# PMPB14XNX Datasheet


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| | |
|---|---|
| DiGi Electronics Part Number | PMPB14XNX-DG |
| Manufacturer | Nexperia USA Inc. |
| Manufacturer Product Number | PMPB14XNX |
| Description | MOSFET N-CH 40V 8.1A DFN2020MD-6 |
| Detailed Description | N-Channel 40 V 8.1A (Ta) 3.8W (Ta), 12.5W (Tc) Surface Mount DFN2020MD-6 |

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RFQ Email: Info@DiGi-Electronics.com

## Purchase and inquiry

| Manufacturer Product Number: | Manufacturer: |
| --- | --- |
| PMPB14XNX | Nexperia USA Inc. |
| Series: | Product Status: |
| TrenchMOS™ | Active |
| FET Type: | Technology: |
| N-Channel | MOSFET (Metal Oxide) |
| Drain to Source Voltage (Vdss): | Current - Continuous Drain (Id) @ 25°C: |
| 40 V | 8.1A (Ta) |
| Drive Voltage (Max Rds On, Min Rds On): | Rds On (Max) @ Id, Vgs: |
| 1.5V, 4.5V | 18mOhm @ 8.1A, 4.5V |
| Vgs(th) (Max) @ Id: | Gate Charge (Qg) (Max) @ Vgs: |
| 900mV @ 250µA | 28 nC @ 4.5 V |
| Vgs (Max): | Input Capacitance (Ciss) (Max) @ Vds: |
| ±8V | 1625 pF @ 20 V |
| FET Feature: | Power Dissipation (Max): |
| - | 3.8W (Ta), 12.5W (Tc) |
| Operating Temperature: | Mounting Type: |
| -55°C ~ 150°C (TJ) | Surface Mount |
| Supplier Device Package: | Package / Case: |
| DFN2020MD-6 | 6-UDFN Exposed Pad |
| Base Product Number: | |
| PMPB14 | |

## Environmental & Export classification

| RoHS Status: | Moisture Sensitivity Level (MSL): |
| --- | --- |
| ROHS3 Compliant | 1 (Unlimited) |
| REACH Status: | ECCN: |
| REACH Unaffected | EAR99 |
| HTSUS: | |
| 8541.29.0095 | |

# PMPB14XN

## 40 V, N-channel Trench MOSFET

**11 March 2020** **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

- Very fast switching
- Low threshold voltage
- Trench MOSFET technology
- Side wettable flanks for optical solder inspection
- Exposed drain pad for excellent thermal conduction

## 3. Applications

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

## 4. Quick reference data

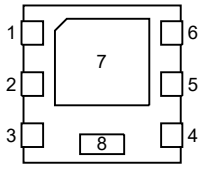
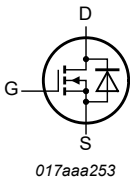
**Table 1. Quick reference data**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{DS}$ | drain-source voltage | $T_j$ = 25 °C | | - | - | 40 | V |
| $V_{GS}$ | gate-source voltage | | | -8 | - | 8 | V |
| $I_D$ | drain current | $V_{GS}$ = 4.5 V; $T_{amb}$ = 25 °C; t ≤ 5 s | [1] | - | - | 11.5 | A |
| **Static characteristics** | | | | | | | |
| $R_{DSon}$ | drain-source on-state resistance | $V_{GS}$ = 4.5 V; $I_D$ = 8.1 A; $T_j$ = 25 °C | | - | 15 | 18 | mΩ |

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

## 5. Pinning information

**Table 2. Pinning information**

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|---|---|---|---|---|
| 1 | D | drain |  Transparent top view DFN2020MD-6 **(SOT1220)** |  *017aaa253* |
| 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 |
| PMPB14XN | DFN2020MD-6 | plastic, leadless thermal enhanced ultra thin small outline package with side-wettable flanks (SWF); 6 terminals; 0.65 mm pitch; 2 mm x 2 mm x 0.65 mm body | SOT1220 |

