

## 100V N-Channel Enhancement Mode MOSFET

### Description

The NP60S10D6 uses SGT technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of  $R_{DS(ON)}$  and  $Q_g$ . This device is ideal for high-frequency switching and synchronous rectification.

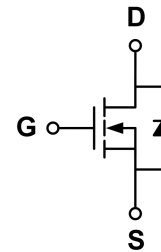
### General Features

- ◆  $V_{DS} = 100V$ ,  $I_D = 60A$   
 $R_{DS(ON)}(Typ.) = 4.6m\Omega @ V_{GS} = 10V$   
 $R_{DS(ON)}(Typ.) = 6.5m\Omega @ V_{GS} = 4.5V$
- ◆ Excellent gate charge x  $R_{DS(on)}$  product(FOM)
- ◆ Very low on-resistance  $R_{DS(on)}$
- ◆ 150 °C operating temperature
- ◆ 100% UIS tested

### Application

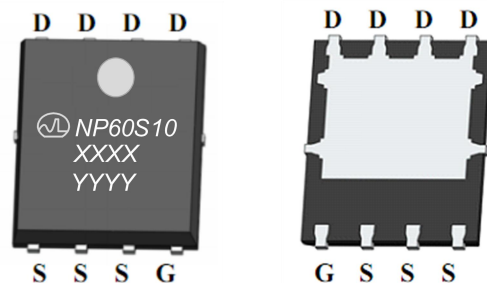
- ◆ Synchronous Rectification in DC/DC and AC/DC Converters
- ◆ Industrial and Motor Drive applications

### Schematic diagram



### Marking and pin assignment

#### PDFN5\*6-8L-A



Top View

Bottom View

XXXX—Wafer Information

YYYY—Quality Code

### Ordering Information

| Part Number | Storage Temperature | Package      | Devices Per Reel |
|-------------|---------------------|--------------|------------------|
| NP60S10D6-G | -55°C to +150°C     | PDFN5*6-8L-A | 5000             |

### Absolute Maximum Ratings (TA=25°C unless otherwise noted)

| parameter                            | symbol   | limit   | unit |   |
|--------------------------------------|----------|---------|------|---|
| Drain-source voltage                 | $V_{DS}$ | 100     | V    |   |
| Gate-source voltage                  | $V_{GS}$ | ±20     | V    |   |
| Continuous Drain Current             | $I_D$    | TC=25°C | 60   | A |
|                                      |          | TC=70°C | 42   |   |
| Pulsed Drain Current                 | $I_{DP}$ | 240     | A    |   |
| Power Dissipation                    | $P_D$    | TC=25°C | 160  | W |
|                                      |          | TC=70°C | 85   |   |
| Operating junction Temperature range | $T_j$    | -55—150 | °C   |   |

