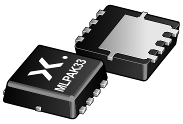


PXN012-60QL

N-channel 60 V, 11.5 mOhm, logic level Trench MOSFET in MLPAK33

8 July 2021 Product data sheet

1. General description

General purpose, 42 A rated, logic level N-channel enhancement mode Power MOSFET in MLPAK33 package.

2. Features and benefits

- Logic level compatibility
- Trench MOSFET technology
- Thermally efficient package in a small form factor (3.3 mm x 3.3 mm footprint)

3. Applications

- Secondary side synchronous rectification
- DC-to-DC converters
- Motor drive
- LED lighting
- Load switching
- Auxiliary control
- Fan control

4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DS}	drain-source voltage	25 °C ≤ T_j ≤ 150 °C		-	-	60	V
I_D	drain current	V_{GS} = 10 V; T_{sp} = 25 °C; Fig. 2		-	-	42	A
P_{tot}	total power dissipation	T_{sp} = 25 °C; Fig. 1		-	-	34.7	W
T_j	junction temperature			-55	-	150	°C
Static characteristics							
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 10 A; T_j = 25 °C; Fig. 9		-	9.8	11.5	mΩ
		V_{GS} = 4.5 V; I_D = 10 A; T_j = 25 °C; Fig. 9		-	14	17.6	mΩ
Dynamic characteristics							
Q_{GD}	gate-drain charge	I_D = 10 A; V_{DS} = 30 V; V_{GS} = 4.5 V; T_j = 25 °C; Fig. 11; Fig. 12		-	4.3	-	nC
$Q_{G(tot)}$	total gate charge			-	9.64	-	nC
Avalanche ruggedness							
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	I_D = 3.5 A; $T_{j(init)}$ = 25 °C; unclamped	[1]	-	-	90	mJ

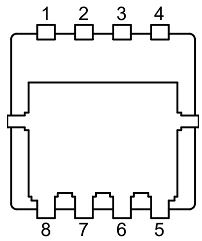
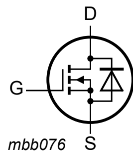
nexperia

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Source-drain diode							
Q_r	recovered charge	I_S = 10 A; dI_S/dt = -100 A/µs; V_{GS} = 0 V; V_{DS} = 30 V; T_j = 25 °C; Fig. 15	[2]	-	13	-	nC

[1] Protected by 100% test
[2] includes capacitive recovery

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
PXN012-60QL	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
PXN012-60QL	7AB

