

PMCXB290UE

20 V, complementary N/P-channel Trench MOSFET

30 May 2023

Product data sheet

1. General description

Complementary N/P-channel enhancement mode Field-Effect Transistor (FET) in a leadless ultra small DFN1010B-6 (SOT1216) Surface-Mounted Device (SMD) plastic package using Trench MOSFET technology.

2. Features and benefits

- Low threshold voltage
- Very fast switching
- Trench MOSFET technology
- ElectroStatic Discharge (ESD) protection typically > 2 kV HBM

3. Applications

- Relay driver
- High-speed line driver
- Level shifter
- Power management in battery-driven portables

4. Quick reference data

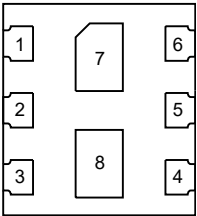
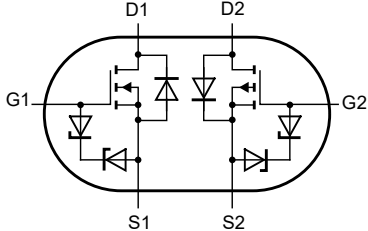
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
TR1 (N-channel), Static characteristics						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 4.5 \text{ V}; I_D = 1.2 \text{ A}; T_j = 25 \text{ }^{\circ}\text{C}$	-	270	320	m Ω
TR2 (P-channel), Static characteristics						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = -4.5 \text{ V}; I_D = -1.2 \text{ A}; T_j = 25 \text{ }^{\circ}\text{C}$	-	590	770	m Ω
TR1 (N-channel)						
V_{DS}	drain-source voltage	$T_j = 25 \text{ }^{\circ}\text{C}$	-	-	20	V
I_D	drain current	$V_{GS} = 4.5 \text{ V}; T_{amb} = 25 \text{ }^{\circ}\text{C}$	[1]	-	930	mA
TR2 (P-channel)						
V_{DS}	drain-source voltage	$T_j = 25 \text{ }^{\circ}\text{C}$	-	-	-20	V
I_D	drain current	$V_{GS} = -4.5 \text{ V}; T_{amb} = 25 \text{ }^{\circ}\text{C}$	[1]	-	-570	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	 Transparent top view DFN1010B-6 (SOT1216)	 017aaa262
2	G1	gate TR1		
3	D2	drain TR2		
4	S2	source TR2		
5	G2	gate TR2		
6	D1	drain TR1		
7	D1	drain TR1		
8	D2	drain TR2		

6. Ordering information

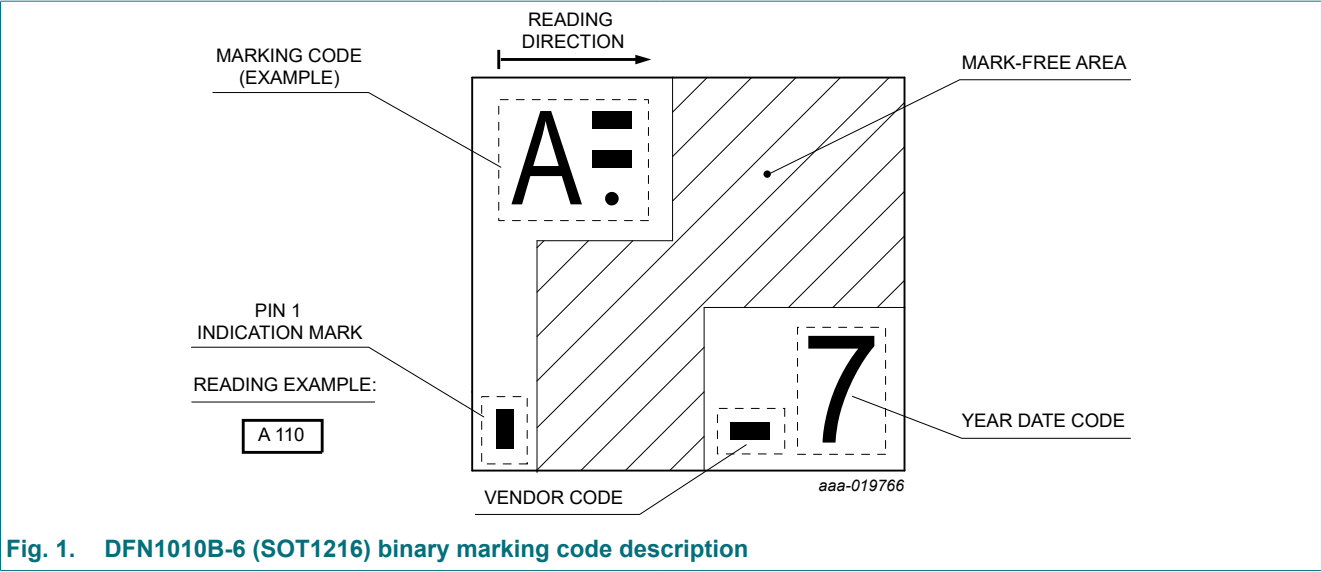
Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PMCXB290UE	DFN1010B-6	plastic, leadless thermal enhanced ultra thin small outline package; 6 terminals; 0.35 mm pitch; 1.1 mm x 1 mm x 0.37 mm body	SOT1216

7. Marking

Table 4. Marking codes

Type number	Marking code
PMCXB290UE	C 111

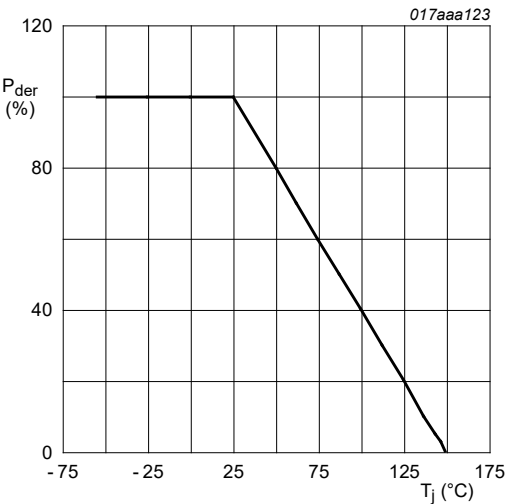


8. Limiting values

Table 5. Limiting values
In accordance with the Absolute Maximum Rating System (IEC 60134).

