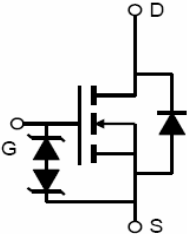
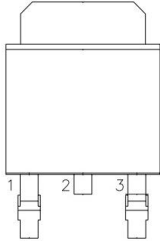
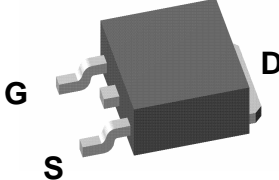


# FH2050D

## N-Channel Trench Power MOSFET

<p><b>Description</b></p> <p>The FH2050D uses advanced trench technology and design to provide excellent <math>R_{DS(ON)}</math> with low gate charge. It can be used in a wide variety of applications.</p> <p><b>Application</b></p> <ul style="list-style-type: none"> <li>● Load switching</li> <li>● Hard switched and high frequency circuits</li> <li>● Uninterruptible power supply</li> </ul>	<p><b>General Features</b></p> <ul style="list-style-type: none"> <li>● <math>V_{DS} = 20V, I_b = 50A</math></li> <li>● <math>R_{DS(ON)} &lt; 7m\Omega</math> ( MAX ) @ <math>V_{GS} = 4.5V</math></li> <li>● <math>R_{DS(ON)} &lt; 9m\Omega</math> ( MAX ) @ <math>V_{GS} = 2.5V</math></li> <li>● High density cell design for ultra low <math>R_{dson}</math></li> <li>● Fully characterized avalanche voltage and current</li> <li>● Good stability</li> <li>● Excellent package for good heat dissipation</li> </ul>
<p><b>TO-252</b></p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>Schematic diagram</p> </div> <div style="text-align: center;">  <p>Marking and pin assignment</p> </div> <div style="text-align: center;">  <p>TO-252 top view</p> </div> </div>	

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	20	V
Gate-Source Voltage	$V_{GS}$	$\pm 10$	V
Drain Current Continuous	$I_D$	50	A
Drain Current-Continuous( $T_C = 100^\circ C$ )	$I_D(100^\circ C)$	38	A
Pulsed Drain Current	$I_{DM}$	150	A
Maximum Power Dissipation	$P_D$	50	W
Derating factor		0.48	$W/^\circ C$
Single pulse avalanche energy <sup>(Note5)</sup>	$E_{AS}$	100	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 150	$^\circ C$

### Thermal Characteristic

Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup>	$R_{\theta JC}$	2.1	$^\circ C/W$
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## Electrical Characteristics (T<sub>C</sub>=25 °C unless otherwise noted)

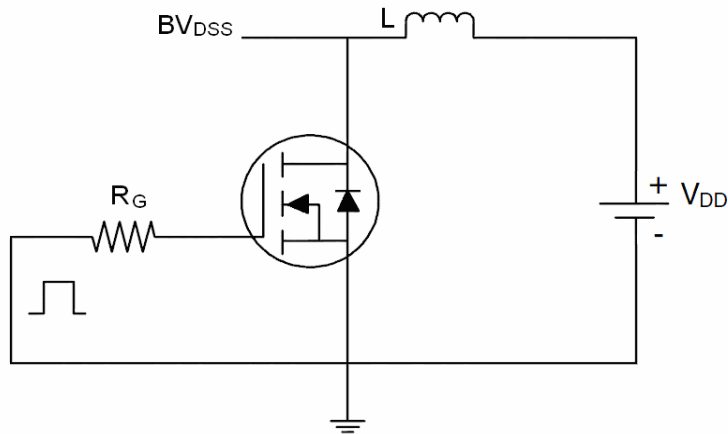
Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA	20	-	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =16V, V <sub>GS</sub> =0V	-	-	1	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±10V, V <sub>DS</sub> =0V	-	-	±10	uA
<b>On Characteristics</b> (Note3)						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	0.5	0.8	1.0	V
Drain Source On State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =4.5V, I <sub>D</sub> =20 A	-	5.8	7	mΩ
		V <sub>GS</sub> =2.5V, I <sub>D</sub> =15A		7.6	9	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =10V, I <sub>D</sub> =20A	15	-	-	S
<b>Dynamic Characteristics</b> (Note4)						
Input Capacitance	C <sub>ISS</sub>	V <sub>DS</sub> =10V, V <sub>GS</sub> =0V, F=1.0MHz		1800		PF
Output Capacitance	C <sub>OSS</sub>		-	500	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>			220		PF
<b>Switching Characteristics</b> (Note4)						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =10V, I <sub>D</sub> =2A, R <sub>L</sub> =1Ω V <sub>GS</sub> =4.5V, R <sub>G</sub> =3Ω	-	6.4	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	17.2	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	29.6	-	nS
Turn Off Fall Time	t <sub>f</sub>			16.8		nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =10V, I <sub>D</sub> =20A, V <sub>GS</sub> =10V	-	27		nC
Gate Source Charge	Q <sub>gs</sub>			6.5		nC
Gate-Drain Charge	Q <sub>gd</sub>		-	6.4		nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage (Note 3)	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =10A	-		1.2	V
Diode Forward Current (Note 2)	I <sub>S</sub>		-	-	50	A
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> = 25°C, I <sub>F</sub> = 20A	-	25	-	nS
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 100A/μs (Note3)	-	24	-	nC
Forward Turn-On Time	t <sub>on</sub>	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

