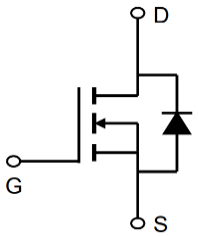
# AP60N02DF

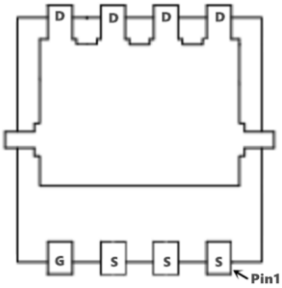
## 20V N-Channel Enhancement Mode MOSFET

### Description

The AP60N02DF 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.



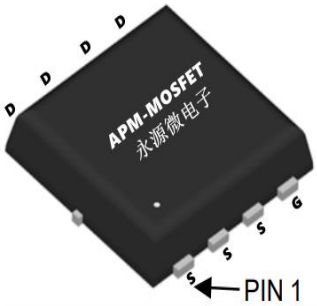


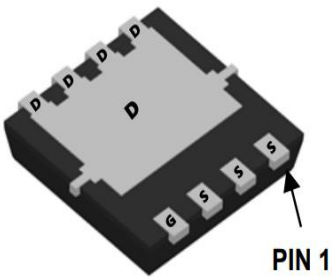



### General Features

$V_{DS}$=20V $I_D$=60A

$R_{DS(ON)}$ < 6.0mΩ @ $V_{GS}$=4.5V （**Type：4.8mΩ**）




### Application

Battery protection

Load switch

Uninterruptible power supply

### Package Marking and Ordering Information

| Product ID | Pack | Marking | Qty(PCS) |
|---|---|---|---|
| AP60N02DF | PDFN3*3-8L | AP60N02DF XXX YYYY | 5000 |

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

| Symbol | Parameter | Max. | Units |
|---|---|---|---|
| VDSS | Drain-Source Voltage | 20 | V |
| VGSS | Gate-Source Voltage | ±12 | V |
| ID@TA=25℃ | Continuous Drain Current, VGS @ 4.5V | 60 | A |
| ID@TA=70℃ | Continuous Drain Current, VGS @ 4.5V | 39 | A |
| IDM | Pulsed Drain Current note1 | 200 | A |
| EAS | Single Pulsed Avalanche Energy note2 | 47.6 | mJ |
| PD@TA=25℃ | Power Dissipation | 37 | W |
| TJ, TSTG | Operating and Storage Temperature Range | -55 to +175 | ℃ |
| $R_{\theta}JA$ | Thermal Resistance Junction-Ambient [1] | 62 | ℃/W |
| RθJC | Thermal Resistance, Junction to Case | 4 | ℃/W |

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

| Symbol | Parameter | Test Condition | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| V(BR)DSS | Drain-Source Breakdown Voltage | VGS=0V, ID=250μA | 20 | 24 | - | V |
| IDSS | Zero Gate Voltage Drain Current | VDS=20V, VGS=0V, | - | - | 1.0 | μA |
| IGSS | Gate to Body Leakage Current | VDS=0V, VGS=±12V | - | - | ±100 | nA |
| VGS(th) | Gate Threshold Voltage | VDS=VGS, ID=250μA | 0.5 | 0.7 | 1.2 | V |
| RDS(on) | Static Drain-Source on-Resistance note3 | VGS=4.5V, ID=30A | - | 4.8 | 6.5 | mΩ |
| | | VGS=2.5V, ID=20A | - | 8.2 | 10 | |
| Ciss | Input Capacitance | VDS=10V, VGS=0V, f = 1.0MHz | - | 1832 | - | pF |
| Coss | Output Capacitance | | - | 289 | - | pF |
| Crss | Reverse Transfer Capacitance | | - | 271 | - | pF |
| Qg | Total Gate Charge | VDS=10V, ID=30A, VGS=4.5V | - | 23 | - | nC |
| Qgs | Gate-Source Charge | | - | 4.5 | - | nC |
| Qgd | Gate-Drain(“Miller”) Charge | | - | 7.3 | - | nC |
| td(on) | Turn-on Delay Time | VDS=10V, ID=30A, RGEN=3Ω, VGS =4.5V | - | 15 | - | ns |
| tr | Turn-on Rise Time | | - | 37 | - | ns |
| td(off) | Turn-off Delay Time | | - | 52 | - | ns |
| tf | Turn-off Fall Time | | - | 21 | - | ns |
| IS | Maximum Continuous Drain to Source Diode Forward Current | | - | - | 60 | A |
| ISM | Maximum Pulsed Drain to Source Diode Forward Current | | - | - | 210 | A |
| VSD | Drain to Source Diode Forward Voltage | VGS = 0V, IS=25A | - | - | 1.2 | V |

