

PSMN5R8-40YS

N-channel LFPAK 40 V 5.7 m Ω standard level MOSFET

Rev. 03 — 25 October 2010

Product data sheet

1. Product profile

1.1 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 industrial, communications and domestic equipment.

1.2 Features and benefits

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

1.3 Applications

- DC-to-DC convertors
- Lithium-ion battery protection
- Load switching

- Motor control
- Server power supplies

1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
V_{DS}	drain-source voltage	T _j ≥ 25 °C; T _j ≤ 175 °C	-	-	40	V
I _D	drain current	T_{mb} = 25 °C; V_{GS} = 10 V; see <u>Figure 1</u>	-	-	90	Α
P _{tot}	total power dissipation	T _{mb} = 25 °C; see <u>Figure 2</u>	-	-	89	W
Tj	junction temperature		-55	-	175	°C
Static char	acteristics					
R _{DSon}	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 15 \text{ A};$ $T_j = 100 ^{\circ}\text{C}; \text{ see } \frac{\text{Figure } 12}{}$	-	-	7.7	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 15 \text{ A};$ $T_j = 25 \text{ °C}; \text{ see } \frac{\text{Figure } 13}{}$	-	4.4	5.7	mΩ



Table 1. Quick reference data ...continued

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
Dynamic ch	naracteristics					
Q_{GD}	gate-drain charge	$V_{GS} = 10 \text{ V}; I_D = 75 \text{ A};$	-	7.8	-	nC
Q _{G(tot)}	total gate charge	V _{DS} = 20 V; see <u>Figure 14</u> ; see <u>Figure 15</u>	-	28.8	-	nC
Avalanche ruggedness						
E _{DS(AL)S}	non-repetitive drain-source avalanche energy	V_{GS} = 10 V; $T_{j(init)}$ = 25 °C; I_D = 90 A; $V_{sup} \le$ 40 V; unclamped; R_{GS} = 50 Ω	-	-	65	mJ

2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S	source		
2	S	source	mb	D D
3	S	source		
4	G	gate		
mb	D	mounting base; connected to drain	1 2 3 4	mbb076 S
			SOT669 (LFPAK)	

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PSMN5R8-40YS	LFPAK	plastic single-ended surface-mounted package (LFPAK); 4 leads	SOT669

4. 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	-	40	V
V_{DGR}	drain-gate voltage	$T_j \ge 25$ °C; $T_j \le 175$ °C; $R_{GS} = 20$ kΩ	-	40	V
V_{GS}	gate-source voltage		-20	20	V
I _D	drain current	$V_{GS} = 10 \text{ V}; T_{mb} = 100 \text{ °C}; \text{ see } \frac{\text{Figure 1}}{\text{Model}}$	-	64	Α
		$V_{GS} = 10 \text{ V}; T_{mb} = 25 \text{ °C}; \text{ see } \frac{\text{Figure 1}}{\text{Model}}$	-	90	Α
I _{DM}	peak drain current	pulsed; $t_p \le 10 \mu s$; $T_{mb} = 25 ^{\circ}C$; see Figure 3	-	360	Α
P _{tot}	total power dissipation	T _{mb} = 25 °C; see <u>Figure 2</u>	-	89	W
T _{stg}	storage temperature		-55	175	°C
Tj	junction temperature		-55	175	°C
T _{sld(M)}	peak soldering temperature		-	260	°C
Source-drain	diode				
Is	source current	T _{mb} = 25 °C	-	90	Α
I _{SM}	peak source current	pulsed; $t_p \le 10 \ \mu s$; $T_{mb} = 25 \ ^{\circ}C$	-	360	Α
Avalanche ru	iggedness				
E _{DS(AL)S}	non-repetitive drain-source avalanche energy	V_{GS} = 10 V; $T_{j(init)}$ = 25 °C; I_D = 90 A; $V_{sup} \le$ 40 V; unclamped; R_{GS} = 50 Ω	-	65	mJ

