



## STN1NC60

N-CHANNEL 600V - 12Ω - 0.3A - SOT-223

PowerMesh™II MOSFET

| TYPE     | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> |
|----------|------------------|---------------------|----------------|
| STN1NC60 | 600 V            | <15Ω                | 0.3 A          |

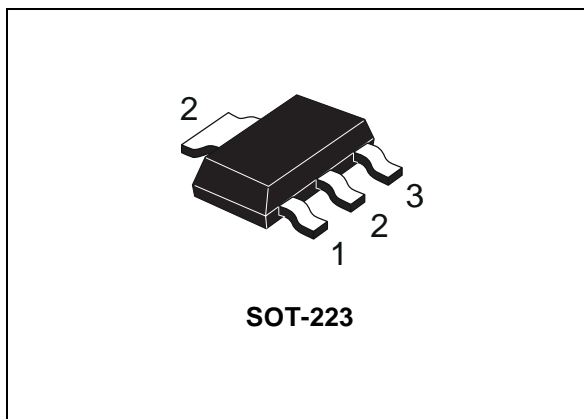
- TYPICAL R<sub>DS(on)</sub> = 12Ω
- EXTREMELY HIGH dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- NEW HIGH VOLTAGE BENCHMARK
- GATE CHARGE MINIMIZED

### DESCRIPTION

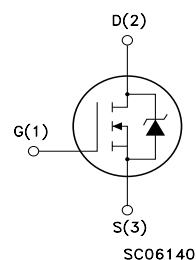
The PowerMESH™II is the evolution of the first generation of MESH OVERLAY™. The layout refinements introduced greatly improve the Ron\*area figure of merit while keeping the device at the leading edge for what concerns switching speed, gate charge and ruggedness.

### APPLICATIONS

- AC ADAPTORS AND BATTERY CHARGERS
- SWITCH MODE POWER SUPPLIES (SMPS)



### INTERNAL SCHEMATIC DIAGRAM



### ABSOLUTE MAXIMUM RATINGS

| Symbol                         | Parameter  | Value      | Unit |
|--------------------------------|--|------------|------|
| V <sub>DS</sub>                | Drain-source Voltage (V <sub>GS</sub> = 0)           | 600        | V    |
| V <sub>DGR</sub>               | Drain-gate Voltage (R <sub>GS</sub> = 20 kΩ)         | 600        | V    |
| V <sub>GS</sub>                | Gate- source Voltage                                 | ±30        | V    |
| I <sub>D</sub>                 | Drain Current (continuous) at T <sub>C</sub> = 25°C  | 0.3        | A    |
| I <sub>D</sub>                 | Drain Current (continuous) at T <sub>C</sub> = 100°C | 0.18       | A    |
| I <sub>DM</sub> <sup>(1)</sup> | Drain Current (pulsed)                               | 1.2        | A    |
| P <sub>TOT</sub>               | Total Dissipation at T <sub>C</sub> = 25°C           | 2.5        | W    |
|                                | Derating Factor                                      | 0.02       | W/°C |
| dv/dt                          | Peak Diode Recovery voltage slope                    | 3          | V/ns |
| T <sub>stg</sub>               | Storage Temperature                                  | -60 to 150 | °C   |
| T <sub>j</sub>                 | Max. Operating Junction Temperature                  | 150        | °C   |

(\*)Pulse width limited by safe operating area

(1)I<sub>SD</sub> ≤ 0.3A, di/dt ≤ 100A/μs, V<sub>DD</sub> ≤ V<sub>(BR)DSS</sub>, T<sub>j</sub> ≤ T<sub>JMAX</sub>

## STN1NC60

### THERMAL DATA

|                |  |     |                    |
|----------------|--|-----|--------------------|
| Rthj-pcb       | Thermal Resistance Junction-PC Board                         | 50  | °C/W<br>°C/W<br>°C |
| Rthj-amb       | Thermal Resistance Junction-ambient Max<br>(Surface Mounted) | 60  |                    |
| T <sub>l</sub> | Maximum Lead Temperature For Soldering Purpose               | 260 |                    |