**Electrical Characteristics** (TA=25°C unless otherwise noted)

| Parameter                        | Symbol              | Condition   | Min | Typ  | Max  | Unit |
|----------------------------------|---------------------|---|-----|------|------|------|
| <b>Static Characteristics</b>    |                     |   |     |      |      |      |
| Drain-source breakdown voltage   | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA  | 100 | -    | -    | V    |
| Zero gate voltage drain current  | I <sub>DSS</sub>    | V <sub>DS</sub> =100V, V <sub>GS</sub> =0V  | -   | -    | 1    | μA   |
|                                  |                     | T <sub>J</sub> =55°C  | -   | -    | 5    |      |
| Gate Leakage Current             | I <sub>GSS</sub>    | V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V  | -   | -    | ±100 | nA   |
| Gate threshold voltage           | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                | 1.0 | 1.4  | 2.5  | V    |
| Drain-source on-state resistance | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =20A   | -   | 4.6  | 6.5  | mΩ   |
|                                  |                     | V <sub>GS</sub> =4.5V, I <sub>D</sub> =10A  | -   | 6.5  | 9.5  |      |
| Forward Transconductance         | g <sub>FS</sub>     | V <sub>DS</sub> =5V, I <sub>D</sub> =20A  | -   | 50   | -    | S    |
| <b>Diode Characteristics</b>     |                     |   |     |      |      |      |
| Diode Forward Voltage            | V <sub>SD</sub>     | I <sub>SD</sub> =1A, V <sub>GS</sub> =0V  | -   | 0.7  | 1.2  | V    |
| Diode Continuous Forward Current | I <sub>S</sub>      |   | -   | -    | 20   | A    |
| Reverse Recovery Time            | t <sub>rr</sub>     | T <sub>J</sub> = 25°C, I <sub>F</sub> =60A di/dt = 100A/μs                              | -   | 58   | -    | ns   |
| Reverse Recovery Charge          | Q <sub>rr</sub>     |   | -   | 118  | -    | nC   |
| <b>Dynamic Characteristics</b>   |                     |   |     |      |      |      |
| Gate Resistance                  | R <sub>G</sub>      | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz  | -   | 13   | 15   | Ω    |
| Input capacitance                | C <sub>ISS</sub>    | V <sub>GS</sub> =0V, V <sub>DS</sub> =50V<br>f=1.0MHz                                   | -   | 3499 | -    | pF   |
| Output capacitance               | C <sub>OSS</sub>    |   | -   | 638  | -    |      |
| Reverse transfer capacitance     | C <sub>RSS</sub>    |   | -   | 23   | -    |      |
| Turn-on delay time               | t <sub>D(ON)</sub>  | V <sub>GS</sub> =10V, V <sub>DS</sub> =50V, R <sub>L</sub> =2.5Ω,<br>R <sub>G</sub> =3Ω | -   | 13   | -    | ns   |
| Turn-on Rise time                | t <sub>r</sub>      |   | -   | 5    | -    |      |
| Turn-off delay time              | t <sub>D(OFF)</sub> |   | -   | 21   | -    |      |
| Turn-off Fall time               | t <sub>f</sub>      |   | -   | 5    | -    |      |
| Total gate charge                | Q <sub>g</sub>      | V <sub>GS</sub> =10V, V <sub>DS</sub> =50V, I <sub>D</sub> =20A                         | -   | 72   | -    | nC   |
| Gate-source charge               | Q <sub>gs</sub>     |   | -   | 10.4 | -    |      |
| Gate-drain charge                | Q <sub>gd</sub>     |   | -   | 20.9 | -    |      |

**Thermal Characteristics**

| Parameter                                | Symbol       | Typ              | Max | Unit |
|--|--------------|------------------|-----|------|
| Maximum Junction-to-Ambient <sup>A</sup> | ≤ 10s        | R <sub>θJA</sub> | 14  | °C/W |
| Maximum Junction-to-Ambient <sup>A</sup> | Steady-State |                  | 45  |      |
| Maximum Junction-to-Lead <sup>B</sup>    | Steady-State | R <sub>θJC</sub> | 0.6 |      |

A: The value of R<sub>qJA</sub> is measured with the device mounted on 1in 2 FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25°C. The value in any given application depends on the user's specific board design. The current rating is based on the t ≤ 10s thermal resistance rating.

B: The R<sub>qJA</sub> is the sum of the thermal impedance from junction to lead R<sub>qJL</sub> and lead to ambient.

