



# PMV48XPA

20 V, P-channel Trench MOSFET

10 March 2014

Product data sheet

## 1. General description

P-channel enhancement mode Field-Effect Transistor (FET) in a small SOT23 (TO-236AB) Surface-Mounted Device (SMD) plastic package using Trench MOSFET technology.

## 2. Features and benefits

- Logic-level compatible
- Trench MOSFET technology
- Very fast switching
- AEC-Q101 qualified

## 3. Applications

- High-side loadswitch
- High-speed line driver
- Relay driver
- Switching circuits

## 4. Quick reference data

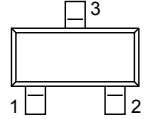
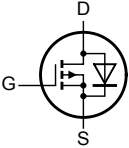
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_{amb} = 25\text{ °C}$	-	-	-20	V
$V_{GS}$	gate-source voltage		-12	-	12	V
$I_D$	drain current	$V_{GS} = -4.5\text{ V}; T_{amb} = 25\text{ °C}$	[1]	-	-3.5	A
<b>Static characteristics</b>						
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = -4.5\text{ V}; I_D = -2.4\text{ A}; T_j = 25\text{ °C}$	-	48	55	mΩ

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

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 TO-236AB (SOT23)	 017aaa094
2	S	source		
3	D	drain		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PMV48XPA	TO-236AB	plastic surface-mounted package; 3 leads	SOT23

## 7. Marking

Table 4. Marking codes

Type number	Marking code
PMV48XPA	%DZ

[1] % = placeholder for manufacturing site code

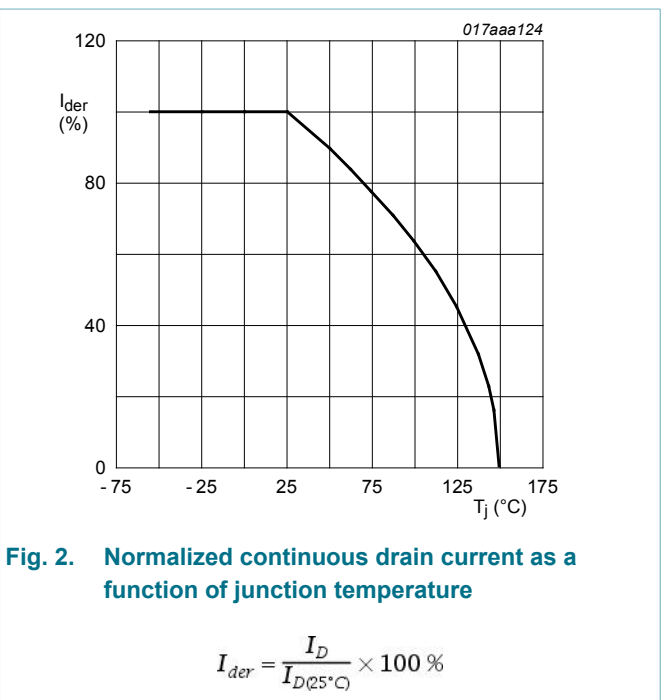
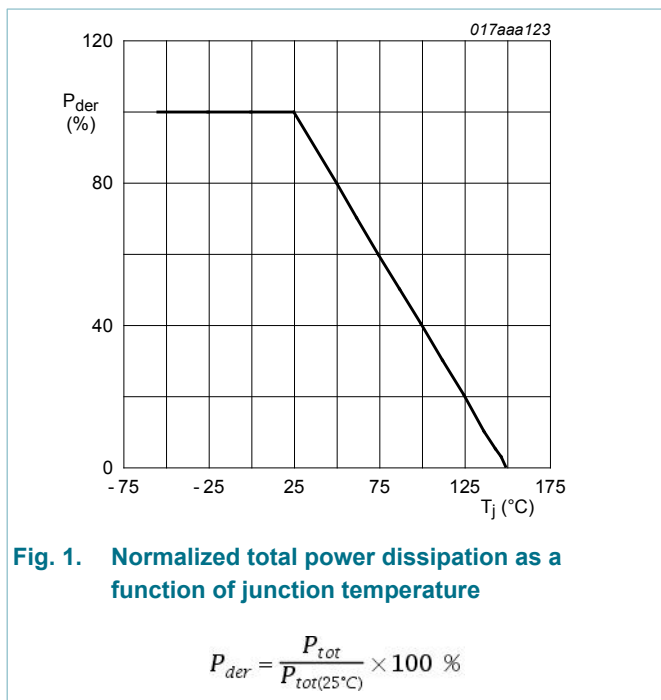
## 8. Limiting values

