



PMCXB900UEL

20 V, complementary N/P-channel Trench MOSFET

28 June 2016

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 leakage current
- Trench MOSFET technology
- Very low threshold voltage for portable applications: $V_{GS(th)} = 0.7 \text{ V}$
- Leadless ultra small and ultra thin SMD plastic package: $1.1 \times 1.0 \times 0.37 \text{ mm}$
- ElectroStatic Discharge (ESD) protection $> 1 \text{ kV HBM}$

3. Applications

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

4. Quick reference data

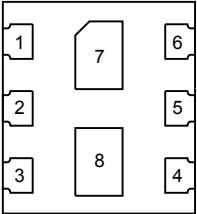
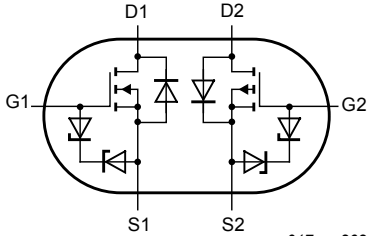
Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
TR1 (N-channel)							
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]	-	-	600	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
TR1 (N-channel), Static characteristics							
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 4.5 \text{ V}; I_D = 600 \text{ mA}; T_J = 25 \text{ }^{\circ}\text{C}$		-	470	620	m Ω

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

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
PMCXB900UEL	DFN1010B-6	DFN1010B-6: plastic thermal enhanced ultra thin small outline package; no leads; 6 terminals	SOT1216

7. Marking

Table 4. Marking codes

Type number	Marking code
PMCXB900UEL	B 110

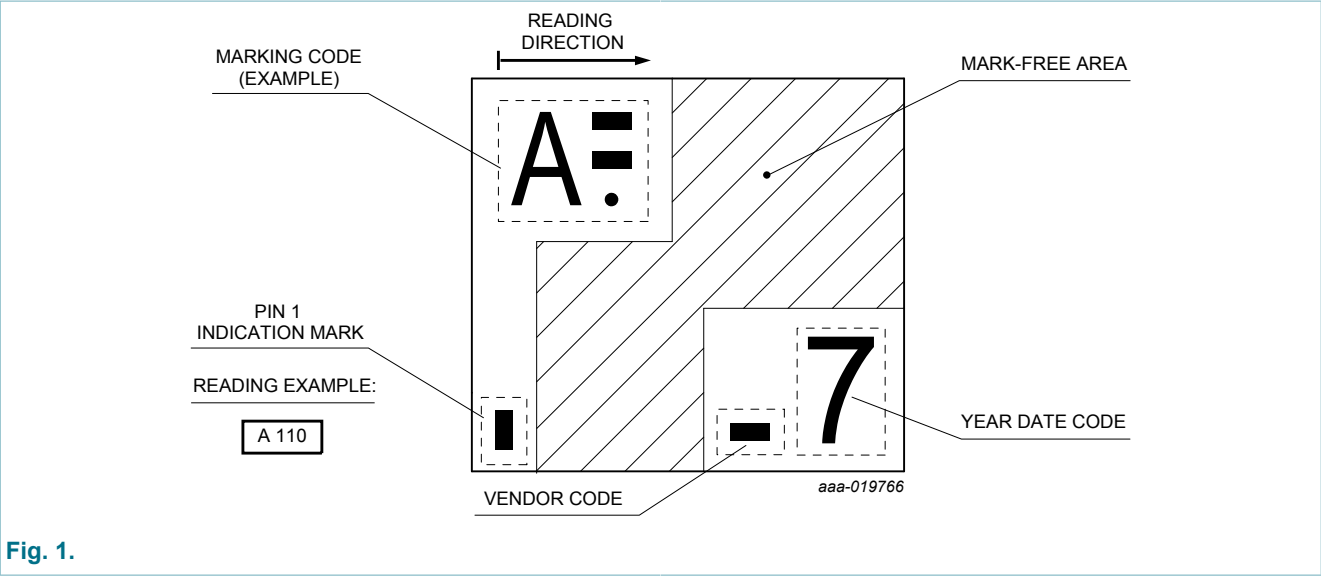


Fig. 1.

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]	-	600	mA
		V _{GS} = 4.5 V; T _{amb} = 100 °C	[1]	-	400	mA
I _{DM}	peak drain current	T _{amb} = 25 °C; single pulse; t _p ≤ 10 μs		-	2.5	A
P _{tot}	total power dissipation	T _{amb} = 25 °C	[2]	-	265	mW
			[1]	-	380	mW
		T _{sp} = 25 °C		-	4025	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]	-	-500	mA
		V _{GS} = -4.5 V; T _{amb} = 100 °C	[1]	-	-300	mA
I _{DM}	peak drain current	T _{amb} = 25 °C; single pulse; t _p ≤ 10 μs		-	-2	A
P _{tot}	total power dissipation	T _{amb} = 25 °C	[2]	-	265	mW
			[1]	-	380	mW
		T _{sp} = 25 °C		-	4025	mW
Per device						
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]	-	400	mA
TR2 (P-channel), Source-drain diode						
I _S	source current	T _{amb} = 25 °C	[1]	-	-350	mA

[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.

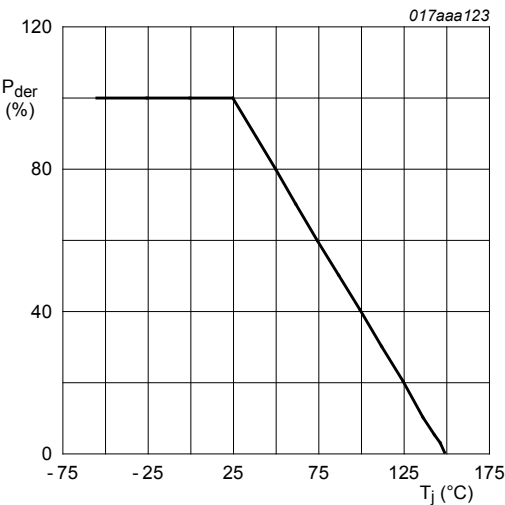


Fig. 2. MOSFET transistor: Normalized total power dissipation as a function of junction temperature

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

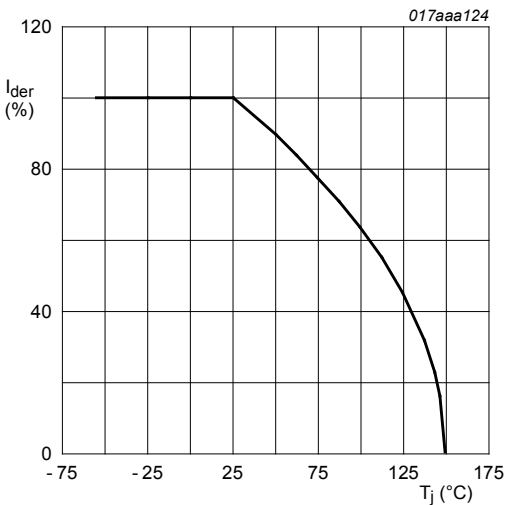


Fig. 3. MOSFET transistor: Normalized continuous drain current as a function of junction temperature