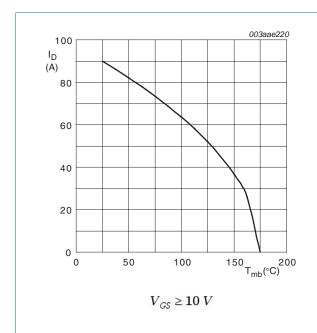


Fig 1. Continuous drain current as a function of mounting base temperature

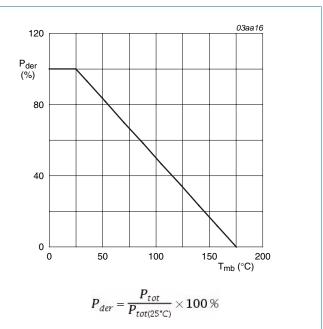
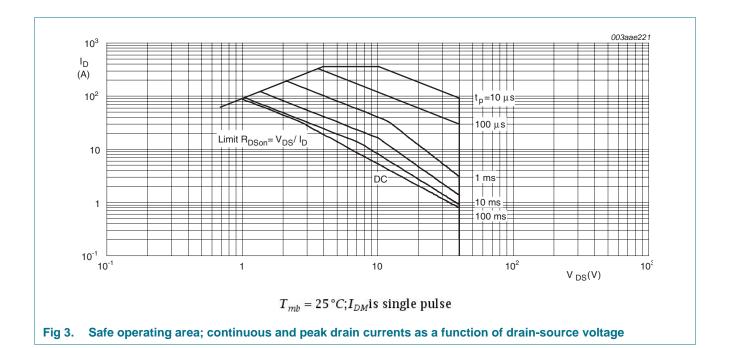


Fig 2. Normalized total power dissipation as a function of mounting base temperature

PSMN5R8-40YS

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5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see Figure 4	-	0.81	1.68	K/W

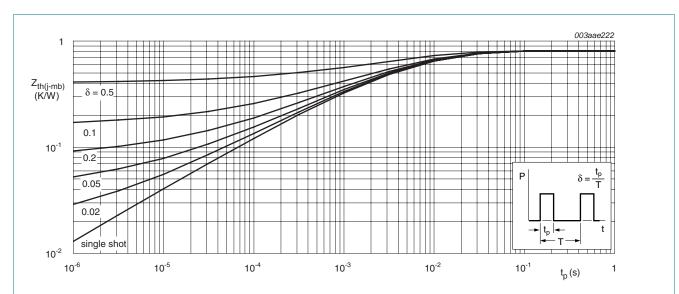


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration; typical values

6. Characteristics

Table 6. Characteristics

Table 6.	Characteristics					
Symbol	Parameter	Conditions	Min	Тур	Max	Unit
Static cha	racteristics					
$V_{(BR)DSS}$	drain-source breakdown	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55 °C$	36	-	-	V
	voltage	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 °C$	40	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}$; $V_{DS} = V_{GS}$; $T_j = -55 \text{ °C}$; see Figure 10	-	-	4.6	V
		$I_D = 1$ mA; $V_{DS} = V_{GS}$; $T_j = 175$ °C; see Figure 10	1	-	-	V
	$I_D = 1 \text{ mA}$; $V_{DS} = V_{GS}$; $T_j = 25 \text{ °C}$; see <u>Figure 11</u> ; see <u>Figure 10</u>	2	3	4	V	
I _{DSS}	drain leakage current	$V_{DS} = 40 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ °C}$	-	0.02	1	μΑ
		$V_{DS} = 40 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 125 \text{ °C}$	-	10	100	μΑ
I_{GSS}	gate leakage current	$V_{GS} = 20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ °C}$	-	10	100	nΑ
		$V_{GS} = -20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ °C}$	-	10	100	nΑ
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 100 °C;$ see Figure 12	-	-	7.7	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 175 ^{\circ}\text{C};$ see Figure 12	-	-	10.26	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 25 ^{\circ}\text{C};$ see Figure 13	-	4.4	5.7	mΩ
R_{G}	internal gate resistance (AC)	f = 1 MHz	-	0.53	-	Ω
Dynamic (characteristics					
Q _{G(tot)}	total gate charge	$I_D = 0 \text{ A}; V_{DS} = 0 \text{ V}; V_{GS} = 10 \text{ V}$	-	23.8	-	nC
		$I_D = 75 \text{ A}$; $V_{DS} = 20 \text{ V}$; $V_{GS} = 10 \text{ V}$; see Figure 14; see Figure 15	-	28.8	-	nC
Q _{GS}	gate-source charge	$I_D = 75 \text{ A}; V_{DS} = 20 \text{ V}; V_{GS} = 10 \text{ V};$	-	9.8	-	nC
Q _{GS(th)}	pre-threshold gate-source charge	see Figure 14	-	5.1	-	nC
Q _{GS(th-pl)}	post-threshold gate-source charge		-	4.7	-	nC
Q_{GD}	gate-drain charge	$I_D = 75 \text{ A}$; $V_{DS} = 20 \text{ V}$; $V_{GS} = 10 \text{ V}$; see Figure 14; see Figure 15	-	7.8	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$I_D = 75 \text{ A}$; $V_{DS} = 20 \text{ V}$; see Figure 14; see Figure 15	-	5.7	-	V
C _{iss}	input capacitance	$V_{DS} = 20 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz};$	-	1703	-	pF
C _{oss}	output capacitance	T _j = 25 °C; see <u>Figure 16</u>	-	384	-	pF
C _{rss}	reverse transfer capacitance		-	213	-	pF
t _{d(on)}	turn-on delay time	$V_{DS} = 20 \text{ V}; R_L = 0.3 \Omega; V_{GS} = 10 \text{ V};$	-	16	-	ns
t _r	rise time	$R_{G(ext)} = 4.7 \Omega$	-	12	-	ns
t _{d(off)}	turn-off delay time		-	25	-	ns
t _f	fall time		-	8	-	ns

