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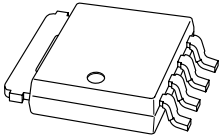
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Kind regards,

Team Nexperia



# PH4840S

## N-channel TrenchMOS intermediate level FET

Rev. 02 — 6 November 2006

Product data sheet

## 1. Product profile

### 1.1 General description

N-channel enhancement mode Field-Effect Transistor (FET) in a plastic package using TrenchMOS technology.

### 1.2 Features

- Low thermal resistance
- Low threshold voltage
- SO8 equivalent area footprint
- Low on-state resistance

### 1.3 Applications

- DC-to-DC converters
- Portable appliances
- DC motor drives
- Switched-mode power supplies
- Notebook computers

### 1.4 Quick reference data

- $V_{DS} \leq 40$  V
- $R_{DS(on)} \leq 4.1$  m $\Omega$
- $I_D \leq 94.5$  A
- $P_{tot} \leq 62.5$  W

## 2. Pinning information

Table 1. Pinning

Pin	Description	Simplified outline	Symbol
1, 2, 3	source (S)		
4	gate (G)		
mb	mounting base; connected to drain (D)		

**SOT669 (LFAK)**

### 3. Ordering information

**Table 2. Ordering information**

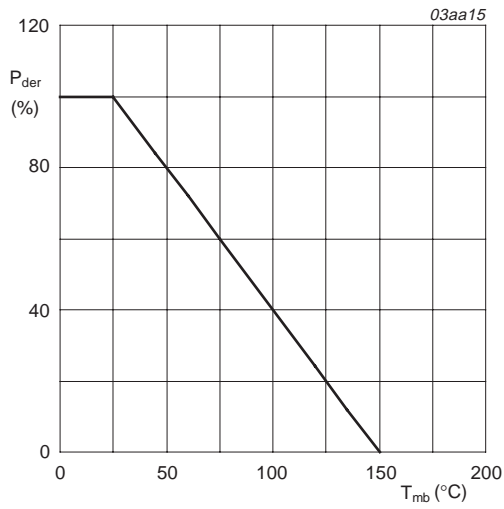
Type number	Package		Version
	Name	Description	
PH4840S	LFPAK	plastic single-ended surface-mounted package; 4 leads	SOT669

### 4. Limiting values

**Table 3. Limiting values**

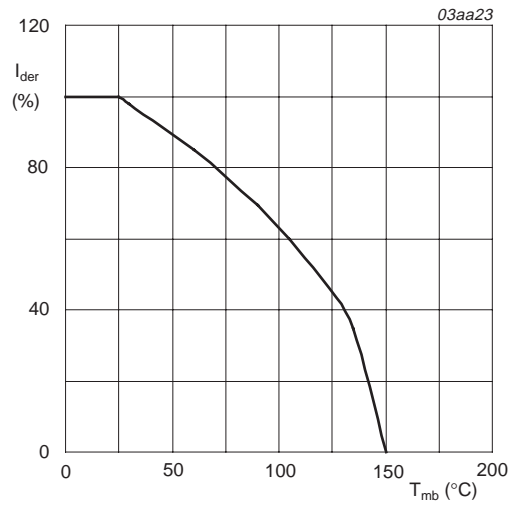
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DS}$	drain-source voltage	$25\text{ °C} \leq T_j \leq 150\text{ °C}$	-	40	V
$V_{GS}$	gate-source voltage		-	$\pm 20$	V
$I_D$	drain current	$T_{mb} = 25\text{ °C}$ ; $V_{GS} = 10\text{ V}$ ; see <a href="#">Figure 2</a> and <a href="#">3</a>	-	94.5	A
		$T_{mb} = 100\text{ °C}$ ; $V_{GS} = 10\text{ V}$ ; see <a href="#">Figure 2</a>	-	59.5	A
$I_{DM}$	peak drain current	$T_{mb} = 25\text{ °C}$ ; pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; see <a href="#">Figure 3</a>	-	283	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 1</a>	-	62.5	W
$T_{stg}$	storage temperature		-55	+150	°C
$T_j$	junction temperature		-55	+150	°C
<b>Source-drain diode</b>					
$I_S$	source current	$T_{mb} = 25\text{ °C}$	-	52	A
$I_{SM}$	peak source current	$T_{mb} = 25\text{ °C}$ ; pulsed; $t_p \leq 10\text{ }\mu\text{s}$	-	150	A
<b>Avalanche ruggedness</b>					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	unclamped inductive load; $I_D = 51\text{ A}$ ; $t_p = 0.21\text{ ms}$ ; $V_{DS} \leq 40\text{ V}$ ; $V_{GS} = 10\text{ V}$ ; starting at $T_j = 25\text{ °C}$	-	250	mJ



