PH0925CL

N-channel 25 V 0.75 mΩ logic level MOSFET in LFPAK using NextPower technology

26 March 2013 **Product data sheet**

1. General description

Logic level enhancement mode N-channel MOSFET in LFPAK package. This product is designed for use in computing and consumer applications.

2. Features and benefits

- High reliability Power SO8 package, qualified to 175°C
- Optimised for 4.5V Gate drive utilising NextPower Superjunction technology
- Ultra low QG, QGD & QOSS for high system efficiencies at low and high loads
- Ultra low Rdson and low parasitic inductance

3. Applications

- Consumer applications
- Desktop voltage regulator module (VRM)
- Notebook voltage regulator module (VRM)

4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DS}	drain-source voltage	25 °C ≤ T_j ≤ 175 °C		-	-	25	V
I_D	drain current	T_{mb} = 25 °C; Fig. 1	[1]	-	-	100	A
P_{tot}	total power dissipation	T_{mb} = 25 °C; Fig. 2		-	-	272	W
T_j	junction temperature			-55	-	175	°C
Static characteristics							
R_{DSon}	drain-source on-state resistance	V_{GS} = 4.5 V; I_D = 25 A; T_j = 25 °C; Fig. 12		-	0.95	1.25	mΩ
		V_{GS} = 10 V; I_D = 25 A; T_j = 25 °C; Fig. 12		-	0.75	0.99	mΩ
Dynamic characteristics							
Q_{GD}	gate-drain charge	V_{GS} = 4.5 V; I_D = 25 A; V_{DS} = 12 V; Fig. 14; Fig. 15		-	14	-	nC
$Q_{G(tot)}$	total gate charge	V_{GS} = 4.5 V; I_D = 25 A; V_{DS} = 12 V; Fig. 14		-	51	-	nC

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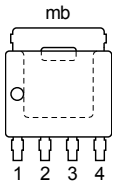
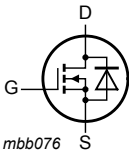
[1] Continuous current is limited by package

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S	source	 **LFPAK56; Power-SO8 (SOT669)**	
2	S	source		
3	S	source		
4	G	gate		
mb	D	mounting base; connected to drain		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PH0925CL	LFPAK56; Power-SO8	Plastic single-ended surface-mounted package (LFPAK56; Power-SO8); 4 leads	SOT669

7. Marking

Table 4. Marking codes

Type number	Marking code
PH0925CL	0925CL

8. Limiting values

Table 5. 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 ≤ 175 °C		-	25	V
V_{DGR}	drain-gate voltage	25 °C ≤ T_j ≤ 175 °C; R_{GS} = 20 kΩ		-	25	V
V_{GS}	gate-source voltage			-20	20	V
I_D	drain current	T_{mb} = 25 °C; Fig. 1	[1]	-	100	A
		T_{mb} = 100 °C; Fig. 1	[1]	-	100	A
I_{DM}	peak drain current	pulsed; t_p ≤ 10 µs; T_{mb} = 25 °C; Fig. 4		-	1563	A
P_{tot}	total power dissipation	T_{mb} = 25 °C; Fig. 2		-	272	W

Symbol	Parameter	Conditions		Min	Max	Unit
T_{stg}	storage temperature			-55	175	°C
T_j	junction temperature			-55	175	°C
$T_{sld(M)}$	peak soldering temperature			-	260	°C
V_{ESD}	electrostatic discharge voltage	MM (JEDEC JESD22-A115)		920	-	V
Source-drain diode						
I_S	source current	T_{mb} = 25 °C	[1]	-	100	A
I_{SM}	peak source current	pulsed; $t_p \leq 10$ µs; T_{mb} = 25 °C		-	1563	A
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; $V_{sup} \leq 25$ V; unclamped; R_{GS} = 50 Ω; Fig. 3		-	342	mJ

