

• Product Summary

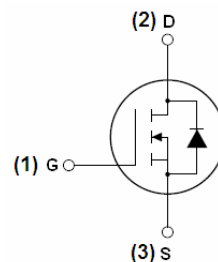
Part #	V_{DS}	$R_{DS(on).typ}$ (@ $V_{GS}=10V$)	$R_{DS(on).typ}$ (@ $V_{GS}=4.5V$)	I_D
EFM140N06D	60V	12m Ω	18m Ω	50A

• Description

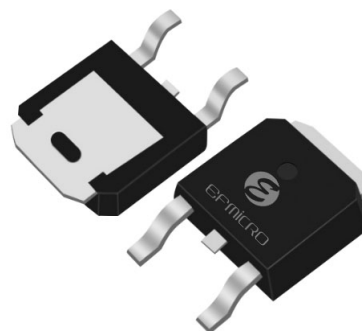
- The EFM140N06D is the high cell density trench
- N-ch MOSFETs which provide excellent
- RDSON and gate charge for most of the
- synchronous buck converter applications.
- The EFM140N06D meet the RoHS and Green
- Product requirement, 100 % EAS guaranteed
- with full function reliability approved.

• Application

- Super Low Gate Charge 100% EAS Guaranteed
- Green Device Available Excellent CdV/dt effect decline
- Advanced high cell density Trench technology



N-Channel MOSFET



TO-252-2L

• Ordering Information:

Part NO.	EFM140N06D
Marking	140N06D****
Packing Information	REEL TAPE
Basic ordering unit (pcs)	2500

• Absolute Maximum Ratings ($T_C=25^{\circ}C$)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	60	V
Gate-Source Voltage	V_{GS}	± 20	V
Drain Current-Continuous	I_D	50	A
Drain Current-Pulsed ^(Note 1)	I_{DM}	200	A
Maximum Power Dissipation	P_D	85	W
Single pulse avalanche energy ^(Note 5)	E_{AS}	200	mJ
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 150	$^{\circ}C$

• Thermal Characteristic

Thermal Resistance, Junction-to-Ambient ^(Note 2)	$R_{\theta JC}$	1.8	$^{\circ}C/W$
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• Static Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise stated)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V$ $I_D=250\mu A$	60	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=60V$ $V_{GS}=0V$	--	--	1	μA
Gate-Body Leakage Current	I_{GSS}	$V_{GS}=\pm 20V$ $V_{DS}=0V$	--	--	± 100	nA
On Characteristics (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}$ $I_D=250\mu A$	1.1	1.6	2.5	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=10V$ $I_D=20A$	--	12	15	m Ω
		$V_{GS}=4.5V$ $I_D=20A$	--	18	21	m Ω
Forward Transconductance	g_{FS}	$V_{DS}=5V$ $I_D=20A$	18	--	--	S

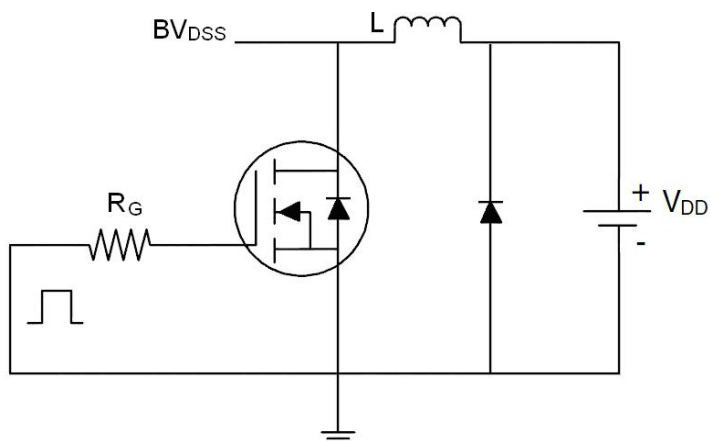
Dynamic Characteristics (Note4)						
Input Capacitance	C _{Iss}	V _{DS} =30V V _{GS} =0V F=1.0MHz	--	1630	--	PF
Output Capacitance	C _{Oss}		--	113	--	PF
Reverse Transfer Capacitance	C _{Rss}		--	97	--	PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	t _{d(on)}	V _{DD} =30V I _D =20A V _{GS} =10V R _G =3Ω,	--	7.4	--	nS
Turn-on Rise Time	t _r		--	5.1	--	nS
Turn-Off Delay Time	t _{d(off)}		--	28	--	nS
Turn-Off Fall Time	t _f		--	5.5	--	nS
Total Gate Charge	Q _g	V _{DS} =30V I _D =20A V _{GS} =10V	--	39	--	nC
Gate-Source Charge	Q _{gs}		--	7	--	nC
Gate-Drain Charge	Q _{gd}		--	8.5	--	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V _{SD}	V _{GS} =0V I _S =20A	--	--	1.2	V
Diode Forward Current (Note 2)	I _S		--	--	50	A

