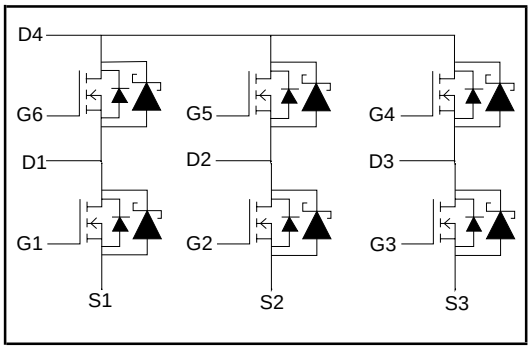
TrenchMOS/ Schottky diode array PHN603S
Three phase brushless d.c. motor driver

FEATURES

- Schottky diode across each MOSFET
- Low on-state resistance
- Fast switching
- Logic level compatible
- Surface mount package

SYMBOL



QUICK REFERENCE DATA

V_{DS} = 25 V

I_D = 5.5 A

$R_{DS(ON)} \leq 35\ m\Omega$ (V_{GS} = 10 V)

$R_{DS(ON)} \leq 55\ m\Omega$ (V_{GS} = 4.5 V)

GENERAL DESCRIPTION

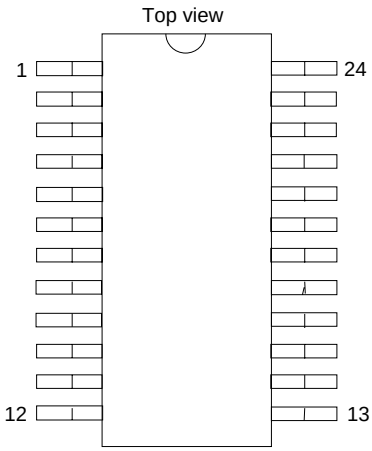
Six n-channel, enhancement mode, logic level, field-effect power transistors and six schottky diodes configured as three half-bridges. This device has low on-state resistance and fast switching. The intended application is in computer disk and tape drives as a three phase brushless d.c. motor driver.

The PHN603S is supplied in the SOT137-1 (SO24) surface mounting package.

PINNING

PIN	DESCRIPTION
1,4	drain 1
2	source 1
3	gate 1
5,8	drain 2
6	source 2
7	gate 2
9,12	drain 3
10	source 3
11	gate 3
13	gate 4
14-16, 18-20, 22-24	drain 4
17	gate 5
21	gate 6

SOT137-1 (SO24)



LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	Repetitive peak drain-source voltage	T_j = 25 ˚C to 150˚C	-	25	V
V_{DS}	Continuous drain-source voltage	$T_j \leq 80$ ˚C[1]	-	25	V
V_{DGR}	Drain-gate voltage	R_{GS} = 20 kΩ	-	25	V
V_{GS}	Gate-source voltage		-	± 20	V
I_D	Drain current per device (DC)	T_a = 25 ˚C	-	5.5	A
		T_a = 100 ˚C	-	3.5	A
I_{DM}	Drain current per device (pulse peak value)	T_a = 25 ˚C	-	22	A
P_{tot}	Total power dissipation per device	T_a = 25 ˚C	-	1.67	W
		T_a = 100 ˚C	-	0.67	W
P_{tot}	Total power dissipation all devices conducting	T_a = 25 ˚C	-	2.78	W
		T_a = 100 ˚C	-	1.11	W
T_{stg}, T_j	Storage & operating temperature		- 55	150	˚C

1 The maximum permissible junction temperature prior to application of continuous drain-source voltage is limited by thermal runaway.

