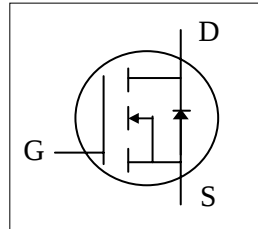




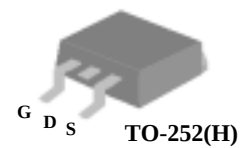
- ▼ Low Gate Charge
- ▼ Simple Drive Requirement
- ▼ Fast Switching



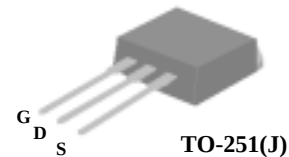
|              |              |
|--------------|--------------|
| $BV_{DS}$    | 30V          |
| $R_{DS(ON)}$ | 52m $\Omega$ |
| $I_D$        | 20A          |

## Description

The TO-252 package is universally preferred for all commercial-industrial surface mount applications and suited for low voltage applications such as DC/DC converters. The through-hole version (AP20N03J) is available for low-profile applications.



TO-252(H)



TO-251(J)

## Absolute Maximum Ratings

| Symbol                      | Parameter                                | Rating     | Units               |
|-----------------------------|------------------------------------------|------------|---------------------|
| $V_{DS}$                    | Drain-Source Voltage                     | 30         | V                   |
| $V_{GS}$                    | Gate-Source Voltage                      | $\pm 20$   | V                   |
| $I_D@T_C=25^\circ\text{C}$  | Continuous Drain Current, $V_{GS}$ @ 10V | 20         | A                   |
| $I_D@T_C=100^\circ\text{C}$ | Continuous Drain Current, $V_{GS}$ @ 10V | 13         | A                   |
| $I_{DM}$                    | Pulsed Drain Current <sup>1</sup>        | 53         | A                   |
| $P_D@T_C=25^\circ\text{C}$  | Total Power Dissipation                  | 31         | W                   |
|                             | Linear Derating Factor                   | 0.25       | W/ $^\circ\text{C}$ |
| $T_{STG}$                   | Storage Temperature Range                | -55 to 150 | $^\circ\text{C}$    |
| $T_J$                       | Operating Junction Temperature Range     | -55 to 150 | $^\circ\text{C}$    |

## Thermal Data

| Symbol         | Parameter                                | Value | Unit                      |
|----------------|------------------------------------------|-------|---------------------------|
| $R_{thj-case}$ | Thermal Resistance Junction-case Max.    | 4.0   | $^\circ\text{C}/\text{W}$ |
| $R_{thj-amb}$  | Thermal Resistance Junction-ambient Max. | 110   | $^\circ\text{C}/\text{W}$ |



