

## STD20NF06L

### General Description

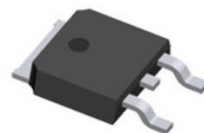
The STD20NF06L uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. It can be used in a wide variety of applications.

### Features

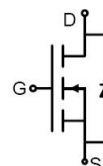
- $V_{DS} = 60V, I_D = 30A$   
 $R_{DS(ON)}, 25m\Omega$  (Typ) @  $V_{GS} = 10V$   
 $R_{DS(ON)}, 30m\Omega$  (Typ) @  $V_{GS} = 4.5V$
- Advanced Trench Technology
- Excellent  $R_{DS(ON)}$  and Low Gate Charge
- Lead free product is acquired

### Application

- Load Switch
- PWM Application
- Power management



TO-252(DPAK) top view



Schematic Diagram

### Package Marking and Ordering Information

| Device Marking | Device     | Device Package | Reel Size | Tape width | Quantity |
|----------------|------------|----------------|-----------|------------|----------|
| STD20NF06L     | STD20NF06L | TO-252         | 330mm     | 12mm       | 2500     |

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

| Parameter                                 |          | Symbol    | Value       | Unit |
|-------------------------------------------|----------|-----------|-------------|------|
| Drain-Source Voltage                      |          | $V_{DS}$  | 60          | V    |
| Gate-Source Voltage                       |          | $V_{GS}$  | $\pm 20$    | V    |
| Drain Current-Continuous <sup>Note3</sup> | TC=25°C  | $I_D$     | 30          | A    |
|                                           | TC=100°C |           | 20          | A    |
| Drain Current-Pulsed <sup>Note1</sup>     |          | $I_{DM}$  | 120         | A    |
| Avalanche Energy <sup>Note4</sup>         |          | $E_{AS}$  | 72          | mJ   |
| Maximum Power Dissipation                 | TC=25°C  | $P_D$     | 55          | W    |
| Storage Temperature Range                 |          | $T_{STG}$ | -55 to +150 | °C   |
| Operating Junction Temperature Range      |          | $T_J$     | -55 to +150 | °C   |

### Thermal Resistance

| Parameter                            | Symbol          | Min. | Typ. | Max | Unit |
|--------------------------------------|-----------------|------|------|-----|------|
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | -    | -    | 2.7 | °C/W |

**Electrical Characteristics(T<sub>J</sub>=25℃ unless otherwise noted)**

| OFF CHARACTERISTICS             |                   |                                             |      |      |      |      |
|---------------------------------|-------------------|---------------------------------------------|------|------|------|------|
| Parameter                       | Symbol            | Conditions                                  | Min. | Typ. | Max. | Unit |
| Drain-Source Breakdown Voltage  | BV <sub>DSS</sub> | V <sub>GS</sub> =0V, I <sub>DS</sub> =250uA | 60   | -    | -    | V    |
| Zero Gate Voltage Drain Current | I <sub>DSS</sub>  | V <sub>DS</sub> =60V, V <sub>GS</sub> =0V   | -    | -    | 1    | uA   |
| Gate-Body Leakage               | I <sub>GSS</sub>  | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V  | -    | -    | ±100 | nA   |

| ON CHARACTERISTICS               |                     |                                                           |      |      |      |      |
|----------------------------------|---------------------|-----------------------------------------------------------|------|------|------|------|
| Parameter                        | Symbol              | Conditions                                                | Min. | Typ. | Max. | Unit |
| Gate Threshold Voltage           | V <sub>GS(TH)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =250uA | 1.0  | 1.6  | 2.5  | V    |
| Drain-Source On-State Resistance | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>DS</sub> =15A                | -    | 25   | 35   | mΩ   |
|                                  |                     | V <sub>GS</sub> =4.5V, I <sub>DS</sub> =10A               | -    | 30   | 40   | mΩ   |

