



PSMN4R0-60YS

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

14 May 2015

Product data sheet

1. General description

Standard level N-channel MOSFET in LPAK 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
- LPAK 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	$T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$		-	-	60	V
I_D	drain current	$T_{mb} = 25\text{ °C}$; Fig. 2	[1]	-	-	100	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; Fig. 1		-	-	130	W
T_j	junction temperature			-55	-	175	°C
Static characteristics							
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10\text{ V}$; $I_D = 15\text{ A}$; $T_j = 100\text{ °C}$; Fig. 12		-	-	8.3	mΩ
		$V_{GS} = 10\text{ V}$; $I_D = 15\text{ A}$; $T_j = 25\text{ °C}$; Fig. 13		-	3.6	4	mΩ

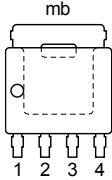
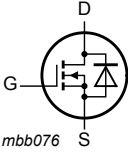
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Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Dynamic characteristics						
Q_{GD}	gate-drain charge	$V_{GS} = 10\text{ V}$; $I_D = 75\text{ A}$; $V_{DS} = 30\text{ V}$;	-	11.2	-	nC
$Q_{G(tot)}$	total gate charge	Fig. 14; Fig. 15	-	56	-	nC
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$; $T_{j(init)} = 25\text{ °C}$; $I_D = 100\text{ A}$; $V_{sup} \leq 60\text{ V}$; $R_{GS} = 50\text{ }\Omega$; 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	 LPAK56; Power-SO8 (SOT669)	 mbb076 S
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	LPAK56; Power-SO8	Plastic single-ended surface-mounted package (LPAK56; Power-SO8); 4 leads	SOT669

7. Limiting values

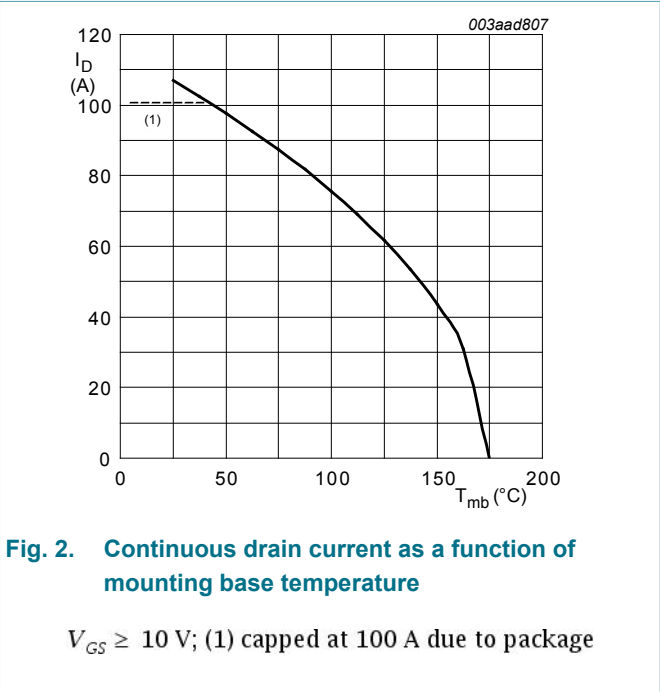
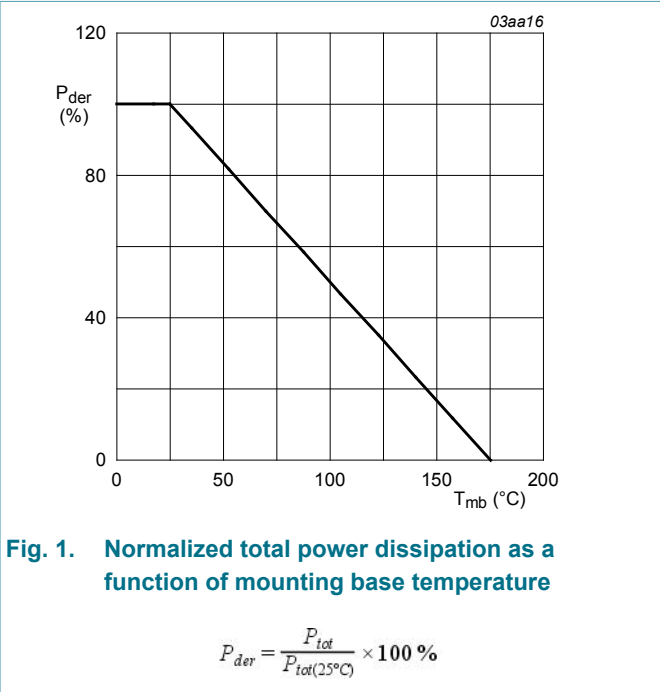
Table 4. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$	-	60	V
V_{DGR}	drain-gate voltage	$T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$; $R_{GS} = 20\text{ k}\Omega$	-	60	V
V_{GS}	gate-source voltage		-20	20	V
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; Fig. 1	-	130	W
I_D	drain current	$T_{mb} = 100\text{ °C}$; Fig. 2	-	74	A

