

# PMCXB1000UE

30 V, complementary N/P-channel Trench MOSFET

27 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

- 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  $> 2 \text{ kV HBM}$

## 3. Applications

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

## 4. Quick reference data

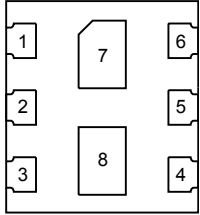
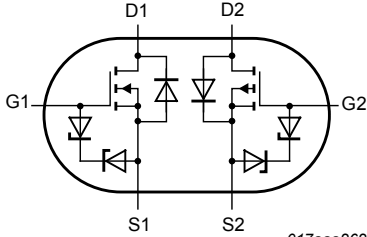
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>TR1 (N-channel), Static characteristics</b>						
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 4.5 \text{ V}; I_D = 590 \text{ mA}; T_j = 25 \text{ }^\circ\text{C}$	-	550	670	m $\Omega$
<b>TR2 (P-channel), Static characteristics</b>						
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = -4.5 \text{ V}; I_D = -410 \text{ mA}; T_j = 25 \text{ }^\circ\text{C}$	-	1.2	1.4	$\Omega$
<b>TR1 (N-channel)</b>						
$V_{DS}$	drain-source voltage	$T_j = 25 \text{ }^\circ\text{C}$	-	-	30	V
$I_D$	drain current	$V_{GS} = 4.5 \text{ V}; T_{amb} = 25 \text{ }^\circ\text{C}$	[1]	-	590	mA
<b>TR2 (P-channel)</b>						
$V_{DS}$	drain-source voltage	$T_j = 25 \text{ }^\circ\text{C}$	-	-	-30	V
$I_D$	drain current	$V_{GS} = -4.5 \text{ V}; T_{amb} = 25 \text{ }^\circ\text{C}$	[1]	-	-410	mA

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

### 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S1	source TR1	 <p>Transparent top view <b>DFN1010B-6 (SOT1216)</b></p>	 <p>017aaa262</p>
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

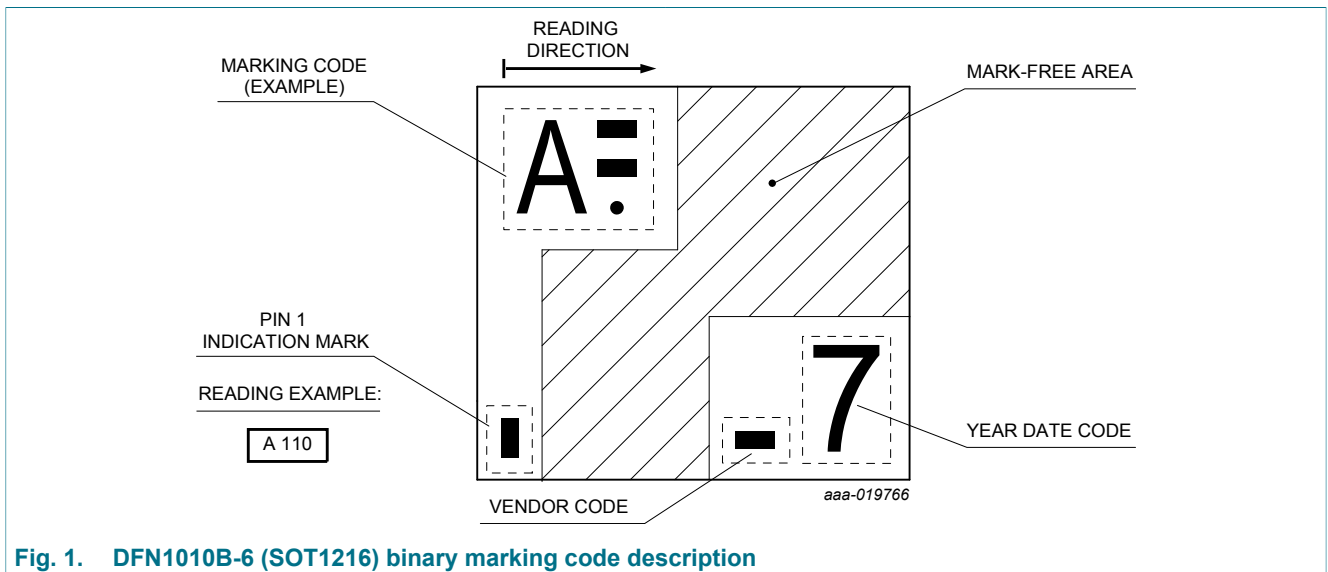
Table 3. Ordering information

Type number	Package		Version
	Name	Description	
PMCXB1000UE	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
PMCXB1000UE	B 101



