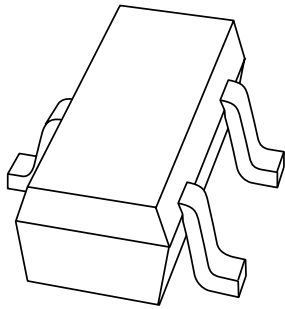


# DATA SHEET



## **BFR93AT** NPN 5 GHz wideband transistor

Product specification  
Supersedes data of 1999 Nov 02

2000 Mar 09

## NPN 5 GHz wideband transistor

## BFR93AT

## FEATURES

- High power gain
- Gold metallization ensures excellent reliability
- SOT416 (SC-75) package.

## APPLICATIONS

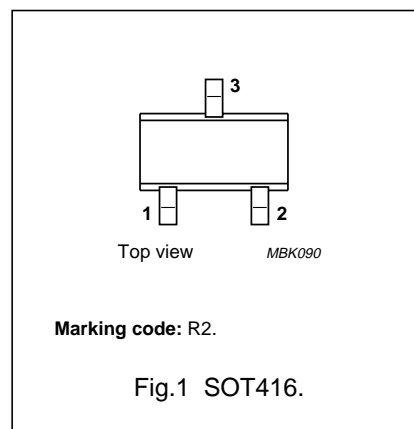
Designed for use in RF amplifiers, mixers and oscillators with signal frequencies up to 1 GHz.

## DESCRIPTION

Silicon NPN transistor encapsulated in a plastic SOT416 (SC-75) package. The BFR93AT uses the same die as the SOT23 version: BFR93A.

## PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector



## QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{CBO}$	collector-base voltage	open emitter	–	–	15	V
$V_{CEO}$	collector-emitter voltage	open base	–	–	12	V
$I_C$	collector current (DC)		–	–	35	mA
$P_{tot}$	total power dissipation	$T_s \leq 75\text{ }^\circ\text{C}$ ; note 1	–	–	150	mW
$h_{FE}$	DC current gain	$I_C = 30\text{ mA}$ ; $V_{CE} = 5\text{ V}$	40	90	–	
$C_{re}$	feedback capacitance	$I_C = 0$ ; $V_{CE} = 5\text{ V}$ ; $f = 1\text{ MHz}$ ; $T_{amb} = 25\text{ }^\circ\text{C}$	–	0.6	–	pF
$f_T$	transition frequency	$I_C = 30\text{ mA}$ ; $V_{CE} = 5\text{ V}$ ; $f = 500\text{ MHz}$	4	5	–	GHz
$G_{UM}$	maximum unilateral power gain	$I_C = 30\text{ mA}$ ; $V_{CE} = 8\text{ V}$ ; $T_{amb} = 25\text{ }^\circ\text{C}$ ; $f = 1\text{ GHz}$ $f = 2\text{ GHz}$	–	13 8	–	dB dB
F	noise figure	$I_C = 5\text{ mA}$ ; $V_{CE} = 8\text{ V}$ ; $f = 1\text{ GHz}$ ; $\Gamma_s = \Gamma_{opt}$	–	1.5	–	dB
$T_j$	junction temperature		–	–	150	$^\circ\text{C}$

## Note

1.  $T_s$  is the temperature at the soldering point of the collector pin.

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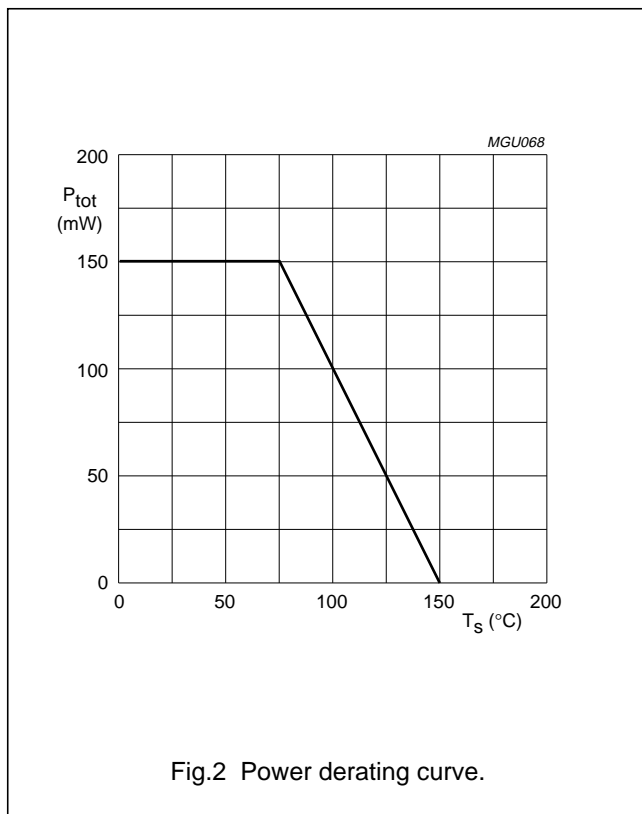
**LIMITING VALUES**

In accordance with the Absolute Maximum Rating System (IEC 60134).

SYMBOL	PARAMETER	CONDITION	MIN.	MAX.	UNIT
$V_{CBO}$	collector-base voltage	open emitter	-	15	V
$V_{CEO}$	collector-emitter voltage	open base	-	12	V
$V_{EBO}$	emitter-base voltage	open collector	-	2	V
$I_C$	DC collector current		-	35	mA
$P_{tot}$	total power dissipation	$T_s \leq 75\text{ }^\circ\text{C}$ ; see Fig.2	-	150	mW
$T_{stg}$	storage temperature		-65	+150	$^\circ\text{C}$
$T_j$	junction temperature		-	150	$^\circ\text{C}$

**THERMAL CHARACTERISTICS**

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j-s}$	thermal resistance from junction to soldering point	500	K/W



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**CHARACTERISTICS**

$T_j = 25\text{ °C}$ ; unless otherwise specified.

