PSMN4R0-60YS

N-channel LFPAK 60 V, 4.0 mΩ standard level FET

14 May 2015 Product data sheet

1. General description

Standard level N-channel MOSFET in LFPAK package qualified to 175 °C. This product is designed and qualified for use in a wide range of telecom, industrial and domestic equipment.

2. Features and benefits

- Advanced TrenchMOS provides low R_{DSon} and low gate charge
- High efficiency in switching power converters
- Improved mechanical and thermal characteristics
- LFPAK provides maximum power density in a Power SO8 package

3. Applications

- DC-to-DC converters
- Lithium-ion battery protection
- Load switching
- Motor control
- Server power supplies
- Telecom power

4. Quick reference data

Table 1. Quick reference data

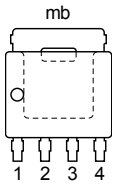
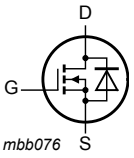
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25$ °C; $T_j \leq 175$ °C		-	-	60	V
I_D	drain current	T_{mb} = 25 °C; Fig. 2	[1]	-	-	100	A
P_{tot}	total power dissipation	T_{mb} = 25 °C; Fig. 1		-	-	130	W
T_j	junction temperature			-55	-	175	°C
Static characteristics							
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 15 A; T_j = 100 °C; Fig. 12		-	-	8.3	mΩ
		V_{GS} = 10 V; I_D = 15 A; T_j = 25 °C; Fig. 13		-	3.6	4	mΩ

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Dynamic characteristics							
Q_{GD}	gate-drain charge	V_{GS} = 10 V; I_D = 75 A; V_{DS} = 30 V; Fig. 14; Fig. 15		-	11.2	-	nC
$Q_{G(tot)}$	total gate charge			-	56	-	nC
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} ≤ 60 V; R_{GS} = 50 Ω; unclamped		-	-	170	mJ

[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
PSMN4R0-60YS	LFPAK56; Power-SO8	Plastic single-ended surface-mounted package (LFPAK56; Power-SO8); 4 leads	SOT669

7. 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 ≥ 25 °C; T_j ≤ 175 °C		-	60	V
V_{DGR}	drain-gate voltage	T_j ≥ 25 °C; T_j ≤ 175 °C; R_{GS} = 20 kΩ		-	60	V
V_{GS}	gate-source voltage			-20	20	V
P_{tot}	total power dissipation	T_{mb} = 25 °C; Fig. 1		-	130	W
I_D	drain current	T_{mb} = 100 °C; Fig. 2		-	74	A

Symbol	Parameter	Conditions		Min	Max	Unit
		T_{mb} = 25 °C; Fig. 2	[1]	-	100	A
I_{DM}	peak drain current	pulsed; $t_p \leq 10$ µs; T_{mb} = 25 °C; Fig. 3		-	418	A
T_{stg}	storage temperature			-55	175	°C
T_j	junction temperature			-55	175	°C
$T_{sld(M)}$	peak soldering temperature			-	260	°C
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		-	418	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; $V_{sup} \leq 60$ V; R_{GS} = 50 Ω; unclamped		-	170	mJ

[1] Continuous current is limited by package.

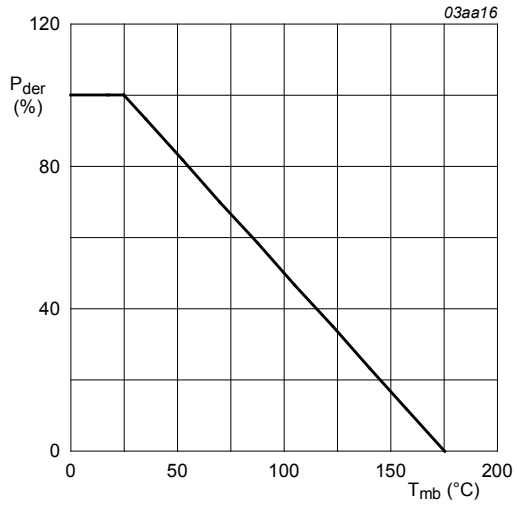


Fig. 1. Normalized total power dissipation as a function of mounting base temperature

