



# PMDT290UNE

20 V, 800 mA dual N-channel Trench MOSFET

Rev. 1 — 13 September 2011

Product data sheet

## 1. Product profile

### 1.1 General description

Dual N-channel enhancement mode Field-Effect Transistor (FET) in an ultra small and flat lead SOT666 Surface-Mounted Device (SMD) plastic package using Trench MOSFET technology.

### 1.2 Features and benefits

- Very fast switching
- Trench MOSFET technology
- ESD protection up to 2 kV
- AEC-Q101 qualified

### 1.3 Applications

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

### 1.4 Quick reference data

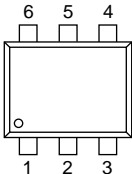
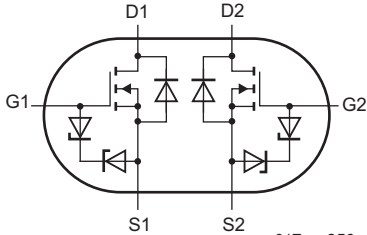
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Per transistor</b>						
$V_{DS}$	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]	-	800	mA
<b>Static characteristics (per transistor)</b>						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 4.5\text{ V}$ ; $I_D = 500\text{ mA}$ ; $T_j = 25\text{ °C}$	-	290	380	mΩ

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

2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S1	source TR1	 SOT666	 017aaa256
2	G1	gate TR1		
3	D2	drain TR2		
4	S2	source TR2		
5	G2	gate TR2		
6	D1	drain TR1		

3. Ordering information

Table 3. Ordering information

Type number	Package		Version
	Name	Description	
PMDT290UNE	-	plastic surface-mounted package; 6 leads	SOT666

4. Marking

Table 4. Marking codes

Type number	Marking code
PMDT290UNE	AE

5. Limiting values

Table 5. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
Per transistor					
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]	800	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	-	3.2	A
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = 25 °C	[2]	330	mW
			[1]	390	mW
		T <sub>sp</sub> = 25 °C	-	1090	mW
Per device					
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = 25 °C	[2]	500	mW
T <sub>j</sub>	junction temperature		-55	150	°C
T <sub>amb</sub>	ambient temperature		-55	150	°C

Table 5. Limiting values ...continued  
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
T <sub>stg</sub>	storage temperature		-65	150	°C
Source-drain diode					
I <sub>S</sub>	source current	T <sub>amb</sub> = 25 °C	-	370	mA
ESD maximum rating					
V <sub>ESD</sub>	electrostatic discharge voltage	HBM	[3]	2000	V

