

# AP01N60P

**Pb Free Plating Product**

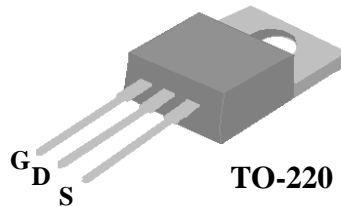


**Advanced Power  
Electronics Corp.**

*N-CHANNEL ENHANCEMENT MODE*

*POWER MOSFET*

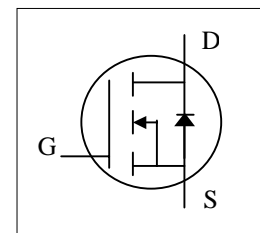
- ▼ Dynamic dv/dt Rating
- ▼ Repetitive Avalanche Rated
- ▼ Fast Switching
- ▼ Simple Drive Requirement
- ▼ RoHS Compliant



|              |            |
|--------------|------------|
| $BV_{DSS}$   | 600V       |
| $R_{DS(ON)}$ | 8 $\Omega$ |
| $I_D$        | 1.6A       |

## Description

The TO-220 package is universally preferred for all commercial-industrial applications. The device is suited for DC-DC ,DC-AC converters for telecom, industrial and consumer environment.



## Absolute Maximum Ratings

| Symbol                | Parameter                                  | Rating     | Units         |
|-----------------------|--|------------|---------------|
| $V_{DS}$              | Drain-Source Voltage                       | 600        | V             |
| $V_{GS}$              | Gate-Source Voltage                        | $\pm 30$   | V             |
| $I_D@T_C=25^\circ C$  | Continuous Drain Current, $V_{GS}$ @ 10V   | 1.6        | A             |
| $I_D@T_C=100^\circ C$ | Continuous Drain Current, $V_{GS}$ @ 10V   | 1          | A             |
| $I_{DM}$              | Pulsed Drain Current <sup>1</sup>          | 6          | A             |
| $P_D@T_C=25^\circ C$  | Total Power Dissipation                    | 39         | W             |
|                       | Linear Derating Factor                     | 0.31       | W/ $^\circ C$ |
| $E_{AS}$              | Single Pulse Avalanche Energy <sup>2</sup> | 13         | mJ            |
| $I_{AR}$              | Avalanche Current                          | 1.6        | A             |
| $E_{AR}$              | Repetitive Avalanche Energy                | 0.5        | mJ            |
| $T_{STG}$             | Storage Temperature Range                  | -55 to 150 | $^\circ C$    |
| $T_J$                 | Operating Junction Temperature Range       | -55 to 150 | $^\circ C$    |

## Thermal Data

| Symbol | Parameter                           | Value    | Units        |
|--------|-------------------------------------|----------|--------------|
| Rthj-c | Thermal Resistance Junction-case    | Max. 3.2 | $^\circ C/W$ |
| Rthj-a | Thermal Resistance Junction-ambient | Max. 62  | $^\circ C/W$ |



