



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

### Product Summary

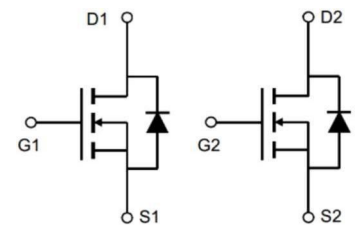
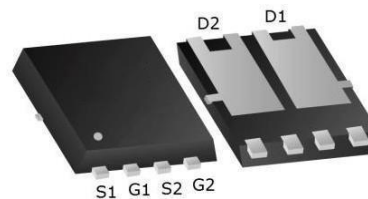
| BVDSS | RDSON | ID  |
|-------|-------|-----|
| 30V   | 15mΩ  | 20A |

### Description

The XR304 is the high cell density trenched N-ch MOSFETs, which provide excellent RDSON and gate charge for most of the synchronous buck converter applications.

The XR304 meet the RoHS and Green

### PDFN3333-8L Pin Configuration



### Absolute Maximum Ratings

| Symbol                | Parameter                                             | Rating     | Units      |
|-----------------------|-------------------------------------------------------|------------|------------|
| $V_{DS}$              | Drain-Source Voltage                                  | 30         | V          |
| $V_{GS}$              | Gate-Source Voltage                                   | $\pm 20$   | V          |
| $I_D@T_C=25^\circ C$  | Continuous Drain Current, $V_{GS}$ @ 10V <sup>1</sup> | 20         | A          |
| $I_D@T_C=100^\circ C$ | Continuous Drain Current, $V_{GS}$ @ 10V <sup>1</sup> | 10         | A          |
| $I_{DM}$              | Pulsed Drain Current <sup>2</sup>                     | 56         | A          |
| EAS                   | Single Pulse Avalanche Energy <sup>3</sup>            | 12.1       | mJ         |
| $I_{AS}$              | Avalanche Current                                     | 48         | A          |
| $P_D@T_C=25^\circ C$  | Total Power Dissipation <sup>4</sup>                  | 6.0        | W          |
| $T_{STG}$             | Storage Temperature Range                             | -55 to 150 | $^\circ C$ |
| $T_J$                 | Operating Junction Temperature Range                  | -55 to 150 | $^\circ C$ |

### Thermal Data

| Symbol          | Parameter                                        | Typ. | Max. | Unit         |
|-----------------|--------------------------------------------------|------|------|--------------|
| $R_{\theta JA}$ | Thermal Resistance Junction-ambient <sup>1</sup> | ---  | 75   | $^\circ C/W$ |

**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                                              | 30   | -    | -    | V     |
| I <sub>DSS</sub>                                       | Zero Gate Voltage Drain Current                          | V <sub>DS</sub> =30V, 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> =±20V                                              | -    | -    | ±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                                | 1.0  | 1.5  | 2.5  | V     |
| R <sub>DS(on)</sub>                                    | Static Drain-Source on-Resistance<br>note2               | V <sub>GS</sub> =10V, I <sub>D</sub> =5A                                                | -    | 15   | 20   | mΩ    |
|                                                        |                                                          | V <sub>GS</sub> =4.5V, I <sub>D</sub> =3A                                               | -    | 21   | 29   | mΩ    |
| Dynamic Characteristics                                |                                                          |                                                                                         |      |      |      |       |
| C <sub>iss</sub>                                       | Input Capacitance                                        | V <sub>DS</sub> =15V, V <sub>GS</sub> =0V,<br>f=1.0MHz                                  | -    | 490  | -    | pF    |
| C <sub>oss</sub>                                       | Output Capacitance                                       |                                                                                         | -    | 79   | -    | pF    |
| C <sub>rss</sub>                                       | Reverse Transfer Capacitance                             |                                                                                         | -    | 61   | -    | pF    |
| Q <sub>g</sub>                                         | Total Gate Charge                                        | V <sub>DS</sub> =15V, I <sub>D</sub> =5.8A,<br>V <sub>GS</sub> =10V                     | -    | 5.2  | -    | nC    |
| Q <sub>gs</sub>                                        | Gate-Source Charge                                       |                                                                                         | -    | 0.9  | -    | nC    |
| Q <sub>gd</sub>                                        | Gate-Drain(“Miller”) Charge                              |                                                                                         | -    | 1.3  | -    | nC    |
| Switching Characteristics                              |                                                          |                                                                                         |      |      |      |       |
| t <sub>d(on)</sub>                                     | Turn-on Delay Time                                       | V <sub>DS</sub> =15V, I <sub>D</sub> =3A,<br>V <sub>GS</sub> =10V, R <sub>REN</sub> =3Ω | -    | 4.5  | -    | ns    |
| t <sub>r</sub>                                         | Turn-on Rise Time                                        |                                                                                         | -    | 2.5  | -    | ns    |
| t <sub>d(off)</sub>                                    | Turn-off Delay Time                                      |                                                                                         | -    | 14.5 | -    | ns    |
| t <sub>f</sub>                                         | Turn-off Fall Time                                       |                                                                                         | -    | 3.5  | -    | ns    |
| Drain-Source Diode Characteristics and Maximum Ratings |                                                          |                                                                                         |      |      |      |       |
| I <sub>S</sub>                                         | Maximum Continuous Drain to Source Diode Forward Current |                                                                                         | -    | -    | 12   | A     |
| I <sub>SM</sub>                                        | Maximum Pulsed Drain to Source Diode Forward Current     |                                                                                         | -    | -    | 48   | A     |
| V <sub>SD</sub>                                        | Drain to Source Diode Forward Voltage                    | V <sub>GS</sub> =0V, I <sub>S</sub> = 12A                                               | -    | -    | 1.2  | V     |