## 8. Limiting values

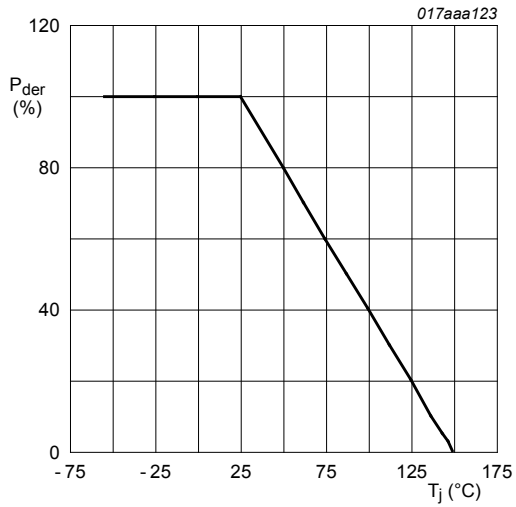
**Table 5. Limiting values**

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

Symbol	Parameter	Conditions		Min	Max	Unit
<b>TR1 (N-channel)</b>						
$V_{DS}$	drain-source voltage	$T_j = 25\text{ °C}$		-	30	V
$V_{GS}$	gate-source voltage			-8	8	V
$I_D$	drain current	$V_{GS} = 4.5\text{ V}; T_{amb} = 25\text{ °C}$	[1]	-	590	mA
		$V_{GS} = 4.5\text{ V}; T_{amb} = 100\text{ °C}$	[1]	-	370	mA
$I_{DM}$	peak drain current	$T_{amb} = 25\text{ °C}; \text{single pulse}; t_p \leq 10\text{ }\mu\text{s}$		-	2.3	A
$P_{tot}$	total power dissipation	$T_{amb} = 25\text{ °C}$	[2]	-	285	mW
			[1]	-	410	mW
		$T_{sp} = 25\text{ °C}$		-	4	W
<b>TR2 (P-channel)</b>						
$V_{DS}$	drain-source voltage	$T_j = 25\text{ °C}$		-	-30	V
$V_{GS}$	gate-source voltage			-8	8	V
$I_D$	drain current	$V_{GS} = -4.5\text{ V}; T_{amb} = 25\text{ °C}$	[1]	-	-410	mA
		$V_{GS} = -4.5\text{ V}; T_{amb} = 100\text{ °C}$	[1]	-	-260	mA
$I_{DM}$	peak drain current	$T_{amb} = 25\text{ °C}; \text{single pulse}; t_p \leq 10\text{ }\mu\text{s}$		-	-1.7	A
$P_{tot}$	total power dissipation	$T_{amb} = 25\text{ °C}$	[2]	-	285	mW
			[1]	-	410	mW
		$T_{sp} = 25\text{ °C}$		-	4	W
<b>Per device</b>						
$T_j$	junction temperature			-55	150	°C
$T_{amb}$	ambient temperature			-55	150	°C
$T_{stg}$	storage temperature			-65	150	°C
<b>TR1 (N-channel), Source-drain diode</b>						
$I_S$	source current	$T_{amb} = 25\text{ °C}$	[1]	-	380	mA
<b>TR2 (P-channel), Source-drain diode</b>						
$I_S$	source current	$T_{amb} = 25\text{ °C}$	[1]	-	-410	mA

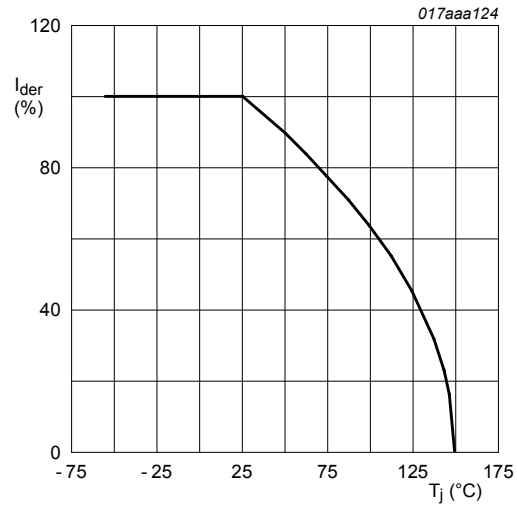
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for drain  $1\text{ cm}^2$ .

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



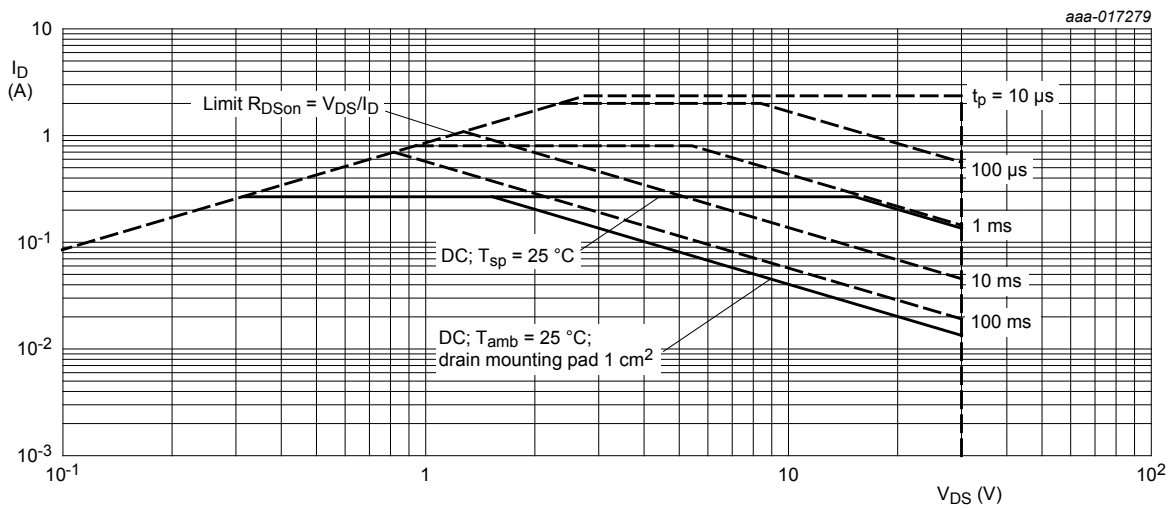
$$P_{der} = \frac{P_{tot}}{P_{tot(25^\circ C)}} \times 100 \%$$

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

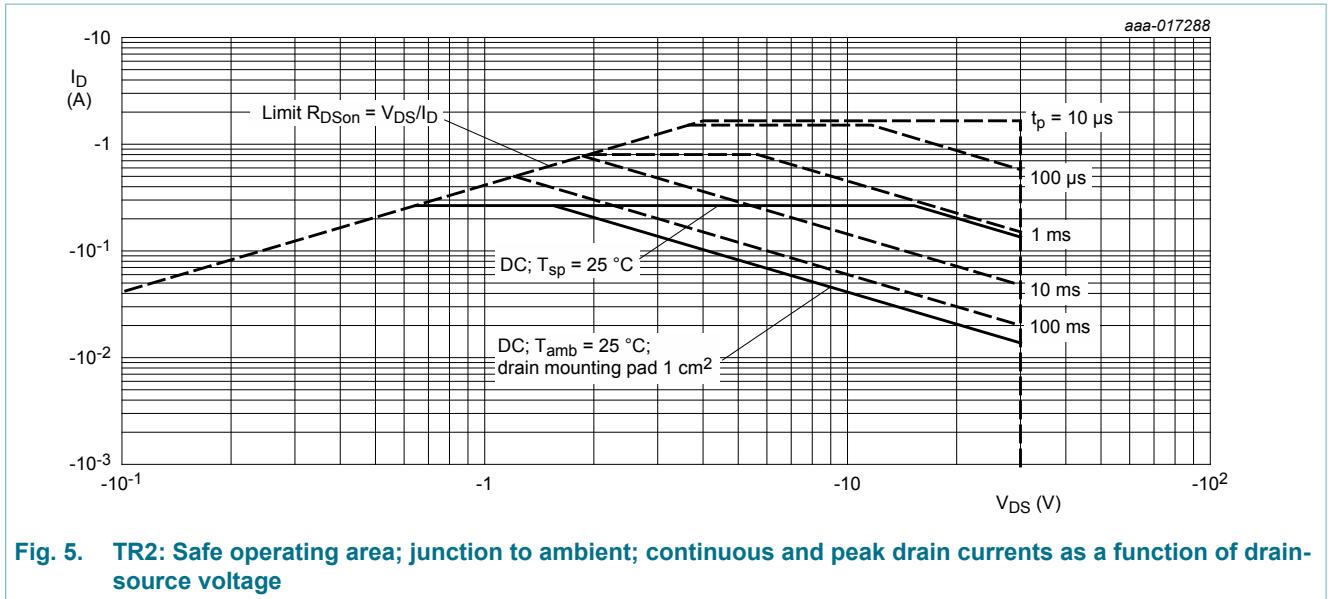


$$I_{der} = \frac{I_D}{I_{D(25^\circ C)}} \times 100 \%$$

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



**Fig. 4. TR1: Safe operating area; junction to ambient; continuous and peak drain currents as a function of drain-source voltage**



