

- ★ Green Device Available
- ★ Super Low Gate Charge
- ★ Excellent  $CdV/dt$  effect decline
- ★ Advanced high cell density Trench technology

## Description

The 20P02D is the high cell density trenched P-ch MOSFETs, which provides excellent  $R_{DS(on)}$  and gate charge for most of the synchronous buck converter applications. The 20P02D meets the RoHS and Green Product requirement with full function reliability approved.

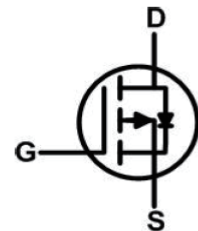
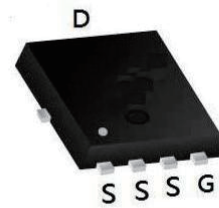
## Product Summary

RoHS

| BVDSS | $R_{DS(on)}$ | ID   |
|-------|--------------|------|
| -20V  | 15mΩ         | -20A |

## PDFN3\*3

## Pin Configuration



## Absolute Maximum Ratings

| Symbol                            | Parameter                                 |                        | Max.        | Units |
|-----------------------------------|-------------------------------------------|------------------------|-------------|-------|
| V <sub>DSS</sub>                  | Drain-Source Voltage                      |                        | -20         | V     |
| V <sub>GSS</sub>                  | Gate-Source Voltage                       |                        | ±12         | V     |
| I <sub>D</sub>                    | Continuous Drain Current                  | T <sub>A</sub> = 25°C  | -20         | A     |
|                                   |                                           | T <sub>A</sub> = 100°C | -12         | A     |
| I <sub>DM</sub>                   | Pulsed Drain Current <small>note1</small> |                        | -28         | A     |
| P <sub>D</sub>                    | Power Dissipation                         | T <sub>A</sub> = 25°C  | 5           | W     |
| R <sub>θJA</sub>                  | Thermal Resistance, Junction to Ambient   |                        | 62.5        | °C/W  |
| T <sub>J</sub> , T <sub>STG</sub> | Operating and Storage Temperature Range   |                        | -55 to +150 | °C    |

Electrical Characteristics ( $T_J = 25^\circ\text{C}$  unless otherwise specified)

| Symbol                                                 | Parameter                                                 | Test condition                                                                                   | Min. | Typ. | Max. | Units |
|--------------------------------------------------------|-----------------------------------------------------------|--------------------------------------------------------------------------------------------------|------|------|------|-------|
| Off Characteristic                                     |                                                           |                                                                                                  |      |      |      |       |
| V <sub>(BR)DSS</sub>                                   | Drain-Source Breakdown Voltage                            | V <sub>GS</sub> =0V, I <sub>D</sub> = -250μA                                                     | -20  | -    | -    | V     |
| I <sub>DSS</sub>                                       | Zero Gate Voltage Drain Current                           | V <sub>DS</sub> = -20V, V <sub>GS</sub> =0V,                                                     | -    | -    | -1   | μA    |
| I <sub>GSS</sub>                                       | Gate to Body Leakage Current                              | V <sub>DS</sub> =0V, V <sub>GS</sub> = ±12V                                                      | -    | -    | ±100 | nA    |
| On Characteristics                                     |                                                           |                                                                                                  |      |      |      |       |
| V <sub>GS(th)</sub>                                    | Gate Threshold Voltage                                    | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> = -250μA                                       | -0.4 | -0.7 | -1   | V     |
| R <sub>DS(on)</sub>                                    | Static Drain-Source on-Resistance<br><small>note2</small> | V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -7A                                                    | -    | 15   | 20   | mΩ    |
|                                                        |                                                           | V <sub>GS</sub> = -2.5V, I <sub>D</sub> = -5A                                                    | -    | 21   | 32   |       |
| Dynamic Characteristics                                |                                                           |                                                                                                  |      |      |      |       |
| C <sub>iss</sub>                                       | Input Capacitance                                         | V <sub>DS</sub> = -10V, V <sub>GS</sub> =0V,<br>f=1.0MHz                                         | -    | 2000 | -    | pF    |
| C <sub>oss</sub>                                       | Output Capacitance                                        |                                                                                                  | -    | 242  | -    | pF    |
| C <sub>rss</sub>                                       | Reverse Transfer Capacitance                              |                                                                                                  | -    | 231  | -    | pF    |
| Q <sub>g</sub>                                         | Total Gate Charge                                         | V <sub>DS</sub> = -10V, I <sub>D</sub> = -3A,<br>V <sub>GS</sub> = -4.5V                         | -    | 15.3 | -    | nC    |
| Q <sub>gs</sub>                                        | Gate-Source Charge                                        |                                                                                                  | -    | 2.2  | -    | nC    |
| Q <sub>gd</sub>                                        | Gate-Drain(“Miller”) Charge                               |                                                                                                  | -    | 4.4  | -    | nC    |
| Switching Characteristics                              |                                                           |                                                                                                  |      |      |      |       |
| t <sub>d(on)</sub>                                     | Turn-on Delay Time                                        | V <sub>DD</sub> = -10V, I <sub>D</sub> = -7A,<br>V <sub>GS</sub> = -4.5V, R <sub>GEN</sub> =2.5Ω | -    | 10   | -    | ns    |
| t <sub>r</sub>                                         | Turn-on Rise Time                                         |                                                                                                  | -    | 31   | -    | ns    |
| t <sub>d(off)</sub>                                    | Turn-off Delay Time                                       |                                                                                                  | -    | 28   | -    | ns    |
| t <sub>f</sub>                                         | Turn-off Fall Time                                        |                                                                                                  | -    | 8    | -    | ns    |
| Drain-Source Diode Characteristics and Maximum Ratings |                                                           |                                                                                                  |      |      |      |       |
| I <sub>S</sub>                                         | Maximum Continuous Drain to Source Diode Forward Current  |                                                                                                  | -    | -    | -20  | A     |
| I <sub>SM</sub>                                        | Maximum Pulsed Drain to Source Diode Forward Current      |                                                                                                  | -    | -    | -28  | A     |
| V <sub>SD</sub>                                        | Drain to Source Diode Forward Voltage                     | V <sub>GS</sub> =0V, I <sub>S</sub> = -7A                                                        | -    | -0.8 | -1.2 | V     |

