



PMR290UNE

20 V, 700 mA N-channel Trench MOSFET

Rev. 1 — 13 September 2011

Product data sheet

1. Product profile

1.1 General description

N-channel enhancement mode Field-Effect Transistor (FET) in a small SOT416 (SC-75) 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

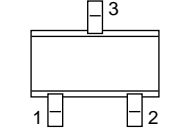
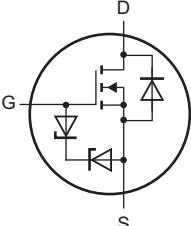
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
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]	-	700	mA
Static characteristics						
$R_{DS(on)}$	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 PCB, single-sided copper, tin-plated, mounting pad for drain 1 cm².

2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 SOT416 (SC-75)	 017aaa255
2	S	source		
3	D	drain		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PMR290UNE	SC-75	plastic surface-mounted package; 3 leads	SOT416

4. Marking

Table 4. Marking codes

Type number	Marking code
PMR290UNE	AC

5. Limiting values

Table 5. Limiting values

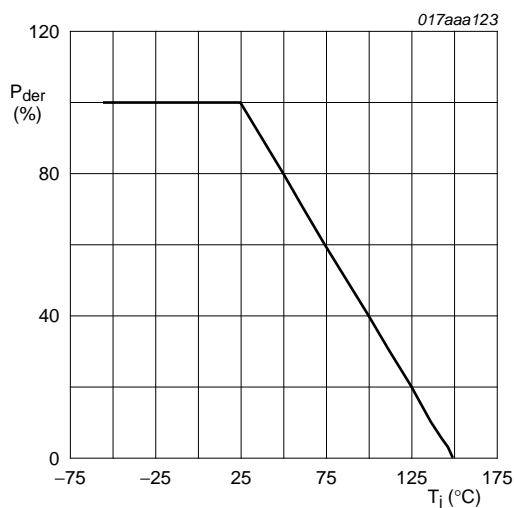
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V _{DS}	drain-source voltage	T _j = 25 °C	-	20	V
V _{GS}	gate-source voltage		-8	8	V
I _D	drain current	V _{GS} = 4.5 V; T _{amb} = 25 °C	[1]	700	mA
		V _{GS} = 4.5 V; T _{amb} = 100 °C	[1]	440	mA
I _{DM}	peak drain current	T _{amb} = 25 °C; single pulse; t _p ≤ 10 μs	-	2.8	A
P _{tot}	total power dissipation	T _{amb} = 25 °C	[2]	250	mW
			[1]	300	mW
		T _{sp} = 25 °C	-	770	mW
T _j	junction temperature		-55	150	°C
T _{amb}	ambient temperature		-55	150	°C
T _{stg}	storage temperature		-65	150	°C
Source-drain diode					
I _S	source current	T _{amb} = 25 °C	[1]	300	mA
ESD maximum rating					
V _{ESD}	electrostatic discharge voltage	HBM	[3]	2000	V

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for drain 1 cm².

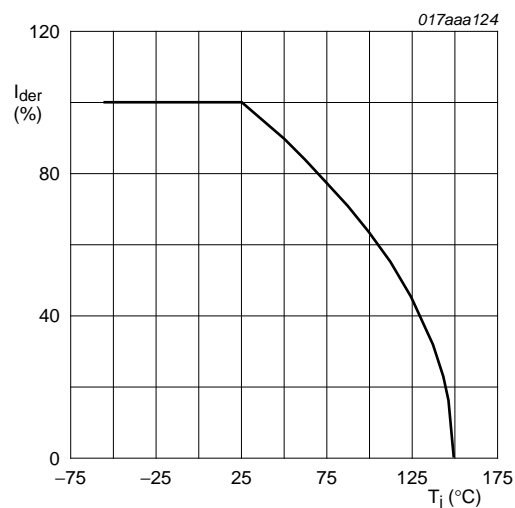
[2] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.

[3] Measured between all pins.



