

N-Channel Trench Power MOSFET

General Description

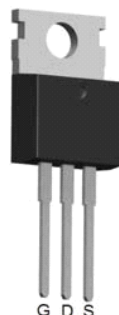
The HM4030 is N-channel MOS Field Effect Transistor designed for high current switching applications. Rugged EAS capability and ultra low $R_{DS(ON)}$ is suitable for PWM, load switching especially for E-Bike controller applications.

Features

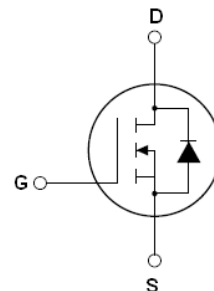
- $V_{DS}=100V$; $I_D=190A@V_{GS}=10V$;
 $R_{DS(ON)}<7.1m\Omega @V_{GS}=10V$
- Special Designed for E-Bike Controller Application
- Ultra Low On-Resistance
- High UIS and UIS 100% Test

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
HM4030	HM4030	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
$I_{DM(pluse)}$	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	$^{\circ}\text{C}/\text{W}$

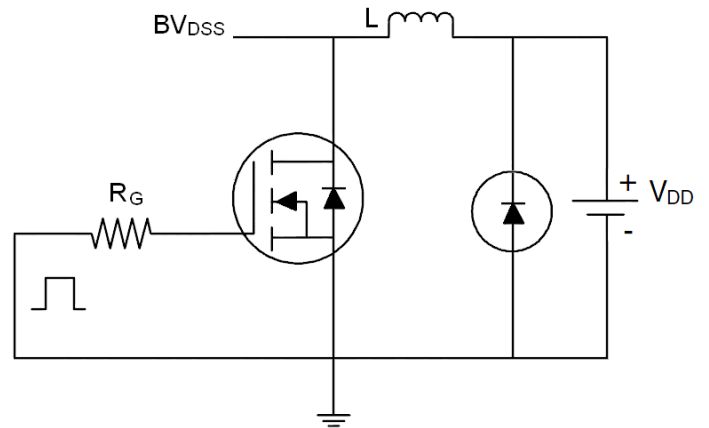
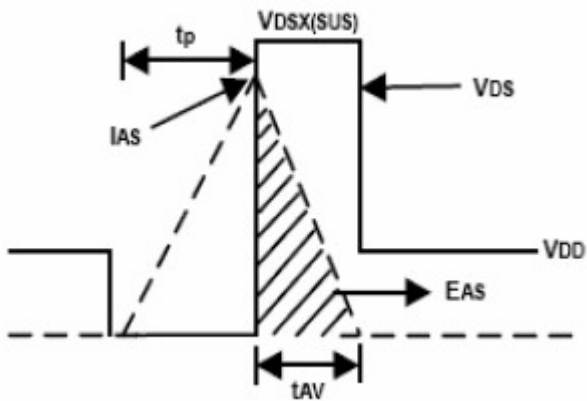
Table 3. Electrical Characteristics (TA=25 $^{\circ}\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
On/Off States						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V I _D =250μA	100			V
I _{DSS}	Zero Gate Voltage Drain Current(Tc=25℃)	V _{DS} =100V,V _{GS} =0V			1	μA
I _{DSS}	Zero Gate Voltage Drain Current(Tc=125℃)	V _{DS} =100V,V _{GS} =0V			1	μA
I _{GSS}	Gate-Body Leakage Current	V _{GS} =±20V,V _{DS} =0V			±100	nA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} ,I _D =250μA	2		4	V
R _{DS(ON)}	Drain-Source On-State Resistance	V _{GS} =10V, I _D =40A		6.8	7.1	mΩ
Dynamic Characteristics						
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
Switching Times						
t _{d(on)}	Turn-on Delay Time	V _{DD} =65V,I _D =40A,R _L =15Ω V _{GS} =10V,R _G =2.5Ω		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
Source-Drain Diode Characteristics						
I _{SD}	Source-Drain Current(Body Diode)			190		A
I _{SDM}	Pulsed Source-Drain Current(Body Diode)			760		A
V _{SD}	Forward On Voltage ^(Note 1)	T _J =25℃,I _{SD} =40A,V _{GS} =0V		0.85	1	V
t _{rr}	Reverse Recovery Time ^(Note 1)	T _J =25℃,I _F =40A di/dt=100A/μs		95		nS
Q _{rr}	Reverse Recovery Charge ^(Note 1)			189		nC
t _{on}	Forward Turn-on Time	Intrinsic turn-on time is negligible(turn-on is dominated by L _S +L _D)				

