



PSMN3R9-25MLC

N-channel 25 V 4.15 mΩ logic level MOSFET in LPAK33 using NextPower Technology

Rev. 4 — 15 June 2012

Product data sheet

1. Product profile

1.1 General description

Logic level enhancement mode N-channel MOSFET in LPAK33 package. This product is designed and qualified for use in a wide range of industrial, communications and domestic equipment.

1.2 Features and benefits

- Low parasitic inductance and resistance
- Optimised for 4.5V Gate drive utilising NextPower Superjunction technology
- Ultra low QG, QGD, & QOSS for high system efficiencies at low and high loads

1.3 Applications

- DC-to-DC converters
- Load switching
- Synchronous buck regulator

1.4 Quick reference data

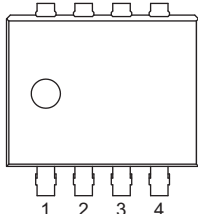
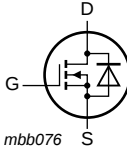
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V _{DS}	drain-source voltage	T _j = 25°C	-	-	25	V
I _D	drain current	T _{mb} = 25 °C; V _{GS} = 10 V; see Figure 1	[1]	-	70	A
P _{tot}	total power dissipation	T _{mb} = 25 °C; see Figure 2	-	-	69	W
T _j	junction temperature		-55	-	175	°C
Static characteristics						
R _{DSon}	drain-source on-state resistance	V _{GS} = 4.5 V; I _D = 25 A; T _j = 25 °C; see Figure 10	-	4.85	5.55	mΩ
		V _{GS} = 10 V; I _D = 25 A; T _j = 25 °C; see Figure 10	-	3.65	4.15	mΩ
Dynamic characteristics						
Q _{GD}	gate-drain charge	V _{GS} = 4.5 V; I _D = 25 A; V _{DS} = 12.5 V; see Figure 12 ; see Figure 13	-	2.3	-	nC
Q _{G(tot)}	total gate charge	V _{GS} = 4.5 V; I _D = 25 A; V _{DS} = 12.5 V; see Figure 12 ; see Figure 13	-	9.7	-	nC

[1] Continuous current is limited by package.

2. Pinning information

Table 2. Pinning information

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

SOT1210 (LPAK33)

3. Ordering information

Table 3. Ordering information

Type number	Package		Version
	Name	Description	
PSMN3R9-25MLC	LPAK33	Plastic single ended surface mounted package (LPAK33); 4 leads	SOT1210

