



# PMX400UPE

20 V, P-channel Trench MOSFET

20 March 2023

Product data sheet

## 1. General description

P-channel enhancement mode Field-Effect Transistor (FET) in a leadless ultra small DFN0603-3 (SOT8013) Surface-Mounted Device (SMD) using Trench MOSFET technology.

## 2. Features and benefits

- Low threshold voltage
- Leadless ultra small package 0.63 x 0.33 x 0.25 mm
- Trench MOSFET technology
- Low profile (0.25 mm)
- ElectroStatic Discharge (ESD) protection > 2 kV HBM

## 3. Applications

- Battery switch
- High-speed line driver
- High-side load switch
- Switching circuits

## 4. Quick reference data

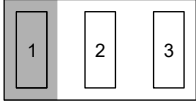
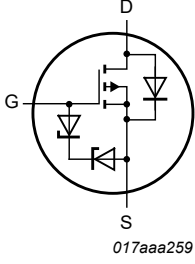
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j = 25\text{ °C}$	-	-	-20	V
$V_{GS}$	gate-source voltage		-8	-	8	V
$I_D$	drain current	$V_{GS} = -4.5\text{ V}; T_{amb} = 25\text{ °C}$	[1]	-	-900	mA
<b>Static characteristics</b>						
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = -4.5\text{ V}; I_D = -1\text{ A}; T_j = 25\text{ °C}$	-	425	500	m $\Omega$

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

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 <p>Transparent top view <b>DFN0603-3 (SOT8013)</b></p>	 <p>017aaa259</p>
2	S	source		
3	D	drain		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PMX400UPE	DFN0603-3	DFN0603-3; plastic, ultra small and leadless full encapsulated package; 3 terminals; 0.225 mm pitch; 0.63 mm x 0.33 mm x 0.25 mm body	SOT8013

## 7. Marking

Table 4. Marking codes

Type number	Marking code
PMX400UPE	F

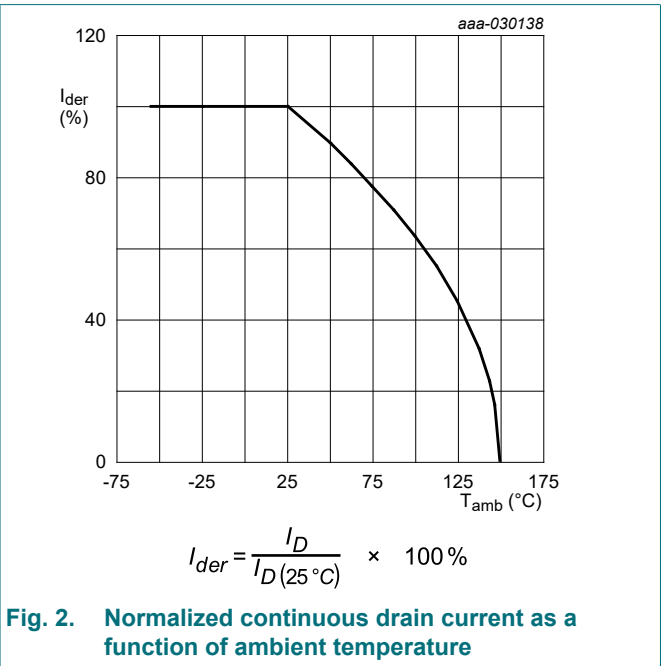
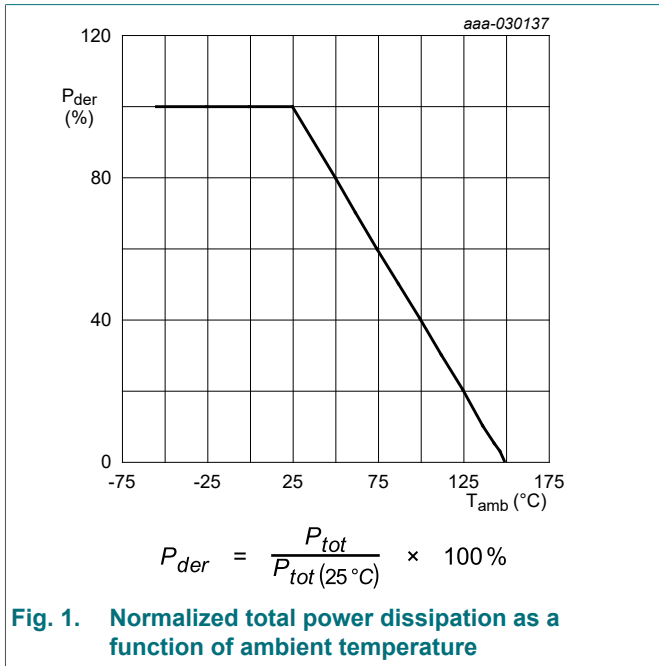
## 8. Limiting values