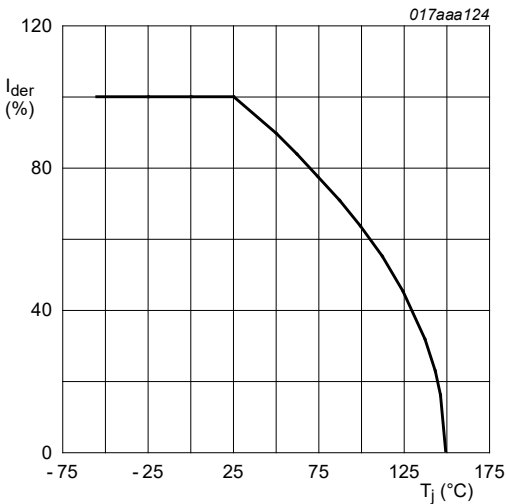
Symbol	Parameter	Conditions		Min	Max	Unit
TR1 (N-channel)						
V _{DS}	drain-source voltage	T _j = 25 °C		-	20	V
V _{GS}	gate-source voltage			-8	8	V
I _D	drain current	V _{GS} = 4.5 V; T _{amb} = 25 °C	[1]	-	930	mA
		V _{GS} = 4.5 V; T _{sp} = 25 °C		-	3.5	A
		V _{GS} = 4.5 V; T _{amb} = 100 °C	[1]	-	590	mA
		V _{GS} = 4.5 V; T _{sp} = 100 °C		-	2.2	A
I _{DM}	peak drain current	T _{amb} = 25 °C; single pulse; t _p ≤ 10 μs		-	14	A
P _{tot}	total power dissipation	T _{amb} = 25 °C	[2]	-	280	mW
			[1]	-	370	mW
		T _{sp} = 25 °C		-	6	W
TR1 (N-channel), Source-drain diode						
I _S	source current	T _{amb} = 25 °C	[1]	-	300	mA
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]	-	-570	mA
		V _{GS} = -4.5 V; T _{sp} = 25 °C		-	-2.3	A
		V _{GS} = -4.5 V; T _{amb} = 100 °C	[1]	-	-360	mA
		V _{GS} = -4.5 V; T _{sp} = 100 °C		-	-1.5	A
I _{DM}	peak drain current	T _{amb} = 25 °C; single pulse; t _p ≤ 10 μs		-	-9.2	A
P _{tot}	total power dissipation	T _{amb} = 25 °C	[2]	-	280	mW
			[1]	-	370	mW
		T _{sp} = 25 °C		-	6	W
TR2 (P-channel), Source-drain diode						
I _S	source current	T _{amb} = 25 °C	[1]	-	-350	mA
Per device						
T _j	junction temperature			-55	150	°C
T _{amb}	ambient temperature			-55	150	°C
T _{stg}	storage temperature			-65	150	°C

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



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

Fig. 2. MOSFET transistor: Normalized total power dissipation as a function of junction temperature



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

Fig. 3. MOSFET transistor: Normalized continuous drain current as a function of junction temperature

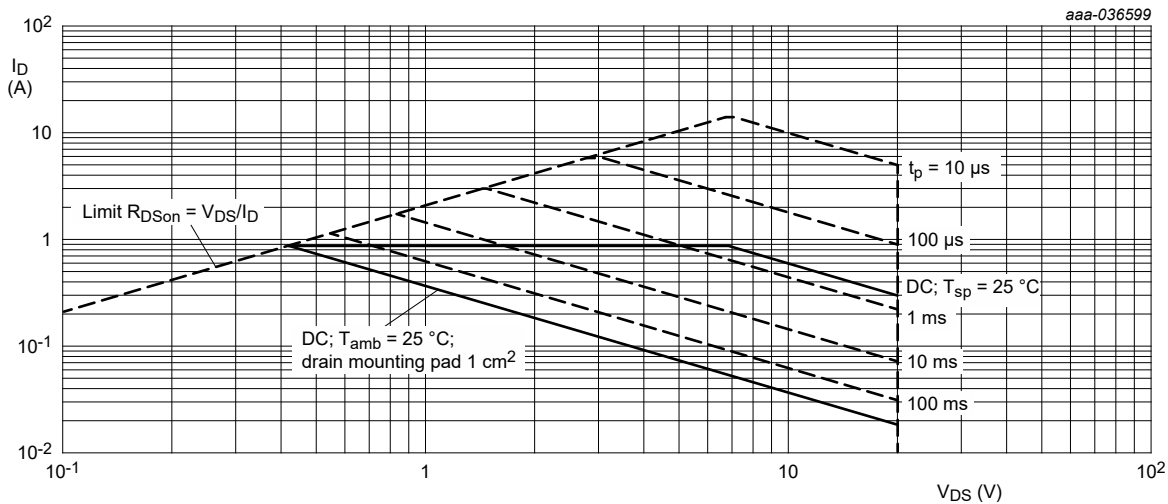
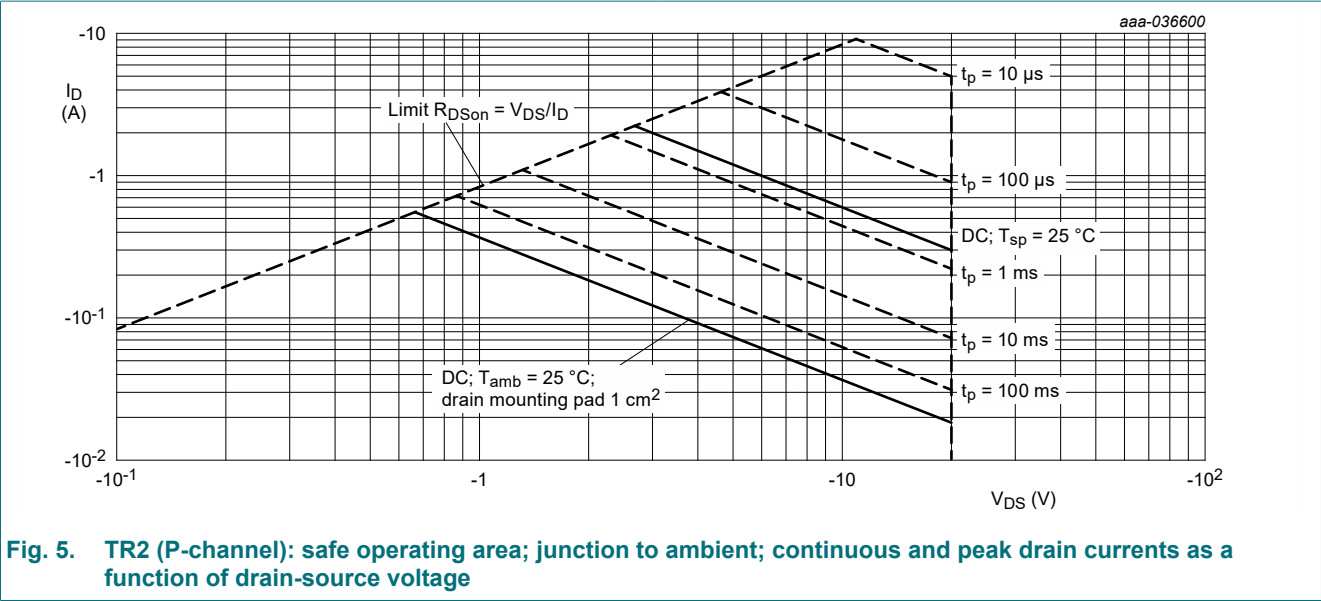


Fig. 4. TR1 (N-channel): safe operating area; junction to ambient; continuous and peak drain currents as a function of drain-source voltage



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]	-	386	444	K/W
			[2]	-	297	342	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	18	21	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 and mounting pad for drain 1 cm².

