



PMDT290UCE

20 / 20 V, 800 / 550 mA N/P-channel Trench MOSFET

28 December 2022

Product data sheet

1. General description

Complementary N/P-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.

2. Features and benefits

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

3. Applications

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

4. Quick reference data

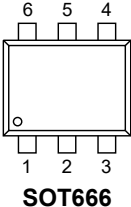
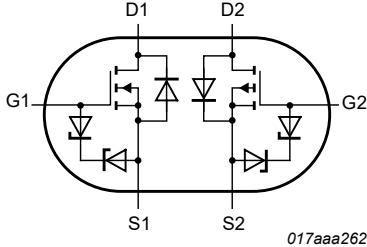
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
TR1 (N-channel), Static characteristics						
R_{DSon}	drain-source on-state resistance	$V_{GS} = 4.5 \text{ V}; I_D = 500 \text{ mA}; T_j = 25 \text{ }^{\circ}\text{C}$	-	290	380	m Ω
TR2 (P-channel), Static characteristics						
R_{DSon}	drain-source on-state resistance	$V_{GS} = -4.5 \text{ V}; I_D = -400 \text{ mA}; T_j = 25 \text{ }^{\circ}\text{C}$	-	0.67	0.85	Ω
TR1 (N-channel)						
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	$V_{GS} = 4.5 \text{ V}; T_{amb} = 25 \text{ }^{\circ}\text{C}$	[1]	-	800	mA
TR2 (P-channel)						
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	$V_{GS} = -4.5 \text{ V}; T_{amb} = 25 \text{ }^{\circ}\text{C}$	[1]	-	-550	mA

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

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S1	source TR1	 SOT666	 017aaa262
2	G1	gate TR1		
3	D2	drain TR2		
4	S2	source TR2		
5	G2	gate TR2		
6	D1	drain TR1		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PMDT290UCE	SOT666	plastic, surface-mounted package; 6 leads; 0.5 mm pitch; 1.6 mm x 1.2 mm x 0.55 mm body	SOT666

7. Marking

Table 4. Marking codes

Type number	Marking code
PMDT290UCE	AF

8. Limiting values

Table 5. Limiting values

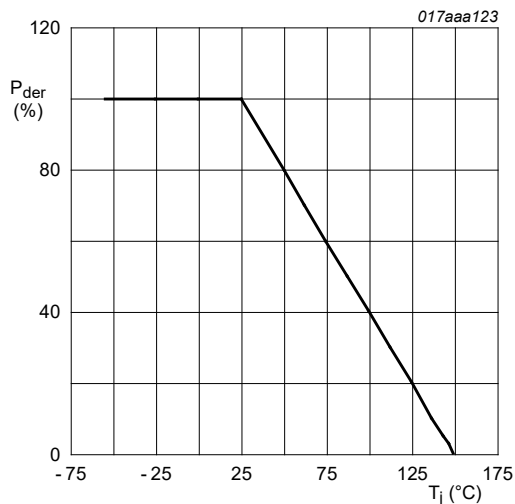
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
TR1 (N-channel)						
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]	-	800	mA
		V _{GS} = 4.5 V; T _{amb} = 100 °C	[1]	-	500	mA
I _{DM}	peak drain current	T _{amb} = 25 °C; single pulse; t _p ≤ 10 μs		-	3.2	A
P _{tot}	total power dissipation	T _{amb} = 25 °C	[2]	-	330	mW
			[1]	-	390	mW
		T _{sp} = 25 °C		-	1090	mW
TR2 (P-channel)						
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]	-	-550	mA
		V _{GS} = -4.5 V; T _{amb} = 100 °C	[1]	-	-350	mA
I _{DM}	peak drain current	T _{amb} = 25 °C; single pulse; t _p ≤ 10 μs		-	-2.2	A
P _{tot}	total power dissipation	T _{amb} = 25 °C	[2]	-	330	mW
			[1]	-	390	mW
		T _{sp} = 25 °C		-	1090	mW
Per device						
P _{tot}	total power dissipation	T _{amb} = 25 °C	[2]	-	500	mW
T _j	junction temperature			-55	150	°C
T _{amb}	ambient temperature			-55	150	°C
T _{stg}	storage temperature			-65	150	°C
TR1 (N-channel), Source-drain diode						
I _S	source current	T _{amb} = 25 °C	[1]	-	370	mA
TR2 (P-channel), Source-drain diode						
I _S	source current	T _{amb} = 25 °C	[1]	-	-370	mA
TR1 (N-channel), ESD maximum rating						
V _{ESD}	electrostatic discharge voltage	HBM	[3]	-	2000	V
TR2 (P-channel), ESD maximum rating						
V _{ESD}	electrostatic discharge voltage	HBM	[3]	-	2000	V

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

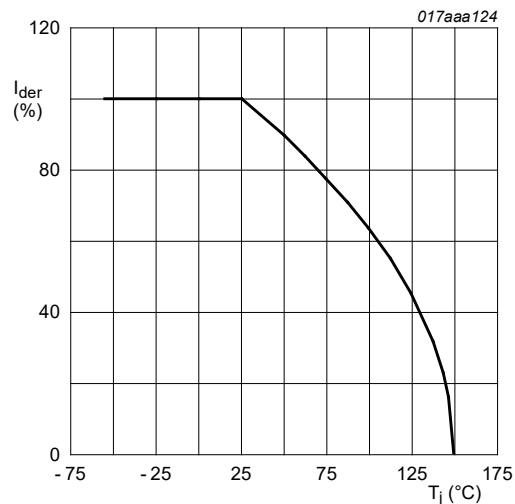
[2] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper; tin-plated and standard footprint.

[3] Measured between all pins.



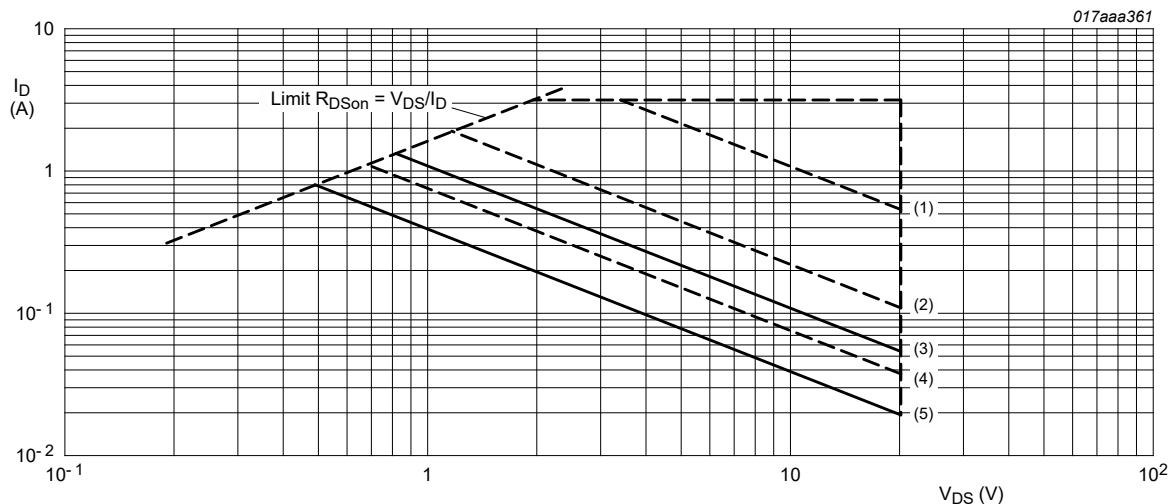
$$P_{der} = \frac{P_{tot}}{P_{tot(25^\circ\text{C})}} \times 100 \%$$

