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With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!



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## N-Channel Power MOSFET

600V, 11A, 0.38Ω

### FEATURES

- Super-Junction technology
- High performance, small  $R_{DS(ON)} * Q_g$  figure of merit (FOM)
- High ruggedness performance
- 100% UIS and  $R_g$  tested
- Compliant to RoHS Directive 2011/65/EU and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21

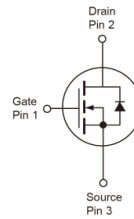
| KEY PERFORMANCE PARAMETERS |       |      |
|----------------------------|-------|------|
| PARAMETER                  | VALUE | UNIT |
| $V_{DS}$                   | 600   | V    |
| $R_{DS(on)}$ (max)         | 0.38  | Ω    |
| $Q_g$                      | 21    | nC   |

### APPLICATIONS

- Power Supply
- AC/DC LED Lighting



ITO-220S



| 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 <sup>(Note 1)</sup>                                | $I_D$          | $T_C = 25^\circ\text{C}$  | 11   |
|   |                | $T_C = 100^\circ\text{C}$ | 7    |
| Pulsed Drain Current <sup>(Note 2)</sup>                                    | $I_{DM}$       | 33                        | A    |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$                          | $P_D$          | 62.5                      | W    |
| Single Pulse Avalanche Energy <sup>(Note 3)</sup>                           | $E_{AS}$       | 256                       | mJ   |
| Single Pulse Avalanche Current <sup>(Note 3)</sup>                          | $I_{AS}$       | 3.2                       | 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    | $R_{\theta JC}$ | 2.1   | °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.

| <b>ELECTRICAL SPECIFICATIONS</b> ( $T_A = 25^\circ\text{C}$ unless otherwise noted) |  |              |     |      |           |               |
|---|--|--------------|-----|------|-----------|---------------|
| PARAMETER   | CONDITIONS   | SYMBOL       | MIN | TYP  | MAX       | UNIT          |
| <b>Static</b>   |  |              |     |      |           |               |
| Drain-Source Breakdown Voltage  | $V_{GS} = 0\text{V}, I_D = 250\mu\text{A}$   | $BV_{DSS}$   | 600 | --   | --        | V             |
| Gate Threshold Voltage  | $V_{DS} = V_{GS}, I_D = 250\mu\text{A}$  | $V_{GS(TH)}$ | 2   | 3.3  | 4         | V             |
| Gate Body Leakage   | $V_{GS} = \pm 30\text{V}, V_{DS} = 0\text{V}$  | $I_{GSS}$    | --  | --   | $\pm 100$ | nA            |
| Zero Gate Voltage Drain Current   | $V_{DS} = 600\text{V}, V_{GS} = 0\text{V}$   | $I_{DSS}$    | --  | --   | 1         | $\mu\text{A}$ |
| Drain-Source On-State Resistance<br>(Note 4)  | $V_{GS} = 10\text{V}, I_D = 2.7\text{A}$   | $R_{DS(on)}$ | --  | 0.28 | 0.38      | $\Omega$      |
| <b>Dynamic</b> (Note 5)   |  |              |     |      |           |               |
| Total Gate Charge   | $V_{DS} = 480\text{V}, I_D = 8\text{A},$<br>$V_{GS} = 10\text{V}$                          | $Q_g$        | --  | 21   | --        | nC            |
| Gate-Source Charge  |  | $Q_{gs}$     | --  | 5    | --        |               |
| Gate-Drain Charge   |  | $Q_{gd}$     | --  | 9    | --        |               |
| Input Capacitance   | $V_{DS} = 100\text{V}, V_{GS} = 0\text{V},$<br>$f = 1.0\text{MHz}$                         | $C_{iss}$    | --  | 810  | --        | pF            |
| Output Capacitance  |  | $C_{oss}$    | --  | 39   | --        |               |
| Reverse Transfer Capacitance  |  | $C_{rss}$    | --  | 1    | --        |               |
| Gate Resistance   | $f = 1.0\text{MHz}$  | $R_g$        | --  | 3    | 6         | $\Omega$      |
| <b>Switching</b> (Note 6)   |  |              |     |      |           |               |
| Turn-On Delay Time  | $V_{DD} = 300\text{V},$<br>$R_{GEN} = 5\Omega,$<br>$I_D = 8\text{A}, V_{GS} = 10\text{V},$ | $t_{d(on)}$  | --  | 9    | --        | ns            |
| Turn-On Rise Time   |  | $t_r$        | --  | 20   | --        |               |
| Turn-Off Delay Time   |  | $t_{d(off)}$ | --  | 21   | --        |               |
| Turn-Off Fall Time  |  | $t_f$        | --  | 20   | --        |               |
| <b>Source-Drain Diode</b>   |  |              |     |      |           |               |
| Body-Diode Continuous Forward Current   |  | $I_S$        |     |      | 11        | A             |
| Body-Diode Pulsed Current   |  | $I_{SM}$     |     |      | 33        | A             |
| Forward On Voltage (Note 4)   | $I_S = 8\text{A}, V_{GS} = 0\text{V}$  | $V_{SD}$     | --  | --   | 1.4       | V             |
| Reverse Recovery Time   | $I_S = 8\text{A}$  | $t_{rr}$     | --  | 224  | --        | ns            |
| Reverse Recovery Charge   | $di_F/dt = 100\text{A}/\mu\text{s}$  | $Q_{rr}$     | --  | 2.1  | --        | $\mu\text{C}$ |