### Notes:

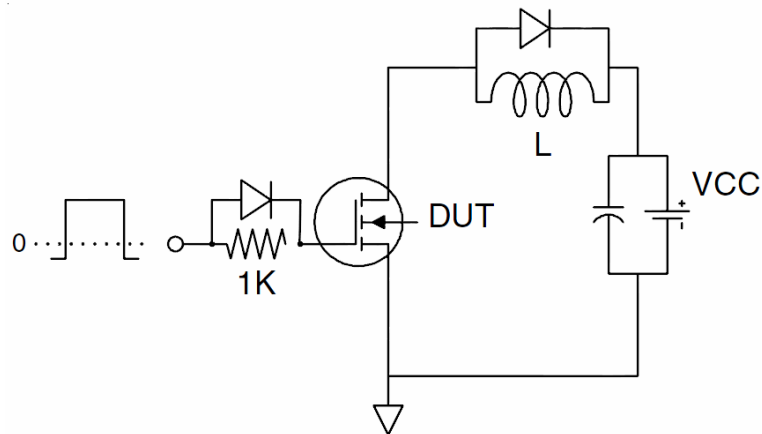
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production
5. EAs condition : T<sub>J</sub>=25°C, V<sub>DD</sub>=10V, V<sub>G</sub>=10V, L=0.5mH, R<sub>g</sub>=25Ω,

## Test circuit

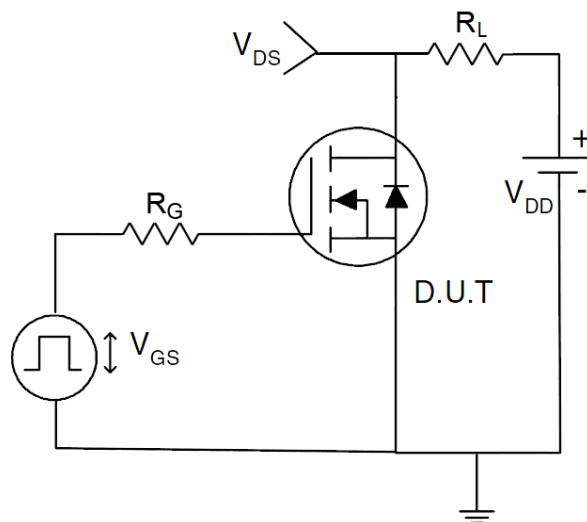
### 1) E<sub>AS</sub> Test Circuit



### 2) Gate Charge Test Circuit



### 3) Switch Time Test Circuit



Typical Electrical and Thermal Characteristics(Curves)

