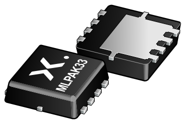

PXN6R7-30QL

30 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 °C		-	-	30	V
V_{GS}	gate-source voltage			-20	-	20	V
I_D	drain current	V_{GS} = 10 V; T_{amb} = 25 °C; t ≤ 5 s	[1]	-	-	21.5	A
Static characteristics							
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 12.7 A; T_j = 25 °C		-	5.7	6.7	mΩ
		V_{GS} = 4.5 V; I_D = 11.2 A; T_j = 25 °C		-	6.9	8.6	mΩ
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	V_{DS} = 15 V; I_D = 11.2 A; V_{GS} = 4.5 V; T_j = 25 °C		-	7.9	11.9	nC

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

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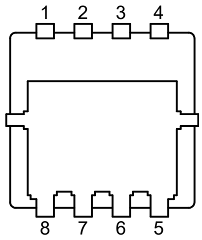
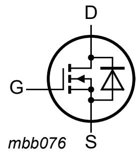
5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S	source	 **MLPAK33 (SOT8002-1)**	
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
PXN6R7-30QL	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
PXN6R7-30QL	9AF

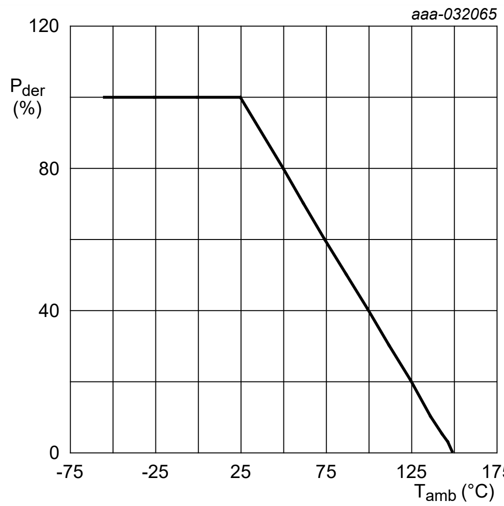
8. Limiting values

Table 5. Limiting values

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

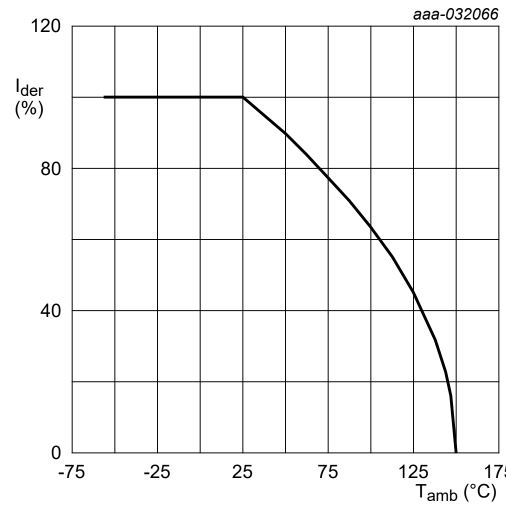
Symbol	Parameter	Conditions		Min	Max	Unit
V_{DS}	drain-source voltage	T_j = 25 °C		-	30	V
V_{GS}	gate-source voltage			-20	20	V
I_D	drain current	V_{GS} = 10 V; T_{amb} = 25 °C; t ≤ 5 s	[1]	-	21.5	A
		V_{GS} = 10 V; T_{amb} = 25 °C	[1]	-	12.7	A
		V_{GS} = 10 V; T_{amb} = 100 °C	[1]	-	8	A
		V_{GS} = 10 V; T_{sp} = 25 °C		-	62	A
I_{DM}	peak drain current	T_{amb} = 25 °C; single pulse; t_p ≤ 10 µs		-	87	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; t ≤ 5 s	[1]	-	4.8	W
		T_{amb} = 25 °C	[1]	-	1.7	W
		T_{sp} = 25 °C		-	40.3	W
T_j	junction temperature			-55	150	°C
T_{amb}	ambient temperature			-55	150	°C
T_{stg}	storage temperature			-65	150	°C
Source-drain diode						
I_S	source current	T_{amb} = 25 °C	[1]	-	1.5	A
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$T_{j(init)}$ = 25 °C; I_D = 2.3 A; DUT in avalanche (unclamped)		-	34.5	mJ

