

DATA SHEET

BFG520; BFG520/X; BFG520/XR NPN 9 GHz wideband transistor

Product specification
File under Discrete Semiconductors, SC14

September 1995

NPN 9 GHz wideband transistor

BFG520; BFG520/X; BFG520/XR

FEATURES

- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability.

DESCRIPTION

NPN silicon planar epitaxial transistors, intended for applications in the RF frontend in the GHz range, such as analog and digital cellular telephones, cordless telephones (CT1, CT2, DECT, etc.), radar detectors, pagers and satellite TV tuners (SATV) and repeater amplifiers in fibre-optic systems.

The transistors are encapsulated in 4-pin, dual-emitter plastic SOT143 and SOT143R envelopes.

PINNING

PIN	DESCRIPTION
BFG520 (Fig.1) Code: N36	
1	collector
2	base
3	emitter
4	emitter
BFG520/X (Fig.1) Code: N42	
1	collector
2	emitter
3	base
4	emitter
BFG520/XR (Fig.2) Code: N48	
1	collector
2	emitter
3	base
4	emitter

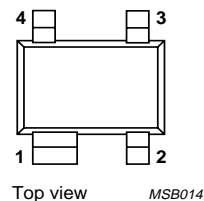


Fig.1 SOT143B.

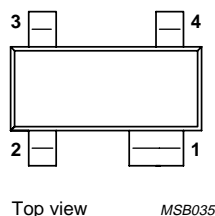


Fig.2 SOT143R.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CB0}	collector-base voltage	open emitter	—	—	20	V
V_{CEO}	collector-emitter voltage	open base	—	—	15	V
I_C	DC collector current		—	—	70	mA
P_{tot}	total power dissipation	up to $T_s = 88\text{ °C}$; note 1	—	—	300	mW
h_{FE}	DC current gain	$I_C = 20\text{ mA}$; $V_{CE} = 6\text{ V}$; $T_j = 25\text{ °C}$	60	120	250	
C_{re}	feedback capacitance	$I_C = 0$; $V_{CB} = 6\text{ V}$; $f = 1\text{ MHz}$	—	0.3	—	pF
f_T	transition frequency	$I_C = 20\text{ mA}$; $V_{CE} = 6\text{ V}$; $f = 1\text{ GHz}$; $T_{amb} = 25\text{ °C}$	—	9	—	GHz
G_{UM}	maximum unilateral power gain	$I_C = 20\text{ mA}$; $V_{CE} = 6\text{ V}$; $f = 900\text{ MHz}$; $T_{amb} = 25\text{ °C}$	—	19	—	dB
		$I_C = 20\text{ mA}$; $V_{CE} = 6\text{ V}$; $f = 2\text{ GHz}$; $T_{amb} = 25\text{ °C}$	—	13	—	dB
$ S_{21} ^2$	insertion power gain	$I_C = 20\text{ mA}$; $V_{CE} = 6\text{ V}$; $f = 900\text{ MHz}$; $T_{amb} = 25\text{ °C}$	17	18	—	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 5\text{ mA}$; $V_{CE} = 6\text{ V}$; $f = 900\text{ MHz}$; $T_{amb} = 25\text{ °C}$	—	1.1	1.6	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 20\text{ mA}$; $V_{CE} = 6\text{ V}$; $f = 900\text{ MHz}$; $T_{amb} = 25\text{ °C}$	—	1.6	2.1	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 5\text{ mA}$; $V_{CE} = 8\text{ V}$; $f = 2\text{ GHz}$; $T_{amb} = 25\text{ °C}$	—	1.9	—	dB

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LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	70	mA
P_{tot}	total power dissipation	up to $T_s = 88\text{ °C}$; note 1	–	300	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j-s}$	thermal resistance from junction to soldering point	up to $T_s = 88\text{ °C}$; note 1	290 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

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CHARACTERISTICS

$T_j = 25\text{ }^{\circ}\text{C}$ unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 6\text{ V}$	–	–	50	nA
h_{FE}	DC current gain	$I_C = 20\text{ mA}$; $V_{CE} = 6\text{ V}$	60	120	250	
C_e	emitter capacitance	$I_C = I_{C0}$; $V_{EB} = 0.5\text{ V}$; $f = 1\text{ MHz}$	–	1	–	pF
C_c	collector capacitance	$I_E = I_{E0}$; $V_{CB} = 6\text{ V}$; $f = 1\text{ MHz}$	–	0.6	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CB} = 6\text{ V}$; $f = 1\text{ MHz}$	–	0.3	–	pF
f_T	transition frequency	$I_C = 20\text{ mA}$; $V_{CE} = 6\text{ V}$; $f = 1\text{ GHz}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	–	9	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 20\text{ mA}$; $V_{CE} = 6\text{ V}$; $f = 900\text{ MHz}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	–	19	–	dB
		$I_C = 20\text{ mA}$; $V_{CE} = 6\text{ V}$; $f = 2\text{ GHz}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	–	13	–	dB
$ S_{21} ^2$	insertion power gain	$I_C = 20\text{ mA}$; $V_{CE} = 6\text{ V}$; $f = 900\text{ MHz}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	17	18	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 5\text{ mA}$; $V_{CE} = 6\text{ V}$; $f = 900\text{ MHz}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	–	1.1	1.6	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 20\text{ mA}$; $V_{CE} = 6\text{ V}$; $f = 900\text{ MHz}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	–	1.6	2.1	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 5\text{ mA}$; $V_{CE} = 6\text{ V}$; $f = 2\text{ GHz}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	–	1.9	–	dB
P_{L1}	output power at 1 dB gain compression	$I_C = 20\text{ mA}$; $V_{CE} = 6\text{ V}$; $R_L = 50\text{ }\Omega$; $f = 900\text{ MHz}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	–	17	–	dBm
ITO	third order intercept point	note 2	–	26	–	dBm
V_o	output voltage	note 3	–	275	–	mV
d_2	second order intermodulation distortion	$I_C = 20\text{ mA}$; $V_{CE} = 6\text{ V}$; $V_o = 75\text{ mV}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$; $f_{(p+q)} = 810\text{ MHz}$	–	–50	–	dB