**Table 5. Limiting values**

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

Symbol	Parameter	Conditions		Min	Max	Unit
V <sub>DS</sub>	drain-source voltage	T <sub>j</sub> = 25 °C		-	-20	V
V <sub>GS</sub>	gate-source voltage			-8	8	V
I <sub>D</sub>	drain current	V <sub>GS</sub> = -4.5 V; T <sub>amb</sub> = 25 °C	[1]	-	-900	mA
		V <sub>GS</sub> = -4.5 V; T <sub>amb</sub> = 100 °C	[1]	-	-500	mA
I <sub>DM</sub>	peak drain current	T <sub>amb</sub> = 25 °C; single pulse; t <sub>p</sub> ≤ 10 μs		-	-3.4	A
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = 25 °C	[2]	-	300	mW
			[1]	-	500	mW
		T <sub>sp</sub> = 25 °C		-	4.7	W
T <sub>j</sub>	junction temperature			-55	150	°C
T <sub>amb</sub>	ambient temperature			-55	150	°C
T <sub>stg</sub>	storage temperature			-65	150	°C
<b>Source-drain diode</b>						
I <sub>S</sub>	source current	T <sub>amb</sub> = 25 °C	[1]	-	-500	mA

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



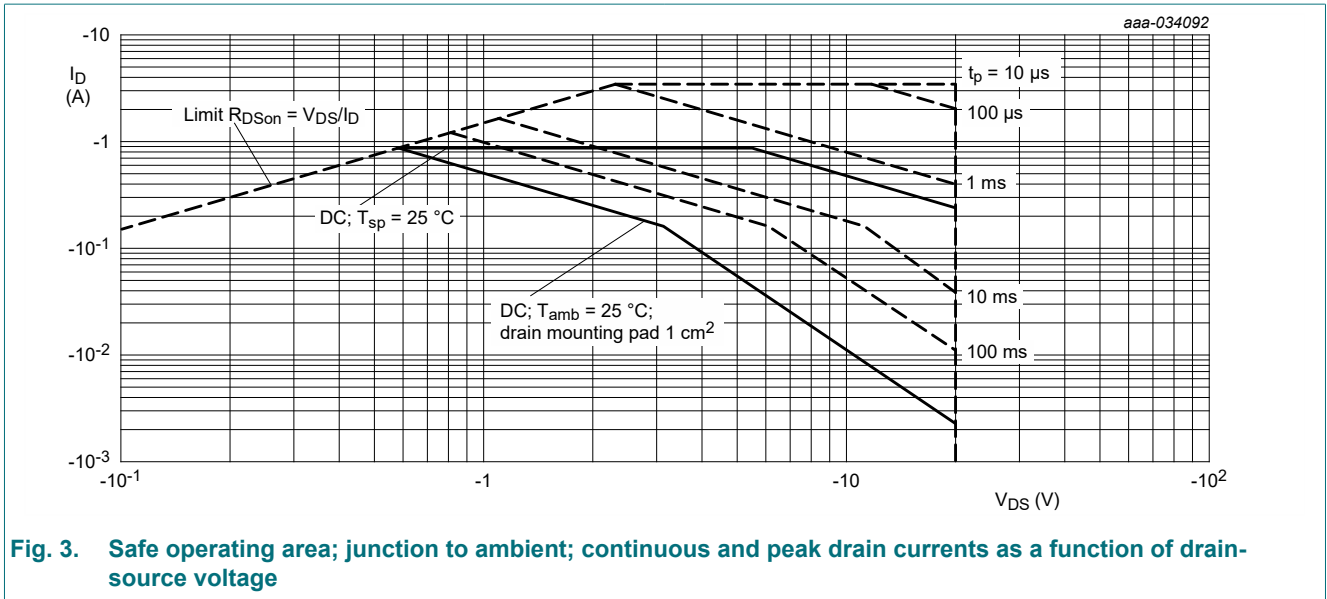


Fig. 3. Safe operating area; junction to ambient; continuous and peak drain currents as a function of drain-source voltage

### 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]	-	360	415	K/W
			[2]	-	215	250	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	23	26.5	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 and mounting pad for drain 1 cm<sup>2</sup>.

