

## N-Channel Power MOSFET

500V, 5A, 1.5Ω

### FEATURES

- 100% UIS and R<sub>g</sub> 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

### KEY PERFORMANCE PARAMETERS

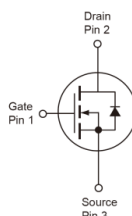
| PARAMETER                 | VALUE | UNIT |
|---------------------------|-------|------|
| V <sub>DS</sub>           | 500   | V    |
| R <sub>DS(on)</sub> (max) | 1.5   | Ω    |
| Q <sub>g</sub>            | 16    | nC   |

### APPLICATIONS

- Power Supply
- AC/DC LED Lighting



ITO-220



### ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C unless otherwise noted)

| PARAMETER                                          |                        | SYMBOL                            | LIMIT        | UNIT |
|----------------------------------------------------|------------------------|-----------------------------------|--------------|------|
| Drain-Source Voltage                               |                        | V <sub>DS</sub>                   | 500          | V    |
| Gate-Source Voltage                                |                        | V <sub>GS</sub>                   | ±30          | V    |
| Continuous Drain Current <sup>(Note 1)</sup>       | T <sub>C</sub> = 25°C  | I <sub>D</sub>                    | 5            | A    |
|                                                    | T <sub>C</sub> = 100°C |                                   | 3.2          | A    |
| Pulsed Drain Current <sup>(Note 2)</sup>           |                        | I <sub>DM</sub>                   | 20           | A    |
| Total Power Dissipation @ T <sub>C</sub> = 25°C    |                        | P <sub>DTOT</sub>                 | 42           | W    |
| Single Pulse Avalanche Energy <sup>(Note 3)</sup>  |                        | E <sub>AS</sub>                   | 160          | mJ   |
| Single Pulse Avalanche Current <sup>(Note 3)</sup> |                        | I <sub>AS</sub>                   | 4            | A    |
| Operating Junction and Storage Temperature Range   |                        | T <sub>J</sub> , T <sub>STG</sub> | - 55 to +150 | °C   |

### THERMAL PERFORMANCE

| PARAMETER                              | SYMBOL           | LIMIT | UNIT |
|----------------------------------------|------------------|-------|------|
| Junction to Case Thermal Resistance    | R <sub>θJC</sub> | 3     | °C/W |
| Junction to Ambient Thermal Resistance | R <sub>θJA</sub> | 62    | °C/W |

**Thermal Performance Notes:** R<sub>θJA</sub> 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<sub>θJA</sub> is guaranteed by design while R<sub>θCA</sub> is determined by the user's board design. R<sub>θJA</sub> shown below for single device operation on FR-4 PCB with minimum recommended footprint in still air.