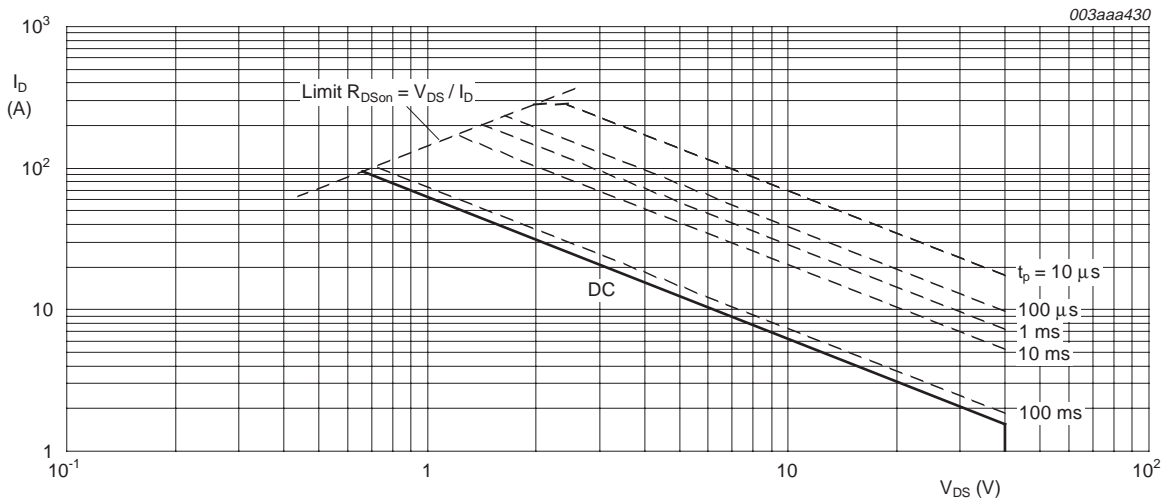
$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}C)}} \times 100\%$$

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



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

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



T<sub>mb</sub> = 25 °C; I<sub>DM</sub> is single pulse; V<sub>GS</sub> = 10 V

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

### 5. Thermal characteristics

Table 4. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see <a href="#">Figure 4</a>	-	-	2	K/W

