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PMF170XP

20 V, 1 A P-channel Trench MOSFET

29 October 2013 **Product data sheet**

1. General description

P-channel enhancement mode Field-Effect Transistor (FET) in a SOT323 (SC-70) small Surface-Mounted Device (SMD) plastic package using Trench MOSFET technology.

2. Features and benefits

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

3. Applications

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

4. Quick reference data

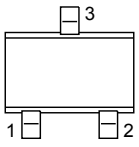
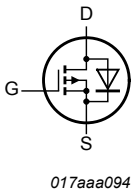
Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DS}	drain-source voltage	T_j = 25 °C		-	-	-20	V
V_{GS}	gate-source voltage			-12	-	12	V
I_D	drain current	V_{GS} = -4.5 V; T_{amb} 25 °C	[1]	-	-	-1	A
Static characteristics							
R_{DSon}	drain-source on-state resistance	V_{GS} = -4.5 V; I_D = -1 A; T_j = 25 °C		-	175	200	mΩ

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

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 SC-70 (SOT323)	 017aaa094
2	S	source		
3	D	drain		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PMF170XP	SC-70	plastic surface-mounted package; 3 leads	SOT323

7. Marking

Table 4. Marking codes

Type number	Marking code [1]
PMF170XP	XD%

[1] % = placeholder for manufacturing site code

8. 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			-12	12	V
I_D	drain current	V_{GS} = -4.5 V; T_{amb} 25 °C	[1]	-	-1	A
		V_{GS} = -4.5 V; T_{amb} = 100 °C	[1]	-	-0.7	A
I_{DM}	peak drain current	T_{amb} = 25 °C; single pulse; $t_p \leq 10$ µs		-	-4	A
P_{tot}	total power dissipation	T_{amb} = 25 °C	[2]	-	290	mW
			[1]	-	360	mW
		T_{sp} = 25 °C		-	1670	mW
T_j	junction temperature			-55	150	°C

Symbol	Parameter	Conditions		Min	Max	Unit
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]	-	-0.4	A

