



PSMN8R0-40HL

N-channel 40 V, 9.4 mOhm, logic level MOSFET in LPAK56D using TrenchMOS technology

30 September 2022

Product data sheet

1. General description

Dual logic level N-channel MOSFET in an LPAK56D (Dual Power-SO8) package using TrenchMOS technology.

2. Features and benefits

- Dual MOSFET
- Repetitive avalanche rated
- High reliability LPAK56D package
- Copper-clip, solder die attach
- Qualified to 175 °C

3. Applications

- Brushless DC motor control
- DC-to-DC converters
- High-performance synchronous rectification
- High performance and high efficiency server power supply

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 ≤ 175 °C		-	-	40	V
I _D	drain current	V _{GS} = 5 V; T _{mb} = 25 °C; Fig. 2	[1]	-	-	30	A
P _{tot}	total power dissipation	T _{mb} = 25 °C; Fig. 1		-	-	53	W
T _j	junction temperature			-55	-	175	°C
Static characteristics FET1 and FET2							
R _{DSon}	drain-source on-state resistance	V _{GS} = 5 V; I _D = 10 A; T _j = 25 °C; Fig. 11		-	7.66	9.4	mΩ
		V _{GS} = 5 V; I _D = 10 A; T _j = 175 °C; Fig. 11 ; Fig. 12		-	15.4	18.9	mΩ
Dynamic characteristics FET1 and FET2							
Q _{GD}	gate-drain charge	I _D = 10 A; V _{DS} = 32 V; V _{GS} = 5 V; T _j = 25 °C; Fig. 13 ; Fig. 14		-	5.3	-	nC
Q _{G(tot)}	total gate charge			-	15.7	-	nC
Avalanche ruggedness FET1 and FET2							
E _{DS(AL)S}	non-repetitive drain-source avalanche energy	I _D = 30 A; V _{sup} ≤ 40 V; V _{GS} = 10 V; T _{j(init)} = 25 °C; Fig. 4	[2] [3]	-	-	84	mJ

N-channel 40 V, 9.4 mOhm, logic level MOSFET in LPAK56D using TrenchMOS technology

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Source-drain diode FET1 and FET2						
Q_r	recovered charge	$I_S = 10\text{ A}$; $dI_S/dt = -100\text{ A}/\mu\text{s}$; $V_{GS} = 0\text{ V}$; $V_{DS} = 20\text{ V}$; $T_J = 25\text{ }^\circ\text{C}$	-	12.1	-	nC

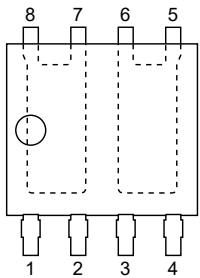
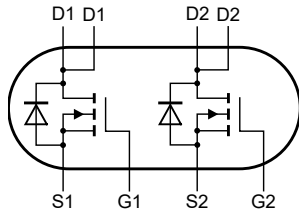
[1] Continuous current is limited by package.

[2] Refer to application note AN10273 for further information

[3] Single-pulse avalanche rating limited by maximum junction temperature of 175 °C

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S1	source1	 LPAK56D; Dual LPAK (SOT1205)	 mbk725
2	G1	gate1		
3	S2	source2		
4	G2	gate2		
5	D2	drain2		
6	D2	drain2		
7	D1	drain1		
8	D1	drain1		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PSMN8R0-40HL	LPAK56D; Dual LPAK	plastic, single ended surface mounted package (LPAK56D); 8 leads	SOT1205

7. Marking

Table 4. Marking codes

Type number	Marking code
PSMN8R0-40HL	8R0L40H

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	$25\text{ }^\circ\text{C} \leq T_J \leq 175\text{ }^\circ\text{C}$	-	40	V
V_{DGR}	drain-gate voltage	$R_{GS} = 20\text{ k}\Omega$	-	40	V
V_{GS}	gate-source voltage	Pulsed; $T_J \leq 175\text{ }^\circ\text{C}$	[1] [2] -15	15	V
		DC; $T_J \leq 175\text{ }^\circ\text{C}$	-10	10	V
P_{tot}	total power dissipation	$T_{mb} = 25\text{ }^\circ\text{C}$; Fig. 1	-	53	W

N-channel 40 V, 9.4 mOhm, logic level MOSFET in LPAK56D using TrenchMOS technology