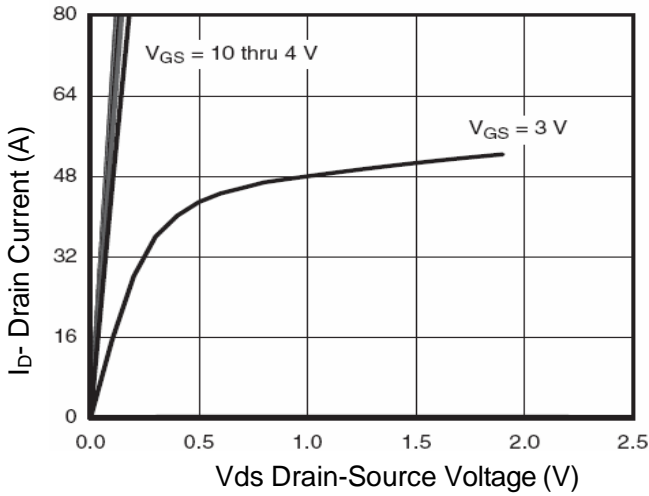


Figure 1 Output Characteristics

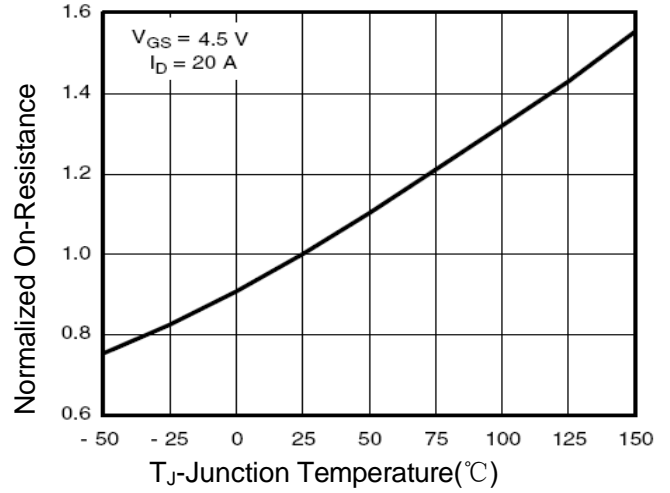


Figure 4 Rdson-Junction Temperature

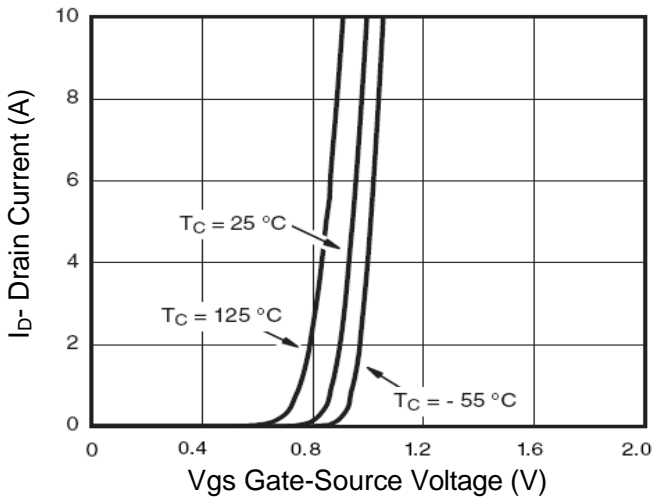


Figure 2 Transfer Characteristics

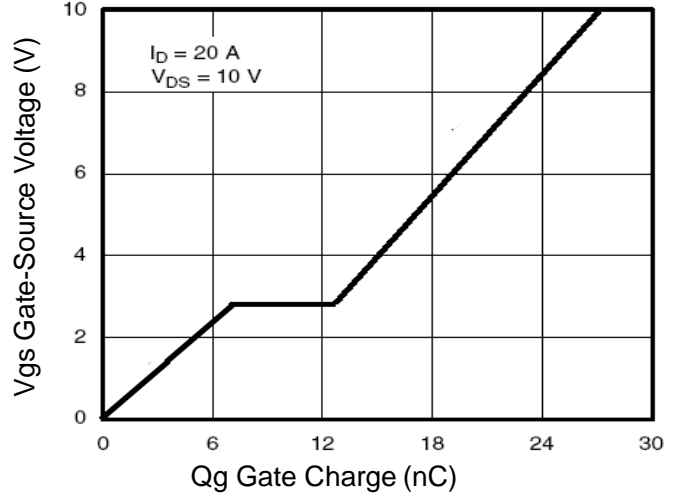