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

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

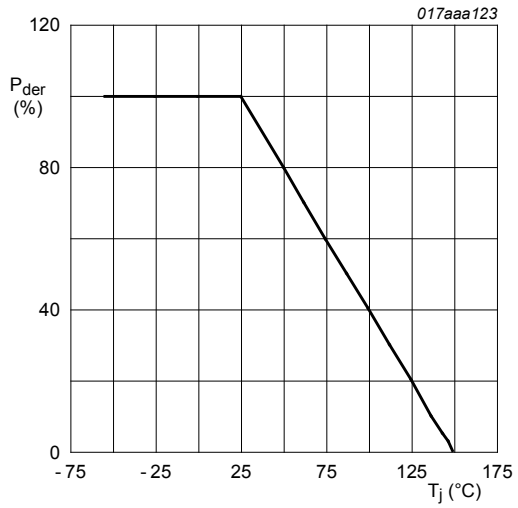


Fig. 1. Normalized total power dissipation as a function of junction temperature

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

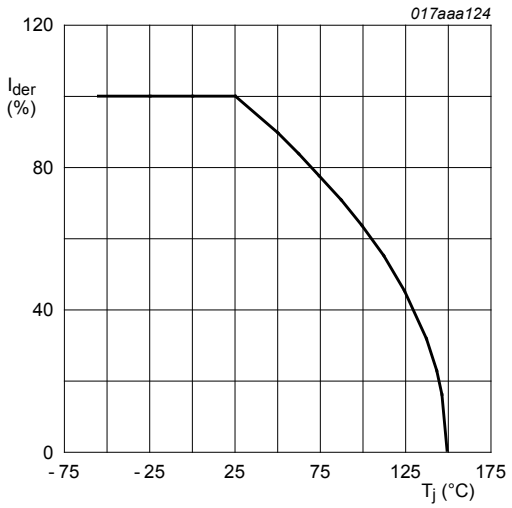
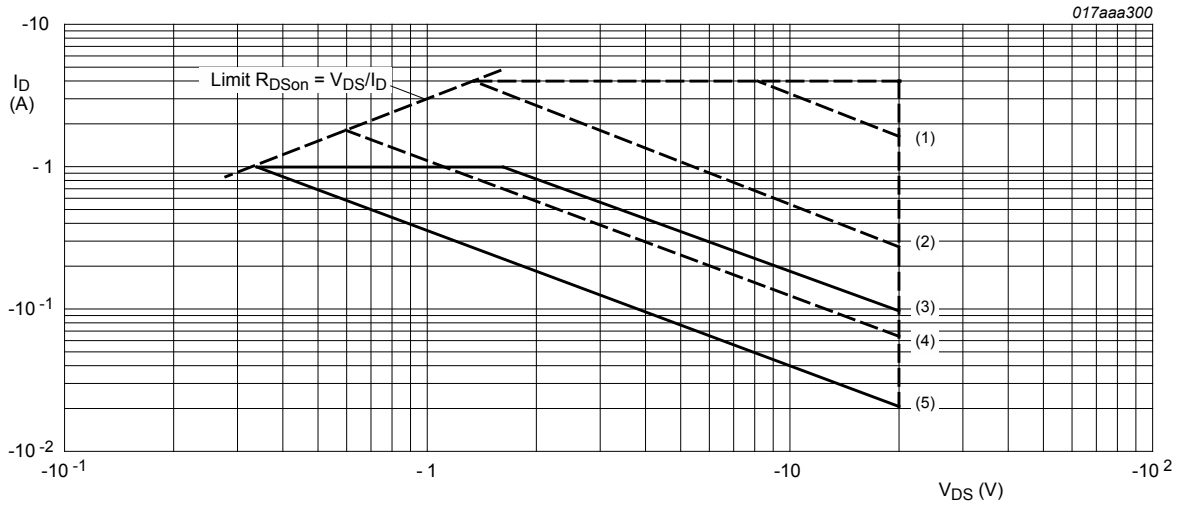


Fig. 2. Normalized continuous drain current as a function of junction temperature

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



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 6 cm^2

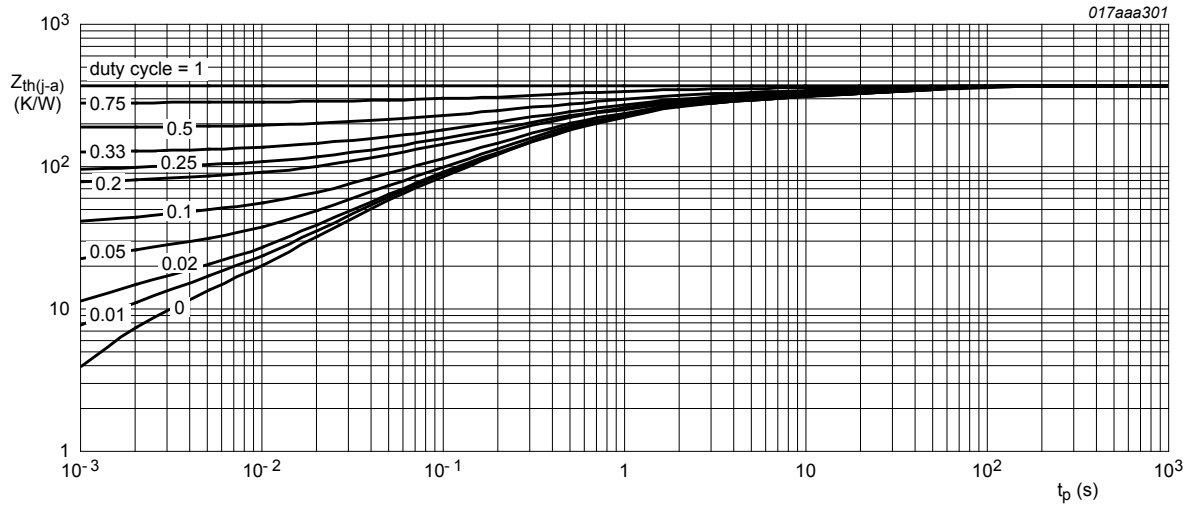
Fig. 3. Safe operating area; junction to ambient; continuous and peak drain currents as a function of drain-source voltage

