

## N-Channel Super Junction Power MOSFET III

### General Description

The series of devices use advanced trench gate super junction technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. This super junction MOSFET fits the industry's AC-DC SMPS requirements for PFC, AC/DC power conversion, and industrial power applications.

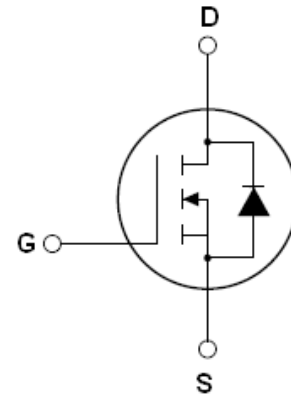
### Features

- New technology for high voltage device
- Low on-resistance and low conduction losses
- Small package
- Ultra Low Gate Charge cause lower driving requirements
- 100% Avalanche Tested
- ROHS compliant

### Application

- Power factor correction (PFC)
- Switched mode power supplies(SMPS)
- Uninterruptible Power Supply (UPS)

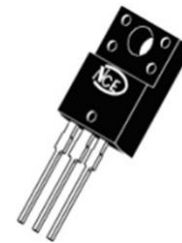
$V_{DS}$	700	V
$R_{DS(ON)TYP}$	260	m $\Omega$
$I_D$	15	A



Schematic diagram

### Package Marking And Ordering Information

Device	Device Package	Marking
NCE70T260EF	TO-220F	NCE70T260EF



TO-220F

Table 1. Absolute Maximum Ratings ( $T_C=25^\circ\text{C}$ )

Parameter	Symbol	Value	Unit
Drain-Source Voltage ( $V_{GS}=0V$ )	$V_{DS}$	700	V
Gate-Source Voltage ( $V_{DS}=0V$ ) AC ( $f>1$ Hz)	$V_{GS}$	$\pm 30$	V
Continuous Drain Current at $T_C=25^\circ\text{C}$	$I_D$ (DC)	15*	A
Continuous Drain Current at $T_C=100^\circ\text{C}$	$I_D$ (DC)	10*	A
Pulsed drain current (Note 1)	$I_{DM}$ (pluse)	60*	A
Maximum Power Dissipation( $T_C=25^\circ\text{C}$ )	$P_D$	33.2	W
Derate above $25^\circ\text{C}$		0.265	W/ $^\circ\text{C}$
Single pulse avalanche energy (Note 2)	$E_{AS}$	304	mJ
Avalanche current (Note 1)	$I_{AR}$	3	A
Repetitive Avalanche energy, $t_{AR}$ limited by $T_{jmax}$ (Note 1)	$E_{AR}$	1.6	mJ

Parameter	Symbol	Value	Unit
Drain Source voltage slope, $V_{DS} \leq 480V$ ,	dv/dt	50	V/ns
Reverse diode dv/dt, $V_{DS} \leq 480V, I_{SD} < I_D$	dv/dt	15	V/ns
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55...+150	°C

\* limited by maximum junction temperature

**Table 2. Thermal Characteristic**

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case (Maximum)	$R_{thJC}$	3.76	°C/W
Thermal Resistance, Junction-to-Ambient (Maximum)	$R_{thJA}$	80	°C/W

