

PH5330

N-channel enhancement mode field-effect transistor

Rev. 02 — 18 July 2003

Product data

1. Description

N-channel enhancement mode field-effect power transistor in a SOT669 (LFPAK) package.

Product availability:

PH5330 in SOT669 (LFPAK).

2. Features

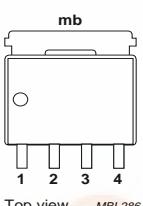
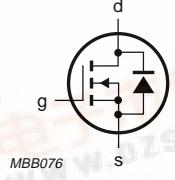
- Logic level compatible
- Low drive current
- High-density mounting
- Very low on-state resistance.

3. Applications

- DC-to-DC converters
- Computer motherboards
- Switched mode power supplies.

4. Pinning information

Table 1: Pinning - SOT669 (LFPAK), simplified outline and symbol

Pin	Description	Simplified outline	Symbol
1,2,3	source (s)		
4	gate (g)		
5	drain (d)	 Top view MBL266	

SOT669 (LFPAK)

5. Quick reference data

Table 2: Quick reference data

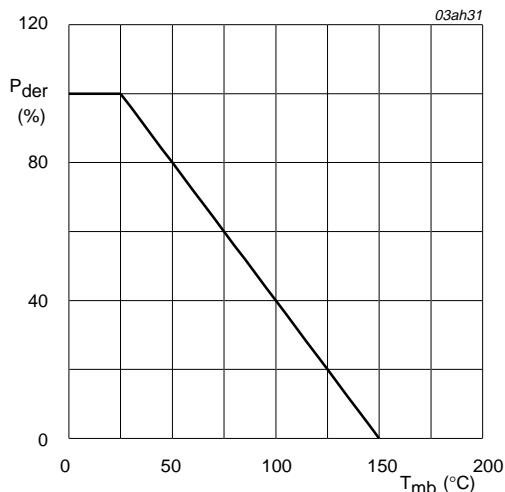
Symbol	Parameter	Conditions	Typ	Max	Unit
V_{DS}	drain-source voltage (DC)	$T_j = 25^\circ\text{C}$	-	30	V
I_D	drain current (DC)	$T_{mb} = 25^\circ\text{C}; V_{GS} = 10\text{ V}$	-	50	A
P_{tot}	total power dissipation	$T_{mb} = 25^\circ\text{C}$	-	39	W
T_j	junction temperature		-	150	$^\circ\text{C}$
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 20\text{ A}; T_j = 25^\circ\text{C}$	4.6	5.3	$\text{m}\Omega$
		$V_{GS} = 4.5\text{ V}; I_D = 20\text{ A}; T_j = 25^\circ\text{C}$	8.0	10	$\text{m}\Omega$

6. Limiting values

Table 3: Limiting values

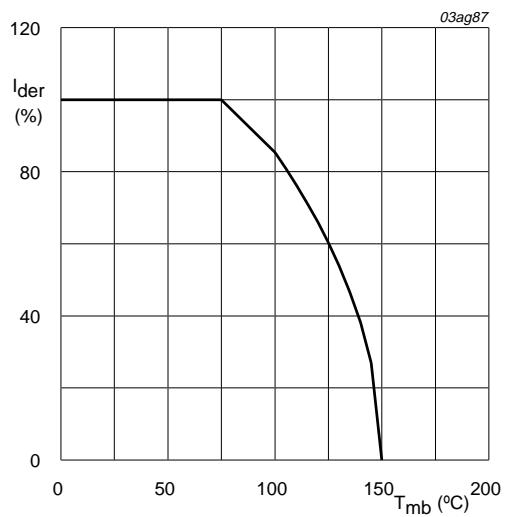
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage (DC)	$T_j = 25 \text{ to } 150^\circ\text{C}$	-	30	V
V_{GS}	gate-source voltage (DC)		-	± 20	V
I_D	drain current (DC)	$T_{mb} = 25^\circ\text{C}; V_{GS} = 10\text{ V}; \text{Figure 2 and 3}$	-	50	A
I_{DM}	peak drain current	$T_{mb} = 25^\circ\text{C}; \text{pulsed}; t_p \leq 10\ \mu\text{s}; \text{Figure 3}$	-	160	A
P_{tot}	total power dissipation	$T_{mb} = 25^\circ\text{C}; \text{Figure 1}$	-	39	W
T_{stg}	storage temperature		-55	+150	$^\circ\text{C}$
T_j	operating junction temperature		-55	+150	$^\circ\text{C}$
Source-drain diode					
I_{SM}	peak source (diode forward) current	$T_{mb} = 25^\circ\text{C}; \text{pulsed}; t_p \leq 10\ \mu\text{s}$	-	50	A



