

PSMN6R0-25YLD

N-channel 25 V, 6.75 m Ω logic level MOSFET in LFPAK56 using NextPowerS3 Technology

6 April 2016

Product data sheet

1. General description

Logic level gate drive N-channel enhancement mode MOSFET in LFPAK56 package. NextPowerS3 portfolio utilising Nexperia'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

- Ultra low Q_G, Q_{GD} and Q_{OSS} for high system efficiency, especially at higher switching frequencies
- Superfast switching with soft-recovery; s-factor > 1
- Low spiking and ringing for low EMI designs
- Unique "SchottkyPlus" technology; Schottky-like performance with < 1 μA 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, gualified 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>	-	-	61	Α
P _{tot}	total power dissipation	T _{mb} = 25 °C; <u>Fig. 1</u>	-	-	43	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	$V_{GS} = 4.5 \text{ V}; I_D = 10 \text{ A}; T_j = 25 ^{\circ}\text{C};$ Fig. 10	-	8.29	10.19	mΩ	
		V _{GS} = 10 V; I _D = 15 A; T _j = 25 °C; Fig. 10	-	5.84	6.75	mΩ
Dynamic cl	haracteristics					,
Q _{G(tot)} total gate charge	total gate charge	I _D = 15 A; V _{DS} = 12 V; V _{GS} = 10 V; Fig. 12; Fig. 13	-	10.5	-	nC
		I _D = 15 A; V _{DS} = 12 V; V _{GS} = 4.5 V; Fig. 12; Fig. 13	-	4.9	-	nC
		I _D = 0 A; V _{DS} = 0 V; V _{GS} = 10 V	-	5.6	-	nC
Q_{GD}	gate-drain charge	I _D = 15 A; V _{DS} = 12 V; V _{GS} = 4.5 V; Fig. 12; Fig. 13	-	1.1	-	nC
Source-dra	in diode				-	1
S	softness factor	I_S = 15 A; dI_S/dt = -100 A/ μ s; V_{GS} = 0 V; V_{DS} = 12 V; Fig. 16	-	1.1	-	

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 A
4	G	gate	<u> </u>	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	kage				
	Name	Description	Version			
PSMN6R0-25YLD	LFPAK56; Power-SO8	Plastic single-ended surface-mounted package (LFPAK56; Power-SO8); 4 leads	SOT669			

7. Marking

Table 4. Marking codes

Type number	Marking code
PSMN6R0-25YLD	6D025L

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	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>		-	43	W
I _D	drain current	V _{GS} = 10 V; T _{mb} = 25 °C; <u>Fig. 2</u>		-	61	Α
		V _{GS} = 10 V; T _{mb} = 100 °C; <u>Fig. 2</u>		-	43	Α
I _{DM}	peak drain current	pulsed; $t_p \le 10 \mu s$; $T_{mb} = 25 \text{ °C}$; Fig. 3		-	244	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		300	-	V
Source-dra	in diode					
I _S	source current	T _{mb} = 25 °C		-	36	Α
I _{SM}	peak source current	pulsed; $t_p \le 10 \ \mu s$; $T_{mb} = 25 \ ^{\circ}C$		-	244	Α
Avalanche	ruggedness					
E _{DS(AL)S}	non-repetitive drain-source avalanche energy	I_D = 15 A; $V_{sup} \le$ 25 V; R_{GS} = 50 Ω; V_{GS} = 10 V; $T_{j(init)}$ = 25 °C; unclamped; t_p = 209 μs	[1]	-	50.9	mJ
		1				

^[1] Protected by 100% test

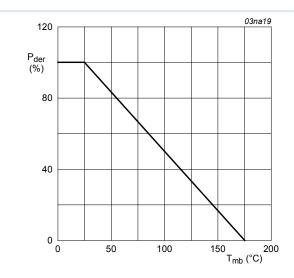


Fig. 1. Normalized total power dissipation as a function of mounting base temperature

