



PMN40XPEA

20 V, P-channel Trench MOSFET

7 July 2020

Product data sheet

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.

2. Features and benefits

- Low threshold voltage
- Extended temperature range $T_j = 175\text{ °C}$
- Very fast switching
- Trench MOSFET technology
- ElectroStatic Discharge (ESD) protection $> 1000\text{ V HBM}$ (class H1C)
- AEC-Q101 qualified

3. Applications

- Relay driver
- High-speed line driver
- High-side load switch
- Switching circuits

4. Quick reference data

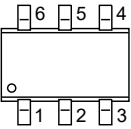
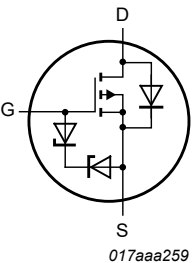
Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j = 25\text{ °C}$		-	-	-20	V
V_{GS}	gate-source voltage			-12	-	12	V
I_D	drain current	$V_{GS} = -4.5\text{ V}; T_{amb} = 25\text{ °C}$	[1]	-	-	-4.7	A
Static characteristics							
R_{DSon}	drain-source on-state resistance	$V_{GS} = -4.5\text{ V}; I_D = -4.7\text{ A}; T_j = 25\text{ °C}$		-	43	50	mΩ

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

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	D	drain	 SC-74; TSOP6 (SOT457)	 017aaa259
2	D	drain		
3	G	gate		
4	S	source		
5	D	drain		
6	D	drain		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PMN40XPEA	SC-74; TSOP6	plastic, surface-mounted package (SC-74; TSOP6); 6 leads	SOT457

7. Marking

Table 4. Marking codes

Type number	Marking code
PMN40XPEA	6F

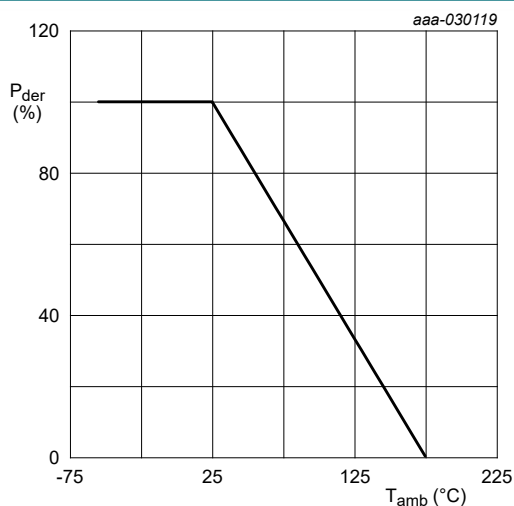
8. Limiting values

Table 5. Limiting values

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

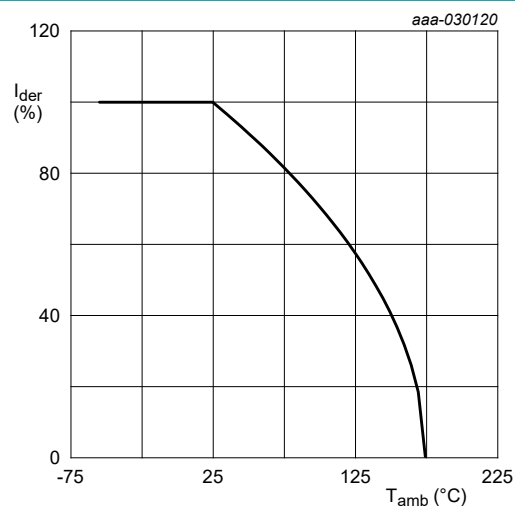
Symbol	Parameter	Conditions		Min	Max	Unit
V _{DS}	drain-source voltage	T _j = 25 °C		-	-20	V
V _{GS}	gate-source voltage			-12	12	V
I _D	drain current	V _{GS} = -4.5 V; T _{amb} = 25 °C	[1]	-	-4.7	A
		V _{GS} = -4.5 V; T _{amb} = 100 °C	[1]	-	-3	A
I _{DM}	peak drain current	T _{amb} = 25 °C; single pulse; t _p ≤ 10 μs		-	-19	A
P _{tot}	total power dissipation	T _{amb} = 25 °C	[2]	-	660	mW
			[1]	-	1.7	W
		T _{sp} = 25 °C		-	7.5	W
T _j	junction temperature			-55	175	°C
T _{amb}	ambient temperature			-55	175	°C
T _{stg}	storage temperature			-65	175	°C
Source-drain diode						
I _S	source current	T _{amb} = 25 °C	[1]	-	-1.7	A
ESD maximum rating						
V _{ESD}	electrostatic discharge voltage	HBM	[3]	-	1000	V
Avalanche ruggedness						
E _{DS(AL)S}	non-repetitive drain-source avalanche energy	T _{j(initial)} = 25 °C; I _D = -1.5 A; DUT in avalanche (unclamped)		-	15	mJ

- [1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and mounting pad for drain 6 cm².
 [2] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.
 [3] Measured between all pins.



