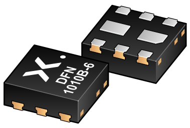

PMCXB290UE

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_{DSon}	drain-source on-state resistance	V_{GS} = 4.5 V; I_D = 1.2 A; T_j = 25 °C		-	270	320	mΩ
TR2 (P-channel), Static characteristics							
R_{DSon}	drain-source on-state resistance	V_{GS} = -4.5 V; I_D = -1.2 A; T_j = 25 °C		-	590	770	mΩ
TR1 (N-channel)							
V_{DS}	drain-source voltage	T_j = 25 °C		-	-	20	V
I_D	drain current	V_{GS} = 4.5 V; T_{amb} = 25 °C	[1]	-	-	930	mA
TR2 (P-channel)							
V_{DS}	drain-source voltage	T_j = 25 °C		-	-	-20	V
I_D	drain current	V_{GS} = -4.5 V; T_{amb} = 25 °C	[1]	-	-	-570	mA

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

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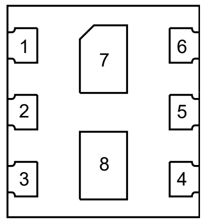
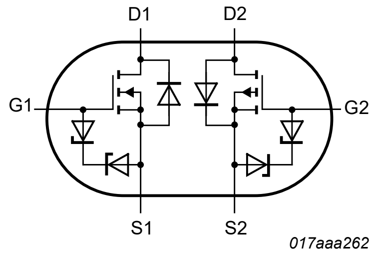
5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S1	source TR1	Transparent top view **DFN1010B-6 (SOT1216)**	
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

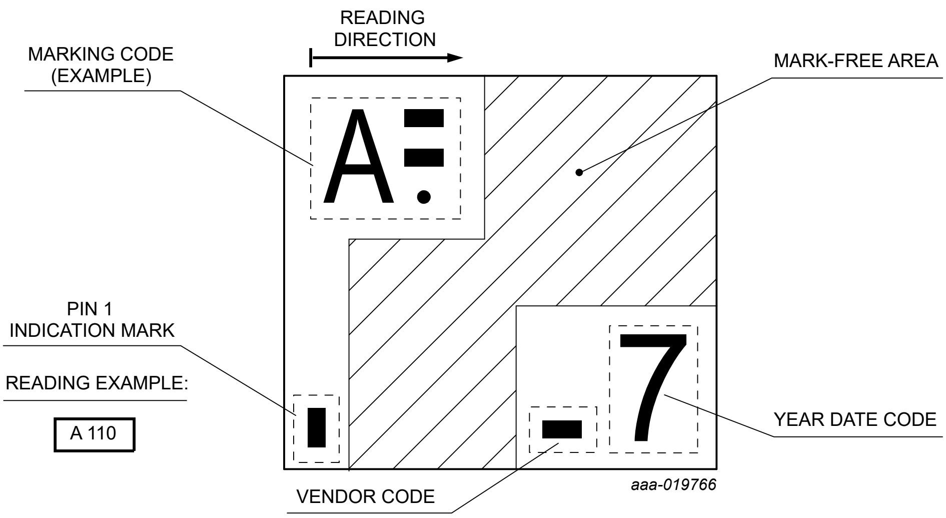


Fig. 1. DFN1010B-6 (SOT1216) binary marking code description

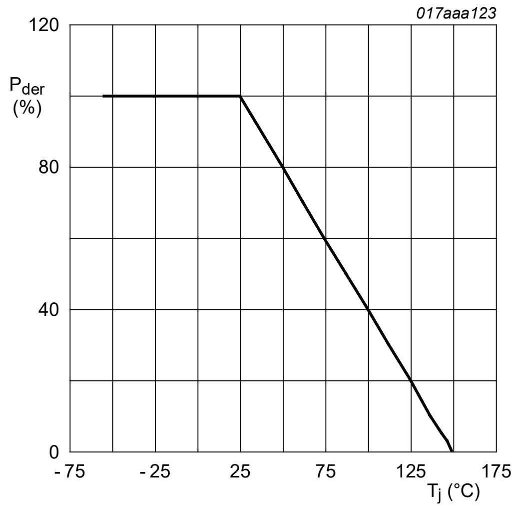
8. Limiting values

Table 5. Limiting values

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

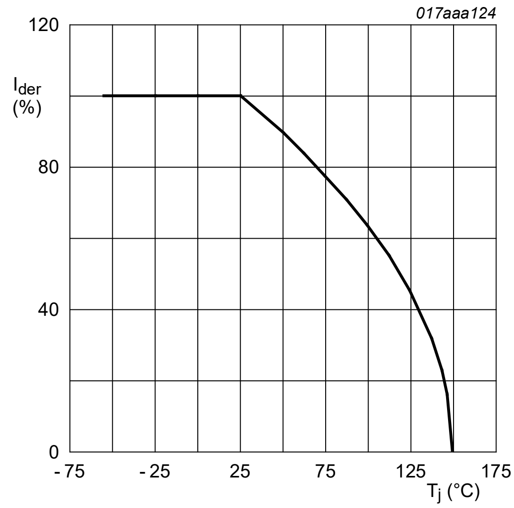
Symbol	Parameter	Conditions		Min	Max	Unit
TR1 (N-channel)						
V_{DS}	drain-source voltage	T_j = 25 °C		-	20	V
V_{GS}	gate-source voltage			-8	8	V
I_D	drain current	V_{GS} = 4.5 V; T_{amb} = 25 °C	[1]	-	930	mA
		V_{GS} = 4.5 V; T_{sp} = 25 °C		-	3.5	A
		V_{GS} = 4.5 V; T_{amb} = 100 °C	[1]	-	590	mA
		V_{GS} = 4.5 V; T_{sp} = 100 °C		-	2.2	A
I_{DM}	peak drain current	T_{amb} = 25 °C; single pulse; $t_p \leq$ 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; $t_p \leq$ 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 cm^2.
[2] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.