Symbol	Parameter	Conditions		Min	Max	Unit
I_D	drain current	$V_{GS} = 5\text{ V}$; $T_{mb} = 25\text{ }^{\circ}\text{C}$; Fig. 2	[3]	-	30	A
		$V_{GS} = 5\text{ V}$; $T_{mb} = 100\text{ }^{\circ}\text{C}$; Fig. 2	[3]	-	30	A
I_{DM}	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ }^{\circ}\text{C}$; Fig. 3		-	211	A
T_{stg}	storage temperature			-55	175	$^{\circ}\text{C}$
T_j	junction temperature			-55	175	$^{\circ}\text{C}$
Source-drain diode FET1 and FET2						
I_S	source current	$T_{mb} = 25\text{ }^{\circ}\text{C}$	[3]	-	30	A
I_{SM}	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ }^{\circ}\text{C}$		-	211	A
Avalanche ruggedness FET1 and FET2						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 30\text{ A}$; $V_{sup} \leq 40\text{ V}$; $V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25\text{ }^{\circ}\text{C}$; Fig. 4	[4] [5]	-	84	mJ

- [1] Accumulated Pulse duration up to 50 hours delivers zero defect ppm
 [2] Significantly longer life times are achieved by lowering T_j and or V_{GS} .
 [3] Continuous current is limited by package.
 [4] Refer to application note AN10273 for further information
 [5] Single-pulse avalanche rating limited by maximum junction temperature of 175 $^{\circ}\text{C}$

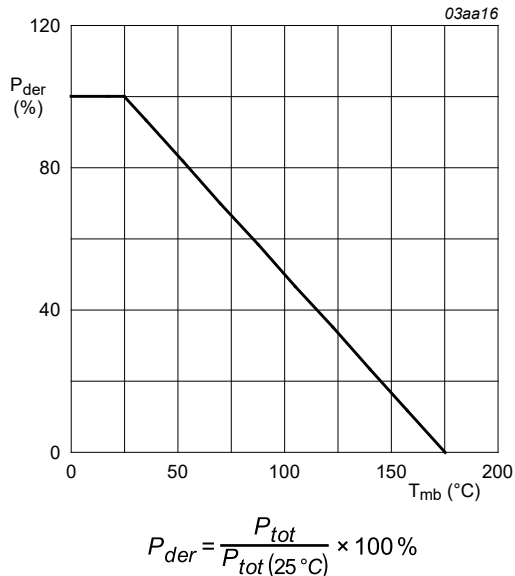


Fig. 1. Normalized total power dissipation as a function of mounting base temperature

