N-Channel Trench Power MOSFET

General Description

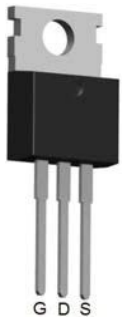
The CS40N27 is N-channel MOS Field Effect Transistor designed for high current switching applications. Rugged E_{AS} capability and ultra low $R_{DS(ON)}$ is suitable for PWM, load switching .

Features

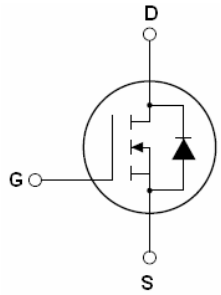
- V_{DS}=40V; I_D=170A@ V_{GS}=10V; $R_{DS(ON)}$<3.6mΩ @ V_{GS}=10V
- Ultra Low On-Resistance
- High UIS and UIS 100% Test

Application

- Hard Switched and High Frequency Circuits
- Uninterruptible Power Supply



To-220 Top View



Schematic Diagram

V_{DSS} = 40V

I_{DSS} = 170A

$R_{DS(ON)}$= 3.0mΩ

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
CS40N27	CS40N27	TO-220	-	-	-

Table 1. Absolute Maximum Ratings (TA=25℃)

Symbol	Parameter	Value	Unit
V_{DS}	Drain-Source Voltage (V_{GS}=0V)	40	V
V_{GS}	Gate-Source Voltage (V_{DS}=0V)	±20	V
$I_{D\ (DC)}$	Drain Current (DC) at Tc=25℃	170	A
$I_{D\ (DC)}$	Drain Current (DC) at Tc=100℃	119	A
$I_{DM\ (pluse)}$	Drain Current-Continuous@ Current-Pulsed **(Note 1)**	680	A
dv/dt	Peak Diode Recovery Voltage	1.83	V/ns
P_D	Maximum Power Dissipation(Tc=25℃)	231	W
	Derating Factor	1.54	W/℃
E_{AS}	Single Pulse Avalanche Energy **(Note 2)**	1800	mJ
T_J,T_{STG}	Operating Junction and Storage Temperature Range	-55 To 175	℃

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

2.E_{AS} condition:T_J=25℃,I_{AS}=85A,V_G=10V, R_G=25Ω

Table 2. Thermal Characteristic

Symbol	Parameter	Value	Max	Unit
$R_{\theta JC}$	Thermal Resistance,Junction-to-Case	---	0.65	℃/W

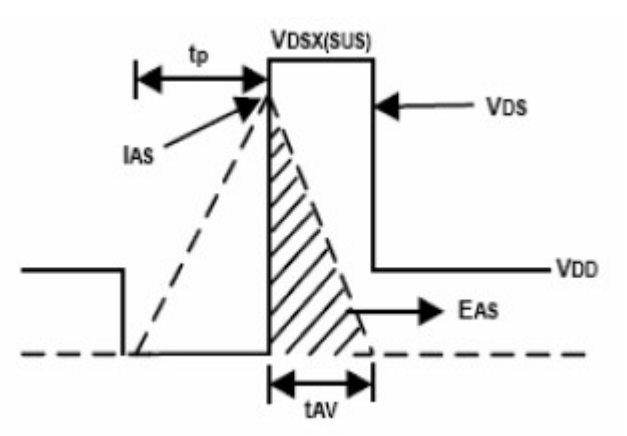
Table 3. Electrical Characteristics (TA=25℃unless otherwise noted)

