

## N-Channel Trench Power MOSFET

### General Description

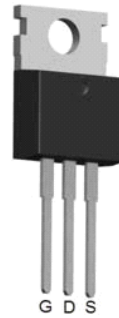
The PTI €€ is N-channel MOS Field Effect Transistor designed for high current switching applications. Rugged EAS capability and ultra low  $R_{DS(ON)}$  is suitable for PWM, load switching especially for E-Bike controller applications.

### Features

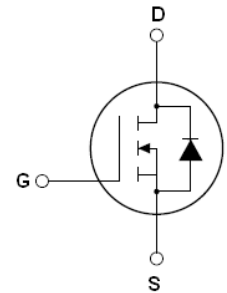
- $V_{DS}=100V$ ;  $I_D=190A@ V_{GS}=10V$ ;  
 $R_{DS(ON)}<7.1m\Omega @ V_{GS}=10V$
- Special Designed for E-Bike Controller Application
- Ultra Low On-Resistance
- High UIS and UIS 100% Test

### Application

- 72V E-Bike controller applications
- Hard Switched and High Frequency Circuits
- Uninterruptible Power Supply



To-220 Top View



Schematic Diagram

$$V_{DSS} = 100V$$

$$I_{DSS} = 190A$$

$$R_{DS(ON)} = 6.8m\Omega$$

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
PTI €€	PTI €€	TO-220	-	-	-

Table 1. Absolute Maximum Ratings (TA=25°C)

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-Source Voltage ( $V_{GS}=0V$ )	100	V
$V_{GS}$	Gate-Source Voltage ( $V_{DS}=0V$ )	±25	V
$I_{D(DC)}$	Drain Current (DC) at $T_c=25^\circ C$	190	A
$I_{D(DC)}$	Drain Current (DC) at $T_c=100^\circ C$	187	A
$I_{DM(plus)}$	Drain Current-Continuous@ Current-Pulsed (Note 1)	760	A
$P_D$	Maximum Power Dissipation( $T_c=25^\circ C$ )	330	W
	Derating Factor	2.2	W/°C
$E_{AS}$	Single Pulse Avalanche Energy (Note 2)	960	mJ
$T_J, T_{STG}$	Operating Junction and Storage Temperature Range	-55 To 175	°C

