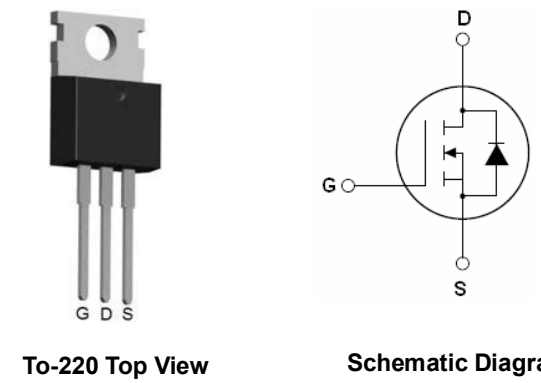


## N-Channel Trench Power MOSFET

<p><b>General Description</b></p> <p>The CS55N50 is N-channel MOS Field Effect Transistor designed for high current switching applications. Rugged EAS capability and ultra low <math>R_{DS(ON)}</math> is suitable for PWM, load switching .</p> <p><b>Features</b></p> <ul style="list-style-type: none"> <li>● <math>V_{DS}=55V</math>; <math>I_D=105A@ V_{GS}=10V</math>;  <math>R_{DS(ON)}&lt;6.0m\Omega @ V_{GS}=10V</math></li> <li>● Ultra Low On-Resistance</li> <li>● High UIS and UIS 100% Test</li> </ul> <p><b>Application</b></p> <ul style="list-style-type: none"> <li>● Hard Switched and High Frequency Circuits</li> <li>● Uninterruptible Power Supply</li> </ul>	 <p><b>To-220 Top View</b>                      <b>Schematic Diagram</b></p> <p><math>V_{DS} = 55 V</math></p> <p><math>I_D = 105 A</math></p> <p><math>R_{DS(ON)} = 5.0 m\Omega</math></p>
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### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
CS55N50	CS55N50	TO-220	-	-	-

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

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-Source Voltage ( $V_{GS}=0V$ )	55	V
$V_{GS}$	Gate-Source Voltage ( $V_{DS}=0V$ )	$\pm 25$	V
$I_{D(DC)}$	Drain Current (DC) at $T_c=25^\circ C$	105	A
$I_{D(DC)}$	Drain Current (DC) at $T_c=100^\circ C$	74	A
$I_{DM (pluse)}$	Drain Current-Continuous@ Current-Pulsed <b>(Note 1)</b>	420	A
dv/dt	Peak Diode Recovery Voltage	6.9	V/ns
$P_D$	Maximum Power Dissipation( $T_c=25^\circ C$ )	147	W
	Derating Factor	0.98	W/°C
$E_{AS}$	Single Pulse Avalanche Energy <b>(Note 2)</b>	625	mJ
$T_J, T_{STG}$	Operating Junction and Storage Temperature Range	-55 To 175	°C

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

2.EAS condition: $T_J=25^\circ C, V_{DD}=40V, V_G=10V, R_G=25 \Omega$

**Table 2. Thermal Characteristic**

Symbol	Parameter	Value	Max	Unit
R <sub>θJC</sub>	Thermal Resistance, Junction-to-Case	---	1.02	°C/W

