



# PSMN6R4-30MLD

N-channel 30 V, 6.4 mΩ logic level MOSFET in LFPAK33 using NextPowerS3 Technology

21 January 2019

Product data sheet

## 1. General description

Logic level gate drive N-channel enhancement mode MOSFET in an LFPAK33 package. The NextPowerS3 portfolio, utilising Nexperia's unique "SchottkyPlus" technology, delivers high efficiency and the low spiking performance usually associated with MOSFETs with an integrated Schottky or Schottky-like body 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  $Q_{GSS}$  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  $< 1 \mu\text{A}$  leakage at 25 °C
- Optimised for 4.5 V gate drive
- Low parasitic inductance and resistance
- High reliability clip bonded and solder die attach Mini Power SO8 package; no glue, no wire bonds, qualified to 175 °C
- Exposed leads for optimal visual solder inspection

## 3. Applications

- On-board DC-to-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

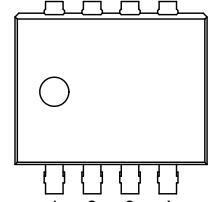
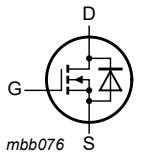
## 4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$25^\circ\text{C} \leq T_j \leq 175^\circ\text{C}$		-	-	30	V
$I_D$	drain current	$V_{GS} = 10 \text{ V}$ ; $T_{mb} = 25^\circ\text{C}$ ; <a href="#">Fig. 2</a>		-	-	66	A
$P_{tot}$	total power dissipation	$T_{mb} = 25^\circ\text{C}$ ; <a href="#">Fig. 1</a>		-	-	51	W
<b>Static characteristics</b>							
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 4.5 \text{ V}$ ; $I_D = 15 \text{ A}$ ; $T_j = 25^\circ\text{C}$ ; <a href="#">Fig. 10</a>		-	6.9	8.3	$\text{m}\Omega$
<b>Dynamic characteristics</b>							
$Q_{GD}$	gate-drain charge	$I_D = 15 \text{ A}$ ; $V_{DS} = 15 \text{ V}$ ; $V_{GS} = 4.5 \text{ V}$ ; <a href="#">Fig. 12</a> ; <a href="#">Fig. 13</a>		-	1.8	3	nC

## 5. 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	 <b>LFPAK33 (SOT1210)</b>	

## 6. Ordering information

**Table 3. Ordering information**

Type number	Package		
	Name	Description	Version
PSMN6R4-30MLD	LFPAK33	Plastic single ended surface mounted package (LFPAK33); 8 leads	SOT1210

