



PSMN020-100YS

N-channel 100V 20.5mΩ standard level MOSFET in LPAK

7 November 2013

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 industrial, communications and domestic equipment.

2. Features and benefits

- Advanced TrenchMOS provides low $R_{DS(on)}$ and low gate charge
- High efficiency gains 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

4. 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		-	-	100	V
I _D	drain current	T _{mb} = 25 °C; V _{GS} = 10 V; Fig. 1		-	-	43	A
P _{tot}	total power dissipation	T _{mb} = 25 °C; Fig. 2		-	-	106	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. 13		-	-	37	mΩ
		V _{GS} = 10 V; I _D = 15 A; T _j = 25 °C; Fig. 14		-	15	20.5	mΩ
Dynamic characteristics							
Q _{GD}	gate-drain charge	V _{GS} = 10 V; I _D = 30 A; V _{DS} = 50 V; Fig. 15 ; Fig. 16		-	11.8	16.5	nC
Q _{G(tot)}	total gate charge			-	41	57.4	nC



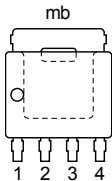
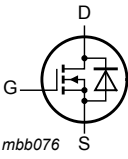
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Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25\text{ °C}$; $I_D = 43\text{ A}$; $V_{sup} \leq 100\text{ V}$; unclamped; $R_{GS} = 50\text{ }\Omega$; Fig. 3	-	-	103	mJ

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S	source	 LPAK56; Power-SO8 (SOT669)	 mbb076
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
PSMN020-100YS	LPAK56; Power-SO8	Plastic single-ended surface-mounted package (LPAK56; Power-SO8); 4 leads	SOT669

7. Marking

Table 4. Marking codes

Type number	Marking code
PSMN020-100YS	20100

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	$T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$	-	100	V
V_{DGR}	drain-gate voltage	$T_j \leq 175\text{ °C}$; $T_j \geq 25\text{ °C}$; $R_{GS} = 20\text{ k}\Omega$	-	100	V
V_{GS}	gate-source voltage		-20	20	V
I_D	drain current	$V_{GS} = 10\text{ V}$; $T_{mb} = 100\text{ °C}$; Fig. 1	-	30	A

Symbol	Parameter	Conditions		Min	Max	Unit
		$V_{GS} = 10\text{ V}$; $T_{mb} = 25\text{ °C}$; Fig. 1		-	43	A
I_{DM}	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$; Fig. 4		-	172	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; Fig. 2		-	106	W
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	$T_{mb} = 25\text{ °C}$		-	43	A
I_{SM}	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$		-	172	A
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25\text{ °C}$; $I_D = 43\text{ A}$; $V_{sup} \leq 100\text{ V}$; unclamped; $R_{GS} = 50\text{ }\Omega$; Fig. 3		-	103	mJ