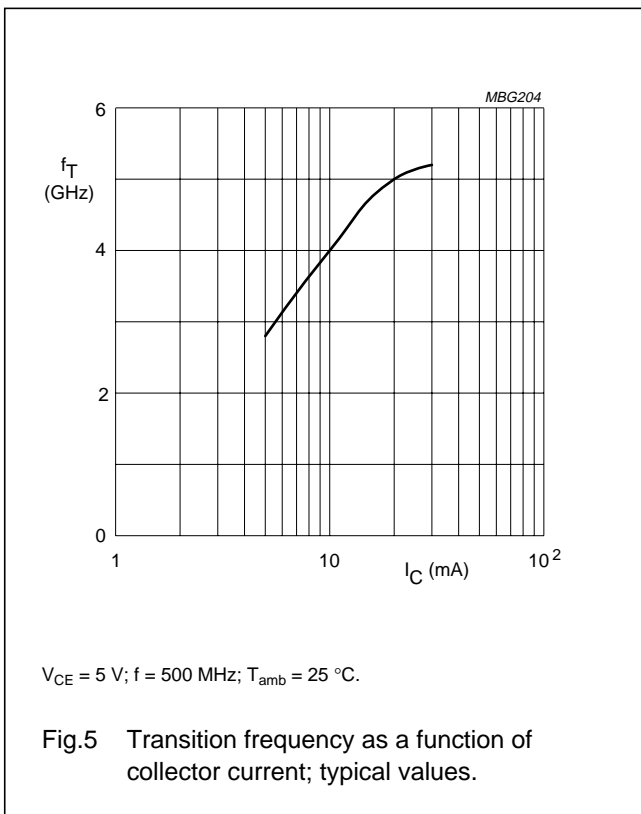
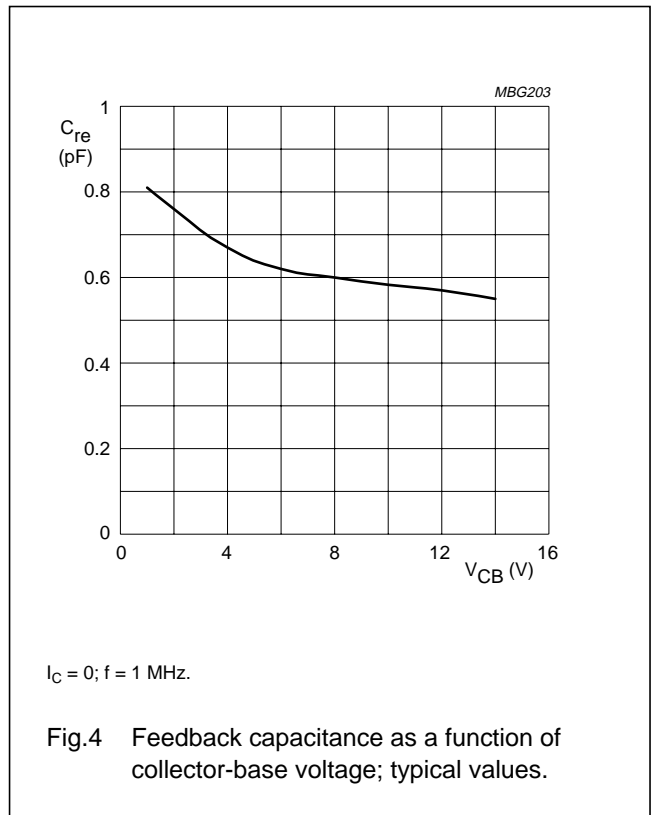
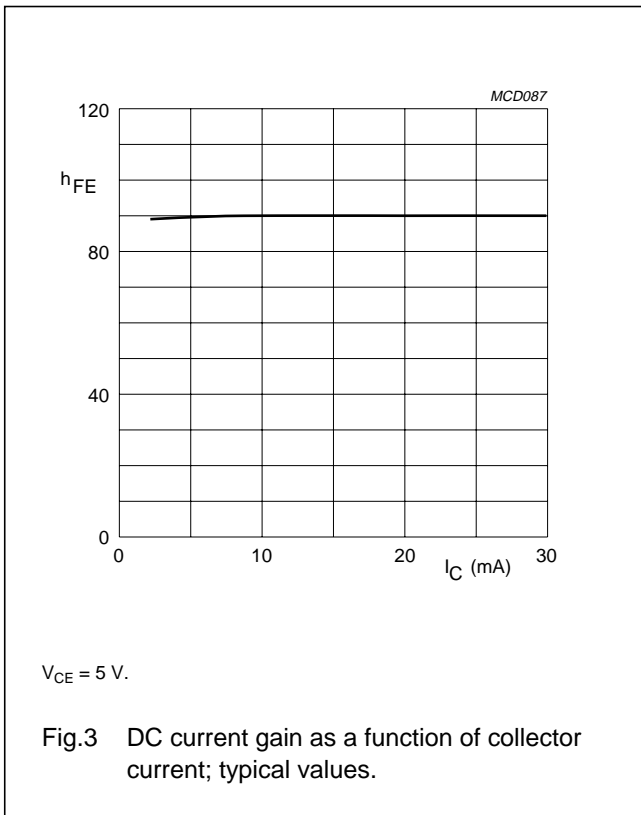
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$I_{CBO}$	collector cut-off current	$I_E = 0; V_{CB} = 5\text{ V}$	–	–	50	nA
$h_{FE}$	DC current gain	$I_C = 30\text{ mA}; V_{CE} = 5\text{ V}$	40	90	–	
$C_c$	collector capacitance	$I_E = I_e = 0; V_{CB} = 5\text{ V}; f = 1\text{ MHz}$	–	0.7	–	pF
$C_e$	emitter capacitance	$I_C = I_c = 0; V_{EB} = 0.5\text{ V}; f = 1\text{ MHz}$	–	2.3	–	pF
$C_{re}$	feedback capacitance	$I_C = 0; V_{CE} = 5\text{ V}; f = 1\text{ MHz}$	–	0.6	–	pF
$f_T$	transition frequency	$I_C = 30\text{ mA}; V_{CE} = 5\text{ V}; f = 500\text{ MHz}$	4	5	–	GHz
$G_{UM}$	maximum unilateral power gain	$I_C = 30\text{ mA}; V_{CE} = 8\text{ V}; T_{amb} = 25\text{ °C}$ ; note 1; $f = 1\text{ GHz}$ $f = 2\text{ GHz}$	– –	13 8	– –	dB dB
F	noise figure	$I_C = 5\text{ mA}; V_{CE} = 8\text{ V}; \Gamma_s = \Gamma_{opt}$ ; $f = 1\text{ GHz}$ $f = 2\text{ GHz}$	– –	1.5 2.1	– –	dB dB

