

## NCE N-Channel Enhancement Mode Power MOSFET

### Description

The NCE6990 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

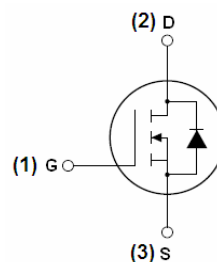
- $V_{DS} = 69V, I_D = 88A$   
 $R_{DS(ON)} < 7.2m\Omega @ V_{GS} = 10V$  (Typ: 6.2m $\Omega$ )
- High density cell design for ultra low  $R_{dson}$
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high  $E_{AS}$
- Excellent package for good heat dissipation
- Special process technology for high ESD capability

### Application

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

**100% UIS TESTED!**

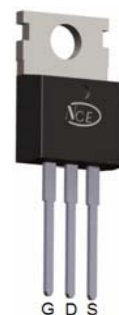
**100%  $\Delta V_{ds}$  TESTED!**



Schematic diagram



Marking and pin assignment



TO-220-3L top view

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
NCE6990	NCE6990	TO-220	-	-	-

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V <sub>DS</sub>	69	V
Gate-Source Voltage	V <sub>GS</sub>	±20	V
Drain Current-Continuous	I <sub>D</sub>	88	A
Drain Current-Continuous( $T_C = 100^\circ C$ )	I <sub>D</sub> (100 $^\circ C$ )	62	A
Pulsed Drain Current	I <sub>DM</sub>	310	A
Maximum Power Dissipation	PD	160	W
Derating factor		1.1	W/ $^\circ C$
Single pulse avalanche energy <sup>(Note 5)</sup>	E <sub>AS</sub>	450	mJ
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55 To 175	$^\circ C$

### Thermal Characteristic

Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup>	R $\theta$ JC	0.9	°C/W
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### Electrical Characteristics (T<sub>C</sub>=25°C unless otherwise noted)

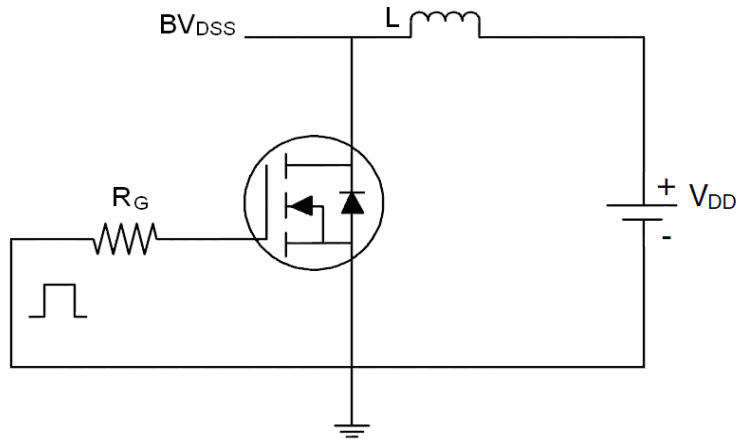
Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	BVDSS	VGS=0V ID=250μA	69	73	-	V
Zero Gate Voltage Drain Current	IDSS	VDS=69V, VGS=0V	-	-	1	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	-	-	±100	nA
<b>On Characteristics</b> <sup>(Note 3)</sup>						
Gate Threshold Voltage	VGS(th)	VDS=VGS, ID=250μA	2	2.9	4	V
Drain-Source On-State Resistance	RDS(ON)	VGS=10V, ID=30A	-	6.2	7.2	mΩ
Forward Transconductance	gFS	VDS=10V, ID=100A	25	-	-	S
<b>Dynamic Characteristics</b> <sup>(Note 4)</sup>						
Input Capacitance	Ciss	VDS=25V, VGS=0V, F=1.0MHz	-	3400	-	PF
Output Capacitance	Coss		-	310	-	PF
Reverse Transfer Capacitance	Crss		-	221	-	PF
<b>Switching Characteristics</b> <sup>(Note 4)</sup>						
Turn-on Delay Time	td(on)	VDD=30V, ID=2A, RL=15Ω VGS=10V, RG=2.5Ω	-	15	-	nS
Turn-on Rise Time	tr		-	11	-	nS
Turn-Off Delay Time	td(off)		-	52	-	nS
Turn-Off Fall Time	tf		-	13	-	nS
Total Gate Charge	Qg	VDS=30V, ID=30A, VGS=10V	-	94	-	nC
Gate-Source Charge	Qgs		-	16	-	nC
Gate-Drain Charge	Qgd		-	24	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage <sup>(Note 3)</sup>	VSD	VGS=0V, IS=30A	-	-	1.2	V
Diode Forward Current <sup>(Note 2)</sup>	IS		-	-	78	A
Reverse Recovery Time	trr	T <sub>J</sub> = 25°C, I <sub>F</sub> = 75A di/dt = 100A/μs <sup>(Note 3)</sup>	-	33		nS
Reverse Recovery Charge	Qrr		-	54		nC
Forward Turn-On Time	ton	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