## Typical Performance Characteristics

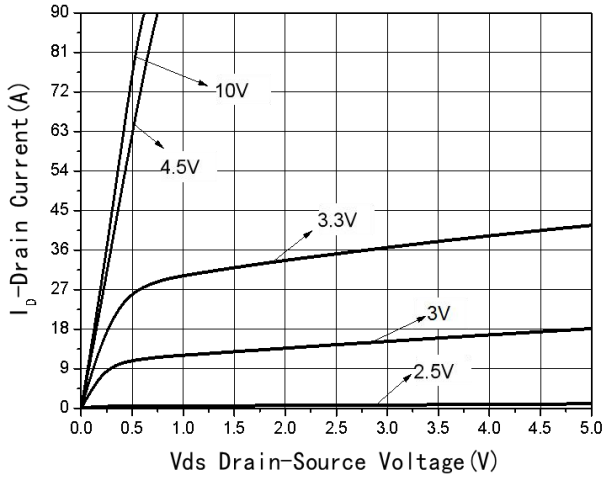


Fig1 Output Characteristics

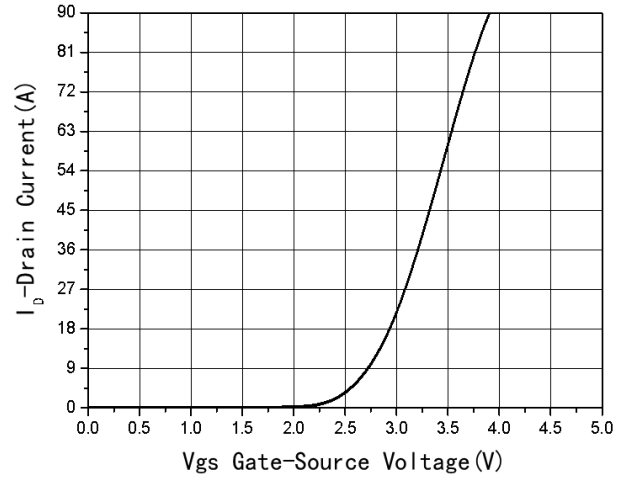


Fig2 Transfer Characteristics

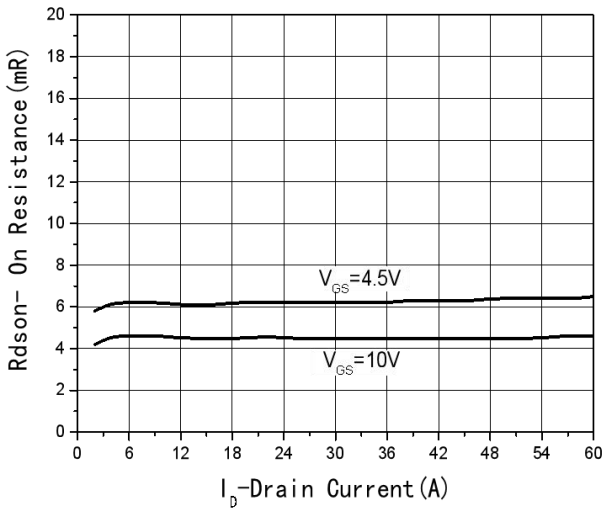


Fig3  $R_{DS(on)}$ -Drain current

