



## TGD N-Channel Super Trench Power MOSFET

### Description

The TGDP0178AK uses **Super Trench** technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of  $R_{DS(ON)}$  and  $Q_g$ . This device is ideal for high-frequency switching and synchronous rectification.

### General Features

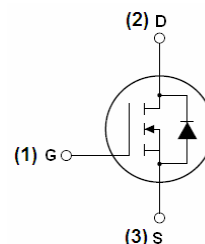
- $V_{DS} = 100V, I_D = 78A$   
 $R_{DS(ON)} = 7.2m\Omega$ (typical) @  $V_{GS} = 10V$   
 $R_{DS(ON)} = 9.5m\Omega$ (typical) @  $V_{GS} = 4.5V$
- Excellent gate charge x  $R_{DS(on)}$  product(FOM)
- Very low on-resistance  $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating
- 100% UIS tested

### Application

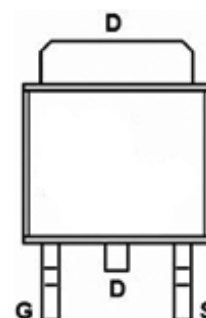
- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification

**100% UIS TESTED!**

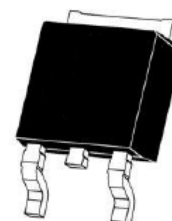
**100%  $\Delta V_{ds}$  TESTED!**



Schematic diagram



pin assignment



TO-252-2L top view

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
TGDP0178AK	TGDP0178AK	TO-252-2L	-	-	-

### Absolute Maximum Ratings ( $T_C = 25^\circ C$ unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	100	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	78	A
Drain Current-Continuous( $T_C = 100^\circ C$ )	$I_D (100^\circ C)$	60	A
Pulsed Drain Current	$I_{DM}$	320	A
Maximum Power Dissipation	$P_D$	125	W
Derating factor		0.83	W/ $^\circ C$
Single pulse avalanche energy (Note 5)	$E_{AS}$	320	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 175	$^\circ C$



## Thermal Characteristic

Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup>	$R_{\theta JC}$	1.2	$^{\circ}\text{C/W}$
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## Electrical Characteristics ( $T_C=25^{\circ}\text{C}$ unless otherwise noted)

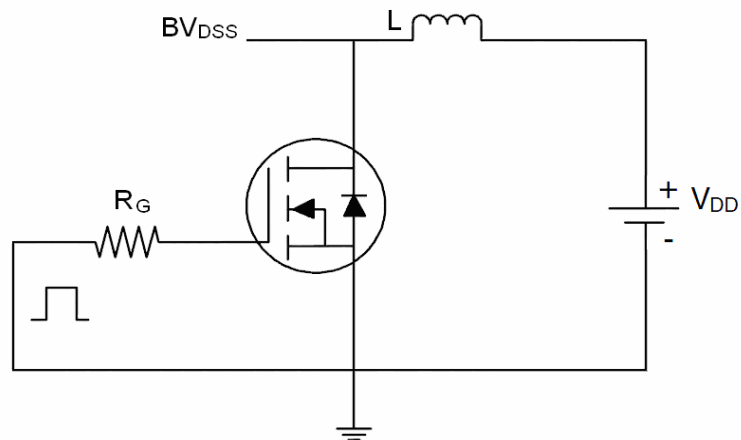
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V I <sub>D</sub> =250μA	100		-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =100V, V <sub>GS</sub> =0V	-	-	1	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	-	-	±100	nA
On Characteristics (Note 3)						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	1.2	1.7	2.2	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =39A	-	7.2	8.5	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =39A	-	9.5	12	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =10V, I <sub>D</sub> =39A	40	-	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C <sub>ISS</sub>	V <sub>DS</sub> =50V, V <sub>GS</sub> =0V, F=1.0MHz	-	4200	5480	PF
Output Capacitance	C <sub>OSS</sub>		-	354	425	PF
Reverse Transfer Capacitance	C <sub>RSS</sub>		-	23	30	PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =50V, I <sub>D</sub> =39A V <sub>GS</sub> =10V, R <sub>G</sub> =4.7Ω	-	15	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	10	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	41	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	6	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =50V, I <sub>D</sub> =39A, V <sub>GS</sub> =10V	-	65		nC
Gate-Source Charge	Q <sub>gs</sub>		-	15.3		nC
Gate-Drain Charge	Q <sub>gd</sub>		-	9		nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =78A	-		1.2	V
Diode Forward Current (Note 2)	I <sub>S</sub>		-	-	78	A
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> = 25°C, I <sub>F</sub> = I <sub>S</sub> di/dt = 100A/μs (Note3)	-	101		nS
Reverse Recovery Charge	Q <sub>rr</sub>		-	193		nC