[1] Continuous current is limited by package

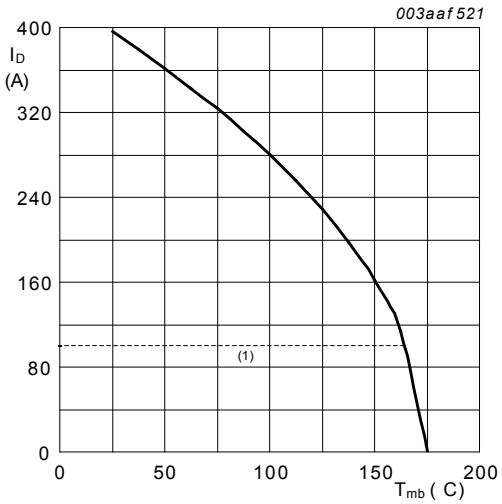


Fig. 1. Continuous drain current as a function of mounting base temperature

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

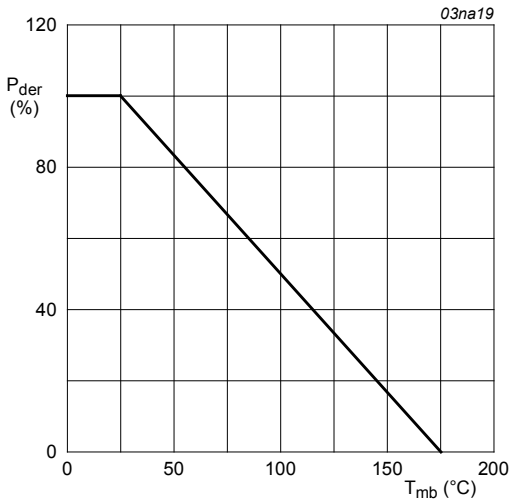


Fig. 2. Normalized total power dissipation as a function of mounting base temperature

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

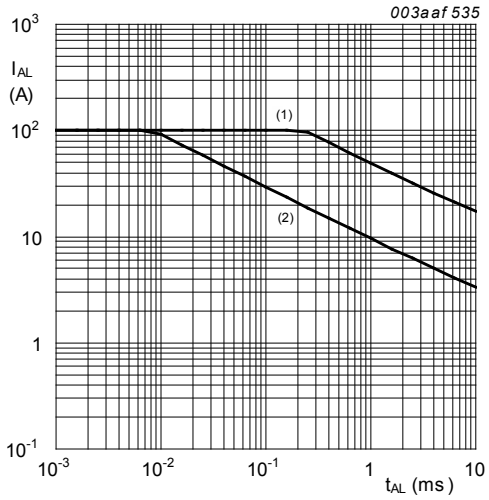


Fig. 3. Single pulse avalanche rating; avalanche current as a function of avalanche time

