

# PRELIMINARY DATA SHEET

# NEC

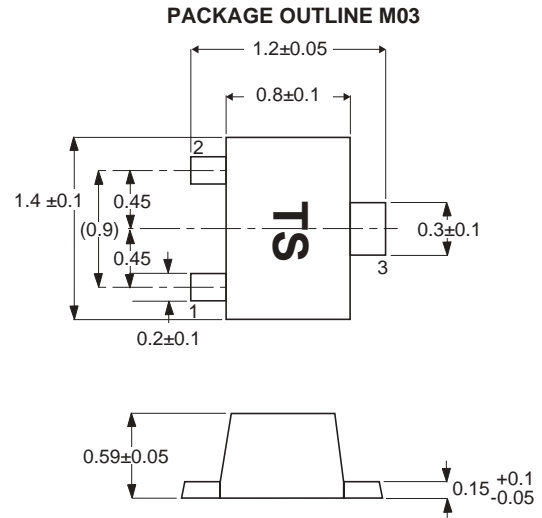
## NPN SILICON TRANSISTOR

## NE688M03

### FEATURES

- **NEW M03 PACKAGE:**
  - Smallest transistor outline package available
  - Low profile/0.59 mm package height
  - Flat lead style for better RF performance
- **HIGH GAIN BANDWIDTH PRODUCT:**  
 $f_T = 9.5 \text{ GHz}$
- **LOW NOISE FIGURE:**  
 $NF = 1.7 \text{ dB at } 2 \text{ GHz}$
- **HIGH COLLECTOR CURRENT:**  
 $I_{C\text{MAX}} = 100 \text{ mA}$

### OUTLINE DIMENSIONS (Units in mm)



### DESCRIPTION

The NE688M03 transistor is designed for low cost amplifier and oscillator applications. Low noise figure, high gain and high current capability equate to wide dynamic range and excellent linearity. NEC's new low profile/flat lead style "M03" package is ideal for today's portable wireless applications. The NE688 is also available in chip and six different low cost plastic surface mount package styles.

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

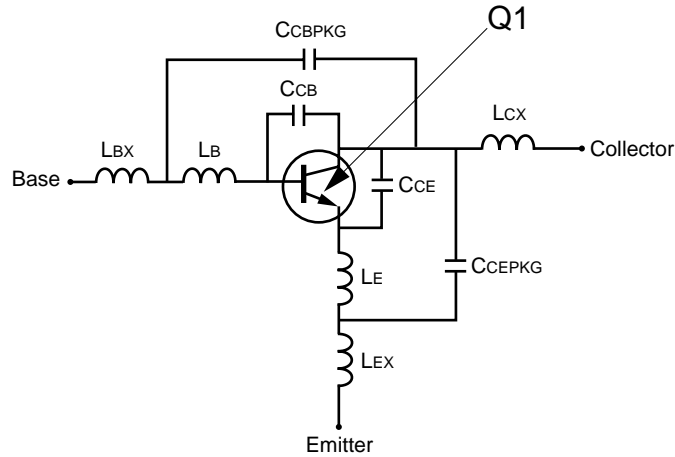
PART NUMBER EIAJ <sup>1</sup> REGISTERED NUMBER PACKAGE OUTLINE		NE688M03 2SC5437 M03			
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
$f_T$	Gain Bandwidth at $V_{CE} = 1 \text{ V}$ , $I_C = 3 \text{ mA}$ , $f = 2 \text{ GHz}$ $V_{CE} = 3 \text{ V}$ , $I_C = 20 \text{ mA}$ , $f = 2 \text{ GHz}$	GHz	4	5	
		GHz		9.5	
NF	Noise Figure at $V_{CE} = 1 \text{ V}$ , $I_C = 3 \text{ mA}$ , $f = 2 \text{ GHz}$ $V_{CE} = 3 \text{ V}$ , $I_C = 7 \text{ mA}$ , $f = 2 \text{ GHz}$	dB		1.9	2.5
		dB		1.7	
$ S_{21E} ^2$	Insertion Power Gain at $V_{CE} = 1 \text{ V}$ , $I_C = 3 \text{ mA}$ , $f = 2 \text{ GHz}$ $V_{CE} = 3 \text{ V}$ , $I_C = 20 \text{ mA}$ , $f = 2 \text{ GHz}$	dB	3	4	
		dB		8	
$h_{FE}^2$	Forward Current Gain at $V_{CE} = 1 \text{ V}$ , $I_C = 3 \text{ mA}$		80		145
$I_{CBO}$	Collector Cutoff Current at $V_{CB} = 5 \text{ V}$ , $I_E = 0$	$\mu\text{A}$			0.1
$I_{EBO}$	Emitter Cutoff Current at $V_{EB} = 1 \text{ V}$ , $I_C = 0$	$\mu\text{A}$			0.1
$C_{RE}^3$	Feedback Capacitance at $V_{CB} = 1 \text{ V}$ , $I_E = 0$ , $f = 1 \text{ MHz}$	pF		0.7	0.8

Notes:

1. Electronic Industrial Association of Japan.
2. Pulsed measurement, pulse width  $\leq 350 \mu\text{s}$ , duty cycle  $\leq 2 \%$ .
3. Capacitance is measured with emitter and case connected to the guard terminal at the bridge.

