DATA SHEET

BLT71
UHF power transistor

Product specification

1995 Aug 17

Philips
Semiconductors

PHILIPS

UHF power transistor BLT71

FEATURES

- Very high efficiency
- Low supply voltage.

APPLICATIONS

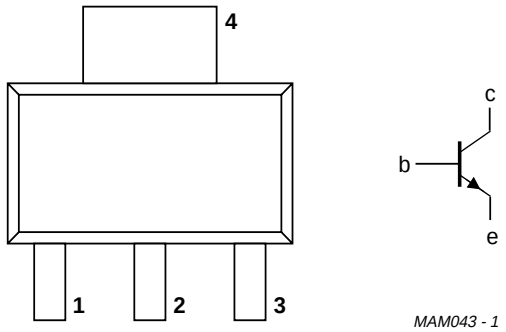
- Hand-held radio equipment in common emitter class-AB operation in the 900 MHz communications band.

DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a SOT223 envelope.

PINNING - SOT223

PIN	SYMBOL	DESCRIPTION
1	e	emitter
2	b	base
3	e	emitter
4	c	collector



Top view

Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

RF performance at $T_s \leq 60$ °C in a common emitter test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_C (%)
CW, class-AB	900	4.8	1.2	≥6	≥60

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	16	V
V_{CEO}	collector-emitter voltage	open base	–	8	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	collector current (DC)		–	500	mA
P_{tot}	total power dissipation	up to T_s = 90 °C	–	3.5	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	175	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	P_{tot} = 3.5 W; up to T_s = 90 °C; note 1	24	K/W

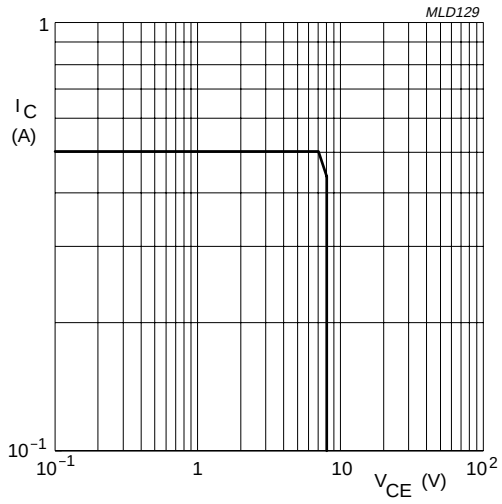
Note

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

CHARACTERISTICS

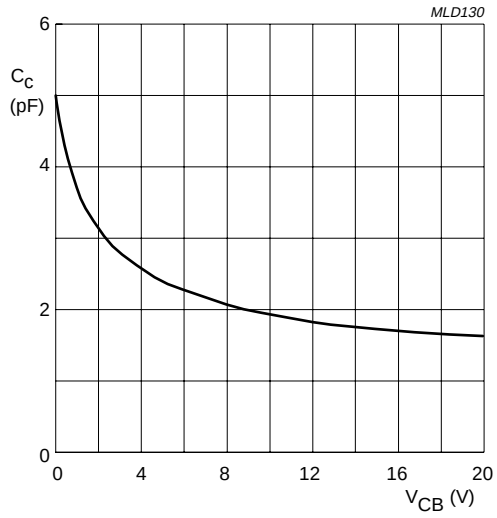
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 0.5 mA	16	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 10 mA	8	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 0.1 mA	2.5	–	–	V
I_{CES}	collector leakage current	V_{CE} = 8 V; V_{BE} = 0	–	–	100	µA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 100 mA	25	–	–	
C_c	collector capacitance	V_{CB} = 4.8 V; I_E = i_e = 0; f = 1 MHz	–	–	7	pF
C_{re}	feedback capacitance	V_{CE} = 4.8 V; I_C = 0; f = 1 MHz	–	–	5	pF



