

40V N-Channel Enhancement Mode MOSFET

Description

The NP60S04D6 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.

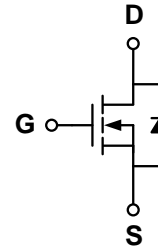
General Features

- ◆ $V_{DS} = 40V$, $I_D = 60A$
 $R_{DS(ON)}(Typ.) = 5.9m\Omega @V_{GS}=10V$
 $R_{DS(ON)}(Typ.) = 8.9m\Omega @V_{GS}=4.5V$
- ◆ Very low on-resistance $R_{DS(on)}$
- ◆ 150 °C operating temperature
- ◆ 100% UIS tested

Application

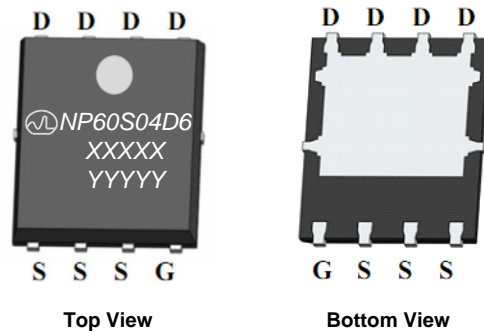
- ◆ Synchronous Rectification in DC/DC and AC/DC Converters
- ◆ Industrial and Motor Drive applications

Schematic diagram



Marking and pin assignment

PDFN5*6-8L-A



XXXX—Wafer Information
 YYYY—Quality Code

Ordering Information

| Part Number | Storage Temperature | Package | Devices Per Reel |
|-------------|---------------------|--------------|------------------|
| NP60S04D6-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} | 40 | V | |
| Gate-source voltage | V_{GS} | ±20 | V | |
| Continuous Drain Current | I_D | TC=25°C | 60 | A |
| | | TC=100°C | 38 | |
| Avalanche energy(T _j =25°C, V _{DD} =30V, V _G =10V, L=0.5mH, R _g =25Ω) | | E_{AS} | 60 | mJ |
| Power Dissipation | P_D | TC=25°C | 35 | W |
| | | TC=100°C | 14 | |
| Operating junction Temperature range | | T_j | -55—150 | °C |

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

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|----------------------------------|---------------------|---|-----|-----|------|------|
| Static Characteristics | | | | | | |
| Drain-source breakdown voltage | BV _{DSS} | V _{GS} =0V, I _D =250μA | 40 | - | - | V |
| Zero gate voltage drain current | I _{DSS} | V _{DS} =40V, V _{GS} =0V T _J =85°C | - | - | 1 | μA |
| | | | - | - | 5 | |
| Gate Leakage Current | I _{GSS} | V _{DS} =0V, V _{GS} =±20V | - | - | ±100 | nA |
| Gate threshold voltage | V _{GS(th)} | V _{DS} =V _{GS} , I _D =250μA | 1 | 1.7 | 2.5 | V |
| Drain-source on-state resistance | R _{DS(ON)} | V _{GS} =10V, I _D =20A | - | 5.9 | 8.5 | mΩ |
| | | V _{GS} =4.5V, I _D =20A | - | 8.9 | 15 | |
| Forward Transconductance | g _{FS} | V _{DS} =5V, I _D =20A | - | 70 | - | S |
| Diode Characteristics | | | | | | |
| Diode Forward Voltage | V _{SD} | I _{SD} =1A, V _{GS} =0V | - | 0.7 | 1.2 | V |
| Diode Continuous Forward Current | I _S | | - | - | 60 | A |
| Reverse Recovery Time | t _{rr} | T _J = 25°C, I _F = I _S di/dt = 100A/μs | - | 11 | - | ns |
| Reverse Recovery Charge | Q _{rr} | | - | 21 | - | nC |
| Dynamic Characteristics | | | | | | |
| Gate Resistance | R _G | V _{GS} =0V, V _{DS} =0V, f=1MHz | - | 0.9 | 1.35 | Ω |
| Input capacitance | C _{ISS} | V _{GS} =0V, V _{DS} =20V f=1.0MHz | - | 740 | - | pF |
| Output capacitance | C _{OSS} | | - | 230 | - | |
| Reverse transfer capacitance | C _{RSS} | | - | 36 | - | |
| Turn-on delay time | t _{D(ON)} | V _{GS} =10V, V _{DS} =20V, R _L =1.5Ω, R _G =3Ω | - | 7.5 | - | ns |
| Turn-on Rise time | t _r | | - | 2 | - | |
| Turn-off delay time | t _{D(OFF)} | | - | 23 | - | |
| Turn-off Fall time | t _f | | - | 3 | - | |
| Total gate charge | Q _g | V _{GS} =10V, V _{DS} =20V, I _D =20A | - | 17 | - | nC |
| Gate-source charge | Q _{gs} | | - | 2.6 | - | |
| Gate-drain charge | Q _{gd} | | - | 3.8 | - | |