## Notes:

1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
2. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$

Typical Electrical and Thermal Characteristics (Curves)

Figure1: Output Characteristics

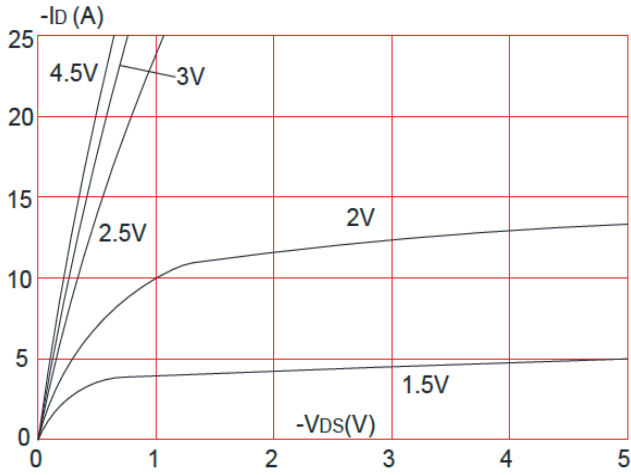


Figure 2: Typical Transfer Characteristics

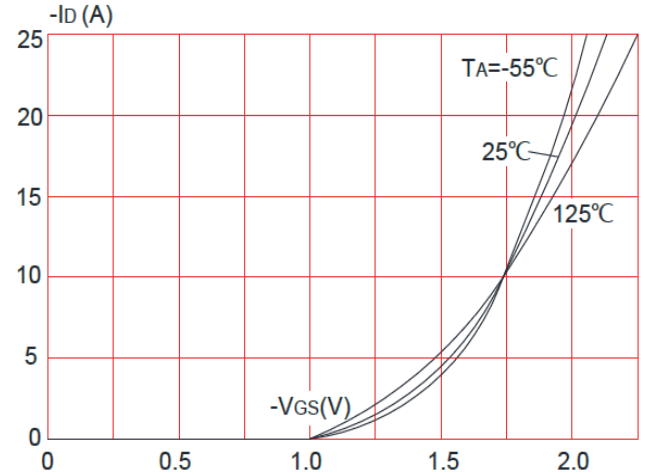


Figure 3: On-resistance vs. Drain Current

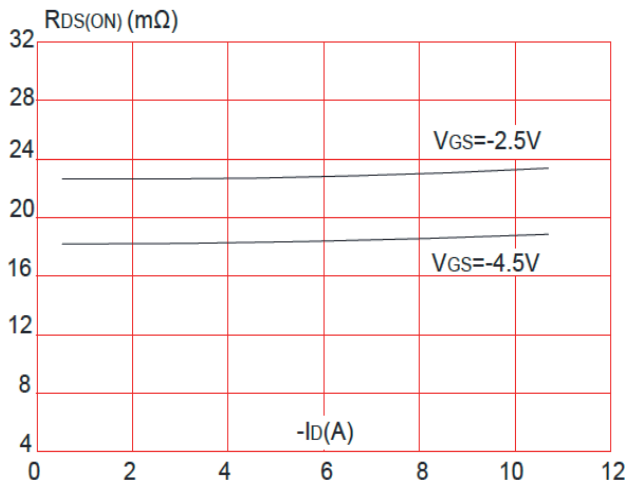


Figure 4: Body Diode Characteristics

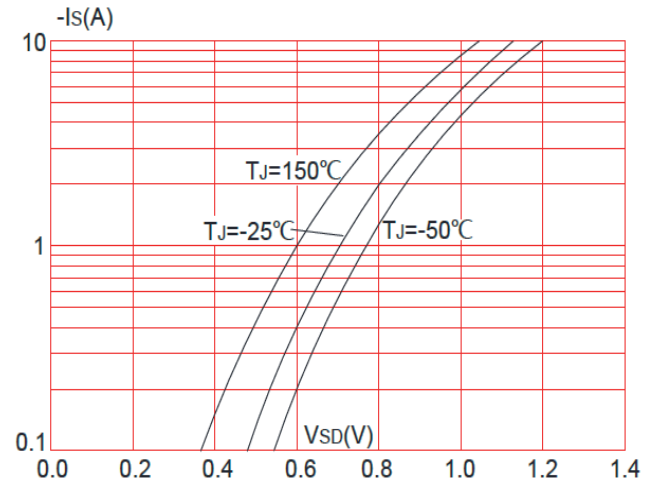


Figure 5: Gate Charge Characteristics

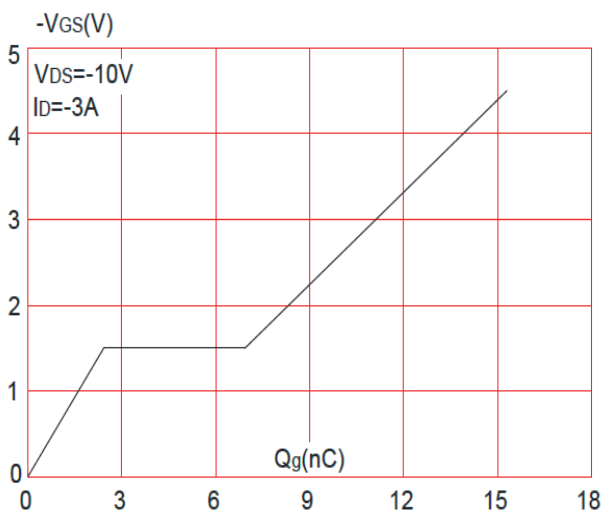
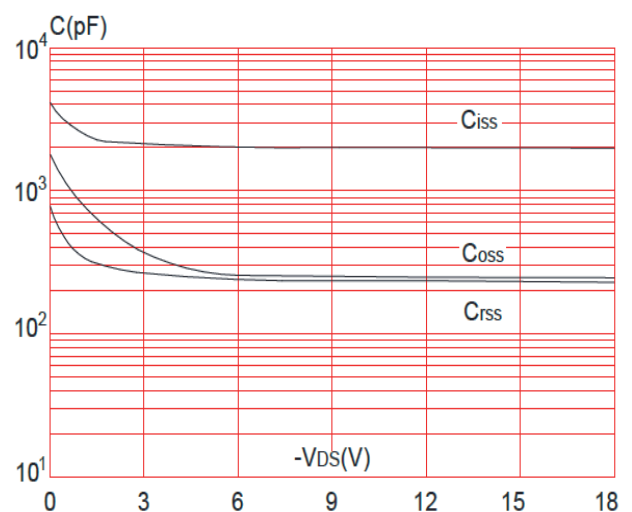