9. Thermal characteristics

Table 6. Thermal characteristics

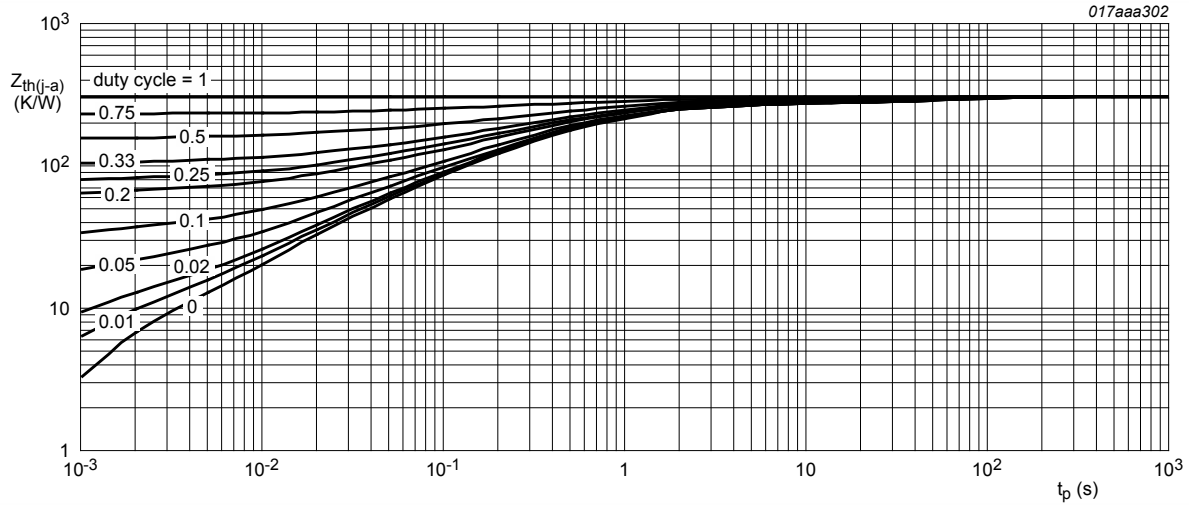
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	377	430	K/W
			[2]	-	305	350	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	65	75	K/W

[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^2.



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^2

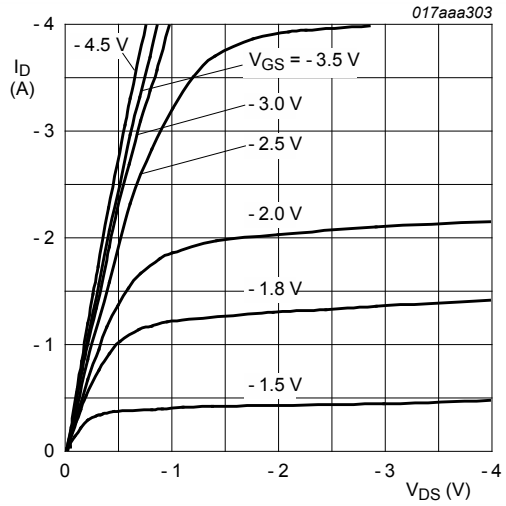
Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