## 7. Marking

**Table 4. Marking codes**

| Type number | Marking code |
|---|---|
| PMPB14XN | 5D |

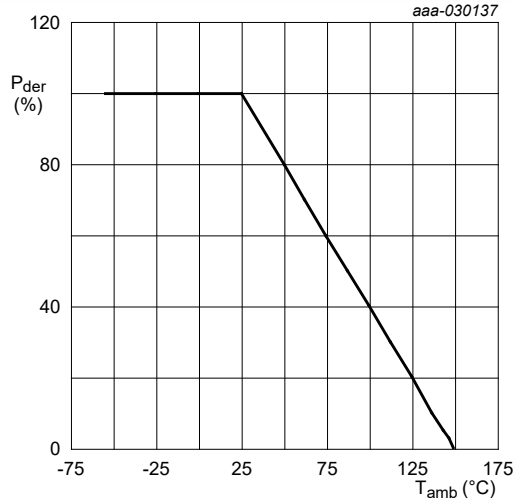
# 8. Limiting values

**Table 5. Limiting values**

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

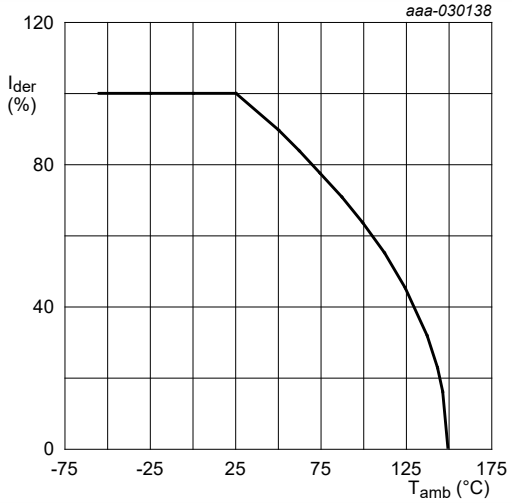
| Symbol | Parameter | Conditions | | Min | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{DS}$ | drain-source voltage | $T_j$ = 25 °C | | - | 40 | V |
| $V_{GS}$ | gate-source voltage | | | -8 | 8 | V |
| $I_D$ | drain current | $V_{GS}$ = 4.5 V; $T_{amb}$ = 25 °C; t ≤ 5 s | [1] | - | 11.5 | A |
| | | $V_{GS}$ = 4.5 V; $T_{amb}$ = 25 °C | [1] | - | 8.1 | A |
| | | $V_{GS}$ = 4.5 V; $T_{amb}$ = 100 °C | [1] | - | 5.1 | A |
| $I_{DM}$ | peak drain current | $T_{amb}$ = 25 °C; single pulse; $t_p$ ≤ 10 µs | | - | 33 | A |
| $P_{tot}$ | total power dissipation | $T_{amb}$ = 25 °C | [1] | - | 1.9 | W |
| | | $T_{amb}$ = 25 °C; t ≤ 5 s | [1] | - | 3.8 | W |
| | | $T_{sp}$ = 25 °C | | - | 12.5 | W |
| $T_j$ | junction temperature | | | -55 | 150 | °C |
| $T_{amb}$ | ambient temperature | | | -55 | 150 | °C |
| $T_{stg}$ | storage temperature | | | -65 | 150 | °C |
| **Source-drain diode** | | | | | | |
| $I_S$ | source current | $T_{amb}$ = 25 °C | [1] | - | 1.9 | A |