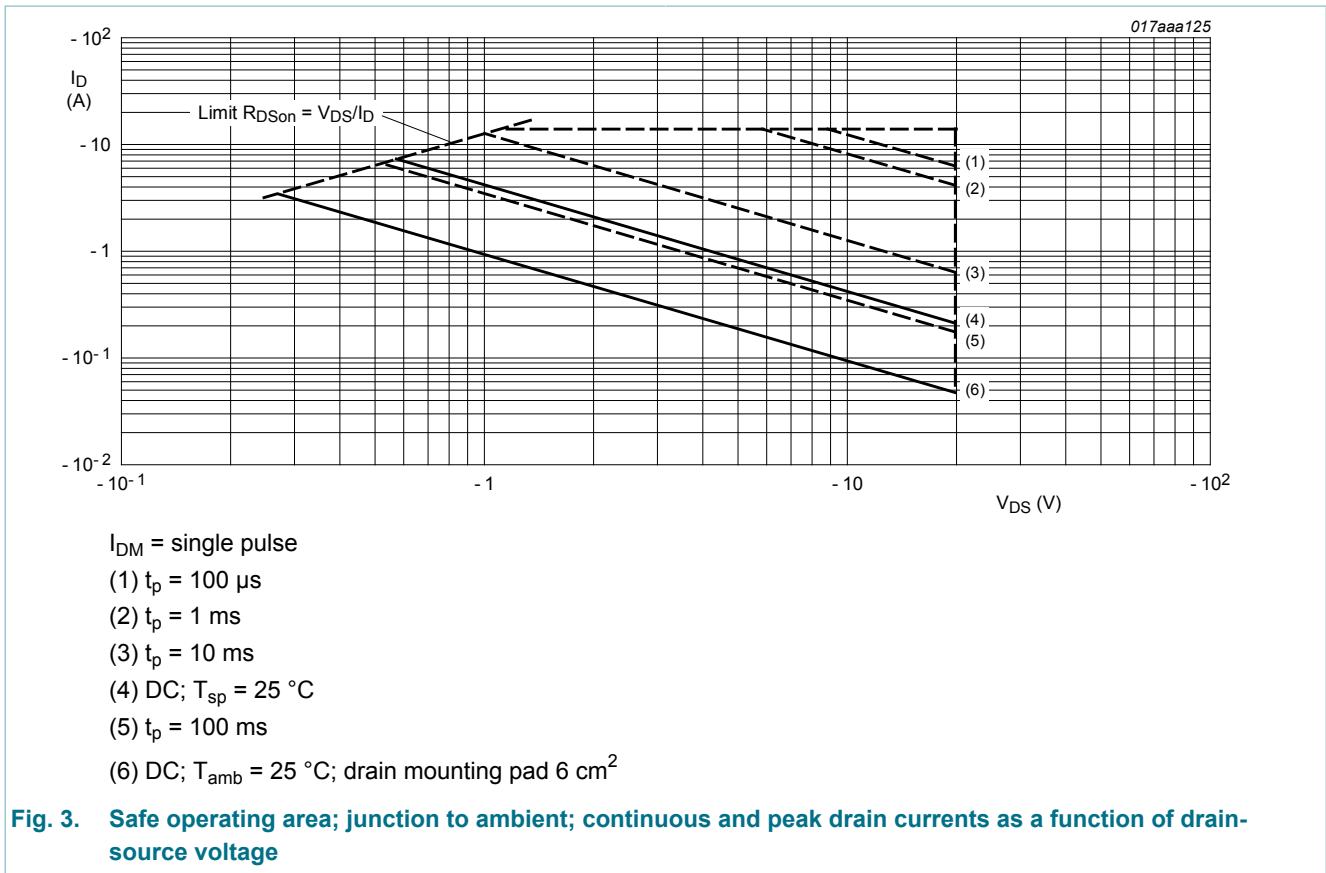
**Table 5. Limiting values**

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>amb</sub> = 25 °C		-	-20	V
V <sub>GS</sub>	gate-source voltage			-12	12	V
I <sub>D</sub>	drain current	V <sub>GS</sub> = -4.5 V; T <sub>amb</sub> = 25 °C	[1]	-	-3.5	A
		V <sub>GS</sub> = -4.5 V; T <sub>amb</sub> = 100 °C	[1]	-	-2.2	A
I <sub>DM</sub>	peak drain current	T <sub>amb</sub> = 25 °C; single pulse; t <sub>p</sub> ≤ 10 μs		-	-14	A
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = 25 °C	[2]	-	510	mW
			[1]	-	930	mW
		T <sub>sp</sub> = 25 °C		-	4150	mW
T <sub>j</sub>	junction temperature			-	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]	-	-1	A

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





## 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]	-	213	245	K/W
			[2]	-	117	135	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	25	30	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  $6 \text{ cm}^2$ .

