



# PMPB215ENEA

80 V, single N-channel Trench MOSFET

18 December 2013

Product data sheet

## 1. General description

N-channel enhancement mode Field-Effect Transistor (FET) in a leadless medium power DFN2020MD-6 (SOT1220) Surface-Mounted Device (SMD) plastic package using Trench MOSFET technology.

## 2. Features and benefits

- Trench MOSFET technology
- Small and leadless ultra thin SMD plastic package: 2 x 2 x 0.65 mm
- Exposed drain pad for excellent thermal conduction
- Tin-plated 100 % solderable side pads for optical solder inspection
- AEC-Q101 qualified

## 3. Applications

- Relay driver
- High-speed line driver
- Low-side load switch
- Switching circuits

## 4. Quick reference data

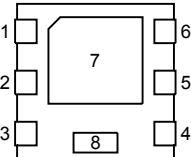
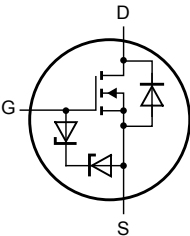
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j = 25\text{ °C}$	-	-	80	V
$V_{GS}$	gate-source voltage		-20	-	20	V
$I_D$	drain current	$V_{GS} = 10\text{ V}; T_{amb} = 25\text{ °C}; t \leq 5\text{ s}$	[1]	-	2.8	A
<b>Static characteristics</b>						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 1.9\text{ A}; T_j = 25\text{ °C}$	-	175	230	m $\Omega$

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated, mounting pad for drain 6 cm<sup>2</sup>.

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	D	drain	 <p>Transparent top view DFN2020MD-6 (SOT1220)</p>	 <p>017aaa255</p>
2	D	drain		
3	G	gate		
4	S	source		
5	D	drain		
6	D	drain		
7	D	drain		
8	S	source		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PMPB215ENEA	DFN2020MD-6	DFN2020MD-6: plastic thermal enhanced ultra thin small outline package; no leads; 6 terminals	SOT1220

## 7. Marking

Table 4. Marking codes

Type number	Marking code
PMPB215ENEA	2B

## 8. Limiting values

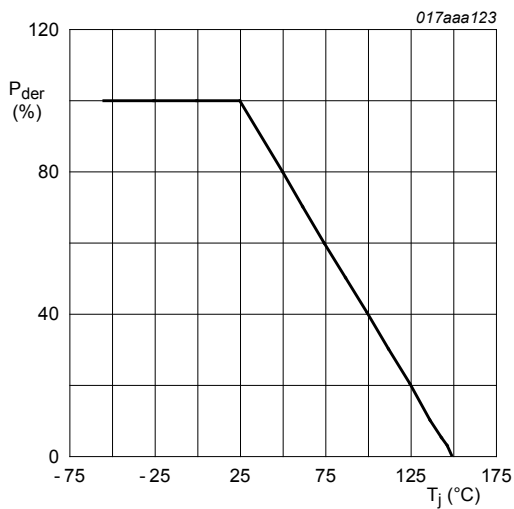
Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
$V_{DS}$	drain-source voltage	$T_j = 25\text{ }^\circ\text{C}$		-	80	V
$V_{GS}$	gate-source voltage			-20	20	V
$I_D$	drain current	$V_{GS} = 10\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}; t \leq 5\text{ s}$	[1]	-	2.8	A
		$V_{GS} = 10\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}$	[1]	-	1.9	A
		$V_{GS} = 10\text{ V}; T_{amb} = 100\text{ }^\circ\text{C}$	[1]	-	1.2	A
$I_{DM}$	peak drain current	$T_{amb} = 25\text{ }^\circ\text{C}; \text{single pulse}; t_p \leq 10\text{ }\mu\text{s}$		-	7.6	A

