

## N-Channel Power MOSFET

600V, 4A, 2.5Ω

### FEATURES

- 100% UIS and  $R_g$  tested
- Advanced planar process
- Compliant to RoHS Directive 2011/65/EU and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21

### APPLICATIONS

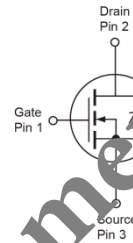
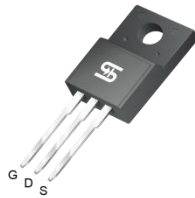
- AC/DC LED Lighting
- Power Supply

### KEY PERFORMANCE PARAMETERS

| PARAMETER          | VALUE | UNIT |
|--------------------|-------|------|
| $V_{DS}$           | 600   | V    |
| $R_{DS(on)}$ (max) | 2.5   | Ω    |
| $Q_g$              | 18    | nC   |



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### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

| PARAMETER                                          | SYMBOL         | Limit                     | UNIT |
|----------------------------------------------------|----------------|---------------------------|------|
| Drain-Source Voltage                               | $V_{DS}$       | 600                       | V    |
| Gate-Source Voltage                                | $V_{GS}$       | ±30                       | V    |
| Continuous Drain Current (Note 1)                  | $I_D$          | $T_C = 25^\circ\text{C}$  | A    |
|                                                    |                | $T_C = 100^\circ\text{C}$ |      |
| Pulsed Drain Current (Note 2)                      | $I_{DM}$       | 12                        | A    |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$ | $P_{D(TOT)}$   | 40                        | W    |
| Single Pulse Avalanche Energy (Note 3)             | $E_{AS}$       | 152                       | mJ   |
| Single Pulse Avalanche Current (Note 3)            | $I_{AS}$       | 3.9                       | A    |
| Operating Junction and Storage Temperature Range   | $T_J, T_{STG}$ | - 55 to +150              | °C   |

### THERMAL PERFORMANCE

| PARAMETER                              | SYMBOL          | Limit | UNIT |
|----------------------------------------|-----------------|-------|------|
| Junction to Case Thermal Resistance    | $R_{\theta JC}$ | 3.1   | °C/W |
| Junction to Ambient Thermal Resistance | $R_{\theta JA}$ | 62    | °C/W |

**Thermal Performance Note:**  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistances. The case-thermal reference is defined at the solder mounting surface of the drain pins.  $R_{\theta JA}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.  $R_{\theta JA}$  shown below for single device operation on FR-4 PCB in still air.