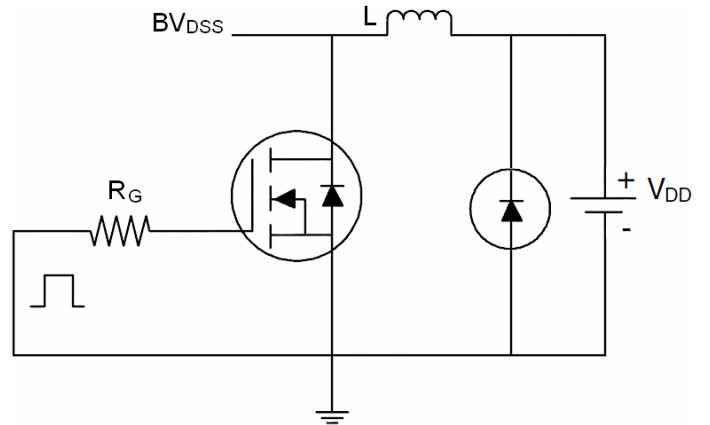
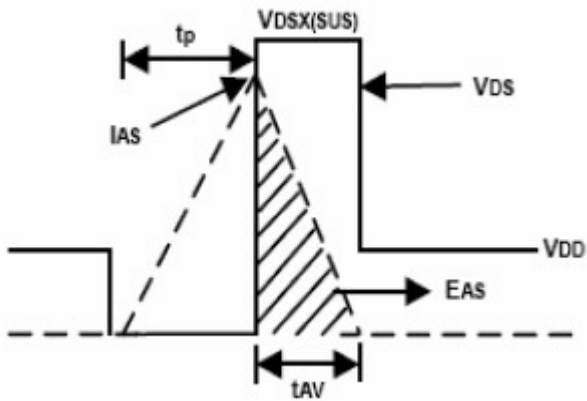
**Table 3. Electrical Characteristics (TA=25°C unless otherwise noted)**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>On/Off States</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA	55			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current(Tc=25°C)	V <sub>DS</sub> =55V, V <sub>GS</sub> =0V			1	μA
I <sub>DSS</sub>	Zero Gate Voltage Drain Current(Tc=125°C)	V <sub>DS</sub> =55V, V <sub>GS</sub> =0V			1	μA
I <sub>GSS</sub>	Gate-Body Leakage Current	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V			±100	nA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	2		4	V
R <sub>DS(ON)</sub>	Drain-Source On-State Resistance	V <sub>GS</sub> =10V, I <sub>D</sub> =40A		5.0	6.0	mΩ
<b>Dynamic Characteristics</b>						
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> =25V, I <sub>D</sub> =40A	18			S
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =25V, V <sub>GS</sub> =0V, f=1.0MHz		4061		PF
C <sub>oss</sub>	Output Capacitance			485		PF
C <sub>rss</sub>	Reverse Transfer Capacitance			227		PF
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =30V, I <sub>D</sub> =30A, V <sub>GS</sub> =10V		91		nC
Q <sub>gs</sub>	Gate-Source Charge			17		nC
Q <sub>gd</sub>	Gate-Drain Charge			40		nC
<b>Switching Times</b>						
t <sub>d(on)</sub>	Turn-on Delay Time	V <sub>DD</sub> =30V, I <sub>D</sub> =2A, R <sub>L</sub> =15Ω V <sub>GS</sub> =10V, R <sub>G</sub> =2.5Ω		27		nS
t <sub>r</sub>	Turn-on Rise Time			33		nS
t <sub>d(off)</sub>	Turn-Off Delay Time			67		nS
t <sub>f</sub>	Turn-Off Fall Time			34		nS
<b>Source-Drain Diode Characteristics</b>						
I <sub>SD</sub>	Source-drain Current(Body Diode)			105		A
I <sub>SDM</sub>	Pulsed Source-Drain Current(Body Diode)			420		A
V <sub>SD</sub>	Forward On Voltage <sup>(Note 1)</sup>	T <sub>J</sub> =25°C, I <sub>SD</sub> =40A, V <sub>GS</sub> =0V		0.87	0.99	V
t <sub>rr</sub>	Reverse Recovery Time <sup>(Note 1)</sup>	T <sub>J</sub> =25°C, I <sub>F</sub> =75A di/dt=100A/μs		32		nS
Q <sub>rr</sub>	Reverse Recovery Charge <sup>(Note 1)</sup>			49		nC
t <sub>on</sub>	Forward Turn-on Time	Intrinsic turn-on time is negligible(turn-on is dominated by L <sub>S</sub> +L <sub>D</sub> )				

