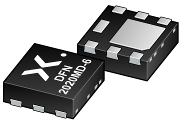


BUK6D120-60P

60 V, P-channel Trench MOSFET

3 April 2018 — Product data sheet

1. General description

P-channel enhancement mode Field-Effect Transistor (FET) in a leadless medium power DFN2020MD-6 (SOT1220) Surface-Mounted Device (SMD) plastic package using Trench MOSFET technology.

2. Features and benefits

- Extended temperature range T_j = 175 °C
- Side wettable flanks for optical solder inspection
- Small and leadless ultra thin SMD plastic package: 2 x 2 x 0.65 mm
- Trench MOSFET technology
- AEC-Q101 qualified

3. Applications

- Relay driver
- High-speed line driver
- High-side load switch
- Switching circuits

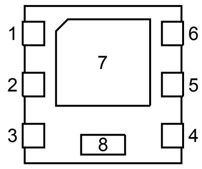
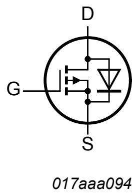
4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DS}	drain-source voltage	T_j = 25 °C		-	-	-60	V
V_{GS}	gate-source voltage			-20	-	20	V
I_D	drain current	V_{GS} = -10 V; T_{sp} = 25 °C		-	-	-8	A
P_{tot}	total power dissipation	T_{sp} = 25 °C		-	-	15	W
Static characteristics							
R_{DSon}	drain-source on-state resistance	V_{GS} = -10 V; I_D = -3 A; T_j = 25 °C		-	95	120	mΩ

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	D	drain	 Transparent top view **DFN2020MD-6 (SOT1220)**	
2	D	drain		
3	G	gate		
4	S	source		
5	D	drain		
6	D	drain		
7	D	drain		
8	S	source		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BUK6D120-60P	DFN2020MD-6	DFN2020MD-6: plastic thermal enhanced ultra thin small outline package; no leads; 6 terminals	SOT1220

7. Marking

Table 4. Marking codes

Type number	Marking code
BUK6D120-60P	4S

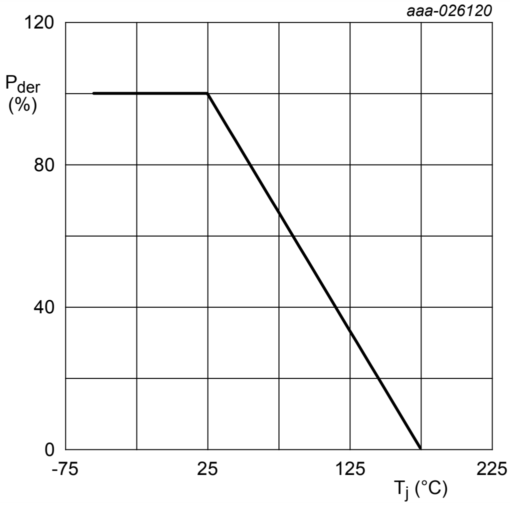
8. Limiting values

Table 5. Limiting values

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

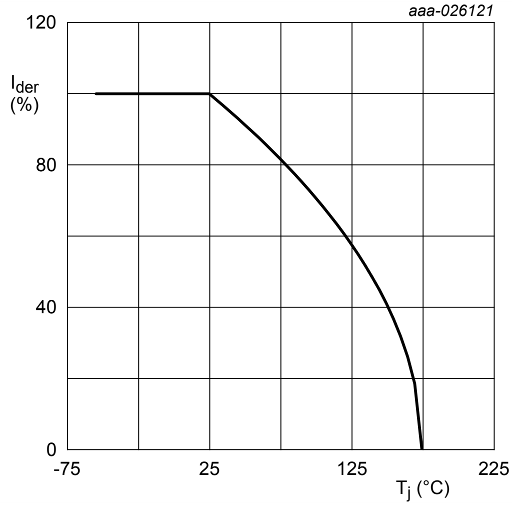
Symbol	Parameter	Conditions		Min	Max	Unit
V_{DS}	drain-source voltage	T_j = 25 °C		-	-60	V
V_{GS}	gate-source voltage			-20	20	V
I_D	drain current	V_{GS} = -10 V; T_{sp} = 25 °C		-	-8	A
		V_{GS} = -10 V; T_{sp} = 100 °C		-	-5.1	A
		V_{GS} = -10 V; T_{amb} = 25 °C	[1]	-	-3	A
I_{DM}	peak drain current	T_{sp} = 25 °C; single pulse; $t_p \leq$ 10 µs		-	-32	A
P_{tot}	total power dissipation	T_{sp} = 25 °C		-	15	W
		T_{amb} = 25 °C	[1]	-	2.3	W
T_j	junction temperature			-55	175	°C
T_{amb}	ambient temperature			-55	175	°C
T_{stg}	storage temperature			-65	175	°C
Source-drain diode						
I_S	source current	T_{sp} = 25 °C		-	-8	A
		T_{amb} = 25 °C	[1]	-	-2.3	A
I_{SM}	peak source current	single pulse; $t_p \leq$ 10 µs; T_{sp} = 25 °C		-	-32	A
ESD maximum rating						
V_{ESD}	electrostatic discharge voltage	HBM	[2]	-	500	V
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$T_{j(init)}$ = 25 °C; I_D = -0.85 A; DUT in avalanche (unclamped)		-	28	mJ