**Notes:**

- Current limited by package.
- Pulse width limited by the maximum junction temperature.
- $L = 50\text{mH}, I_{AS} = 3.2\text{A}, V_{DD} = 50\text{V}, R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$
- Pulse test:  $PW \leq 300\mu\text{s}$ , duty cycle  $\leq 2\%$ .
- For DESIGN AID ONLY, not subject to production testing.
- Switching time is essentially independent of operating temperature.

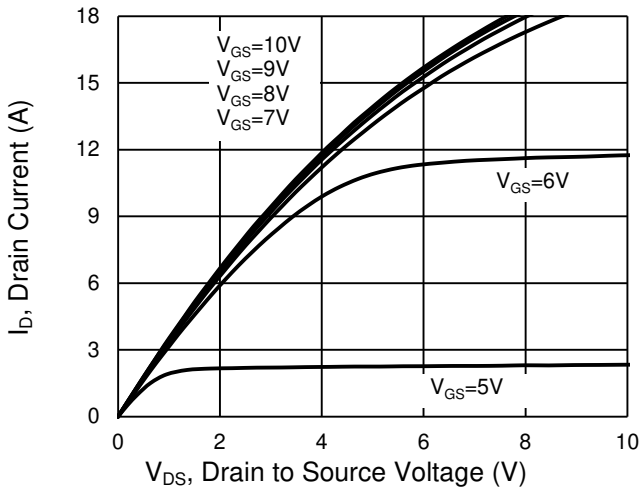
**ORDERING INFORMATION**

| PART NO.         | PACKAGE  | PACKING      |
|------------------|----------|--------------|
| TSM60NB380CF C0G | ITO-220S | 50pcs / Tube |