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




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

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




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

**Fig. 2. Normalized continous drain current as a function of ambient temperature**

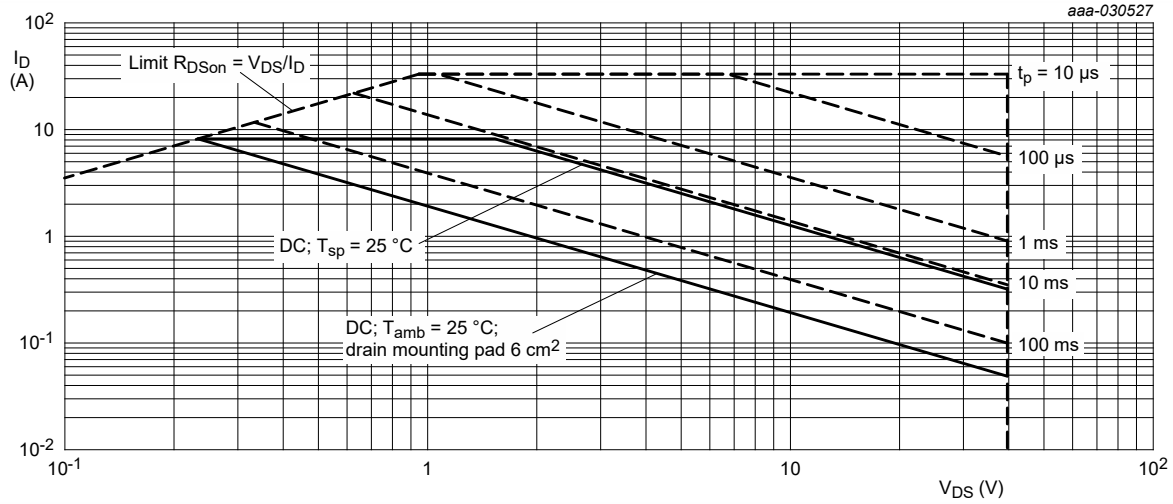


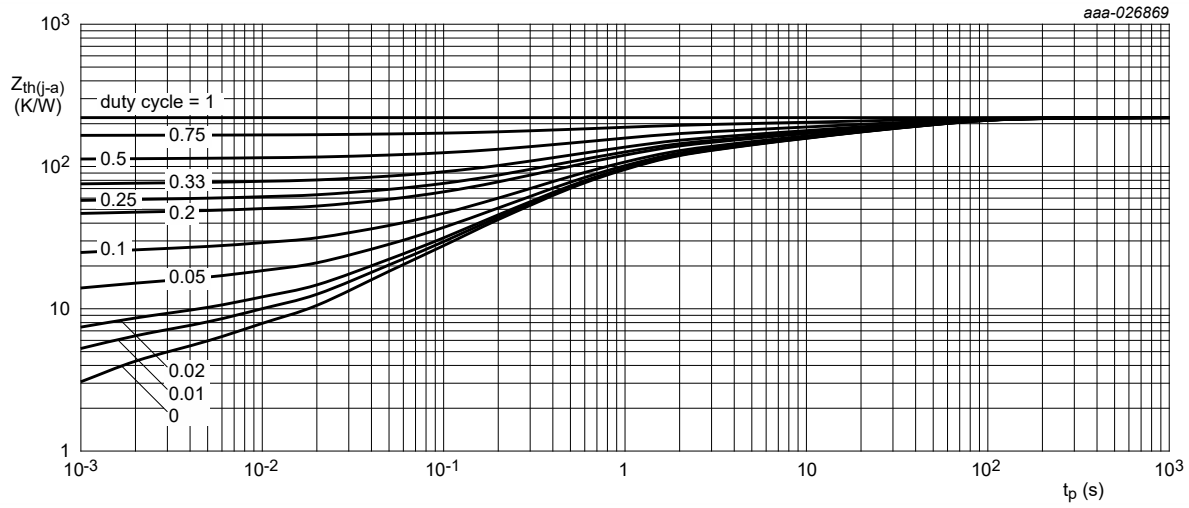

**Fig. 3. Safe operating area; junction to ambient; continuous and peak drain currents as a function of drain-source voltage**

# 9. Thermal characteristics

**Table 6. Thermal characteristics**

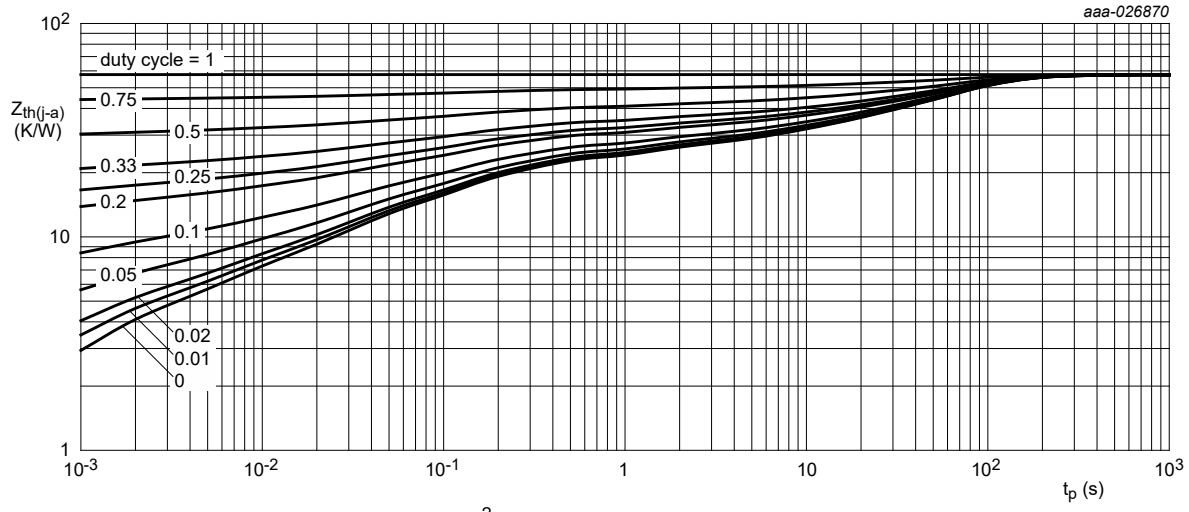
| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1] | - | 223 | 256 | K/W |
| | | | [2] | - | 57 | 66 | K/W |
| | | in free air; t ≤ 5 s | [2] | - | 29 | 33 | K/W |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point | | | - | 6 | 10 | 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 6 $cm^2$.