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

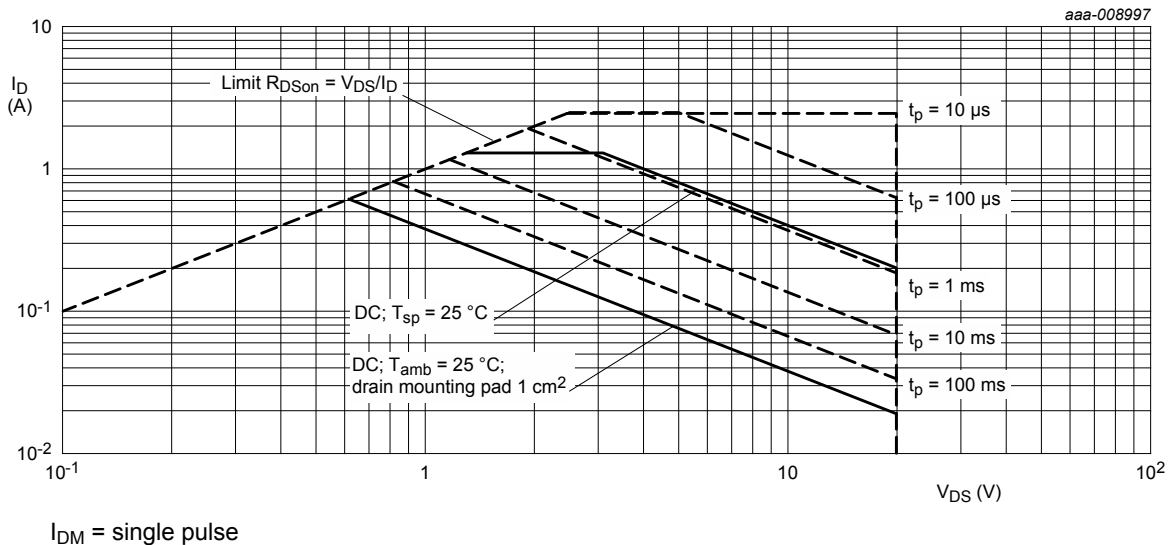
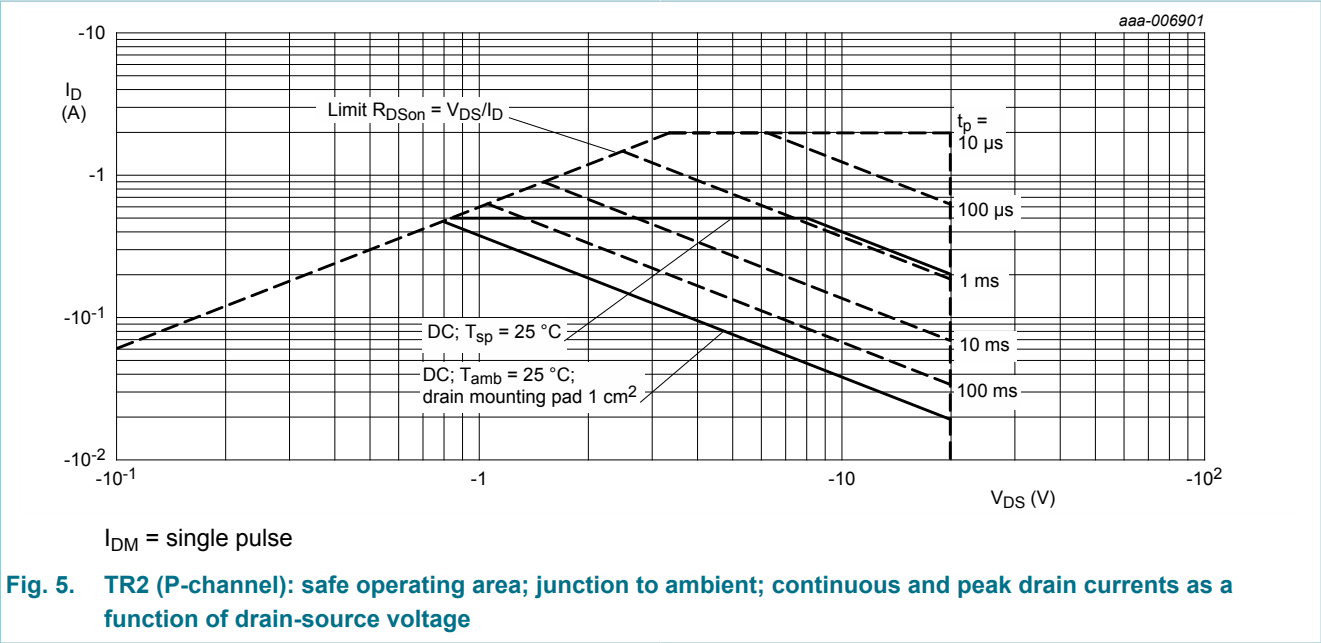


Fig. 4. TR1 (N-channel): safe operating area; junction to ambient; continuous and peak drain currents as a function of drain-source voltage

