



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.

General Features

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

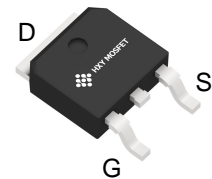
$R_{DS(ON)} < 140m\Omega$ @ $V_{GS}=10V$

Application

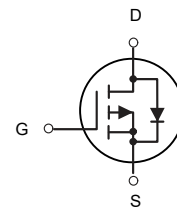
Brushless motor

Load switch

Uninterruptible power supply



TO-252-2L
(TO-252-3-313)



P-Channel MOSFET

Package Marking and Ordering Information

| Product ID | Pack | Marking | Qty(PCS) |
|------------------|-------------------------|---------------|----------|
| IPD40DP06NMATMA1 | TO-252-2L(TO-252-3-313) | 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)

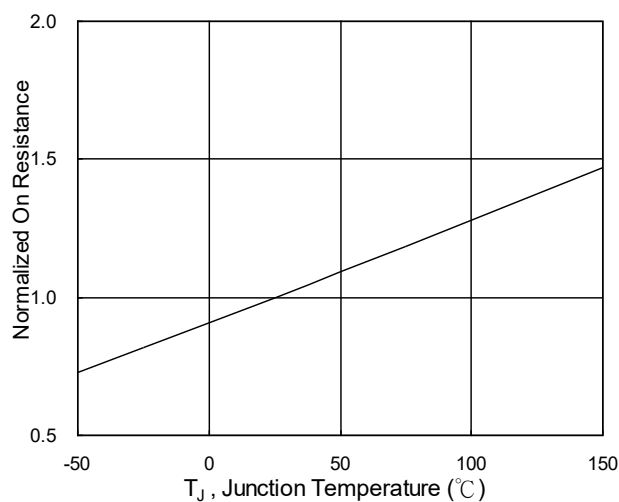
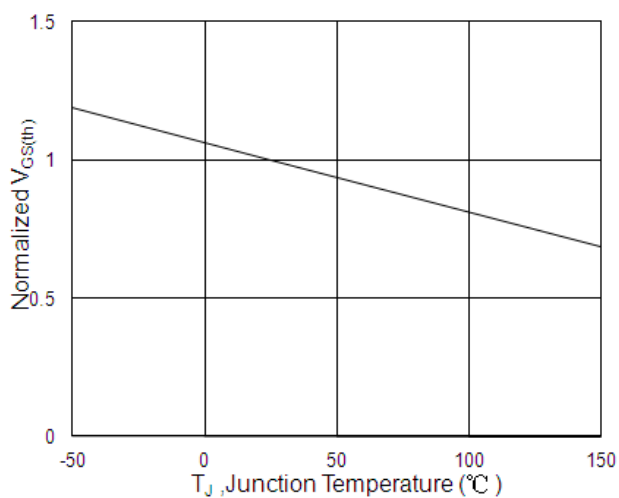
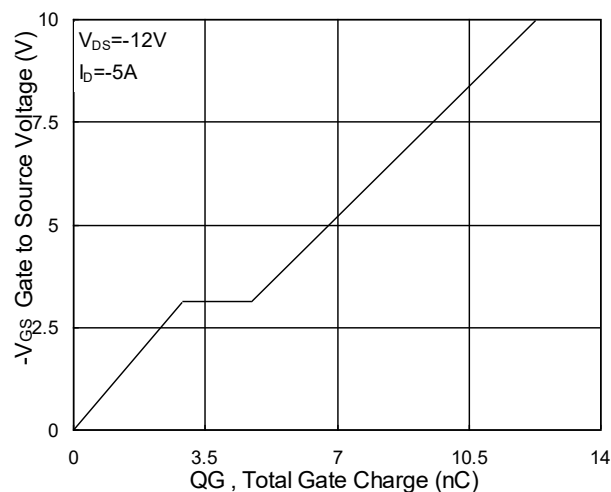
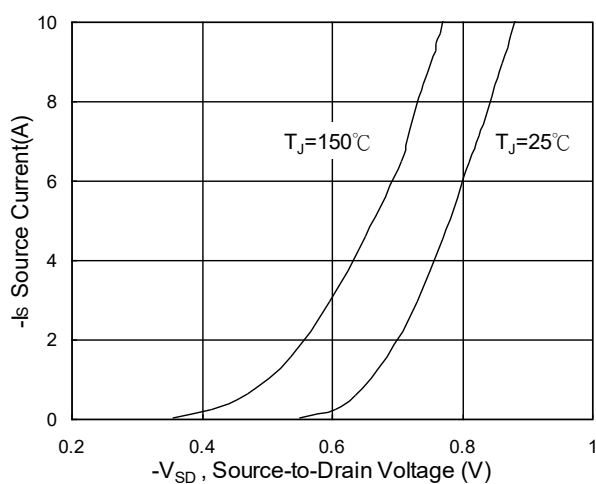
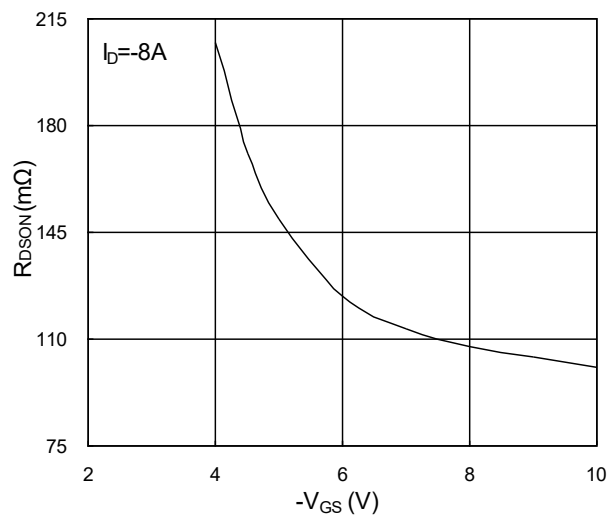
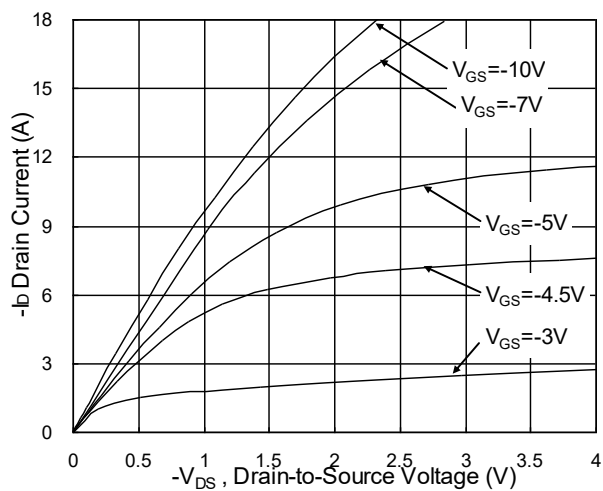
| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|----------------------------|--|--|------|--------|-----------|---------------------|
| BV_{DSS} | Drain-Source Breakdown Voltage | $V_{GS}=0V, I_D=-250\mu A$ | -60 | --- | --- | V |
| $\Delta BV_{DSS}/\Delta T$ | BV_{DSS} Temperature Coefficient | Reference to 25°C , $I_D=-1mA$ | --- | -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 | $V_{DS}=-15V, V_{GS}=0V, F=1MHz$ | --- | 715 | --- | pF |
| C_{oss} | Output Capacitance | | --- | 51 | --- | |
| C_{rss} | Reverse Transfer Capacitance | | --- | 34 | --- | |
| I_S | Continuous Source Current ^{1,5} | $V_G=V_D=0V$, 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 20Z 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 $V_{DD}=-25V, V_{GS}=-10V, L=0.1mH, I_{AS}=-15A$
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



