Product data sheet

1. General description

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

2. Features and benefits

- Extended temperature range T_i = 175 °C
- Side wettable flanks for optical solder inspection
- ElectroStatic Discharge (ESD) protection > 2 kV HBM (class H2)
- Trench MOSFET technology
- AEC-Q101 qualified

3. Applications

- LED lighting
- · High-speed line driver
- · Low-side load switch
- · Switching circuits

4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Тур	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		-	-	5.7	Α
P _{tot}	total power dissipation	T _{sp} = 25 °C		-	-	15	W
Static charac	cteristics		'			'	
R _{DSon}	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 2.1 \text{ A}; T_j = 25 \text{ °C}$		-	160	210	mΩ



5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	D	drain	15776	D
2	D	drain		
3	G	gate	2 5	G ← I ★ \
4	S	source	3 8 4	
5	D	drain	Transparent top view	
6	D	drain	DFN2020MD-6 (SOT1220)	s
7	D	drain		017aaa255
8	S	source		

6. Ordering information

Table 3. Ordering information

Type number	Package					
	Name	Description	Version			
BUK6D210-60E		plastic, leadless thermal enhanced ultra thin small outline package; 6 terminals; 0.65 mm pitch; 2 mm x 2 mm x 0.65 mm body	SOT1220			

7. Marking

Table 4. Marking codes

Type number	Marking code
BUK6D210-60E	5G

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		-	5.7	Α
		V _{GS} = 10 V; T _{sp} = 100 °C		-	4.1	Α
		V _{GS} = 10 V; T _{amb} = 25 °C	[1]	-	2.1	Α
I _{DM}	peak drain current	T_{sp} = 25 °C; single pulse; $t_p \le 10 \mu s$		-	23	Α
P _{tot}	total power dissipation	T _{sp} = 25 °C		-	15	W
		T _{amb} = 25 °C	[1]	-	2	W
Tj	junction temperature			-55	175	°C
T _{amb}	ambient temperature			-55	175	°C
T _{stg}	storage temperature			-65	175	°C
Source-drain d	iode		'	'		_
Is	source current	T _{sp} = 25 °C		-	5.7	Α
		T _{amb} = 25 °C	[1]	-	2	Α
I _{SM}	peak source current	single pulse; $t_p \le 10 \mu s$; $T_{sp} = 25 °C$		-	23	Α
ESD maximum	rating				1	
V _{ESD}	electrostatic discharge voltage	НВМ	[2]	-	2000	V
Avalanche rugo	gedness					•
E _{DS(AL)S}	non-repetitive drain- source avalanche energy	T _{j(init)} = 25 °C; I _D = 0.17 A; DUT in avalanche (unclamped)		-	5.3	mJ

- [1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and mounting pad for drain 6 cm².
- [2] Measured between all pins.

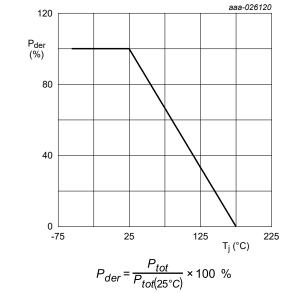


Fig. 1. Normalized total power dissipation as a function of junction temperature

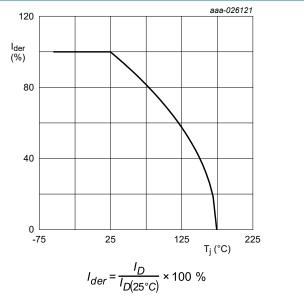


Fig. 2. Normalized continuous drain current as a function of junction temperature

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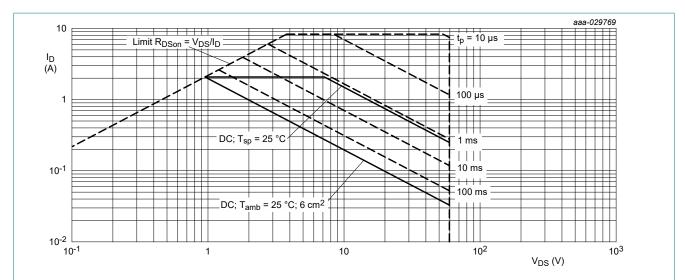


Fig. 3. Safe operating area; junction to ambient; continuous and peak drain currents as a function of drain-source voltage

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Тур	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	66	76	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	5	10	K/W

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for drain 6 cm².

