

N-Channel Trench Power MOSFET

General Description

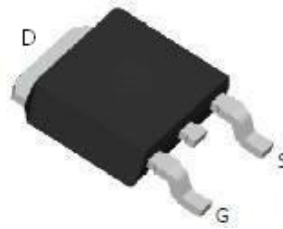
The D444 combines advanced trench MOSFET technology with a low resistance package to provide extremely low $R_{DS(ON)}$. Those devices are suitable for use in PWM, load switching and general purpose applications.

Features

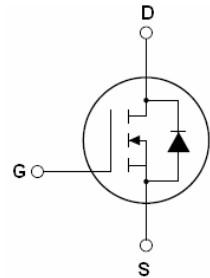
- $V_{DS}=60V$; $I_D=15A$
 $R_{DS(ON)}<40m\Omega$ @ $V_{GS}=10V$
- Ultra Low On-Resistance
- High UIS and UIS 100% Test

Application

- Power switching application
- load switching



To-252 Top View



Schematic Diagram

$$V_{DS} = 60V$$

$$I_D = 15A$$

$$R_{DS(ON)} = 32m\Omega$$

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
D444	D444	TO-252	-	-	-

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

Symbol	Parameter	Value	Unit
V_{DS}	Drain-Source Voltage ($V_{GS}=0V$)	60	V
V_{GS}	Gate-Source Voltage ($V_{DS}=0V$)	± 20	V
$I_{D(DC)}$	Drain Current (DC) at $T_c=25^\circ C$	15	A
$I_{D(DC)}$	Drain Current (DC) at $T_c=100^\circ C$	10.5	A
$I_{DM(pluse)}$	Drain Current-Continuous@ Current-Pulsed (Note 1)	60	A
P_D	Maximum Power Dissipation($T_c=25^\circ C$)	23	W
E_{AS}	Single Pulse Avalanche Energy (Note 2)	25	mJ
T_J, T_{STG}	Operating Junction and Storage Temperature Range	-55 To 175	$^\circ C$

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

2.EAS condition: $T_J=25^\circ C, V_{DD}=30V, V_G=10V, R_G=25\Omega$

Table 2. Thermal Characteristic

Symbol	Parameter	Value	Max	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	---	6.6	$^{\circ}C/W$