| DYNAMIC CHARACTERISTICS      |                  |                                                       |      |      |      |      |
|------------------------------|------------------|-------------------------------------------------------|------|------|------|------|
| Parameter                    | Symbol           | Conditions                                            | Min. | Typ. | Max. | Unit |
| Input Capacitance            | C <sub>iss</sub> | V <sub>DS</sub> =25V, V <sub>GS</sub> = 0V,<br>f=1MHz | -    | 1562 | -    | pF   |
| Output Capacitance           | C <sub>OSS</sub> |                                                       | -    | 75.4 | -    |      |
| Reverse Transfer Capacitance | C <sub>rss</sub> |                                                       | -    | 66.8 | -    |      |

| SWITCHING CHARACTERISTICS   |                     |                                                                                              |      |      |      |      |
|-----------------------------|---------------------|----------------------------------------------------------------------------------------------|------|------|------|------|
| Parameter                   | Symbol              | Conditions                                                                                   | Min. | Typ. | Max. | Unit |
| Turn-On Delay Time          | T <sub>d(on)</sub>  | V <sub>GS</sub> =10V, V <sub>DS</sub> =30V,<br>R <sub>GEN</sub> =1.8Ω<br>I <sub>D</sub> =15A | -    | 7.5  | -    | ns   |
| Rise Time                   | t <sub>r</sub>      |                                                                                              | -    | 21   | -    |      |
| Turn-Off Delay Time         | T <sub>d(off)</sub> |                                                                                              | -    | 16   | -    |      |
| Fall Time                   | t <sub>f</sub>      |                                                                                              | -    | 23.5 | -    |      |
| Total Gate Charge at 10V    | Q <sub>g</sub>      | V <sub>DS</sub> =30V, I <sub>DS</sub> =15A,<br>V <sub>GS</sub> =10V                          | -    | 25   | -    | nC   |
| Gate to Source Gate Charge  | Q <sub>gs</sub>     |                                                                                              | -    | 4.5  | -    |      |
| Gate to Drain“Miller”Charge | Q <sub>gd</sub>     |                                                                                              | -    | 6.5  | -    |      |

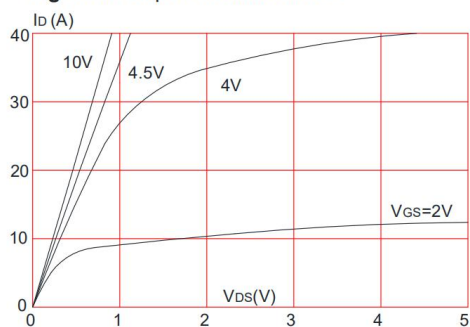
| DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS |                 |                                                           |      |      |      |      |
|--------------------------------------------------------|-----------------|-----------------------------------------------------------|------|------|------|------|
| Parameter                                              | Symbol          | Conditions                                                | Min. | Typ. | Max. | Unit |
| Drain-Source Diode Forward Voltage                     | V <sub>SD</sub> | V <sub>GS</sub> =0V, I <sub>DS</sub> =15A                 | -    | -    | 1.2  | V    |
| Reverse Recovery Time                                  | t <sub>rr</sub> | T <sub>J</sub> =25℃, I <sub>F</sub> =15A<br>di/dt=100A/us | -    | 29   | -    | nS   |
| Reverse Recovery Charge                                | Q <sub>rr</sub> |                                                           | -    | 45   | -    | nC   |

**Notes:**

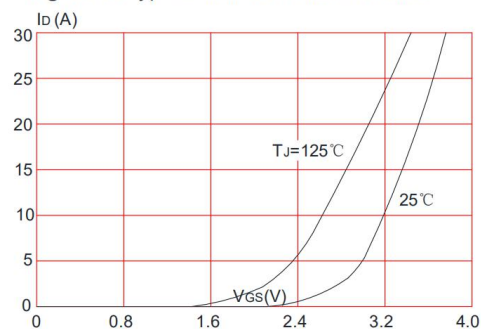
- 1: Repetitive rating, pulse width limited by maximum junction temperature.
- 2: Surface mounted on FR4 Board, t≤10sec.
- 3: Pulse width ≤ 300μs, duty cycle ≤ 2%.
- 4: EAS condition: L=0.5mH, VDD=30V, V<sub>G</sub>=10V, V<sub>GATE</sub>=60V, Start T<sub>J</sub>=25℃.