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

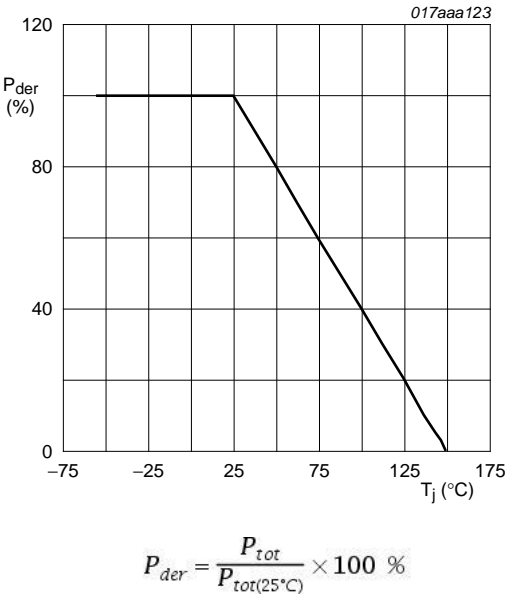


Fig 1. Normalized total power dissipation as a function of junction temperature

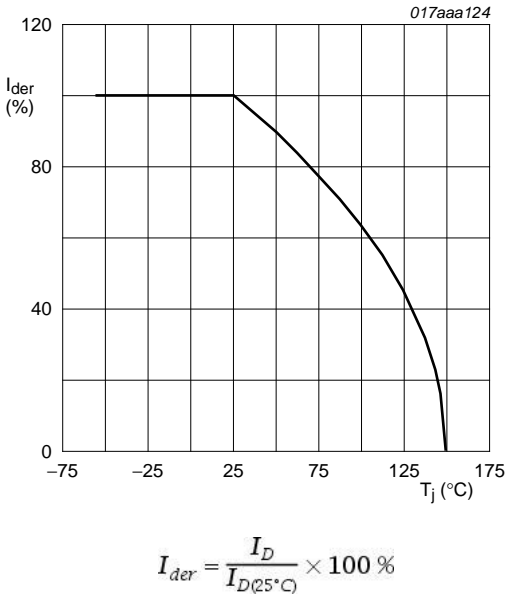
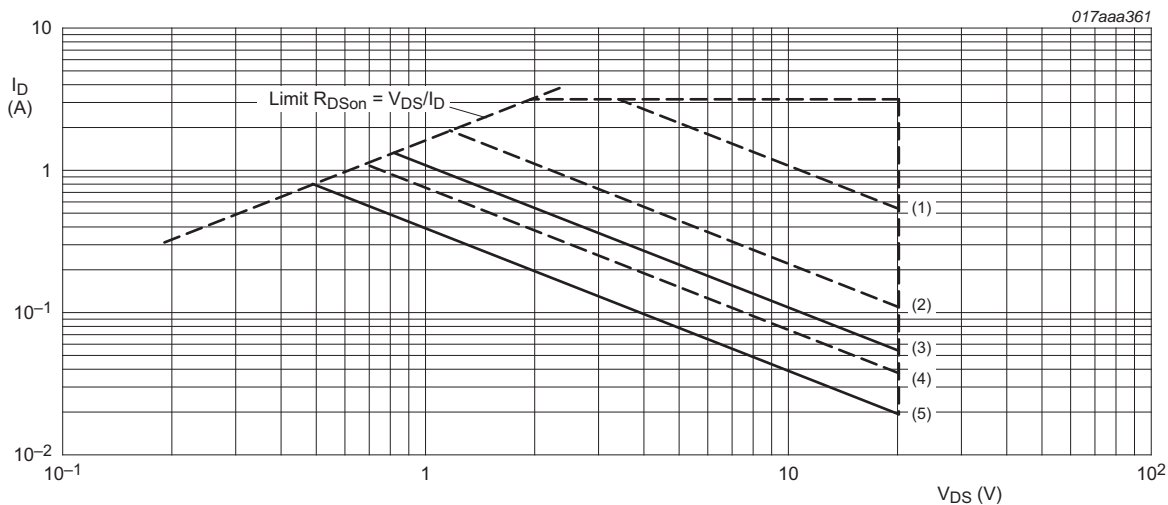