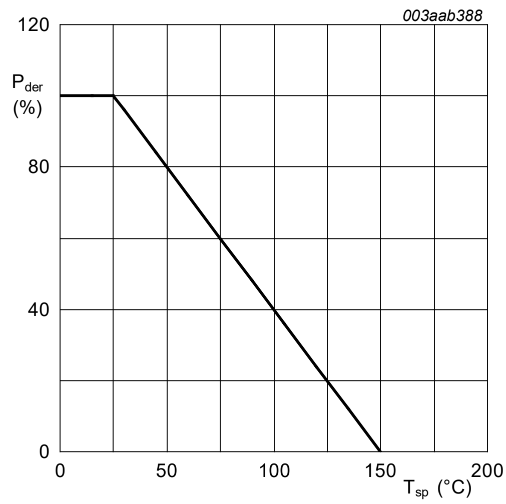
8. Limiting values

Table 5. Limiting values

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

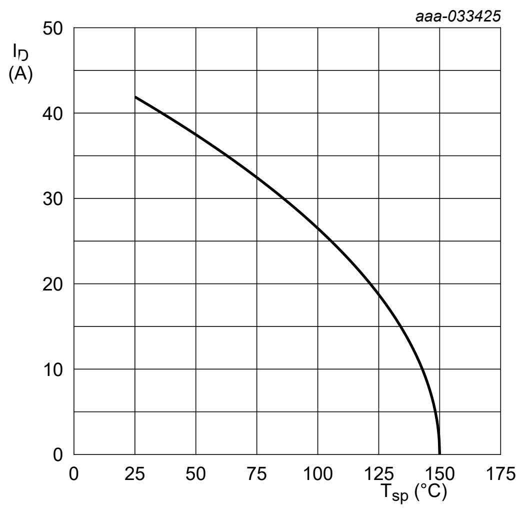
Symbol	Parameter	Conditions		Min	Max	Unit
V_{DS}	drain-source voltage	25 °C ≤ T_j ≤ 150 °C		-	60	V
V_{GS}	gate-source voltage			-20	20	V
P_{tot}	total power dissipation	T_{sp} = 25 °C; Fig. 1		-	34.7	W
I_D	drain current	V_{GS} = 10 V; T_{sp} = 25 °C; Fig. 2		-	42	A
		V_{GS} = 10 V; T_{sp} = 100 °C; Fig. 2		-	26	A
I_{DM}	peak drain current	pulsed; t_p ≤ 10 µs; T_{sp} = 25 °C; Fig. 3		-	168	A
T_{stg}	storage temperature			-55	150	°C
T_j	junction temperature			-55	150	°C
$T_{sld(M)}$	peak soldering temperature			-	260	°C
Source-drain diode						
I_S	source current	T_{sp} = 25 °C		-	29	A
I_{SM}	peak source current	pulsed; t_p ≤ 10 µs; T_{sp} = 25 °C		-	168	A
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	I_D = 3.5 A; $T_{j(init)}$ = 25 °C; unclamped	[1]	-	90	mJ
I_{AS}	non-repetitive avalanche current	$T_{j(init)}$ = 25 °C	[1]	-	3.5	A

[1] Protected by 100% test



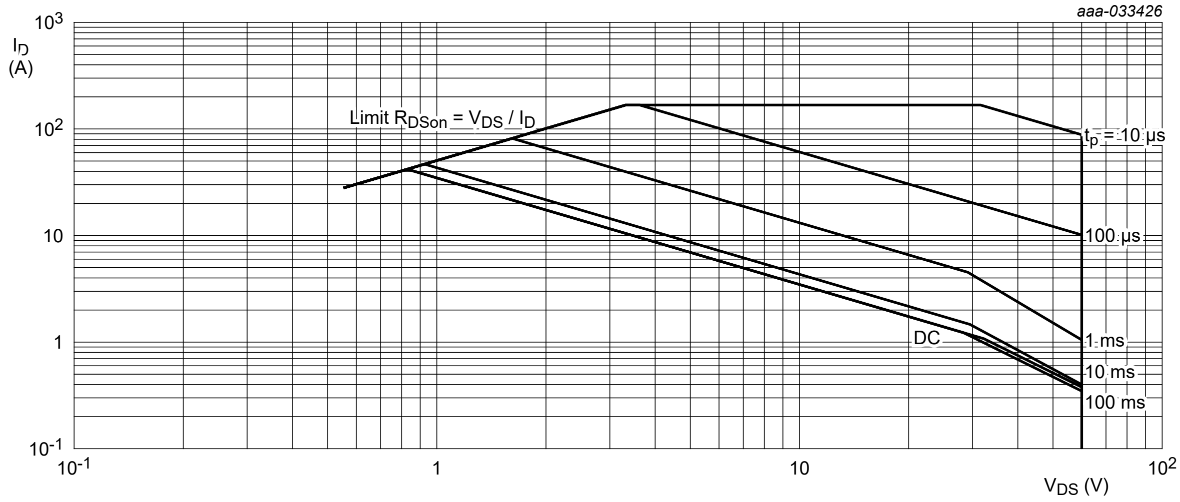
$$P_{der} = \frac{P_{tot}}{P_{tot(25°C)}} \times 100\,\%$$

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



V_{GS} ≥ 10 V

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



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	Typ	Max	Unit
$R_{th(j-sp)}$	thermal resistance from junction to solder point	Fig. 4		-	3	3.6	K/W