| ELECTRICAL SPECIFICATIONS (T <sub>A</sub> = 25°C unless otherwise noted) |                                                                                              |                     |     |      |      |      |
|--------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|---------------------|-----|------|------|------|
| PARAMETER                                                                | CONDITIONS                                                                                   | SYMBOL              | MIN | TYP  | MAX  | UNIT |
| Static <sup>(Note 4)</sup>                                               |                                                                                              |                     |     |      |      |      |
| Drain-Source Breakdown Voltage                                           | V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA                                                 | BV <sub>DSS</sub>   | 500 | --   | --   | V    |
| Gate Threshold Voltage                                                   | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA                                   | V <sub>GS(TH)</sub> | 2.5 | 3    | 3.8  | V    |
| Gate Body Leakage                                                        | V <sub>GS</sub> = ±30V, V <sub>DS</sub> = 0V                                                 | I <sub>GSS</sub>    | --  | --   | ±100 | nA   |
| Zero Gate Voltage Drain Current                                          | V <sub>DS</sub> = 500V, V <sub>GS</sub> = 0V                                                 | I <sub>DSS</sub>    | --  | --   | 1    | μA   |
| Drain-Source On-State Resistance                                         | V <sub>GS</sub> = 10V, I <sub>D</sub> = 1.6A                                                 | R <sub>DS(on)</sub> | --  | 1.16 | 1.5  | Ω    |
| Dynamic <sup>(Note 5)</sup>                                              |                                                                                              |                     |     |      |      |      |
| Total Gate Charge                                                        | V <sub>DS</sub> = 400V, I <sub>D</sub> = 3.2A,<br>V <sub>GS</sub> = 10V                      | Q <sub>g</sub>      | --  | 16   | --   | nC   |
| Gate-Source Charge                                                       |                                                                                              | Q <sub>gs</sub>     | --  | 3.2  | --   |      |
| Gate-Drain Charge                                                        |                                                                                              | Q <sub>gd</sub>     | --  | 7.2  | --   |      |
| Input Capacitance                                                        | V <sub>DS</sub> = 50V, V <sub>GS</sub> = 0V,<br>f = 1.0MHz                                   | C <sub>iss</sub>    | --  | 603  | --   | pF   |
| Output Capacitance                                                       |                                                                                              | C <sub>oss</sub>    | --  | 50   | --   |      |
| Reverse Transfer Capacitance                                             |                                                                                              | C <sub>rss</sub>    | --  | 1    | --   |      |
| Gate Resistance                                                          |                                                                                              | R <sub>g</sub>      | --  | 2    | 4    | Ω    |
| Switching <sup>(Note 6)</sup>                                            |                                                                                              |                     |     |      |      |      |
| Turn-On Delay Time                                                       | V <sub>DD</sub> = 250V, R <sub>G</sub> = 5Ω,<br>I <sub>D</sub> = 3.2A, V <sub>GS</sub> = 10V | t <sub>d(on)</sub>  | --  | 6.2  | --   | ns   |
| Turn-On Rise Time                                                        |                                                                                              | t <sub>r</sub>      | --  | 19   | --   |      |
| Turn-Off Delay Time                                                      |                                                                                              | t <sub>d(off)</sub> | --  | 16   | --   |      |
| Turn-Off Fall Time                                                       |                                                                                              | t <sub>f</sub>      | --  | 21   | --   |      |
| Source-Drain Diode <sup>(Note 4)</sup>                                   |                                                                                              |                     |     |      |      |      |
| Body-Diode Continuous Forward Current                                    |                                                                                              | I <sub>S</sub>      | --  | --   | 5    | A    |
| Body-Diode Pulsed Current                                                |                                                                                              | I <sub>SM</sub>     | --  | --   | 20   | A    |
| Forward On Voltage                                                       | I <sub>S</sub> = 3.2A, V <sub>GS</sub> = 0V                                                  | V <sub>SD</sub>     | --  | --   | 1.2  | V    |
| Reverse Recovery Time                                                    | I <sub>S</sub> = 3.2A                                                                        | t <sub>rr</sub>     | --  | 191  | --   | ns   |
| Reverse Recovery Charge                                                  | dl <sub>F</sub> /dt = 100A/μs                                                                | Q <sub>rr</sub>     | --  | 1.2  | --   | μC   |

**Notes:**

1. Current limited by package.
2. Pulse width limited by the maximum junction temperature.
3.  $L = 20mH, I_{AS} = 4A, V_{DD} = 50V, R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$
4. Pulse test:  $PW \leq 300\mu s$ , duty cycle  $\leq 2\%$ .
5. For DESIGN AID ONLY, not subject to production testing.
6. Switching time is essentially independent of operating temperature.

