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Product Reference Information

Part Number:	PMCM4401UPEZ
Manufacturer:	Nexperia USA Inc.
Package:	Please confirm with sales
Availability:	Please confirm with sales

Product Page:

<https://antrexco.com/product/details/nexperia-usa-inc/pmcm4401upez.html>

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Note:

This PDF includes an ANTREX product reference cover page.

The original manufacturer datasheet follows from the next page.

PMCM4401UPE

20 V, P-channel Trench MOSFET

7 October 2016

Product data sheet

1. General description

P-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: $0.78 \times 0.78 \times 0.35$ 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

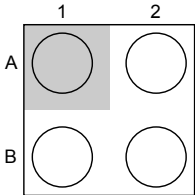
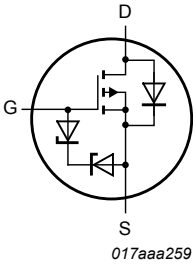
Table 1. Quick reference data

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]	-	-	-4	A
Static characteristics							
R_{DSon}	drain-source on-state resistance	$V_{GS} = -4.5\text{ V}; I_D = -3\text{ A}; T_j = 25\text{ }^{\circ}\text{C}$		-	75	95	m Ω

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

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
A1	G	gate	 Transparent top view WLCSP4 (OL-PMCM4401UPE)	
A2	S	source		
B1	D	drain		
B2	S	source		

6. Ordering information

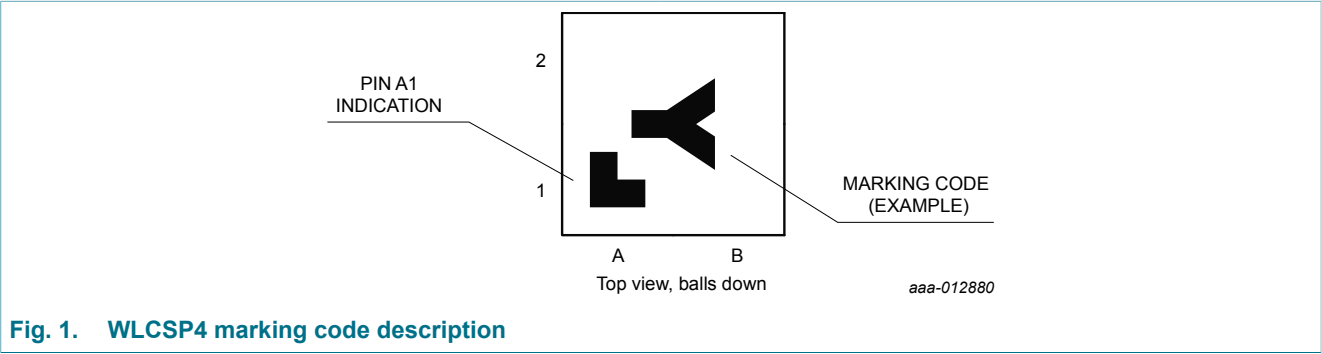
Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PMCM4401UPE	WLCSP4	WLCSP4: wafer level chip-size package; 4 bumps (2 x 2)	OL-PMCM4401UPE

