

NPN SILICON EPITAXIAL TRANSISTOR  
POWER MINI MOLD

DESCRIPTION

The 2SC3357 is an NPN silicon epitaxial transistor designed for low noise amplifier at VHF, UHF and CATV band.

It has large dynamic range and good current characteristic.

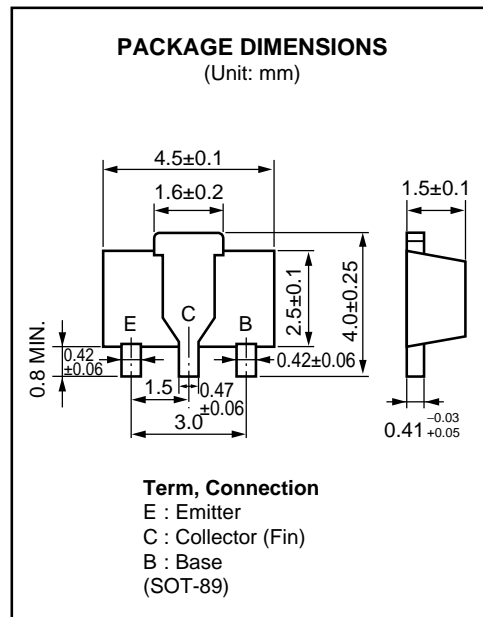
FEATURES

- Low Noise and High Gain  
 $NF = 1.1 \text{ dB TYP.}, G_a = 8.0 \text{ dB TYP. @ } V_{CE} = 10 \text{ V},$   
 $I_C = 7 \text{ mA}, f = 1.0 \text{ GHz}$   
 $NF = 1.8 \text{ dB TYP.}, G_a = 9.0 \text{ dB TYP. @ } V_{CE} = 10 \text{ V},$   
 $I_C = 40 \text{ mA}, f = 1.0 \text{ GHz}$
- Large  $P_T$  in Small Package  
 $P_T : 2 \text{ W with } 16 \text{ cm}^2 \times 0.7 \text{ mm Ceramic Substrate.}$

ABSOLUTE MAXIMUM RATINGS ( $T_A = 25 \text{ }^\circ\text{C}$ )

|                              |                 |             |                    |
|------------------------------|-----------------|-------------|--------------------|
| Collector to Base Voltage    | $V_{CBO}$       | 20          | V                  |
| Collector to Emitter Voltage | $V_{CEO}$       | 12          | V                  |
| Emitter to Base Voltage      | $V_{EBO}$       | 3.0         | V                  |
| Collector Current            | $I_C$           | 100         | mA                 |
| Total Power Dissipation      | $P_T^*$         | 1.2         | W                  |
| Thermal Resistance           | $R_{th(j-a)}^*$ | 62.5        | $^\circ\text{C/W}$ |
| Junction Temperature         | $T_j$           | 150         | $^\circ\text{C}$   |
| Storage Temperature          | $T_{stg}$       | -65 to +150 | $^\circ\text{C}$   |

\* mounted on  $16 \text{ cm}^2 \times 0.7 \text{ mm}$  Ceramic Substrate



**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C)**

| CHARACTERISTIC           | SYMBOL                          | MIN. | TYP. | MAX. | UNIT | TEST CONDITIONS                                             |
|--------------------------|---------------------------------|------|------|------|------|-------------------------------------------------------------|
| Collector Cutoff Current | I <sub>CB0</sub>                |      |      | 1.0  | μA   | V <sub>CB</sub> = 10 V, I <sub>E</sub> = 0                  |
| Emitter Cutoff Current   | I <sub>EB0</sub>                |      |      | 1.0  | μA   | V <sub>EB</sub> = 1.0 V, I <sub>C</sub> = 0                 |
| DC Current Gain          | h <sub>FE</sub> *               | 50   | 120  | 300  |      | V <sub>CE</sub> = 10 V, I <sub>C</sub> = 20 mA              |
| Gain Bandwidth Product   | f <sub>T</sub>                  |      | 6.5  |      | GHz  | V <sub>CE</sub> = 10 V, I <sub>C</sub> = 20 mA              |
| Feed-Back Capacitance    | C <sub>re</sub> **              |      | 0.65 | 1.0  | pF   | V <sub>CB</sub> = 10 V, I <sub>E</sub> = 0, f = 1.0 MHz     |
| Insertion Power Gain     | S <sub>21e</sub>   <sup>2</sup> |      | 9    |      | dB   | V <sub>CE</sub> = 10 V, I <sub>C</sub> = 20 mA, f = 1.0 GHz |
| Noise Figure             | NF                              |      | 1.1  |      | dB   | V <sub>CE</sub> = 10 V, I <sub>C</sub> = 7 mA, f = 1.0 GHz  |
| Noise Figure             | NF                              |      | 1.8  | 3.0  | dB   | V <sub>CE</sub> = 10 V, I <sub>C</sub> = 40 mA, f = 1.0 GHz |

