

## N-Channel Power MOSFET

### FEATURES

- Latest super-junction technology
- Low gate charge capacitance
- High gate noise immunity
- RoHS compliant
- Halogen-free

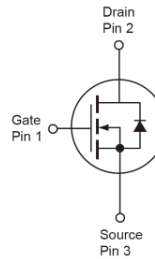
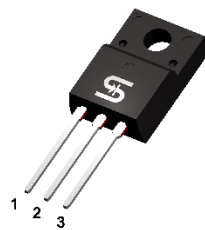
### APPLICATIONS

- Switching applications
- Industrial

KEY PERFORMANCE PARAMETERS		
PARAMETER	VALUE	UNIT
$V_{DS} @ T_{j,max}$	650	V
$R_{DS(on)} (max)$	285	m $\Omega$
$Q_{g,typ}$	22	nC



ITO-220TL



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	$V_{GS}$	$\pm 30$	V
Continuous Drain Current	$I_D$	9.5	A
Pulsed Drain Current (Note 1)	$I_{DM}$	38	A
Total Power Dissipation @ $T_C = 25^\circ\text{C}$	$P_D$	56	W
Single Pulse Avalanche Energy (Note 2)	$E_{AS}$	221	mJ
Single Pulse Avalanche Current (Note 2)	$I_{AS}$	3	A
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	- 55 to +150	$^\circ\text{C}$

THERMAL PERFORMANCE			
PARAMETER	SYMBOL	LIMIT	UNIT
Junction to Case Thermal Resistance	$R_{\theta JC}$	2.2	$^\circ\text{C/W}$
Junction to Ambient Thermal Resistance (Note 3)	$R_{\theta JA}$	65	$^\circ\text{C/W}$

#### Notes:

1. Pulse Width  $\leq 100\mu\text{s}$ .
2.  $L = 50\text{mH}$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$ .
3.  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistances.  $R_{\theta JA}$  is guaranteed by design while  $R_{\theta JC}$  is determined by the user's board design.

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

PARAMETER	CONDITIONS	SYMBOL	MIN	TYP	MAX	UNIT
<b>Static</b> (Note 4)						
Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 1mA$	$BV_{DSS}$	600	--	--	V
Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 1.4mA$	$V_{GS(TH)}$	4	4.8	6	V
Gate Body Leakage	$V_{GS} = \pm 30V, V_{DS} = 0V$	$I_{GSS}$	--	--	$\pm 100$	nA
Zero Gate Voltage Drain Current	$V_{DS} = 600V, V_{GS} = 0V$	$I_{DSS}$	--	--	100	$\mu A$
Drain-Source On-State Resistance	$V_{GS} = 10V, I_D = 3.2A$	$R_{DS(on)}$	--	239	285	m $\Omega$
	$V_{GS} = 12V, I_D = 3.2A$		--	228	274	
<b>Dynamic</b> (Note 5)						
Total Gate Charge	$V_{DS} = 480V, I_D = 9.5A,$ $V_{GS} = 10V$	$Q_g$	--	22	--	nC
Gate-Source Charge		$Q_{gs}$	--	7.5	--	
Gate-Drain Charge		$Q_{gd}$	--	12	--	
Input Capacitance	$V_{DS} = 300V, V_{GS} = 0V,$ $f = 100kHz$	$C_{iss}$	--	894	--	pF
Output Capacitance		$C_{oss}$	--	30	--	
Reverse Transfer Capacitance		$C_{rss}$	--	7	--	
Gate Resistance	$f = 1.0MHz$	$R_g$	--	1.2	--	$\Omega$
<b>Switching</b> (Note 6)						
Turn-On Delay Time	$V_{DD} = 300V, R_G = 3.3\Omega,$ $I_D = 9.5A, V_{GS} = 10V$	$t_{d(on)}$	--	23	--	ns
Turn-On Rise Time		$t_r$	--	22	--	
Turn-Off Delay Time		$t_{d(off)}$	--	45	--	
Turn-Off Fall Time		$t_f$	--	4.2	--	
<b>Source-Drain Diode</b>						
Forward Voltage (Note 4)	$I_S = 3.2A, V_{GS} = 0V$	$V_{SD}$	--	0.8	1.5	V
Reverse Recovery Time	$I_S = 4.8A$	$t_{rr}$	--	257	--	ns
Reverse Recovery Charge	$di_f/dt = 100A/\mu s$	$Q_{rr}$	--	2.8	--	$\mu C$

**Notes:**

- Pulse test: Pulse Width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ .
- Defined by design. Not subject to production test.
- Switching time is essentially independent of operating temperature.

