



# PMN48XP

20 V, 4.1 A P-channel Trench MOSFET

Rev. 1 — 21 April 2011

Product data sheet

## 1. Product profile

### 1.1 General description

P-channel enhancement mode Field-Effect Transistor (FET) in a small SOT457 (SC-74) Surface-Mounted Device (SMD) plastic package using Trench MOSFET technology.

### 1.2 Features and benefits

- Low  $R_{DSon}$
- Very fast switching
- Trench MOSFET technology

### 1.3 Applications

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

### 1.4 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		-12	-	12	V
$I_D$	drain current	$V_{GS} = -4.5\text{ V}; T_{amb} = 25\text{ °C}$	[1]	-	-4.1	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>.

## 2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	D	drain	<p>SOT457 (TSOP6)</p>	<p>017aaa094</p>
2	D	drain		
3	G	gate		
4	S	source		
5	D	drain		
6	D	drain		

### 3. Ordering information

Table 3. Ordering information

Type number	Package		Version
	Name	Description	
PMN48XP	TSOP6	plastic surface-mounted package (TSOP6); 6 leads	SOT457

### 4. Marking

Table 4. Marking codes

Type number	Marking code
PMN48XP	ZV

### 5. Limiting values

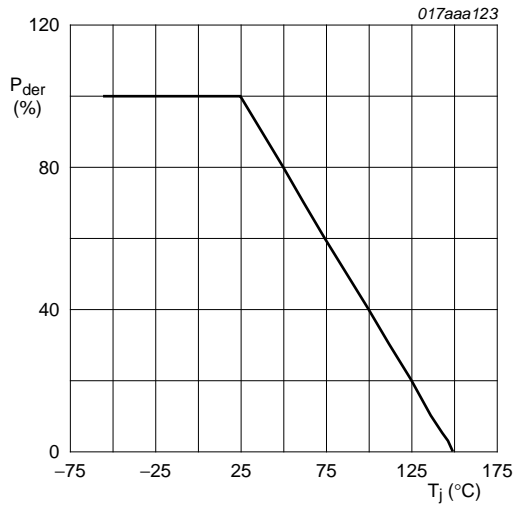
Table 5. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit	
$V_{DS}$	drain-source voltage	$T_j = 25\text{ °C}$	-	-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]	-	-4.1	A
		$V_{GS} = -4.5\text{ V}; T_{amb} = 100\text{ °C}$	[1]	-	-2.5	A
$I_{DM}$	peak drain current	$T_{amb} = 25\text{ °C};$ single pulse; $t_p \leq 10\text{ }\mu\text{s}$	-	-20	A	
$P_{tot}$	total power dissipation	$T_{amb} = 25\text{ °C}$	[2]	-	530	mW
			[1]	-	1285	mW
		$T_{sp} = 25\text{ °C}$		-	6250	mW
$T_j$	junction temperature		-55	150	°C	
$T_{amb}$	ambient temperature		-55	150	°C	
$T_{stg}$	storage temperature		-65	150	°C	
<b>Source-drain diode</b>						
$I_S$	source current	$T_{amb} = 25\text{ °C}$	[1]	-	-1.4	A

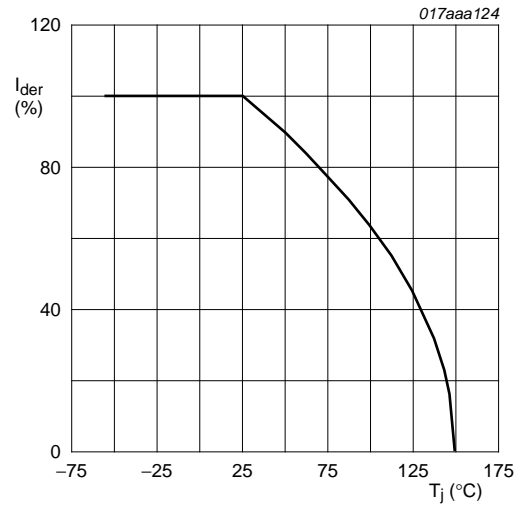
[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated, mounting pad for drain 6 cm<sup>2</sup>.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.



