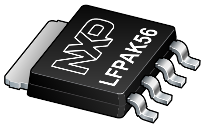


PSMN013-60YL

N-channel 60 V, 13 mΩ logic level MOSFET in LFPAK56

15 October 2015 Preliminary 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. Quick reference data

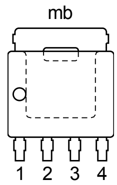
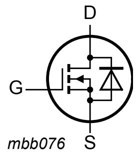
Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DS}	drain-source voltage	T_j ≥ 25 °C; T_j ≤ 175 °C		-	-	60	V
I_D	drain current	V_{GS} = 5 V; T_{mb} = 25 °C; Fig. 2		-	-	53	A
P_{tot}	total power dissipation	T_{mb} = 25 °C; Fig. 1		-	-	95	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 = 25 °C; Fig. 11		-	10.8	13	mΩ
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	V_{GS} = 10 V; I_D = 15 A; V_{DS} = 48 V; T_j = 25 °C; Fig. 13; Fig. 14		-	33.2	-	nC
Q_{GD}	gate-drain charge	V_{GS} = 5 V; I_D = 15 A; V_{DS} = 48 V; T_j = 25 °C; Fig. 13; Fig. 14		-	6	-	nC
Avalanche ruggedness							
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	I_D = 53 A; V_{sup} ≤ 60 V; R_{GS} = 50 Ω; V_{GS} = 5 V; $T_{j(init)}$ = 25 °C; unclamped; Fig. 4	[1][2]	-	-	42.7	mJ

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

4. 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		

5. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PSMN013-60YL	LFPAK56; Power-SO8	Plastic single-ended surface-mounted package (LFPAK56; Power-SO8); 4 leads	SOT669

6. 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	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		-	95	W
I_D	drain current	T_{mb} = 25 °C; V_{GS} = 5 V; Fig. 2		-	53	A
		T_{mb} = 100 °C; V_{GS} = 5 V; Fig. 2		-	37.4	A
I_{DM}	peak drain current	T_{mb} = 25 °C; pulsed; t_p ≤ 10 µs; Fig. 3		-	212	A
T_{stg}	storage temperature			-55	175	°C
T_j	junction temperature			-55	175	°C
Source-drain diode						
I_S	source current	T_{mb} = 25 °C		-	53	A
I_{SM}	peak source current	pulsed; t_p ≤ 10 µs; T_{mb} = 25 °C		-	212	A

Symbol	Parameter	Conditions		Min	Max	Unit
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	I_D = 53 A; V_{sup} ≤ 60 V; R_{GS} = 50 Ω; V_{GS} = 5 V; $T_{j(init)}$ = 25 °C; unclamped; Fig. 4	[1][2]	-	42.7	mJ

[1] Single-pulse avalanche rating limited by maximum junction temperature of 175 °C.

[2] Refer to application note AN10273 for further information.

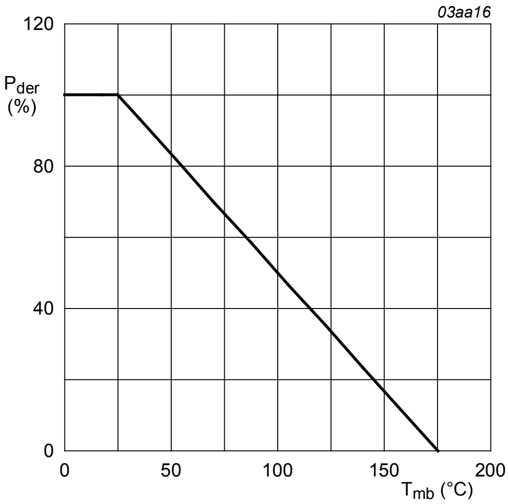


Fig. 1. Normalized total power dissipation as a function of mounting base temperature

