

## N-Channel Power MOSFET

600V, 4A, 2.5Ω

### FEATURES

- 100% Avalanche Tested
- Pb-free plating
- RoHS compliant
- Halogen-free according to IEC 61249-2-21

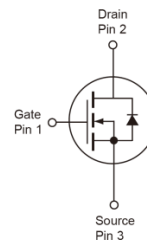
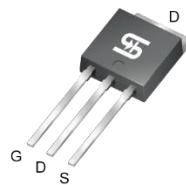
### APPLICATIONS

- Lighting
- Charger
- Power Supply
- Switching applications

PRODUCT SUMMARY			
PARAMETER		VALUE	UNIT
$V_{DS}$		600	V
$R_{DS(on)}$ (max)	$V_{GS} = 10V$	2.5	Ω
$Q_g$	$V_{GS} = 10V$	16	nC



TO-251 (IPAK)



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)	$T_C = 25^\circ\text{C}$	$I_D$	4	A
	$T_C = 100^\circ\text{C}$		2.7	
Pulsed Drain Current		$I_{DM}$	16	A
Single Pulse Avalanche Current (Note 2)		$I_{AS}$	4.6	A
Single Pulse Avalanche Energy (Note 2)		$E_{AS}$	84	mJ
Total Power Dissipation	$T_C = 25^\circ\text{C}$	$P_D$	114	W
Operating Junction and Storage Temperature Range		$T_J, T_{STG}$	- 55 to +150	°C

THERMAL RESISTANCE			
PARAMETER	SYMBOL	MAXIMUM	UNIT
Thermal Resistance – Junction to Case	$R_{\theta JC}$	1.1	°C/W
Thermal Resistance – Junction to Ambient	$R_{\theta JA}$	62	°C/W

**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.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design

<b>ELECTRICAL CHARACTERISTICS</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	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	$V_{GS(TH)}$	2.5	2.8	4.5	V
Gate-Source Leakage Current	$V_{GS} = \pm 30\text{V}, V_{DS} = 0\text{V}$	$I_{GSS}$	--	--	$\pm 100$	nA
Drain-Source Leakage Current	$V_{GS} = 0\text{V}, V_{DS} = 600\text{V}$	$I_{DSS}$	--	--	1	$\mu\text{A}$
Drain-Source On-State Resistance (Note 3)	$V_{GS} = 10\text{V}, I_D = 2\text{A}$	$R_{DS(on)}$	--	2	2.5	$\Omega$
Forward Transfer Conductance	$V_{DS} = 10\text{V}, I_D = 2\text{A}$	$g_{fs}$	--	4	--	S
<b>Dynamic</b>						
Total Gate Charge	$V_{GS} = 10\text{V}, V_{DS} = 480\text{V}, I_D = 4\text{A}$	$Q_g$	--	16	--	nC
Gate-Source Charge		$Q_{gs}$	--	2.6	--	
Gate-Drain Charge		$Q_{gd}$	--	7	--	
Input Capacitance	$V_{GS} = 0\text{V}, V_{DS} = 25\text{V}, f = 1.0\text{MHz}$	$C_{iss}$	--	574	--	pF
Output Capacitance		$C_{oss}$	--	56	--	
Reverse Transfer Capacitance		$C_{rss}$	--	7	--	
<b>Switching</b> (Note 4)						
Turn-On Delay Time	$V_{GS} = 10\text{V}, V_{DS} = 300\text{V}, I_D = 4\text{A}, R_G = 25\Omega$	$t_{d(on)}$	--	11	--	ns
Rise Time		$t_r$	--	14	--	
Turn-Off Delay Time		$t_{d(off)}$	--	38	--	
Fall Time		$t_f$	--	21	--	
<b>Source-Drain Diode</b>						
Diode Forward Voltage (Note 3)	$V_{GS} = 0\text{V}, I_S = 4\text{A}$	$V_{SD}$	--	--	1.13	V
Reverse Recovery Time	$V_{GS} = 10\text{V}, I_S = 2\text{A}, dI_F/dt = 100\text{A}/\mu\text{s}$	$t_{rr}$	--	188	--	ns
Reverse Recovery Charge		$Q_{rr}$	--	1.1	--	$\mu\text{C}$
Source Current (Note 1)	Integral reverse diode In the MOSFET	$I_S$	--	--	4	A
Source Current (Pulse)		$I_{SM}$	--	--	16	

**Notes:**

1. Pulsed width limited by maximum junction temperature.
2.  $L = 8\text{mH}, V_{GS} = 10\text{V}, R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$ .
3. Pulse test: Pulse Width  $\leq 300\mu\text{s}$ , duty cycle  $\leq 2\%$ .
4. Switching time is essentially independent of operating temperature.