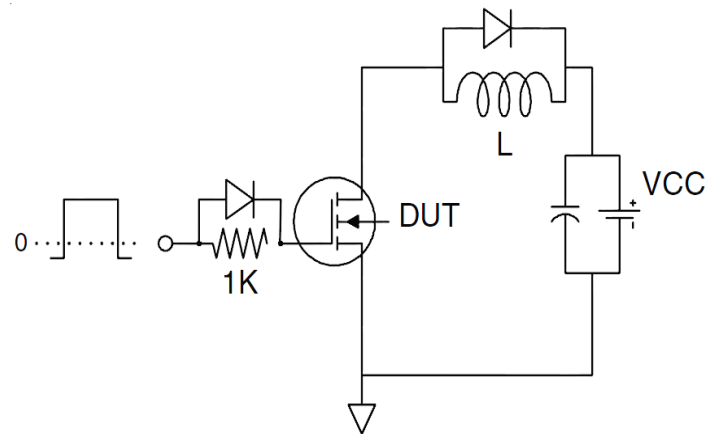
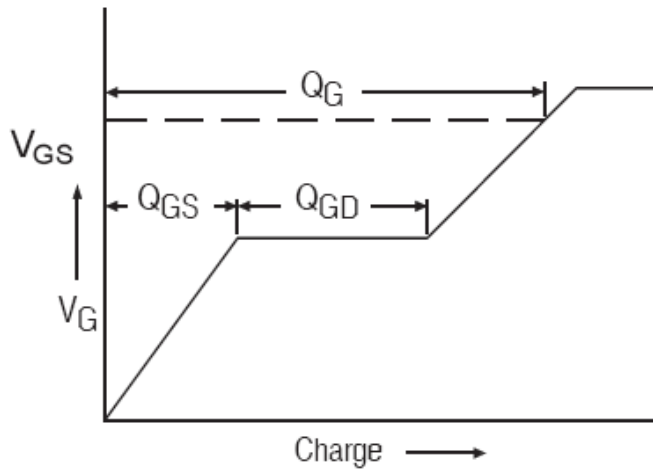
Notes 1. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 1.5\%$, $R_G=25\Omega$, Starting $T_J=25^{\circ}\text{C}$

Test Circuit

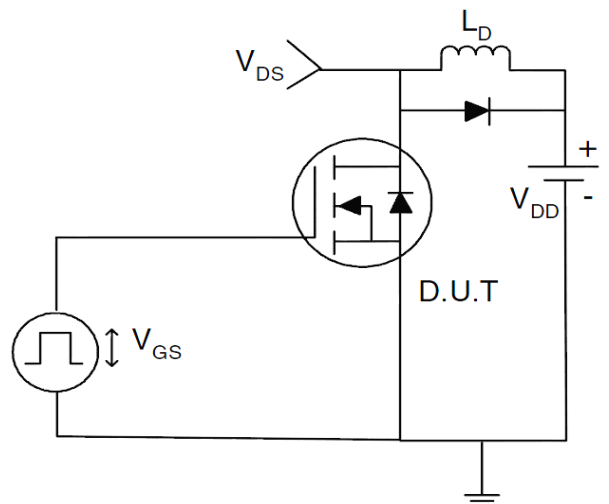
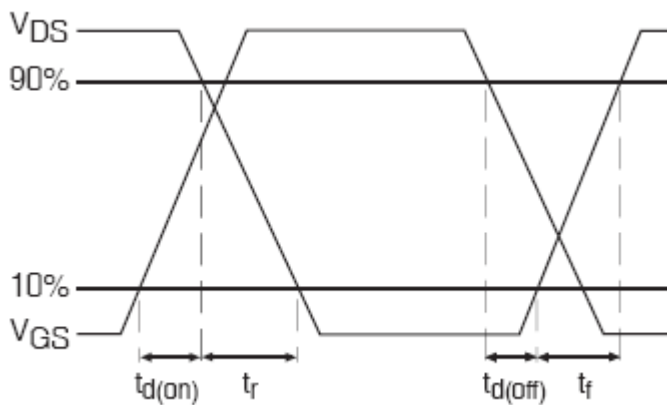
1) E_{AS} Test Circuits