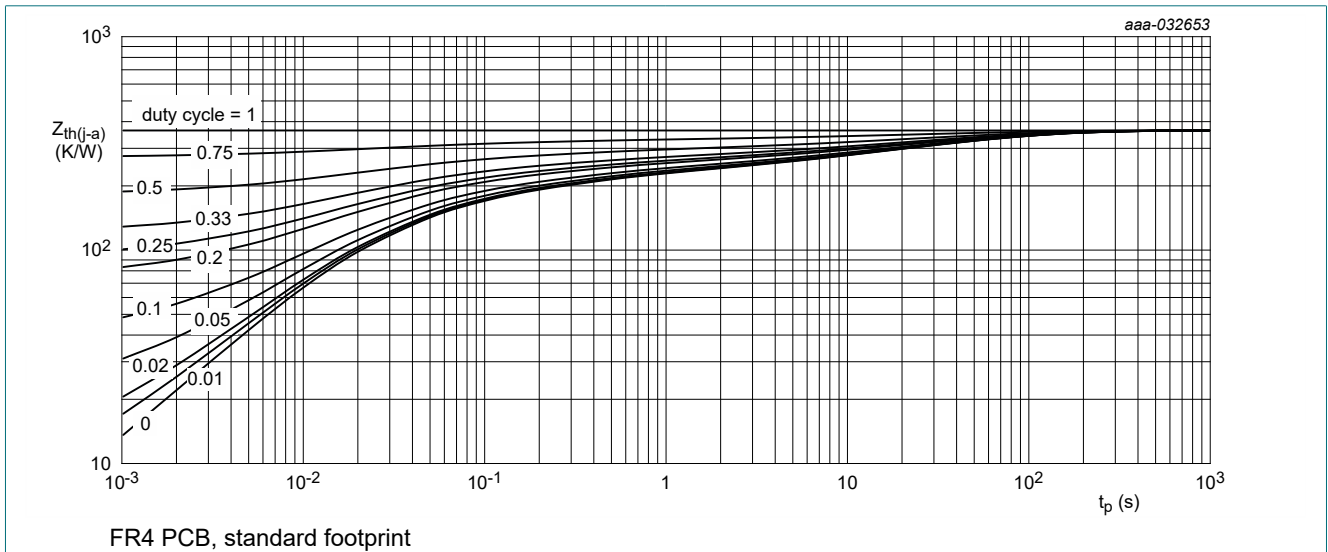


Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

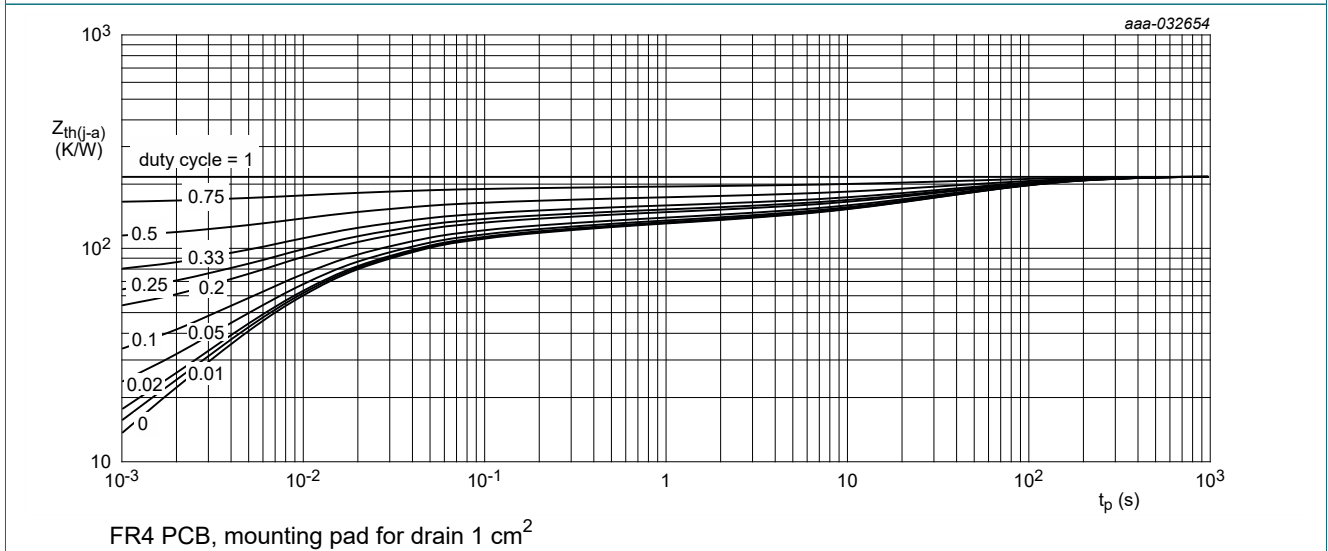


Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = -250 \mu\text{A}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-20	-	-	V
$V_{GSth}$	gate-source threshold voltage	$I_D = -250 \mu\text{A}$ ; $V_{DS} = V_{GS}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-0.5	-0.7	-0.95	V
$I_{DSS}$	drain leakage current	$V_{DS} = -20 \text{ V}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	-	-1	$\mu\text{A}$
$I_{GSS}$	gate leakage current	$V_{GS} = -8 \text{ V}$ ; $V_{DS} = 0 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	-	-10	$\mu\text{A}$
		$V_{GS} = 8 \text{ V}$ ; $V_{DS} = 0 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	-	10	$\mu\text{A}$
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = -4.5 \text{ V}$ ; $I_D = -1 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	425	500	$\text{m}\Omega$
		$V_{GS} = -4.5 \text{ V}$ ; $I_D = -1 \text{ A}$ ; $T_j = 150 \text{ }^\circ\text{C}$	-	570	670	$\text{m}\Omega$
		$V_{GS} = -2.5 \text{ V}$ ; $I_D = -1 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	510	600	$\text{m}\Omega$
