

## 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



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 (Note 1)	I <sub>D</sub>	T <sub>C</sub> = 25°C	5
		T <sub>C</sub> = 100°C	3.2
Pulsed Drain Current (Note 2)	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 (Note 3)	E <sub>AS</sub>	160	mJ
Single Pulse Avalanche Current (Note 3)	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.

<b>ELECTRICAL SPECIFICATIONS</b> ( $T_A = 25^\circ\text{C}$ unless otherwise noted)						
PARAMETER	CONDITIONS	SYMBOL	MIN	TYP	MAX	UNIT
<b>Static</b> (Note 4)						
Drain-Source Breakdown Voltage	$V_{GS} = 0\text{V}, I_D = 250\mu\text{A}$	$BV_{DSS}$	500	--	--	V
Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$	$V_{GS(TH)}$	2.5	3	3.8	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	$V_{DS} = 500\text{V}, V_{GS} = 0\text{V}$	$I_{DSS}$	--	--	1	$\mu\text{A}$
Drain-Source On-State Resistance	$V_{GS} = 10\text{V}, I_D = 1.6\text{A}$	$R_{DS(on)}$	--	1.16	1.5	$\Omega$
<b>Dynamic</b> (Note 5)						
Total Gate Charge	$V_{DS} = 400\text{V}, I_D = 3.2\text{A},$ $V_{GS} = 10\text{V}$	$Q_g$	--	16	--	nC
Gate-Source Charge		$Q_{gs}$	--	3.2	--	
Gate-Drain Charge		$Q_{gd}$	--	7.2	--	
Input Capacitance	$V_{DS} = 50\text{V}, V_{GS} = 0\text{V},$ $f = 1.0\text{MHz}$	$C_{iss}$	--	603	--	pF
Output Capacitance		$C_{oss}$	--	50	--	
Reverse Transfer Capacitance		$C_{rss}$	--	1	--	
Gate Resistance		$R_g$	--	2	4	$\Omega$
<b>Switching</b> (Note 6)						
Turn-On Delay Time	$V_{DD} = 250\text{V}, R_G = 5\Omega,$ $I_D = 3.2\text{A}, V_{GS} = 10\text{V}$	$t_{d(on)}$	--	6.2	--	ns
Turn-On Rise Time		$t_r$	--	19	--	
Turn-Off Delay Time		$t_{d(off)}$	--	16	--	
Turn-Off Fall Time		$t_f$	--	21	--	
<b>Source-Drain Diode</b> (Note 4)						
Body-Diode Continuous Forward Current		$I_S$	--	--	5	A
Body-Diode Pulsed Current		$I_{SM}$	--	--	20	A
Forward On Voltage	$I_S = 3.2\text{A}, V_{GS} = 0\text{V}$	$V_{SD}$	--	--	1.2	V
Reverse Recovery Time	$I_S = 3.2\text{A}$ $di_f/dt = 100\text{A}/\mu\text{s}$	$t_{rr}$	--	191	--	ns
Reverse Recovery Charge		$Q_{rr}$	--	1.2	--	$\mu\text{C}$

