

## NCE P-Channel Enhancement Mode Power MOSFET

### Description

The NCE60P70D 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

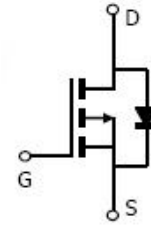
- $V_{DS} = -60V, I_D = -70A$   
 $R_{DS(ON)} < 18m\Omega @ V_{GS} = -10V$
- High density cell design for ultra low  $R_{dson}$
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high  $E_{AS}$
- Excellent package for good heat dissipation

### Application

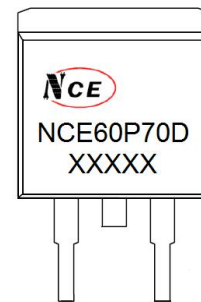
- Power switching application
- Hard switched and high frequency circuits
- Uninterruptible power supply

**100% UIS TESTED!**

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



Schematic diagram



Marking and pin assignment



TO-263-2L top view

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
NCE60P70D	NCE60P70D	TO-263-2L	-	-	-

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	-60	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	-70	A
Drain Current-Continuous( $T_C = 100^\circ C$ )	$I_D(100^\circ C)$	-49.5	A
Pulsed Drain Current	$I_{DM}$	280	A
Maximum Power Dissipation	$P_D$	160	W
Derating factor		1.07	W/ $^\circ C$
Single pulse avalanche energy (Note 5)	$E_{AS}$	420	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 175	$^\circ C$

### Thermal Characteristic

Thermal Resistance, Junction-to-Case (Note 2)	$R_{\theta JC}$	0.94	$^\circ C/W$
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## Electrical Characteristics (T<sub>c</sub>=25°C unless otherwise noted)

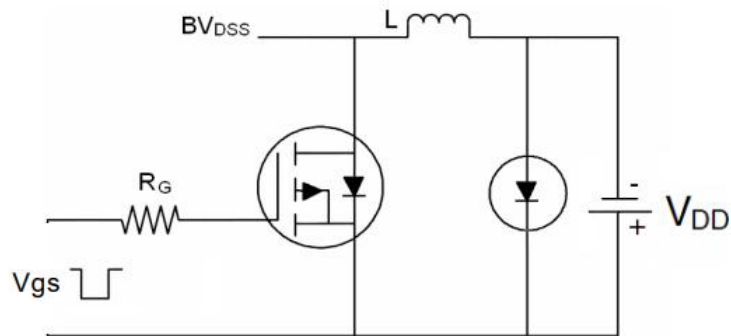
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V I <sub>D</sub> =-250μA	-60	-	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =-60V, V <sub>GS</sub> =0V	-	-	1	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	-	-	±100	nA
On Characteristics (Note 3)						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA	-2.0	-2.6	-3.5	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =-10V, I <sub>D</sub> =-20A	-	15	18	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =-5V, I <sub>D</sub> =-40A	-	50	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =-30V, V <sub>GS</sub> =0V, F=1.0MHz	-	4177	-	PF
Output Capacitance	C <sub>oss</sub>		-	235	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	178	-	PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =-30V, I <sub>D</sub> =-20A V <sub>GS</sub> =-10V, R <sub>GEN</sub> =3Ω	-	16	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	19	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	70	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	30	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =-30V, I <sub>D</sub> =-20A, V <sub>GS</sub> =-10V	-	78	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	16	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	17	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =-20A	-	-	1.2	V
Diode Forward Current (Note 2)	I <sub>S</sub>		-	-	-70	A
Reverse Recovery Time	t <sub>rr</sub>	TJ = 25°C, IF = -20A	-	48	-	nS
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 100A/μs <sup>(Note3)</sup>	-	70	-	nC

### Notes:

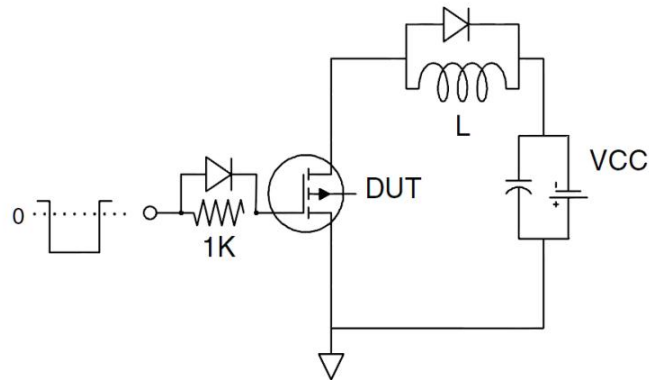
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production
5. E<sub>AS</sub> condition: T<sub>J</sub>=25°C, V<sub>DD</sub>=-30V, V<sub>G</sub>=-10V, L=0.5mH, R<sub>g</sub>=25Ω