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

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



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

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

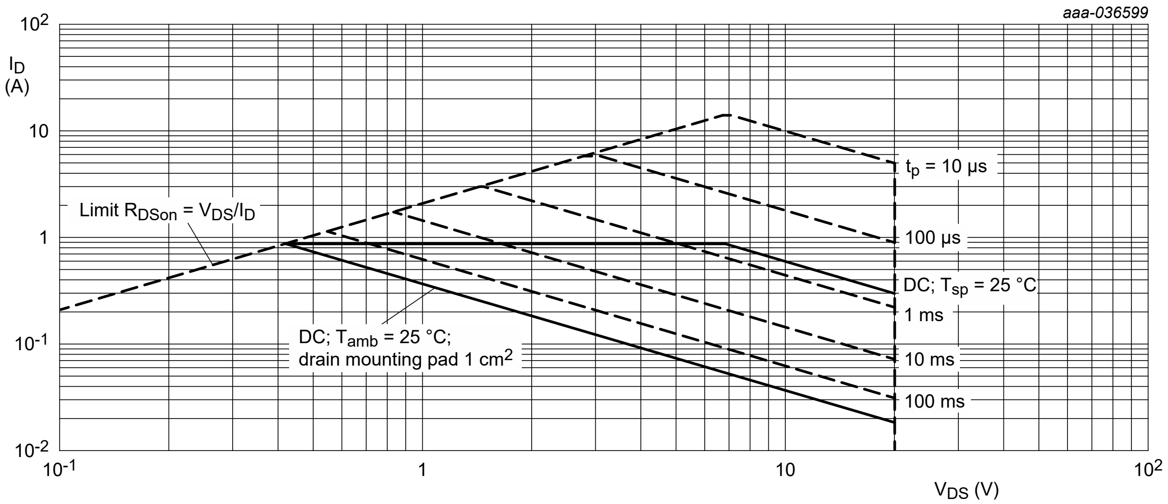


Fig. 4. TR1 (N-channel): safe operating area; junction to ambient; continuous and peak drain currents as a function of drain-source voltage

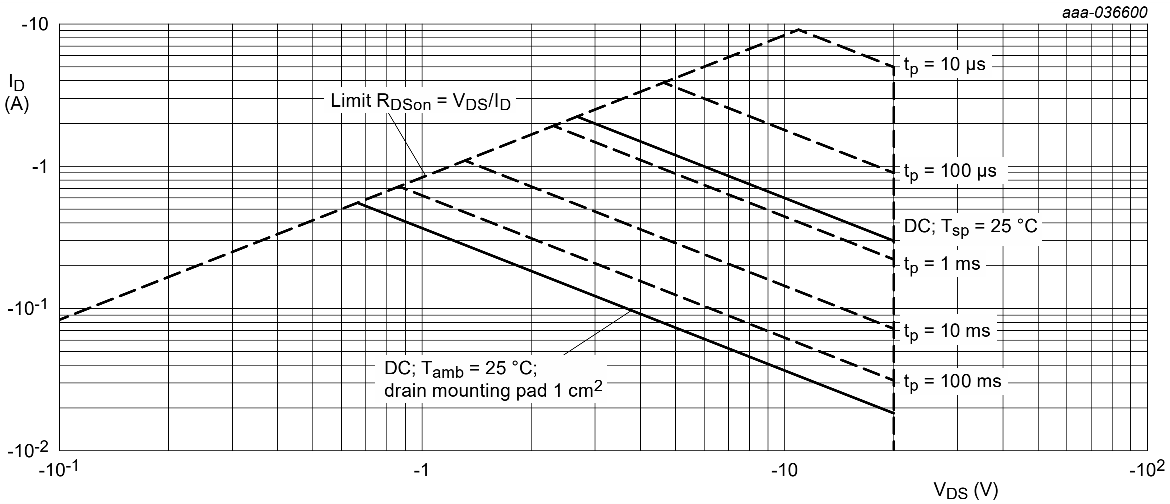


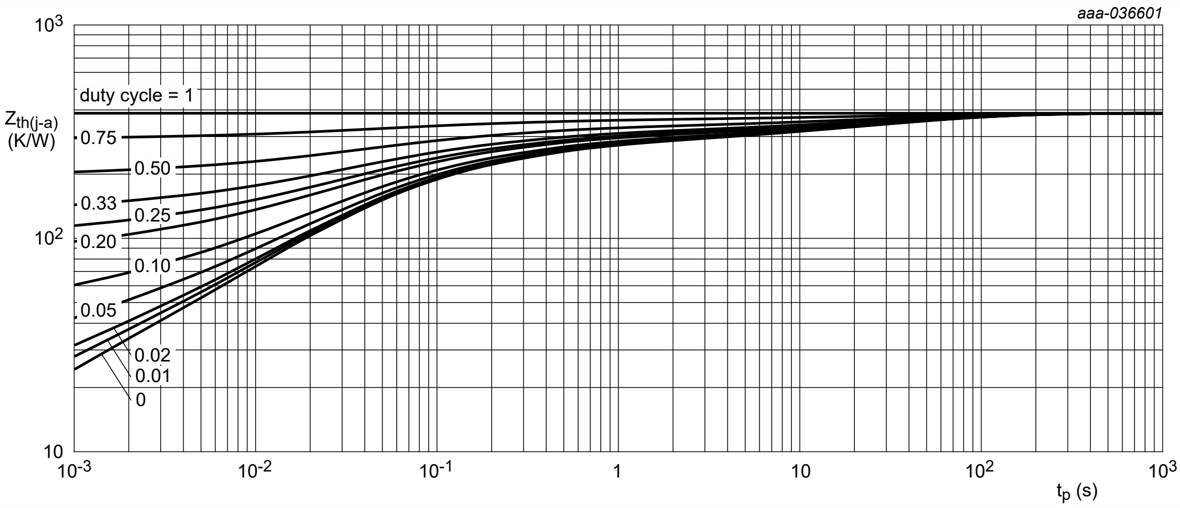
Fig. 5. TR2 (P-channel): safe operating area; junction to ambient; continuous and peak drain currents as a function of drain-source voltage

