PH1955L

N-channel TrenchMOS logic level FET

Rev. 02 — 25 February 2009 Product data sheet

1. Product profile

1.1 General description

Logic level N-channel enhancement mode Field-Effect Transistor (FET) in a plastic package using TrenchMOS technology. This product is designed and qualified for use in computing, communications, consumer and industrial applications only.

1.2 Features and benefits

- Low conduction losses due to low on-state resistance
- Suitable for logic level gate drive sources
- Suitable for thermally demanding environments due to 175 °C rating

1.3 Applications

- 12 V and 24 V loads
- DC-to-DC convertors
- General purpose power switching
- Motors, lamps and solenoids

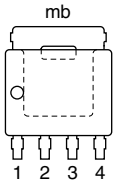
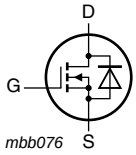
1.4 Quick reference data

Table 1. Quick reference

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25$ °C; $T_j \leq 175$ °C	-	-	55	V
I_D	drain current	T_{mb} = 25 °C; V_{GS} = 5 V; see Figure 1; see Figure 3	-	-	40	A
P_{tot}	total power dissipation	T_{mb} = 25 °C; see Figure 2	-	-	75	W
Dynamic characteristics						
Q_{GD}	gate-drain charge	V_{GS} = 5 V; I_D = 25 A; V_{DS} = 44 V; T_j = 25 °C; see Figure 9	-	8	-	nC
Static characteristics						
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 25 A; T_j = 25 °C; see Figure 7; see Figure 8	-	14.3	17.3	mΩ

2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S	source	 **SOT669 (LFPAK)**	
2	S	source		
3	S	source		
4	G	gate		
mb	D	mounting base; connected to drain		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PH1955L	LFPAK	plastic single-ended surface-mounted package (LFPAK); 4 leads	SOT669

4. Limiting values

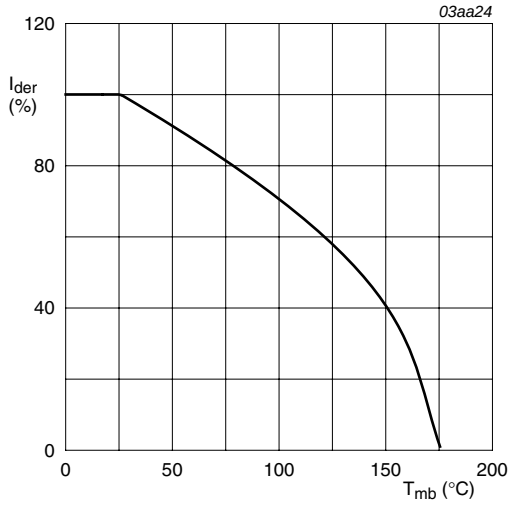
Table 4. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25$ °C; $T_j \leq 175$ °C		-	55	V
V_{DGR}	drain-gate voltage	$T_j \geq 25$ °C; $T_j \leq 175$ °C; $R_{GS} = 20$ kΩ		-	55	V
V_{GS}	gate-source voltage			-15	15	V
I_D	drain current	$V_{GS} = 5$ V; $T_{mb} = 100$ °C; see Figure 1		-	28	A
		$V_{GS} = 5$ V; $T_{mb} = 25$ °C; see Figure 1; see Figure 3		-	40	A
I_{DM}	peak drain current	$t_p \leq 10$ µs; pulsed; $T_{mb} = 25$ °C; see Figure 3		-	160	A
P_{tot}	total power dissipation	$T_{mb} = 25$ °C; see Figure 2		-	75	W
T_{stg}	storage temperature			-55	175	°C
T_j	junction temperature			-55	175	°C
Source-drain diode						
I_S	source current	$T_{mb} = 25$ °C		-	40	A
I_{SM}	peak source current	$t_p \leq 10$ µs; pulsed; $T_{mb} = 25$ °C		-	160	A
Avalanche ruggedness						
$E_{DS(AL)R}$	repetitive drain-source avalanche energy	$V_{GS} = 10$ V; $I_D = 4$ A; $V_{sup} \leq 55$ V; unclamped; $t_p = 0.06$ ms; $R_{GS} = 50$ Ω;	[1][2]	-	0.8	mJ
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10$ V; $T_{j(init)} = 25$ °C; $I_D = 40$ A; $V_{sup} \leq 55$ V; unclamped; $t_p = 0.06$ ms; $R_{GS} = 50$ Ω		-	80	mJ