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and

$$G_{UM} = 10 \log \left(\frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)} \right) \text{ dB.}$$

2. $I_C = 20\text{ mA}$; $V_{CE} = 6\text{ V}$; $R_L = 50\text{ }\Omega$; $f = 900\text{ MHz}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$;
 $f_p = 900\text{ MHz}$; $f_q = 902\text{ MHz}$;
 measured at $f_{(2p-q)} = 898\text{ MHz}$ and $f_{(2q-p)} = 904\text{ MHz}$.
3. $d_{im} = -60\text{ dB}$ (DIN 45004B);
 $V_p = V_o$; $V_q = V_o - 6\text{ dB}$; $V_r = V_o - 6\text{ dB}$;
 $f_p = 795.25\text{ MHz}$; $f_q = 803.25\text{ MHz}$; $f_r = 805.25\text{ MHz}$;
 measured at $f_{(p+q-r)} = 793.25\text{ MHz}$

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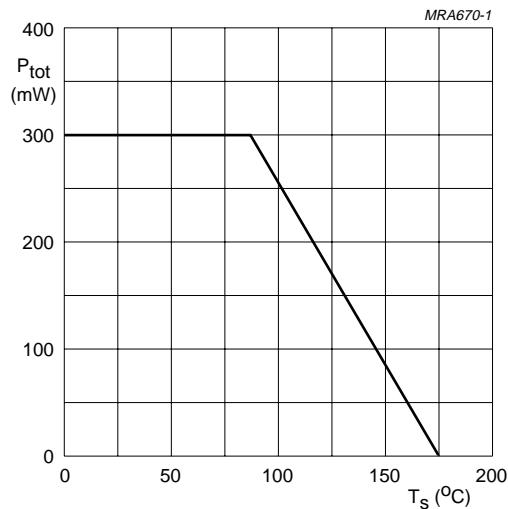
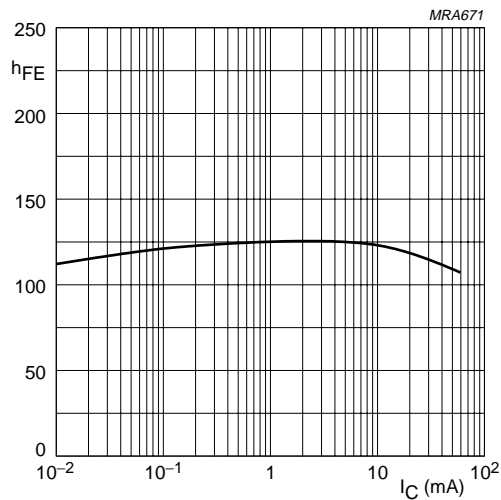
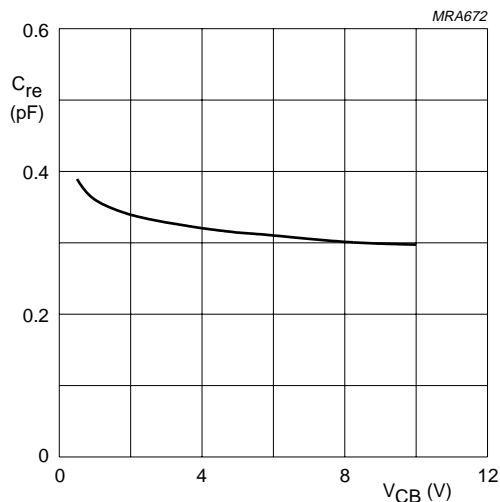


Fig.3 Power derating curve.



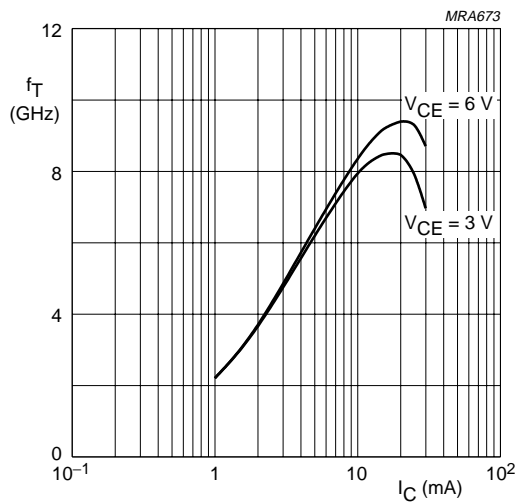
$V_{CE} = 6\text{ V}$; $T_j = 25\text{ °C}$.

Fig.4 DC current gain as a function of collector current.



$I_C = 0$; $f = 1\text{ MHz}$.

Fig.5 Feedback capacitance as a function of collector-base voltage.