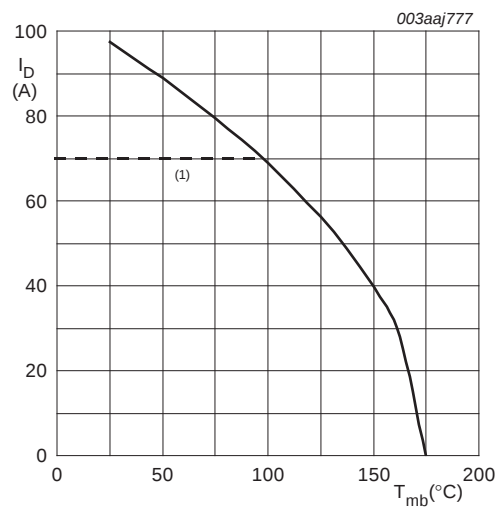
4. Limiting values

Table 4. Limiting values

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

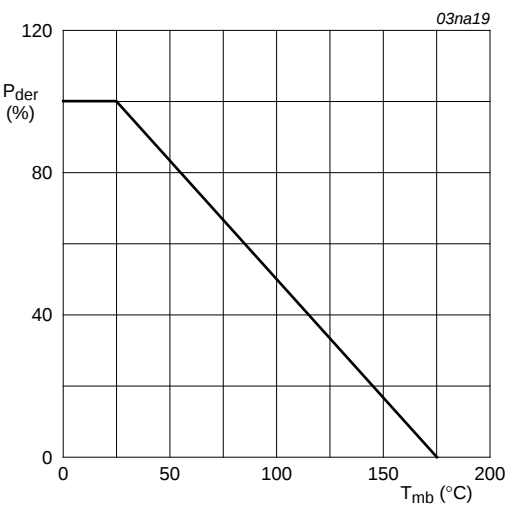
Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage	$T_j = 25^\circ\text{C}$	-	25	V
V_{GS}	gate-source voltage		-20	20	V
I_D	drain current	$V_{GS} = 10\text{ V}$; $T_{mb} = 25^\circ\text{C}$; see Figure 1	[1]	70	A
		$V_{GS} = 10\text{ V}$; $T_{mb} = 100^\circ\text{C}$; see Figure 1	-	69	A
I_{DM}	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25^\circ\text{C}$; see Figure 4	-	390	A
P_{tot}	total power dissipation	$T_{mb} = 25^\circ\text{C}$; see Figure 2	-	69	W
T_{stg}	storage temperature		-55	175	$^\circ\text{C}$
T_j	junction temperature		-55	175	$^\circ\text{C}$
$T_{sld(M)}$	peak soldering temperature		-	260	$^\circ\text{C}$
V_{ESD}	electrostatic discharge voltage	MM (JEDEC JESD22-A115)	230	-	V
Source-drain diode					
I_S	source current	$T_{mb} = 25^\circ\text{C}$	-	63	A
I_{SM}	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25^\circ\text{C}$	-	390	A
Avalanche ruggedness					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25^\circ\text{C}$; $I_D = 70\text{ A}$; $V_{sup} \leq 25\text{ V}$; $R_{GS} = 50\text{ }\Omega$; unclamped; see Figure 3	-	34.5	mJ

[1] Continuous current is limited by package.



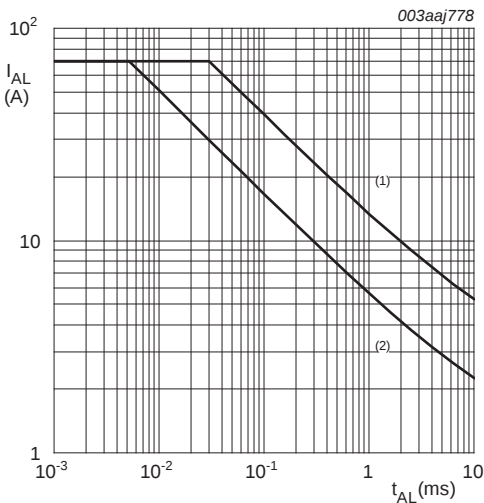
$V_{GS} \geq 10V$
(1) Capped at 70 A due to package.

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



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

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



(1) $T_j (amb) = 25^{\circ}C$; (2) $T_j (amb) = 100^{\circ}C$

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

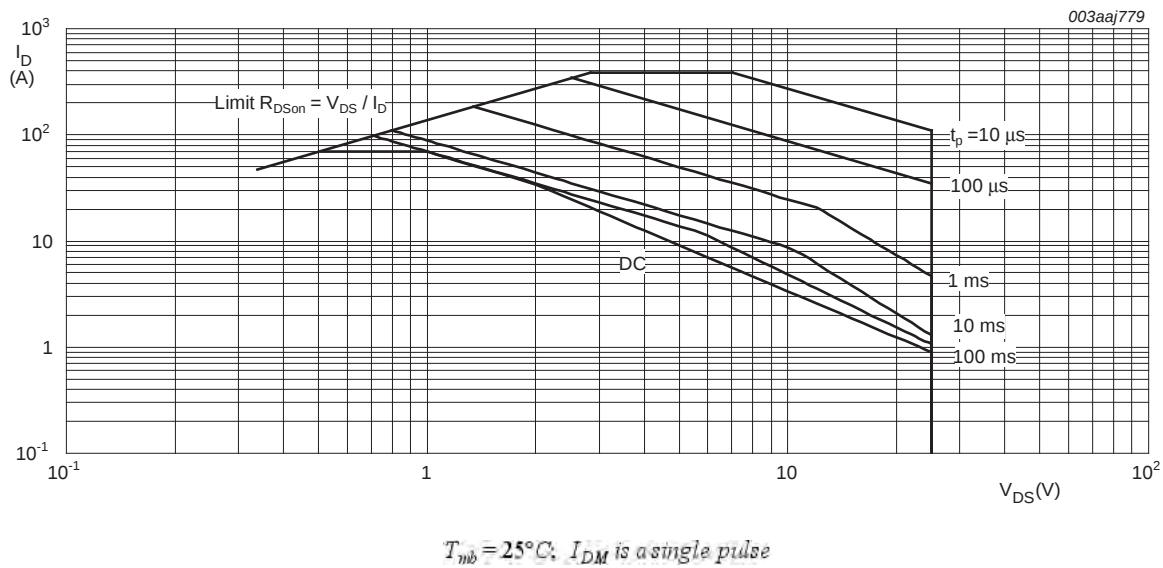


Fig 4. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see Figure 5	-	1.95	2.18	K/W