### AVALANCHE CHARACTERISTICS

| Symbol          | Parameter   | Max Value | Unit |
|-----------------|---|-----------|------|
| I <sub>AR</sub> | Avalanche Current, Repetitive or Not-Repetitive<br>(pulse width limited by T <sub>j</sub> max)                                | 0.3       | A    |
| E <sub>AS</sub> | Single Pulse Avalanche Energy<br>(starting T <sub>j</sub> = 25 °C, I <sub>D</sub> = I <sub>AR</sub> , V <sub>DD</sub> = 50 V) | 60        | mJ   |

### ELECTRICAL CHARACTERISTICS (TCASE = 25 °C UNLESS OTHERWISE SPECIFIED)

#### OFF

| Symbol               | Parameter  | Test Conditions   | Min. | Typ. | Max.    | Unit     |
|----------------------|--|---|------|------|---------|----------|
| V <sub>(BR)DSS</sub> | Drain-source<br>Breakdown Voltage                        | I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0  | 600  |      |         | V        |
| I <sub>DSS</sub>     | Zero Gate Voltage<br>Drain Current (V <sub>GS</sub> = 0) | V <sub>DS</sub> = Max Rating<br>V <sub>DS</sub> = Max Rating, T <sub>C</sub> = 125 °C |      |      | 1<br>50 | μA<br>μA |
| I <sub>GSS</sub>     | Gate-body Leakage<br>Current (V <sub>DS</sub> = 0)       | V <sub>GS</sub> = ±30V  |      |      | ±100    | nA       |

#### ON (1)

| Symbol              | Parameter                            | Test Conditions  | Min. | Typ. | Max. | Unit |
|---------------------|--------------------------------------|--|------|------|------|------|
| V <sub>GS(th)</sub> | Gate Threshold Voltage               | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA                               | 2    | 3    | 4    | V    |
| R <sub>DS(on)</sub> | Static Drain-source On<br>Resistance | V <sub>GS</sub> = 10V, I <sub>D</sub> = 0.5 A  |      | 12   | 15   | Ω    |
| I <sub>D(on)</sub>  | On State Drain Current               | V <sub>DS</sub> > I <sub>D(on)</sub> × R <sub>DS(on)max</sub> ,<br>V <sub>GS</sub> = 10V | 1    |      |      | A    |

### DYNAMIC

| Symbol              | Parameter                       | Test Conditions  | Min. | Typ. | Max. | Unit |
|---------------------|---------------------------------|--|------|------|------|------|
| g <sub>fs</sub> (1) | Forward Transconductance        | V <sub>DS</sub> > I <sub>D(on)</sub> × R <sub>DS(on)max</sub> ,<br>I <sub>D</sub> = 0.5A |      | 0.87 |      | S    |
| C <sub>iss</sub>    | Input Capacitance               | V <sub>DS</sub> = 25V, f = 1 MHz, V <sub>GS</sub> = 0                                    |      | 108  |      | pF   |
| C <sub>oss</sub>    | Output Capacitance              |  |      | 18   |      | pF   |
| C <sub>rss</sub>    | Reverse Transfer<br>Capacitance |  |      | 2.5  |      | pF   |

**ELECTRICAL CHARACTERISTICS (CONTINUED)**

**SWITCHING ON**

| Symbol               | Parameter                       | Test Conditions  | Min. | Typ.     | Max. | Unit     |
|----------------------|---------------------------------|--|------|----------|------|----------|
| $t_{d(on)}$<br>$t_r$ | Turn-on Delay Time<br>Rise Time | $V_{DD} = 300V, I_D = 0.5A$<br>$R_G = 4.7\Omega, V_{GS} = 10V$<br>(see test circuit, Figure 3) |      | 7.2<br>8 |      | ns<br>ns |
| $Q_g$                | Total Gate Charge               | $V_{DD} = 480V, I_D = 1A,$<br>$V_{GS} = 10V$   |      | 7.3      | 10   | nC       |
| $Q_{gs}$             | Gate-Source Charge              |  |      | 3.4      |      | nC       |
| $Q_{gd}$             | Gate-Drain Charge               |  |      | 2.5      |      | nC       |