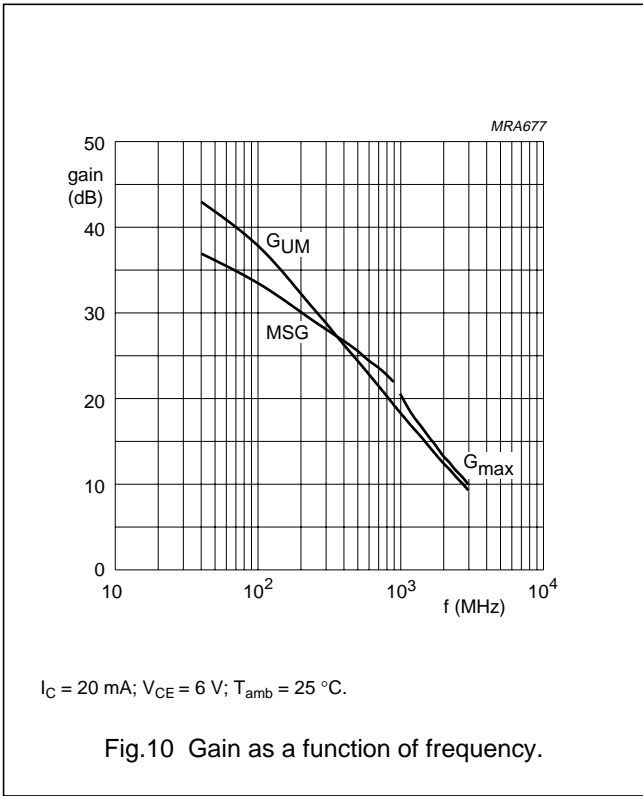
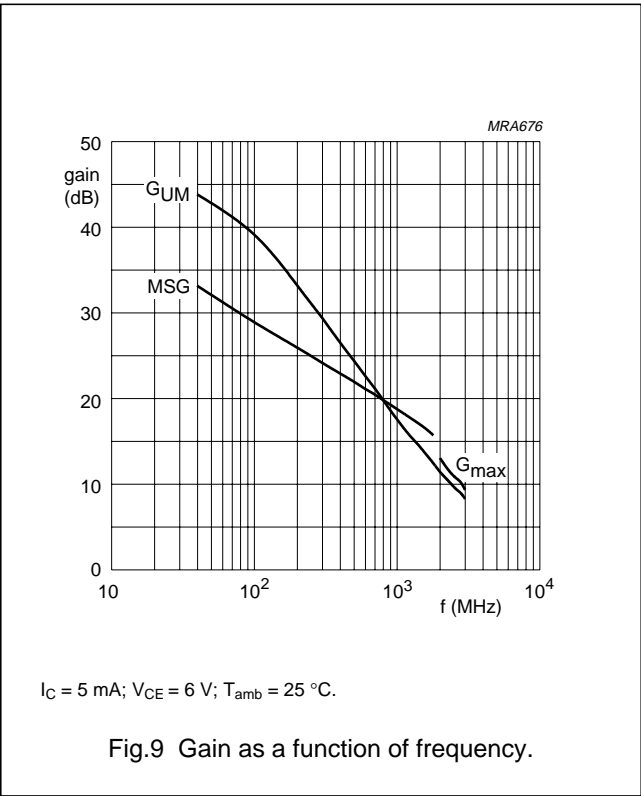
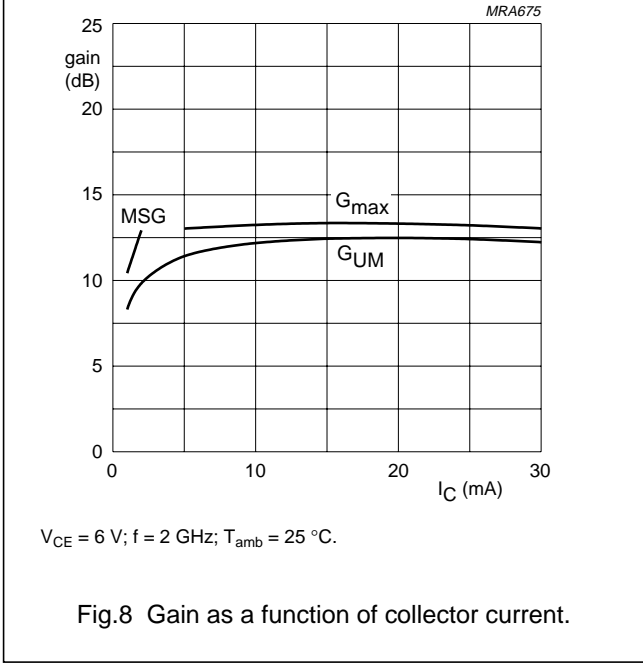
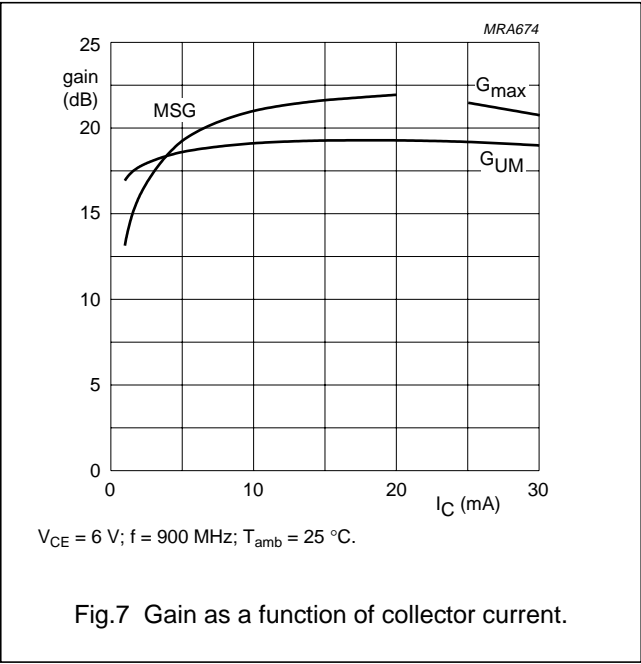
$f = 1\text{ GHz}$; $T_{amb} = 25\text{ °C}$.

Fig.6 Transition frequency as a function of collector current.