## Test Circuit

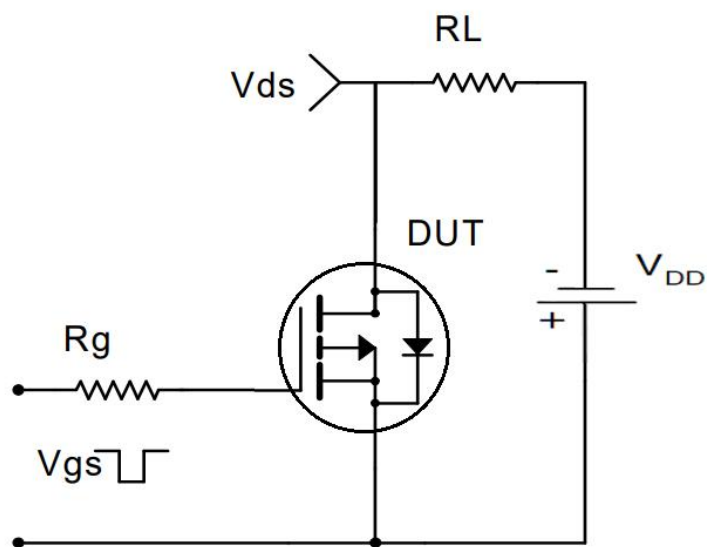
### 1) $E_{AS}$ test Circuit



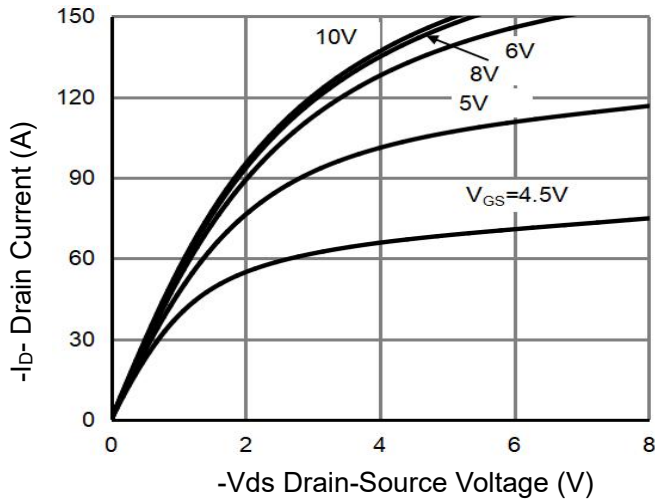
### 2) Gate charge test Circuit



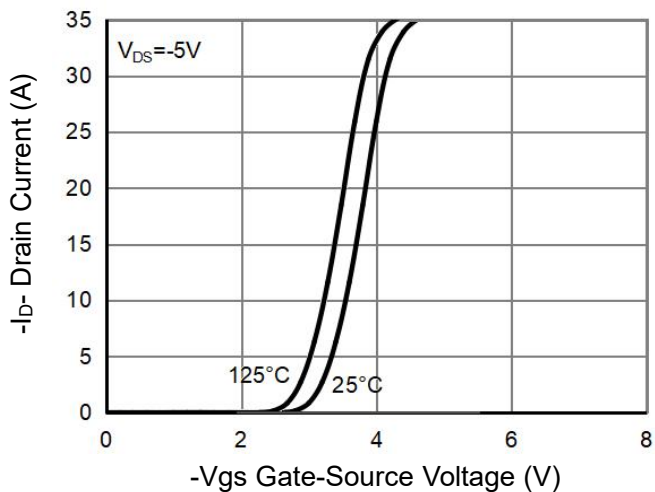
### 3) Switch Time Test Circuit



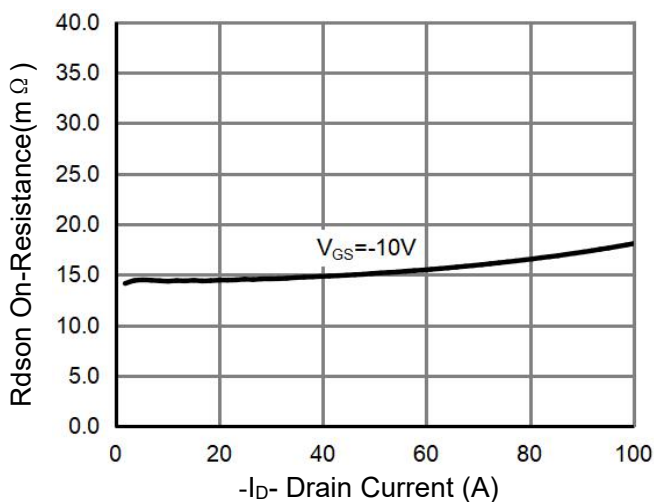
## Typical Electrical and Thermal Characteristics (Curves)