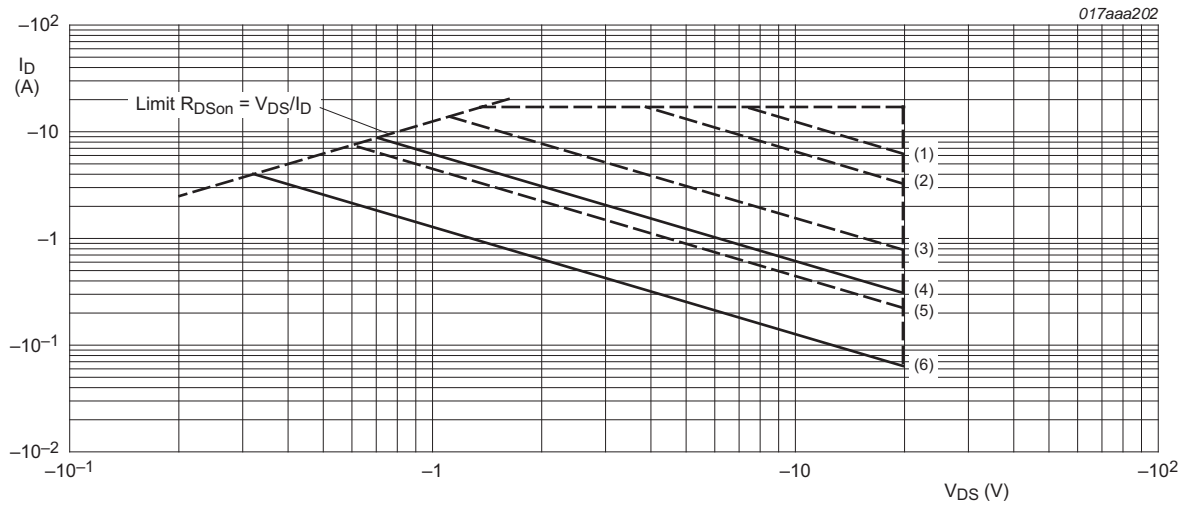
$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}\text{C})}} \times 100 \%$$

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



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

Fig 2. Normalized continuous drain current as a function of junction temperature



$I_{DM}$  = single pulse

(1)  $t_p = 100 \mu s$

(2)  $t_p = 1 ms$

(3)  $t_p = 10 ms$

(4) DC;  $T_{sp} = 25 \text{ }^\circ\text{C}$

(5)  $t_p = 100 ms$

(6) DC;  $T_{amb} = 25 \text{ }^\circ\text{C}$ ; drain mounting pad  $6 \text{ cm}^2$