2) Gate Charge Test Circuit:



3) Switch Time Test Circuit:



TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (Curves)

Figure1. Output Characteristics

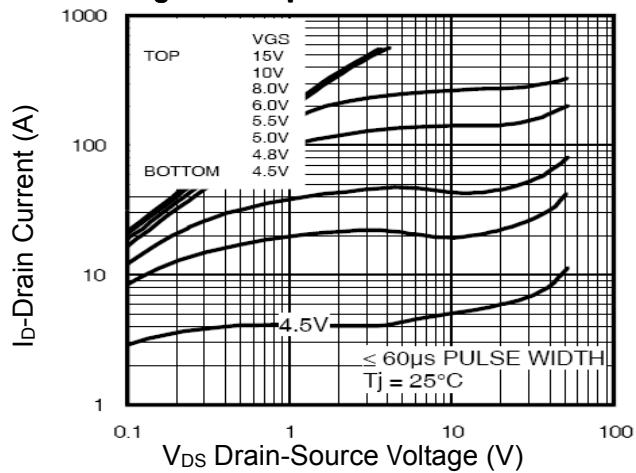


Figure2. Transfer Characteristics

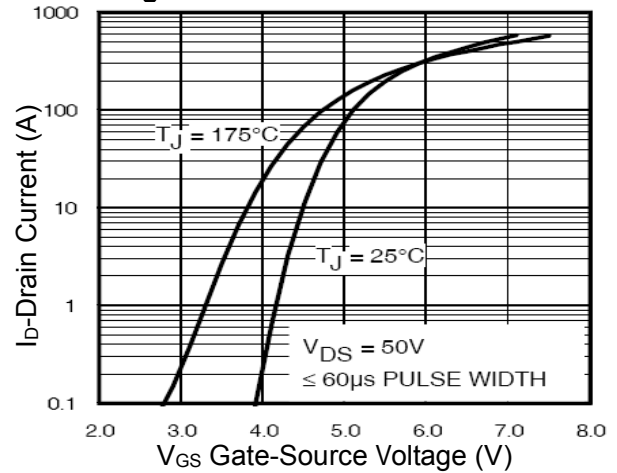