## Notes:

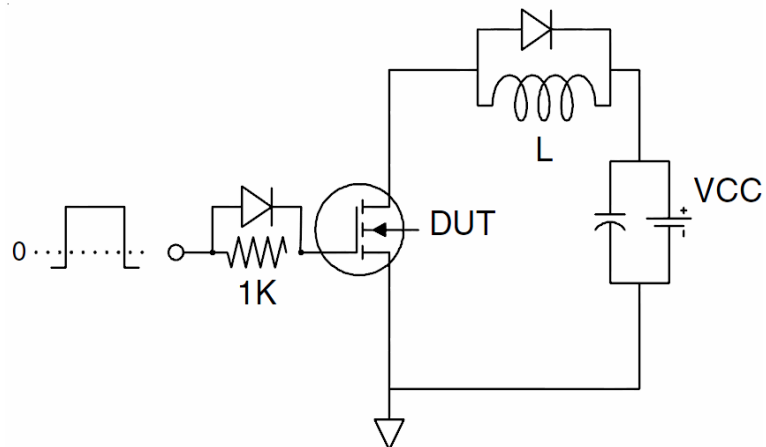
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS condition :  $T_J=25^{\circ}\text{C}, V_{DD}=50V, V_G=10V, L=0.5\text{mH}, R_G=25\Omega$

