



BUK7V4R2-40H

Dual N-channel 40 V, 4.2 mOhm standard level MOSFET in LFPAK56D (half-bridge configuration)

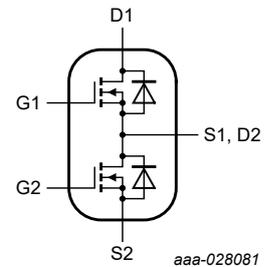
11 February 2021

Product data sheet

1. General description

Dual, standard level N-channel MOSFET in an LFPAK56D package (half-bridge configuration), using Trench 9 TrenchMOS technology. This product has been designed and qualified to AEC-Q101.

An internal connection is made between the source (S1) of the high-side FET to the drain (D2) of the low-side FET, making the device ideal to use as a half-bridge switch in high-performance automotive PWM applications.



2. Features and benefits

- LFPAK56D package with half-bridge configuration enables:
 - Reduced PCB layout complexity
 - PCB shrinkage through reduced component footprint for 3-phase motor drive
 - Improved system level $R_{th(j-amb)}$ due to optimized package design
 - Lower parasitic inductance to support higher efficiency
 - Footprint compatibility with LFPAK56D Dual package
- Advanced AEC-Q101 grade Trench 9 silicon technology:
 - Low power losses, high power density
 - Superior avalanche performance
 - Repetitive avalanche rated
- LFPAK copper clip packaging provides high robustness and reliability
- Gull wing leads support high manufacturability and Automated Optical Inspection (AOI)

3. Applications

- 12 V automotive systems
- Powertrain, chassis, body and infotainment applications
- Brushless or brushed DC motor drive
- DC-to-DC systems
- LED lighting

4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Limiting values FET1 and FET2						
V_{DS}	drain-source voltage	$25\text{ °C} \leq T_j \leq 175\text{ °C}$	-	-	40	V
I_D	drain current	$V_{GS} = 10\text{ V}; T_{mb} = 25\text{ °C}; \text{Fig. 2}$	[1]	-	98	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}; \text{Fig. 1}$	-	-	85	W

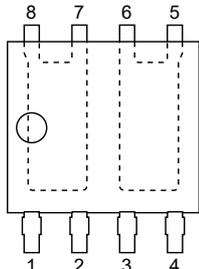
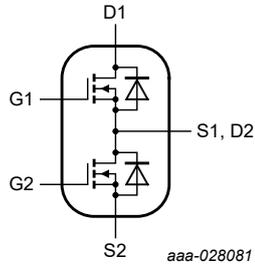
Dual N-channel 40 V, 4.2 mOhm standard level MOSFET in LFPAK56D (half-bridge configuration)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics FET1 and FET2						
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10\text{ V}$; $I_D = 20\text{ A}$; $T_j = 25\text{ °C}$; Fig. 11	2.5	3.5	4.2	mΩ
Dynamic characteristics FET1 and FET2						
Q_{GD}	gate-drain charge	$I_D = 20\text{ A}$; $V_{DS} = 32\text{ V}$; $V_{GS} = 10\text{ V}$; $T_j = 25\text{ °C}$; Fig. 13 ; Fig. 14	-	4.7	9.4	nC
Source-drain diode FET1 and FET2						
Q_r	recovered charge	$I_S = 20\text{ A}$; $di_S/dt = -100\text{ A}/\mu\text{s}$; $V_{GS} = 0\text{ V}$; $V_{DS} = 20\text{ V}$; $T_j = 25\text{ °C}$	-	9.2	-	nC

[1] 98A continuous current has been successfully demonstrated during application tests. Practically the current will be limited by PCB, thermal design and operating temperature.

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S2	source2	 <p>LFPAK56D; Dual LFPAK (SOT1205)</p>	 <p>aaa-028081</p>
2	G2	gate2		
3	S1	source1		
4	G1	gate1		
5	D1	drain1		
6	D1	drain1		
7	S1, D2	source1, drain2		
8	S1, D1	source1, drain2		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BUK7V4R2-40H	LFPAK56D; Dual LFPAK	plastic, single ended surface mounted package (LFPAK56D); 8 leads	SOT1205