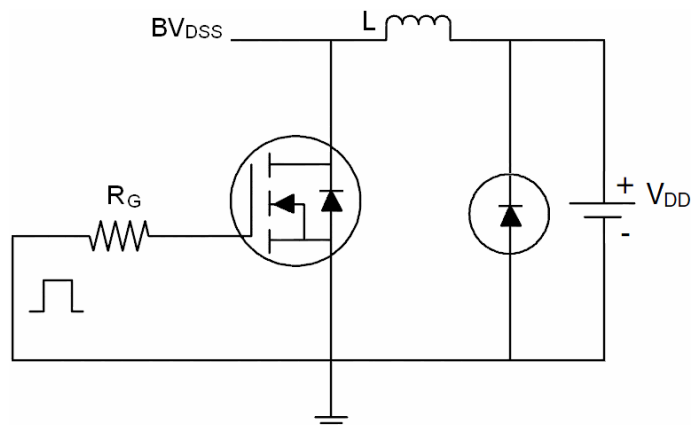
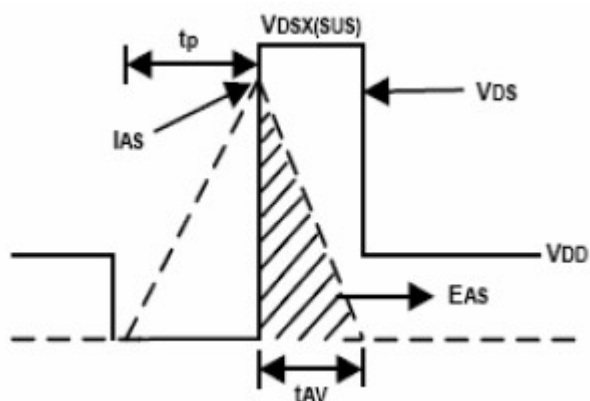
Table 3. Electrical Characteristics (TA=25 $^{\circ}C$ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
On/Off States						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V I _D =250μA	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} =±20V,V _{DS} =0V			±100	nA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} ,I _D =250μA	1	2.3	3	V
R _{DS(ON)}	Drain-Source On-State Resistance	V _{GS} =10V, I _D =12A		32	45	mΩ
R _{DS(ON)}	Drain-Source On-State Resistance	V _{GS} =4.5V, I _D =6A		37	50	mΩ
Dynamic Characteristics						
g _{FS}	Forward Transconductance	V _{DS} =10V,I _D =15A	12			S
C _{iss}	Input Capacitance	V _{DS} =30V,V _{GS} =0V f=1.0MHz		778		PF
C _{oss}	Output Capacitance			66		PF
C _{rss}	Reverse Transfer Capacitance			41		PF
Q _g	Total Gate Charge	V _{DS} =30V,I _D =15A V _{GS} =10V		13.5		nC
Q _{gs}	Gate-Source Charge			3.2		nC
Q _{gd}	Gate-Drain Charge			6.2		nC
Switching Times						
t _{d(on)}	Turn-on Delay Time	V _{DS} =30V,R _L =2.5Ω V _{GS} =10V,R _G =3Ω		4.2		nS
t _r	Turn-on Rise Time			3.4		nS
t _{d(off)}	Turn-Off Delay Time			16		nS
t _f	Turn-Off Fall Time			2		nS
Source-Drain Diode Characteristics						
I _{SD}	Source-Drain Current(Body Diode)			15		A
I _{SDM}	Pulsed Source-Drain Current(Body Diode)			60		A
V _{SD}	Forward On Voltage ^(Note 1)	T _J =25℃,I _{SD} =1A,V _{GS} =0V		0.74	0.99	V
t _{rr}	Reverse Recovery Time ^(Note 1)	T _J =25℃,I _F =15A di/dt=100A/μs		27		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)				

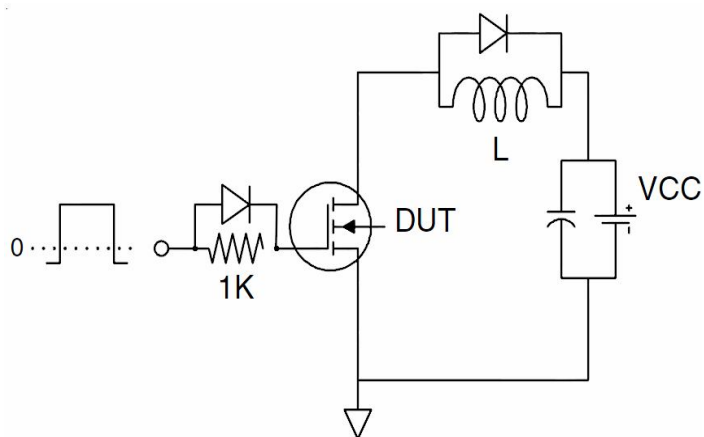
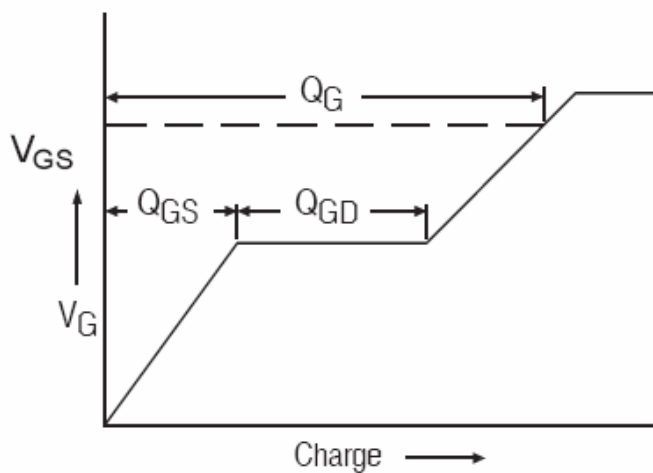
Notes 1. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 1.5\%$, Starting $T_J=25^{\circ}C$