**Note**

1.  $G_{UM}$  is the maximum unilateral power gain, assuming  $s_{12}$  is zero and  $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$  dB

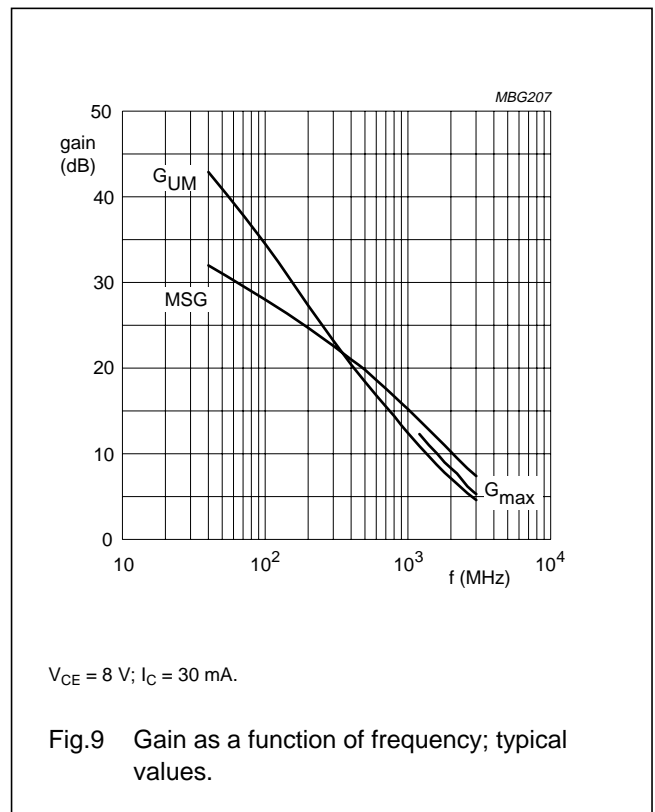
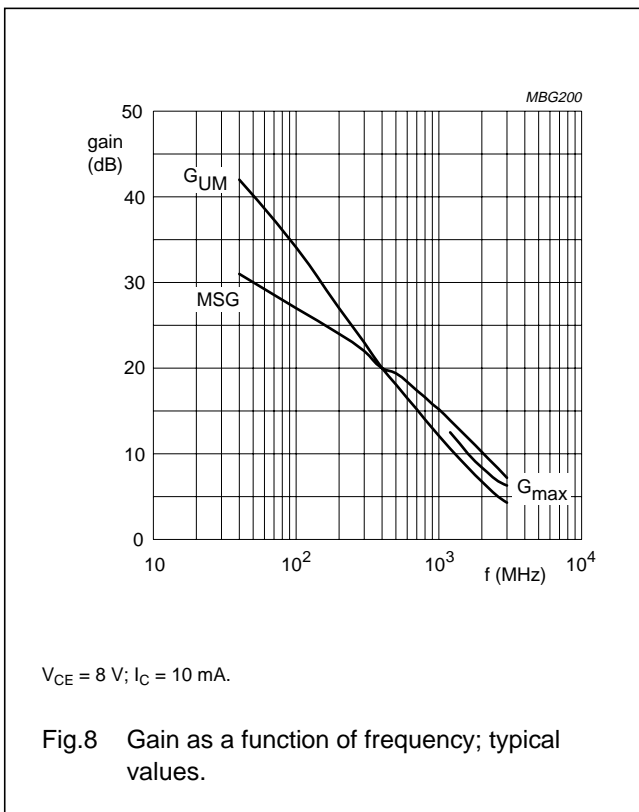
