

## NCE N-Channel Enhancement Mode Power MOSFET

### Description

The NCE85H21T uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. It can be used in automotive applications and a wide variety of other applications.

### General Features

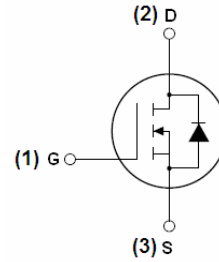
- $V_{DSS} = 85V, I_D = 210A$   
 $R_{DS(ON)} < 3.5m\Omega @ V_{GS} = 10V$
- Good stability and uniformity with high  $E_{AS}$
- Special process technology for high ESD capability
- High density cell design for ultra low  $R_{ds(on)}$
- Fully characterized avalanche voltage and current
- Excellent package for good heat dissipation

### Application

- Automotive applications
- Hard switched and high frequency circuits
- Uninterruptible power supply

**100% UIS TESTED!**

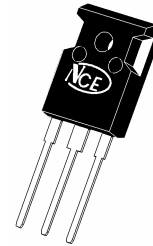
**100%  $\Delta V_d$ s TESTED!**



Schematic diagram



Marking and pin assignment



TO-247 top view

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
NCE85H21T	NCE85H21T	TO-247	-	-	-

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DSS}$	85	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	210	A
Drain Current-Continuous( $T_C = 100^\circ C$ )	$I_D(100^\circ C)$	150	A
Pulsed Drain Current	$I_{DM}$	850	A
Maximum Power Dissipation	$P_D$	330	W
Derating factor		2.2	W/ $^\circ C$
Single pulse avalanche energy <sup>(Note 3)</sup>	$E_{AS}$	2200	mJ
Peak Diode Recovery $dv/dt$ <sup>(Note 4)</sup>	$dv/dt$	5	V/ns
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 175	$^\circ C$

## Thermal Characteristic

Thermal Resistance, Junction-to-Case <sup>(Note 1)</sup>	$R_{\theta JC}$	0.45	°C/W
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## Electrical Characteristics ( $T_C=25^\circ\text{C}$ unless otherwise noted)

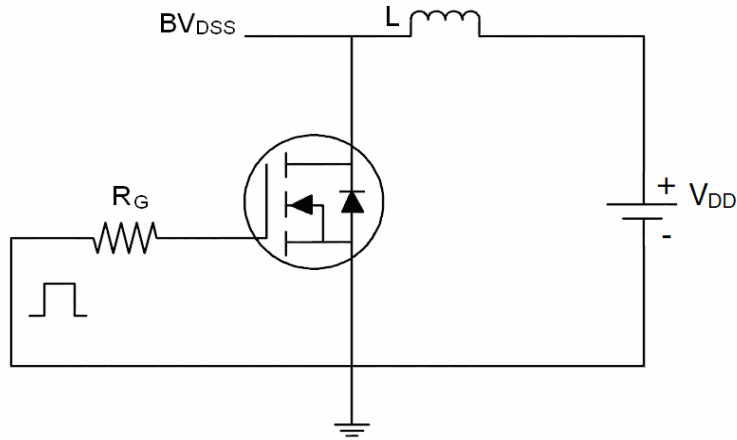
Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS}=0V, I_D=250\mu A$	85	-	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=85V, V_{GS}=0V$	-	-	1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 200$	nA
<b>On Characteristics</b>						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2	3	4	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=40A$	-	2.9	3.5	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=25V, I_D=40A$	100	165	-	S
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{iss}$	$V_{DS}=25V, V_{GS}=0V,$ $F=1.0\text{MHz}$	-	11000	-	PF
Output Capacitance	$C_{oss}$		-	914	-	PF
Reverse Transfer Capacitance	$C_{rss}$		-	695	-	PF
<b>Switching Characteristics</b>						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=30V, I_D=2A, R_L=15\Omega$ $V_{GS}=10V, R_G=2.5\Omega$	-	23	-	nS
Turn-on Rise Time	$t_r$		-	190	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	130	-	nS
Turn-Off Fall Time	$t_f$		-	120	-	nS
Total Gate Charge	$Q_g$	$I_D=30A, V_{DD}=30V, V_{GS}=10V$	-	250	-	nC
Gate-Source Charge	$Q_{gs}$		-	48	-	nC
Gate-Drain Charge	$Q_{gd}$		-	98	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage	$V_{SD}$	$V_{GS}=0V, I_S=40A$	-	-	1.2	V
Reverse Recovery Time	$t_{rr}$	$T_J=25^\circ\text{C}, I_F=40A$ $di/dt=100A/\mu s$ <sup>(Note2)</sup>	-	63	-	nS
Reverse Recovery Charge	$Q_{rr}$		-	98	-	nC
Forward Turn-On Time	$t_{on}$	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