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



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

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



$$I_{der} = \frac{I_D}{I_{D(25\,°C)}} \times 100\,\%$$

Fig. 2. Normalized continous drain current as a function of ambient temperature

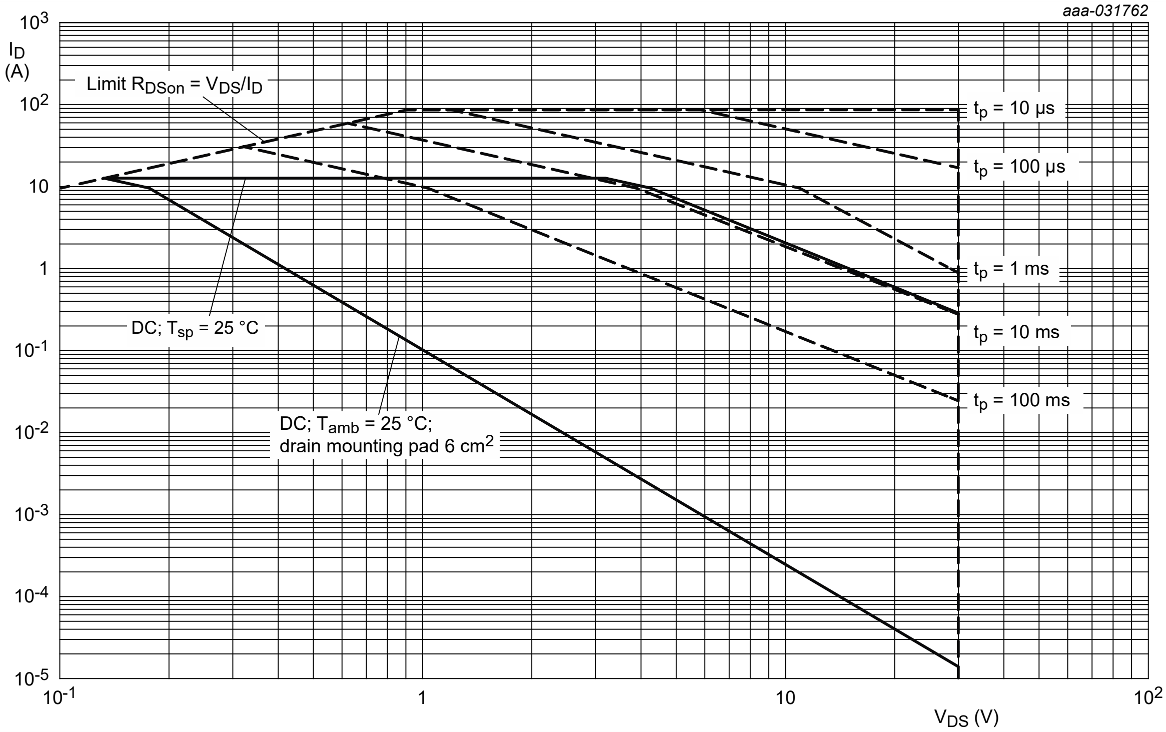


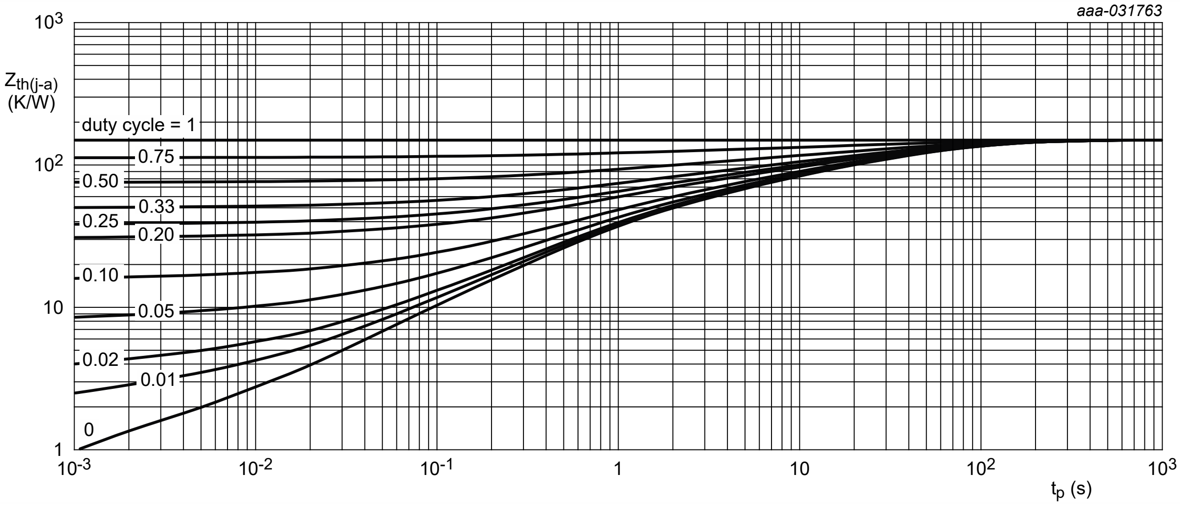
Fig. 3. Safe operating area; junction to ambient; continuous and peak drain currents as a function of drain-source voltage

