

## -30V P-Channel Enhancement Mode MOSFET

### Description

The AP70P03NF uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 4.5V. This device is suitable for use as a Battery protection or in other Switching application.

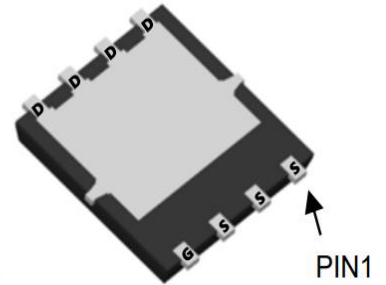
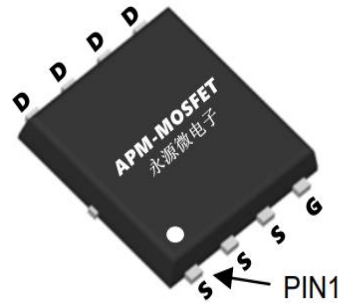
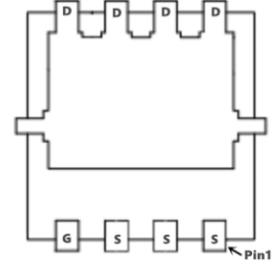
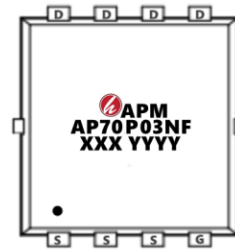
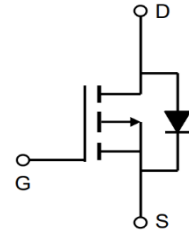
### General Features

$V_{DS} = -30V$   $I_D = -78A$

$R_{DS(ON)} < 7.5m\Omega$  @  $V_{GS} = -10V$  (Type: 5.2m $\Omega$ )

### Application

Lithium battery protection  
Wireless impact  
Mobile phone fast charging



### Package Marking and Ordering Information

| Product ID | Pack       | Marking            | Qty(PCS) |
|------------|------------|--------------------|----------|
| AP70P03NF  | PDFN5*6-8L | AP70P03NF XXX YYYY | 5000     |

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

| Symbol                 | Parameter                                     | Rating     | Units        |
|------------------------|-----------------------------------------------|------------|--------------|
| $V_{DS}$               | Drain-Source Voltage                          | -30        | V            |
| $V_{GS}$               | Gate-Source Voltage                           | $\pm 20$   | V            |
| $I_{D@TC=25^\circ C}$  | Continuous Drain Current, $V_{GS} @ -10V$     | -78        | A            |
| $I_{D@TC=100^\circ C}$ | Continuous Drain Current, $V_{GS} @ -10V$     | -57        | A            |
| $I_{DM}$               | Pulsed Drain Current <sup>2</sup>             | -200       | A            |
| $E_{AS}$               | Single Pulse Avalanche Energy <sup>3</sup>    | 125        | mJ           |
| $I_{AS}$               | Avalanche Current                             | -40        | A            |
| $P_{D@TC=25^\circ C}$  | Total Power Dissipation <sup>4</sup>          | 69         | W            |
| $T_{STG}$              | Storage Temperature Range                     | -55 to 150 | $^\circ C$   |
| $T_J$                  | Operating Junction Temperature Range          | -55 to 150 | $^\circ C$   |
| $R_{\theta JA}$        | Thermal Resistance Junction-Ambient 1         | 25         | $^\circ C/W$ |
| $R_{\theta JC}$        | Thermal Resistance Junction-Case <sup>1</sup> | 1.6        | $^\circ C/W$ |

