



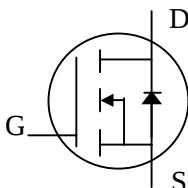
## N-channel Enhancement-mode Power MOSFET

Simple Drive Requirement

Low On-resistance

Fast Switching Performance

RoHS-compliant, halogen-free

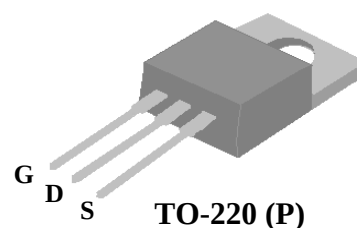


|              |              |
|--------------|--------------|
| $BV_{DS}$    | 55V          |
| $R_{DS(ON)}$ | 12m $\Omega$ |
| $I_D$        | 46A          |

### Description

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

The AP60T06GP-HF-3 is in the TO-220 through-hole package which is used where a low PCB footprint or an attached heatsink is required.



### Absolute Maximum Ratings

| Symbol                           | Parameter                            | Rating     | Units            |
|----------------------------------|--------------------------------------|------------|------------------|
| $V_{DS}$                         | Drain-Source Voltage                 | 55         | V                |
| $V_{GS}$                         | Gate-Source Voltage                  | $\pm 20$   | V                |
| $I_D$ at $T_C=25^\circ\text{C}$  | Continuous Drain Current             | 46         | A                |
|                                  |                                      |            |                  |
| $I_D$ at $T_C=100^\circ\text{C}$ | Continuous Drain Current             | 29         | A                |
| $I_{DM}$                         | Pulsed Drain Current <sup>1</sup>    | 160        | A                |
| $P_D$ at $T_C=25^\circ\text{C}$  | Total Power Dissipation              | 44.6       | W                |
| $P_D$ at $T_A=25^\circ\text{C}$  | Total Power Dissipation              | 2          | W                |
| $T_{STG}$                        | 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    | 2.8   | $^\circ\text{C/W}$ |
| Rthj-a | Maximum Thermal Resistance, Junction-ambient | 62    | $^\circ\text{C/W}$ |

### Ordering Information

AP60T06GP-HF-3TB    RoHS-compliant halogen-free TO-220, shipped in tubes (50pcs/tube)



**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                 | $V_{GS}=0V, I_D=250\mu A$                    | 55   | -    | -         | V          |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance <sup>2</sup> | $V_{GS}=10V, I_D=30A$                        | -    | -    | 12        | m $\Omega$ |
| $V_{GS(th)}$ | Gate Threshold Voltage                         | $V_{DS}=V_{GS}, I_D=250\mu A$                | 2    | -    | 5         | V          |
| $g_{fs}$     | Forward Transconductance                       | $V_{DS}=10V, I_D=20A$                        | -    | 26   | -         | S          |
| $I_{DSS}$    | Drain-Source Leakage Current                   | $V_{DS}=44V, V_{GS}=0V$                      | -    | -    | 25        | $\mu A$    |
| $I_{GSS}$    | Gate-Source Leakage                            | $V_{GS}=\pm 20V, V_{DS}=0V$                  | -    | -    | $\pm 100$ | nA         |
| $Q_g$        | Total Gate Charge <sup>2</sup>                 | $I_D=20A$<br>$V_{DS}=48V$<br>$V_{GS}=10V$    | -    | 28   | 45        | nC         |
| $Q_{gs}$     | Gate-Source Charge                             |                                              | -    | 6.5  | -         | nC         |
| $Q_{gd}$     | Gate-Drain ("Miller") Charge                   |                                              | -    | 13   | -         | nC         |
| $t_{d(on)}$  | Turn-on Delay Time <sup>2</sup>                | $V_{DS}=30V$<br>$I_D=20A$<br>$R_G=3.3\Omega$ | -    | 11.5 | -         | ns         |
| $t_r$        | Rise Time                                      |                                              | -    | 42   | -         | ns         |
| $t_{d(off)}$ | Turn-off Delay Time                            |                                              | -    | 20   | -         | ns         |
| $t_f$        | Fall Time                                      | $V_{GS}=10V$                                 | -    | 8    | -         | ns         |
| $C_{iss}$    | Input Capacitance                              | $V_{GS}=0V$                                  | -    | 1380 | 2200      | pF         |
| $C_{oss}$    | Output Capacitance                             | $V_{DS}=25V$                                 | -    | 240  | -         | pF         |
| $C_{rss}$    | Reverse Transfer Capacitance                   | $f=1.0\text{MHz}$                            | -    | 140  | -         | pF         |
| $R_g$        | Gate Resistance                                | $f=1.0\text{MHz}$                            | -    | 1    | 2         | $\Omega$   |