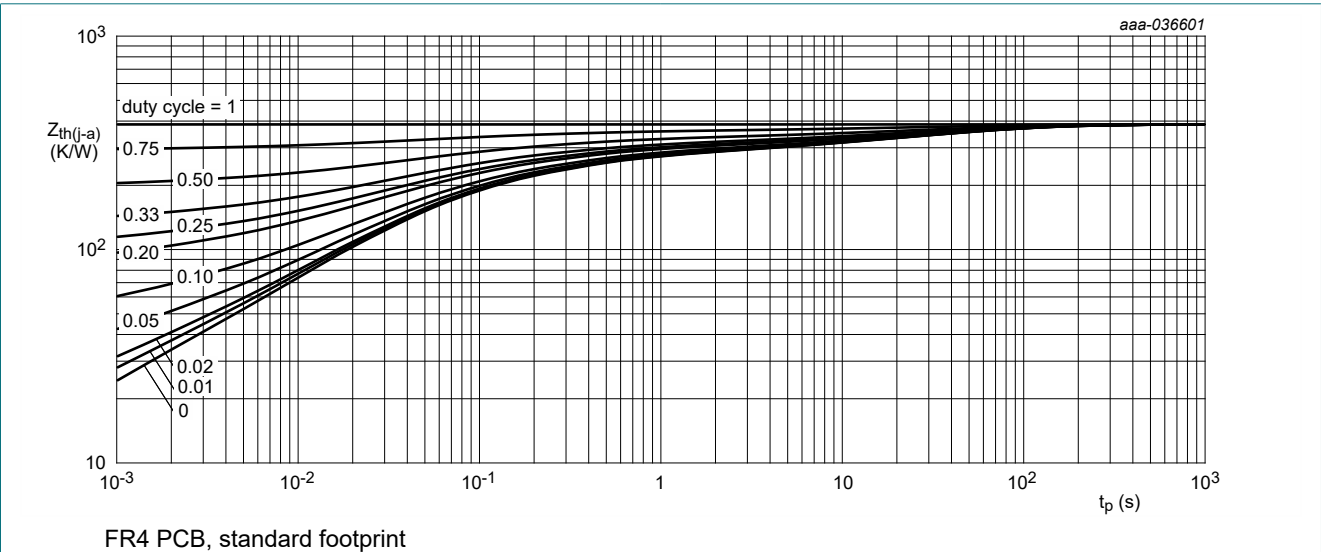


Fig. 6. TR1 and TR2: transient thermal impedance from junction to ambient as a function of pulse duration; typical values

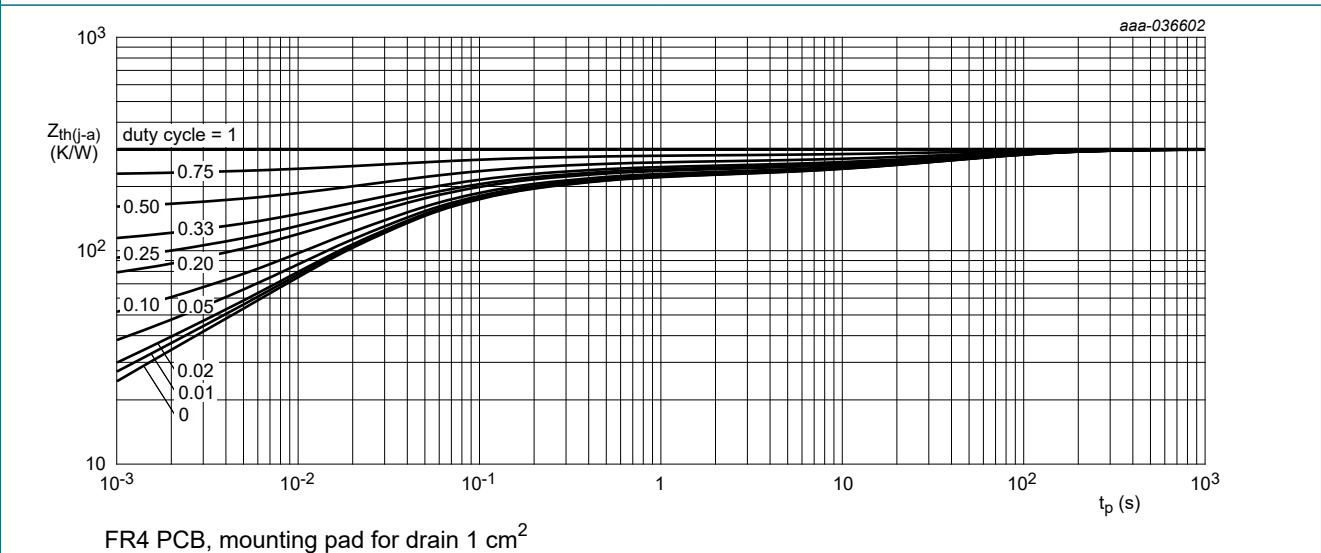


Fig. 7. TR1 and TR2: transient thermal impedance from junction to ambient as a function of pulse duration; typical values

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 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		0.45	0.7	1	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		-	-	20	μA
I _{GSS}	gate leakage current	V _{GS} = 8 V; V _{DS} = 0 V; T _j = 25 °C		-	-	10	μA
		V _{GS} = -8 V; V _{DS} = 0 V; T _j = 25 °C		-	-	-10	μA
		V _{GS} = 4.5 V; V _{DS} = 0 V; T _j = 25 °C		-	-	1	μA
		V _{GS} = -4.5 V; V _{DS} = 0 V; T _j = 25 °C		-	-	-1	μA
		V _{GS} = 2.5 V; V _{DS} = 0 V; T _j = 25 °C		-	-	500	nA
		V _{GS} = -2.5 V; V _{DS} = 0 V; T _j = 25 °C		-	-	-500	nA
		R _{DSon}	drain-source on-state resistance	V _{GS} = 4.5 V; I _D = 1.2 A; T _j = 25 °C		-	270
V _{GS} = 4.5 V; I _D = 1.2 A; T _j = 150 °C				-	400	480	mΩ
V _{GS} = 2.5 V; I _D = 1 A; T _j = 25 °C				-	360	480	mΩ
V _{GS} = 1.8 V; I _D = 120 mA; T _j = 25 °C				-	470	680	mΩ
V _{GS} = 1.5 V; I _D = 10 mA; T _j = 25 °C				-	600	1190	mΩ
g _{fs}	forward transconductance	V _{DS} = 5 V; I _D = 600 mA; T _j = 25 °C		-	1.9	-	S
TR1 (N-channel), Dynamic characteristics							
Q _{G(tot)}	total gate charge	V _{DS} = 10 V; I _D = 1.2 A; V _{GS} = 4.5 V; T _j = 25 °C		-	0.6	0.9	nC
Q _{GS}	gate-source charge			-	0.1	-	nC
Q _{GD}	gate-drain charge			-	0.2	-	nC
C _{iss}	input capacitance	V _{DS} = 10 V; f = 1 MHz; V _{GS} = 0 V; T _j = 25 °C		-	43.6	-	pF
C _{oss}	output capacitance			-	10.1	-	pF
C _{rss}	reverse transfer capacitance			-	8.2	-	pF
t _{d(on)}	turn-on delay time	V _{DS} = 10 V; I _D = 1.2 A; V _{GS} = 4.5 V; R _{G(ext)} = 6 Ω; T _j = 25 °C		-	1	-	ns
t _r	rise time			-	3	-	ns
t _{d(off)}	turn-off delay time			-	5	-	ns
t _f	fall time			-	3	-	ns
TR1 (N-channel), Source-drain diode characteristics							
V _{SD}	source-drain voltage	I _S = 340 mA; V _{GS} = 0 V; T _j = 25 °C		-	0.9	1.2	V

