

## NCE N-Channel Enhancement Mode Power MOSFET

### Description

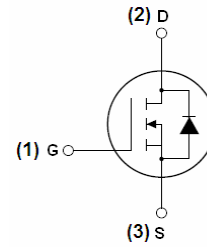
The NCE85H21TC uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. It can be used in automotive applications and a wide variety of other applications.

### General Features

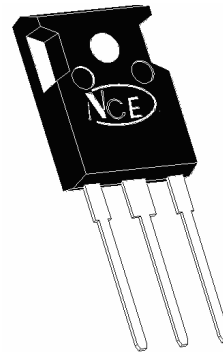
- $V_{DSS} = 85V, I_D = 210A$   
 $R_{DS(ON)} < 3.9m\Omega @ V_{GS} = 10V$
- Good stability and uniformity with high  $E_{AS}$
- Special process technology for high ESD capability
- High density cell design for ultra low  $R_{ds(on)}$
- Fully characterized avalanche voltage and current
- Excellent package for good heat dissipation

### Application

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



Schematic diagram



TO-247 top view

**100% UIS TESTED!**

**100%  $\Delta V_{ds}$  TESTED!**

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
NCE85H21TC	NCE85H21TC	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	$P_D$	300	W
Derating factor		2.0	W/ $^\circ C$
Single pulse avalanche energy <sup>(Note 3)</sup>	$E_{AS}$	1800	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 1)</sup>	$R_{\theta JC}$	0.5	$^\circ C/W$
--	-----------------	-----	--------------

**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	85	-	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =85V, V <sub>GS</sub> =0V	-	-	1	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	-	-	±200	nA
<b>On Characteristics</b>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	2	3.2	4	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =40A	-	3.4	3.9	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =10V, I <sub>D</sub> =20A	35	-	-	S
<b>Dynamic Characteristics</b>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =25V, V <sub>GS</sub> =0V, F=1.0MHz	-	7600	-	PF
Output Capacitance	C <sub>oss</sub>		-	720	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	346	-	PF
<b>Switching Characteristics</b>						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =40V, I <sub>D</sub> =2A, R <sub>L</sub> =15Ω V <sub>GS</sub> =10V, R <sub>G</sub> =2.5Ω	-	23	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	124	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	84	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	78	-	nS
Total Gate Charge	Q <sub>g</sub>	I <sub>D</sub> =40A, V <sub>DD</sub> =40V, V <sub>GS</sub> =10V	-	140	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	40	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	57	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =40A	-	-	1.2	V
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> = 25°C, I <sub>F</sub> = 40A di/dt = 100A/μs <sup>(Note2)</sup>	-	110	-	nS
Reverse Recovery Charge	Q <sub>rr</sub>		-	300	-	nC

**Notes:**

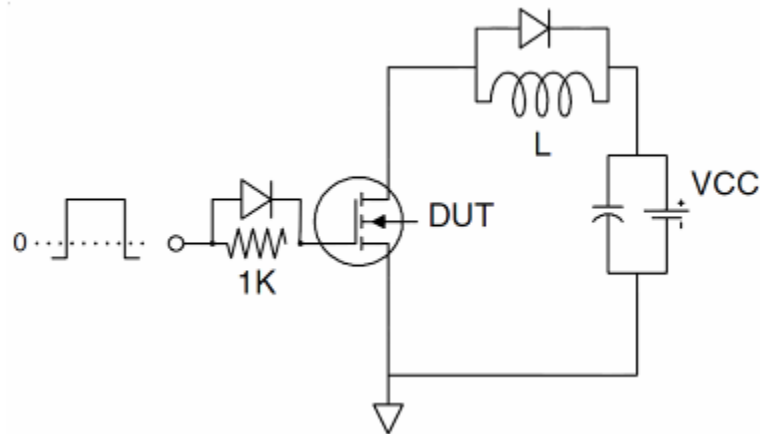
- Surface Mounted on FR4 Board, t ≤ 10 sec.
- Pulse Test: Pulse Width ≤ 400μs, Duty Cycle ≤ 2%.
- EAS condition: T<sub>J</sub>=25°C, V<sub>DD</sub>=42.5V, V<sub>G</sub>=10V, L=2mH, R<sub>G</sub>=25Ω, I<sub>AS</sub>=37A
- I<sub>SD</sub> ≤ 125A, di/dt ≤ 260A/μs, V<sub>DD</sub> ≤ V<sub>(BR)DSS</sub>, T<sub>J</sub> ≤ 175°C