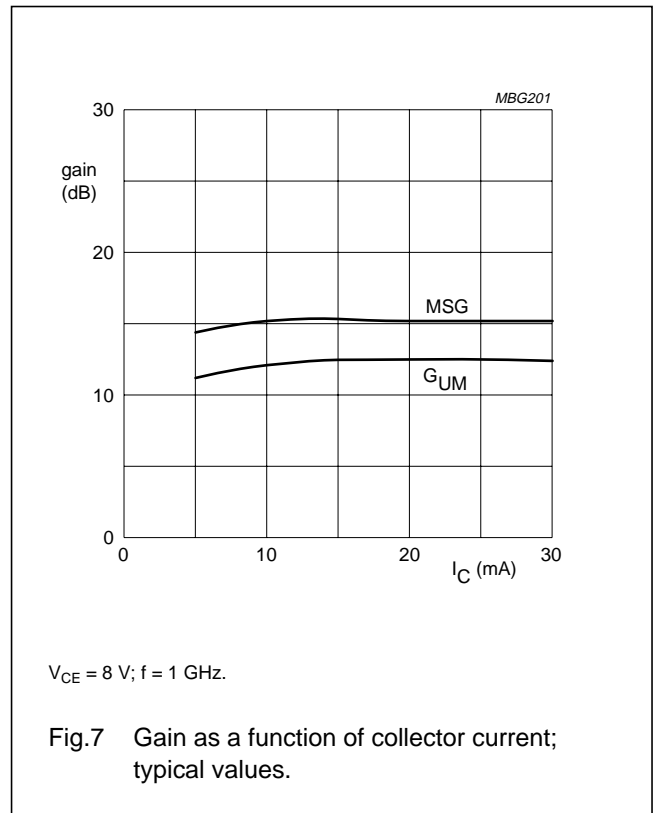
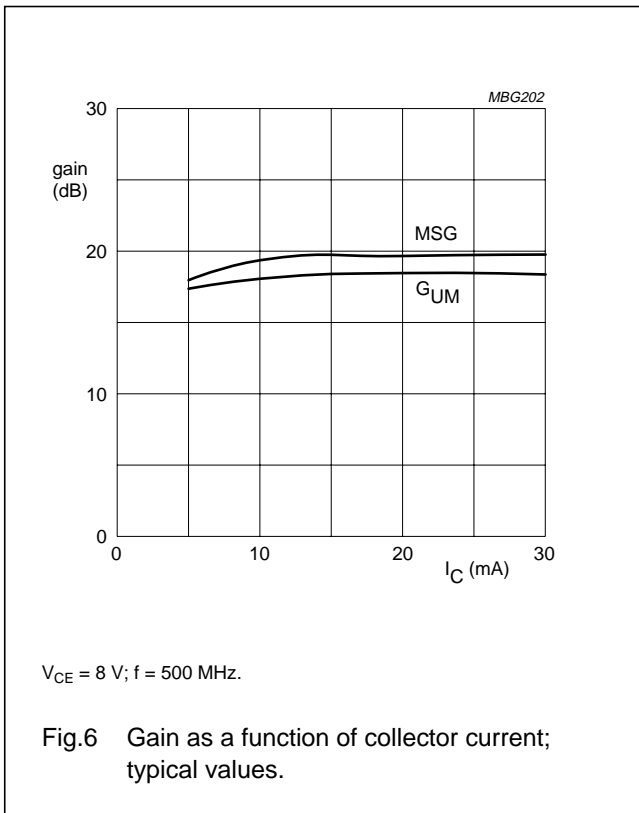
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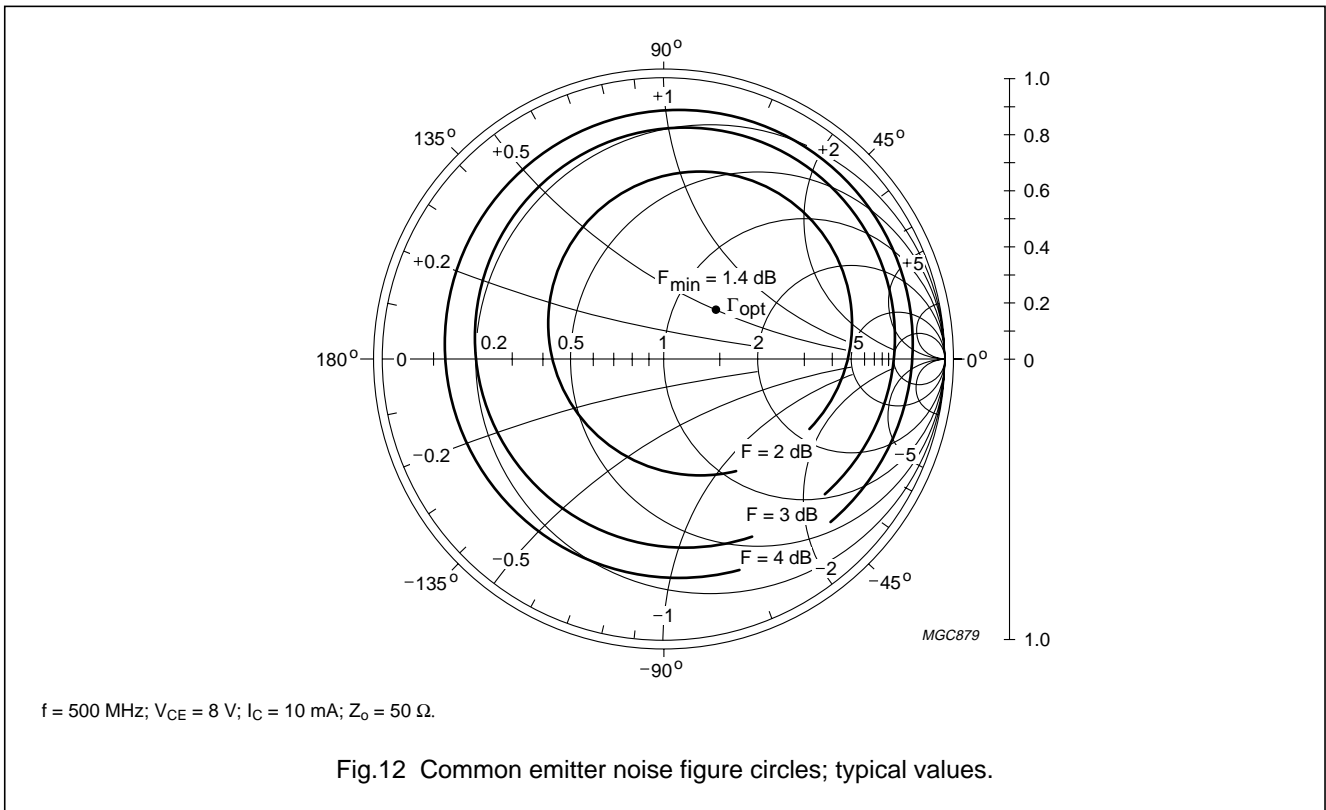
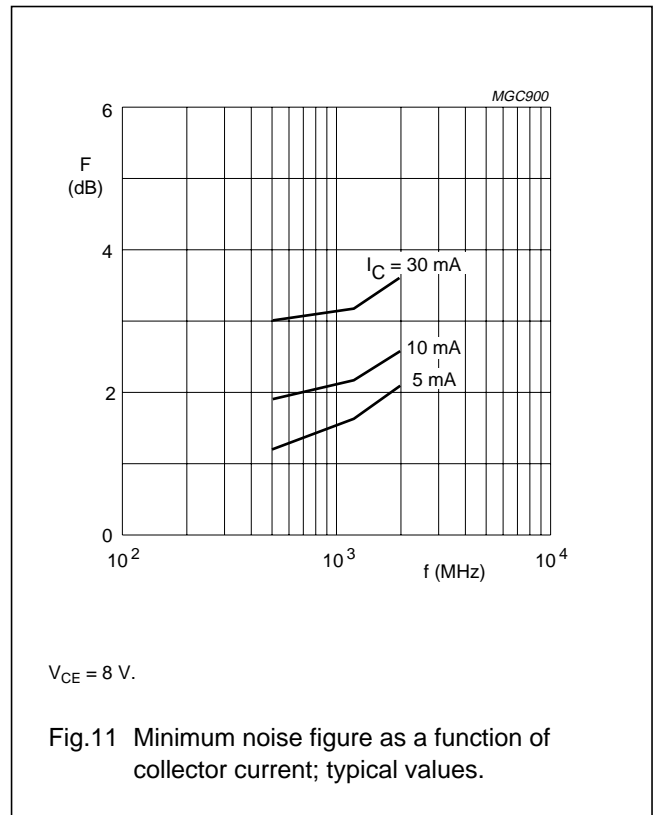