$$(1)\ T_{j(init)} = 25°C;\ (2)\ T_{j(init)} = 100°C$$

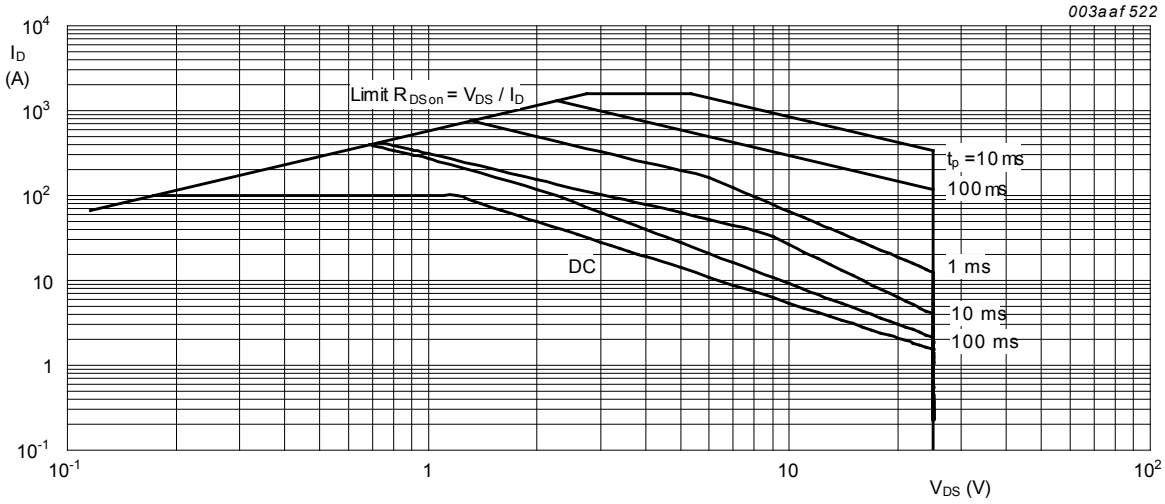


Fig. 4. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

$$T_{mb} = 25°C;\ I_{DM}\ is\ a\ single\ pulse$$

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	Fig. 5		-	0.45	0.55	K/W

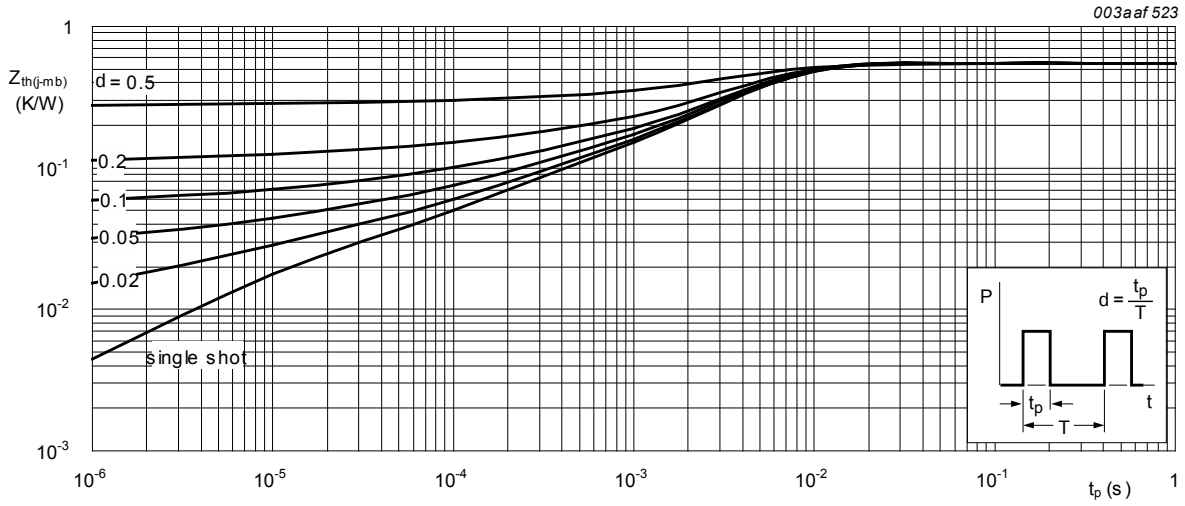


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

10. Characteristics

Table 7. Characteristics

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
		I_D = 250 µA; V_{GS} = 0 V; T_j = -55 °C		22.5	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	I_D = 1 mA; V_{DS} = V_{GS}; T_j = 25 °C; Fig. 10		1.05	1.41	1.95	V
		I_D = 10 mA; V_{DS} = V_{GS}; T_j = 150 °C		0.5	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	I_D = 1 mA; V_{DS} = V_{GS}; T_j = -55 °C; Fig. 11		-	-	2.25	V
I_{DSS}	drain leakage current	V_{DS} = 25 V; V_{GS} = 0 V; T_j = 25 °C		-	-	1	µA
		V_{DS} = 25 V; V_{GS} = 0 V; T_j = 150 °C		-	-	100	µA
I_{GSS}	gate leakage current	V_{GS} = 16 V; V_{DS} = 0 V; T_j = 25 °C		-	-	100	nA
		V_{GS} = -16 V; V_{DS} = 0 V; T_j = 25 °C		-	-	100	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = 4.5 V; I_D = 25 A; T_j = 25 °C; Fig. 12		-	0.95	1.25	mΩ
		V_{GS} = 4.5 V; I_D = 25 A; T_j = 150 °C; Fig. 12; Fig. 13		-	-	2.125	mΩ
		V_{GS} = 10 V; I_D = 25 A; T_j = 25 °C; Fig. 12		-	0.75	0.99	mΩ
		V_{GS} = 10 V; I_D = 25 A; T_j = 150 °C; Fig. 12; Fig. 13		-	-	1.68	mΩ