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

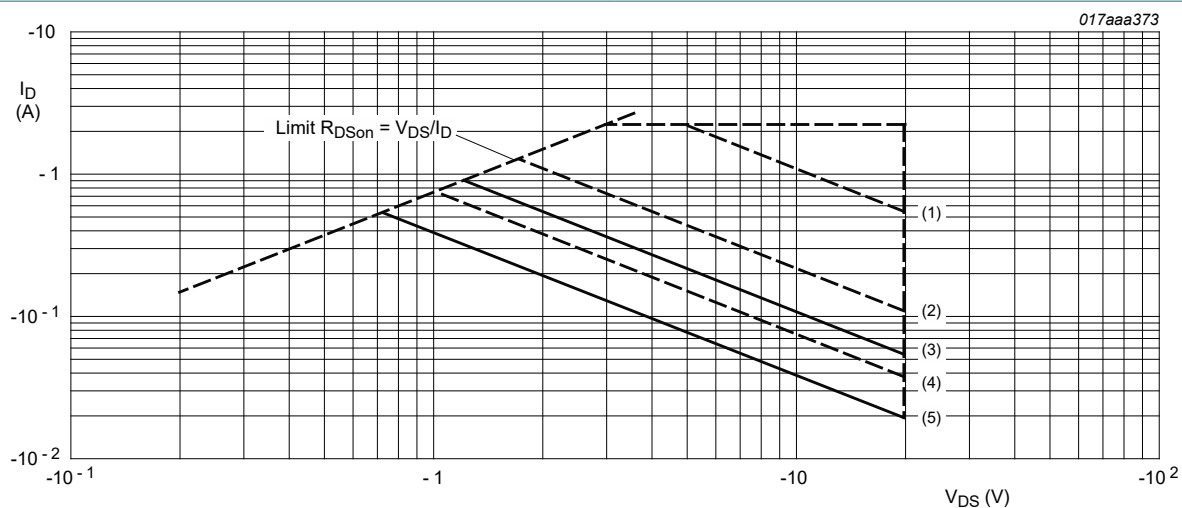
(2) $t_p = 10$ ms

(3) DC; $T_{sp} = 25^\circ\text{C}$

(4) $t_p = 100$ ms

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

Fig. 3. Safe operating area TR1 (N-channel); junction to ambient; continuous and peak drain currents as a function of drain-source voltage



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

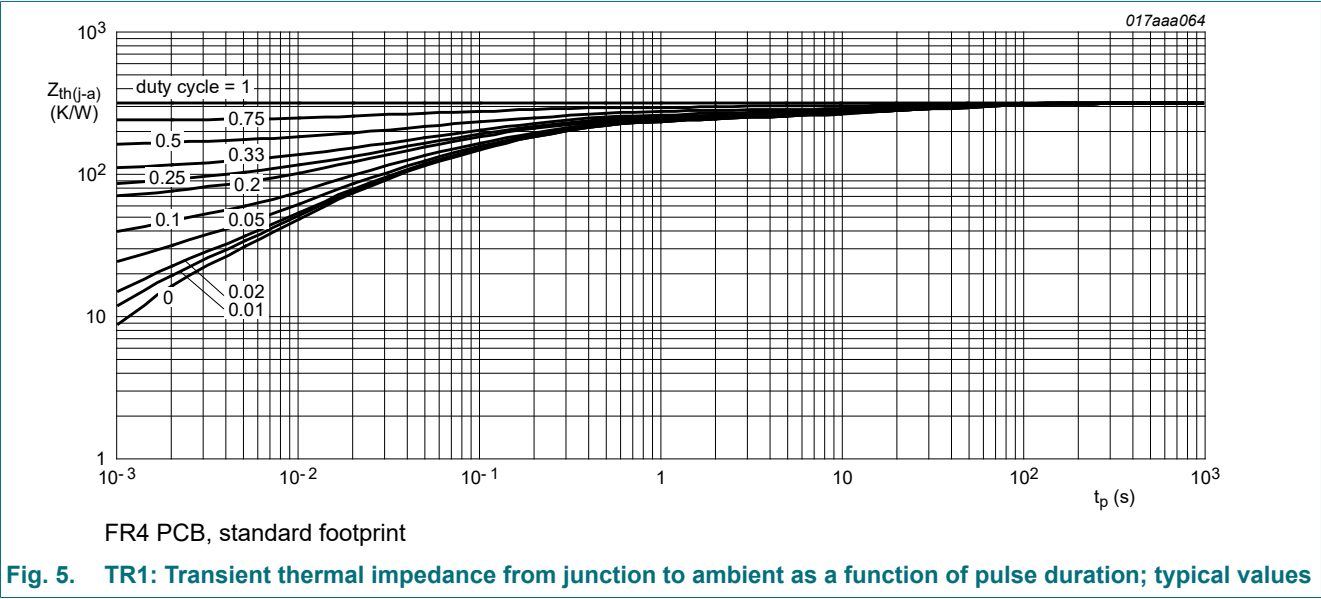
Fig. 4. Safe operating area TR2 (P-channel); junction to ambient; continuous and peak drain currents as a function of drain-source voltage

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
TR1 (N-channel)							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	330	380	K/W
			[2]	-	280	320	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	115	K/W
TR2 (P-channel)							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	330	380	K/W
			[2]	-	280	320	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 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 1 cm².