## AP20N03H/J

### 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               | 30   | -     | -    | V     |
| ΔBV <sub>DSS</sub> /ΔT <sub>j</sub> | Breakdown Voltage Temperature Coefficient            | Reference to 25°C, I <sub>D</sub> =1mA                   | -    | 0.037 | -    | V/°C  |
| R <sub>DS(ON)</sub>                 | Static Drain-Source On-Resistance                    | V <sub>GS</sub> =10V, I <sub>D</sub> =10A                | -    | -     | 52   | mΩ    |
|                                     |                                                      | V <sub>GS</sub> =4.5V, I <sub>D</sub> =8A                | -    | -     | 85   | mΩ    |
| V <sub>GS(th)</sub>                 | Gate Threshold Voltage                               | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250uA | 1    | -     | 3    | V     |
| I <sub>DSS</sub>                    | Drain-Source Leakage Current (T <sub>j</sub> =25°C)  | V <sub>DS</sub> =30V, V <sub>GS</sub> =0V                | -    | -     | 1    | uA    |
|                                     | Drain-Source Leakage Current (T <sub>j</sub> =150°C) | V <sub>DS</sub> =24V, V <sub>GS</sub> =0V                | -    | -     | 25   | uA    |
| I <sub>GSS</sub>                    | Gate-Source Leakage                                  | V <sub>GS</sub> = ± 20V                                  | -    | -     | ±100 | nA    |
| Q <sub>g</sub>                      | Total Gate Charge <sup>2</sup>                       | I <sub>D</sub> =10A                                      | -    | 6.1   | -    | nC    |
| Q <sub>gs</sub>                     | Gate-Source Charge                                   | V <sub>DS</sub> = 24V                                    | -    | 1.4   | -    | nC    |
| Q <sub>gd</sub>                     | Gate-Drain ("Miller") Charge                         | V <sub>GS</sub> =5V                                      | -    | 4     | -    | nC    |
| t <sub>d(on)</sub>                  | Turn-on Delay Time <sup>2</sup>                      | V <sub>DS</sub> =15V                                     | -    | 4.9   | -    | ns    |
| t <sub>r</sub>                      | Rise Time                                            | I <sub>D</sub> =20A                                      | -    | 29    | -    | ns    |
| t <sub>d(off)</sub>                 | Turn-off Delay Time                                  | R <sub>G</sub> =3.3Ω, V <sub>GS</sub> =10V               | -    | 14.3  | -    | ns    |
| t <sub>f</sub>                      | Fall Time                                            | R <sub>D</sub> =0.75Ω                                    | -    | 3.6   | -    | ns    |
| C <sub>iss</sub>                    | Input Capacitance                                    | V <sub>GS</sub> =0V                                      | -    | 290   | -    | pF    |
| C <sub>oss</sub>                    | Output Capacitance                                   | V <sub>DS</sub> =25V                                     | -    | 160   | -    | pF    |
| C <sub>rss</sub>                    | Reverse Transfer Capacitance                         | f=1.0MHz                                                 | -    | 45    | -    | pF    |

### Source-Drain Diode

| Symbol          | Parameter                                         | Test Conditions                                                | Min. | Typ. | Max. | Units |
|-----------------|---------------------------------------------------|----------------------------------------------------------------|------|------|------|-------|
| I <sub>S</sub>  | Continuous Source Current ( Body Diode )          | V <sub>D</sub> =V <sub>G</sub> =0V , V <sub>S</sub> =1.3V      | -    | -    | 20   | A     |
| I <sub>SM</sub> | Pulsed Source Current ( Body Diode ) <sup>1</sup> |                                                                | -    | -    | 53   | A     |
| V <sub>SD</sub> | Forward On Voltage <sup>2</sup>                   | T <sub>j</sub> =25°C, I <sub>S</sub> =20A, V <sub>GS</sub> =0V | -    | -    | 1.3  | V     |

#### Notes:

1.Pulse width limited by safe operating area.

2.Pulse width ≤300us , duty cycle ≤2%.

