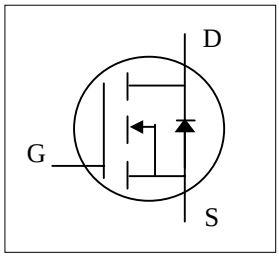
# XP60SL280DI

**Halogen-Free Product**

*N-CHANNEL ENHANCEMENT MODE*

*POWER MOSFET*

- **100% $R_g$ & UIS Test**
- **Fast Switching Characteristic**
- **Simple Drive Requirement**
- **RoHS Compliant & Halogen-Free**

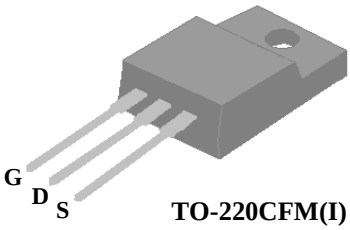



| | |
|---|---|
| $BV_{DSS}$ | 600V |
| $R_{DS(ON)}$ | 0.28Ω |
| $I_D$ [3,4] | 13.5A |

## Description

XP60SL280D series are innovated design and silicon process technology to achieve the lowest possible on-resistance and fast switching performance. It provides the designer with an extreme efficient device for use in a wide range of power applications.

The TO-220CFM package is widely preferred for all commercial-industrial through hole applications. The mold compound provides a high isolation voltage capability and low thermal resistance between the tab and the external heat-sink.




**TO-220CFM(I)**

## Absolute Maximum Ratings@$T_j$=25°C(unless otherwise specified)

| Symbol | Parameter | Rating | Units |
|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | 600 | V |
| $V_{GS}$ | Gate-Source Voltage | ±20 | V |
| $V_{GS}$ | Gate-Source Voltage, AC (f > 1Hz) | ±30 | V |
| $I_D$@$T_C$=25℃ | Drain Current, $V_{GS}$ @ 10V[3,4] | 13.5 | A |
| $I_D$@$T_C$=100℃ | Drain Current, $V_{GS}$ @ 10V[3,4] | 8.5 | A |
| $I_{DM}$ | Pulsed Drain Current[1] | 39 | A |
| dv/dt | MOSFET dv/dt Ruggedness ($V_{DS}$ = 0 …400V ) | 40 | V/ns |
| $P_D$@$T_C$=25℃ | Total Power Dissipation | 32 | W |
| $P_D$@$T_A$=25℃ | Total Power Dissipation | 1.92 | W |
| $E_{AS}$ | Single Pulse Avalanche Energy[5] | 147 | mJ |
| dv/dt | Peak Diode Recovery dv/dt[6] | 15 | V/ns |
| $T_{STG}$ | Storage Temperature Range | -55 to 150 | ℃ |
| $T_J$ | Operating Junction Temperature Range | -55 to 150 | ℃ |

## Thermal Data

| Symbol | Parameter | Value | Units |
|---|---|---|---|
| Rthj-c | Maximum Thermal Resistance, Junction-case | 3.9 | ℃/W |
| Rthj-a | Maximum Thermal Resistance, Junction-ambient | 65 | ℃/W |

## Electrical Characteristics@$T_j$=25°C(unless otherwise specified)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V, $I_D$=250uA | 600 | - | - | V |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance[2] | $V_{GS}$=10V, $I_D$=5.2A | - | - | 0.28 | Ω |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$, $I_D$=250uA | 2 | - | 5 | V |
| $g_{fs}$ | Forward Transconductance | $V_{DS}$=15V, $I_D$=5.2A | - | 8 | - | S |
| $I_{DSS}$ | Drain-Source Leakage Current | $V_{DS}$=480V, $V_{GS}$=0V | - | - | 100 | uA |
| $I_{GSS}$ | Gate-Source Leakage | $V_{GS}$=±20V, $V_{DS}$=0V | - | - | ±100 | nA |
| $Q_g$ | Total Gate Charge | $I_D$=5A | - | 39 | 62.4 | nC |
| $Q_{gs}$ | Gate-Source Charge | $V_{DS}$=480V | - | 8 | - | nC |
| $Q_{gd}$ | Gate-Drain ("Miller") Charge | $V_{GS}$=10V | - | 17.5 | - | nC |
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DD}$=300V | - | 14 | - | ns |
| $t_r$ | Rise Time | $I_D$=5A | - | 12 | - | ns |
| $t_{d(off)}$ | Turn-off Delay Time | $R_G$=3.3Ω | - | 42 | - | ns |
| $t_f$ | Fall Time | $V_{GS}$=10V | - | 8 | - | ns |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V | - | 1330 | 2128 | pF |
| $C_{oss}$ | Output Capacitance | $V_{DS}$=100V | - | 45 | - | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | f=1.0MHz | - | 7 | - | pF |
| $R_g$ | Gate Resistance | f=1.0MHz | - | 3.5 | 7 | Ω |

