# PS20N600A

## 600V Single Channel NMOSEFT

| | | |
|---|---|---|
| Revision | : | 1.0 |
| Update Date | : | Jan. 2012 |

**ProsPower Microelectronics Co., Ltd**

## 1. General Description

The PS20N600A uses advanced high voltage technology and design to provide excellent Rds(on) with ultra low gate charge. This device is suitable for use load switching and general purpose applications. Standard Product PS20N600A is Pb-free (meets ROHS & Sony 259 specifications). It is offered in the very popular TO-220 package

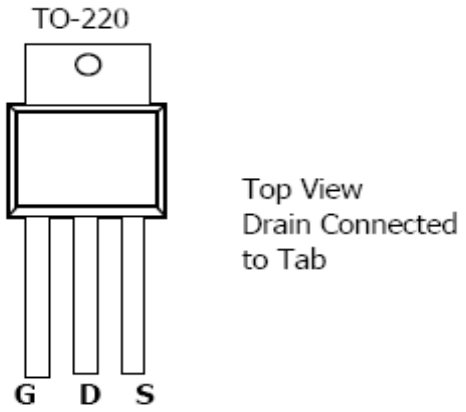
## 2. Applications

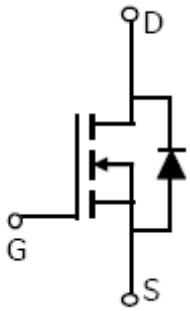
- Power factor correction (PFC)
- Switched mode power supplies (SMPS)
- Uninterruptible Power Supply (UPS)

## 3. Features

- Vds=600V
- Id=20A
- Rds(on)=<0.2ohm (Vgs=10V)
- Exceptional dv/dt capability
- 100% avalanche tested

### Pin Configuration




### Pin Descriptions

| Pin Name | Symbol | Function |
|---|---|---|
| Gate | G | Device Gate terminal |
| Drain | D | Device drain terminal |
| Source | S | Device source terminal |

**Absolute Maximum Ratings**

Stress greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These stress ratings only, and functional operation of the device at these or any conditions beyond those indicated under recommended Operating Conditions is not implied. Exposure to "Absolute Maximum Rating" for extended periods may affect device reliability. Use of standard ESD handling precautions is required.

| Parameter | | Symbol | Maximum | Units |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 600 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±30 | V |
| Continuous Drain Current | $T_C$=25°C (G) | $I_D$ | 20 | A |
| | $T_C$=100°C | | 14 | |
| Pulsed Drain Current (C) | | $I_{DM}$ | 80 | A |
| Avalanche Current (C) | | $I_{AR}$ | 3.4 | A |
| Avalanche energy, single pulse (H) | | $E_{AS}$ | 190 | mJ |
| Power Dissipation (B) | $T_C$=25°C | $P_D$ | 266 | W |
| Junction and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to 150 | °C |

**Thermal Characteristics**

| Parameter | | Symbol | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Maximum Junction-to-Ambient (A) | Steady-State | $R_{\theta JA}$ | 45 | 60 | °C/W |
| Maximum Junction-to-Case (B) | Steady-State | $R_{\theta JC}$ | 0.45 | 0.56 | °C/W |

**Electrical Specifications**

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| **STATIC PARAMETERS** | | | | | | |
| Drain-Source Breakdown Voltage | $BVD_{SS}$ | $I_D$=250uA, $V_{GS}$=0V | 600 | | | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=600V, $V_{GS}$=0V | | | 1 | uA |
| Gate-Body leakage current | $I_{GSS}$ | $V_{DS}$=0V, $V_{GS}$=±30V | | | ±0.1 | μA |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$, $I_D$=250μA | 2.8 | 3.4 | 4.1 | V |
| On state drain current | $I_{D(ON)}$ | $V_{GS}$=10V, $V_{DS}$=5V | 20 | | | A |
| Static Drain-Source On-Resistance | $R_{DS(ON)}$ | $V_{GS}$=10V, $I_D$=10A | | 0.140 | 0.199 | Ω |
| Diode Forward Voltage | $V_{SD}$ | $I_S$=10A, $V_{GS}$=0V | | 0.84 | | V |
| Body-Diode Continuous Current (G) | $I_S$ | | | | 20 | A |
| Body-Diode pulse Current | $I_{SM}$ | | | | 80 | A |
| **DYNAMIC PARAMETERS** | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$=0V, $V_{DS}$=100V, f=1MHz | | 1038 | | pF |
| Output Capacitance | $C_{oss}$ | | | 68 | | pF |