Figure3. $R_{DS(ON)}$ - Drain Current

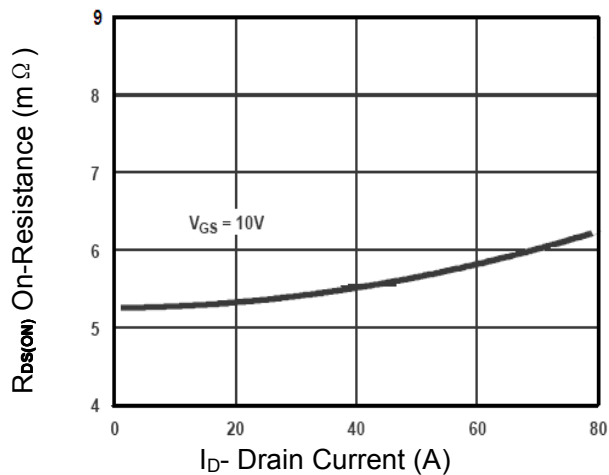


Figure4. $R_{DS(ON)}$ - Junction Temperature

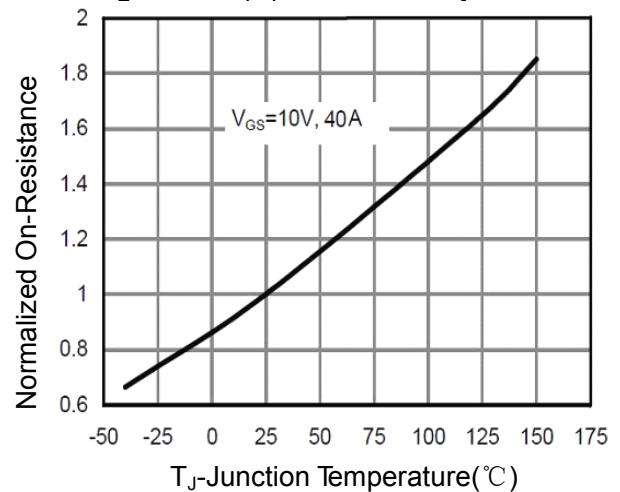


Figure5. Gate Charge

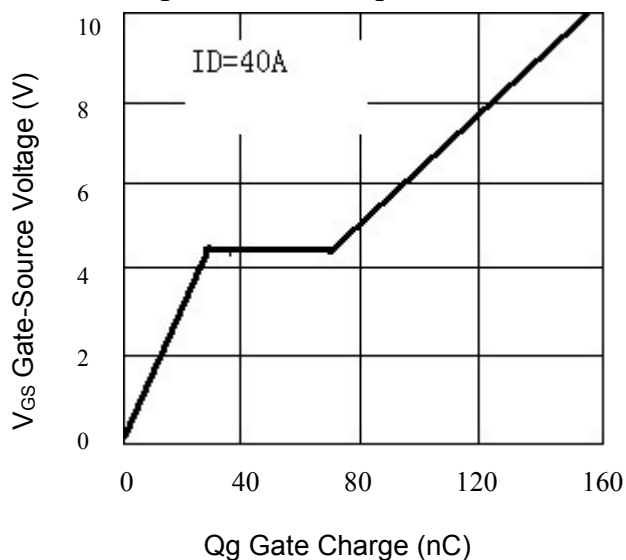


Figure6. Source- Drain Diode Forward