7. Marking

Table 4. Marking codes

Type number	Marking code
PMCM4401UPE	S

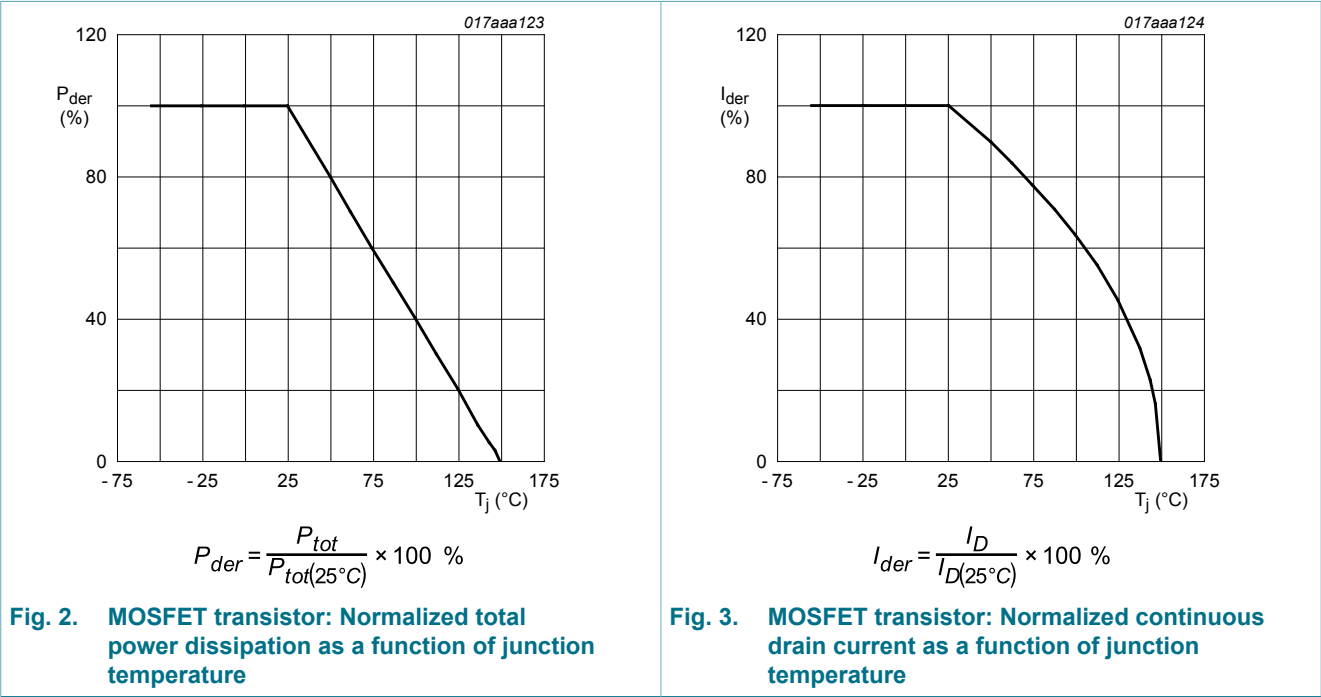


8. Limiting values

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		-	-20	V
V _{GS}	gate-source voltage			-8	8	V
I _D	drain current	V _{GS} = -4.5 V; T _{amb} = 25 °C; t ≤ 5 s	[1]	-	-4	A
		V _{GS} = -4.5 V; T _{amb} = 25 °C	[1]	-	-3.2	A
		V _{GS} = -4.5 V; T _{amb} = 100 °C	[1]	-	-2	A
I _{DM}	peak drain current	T _{amb} = 25 °C; single pulse; t _p ≤ 10 μs		-	-13	A
P _{tot}	total power dissipation	T _{amb} = 25 °C	[2]	-	400	mW
			[1]	-	1300	mW
		T _{sp} = 25 °C		-	12500	mW
T _j	junction temperature			-55	150	°C
T _{amb}	ambient temperature			-55	150	°C
T _{stg}	storage temperature			-65	150	°C
Source-drain diode						
I _S	source current	T _{amb} = 25 °C	[1]	-	-1.2	A