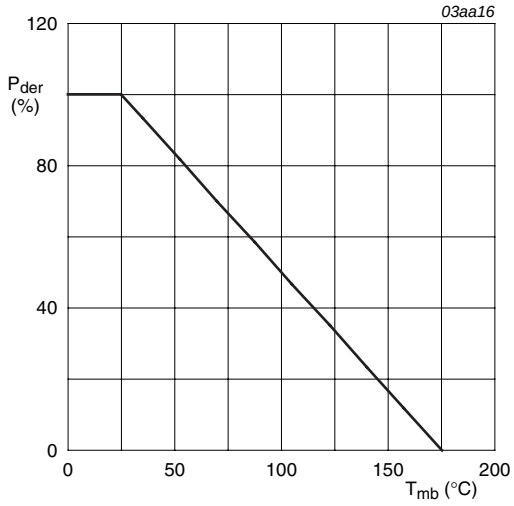
[1] Duty cycle is limited by the maximum junction temperature.

[2] Repetitive avalanche failure is not determined simply by thermal effects. Repetitive avalanche transient should only be applied for short bursts, not every switching cycle.



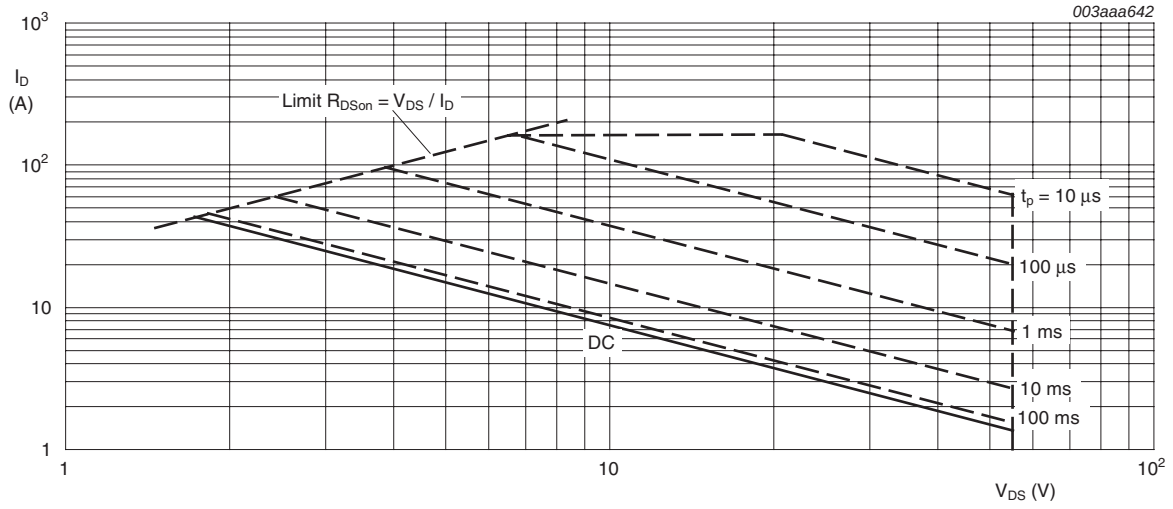
$$I_{der} = \frac{I_D}{I_{D(25°C)}} \times 100\,\%$$

Fig 1. Normalized continuous drain current as a function of mounting base temperature



$$P_{der} = \frac{P_{tot}}{P_{tot(25°C)}} \times 100\,\%$$

Fig 2. Normalized total power dissipation as a function of mounting base temperature



$T_{mb} = 25°C; I_{DM}$ is single pulse

Fig 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j\text{-}mb)}$	thermal resistance from junction to mounting base	see Figure 4	-	-	2	K/W