## Typical Performance Characteristics

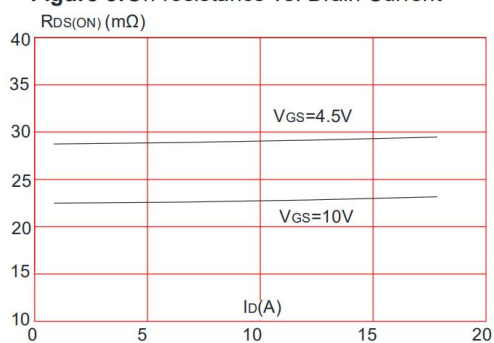
**Figure 1: Output Characteristics**



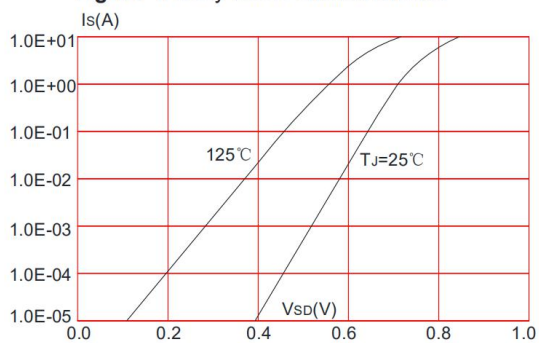
**Figure 2: Typical Transfer Characteristics**



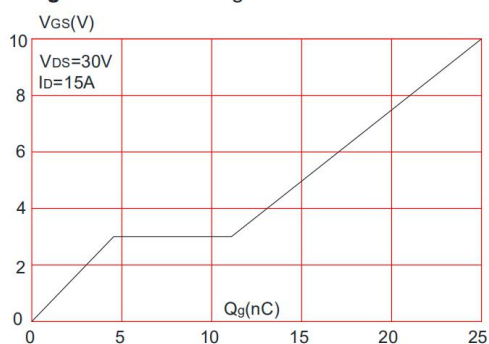
**Figure 3: On-resistance vs. Drain Current**



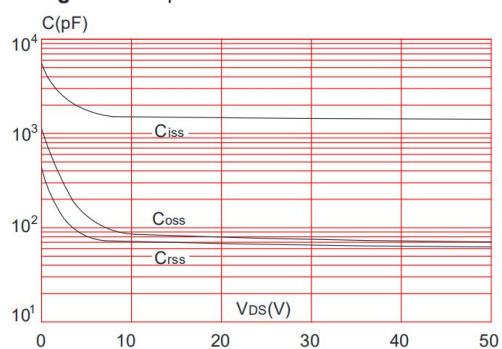
**Figure 4: Body Diode Characteristics**



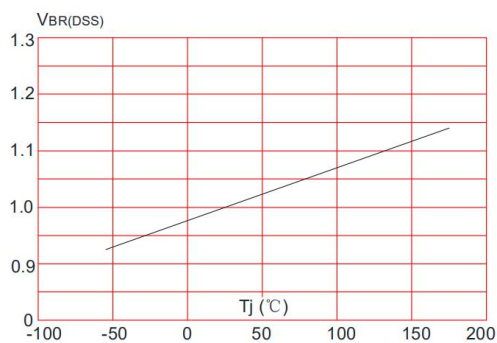
**Figure 5: Gate Charge Characteristics**