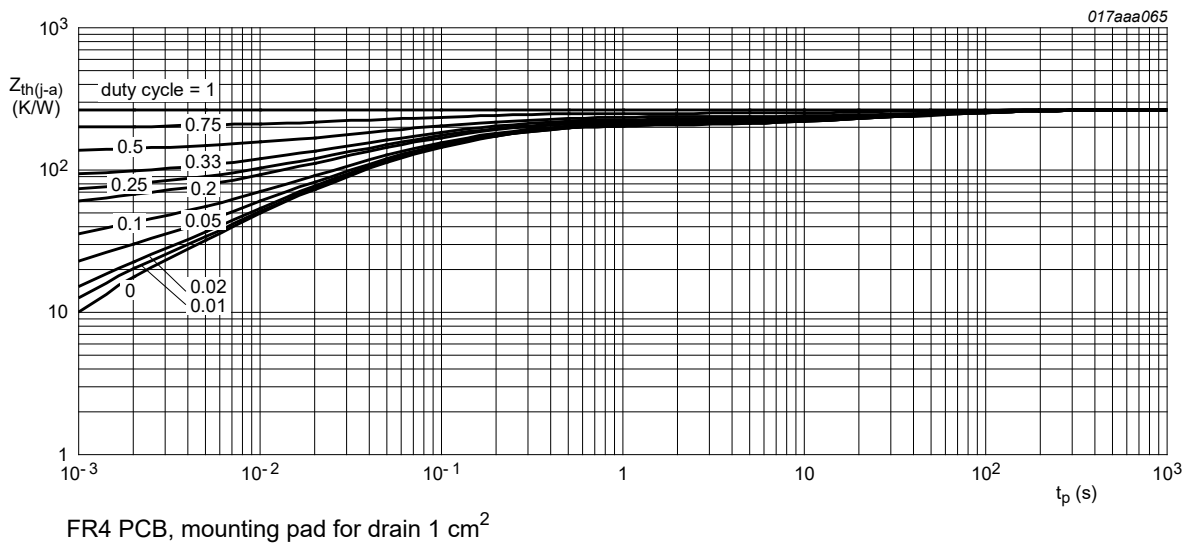


Fig. 6. TR1: Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

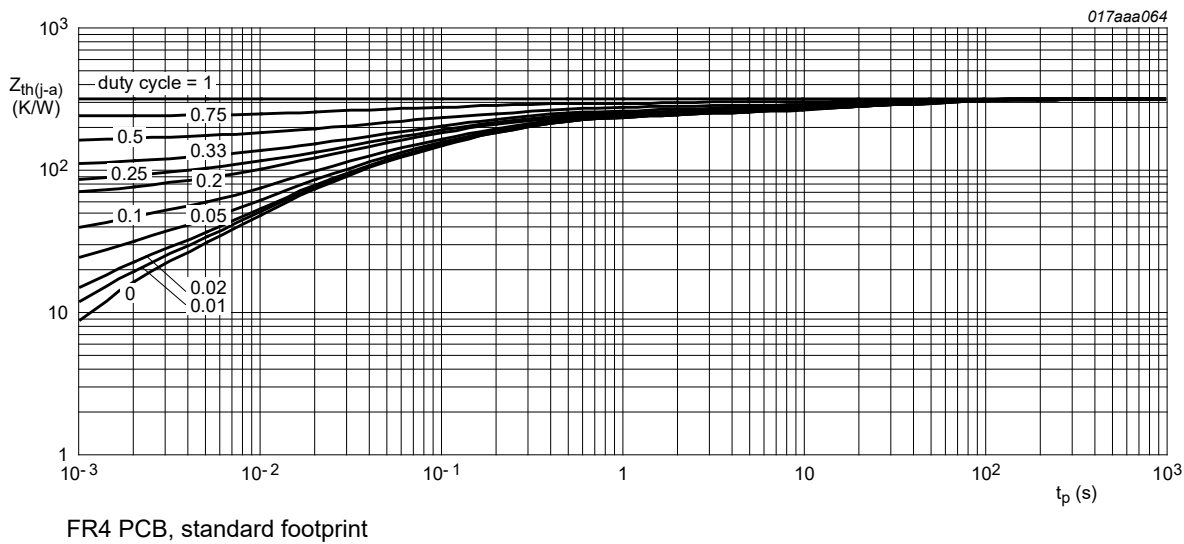


Fig. 7. TR2: Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

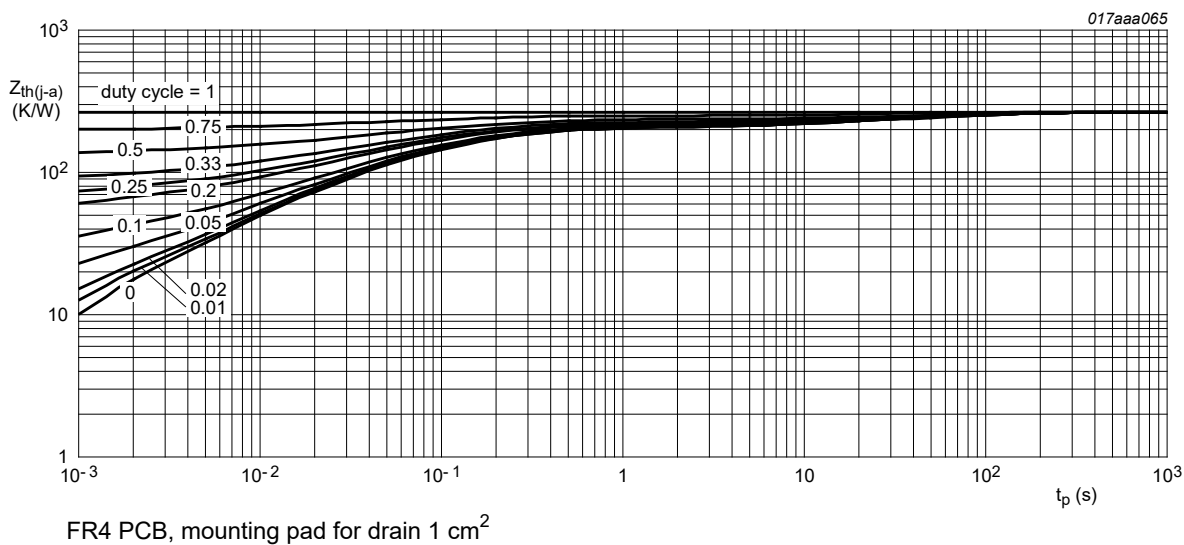


Fig. 8. TR2: Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
TR1 (N-channel), Static characteristics							
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A$; $V_{GS} = 0 V$; $T_j = 25 ^\circ C$		20	-	-	V
V_{GSth}	gate-source threshold voltage	$I_D = 250 \mu A$; $V_{DS} = V_{GS}$; $T_j = 25 ^\circ C$		0.5	0.75	0.95	V
I_{DSS}	drain leakage current	$V_{DS} = 20 V$; $V_{GS} = 0 V$; $T_j = 25 ^\circ C$		-	-	1	μA
		$V_{DS} = 20 V$; $V_{GS} = 0 V$; $T_j = 150 ^\circ C$		-	-	10	μA
I_{GSS}	gate leakage current	$V_{GS} = 8 V$; $V_{DS} = 0 V$; $T_j = 25 ^\circ C$		-	-	2	μA
		$V_{GS} = -8 V$; $V_{DS} = 0 V$; $T_j = 25 ^\circ C$		-	-	2	μA
		$V_{GS} = 4.5 V$; $V_{DS} = 0 V$; $T_j = 25 ^\circ C$		-	-	500	nA
		$V_{GS} = -4.5 V$; $V_{DS} = 0 V$; $T_j = 25 ^\circ C$		-	-	500	nA
R_{DSon}	drain-source on-state resistance	$V_{GS} = 4.5 V$; $I_D = 500 mA$; $T_j = 25 ^\circ C$		-	290	380	m Ω
		$V_{GS} = 4.5 V$; $I_D = 500 mA$; $T_j = 150 ^\circ C$		-	460	610	m Ω
		$V_{GS} = 2.5 V$; $I_D = 200 mA$; $T_j = 25 ^\circ C$		-	420	620	m Ω
		$V_{GS} = 1.8 V$; $I_D = 10 mA$; $T_j = 25 ^\circ C$		-	0.6	1.1	Ω
g_{fs}	forward transconductance	$V_{DS} = 10 V$; $I_D = 200 mA$; $T_j = 25 ^\circ C$		-	1.6	-	S
TR2 (P-channel), Static characteristics							
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = -250 \mu A$; $V_{GS} = 0 V$; $T_j = 25 ^\circ C$		-20	-	-	V
V_{GSth}	gate-source threshold voltage	$I_D = -250 \mu A$; $V_{DS} = V_{GS}$; $T_j = 25 ^\circ C$		-0.5	-0.8	-1.3	V
I_{DSS}	drain leakage current	$V_{DS} = -20 V$; $V_{GS} = 0 V$; $T_j = 25 ^\circ C$		-	-	-1	μA
		$V_{DS} = -20 V$; $V_{GS} = 0 V$; $T_j = 150 ^\circ C$		-	-	-10	μA
I_{GSS}	gate leakage current	$V_{GS} = -8 V$; $V_{DS} = 0 V$; $T_j = 25 ^\circ C$		-	-	-2	μA
		$V_{GS} = 8 V$; $V_{DS} = 0 V$; $T_j = 25 ^\circ C$		-	-	-2	μA
		$V_{GS} = -4.5 V$; $V_{DS} = 0 V$; $T_j = 25 ^\circ C$		-	-	-0.5	μA
		$V_{GS} = 4.5 V$; $V_{DS} = 0 V$; $T_j = 25 ^\circ C$		-	-	-0.5	μA
R_{DSon}	drain-source on-state resistance	$V_{GS} = -4.5 V$; $I_D = -400 mA$; $T_j = 25 ^\circ C$		-	0.67	0.85	Ω
		$V_{GS} = -4.5 V$; $I_D = -400 mA$; $T_j = 150 ^\circ C$		-	1.1	1.4	Ω
		$V_{GS} = -2.5 V$; $I_D = -200 mA$; $T_j = 25 ^\circ C$		-	1.2	1.5	Ω
		$V_{GS} = -1.8 V$; $I_D = -10 mA$; $T_j = 25 ^\circ C$		-	1.8	2.8	Ω
g_{fs}	forward transconductance	$V_{DS} = -10 V$; $I_D = -200 mA$; $T_j = 25 ^\circ C$		-	610	-	mS
TR1 (N-channel), Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	$V_{DS} = 10 V$; $I_D = 500 mA$; $V_{GS} = 4.5 V$; $T_j = 25 ^\circ C$		-	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	$V_{DS} = 10 V$; $f = 1 MHz$; $V_{GS} = 0 V$; $T_j = 25 ^\circ C$		-	55	83	pF
C_{oss}	output capacitance			-	15	-	pF
C_{rss}	reverse transfer capacitance			-	7	-	pF

