

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 and consumer applications.

1.2 Features and benefits

- High efficiency due to low switching and conduction losses
- Suitable for logic level gate drive sources

1.3 Applications

- Consumer applications
- Desktop Voltage Regulator Module (VRM)
- Notebook Voltage Regulator Module (VRM)

1.4 Quick reference data

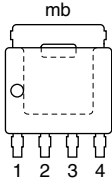
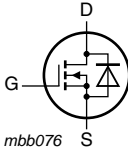
Table 1. Quick reference

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$	-	-	30	V
I_D	drain current	$T_{mb} = 25\text{ °C}; V_{GS} = 10\text{ V};$ see Figure 1	[1]	-	100	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C};$ see Figure 2	-	-	69	W
Dynamic characteristics						
Q_{GD}	gate-drain charge	$V_{GS} = 4.5\text{ V}; I_D = 10\text{ A};$	-	4.3	-	nC
$Q_{G(tot)}$	total gate charge	$V_{DS} = 12\text{ V};$ see Figure 14 and 15	-	17.6	-	nC
Static characteristics						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 15\text{ A};$ $T_j = 25\text{ °C}$	-	2.72	4	m Ω

[1] Continuous current limited by package.

2. Pinning information

Table 2. Pinning information

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

SOT669 (LFAK)

3. Ordering information

Table 3. Ordering information

Type number	Package		Version
	Name	Description	
PH4030AL	LFAK	plastic single-ended surface-mounted package (LFAK); 4 leads	SOT669

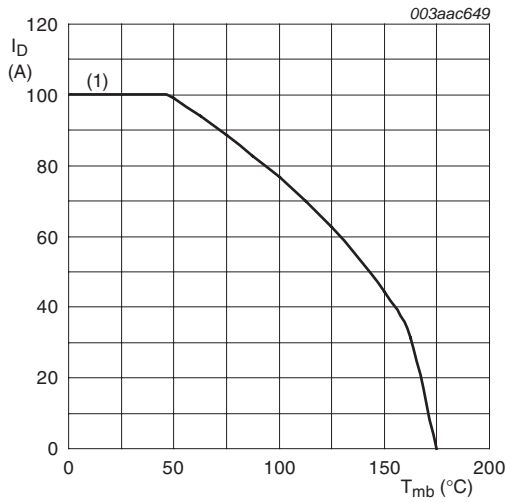
4. Limiting values

Table 4. Limiting values

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

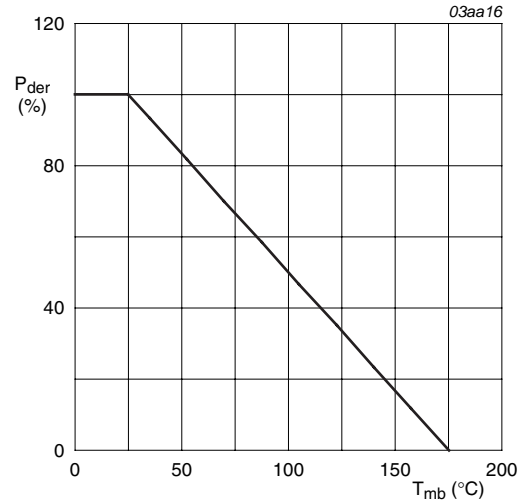
Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$	-	30	V
V_{DGR}	drain-gate voltage	$T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$; $R_{GS} = 20\text{ k}\Omega$	-	30	V
V_{GS}	gate-source voltage		-20	20	V
I_D	drain current	$V_{GS} = 10\text{ V}$; $T_{mb} = 100\text{ °C}$; see Figure 1	-	76	A
		$V_{GS} = 10\text{ V}$; $T_{mb} = 25\text{ °C}$; see Figure 1	[1]	100	A
I_{DM}	peak drain current	$t_p \leq 10\text{ }\mu\text{s}$; pulsed; $T_{mb} = 25\text{ °C}$; see Figure 3	-	396	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; see Figure 2	-	69	W
T_{stg}	storage temperature		-55	175	°C
T_j	junction temperature		-55	175	°C
Source-drain diode					
I_S	source current	$T_{mb} = 25\text{ °C}$;	[1]	100	A
I_{SM}	peak source current	$t_p \leq 10\text{ }\mu\text{s}$; pulsed; $T_{mb} = 25\text{ °C}$	-	396	A
Avalanche ruggedness					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25\text{ °C}$; $I_D = 99\text{ A}$; $V_{sup} \leq 30\text{ V}$; $R_{GS} = 50\text{ }\Omega$; unclamped	-	41	mJ

[1] Continuous current limited by package.



