



NEC's NPN SILICON TRANSISTOR

NE687M03

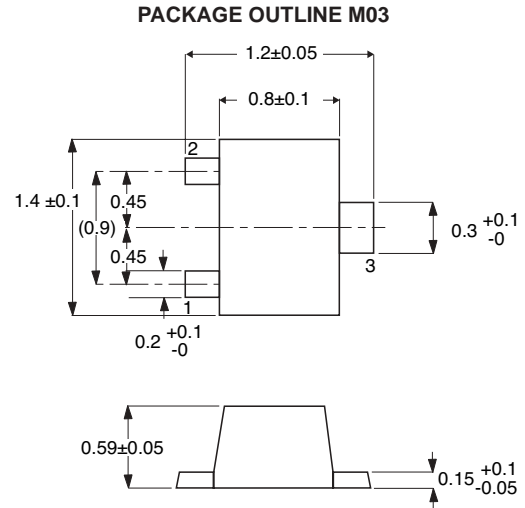
FEATURES

- **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:**
 $f_T = 14 \text{ GHz}$
- **LOW NOISE FIGURE:**
 $NF = 1.4 \text{ dB at } 2 \text{ GHz}$

DESCRIPTION

NEC's NE687M03 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/flat lead style "M03" 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)



PIN CONNECTIONS

1. Emitter
2. Base
3. Collector

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

PART NUMBER EIAJ ¹ REGISTERED NUMBER PACKAGE OUTLINE		NE687M03 2SC5436 M03			
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
f_T	Gain Bandwidth at $V_{CE} = 2 \text{ V}$, $I_C = 20 \text{ mA}$, $f = 2 \text{ GHz}$ $V_{CE} = 1 \text{ V}$, $I_C = 10 \text{ mA}$, $f = 2 \text{ GHz}$	GHz	9	14	
		GHz	7	12	
NF	Noise Figure at $V_{CE} = 2 \text{ V}$, $I_C = 3 \text{ mA}$, $f = 2 \text{ GHz}$ $V_{CE} = 1 \text{ V}$, $I_C = 3 \text{ mA}$, $f = 2 \text{ GHz}$	dB		1.3	2
		dB		1.3	2
$ S_{21E} ^2$	Insertion Power Gain at $V_{CE} = 2 \text{ V}$, $I_C = 20 \text{ mA}$, $f = 2 \text{ GHz}$ $V_{CE} = 1 \text{ V}$, $I_C = 10 \text{ mA}$, $f = 2 \text{ GHz}$	dB	8.5	10	
		dB	6	9.0	
h_{FE}^2	Forward Current Gain at $V_{CE} = 2 \text{ V}$, $I_C = 20 \text{ mA}$		70		130
I_{CBO}	Collector Cutoff Current at $V_{CB} = 5 \text{ V}$, $I_E = 0$	μA			0.1
I_{EBO}	Emitter Cutoff Current at $V_{EB} = 1 \text{ V}$, $I_C = 0$	μA			0.1
C_{RE}^3	Feedback Capacitance at $V_{CB} = 2 \text{ V}$, $I_E = 0$, $f = 1 \text{ MHz}$	pF		0.4	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.