Table 8. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
TR2 (P-channel), 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		-0.45	-0.7	-1	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		-	-	-20	μA
I _{GSS}	gate leakage current	V _{GS} = 8 V; V _{DS} = 0 V; T _j = 25 °C		-	-	10	μA
		V _{GS} = -8 V; V _{DS} = 0 V; T _j = 25 °C		-	-	-10	μA
		V _{GS} = 4.5 V; V _{DS} = 0 V; T _j = 25 °C		-	-	1	μA
		V _{GS} = -4.5 V; V _{DS} = 0 V; T _j = 25 °C		-	-	-1	μA
		V _{GS} = 2.5 V; V _{DS} = 0 V; T _j = 25 °C		-	-	500	nA
		V _{GS} = -2.5 V; V _{DS} = 0 V; T _j = 25 °C		-	-	-500	nA
R _{DSon}	drain-source on-state resistance	V _{GS} = -4.5 V; I _D = -1.2 A; T _j = 25 °C		-	590	770	mΩ
		V _{GS} = -4.5 V; I _D = -1.2 mA; T _j = 150 °C		-	890	1200	mΩ
		V _{GS} = -2.5 V; I _D = -1 A; T _j = 25 °C		-	980	1400	mΩ
		V _{GS} = -1.8 V; I _D = -120 mA; T _j = 25 °C		-	1170	1970	mΩ
g _{fs}	forward transconductance	V _{DS} = -5 V; I _D = -600 mA; T _j = 25 °C		-	1.2	-	S
TR2 (P-channel), Dynamic characteristics							
Q _{G(tot)}	total gate charge	V _{DS} = -10 V; I _D = -600 mA; V _{GS} = -4.5 V; T _j = 25 °C		-	0.6	0.8	nC
Q _{GS}	gate-source charge			-	0.1	-	nC
Q _{GD}	gate-drain charge			-	0.1	-	nC
C _{iss}	input capacitance	V _{DS} = -10 V; f = 1 MHz; V _{GS} = 0 V; T _j = 25 °C		-	53.5	-	pF
C _{oss}	output capacitance			-	9.6	-	pF
C _{rss}	reverse transfer capacitance			-	7.8	-	pF
t _{d(on)}	turn-on delay time	V _{DS} = -10 V; I _D = -1.2 A; V _{GS} = -4.5 V; R _{G(ext)} = 6 Ω; T _j = 25 °C		-	1	-	ns
t _r	rise time			-	3	-	ns
t _{d(off)}	turn-off delay time			-	6	-	ns
t _f	fall time			-	3.7	-	ns
TR2 (P-channel), Source-drain diode characteristics							
V _{SD}	source-drain voltage	I _S = -340 mA; V _{GS} = 0 V; T _j = 25 °C		-	-0.9	-1.2	V

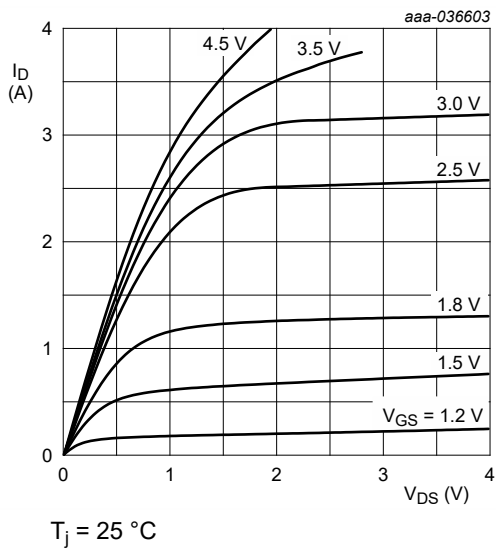


Fig. 8. TR1: output characteristics; drain current as a function of drain-source voltage; typical values

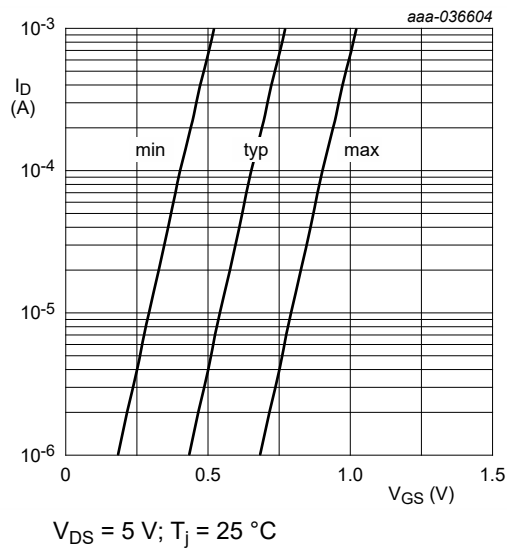


Fig. 9. TR1: sub-threshold drain current as a function of gate-source voltage

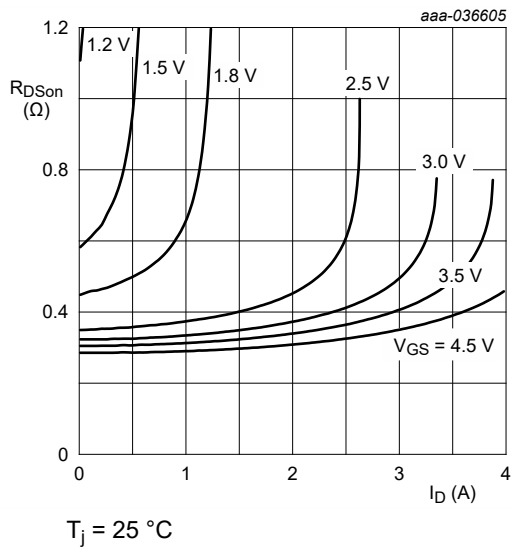


Fig. 10. TR1: drain-source on-state resistance as a function of drain current; typical values

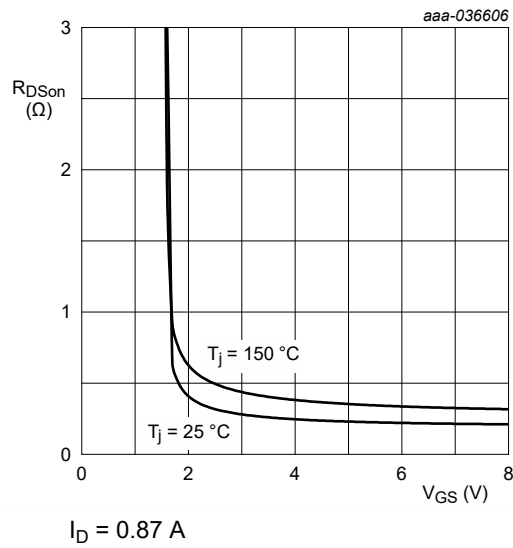


Fig. 11. TR1: drain-source on-state resistance as a function of gate-source voltage; typical values