		$V_{GS} = -1.8 \text{ V}$ ; $I_D = -0.5 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	765	-	$\text{m}\Omega$
$g_{fs}$	forward transconductance	$V_{DS} = -10 \text{ V}$ ; $I_D = -1 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	2.5	-	S
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$V_{DS} = -10 \text{ V}$ ; $I_D = -1 \text{ A}$ ; $V_{GS} = -4.5 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	1.6	2.3	nC
$Q_{GS}$	gate-source charge		-	0.2	-	nC
$Q_{GD}$	gate-drain charge		-	0.5	-	nC
$C_{iss}$	input capacitance	$V_{DS} = -10 \text{ V}$ ; $f = 1 \text{ MHz}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	127	-	pF
$C_{oss}$	output capacitance		-	18	-	pF
$C_{rss}$	reverse transfer capacitance		-	13	-	pF
$t_{d(on)}$	turn-on delay time		$V_{DS} = -10 \text{ V}$ ; $I_D = -1 \text{ A}$ ; $V_{GS} = -4.5 \text{ V}$ ; $R_{G(ext)} = 6 \Omega$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	4	-
$t_r$	rise time	-		17	-	ns
$t_{d(off)}$	turn-off delay time	-		50	-	ns
$t_f$	fall time	-		35	-	ns
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = -0.5 \text{ A}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	-0.9	-1.2	V

