



PMCM4401UNE

20 V, N-channel Trench MOSFET

29 May 2017

Product data sheet

1. General description

N-channel enhancement mode Field-Effect Transistor (FET) in a 4 bumps Wafer Level Chip-Size Package (WLCSP) using Trench MOSFET technology.

2. Features and benefits

- Low threshold voltage
- Ultra small package: 0.78 x 0.78 x 0.35 mm
- Trench MOSFET technology
- ElectroStatic Discharge (ESD) protection > 2 kV HBM

3. Applications

- Battery switch
- High-speed line driver
- Low-side loadswitch
- Switching circuits

4. Quick reference data

Table 1. Quick reference data

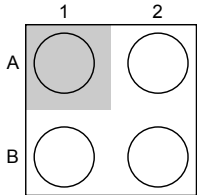
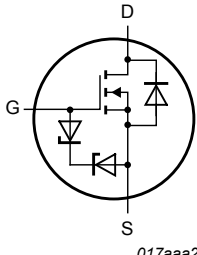
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j = 25\text{ }^{\circ}\text{C}$		-	-	20	V
V_{GS}	gate-source voltage			-8	-	8	V
I_D	drain current	$V_{GS} = 4.5\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}; t \leq 5\text{ s}$	[1]	-	-	5.4	A
Static characteristics							
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 4.5\text{ V}; I_D = 3\text{ A}; T_j = 25\text{ }^{\circ}\text{C}$		-	43	52	m Ω

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

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5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
A1	G	gate	 Transparent top view WLCSP4 (WLCSP4_2-2)	 017aaa255
A2	S	source		
B1	D	drain		
B2	S	source		

6. Ordering information

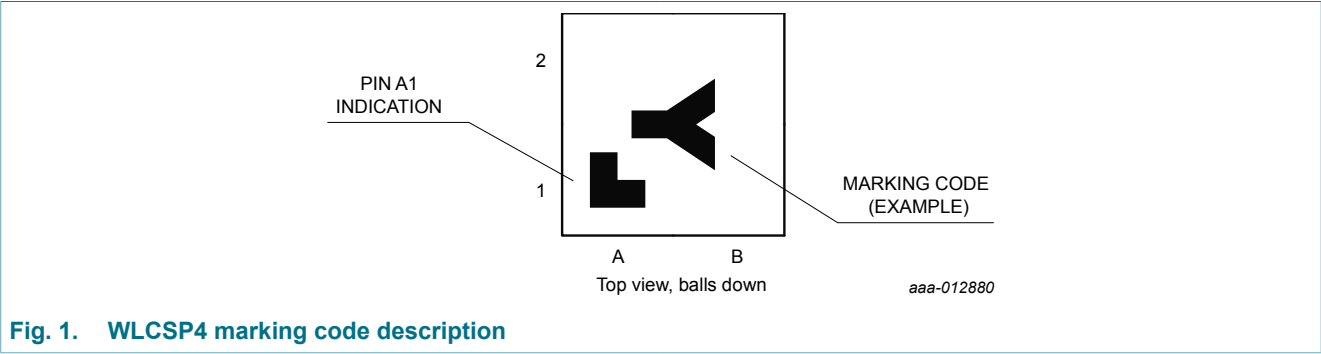
Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PMCM4401UNE	WLCSP4	wafer level chip-size package; 4 bumps (2 x 2)	WLCSP4_2-2