### Notes:

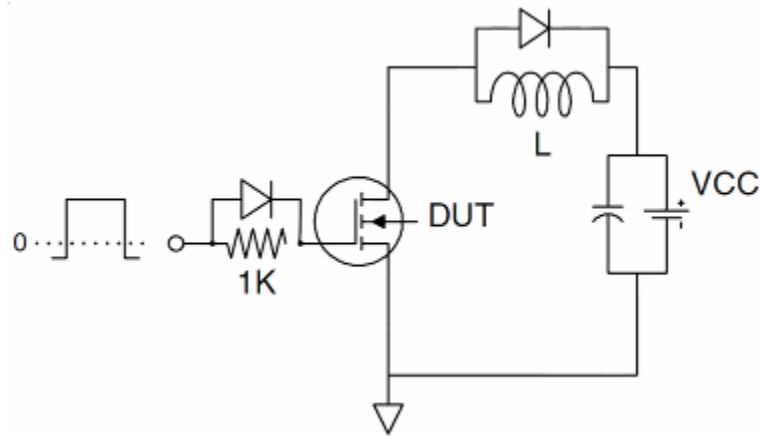
1. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
2. Pulse Test: Pulse Width  $\leq 400\mu s$ , Duty Cycle  $\leq 2\%$ .
3. EAS condition:  $T_J=25^\circ\text{C}, V_{DD}=42.5V, V_G=10V, L=2mH, R_G=25\Omega, I_{AS}=37A$
4.  $I_{SD} \leq 125A, di/dt \leq 260A/\mu s, V_{DD} \leq V_{(BR)DSS}, T_J \leq 175^\circ\text{C}$