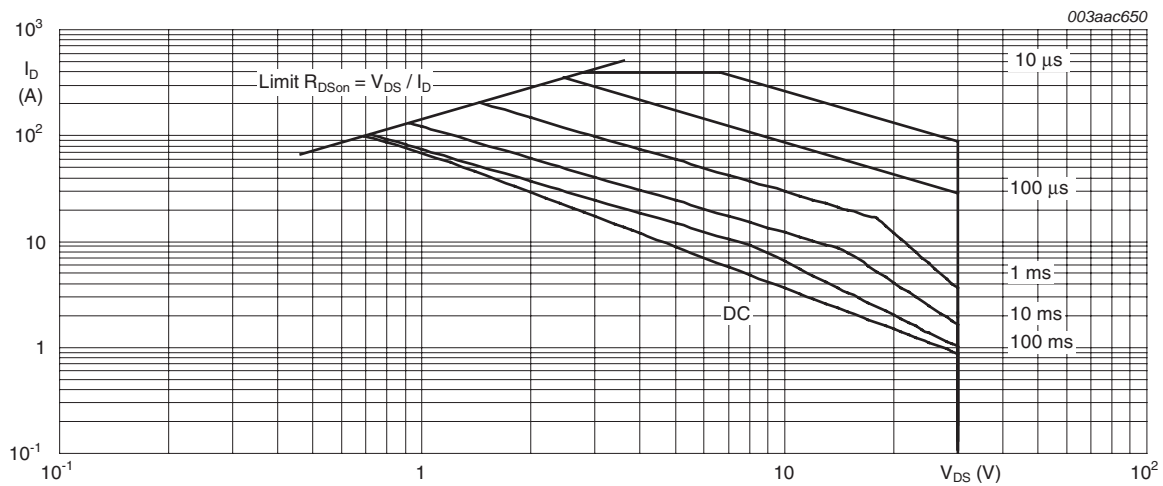
$V_{GS} \geq 10V$; (1) Capped at 100 A due to package.

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



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

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



$T_{mb} = 25^{\circ}C$; 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
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see Figure 4	-	0.96	1.82	K/W