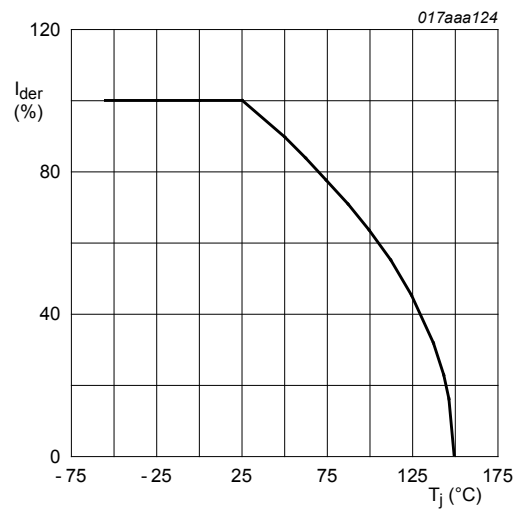
Symbol	Parameter	Conditions		Min	Max	Unit
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$T_{j(\text{init})} = 25\text{ °C}$ ; $I_D = 0.27\text{ A}$ ; DUT in avalanche (unclamped)		-	11.3	mJ
$P_{\text{tot}}$	total power dissipation	$T_{\text{amb}} = 25\text{ °C}$	[1]	-	1.6	W
		$T_{\text{amb}} = 25\text{ °C}$ ; $t \leq 5\text{ s}$	[1]	-	3.3	W
		$T_{\text{sp}} = 25\text{ °C}$		-	15.6	W
$T_j$	junction temperature			-55	150	°C
$T_{\text{amb}}$	ambient temperature			-55	150	°C
$T_{\text{stg}}$	storage temperature			-65	150	°C
<b>Source-drain diode</b>						
$I_S$	source current	$T_{\text{amb}} = 25\text{ °C}$	[1]	-	0.8	A
<b>ESD maximum rating</b>						
$V_{\text{ESD}}$	electrostatic discharge voltage	HBM	[2]	-	2000	V

- [1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated, mounting pad for drain 6 cm<sup>2</sup>.
- [2] Measured between all pins.



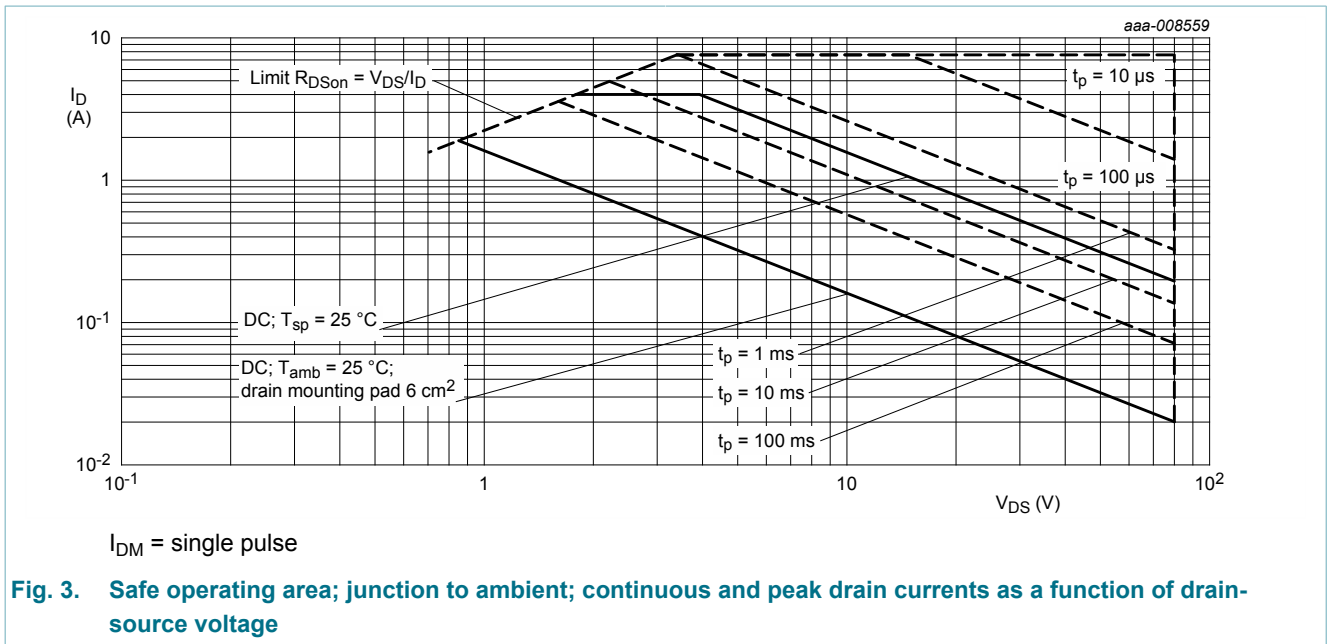
**Fig. 1. Normalized total power dissipation as a function of junction temperature**