## Test Circuit

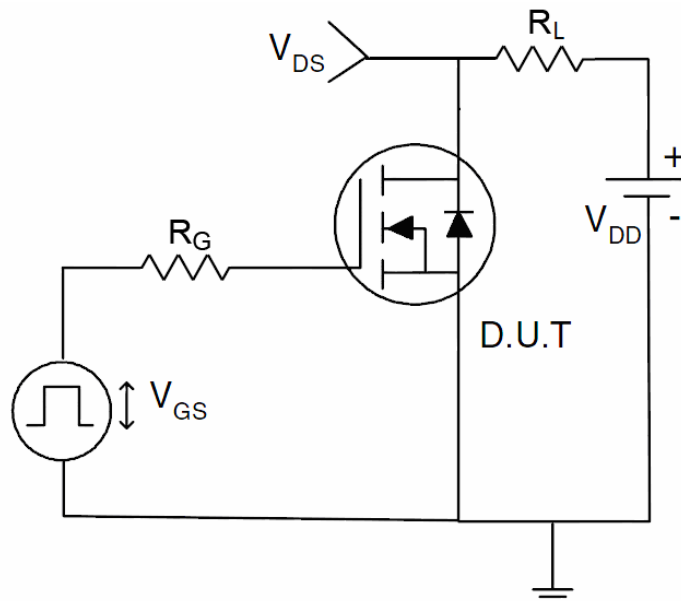
### 1) $E_{AS}$ test Circuit



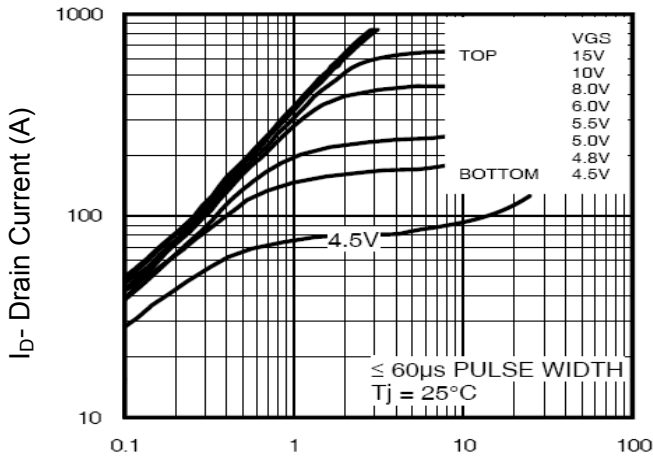
### 2) Gate charge test Circuit



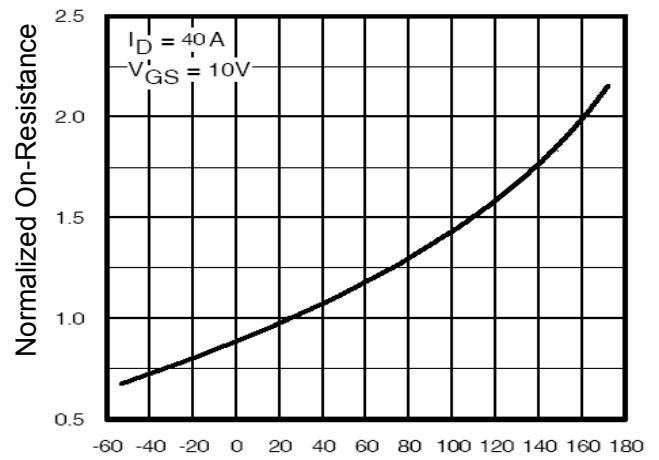
### 3) Switch Time Test Circuit



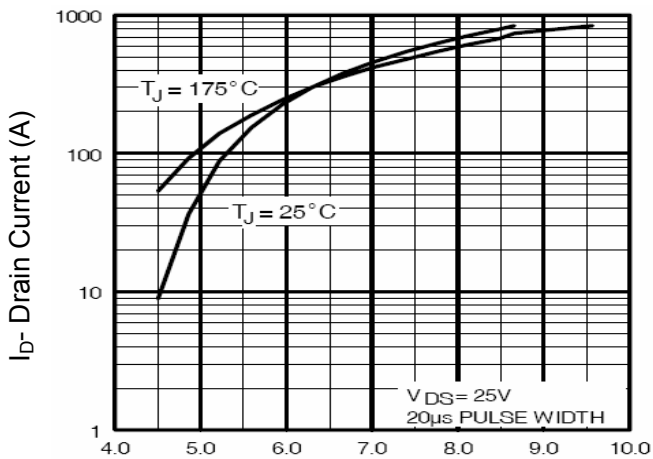
## Typical Electrical and Thermal Characteristics



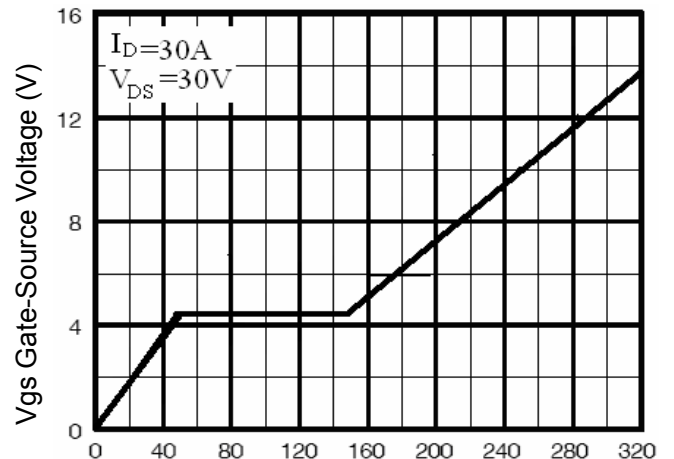
Vds Drain-Source Voltage (V)  
**Figure 1 Output Characteristics**



