

## NCE N-Channel Super Trench Power MOSFET

### Description

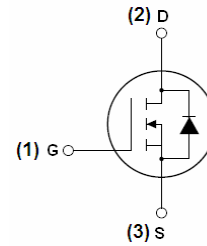
The NCEP02590T uses **Super Trench** technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of  $R_{DS(ON)}$  and  $Q_g$ . This device is ideal for high-frequency switching and synchronous rectification.

### General Features

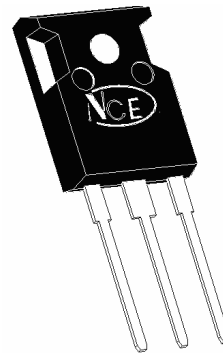
- $V_{DS} = 250V, I_D = 90A$   
 $R_{DS(ON)} < 15m\Omega @ V_{GS} = 10V$
- Excellent gate charge x  $R_{DS(on)}$  product
- Very low on-resistance  $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating
- Optimized body diode reverse recovery performance

### Application

- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification



Schematic diagram



TO-247 top view

**100% UIS TESTED!**  
**100% ΔVds TESTED!**

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
NCEP02590T	NCEP02590T	TO-247-3L	-	-	-

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	250	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	90	A
Drain Current-Continuous( $T_C = 100^\circ C$ )	$I_D(100^\circ C)$	63.6	A
Pulsed Drain Current <sup>(Note 1)</sup>	$I_{DM}$	360	A
Maximum Power Dissipation	$P_D$	330	W
Derating factor		2.2	W/°C
Single pulse avalanche energy <sup>(Note 5)</sup>	$E_{AS}$	1700	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 175	°C

### Thermal Characteristic

Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup>	$R_{\theta JC}$	0.45	°C/W
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## Electrical Characteristics ( $T_C=25^\circ\text{C}$ unless otherwise noted)

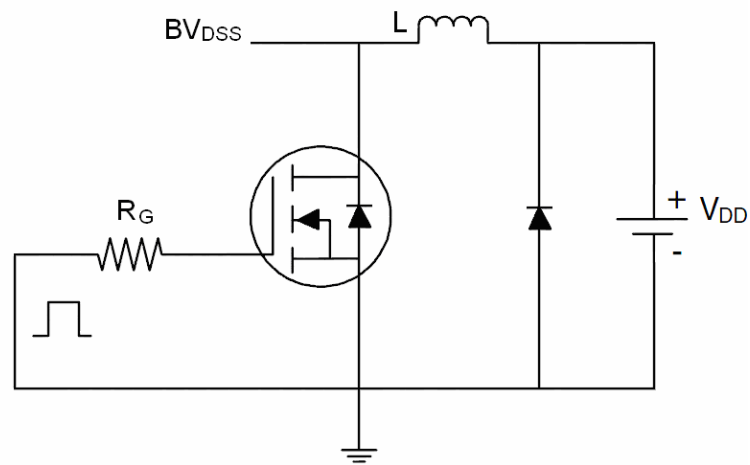
Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	250		-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=250V, V_{GS}=0V$	-	-	1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
<b>On Characteristics</b> (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2.5		4.5	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=45A$	-	14	15	m $\Omega$
Gate resistance	$R_G$		-	3.3	-	$\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=10V, I_D=45A$	70	-	-	S
<b>Dynamic Characteristics</b> (Note 4)						
Input Capacitance	$C_{iss}$	$V_{DS}=125V, V_{GS}=0V,$ $F=1.0\text{MHz}$	-	6595	-	PF
Output Capacitance	$C_{oss}$		-	409.5	-	PF
Reverse Transfer Capacitance	$C_{rss}$		-	11	-	PF
<b>Switching Characteristics</b> (Note 4)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=125V, I_D=45A$ $V_{GS}=10V, R_G=4.7\Omega$	-	19.5	-	nS
Turn-on Rise Time	$t_r$		-	28	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	48	-	nS
Turn-Off Fall Time	$t_f$		-	15	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=125V, I_D=45A,$ $V_{GS}=10V$	-	90.9		nC
Gate-Source Charge	$Q_{gs}$		-	40.4		nC
Gate-Drain Charge	$Q_{gd}$		-	18		nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage	$V_{SD}$	$V_{GS}=0V, I_S=90A$	-		1.2	V
Diode Forward Current	$I_S$		-	-	90	A
Reverse Recovery Time	$t_{rr}$	$T_J = 25^\circ\text{C}, I_F = 45A$ $di/dt = 100A/\mu s$ (Note 3)	-	204		nS
Reverse Recovery Charge	$Q_{rr}$		-	1.81		$\mu C$