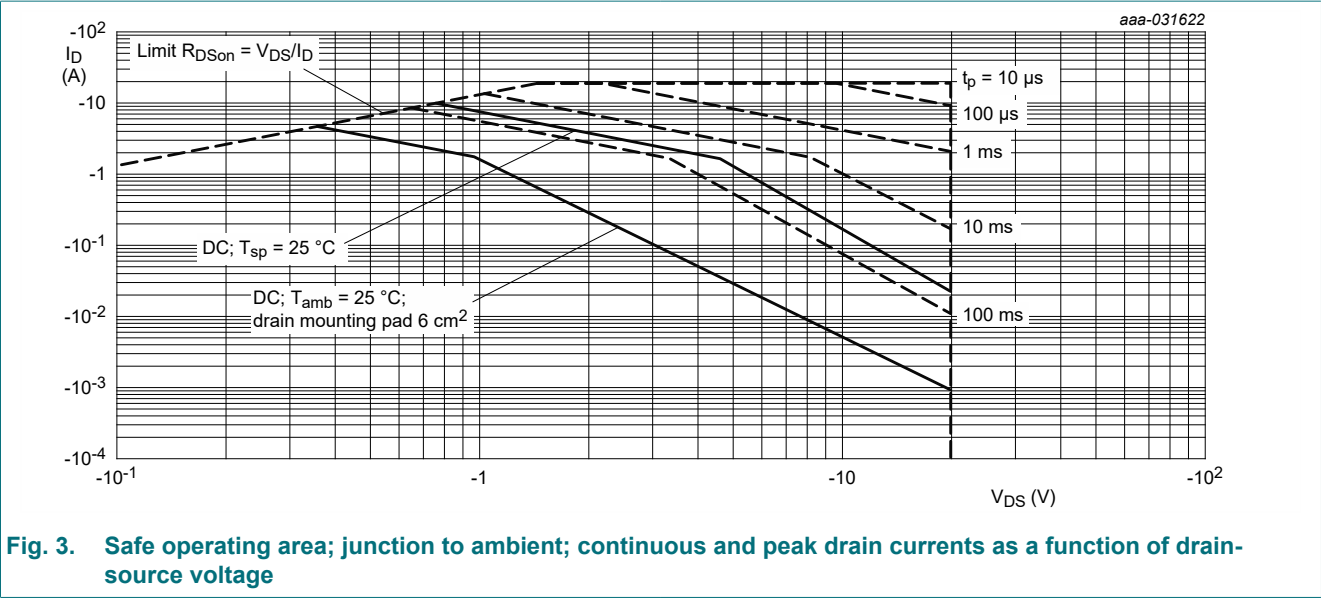
$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}\text{C})}} \times 100 \%$$

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



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

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



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]	-	195	225	K/W
			[2]	-	78	90	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	15	20	K/W

- [1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.
[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for drain 6 cm².

