

PH1330AL

N-channel 30 V 1.3 mΩ logic level MOSFET in LPAK

Rev. 01 — 14 October 2009

Product data sheet

1. Product profile

1.1 General description

Logic level N-channel MOSFET in LPAK package qualified to 150 °C. This product is designed for computing customers only

1.2 Features and benefits

- Advanced TrenchMOS provides low RDSon and low gate charge
- High efficiency gains in switching power convertors
- Improved mechanical and thermal characteristics
- LPAK provides maximum power density in a Power SO8 package

1.3 Applications

- For computing customers only

1.4 Quick reference data

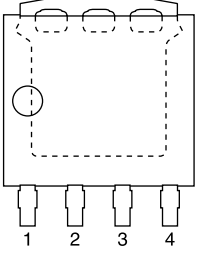
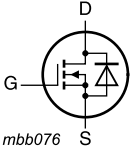
Table 1. Quick reference

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V _{DS}	drain-source voltage	T _j ≥ 25 °C; T _j ≤ 150 °C	-	-	30	V
I _D	drain current	T _{mb} = 25 °C; V _{GS} = 10 V; see Figure 1	[1]	-	100	A
P _{tot}	total power dissipation	T _{mb} = 25 °C; see Figure 2	-	-	121	W
T _j	junction temperature		-55	-	150	°C
Avalanche ruggedness						
E _{DS(AL)S}	non-repetitive drain-source avalanche energy	V _{GS} = 10 V; T _{j(init)} = 25 °C; I _D = 100 A; V _{sup} ≤ 30 V; R _{GS} = 50 Ω; unclamped	-	-	383	mJ
Dynamic characteristics						
Q _{GD}	gate-drain charge	V _{GS} = 4.5 V; I _D = 25 A;	-	9.3	-	nC
Q _{G(tot)}	total gate charge	V _{DS} = 12 V; see Figure 13 and 14	-	46.6	-	nC
Static characteristics						
R _{DSon}	drain-source on-state resistance	V _{GS} = 10 V; I _D = 15 A; T _j = 100 °C; see Figure 12	-	-	1.8	mΩ
		V _{GS} = 10 V; I _D = 15 A; T _j = 25 °C; see Figure 17	-	1.04	1.3	mΩ

[1] Continuous current is 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		

**SOT1023
(LFAK2)**

3. Ordering information

Table 3. Ordering information

Type number	Package		Version
	Name	Description	
PH1330AL	LFAK2	Plastic single-ended surface-mounted package (LFAK2); 4 leads	SOT1023

