

PSMN1R7-25YLD

N-channel 25 V, 1.75 m Ω , 170 A logic level MOSFET in LFPAK56 using NextPowerS3 Technology

19 April 2016

Product data sheet

1. General description

Logic level gate drive N-channel enhancement mode MOSFET in LFPAK56 package. NextPowerS3 portfolio utilising NXP's unique "SchottkyPlus" technology delivers high efficiency, low spiking performance usually associated with MOSFETS with an integrated Schottky or Schottky-like diode but without problematic high leakage current. NextPowerS3 is particularly suited to high efficiency applications at high switching frequencies.

2. Features and benefits

- 100% Avalanche tested at I_(AS) = 100 A
- Ultra low Q_G, Q_{GD} and Q_{OSS} for high system efficiency, especially at higher switching frequencies
- Superfast switching with soft-recovery
- Low spiking and ringing for low EMI designs
- Unique "SchottkyPlus" technology; Schottky-like performance with < 1 μ A leakage at 25 °C
- Optimised for 4.5 V gate drive
- Low parasitic inductance and resistance
- High reliability clip bonded and solder die attach Power SO8 package; no glue, no wire bonds, qualified to 175 °C
- Wave solderable; exposed leads for optimal visual solder inspection

3. Applications

- On-board DC:DC solutions for server and telecommunications
- Secondary-side synchronous rectification in telecommunication applications
- Voltage regulator modules (VRM)
- Point-of-Load (POL) modules
- Power delivery for V-core, ASIC, DDR, GPU, VGA and system components
- Brushed and brushless motor control

4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Тур	Max	Unit
V_{DS}	drain-source voltage	25 °C ≤ T _j ≤ 175 °C		-	_	25	V
I _D	drain current	V _{GS} = 10 V; T _{mb} = 25 °C; <u>Fig. 2</u>	[1]	-	-	100	Α
P _{tot}	total power dissipation	T _{mb} = 25 °C; <u>Fig. 1</u>		-	-	135	W





Symbol	Parameter	Conditions	Min	Тур	Max	Unit
T _j	junction temperature		-55	-	175	°C
Static char	acteristics			'		
R _{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_{D} = 25 A; T_{j} = 25 °C; Fig. 10	-	1.53	1.75	mΩ
		V_{GS} = 4.5 V; I_{D} = 25 A; T_{j} = 25 °C; Fig. 10	-	2.03	2.42	mΩ
Dynamic cl	haracteristics		,			,
Q _{G(tot)}	total gate charge	I _D = 25 A; V _{DS} = 12 V; V _{GS} = 10 V; Fig. 12; Fig. 13	-	46.7	-	nC
			I _D = 25 A; V _{DS} = 12 V; V _{GS} = 4.5 V; Fig. 12; Fig. 13	-	21.5	-
		I _D = 0 A; V _{DS} = 0 V; V _{GS} = 10 V	-	24.6	-	nC
Q_{GD}	gate-drain charge	I _D = 25 A; V _{DS} = 12 V; V _{GS} = 4.5 V; Fig. 12; Fig. 13	-	5.1	-	nC
Source-dra	in diode			'	-	
S	softness factor	I_S = 25 A; dI_S/dt = -100 A/ μ s; V_{GS} = 0 V; V_{DS} = 12 V; Fig. 16	-	0.9	-	

^[1] Continuous current is limited by package.

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S	source	mb	D I
2	S	source		
3	S	source	[d	G T T
4	G	gate	و و و و	mbb076 S
mb	D	mounting base; connected to drain	1 2 3 4 LFPAK56; Power- SO8 (SOT669)	

6. Ordering information

Table 3. Ordering information

Type number	Package				
	Name	Description	Version		
PSMN1R7-25YLD	LFPAK56; Power-SO8	Plastic single-ended surface-mounted package (LFPAK56; Power-SO8); 4 leads	SOT669		