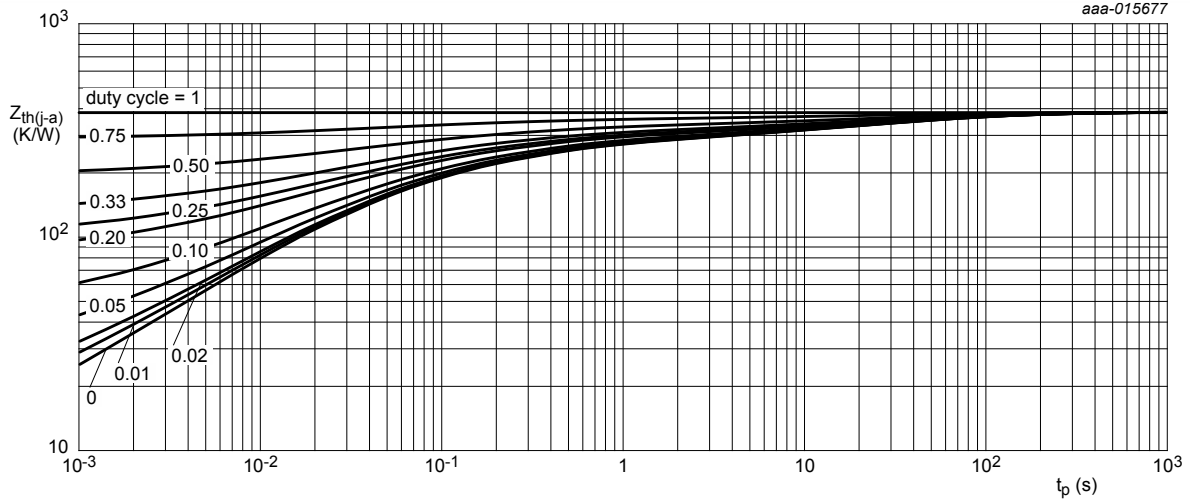
## 9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
<b>TR1 (N-channel)</b>							
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air	[1]	-	380	440	K/W
			[2]	-	275	305	K/W
R <sub>th(j-sp)</sub>	thermal resistance from junction to solder point			-	27	31	K/W
<b>TR2 (P-channel)</b>							
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air	[1]	-	380	440	K/W
			[2]	-	275	305	K/W
R <sub>th(j-sp)</sub>	thermal resistance from junction to solder point			-	27	31	K/W

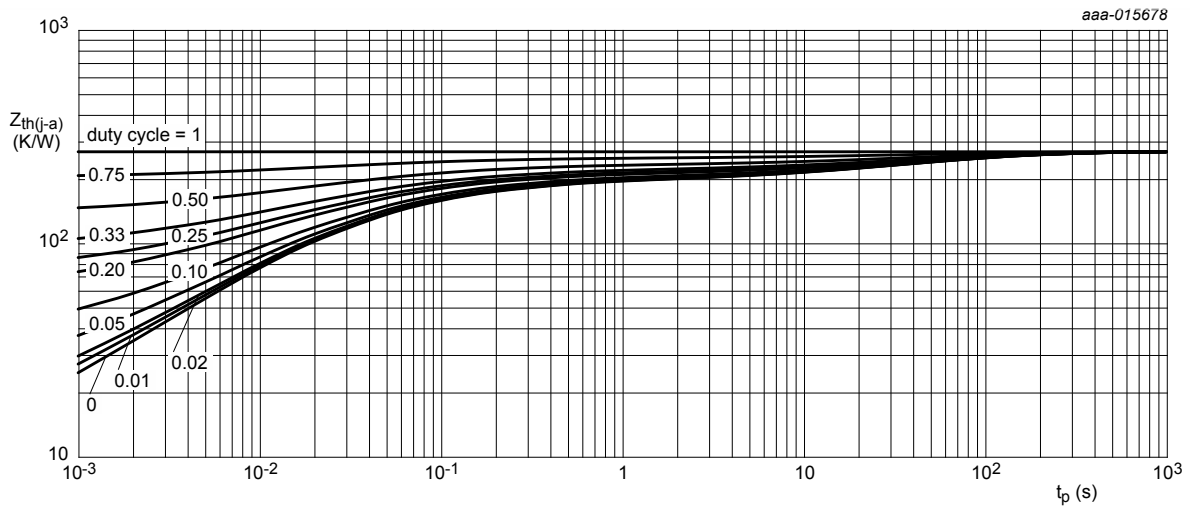
[1] Device mounted on an FR4 PCB, single-sided copper; tin-plated and standard footprint.