### 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. EAS condition: T<sub>J</sub>=25°C, V<sub>DD</sub>=35V, V<sub>G</sub>=10V, L=0.5mH, R<sub>g</sub>=25Ω

**Test Circuit**

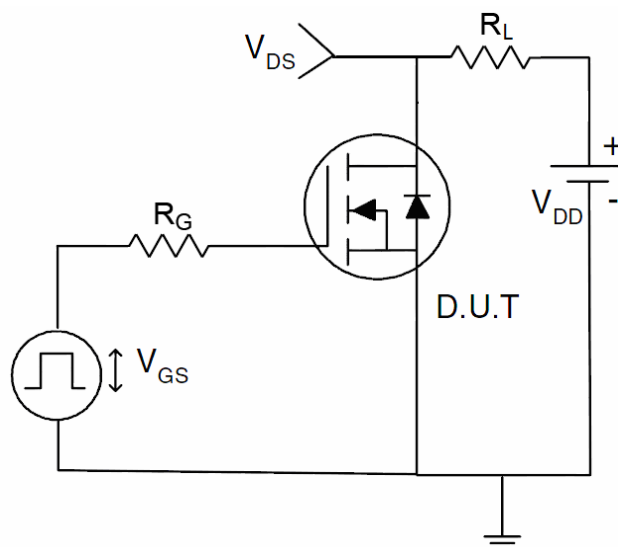
**1) EAS test Circuit**



**2) Gate charge test Circuit**



**3) Switch Time Test Circuit**



Typical Electrical and Thermal Characteristics (Curves)