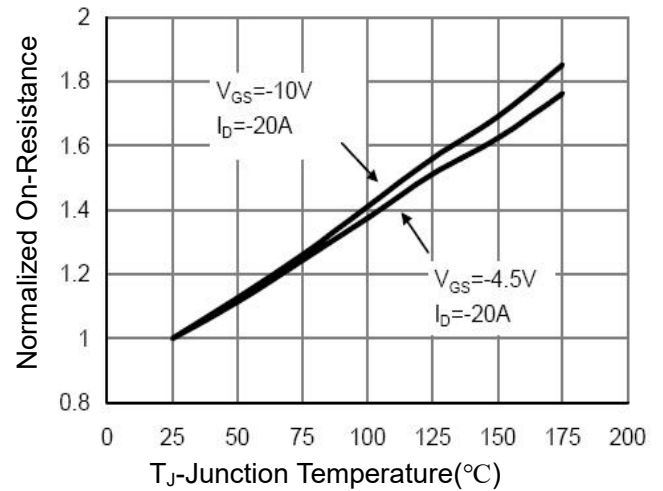
**Figure 1 Output Characteristics**



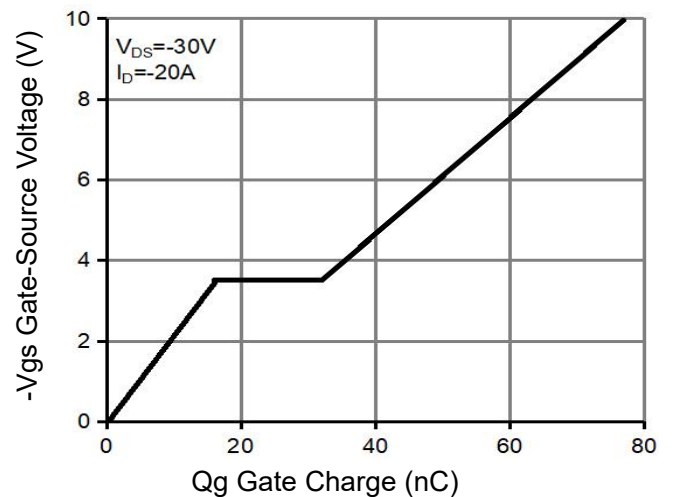
**Figure 2 Transfer Characteristics**



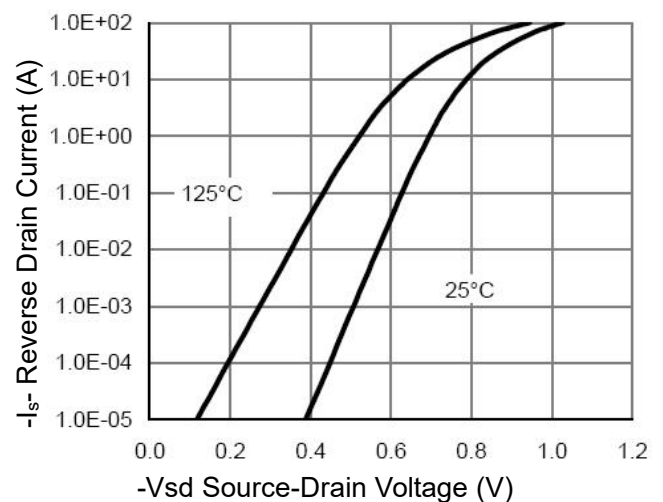
**Figure 3 Rdson- Drain Current**