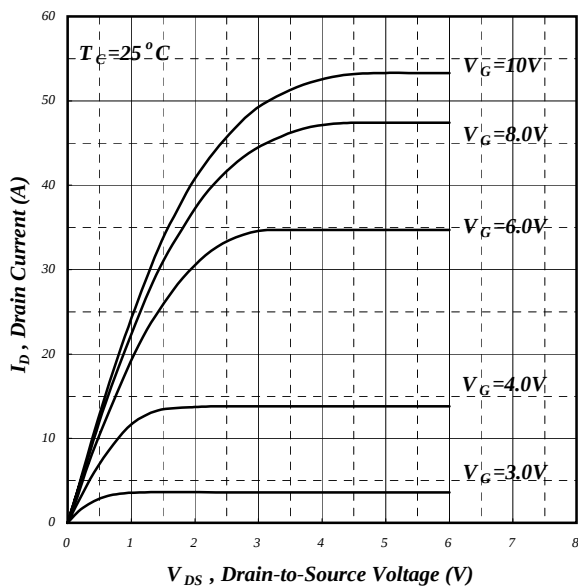


Fig 1. Typical Output Characteristics

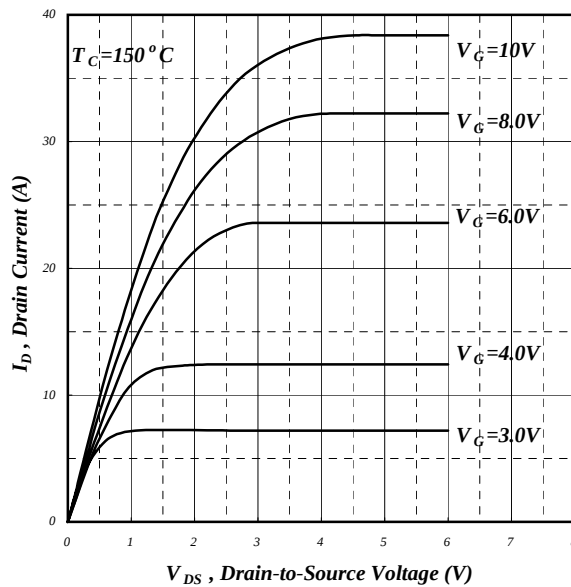


Fig 2. Typical Output Characteristics

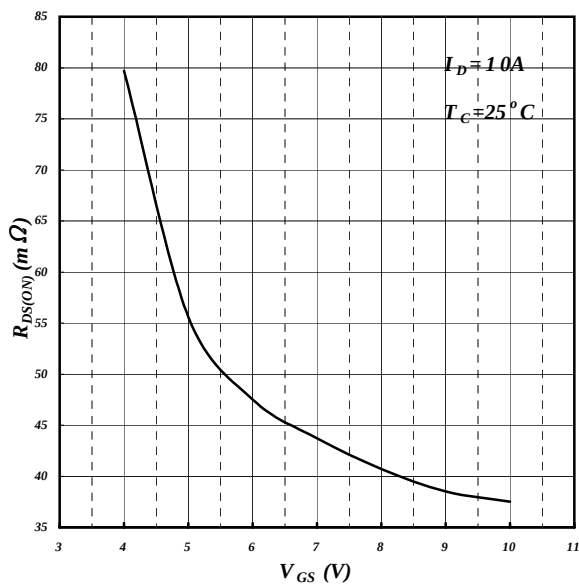


Fig 3. On-Resistance v.s. Gate Voltage

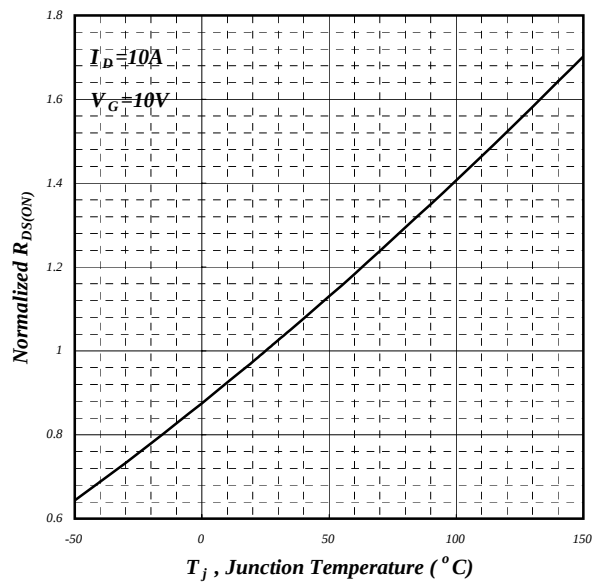