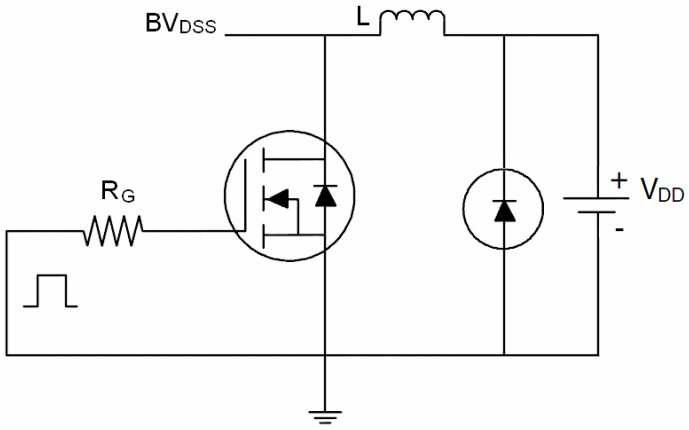
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
On/Off States						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS}=0V I_D=250μA	40			V
I_{DSS}	Zero Gate Voltage Drain Current(Tc=25℃)	V_{DS}=40V,V_{GS}=0V			1	μA
I_{DSS}	Zero Gate Voltage Drain Current(Tc=125℃)	V_{DS}=40V,V_{GS}=0V			1	μA
I_{GSS}	Gate-Body 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		3.0	3.6	mΩ
Dynamic Characteristics						
g_{FS}	Forward Transconductance	V_{DS}=10V,I_D=40A	40			S
C_{iss}	Input Capacitance	V_{DS}=25V,V_{GS}=0V f=1.0MHz		7585		PF
C_{oss}	Output Capacitance			967		PF
C_{rss}	Reverse Transfer Capacitance			625		PF
Q_g	Total Gate Charge	V_{DS}=32V,I_D=75A V_{GS}=10V		144		nC
Q_{gs}	Gate-Source Charge			36		nC
Q_{gd}	Gate-Drain Charge			53		nC
Switching Times						
$t_{d(on)}$	Turn-on Delay Time	V_{DD}=20V,I_D=75A V_{GS}=10V,R_G=3.0Ω		38		nS
t_r	Turn-on Rise Time			47		nS
$t_{d(off)}$	Turn-Off Delay Time			64		nS
t_f	Turn-Off Fall Time			26		nS
Source-Drain Diode Characteristics						
I_{SD}	Source-Drain Current(Body Diode)			170		A
I_{SDM}	Pulsed Source-Drain Current(Body Diode)			680		A
V_{SD}	Forward On Voltage**(Note 1)**	T_J=25℃,I_{SD}=40A,V_{GS}=0V		0.82	0.99	V
t_{rr}	Reverse Recovery Time**(Note 1)**	T_J=25℃,I_F=40A di/dt=100A/μs		28		nS
Q_{rr}	Reverse Recovery Charge**(Note 1)**			22		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 ≤ 300μs, Duty Cycle ≤ 1.5%, R_G=25Ω, Starting T_J=25℃