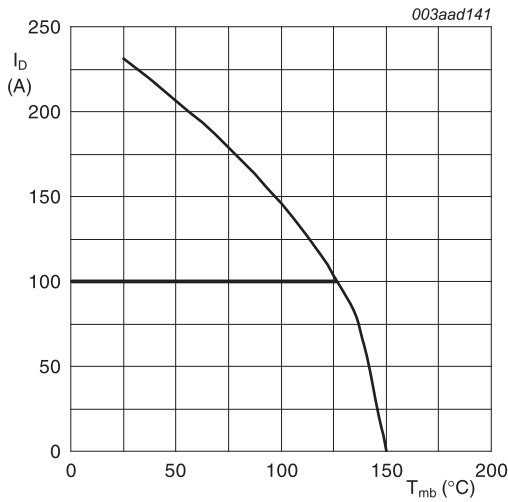
4. Limiting values

Table 4. Limiting values

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

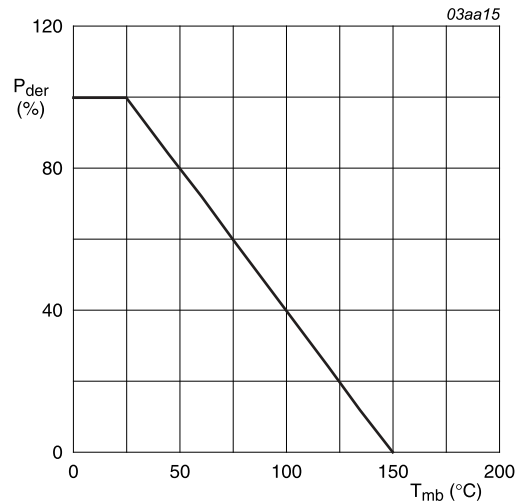
Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25\text{ °C}$; $T_j \leq 150\text{ °C}$	-	30	V
V_{DGR}	drain-gate voltage	$T_j \geq 25\text{ °C}$; $T_j \leq 150\text{ °C}$; $R_{GS} = 20\text{ k}\Omega$	-	30	V
V_{GS}	gate-source voltage		-20	20	V
I_D	drain current	$V_{GS} = 10\text{ V}$; $T_{mb} = 100\text{ °C}$; see Figure 1	[1]	100	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	-	923	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; see Figure 2	-	121	W
T_{stg}	storage temperature		-55	150	°C
T_j	junction temperature		-55	150	°C
$T_{sld(M)}$	peak soldering temperature		-	260	°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; $T_{mb} = 25\text{ °C}$	-	923	A
Avalanche ruggedness					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$; $T_{j(init)} = 25\text{ °C}$; $I_D = 100\text{ A}$; $V_{sup} \leq 30\text{ V}$; $R_{GS} = 50\text{ }\Omega$; unclamped	-	383	mJ

[1] Continuous current is limited by package.



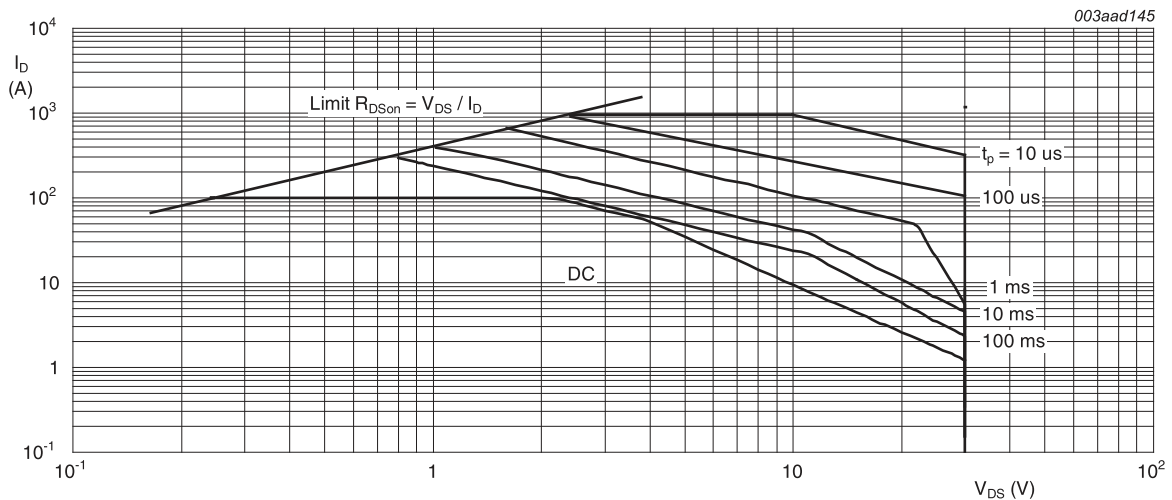
$$I_{der} = \frac{I_D}{I_{D(25^\circ\text{C})}} \times 100\%$$

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



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

Fig 2. Normalized total power dissipation 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

