

# 2N5655G, 2N5657G

## Plastic NPN Silicon High-Voltage Power Transistors

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

### Features

- Excellent DC Current Gain
- High Current-Gain – Bandwidth Product
- These Devices are Pb-Free and are RoHS Compliant\*

### MAXIMUM RATINGS (Note 1)

Rating	Symbol	Value	Unit
Collector-Emitter Voltage 2N5655G 2N5657G	$V_{CEO}$	250 350	Vdc
Collector-Base Voltage 2N5655G 2N5657G	$V_{CB}$	275 375	Vdc
Emitter-Base Voltage	$V_{EB}$	6.0	Vdc
Collector Current – Continuous	$I_C$	0.5	Adc
Collector Current – Peak	$I_{CM}$	1.0	Adc
Base Current	$I_B$	1.0	Adc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	20 0.16	W W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-65 to +150	$^\circ\text{C/W}$

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Indicates JEDEC registered data.

### THERMAL CHARACTERISTICS

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

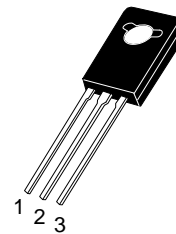
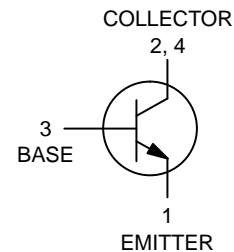
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



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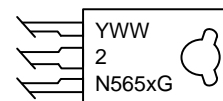
<http://onsemi.com>

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



**TO-225  
CASE 77-09  
STYLE 1**

### MARKING DIAGRAM



Y = Year  
 WW = Work Week  
 2N565x = Device Code  
 x = 5 or 7  
 G = Pb-Free Package

### ORDERING INFORMATION

Device	Package	Shipping
2N5655G	TO-225 (Pb-Free)	500 Units / Bulk
2N5657G	TO-225 (Pb-Free)	500 Units / Bulk

## 2N5655G, 2N5657G

### ELECTRICAL CHARACTERISTICS ( $T_C = 25^\circ\text{C}$ unless otherwise noted) (Note 2)

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector–Emitter Sustaining Voltage ( $I_C = 100\text{ mAdc}$ (inductive), $L = 50\text{ mH}$ ) 2N5655G 2N5657G	$V_{CE(sus)}$	250 350	– –	Vdc
Collector–Emitter Breakdown Voltage ( $I_C = 1.0\text{ mAdc}$ , $I_B = 0$ ) 2N5655G 2N5657G	$V_{(BR)CEO}$	250 350	– –	Vdc
Collector Cutoff Current ( $V_{CE} = 150\text{ Vdc}$ , $I_B = 0$ ) 2N5655G ( $V_{CE} = 250\text{ Vdc}$ , $I_B = 0$ ) 2N5657G	$I_{CEO}$	– –	0.1 0.1	mAdc
Collector Cutoff Current ( $V_{CE} = 250\text{ Vdc}$ , $V_{EB(off)} = 1.5\text{ Vdc}$ ) 2N5655G ( $V_{CE} = 350\text{ Vdc}$ , $V_{EB(off)} = 1.5\text{ Vdc}$ ) 2N5657G ( $V_{CE} = 150\text{ Vdc}$ , $V_{EB(off)} = 1.5\text{ Vdc}$ , $T_C = 100^\circ\text{C}$ ) 2N5655G ( $V_{CE} = 250\text{ Vdc}$ , $V_{EB(off)} = 1.5\text{ Vdc}$ , $T_C = 100^\circ\text{C}$ ) 2N5657G	$I_{CEX}$	– – – –	0.1 0.1 1.0 1.0	mAdc
Collector Cutoff Current ( $V_{CB} = 275\text{ Vdc}$ , $I_E = 0$ ) 2N5655G ( $V_{CB} = 375\text{ Vdc}$ , $I_E = 0$ ) 2N5657G	$I_{CBO}$	– –	10 10	$\mu\text{Adc}$
Emitter Cutoff Current ( $V_{EB} = 6.0\text{ Vdc}$ , $I_C = 0$ )	$I_{EBO}$	–	10	$\mu\text{Adc}$
<b>ON CHARACTERISTICS</b>				
DC Current Gain (Note 3) ( $I_C = 50\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ ) ( $I_C = 100\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ ) ( $I_C = 250\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ ) ( $I_C = 500\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ )	$h_{FE}$	25 30 15 5.0	– 250 – –	–
Collector–Emitter Saturation Voltage (Note 3) ( $I_C = 100\text{ mAdc}$ , $I_B = 10\text{ mAdc}$ ) ( $I_C = 250\text{ mAdc}$ , $I_B = 25\text{ mAdc}$ ) ( $I_C = 500\text{ mAdc}$ , $I_B = 100\text{ mAdc}$ )	$V_{CE(sat)}$	– – –	1.0 2.5 10	Vdc
Base–Emitter Voltage ( $I_C = 100\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ ) (Note 3)	$V_{BE}$	–	1.0	Vdc
<b>DYNAMIC CHARACTERISTICS</b>				
Current–Gain – Bandwidth Product ( $I_C = 50\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 10\text{ MHz}$ ) (Note 4)	$f_T$	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	–	–

