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Kind regards,

Team Nexperia

# PMN40UPE

20 V, single P-channel Trench MOSFET

13 August 2012

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 threshold voltage
- Fast switching
- Trench MOSFET technology
- 4 kV ESD protection

### 1.3 Applications

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

### 1.4 Quick reference data

Table 1. Quick reference data

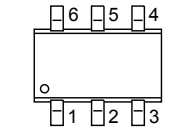
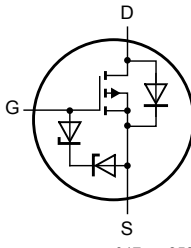
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_J = 25\text{ °C}$	-	-	-20	V
$V_{GS}$	gate-source voltage		-8	-	8	V
$I_D$	drain current	$V_{GS} = -4.5\text{ V}; T_{amb} = 25\text{ °C}; t \leq 5\text{ s}$	[1]	-	-6	A
<b>Static characteristics</b>						
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = -4.5\text{ V}; I_D = -3\text{ A}; T_J = 25\text{ °C}$	-	37	43	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	D	drain	 <p>TSOP6 (SOT457)</p>	 <p>017aaa259</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		
	Name	Description	Version
PMN40UPE	TSOP6	plastic surface-mounted package (TSOP6); 6 leads	SOT457

## 4. Marking

Table 4. Marking codes

Type number	Marking code
PMN40UPE	WD

## 5. Limiting values

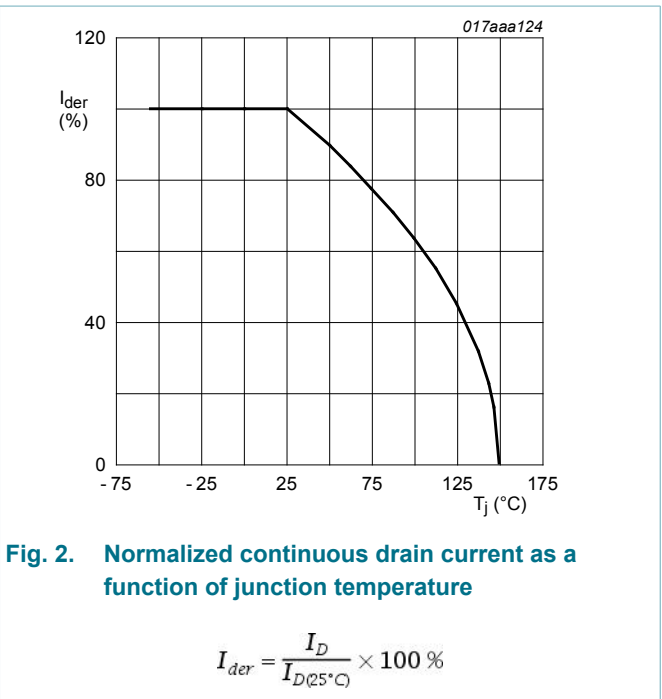
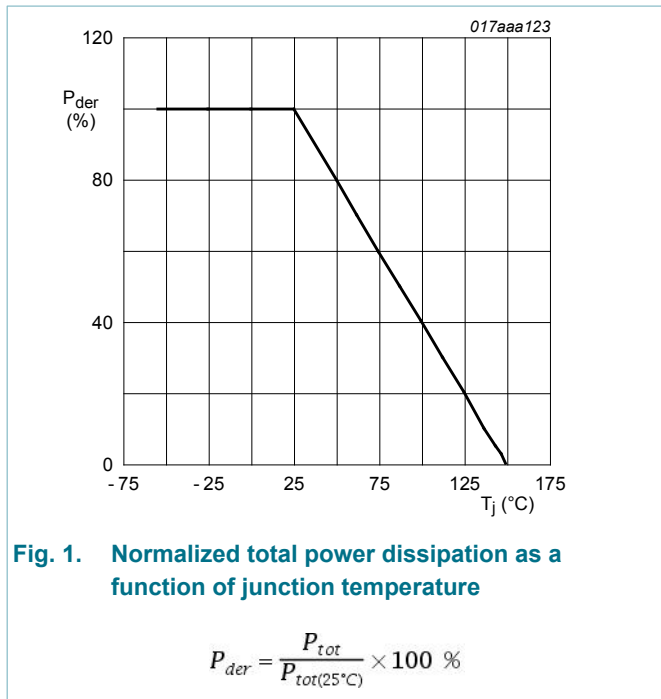
Table 5. Limiting values

