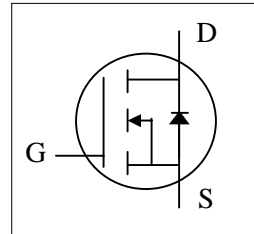




- ▼ 100% Avalanche Test
- ▼ Fast Switching Characteristic
- ▼ Simple Drive Requirement
- ▼ RoHS Compliant & Halogen-Free

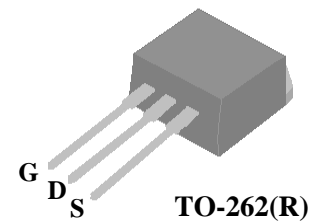


|              |              |
|--------------|--------------|
| $BV_{DSS}$   | 650V         |
| $R_{DS(ON)}$ | 2.5 $\Omega$ |
| $I_D$        | 4A           |

### Description

AP04N60 series are specially designed as main switching devices for universal 90~265VAC off-line AC/DC converter applications. It provide high blocking voltage to overcome voltage surge and sag in the toughest power system with the best combination of fast switching design and cost-effectiveness.

The TO-262 package is widely preferred for commercial-industrial applications. The device is suited for switch mode power supplies, DC-AC converters and high current high speed switching circuits.



### Absolute Maximum Ratings

| Symbol                    | Parameter                                  | Rating     | Units      |
|---------------------------|--|------------|------------|
| $V_{DS}$                  | Drain-Source Voltage                       | 650        | V          |
| $V_{GS}$                  | Gate-Source Voltage                        | $\pm 30$   | V          |
| $I_D @ T_C = 25^\circ C$  | Continuous Drain Current, $V_{GS} @ 10V$   | 4          | A          |
| $I_D @ T_C = 100^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V$   | 2.2        | A          |
| $I_{DM}$                  | Pulsed Drain Current <sup>1</sup>          | 15         | A          |
| $P_D @ T_C = 25^\circ C$  | Total Power Dissipation                    | 59.5       | W          |
| $P_D @ T_A = 25^\circ C$  | Total Power Dissipation                    | 2          | W          |
| $E_{AS}$                  | Single Pulse Avalanche Energy <sup>3</sup> | 8          | mJ         |
| $I_{AR}$                  | Avalanche Current                          | 4          | A          |
| $T_{STG}$                 | 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 | Maximum Thermal Resistance, Junction-case    | 2.1   | $^\circ C/W$ |
| Rthj-a | Maximum Thermal Resistance, Junction-ambient | 62    | $^\circ C/W$ |



**Electrical Characteristics @T<sub>j</sub>=25°C(unless otherwise specified)**

| Symbol              | Parameter                                      | Test Conditions  | Min. | Typ. | Max. | Units |
|---------------------|--|--|------|------|------|-------|
| BV <sub>DSS</sub>   | Drain-Source Breakdown Voltage                 | V <sub>GS</sub> =0V, I <sub>D</sub> =250uA               | 650  | -    | -    | V     |
| R <sub>DS(ON)</sub> | Static Drain-Source On-Resistance <sup>2</sup> | V <sub>GS</sub> =10V, I <sub>D</sub> =2A                 | -    | -    | 2.5  | Ω     |
| V <sub>GS(th)</sub> | Gate Threshold Voltage                         | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250uA | 2    | -    | 4    | V     |
| g <sub>fs</sub>     | Forward Transconductance                       | V <sub>DS</sub> =10V, I <sub>D</sub> =2A                 | -    | 3.4  | -    | S     |
| I <sub>DSS</sub>    | Drain-Source Leakage Current                   | V <sub>DS</sub> =480V, V <sub>GS</sub> =0V               | -    | -    | 100  | uA    |
| I <sub>GSS</sub>    | Gate-Source Leakage                            | V <sub>GS</sub> =+30V, V <sub>DS</sub> =0V               | -    | -    | ±100 | nA    |
| Q <sub>g</sub>      | Total Gate Charge                              | I <sub>D</sub> =1A                                       | -    | 19.5 | 31   | nC    |
| Q <sub>gs</sub>     | Gate-Source Charge                             | V <sub>DS</sub> =480V                                    | -    | 3.5  | -    | nC    |
| Q <sub>gd</sub>     | Gate-Drain ("Miller") Charge                   | V <sub>GS</sub> =10V                                     | -    | 8.5  | -    | nC    |
| t <sub>d(on)</sub>  | Turn-on Delay Time                             | V <sub>DD</sub> =300V                                    | -    | 21   | -    | ns    |
| t <sub>r</sub>      | Rise Time                                      | I <sub>D</sub> =2A                                       | -    | 20   | -    | ns    |
| t <sub>d(off)</sub> | Turn-off Delay Time                            | R <sub>G</sub> =50 Ω                                     | -    | 105  | -    | ns    |
| t <sub>f</sub>      | Fall Time                                      | V <sub>GS</sub> =10V                                     | -    | 27   | -    | ns    |
| C <sub>iss</sub>    | Input Capacitance                              | V <sub>GS</sub> =0V                                      | -    | 740  | 1200 | pF    |
| C <sub>oss</sub>    | Output Capacitance                             | V <sub>DS</sub> =25V                                     | -    | 70   | -    | pF    |
| C <sub>rss</sub>    | Reverse Transfer Capacitance                   | f=1.0MHz   | -    | 10   | -    | pF    |