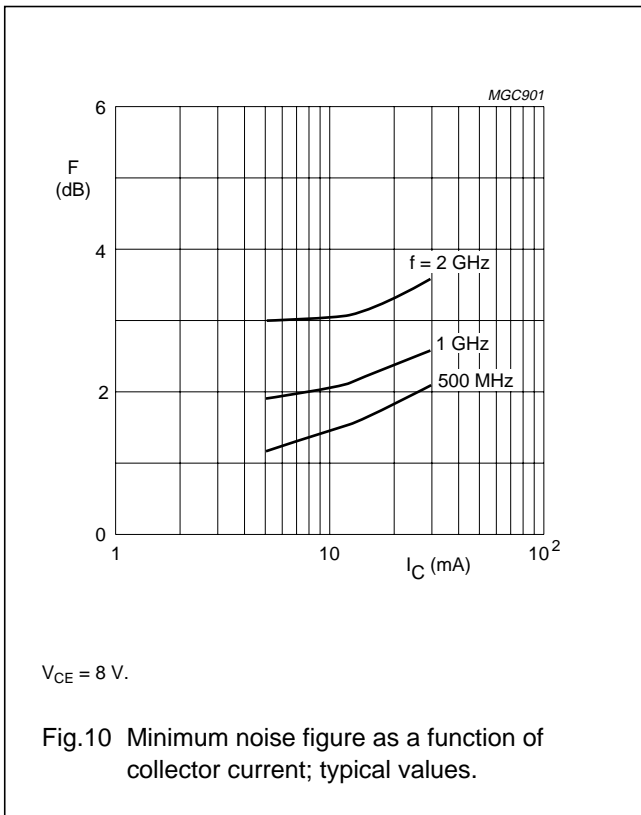
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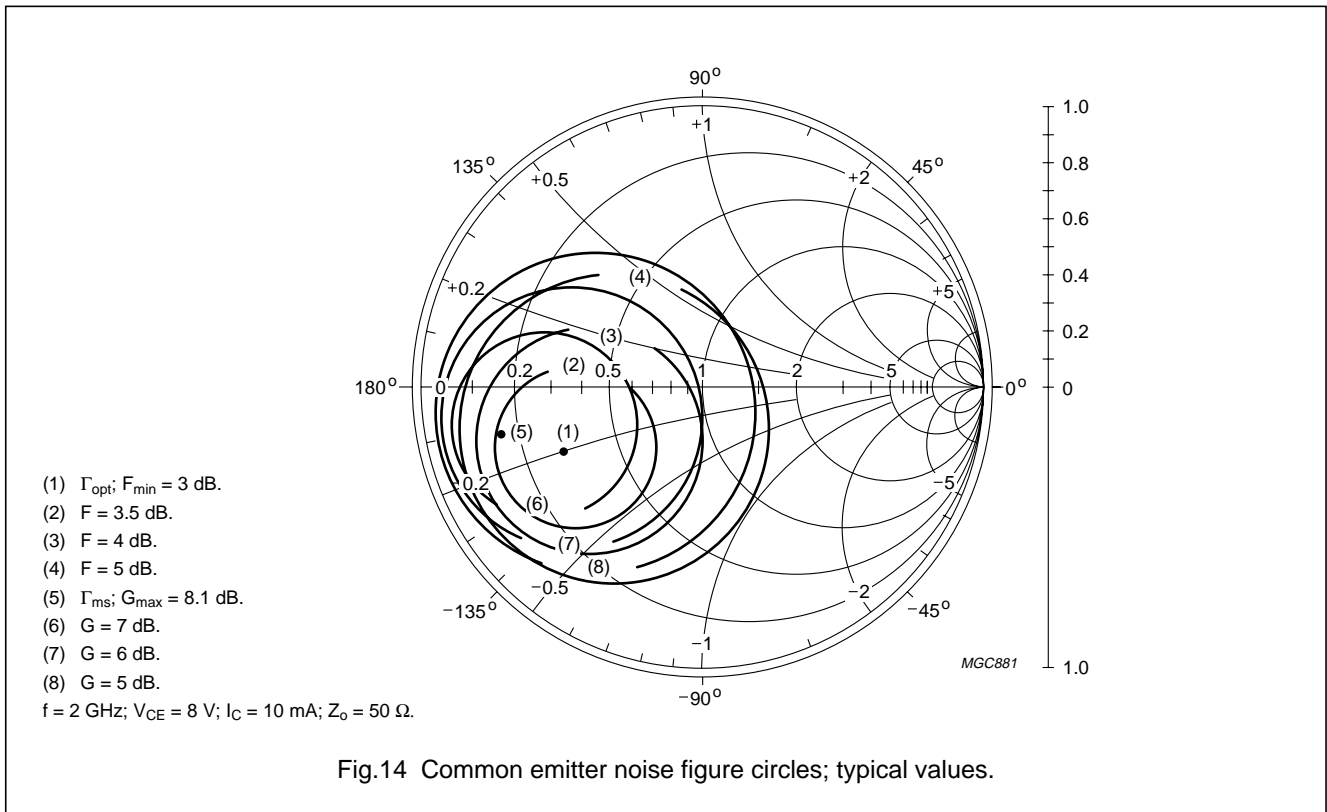
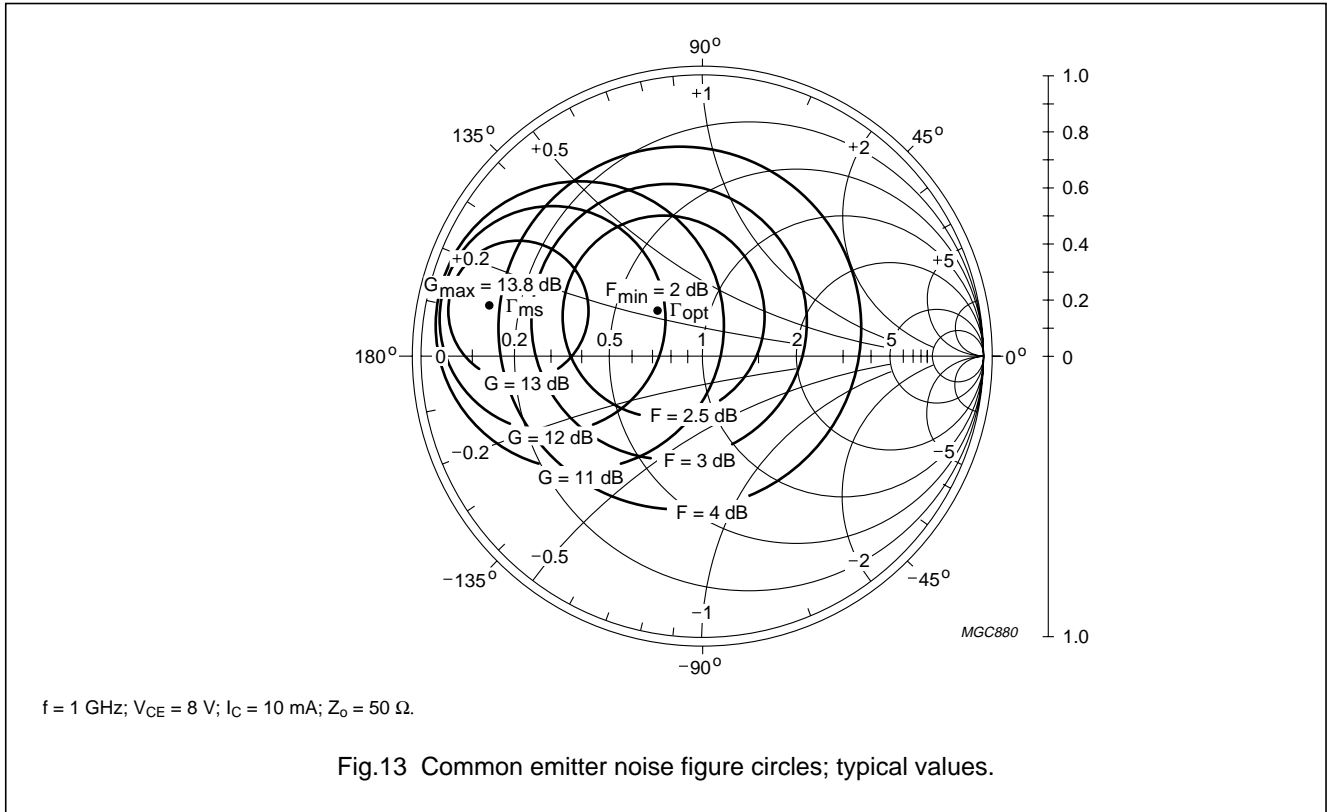
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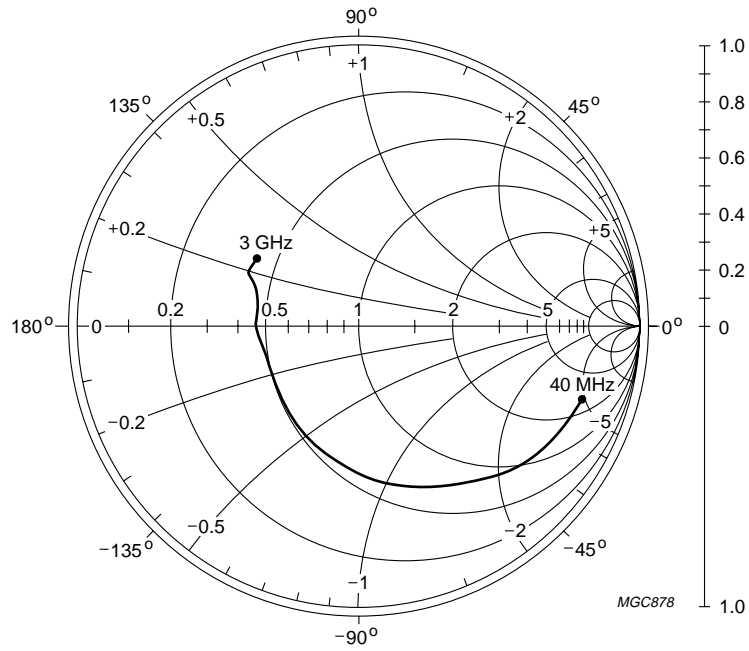