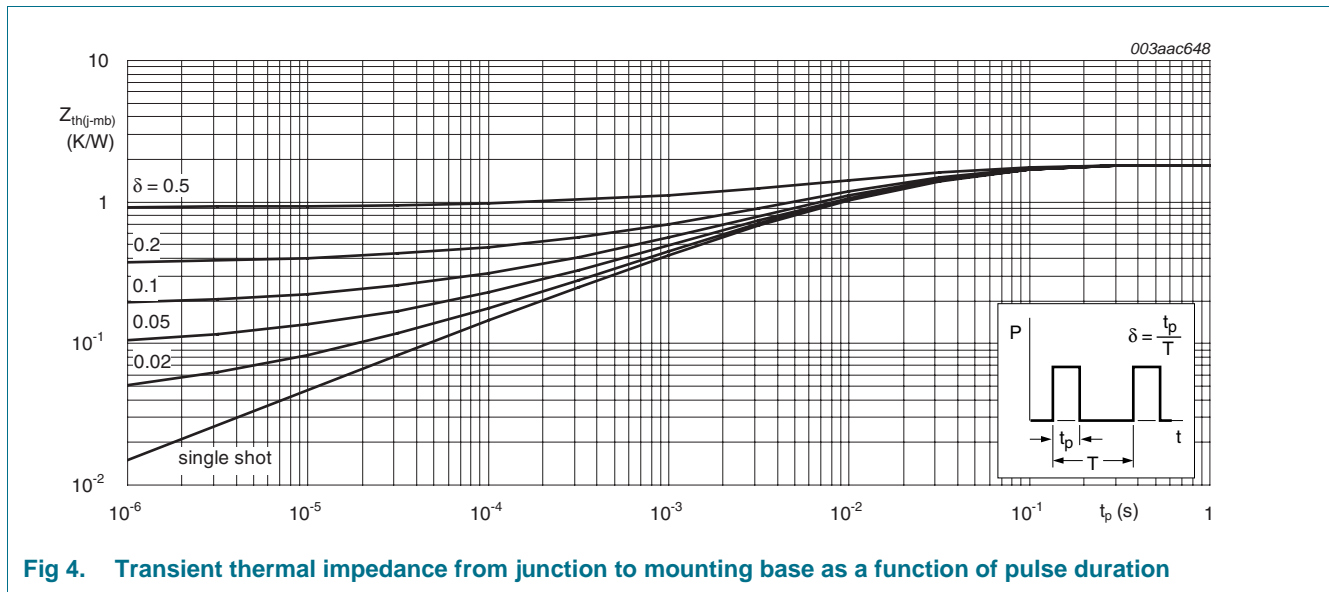


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 20\text{ A}$; $V_{GS} = 0\text{ V}$; $T_j = 25\text{ °C}$; $t_{av} = 100\text{ ns}$	35	-	-	V
		$I_D = 250\text{ }\mu\text{A}$; $V_{GS} = 0\text{ V}$; $T_j = 25\text{ °C}$	30	-	-	V
		$I_D = 250\text{ }\mu\text{A}$; $V_{GS} = 0\text{ V}$; $T_j = -55\text{ °C}$	27	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\text{ mA}$; $V_{DS} = V_{GS}$; $T_j = 25\text{ °C}$; see Figure 11 and 12	1.3	1.7	2.15	V
		$I_D = 1\text{ mA}$; $V_{DS} = V_{GS}$; $T_j = 150\text{ °C}$; see Figure 12	0.65	-	-	V
		$I_D = 1\text{ mA}$; $V_{DS} = V_{GS}$; $T_j = -55\text{ °C}$; see Figure 12	-	-	2.45	V
I_{DSS}	drain leakage current	$V_{DS} = 30\text{ V}$; $V_{GS} = 0\text{ V}$; $T_j = 25\text{ °C}$	-	-	1	μA
		$V_{DS} = 30\text{ V}$; $V_{GS} = 0\text{ V}$; $T_j = 150\text{ °C}$	-	-	100	μA
I_{GSS}	gate leakage current	$V_{GS} = 16\text{ V}$; $V_{DS} = 0\text{ V}$; $T_j = 25\text{ °C}$	-	-	100	nA
		$V_{GS} = -16\text{ V}$; $V_{DS} = 0\text{ V}$; $T_j = 25\text{ °C}$	-	-	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 4.5\text{ V}$; $I_D = 15\text{ A}$; $T_j = 25\text{ °C}$	-	3.73	5.25	m Ω
		$V_{GS} = 10\text{ V}$; $I_D = 15\text{ A}$; $T_j = 150\text{ °C}$; see Figure 13	-	-	7	m Ω
		$V_{GS} = 10\text{ V}$; $I_D = 15\text{ A}$; $T_j = 25\text{ °C}$	-	2.72	4	m Ω
R_G	gate resistance	$f = 1\text{ MHz}$	-	0.52	1.5	Ω
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$I_D = 10\text{ A}$; $V_{DS} = 12\text{ V}$; $V_{GS} = 10\text{ V}$; see Figure 14 and 15	-	36.6	-	nC
		$I_D = 10\text{ A}$; $V_{DS} = 12\text{ V}$; $V_{GS} = 4.5\text{ V}$; see Figure 14 and 15	-	17.6	-	nC
		$I_D = 0\text{ A}$; $V_{DS} = 0\text{ V}$; $V_{GS} = 10\text{ V}$	-	33	-	nC
Q_{GS}	gate-source charge	$I_D = 10\text{ A}$; $V_{DS} = 12\text{ V}$; $V_{GS} = 4.5\text{ V}$; see Figure 14 and 15	-	5.6	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge		-	3.6	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	2	-	nC
Q_{GD}	gate-drain charge		-	4.3	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$V_{DS} = 12\text{ V}$; see Figure 14 and 15	-	2.3	-	V
C_{iss}	input capacitance	$V_{DS} = 12\text{ V}$; $V_{GS} = 0\text{ V}$; $f = 1\text{ MHz}$; $T_j = 25\text{ °C}$; see Figure 16	-	2090	-	pF
C_{oss}	output capacitance		-	469	-	pF
C_{rss}	reverse transfer capacitance		-	227	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 12\text{ V}$; $R_L = 0.5\text{ }\Omega$; $V_{GS} = 4.5\text{ V}$; $R_{G(ext)} = 4.7\text{ }\Omega$	-	28	-	ns
t_r	rise time		-	51	-	ns
$t_{d(off)}$	turn-off delay time		-	44	-	ns
t_f	fall time		-	18	-	ns