Notes 1.Repetitive Rating: Pulse width limited by maximum junction temperature

2.EAS condition: $T_J=25^\circ C, V_{DD}=50V, V_G=10V, R_G=25\Omega$

**Table 2. Thermal Characteristic**

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.45	$^{\circ}C/W$

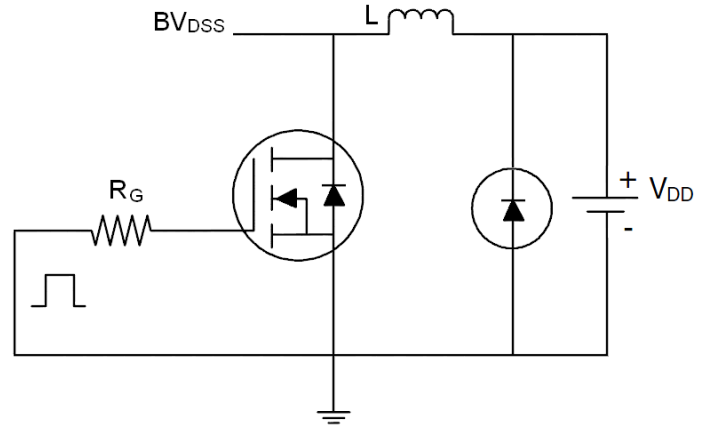
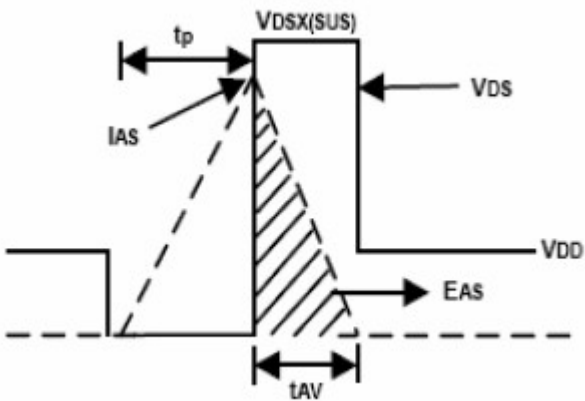
**Table 3. Electrical Characteristics (TA=25 $^{\circ}C$  unless otherwise noted)**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>On/Off States</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	100			V
$I_{DSS}$	Zero Gate Voltage Drain Current(Tc=25 $^{\circ}C$ )	$V_{DS}=100V, V_{GS}=0V$			1	$\mu A$
$I_{DSS}$	Zero Gate Voltage Drain Current(Tc=125 $^{\circ}C$ )	$V_{DS}=100V, V_{GS}=0V$			1	$\mu A$
$I_{GSS}$	Gate-Body Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$			$\pm 100$	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	2		4	V
$R_{DS(on)}$	Drain-Source On-State Resistance	$V_{GS}=10V, I_D=40A$		6.8	7.1	m $\Omega$
<b>Dynamic Characteristics</b>						
$g_{FS}$	Forward Transconductance	$V_{DS}=50V, I_D=40A$	170			S
$C_{iss}$	Input Capacitance	$V_{DS}=25V, V_{GS}=0V$ $f=1.0MHz$		7633		PF
$C_{oss}$	Output Capacitance			916		PF
$C_{rss}$	Reverse Transfer Capacitance			513		PF
$Q_g$	Total Gate Charge	$V_{DS}=44V, I_D=40A$ $V_{GS}=10V$		158		nC
$Q_{gs}$	Gate-Source Charge			29		nC
$Q_{gd}$	Gate-Drain Charge			42		nC
<b>Switching Times</b>						
$t_{d(on)}$	Turn-on Delay Time	$V_{DD}=65V, I_D=40A, R_L=15\Omega$ $V_{GS}=10V, R_G=2.5\Omega$		25		nS
$t_r$	Turn-on Rise Time			29		nS
$t_{d(off)}$	Turn-Off Delay Time			53		nS
$t_f$	Turn-Off Fall Time			63		nS
<b>Source-Drain Diode Characteristics</b>						
$I_{SD}$	Source-Drain Current(Body Diode)			190		A
$I_{SDM}$	Pulsed Source-Drain Current(Body Diode)			760		A
$V_{SD}$	Forward On Voltage <b>(Note 1)</b>	$T_J=25^{\circ}C, I_{SD}=40A, V_{GS}=0V$		0.85	1	V
$t_{rr}$	Reverse Recovery Time <b>(Note 1)</b>	$T_J=25^{\circ}C, I_F=40A$ $di/dt=100A/\mu s$		95		nS
$Q_{rr}$	Reverse Recovery Charge <b>(Note 1)</b>			189		nC
$t_{on}$	Forward Turn-on Time	Intrinsic turn-on time is negligible(turn-on is dominated by $L_S+L_D$ )				

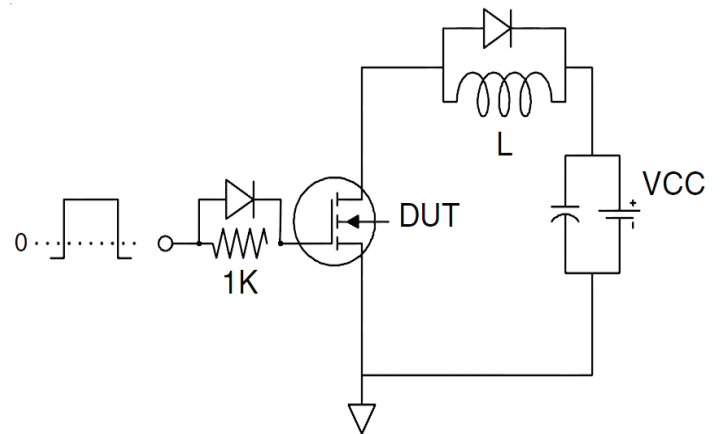
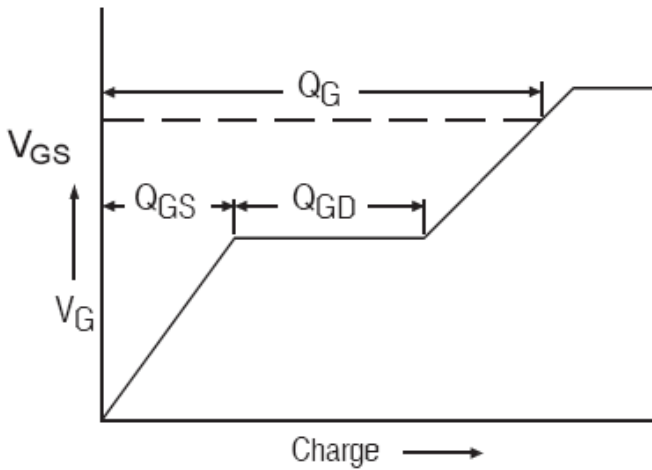
Notes 1. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 1.5\%$ ,  $R_G=25\Omega$ , Starting  $T_J=25^{\circ}C$