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

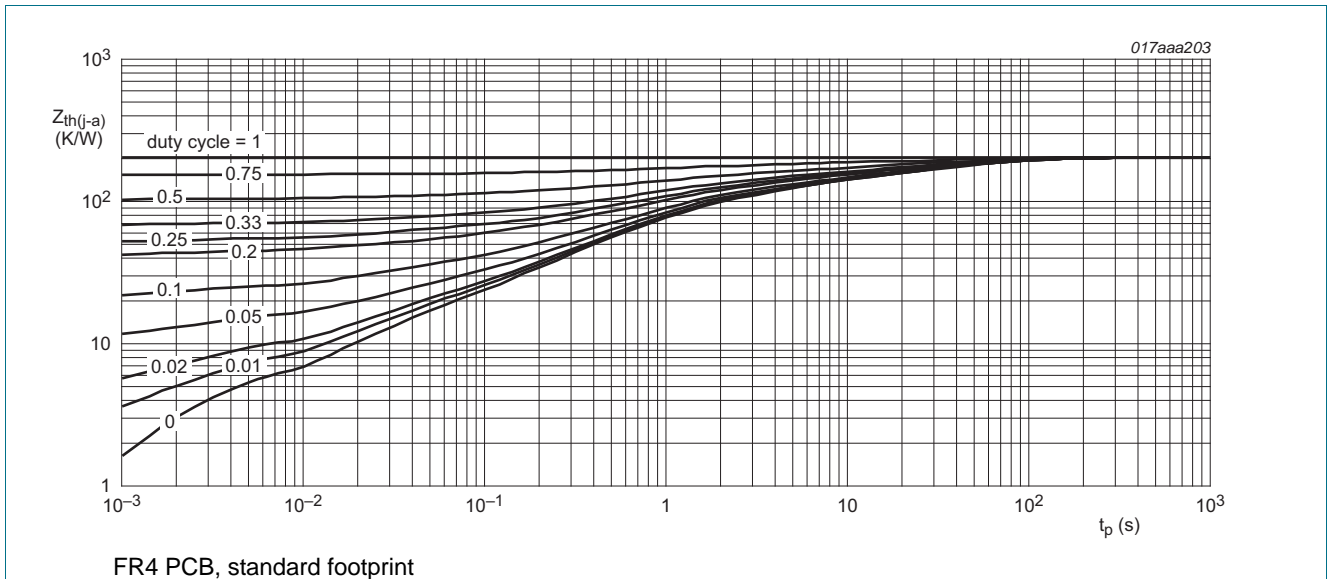
## 6. Thermal characteristics

**Table 6. Thermal characteristics**

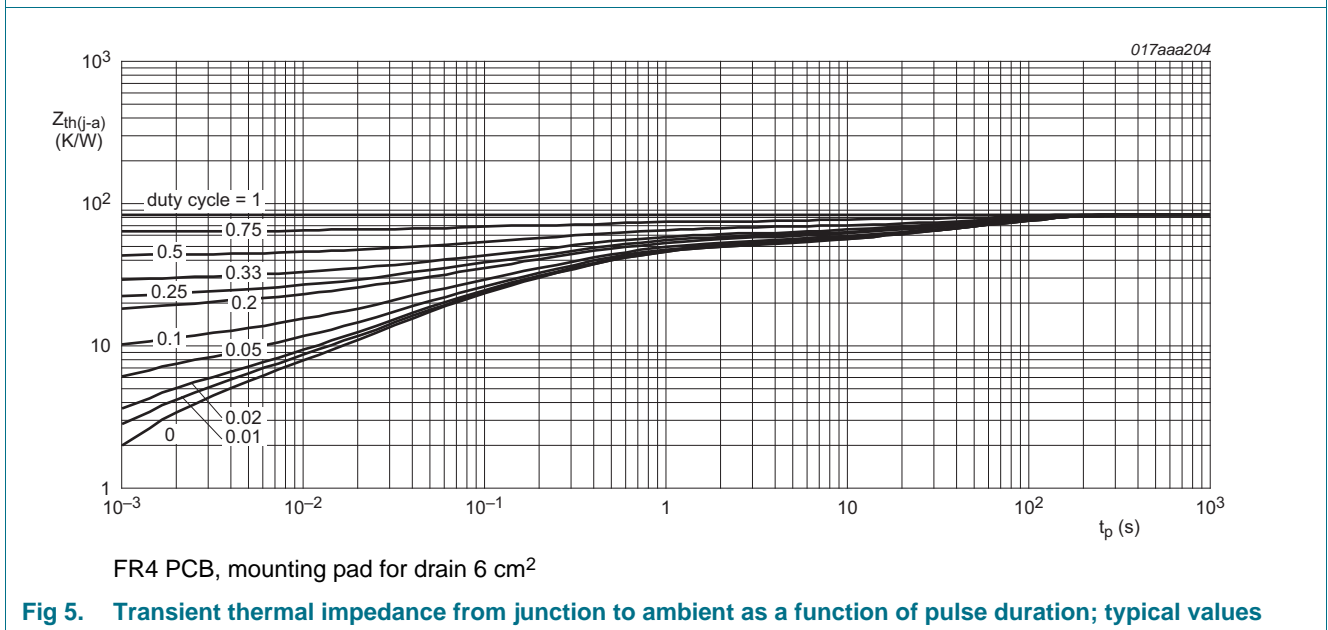
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	[1]	-	204	235	K/W
		[2]	-	84	97	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		-	17	20	K/W

[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 cm<sup>2</sup>.