Figure 5 Gate Charge

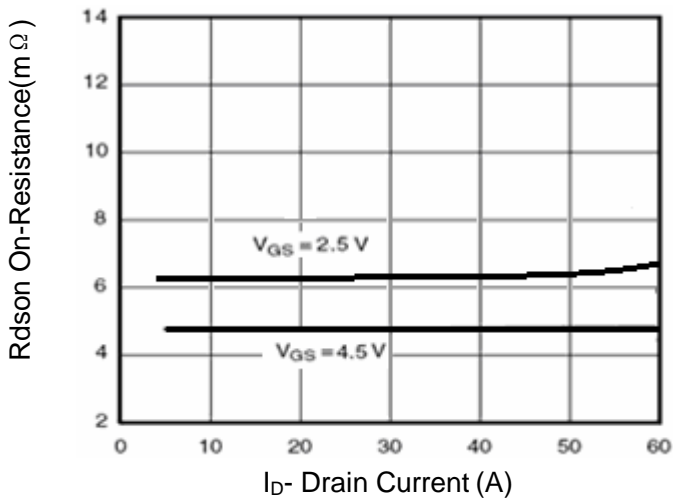


Figure 3 Rdson- Drain Current

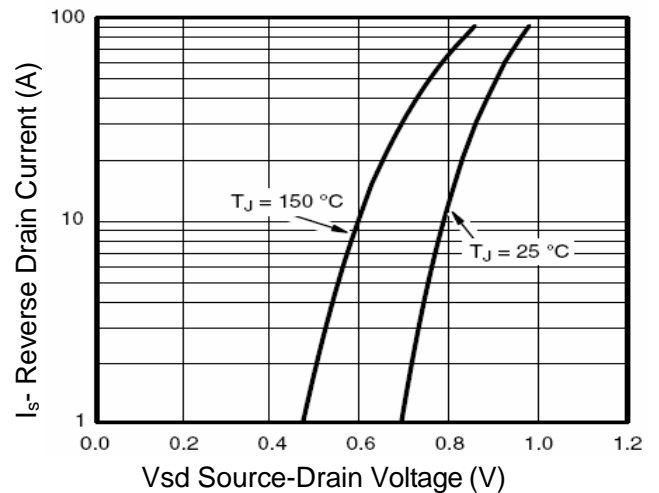


Figure 6 Source- Drain Diode Forward

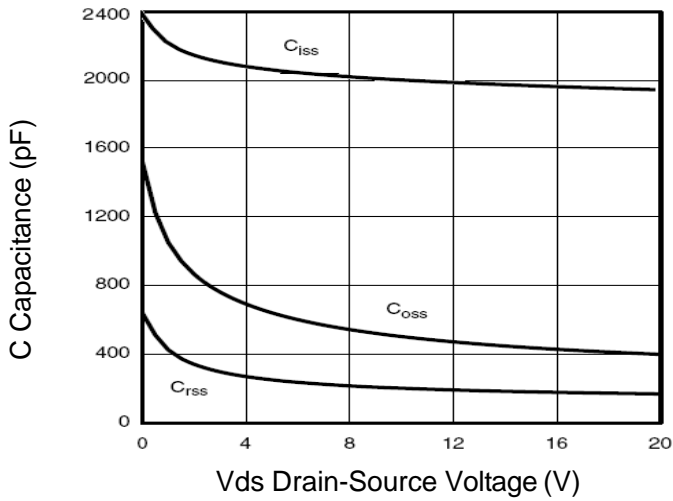


Figure 7 Capacitance vs Vds