**Notes:**

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

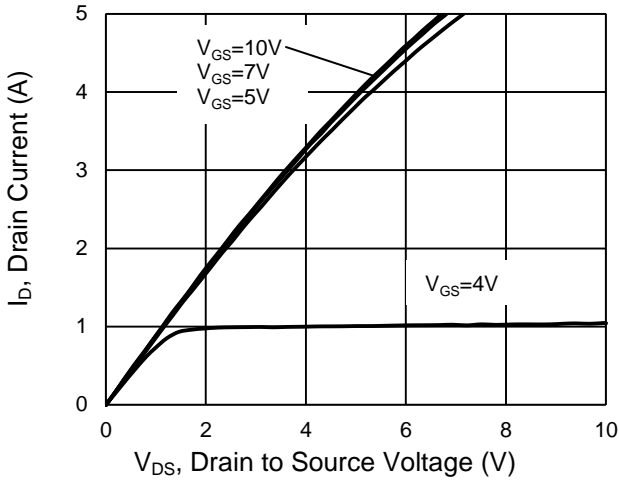
**ORDERING INFORMATION**

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

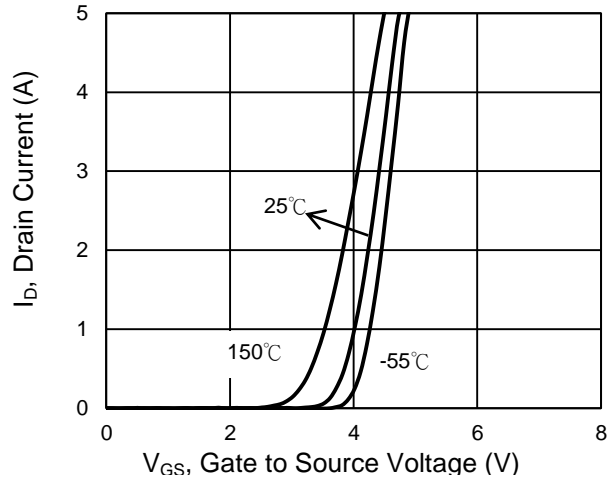
**CHARACTERISTICS CURVES**

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

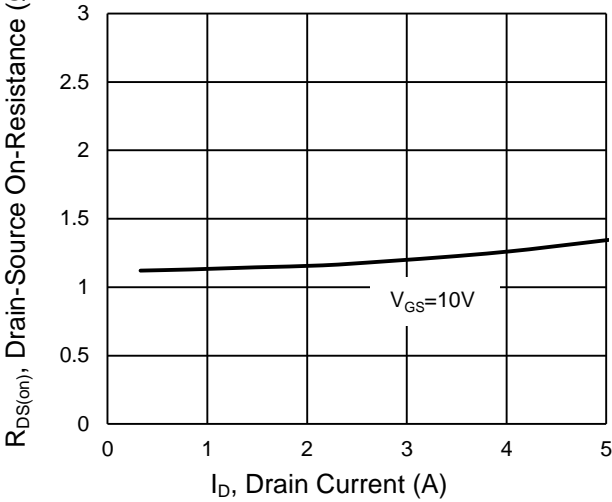
**Output Characteristics**



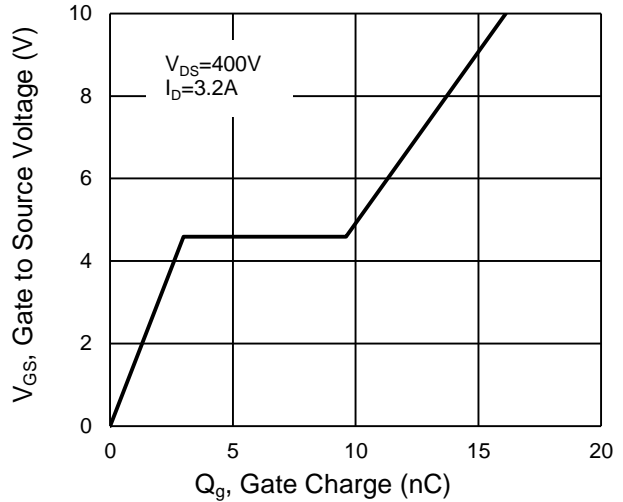
**Transfer Characteristics**



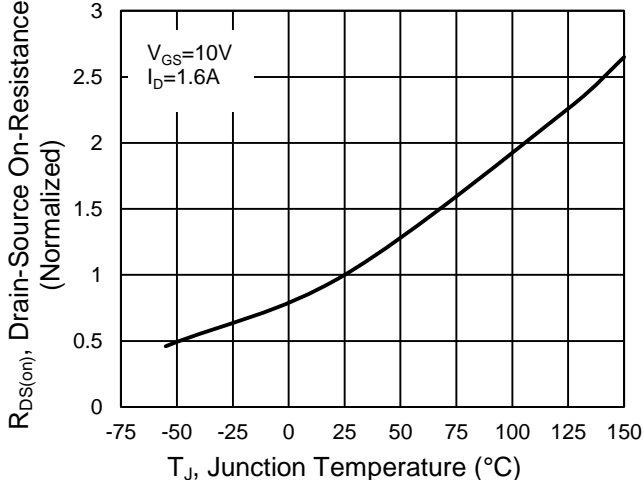