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### Electrical Characteristics (T<sub>J</sub>=25 °C, unless otherwise noted)

| Symbol                              | Parameter                                   | Conditions                                                                                     | Min. | Typ.    | Max. | Unit  |
|-------------------------------------|---------------------------------------------|------------------------------------------------------------------------------------------------|------|---------|------|-------|
| BV <sub>DSS</sub>                   | Drain-Source Breakdown Voltage              | V <sub>GS</sub> =0V, I <sub>D</sub> =-250uA                                                    | -30  | -34     | ---  | V     |
| ΔBV <sub>DSS</sub> /ΔT <sub>J</sub> | BVDSS Temperature Coefficient               | Reference to 25°C, I <sub>D</sub> =-1mA                                                        | ---  | -0.0232 | ---  | V/°C  |
| RDS(ON)                             | Static Drain-Source On-Resistance           | V <sub>GS</sub> =-10V, I <sub>D</sub> =-20A                                                    | ---  | 5.2     | 7.5  | mΩ    |
|                                     |                                             | V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-15A                                                   | ---  | 8.0     | 11   |       |
| V <sub>GS(th)</sub>                 | Gate Threshold Voltage                      | V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =-250uA                                      | -1.2 | -1.4    | -2.5 | V     |
| ΔV <sub>GS(th)</sub>                | V <sub>GS(th)</sub> Temperature Coefficient |                                                                                                | ---  | 4.6     | ---  | mV/°C |
| I <sub>DSS</sub>                    | Drain-Source Leakage Current                | V <sub>DS</sub> =-24V, V <sub>GS</sub> =0V, T <sub>J</sub> =25°C                               | ---  | ---     | -1   | uA    |
|                                     |                                             | V <sub>DS</sub> =-24V, V <sub>GS</sub> =0V, T <sub>J</sub> =55°C                               | ---  | ---     | -5   |       |
| I <sub>GSS</sub>                    | Gate-Source Leakage Current                 | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V                                                     | ---  | ---     | ±100 | nA    |
| g <sub>fs</sub>                     | Forward Transconductance                    | V <sub>DS</sub> =-5V, I <sub>D</sub> =-30A                                                     | ---  | 30      | ---  | S     |
| R <sub>g</sub>                      | Gate Resistance                             | V <sub>DS</sub> =0V, V <sub>GS</sub> =0V, f=1MHz                                               | ---  | 9.8     | ---  | Ω     |
| Q <sub>g</sub>                      | Total Gate Charge (-4.5V)                   | V <sub>DS</sub> =-15V, V <sub>GS</sub> =-4.5V<br>I <sub>D</sub> =-20A                          | ---  | 35      | ---  | nC    |
| Q <sub>gs</sub>                     | Gate-Source Charge                          |                                                                                                | ---  | 9.9     | ---  |       |
| Q <sub>gd</sub>                     | Gate-Drain Charge                           |                                                                                                | ---  | 10.5    | ---  |       |
| T <sub>d(on)</sub>                  | Turn-On Delay Time                          | V <sub>DD</sub> =-15V, V <sub>GS</sub> =-10V ,<br>R <sub>G</sub> =3.0Ω<br>I <sub>D</sub> =-20A | ---  | 10.8    | ---  | ns    |
| T <sub>r</sub>                      | Rise Time                                   |                                                                                                | ---  | 13.2    | ---  |       |
| T <sub>d(off)</sub>                 | Turn-Off Delay Time                         |                                                                                                | ---  | 73      | ---  |       |
| T <sub>f</sub>                      | Fall Time                                   |                                                                                                | ---  | 35      | ---  |       |
| C <sub>iss</sub>                    | Input Capacitance                           | V <sub>DS</sub> =-15V, V <sub>GS</sub> =0V, f=1MHz                                             | ---  | 3520    | ---  | pF    |
| C <sub>oss</sub>                    | Output Capacitance                          |                                                                                                | ---  | 465     | ---  |       |
| C <sub>rss</sub>                    | Reverse Transfer Capacitance                |                                                                                                | ---  | 370     | ---  |       |
| I <sub>S</sub>                      | Continuous Source Current                   | V <sub>G</sub> =V <sub>D</sub> =0V, Force Current                                              | ---  | ---     | -70  | A     |
| I <sub>SM</sub>                     | Pulsed Source Current                       |                                                                                                | ---  | ---     | -130 | A     |
| V <sub>SD</sub>                     | Diode Forward Voltage                       | V <sub>GS</sub> =0V, I <sub>S</sub> =-1A, T <sub>J</sub> =25°C                                 | ---  | ---     | -1.3 | V     |
| t <sub>rr</sub>                     | Reverse Recovery Time                       | I <sub>F</sub> =-20A, dI/dt=100A/μs ,<br>T <sub>J</sub> =25°C                                  | ---  | 25      | ---  | nS    |
| Q <sub>rr</sub>                     | Reverse Recovery Charge                     |                                                                                                | ---  | 10      | ---  | nC    |