9. Thermal characteristics

Table 6. Thermal characteristics

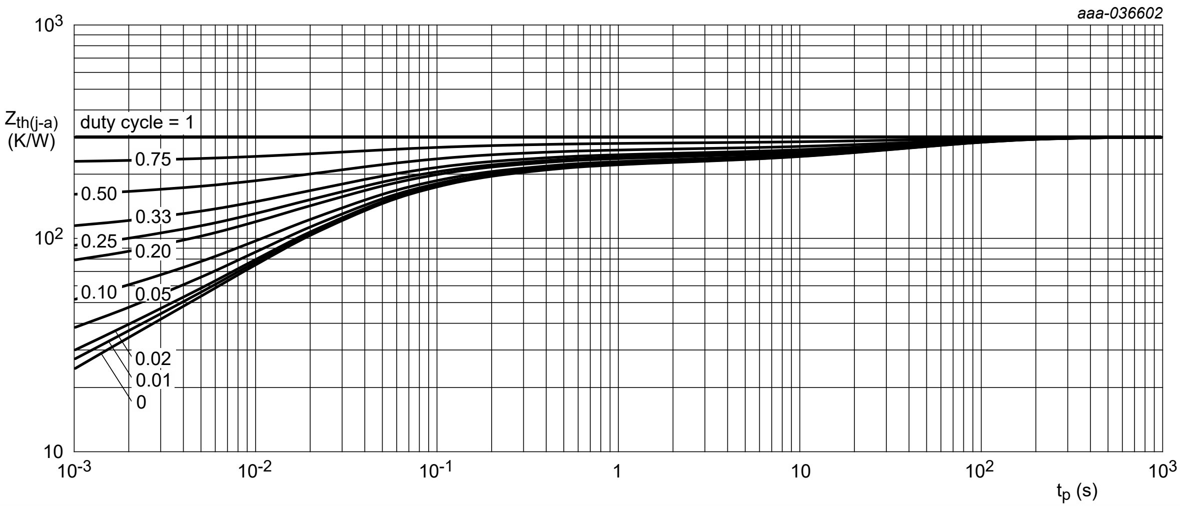
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	386	444	K/W
			[2]	-	297	342	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	18	21	K/W

[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 cm^2.



FR4 PCB, standard footprint

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



FR4 PCB, mounting pad for drain 1 cm^2

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

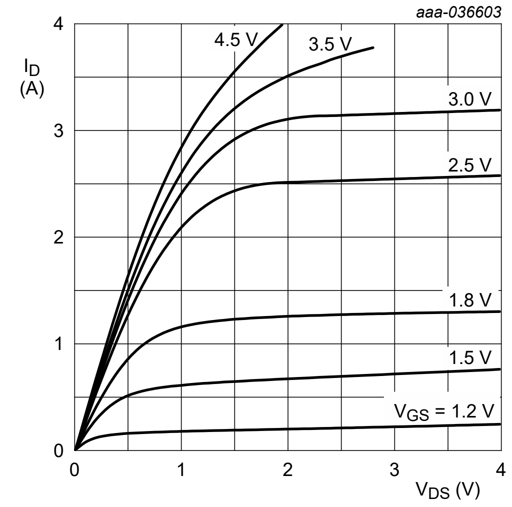
10. Characteristics

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	320	mΩ
		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

