



Advanced Power  
Electronics Corp.

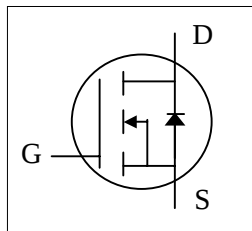
AP3990P

RoHS-compliant Product

N-CHANNEL ENHANCEMENT MODE

POWER MOSFET

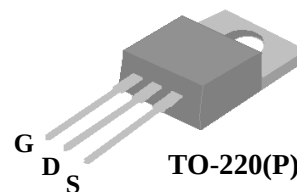
- ▼ 100% Avalanche Test
- ▼ Fast Switching Characteristic
- ▼ Simple Drive Requirement



|              |              |
|--------------|--------------|
| $BV_{DSS}$   | 600V         |
| $R_{DS(ON)}$ | 0.6 $\Omega$ |
| $I_D$        | 10A          |

## Description

AP3990 series are specially designed as main switching devices for universal 90~265VAC off-line AC/DC converter applications. The TO-220 type provide high blocking voltage to overcome voltage surge and sag in the toughest power system with the best combination of fast switching, ruggedized design and cost-effectiveness.



The TO-220 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                       | 600        | V           |
| $V_{GS}$               | Gate-Source Voltage                        | $\pm 30$   | V           |
| $I_D@T_C=25^{\circ}C$  | Continuous Drain Current, $V_{GS}$ @ 10V   | 10         | A           |
| $I_D@T_C=100^{\circ}C$ | Continuous Drain Current, $V_{GS}$ @ 10V   | 6.5        | A           |
| $I_{DM}$               | Pulsed Drain Current <sup>1</sup>          | 40         | A           |
| $P_D@T_C=25^{\circ}C$  | Total Power Dissipation                    | 174        | W           |
| $E_{AS}$               | Single Pulse Avalanche Energy <sup>2</sup> | 50         | mJ          |
| $I_{AR}$               | Avalanche Current                          | 10         | 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    | 0.72  | $^{\circ}C/W$ |
| $R_{thj-a}$ | Maximum Thermal Resistance, Junction-ambient | 62    | $^{\circ}C/W$ |

Data & specifications subject to change without notice

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**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> =1.0mA               | 600  | -    | -    | V     |
| R <sub>DS(ON)</sub> | Static Drain-Source On-Resistance <sup>3</sup>       | V <sub>GS</sub> =10V, I <sub>D</sub> =5.0A               | -    | -    | 0.6  | Ω     |
| V <sub>GS(th)</sub> | Gate Threshold Voltage                               | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250uA | 2    | -    | 4.5  | V     |
| g <sub>fs</sub>     | Forward Transconductance                             | V <sub>DS</sub> =10V, I <sub>D</sub> =5A                 | -    | 5    | -    | S     |
| I <sub>DSS</sub>    | Drain-Source Leakage Current                         | V <sub>DS</sub> =480V, V <sub>GS</sub> =0V               | -    | -    | 25   | uA    |
|                     | Drain-Source Leakage Current (T <sub>J</sub> =125°C) | V <sub>DS</sub> =480V, V <sub>GS</sub> =0V               | -    | -    | 500  | 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> =10A                                      | -    | 34   | 57   | nC    |
| Q <sub>gs</sub>     | Gate-Source Charge                                   | V <sub>DS</sub> =480V                                    | -    | 11   | -    | nC    |
| Q <sub>gd</sub>     | Gate-Drain ("Miller") Charge                         | V <sub>GS</sub> =10V                                     | -    | 11   | -    | nC    |
| t <sub>d(on)</sub>  | Turn-on Delay Time <sup>3</sup>                      | V <sub>DD</sub> =300V                                    | -    | 19   | -    | ns    |
| t <sub>r</sub>      | Rise Time                                            | I <sub>D</sub> =10A                                      | -    | 28   | -    | ns    |
| t <sub>d(off)</sub> | Turn-off Delay Time                                  | R <sub>G</sub> =10Ω, V <sub>GS</sub> =10V                | -    | 43   | -    | ns    |
| t <sub>f</sub>      | Fall Time                                            | R <sub>D</sub> =30Ω                                      | -    | 22   | -    | ns    |
| C <sub>iss</sub>    | Input Capacitance                                    | V <sub>GS</sub> =0V                                      | -    | 2030 | 3250 | pF    |
| C <sub>oss</sub>    | Output Capacitance                                   | V <sub>DS</sub> =25V                                     | -    | 225  | -    | pF    |
| C <sub>rss</sub>    | Reverse Transfer Capacitance                         | f=1.0MHz                                                 | -    | 9    | -    | 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> =10A, V <sub>GS</sub> =0V  | -    | -    | 1.5  | V     |
| t <sub>rr</sub> | Reverse Recovery Time <sup>3</sup> | I <sub>S</sub> =10A, V <sub>GS</sub> =0V, | -    | 600  | -    | ns    |
| Q <sub>rr</sub> | Reverse Recovery Charge            | dI/dt=100A/μs                             | -    | 12   | -    | uC    |

**Notes:**

- 1.Pulse width limited by Max. junction temperature.
- 2.Starting T<sub>J</sub>=25°C , V<sub>DD</sub>=50V , L=1.0mH , R<sub>G</sub>=25Ω , I<sub>AS</sub>=10A.
- 3.Pulse test

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.