Symbol	Parameter	Conditions		Min	Max	Unit
		$T_{mb} = 25\text{ °C}$; Fig. 2	[1]	-	100	A
I_{DM}	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$; 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	$T_{mb} = 25\text{ °C}$	[1]	-	100	A
I_{SM}	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$		-	418	A
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25\text{ °C}$; $I_D = 100\text{ A}$; $V_{sup} \leq 60\text{ V}$; $R_{GS} = 50\text{ }\Omega$; unclamped		-	170	mJ

[1] Continuous current is limited by package.



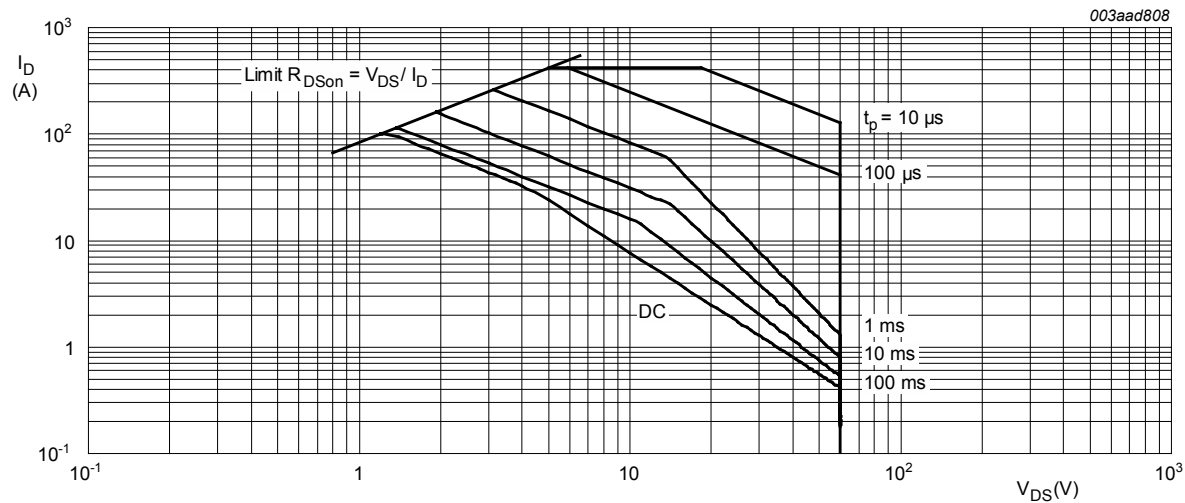


Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

$T_{mb} = 25\text{ }^{\circ}\text{C}$; 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