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_{d(on)}$	turn-on delay time	$V_{DS} = 10 \text{ V}; R_L = 250 \text{ } \Omega; V_{GS} = 4.5 \text{ V};$ $R_{G(ext)} = 6 \text{ } \Omega; T_j = 25 \text{ } ^\circ\text{C}$	-	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

TR2 (P-channel), Dynamic characteristics

$Q_{G(tot)}$	total gate charge	$V_{DS} = -10 \text{ V}; I_D = -400 \text{ mA};$ $V_{GS} = -4.5 \text{ V}; T_j = 25 \text{ } ^\circ\text{C}$	-	0.76	1.14	nC
Q_{GS}	gate-source charge		-	0.28	-	nC
Q_{GD}	gate-drain charge		-	0.18	-	nC
C_{iss}	input capacitance	$V_{DS} = -10 \text{ V}; f = 1 \text{ MHz}; V_{GS} = 0 \text{ V};$ $T_j = 25 \text{ } ^\circ\text{C}$	-	58	87	pF
C_{oss}	output capacitance		-	21	-	pF
C_{rss}	reverse transfer capacitance		-	12	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = -10 \text{ V}; R_L = 250 \text{ } \Omega; V_{GS} = -4.5 \text{ V};$ $R_{G(ext)} = 6 \text{ } \Omega; T_j = 25 \text{ } ^\circ\text{C}$	-	18	36	ns
t_r	rise time		-	30	-	ns
$t_{d(off)}$	turn-off delay time		-	80	160	ns
t_f	fall time		-	72	-	ns

TR1 (N-channel), Source-drain diode characteristics

V_{SD}	source-drain voltage	$I_S = 300 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ } ^\circ\text{C}$	0.48	0.77	1.2	V
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TR2 (P-channel), Source-drain diode characteristics

V_{SD}	source-drain voltage	$I_S = -300 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ } ^\circ\text{C}$	-0.48	-0.84	-1.2	V
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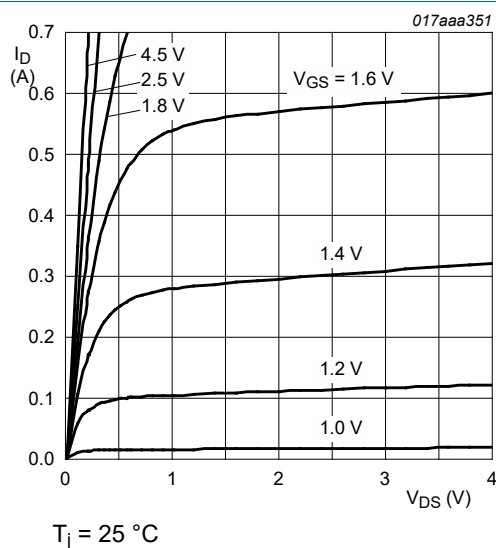


Fig. 9. TR1; Output characteristics: drain current as a function of drain-source voltage; typical values

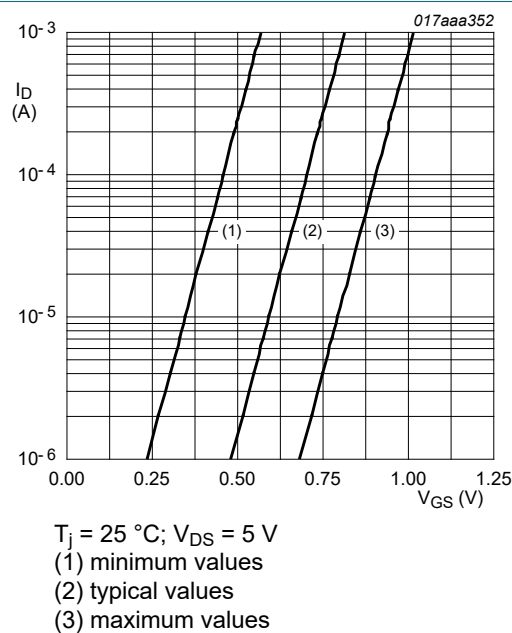


Fig. 10. TR1; Sub-threshold drain current as a function of gate-source voltage

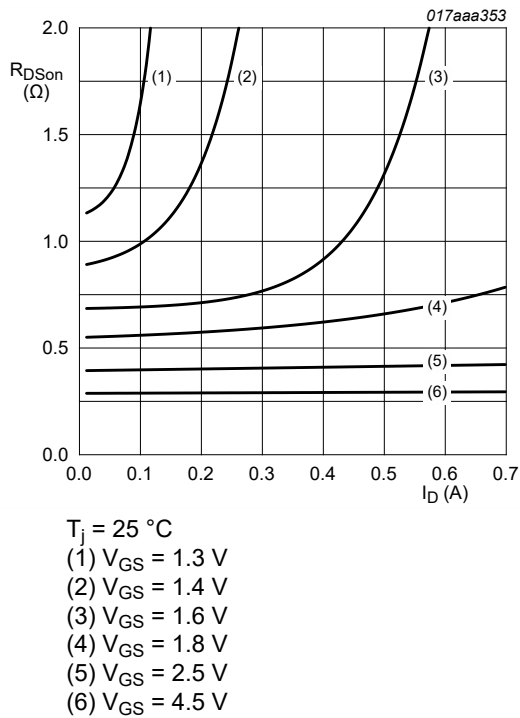


Fig. 11. TR1; Drain-source on-state resistance as a function of drain current; typical values