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

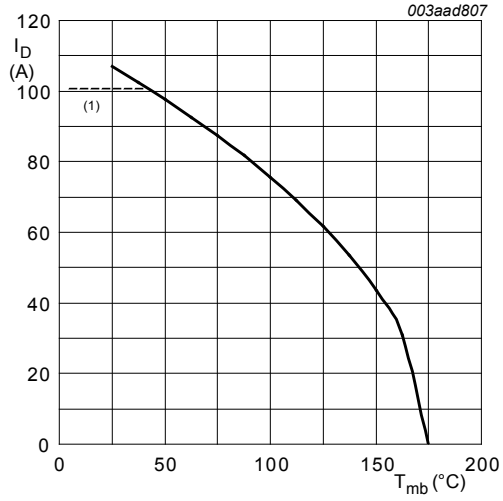


Fig. 2. Continuous drain current as a function of mounting base temperature

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

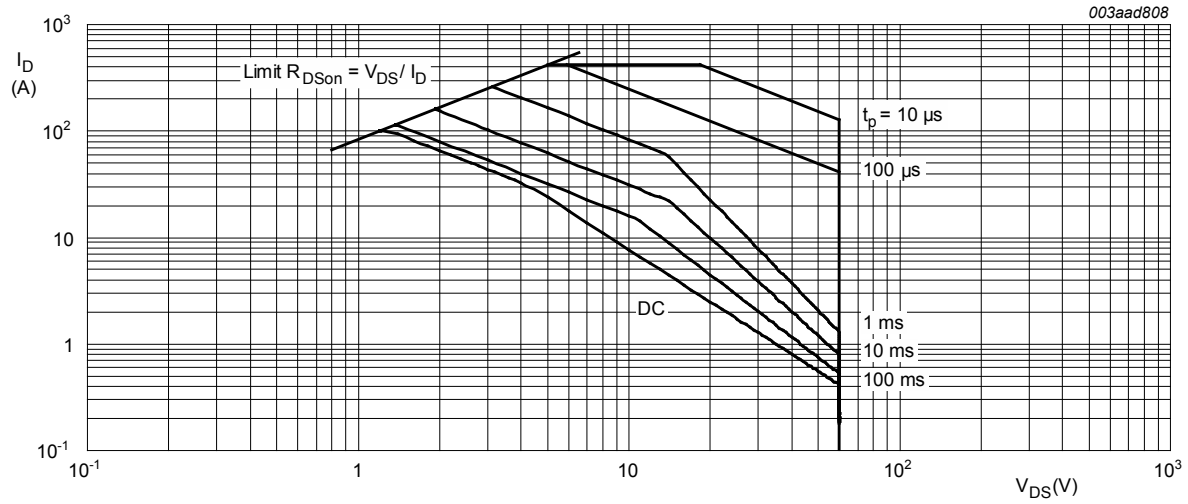


Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

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

8. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	Fig. 4		-	0.5	1.1	K/W

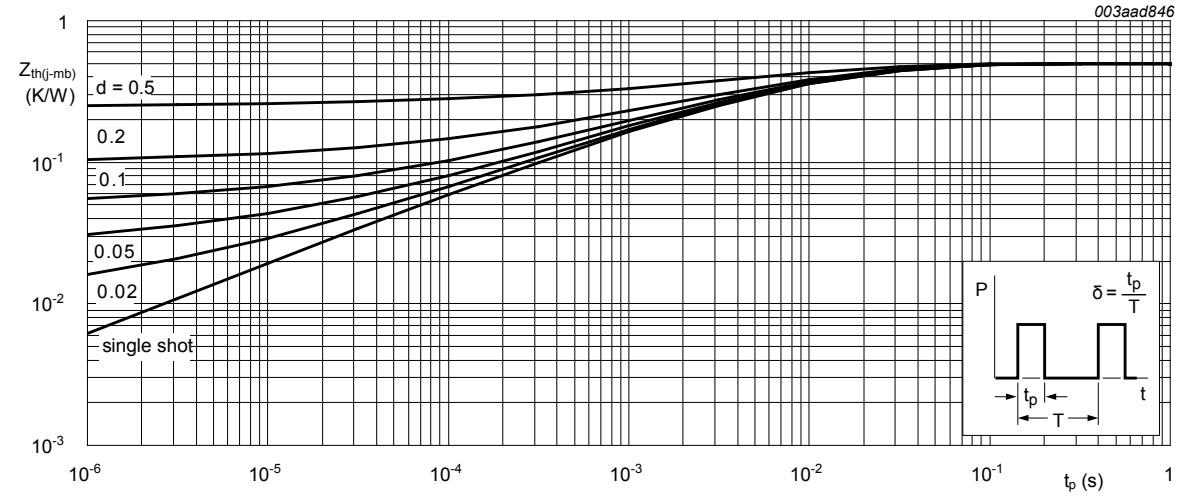


Fig. 4. Transient thermal impedance from junction to mounting base as a function of pulse duration; typical values

9. Characteristics

Table 6. 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 = -55 °C		54	-	-	V
		I_D = 250 µA; V_{GS} = 0 V; T_j = 25 °C		63	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	I_D = 1 mA; V_{DS} = V_{GS}; T_j = 25 °C; Fig. 10; Fig. 11		2	3	4	V
V_{GSth}	gate-source threshold voltage	I_D = 1 mA; V_{DS} = V_{GS}; T_j = -55 °C; Fig. 11		-	-	4.6	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = 175 °C; Fig. 11		0.95	-	-	V
I_{DSS}	drain leakage current	V_{DS} = 60 V; V_{GS} = 0 V; T_j = 25 °C		-	0.05	5	µA