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In Figs 7 to 10, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



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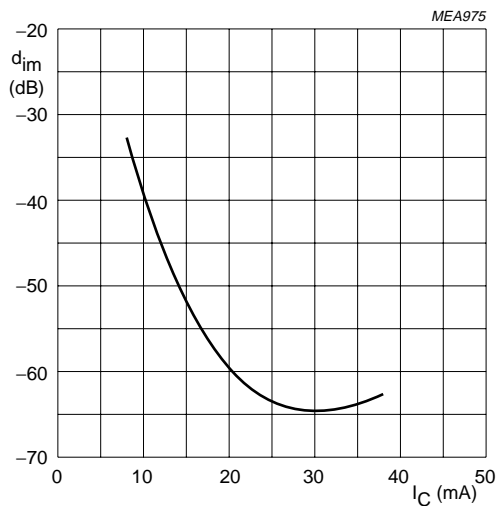


Fig.11 Intermodulation distortion as a function of collector current.

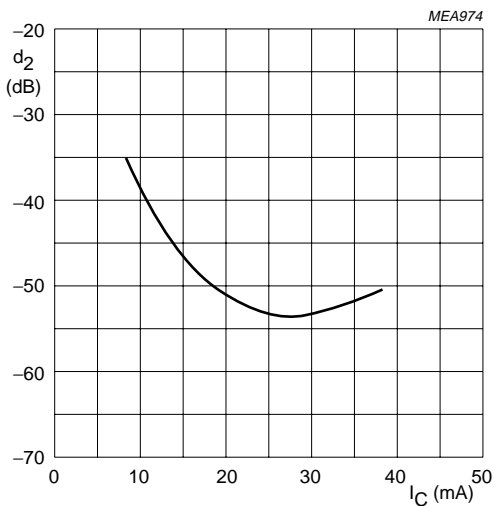
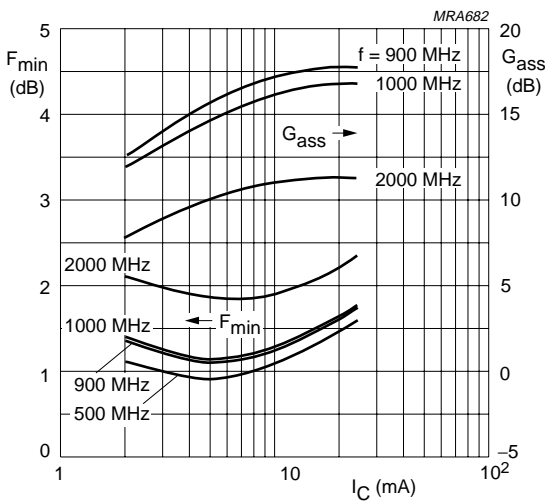
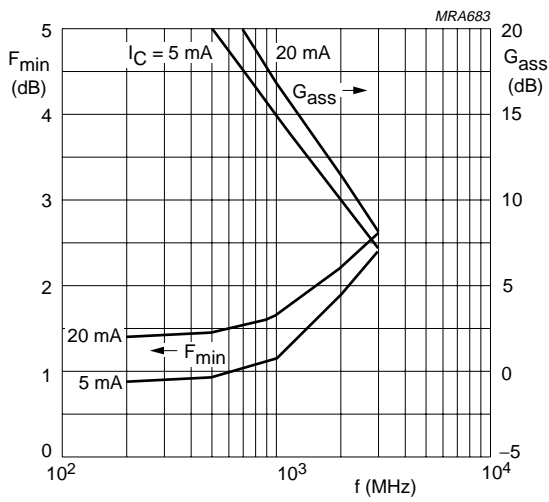


Fig.12 Second order intermodulation distortion as a function of collector current.



$V_{CE} = 6\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$.

Fig.13 Minimum noise figure and associated available gain as functions of collector current.



$V_{CE} = 6\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$.

Fig.14 Minimum noise figure and associated available gain as functions of frequency.

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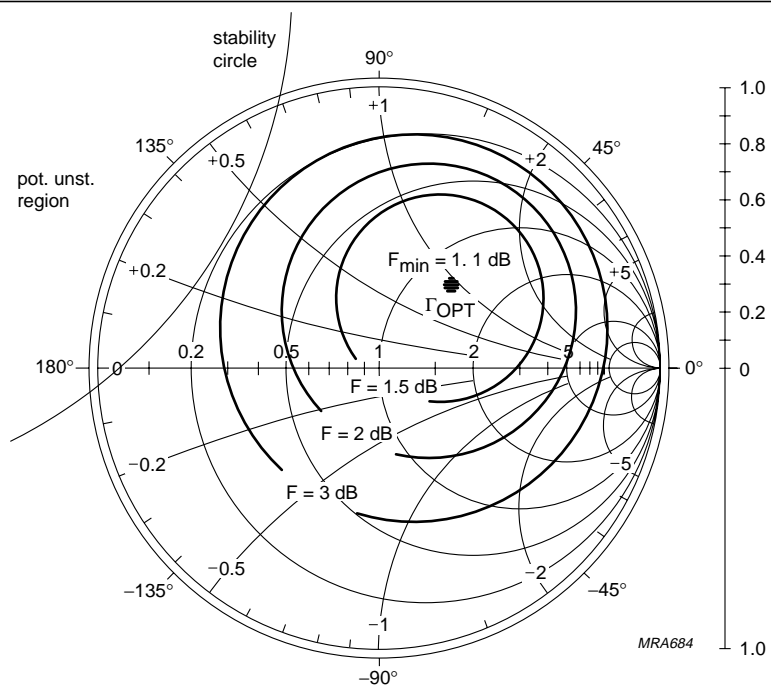


Fig.15 Noise circle figure.