**ELECTRICAL SPECIFICATIONS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

| PARAMETER                                    | CONDITIONS                                                    | SYMBOL       | MIN | TYP | MAX       | UNIT     |
|----------------------------------------------|---------------------------------------------------------------|--------------|-----|-----|-----------|----------|
| Static                                       |                                                               |              |     |     |           |          |
| Drain-Source Breakdown Voltage               | $V_{GS} = 0V, I_D = 250\mu A$                                 | $BV_{DSS}$   | 600 | --  | --        | V        |
| Gate Threshold Voltage                       | $V_{DS} = V_{GS}, I_D = 250\mu A$                             | $V_{GS(TH)}$ | 2   | 2.9 | 4         | V        |
| Gate Body Leakage                            | $V_{GS} = \pm 30V, V_{DS} = 0V$                               | $I_{GSS}$    | --  | --  | $\pm 100$ | nA       |
| Zero Gate Voltage Drain Current              | $V_{DS} = 600V, V_{GS} = 0V$                                  | $I_{DSS}$    | --  | --  | 1         | $\mu A$  |
| Drain-Source On-State Resistance<br>(Note 4) | $V_{GS} = 10V, I_D = 1.3A$                                    | $R_{DS(on)}$ | --  | 2   | 2.5       | $\Omega$ |
| Forward Transconductance (Note 4)            | $V_{DS} = 10V, I_D = 2.5A$                                    | $g_{fs}$     | --  | 5   | --        | S        |
| Dynamic (Note 5)                             |                                                               |              |     |     |           |          |
| Total Gate Charge                            | $V_{DS} = 480V, I_D = 2.5A,$<br>$V_{GS} = 10V$                | $Q_g$        | --  | 18  | --        | nC       |
| Gate-Source Charge                           |                                                               | $Q_{gs}$     | --  | 3.4 | --        |          |
| Gate-Drain Charge                            |                                                               | $Q_{gd}$     | --  | 7.5 | --        |          |
| Input Capacitance                            | $V_{DS} = 50V, V_{GS} = 0V,$<br>$f = 1.0MHz$                  | $C_{iss}$    | --  | 654 | --        | pF       |
| Output Capacitance                           |                                                               | $C_{oss}$    | --  | 37  | --        |          |
| Reverse Transfer Capacitance                 |                                                               | $C_{rss}$    | --  | 1   | --        |          |
| Gate Resistance                              | $f = 1.0MHz, \text{open drain}$                               | $R_g$        | 0.3 | 1   | 2         | $\Omega$ |
| Switching (Note 6)                           |                                                               |              |     |     |           |          |
| Turn-On Delay Time                           | $V_{DD} = 300V, R_g = 5\Omega,$<br>$I_D = 2.5A, V_{GS} = 10V$ | $t_{d(on)}$  | --  | 8   | --        | ns       |
| Turn-On Rise Time                            |                                                               | $t_r$        | --  | 20  | --        |          |
| Turn-Off Delay Time                          |                                                               | $t_{d(off)}$ | --  | 23  | --        |          |
| Turn-Off Fall Time                           |                                                               | $t_f$        | --  | 23  | --        |          |
| Source-Drain Diode                           |                                                               |              |     |     |           |          |
| Forward Voltage (Note 4)                     | $I_S = 2.5A, V_{GS} = 0V$                                     | $V_{SD}$     | --  | --  | 1.5       | V        |
| Reverse Recovery Time                        | $I_S = 2.5A$<br>$dI_F/dt = 100A/\mu s$                        | $t_{rr}$     | --  | 325 | --        | ns       |
| Reverse Recovery Charge                      |                                                               | $Q_{rr}$     | --  | 1.8 | --        | $\mu C$  |

**Notes:**

- Current limited by package
- Pulse width limited by the maximum junction temperature
- $L = 20mH, I_{AS} = 3.9A, V_{DD} = 50V, R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$
- Pulse test:  $PW \leq 300\mu s$ , duty cycle  $\leq 2\%$
- For DESIGN AID ONLY, not subject to production testing.
- Switching time is essentially independent of operating temperature.

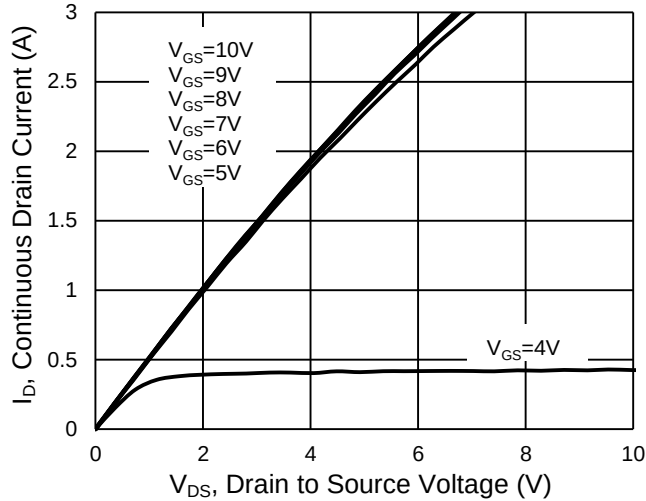
**ORDERING INFORMATION**

| PART NO.       | PACKAGE | PACKING      |
|----------------|---------|--------------|
| TSM4NC60CI C0G | ITO-220 | 50pcs / Tube |