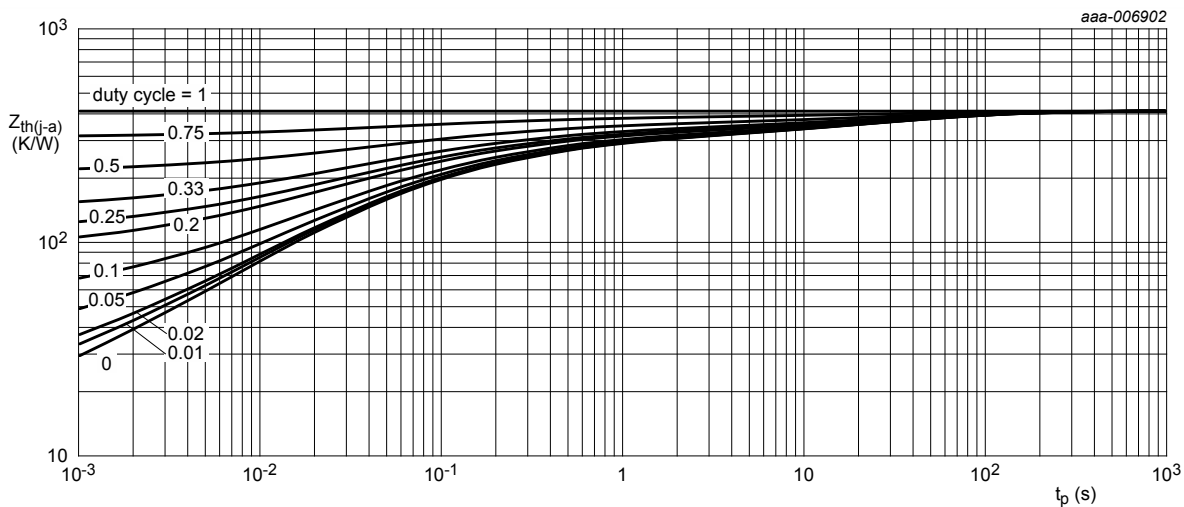


9. Thermal characteristics

Table 6. Thermal characteristics

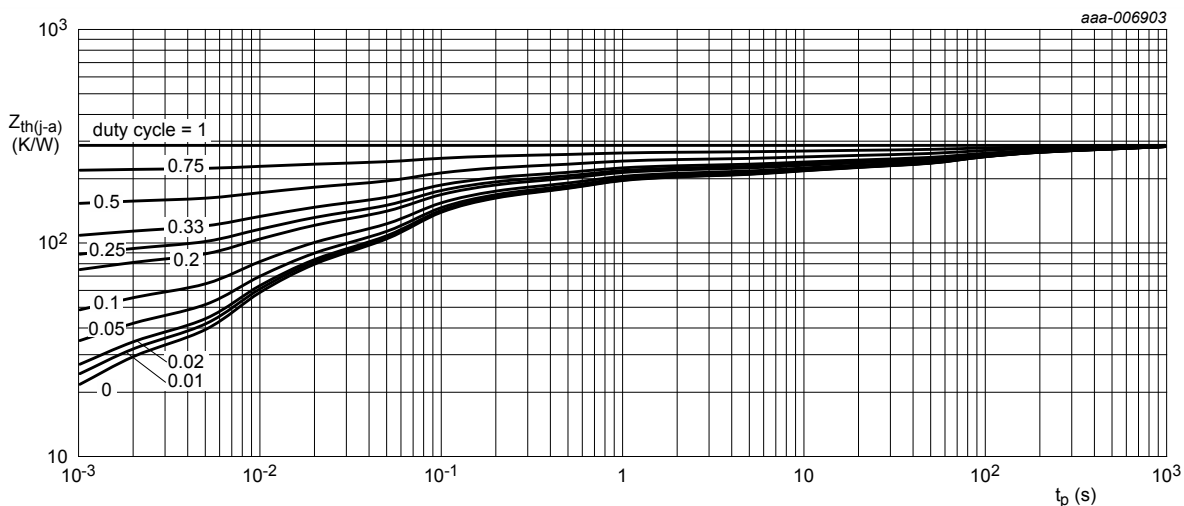
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
TR1 (N-channel)							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	410	475	K/W
			[2]	-	285	330	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	27	31	K/W
TR2 (P-channel)							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	410	475	K/W
			[2]	-	285	330	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	27	31	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 cm²

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	$I_D = 250\ \mu A$; $V_{GS} = 0\ V$; $T_j = 25\ ^\circ C$	20	-	-	V
V_{GSth}	gate-source threshold voltage	$I_D = 250\ \mu A$; $V_{DS} = V_{GS}$; $T_j = 25\ ^\circ C$	0.45	0.7	0.95	V
I_{DSS}	drain leakage current	$V_{DS} = 20\ V$; $V_{GS} = 0\ V$; $T_j = 25\ ^\circ C$	-	-	1	μA
		$V_{DS} = 5\ V$; $V_{GS} = 0\ V$; $T_j = 25\ ^\circ C$	-	-	25	nA
I_{GSS}	gate leakage current	$V_{GS} = 8\ V$; $V_{DS} = 0\ V$; $T_j = 25\ ^\circ C$	-	-	10	μA
		$V_{GS} = -8\ V$; $V_{DS} = 0\ V$; $T_j = 25\ ^\circ C$	-	-	-10	μA
		$V_{GS} = 4.5\ V$; $V_{DS} = 0\ V$; $T_j = 25\ ^\circ C$	-	-	1	μA
		$V_{GS} = -4.5\ V$; $V_{DS} = 0\ V$; $T_j = 25\ ^\circ C$	-	-	-1	μA
		$V_{GS} = 1.8\ V$; $V_{DS} = 0\ V$; $T_j = 25\ ^\circ C$	-	-	50	nA
		$V_{GS} = -1.8\ V$; $V_{DS} = 0\ V$; $T_j = 25\ ^\circ C$	-	-	-50	nA
R_{DSon}	drain-source on-state resistance	$V_{GS} = 4.5\ V$; $I_D = 600\ mA$; $T_j = 25\ ^\circ C$	-	470	620	m Ω
		$V_{GS} = 4.5\ V$; $I_D = 600\ mA$; $T_j = 150\ ^\circ C$	-	760	1000	m Ω
		$V_{GS} = 2.5\ V$; $I_D = 500\ mA$; $T_j = 25\ ^\circ C$	-	620	850	m Ω
		$V_{GS} = 1.8\ V$; $I_D = 100\ mA$; $T_j = 25\ ^\circ C$	-	845	1300	m Ω
		$V_{GS} = 1.5\ V$; $I_D = 10\ mA$; $T_j = 25\ ^\circ C$	-	1125	3000	m Ω
		$V_{GS} = 1.2\ V$; $I_D = 1\ mA$; $T_j = 25\ ^\circ C$	-	2210	-	m Ω
g_{fs}	forward transconductance	$V_{DS} = 5\ V$; $I_D = 600\ mA$; $T_j = 25\ ^\circ C$	-	1	-	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	$I_D = -250\ \mu A$; $V_{DS} = V_{GS}$; $T_j = 25\ ^\circ C$	-0.45	-0.7	-0.95	V
I_{DSS}	drain leakage current	$V_{DS} = -20\ V$; $V_{GS} = 0\ V$; $T_j = 25\ ^\circ C$	-	-	-1	μA
		$V_{DS} = -5\ V$; $V_{GS} = 0\ V$; $T_j = 25\ ^\circ C$	-	-	-25	nA
I_{GSS}	gate leakage current	$V_{GS} = 8\ V$; $V_{DS} = 0\ V$; $T_j = 25\ ^\circ C$	-	-	10	μA
		$V_{GS} = -8\ V$; $V_{DS} = 0\ V$; $T_j = 25\ ^\circ C$	-	-	-10	μA
		$V_{GS} = 4.5\ V$; $V_{DS} = 0\ V$; $T_j = 25\ ^\circ C$	-	-	1	μA
		$V_{GS} = -4.5\ V$; $V_{DS} = 0\ V$; $T_j = 25\ ^\circ C$	-	-	-1	μA
		$V_{GS} = 1.8\ V$; $V_{DS} = 0\ V$; $T_j = 25\ ^\circ C$	-	-	50	nA
		$V_{GS} = -1.8\ V$; $V_{DS} = 0\ V$; $T_j = 25\ ^\circ C$	-	-	-50	nA