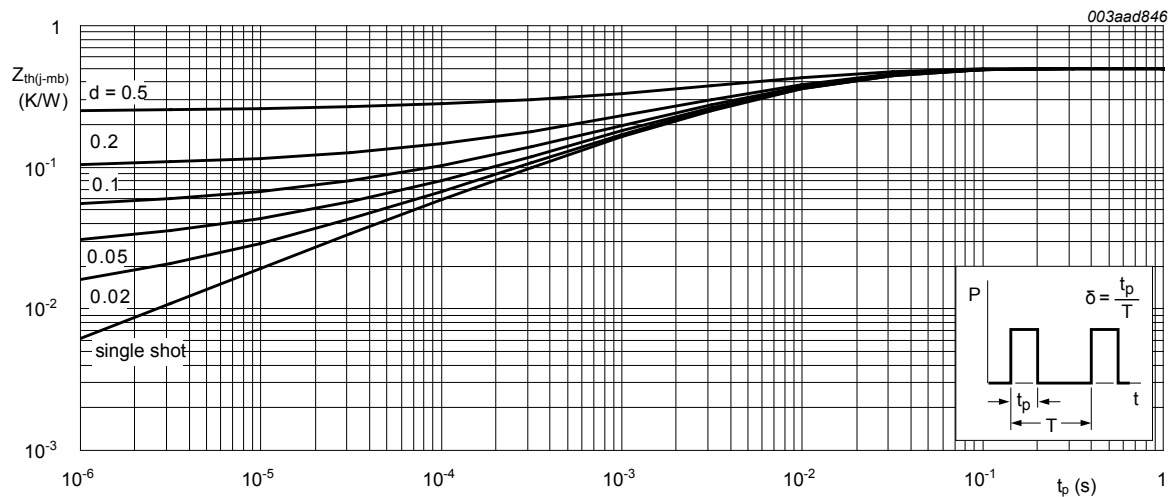


Fig. 4. Transient thermal impedance from junction to mounting base as a function of pulse duration; typical values

9. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250\ \mu A$; $V_{GS} = 0\ V$; $T_J = -55\ ^\circ C$	54	-	-	V
		$I_D = 250\ \mu A$; $V_{GS} = 0\ V$; $T_J = 25\ ^\circ C$	63	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\ mA$; $V_{DS} = V_{GS}$; $T_J = 25\ ^\circ C$; Fig. 10 ; Fig. 11	2	3	4	V
V_{GSth}	gate-source threshold voltage	$I_D = 1\ mA$; $V_{DS} = V_{GS}$; $T_J = -55\ ^\circ C$; Fig. 11	-	-	4.6	V
		$I_D = 1\ mA$; $V_{DS} = V_{GS}$; $T_J = 175\ ^\circ C$; Fig. 11	0.95	-	-	V
I_{DSS}	drain leakage current	$V_{DS} = 60\ V$; $V_{GS} = 0\ V$; $T_J = 25\ ^\circ C$	-	0.05	5	μA
		$V_{DS} = 63\ V$; $V_{GS} = 0\ V$; $T_J = 25\ ^\circ C$	-	0.07	7	μA
		$V_{DS} = 60\ V$; $V_{GS} = 0\ V$; $T_J = 125\ ^\circ C$	-	-	100	μA
		$V_{DS} = 63\ V$; $V_{GS} = 0\ V$; $T_J = 125\ ^\circ C$	-	3.25	150	μA
I_{GSS}	gate leakage current	$V_{GS} = 20\ V$; $V_{DS} = 0\ V$; $T_J = 25\ ^\circ C$	-	2	100	nA
		$V_{GS} = -20\ V$; $V_{DS} = 0\ V$; $T_J = 25\ ^\circ C$	-	2	100	nA
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10\ V$; $I_D = 15\ A$; $T_J = 175\ ^\circ C$; Fig. 12	-	7.6	12	mΩ
		$V_{GS} = 10\ V$; $I_D = 15\ A$; $T_J = 100\ ^\circ C$; Fig. 12	-	-	8.3	mΩ
		$V_{GS} = 10\ V$; $I_D = 15\ A$; $T_J = 25\ ^\circ C$; 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