## 7. Marking

**Table 4. Marking codes**

Type number	Marking code
PSMN6R4-30MLD	6D430L

## 8. Limiting values

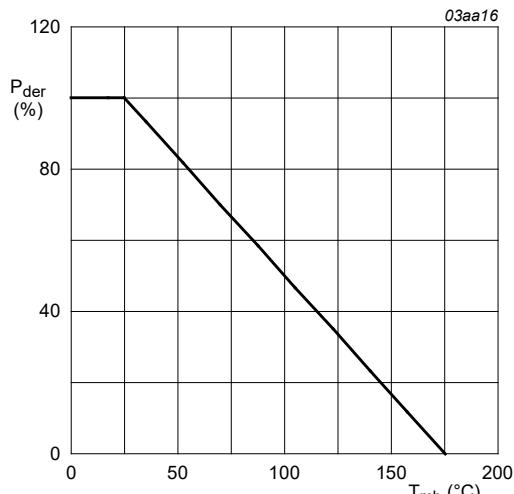
**Table 5. Limiting values**

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

Symbol	Parameter	Conditions		Min	Max	Unit
$V_{DS}$	drain-source voltage	$25^{\circ}\text{C} \leq T_j \leq 175^{\circ}\text{C}$		-	30	V
$V_{DGR}$	drain-gate voltage	$25^{\circ}\text{C} \leq T_j \leq 175^{\circ}\text{C}; R_{GS} = 20\text{ k}\Omega$		-	30	V
$V_{GS}$	gate-source voltage			-20	20	V
$P_{\text{tot}}$	total power dissipation	$T_{mb} = 25^{\circ}\text{C}$ ; <a href="#">Fig. 1</a>		-	51	W
$I_D$	drain current	$V_{GS} = 10\text{ V}; T_{mb} = 25^{\circ}\text{C}$ ; <a href="#">Fig. 2</a>		-	66	A
		$V_{GS} = 10\text{ V}; T_{mb} = 100^{\circ}\text{C}$ ; <a href="#">Fig. 2</a>		-	47	A
$I_{DM}$	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; $T_{mb} = 25^{\circ}\text{C}$ ; <a href="#">Fig. 3</a>		-	264	A
$T_{\text{stg}}$	storage temperature			-55	175	°C
$T_j$	junction temperature			-55	175	°C
$T_{\text{sld(M)}}$	peak soldering temperature			-	260	°C
<b>Source-drain diode</b>						
$I_S$	source current	$T_{mb} = 25^{\circ}\text{C}$		-	43	A
$I_{SM}$	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; $T_{mb} = 25^{\circ}\text{C}$		-	264	A
<b>Avalanche ruggedness</b>						

Symbol	Parameter	Conditions		Min	Max	Unit
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 15 \text{ A}$ ; $V_{sup} \leq 30 \text{ V}$ ; $R_{GS} = 50 \Omega$ ; $V_{GS} = 10 \text{ V}$ ; $T_{j(init)} = 25 \text{ }^\circ\text{C}$ ; unclamped; $t_p = 159 \mu\text{s}$	[1]	-	46.6	mJ

[1] Protected by 100% test



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

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

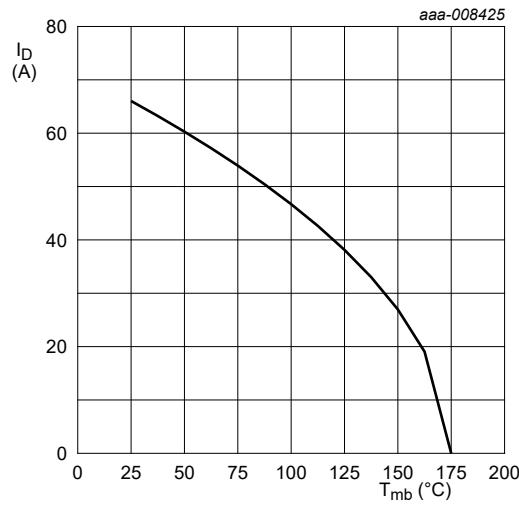
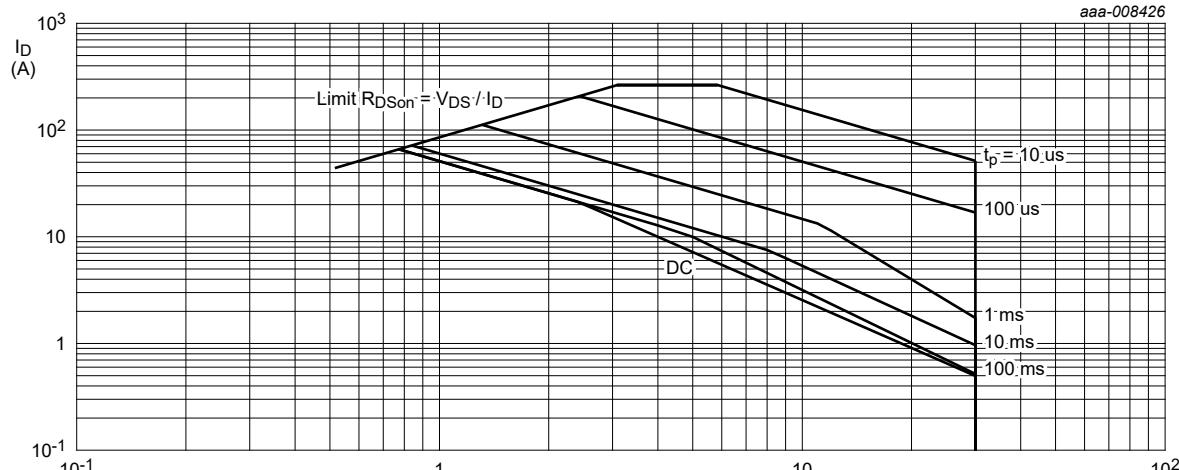


Fig. 2. Continuous drain current as a function of mounting base temperature



$T_{mb} = 25 \text{ }^\circ\text{C}$ ;  $I_{DM}$  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	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	Fig. 4		-	2.72	2.94	K/W

