



# PXM7R7-25QL

25 V, N-channel Trench MOSFET

2 November 2020

Product data sheet

## 1. General description

N-channel enhancement mode Field-Effect Transistor (FET) in an MLPAK33 (SOT8002) Surface-Mounted Device (SMD) plastic package using Trench MOSFET technology.

## 2. Features and benefits

- Logic-level compatible
- Trench MOSFET technology
- Ultra low  $Q_G$  and  $Q_{GD}$  for high system efficiency, especially at higher switching frequencies
- Superfast switching with soft-recovery
- Low spiking and ringing for low EMI designs
- MLPAK33 package (3.3 x 3.3 mm footprint)

## 3. Applications

- DC to DC conversion
- Battery management
- Low-side load switch
- Switching circuits

## 4. Quick reference data

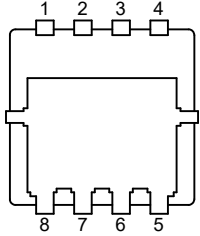
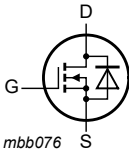
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j = 25\text{ °C}$	-	-	25	V
$V_{GS}$	gate-source voltage		-20	-	20	V
$I_D$	drain current	$V_{GS} = 10\text{ V}; T_{amb} = 25\text{ °C}; t \leq 5\text{ s}$	[1]	-	19	A
<b>Static characteristics</b>						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 11.8\text{ A}; T_j = 25\text{ °C}$	-	6.6	7.7	mΩ
		$V_{GS} = 4.5\text{ V}; I_D = 9.8\text{ A}; T_j = 25\text{ °C}$	-	8.9	11.1	mΩ
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$V_{DS} = 12.5\text{ V}; I_D = 9.8\text{ A}; V_{GS} = 4.5\text{ V}; T_j = 25\text{ °C}$	-	5.3	8	nC

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and mounting pad for drain 6 cm<sup>2</sup>.

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S	source	 <p>MLPAK33 (SOT8002-1)</p>	
2	S	source		
3	S	source		
4	G	gate		
5	D	drain		
6	D	drain		
7	D	drain		
8	D	drain		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PXN7R7-25QL	MLPAK33	plastic thermal enhanced surface mounted package; mini leads; 8 terminals; pitch 0.65 mm; 3.3 x 3.3 x 0.8 mm body	SOT8002-1

## 7. Marking

Table 4. Marking codes

Type number	Marking code
PXN7R7-25QL	9AE

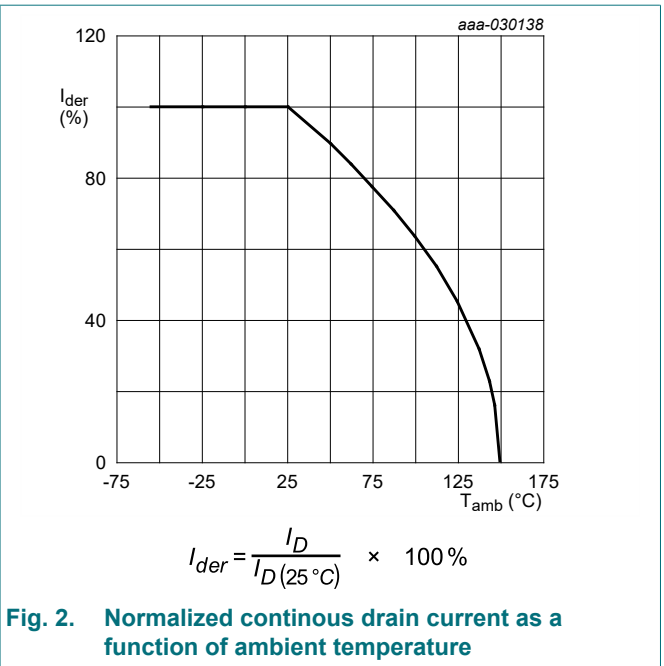
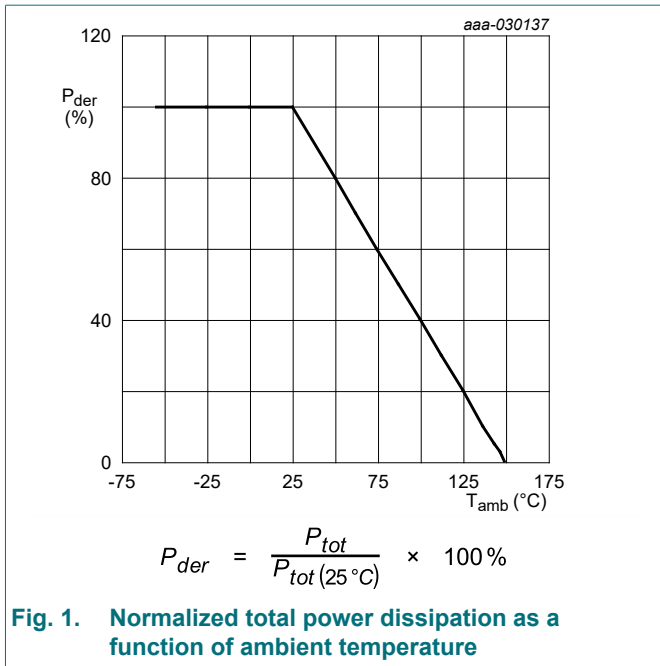
## 8. Limiting values