**Diode Characteristics**

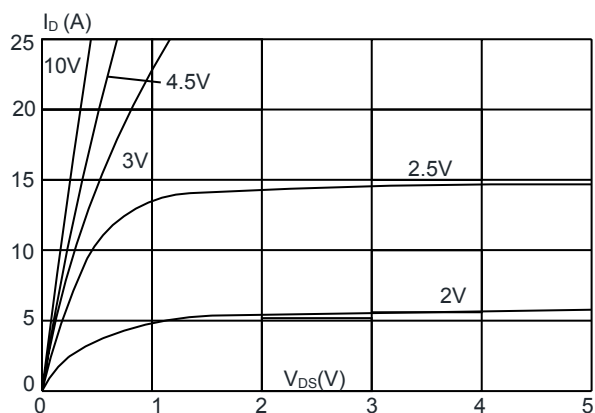
| Symbol   | Parameter                                | Conditions                                  | Min. | Typ. | Max. | Unit |
|----------|------------------------------------------|---------------------------------------------|------|------|------|------|
| $I_S$    | Continuous Source Current <sup>1,5</sup> | $V_G=V_D=0V$ , Force Current                | ---  | ---  | 28   | A    |
| $I_{SM}$ | Pulsed Source Current <sup>2,5</sup>     |                                             | ---  | ---  | 56   | A    |
| $V_{SD}$ | Diode Forward Voltage <sup>2</sup>       | $V_{GS}=0V, I_S=1A, T_J=25^{\circ}\text{C}$ | ---  | ---  | 1.2  | V    |

Note :

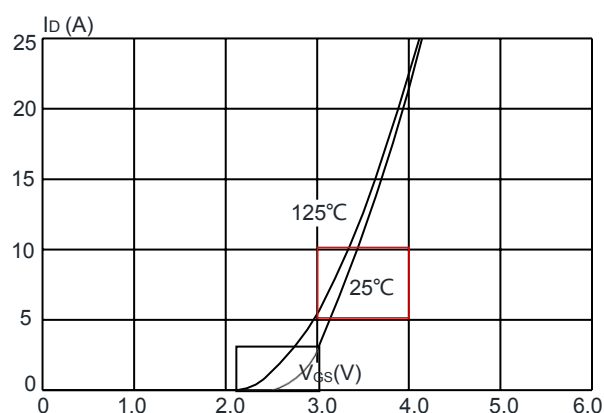
1. The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 20Z copper.2. The data tested by pulsed, pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ 3. The EAS data shows Max. rating. The test condition is  $V_{DD}=25V, V_{GS}=10V, L=0.1mH, I_{AS}=21A$ 4. The power dissipation is limited by  $150^{\circ}\text{C}$  junction temperature5. The data is theoretically the same as  $I_D$  and  $I_{DM}$ , in real applications, should be limited by total power dissipation.