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

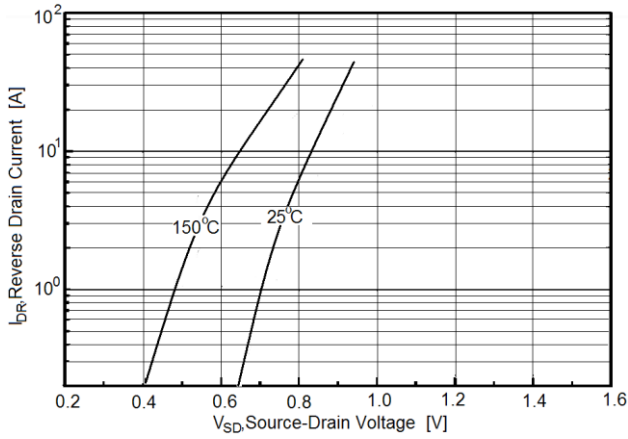
Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>On/off states</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	700			V
Zero Gate Voltage Drain Current( $T_C=25^\circ C$ )	$I_{DSS}$	$V_{DS}=700V, V_{GS}=0V$			1	$\mu A$
Zero Gate Voltage Drain Current( $T_C=125^\circ C$ )	$I_{DSS}$	$V_{DS}=700V, V_{GS}=0V$			100	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$			$\pm 100$	nA
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	3	3.5	4	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=8A$		260	300	m $\Omega$
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{iss}$	$V_{DS}=50V, V_{GS}=0V,$ $F=1.0MHz$		1160		pF
Output Capacitance	$C_{oss}$			79		pF
Reverse Transfer Capacitance	$C_{rss}$			5.3		pF
Total Gate Charge	$Q_g$	$V_{DS}=400V, I_D=15A,$ $V_{GS}=10V$		32		nC
Gate-Source Charge	$Q_{gs}$			8.4		nC
Gate-Drain Charge	$Q_{gd}$			12.8		nC
<b>Switching times</b>						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=420V, I_D=8A,$ $R_G=2.3\Omega, V_{GS}=10V$		15		nS
Turn-on Rise Time	$t_r$			11		nS
Turn-Off Delay Time	$t_{d(off)}$			63		nS
Turn-Off Fall Time	$t_f$			10		nS
<b>Source- Drain Diode Characteristics</b>						
Source-drain current(Body Diode)	$I_{SD}$	$T_C=25^\circ C$			15	A
Pulsed Source-drain current(Body Diode)	$I_{SDM}$				60	A
Forward On Voltage	$V_{SD}$	$T_J=25^\circ C, I_{SD}=15A, V_{GS}=0V$		0.9	1.2	V
Reverse Recovery Time	$t_{rr}$	$T_J=25^\circ C, I_F=7.5A, di/dt=100A/\mu s$		240		nS
Reverse Recovery Charge	$Q_{rr}$			2		$\mu C$
Peak Reverse Recovery Current	$I_{rrm}$			17		A

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

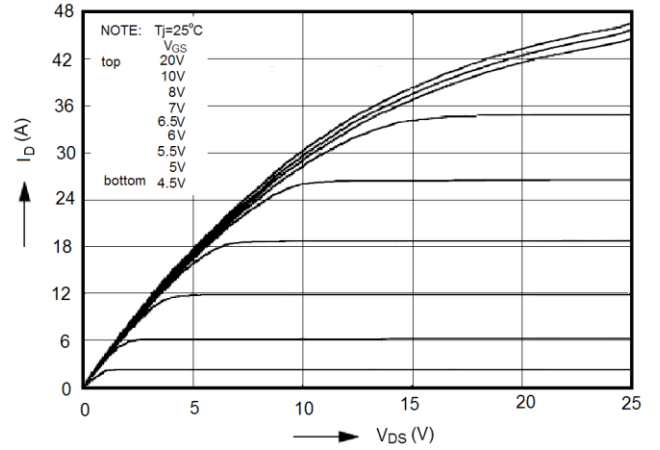
2.  $T_J=25^\circ C, V_{DD}=50V, V_G=10V, R_G=25\Omega$

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)

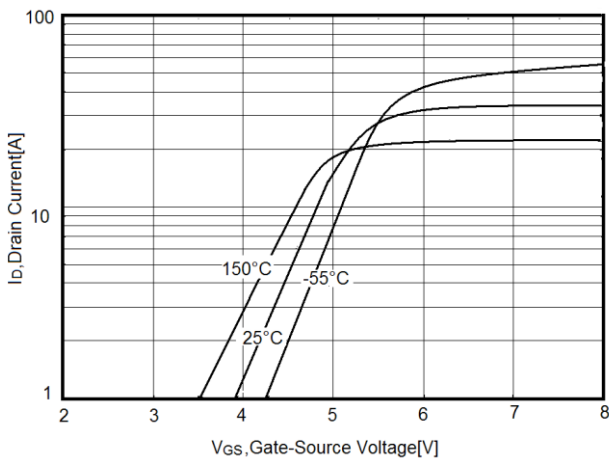
**Figure1. Source-Drain Diode Forward Voltage**