## Test Circuit

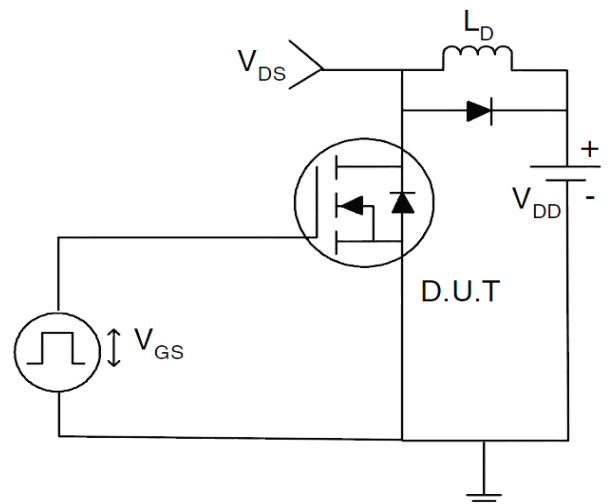
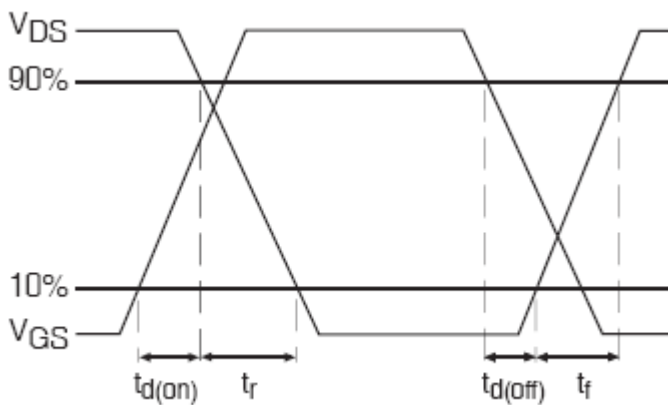
### 1) EAS Test Circuits