9. Thermal characteristics

Table 6. Thermal characteristics

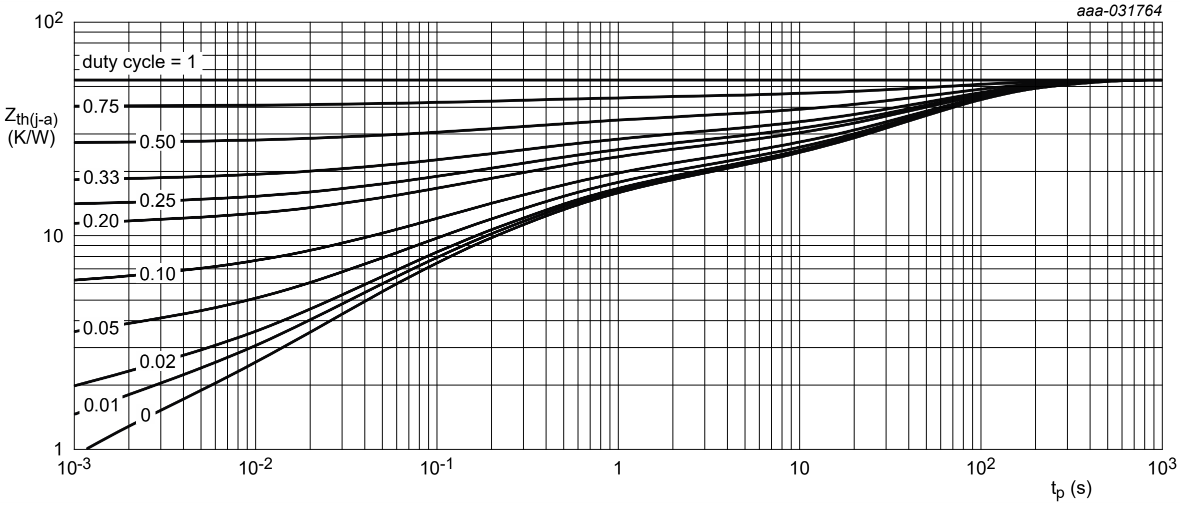
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	150	190	K/W
			[2]	-	60	75	K/W
		in free air; t ≤ 5 s	[2]	-	21	26	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	2.1	3.1	K/W

[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^2.