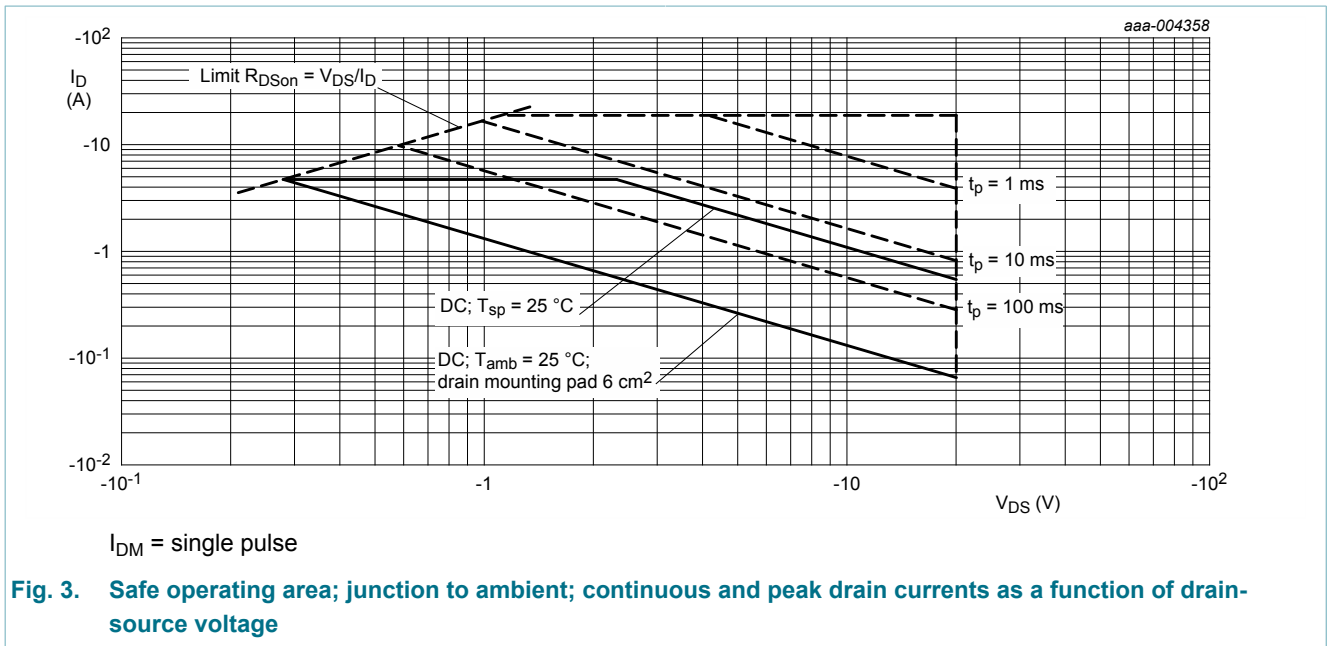
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
$V_{DS}$	drain-source voltage	$T_j = 25\text{ }^\circ\text{C}$		-	-20	V
$V_{GS}$	gate-source voltage			-8	8	V
$I_D$	drain current	$V_{GS} = -4.5\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}; t \leq 5\text{ s}$	[1]	-	-6	A
		$V_{GS} = -4.5\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}$	[1]	-	-4.7	A
		$V_{GS} = -4.5\text{ V}; T_{amb} = 100\text{ }^\circ\text{C}$	[1]	-	-3.5	A
$I_{DM}$	peak drain current	$T_{amb} = 25\text{ }^\circ\text{C}; \text{single pulse}; t_p \leq 10\text{ }\mu\text{s}$		-	-16	A
$P_{tot}$	total power dissipation	$T_{amb} = 25\text{ }^\circ\text{C}$	[2]	-	500	mW
			[1]	-	1220	mW
		$T_{sp} = 25\text{ }^\circ\text{C}$		-	8330	mW

Symbol	Parameter	Conditions		Min	Max	Unit
T <sub>j</sub>	junction temperature			-55	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]	-	-1.3	A
<b>ESD maximum rating</b>						
V <sub>ESD</sub>	electrostatic discharge voltage	HBM	[3]	-	4000	V

- [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.
- [3] Measured between all pins.





## 6. Thermal characteristics

**Table 6. Thermal characteristics**

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air	[1]	-	216	250	K/W
			[2]	-	83	95	K/W
		in free air; t ≤ 5 s	[2]	-	51	60	K/W
R <sub>th(j-sp)</sub>	thermal resistance from junction to solder point			-	10	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>.