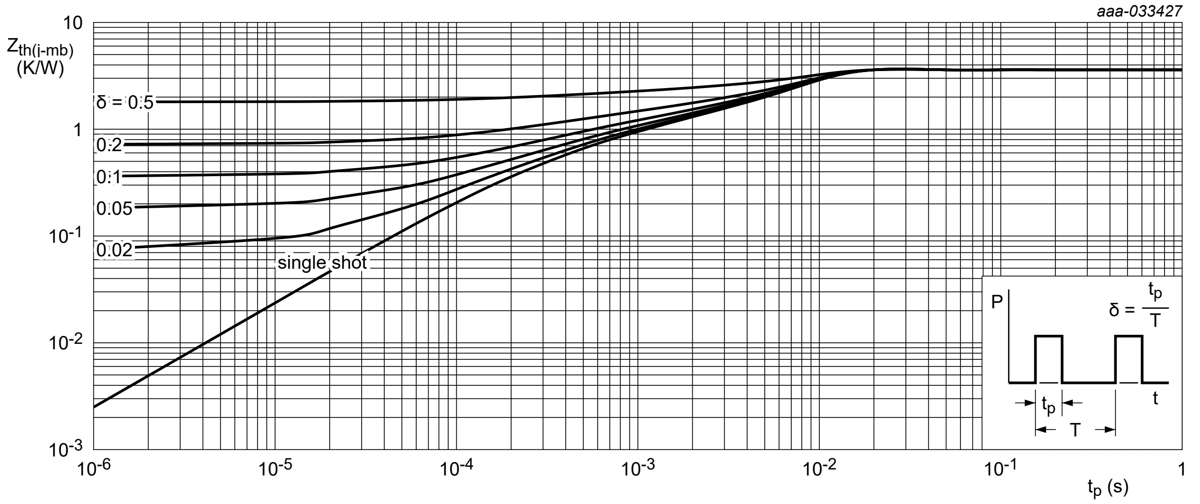


Fig. 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

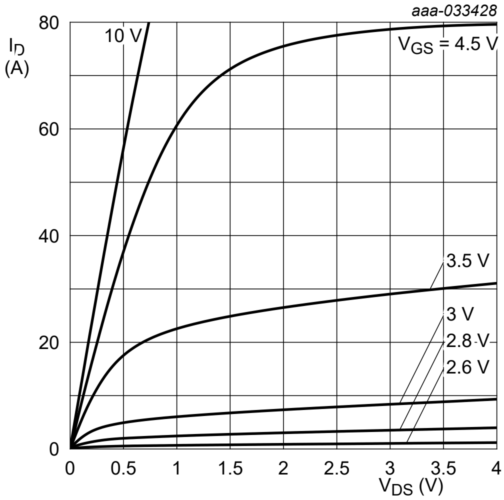
10. Characteristics

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		60	70	-	V
		I_D = 250 µA; V_{GS} = 0 V; T_j = -55 °C		-	64	-	V
$V_{GS(th)}$	gate-source threshold voltage	I_D = 1 mA; V_{DS}=V_{GS}; T_j = 25 °C; Fig. 8		1.5	1.9	2.5	V
		I_D = 1 mA; V_{DS}=V_{GS}; T_j = 150 °C		0.9	-	-	V
		I_D = 1 mA; V_{DS}=V_{GS}; T_j = -55 °C		-	-	2.9	V
$\Delta V_{GS(th)}/\Delta T$	gate-source threshold voltage variation with temperature	25 °C ≤ T_j ≤ 150 °C		-	-4.7	-	mV/K
I_{DSS}	drain leakage current	V_{DS} = 60 V; V_{GS} = 0 V; T_j = 25 °C		-	0.01	1	µA
		V_{DS} = 60 V; V_{GS} = 0 V; T_j = 150 °C		-	-	500	µA
I_{GSS}	gate leakage current	V_{GS} = 20 V; V_{DS} = 0 V; T_j = 25 °C		-	2	100	nA
		V_{GS} = -20 V; V_{DS} = 0 V; T_j = 25 °C		-	2	100	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 10 A; T_j = 25 °C; Fig. 9		-	9.8	11.5	mΩ
		V_{GS} = 10 V; I_D = 10 A; T_j = 150 °C; Fig. 10		-	-	20	mΩ
		V_{GS} = 4.5 V; I_D = 10 A; T_j = 25 °C; Fig. 9		-	14	17.6	mΩ
		V_{GS} = 4.5 V; I_D = 10 A; T_j = 150 °C; Fig. 10		-	-	30	mΩ
R_G	gate resistance	f = 1 MHz; T_j = 25 °C		-	1.66	-	Ω
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	I_D = 10 A; V_{DS} = 30 V; V_{GS} = 4.5 V; T_j = 25 °C; Fig. 11; Fig. 12		-	9.64	-	nC
		I_D = 10 A; V_{DS} = 30 V; V_{GS} = 10 V; T_j = 25 °C; Fig. 11; Fig. 12		-	18.77	-	nC
		I_D = 0 A; V_{DS} = 0 V; V_{GS} = 4.5 V; T_j = 25 °C; Fig. 11; Fig. 12		-	9.54	-	nC