FR4 PCB, standard footprint

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



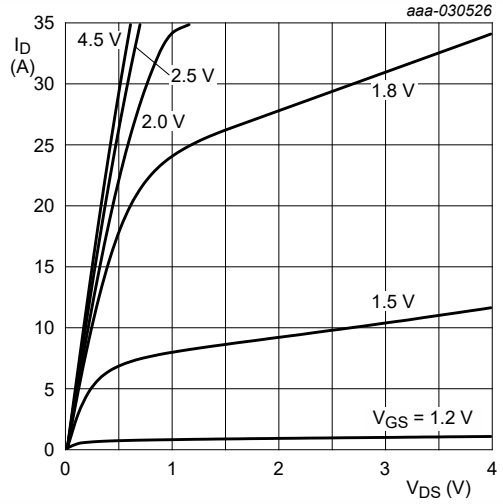

FR4 PCB, mounting pad for drain 6 $cm^2$

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

# 10. Characteristics

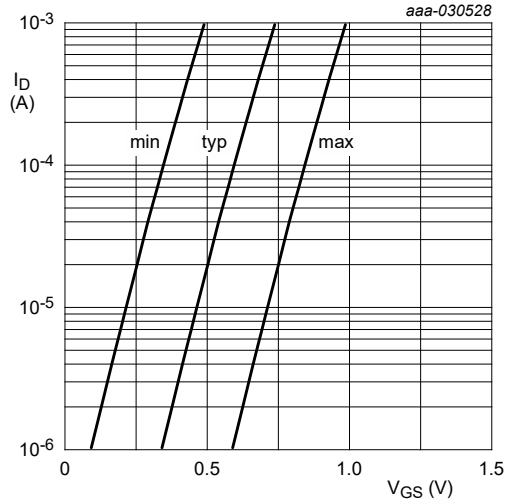
**Table 7. Characteristics**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Static characteristics** | | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D$ = 250 µA; $V_{GS}$ = 0 V; $T_j$ = 25 °C | | 40 | - | - | V |
| $V_{GSth}$ | gate-source threshold voltage | $I_D$ = 250 µA; $V_{DS}$ = $V_{GS}$; $T_j$ = 25 °C | | 0.4 | 0.65 | 0.9 | V |
| $I_{DSS}$ | drain leakage current | $V_{DS}$ = 40 V; $V_{GS}$ = 0 V; $T_j$ = 25 °C | | - | - | 1 | µA |
| $I_{GSS}$ | gate leakage current | $V_{GS}$ = -8 V; $V_{DS}$ = 0 V; $T_j$ = 25 °C | | - | - | -100 | nA |
| | | $V_{GS}$ = 8 V; $V_{DS}$ = 0 V; $T_j$ = 25 °C | | - | - | 100 | nA |
| $R_{DSon}$ | drain-source on-state resistance | $V_{GS}$ = 4.5 V; $I_D$ = 8.1 A; $T_j$ = 25 °C | | - | 15 | 18 | mΩ |
| | | $V_{GS}$ = 4.5 V; $I_D$ = 8.1 A; $T_j$ = 150 °C | | - | 24 | 29 | mΩ |
| | | $V_{GS}$ = 2.5 V; $I_D$ = 7.3 A; $T_j$ = 25 °C | | - | 17 | 22 | mΩ |
| | | $V_{GS}$ = 1.8 V; $I_D$ = 3 A; $T_j$ = 25 °C | | - | 23 | 32 | mΩ |
| | | $V_{GS}$ = 1.5 V; $I_D$ = 0.5 A; $T_j$ = 25 °C | | - | 40 | 100 | mΩ |
| $g_{fs}$ | forward transconductance | $V_{DS}$ = 10 V; $I_D$ = 8.3 A; $T_j$ = 25 °C | | - | 22 | - | S |
| $R_G$ | gate resistance | f = 1 MHz | | - | 2.4 | - | Ω |
| **Dynamic characteristics** | | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $V_{DS}$ = 20 V; $I_D$ = 8.3 A; $V_{GS}$ = 4.5 V; $T_j$ = 25 °C | | - | 19.4 | 28 | nC |
| $Q_{GS}$ | gate-source charge | | | - | 2.4 | - | nC |
| $Q_{GD}$ | gate-drain charge | | | - | 5.6 | - | nC |
| $C_{iss}$ | input capacitance | $V_{DS}$ = 20 V; f = 1 MHz; $V_{GS}$ = 0 V; $T_j$ = 25 °C | | - | 1625 | - | pF |
| $C_{oss}$ | output capacitance | | | - | 99 | - | pF |
| $C_{rss}$ | reverse transfer capacitance | | | - | 85 | - | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS}$ = 20 V; $I_D$ = 8.3 A; $V_{GS}$ = 4.5 V; $R_{G(ext)}$ = 6 Ω; $T_j$ = 25 °C | | - | 5 | - | ns |
| $t_r$ | rise time | | | - | 8 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | | - | 35 | - | ns |
| $t_f$ | fall time | | | - | 15 | - | ns |
| **Source-drain diode** | | | | | | | |
| $V_{SD}$ | source-drain voltage | $I_S$ = 1.9 A; $V_{GS}$ = 0 V; $T_j$ = 25 °C | | - | 0.7 | 1.2 | V |