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}a}$	Thermal resistance junction to ambient	FR4 board, minimum footprint			
		Per device	75	-	K/W
		All devices conducting	42	-	K/W

ELECTRICAL CHARACTERISTICS

T_j= 25˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	Drain-source breakdown voltage	V_{GS} = 0 V; I_D = 1 mA	25	-	-	V
$V_{GS(TO)}$	Gate threshold voltage	V_{DS} = V_{GS}; I_D = 1 mA	1.0	1.8	-	V
		T_j = 150˚C	0.4	-	-	V
$R_{DS(ON)}$	Drain-source on-state resistance	V_{GS} = 10 V; I_D = 5 A	-	30	35	mΩ
		V_{GS} = 4.5 V; I_D = 2.5 A	-	50	55	mΩ
		V_{GS} = 10 V; I_D = 5 A; T_j = 150˚C	-	50	60	mΩ
I_{GSS}	Gate source leakage current	V_{GS} = ±20 V; V_{DS} = 0 V	-	10	100	nA
I_{DSS}	Zero gate voltage drain current	V_{DS} = 25 V; V_{GS} = 0 V;	-	0.2	1.0	mA
		T_j = 100˚C	-	5	10	mA
$Q_{g(tot)}$	Total gate charge	I_D = 1 A; V_{DD} = 20 V; V_{GS} = 10 V	-	17	-	nC
Q_{gs}	Gate-source charge		-	1.7	-	nC
Q_{gd}	Gate-drain (Miller) charge		-	5.2	-	nC
$t_{d\ on}$	Turn-on delay time	V_{DD} = 20 V; I_D = 1 A;	-	8	-	ns
t_r	Turn-on rise time	V_{GS} = 10 V; R_G = 6 Ω	-	11	-	ns
$t_{d\ off}$	Turn-off delay time	Resistive load	-	31	-	ns
t_f	Turn-off fall time		-	17	-	ns
C_{iss}	Input capacitance	V_{GS} = 0 V; V_{DS} = 20 V; f = 1 MHz	-	650	-	pF
C_{oss}	Output capacitance		-	320	-	pF
C_{rss}	Feedback capacitance		-	130	-	pF

SCHOTTKY DIODE LIMITING VALUES AND CHARACTERISTICS

T_j = 25˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_F	Continuous forward diode current	T_a = 25 ˚C	-	-	5.5	A
I_{FRM}	Repetitive peak forward diode current		-	-	22	A
V_F	Diode forward voltage	I_F = 2.5 A; V_{GS} = 0 V	-	0.4	0.6	V
		I_F = 2.5 A; V_{GS} = 0 V, T_j = 100 ˚C	-	0.3	0.55	V
t_{rr}	Reverse recovery time	I_F = 0.5 A to I_R = 0.5 A	-	20	-	ns

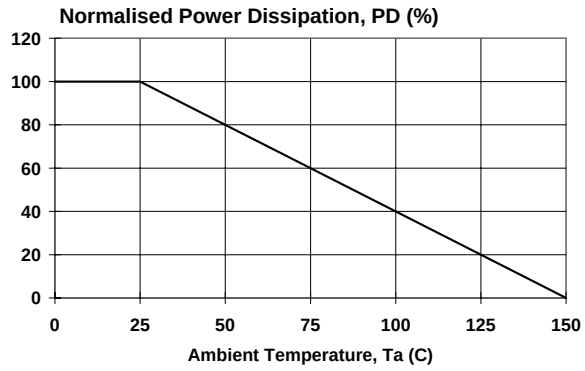


Fig.1. Normalised power dissipation.
PD% = 100·P_D/$P_{D\ 25\ ^\circ C}$ = f(T_a)

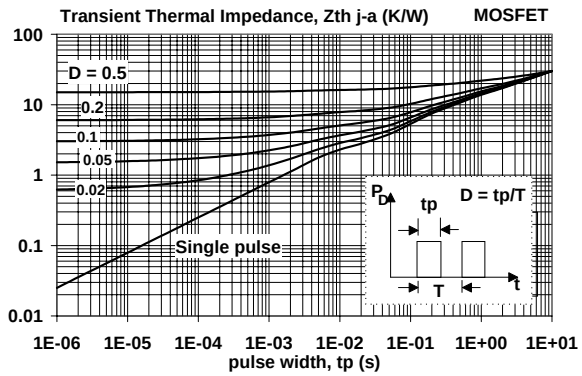


Fig.4. Transient thermal impedance; MOSFET.
$Z_{th\ j\text{-}a}$ = f(t); parameter D = t_p/T