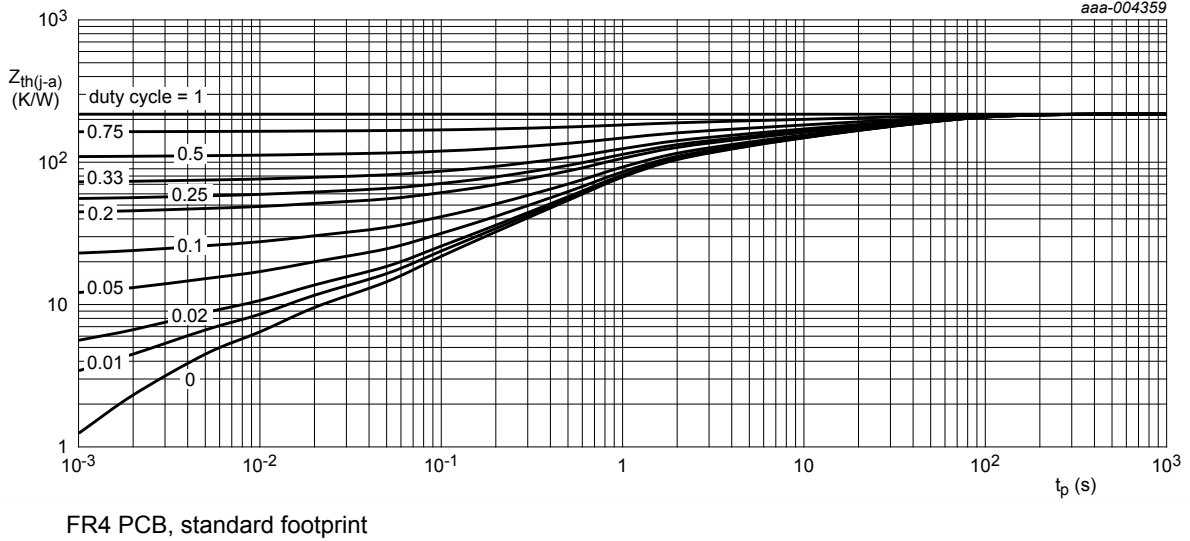


Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

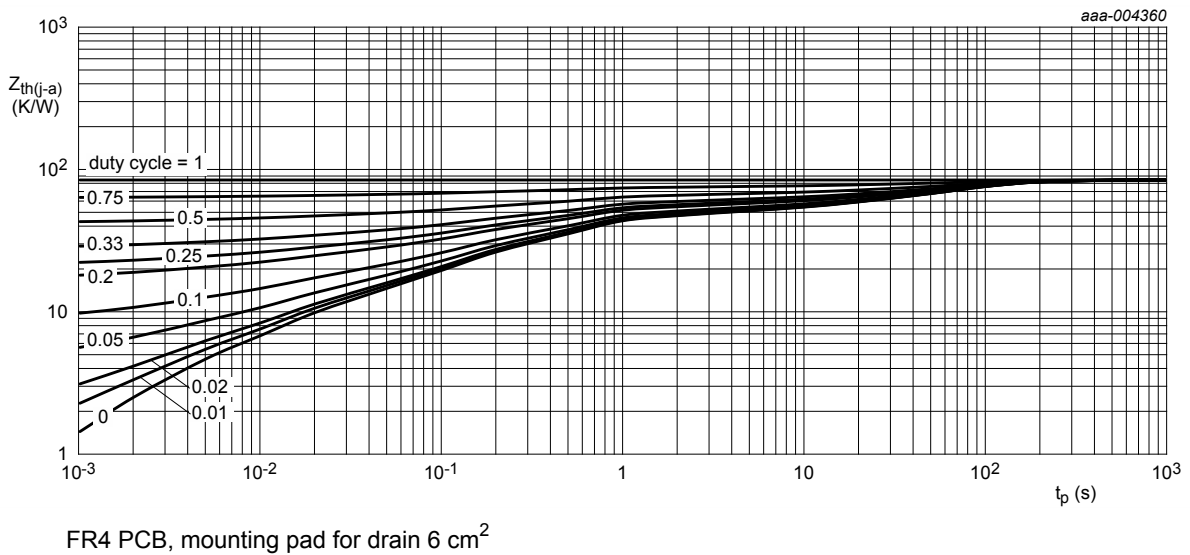


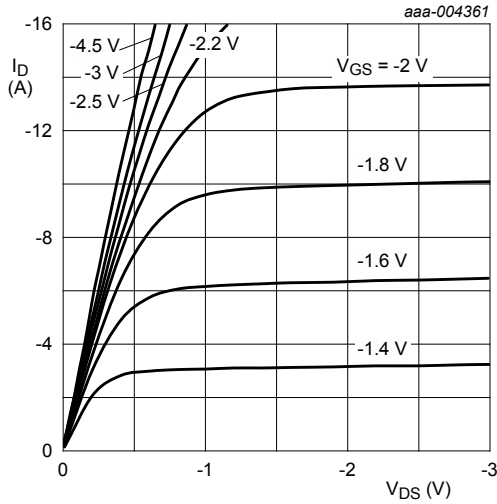
Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 7. Characteristics

Table 7. Characteristics

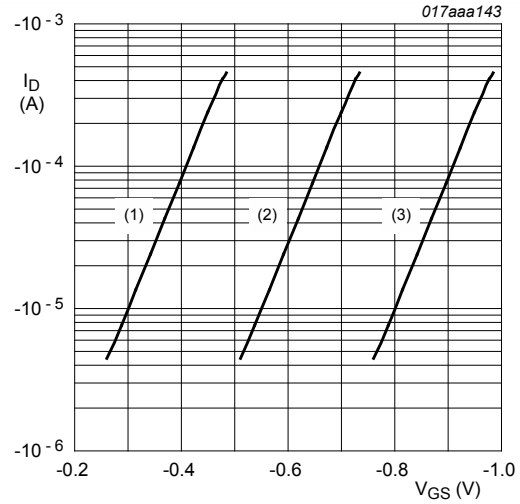
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = -250 \mu A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$	-20	-	-	V
$V_{GSth}$	gate-source threshold voltage	$I_D = -250 \mu A; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ C$	-0.45	-0.7	-0.95	V
$I_{DSS}$	drain leakage current	$V_{DS} = -20 V; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$	-	-	-1	$\mu A$
		$V_{DS} = -20 V; V_{GS} = 0 V; T_{amb} = 150 \text{ }^\circ C$	-	-	-15	$\mu A$

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I <sub>GSS</sub>	gate leakage current	V <sub>GS</sub> = 8 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C	-	-	-10	μA
		V <sub>GS</sub> = -8 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C	-	-	-10	μA
R <sub>DSon</sub>	drain-source on-state resistance	V <sub>GS</sub> = -4.5 V; I <sub>D</sub> = -3 A; T <sub>j</sub> = 25 °C	-	37	43	mΩ
		V <sub>GS</sub> = -4.5 V; I <sub>D</sub> = -3 A; T <sub>j</sub> = 150 °C	-	51	59	mΩ