20 V, complementary N/P-channel Trench MOSFET

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
R _{DSon}	drain-source on-state resistance	V _{GS} = -4.5 V; I _D = -500 mA; T _j = 25 °C		-	1.02	1.4	Ω
		V _{GS} = -4.5 V; I _D = -500 mA; T _j = 150 °C		-	1.54	2.1	Ω
		V _{GS} = -2.5 V; I _D = -200 mA; T _j = 25 °C		-	1.27	2.2	Ω
		V _{GS} = -1.8 V; I _D = -40 mA; T _j = 25 °C		-	1.7	3.3	Ω
		V _{GS} = -1.5 V; I _D = -10 mA; T _j = 25 °C		-	2.3	5	Ω
		V _{GS} = -1.2 V; I _D = -1 mA; T _j = 25 °C		-	3.5	-	Ω
g _{fs}	forward transconductance	V _{DS} = -10 V; I _D = -500 mA; T _j = 25 °C		-	480	-	mS
TR1 (N-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		-	0.4	0.7	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		-	21.3	-	pF
C _{oss}	output capacitance			-	5.4	-	pF
C _{rss}	reverse transfer capacitance			-	4.2	-	pF
t _{d(on)}	turn-on delay time	V _{DS} = 10 V; I _D = 600 mA; V _{GS} = 4.5 V; R _{G(ext)} = 6 Ω; T _j = 25 °C		-	5.6	-	ns
t _r	rise time			-	9.2	-	ns
t _{d(off)}	turn-off delay time			-	19	-	ns
t _f	fall time			-	51	-	ns
TR2 (P-channel), Dynamic characteristics							
Q _{G(tot)}	total gate charge	V _{DS} = -10 V; I _D = -450 mA; V _{GS} = -4.5 V; T _j = 25 °C		-	1.19	2.1	nC
Q _{GS}	gate-source charge			-	0.17	-	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		-	43	-	pF
C _{oss}	output capacitance			-	14	-	pF
C _{rss}	reverse transfer capacitance			-	8	-	pF
t _{d(on)}	turn-on delay time	V _{DS} = -10 V; I _D = -450 mA; V _{GS} = -4.5 V; R _{G(ext)} = 6 Ω; T _j = 25 °C		-	2.3	-	ns
t _r	rise time			-	5	-	ns
t _{d(off)}	turn-off delay time			-	13.5	-	ns
t _f	fall time			-	6	-	ns
TR1 (N-channel), Source-drain diode characteristics							
V _{SD}	source-drain voltage	I _S = 360 mA; V _{GS} = 0 V; T _j = 25 °C		-	0.8	1.2	V
TR2 (P-channel), Source-drain diode characteristics							
V _{SD}	source-drain voltage	I _S = -115 mA; V _{GS} = 0 V; T _j = 25 °C		-	-0.7	-1.2	V

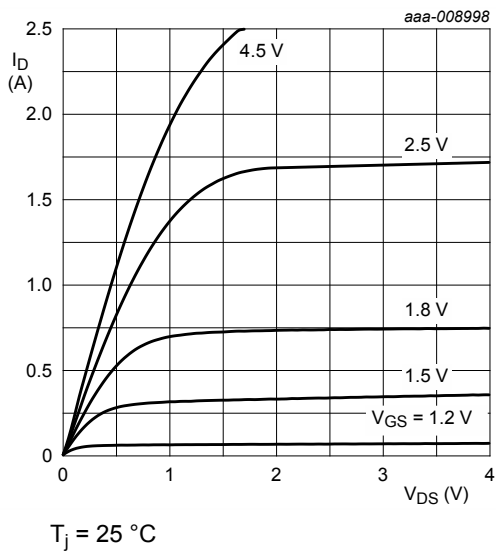


Fig. 8. TR1: output characteristics; drain current as a function of drain-source voltage; typical values

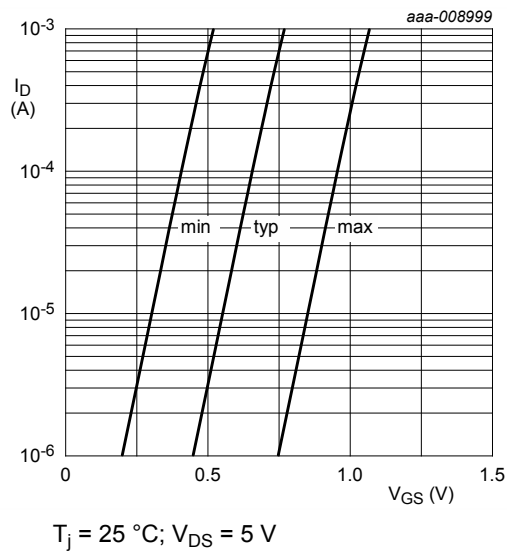


Fig. 9. TR1: sub-threshold drain current as a function of gate-source voltage

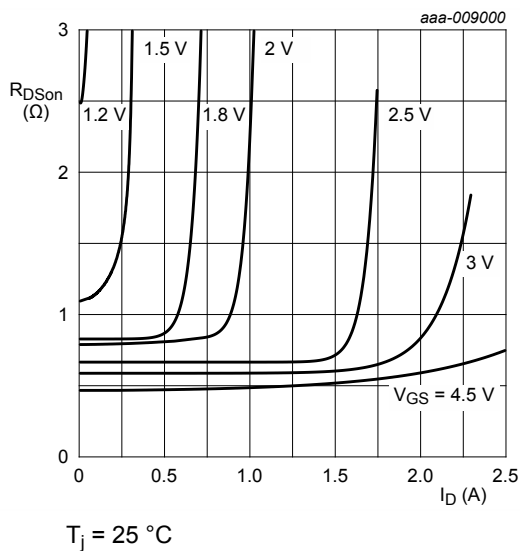


Fig. 10. TR1: drain-source on-state resistance as a function of drain current; typical values