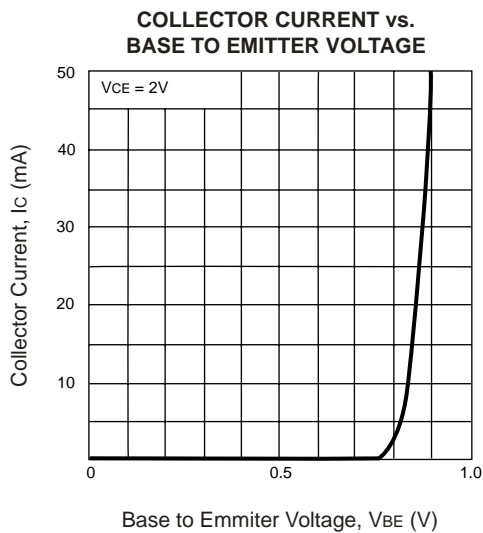
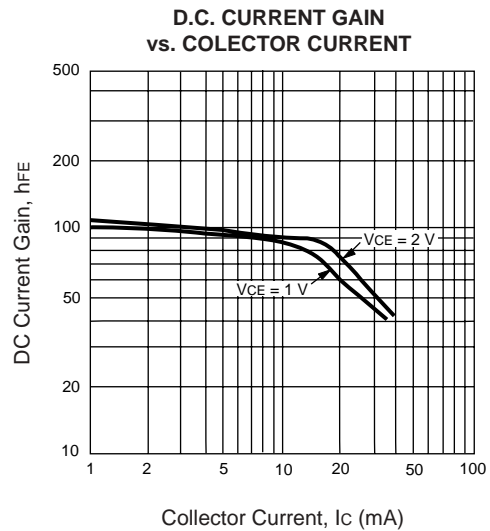
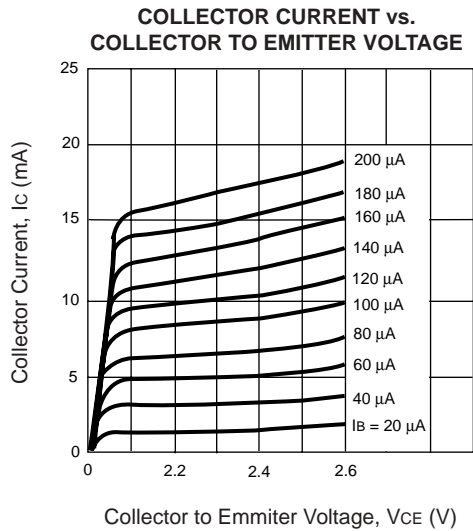
ABSOLUTE MAXIMUM RATINGS¹ (T_A = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V _{CBO}	Collector to Base Voltage	V	5
V _{CEO}	Collector to Emitter Voltage	V	3
V _{EB0}	Emitter to Base Voltage	V	2
I _C	Collector Current	mA	30
P _T	Total Power Dissipation	mW	90
T _J	Junction Temperature	°C	150
T _{STG}	Storage Temperature	°C	-65 to +150

Note:

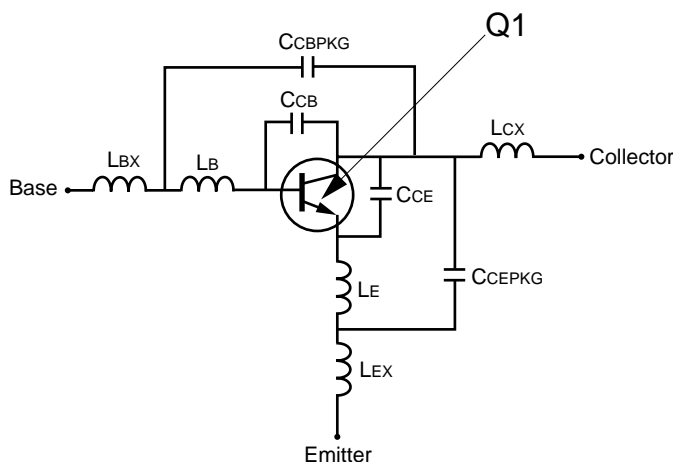
1. Operation in excess of any one of these parameters may result in permanent damage.

TYPICAL PERFORMANCE CURVES (T_A = 25°C)



NE687M03 NONLINEAR MODEL

SCHEMATIC

BJT NONLINEAR MODEL PARAMETERS⁽¹⁾

Parameters	Q1	Parameters	Q1
IS	302.3e-18	MJC	0.53
BF	104	XCJC	0.27
NF	1.038	CJS	0
VAF	10	VJS	0.75
IKF	0.370	MJS	0
ISE	1e-6	FC	0.37
NE	31.19	TF	5e-12
BR	17.54	XTF	8
NR	1.023	VTF	0.06
VAR	30	ITF	1.0
IKR	8.369e-3	PTF	69.1
ISC	81.93e-12	TR	1.e-9
NC	4.986	EG	1.11
RE	0.80	XTB	0
RB	11.10	XTI	3
RBM	2.46	KF	0
IRB	17e-3	AF	1
RC	4.477		
CJE	0.415e-12		
VJE	0.68		
MJE	0.53		
CJC	0.102e-12		
VJC	0.8		

(1) Gummel-Poon Model

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.

UNITS

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

ADDITIONAL PARAMETERS

Parameters	687M03
CCB	0.26e-12
CCE	0.19e-12
LB	0.4e-9
LE	0.7e-9
CCBPKG	0.08e-12
CCEPKG	0.08e-12
LBX	0.12e-9
LCX	0.10e-9
LEX	0.12e-9

MODEL TEST CONDITIONS

Frequency: 0.1 to 5.0 GHz

Bias: $V_{CE} = 0.5 \text{ V to } 2.5 \text{ V}$, $I_c = 0.5 \text{ mA to } 30 \text{ mA}$

Date: 11/98

hFE = 108 at 2 V, 20 mA