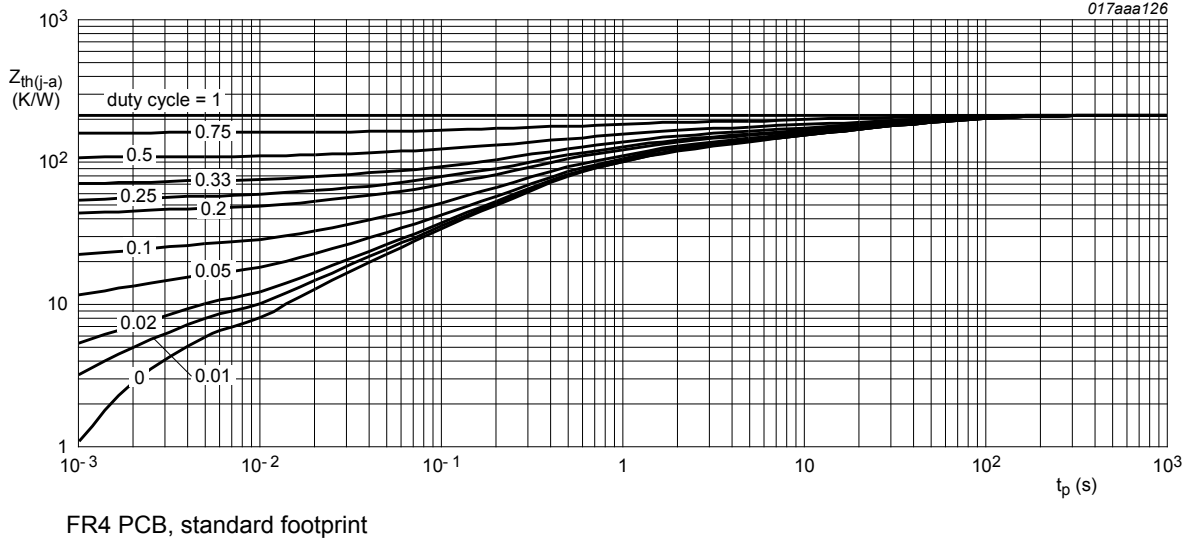


Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

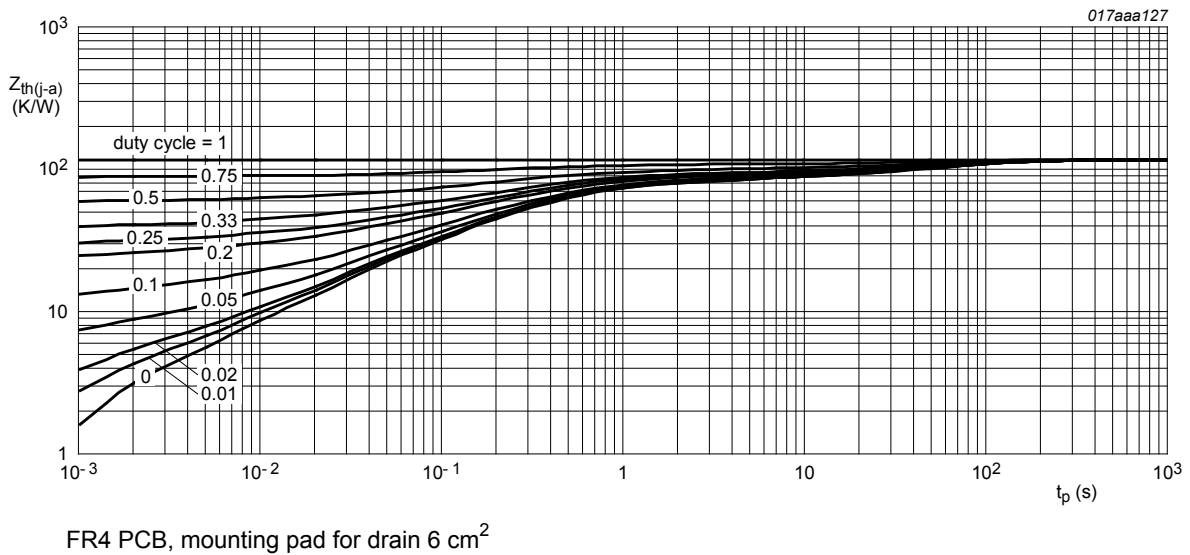
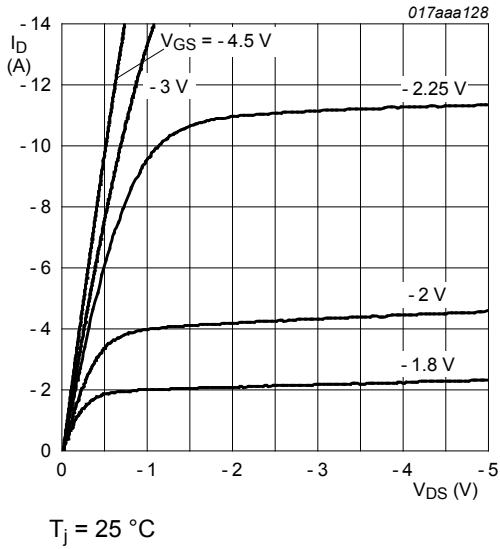


Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

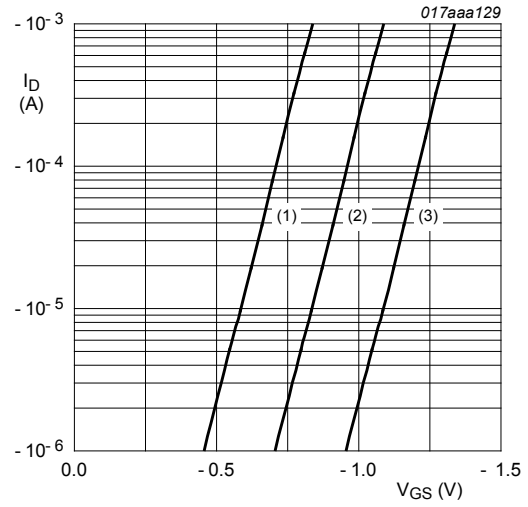
## 10. Characteristics

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	$I_D = -250 \mu\text{A}$ ; $V_{DS} = V_{GS}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-0.75	-1	-1.25	V
$I_{DSS}$	drain leakage current	$V_{DS} = -20 \text{ V}$ ; $V_{GS} = 0 \text{ V}$ ; $T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	-1	$\mu\text{A}$
$I_{GSS}$	gate leakage current	$V_{GS} = -12 \text{ V}$ ; $V_{DS} = 0 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	-	-100	nA
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = -4.5 \text{ V}$ ; $I_D = -2.4 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	48	55	m $\Omega$
		$V_{GS} = -4.5 \text{ V}$ ; $I_D = -2.4 \text{ A}$ ; $T_j = 150 \text{ }^\circ\text{C}$	-	70	80	m $\Omega$
		$V_{GS} = -2.5 \text{ V}$ ; $I_D = -2 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	71	81	m $\Omega$
$g_{fs}$	forward transconductance	$V_{DS} = -12 \text{ V}$ ; $I_D = -2 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	12	-	S
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$V_{DS} = -10 \text{ V}$ ; $I_D = -1 \text{ A}$ ; $V_{GS} = -4.5 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	8.5	11	nC
$Q_{GS}$	gate-source charge		-	1.8	-	nC
$Q_{GD}$	gate-drain charge		-	1.8	-	nC
$C_{iss}$	input capacitance	$V_{DS} = -10 \text{ V}$ ; $f = 1 \text{ MHz}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	1000	-	pF
$C_{oss}$	output capacitance		-	130	-	pF
$C_{rss}$	reverse transfer capacitance		-	90	-	pF
$t_{d(on)}$	turn-on delay time		$V_{DS} = -10 \text{ V}$ ; $I_D = -1 \text{ A}$ ; $V_{GS} = -4.5 \text{ V}$ ; $R_{G(ext)} = 6 \Omega$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	11	-
$t_r$	rise time	-		13	-	ns
$t_{d(off)}$	turn-off delay time	-		61	-	ns
$t_f$	fall time	-		23	-	ns
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = -2.4 \text{ A}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	-0.82	-1.2	V