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for drain 6 cm^2.
[2] Measured between all pins.



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

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



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

Fig. 2. Normalized continuous drain current as a function of junction temperature

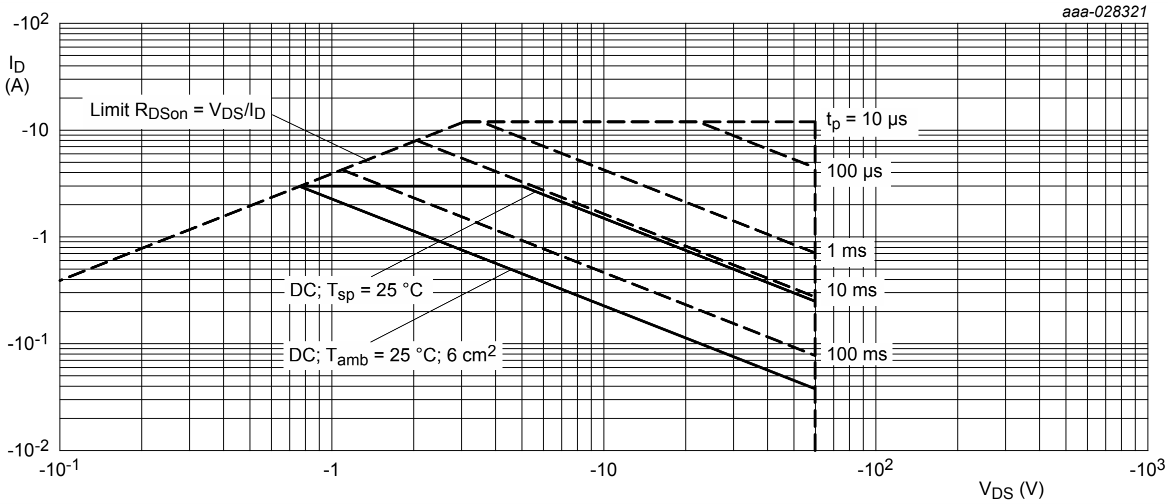


Fig. 3. Safe operating area; junction to ambient; continuous and peak drain currents as a function of drain-source voltage

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]	-	57	66	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	6	10	K/W