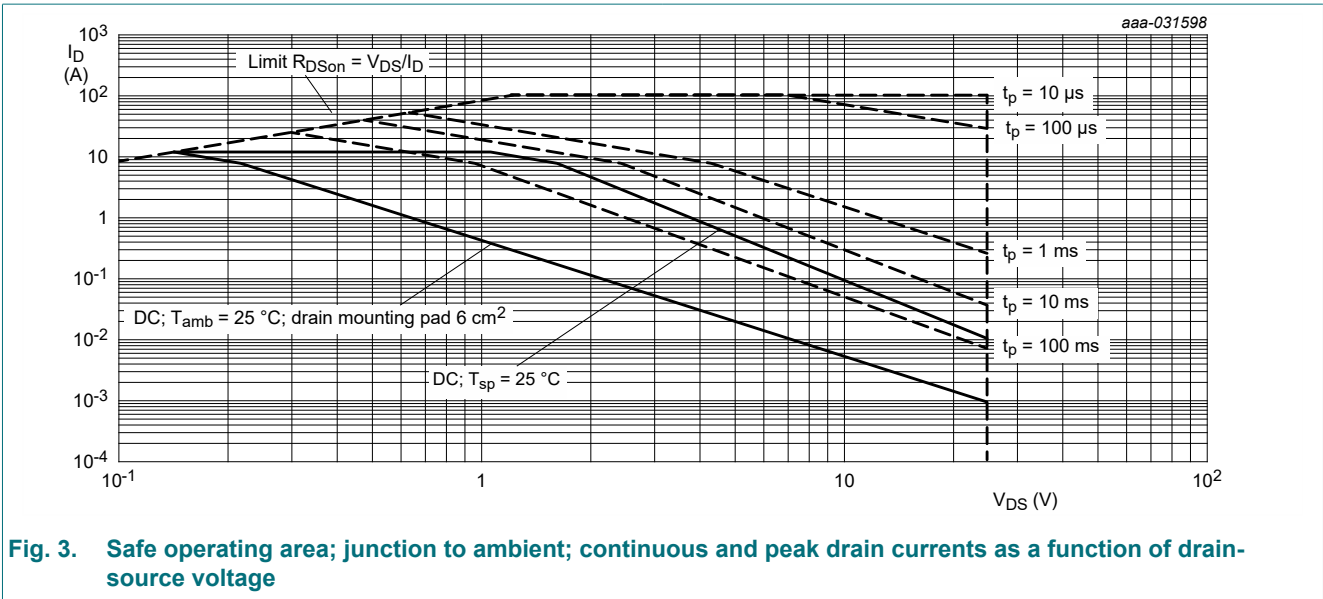
**Table 5. Limiting values**

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

Symbol	Parameter	Conditions		Min	Max	Unit
V <sub>DS</sub>	drain-source voltage	T <sub>j</sub> = 25 °C		-	25	V
V <sub>GS</sub>	gate-source voltage			-20	20	V
I <sub>D</sub>	drain current	V <sub>GS</sub> = 10 V; T <sub>amb</sub> = 25 °C; t ≤ 5 s	[1]	-	19	A
		V <sub>GS</sub> = 10 V; T <sub>amb</sub> = 25 °C	[1]	-	11.8	A
		V <sub>GS</sub> = 10 V; T <sub>amb</sub> = 100 °C	[1]	-	7.5	A
		V <sub>GS</sub> = 10 V; T <sub>sp</sub> = 25 °C		-	32	A
I <sub>DM</sub>	peak drain current	T <sub>amb</sub> = 25 °C; single pulse; t <sub>p</sub> ≤ 10 μs		-	102	A
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = 25 °C; t ≤ 5 s	[1]	-	4.3	W
		T <sub>amb</sub> = 25 °C	[1]	-	1.7	W
		T <sub>sp</sub> = 25 °C		-	12.5	W
T <sub>j</sub>	junction temperature			-55	150	°C
T <sub>amb</sub>	ambient temperature			-55	150	°C
T <sub>stg</sub>	storage temperature			-65	150	°C
<b>Source-drain diode</b>						
I <sub>S</sub>	source current	T <sub>amb</sub> = 25 °C	[1]	-	1.5	A
<b>Avalanche ruggedness</b>						
E <sub>DS(AL)S</sub>	non-repetitive drain-source avalanche energy	T <sub>j(initial)</sub> = 25 °C; I <sub>D</sub> = 1.8 A; DUT in avalanche (unclamped)		-	22.5	mJ

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and mounting pad for drain 6 cm<sup>2</sup>.