**Source-Drain Diode**

| Symbol   | Parameter                          | Test Conditions                            | Min. | Typ. | Max. | Units |
|----------|------------------------------------|--------------------------------------------|------|------|------|-------|
| $V_{SD}$ | Forward On Voltage <sup>2</sup>    | $I_S=30A, V_{GS}=0V$                       | -    | -    | 1.3  | V     |
| $t_{rr}$ | Reverse Recovery Time <sup>2</sup> | $I_S=20A, V_{GS}=0V$<br>$dI/dt=100A/\mu s$ | -    | 38   | -    | ns    |
| $Q_{rr}$ | Reverse Recovery Charge            |                                            | -    | 55   | -    | nC    |

**Notes:**

1. Pulse width limited by maximum junction temperature.
2. 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

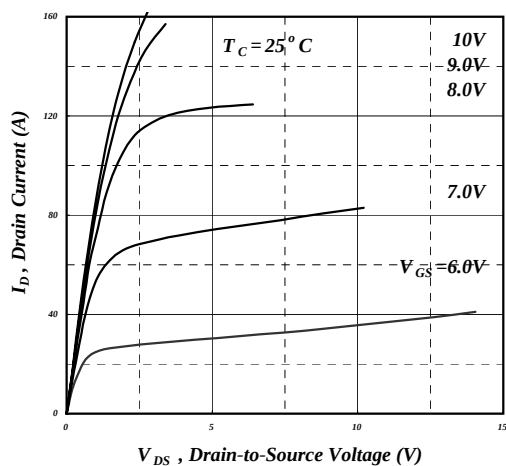


Fig 1. Typical Output Characteristics

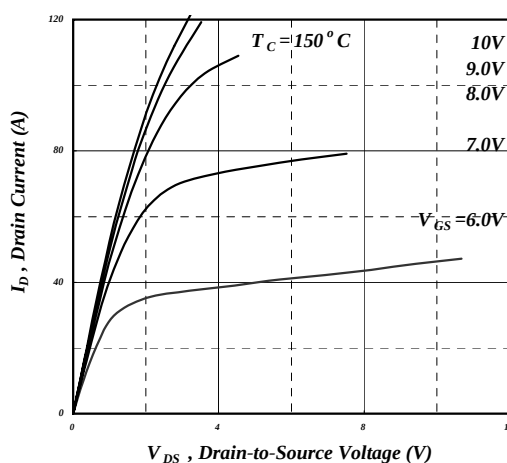


Fig 2. Typical Output Characteristics

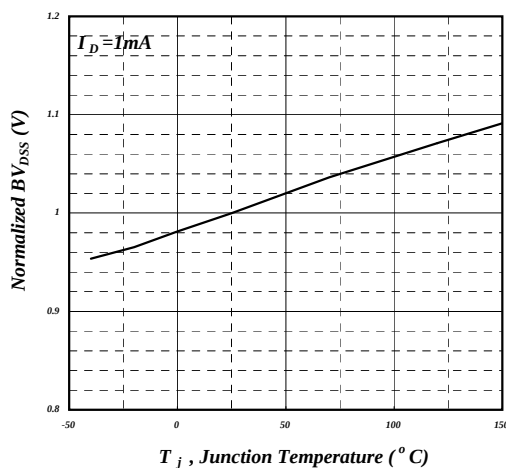


Fig 3. Normalized  $BV_{DSS}$   
vs. Junction Temperature

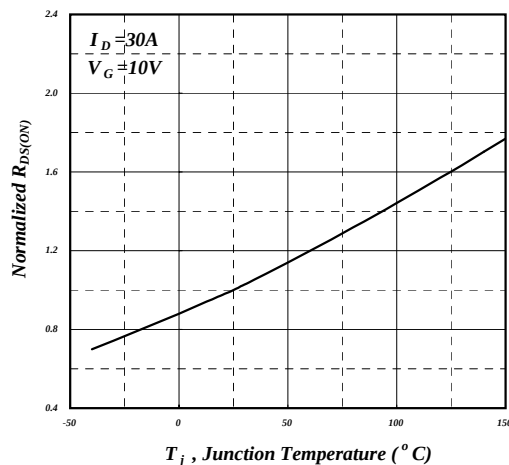


Fig 4. Normalized On-Resistance  
vs. Junction Temperature

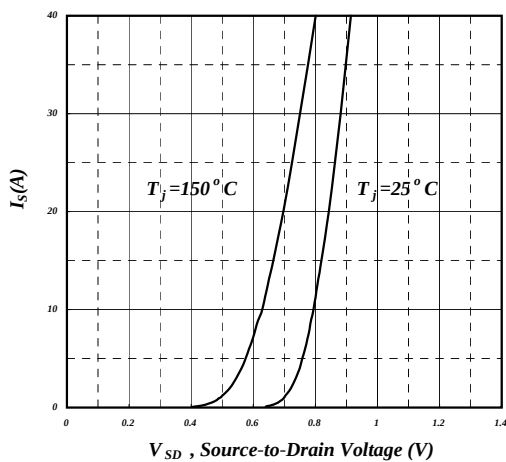


Fig 5. Forward Characteristic of  
Reverse Diode

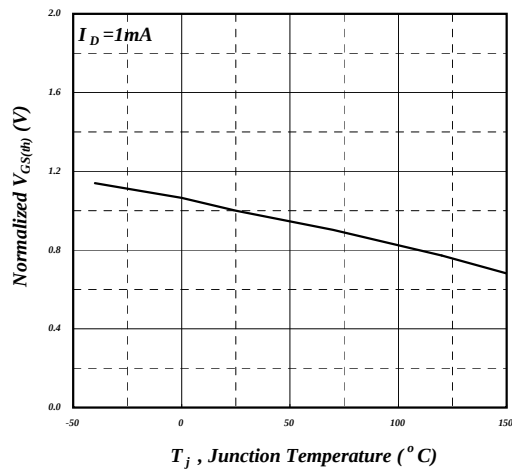


Fig 6. Gate Threshold Voltage v.s.  
Junction Temperature



Typical Electrical Characteristics (cont.)

