



# PMT21EN

30 V, 7.4 A N-channel Trench MOSFET

Rev. 1 — 30 August 2011

Product data sheet

## 1. Product profile

### 1.1 General description

N-channel enhancement mode Field-Effect Transistor (FET) in a small SOT223 (SC-73) small Surface-Mounted Device (SMD) plastic package using Trench MOSFET technology.

### 1.2 Features and benefits

- Logic-level compatible
- Trench MOSFET technology
- Very fast switching

### 1.3 Applications

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

### 1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j = 25\text{ }^{\circ}\text{C}$	-	-	30	V
$V_{GS}$	gate-source voltage		-20	-	20	V
$I_D$	drain current	$V_{GS} = 10\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}$	[1]	-	7.4	A
<b>Static characteristics</b>						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 7.4\text{ A}; T_j = 25\text{ }^{\circ}\text{C}$	-	18	21	m $\Omega$

[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	G	gate	<p>SOT223 (SC-73)</p>	<p>017aaa253</p>
2	D	drain		
3	S	source		
4	D	drain		



### 3. Ordering information

Table 3. Ordering information

Type number	Package		Version
	Name	Description	
PMT21EN	SC-73	plastic surface-mounted package with increased heatsink; 4 leads	SOT223

### 4. Marking

Table 4. Marking codes

Type number	Marking code
PMT21EN	MT21EN

### 5. Limiting values

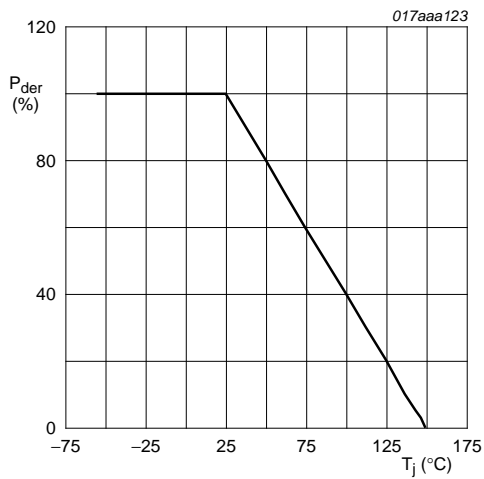
Table 5. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DS}$	drain-source voltage	$T_j = 25\text{ }^{\circ}\text{C}$	-	30	V
$V_{GS}$	gate-source voltage		-20	20	V
$I_D$	drain current <sup>0</sup>	$V_{GS} = 10\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}$ [1]	-	7.4	A
		$V_{GS} = 10\text{ V}; T_{amb} = 100\text{ }^{\circ}\text{C}$ [1]	-	4.7	A
$I_{DM}$	peak drain current	$T_{amb} = 25\text{ }^{\circ}\text{C}$ ; single pulse; $t_p \leq 10\text{ }\mu\text{s}$	-	30	A
$P_{tot}$	total power dissipation	$T_{amb} = 25\text{ }^{\circ}\text{C}$ [2]	-	820	mW
		[1]	-	1760	mW
		$T_{sp} = 25\text{ }^{\circ}\text{C}$	-	8330	mW
$T_j$	junction temperature		-55	150	$^{\circ}\text{C}$
$T_{amb}$	ambient temperature		-55	150	$^{\circ}\text{C}$
$T_{stg}$	storage temperature		-65	150	$^{\circ}\text{C}$
<b>Source-drain diode</b>					
$I_S$	source current	$T_{amb} = 25\text{ }^{\circ}\text{C}$ [1]	-	1.9	A

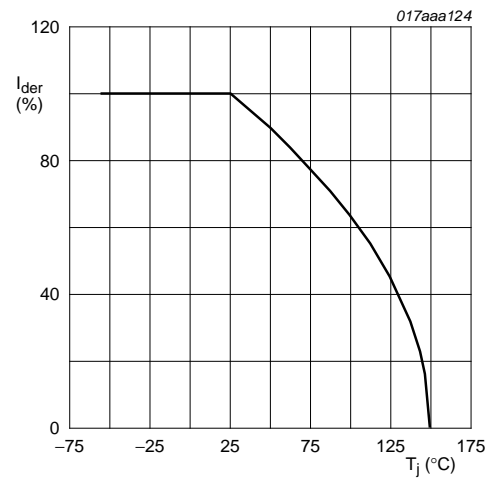
[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated, mounting pad for drain 6 cm<sup>2</sup>.