## 9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	150	190	K/W
			[2]	-	60	75	K/W
		in free air; $t \leq 5$ s	[2]	-	24	29	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	7	10	K/W

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for drain 6 cm<sup>2</sup>.

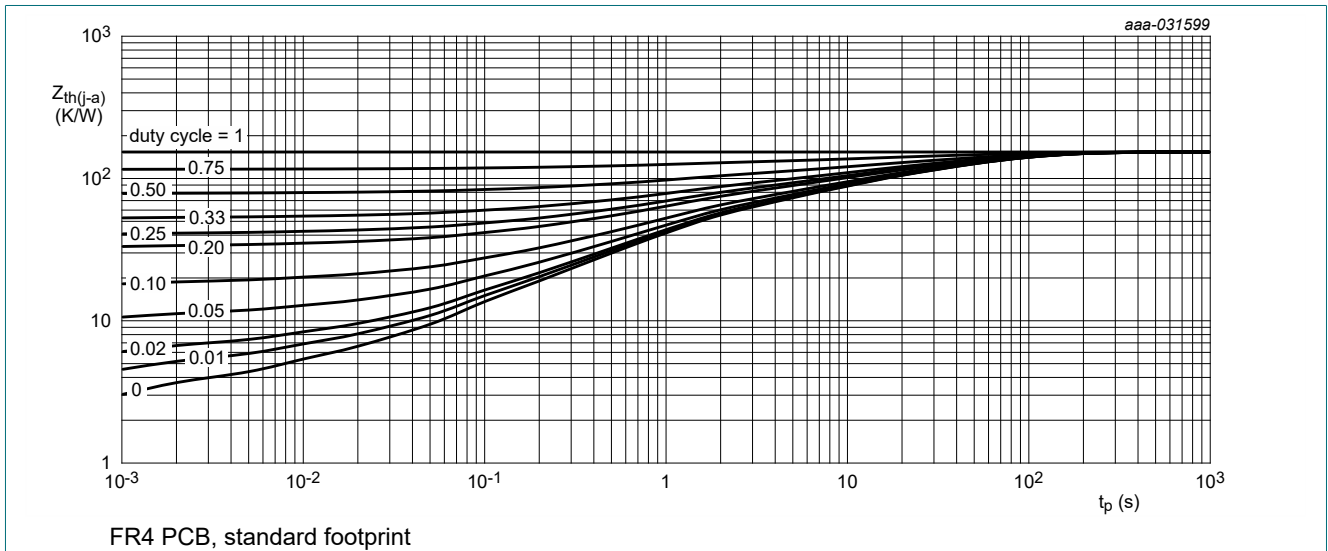


Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

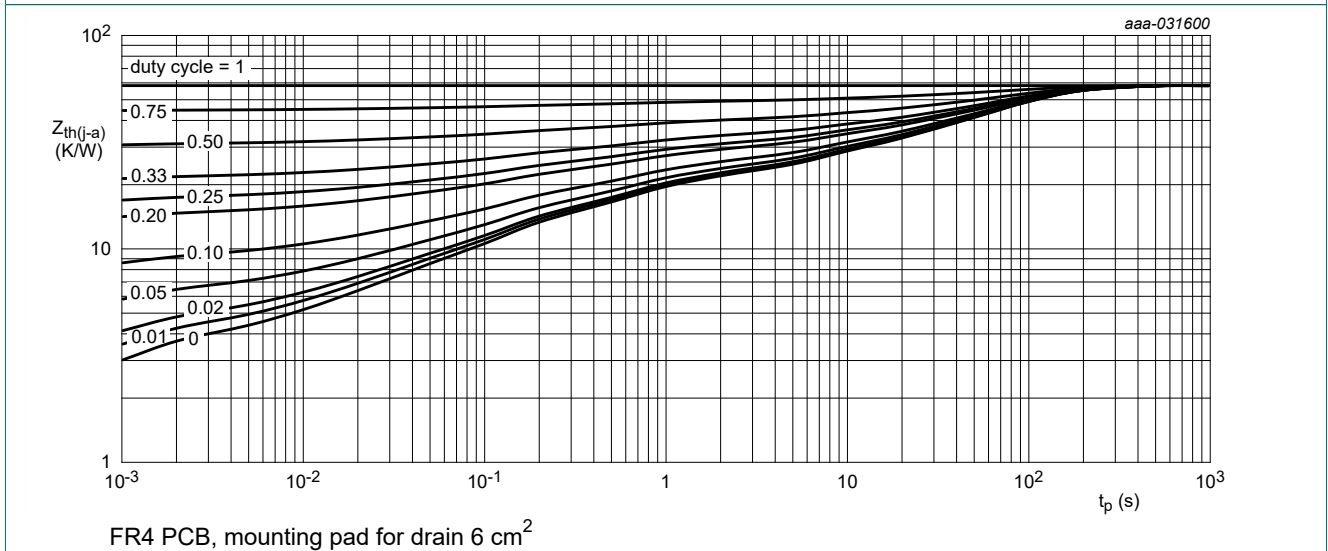


Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	25	-	-	V
$V_{GSth}$	gate-source threshold voltage	$I_D = 250 \mu A$ ; $V_{DS} = V_{GS}$ ; $T_j = 25 \text{ }^\circ C$	1.2	1.7	2.2	V
$I_{DSS}$	drain leakage current	$V_{DS} = 25 V$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	1	$\mu A$
$I_{GSS}$	gate leakage current	$V_{GS} = 20 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	0.1	$\mu A$
		$V_{GS} = -20 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	-0.1	$\mu A$
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 10 V$ ; $I_D = 11.8 A$ ; $T_j = 25 \text{ }^\circ C$	-	6.6	7.7	m $\Omega$
		$V_{GS} = 10 V$ ; $I_D = 11.8 A$ ; $T_j = 150 \text{ }^\circ C$	-	10.2	11.9	m $\Omega$
		$V_{GS} = 4.5 V$ ; $I_D = 9.8 A$ ; $T_j = 25 \text{ }^\circ C$	-	8.9	11.1	m $\Omega$
$g_{fs}$	forward transconductance	$V_{DS} = 10 V$ ; $I_D = 11.8 A$ ; $T_j = 25 \text{ }^\circ C$	-	25	-	S
$R_G$	gate resistance	$f = 1 \text{ MHz}$	-	2.3	-	$\Omega$
