



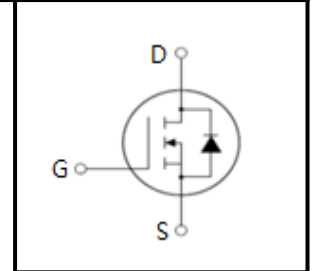
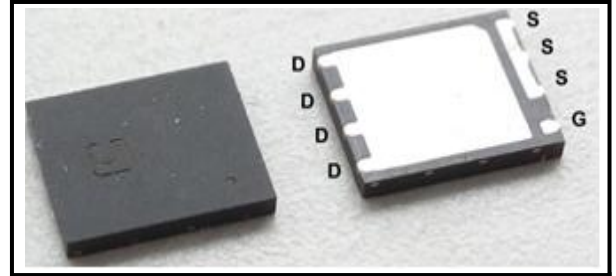
## 60V N-Channel DTMOS

### FEATURES

- Trench Power DTMOS Technology
- Low  $R_{DS(ON)}$
- Low Gate Charge
- Optimized for Fast-switching Applications

### APPLICATIONS

- Synchronous Rectification in DC/DC and AC/DC Converters
- Isolated DC/DC Converters in Telecom and Industrial



### Device Marking and Package Information

| Device    | Package | Marking |
|-----------|---------|---------|
| TSG12N06A | DFN5×6  | 12N06A  |

### Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ , unless otherwise noted

| Parameter  | Symbol         | Value    | Unit             |
|--|----------------|----------|------------------|
| Drain-Source Voltage ( $V_{GS} = 0\text{V}$ )    | $V_{DSS}$      | 60       | V                |
| Continuous Drain Current                         | $I_D$          | 64       | A                |
| Pulsed Drain Current (note1)                     | $I_{DM}$       | 256      | A                |
| Gate-Source Voltage                              | $V_{GSS}$      | $\pm 20$ | V                |
| Single Pulse Avalanche Energy (note2)            | $E_{AS}$       | 65       | mJ               |
| Avalanche Current (note1)                        | $I_{AS}$       | 36       | A                |
| Power Dissipation ( $T_C = 25^\circ\text{C}$ )   | $P_D$          | 56.5     | W                |
| Operating Junction and Storage Temperature Range | $T_J, T_{stg}$ | -55~+150 | $^\circ\text{C}$ |

### Thermal Resistance

| Parameter                               | Symbol     | Value | Unit                      |
|---|------------|-------|---------------------------|
| Thermal Resistance, Junction-to-Case    | $R_{thJC}$ | 1.7   | $^\circ\text{C}/\text{W}$ |
| Thermal Resistance, Junction-to-Ambient | $R_{thJA}$ | 50    |                           |



