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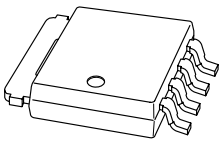


PH4025L

N-channel TrenchMOS logic level FET

Rev. 01 — 22 August 2007 **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.

1.2 Features

- Logic level threshold
- Optimized for use in DC-to-DC converters
- 100 % R_G tested
- Lead-free package
- Very low switching and conduction losses
- 100 % ruggedness tested

1.3 Applications

- DC-to-DC converters
- Voltage regulators
- Switched-mode power supplies
- PC Motherboards

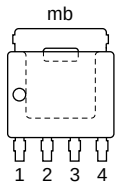
1.4 Quick reference data

- $V_{DS} \leq 25$ V
- $R_{DSon} \leq 4.0$ mΩ
- $I_D \leq 99$ A
- $Q_{GD} = 5$ nC (typ)

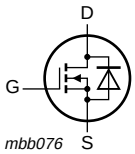
2. Pinning information

Table 1. Pinning

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



SOT669 (LFPAK)



3. Ordering information

Table 2. Ordering information

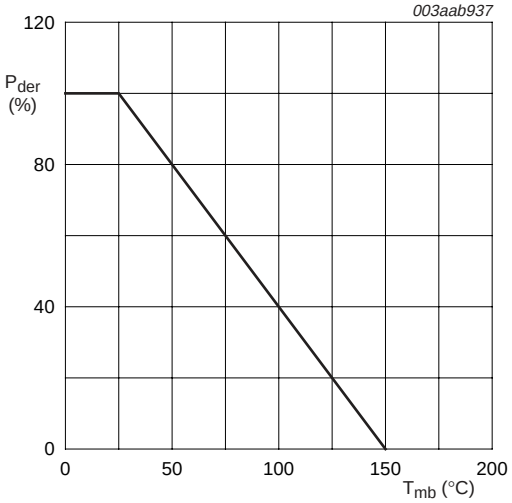
Type number	Package		
	Name	Description	Version
PH4025L	LFPAK	plastic single-ended surface-mounted package (lfpak); 4 leads	SOT669

4. Limiting values

Table 3. Limiting values

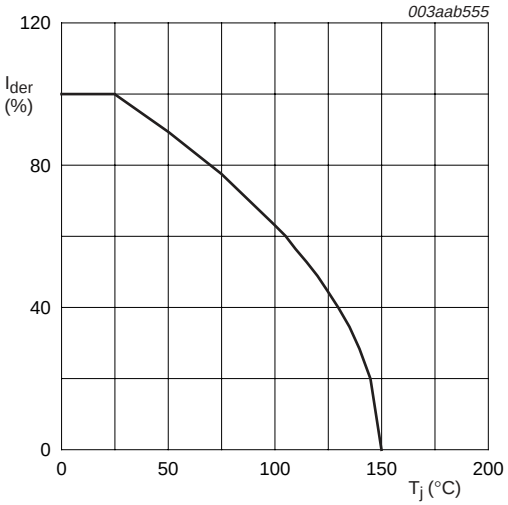
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage	25 °C ≤ T_j ≤ 150 °C	-	25	V
V_{DGR}	drain-gate voltage (DC)	25 °C ≤ T_j ≤ 150 °C; R_{GS} = 20 kΩ	-	25	V
V_{GS}	gate-source voltage		-	±20	V
I_D	drain current	T_{mb} = 25 °C; V_{GS} = 10 V; see Figure 2 and 3	-	99	A
		T_{mb} = 100 °C; V_{GS} = 10 V; see Figure 2	-	67.5	A
I_{DM}	peak drain current	T_{mb} = 25 °C; pulsed; t_p ≤ 10 µs; see Figure 3	-	300	A
P_{tot}	total power dissipation	T_{mb} = 25 °C; see Figure 1	-	46.4	W
T_{stg}	storage temperature		–55	+150	°C
T_j	junction temperature		–55	+150	°C
Source-drain diode					
I_S	source current	T_{mb} = 25 °C	-	52	A
I_{SM}	peak source current	T_{mb} = 25 °C; pulsed; t_p ≤ 10 µs	-	208	A
Avalanche ruggedness					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	unclamped inductive load; I_D = 56 A; t_p = 0.16 ms; V_{DS} ≤ 25 V; R_{GS} = 50 Ω; V_{GS} = 10 V; starting at T_j = 25 °C	-	150	mJ



