N-Channel Trench Power MOSFET

General Description

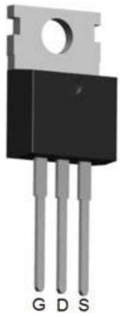
The CS50N06 combines advanced trench MOSFET technology with a low resistance package to provide extremely low $R_{DS(ON)}$. Those devices are suitable for use in PWM, load switching and general purpose applications.

Features

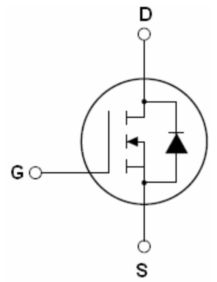
- V_{DS}=60V; I_D=45A
  $R_{DS(ON)}$<15mΩ @ V_{GS}=10V
- Ultra Low On-Resistance
- High UIS and UIS 100% Test

Application

- Power switching application
- load switching



To-220 Top View



Schematic Diagram

V_{DS} =60V

I_D = 45A

$R_{DS(ON)}$= 11.5mΩ

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
CS50N06	CS50N06	TO-220	-	-	-

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

Symbol	Parameter	Value	Unit
V_{DS}	Drain-Source Voltage (V_{GS}=0V)	60	V
V_{GS}	Gate-Source Voltage (V_{DS}=0V)	±25	V
$I_{D\ (DC)}$	Drain Current (DC) at Tc=25℃	45	A
$I_{D\ (DC)}$	Drain Current (DC) at Tc=100℃	32	A
$I_{DM\ (pluse)}$	Drain Current-Continuous@ Current-Pulsed (Note 1)	180	A
dv/dt	Peak Diode Recovery Voltage	11	V/ns
P_D	Maximum Power Dissipation(Tc=25℃)	68	W
	Derating Factor	0.45	W/℃
E_{AS}	Single Pulse Avalanche Energy (Note 2)	182	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℃,V_{DD}=30V,V_G=10V, R_G=25Ω

Table 2. Thermal Characteristic

Symbol	Parameter	Value	Max	Unit
$R_{\theta JC}$	Thermal Resistance,Junction-to-Case	---	2.2	℃/W

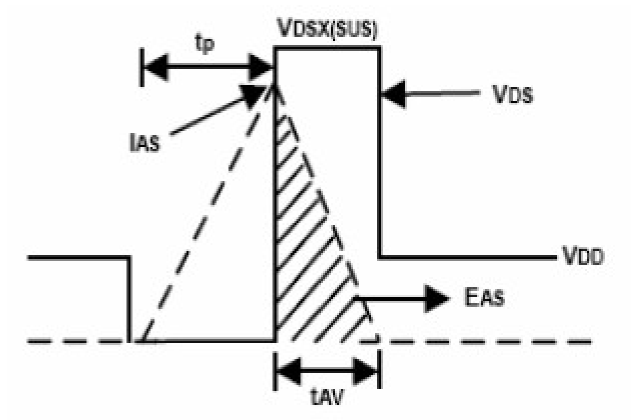
Table 3. Electrical Characteristics (TA=25℃unless otherwise noted)