| Specifications $T_J = 25^\circ\text{C}$ , unless otherwise noted |               |  |       |      |           |            |
|--|---------------|--|-------|------|-----------|------------|
| Parameter  | Symbol        | Test Conditions  | Value |      |           | Unit       |
|  |               |  | Min.  | Typ. | Max.      |            |
| <b>Static</b>  |               |  |       |      |           |            |
| Drain-Source Breakdown Voltage                                   | $V_{(BR)DSS}$ | $V_{GS} = 0V, I_D = 250\mu A$                            | 60    | --   | --        | V          |
| Zero Gate Voltage Drain Current                                  | $I_{DSS}$     | $V_{DS} = 60V, V_{GS} = 0V, T_J = 25^\circ\text{C}$      | --    | --   | 1         | $\mu A$    |
|  |               | $V_{DS} = 60V, V_{GS} = 0V, T_J = 150^\circ\text{C}$     | --    | --   | 100       |            |
| Gate-Source Leakage  | $I_{GSS}$     | $V_{GS} = \pm 20V$                                       | --    | --   | $\pm 100$ | nA         |
| Gate-Source Threshold Voltage                                    | $V_{GS(th)}$  | $V_{DS} = V_{GS}, I_D = 250\mu A$                        | 2.5   | --   | 4         | V          |
| Drain-Source On-Resistance (Note3)                               | $R_{DS(on)}$  | $V_{GS} = 10V, I_D = 20A$                                | --    | 6.5  | 9         | m $\Omega$ |
| Forward Transconductance (Note3)                                 | $g_{fs}$      | $V_{DS} = 5V, I_D = 20A$                                 | --    | 85   | --        | S          |
| <b>Dynamic</b>   |               |  |       |      |           |            |
| Input Capacitance  | $C_{iss}$     | $V_{GS} = 0V,$<br>$V_{DS} = 30V,$<br>$f = 1.0\text{MHz}$ | --    | 2455 | --        | pF         |
| Output Capacitance   | $C_{oss}$     |  | --    | 240  | --        |            |
| Reverse Transfer Capacitance                                     | $C_{rss}$     |  | --    | 34   | --        |            |
| Total Gate Charge  | $Q_g$         | $V_{DD} = 30V, I_D = 20A,$<br>$V_{GS} = 10V$             | --    | 45   | --        | nC         |
| Gate-Source Charge   | $Q_{gs}$      |  | --    | 13.5 | --        |            |
| Gate-Drain Charge  | $Q_{gd}$      |  | --    | 11.5 | --        |            |
| Turn-on Delay Time   | $t_{d(on)}$   | $V_{DD} = 30V, I_D = 20A,$<br>$R_G = 3\Omega$            | --    | 8    | --        | ns         |
| Turn-on Rise Time  | $t_r$         |  | --    | 3    | --        |            |
| Turn-off Delay Time  | $t_{d(off)}$  |  | --    | 25   | --        |            |
| Turn-off Fall Time   | $t_f$         |  | --    | 4    | --        |            |
| <b>Drain-Source Body Diode Characteristics</b>                   |               |  |       |      |           |            |
| Continuous Body Diode Current                                    | $I_S$         | $T_C = 25^\circ\text{C}$                                 | --    | --   | 46        | A          |
| Pulsed Diode Forward Current                                     | $I_{SM}$      |  | --    | --   | 138       |            |
| Body Diode Voltage   | $V_{SD}$      | $T_J = 25^\circ\text{C}, I_{SD} = 1A, V_{GS} = 0V$       | --    | 0.72 | 1         | V          |
| Reverse Recovery Time  | $t_{rr}$      | $I_F = 20A,$<br>$di_F/dt = 500A/\mu s$                   | --    | 25   | --        | ns         |
| Reverse Recovery Charge  | $Q_{rr}$      |  | --    | 110  | --        | nC         |

**Notes**

1. Repetitive Rating: Pulse Width limited by maximum junction temperature
2.  $I_{AS} = 36A, V_{DD} = 50V, R_G = 25\Omega, \text{Starting } T_J = 25^\circ\text{C}$
3. Pulse Test: Pulse Width  $\leq 300\mu s, \text{Duty Cycle } \leq 1\%$