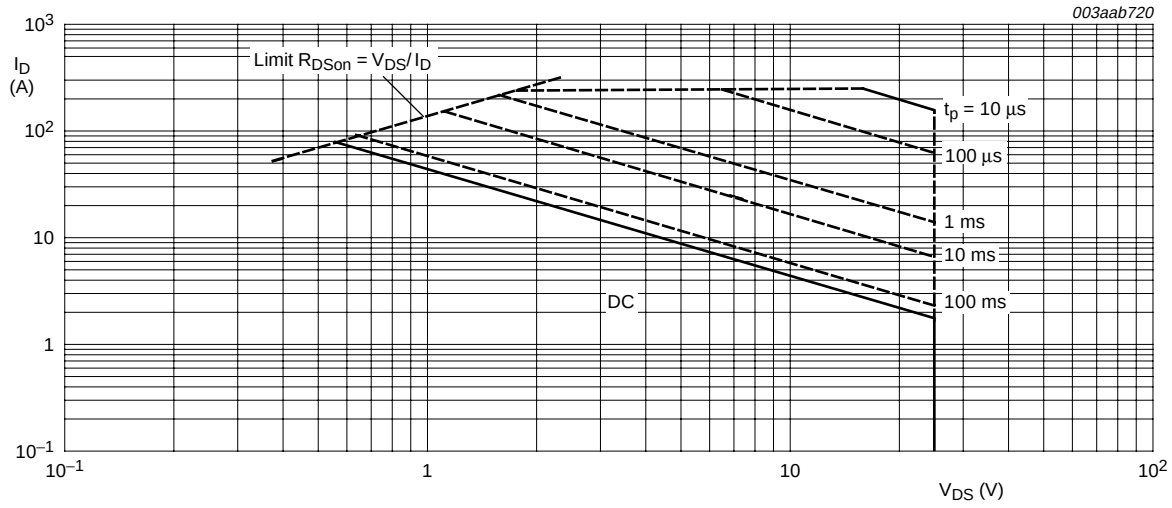
$$P_{der} = \frac{P_{tot}}{P_{tot(25°C)}} \times 100\ \%$$

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



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

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



T_{mb} = 25 °C

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
$R_{th(j\text{-}mb)}$	thermal resistance from junction to mounting base	see Figure 4	-	-	2	K/W