Table 6. Characteristics ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Source-drain diode						
V_{SD}	source-drain voltage	$I_S = 25\text{ A}$; $V_{GS} = 0\text{ V}$; $T_j = 25\text{ }^\circ\text{C}$; see Figure 17	-	0.83	1.2	V
t_{rr}	reverse recovery time	$I_S = 20\text{ A}$; $di_S/dt = -100\text{ A}/\mu\text{s}$; $V_{GS} = 0\text{ V}$; $V_{DS} = 20\text{ V}$	-	39	-	ns
Q_r	recovered charge		-	36	-	nC

[1] Tested to JEDEC standards where applicable.

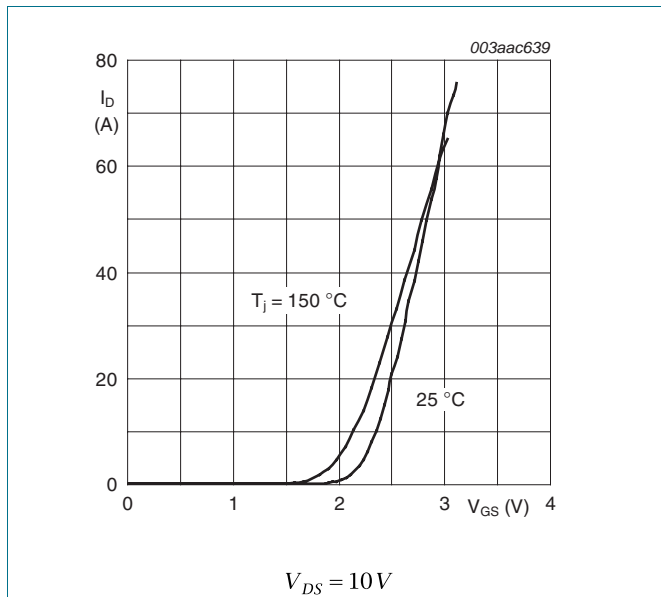


Fig 5. Transfer characteristics: drain current as a function of gate-source voltage; typical values

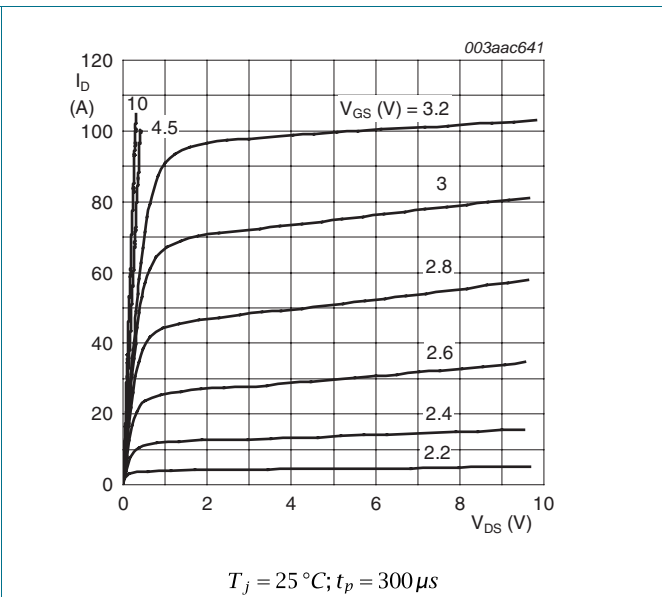


Fig 6. Output characteristics: drain current as a function of drain-source voltage; typical values