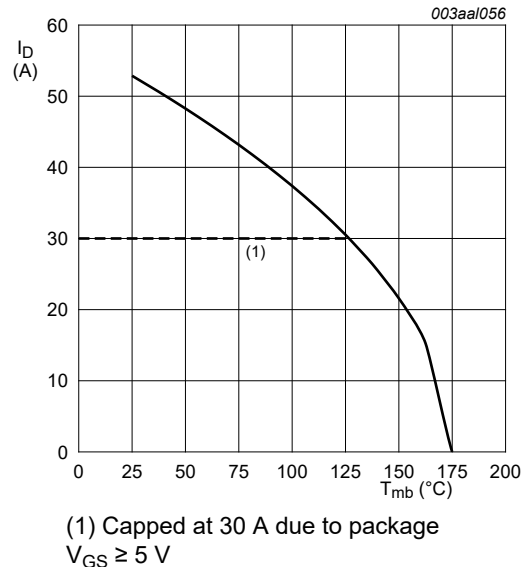


Fig. 2. Continuous drain current as a function of mounting base temperature

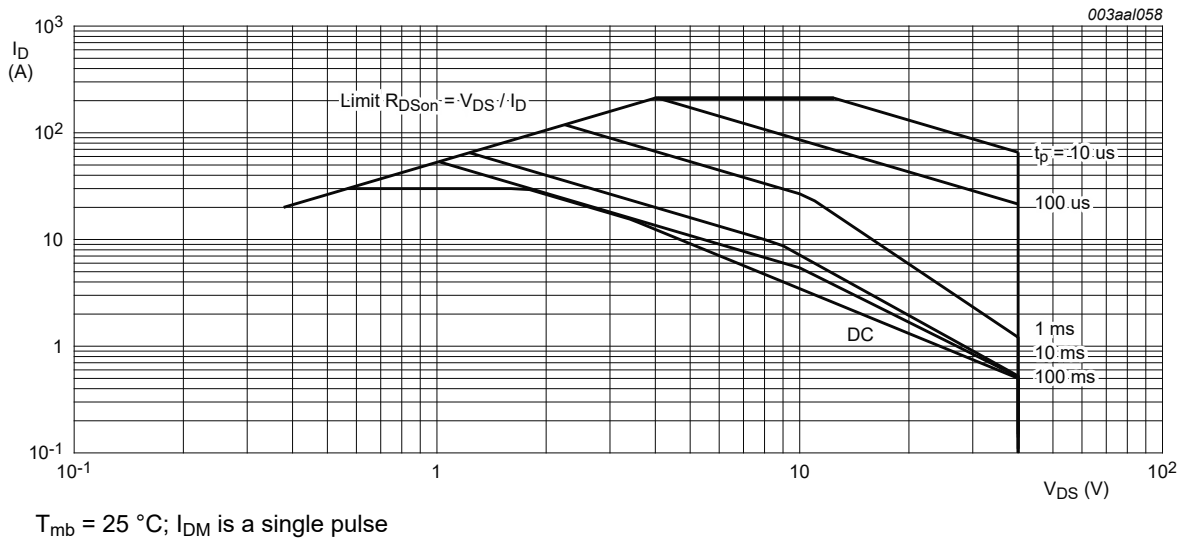
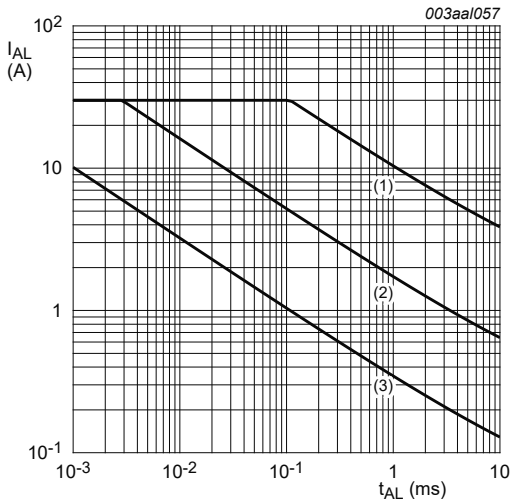


Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage



(1) $T_{j\text{ (init)}} = 25\text{ °C}$; (2) $T_{j\text{ (init)}} = 150\text{ °C}$; (3) Repetitive Avalanche

Fig. 4. Avalanche rating; avalanche current as a function of avalanche time

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	-	-	2.84	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	Minimum footprint; mounted on a printed circuit board	-	95	-	K/W

