



Description

The IPD40DP06NMATMA1 uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as 4.5V. This device is suitable for use as a Battery protection or in other Switching application.



TO-252-2L

General Features

$V_{DS} = -60V$ $I_D = -10A$

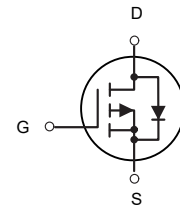
$R_{DS(ON)} < 140m\Omega$ @ $V_{GS}=10V$

Application

Brushless motor

Load switch

Uninterruptible power supply



P-Channel MOSFET

Package Marking and Ordering Information

| Product ID | Pack | Marking | Qty(PCS) |
|------------------|-----------|---------------|----------|
| IPD40DP06NMATMA1 | TO-252-2L | 40DP06NM XXXX | 2500 |

Absolute Maximum Ratings ($T_C=25^\circ C$ unless otherwise noted)

| Symbol | Parameter | Rating | Units |
|-----------------------|--|------------|--------------|
| V_{DS} | Drain-Source Voltage | -60 | V |
| V_{GS} | Gate-Source Voltage | ± 20 | V |
| $I_D@T_C=25^\circ C$ | Continuous Drain Current, $V_{GS} @ -10V^1$ | -10 | A |
| $I_D@T_C=100^\circ C$ | Continuous Drain Current, $V_{GS} @ -10V^1$ | -8.3 | A |
| I_{DM} | Pulsed Drain Current ² | -26 | A |
| EAS | Single Pulse Avalanche Energy ³ | 29.8 | mJ |
| I_{AS} | Avalanche Current | -24.4 | A |
| $P_D@T_C=25^\circ C$ | Total Power Dissipation ⁴ | 31.3 | W |
| $P_D@T_A=25^\circ C$ | Total Power Dissipation ⁴ | 2 | W |
| T_{STG} | Storage Temperature Range | -55 to 150 | $^\circ C$ |
| T_J | Operating Junction Temperature Range | -55 to 150 | $^\circ C$ |
| $R_{\theta JA}$ | Thermal Resistance Junction-Ambient ¹ | 62 | $^\circ C/W$ |
| $R_{\theta JC}$ | Thermal Resistance Junction-Case ¹ | 4.0 | $^\circ C/W$ |



Electrical Characteristics ($T_J=25^\circ\text{C}$, unless otherwise noted)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|----------------------------|--|---|------|--------|-----------|---------------------|
| BV_{DSS} | Drain-Source Breakdown Voltage | $V_{GS}=0V, I_D=-250\mu A$ | -60 | --- | --- | V |
| $\Delta BV_{DSS}/\Delta T$ | BV_{DSS} Temperature Coefficient | Reference to 25°C , $I_D=-1\text{mA}$ | --- | -0.049 | --- | $V/^\circ\text{C}$ |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance ² | $V_{GS}=-10V, I_D=-8A$ | --- | 125 | 140 | $m\Omega$ |
| | | $V_{GS}=-4.5V, I_D=-6A$ | --- | 168 | 210 | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}=V_{DS}, I_D=-250\mu A$ | -1.0 | --- | -2.5 | V |
| $\Delta V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient | | --- | 5.42 | --- | $mV/^\circ\text{C}$ |
| I_{DSS} | Drain-Source Leakage Current | $V_{DS}=-48V, V_{GS}=0V, T_J=25^\circ\text{C}$ | --- | --- | 1 | μA |
| | | $V_{DS}=-48V, V_{GS}=0V, T_J=150^\circ\text{C}$ | --- | --- | 5 | |
| I_{GSS} | Gate-Source Leakage Current | $V_{GS}=\pm 20V, V_{DS}=0V$ | --- | --- | ± 100 | nA |
| g_{fs} | Forward Transconductance | $V_{DS}=-5V, I_D=-5A$ | --- | 5.8 | --- | S |
| Q_g | Total Gate Charge (-4.5V) | $V_{DS}=-20V, V_{GS}=-4.5V, I_D=-5A$ | --- | 5.85 | --- | nC |
| Q_{gs} | Gate-Source Charge | | --- | 2.9 | --- | |
| Q_{gd} | Gate-Drain Charge | | --- | 1.8 | --- | |
| $T_{d(on)}$ | Turn-On Delay Time | $V_{DD}=-12V, V_{GS}=-10V, R_G=3.3\Omega, I_D=-5A$ | --- | 10 | --- | ns |
| T_r | Rise Time | | --- | 17 | --- | |
| $T_{d(off)}$ | Turn-Off Delay Time | | --- | 22 | --- | |
| T_f | Fall Time | | --- | 21 | --- | |
| C_{iss} | Input Capacitance | $V_{DS}=-15V, V_{GS}=0V, F=1\text{MHz}$ | --- | 715 | --- | pF |
| C_{oss} | Output Capacitance | | --- | 51 | --- | |
| C_{rss} | Reverse Transfer Capacitance | | --- | 34 | --- | |
| I_S | Continuous Source Current ^{1,5} | $V_G=V_D=0V, \text{Force Current}$ | --- | --- | -9.5 | A |
| I_{SM} | Pulsed Source Current ^{2,5} | | --- | --- | -24 | A |
| V_{SD} | Diode Forward Voltage ² | $V_{GS}=0V, I_S=-1A, T_J=25^\circ\text{C}$ | --- | --- | -1.2 | V |
| t_{rr} | Reverse Recovery Time | $I_F=-8A, dI/dt=100A/\mu s, T_J=25^\circ\text{C}$ | --- | 10.2 | --- | nS |
| Q_{rr} | Reverse Recovery Charge | | --- | 5.4 | --- | nC |