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

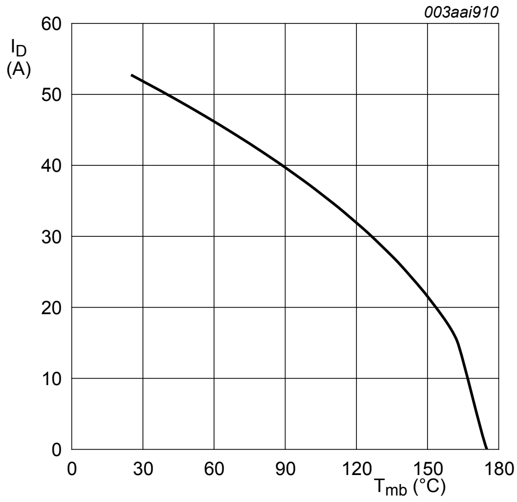


Fig. 2. Continuous drain current as a function of mounting base temperature

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

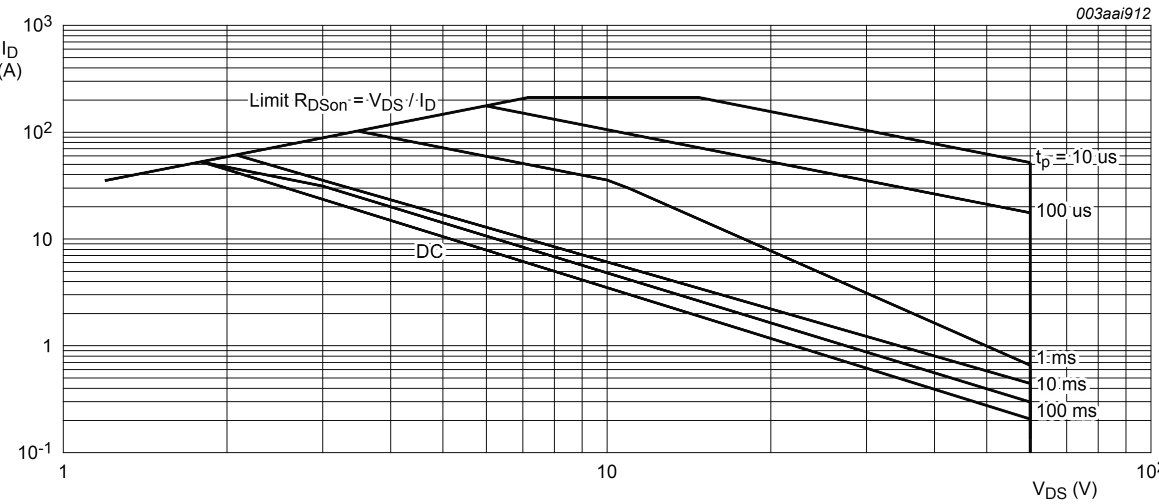


Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

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

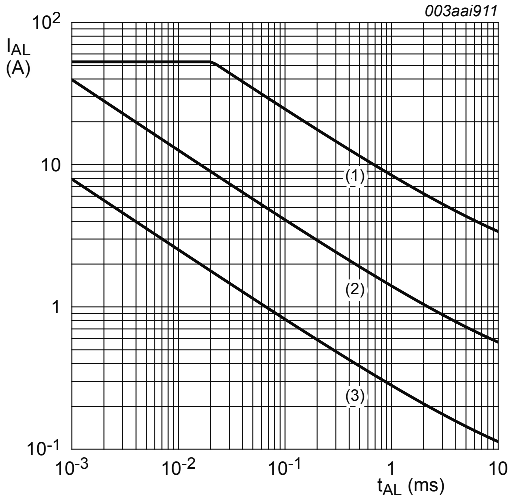


Fig. 4. Avalanche rating; avalanche current as a function of avalanche time

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

7. 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. 5		-	-	1.58	K/W

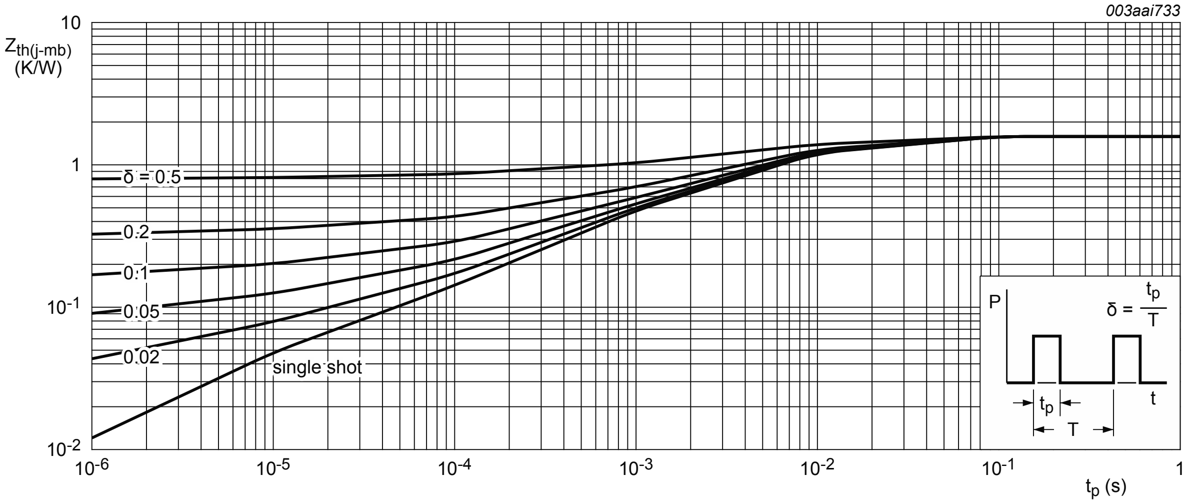


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

8. 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 = 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 = 175 °C		-	-	500	µA
		V_{DS} = 60 V; V_{GS} = 0 V; T_j = 25 °C		-	0.05	1	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 = 15 A; T_j = 25 °C; Fig. 11		-	12.1	15	mΩ
		V_{GS} = 10 V; I_D = 15 A; T_j = 25 °C; Fig. 11		-	10.8	13	mΩ
		V_{GS} = 5 V; I_D = 15 A; T_j = 175 °C; Fig. 12; Fig. 11		-	-	33.9	mΩ