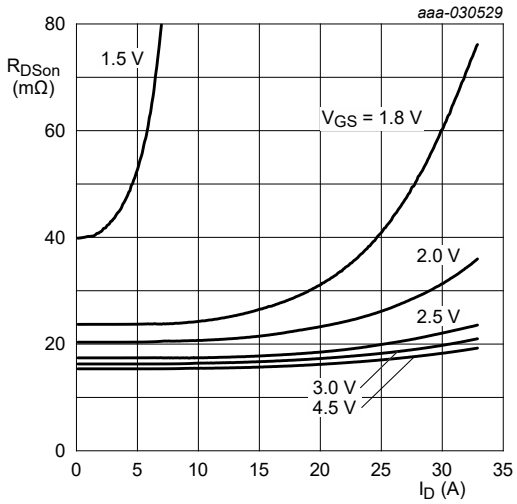

$T_j$ = 25 °C

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



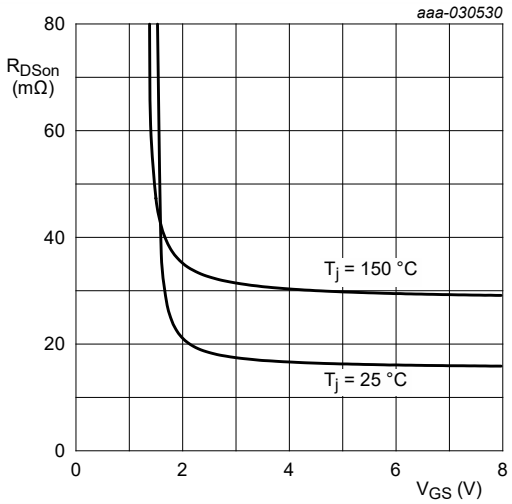

$V_{DS}$ = 5 V; $T_j$ = 25 °C

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



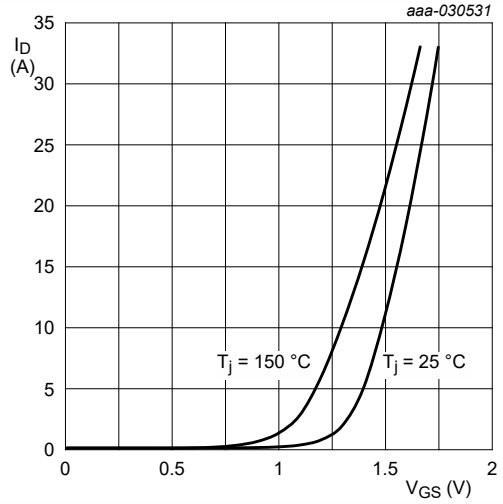

$T_j$ = 25 °C

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



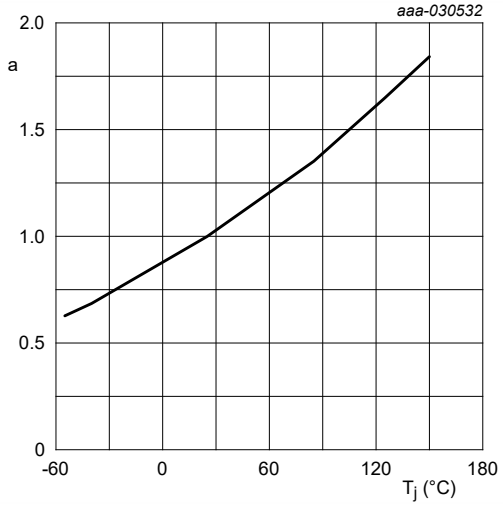

$I_D$ = 8.3 A

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



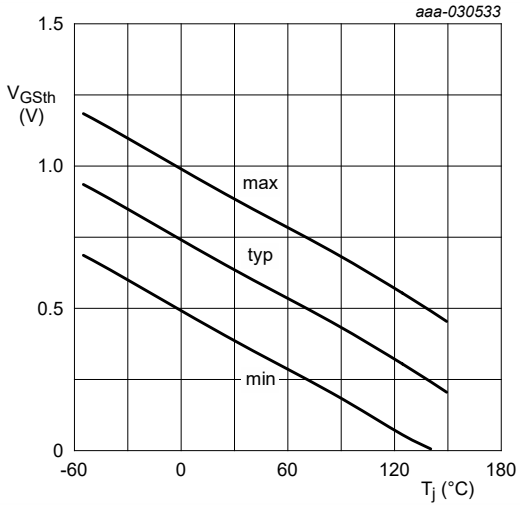

$V_{DS}$ = 5 V

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