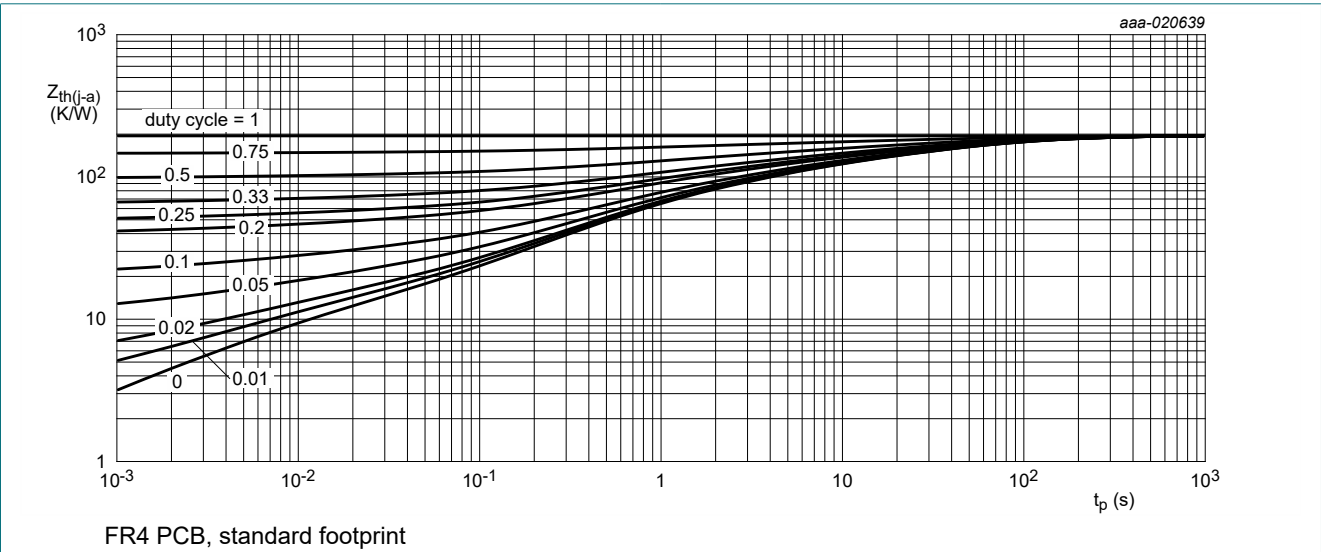


Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

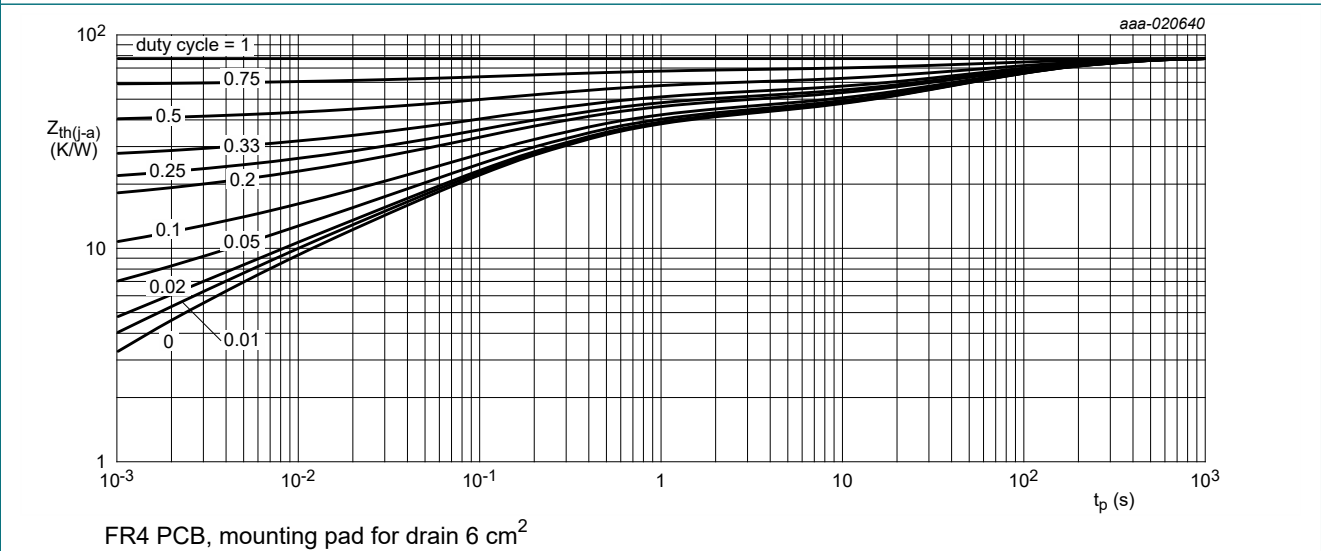


Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

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 μA; V _{DS} = V _{GS} ; T _j = 25 °C		-0.6	-0.95	-1.3	V
I _{DSS}	drain leakage current	V _{DS} = -20 V; V _{GS} = 0 V; T _j = 25 °C		-	-	-1	μA
I _{GSS}	gate leakage current	V _{GS} = -12 V; V _{DS} = 0 V; T _j = 25 °C		-	-	-10	μA
		V _{GS} = 12 V; V _{DS} = 0 V; T _j = 25 °C		-	-	10	μA
		V _{GS} = -4.5 V; V _{DS} = 0 V; T _j = 25 °C		-	-	-2	μA
		V _{GS} = 4.5 V; V _{DS} = 0 V; T _j = 25 °C		-	-	2	μA
R _{DSon}	drain-source on-state resistance	V _{GS} = -8 V; I _D = -4.7 A; T _j = 25 °C		-	39	46	mΩ
		V _{GS} = -8 V; I _D = -4.7 A; T _j = 175 °C		-	59	70	mΩ
		V _{GS} = -4.5 V; I _D = -4.7 A; T _j = 25 °C		-	43	50	mΩ
		V _{GS} = -2.5 V; I _D = -2 A; T _j = 25 °C		-	64	78	mΩ
g _{fs}	forward transconductance	V _{DS} = -10 V; I _D = -4.7 A; T _j = 25 °C		-	9.5	-	S
R _G	gate resistance	f = 1 MHz		-	21	-	Ω
Dynamic characteristics							
Q _{G(tot)}	total gate charge	V _{DS} = -10 V; I _D = -5.8 A; V _{GS} = -4.5 V; T _j = 25 °C		-	10.6	16	nC
Q _{GS}	gate-source charge			-	2.1	-	nC
Q _{GD}	gate-drain charge			-	3.6	-	nC
C _{iss}	input capacitance	V _{DS} = -10 V; f = 1 MHz; V _{GS} = 0 V; T _j = 25 °C		-	1025	-	pF
C _{oss}	output capacitance			-	137	-	pF
C _{rss}	reverse transfer capacitance			-	113	-	pF
t _{d(on)}	turn-on delay time	V _{DS} = -10 V; I _D = -5.8 A; V _{GS} = -4.5 V; R _{G(ext)} = 6 Ω; T _j = 25 °C		-	6	-	ns
t _r	rise time			-	17	-	ns
t _{d(off)}	turn-off delay time			-	23	-	ns
t _f	fall time			-	19	-	ns
Source-drain diode							
V _{SD}	source-drain voltage	I _S = -1.7 A; V _{GS} = 0 V; T _j = 25 °C		-	-0.8	-1.2	V
t _{rr}	reverse recovery time	I _S = -2 A; dI _S /dt = 100 A/μs; V _{GS} = 0 V; V _{DS} = -10 V; T _j = 25 °C		-	17	-	ns
Q _r	recovered charge			-	5	-	nC

