

## NCE N-Channel Enhancement Mode Power MOSFET

### Description

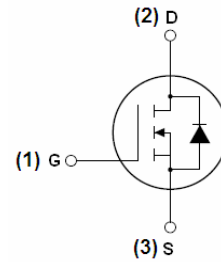
The VCRR4558K uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. It can be used in a wide variety of applications.

### General Features

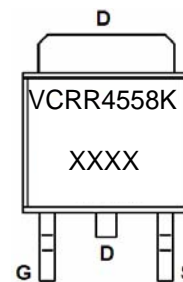
- $V_{DS} = 45V, I_D = 58A$   
 $R_{DS(ON)} < 12m\Omega @ V_{GS} = 10V$   
 $R_{DS(ON)} < 18m\Omega @ V_{GS} = 4.5V$
- High density cell design for ultra low  $R_{dson}$
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high  $E_{AS}$
- Excellent package for good heat dissipation
- Special process technology for high ESD capability

### Application

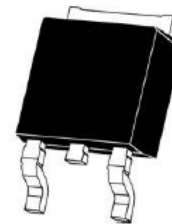
- Load switching
- Hard switched and high frequency circuits
- Uninterruptible power supply



Schematic diagram



Marking and pin assignment



TO-252-2L top view

### Package Marking and Ordering Information

Device Marking	Device	Device Package
VCRR4558K		TO-252-2L

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	45	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	58	A
Drain Current-Continuous( $T_C = 100^\circ C$ )	$I_D(100^\circ C)$	41	A
Pulsed Drain Current	$I_{DM}$	200	A
Maximum Power Dissipation	$P_D$	65	W
Derating factor		0.43	W/ $^\circ C$
Single pulse avalanche energy <sup>(Note 5)</sup>	$E_{AS}$	240	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>	$R_{\theta JC}$	2.3	$^{\circ}C/W$
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## Electrical Characteristics ( $T_C=25^{\circ}C$ unless otherwise noted)

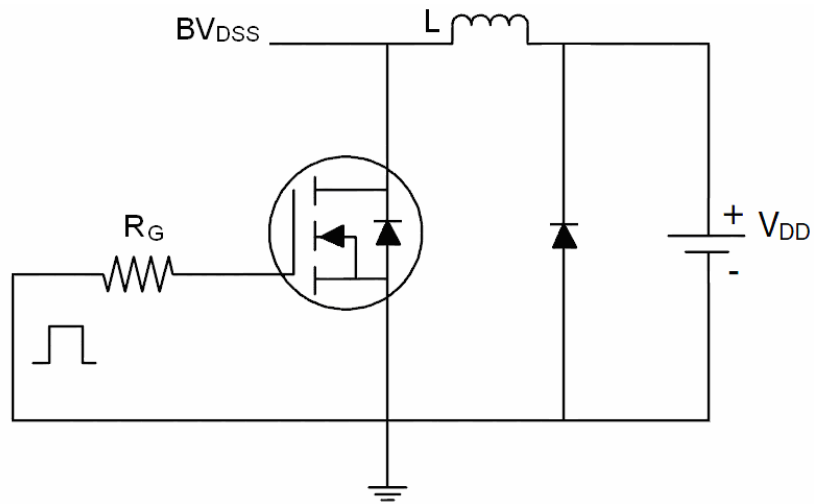
Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	45	-	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=45V, V_{GS}=0V$	-	-	1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
<b>On Characteristics</b> <sup>(Note 3)</sup>						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	1.2	1.9	2.5	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=20A$	-	8.0	10	m $\Omega$
		$V_{GS}=4.5V, I_D=15A$		11.6	18	
Forward Transconductance	$g_{FS}$	$V_{DS}=5V, I_D=20A$	20	-	-	S
<b>Dynamic Characteristics</b> <sup>(Note 4)</sup>						
Input Capacitance	$C_{iss}$	$V_{DS}=20V, V_{GS}=0V,$ $F=1.0MHz$	-	1800	-	PF
Output Capacitance	$C_{oss}$		-	182	-	PF
Reverse Transfer Capacitance	$C_{rss}$		-	138	-	PF
<b>Switching Characteristics</b> <sup>(Note 4)</sup>						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=20V, R_L=1\Omega$ $V_{GS}=10V, R_G=3\Omega$	-	6.4	-	nS
Turn-on Rise Time	$t_r$		-	17.2	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	29.6	-	nS
Turn-Off Fall Time	$t_f$		-	16.8	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=20V, I_D=20A,$ $V_{GS}=10V$	-	36.8		nC
Gate-Source Charge	$Q_{gs}$		-	4.8		nC
Gate-Drain Charge	$Q_{gd}$		-	11.2		nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage <sup>(Note 3)</sup>	$V_{SD}$	$V_{GS}=0V, I_S=10A$	-		1.2	V
Diode Forward Current <sup>(Note 2)</sup>	$I_S$		-	-	58	A
Reverse Recovery Time	$t_{rr}$	$T_J = 25^{\circ}C, I_F = 20A$ $di/dt = 100A/\mu s$ <sup>(Note 3)</sup>	-	29	-	nS
Reverse Recovery Charge	$Q_{rr}$		-	26	-	nC