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	-	0.4	1.03	K/W

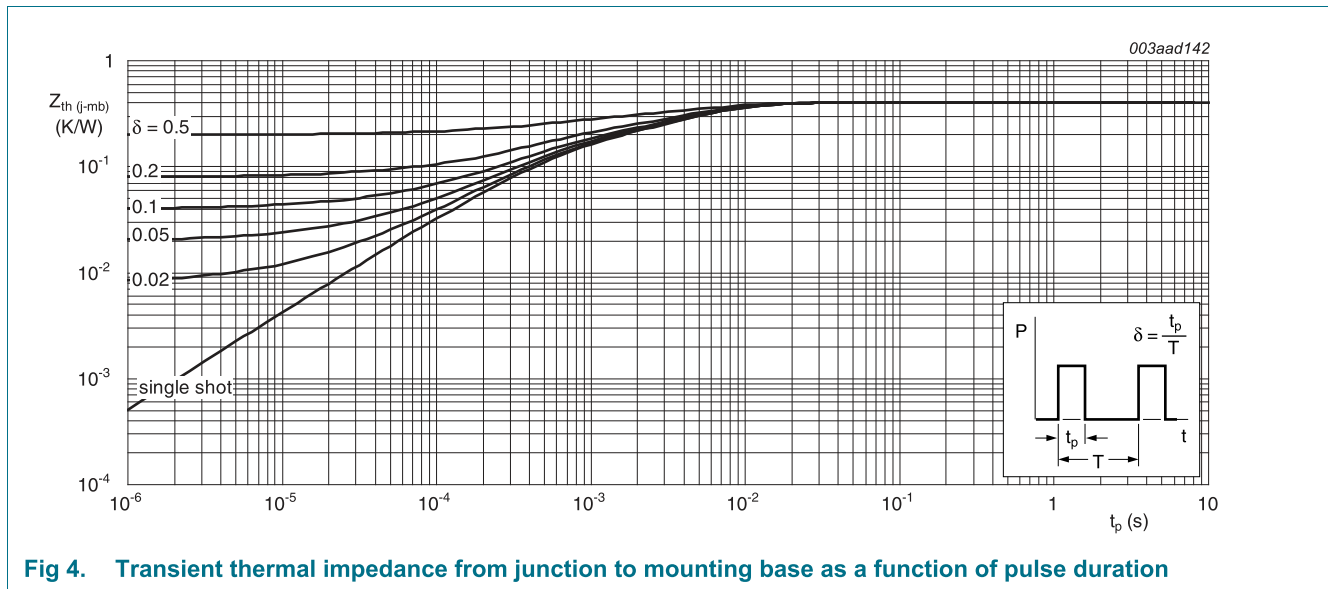


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

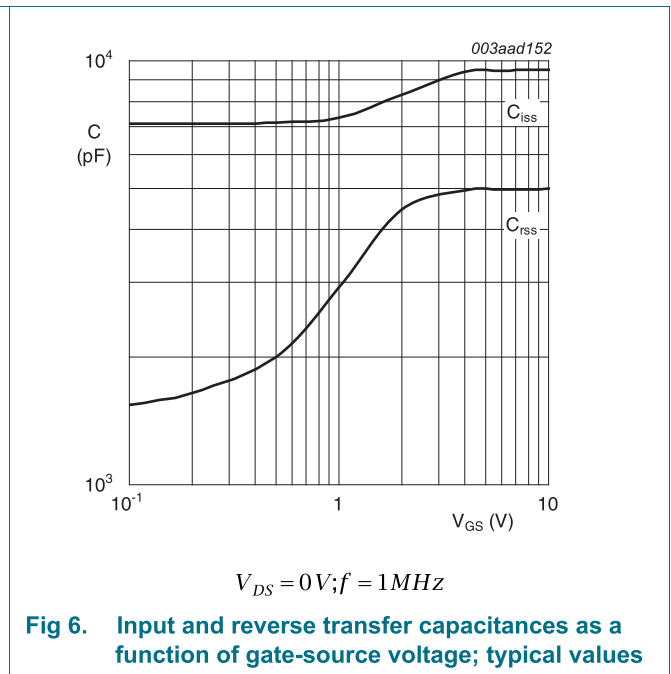
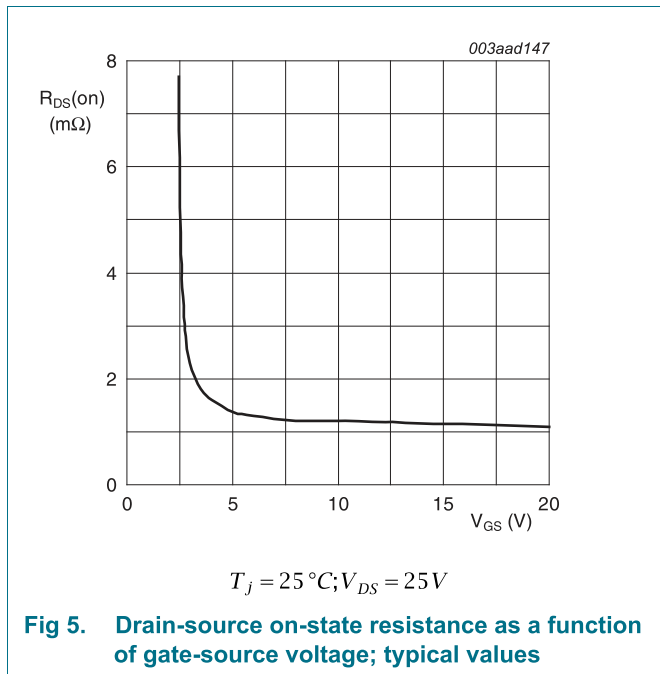
6. Characteristics