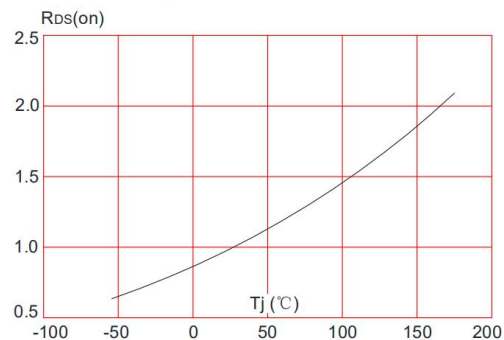
**Figure 6: Capacitance Characteristics**



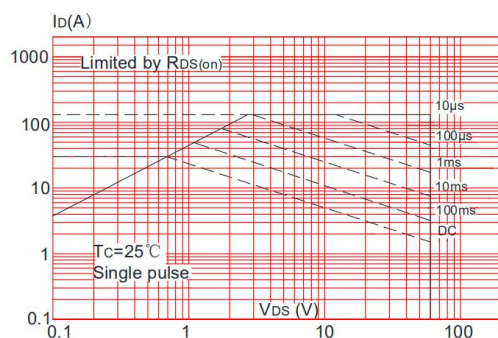
**Figure 7:** Normalized Breakdown Voltage vs. Junction Temperature



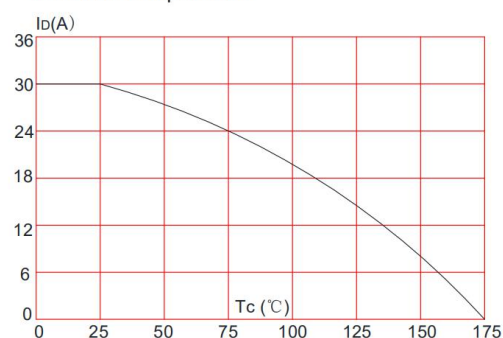
**Figure 8:** Normalized on Resistance vs. Junction Temperature



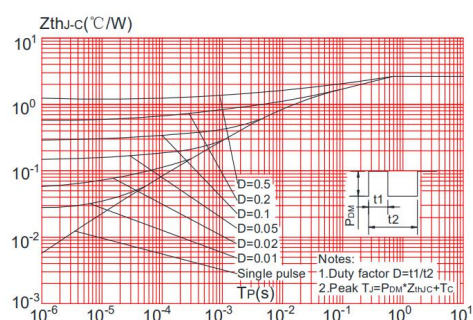
**Figure 9:** Maximum Safe Operating Area