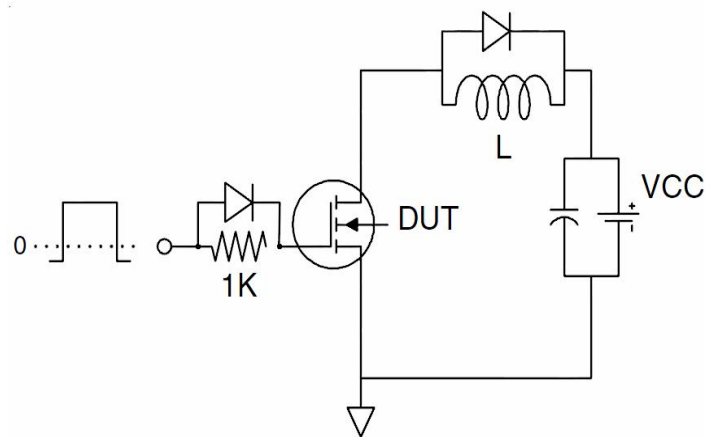
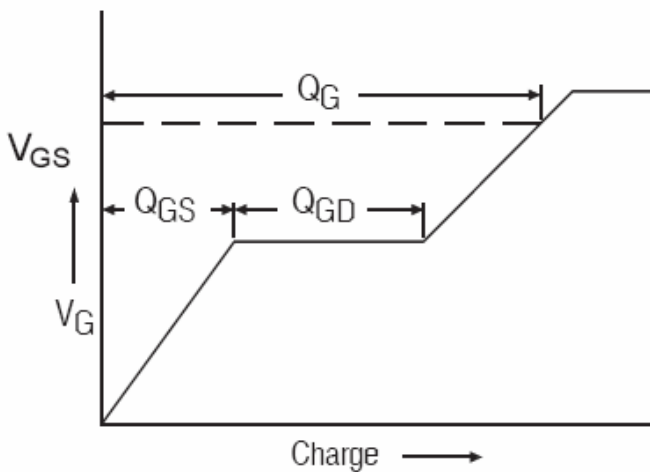
Notes 1. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 1.5%, R<sub>G</sub>=25Ω, Starting T<sub>J</sub>=25°C

## Test Circuit

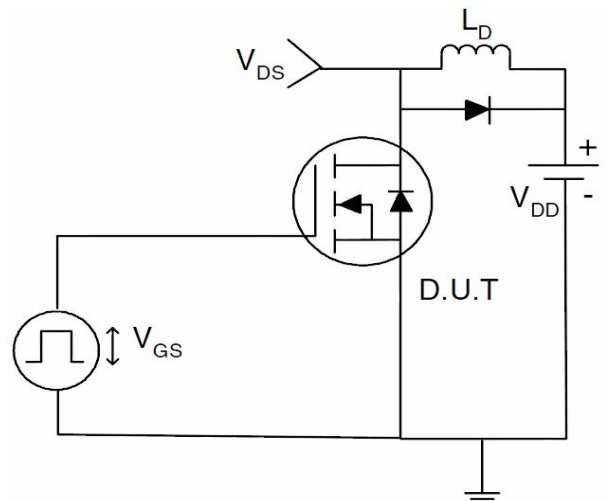
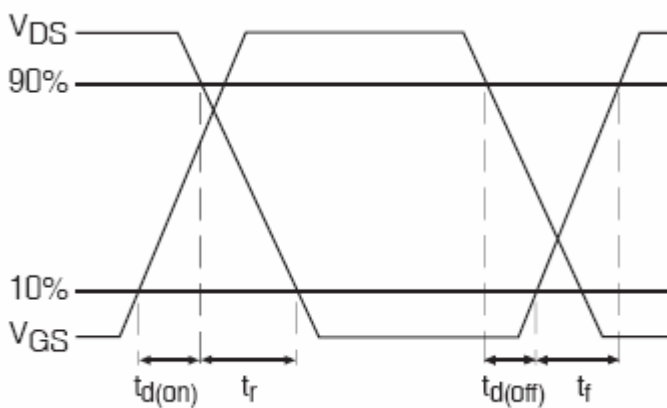
### 1) $E_{AS}$ Test Circuits