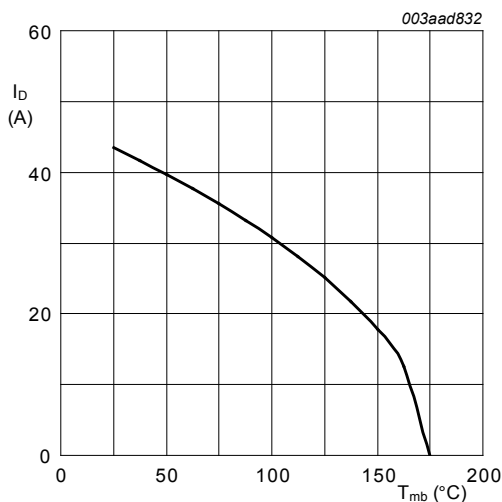


Fig. 1. Continuous drain current as a function of mounting base temperature

$$V_{GS} \geq 10\text{ V}$$

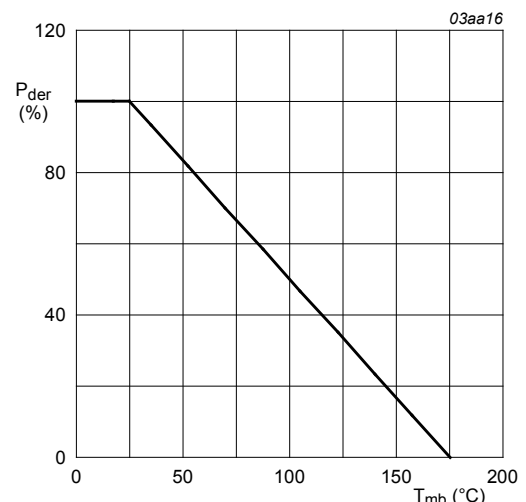
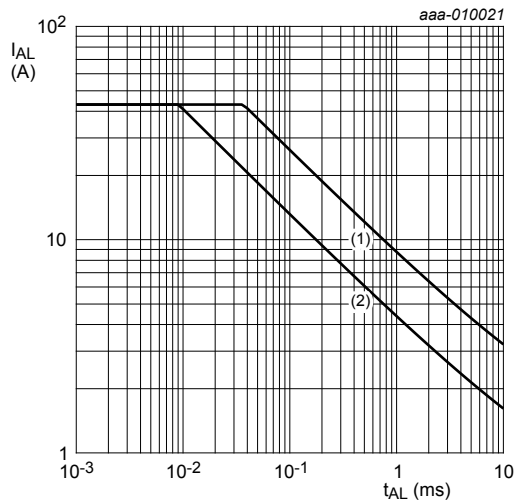


Fig. 2. Normalized total power dissipation as a function of mounting base temperature

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



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

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

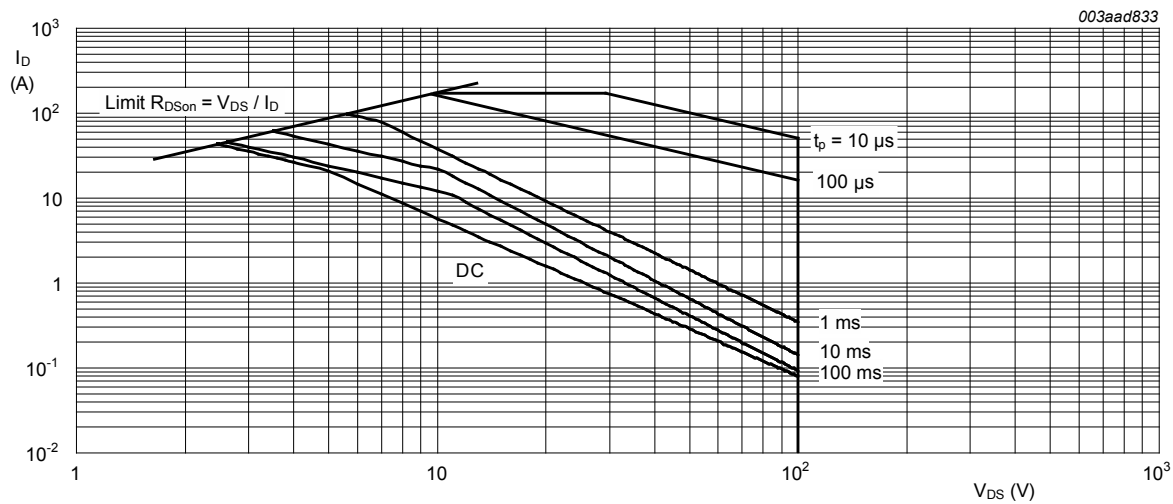


Fig. 4. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

$T_{mb} = 25\text{ °C}$; I_{DM} is 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	-	0.63	1.42	K/W

