



BUK6D30-40E

40 V, N-channel Trench MOSFET

11 March 2020

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 $T_j = 175\text{ °C}$
- Side wettable flanks for optical solder inspection
- ElectroStatic Discharge (ESD) protection $> 2\text{ kV HBM (class H2)}$
- Trench MOSFET technology
- AEC-Q101 qualified

3. Applications

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

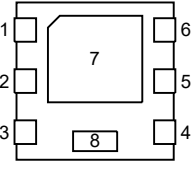
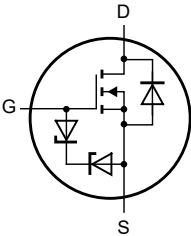
4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j = 25\text{ °C}$	-	-	40	V
V_{GS}	gate-source voltage		-20	-	20	V
I_D	drain current	$V_{GS} = 10\text{ V}; T_{sp} = 25\text{ °C}$	-	-	18	A
P_{tot}	total power dissipation	$T_{sp} = 25\text{ °C}$	-	-	19	W
Static characteristics						
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 6\text{ A}; T_j = 25\text{ °C}$	-	23	30	m Ω

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	D	drain	 <p>Transparent top view DFN2020MD-6 (SOT1220)</p>	 <p>017aaa255</p>
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
BUK6D30-40E	DFN2020MD-6	plastic, leadless thermal enhanced ultra thin small outline package with side-wettable flanks (SWF); 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
BUK6D30-40E	K6

8. Limiting values

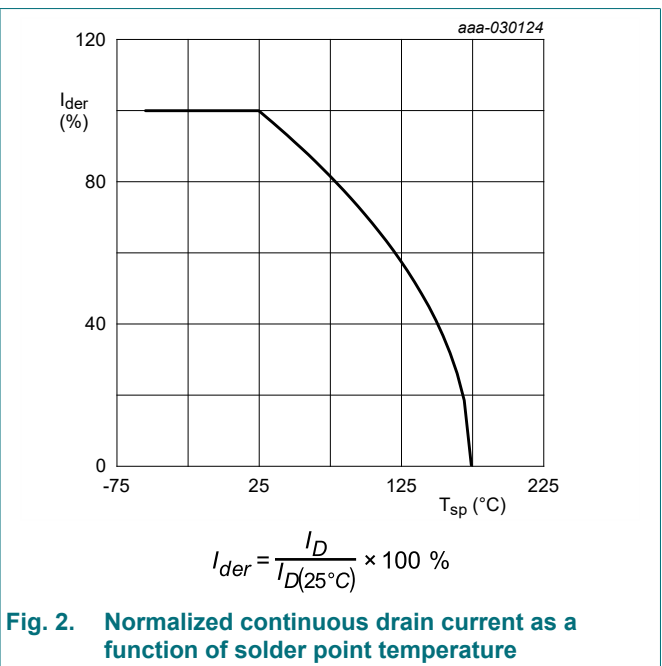
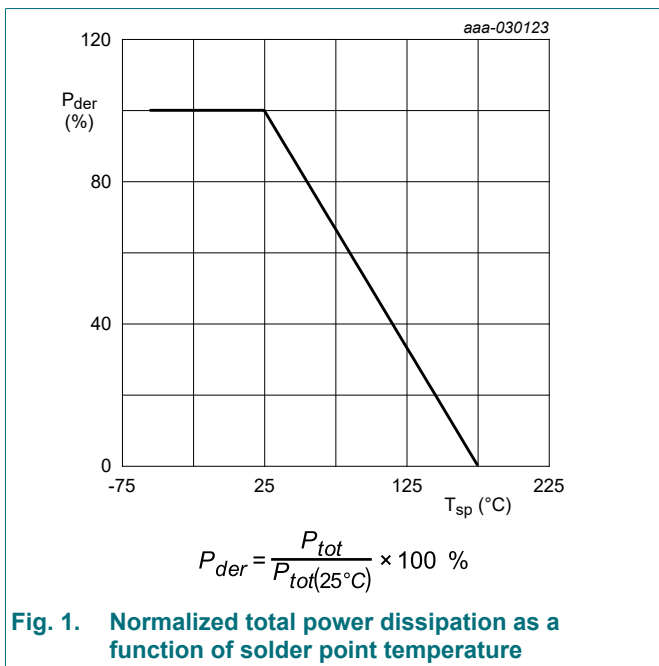
Table 5. Limiting values