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



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<sup>2</sup>

**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
<b>TR1 (N-channel), Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	30	-	-	V
$V_{GSth}$	gate-source threshold voltage	$I_D = 250 \mu A$ ; $V_{DS} = V_{GS}$ ; $T_j = 25 \text{ }^\circ C$	0.45	0.7	0.95	V
$I_{DSS}$	drain leakage current	$V_{DS} = 30 V$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	1	$\mu A$
$I_{GSS}$	gate leakage current	$V_{GS} = 8 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	5	$\mu A$
		$V_{GS} = -8 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	-5	$\mu A$
		$V_{GS} = 4.5 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	1	$\mu A$
		$V_{GS} = -4.5 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	-1	$\mu A$
		$V_{GS} = 2.5 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	100	nA
		$V_{GS} = -2.5 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	-100	nA
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 4.5 V$ ; $I_D = 590 \text{ mA}$ ; $T_j = 25 \text{ }^\circ C$	-	550	670	m $\Omega$
		$V_{GS} = 4.5 V$ ; $I_D = 590 \text{ mA}$ ; $T_j = 150 \text{ }^\circ C$	-	960	1170	m $\Omega$
		$V_{GS} = 2.5 V$ ; $I_D = 590 \text{ mA}$ ; $T_j = 25 \text{ }^\circ C$	-	660	900	m $\Omega$
		$V_{GS} = 1.8 V$ ; $I_D = 80 \text{ mA}$ ; $T_j = 25 \text{ }^\circ C$	-	770	1120	m $\Omega$
		$V_{GS} = 1.5 V$ ; $I_D = 10 \text{ mA}$ ; $T_j = 25 \text{ }^\circ C$	-	890	1500	m $\Omega$
$g_{fs}$	forward transconductance	$V_{DS} = 10 V$ ; $I_D = 590 \text{ mA}$ ; $T_j = 25 \text{ }^\circ C$	-	600	-	mS
<b>TR2 (P-channel), Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = -250 \mu A$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-30	-	-	V
$V_{GSth}$	gate-source threshold voltage	$I_D = -250 \mu A$ ; $V_{DS} = V_{GS}$ ; $T_j = 25 \text{ }^\circ C$	-0.45	-0.7	-0.95	V
$I_{DSS}$	drain leakage current	$V_{DS} = -30 V$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	-1	$\mu A$
$I_{GSS}$	gate leakage current	$V_{GS} = 8 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	5	$\mu A$
		$V_{GS} = -8 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	-5	$\mu A$
		$V_{GS} = 4.5 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	1	$\mu A$
		$V_{GS} = -4.5 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	-1	$\mu A$
		$V_{GS} = 2.5 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	100	nA
		$V_{GS} = -2.5 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	-100	nA
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = -4.5 V$ ; $I_D = -410 \text{ mA}$ ; $T_j = 25 \text{ }^\circ C$	-	1.2	1.4	$\Omega$
		$V_{GS} = -4.5 V$ ; $I_D = -410 \text{ mA}$ ; $T_j = 150 \text{ }^\circ C$	-	2	2.4	$\Omega$
		$V_{GS} = -2.5 V$ ; $I_D = -320 \text{ mA}$ ; $T_j = 25 \text{ }^\circ C$	-	1.7	2.3	$\Omega$
		$V_{GS} = -1.8 V$ ; $I_D = -80 \text{ mA}$ ; $T_j = 25 \text{ }^\circ C$	-	2.1	3.1	$\Omega$
		$V_{GS} = -1.5 V$ ; $I_D = -10 \text{ mA}$ ; $T_j = 25 \text{ }^\circ C$	-	3	5.1	$\Omega$

## 30 V, complementary N/P-channel Trench MOSFET

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$g_{fs}$	forward transconductance	$V_{DS} = -10\text{ V}; I_D = -410\text{ mA}; T_j = 25\text{ }^\circ\text{C}$	-	820	-	mS
<b>TR1 (N-channel), Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$V_{DS} = 15\text{ V}; I_D = 590\text{ mA}; V_{GS} = 4.5\text{ V}; T_j = 25\text{ }^\circ\text{C}$	-	0.6	1.05	nC
$Q_{GS}$	gate-source charge		-	0.1	-	nC
$Q_{GD}$	gate-drain charge		-	0.1	-	nC
$C_{iss}$	input capacitance	$V_{DS} = 15\text{ V}; f = 1\text{ MHz}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C}$	-	30.3	-	pF
$C_{oss}$	output capacitance		-	5.8	-	pF
$C_{rss}$	reverse transfer capacitance		-	4.2	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 15\text{ V}; I_D = 590\text{ mA}; V_{GS} = 4.5\text{ V}; R_{G(ext)} = 6\text{ }\Omega; T_j = 25\text{ }^\circ\text{C}$	-	4	-	ns
$t_r$	rise time		-	7	-	ns
$t_{d(off)}$	turn-off delay time		-	12	-	ns
$t_f$	fall time		-	3	-	ns
<b>TR2 (P-channel), Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$V_{DS} = -15\text{ V}; I_D = -410\text{ mA}; V_{GS} = -4.5\text{ V}; T_j = 25\text{ }^\circ\text{C}$	-	0.7	1.2	nC
$Q_{GS}$	gate-source charge		-	0.17	-	nC
$Q_{GD}$	gate-drain charge		-	0.16	-	nC
$C_{iss}$	input capacitance	$V_{DS} = -15\text{ V}; f = 1\text{ MHz}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C}$	-	43.2	-	pF
$C_{oss}$	output capacitance		-	5.9	-	pF
$C_{rss}$	reverse transfer capacitance		-	4.2	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = -15\text{ V}; I_D = -410\text{ mA}; V_{GS} = -4.5\text{ V}; R_{G(ext)} = 6\text{ }\Omega; T_j = 25\text{ }^\circ\text{C}$	-	3	-	ns
$t_r$	rise time		-	4	-	ns
$t_{d(off)}$	turn-off delay time		-	14	-	ns
$t_f$	fall time		-	5	-	ns
<b>TR1 (N-channel), Source-drain diode characteristics</b>						
$V_{SD}$	source-drain voltage	$I_S = 380\text{ mA}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C}$	-	0.86	1.2	V
<b>TR2 (P-channel), Source-drain diode characteristics</b>						
$V_{SD}$	source-drain voltage	$I_S = -410\text{ mA}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C}$	-	-0.95	-1.2	V



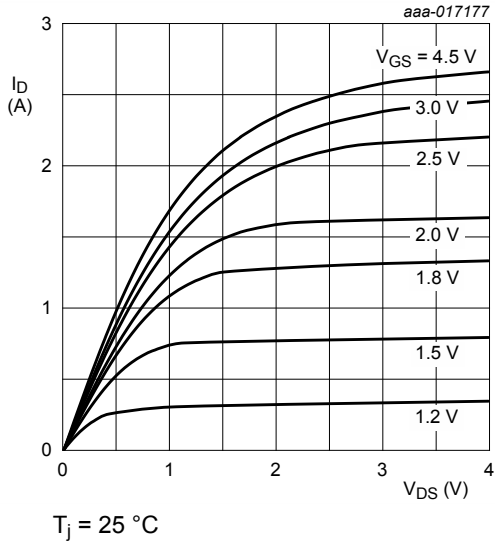


Fig. 8. TR1: Output characteristics: drain current as a function of drain-source voltage; typical values

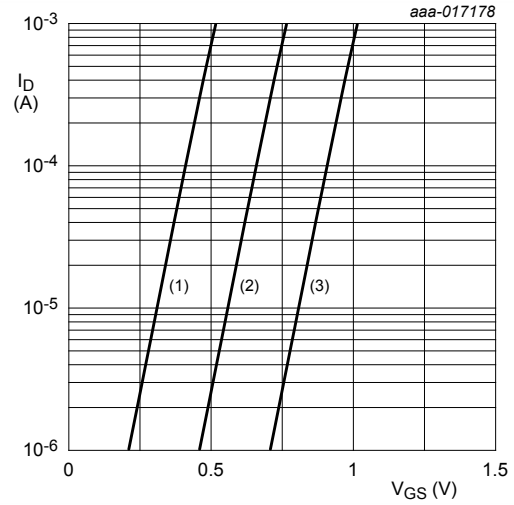


Fig. 9. TR1: Sub-threshold drain current as a function of gate-source voltage  
 (1) minimum values  
 (2) typical values  
 (3) maximum values