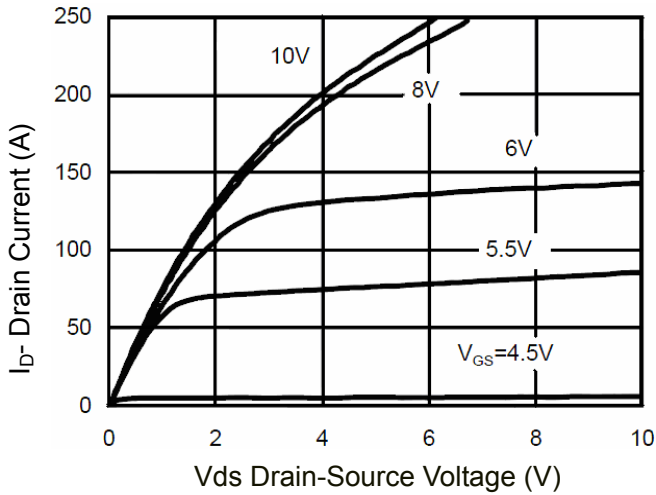


Figure 1 Output Characteristics

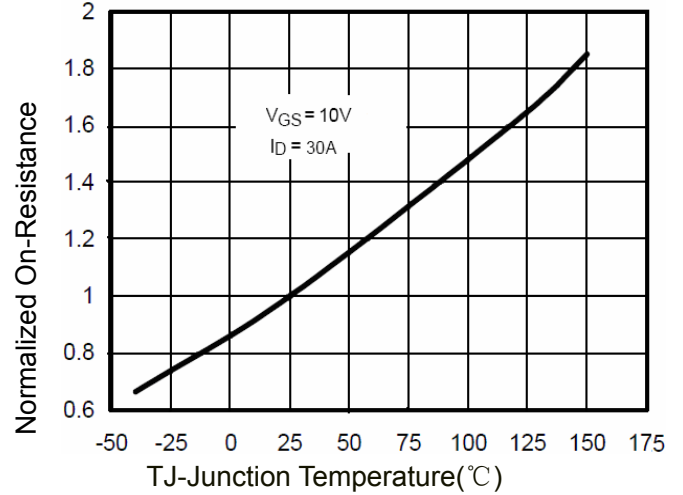


Figure 4 Rdson-Junction Temperature

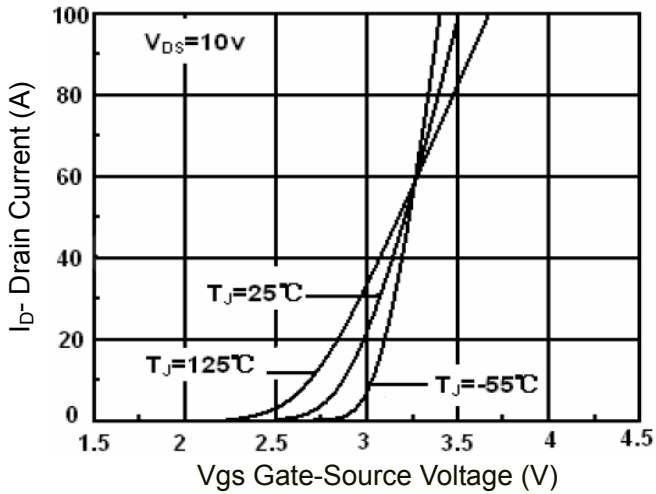


Figure 2 Transfer Characteristics

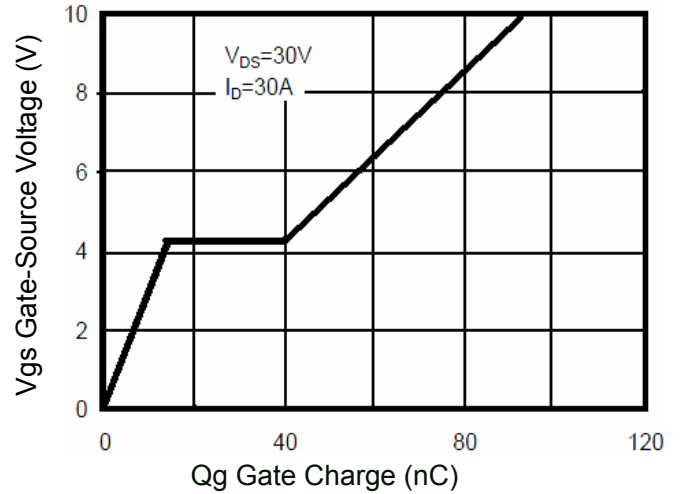


Figure 5 Gate Charge

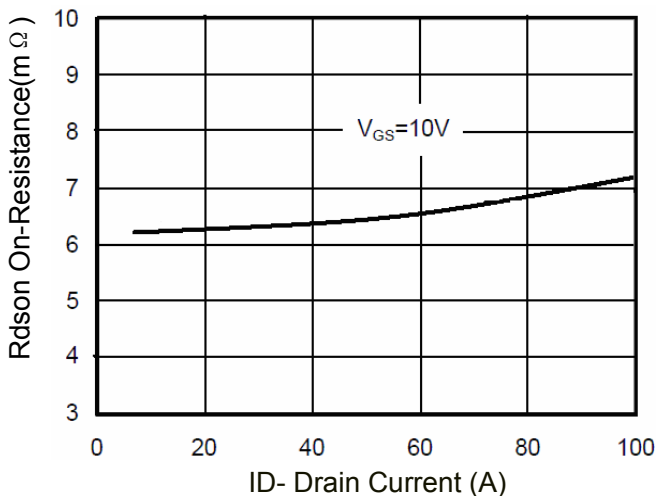


Figure 3 Rdson- Drain Current