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	-	40	V
V _{GS}	gate-source voltage		-20	20	V
I _D	drain current	V _{GS} = 10 V; T _{sp} = 25 °C	-	18	A
		V _{GS} = 10 V; T _{sp} = 100 °C	-	12.8	A
		V _{GS} = 10 V; T _{amb} = 25 °C	[1]	6	A
I _{DM}	peak drain current	T _{sp} = 25 °C; single pulse; t _p ≤ 10 μs	-	73	A
P _{tot}	total power dissipation	T _{sp} = 25 °C	-	19	W
		T _{amb} = 25 °C	[1]	2	W
T _j	junction temperature		-55	175	°C
T _{amb}	ambient temperature		-55	175	°C
T _{stg}	storage temperature		-65	175	°C
I _{SM}	peak source current	single pulse; t _p ≤ 10 μs; T _{sp} = 25 °C	-	72	A
Source-drain diode					
I _S	source current	T _{sp} = 25 °C	-	18	A
		T _{amb} = 25 °C	[1]	1.9	A
ESD maximum rating					
V _{ESD}	electrostatic discharge voltage	HBM	[2]	2000	V
Avalanche ruggedness					
E _{DS(AL)S}	non-repetitive drain-source avalanche energy	T _{j(init)} = 25 °C; I _D = 1 A; DUT in avalanche (unclamped)	-	17	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.



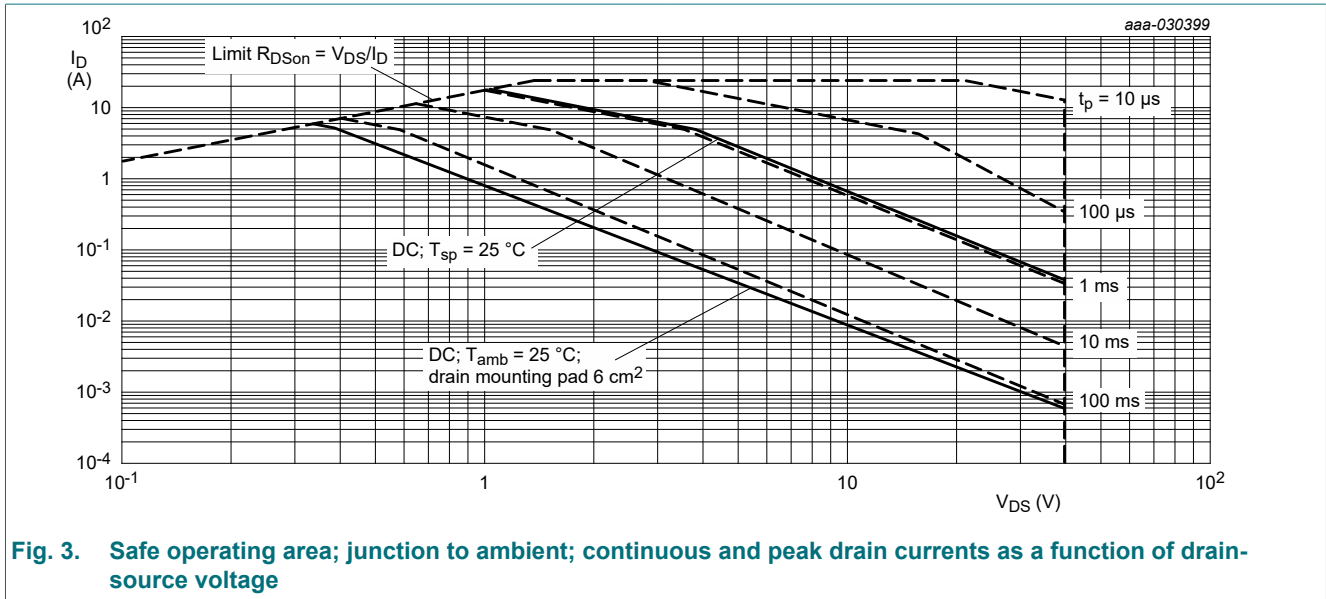


Fig. 3. Safe operating area; junction to ambient; continuous and peak drain currents as a function of drain-source voltage

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]	-	66	76	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	4	8	K/W