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

2. Indicates JEDEC registered data for 2N5655 Series.
3. Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .
4.  $f_T$  is defined as the frequency at which  $|h_{fe}|$  extrapolates to unity.

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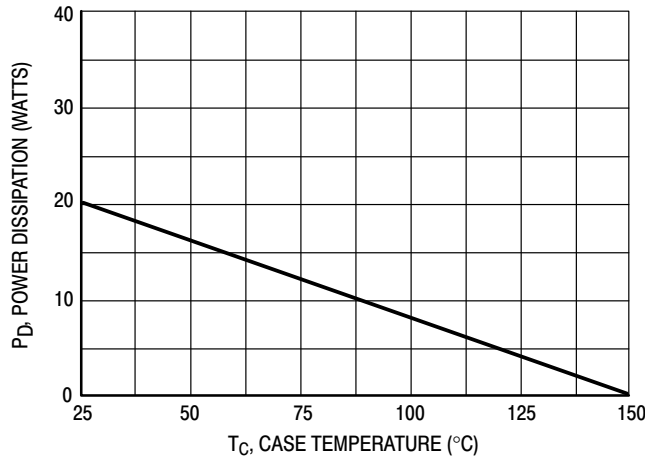


Figure 1. Power Derating

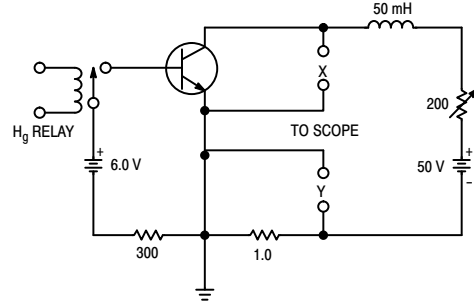


Figure 2. Sustaining Voltage Test Circuit

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

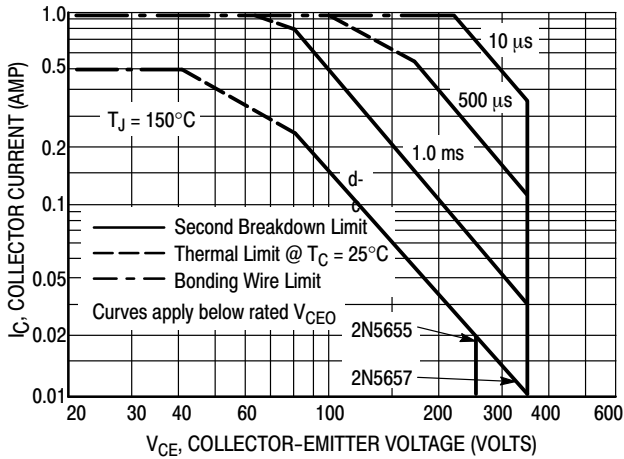


Figure 3. Active-Region Safe Operating Area

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.