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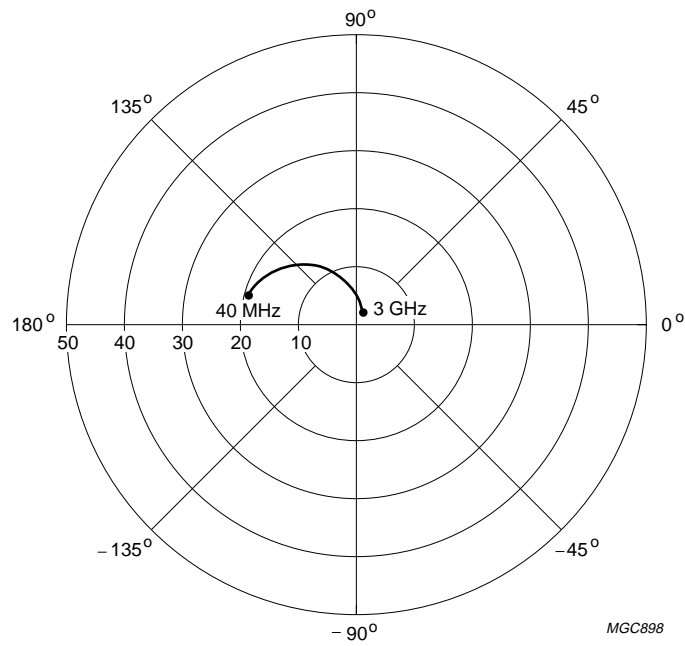
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$V_{CE} = 8\text{ V}; I_C = 30\text{ mA}; Z_0 = 50\ \Omega.$