### Notes:

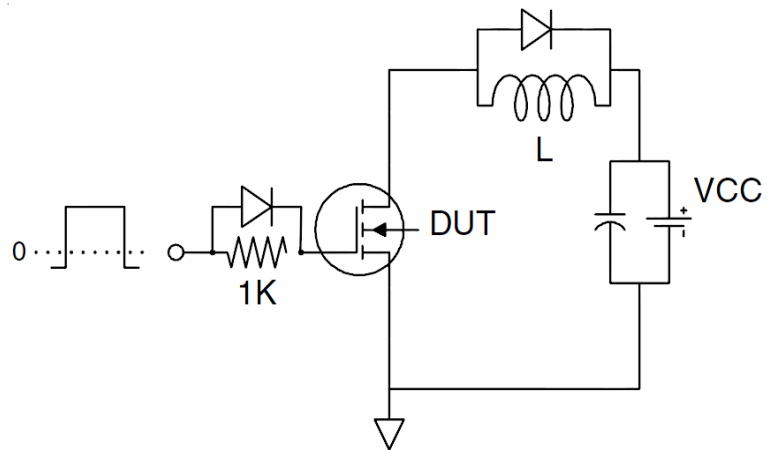
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS condition :  $T_J=25^\circ\text{C}, V_{DD}=50V, V_G=10V, L=0.5\text{mH}, R_G=25\Omega$