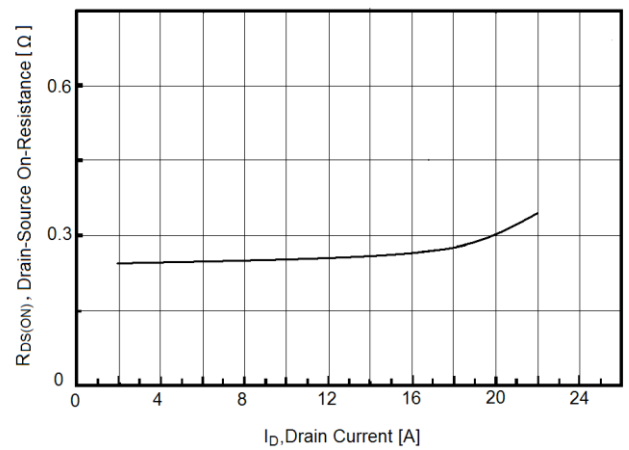
**Figure2. Output characteristics**



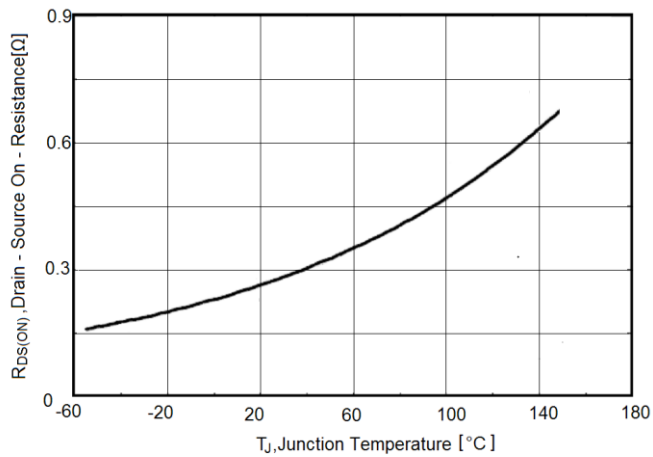
**Figure3. Transfer characteristics**



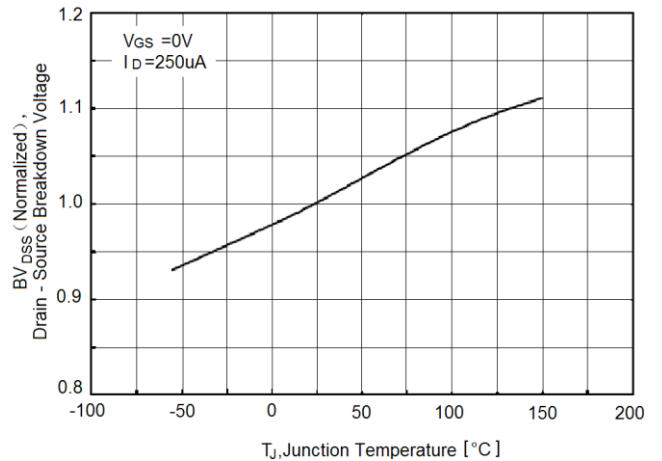
**Figure4. Static drain-source on resistance**