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



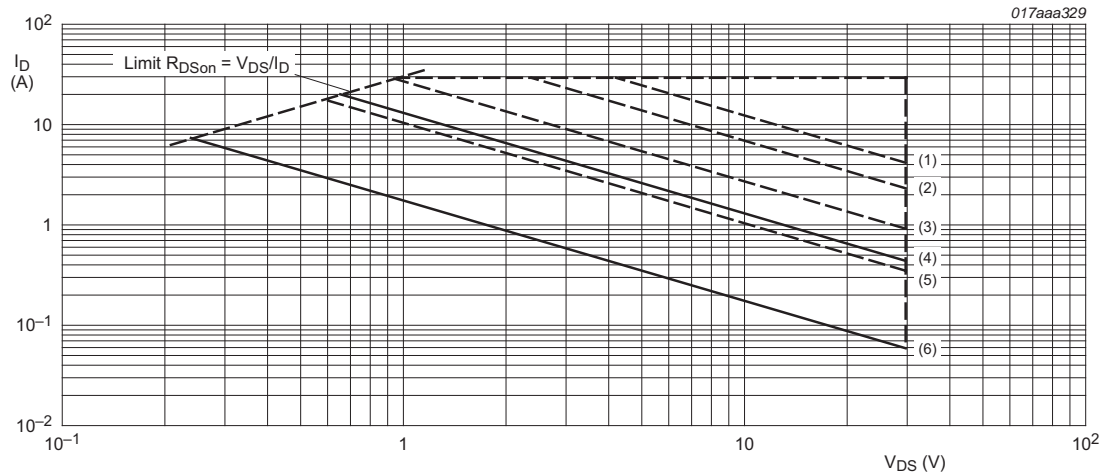
$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}\text{C})}} \times 100 \%$$

**Fig 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)  $t_p = 100 \mu\text{s}$

(2)  $t_p = 1 \text{ ms}$

(3)  $t_p = 10 \text{ ms}$

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

(5)  $t_p = 100 \text{ ms}$

(6) DC;  $T_{amb} = 25^{\circ}\text{C}$ ; 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**