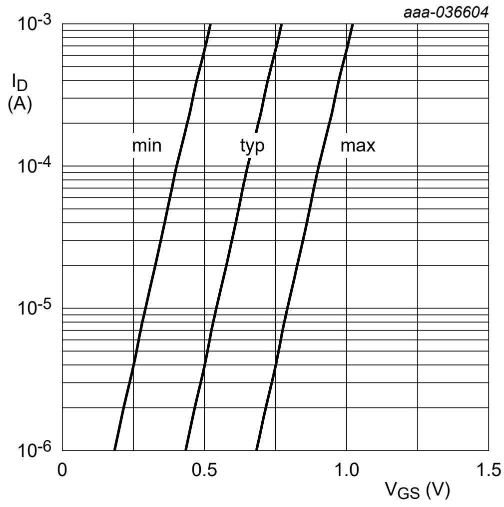
Table 8. Characteristics

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



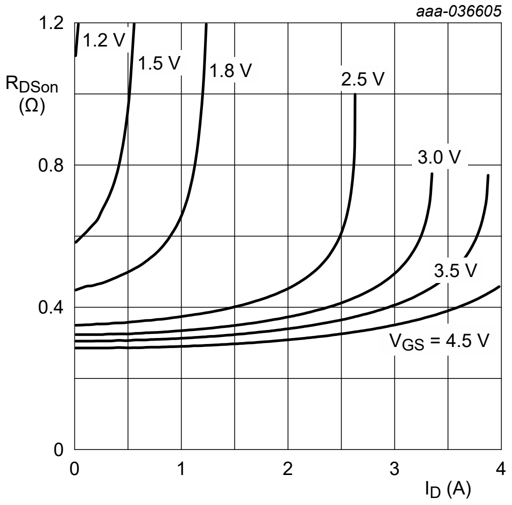
T_j = 25 °C

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



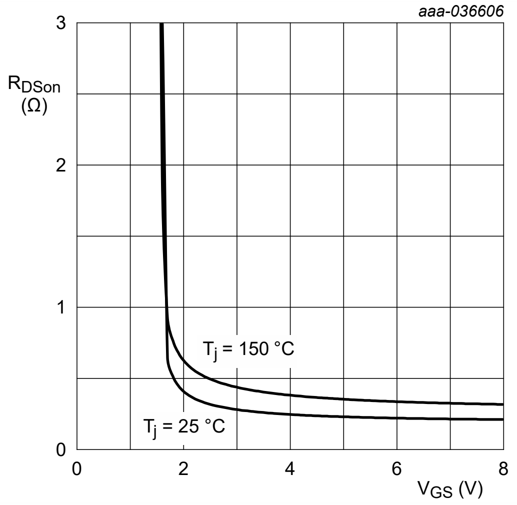
V_{DS} = 5 V; T_j = 25 °C

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



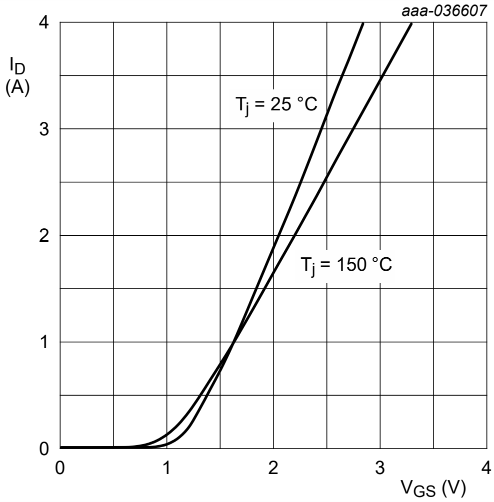
T_j = 25 °C

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



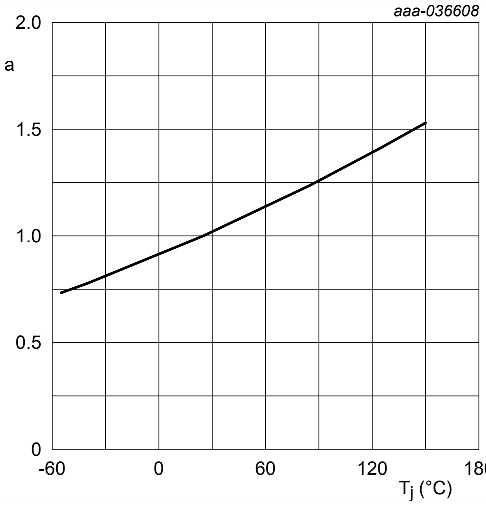
I_D = 0.87 A

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



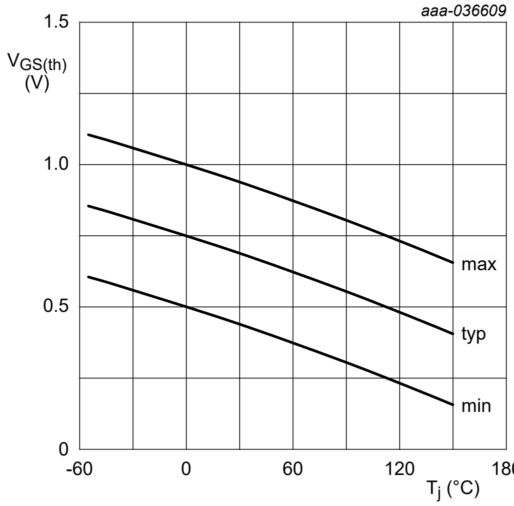
$V_{DS} = I_D \times R_{DSon}$