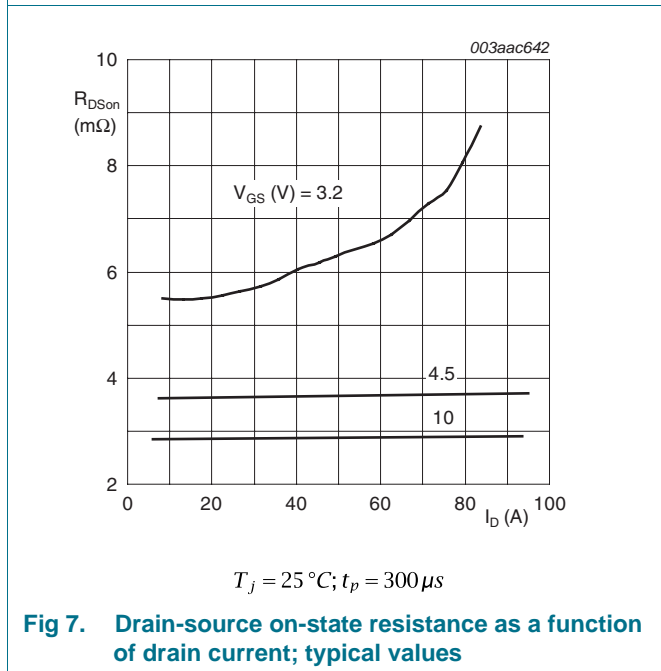


Fig 7. Drain-source on-state resistance as a function of drain current; typical values

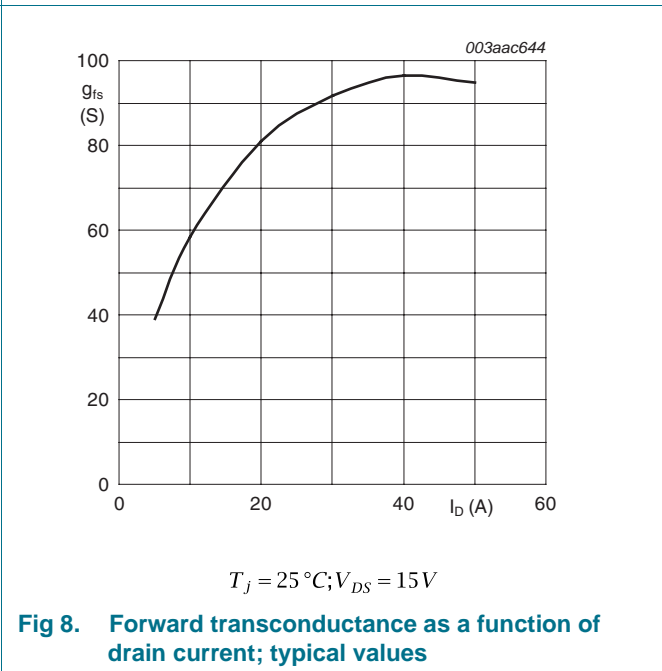
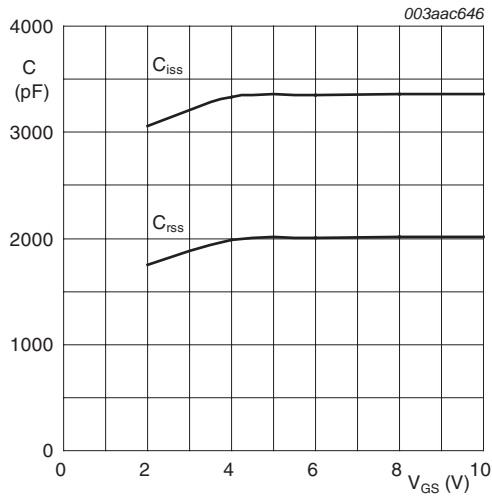
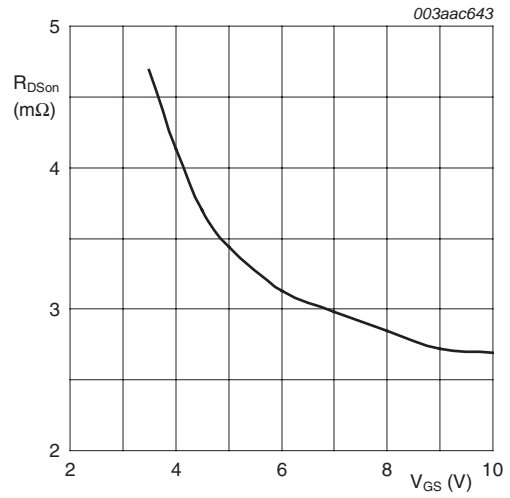