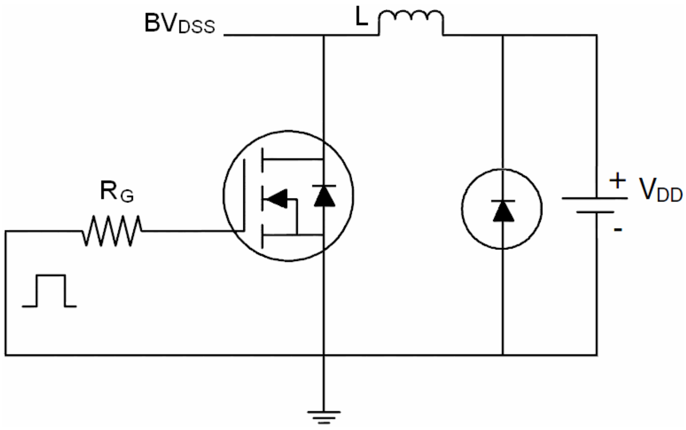
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
On/Off States						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS}=0V I_D=250μA	60			V
I_{DSS}	Zero Gate Voltage Drain Current(Tc=25℃)	V_{DS}=60V,V_{GS}=0V			1	μA
I_{DSS}	Zero Gate Voltage Drain Current(Tc=100℃)	V_{DS}=60V,V_{GS}=0V			5	μA
I_{GSS}	Gate-Body Leakage Current	V_{GS}=±25V,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		11.5	15	mΩ
Dynamic Characteristics						
g_{FS}	Forward Transconductance	V_{DS}=10V,I_D=15A	18			S
C_{iss}	Input Capacitance	V_{DS}=25V,V_{GS}=0V f=1.0MHz		1717		PF
C_{oss}	Output Capacitance			180		PF
C_{rss}	Reverse Transfer Capacitance			140		PF
Q_g	Total Gate Charge	V_{DS}=30V,I_D=15A V_{GS}=10V		50		nC
Q_{gs}	Gate-Source Charge			12		nC
Q_{gd}	Gate-Drain Charge			23		nC
Switching Times						
$t_{d(on)}$	Turn-on Delay Time	V_{DS}=30V,R_L=2.5Ω V_{GS}=10V,R_G=3Ω		15		nS
t_r	Turn-on Rise Time			25		nS
$t_{d(off)}$	Turn-Off Delay Time			50		nS
t_f	Turn-Off Fall Time			23		nS
Source-Drain Diode Characteristics						
I_{SD}	Source-Drain Current(Body Diode)			45		A
I_{SDM}	Pulsed Source-Drain Current(Body Diode)			180		A
V_{SD}	Forward On Voltage**(Note 1)**	T_J=25℃,I_{SD}=1A,V_{GS}=0V		0.85	0.99	V
t_{rr}	Reverse Recovery Time**(Note 1)**	T_J=25℃,I_F=15A di/dt=100A/μs		24		nS
Q_{rr}	Reverse Recovery Charge**(Note 1)**			30		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%, Starting T_J=25℃