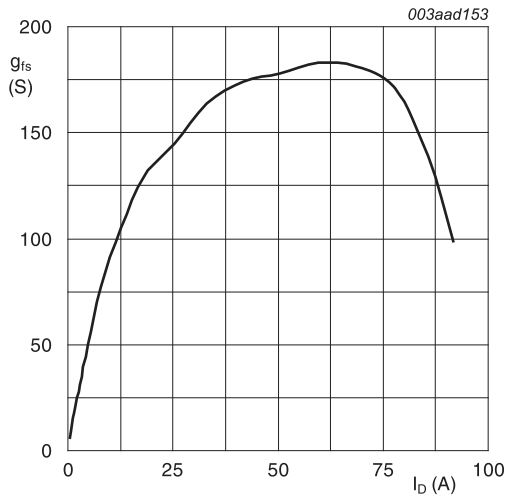
Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	30	-	-	V
		$I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ }^\circ\text{C}$	27	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 10 and 11	1.3	1.7	2.15	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 150 \text{ }^\circ\text{C};$ see Figure 10	0.65	-	-	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ\text{C};$ see Figure 10	-	-	2.45	V
I_{DSS}	drain leakage current	$V_{DS} = 30 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	-	1.5	μA
		$V_{DS} = 30 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 150 \text{ }^\circ\text{C}$	-	-	500	μA
I_{GSS}	gate leakage current	$V_{GS} = 15 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	-	100	nA
		$V_{GS} = -15 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	-	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 4.5 \text{ V}; I_D = 15 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 17	-	1.43	1.95	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 100 \text{ }^\circ\text{C};$ see Figure 12	-	-	1.8	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 150 \text{ }^\circ\text{C};$ see Figure 12	-	1.9	2.8	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 17	-	1.04	1.3	mΩ
R_G	gate resistance		-	0.89	-	Ω
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$I_D = 25 \text{ A}; V_{DS} = 12 \text{ V}; V_{GS} = 10 \text{ V};$ see Figure 13 and 14	-	100	-	nC
		$I_D = 0 \text{ A}; V_{DS} = 0 \text{ V}; V_{GS} = 10 \text{ V}$	-	90	-	nC
		$I_D = 25 \text{ A}; V_{DS} = 12 \text{ V}; V_{GS} = 4.5 \text{ V};$ see Figure 13 and 14	-	46.6	-	nC
Q_{GS}	gate-source charge		-	17.9	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge	$I_D = 25 \text{ A}; V_{DS} = 12 \text{ V}; V_{GS} = 4.5 \text{ V};$ see Figure 13	-	11	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	6.9	-	nC
Q_{GD}	gate-drain charge	$I_D = 25 \text{ A}; V_{DS} = 12 \text{ V}; V_{GS} = 4.5 \text{ V};$ see Figure 13 and 14	-	9.3	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$V_{DS} = 12 \text{ V};$ see Figure 13 and 14	-	2.53	-	V
C_{iss}	input capacitance	$V_{DS} = 12 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz};$ $T_j = 25 \text{ }^\circ\text{C};$ see Figure 15	-	6227	-	pF
C_{oss}	output capacitance		-	1415	-	pF
C_{rss}	reverse transfer capacitance		-	619	-	pF