## Test Circuit

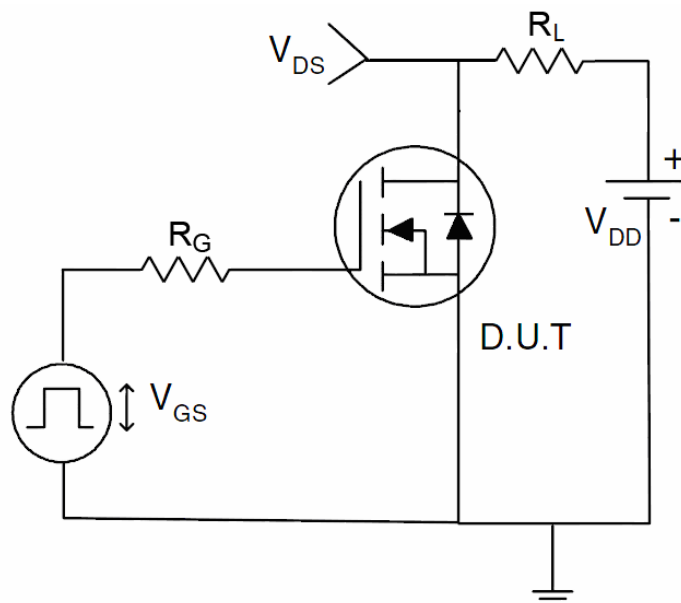
### 1) $E_{AS}$ test Circuit



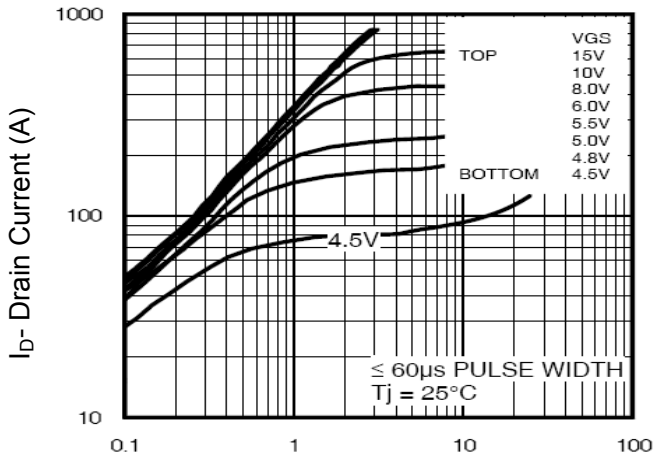
### 2) Gate charge test Circuit



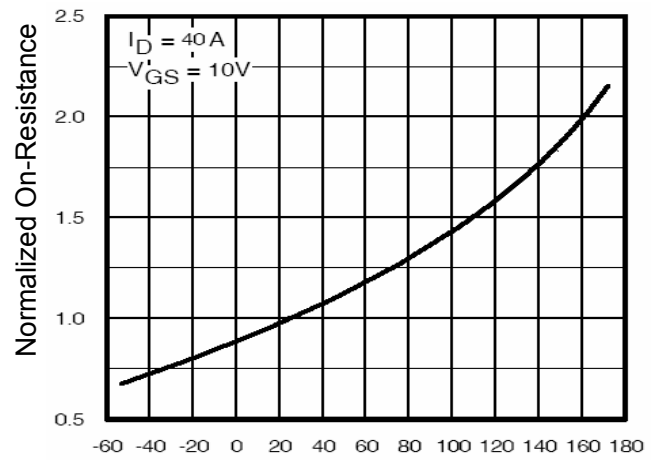
### 3) Switch Time Test Circuit



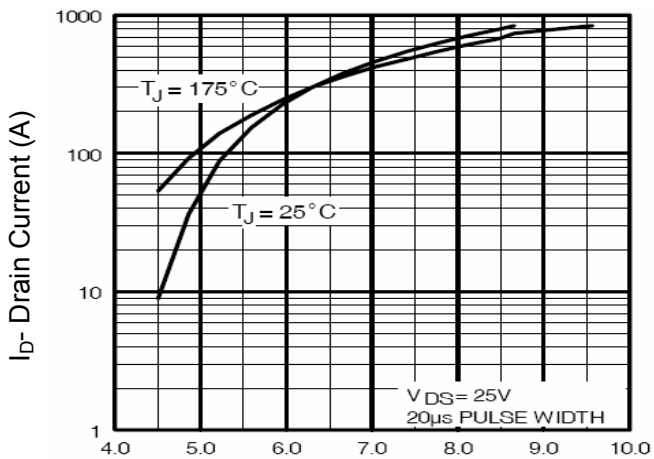
Typical Electrical and Thermal Characteristics