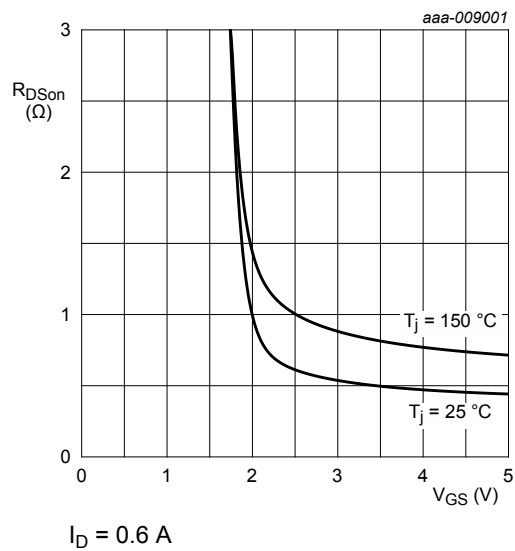


Fig. 11. TR1: drain-source on-state resistance as a function of gate-source voltage; typical values

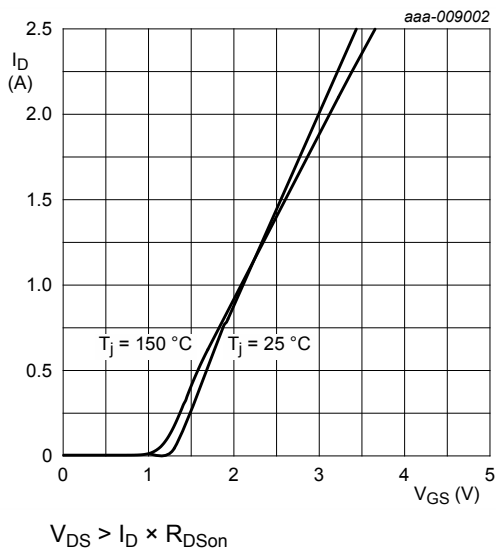


Fig. 12. TR1: transfer characteristics; drain current as a function of gate-source voltage; typical values

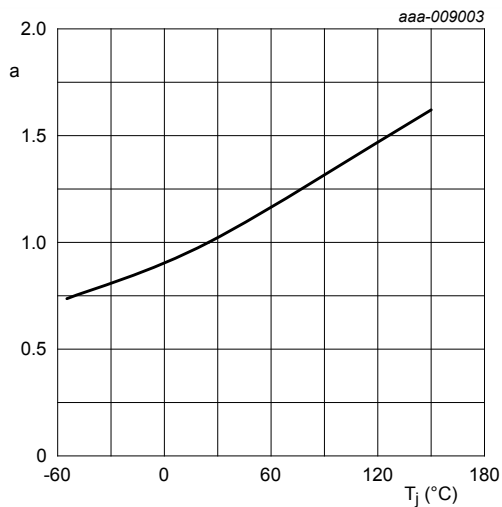


Fig. 13. TR1: normalized drain-source on-state resistance as a function of junction temperature; typical values

$$a = \frac{R_{DSon}}{R_{DSon}(25^\circ\text{C})}$$

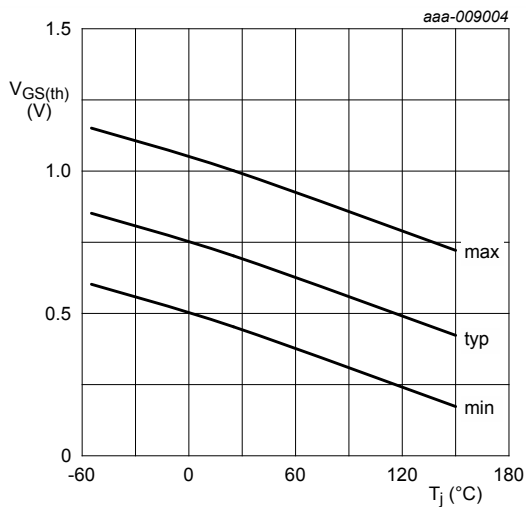


Fig. 14. TR1: gate-source threshold voltage as a function of junction temperature

$I_D = 0.25\text{ mA}$; $V_{DS} = V_{GS}$

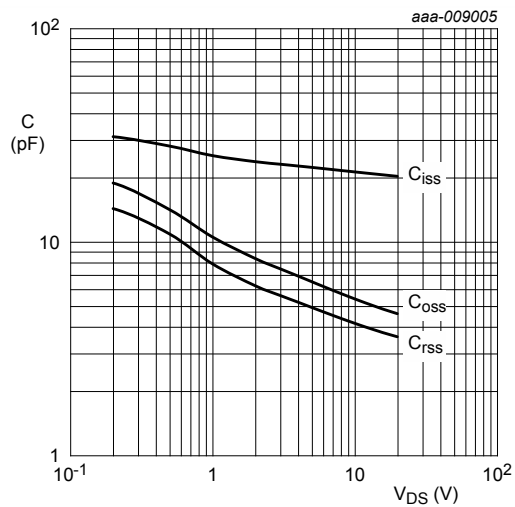


Fig. 15. TR1: input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

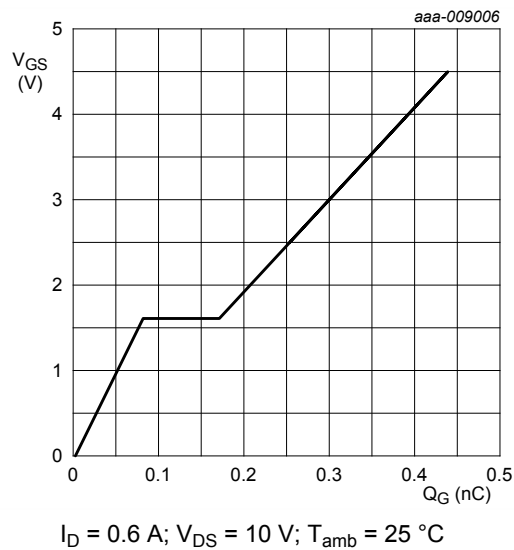


Fig. 16. TR1: gate-source voltage as a function of gate charge; typical values

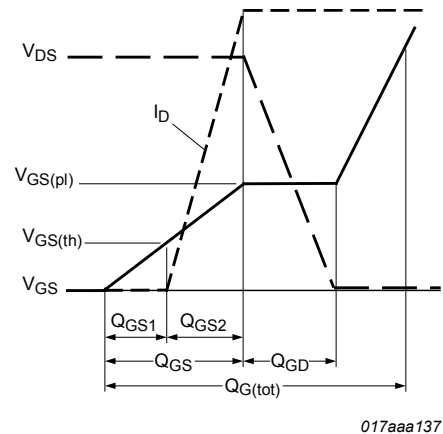


Fig. 17. Gate charge waveform definitions

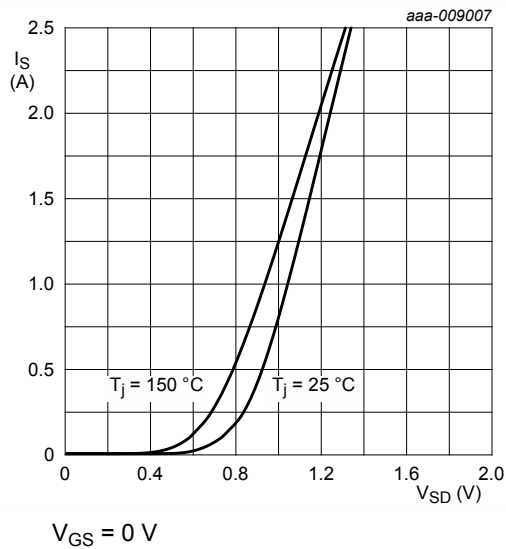


Fig. 18. TR1: source current as a function of source-drain voltage; typical values