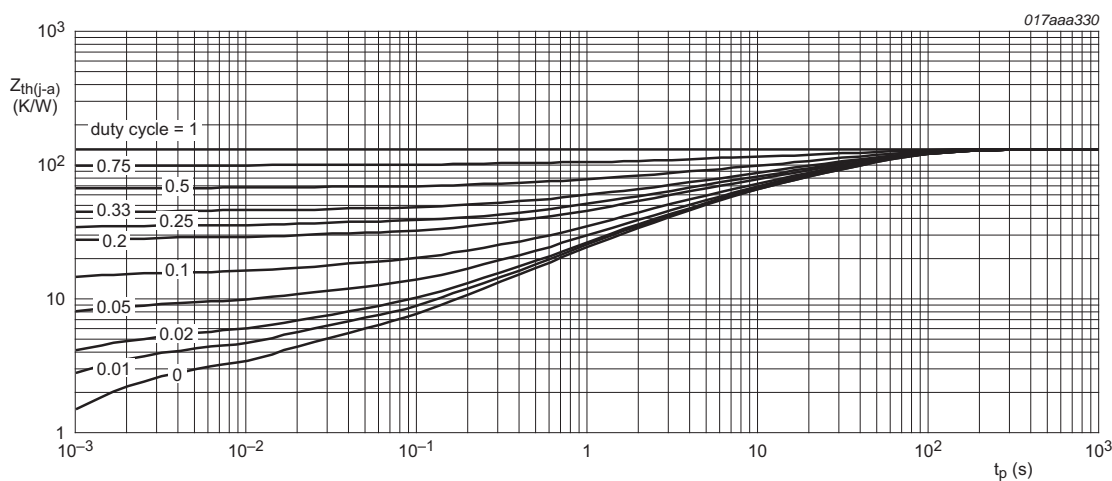
## 6. Thermal characteristics

**Table 6. Thermal characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	132	152 K/W
			[2]	-	62	71 K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		-	8	15	K/W

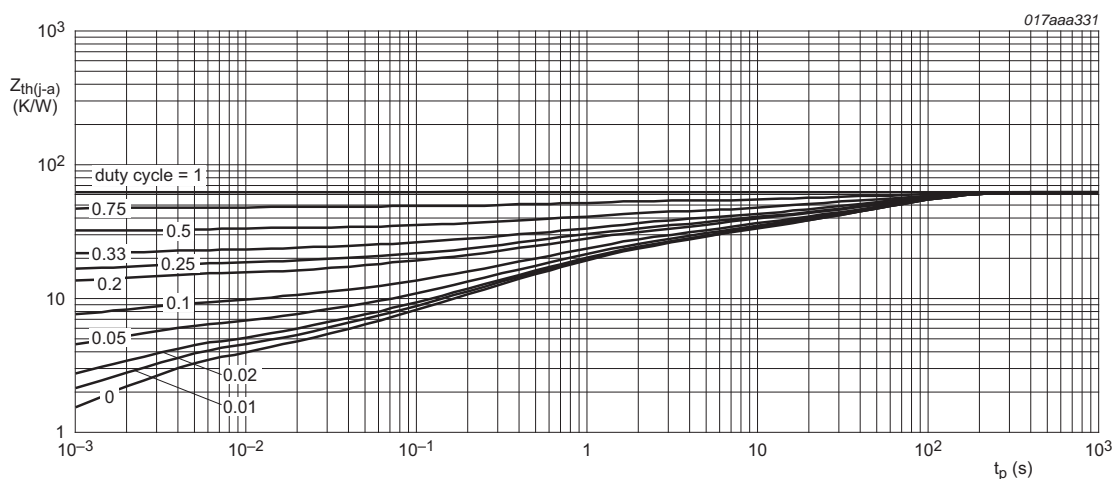
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

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



FR4 PCB, standard footprint

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



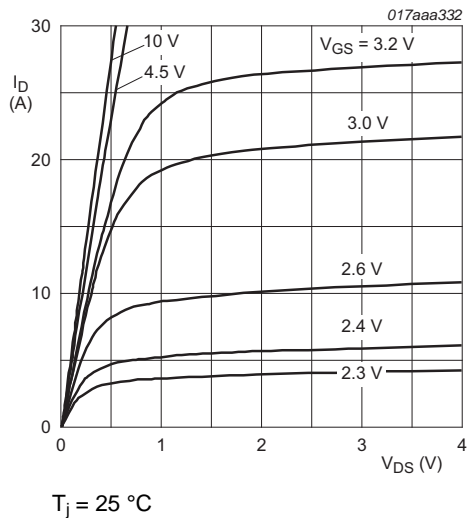
FR4 PCB, mounting pad for drain 6 cm<sup>2</sup>