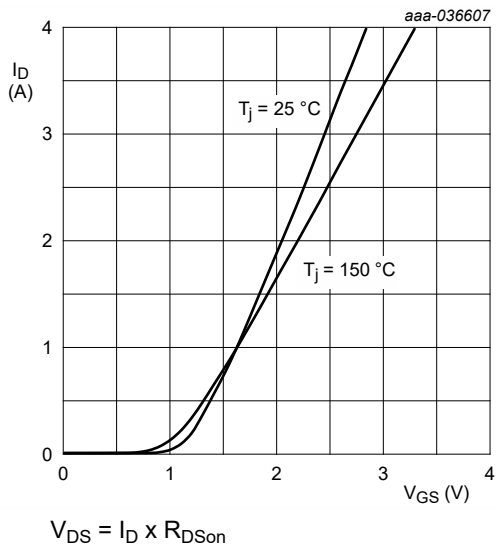


Fig. 12. TR1: transfer characteristics; drain current as a function of gate-source voltage; typical values

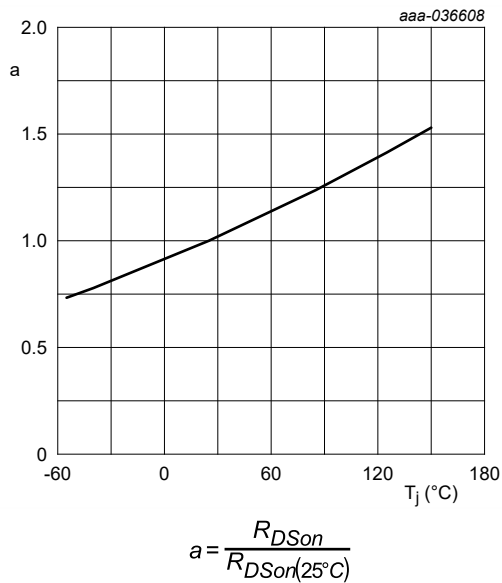


Fig. 13. TR1: normalized drain-source on-state resistance as a function of junction temperature; typical values

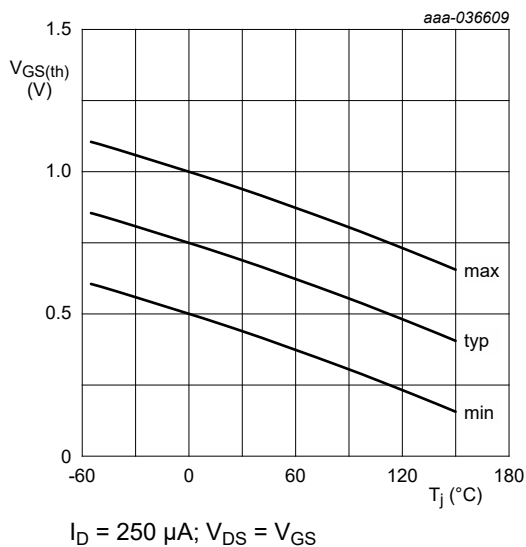


Fig. 14. TR1: gate-source threshold voltage as a function of junction temperature

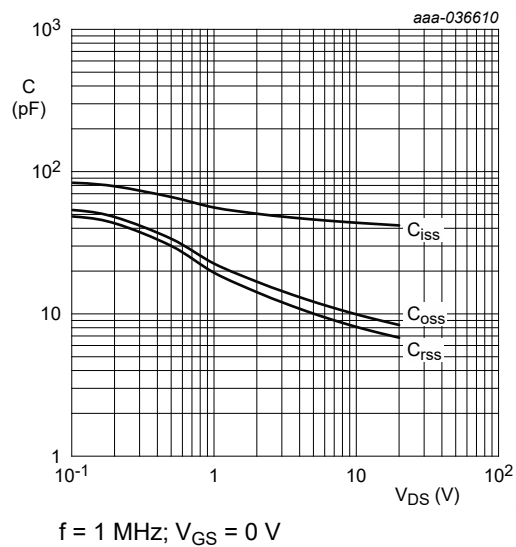


Fig. 15. TR1: input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

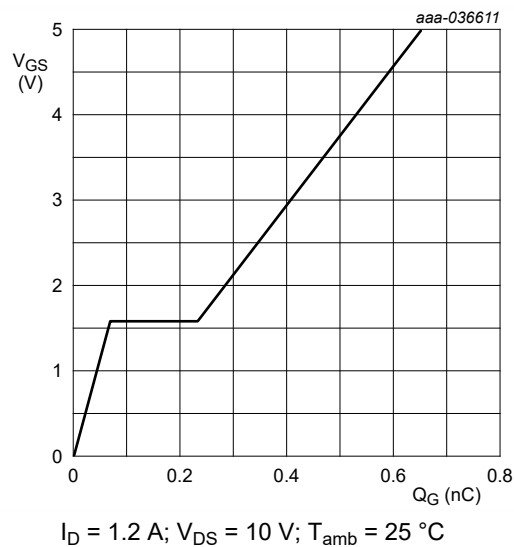


Fig. 16. TR1: gate-source voltage as a function of gate charge; typical values

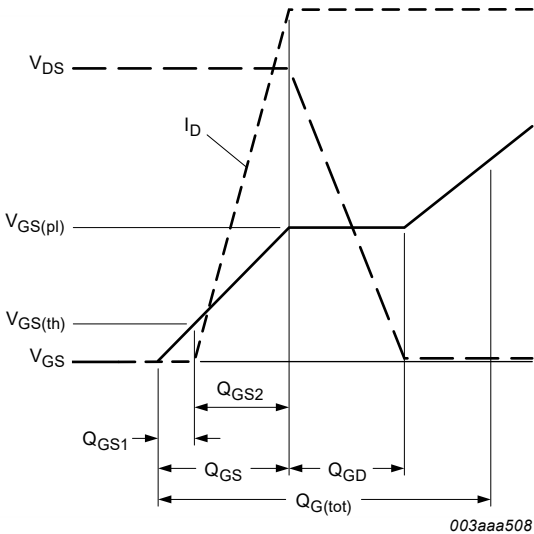


Fig. 17. Gate charge waveform definitions

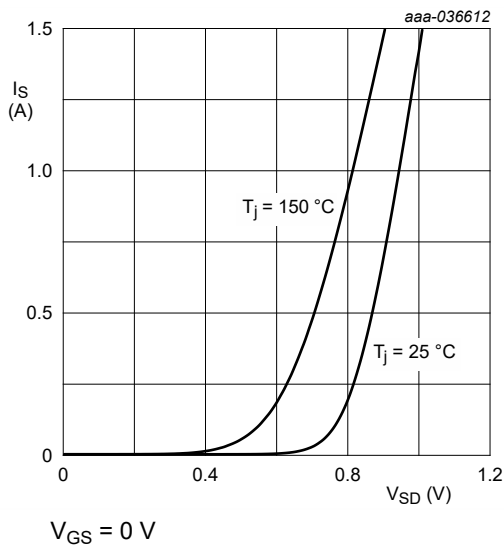


Fig. 18. TR1: source current as a function of source-drain voltage; typical values