### Notes:

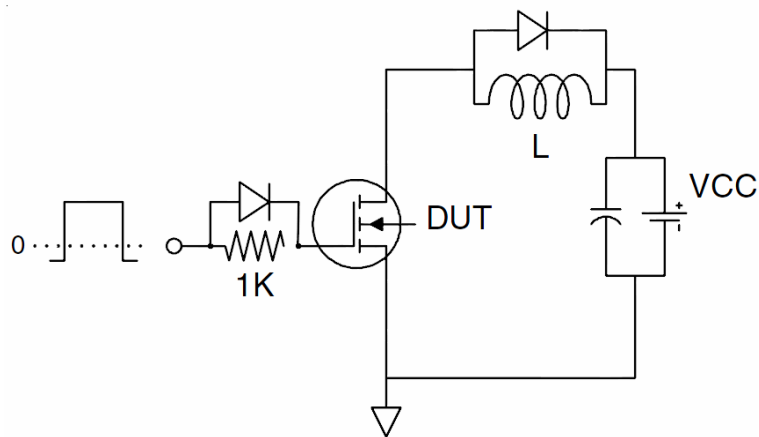
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5.  $E_{AS}$  condition :  $T_J=25^{\circ}C, V_{DD}=20V, V_G=10V, L=0.5mH, R_g=25\Omega$ ,