### Typical Performance Characteristics

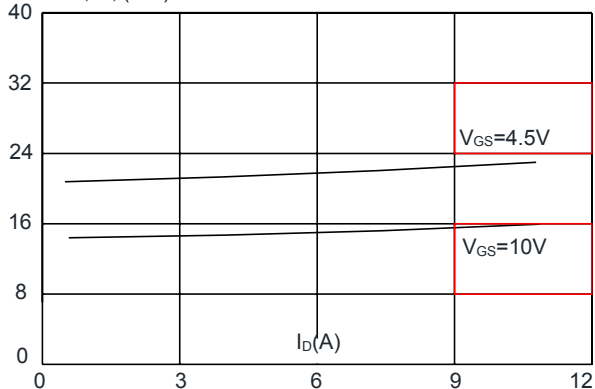
**Figure 1:** Output Characteristics



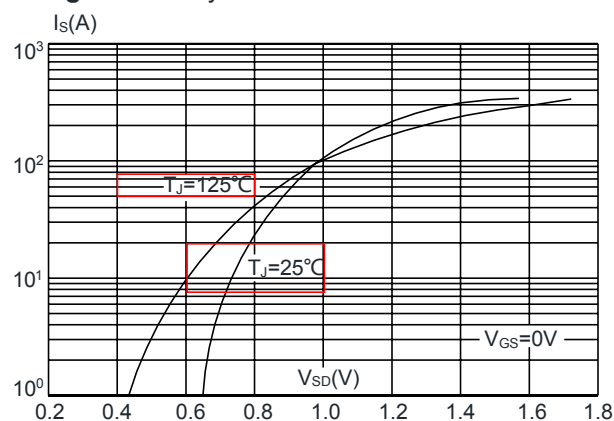
**Figure 2:** Typical Transfer Characteristics



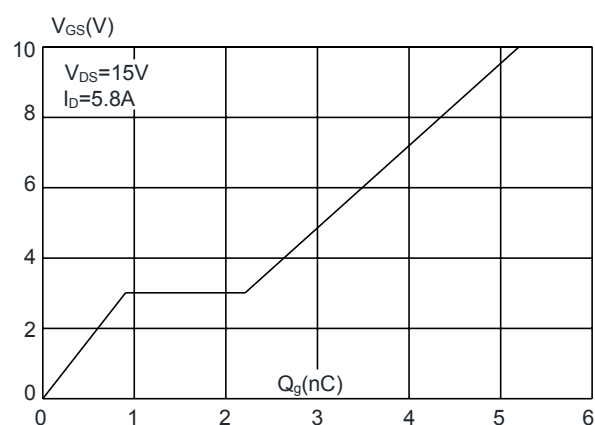
**Figure 3:** On-resistance vs. Drain Current



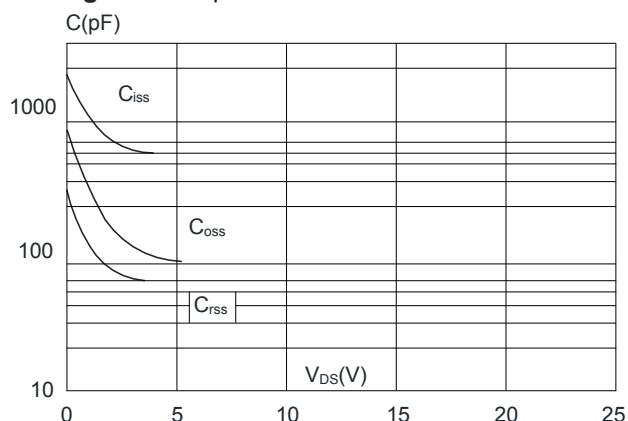
**Figure 4:** Body Diode Characteristics