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
R_G	internal gate resistance (AC)	f = 1 MHz		-	1.1	2.2	Ω
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	I_D = 25 A; V_{DS} = 12 V; V_{GS} = 10 V; Fig. 14; Fig. 15		-	110	-	nC
		I_D = 25 A; V_{DS} = 12 V; V_{GS} = 4.5 V; Fig. 14		-	51	-	nC
		I_D = 0 A; V_{DS} = 0 V; V_{GS} = 10 V; Fig. 14		-	104	-	nC
Q_{GS}	gate-source charge	I_D = 25 A; V_{DS} = 12 V; V_{GS} = 4.5 V; Fig. 14; Fig. 15		-	14.8	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge			-	10.5	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge			-	4.4	-	nC
Q_{GD}	gate-drain charge			-	14	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	I_D = 25 A; V_{DS} = 12 V; Fig. 14; Fig. 15		-	2.4	-	V
C_{iss}	input capacitance	V_{DS} = 12 V; V_{GS} = 0 V; f = 1 MHz; T_j = 25 °C; Fig. 16		-	6775	-	pF
C_{oss}	output capacitance			-	1437	-	pF
C_{rss}	reverse transfer capacitance			-	573	-	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 12 V; R_L = 0.5 Ω; V_{GS} = 4.5 V; $R_{G(ext)}$ = 4.7 Ω		-	42.5	-	ns
t_r	rise time			-	74	-	ns
$t_{d(off)}$	turn-off delay time			-	103.5	-	ns
t_f	fall time			-	55	-	ns
Q_{oss}	output charge	V_{GS} = 0 V; V_{DS} = 12 V; f = 1 MHz		-	31.57	-	nC
Source-drain diode							
V_{SD}	source-drain voltage	I_S = 25 A; V_{GS} = 0 V; T_j = 25 °C; Fig. 17		-	0.8	1.1	V
t_{rr}	reverse recovery time	I_S = 25 A; dI_S/dt = -100 A/µs; V_{GS} = 0 V; V_{DS} = 12 V		-	48	-	ns
Q_r	recovered charge			-	60	-	nC
t_a	reverse recovery rise time	V_{GS} = 0 V; I_S 25 A; dI_S/dt = -100 A/µs; V_{DS} = 12 V; Fig. 18		-	26.3	-	ns
t_b	reverse recovery fall time	V_{GS} = 0 V; I_S = 25 A; dI_S/dt = -100 A/µs; V_{DS} = 12 V; Fig. 18		-	21.7	-	ns

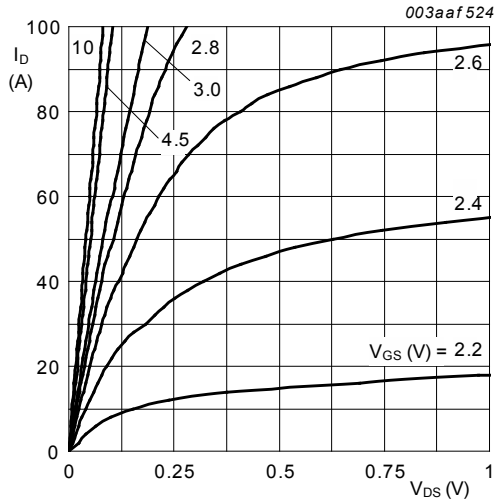


Fig. 6. Output characteristics; drain current as a function of drain-source voltage; typical values