7. Marking

Table 4. Marking codes

Type number	Marking code
PMCM4401UNE	R



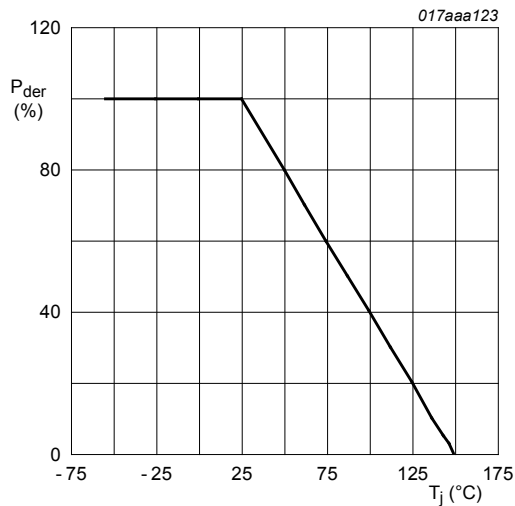
8. Limiting values

Table 5. Limiting values

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

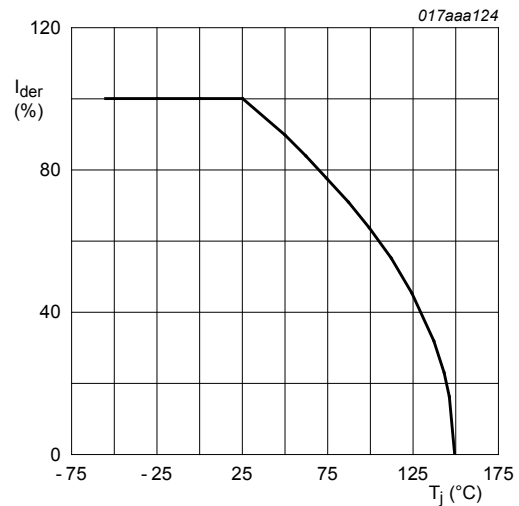
Symbol	Parameter	Conditions		Min	Max	Unit
V_{DS}	drain-source voltage	$T_j = 25\text{ }^{\circ}\text{C}$		-	20	V
V_{GS}	gate-source voltage			-8	8	V
I_D	drain current	$V_{GS} = 4.5\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}; t \leq 5\text{ s}$	[1]	-	5.4	A
		$V_{GS} = 4.5\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}$	[1]	-	4.2	A
		$V_{GS} = 4.5\text{ V}; T_{amb} = 100\text{ }^{\circ}\text{C}$	[1]	-	2.7	A
I_{DM}	peak drain current	$T_{amb} = 25\text{ }^{\circ}\text{C}$; single pulse; $t_p \leq 10\text{ }\mu\text{s}$		-	17	A
P_{tot}	total power dissipation	$T_{amb} = 25\text{ }^{\circ}\text{C}$	[2]	-	400	mW
			[1]	-	1.3	W
		$T_{sp} = 25\text{ }^{\circ}\text{C}$		-	12.5	W
T_j	junction temperature			-55	150	$^{\circ}\text{C}$
T_{amb}	ambient temperature			-55	150	$^{\circ}\text{C}$
T_{stg}	storage temperature			-65	150	$^{\circ}\text{C}$
Source-drain diode						
I_S	source current	$T_{amb} = 25\text{ }^{\circ}\text{C}$	[1]	-	1.2	A

- [1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for drain 6 cm^2
 [2] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper; tin-plated and standard footprint.



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

Fig. 2. Normalized total power dissipation as a function of junction temperature



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

Fig. 3. Normalized continuous drain current as a function of junction temperature