Note :

1. The data tested by surface mounted on a 1 inch² FR-4 board with 2OZ copper.
2. The data tested by pulsed , pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$
3. The EAS data shows Max. rating. The test condition is $V_{DD}=-25V, V_{GS}=-10V, L=0.1\text{mH}, I_{AS}=-15A$
4. The power dissipation is limited by 150°C junction temperature
5. The data is theoretically the same as I_D and I_{DM} , in real applications, should be limited by total power dissipation.



Typical Characteristics

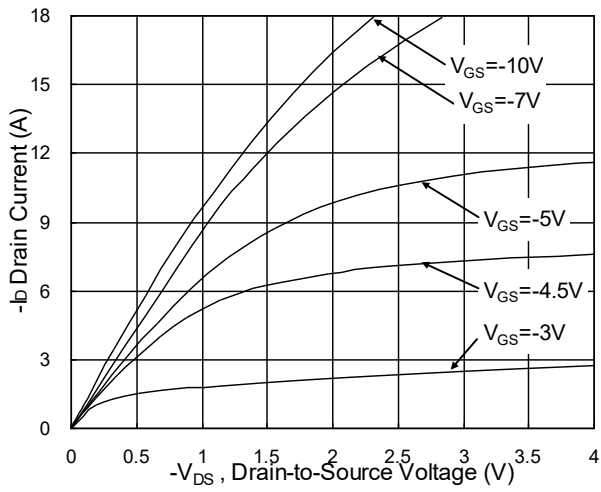


Fig.1 Typical Output Characteristics

