



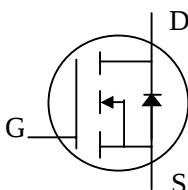
## N-channel Enhancement-mode Power MOSFET

100% Avalanche-Tested

Simple Drive Requirement

Fast Switching Performance

RoHS-compliant

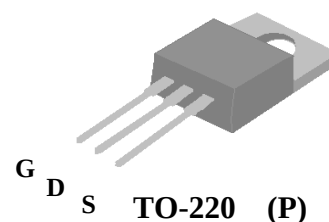


|              |             |
|--------------|-------------|
| $BV_{DSS}$   | 600V        |
| $R_{DS(ON)}$ | $0.6\Omega$ |
| $I_D$        | 10A         |

### Description

Advanced Power MOSFETs from APEC provide the designer with the best combination of fast switching, low on-resistance and cost-effectiveness.

The AP3990P-3 is in the popular TO-220 through-hole package which is widely used in commercial and industrial applications where a small PCB footprint or an attached isolated heatsink is required. This device is well suited as the main switching device for universal 90~265VAC off-line AC/DC converters.



### Absolute Maximum Ratings

| Symbol                           | Parameter                                  | Rating     | Units            |
|----------------------------------|--------------------------------------------|------------|------------------|
| $V_{DS}$                         | Drain-Source Voltage                       | 600        | V                |
| $V_{GS}$                         | Gate-Source Voltage                        | $\pm 30$   | V                |
| $I_D$ at $T_C=25^\circ\text{C}$  | Continuous Drain Current                   | 10         | A                |
| $I_D$ at $T_C=100^\circ\text{C}$ | Continuous Drain Current                   | 6.5        | A                |
| $I_{DM}$                         | Pulsed Drain Current <sup>1</sup>          | 40         | A                |
| $P_D$ at $T_C=25^\circ\text{C}$  | Total Power Dissipation                    | 174        | W                |
| $E_{AS}$                         | Single Pulse Avalanche Energy <sup>3</sup> | 50         | mJ               |
| $I_{AR}$                         | Avalanche Current                          | 10         | A                |
| $T_{STG}$                        | 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 | Units              |
|--------|----------------------------------------------|-------|--------------------|
| Rthj-c | Maximum Thermal Resistance, Junction-case    | 0.72  | $^\circ\text{C/W}$ |
| Rthj-a | Maximum Thermal Resistance, Junction-ambient | 62    | $^\circ\text{C/W}$ |