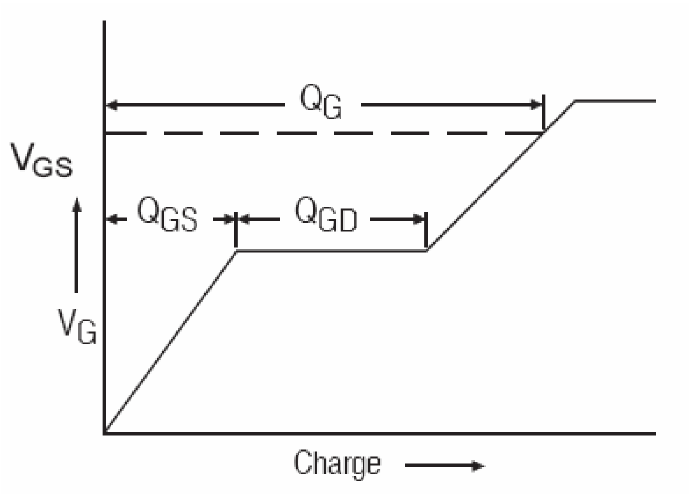
Test Circuit

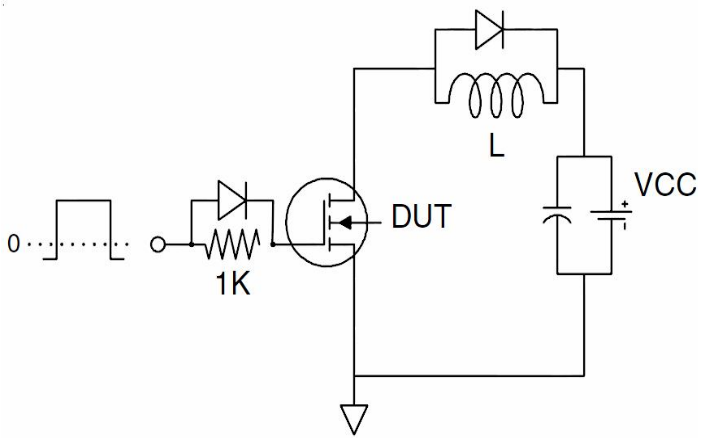
1）E_{AS} Test Circuits



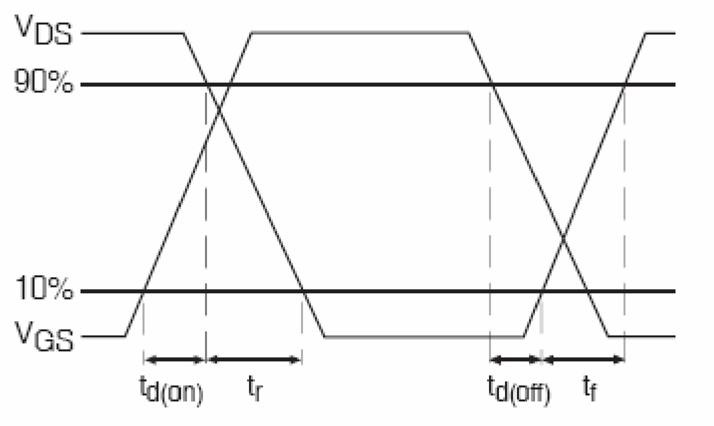


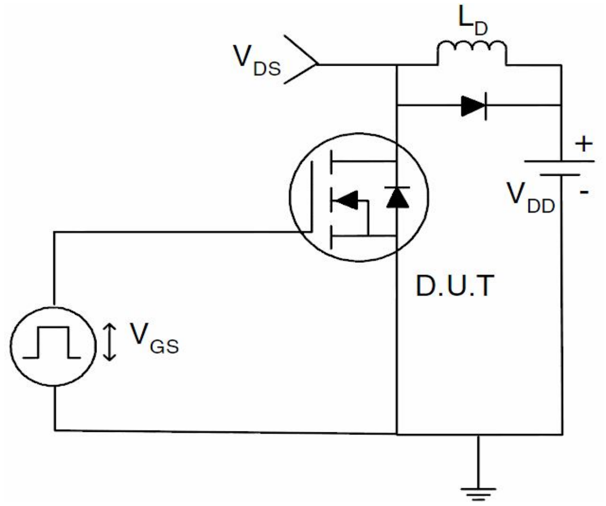
2）Gate Charge Test Circuit:





3）Switch Time Test Circuit：





TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (Curves)