Test Circuit

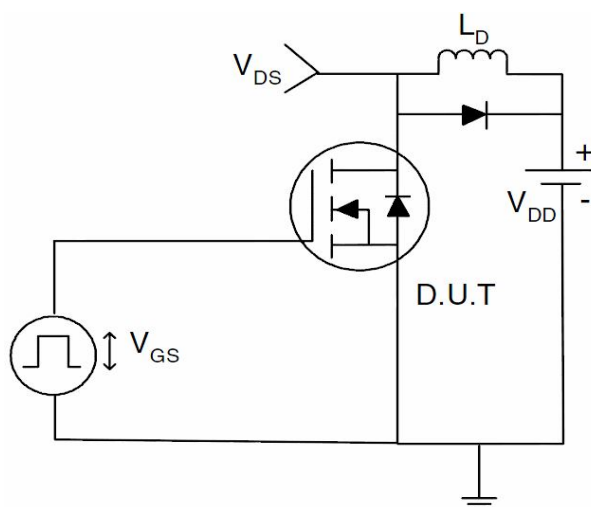
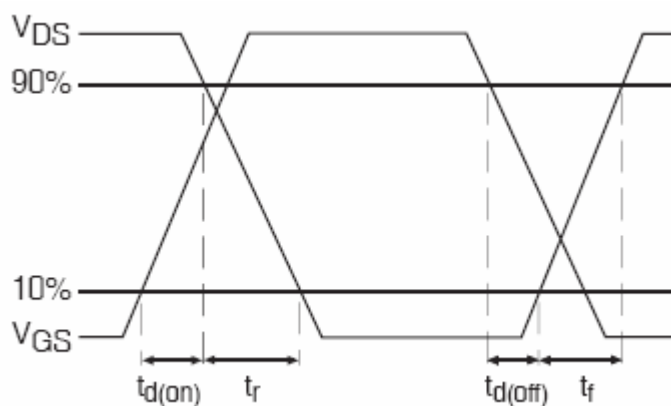
1) E_{AS} Test Circuits



2) Gate Charge Test Circuit:



3) Switch Time Test Circuit:



TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (Curves)