| | | | | | | |
|---|---|---|---|---|---|---|
| Reverse Transfer Capacitance | $C_{rss}$ | $V_{GS}$=0V, $V_{DS}$=0V, f=1MHz | | 2.1 | | pF |
| Gate resistance | $R_g$ | $V_{GS}$=0V, $V_{DS}$=0V, f=1MHz | | 9.3 | | Ω |
| Effective output capacitance, energy related | $C_{0(er)}$ | $V_{GS}$=0V, $V_{DS}$ from 0 to 480V, f=1MHz | | 56 | | pF |
| Effective output capacitance, time related | $C_{o(tr)}$ | | | 176 | | pF |
| **SWITCHING PARAMETERS** | | | | | | |
| Total Gate Charge | $Q_g$ | $V_{GS}$=10V, $V_{DD}$=480V, $I_D$=10A | | 20 | | nC |
| Gate Source Charge | $Q_{gs}$ | | | 5 | | nC |
| Gate Drain Charge | $Q_{gd}$ | | | 8 | | nC |
| Turn-On Delay Time | $t_{D(on)}$ | $V_{GS}$=10V, $V_{DD}$=400V, $I_D$=10A, $R_G$=25Ω | | 28 | | ns |
| Turn-On Rise Time | $t_r$ | | | 32 | | ns |
| Turn-Off Delay Time | $t_{D(off)}$ | | | 88 | | ns |
| Turn-Off Fall Time | $t_f$ | | | 30 | | ns |
| Body Diode Reverse Recovery Time | $t_{rr}$ | $I_F$=10A, dI/dt=100A/μs, $V_R$=400V | | 350 | | ns |
| Peak Reverse Recovery Current | $I_{rrm}$ | | | 28 | | A |
| Body Diode Reverse Recovery Charge | $Q_{rr}$ | | | 6 | | uC |

(A): The value of R θJA is measured with the device in a still air environment with T A =25°C.

(B). The power dissipation PD is based on TJ(MAX)=175°C, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heat sinking is used.

(C): Repetitive rating, pulse width limited by junction temperature TJ(MAX)=175°C.

(D). The R θJA is the sum of the thermal impedance from junction to case R θJC and case to ambient.

(E). The static characteristics in Figures 1 to 6 are obtained using <300 μs pulses, duty cycle 0.5% max.

(F). These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heat sinking, assuming a maximum junction temperature of TJ(MAX)=175°C.

(G). The maximum current rating is limited by bond-wires.