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



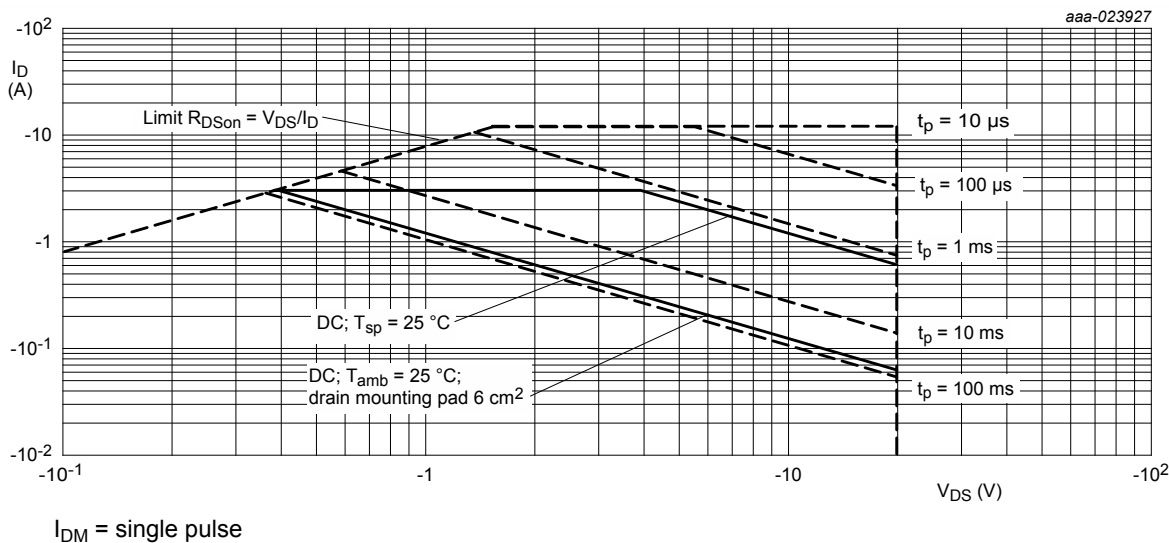


Fig. 4. Safe operating area; junction to ambient; continuous and peak drain currents as a function of drain-source voltage

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
		in free air; 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 PCB, single-sided copper, tin-plated and standard footprint.
[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for drain, 4-layer, 1 cm².
[3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for drain 6 cm².