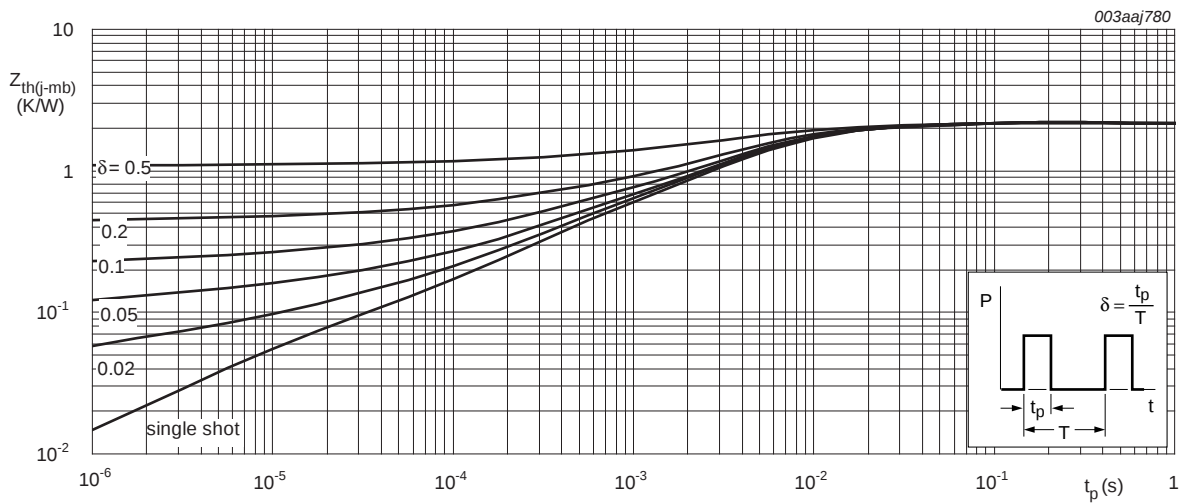


Fig 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250\ \mu A$; $V_{GS} = 0\ V$; $T_j = 25\ ^\circ C$	25	-	-	V
		$I_D = 250\ \mu A$; $V_{GS} = 0\ V$; $T_j = -55\ ^\circ C$	22.5	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\ mA$; $V_{DS} = V_{GS}$; $T_j = 25\ ^\circ C$	1.45	1.81	2.15	V
$\Delta V_{GS(th)}/\Delta T$	gate-source threshold voltage variation with temperature		-	-4.1	-	mV/K
I_{DSS}	drain leakage current	$V_{DS} = 25\ V$; $V_{GS} = 0\ V$; $T_j = 25\ ^\circ C$	-	-	1	μA
		$V_{DS} = 25\ V$; $V_{GS} = 0\ V$; $T_j = 150\ ^\circ C$	-	-	100	μA
I_{GSS}	gate leakage current	$V_{GS} = 16\ V$; $V_{DS} = 0\ V$; $T_j = 25\ ^\circ C$	-	-	100	nA
		$V_{GS} = -16\ V$; $V_{DS} = 0\ V$; $T_j = 25\ ^\circ C$	-	-	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 4.5\ V$; $I_D = 25\ A$; $T_j = 25\ ^\circ C$; see Figure 10	-	4.85	5.55	mΩ
		$V_{GS} = 4.5\ V$; $I_D = 25\ A$; $T_j = 150\ ^\circ C$; see Figure 10 ; see Figure 11	-	-	8.9	mΩ
		$V_{GS} = 10\ V$; $I_D = 25\ A$; $T_j = 25\ ^\circ C$; see Figure 10	-	3.65	4.15	mΩ
		$V_{GS} = 10\ V$; $I_D = 25\ A$; $T_j = 150\ ^\circ C$; see Figure 10 ; see Figure 11	-	-	6.65	mΩ
R_G	gate resistance	$f = 1\ MHz$	0.9	1.8	3.6	Ω
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$I_D = 25\ A$; $V_{DS} = 12.5\ V$; $V_{GS} = 10\ V$; see Figure 12 ; see Figure 13	-	21.5	-	nC
		$I_D = 25\ A$; $V_{DS} = 12.5\ V$; $V_{GS} = 4.5\ V$; see Figure 12 ; see Figure 13	-	9.7	-	nC
		$I_D = 0\ A$; $V_{DS} = 0\ V$; $V_{GS} = 10\ V$	-	20.9	-	nC
Q_{GS}	gate-source charge	$I_D = 25\ A$; $V_{DS} = 12.5\ V$; $V_{GS} = 4.5\ V$; see Figure 12 ; see Figure 13	-	3.9	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge		-	2.4	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	1.5	-	nC
Q_{GD}	gate-drain charge		-	2.3	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$I_D = 25\ A$; $V_{DS} = 12.5\ V$; see Figure 12 ; see Figure 13	-	2.9	-	V
C_{iss}	input capacitance	$V_{DS} = 12.5\ V$; $V_{GS} = 0\ V$; $f = 1\ MHz$; $T_j = 25\ ^\circ C$; see Figure 14	-	1524	-	pF
C_{oss}	output capacitance		-	376	-	pF
C_{rss}	reverse transfer capacitance		-	128	-	pF