PSMN1R7-25YLD

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7. Marking

Table 4. Marking codes

Type number	Marking code
PSMN1R7-25YLD	1D725L

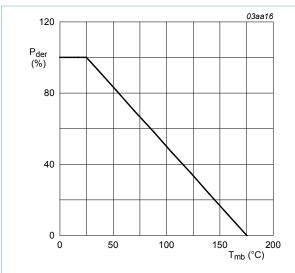
Limiting values

Table 5. **Limiting values**

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

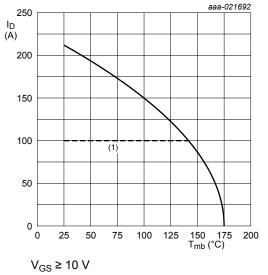
Symbol	Parameter	Conditions		Min	Max	Unit
V _{DS}	drain-source voltage	25 °C ≤ T _j ≤ 175 °C		-	25	V
V_{DGR}	drain-gate voltage	25 °C ≤ T_j ≤ 175 °C; R_{GS} = 20 kΩ		-	25	V
V_{GS}	gate-source voltage			-20	20	V
P _{tot}	total power dissipation	T _{mb} = 25 °C; <u>Fig. 1</u>		-	135	W
I _D	drain current	V _{GS} = 10 V; T _{mb} = 25 °C; <u>Fig. 2</u>	[1]	-	100	Α
		V _{GS} = 10 V; T _{mb} = 100 °C; <u>Fig. 2</u>	[1]	-	100	Α
I _{DM}	peak drain current	pulsed; $t_p \le 10 \mu s$; $T_{mb} = 25 °C$; Fig. 3		-	860	Α
T _{stg}	storage temperature			-55	175	°C
Tj	junction temperature			-55	175	°C
$T_{sld(M)}$	peak soldering temperature			-	260	°C
V _{ESD}	electrostatic discharge voltage	НВМ		1400	-	V
Source-dra	nin diode					,
I _S	source current	T _{mb} = 25 °C	[1]	-	100	Α
I _{SM}	peak source current	pulsed; $t_p \le 10 \ \mu s$; $T_{mb} = 25 \ ^{\circ}C$		-	860	Α
Avalanche	ruggedness					
E _{DS(AL)S}	non-repetitive drain-source avalanche energy	I_D = 25 A; $V_{sup} \le$ 25 V; R_{GS} = 50 Ω; V_{GS} = 10 V; $T_{j(init)}$ = 25 °C; unclamped; t_p = 1.84 ms	[2]	-	746	mJ

^[1] Continuous current is limited by package.[2] Protected by 100% test



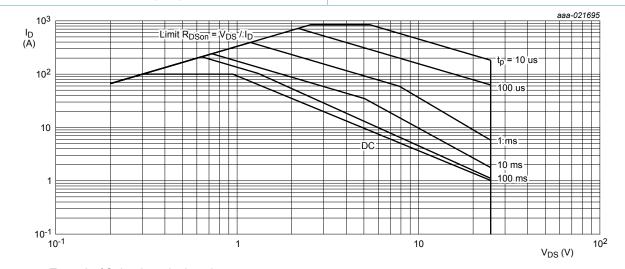
Normalized total power dissipation as a function of mounting base temperature

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



(1) Capped at 100A due to package

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



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

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

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
R _{th(j-mb)}	thermal resistance from junction to mounting base	Fig. 4	-	0.95	1.11	K/W
R _{th(j-a)}	thermal resistance from junction to ambient	Fig. 5 Fig. 6	-	50 125	-	K/W K/W

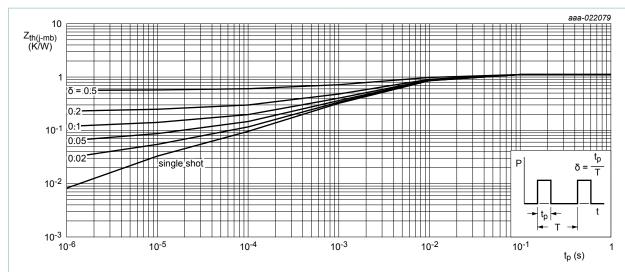


Fig. 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

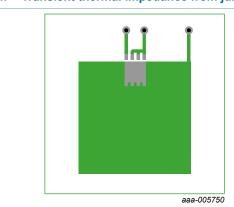


Fig. 5. PCB layout for thermal impedance junction to ambient 1" square pad; FR4 Board; 2oz copper

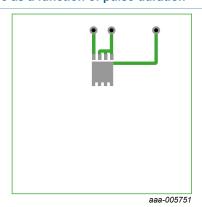


Fig. 6. PCB layout for thermal resistance junction to ambient minimum footprint; FR4 Board; 2oz copper

