# 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 <sub>CEO</sub>	250 350	Vdc
Collector–Base Voltage 2N5655G 2N5657G	V <sub>CB</sub>	275 375	Vdc
Emitter-Base Voltage	V <sub>EB</sub>	6.0	Vdc
Collector Current – Continuous	I <sub>C</sub>	0.5	Adc
Collector Current – Peak	I <sub>CM</sub>	1.0	Adc
Base Current	I <sub>B</sub>	1.0	Adc
Total Device Dissipation @ T <sub>C</sub> = 25°C Derate above 25°C	P <sub>D</sub>	20 0.16	W W/°C
Operating and Storage Junction Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-65 to +150	°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

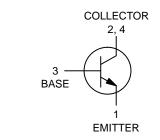
Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction-to-Case	$R_{ heta JC}$	6.25	°C/W



# ON Semiconductor®

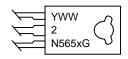
http://onsemi.com

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





### **MARKING DIAGRAM**



## ORDERING INFORMATION

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

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

# **ELECTRICAL CHARACTERISTICS** ( $T_C = 25$ °C unless otherwise noted) (Note 2)

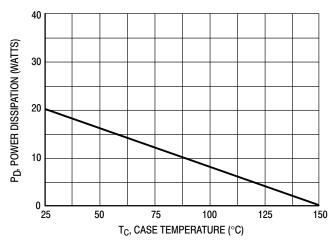
Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS	1		U.	
Collector–Emitter Sustaining Voltage (I <sub>C</sub> = 100 mAdc (inductive), L = 50 mH) 2N5655G 2N5657G	V <sub>CEO(sus)</sub>	250 350	_ _	Vdc
Collector–Emitter Breakdown Voltage ( $I_C = 1.0 \text{ mAdc}, I_B = 0$ ) 2N5655G 2N5657G	V <sub>(BR)</sub> 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	ICEO	-	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 <sub>CEX</sub>	- - -	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	Ісво	-	10 10	μAdc
Emitter Cutoff Current (V <sub>EB</sub> = 6.0 Vdc, I <sub>C</sub> = 0)	I <sub>EBO</sub>	_	10	μAdc
ON CHARACTERISTICS	<u> </u>		·I	
DC Current Gain (Note 3) $ \begin{aligned} &\text{(I}_{\text{C}} = 50 \text{ mAdc, V}_{\text{CE}} = 10 \text{ Vdc)} \\ &\text{(I}_{\text{C}} = 100 \text{ mAdc, V}_{\text{CE}} = 10 \text{ Vdc)} \\ &\text{(I}_{\text{C}} = 250 \text{ mAdc, V}_{\text{CE}} = 10 \text{ Vdc)} \\ &\text{(I}_{\text{C}} = 500 \text{ mAdc, V}_{\text{CE}} = 10 \text{ Vdc)} \end{aligned} $	h <sub>FE</sub>	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 <sub>CE(sat)</sub>	- - -	1.0 2.5 10	Vdc
Base–Emitter Voltage (I <sub>C</sub> = 100 mAdc, V <sub>CE</sub> = 10 Vdc) (Note 3)	V <sub>BE</sub>	_	1.0	Vdc
DYNAMIC CHARACTERISTICS	1			
Current–Gain – Bandwidth Product ( $I_C = 50 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}, f = 10 \text{ MHz}$ ) (Note 4)	f <sub>T</sub>	10	_	MHz
Output Capacitance (V <sub>CB</sub> = 10 Vdc, I <sub>E</sub> = 0, f = 100 kHz)	C <sub>ob</sub>	-	25	pF
Small–Signal Current Gain (I <sub>C</sub> = 100 mAdc, V <sub>CE</sub> = 10 Vdc, f = 1.0 kHz)	h <sub>fe</sub>	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 for the listed test conditions.

2. Indicates JEDEC registered data for 2N5655 Series.

3. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

4. f<sub>T</sub> is defined as the frequency at which |h<sub>fe</sub>| extrapolates to unity.