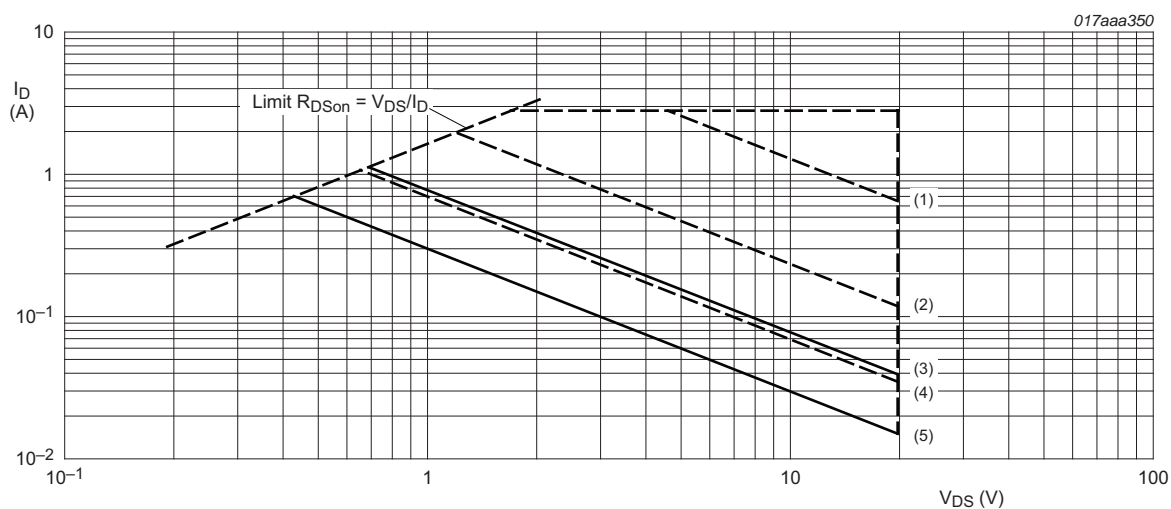
$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}\text{C})}} \times 100 \%$$

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) $t_p = 1$ 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 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]	440	510	K/W
			[2]	360	415	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		-	-	160	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 cm².