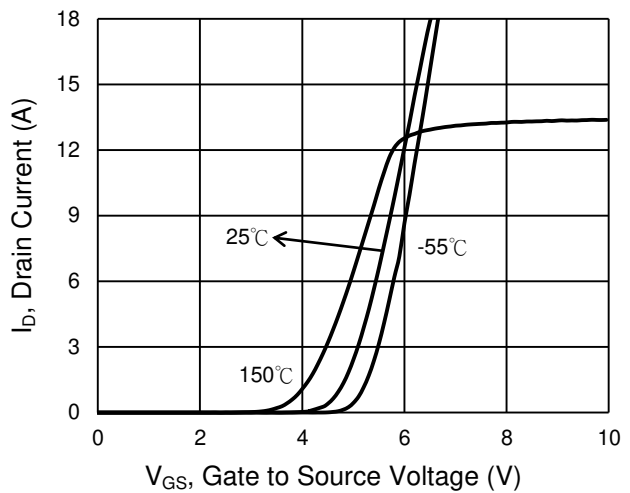
**CHARACTERISTICS CURVES**

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

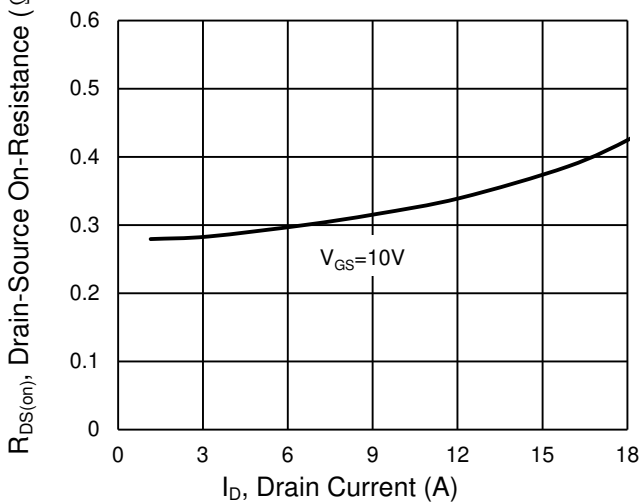
**Output Characteristics**



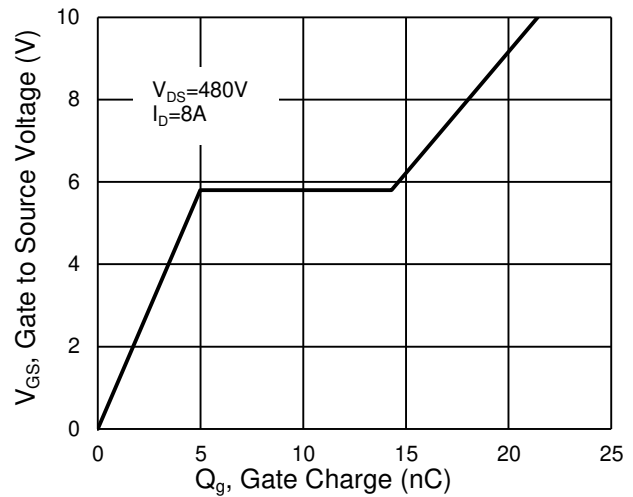
**Transfer Characteristics**



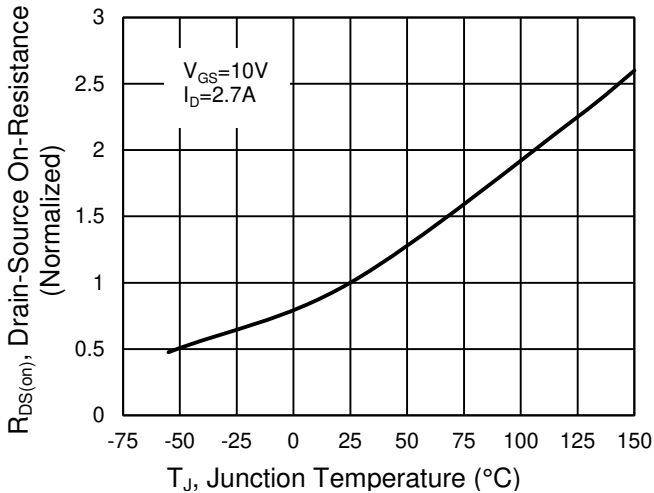
**On-Resistance vs. Drain Current**



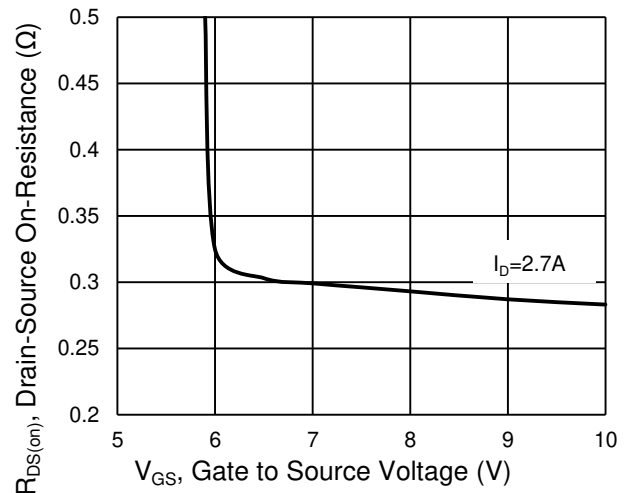
**Gate-Source Voltage vs. Gate Charge**



**On-Resistance vs. Junction Temperature**



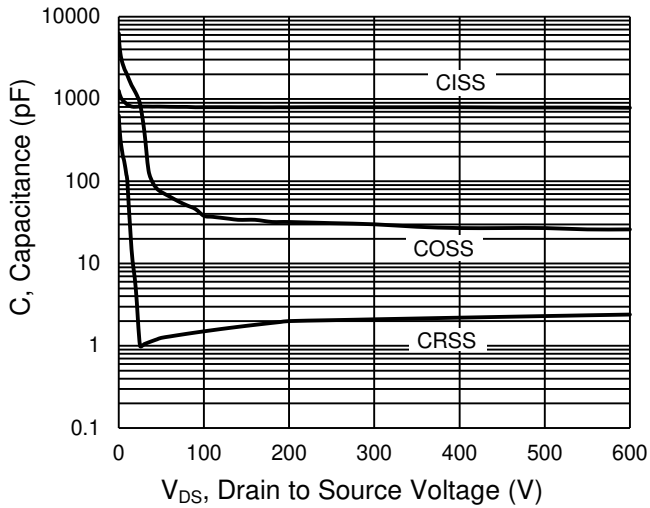
**On-Resistance vs. Gate-Source Voltage**



