# P-Channel Enhancement Mode Power MOSFET

## Description

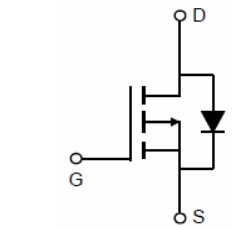
The HM85P02D uses advanced trench technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. It can be used in a wide variety of applications.

## General Features

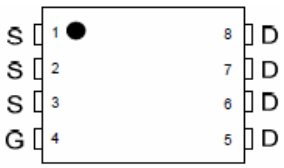
- $V_{DS}$ =-20V,$I_D$ =-85A
  $R_{DS(ON)}$ < 2.5mΩ @ $V_{GS}$=-4.5V
  $R_{DS(ON)}$ < 4mΩ @ $V_{GS}$=-2.5V
- High density cell design for ultra low Rdson
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high $E_{AS}$
- Excellent package for good heat dissipation

## Application

- Load switch
- Battery protection

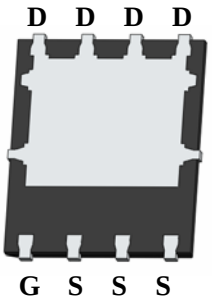



Schematic diagram




Pin Assignment


Top View




Bottom View

## Package Marking and Ordering Information

| Device Marking | Device | Device Package | Reel Size | Tape width | Quantity |
|---|---|---|---|---|---|
| HM85P02D | HM85P02D | DFN 5x6 -8L | - | | |

## Absolute Maximum Ratings ($T_C$=25℃unless otherwise noted)

| Parameter | Symbol | Limit | Unit |
|---|---|---|---|
| Drain-Source Voltage | $V_{DS}$ | -20 | V |
| Gate-Source Voltage | $V_{GS}$ | ±10 | V |
| Drain Current-Continuous | $I_D$ | -85 | A |
| Drain Current-Continuous($T_C$=100℃) | $I_D$ (100℃) | -49.5 | A |
| Pulsed Drain Current | $I_{DM}$ | -340 | A |
| Maximum Power Dissipation | $P_D$ | 135 | W |
| Derating factor | | 1.08 | W/℃ |
| Operating Junction and Storage Temperature Range | $T_J$,$T_{STG}$ | -55 To 150 | ℃ |

## Thermal Characteristic

| | | | |
|---|---|---|---|
| Thermal Resistance,Junction-to-Case(Note 2) | $R_{\theta JC}$ | 0.93 | ℃/W |

## Electrical Characteristics ($T_C$=25℃unless otherwise noted)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$=0V $I_D$=-250μA | -20 | - | - | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=-20V,$V_{GS}$=0V | - | - | 1 | μA |
| Gate-Body Leakage Current | $I_{GSS}$ | $V_{GS}$=±10V,$V_{DS}$=0V | - | - | ±100 | nA |
| **On Characteristics** (Note 3) | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$,$I_D$=-250μA | -0.4 | -0.6 | -1.0 | V |
| Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS}$=-4.5V, $I_D$=-20A | - | 2.0 | 2.5 | mΩ |
| | | $V_{GS}$=-2.5V, $I_D$=-20A | - | 2.7 | 4 | |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$=-5V,$I_D$=-20A | 100 | - | - | S |
| **Dynamic Characteristics** (Note4) | | | | | | |
| Input Capacitance | $C_{lss}$ | $V_{DS}$=-10V,$V_{GS}$=0V, F=1.0MHz | - | 18567.5 | - | PF |
| Output Capacitance | $C_{oss}$ | | - | 1662 | - | PF |
| Reverse Transfer Capacitance | $C_{rss}$ | | - | 1432 | - | PF |
| **Switching Characteristics** (Note 4) | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}$=-10V, $R_{GEN}$=1Ω $V_{GS}$=-4.5V,$R_L$=0.5Ω | - | 16 | - | nS |
| Turn-on Rise Time | $t_r$ | | - | 70 | - | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 460 | - | nS |
| Turn-Off Fall Time | $t_f$ | | - | 240 | - | nS |
| Total Gate Charge | $Q_g$ | $V_{DS}$=-10V,$I_D$=-20A, $V_{GS}$=-10V | - | 482.8 | - | nC |
| Gate-Source Charge | $Q_{gs}$ | | - | 28.5 | - | nC |
| Gate-Drain Charge | $Q_{gd}$ | | - | 75.3 | - | nC |
| **Drain-Source Diode Characteristics** | | | | | | |
| Diode Forward Voltage (Note 3) | $V_{SD}$ | $V_{GS}$=0V,$I_S$=-20A | - | - | -1.2 | V |
| Diode Forward Current (Note 2) | $I_S$ | | - | - | -85 | A |
| Reverse Recovery Time | $t_{rr}$ | TJ = 25°C, IF = -10A di/dt = 100A/μs (Note3) | - | 157 | - | nS |
| Reverse Recovery Charge | Qrr | | - | 246 | - | nC |
| Forward Turn-On Time | $t_{on}$ | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD) | | | | |