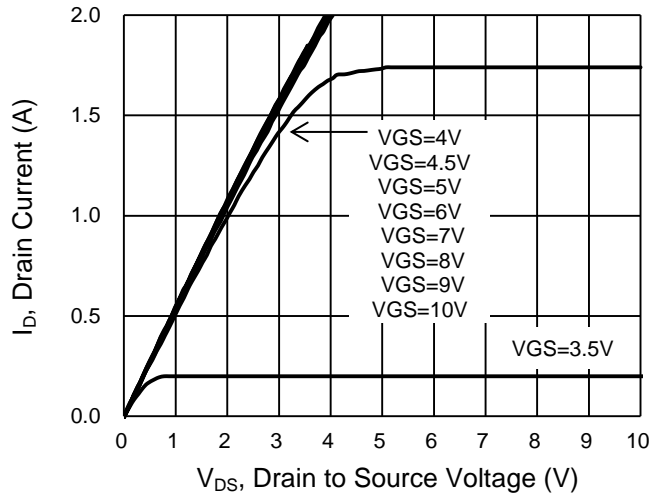
**ORDERING INFORMATION**

ORDERING CODE	PACKAGE	PACKING
TSM4NB60CH C5G	TO-251 (IPAK)	75 pcs / Tube

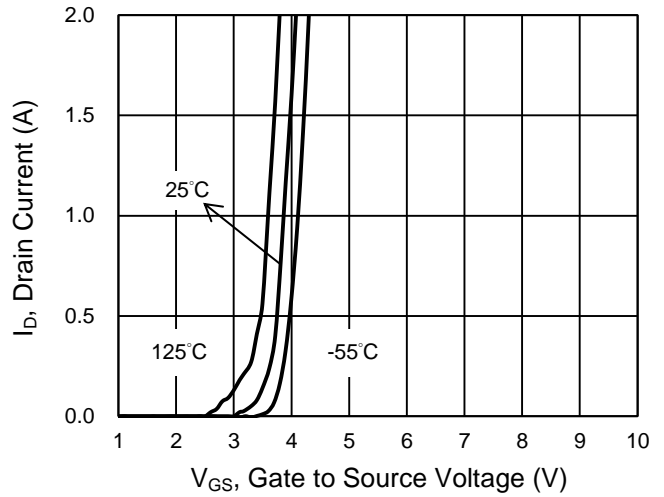
**CHARACTERISTICS CURVES**

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

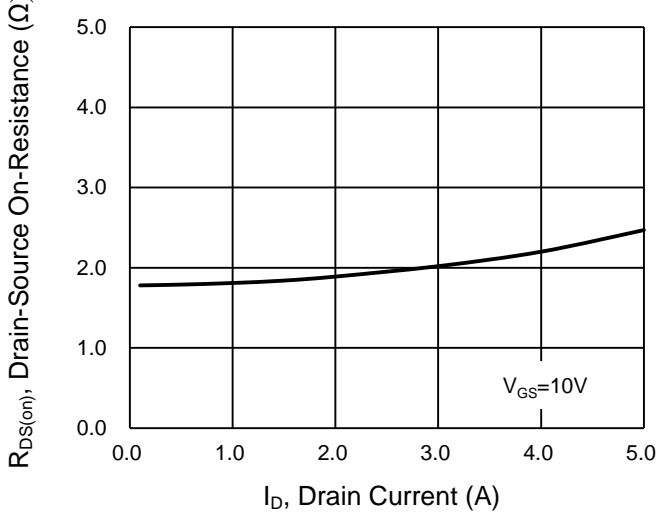
**Output Characteristics**



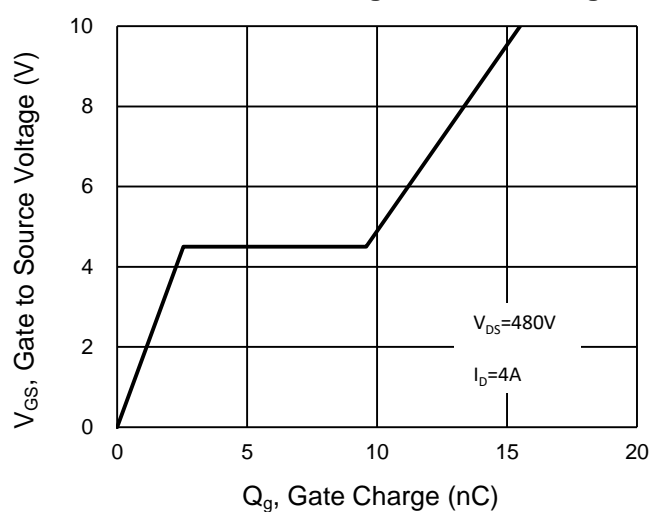