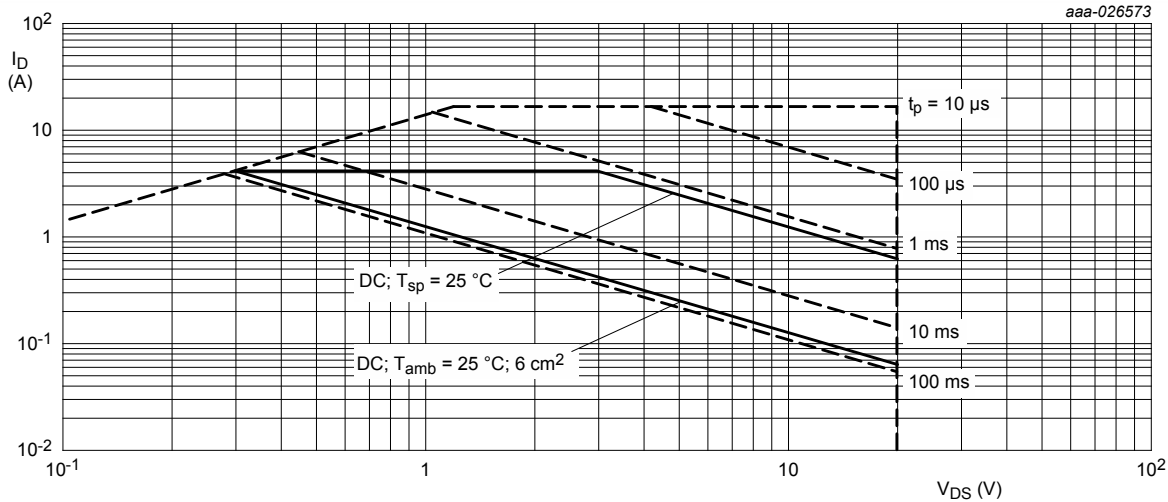


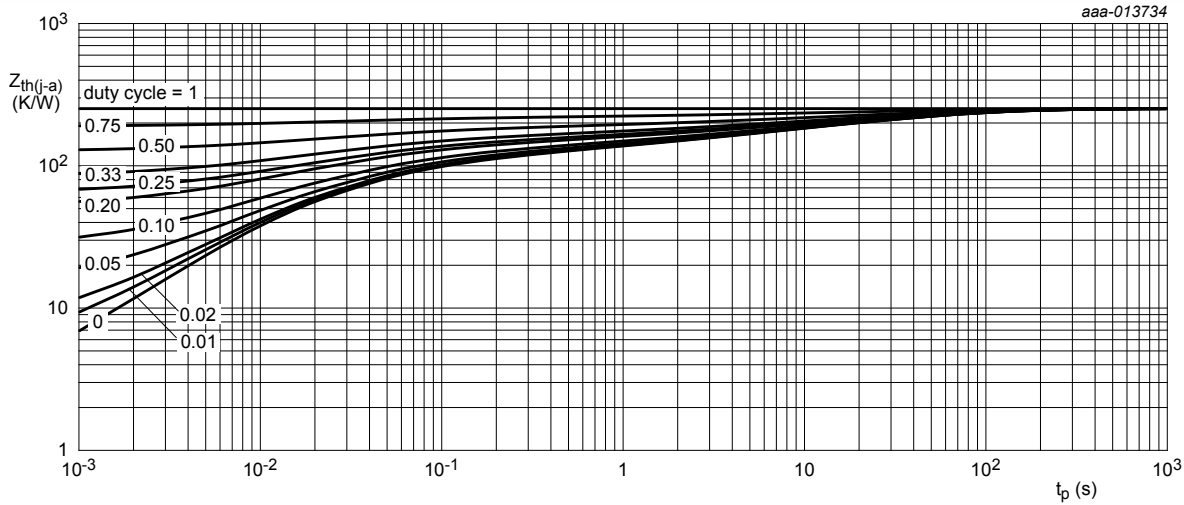
Fig. 4. Safe operating area; junction to ambient; continuous and peak drain currents as a function of drain-source voltage

9. Thermal characteristics

Table 6. Thermal characteristics

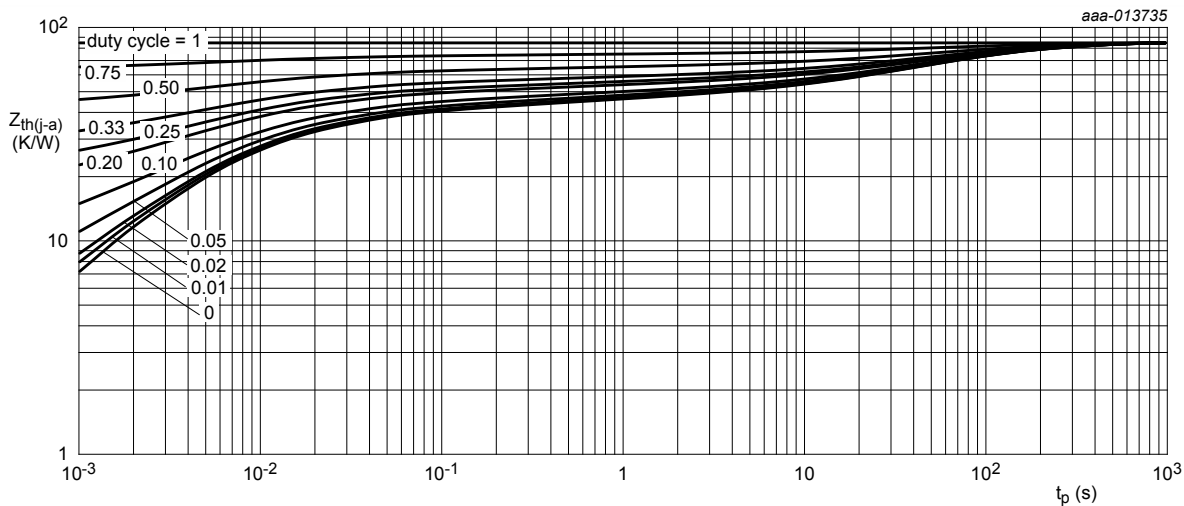
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
R _{th(j-a)}	thermal resistance from junction to ambient	in free air	[1]	-	250	300	K/W
			[2]	-	70	85	K/W
			[3]	-	85	100	K/W
		t ≤ 5 s	[3]	-	50	60	K/W
R _{th(j-sp)}	thermal resistance from junction to solder point			-	5	10	K/W

- [1] Device mounted on an FR4 Printed-Circuit Board (PCB), single sided-copper; tin-plated and standard footprint.
[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for drain, 4 layer, 1 cm²
[3] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for drain 6 cm².