Fig 4. Normalized On-Resistance  
v.s. Junction Temperature

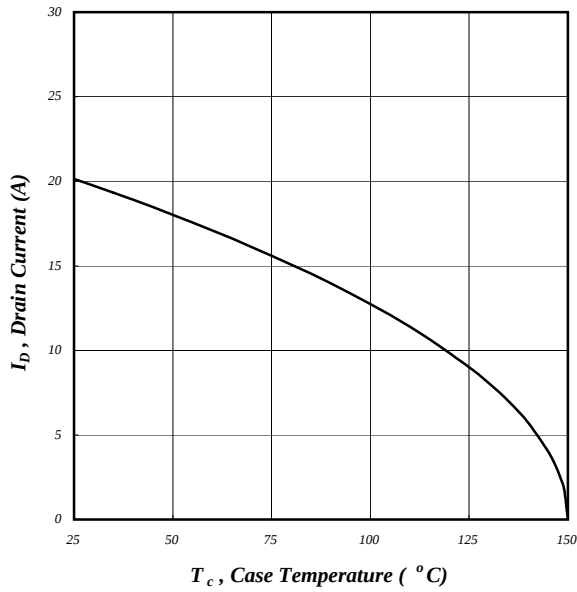


Fig 5. Maximum Drain Current v.s. Case Temperature

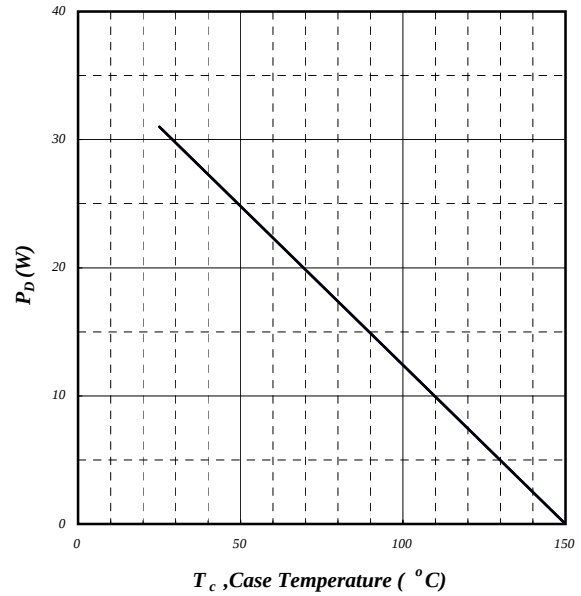


Fig 6. Typical Power Dissipation