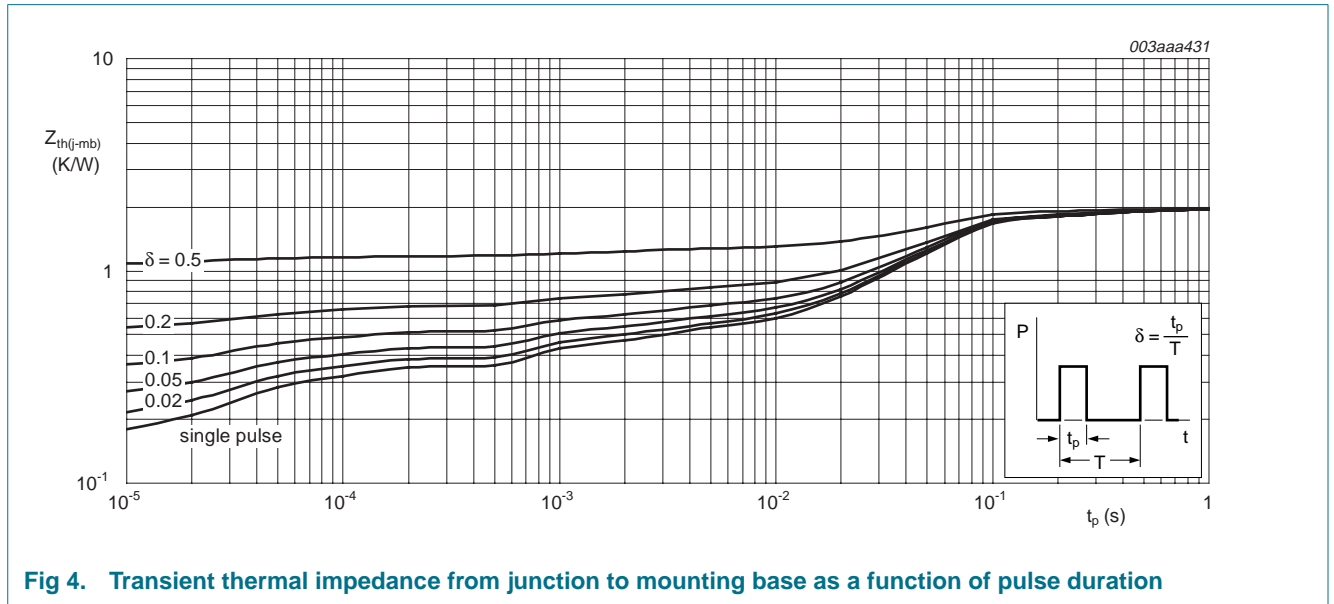


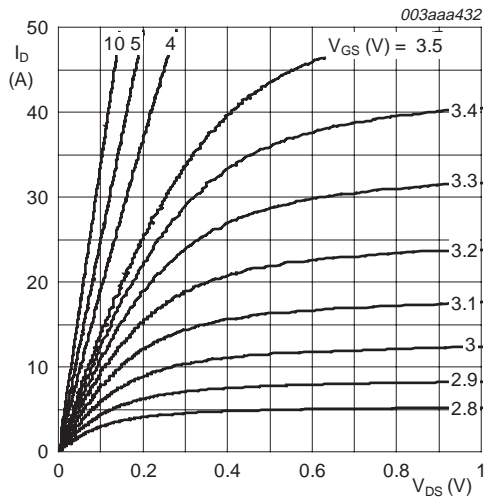
Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 6. Characteristics

**Table 5. Characteristics**

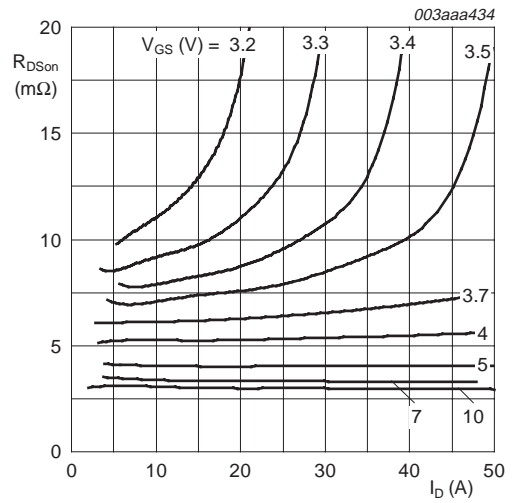
$T_j = 25\text{ °C}$  unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250\ \mu\text{A}; V_{GS} = 0\ \text{V}$	40	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\ \text{mA}; V_{DS} = V_{GS}$ ; see <a href="#">Figure 9</a> and <a href="#">10</a>				
		$T_j = 25\text{ °C}$	1	2	3	V
		$T_j = 150\text{ °C}$	0.5	-	-	V
$I_{DSS}$	drain leakage current	$V_{DS} = 40\ \text{V}; V_{GS} = 0\ \text{V}$				
		$T_j = 25\text{ °C}$	-	0.06	1	$\mu\text{A}$
$I_{GSS}$	gate leakage current	$V_{GS} = \pm 20\ \text{V}; V_{DS} = 0\ \text{V}$	-	2	100	nA
		$T_j = 150\text{ °C}$	-	-	500	$\mu\text{A}$
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\ \text{V}; I_D = 25\ \text{A}$ ; see <a href="#">Figure 6</a> and <a href="#">8</a>				
		$T_j = 25\text{ °C}$	-	3.5	4.1	m $\Omega$
		$T_j = 150\text{ °C}$	-	5.6	7.0	m $\Omega$
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 7\ \text{V}; I_D = 25\ \text{A}$ ; see <a href="#">Figure 6</a> and <a href="#">8</a>	-	3.85	4.8	m $\Omega$
		$T_j = 150\text{ °C}$	-	5.6	7.0	m $\Omega$
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = 30\ \text{A}; V_{DS} = 32\ \text{V}; V_{GS} = 10\ \text{V}$ ; see <a href="#">Figure 11</a> and <a href="#">12</a>	-	67	-	nC
$Q_{GS}$	gate-source charge		-	8.6	-	nC
$Q_{GD}$	gate-drain charge		-	16	-	nC
$C_{iss}$	input capacitance	$V_{GS} = 0\ \text{V}; V_{DS} = 10\ \text{V}; f = 1\ \text{MHz}$ ; see <a href="#">Figure 14</a>	-	3660	-	pF
$C_{oss}$	output capacitance		-	877	-	pF
$C_{rss}$	reverse transfer capacitance		-	454	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 20\ \text{V}; I_D = 25\ \text{A}; V_{GS} = 10\ \text{V}$ ; $R_G = 4.7\ \Omega$	-	21	-	ns
$t_r$	rise time		-	35	-	ns
$t_{d(off)}$	turn-off delay time		-	82	-	ns
$t_f$	fall time		-	31	-	ns
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = 25\ \text{A}; V_{GS} = 0\ \text{V}$ ; see <a href="#">Figure 13</a>	-	0.85	1.2	V
$t_{rr}$	reverse recovery time	$I_S = 20\ \text{A}; di_S/dt = -100\ \text{A}/\mu\text{s}; V_{GS} = 0\ \text{V}$	-	46	-	ns



