

N-Channel Trench Power MOSFET

General Description

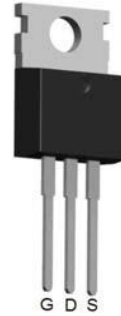
The MST7078 is N-channel MOS Field Effect Transistor designed for high current switching applications. Rugged EAS capability and ultra low $R_{DS(ON)}$ is suitable for PWM, load switching especially for E-Bike controller applications.

Features

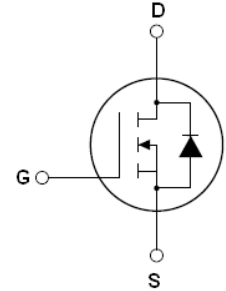
- $V_{DS}=70V$; $I_D=80A @ V_{GS}=10V$;
 $R_{DS(ON)} < 7.2m\Omega @ V_{GS}=10V$
- Special Designed for E-Bike Controller Application
- Ultra Low On-Resistance
- High UIS and UIS 100% Test

Application

- 48V E-Bike Controller Applications
- Hard Switched and High Frequency Circuits
- Uninterruptible Power Supply



To-220 Top View



Schematic Diagram

$$V_{DS} = 70 V$$

$$I_D = 80 A$$

$$R_{DS(ON)} = 5.9 m\Omega$$

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
MST7078	MST7078	TO-220	-	-	-

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

Symbol	Parameter	Value	Unit
V_{DS}	Drain-Source Voltage ($V_{GS}=0V$)	70	V
V_{GS}	Gate-Source Voltage ($V_{DS}=0V$)	± 25	V
$I_{D(DC)}$	Drain Current (DC) at $T_c=25^\circ C$	80	A
$I_{D(DC)}$	Drain Current (DC) at $T_c=100^\circ C$	56	A
$I_{DM(pluse)}$	Drain Current-Continuous@ Current-Pulsed (Note 1)	320	A
dv/dt	Peak Diode Recovery Voltage	30	V/ns
P_D	Maximum Power Dissipation($T_c=25^\circ C$)	100	W
	Derating Factor	0.66	W/°C
E_{AS}	Single Pulse Avalanche Energy (Note 2)	360	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: $T_J=25^{\circ}\text{C}$, $V_{DD}=33\text{V}$, $V_G=10\text{V}$, $I_D=48.5\text{A}$

Table 2. Thermal Characteristic

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance,Junction-to-Case	1.5	$^{\circ}\text{C}/\text{W}$

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
On/Off States						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS}=0\text{V}$, $I_D=250\mu\text{A}$	70			V
I_{DSS}	Zero Gate Voltage Drain Current($T_c=25^{\circ}\text{C}$)	$V_{DS}=68\text{V}$, $V_{GS}=0\text{V}$			1	μA
I_{DSS}	Zero Gate Voltage Drain Current($T_c=125^{\circ}\text{C}$)	$V_{DS}=68\text{V}$, $V_{GS}=0\text{V}$			10	μA
I_{GSS}	Gate-Body Leakage Current	$V_{GS}=\pm 25\text{V}$, $V_{DS}=0\text{V}$			± 100	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$, $I_D=250\mu\text{A}$	2		4	V
$R_{DS(ON)}$	Drain-Source On-State Resistance	$V_{GS}=10\text{V}$, $I_D=40\text{A}$		5.9	7.2	m Ω
Dynamic Characteristics						
g_{FS}	Forward Transconductance	$V_{DS}=10\text{V}$, $I_D=40\text{A}$		28		S
C_{iss}	Input Capacitance	$V_{DS}=25\text{V}$, $V_{GS}=0\text{V}$, $f=1.0\text{MHz}$		3187		pF
C_{oss}	Output Capacitance			396		pF
C_{rss}	Reverse Transfer Capacitance			184		pF
Q_g	Total Gate Charge	$V_{DS}=50\text{V}$, $I_D=40\text{A}$, $V_{GS}=10\text{V}$		82		nC
Q_{gs}	Gate-Source Charge			16.2		nC
Q_{gd}	Gate-Drain Charge			36.7		nC
Switching Times						
$t_{d(on)}$	Turn-on Delay Time	$V_{DD}=30\text{V}$, $I_D=2\text{A}$, $R_L=15\Omega$ $V_{GS}=10\text{V}$, $R_G=2.5\Omega$		11		nS
t_r	Turn-on Rise Time			13		nS
$t_{d(off)}$	Turn-Off Delay Time			22		nS
t_f	Turn-Off Fall Time			27		nS
Source-Drain Diode Characteristics						
I_{SD}	Source-Drain Current(Body Diode)			80		A
I_{SDM}	Pulsed Source-Drain Current(Body Diode)			320		A
V_{SD}	Forward On Voltage (Note 1)	$T_J=25^{\circ}\text{C}$, $I_{SD}=40\text{A}$, $V_{GS}=0\text{V}$		0.69	0.95	V