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

| Symbol                       | Parameter  | Test Conditions                          | Min. | Typ. | Max.      | Units              |
|------------------------------|--|--|------|------|-----------|--------------------|
| $BV_{DSS}$                   | Drain-Source Breakdown Voltage                           | $V_{GS}=0V, I_D=1mA$                     | 600  | -    | -         | V                  |
| $\Delta BV_{DSS}/\Delta T_j$ | Breakdown Voltage Temperature Coefficient                | Reference to $25^\circ\text{C}, I_D=1mA$ | -    | 0.6  | -         | $V/^\circ\text{C}$ |
| $R_{DS(ON)}$                 | Static Drain-Source On-Resistance                        | $V_{GS}=10V, I_D=0.8A$                   | -    | 7.2  | 8         | $\Omega$           |
| $V_{GS(th)}$                 | Gate Threshold Voltage                                   | $V_{DS}=V_{GS}, I_D=250\mu A$            | 2    | -    | 4         | V                  |
| $g_{fs}$                     | Forward Transconductance                                 | $V_{DS}=50V, I_D=0.8A$                   | -    | 0.8  | -         | S                  |
| $I_{DSS}$                    | Drain-Source Leakage Current ( $T_j=25^\circ\text{C}$ )  | $V_{DS}=600V, V_{GS}=0V$                 | -    | -    | 10        | $\mu A$            |
|                              | Drain-Source Leakage Current ( $T_j=150^\circ\text{C}$ ) | $V_{DS}=480V, V_{GS}=0V$                 | -    | -    | 100       | $\mu A$            |
| $I_{GSS}$                    | Gate-Source Leakage                                      | $V_{GS}=\pm 30V$                         | -    | -    | $\pm 100$ | nA                 |
| $Q_g$                        | Total Gate Charge <sup>3</sup>                           | $I_D=1.6A$                               | -    | 7.7  | -         | nC                 |
| $Q_{gs}$                     | Gate-Source Charge                                       | $V_{DS}=480V$                            | -    | 1.5  | -         | nC                 |
| $Q_{gd}$                     | Gate-Drain ("Miller") Charge                             | $V_{GS}=10V$                             | -    | 2.6  | -         | nC                 |
| $t_{d(on)}$                  | Turn-on Delay Time <sup>3</sup>                          | $V_{DD}=300V$                            | -    | 8    | -         | ns                 |
| $t_r$                        | Rise Time  | $I_D=1.6A$                               | -    | 5    | -         | ns                 |
| $t_{d(off)}$                 | Turn-off Delay Time                                      | $R_G=10\Omega, V_{GS}=10V$               | -    | 14   | -         | ns                 |
| $t_f$                        | Fall Time  | $R_D=187.5\Omega$                        | -    | 7    | -         | ns                 |
| $C_{iss}$                    | Input Capacitance  | $V_{GS}=0V$                              | -    | 286  | -         | pF                 |
| $C_{oss}$                    | Output Capacitance                                       | $V_{DS}=25V$                             | -    | 25   | -         | pF                 |
| $C_{rss}$                    | Reverse Transfer Capacitance                             | $f=1.0MHz$                               | -    | 5    | -         | pF                 |

## Source-Drain Diode

| Symbol   | Parameter   | Test Conditions                             | Min. | Typ. | Max. | Units |
|----------|---|---|------|------|------|-------|
| $I_S$    | Continuous Source Current ( Body Diode )          | $V_D=V_G=0V, V_S=1.5V$                      | -    | -    | 1.6  | A     |
| $I_{SM}$ | Pulsed Source Current ( Body Diode ) <sup>1</sup> |   | -    | -    | 6    | A     |
| $V_{SD}$ | Forward On Voltage <sup>3</sup>                   | $T_j=25^\circ\text{C}, I_S=1.6A, V_{GS}=0V$ | -    | -    | 1.5  | V     |

### Notes:

1. Pulse width limited by safe operating area.
2. Starting  $T_j=25^\circ\text{C}, V_{DD}=50V, L=10mH, R_G=25\Omega, I_{AS}=1.6A$ .
3. Pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ .

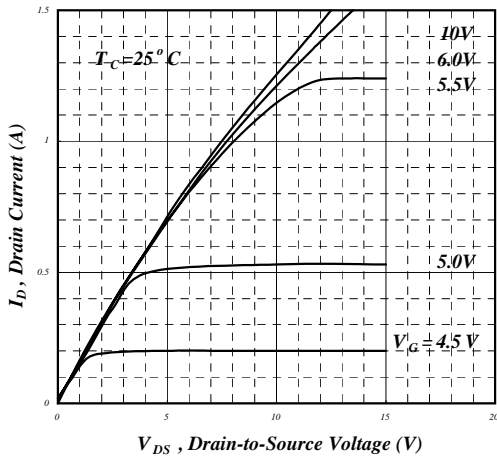


Fig 1. Typical Output Characteristics

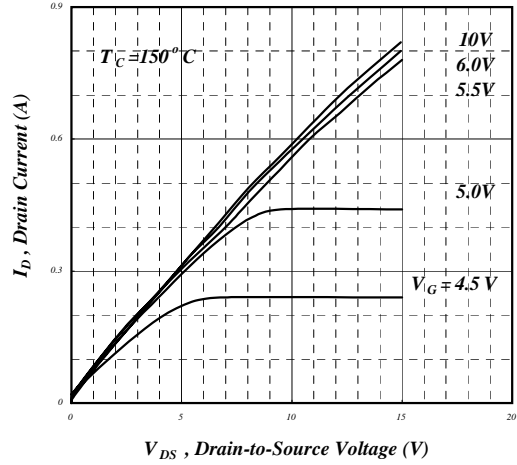


Fig 2. Typical Output Characteristics

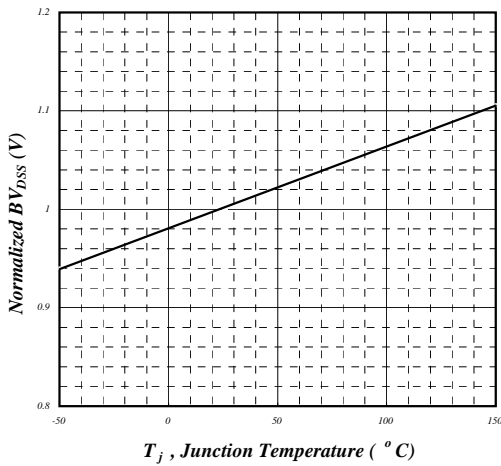


Fig 3. Normalized BV<sub>DSS</sub> v.s. Junction Temperature

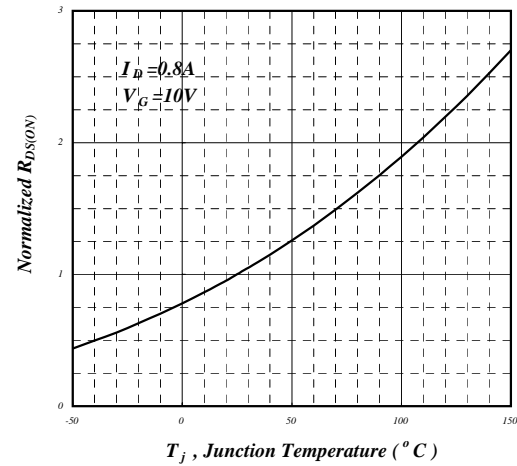


Fig 4. Normalized On-Resistance v.s. Junction Temperature

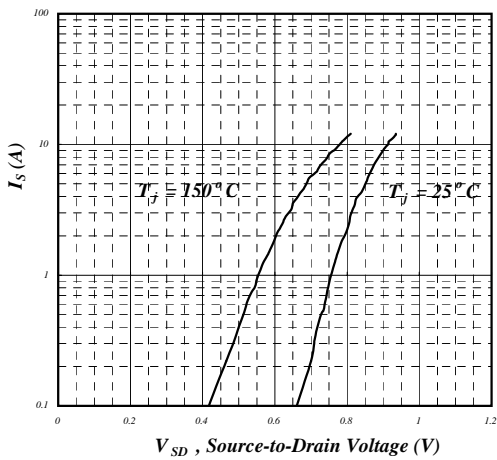


Fig 5. Forward Characteristic of Reverse Diode

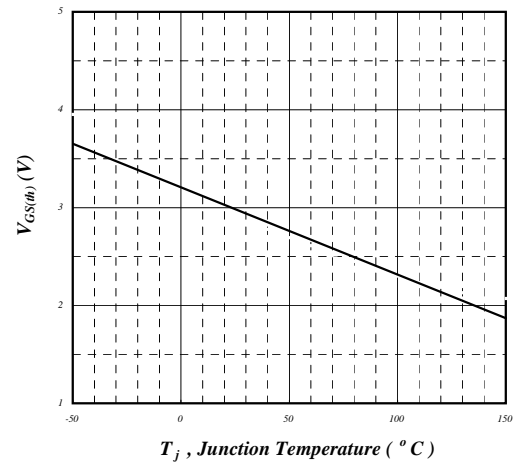