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	I_D = 15 A; V_{DS} = 48 V; V_{GS} = 5 V; T_j = 25 °C; Fig. 13; Fig. 14		-	17.2	-	nC
		I_D = 15 A; V_{DS} = 48 V; V_{GS} = 10 V; T_j = 25 °C; Fig. 13; Fig. 14		-	33.2	-	nC
Q_{GS}	gate-source charge	I_D = 15 A; V_{DS} = 48 V; V_{GS} = 5 V; T_j = 25 °C; Fig. 13; Fig. 14		-	4.9	-	nC
Q_{GD}	gate-drain charge			-	6	-	nC
C_{iss}	input capacitance	V_{GS} = 0 V; V_{DS} = 25 V; f = 1 MHz; T_j = 25 °C; Fig. 15		-	1952	2603	pF
C_{oss}	output capacitance			-	182	218	pF
C_{rss}	reverse transfer capacitance			-	100	137	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 45 V; R_L = 3 Ω; V_{GS} = 5 V; $R_{G(ext)}$ = 5 Ω; T_j = 25 °C		-	11.4	-	ns
t_r	rise time			-	17.3	-	ns
$t_{d(off)}$	turn-off delay time			-	25.2	-	ns
t_f	fall time			-	15.3	-	ns

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Source-drain diode							
V_{SD}	source-drain voltage	I_S = 15 A; V_{GS} = 0 V; T_j = 25 °C; Fig. 16		-	0.83	1.2	V
t_{rr}	reverse recovery time	I_S = 10 A; dI_S/dt = -100 A/µs; V_{GS} = 0 V; V_{DS} = 25 V; T_j = 25 °C		-	20.7	-	ns
Q_r	recovered charge			-	18.7	-	nC

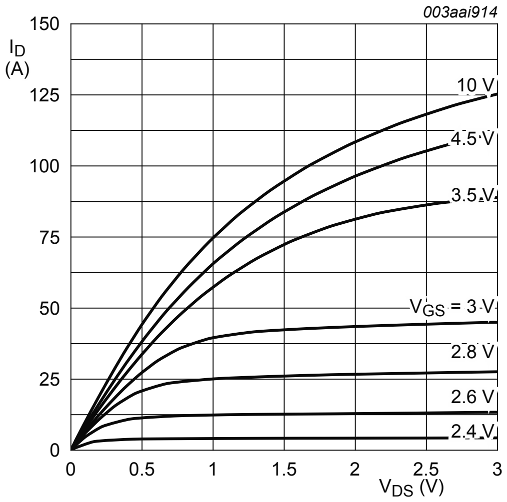


Fig. 6. Drain-source on-state resistance as a function of gate-source voltage; typical values