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



**Fig. 2. Normalized continuous drain current as a function of junction temperature**

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



## 9. Thermal characteristics

**Table 6. Thermal characteristics**

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air	[1]	-	245	282	K/W
			[2]	-	68	78	K/W
		in free air; t ≤ 5 s	[2]	-	33	38	K/W
R <sub>th(j-sp)</sub>	thermal resistance from junction to solder point			-	4	8	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, mounting pad for drain 6 cm<sup>2</sup>.

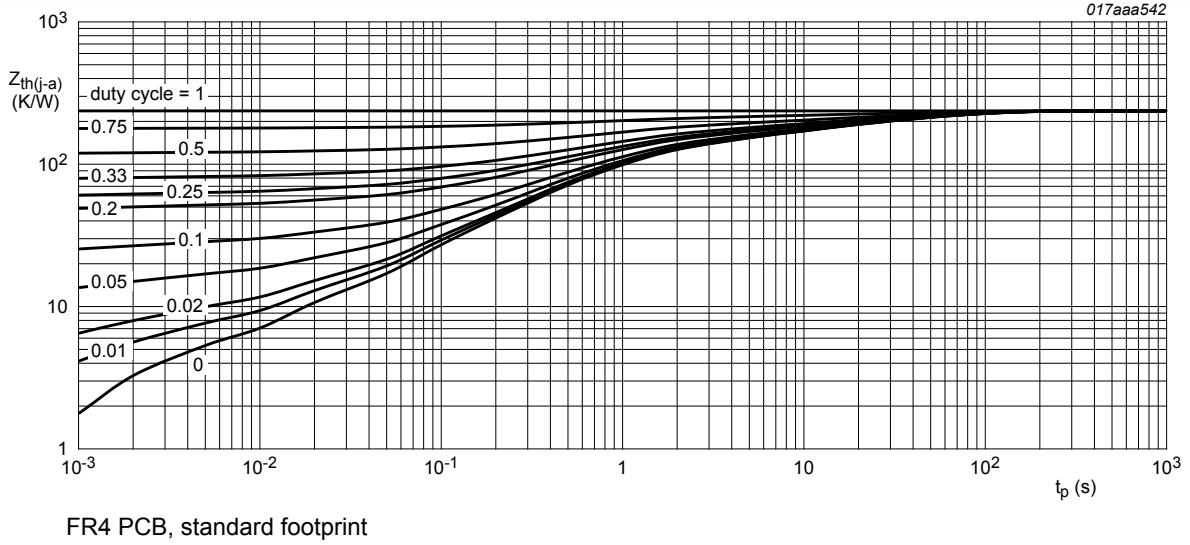


Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

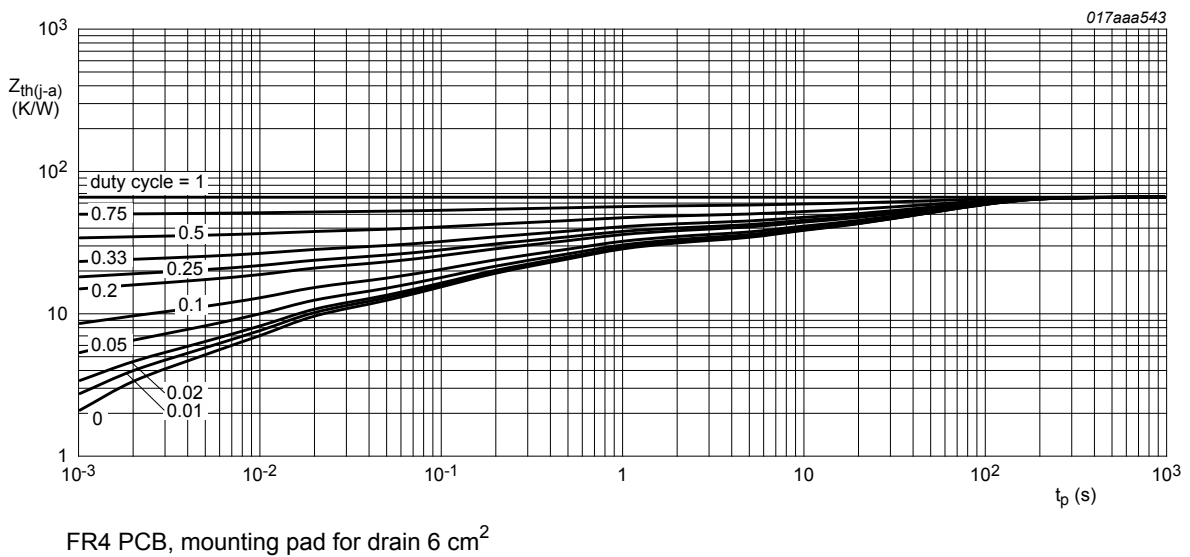


Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	80	-	-	V
$V_{GSth}$	gate-source threshold voltage	$I_D = 250 \mu A$ ; $V_{DS} = V_{GS}$ ; $T_j = 25 \text{ }^\circ C$	1.3	1.7	2.7	V
$I_{DSS}$	drain leakage current	$V_{DS} = 80 V$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	1	$\mu A$
		$V_{DS} = 80 V$ ; $V_{GS} = 0 V$ ; $T_j = 150 \text{ }^\circ C$	-	-	10	$\mu A$
$I_{GSS}$	gate leakage current	$V_{GS} = 20 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	15	$\mu A$
		$V_{GS} = -20 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	-15	$\mu A$
		$V_{GS} = 10 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	1	$\mu A$