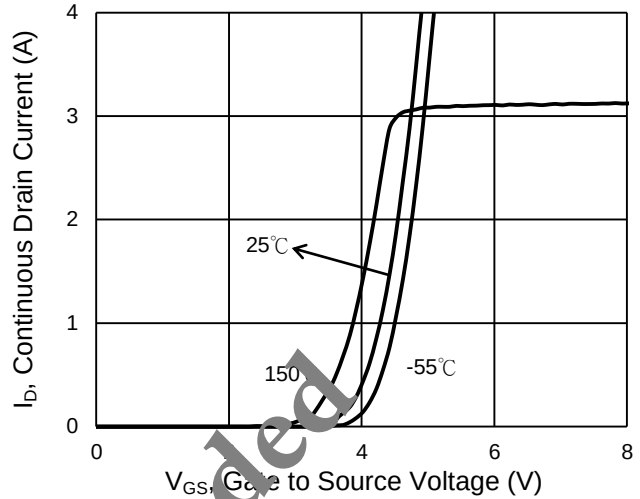
## CHARACTERISTICS CURVES

( $T_A = 25^\circ\text{C}$  unless otherwise noted)

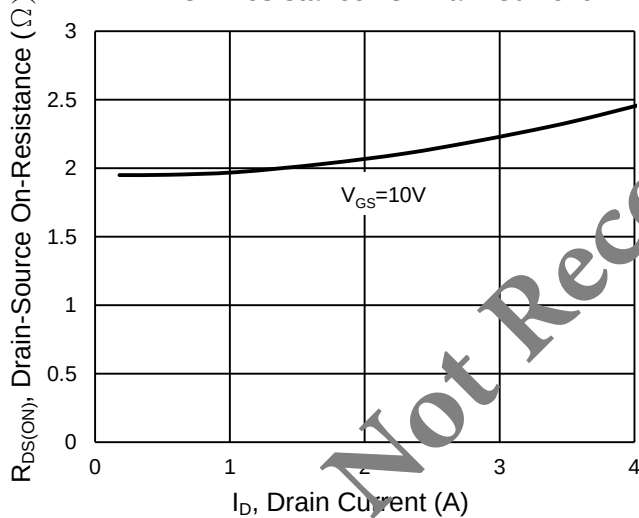
**Output Characteristics**



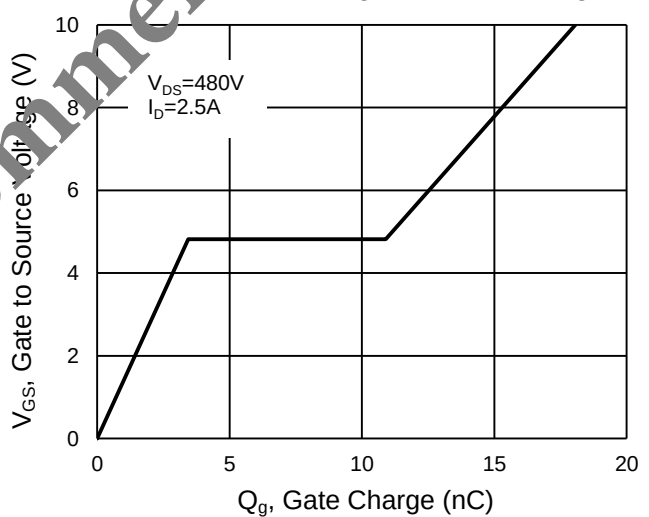