7. Marking

Table 4. Marking codes

Type number	Marking code
BUK7V4R2-40H	74V240H

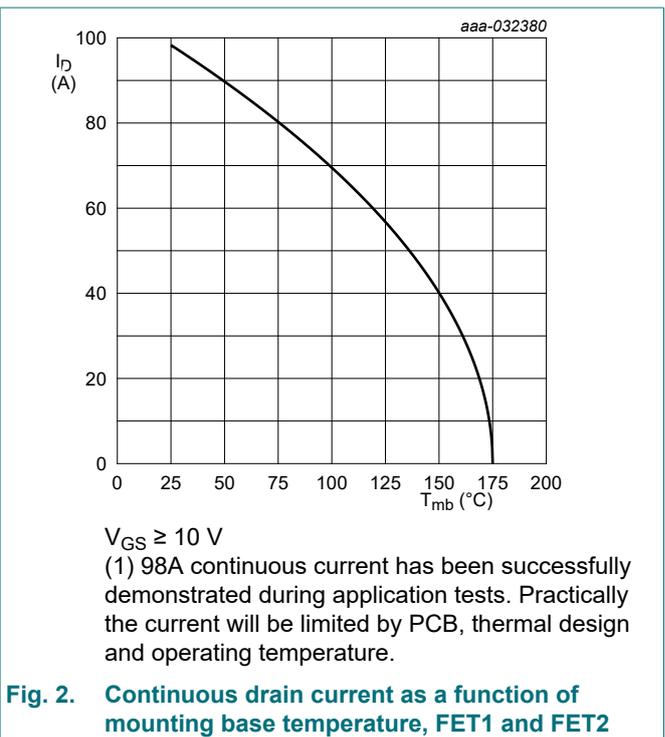
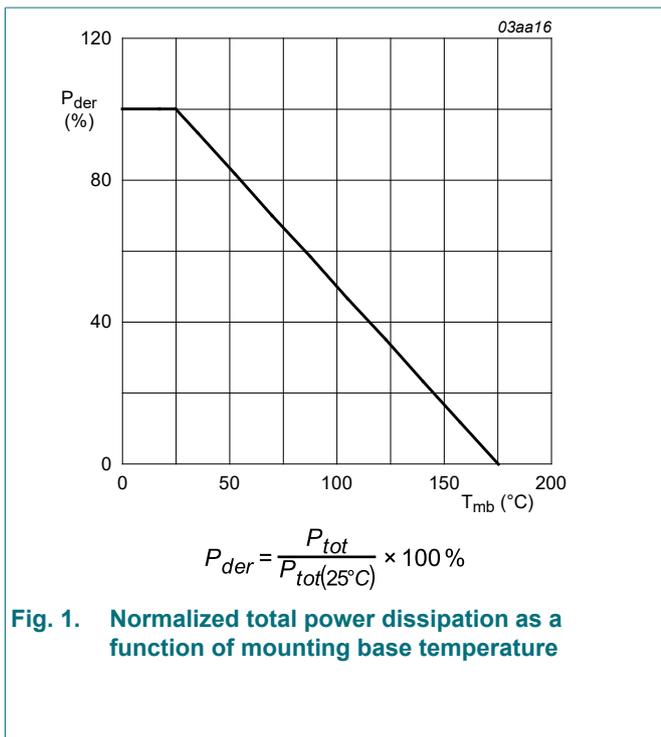
8. Limiting values