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

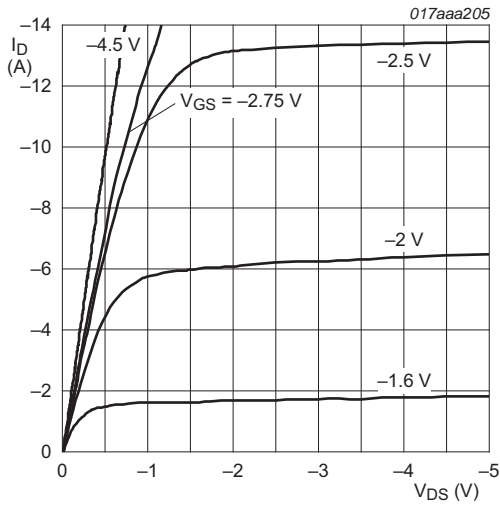


**Fig 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values**

## 7. Characteristics

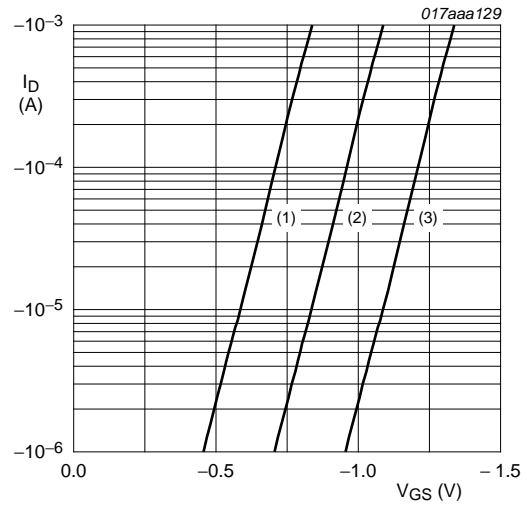
Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = -250 \mu A$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-20	-	-	V
$V_{GSth}$	gate-source threshold voltage	$I_D = -250 \mu A$ ; $V_{DS} = V_{GS}$ ; $T_j = 25 \text{ }^\circ C$	-0.75	-1	-1.25	V
$I_{DSS}$	drain leakage current	$V_{DS} = -20 V$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	-1	$\mu A$
		$V_{DS} = -20 V$ ; $V_{GS} = 0 V$ ; $T_j = 150 \text{ }^\circ C$	-	-	-10	$\mu A$
$I_{GSS}$	gate leakage current	$V_{GS} = -12 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	-100	nA
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = -4.5 V$ ; $I_D = -2.4 A$ ; $T_j = 25 \text{ }^\circ C$	-	48	55	m $\Omega$
		$V_{GS} = -4.5 V$ ; $I_D = -2.4 A$ ; $T_j = 150 \text{ }^\circ C$	-	70	80	m $\Omega$
		$V_{GS} = -2.5 V$ ; $I_D = -2 A$ ; $T_j = 25 \text{ }^\circ C$	-	72	82	m $\Omega$
$g_{fs}$	forward transconductance	$V_{DS} = -5 V$ ; $I_D = -2.4 A$ ; $T_j = 25 \text{ }^\circ C$	-	10	-	S
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = -1 A$ ; $V_{DS} = -10 V$ ; $V_{GS} = -4.5 V$ ; $T_j = 25 \text{ }^\circ C$	-	8.7	13	nC
$Q_{GS}$	gate-source charge		-	1.8	-	nC
$Q_{GD}$	gate-drain charge		-	1.7	-	nC
$C_{iss}$	input capacitance	$V_{GS} = 0 V$ ; $V_{DS} = -10 V$ ; $f = 1 \text{ MHz}$ ; $T_j = 25 \text{ }^\circ C$	-	1000	-	pF
$C_{oss}$	output capacitance		-	130	-	pF
$C_{rss}$	reverse transfer capacitance		-	90	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = -10 V$ ; $V_{GS} = -5 V$ ; $R_{G(ext)} = 6 \Omega$ ; $T_j = 25 \text{ }^\circ C$ ; $I_D = -1 A$	-	15	-	ns
$t_r$	rise time		-	22	-	ns
$t_{d(off)}$	turn-off delay time		-	51	-	ns
$t_f$	fall time		-	22	-	ns
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = -2.4 A$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-0.75	-1	V



$T_j = 25\text{ }^\circ\text{C}$

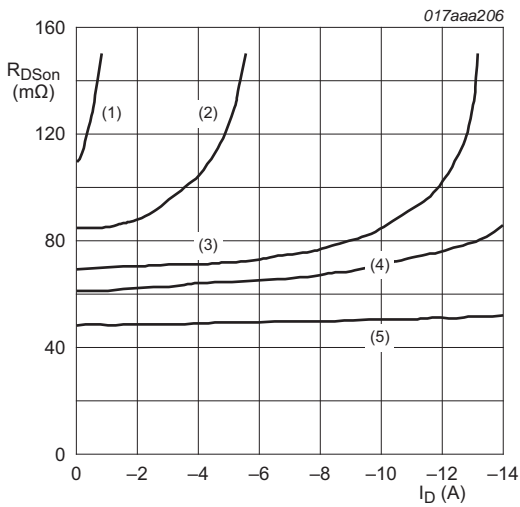
**Fig 6. Output characteristics: drain current as a function of drain-source voltage; typical values**