**Transfer Characteristics**



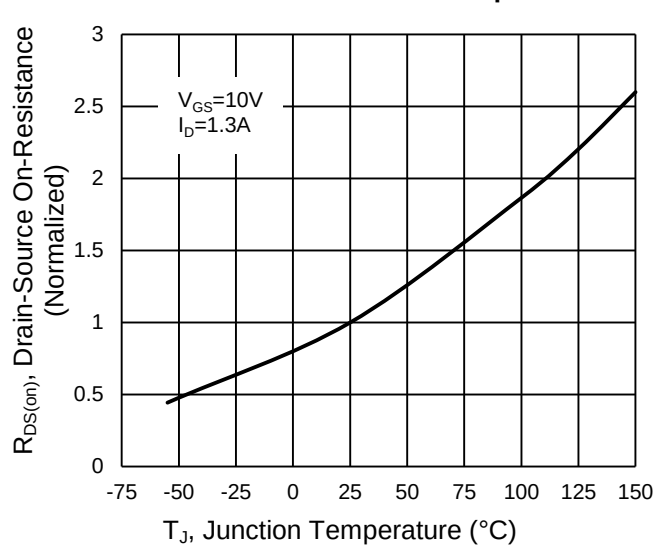
**On-Resistance vs. Drain Current**



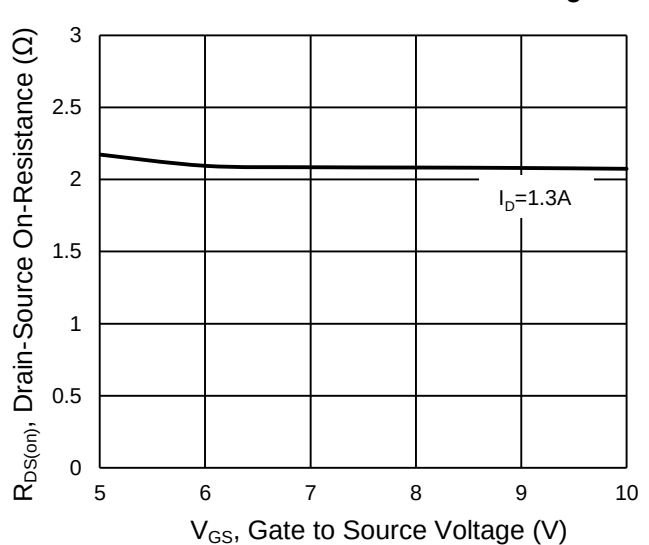
**Gate Source Voltage vs. Gate Charge**



**On-Resistance vs. Junction