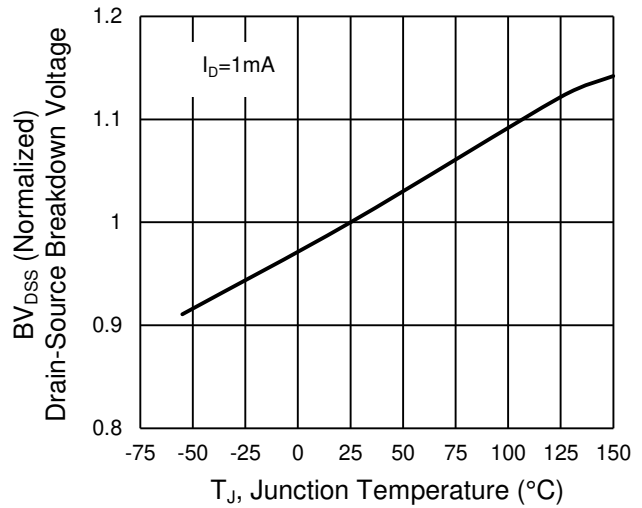
**CHARACTERISTICS CURVES**

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

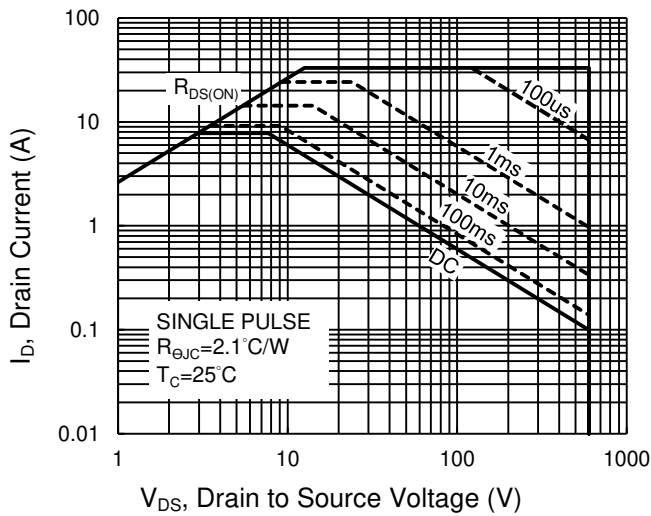
**Capacitance vs. Drain-Source Voltage**



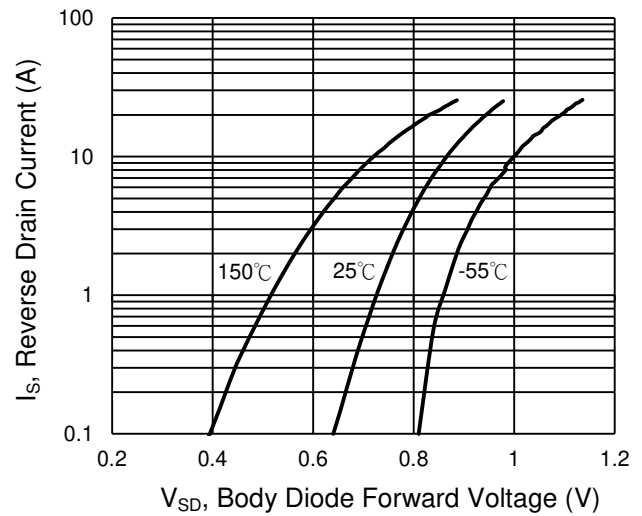
**$BV_{DSS}$  vs. Junction Temperature**