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

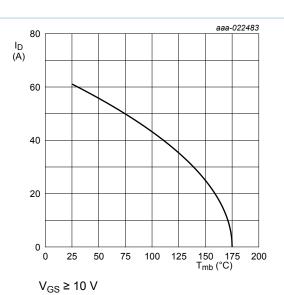
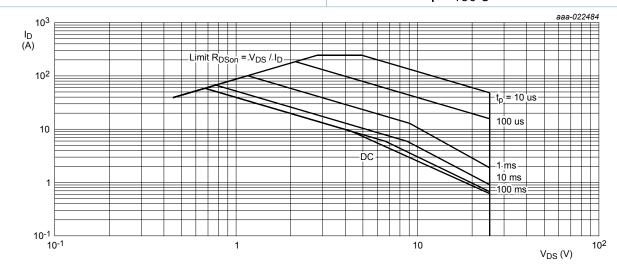


Fig. 2. Continuous drain current as a function of mounting base temperature

$$I_D = 61A \times \sqrt{\frac{175^{\circ}C - T_{mb}}{150^{\circ}C}}$$
 for $T_{mb} \ge 25^{\circ}C$



 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	-	3.1	3.5	K/W

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Symbol	Parameter	Conditions	Min	Тур	Max	Unit
R _{th(j-a)}	thermal resistance	<u>Fig. 5</u>	-	50	-	K/W
	from junction to ambient	Fig. 6	-	125	-	K/W

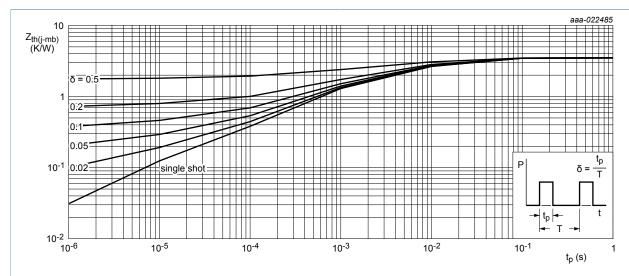


Fig. 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

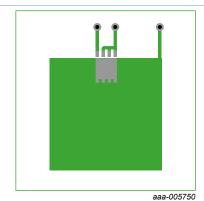


Fig. 5. PCB layout for thermal impedance junction to ambient 1" square pad; FR4 Board; 2oz copper

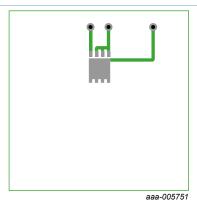


Fig. 6. PCB layout for thermal resistance junction to ambient minimum footprint; FR4 Board; 2oz copper

10. Characteristics

Table 7. Characteristics

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Symbol	Parameter	Conditions		Min	Тур	Max	Unit
Static characteristics							
V _{(BR)DSS}	• •	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 °C$		25	-	-	V
	breakdown voltage	I_D = 250 μ 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	1.76	2.2	V