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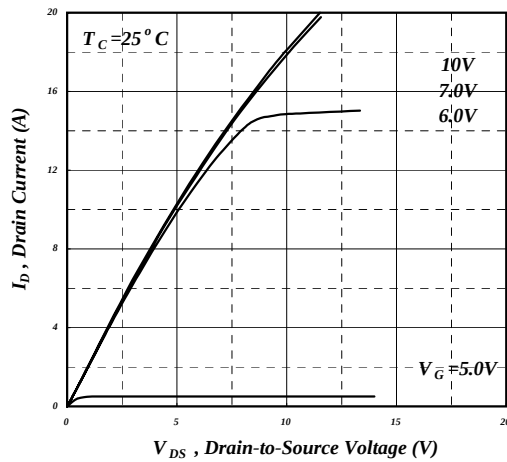


Fig 1. Typical Output Characteristics

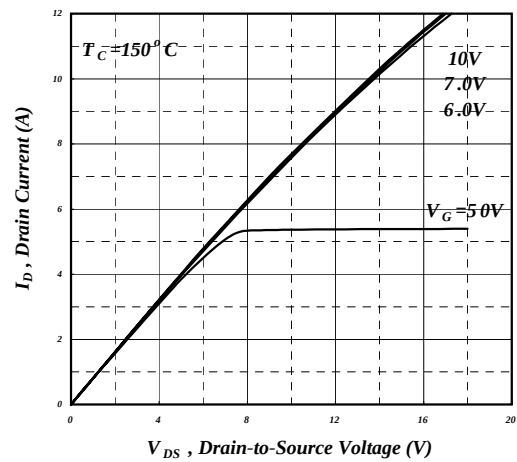


Fig 2. Typical Output Characteristics

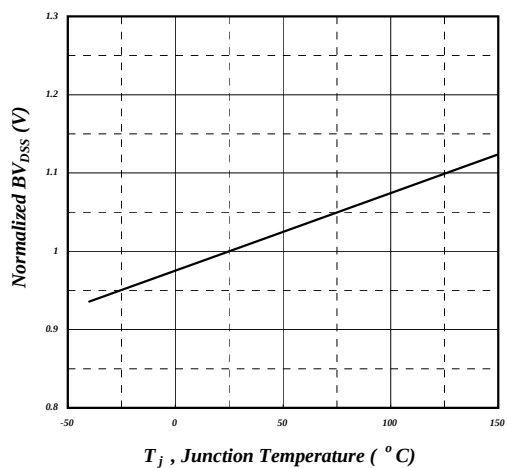


Fig 3. Normalized  $BV_{DSS}$  v.s. Junction Temperature

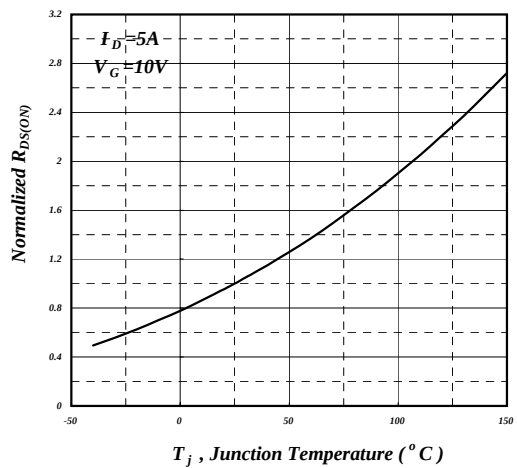


Fig 4. Normalized On-Resistance v.s. Junction Temperature

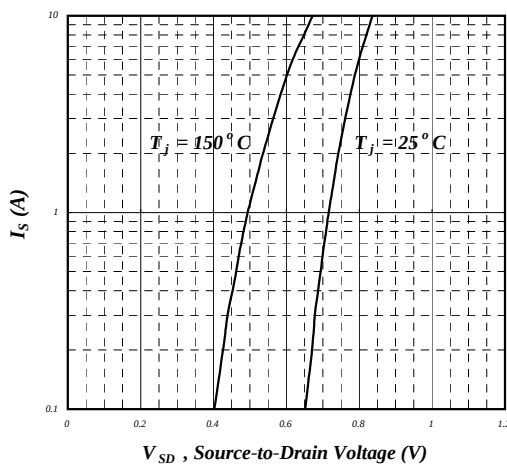


Fig 5. Forward Characteristic of Reverse Diode

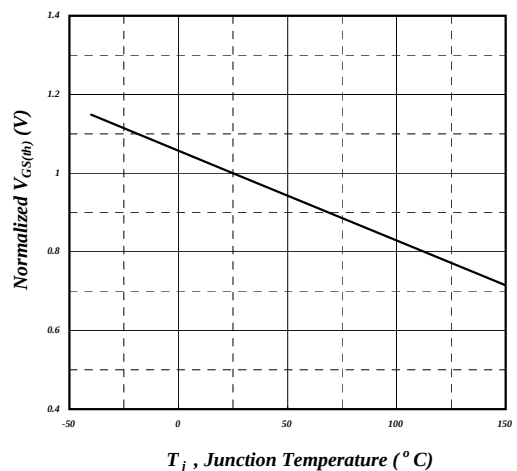


Fig 6. Gate Threshold Voltage v.s. Junction Temperature