Fig 2. Normalized continuous drain current as a function of junction temperature



$I_{DM}$  = single pulse

(1)  $t_p = 1$  ms

(2)  $t_p = 10$  ms

(3) DC;  $T_{sp} = 25$  °C

(4)  $t_p = 100$  ms

(5) DC;  $T_{amb} = 25$  °C; drain mounting pad  $1\text{ cm}^2$

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

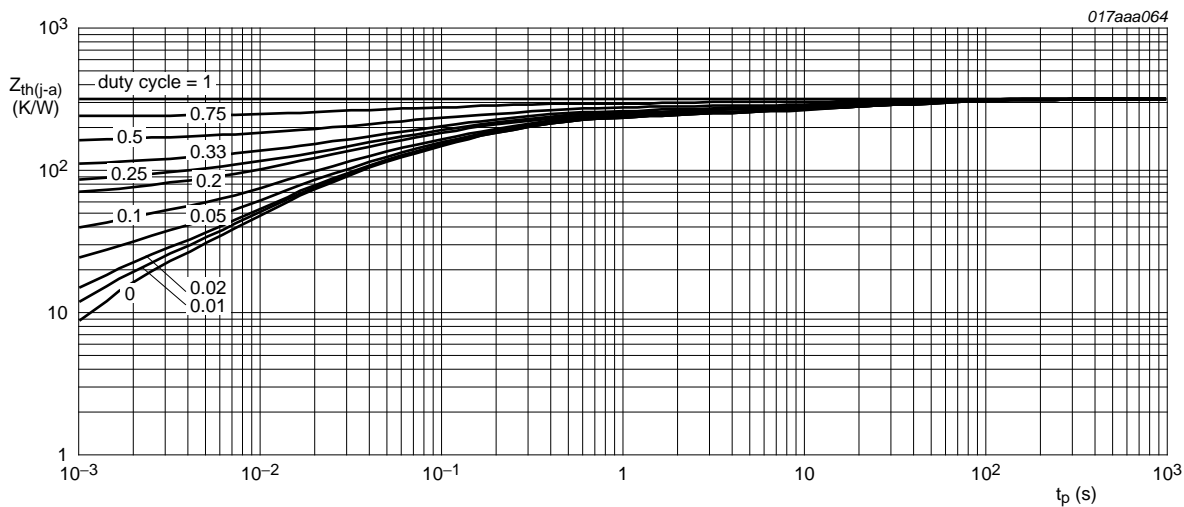
6. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Per transistor						
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	330	K/W
			[2]	-	280	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		-	-	115	K/W
Per device						
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	250	K/W

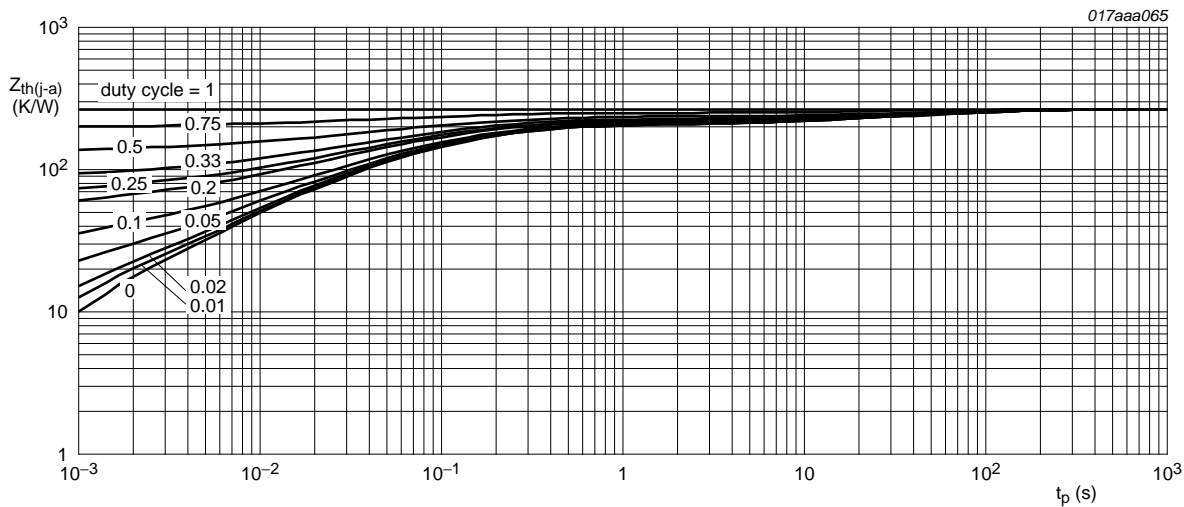
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for drain  $1\text{ cm}^2$ .