FR4 PCB, standard footprint

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



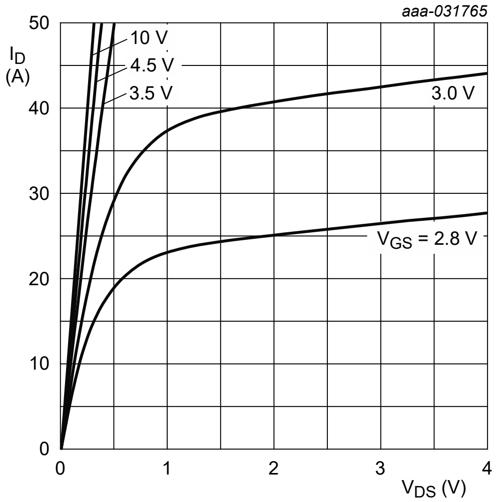
FR4 PCB, mounting pad for drain 6 cm^2

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

10. Characteristics

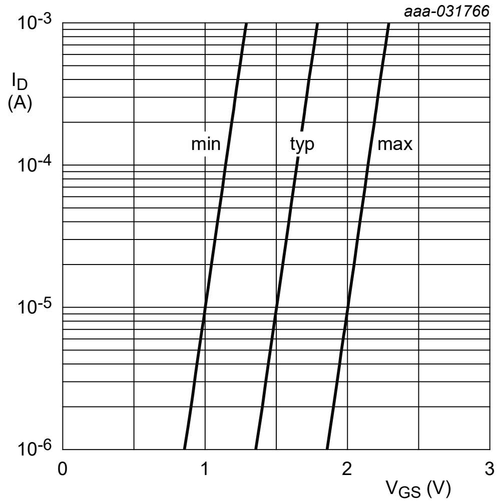
Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 250 μA; V_{GS} = 0 V; T_j = 25 °C		30	-	-	V
V_{GSth}	gate-source threshold voltage	I_D = 250 μA; V_{DS} = V_{GS}; T_j = 25 °C		1.2	1.7	2.2	V
I_{DSS}	drain leakage current	V_{DS} = 30 V; V_{GS} = 0 V; T_j = 25 °C		-	-	1	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} = 10 V; I_D = 12.7 A; T_j = 25 °C		-	5.7	6.7	mΩ
		V_{GS} = 10 V; I_D = 12.7 A; T_j = 150 °C		-	8.8	10.4	mΩ
		V_{GS} = 4.5 V; I_D = 11.2 A; T_j = 25 °C		-	6.9	8.6	mΩ
g_{fs}	forward transconductance	V_{DS} = 10 V; I_D = 12.7 A; T_j = 25 °C		-	33	-	S
R_G	gate resistance	f = 1 MHz		-	1.2	-	Ω
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	V_{DS} = 15 V; I_D = 12.7 A; V_{GS} = 10 V; T_j = 25 °C		-	16.5	24.8	nC
		V_{DS} = 15 V; I_D = 11.2 A; V_{GS} = 4.5 V; T_j = 25 °C		-	7.9	11.9	nC
Q_{GS}	gate-source charge			-	2.8	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge			-	1.7	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge			-	1.1	-	nC
Q_{GD}	gate-drain charge			-	2.1	-	nC
V_{GSpl}	gate-source plateau voltage	V_{DS} = 15 V; I_D = 11.2 A; T_j = 25 °C		-	2.6	-	V
C_{iss}	input capacitance	V_{DS} = 15 V; f = 1 MHz; V_{GS} = 0 V; T_j = 25 °C		-	1150	-	pF
C_{oss}	output capacitance			-	380	-	pF
C_{rss}	reverse transfer capacitance			-	66	-	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 15 V; I_D = 11.2 A; V_{GS} = 4.5 V; $R_{G(ext)}$ = 5 Ω; T_j = 25 °C		-	5	-	ns
t_r	rise time			-	8	-	ns
$t_{d(off)}$	turn-off delay time			-	6	-	ns
t_f	fall time			-	3	-	ns
Source-drain diode							
V_{SD}	source-drain voltage	I_S = 1.5 A; V_{GS} = 0 V; T_j = 25 °C		-	0.7	1.2	V
t_{rr}	reverse recovery time	I_S = 1.5 A; dI_S/dt = -100 A/μs; V_{GS} = 4.5 V; V_{DS} = 15 V; T_j = 25 °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