Table 6. Characteristics ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_{d(on)}$	turn-on delay time	$V_{DS} = 12.5\text{ V}; R_L = 0.5\text{ }\Omega; V_{GS} = 4.5\text{ V};$ $R_{G(ext)} = 5\text{ }\Omega$	-	13	-	ns
t_r	rise time		-	23.2	-	ns
$t_{d(off)}$	turn-off delay time		-	15.6	-	ns
t_f	fall time		-	9.8	-	ns
Q_{oss}	output charge	$V_{GS} = 0\text{ V}; V_{DS} = 12.5\text{ V}; f = 1\text{ MHz};$ $T_j = 25\text{ }^{\circ}\text{C}$	-	9.9	-	nC
Source-drain diode						
V_{SD}	source-drain voltage	$I_S = 25\text{ A}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^{\circ}\text{C};$ see Figure 15	-	0.82	1.1	V
t_{rr}	reverse recovery time	$I_S = 25\text{ A}; dI_S/dt = -100\text{ A}/\mu\text{s}; V_{GS} = 0\text{ V};$ $V_{DS} = 12.5\text{ V}$	-	17.6	-	ns
Q_r	recovered charge		-	9.2	-	nC
t_a	reverse recovery rise time	$V_{GS} = 0\text{ V}; I_S = 25\text{ A}; dI_S/dt = -100\text{ A}/\mu\text{s};$ $V_{DS} = 12.5\text{ V};$ see Figure 16	-	9.8	-	ns
t_b	reverse recovery fall time		-	7.8	-	ns

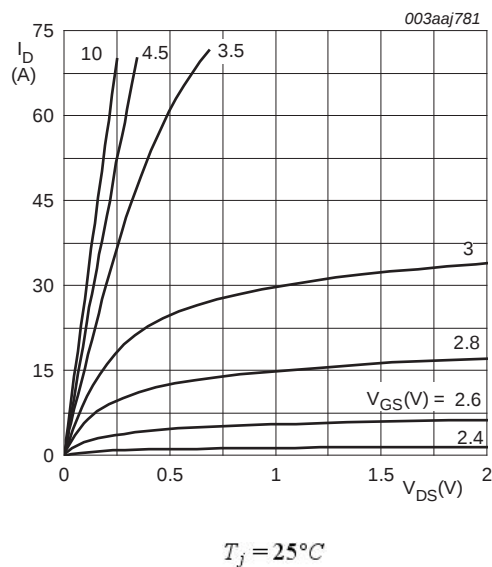


Fig 6. Output characteristics; drain current as a function of drain-source voltage; typical values