### Ordering Information

AP3990P-3TB    RoHS-compliant TO-220, shipped in tubes



**Electrical Specifications at  $T_j=25^{\circ}\text{C}$  (unless otherwise specified)**

| Symbol       | Parameter                                                  | Test Conditions               | Min. | Typ. | Max.      | Units    |
|--------------|------------------------------------------------------------|-------------------------------|------|------|-----------|----------|
| $BV_{DSS}$   | Drain-Source Breakdown Voltage                             | $V_{GS}=0V, I_D=1.0mA$        | 600  | -    | -         | V        |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance <sup>3</sup>             | $V_{GS}=10V, I_D=5.0A$        | -    | -    | 0.6       | $\Omega$ |
| $V_{GS(th)}$ | Gate Threshold Voltage                                     | $V_{DS}=V_{GS}, I_D=250\mu A$ | 2    | -    | 4.5       | V        |
| $g_{fs}$     | Forward Transconductance                                   | $V_{DS}=10V, I_D=5A$          | -    | 5    | -         | S        |
| $I_{DSS}$    | Drain-Source Leakage Current                               | $V_{DS}=480V, V_{GS}=0V$      | -    | -    | 25        | $\mu A$  |
|              | Drain-Source Leakage Current ( $T_j=150^{\circ}\text{C}$ ) | $V_{DS}=480V, V_{GS}=0V$      | -    | -    | 500       | $\mu A$  |
| $I_{GSS}$    | Gate-Source Leakage                                        | $V_{GS}=\pm 30V$              | -    | -    | $\pm 100$ | nA       |
| $Q_g$        | Total Gate Charge <sup>3</sup>                             | $I_D=10A$                     | -    | 34   | 57        | nC       |
| $Q_{gs}$     | Gate-Source Charge                                         | $V_{DS}=480V$                 | -    | 11   | -         | nC       |
| $Q_{gd}$     | Gate-Drain ("Miller") Charge                               | $V_{GS}=10V$                  | -    | 11   | -         | nC       |
| $t_{d(on)}$  | Turn-on Delay Time <sup>3</sup>                            | $V_{DD}=300V$                 | -    | 19   | -         | ns       |
| $t_r$        | Rise Time                                                  | $I_D=10A$                     | -    | 28   | -         | ns       |
| $t_{d(off)}$ | Turn-off Delay Time                                        | $R_G=10\Omega, V_{GS}=10V$    | -    | 43   | -         | ns       |
| $t_f$        | Fall Time                                                  | $R_D=30\Omega$                | -    | 22   | -         | ns       |
| $C_{iss}$    | Input Capacitance                                          | $V_{GS}=0V$                   | -    | 2030 | 3250      | pF       |
| $C_{oss}$    | Output Capacitance                                         | $V_{DS}=25V$                  | -    | 225  | -         | pF       |
| $C_{rss}$    | Reverse Transfer Capacitance                               | $f=1.0MHz$                    | -    | 9    | -         | pF       |

**Source-Drain Diode**

| Symbol   | Parameter                          | Test Conditions       | Min. | Typ. | Max. | Units   |
|----------|------------------------------------|-----------------------|------|------|------|---------|
| $V_{SD}$ | Forward On Voltage <sup>3</sup>    | $I_S=10A, V_{GS}=0V$  | -    | -    | 1.5  | V       |
| $t_{rr}$ | Reverse Recovery Time <sup>3</sup> | $I_S=10A, V_{GS}=0V,$ | -    | 600  | -    | ns      |
| $Q_{rr}$ | Reverse Recovery Charge            | $di/dt=100A/\mu s$    | -    | 12   | -    | $\mu C$ |

**Notes:**

1. Pulse width limited by maximum junction temperature.
2. Starting  $T_j=25^{\circ}\text{C}$ ,  $V_{DD}=50V$ ,  $L=1mH$ ,  $R_G=25\Omega$ ,  $I_{AS}=10A$
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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## Typical Electrical Characteristics