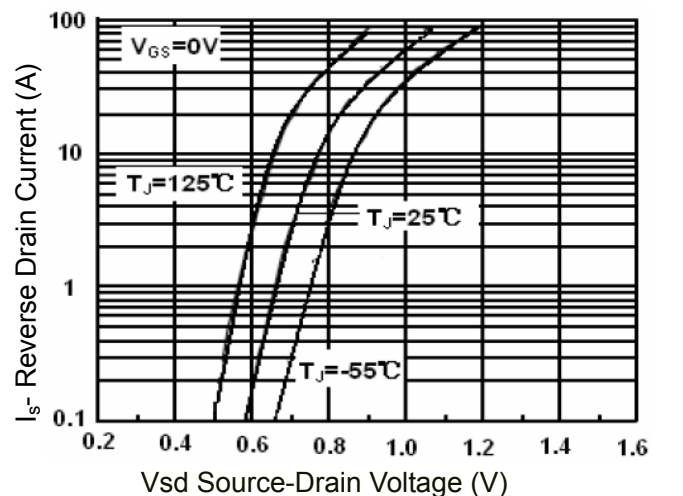


Figure 6 Source- Drain Diode Forward

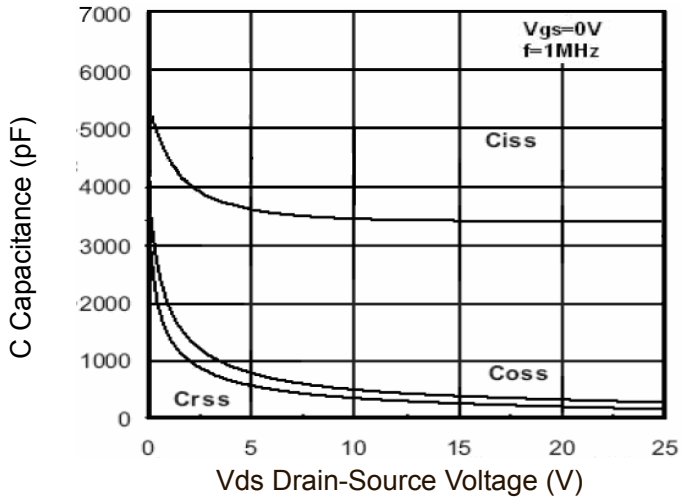


Figure 7 Capacitance vs Vds

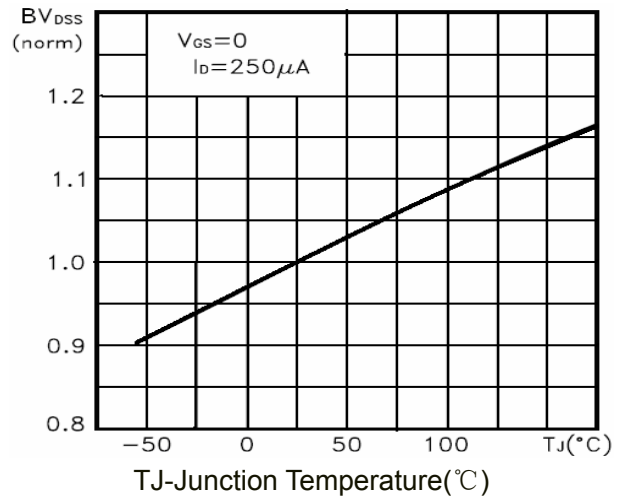


Figure 9  $BV_{DSS}$  vs Junction Temperature

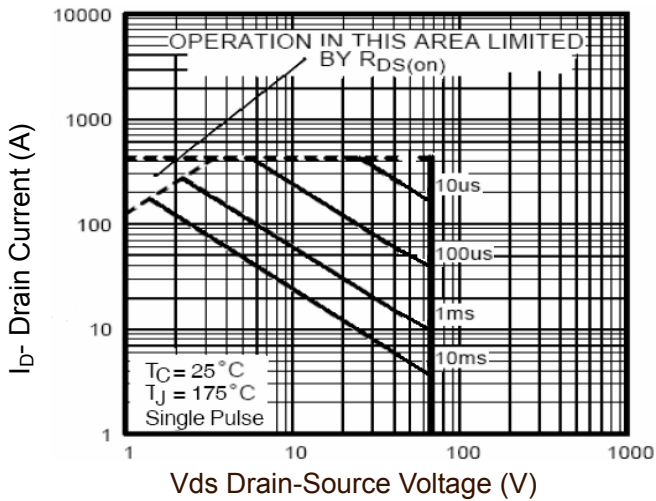


Figure 8 Safe Operation Area

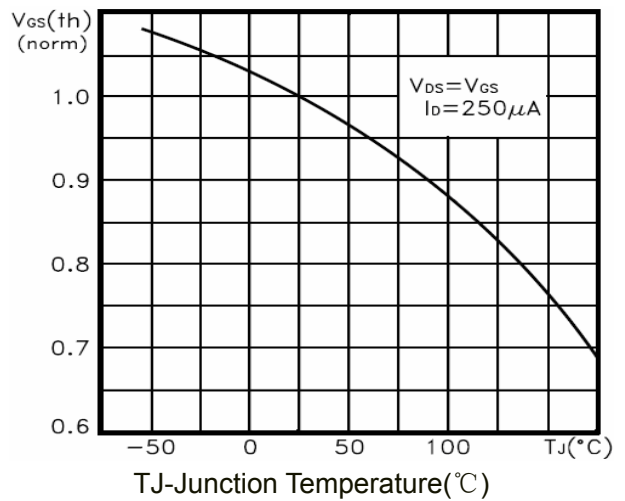