Figure1. On-Region Characteristics

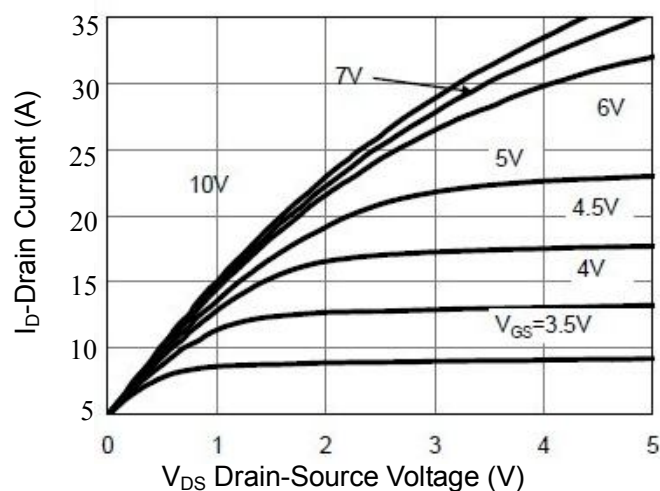


Figure 2: Transfer Characteristics

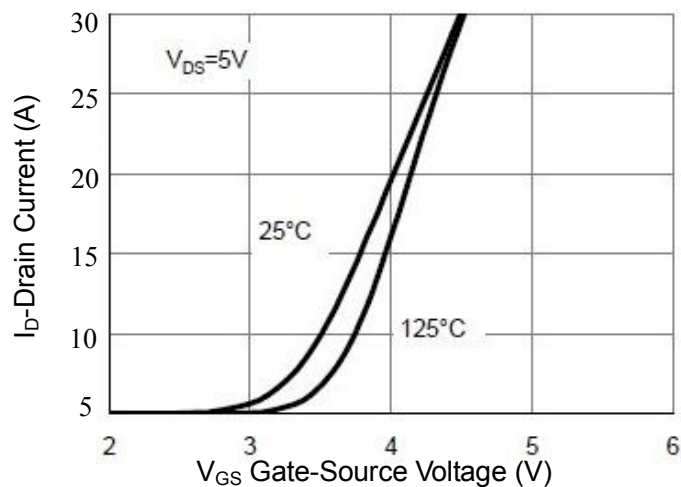


Figure3. I_D vs Junction Temperature

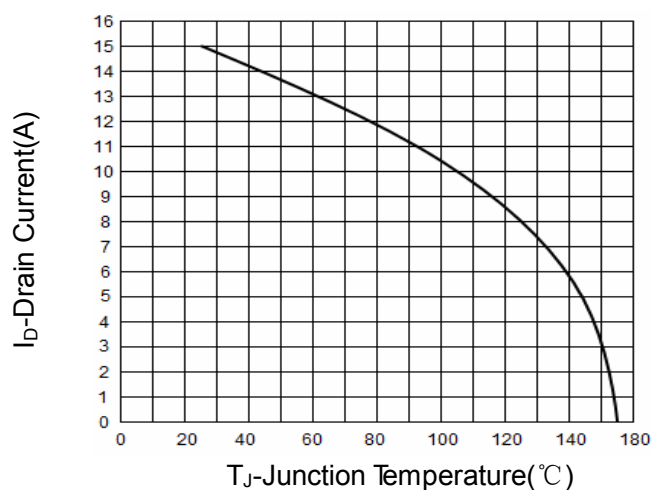


Figure4. On-Resistance vs. Junction Temperature

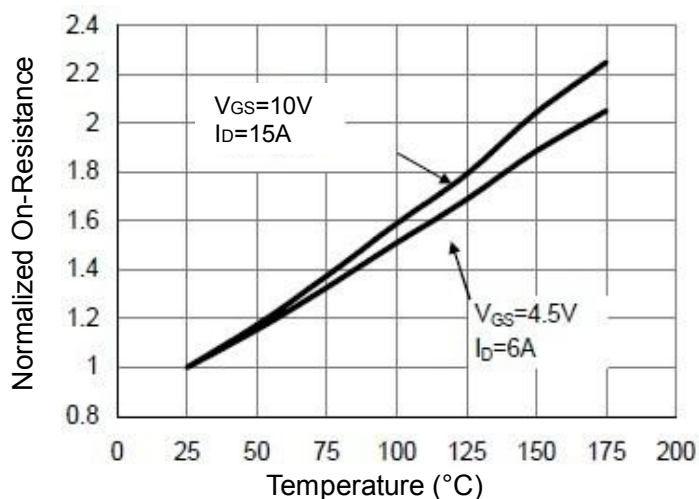


Figure5. On-Resistance vs. Gate-Source Voltage