		V_{DS} = 63 V; V_{GS} = 0 V; T_j = 25 °C		-	0.07	7	µA
		V_{DS} = 60 V; V_{GS} = 0 V; T_j = 125 °C		-	-	100	µA
		V_{DS} = 63 V; V_{GS} = 0 V; T_j = 125 °C		-	3.25	150	µA
I_{GSS}	gate leakage current	V_{GS} = 20 V; V_{DS} = 0 V; T_j = 25 °C		-	2	100	nA
		V_{GS} = -20 V; V_{DS} = 0 V; T_j = 25 °C		-	2	100	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 15 A; T_j = 175 °C; Fig. 12		-	7.6	12	mΩ
		V_{GS} = 10 V; I_D = 15 A; T_j = 100 °C; Fig. 12		-	-	8.3	mΩ
		V_{GS} = 10 V; I_D = 15 A; T_j = 25 °C; Fig. 13		-	3.6	4	mΩ
R_G	gate resistance	f = 1 MHz		-	0.7	-	Ω
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	I_D = 75 A; V_{DS} = 30 V; V_{GS} = 10 V; Fig. 14; Fig. 15		-	56	-	nC
		I_D = 0 A; V_{DS} = 0 V; V_{GS} = 10 V		-	47.5	-	nC
Q_{GS}	gate-source charge	I_D = 75 A; V_{DS} = 30 V; V_{GS} = 10 V; Fig. 14; Fig. 15		-	18.7	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge	I_D = 75 A; V_{DS} = 30 V; V_{GS} = 10 V; Fig. 14		-	10.3	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge			-	8.4	-	nC
Q_{GD}	gate-drain charge	I_D = 75 A; V_{DS} = 30 V; V_{GS} = 10 V; Fig. 14; Fig. 15		-	11.2	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	V_{DS} = 30 V; Fig. 14; Fig. 15		-	4.9	-	V

