NEC

NPN SILICON TRANSISTOR | NE685M03

FEATURES

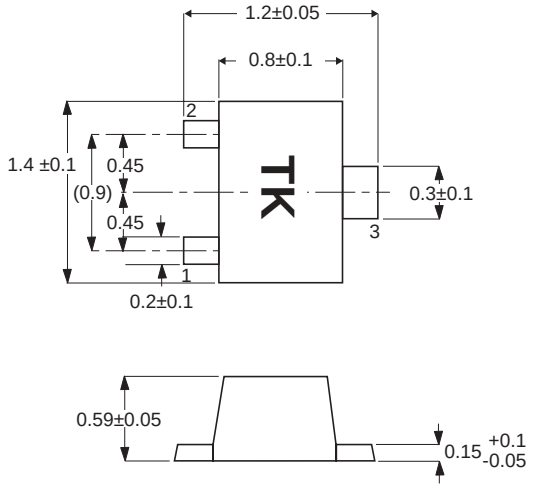
- **NEW M03 PACKAGE:**
  - Smallest transistor outline package available
  - Low profile/0.59 mm package height
  - Flat lead style for better RF performance
- **HIGH GAIN BANDWIDTH PRODUCT:**
  f_T = 12 GHz
- **LOW NOISE FIGURE:**
  NF = 1.5 dB at 2 GHz

DESCRIPTION

The NE685M03 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 NE685 is also available in 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		NE685M03 2SC5435 M03			
SYMBOLS	**PARAMETERS AND CONDITIONS**	**UNITS**	**MIN**	**TYP**	**MAX**
f_T	Gain Bandwidth at V_{CE} = 3 V, I_C = 10 mA, f = 2 GHz	GHz		12	
NF	Noise Figure at V_{CE} = 3 V, I_C = 3 mA, f = 2 GHz	dB		1.5	2.5
$\|S_{21E}\|^2$	Insertion Power Gain at V_{CE} = 3 V, I_C = 10 mA, f = 2 GHz	dB	7	9	
h_{FE}[2]	Forward Current Gain at V_{CE} = 3 V, I_C = 10 mA		75		140
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} = 3 V, I_E = 0, f = 1 MHz	pF		0.4	0.7

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.

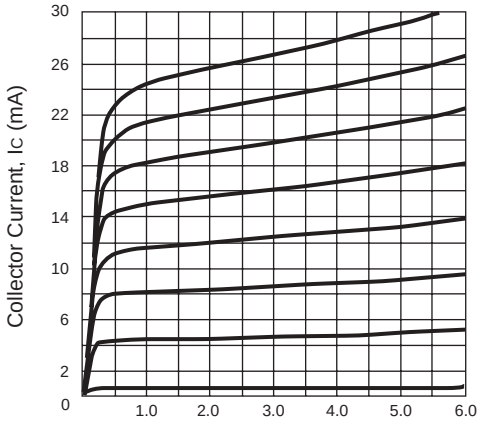
ABSOLUTE MAXIMUM RATINGS[1] (T_A = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{CBO}	Collector to Base Voltage	V	9
V_{CEO}	Collector to Emitter Voltage	V	5
V_{EBO}	Emitter to Base Voltage	V	2
I_C	Collector Current	mA	30
P_T	Total Power Dissipation	mW	125
T_J	Junction Temperature	°C	150
T_{STG}	Storage Temperature	°C	-65 to +150

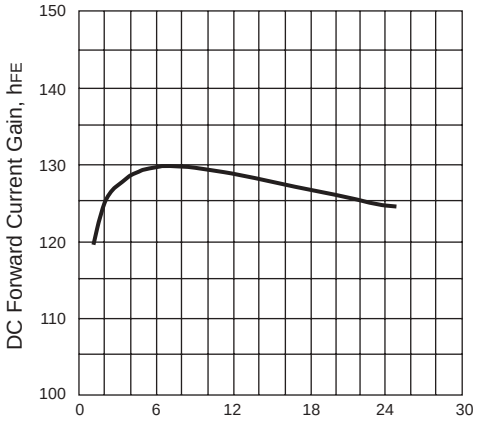
Note:
1. Operation in excess of any one of these parameters may result in permanent damage.

TYPICAL PERFORMANCE CURVES (T_A = 25°C)

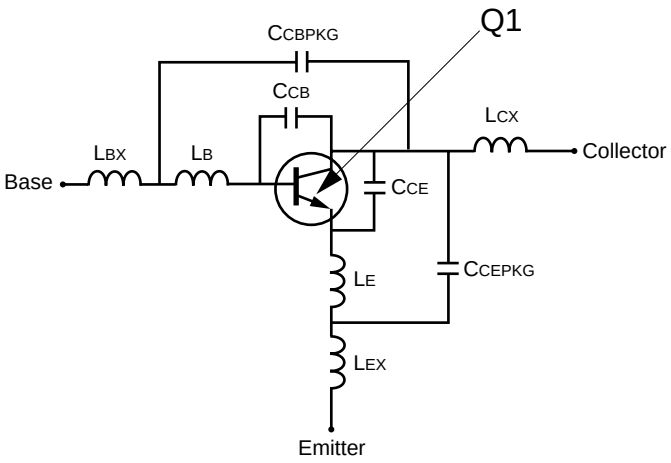
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



D.C. FORWARD CURRENT GAIN vs. COLLECTOR CURRENT



SCHEMATIC



BJT NONLINEAR MODEL PARAMETERS (1)

Parameters	Q1	Parameters	Q1
IS	8.98e-17	MJC	0.19
BF	107.1	XCJC	0
NF	0.99	CJS	0
VAF	22	VJS	0.75
IKF	0.55	MJS	0
ISE	1e-6	FC	0.5
NE	31.10	TF	4e-12
BR	16.06	XTF	12
NR	0.98	VTF	1
VAR	6	ITF	0.04
IKR	8.02e-3	PTF	120
ISC	0	TR	1e-9
NC	2	EG	1.11
RE	0.6	XTB	0
RB	10	XTI	3
RBM	8.34	KF	0
IRB	0.009	AF	1
RC	5.07		
CJE	0.50e-12		
VJE	0.95		
MJE	0.5		
CJC	0.11e-12		
VJC	0.56		

(1) Gummel-Poon Model

UNITS

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

ADDITIONAL PARAMETERS

Parameters	68533
CCB	0.13e-12
CCE	0.14e-12
LB	0.3e-9
LE	0.8e-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 4.0 GHz
Bias: V_{CE} = 0.5 V to 3 V, I_C = 0.5 mA to 20 mA
Date: 11/98