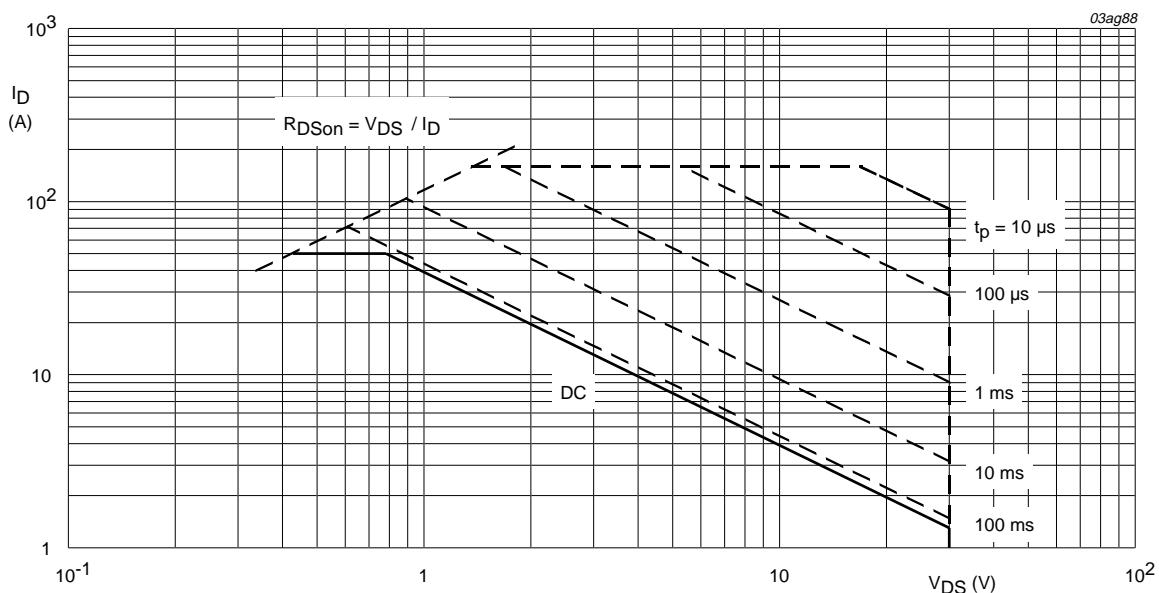
$$P_{der} = \frac{P_{tot}}{P_{tot}(25^\circ\text{C})} \times 100\%$$

Fig 1. Normalized total power dissipation as a function of mounting base temperature.



$$I_{der} = \frac{I_D}{I_{D(25^\circ\text{C})}} \times 100\%$$

Fig 2. Normalized continuous drain current as a function of mounting base temperature.



$T_{mb} = 25^\circ\text{C}$; I_{DM} is single pulse.

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

7. Thermal characteristics

Table 4: Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j\text{-mb})}$	thermal resistance from junction to mounting base	Figure 4	-	-	3.2	K/W