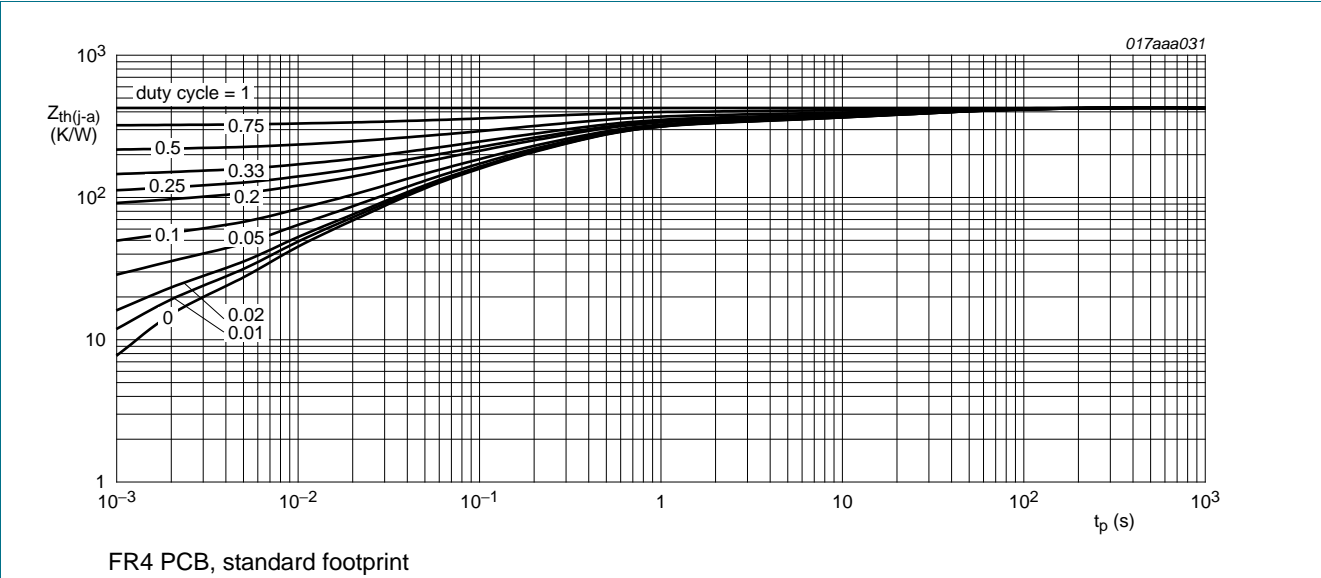


Fig 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

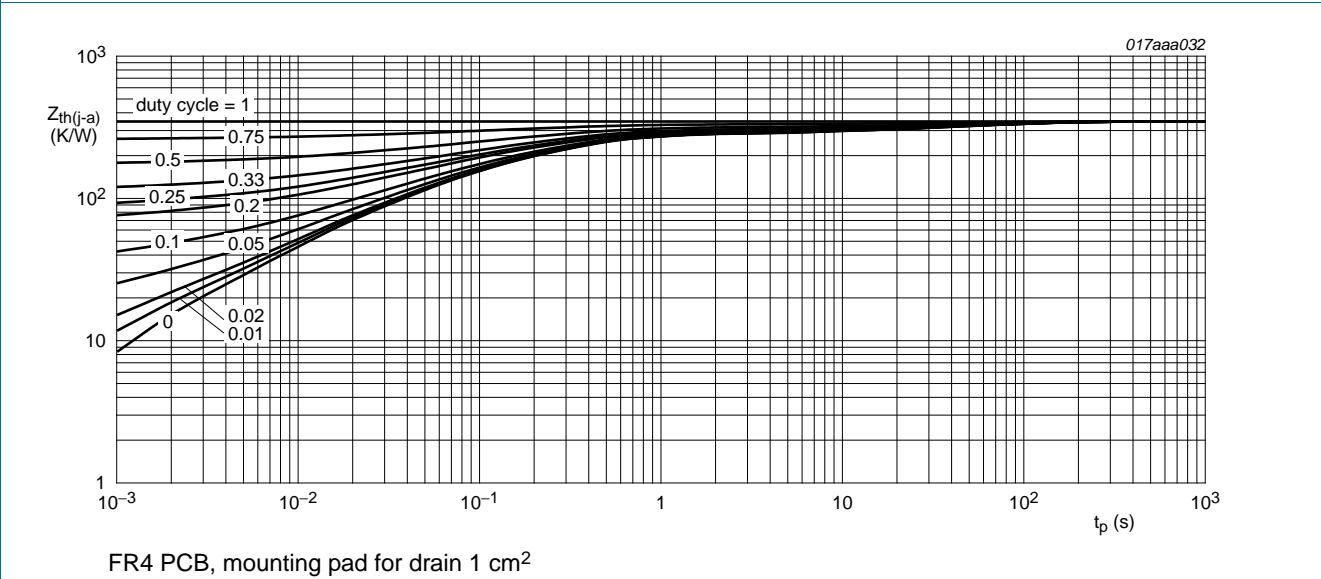


Fig 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

7. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	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	μA
		$V_{DS} = 20\ \text{V}$; $V_{GS} = 0\ \text{V}$; $T_j = 150\ ^\circ\text{C}$	-	-	10	μA
I_{GSS}	gate leakage current	$V_{GS} = 8\ \text{V}$; $V_{DS} = 0\ \text{V}$; $T_j = 25\ ^\circ\text{C}$	-	-	2	μA
		$V_{GS} = -8\ \text{V}$; $V_{DS} = 0\ \text{V}$; $T_j = 25\ ^\circ\text{C}$	-	-	2	μA
		$V_{GS} = 4.5\ \text{V}$; $V_{DS} = 0\ \text{V}$; $T_j = 25\ ^\circ\text{C}$	-	-	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 Ω
