PSMN5R6-60YL

N-channel 60 V, 5.6 mΩ logic level MOSFET in LFPAK56

3 June 2016 Product data sheet

1. General description

Logic level N-channel MOSFET in an LFPAK56 (Power SO8) package using TrenchMOS technology. This product is designed and qualified for use in a wide range of power supply & motor control equipment.

2. Features and benefits

- Advanced TrenchMOS provides low R_{DSon} and low gate charge
- Logic level gate operation
- Avalanche rated, 100% tested
- LFPAK provides maximum power density in a Power SO8 package

3. Applications

- Synchronous rectifier in LLC topology
- Chargers & adaptors with V_{out} < 10 V
- Fast charge & USB-PD applications
- Battery powered motor control
- LED lighting & TV backlight

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		-	-	60	V
I_D	drain current	V_{GS} = 5 V; T_{mb} = 25 °C; Fig. 2	[1]	-	-	100	A
P_{tot}	total power dissipation	T_{mb} = 25 °C; Fig. 1		-	-	167	W
Static characteristics							
R_{DSon}	drain-source on-state resistance	V_{GS} = 5 V; I_D = 25 A; T_j = 25 °C; Fig. 11		-	5.4	7.2	mΩ
Dynamic characteristics							
Q_{GD}	gate-drain charge	I_D = 25 A; V_{DS} = 48 V; V_{GS} = 5 V; T_j = 25 °C; Fig. 13; Fig. 14		-	12	-	nC

[1] Continuous current is limited by package.

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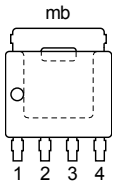
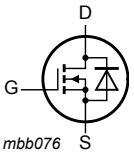
5. Pinning information

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
PSMN5R6-60YL	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
PSMN5R6-60YL	5R6L60

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		-	60	V
V_{DGR}	drain-gate voltage	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		-	167	W
I_D	drain current	V_{GS} = 5 V; T_{mb} = 25 °C; Fig. 2	[1]	-	100	A
		V_{GS} = 5 V; T_{mb} = 100 °C; Fig. 2		-	72	A
I_{DM}	peak drain current	pulsed; t_p ≤ 10 µs; T_{mb} = 25 °C; Fig. 3		-	405	A
T_{stg}	storage temperature			-55	175	°C

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Symbol	Parameter	Conditions		Min	Max	Unit
T_j	junction temperature			-55	175	°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		-	405	A
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	I_D = 100 A; $V_{sup} \leq 60$ V; R_{GS} = 50 Ω; V_{GS} = 5 V; $T_{j(init)}$ = 25 °C; unclamped; Fig. 4	[2][3]	-	88.2	mJ

[1] Continuous current is limited by package.
[2] Single-pulse avalanche rating limited by maximum junction temperature of 175 °C.
[3] Refer to application note AN10273 for further information.

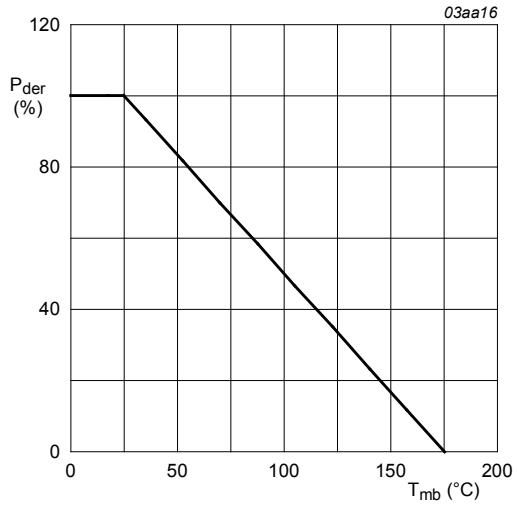
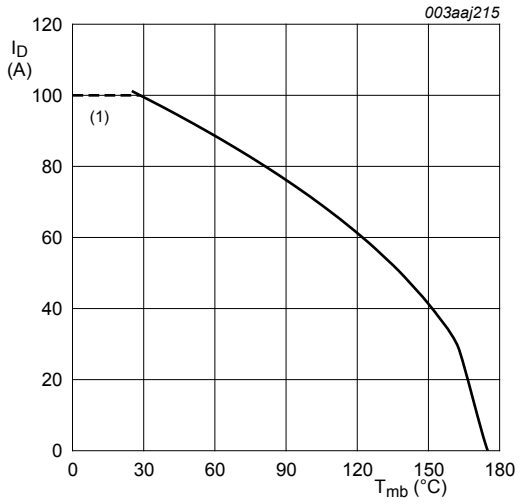