**Transfer Characteristics**



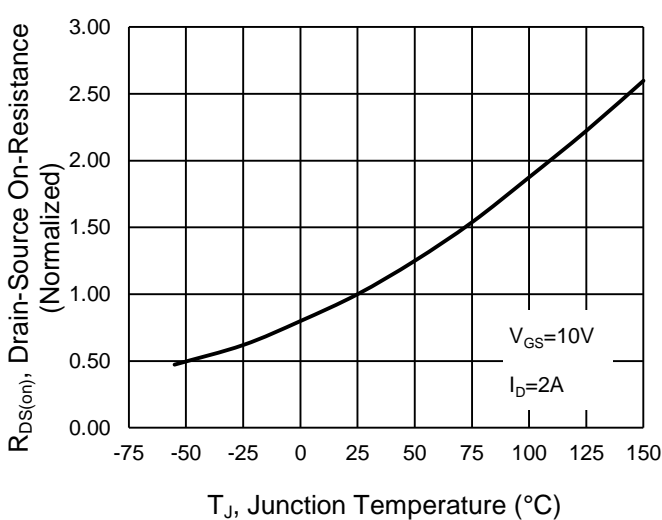
**On-Resistance vs. Drain Current**



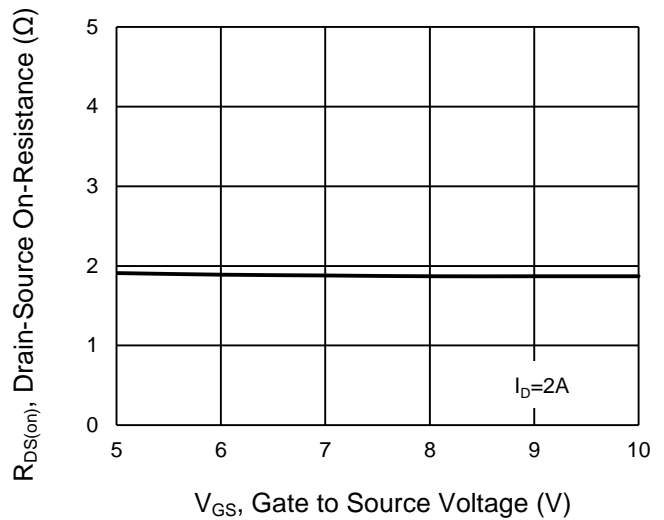
**Gate-Source Voltage vs. Gate Charge**



**On-Resistance vs. Junction Temperature**



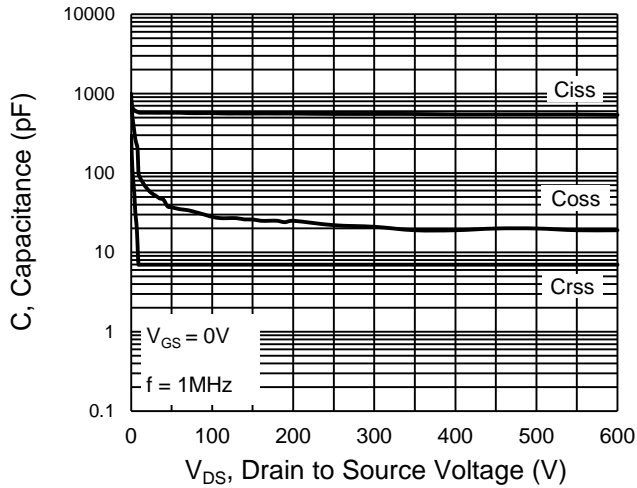
**On-Resistance vs. Gate-Source Voltage**