**Figure 10:** Maximum Continuous Drain Current vs. Case Temperature



**Figure.11:** Maximum Effective Transient Thermal Impedance, Junction-to-Case



## Test Circuit

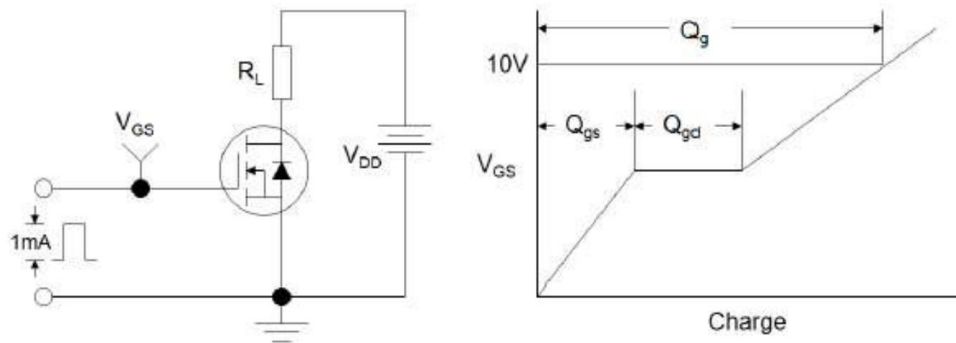


Figure1:Gate Charge Test Circuit & Waveform

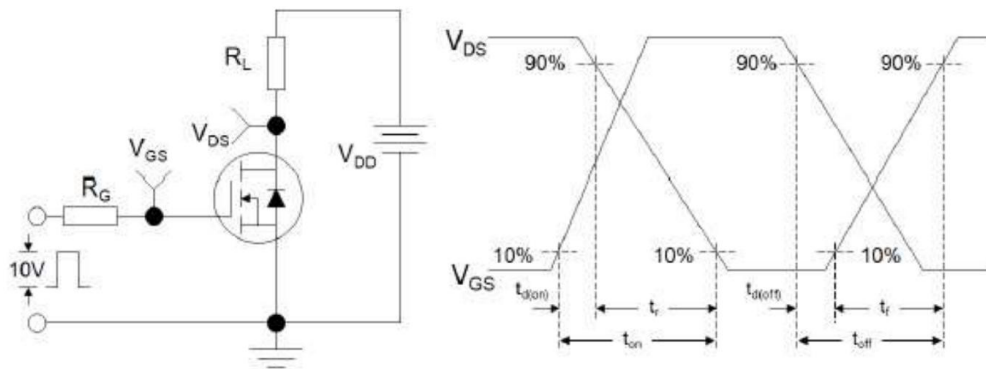


Figure 2: Resistive Switching Test Circuit & Waveforms

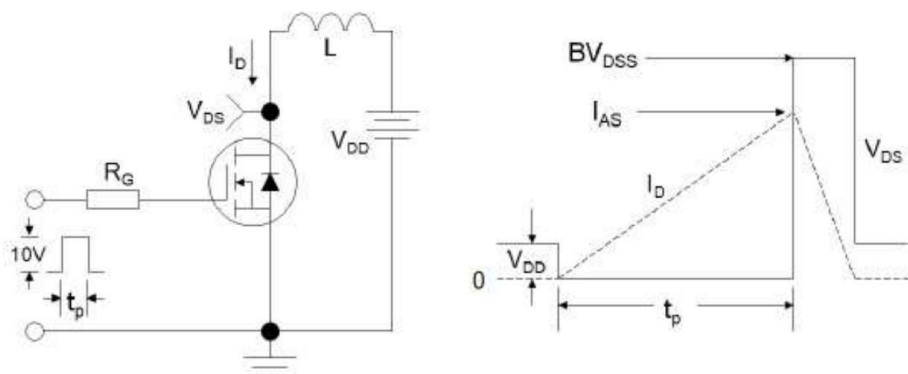
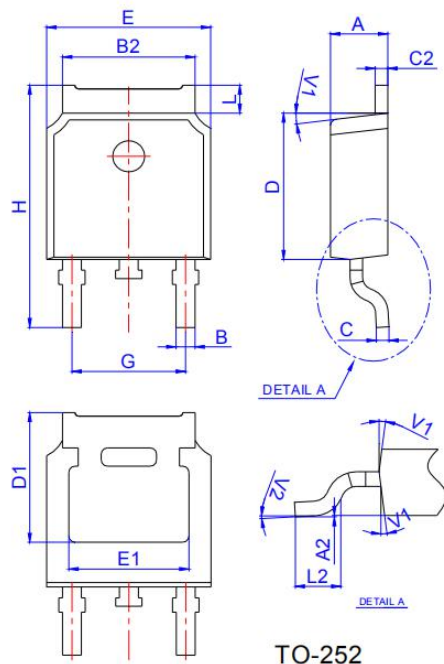