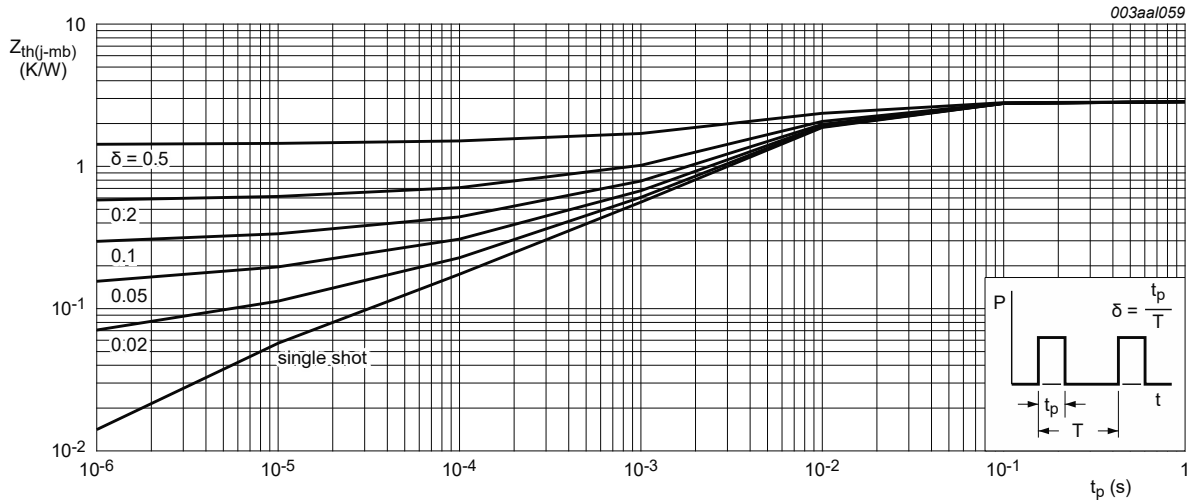


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

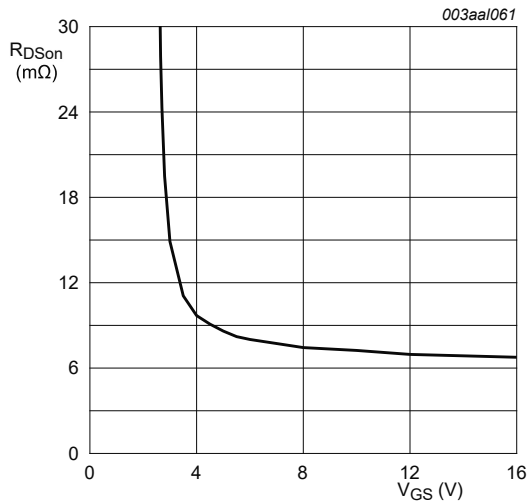
10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics FET1 and FET2							
V _{(BR)DSS}	drain-source breakdown voltage	I _D = 250 μA; V _{GS} = 0 V; T _j = -55 °C		36	-	-	V
		I _D = 250 μA; V _{GS} = 0 V; T _j = 25 °C		40	-	-	V
V _{GS(th)}	gate-source threshold voltage	I _D = 1 mA; V _{DS} =V _{GS} ; T _j = 25 °C; Fig. 9 ; Fig. 10		1.4	1.7	2.1	V
		I _D = 1 mA; V _{DS} =V _{GS} ; T _j = 175 °C; Fig. 9 ; Fig. 10		0.5	-	-	V
		I _D = 1 mA; V _{DS} =V _{GS} ; T _j = -55 °C; Fig. 9 ; Fig. 10		-	-	2.45	V
I _{DSS}	drain leakage current	V _{DS} = 40 V; V _{GS} = 0 V; T _j = 175 °C		-	-	500	μA
		V _{DS} = 40 V; V _{GS} = 0 V; T _j = 25 °C		-	0.02	1	μA
I _{GSS}	gate leakage current	V _{GS} = -10 V; V _{DS} = 0 V; T _j = 25 °C		-	2	100	nA
		V _{GS} = 10 V; V _{DS} = 0 V; T _j = 25 °C		-	2	100	nA
R _{DSon}	drain-source on-state resistance	V _{GS} = 5 V; I _D = 10 A; T _j = 25 °C; Fig. 11		-	7.66	9.4	mΩ
		V _{GS} = 5 V; I _D = 10 A; T _j = 175 °C; Fig. 11 ; Fig. 12		-	15.4	18.9	mΩ
		V _{GS} = 10 V; I _D = 10 A; T _j = 25 °C; Fig. 11		-	6.26	8	mΩ
Dynamic characteristics FET1 and FET2							
Q _{G(tot)}	total gate charge	I _D = 10 A; V _{DS} = 32 V; V _{GS} = 5 V; T _j = 25 °C; Fig. 13 ; Fig. 14		-	15.7	-	nC
Q _{GS}	gate-source charge			-	3.2	-	nC
Q _{GD}	gate-drain charge			-	5.3	-	nC
C _{iss}	input capacitance	V _{DS} = 25 V; V _{GS} = 0 V; f = 1 MHz; T _j = 25 °C; Fig. 15		-	1583	2110	pF
C _{oss}	output capacitance			-	225	270	pF
C _{rss}	reverse transfer capacitance			-	114	157	pF
t _{d(on)}	turn-on delay time	V _{DS} = 32 V; R _L = 3.3 Ω; V _{GS} = 5 V; R _{G(ext)} = 5 Ω; T _j = 25 °C		-	10.8	-	ns
t _r	rise time			-	19.8	-	ns

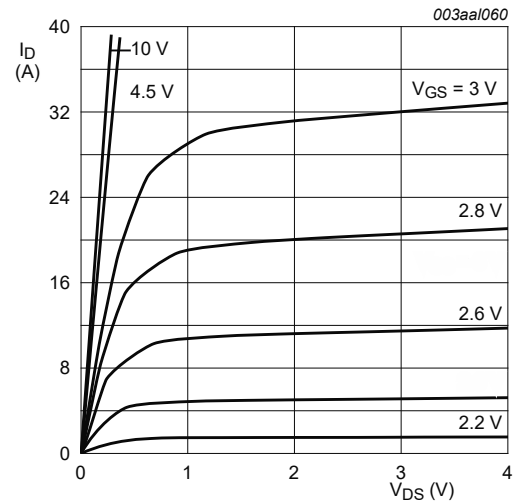
N-channel 40 V, 9.4 mOhm, logic level MOSFET in LPAK56D using TrenchMOS technology