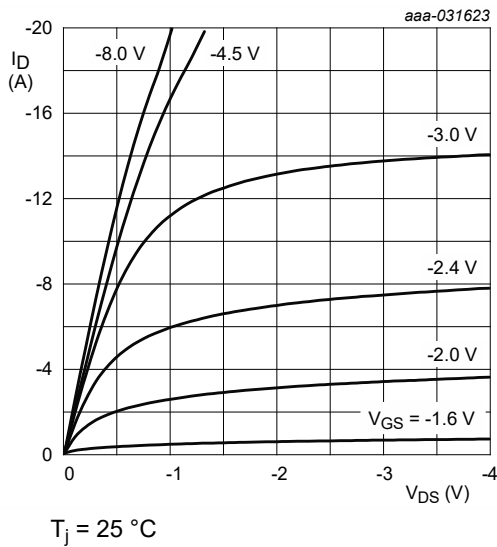


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

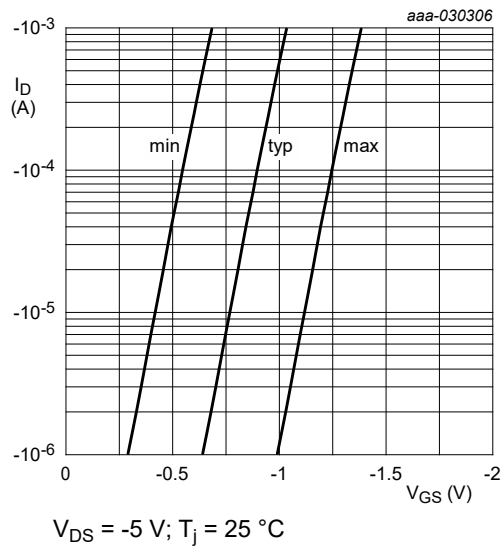


Fig. 7. Sub-threshold drain current as a function of gate-source voltage

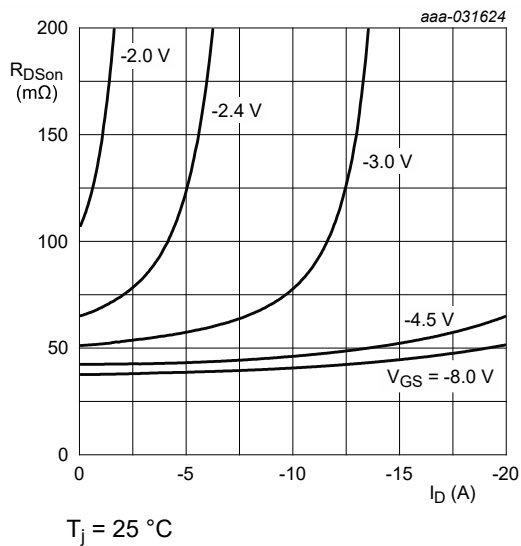


Fig. 8. Drain-source on-state resistance as a function of drain current; typical values