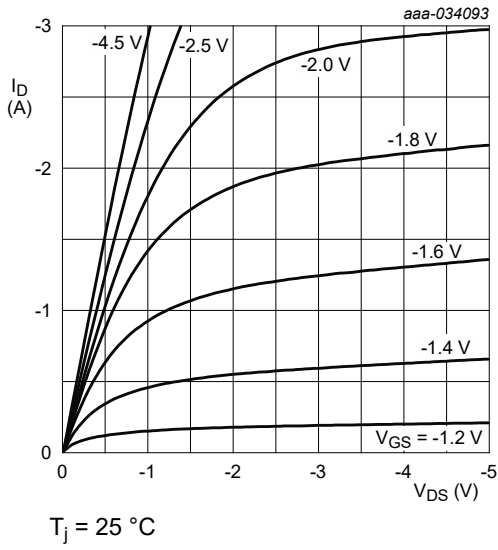


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

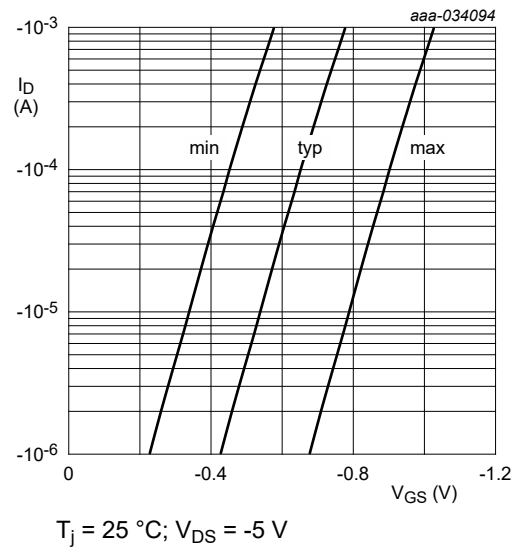


Fig. 7. Sub-threshold drain current as a function of gate-source voltage

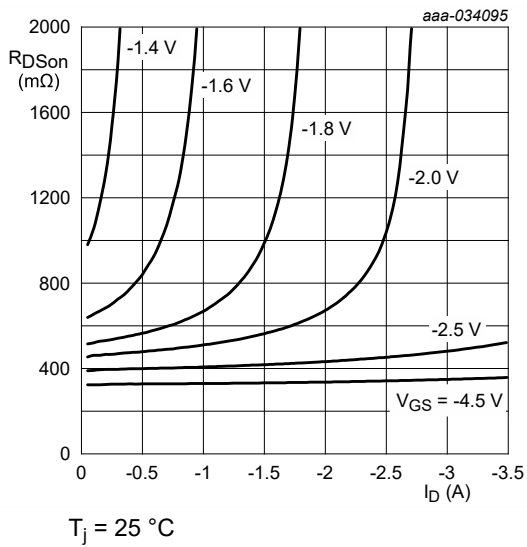


Fig. 8. Drain-source on-state resistance as a function of drain current; typical values