Fig 8. Forward transconductance as a function of drain current; typical values



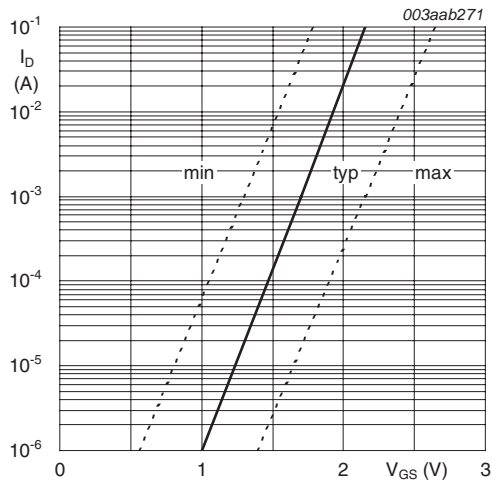
$V_{DS} = 0V; f = 1MHz$

Fig 9. Input and reverse transfer capacitances as a function of gate-source voltage; typical values



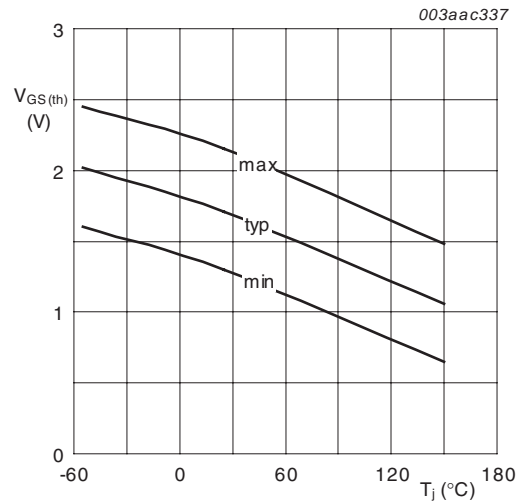
$T_j = 25^\circ C; I_D = 15A$

Fig 10. Drain-source on-state resistance as a function of gate-source voltage; typical values



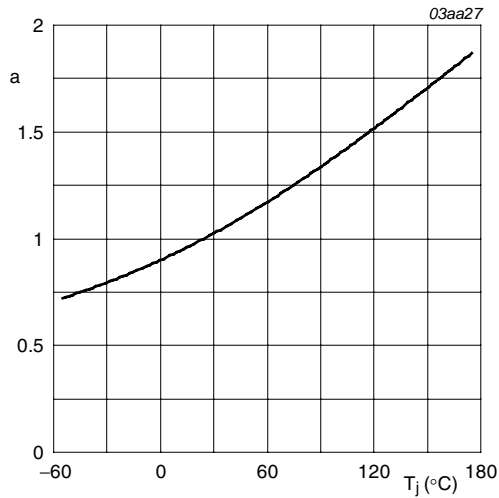
$T_j = 25^\circ C; V_{DS} = 5V$

Fig 11. Sub-threshold drain current as a function of gate-source voltage



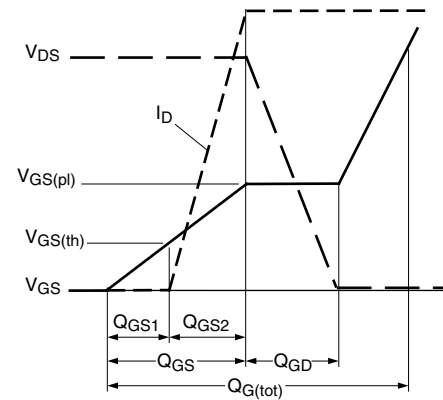
$I_D = 1mA; V_{DS} = V_{GS}$

Fig 12. Gate-source threshold voltage as a function of junction temperature



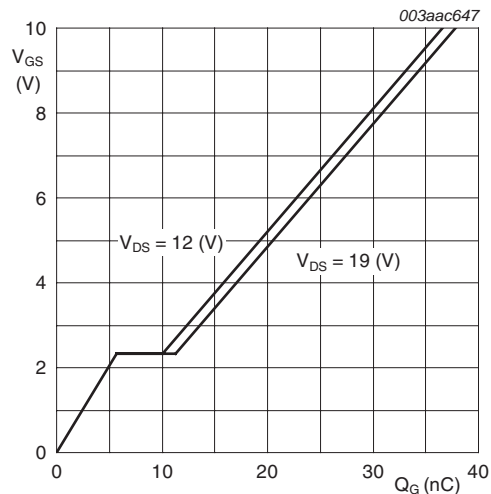
$$a = \frac{R_{DSon}}{R_{DSon(25^{\circ}C)}}$$