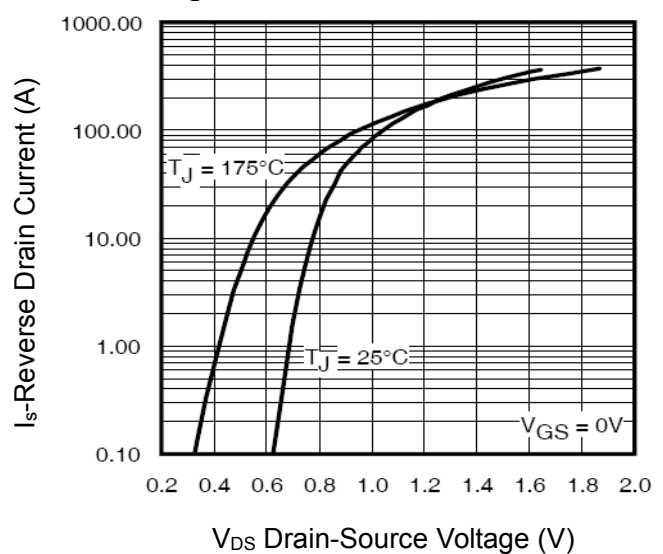


Figure7. Capacitance vs V_{DS}

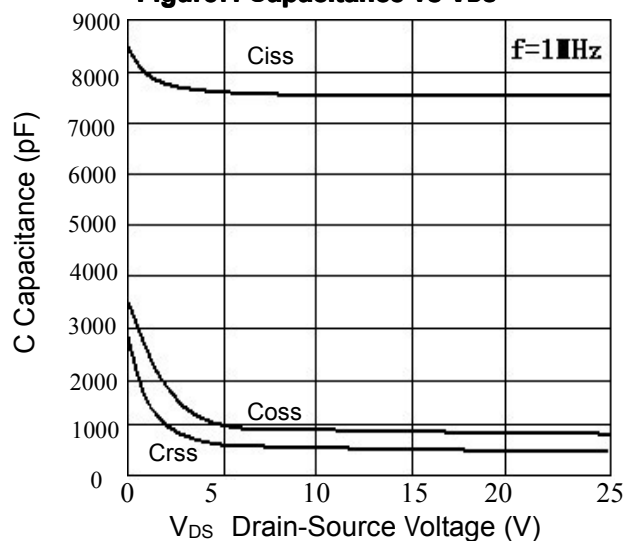


Figure8. Safe Operation Area

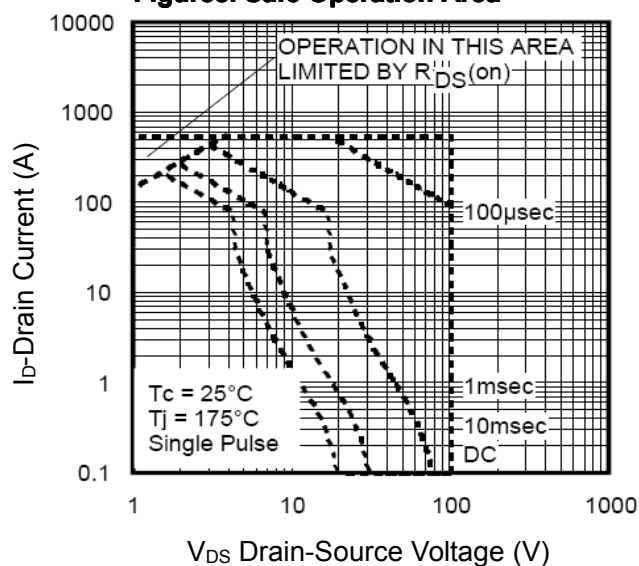


Figure9. BV_{DSS} vs Junction Temperature

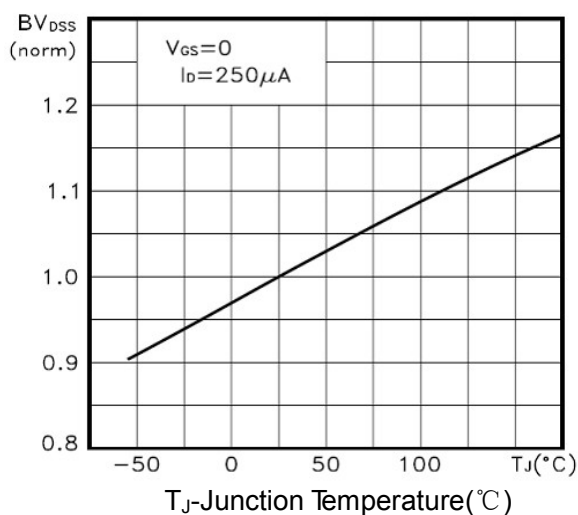


Figure10. V_{GS(th)} vs Junction Temperature