**Notes:**

**1.** Repetitive Rating: Pulse width limited by maximum junction temperature.
**2.** Surface Mounted on FR4 Board, t ≤ 10 sec.
**3.** Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
**4.** Guaranteed by design, not subject to production

## Typical Electrical and Thermal Characteristics (Curves)

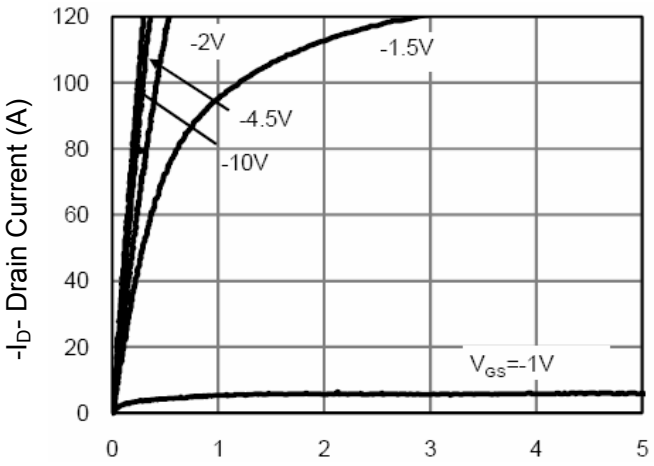



**Figure 1 Output Characteristics**

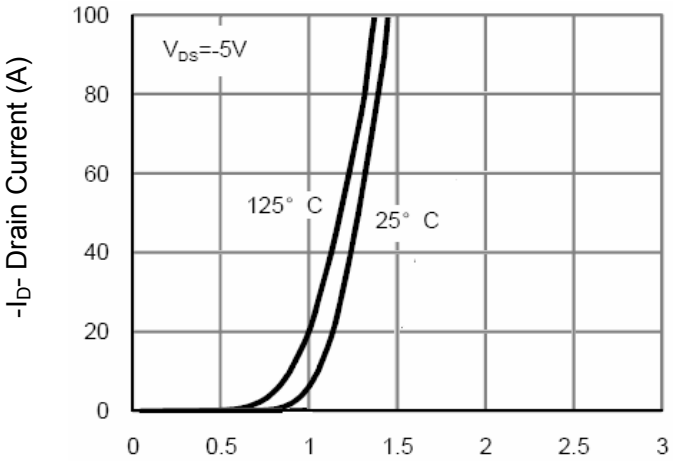



**Figure 2 Transfer Characteristics**

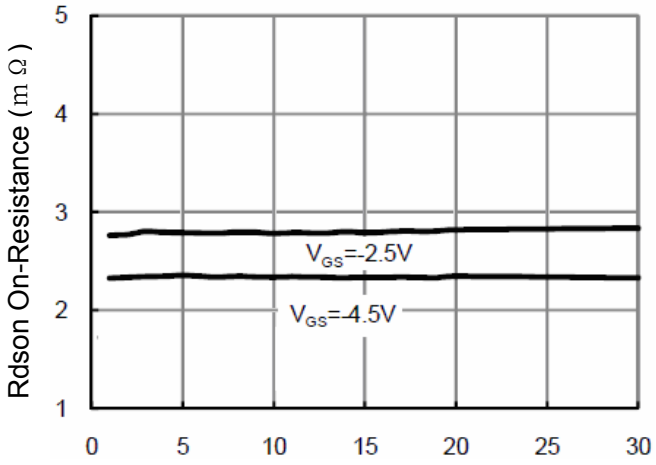