7.1 Transient thermal impedance

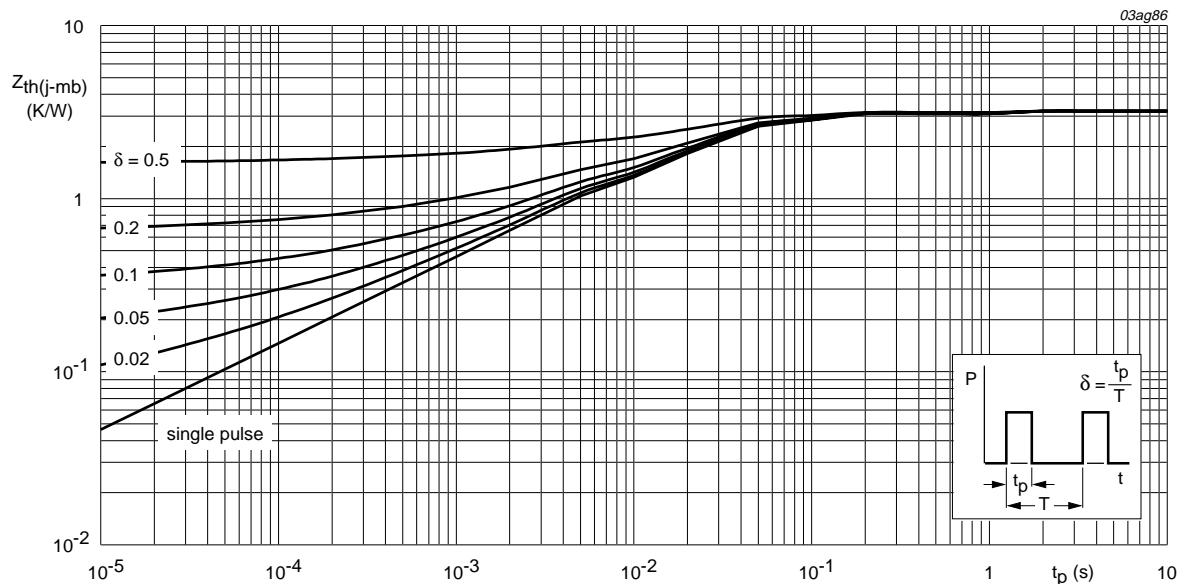
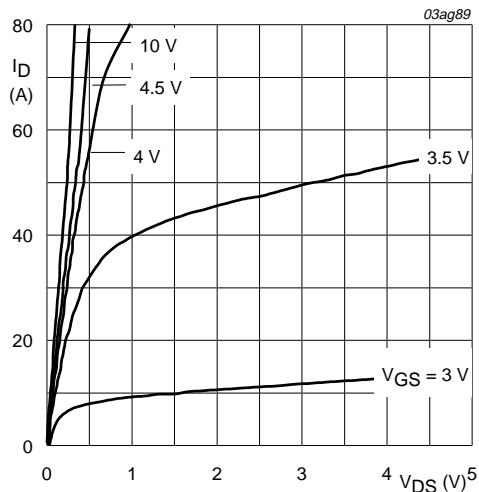


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration.

8. Characteristics

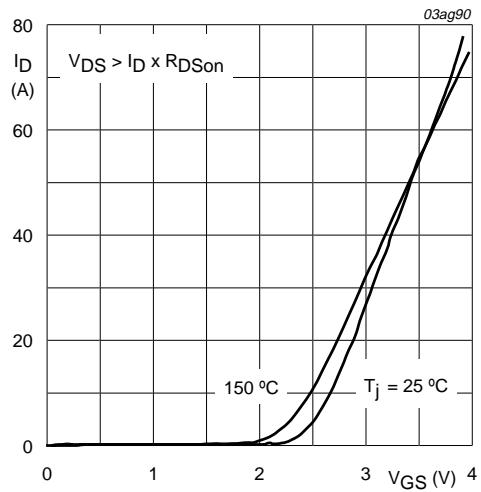
Table 5: Characteristics $T_j = 25^\circ\text{C}$ unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(\text{BR})\text{DSS}}$	drain-source breakdown voltage	$I_D = 10 \text{ mA}; V_{GS} = 0 \text{ V}$	30	-	-	V
$V_{GS(\text{th})}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}$; Figure 9	1	1.9	2.5	V
I_{DSS}	drain-source leakage current	$V_{DS} = 30 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25^\circ\text{C}$	-	0.06	1	μA
I_{GSS}	gate-source leakage current	$V_{GS} = \pm 16 \text{ V}; V_{DS} = 0 \text{ V}$	-	0.9	10	μA
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 20 \text{ A}$; Figure 7 and 8	-	4.6	5.3	$\text{m}\Omega$
		$V_{GS} = 4.5 \text{ V}; I_D = 20 \text{ A}$; Figure 8	-	8.0	10	$\text{m}\Omega$
Dynamic characteristics						
g_{fs}	forward transconductance	$V_{DS} = 10 \text{ V}; I_D = 20 \text{ A}$; Figure 11	30	50	-	S
$Q_{g(\text{tot})}$	total gate charge	$I_D = 40 \text{ A}; V_{DD} = 10 \text{ V}; V_{GS} = 10 \text{ V}$; Figure 14	-	40	-	nC
Q_{gs}	gate-source charge		-	7	-	nC
Q_{gd}	gate-drain (Miller) charge		-	8	-	nC
C_{iss}	input capacitance	$V_{GS} = 0 \text{ V}; V_{DS} = 10 \text{ V}; f = 1 \text{ MHz}$; Figure 12	-	2200	-	pF
C_{oss}	output capacitance		-	600	-	pF
C_{rss}	reverse transfer capacitance		-	330	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DD} = 10 \text{ V}; I_D = 20 \text{ A}; V_{GS} = 10 \text{ V}; R_G = 4.7 \Omega$	-	20	-	ns
t_r	rise time		-	62	-	ns
$t_{d(off)}$	turn-off delay time		-	59	-	ns
t_f	fall time		-	18	-	ns
Source-drain (reverse) diode						
V_{SD}	source-drain (diode forward) voltage	$I_S = 40 \text{ A}; V_{GS} = 0 \text{ V}$; Figure 13	-	0.85	1.11	V
t_{rr}	reverse recovery time	$I_S = 40 \text{ A}; dI_S/dt = -50 \text{ A}/\mu\text{s}$; $V_{GS} = 0 \text{ V}$	-	60	-	ns