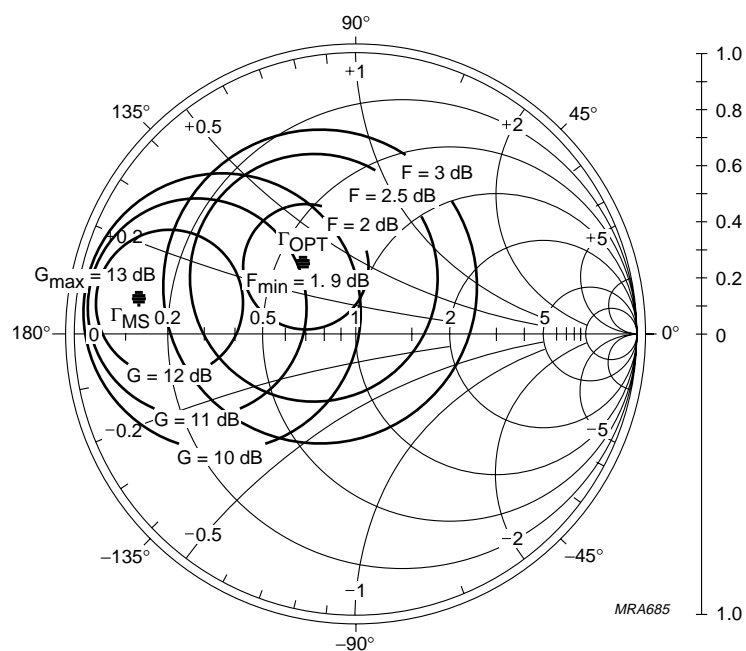
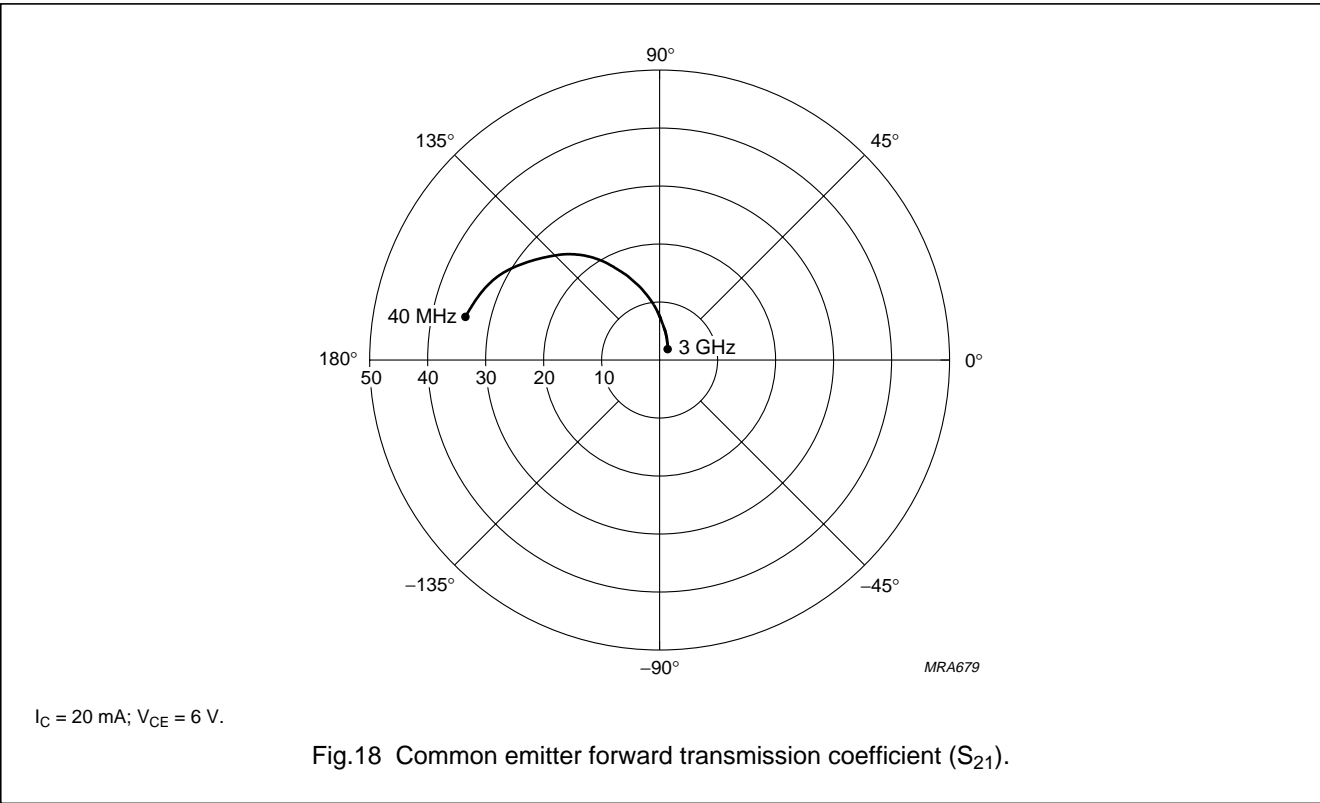
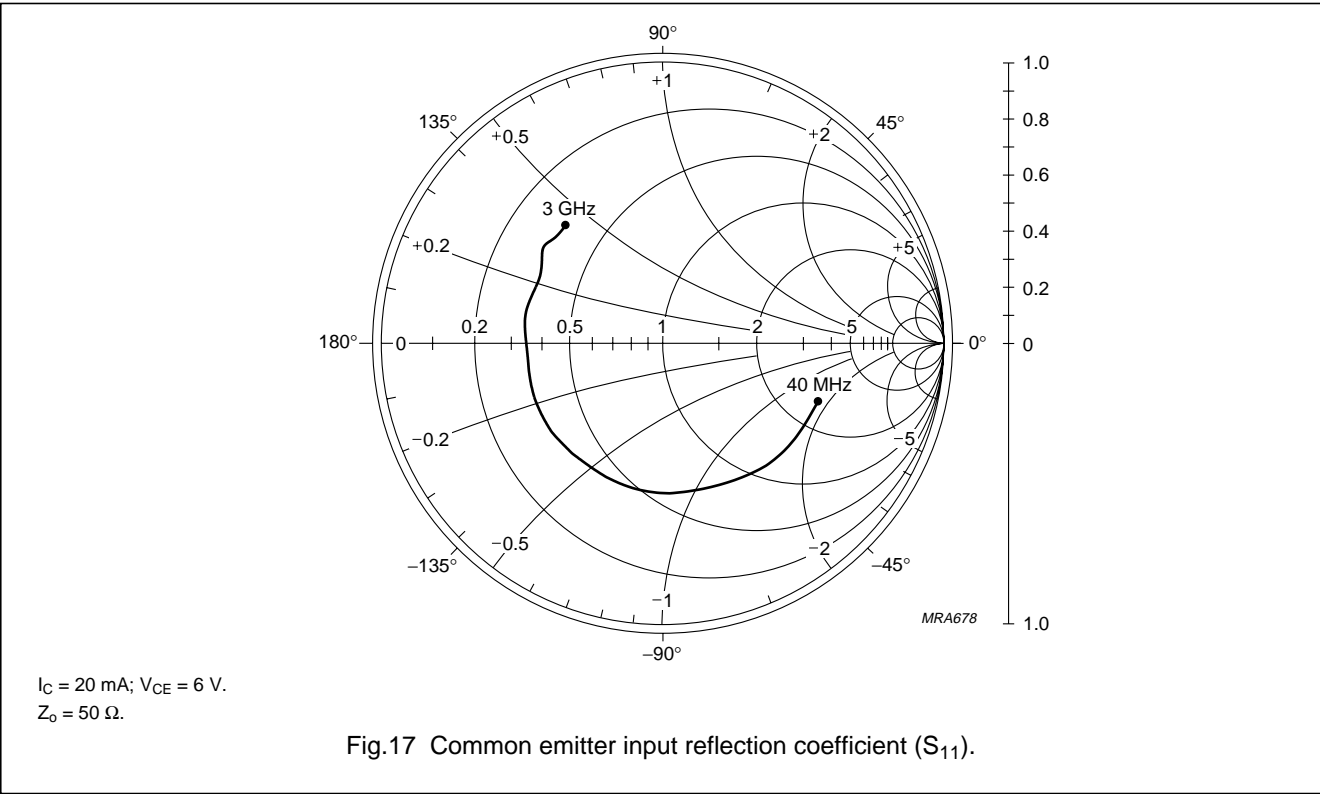