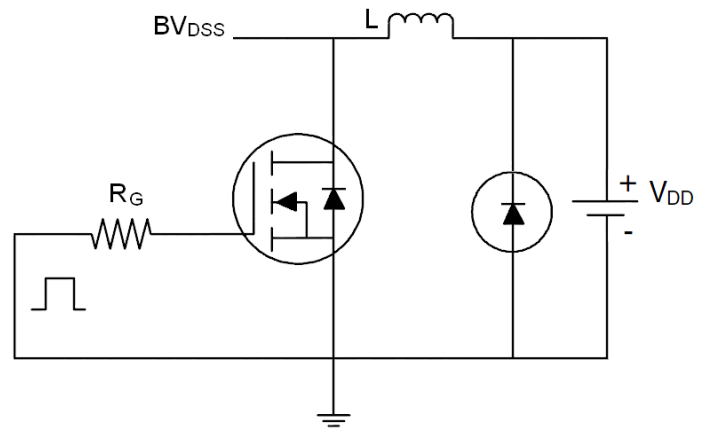
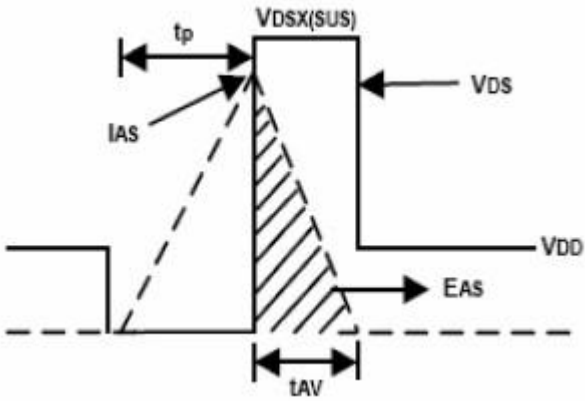


t_{rr}	Reverse Recovery Time (Note 1)	$T_J=25^{\circ}\text{C}, I_F=75\text{A}$ $di/dt=100\text{A}/\mu\text{s}$		40		nS
Q_{rr}	Reverse Recovery Charge (Note 1)			81		nC
t_{on}	Forward Turn-on Time	Intrinsic turn-on time is negligible(turn-on is dominated by L_S+L_D)				