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	<a href="#">Fig. 5</a>		-	57	-	K/W
		<a href="#">Fig. 6</a>		-	178	-	K/W

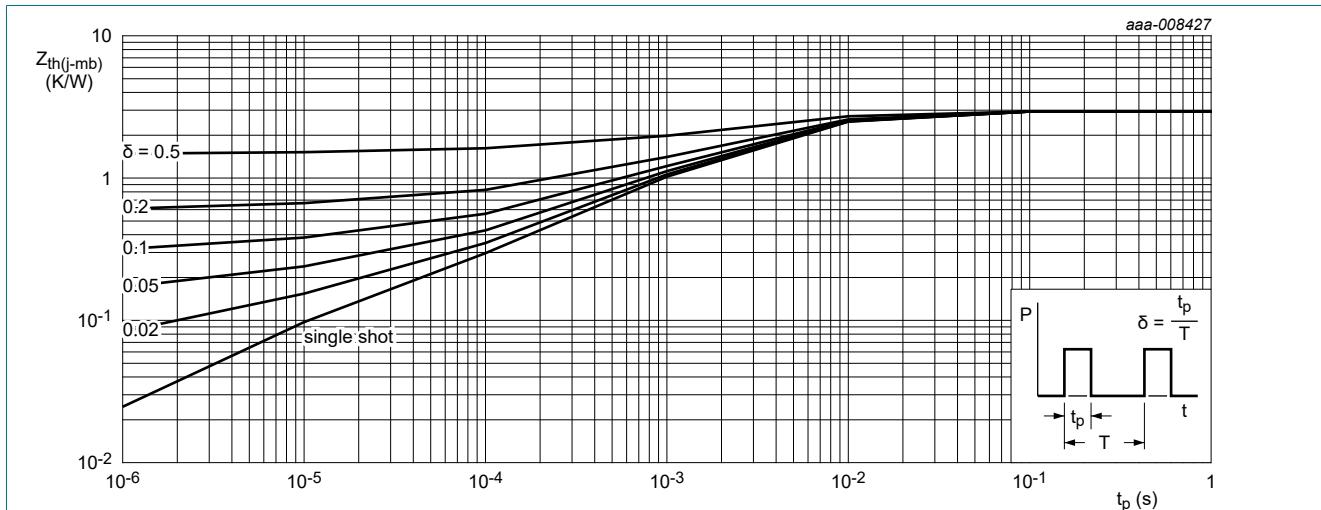


Fig. 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

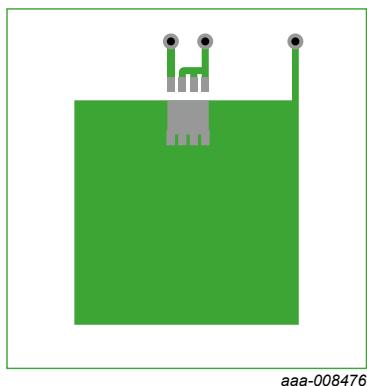


Fig. 5. PCB layout for thermal resistance junction to ambient 1" square pad; FR4 Board; 2oz copper

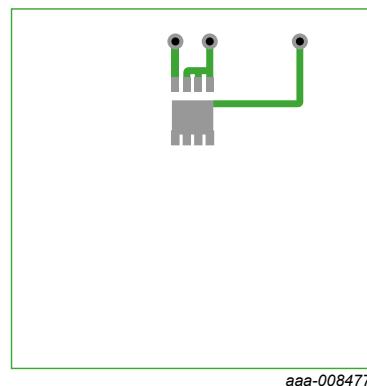


Fig. 6. PCB layout for thermal resistance junction to ambient minimum footprint; FR4 Board; 2oz copper