**Notes:**

1、Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature

2、The test condition is, VDD=10V, VG=4.5V, L=0.5mH, RG=25Ω, IAS=13.8A

3、The data tested by pulsed Pulse Test: Pulse Width≤300μs, Duty Cycle≤0.5%

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

## Typical Characteristics

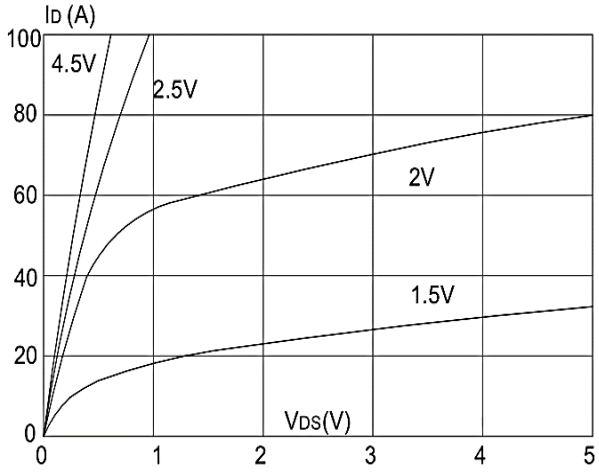



**Figure1: Output Characteristics**

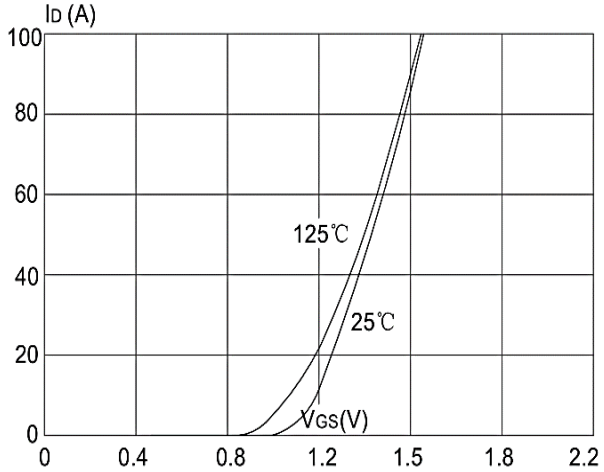



**Figure 2: Typical Transfer Characteristics**

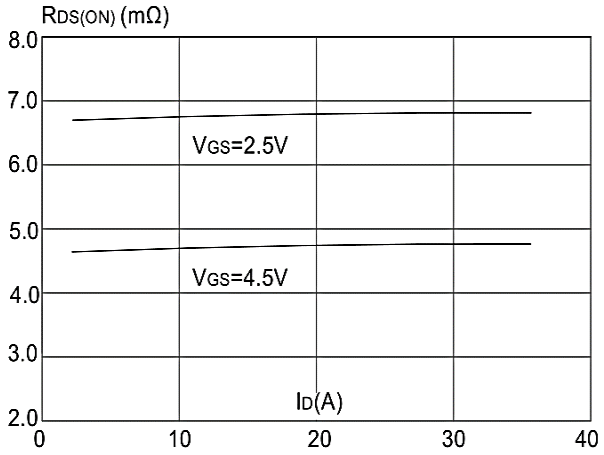



**Figure 3:On-resistance vs. Drain Current**

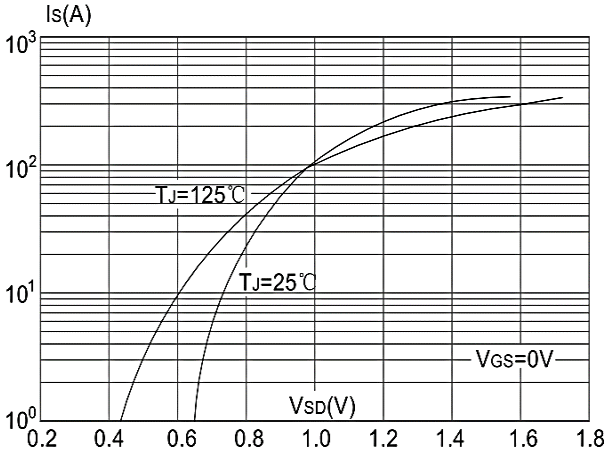



**Figure 4: Body Diode Characteristics**

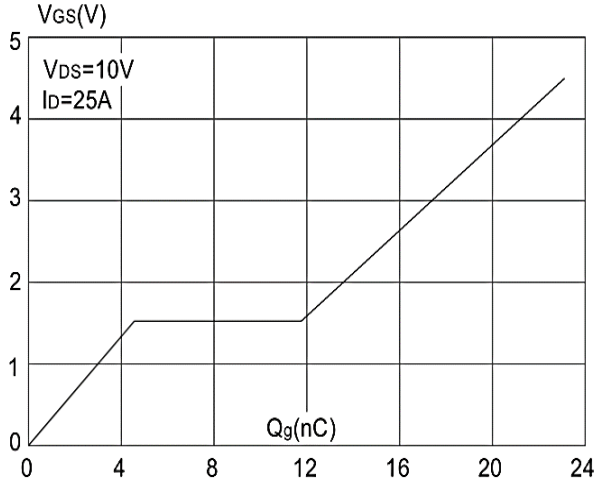