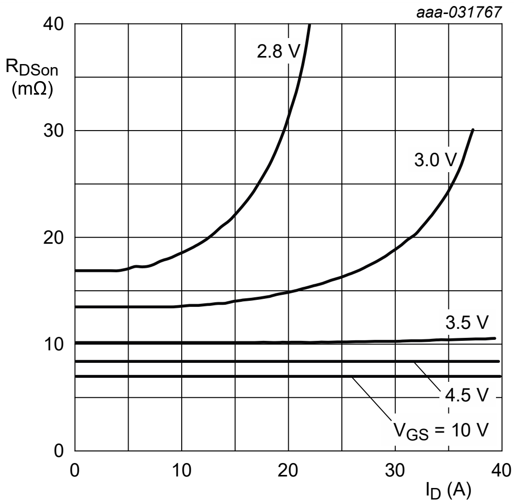
T_j = 25 °C

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



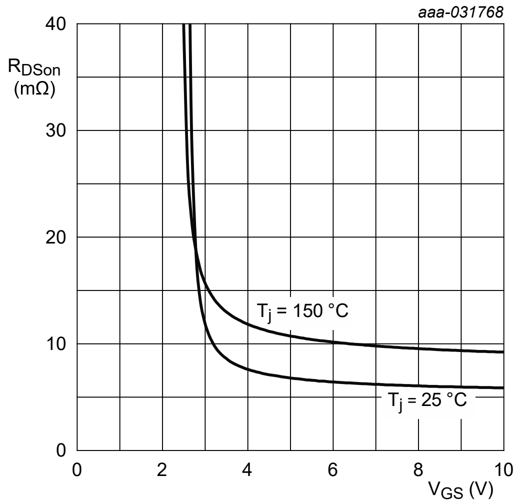
T_j = 25 °C; V_{DS} = 5 V

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



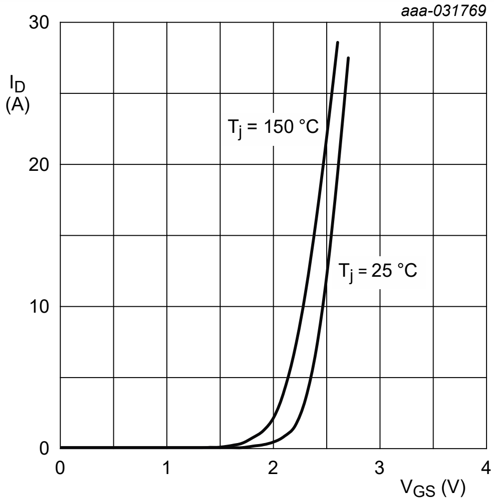
T_j = 25 °C

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



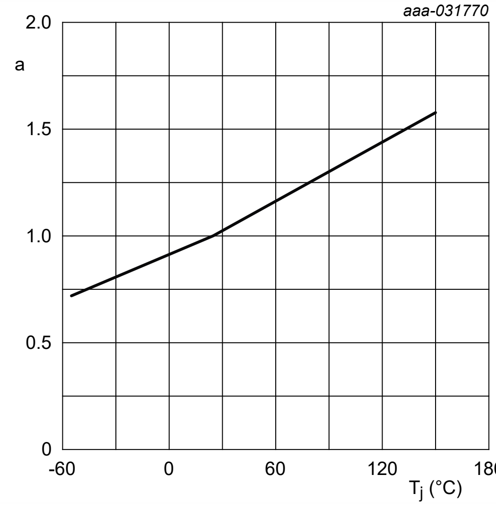
I_D = 12.7 A

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



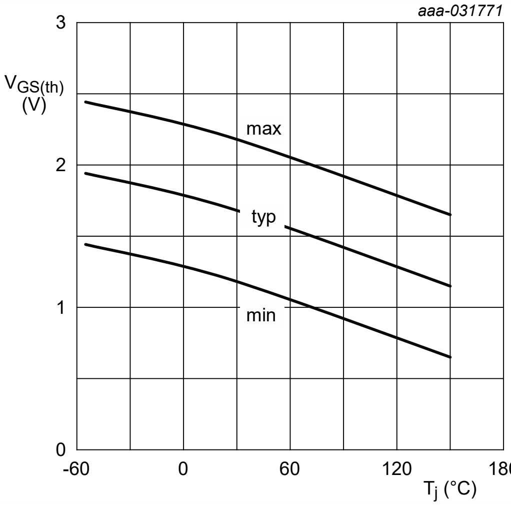
V_{DS} = 10 V

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



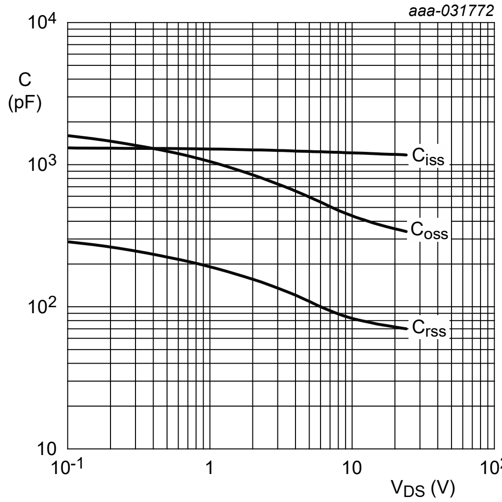