		$V_{GS} = -10 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	-1	$\mu A$
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 10 V$ ; $I_D = 1.9 A$ ; $T_j = 25 \text{ }^\circ C$	-	175	230	m $\Omega$
		$V_{GS} = 10 V$ ; $I_D = 1.9 A$ ; $T_j = 150 \text{ }^\circ C$	-	340	445	m $\Omega$
		$V_{GS} = 4.5 V$ ; $I_D = 1.8 A$ ; $T_j = 25 \text{ }^\circ C$	-	195	275	m $\Omega$
$g_{fs}$	forward transconductance	$V_{DS} = 10 V$ ; $I_D = 1.9 A$ ; $T_j = 25 \text{ }^\circ C$	-	7	-	S
$R_G$	gate resistance	$f = 1 \text{ MHz}$ ; $T_j = 25 \text{ }^\circ C$	-	1	-	$\Omega$
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$V_{DS} = 40 V$ ; $I_D = 1.9 A$ ; $V_{GS} = 10 V$ ; $T_j = 25 \text{ }^\circ C$	-	4.8	7.2	nC
$Q_{GS}$	gate-source charge		-	0.6	-	nC
$Q_{GD}$	gate-drain charge		-	0.9	-	nC
$C_{iss}$	input capacitance	$V_{DS} = 40 V$ ; $f = 1 \text{ MHz}$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	215	-	pF
$C_{oss}$	output capacitance		-	25	-	pF
$C_{riss}$	reverse transfer capacitance		-	15	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 40 V$ ; $I_D = 1.9 A$ ; $V_{GS} = 10 V$ ; $R_{G(ext)} = 6 \text{ } \Omega$ ; $T_j = 25 \text{ }^\circ C$	-	3.5	-	ns
$t_r$	rise time		-	2	-	ns
$t_{d(off)}$	turn-off delay time		-	9.5	-	ns
$t_f$	fall time		-	3	-	ns
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = 0.8 A$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	0.8	1.2	V