Q_{GS}	gate-source charge	I_D = 10 A; V_{DS} = 30 V; V_{GS} = 4.5 V; T_j = 25 °C; Fig. 11; Fig. 12		-	3	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge			-	1.6	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge			-	1.4	-	nC
Q_{GD}	gate-drain charge			-	4.3	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	I_D = 10 A; V_{DS} = 30 V; T_j = 25 °C; Fig. 11; Fig. 12		-	3.1	-	V
C_{iss}	input capacitance	V_{DS} = 30 V; V_{GS} = 0 V; f = 1 MHz; T_j = 25 °C; Fig. 13		-	957	-	pF
C_{oss}	output capacitance			-	386	-	pF
C_{rss}	reverse transfer capacitance			-	31	-	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 30 V; R_L = 3 Ω; V_{GS} = 4.5 V; $R_{G(ext)}$ = 5 Ω; T_j = 25 °C		-	8.8	-	ns
t_r	rise time			-	18.5	-	ns
$t_{d(off)}$	turn-off delay time			-	12.2	-	ns
t_f	fall time			-	10.9	-	ns

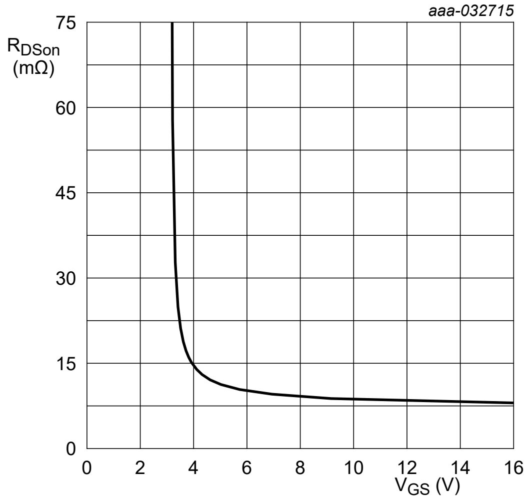
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Q_{oss}	output charge	V_{GS} = 0 V; V_{DS} = 30 V; f = 1 MHz; T_j = 25 °C		-	18	-	nC
Source-drain diode							
V_{SD}	source-drain voltage	I_S = 10 A; V_{GS} = 0 V; T_j = 25 °C; Fig. 14		-	0.82	1.2	V
t_{rr}	reverse recovery time	I_S = 10 A; dI_S/dt = -100 A/µs; V_{GS} = 0 V; V_{DS} = 30 V; T_j = 25 °C; Fig. 15		-	22.1	-	ns
Q_r	recovered charge		[1]	-	13	-	nC

[1] includes capacitive recovery



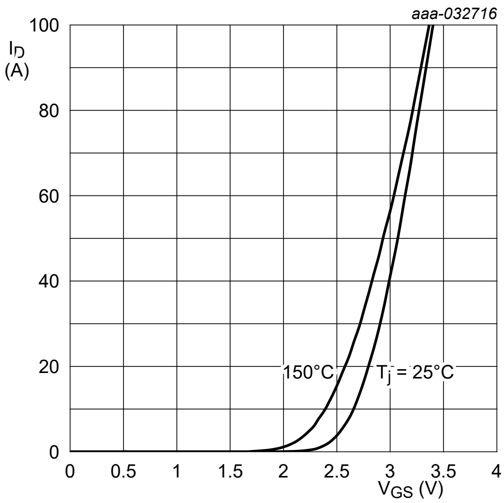
T_j = 25 °C

Fig. 5. Output characteristics; drain current as a function of drain-source voltage; typical values