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

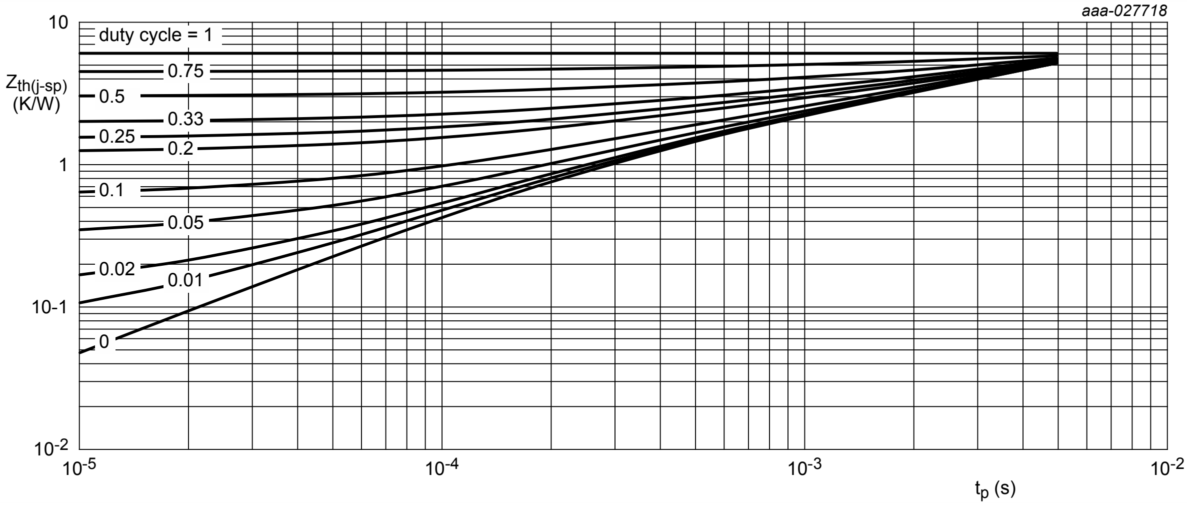
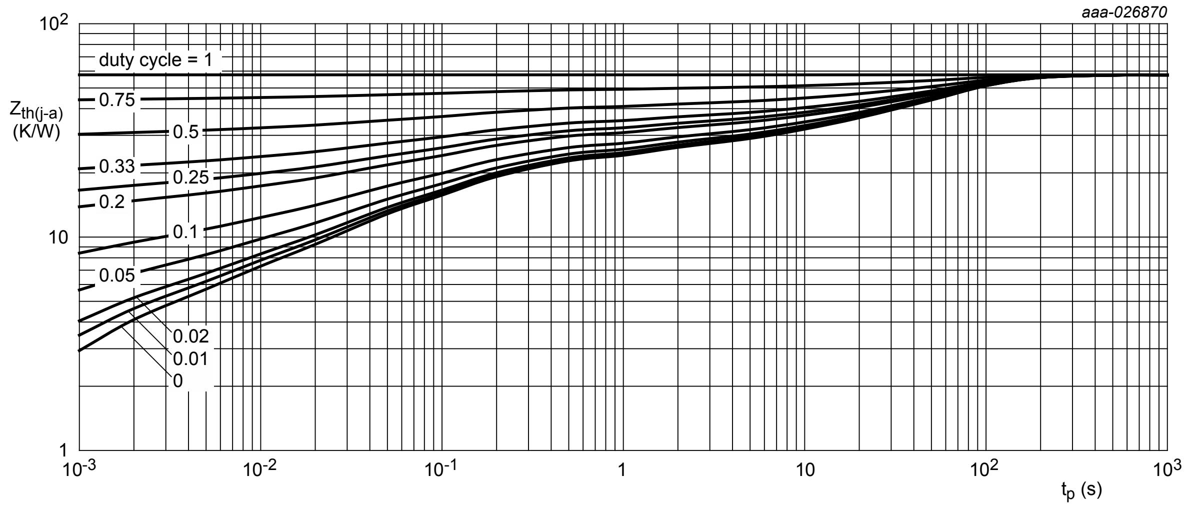


Fig. 4. Transient thermal impedance from junction to solder point as a function of pulse duration; typical values