FR4 PCB, standard footprint

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



FR4 PCB, mounting pad for drain 6 cm²

Fig. 6. Transient thermal impedance from junction to ambient 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 μA; V _{GS} = 0 V; T _j = 25 °C		20	-	-	V
V _{GSth}	gate-source threshold voltage	I _D = 250 μA; V _{DS} = V _{GS} ; T _j = 25 °C		0.4	0.6	0.9	V
I _{DSS}	drain leakage current	V _{DS} = 20 V; V _{GS} = 0 V; T _j = 25 °C		-	-	1	μA
I _{GSS}	gate leakage current	V _{GS} = 8 V; V _{DS} = 0 V; T _j = 25 °C		-	-	10	μA
		V _{GS} = -8 V; V _{DS} = 0 V; T _j = 25 °C		-	-	-10	μA
		V _{GS} = 4.5 V; V _{DS} = 0 V; T _j = 25 °C		-	-	1	μA
		V _{GS} = -4.5 V; V _{DS} = 0 V; T _j = 25 °C		-	-	-1	μA
		V _{GS} = 2.5 V; V _{DS} = 0 V; T _j = 25 °C		-	-	200	nA
		V _{GS} = -2.5 V; V _{DS} = 0 V; T _j = 25 °C		-	-	-200	nA
R _{DSon}	drain-source on-state resistance	V _{GS} = 4.5 V; I _D = 3 A; T _j = 25 °C		-	43	52	mΩ
		V _{GS} = 4.5 V; I _D = 3 A; T _j = 150 °C		-	60	71	mΩ
		V _{GS} = 2.5 V; I _D = 3 A; T _j = 25 °C		-	55	64	mΩ
		V _{GS} = 1.8 V; I _D = 1 A; T _j = 25 °C		-	65	85	mΩ
		V _{GS} = 1.5 V; I _D = 0.1 A; T _j = 25 °C		-	75	120	mΩ
g _{fs}	forward transconductance	V _{DS} = 5 V; I _D = 3 A; T _j = 25 °C		-	22	-	S
R _G	gate resistance	f = 1 MHz; T _j = 25 °C		-	4.6	-	Ω
Dynamic characteristics							
Q _{G(tot)}	total gate charge	V _{DS} = 10 V; I _D = 4 A; V _{GS} = 4.5 V; T _j = 25 °C		-	6.2	9	nC
Q _{GS}	gate-source charge			-	0.4	-	nC
Q _{GD}	gate-drain charge			-	2	-	nC
C _{iss}	input capacitance	V _{DS} = 10 V; f = 1 MHz; V _{GS} = 0 V; T _j = 25 °C		-	315	-	pF
C _{oss}	output capacitance			-	70	-	pF
C _{rss}	reverse transfer capacitance			-	65	-	pF
t _{d(on)}	turn-on delay time	V _{DS} = 10 V; I _D = 4 A; V _{GS} = 4.5 V; R _{G(ext)} = 6 Ω; T _j = 25 °C		-	4.4	-	ns
t _r	rise time			-	23	-	ns
t _{d(off)}	turn-off delay time			-	27	-	ns
t _f	fall time			-	10	-	ns
Source-drain diode							
V _{SD}	source-drain voltage	I _S = 1.2 A; V _{GS} = 0 V; T _j = 25 °C		-	0.7	1.2	V

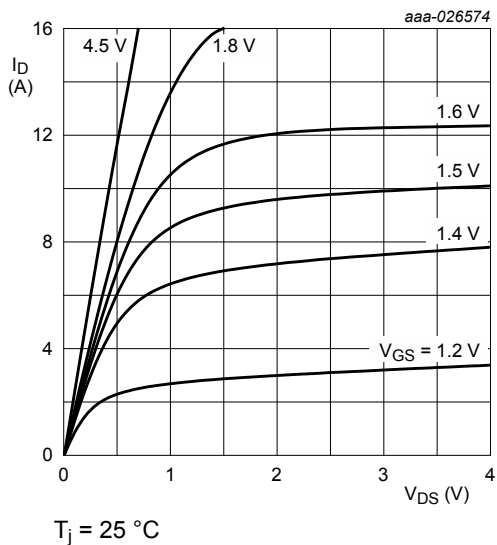


Fig. 7. Output characteristics: drain current as a function of drain-source voltage; typical values