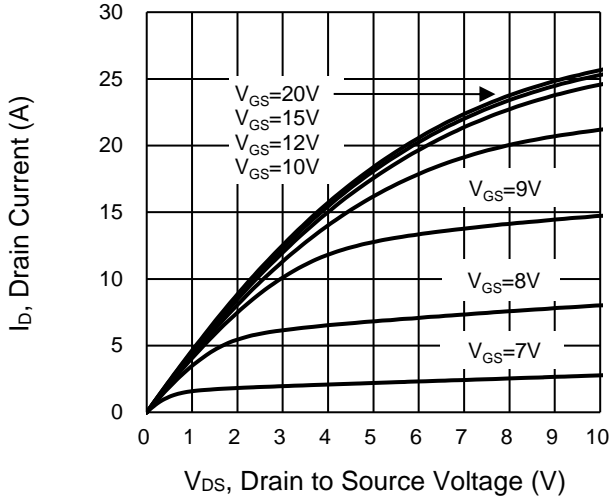
**ORDERING INFORMATION**

ORDERING CODE	PACKAGE	PACKING
TSM60NE285CIT C0G	ITO-220TL	50pcs / Tube

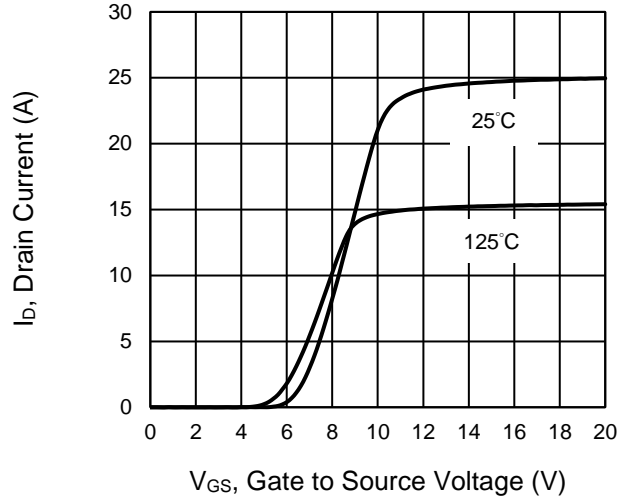
**CHARACTERISTICS CURVES**

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

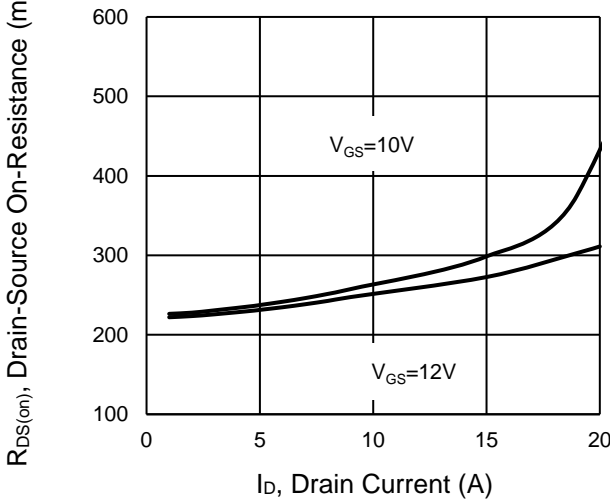
**Output Characteristics**



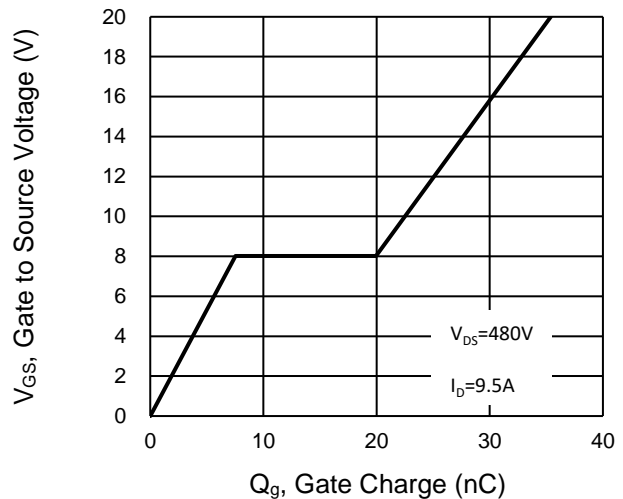