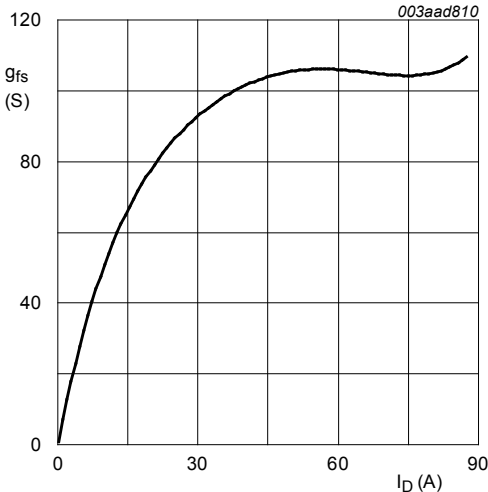


Fig. 5. Forward transconductance as a function of drain current; typical values

T_j = 25 °C; V_{DS} = 15 V

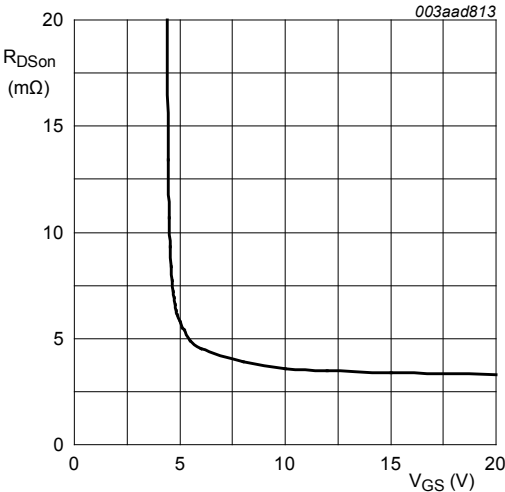


Fig. 6. Drain-source on-state resistance as a function of gate-source voltage; typical values

T_j = 25 °C; I_D = 25 A

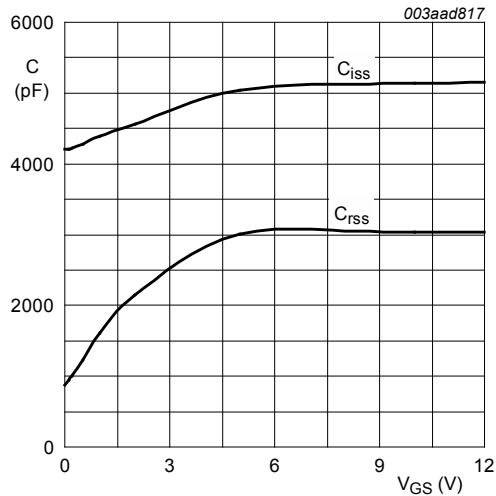


Fig. 7. Input and reverse transfer capacitances as a function of gate-source voltage, typical values

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

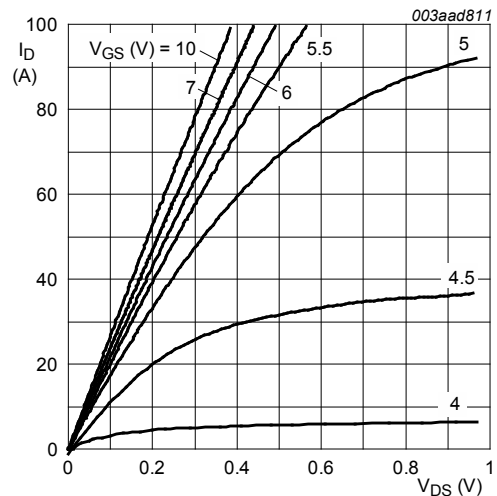


Fig. 8. Output characteristics: drain current as a function of drain-source voltage; typical values

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

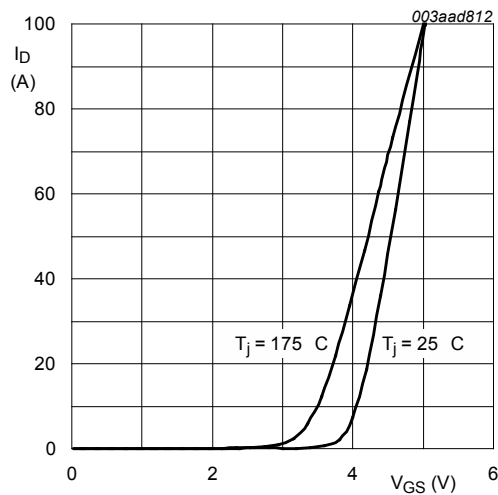


Fig. 9. Transfer characteristics: drain current as a function of gate-source voltage; typical values