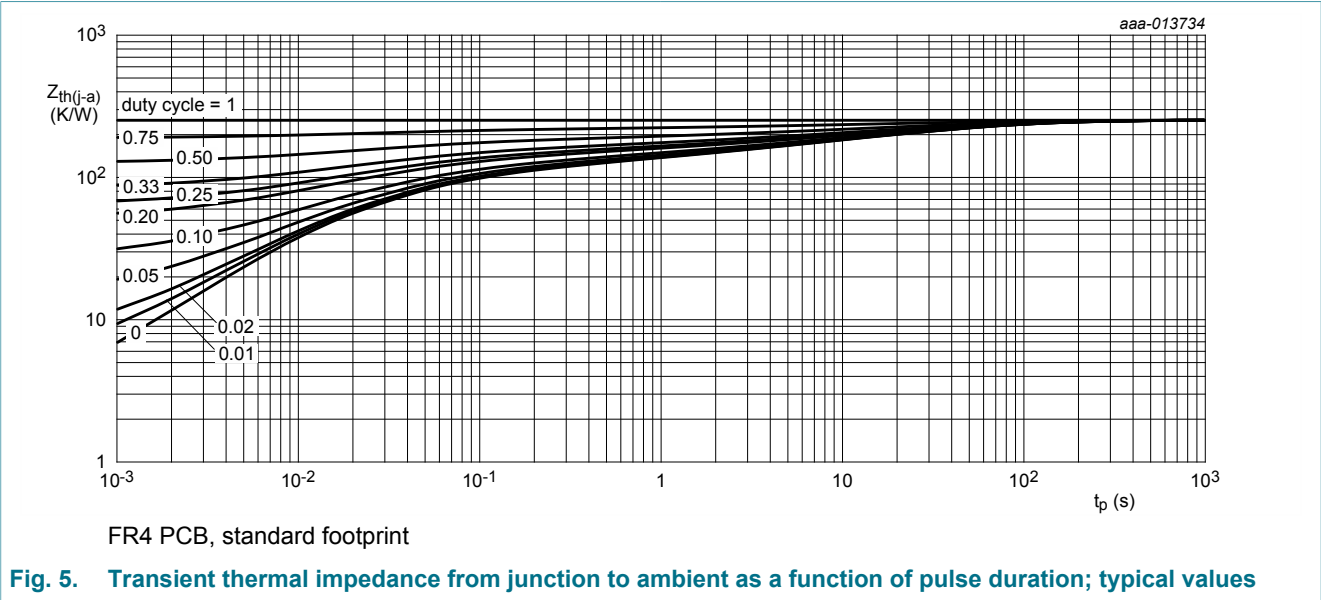


Fig. 6. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

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		-	75	95	mΩ
		V _{GS} = -4.5 V; I _D = -3 A; T _j = 150 °C		-	100	120	mΩ
		V _{GS} = -2.5 V; I _D = -2 A; T _j = 25 °C		-	95	130	mΩ
		V _{GS} = -1.8 V; I _D = -0.1 A; T _j = 25 °C		-	130	190	mΩ
g _{fs}	forward transconductance	V _{DS} = -6 V; I _D = -3 A; T _j = 25 °C		-	10.8	-	S
R _G	gate resistance	f = 1 MHz		-	7	-	Ω
Dynamic characteristics							
Q _{G(tot)}	total gate charge	V _{DS} = -10 V; I _D = -3 A; V _{GS} = -4.5 V; T _j = 25 °C		-	5.9	10	nC
Q _{GS}	gate-source charge			-	0.6	-	nC
Q _{GD}	gate-drain charge			-	1.7	-	nC
C _{iss}	input capacitance	V _{DS} = -10 V; f = 1 MHz; V _{GS} = 0 V; T _j = 25 °C		-	420	-	pF
C _{oss}	output capacitance			-	64	-	pF
C _{rss}	reverse transfer capacitance			-	58	-	pF
t _{d(on)}	turn-on delay time	V _{DS} = -10 V; I _D = -3.3 A; V _{GS} = -4.5 V; R _{G(ext)} = 6 Ω; T _j = 25 °C		-	4	-	ns
t _r	rise time			-	18	-	ns
t _{d(off)}	turn-off delay time			-	31	-	ns
t _f	fall time			-	13	-	ns
Source-drain diode							
V _{SD}	source-drain voltage	I _S = -1.2 A; V _{GS} = 0 V; T _j = 25 °C		-	-0.8	-1.2	V

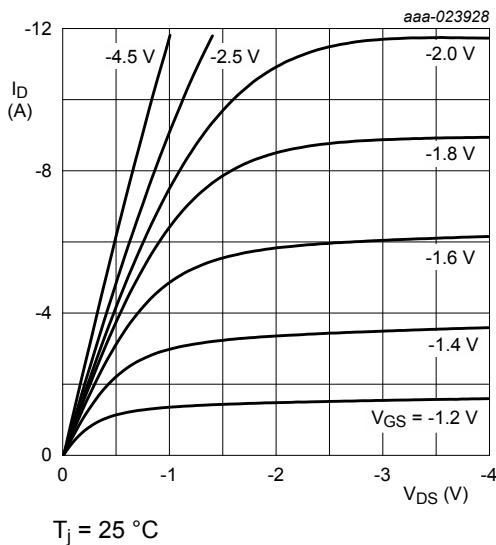


Fig. 7. Output characteristics: drain current as a function of drain-source voltage; typical values

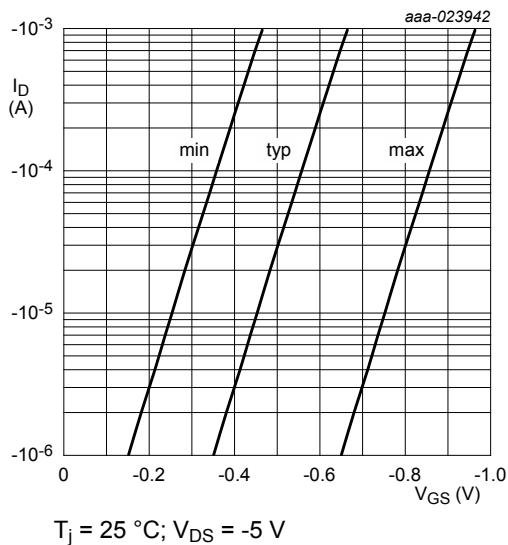


Fig. 8. Sub-threshold drain current as a function of gate-source voltage

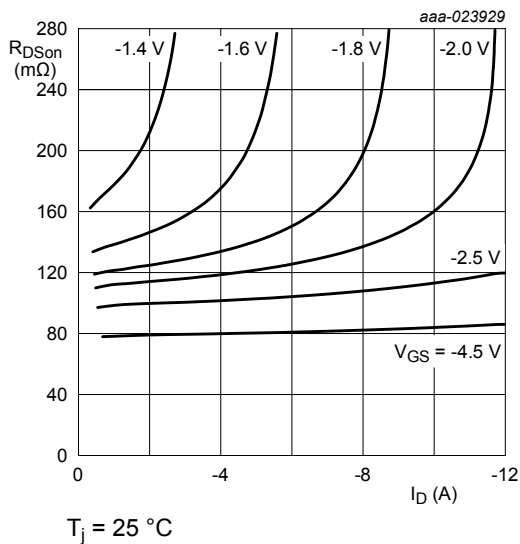


Fig. 9. Drain-source on-state resistance as a function of drain current; typical values