Fig 13. Normalized drain-source on-state resistance factor as a function of junction temperature



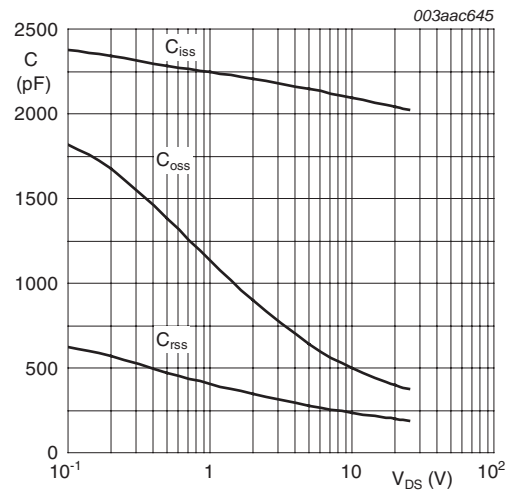
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Fig 14. Gate charge waveform definitions



$T_j = 25^{\circ}C; I_D = 10A$

Fig 15. Gate-source voltage as a function of gate charge; typical values



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

Fig 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

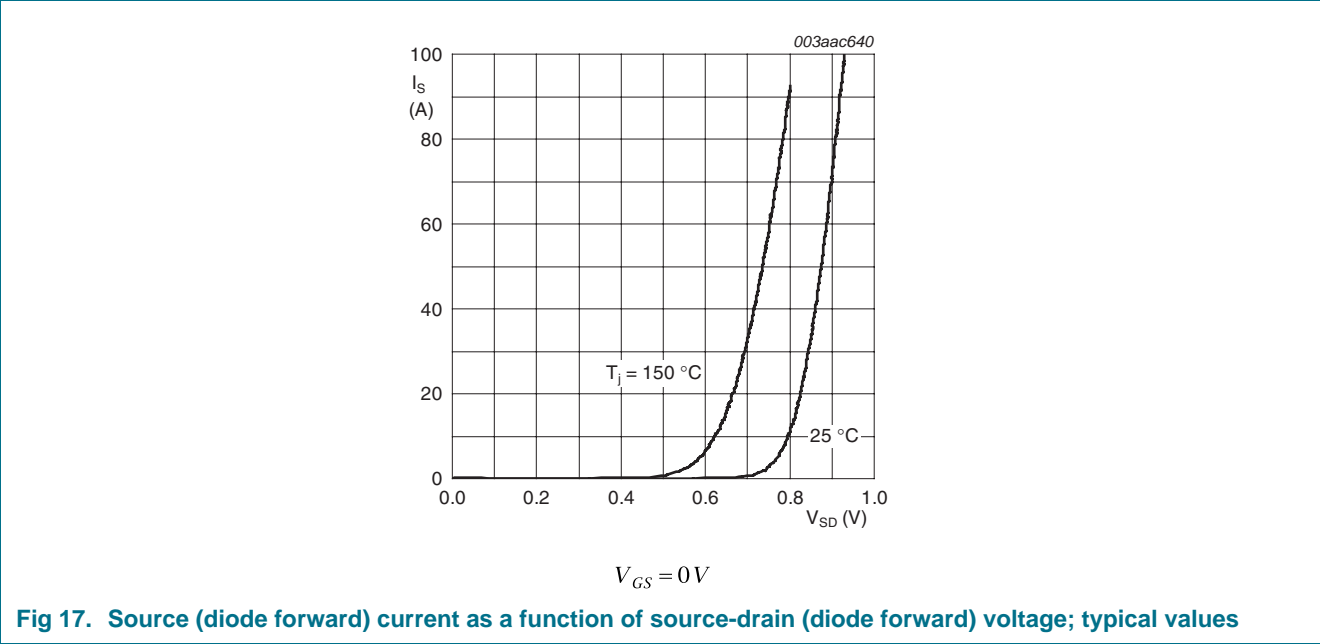


Fig 17. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

7. Package outline

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