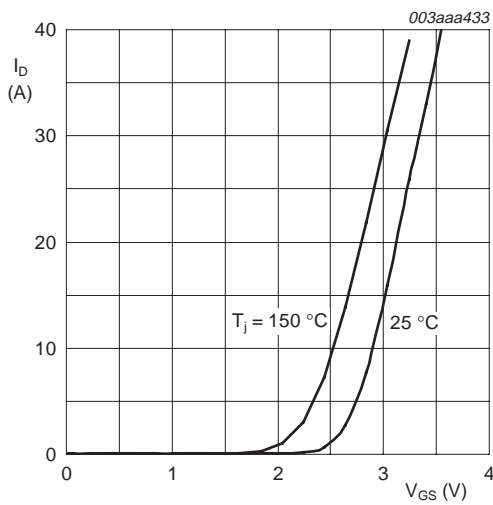
$T_j = 25\text{ }^\circ\text{C}$

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



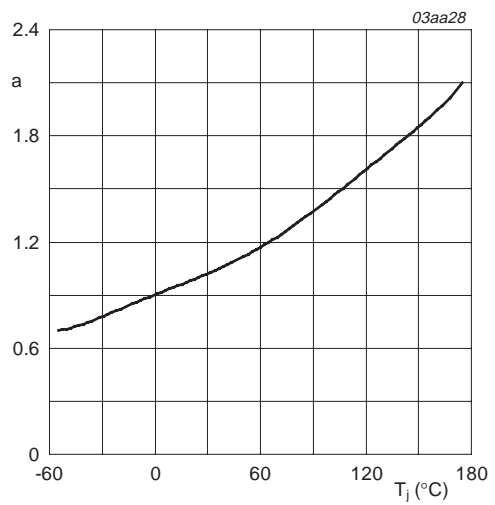
$T_j = 25\text{ }^\circ\text{C}$

Fig 6. Drain-source on-state resistance as a function of drain current; typical values



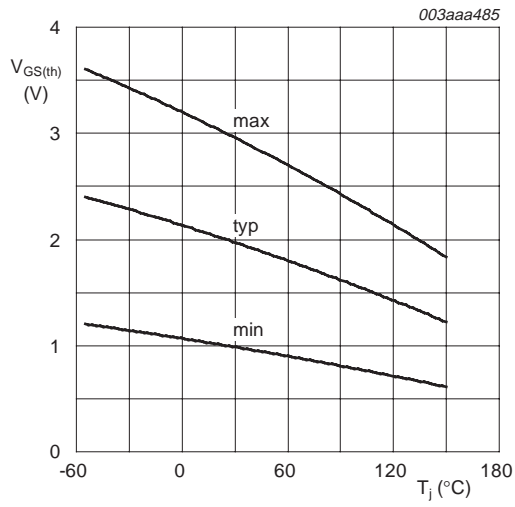
$T_j = 25\text{ }^\circ\text{C}$  and  $150\text{ }^\circ\text{C}$ ;  $V_{DS} > I_D \times R_{DSon}$

Fig 7. Transfer characteristics: drain current as a function of gate-source voltage; typical values



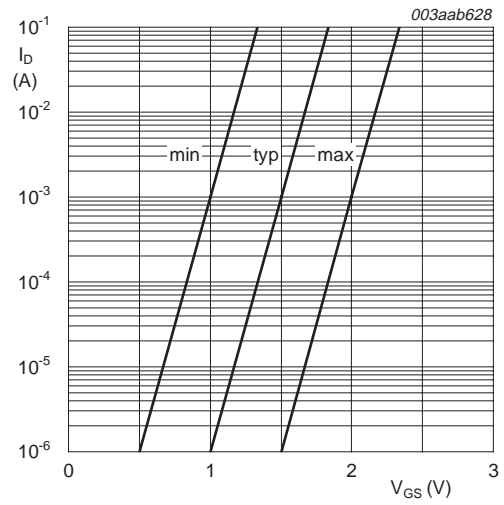
$$a = \frac{R_{DSon}}{R_{DSon(25^\circ\text{C})}}$$