#### Note :

- 1、The data tested by surface mounted on a 1 inch 2 FR-4 board with 20Z copper.
- 2、The data tested by pulsed , pulse width .The EAS data shows Max. rating .
- 3、The power dissipation is limited by 175°C junction temperature
- 4、EAS condition: T<sub>J</sub>=25°C, V<sub>DD</sub>= -24V, V<sub>G</sub>= -10V, R<sub>G</sub>=7Ω, L=0.1mH, I<sub>AS</sub>= -40A
- 5、The data is theoretically the same as I<sub>D</sub> and I<sub>DM</sub> , in real applications , should be limited by total power dissipation.

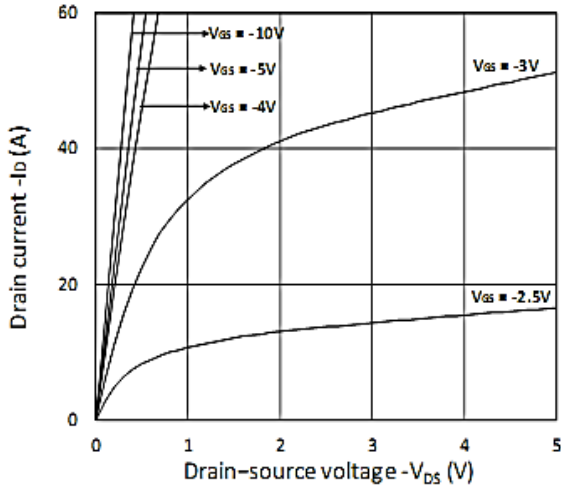
**-30V P-Channel Enhancement Mode MOSFET****Typical Characteristics**