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
C_{iss}	input capacitance	V_{DS} = 30 V; V_{GS} = 0 V; f = 1 MHz; T_j = 25 °C; Fig. 16		-	3501	-	pF
C_{oss}	output capacitance			-	457	-	pF
C_{rss}	reverse transfer capacitance			-	240	-	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 30 V; R_L = 0.4 Ω; V_{GS} = 10 V; $R_{G(ext)}$ = 4.7 Ω		-	23	-	ns
t_r	rise time			-	24	-	ns
$t_{d(off)}$	turn-off delay time			-	44	-	ns
t_f	fall time			-	14	-	ns
Source-drain diode							
V_{SD}	source-drain voltage	I_S = 15 A; V_{GS} = 0 V; T_j = 25 °C; Fig. 17		-	0.8	1.2	V
t_{rr}	reverse recovery time	I_S = 25 A; dI_S/dt = -100 A/μs; V_{GS} = 0 V; V_{DS} = 30 V		-	43	-	ns
Q_r	recovered charge			-	58	-	nC

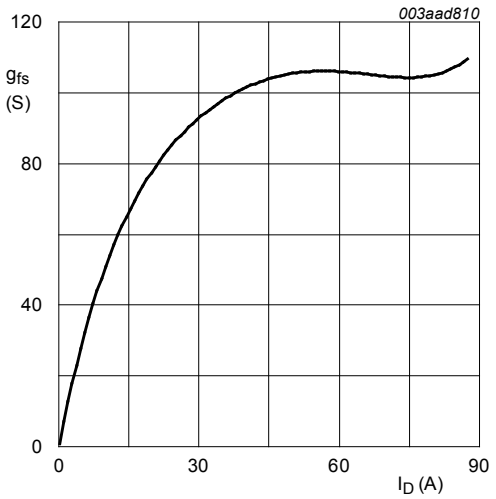


Fig. 5. Forward transconductance as a function of drain current; typical values

$T_j = 25$ °C; $V_{DS} = 15$ V

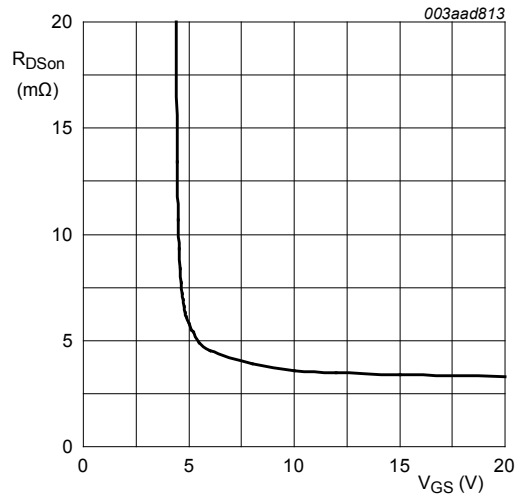


Fig. 6. Drain-source on-state resistance as a function of gate-source voltage; typical values

$T_j = 25$ °C; $I_D = 25$ A

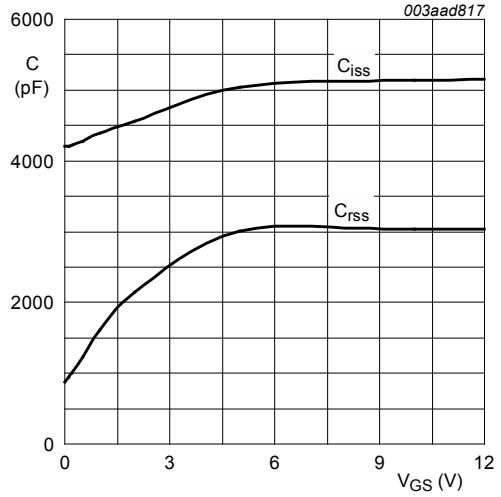


Fig. 7. Input and reverse transfer capacitances as a function of gate-source voltage, typical values

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

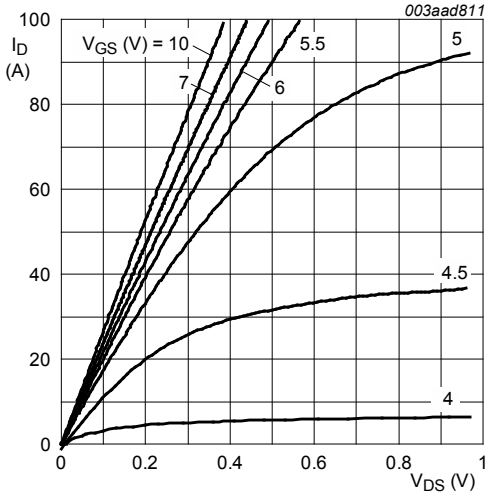


Fig. 8. Output characteristics: drain current as a function of drain-source voltage; typical values