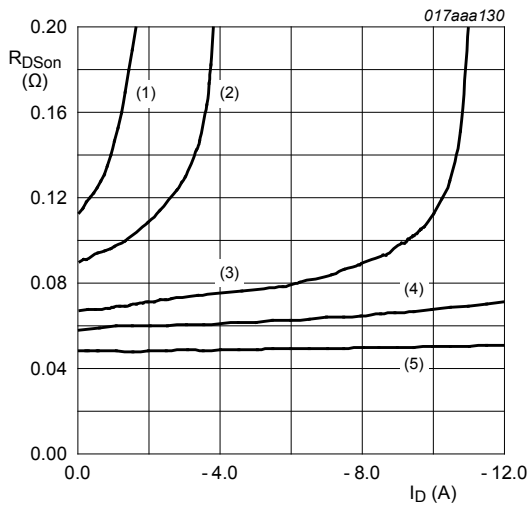


**Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values**



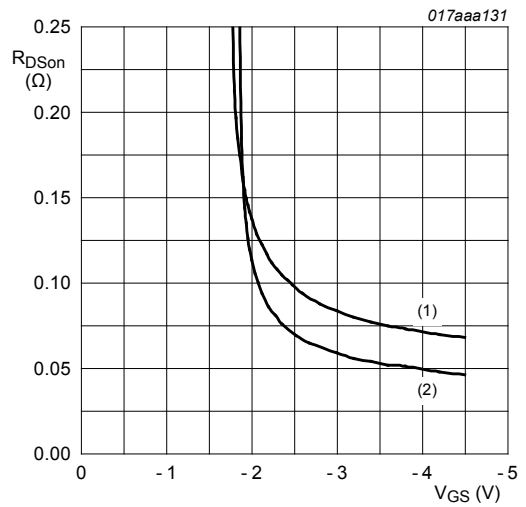
$T_j = 25\text{ }^\circ\text{C}$ ;  $V_{DS} = -3\text{ V}$   
 (1) minimum values  
 (2) typical values  
 (3) maximum values

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



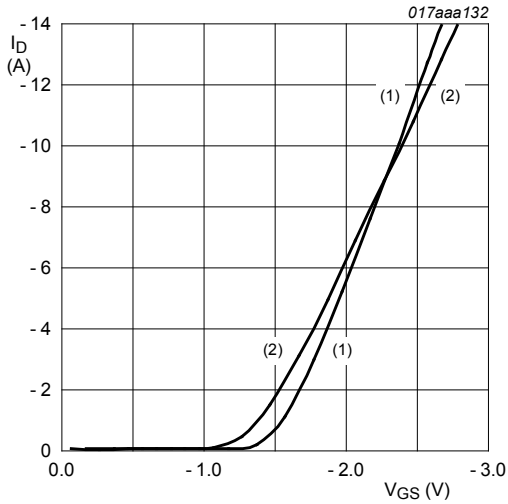
$T_j = 25\text{ }^\circ\text{C}$   
 (1)  $V_{GS} = -1.8\text{ V}$   
 (2)  $V_{GS} = -2.0\text{ V}$   
 (3)  $V_{GS} = -2.25\text{ V}$   
 (4)  $V_{GS} = -3.0\text{ V}$   
 (5)  $V_{GS} = -4.5\text{ V}$

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



$I_D = -2.4\text{ A}$   
 (1)  $T_j = 125\text{ }^\circ\text{C}$   
 (2)  $T_j = 25\text{ }^\circ\text{C}$

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



$V_{DS} > I_D \times R_{DS(on)}$   
 (1)  $T_j = 25\text{ }^\circ\text{C}$   
 (2)  $T_j = 150\text{ }^\circ\text{C}$