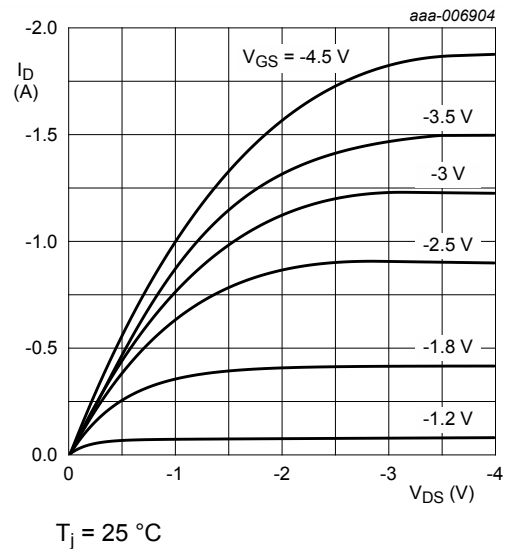


Fig. 19. TR2: output characteristics; drain current as a function of drain-source voltage; typical values

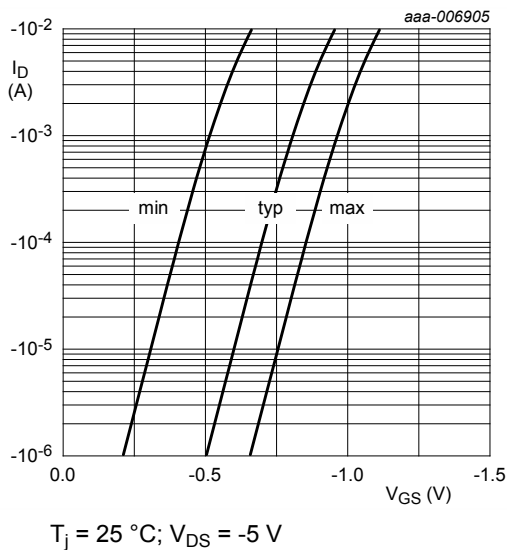


Fig. 20. TR2: sub-threshold drain current as a function of gate-source voltage

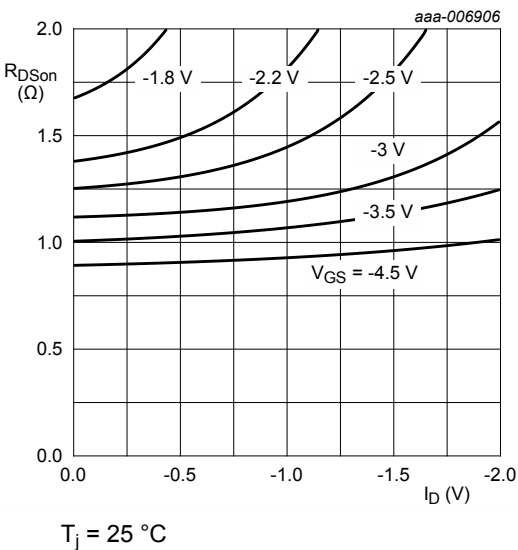


Fig. 21. TR2: drain-source on-state resistance as a function of drain current; typical values

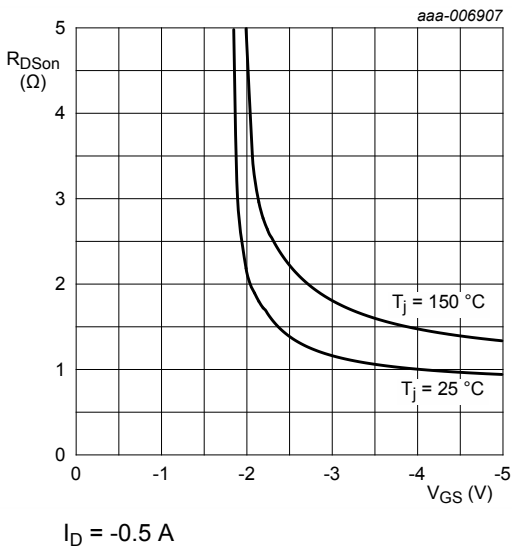


Fig. 22. TR2: drain-source on-state resistance as a function of gate-source voltage; typical values

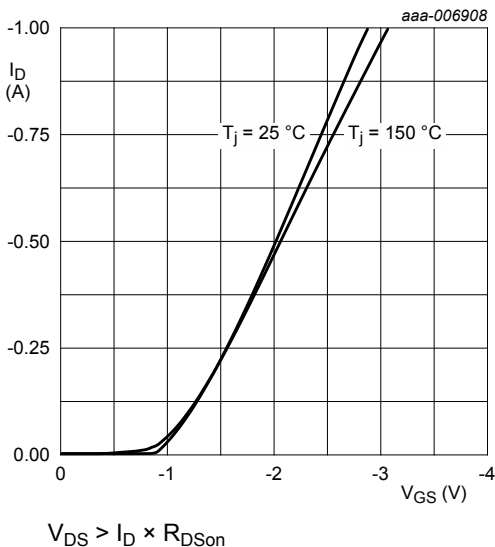


Fig. 23. TR2: transfer characteristics; drain current as a function of gate-source voltage; typical values