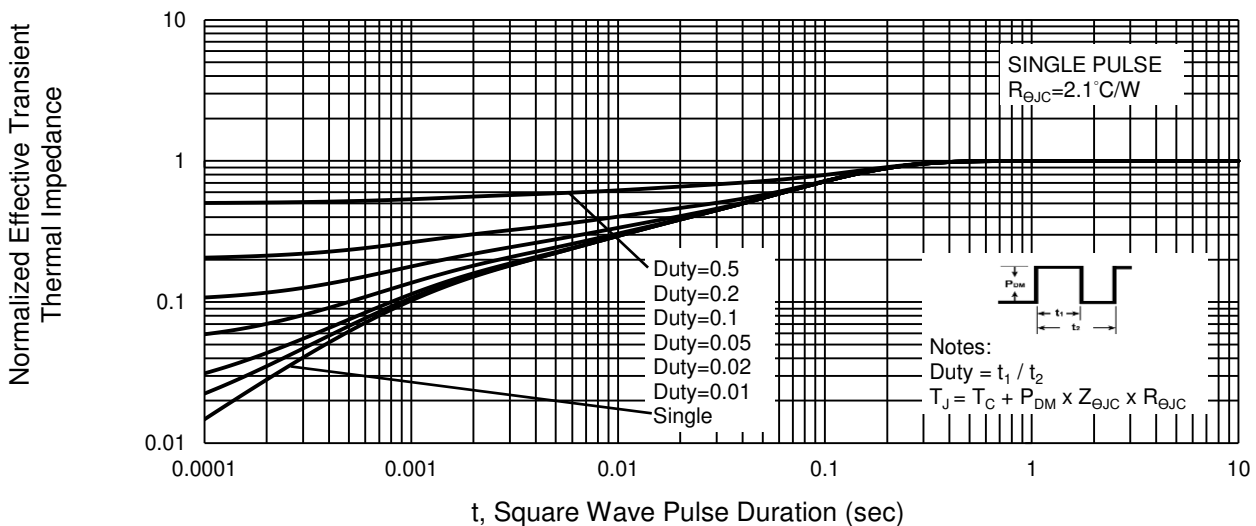
**Maximum Safe Operating Area, Junction-to-Case**



**Source-Drain Diode Forward Current vs. Voltage**

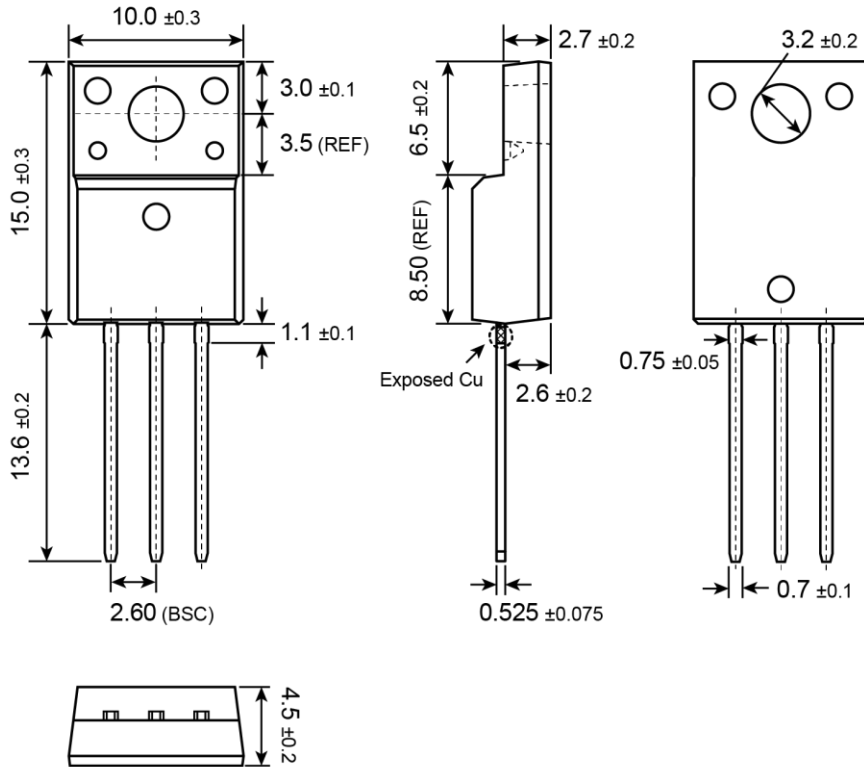


**Normalized Thermal Transient Impedance, Junction-to-Case**

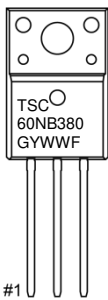


**PACKAGE OUTLINE DIMENSIONS** (Unit: Millimeters)

**ITO-220S**



**MARKING DIAGRAM**



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

## Notice

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