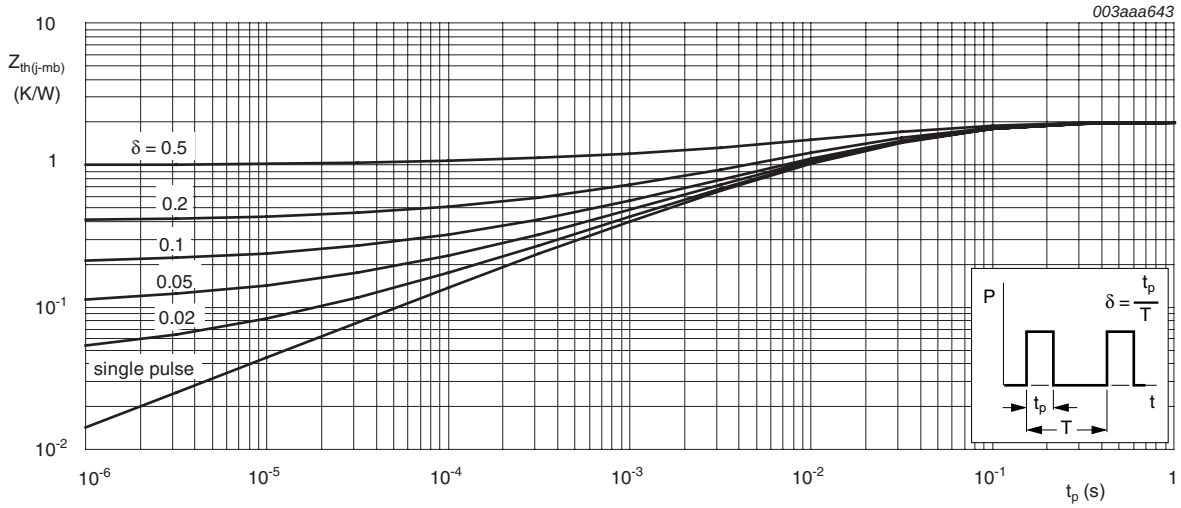
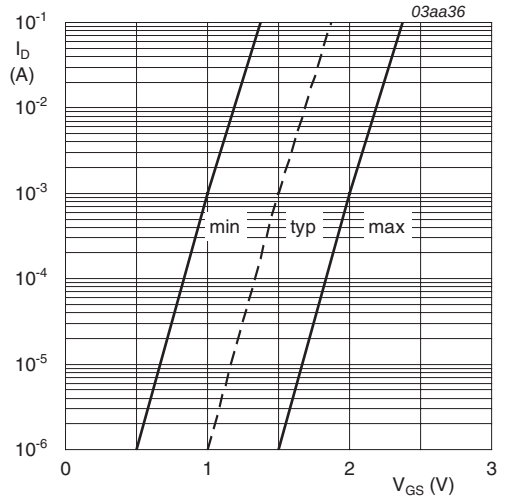