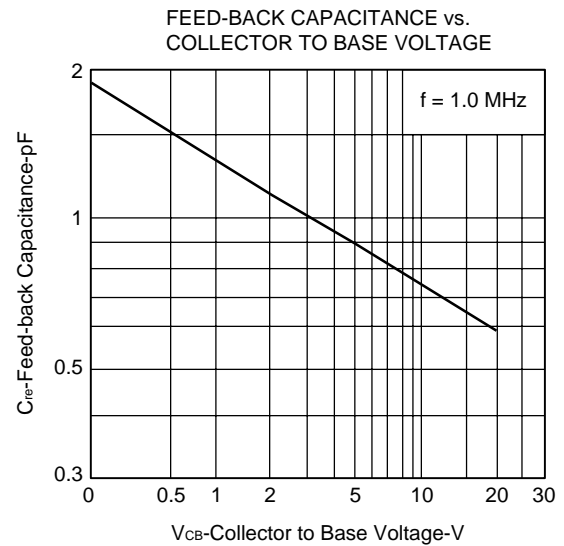
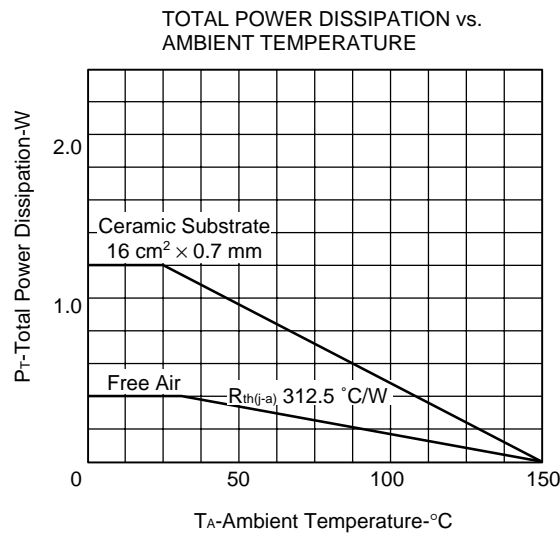
\* Pulse Measurement PW ≤ 350 μs, Duty Cycle ≤ 2 %

\*\* The emitter terminal and the case shall be connected to the guard terminal of the three-terminal capacitance bridge.

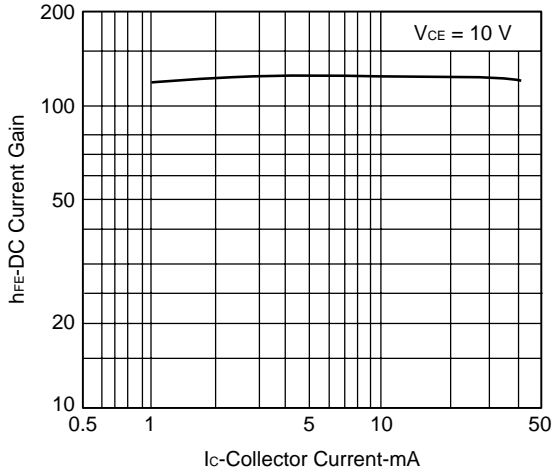
**h<sub>FE</sub> Classification**

| Class           | RH        | RF        | RE         |
|-----------------|-----------|-----------|------------|
| Marking         | RH        | RF        | RE         |
| h <sub>FE</sub> | 50 to 100 | 80 to 160 | 125 to 250 |

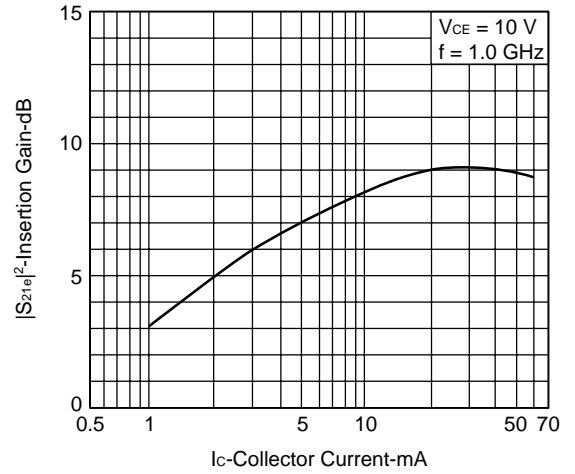
**TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C)**