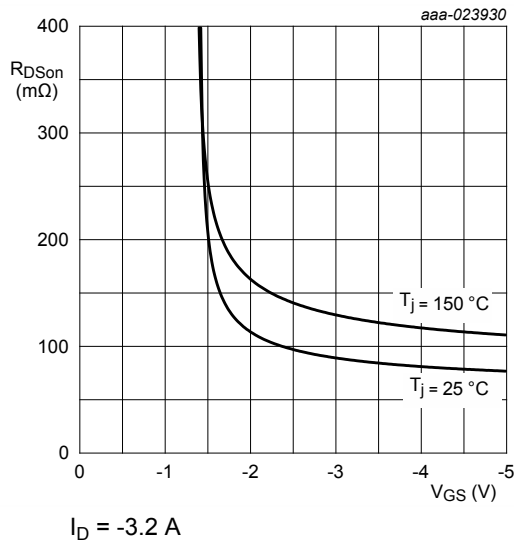


Fig. 10. Drain-source on-state resistance as a function of gate-source voltage; typical values

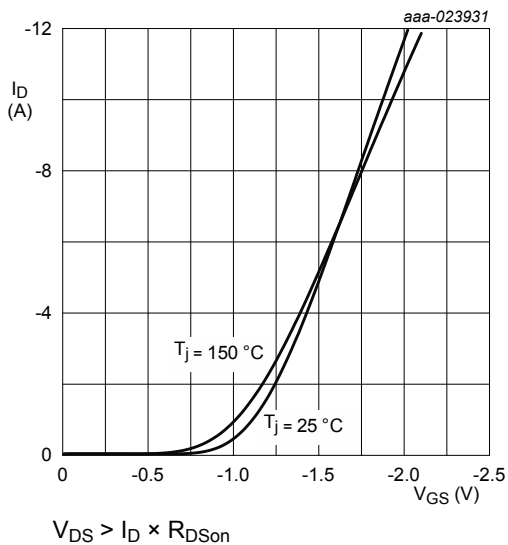


Fig. 11. Transfer characteristics: drain current as a function of gate-source voltage; typical values

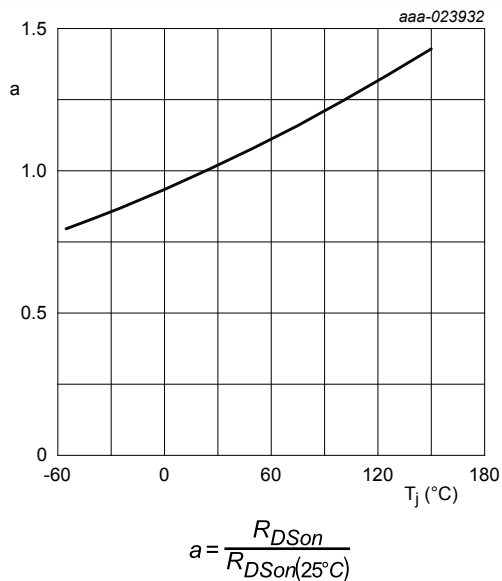


Fig. 12. Normalized drain-source on-state resistance as a function of junction temperature; typical values