Figure 1. Output Characteristics

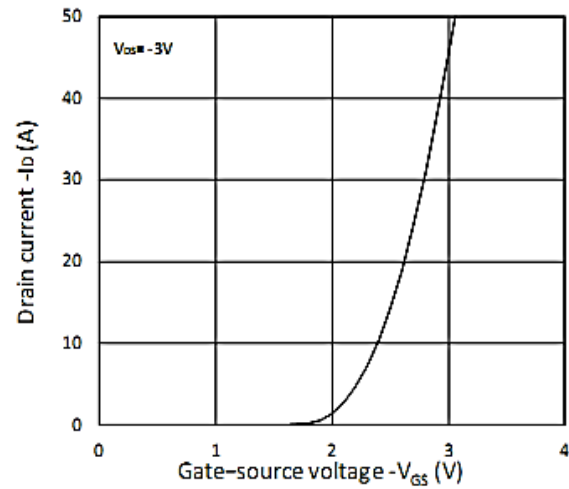


Figure 2. Transfer Characteristics

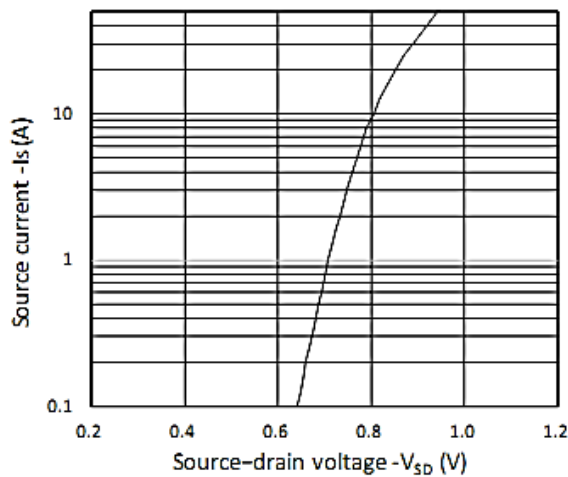
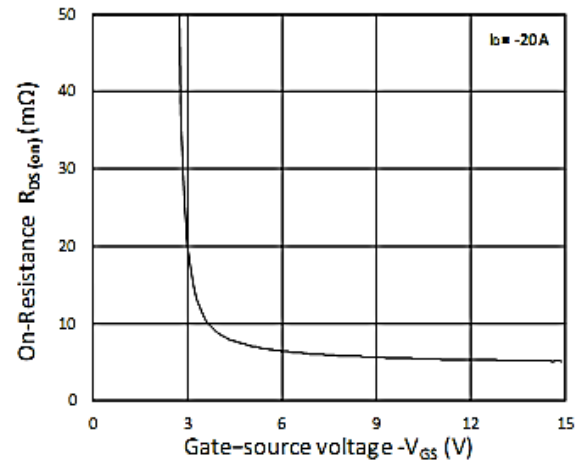
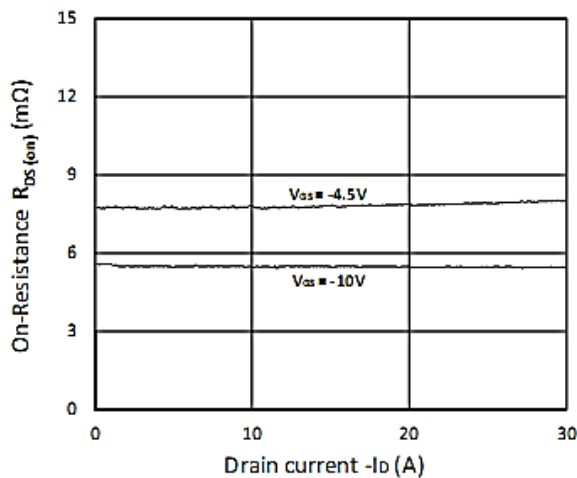
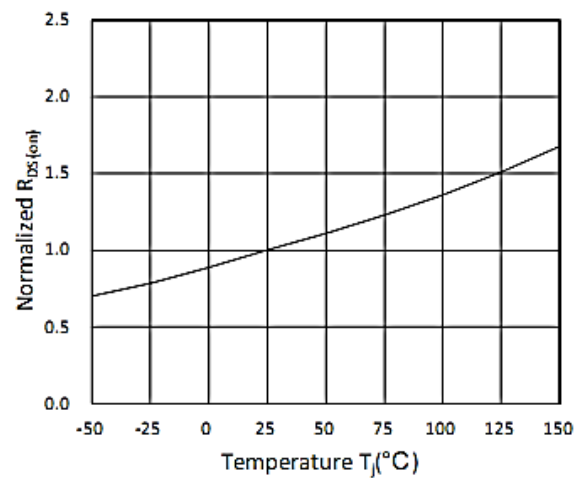


Figure 3. Forward Characteristics of Reverse

Figure 4.  $R_{DS(ON)}$  vs.  $V_{GS}$ Figure 5.  $R_{DS(ON)}$  vs.  $I_D$ Figure 6. Normalized  $R_{DS(ON)}$  vs. Temperature

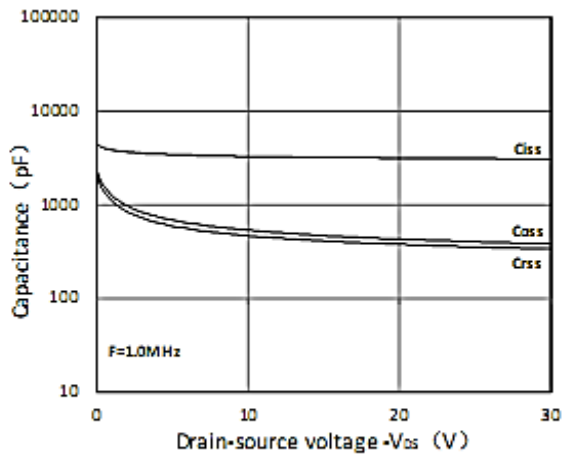
**-30V P-Channel Enhancement Mode MOSFET**

