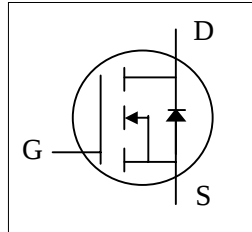
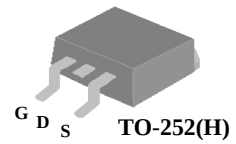




- ▼ 100% Avalanche Test
- ▼ Fast Switching Characteristic
- ▼ Simple Drive Requirement



|              |            |
|--------------|------------|
| $BV_{DSS}$   | 400V       |
| $R_{DS(ON)}$ | 5 $\Omega$ |
| $I_D$        | 1.6A       |

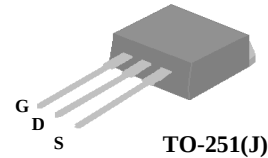


TO-252(H)

## Description

AP02N40 uses rugged design with the best combination of fast switching and cost-effectiveness.

The TO-252 package is widely preferred for all commercial-industrial surface mount applications and suited for AC/DC converters. The through-hole version (AP02N40J) is available for low-profile applications.



TO-251(J)

## Absolute Maximum Ratings

| Symbol                 | Parameter                                  | Rating     | Units       |
|------------------------|--------------------------------------------|------------|-------------|
| $V_{DS}$               | Drain-Source Voltage                       | 400        | 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>          | 3          | A           |
| $P_D@T_C=25^{\circ}C$  | Total Power Dissipation                    | 33         | W           |
| $E_{AS}$               | Single Pulse Avalanche Energy <sup>2</sup> | 5          | mJ          |
| $I_{AR}$               | Avalanche Current                          | 1          | 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 | Unit          |
|-------------|-----------------------------------------------------------------------|-------|---------------|
| $R_{thj-c}$ | Maximum Thermal Resistance, Junction-case                             | 3.8   | $^{\circ}C/W$ |
| $R_{thj-a}$ | Maximum Thermal Resistance, Junction-ambient (PCB mount) <sup>4</sup> | 62.5  | $^{\circ}C/W$ |
| $R_{thj-a}$ | Maximum Thermal Resistance, Junction-ambient                          | 110   | $^{\circ}C/W$ |

**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> =1mA                 | 400  | -    | -    | V     |
| R <sub>DS(ON)</sub> | Static Drain-Source On-Resistance <sup>3</sup>       | V <sub>GS</sub> =10V, I <sub>D</sub> =0.7A               | -    | -    | 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> =1A                 | -    | 1.5  | -    | S     |
| I <sub>DSS</sub>    | Drain-Source Leakage Current                         | V <sub>DS</sub> =400V, V <sub>GS</sub> =0V               | -    | -    | 25   | uA    |
|                     | Drain-Source Leakage Current (T <sub>j</sub> =125°C) | V <sub>DS</sub> =320V, V <sub>GS</sub> =0V               | -    | -    | 250  | 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 <sup>3</sup>                       | I <sub>D</sub> =1A                                       | -    | 6.4  | 10   | nC    |
| Q <sub>gs</sub>     | Gate-Source Charge                                   | V <sub>DS</sub> =320V                                    | -    | 1.2  | -    | nC    |
| Q <sub>gd</sub>     | Gate-Drain ("Miller") Charge                         | V <sub>GS</sub> =10V                                     | -    | 3.2  | -    | nC    |
| t <sub>d(on)</sub>  | Turn-on Delay Time <sup>3</sup>                      | V <sub>DD</sub> =200V                                    | -    | 8    | -    | ns    |
| t <sub>r</sub>      | Rise Time                                            | I <sub>D</sub> =1A                                       | -    | 9    | -    | ns    |
| t <sub>d(off)</sub> | Turn-off Delay Time                                  | R <sub>G</sub> =50Ω, V <sub>GS</sub> =10V                | -    | 21   | -    | ns    |
| t <sub>f</sub>      | Fall Time                                            | R <sub>D</sub> =200Ω                                     | -    | 12   | -    | ns    |
| C <sub>iss</sub>    | Input Capacitance                                    | V <sub>GS</sub> =0V                                      | -    | 180  | 300  | pF    |
| C <sub>oss</sub>    | Output Capacitance                                   | V <sub>DS</sub> =25V                                     | -    | 22   | -    | pF    |
| C <sub>rss</sub>    | Reverse Transfer Capacitance                         | f=1.0MHz                                                 | -    | 5.6  | -    | pF    |