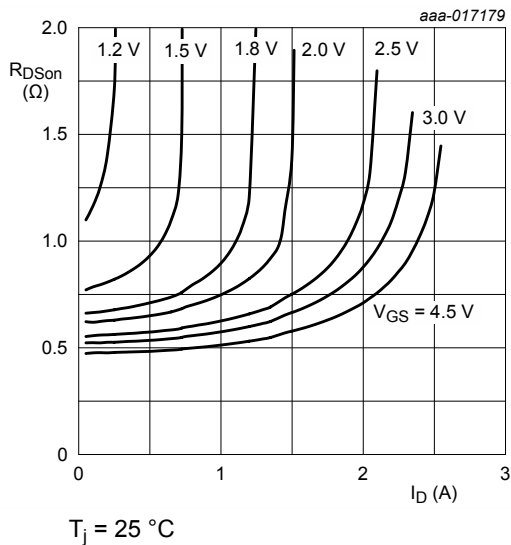


Fig. 10. TR1: Drain-source on-state resistance as a function of drain current; typical values

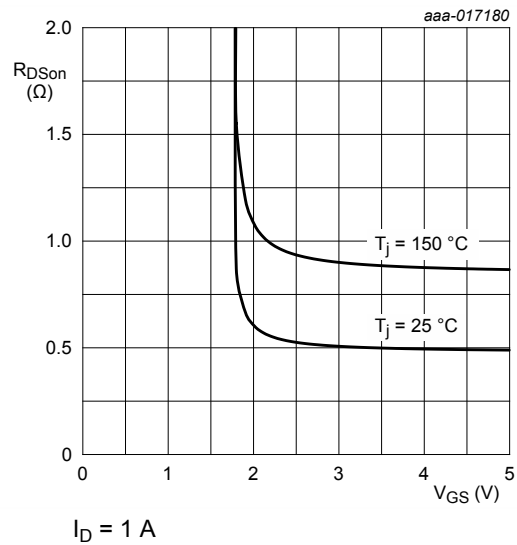
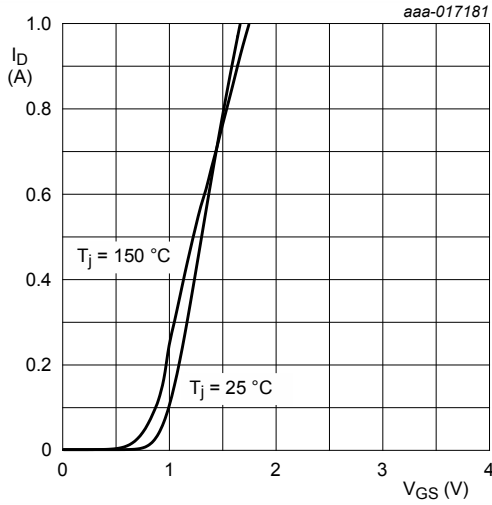
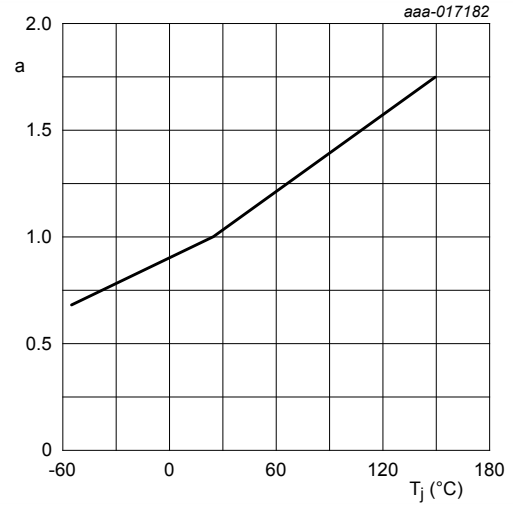


Fig. 11. TR1: Drain-source on-state resistance as a function of gate-source voltage; typical values



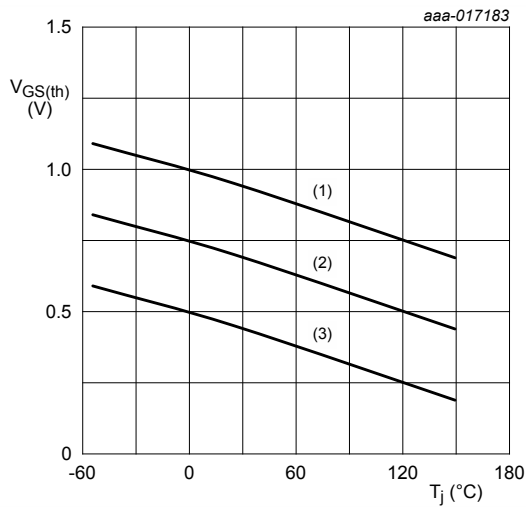
$$V_{DS} > I_D \times R_{DSon}$$

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



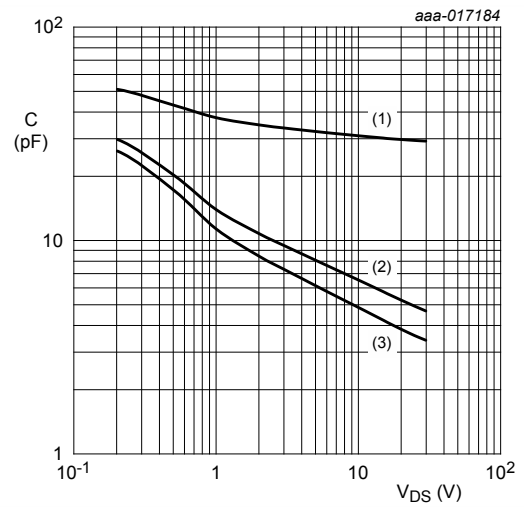
$$a = \frac{R_{DSon}}{R_{DSon(25^{\circ}C)}}$$

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



$I_D = 0.25 \text{ mA}; V_{DS} = V_{GS}$   
 (1) maximum values  
 (2) typical values  
 (3) minimum values