(H). L=60mH, I=2.5A, Vdd=150V, Tj=25°C

## Typical Performance Characteristics

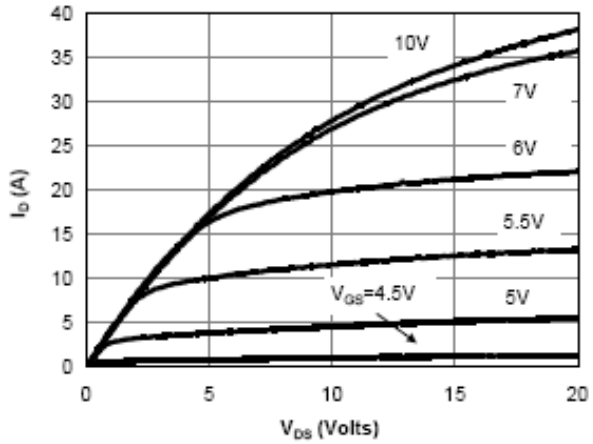


Figure 1: On-Region Characteristics@25℃

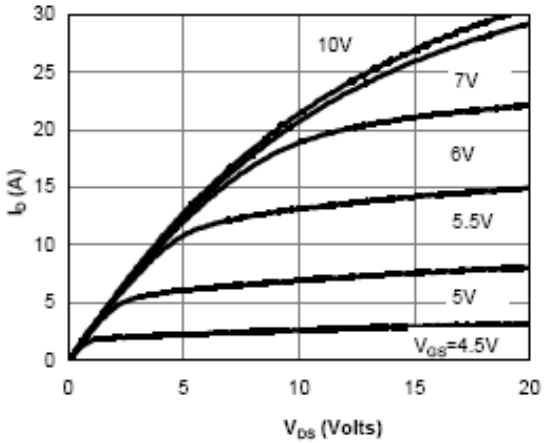


Figure 2: On-Region Characteristics@125℃

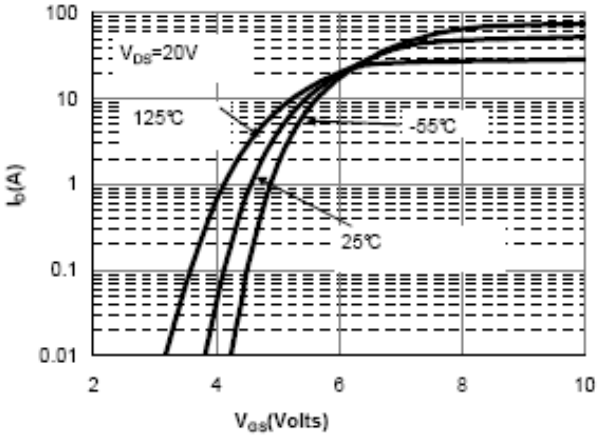


Figure 3: Transfer Characteristics

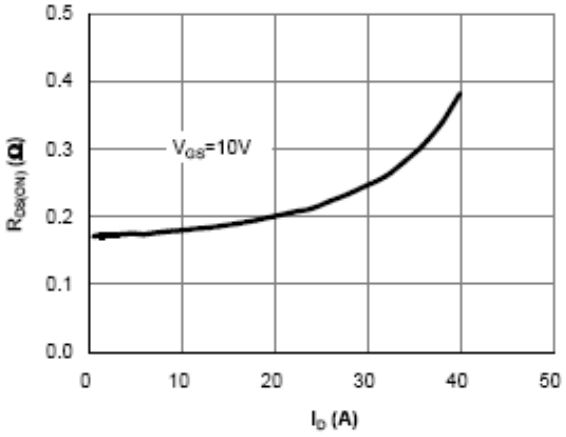


Figure 4: On-Resistance vs. Drain Current and Gate Voltage

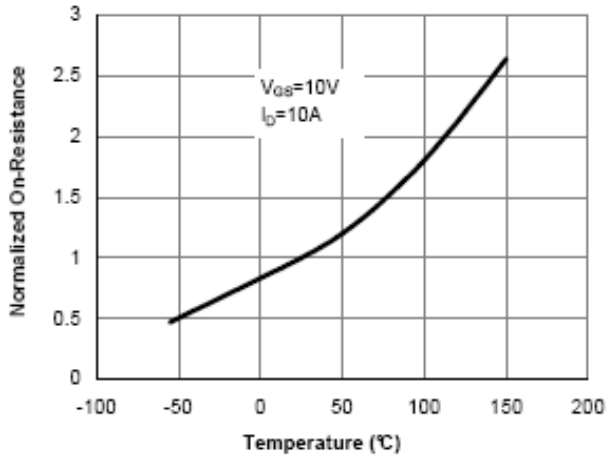


Figure 5: On-Resistance vs. Junction Temperature

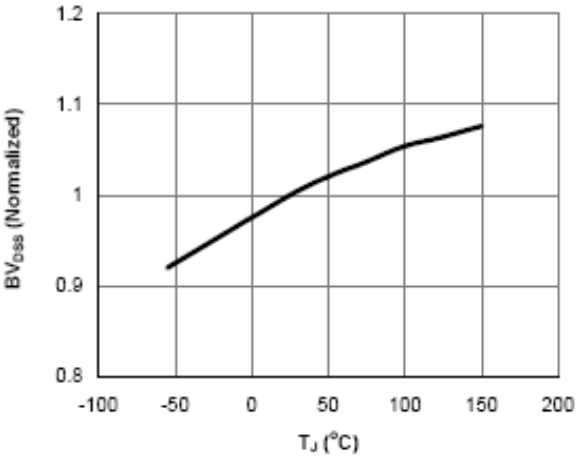