Figure1. Output Characteristics

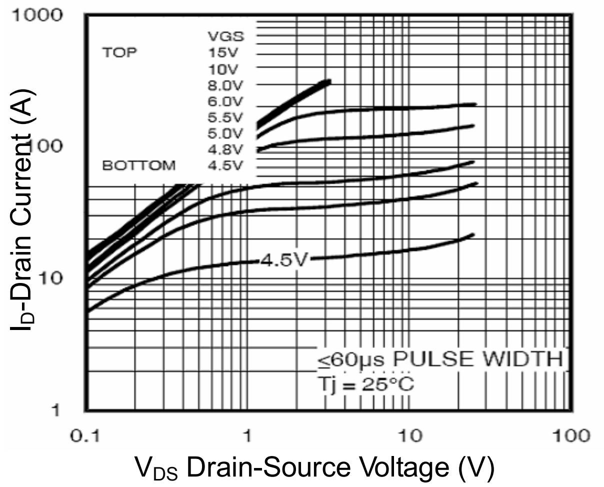


Figure2. Transfer Characteristics

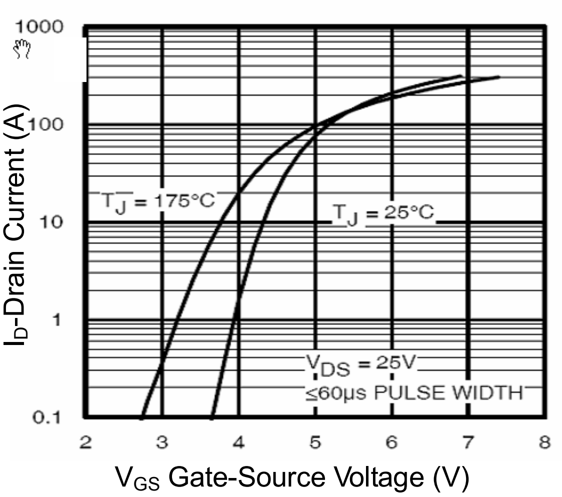


Figure3. BVDSS vs Junction Temperature

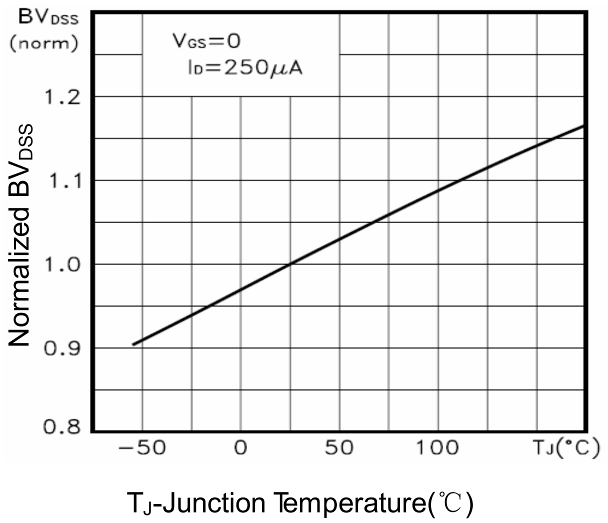


Figure4. ID vs Junction Temperature

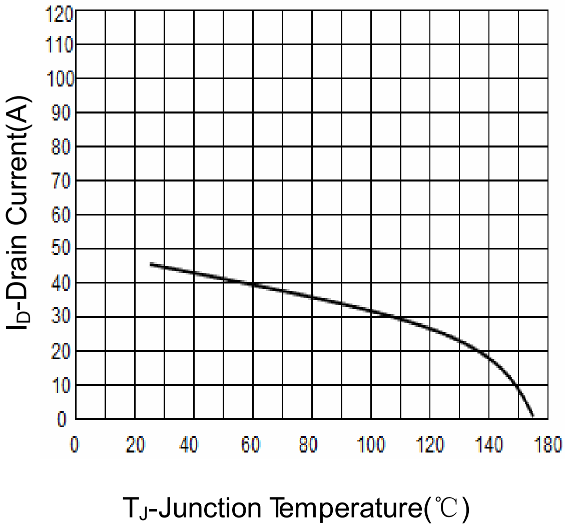


Figure5. VGS(th) vs Junction Temperature