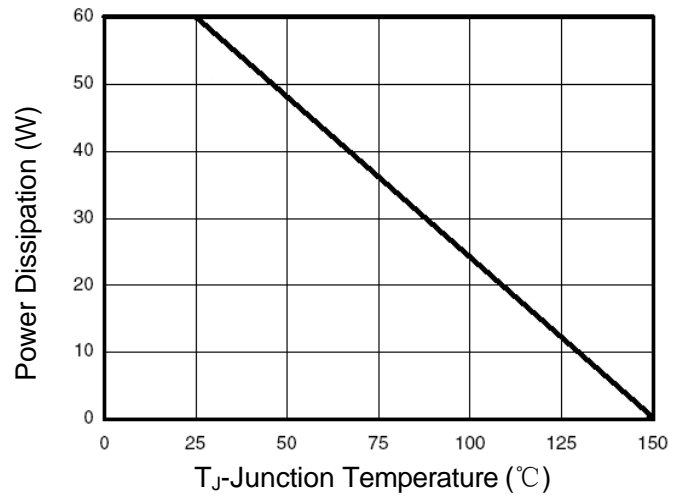


Figure 9 Power De-rating

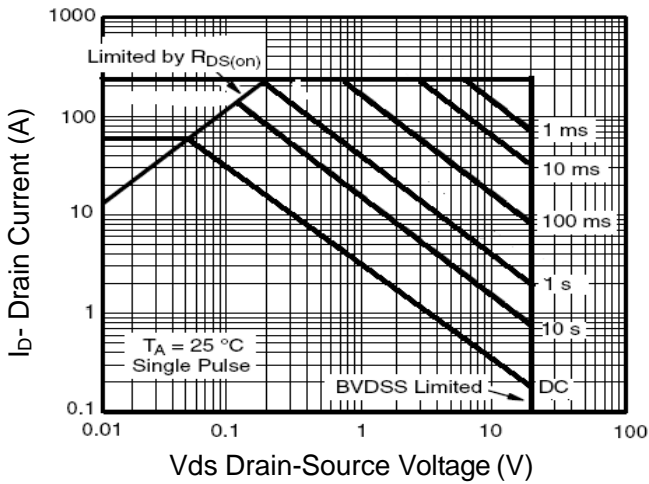


Figure 8 Safe Operation Area

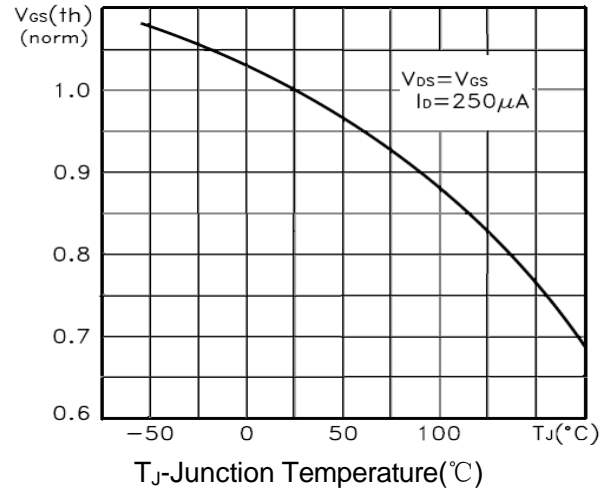


Figure 10  $V_{GS(th)}$  vs Junction Temperature

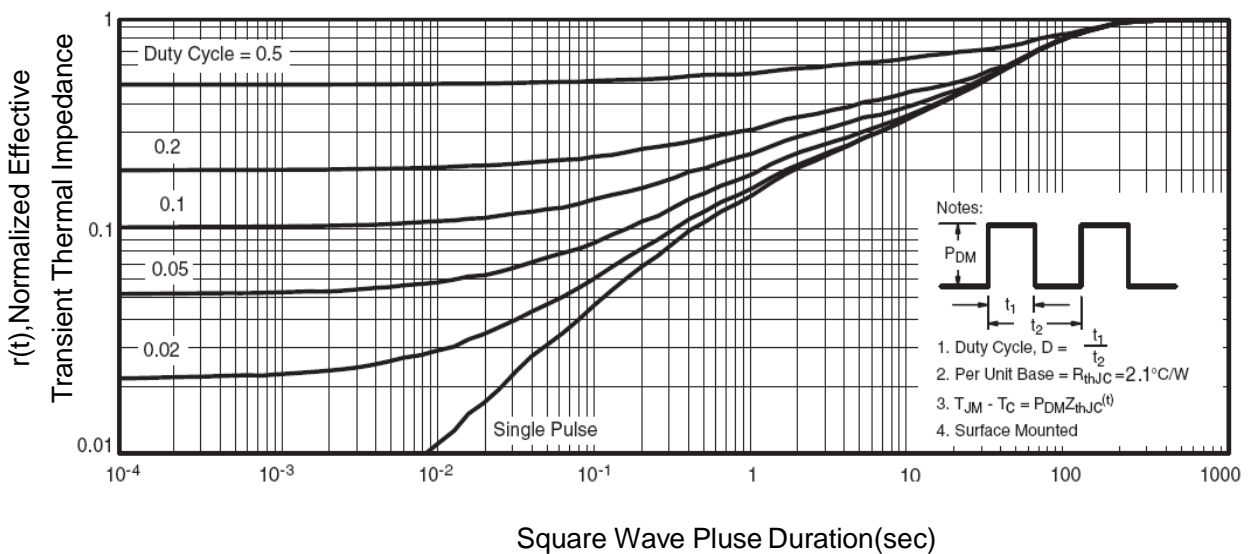