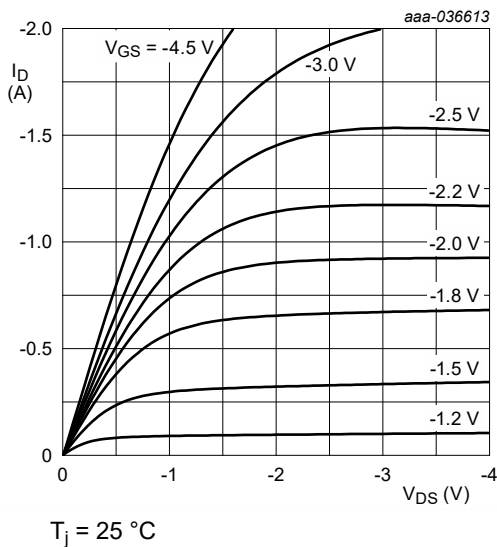


Fig. 19. TR2: output characteristics; drain current as a function of drain-source voltage; typical values

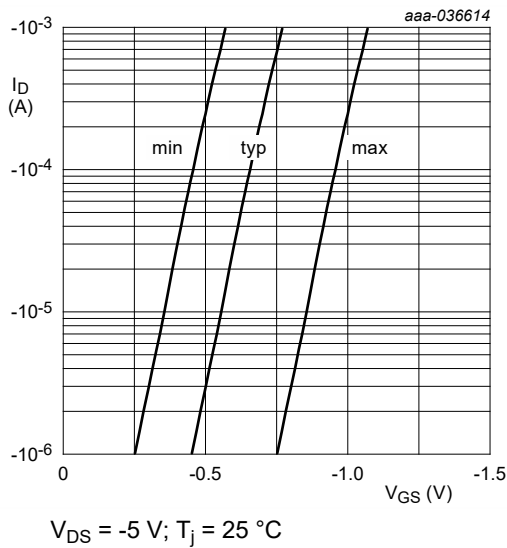


Fig. 20. TR2: sub-threshold drain current as a function of gate-source voltage

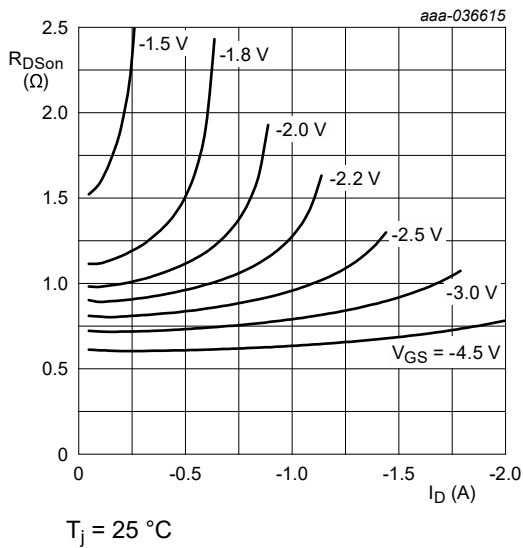


Fig. 21. TR2: drain-source on-state resistance as a function of drain current; typical values

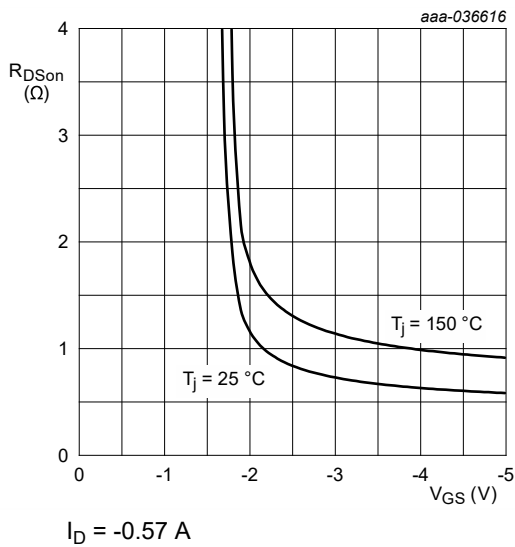


Fig. 22. TR2: drain-source on-state resistance as a function of gate-source voltage; typical values

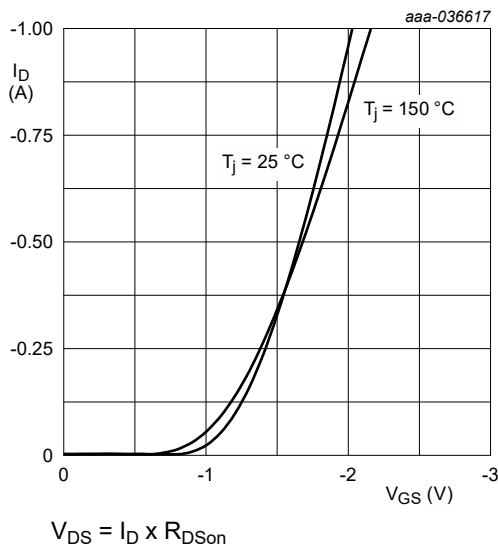


Fig. 23. TR2: transfer characteristics; drain current as a function of gate-source voltage; typical values

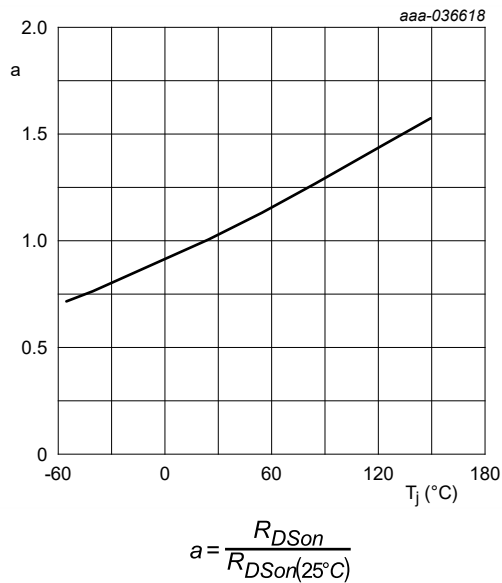


Fig. 24. TR2: normalized drain-source on-state resistance as a function of junction temperature; typical values

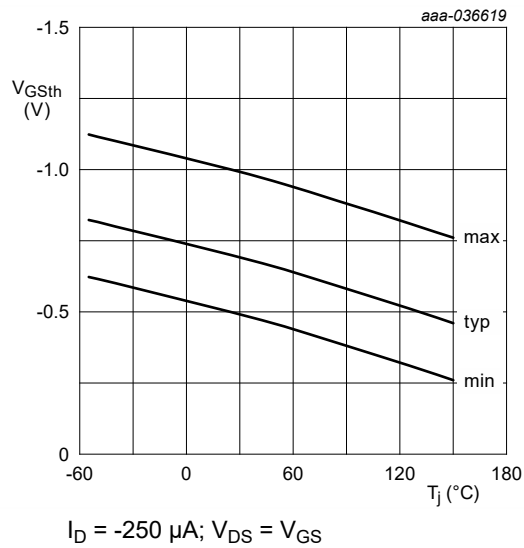


Fig. 25. TR2: gate-source threshold voltage as a function of junction temperature