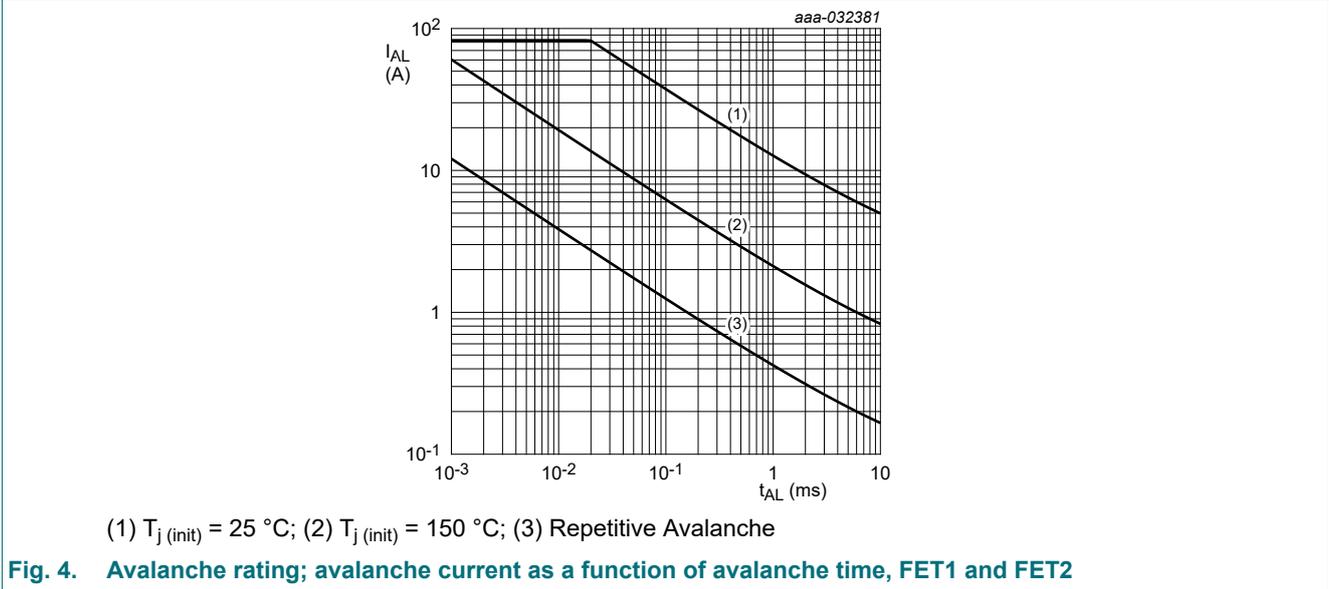
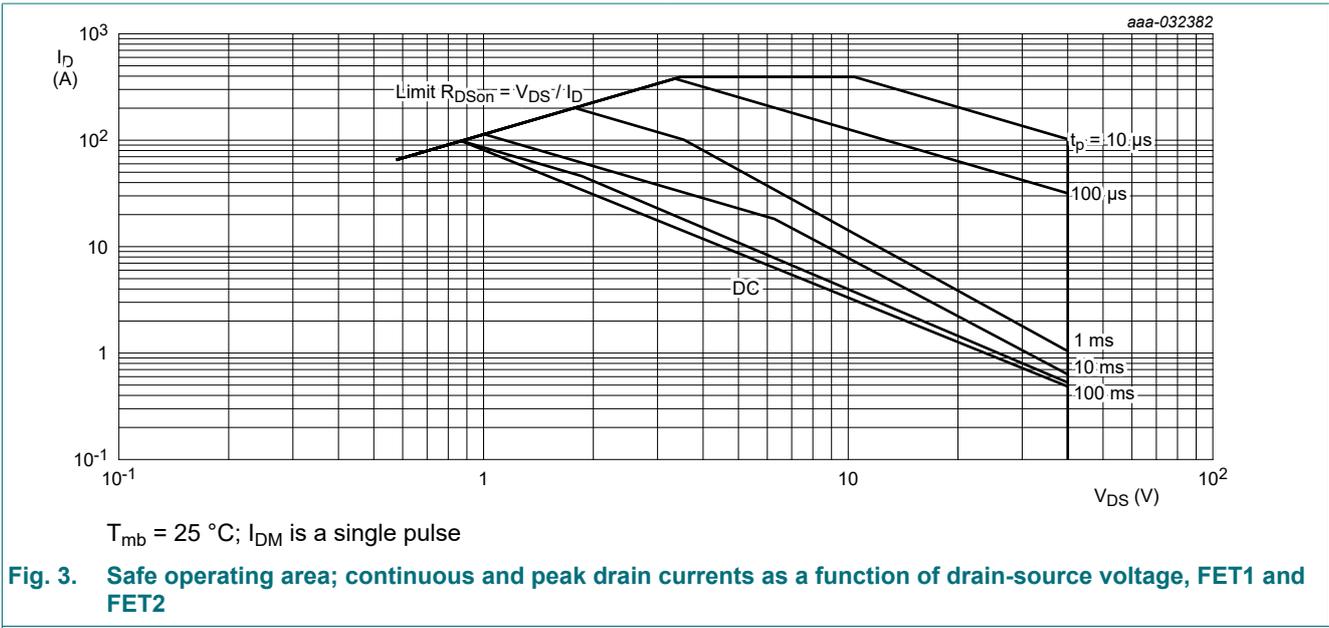
Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
Limiting values FET1 and FET2						
V _{DS}	drain-source voltage	25 °C ≤ T _j ≤ 175 °C		-	40	V
V _{GS}	gate-source voltage	DC; T _j = 25 °C		-20	20	V
P _{tot}	total power dissipation	T _{mb} = 25 °C; Fig. 1		-	85	W
I _D	drain current	V _{GS} = 10 V; T _{mb} = 25 °C; Fig. 2	[1]	-	98	A
		V _{GS} = 10 V; T _{mb} = 100 °C; Fig. 2		-	69.5	A
I _{DM}	peak drain current	pulsed; t _p ≤ 10 μs; T _{mb} = 25 °C; Fig. 3		-	393	A
T _{stg}	storage temperature			-55	175	°C
T _j	junction temperature			-55	175	°C
Source-drain diode FET1 and FET2						
I _S	source current	T _{mb} = 25 °C		-	85	A
I _{SM}	peak source current	pulsed; t _p ≤ 10 μs; T _{mb} = 25 °C		-	393	A
Avalanche ruggedness FET1 and FET2						
E _{DS(AL)S}	non-repetitive drain-source avalanche energy	I _D = 82.6 A; V _{sup} ≤ 40 V; R _{GS} = 50 Ω; V _{GS} = 10 V; T _{j(init)} = 25 °C; unclamped; Fig. 4	[2] [3]	-	42.3	mJ
I _{AS}	non-repetitive avalanche current	V _{sup} = 40 V; V _{GS} = 10 V; T _{j(init)} = 25 °C; R _{GS} = 50 Ω	[4]	-	82.6	A

- [1] 98A continuous current has been successfully demonstrated during application tests. Practically the current will be limited by PCB, thermal design and operating temperature.
- [2] Single-pulse avalanche rating limited by maximum junction temperature of 175 °C.
- [3] Refer to application note AN10273 for further information.
- [4] Protected by 100% test