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

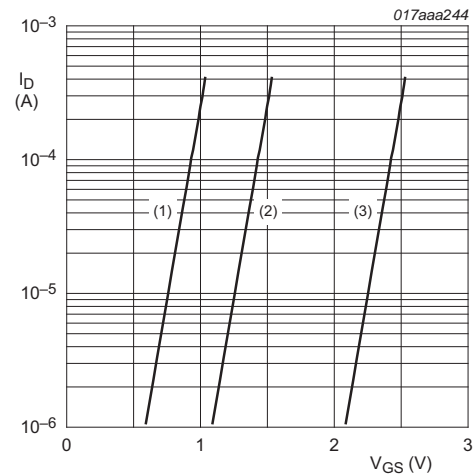
## 7. Characteristics

Table 7. Characteristics

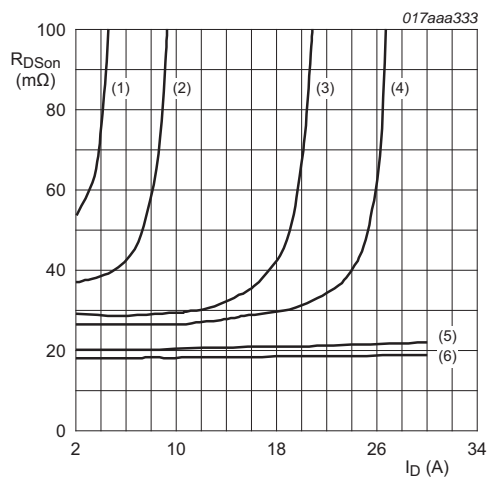
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
V <sub>(BR)DSS</sub>	drain-source breakdown voltage	I <sub>D</sub> = 250 μA; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C	30	-	-	V
V <sub>GSth</sub>	gate-source threshold voltage	I <sub>D</sub> = 250 μA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>j</sub> = 25 °C	1	1.5	2.5	V
I <sub>DSS</sub>	drain leakage current	V <sub>DS</sub> = 30 V; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C	-	-	1	μA
		V <sub>DS</sub> = 30 V; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 150 °C	-	-	20	μA
I <sub>GSS</sub>	gate leakage current	V <sub>GS</sub> = 20 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C	-	-	100	nA
		V <sub>GS</sub> = -20 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C	-	-	100	nA
R <sub>DSon</sub>	drain-source on-state resistance	V <sub>GS</sub> = 10 V; I <sub>D</sub> = 7.4 A; T <sub>j</sub> = 25 °C	-	18	21	mΩ
		V <sub>GS</sub> = 10 V; I <sub>D</sub> = 7.4 A; T <sub>j</sub> = 150 °C	-	27	32	mΩ
		V <sub>GS</sub> = 4.5 V; I <sub>D</sub> = 6.6 A; T <sub>j</sub> = 25 °C	-	21	26	mΩ
g <sub>fs</sub>	forward transconductance	V <sub>DS</sub> = 10 V; I <sub>D</sub> = 7.4 A; T <sub>j</sub> = 25 °C	-	24	-	S
Dynamic characteristics						
Q <sub>G(tot)</sub>	total gate charge	V <sub>DS</sub> = 15 V; I <sub>D</sub> = 6 A; V <sub>GS</sub> = 10 V; T <sub>j</sub> = 25 °C	-	12.5	14.4	nC
Q <sub>GS</sub>	gate-source charge		-	1.7	-	nC
Q <sub>GD</sub>	gate-drain charge		-	1.8	-	nC
C <sub>iss</sub>	input capacitance	V <sub>DS</sub> = 15 V; f = 1 MHz; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C	-	588	-	pF
C <sub>oss</sub>	output capacitance		-	154	-	pF
C <sub>rss</sub>	reverse transfer capacitance		-	62	-	pF
t <sub>d(on)</sub>	turn-on delay time	V <sub>DS</sub> = 15 V; V <sub>GS</sub> = 10 V; R <sub>G(ext)</sub> = 6 Ω; T <sub>j</sub> = 25 °C; I <sub>D</sub> = 6 A	-	4	-	ns
t <sub>r</sub>	rise time		-	29	-	ns
t <sub>d(off)</sub>	turn-off delay time		-	172	-	ns
t <sub>f</sub>	fall time		-	77	-	ns
Source-drain diode						
V <sub>SD</sub>	source-drain voltage	I <sub>S</sub> = 1.92 A; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C	-	0.7	1.2	V