**Transfer Characteristics**



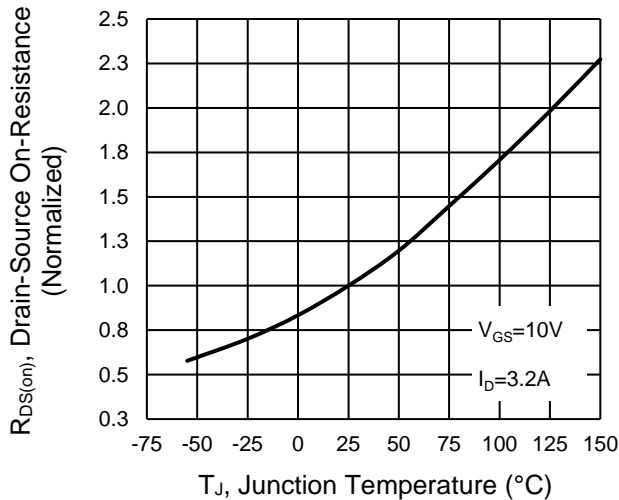
**On-Resistance vs. Drain Current**



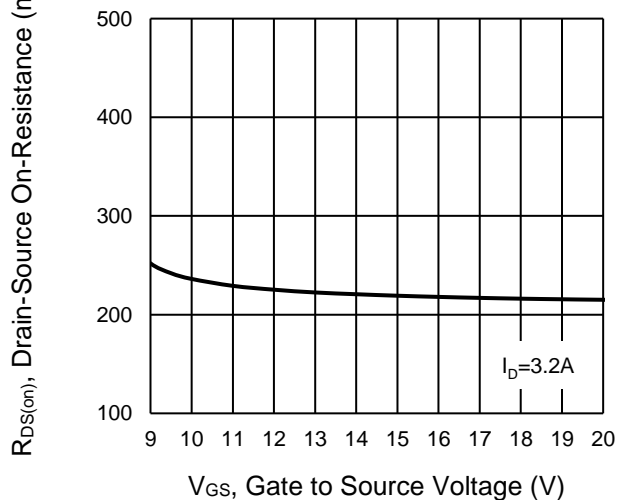
**Gate-Source Voltage vs. Gate Charge**



**On-Resistance vs. Junction Temperature**



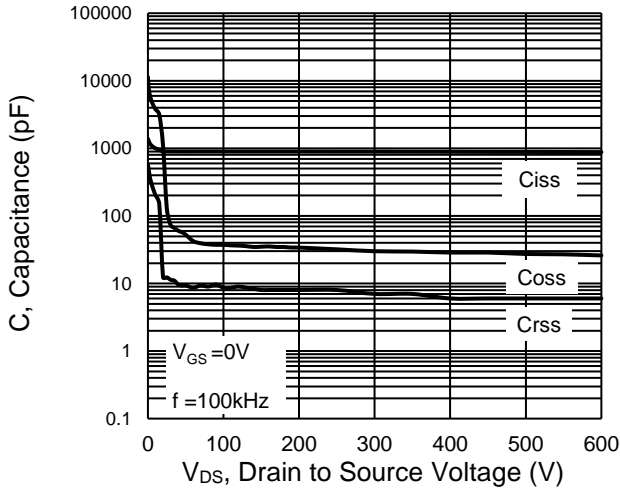
**On-Resistance vs. Gate-Source Voltage**