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Symbol	Parameter	Conditions	Min	Тур	Max	Unit
$\Delta V_{GS(th)}/\Delta T$	gate-source threshold voltage variation with temperature	25 °C ≤ T _j ≤ 175 °C	-	-4.2	-	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	-	0.89	-	μA
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} = 4.5 V; I_{D} = 10 A; T_{j} = 25 °C; Fig. 10	-	8.29	10.19	mΩ
		V _{GS} = 4.5 V; I _D = 10 A; T _j = 175 °C; Fig. 10; Fig. 11	-	-	17.32	mΩ
		V _{GS} = 10 V; I _D = 15 A; T _j = 25 °C; <u>Fig. 10</u>	-	5.84	6.75	mΩ
		V _{GS} = 10 V; I _D = 15 A; T _j = 175 °C; Fig. 10; Fig. 11	-	-	11.48	mΩ
R _G	gate resistance	f = 1 MHz	-	0.68	-	Ω
Dynamic ch	aracteristics					,
Q _{G(tot)} total gate charge	total gate charge	I _D = 15 A; V _{DS} = 12 V; V _{GS} = 10 V; Fig. 12; Fig. 13	-	10.5	-	nC
		I _D = 15 A; V _{DS} = 12 V; V _{GS} = 4.5 V; Fig. 12; Fig. 13	-	4.9	-	nC
		I _D = 0 A; V _{DS} = 0 V; V _{GS} = 10 V	-	5.6	-	nC
Q _{GS}	gate-source charge	I _D = 15 A; V _{DS} = 12 V; V _{GS} = 4.5 V;	-	2.3	-	nC
Q _{GS(th)}	pre-threshold gate- source charge	Fig. 12; Fig. 13	-	1.2	-	nC
Q _{GS(th-pl)}	post-threshold gate- source charge		-	1.1	-	nC
Q_{GD}	gate-drain charge		-	1.1	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	I _D = 15 A; V _{DS} = 12 V; <u>Fig. 12</u> ; <u>Fig. 13</u>	-	3	-	V
C _{iss}	input capacitance	V _{DS} = 12 V; V _{GS} = 0 V; f = 1 MHz;	-	705	-	pF
C _{oss}	output capacitance	T _j = 25 °C; <u>Fig. 14</u>	-	598	-	pF
C _{rss}	reverse transfer capacitance		-	46	-	pF
t _{d(on)}	turn-on delay time	V_{DS} = 12 V; R_L = 1 Ω ; V_{GS} = 4.5 V;	-	7.6	-	ns
t _r	rise time	$R_{G(ext)} = 5 \Omega$	-	7.4	-	ns
t _{d(off)}	turn-off delay time	-	-	7.6	-	ns
t _f	fall time		-	4.5	-	ns

Symbol	Parameter	Conditions		Min	Тур	Max	Unit
Q _{oss}	output charge	$V_{GS} = 0 \text{ V}; V_{DS} = 12 \text{ V}; f = 1 \text{ MHz};$ $T_j = 25 \text{ °C}$		-	9.3	-	nC
Source-dra	ain diode						
V_{SD}	source-drain voltage	$I_S = 15 \text{ A}; V_{GS} = 0 \text{ V}; T_j = 25 ^{\circ}\text{C}; Fig. 15$		-	0.82	1.2	V
t _{rr}	reverse recovery time	$I_S = 15 \text{ A}; dI_S/dt = -100 \text{ A/}\mu\text{s}; V_{GS} = 0 \text{ V};$		-	20.2	-	ns
Q _r	recovered charge	V _{DS} = 12 V; <u>Fig. 16</u>	[1]	-	10	-	nC
t _a	reverse recovery rise time			-	9.4	-	ns
t _b	reverse recovery fall time	Ĭ		-	10.8	-	ns
S	softness factor			-	1.1	-	

[1] includes capacitive recovery

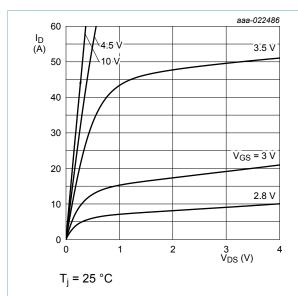


Fig. 7. Output characteristics; drain current as a function of drain-source voltage; typical values

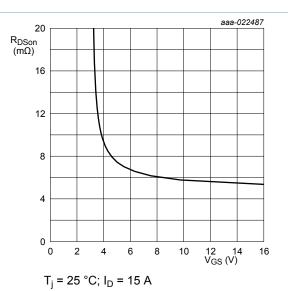


Fig. 8. Drain-source on-state resistance as a function of gate-source voltage; typical values

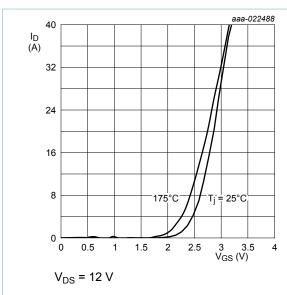


Fig. 9. Transfer characteristics; drain current as a function of gate-source voltage; typical values

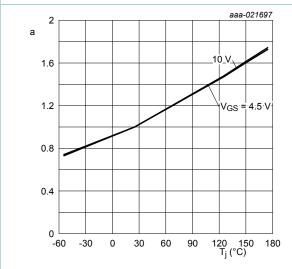


Fig. 11. Normalized drain-source on-state resistance factor as a function of junction temperature

