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# DATA SHEET



## NEC's NPN SILICON TRANSISTOR

## NE687M33

### FEATURES

- **LOW NOISE:**  
NF = 1.5 dB TYP. @  $V_{CE} = 1\text{ V}$ ,  $I_c = 3\text{ mA}$ ,  $f = 2\text{ GHz}$
- **3-PIN SUPER LEAD-LESS MINIMOLD (M33) PACKAGE**

### ORDERING INFORMATION

| PART NUMBER   | QUANTITY          | SUPPLYING FORM                                       |
|---------------|-------------------|------------------------------------------------------|
| NE687M33-A    | 50 pcs (Non reel) | • 8 mm wide embossed taping                          |
| NE687M33-T3-A | 10 kpcs/reel      | • Pin 2 (Base) face the perforation side of the tape |

**Remark** To order evaluation samples, contact your nearby sales office.  
The unit sample quantity is 50 pcs.

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

| PARAMETER                    | SYMBOL                    | RATINGS     | UNIT             |
|------------------------------|---------------------------|-------------|------------------|
| Collector to Base Voltage    | $V_{CBO}$                 | 5.0         | V                |
| Collector to Emitter Voltage | $V_{CEO}$                 | 3.0         | V                |
| Emitter to Base Voltage      | $V_{EBO}$                 | 2.0         | V                |
| Collector Current            | $I_c$                     | 30          | mA               |
| Total Power Dissipation      | $P_{tot}$ <sup>Note</sup> | 90          | mW               |
| Junction Temperature         | $T_j$                     | 150         | $^\circ\text{C}$ |
| Storage Temperature          | $T_{stg}$                 | -65 to +150 | $^\circ\text{C}$ |

**Note** Mounted on  $1.08\text{ cm}^2 \times 1.0\text{ mm}$  (t) glass epoxy PCB

**Caution** Observe precautions when handling because these devices are sensitive to electrostatic discharge.

**ELECTRICAL CHARACTERISTICS** ( $T_A = +25^\circ\text{C}$ )

| PARAMETER                    | SYMBOL                     | TEST CONDITIONS                                                                | MIN. | TYP. | MAX. | UNIT |
|------------------------------|----------------------------|--------------------------------------------------------------------------------|------|------|------|------|
| <b>DC Characteristics</b>    |                            |                                                                                |      |      |      |      |
| Collector Cut-off Current    | $I_{CBO}$                  | $V_{CB} = 5\text{ V}, I_E = 0\text{ mA}$                                       | –    | –    | 100  | nA   |
| Emitter Cut-off Current      | $I_{EBO}$                  | $V_{EB} = 1\text{ V}, I_C = 0\text{ mA}$                                       | –    | –    | 100  | nA   |
| DC Current Gain              | $h_{FE}$ <sup>Note 1</sup> | $V_{CE} = 1\text{ V}, I_C = 10\text{ mA}$                                      | 70   | 110  | 140  | –    |
| <b>RF Characteristics</b>    |                            |                                                                                |      |      |      |      |
| Gain Bandwidth Product       | $f_T$                      | $V_{CE} = 1\text{ V}, I_C = 10\text{ mA}, f = 2\text{ GHz}$                    | 10   | 12   | –    | GHz  |
| Insertion Power Gain         | $ S_{21e} ^2$              | $V_{CE} = 1\text{ V}, I_C = 10\text{ mA}, f = 2\text{ GHz}$                    | 7    | 9    | –    | dB   |
| Noise Figure                 | NF                         | $V_{CE} = 1\text{ V}, I_C = 3\text{ mA}, f = 2\text{ GHz},$<br>$Z_S = Z_{opt}$ | –    | 1.5  | 2.0  | dB   |
| Reverse Transfer Capacitance | $C_{re}$ <sup>Note 2</sup> | $V_{CB} = 0.5\text{ V}, I_C = 0\text{ mA}, f = 1\text{ MHz}$                   | –    | 0.4  | 0.7  | pF   |

**Notes** 1. Pulse measurement:  $PW \leq 350\ \mu\text{s}$ , Duty Cycle  $\leq 2\%$

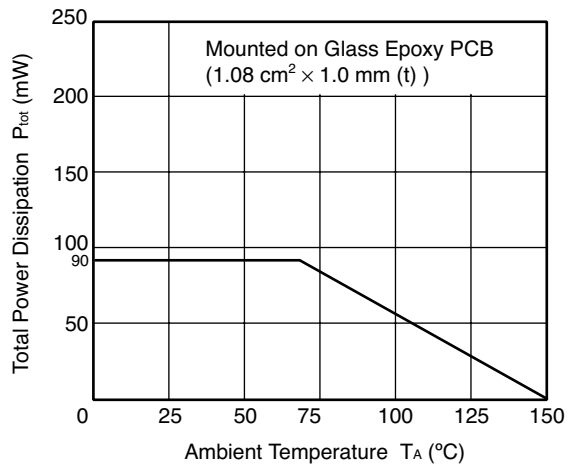
2. Collector to base capacitance when the emitter grounded