Notes:

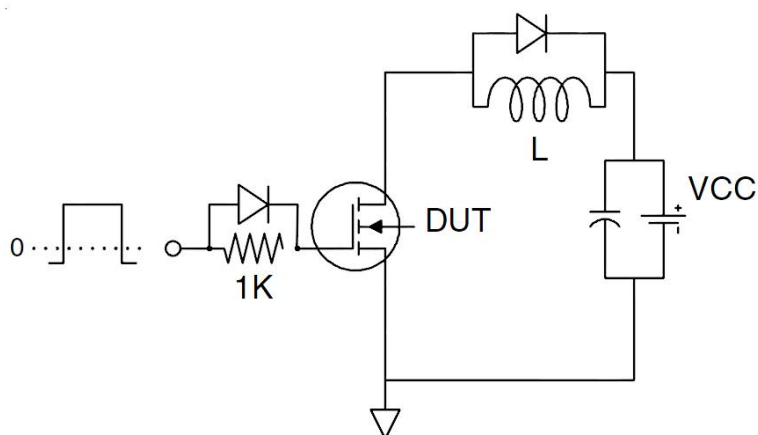
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, $t \leq 10$ sec.
3. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$.
4. Guaranteed by design, not subject to production
5. EAS condition: $T_J=25^\circ\text{C}$, $V_{DD}=10V$, $V_G=10V$,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