$T_j = 25\text{ }^\circ\text{C}; V_{DS} = -3\text{ V}$

- (1) minimum values
- (2) typical values
- (3) maximum values

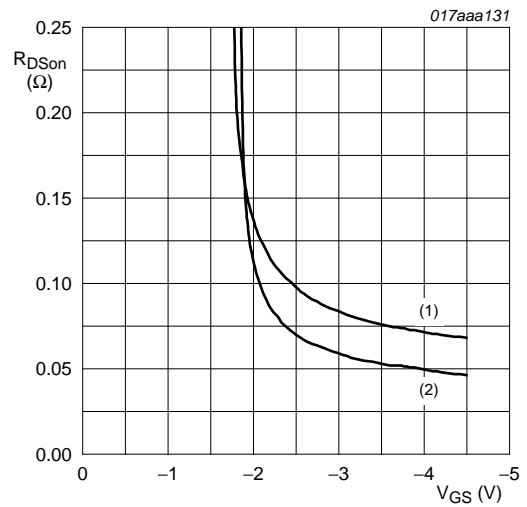
**Fig 7. Sub-threshold drain current as a function of gate-source voltage**



$T_j = 25\text{ }^\circ\text{C}$

- (1)  $V_{GS} = -1.6\text{ V}$
- (2)  $V_{GS} = -2.0\text{ V}$
- (3)  $V_{GS} = -2.5\text{ V}$
- (4)  $V_{GS} = -2.75\text{ V}$
- (5)  $V_{GS} = -4.5\text{ V}$

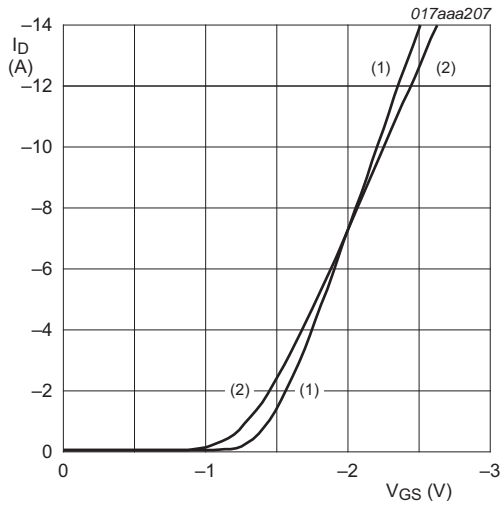
**Fig 8. Drain-source on-state resistance as a function of drain current; typical values**



$I_D = -2.4\text{ A}$

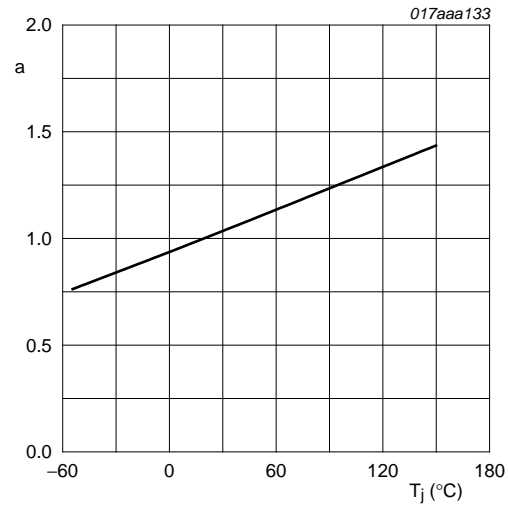
- (1)  $T_j = 125\text{ }^\circ\text{C}$
- (2)  $T_j = 25\text{ }^\circ\text{C}$

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



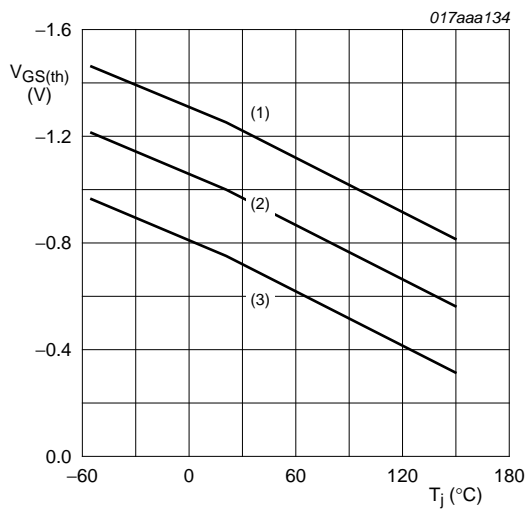
$V_{DS} > I_D \times R_{DS(on)}$   
 (1)  $T_j = 25\text{ °C}$   
 (2)  $T_j = 150\text{ °C}$