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

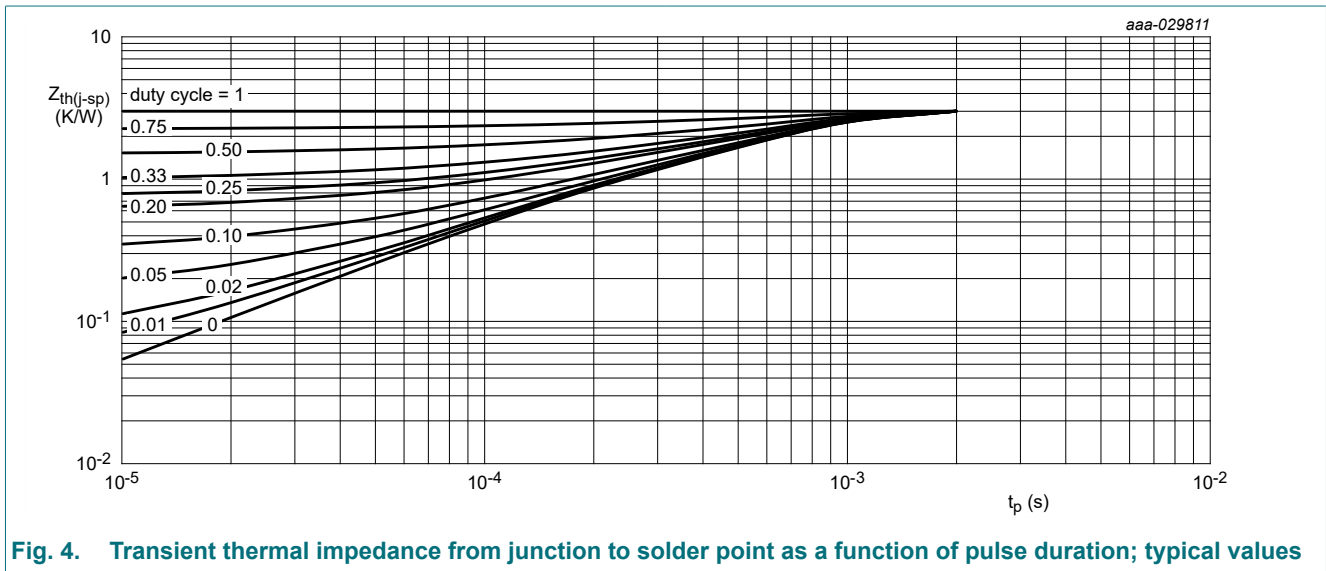
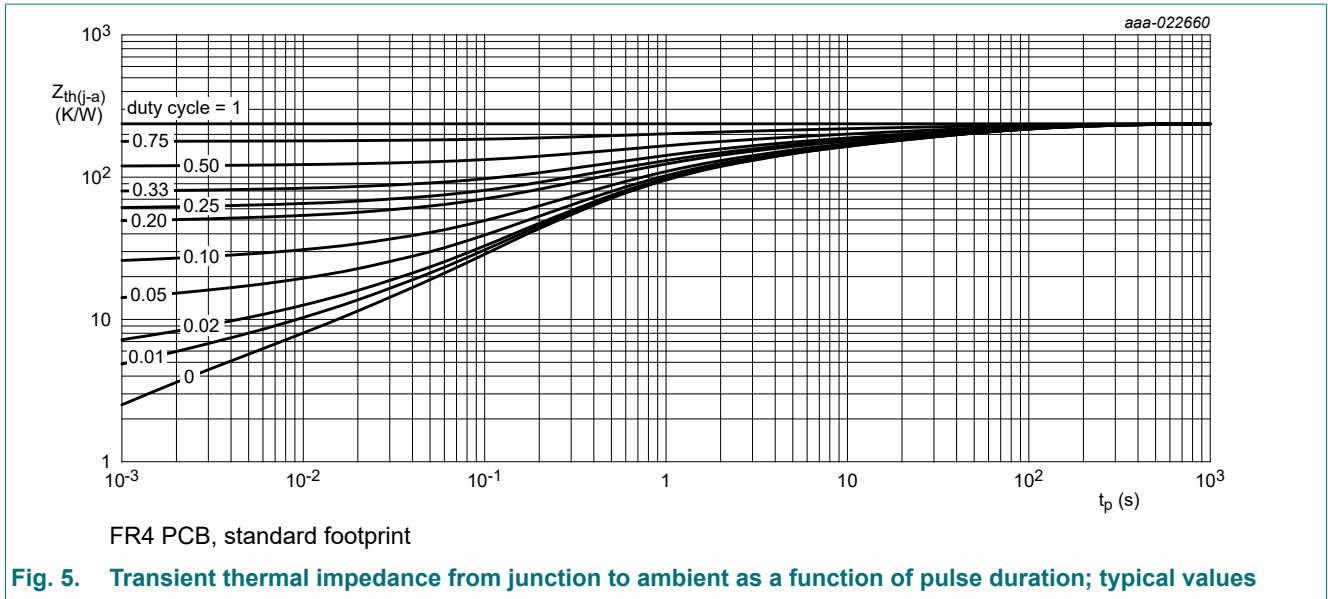


Fig. 4. Transient thermal impedance from junction to solder point as a function of pulse duration; typical values