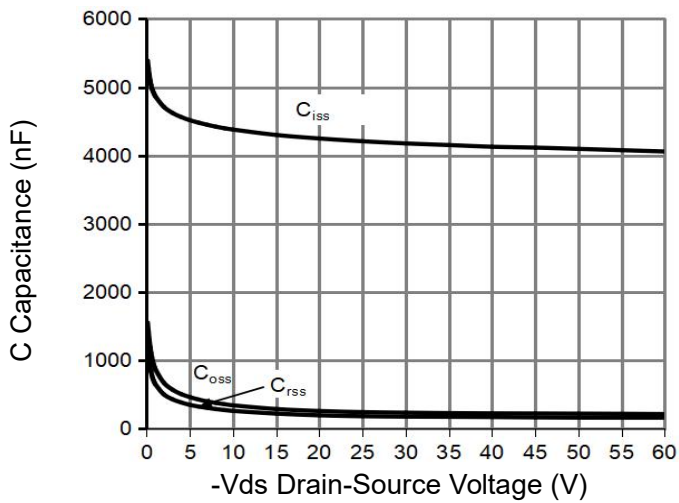
**Figure 4 Rdson-Junction Temperature**



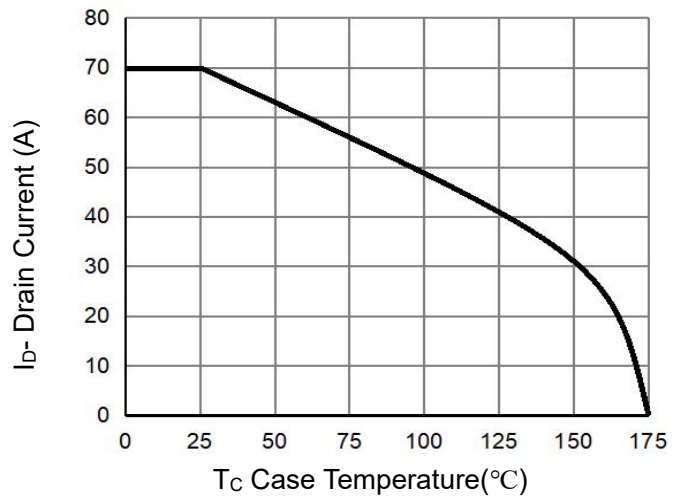
**Figure 5 Gate Charge**



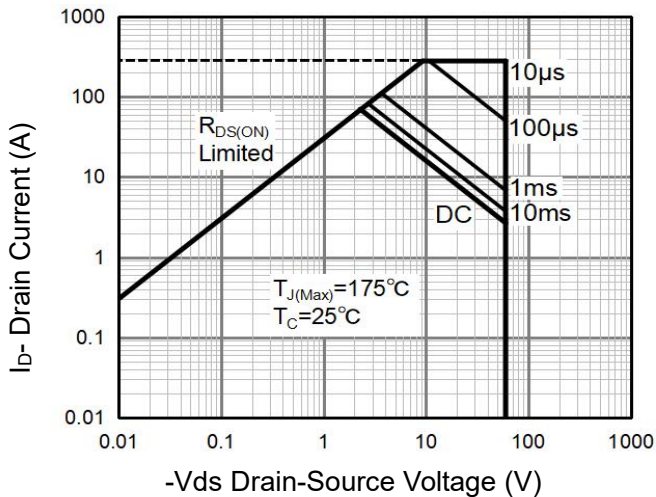
**Figure 6 Source- Drain Diode Forward**