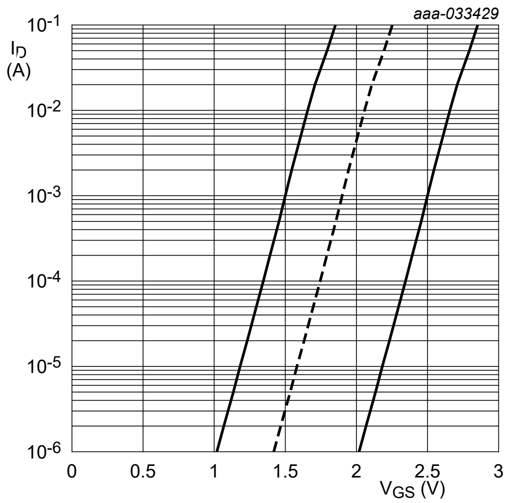
T_j = 25 °C; I_D = 10 A

Fig. 6. Drain-source on-state resistance as a function of gate-source voltage; typical values



V_{DS} = 8 V

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



T_j = 25 °C; V_{DS} = 5 V

Fig. 8. Sub-threshold drain current as a function of gate-source voltage

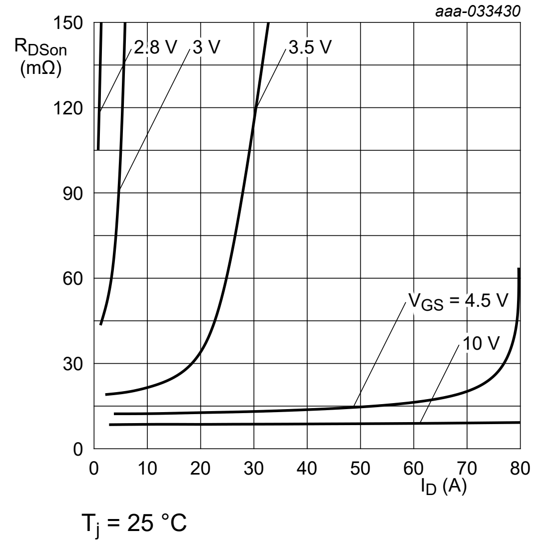
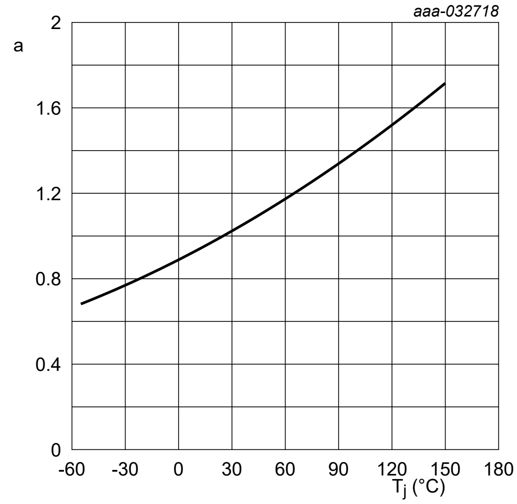


Fig. 9. Drain-source on-state resistance as a function of drain current; typical values



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

Fig. 10. Normalized drain-source on-state resistance factor as a function of junction temperature