$$a = \frac{R_{DSon}}{R_{DSon(25°C)}}$$

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



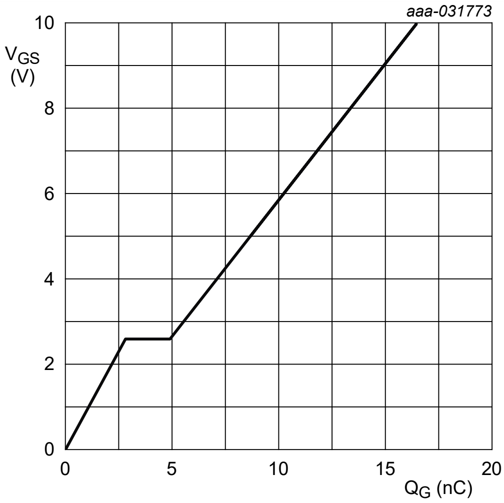
I_D = 250 µA; V_{DS} = V_{GS}

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



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

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



I_D = 11.2 A; V_{DS} =15 V; T_j = 25 °C

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

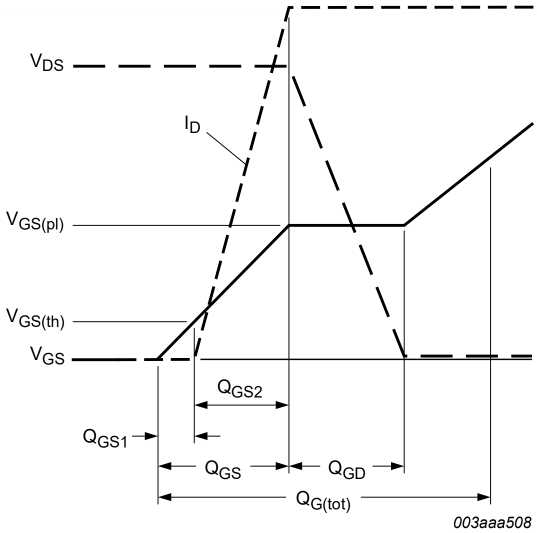


Fig. 15. Gate charge waveform definitions

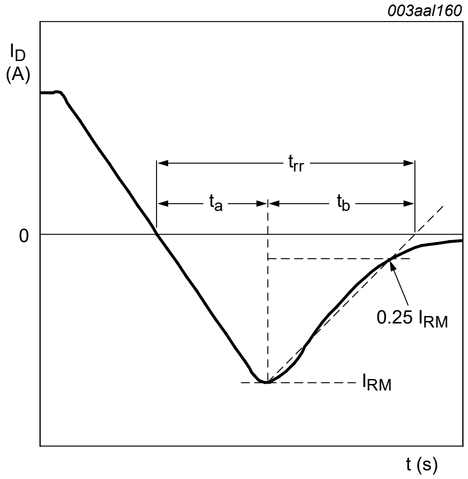
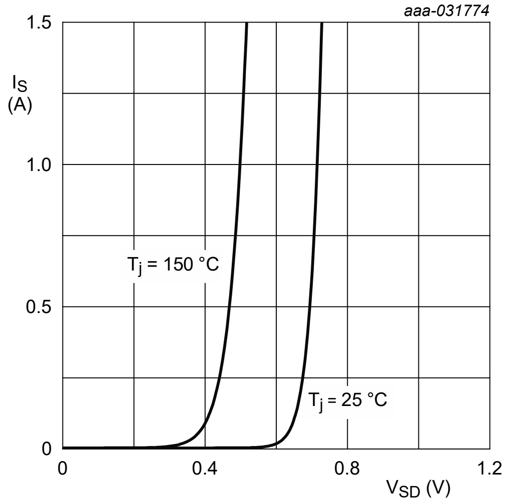