**Source-Drain Diode**

| Symbol          | Parameter                       | Test Conditions                         | Min. | Typ. | Max. | Units |
|-----------------|---------------------------------|---|------|------|------|-------|
| V <sub>SD</sub> | Forward On Voltage <sup>2</sup> | I <sub>S</sub> =2A, V <sub>GS</sub> =0V | -    | -    | 1.5  | V     |
| t <sub>rr</sub> | Reverse Recovery Time           | I <sub>S</sub> =2A, V <sub>GS</sub> =0V | -    | 280  | -    | ns    |
| Q <sub>rr</sub> | Reverse Recovery Charge         | dI/dt=100A/μs                           | -    | 2.94 | -    | μC    |

**Notes:**

- 1.Pulse width limited by max. junction temperature.
- 2.Pulse test
- 3.Starting T<sub>j</sub>=25°C , V<sub>DD</sub>=50V , L=1mH , R<sub>G</sub>=25 Ω

THIS PRODUCT IS SENSITIVE TO ELECTROSTATIC DISCHARGE, PLEASE HANDLE WITH CAUTION.

USE OF THIS PRODUCT AS A CRITICAL COMPONENT IN LIFE SUPPORT OR OTHER SIMILAR SYSTEMS IS NOT AUTHORIZED.

APEC DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

APEC RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN.