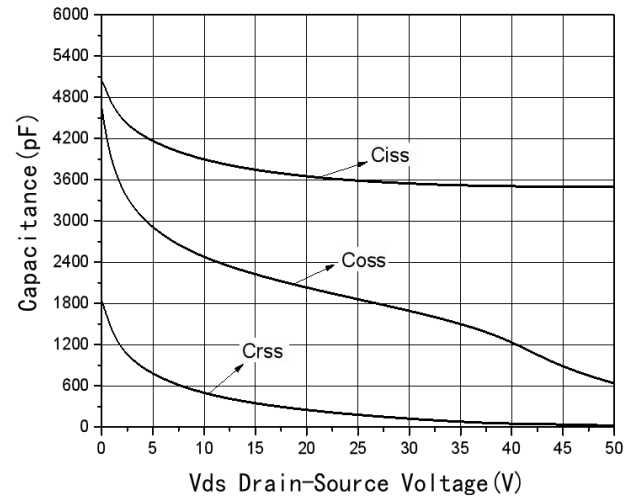


Fig4 Capacitance vs  $V_{DS}$

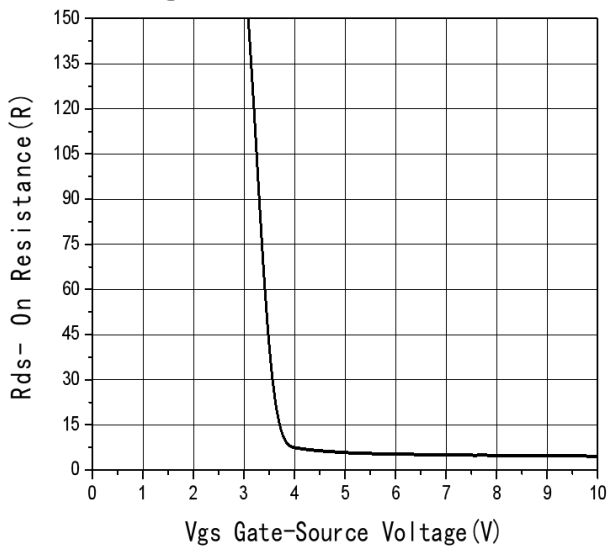


Fig5  $R_{DS(on)}$ -Gate Drain voltage

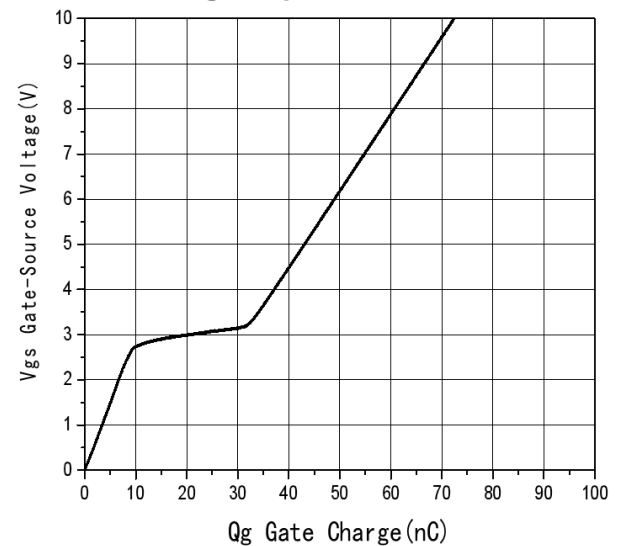
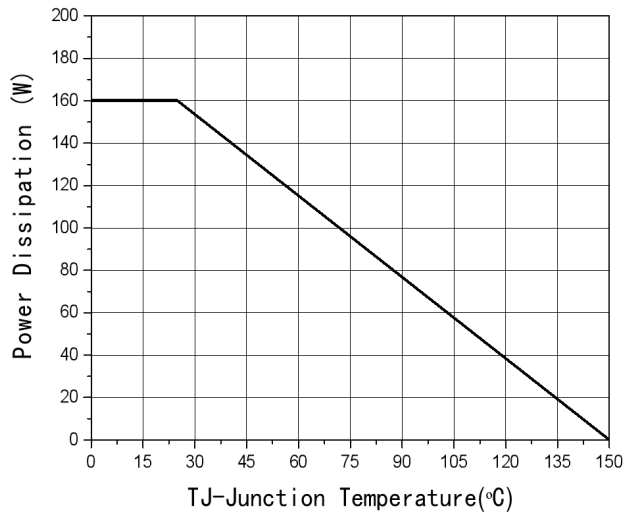
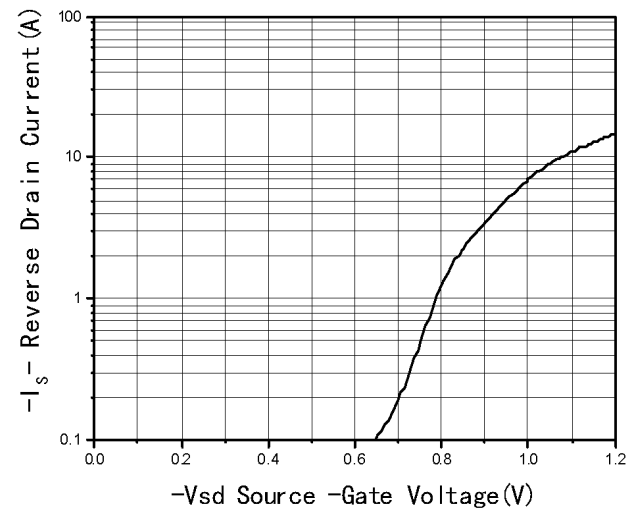