**Test circuit**

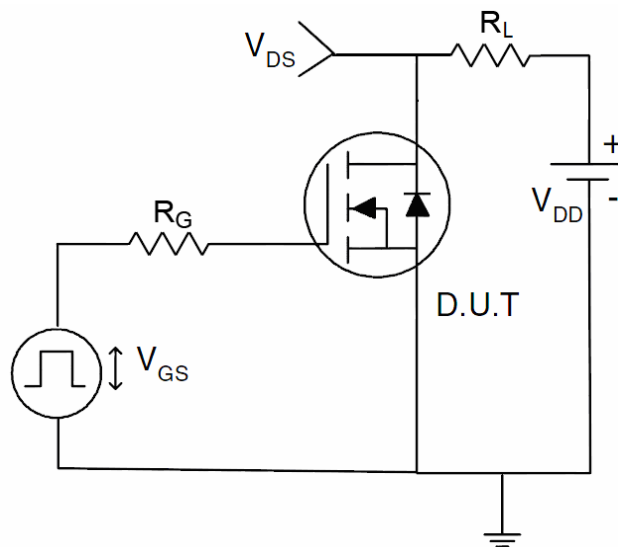
**1) E<sub>AS</sub> Test Circuit**



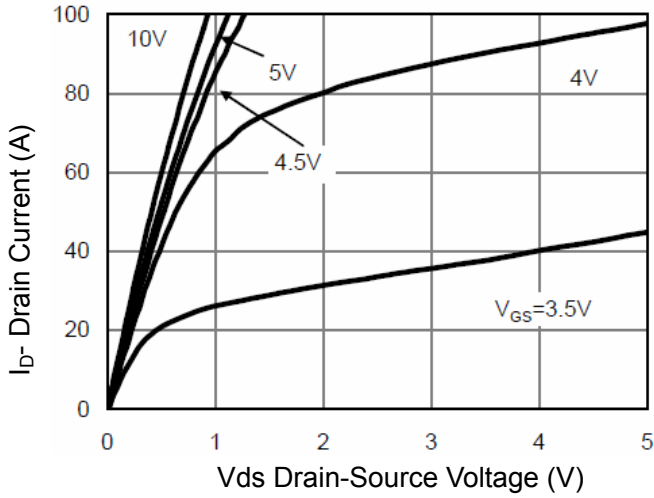
**2) Gate Charge Test Circuit**



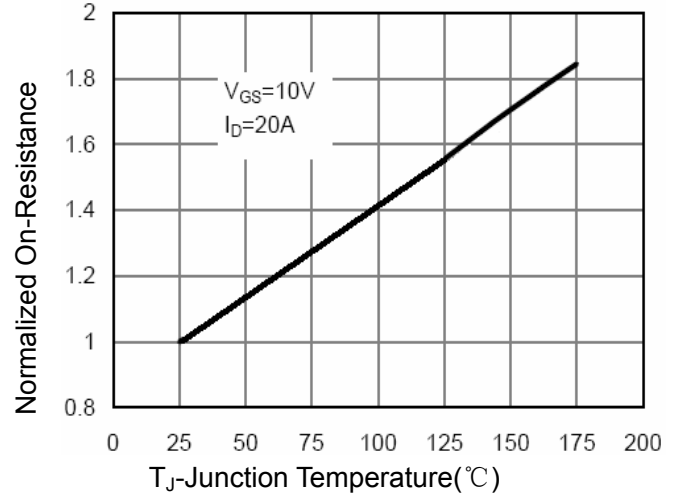
**3) Switch Time Test Circuit**



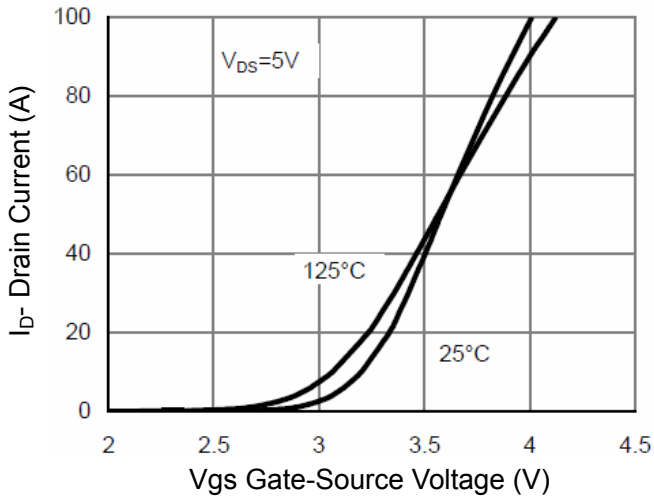
**Typical Electrical and Thermal Characteristics (Curves)**