## 10. Characteristics

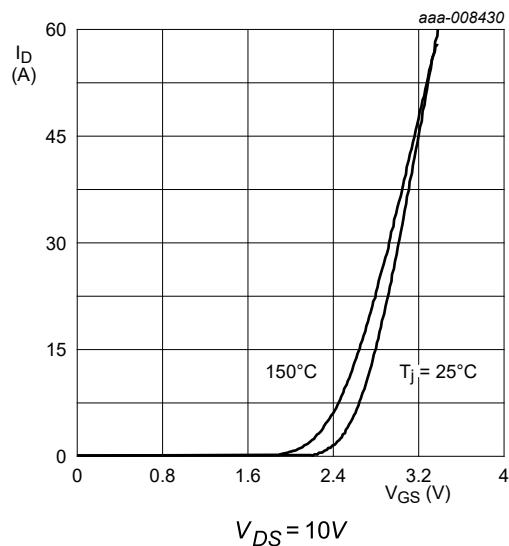
Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
<b>Static characteristics</b>							
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25^\circ C$		30	-	-	V
		$I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55^\circ C$		27	-	-	V
$V_{GS(th)}$							
$\Delta V_{GS(th)}/\Delta T$	gate-source threshold voltage variation with temperature	$I_D = 1 mA; V_{DS}=V_{GS}; T_j = 25^\circ C$		1.2	1.7	2.2	V
		$25^\circ C \leq T_j \leq 150^\circ C$		-	-3.8	-	mV/K
$I_{DSS}$	drain leakage current	$V_{DS} = 24 V; V_{GS} = 0 V; T_j = 25^\circ C$		-	-	1	$\mu A$
		$V_{DS} = 24 V; V_{GS} = 0 V; T_j = 125^\circ C$		-	0.45	-	$\mu A$
$I_{GSS}$	gate leakage current	$V_{GS} = 16 V; V_{DS} = 0 V; T_j = 25^\circ C$		-	-	100	nA

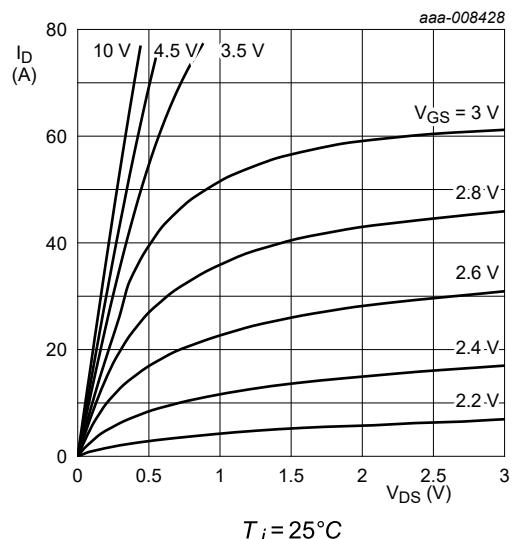
## N-channel 30 V, 6.4 mΩ logic level MOSFET in LFPAK33 using NextPowerS3 Technology

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
		$V_{GS} = -16 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	-	100	nA
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 4.5 \text{ V}; I_D = 15 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ <a href="#">Fig. 10</a>	-	6.9	8.3	mΩ
		$V_{GS} = 4.5 \text{ V}; I_D = 15 \text{ A}; T_j = 150 \text{ }^\circ\text{C};$ <a href="#">Fig. 10</a> ; <a href="#">Fig. 11</a>	-	-	13.7	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ <a href="#">Fig. 10</a>	-	5.3	6.3	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 150 \text{ }^\circ\text{C};$ <a href="#">Fig. 10</a> ; <a href="#">Fig. 11</a>	-	-	10.4	mΩ
$R_G$	gate resistance	$f = 1 \text{ MHz}$	-	2.36	5.8	Ω
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = 15 \text{ A}; V_{DS} = 15 \text{ V}; V_{GS} = 10 \text{ V};$ <a href="#">Fig. 12</a> ; <a href="#">Fig. 13</a>	-	13.7	19	nC
		$I_D = 15 \text{ A}; V_{DS} = 15 \text{ V}; V_{GS} = 4.5 \text{ V};$ <a href="#">Fig. 12</a> ; <a href="#">Fig. 13</a>	-	6.5	9	nC
		$I_D = 0 \text{ A}; V_{DS} = 0 \text{ V}; V_{GS} = 10 \text{ V}$	-	12.2	-	nC
$Q_{GS}$	gate-source charge	$I_D = 15 \text{ A}; V_{DS} = 15 \text{ V}; V_{GS} = 4.5 \text{ V};$ <a href="#">Fig. 12</a> ; <a href="#">Fig. 13</a>	-	1.7	4	nC
$Q_{GS(th)}$	pre-threshold gate-source charge		-	1.2	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	0.5	-	nC
$Q_{GD}$	gate-drain charge		-	1.8	3	nC
$V_{GS(pl)}$	gate-source plateau voltage	$I_D = 15 \text{ A}; V_{DS} = 15 \text{ V};$ <a href="#">Fig. 12</a> ; <a href="#">Fig. 13</a>	-	2.2	-	V
$C_{iss}$	input capacitance	$V_{DS} = 15 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz};$ $T_j = 25 \text{ }^\circ\text{C};$ <a href="#">Fig. 14</a>	-	832	-	pF
$C_{oss}$	output capacitance		-	587	-	pF
$C_{rss}$	reverse transfer capacitance		-	64	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 15 \text{ V}; R_L = 1 \Omega; V_{GS} = 4.5 \text{ V};$ $R_{G(ext)} = 5 \Omega$	-	9	-	ns
$t_r$	rise time		-	16.2	-	ns
$t_{d(off)}$	turn-off delay time		-	10.5	-	ns
$t_f$	fall time		-	10.9	-	ns
$Q_{oss}$	output charge	$V_{GS} = 0 \text{ V}; V_{DS} = 15 \text{ V}; f = 1 \text{ MHz};$ $T_j = 25 \text{ }^\circ\text{C}$	-	12.6	-	nC
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = 10 \text{ A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C};$ <a href="#">Fig. 15</a>	-	0.8	1.2	V
$t_{rr}$	reverse recovery time	$I_S = 15 \text{ A}; dI_S/dt = -100 \text{ A}/\mu\text{s}; V_{GS} = 0 \text{ V};$ $V_{DS} = 15 \text{ V};$ <a href="#">Fig. 16</a>	-	23.4	-	ns
$Q_r$	recovered charge		[1]	12.6	-	nC
$t_a$	reverse recovery rise time		-	10.6	-	ns
$t_b$	reverse recovery fall time		-	12.8	-	ns
$S$	softness factor		-	1.2	-	