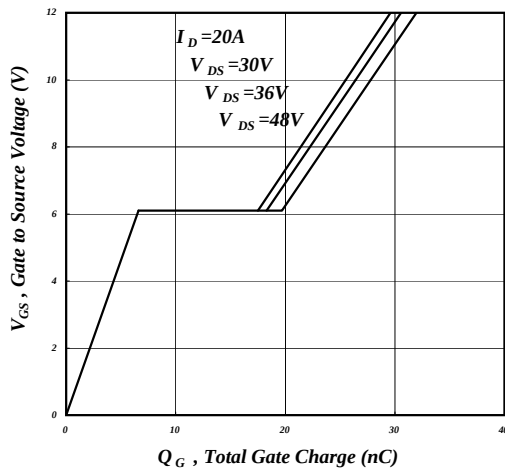


Fig 7. Gate Charge Characteristics

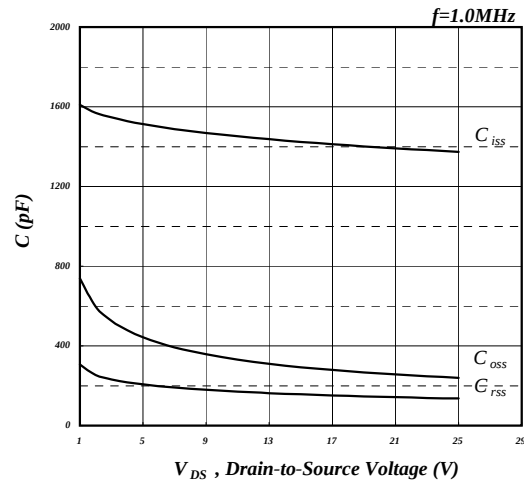


Fig 8. Typical Capacitance Characteristics

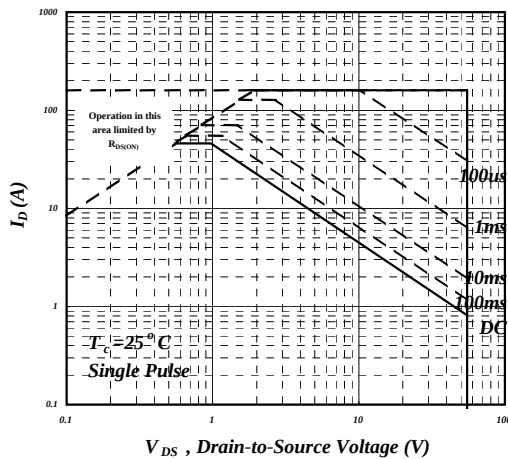


Fig 9. Maximum Safe Operating Area

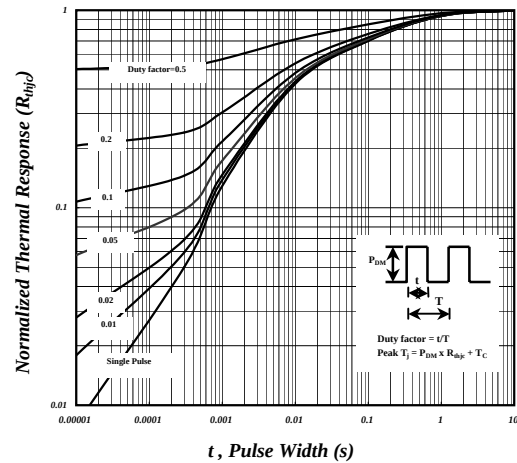


Fig 10. Effective Transient Thermal Impedance