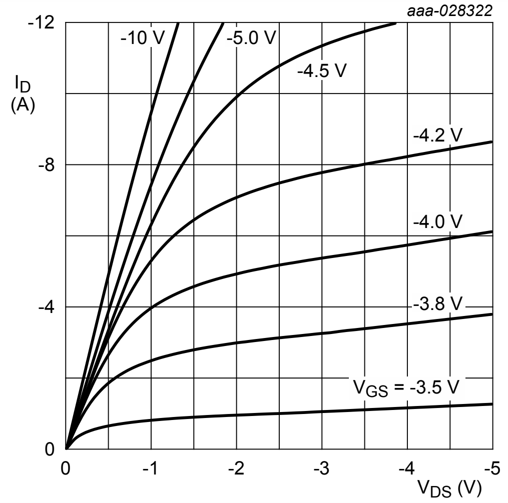
FR4 PCB, mounting pad for drain 6 cm^2

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

10. Characteristics

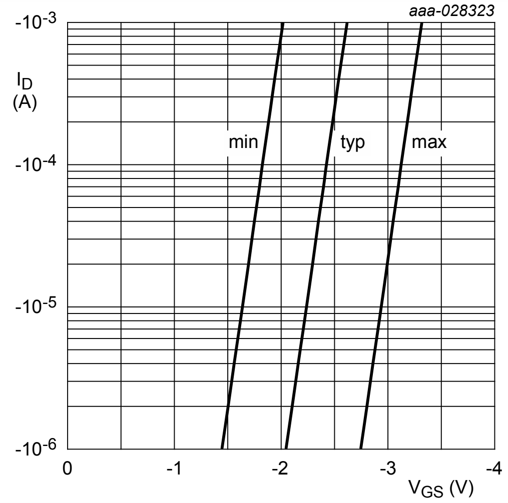
Table 7. Characteristics
T_j = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = -250 µA; V_{GS} = 0 V		-60	-	-	V
V_{GSth}	gate-source threshold voltage	I_D = -250 µA; V_{DS} = V_{GS}; T_j = 25 °C		-1.9	-2.5	-3.2	V
I_{DSS}	drain leakage current	V_{DS} = -60 V; V_{GS} = 0 V; T_j = 25 °C		-	-	-1	µA
		V_{DS} = -60 V; V_{GS} = 0 V; T_j = 175 °C		-	-	-500	µA
I_{GSS}	gate leakage current	V_{GS} = -20 V; V_{DS} = 0 V		-	-	-100	nA
		V_{GS} = 20 V; V_{DS} = 0 V		-	-	100	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = -10 V; I_D = -3 A; T_j = 25 °C		-	95	120	mΩ
		V_{GS} = -10 V; I_D = -3 A; T_j = 175 °C		-	202	256	mΩ
		V_{GS} = -4.5 V; I_D = -2.5 A		-	125	170	mΩ
g_{fs}	forward transconductance	V_{DS} = -10 V; I_D = -3 A		-	13	-	S
R_G	gate resistance	f = 1 MHz		-	8	-	Ω
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	V_{DS} = -30 V; I_D = -3 A; V_{GS} = -10 V		-	12	18	nC
Q_{GS}	gate-source charge			-	2.6	-	nC
Q_{GD}	gate-drain charge			-	2.6	-	nC
C_{iss}	input capacitance	V_{DS} = -30 V; f = 1 MHz; V_{GS} = 0 V		-	724	-	pF
C_{oss}	output capacitance			-	55	-	pF
C_{rss}	reverse transfer capacitance			-	30	-	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = -30 V; I_D = -3 A; V_{GS} = -10 V; $R_{G(ext)}$ = 6 Ω		-	9	-	ns
t_r	rise time			-	10	-	ns
$t_{d(off)}$	turn-off delay time			-	24	-	ns
t_f	fall time			-	18	-	ns
Source-drain diode							
V_{SD}	source-drain voltage	I_S = -2.3 A; V_{GS} = 0 V		-	-0.8	-1.2	V
t_{rr}	reverse recovery time	I_S = -2.3 A; dI_S/dt = 100 A/µs; V_{GS} = 0 V; V_{DS} = -30 V; T_j = 25 °C		-	24	-	ns
Q_r	recovered charge			-	24	-	nC