		$V_{GS} = 4.5\ \text{V}$; $I_D = 500\ \text{mA}$; $T_j = 150\ ^\circ\text{C}$	-	460	610	m Ω
		$V_{GS} = 2.5\ \text{V}$; $I_D = 400\ \text{mA}$; $T_j = 25\ ^\circ\text{C}$	-	420	620	m Ω
		$V_{GS} = 1.8\ \text{V}$; $I_D = 100\ \text{mA}$; $T_j = 25\ ^\circ\text{C}$	-	600	1100	m Ω
g_{fs}	forward transconductance	$V_{DS} = 10\ \text{V}$; $I_D = 200\ \text{mA}$; $T_j = 25\ ^\circ\text{C}$	-	1.6	-	S
Dynamic characteristics						
$Q_{G(tot)}$	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
Source-drain diode						
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

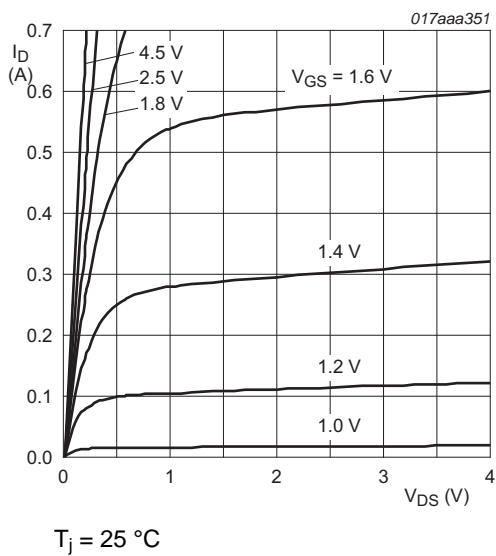


Fig 6. Output characteristics: drain current as a function of drain-source voltage; typical values