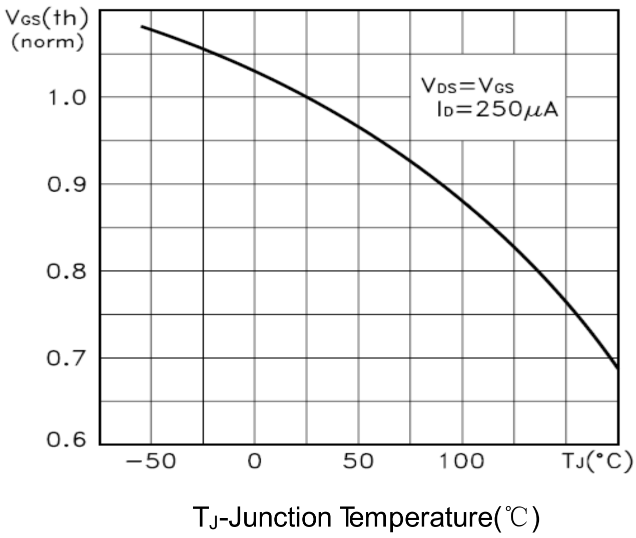


Figure6. Rdson Vs Junction Temperature

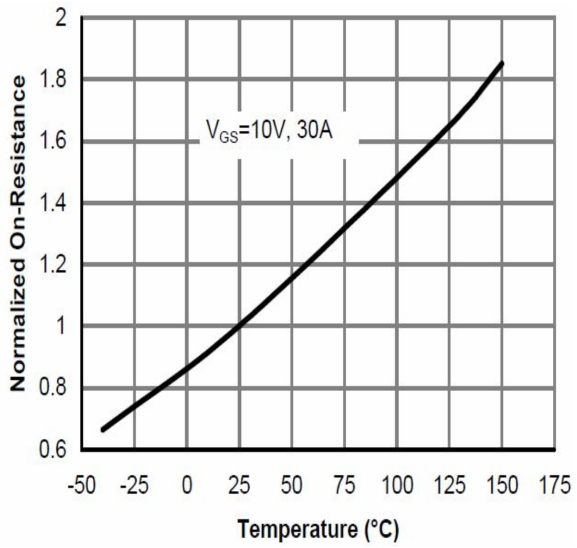


Figure7. Gate Charge

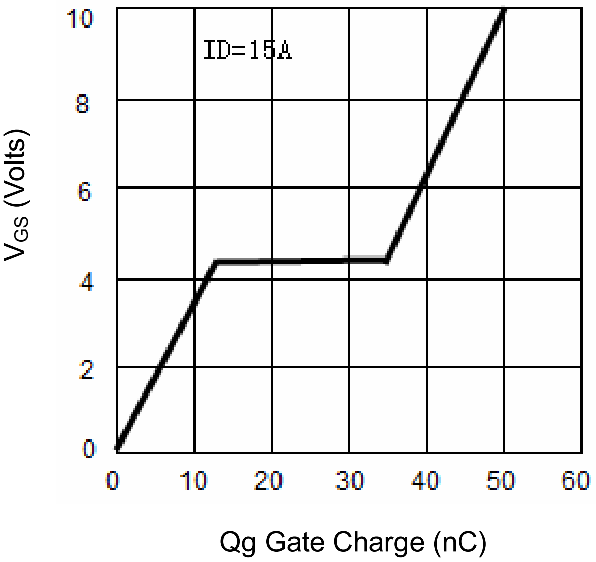


Figure8. Capacitance vs Vds

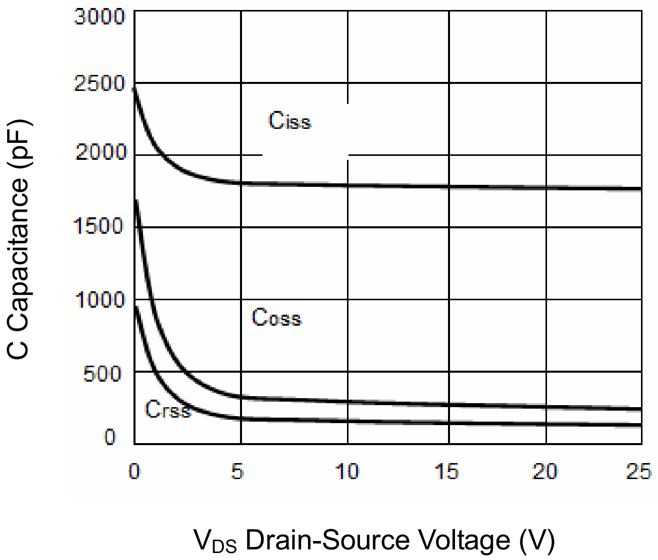


Figure9. Source- Drain Diode Forward

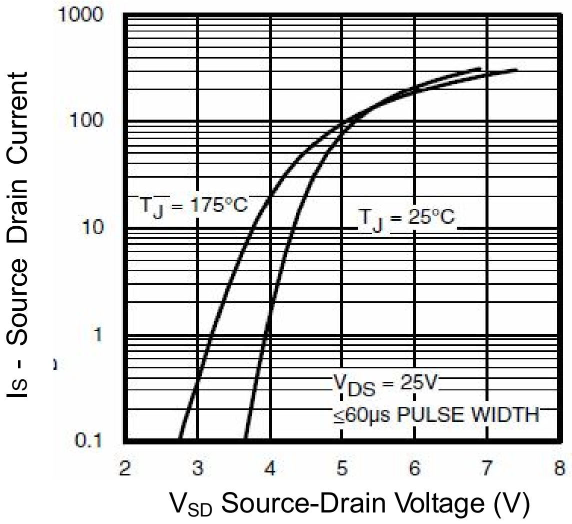


Figure10. Safe Operation Area