**Figure 5:** Gate Charge Characteristics

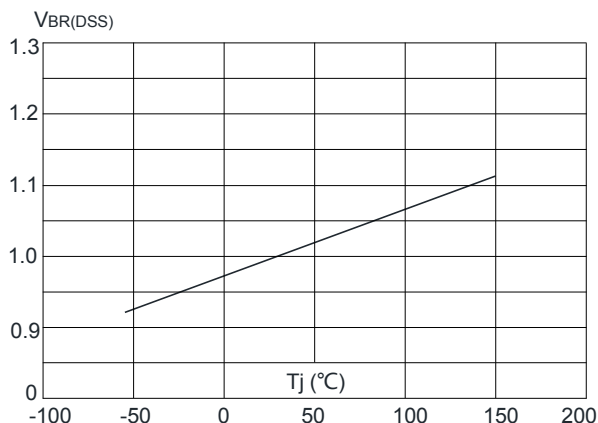


**Figure 6:** Capacitance Characteristics

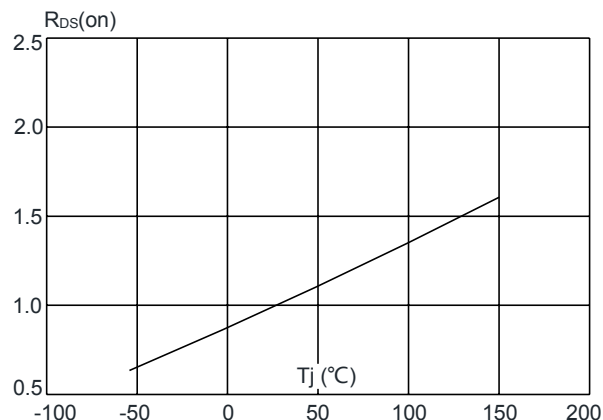


## Dual N-Ch 30V Fast Switching MOSFETs

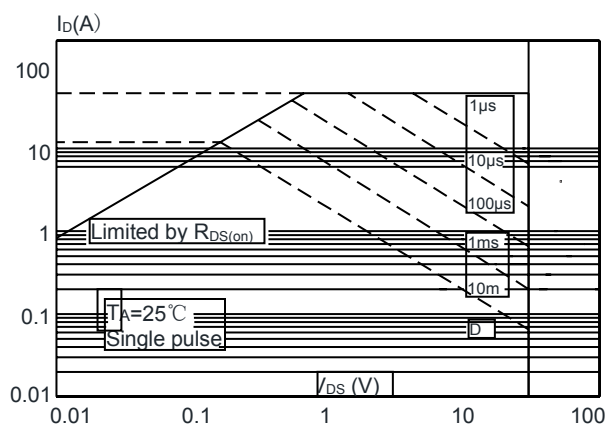
**Figure 7:** Normalized Breakdown Voltage vs. Junction Temperature



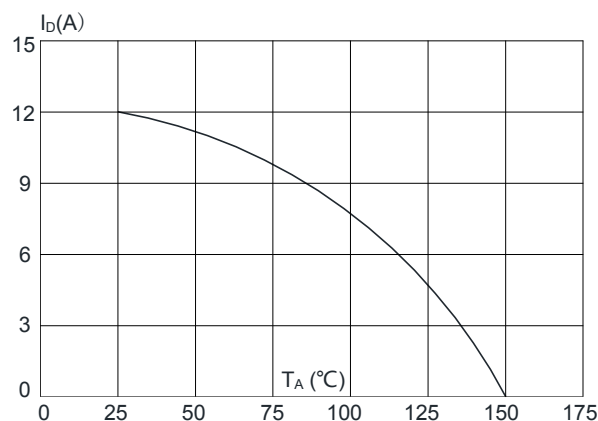
**Figure 8:** Normalized on Resistance vs. Junction Temperature



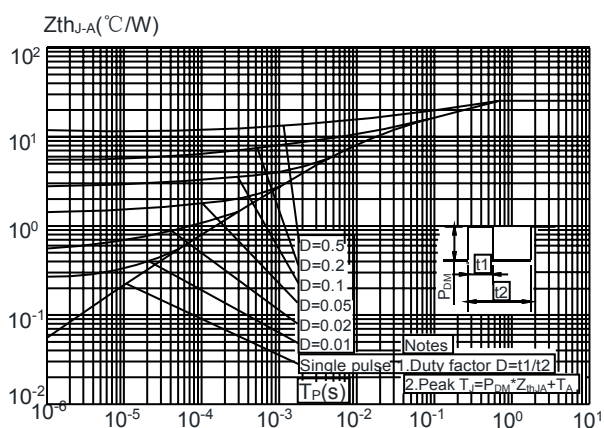
**Figure 9:** Maximum Safe Operating Area