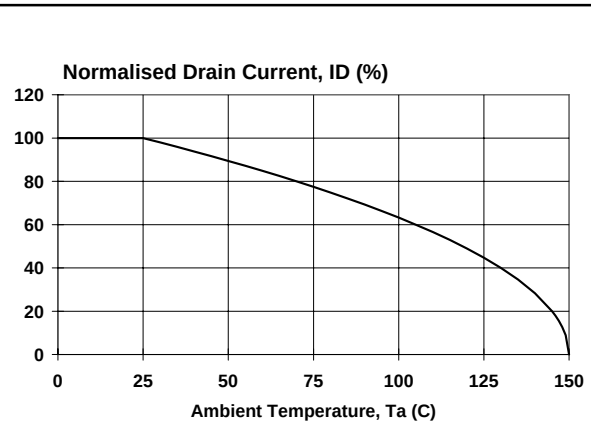


Fig.2. Normalised continuous drain current.
ID% = 100·I_D/$I_{D\ 25\ ^\circ C}$ = f(T_a); conditions: $V_{GS} \geq 4.5$ V

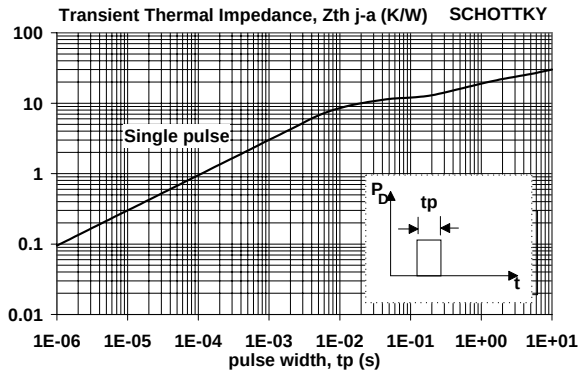


Fig.5. Transient thermal impedance; Schottky Diode.
$Z_{th\ j\text{-}a}$ = f(t)

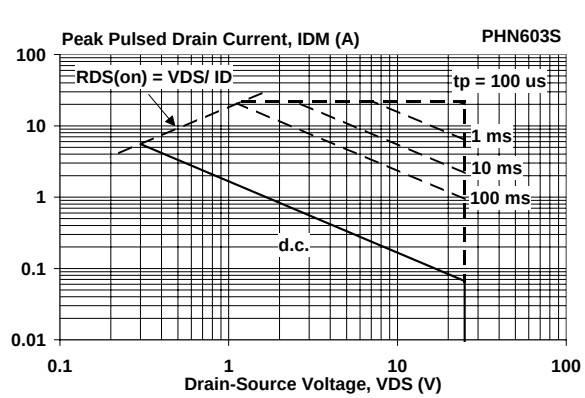


Fig.3. Safe operating area. T_a = 25 ˚C
I_D & I_{DM} = f(V_{DS}); I_{DM} single pulse; parameter t_p

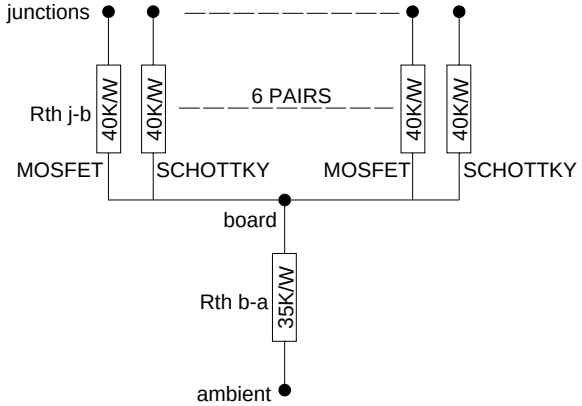


Fig.6. Thermal model; typical values.
$R_{th\ j\text{-}b}$ and $R_{th\ b\text{-}a}$