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
t _{d(off)}	turn-off delay time			-	20.5	-	ns
t _f	fall time			-	18.2	-	ns
Source-drain diode FET1 and FET2							
V _{SD}	source-drain voltage	I _S = 10 A; V _{GS} = 0 V; T _j = 25 °C; Fig. 16		-	0.78	1.2	V
t _{rr}	reverse recovery time	I _S = 10 A; dI _S /dt = -100 A/μs; V _{GS} = 0 V;		-	20.5	-	ns
Q _r	recovered charge	V _{DS} = 20 V; T _j = 25 °C		-	12.1	-	nC



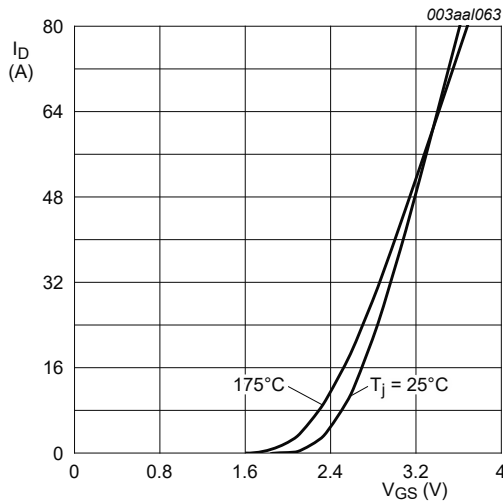
$T_J = 25\text{ }^{\circ}\text{C}$; $I_D = 10\text{ A}$

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



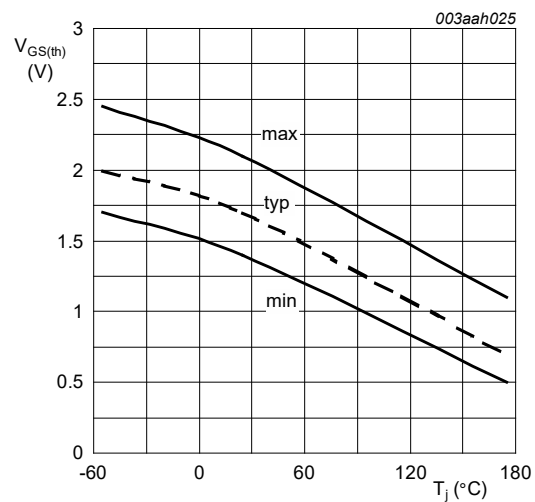
$T_J = 25\text{ }^{\circ}\text{C}$; $t_p = 300\text{ }\mu\text{s}$