$T_j = 25\ °C$

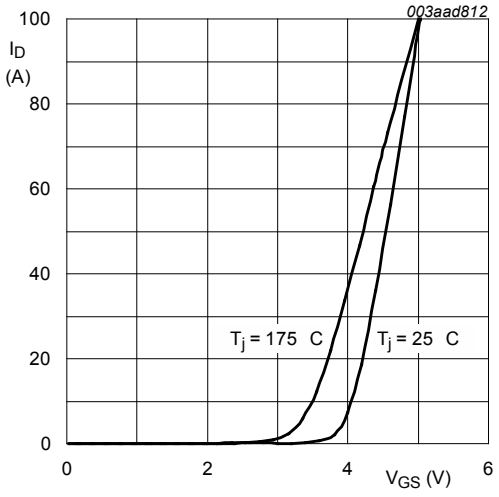


Fig. 9. Transfer characteristics: drain current as a function of gate-source voltage; typical values

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

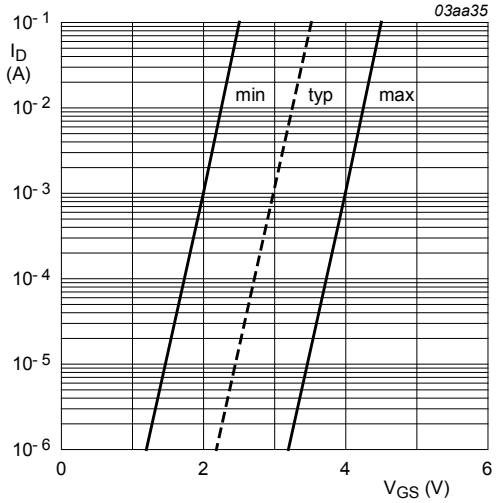


Fig. 10. Sub-threshold drain current as a function of gate-source voltage

$T_j = 25\ °C; V_{DS} = 5V$

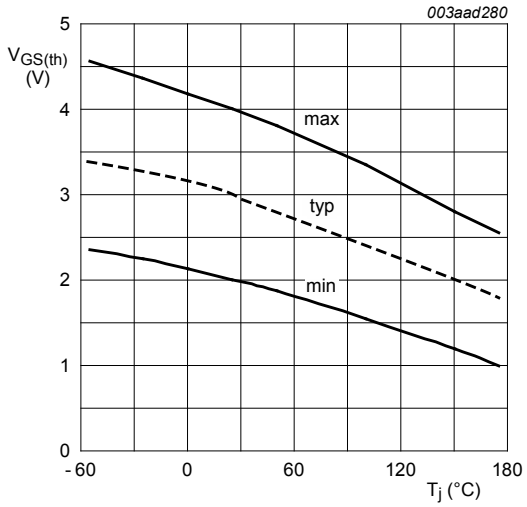


Fig. 11. Gate-source threshold voltage as a function of junction temperature

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

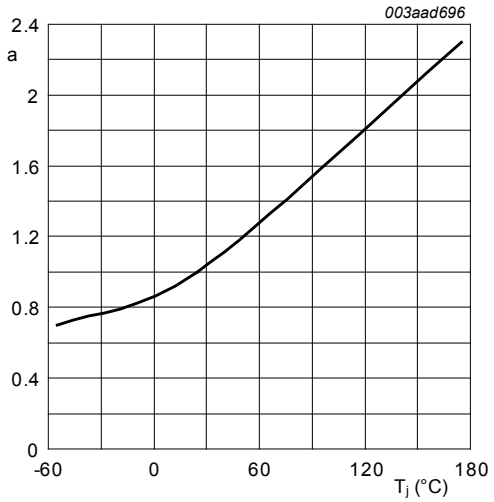


Fig. 12. Normalized drain-source on-state resistance factor as a function of junction temperature.