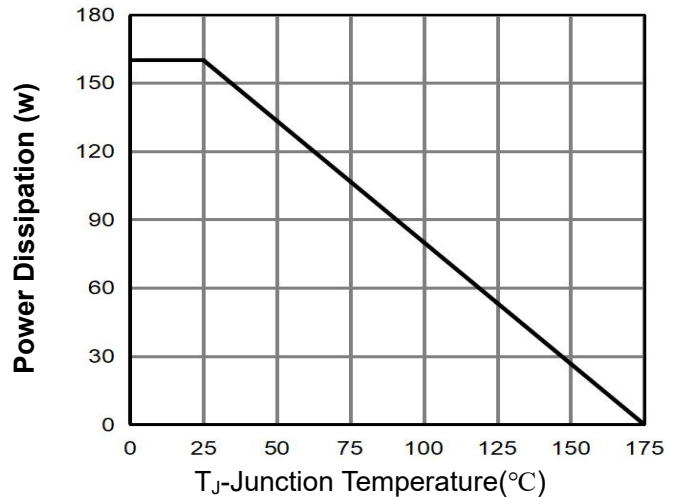
**Figure 7 Capacitance vs Vds**



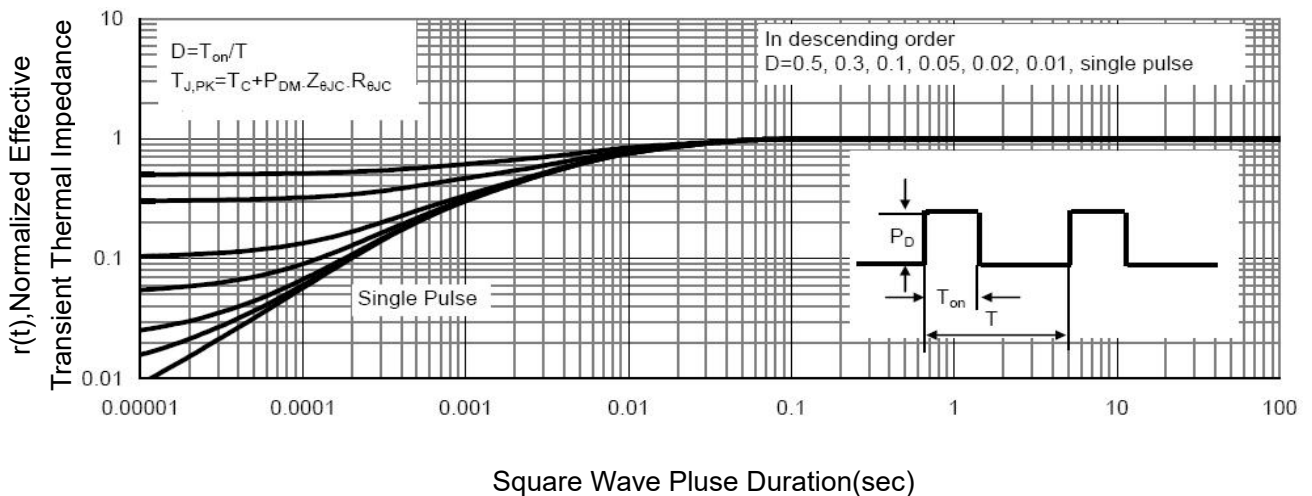
**Figure 9 Drain Current vs Case Temperature**



**Figure 8 Safe Operation Area**

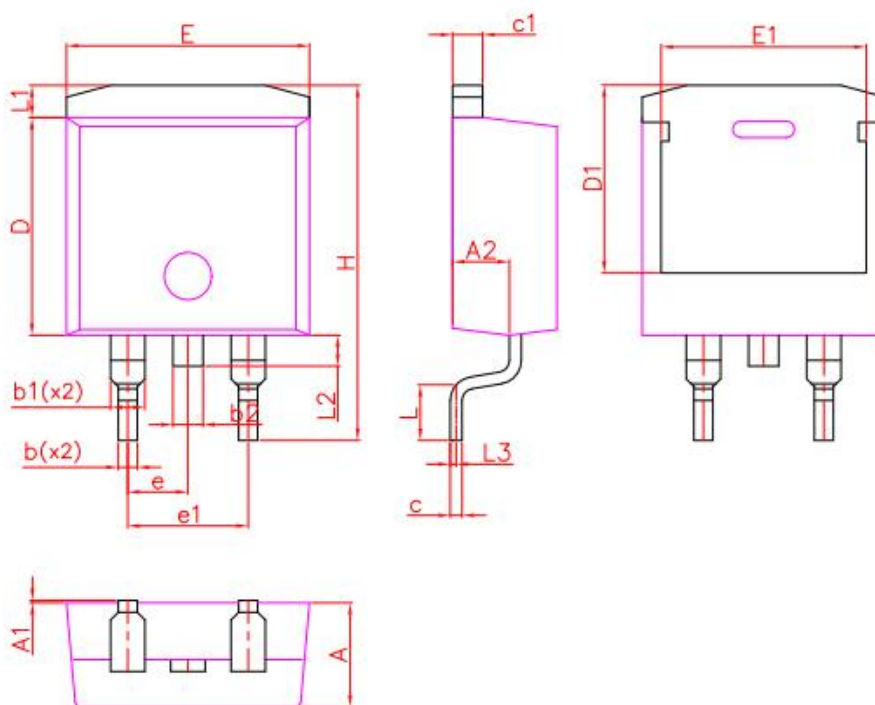


**Figure 10 Power De-rating**



**Figure 11 Normalized Maximum Transient Thermal Impedance**

## TO-263-2L Package Information



T0263			
DIM.	MIN.	NOM.	MAX.
A	4.20	4.40	4.60
A1	0.00	0.10	0.25
A2	2.20	2.40	2.60
b	0.70	0.80	0.90
b1	1.20	1.45	1.75
b2	1.17	1.27	1.37
c	0.40	0.50	0.60
c1	1.15	1.27	1.40
D	9.10	9.20	9.30
D1	7.63	7.93	8.23
E	10.05	10.25	10.45
E1	8.35	8.65	8.95
e	2.54BSC		
e1	5.08BSC		
H	14.61	15.00	15.88
L	1.78	2.35	2.79
L1	1.36REF		
L2	1.3REF		
L3	0.25REF		
All dimensions in millimeters			

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