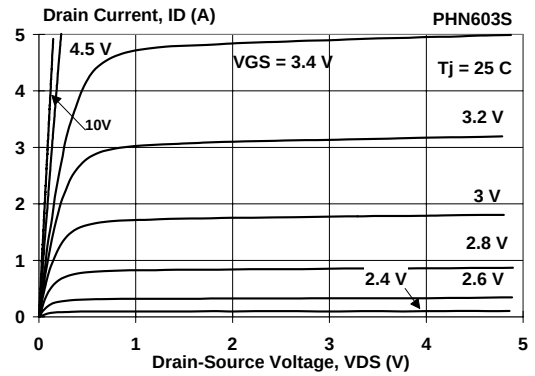


Fig.7. Typical output characteristics, T_j = 25 ˚C. $I_D = f(V_{DS})$; parameter V_{GS}

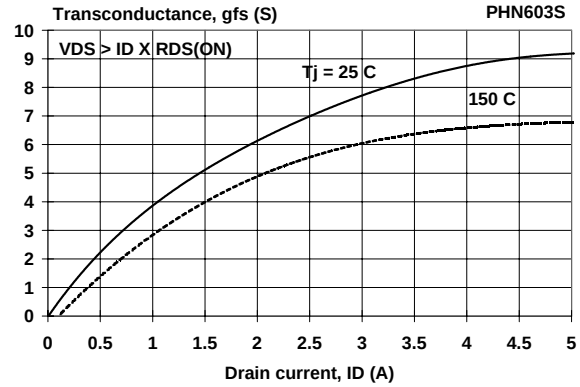


Fig.10. Typical transconductance, T_j = 25 ˚C. $g_{fs} = f(I_D)$

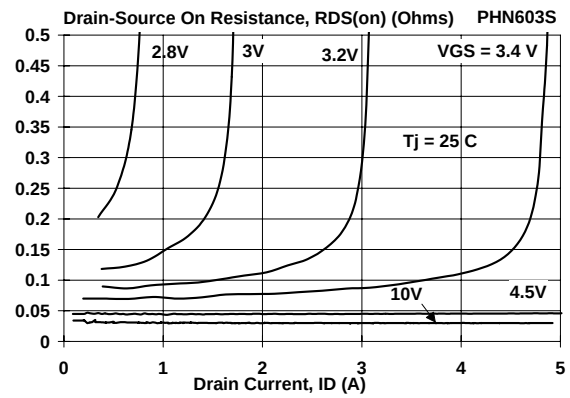


Fig.8. Typical on-state resistance, T_j = 25 ˚C. $R_{DS(ON)} = f(I_D)$; parameter V_{GS}

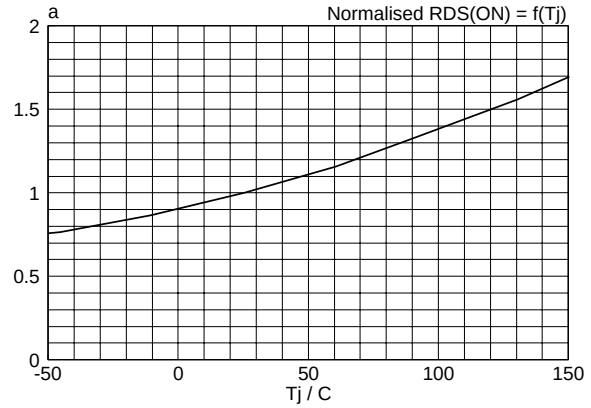


Fig.11. Normalised drain-source on-state resistance. $R_{DS(ON)}/R_{DS(ON)25\ ˚C} = f(T_j)$

