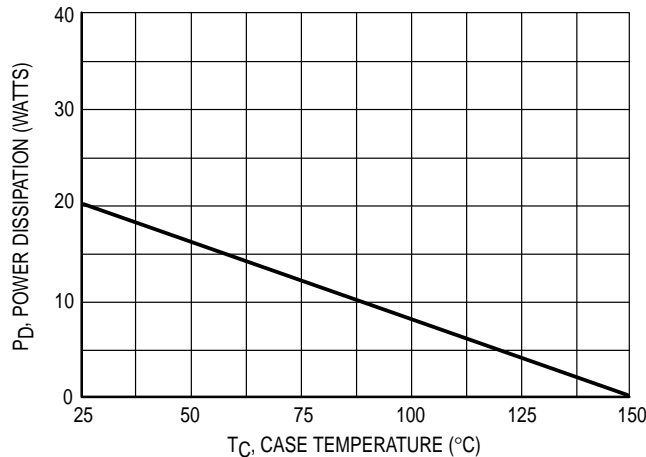


Figure 1. Power Derating

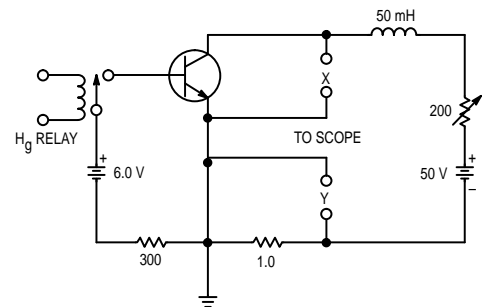
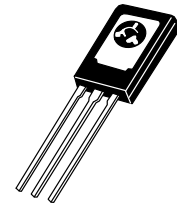


Figure 2. Sustaining Voltage Test Circuit

**2N5655**  
**2N5656**  
**2N5657**

**0.5 AMPERE**  
**POWER TRANSISTORS**  
**NPN SILICON**  
**250-300-350 VOLTS**  
**20 WATTS**



**CASE 77-08**  
**TO-225AA TYPE**

## 2N5655 2N5656 2N5657

\*ELECTRICAL CHARACTERISTICS ( $T_C = 25^\circ\text{C}$  unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit	
<b>OFF CHARACTERISTICS</b>					
Collector–Emitter Sustaining Voltage ( $I_C = 100\text{ mAdc}$ (inductive), $L = 50\text{ mH}$ )	2N5655 2N5656 2N5657	$V_{CE(sus)}$	250 300 350	— — —	Vdc
Collector–Emitter Breakdown Voltage ( $I_C = 1.0\text{ mAdc}$ , $I_B = 0$ )	2N5655 2N5656 2N5657	$V_{(BR)CEO}$	250 300 350	— — —	Vdc
Collector Cutoff Current ( $V_{CE} = 150\text{ Vdc}$ , $I_B = 0$ ) ( $V_{CE} = 200\text{ Vdc}$ , $I_B = 0$ ) ( $V_{CE} = 250\text{ Vdc}$ , $I_B = 0$ )	2N5655 2N5656 2N5657	$I_{CEO}$	— — —	0.1 0.1 0.1	mAdc
Collector Cutoff Current ( $V_{CE} = 250\text{ Vdc}$ , $V_{EB(off)} = 1.5\text{ Vdc}$ ) ( $V_{CE} = 300\text{ Vdc}$ , $V_{EB(off)} = 1.5\text{ Vdc}$ ) ( $V_{CE} = 350\text{ Vdc}$ , $V_{EB(off)} = 1.5\text{ Vdc}$ ) ( $V_{CE} = 150\text{ Vdc}$ , $V_{EB(off)} = 1.5\text{ Vdc}$ , $T_C = 100^\circ\text{C}$ ) ( $V_{CE} = 200\text{ Vdc}$ , $V_{EB(off)} = 1.5\text{ Vdc}$ , $T_C = 100^\circ\text{C}$ ) ( $V_{CE} = 250\text{ Vdc}$ , $V_{EB(off)} = 1.5\text{ Vdc}$ , $T_C = 100^\circ\text{C}$ )	2N5655 2N5656 2N5657 2N5655 2N5656 2N5657	$I_{CEX}$	— — — — — —	0.1 0.1 0.1 1.0 1.0 1.0	mAdc
Collector Cutoff Current ( $V_{CB} = 275\text{ Vdc}$ , $I_E = 0$ ) ( $V_{CB} = 325\text{ Vdc}$ , $I_E = 0$ ) ( $V_{CB} = 375\text{ Vdc}$ , $I_E = 0$ )	2N5655 2N5656 2N5657	$I_{CBO}$	— — —	10 10 10	$\mu\text{Adc}$
Emitter Cutoff Current ( $V_{EB} = 6.0\text{ Vdc}$ , $I_C = 0$ )		$I_{EBO}$	—	10	$\mu\text{Adc}$