Fig. 16. Reverse recovery timing definition



V_{GS} = 0 V

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

11. Test information

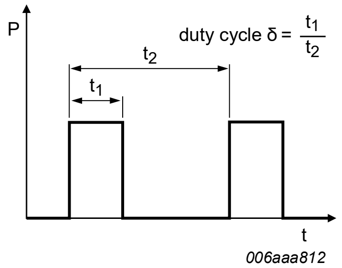
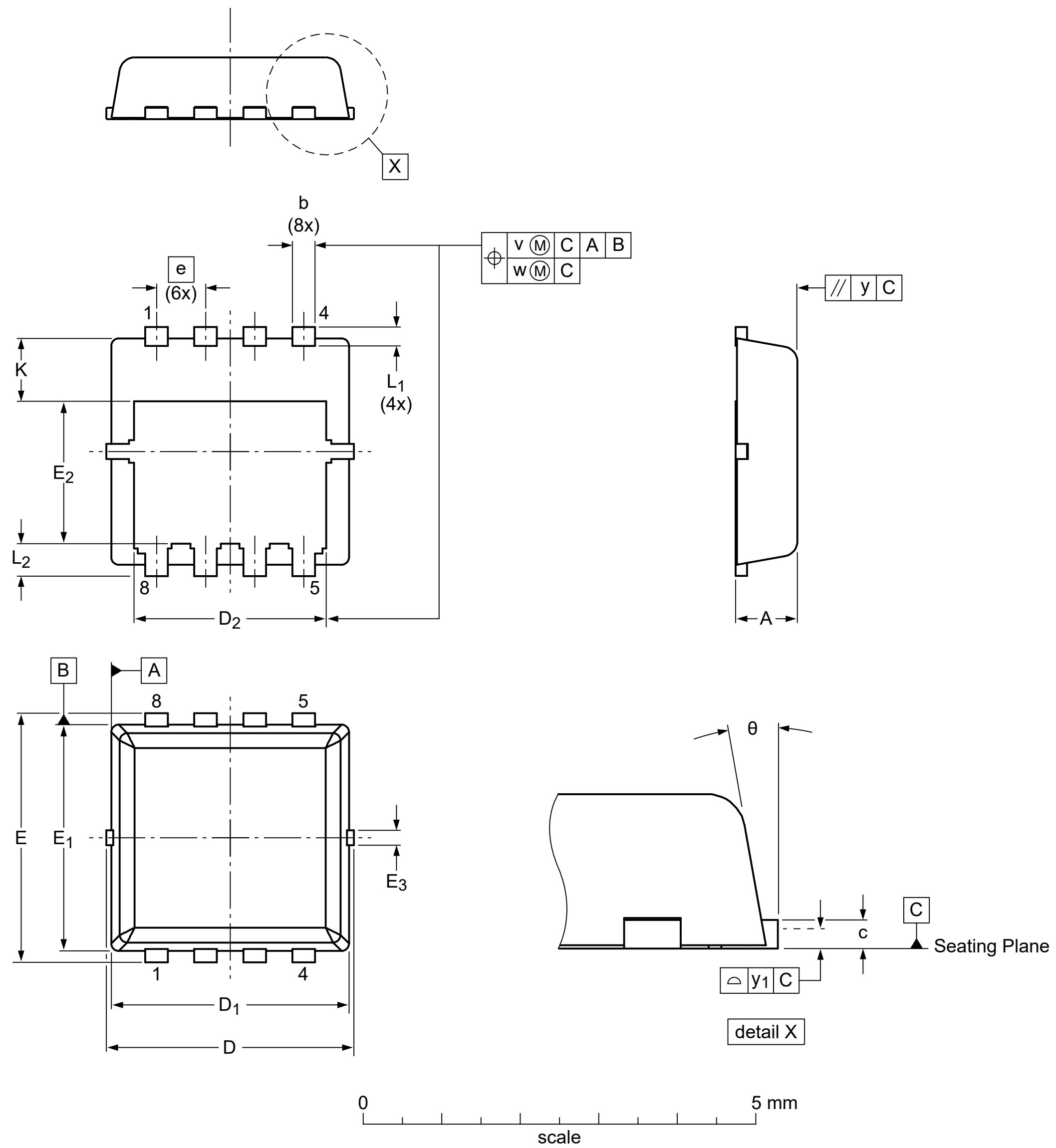


