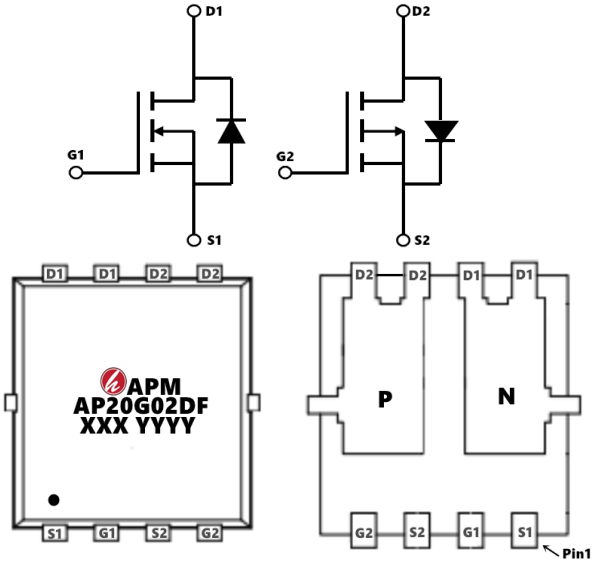
# AP20G02DF

## 20V N+P-Channel Enhancement Mode MOSFET

### Description

The AP20G02DF uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as 2.5V. This device is suitable for use as a Battery protection or in other Switching application.




### General Features

$V_{DS}$ = 20V $I_D$ =25A

$R_{DS(ON)}$ < 10mΩ @ $V_{GS}$=4.5V （**Type：8.0mΩ**）

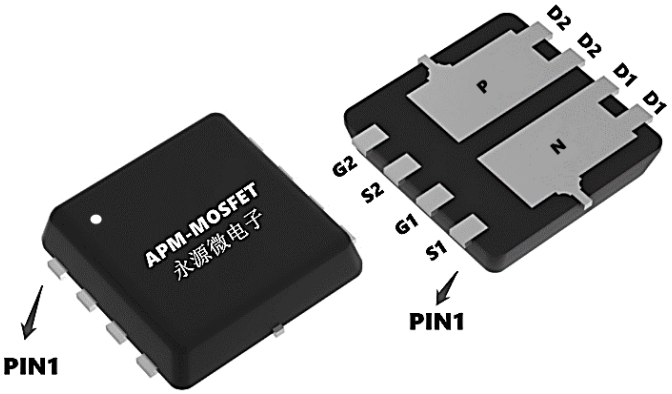
$V_{DS}$ = -20V $I_D$ =-20A

$R_{DS(ON)}$ < 20mΩ @ $V_{GS}$=-4.5V （**Type：16mΩ**）

### Application

Wireless charging

Brushless motor




### Package Marking and Ordering Information

| Product ID | Pack | Marking | Qty(PCS) |
|---|---|---|---|
| AP20G02DF | PDFN3*3-8L | AP20G02DF XXX YYYY | 5000 |

### Absolute Maximum Ratings ($T_C$=25℃unless otherwise noted)

| Symbol | Parameter | N-Ch | P-Ch | Units |
|---|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | 20 | -20 | V |
| $V_{GS}$ | Gate-Source Voltage | ±12 | ±12 | V |
| $I_D$@$T_C$=25℃ | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 25 | -20 | A |
| $I_D$@$T_C$=100℃ | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 17.4 | -15.5 | A |
| $I_{DM}$ | Pulsed Drain Current[2] | 78 | -69.1 | A |
| EAS | Single Pulse Avalanche Energy[3] | 150 | 135 | mJ |
| $I_{AS}$ | Avalanche Current | 72 | 68 | A |
| $P_D$@$T_C$=25℃ | Total Power Dissipation[4] | 46 | 41.3 | W |
| $T_{STG}$ | Storage Temperature Range | -55 to 150 | -55 to 150 | ℃ |
| $T_J$ | Operating Junction Temperature Range | -55 to 150 | -55 to 150 | ℃ |
| $R_{\theta JA}$ | Thermal Resistance Junction-Ambient [1] | 25 | | ℃/W |
| $R_{\theta JC}$ | Thermal Resistance Junction-Case[1] | 5 | | ℃/W |