**Figure 3 Rdson- Drain Current**

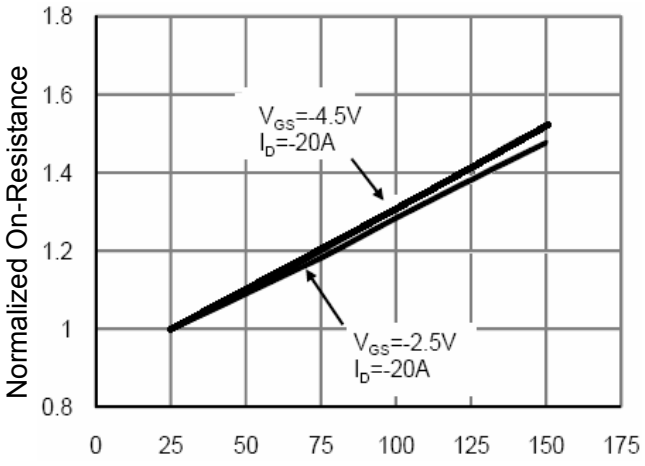



**Figure 4 Rdson-Junction Temperature**

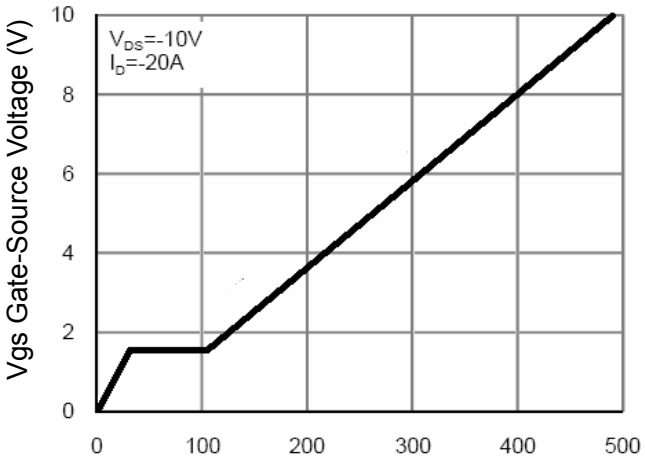



**Figure 5 Gate Charge**

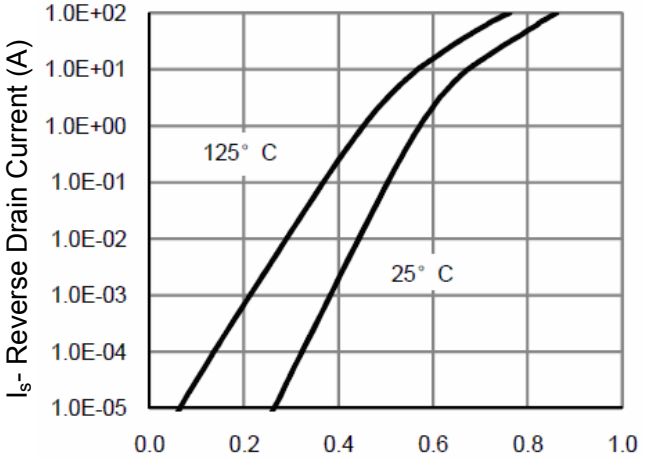



**Figure 6 Source- Drain Diode Forward**

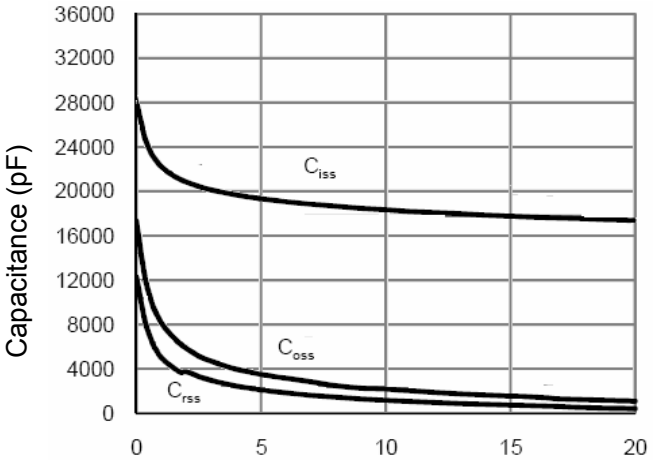



**Figure 7 Capacitance vs Vds**

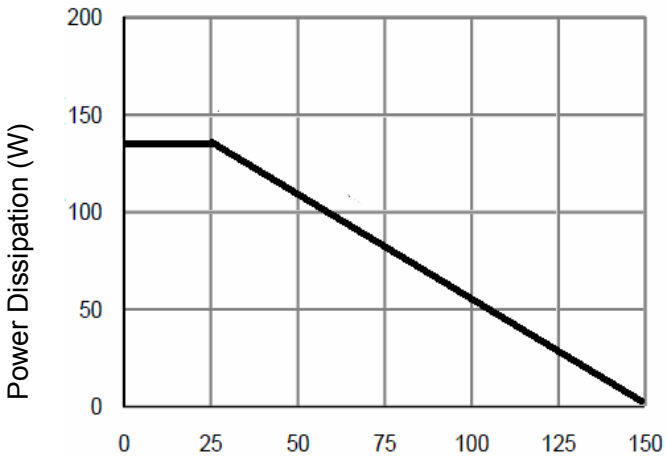



**Figure 9 Power De-rating**

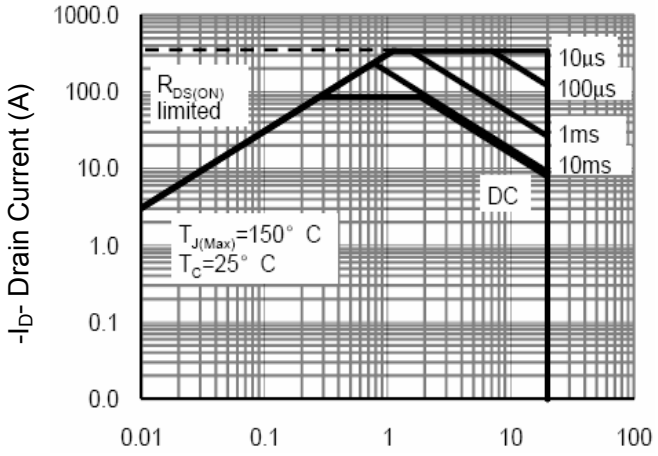