**Source-Drain Diode**

| Symbol          | Parameter                          | Test Conditions                           | Min. | Typ. | Max. | Units |
|-----------------|------------------------------------|-------------------------------------------|------|------|------|-------|
| V <sub>SD</sub> | Forward On Voltage <sup>3</sup>    | I <sub>S</sub> =1.6A, V <sub>GS</sub> =0V | -    | -    | 1.5  | V     |
| t <sub>rr</sub> | Reverse Recovery Time <sup>3</sup> | I <sub>S</sub> =1A, V <sub>GS</sub> =0V,  | -    | 150  | -    | ns    |
| Q <sub>rr</sub> | Reverse Recovery Charge            | dI/dt=100A/μs                             | -    | 680  | -    | nC    |

**Notes:**

- 1.Pulse width limited by Max. junction temperature.
- 2.Starting T<sub>j</sub>=25°C , V<sub>DD</sub>=50V , L=10mH , R<sub>G</sub>=25Ω
- 3.Pulse test
- 4.Surface mounted on 1 in<sup>2</sup> copper pad of FR4 board

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.

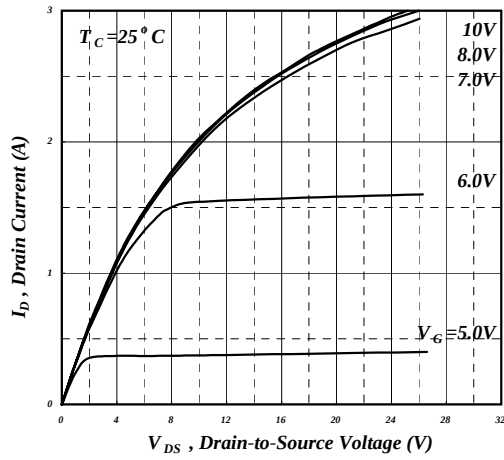


Fig 1. Typical Output Characteristics

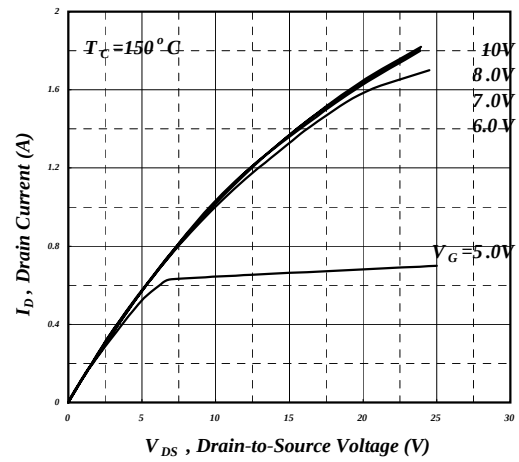


Fig 2. Typical Output Characteristics

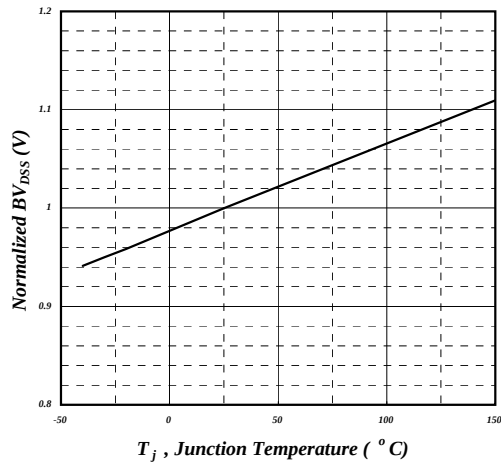


Fig 3. Normalized  $BV_{DSS}$  v.s. Junction Temperature

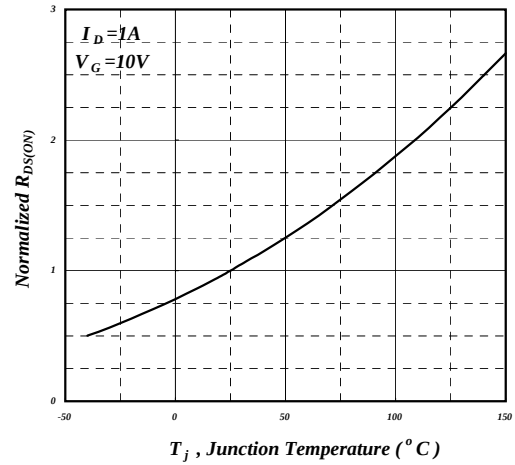


Fig 4. Normalized On-Resistance v.s. Junction Temperature