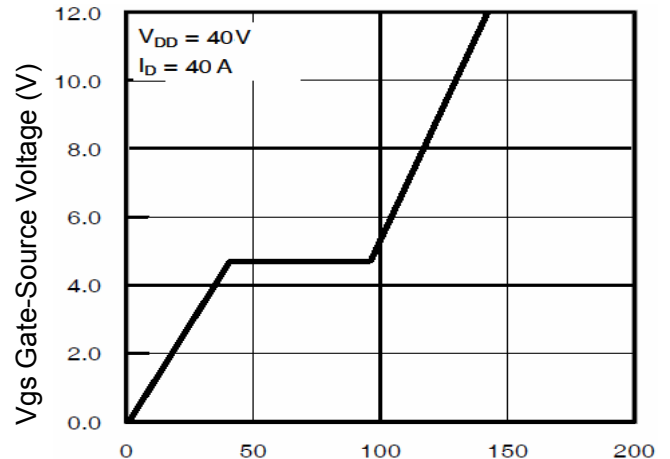
Vds Drain-Source Voltage (V)  
**Figure 1 Output Characteristics**



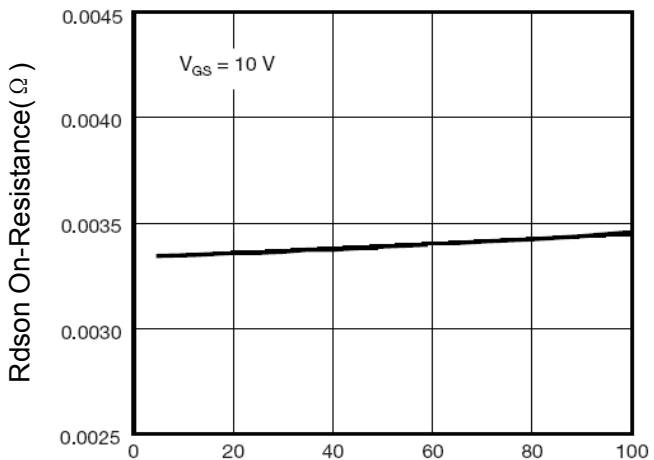
Tj-Junction Temperature(°C)  
**Figure 4 Rdson-Junction Temperature**



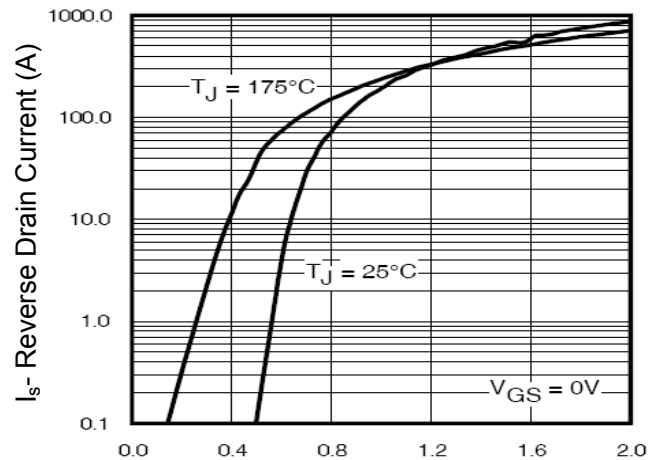
Vgs Gate-Source Voltage (V)  
**Figure 2 Transfer Characteristics**