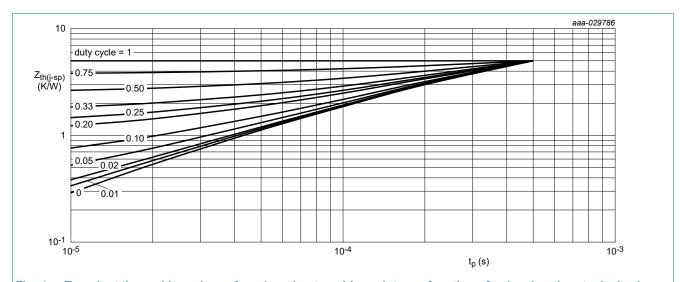


Fig. 4. Transient thermal impedance from junction to solder point as a function of pulse duration; typical values

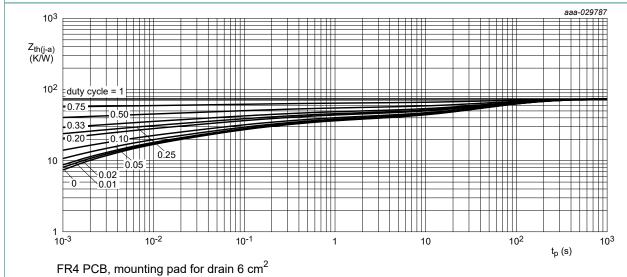


Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
Static chara	acteristics					
V _{(BR)DSS}	drain-source breakdown voltage	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 °C$	60	-	-	V
V_{GSth}	gate-source threshold voltage	$I_D = 250 \mu A; V_{DS} = V_{GS}; T_j = 25 \text{ °C}$	1.3	1.7	2.7	V
I _{DSS}	drain leakage current	V _{DS} = 60 V; V _{GS} = 0 V; T _j = 25 °C	-	-	1	μΑ
		V _{DS} = 60 V; V _{GS} = 0 V; T _j = 125 °C	-	-	4	μΑ
I _{GSS}	gate leakage current	V _{GS} = 20 V; V _{DS} = 0 V; T _j = 25 °C	-	-	10	μΑ
		V _{GS} = -20 V; V _{DS} = 0 V; T _j = 25 °C	-	-	-10	μΑ
		V _{GS} = 10 V; V _{DS} = 0 V; T _j = 25 °C	-	-	1	μΑ
		V _{GS} = -10 V; V _{DS} = 0 V; T _j = 25 °C	-	-	-1	μΑ
R _{DSon}	drain-source on-state resistance	V _{GS} = 10 V; I _D = 2.1 A; T _j = 25 °C	-	160	210	mΩ
		V _{GS} = 10 V; I _D = 2.1 A; T _j = 175 °C	-	347	456	mΩ
		V _{GS} = 4.5 V; I _D = 1.9 A; T _j = 25 °C	-	196	262	mΩ
9 _{fs}	forward transconductance	$V_{DS} = 10 \text{ V}; I_D = 2 \text{ A}; T_j = 25 \text{ °C}$	-	4	-	S
R _G	gate resistance	f = 1 MHz	-	13.2	-	Ω
Dynamic ch	naracteristics					
Q _{G(tot)}	total gate charge	V _{DS} = 30 V; I _D = 2.1 A; V _{GS} = 10 V;	-	2.5	3.8	nC
Q _{GS}	gate-source charge	T _j = 25 °C	-	0.3	-	nC
Q_{GD}	gate-drain charge		-	0.7	-	nC
C _{iss}	input capacitance	V _{DS} = 30 V; f = 1 MHz; V _{GS} = 0 V;	-	110	-	pF
C _{oss}	output capacitance	T _j = 25 °C	-	16	-	pF
C _{rss}	reverse transfer capacitance		-	11	-	pF
t _{d(on)}	turn-on delay time	V _{DS} = 30 V; I _D = 2.1 A; V _{GS} = 10 V;	-	2	-	ns
t _r	rise time	$R_{G(ext)} = 6 \Omega; T_j = 25 ^{\circ}C$	-	5	-	ns
t _{d(off)}	turn-off delay time		-	7	-	ns
t _f	fall time		-	3	-	ns
Source-dra	in diode					
V _{SD}	source-drain voltage	I _S = 2 A; V _{GS} = 0 V; T _j = 25 °C	-	8.0	1.2	V
t _{rr}	reverse recovery time	$I_S = 0.8 \text{ A}; dI_S/dt = -100 \text{ A/}\mu\text{s};$	-	10	-	ns
Qr	recovered charge	$V_{GS} = 0 \text{ V}; V_{DS} = 30 \text{ V}; T_j = 25 \text{ °C}$	-	3	-	nC