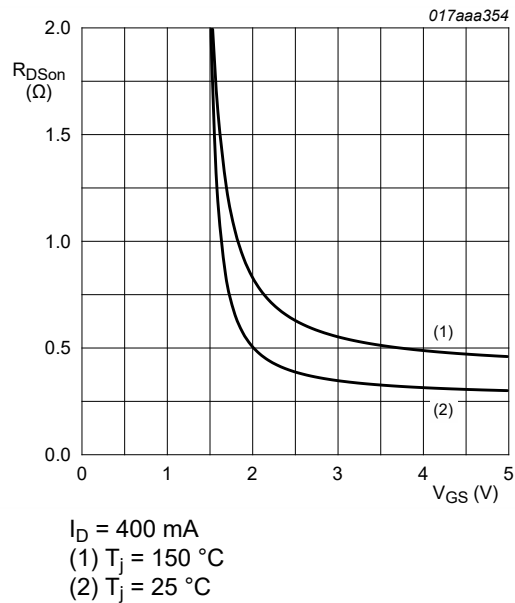


Fig. 12. TR1; Drain-source on-state resistance as a function of gate-source voltage; typical values

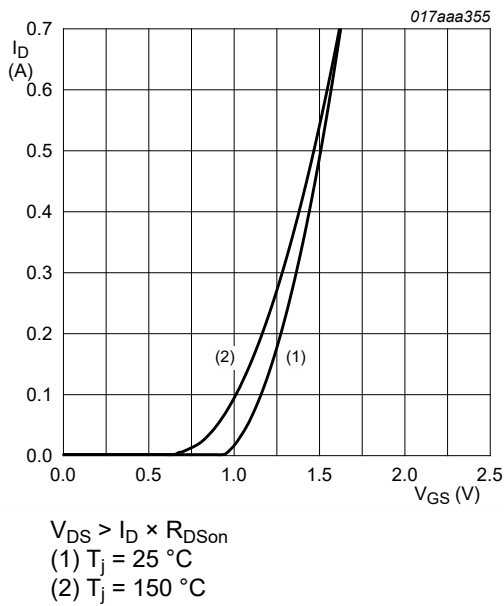


Fig. 13. TR1; Transfer characteristics: drain current as a function of gate-source voltage; typical values

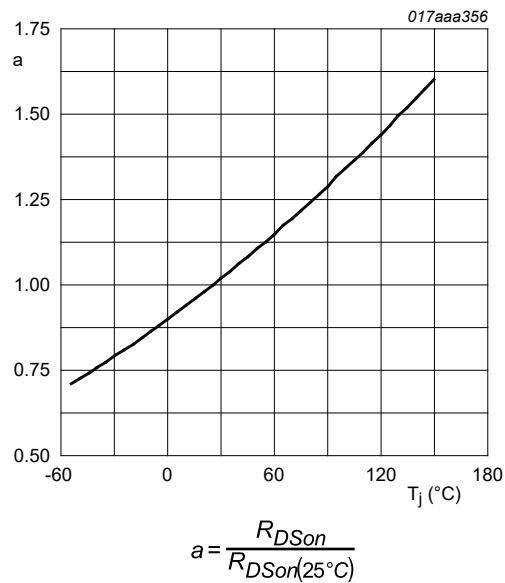


Fig. 14. TR1; Normalized drain-source on-state resistance as a function of junction temperature; typical values

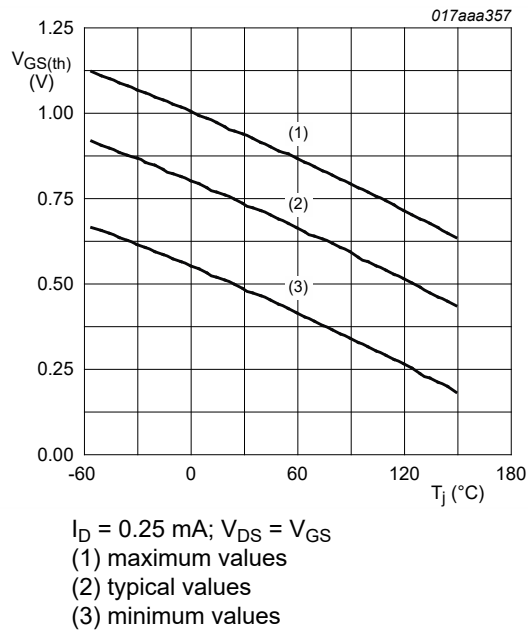


Fig. 15. TR1; Gate-source threshold voltage as a function of junction temperature