## Electrical Characteristics ($T_C$=25℃unless otherwise noted)

| Symbol | Parameter | Test Condition | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| V(BR)DSS | Drain-Source Breakdown Voltage | $V_{GS}$=0V, $I_D$=250μA | 20 | 23 | - | V |
| IDSS | Zero Gate Voltage Drain Current | $V_{DS}$=20V, $V_{GS}$=0V, | - | - | 1.0 | μA |
| IGSS | Gate to Body Leakage Current | $V_{DS}$=0V, $V_{GS}$=±12V | - | - | ±100 | nA |
| VGS(th) | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$, $I_D$=250μA | 0.58 | 0.65 | 1.2 | V |
| RDS(on) | Static Drain-Source on-Resistance note3 | $V_{GS}$=4.5V, $I_D$=25A | - | 8 | 10 | mΩ |
| | | $V_{GS}$=2.5V, $I_D$=10A | - | 10 | 13 | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=10V, $V_{GS}$=0V, f=1.0MHz | - | 1458 | - | pF |
| Coss | Output Capacitance | | - | 238 | - | pF |
| Crss | Reverse Transfer Capacitance | | - | 212 | - | pF |
| $Q_g$ | Total Gate Charge | $V_{DS}$=10V, $I_D$=25A, $V_{GS}$=4.5V | - | 19 | - | nC |
| $Q_{gs}$ | Gate-Source Charge | | - | 3 | - | nC |
| $Q_{gd}$ | Gate-Drain(“Miller”) Charge | | - | 6.4 | - | nC |
| td(on) | Turn-on Delay Time | $V_{DS}$=10V, $I_D$=10A, $R_{GEN}$=3Ω, $V_{GS}$=4.5V | - | 10 | - | ns |
| $t_r$ | Turn-on Rise Time | | - | 21 | - | ns |
| td(off) | Turn-off Delay Time | | - | 39 | - | ns |
| $t_f$ | Turn-off Fall Time | | - | 19 | - | ns |
| IS | Maximum Continuous Drain to Source Diode Forward Current | | - | - | 50 | A |
| ISM | Maximum Pulsed Drain to Source Diode Forward Current | | - | - | 200 | A |
| VSD | Drain to Source Diode Forward Voltage | $V_{GS}$=0V, $I_S$=30A | - | - | 1.2 | V |
| trr | Body Diode Reverse Recovery Time | IF=20A,dI/dt=100A/μs | - | 25 | - | ns |
| Qrr | Body Diode Reverse Recovery Charge | | - | 20 | - | nC |

**Note :**

1、The data tested by surface mounted on a 1 inch$^2$ FR-4 board with 2OZ copper.

2、The data tested by pulsed , pulse width ≦ 300us , duty cycle ≦ 2%

3、The EAS data shows Max. rating . The test condition is $V_{DD}$=16V,$V_{GS}$=10V,L=0.1mH,$I_{AS}$=21A

4、The power dissipation is limited by 150℃ junction temperature

5、The data is theoretically the same as $I_D$ and $I_{DM}$ , in real applications , should be limited by total power dissipation.

## Electrical Characteristics ($T_C$=25℃unless otherwise noted)

| Symbol | Parameter | Test Condition | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| V(BR)DSS | Drain-Source Breakdown Voltage | $V_{GS}$=0V, $I_D$= -250μA | -20 | -22 | - | V |
| IDSS | Zero Gate Voltage Drain Current | $V_{DS}$= -20V, $V_{GS}$=0V, | - | - | -1 | μA |
| IGSS | Gate to Body Leakage Current | $V_{DS}$=0V, $V_{GS}$= ±12V | - | - | ±100 | nA |
| VGS(th) | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$, $I_D$= -250μA | -0.58 | -0.7 | -1.2 | V |
| RDS(on) | Static Drain-Source on-Resistance note2 | $V_{GS}$= -4.5V, $I_D$= -10A | - | 16.8 | 20 | mΩ |
| | | $V_{GS}$= -2.5V, $I_D$= -5A | - | 21.5 | 25 | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$= -10V, $V_{GS}$=0V, f=1.0MHz | - | 2000 | - | pF |
| Coss | Output Capacitance | | - | 242 | - | pF |
| Crss | Reverse Transfer Capacitance | | - | 231 | - | pF |
| $Q_g$ | Total Gate Charge | $V_{DS}$= -10V, $I_D$= -6A, $V_{GS}$= -4.5V | - | 15.3 | - | nC |
| $Q_{gs}$ | Gate-Source Charge | | - | 2.2 | - | nC |
| $Q_{gd}$ | Gate-Drain(“Miller”) Charge | | - | 4.4 | - | nC |
| td(on) | Turn-on Delay Time | $V_{DD}$ = -10V, $I_D$= -12A, $V_{GS}$= -4.5V, $R_{GEN}$=2.5Ω | - | 10 | - | ns |
| $t_r$ | Turn-on Rise Time | | - | 31 | - | ns |
| td(off) | Turn-off Delay Time | | - | 28 | - | ns |
| $t_f$ | Turn-off Fall Time | | - | 8 | - | ns |
| IS | Maximum Continuous Drain to Source Diode ForwardCurrent | | - | - | -12 | A |
| ISM | Maximum Pulsed Drain to Source Diode Forward Current | | - | - | -48 | A |
| VSD | Drain to Source Diode Forward Voltage | $V_{GS}$=0V, $I_S$= -12A | - | -0.8 | -1.2 | V |

**Note :**

1、The data tested by surface mo unted on a 1 inch$^2$ FR-4 board with 2OZ copper.