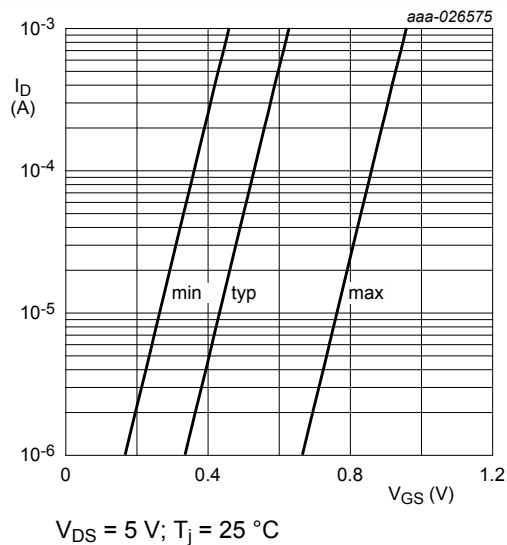


Fig. 8. Sub-threshold drain current as a function of gate-source voltage

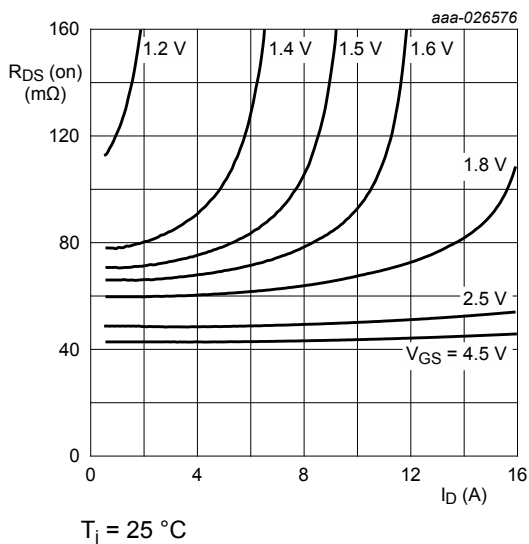


Fig. 9. Drain-source on-state resistance as a function of drain current; typical values

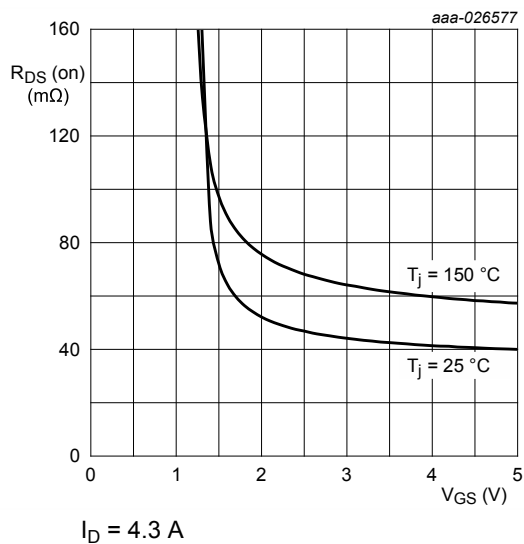


Fig. 10. Drain-source on-state resistance as a function of gate-source voltage; typical values

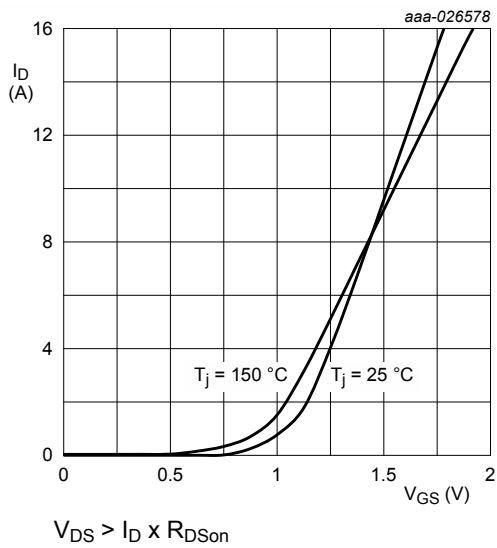


Fig. 11. Transfer characteristics; drain current as a function of gate-source voltage; typical values