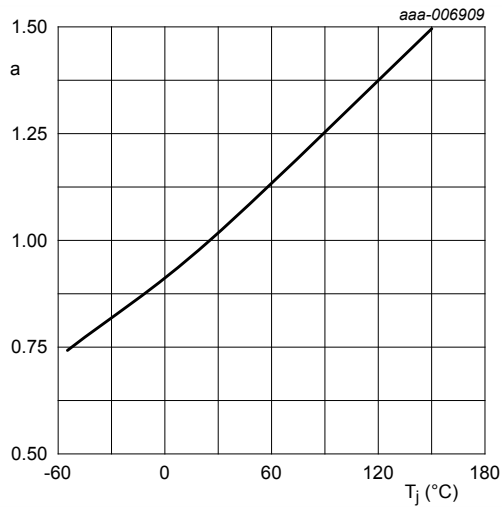
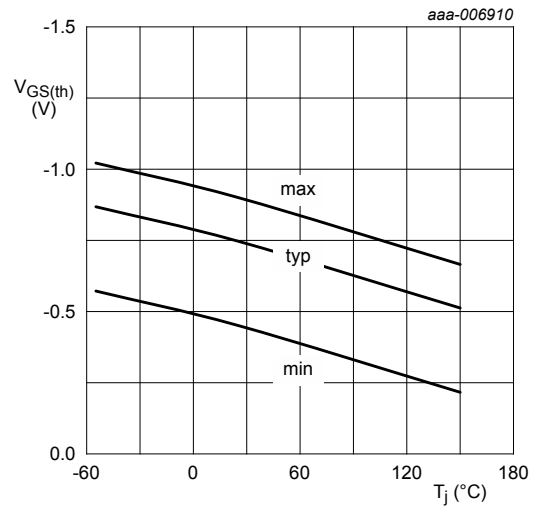


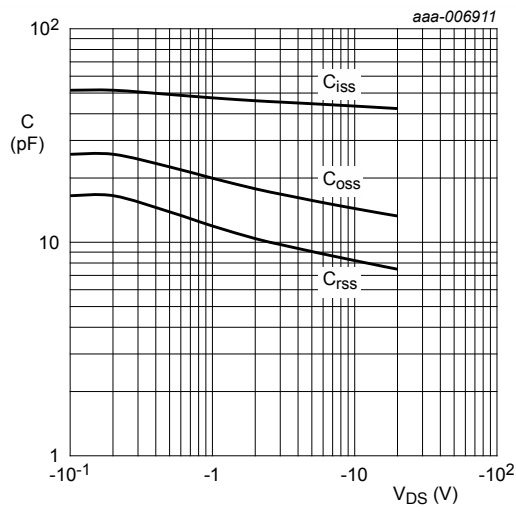
Fig. 24. TR2: normalized drain-source on-state resistance as a function of junction temperature; typical values

$$a = \frac{R_{DSon}}{R_{DSon}(25^\circ\text{C})}$$



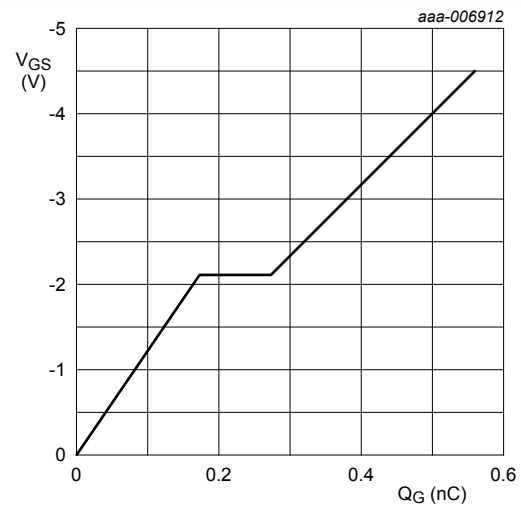
$$I_D = -0.25 \text{ mA}; V_{DS} = V_{GS}$$

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



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

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



$$I_D = -0.45 \text{ A}; V_{DS} = -10 \text{ V}; T_{amb} = 25^\circ\text{C}$$

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

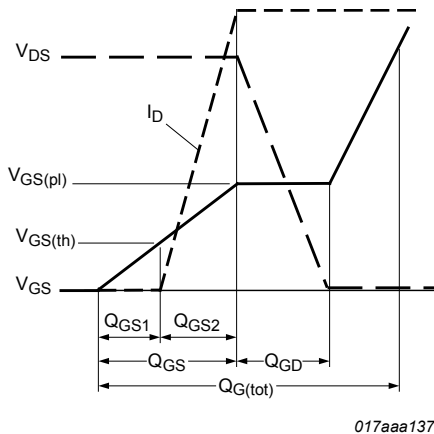


Fig. 28. MOSFET transistor: Gate charge waveform definitions

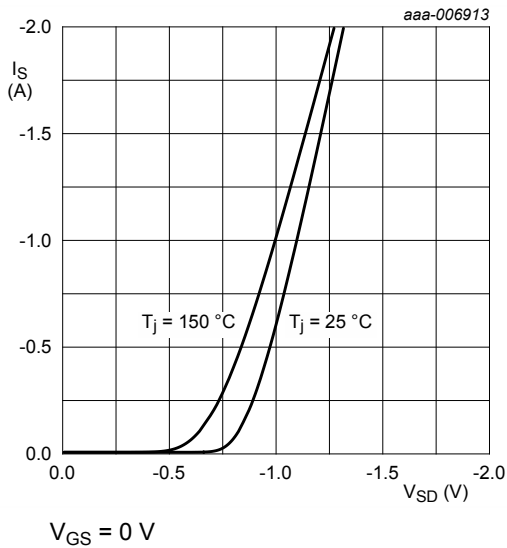


Fig. 29. TR2: source current as a function of source-drain voltage; typical values