9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	Fig. 5	-	1.64	1.76	K/W

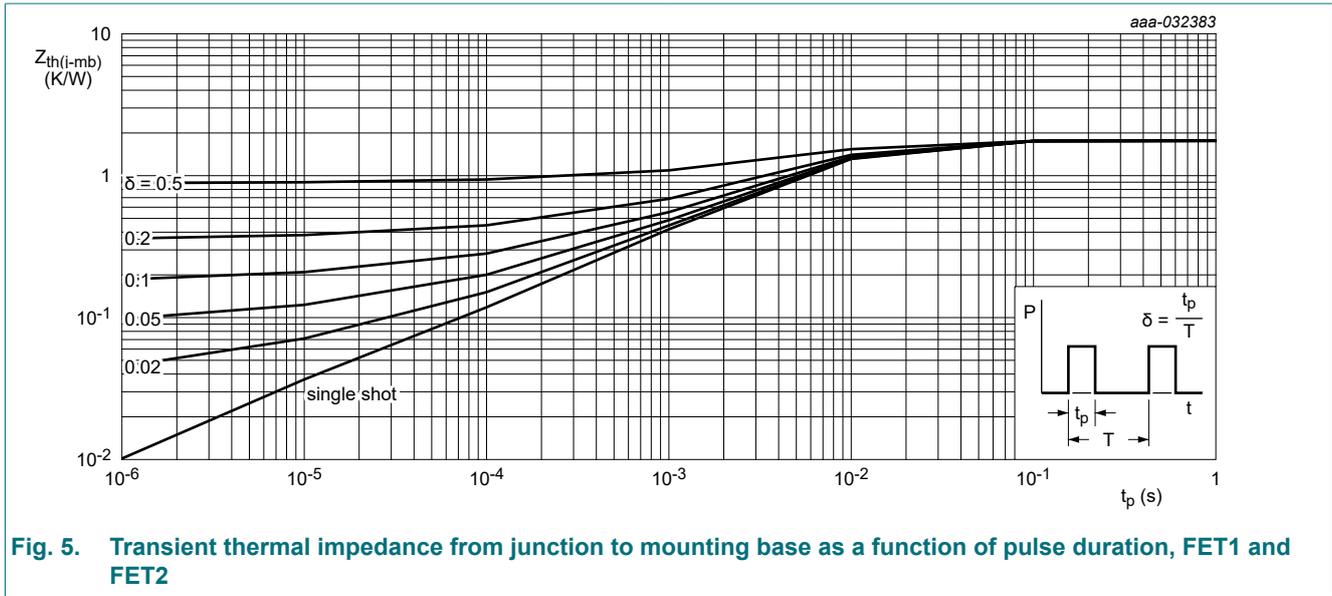


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration, FET1 and FET2

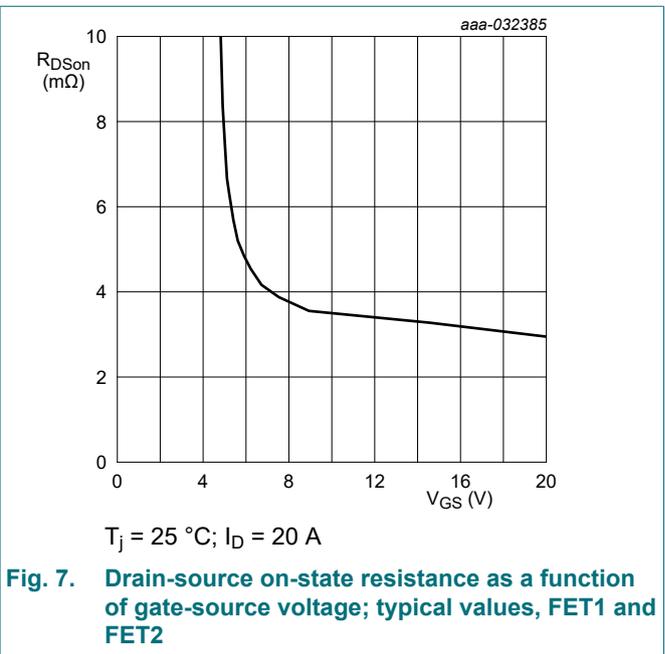
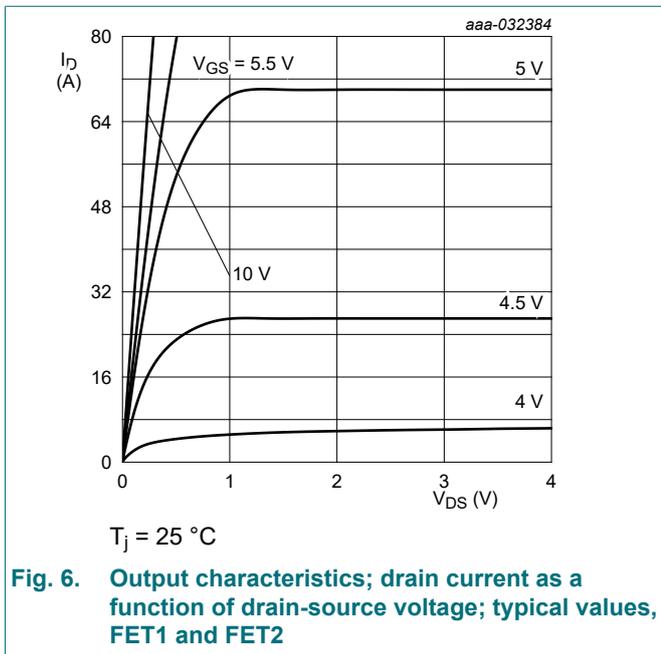
10. Characteristics