Fig. 18. Duty cycle definition

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_1	D_2	e	E	E_1	E_2	E_3	K	L_1	L_2	θ	y	y_1	v	w
mm	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°				
	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

Footprint information for reflow soldering of MLPAK33 package SOT8002-1

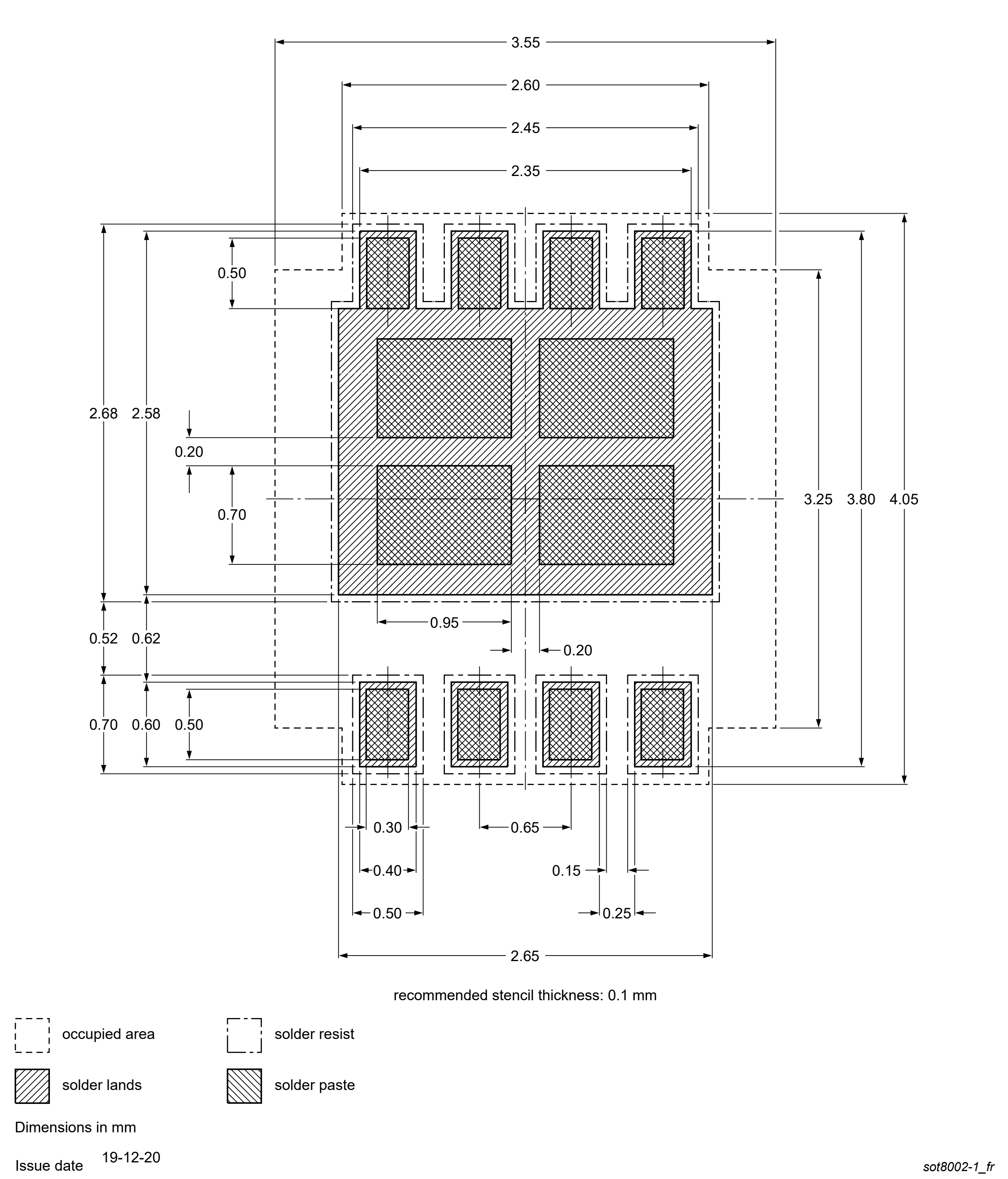


Fig. 20. Reflow soldering footprint for MLPAK33 (SOT8002-1)

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PXN6R7-30QL 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.
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".
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Date of release: 2 November 2020