## Test Circuit

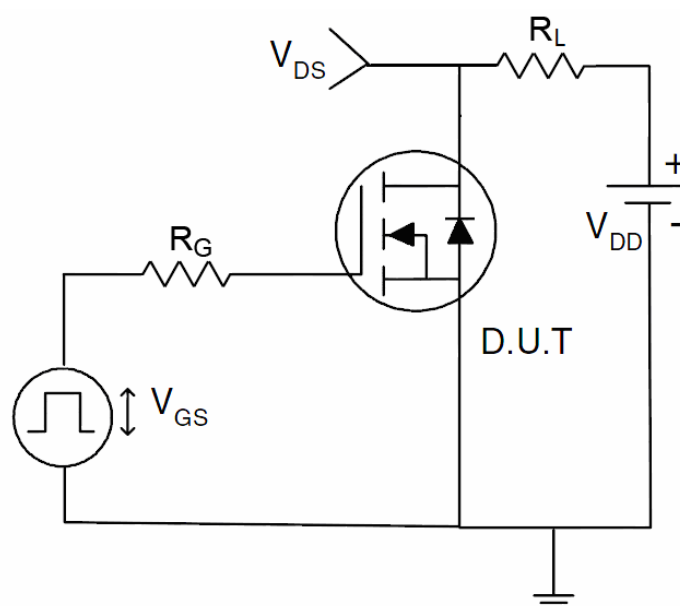
### 1) $E_{AS}$ test Circuit



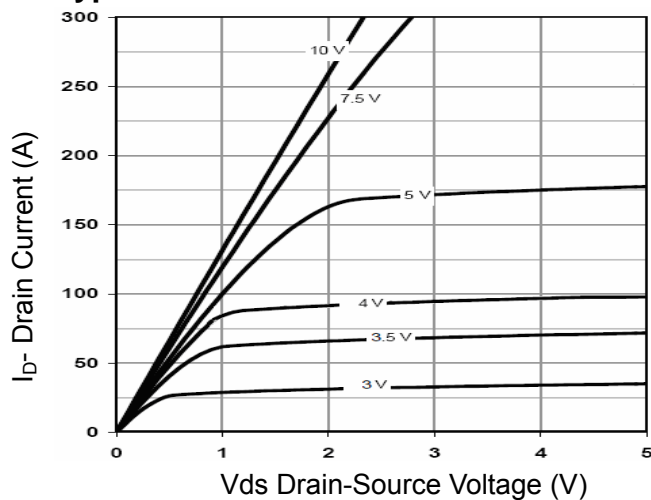
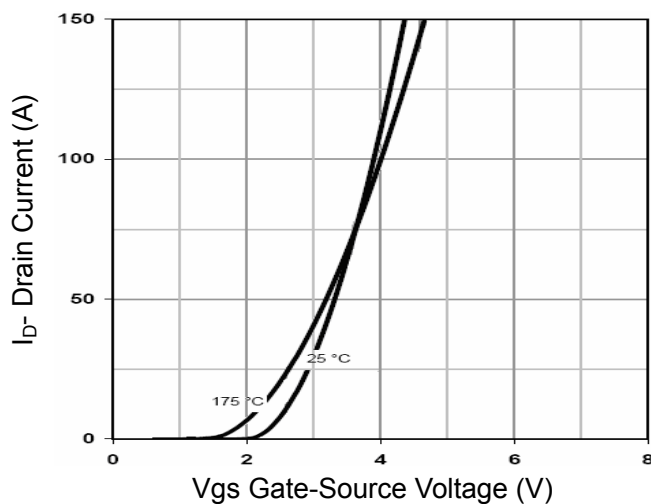