Thermal Characteristics

| Parameter | Symbol | Typ | Max | Unit |
|--------------------------|----------------------------------|-----|-----|------|
| Maximum Junction-to-Lead | Steady-State R _{θJC} | 3 | 3.5 | °C/W |

The value of R_{qJA} is measured with the device mounted on 1in 2 FR-4 board with 2oz. Copper, in a still air environment with T_A=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.

The R_{qJA} is the sum of the thermal impedance from junction to lead R_{qJL} and lead to ambient.

Typical Performance Characteristics

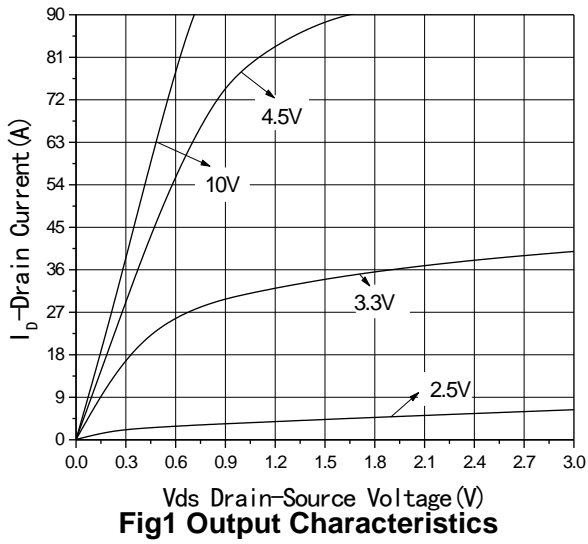


Fig1 Output Characteristics

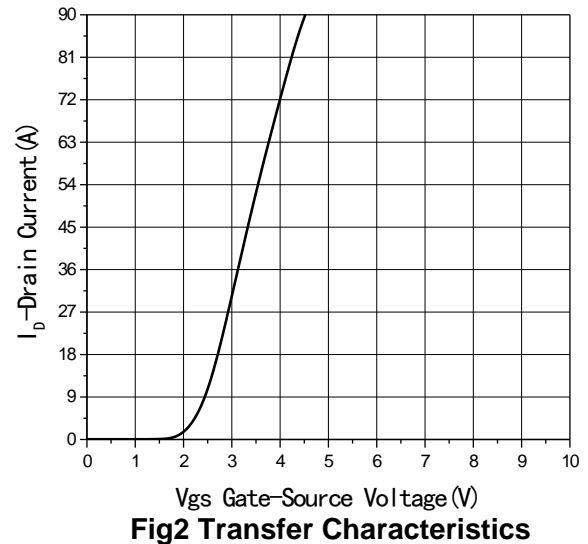


Fig2 Transfer Characteristics

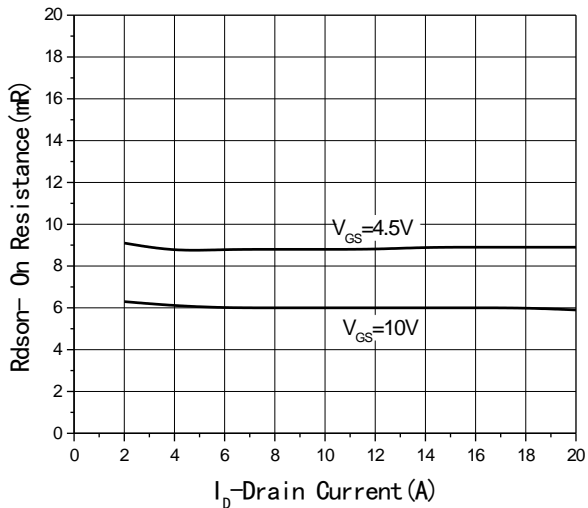


Fig3 $R_{DS(on)}$ -Drain current

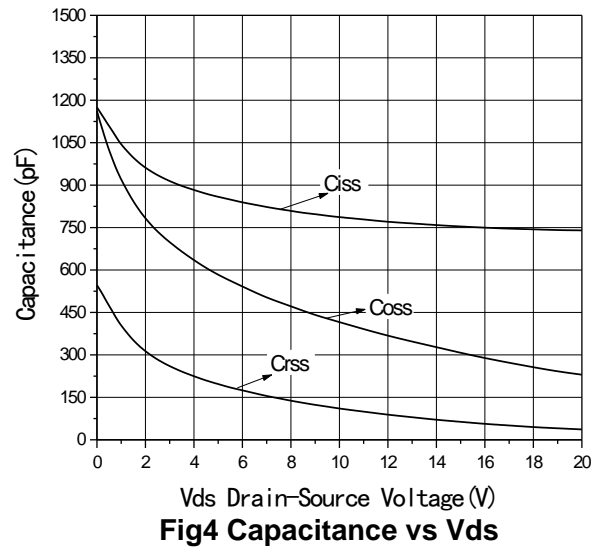


Fig4 Capacitance vs V_{DS}

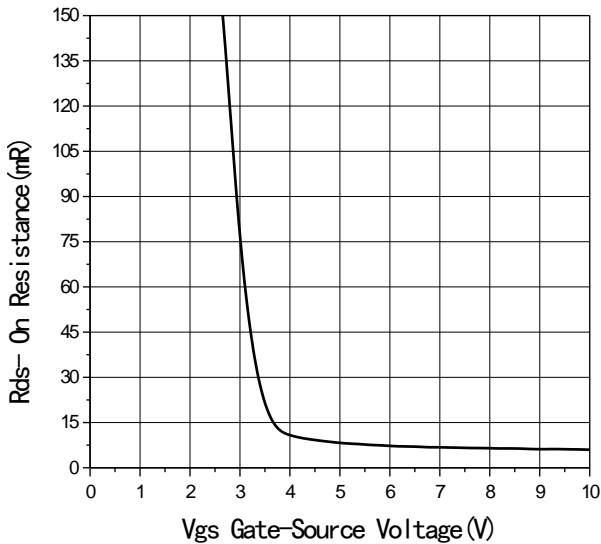


Fig5 $R_{DS(on)}$ -Gate Drain voltage

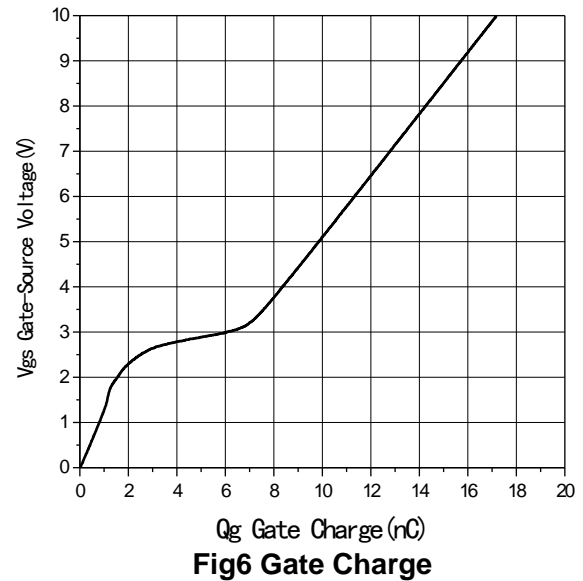


Fig6 Gate Charge