Table 7. Characteristics

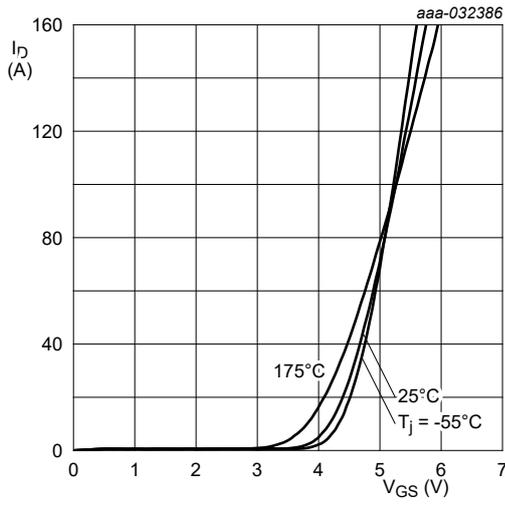
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics FET1 and FET2						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$	40	43	-	V
		$I_D = 250 \mu A; V_{GS} = 0 V; T_j = -40 \text{ }^\circ C$	-	40.5	-	V
		$I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55 \text{ }^\circ C$	36	40	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS}=V_{GS}; T_j = 25 \text{ }^\circ C$; Fig. 9 ; Fig. 10	2.4	3	3.6	V
		$I_D = 1 \text{ mA}; V_{DS}=V_{GS}; T_j = 175 \text{ }^\circ C$; Fig. 10	1	-	-	V
		$I_D = 1 \text{ mA}; V_{DS}=V_{GS}; T_j = -55 \text{ }^\circ C$; Fig. 10	-	-	4.3	V
I_{DSS}	drain leakage current	$V_{DS} = 40 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$	-	0.007	1	μA
		$V_{DS} = 16 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 125 \text{ }^\circ C$	-	0.3	10	μA
		$V_{DS} = 40 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 175 \text{ }^\circ C$	-	53	500	μA
I_{GSS}	gate leakage current	$V_{GS} = 20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$	-	2	100	nA
		$V_{GS} = -10 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$	-	2	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 20 \text{ A}; T_j = 25 \text{ }^\circ C$; Fig. 11	2.5	3.5	4.2	m Ω
		$V_{GS} = 10 \text{ V}; I_D = 20 \text{ A}; T_j = 105 \text{ }^\circ C$; Fig. 12	3.4	5.2	6.4	m Ω
		$V_{GS} = 10 \text{ V}; I_D = 20 \text{ A}; T_j = 125 \text{ }^\circ C$; Fig. 12	3.7	5.8	7.2	m Ω
		$V_{GS} = 10 \text{ V}; I_D = 20 \text{ A}; T_j = 175 \text{ }^\circ C$; Fig. 12	4.5	7.2	8.8	m Ω
R_G	gate resistance	$f = 1 \text{ MHz}; T_j = 25 \text{ }^\circ C$	0.72	1.8	4.5	Ω
Dynamic characteristics FET1 and FET2						
$Q_{G(tot)}$	total gate charge	$I_D = 20 \text{ A}; V_{DS} = 32 \text{ V}; V_{GS} = 10 \text{ V}; T_j = 25 \text{ }^\circ C$; Fig. 13 ; Fig. 14	-	26	37	nC
Q_{GS}	gate-source charge		-	7.8	12	nC
Q_{GD}	gate-drain charge		-	4.7	9.4	nC

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Symbol	Parameter	Conditions	Min	Typ	Max	Unit
C_{iss}	input capacitance	$V_{DS} = 25\text{ V}; V_{GS} = 0\text{ V}; f = 1\text{ MHz}; T_j = 25\text{ }^\circ\text{C};$ Fig. 15	-	1850	2590	pF
C_{oss}	output capacitance		-	565	791	pF
C_{rss}	reverse transfer capacitance		-	91	200	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 30\text{ V}; R_L = 1.5\text{ }\Omega; V_{GS} = 10\text{ V}; R_{G(ext)} = 5\text{ }\Omega; T_j = 25\text{ }^\circ\text{C}$	-	7	-	ns
t_r	rise time		-	9	-	ns
$t_{d(off)}$	turn-off delay time		-	19	-	ns
t_f	fall time		-	11.8	-	ns
Source-drain diode FET1 and FET2						
V_{SD}	source-drain voltage	$I_S = 20\text{ A}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C};$ Fig. 16	-	0.81	1	V
t_{rr}	reverse recovery time	$I_S = 20\text{ A}; di_S/dt = -100\text{ A}/\mu\text{s}; V_{GS} = 0\text{ V}; V_{DS} = 20\text{ V}; T_j = 25\text{ }^\circ\text{C}$	-	18.6	-	ns
Q_r	recovered charge		-	9.2	-	nC