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



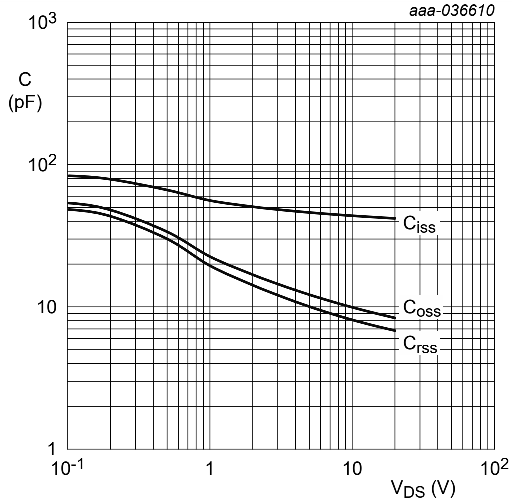
$$a = \frac{R_{DSon}}{R_{DSon(25°C)}}$$

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



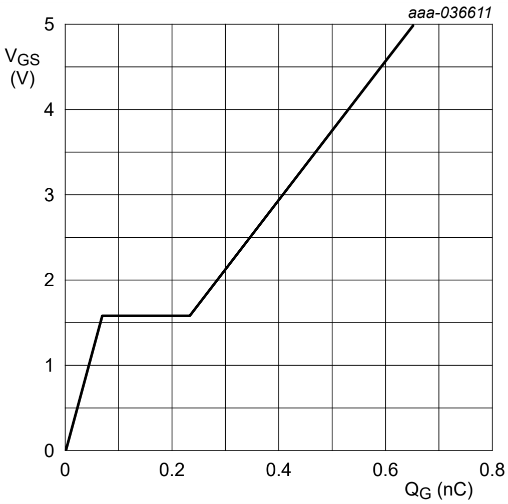
$I_D = 250\ \mu A$; $V_{DS} = V_{GS}$

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



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

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



I_D = 1.2 A; V_{DS} = 10 V; T_{amb} = 25 °C

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

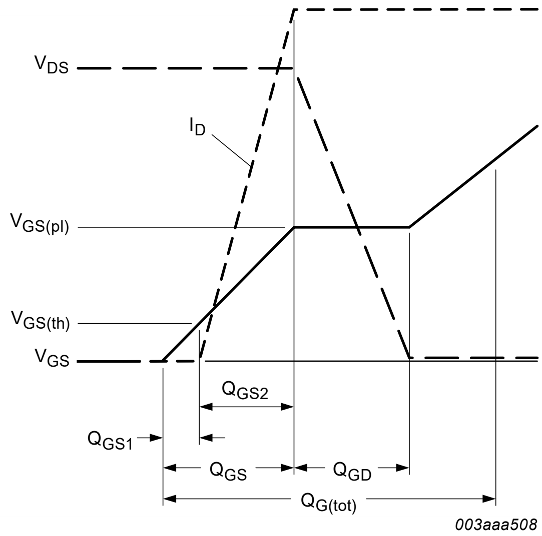
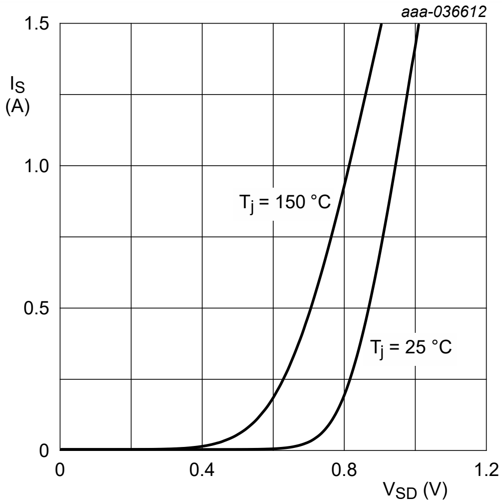
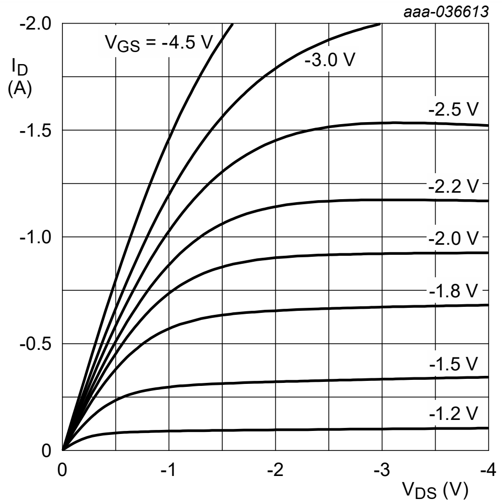