Fig.16 Noise circle figure.

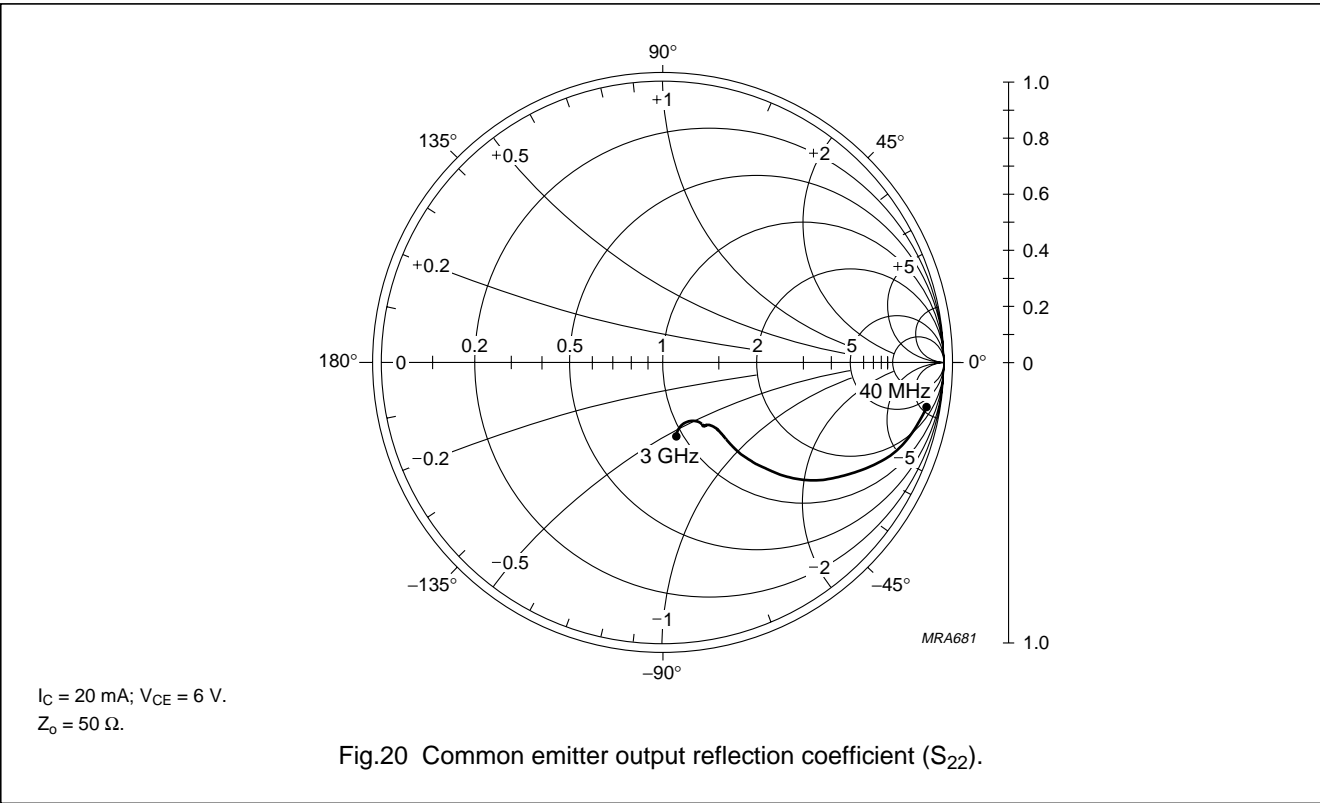
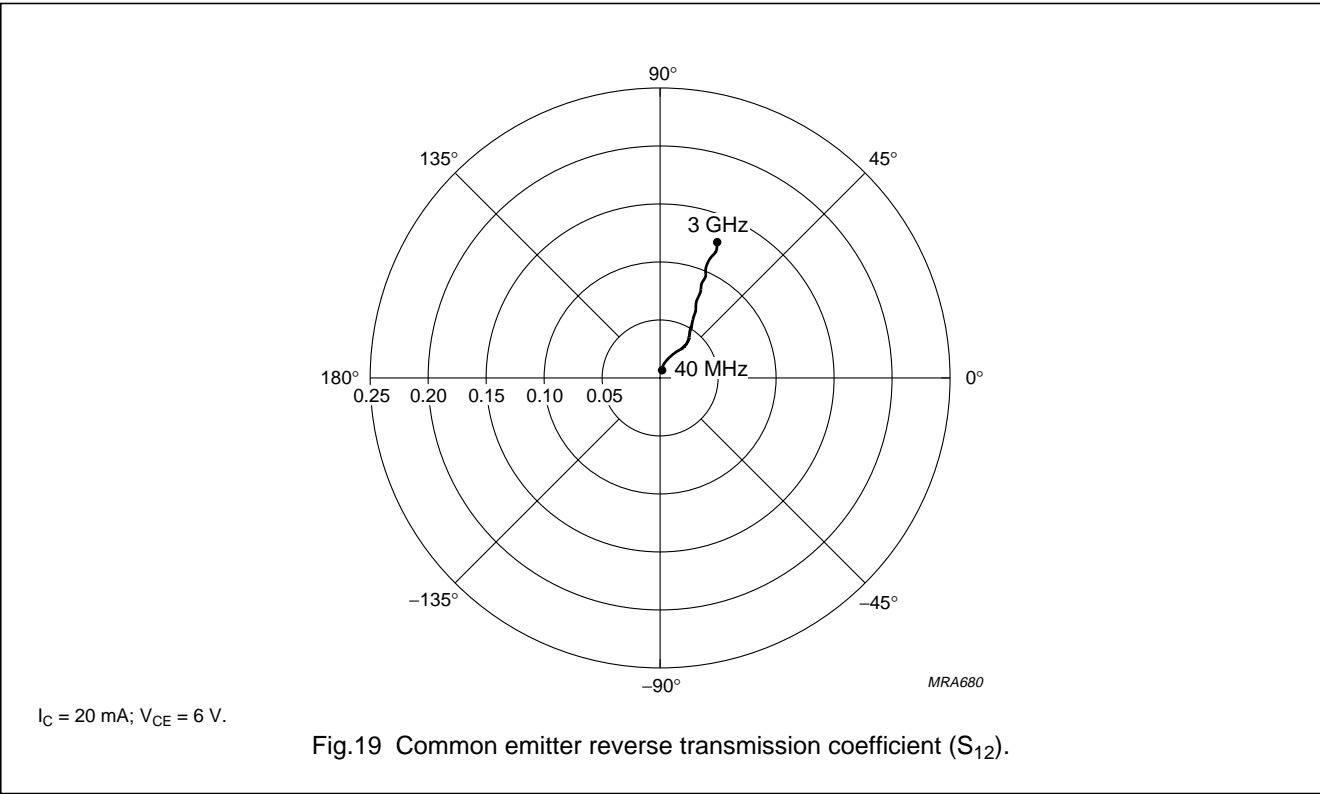
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