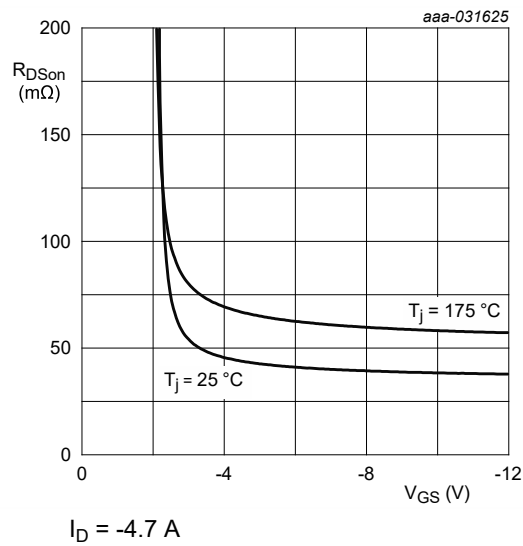


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values

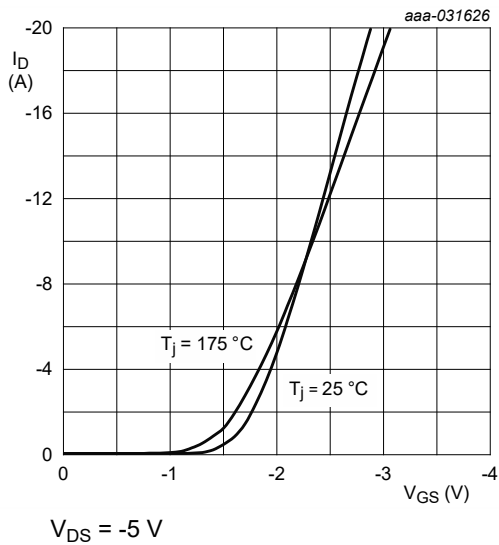


Fig. 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values

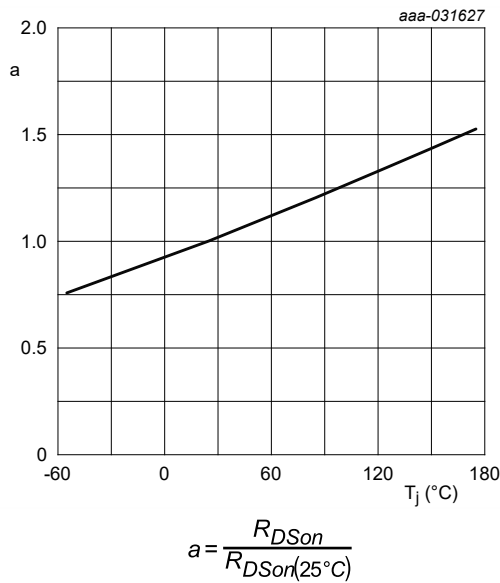


Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values

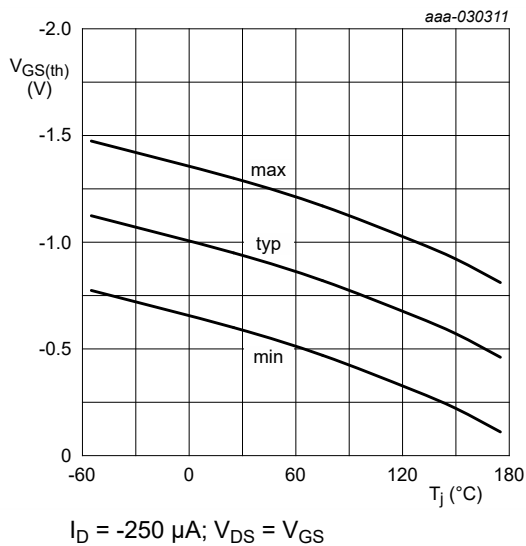


Fig. 12. Gate-source threshold voltage as a function of junction temperature

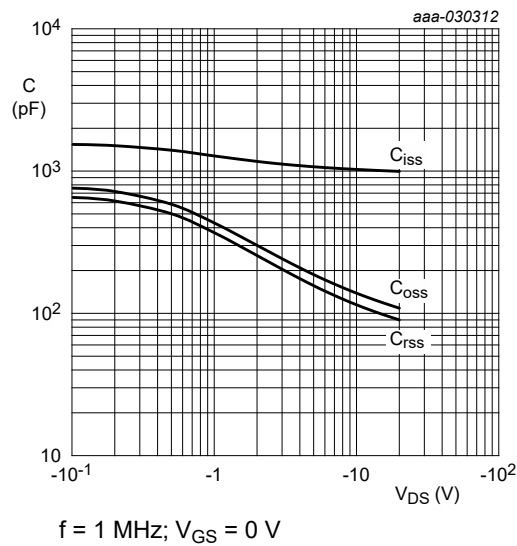