FR4 PCB; standard footprint

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



FR4 PCB, mounting pad for drain 1 cm<sup>2</sup>

Fig 5. Per transistor: 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 (per transistor)</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250\ \mu\text{A}$ ; $V_{GS} = 0\ \text{V}$ ; $T_j = 25\ ^\circ\text{C}$	20	-	-	V
$V_{GSth}$	gate-source threshold voltage	$I_D = 250\ \mu\text{A}$ ; $V_{DS} = V_{GS}$ ; $T_j = 25\ ^\circ\text{C}$	0.5	0.75	0.95	V
$I_{DSS}$	drain leakage current	$V_{DS} = 20\ \text{V}$ ; $V_{GS} = 0\ \text{V}$ ; $T_j = 25\ ^\circ\text{C}$	-	-	1	$\mu\text{A}$
		$V_{DS} = 20\ \text{V}$ ; $V_{GS} = 0\ \text{V}$ ; $T_j = 150\ ^\circ\text{C}$	-	-	10	$\mu\text{A}$
$I_{GSS}$	gate leakage current	$V_{GS} = 8\ \text{V}$ ; $V_{DS} = 0\ \text{V}$ ; $T_j = 25\ ^\circ\text{C}$	-	-	2	$\mu\text{A}$
		$V_{GS} = -8\ \text{V}$ ; $V_{DS} = 0\ \text{V}$ ; $T_j = 25\ ^\circ\text{C}$	-	-	2	$\mu\text{A}$
		$V_{GS} = 4.5\ \text{V}$ ; $V_{DS} = 0\ \text{V}$ ; $T_j = 25\ ^\circ\text{C}$	-	-	500	nA
		$V_{GS} = -4.5\ \text{V}$ ; $V_{DS} = 0\ \text{V}$ ; $T_j = 25\ ^\circ\text{C}$	-	-	500	nA
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 4.5\ \text{V}$ ; $I_D = 500\ \text{mA}$ ; $T_j = 25\ ^\circ\text{C}$	-	290	380	m $\Omega$
		$V_{GS} = 4.5\ \text{V}$ ; $I_D = 500\ \text{mA}$ ; $T_j = 150\ ^\circ\text{C}$	-	460	610	m $\Omega$
		$V_{GS} = 2.5\ \text{V}$ ; $I_D = 400\ \text{mA}$ ; $T_j = 25\ ^\circ\text{C}$	-	420	620	m $\Omega$
		$V_{GS} = 1.8\ \text{V}$ ; $I_D = 100\ \text{mA}$ ; $T_j = 25\ ^\circ\text{C}$	-	600	1100	m $\Omega$
$g_{fs}$	forward transconductance	$V_{DS} = 10\ \text{V}$ ; $I_D = 200\ \text{mA}$ ; $T_j = 25\ ^\circ\text{C}$	-	1.6	-	S
<b>Dynamic characteristics (per transistor)</b>						
$Q_{G(tot)}$	total gate charge	$V_{DS} = 10\ \text{V}$ ; $I_D = 500\ \text{mA}$ ; $V_{GS} = 4.5\ \text{V}$ ; $T_j = 25\ ^\circ\text{C}$	-	0.45	0.68	nC
$Q_{GS}$	gate-source charge		-	0.15	-	nC
$Q_{GD}$	gate-drain charge		-	0.15	-	nC
$C_{iss}$	input capacitance	$V_{DS} = 10\ \text{V}$ ; $f = 1\ \text{MHz}$ ; $V_{GS} = 0\ \text{V}$ ; $T_j = 25\ ^\circ\text{C}$	-	55	83	pF
$C_{oss}$	output capacitance		-	15	-	pF
$C_{rss}$	reverse transfer capacitance		-	7	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 10\ \text{V}$ ; $R_L = 250\ \Omega$ ; $V_{GS} = 4.5\ \text{V}$ ; $R_{G(ext)} = 6\ \Omega$ ; $T_j = 25\ ^\circ\text{C}$	-	6	12	ns
$t_r$	rise time		-	4	-	ns
$t_{d(off)}$	turn-off delay time		-	86	172	ns
$t_f$	fall time		-	31	-	ns
<b>Source-drain diode (per transistor)</b>						
$V_{SD}$	source-drain voltage	$I_S = 300\ \text{mA}$ ; $V_{GS} = 0\ \text{V}$ ; $T_j = 25\ ^\circ\text{C}$	0.48	0.77	1.2	V