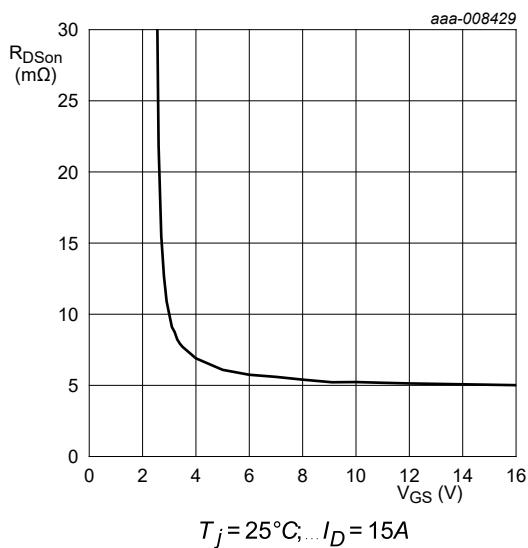
[1] includes capacitive recovery



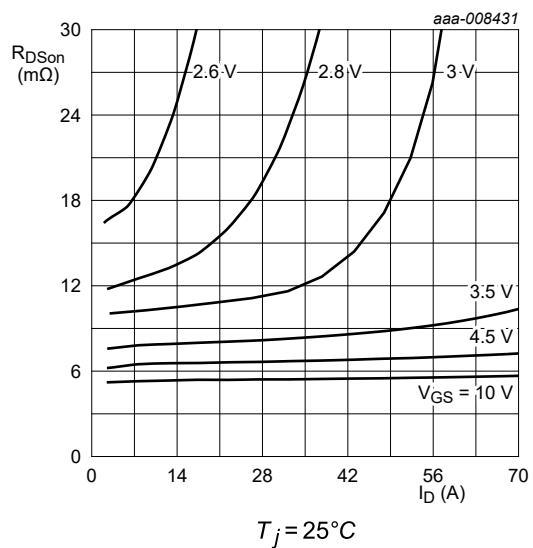
**Fig. 7. Transfer characteristics; drain current as a function of gate-source voltage; typical values**