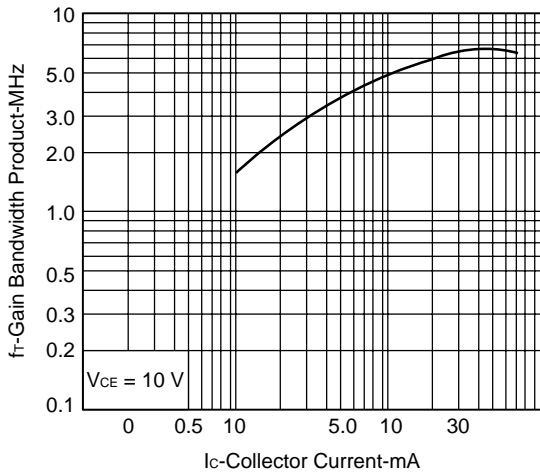
DC CURRENT GAIN vs. COLLECTOR CURRENT



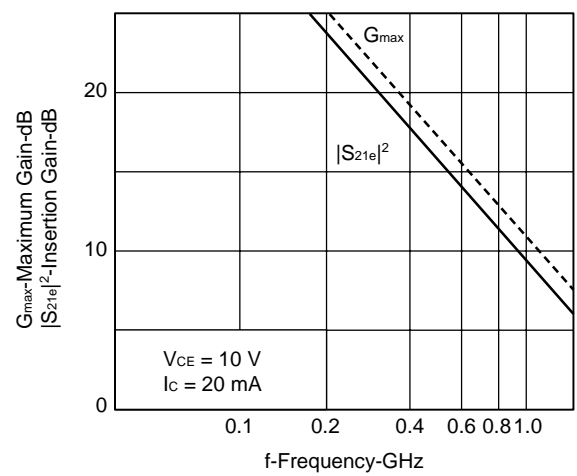
INSERTION GAIN vs. COLLECTOR CURRENT



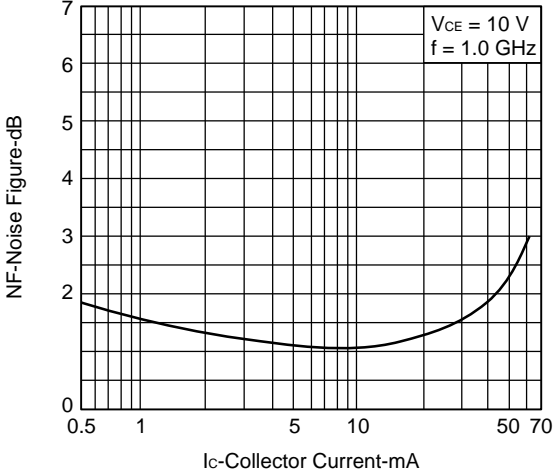
GAIN BANDWIDTH PROUDCT vs. COLLECTOR CURRENT



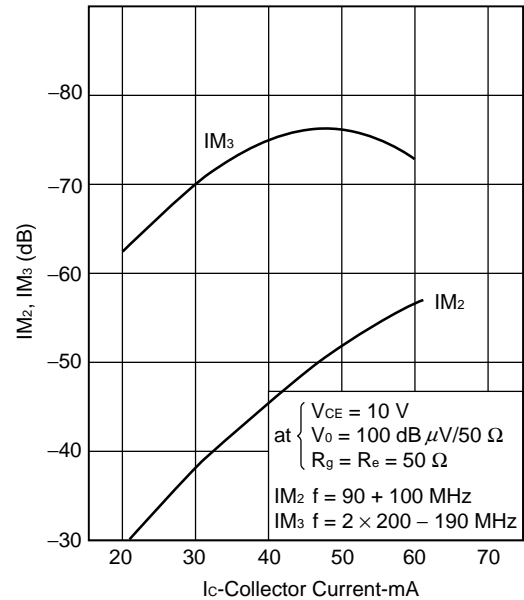
INSERTION GAIN, MAXIMUM GAIN vs. FREQUENCY