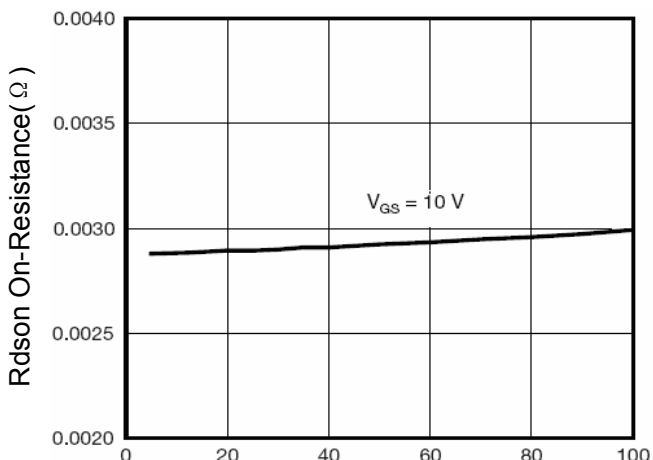
T<sub>J</sub>-Junction Temperature(°C)  
**Figure 4 Rdson-Junction Temperature**



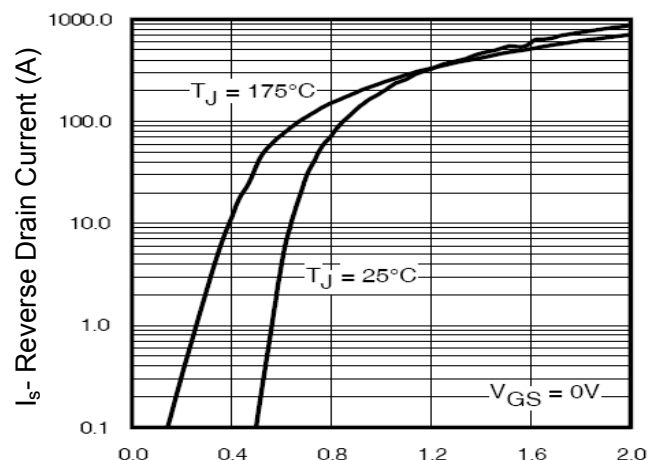
Vgs Gate-Source Voltage (V)  
**Figure 2 Transfer Characteristics**



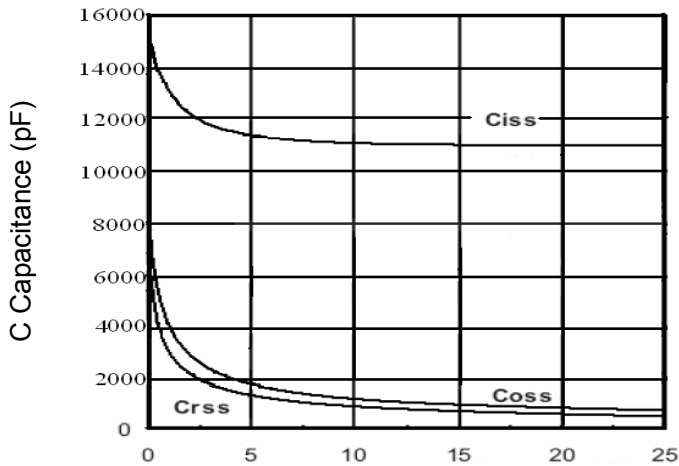
Qg Gate Charge (nC)  
**Figure 5 Gate Charge**



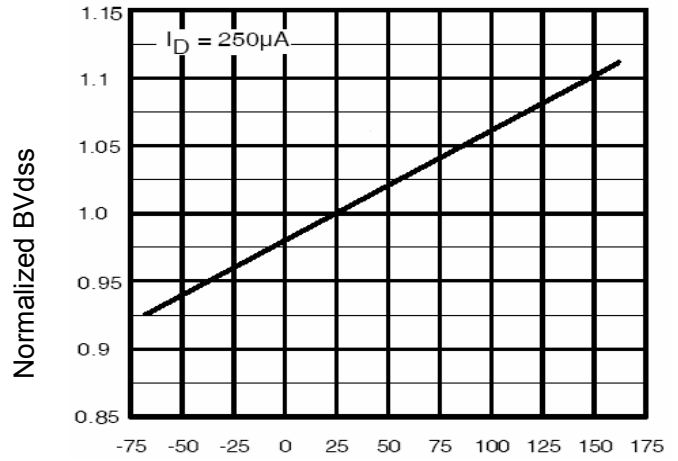
$I_D$ - Drain Current (A)  
**Figure 3 Rdson- Drain Current**