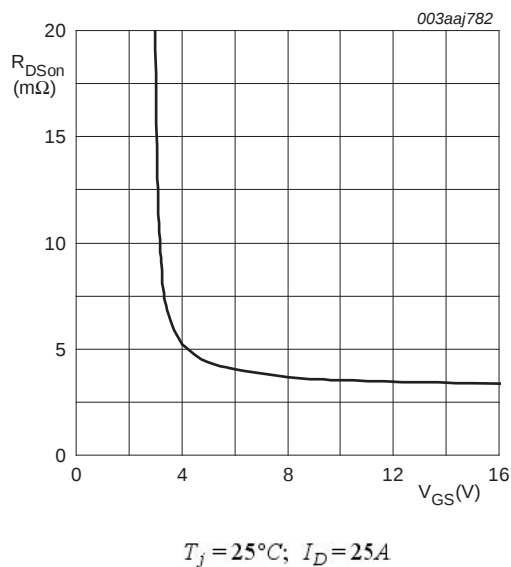


Fig 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

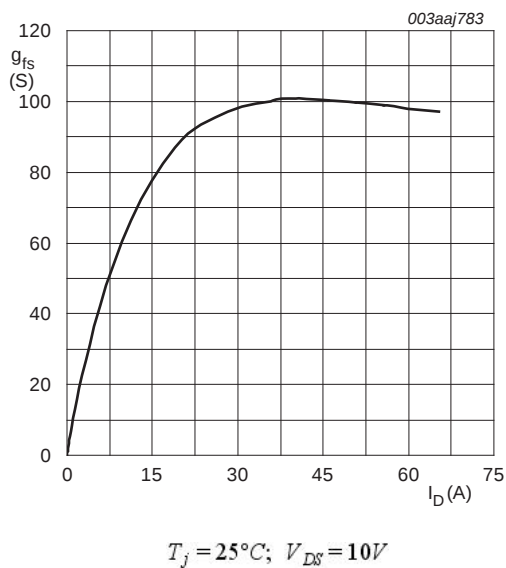


Fig 8. Forward transconductance as a function of drain current; typical values

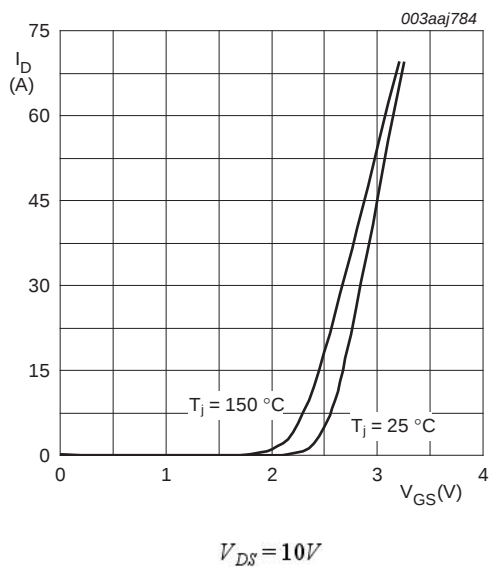


Fig 9. Transfer characteristics; drain current as a function of gate-source voltage; typical values

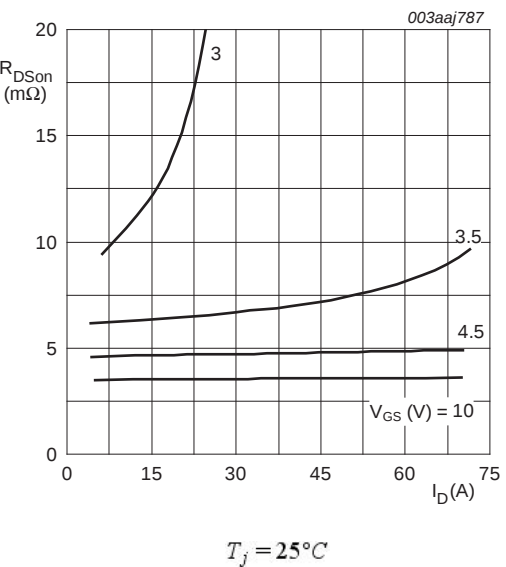


Fig 10. Drain-source on-state resistance as a function of drain current; typical values

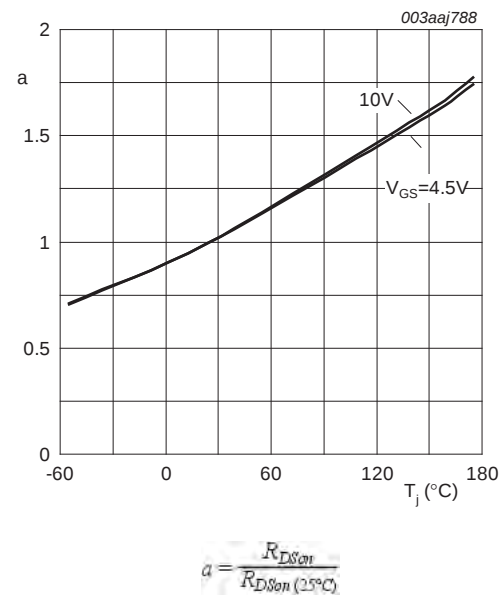


Fig 11. Normalized drain-source on-state resistance factor as a function of junction temperature