Fig6 Gate Charge



**Fig7 Power De-rating**

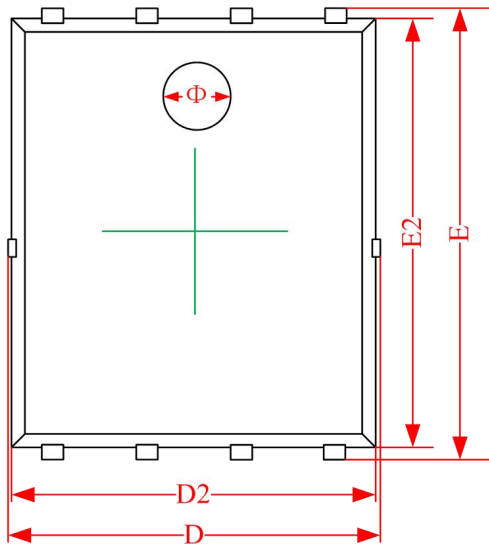


**Fig8 Source-Drain Diode Forward**

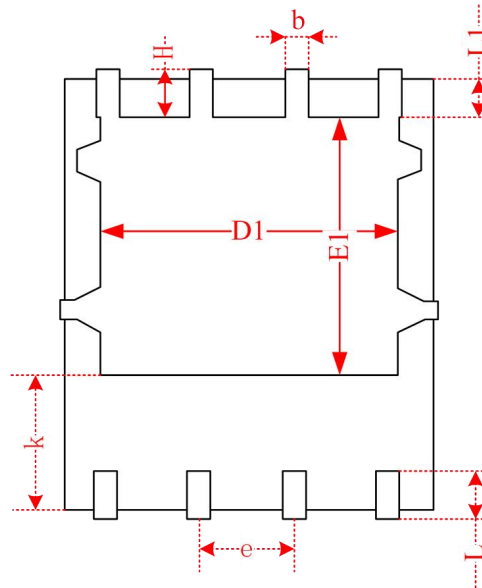
## Package Information

- PDFN5\*6-8L-A

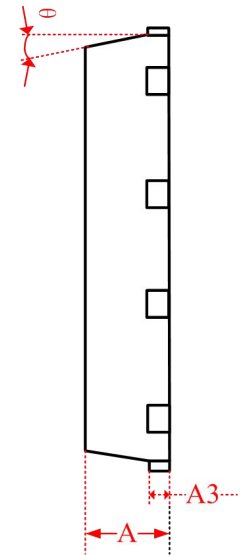
### Top View



### Bottom View



### Side View



| SYMBOLS  | DIMENSIONS IN MILLIMETERS |       |       | DIMENSIONS IN INCHES |       |       |
|----------|---------------------------|-------|-------|----------------------|-------|-------|
|          | MIN                       | NOM   | MAX   | MIN                  | NOM   | MAX   |
| A        | 0.870                     | 0.900 | 0.930 | 0.034                | 0.035 | 0.036 |
| A3       | 0.203REF.                 |       |       | 0.008REF.            |       |       |
| D        | 4.944                     | 5.020 | 5.096 | 0.195                | 0.198 | 0.201 |
| E        | 5.974                     | 6.050 | 6.126 | 0.235                | 0.238 | 0.241 |
| D1       | 3.910                     | 4.010 | 4.110 | 0.154                | 0.158 | 0.162 |
| E1       | 3.375                     | 3.475 | 3.575 | 0.133                | 0.137 | 0.141 |
| D2       | 4.870                     | 4.900 | 4.930 | 0.192                | 0.193 | 0.194 |
| E2       | 5.720                     | 5.750 | 5.780 | 0.226                | 0.227 | 0.228 |
| k        | 1.190                     | 1.290 | 1.390 | 0.047                | 0.051 | 0.055 |
| b        | 0.350                     | 0.380 | 0.410 | 0.014                | 0.015 | 0.016 |
| e        | 1.270TYP.                 |       |       | 0.050TYP.            |       |       |
| L        | 0.559                     | 0.635 | 0.711 | 0.022                | 0.025 | 0.028 |
| L1       | 0.424                     | 0.500 | 0.576 | 0.017                | 0.020 | 0.023 |
| H        | 0.574                     | 0.650 | 0.726 | 0.023                | 0.026 | 0.029 |
| $\theta$ | 10°                       | 11°   | 12°   | 10°                  | 11°   | 12°   |
| $\Phi$   | 1.150                     | 1.200 | 1.250 | 0.045                | 0.047 | 0.049 |