$T_j = 25°C$

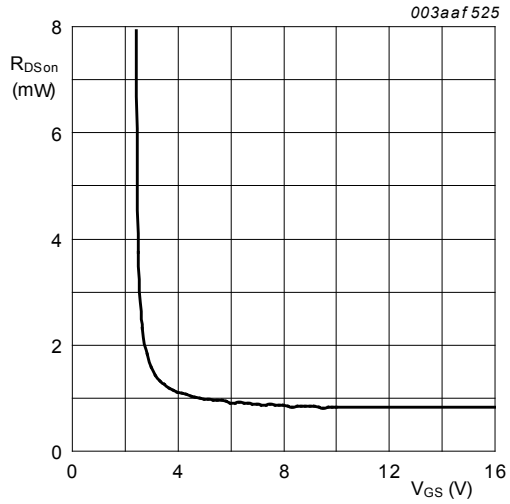


Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

$T_j = 25°C;\ I_D = 25A$

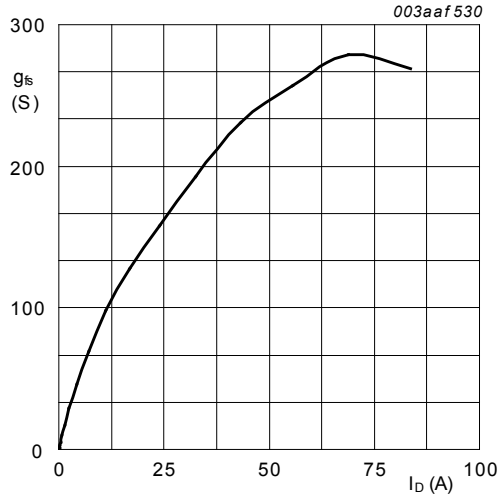


Fig. 8. Forward transconductance as a function of drain current; typical values

$T_j = 25°C;\ V_{DS} = 10V$

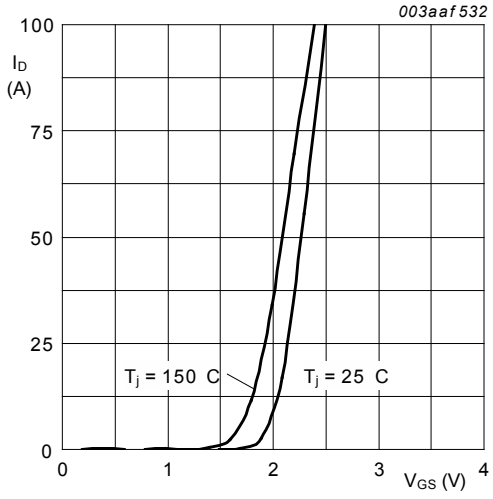


Fig. 9. Transfer characteristics; drain current as a function of gate-source voltage; typical values