**On-Resistance vs. Drain Current**



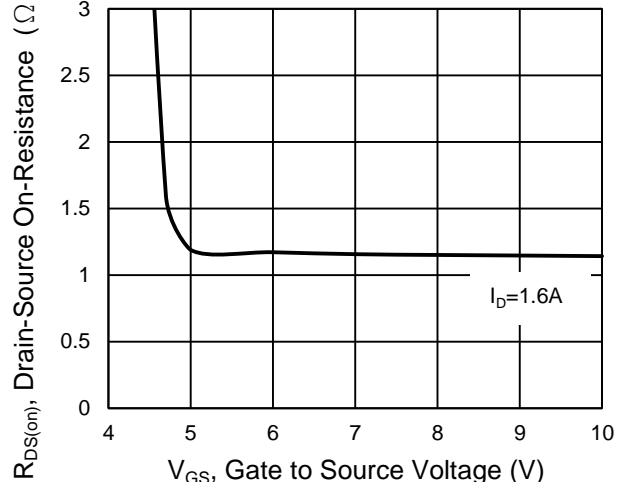
**Gate-Source Voltage vs. Gate Charge**



**On-Resistance vs. Junction Temperature**



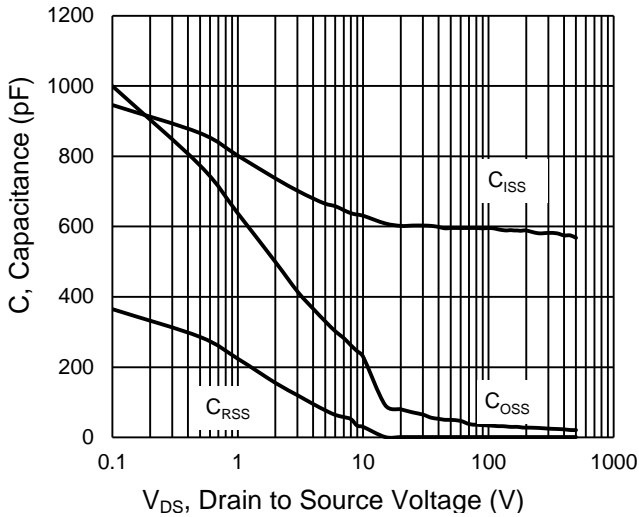
**On-Resistance vs. Gate-Source Voltage**



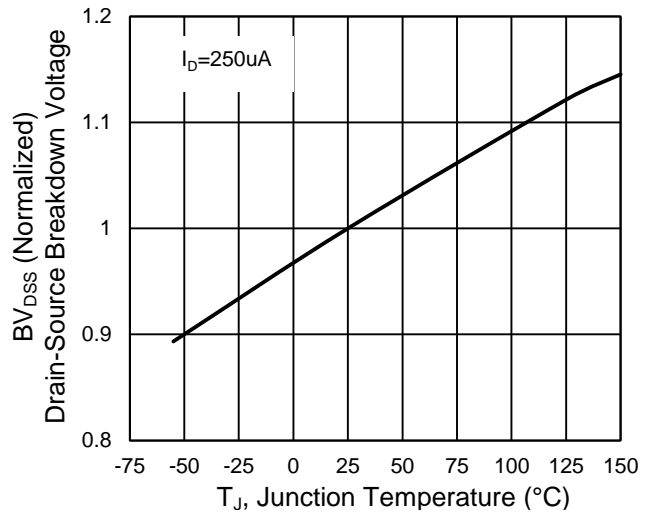
**CHARACTERISTICS CURVES**

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

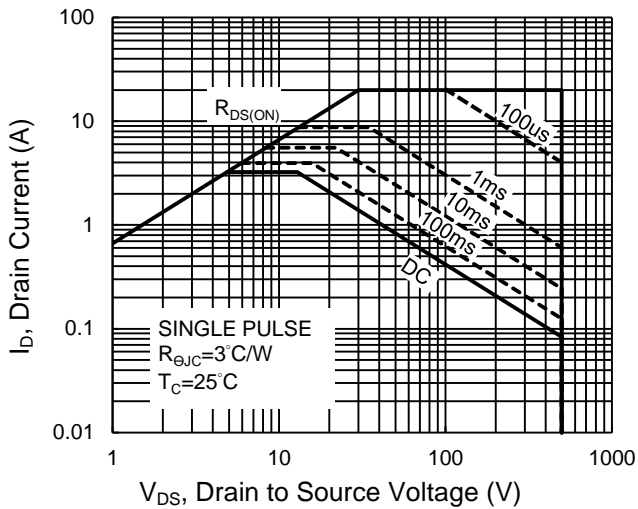
**Capacitance vs. Drain-Source Voltage**



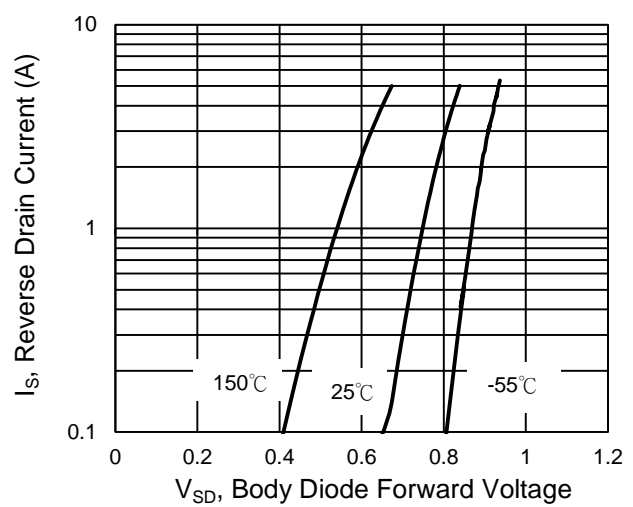
**$BV_{DSS}$  vs. Junction Temperature**