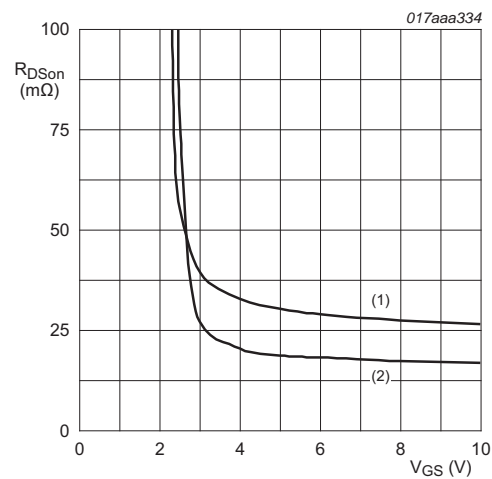
**Fig 6. Output characteristics: drain current as a function of drain-source voltage; typical values**



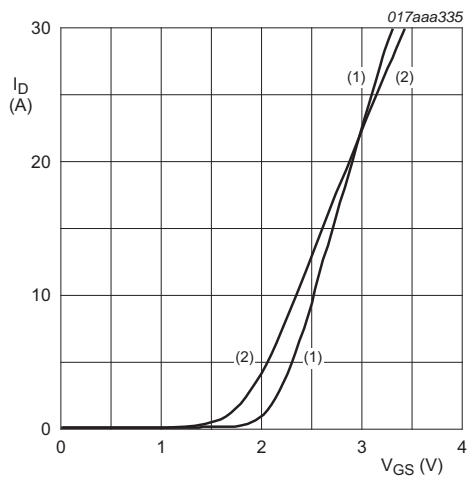
**Fig 7. Sub-threshold drain current as a function of gate-source voltage**



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

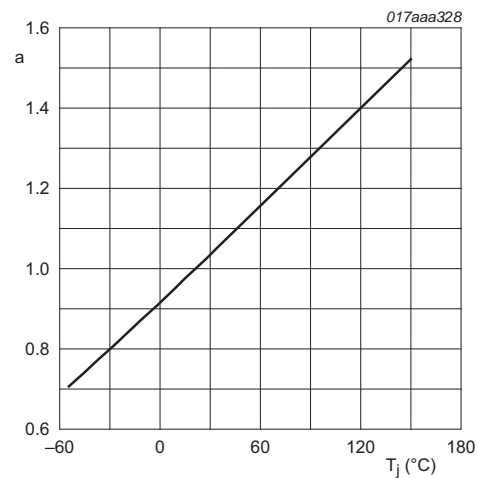


**Fig 9. Drain-source on-state resistance as a function of gate-source voltage; typical values**



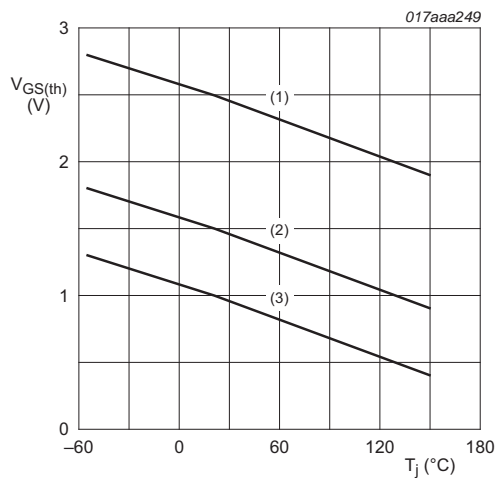
$V_{DS} > I_D \times R_{DSon}$   
 (1)  $T_j = 25\text{ °C}$   
 (2)  $T_j = 150\text{ °C}$