10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$	40	-	-	V
V_{GSth}	gate-source threshold voltage	$I_D = 250 \mu A; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ C$	1	1.6	2.5	V
I_{DSS}	drain leakage current	$V_{DS} = 40 V; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$	-	-	1	μA
		$V_{DS} = 40 V; T_j = 125 \text{ }^\circ C$	-	-	20	μA
I_{GSS}	gate leakage current	$V_{GS} = 20 V; V_{DS} = 0 V; T_j = 25 \text{ }^\circ C$	-	-	10	μA
		$V_{GS} = -20 V; V_{DS} = 0 V; T_j = 25 \text{ }^\circ C$	-	-	-10	μA
		$V_{GS} = 10 V; V_{DS} = 0 V; T_j = 25 \text{ }^\circ C$	-	-	2	μA
		$V_{GS} = -10 V; V_{DS} = 0 V; T_j = 25 \text{ }^\circ C$	-	-	-2	μA
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10 V; I_D = 6 A; T_j = 25 \text{ }^\circ C$	-	23	30	m Ω
		$V_{GS} = 10 V; I_D = 6 A; T_j = 175 \text{ }^\circ C$	-	44	57	m Ω
		$V_{GS} = 4.5 V; I_D = 5.1 A; T_j = 25 \text{ }^\circ C$	-	30	40	m Ω
g_{fs}	forward transconductance	$V_{DS} = 10 V; I_D = 2 A; T_j = 25 \text{ }^\circ C$	-	19	-	S
R_G	gate resistance	$f = 1 \text{ MHz}$	-	2	-	Ω
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$V_{DS} = 20 V; I_D = 5 A; V_{GS} = 10 V; T_j = 25 \text{ }^\circ C$	-	8	12	nC
Q_{GS}	gate-source charge	$T_j = 25 \text{ }^\circ C$	-	1.2	-	nC
Q_{GD}	gate-drain charge		-	1.6	-	nC
C_{iss}	input capacitance	$V_{DS} = 20 V; f = 1 \text{ MHz}; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$	-	440	-	pF
C_{oss}	output capacitance	$T_j = 25 \text{ }^\circ C$	-	76	-	pF
C_{rss}	reverse transfer capacitance		-	39	-	pF

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_{d(on)}$	turn-on delay time	$V_{DS} = 20\text{ V}; I_D = 5\text{ A}; V_{GS} = 10\text{ V};$ $R_{G(ext)} = 6\ \Omega; T_j = 25\text{ }^\circ\text{C}$	-	4	-	ns
t_r	rise time		-	2	-	ns
$t_{d(off)}$	turn-off delay time		-	20	-	ns
t_f	fall time		-	33	-	ns
Source-drain diode						
V_{SD}	source-drain voltage	$I_S = 1.6\text{ A}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C}$	-	0.8	1.2	V
t_{rr}	reverse recovery time	$I_S = 1.6\text{ A}; di_S/dt = -100\text{ A}/\mu\text{s};$	-	11	-	ns
Q_r	recovered charge	$V_{GS} = 0\text{ V}; V_{DS} = 20\text{ V}; T_j = 25\text{ }^\circ\text{C}$	-	4	-	nC