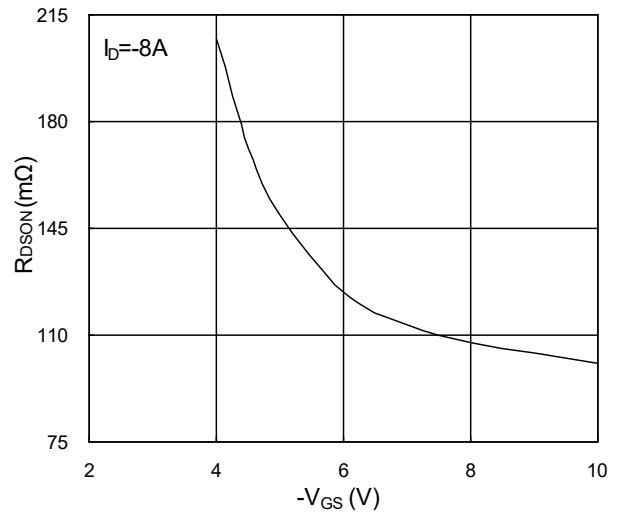


Fig.2 On-Resistance vs. G-S Voltage

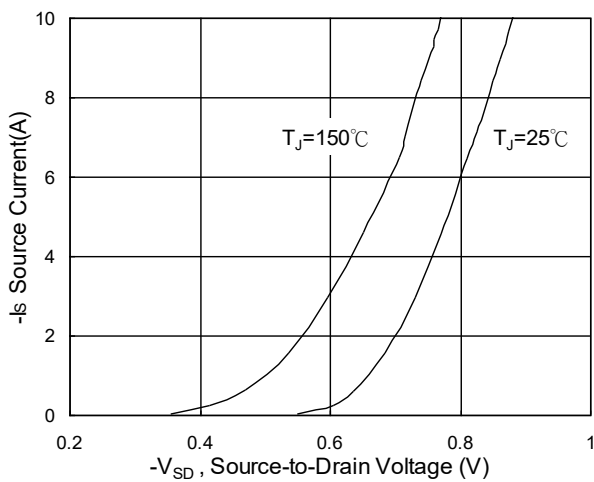


Fig.3 Forward Characteristics Of Reverse

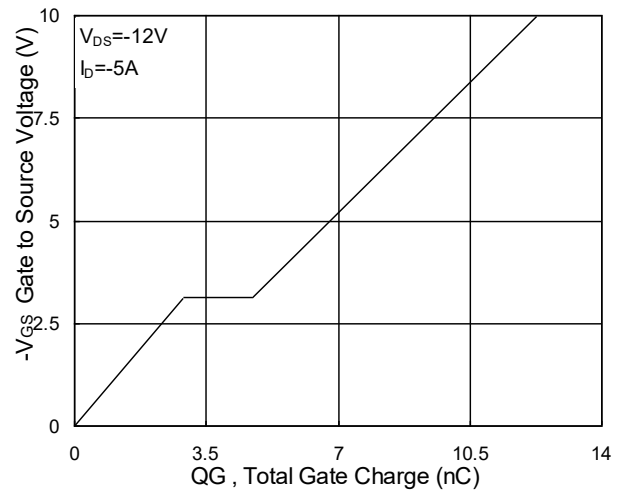


Fig.4 Gate-Charge Characteristics

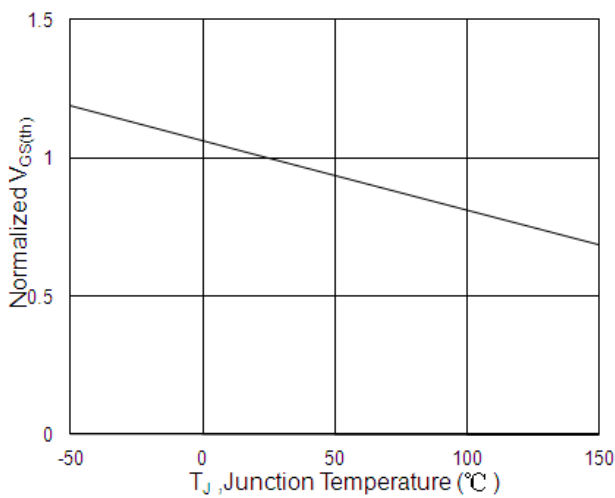


Fig.5 Normalized $V_{GS(th)}$ vs. T_J

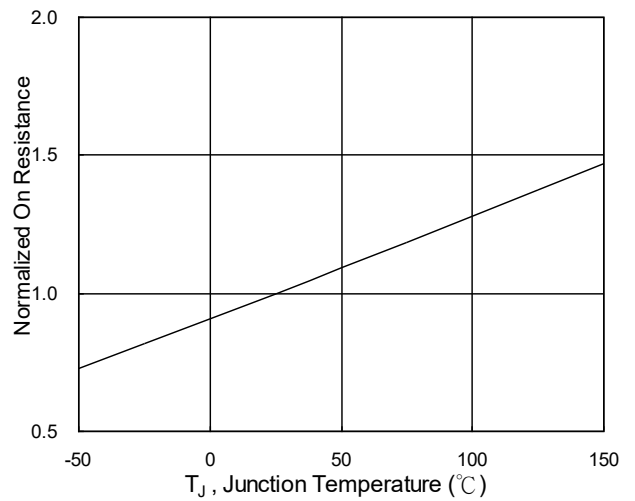


Fig.6 Normalized $R_{DS(on)}$ vs. T_J

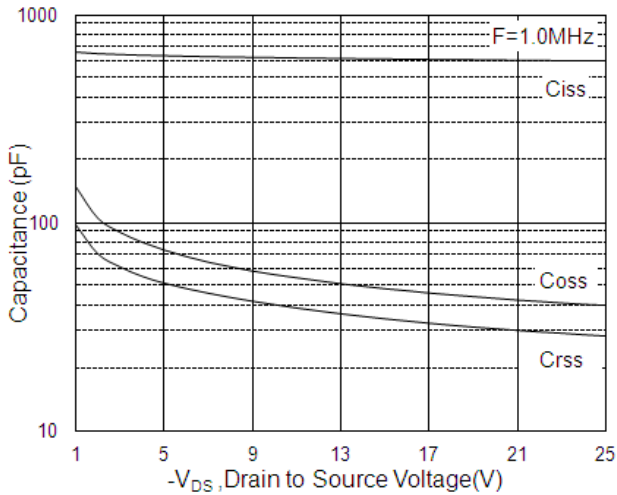


Fig.7 Capacitance

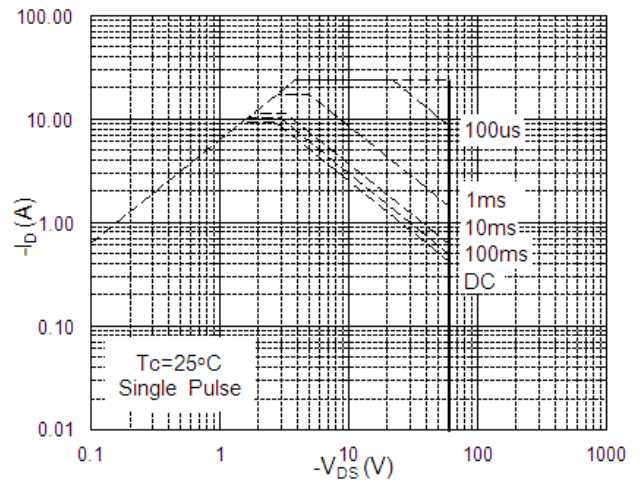


Fig.8 Safe Operating Area

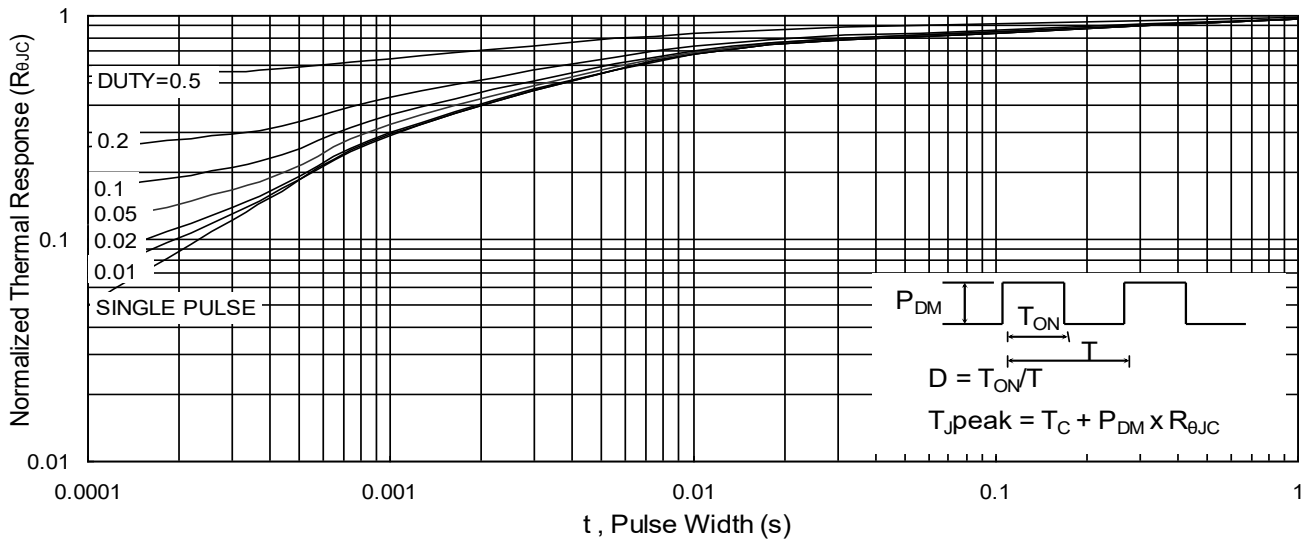