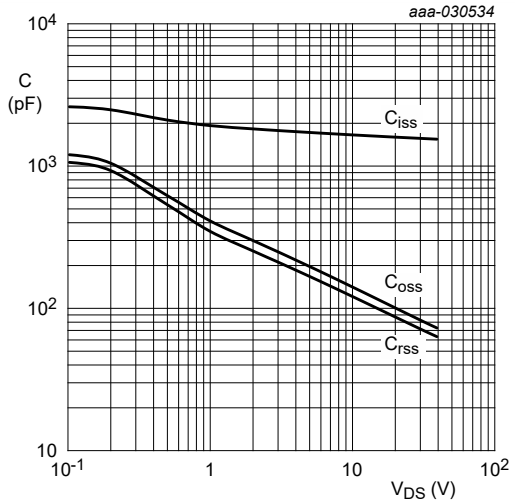

$$a = \frac{R_{DSon}}{R_{DSon(25°C)}}$$

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



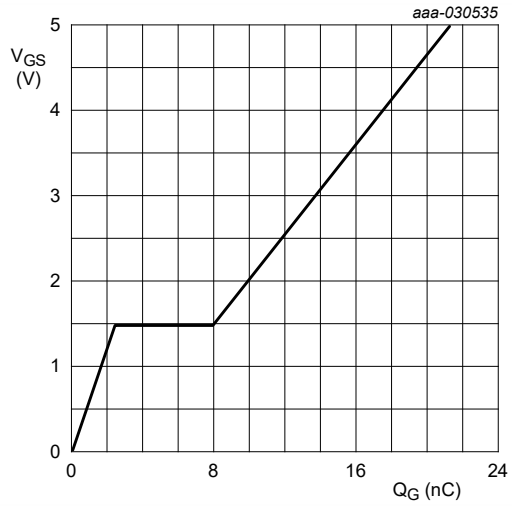

$I_D$ = 250 µA; $V_{DS}$ = $V_{GS}$

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




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

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




$I_D$ = 8.3 A; $V_{DS}$ = 20 V; $T_{amb}$ = 25 °C

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

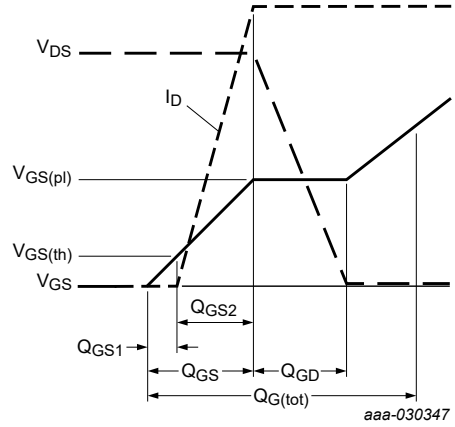
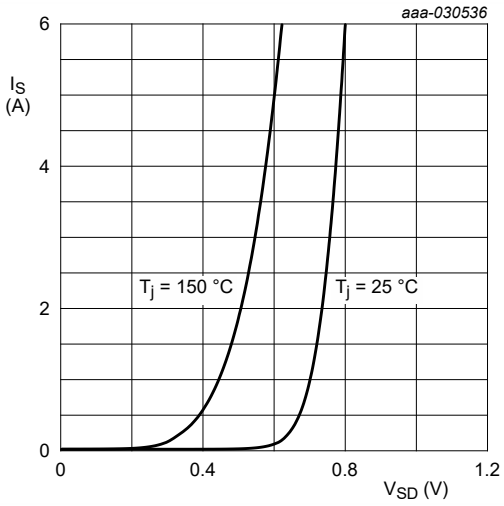