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



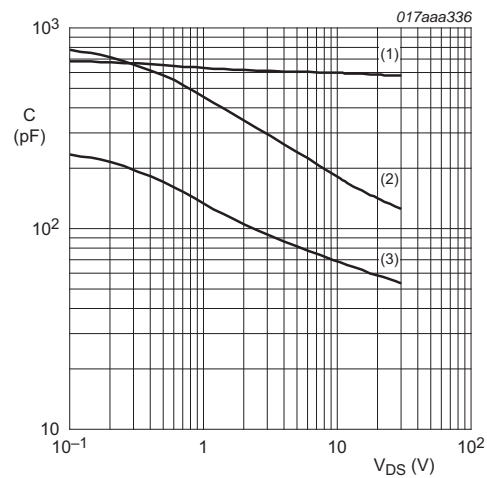
$$a = \frac{R_{DSon}}{R_{DSon(25^\circ\text{C})}}$$

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



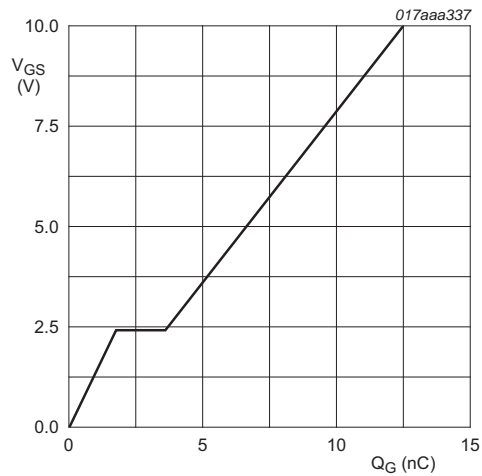
$I_D = 0.25\text{ mA}$ ;  $V_{DS} = V_{GS}$   
 (1) maximum values  
 (2) typical values  
 (3) minimum values

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



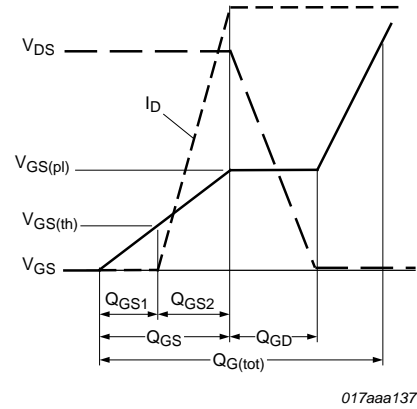
$f = 1\text{ MHz}$ ;  $V_{GS} = 0\text{ V}$   
 (1)  $C_{iss}$   
 (2)  $C_{oss}$   
 (3)  $C_{rss}$

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

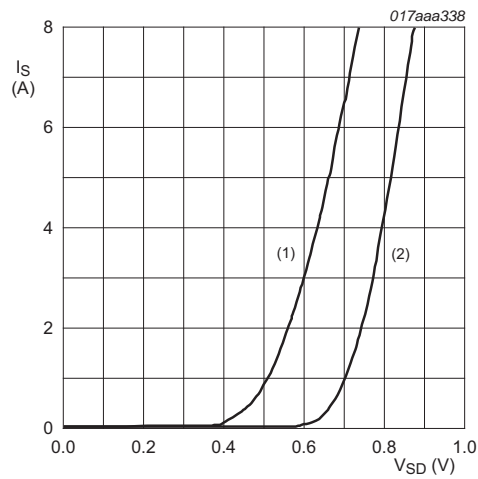


$I_D = 6 \text{ A}$ ;  $V_{DS} = 15 \text{ V}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$