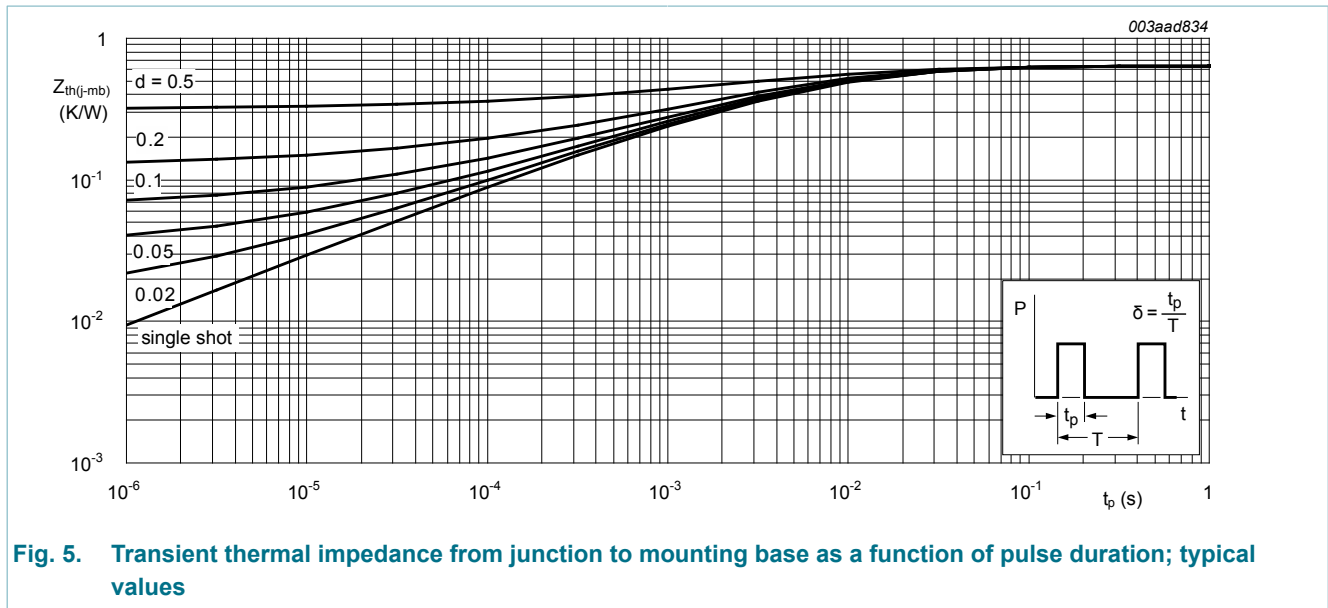


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_J = -55 \text{ }^\circ\text{C}$	90	-	-	V
		$I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_J = 25 \text{ }^\circ\text{C}$	100	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_J = 175 \text{ }^\circ\text{C};$ Fig. 11	0.95	-	-	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_J = 25 \text{ }^\circ\text{C};$ Fig. 12; Fig. 11	2	3	4	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_J = -55 \text{ }^\circ\text{C};$ Fig. 11	-	-	4.6	V
I_{DSS}	drain leakage current	$V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_J = 125 \text{ }^\circ\text{C}$	-	-	100	μA
		$V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_J = 25 \text{ }^\circ\text{C}$	-	0.06	2	μA
I_{GSS}	gate leakage current	$V_{GS} = 20 \text{ V}; V_{DS} = 0 \text{ V}; T_J = 25 \text{ }^\circ\text{C}$	-	10	100	nA
		$V_{GS} = -20 \text{ V}; V_{DS} = 0 \text{ V}; T_J = 25 \text{ }^\circ\text{C}$	-	10	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_J = 100 \text{ }^\circ\text{C};$ Fig. 13	-	-	37	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_J = 175 \text{ }^\circ\text{C};$ Fig. 13	-	39	57.4	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_J = 25 \text{ }^\circ\text{C};$ Fig. 14	-	15	20.5	mΩ
R_G	internal gate resistance (AC)	$f = 1 \text{ MHz}$	-	0.6	-	Ω

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Dynamic characteristics							
Q _{G(tot)}	total gate charge	I _D = 30 A; V _{DS} = 50 V; V _{GS} = 10 V; Fig. 15 ; Fig. 16		-	41	57.4	nC
		I _D = 0 A; V _{DS} = 0 V; V _{GS} = 10 V		-	34	47.6	nC
Q _{GS}	gate-source charge	I _D = 30 A; V _{DS} = 50 V; V _{GS} = 10 V; Fig. 15 ; Fig. 16		-	10.2	14.3	nC
Q _{GS(th)}	pre-threshold gate-source charge	I _D = 30 A; V _{DS} = 50 V; V _{GS} = 10 V; Fig. 15		-	6.9	-	nC
Q _{GS(th-pl)}	post-threshold gate-source charge			-	3.4	-	nC
Q _{GD}	gate-drain charge	I _D = 30 A; V _{DS} = 50 V; V _{GS} = 10 V; Fig. 15 ; Fig. 16		-	11.8	16.5	nC
V _{GS(pl)}	gate-source plateau voltage	V _{DS} = 50 V; Fig. 15 ; Fig. 16		-	4.4	-	V
C _{iss}	input capacitance	V _{DS} = 50 V; V _{GS} = 0 V; f = 1 MHz; T _j = 25 °C; Fig. 17		-	2210	2980	pF
C _{oss}	output capacitance			-	167	226	pF
C _{rss}	reverse transfer capacitance			-	103	144	pF
t _{d(on)}	turn-on delay time	V _{DS} = 50 V; R _L = 1.7 Ω; V _{GS} = 10 V; R _{G(ext)} = 4.7 Ω; T _j = 25 °C		-	17.4	26.1	ns
t _r	rise time			-	18.1	27.2	ns
t _{d(off)}	turn-off delay time			-	37.8	56.7	ns
t _f	fall time			-	15	22.5	ns
Source-drain diode							
V _{SD}	source-drain voltage	I _S = 15 A; V _{GS} = 0 V; T _j = 25 °C; Fig. 18		-	0.8	1.2	V
t _{rr}	reverse recovery time	I _S = 10 A; dI _S /dt = 100 A/μs; V _{GS} = 0 V; V _{DS} = 50 V		-	52	68	ns
Q _r	recovered charge			-	112	146	nC