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

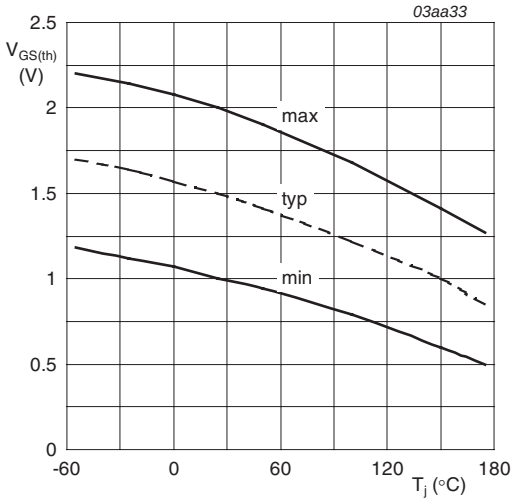
Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 250 µA; V_{GS} = 0 V; T_j = -55 °C	50	-	-	V
		I_D = 250 µA; V_{GS} = 0 V; T_j = 25 °C	55	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	I_D = 1 mA; V_{DS} = V_{GS}; T_j = 175 °C; see Figure 5; see Figure 6	0.5	-	-	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = 25 °C; see Figure 6; see Figure 5	1	1.5	2	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = -55 °C; see Figure 5; see Figure 6	-	-	2.3	V
I_{DSS}	drain leakage current	V_{DS} = 55 V; V_{GS} = 0 V; T_j = 25 °C	-	0.02	1	µA
		V_{DS} = 55 V; V_{GS} = 0 V; T_j = 175 °C	-	-	500	µA
I_{GSS}	gate leakage current	V_{GS} = 15 V; V_{DS} = 0 V; T_j = 25 °C	-	2	100	nA
		V_{GS} = -15 V; V_{DS} = 0 V; T_j = 25 °C	-	2	100	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 25 A; T_j = 25 °C; see Figure 7; see Figure 8	-	14.3	17.3	mΩ
		V_{GS} = 5 V; I_D = 25 A; T_j = 175 °C; see Figure 7; see Figure 8	-	-	40	mΩ
		V_{GS} = 4.5 V; I_D = 25 A; T_j = 25 °C; see Figure 7; see Figure 8	-	-	21	mΩ
		V_{GS} = 5 V; I_D = 25 A; T_j = 25 °C; see Figure 7; see Figure 8	-	16.3	19	mΩ
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	I_D = 25 A; V_{DS} = 44 V; V_{GS} = 5 V; T_j = 25 °C; see Figure 9	-	18	-	nC
Q_{GS}	gate-source charge		-	5	-	nC
Q_{GD}	gate-drain charge		-	8	-	nC
C_{iss}	input capacitance	V_{DS} = 25 V; V_{GS} = 0 V; f = 1 MHz; T_j = 25 °C; see Figure 10	-	1494	1992	pF
C_{oss}	output capacitance		-	217	260	pF
C_{rss}	reverse transfer capacitance		-	86	118	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 30 V; R_L = 1.2 Ω; V_{GS} = 5 V; $R_{G(ext)}$ = 10 Ω; T_j = 25 °C	-	18	-	ns
t_r	rise time		-	180	-	ns
$t_{d(off)}$	turn-off delay time		-	44	-	ns
t_f	fall time		-	134	-	ns
Source-drain diode						
V_{SD}	source-drain voltage	I_S = 25 A; V_{GS} = 0 V; T_j = 25 °C; see Figure 11	-	0.85	1.2	V
t_{rr}	reverse recovery time	I_S = 20 A; dI_S/dt = -100 A/µs; V_{GS} = 0 V; V_{DS} = 30 V; T_j = 25 °C	-	52	-	ns
Q_r	recovered charge		-	38	-	nC



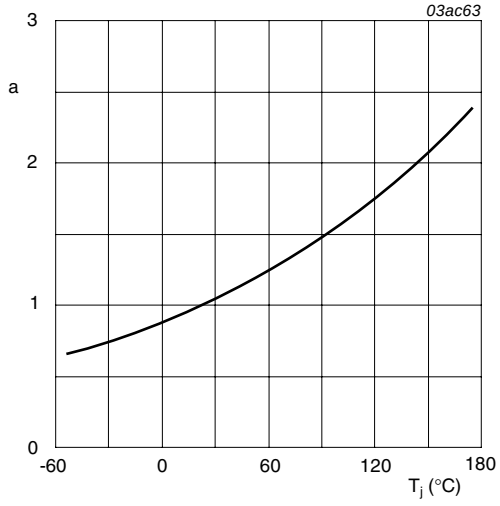
$$T_j = 25\,°C; V_{DS} = V_{GS}$$

Fig 5. Sub-threshold drain current as a function of gate-source voltage



$$I_D = 1\,mA; V_{DS} = V_{GS}$$

Fig 6. Gate-source threshold voltage as a function of junction temperature



$$a = \frac{R_{DSon}}{R_{DSon(25\,°C)}}$$

Fig 7. Normalized drain-source on-state resistance factor as a function of junction temperature