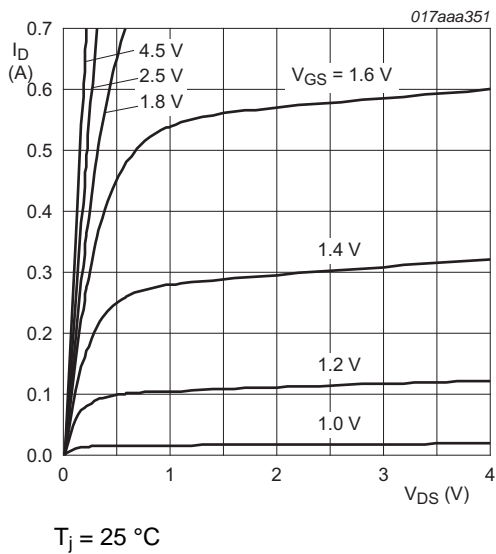


Fig 6. Output characteristics: drain current as a function of drain-source voltage; typical values

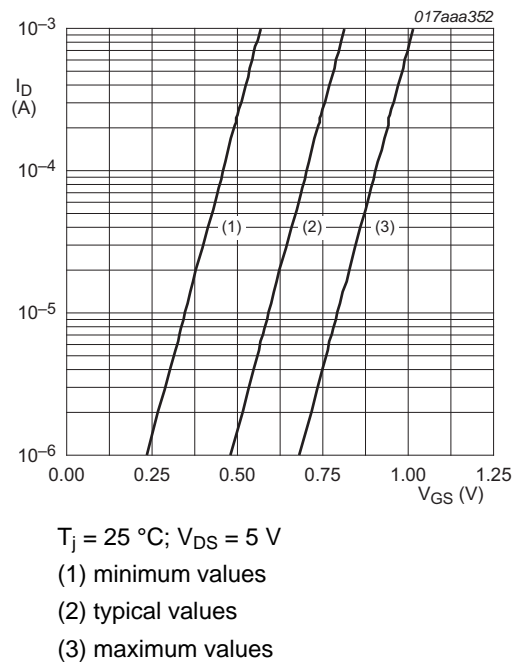


Fig 7. Sub-threshold drain current as a function of gate-source voltage

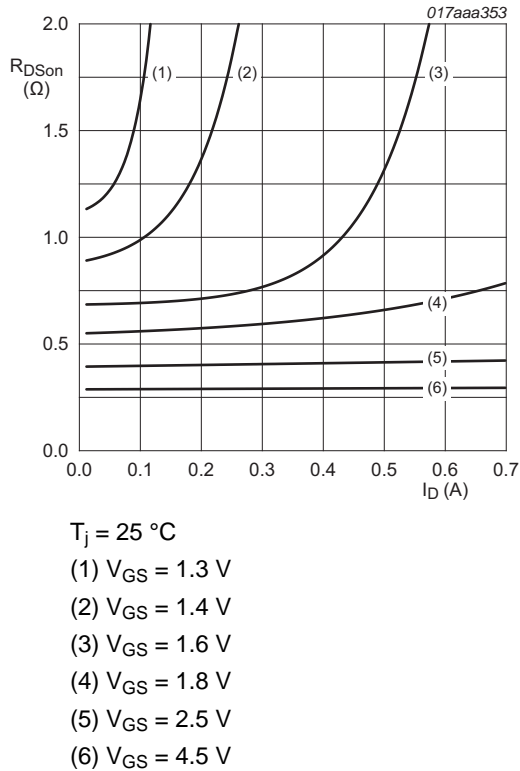


Fig 8. Drain-source on-state resistance as a function of drain current; typical values