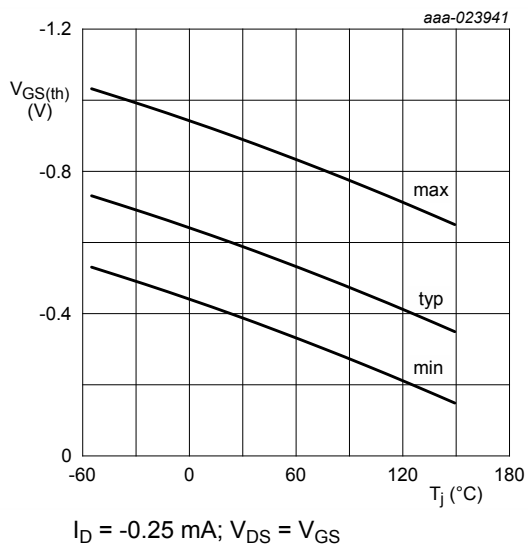


Fig. 13. Gate-source threshold voltage as a function of junction temperature

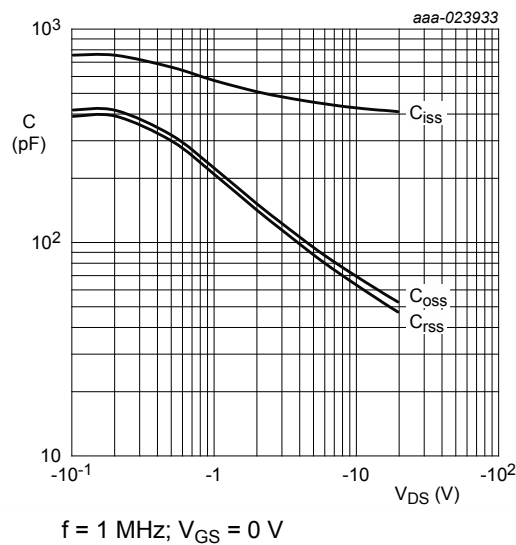


Fig. 14. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

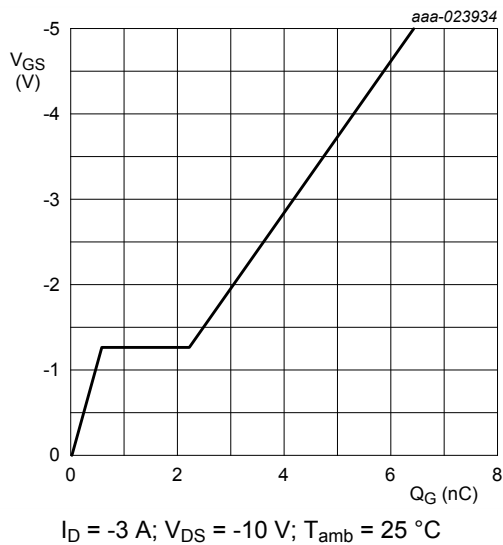


Fig. 15. Gate-source voltage as a function of gate charge; typical values

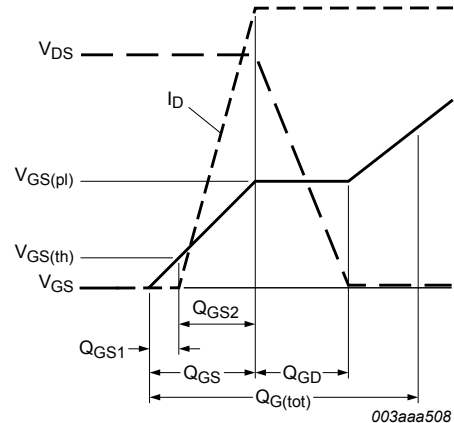


Fig. 16. MOSFET transistor: Gate charge waveform definitions