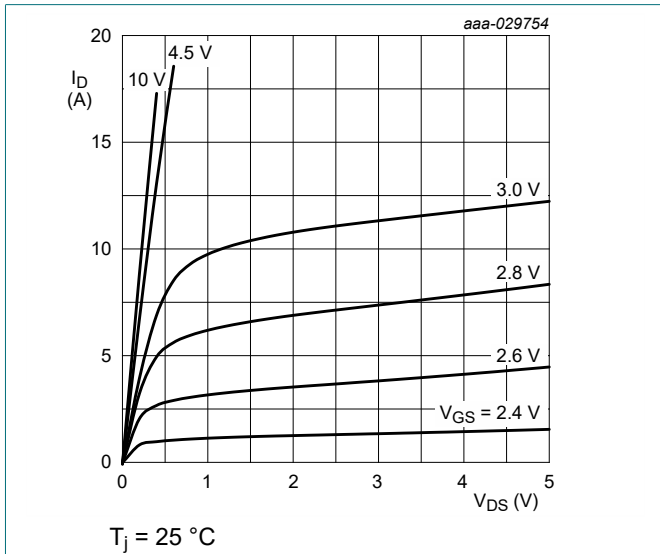


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

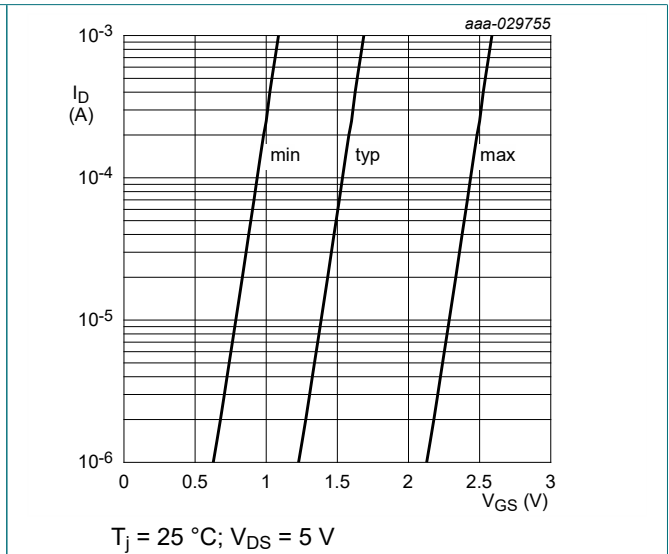


Fig. 7. Sub-threshold drain current as a function of gate-source voltage

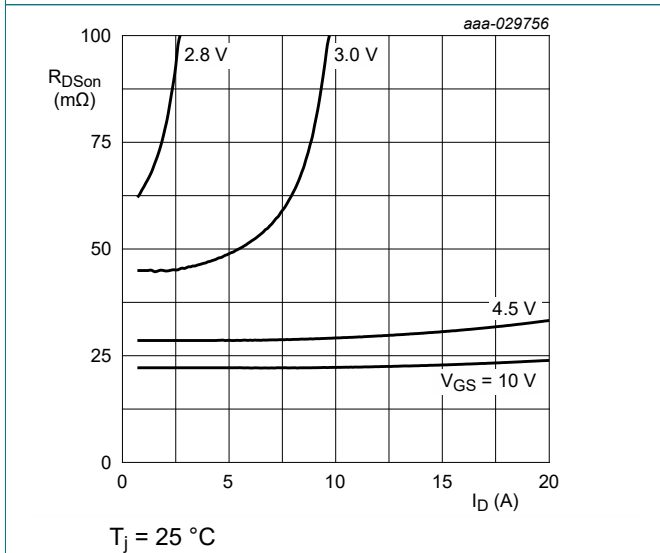


Fig. 8. Drain-source on-state resistance as a function of drain current; typical values