NOISE FIGURE vs. COLLECTOR CURRENT



INTERMODULATION DISTORTION vs. COLLECTOR CURRENT



**S-PARAMETER**

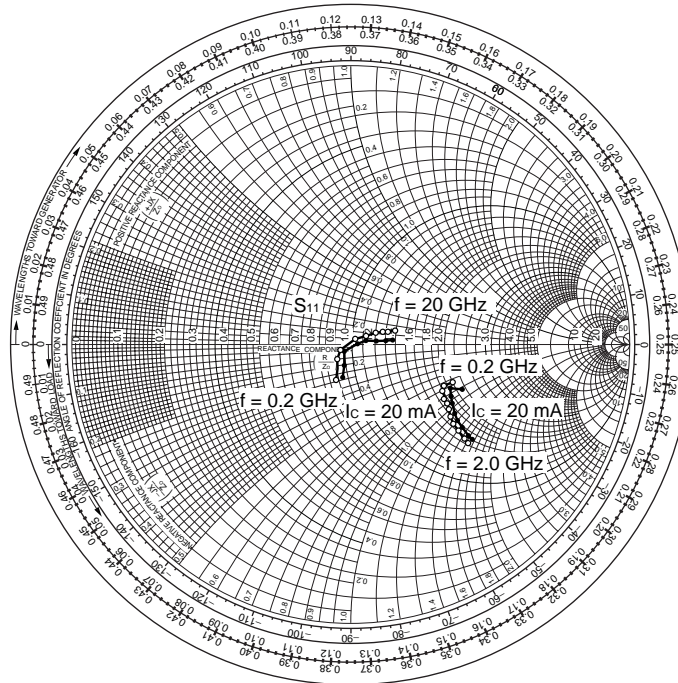
$V_{CE} = 10\text{ V}$ ,  $I_c = 40\text{ mA}$ ,  $Z_o = 50\ \Omega$

| f (MHz) | $ S_{11} $ | $\angle S_{11}$ | $ S_{21} $ | $\angle S_{21}$ | $ S_{12} $ | $\angle S_{12}$ | $ S_{22} $ | $\angle S_{22}$ |
|---------|------------|-----------------|------------|-----------------|------------|-----------------|------------|-----------------|
| 200     | 0.196      | -94.4           | 13.023     | 102.4           | 0.043      | 74.5            | 0.444      | -21.1           |
| 400     | 0.103      | -118.3          | 6.852      | 89.2            | 0.081      | 77.4            | 0.398      | -25.3           |
| 600     | 0.056      | -131.1          | 4.632      | 78.3            | 0.118      | 77.5            | 0.399      | -26.9           |
| 800     | 0.024      | -43.7           | 3.527      | 75.9            | 0.152      | 78.0            | 0.414      | -28.9           |
| 1000    | 0.008      | -2.0            | 2.854      | 68.7            | 0.188      | 78.4            | 0.440      | -33.5           |
| 1200    | 0.039      | 13.1            | 2.421      | 65.7            | 0.218      | 75.7            | 0.461      | -33.3           |
| 1400    | 0.072      | 11.8            | 2.118      | 59.0            | 0.255      | 71.7            | 0.479      | -36.3           |
| 1600    | 0.102      | 9.6             | 1.887      | 57.1            | 0.278      | 73.1            | 0.499      | -35.5           |
| 1800    | 0.129      | 8.6             | 1.681      | 52.5            | 0.308      | 71.3            | 0.515      | -38.8           |
| 2000    | 0.151      | 9.8             | 1.579      | 51.4            | 0.339      | 71.8            | 0.537      | -35.9           |

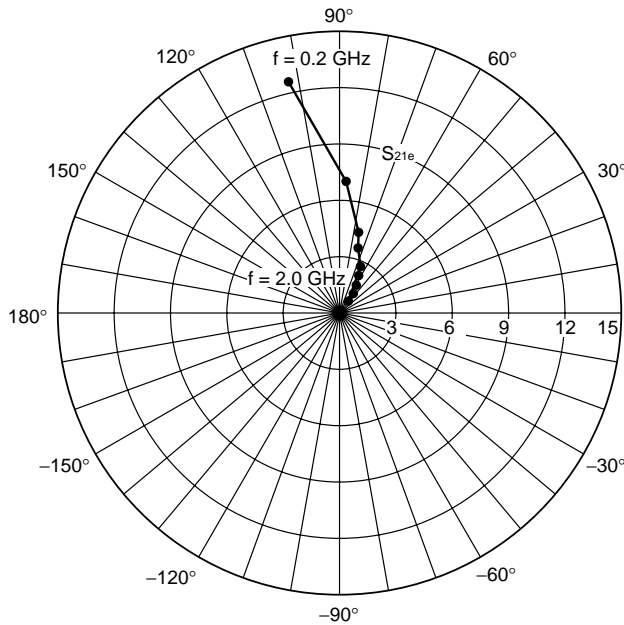
$V_{CE} = 10\text{ V}$ ,  $I_c = 20\text{ mA}$ ,  $Z_o = 50\ \Omega$