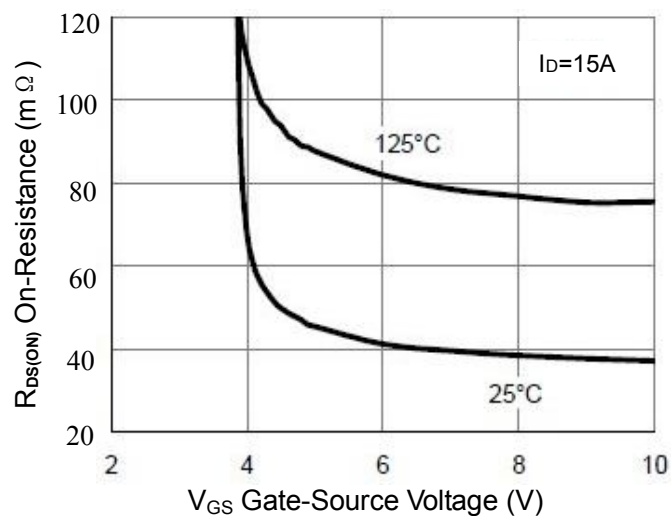


Figure6. Body-Diode Characteristics

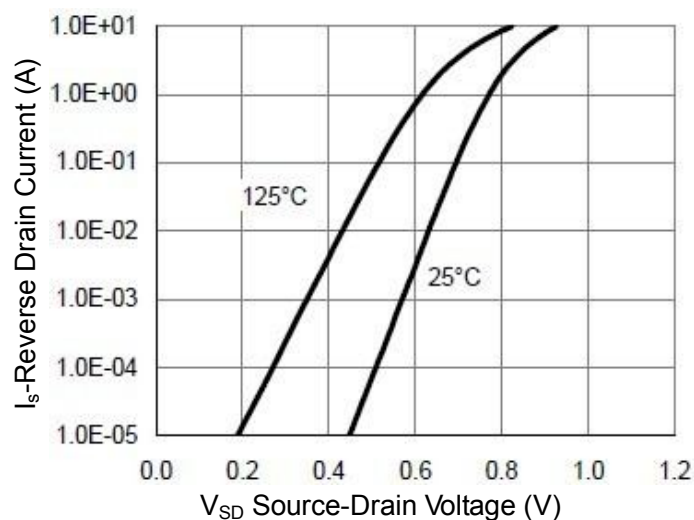


Figure7. Gate-Charge Characteristics

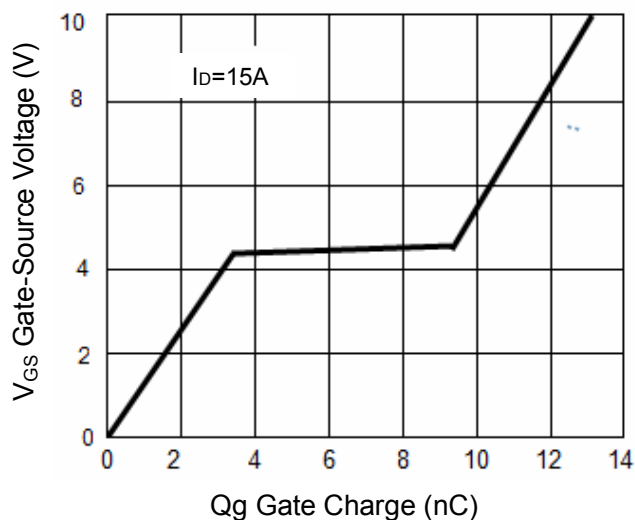


Figure 8. Capacitance Characteristics

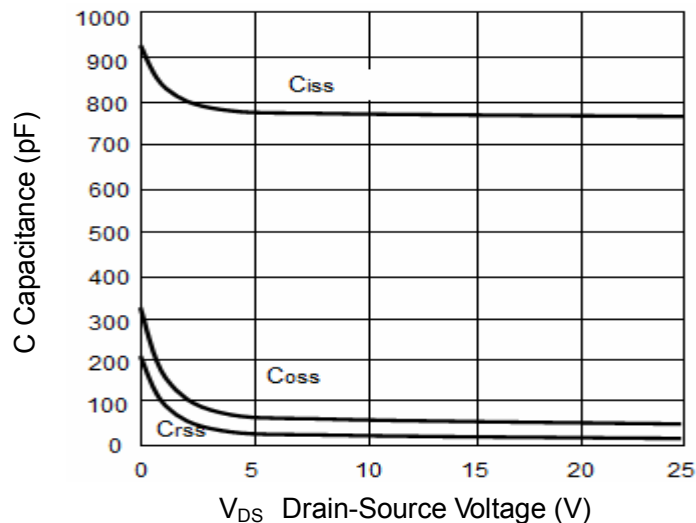


Figure 9. Maximum Forward Biased Safe Operating Area