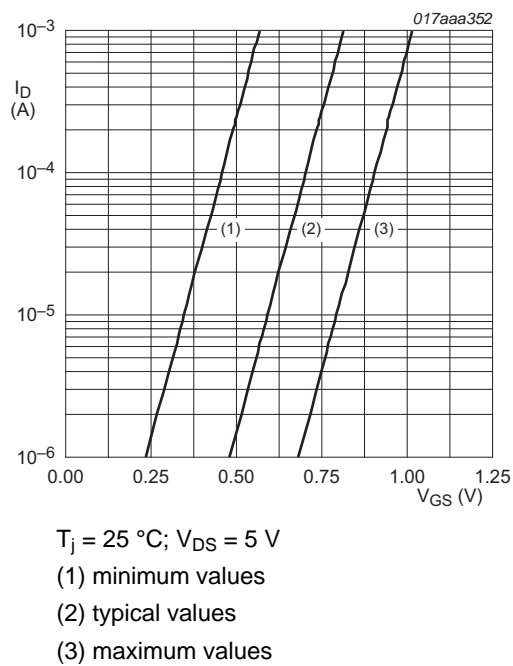


Fig 7. Sub-threshold drain current as a function of gate-source voltage

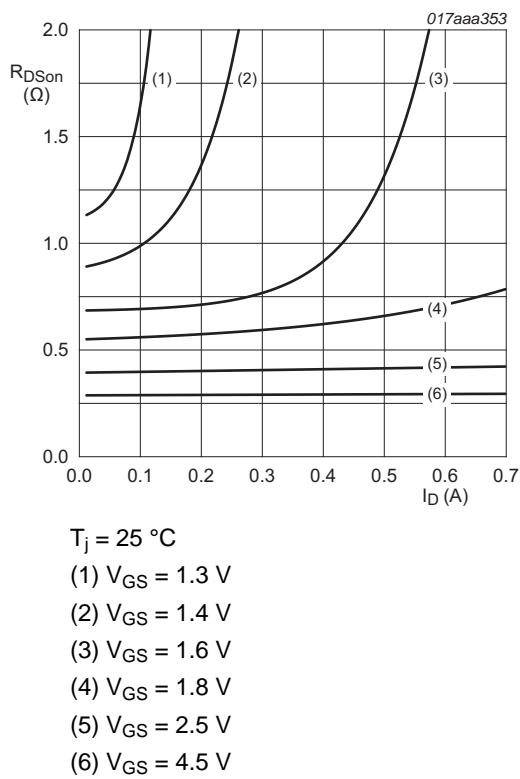


Fig 8. Drain-source on-state resistance as a function of drain current; typical values

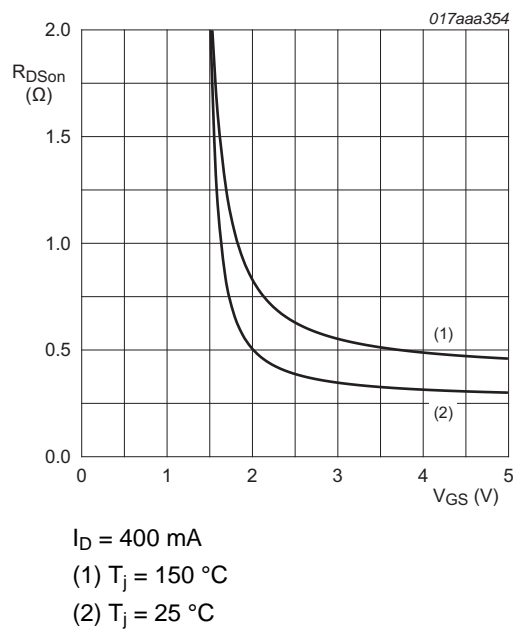
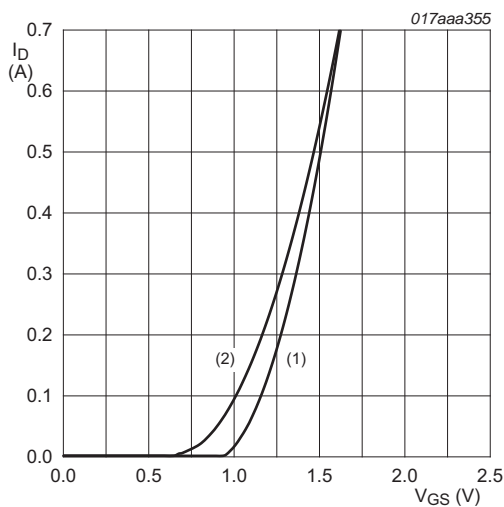
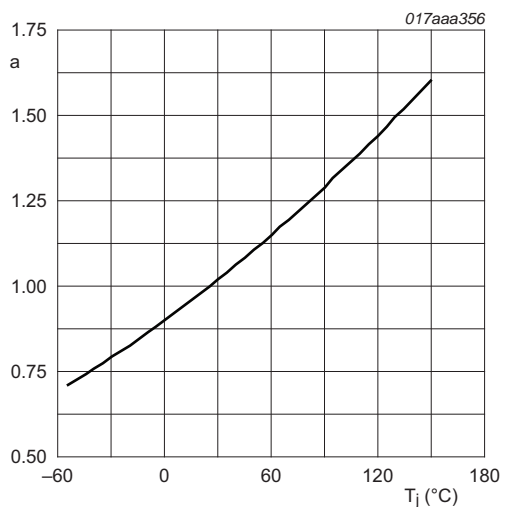


Fig 9. Drain-source on-state resistance as a function of gate-source voltage; typical values