2、The data tested by pulsed , pulse width ≦ 300us , duty cycle ≦ 2%

3、The EAS data shows Max. rating . The test condition is $V^{DD}$=-16V,$V^{GS}$=-10V,L=0.1mH,$I^{AS}$=-21A

4、The power dissipation is limited by 150℃ junction temperature

5 、The data is theoretically the same as $I_D$ and $I_{DM}$ , in real applications , should be limited by total power dissipation.

## N-Typical Characteristics

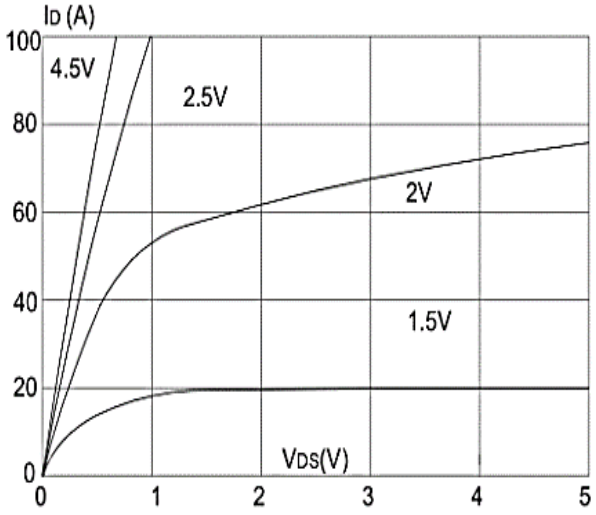