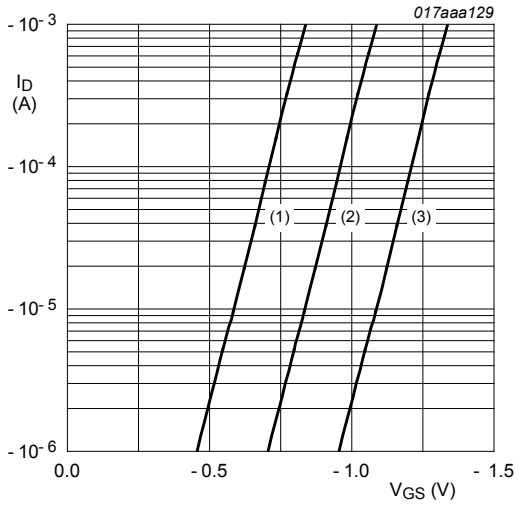
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = -250 µA; V_{GS} = 0 V; T_j = 25 °C		-20	-	-	V
V_{GSth}	gate-source threshold voltage	I_D = -250 A; V_{DS} = V_{GS}; T_j = 25 °C		-0.65	-0.9	-1.15	V
I_{DSS}	drain leakage current	V_{DS} = -20 V; V_{GS} = 0 V; T_j = 25 °C		-	-	-1	µA
		V_{DS} = -20 V; V_{GS} = 0 V; T_j = 150 °C		-	-	-10	µA

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I_{GSS}	gate leakage current	V_{GS} = -12 V; V_{DS} = 0 V; T_j = 25 °C		-	-	-100	nA
		V_{GS} = 12 V; V_{DS} = 0 V; T_j = 25 °C		-	-	-100	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = -4.5 V; I_D = -1 A; T_j = 25 °C		-	175	200	mΩ
		V_{GS} = -4.5 V; I_D = -1 A; T_j = 150 °C		-	250	284	mΩ
		V_{GS} = -2.5 V; I_D = -1 A; T_j = 25 °C		-	240	300	mΩ
g_{fs}	forward transconductance	V_{DS} = -5 V; I_D = -1 A; T_j = 25 °C		-	1.9	-	S
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	V_{DS} = -10 V; I_D = -1 A; V_{GS} = -4.5 V; T_j = 25 °C		-	2.6	3.9	nC
Q_{GS}	gate-source charge			-	0.63	-	nC
Q_{GD}	gate-drain charge			-	0.53	-	nC
C_{iss}	input capacitance	V_{DS} = -10 V; f = 1 MHz; V_{GS} = 0 V; T_j = 25 °C		-	280	-	pF
C_{oss}	output capacitance			-	43	-	pF
C_{rss}	reverse transfer capacitance			-	30	-	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = -10 V; I_D = -1 A; V_{GS} = -4.5 V; $R_{G(ext)}$ = 6 Ω; T_j = 25 °C		-	10	-	ns
t_r	rise time			-	16	-	ns
$t_{d(off)}$	turn-off delay time			-	31	-	ns
t_f	fall time			-	13	-	ns
Source-drain diode							
V_{SD}	source-drain voltage	I_S = -0.4 A; V_{GS} = 0 V; T_j = 25 °C		-	-0.7	-1.2	V