Typical Characteristics  $T_J = 25^\circ\text{C}$ , unless otherwise noted

Figure 1. Output Characteristics

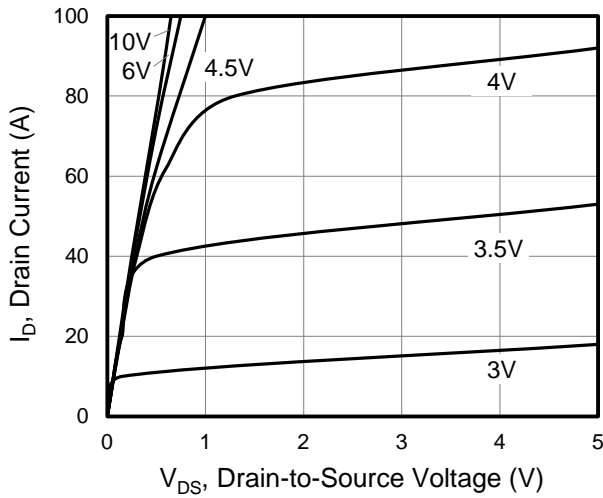


Figure 2. Transfer Characteristics

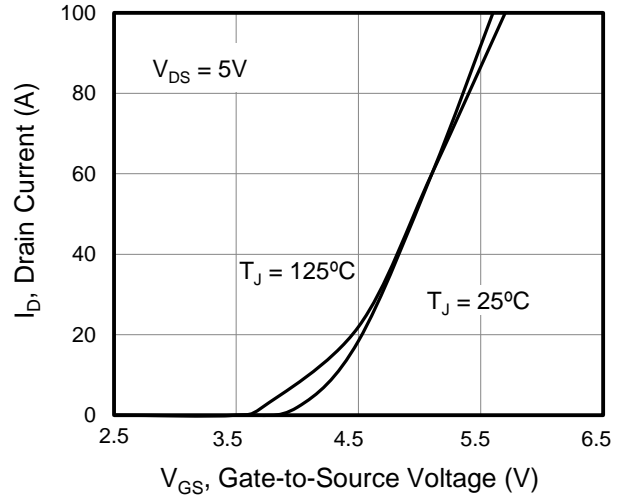


Figure 3. On-Resistance vs. Drain Current

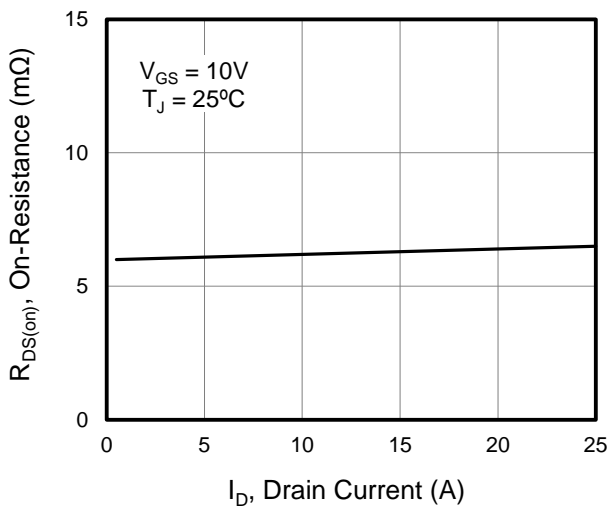


Figure 4. Capacitance

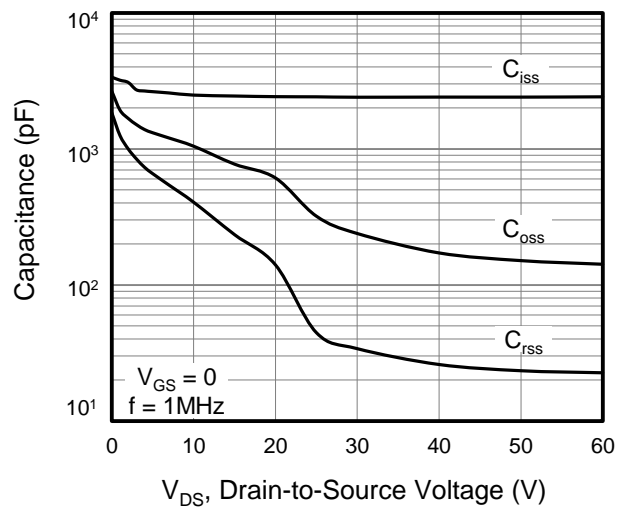


Figure 5. Gate Charge

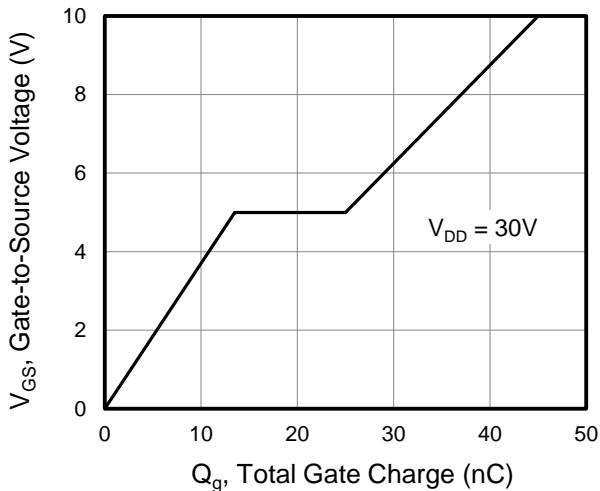
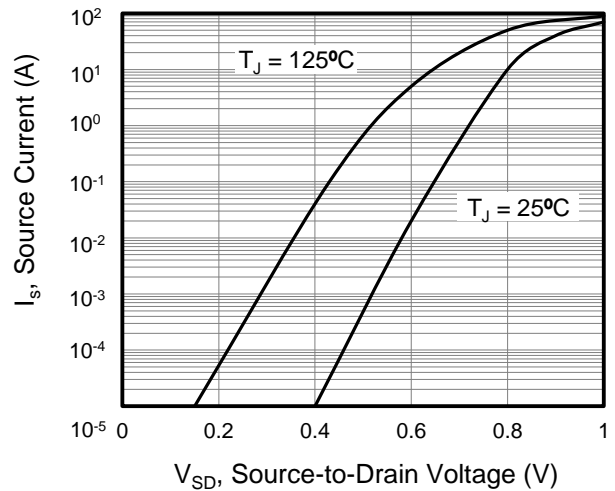