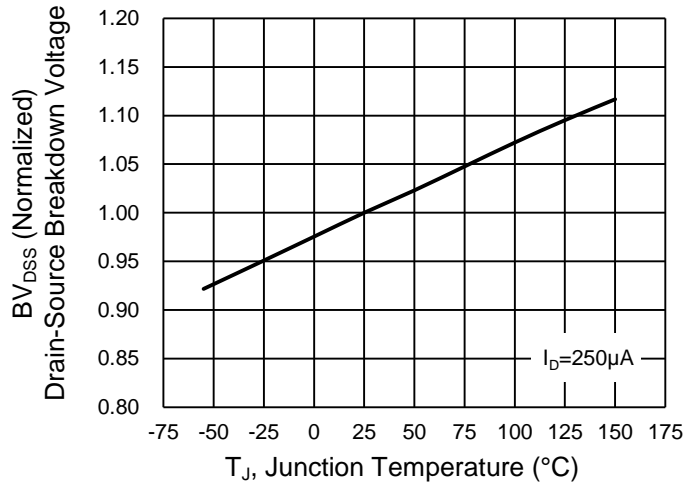
**CHARACTERISTICS CURVES**

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

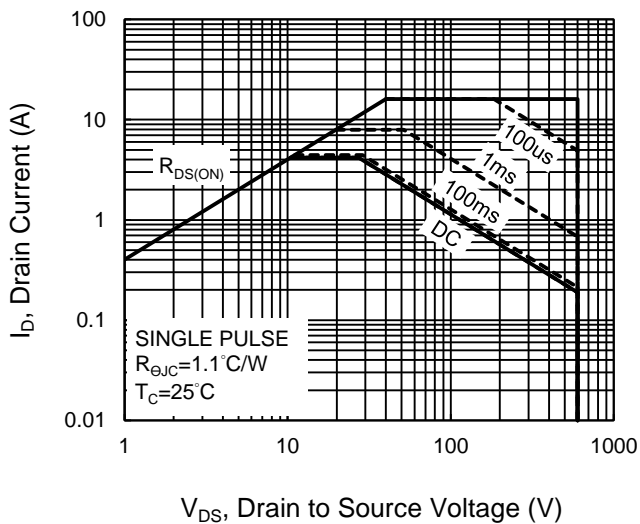
**Capacitance vs. Drain-Source Voltage**



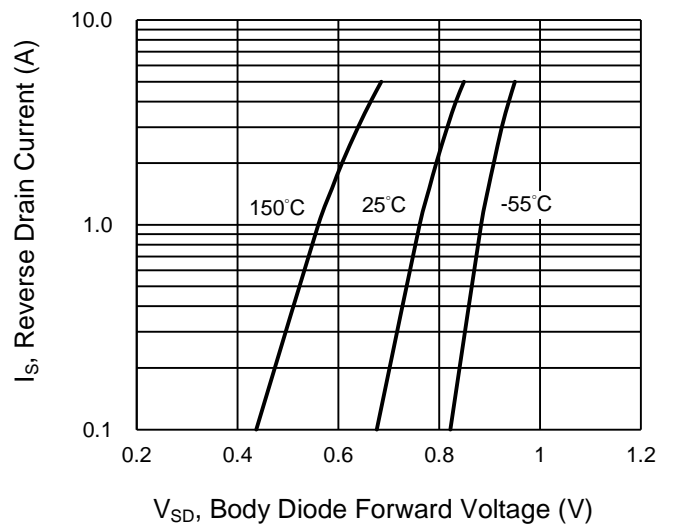
**$BV_{DSS}$  vs. Junction Temperature**