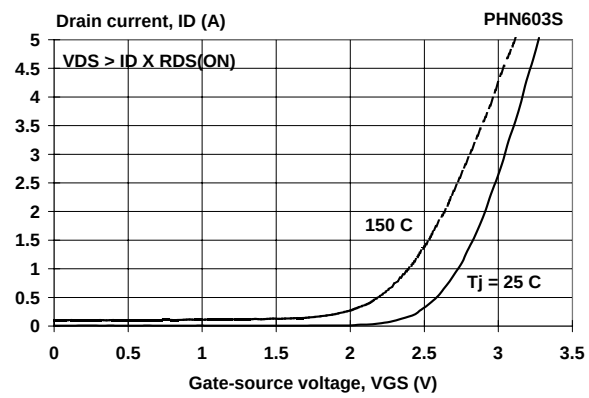


Fig.9. Typical transfer characteristics. $I_D = f(V_{GS})$

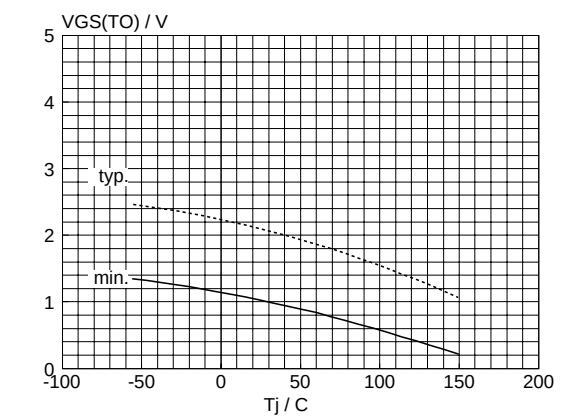


Fig.12. Gate threshold voltage. $V_{GS(TO)} = f(T_j)$; conditions: I_D = 1 mA; $V_{DS} = V_{GS}$

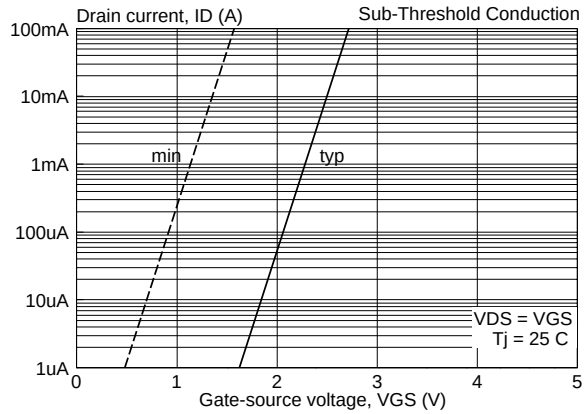


Fig.13. Sub-threshold drain current.
$I_D = f(V_{GS})$; conditions: $T_j = 25$ ˚C

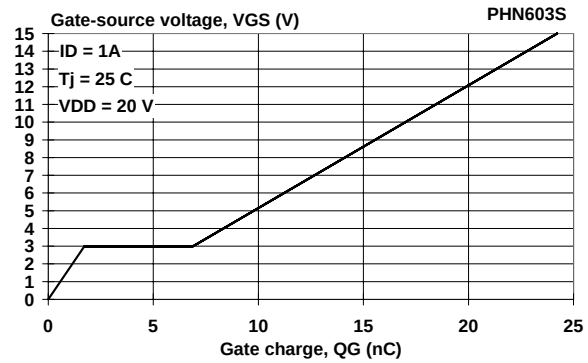


Fig.15. Typical turn-on gate-charge characteristics.
$V_{GS} = f(Q_G)$

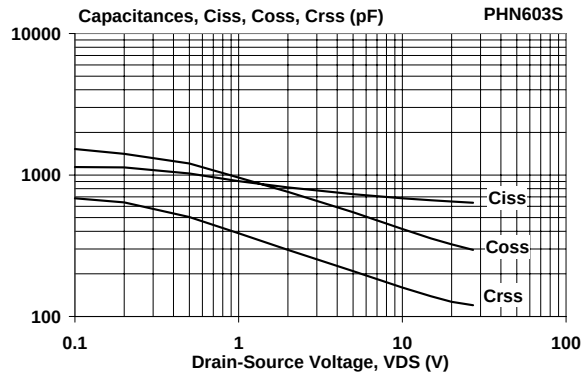


Fig.14. Typical capacitances, C_{iss}, C_{oss}, C_{rss}.
$C = f(V_{DS})$; conditions: $V_{GS} = 0$ V; $f = 1$ MHz