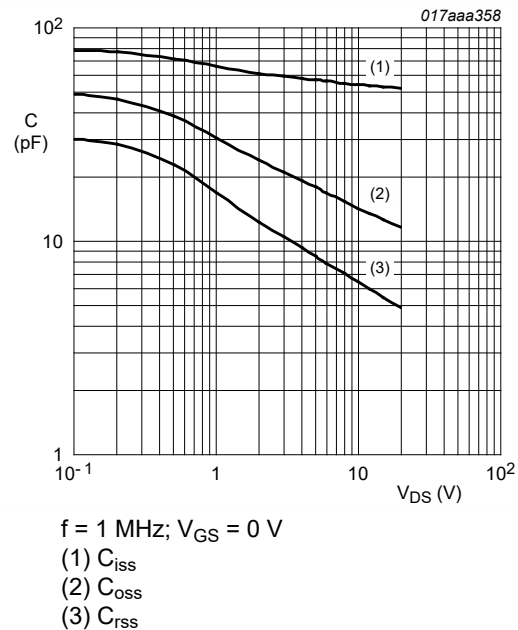


Fig. 16. TR1; Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

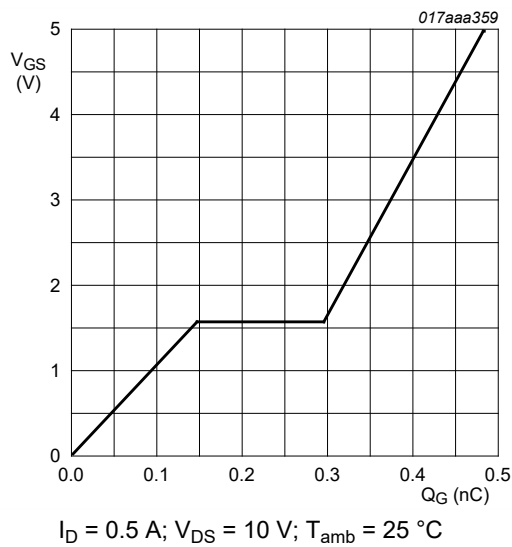


Fig. 17. TR1; Gate-source voltage as a function of gate charge; typical values

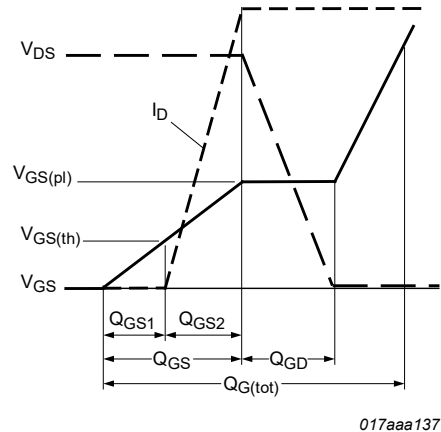


Fig. 18. Gate charge waveform definitions

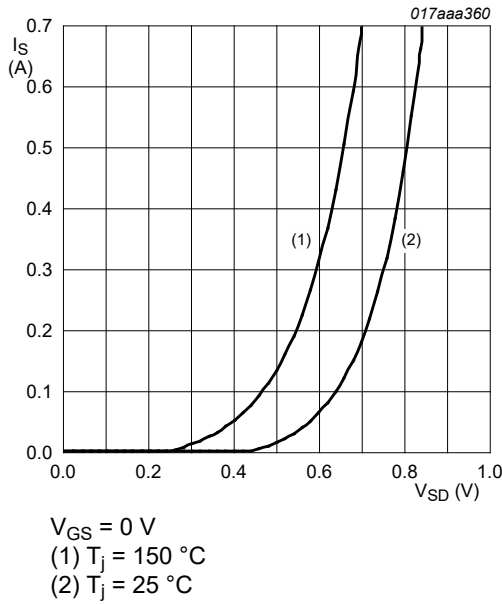


Fig. 19. TR1; Source current as a function of source-drain voltage; typical values

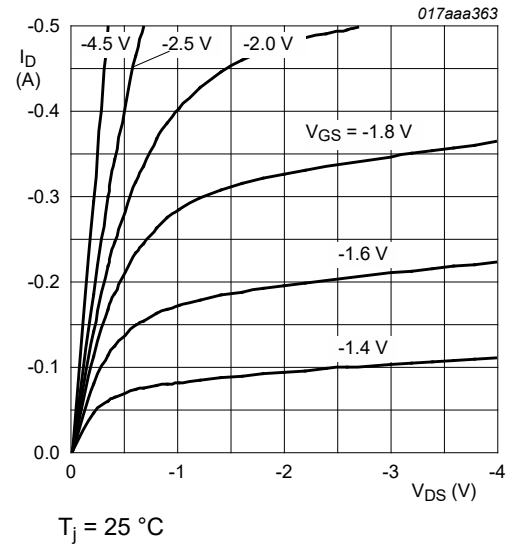


Fig. 20. TR2; Output characteristics: drain current as a function of drain-source voltage; typical values

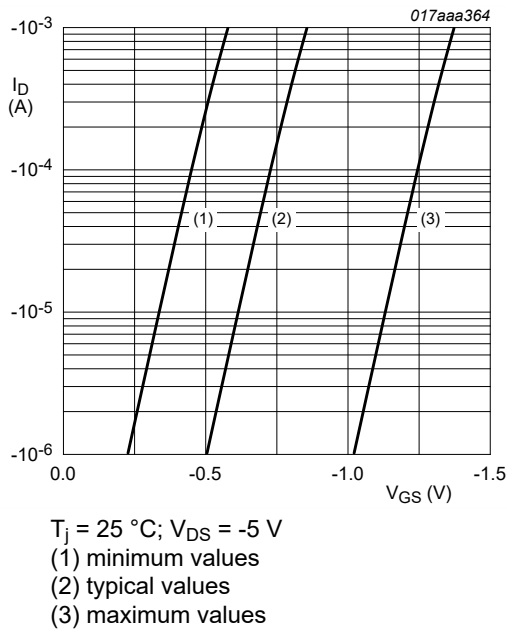


Fig. 21. TR2; Sub-threshold drain current as a function of gate-source voltage

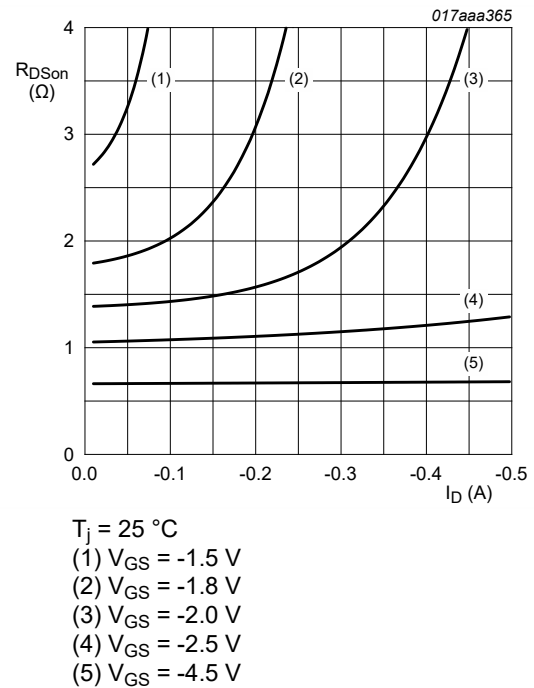


Fig. 22. TR2; Drain-source on-state resistance as a function of drain current; typical values

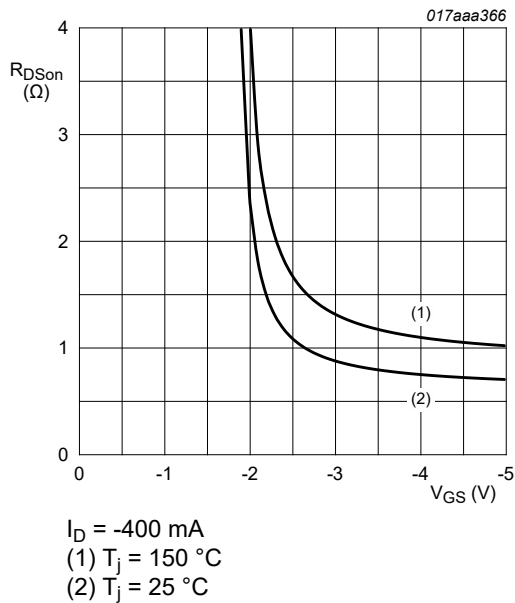


Fig. 23. TR2; Drain-source on-state resistance as a function of gate-source voltage; typical values

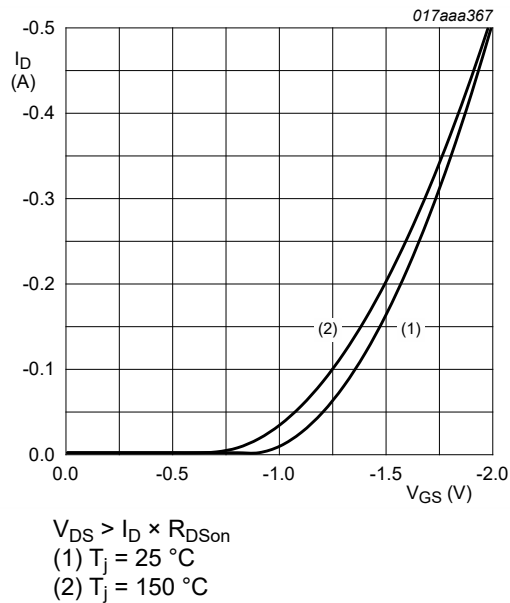


Fig. 24. TR2; Transfer characteristics: drain current as a function of gate-source voltage; typical values