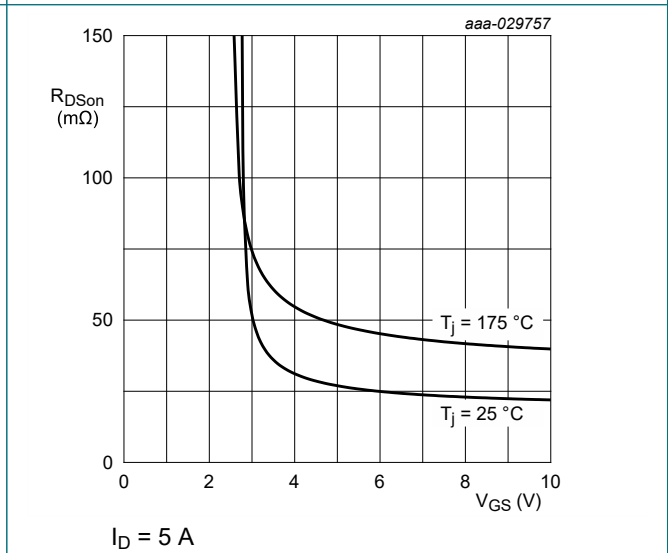


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values

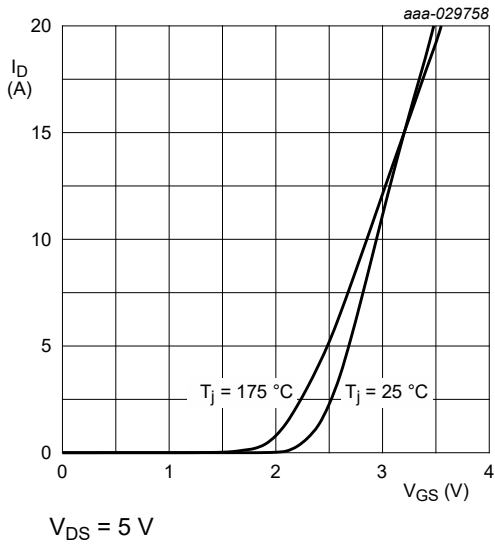


Fig. 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values

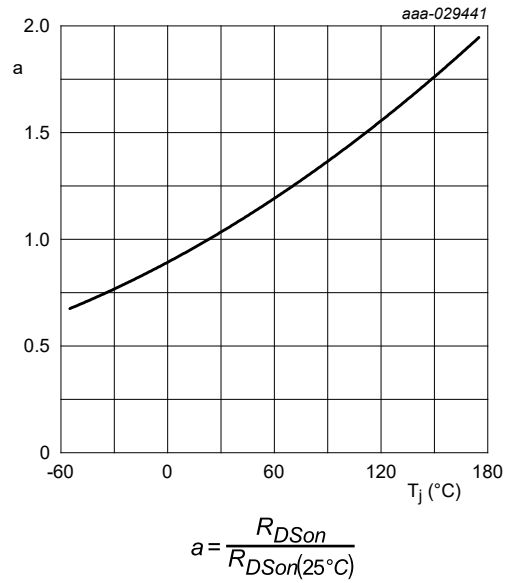


Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values

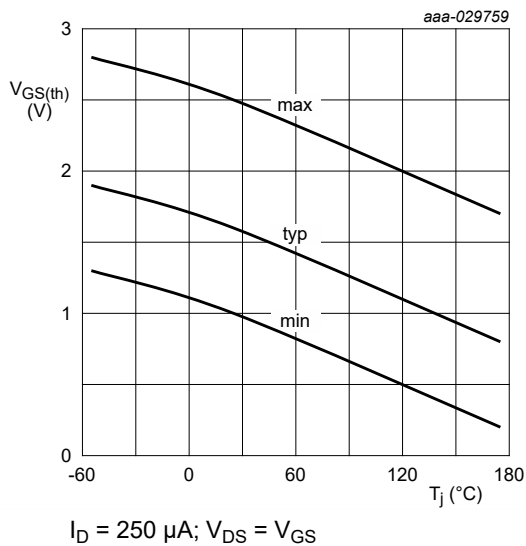


Fig. 12. Gate-source threshold voltage as a function of junction temperature

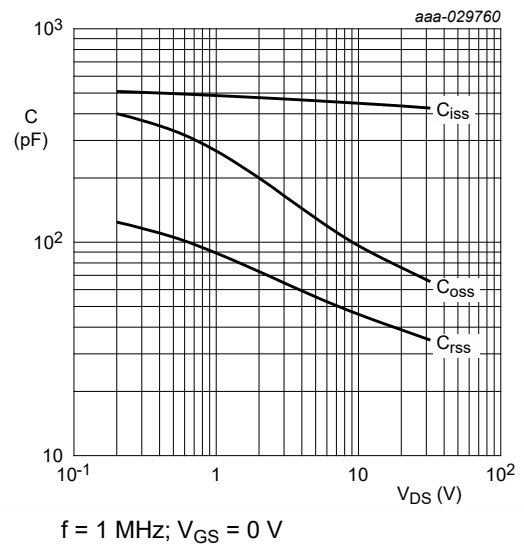
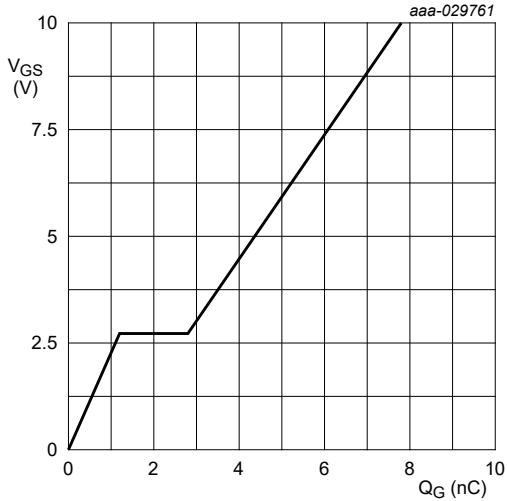


Fig. 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



$V_{DS} = 20\text{ V}$; $I_D = 4.8\text{ A}$; $T_{amb} = 25\text{ }^\circ\text{C}$

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

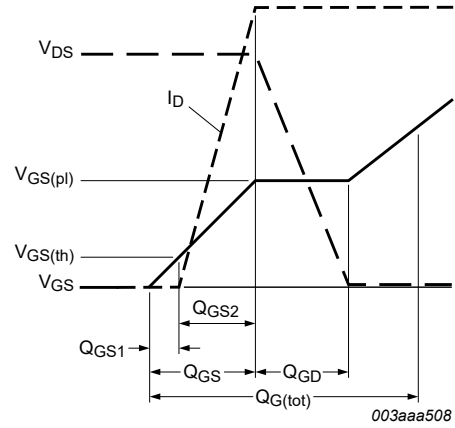
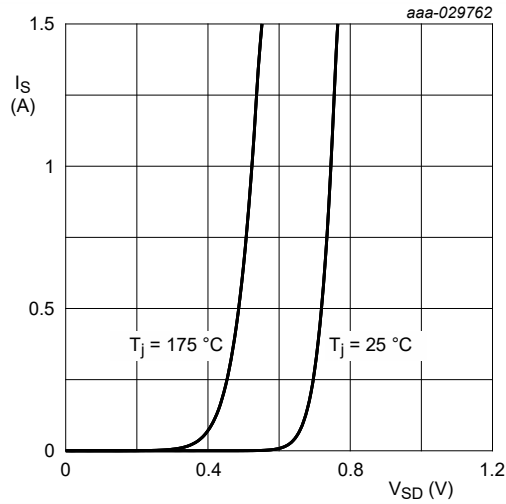