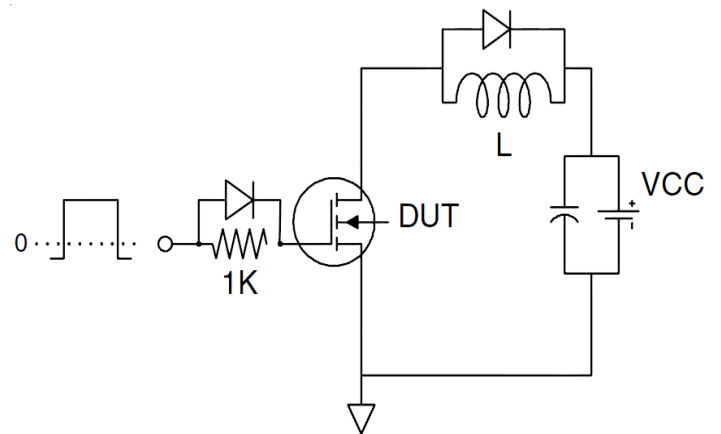
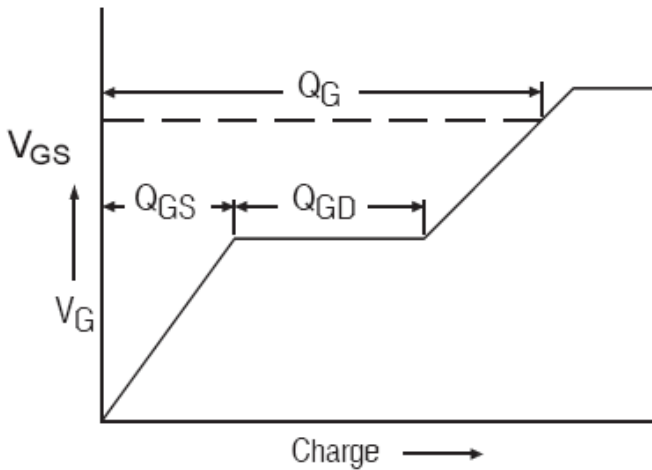
Notes 1.Pulse Test: Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 1.5\%$, $R_G=25\Omega$, Starting $T_J=25^{\circ}\text{C}$

Test Circuit

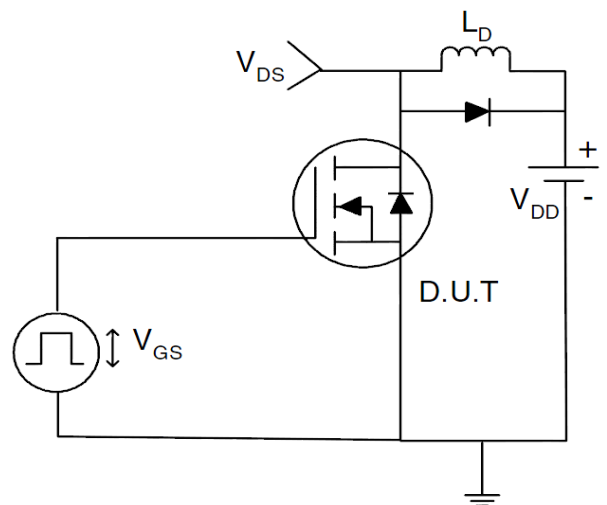
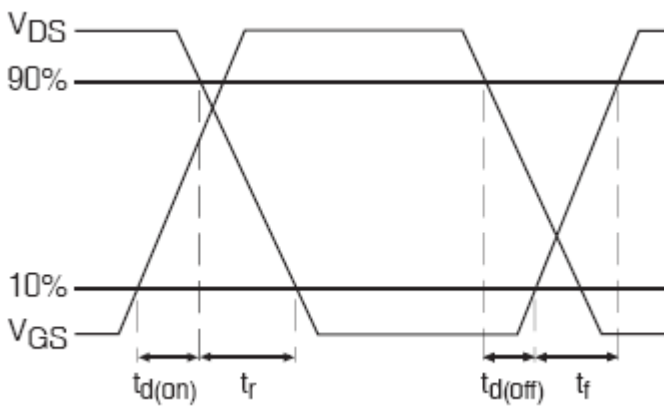
1) E_{AS} Test Circuits



2) Gate Charge Test Circuit:



3) Switch Time Test Circuit:



TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (Curves)