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



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

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

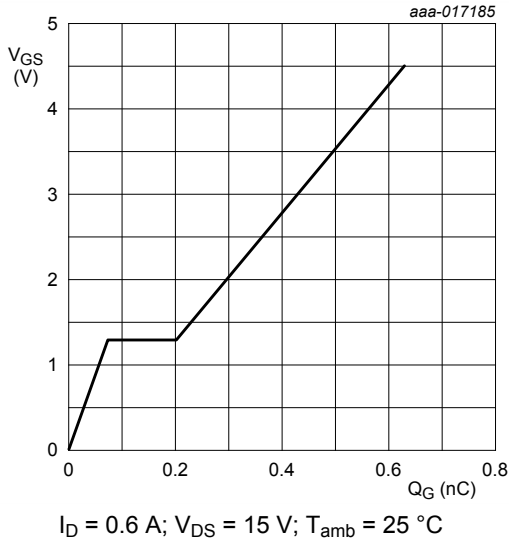


Fig. 16. TR1: Gate-source voltage as a function of gate charge; typical values

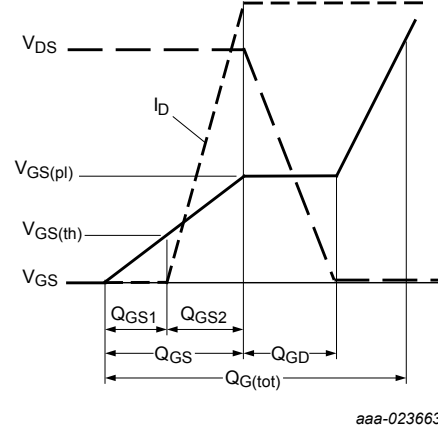


Fig. 17. TR1: Gate charge waveform definitions

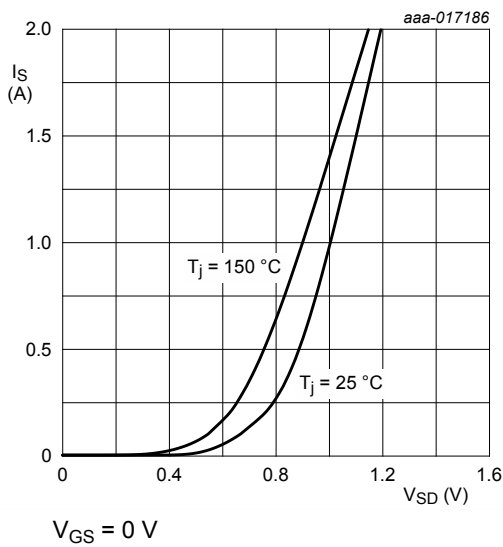


Fig. 18. TR1: Source current as a function of source-drain voltage; typical values

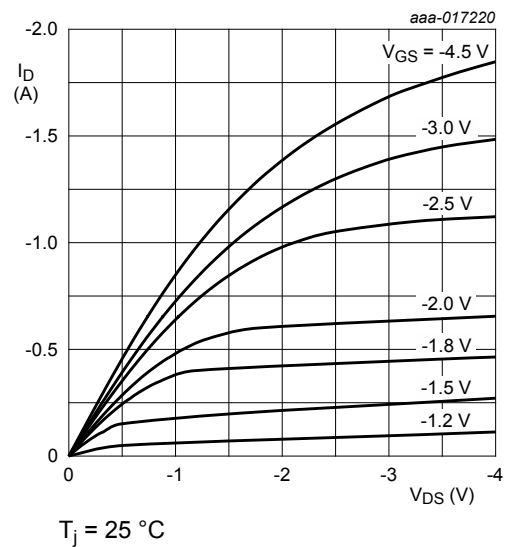
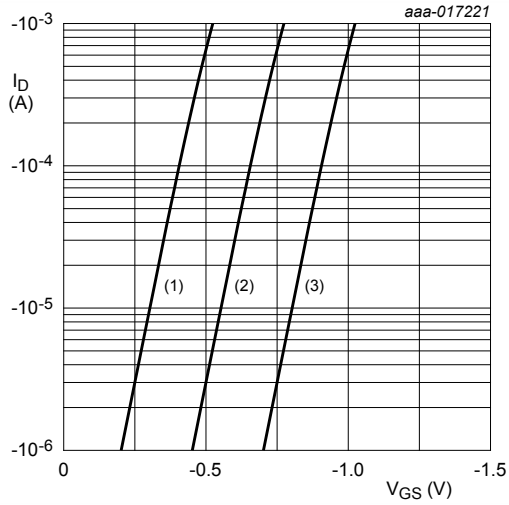
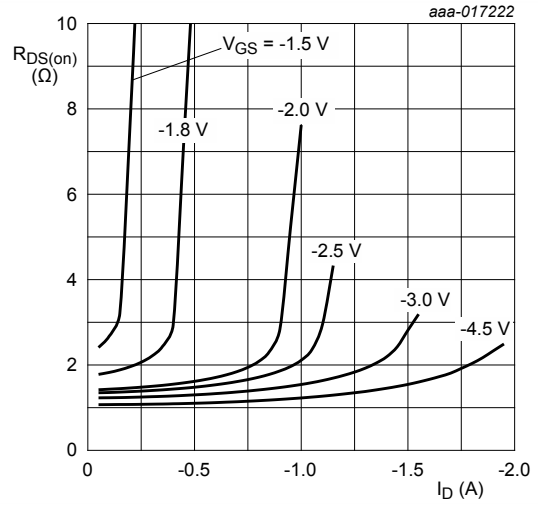


Fig. 19. TR2: Output characteristics: drain current as a function of drain-source voltage; typical values



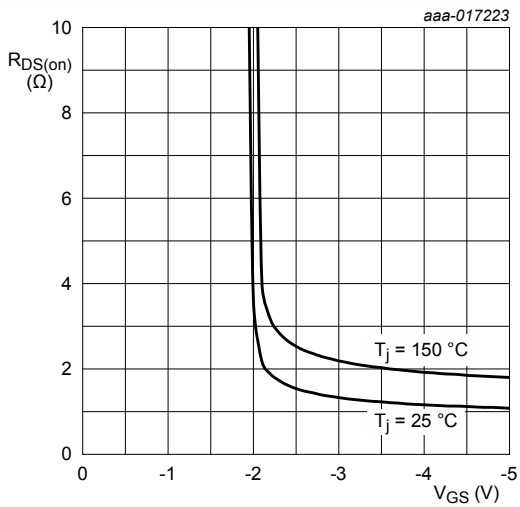
$V_{DS} = -5\text{ V}$   
 $T_j = 25\text{ }^\circ\text{C}$   
 (1) minimum values  
 (2) typical values  
 (3) maximum values