Figure1: Output Characteristics

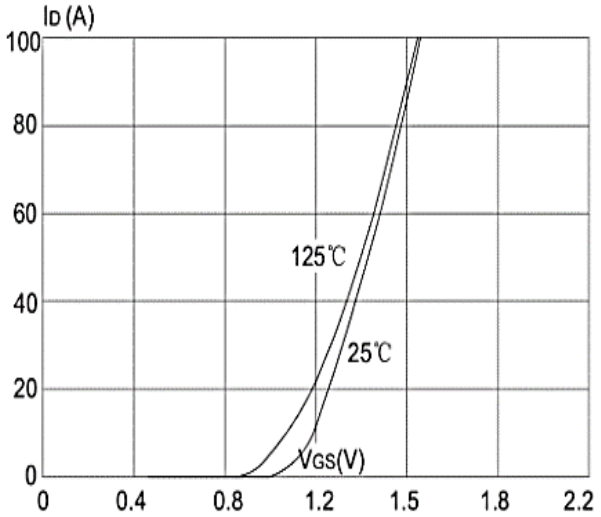



Figure 2: Typical Transfer Characteristics

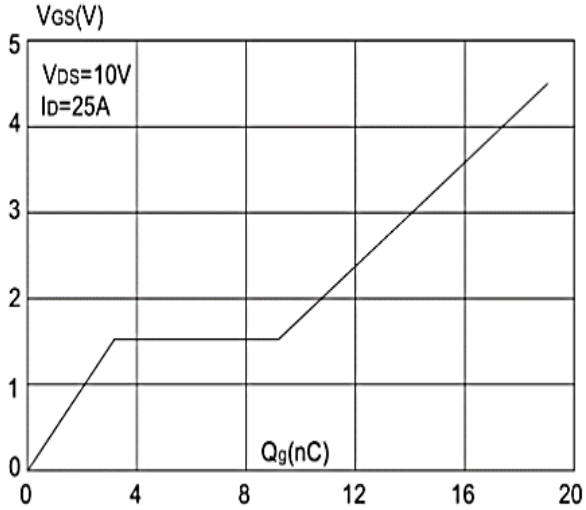



Figure 3:On-resistance vs. Drain Current

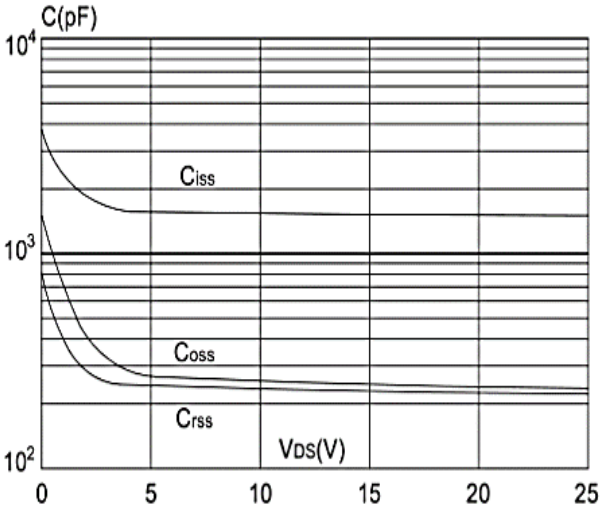



Figure 4: Body Diode Characteristics

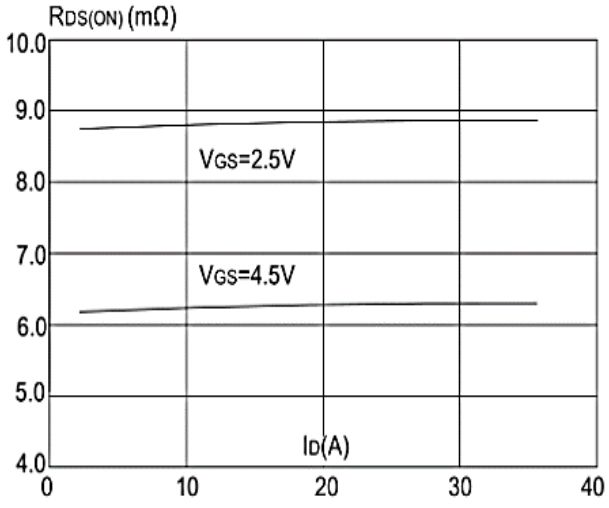



Figure 5: Gate Charge Characteristics

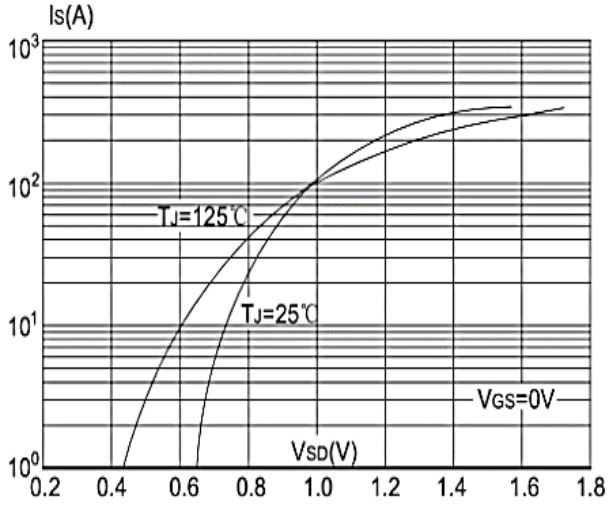