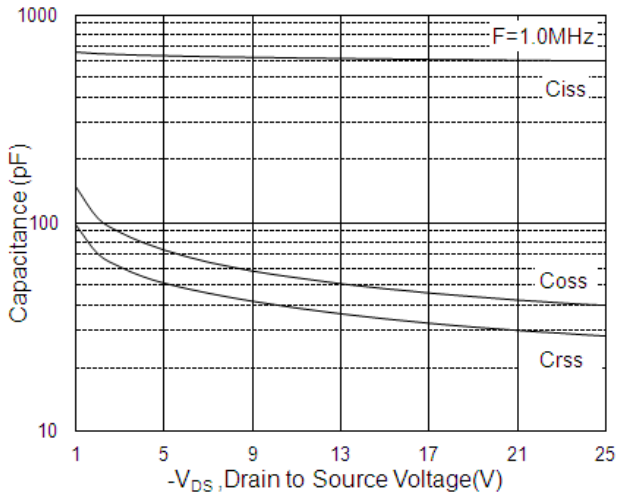


Fig.7 Capacitance

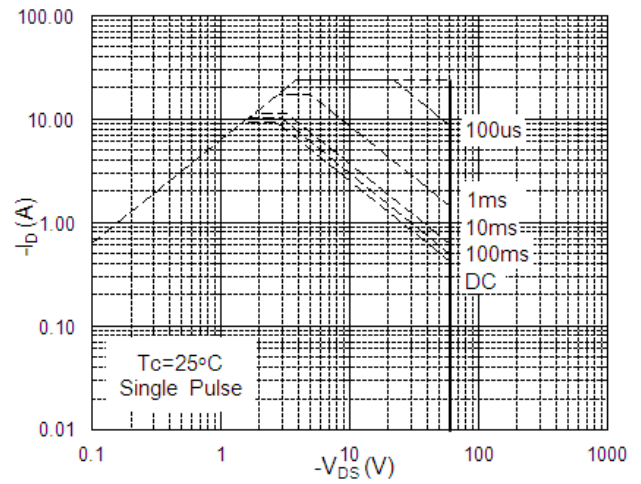


Fig.8 Safe Operating Area

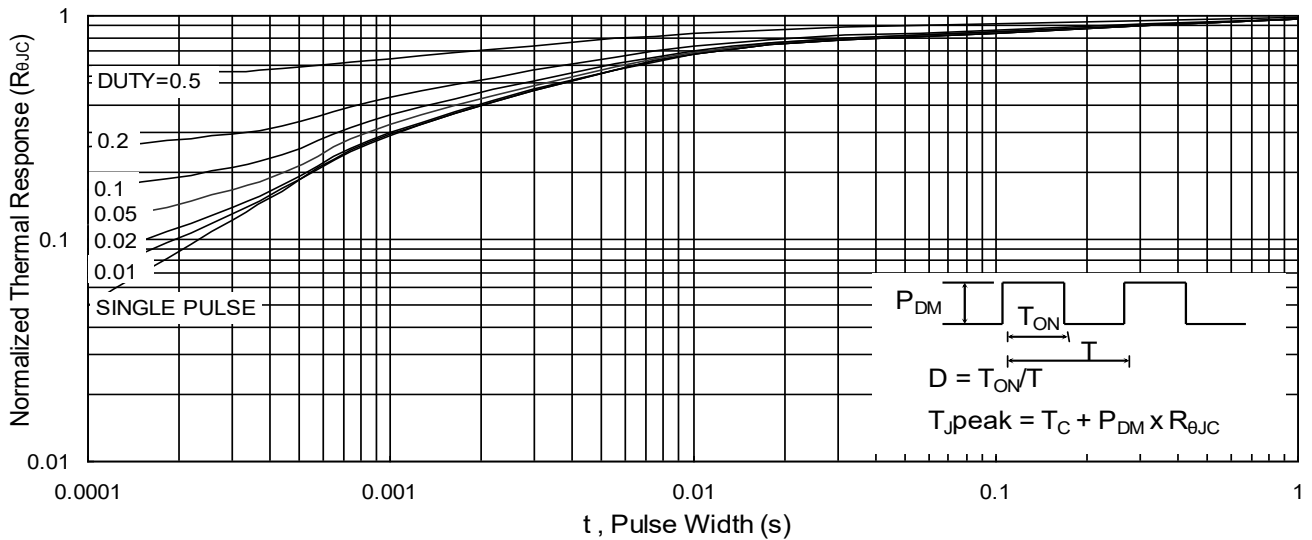


Fig.9 Normalized Maximum Transient Thermal Impedance

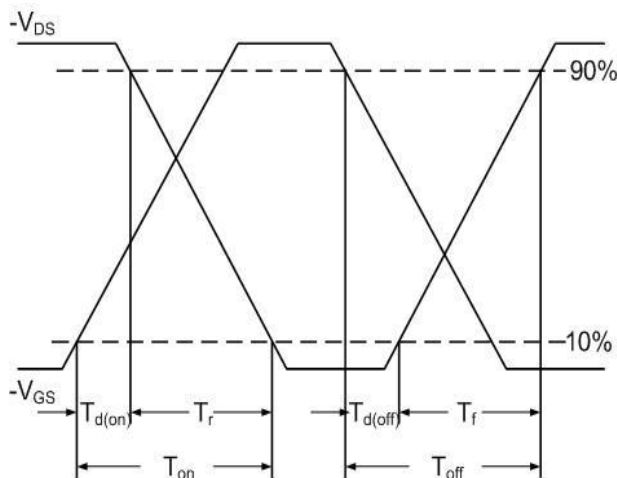


Fig.10 Switching Time Waveform

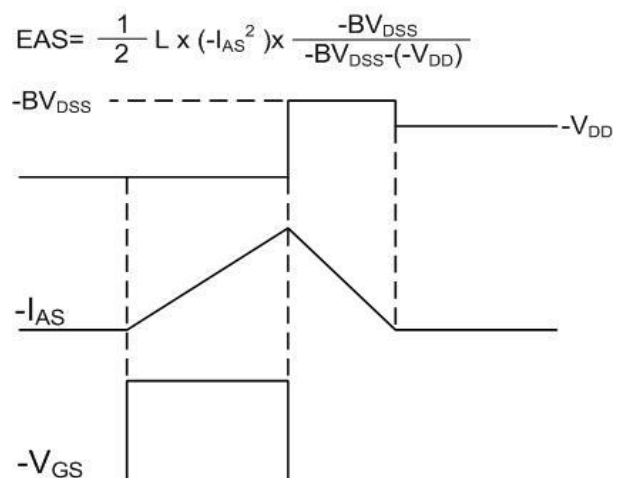