**SWITCHING OFF**

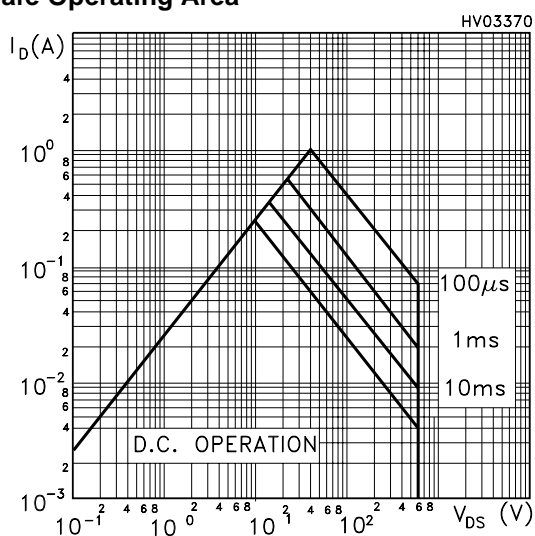
| Symbol        | Parameter             | Test Conditions   | Min. | Typ. | Max. | Unit |
|---------------|-----------------------|---|------|------|------|------|
| $t_{r(Voff)}$ | Off-voltage Rise Time | $V_{DD} = 480V, I_D = 1A,$<br>$R_G = 4.7\Omega, V_{GS} = 10V$<br>(see test circuit, Figure 5) |      | 33   |      | ns   |
| $t_f$         | Fall Time             |   |      | 11   |      | ns   |
| $t_c$         | Cross-over Time       |   |      | 43   |      | ns   |

**SOURCE DRAIN DIODE**

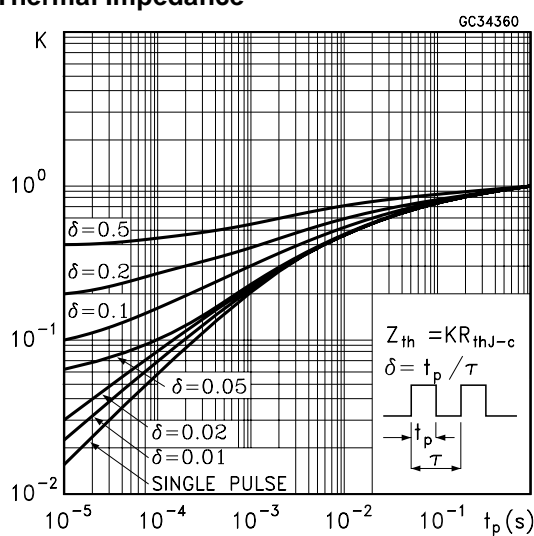
| Symbol       | Parameter                     | Test Conditions   | Min. | Typ. | Max. | Unit    |
|--------------|-------------------------------|---|------|------|------|---------|
| $I_{SD}$     | Source-drain Current          |   |      |      | 0.3  | A       |
| $I_{SDM(2)}$ | Source-drain Current (pulsed) |   |      |      | 1.2  | A       |
| $V_{SD(1)}$  | Forward On Voltage            | $I_{SD} = 0.3 A, V_{GS} = 0$  |      |      | 1.6  | V       |
| $t_{rr}$     | Reverse Recovery Time         | $I_{SD} = 1A, di/dt = 100A/\mu s,$<br>$V_{DD} = 25V, T_j = 150^\circ C$<br>(see test circuit, Figure 5) |      | 450  |      | ns      |
| $Q_{rr}$     | Reverse Recovery Charge       |   |      | 720  |      | $\mu C$ |
| $I_{RRM}$    | Reverse Recovery Current      |   |      | 3.2  |      | A       |

Note: 1. Pulsed: Pulse duration = 300  $\mu s$ , duty cycle 1.5 %.  
2. Pulse width limited by safe operating area.