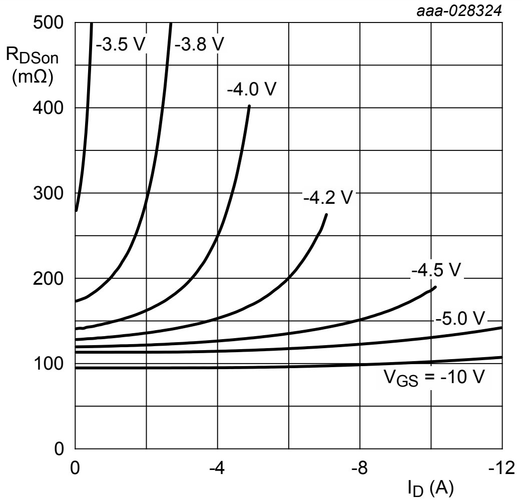
T_j = 25 °C

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



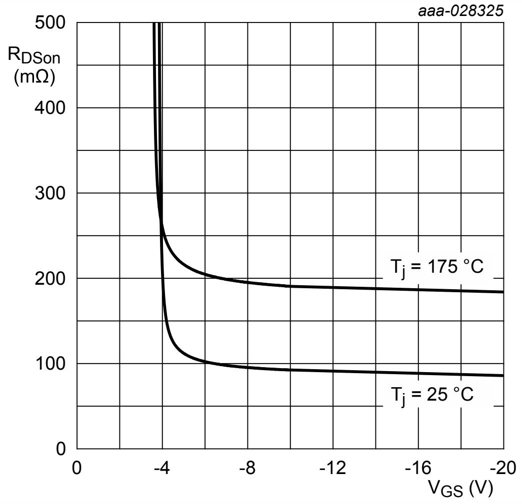
V_{DS} = -5 V; T_j = 25 °C

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



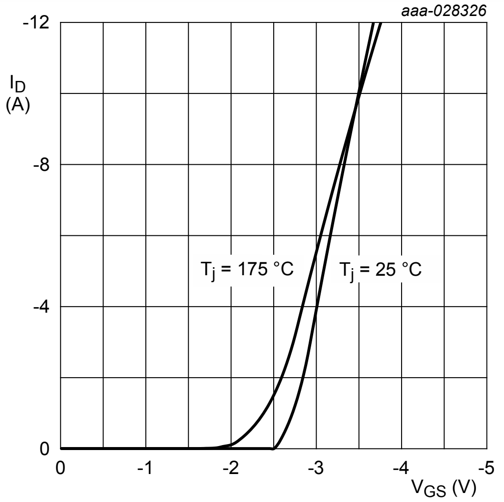
T_j = 25 °C

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



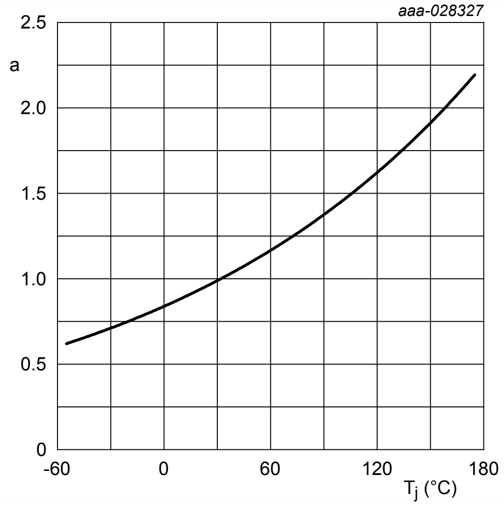
I_D = -3 A

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



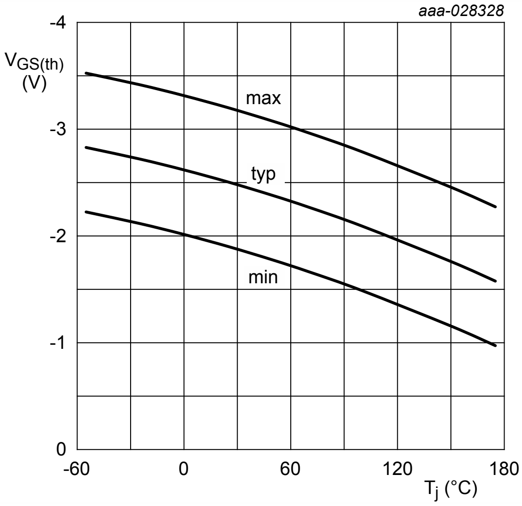
$V_{DS} > I_D \times R_{DSon}$

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



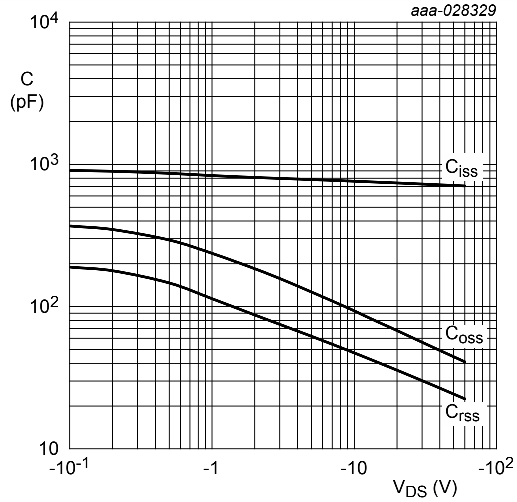
$$a = \frac{R_{DSon}}{R_{DSon(25^\circ C)}}$$