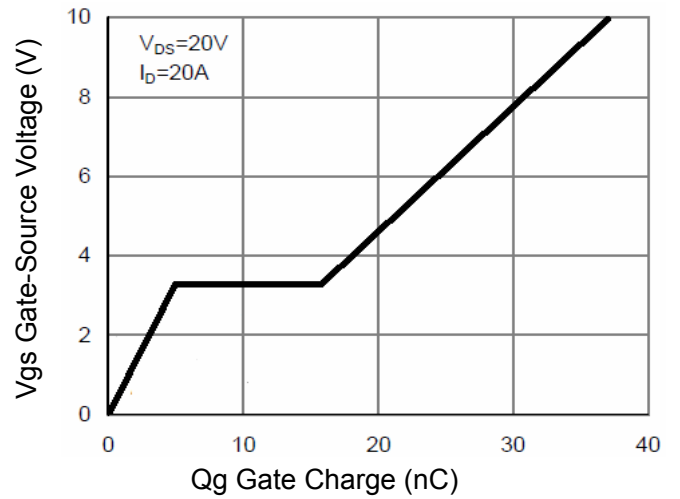
**Figure 1 Output Characteristics**



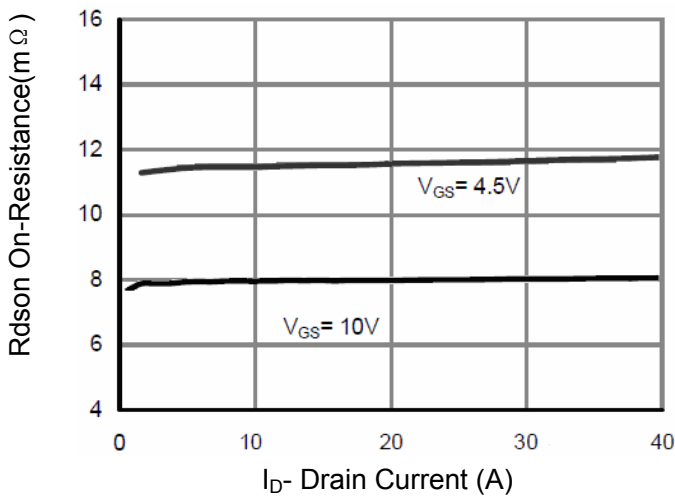
**Figure 4 Rds(on)-Junction Temperature**