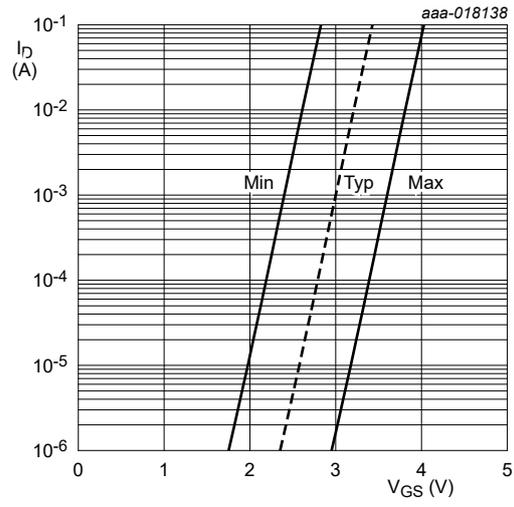


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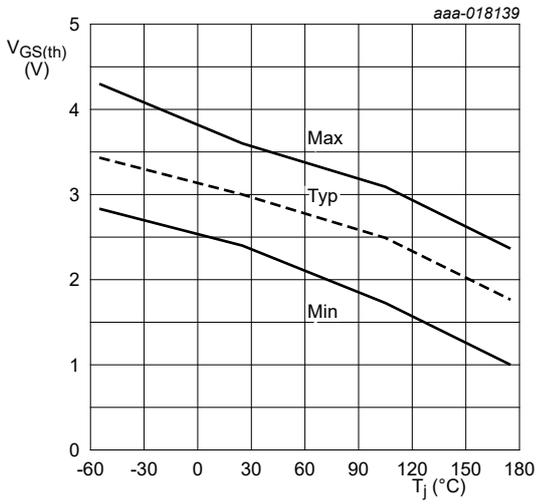
$V_{DS} = 8\text{ V}$

Fig. 8. Transfer characteristics; drain current as a function of gate-source voltage; typical values, FET1 and FET2



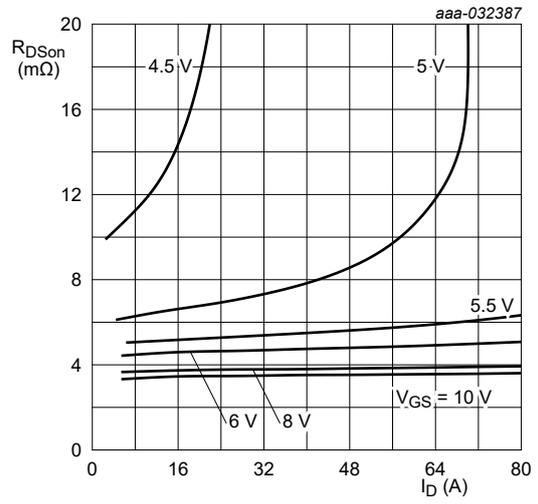
$T_j = 25^\circ\text{C}; V_{DS} = 5\text{ V}$

Fig. 9. Sub-threshold drain current as a function of gate-source voltage, FET1 and FET2



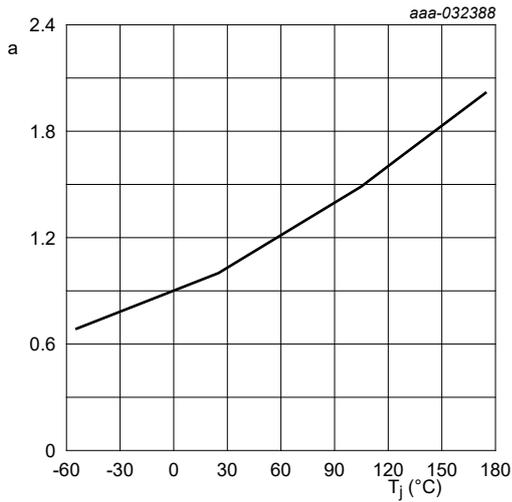
$I_D = 1\text{ mA}; V_{DS} = V_{GS}$

Fig. 10. Gate-source threshold voltage as a function of junction temperature, FET1 and FET2



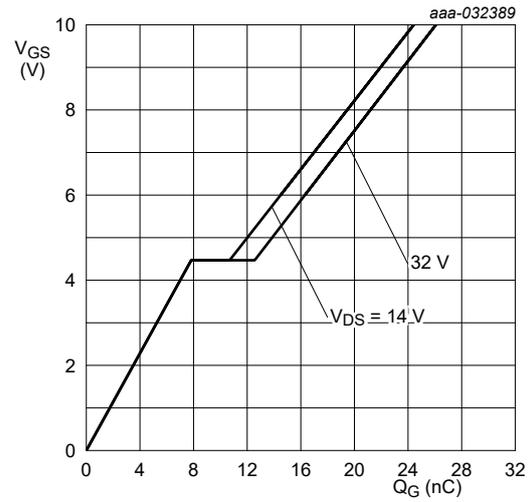
$T_j = 25^\circ\text{C}$

Fig. 11. Drain-source on-state resistance as a function of drain current; typical values, FET1 and FET2



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

Fig. 12. Normalized drain-source on-state resistance factor as a function of junction temperature, FET1 and FET2



$T_j = 25^{\circ}\text{C}; I_D = 20\text{ A}$

Fig. 13. Gate-source voltage as a function of gate charge; typical values, FET1 and FET2