		V <sub>GS</sub> = -2.5 V; I <sub>D</sub> = -3 A; T <sub>j</sub> = 25 °C	-	45	55	mΩ
		V <sub>GS</sub> = -1.8 V; I <sub>D</sub> = -3 A; T <sub>j</sub> = 25 °C	-	59	72	mΩ
g <sub>fs</sub>	forward transconductance	V <sub>DS</sub> = -10 V; I <sub>D</sub> = -4 A; T <sub>j</sub> = 25 °C	-	15	-	S
<b>Dynamic characteristics</b>						
Q <sub>G(tot)</sub>	total gate charge	V <sub>DS</sub> = -10 V; I <sub>D</sub> = -4.4 A; V <sub>GS</sub> = -4.5 V; T <sub>j</sub> = 25 °C	-	15.6	23	nC
Q <sub>GS</sub>	gate-source charge		-	2.5	-	nC
Q <sub>GD</sub>	gate-drain charge		-	2.8	-	nC
C <sub>iss</sub>	input capacitance		V <sub>DS</sub> = -10 V; f = 1 MHz; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C	-	1820	-
C <sub>oss</sub>	output capacitance		-	207	-	pF
C <sub>rss</sub>	reverse transfer capacitance		-	146	-	pF
t <sub>d(on)</sub>	turn-on delay time	V <sub>DS</sub> = -10 V; I <sub>D</sub> = -4 A; V <sub>GS</sub> = -4.5 V; R <sub>G(ext)</sub> = 6 Ω; T <sub>j</sub> = 25 °C	-	8	-	ns
t <sub>r</sub>	rise time		-	21	-	ns
t <sub>d(off)</sub>	turn-off delay time		-	50	-	ns
t <sub>f</sub>	fall time		-	34	-	ns
<b>Source-drain diode</b>						
V <sub>SD</sub>	source-drain voltage	I <sub>S</sub> = -1.2 A; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C	-	-0.7	-1.2	V