Fig. 15. Gate charge waveform definitions



$V_{GS} = 0\text{ V}$

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

11. Test information

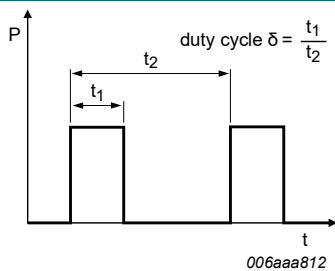


Fig. 17. Duty cycle definition

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

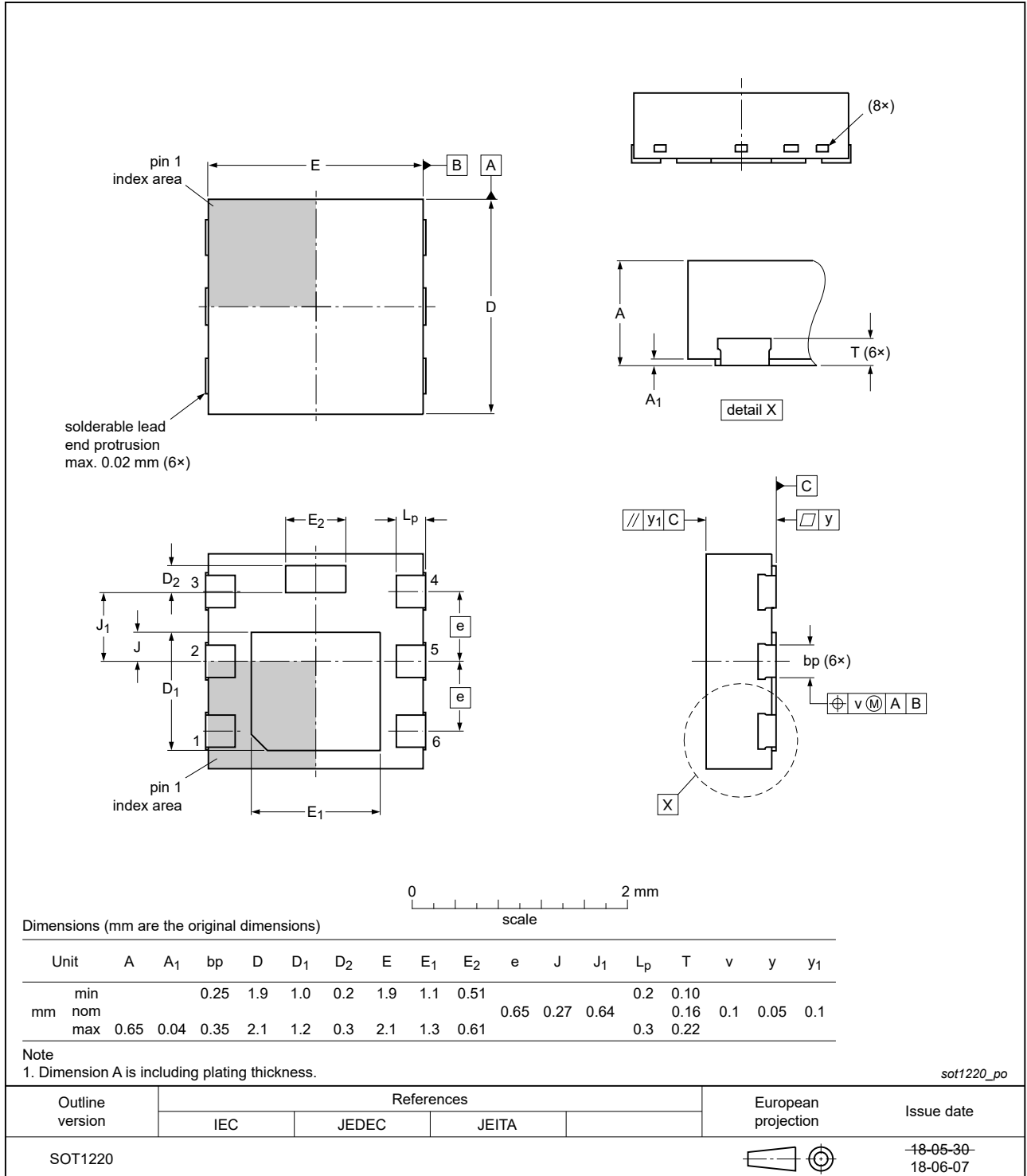


Fig. 18. Package outline DFN2020MD-6 (SOT1220)