Table 6. Characteristics ...continued

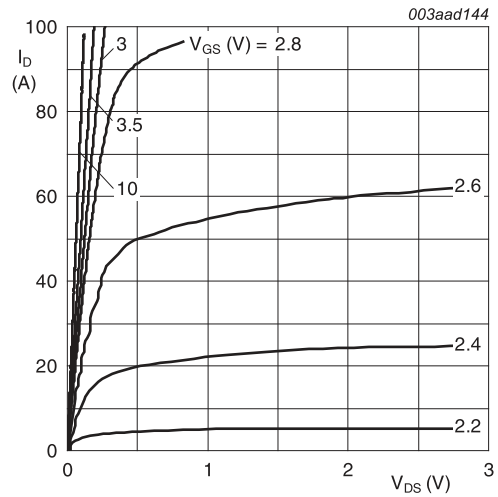
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_{d(on)}$	turn-on delay time	$V_{DS} = 12\text{ V}; R_L = 0.5\ \Omega; V_{GS} = 4.5\text{ V};$ $R_{G(ext)} = 5.6\ \Omega$	-	64	-	ns
t_r	rise time		-	108	-	ns
$t_{d(off)}$	turn-off delay time		-	106	-	ns
t_f	fall time		-	52	-	ns
Source-drain diode						
V_{SD}	source-drain voltage	$I_S = 25\text{ A}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C};$ see Figure 16	-	0.88	1.2	V
t_{rr}	reverse recovery time	$I_S = 20\text{ A}; di_S/dt = -100\text{ A/s}; V_{GS} = 0\text{ V};$	-	46	-	ns
Q_r	recovered charge	$V_{DS} = 20\text{ V}$	-	53	-	nC





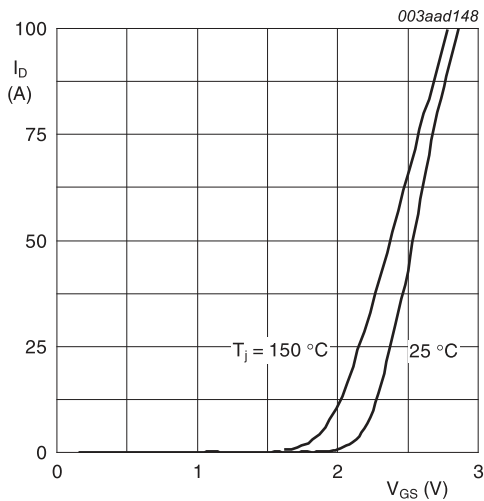
$T_j = 25\text{ }^\circ\text{C}; V_{DS} = 25\text{ V}$