### ON CHARACTERISTICS

DC Current Gain (1) ( $I_C = 50\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ ) ( $I_C = 100\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ ) ( $I_C = 250\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ ) ( $I_C = 500\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ )	$h_{FE}$	25 30 15 5.0	— 250 — —	—
Collector–Emitter Saturation Voltage (1) ( $I_C = 100\text{ mAdc}$ , $I_B = 10\text{ mAdc}$ ) ( $I_C = 250\text{ mAdc}$ , $I_B = 25\text{ mAdc}$ ) ( $I_C = 500\text{ mAdc}$ , $I_B = 100\text{ mAdc}$ )	$V_{CE(sat)}$	— — —	1.0 2.5 10	Vdc
Base–Emitter Voltage (1) ( $I_C = 100\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ )	$V_{BE}$	—	1.0	Vdc

### DYNAMIC CHARACTERISTICS

Current–Gain — Bandwidth Product (2) ( $I_C = 50\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 10\text{ MHz}$ )	$f_T$	10	—	MHz
Output Capacitance ( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f = 100\text{ kHz}$ )	$C_{ob}$	—	25	pF
Small–Signal Current Gain ( $I_C = 100\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	$h_{fe}$	20	—	—

\* Indicates JEDEC Registered Data for 2N5655 Series.