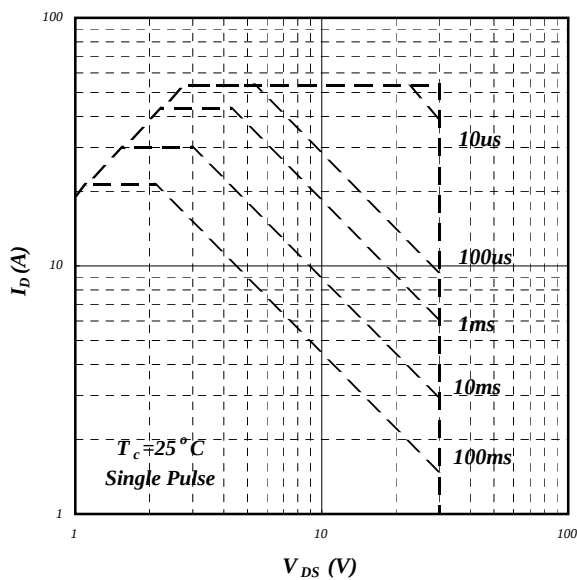


Fig 7. Maximum Safe Operating Area

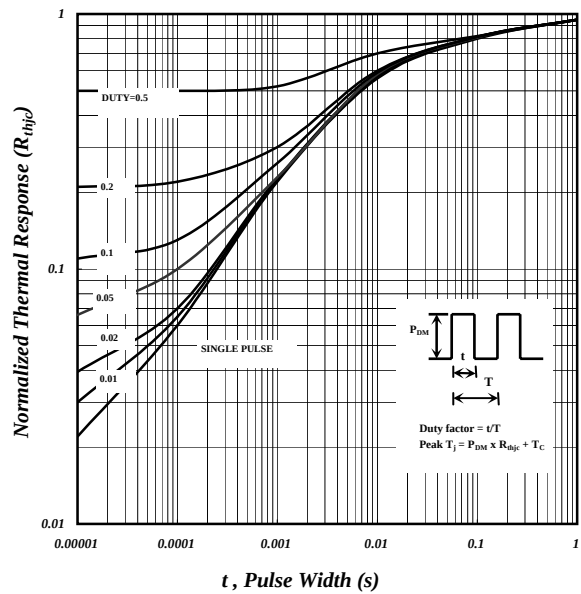
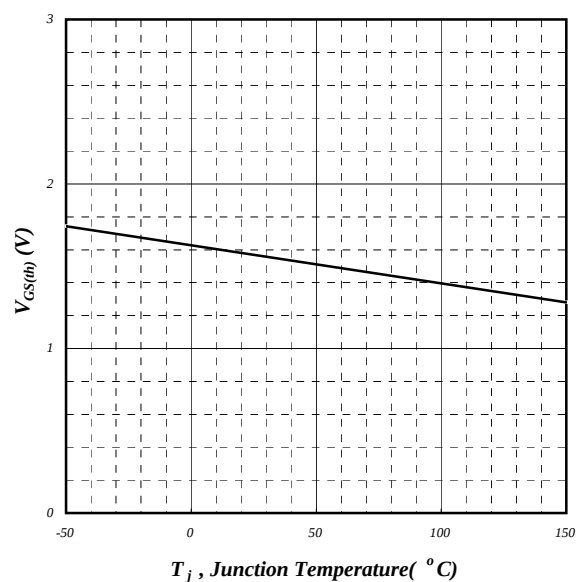
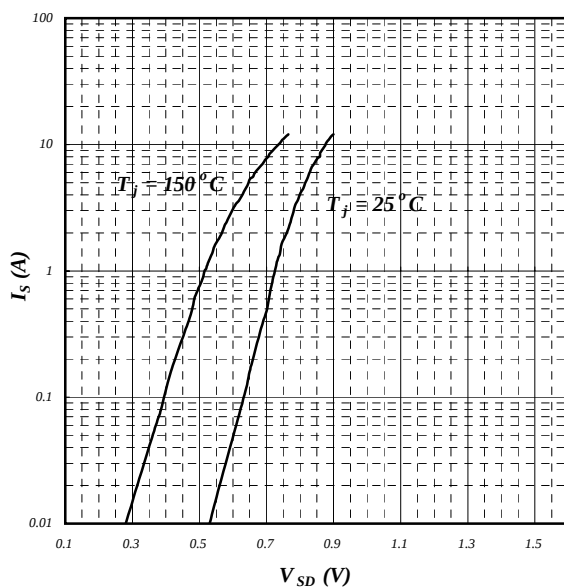
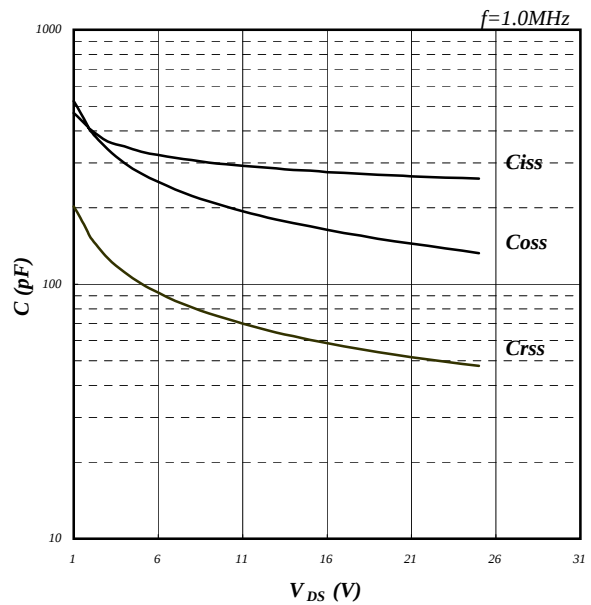
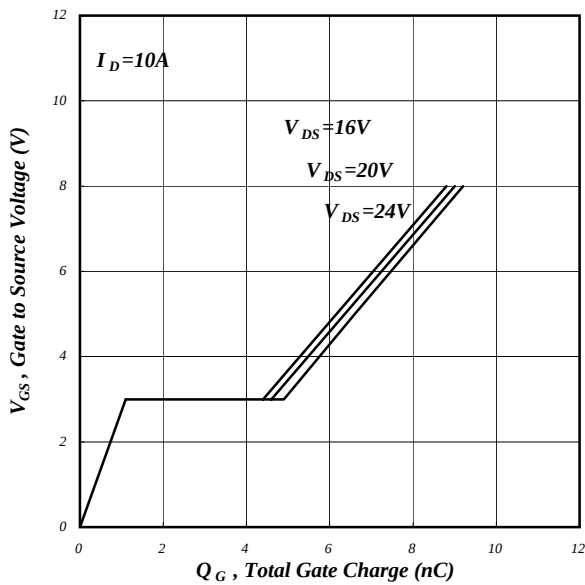