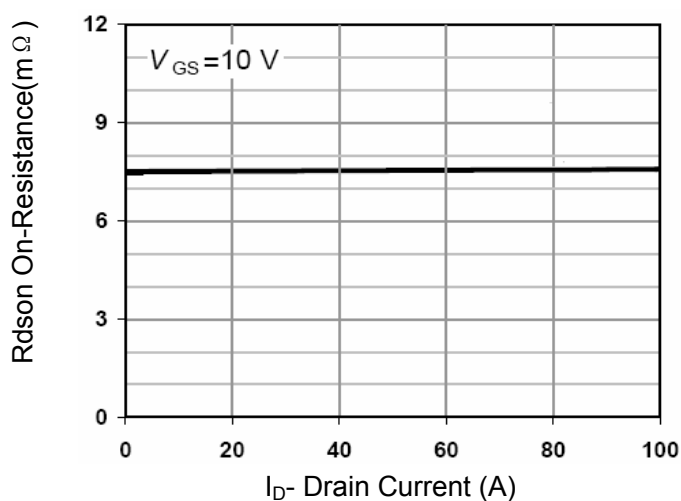
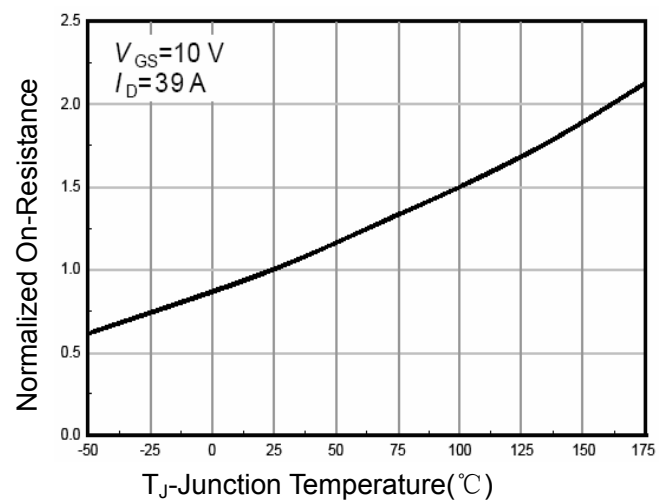
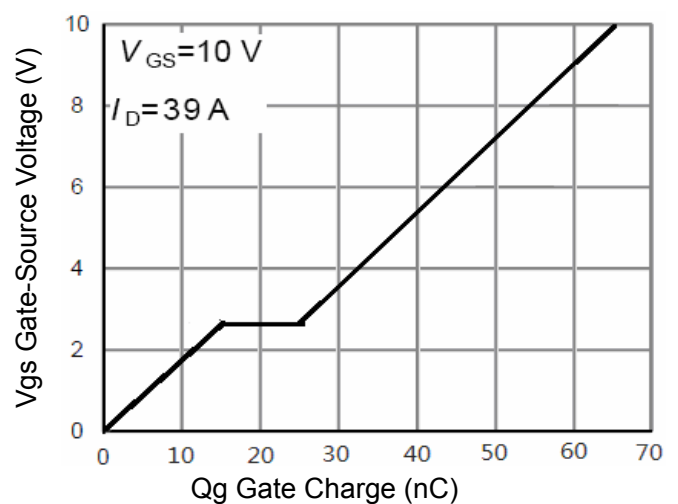
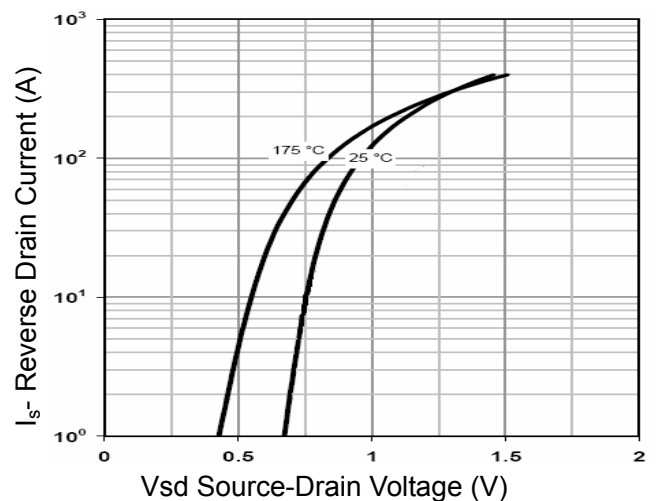
### 2) Gate charge test Circuit