(1) Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

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

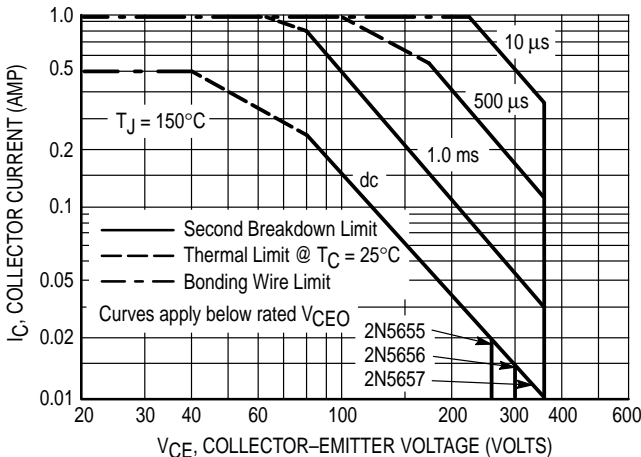


Figure 3. Active–Region Safe Operating Area

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

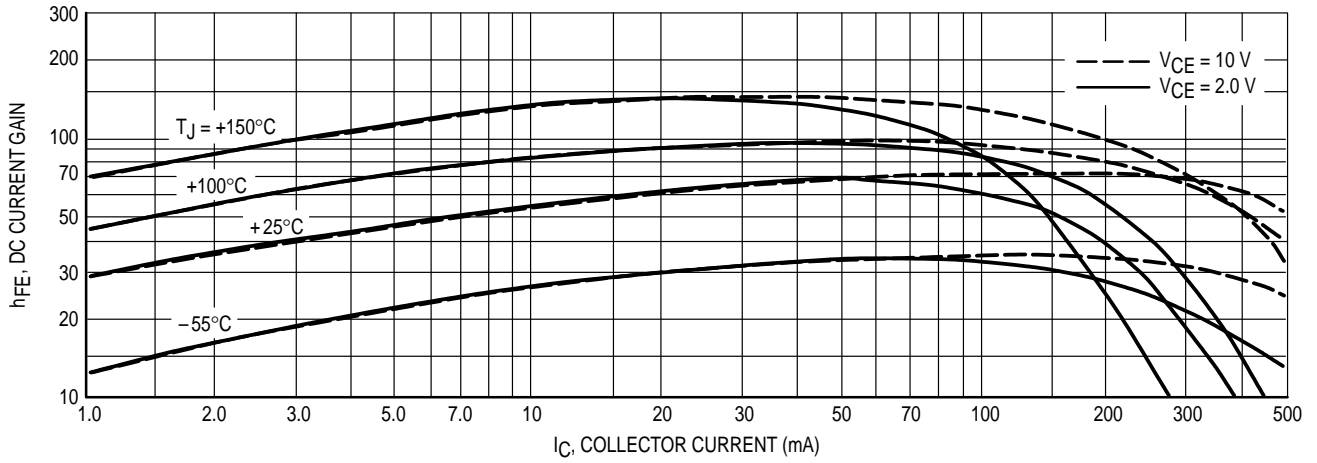


Figure 4. Current Gain

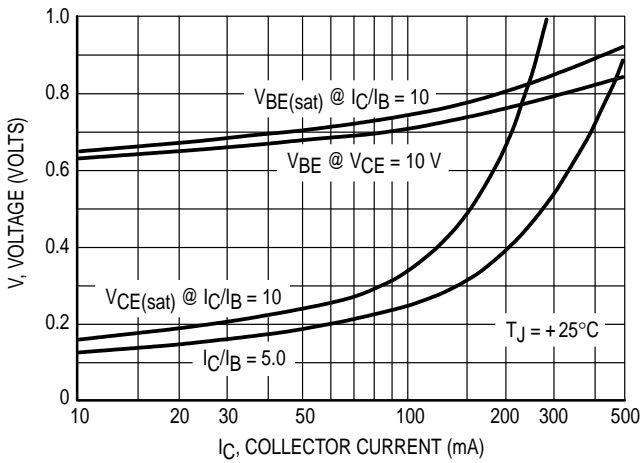


Figure 5. "On" Voltages

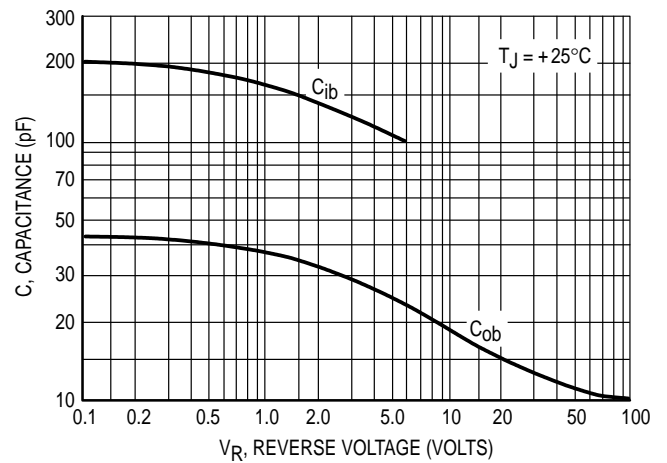


Figure 6. Capacitance

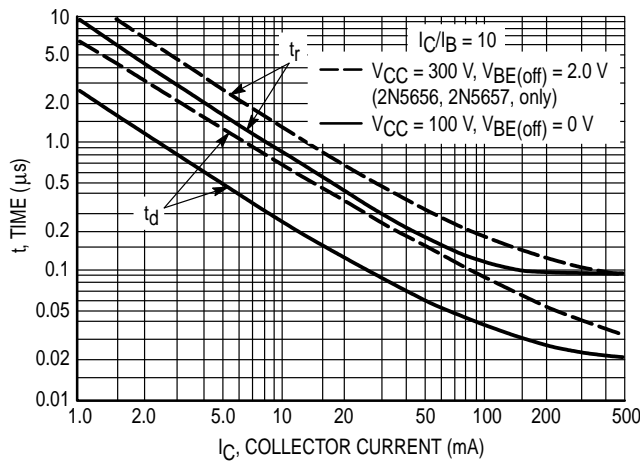


Figure 7. Turn-On Time

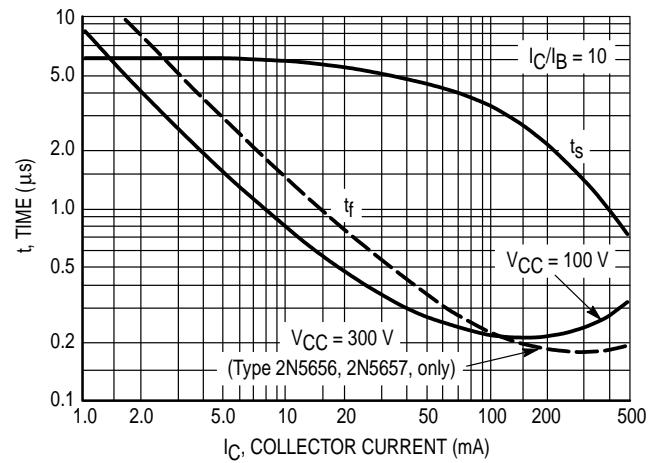
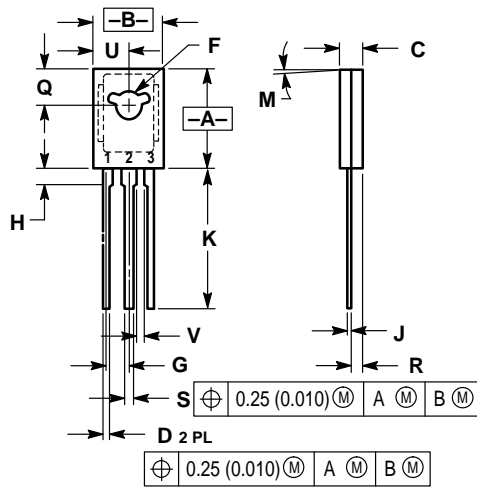


Figure 8. Turn-Off Time

PACKAGE DIMENSIONS



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

DIM	INCHES		MILLIMETERS	
	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	0.055	1.15	1.39
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

CASE 77-08  
 TO-225AA TYPE  
 ISSUE V

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