Fig. 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

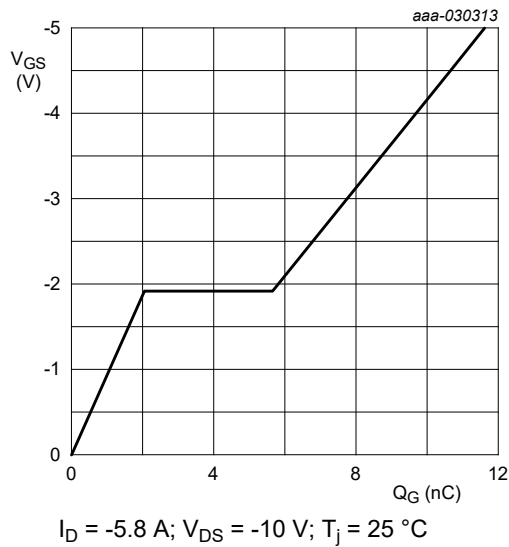


Fig. 14. Gate-source voltage as a function of gate charge; typical values

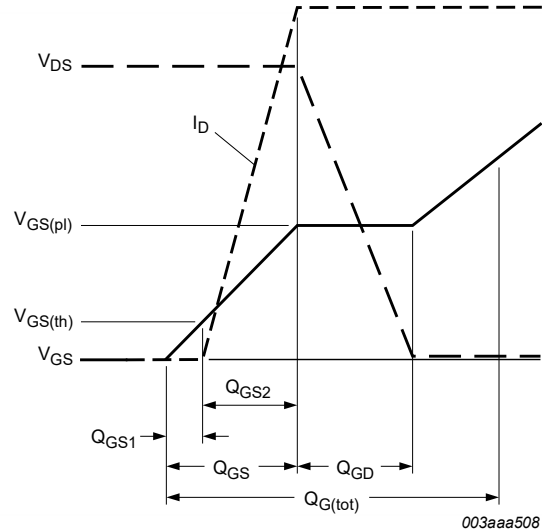


Fig. 15. Gate charge waveform definitions

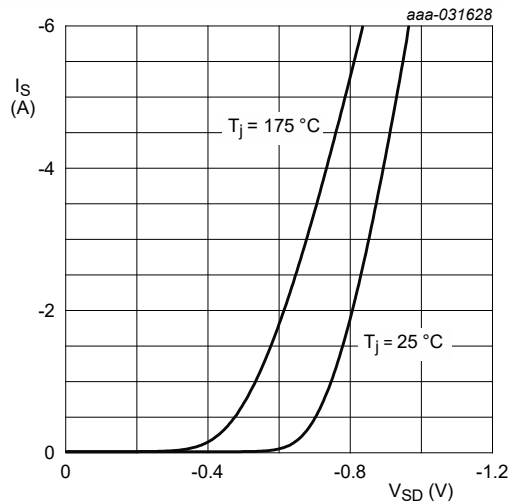


Fig. 16. Source current as a function of source-drain voltage; typical values

11. Test information

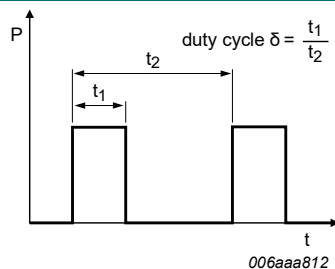


Fig. 17. Duty cycle definition

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.