## Source-Drain Diode

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $V_{SD}$ | Forward On Voltage[2] | $I_S$=5.2A, $V_{GS}$=0V | - | 0.8 | - | V |
| $t_{rr}$ | Reverse Recovery Time | $I_S$=6.6A, $V_{GS}$=0V | - | 130 | - | ns |
| $Q_{rr}$ | Reverse Recovery Charge | dI/dt=100A/μs | - | 820 | - | nC |

**Notes:**

1.Pulse width limited by max. junction temperature.

2.Pulse test

3.Limited by max. junction temperature. Maximum duty cycle D=0.75

4.Ensure that the junction temperature does not exceed $T_{Jmax.}$.

5.Starting $T_j$=25°C , $V_{DD}$=50V , L=150mH , $R_G$=25Ω

6.$I_{SD}$ ≦ $I_D$, $V_{DD}$ ≦ $BV_{DSS}$, starting $T_J$ = 25°C

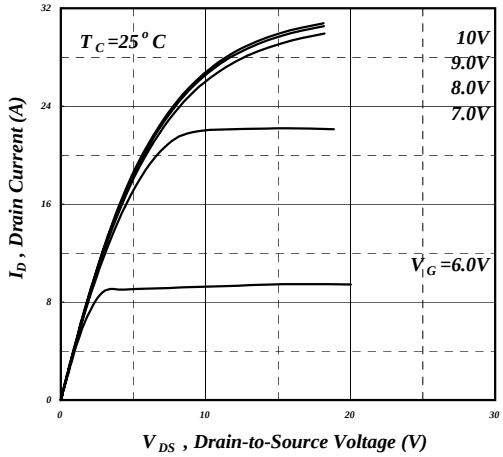



**Fig 1. Typical Output Characteristics**

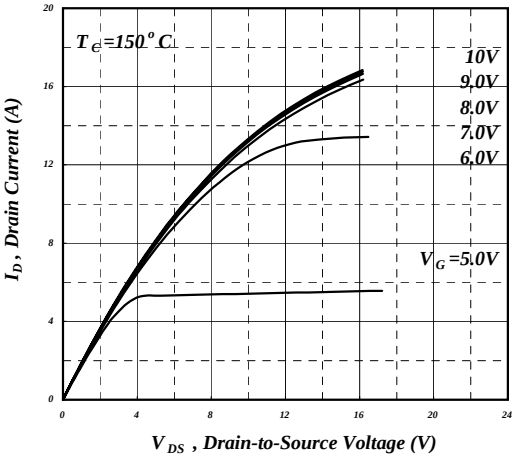



**Fig 2. Typical Output Characteristics**

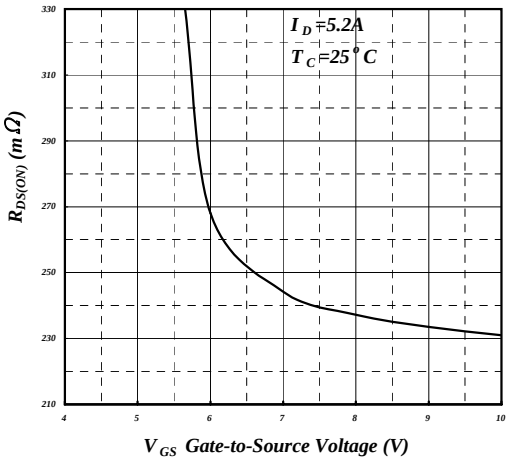



**Fig 3. On-Resistance v.s. Gate Voltage**

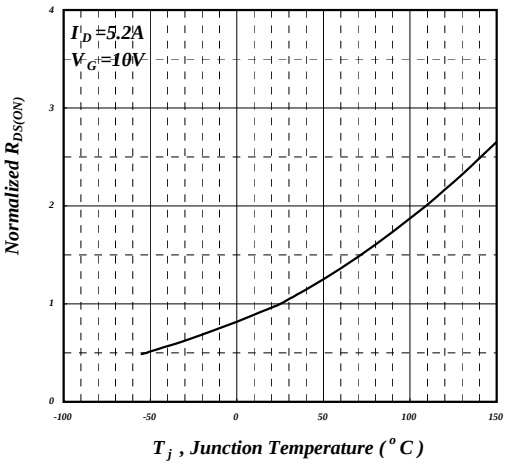



**Fig 4. Normalized On-Resistance v.s. Junction Temperature**

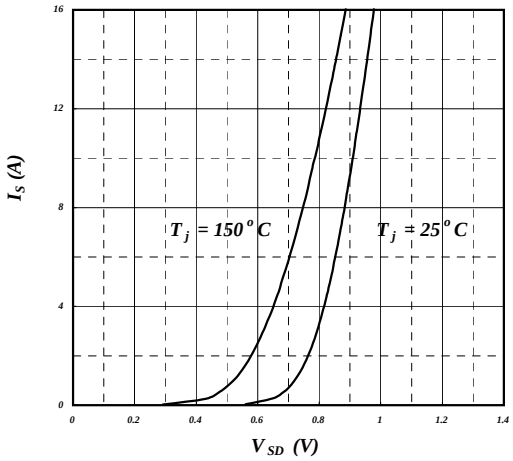



**Fig 5. Forward Characteristic of Reverse Diode**

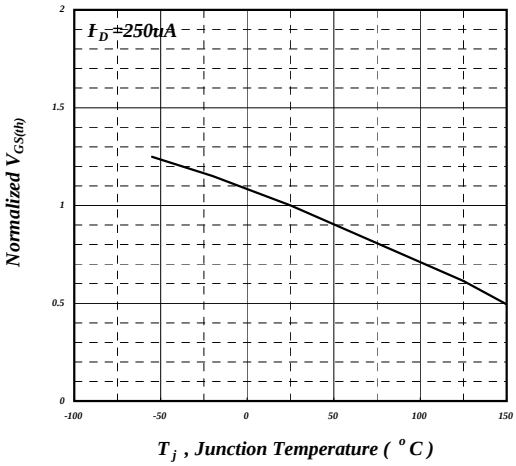



**Fig 6. Gate Threshold Voltage v.s. Junction Temperature**

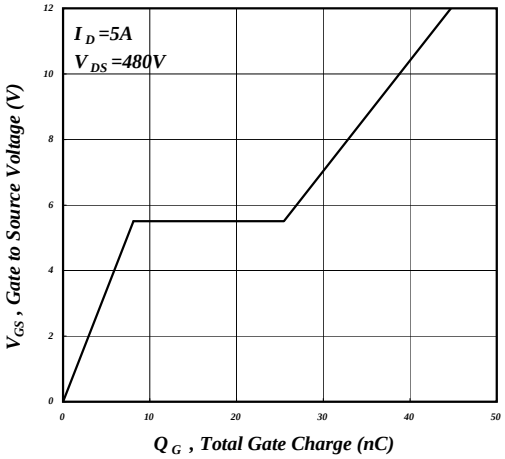



**Fig 7. Gate Charge Characteristics**

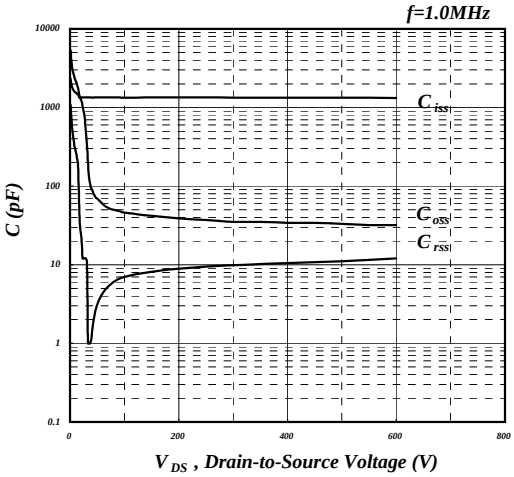