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

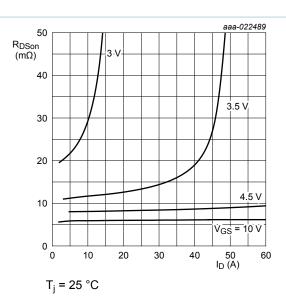


Fig. 10. Drain-source on-state resistance as a function of drain current; typical values

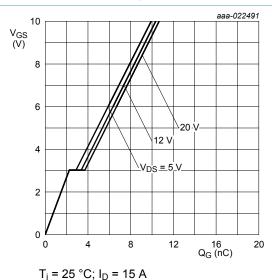


Fig. 12. Gate-source voltage as a function of gate charge; typical values

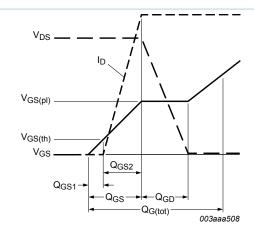
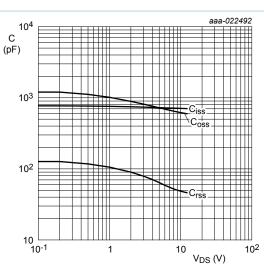


Fig. 13. Gate charge waveform definitions



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

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

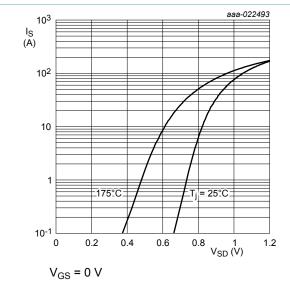


Fig. 15. Source-drain (diode forward) current as a function of source-drain (diode forward) voltage; typical values

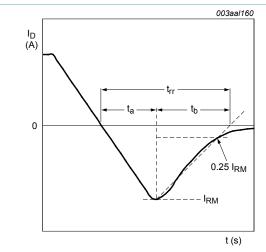
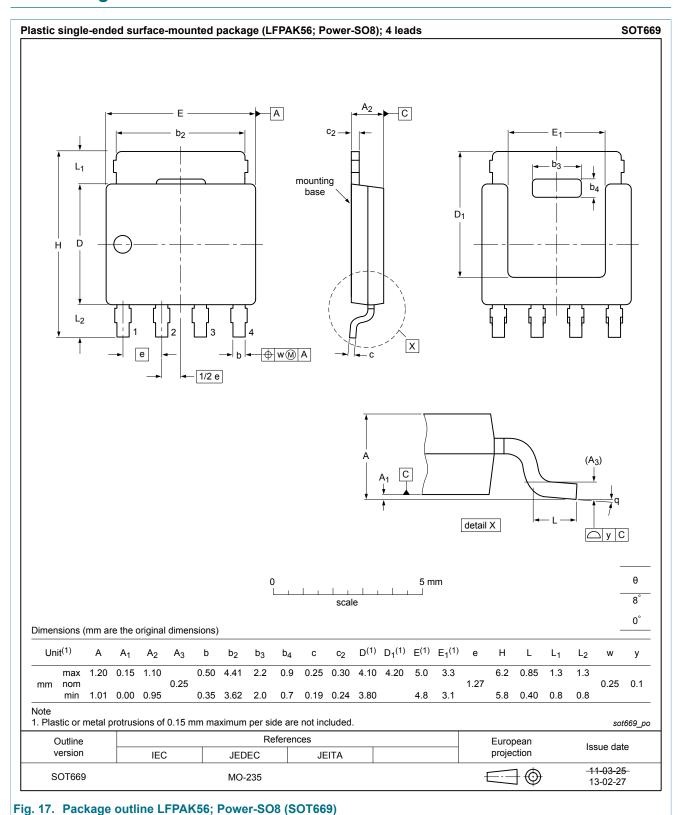


Fig. 16. Reverse recovery timing definition

11. Package outline



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