### 2) Gate Charge Test Circuit:

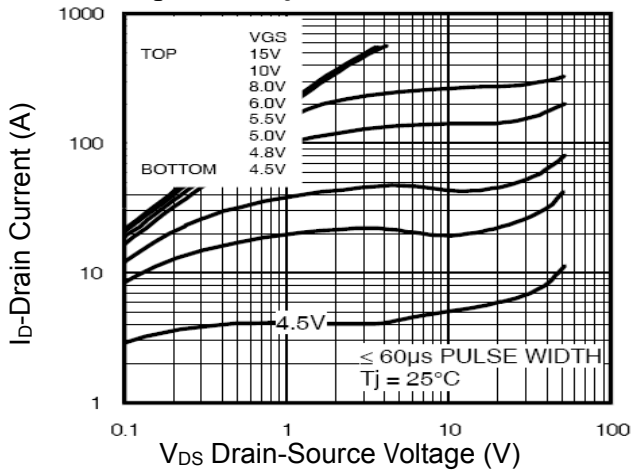


### 3) Switch Time Test Circuit:

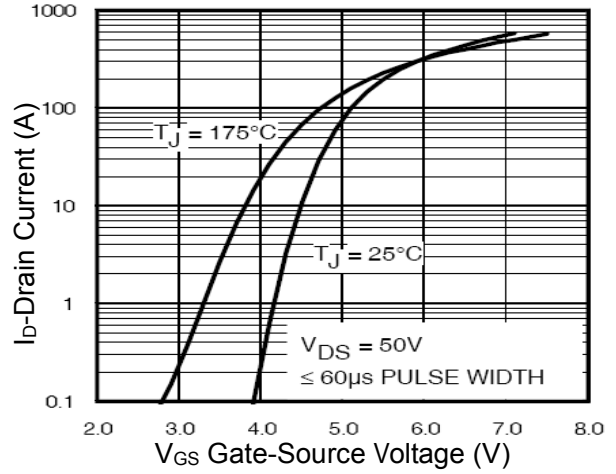


**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (Curves)**

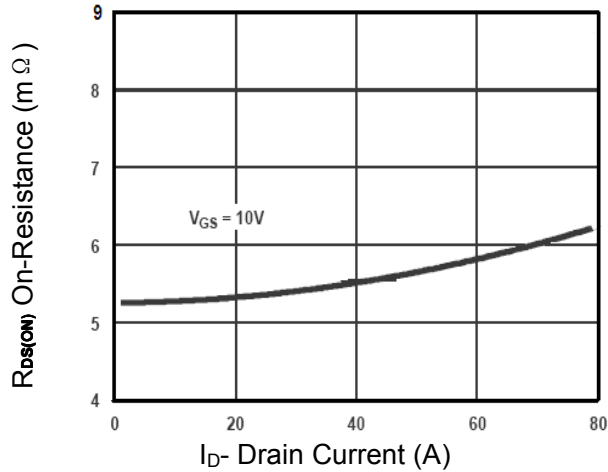
**Figure1. Output Characteristics**



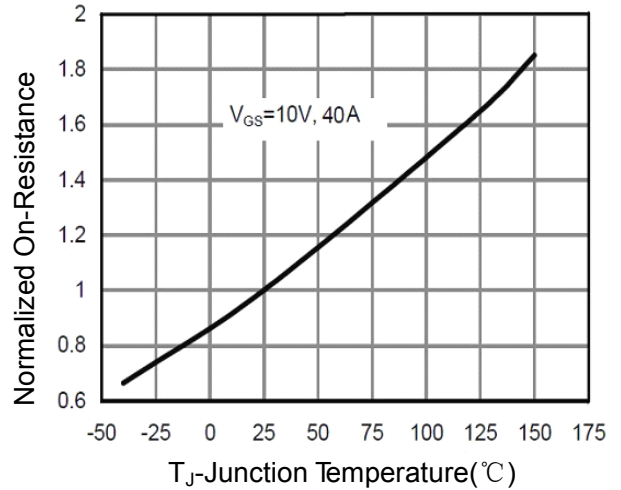
**Figure2. Transfer Characteristics**



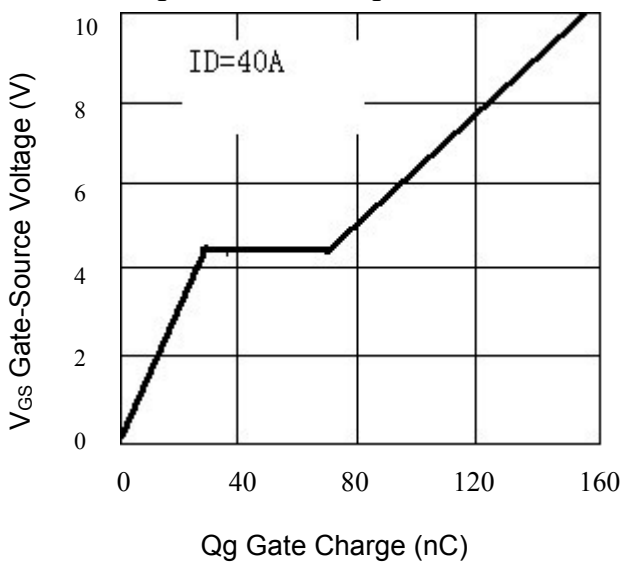