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$V_{DS} = 12.5 V$ ; $I_D = 11.8 A$ ; $V_{GS} = 10 V$ ; $T_j = 25 \text{ }^\circ C$	-	11.1	16.6	nC
		$V_{DS} = 12.5 V$ ; $I_D = 9.8 A$ ; $V_{GS} = 4.5 V$ ; $T_j = 25 \text{ }^\circ C$	-	5.3	8	nC
$Q_{GS}$	gate-source charge		-	2	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge		-	1.2	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	0.8	-	nC
$Q_{GD}$	gate-drain charge		-	1.5	-	nC
$V_{GSpl}$	gate-source plateau voltage	$V_{DS} = 12.5 V$ ; $I_D = 9.8 A$ ; $T_j = 25 \text{ }^\circ C$	-	2.8	-	V
$C_{iss}$	input capacitance	$V_{DS} = 12.5 V$ ; $f = 1 \text{ MHz}$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	770	-	pF
$C_{oss}$	output capacitance		-	310	-	pF
$C_{rss}$	reverse transfer capacitance		-	55	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 12.5 V$ ; $I_D = 9.8 A$ ; $V_{GS} = 4.5 V$ ; $R_{G(ext)} = 5 \Omega$ ; $T_j = 25 \text{ }^\circ C$	-	5	-	ns
$t_r$	rise time		-	8	-	ns
$t_{d(off)}$	turn-off delay time		-	6	-	ns
$t_f$	fall time		-	3	-	ns
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = 1.5 A$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	0.7	1.2	V
$t_{rr}$	reverse recovery time	$I_S = 1.5 A$ ; $di_S/dt = -100 A/\mu s$ ; $V_{GS} = 4.5 V$ ; $V_{DS} = 12.5 V$ ; $T_j = 25 \text{ }^\circ C$	-	15	-	ns
$Q_r$	recovered charge		-	6	-	nC
$t_a$	reverse recovery rise time		-	8	-	ns
$t_b$	reverse recovery fall time		-	7	-	ns