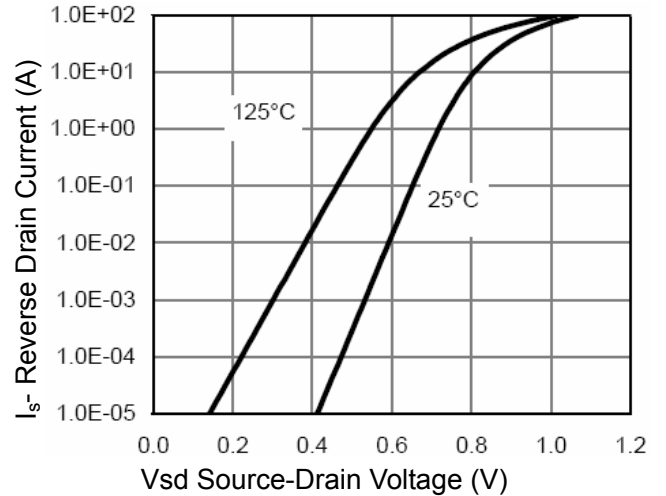
**Figure 2 Transfer Characteristics**



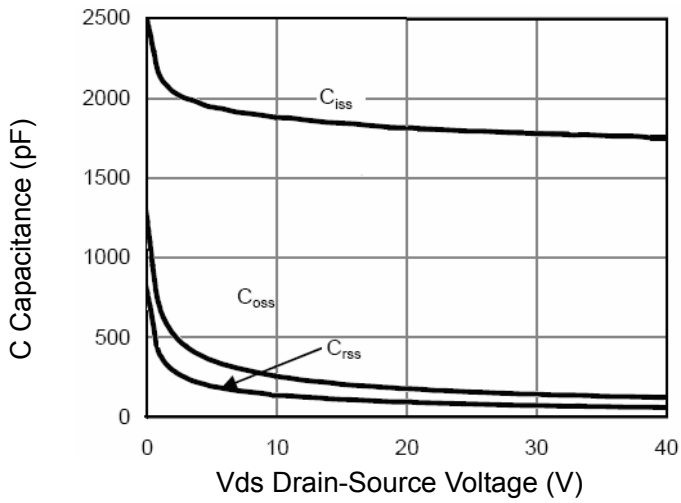
**Figure 5 Gate Charge**



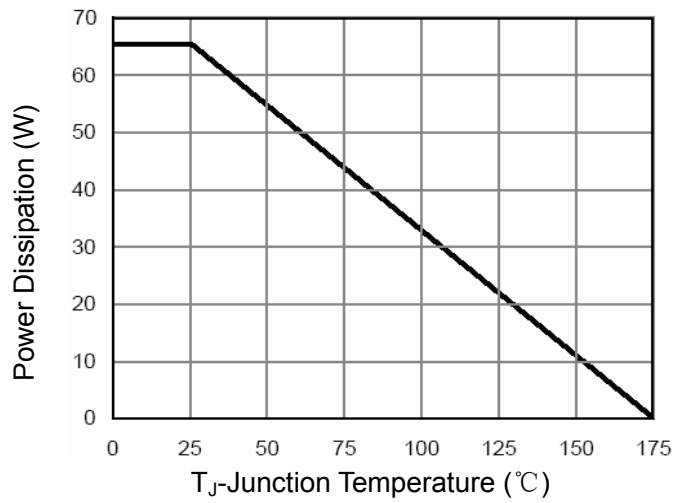
**Figure 3 Rds(on)- Drain Current**



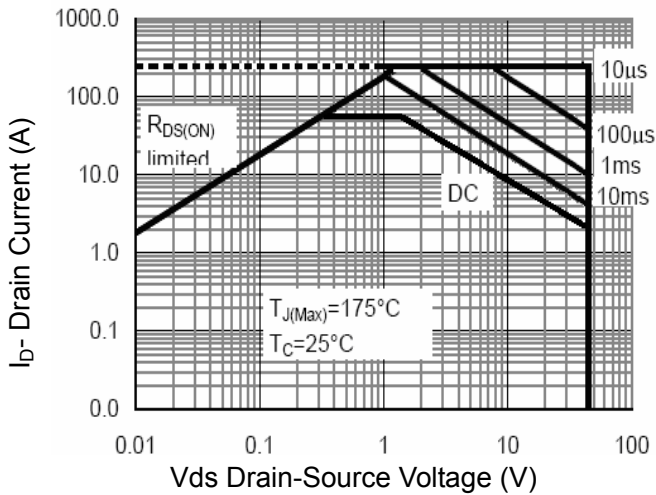
**Figure 6 Source- Drain Diode Forward**