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

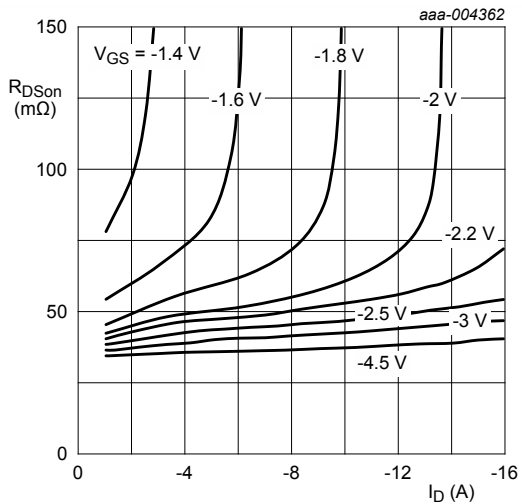
**Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values**



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

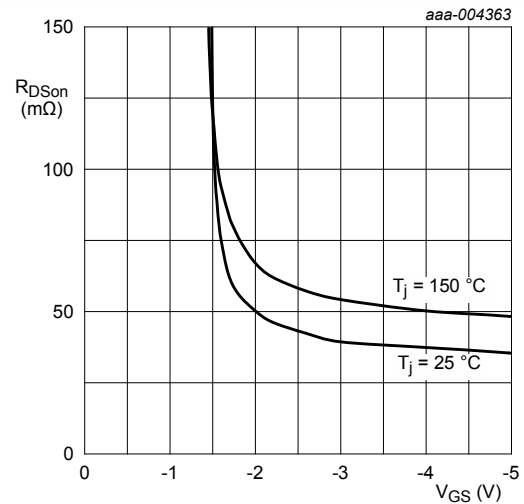
- (1) minimum values
- (2) typical values
- (3) maximum values

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



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

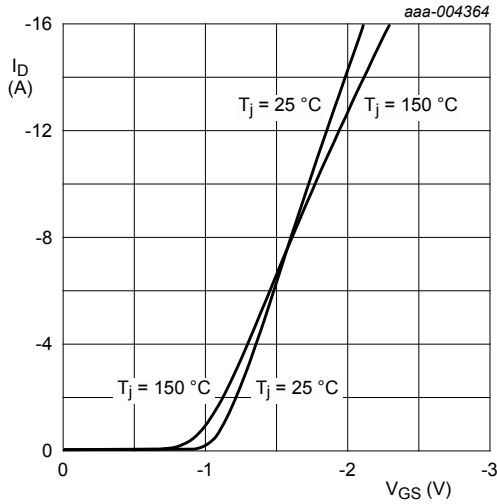
**Fig. 8. Drain-source on-state resistance as a function of drain current; typical values**