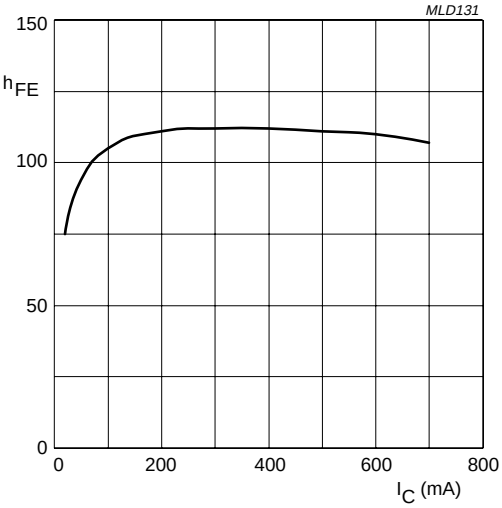
T_s = 90 °C.

Fig.2 DC SOAR.



$I_E = i_e = 0$; f = 1 MHz.

Fig.3 Collector capacitance as a function of collector-base voltage; typical values.



Measured under pulsed conditions: $t_p \leq 300$ μs; $\delta \leq 0.01$.
V_{CE} = 4.8 V.

Fig.4 DC current gain as a function of collector current; typical values.

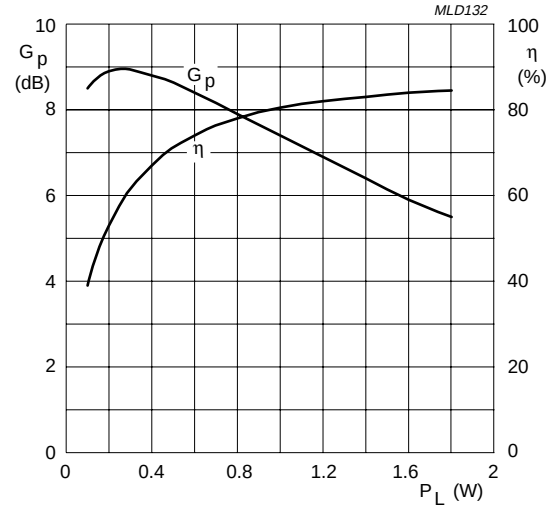
APPLICATION INFORMATION

RF performance at $T_s \leq 60$ °C in a common emitter test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (W)	G_p (dB)	η_C (%)
CW, class-AB	900	4.8	1	1.2	≥6	≥60

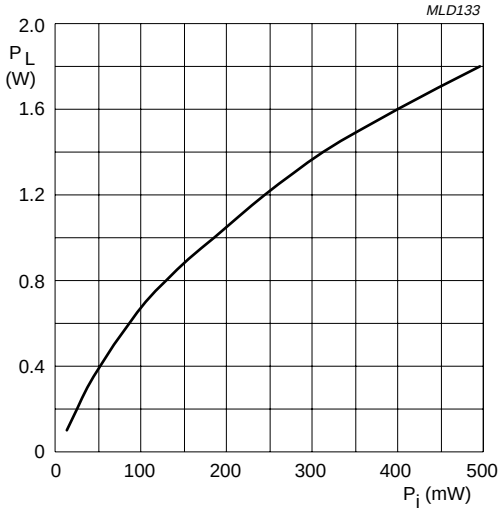
Ruggedness in class-AB operation

The BLT71 is capable of withstanding a load mismatch corresponding to VSWR = 6 : 1 through all phases under the following conditions: P_L = 1.2 W; V_{CE} = 6.5 V; f = 900 MHz.



V_{CE} = 4.8 V.
I_{CQ} = 1 mA.
f = 900 MHz.

Fig.5 Power gain and efficiency as functions of load power; typical values.



V_{CE} = 4.8 V.
I_{CQ} = 1 mA.
f = 900 MHz.

Fig.6 Load power as a function of input power; typical values.

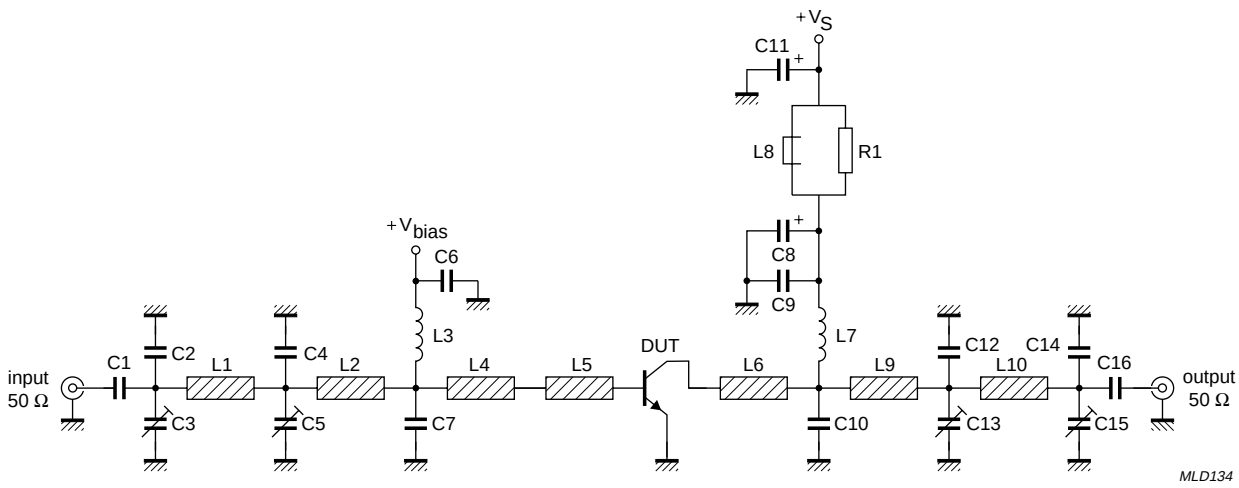


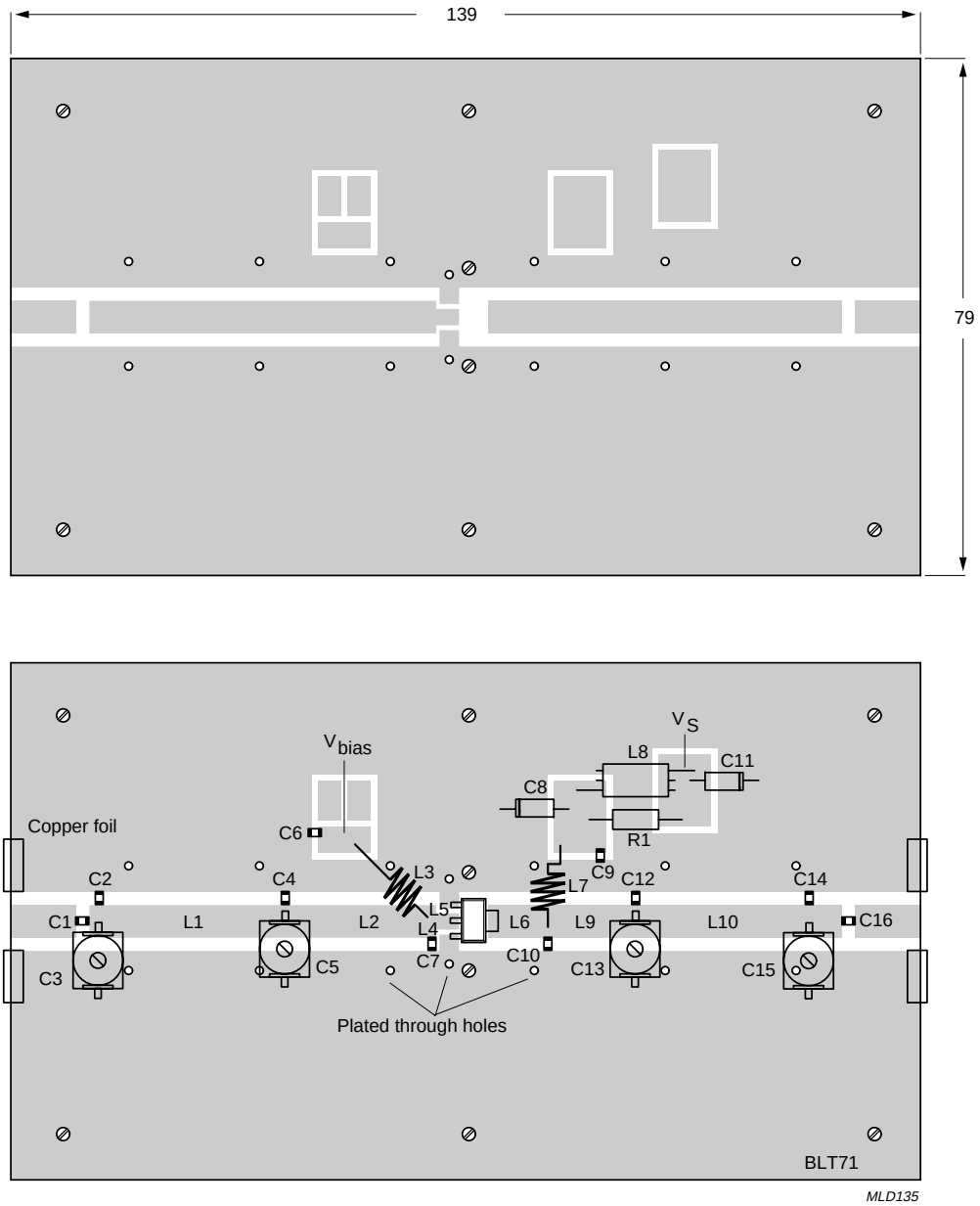
Fig.7 Class-AB test circuit at 900 MHz.

List of components (see Figs 7 and 8)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE No.
C1, C6, C9, C16	multilayer ceramic chip capacitor; note 1	100 pF		
C2, C4, C12, C14	multilayer ceramic chip capacitor; note 1	1 pF		
C3, C5, C13, C15	film dielectric trimmer	1.4 to 5.5 pF		2222 809 09004
C7	multilayer ceramic chip capacitor; note 1	6.8 pF		
C8	tantalum capacitor	1 μF, 35 V		
C10	multilayer ceramic chip capacitor; note 1	5.1 pF		
C11	tantalum capacitor	100 μF, 20 V		
L1	stripline; note 2	50 Ω	length 28.5 mm width 5 mm	
L2	stripline; note 2	50 Ω	length 23 mm width 5 mm	
L3	11 turns enamelled 0.6 mm copper wire	100 nH	length 7.5 mm internal dia. 3.3 mm	
L4	stripline; note 2	50 Ω	length 1 mm width 5 mm	
L5	stripline; note 2	50 Ω	length 3 mm width 2.5 mm	
L6	stripline; note 2	50 Ω	length 9 mm width 5 mm	
L7	7 turns enamelled 0.6 mm copper wire	37 nH	length 7.3 mm internal dia. 3.3 mm	
L8	grade 3B Ferroxcube wideband HF choke			4132 020 36640
L9	stripline; note 2	50 Ω	length 13.5 mm width 5 mm	
L10	stripline; note 2	50 Ω	length 26.5 mm width 5 mm	
R1	metal film resistor	0.1 W, 10 Ω		

Notes

1. American Technical Ceramics type 100A or capacitor of same quality.
2. The striplines are on a double copper-clad printed-circuit board, with DUROID dielectric (ε_r = 2.2); thickness $^1/_{16}$"; thickness of the copper sheet 2 × 35 μm.



Dimensions in mm.

The components are situated on one side of the copper-clad PCB, the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by through metallization.