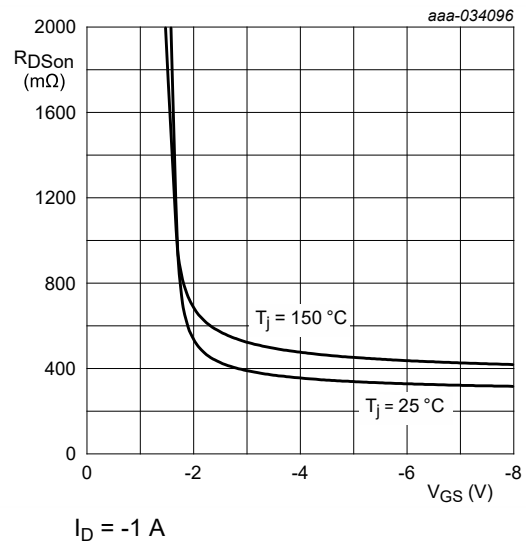


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values

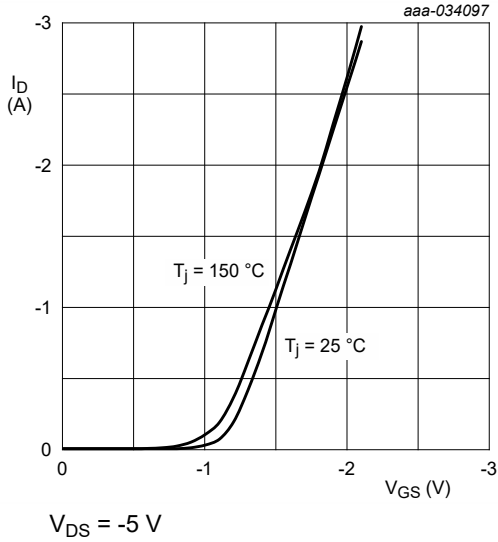


Fig. 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values

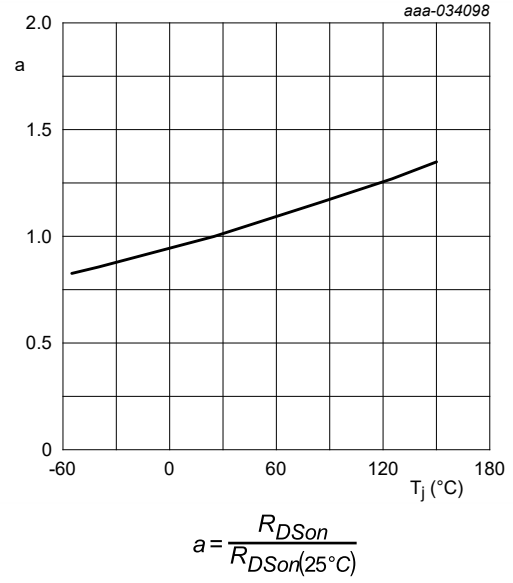


Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values

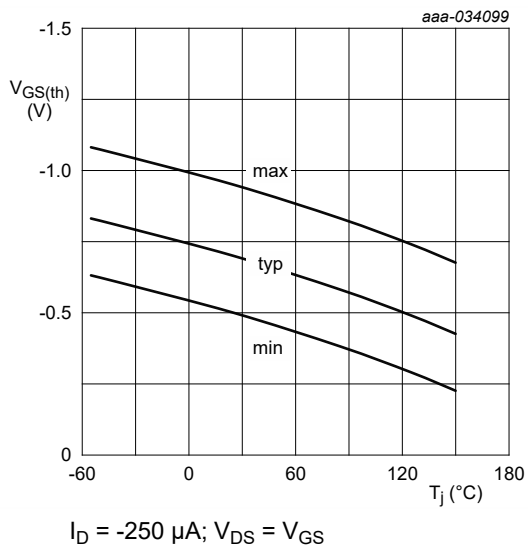


Fig. 12. Gate-source threshold voltage as a function of junction temperature

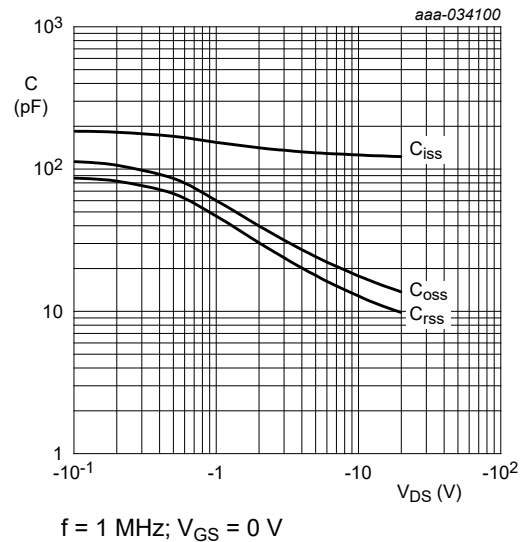
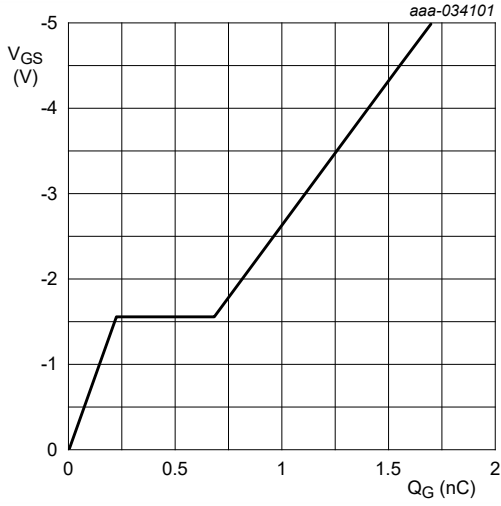