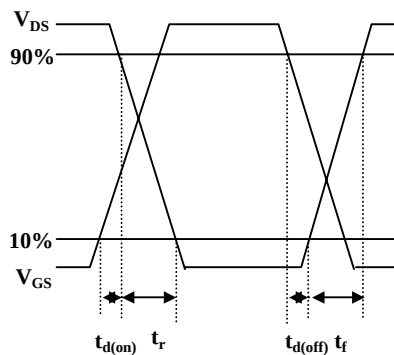


Fig 11. Switching Time Waveform

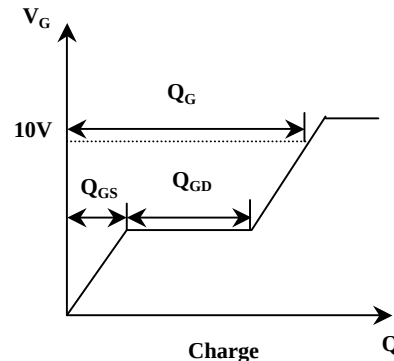
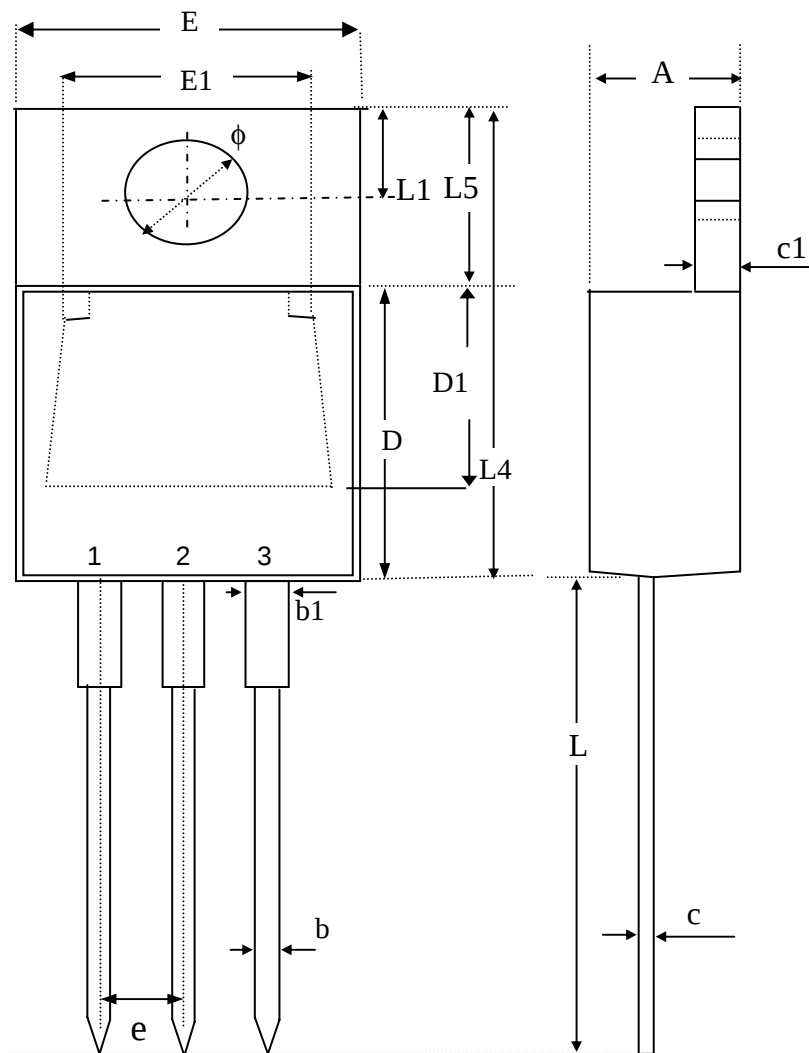


Fig 12. Gate Charge Waveform



## 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  |
| φ       | 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