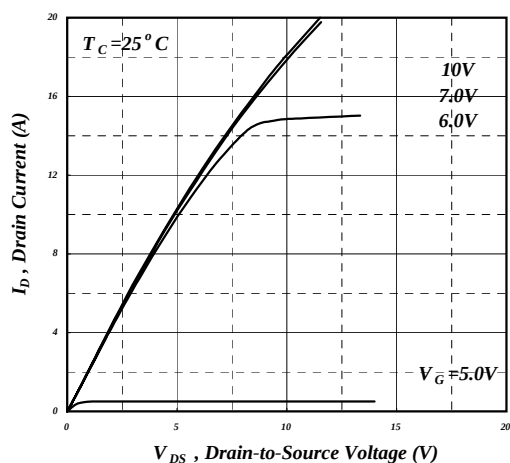


Fig 1. Typical Output Characteristics

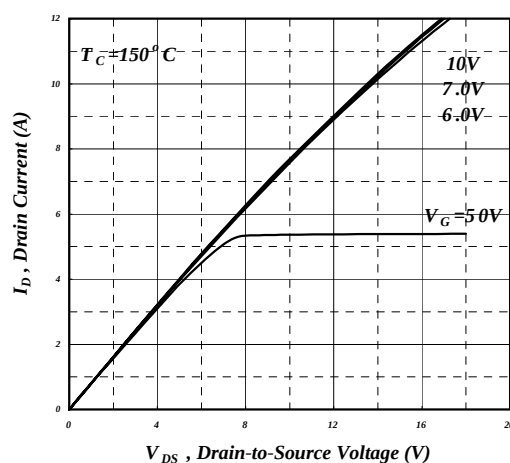


Fig 2. Typical Output Characteristics

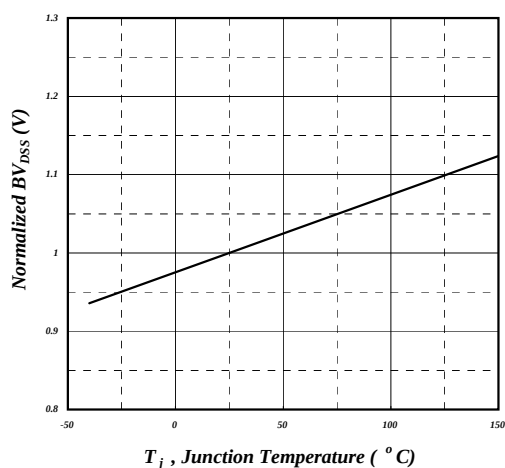


Fig 3. Normalized  $BV_{DS}$   
vs. Junction Temperature

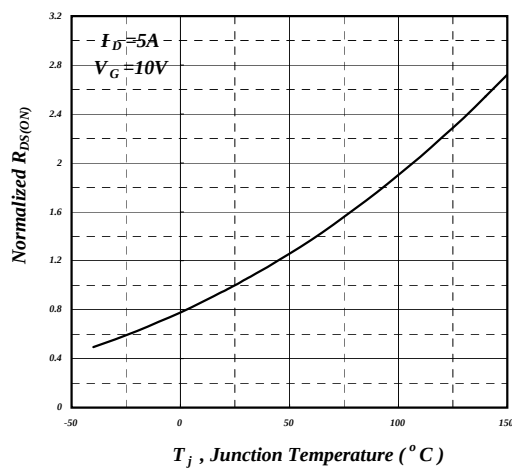


Fig 4. Normalized On-Resistance  
vs. Junction Temperature