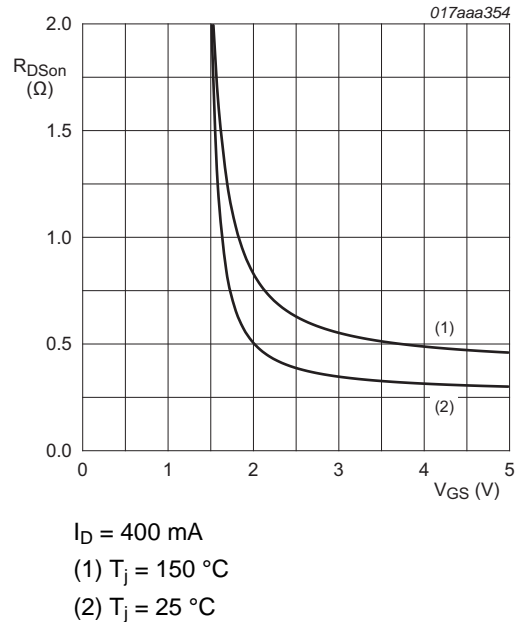
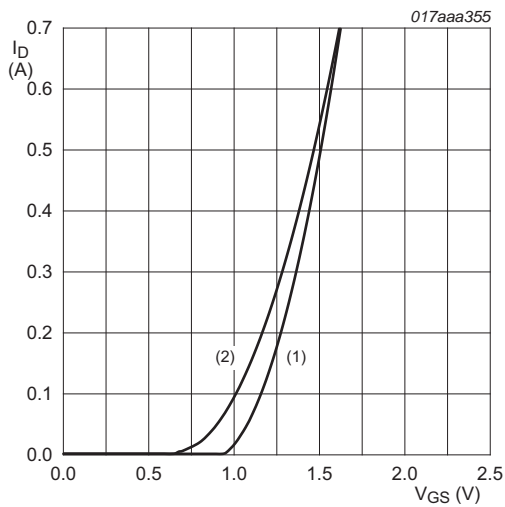


Fig 9. Drain-source on-state resistance as a function of gate-source voltage; typical values