T_j = 25 °C

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



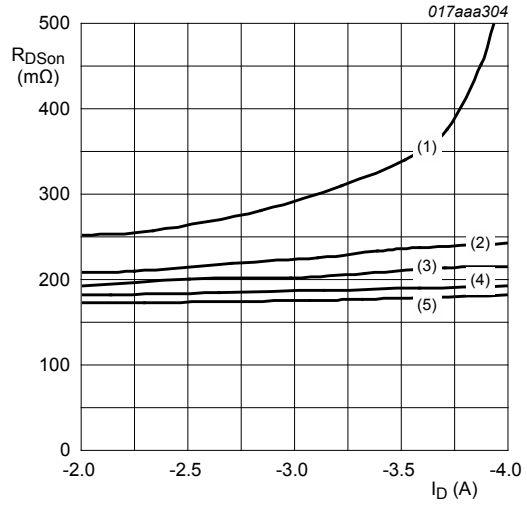
T_j = 25 °C; V_{DS} = -3 V

(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 °C

(1) V_{GS} = -2.5 V

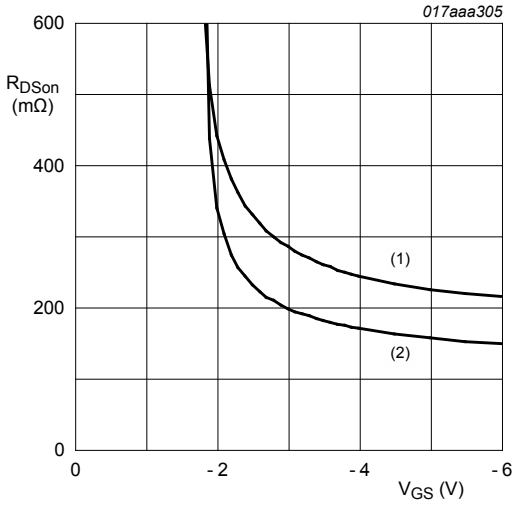
(2) V_{GS} = -3.0 V

(3) V_{GS} = -3.5 V

(4) V_{GS} = -4.0 V

(5) V_{GS} = -4.5 V

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

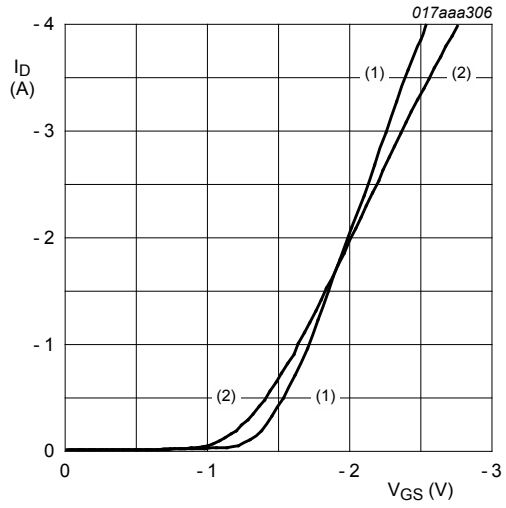


I_D = -1 A

(1) T_j = 150 °C

(2) T_j = 25 °C

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 °C
(2) T_j = 150 °C

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

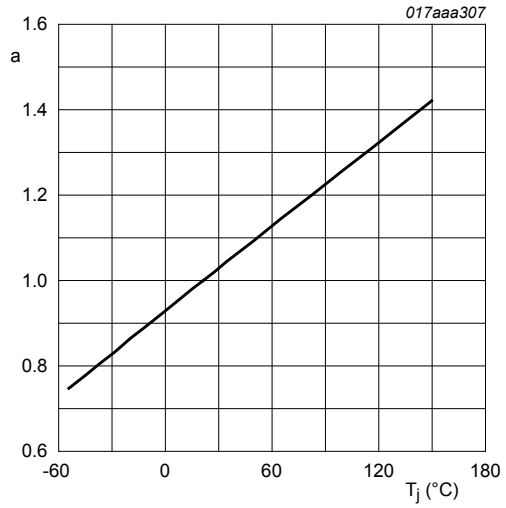
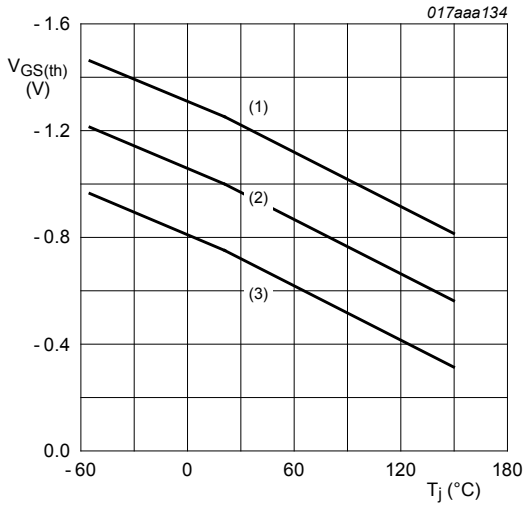


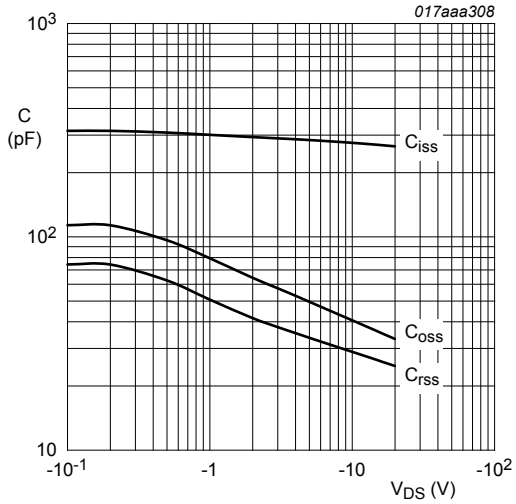
Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values