Figure1. Safe Operating Area

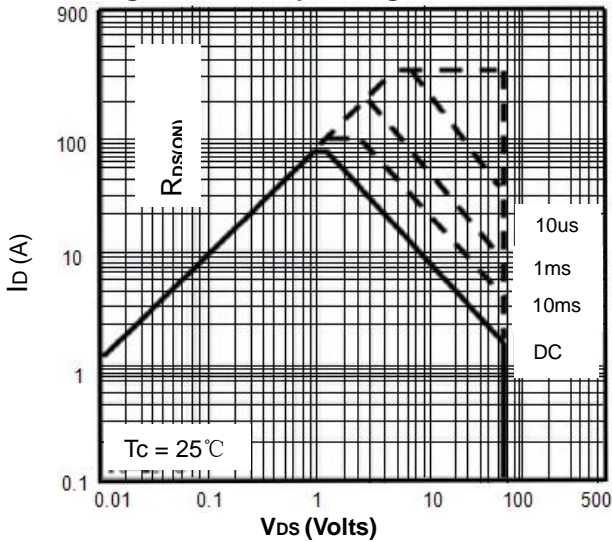


Figure2. Source-Drain Diode Forward Voltage

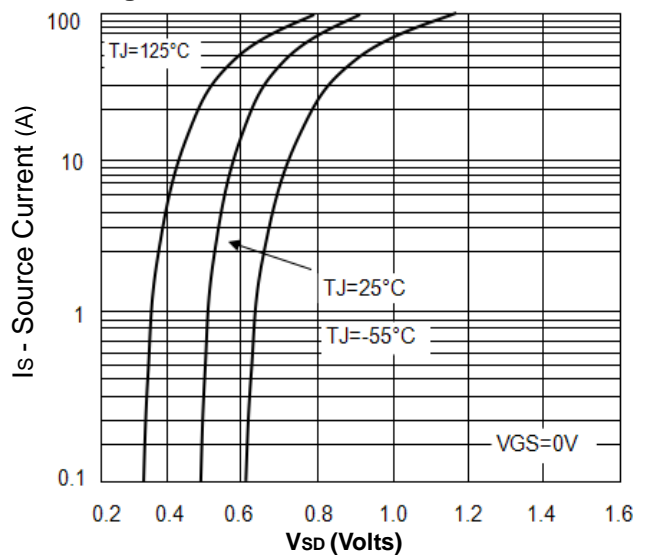


Figure3. Output Characteristics

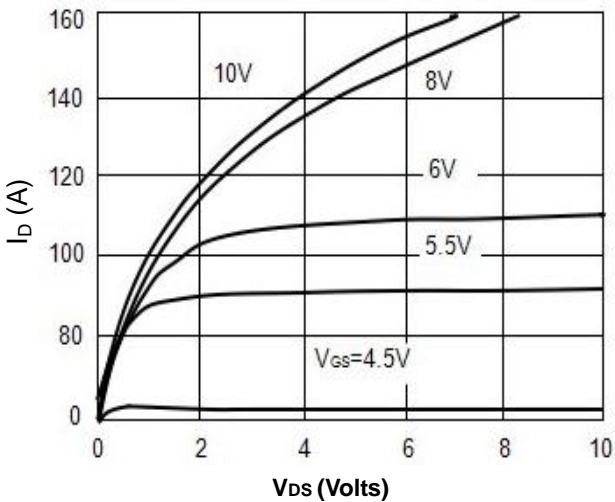


Figure4. Transfer Characteristics

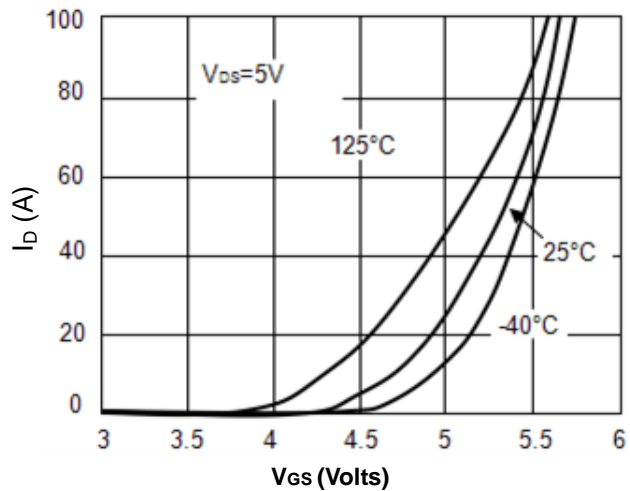


Figure5. Static Drain-Source On Resistance

$R_{DS(ON)}$ (m Ω)