**Figure5. RDS(ON) vs Junction Temperature**

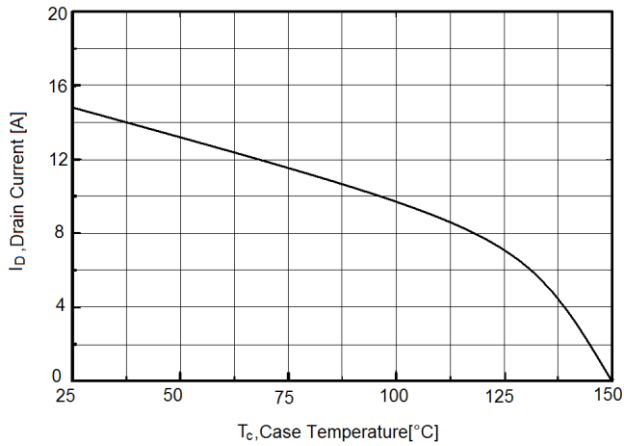


**Figure6. BVDS vs Junction Temperature**

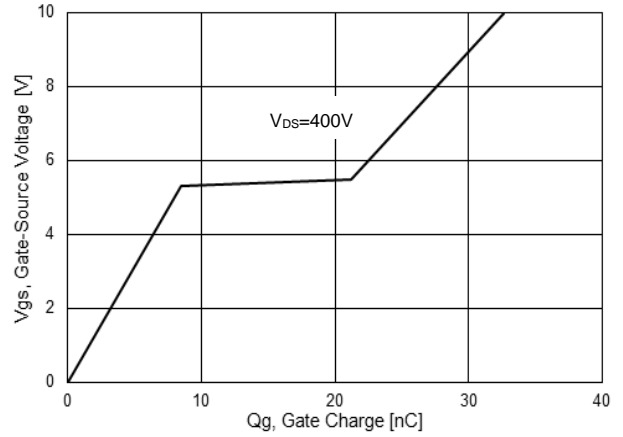


## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)

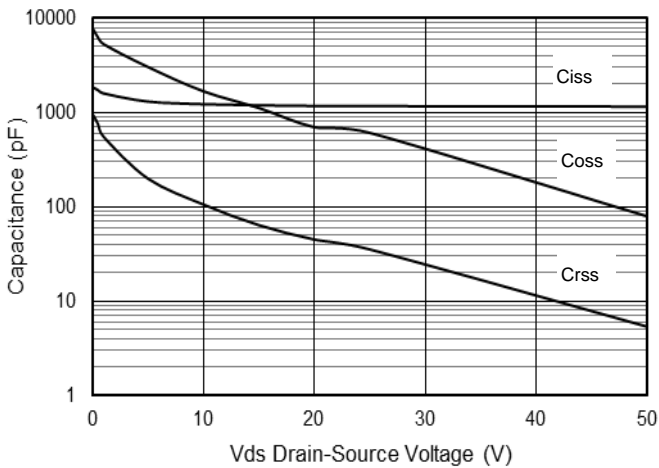
**Figure7. Maximum  $I_D$  vs Junction Temperature**