12. Package outline

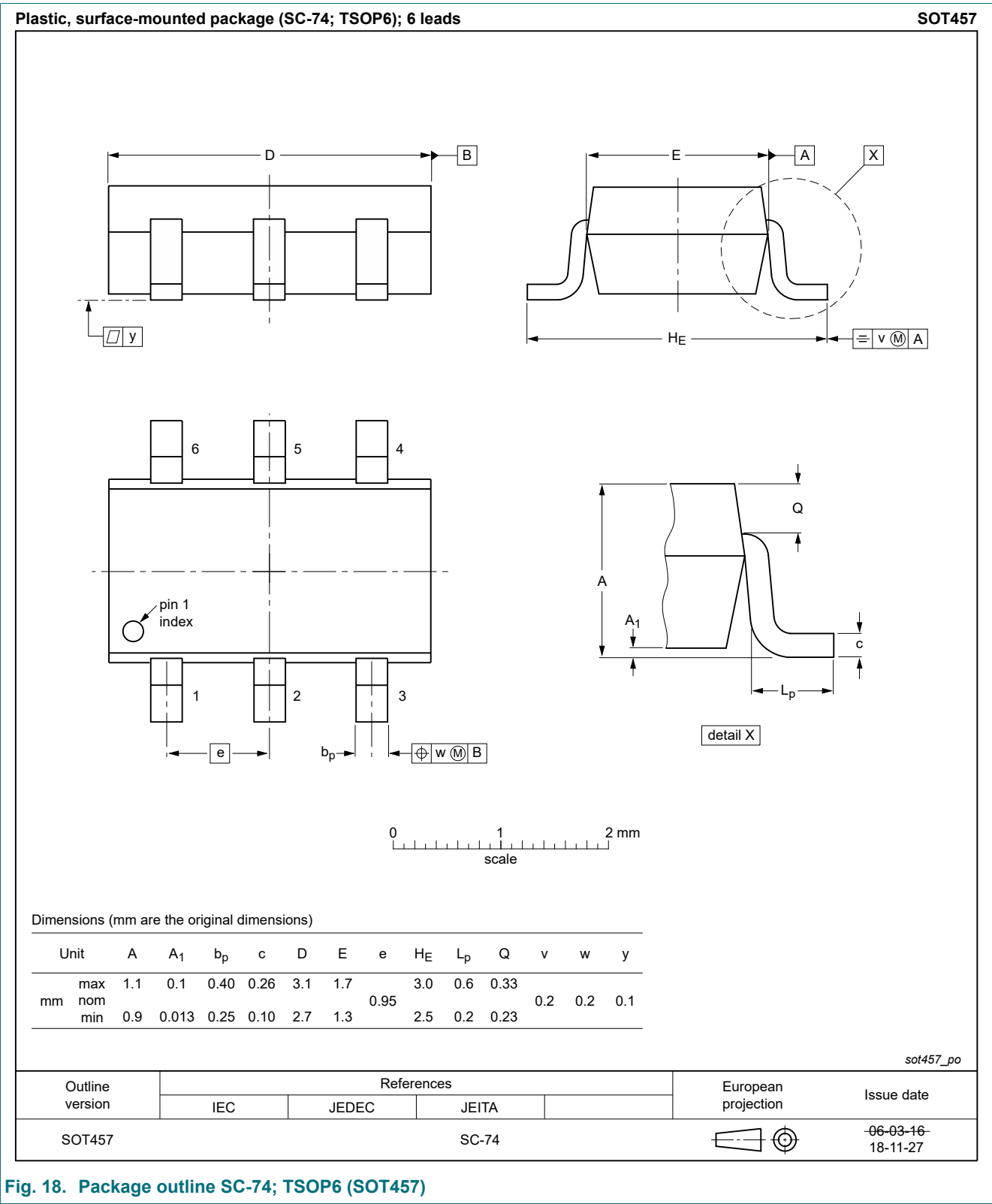
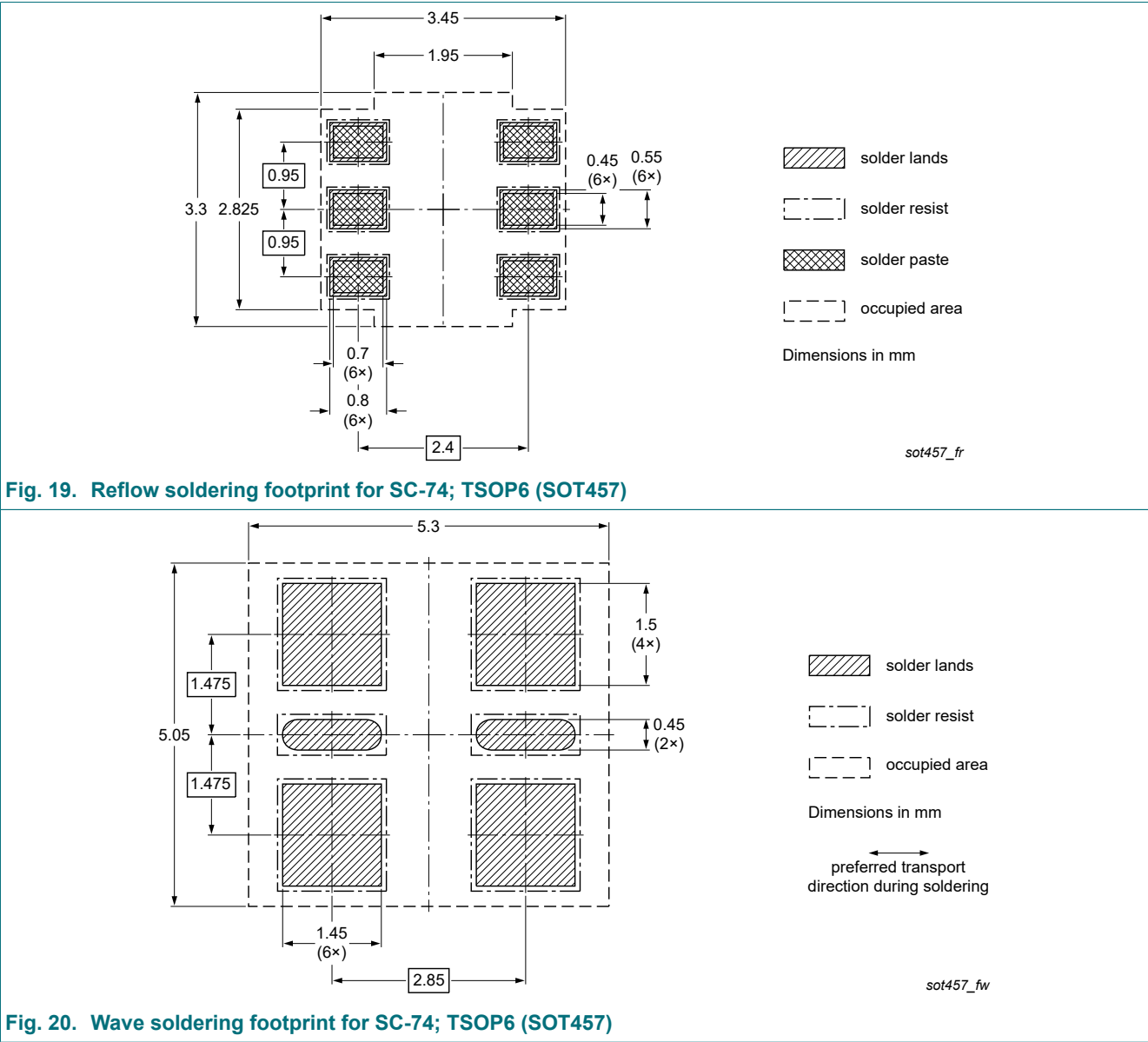


Fig. 18. Package outline SC-74; TSOP6 (SOT457)

13. Soldering



14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMN40XPEA v.1	20200707	Product data sheet	-	-

15. Legal information

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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- [2] The term 'short data sheet' is explained in section "Definitions".
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Date of release: 7 July 2020