Figure 6: Break Down vs. Junction Temperature

## Typical Performance Characteristics (contd.)

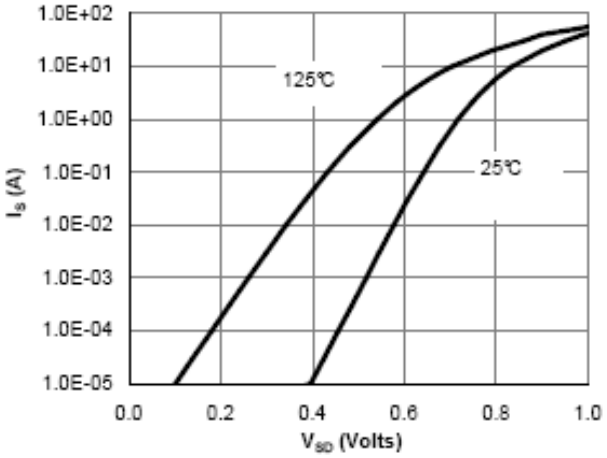



Figure 7: Body-Diode Characteristics (Note E)

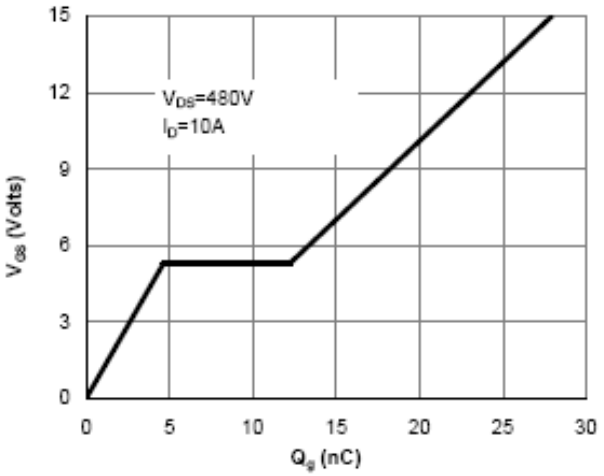



Figure 8: Gate-Charge Characteristics

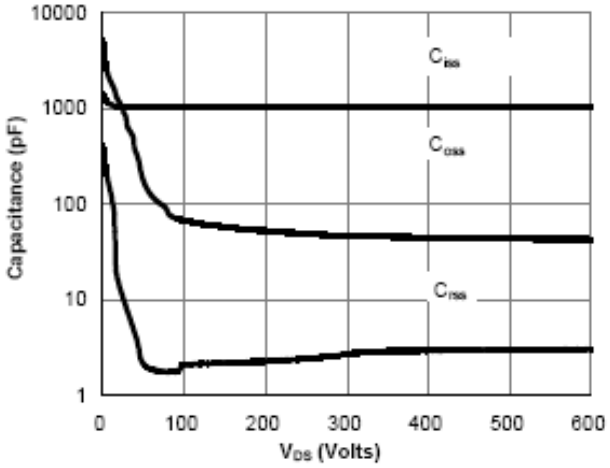



Figure 9: Capacitance Characteristics

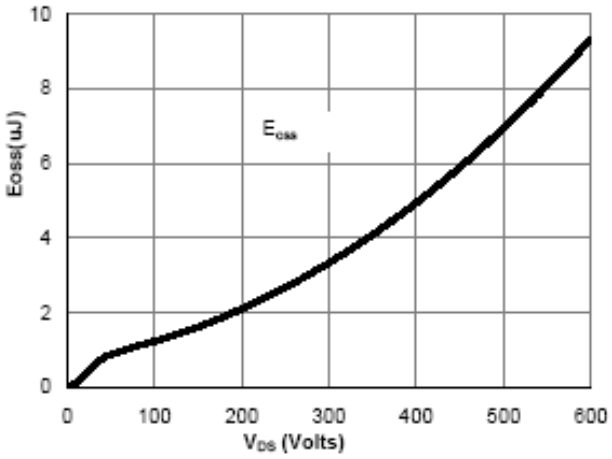



Figure 10: Coss stored Energy

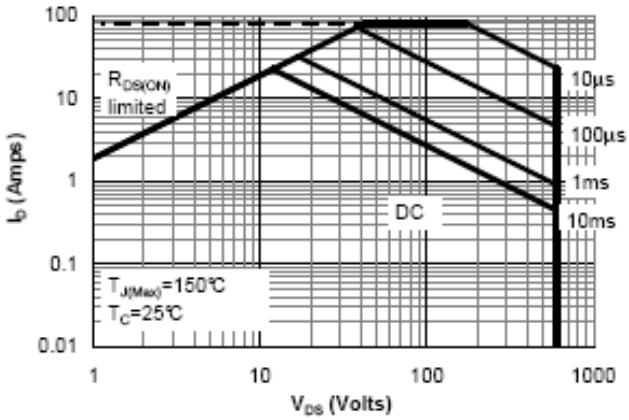



Figure 11: Maximum Forward Biased Safe Operating Area for AOW20S60 (Note F)