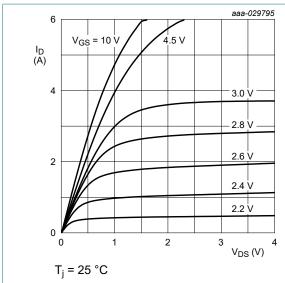


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

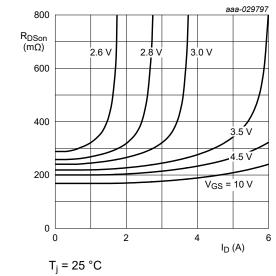


Fig. 8. Drain-source on-state resistance as a function of drain current; typical values

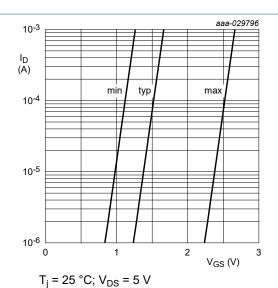


Fig. 7. Sub-threshold drain current as a function of gate-source voltage

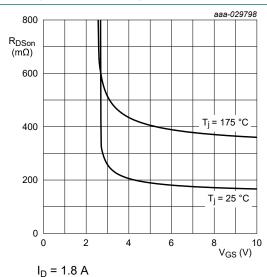


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values

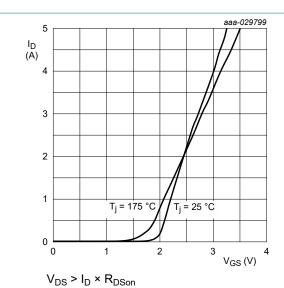


Fig. 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values

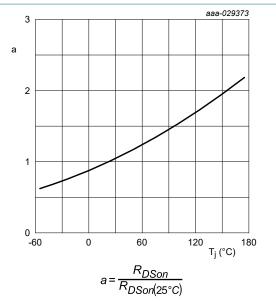


Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values

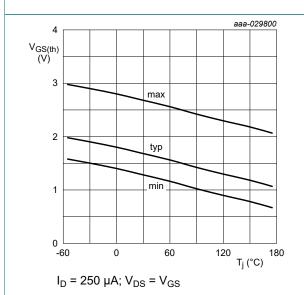


Fig. 12. Gate-source threshold voltage as a function of junction temperature

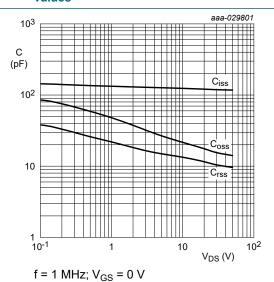


Fig. 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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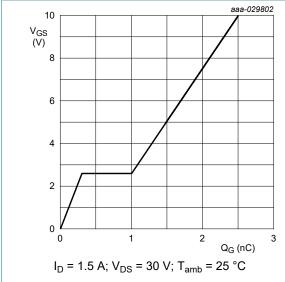


Fig. 14. Gate-source voltage as a function of gate charge; typical values

 $V_{GS} = 0 V$

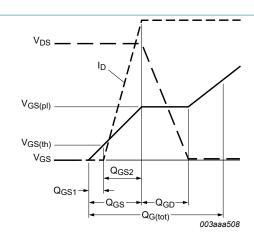


Fig. 15. Gate charge waveform definitions

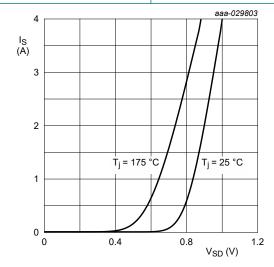
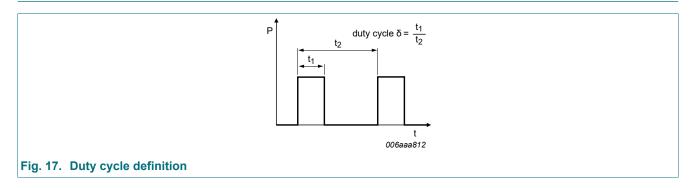