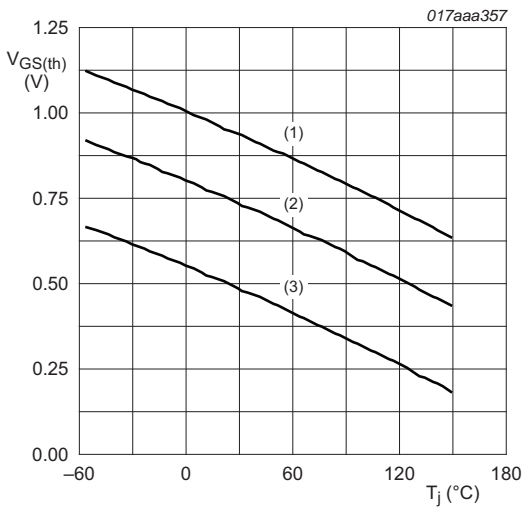
$V_{DS} > I_D \times R_{DSon}$
(1) $T_j = 25\text{ }^{\circ}\text{C}$
(2) $T_j = 150\text{ }^{\circ}\text{C}$

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



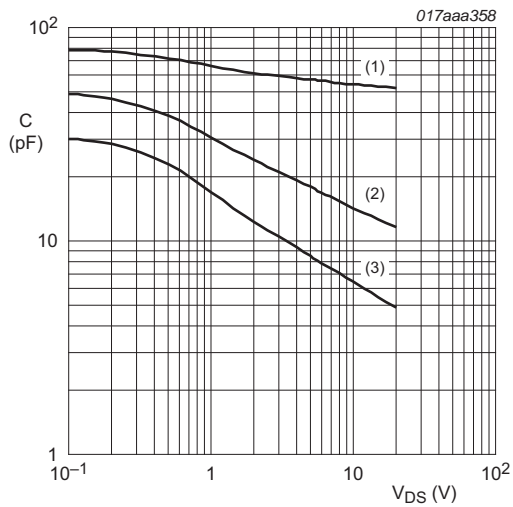
$$a = \frac{R_{DSon}}{R_{DSon}(25^{\circ}\text{C})}$$

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



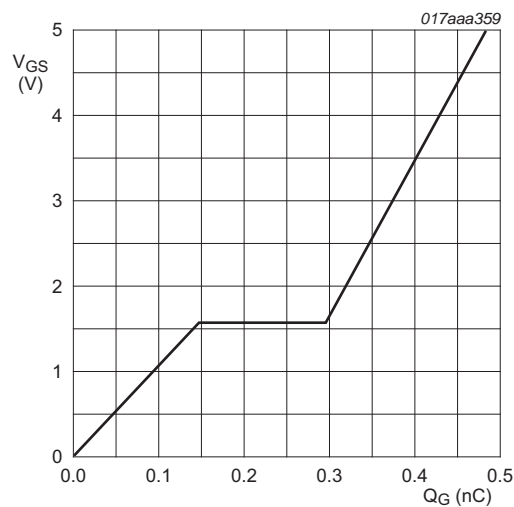
$I_D = 0.25\text{ mA}; V_{DS} = V_{GS}$
(1) maximum values
(2) typical values
(3) minimum values

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



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

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

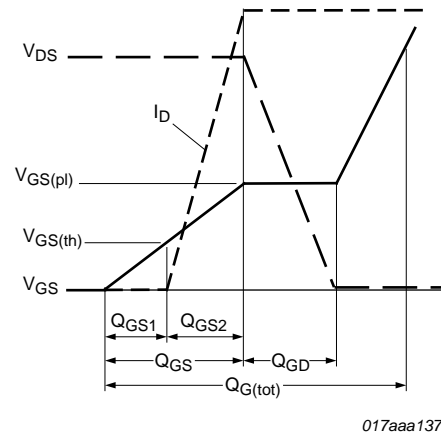
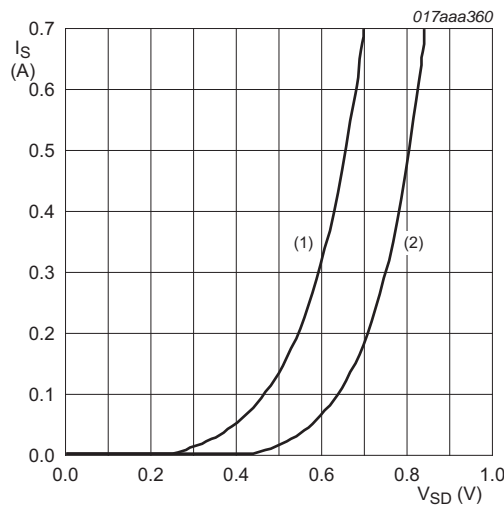