Fig.15 Common emitter input reflection coefficient ( $S_{11}$ ); typical values.

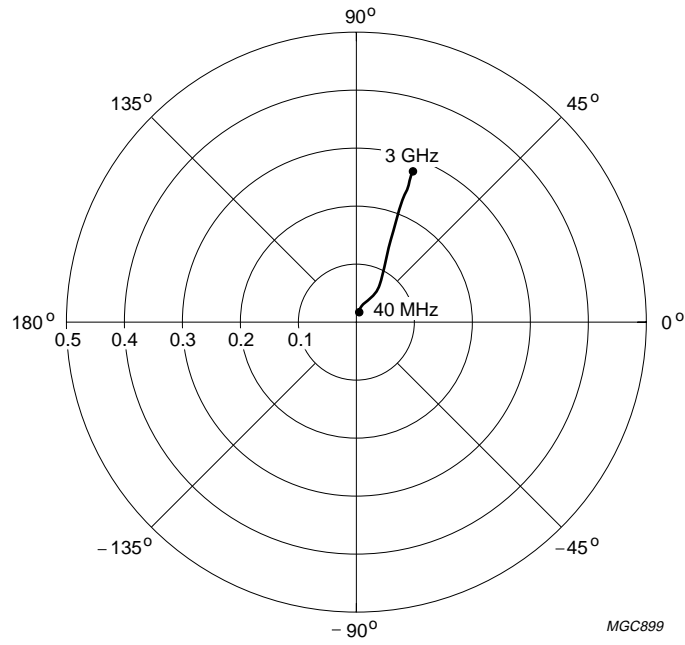


$V_{CE} = 8\text{ V}; I_C = 30\text{ mA}.$

Fig.16 Common emitter forward transmission coefficient ( $S_{21}$ ); typical values.