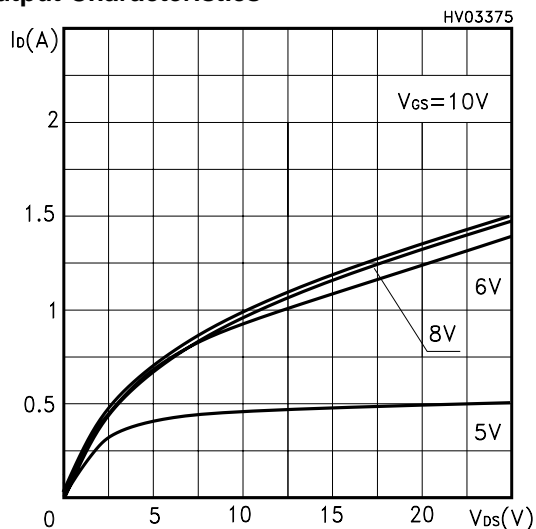
**Safe Operating Area**



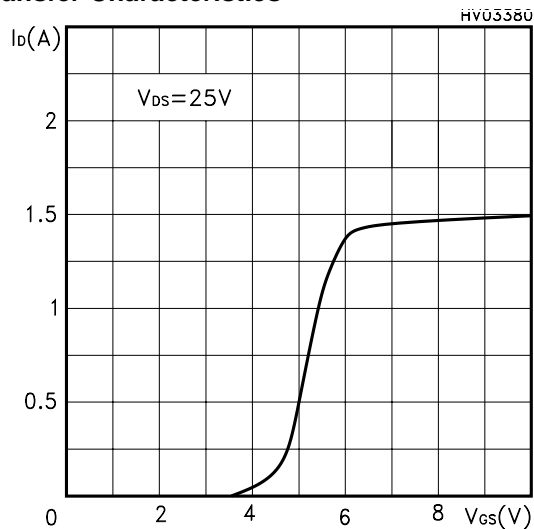
**Thermal Impedance**



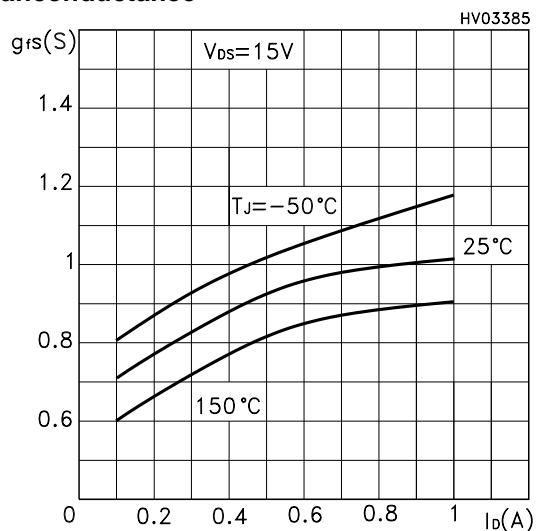
Output Characteristics



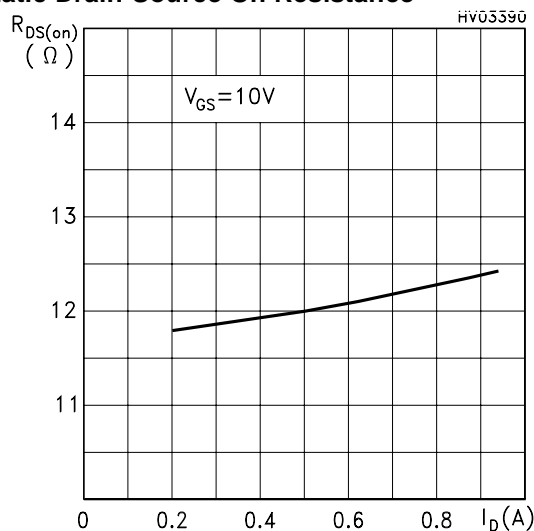
Transfer Characteristics



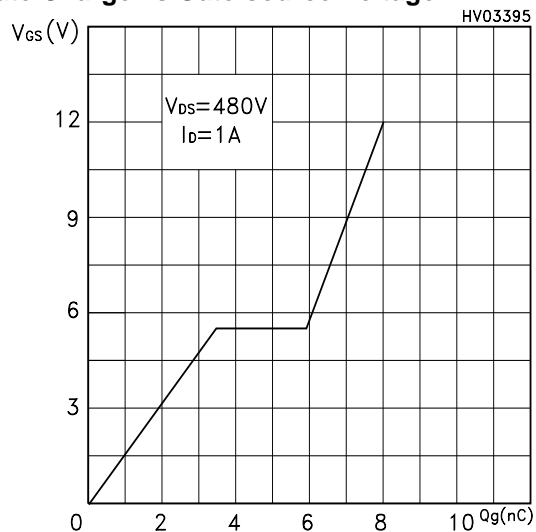