**Fig. 15. Gate charge waveform definitions**




$V_{GS}$ = 0 V

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

## 11. Test information

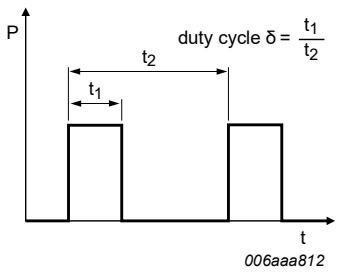
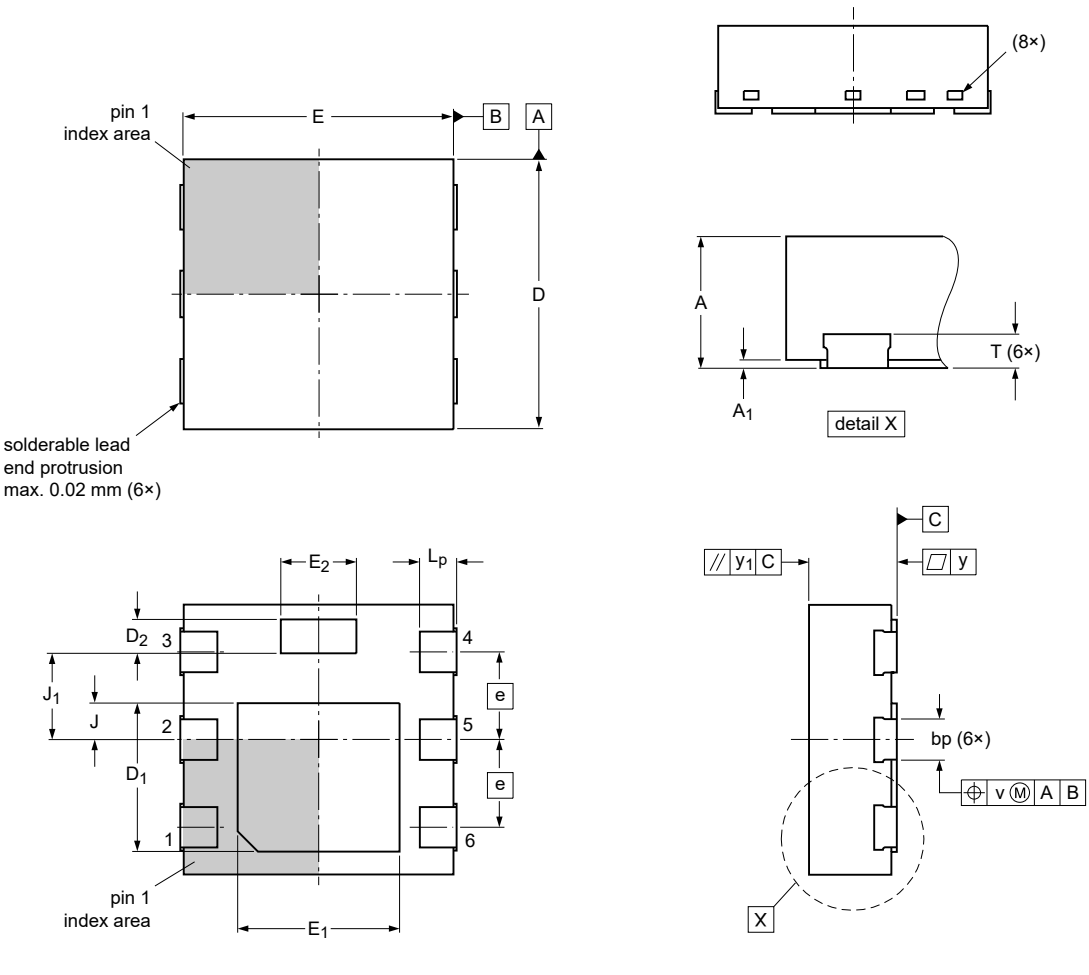



**Fig. 17. Duty cycle definition**

## 12. Package outline

**DFN2020MD-6: plastic thermal enhanced ultra thin small outline package; no leads; 6 terminals; body 2 x 2 x 0.65 mm** **SOT1220**




Dimensions (mm are the original dimensions)

| Unit | | A | $A_1$ | bp | D | $D_1$ | $D_2$ | E | $E_1$ | $E_2$ | e | J | $J_1$ | $L_p$ | T | v | y | $y_1$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | min | | | 0.25 | 1.9 | 1.0 | 0.2 | 1.9 | 1.1 | 0.51 | | | | 0.2 | 0.10 | | | |
| | nom | | | | | | | | | | 0.65 | 0.27 | 0.64 | | 0.16 | 0.1 | 0.05 | 0.1 |
| | max | 0.65 | 0.04 | 0.35 | 2.1 | 1.2 | 0.3 | 2.1 | 1.3 | 0.61 | | | | 0.3 | 0.22 | | | |

Note
1. Dimension A is including plating thickness.