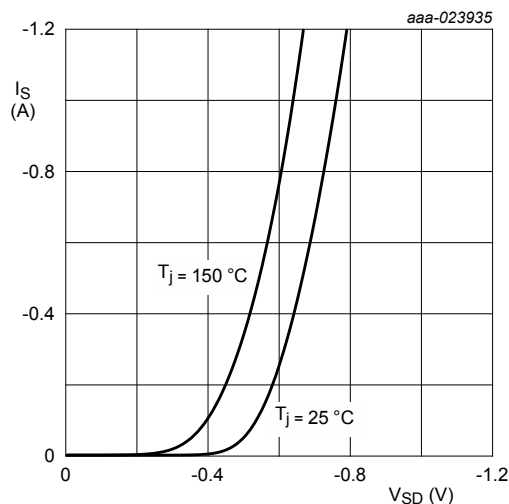


Fig. 17. Source current as a function of source-drain voltage; typical values

11. Test information

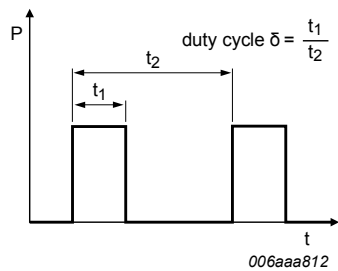


Fig. 18. Duty cycle definition

12. Package outline

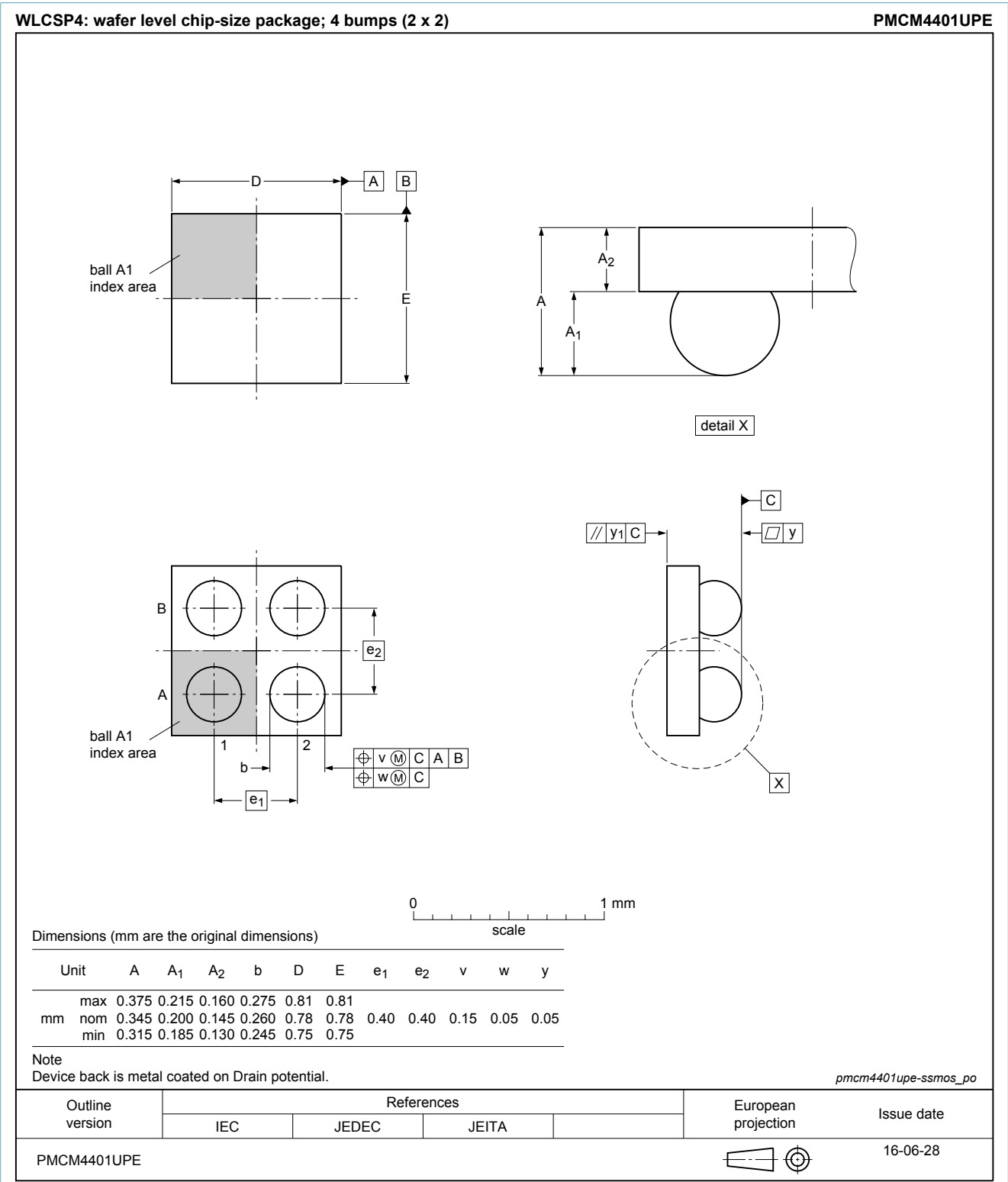
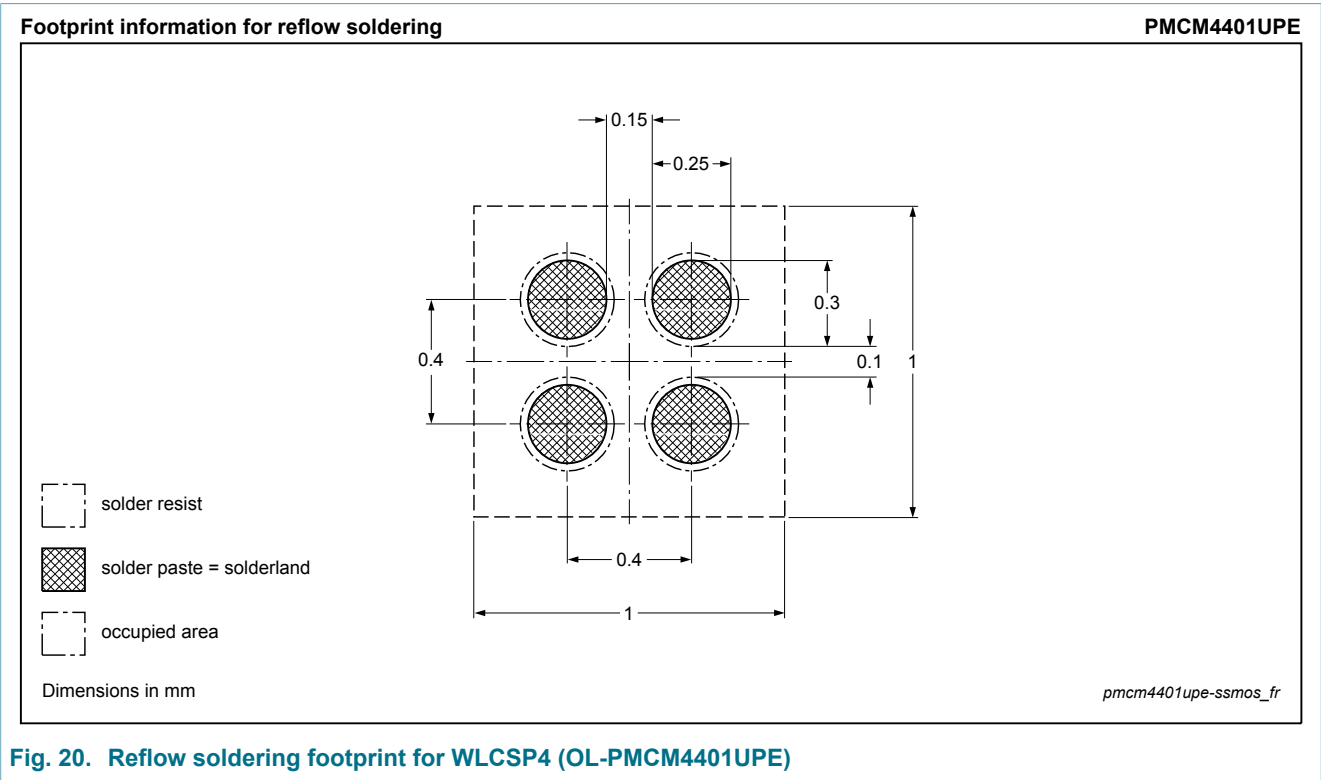


Fig. 19. Package outline WLCSP4 (OL-PMCM4401UPE)

13. Soldering



14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMCM4401UPE v.2	20161007	Product data sheet	-	PMCM4401UPE v.1
Modification:	R_{dson} at $V_{\text{GS}} = -4.5 \text{ V}$; $I_{\text{D}} = -3 \text{ A}$; $T_{\text{j}} = 25 \text{ }^{\circ}\text{C}$ corrected to $95 \text{ m}\Omega$.			
PMCM4401UPE v.1	20160704	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.

- [1] Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
- [3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nexperia.com>.

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