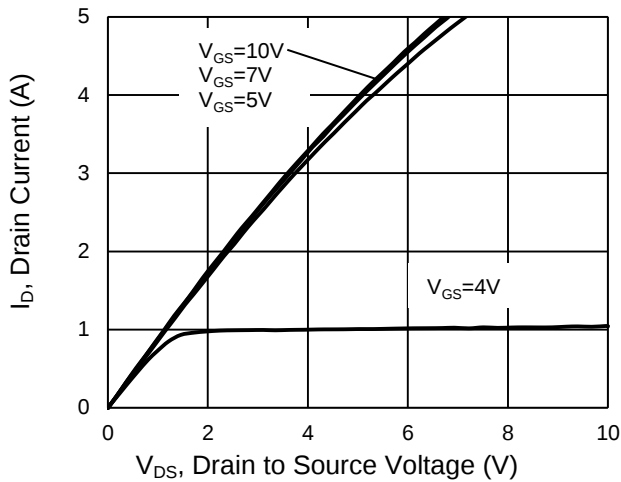
**ORDERING INFORMATION**

| PART NO.       | PACKAGE | PACKING      |
|----------------|---------|--------------|
| TSM5ND50CI C0G | ITO-220 | 50pcs / Tube |

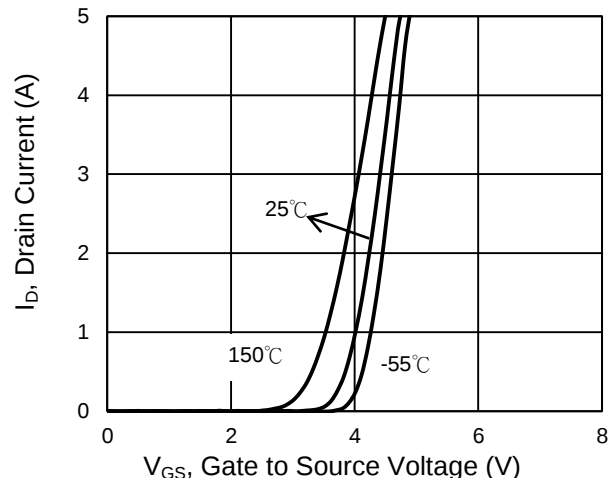
## CHARACTERISTICS CURVES

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

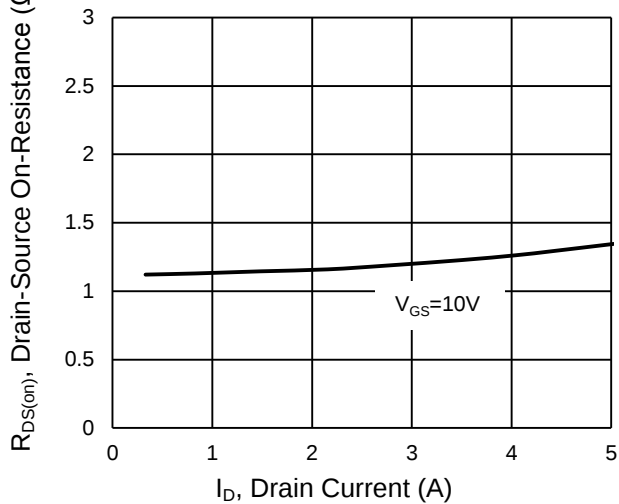