Fig 7. Forward transconductance as a function of drain current; typical values



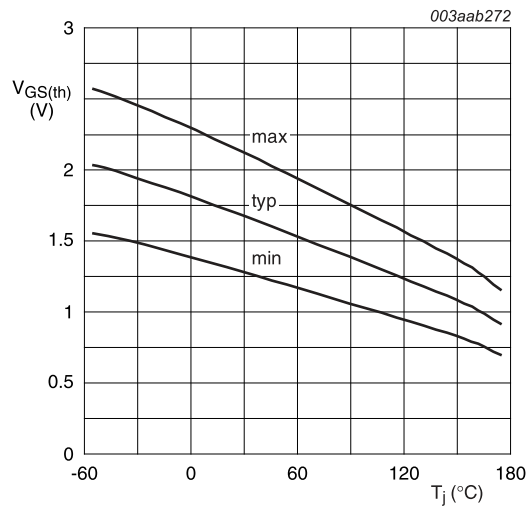
$T_j = 25\text{ }^\circ\text{C}$

Fig 8. Output characteristics: drain current as a function of drain-source voltage; typical values



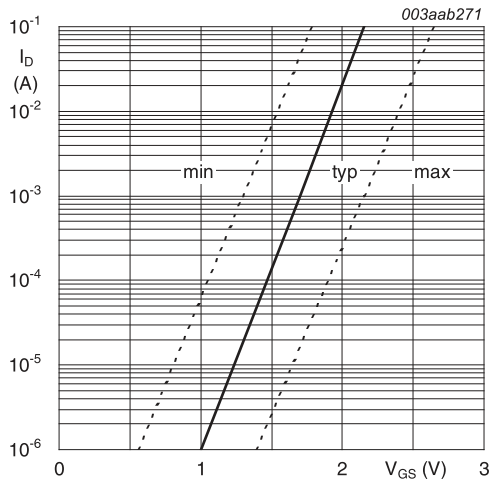
$V_{DS} > I_D \times R_{DSon}$

Fig 9. Transfer characteristics: drain current as a function of gate-source voltage; typical values



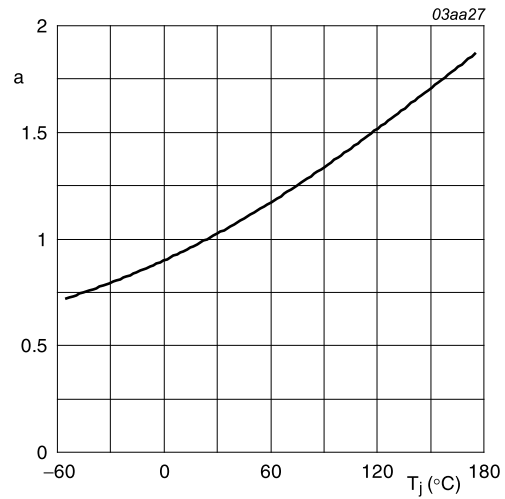
$I_D = 1\text{ mA}; V_{DS} = V_{GS}$

Fig 10. Gate-source threshold voltage as a function of junction temperature



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

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



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

Fig 12. Normalized drain-source on-state resistance factor as a function of junction temperature

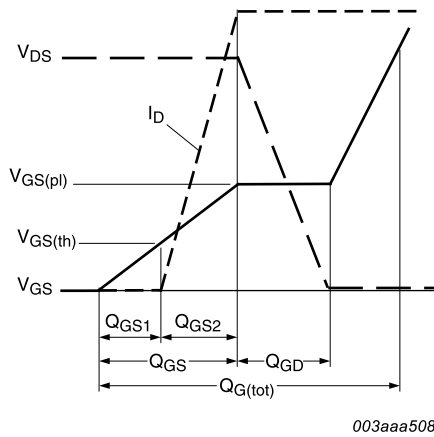
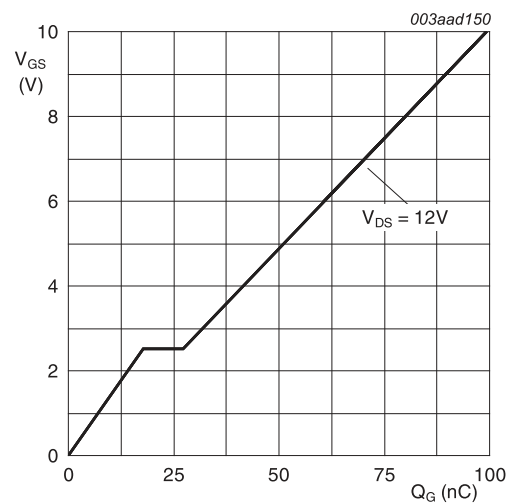
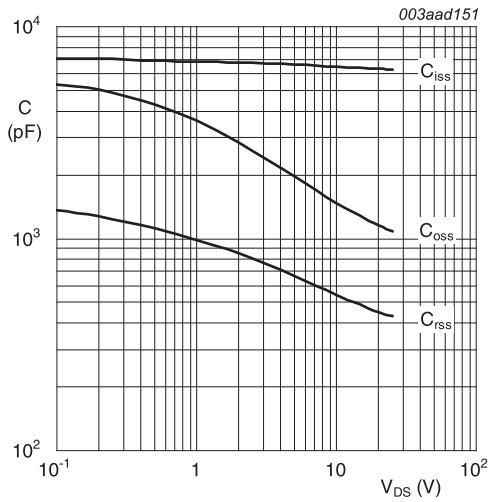