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



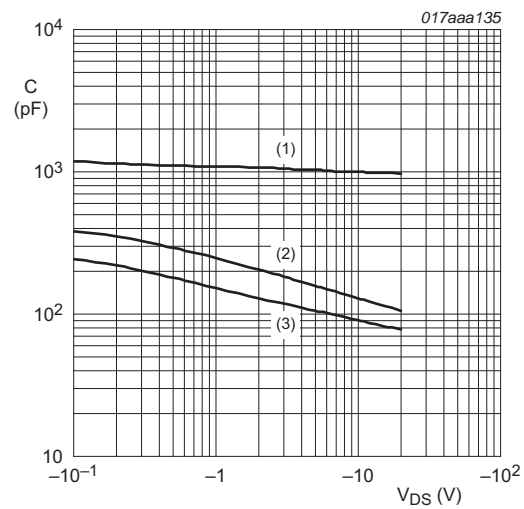
$$a = \frac{R_{DS(on)}}{R_{DS(on)(25^\circ\text{C})}}$$

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



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

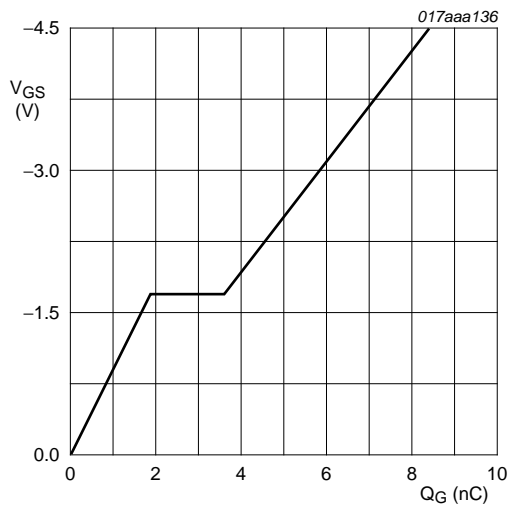
Fig 12. Gate-source threshold voltage as a function of junction temperature



$f = 1\text{ MHz}$ ;  $V_{GS} = 0\text{ V}$   
 (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





$I_D = -2.4$  A;  $V_{DS} = -10$  V;  $T_{amb} = 25$  °C

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

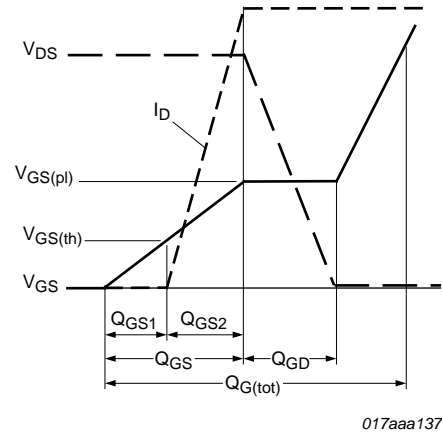
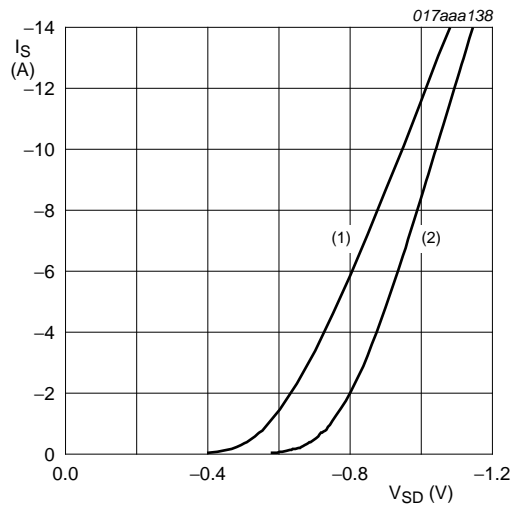