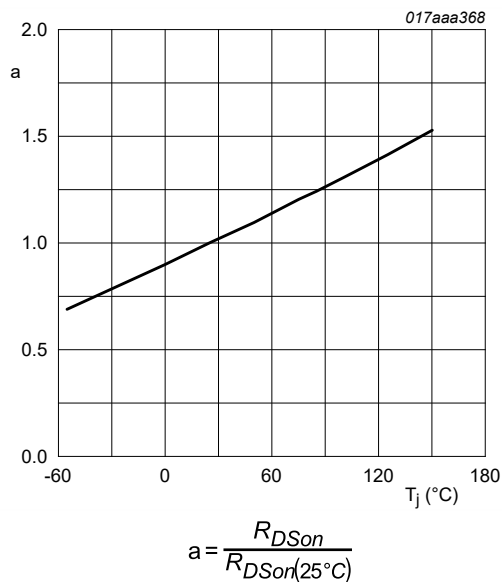


Fig. 25. TR2; Normalized drain-source on-state resistance as a function of ambient temperature; typical values

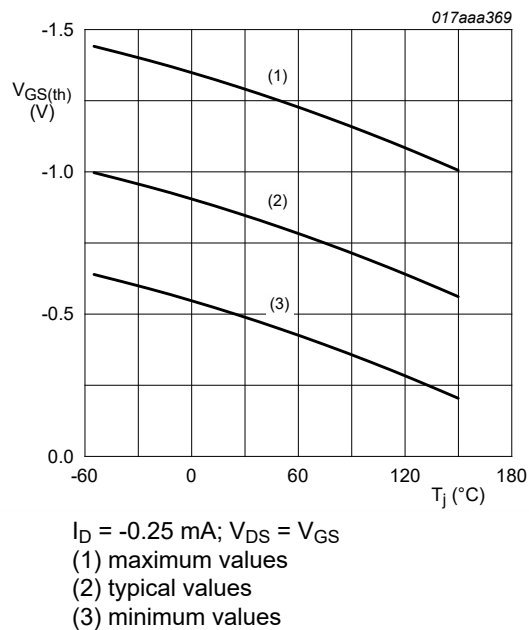
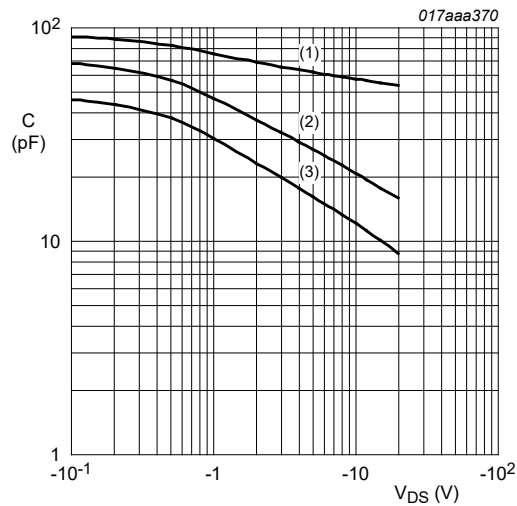
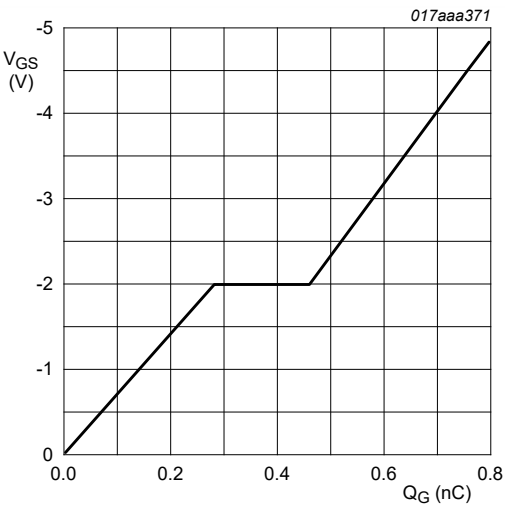


Fig. 26. TR2; Gate-source threshold voltage as a function of junction temperature



f = 1 MHz; V_{GS} = 0 V
(1) C_{iss}
(2) C_{oss}
(3) C_{rss}

Fig. 27. TR2; Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



I_D = -0.4 A; V_{DD} = -10 V; T_{amb} = 25 °C

Fig. 28. TR2; Gate-source voltage as a function of gate charge; typical values

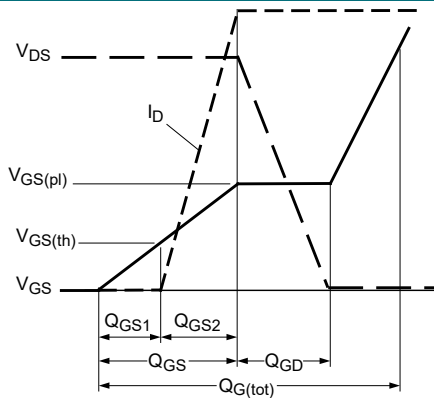
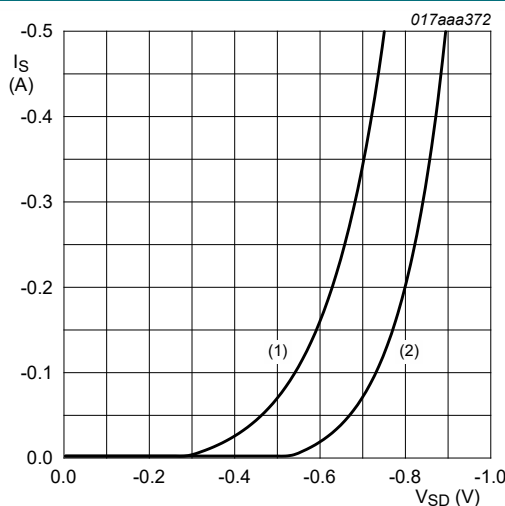


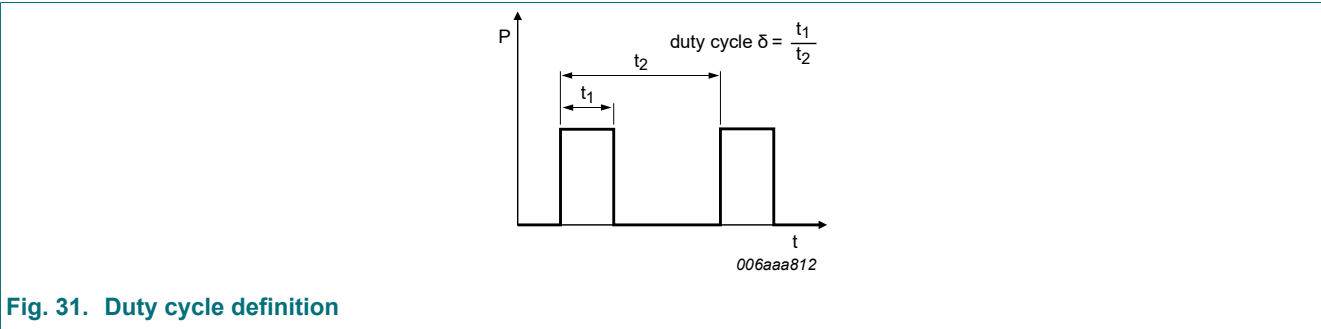
Fig. 29. Gate charge waveform definitions