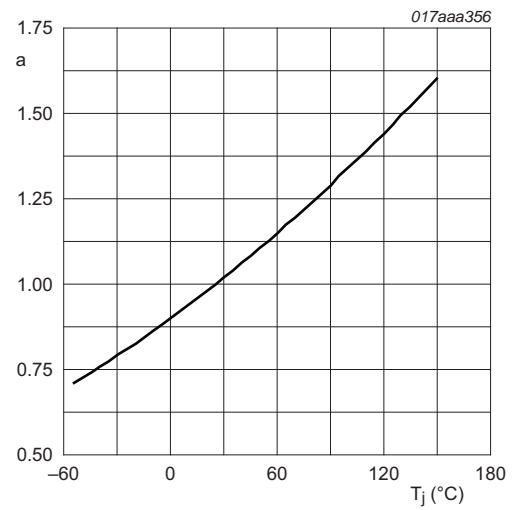


$$V_{DS} > I_D \times R_{DS(on)}$$

(1)  $T_j = 25\text{ °C}$

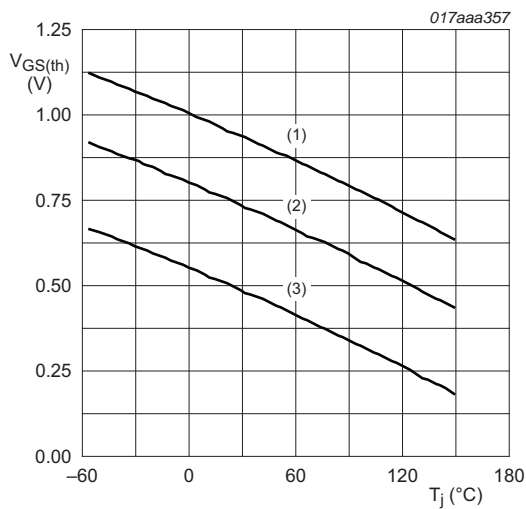
(2)  $T_j = 150\text{ °C}$

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



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

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



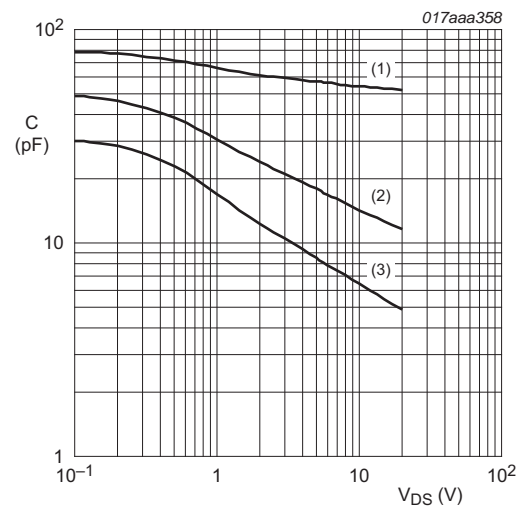
$$I_D = 0.25\text{ mA}; V_{DS} = V_{GS}$$

(1) maximum values

(2) typical values

(3) minimum values

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



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

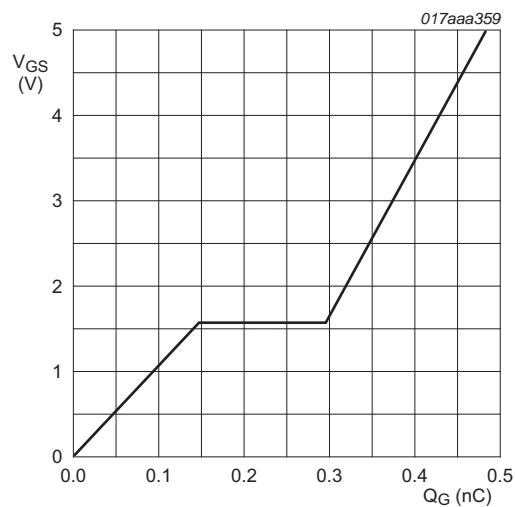
(1)  $C_{iss}$

(2)  $C_{oss}$

(3)  $C_{rss}$

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





$I_D = 0.5\text{ A}$ ;  $V_{DS} = 10\text{ V}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$

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

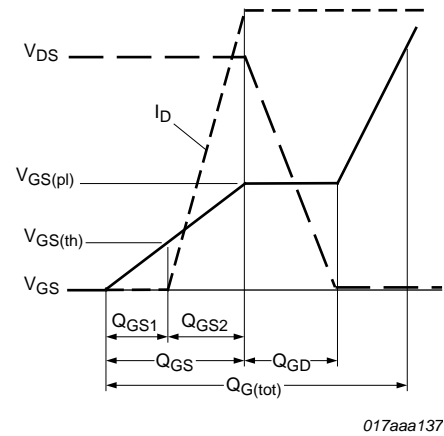
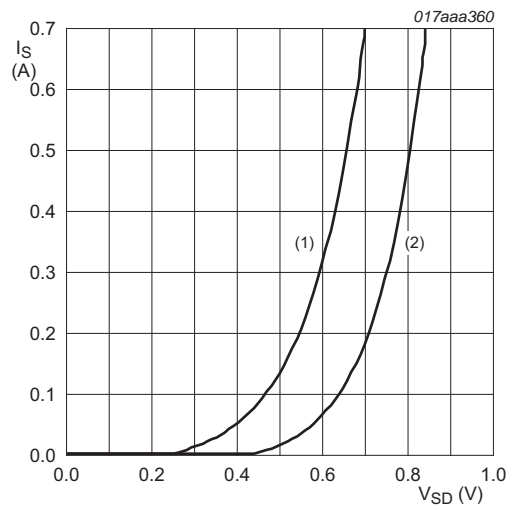