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



Id- Drain Current (A)  
**Figure 3 Rdson- Drain Current**



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

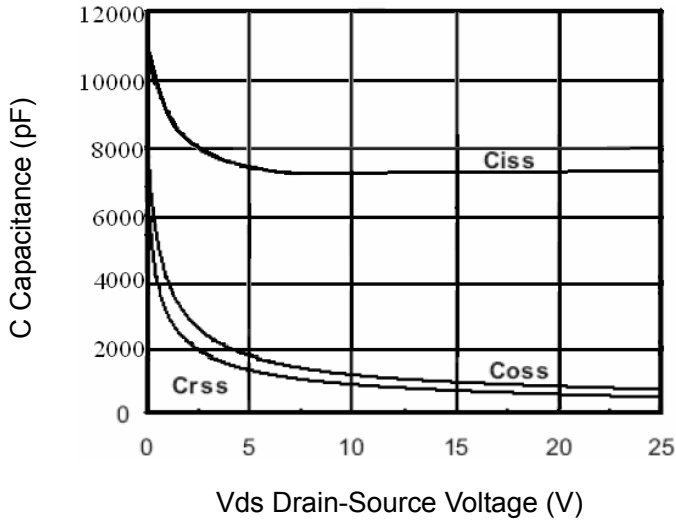


Figure 7 Capacitance vs Vds

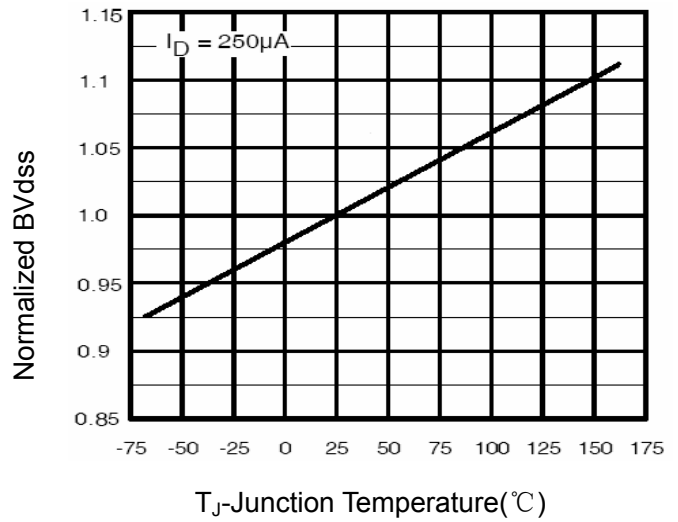