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



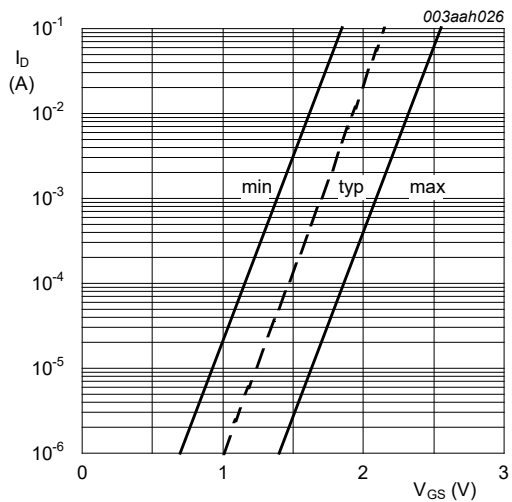
$V_{DS} = 10\text{ V}$

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



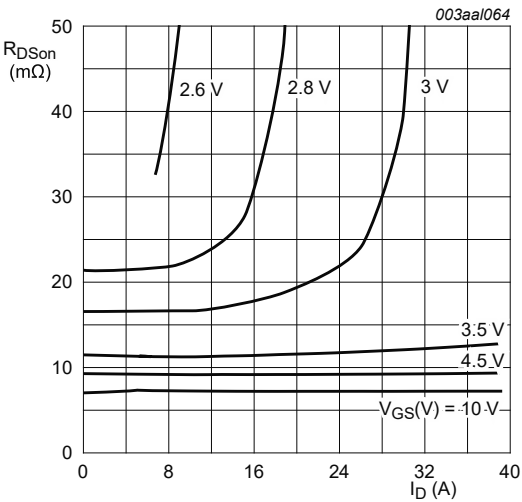
$I_D = 1\text{ mA}$; $V_{DS} = V_{GS}$

Fig. 9. Gate-source threshold voltage as a function of junction temperature



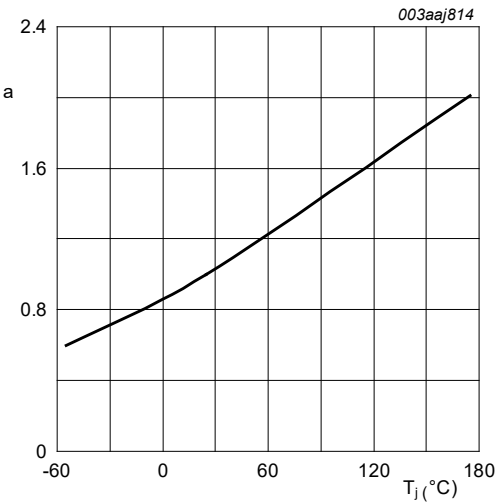
Tj = 25 °C; VDS = 5 V

Fig. 10. Sub-threshold drain current as a function of gate-source voltage



Tj = 25 °C; tp = 300 μs

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



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