| f (MHz) | $ S_{11} $ | $\angle S_{11}$ | $ S_{21} $ | $\angle S_{21}$ | $ S_{12} $ | $\angle S_{12}$ | $ S_{22} $ | $\angle S_{22}$ |
|---------|------------|-----------------|------------|-----------------|------------|-----------------|------------|-----------------|
| 200     | 0.130      | -109.2          | 13.430     | 98.1            | 0.042      | 79.0            | 0.403      | -22.1           |
| 400     | 0.073      | -134.1          | 6.930      | 87.2            | 0.081      | 80.6            | 0.382      | -24.7           |
| 600     | 0.037      | -146.6          | 4.690      | 79.4            | 0.119      | 79.4            | 0.392      | -25.6           |
| 800     | 0.010      | 177.1           | 3.560      | 75.2            | 0.154      | 79.7            | 0.412      | -27.1           |
| 1000    | 0.024      | 23.7            | 2.878      | 68.2            | 0.191      | 76.5            | 0.440      | -31.9           |
| 1200    | 0.056      | 17.2            | 2.439      | 65.4            | 0.220      | 76.8            | 0.463      | -32.3           |
| 1400    | 0.093      | 13.8            | 2.133      | 59.0            | 0.257      | 72.9            | 0.483      | -35.7           |
| 1600    | 0.124      | 12.0            | 1.898      | 57.3            | 0.280      | 74.0            | 0.504      | -35.3           |
| 1800    | 0.151      | 11.0            | 1.693      | 52.9            | 0.311      | 72.4            | 0.519      | -38.4           |
| 2000    | 0.174      | 13.4            | 1.591      | 52.0            | 0.341      | 72.8            | 0.542      | -36.3           |

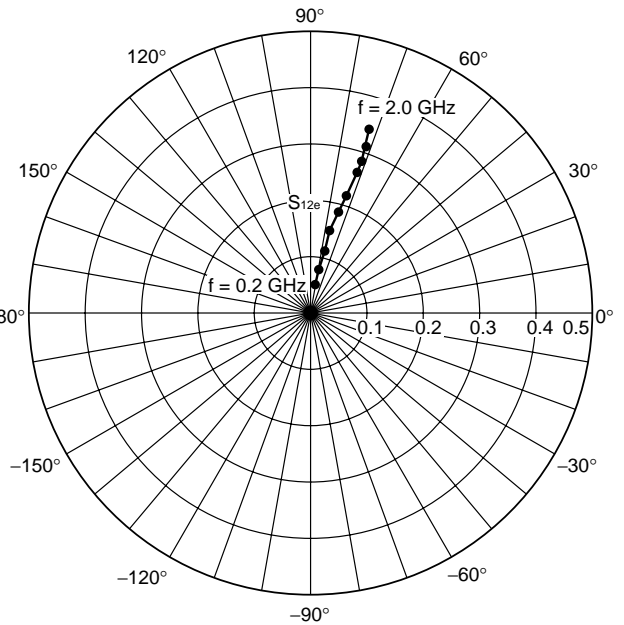
S<sub>11e</sub>, S<sub>22e</sub>-FREQUENCY  
 CONDITION V<sub>CE</sub> = 10 V



S<sub>21e</sub>-FREQUENCY  
 CONDITION V<sub>CE</sub> = 10 V  
 I<sub>C</sub> = 20 mA



S<sub>12e</sub>-FREQUENCY  
 CONDITION V<sub>CE</sub> = 10 V  
 I<sub>C</sub> = 20 mA



[MEMO]

[MEMO]

No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Corporation. NEC Corporation assumes no responsibility for any errors which may appear in this document.

NEC Corporation does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from use of a device described herein or any other liability arising from use of such device. No license, either express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Corporation or others.

While NEC Corporation has been making continuous effort to enhance the reliability of its semiconductor devices, the possibility of defects cannot be eliminated entirely. To minimize risks of damage or injury to persons or property arising from a defect in an NEC semiconductor device, customers must incorporate sufficient safety measures in its design, such as redundancy, fire-containment, and anti-failure features.

NEC devices are classified into the following three quality grades:

"Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.

Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

Specific: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

The quality grade of NEC devices is "Standard" unless otherwise specified in NEC's Data Sheets or Data Books. If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact an NEC sales representative in advance.

Anti-radioactive design is not implemented in this product.