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

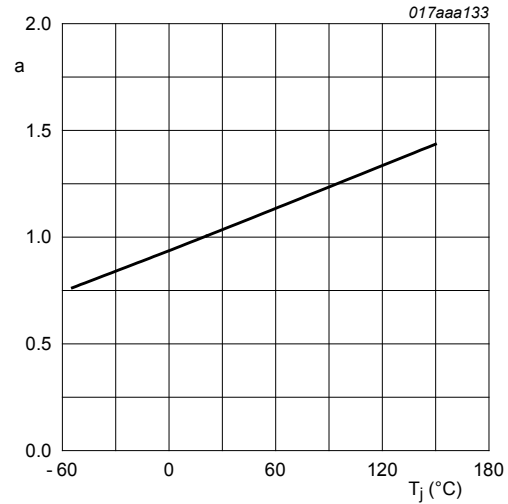
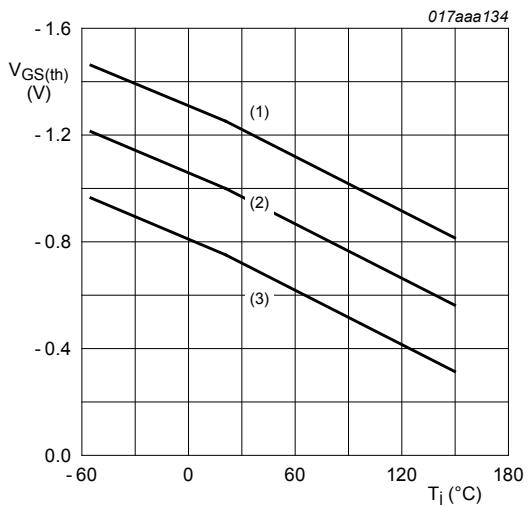


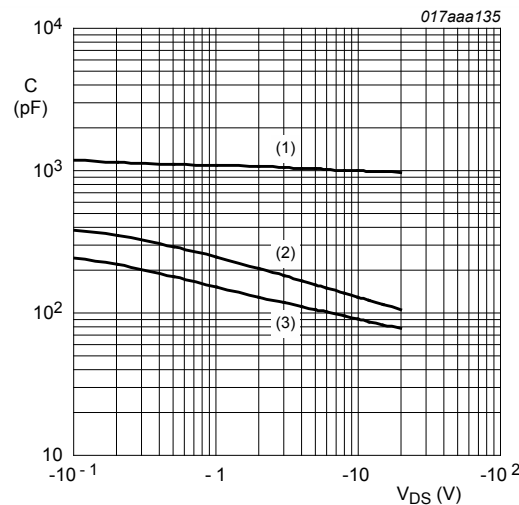
Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values

$$a = \frac{R_{DS(on)}}{R_{DS(on)@25^\circ\text{C}}}$$



$I_D = -0.25\text{ mA}$ ;  $V_{DS} = V_{GS}$   
 (1) maximum values  
 (2) typical values  
 (3) minimum values

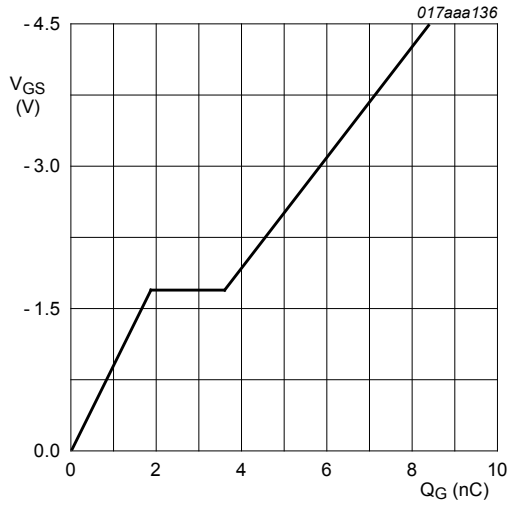
Fig. 12. Gate-source threshold voltage as a function of junction temperature



$f = 1\text{ MHz}$ ;  $V_{GS} = 0\text{ V}$   
 (1)  $C_{iss}$   
 (2)  $C_{oss}$   
 (3)  $C_{rss}$

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





$I_D = -2.4 \text{ A}; V_{DS} = -10 \text{ V}; T_{amb} = 25 \text{ }^\circ\text{C}$