**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**



## 8. Test information

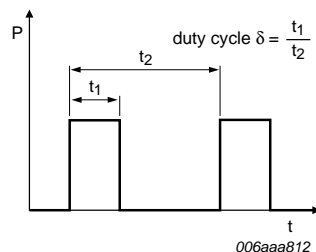
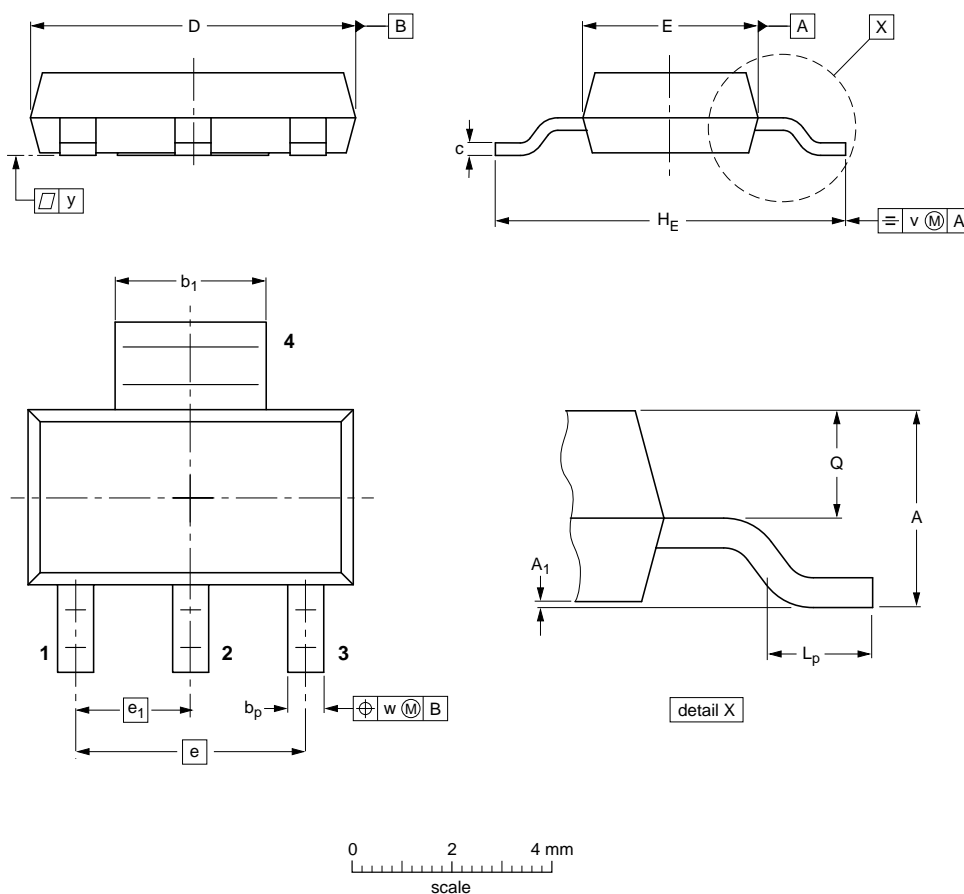


Fig 17. Duty cycle definition

## 9. Package outline

Plastic surface-mounted package with increased heatsink; 4 leads

SOT223



DIMENSIONS (mm are the original dimensions)

UNIT	A	A <sub>1</sub>	b <sub>p</sub>	b <sub>1</sub>	c	D	E	e	e <sub>1</sub>	H <sub>E</sub>	L <sub>p</sub>	Q	v	w	y
mm	1.8 1.5	0.10 0.01	0.80 0.60	3.1 2.9	0.32 0.22	6.7 6.3	3.7 3.3	4.6	2.3	7.3 6.7	1.1 0.7	0.95 0.85	0.2	0.1	0.1

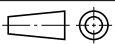
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT223			SC-73			04-11-10 06-03-16

Fig 18. Package outline SOT223 (SC-73)