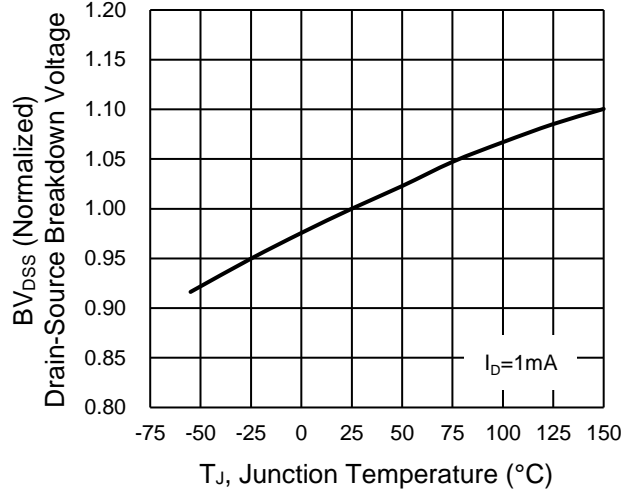
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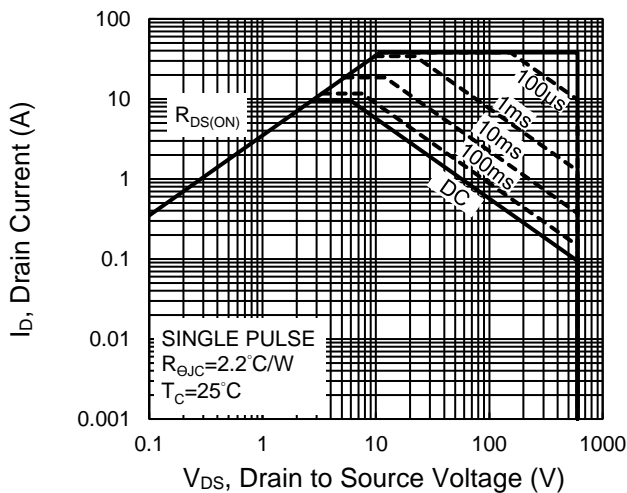
**Capacitance vs. Drain-Source Voltage**



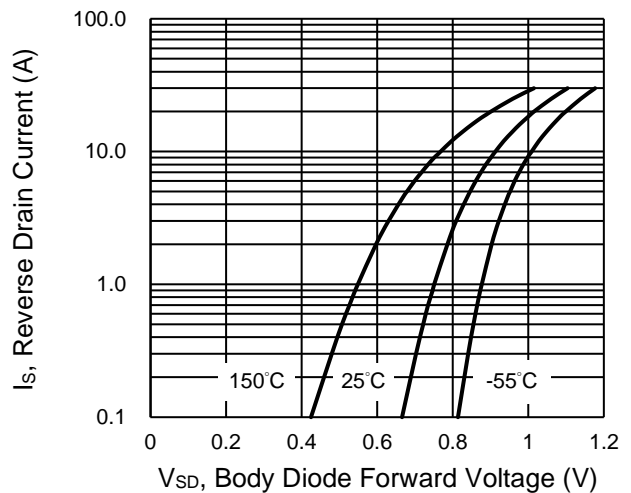
**$BV_{DSS}$  vs. Junction Temperature**



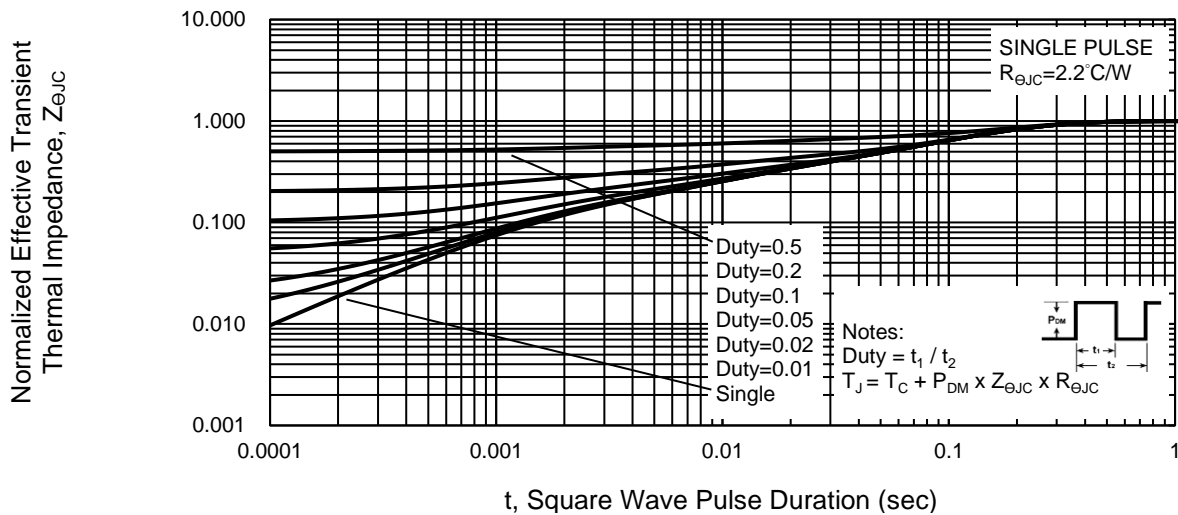
**Maximum Safe Operating Area, Junction-to-Case**