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



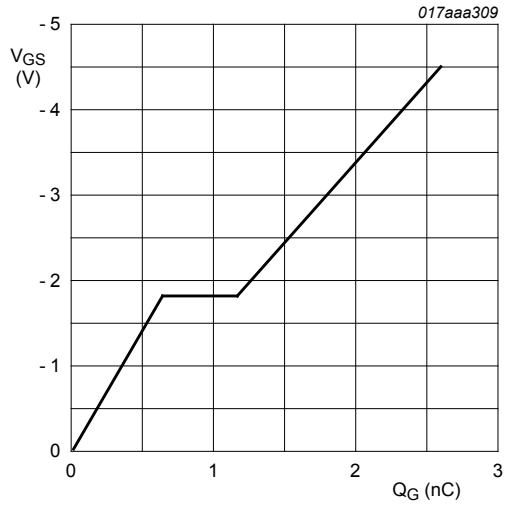
I_D = -0.25 mA; $V_{DS} = V_{GS}$
(1) maximum values
(2) typical values
(3) minimum values

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



f = 1 MHz; V_{GS} = 0 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 = -1.0 A; V_{DS} = -10 V; T_{amb} = 25 °C

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

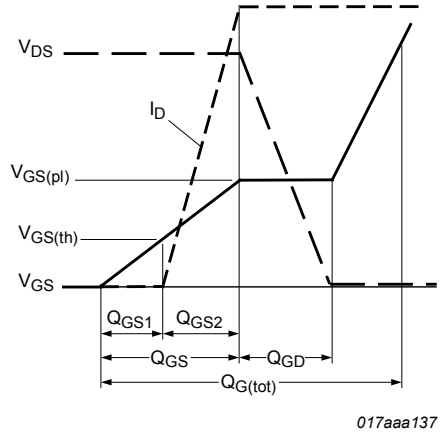
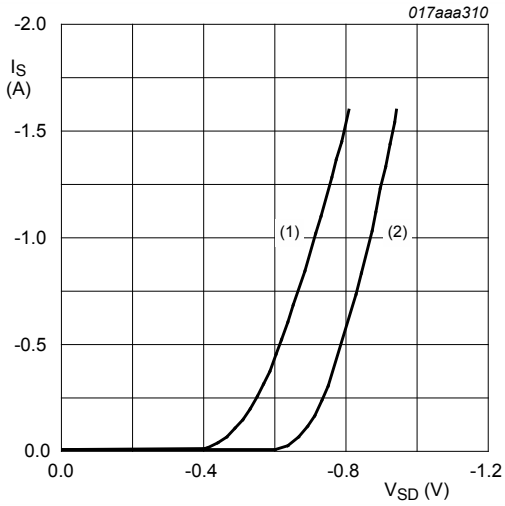


Fig. 15. Gate charge waveform definitions



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

11. Test information

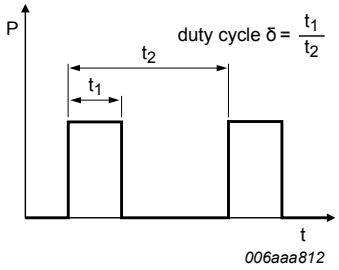


Fig. 17. Duty cycle definition

12. Package outline

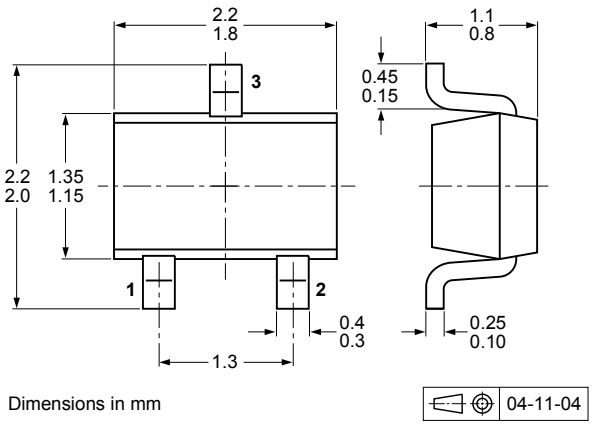


Fig. 18. Package outline SC-70 (SOT323)