### 2) Gate Charge Test Circuit:

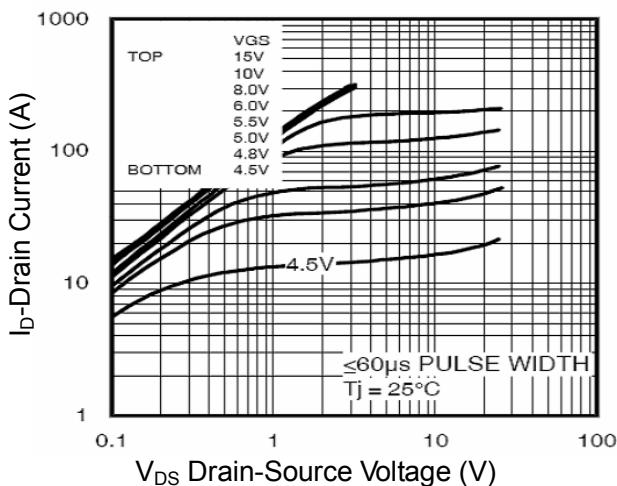


### 3) Switch Time Test Circuit:

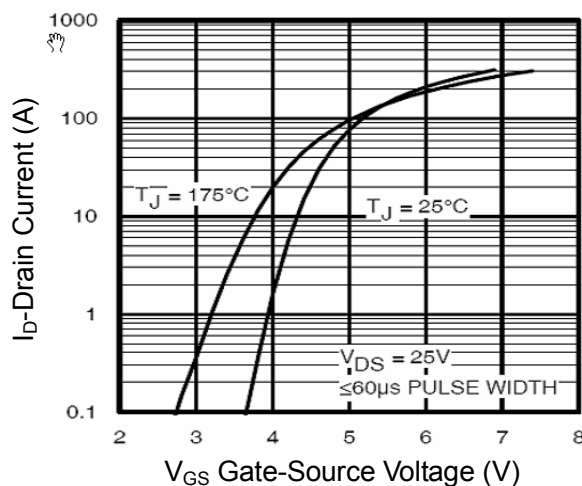


## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (Curves)