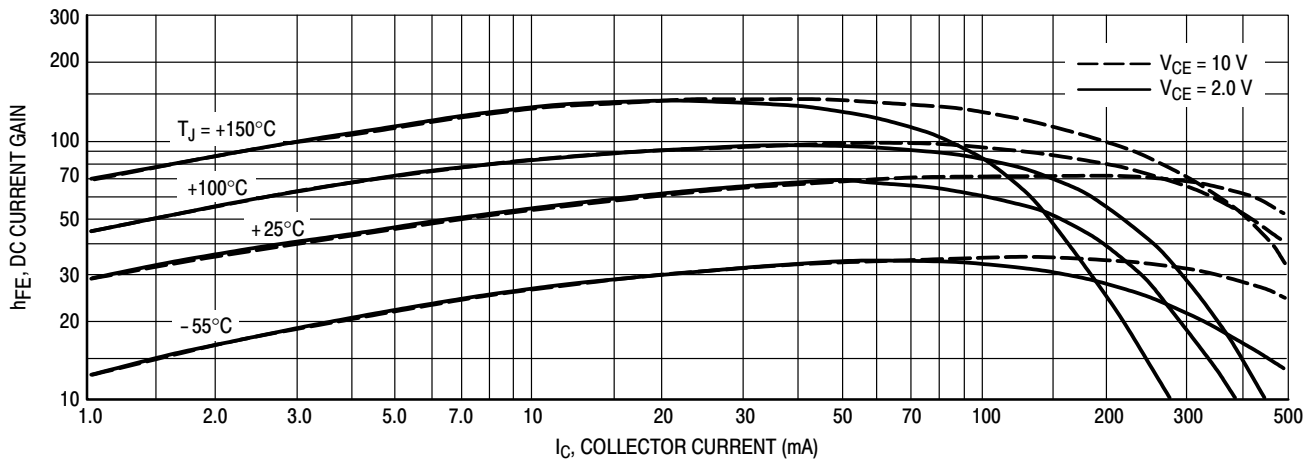


Figure 4. Current Gain

## 2N5655G, 2N5657G

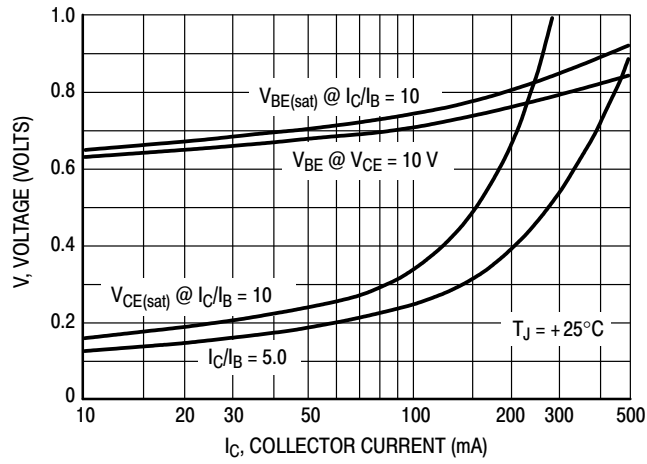


Figure 5. "On" Voltages

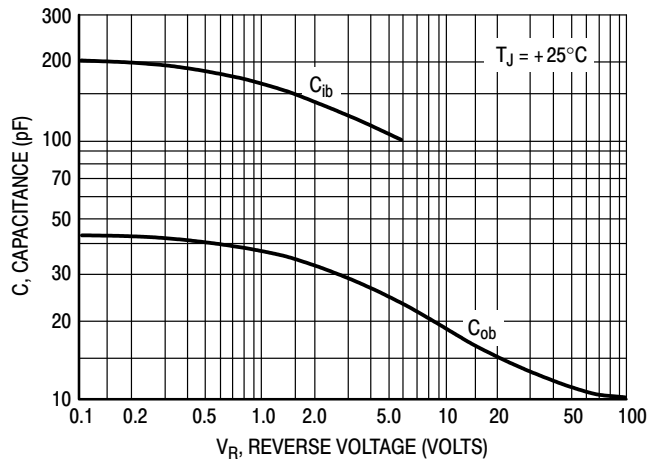


Figure 6. Capacitance

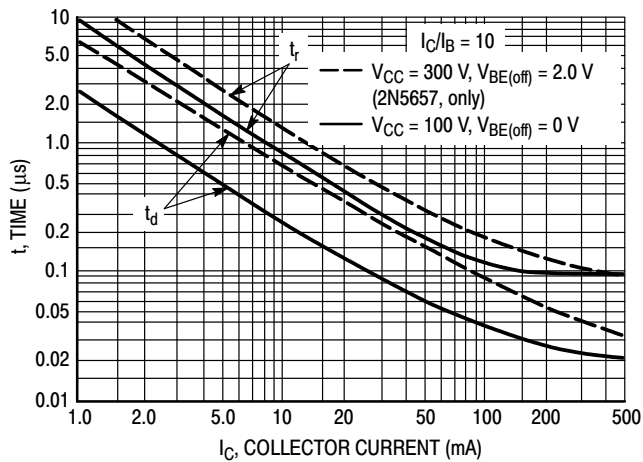


Figure 7. Turn-On Time

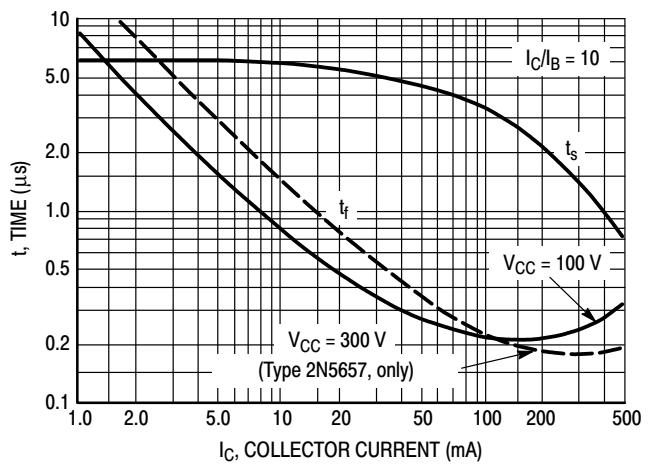
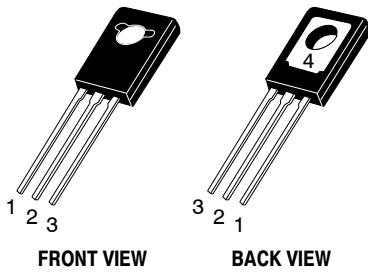


Figure 8. Turn-Off Time

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

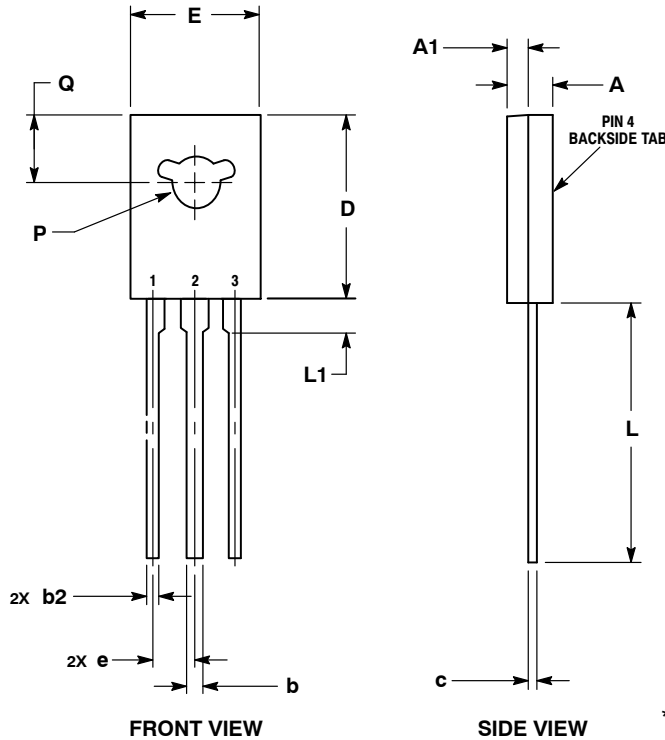
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TO-225  
CASE 77-09  
ISSUE AD

DATE 25 MAR 2015

SCALE 1:1

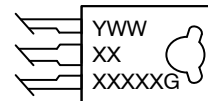


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. NUMBER AND SHAPE OF LUGS OPTIONAL.

DIM	MILLIMETERS	
	MIN	MAX
A	2.40	3.00
A1	1.00	1.50
b	0.60	0.90
b2	0.51	0.88
c	0.39	0.63
D	10.60	11.10
E	7.40	7.80
e	2.04	2.54
L	14.50	16.63
L1	1.27	2.54
P	2.90	3.30
Q	3.80	4.20

GENERIC MARKING DIAGRAM\*