Figure6. $R_{DS(ON)}$ vs Junction Temperature

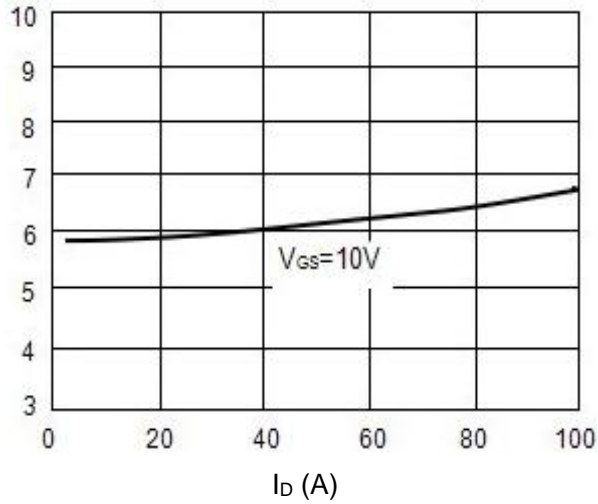


Figure7. BV_{DSS} vs Junction Temperature

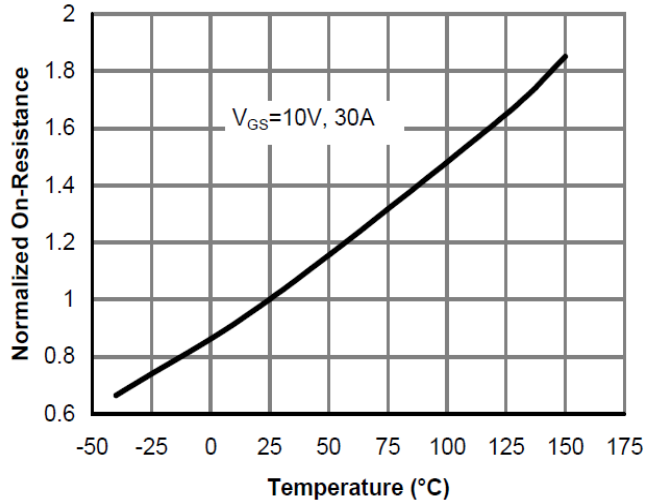


Figure8. $V_{GS(th)}$ vs Junction Temperature