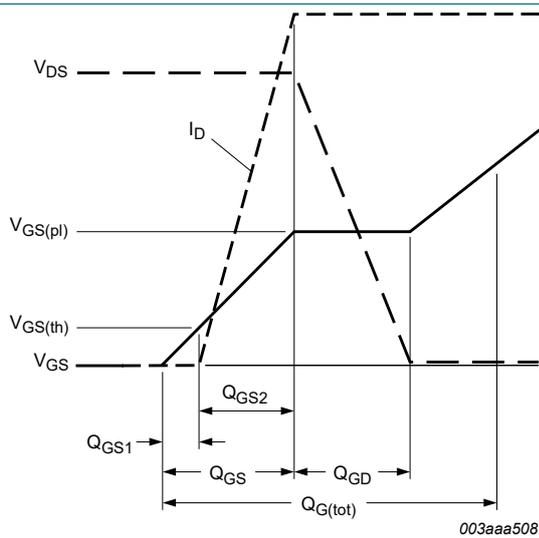
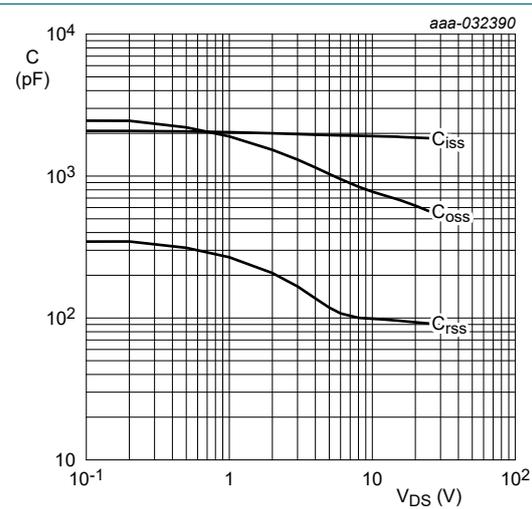
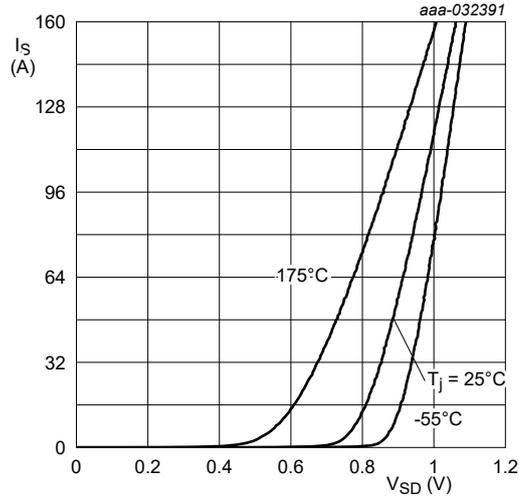


Fig. 14. Gate charge waveform definitions



$V_{GS} = 0\text{ V}; f = 1\text{ MHz}$

Fig. 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values, FET1 and FET2



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

Fig. 16. Source-drain (diode forward) current as a function of source-drain (diode forward) voltage; typical values, FET1 and FET2