**Figure 8 Safe Operation Area**

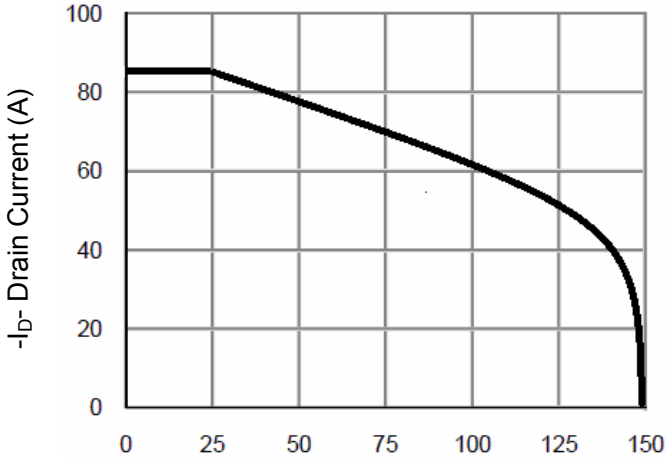



**Figure 10 -Current De-rating**

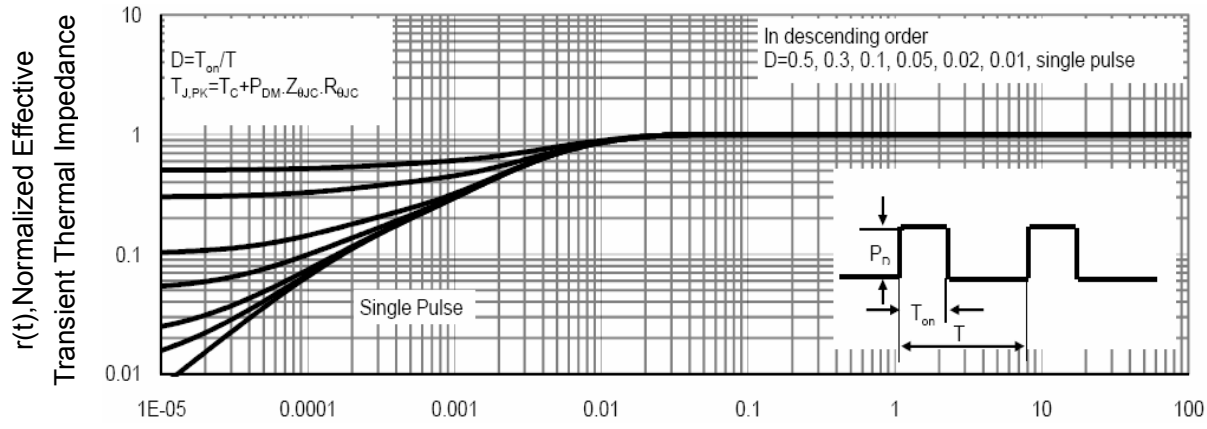
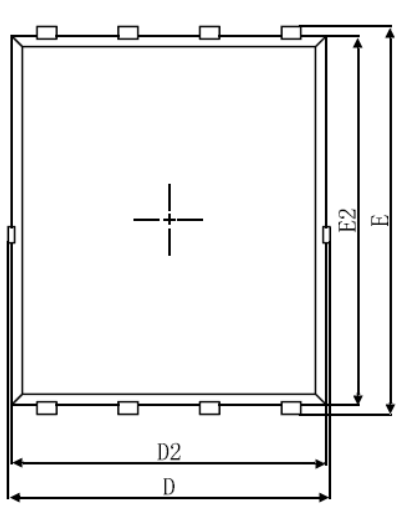
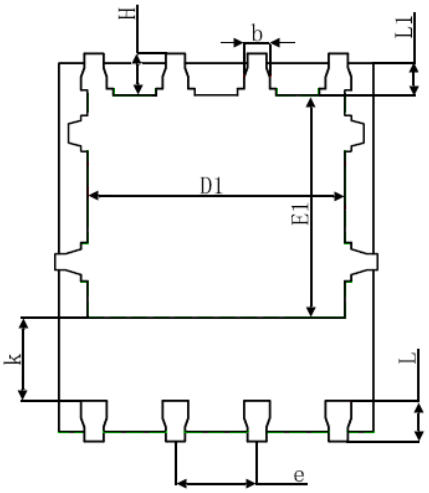



**Figure 11 Normalized Maximum Transient Thermal Impedance**

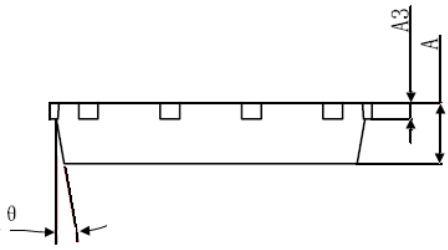
## DFN5X6-8L Package Information




Top View
[顶视图]




Bottom View
[背视图]




Side View
[侧视图]

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 0.900 | 1.000 | 0.035 | 0.039 |
| A3 | 0.254REF. | | 0.010REF. | |
| D | 4.944 | 5.096 | 0.195 | 0.201 |
| E | 5.974 | 6.126 | 0.235 | 0.241 |
| D1 | 3.910 | 4.110 | 0.154 | 0.162 |
| E1 | 3.375 | 3.575 | 0.133 | 0.141 |
| D2 | 4.824 | 4.976 | 0.190 | 0.196 |
| E2 | 5.674 | 5.826 | 0.223 | 0.229 |
| K | 1.190 | 1.390 | 0.047 | 0.055 |
| b | 0.035 | 0.450 | 0.014 | 0.018 |
| e | 1.270(TYP.) | | 0.050(TYP.) | |
| L | 0.559 | 0.711 | 0.022 | 0.028 |
| L1 | 0.424 | 0.576 | 0.017 | 0.023 |
| H | 0.574 | 0.726 | 0.023 | 0.029 |
| θ | 8° | 12° | 8° | 12° |