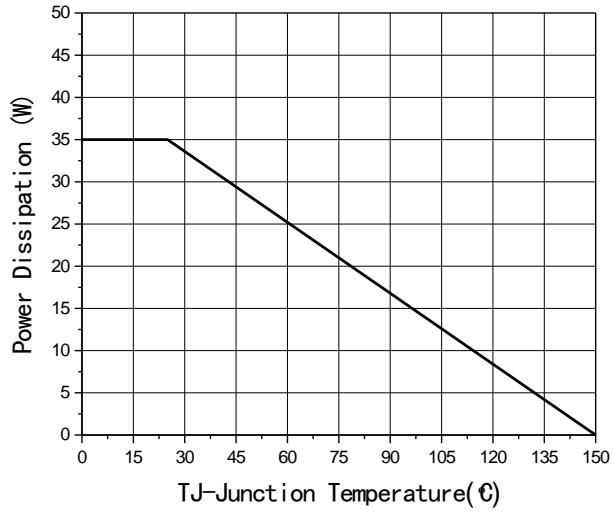


Fig7 Power De-rating

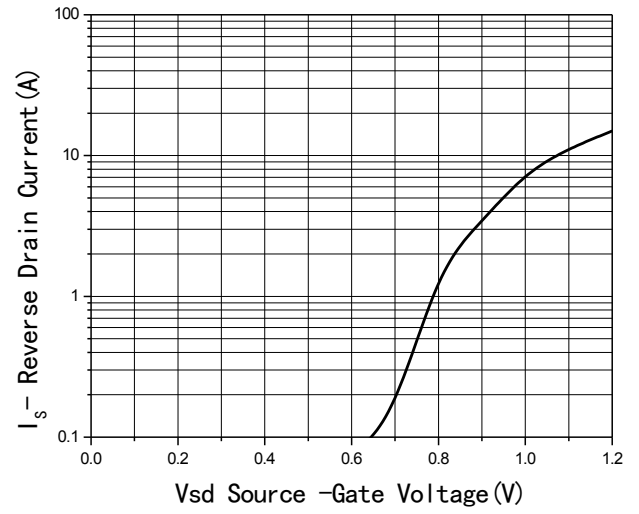
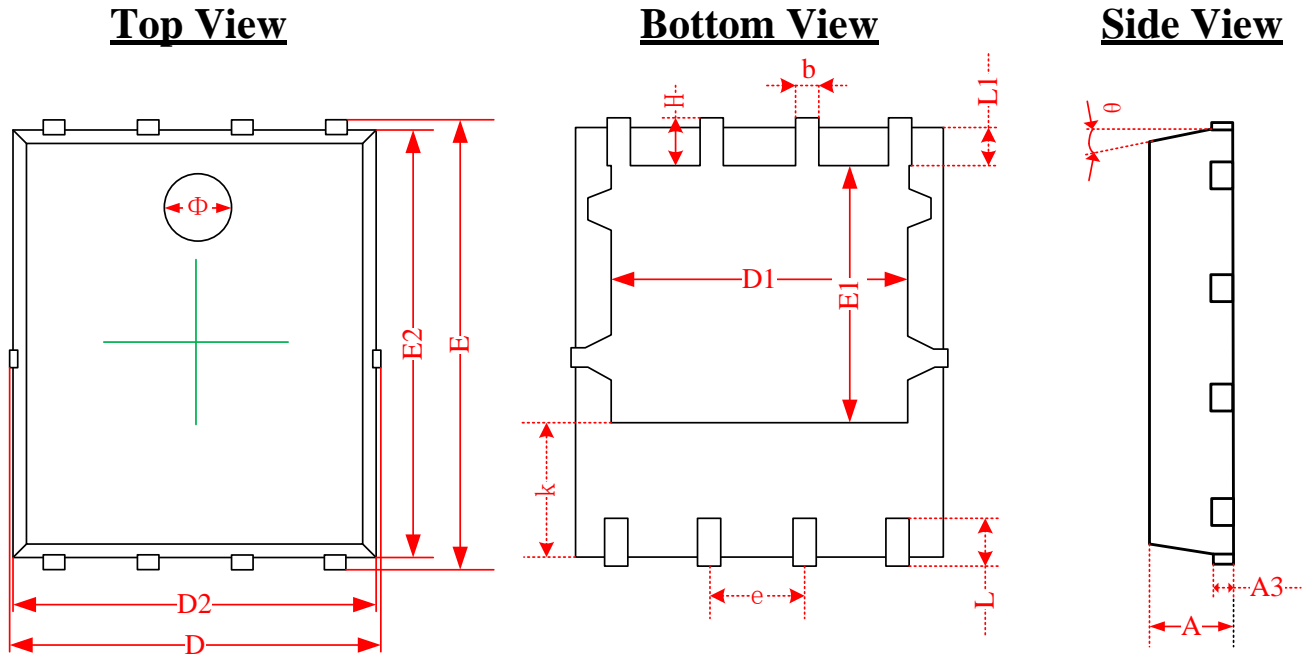


Fig8 Source-Drain Diode Forward

Package Information

- PDFN5*6-8L-A



| 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 | 0.152REF. | | | 0.006REF. | | |
| 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 |
| θ | 10° | 11° | 12° | 10° | 11° | 12° |
| Φ | 1.150 | 1.200 | 1.250 | 0.045 | 0.047 | 0.049 |

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