13. Soldering

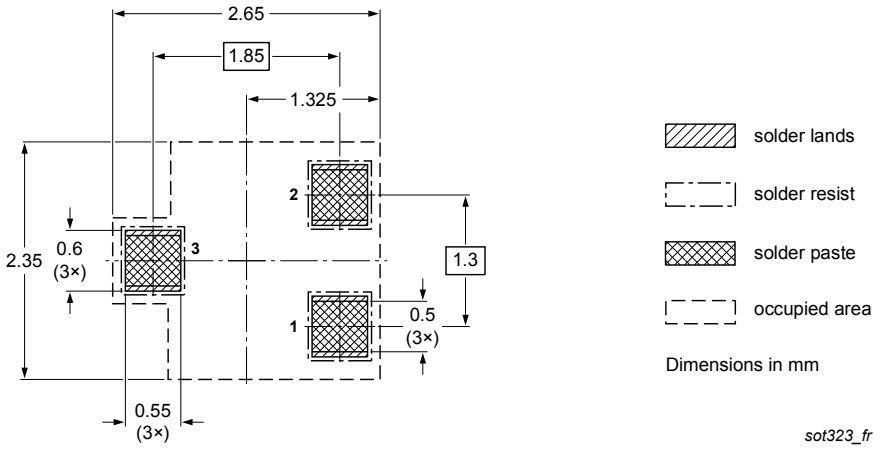


Fig. 19. Reflow soldering footprint for SC-70 (SOT323)

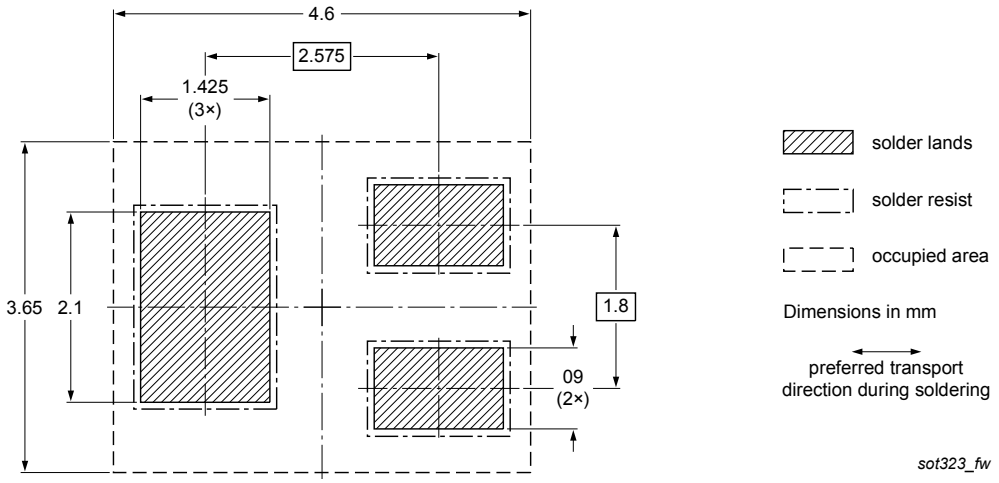


Fig. 20. Wave soldering footprint for SC-70 (SOT323)

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMF170XP v.2	20131029	Product data sheet	-	PMF170XP v.1
Modifications:	• Figure 13 corrected			
PMF170XP v.1	20110902	Product data sheet	-	-

15. Legal information

15.1 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.
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Date of release: 29 October 2013