Fig 15. Gate charge waveform definitions



$V_{GS} = 0$  V  
 (1)  $T_j = 150$  °C  
 (2)  $T_j = 25$  °C

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

## 8. Package outline

Plastic surface-mounted package (TSOP6); 6 leads

SOT457

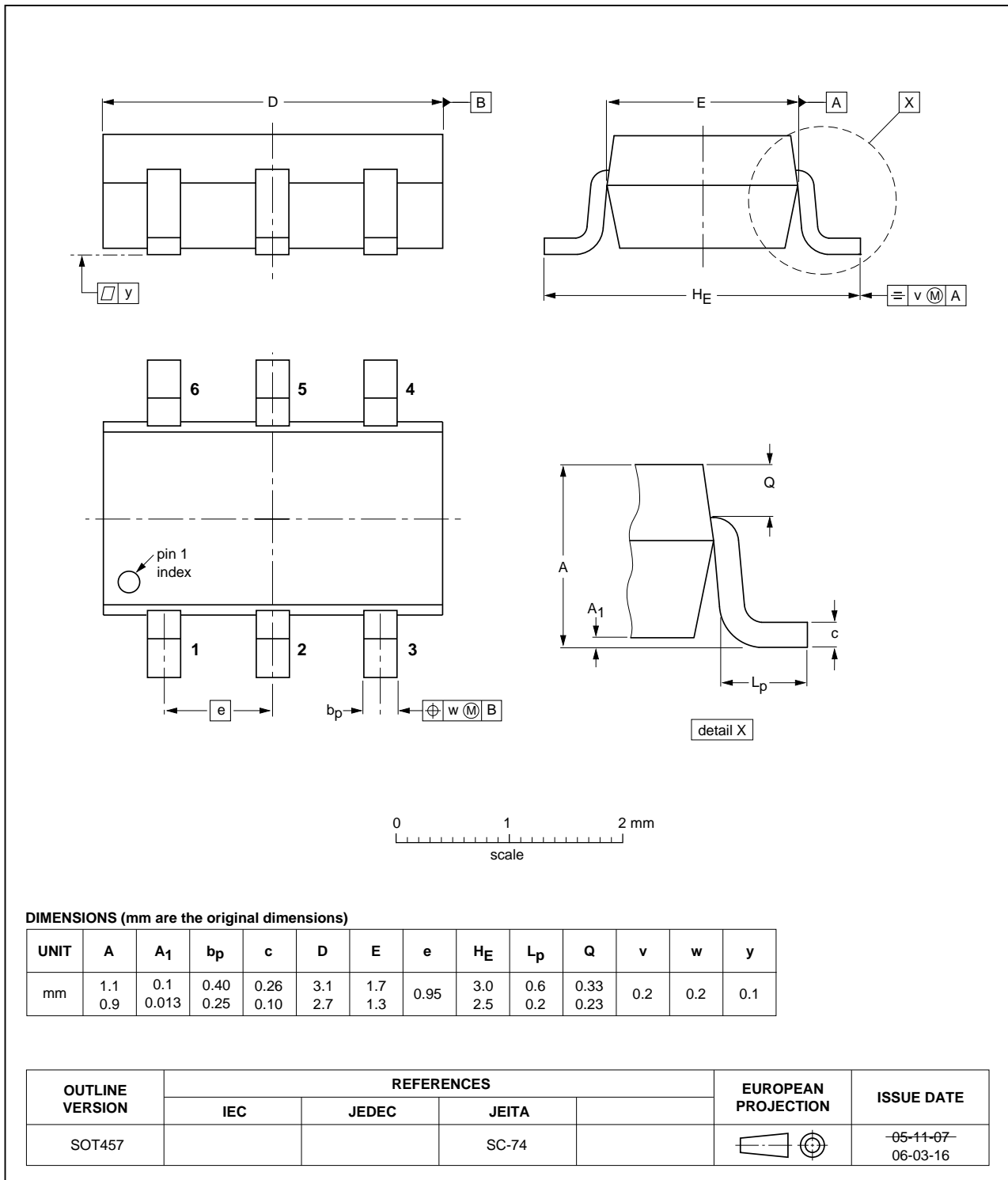


Fig 17. Package outline SOT457 (TSOP6)