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



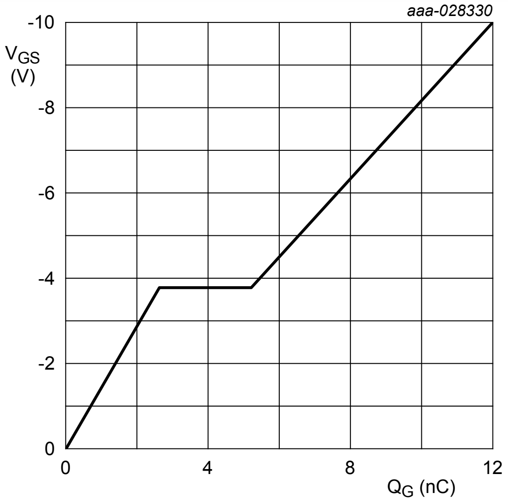
I_D = -250 µA; $V_{DS} = V_{GS}$

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



V_{DS} = -30 V; I_D = -3 A; T_{amb} = 25 °C

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

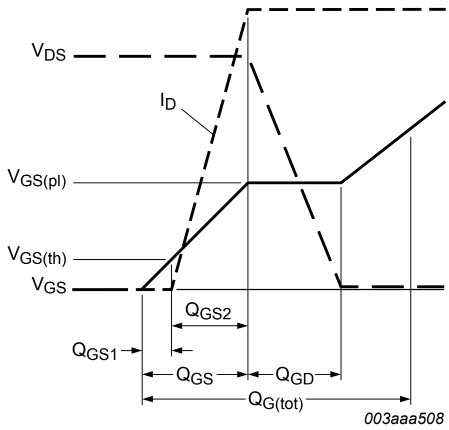
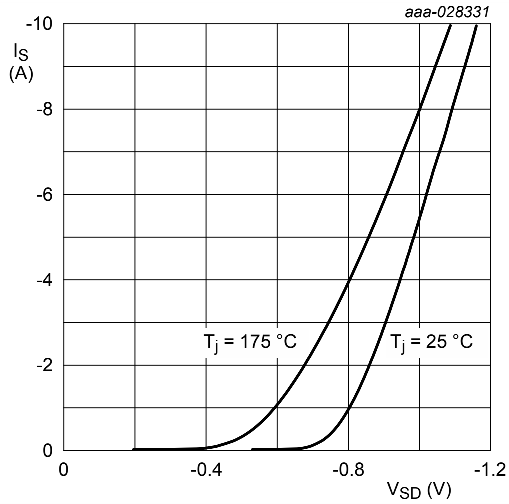


