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 GHz
- **LOW NOISE FIGURE:**
  NF = 1.7 dB at 2 GHz
- **HIGH COLLECTOR CURRENT:**
  I_{CMAX} = 100 mA

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.

OUTLINE DIMENSIONS (Units in mm)

PACKAGE OUTLINE M03

PIN CONNECTIONS
1. Emitter
2. Base
3. Collector

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

	PART NUMBER EIAJ[1] REGISTERED NUMBER PACKAGE OUTLINE		NE688M03 2SC5437 M03		
SYMBOLS	**PARAMETERS AND CONDITIONS**	**UNITS**	**MIN**	**TYP**	**MAX**
f_T	Gain Bandwidth at V_{CE} = 1 V, I_C = 3 mA, f = 2 GHz	GHz	4	5	
	V_{CE} = 3 V, I_C = 20 mA, f = 2 GHz	GHz		9.5	
NF	Noise Figure at V_{CE} = 1 V, I_C = 3 mA, f = 2 GHz	dB		1.9	2.5
	V_{CE} = 3 V, I_C = 7 mA, f = 2 GHz	dB		1.7	
$|S_{21E}|^2$	Insertion Power Gain at V_{CE} = 1 V, I_C = 3 mA, f = 2 GHz	dB	3	4	
	V_{CE} = 3 V, I_C = 20 mA, f = 2 GHz	dB		8	
h_{FE}[2]	Forward Current Gain at V_{CE} = 1 V, I_C = 3 mA		80		145
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} = 1 V, I_E = 0, f = 1 MHz	pF		0.7	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.

NONLINEAR MODEL

SCHEMATIC
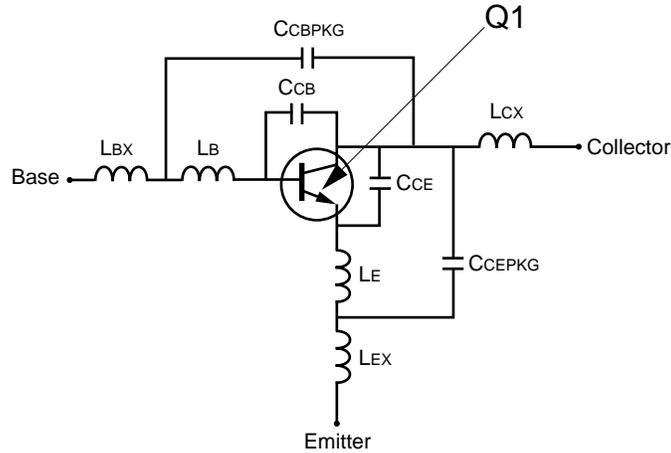
BJT NONLINEAR MODEL PARAMETERS [1]

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		

(1) Gummel-Poon Model

UNITS

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

ADDITIONAL PARAMETERS

Parameters	688M03
C_{CB}	0.24e-12
C_{CE}	0.27e-12
L_B	0.5e-9
L_E	0.6e-9
C_{CBPKG}	0.08e-12
C_{CEPKG}	0.08e-12
L_{BX}	0.12e-9
L_{CX}	0.10e-9
L_{EX}	0.12e-9

MODEL RANGE

Frequency: 0.1 to 5.0 GHz
Bias: V_{CE} = 0.5 V to 3 V, I_C = 0.5 mA to 10 mA
Date: 11/98

ABSOLUTE MAXIMUM RATINGS[1] (T$_A$ = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V$_{CBO}$	Collector to Base Voltage	V	9
V$_{CEO}$	Collector to Emitter Voltage	V	6
V$_{EBO}$	Emitter to Base Voltage	V	2
I$_C$	Collector Current	mA	100
P$_T$	Total Power Dissipation	mW	125
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)

COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE
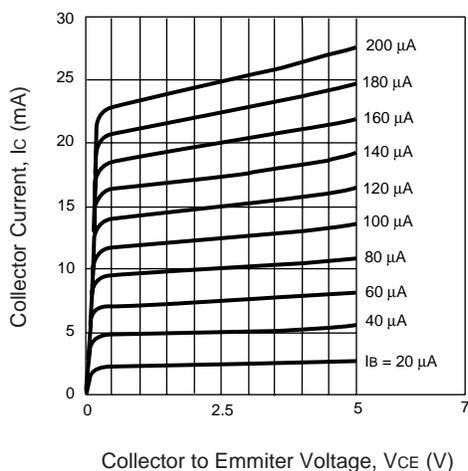
D.C. CURRENT GAIN vs. COLECTOR CURRENT
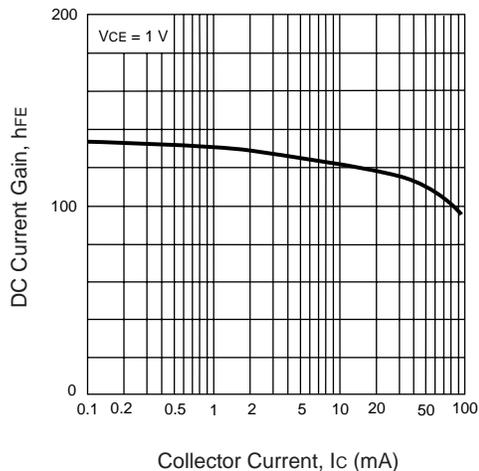
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE
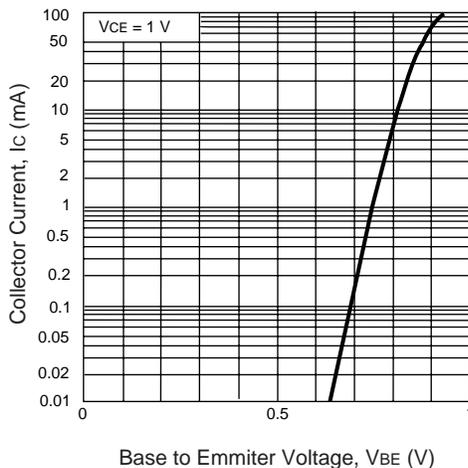
Life Support Applications

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.