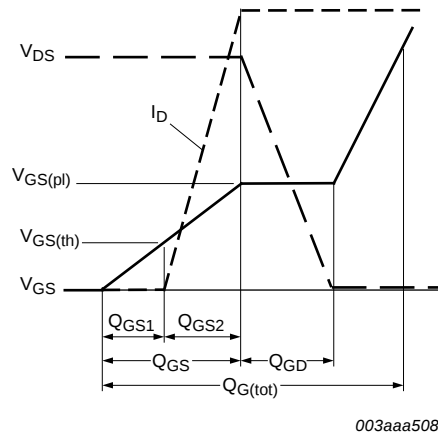
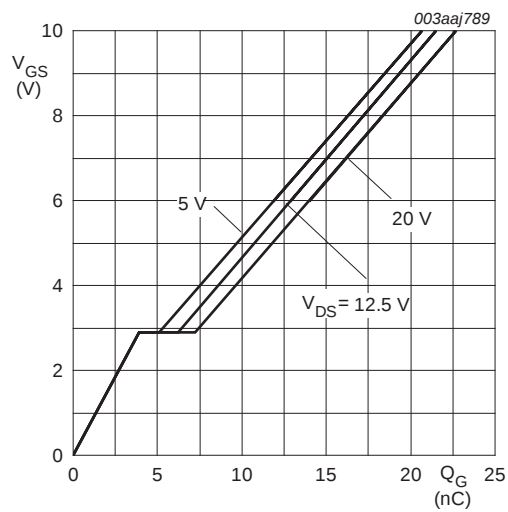
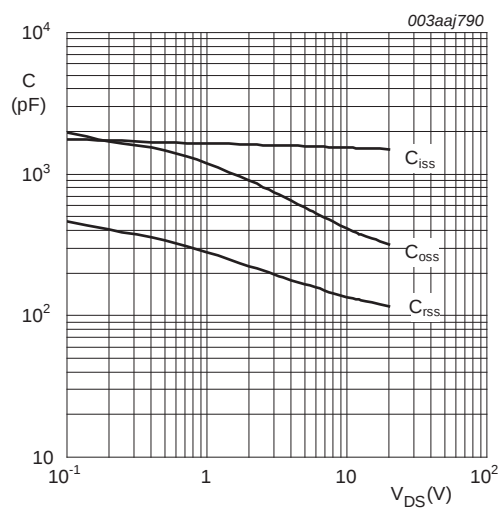


Fig 12. Gate charge waveform definitions



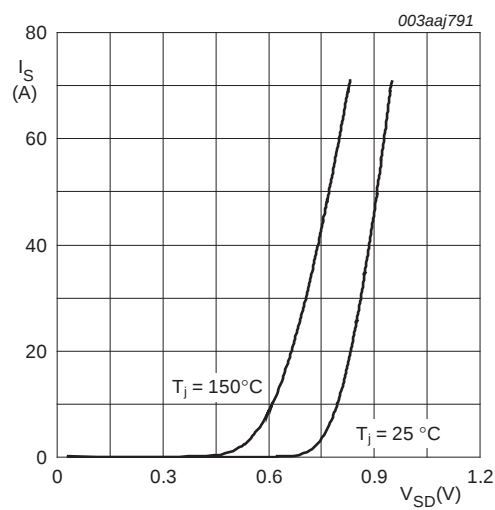
$T_j = 25^{\circ}\text{C}; I_D = 25\text{A}$