**Fig 8. Typical Capacitance Characteristics**

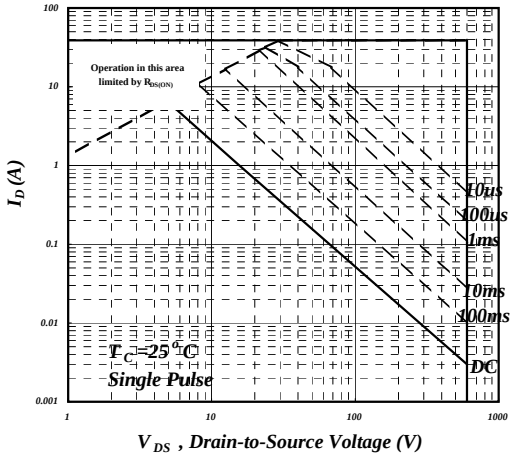



**Fig 9. Maximum Safe Operating Area**

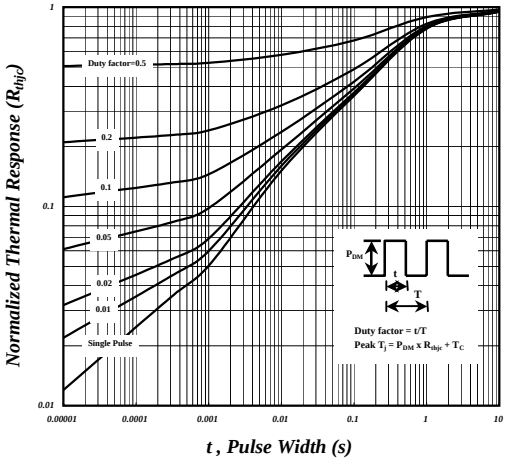



**Fig10. Effective Transient Thermal Impedance**

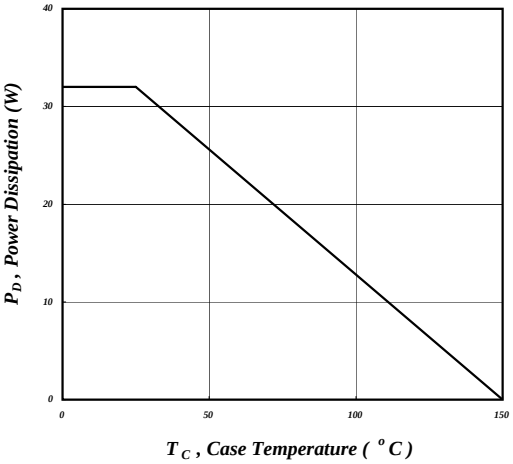



**Fig 11. Total Power Dissipation**

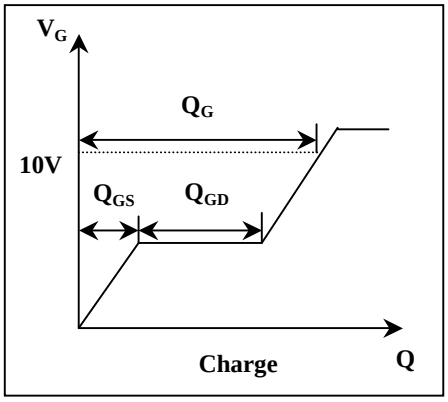
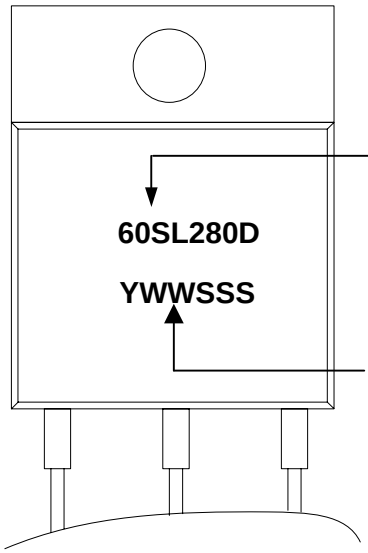
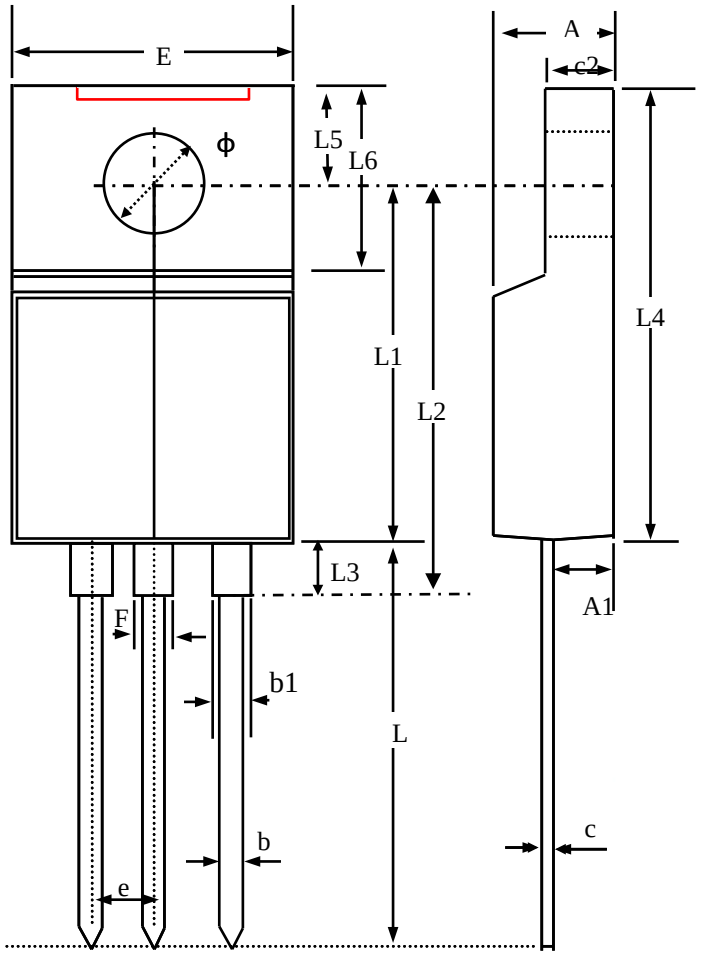



**Fig 12. Gate Charge Waveform**

## MARKING INFORMATION



# Package Outline : TO-220CFM




| SYMBOLS | Millimeters | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| **A** | 4.40 | 4.65 | 4.90 |
| **A1** | 2.50 | 2.68 | 2.86 |
| **b** | 0.70 | 0.84 | 0.98 |
| **b1** | 1.10 | 1.30 | 1.50 |
| **c** | 0.45 | 0.54 | 0.63 |
| **c2** | 2.34 | 2.54 | 2.74 |
| **E** | 10.00 | 10.20 | 10.40 |
| **L** | 12.78 | 13.22 | 13.65 |
| **L1** | 12.45 | 12.70 | 12.95 |
| **L2** | 15.10 | 15.80 | 16.50 |
| **L3** | 2.83 | 3.22 | 3.60 |
| **L4** | 15.67 | 16.04 | 16.40 |
| **L5** | 3.20 | 3.30 | 3.40 |
| **L6** | 6.50 | 6.73 | 6.95 |
| **φ** | 3.00 | 3.14 | 3.28 |
| **e** | 2.40 | 2.55 | 2.70 |
| **F** | 1.15 | 1.33 | 1.50 |

1.All Dimensions Are in Millimeters.

2.Dimension Does Not Include Mold Protrusions.

Draw No. M1-I3-FET-G-v10

## TO-220CFM FOOTPRINT：