**Output Characteristics**



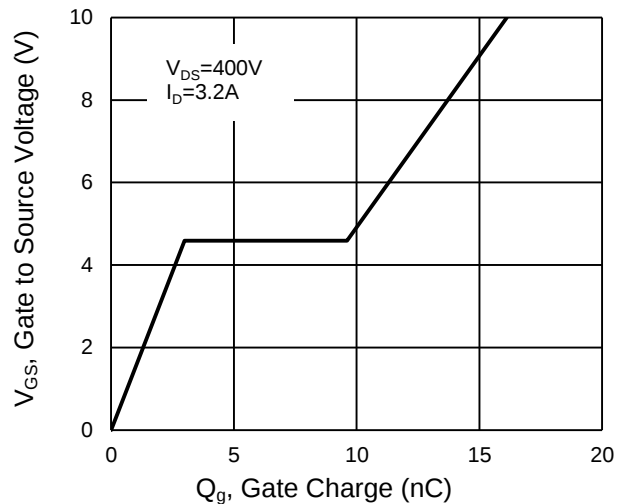
**Transfer Characteristics**



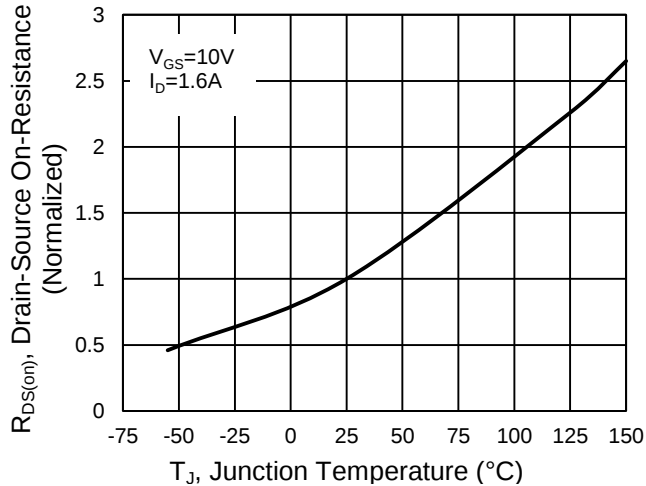
**On-Resistance vs. Drain Current**



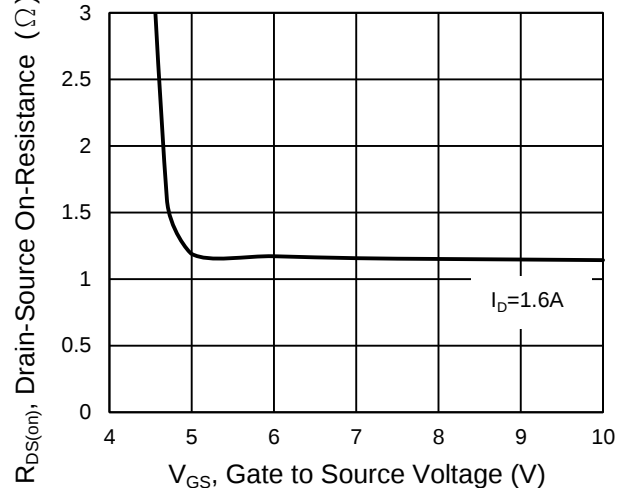
**Gate-Source Voltage vs. Gate Charge**



**On-Resistance vs. Junction Temperature**



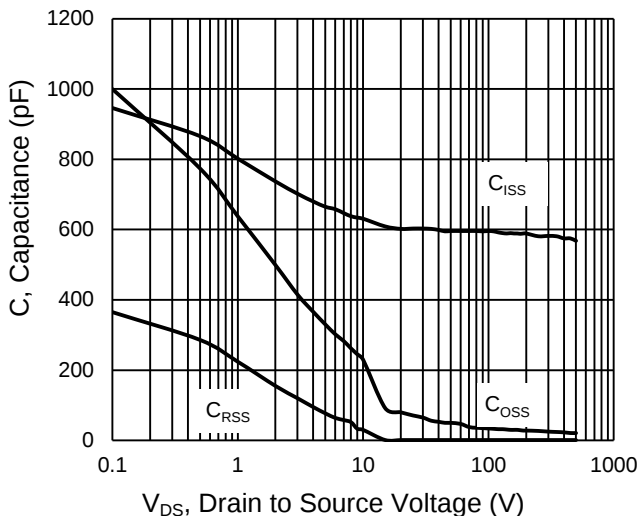
**On-Resistance vs. Gate-Source Voltage**