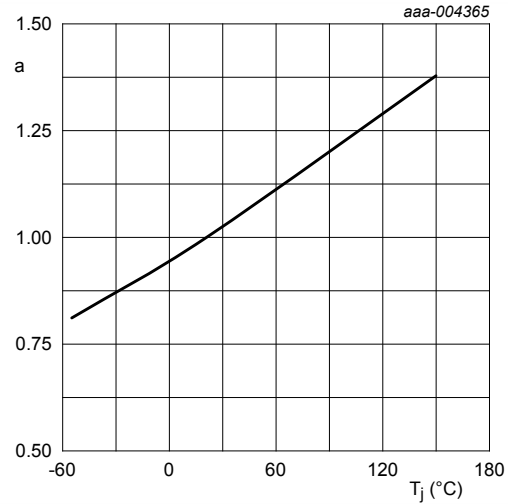
$I_D = -4\text{ A}$

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



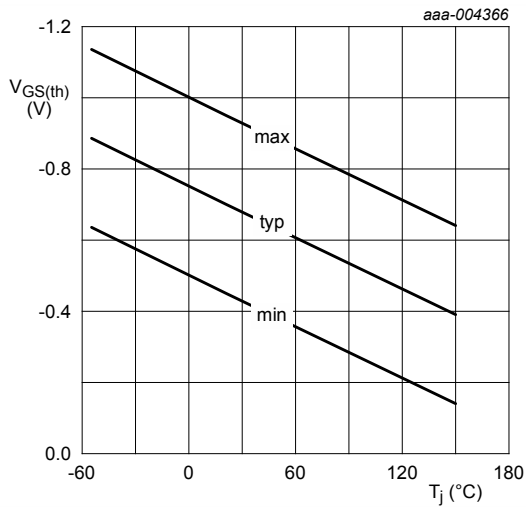


**Fig. 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values**



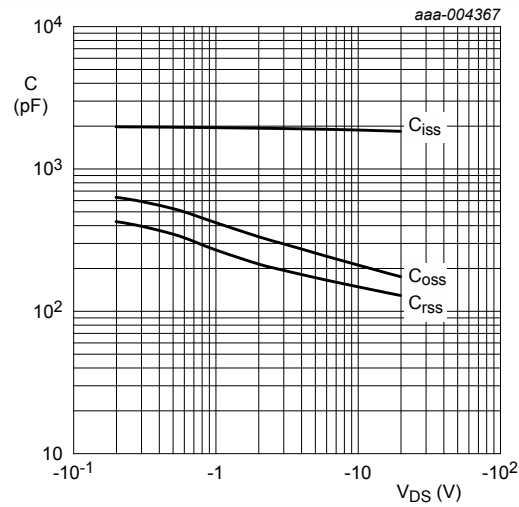
**Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values**

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



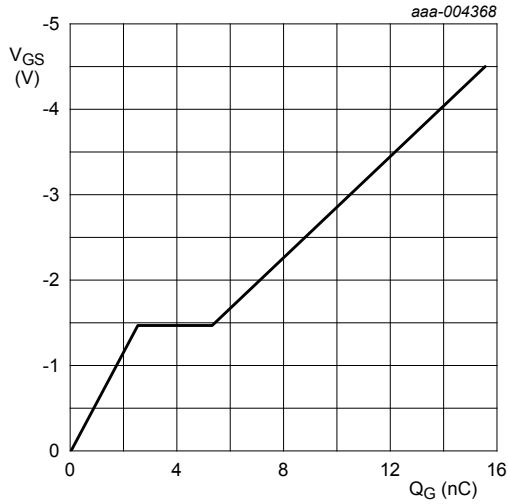
**Fig. 12. Gate-source threshold voltage as a function of junction temperature**

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



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

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



$I_D = -4$  A;  $V_{DS} = -10$  V;  $T_{amb} = 25$  °C

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

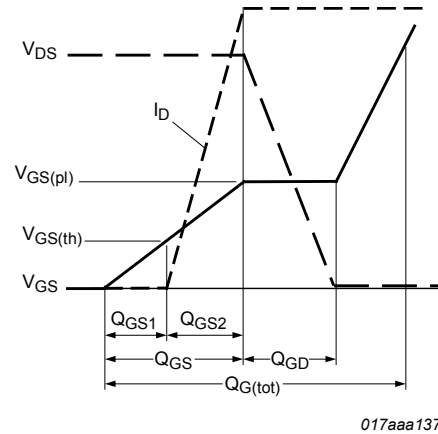
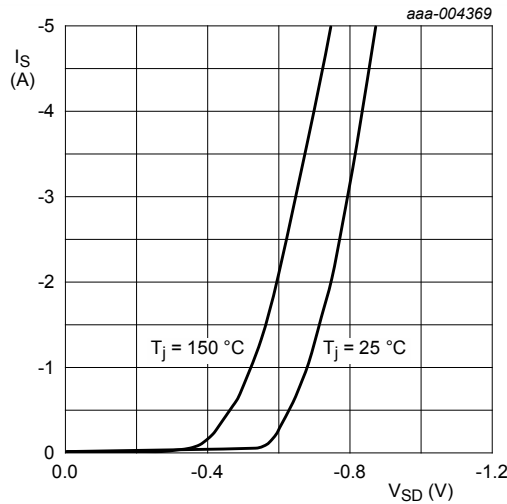