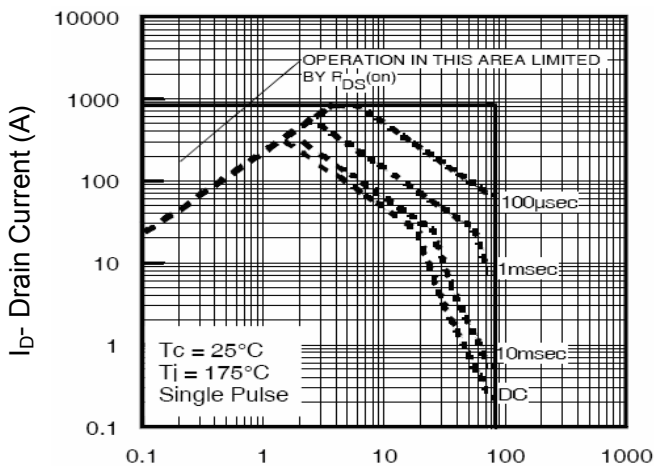
Vsd Source-Drain Voltage (V)  
**Figure 6 Source- Drain Diode Forward**



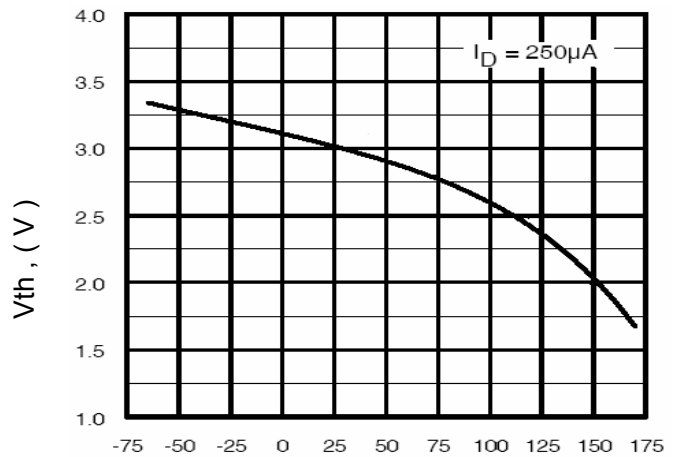
Vds Drain-Source Voltage (V)  
**Figure 7 Capacitance vs Vds**



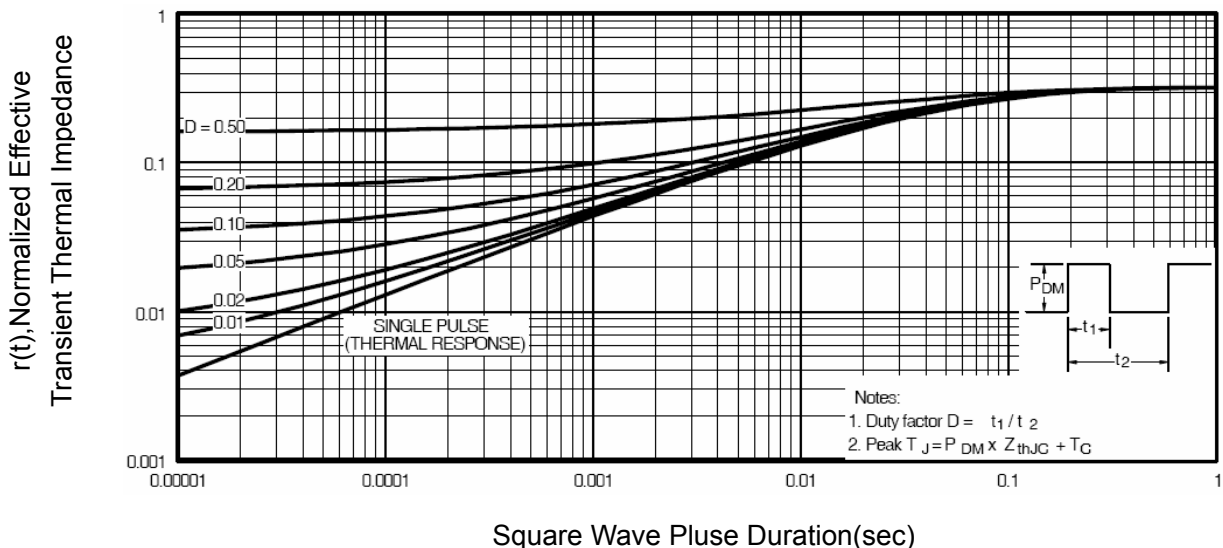
T<sub>J</sub>-Junction Temperature(°C)  
**Figure 9 BV<sub>DSS</sub> vs Junction Temperature**