• Test circuit

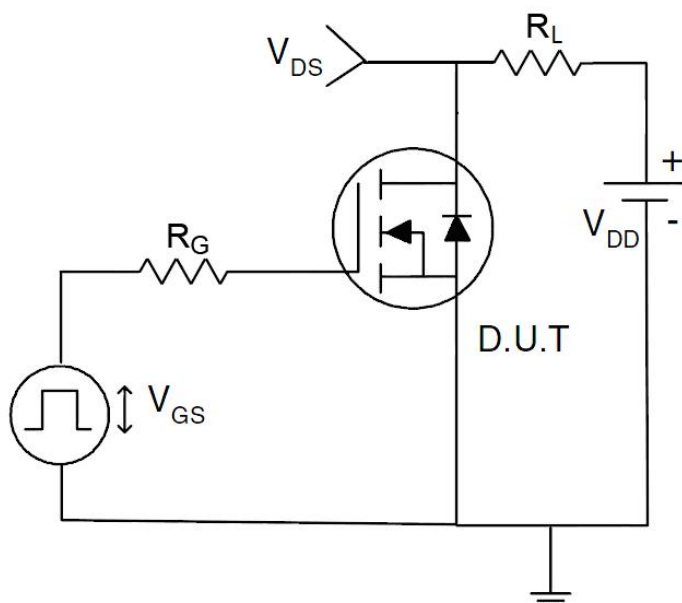
1) E_{AS} test Circuit



2) Gate charge test Circuit



3) Switch Time Test Circuit



• Typical Characteristics

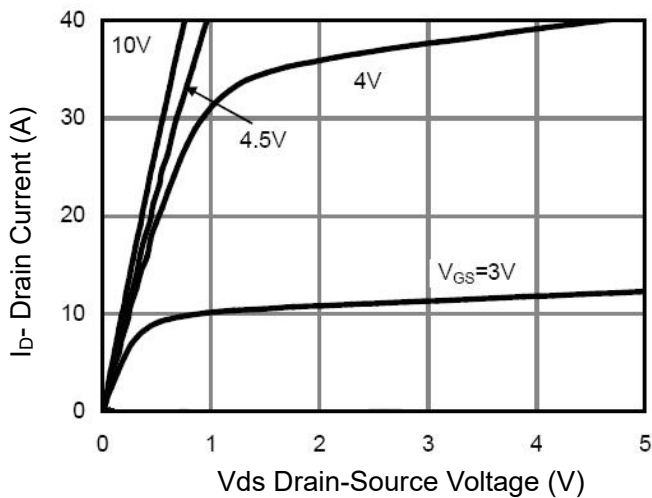


Figure 1 Output Characteristics

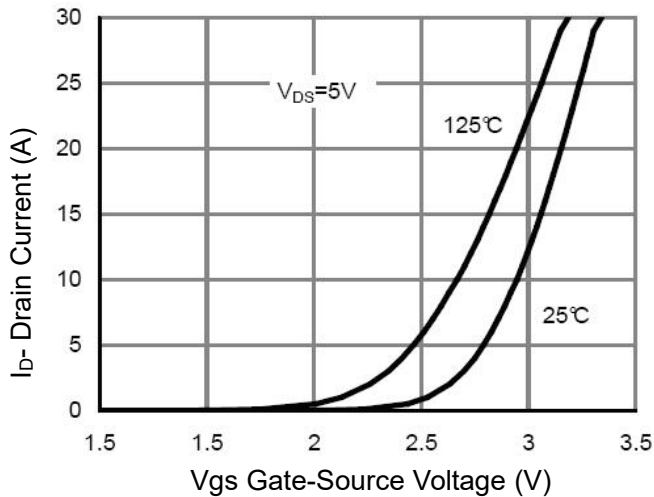


Figure 2 Transfer Characteristics

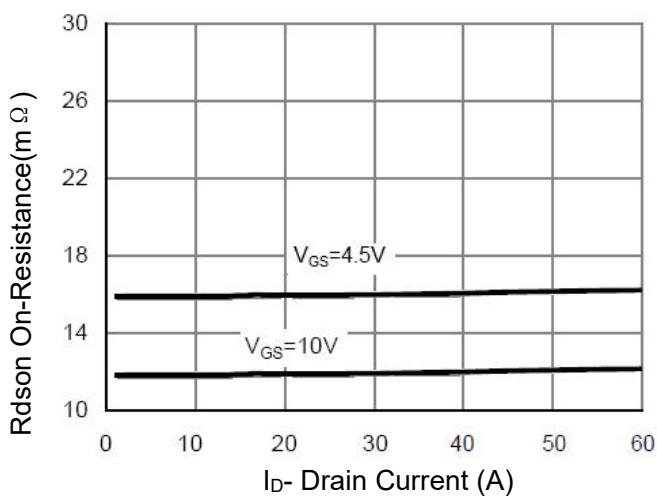


Figure 3 Rdson- Drain Current