- Y = Year
- WW = Work Week
- XXXXX = Device Code
- G = Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "μ", may or may not be present.

- |   |   |   |   |   |
|---|---|---|---|---|
| <p>STYLE 1:<br/>PIN 1. EMITTER<br/>2., 4. COLLECTOR<br/>3. BASE</p> | <p>STYLE 2:<br/>PIN 1. CATHODE<br/>2., 4. ANODE<br/>3. GATE</p> | <p>STYLE 3:<br/>PIN 1. BASE<br/>2., 4. COLLECTOR<br/>3. EMITTER</p> | <p>STYLE 4:<br/>PIN 1. ANODE 1<br/>2., 4. ANODE 2<br/>3. GATE</p> | <p>STYLE 5:<br/>PIN 1. MT 1<br/>2., 4. MT 2<br/>3. GATE</p>     |
| <p>STYLE 6:<br/>PIN 1. CATHODE<br/>2., 4. GATE<br/>3. ANODE</p>     | <p>STYLE 7:<br/>PIN 1. MT 1<br/>2., 4. GATE<br/>3. MT 2</p>     | <p>STYLE 8:<br/>PIN 1. SOURCE<br/>2., 4. GATE<br/>3. DRAIN</p>      | <p>STYLE 9:<br/>PIN 1. GATE<br/>2., 4. DRAIN<br/>3. SOURCE</p>    | <p>STYLE 10:<br/>PIN 1. SOURCE<br/>2., 4. DRAIN<br/>3. GATE</p> |

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