Fig. 1. Normalized total power dissipation as a function of mounting base temperature

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



(1) Capped at 100A due to package

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

$$V_{GS} \geq 5V$$

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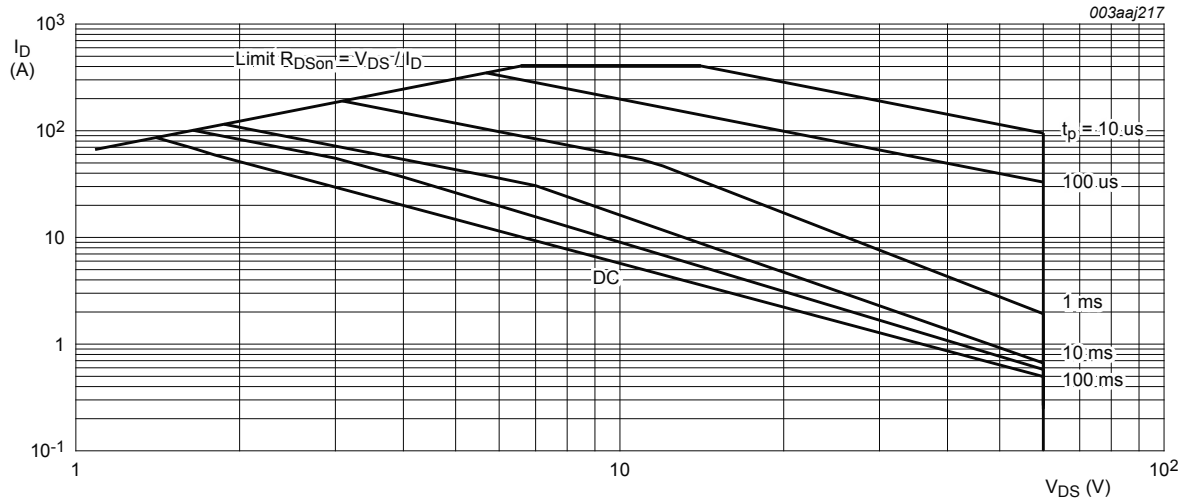

Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

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

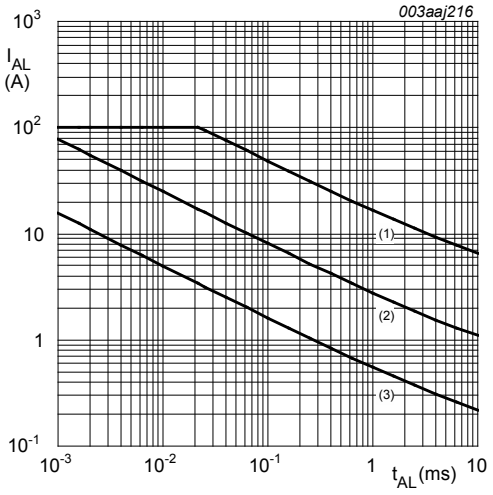

Fig. 4. Avalanche rating; avalanche current as a function of avalanche time

(1) $T_{j(init)} = 25°C$; (2) $T_{j(init)} = 150°C$; (3) Repetitive Avalanche

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		-	-	0.9	K/W

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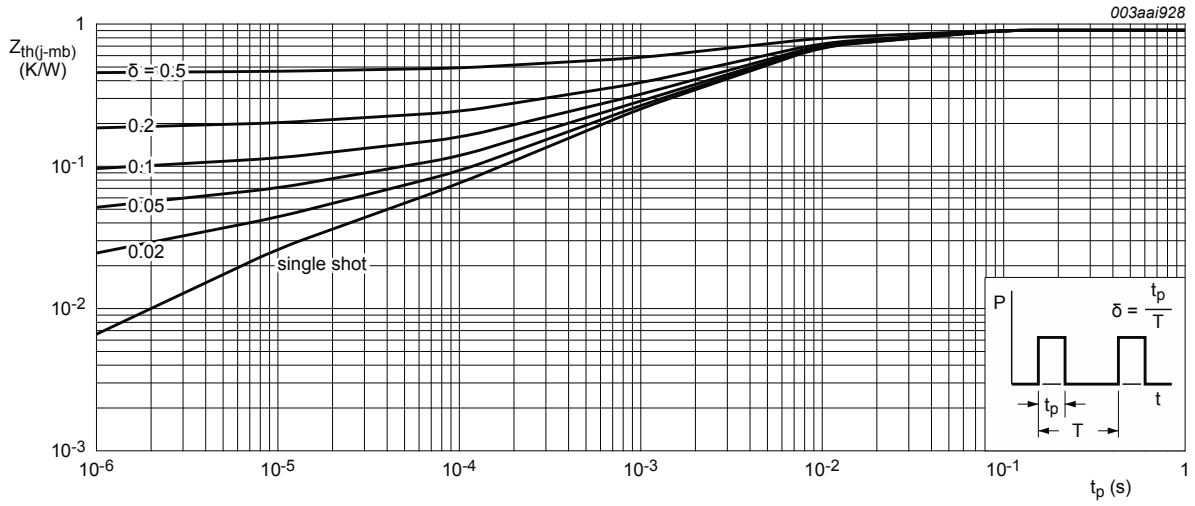

Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

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		60	-	-	V
		I_D = 250 µA; V_{GS} = 0 V; T_j = -55 °C		54	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	I_D = 1 mA; V_{DS}=V_{GS}; T_j = 25 °C; Fig. 9; Fig. 10		1.4	1.7	2.1	V
		I_D = 1 mA; V_{DS}=V_{GS}; T_j = -55 °C; Fig. 9		-	-	2.45	V
		I_D = 1 mA; V_{DS}=V_{GS}; T_j = 175 °C; Fig. 9		0.5	-	-	V
I_{DSS}	drain leakage current	V_{DS} = 60 V; V_{GS} = 0 V; T_j = 25 °C		-	0.05	10	µA
		V_{DS} = 60 V; V_{GS} = 0 V; T_j = 175 °C		-	-	500	µA
I_{GSS}	gate leakage current	V_{GS} = 16 V; V_{DS} = 0 V; T_j = 25 °C		-	2	100	nA
		V_{GS} = -16 V; V_{DS} = 0 V; T_j = 25 °C		-	2	100	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = 5 V; I_D = 25 A; T_j = 25 °C; Fig. 11		-	5.4	7.2	mΩ
		V_{GS} = 10 V; I_D = 25 A; T_j = 25 °C; Fig. 11		-	4.7	5.6	mΩ
		V_{GS} = 5 V; I_D = 25 A; T_j = 175 °C; Fig. 11; Fig. 12		-	-	16.3	mΩ
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	I_D = 25 A; V_{DS} = 48 V; V_{GS} = 10 V; T_j = 25 °C; Fig. 13; Fig. 14		-	66.8	-	nC
		I_D = 25 A; V_{DS} = 48 V; V_{GS} = 5 V; T_j = 25 °C; Fig. 13; Fig. 14		-	35	-	nC
Q_{GS}	gate-source charge			-	9.5	-	nC

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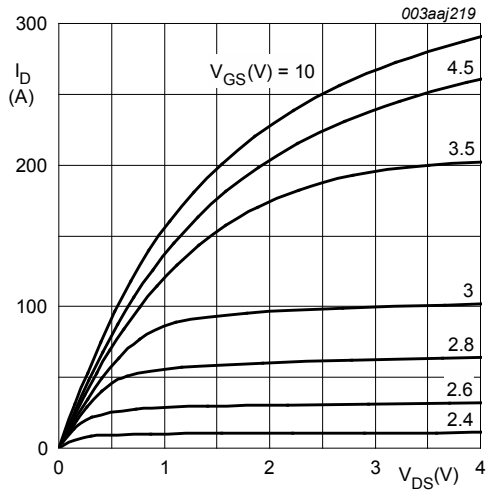
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Q_{GD}	gate-drain charge			-	12	-	nC
C_{iss}	input capacitance	V_{DS} = 25 V; V_{GS} = 0 V; f = 1 MHz; T_j = 25 °C; Fig. 15		-	3769	5026	pF
C_{oss}	output capacitance			-	341	409	pF
C_{rss}	reverse transfer capacitance			-	185	253	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 45 V; R_L = 1.8 Ω; V_{GS} = 5 V; $R_{G(ext)}$ = 5 Ω; T_j = 25 °C		-	19.3	-	ns
t_r	rise time			-	36.4	-	ns
$t_{d(off)}$	turn-off delay time			-	49.4	-	ns
t_f	fall time			-	32.1	-	ns
Source-drain diode							
V_{SD}	source-drain voltage	I_S = 25 A; V_{GS} = 0 V; T_j = 25 °C; Fig. 16		-	0.81	1.2	V
t_{rr}	reverse recovery time	I_S = 20 A; dI_S/dt = -100 A/µs; V_{GS} = 0 V; V_{DS} = 25 V; T_j = 25 °C		-	23.1	-	ns
Q_r	recovered charge			-	18.1	-	nC