Fig. 17. Gate charge waveform definitions



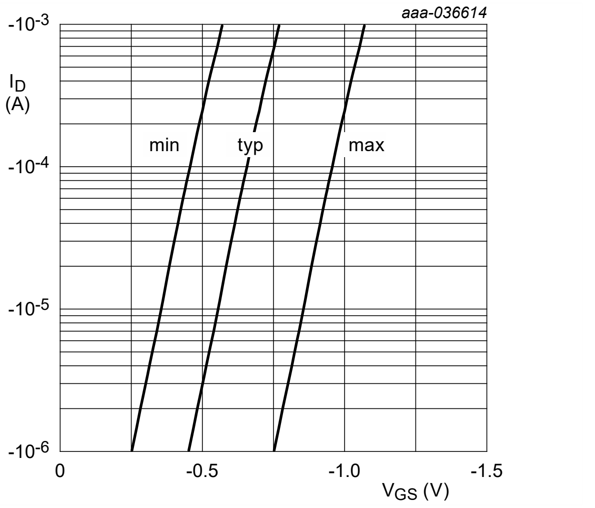
V_{GS} = 0 V

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



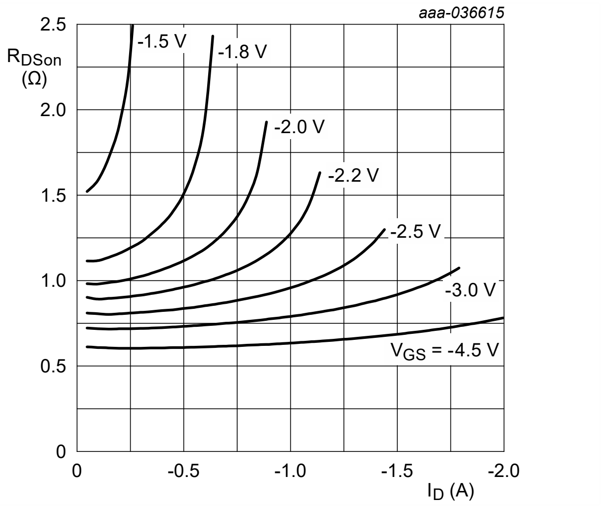
T_j = 25 °C

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



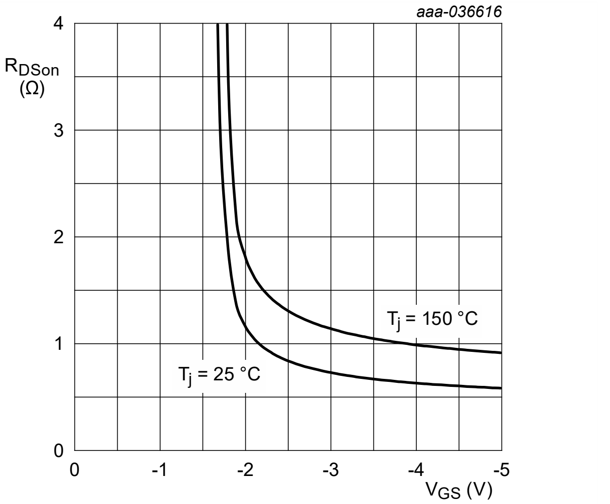
V_{DS} = -5 V; T_j = 25 °C

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



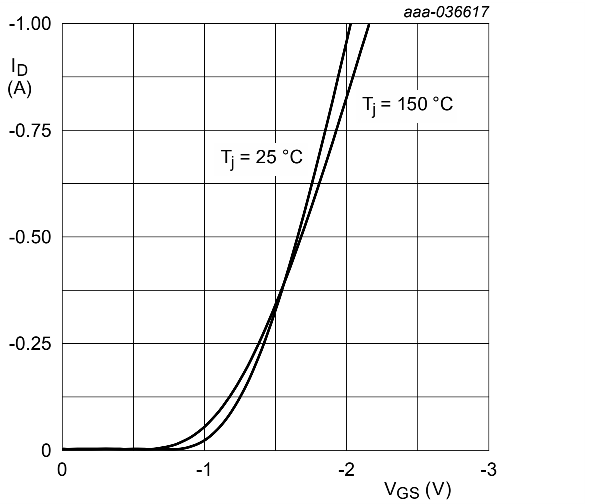
T_j = 25 °C

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



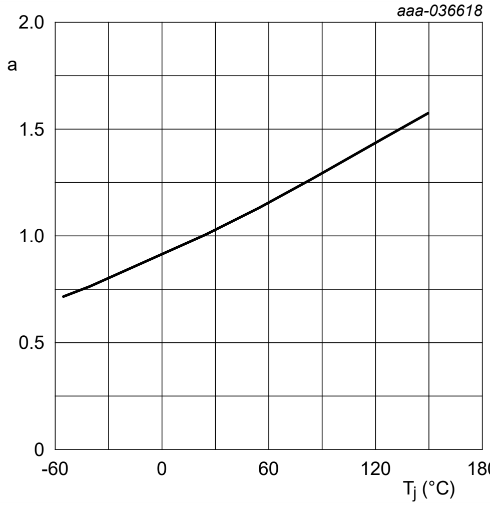
I_D = -0.57 A

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



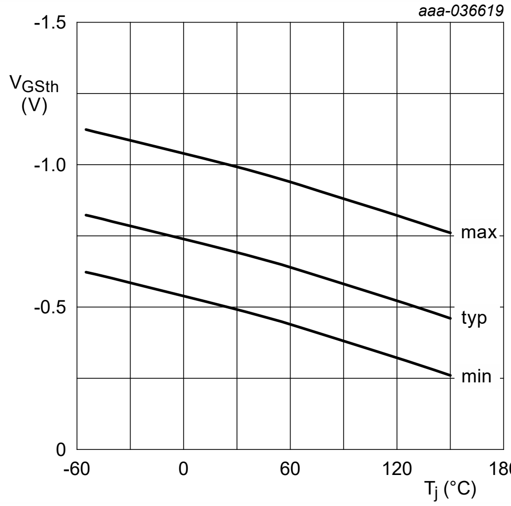
V_{DS} = I_D x R_{DSon}

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