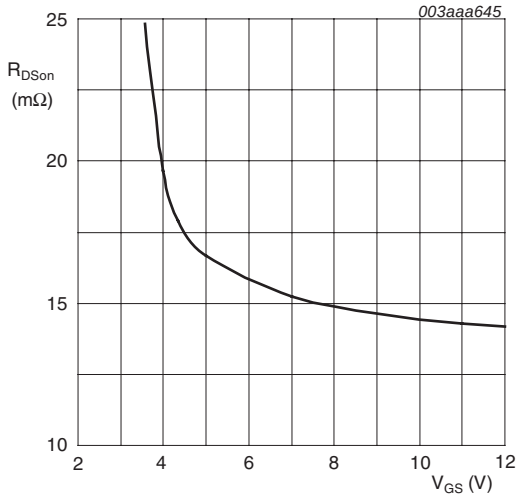
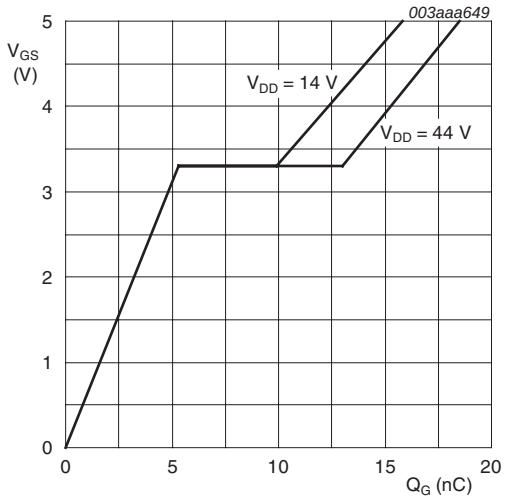
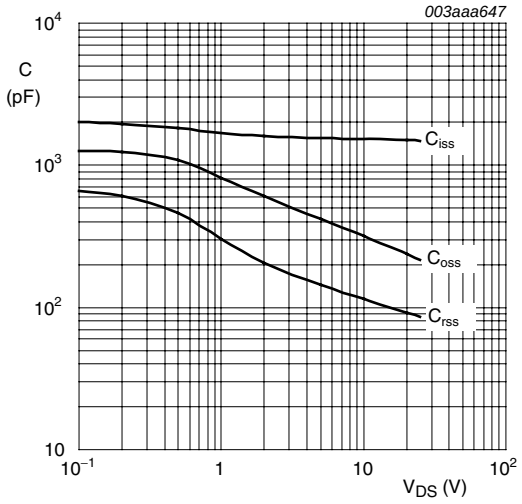


Fig 8. Drain-source on-state resistance as a function of gate-source voltage; typical values



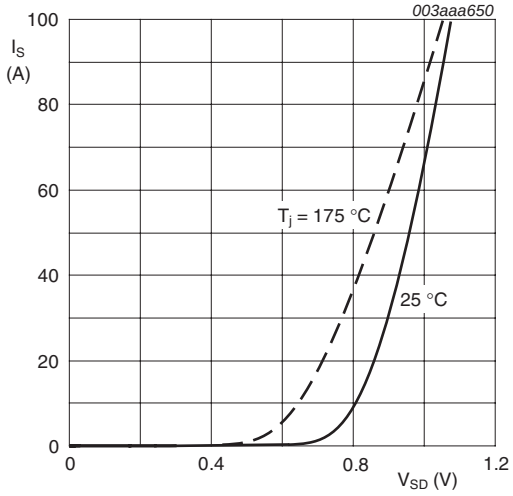
$I_D = 25A; V_{DS} = 14V \text{ and } 44V$