**h<sub>FE</sub> CLASSIFICATION**

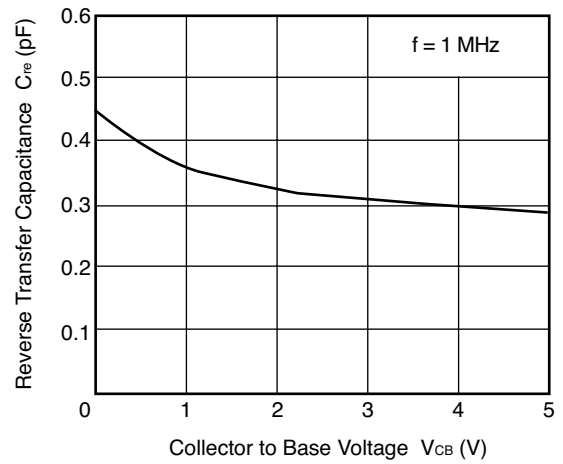
| RANK           | FB        |
|----------------|-----------|
| Marking        | W2        |
| $h_{FE}$ Value | 70 to 140 |

**TYPICAL CHARACTERISTICS** ( $T_A = +25^\circ\text{C}$ , unless otherwise specified)

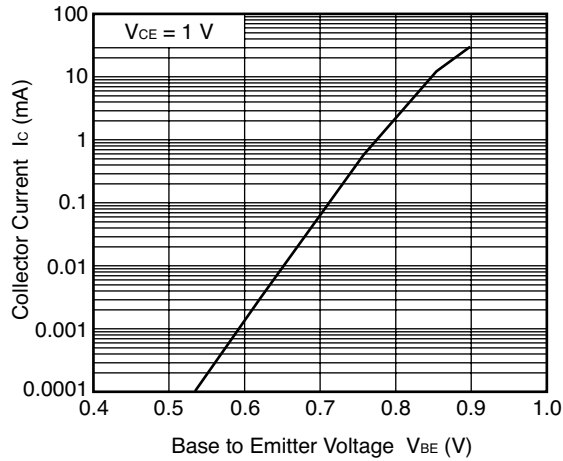
**TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE**



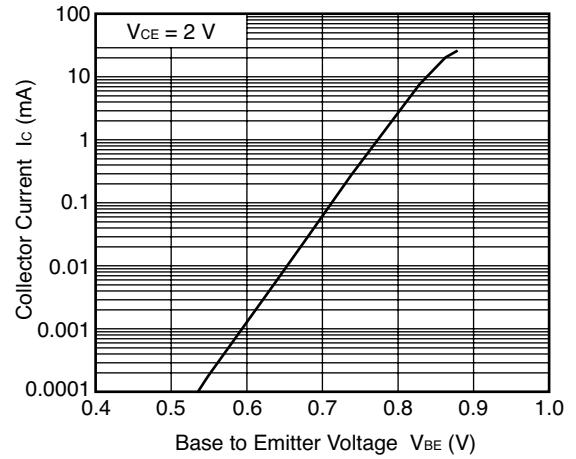
**REVERSE TRANSFER CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE**



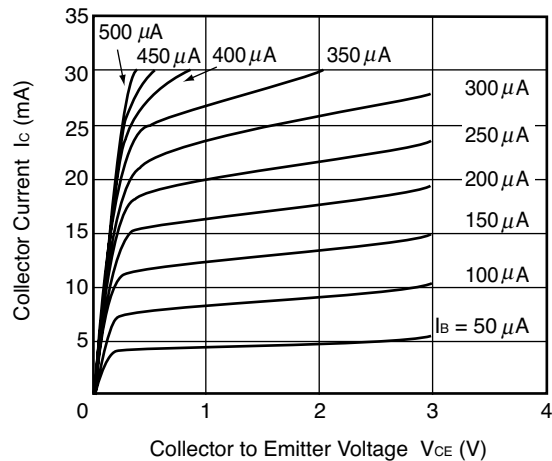
**COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE**



**COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE**

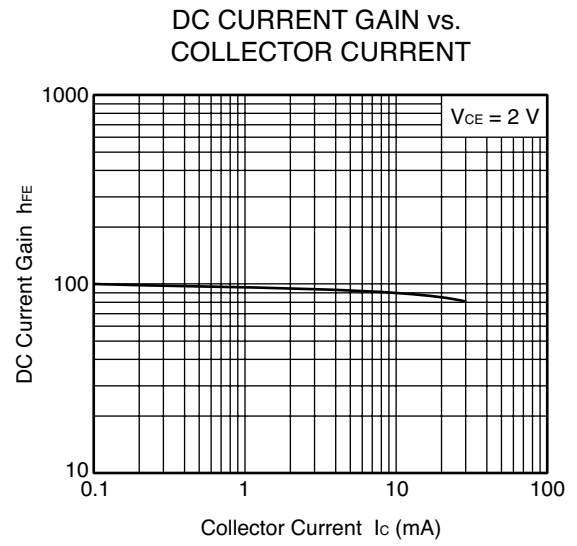
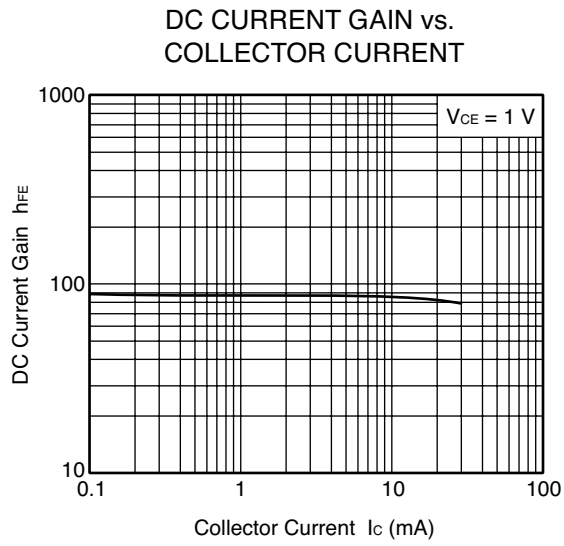


**COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE**



**Remark** The graphs indicate nominal characteristics.

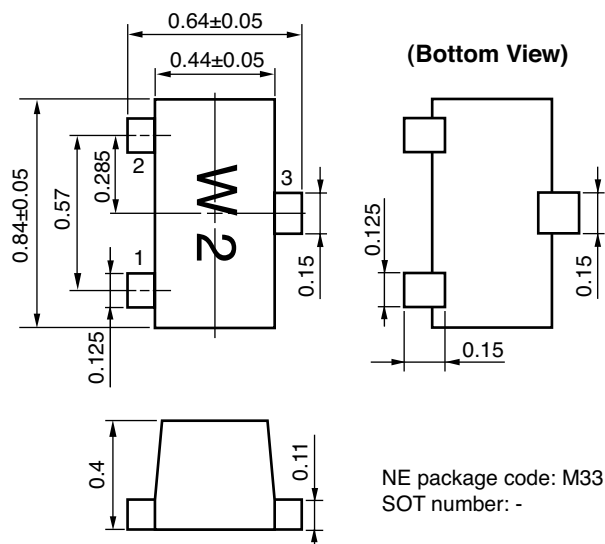
**TYPICAL CHARACTERISTICS** ( $T_A = +25^\circ\text{C}$ , unless otherwise specified)



**Remark** The graphs indicate nominal characteristics.

## PACKAGE DIMENSIONS

### 3-PIN SUPER LEAD-LESS MINIMOLD (M33) (UNIT: mm)



### PIN CONNECTIONS

1. Emitter
2. Base
3. Collector

#### Life Support Applications

These NEC products are not intended for use in life support devices, appliances, or systems where the malfunction of these products can reasonably be expected to result in personal injury. The customers of CEL using or selling these products for use in such applications do so at their own risk and agree to fully indemnify CEL for all damages resulting from such improper use or sale.

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DATA SUBJECT TO CHANGE WITHOUT NOTICE

06/22/2004

Subject: Compliance with EU Directives

CEL certifies, to its knowledge, that semiconductor and laser products detailed below are compliant with the requirements of European Union (EU) Directive 2002/95/EC Restriction on Use of Hazardous Substances in electrical and electronic equipment (RoHS) and the requirements of EU Directive 2003/11/EC Restriction on Penta and Octa BDE.

CEL Pb-free products have the same base part number with a suffix added. The suffix –A indicates that the device is Pb-free. The –AZ suffix is used to designate devices containing Pb which are exempted from the requirement of RoHS directive (\*). In all cases the devices have Pb-free terminals. All devices with these suffixes meet the requirements of the RoHS directive.

This status is based on CEL’s understanding of the EU Directives and knowledge of the materials that go into its products as of the date of disclosure of this information.

| Restricted Substance per RoHS | Concentration Limit per RoHS (values are not yet fixed) | Concentration contained in CEL devices |     |
|-------------------------------|---------------------------------------------------------|----------------------------------------|-----|
|                               |                                                         | -A                                     | -AZ |
| Lead (Pb)                     | < 1000 PPM                                              | Not Detected                           | (*) |
| Mercury                       | < 1000 PPM                                              | Not Detected                           |     |
| Cadmium                       | < 100 PPM                                               | Not Detected                           |     |
| Hexavalent Chromium           | < 1000 PPM                                              | Not Detected                           |     |
| PBB                           | < 1000 PPM                                              | Not Detected                           |     |
| PBDE                          | < 1000 PPM                                              | Not Detected                           |     |

If you should have any additional questions regarding our devices and compliance to environmental standards, please do not hesitate to contact your local representative.

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