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

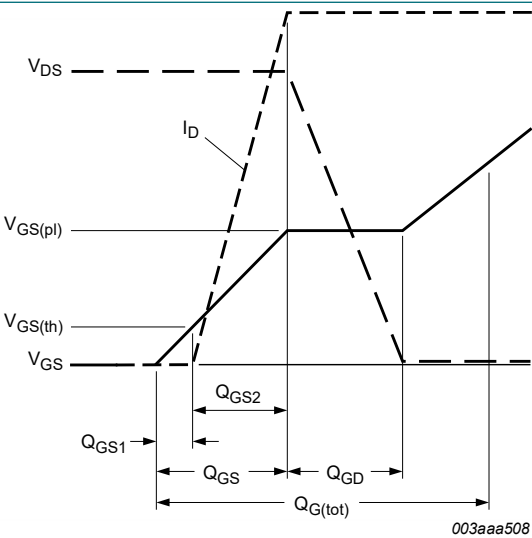


Fig. 13. Gate charge waveform definitions

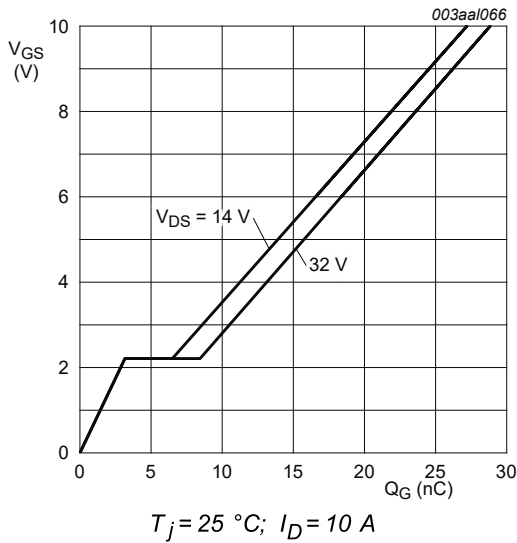


Fig. 14. Gate-source voltage as a function of gate charge; typical values

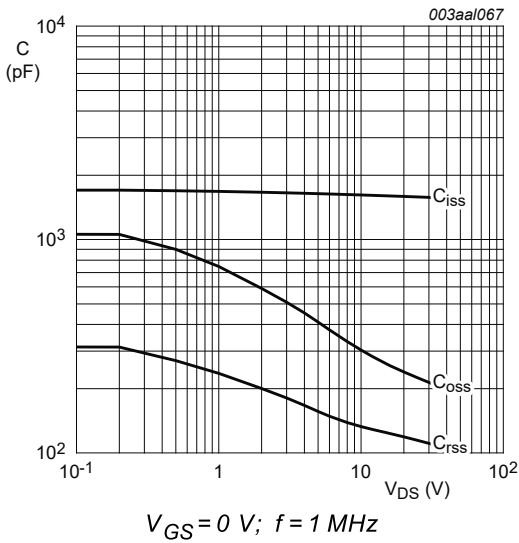


Fig. 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

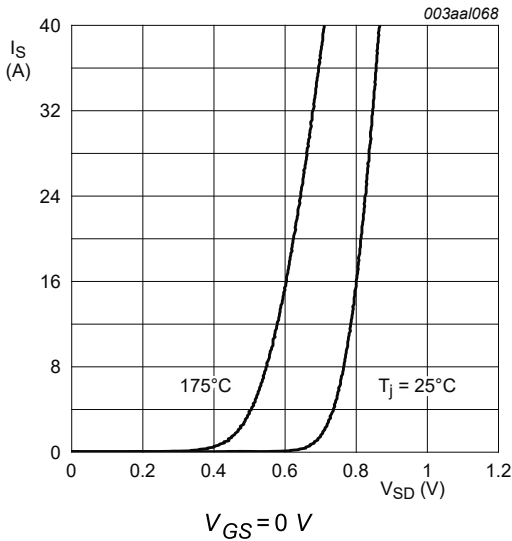


Fig. 16. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

11. Package outline

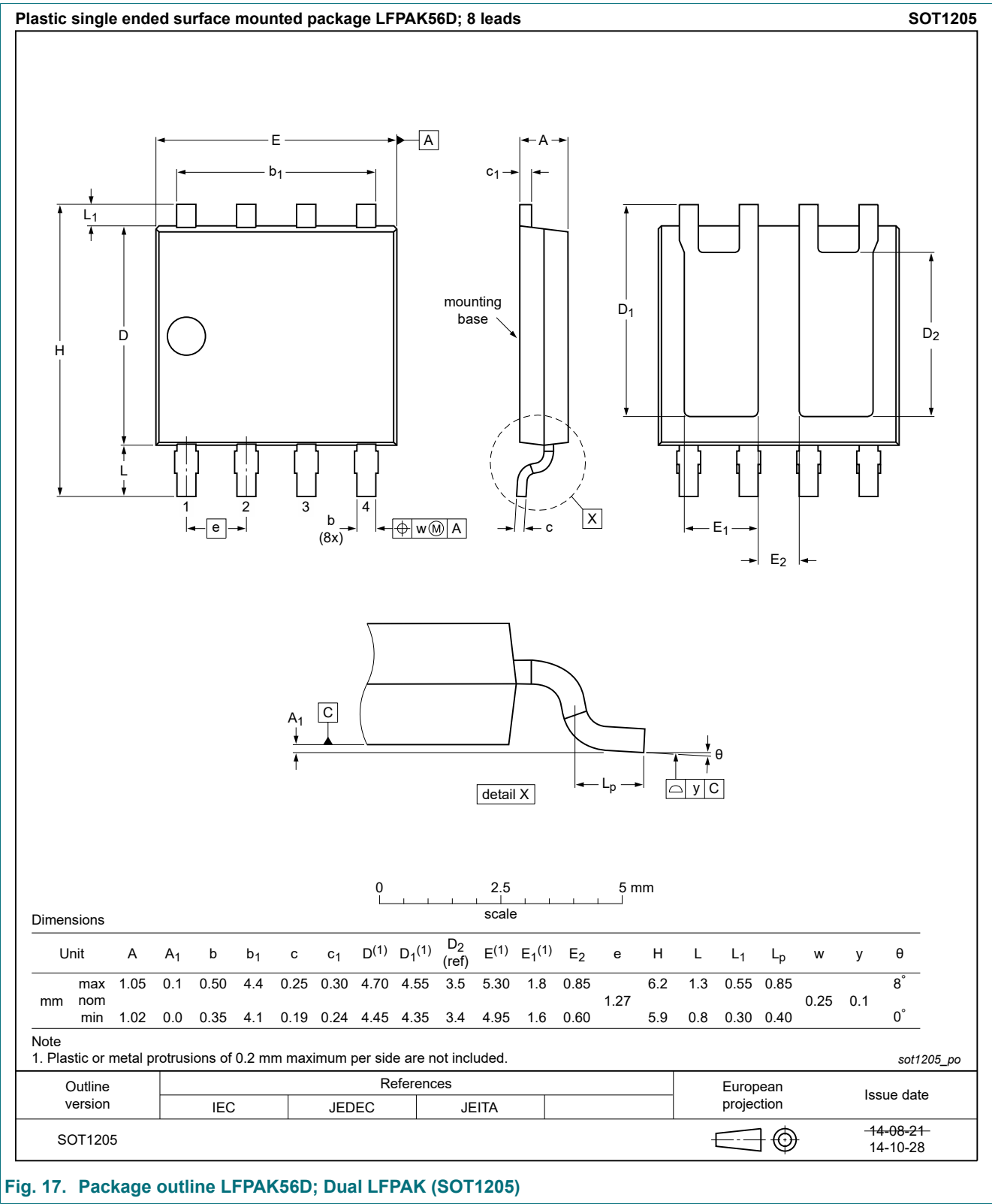


Fig. 17. Package outline LPAK56D; Dual LPAK (SOT1205)