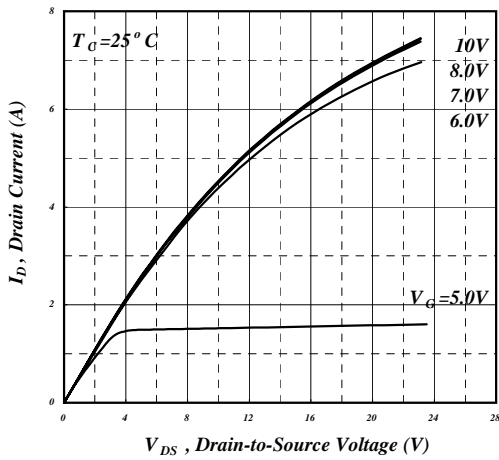


Fig 1. Typical Output Characteristics

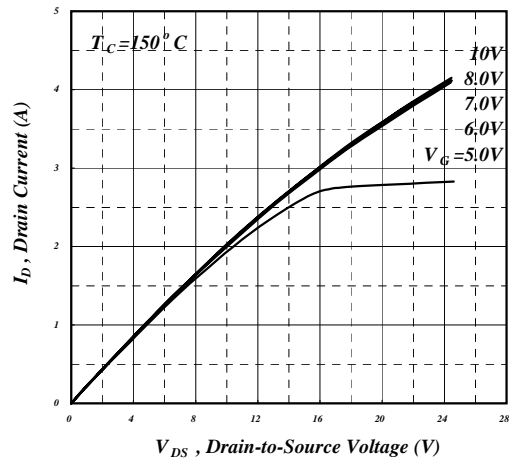


Fig 2. Typical Output Characteristics

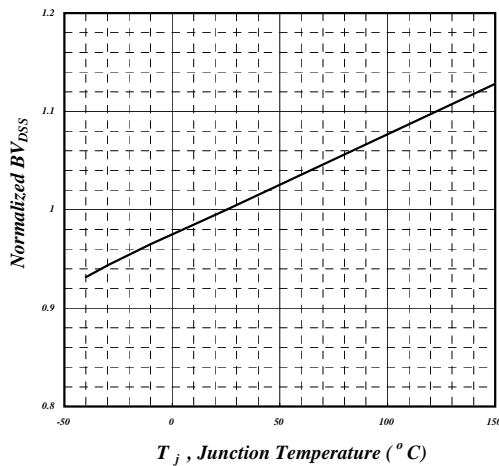


Fig 3. Normalized  $BV_{DSS}$  v.s. Junction Temperature

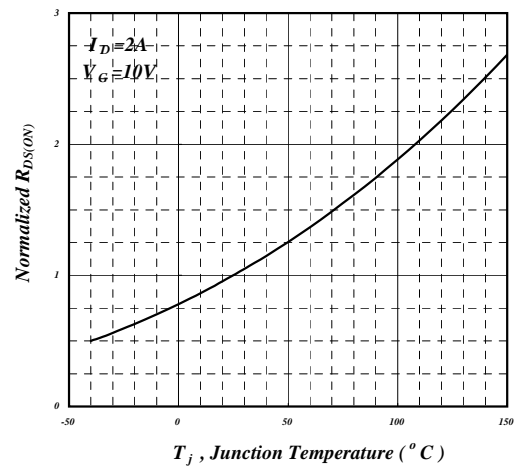


Fig 4. Normalized On-Resistance v.s. Junction Temperature

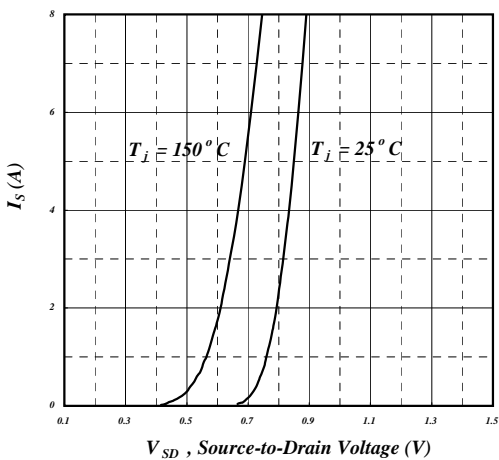


Fig 5. Forward Characteristic of Reverse Diode

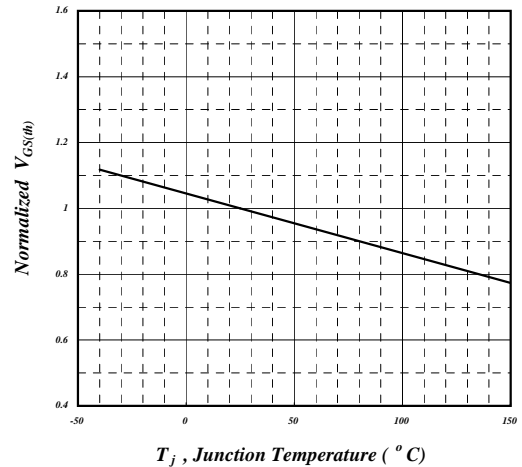