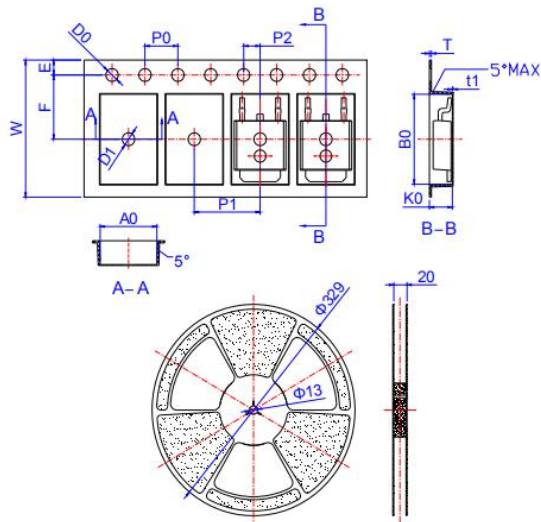
Figure 3:Unclamped Inductive Switching Test Circuit & Waveforms

## Package Mechanical Data



| Ref. | Dimensions  |      |       |          |      |       |
|------|-------------|------|-------|----------|------|-------|
|      | Millimeters |      |       | Inches   |      |       |
|      | Min.        | Typ. | Max.  | Min.     | Typ. | Max.  |
| A    | 2.10        |      | 2.50  | 0.083    |      | 0.098 |
| A2   | 0           |      | 0.10  | 0        |      | 0.004 |
| B    | 0.66        |      | 0.86  | 0.026    |      | 0.034 |
| B2   | 5.18        |      | 5.48  | 0.202    |      | 0.216 |
| C    | 0.40        |      | 0.60  | 0.016    |      | 0.024 |
| C2   | 0.44        |      | 0.58  | 0.017    |      | 0.023 |
| D    | 5.90        |      | 6.30  | 0.232    |      | 0.248 |
| D1   | 5.30REF     |      |       | 0.209REF |      |       |
| E    | 6.40        |      | 6.80  | 0.252    |      | 0.268 |
| E1   | 4.63        |      |       | 0.182    |      |       |
| G    | 4.47        |      | 4.67  | 0.176    |      | 0.184 |
| H    | 9.50        |      | 10.70 | 0.374    |      | 0.421 |
| L    | 1.09        |      | 1.21  | 0.043    |      | 0.048 |
| L2   | 1.35        |      | 1.65  | 0.053    |      | 0.065 |
| V1   |             | 7°   |       |          | 7°   |       |
| V2   | 0°          |      | 6°    | 0°       |      | 6°    |

## Reel Specification-TO-252



| Ref. | Dimensions  |       |       |        |       |       |
|------|-------------|-------|-------|--------|-------|-------|
|      | Millimeters |       |       | Inches |       |       |
|      | Min.        | Typ.  | Max.  | Min.   | Typ.  | Max.  |
| W    | 15.90       | 16.00 | 16.10 | 0.626  | 0.630 | 0.634 |
| E    | 1.65        | 1.75  | 1.85  | 0.065  | 0.069 | 0.073 |
| F    | 7.40        | 7.50  | 7.60  | 0.291  | 0.295 | 0.299 |
| D0   | 1.40        | 1.50  | 1.60  | 0.055  | 0.059 | 0.063 |
| D1   | 1.40        | 1.50  | 1.60  | 0.055  | 0.059 | 0.063 |
| P0   | 3.90        | 4.00  | 4.10  | 0.154  | 0.157 | 0.161 |
| P1   | 7.90        | 8.00  | 8.10  | 0.311  | 0.315 | 0.319 |
| P2   | 1.90        | 2.00  | 2.10  | 0.075  | 0.079 | 0.083 |
| A0   | 6.85        | 6.90  | 7.00  | 0.270  | 0.271 | 0.276 |
| B0   | 10.45       | 10.50 | 10.60 | 0.411  | 0.413 | 0.417 |
| K0   | 2.68        | 2.78  | 2.88  | 0.105  | 0.109 | 0.113 |
| T    | 0.24        |       | 0.27  | 0.009  |       | 0.011 |
| t1   | 0.10        |       |       | 0.004  |       |       |
| 10P0 | 39.80       | 40.00 | 40.20 | 1.567  | 1.575 | 1.583 |