12. Soldering

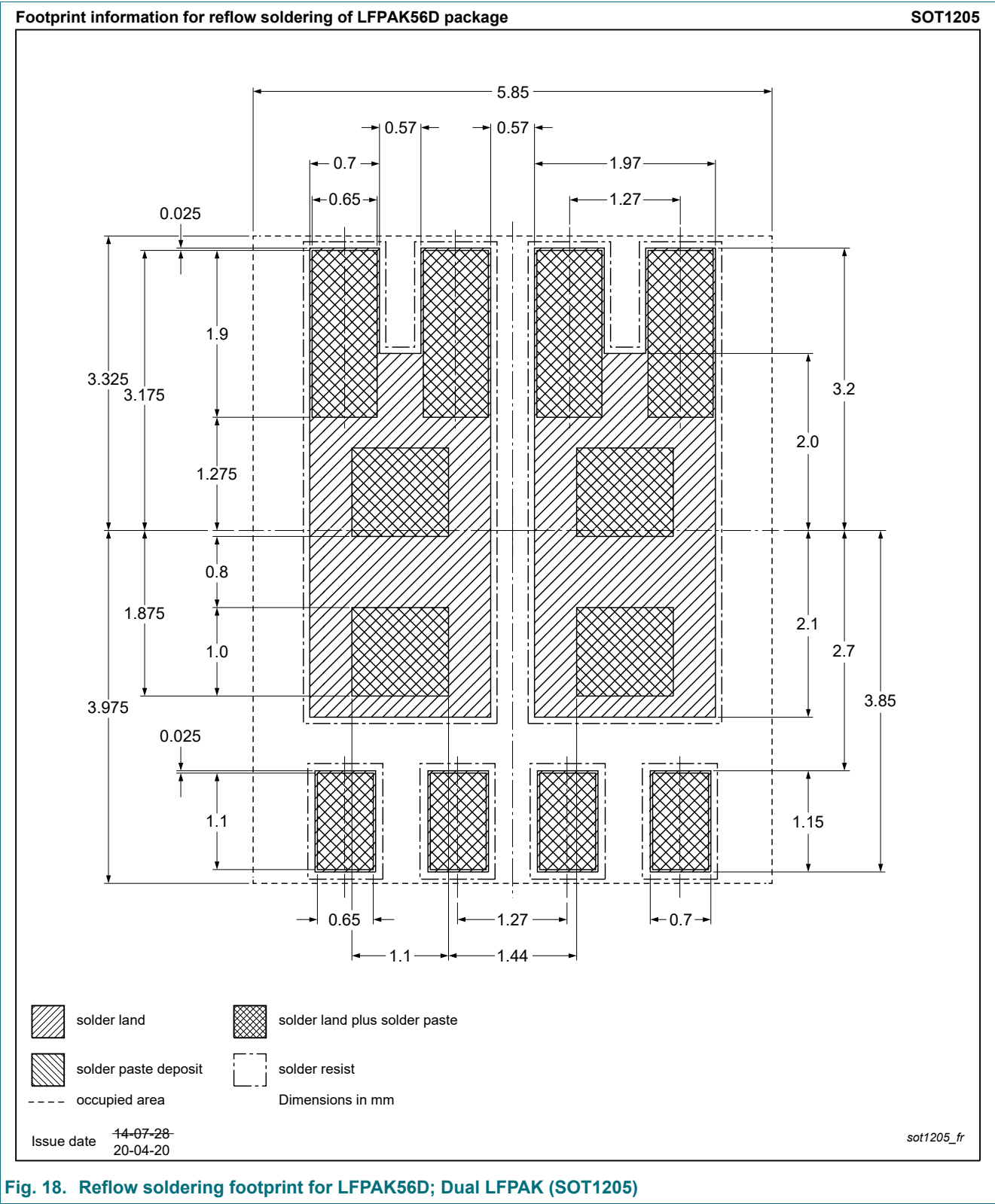


Fig. 18. Reflow soldering footprint for LPAK56D; Dual LPAK (SOT1205)

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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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..... 2

9. Thermal characteristics..... 4

10. Characteristics..... 5

11. Package outline..... 9

12. Soldering..... 10

13. Legal information.....11

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