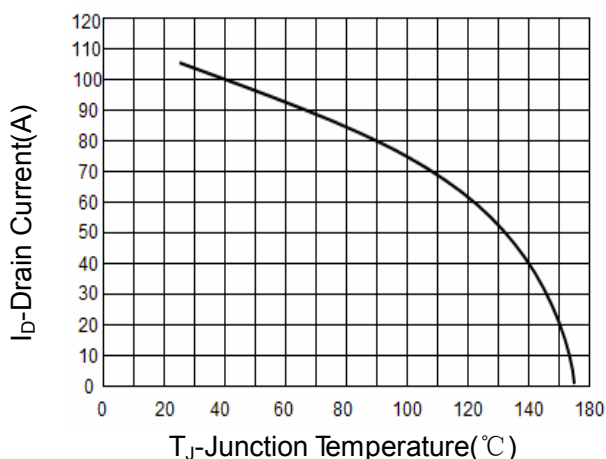
**Figure1. Output Characteristics**



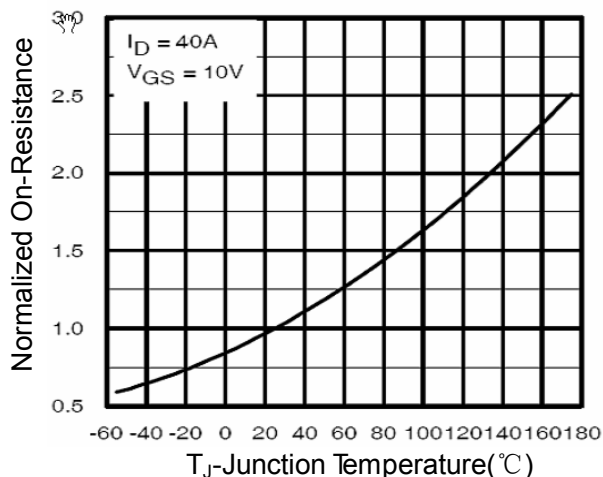
**Figure2. Transfer Characteristics**



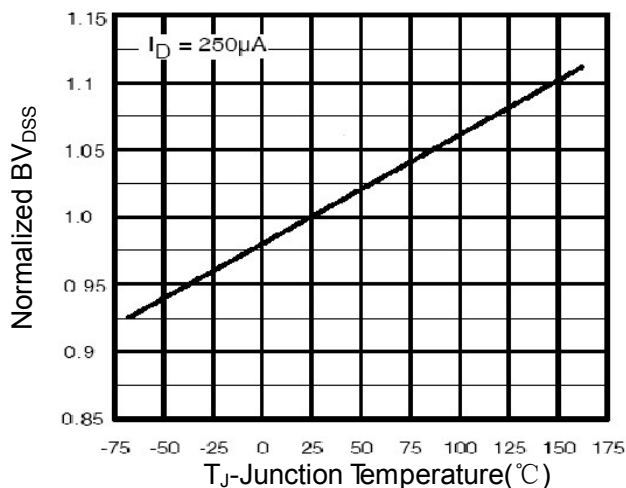
**Figure3. ID vs Junction Temperature**



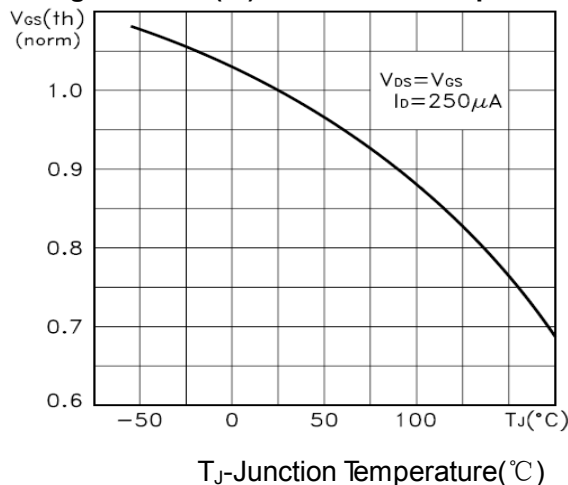
**Figure4. Rdson Vs Junction Temperature**



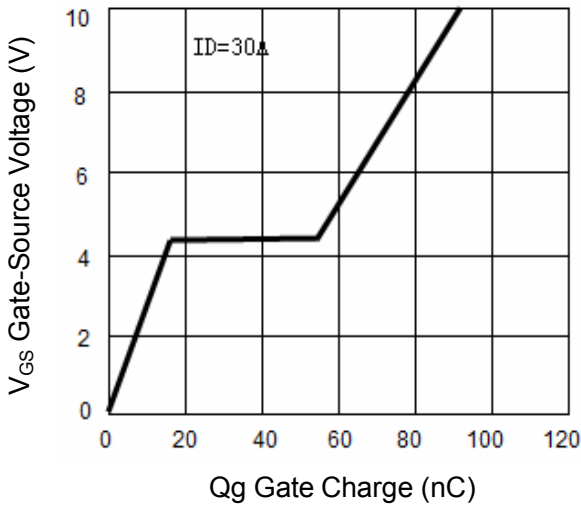
**Figure5. BVDSS vs Junction Temperature**



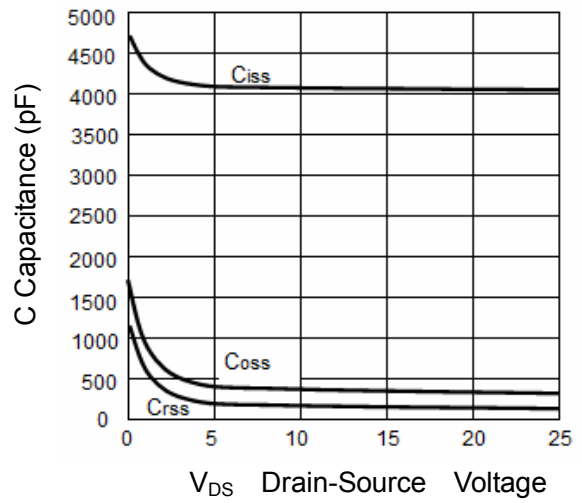
**Figure6. VGS(th) vs Junction Temperature**