**Fig. 8. Output characteristics; drain current as a function of drain-source voltage; typical values**



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



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

## N-channel 30 V, 6.4 mΩ logic level MOSFET in LFPAK33 using NextPowerS3 Technology

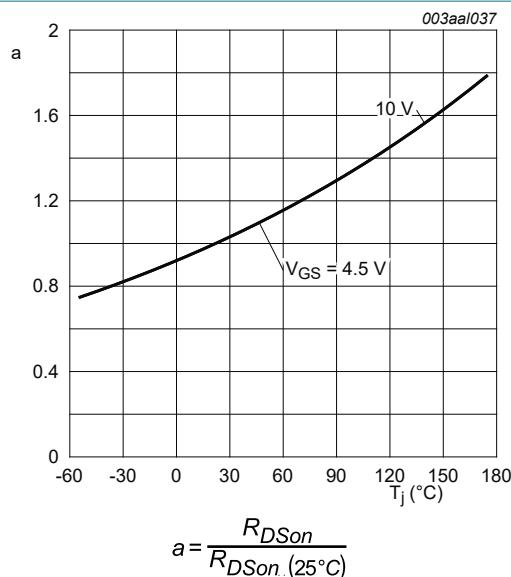


Fig. 11. Normalized drain-source on-state resistance factor as a function of junction temperature