Figure 6: Capacitance Characteristics

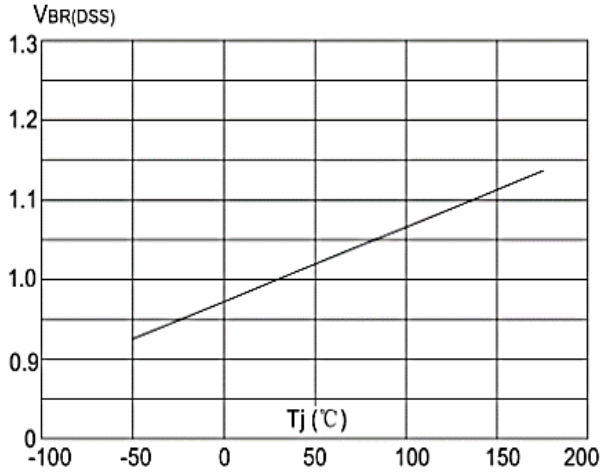



Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

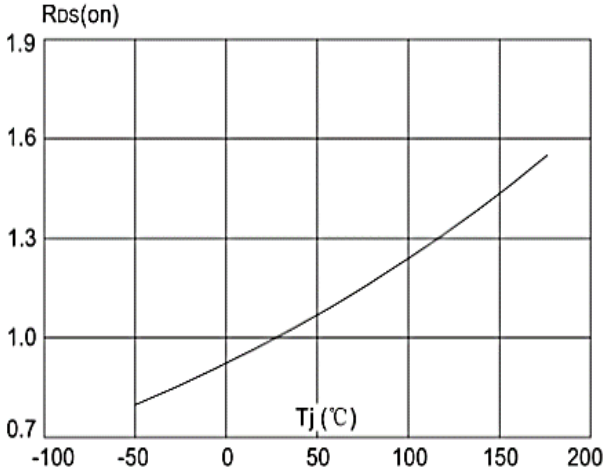



Figure 8: Normalized on Resistance vs. Junction Temperature

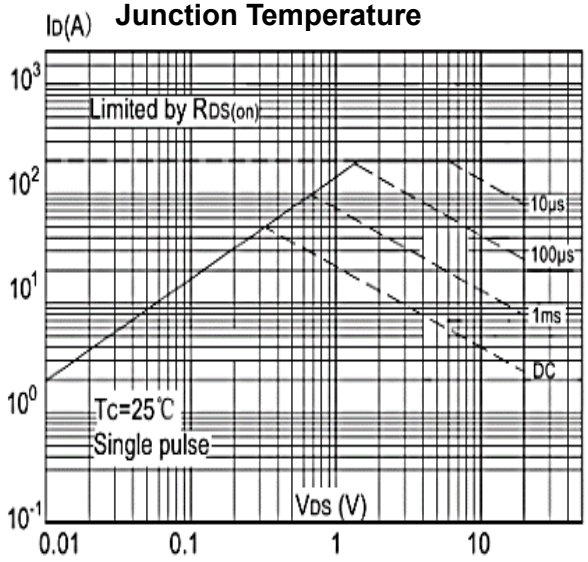



Figure 9: Maximum Safe Operating Area

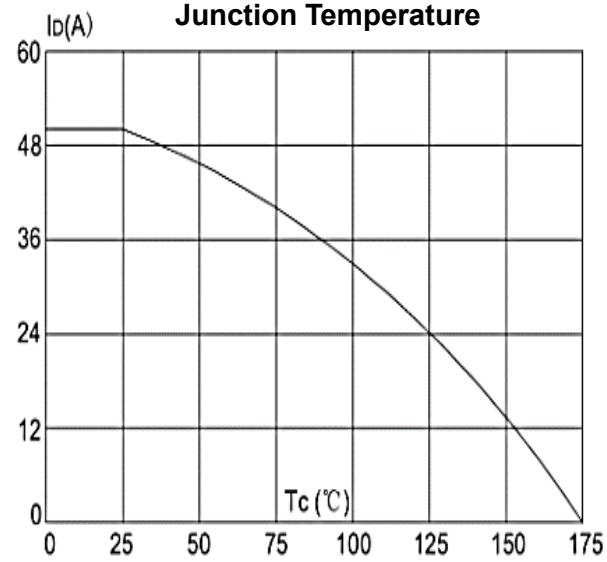



Figure 10: Maximum Continuous Drain Current vs. Case Temperature