T_j = 25 °C; t_p = 300 µs

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

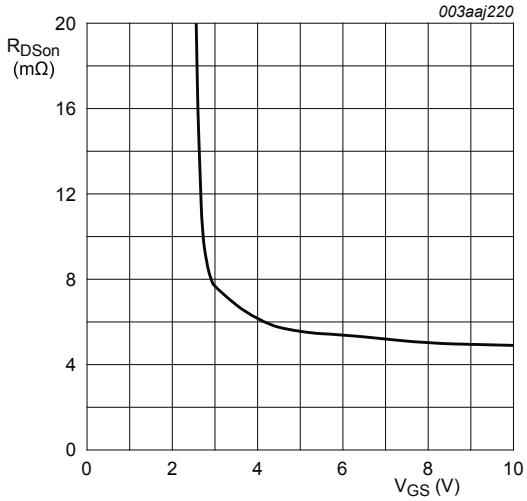


Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

$T_j = 25°C;\ I_D = 25A$

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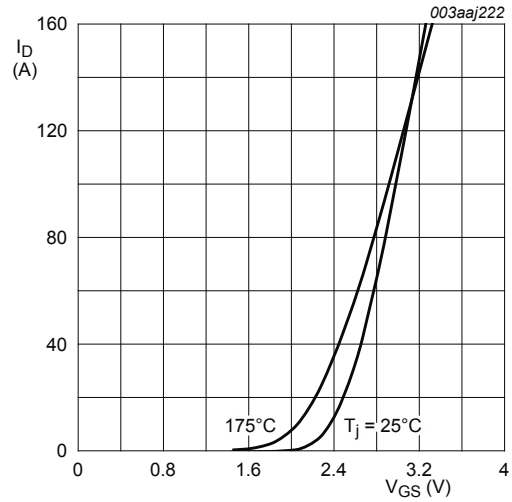


Fig. 8. Transfer characteristics; drain current as a function of gate-source voltage; typical values

$V_{DS} = 10V$

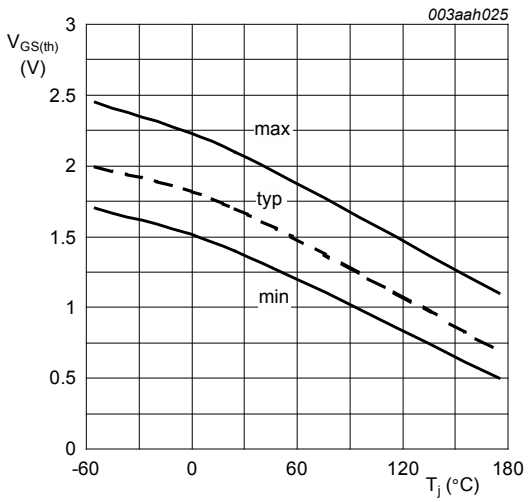


Fig. 9. Gate-source threshold voltage as a function of junction temperature

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

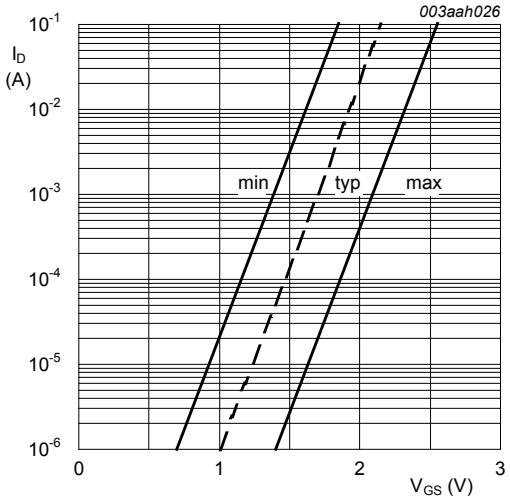
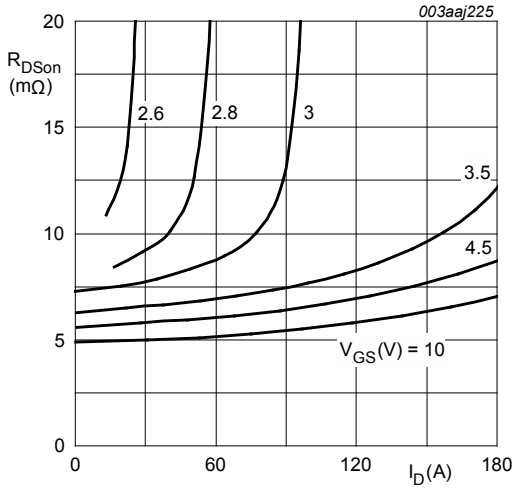