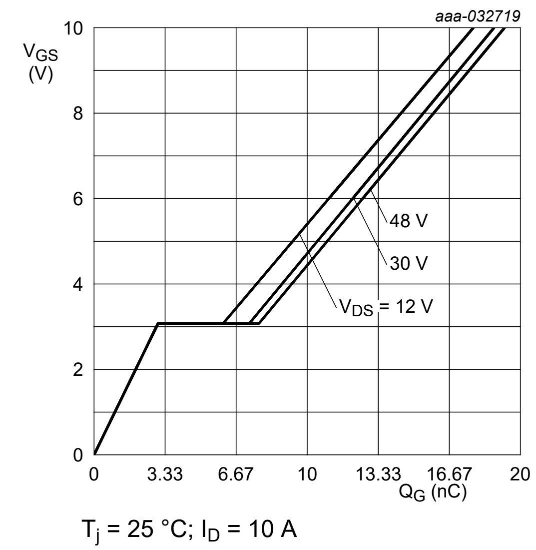


Fig. 11. Gate-source voltage as a function of gate charge; typical values

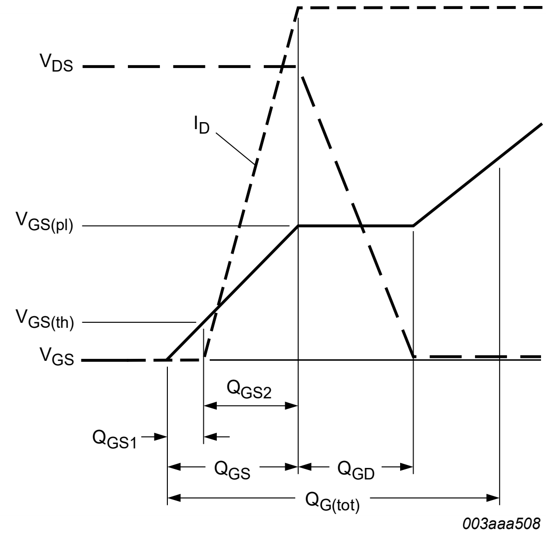
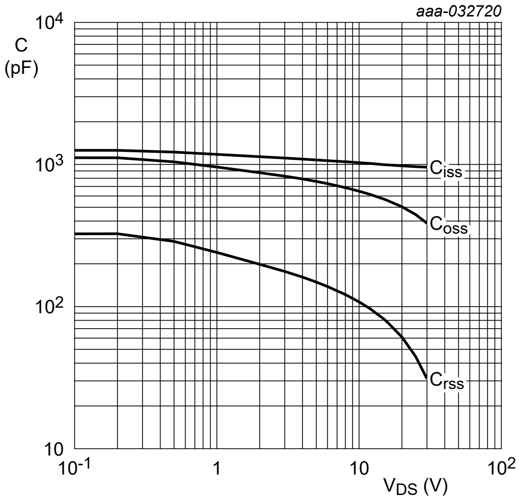
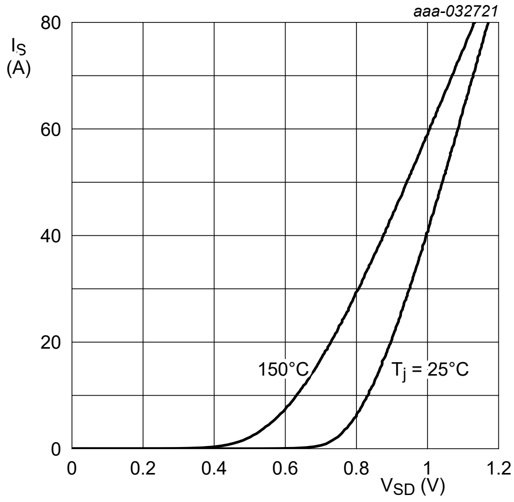


Fig. 12. Gate charge waveform definitions



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

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



V_{GS} = 0 V

Fig. 14. Source-drain (diode forward) current as a function of source-drain (diode forward) voltage; typical values