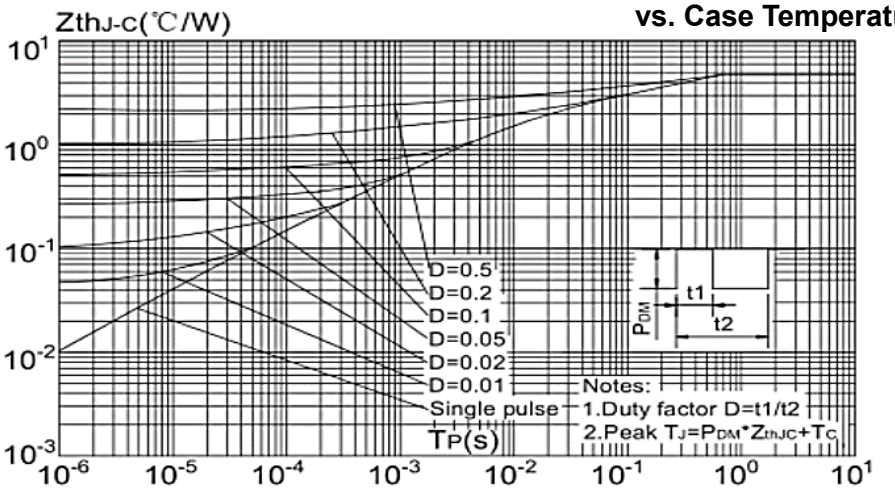



Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Case

## P-Typical Characteristics

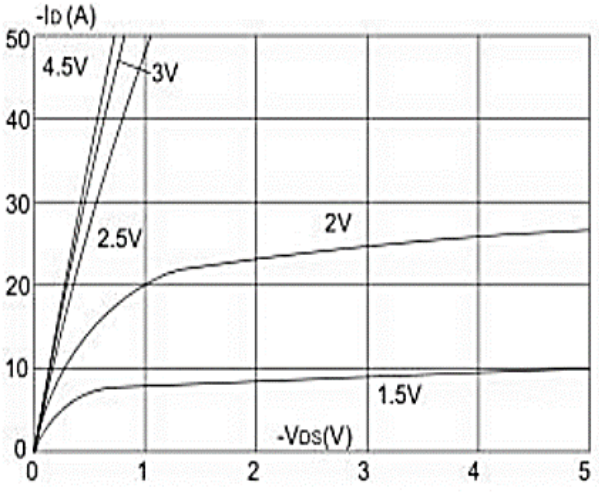



Figure1: Output Characteristics

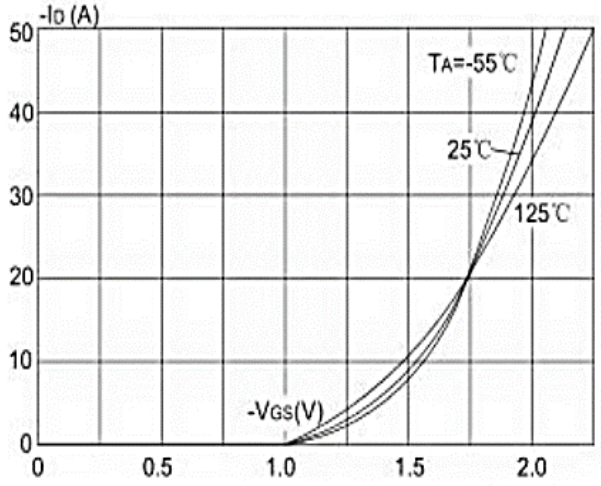
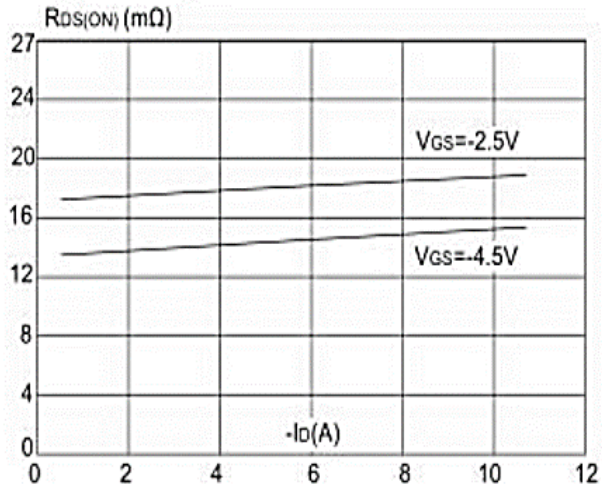



Figure 2: Typical Transfer Characteristics

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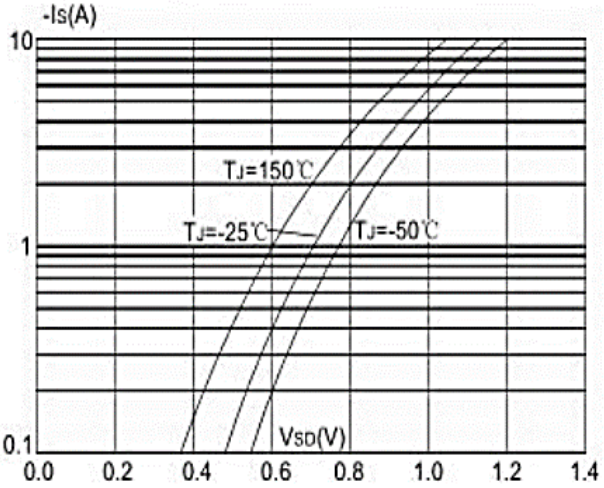