Fig. 10. Sub-threshold drain current as a function of gate-source voltage

$T_j = 25°C$; $V_{DS} = 5V$



T_j = 25 °C; t_p = 300 µs

Fig. 11. Drain-source on-state resistance as a function of drain current; typical values

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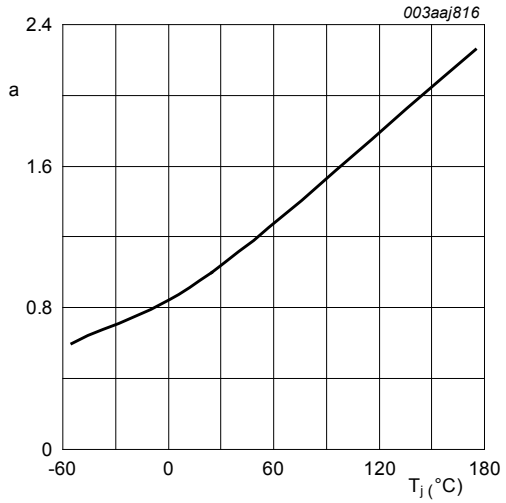

Fig. 12. Normalized drain-source on-state resistance factor as a function of junction temperature

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

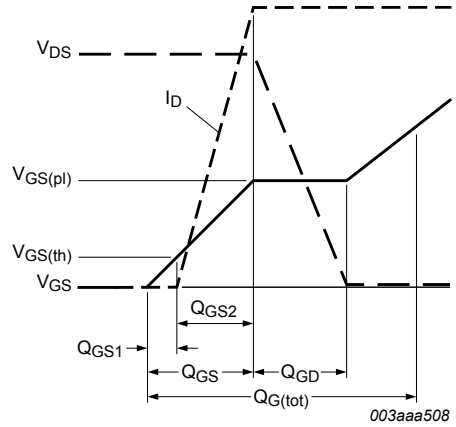

Fig. 13. Gate charge waveform definitions

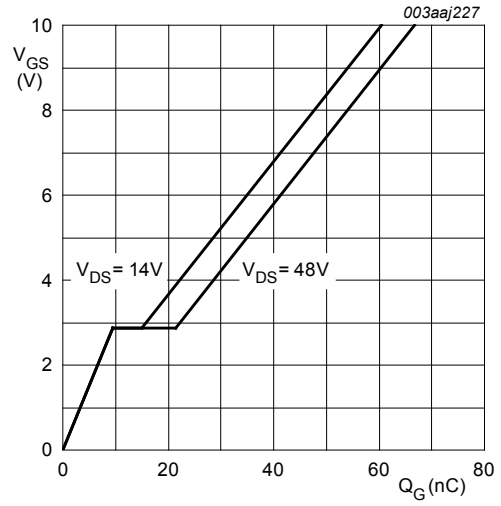

Fig. 14. Gate-source voltage as a function of gate charge; typical values