Figure 10  $V_{GS(th)}$  vs Junction Temperature

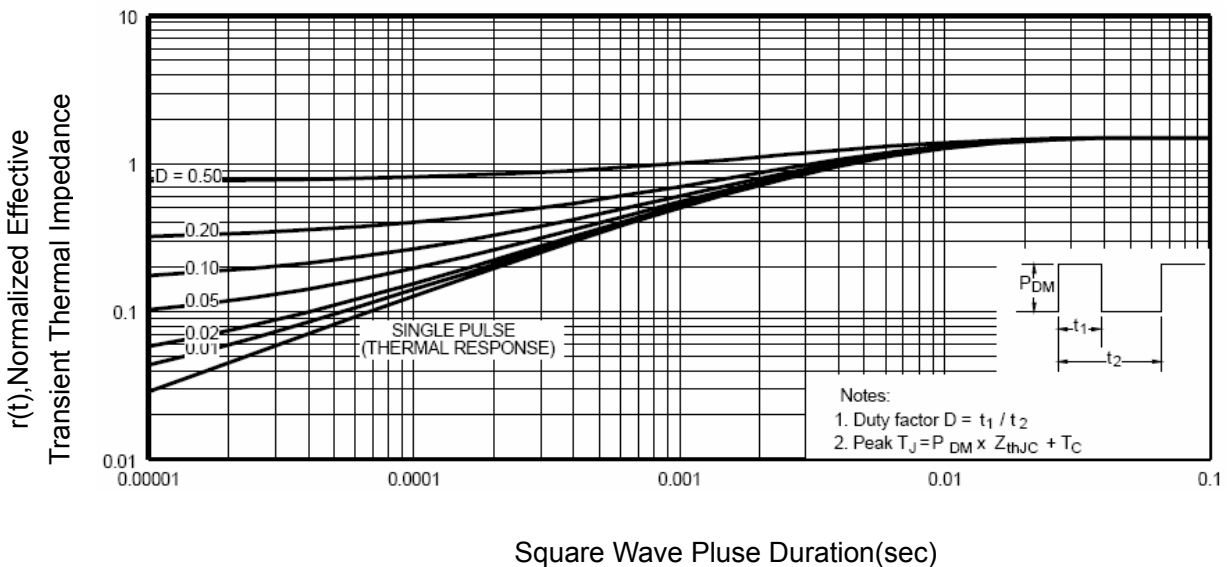
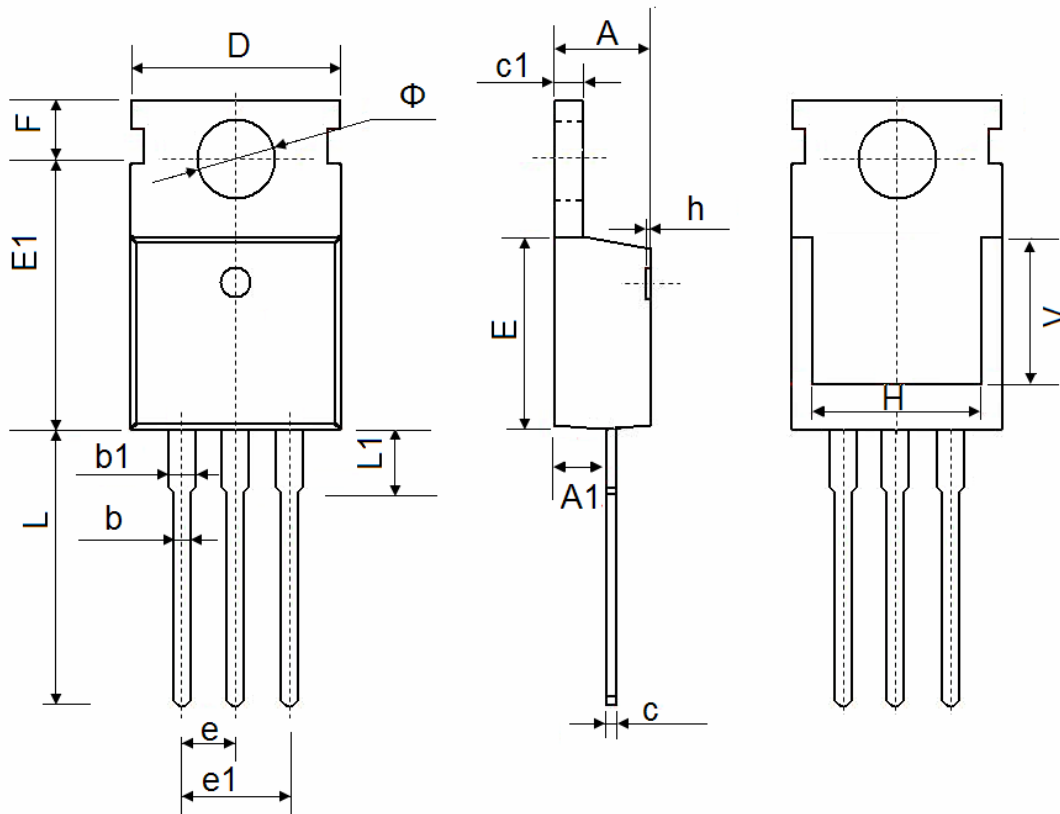


Figure 11 Normalized Maximum Transient Thermal Impedance

**TO-220-3L Package Information**


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.400	4.600	0.173	0.181
A1	2.250	2.550	0.089	0.100
b	0.710	0.910	0.028	0.036
b1	1.170	1.370	0.046	0.054
c	0.330	0.650	0.013	0.026
c1	1.200	1.400	0.047	0.055
D	9.910	10.250	0.390	0.404
E	8.9500	9.750	0.352	0.384
E1	12.650	12.950	0.498	0.510
e	2.540 TYP.		0.100 TYP.	
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	12.900	13.400	0.508	0.528
L1	2.850	3.250	0.112	0.128
V	7.500 REF.		0.295 REF.	
Φ	3.400	3.800	0.134	0.150

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