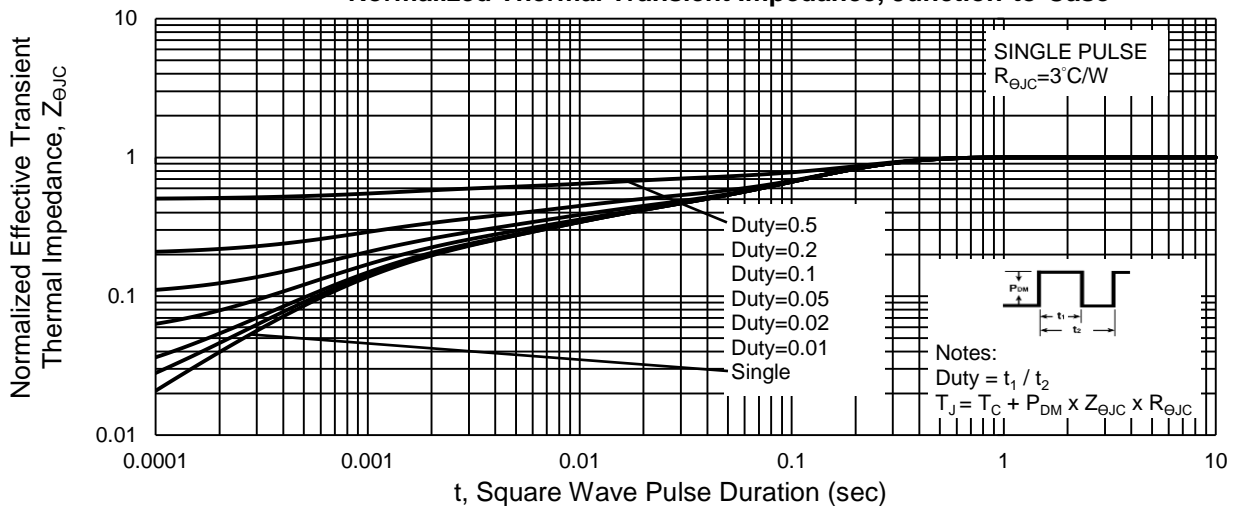
**Maximum Safe Operating Area, Junction-to-Case**



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

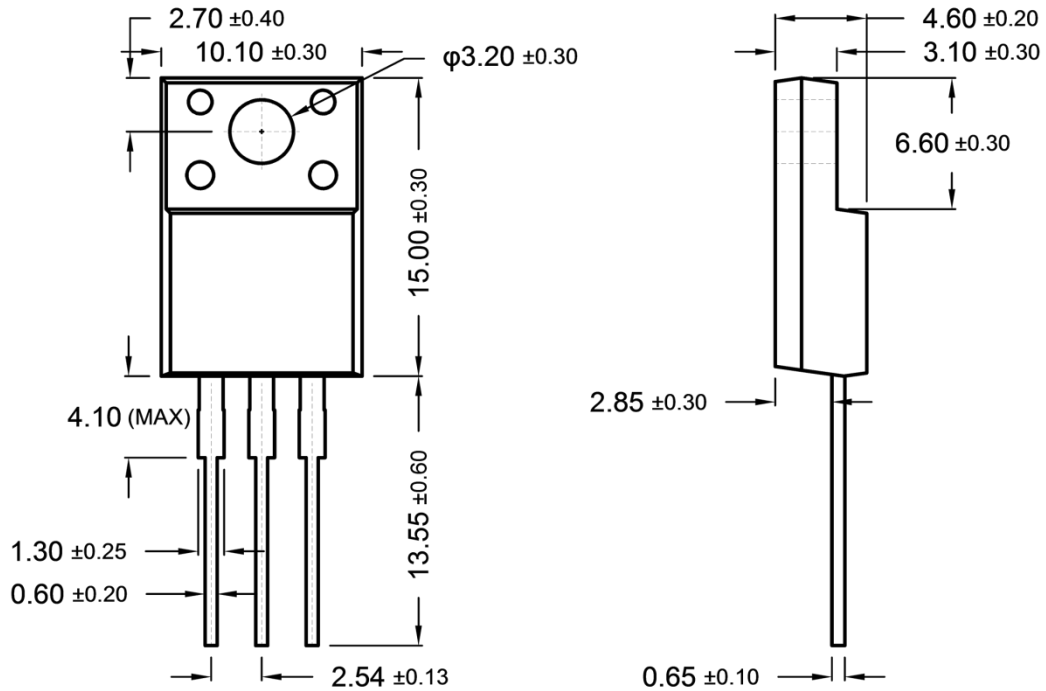


**Normalized Thermal Transient Impedance, Junction-to-Case**

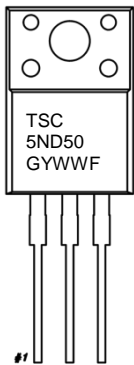


**PACKAGE OUTLINE DIMENSIONS** (Unit: Millimeters)

**ITO-220**



**MARKING DIAGRAM**



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

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