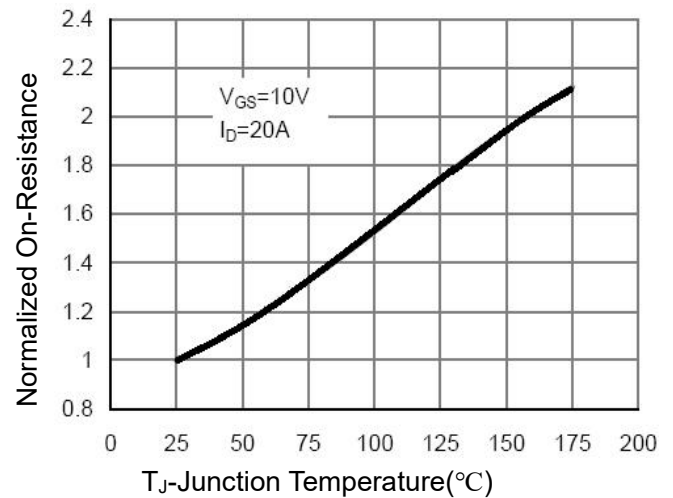


Figure 4 Rdson-Junction Temperature

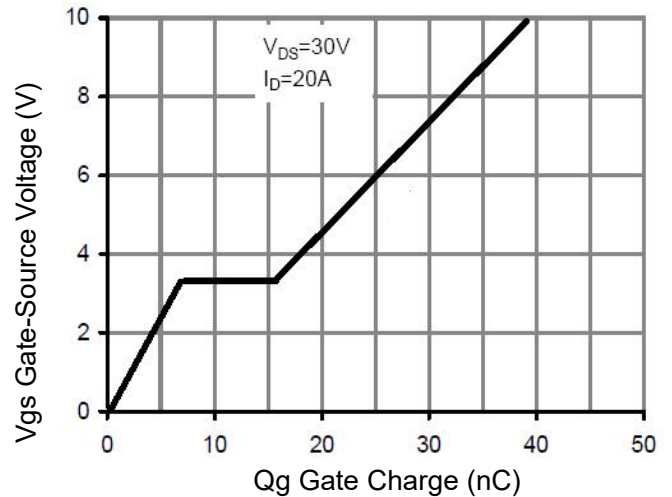


Figure 5 Gate Charge

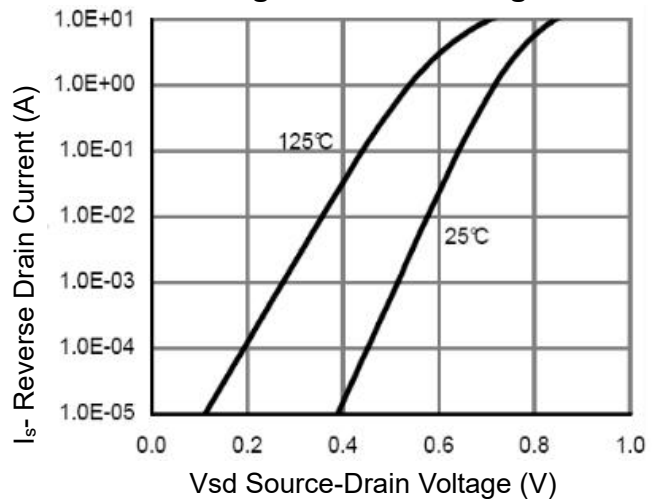


Figure 6 Source- Drain Diode Forward

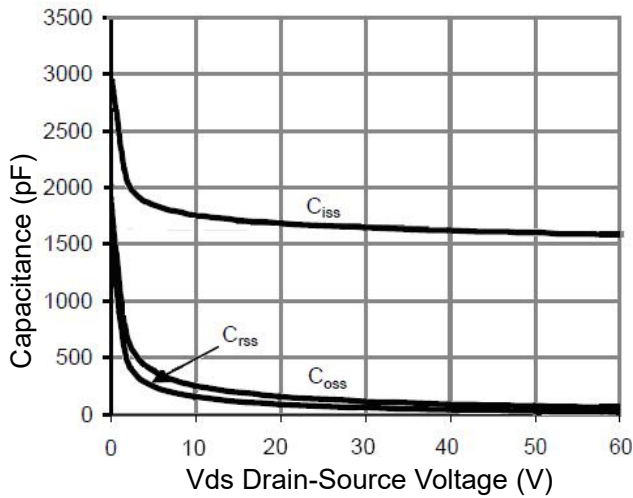


Figure 7 Capacitance vs Vds

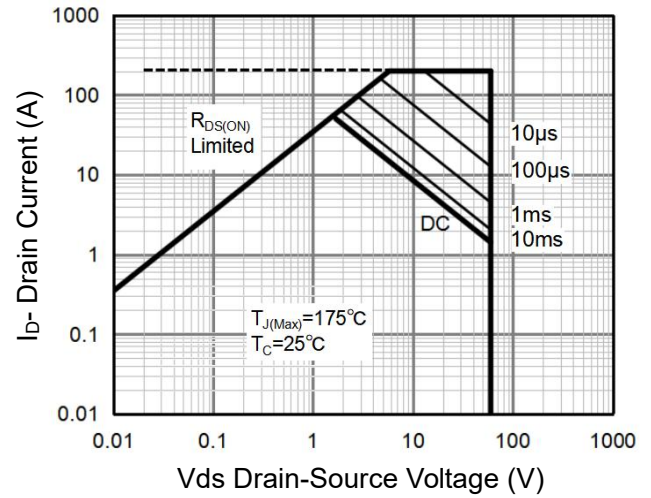


Figure 8 Safe Operation Area (Note 3)