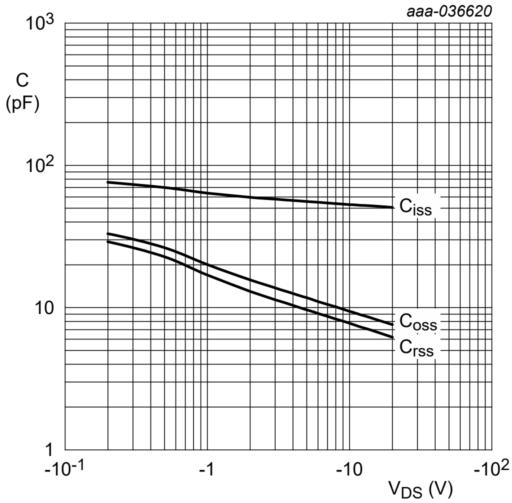
$$a = \frac{R_{DSon}}{R_{DSon(25°C)}}$$

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



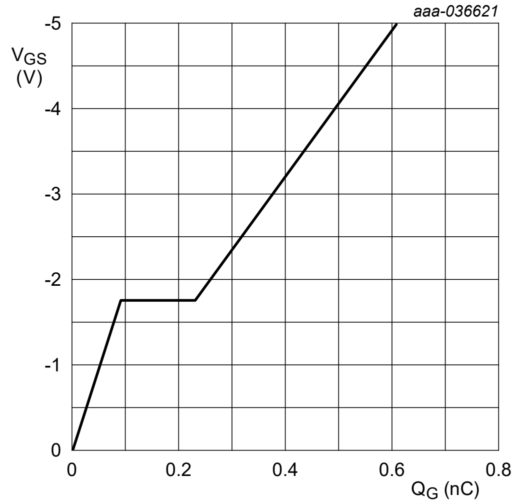
I_D = -250 µA; V_{DS} = V_{GS}

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



f = 1 MHz; V_{GS} = 0 V

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



V_{DS} = -10 V; I_D = -0.6A; T_j = 25 °C

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

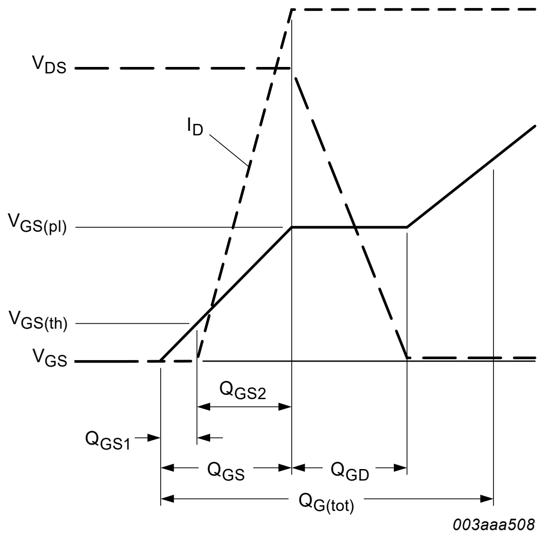


Fig. 28. Gate charge waveform definitions

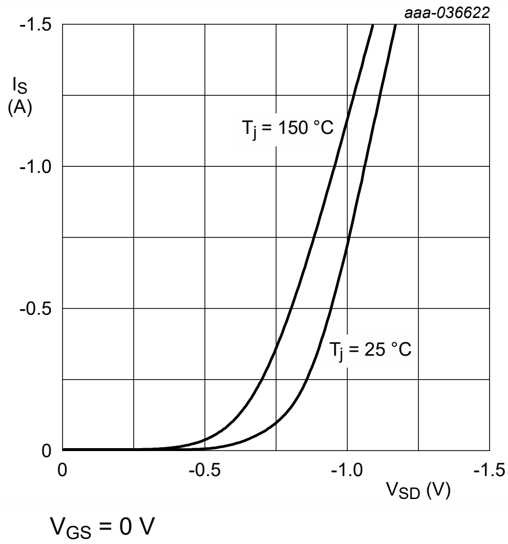


Fig. 29. TR2: source current as a function of source-drain voltage; typical values

11. Test information

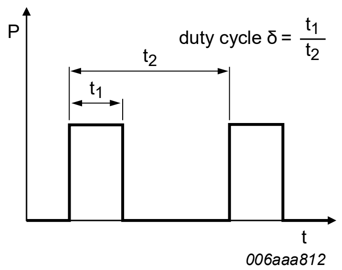
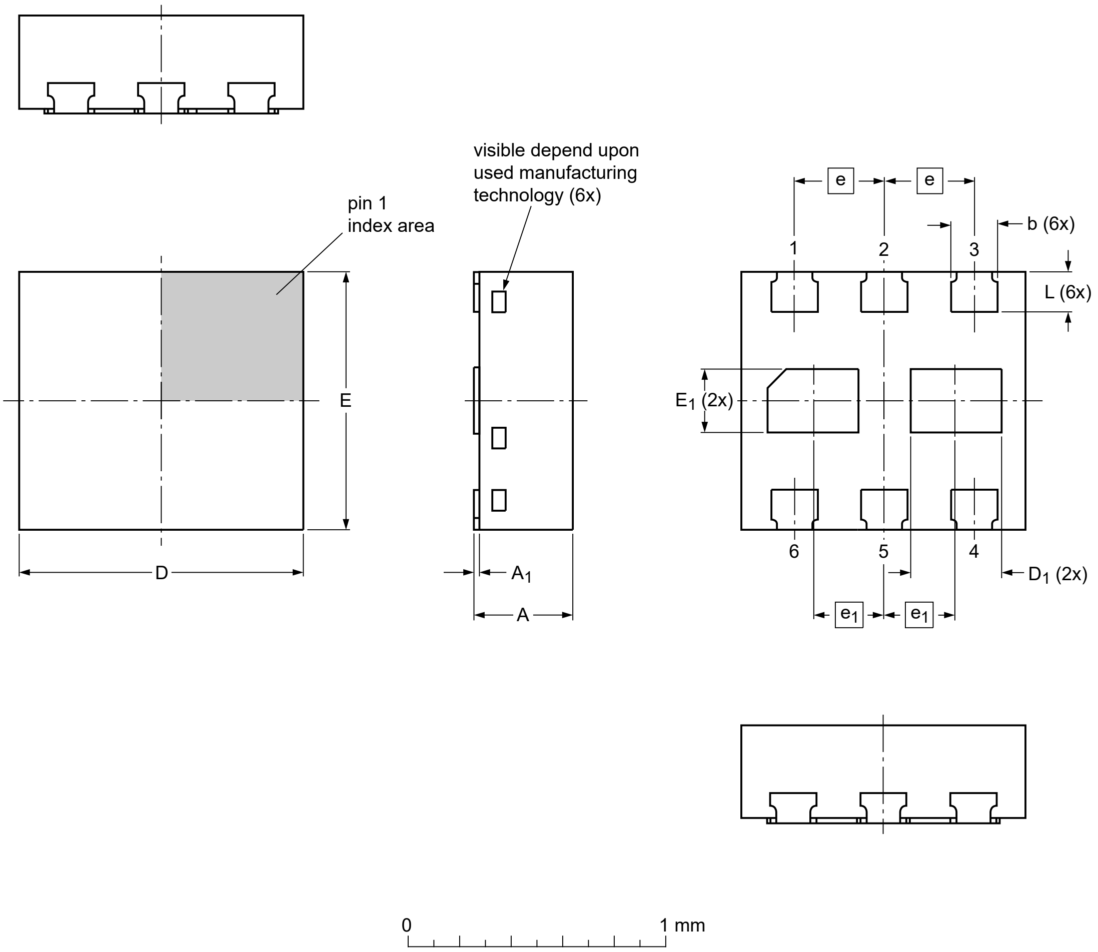