Table 6. Characteristics ... continued

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
Source-dra	in diode					
V_{SD}	source-drain voltage	$I_S = 15 \text{ A}$; $V_{GS} = 0 \text{ V}$; $T_j = 25 \text{ °C}$; see Figure 17	-	0.82	1.2	V
t _{rr}	reverse recovery time	$I_S = 25 \text{ A}$; $dI_S/dt = -100 \text{ A/}\mu\text{s}$;	-	33	-	ns
Q _r	recovered charge	$V_{GS} = 0 \text{ V}; V_{DS} = 20 \text{ V}$	-	30	-	nC

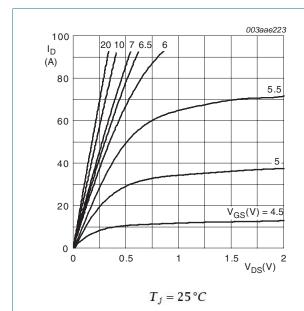


Fig 5. Output characteristics: drain current as a function of drain-source voltage; typical values

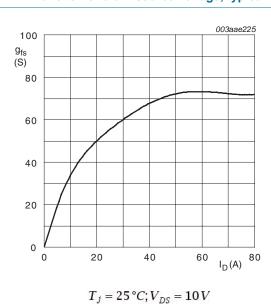


Fig 7. Forward transconductance as a function of drain current; typical values

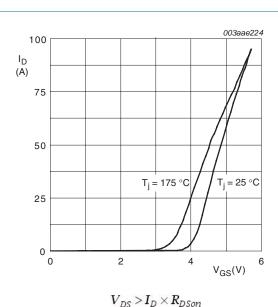
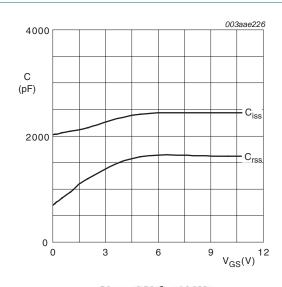


Fig 6. Transfer characteristics: drain current as a function of gate-source voltage; typical values



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

Fig 8. Input and reverse transfer capacitances as a function of gate-source voltage; typical values

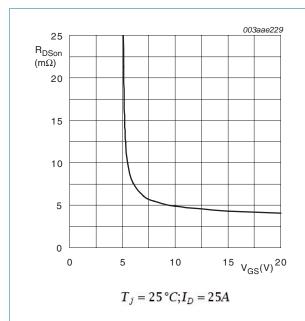


Fig 9. Drain-source on-state resistance as a function of gate-source voltage; typical values.

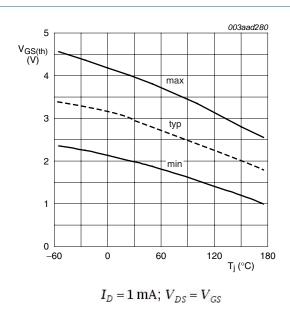


Fig 10. Gate-source threshold voltage as a function of junction temperature

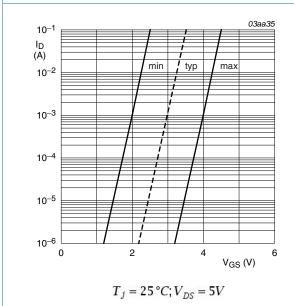


Fig 11. Sub-threshold drain current as a function of gate-source voltage

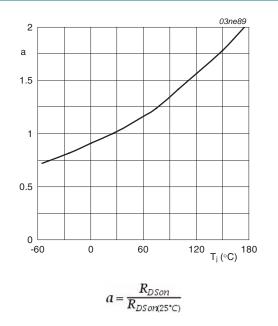
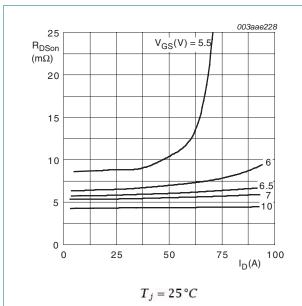