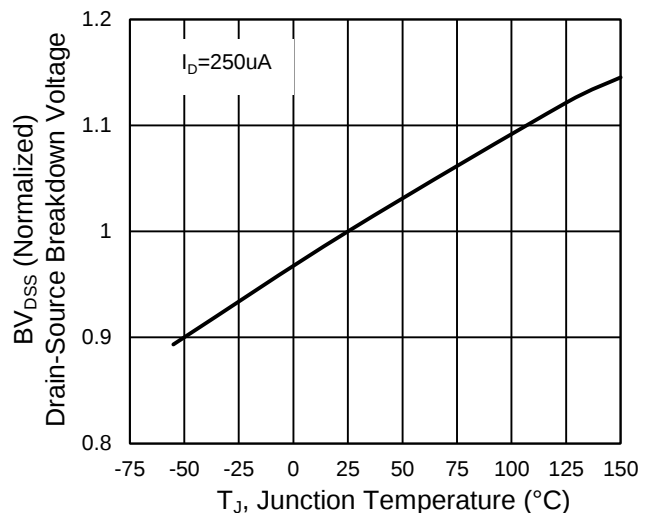
## CHARACTERISTICS CURVES

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

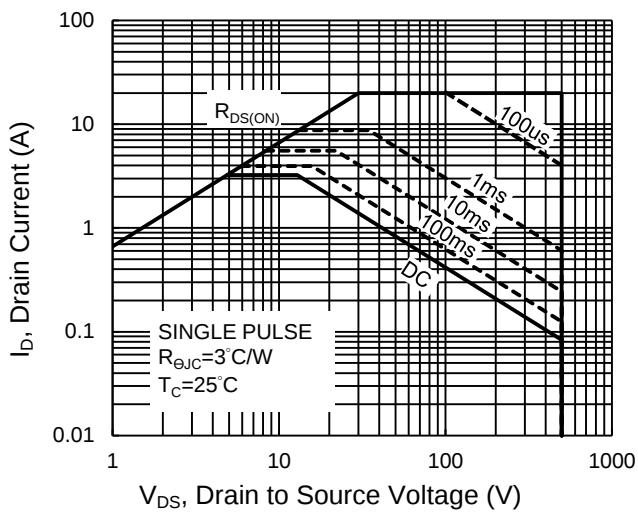
**Capacitance vs. Drain-Source Voltage**



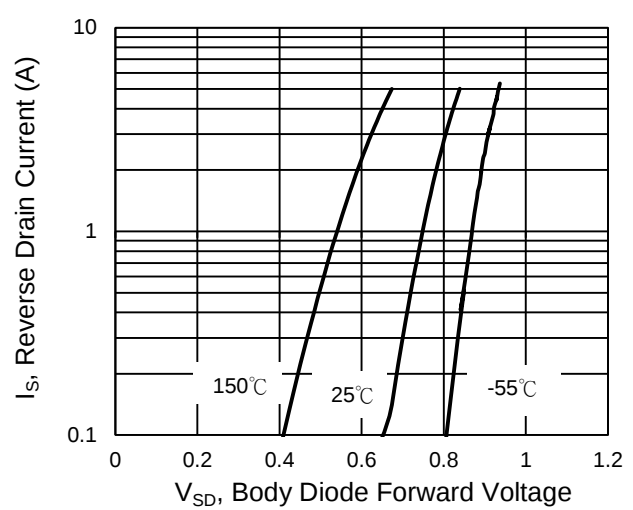
**$BV_{DSS}$  vs. Junction Temperature**



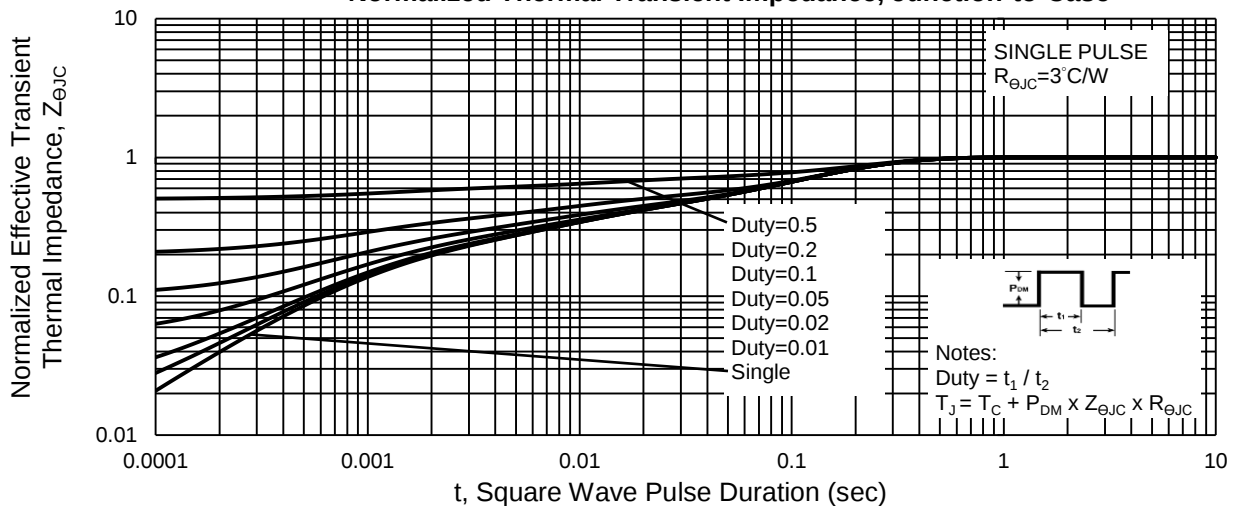
**Maximum Safe Operating Area, Junction-to-Case**