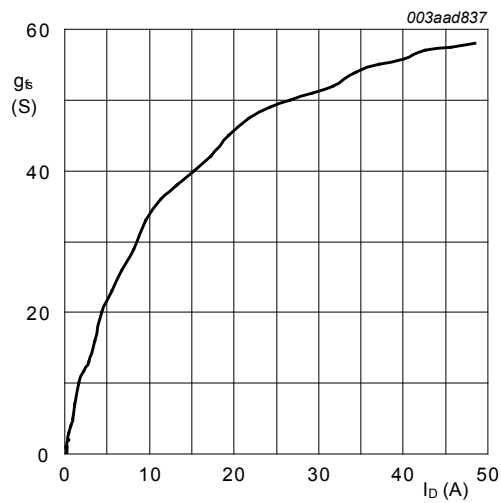


Fig. 6. Forward transconductance as a function of drain current; typical values

$T_j = 25\text{ }^{\circ}\text{C}; V_{DS} = 15\text{ V}$

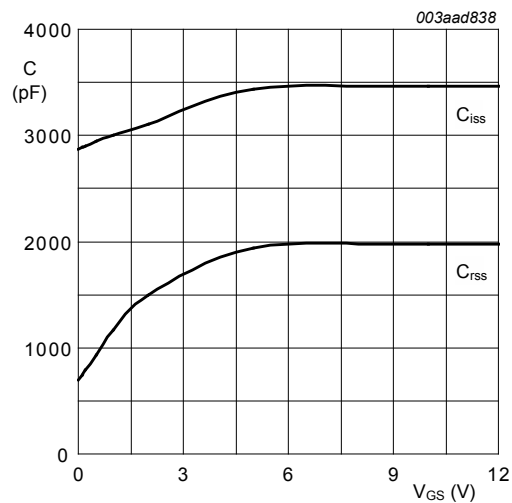


Fig. 7. Input and reverse transfer capacitances as a function of gate-source voltage; typical values

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

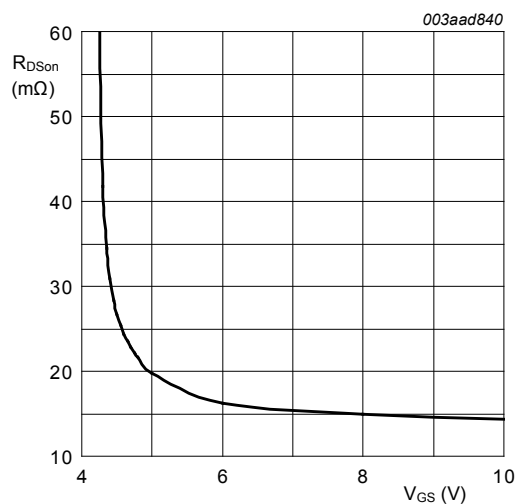


Fig. 8. Drain-source on-state resistance as a function of gate-source voltage; typical values