### 3) Switch Time Test Circuit



### Typical Electrical and Thermal Characteristics


**Figure 1 Output Characteristics**

**Figure 2 Transfer Characteristics**

**Figure 3 Rdson- Drain Current**

**Figure 4 Rdson-Junction Temperature**

**Figure 5 Gate Charge**

**Figure 6 Source- Drain Diode Forward**

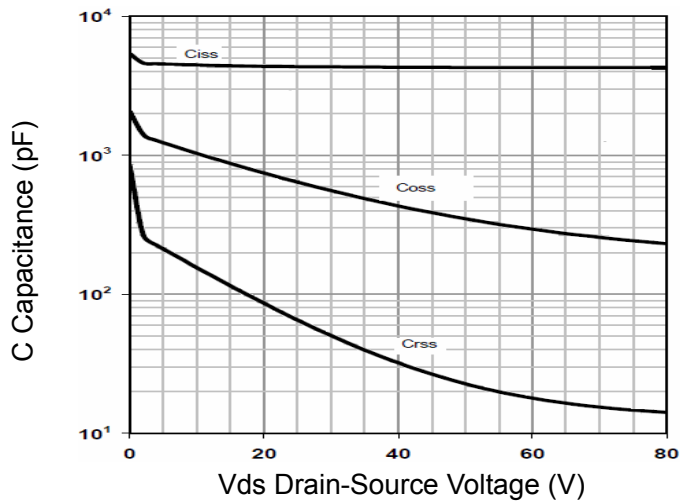


Figure 7 Capacitance vs Vds

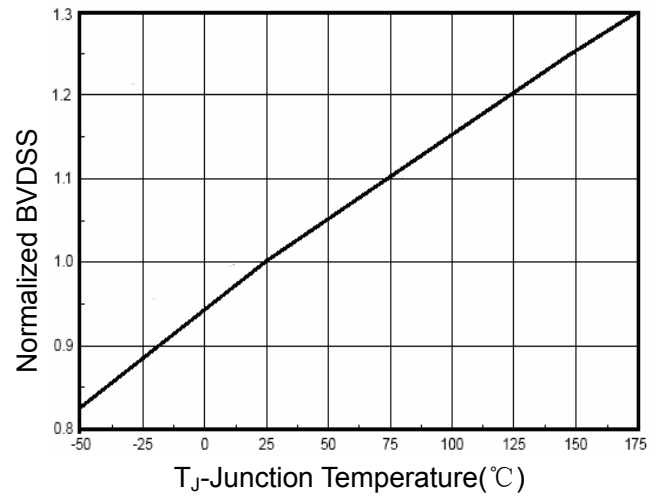


Figure 9 BV<sub>DSS</sub> vs Junction Temperature

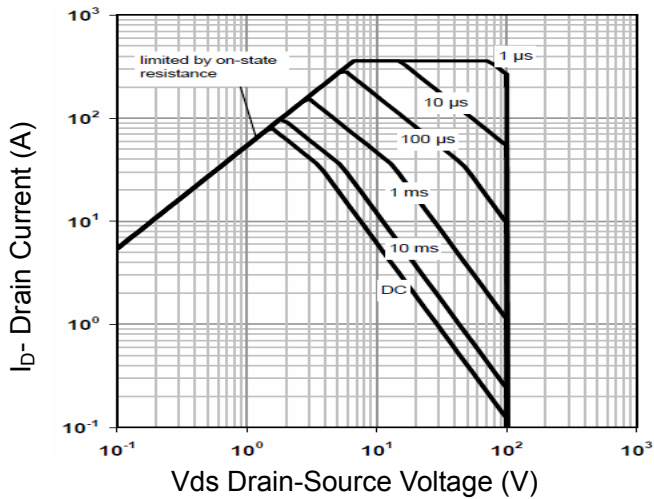


Figure 8 Safe Operation Area

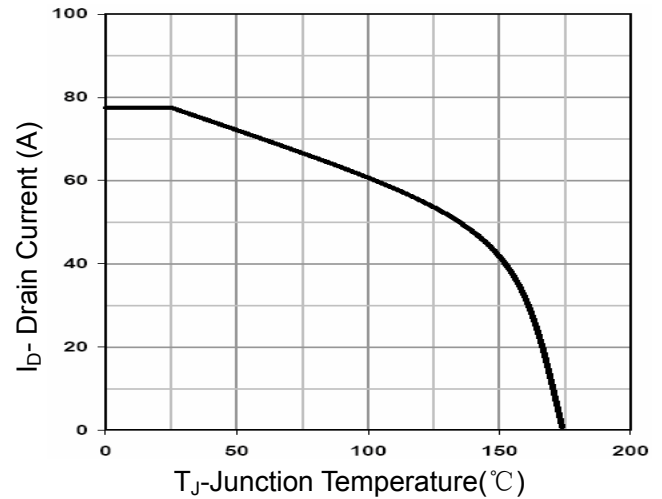


Figure 10 Current De-rating

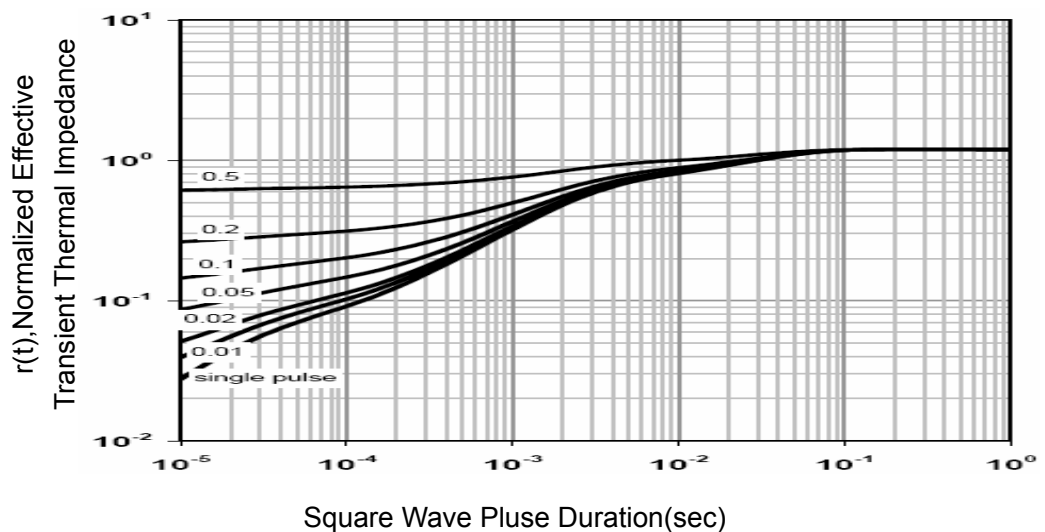
