NEC

# NPN SILICON TRANSISTOR | NE687M23

## FEATURES

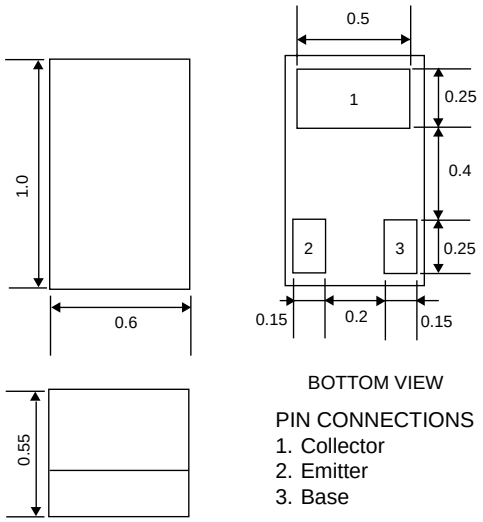
- **NEW MINIATURE M23 PACKAGE:**
  - – World's smallest transistor package footprint — leads are completely underneath package body
  - – Low profile/0.55 mm package height
  - – Ceramic substrate for better RF performance
- **HIGH GAIN BANDWIDTH PRODUCT:**
  $f_T$ = 5.5 GHz
- **LOW NOISE FIGURE:**
  NF = 1.5 dB at 2 GHz

## DESCRIPTION

The NE687M23 transistor is designed for low noise, high gain, and low cost requirements. This high $f_T$ part is well suited for very low voltage/low current designs for portable wireless communications and cellular radio applications. NEC's new low profile/ceramic substrate style "M23" package is ideal for today's portable wireless applications. The NE687 is also available in six different low cost plastic surface mount package styles.

## OUTLINE DIMENSIONS (Units in mm)

**PACKAGE OUTLINE M23**




BOTTOM VIEW

PIN CONNECTIONS
1. Collector
2. Emitter
3. Base

## ELECTRICAL CHARACTERISTICS ($T_A$ = 25°C)

| PART NUMBER<br>EIAJ[1] REGISTERED NUMBER<br>PACKAGE OUTLINE | | NE687M23<br>2SC5653<br>M23 | | | |
|---|---|---|---|---|---|
| **SYMBOLS** | **PARAMETERS AND CONDITIONS** | **UNITS** | **MIN** | **TYP** | **MAX** |
| $f_T$ | Gain Bandwidth at $V_{CE}$ = 1 V, $I_C$ = 5 mA, f = 2 GHz | GHz | | 5.5 | |
| NF | Noise Figure at $V_{CE}$ = 1 V, $I_C$ = 5 mA, f = 2 GHz | dB | | 1.5 | |
| $\|S_{21E}\|^2$ | Insertion Power Gain at $V_{CE}$ = 1 V, $I_C$ = 5 mA, f = 2 GHz | dB | | 4.5 | |
| $h_{FE}$[2] | Forward Current Gain at $V_{CE}$ = 2 V, $I_C$ = 20 mA | | 70 | | 130 |
| $I_{CBO}$ | Collector Cutoff Current at $V_{CB}$ = 5 V, $I_E$ = 0 | μA | | | 0.1 |
| $I_{EBO}$ | Emitter Cutoff Current at $V_{EB}$ = 1 V, $I_C$ = 0 | μA | | | 0.1 |
| $C_{RE}$[3] | Feedback Capacitance at $V_{CB}$ = 0.5 V, $I_E$ = 0, f = 1 MHz | pF | | 0.8 | |

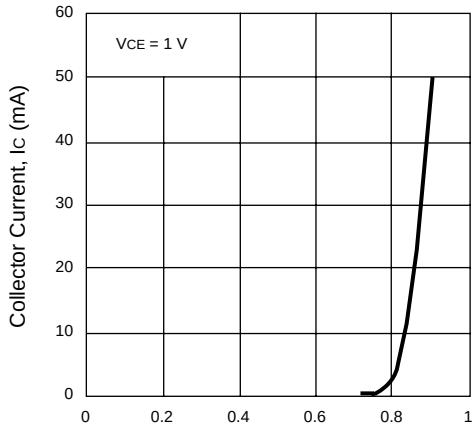
Notes:
1. Electronic Industrial Association of Japan.
2. Pulsed measurement, pulse width ≤ 350 μs, duty cycle ≤ 2 %.
3. Capacitance is measured with emitter and case connected to the guard terminal at the bridge.

## ABSOLUTE MAXIMUM RATINGS[1] ($T_A$ = 25°C)

| SYMBOLS | PARAMETERS | UNITS | RATINGS |
|---|---|---|---|
| $V_{CBO}$ | Collector to Base Voltage | V | 5 |
| $V_{CEO}$ | Collector to Emitter Voltage | V | 3 |
| $V_{EBO}$ | Emitter to Base Voltage | V | 2 |
| $I_C$ | Collector Current | mA | 30 |
| $P_T$ | Total Power Dissipation | mW | TBD |
| $T_J$ | Junction Temperature | °C | 150 |
| $T_{STG}$ | Storage Temperature | °C | -65 to +150 |

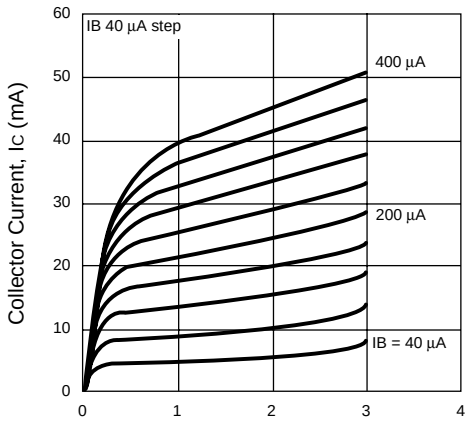
Note:
1. Operation in excess of any one of these parameters may result in permanent damage.

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

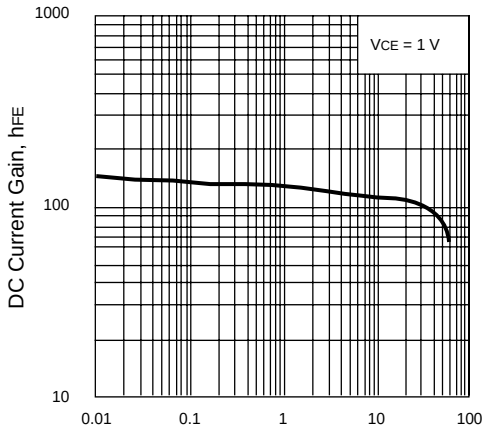



## TYPICAL PERFORMANCE CURVES ($T_A$ = 25°C)

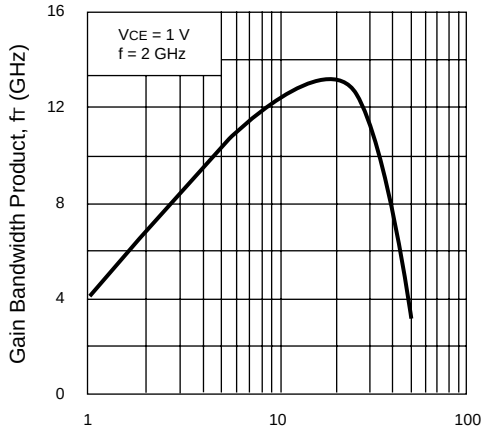
**COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE**




**DC CURRENT GAIN vs. COLLECTOR CURRENT**




**GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT**




**NOISE FIGURE/ASSOCIATED GAIN vs. COLLECTOR CURRENT**