Figure 6: Capacitance Characteristics



# Typical Performance Characteristics

Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

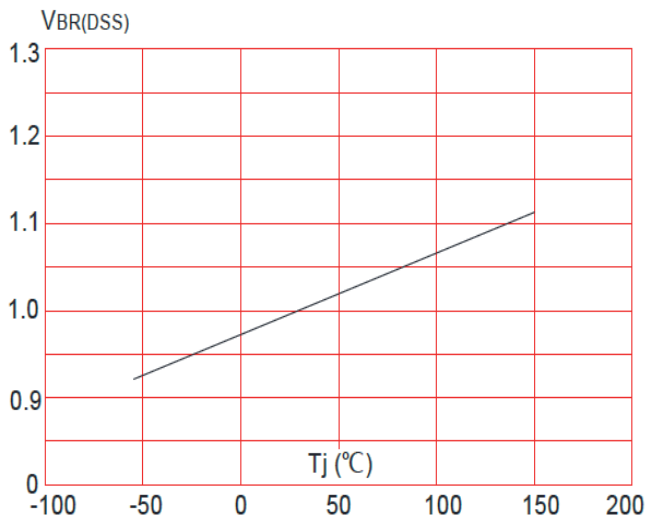


Figure 8: Normalized on Resistance vs. Junction Temperature

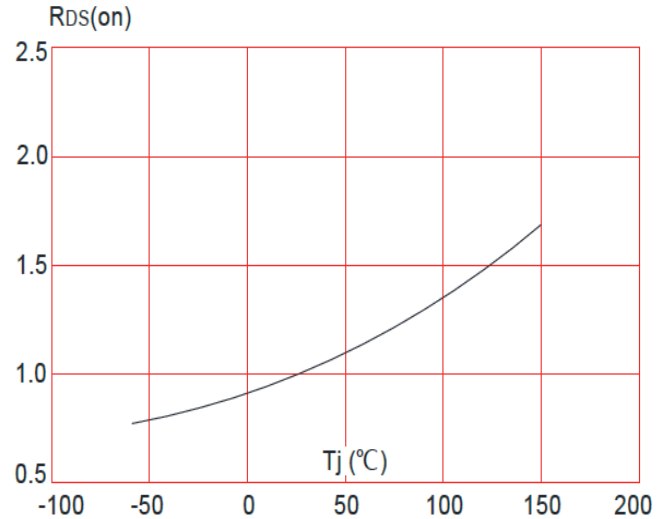


Figure 9: Maximum Safe Operating Area

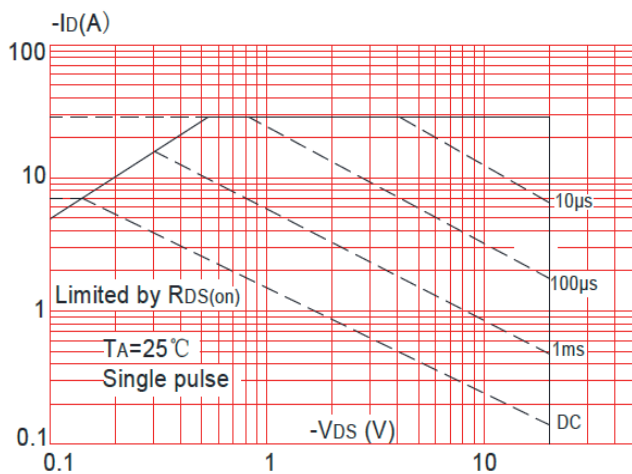


Figure 10: Maximum Continuous Drain Current vs. Ambient Temperature

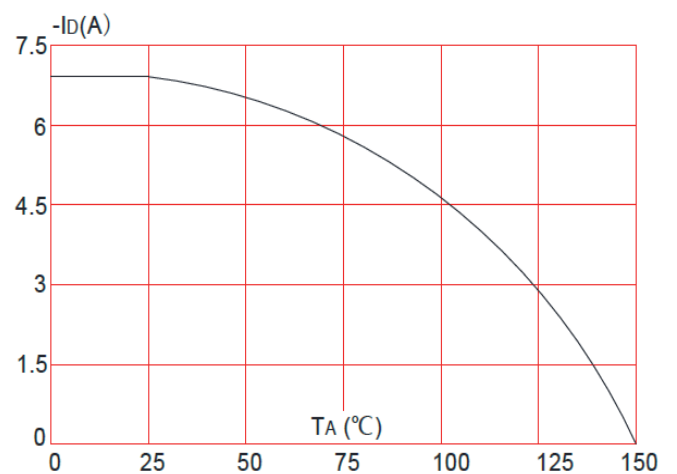
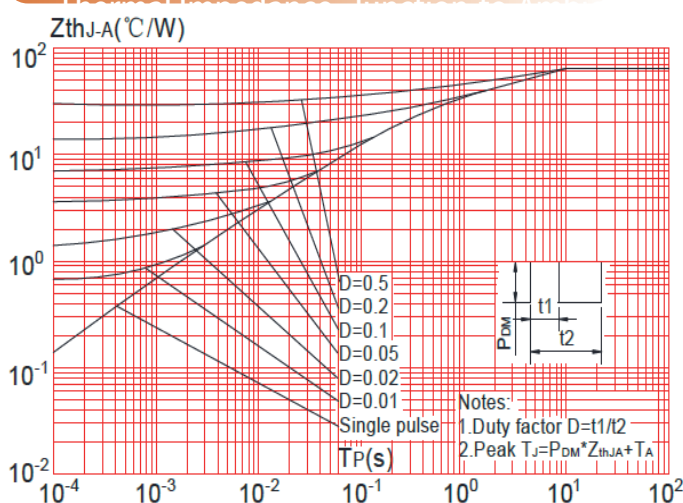
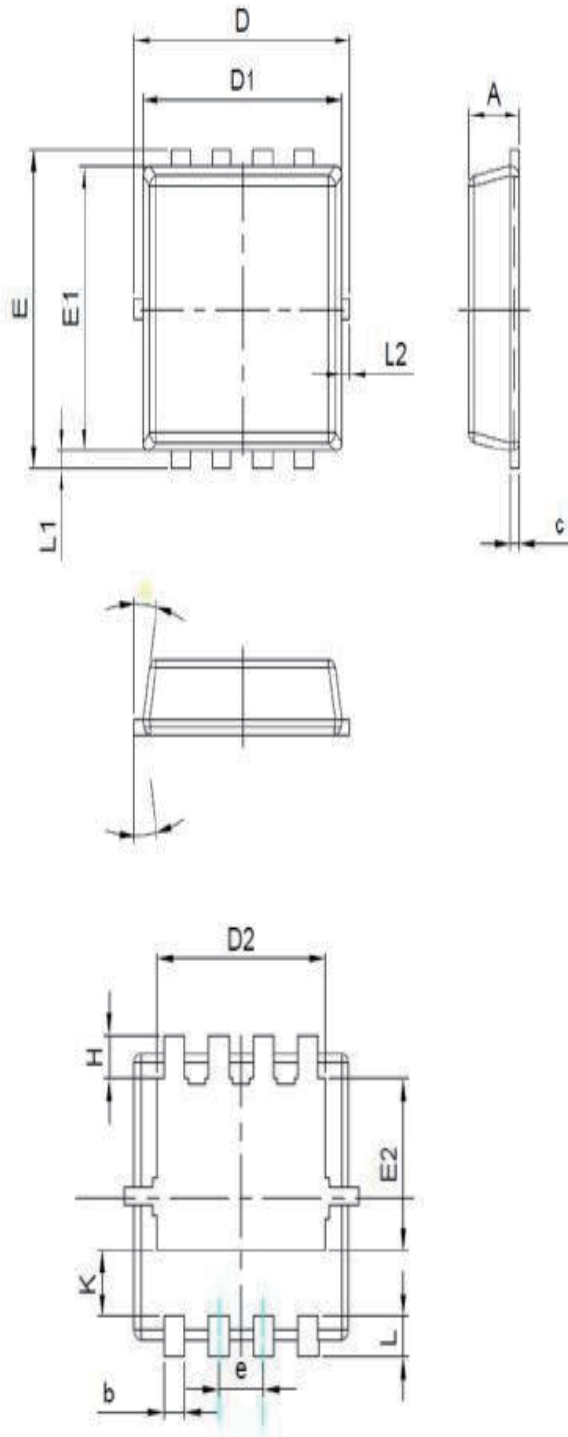


Figure 11: Maximum Effective Transient Thermal Impedance vs. Pulse Width





COMMON DIMENSIONS

( UNITS OF MEASURE = MILLIMETER )

| SYMBOL | MIN      | NOM   | MAX   |
|--------|----------|-------|-------|
| A      | 0.70     | 0.80  | 0.90  |
| b      | 0.25     | 0.30  | 0.39  |
| c      | 0.14     | 0.15  | 0.25  |
| D      | 3.20     | 3.30  | 3.40  |
| D1     | 3.00     | 3.15  | 3.30  |
| D2     | 2.35     | 2.45  | 2.55  |
| e      | 0.65 BSC |       |       |
| E      | 3.25     | 3.35  | 3.45  |
| E1     | 2.85     | 3.00  | 3.15  |
| E2     | 1.635    | 1.735 | 1.835 |
| H      | 0.33     | 0.48  | 0.63  |
| K      | 0.585    | 0.685 | 0.785 |
| L      | 0.30     | 0.40  | 0.50  |
| L1     | 0.05     | 0.15  | 0.25  |
| L2     | -        | -     | 0.15  |
| Ø      | 8°       | 10°   | 12°   |