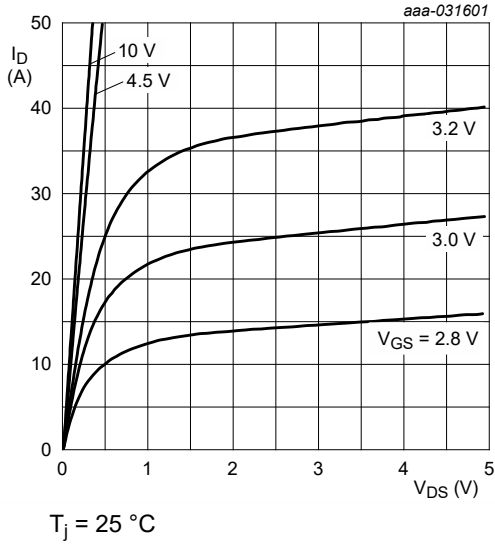


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

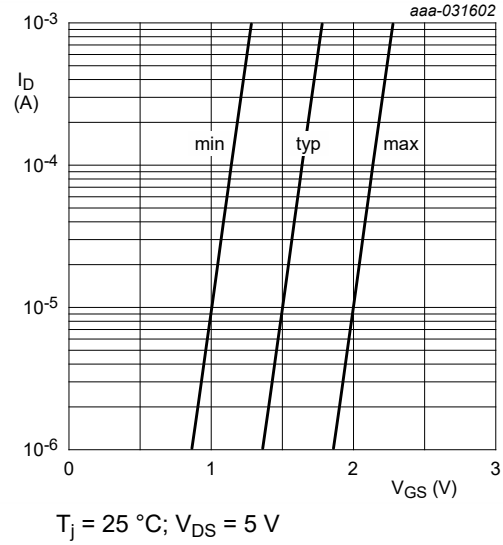


Fig. 7. Subthreshold drain current as a function of gate-source voltage



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

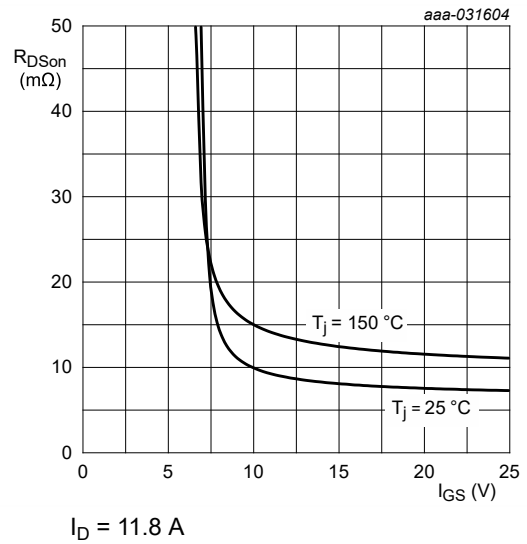


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values

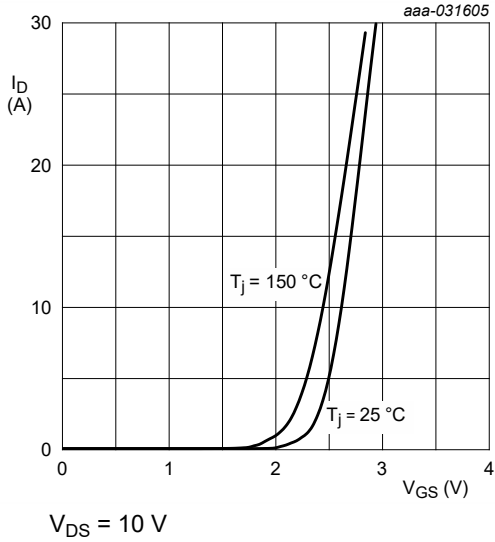
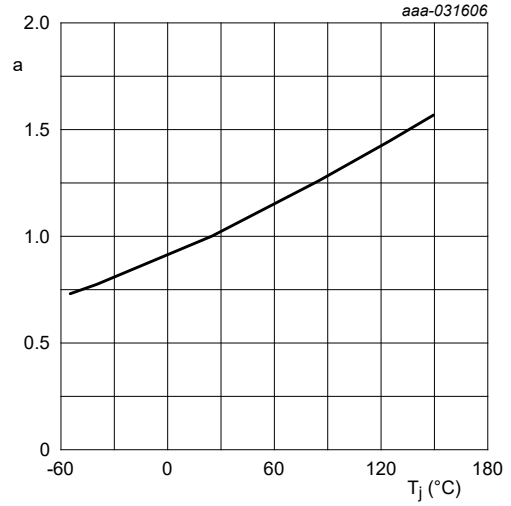