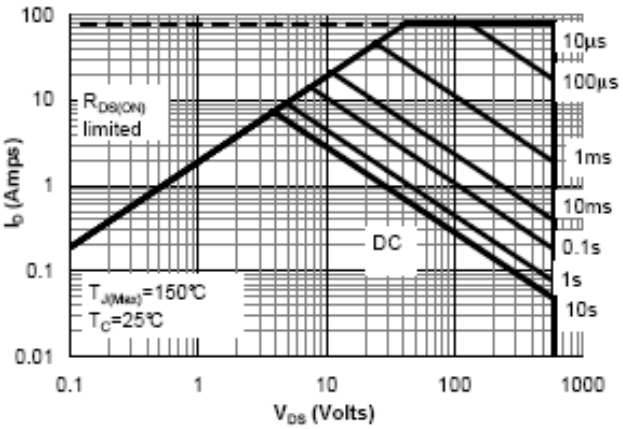



Figure 12: Maximum Forward Biased Safe Operating Area for AOWF20S60(Note F)

**Typical Performance Characteristics (contd.)**

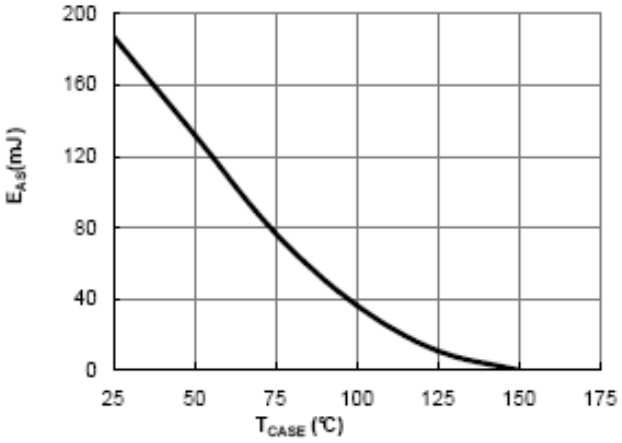



Figure 13: Avalanche energy

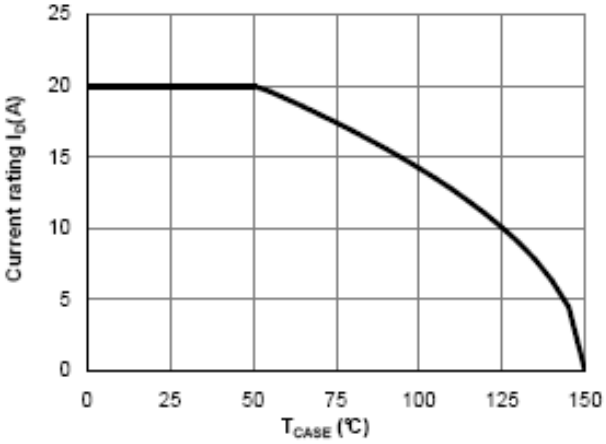



Figure 14: Current De-rating (Note B)