## 10. Soldering

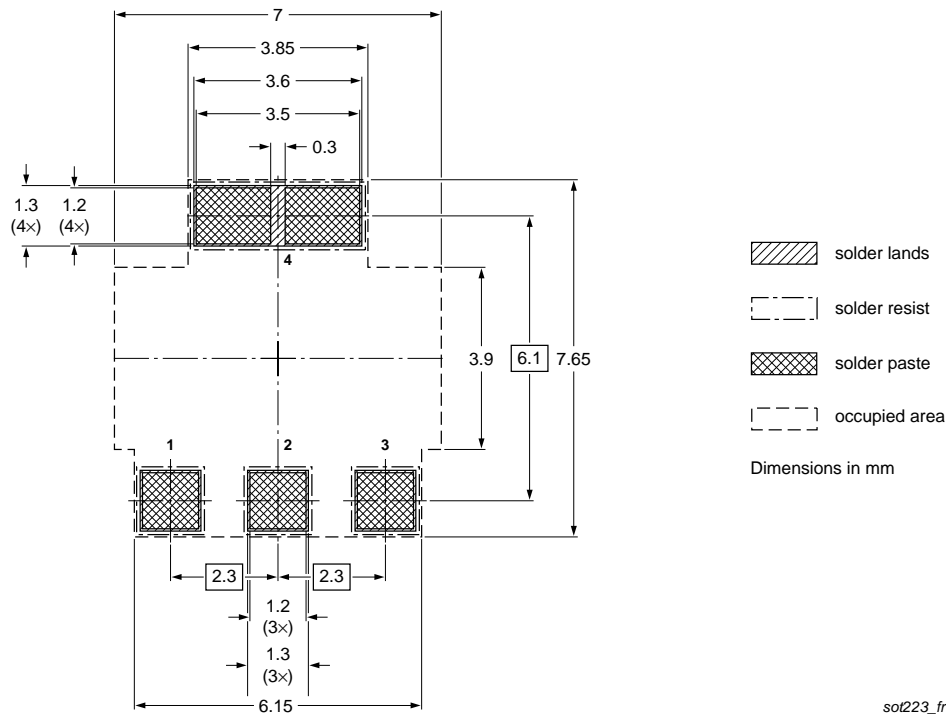


Fig 19. Reflow soldering footprint for SOT223 (SC-73)

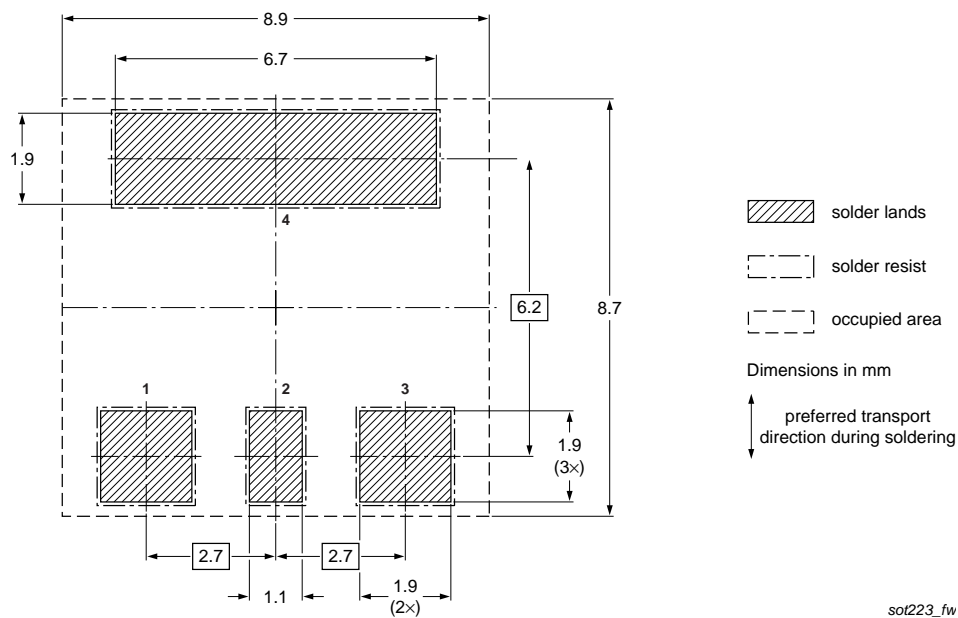


Fig 20. Wave soldering footprint for SOT223 (SC-73)

## 11. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PMT21EN v.1	20110830	Product data sheet	-	-

## 12. Legal information

### 12.1 Data sheet status

Document status <sup>[1] [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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