$T_j = 25\text{ }^{\circ}\text{C}; I_D = 10\text{ A}$

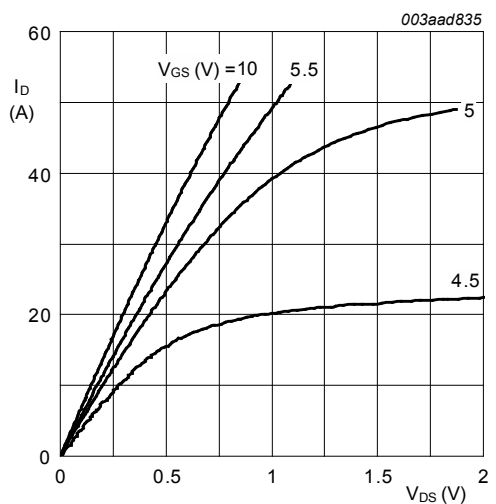


Fig. 9. Output characteristics: drain current as a function of drain-source voltage; typical values

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

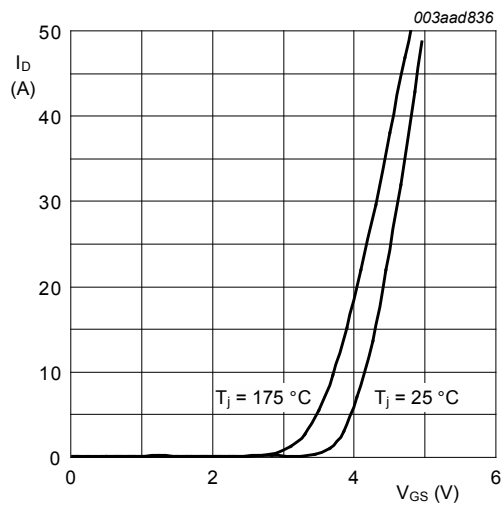


Fig. 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values

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

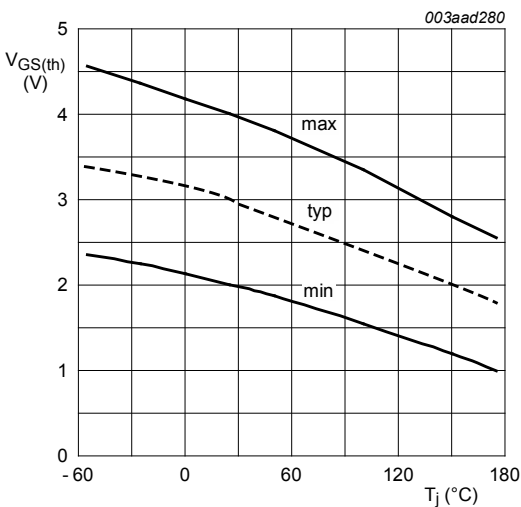


Fig. 11. Gate-source threshold voltage as a function of junction temperature

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

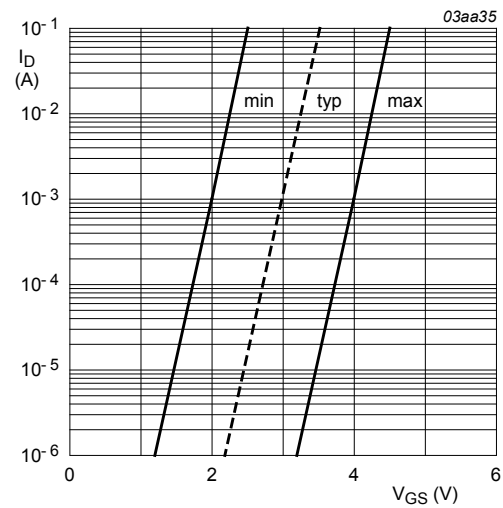


Fig. 12. Sub-threshold drain current as a function of gate-source voltage

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

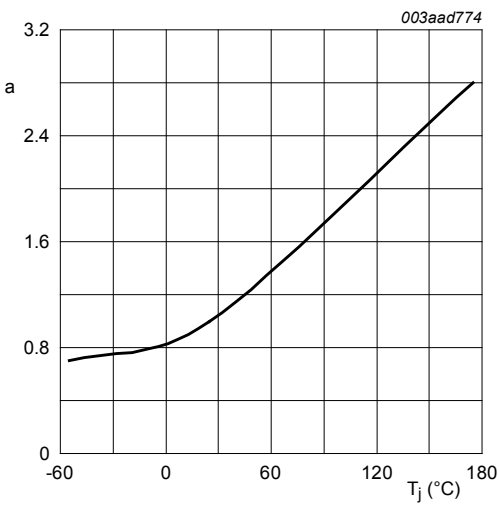


Fig. 13. Normalized drain-source on-state resistance factor as a function of junction temperature