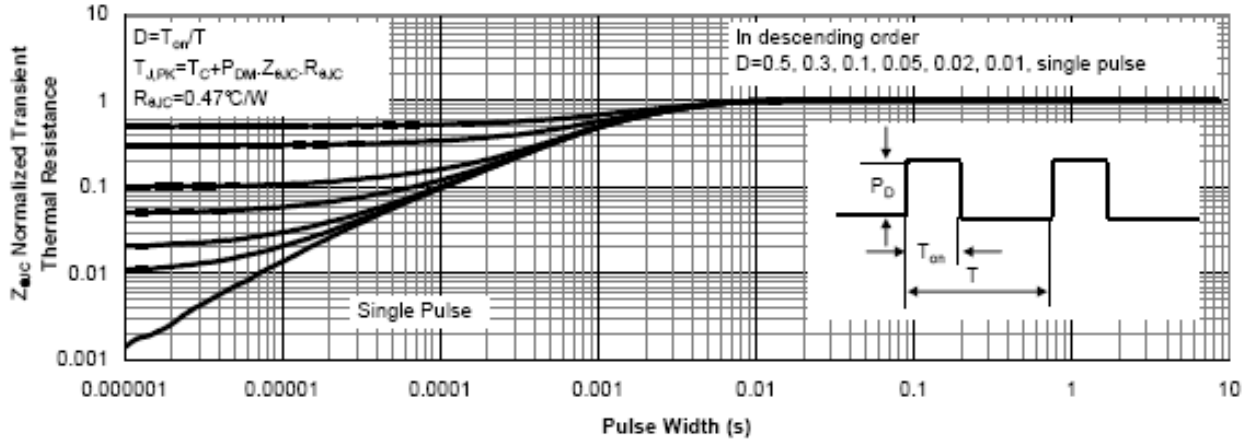



Figure 15: Normalized Maximum Transient Thermal Impedance for AOW20S60 (Note F)

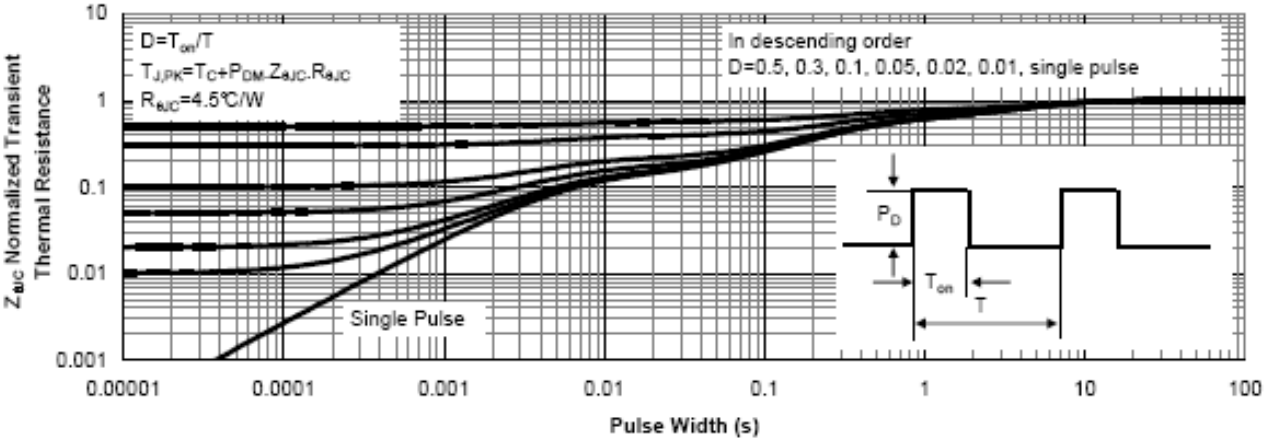
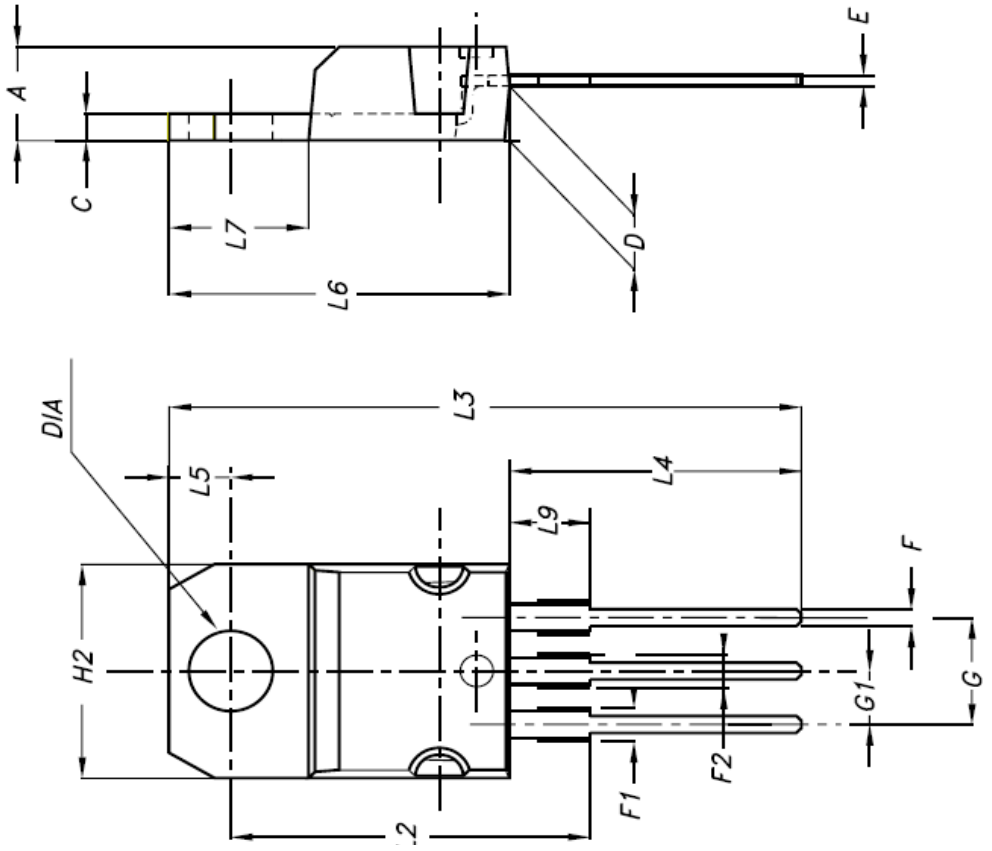