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

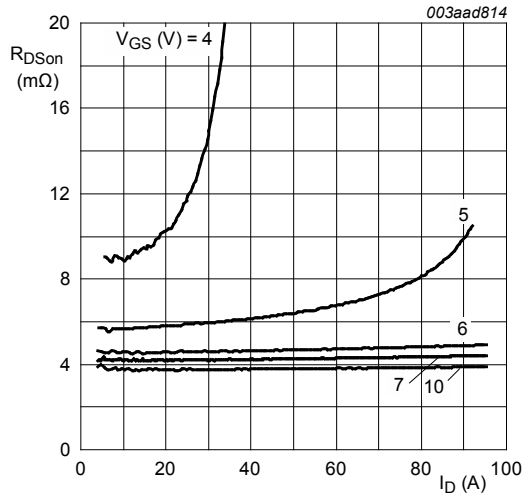


Fig. 13. Drain-source on-state resistance as a function of drain current; typical values

$T_j = 25\,°C$

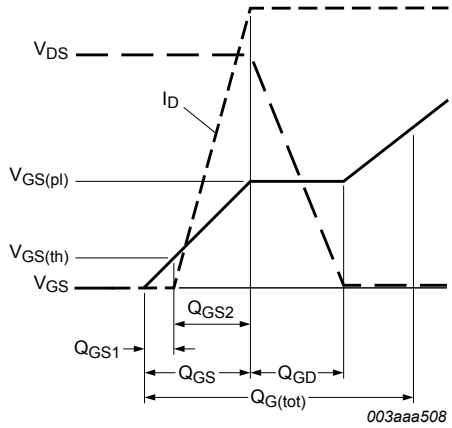


Fig. 14. Gate charge waveform definitions

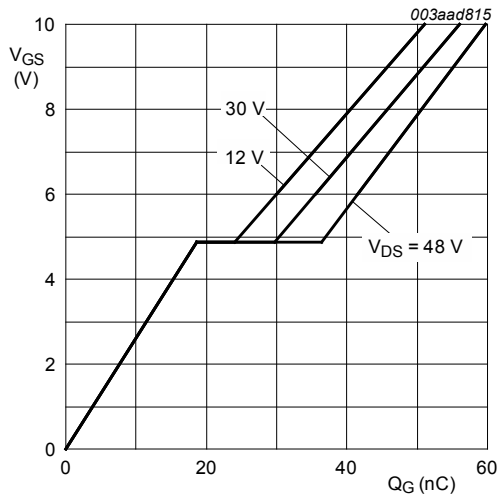


Fig. 15. Gate-source voltage as a function of gate charge; typical values

$T_J = 25\ °C; I_D = 75\ A$

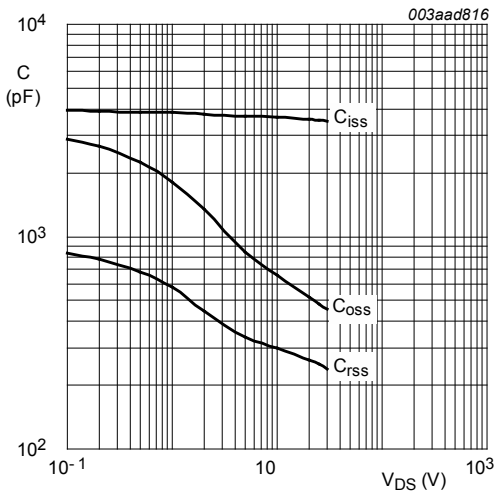