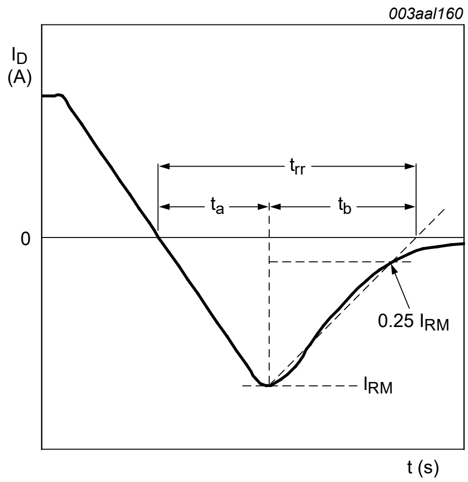
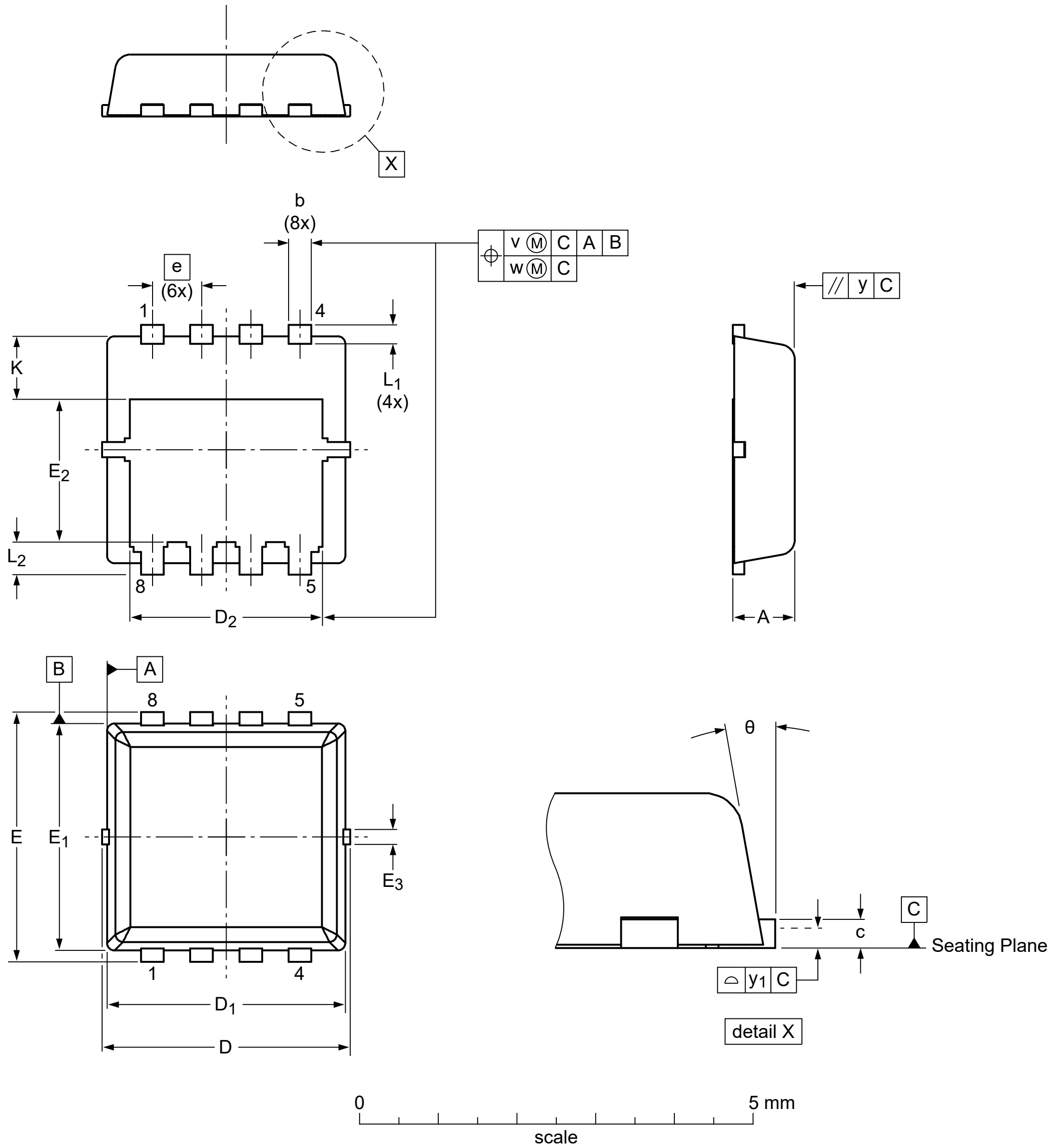