Fig 13. Gate-source voltage as a function of gate charge; typical values



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

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



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

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

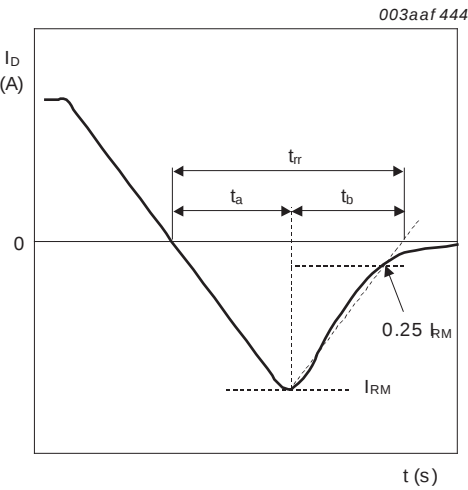


Fig 16. Reverse recovery timing definition

7. Package outline

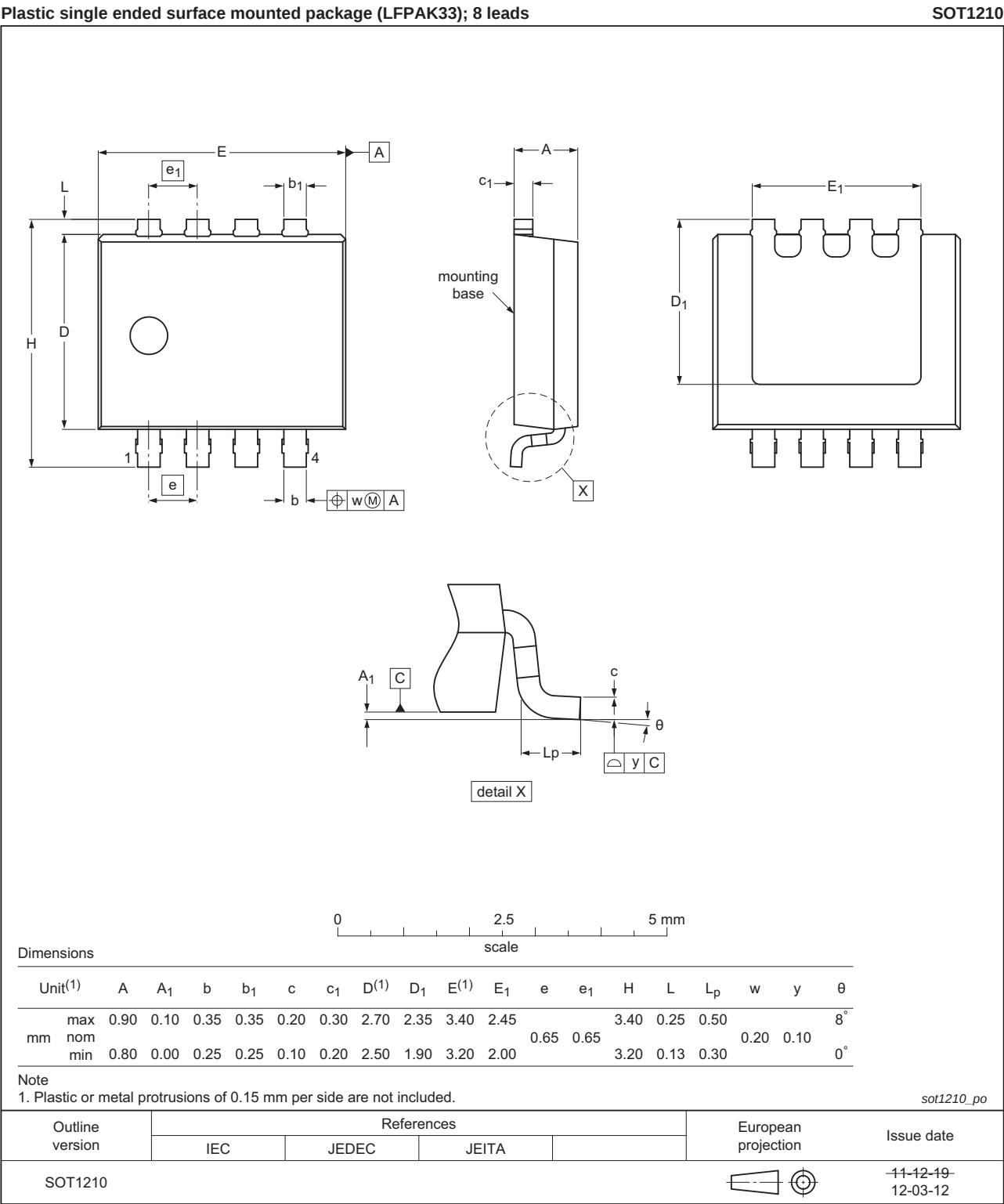


Fig 17. Package outline SOT1210 (LPAK33)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN3R9-25MLC v.4	20120615	Product data sheet	-	PSMN3R9-25MLC v.3
Modifications:		• Various changes to content.		
PSMN3R9-25MLC v.3	20120607	Product data sheet	-	PSMN3R9-25MLC v.2

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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nexperia.com>.

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