Tranconductance



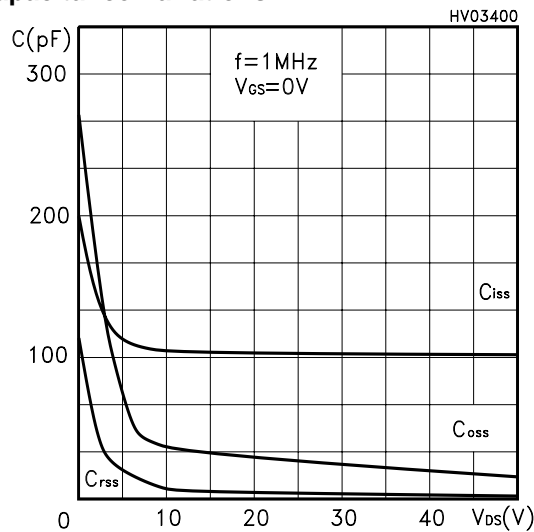
Static Drain-Source On Resistance



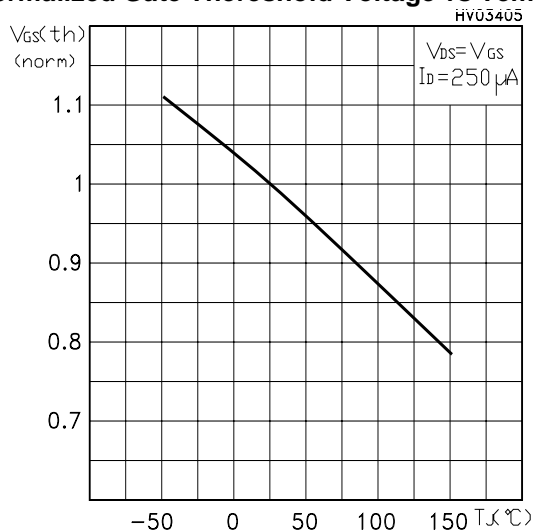
Gate Charge vs Gate-source Voltage



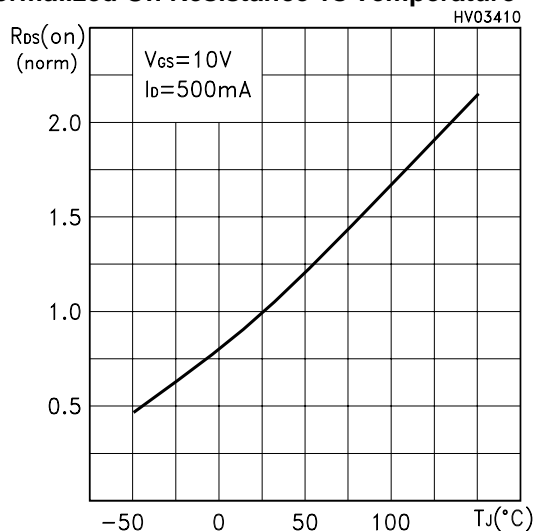
Capacitance Variations



Normalized Gate Threshold Voltage vs Temp.