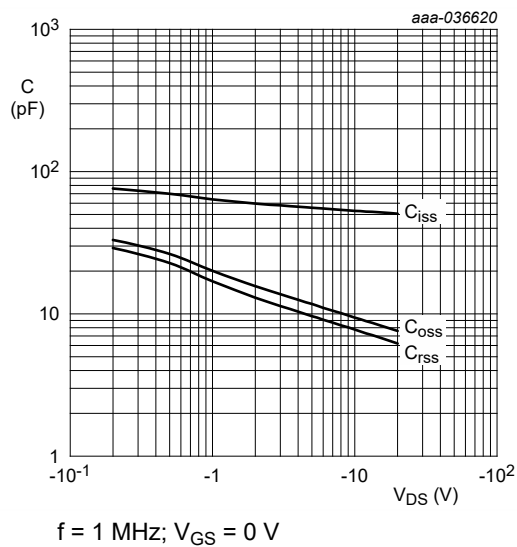


Fig. 26. TR2: input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

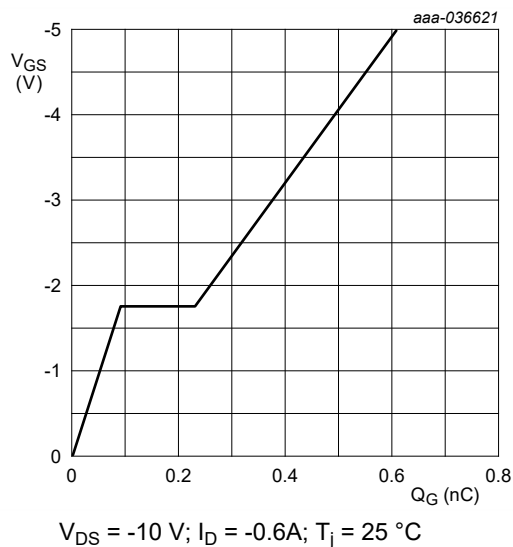
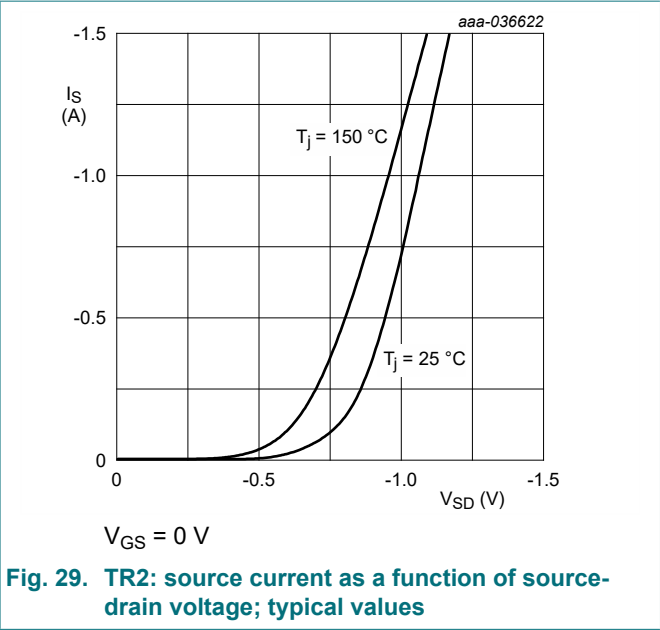
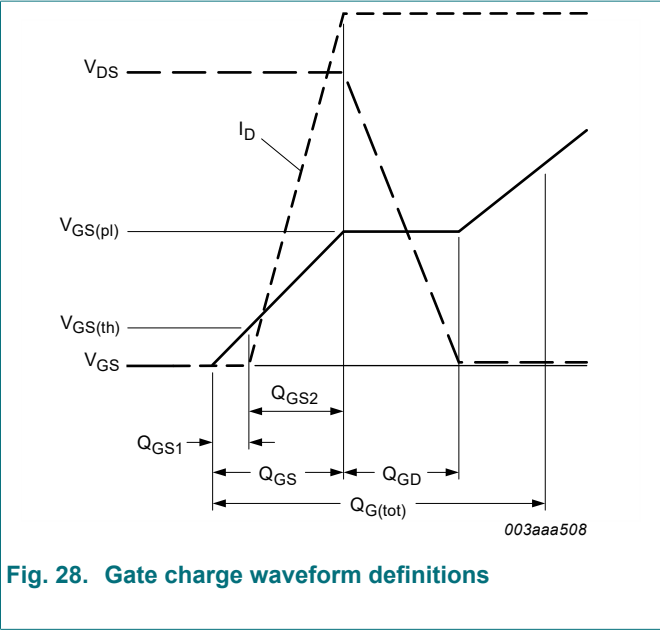
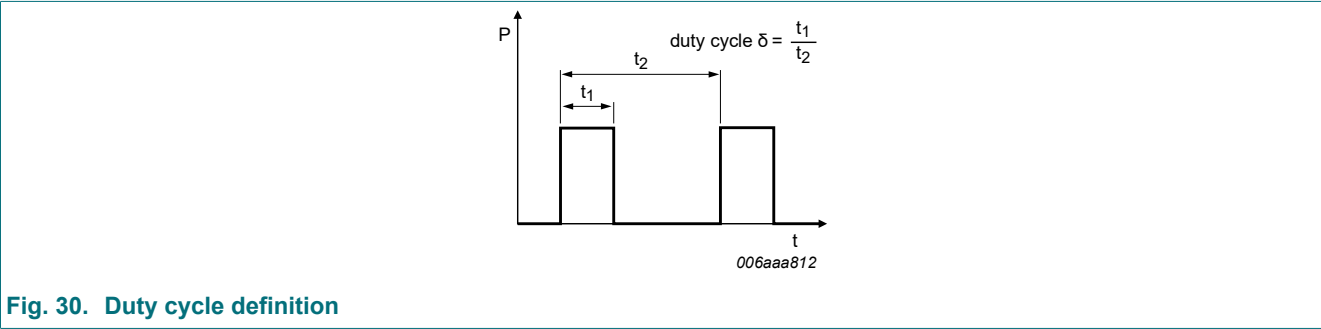


Fig. 27. TR2: gate-source voltage as a function of gate charge; typical values



11. Test information



12. Package outline

DFN1010B-6: plastic thermal enhanced ultra thin small outline package; no leads;
6 terminals; body: 1.1 x 1.0 x 0.37 mm