13. Soldering

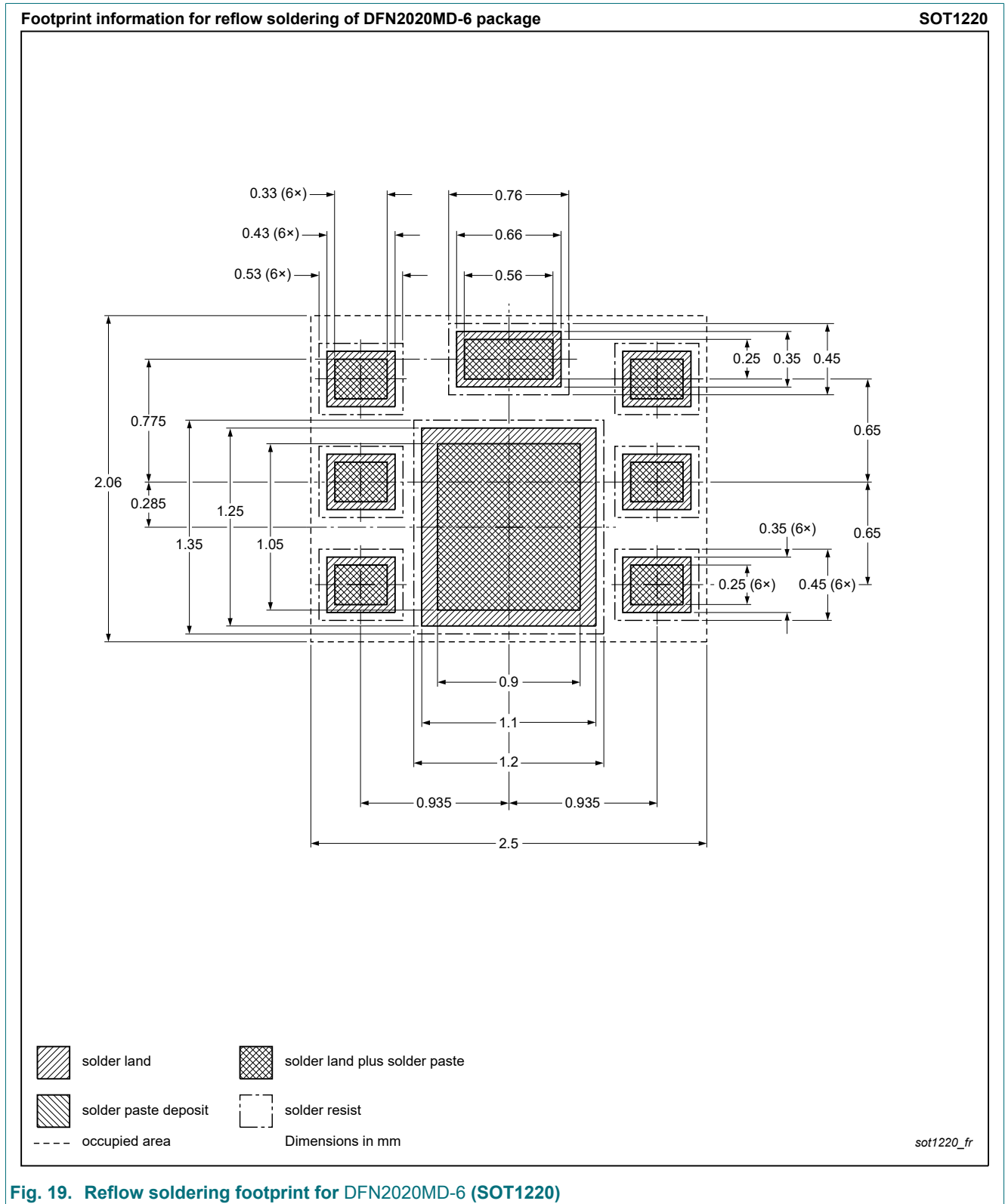


Fig. 19. Reflow soldering footprint for DFN2020MD-6 (SOT1220)

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
BUK6D30-40E v.1	20200311	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.

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