Figure 9  $BV_{DSS}$  vs Junction Temperature

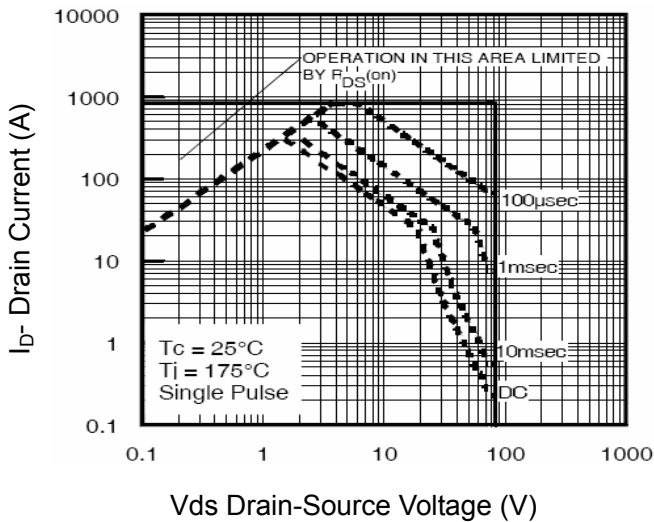


Figure 8 Safe Operation Area

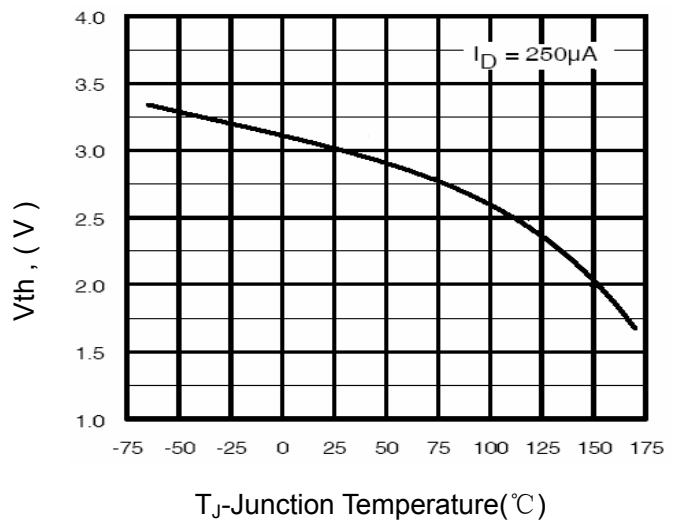


Figure 10  $V_{GS(th)}$  vs Junction Temperature

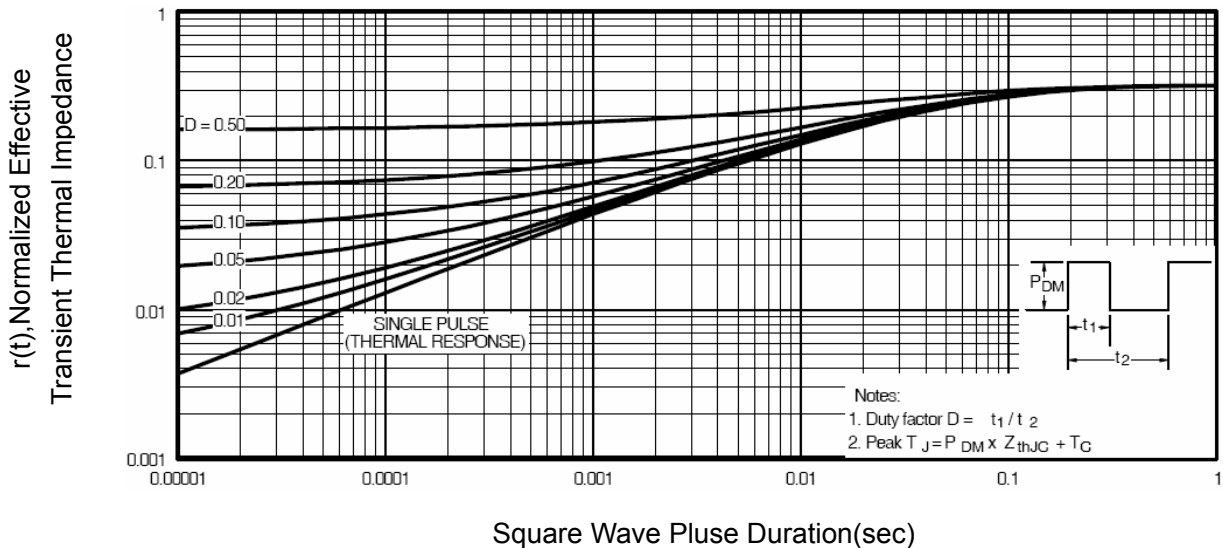
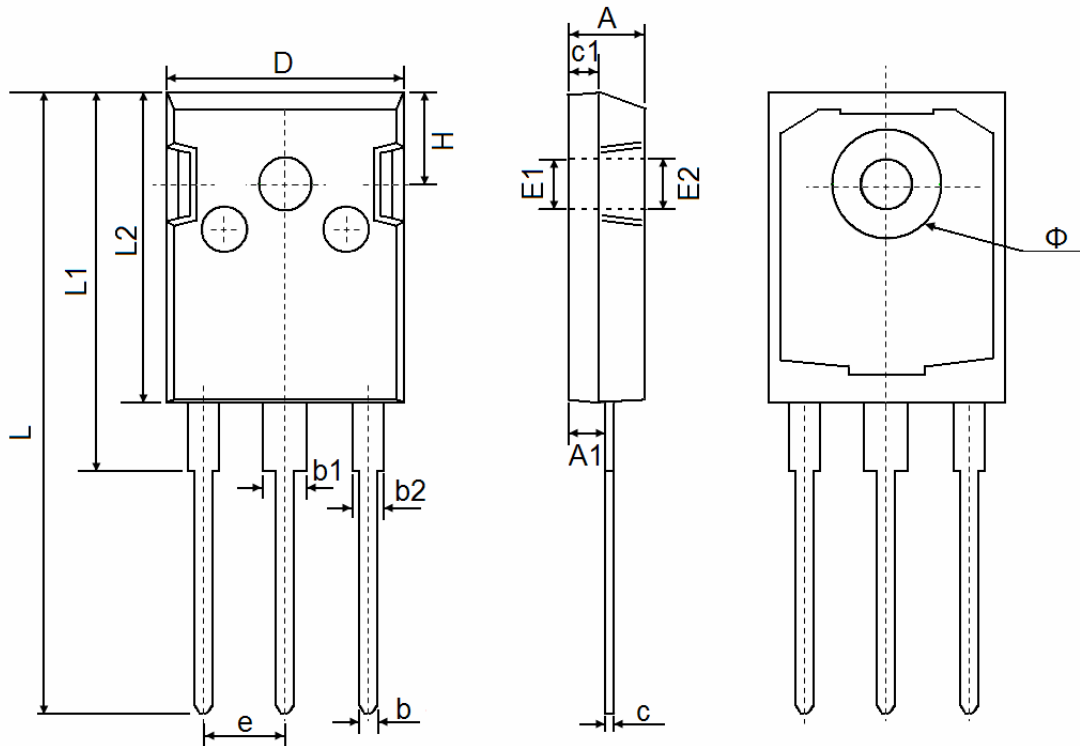