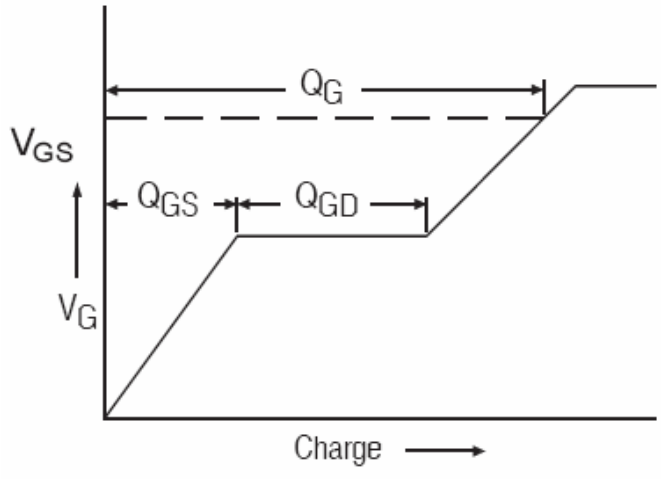
Test Circuit

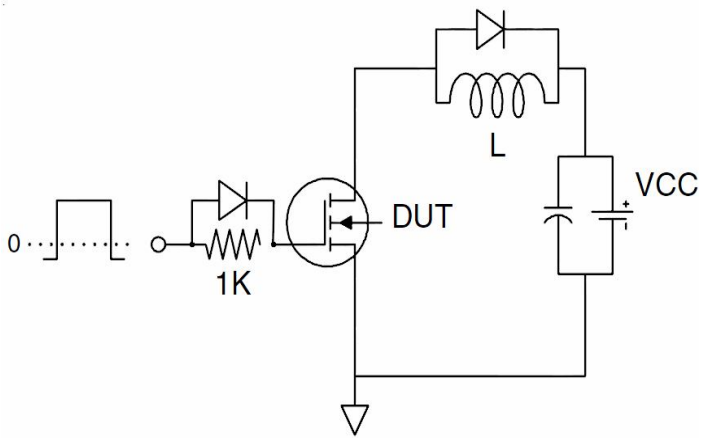
1) E_{AS} Test Circuits



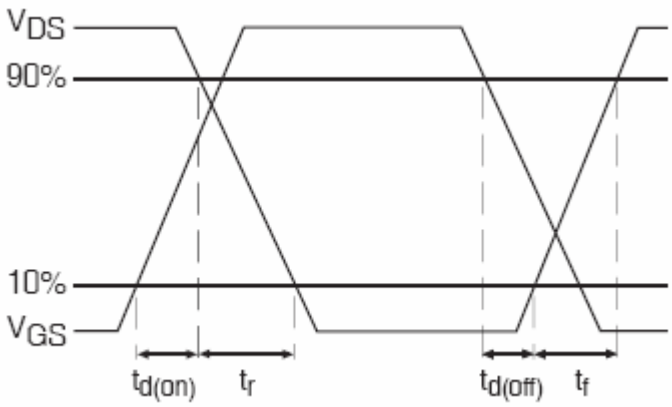


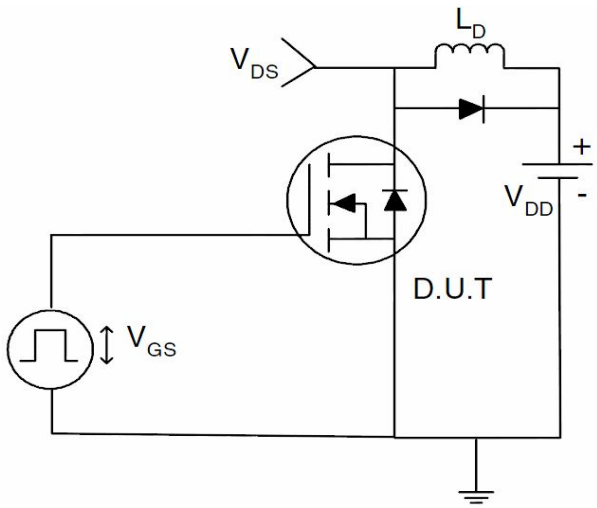
2) Gate Charge Test Circuit:





3) Switch Time Test Circuit:





TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (Curves)