**Figure3. RDS(ON)- Drain Current**



**Figure4. RDS(ON)- Junction Temperature**



**Figure5. Gate Charge**



**Figure6. Source- Drain Diode Forward**

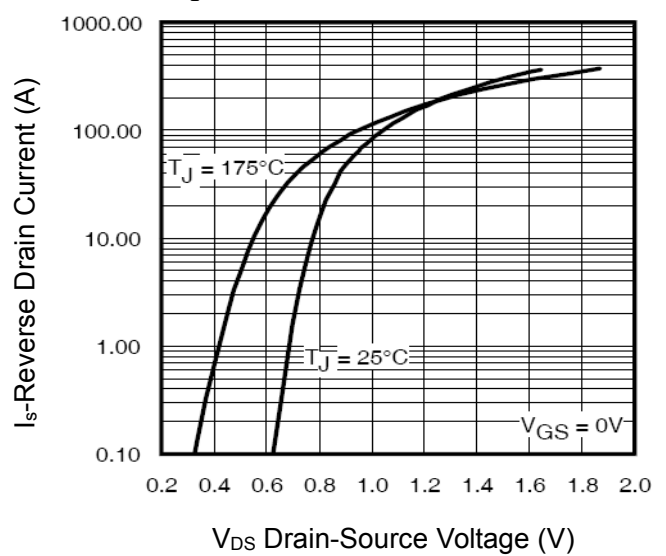


Figure7. Capacitance vs Vds

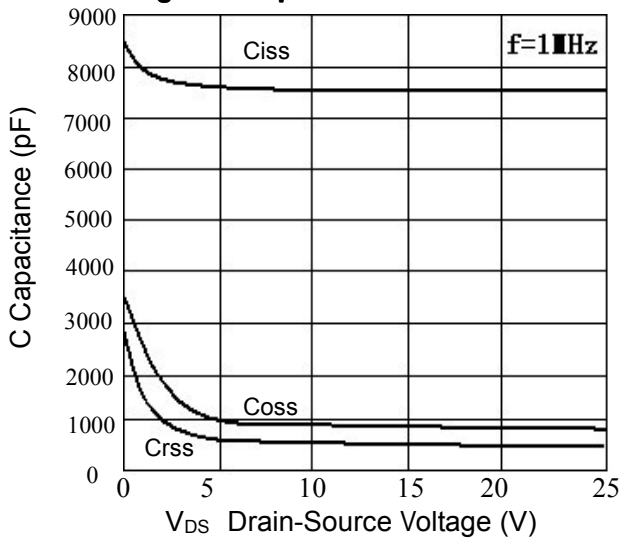


Figure8. Safe Operation Area

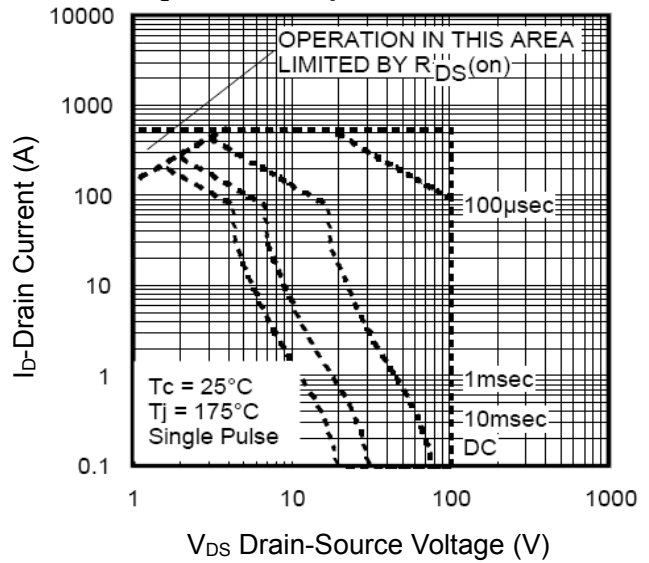


Figure9. BVdss vs Junction Temperature