**Figure 5: Gate Charge Characteristics**

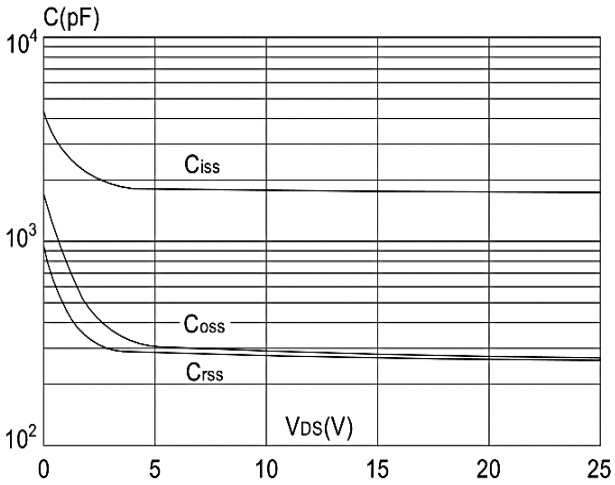



**Figure 6: Capacitance Characteristics**

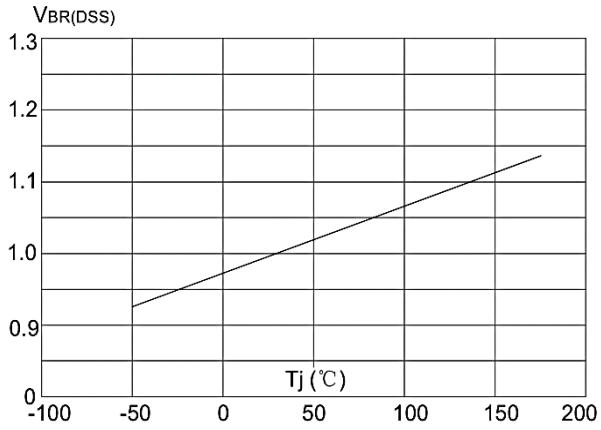



**Figure 7: Normalized Breakdown Voltage vs. Junction Temperature**

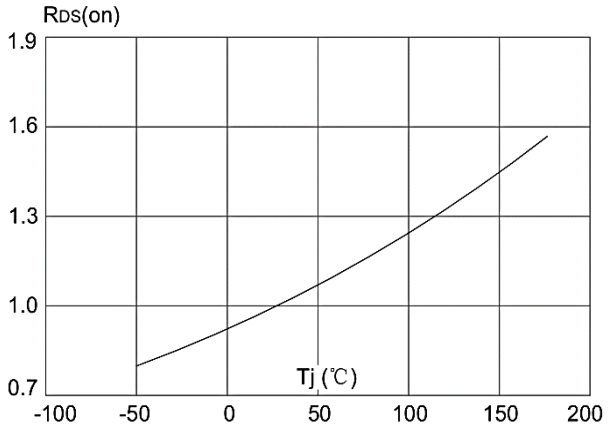



**Figure 8: Normalized on Resistance vs Junction Temperature**

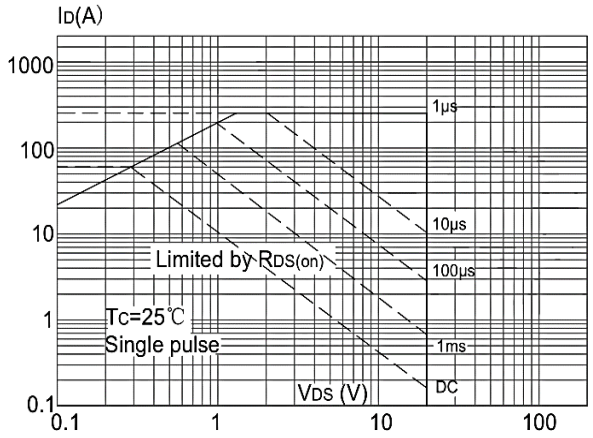



**Figure 9: Maximum Safe Operating Area Current Temperature**

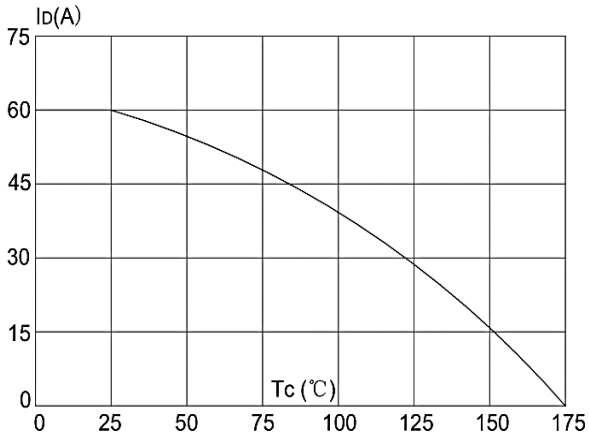



**Figure 10: Maximum Continuous Drain vs. Case**

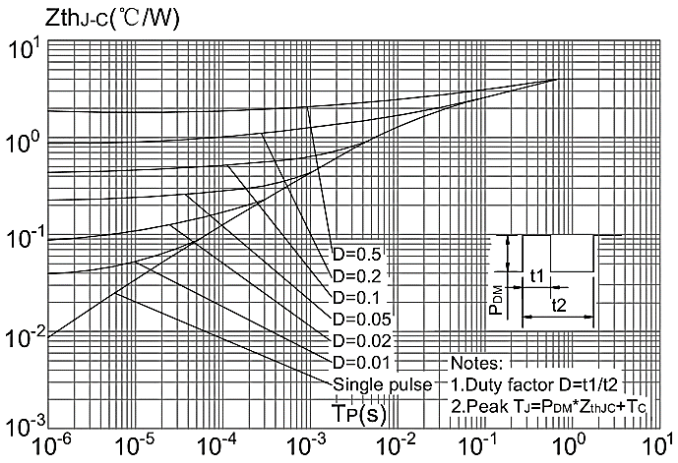
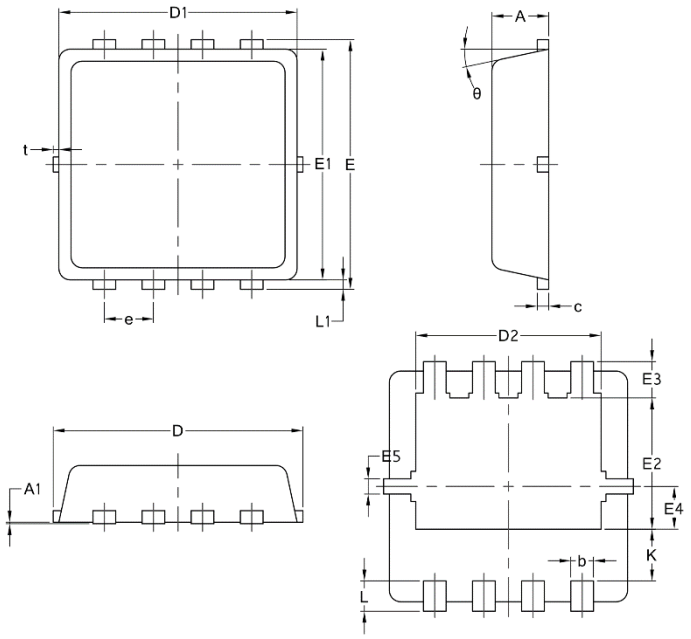



**Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Case**

## Package Mechanical Data-PDFN3*3-8L-JQ Single




| Symbol | Common | | |
|---|---|---|---|
| | mm | | |
| | Mim | Nom | Max |
| A | 0.70 | 0.75 | 0.85 |
| A1 | / | / | 0.05 |
| b | 0.20 | 0.30 | 0.40 |
| c | 0.10 | 0.152 | 0.25 |
| D | 3.15 | 3.30 | 3.45 |
| D1 | 3.00 | 3.15 | 3.25 |
| D2 | 2.29 | 2.45 | 2.65 |
| E | 3.15 | 3.30 | 3.45 |
| E1 | 2.90 | 3.05 | 3.20 |
| E2 | 1.54 | 1.74 | 1.94 |
| 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 | 0.59 | 0.69 | 0.89 |
| L | 0.30 | 0.40 | 0.50 |
| L1 | 0.06 | 0.125 | 0.20 |
| t | 0 | 0.075 | 0.13 |
| Φ | 10 | 12 | 14 |

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|---|---|---|
| Rve1.0 | 2022/4/31 | Initial release |