*sot1220_po*

| Outline version | References | | | | European projection | Issue date |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT1220 | | | | | | ~~18-05-30~~ 18-06-07 |

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

## 13. Soldering

**Footprint information for reflow soldering of DFN2020MD-6 package** **SOT1220**

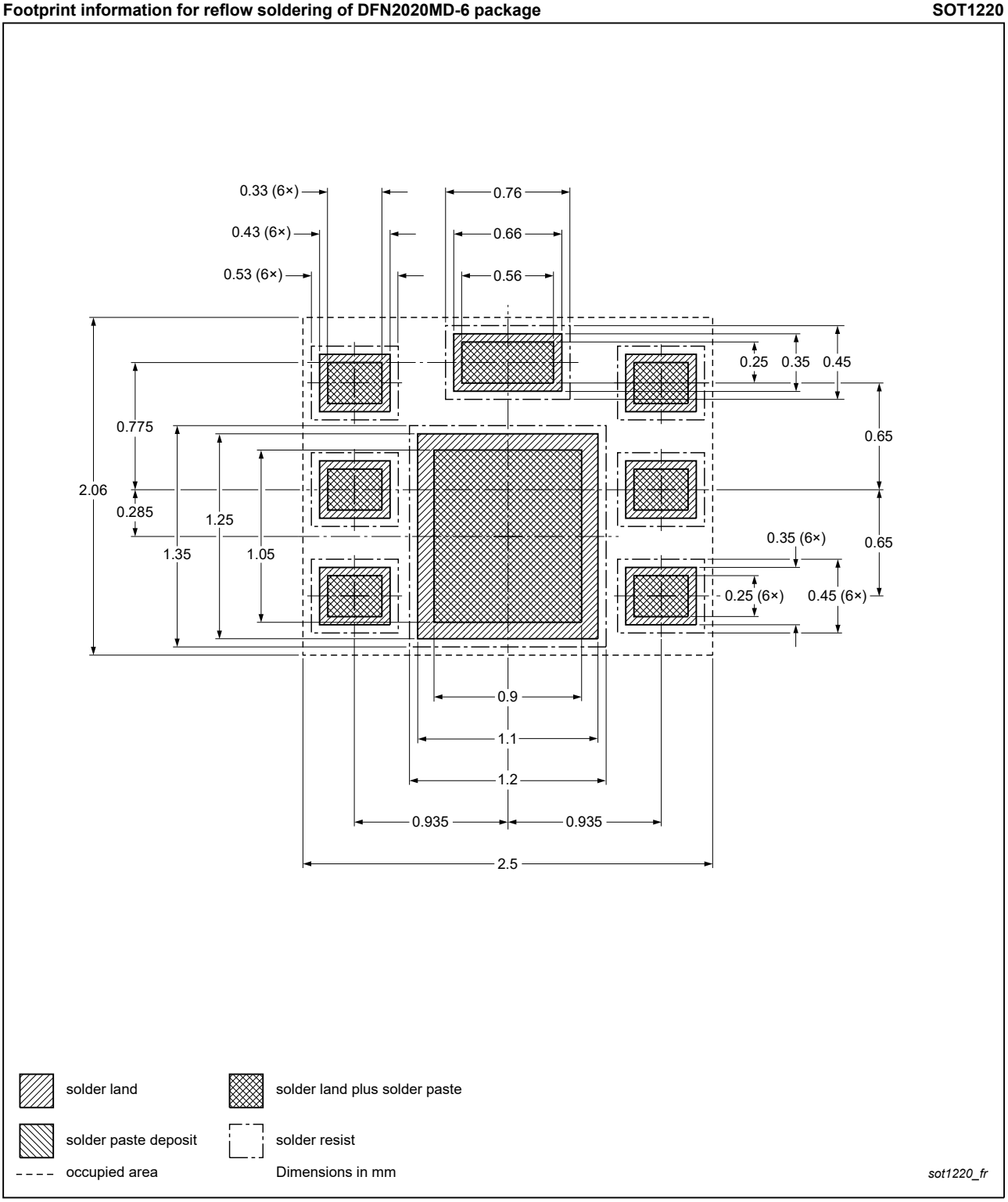



**Fig. 19. Reflow soldering footprint for** DFN2020MD-6 **(SOT1220)**

# 14. Revision history

**Table 8. Revision history**

| Data sheet ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| PMPB14XN v.1 | 20200311 | 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".
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