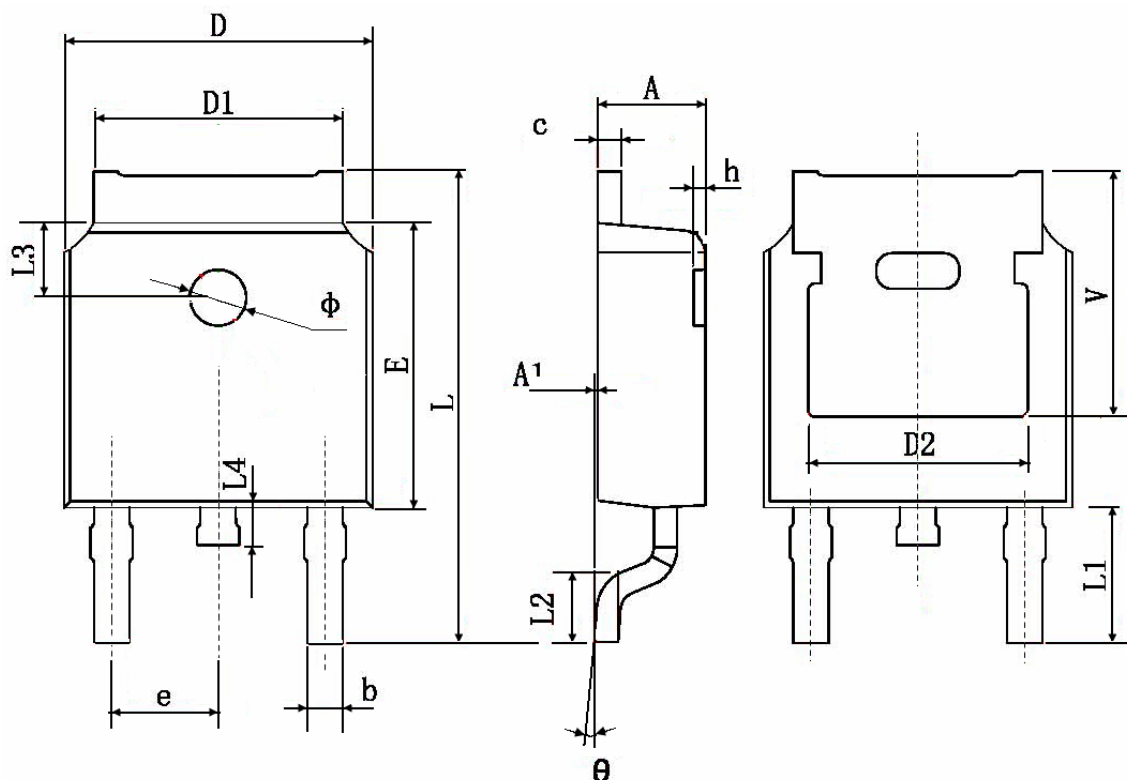


Figure 11 Normalized Maximum Transient Thermal Impedance



TO-252 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.200	2.400	0.087	0.094
A1	0.000	0.127	0.000	0.005
b	0.660	0.860	0.026	0.034
c	0.460	0.580	0.018	0.023
D	6.500	6.700	0.256	0.264
D1	5.100	5.460	0.201	0.215
D2	4.83 TYP.		0.190 TYP.	
E	6.000	6.200	0.236	0.244
e	2.186	2.386	0.086	0.094
L	9.800	10.400	0.386	0.409
L1	2.900 TYP.		0.114 TYP.	
L2	1.400	1.700	0.055	0.067
L3	1.600 TYP.		0.063 TYP.	
L4	0.600	1.000	0.024	0.039
Φ	1.100	1.300	0.043	0.051
θ	0°	8°	0°	8°
h	0.000	0.300	0.000	0.012
V	5.350 TYP.		0.211 TYP.	