**Test Circuit**

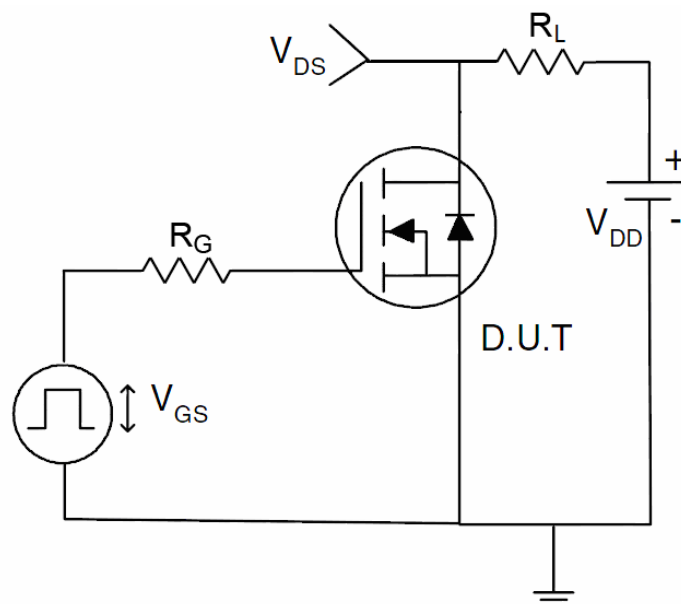
**1)  $E_{AS}$  test Circuit**



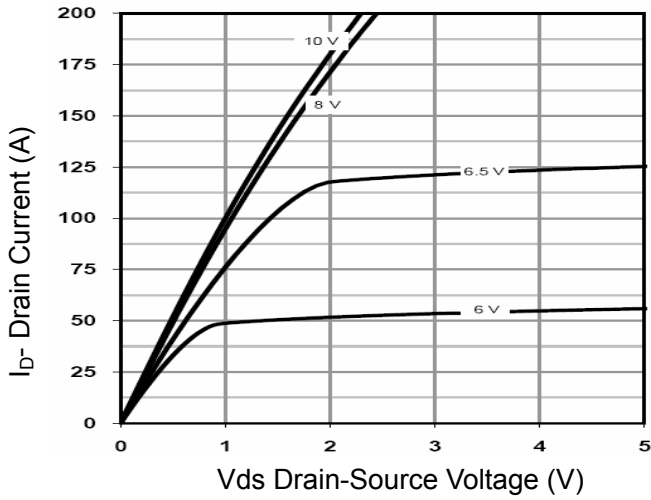
**2) Gate charge test Circuit**



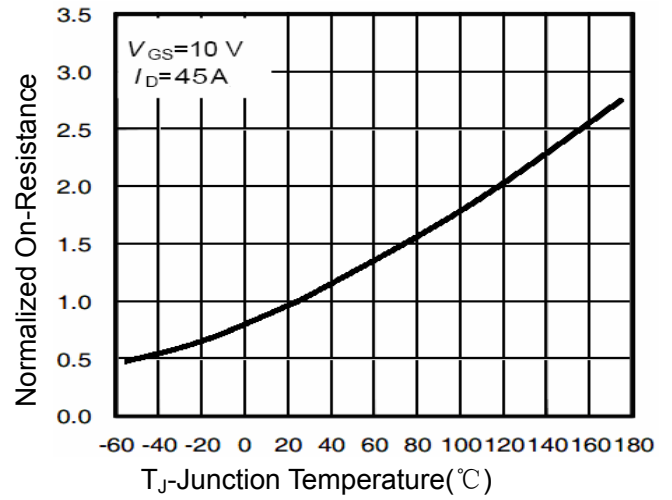
**3) Switch Time Test Circuit**



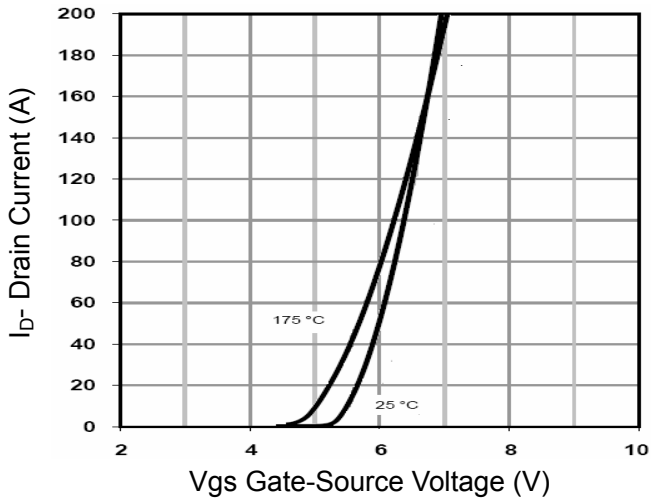
**Typical Electrical and Thermal Characteristics**



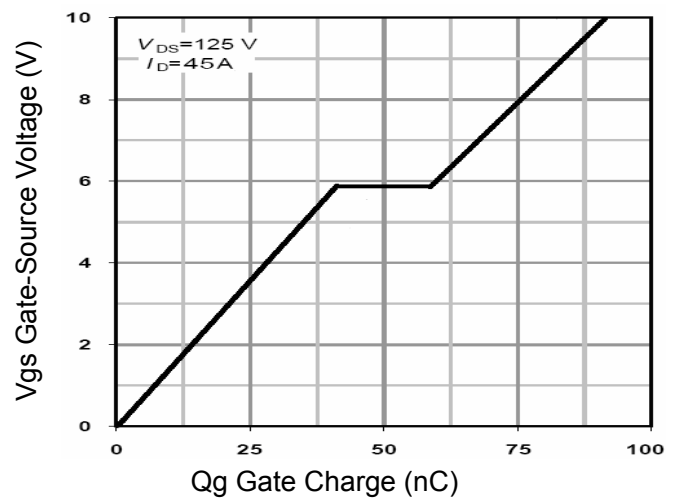
**Figure 1 Output Characteristics**



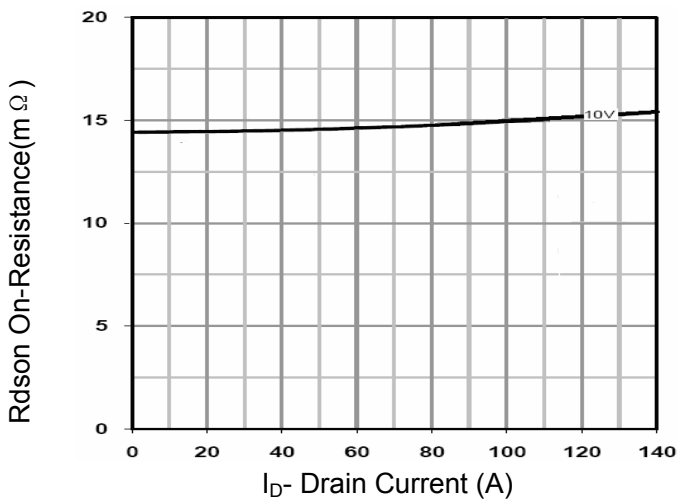
**Figure 4 Rds(on)-Junction Temperature**