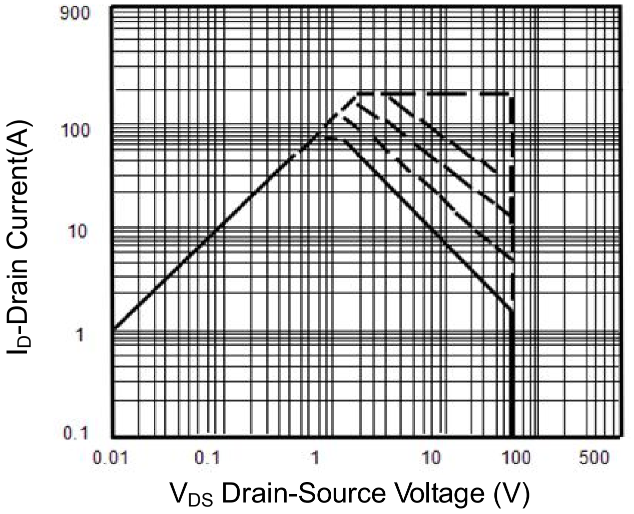
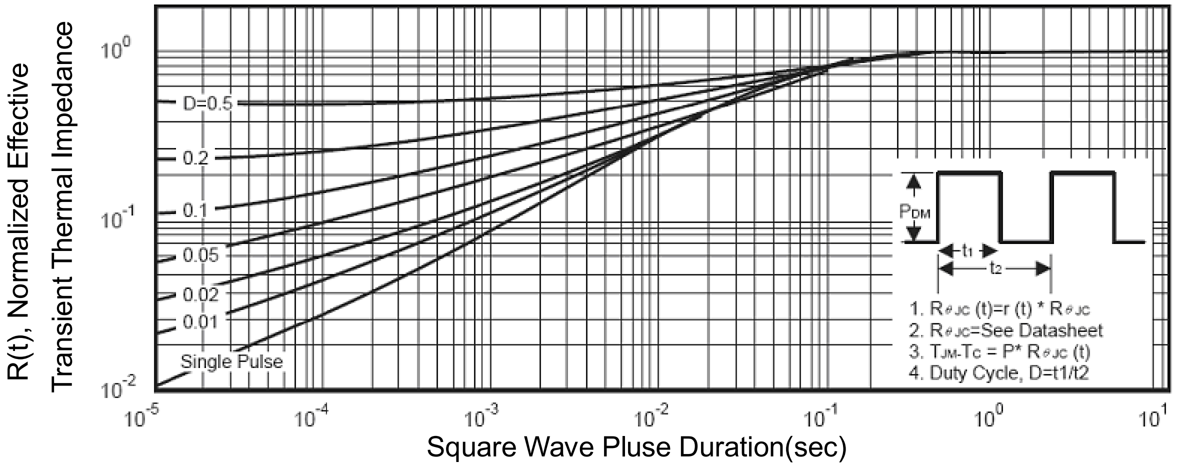
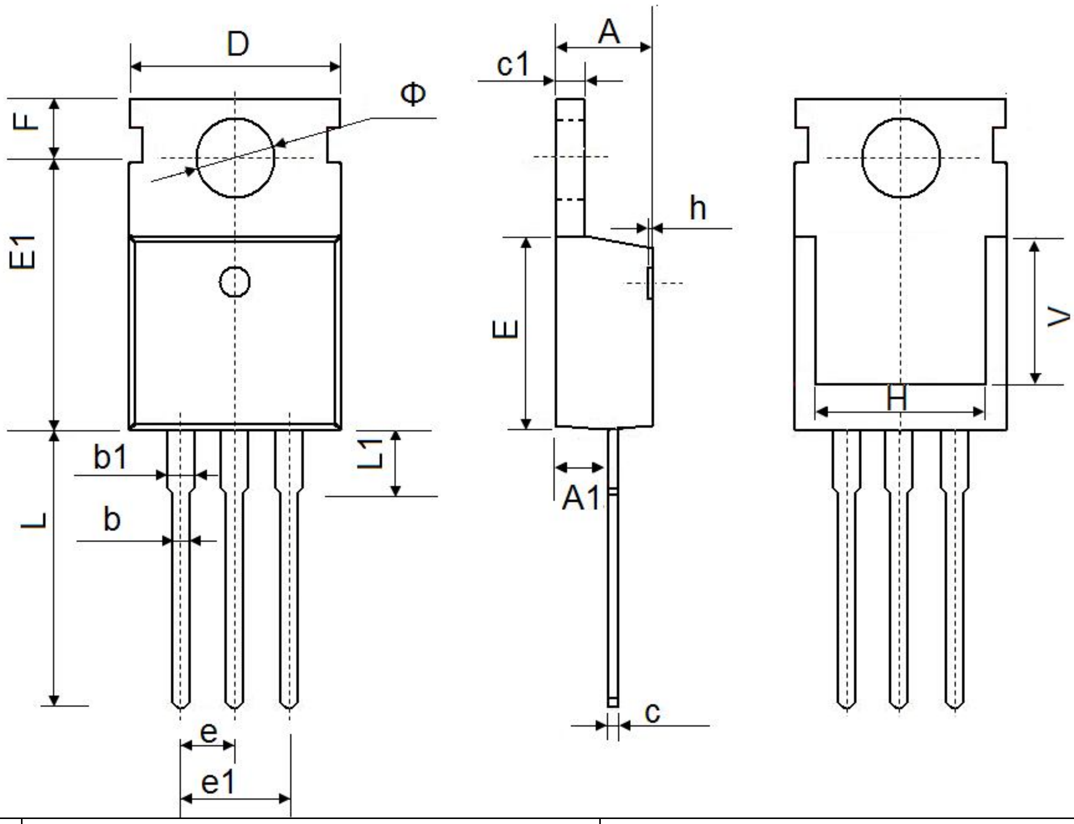


Figure11. Normalized Maximum Transient Thermal Impedance



1. $R_{\theta JC}(t) = r(t) * R_{\theta JC}$
2. $R_{\theta JC}$=See Datasheet
3. $T_{JM} - T_C = P^* R_{\theta JC}(t)$
4. Duty Cycle, D=t1/t2

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