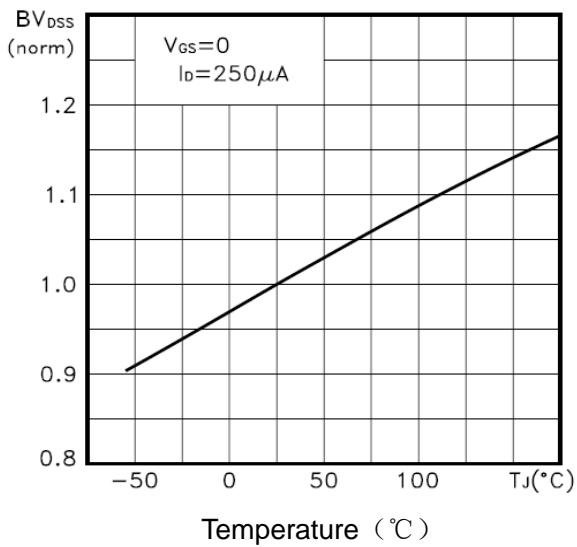


Figure9. Gate Charge Waveforms

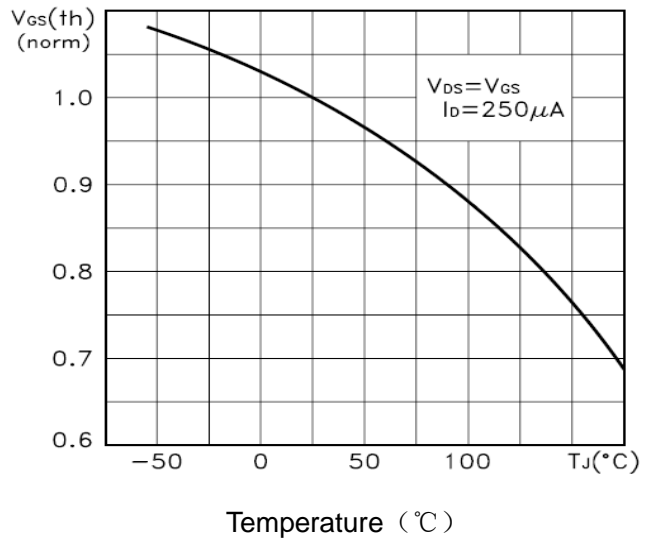


Figure10. Capacitance

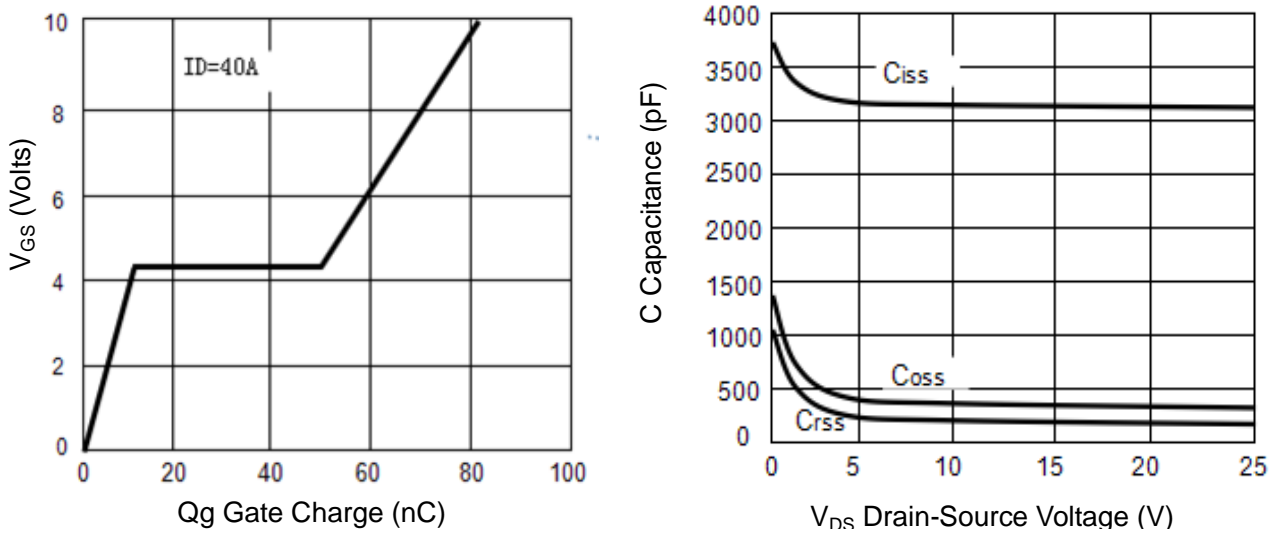