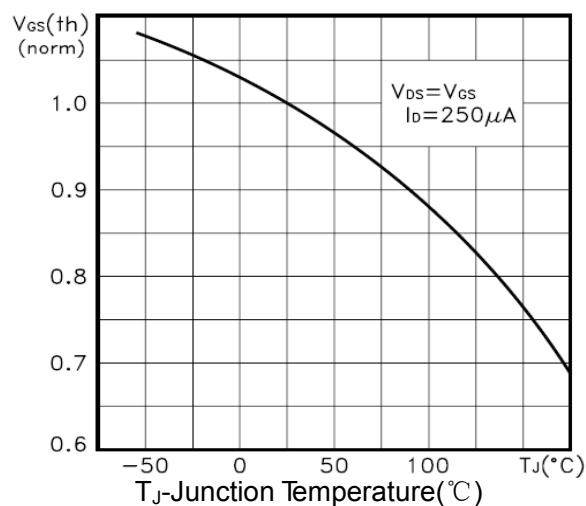
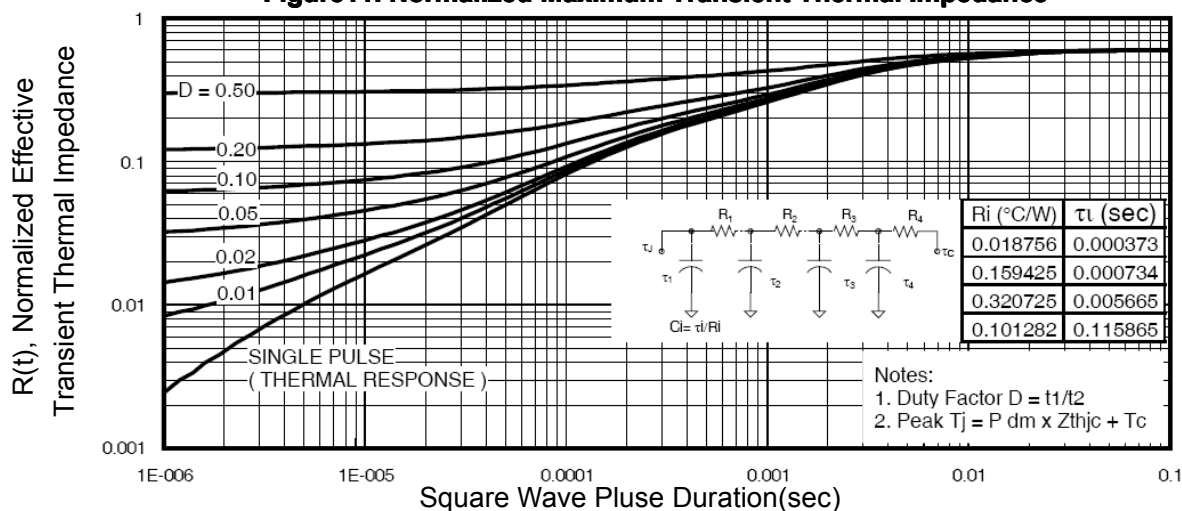
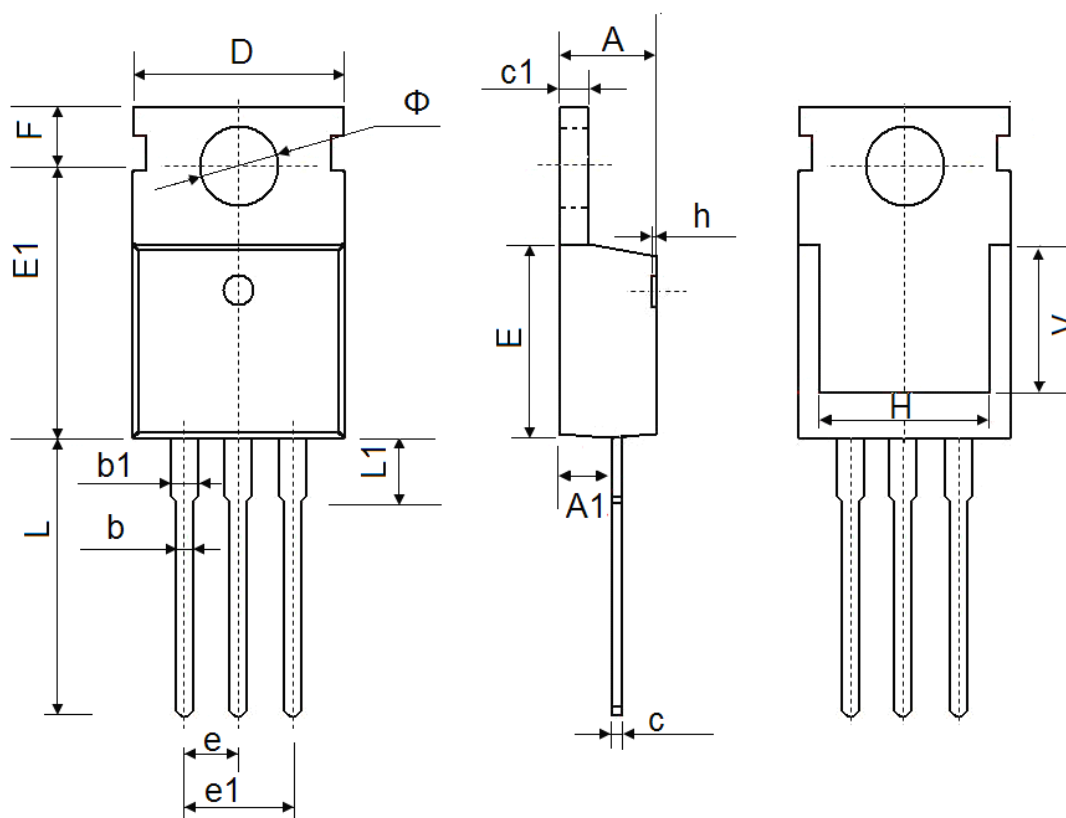


Figure11. Normalized Maximum Transient Thermal Impedance



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.	
Φ	3.400	3.800	0.134	0.150