Fig 8. Effective Transient Thermal Impedance



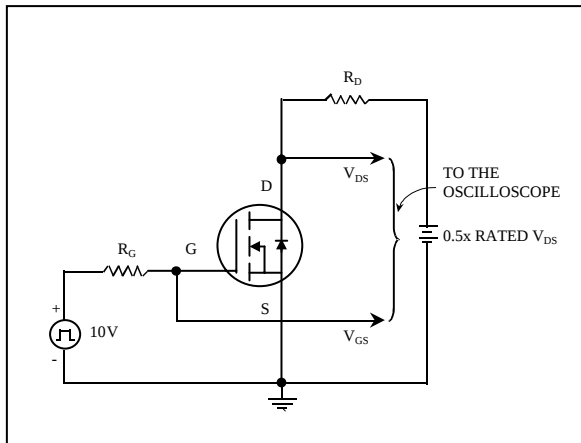


Fig 13. Switching Time Circuit

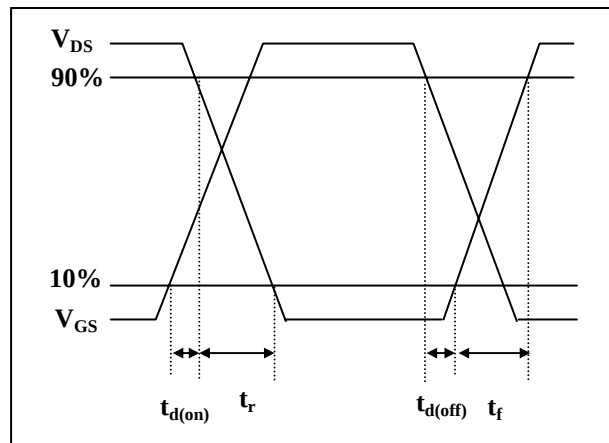


Fig 14. Switching Time Waveform

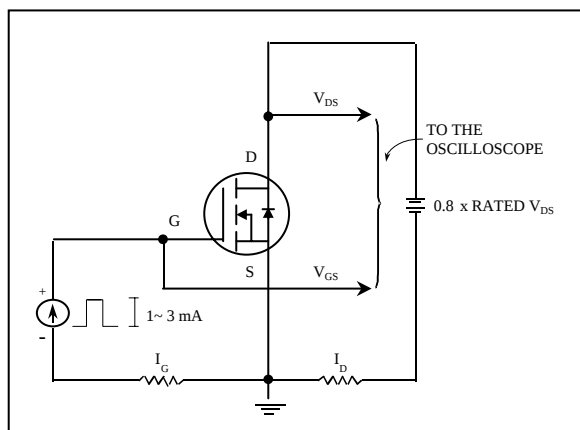


Fig 15. Gate Charge Circuit

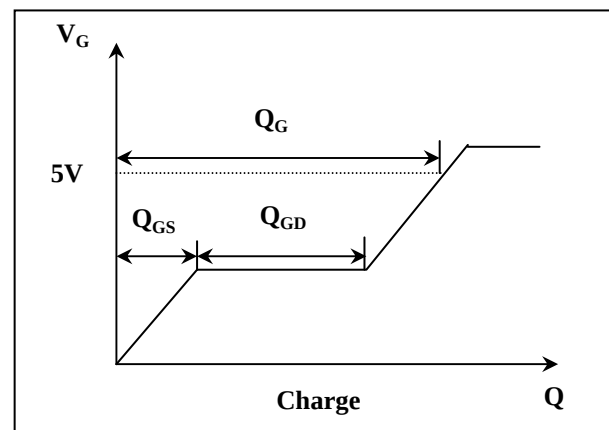


Fig 16. Gate Charge Waveform