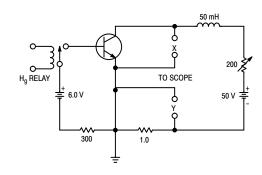
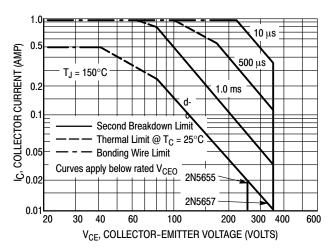


Figure 1. Power Derating

Figure 2. Sustaining Voltage Test Circuit

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



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  $T_{J(pk)} = 150^{\circ}C$ ;  $T_C$  is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided  $T_{J(pk)} \le 150^{\circ}C$ . 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 3. Active-Region Safe Operating Area

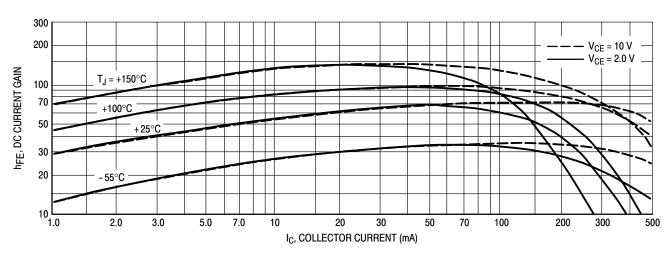


Figure 4. Current Gain

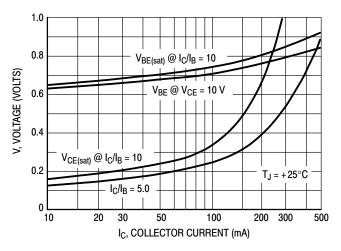


Figure 5. "On" Voltages

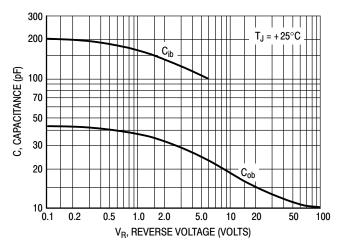


Figure 6. Capacitance

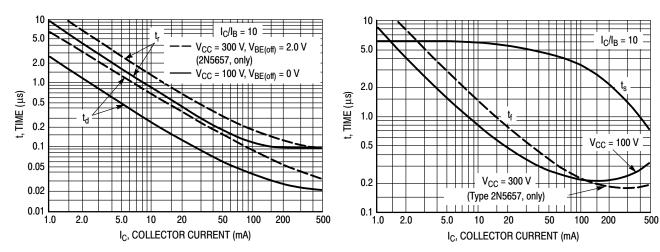
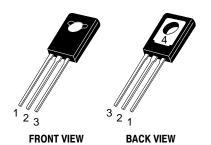


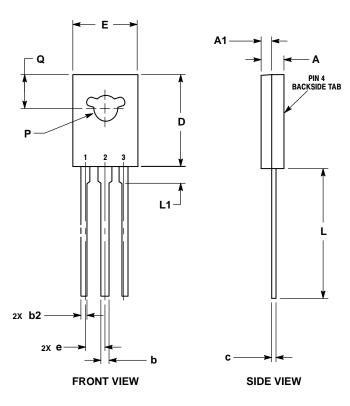
Figure 7. Turn-On Time

Figure 8. Turn-Off Time

### PACKAGE DIMENSIONS



TO-225 CASE 77-09 **ISSUE AC** 



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

	MILLIMETERS	
DIM	MIN	MAX
Α	2.40	3.00
A1	1.00	1.50
b	0.60	0.90
b2	0.51	0.88
С	0.39	0.63
D	10.60	11.10
Е	7.40	7.80
е	2.04	2.54
L	14.50	16.63
L1	1.27	2.54
Р	2.90	3.30
Q	3.80	4.20

PIN 1 FMITTER COLLECTOR 2., 4.

ON Semiconductor and (III) are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of SCILLC's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent—Marking, pdf. SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

# **PUBLICATION ORDERING INFORMATION**

# LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor P.O. Box 5163, Denver, Colorado 80217 USA

**Phone**: 303–675–2175 or 800–344–3860 Toll Free USA/Canada **Fax**: 303–675–2176 or 800–344–3867 Toll Free USA/Canada Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free USA/Canada

Europe, Middle East and Africa Technical Support: Phone: 421 33 790 2910

Japan Customer Focus Center Phone: 81–3–5817–1050

ON Semiconductor Website: www.onsemi.com

Order Literature: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative