DATA SHEET

BLU20/12
UHF power transistor

Product specification

August 1986

Philips
Semiconductors

PHILIPS

UHF power transistor BLU20/12

DESCRIPTION

N-P-N silicon planar epitaxial transistor primarily intended for use in mobile radio transmitters in the 470 MHz communications band.

FEATURES

- multi-base structure and emitter-ballasting resistors for an optimum temperature profile
- gold metallization ensures excellent reliability.
- internal matching to achieve an optimum wideband capability and high power gain.

The transistor has a 6-lead flange envelope with a ceramic cap (SOT-119). All leads are isolated from the flange.

QUICK REFERENCE DATA

Envelope		SOT-119		
Mode of operation		class-B; c.w.		
Collector-emitter voltage (d.c.)	V_{CE}		12,5	V
Frequency	f		470	MHz
Load power	P_L		20	W
Power gain	G_P	>	6,5	dB
Collector efficiency	η_c	>	55	%
Heatsink temperature	T_h		25	°C

PIN CONFIGURATION

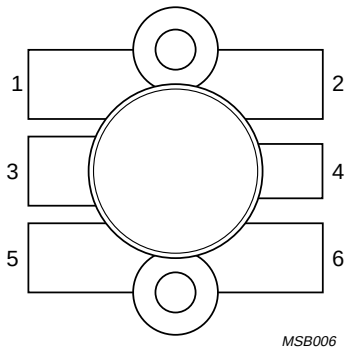


Fig.1 Simplified outline, SOT119A.

PINNING

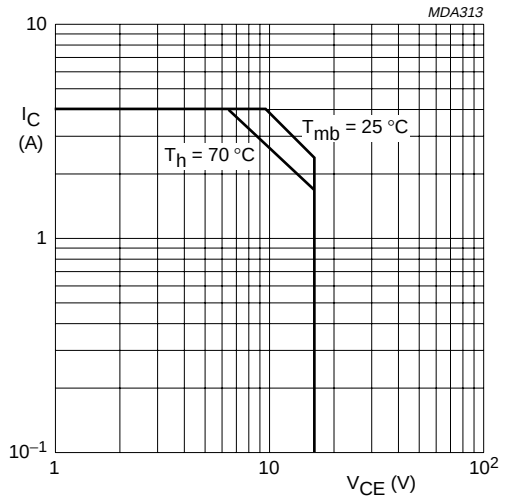
PIN	DESCRIPTION
1	emitter
2	emitter
3	base
4	collector
5	emitter
6	emitter

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

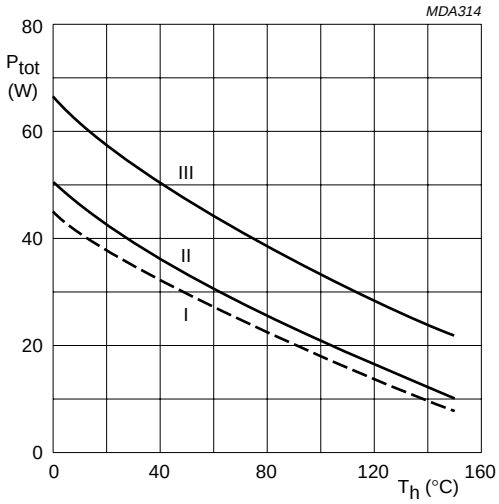
Limiting values in accordance with the Absolute Maximum System (IEC 134).

Collector-base voltage (open emitter)				
peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	16,5	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current				
d.c. or average	I_C	max.	4	A
(peak value); f > 1 MHz	I_{CM}	max.	12	A
Total power dissipation				
at T_{mb} = 25 °C	P_{tot} (d.c.)	max.	38	W
f > 1 MHz; T_{mb} = 25 °C	P_{tot} (r.f.)	max.	44	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C



$R_{th\ mb\text{-}h}$ = 0,2 K/W

Fig.2 D.C. SOAR.



I Continuous operation
II Continuous operation (f > 1 MHz)
III Short-time operation during mismatch; (f > 1 MHz)

Fig.3 Power/temperature derating curves

THERMAL RESISTANCE

(dissipation = 37 W; T_{mb} = 25 °C, i.e. T_h = 18 °C)

From junction to mounting base				
(d.c. dissipation)	$R_{th\ j\text{-}mb(d.c.)}$	max	4,6	K/W
(r.f. dissipation)	$R_{th\ j\text{-}mb(r.f.)}$	max	4,1	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	max	0,2	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage				
I_C = 25 mA; open emitter	$V_{(BR)CBO}$	>	36	V
Collector-emitter breakdown voltage				
I_C = 50 mA; open base	$V_{(BR)CEO}$	>	16,5	V
Emitter-base breakdown voltage				
I_E = 5 mA; open collector	$V_{(BR)EBO}$	>	4	V
Collector cut-off current				
V_{BE} = 0; V_{CE} = 20 V	I_{CES}	<	12,5	mA
Second breakdown energy				
L = 25 mH; f = 50 Hz; R_{BE} = 10 Ω	E_{SBR}	>	5,3	mJ
D.C. current gain				
I_C = 2,7 A; V_{CE} = 10 V	h_{FE}	>	15	
		typ.	60	
Collector capacitance at f = 1 MHz				
$I_E = i_e$ = 0; V_{CB} = 12,5 V	C_C	typ.	53	pF
Feed-back capacitance at f = 1 MHz				
I_C = 0; V_{CE} = 12,5 V	C_{re}	typ.	33	pF
Collector-flange capacitance	C_{cf}	typ.	3	pF

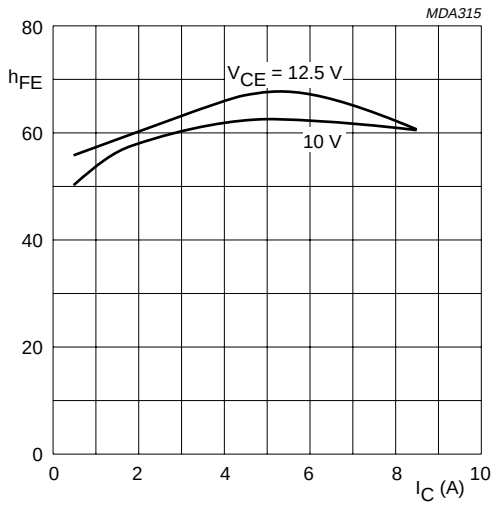


Fig.4 T_j = 25 °C; typ. values.

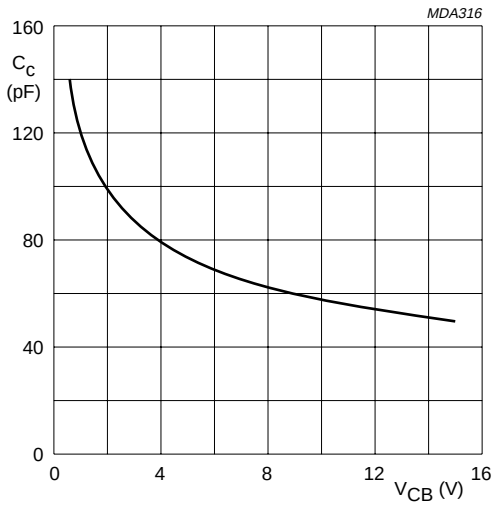


Fig.5 $I_E = I_e$ = 0; f = 1 MHz; typ. values.

APPLICATION INFORMATION

Mode of operation	in narrow band test circuit; class-B; c.w.			
Collector-emitter voltage (d.c.)	V_{CE}		12,5	V
Frequency	f		470	MHz
Load power	P_L		20	W
Power gain	G_p	>	6,5	dB
		typ.	7,8	dB
Collector efficiency	η_c	>	55	%
		typ.	64	%
Heatsink temperature	T_h		25	°C

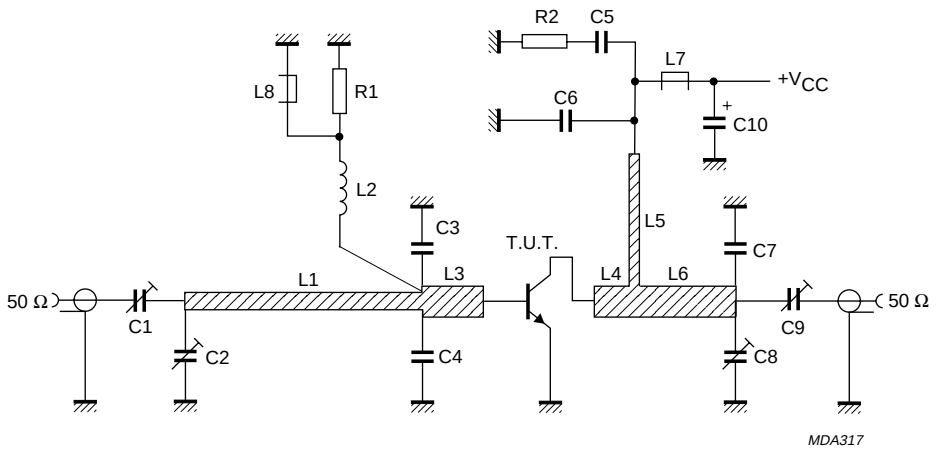


Fig.6 Class-B test circuit at f = 470 MHz.

List of components:

C1 = C9 = 1,8 to 10 pF film dielectric trimmer (cat. no. 2222 809 05002)

C2 = 2 to 9 pF film dielectric trimmer (cat.no. 2222 809 09002)

C3 = C4 = 8,2 pF multilayer ceramic chip capacitor (100A type) (1)

C5 = 100 nF polyester film capacitor

C6 = 120 pF multilayer ceramic chip capacitor

C7 = 8,2 pF multilayer ceramic chip capacitor (100B type) (1)

C8 = 2 to 18 pF film dielectric trimmer (cat.no. 2222 809 09003)

C10 = 2,2 μF electrolytic capacitor

L1 = 50 Ω stripline (43,5 mm × 4,0 mm)

L2 = 100 nH; 5 turns closely wound enamelled Cu-wire (0,5 mm); int. diam. 4 mm; leads 2 × 5 mm

L3 = 37,6 Ω stripline (8,0 mm × 6,0 mm)

L4 = 37,6 Ω stripline (9,0 mm × 6,0 mm)

L5 = 74,4 Ω stripline (22,5 mm × 2,0 mm)

L6 = 37,6 Ω stripline (18,0 mm × 6,0 mm)

L7 = L8 = Ferroxcube wideband h.f. choke, grade 3B (cat.no. 4312 020 36642)

R1 = 1 Ω ± 5%; 0,4 W metal film resistor (MR25 type)

R2 = 10 Ω ± 5%; 0,4 W metal film resistor (MR25 type)

L1, L3, L4, L5 and L6 are striplines on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric (ε_r = 2,74); thickness 1/16 inch.

Note

1. American Technical Ceramics capacitor or capacitor of same quality.

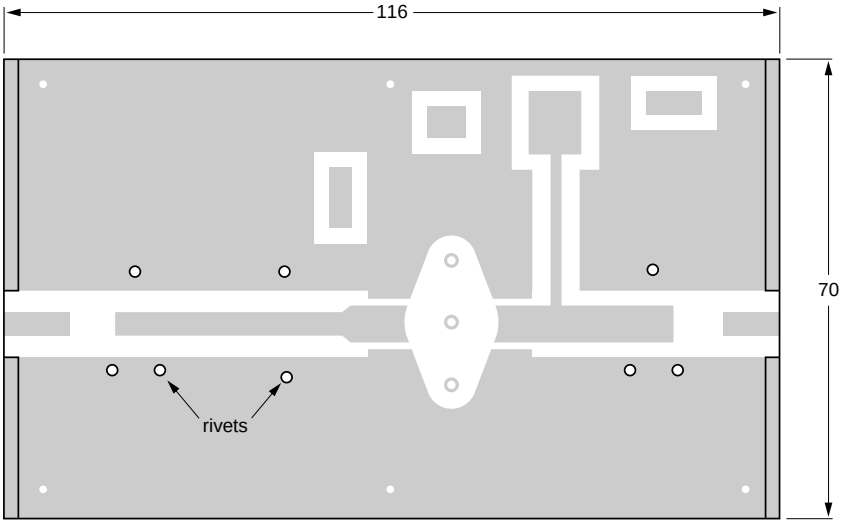
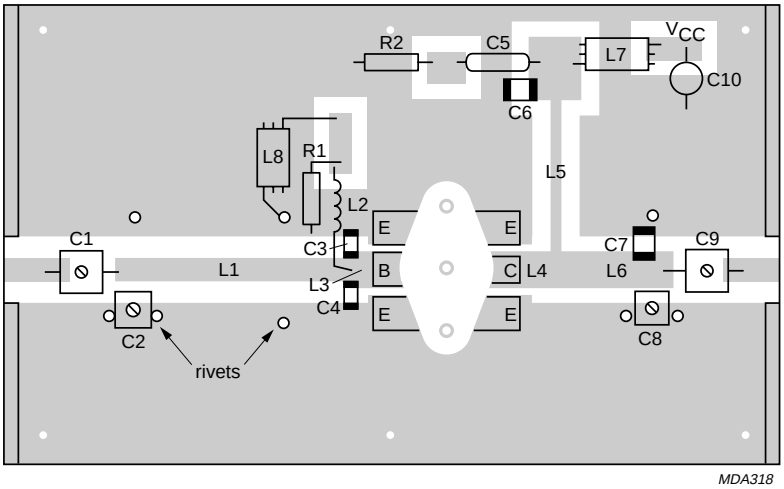


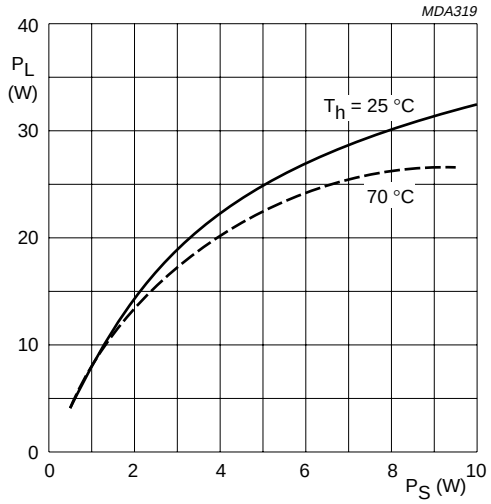
Fig.7 P.C. board for 470 MHz, class-B test circuit.



The circuit and the components are on one side of the P.T.F.E. fibre-glass board; the other side is unetched copper serving as groundplane. Earth connections are made by hollow rivets and also by copper straps under the emitters and around the board to provide a direct contact between the copper on the component side and the ground plane.

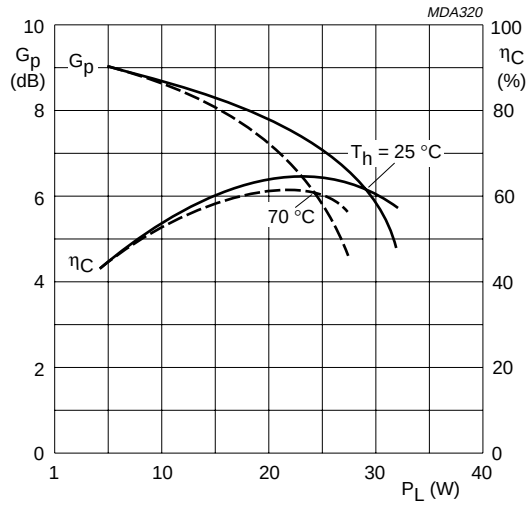
Dimensions in mm.

Fig.8 Component lay-out of 470 MHz, class-B test circuit.



V_{CE} = 12,5 V; f = 470 MHz; class-B operation;
T_h = 25 °C and 70 °C; $R_{th\ mb\text{-}h}$ = 0,2 K/W; typical values.

Fig.9 Load power vs. source power.

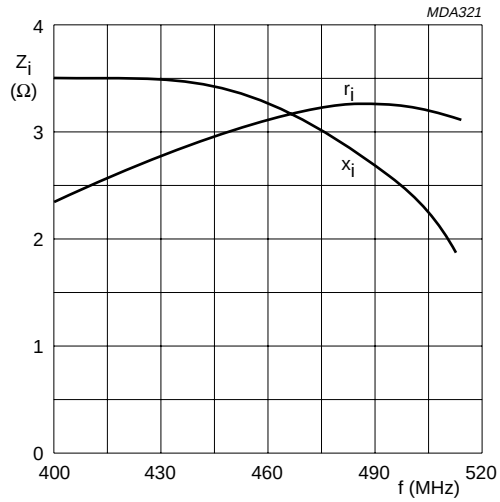


V_{CE} = 12,5 V; f = 470 MHz; class-B operation;
T_h = 25 °C and 70 °C; $R_{th\ mb\text{-}h}$ = 0,2 K/W; typical values.

Fig.10 Power gain and efficiency vs. load power.

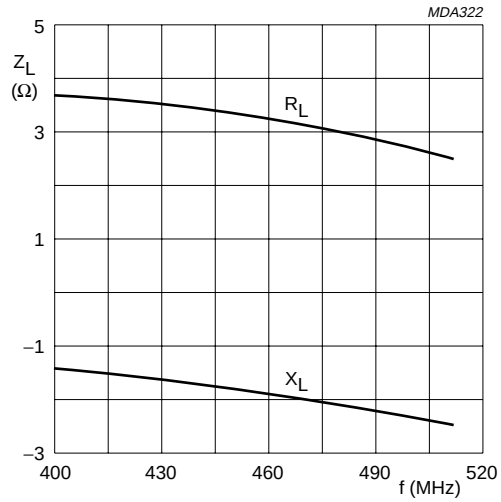
RUGGEDNESS

The device is capable of withstanding a full load mismatch (VSWR = 50; all phases) up to 25 W under the following conditions:
V_{CE} = 15,5 V; f = 470 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0,2 K/W.



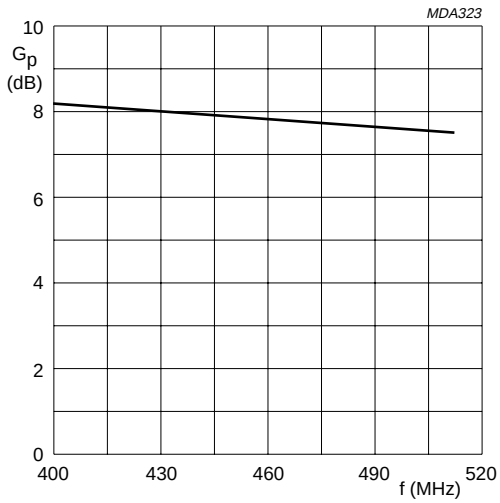
V_{CE} = 12,5 V; P_L = 20 W; f = 400 – 512 MHz;
T_h = 25 °C; class-B operation; $R_{th\ mb\text{-}h}$ = 0,2 K/W;
typical values.

Fig.11 Input impedance (series components).



V_{CE} = 12,5 V; P_L = 20 W; f = 400 – 512 MHz;
T_h = 25 °C; class-B operation; $R_{th\ mb\text{-}h}$ = 0,2 K/W;
typical values.

Fig.12 Load impedance (series components).

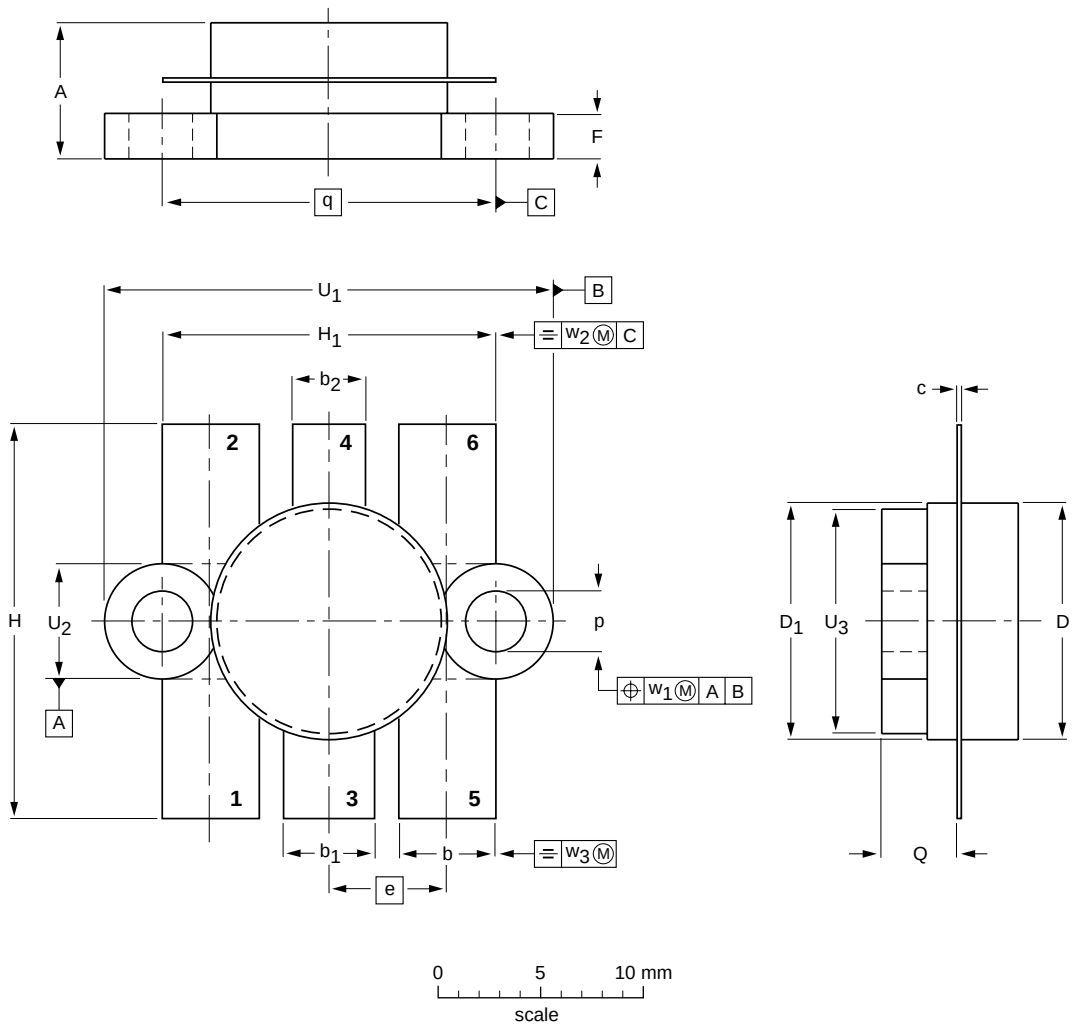


V_{CE} = 12,5 V; P_L = 20 W; f = 400 – 512 MHz;
T_h = 25 °C; class-B operation; $R_{th\ mb\text{-}h}$ = 0,2 K/W;
typical values.

Fig.13 Power gain versus frequency.

PACKAGE OUTLINE

Flanged ceramic package; 2 mounting holes; 6 leads **SOT119A**



DIMENSIONS (millimetre dimensions are derived from the original inch dimensions)

UNIT	A	b	b_1	b_2	c	D	D_1	e	F	H	H_1	p	Q	q	U_1	U_2	U_3	w_1	w_2	w_3
mm	7.39 6.32	5.59 5.33	5.34 5.08	4.07 3.81	0.18 0.07	12.86 12.59	12.83 12.57	6.48	2.54 2.28	22.10 21.08	18.55 18.28	3.31 2.97	4.58 3.98	18.42	25.23 23.95	6.48 6.07	12.76 12.06	0.51	1.02	0.26
inches	0.291 0.249	0.220 0.210	0.210 0.200	0.160 0.150	0.007 0.003	0.505 0.496	0.505 0.495	0.255	0.100 0.090	0.870 0.830	0.730 0.720	0.130 0.117	0.180 0.157	0.725	0.993 0.943	0.255 0.239	0.502 0.475	0.02	0.04	0.01

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT119A						97-06-28

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

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.