Fig. 16. Source current as a function of source-drain voltage; typical values

11. Test information



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

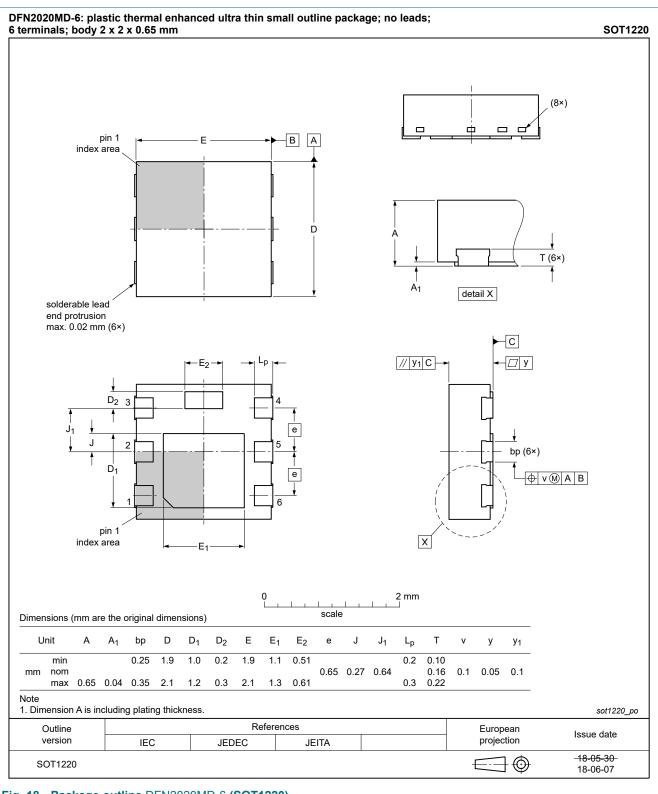
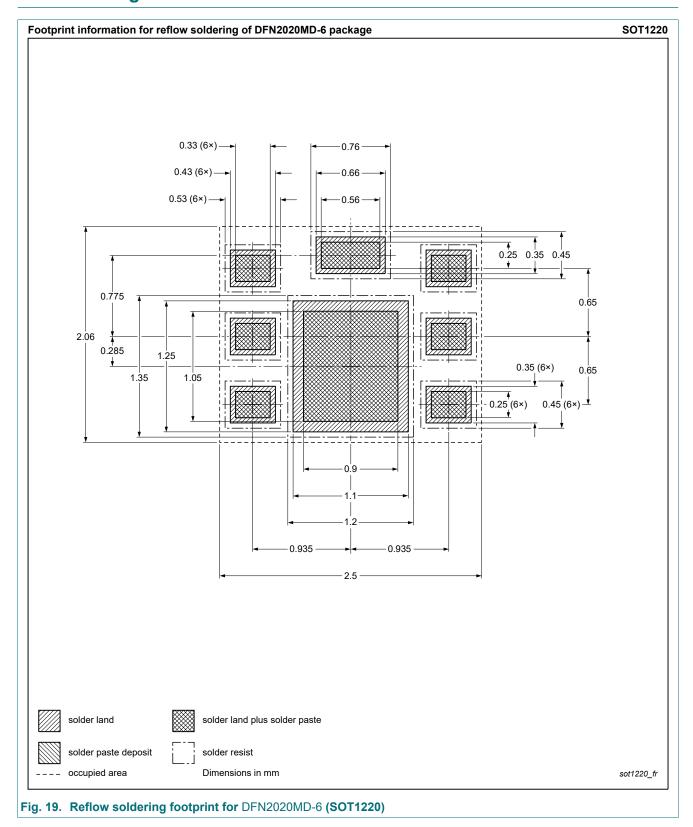


Fig. 18. Package outline DFN2020MD-6 (SOT1220)

13. Soldering



14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
BUK6D210-60E v.1	20190417	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.

- Please consult the most recently issued document before initiating or completing a design.
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Product data sheet

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	3
9.	Thermal characteristics	5
10	. Characteristics	6
11.	. Test information	10
12	. Package outline	11
	. Soldering	
	. Revision history	
	. Legal information	

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