Fig. 15. Gate charge waveform definitions



V_{GS} = 0 V

Fig. 16. Source current as a function of source-drain voltage; typical values

11. Test information

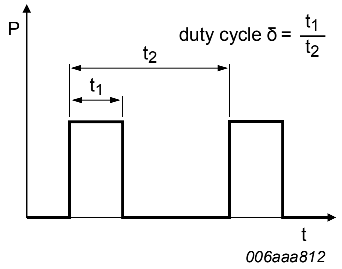


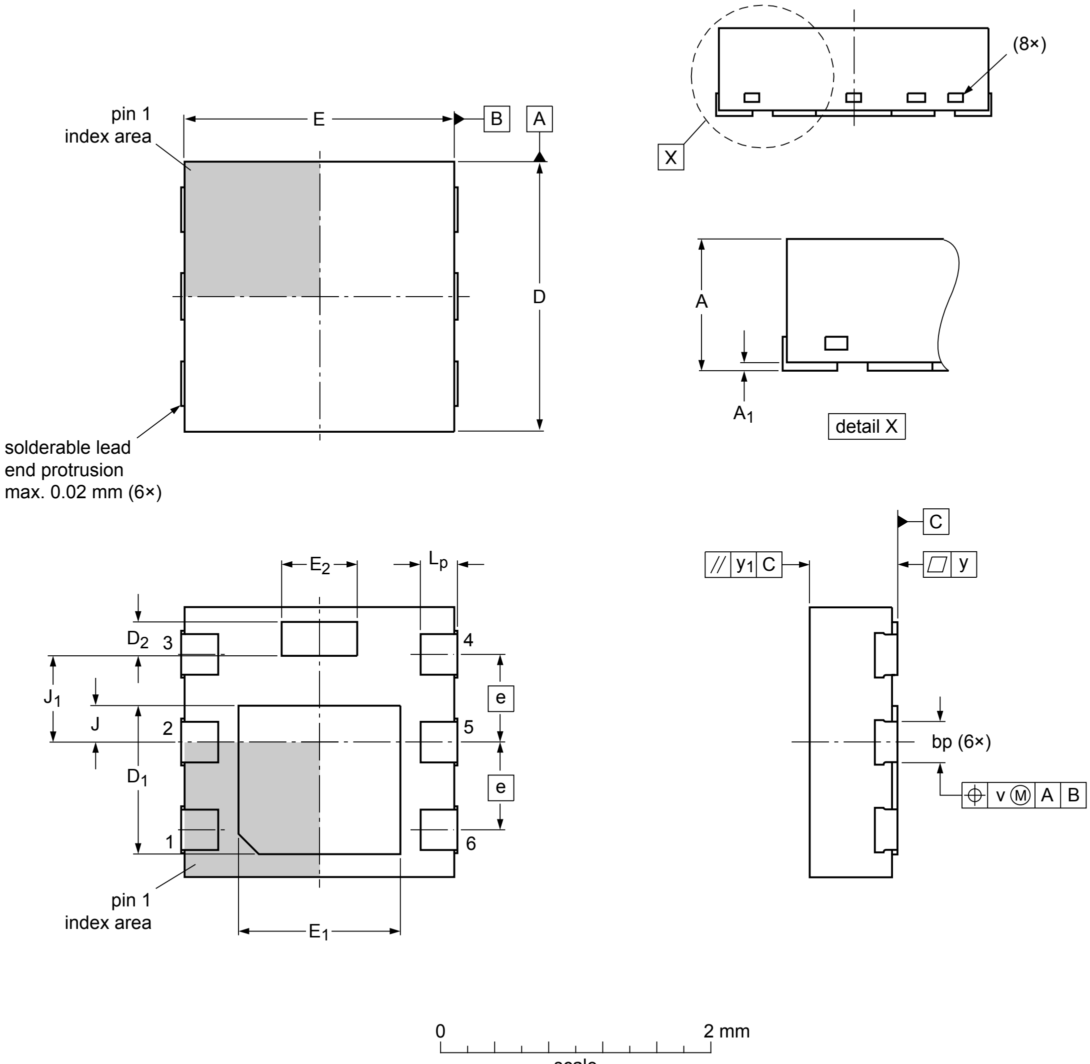
Fig. 17. Duty cycle definition

Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard Q101 - Stress test qualification for discrete semiconductors, and is suitable for use in automotive applications.

12. Package outline

DFN2020MD-6: plastic thermal enhanced ultra thin small outline package; no leads; 6 terminals; body 2 x 2 x 0.65 mm **SOT1220**



Dimensions (mm are the original dimensions)

Unit		A	A_1	bp	D	D_1	D_2	E	E_1	E_2	e	J	J_1	L_p	v	y	y_1
	min			0.25	1.9	1.0	0.2	1.9	1.1	0.51				0.2			
mm	nom										0.65	0.27	0.64		0.1	0.05	0.1
	max	0.65	0.04	0.35	2.1	1.2	0.3	2.1	1.3	0.61				0.3			

Note
1. Dimension A is including plating thickness.

sot1220_po

Outline version	References IEC	References JEDEC	References JEITA		European projection	Issue date
SOT1220						~~12-04-23~~ 12-04-30

Fig. 18. Package outline DFN2020MD-6 (SOT1220)