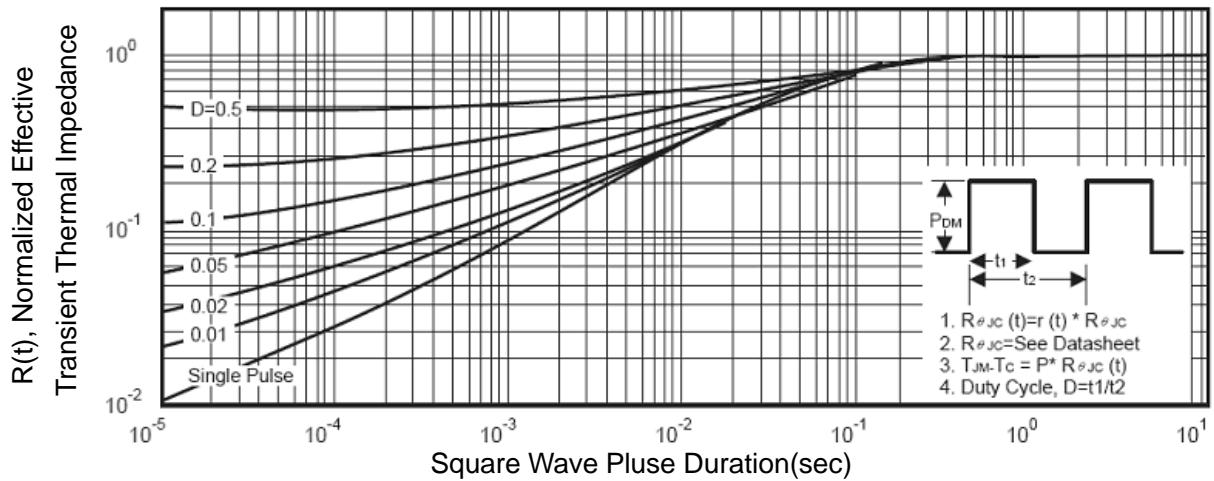
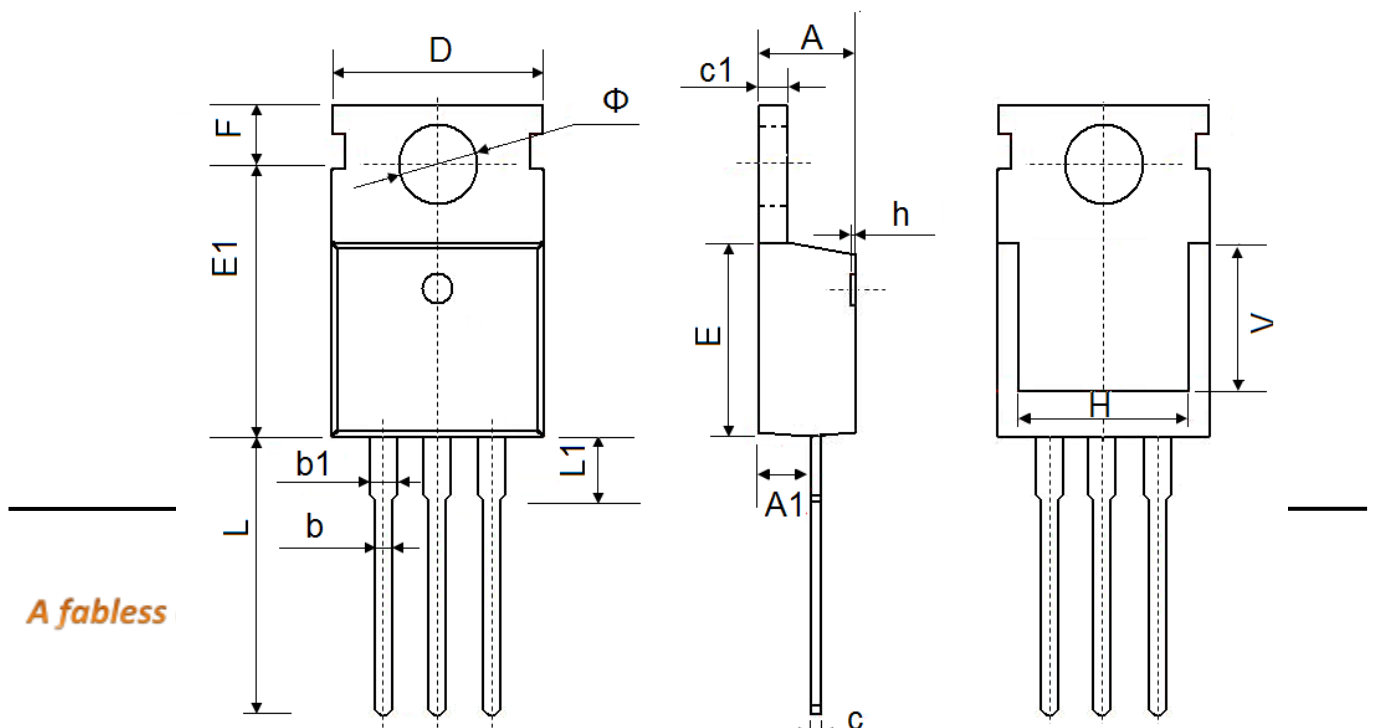


Figure11. Normalized Maximum Transient Thermal Impedance



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