Figure 4: Body Diode Characteristics

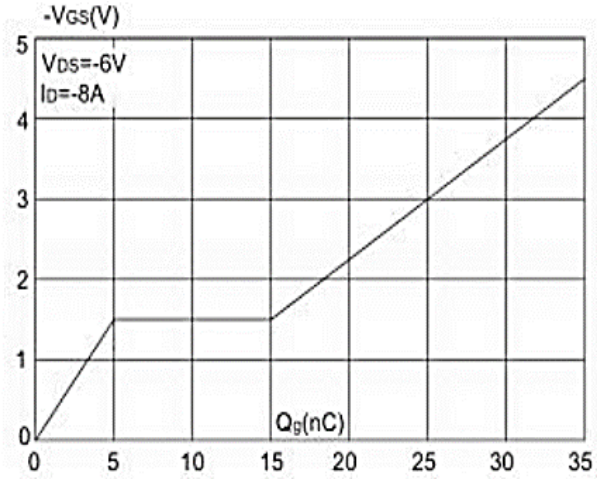



Figure 5: Gate Charge Characteristics

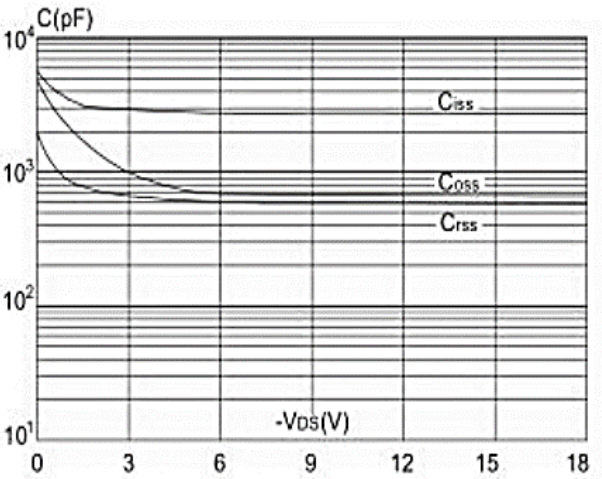



Figure 6: Capacitance Characteristics

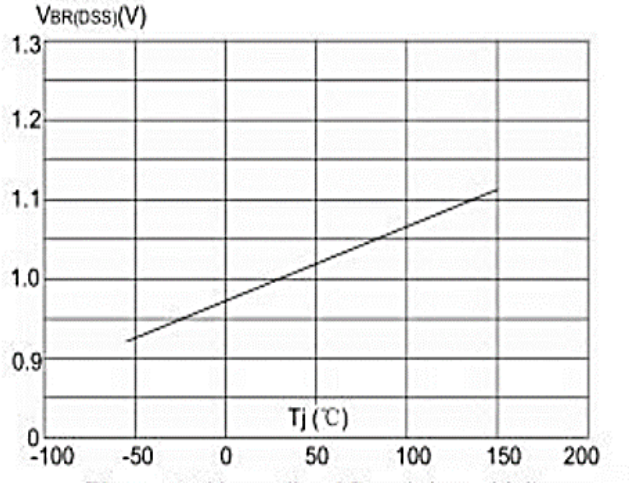



Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

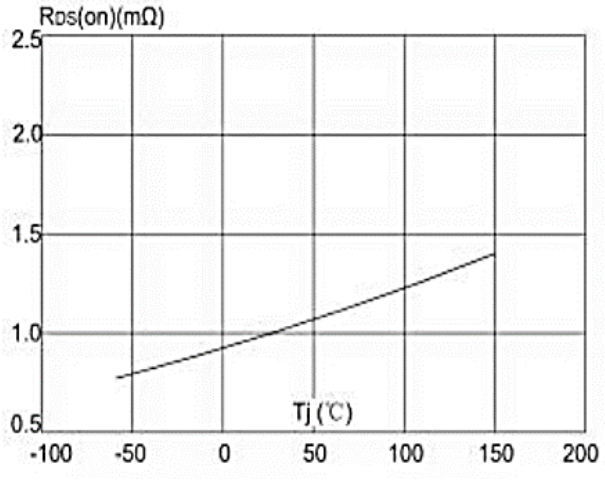



Figure 8: Normalized on Resistance vs. Junction Temperature

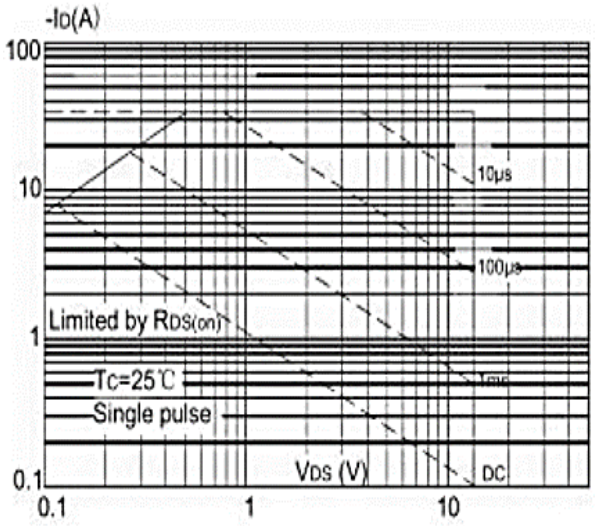



Figure 9: Maximum Safe Operating Area

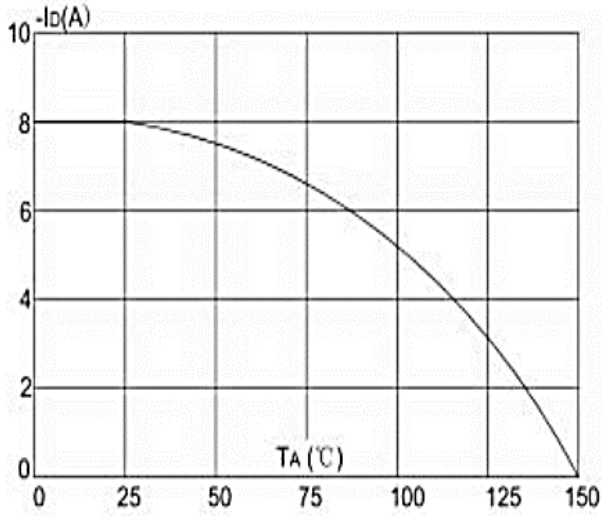



Figure 10: Maximum Continuous Drain Current vs. Case Temperature

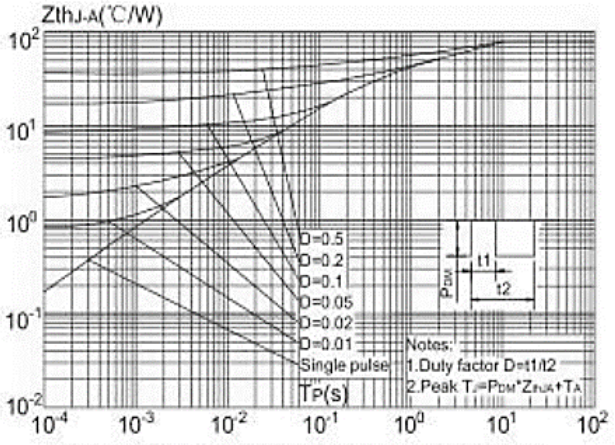
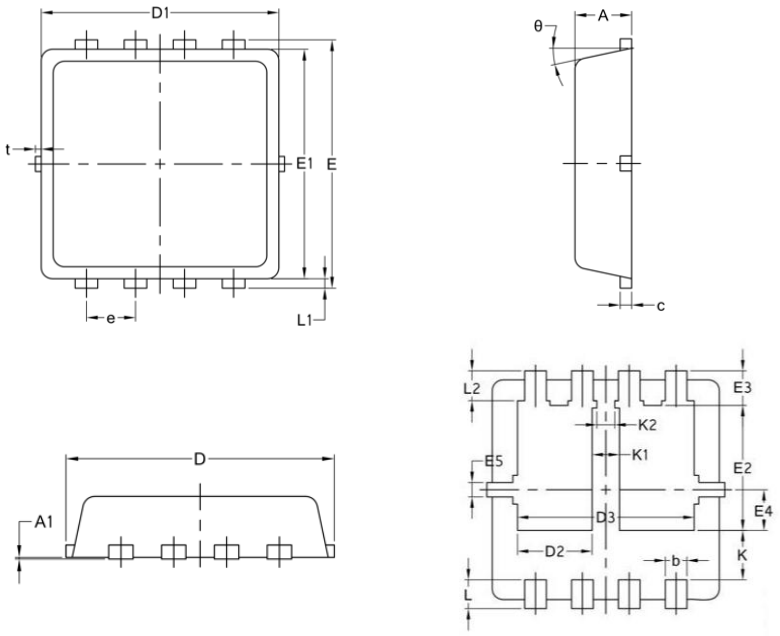



Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Case

## Package Mechanical Data-PDFN3*3-8L Double




| Symbol | Common | | |