Fig. 30. Duty cycle definition

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**



Dimensions (mm are the original dimensions)

Unit		A	A_1	b	D	D_1	E	E_1	e	e_1	L
mm	min	0.34		0.15	1.05	0.32	0.95	0.22			0.125
	nom	0.37		0.18	1.10	0.35	1.00	0.25	0.35	0.275	0.155
	max	0.40	0.04	0.23	1.15	0.40	1.05	0.30			0.205

Note
1. Dimension A is including plating thickness.

sot1216_po

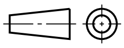
Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1216						~~13-03-05~~ 13-03-06

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

13. Soldering

Footprint information for reflow soldering of DFN1010B-6 package **SOT1216**

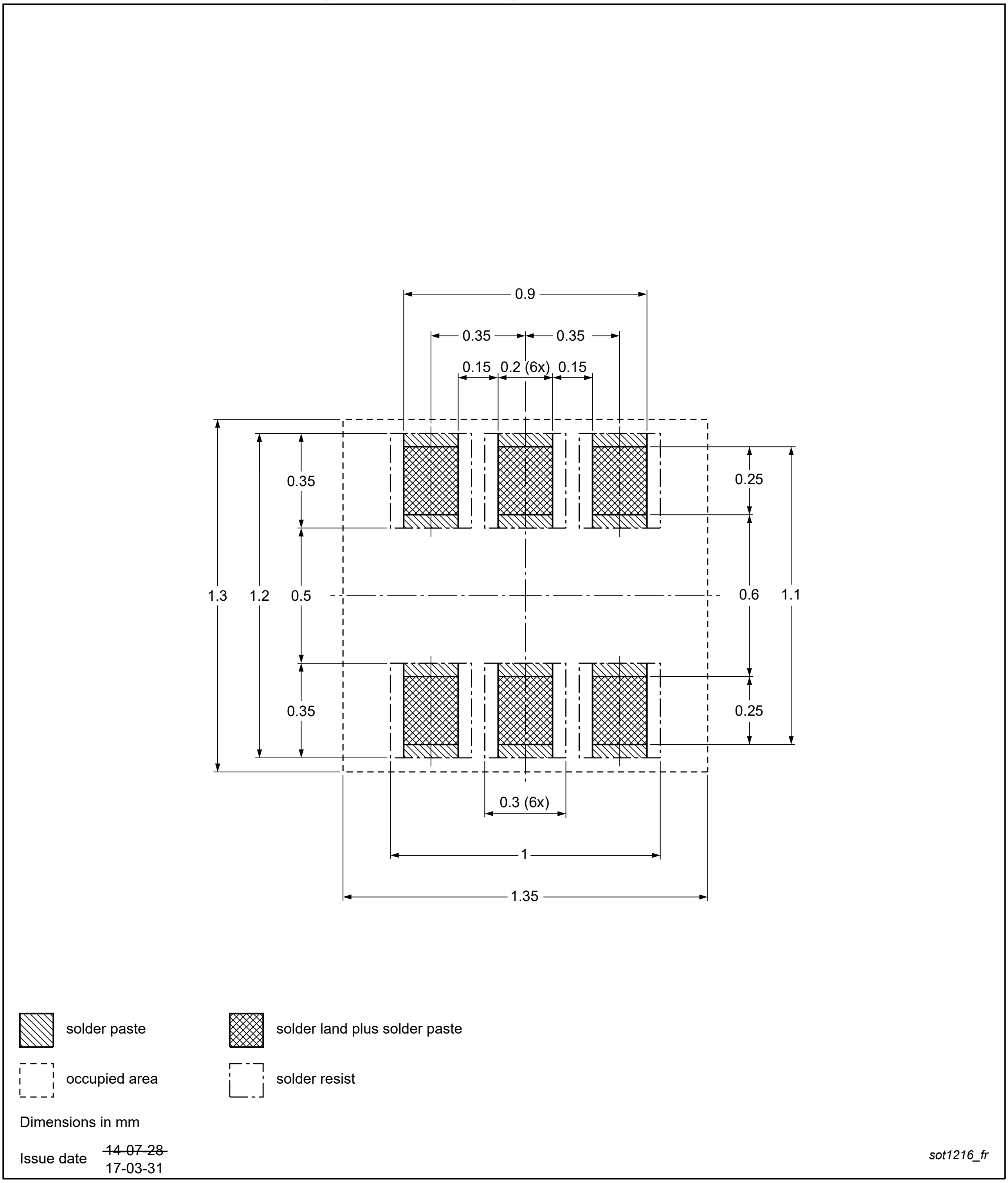


Fig. 32. Reflow soldering footprint for DFN1010B-6 (SOT1216)

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.

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