10. Characteristics

Table 7 Characteristics

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
Static char	acteristics					
V _{(BR)DSS}	drain-source	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 ^{\circ}C$	25	-	-	V
	breakdown voltage	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55 °C$	22.5	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ °C}$	1.2	1.8	2.2	V
$\Delta V_{GS(th)}/\Delta T$	gate-source threshold voltage variation with temperature	25 °C ≤ T _j ≤ 175 °C	-	-4.9	-	mV/K
I _{DSS}	drain leakage current	V _{DS} = 20 V; V _{GS} = 0 V; T _j = 25 °C	-	-	1	μA
		V _{DS} = 20 V; V _{GS} = 0 V; T _j = 125 °C	-	3.9	-	μΑ
I _{GSS}	gate leakage current	V _{GS} = 20 V; V _{DS} = 0 V; T _j = 25 °C	-	-	100	nA
		V _{GS} = -20 V; V _{DS} = 0 V; T _j = 25 °C	-	-	100	nA
R _{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 25 A; T_j = 25 °C; Fig. 10	-	1.53	1.75	mΩ
		V _{GS} = 10 V; I _D = 25 A; T _j = 175 °C; Fig. 10; Fig. 11	-	-	2.98	mΩ
		V _{GS} = 4.5 V; I _D = 25 A; T _j = 25 °C; Fig. 10	-	2.03	2.42	mΩ
		V _{GS} = 4.5 V; I _D = 25 A; T _j = 175 °C; Fig. 10; Fig. 11	-	-	4.11	mΩ
R _G	gate resistance	f = 1 MHz	-	0.9	-	Ω
Dynamic cl	haracteristics					
Q _{G(tot)}	total gate charge	I _D = 25 A; V _{DS} = 12 V; V _{GS} = 10 V; Fig. 12; Fig. 13	-	46.7	-	nC
		I _D = 25 A; V _{DS} = 12 V; V _{GS} = 4.5 V; Fig. 12; Fig. 13	-	21.5	-	nC
		I _D = 0 A; V _{DS} = 0 V; V _{GS} = 10 V	-	24.6	-	nC
Q_{GS}	gate-source charge	I _D = 25 A; V _{DS} = 12 V; V _{GS} = 4.5 V;	-	8.8	-	nC
Q _{GS(th)}	pre-threshold gate- source charge	Fig. 12; Fig. 13	-	5.1	-	nC
Q _{GS(th-pl)}	post-threshold gate- source charge		-	3.7	-	nC
Q_{GD}	gate-drain charge		-	5.1	-	nC
V _{GS(pl)}	gate-source plateau voltage	I _D = 25 A; V _{DS} = 12 V; <u>Fig. 12</u> ; <u>Fig. 13</u>	-	2.9	-	V

Symbol	Parameter	Conditions		Min	Тур	Max	Unit
C _{iss}	input capacitance	V _{DS} = 12 V; V _{GS} = 0 V; f = 1 MHz;		-	3415	-	pF
C _{oss}	output capacitance	T _j = 25 °C; <u>Fig. 14</u>		-	1404	-	pF
C _{rss}	reverse transfer capacitance			-	208	-	pF
t _{d(on)}	turn-on delay time	V_{DS} = 12 V; R_L = 0.6 Ω ; V_{GS} = 4.5 V;		-	21.4	-	ns
t _r	rise time	$R_{G(ext)} = 5 \Omega$		-	25.4	-	ns
$t_{d(off)}$	turn-off delay time			-	21.6	-	ns
t _f	fall time			-	14.3	-	ns
Q _{oss}	output charge	$V_{GS} = 0 \text{ V}; V_{DS} = 12 \text{ V}; f = 1 \text{ MHz};$ $T_j = 25 \text{ °C}$		-	25.4	-	nC
Source-dra	ain diode						
V _{SD}	source-drain voltage	I _S = 25 A; V _{GS} = 0 V; T _j = 25 °C; <u>Fig. 15</u>		-	0.81	1.2	V
t _{rr}	reverse recovery time	$I_S = 25 \text{ A}; dI_S/dt = -100 \text{ A/}\mu\text{s}; V_{GS} = 0 \text{ V};$		-	31.1	-	ns
Q _r	recovered charge	V _{DS} = 12 V; <u>Fig. 16</u>	[1]	-	25.1	-	nC
t _a	reverse recovery rise time			-	16.5	-	ns
t _b	reverse recovery fall time			-	14.6	-	ns
S	softness factor			-	0.9	-	

[1] includes capacitive recovery

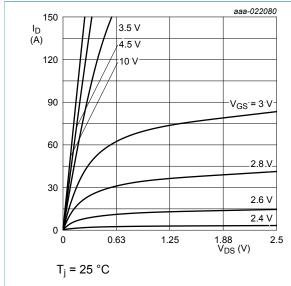


Fig. 7. Output characteristics; drain current as a function of drain-source voltage; typical values

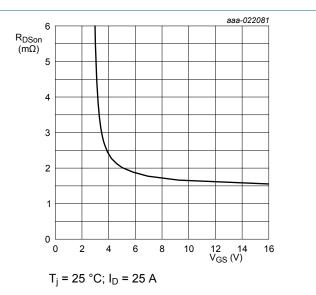


Fig. 8. Drain-source on-state resistance as a function of gate-source voltage; typical values