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

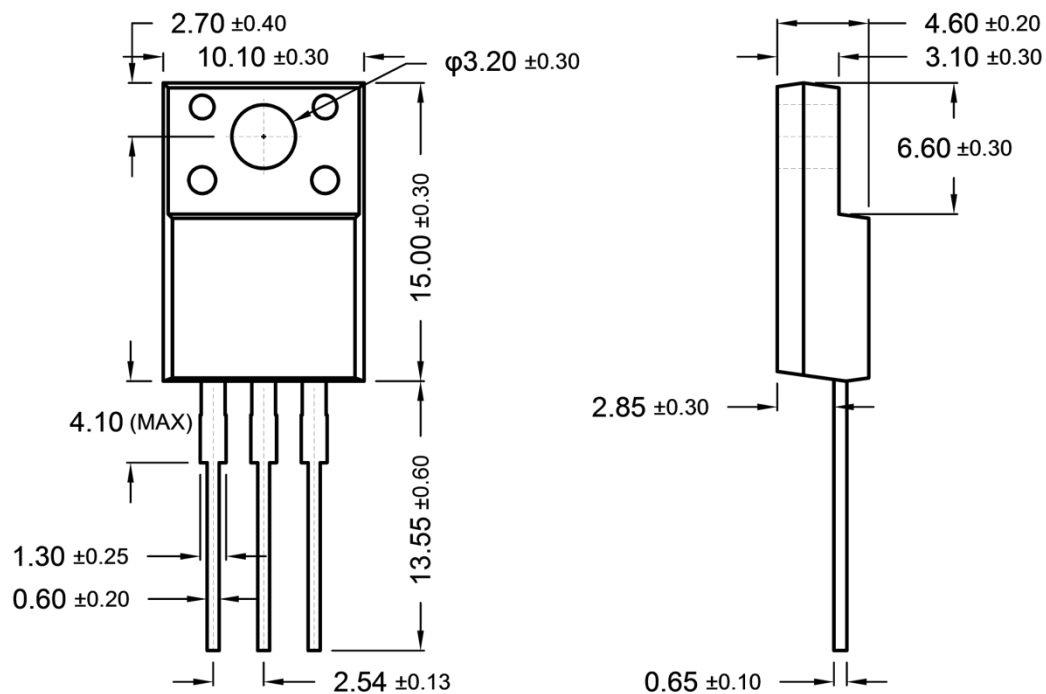


**Normalized Thermal Transient Impedance, Junction-to-Case**

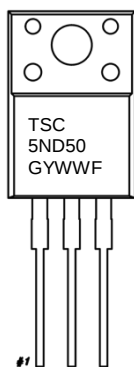


**PACKAGE OUTLINE DIMENSIONS** (Unit: Millimeters)

**ITO-220**



**MARKING DIAGRAM**



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

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105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: [info@moschip.ru](mailto:info@moschip.ru)

Skype отдела продаж:

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