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



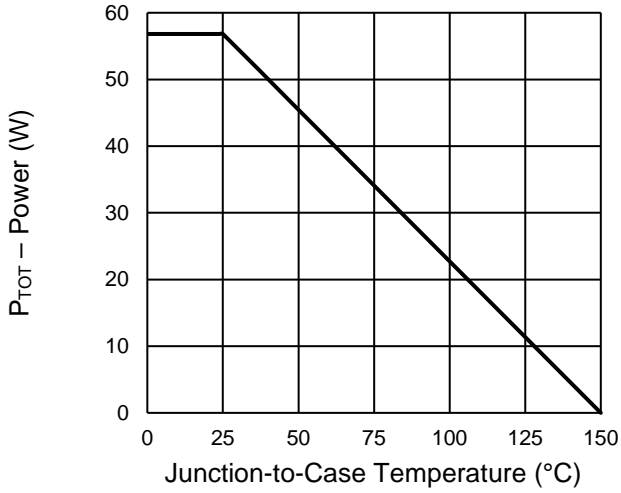
**Normalized Thermal Transient Impedance, Junction-to-Case**



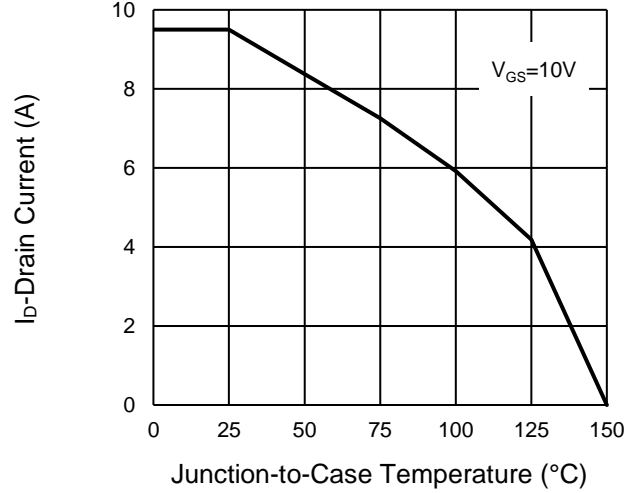
**CHARACTERISTICS CURVES**

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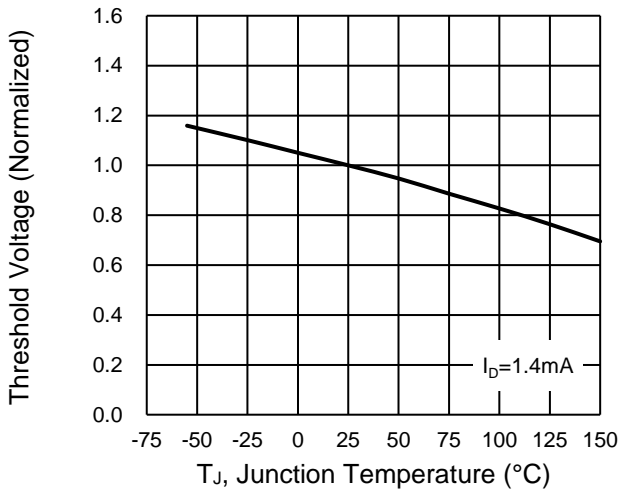
**Power Dissipation**