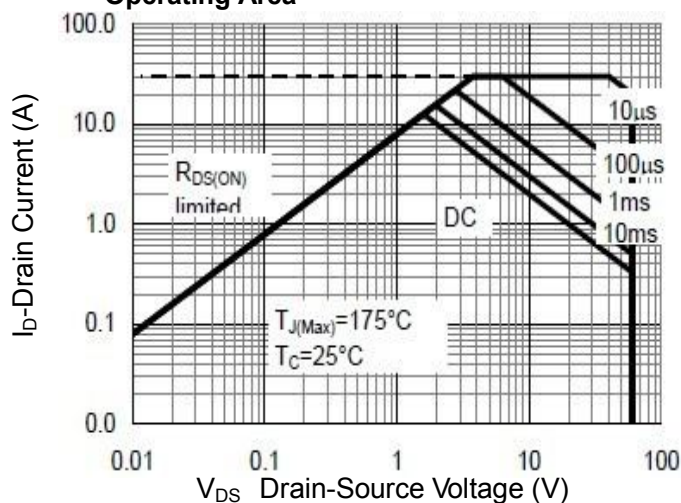


Figure10. Single Pulse Power Rating Junction-to-Case

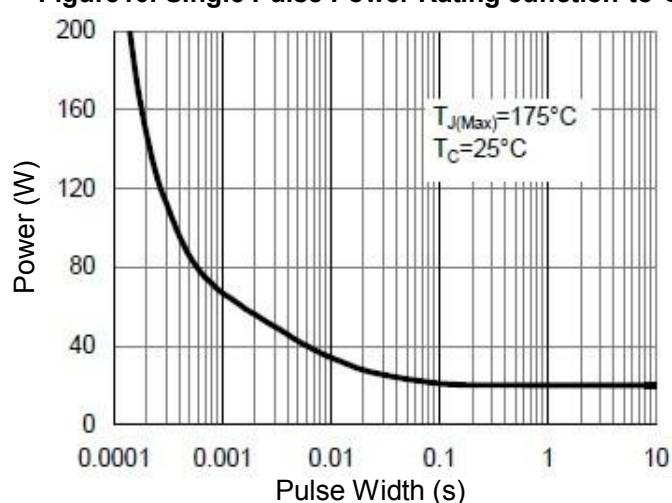
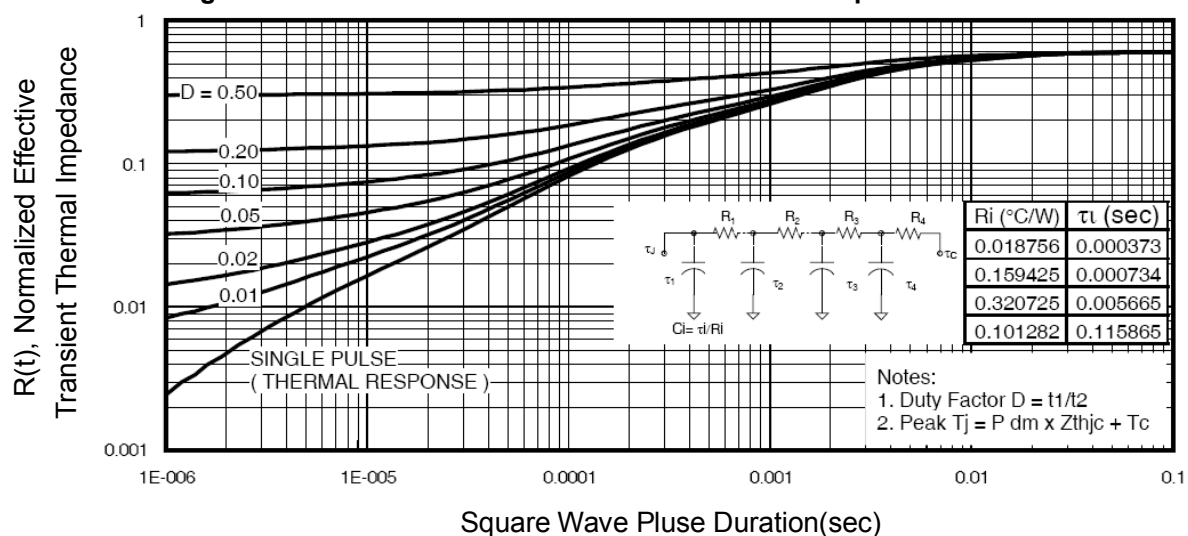
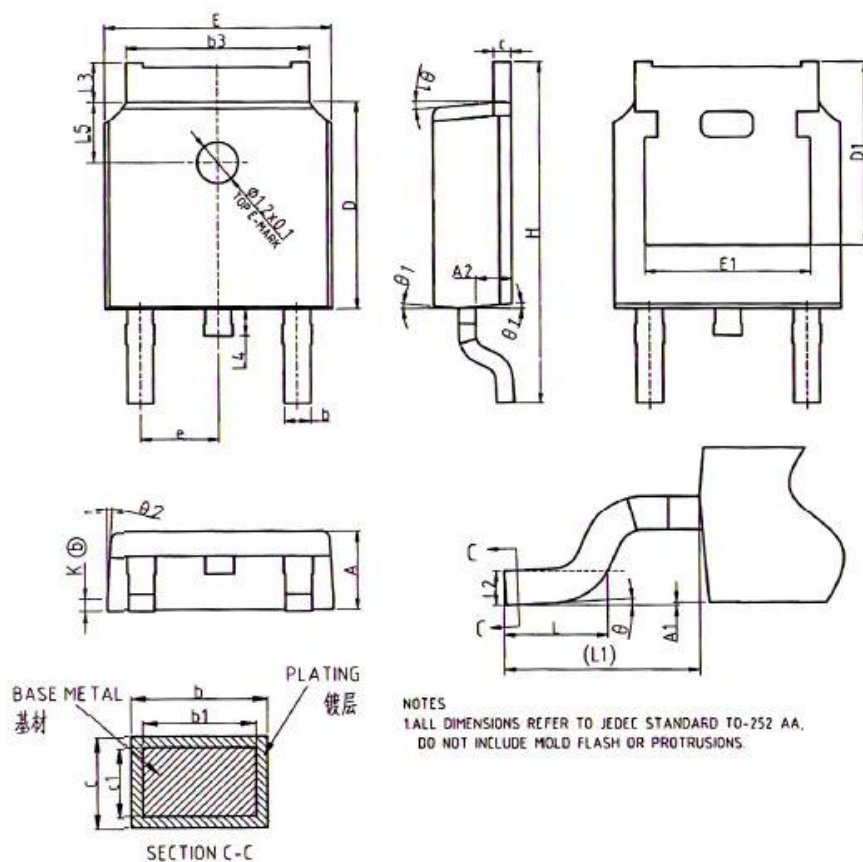


Figure11. Normalized Maximum Transient Thermal Impedance



TO-252 Package Information



COMMON DIMENSIONS			
SYMBOL	mm		
	MIN	NOM	MAX
A	2.20	2.30	2.38
A1	0.00	-	0.10
A2	0.97	1.07	1.17
b	0.72	0.78	0.85
b1	0.71	0.76	0.81
b3	5.23	5.33	5.46
c	0.47	0.53	0.58
c1	0.46	0.51	0.56
D	6.00	6.10	6.20
D1	5.30REF		
E	6.50	6.60	6.70
E1	4.70	4.83	4.92
e	2.286BSC		
H	9.90	10.10	10.30
L	1.40	1.50	1.70
L1	2.90REF		
L2	0.51BSC		
L3	0.90	-	1.25
L4	0.60	0.80	1.00
L5	1.70	1.80	1.90
θ	0°	-	8°
$\theta 1$	5°	7°	9°
$\theta 2$	5°	7°	9°
K	0.10REF		