$T_j = 25°C;\ I_D = 15A$

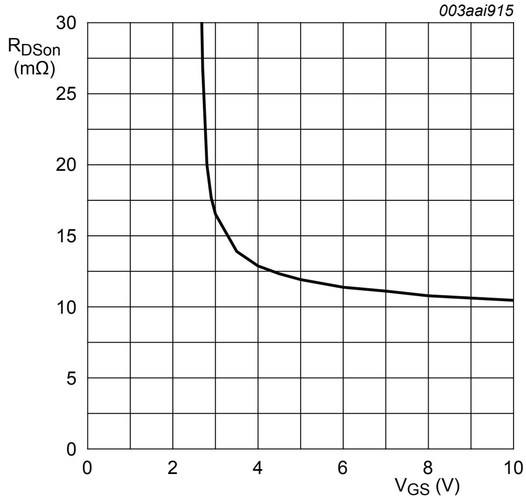


Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

$T_j = 25°C;\ I_D = 15A$

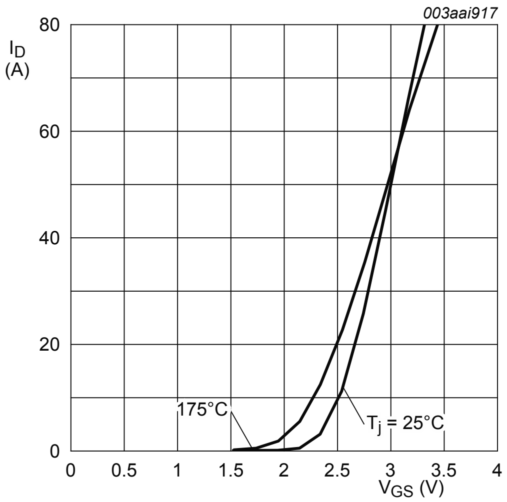


Fig. 8. Transfer characteristics; drain current as a function of gate-source voltage; typical values

$V_{DS} = 10V$

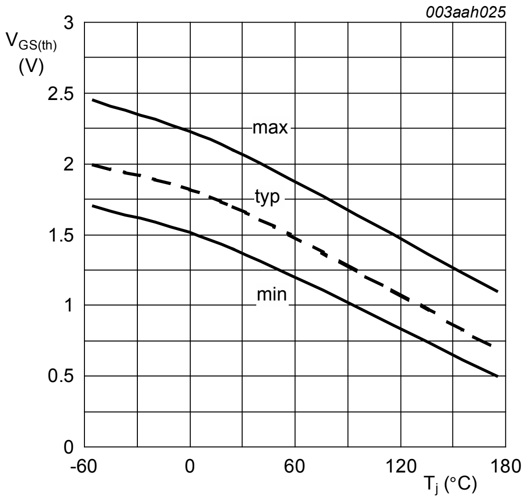


Fig. 9. Gate-source threshold voltage as a function of junction temperature

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

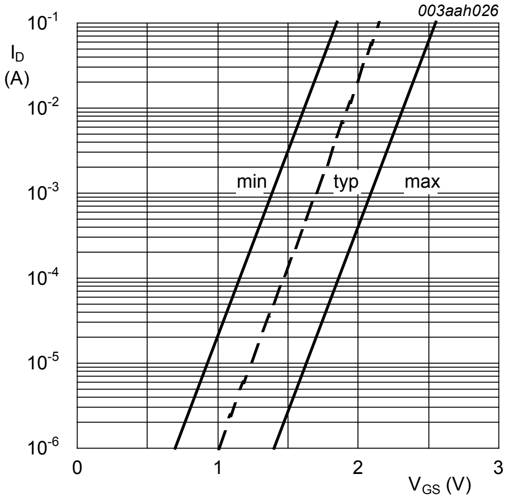
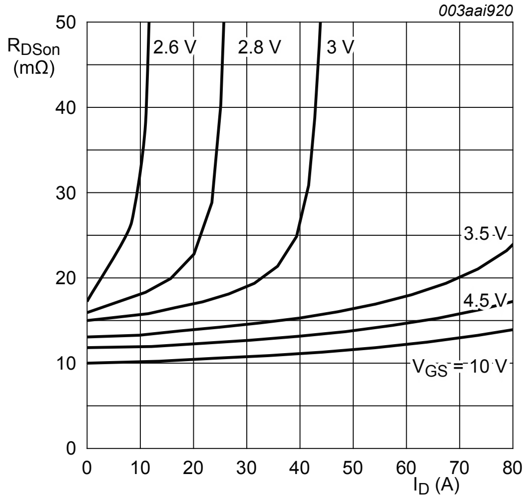