SOT669

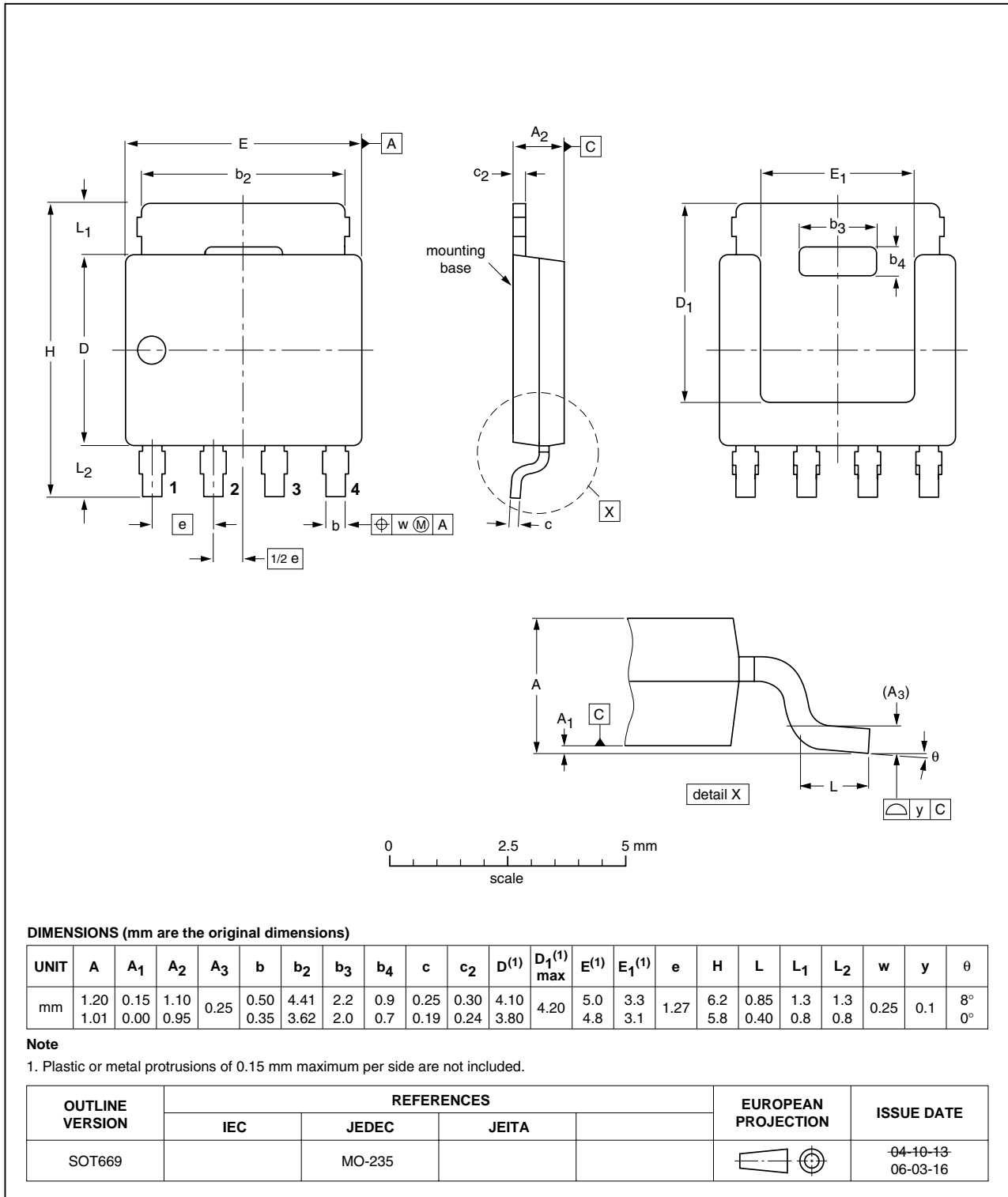


Fig 18. Package outline SOT669 (LFPAK)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PH4030AL_5	20100114	Product data sheet	-	PH4030AL_4
Modifications:	• Various changes to content.			
PH4030AL_4	20091203	Product data sheet	-	PH4030AL_3
PH4030AL_3	20091126	Product data sheet	-	PH4030AL_2
PH4030AL_2	20090121	Product data sheet	-	PH4030AL_1
PH4030AL_1	20080909	Preliminary 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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

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