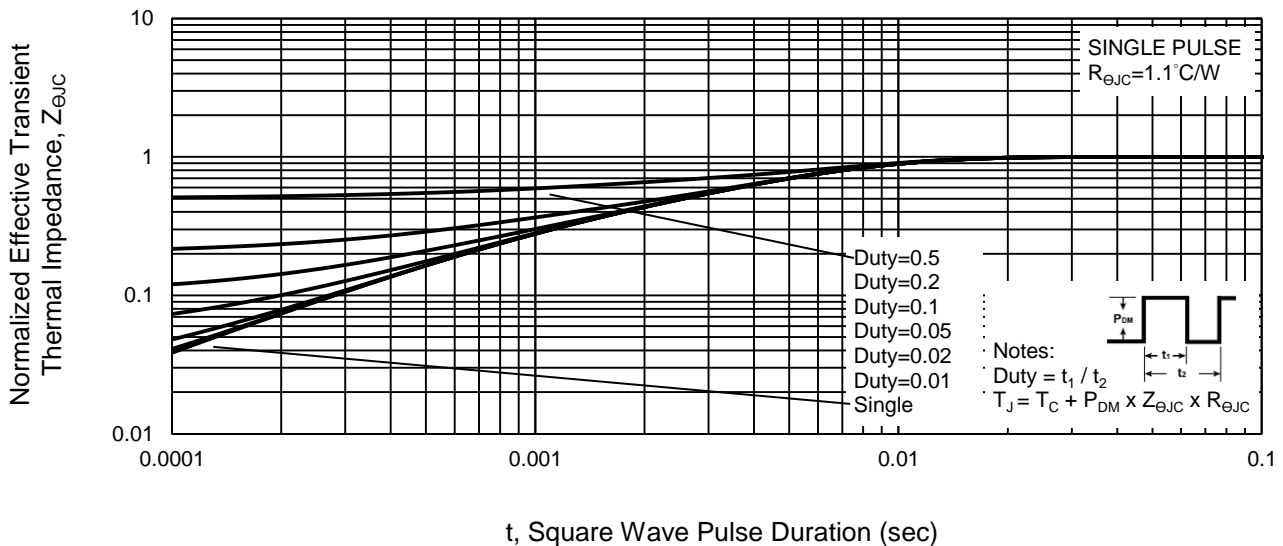
**Maximum Safe Operating Area, Junction-to-Case**



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



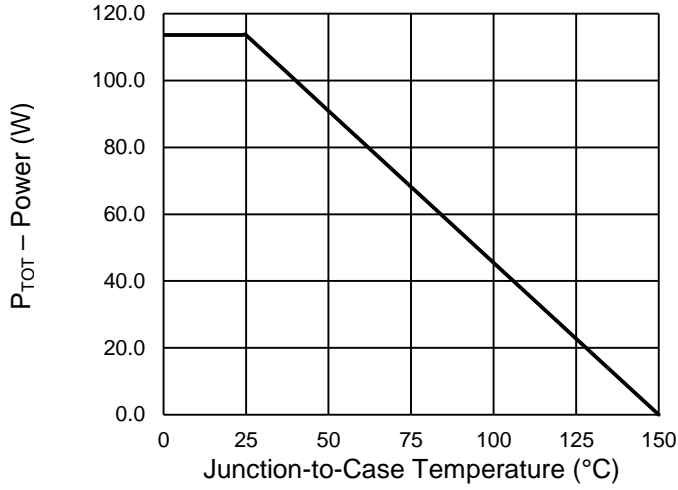
**Normalized Thermal Transient Impedance, Junction-to-Case**