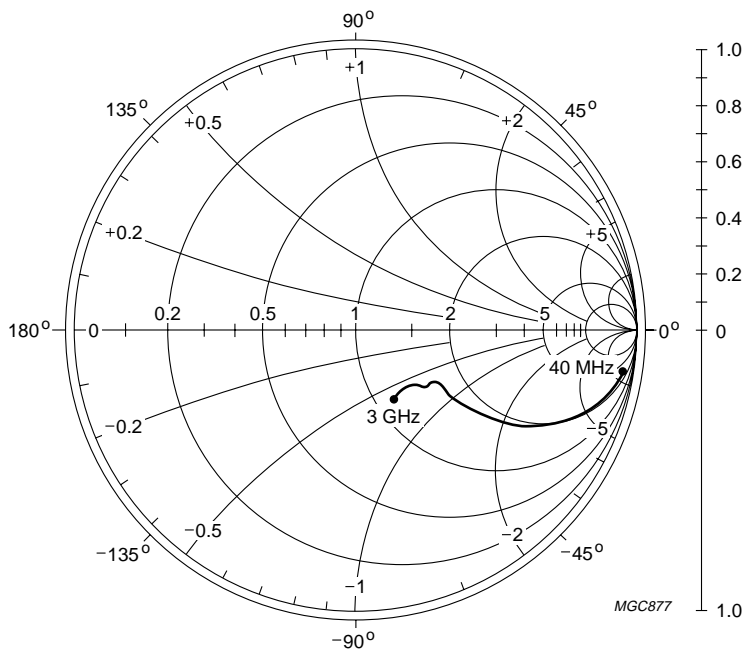
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$V_{CE} = 8\text{ V}; I_C = 30\text{ mA}$ .

Fig.17 Common emitter reverse transmission coefficient ( $S_{12}$ ); typical values.



$V_{CE} = 8\text{ V}; I_C = 30\text{ mA}; Z_0 = 50\ \Omega$ .

Fig.18 Common emitter output reflection coefficient ( $S_{22}$ ); typical values.

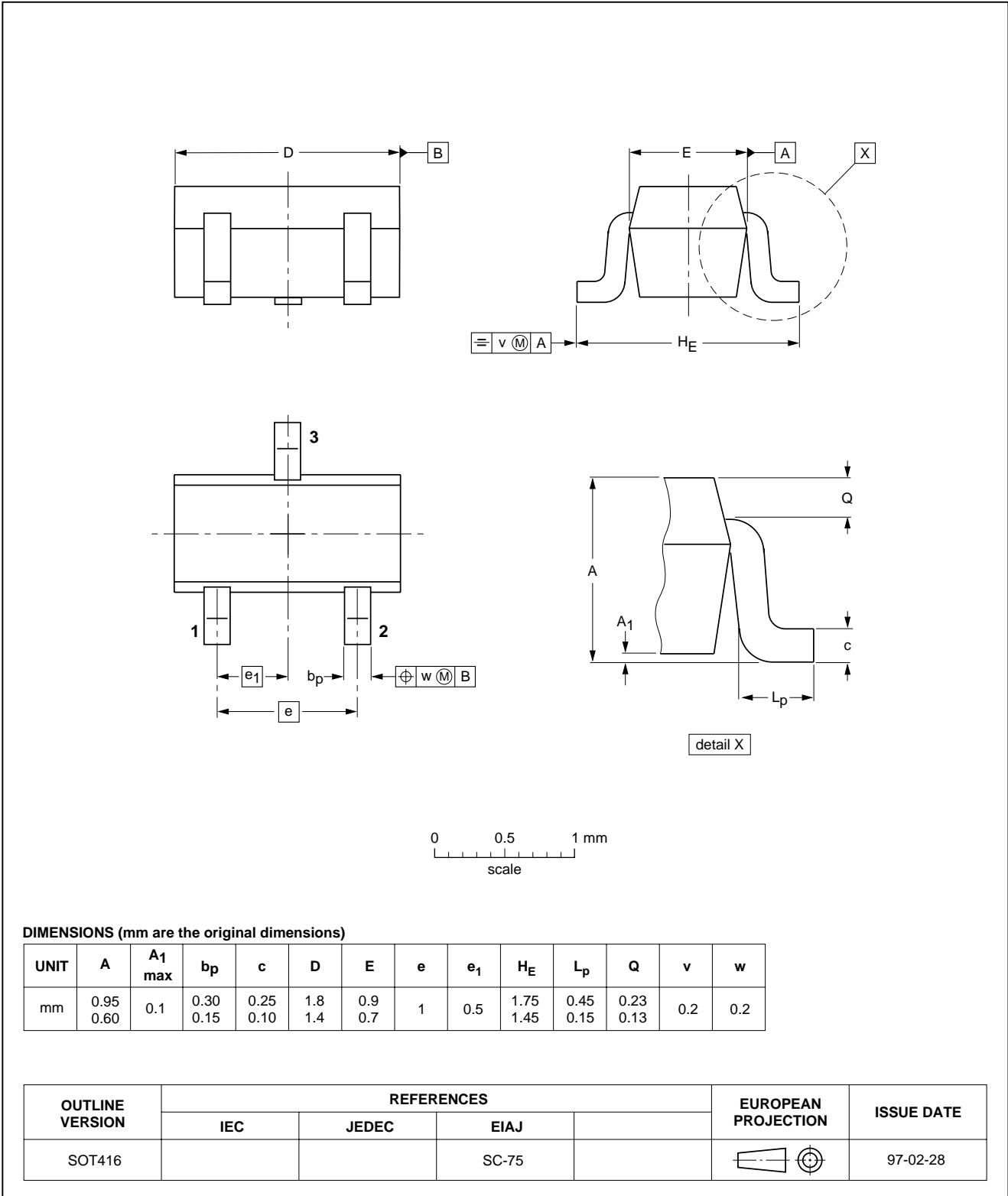
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PACKAGE OUTLINE

Plastic surface mounted package; 3 leads

SOT416



## NPN 5 GHz wideband transistor

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**DEFINITIONS**

<b>Data sheet status</b>	
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.
<b>Limiting values</b>	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). 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.	
<b>Application information</b>	
Where application information is given, it is advisory and does not form part of the specification.	

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**NOTES**

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