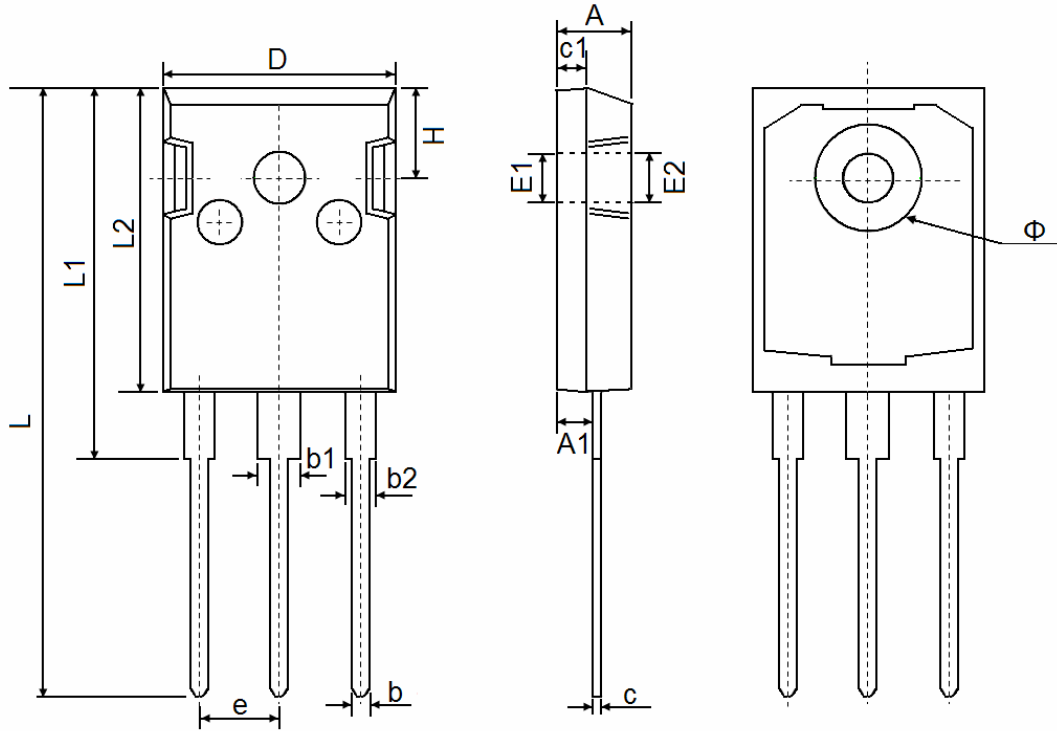
Vds Drain-Source Voltage (V)  
**Figure 8 Safe Operation Area**



T<sub>J</sub>-Junction Temperature(°C)  
**Figure 10 V<sub>GS(th)</sub> vs Junction Temperature**



**Figure 11 Normalized Maximum Transient Thermal Impedance**

**TO-247 Package Information**


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.850	5.150	0.191	0.200
A1	2.200	2.600	0.087	0.102
b	1.000	1.400	0.039	0.055
b1	2.800	3.200	0.110	0.126
b2	1.800	2.200	0.071	0.087
c	0.500	0.700	0.020	0.028
c1	1.900	2.100	0.075	0.083
D	15.450	15.750	0.608	0.620
E1	3.500 REF		0.138 REF	
E2	3.600 REF		0.142 REF	
L	40.900	41.300	1.610	1.626
L1	24.800	25.100	0.976	0.988
L2	20.300	20.600	0.799	0.811
Φ	7.100	7.300	0.280	0.287
e	5.450 TYP		0.215 TYP	
H	5.980 REF		0.235 REF	

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