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

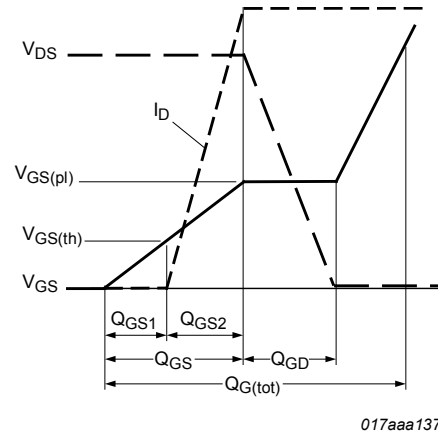
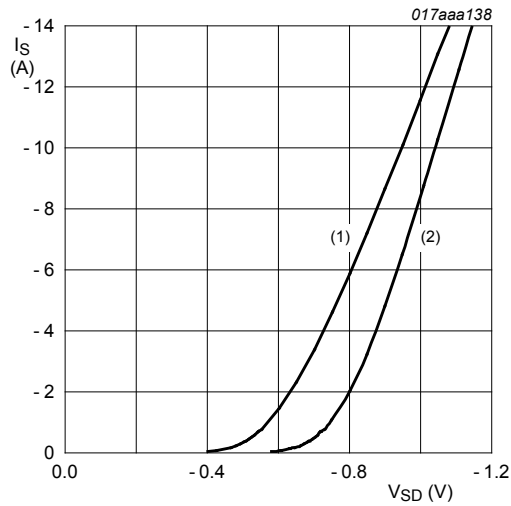


Fig. 15. Gate charge waveform definitions



$V_{GS} = 0 \text{ V}$   
 (1)  $T_j = 150 \text{ }^\circ\text{C}$   
 (2)  $T_j = 25 \text{ }^\circ\text{C}$

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

## 11. Test information

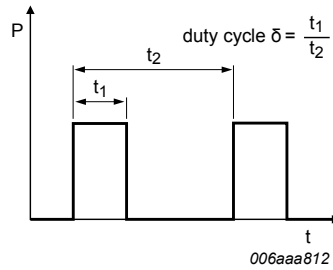


Fig. 17. Duty cycle definition

### 11.1 Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard Q101 - Stress test qualification for discrete semiconductors, and is suitable for use in automotive applications.

## 12. Package outline

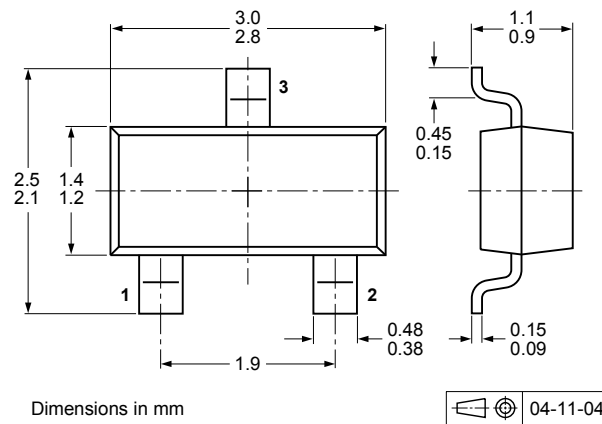


Fig. 18. Package outline TO-236AB (SOT23)