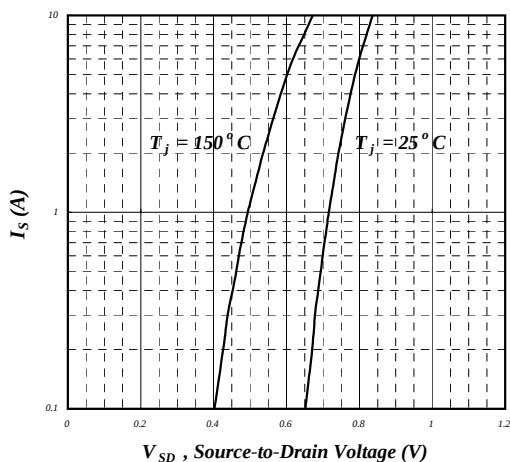


Fig 5. Forward Characteristic of  
Reverse Diode

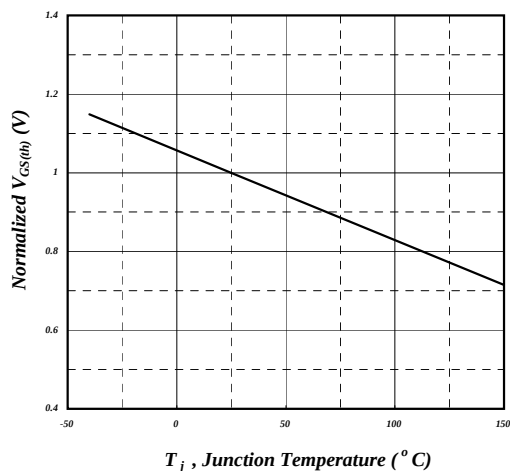
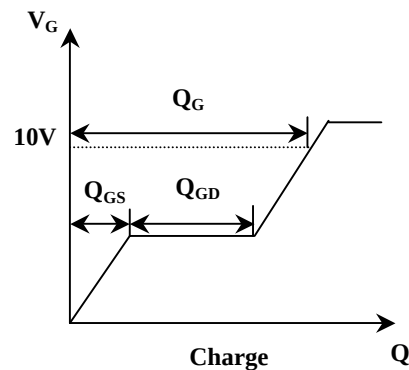
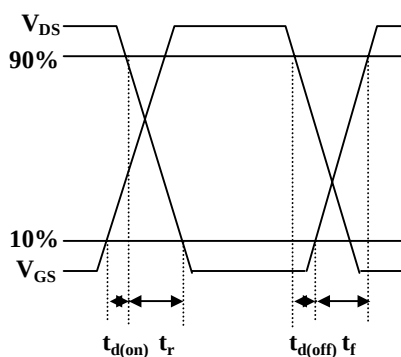
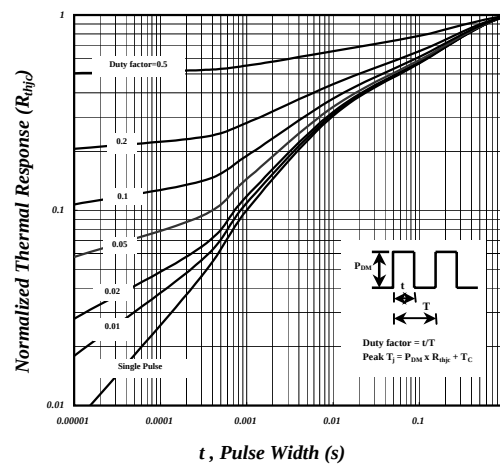
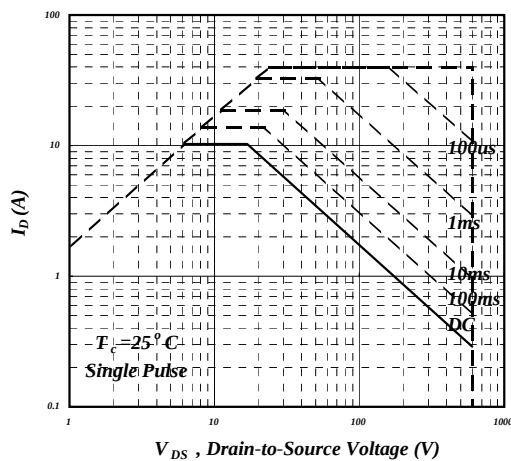
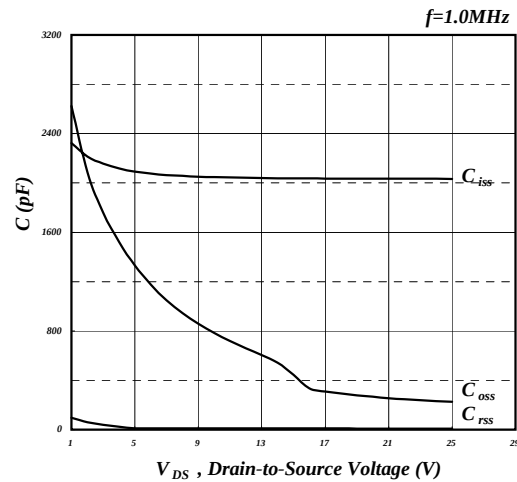
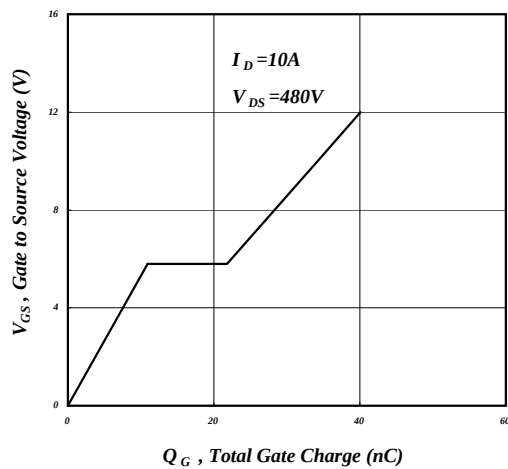