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

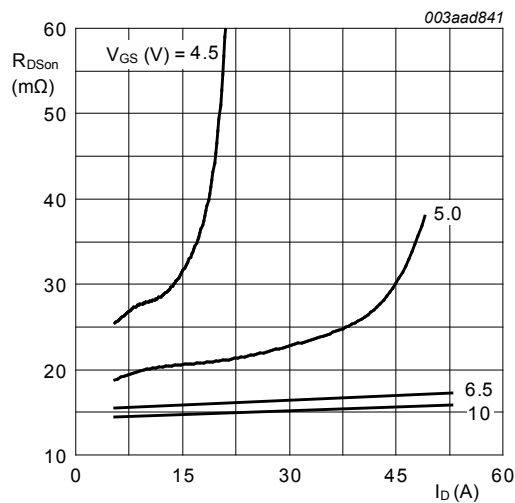


Fig. 14. Drain-source on-state resistance as a function of drain current; typical values

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

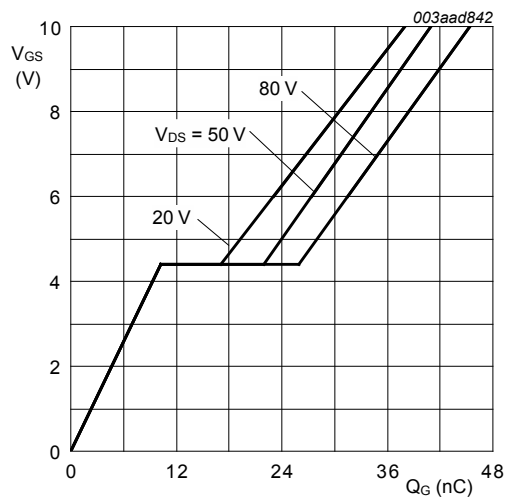


Fig. 16. Gate-source voltage as a function of gate charge; typical values

$T_j = 25\text{ }^{\circ}\text{C}; I_D = 30\text{ A}$

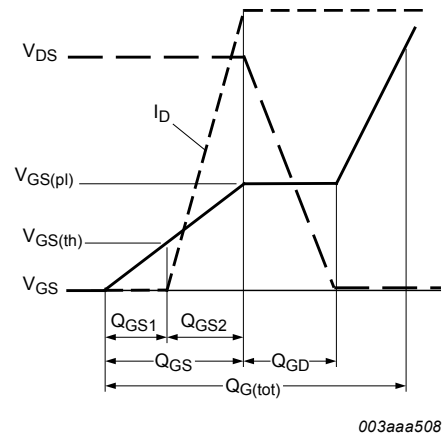


Fig. 15. Gate charge waveform definitions