SOT1216

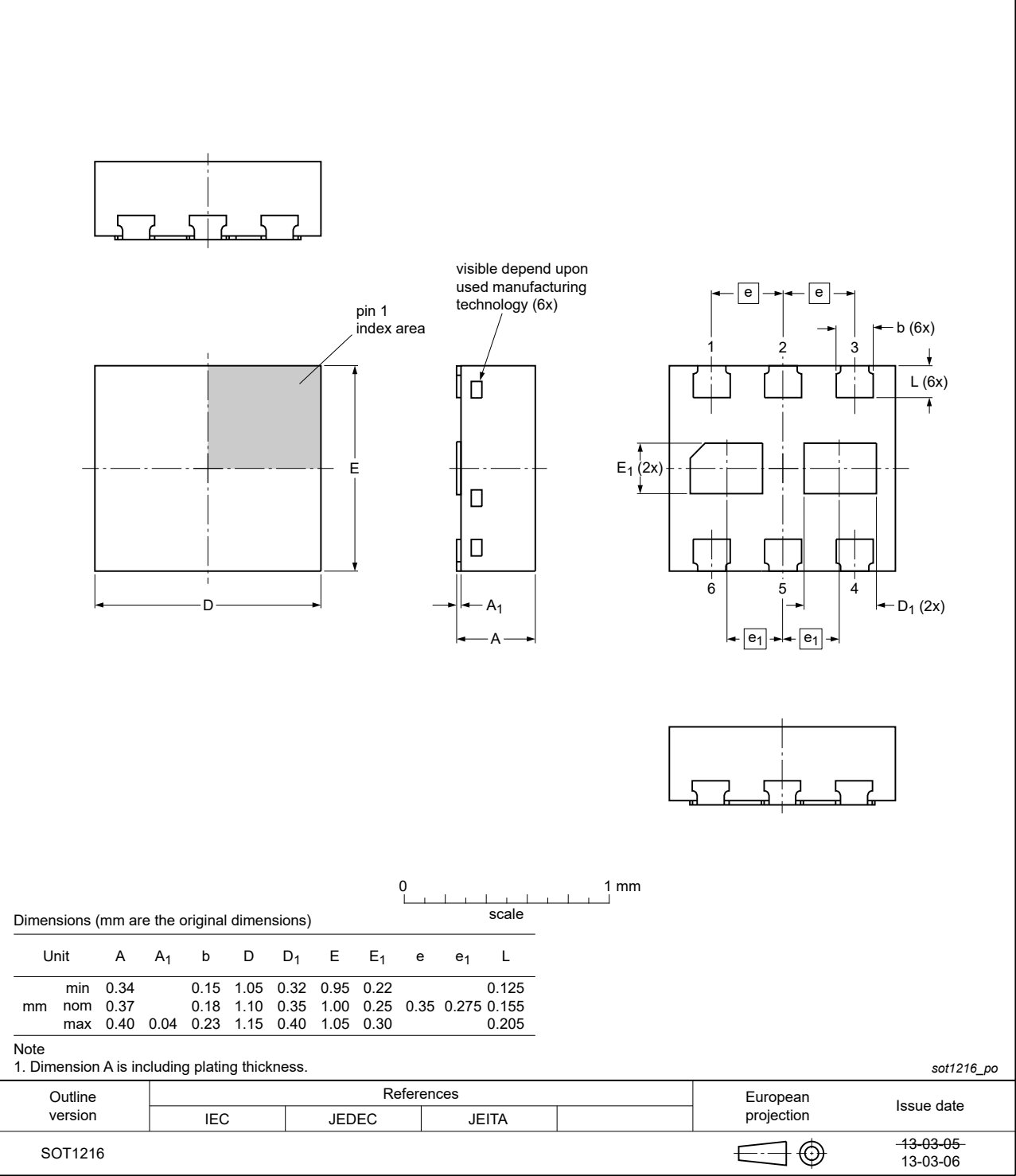
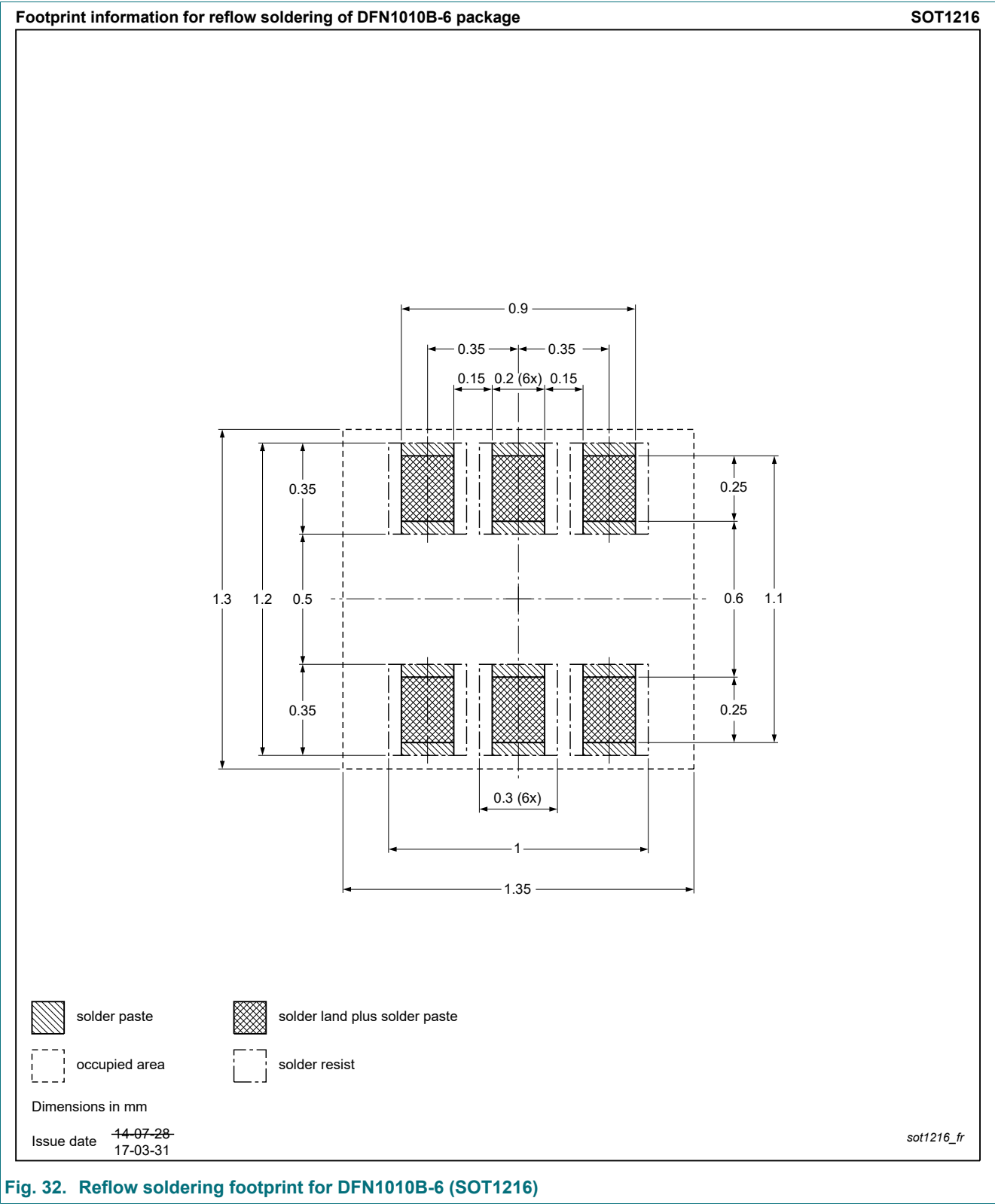


Fig. 31. Package outline DFN1010B-6 (SOT1216)

13. Soldering



14. Revision history

Table 9. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMCXB290UE v.1	20230530	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>.

Definitions

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