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



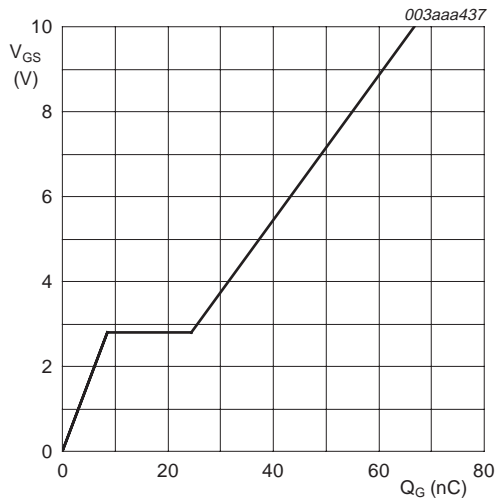
$I_D = 1 \text{ mA}; V_{DS} = V_{GS}$

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



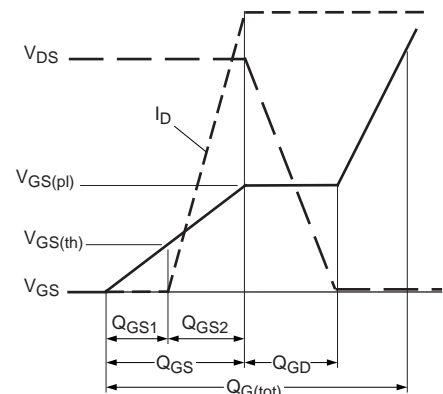
$T_j = 25 \text{ °C}; V_{DS} = 5 \text{ V}$

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



$I_D = 30 \text{ A}; V_{DS} = 32 \text{ V}$

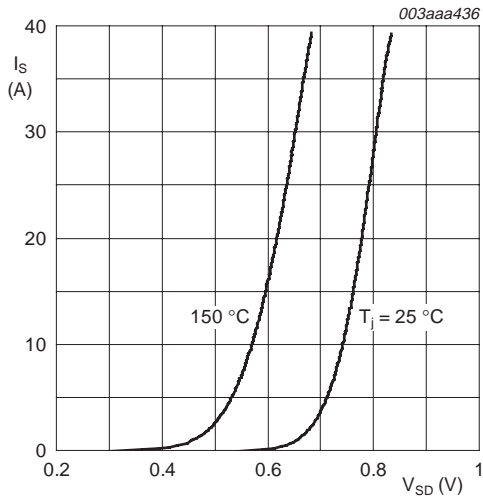
**Fig 11. Gate-source voltage as a function of gate charge; typical values**



003aaa508

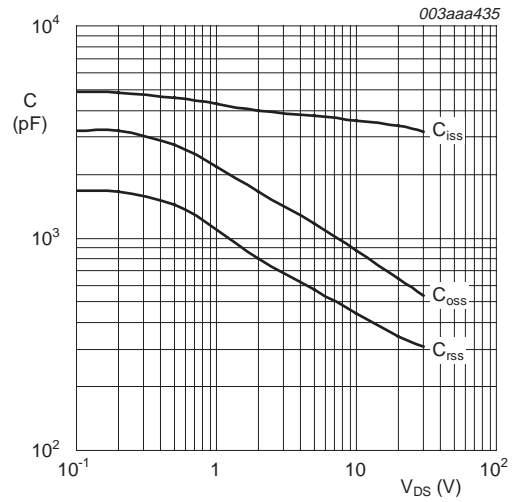
**Fig 12. Gate charge waveform definitions**