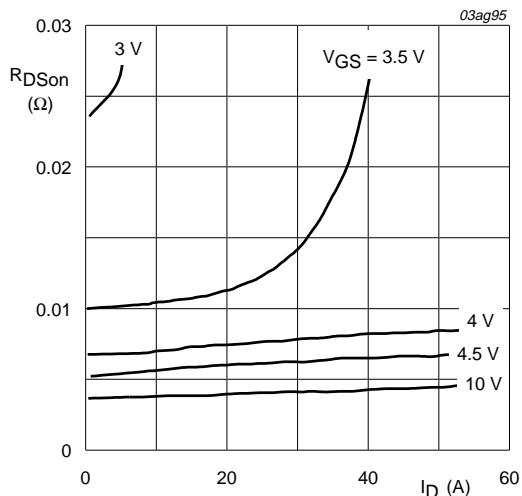
T_j = 25 °C

Fig 5. Output characteristics: drain current as a function of drain-source voltage; typical values.



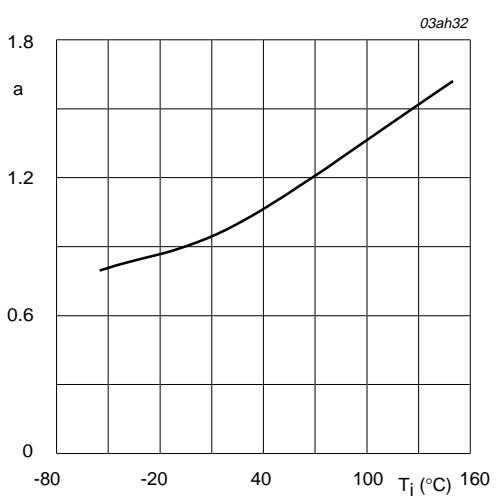
T_j = 25 °C and 150 °C; V_{DS} > I_D × R_{DSon}

Fig 6. Transfer characteristics: drain current as a function of gate-source voltage; typical values.



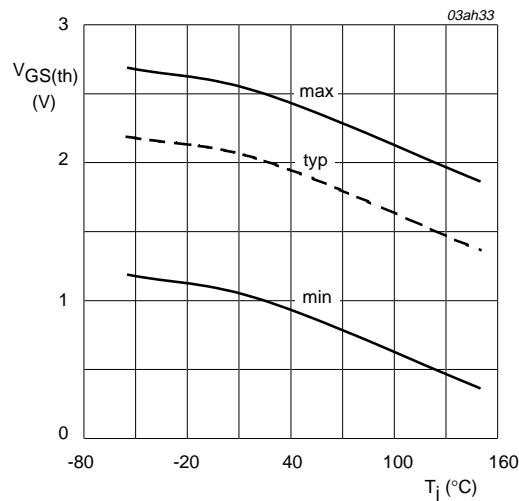
T_j = 25 °C

Fig 7. Drain-source on-state resistance as a function of drain current; typical values.



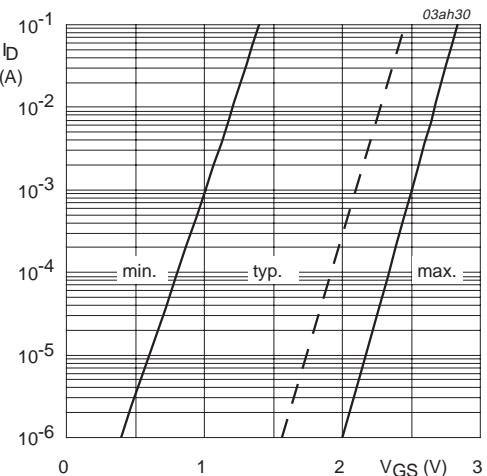
$$a = \frac{R_{DSon}}{R_{DSon(25^{\circ}C)}}$$

Fig 8. Normalized drain-source on-state resistance factor as a function of junction temperature.