Fig 6. Gate Threshold Voltage v.s. Junction Temperature

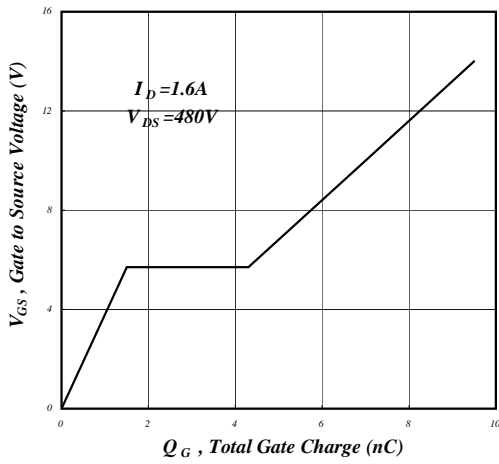


Fig 7. Gate Charge Characteristics

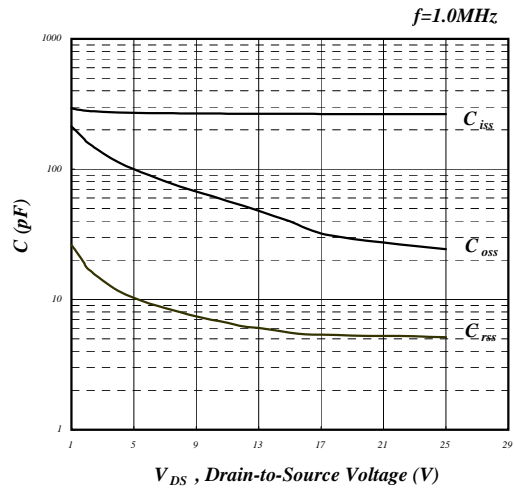


Fig 8. Typical Capacitance Characteristics

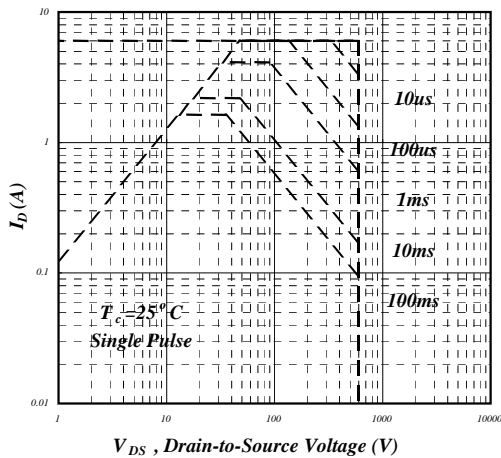


Fig 9. Maximum Safe Operating Area

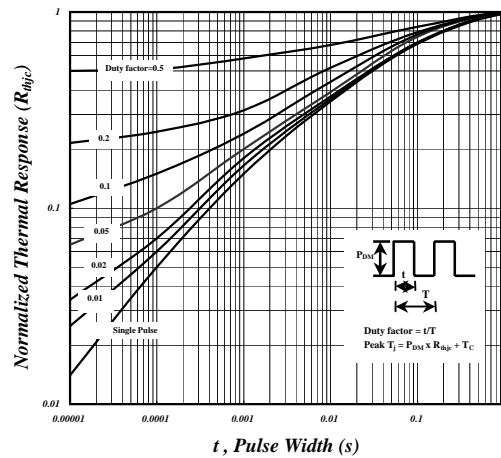


Fig 10. Effective Transient Thermal Impedance

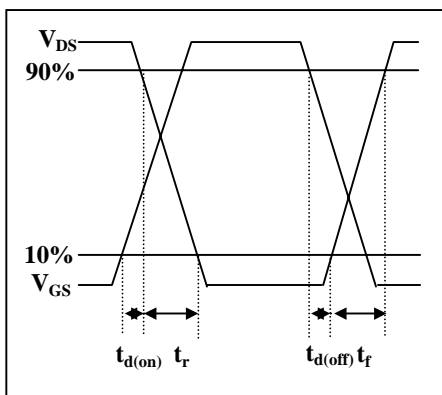


Fig 11. Switching Time Waveform

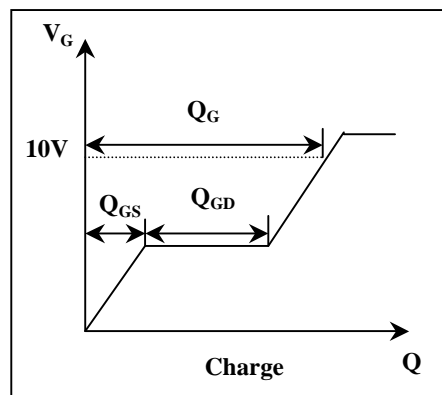


Fig 12. Gate Charge Waveform