Fig. 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values



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

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

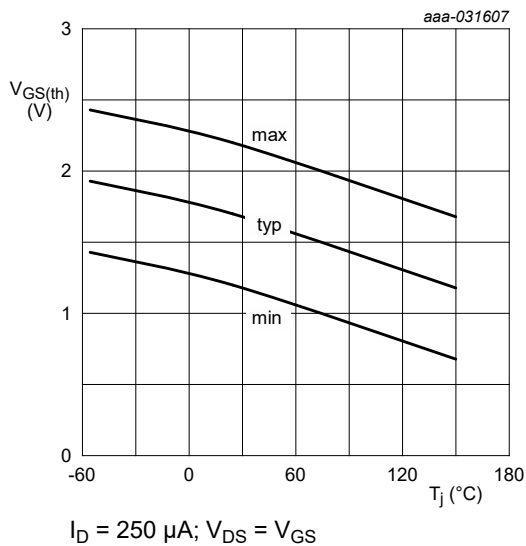


Fig. 12. Gate-source threshold voltage as a function of junction temperature

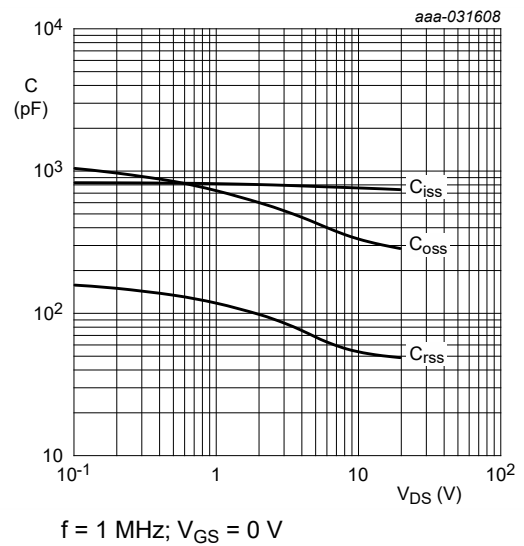
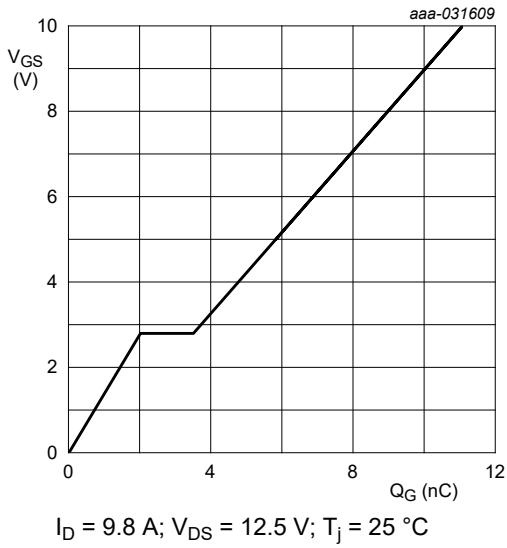
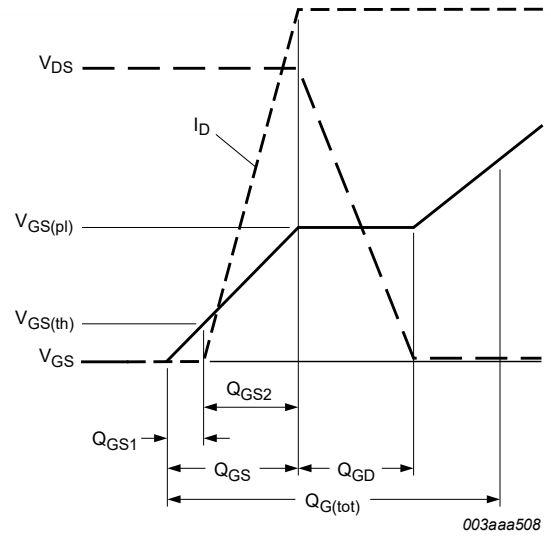


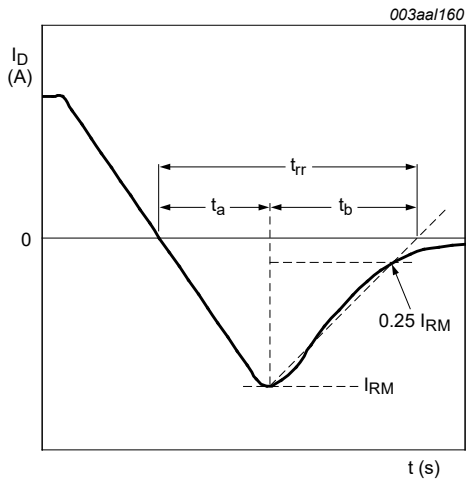
Fig. 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



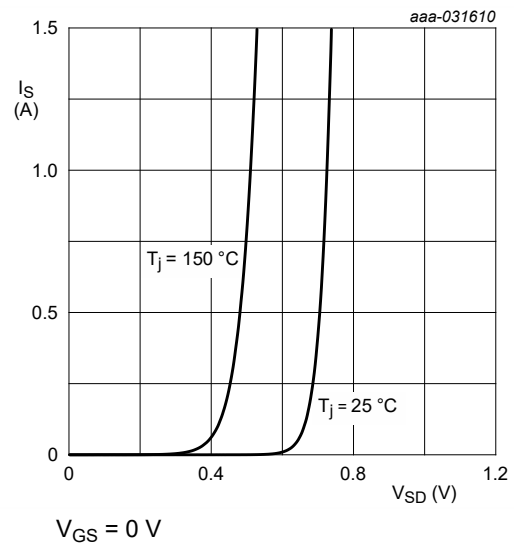
**Fig. 14. Gate-source voltage as a function of gate charge; typical values**