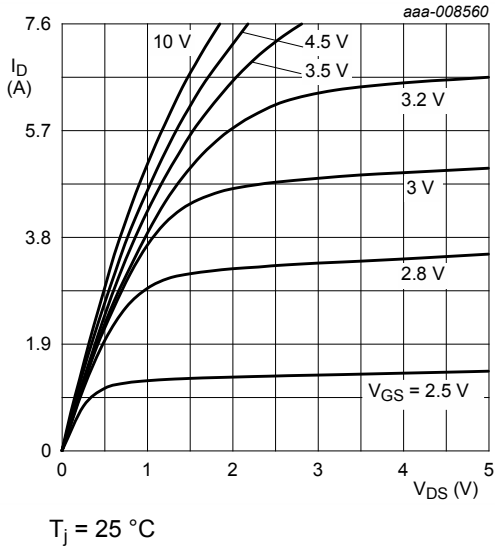


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

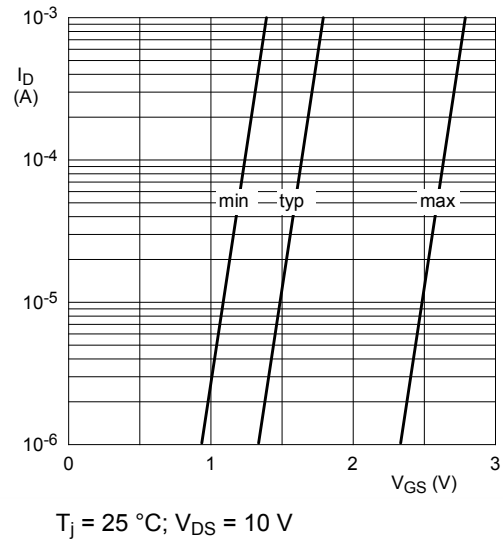


Fig. 7. Sub-threshold drain current as a function of gate-source voltage

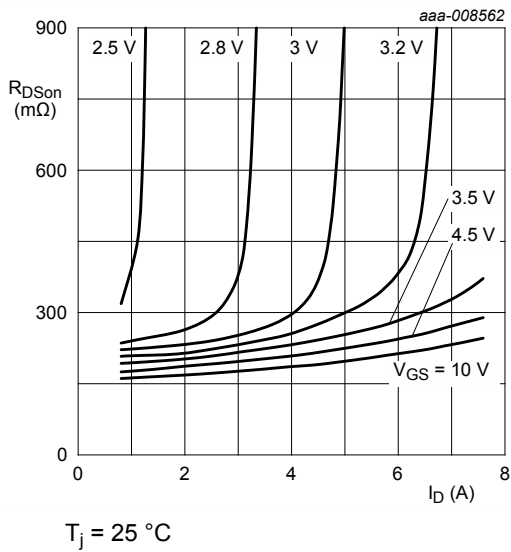


Fig. 8. Drain-source on-state resistance as a function of drain current; typical values