NONLINEAR MODEL

SCHEMATIC



BJT NONLINEAR MODEL PARAMETERS (1)

Parameters	Q1	Parameters	Q1
IS	3.8e-16	MJC	0.48
BF	135.7	XCJC	0.56
NF	1	CJS	0
VAF	28	VJS	0.75
IKF	0.6	MJS	0
ISE	3.8e-15	FC	0.75
NE	1.49	TF	11e-12
BR	12.3	XTF	0.36
NR	1.1	VTF	0.65
VAR	3.5	ITF	0.61
IKR	0.06	PTF	50
ISC	3.5e-16	TR	32e-12
NC	1.62	EG	1.11
RE	0.4	XTB	0
RB	6.14	XTI	3
RBM	3.5	KF	1.5e-14
IRB	0.001	AF	1.22
RC	4.2		
CJE	0.796e-12		
VJE	0.71		
MJE	0.38		
CJC	0.549e-12		
VJC	0.65		

UNITS

Parameter	Units
time	seconds
capacitance	farads
inductance	henries
resistance	ohms
voltage	volts
current	amps

ADDITIONAL PARAMETERS

Parameters	688M03
CCB	0.24e-12
CCE	0.27e-12
LB	0.5e-9
LE	0.6e-9
CCBPKG	0.08e-12
CCEPKG	0.08e-12
LBX	0.12e-9
LCX	0.10e-9
LEX	0.12e-9

MODEL RANGE

Frequency: 0.1 to 5.0 GHz  
 Bias: VCE = 0.5 V to 3 V, Ic = 0.5 mA to 10 mA  
 Date: 11/98

(1) Gummel-Poon Model

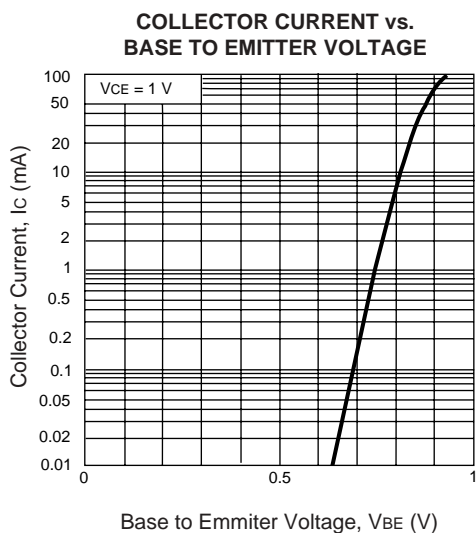
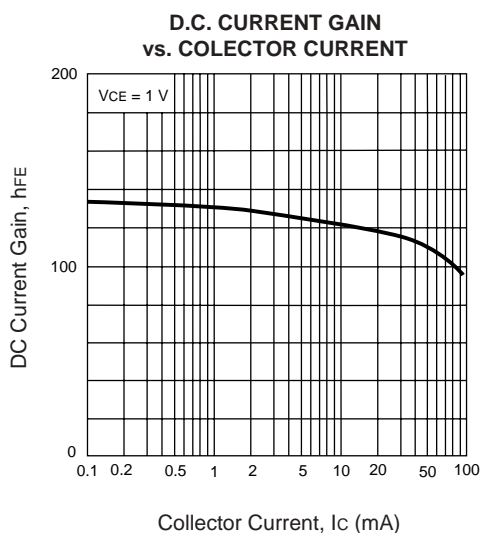
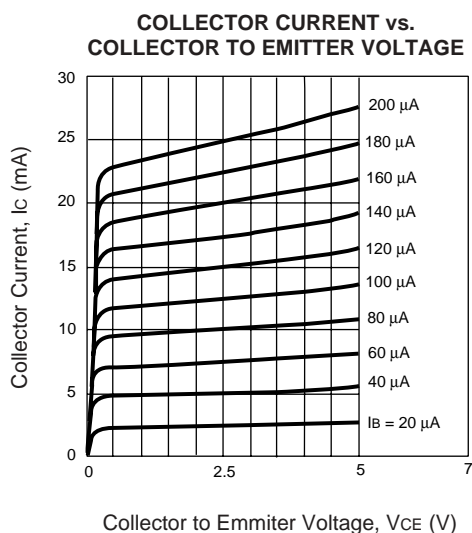
**ABSOLUTE MAXIMUM RATINGS<sup>1</sup>** (T<sub>A</sub> = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V <sub>CB0</sub>	Collector to Base Voltage	V	9
V <sub>CE0</sub>	Collector to Emitter Voltage	V	6
V <sub>EB0</sub>	Emitter to Base Voltage	V	2
I <sub>c</sub>	Collector Current	mA	100
P <sub>T</sub>	Total Power Dissipation	mW	125
T <sub>J</sub>	Junction Temperature	°C	150
T <sub>STG</sub>	Storage Temperature	°C	-65 to +150

Note:

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

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



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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