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

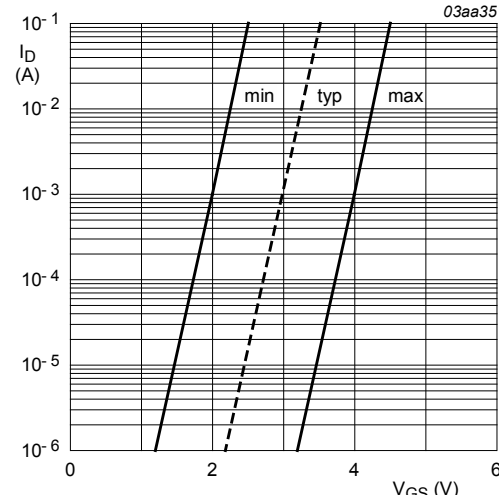


Fig. 10. Sub-threshold drain current as a function of gate-source voltage

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

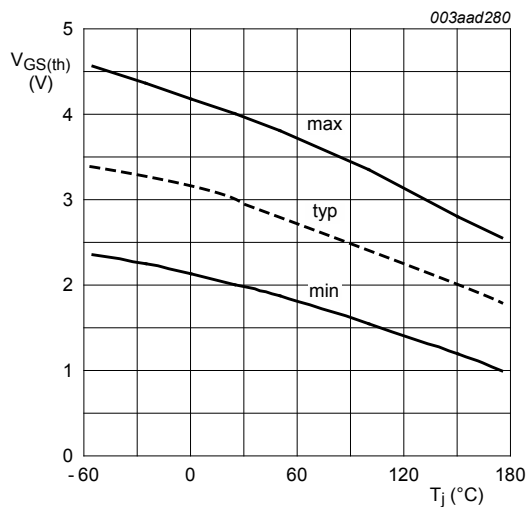


Fig. 11. Gate-source threshold voltage as a function of junction temperature

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

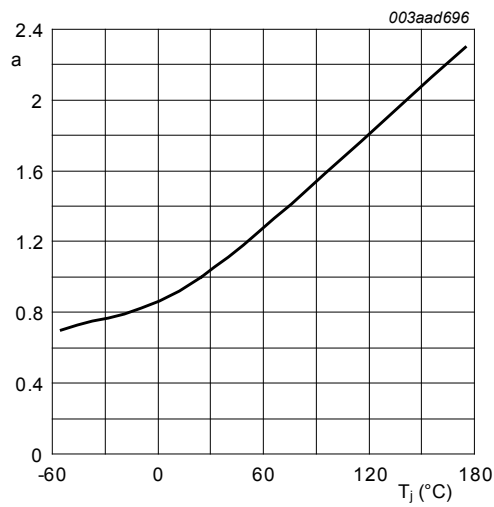


Fig. 12. Normalized drain-source on-state resistance factor as a function of junction temperature.

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

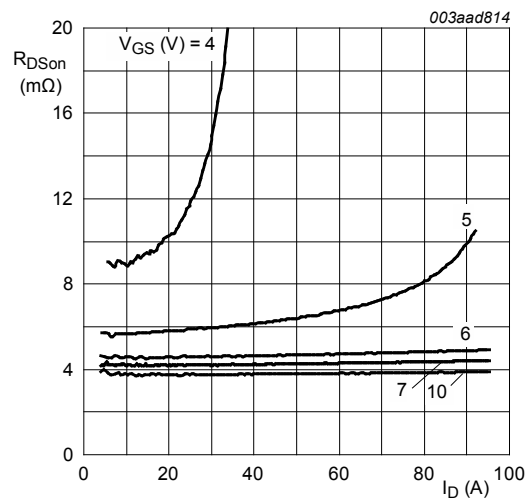


Fig. 13. Drain-source on-state resistance as a function of drain current; typical values