Fig 15. Gate charge waveform definitions



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

## 8. Test information

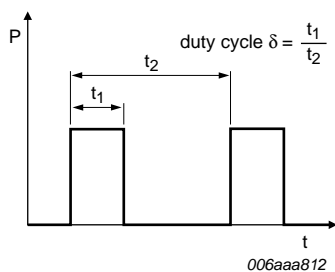


Fig 17. Duty cycle definition

### 8.1 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.

9. Package outline

Plastic surface-mounted package; 6 leads

SOT666

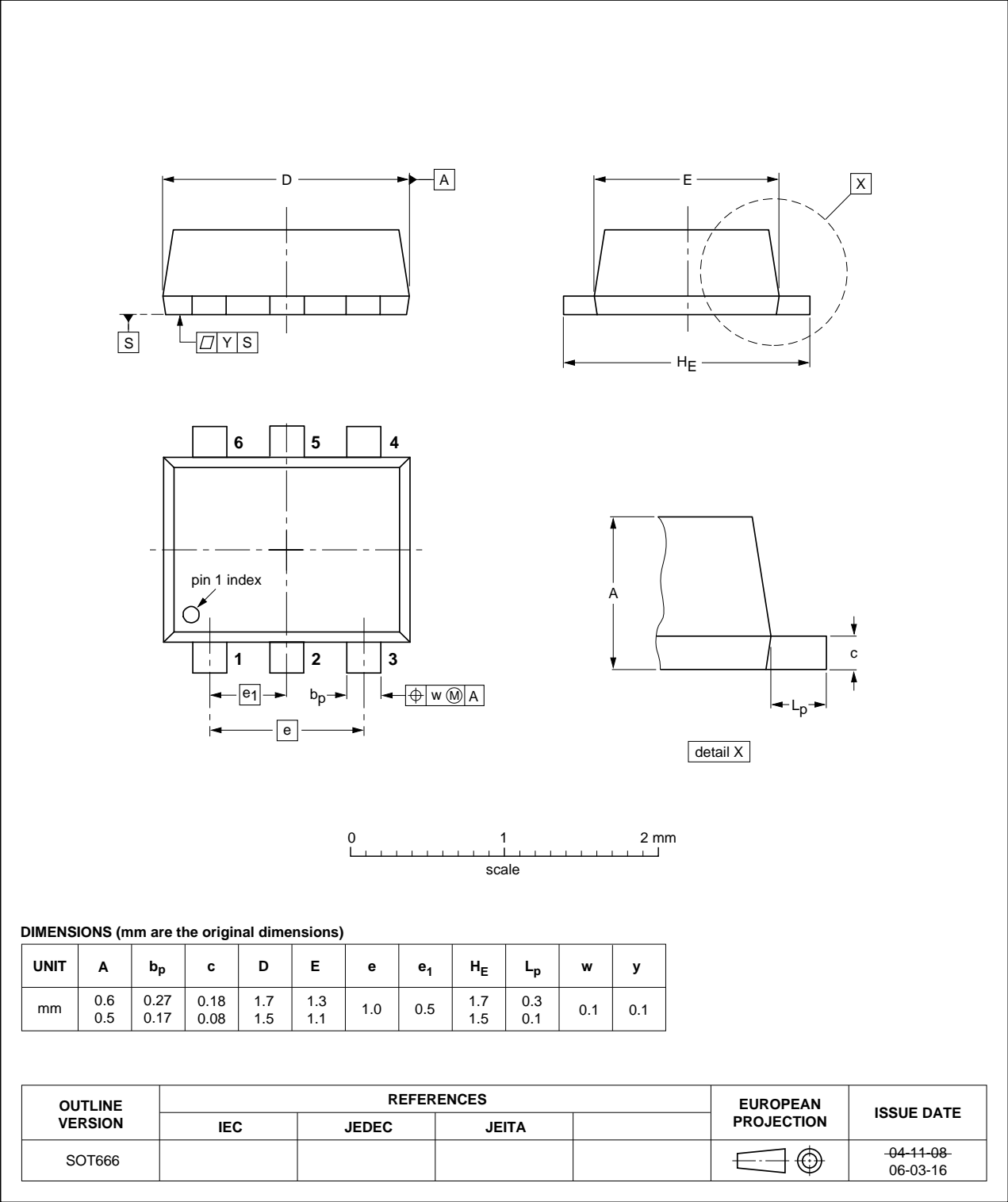


Fig 18. Package outline SOT666



11. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PMDT290UNE v.1	20110913	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.

[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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