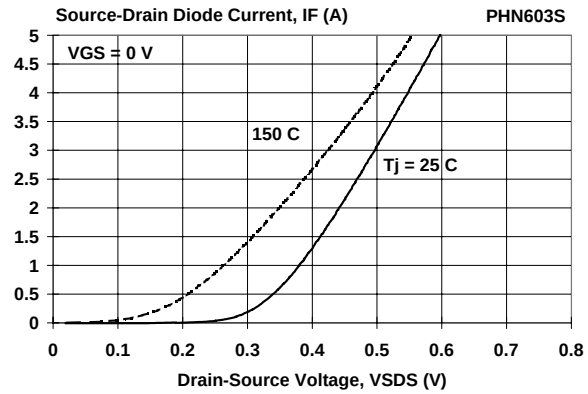
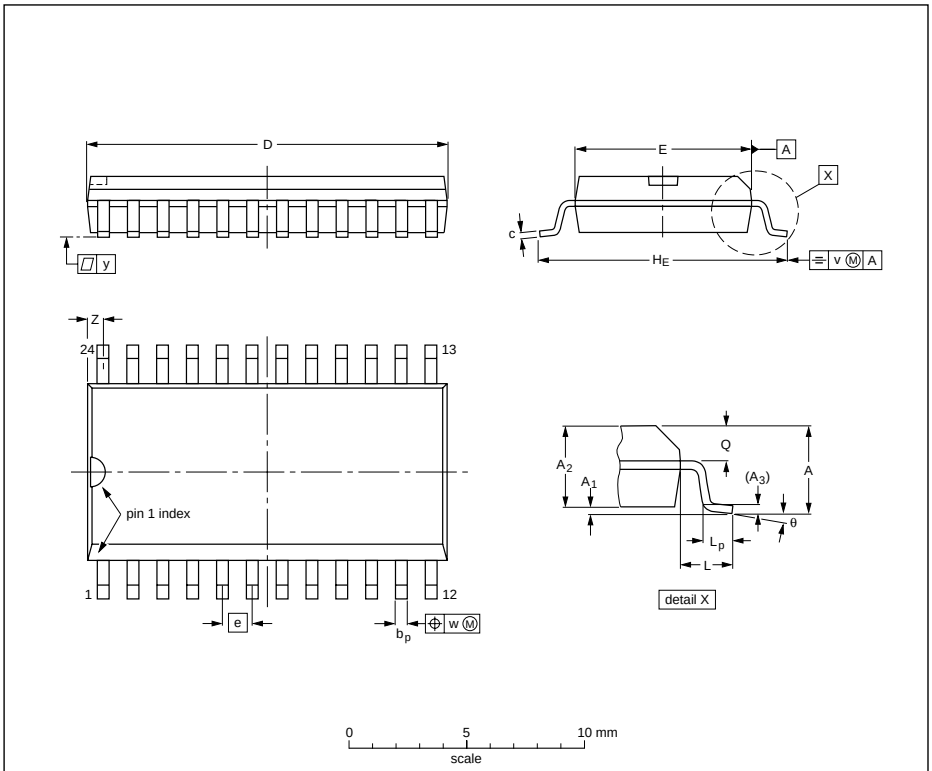


Fig.16. Typical reverse diode current.
$I_F = f(V_{SDS})$; conditions: $V_{GS} = 0$ V; parameter T_j

MECHANICAL DATA

SO24: plastic small outline package; 24 leads; body width 7.5 mm **SOT137-1**



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

UNIT	A max.	A_1	A_2	A_3	b_p	c	D (1)	E (1)	e	H_E	L	L_p	Q	v	w	y	Z (1)	θ
mm	2.65	0.30 0.10	2.45 2.25	0.25	0.49 0.36	0.32 0.23	15.6 15.2	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8^o 0^o
inches	0.10	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.61 0.60	0.30 0.29	0.050	0.419 0.394	0.055	0.043 0.016	0.043 0.039	0.01	0.01	0.004	0.035 0.016	

Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT137-1	075E05	MS-013AD				~~95-01-24~~ 97-05-22

Fig.17. SOT137-1 (SO24) surface mounting package.

Notes

1. This product is supplied in anti-static packaging. The gate-source input must be protected against static discharge during transport or handling.
2. Refer to Integrated Circuit Packages, Data Handbook IC26.
3. Epoxy meets UL94 V0 at 1/8".

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 are given 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 this 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 be reasonably 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.