### 13. Soldering

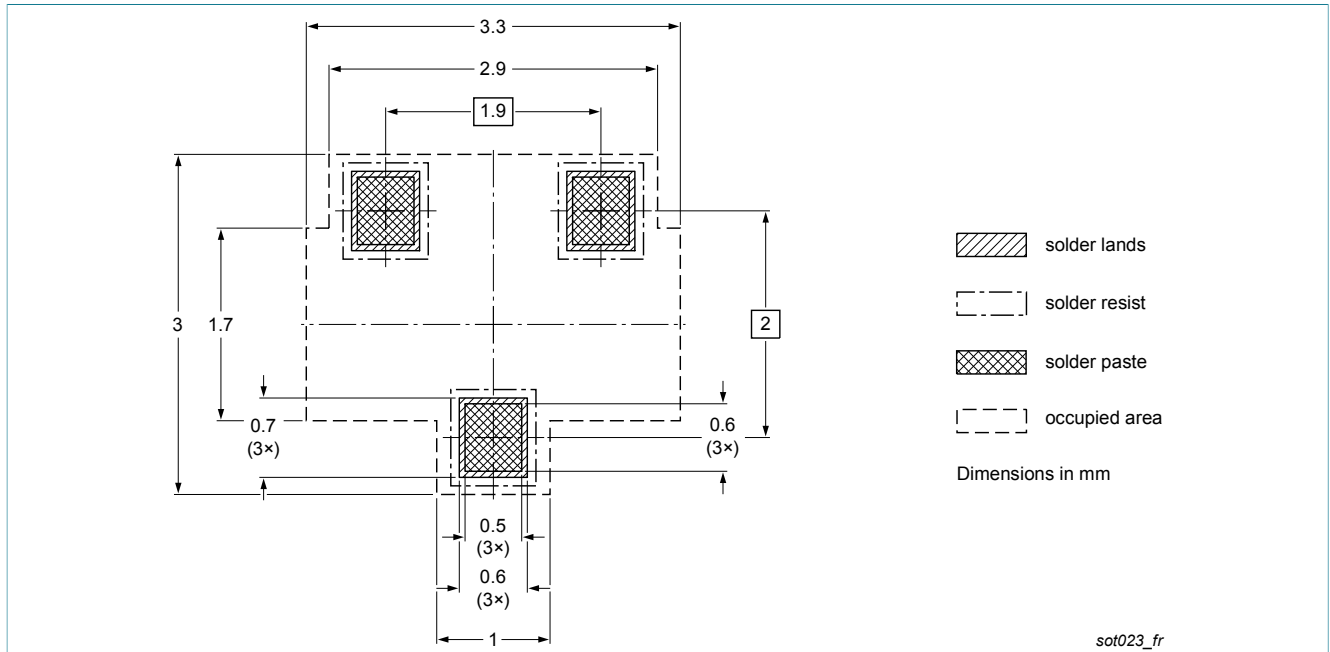


Fig. 19. Reflow soldering footprint for TO-236AB (SOT23)

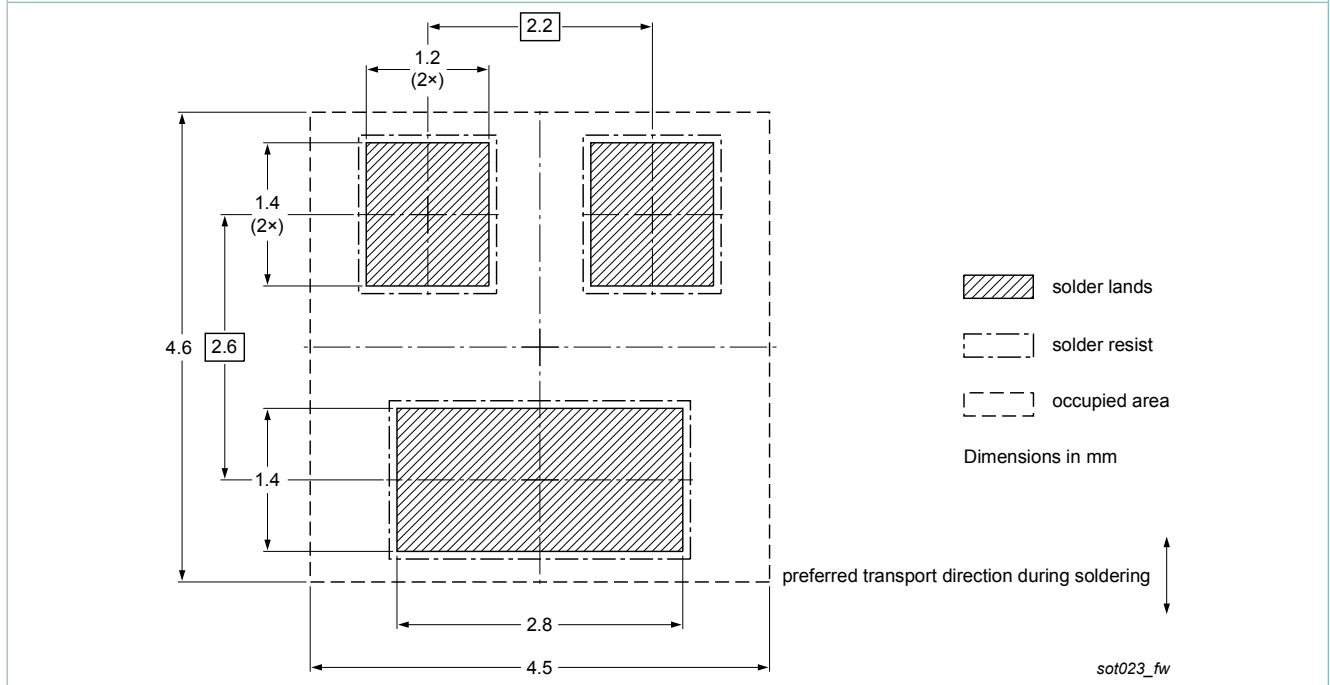


Fig. 20. Wave soldering footprint for TO-236AB (SOT23)

## 14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMV48XPA v.1	20140310	Product data sheet	-	-

## 15. Legal information

### 15.1 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".
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