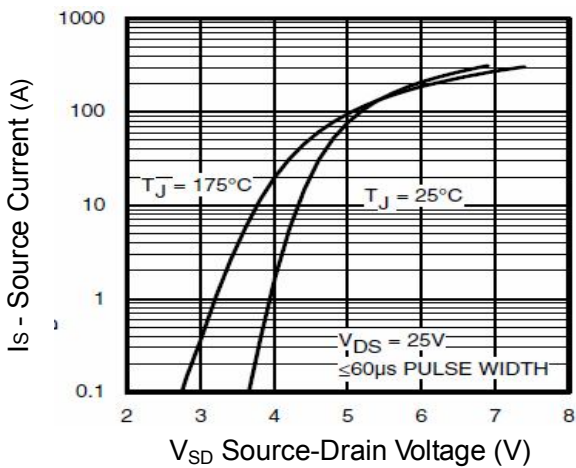
**Figure7. Gate Charge**



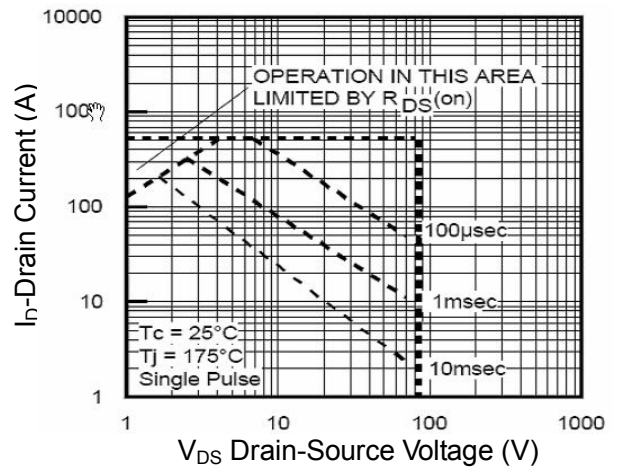
**Figure8. Capacitance vs Vds**



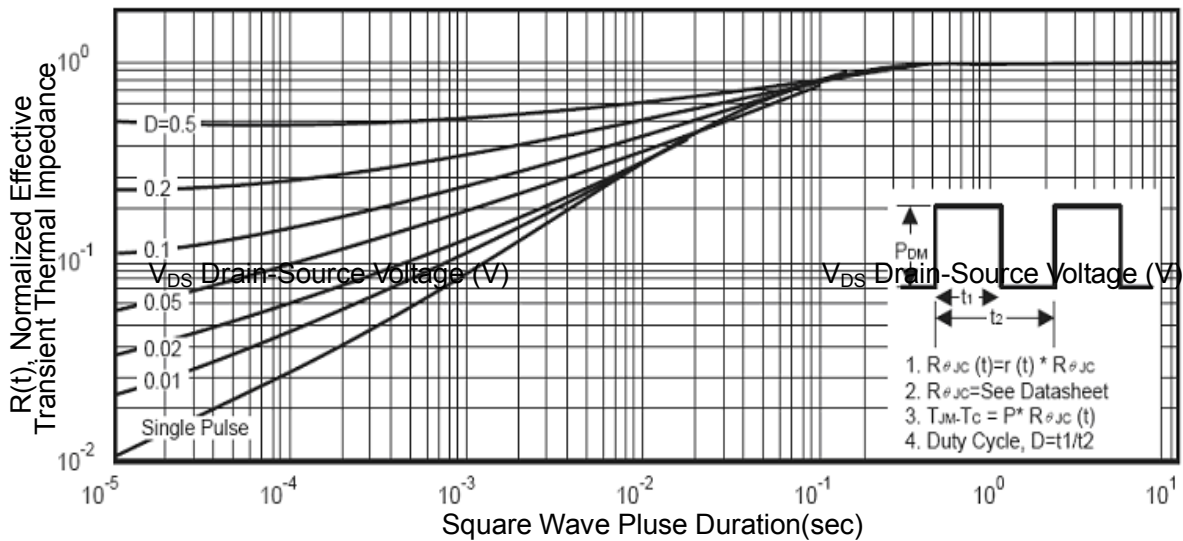
**Figure9. Source- Drain Diode Forward**