Figure 6. Body Diode Forward Voltage





Typical Characteristics  $T_J = 25^\circ\text{C}$ , unless otherwise noted

Figure 7. On-Resistance vs. Junction Temperature

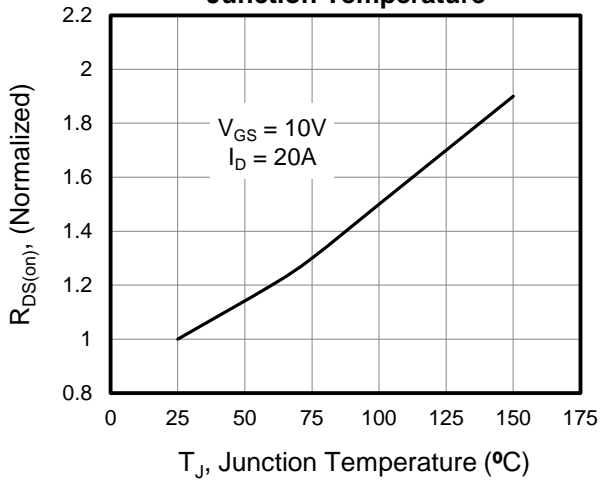


Figure 8. Threshold Voltage vs. Junction Temperature

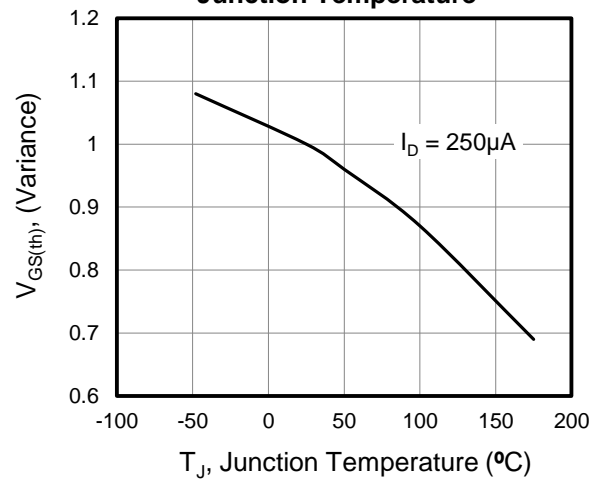


Figure 9. Transient Thermal Impedance

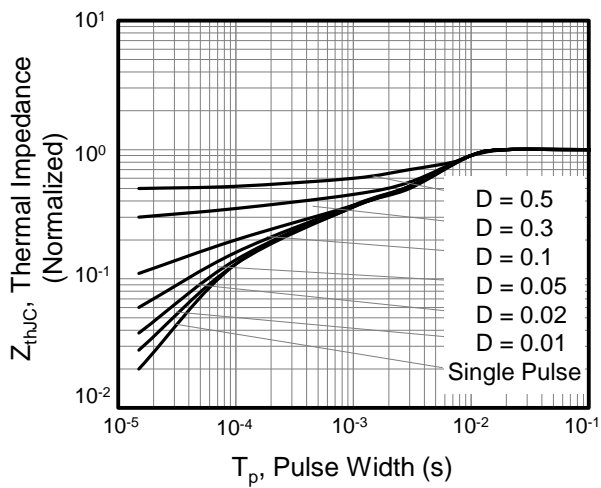




Figure A: Gate Charge Test Circuit and Waveform



Figure B: Resistive Switching Test Circuit and Waveform

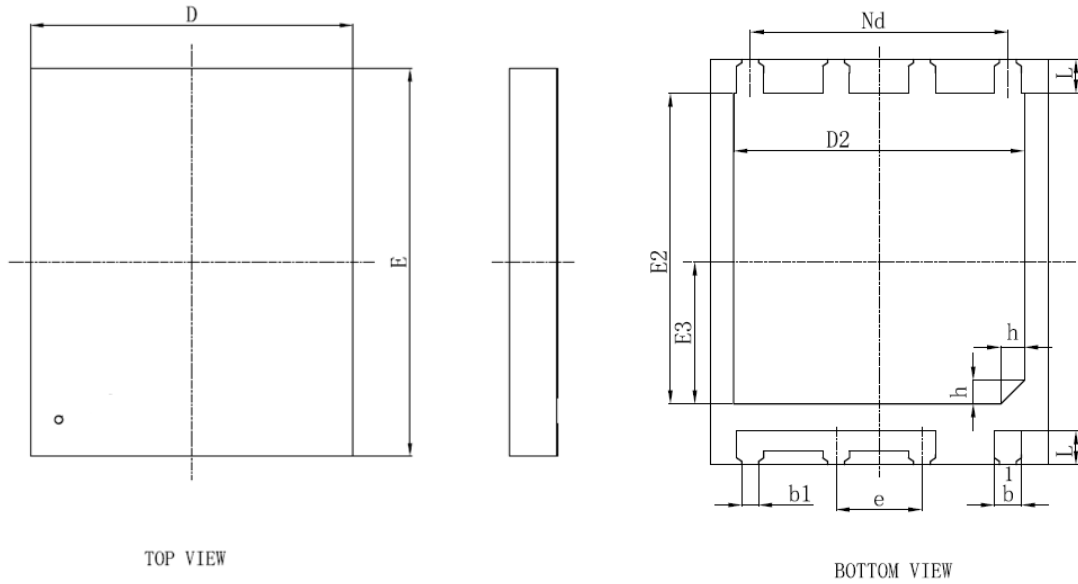


Figure C: Unclamped Inductive Switching Test Circuit and Waveform



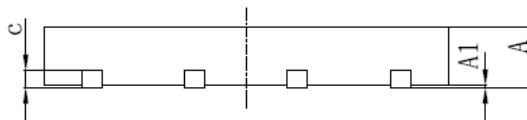


### DFN5×6



TOP VIEW

BOTTOM VIEW



TOP VIEW

| SYMBOL | MILLIMETER |       |      |
|--------|------------|-------|------|
|        | MIN        | NOM   | MAX  |
| A      | 0.70       | 0.75  | 0.80 |
| A1     | 0          | 0.02  | 0.05 |
| b      | 0.35       | 0.40  | 0.45 |
| b1     | 0.25REF    |       |      |
| c      | 0.18       | 0.203 | 0.25 |
| D      | 4.90       | 5.00  | 5.10 |
| D2     | 4.20       | 4.30  | 4.40 |

| SYMBOL | MILLIMETER |      |      |
|--------|------------|------|------|
|        | MIN        | NOM  | MAX  |
| Nd     | 3.81BSC    |      |      |
| e      | 1.27BSC    |      |      |
| E      | 5.90       | 6.00 | 6.10 |
| E2     | 4.50       | 4.60 | 4.70 |
| E3     | 2.00       | 2.10 | 2.20 |
| L      | 0.45       | 0.50 | 0.55 |
| h      | 0.30       | 0.35 | 0.40 |



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