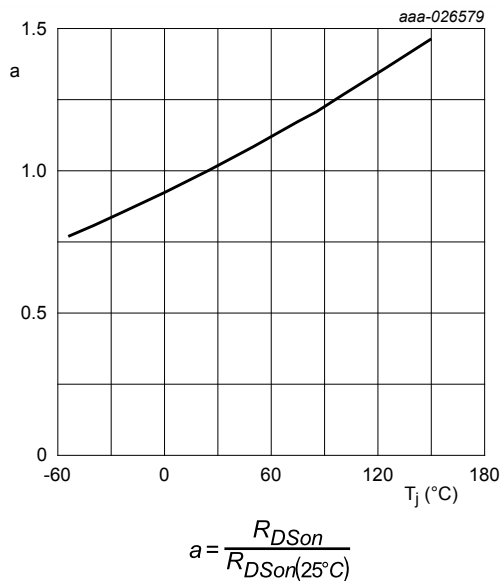


Fig. 12. Normalized drain-source on-state resistance as a function of junction temperature; typical values

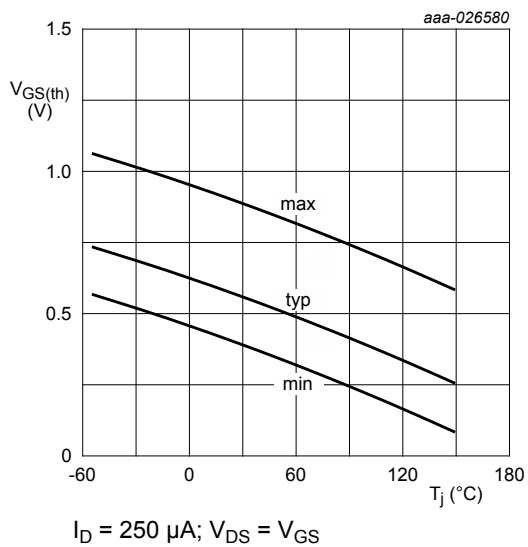


Fig. 13. Gate-source threshold voltage as a function of junction temperature

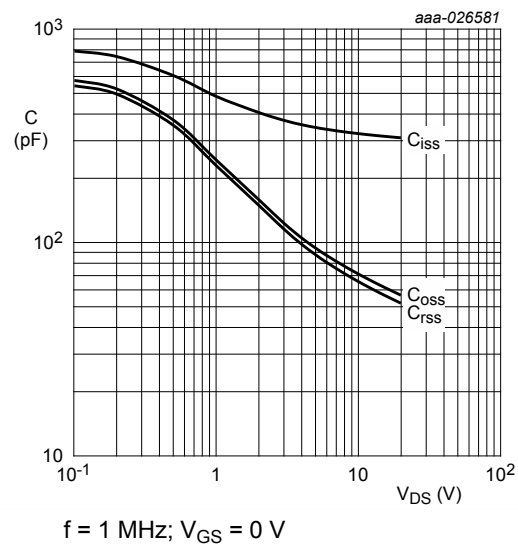


Fig. 14. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

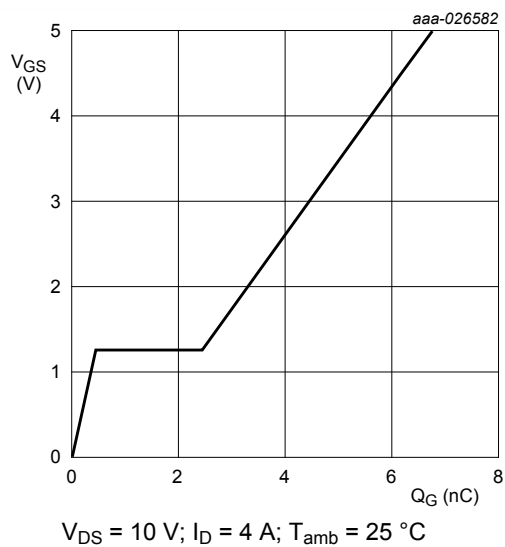


Fig. 15. Gate-source voltage as a function of gate charge; typical values

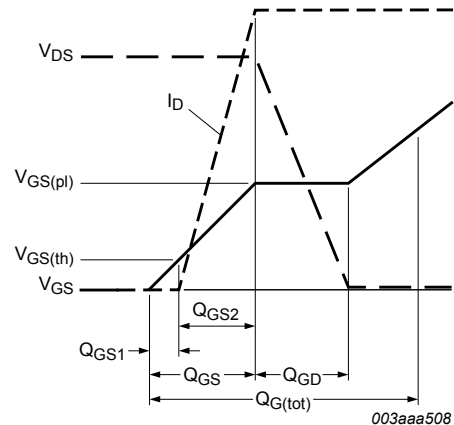