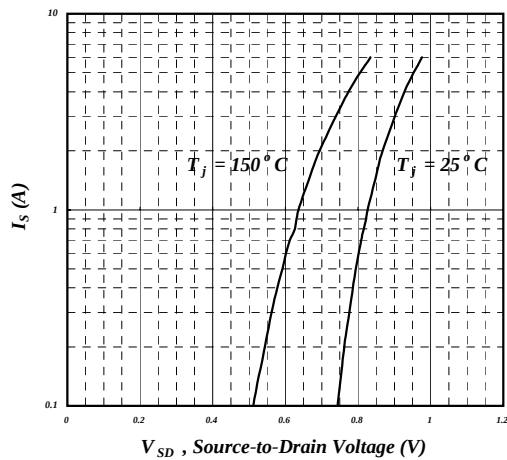


Fig 5. Forward Characteristic of Reverse Diode

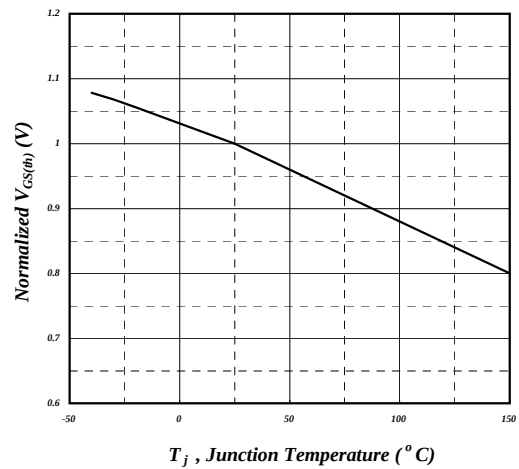


Fig 6. Gate Threshold Voltage v.s. Junction Temperature

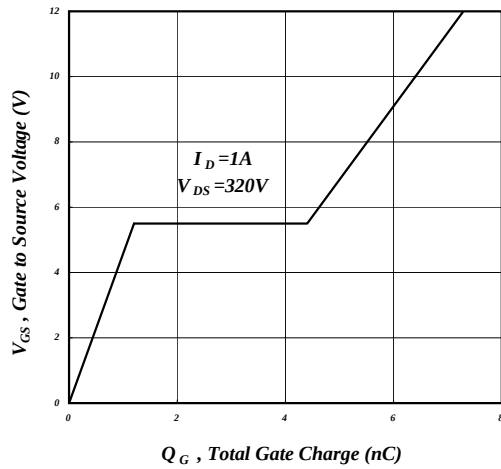


Fig 7. Gate Charge Characteristics

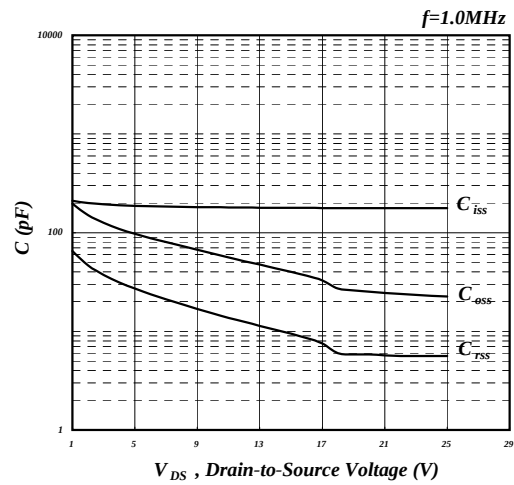


Fig 8. Typical Capacitance Characteristics

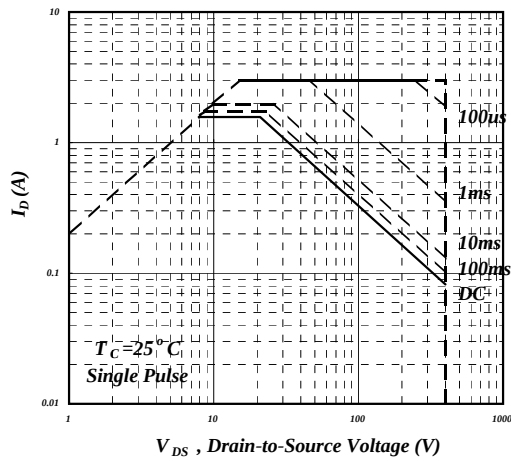


Fig 9. Maximum Safe Operating Area

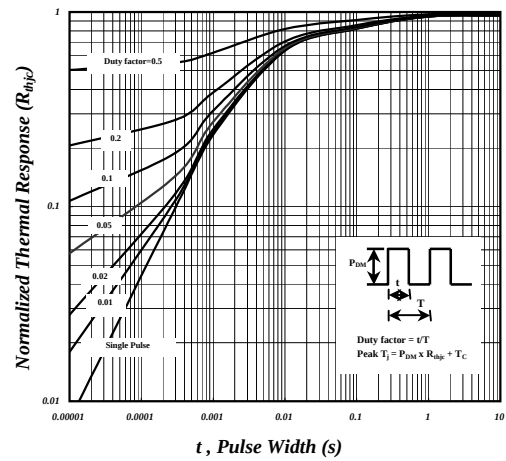


Fig 10. Effective Transient Thermal Impedance

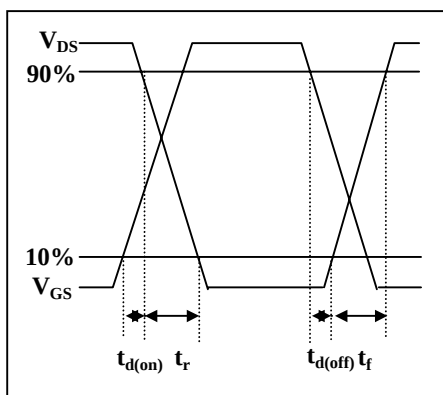


Fig 11. Switching Time Waveform

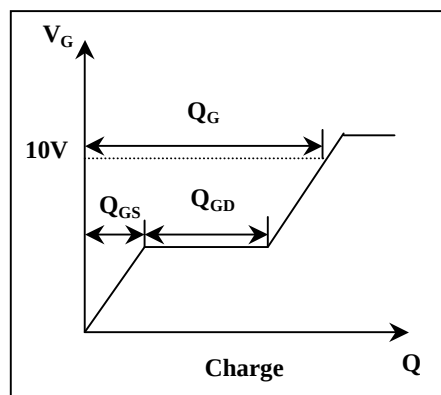


Fig 12. Gate Charge Waveform