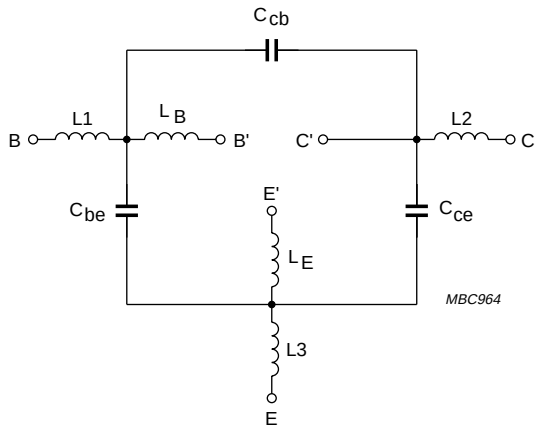
Fig.8 Component lay-out and printed-circuit board for 900 MHz class-AB test circuit.

SPICE parameters for the BLT71 crystal

SEQUENCE No.	PARAMETER	VALUE	UNIT
1	IS	3.503	fA
2	BF	190.5	–
3	NF	0.981	–
4	VAF	35.45	V
5	IKF	24.52	A
6	ISE	184.9	fA
7	NE	1.475	–
8	BR	12.61	–
9	NR	1.042	–
10	VAR	1.476	V
11	IKR	2.206	A
12	ISC	866.5	aA
13	NC	1.025	–
14	RB	2.000	Ω
15	IRB	1.000	μA
16	RBM	2.000	Ω
17	RE	373.8	mΩ
18	RC	330.6	mΩ
19(1)	XTB	0.000	–
20(1)	EG	1.110	eV
21(1)	XTI	3.000	–
22	CJE	9.746	pF
23	VJE	0.600	V
24	MJE	0.288	–
25	TF	11.99	ps
26	XTF	0.979	–
27	VTF	19.52	mV
28	ITF	0.137	A
29	PTF	0.000	deg
30	CJC	5.028	pF
31	VJC	0.609	V
32	MJC	0.368	–
33	XCJC	0.150	–
34	TR	3.841	ns
35(1)	CJS	0.000	F
36(1)	VJS	750.0	mV
37(1)	MJS	0.000	–
38	FC	0.813	–

Note

1. These parameters have not been extracted, the default values are shown.

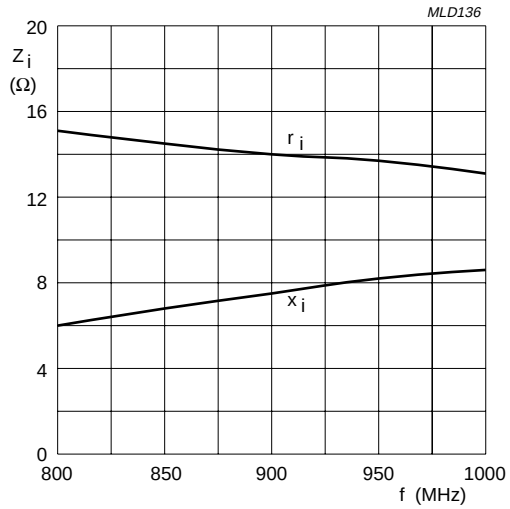


$QL_B = 50$; $QL_E = 50$; $QL_{B,E}(f) = QL_{B,E}\sqrt{(f/Fc)}$;
Fc = scaling frequency = 1 GHz.

Fig.9 Package equivalent circuit SOT223H.

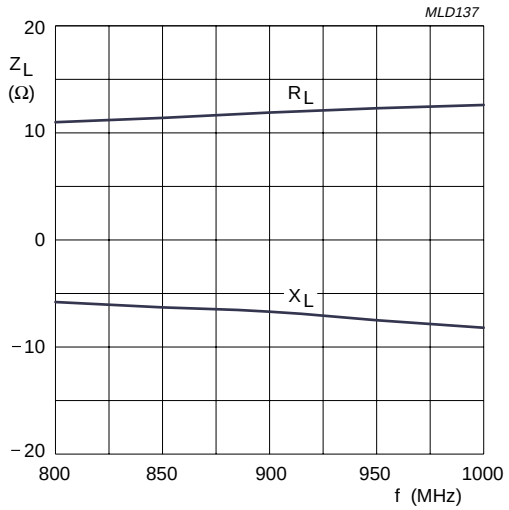
List of components (see Fig.9)