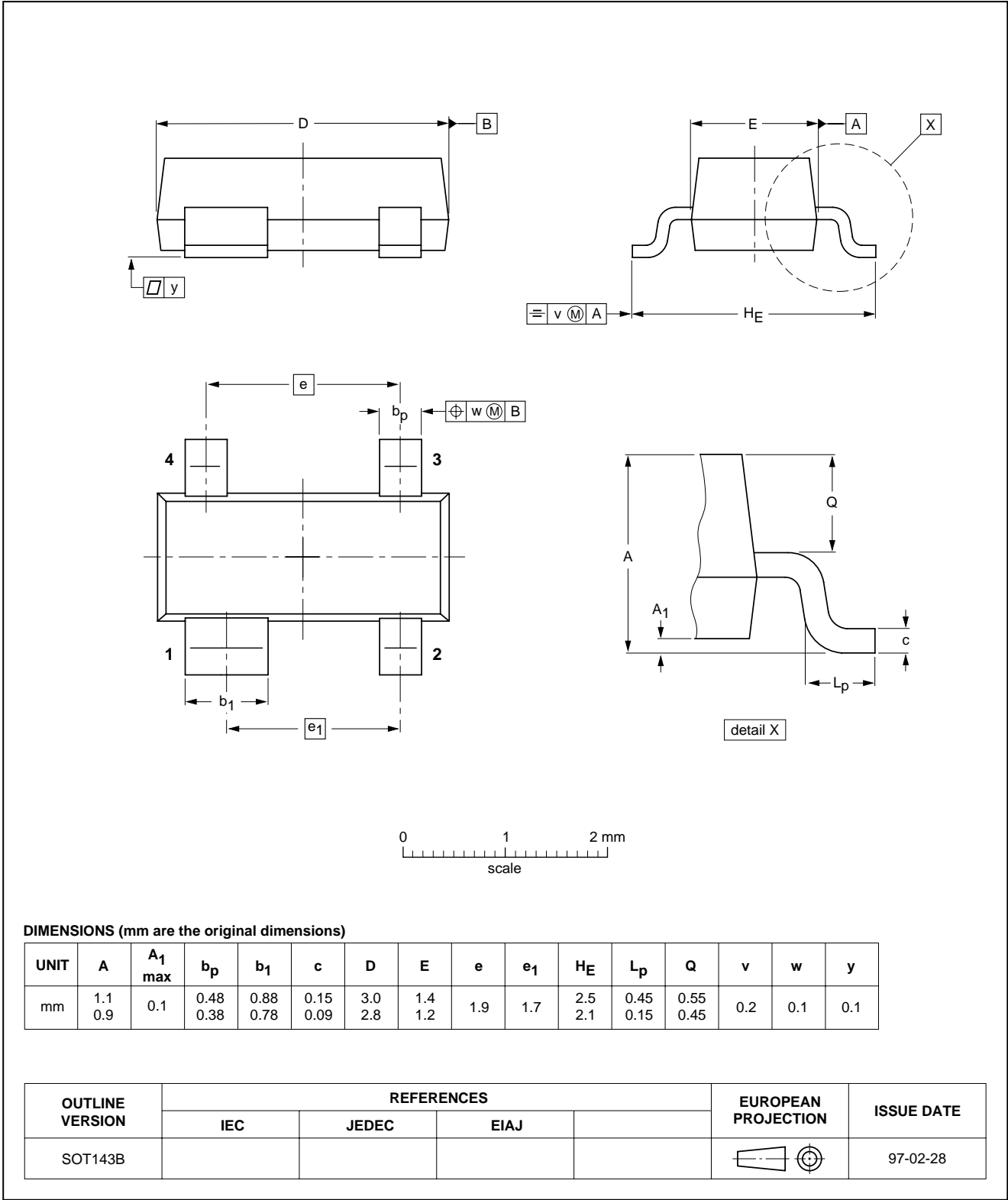
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PACKAGE OUTLINES