$V_{DS} = 10V$

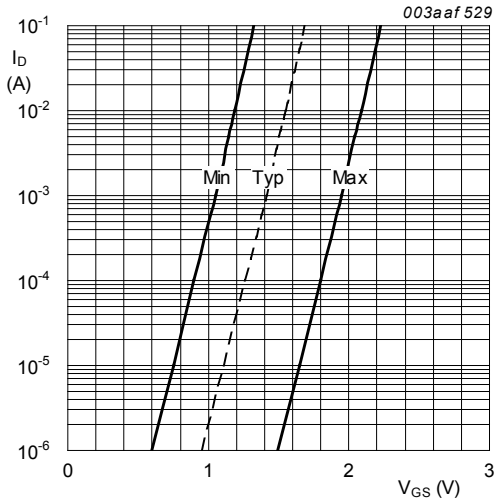


Fig. 10. Sub-threshold drain current as a function of gate-source voltage

$T_j = 25°C;\ V_{DS} = 5V$

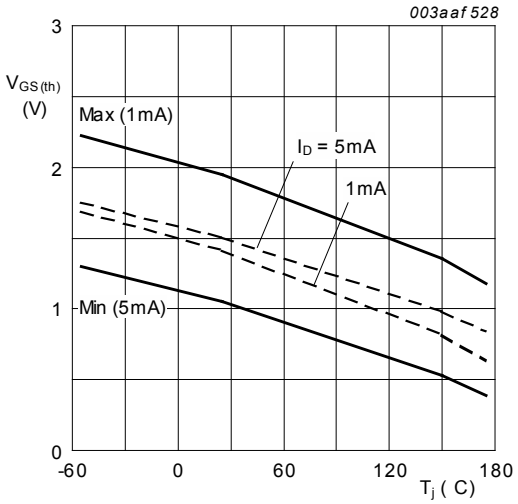


Fig. 11. Gate-source threshold voltage as a function of junction temperature

$V_{DS} = V_{GS}$

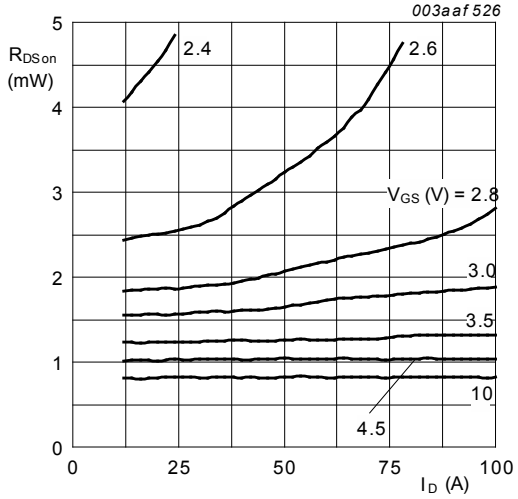


Fig. 12. Drain-source on-state resistance as a function of drain current; typical values

$T_j = 25°C$

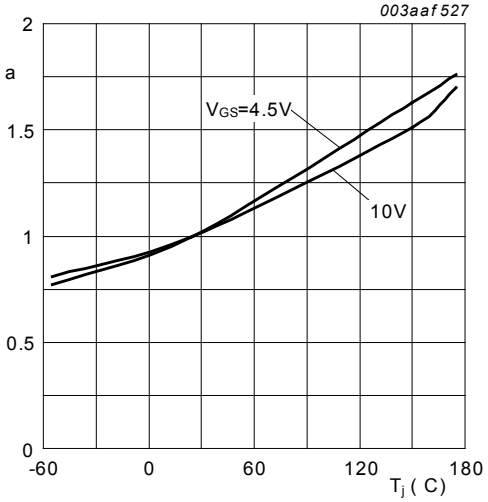


Fig. 13. Normalized drain-source on-state resistance factor as a function of junction temperature