Fig 6. Gate Threshold Voltage v.s. Junction Temperature

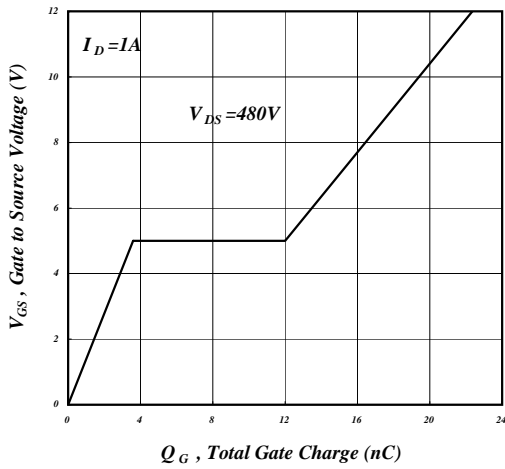


Fig 7. Gate Charge Characteristics

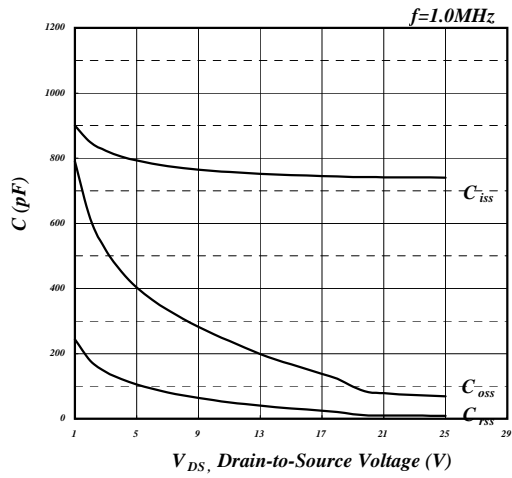


Fig 8. Typical Capacitance Characteristics

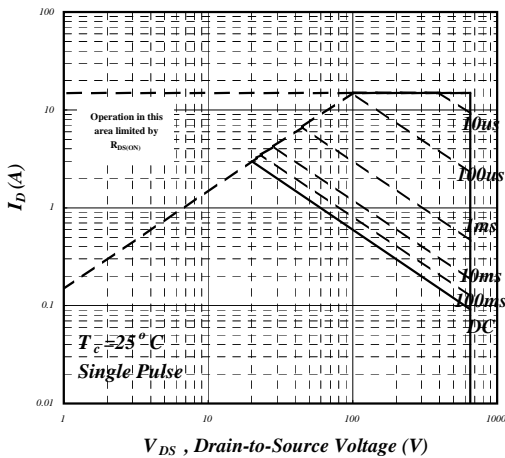


Fig 9. Maximum Safe Operating Area

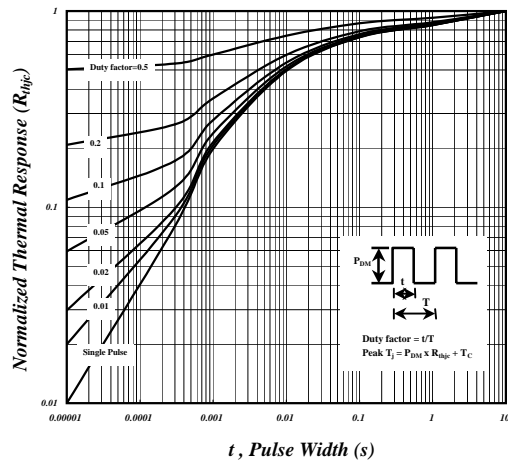


Fig 10. Effective Transient Thermal Impedance

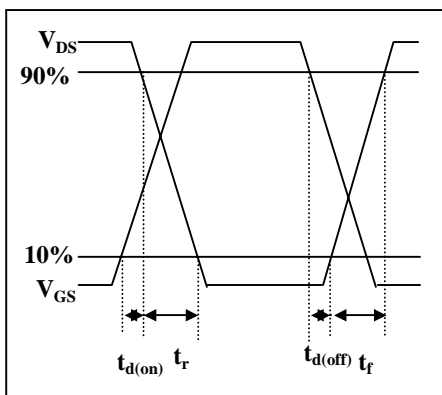


Fig 11. Switching Time Waveform

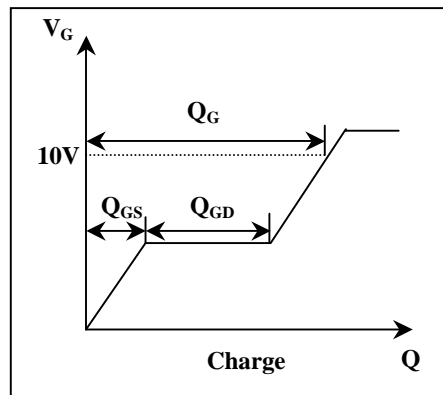


Fig 12. Gate Charge Waveform