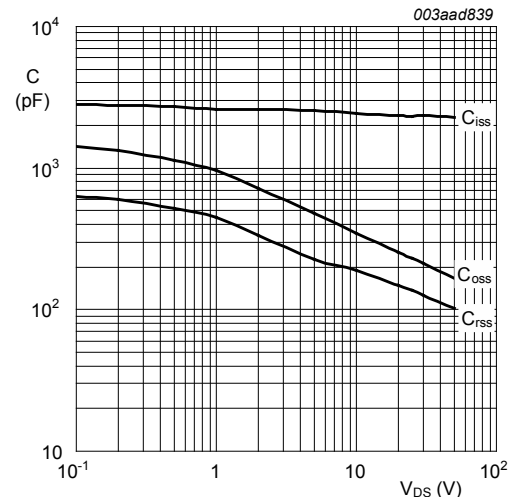


Fig. 17. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

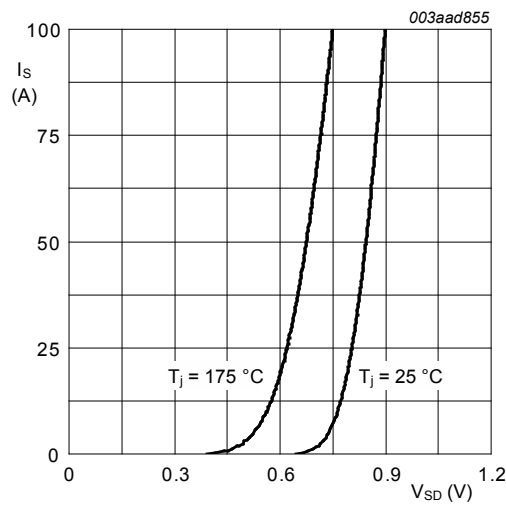


Fig. 18. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

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

11. Package outline

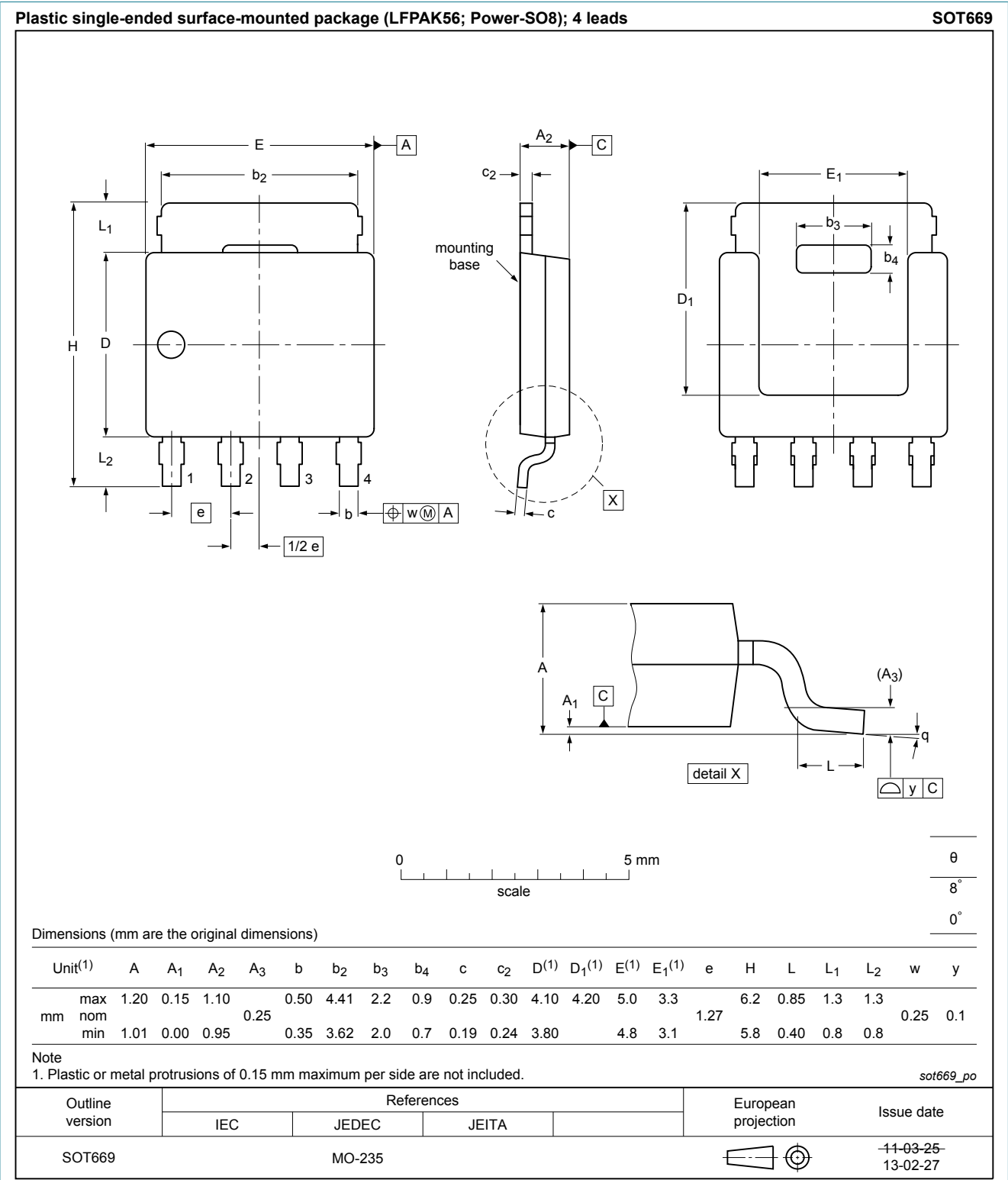


Fig. 19. Package outline LPAK56; Power-SO8 (SOT669)

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.
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