Fig. 15. Gate charge waveform definitions



$V_{GS} = 0$  V

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

### 8. Test information

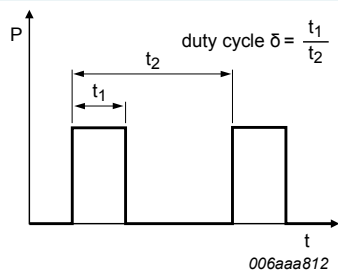


Fig. 17. Duty cycle definition

### 9. Package outline

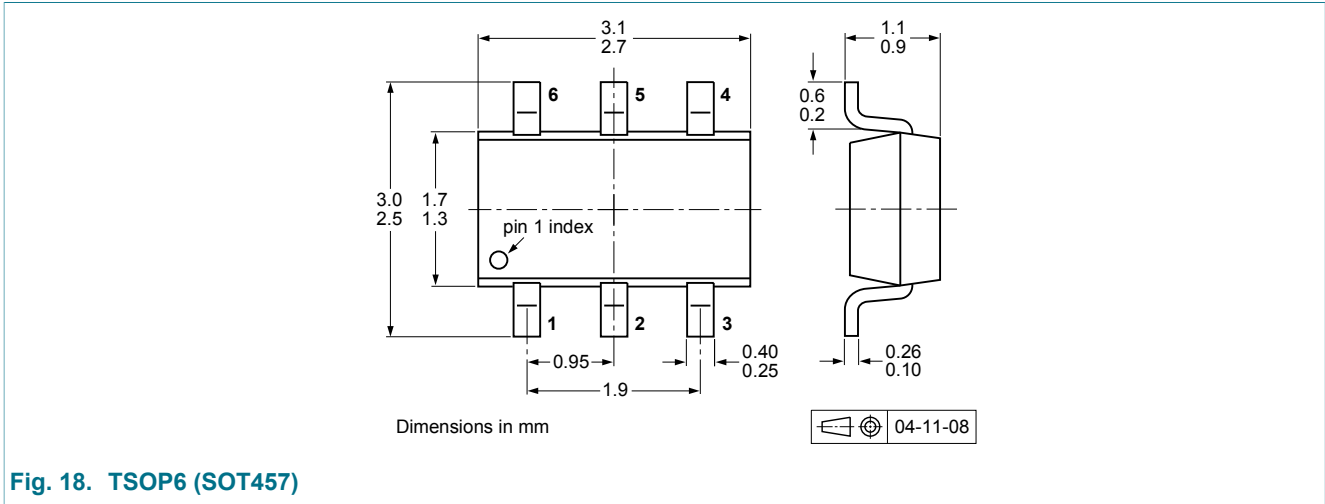


Fig. 18. TSOP6 (SOT457)

### 10. Soldering

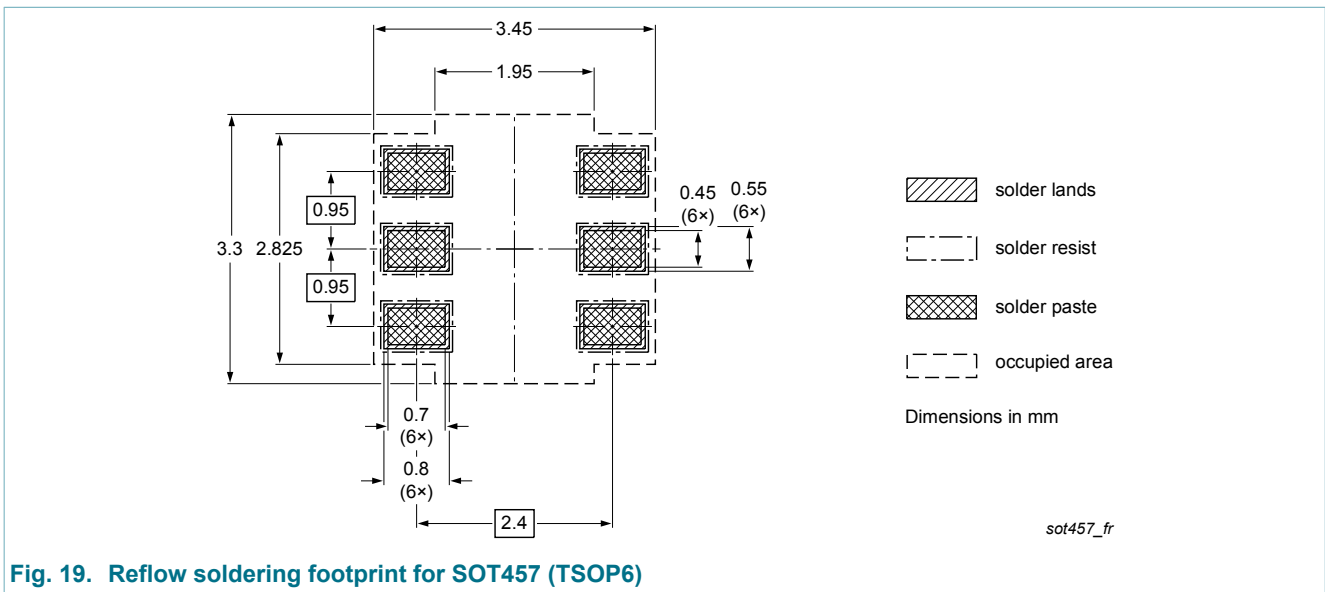


Fig. 19. Reflow soldering footprint for SOT457 (TSOP6)