Plastic surface mounted package; 4 leads

SOT143B

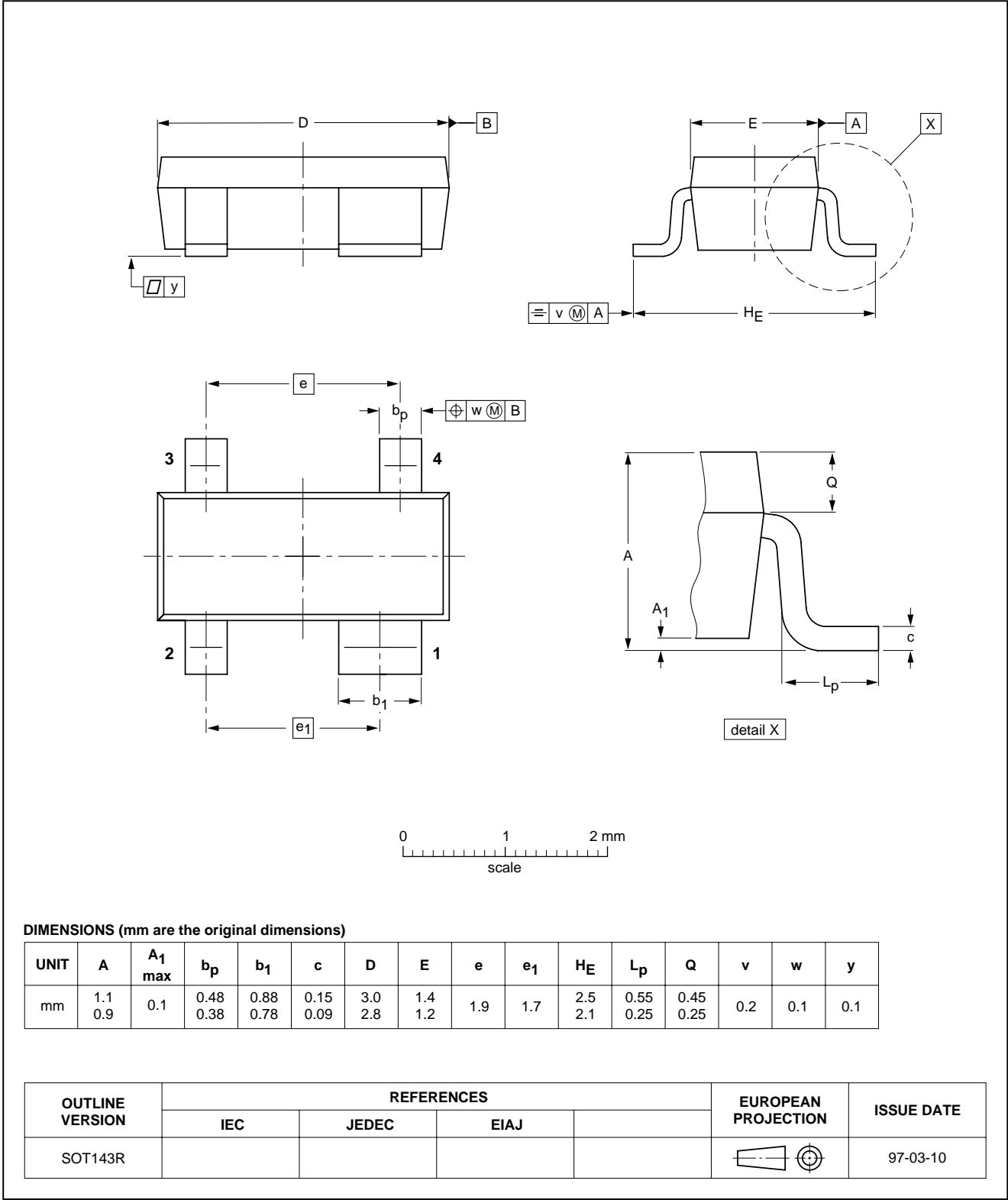


NPN 9 GHz wideband transistor

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Plastic surface mounted package; reverse pinning; 4 leads

SOT143R



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DEFINITIONS

Data Sheet Status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

LIFE SUPPORT APPLICATIONS

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