Fig. 15. Reverse recovery timing definition

11. 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. 16. Package outline MLPAK33 (SOT8002-1)

12. Soldering

Footprint information for reflow soldering of MLPAK33 package **SOT8002-1**

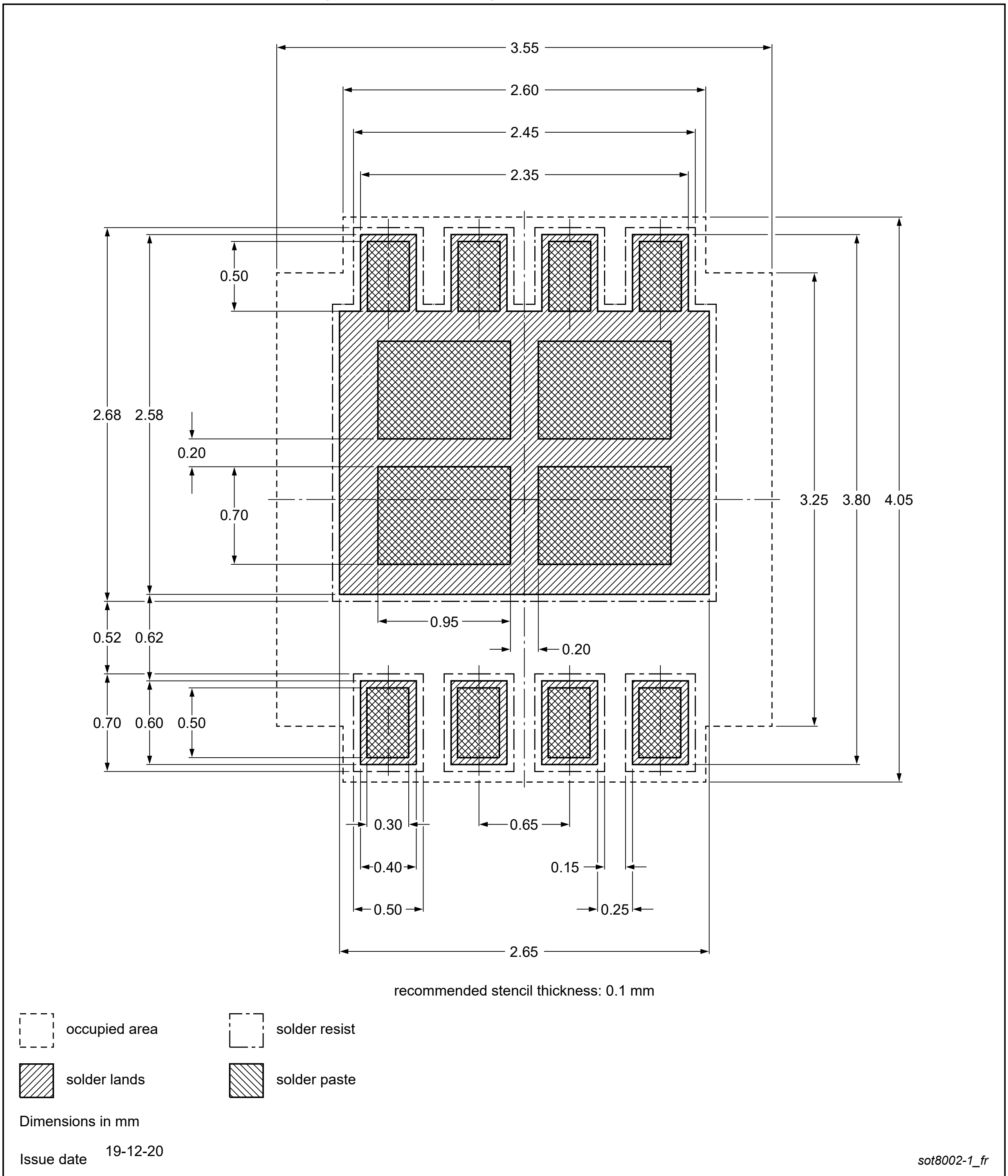


Fig. 17. Reflow soldering footprint for MLPAK33 (SOT8002-1)

13. 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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