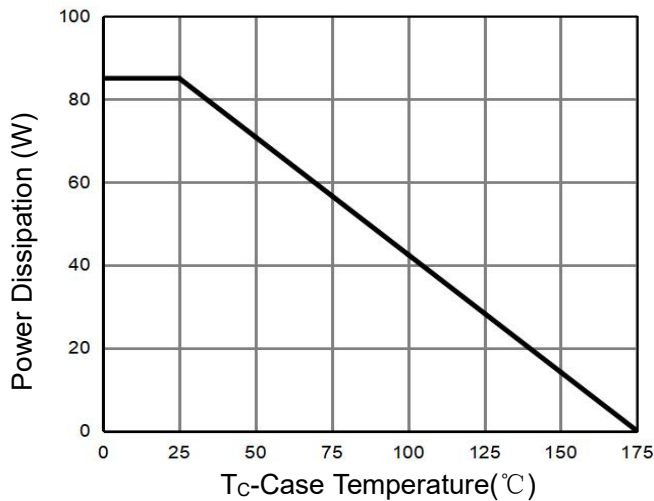


Figure 9 Power De-rating

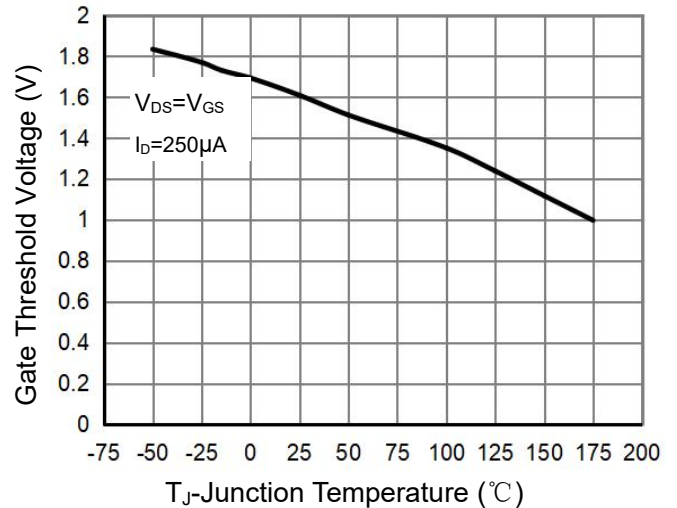


Figure 10 $V_{GS(th)}$ -Junction Temperature