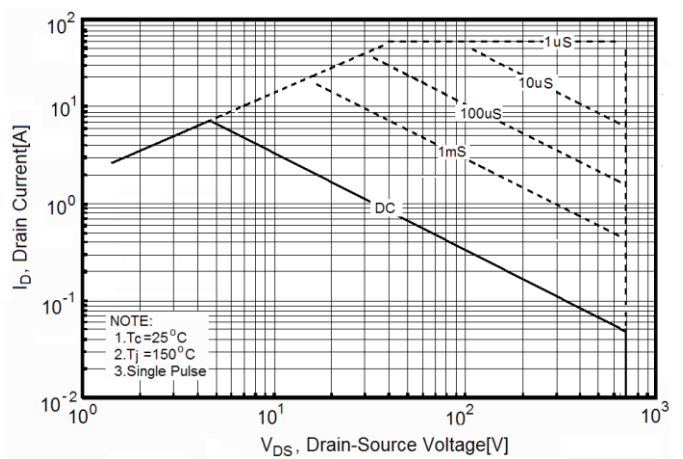
**Figure8. Gate charge waveforms**



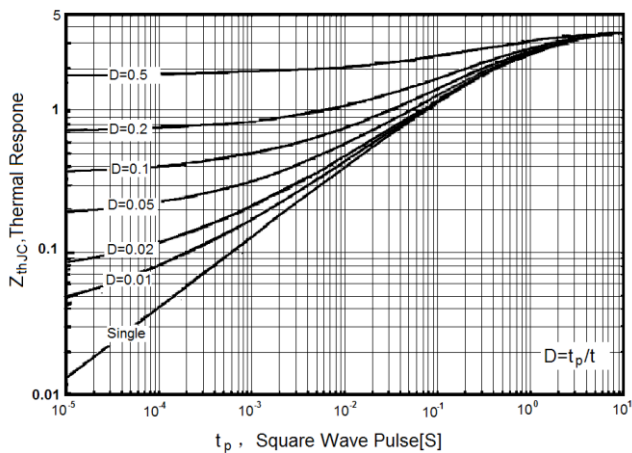
**Figure9. Capacitance**



**Figure10. Safe operating area**

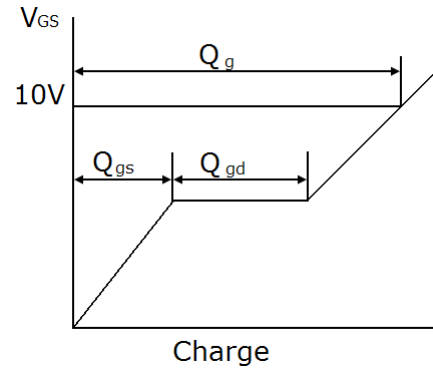
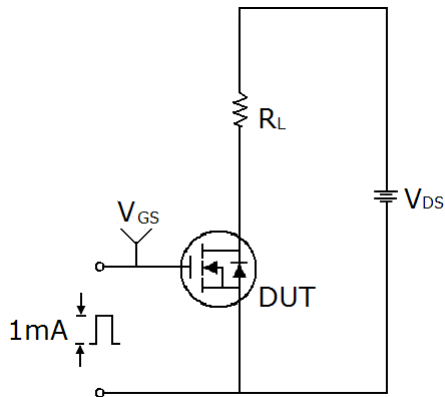


**Figure11. Transient Thermal Impedance**

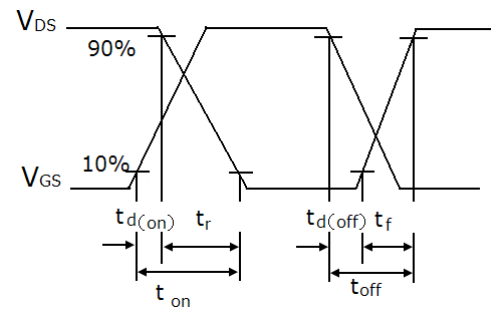
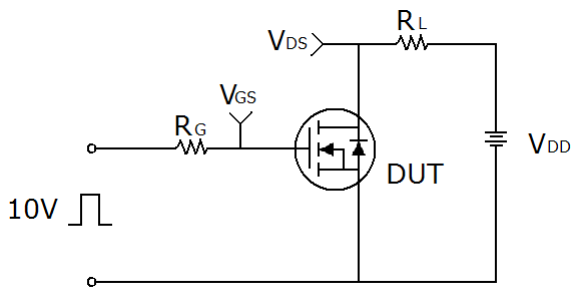


## Test circuit

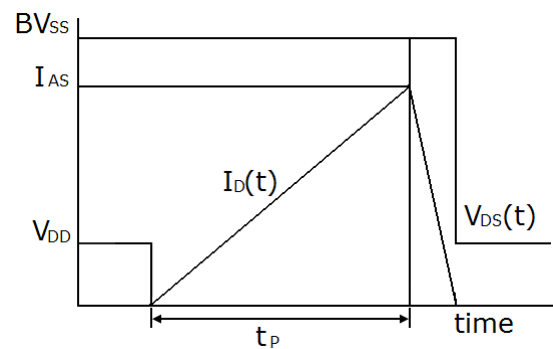
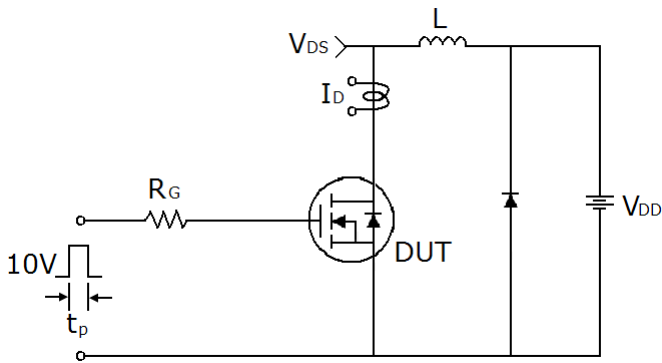
### 1) Gate charge test circuit & Waveform