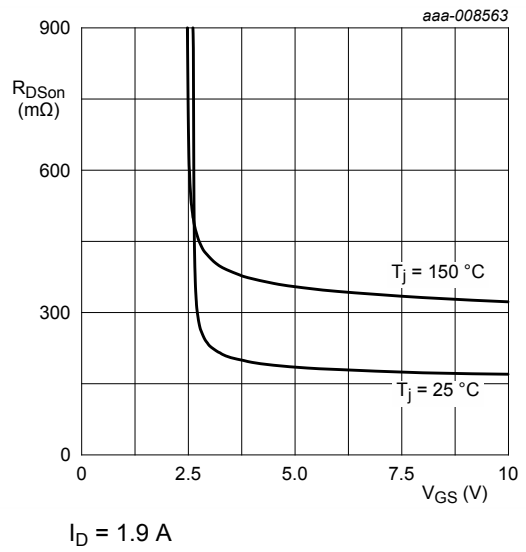
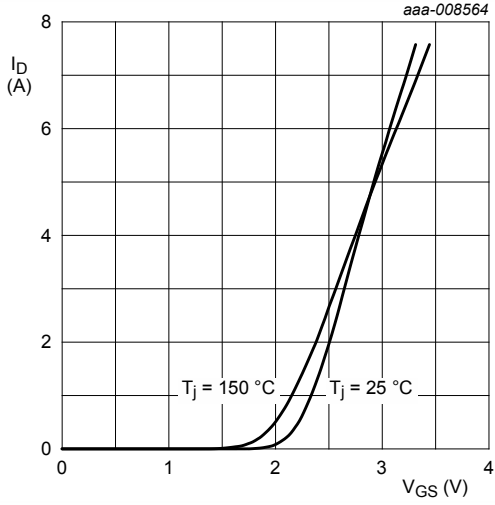
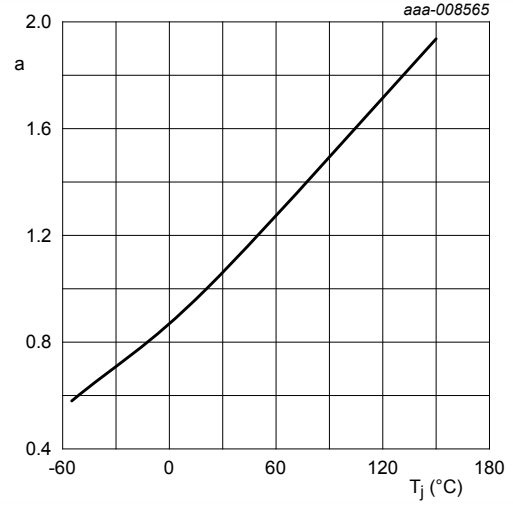


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values



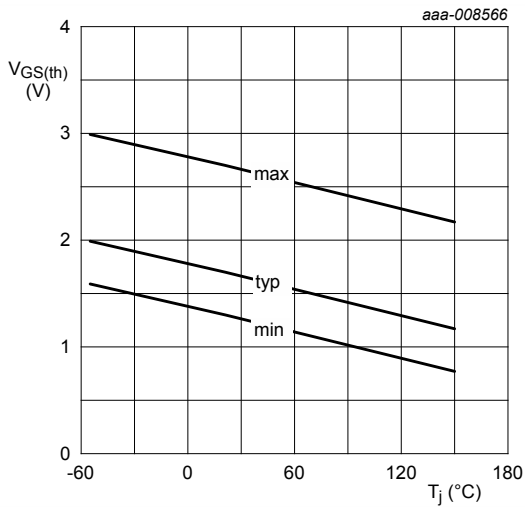
$$V_{DS} > I_D \times R_{DSon}$$

**Fig. 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values**



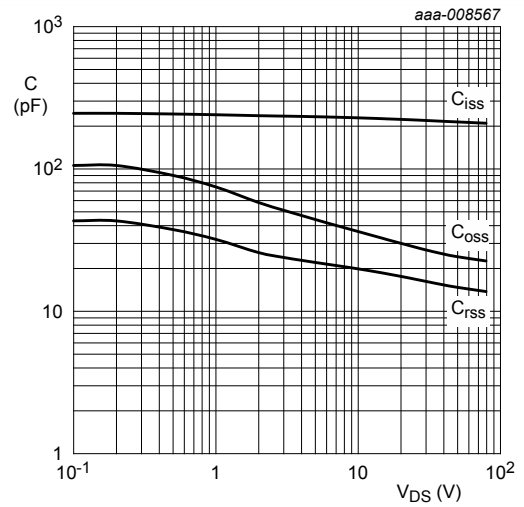
**Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values**