Fig. 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values





$V_{DS} = -10\text{ V}; I_D = -1\text{ A}; T_j = 25\text{ }^\circ\text{C}$

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

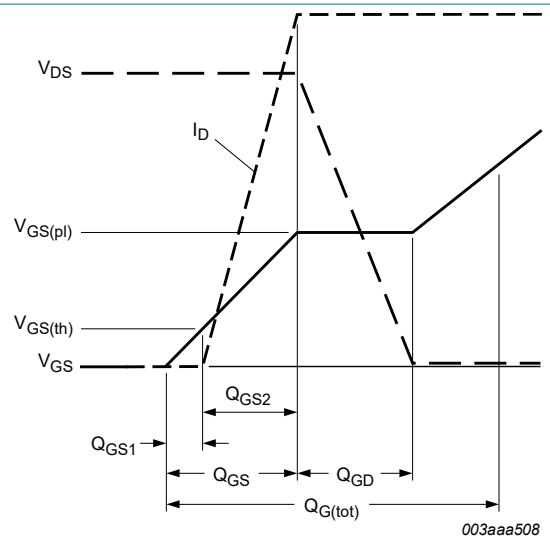
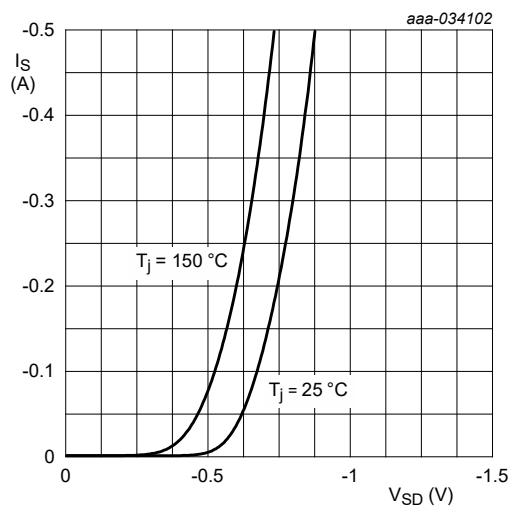