Figure 16: Normalized Maximum Transient Thermal Impedance for AOWF20S60 (Note F)

**Package Dimensions**

**TO-220**




| DIM. | mm. | | | inch. | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | TYP. |
| A | 4.4 | | 4.6 | 0.173 | | 0.181 |
| C | 1.23 | | 1.32 | 0.048 | | 0.051 |
| D | 2.40 | | 2.72 | 0.094 | | 0.107 |
| E | 0.49 | | 0.70 | 0.019 | | 0.027 |
| F | 0.61 | | 0.88 | 0.024 | | 0.034 |
| F1 | 1.14 | | 1.70 | 0.044 | | 0.067 |
| F2 | 1.14 | | 1.70 | 0.044 | | 0.067 |
| G | 4.95 | | 5.15 | 0.194 | | 0.203 |
| G1 | 2.40 | | 2.70 | 0.094 | | 0.106 |
| H2 | 10 | | 10.40 | 0.393 | | 0.409 |
| L2 | | 16.40 | | | 0.645 | |
| L3 | | 28.90 | | | 1.137 | |
| L4 | 13 | | 14 | 0.511 | | 0.551 |
| L5 | 2.65 | | 2.95 | 0.104 | | 0.116 |
| L6 | 15.25 | | 15.75 | 0.600 | | 0.620 |
| L7 | 6.20 | | 6.60 | 0.244 | | 0.260 |
| L9 | 3.50 | | 3.93 | 0.137 | | 0.154 |
| DIA | 3.75 | | 3.85 | 0.147 | | 0.151 |

**Ordering Information**

| Device | Operating $T_j$ | PKG Type | Wrap | Order Number |
|---|---|---|---|---|
| PS20N600A | -55C° ≤150C° | TO-220 | BULK | PS20N600A-T3-BL |

Note: Lead Free and RoHS compliant.

**Warranty and Use**

PROSPOWER MICROELECTRONICS MAKES NO WARRANTY, REPRESENTATION OR GUARANTEE, EXPRESS OR IMPLIED, REGARDING THE SUITABILITY OF ITS PRODUCTS FOR ANY PARTICULAR PURPOSE, NOR THAT THE USE OF ITS PRODUCTS WILL NOT INFRINGE ITS INTELLECTUAL PROPERTY RIGHTS OR THE RIGHTS OF THIRD PARTIES WITH RESPECT TO ANY PARTICULAR USE OR APPLICATION AND SPECIFICALLY DISCLAIMS ANY AND ALL LIABILITY ARISING OUT OF ANY SUCH USE OR APPLICATION, INCLUDING BUT NOT LIMITED TO, CONSEQUENTIAL OR INCIDENTAL DAMAGES.

ProsPower Microelectronics products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the ProsPower Microelectronics product could create a situation where personal injury or death may occur.

ProsPower Microelectronics reserves the right to make changes to or discontinue any product or service described herein without notice. Products with data sheets labeled "Advance Information" or "Preliminary" and other products described herein may not be in production or offered for sale.

ProsPower Microelectronics advises customers to obtain the current version of the relevant product information before placing orders. Circuit diagrams illustrate typical semiconductor applications and may not be complete.