Temperature**

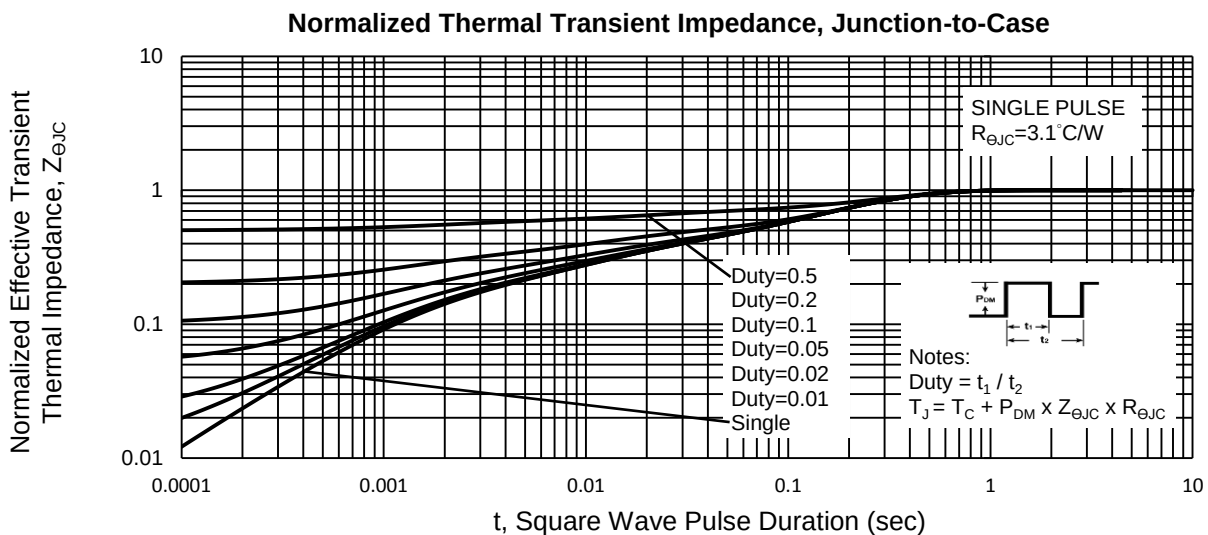
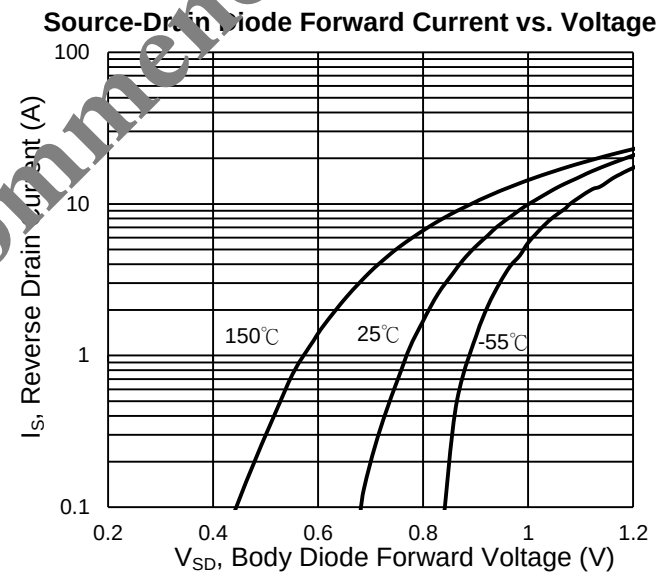
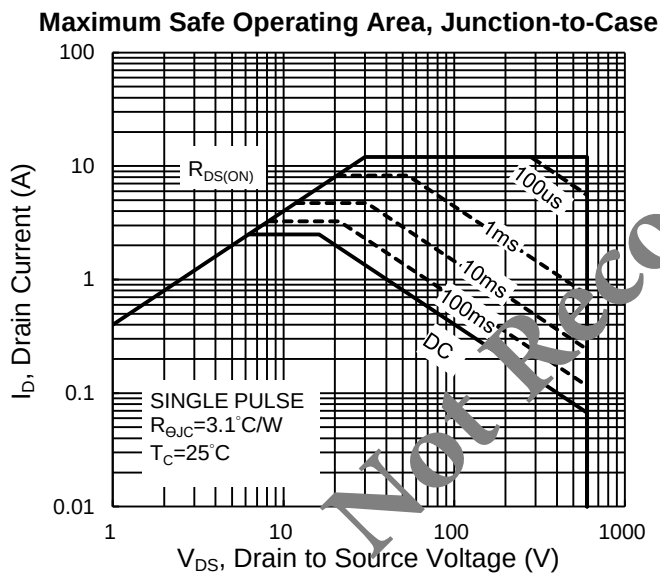
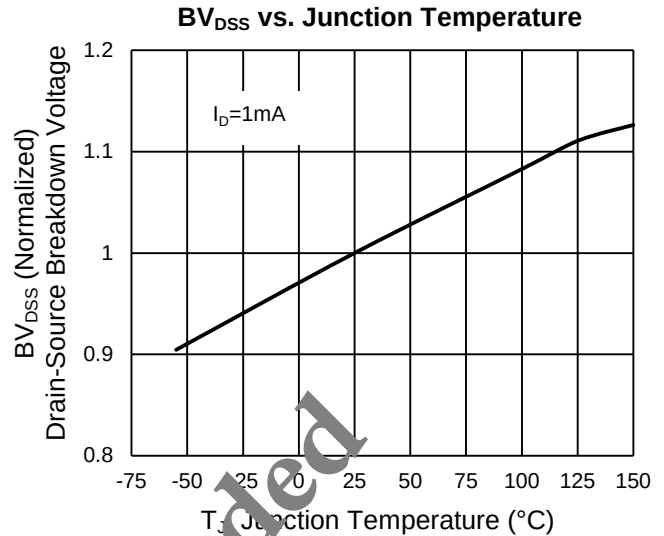
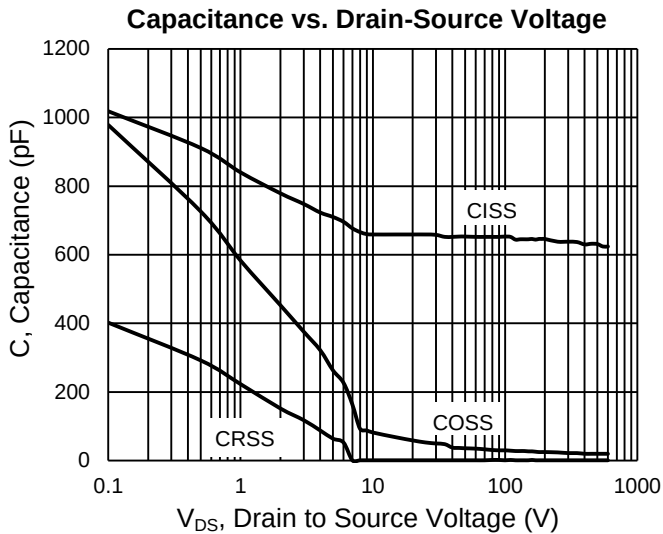