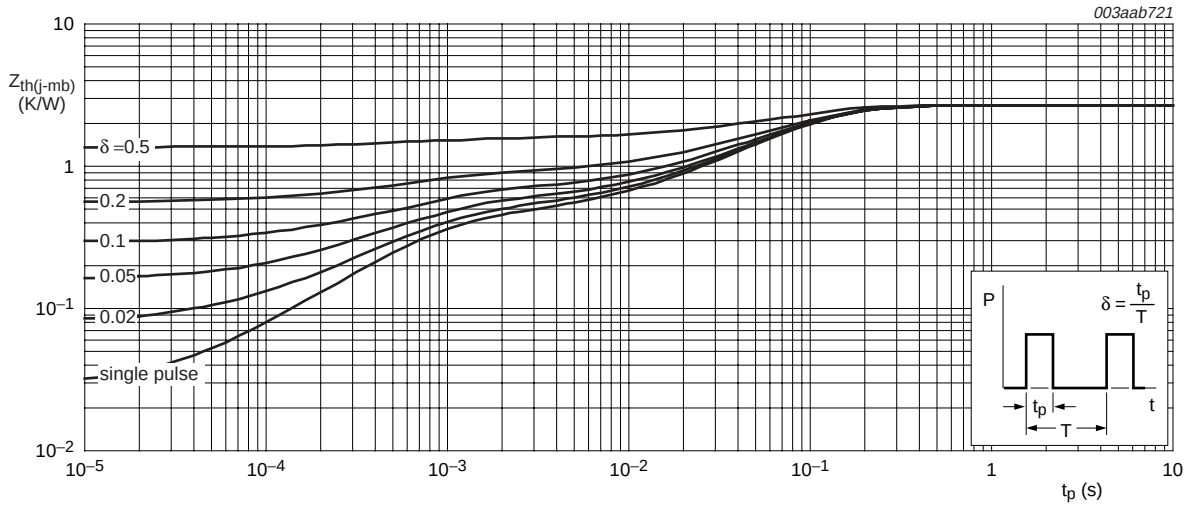


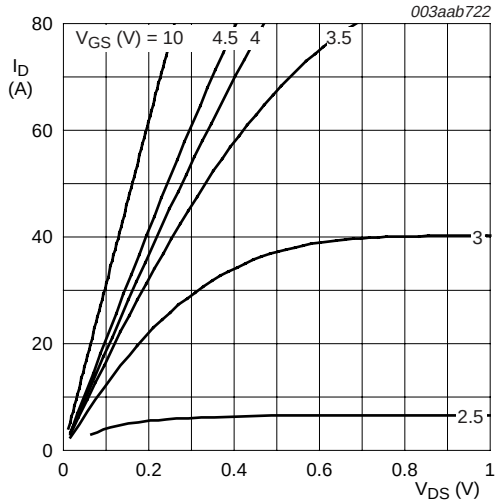
Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

Table 5. Characteristics

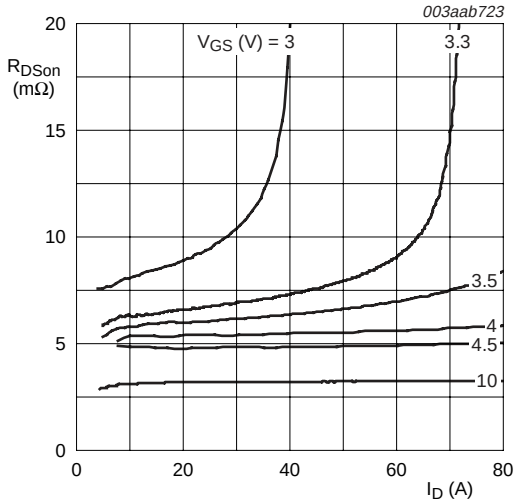
T_j = 25 °C unless otherwise specified.

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 = 25 °C	25	-	-	V
		T_j = −55 °C	22.5	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	I_D = 1 mA; V_{DS} = V_{GS}; see Figure 9 and 10				
		T_j = 25 °C	1.3	1.7	2.15	V
		T_j = 150 °C	0.8	-	-	V
		T_j = −55 °C	-	-	2.6	V
I_{DSS}	drain leakage current	V_{DS} = 25 V; V_{GS} = 0 V				
		T_j = 25 °C	-	-	1	µA
		T_j = 150 °C	-	-	100	µA
I_{GSS}	gate leakage current	V_{GS} = ±16 V; V_{DS} = 0 V	-	-	100	nA
R_G	gate resistance	f = 1 MHz	-	0.48	-	Ω
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 25 A; see Figure 6 and 8				
		T_j = 25 °C	-	3.4	4.0	mΩ
		T_j = 150 °C	-	5.4	6.4	mΩ
		V_{GS} = 4.5 V; I_D = 25 A; see Figure 6 and 8	-	5.1	6.2	mΩ
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	I_D = 25 A; V_{DS} = 12 V; V_{GS} = 4.5 V; see Figure 11 and 12	-	21.3	-	nC
Q_{GS}	gate-source charge		-	8.8	-	nC
Q_{GS1}	pre-$V_{GS(th)}$ gate-source charge		-	5.3	-	nC
Q_{GS2}	post-$V_{GS(th)}$ gate-source charge		-	3.4	-	nC
Q_{GD}	gate-drain charge		-	5	-	nC
$V_{GS(pl)}$	gate-source plateau voltage		-	2.8	-	V
$Q_{G(tot)}$	total gate charge	I_D = 0 A; V_{DS} = 0 V; V_{GS} = 4.5 V	-	1.35	-	nC
C_{iss}	input capacitance	V_{GS} = 0 V; V_{DS} =12 V; f = 1 MHz; see Figure 14	-	2601	-	pF
C_{oss}	output capacitance		-	645	-	pF
C_{rss}	reverse transfer capacitance		-	287	-	pF
C_{iss}	input capacitance	V_{GS} = 0 V; V_{DS} = 0 V; f = 1 MHz	-	2973	-	pF
$t_{d(on)}$	turn-on delay time	V_{DS} =12 V; R_L = 0.5 Ω; V_{GS} = 4.5 V; R_G = 5.6 Ω	-	28.3	-	ns
t_r	rise time		-	52	-	ns
$t_{d(off)}$	turn-off delay time		-	35	-	ns
t_f	fall time		-	24	-	ns
Source-drain diode						
V_{SD}	source-drain voltage	I_S = 25 A; V_{GS} = 0 V; see Figure 13	-	0.8	1.3	V
t_{rr}	reverse recovery time	I_S = 25 A; dI_S/dt = −100 A/µs; V_{GS} = 0 V; V_R = 20 V	-	38	-	ns
Q_r	recovered charge		-	11	-	nC