Fig. 10. Sub-threshold drain current as a function of gate-source voltage

$T_j = 25°C;\ V_{DS} = 5V$



T_j = 25 °C; t_p = 300 µs

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

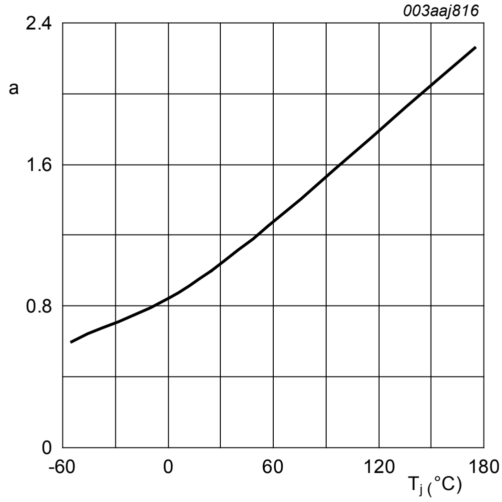


Fig. 12. Normalized drain-source on-state resistance factor as a function of junction temperature

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

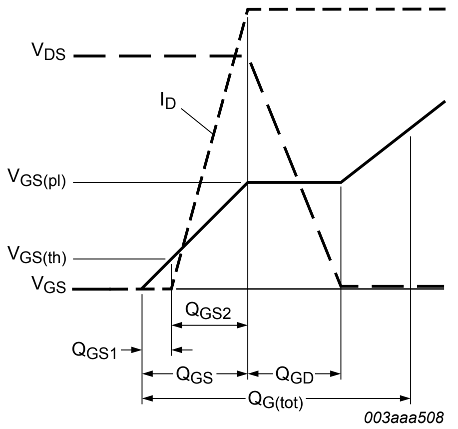


Fig. 13. Gate charge waveform definitions

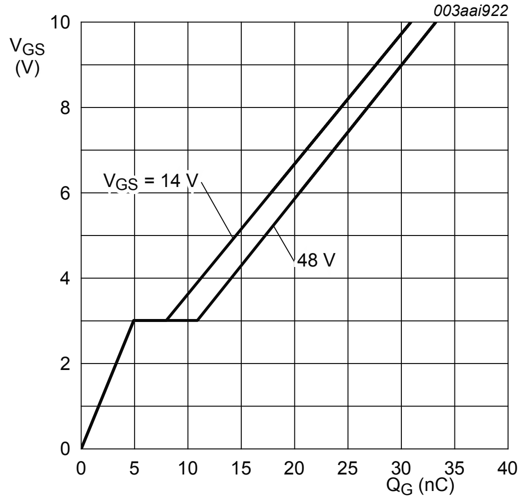


Fig. 14. Gate-source voltage as a function of gate charge; typical values

$T_j = 25°C; \ I_D = 15A$

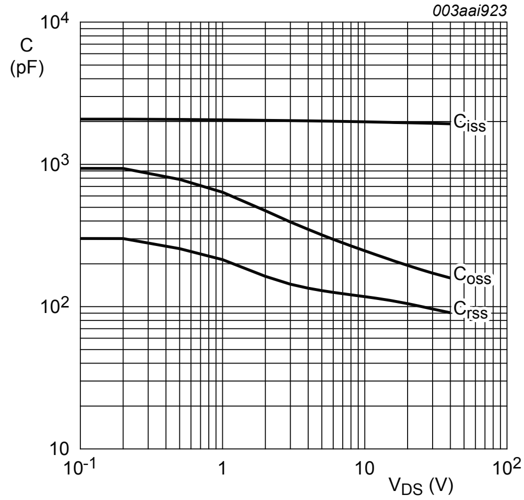


Fig. 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