V_{GS} = 0 V
(1) T_{amb} = 150 °C
(2) T_{amb} = 25 °C

Fig. 30. TR2; Source current as a function of source-drain voltage; typical values

11. Test information



12. Package outline

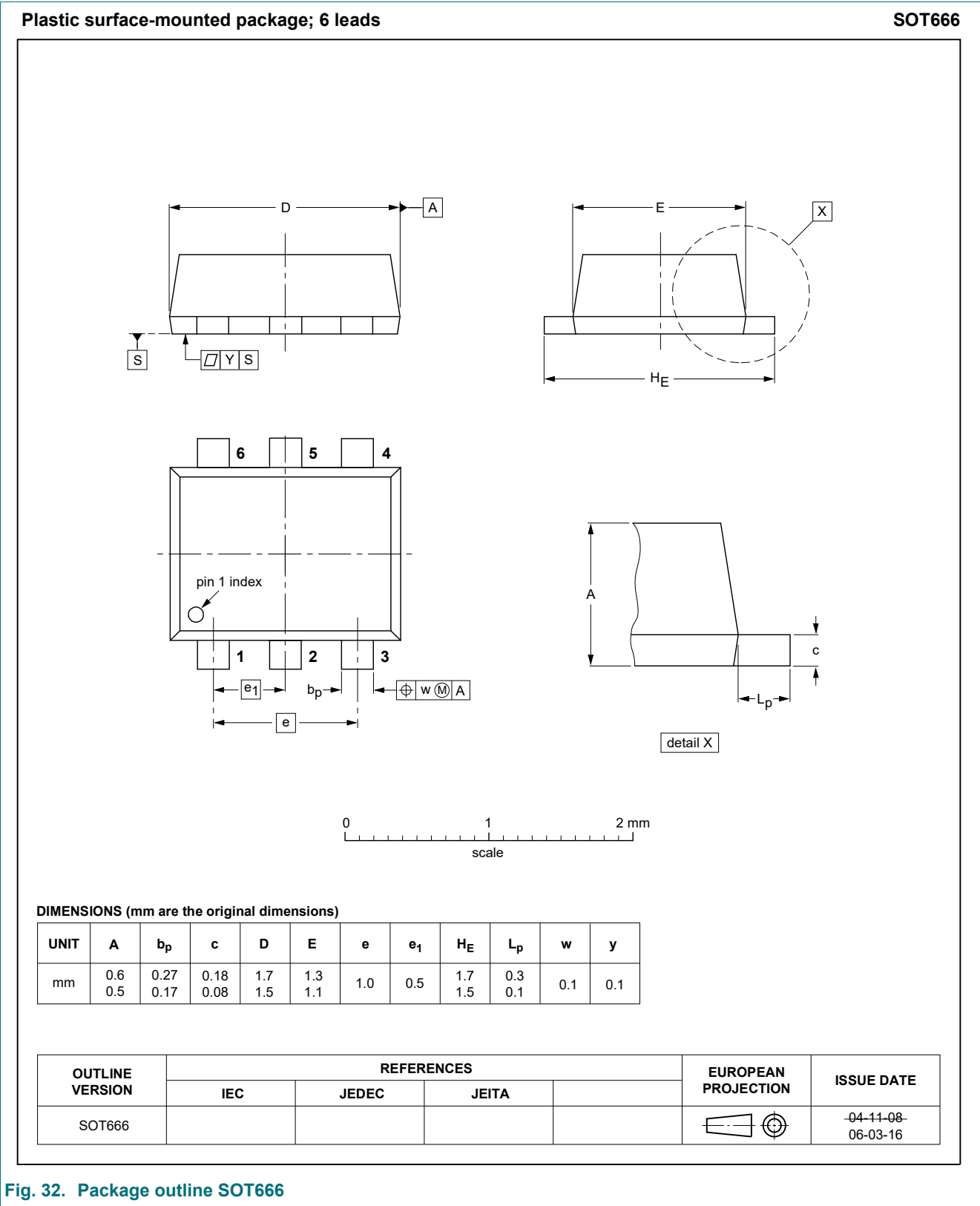


Fig. 32. Package outline SOT666

13. Soldering

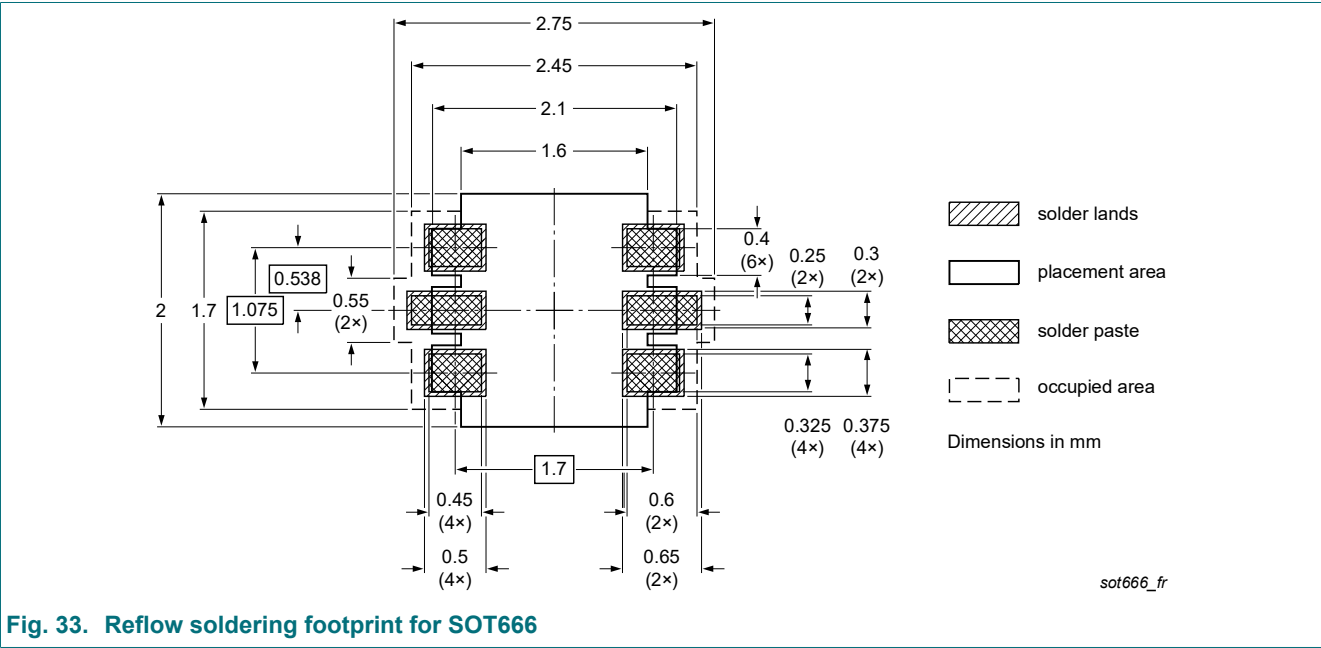


Fig. 33. Reflow soldering footprint for SOT666

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMDT290UCE v.2	20221228	Product data sheet	-	PMDT290UCE v.1
Modifications:	• The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia • Legal texts have been adapted to the new company name where appropriate • Product changed to non-automotive qualification			
PMDT290UCE v.1	20111006	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.

- [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".
- [3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the internet at <https://www.nexperia.com>.

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