13. Soldering

Footprint information for reflow soldering of DFN2020MD-6 package **SOT1220**

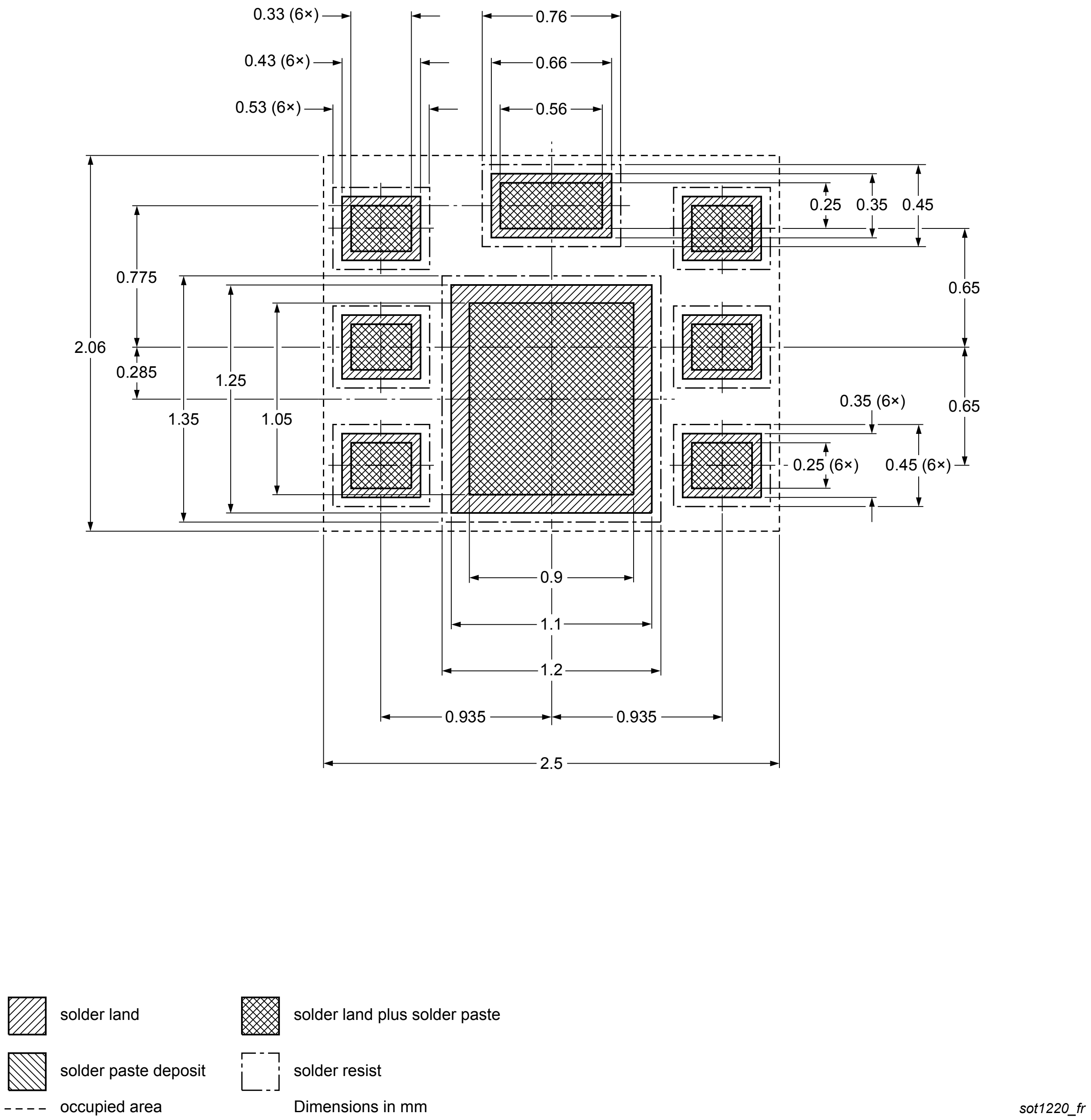


Fig. 19. Reflow soldering footprint for DFN2020MD-6 (SOT1220)

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
BUK6D120-60P v.1	20180403	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".
[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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16. Contents

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Date of release: 3 April 2018

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