**Fig. 15. Gate charge waveform definitions**



**Fig. 16. Reverse recovery timing definition**



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

11. Test information

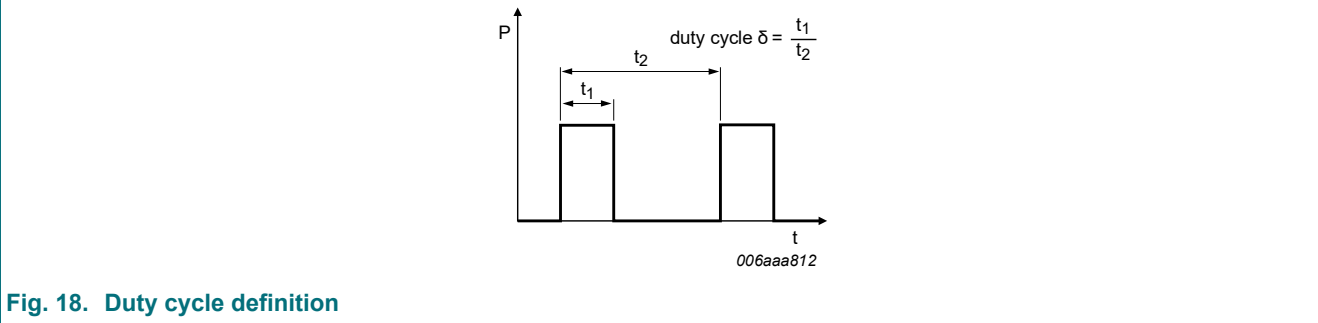
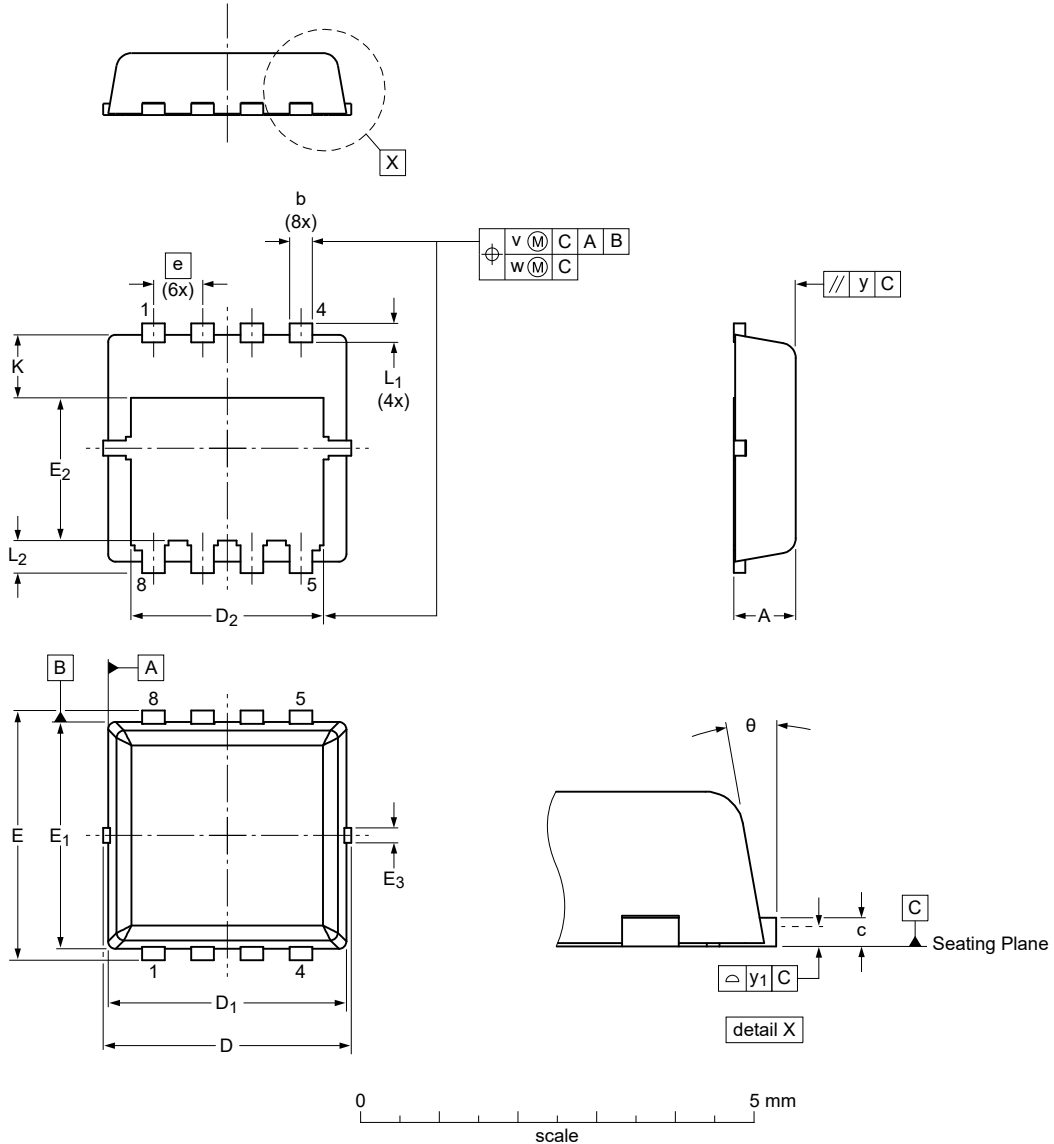


Fig. 18. Duty cycle definition

12. Package outline

MLPAK33: plastic thermal enhanced surface mounted package; mini leads; 8 terminals;  
pitch 0.65 mm; 3.3 x 3.3 x 0.8 mm body

SOT8002-1



Dimensions (mm are the original dimensions)