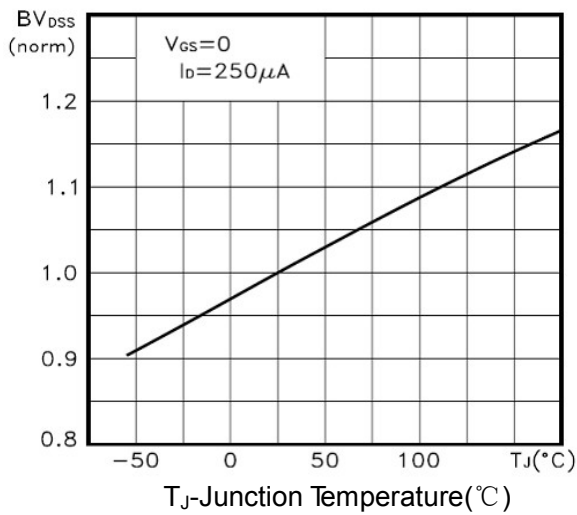


Figure10. VGS(th) vs Junction Temperature

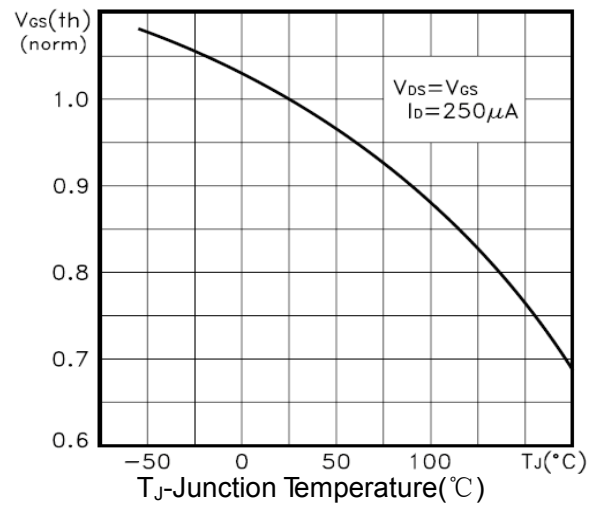
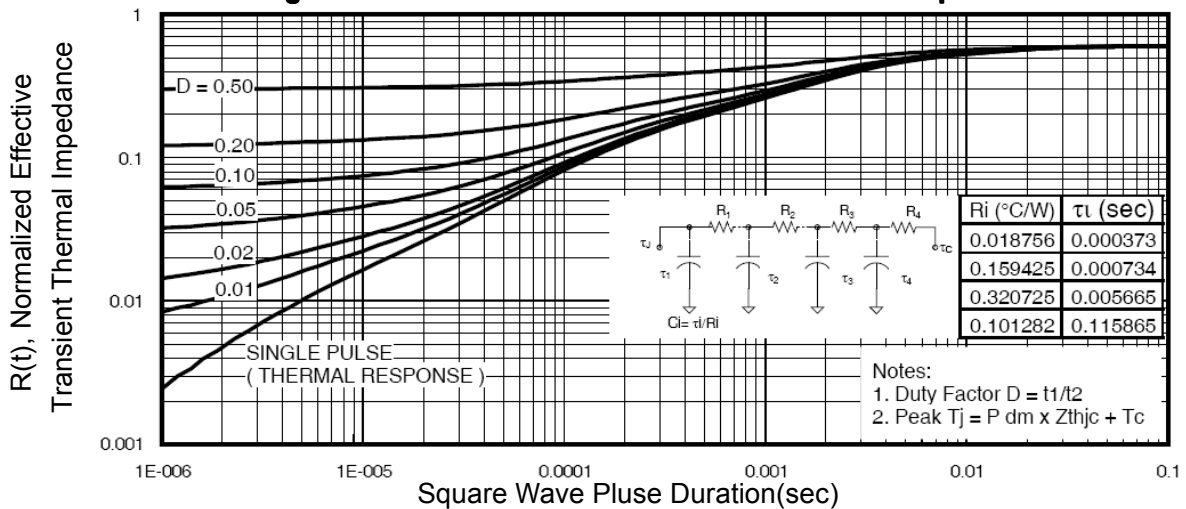
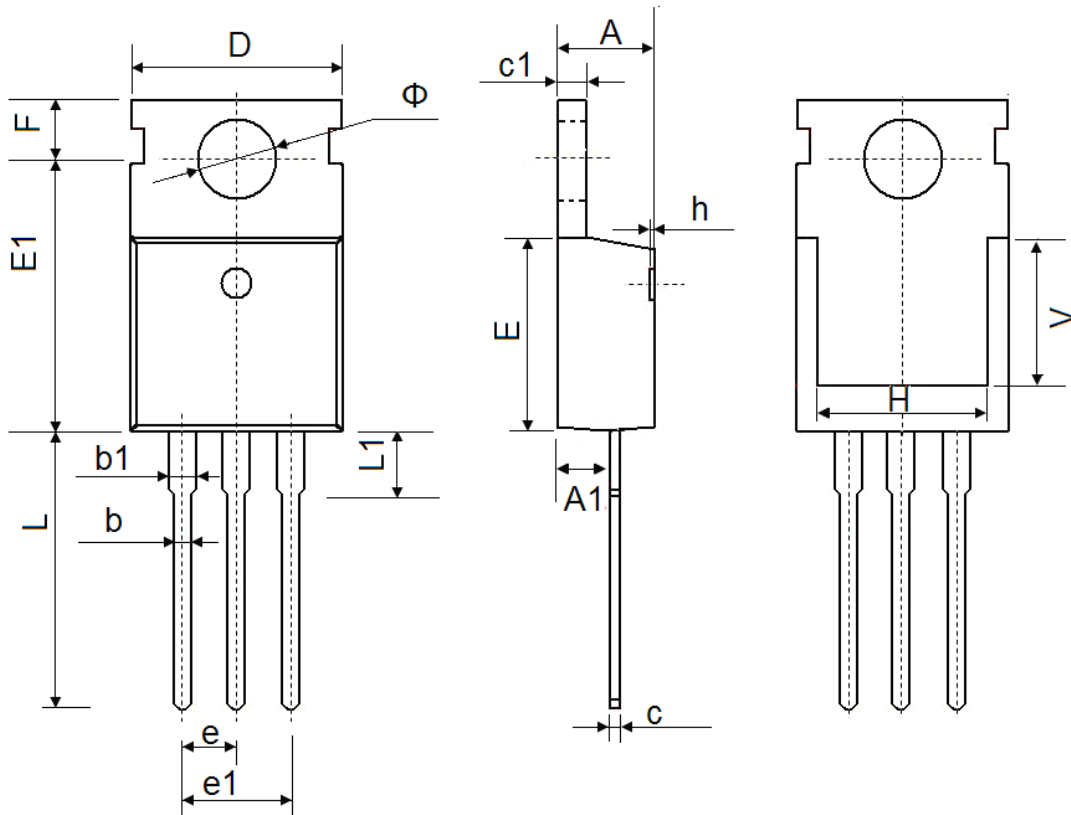


Figure11. Normalized Maximum Transient Thermal Impedance



## TO-220 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.400	4.600	0.173	0.181
A1	2.250	2.550	0.089	0.100
b	0.710	0.910	0.028	0.036
b1	1.170	1.370	0.046	0.054
c	0.330	0.650	0.013	0.026
c1	1.200	1.400	0.047	0.055
D	9.910	10.250	0.390	0.404
E	8.9500	9.750	0.352	0.384
E1	12.650	12.950	0.498	0.510
e	2.540 TYP.		0.100 TYP.	
e1	4.980	5.180	0.196	0.204
F	2.650	2.950	0.104	0.116
H	7.900	8.100	0.311	0.319
h	0.000	0.300	0.000	0.012
L	12.900	13.400	0.508	0.528
L1	2.850	3.250	0.112	0.128
V	7.500 REF.		0.295 REF.	
$\Phi$	3.400	3.800	0.134	0.150