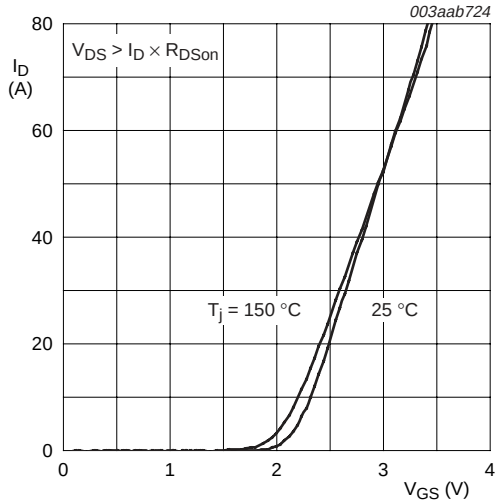
T_j = 25 °C

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



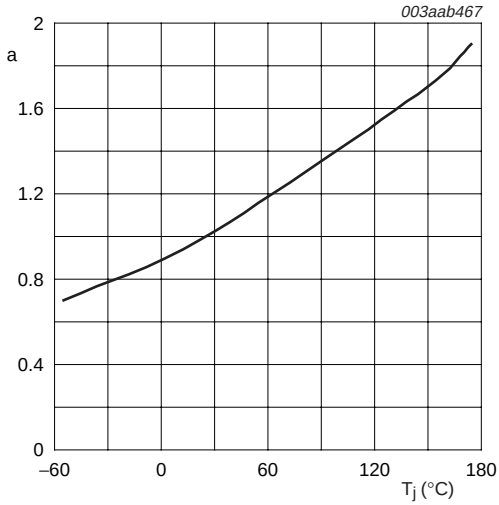
T_j = 25 °C

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



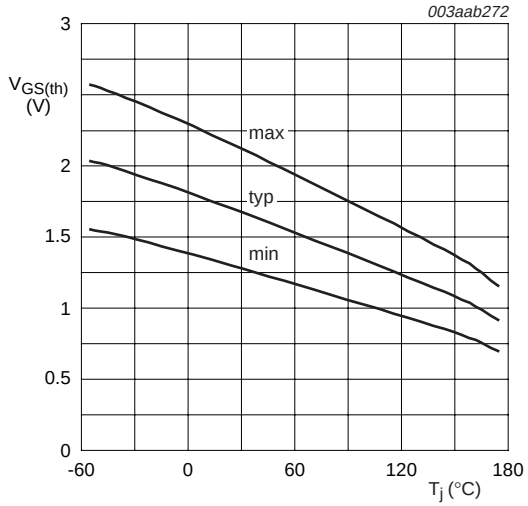
T_j = 25 °C and 150 °C; $V_{DS} > I_D \times R_{DSon}$