Fig 13. Gate charge waveform definitions



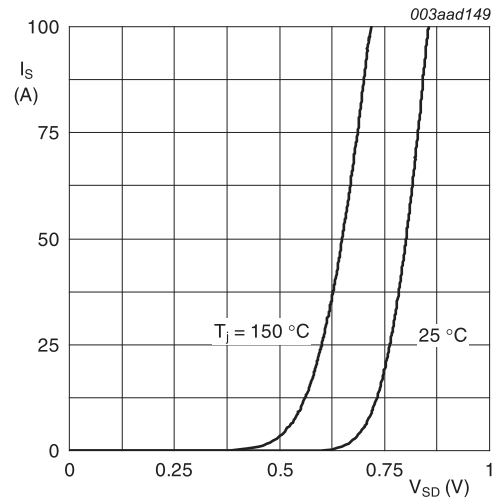
$I_D = 25\text{A}$

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



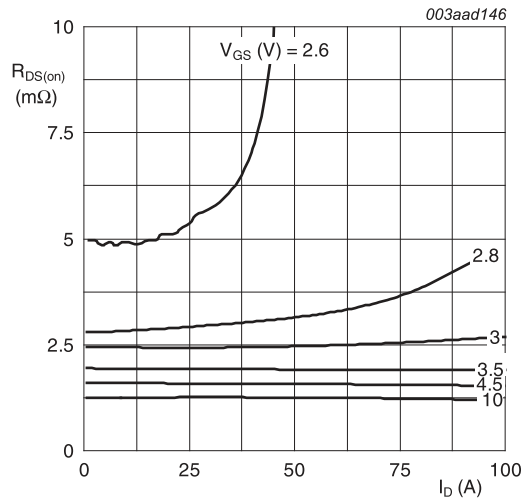
V_{GS} = 0V; f = 1MHz

Fig 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



V_{GS} = 0V

Fig 16. Source current as a function of source-drain voltage; typical values



T_j = 25 °C

Fig 17. Drain-source on-state resistance as a function of drain current; typical values