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



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

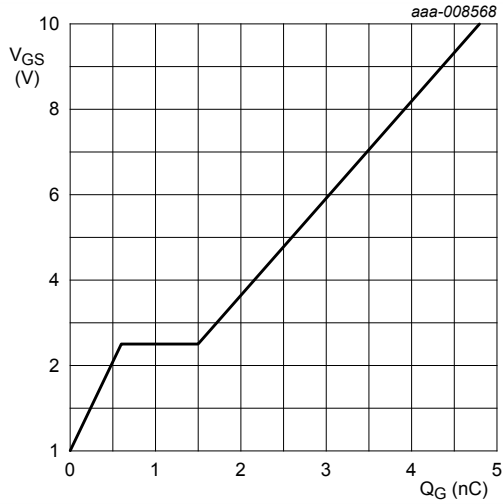
**Fig. 12. Gate-source threshold voltage as a function of junction temperature**



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

**Fig. 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values**





$I_D = 1.9$  A;  $V_{DS} = 40$  V;  $T_{amb} = 25$  °C

Fig. 14. Gate-source voltage as a function of gate charge; typical values

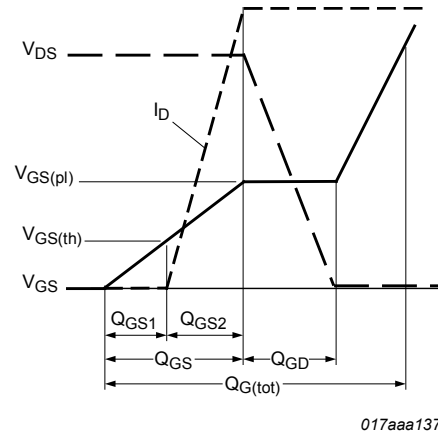
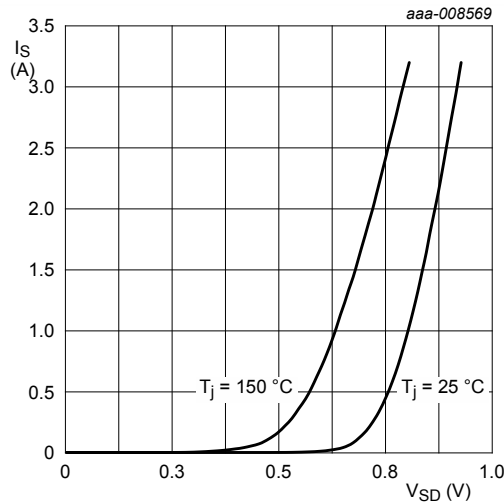


Fig. 15. MOSFET transistor: Gate charge waveform definitions



$V_{GS} = 0$  V

Fig. 16. Source current as a function of source-drain voltage; typical values

## 11. Test information

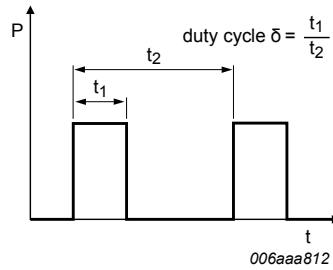


Fig. 17. Duty cycle definition

### 11.1 Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard Q101 - Stress test qualification for discrete semiconductors, and is suitable for use in automotive applications.

## 12. Package outline

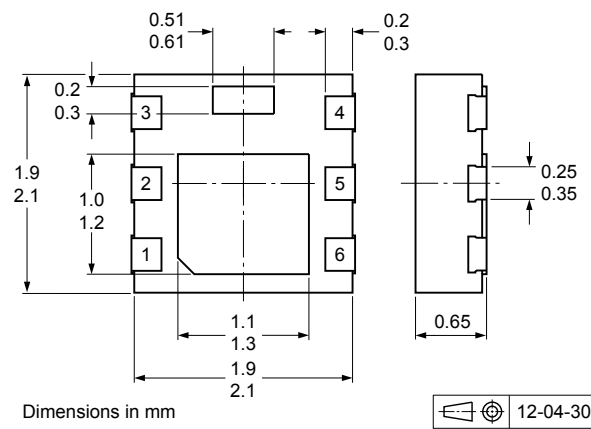


Fig. 18. Package outline DFN2020MD-6 (SOT1220)