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

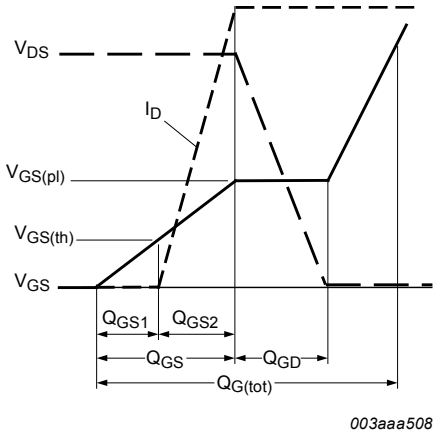


Fig. 14. Gate charge waveform definitions

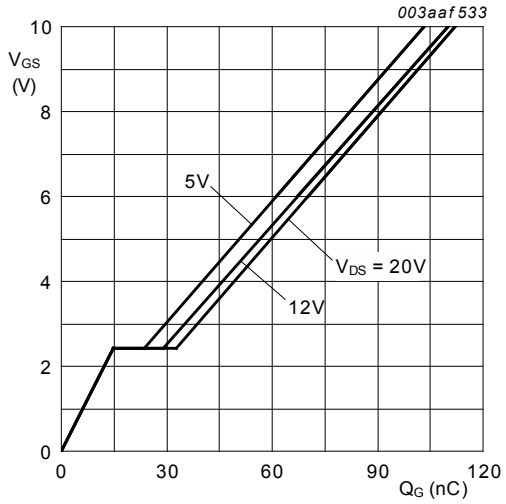


Fig. 15. Gate-source voltage as a function of gate charge; typical values

$$T_j = 25°C;\ I_D = 25A$$

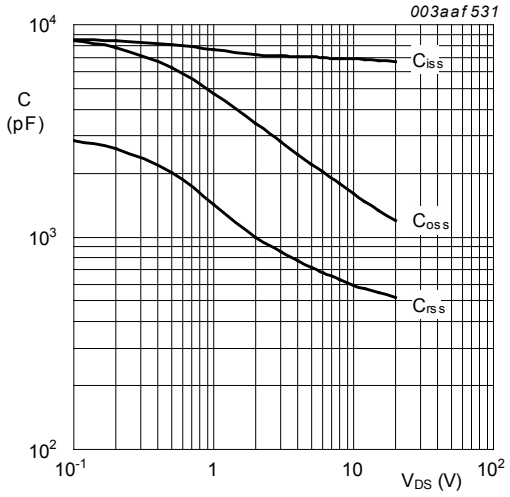


Fig. 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

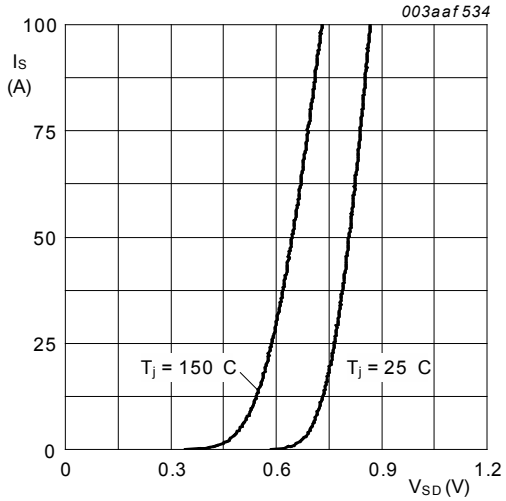


Fig. 17. Source current as a function of source-drain voltage; typical values

$$V_{GS} = 0V$$

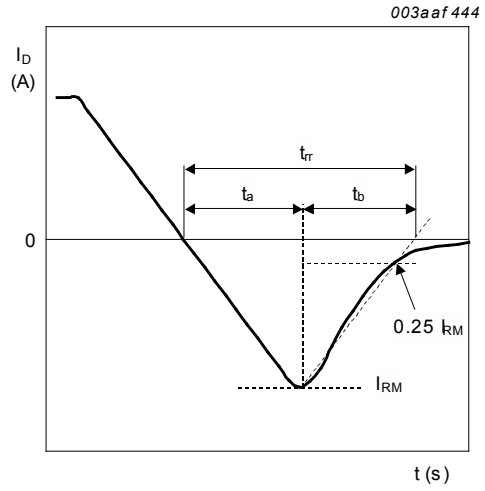
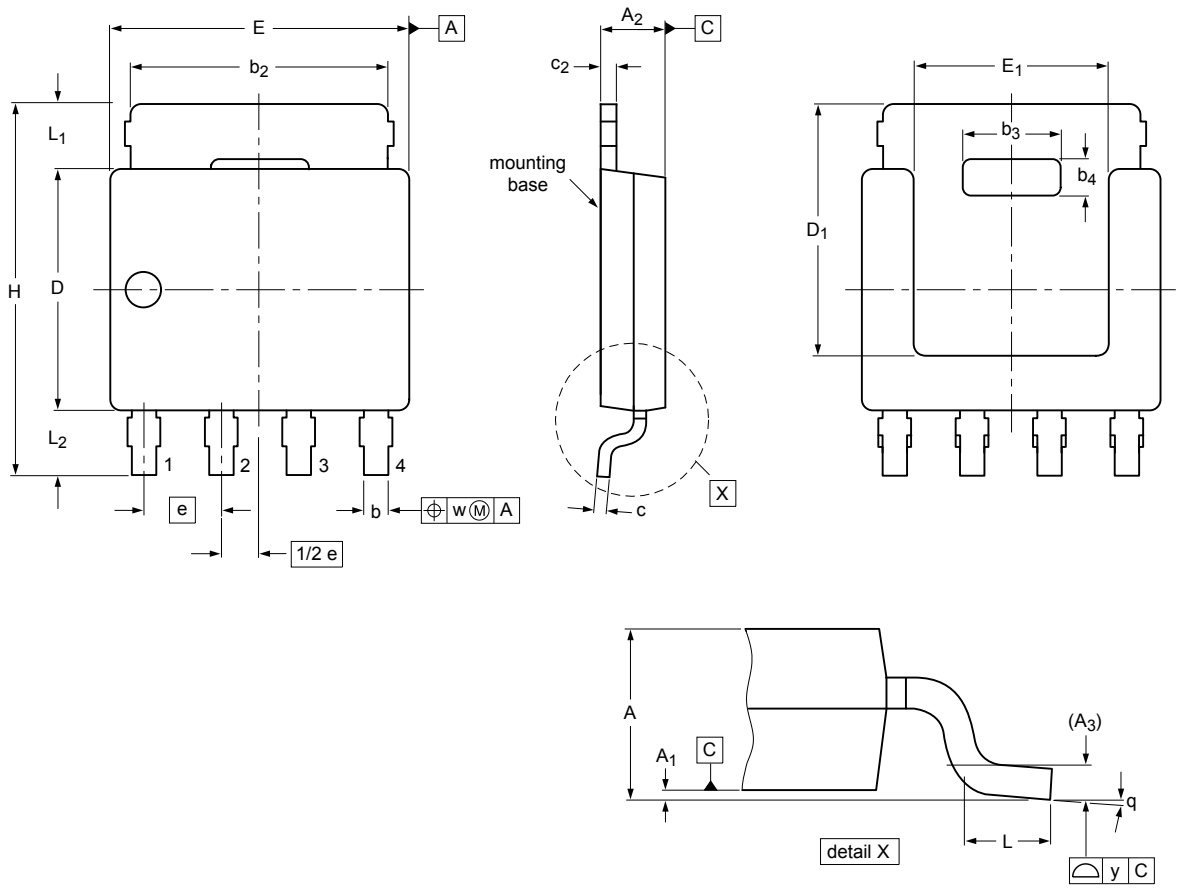


Fig. 18. Reverse recovery timing definition

11. Package outline

Plastic single-ended surface-mounted package (LFPAK56; Power-SO8); 4 leads **SOT669**



θ
8°
0°

Dimensions (mm are the original dimensions)

Unit(1)		A	A_1	A_2	A_3	b	b_2	b_3	b_4	c	c_2	D(1)	D_1(1)	E(1)	E_1(1)	e	H	L	L_1	L_2	w	y
mm	max	1.20	0.15	1.10		0.50	4.41	2.2	0.9	0.25	0.30	4.10	4.20	5.0	3.3		6.2	0.85	1.3	1.3		
	nom				0.25											1.27					0.25	0.1
	min	1.01	0.00	0.95		0.35	3.62	2.0	0.7	0.19	0.24	3.80		4.8	3.1		5.8	0.40	0.8	0.8		

Note
1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

sot669_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT669		MO-235				~~11-03-25~~ 13-02-27

Fig. 19. Package outline LFPAK56; Power-SO8 (SOT669)

12. Legal information

12.1 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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13. Contents

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