Unit	A	b	c	D	D <sub>1</sub>	D <sub>2</sub>	e	E	E <sub>1</sub>	E <sub>2</sub>	E <sub>3</sub>	K	L <sub>1</sub>	L <sub>2</sub>	θ	y	y <sub>1</sub>	v	w
max	0.90	0.35	0.18	3.50	3.25	2.65		3.50	3.10	1.99	0.25		0.40	0.58	12°				
mm nom	0.80	0.30	0.15	3.30	3.15	2.55	0.65	3.30	3.00	1.89	0.20	0.65 (ref)	0.25	0.43	10°	0.05	0.05	0.1	0.05
min	0.70	0.25	0.12	3.10	3.05	2.45		3.10	2.90	1.79	0.15		0.10	0.28	8°				

sot8002-1\_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	EIAJ			
SOT8002-1						19-12-19 20-01-09

Fig. 19. Package outline MLPAK33 (SOT8002-1)

### 13. Soldering

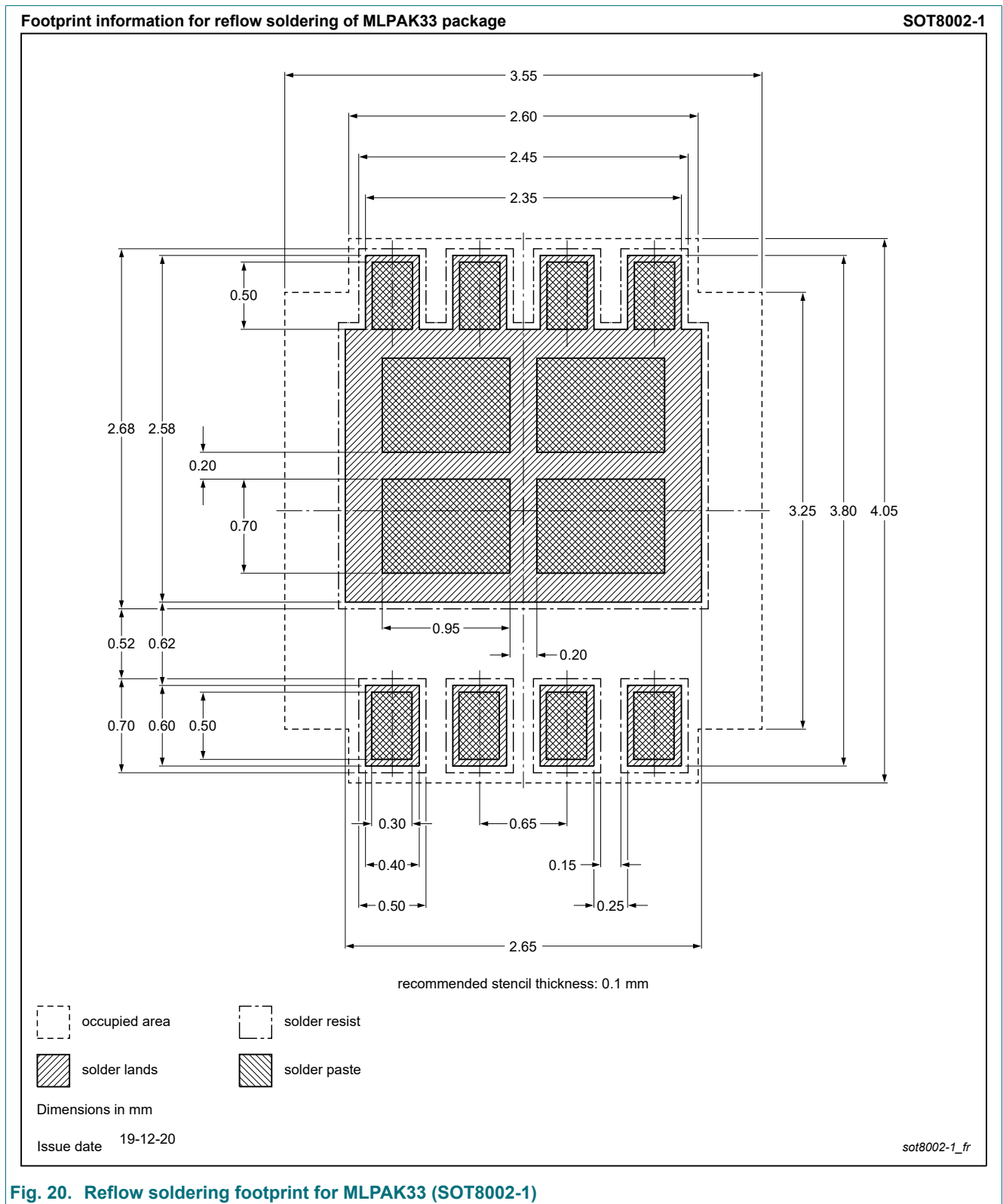


Fig. 20. Reflow soldering footprint for MLPAK33 (SOT8002-1)

## 14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PXN7R7-25QL v.1	20201102	Product data sheet	-	-

## 15. Legal information

### 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.
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Date of release: 2 November 2020

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