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



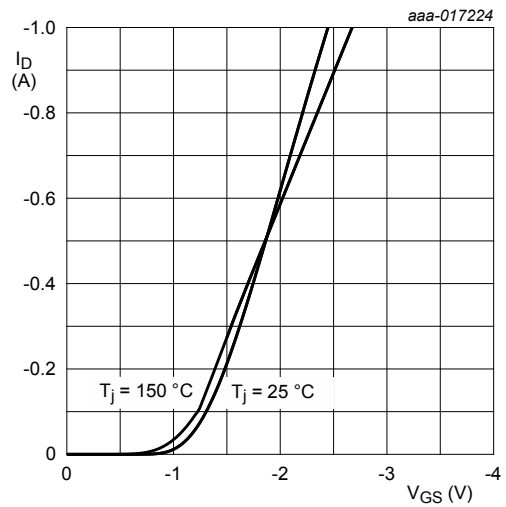
$T_j = 25\text{ }^\circ\text{C}$

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



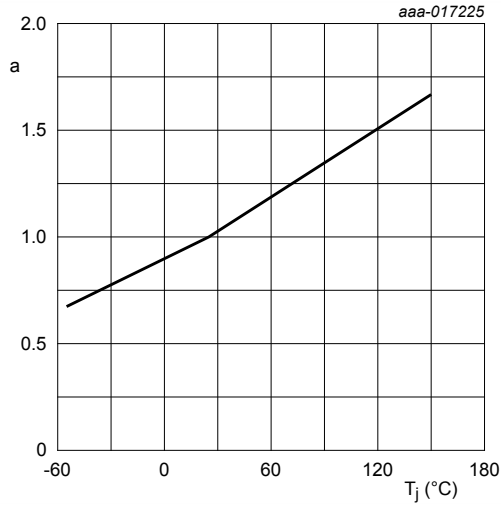
$I_D = -0.4\text{ A}$

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



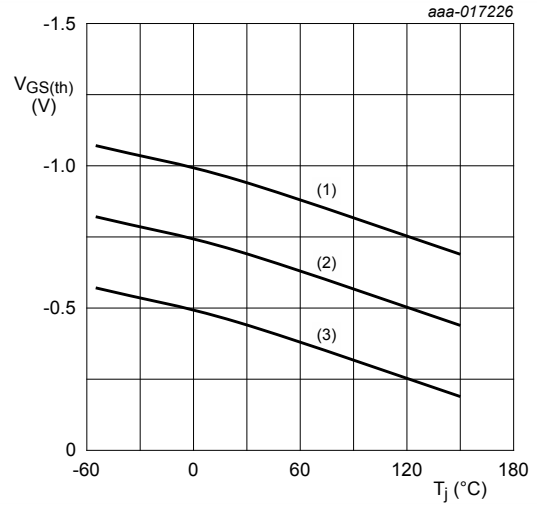
$V_{DS} > I_D \times R_{DS(on)}$

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



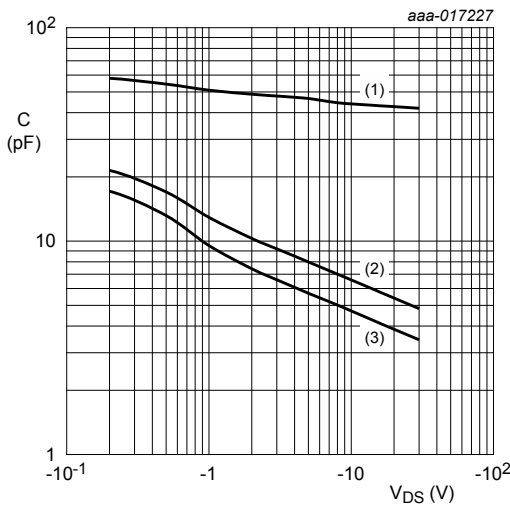
$$a = \frac{R_{DSon}}{R_{DSon(25^{\circ}C)}}$$

**Fig. 24. TR2: Normalized drain-source on-state resistance as a function of ambient temperature; typical values**



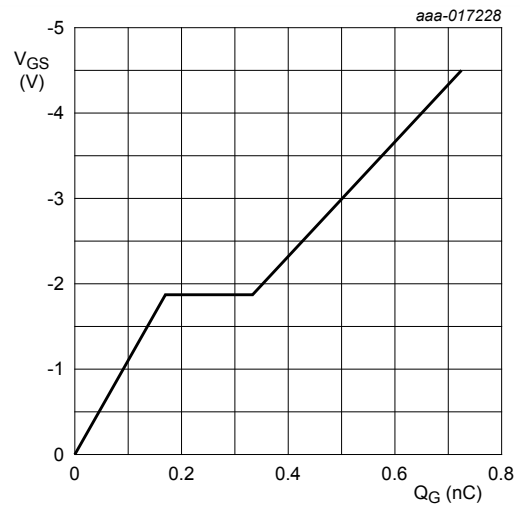
$I_D = -250 \mu A$ ;  $V_{DS} = V_{GS}$   
 (1) maximum values  
 (2) typical values  
 (3) minimum values

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



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

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



$V_{DS} = -15 \text{ V}$ ;  $I_D = -410 \text{ mA}$   $T_{amb} = 25 \text{ }^{\circ}C$

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

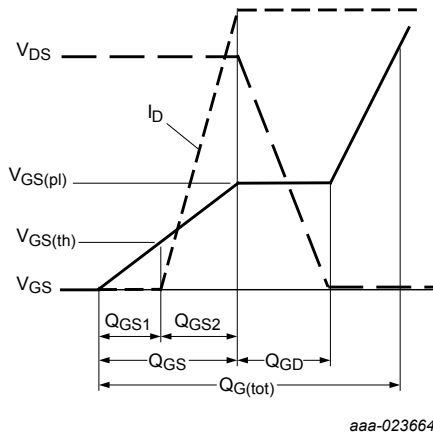


Fig. 28. TR2: Gate charge waveform definitions

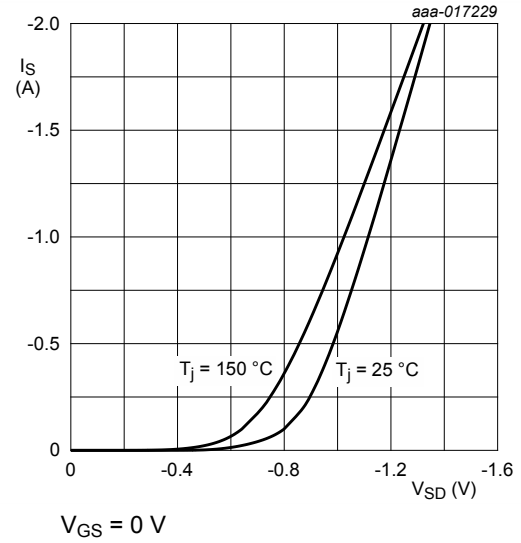


Fig. 29. TR2: Source current as a function of source-drain voltage; typical values