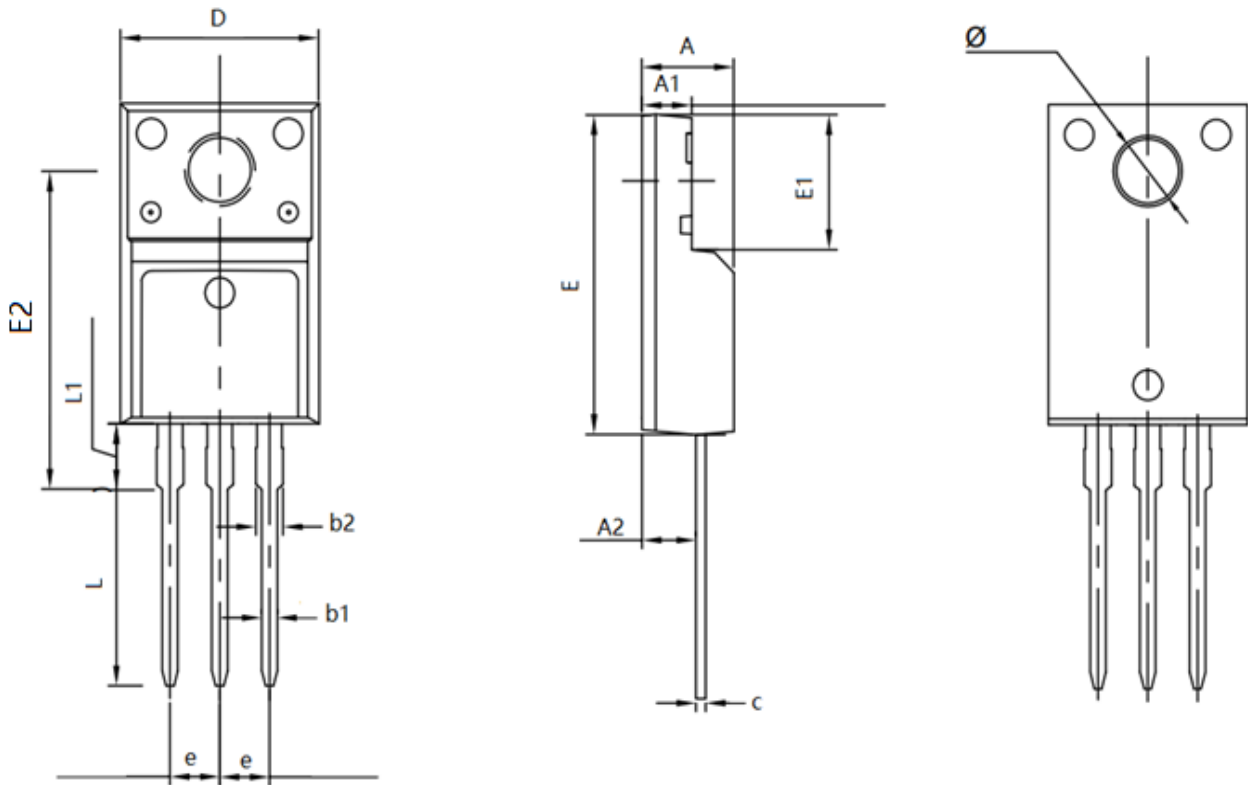
### 2) Switch Time Test Circuit:



### 3) Unclamped Inductive Switching Test Circuit & Waveforms



## TO-220F Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.500	4.900	0.177	0.193
A1	2.340	2.740	0.092	0.108
A2	2.560	2.960	0.101	0.117
b1	0.700	0.900	0.028	0.035
b2	1.180	1.580	0.046	0.062
c	0.400	0.600	0.016	0.024
D	9.960	10.360	0.392	0.408
E	15.670	15.970	0.617	0.629
E1	6.500	6.900	0.256	0.272
E2	15.500	16.100	0.610	0.634
e	2.540 TYP		0.100 TYP	
Φ	3.080	3.280	0.121	0.129
L	12.640	13.240	0.498	0.521
L1	3.030	3.430	0.119	0.135

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