Figure 7. Capacitance Characteristics

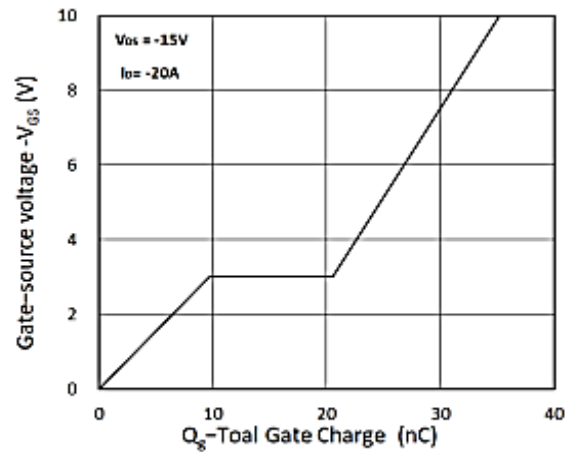


Figure 8. Gate Charge Characteristics

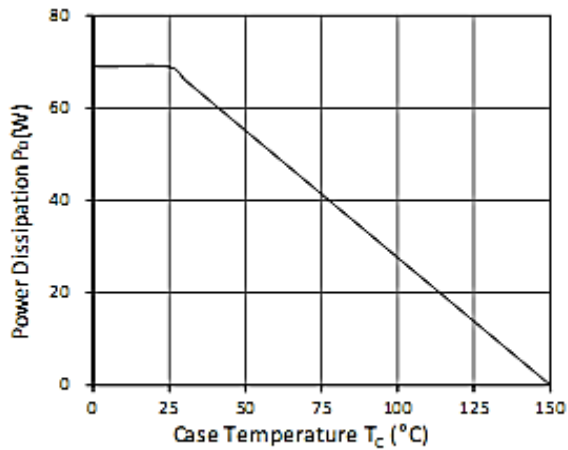


Figure 9. Power Dissipation

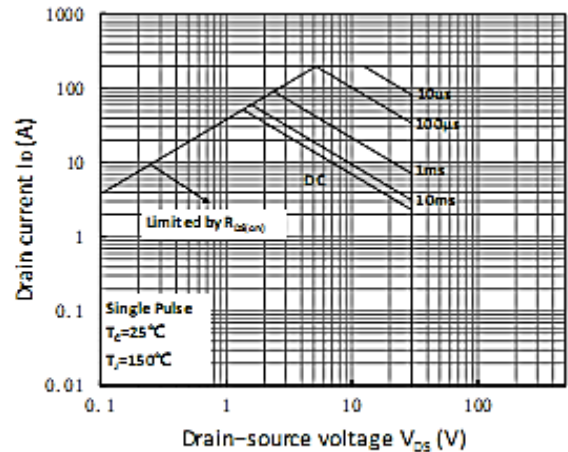


Figure 10. Safe Operating Area

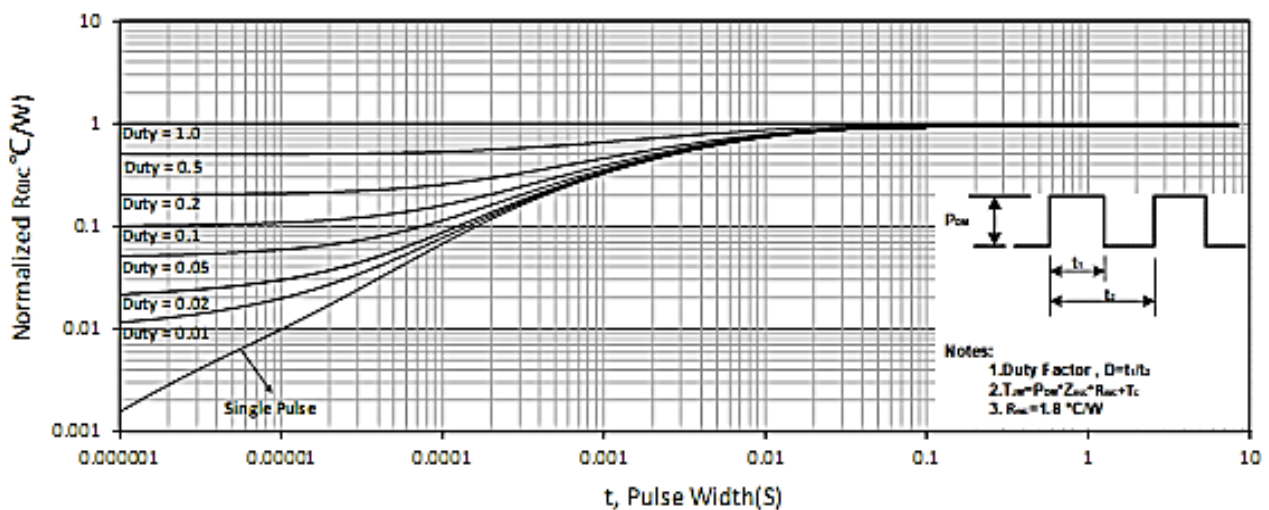
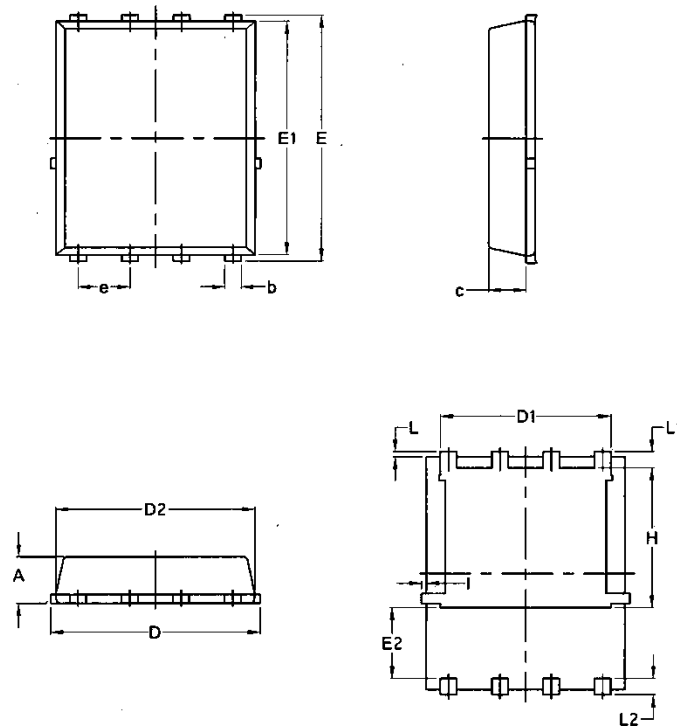


Figure 11. Normalized Maximum Transient Thermal Impedance

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### Package Mechanical Data-DFN5\*6-8L-JQ Single



| Symbol | Common   |        |          |        |
|--------|----------|--------|----------|--------|
|        | mm       |        | Inch     |        |
|        | Mim      | Max    | Min      | Max    |
| A      | 1.03     | 1.17   | 0.0406   | 0.0461 |
| b      | 0.34     | 0.48   | 0.0134   | 0.0189 |
| c      | 0.824    | 0.0970 | 0.0324   | 0.082  |
| D      | 4.80     | 5.40   | 0.1890   | 0.2126 |
| D1     | 4.11     | 4.31   | 0.1618   | 0.1697 |
| D2     | 4.80     | 5.00   | 0.1890   | 0.1969 |
| E      | 5.95     | 6.15   | 0.2343   | 0.2421 |
| E1     | 5.65     | 5.85   | 0.2224   | 0.2303 |
| E2     | 1.60     | /      | 0.0630   | /      |
| e      | 1.27 BSC |        | 0.05 BSC |        |
| L      | 0.05     | 0.25   | 0.0020   | 0.0098 |
| L1     | 0.38     | 0.50   | 0.0150   | 0.0197 |
| L2     | 0.38     | 0.50   | 0.0150   | 0.0197 |
| H      | 3.30     | 3.50   | 0.1299   | 0.1378 |
| I      | /        | 0.18   | /        | 0.0070 |

**-30V P-Channel Enhancement Mode MOSFET****Attention**

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**-30V P-Channel Enhancement Mode MOSFET**

| Edition | Date      | Change              |
|---------|-----------|---------------------|
| Rve3.8  | 2020/4/10 | Initial release     |
| Rve3.9  | 2021/3/10 | Reduce internal RDS |

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