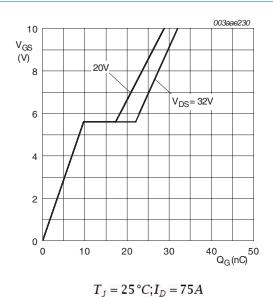
Fig 12. Normalized drain-source on-state resistance factor as a function of junction temperature



V_{GS}(pl)
V_{GS}(th)
V_{GS}
Q_{GS1} Q_{GS2}
Q_G(tot)
003aaa508

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

Fig 14. Gate charge waveform definitions



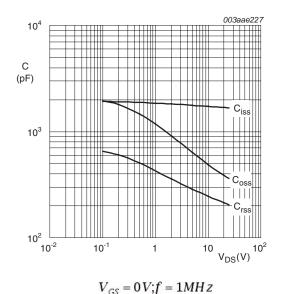


Fig 15. Gate-source voltage as a function of gate

charge; typical values



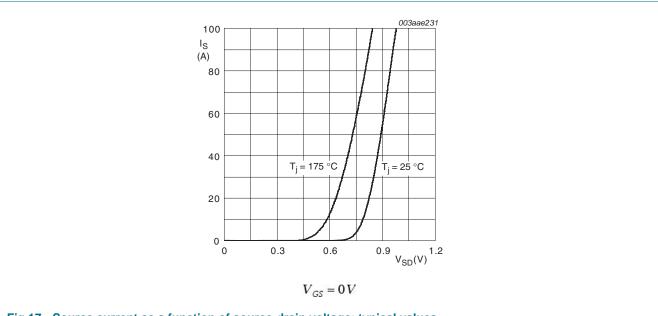


Fig 17. Source current as a function of source-drain voltage; typical values

7. Package outline

Plastic single-ended surface-mounted package (LFPAK); 4 leads

SOT669

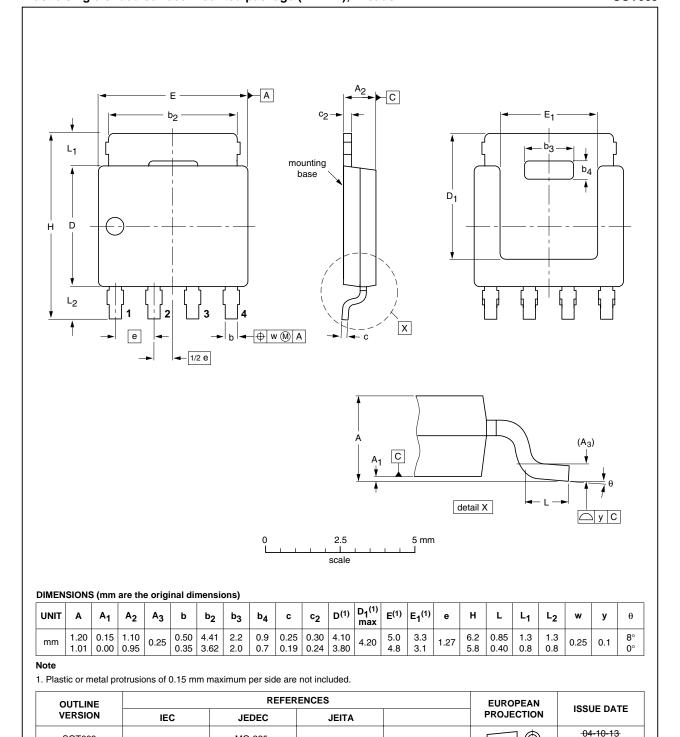


Fig 18. Package outline SOT669 (LFPAK)

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SOT669

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN5R8-40YS v.3	20101025	Product data sheet	-	PSMN5R8-40YS v.2
Modifications: • Status changed from objective to product.				
	 Various changes 	s to content.		
PSMN5R8-40YS v.2	20100526	Objective data sheet	-	PSMN5R8-40YS v.1

9. Legal information

9.1 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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