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



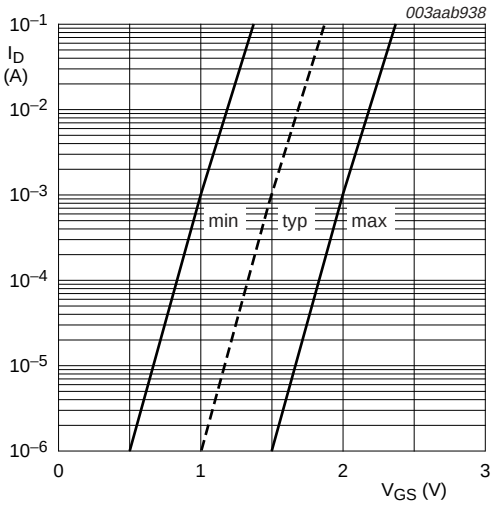
$$a = \frac{R_{DSon}}{R_{DSon(25°C)}}$$

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



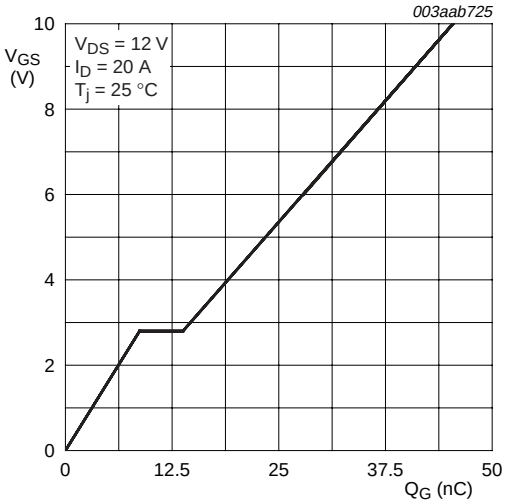
I_D = 1 mA; V_{DS} = V_{GS}

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



T_j = 25 °C; V_{DS} = 5 V

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



I_D = 20 A; V_{DS} = 12 V

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

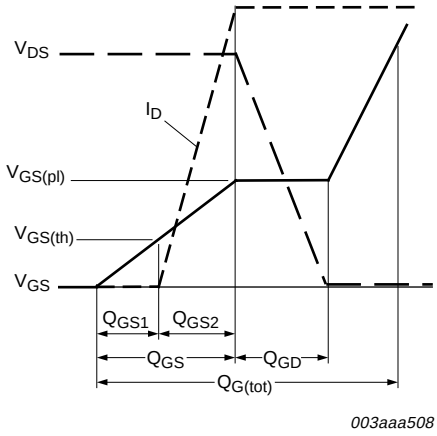
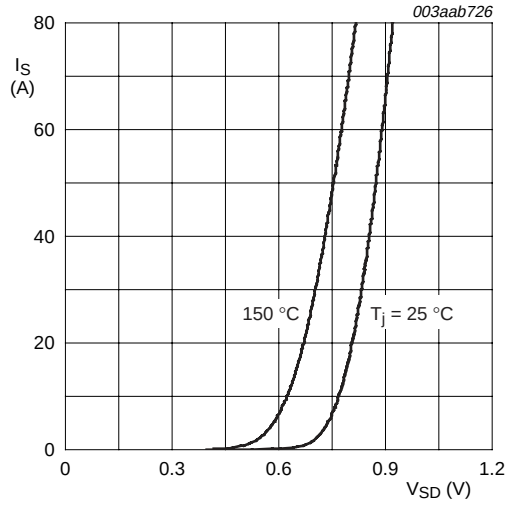
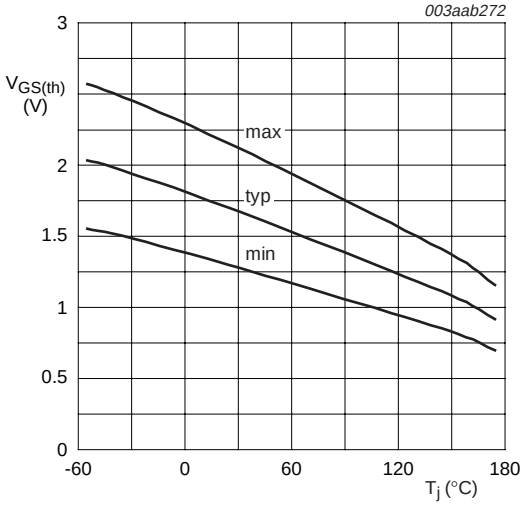