Fig. 15. Gate charge waveform definitions



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

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

### 11. Test information

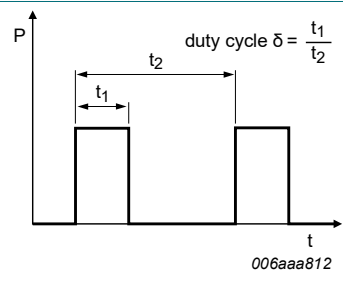
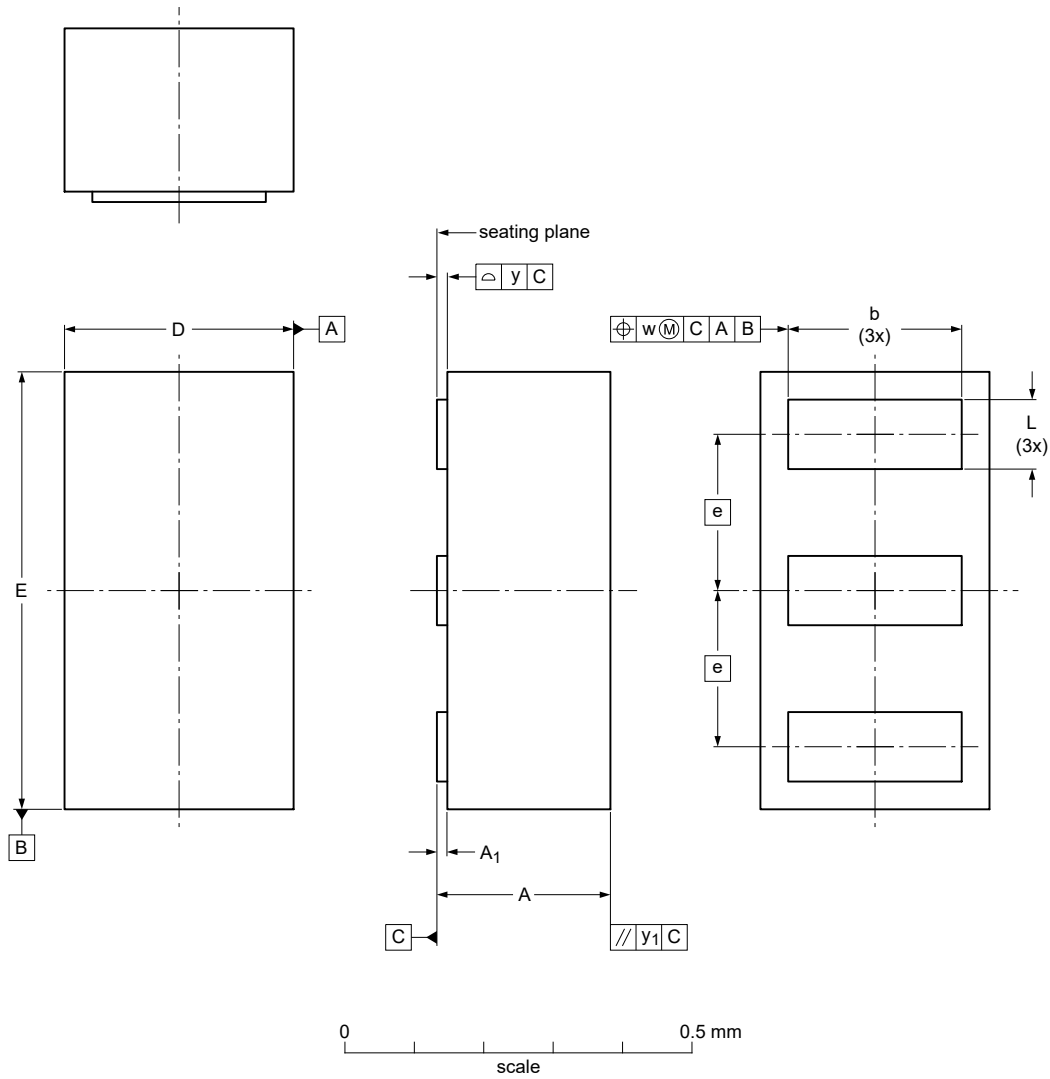


Fig. 17. Duty cycle definition

## 12. Package outline

DFN0603-3; plastic, ultra small and leadless full encapsulated package;  
3 terminals; 0.225 mm pitch; 0.63 mm x 0.33 mm x 0.25 mm body

SOT8013



Dimensions (mm are the original dimensions)

Unit <sup>(1)</sup>	A	A <sub>1</sub>	b	D	E	e	L	w	y	y <sub>1</sub>
mm	max 0.275	0.03	0.27	0.350	0.650		0.12			
	nom 0.225		0.23	0.305	0.605	0.225		0.04	0.03	0.05
	min						0.08			

Note

1. The marking bar indicates Pin 1. For electrical symmetrical devices the marking bar is omitted.

sot8013\_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT8013		---				19-08-06 19-08-29

Fig. 18. Package outline DFN0603-3 (SOT8013)



## 14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMX400UPE v.1	20230320	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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## Contents

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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.....	5
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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