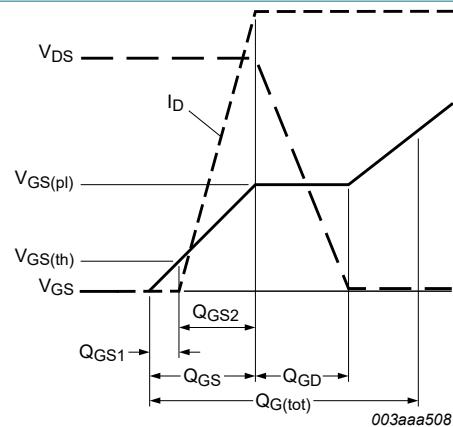


Fig. 12. Gate charge waveform definitions

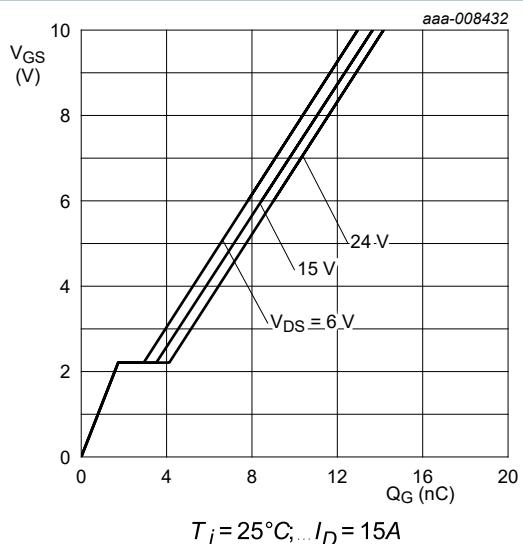


Fig. 13. Gate-source voltage as a function of gate charge; typical values

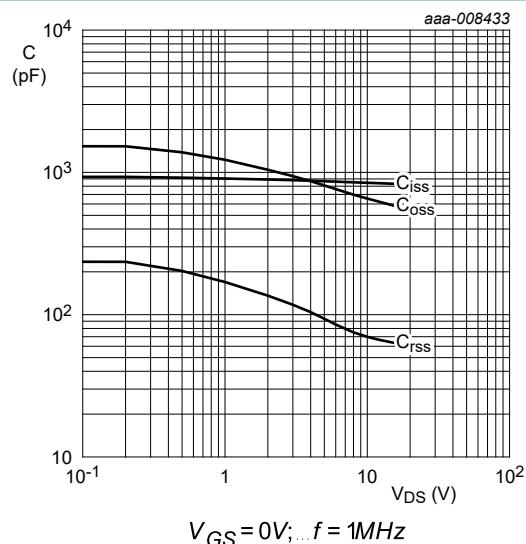


Fig. 14. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

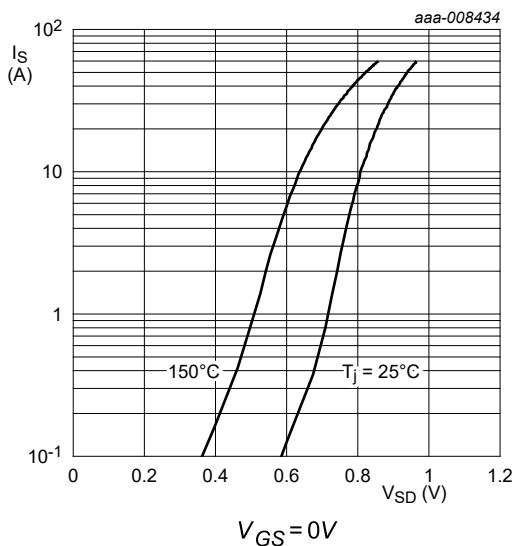


Fig. 15. Source current as a function of source-drain voltage; typical values

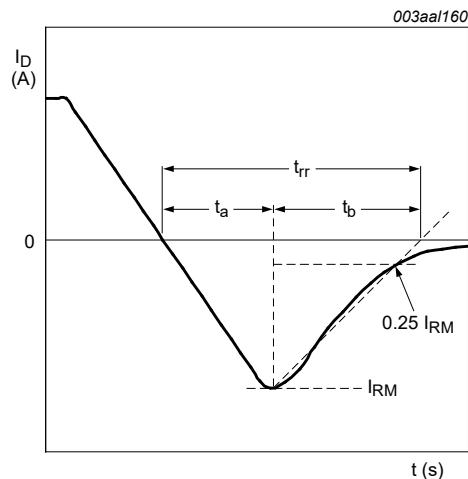
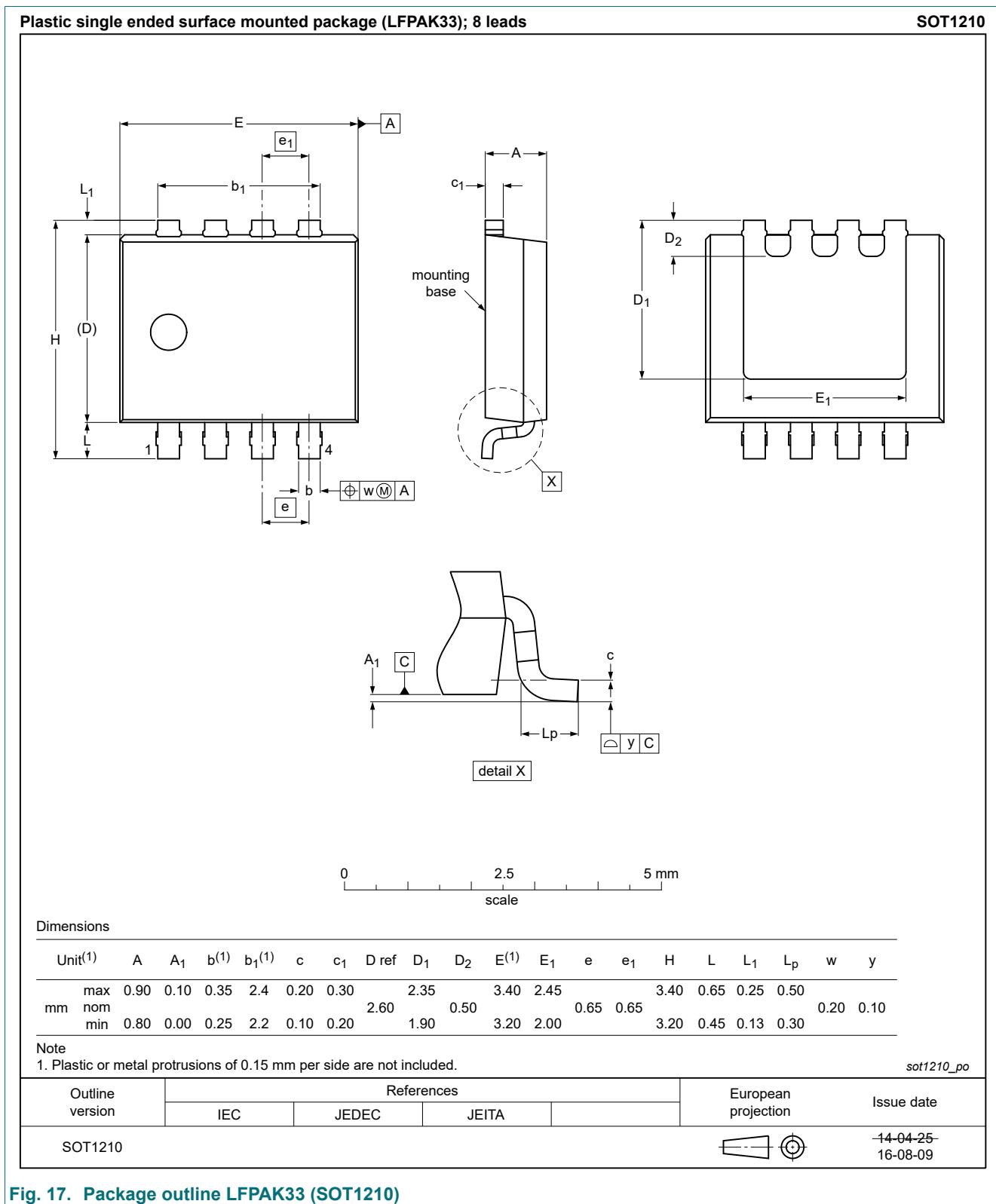