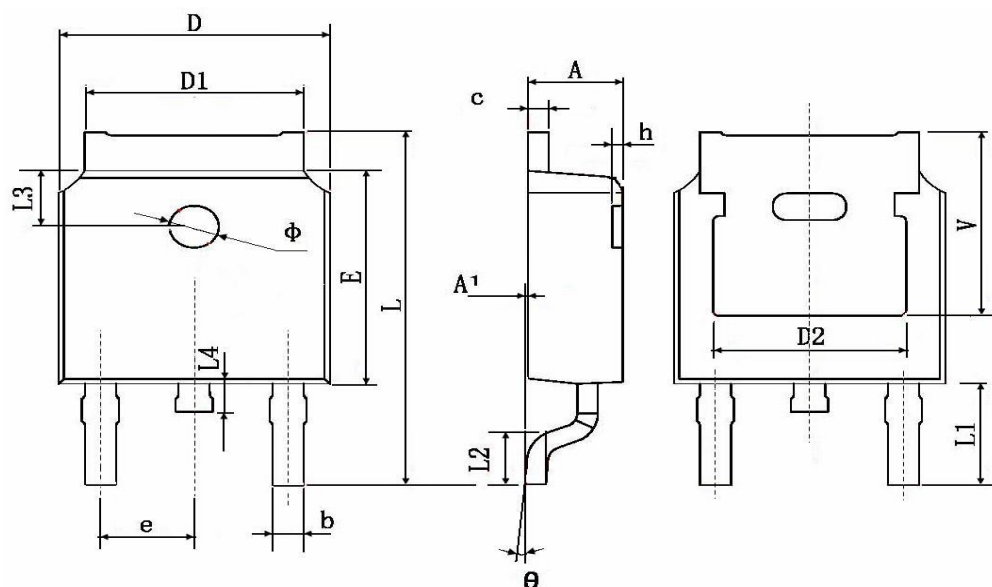


Fig.11 Unclamped Inductive Switching Waveform



TO-252-2L(TO-252-3-313) 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 |
| Φ | 1.100 | 1.300 | 0.043 | 0.051 |
| θ | 0° | 8° | 0° | 8° |
| h | 0.000 | 0.300 | 0.000 | 0.012 |
| V | 5.350 TYP. | | 0.211 TYP. | |



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