Figure 11 Normalized Maximum Transient Thermal Impedance

**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	

## Attention:

- Any and all NCE power products described or contained herein do not have specifications that can handle applications that require extremely high levels of reliability, such as life-support systems, aircraft's control systems, or other applications whose failure can be reasonably expected to result in serious physical and/or material damage. Consult with your NCE power representative nearest you before using any NCE power products described or contained herein in such applications.
- NCE power assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all NCE power products described or contained herein.
- Specifications of any and all NCE power products described or contained herein stipulate the performance, characteristics, and functions of the described products in the independent state, and are not guarantees of the performance, characteristics, and functions of the described products as mounted in the customer's products or equipment. To verify symptoms and states that cannot be evaluated in an independent device, the customer should always evaluate and test devices mounted in the customer's products or equipment.
- NCE power Semiconductor CO.,LTD. strives to supply high-quality high-reliability products. However, any and all semiconductor products fail with some probability. It is possible that these probabilistic failures could give rise to accidents or events that could endanger human lives, that could give rise to smoke or fire, or that could cause damage to other property. When designing equipment, adopt safety measures so that these kinds of accidents or events cannot occur. Such measures include but are not limited to protective circuits and error prevention circuits for safe design, redundant design, and structural design.
- In the event that any or all NCE power products(including technical data, services) described or contained herein are controlled under any of applicable local export control laws and regulations, such products must not be exported without obtaining the export license from the authorities concerned in accordance with the above law.
- No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or any information storage or retrieval system, or otherwise, without the prior written permission of NCE power Semiconductor CO.,LTD.
- Information (including circuit diagrams and circuit parameters) herein is for example only ; it is not guaranteed for volume production. NCE power believes information herein is accurate and reliable, but no guarantees are made or implied regarding its use or any infringements of intellectual property rights or other rights of third parties.
- Any and all information described or contained herein are subject to change without notice due to product/technology improvement, etc. When designing equipment, refer to the "Delivery Specification" for the NCE power product that you intend to use.
- This catalog provides information as of Sep.2010. Specifications and information herein are subject to change without notice.