Fig. 16. Gate charge waveform definitions

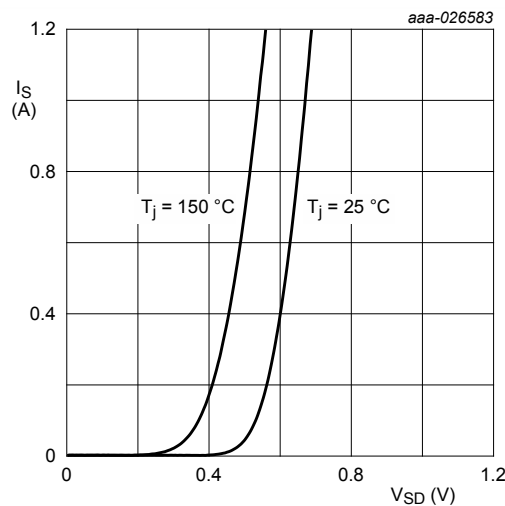


Fig. 17. Source current as a function of source-drain voltage; typical values

11. Test information

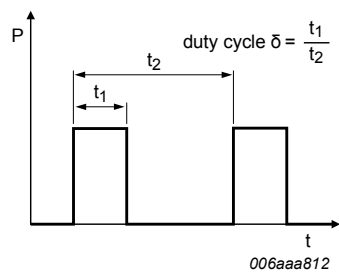


Fig. 18. Duty cycle definition

12. Package outline

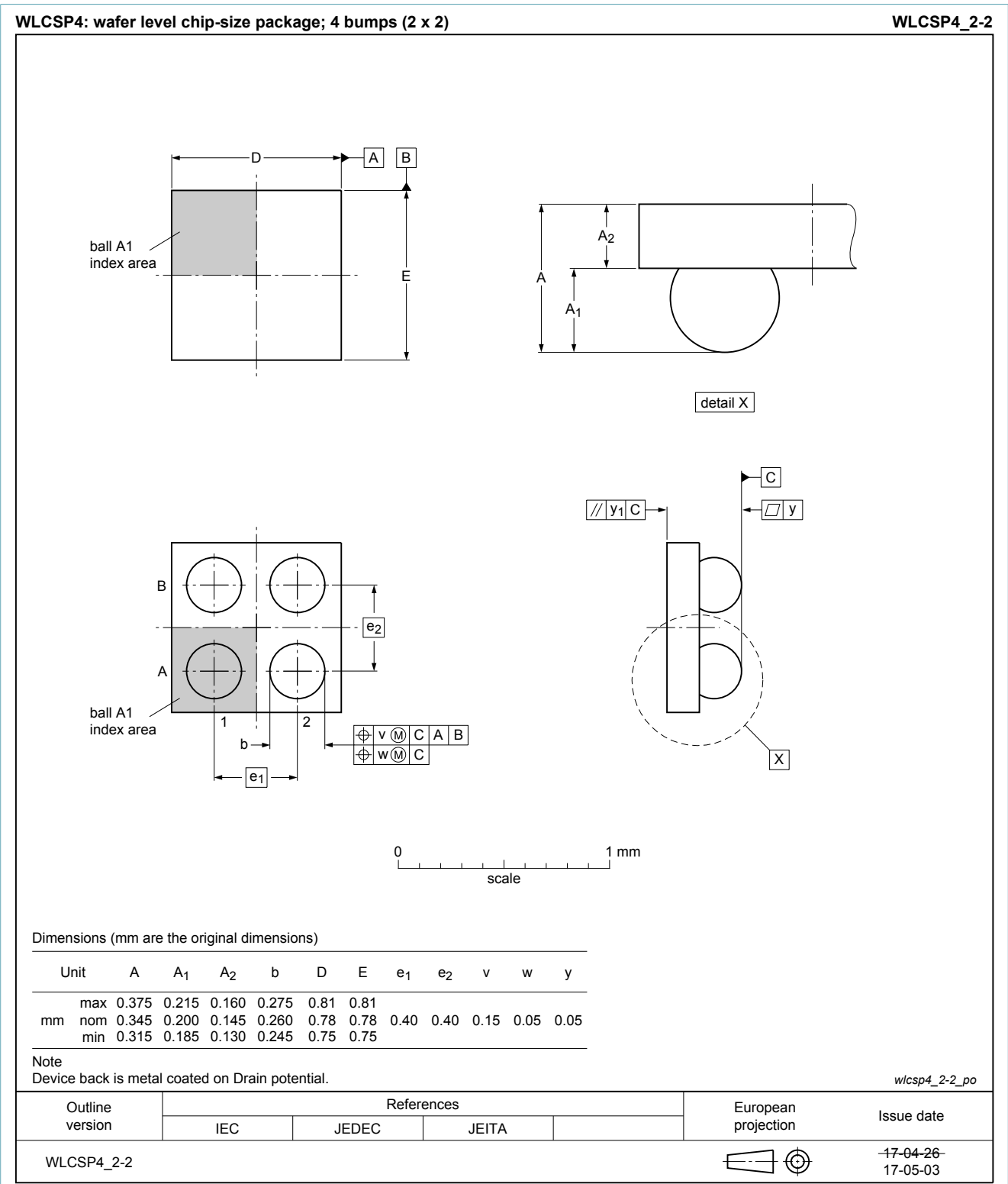


Fig. 19. Package outline WLCSP4 (WLCSP4_2-2)

13. Soldering

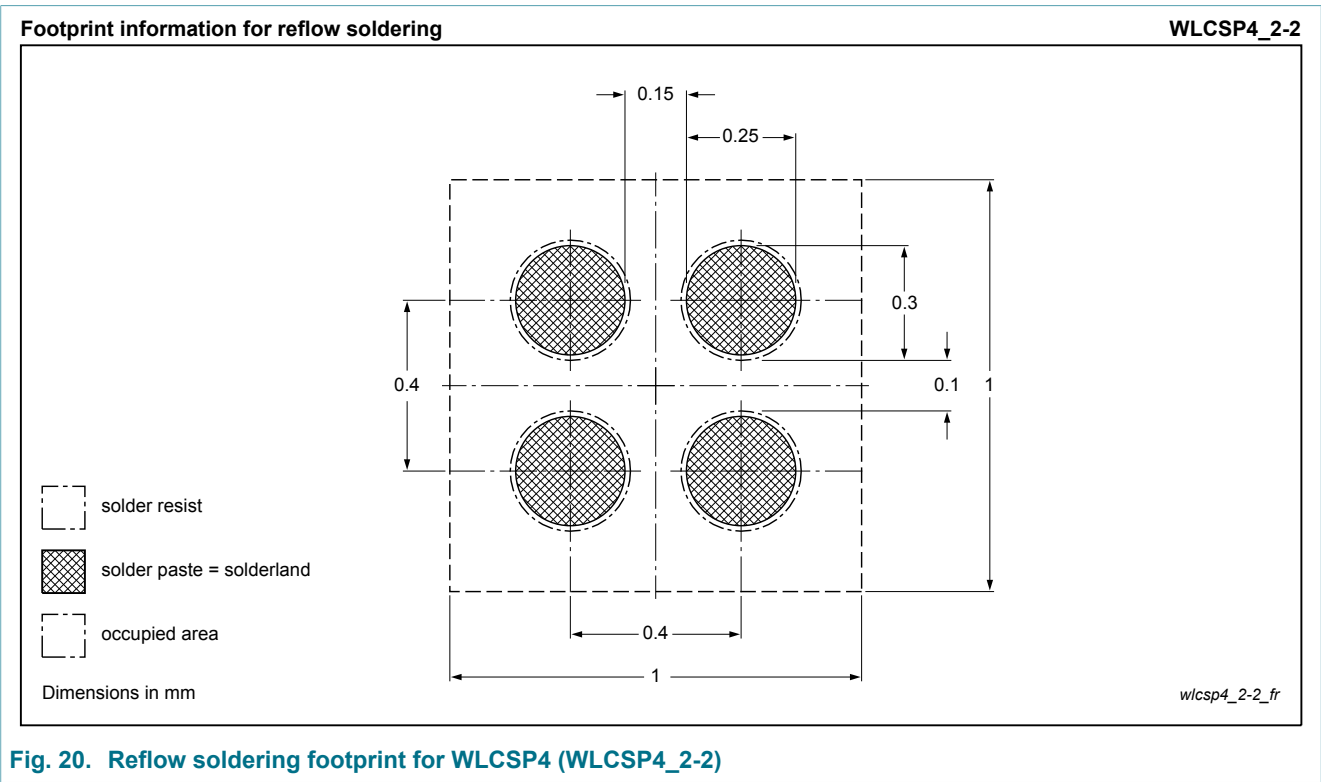


Fig. 20. Reflow soldering footprint for WLCSP4 (WLCSP4_2-2)

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMCM4401UNE v.1	20170529	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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- [2] The term 'short data sheet' is explained in section "Definitions".
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16. 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..... 4

10. Characteristics.....6

11. Test information..... 9

12. Package outline..... 10

13. Soldering..... 11

14. Revision history.....12

15. Legal information..... 13

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