**On-Resistance vs. Gate-Source Voltage**



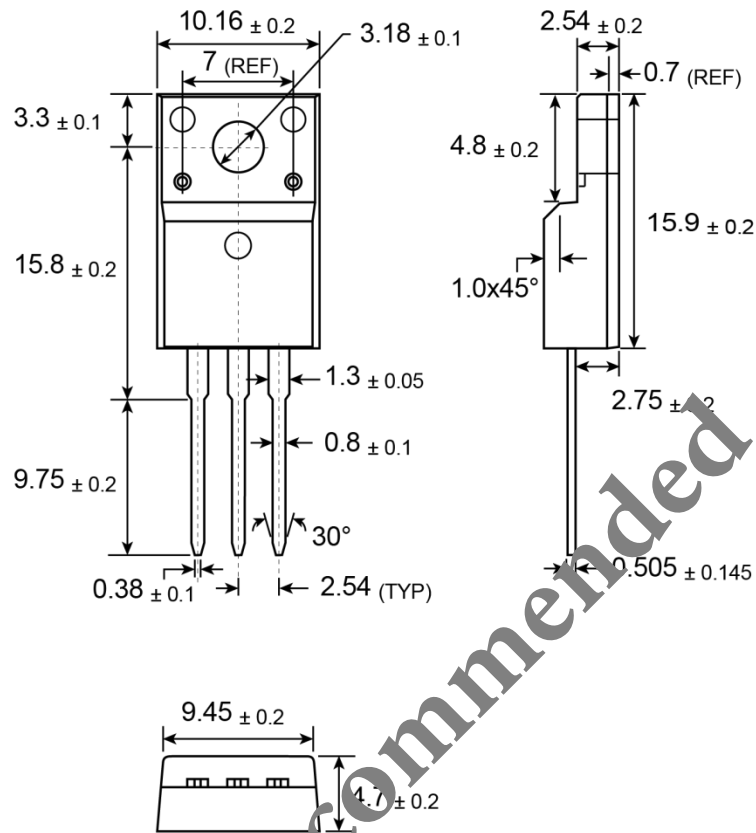
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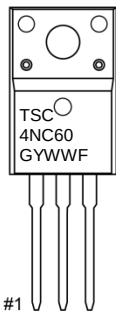


**PACKAGE OUTLINE DIMENSIONS** (Unit: Millimeters)

**ITO-220**



**MARKING DIAGRAM**



- G** = Halogen Free
- Y** = Year Code
- WW** = Week Code (01~52)
- F** = Factory Code

**Not Recommended**

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