Fig 12. Gate charge waveform definitions



T_j = 25 °C and 150 °C; V_{GS} = 0 V

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

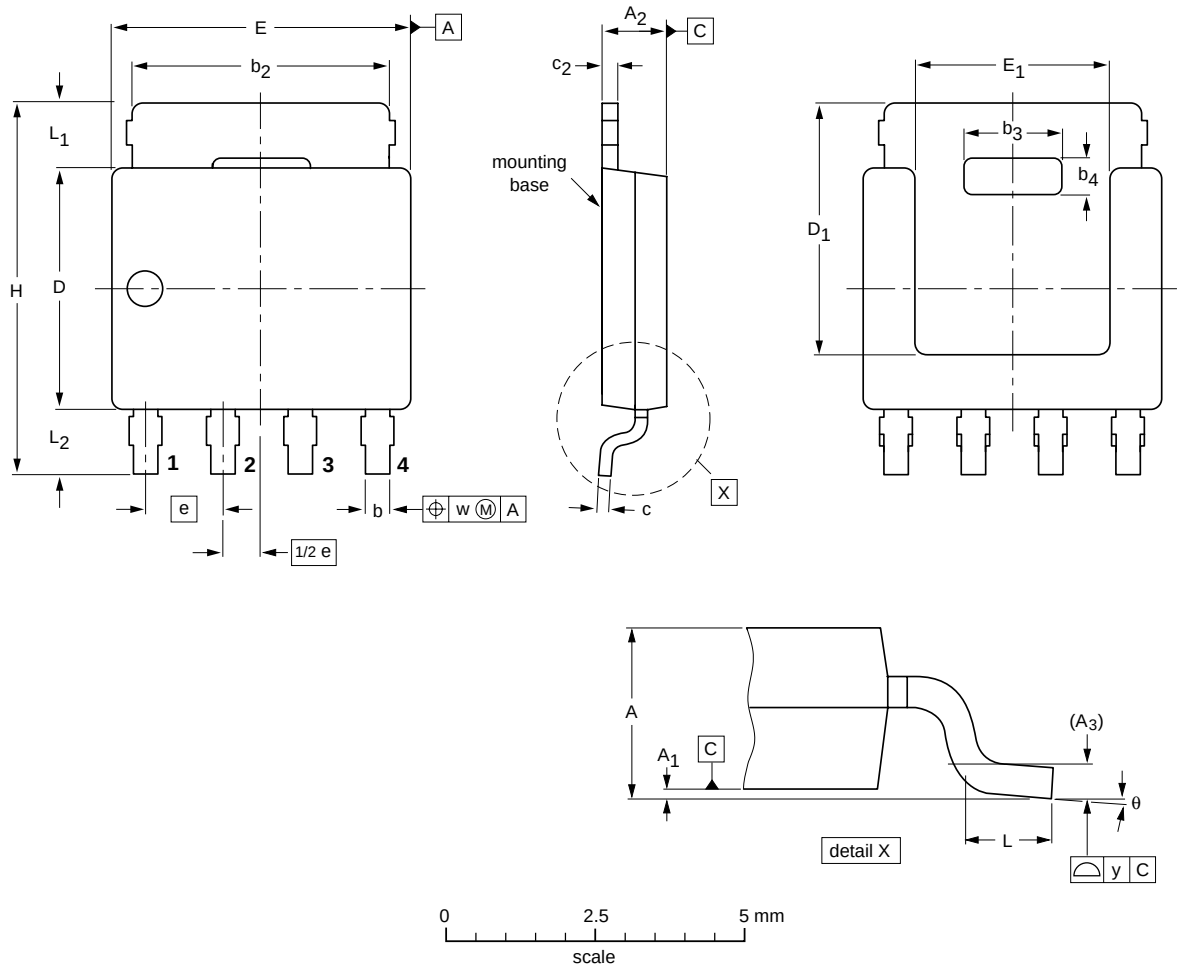


V_{GS} = 0 V; f = 1 MHz

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 (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 15. Package outline SOT669 (LFPAK)

8. Revision history

Table 6. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PH4025L_1	20070822	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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