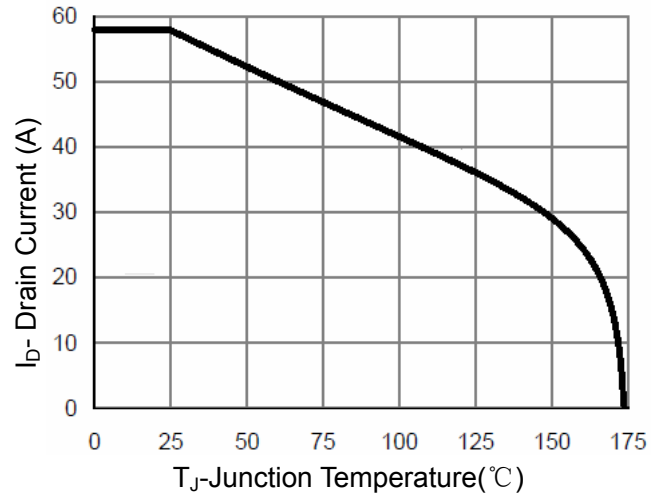
**Figure 7 Capacitance vs Vds**



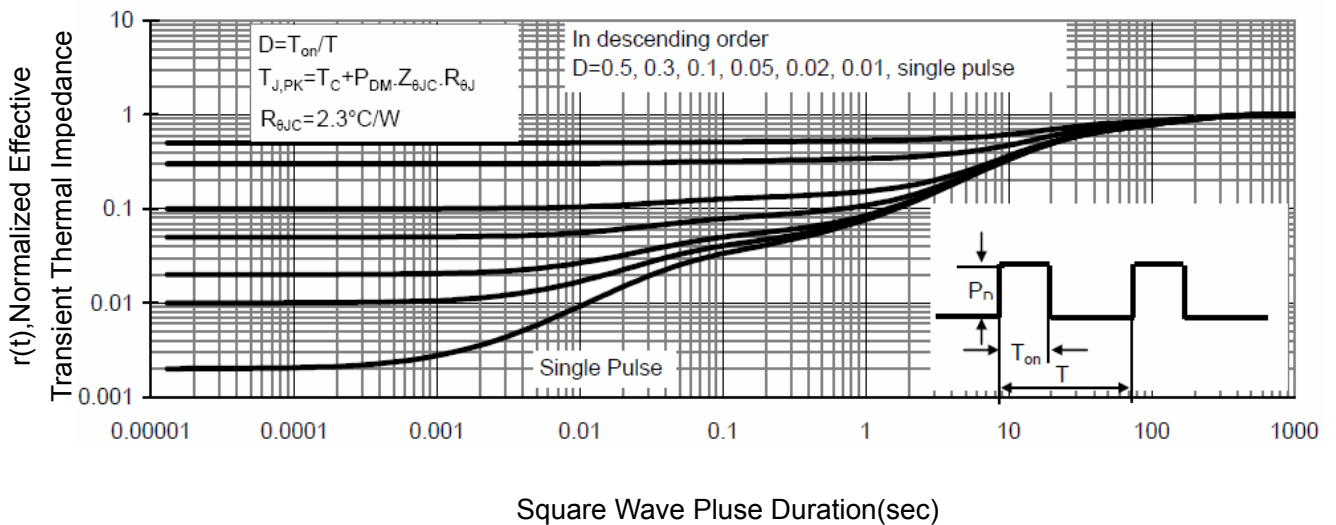
**Figure 9 Power De-rating**



**Figure 8 Safe Operation Area**

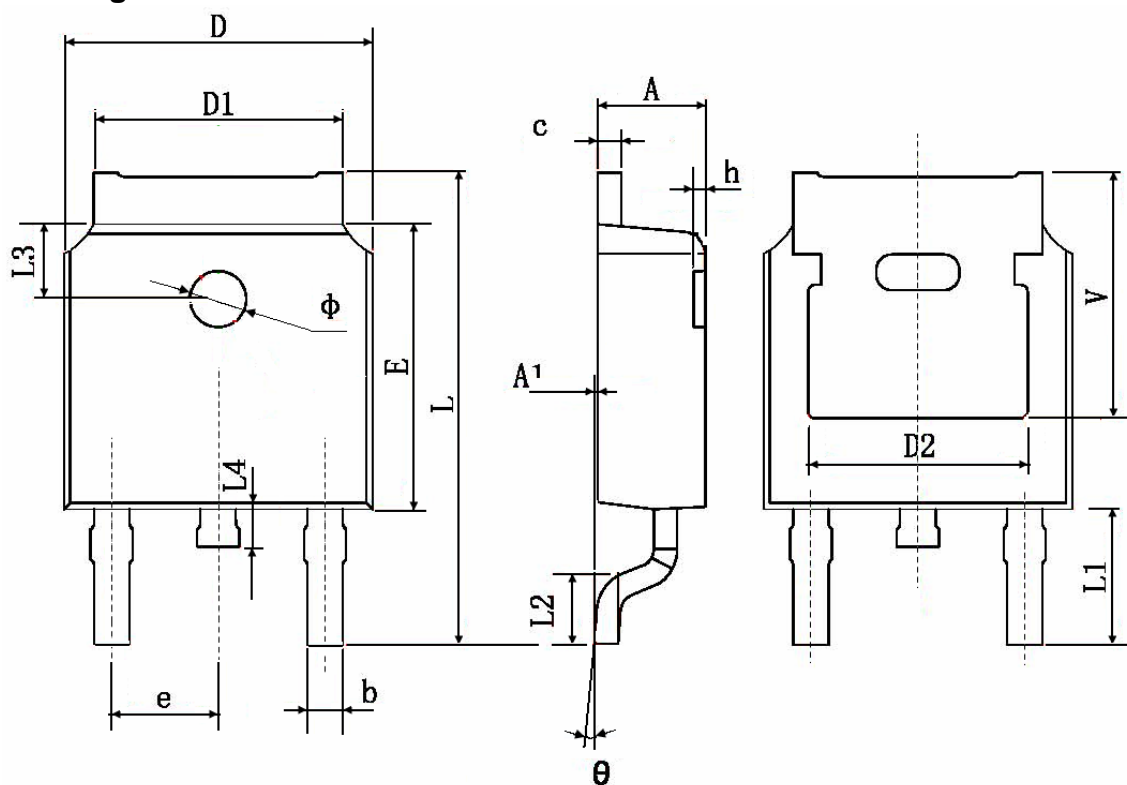


**Figure 10 Current De-rating**



**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	4.830 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
phi	1.100	1.300	0.043	0.051
theta	0°	8°	0°	8°
h	0.000	0.300	0.000	0.012
V	5.350 TYP.		0.211 TYP.	

## Attention

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