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

**Fig 13. Source current as a function of source-drain voltage; typical values**



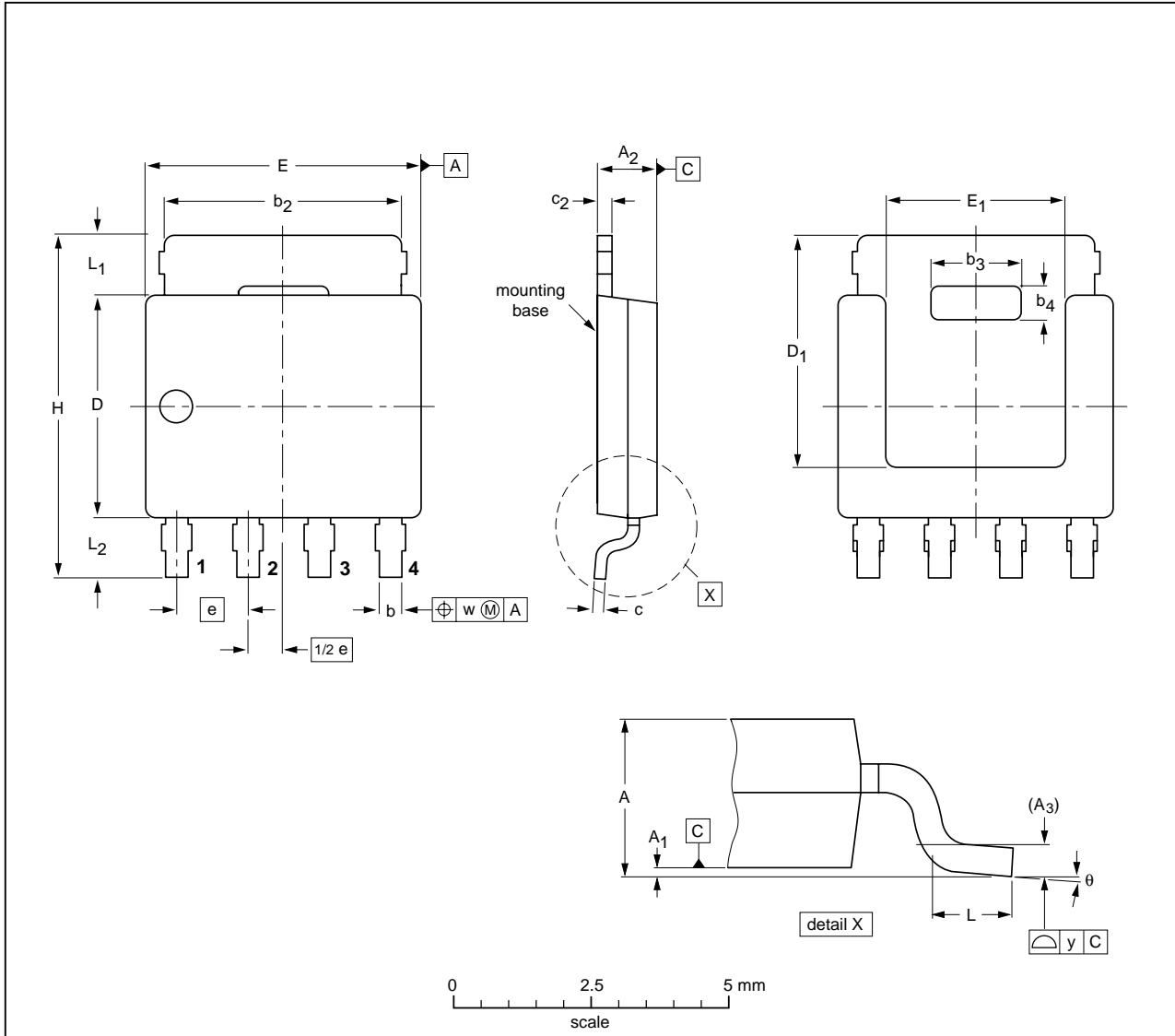
$V_{GS} = 0\text{ V}$ ;  $f = 1\text{ MHz}$

**Fig 14. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values**

7. Package outline

Plastic single-ended surface-mounted package (LPAK); 4 leads

SOT669



DIMENSIONS (mm are the original dimensions)

UNIT	A	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	c	c <sub>2</sub>	D <sup>(1)</sup>	D <sub>1</sub> <sup>(1)</sup> max	E <sup>(1)</sup>	E <sub>1</sub> <sup>(1)</sup>	e	H	L	L <sub>1</sub>	L <sub>2</sub>	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 15. Package outline SOT669 (LPAK)

## 8. Revision history

Table 6. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PH4840S_2	20061106	Product data sheet	-	PH4840S-01
Modifications:				
				<ul style="list-style-type: none"><li>• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li><li>• Legal texts have been adapted to the new company name where appropriate.</li></ul>
PH4840S-01 (9397 750 12814)	20040304	Preliminary data	-	-

## 9. Legal information

### 9.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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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