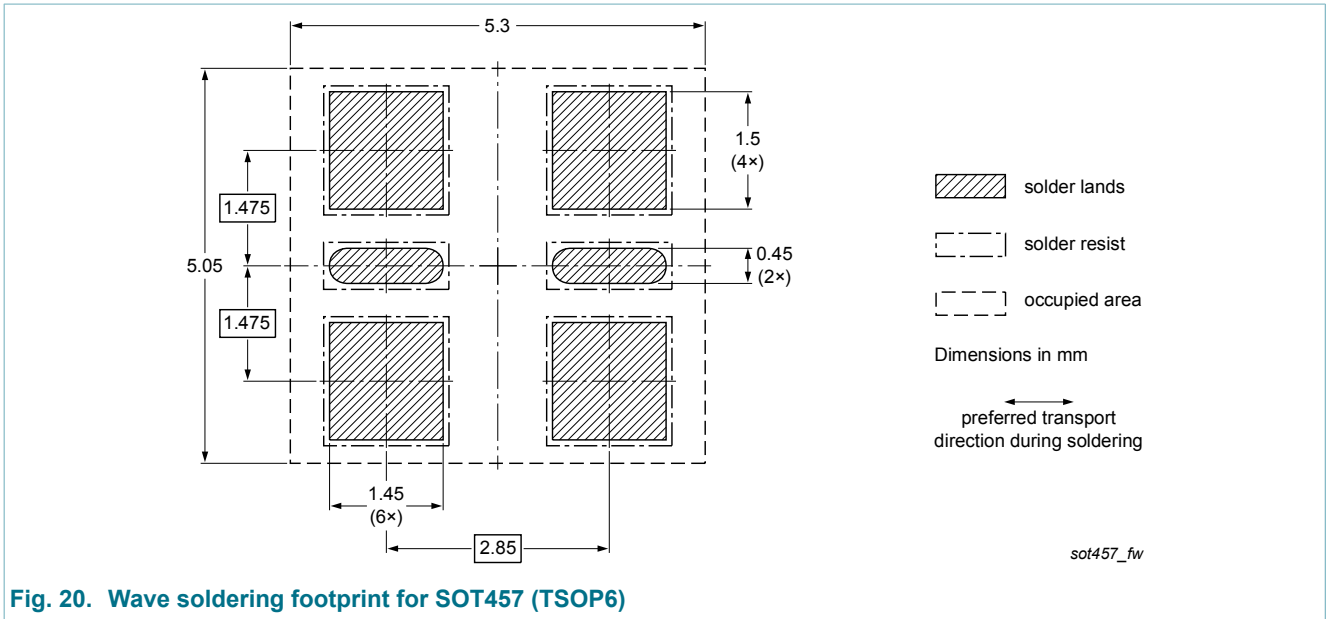


Fig. 20. Wave soldering footprint for SOT457 (TSOP6)

## 11. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMN40UPE v.1	20120813	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.

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## 13. Contents

<b>1</b>	<b>Product profile</b> .....	<b>1</b>
1.1	General description .....	1
1.2	Features and benefits .....	1
1.3	Applications .....	1
1.4	Quick reference data .....	1
<b>2</b>	<b>Pinning information</b> .....	<b>2</b>
<b>3</b>	<b>Ordering information</b> .....	<b>2</b>
<b>4</b>	<b>Marking</b> .....	<b>2</b>
<b>5</b>	<b>Limiting values</b> .....	<b>2</b>
<b>6</b>	<b>Thermal characteristics</b> .....	<b>4</b>
<b>7</b>	<b>Characteristics</b> .....	<b>5</b>
<b>8</b>	<b>Test information</b> .....	<b>9</b>
<b>9</b>	<b>Package outline</b> .....	<b>10</b>
<b>10</b>	<b>Soldering</b> .....	<b>10</b>
<b>11</b>	<b>Revision history</b> .....	<b>11</b>
<b>12</b>	<b>Legal information</b> .....	<b>12</b>
12.1	Data sheet status .....	12
12.2	Definitions .....	12
12.3	Disclaimers .....	12
12.4	Trademarks .....	13

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