Fig. 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

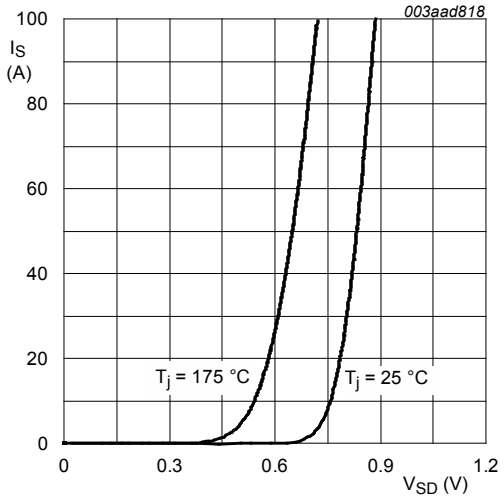
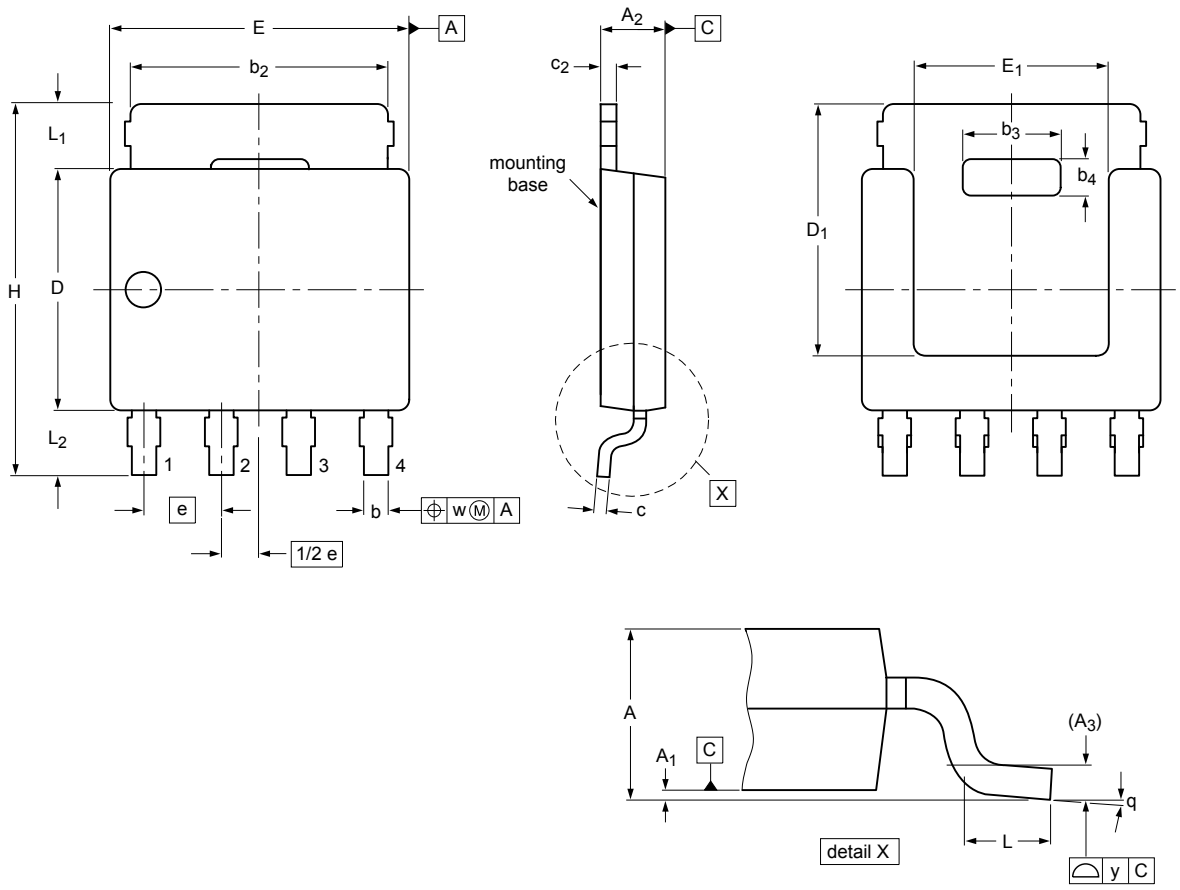


Fig. 17. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

$V_{GS} = 0\ V$

10. 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. 18. Package outline LFPAK56; Power-SO8 (SOT669)

11. Legal information

11.1 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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12. Contents

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