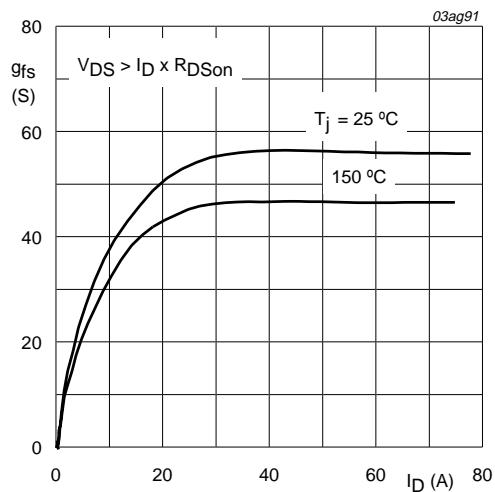
$I_D = 1$ mA; $V_{DS} = V_{GS}$

Fig 9. Gate-source threshold voltage as a function of junction temperature.



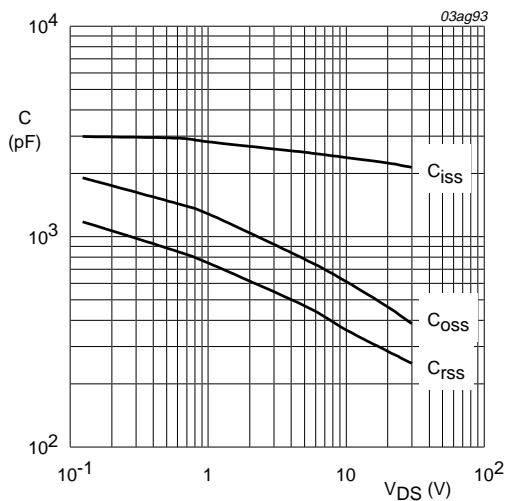
$T_j = 25$ $^{\circ}$ C

Fig 10. Sub-threshold drain current as a function of gate-source voltage.



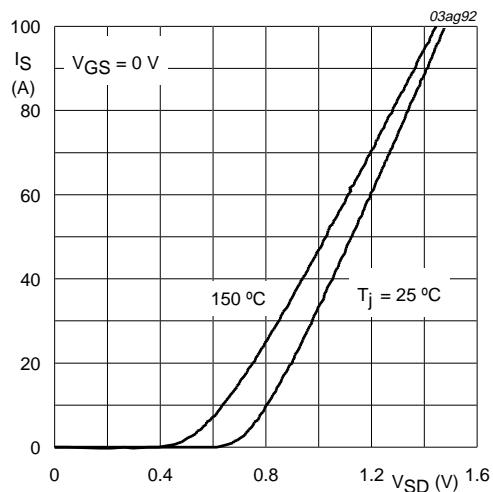
$T_j = 25$ $^{\circ}$ C and 150 $^{\circ}$ C; $V_{DS} > I_D \times R_{DSon}$

Fig 11. Forward transconductance as a function of drain current; typical values.



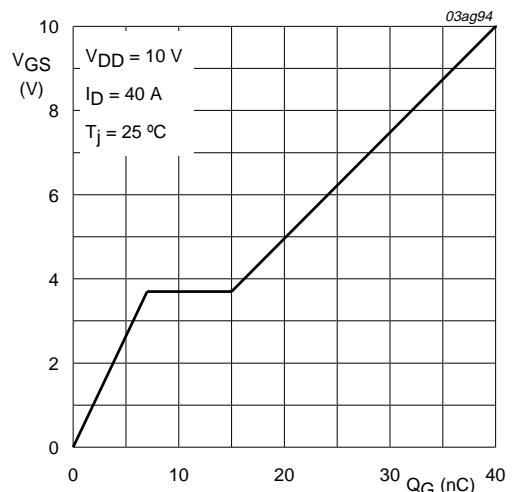
$V_{GS} = 0$ V; $f = 1$ MHz

Fig 12. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values.



$T_j = 25^\circ\text{C}$ and 150°C ; $V_{GS} = 0\text{ V}$

Fig 13. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values.