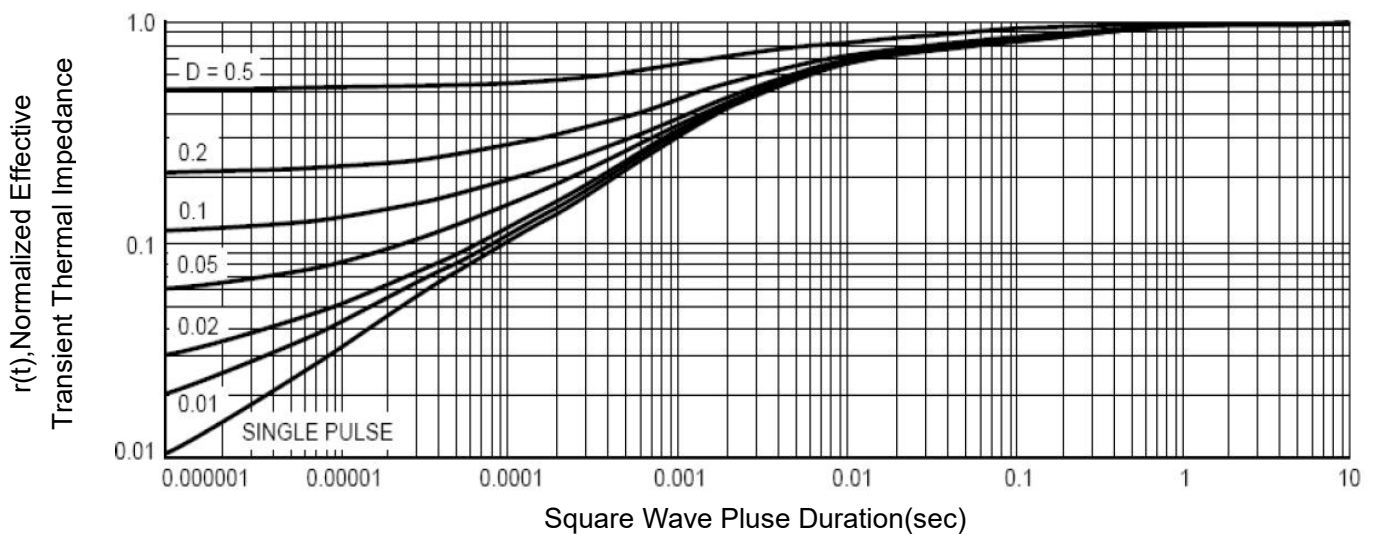
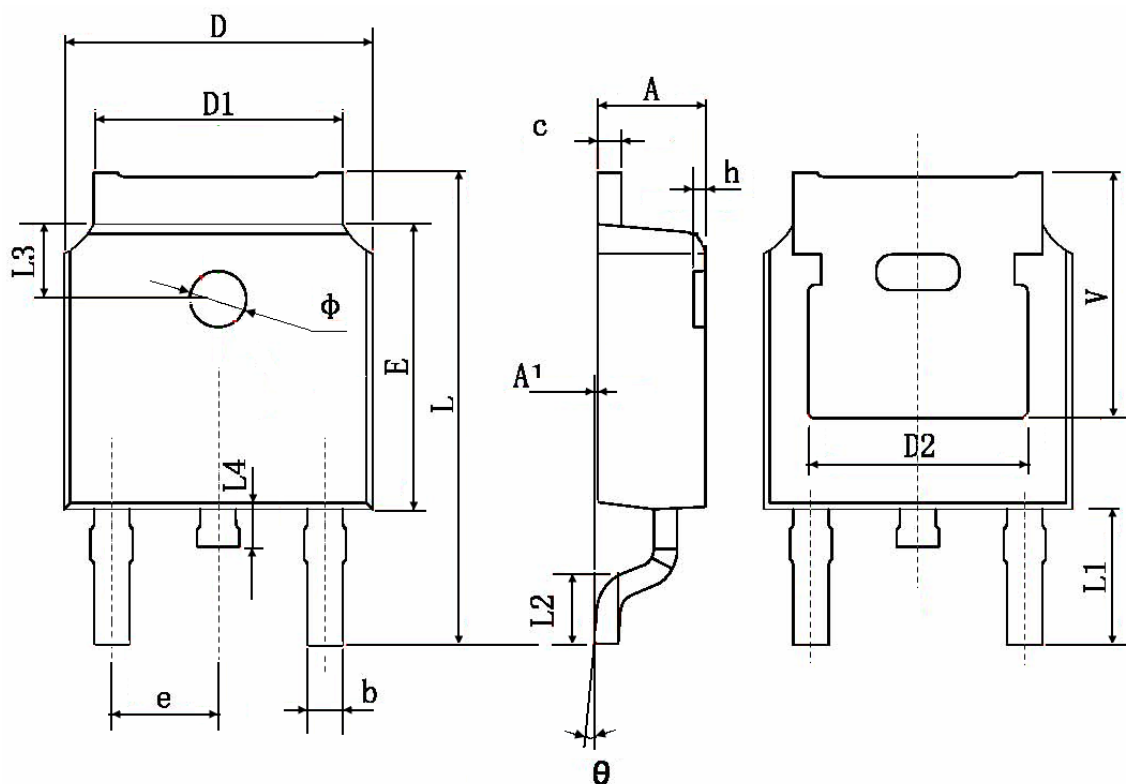


Figure 11 Normalized Maximum Transient Thermal Impedance

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.	