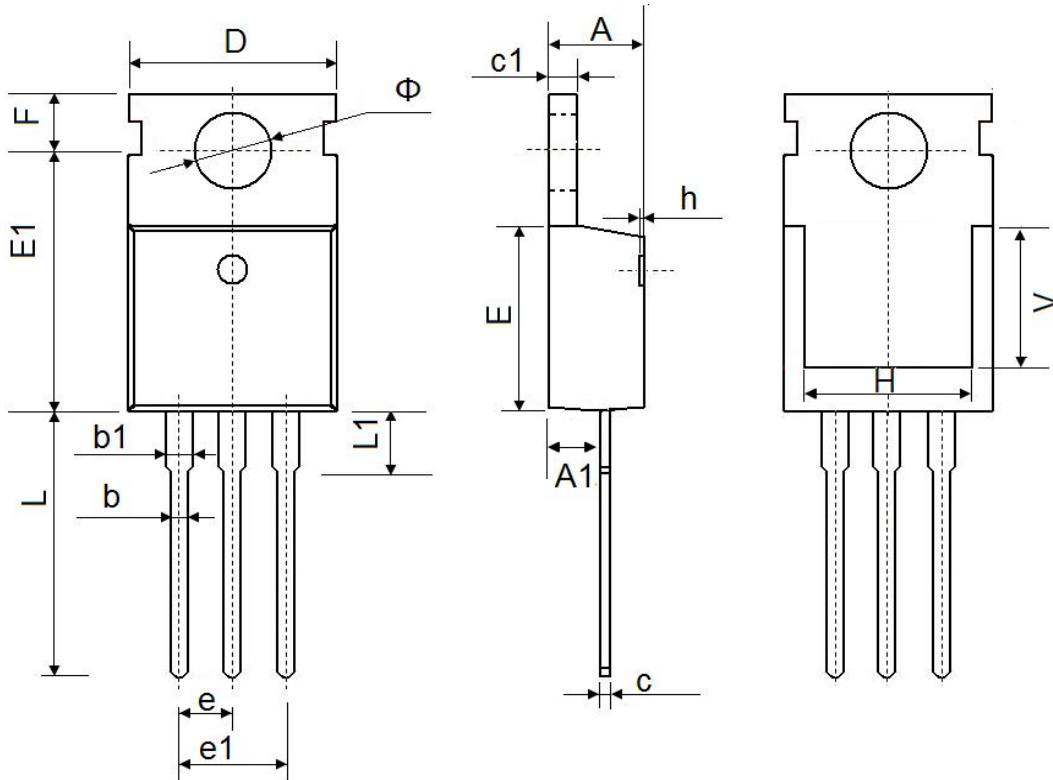
**Figure10. Safe Operation Area**



**Figure11. Normalized Maximum Transient Thermal Impedance**



## TO-220 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.300	4.700	0.169	0.185
A1	2.200	2.600	0.087	0.102
b	0.700	0.950	0.028	0.037
b1	1.170	1.410	0.046	0.056
c	0.450	0.650	0.018	0.026
c1	1.200	1.400	0.047	0.055
D	9.600	10.400	0.378	0.409
E	8.8500	9.750	0.348	0.384
E1	12.650	12.950	0.498	0.510
e	2.540 TYP.		0.100TYP.	
e1	4.980	5.180	0.196	0.204
F	2.650	2.950	0.104	0.116
H	7.900	8.100	0.311	0.319
h	0.000	0.300	0.000	0.012
L	12.750	14.300	0.502	0.563
L1	2.850	3.950	0.112	0.156
V	7.500 REF.		0.295 REF.	
Φ	3.400	4.000	0.134	0.157