Figure1. Output Characteristics

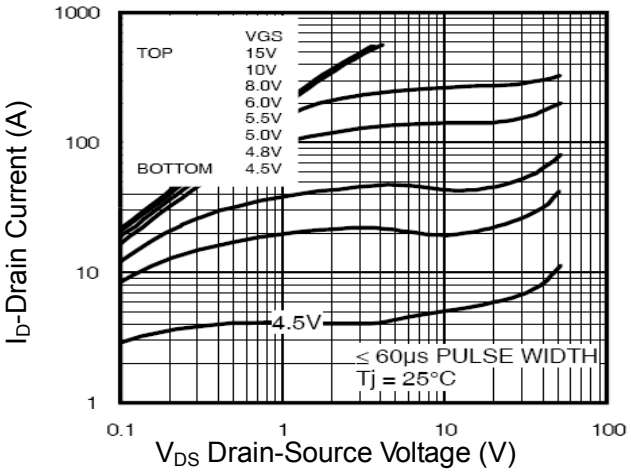


Figure2. Transfer Characteristics

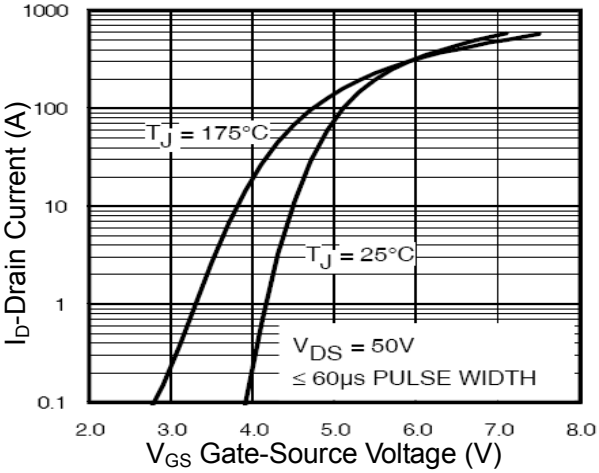


Figure3. VGS(th) vs Junction Temperature

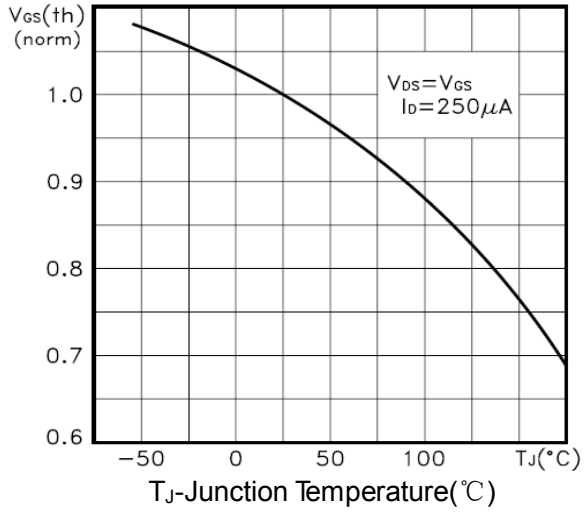


Figure4. BVDSS vs Junction Temperature

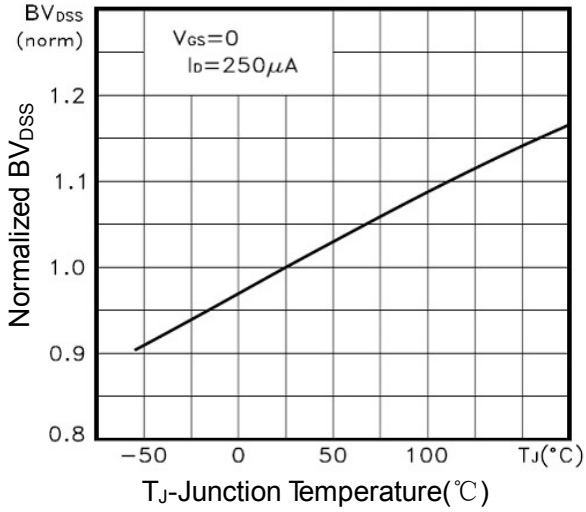


Figure5. ID vs Junction Temperature

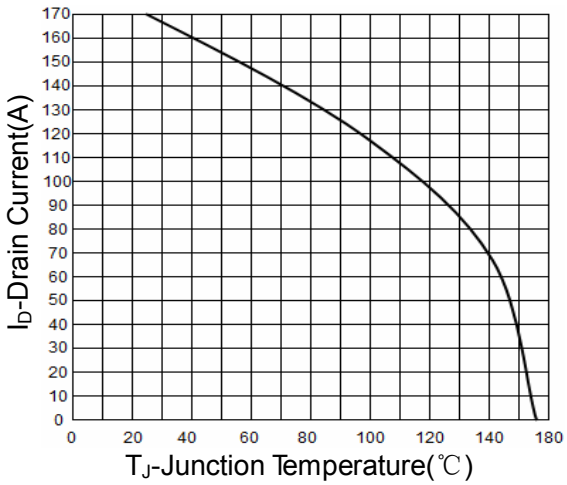


Figure6. $R_{DS(ON)}$- JunctionTemperature

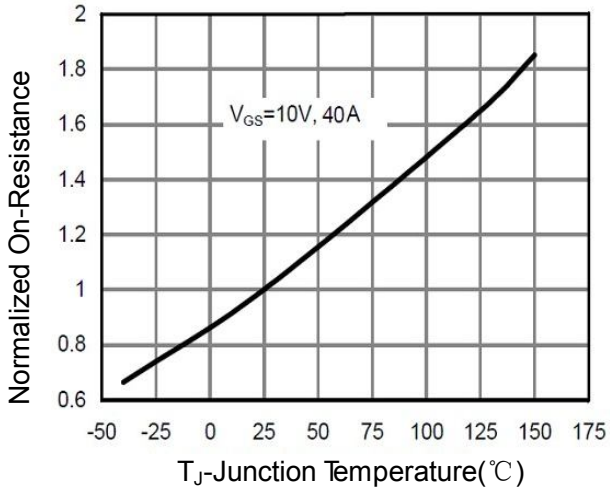