Fig. 16. Reverse recovery timing definition

## 11. Package outline



## 12. Soldering

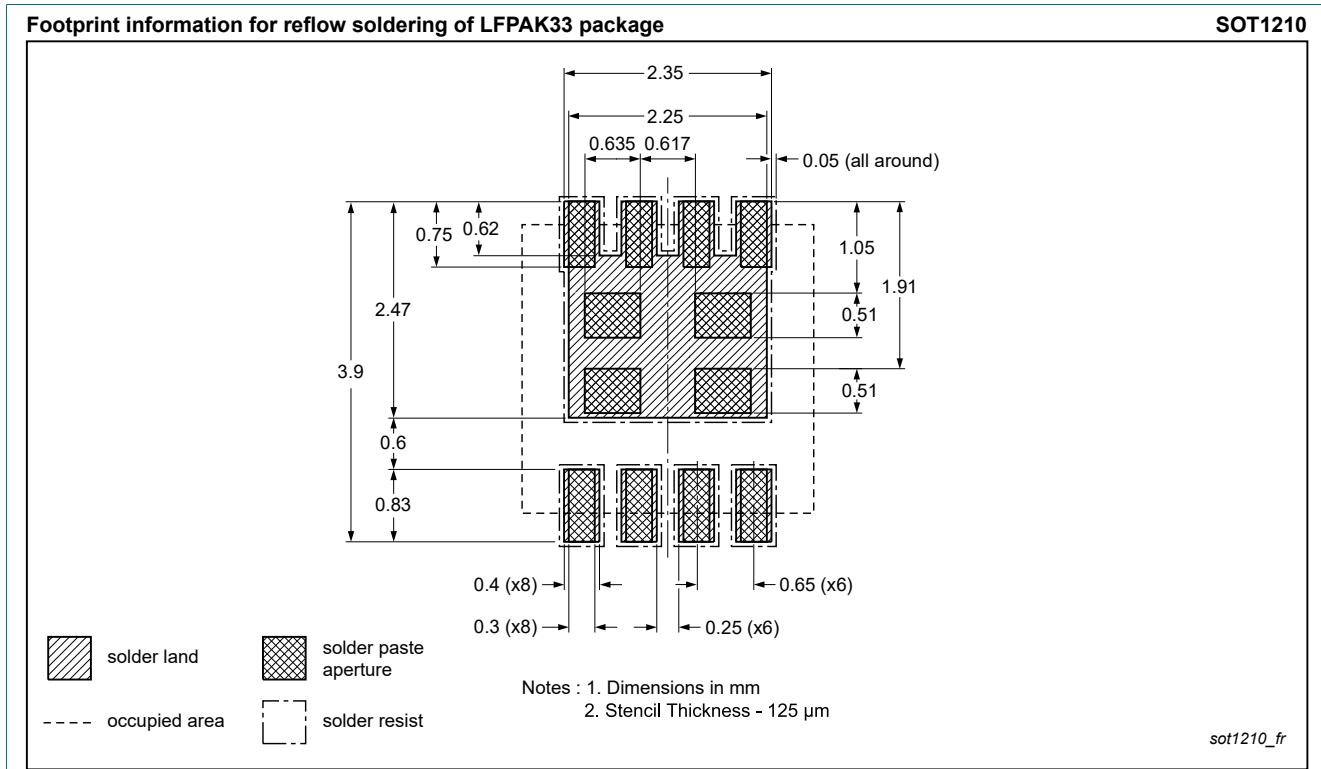


Fig. 18. Reflow soldering footprint for LFPAK33 (SOT1210)

## 13. Legal information

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Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
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## Contents

1. General description.....	1
2. Features and benefits.....	1
3. Applications.....	1
4. Quick reference data.....	1
5. Pinning information.....	2
6. Ordering information.....	2
7. Marking.....	2
8. Limiting values.....	2
9. Thermal characteristics.....	3
10. Characteristics.....	4
11. Package outline.....	9
12. Soldering.....	10
13. Legal information.....	11

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