### 13. Soldering

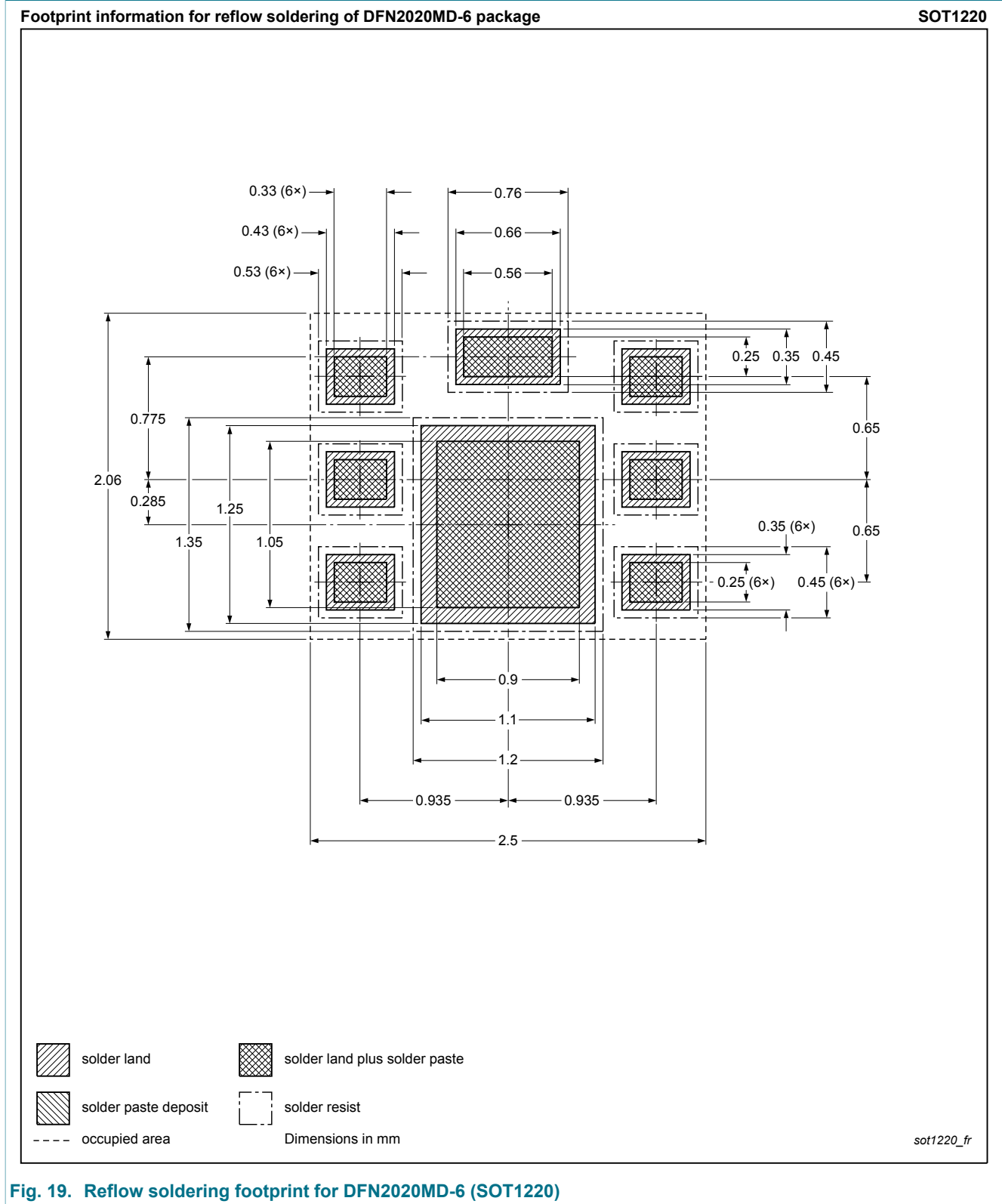


Fig. 19. Reflow soldering footprint for DFN2020MD-6 (SOT1220)

## 14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMPB215ENEA v.2	20131218	Product data sheet	-	PMPB215ENEA v.1
Modifications:	<ul style="list-style-type: none"><li>Product status changed</li></ul>			
PMPB215ENEA v.1	20130219	Objective 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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