Fig 15. Gate charge waveform definitions



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

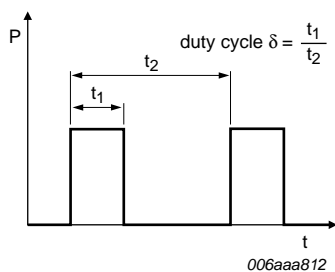


Fig 17. Duty cycle definition

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; 3 leadsSOT416

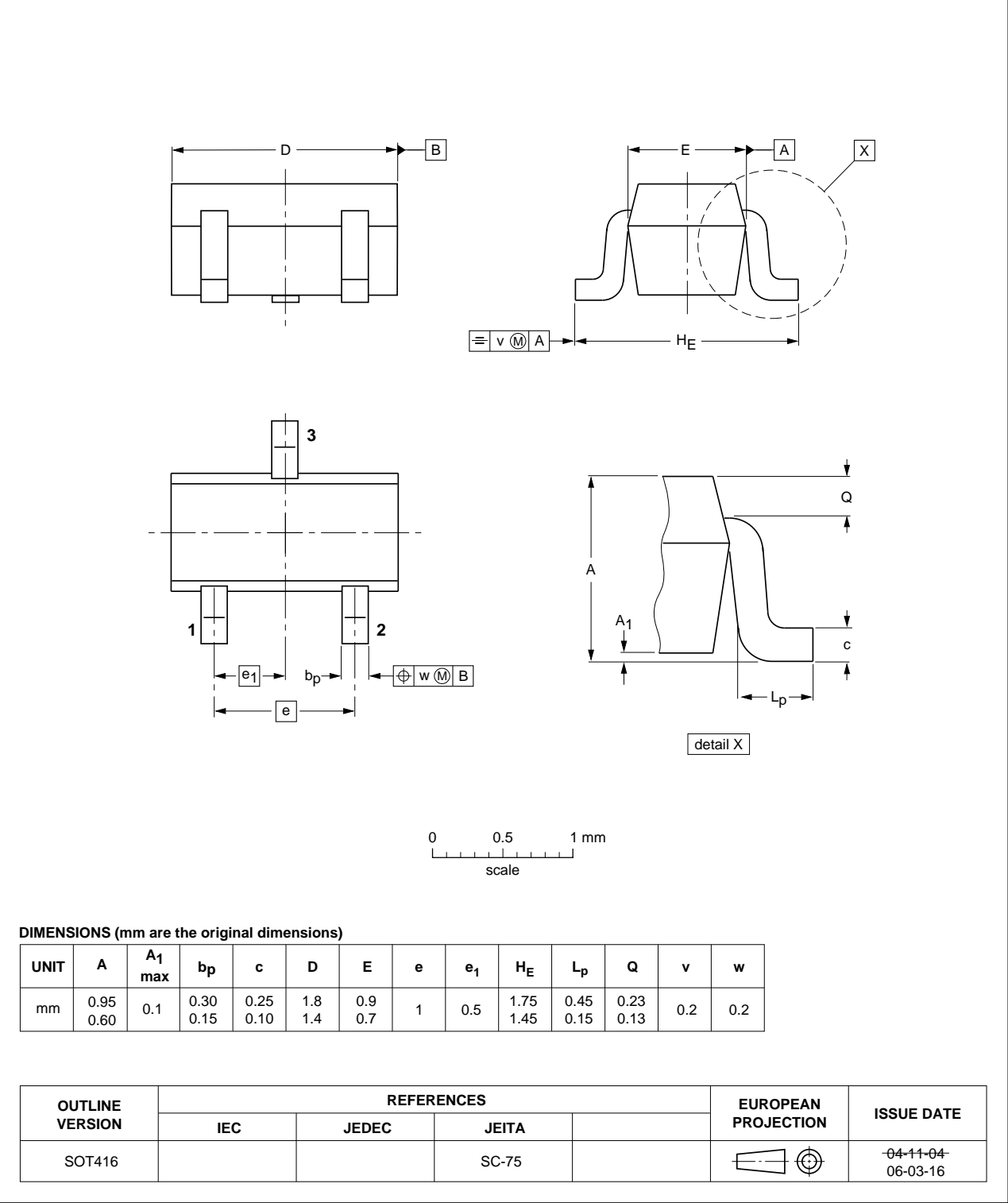


Fig 18. Package outline SOT416 (SC-75)

10. Soldering