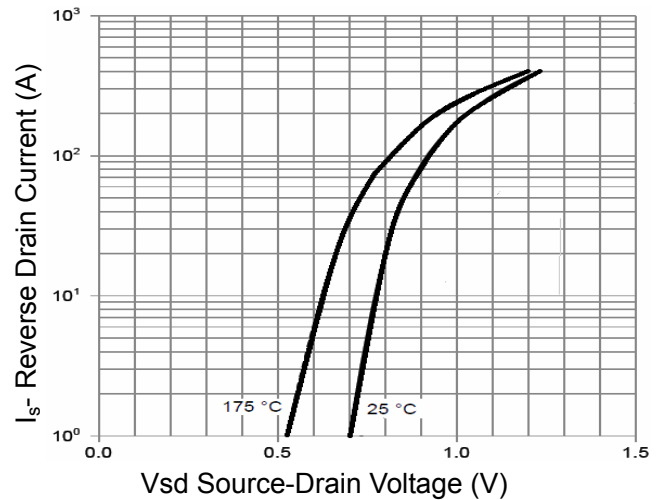
**Figure 2 Transfer Characteristics**



**Figure 5 Gate Charge**



**Figure 3 Rds(on)- Drain Current**



**Figure 6 Source- Drain Diode Forward**

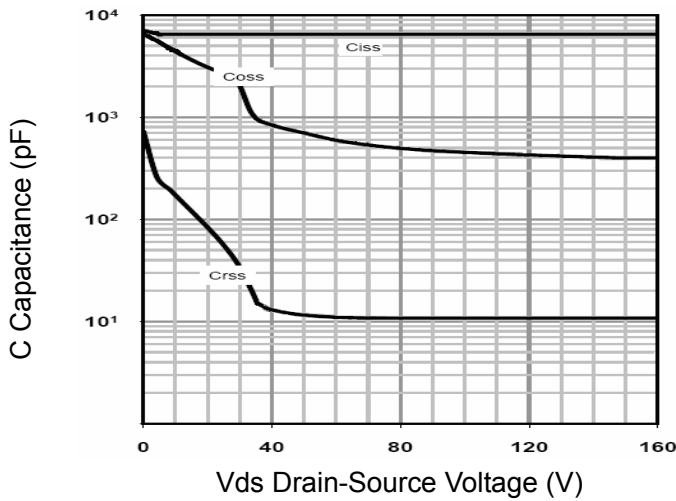


Figure 7 Capacitance vs Vds

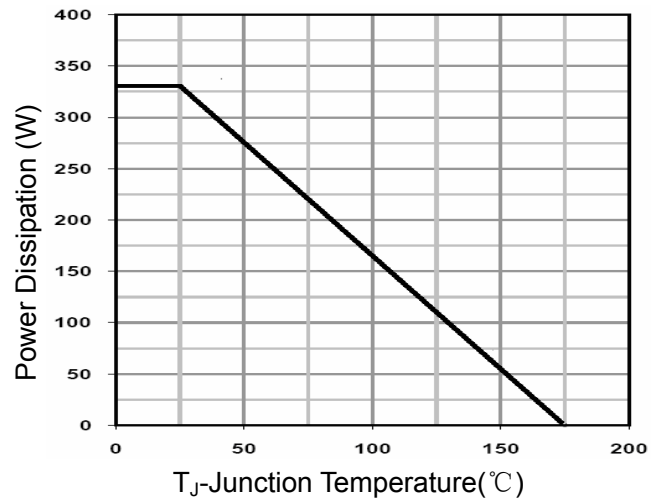


Figure 9 Power De-rating

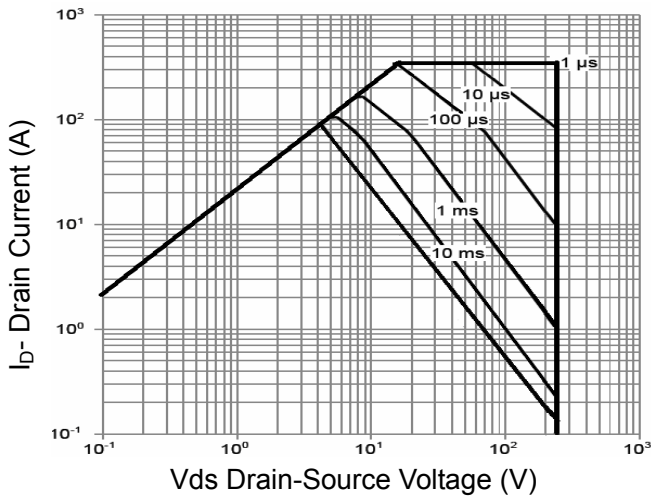