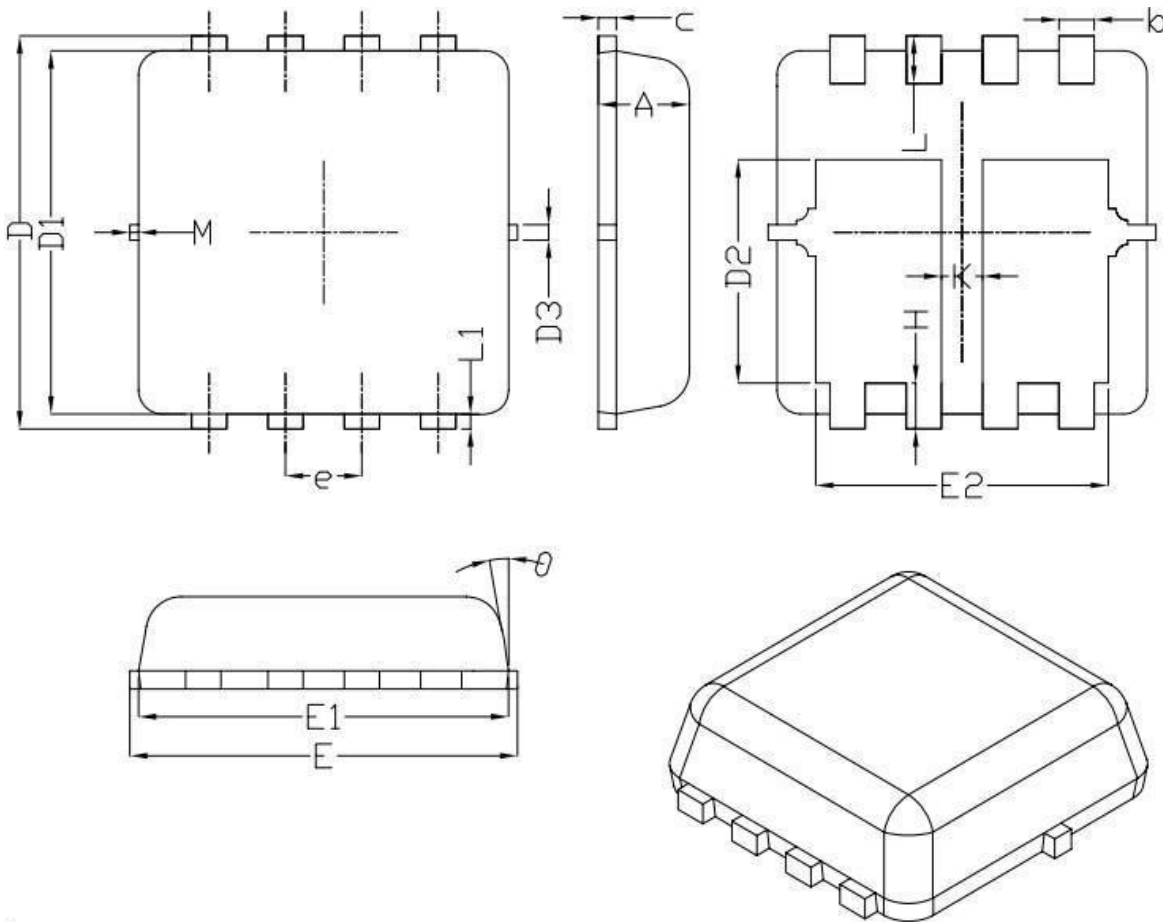
**Figure 10:** Maximum Continuous Drain Current vs. Ambient Temperature



**Figure.11:** Maximum Effective Transient Thermal Impedance, Junction-to-Ambient



### PDFN3333-8L Package Information



| Symbol          | Dimensions (unit: mm) |      |      |
|-----------------|-----------------------|------|------|
|                 | Min                   | Typ  | Max  |
| A               | 0.70                  | 0.75 | 0.80 |
| b               | 0.25                  | 0.30 | 0.35 |
| c               | 0.10                  | 0.15 | 0.25 |
| D               | 3.25                  | 3.35 | 3.45 |
| D1              | 3.00                  | 3.10 | 3.20 |
| D2              | 1.78                  | 1.88 | 1.98 |
| D3              | --                    | 0.13 | --   |
| E               | 3.20                  | 3.30 | 3.40 |
| E1              | 3.00                  | 3.15 | 3.20 |
| E2              | 2.39                  | 2.49 | 2.59 |
| e               | 0.65 BSC              |      |      |
| H               | 0.30                  | 0.39 | 0.50 |
| L               | 0.30                  | 0.40 | 0.50 |
| L1              | --                    | 0.13 | --   |
| K               | 0.30                  | --   | --   |
| θ               | --                    | 10°  | 12°  |
| M               | *                     | *    | 0.15 |
| * Not Specified |                       |      |      |

#### Notes:

1. Refer to JEDEC MO-240 variation CA.
2. Dimensions "D1" and "E1" do NOT include mold flash protrusions or gate burrs.
3. Dimensions "D1" and "E1" include interterminal flash or protrusion.