11. Test information

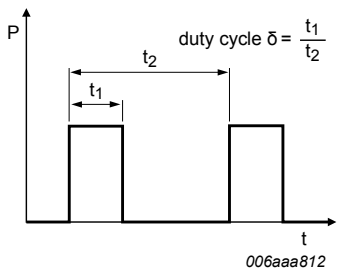
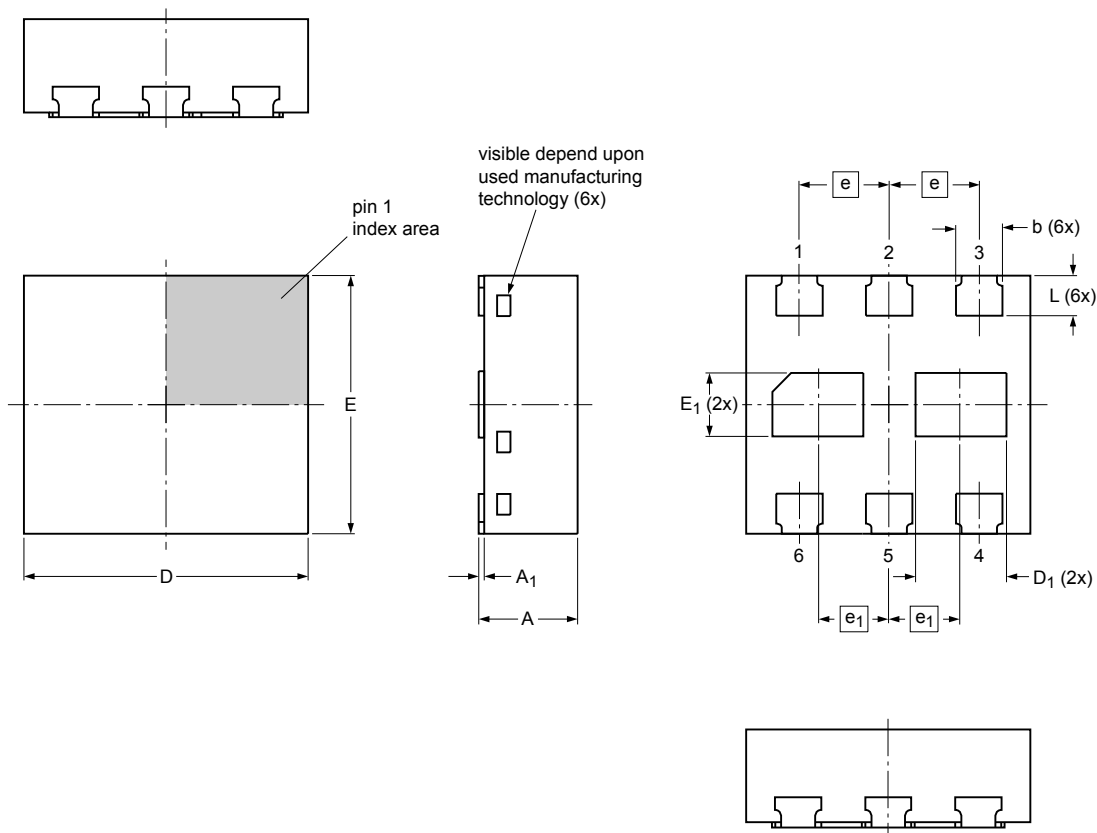


Fig. 30. Duty cycle definition

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



0 1 mm
scale

Dimensions (mm are the original dimensions)

Unit	A	A ₁	b	D	D ₁	E	E ₁	e	e ₁	L
min	0.34		0.15	1.05	0.32	0.95	0.22			0.125
mm	nom		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.

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

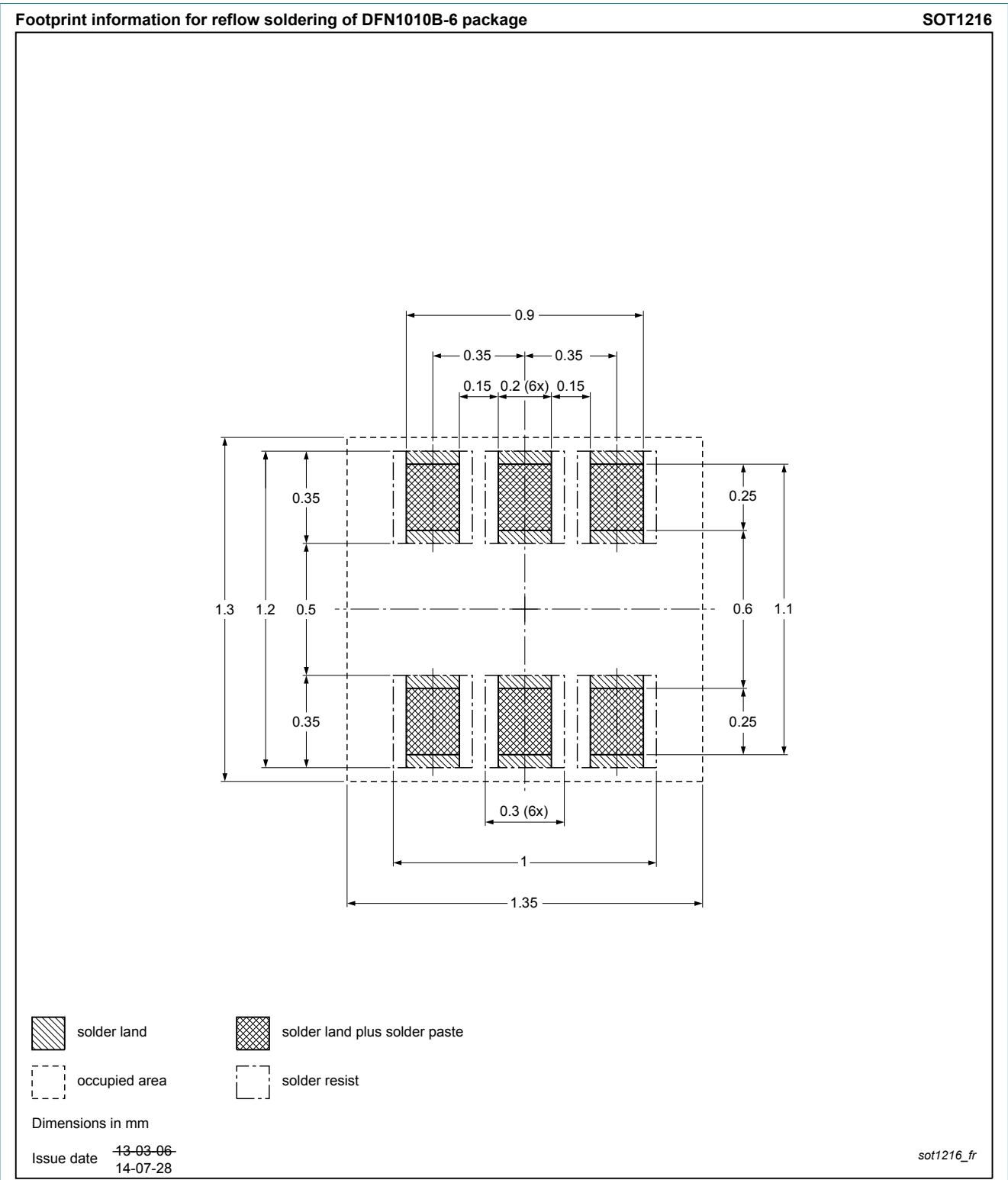


Fig. 32. Reflow soldering footprint for DFN1010B-6 (SOT1216)

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMCXB900UEL v.1	20160628	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.

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- [2] The term 'short data sheet' is explained in section "Definitions".
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16. Contents

1 General description 1

2 Features and benefits 1

3 Applications 1

4 Quick reference data 1

5 Pinning information 2

6 Ordering information 2

7 Marking 2

8 Limiting values 4

9 Thermal characteristics 6

10 Characteristics 8

11 Test information 15

12 Package outline 16

13 Soldering 17

14 Revision history 18

15 Legal information 19

15.1 Data sheet status 19

15.2 Definitions 19

15.3 Disclaimers 19

15.4 Trademarks 20

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