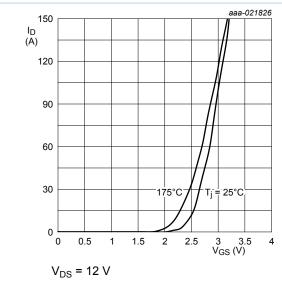


Fig. 9. Transfer characteristics; drain current as a function of gate-source voltage; typical values

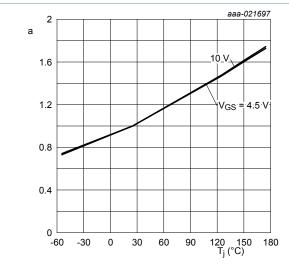


Fig. 11. Normalized drain-source on-state resistance factor as a function of junction temperature

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

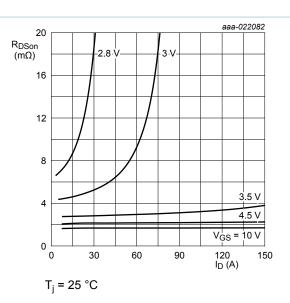


Fig. 10. Drain-source on-state resistance as a function of drain current; typical values

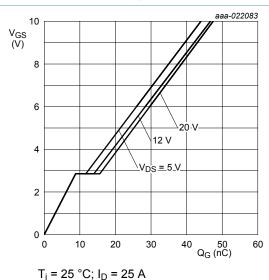


Fig. 12. Gate-source voltage as a function of gate charge; typical values

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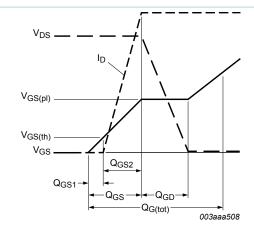
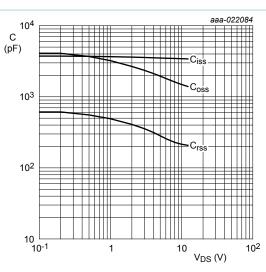


Fig. 13. Gate charge waveform definitions



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

Fig. 14. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

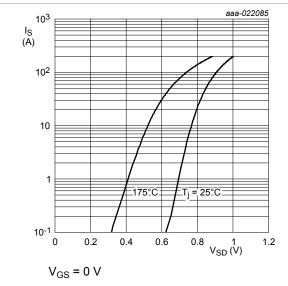


Fig. 15. Source-drain (diode forward) current as a function of source-drain (diode forward) voltage; typical values

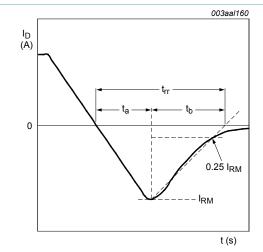
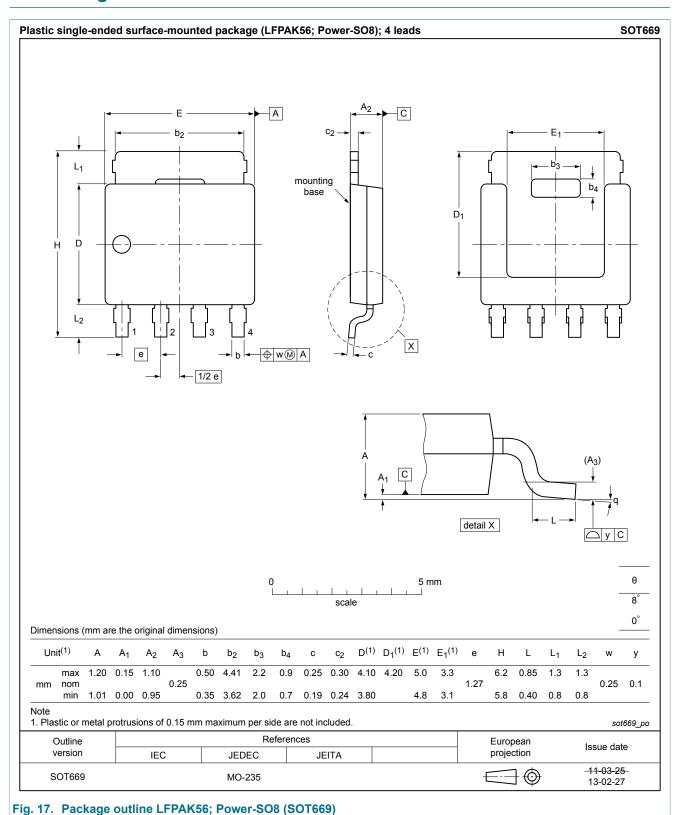


Fig. 16. Reverse recovery timing definition

11. Package outline



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