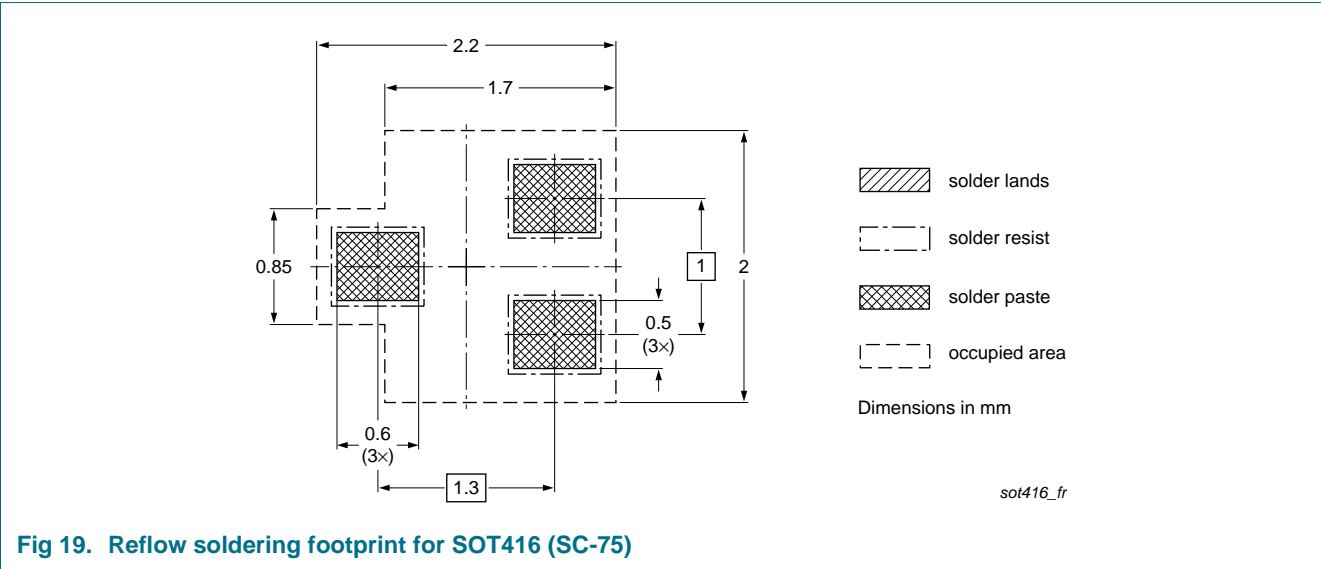


Fig 19. Reflow soldering footprint for SOT416 (SC-75)

11. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PMR290UNE v.1	20110913	Product data sheet	-	-

12. Legal information

12.1 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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