Fig 6. Gate Threshold Voltage vs.  
Junction Temperature

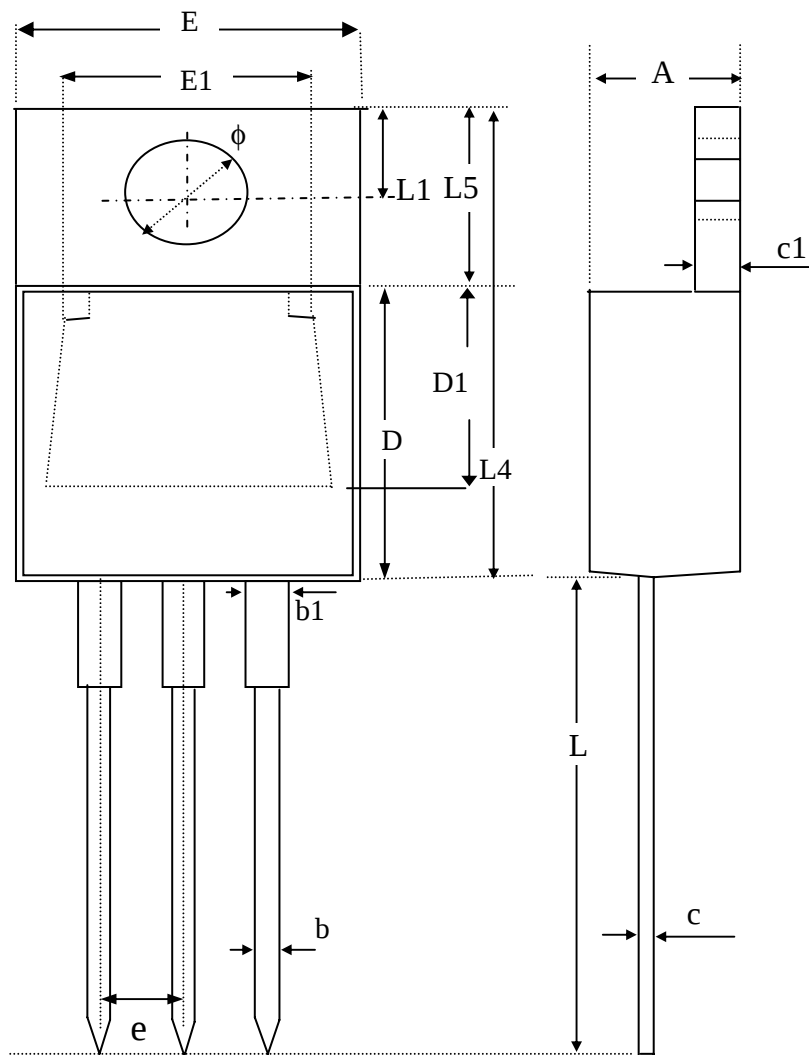


Typical Electrical Characteristics (cont.)





## Package Dimensions: TO-220



| SYMBOLS | Millimeters |       |       |
|---------|-------------|-------|-------|
|         | MIN         | NOM   | MAX   |
| A       | 4.40        | 4.60  | 4.80  |
| b       | 0.76        | 0.88  | 1.00  |
| D       | 8.60        | 8.80  | 9.00  |
| c       | 0.36        | 0.43  | 0.50  |
| E       | 9.80        | 10.10 | 10.40 |
| L4      | 14.70       | 15.00 | 15.30 |
| L5      | 6.20        | 6.40  | 6.60  |
| D1      | 5.10 REF.   |       |       |
| c1      | 1.25        | 1.35  | 1.45  |
| b1      | 1.17        | 1.32  | 1.47  |
| L       | 13.25       | 13.75 | 14.25 |
| e       | 2.54 REF.   |       |       |
| L1      | 2.60        | 2.75  | 2.89  |
| $\phi$  | 3.71        | 3.84  | 3.96  |
| E1      | 7.4 REF.    |       |       |

1. All dimensions are in millimeters.
2. Dimensions do not include mold protrusions.

## Marking Information: TO-220