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

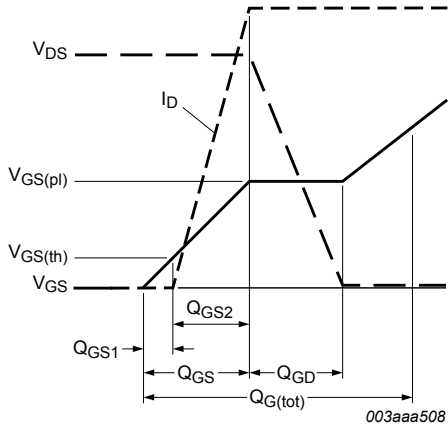


Fig. 14. Gate charge waveform definitions

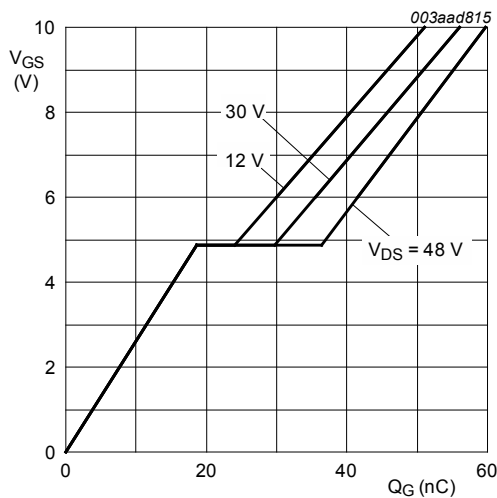


Fig. 15. Gate-source voltage as a function of gate charge; typical values

$T_J = 25\text{ }^{\circ}\text{C}; I_D = 75\text{ A}$

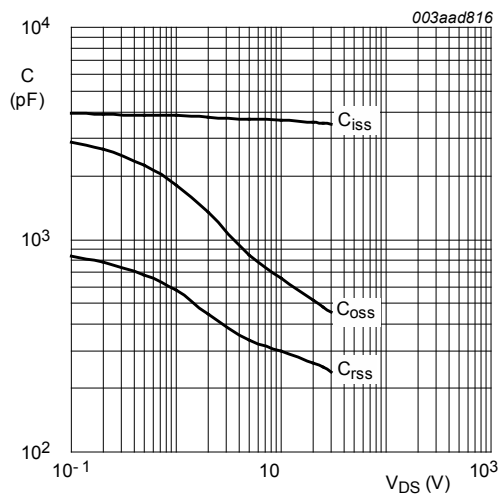


Fig. 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

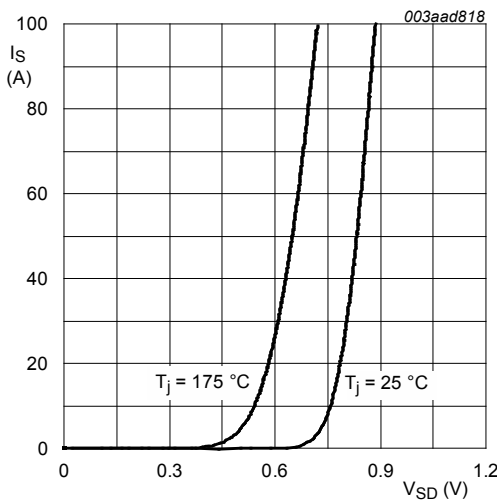


Fig. 17. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

$V_{GS} = 0\text{ V}$

10. Package outline

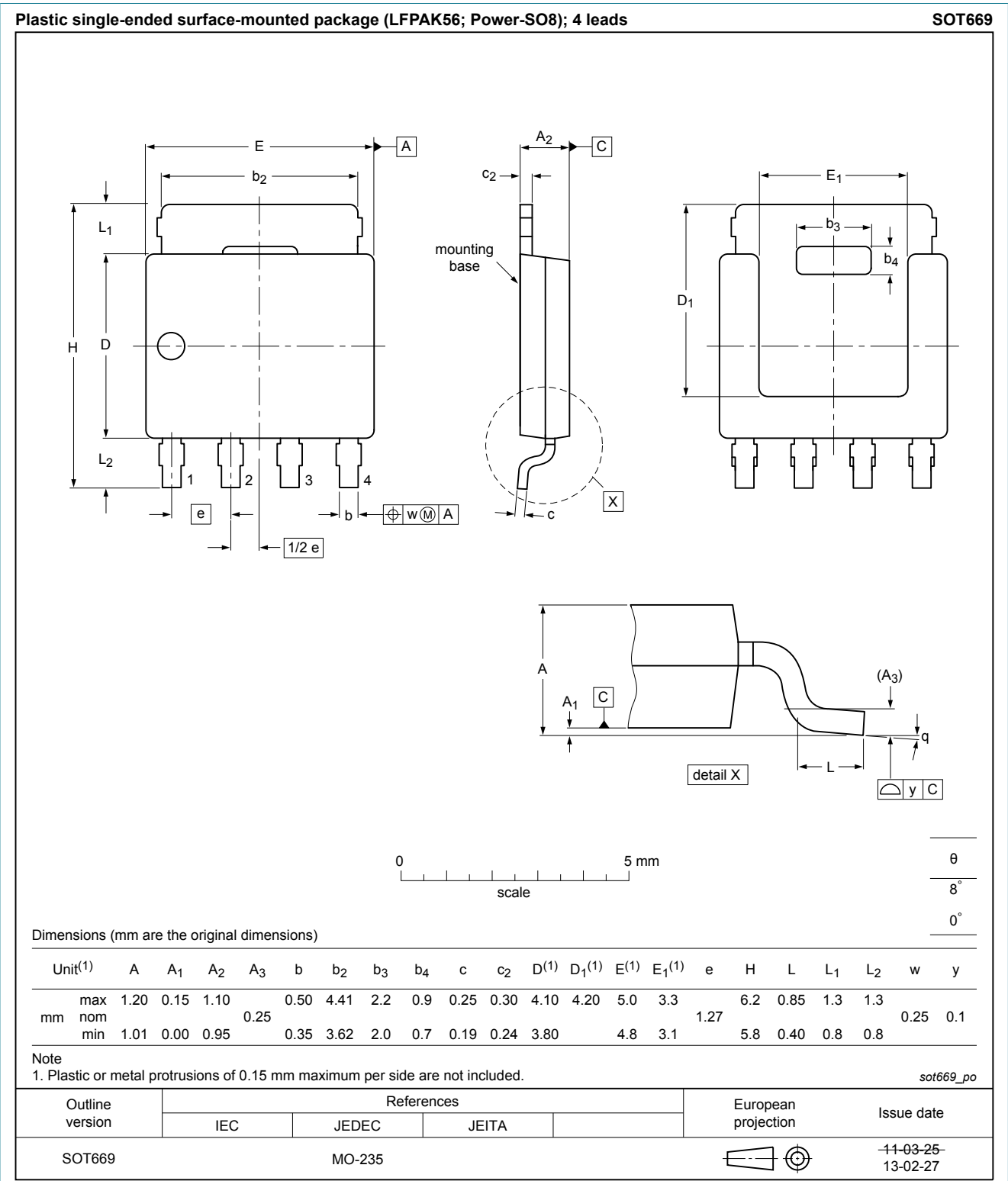


Fig. 18. Package outline LPAK56; Power-SO8 (SOT669)

11. Legal information

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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.
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12. Contents

1 General description 1

2 Features and benefits 1

3 Applications 1

4 Quick reference data 1

5 Pinning information 2

6 Ordering information 2

7 Limiting values 2

8 Thermal characteristics 4

9 Characteristics 5

10 Package outline 10

11 Legal information 11

11.1 Data sheet status 11

11.2 Definitions 11

11.3 Disclaimers 11

11.4 Trademarks 12

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