## 11. Test information

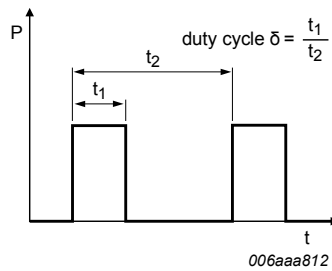


Fig. 30. Duty cycle definition

## 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

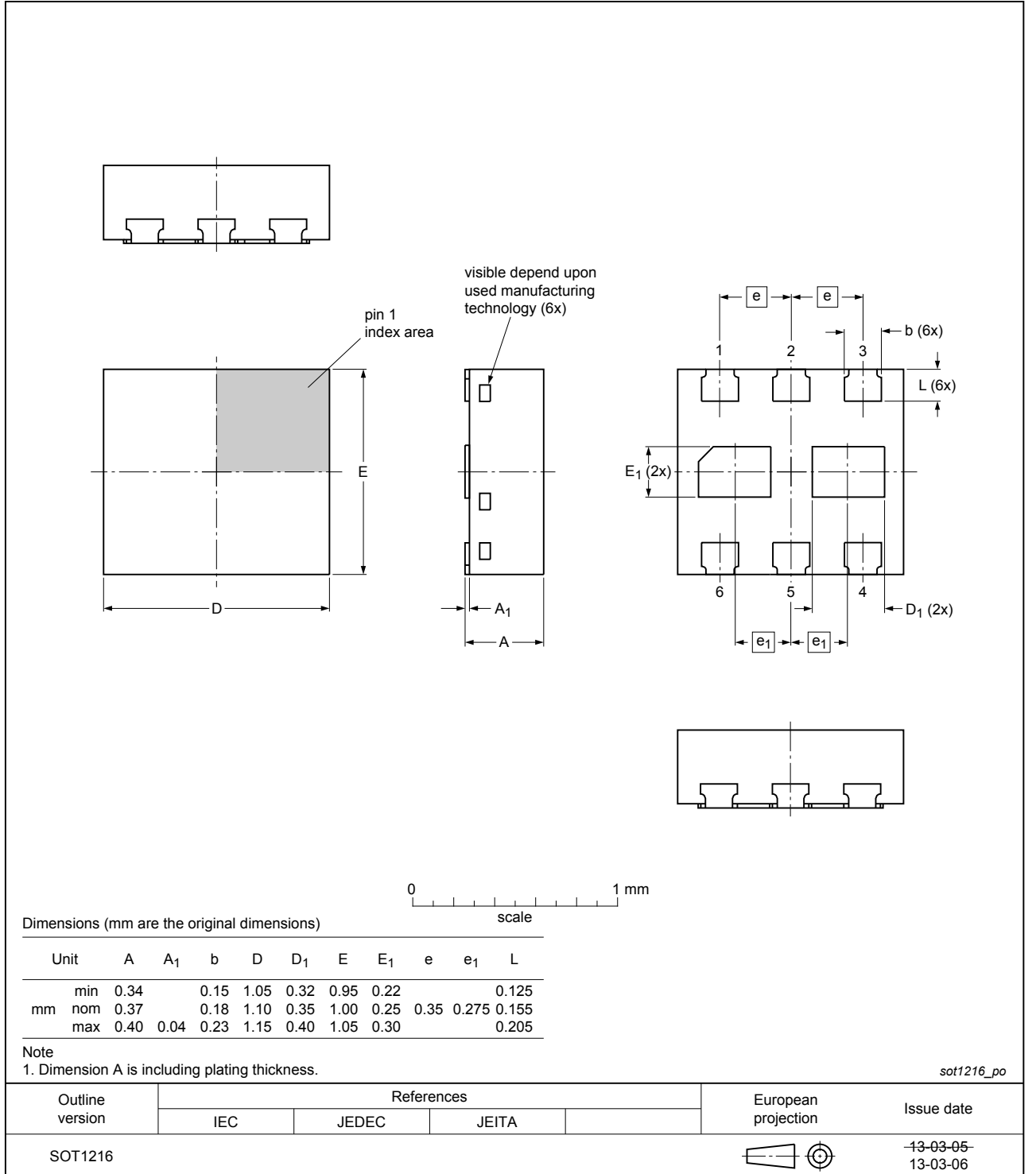
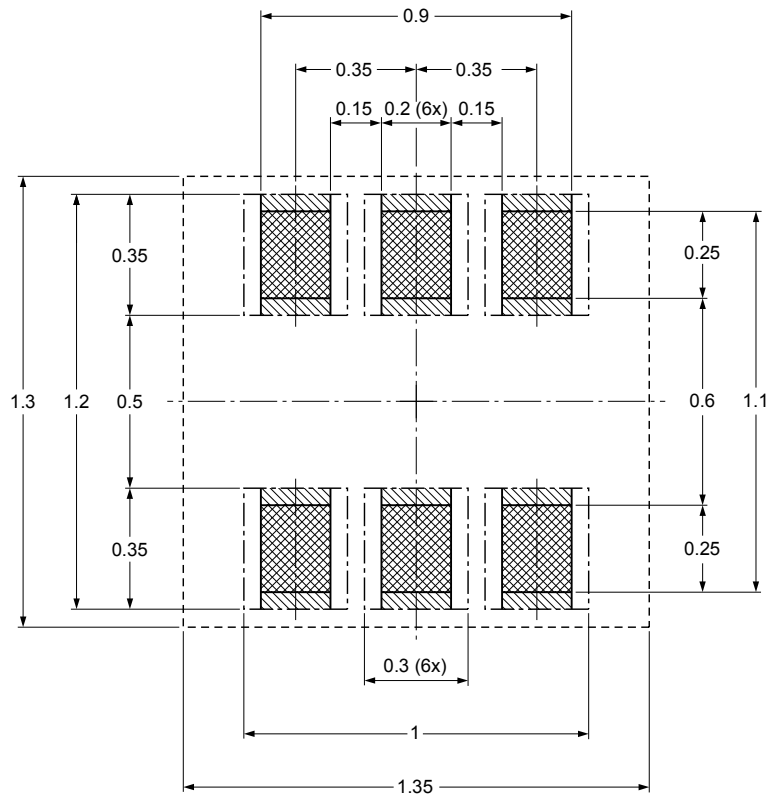


Fig. 31. Package outline DFN1010B-6 (SOT1216)

### 13. Soldering

Footprint information for reflow soldering of DFN1010B-6 package

SOT1216



- solder land
- solder land plus solder paste
- occupied area
- solder resist

Dimensions in mm

Issue date ~~13-03-06~~  
14-07-28

sot1216\_fr

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
PMCXB1000UE v.1	20160627	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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#### Как с нами связаться

**Телефон:** 8 (812) 309 58 32 (многоканальный)

**Факс:** 8 (812) 320-02-42

**Электронная почта:** [org@eplast1.ru](mailto:org@eplast1.ru)

**Адрес:** 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.