9. Soldering

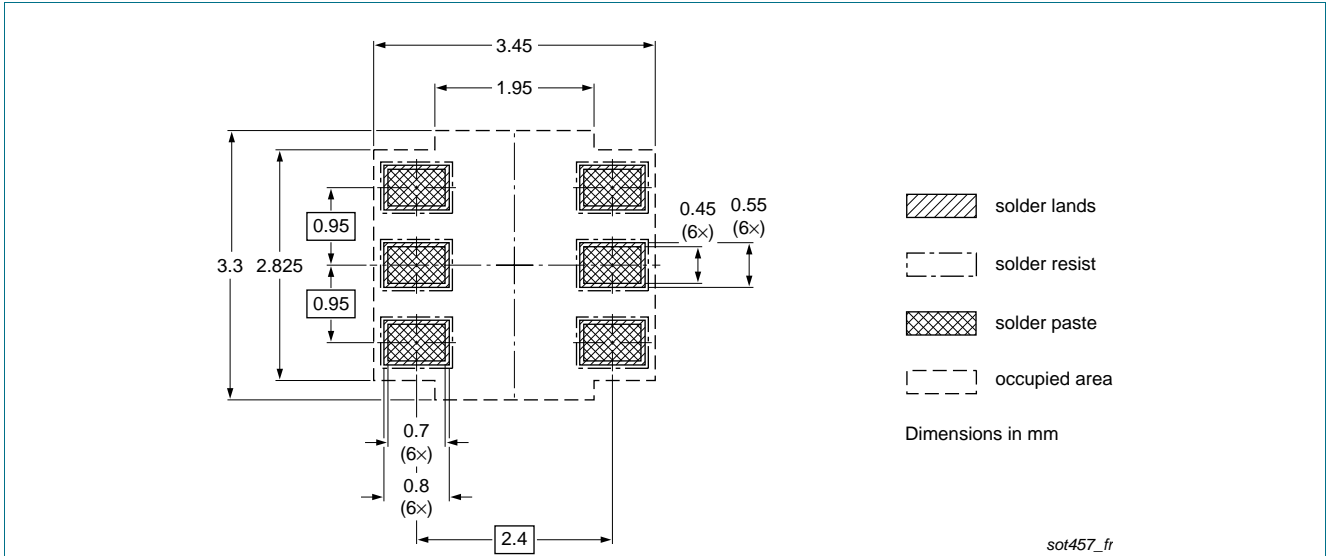


Fig 18. Reflow soldering footprint for SOT457 (TSOP6)

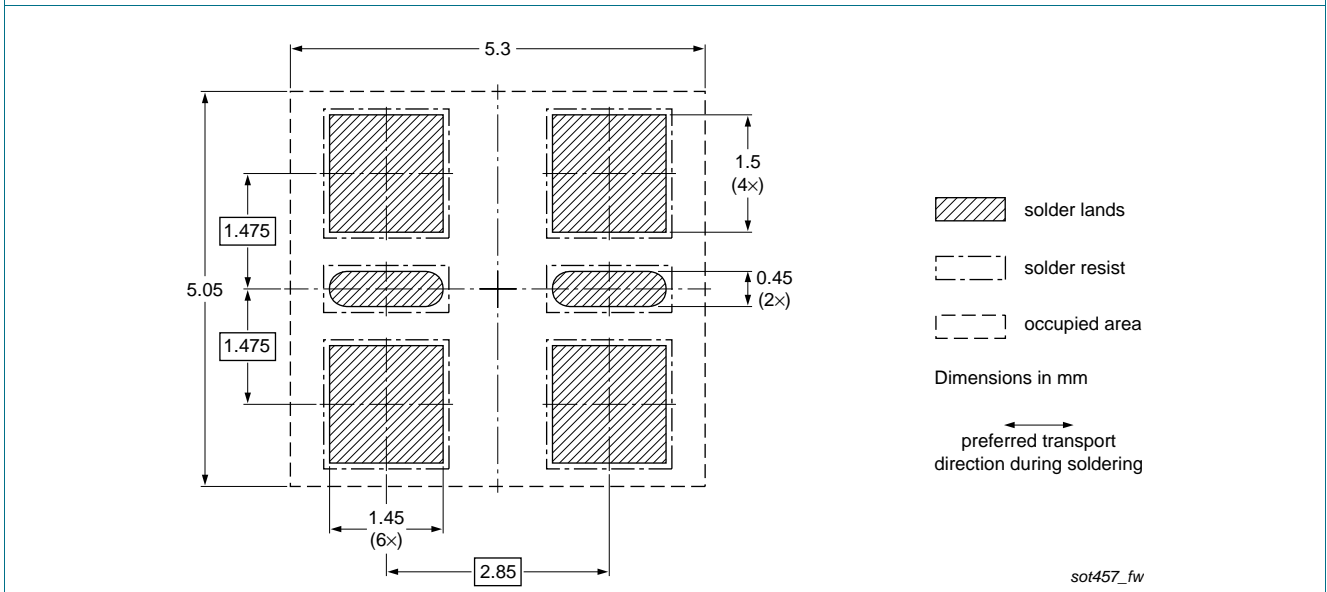


Fig 19. Wave soldering footprint for SOT457 (TSOP6)

## 10. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PMN48XP v.1	20110421	Product data sheet	-	-

## 11. Legal information

### 11.1 Data sheet status

Document status <sup>[1]</sup> <sup>[2]</sup>	Product status <sup>[3]</sup>	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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