Figure7. Gate Charge

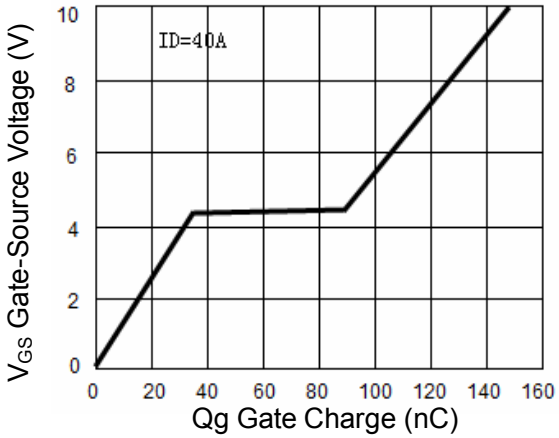


Figure8. Capacitance vs VDS

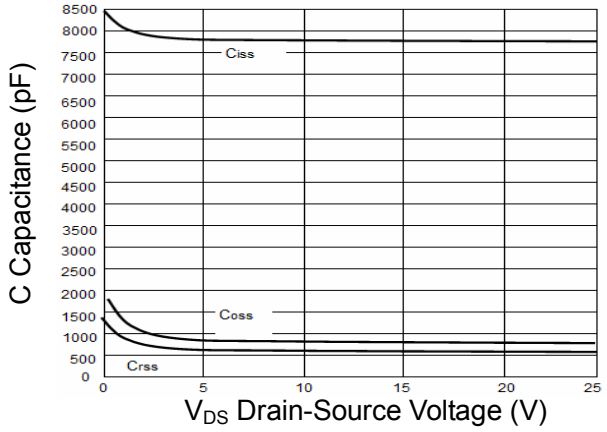


Figure9. Source- Drain Diode Forward

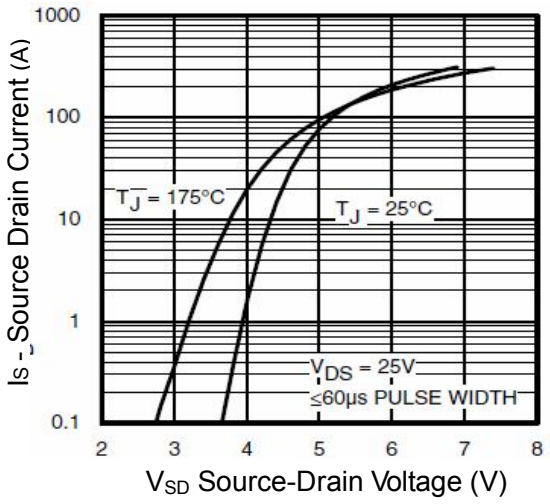


Figure10. Safe Operation Area

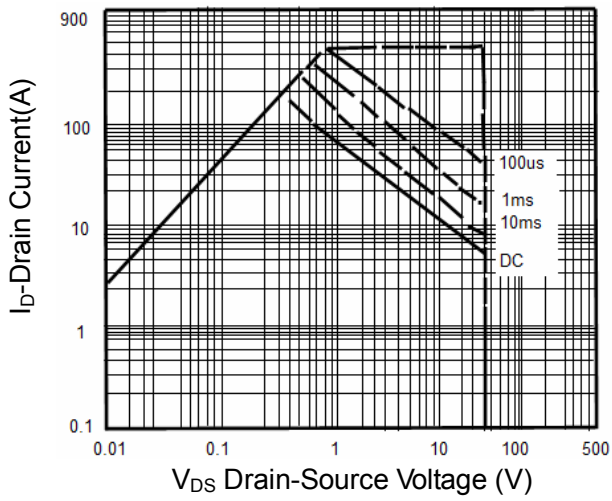
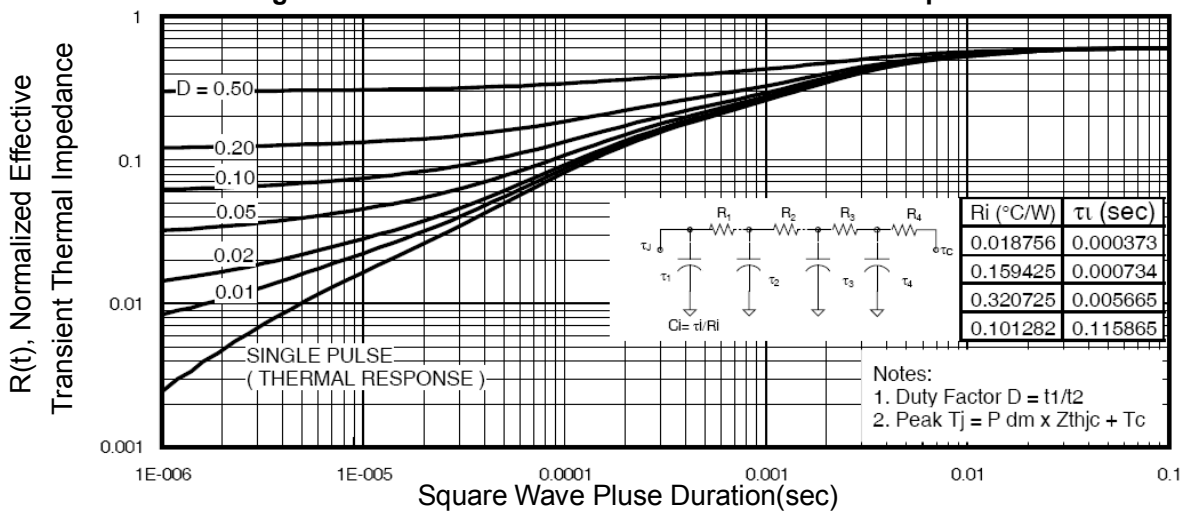
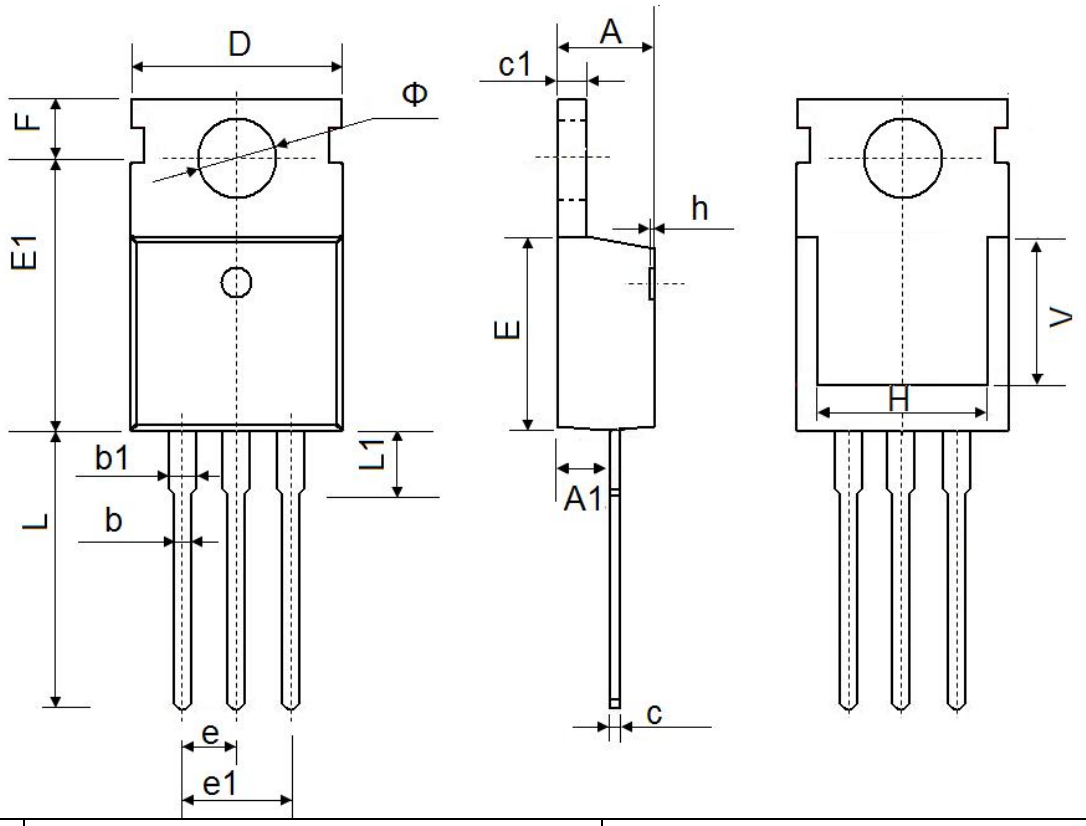


Figure11. Normalized Maximum Transient Thermal Impedance



TO-220 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max
A	4.300	4.700	0.169	0.185
A1	2.200	2.600	0.087	0.102
b	0.700	0.950	0.028	0.037
b1	1.170	1.410	0.046	0.056
c	0.450	0.650	0.018	0.026
c1	1.200	1.400	0.047	0.055
D	9.600	10.400	0.378	0.409
E	8.8500	9.750	0.348	0.384
E1	12.650	12.950	0.498	0.510
e	2.540 TYP.		0.100TYP.	
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	12.750	14.300	0.502	0.563
L1	2.850	3.950	0.112	0.156
V	7.500 REF.		0.295 REF.	
Φ	3.400	4.000	0.134	0.157