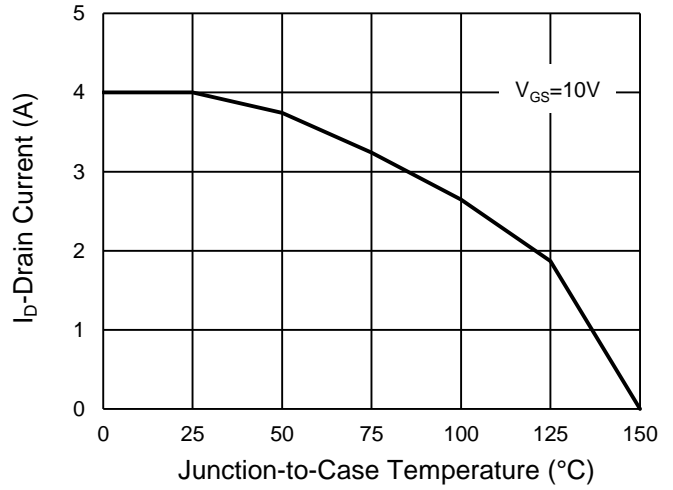
**CHARACTERISTICS CURVES**

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

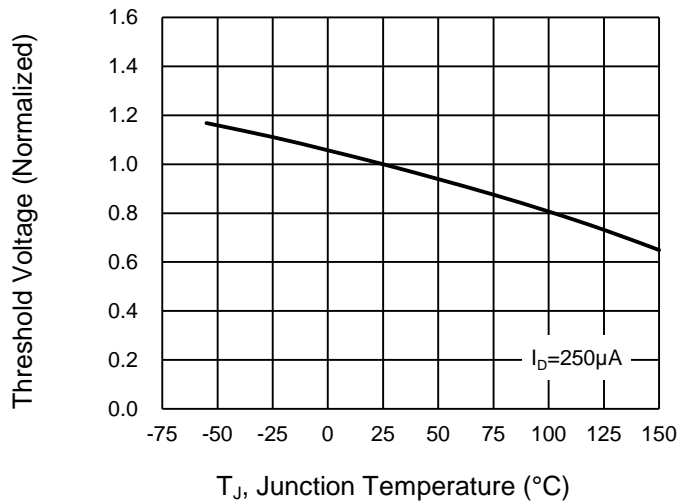
**Power Dissipation**



**Drain Current**

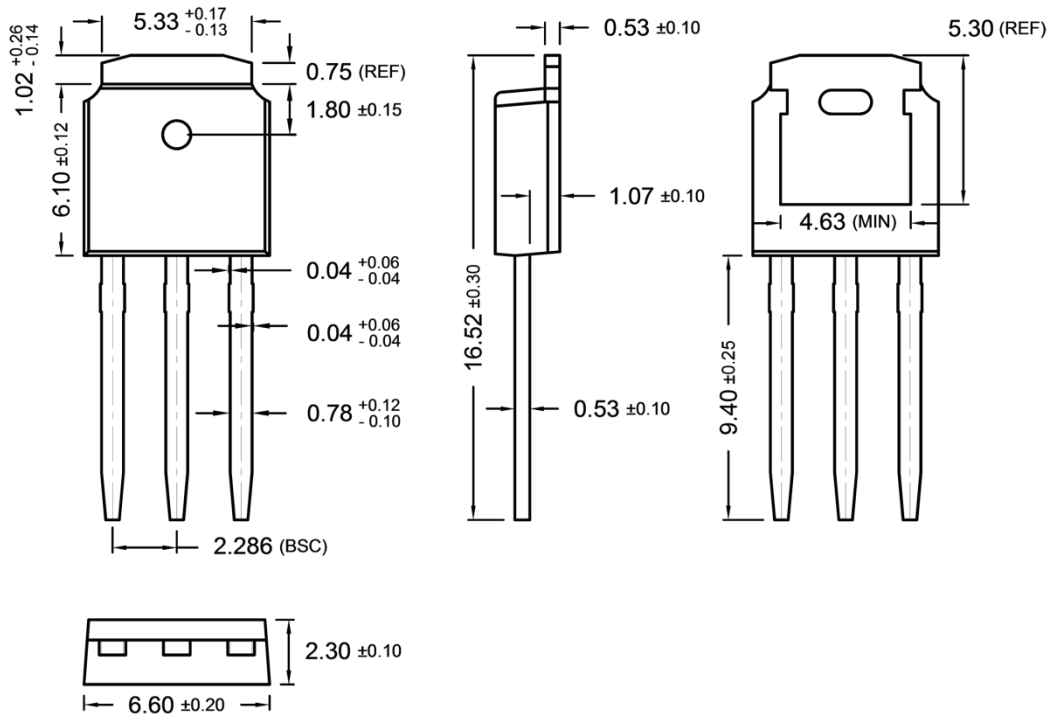


**Normalized gate threshold voltage vs Temperature**

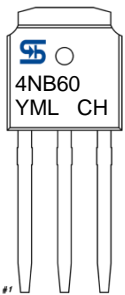


**PACKAGE OUTLINE DIMENSIONS** (Unit: Millimeters)

**TO-251 (IPAK)**



**MARKING DIAGRAM**



- Y** = Year Code
- M** = Month Code
- O** =Jan   **P** =Feb   **Q** =Mar   **R** =Apr
- S** =May   **T** =Jun   **U** =Jul   **V** =Aug
- W** =Sep   **X** =Oct   **Y** =Nov   **Z** =Dec
- L** = Lot Code (1~9, A~Z)

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