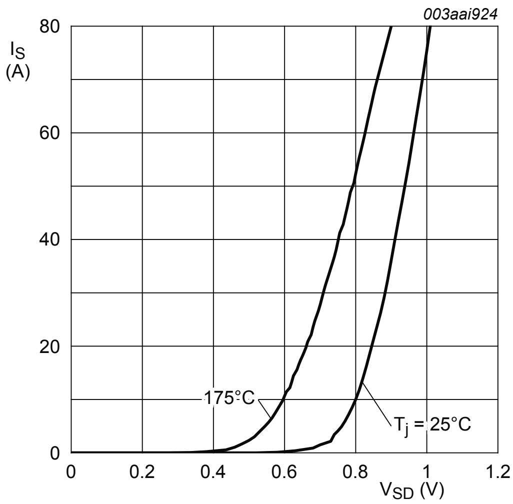
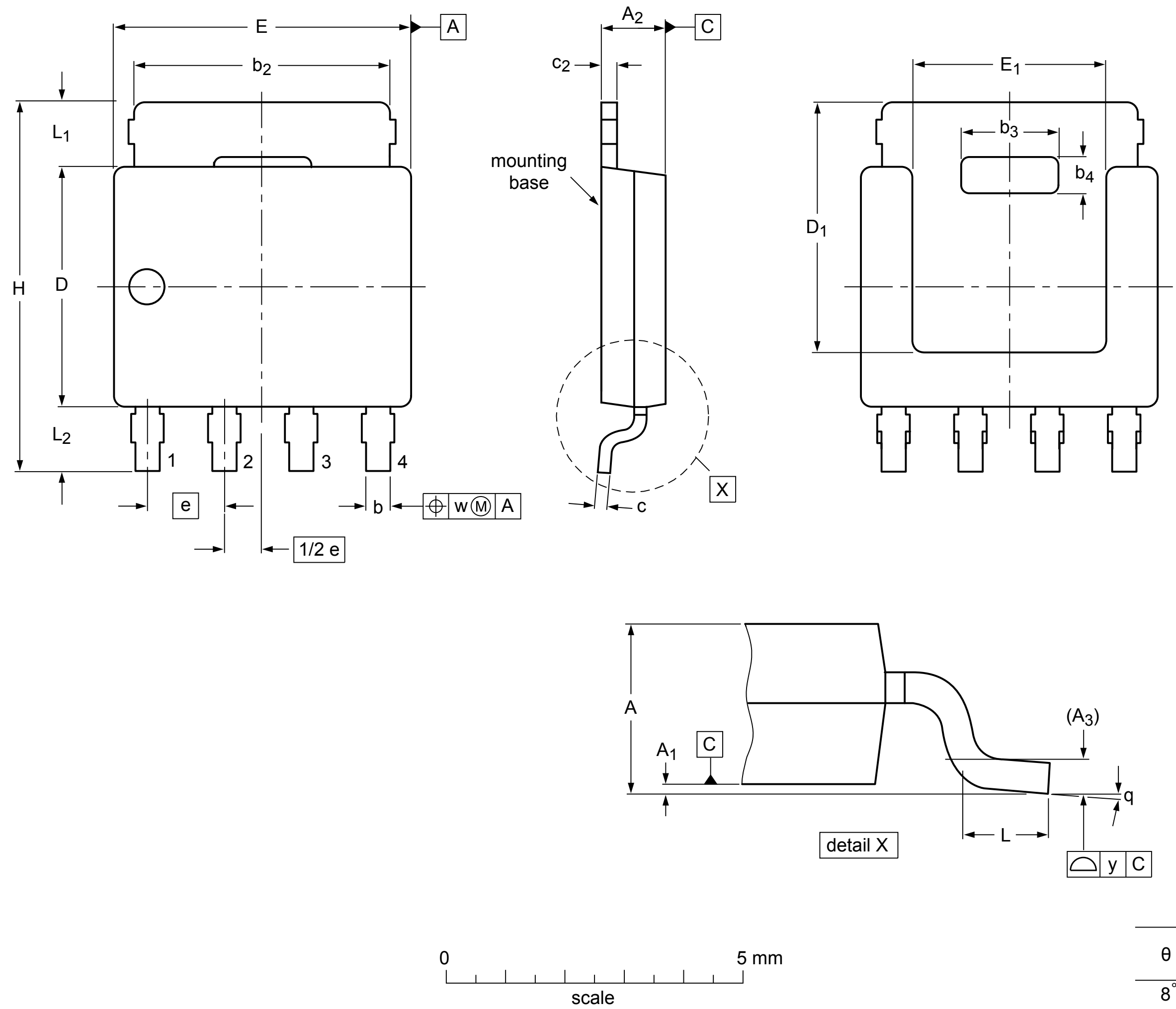


Fig. 16. Source-drain (diode forward) current as a function of source-drain (diode forward) voltage; typical values

$V_{GS} = 0V$

9. Package outline

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



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	θ
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			8°
	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			0°

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)

10. Legal information

10.1 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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Date of release: 15 October 2015