DESIGNATION	VALUE	UNIT
C_{be}	182	fF
C_{cb}	16	fF
C_{ce}	249	fF
L1	0.025	nH
L2	1.19	nH
L3	0.6	nH
L_B	1.85	nH
L_E	1.22	nH



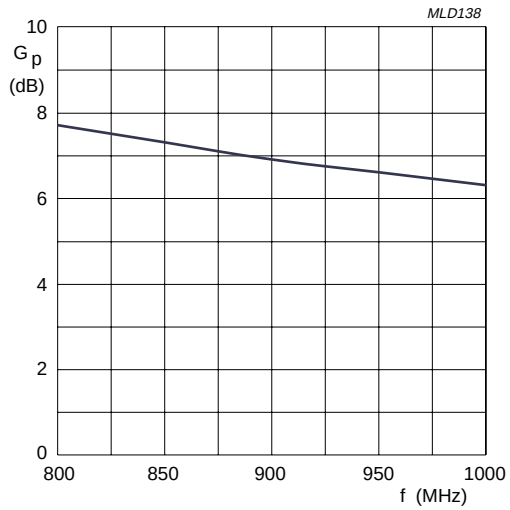
V_{CE} = 4.8 V; I_{CQ} = 1 mA.
P_L = 1.2 W; T_{amb} = 25 °C.

Fig.10 Input impedance as a function of frequency (series components); typical values.



V_{CE} = 4.8 V; I_{CQ} = 1 mA.
P_L = 1.2 W; T_{amb} = 25 °C.

Fig.11 Load impedance as a function of frequency (series components); typical values.



V_{CE} = 4.8 V; I_{CQ} = 1 mA.
P_L = 1.2 W; T_{amb} = 25 °C.

Fig.12 Gain as a function of frequency; typical values.

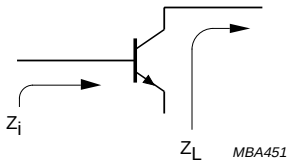
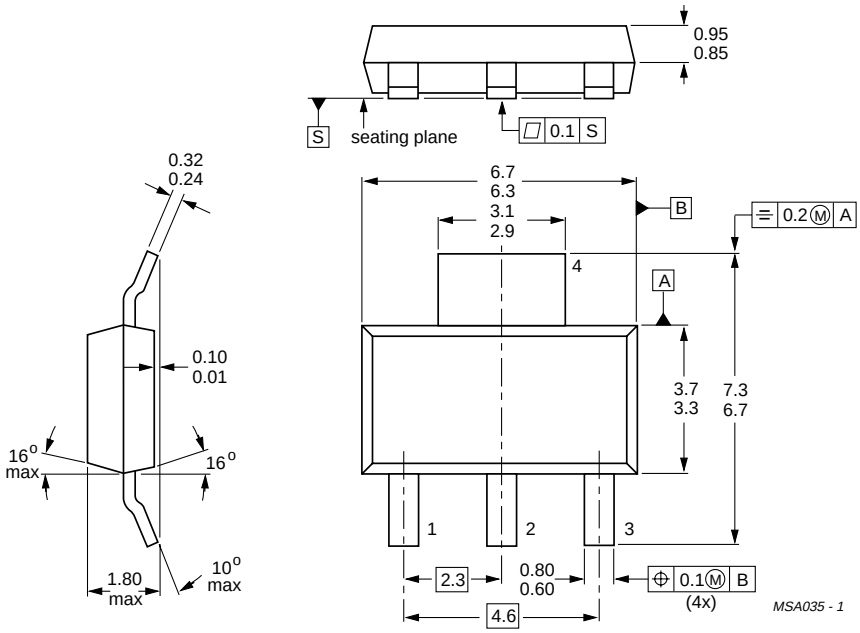


Fig.13 Definition of transistor impedance.

PACKAGE OUTLINE



Dimensions in mm.

Fig.14 SOT223.

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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