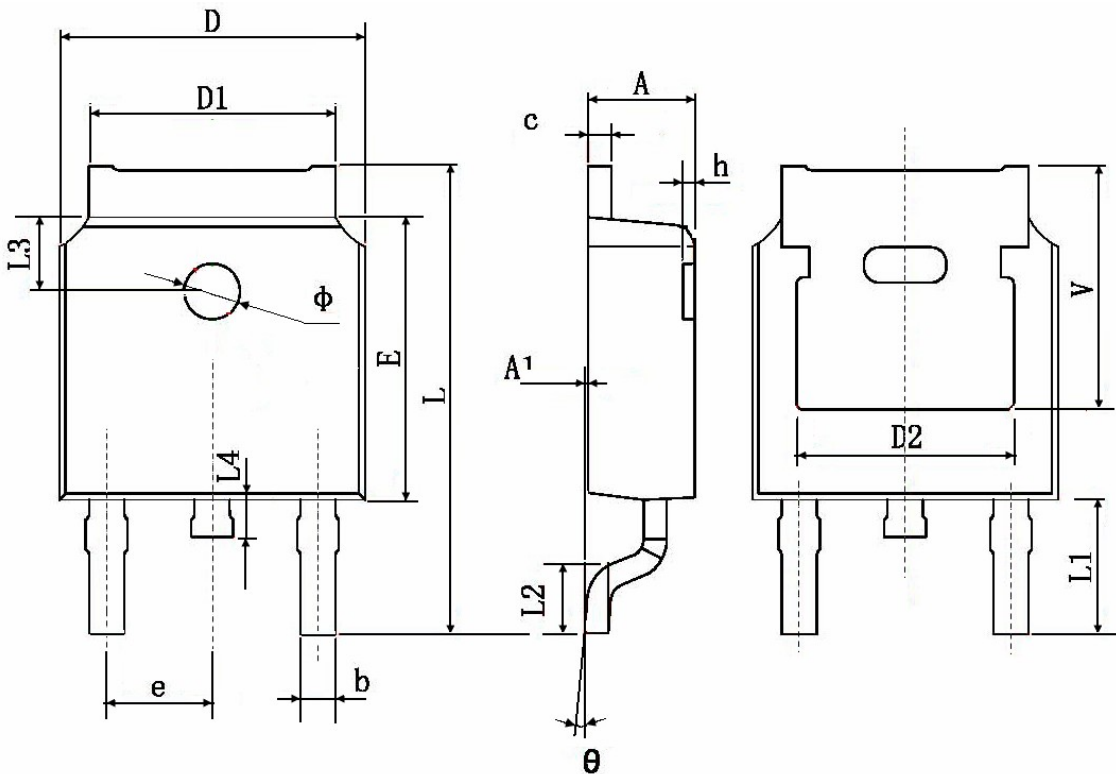


Figure 11 Normalized Maximum Transient Thermal Impedance

Package Information : TO-252



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	4.830 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.	