11. Package outline

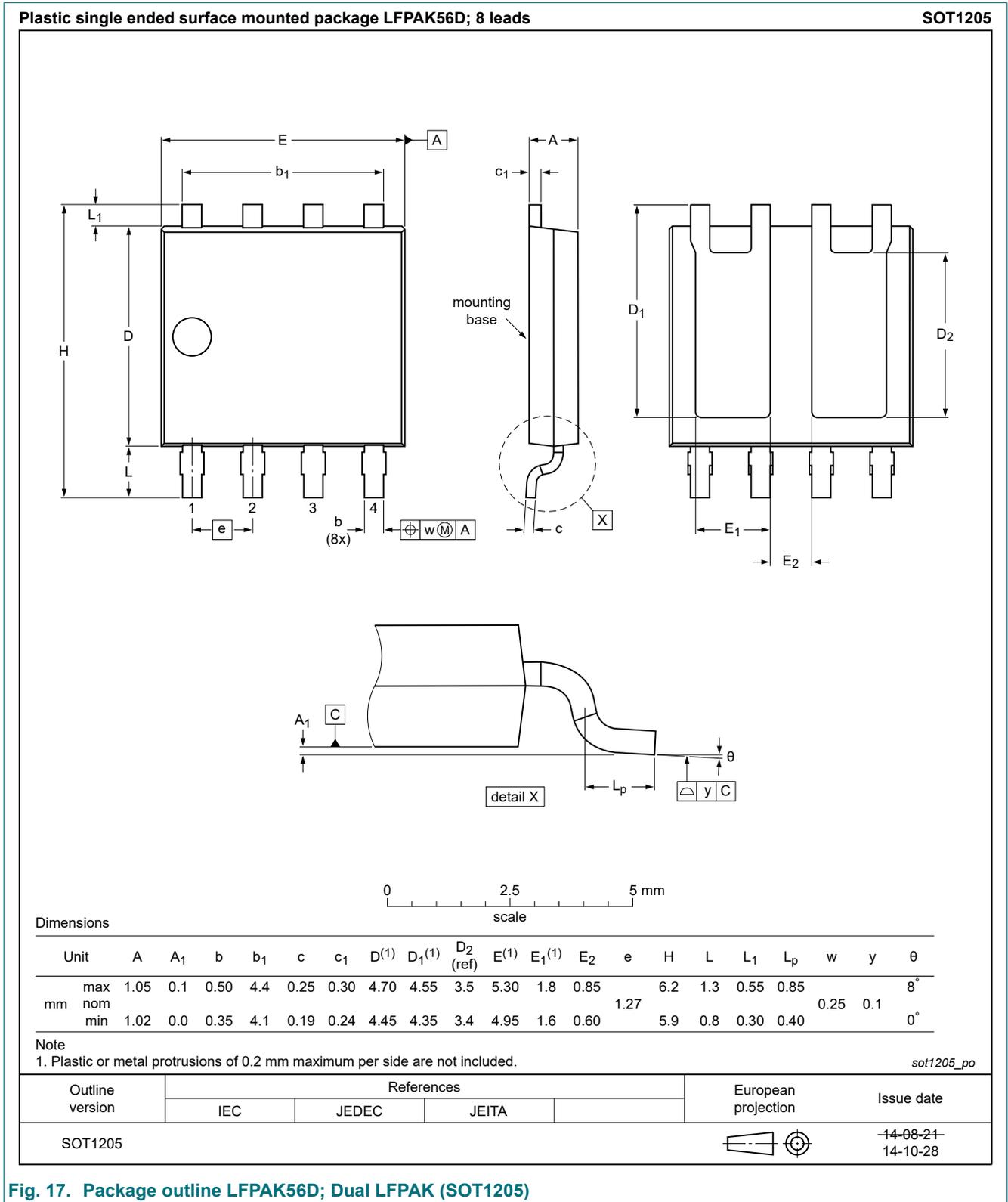


Fig. 17. Package outline LPAK56D; Dual LPAK (SOT1205)

12. Soldering

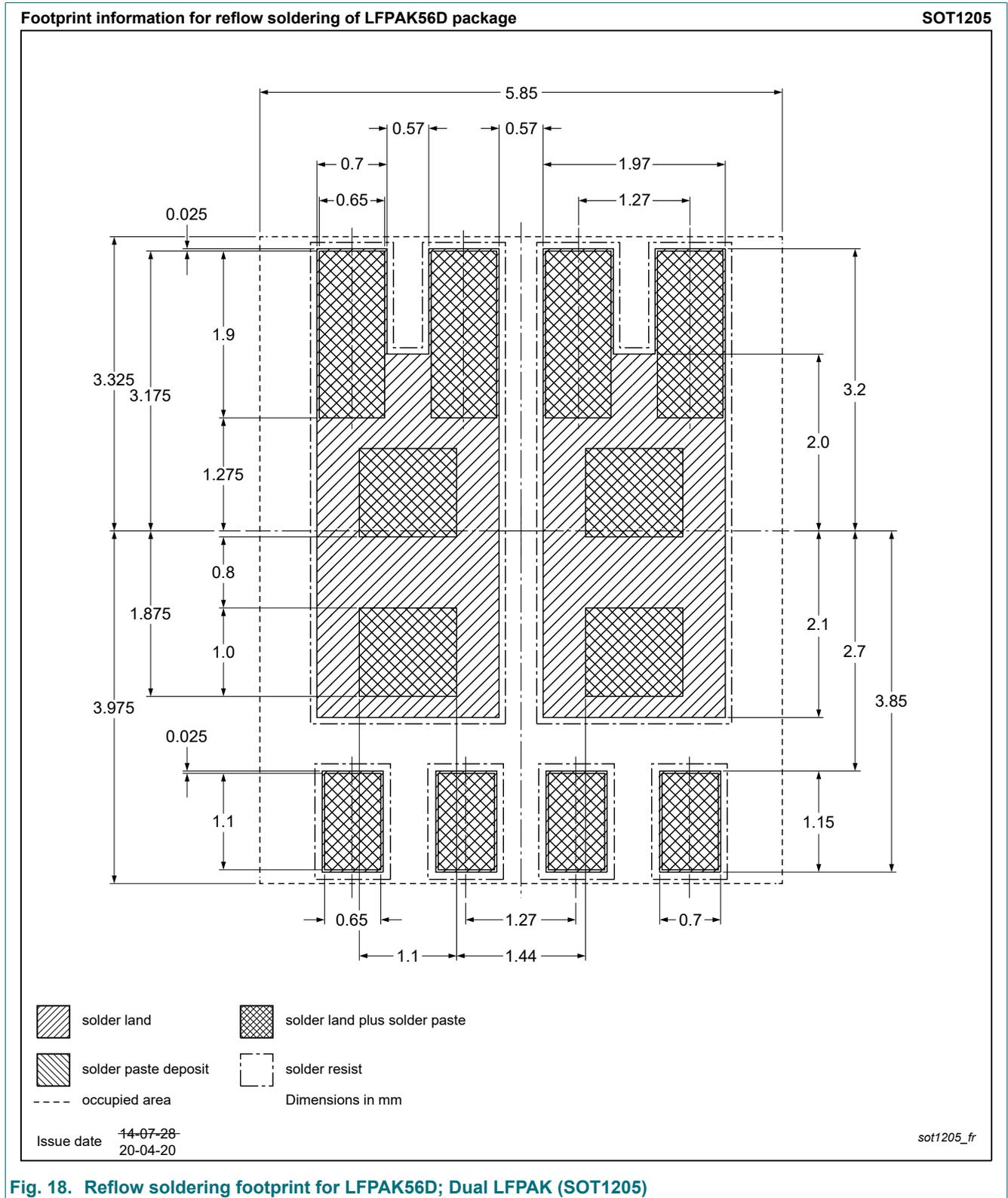


Fig. 18. Reflow soldering footprint for LPAK56D; Dual LPAK (SOT1205)

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.

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- [2] The term 'short data sheet' is explained in section "Definitions".
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