Fig.9 Normalized Maximum Transient Thermal Impedance

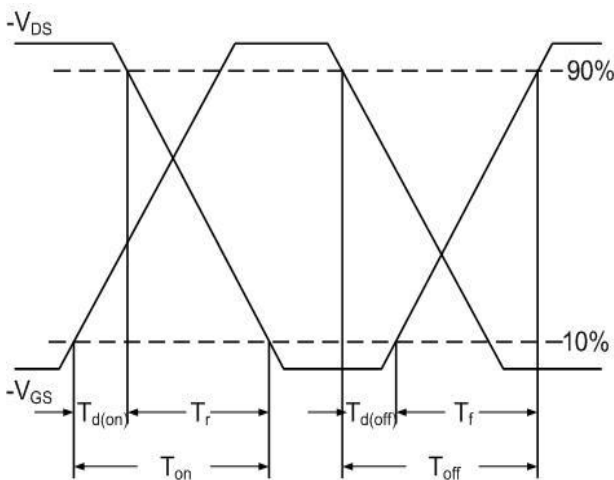


Fig.10 Switching Time Waveform

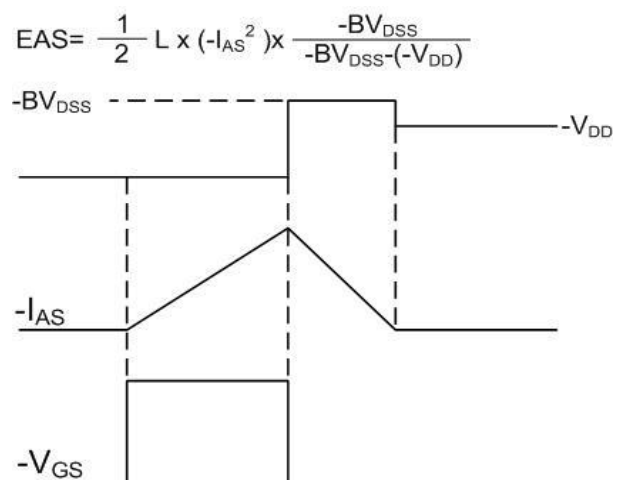
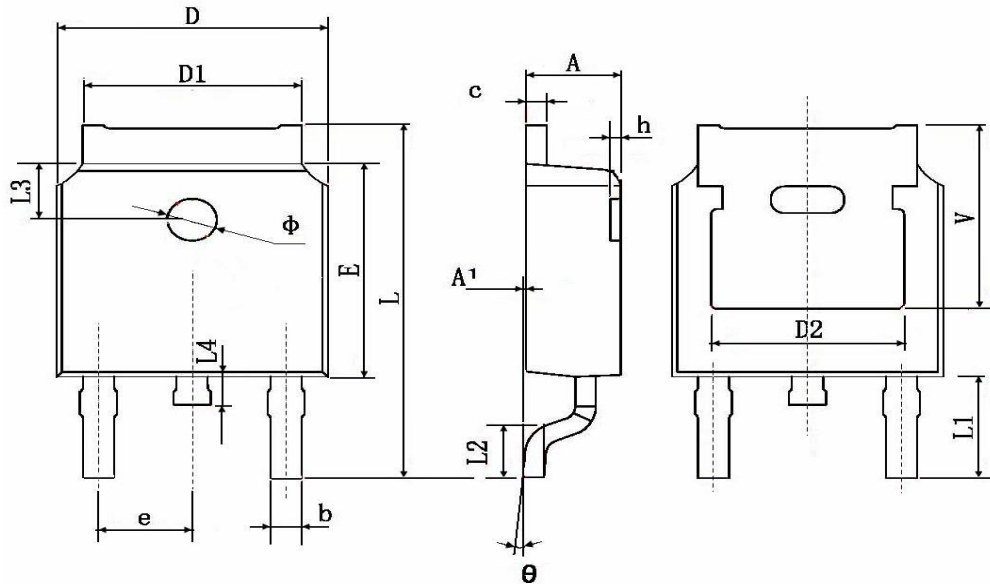


Fig.11 Unclamped Inductive Switching Waveform



TO-252-2L Package Information



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|--------|----------------------|-------|
| | Min. | Max. | Min. | Max. |
| A | 2.200 | 2.400 | 0.087 | 0.094 |
| A1 | 0.000 | 0.127 | 0.000 | 0.005 |
| b | 0.660 | 0.860 | 0.026 | 0.034 |
| c | 0.460 | 0.580 | 0.018 | 0.023 |
| D | 6.500 | 6.700 | 0.256 | 0.264 |
| D1 | 5.100 | 5.460 | 0.201 | 0.215 |
| D2 | 4.830 TYP. | | 0.190 TYP. | |
| E | 6.000 | 6.200 | 0.236 | 0.244 |
| e | 2.186 | 2.386 | 0.086 | 0.094 |
| L | 9.800 | 10.400 | 0.386 | 0.409 |
| L1 | 2.900 TYP. | | 0.114 TYP. | |
| L2 | 1.400 | 1.700 | 0.055 | 0.067 |
| L3 | 1.600 TYP. | | 0.063 TYP. | |
| L4 | 0.600 | 1.000 | 0.024 | 0.039 |
| phi | 1.100 | 1.300 | 0.043 | 0.051 |
| theta | 0° | 8° | 0° | 8° |
| h | 0.000 | 0.300 | 0.000 | 0.012 |
| V | 5.350 TYP. | | 0.211 TYP. | |



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