7. Package outline

Plastic single-ended surface-mounted package (LPAK2); 4 leads

SOT1023

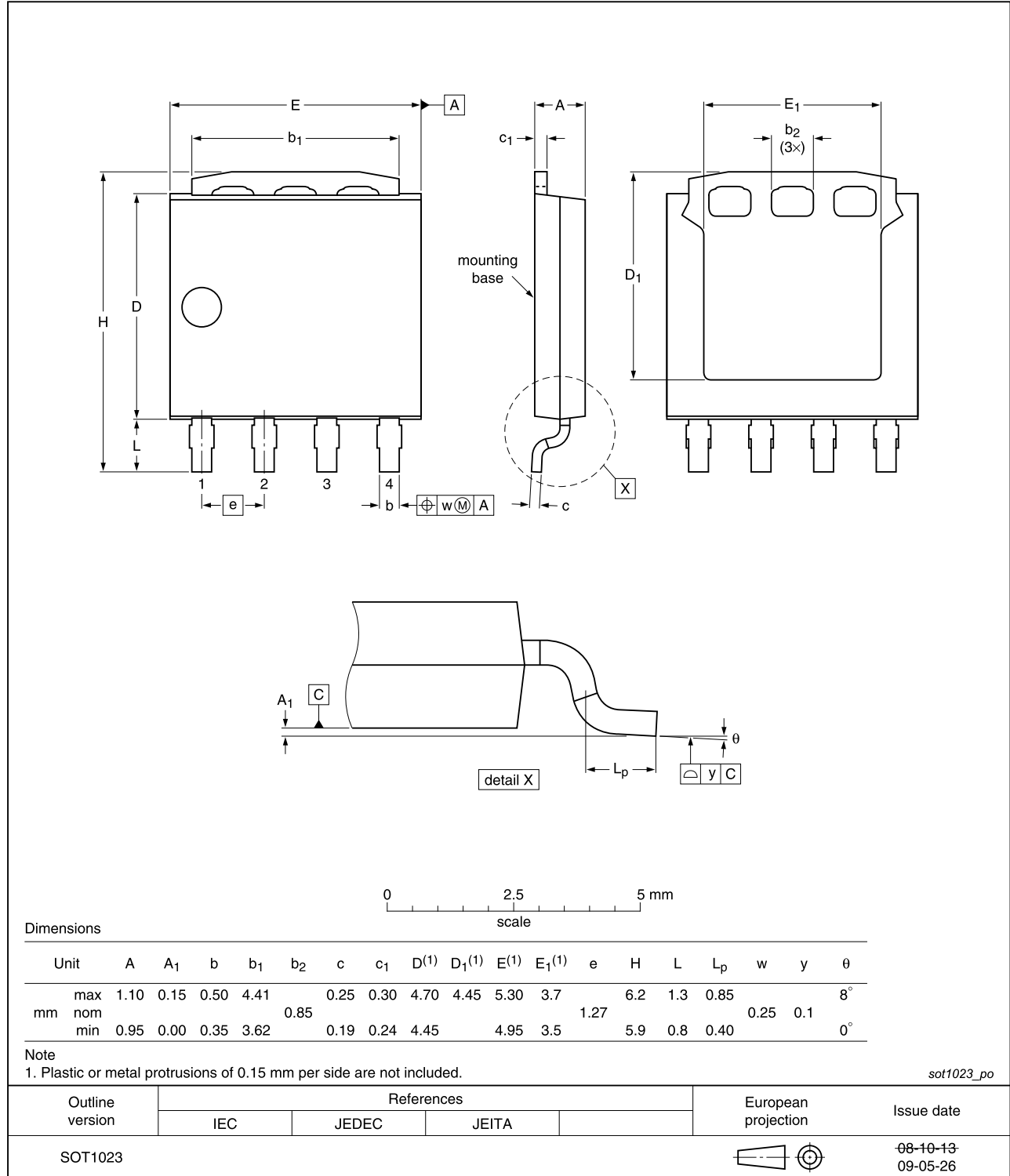


Fig 18. Package outline SOT1023 (LPAK2)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PH1330AL_1	20091014	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".

[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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11. Contents

1	Product profile	1
1.1	General description	1
1.2	Features and benefits	1
1.3	Applications	1
1.4	Quick reference data	1
2	Pinning information	2
3	Ordering information	2
4	Limiting values	2
5	Thermal characteristics	4
6	Characteristics	5
7	Package outline	10
8	Revision history	11
9	Legal information	12
9.1	Data sheet status	12
9.2	Definitions	12
9.3	Disclaimers	12
9.4	Trademarks	12
10	Contact information	12

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