Normalized On Resistance vs Temperature



Source-drain Diode Forward Characteristics

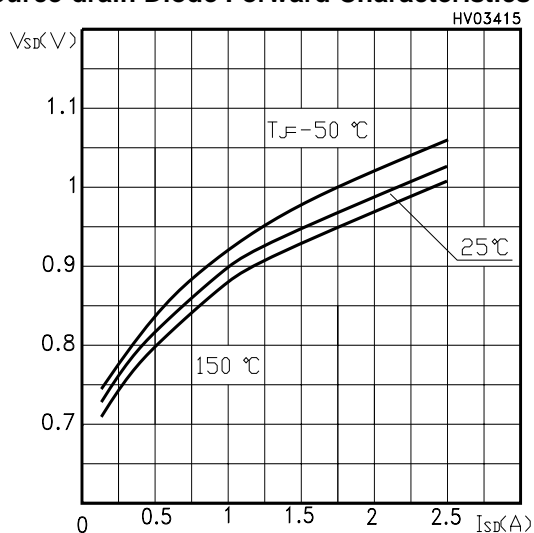


Fig. 1: Unclamped Inductive Load Test Circuit



Fig. 2: Unclamped Inductive Waveform



Fig. 3: Switching Times Test Circuits For Resistive Load



Fig. 4: Gate Charge test Circuit

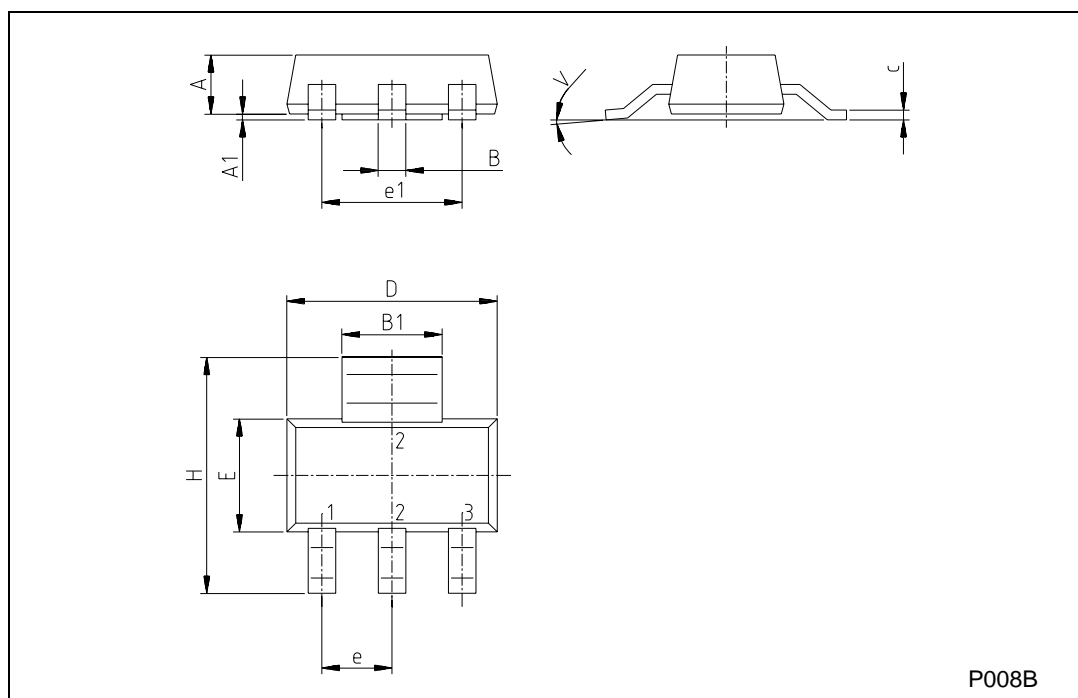


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



## SOT-223 MECHANICAL DATA

| DIM. | mm   |      |      | inch  |       |       |
|------|------|------|------|-------|-------|-------|
|      | MIN. | TYP. | MAX. | MIN.  | TYP.  | MAX.  |
| A    |      |      | 1.80 |       |       | 0.071 |
| B    | 0.60 | 0.70 | 0.80 | 0.024 | 0.027 | 0.031 |
| B1   | 2.90 | 3.00 | 3.10 | 0.114 | 0.118 | 0.122 |
| c    | 0.24 | 0.26 | 0.32 | 0.009 | 0.010 | 0.013 |
| D    | 6.30 | 6.50 | 6.70 | 0.248 | 0.256 | 0.264 |
| e    |      | 2.30 |      |       | 0.090 |       |
| e1   |      | 4.60 |      |       | 0.181 |       |
| E    | 3.30 | 3.50 | 3.70 | 0.130 | 0.138 | 0.146 |
| H    | 6.70 | 7.00 | 7.30 | 0.264 | 0.276 | 0.287 |
| V    |      |      | 10°  |       |       | 10°   |
| A1   |      | 0.02 |      |       |       |       |



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