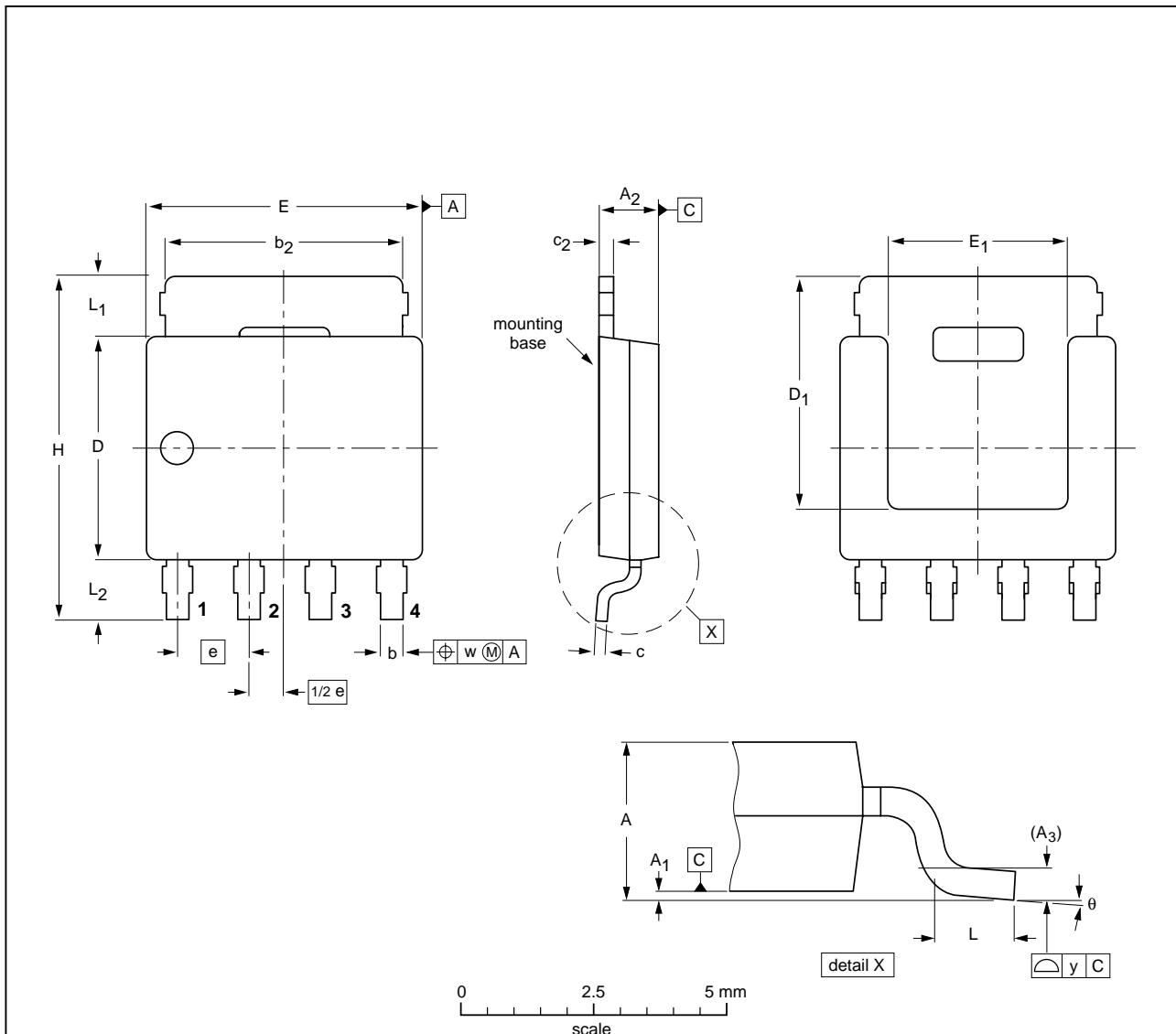
$T_j = 25^\circ\text{C}$; $I_D = 40\text{ A}$; $V_{DD} = 10\text{ V}$

Fig 14. Gate-source voltage as a function of gate charge; typical values.

9. Package outline

Plastic single-ended surface mounted package (Philips version LFPAK); 4 leads

SOT669



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	A_2	A_3	b	b_2	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	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				-02-07-10 03-02-05

Fig 15. SOT669 (LFPAK).

10. Revision history

Table 6: Revision history

Rev	Date	CPCN	Description
02	20030718	-	Product data (9397 750 10951) Modifications: <ul style="list-style-type: none">• JEDEC reference added to package outline drawing in Figure 15
01	20020207	-	Product data (9397 750 09391)

11. Data sheet status

Level	Data sheet status ^[1]	Product status ^{[2][3]}	Definition
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
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[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL <http://www.semiconductors.philips.com>.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

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Limiting values definition — 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.

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