|---|---|---|---|
| | Mm | | |
| | Min | Nom | Max |
| A | 0.70 | 0.75 | 0.85 |
| A1 | / | / | 0.05 |
| b | 0.25 | 0.30 | 0.39 |
| c | 0.14 | 0.152 | 0.20 |
| D | 3.20 | 3.30 | 3.45 |
| D1 | 3.05 | 3.15 | 3.25 |
| D2 | 0.84 | 1.04 | 1.24 |
| D3 | 2.30 | 2.45 | 2.60 |
| E | 3.20 | 3.30 | 3.40 |
| E1 | 2.95 | 3.05 | 3.15 |
| E2 | 1.60 | 1.74 | 1.90 |
| E3 | 0.28 | 0.48 | 0.65 |
| E4 | 0.37 | 0.57 | 0.77 |
| E5 | 0.10 | 0.20 | 0.30 |
| e | 0.60 | 0.65 | 0.70 |
| K | 0.50 | 0.69 | 0.80 |
| K1 | 0.30 | 0.38 | 0.53 |
| K2 | 0.15 | 0.25 | 0.35 |
| L | 0.30 | 0.40 | 0.50 |
| L1 | 0.06 | 0.125 | 0.20 |
| L2 | 0.27 | 0.42 | 0.57 |
| t | 0 | 0.075 | 0.13 |
| Φ | 10° | 12° | 14° |

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| Edition | Date | Change |
|---|---|---|
| REV1.0 | 2021/2/30 | Initial release |