$$T_j = 25°C;\ I_D = 25A$$

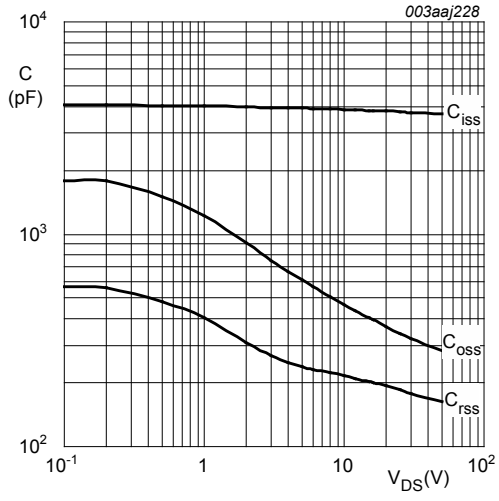

Fig. 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

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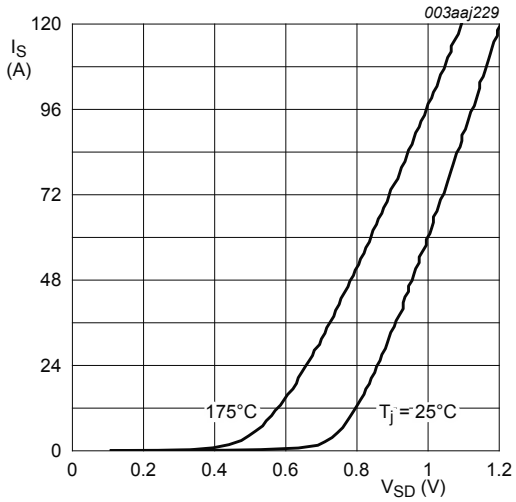

Fig. 16. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

$V_{GS} = 0V$

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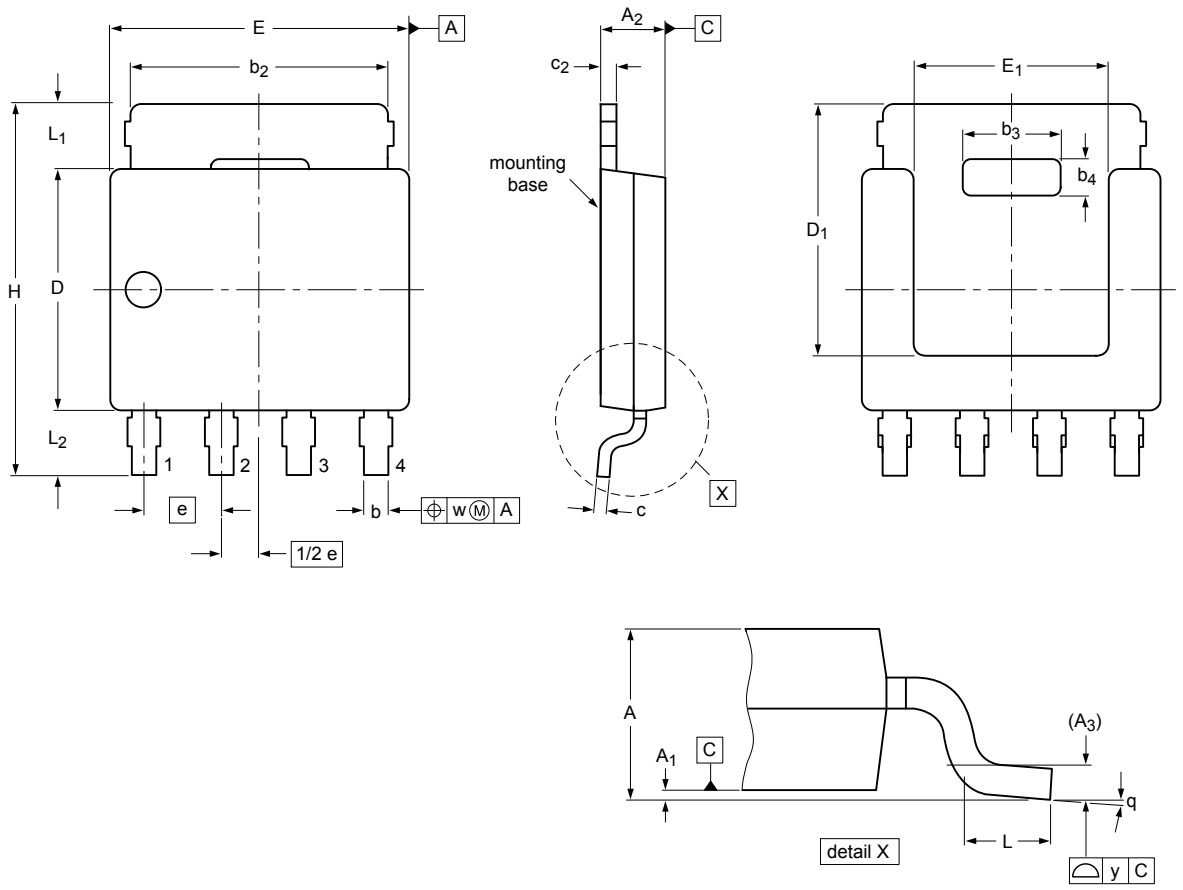
11. Package outline

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. 17. Package outline LFPAK56; Power-SO8 (SOT669)

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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".
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