Fig 9. Gate-source voltage as a function of gate charge; typical values



$V_{GS} = 0V; f = 1MHz$

Fig 10. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

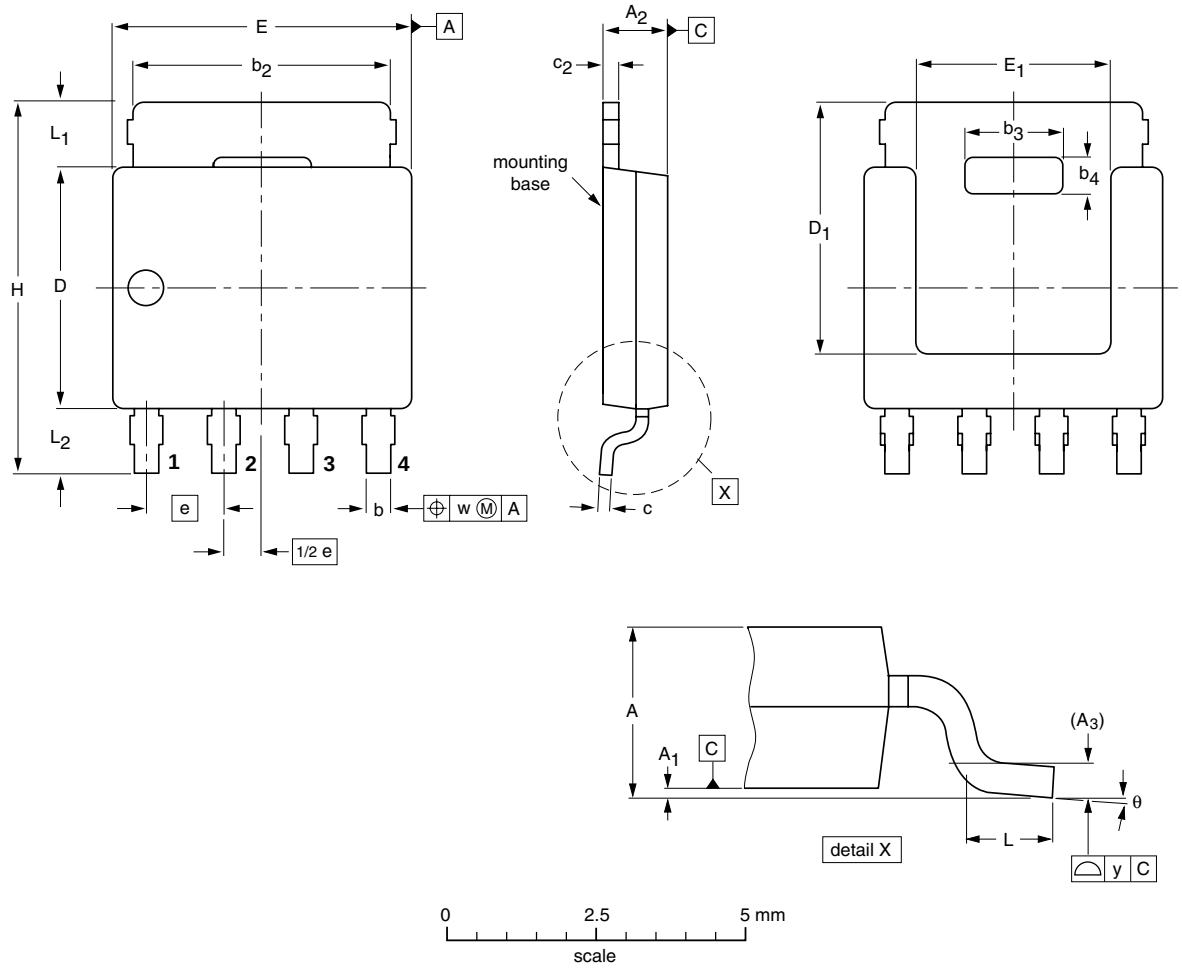


$T_j = 25°C \text{ and } 175°C; V_{GS} = 0V$

Fig 11. Source current as a function of source-drain voltage; typical values

7. Package outline

Plastic single-ended surface-mounted package (LFPAK); 4 leads **SOT669**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	A_2	A_3	b	b_2	b_3	b_4	c	c_2	$D^{(1)}$	$D_1^{(1)}$ max	$E^{(1)}$	$E_1^{(1)}$	e	H	L	L_1	L_2	w	y	θ
mm	1.20 1.01	0.15 0.00	1.10 0.95	0.25	0.50 0.35	4.41 3.62	2.2 2.0	0.9 0.7	0.25 0.19	0.30 0.24	4.10 3.80	4.20	5.0 4.8	3.3 3.1	1.27	6.2 5.8	0.85 0.40	1.3 0.8	1.3 0.8	0.25	0.1	8° 0°

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	JEITA			
SOT669		MO-235				~~04-10-13~~ 06-03-16

Fig 12. Package outline SOT669 (LFPAK)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PH1955L_2	20090225	Product data sheet	-	PH1955L_1
Modifications:	• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate.			
PH1955L_1	20050815	Product data sheet	-	-

9. Legal information

9.1 Data sheet status

Document status [1][2]	Product status[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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11. Contents

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Date of release: 25 February 2009
Document identifier: PH1955L_2

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