**Drain Current**

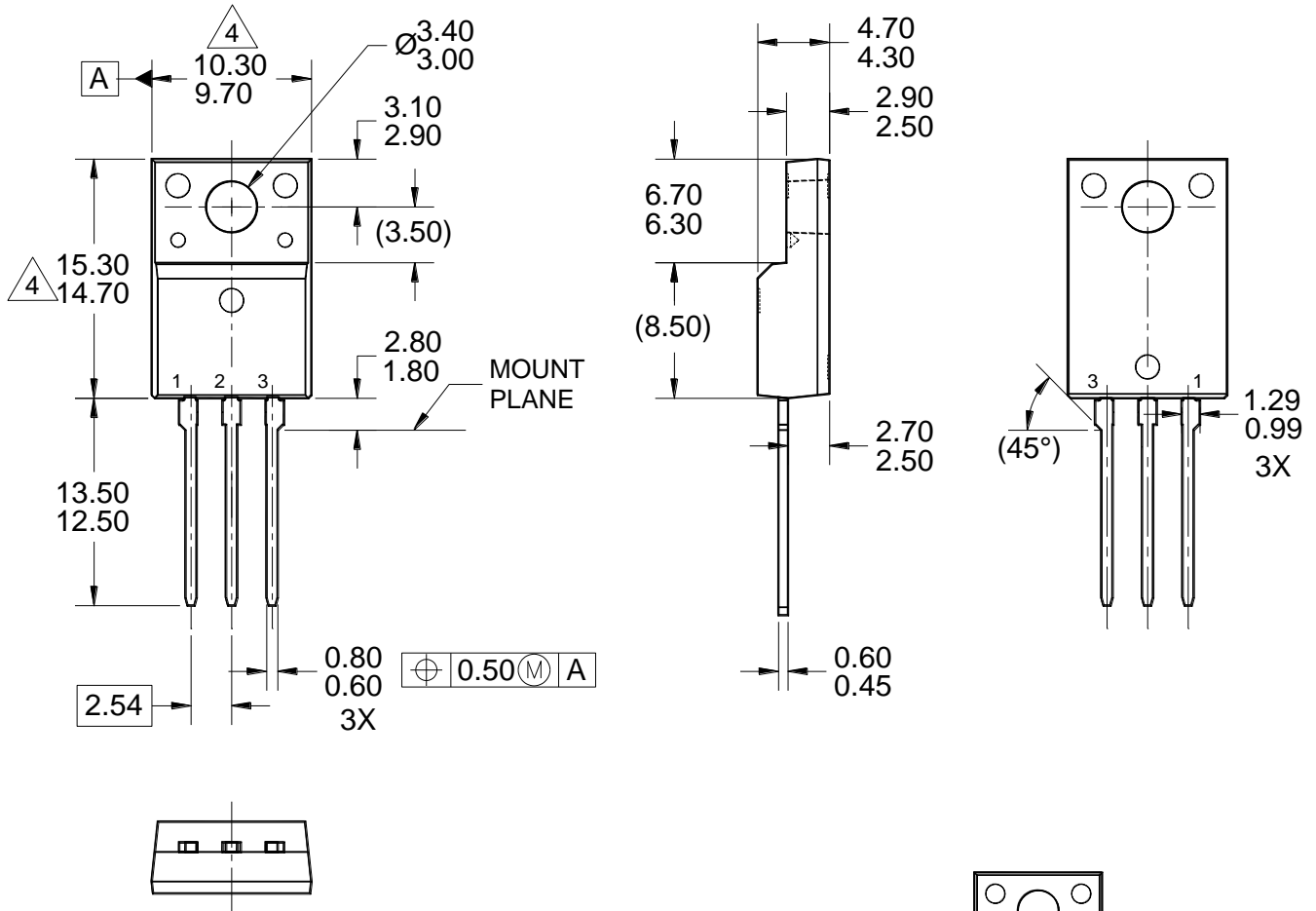


**Normalized gate threshold voltage vs Temperature**



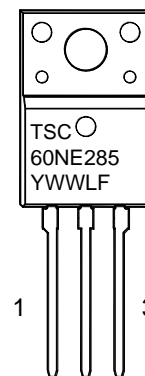
**PACKAGE OUTLINE DIMENSIONS** (Unit: Millimeters)

**ITO-220TL**



**NOTES: UNLESS OTHERWISE SPECIFIED**

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
3. PACKAGE OUTLINE REFERENCE: EIAJ ED-7500A-1, SC-91.
4. MOLDED PLASTIC BODY DIMENSIONS DO NOT INCLUDE MOLD FLASH. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREME OF THE PLASTIC BODY.
5. DWG NO. REF: HQ2SD07-ITO220TL-016 REV B.



**MARKING DIAGRAM**

- |    |                       |
|----|-----------------------|
| Y  | = YEAR CODE           |
| WW | = WEEK CODE (01~52)   |
| L  | = LOT CODE (1~9, A~Z) |
| F  | = FACTORY CODE        |

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