Figure 8 Safe Operation Area

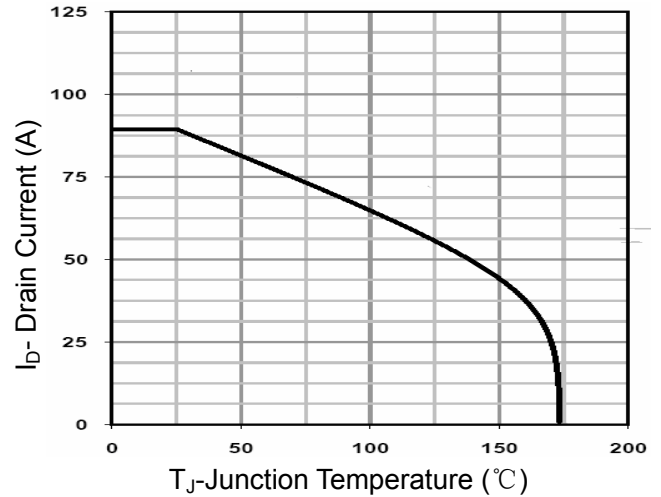


Figure 10 Current De-rating

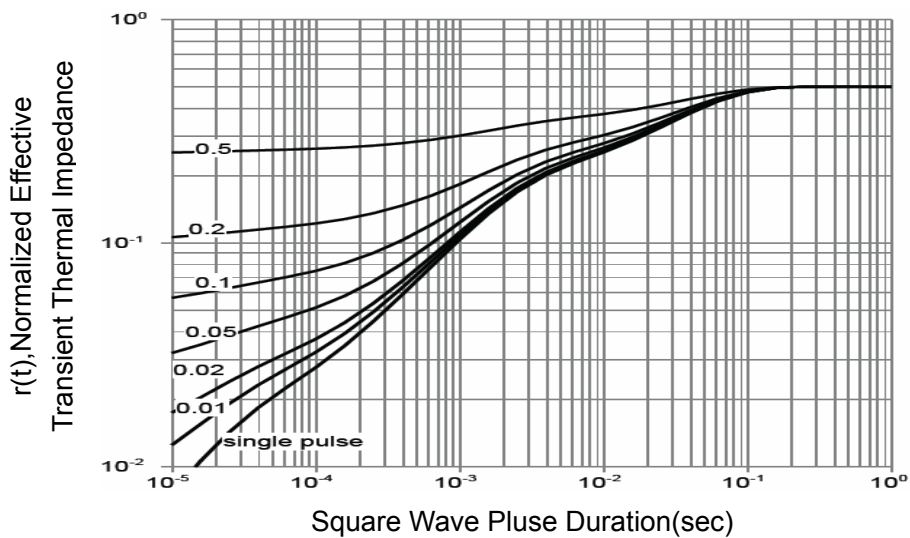
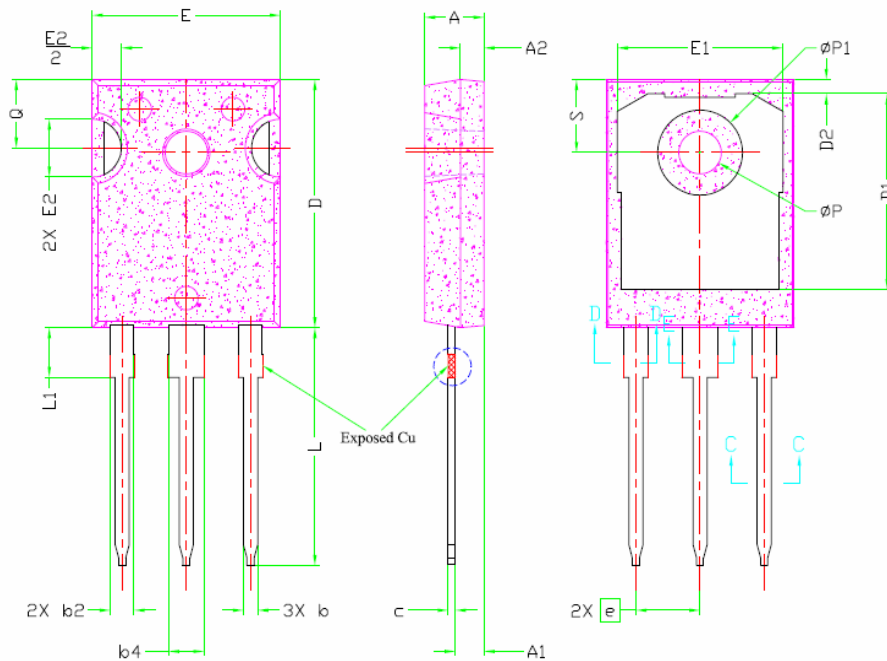


Figure 11 Normalized Maximum Transient Thermal Impedance

**TO-247 Package Information**


Symbol	Dimensions In Millimeters		
	Min.	Nom.	Max.
A	4.83	5.02	5.21
A1	2.29	2.41	2.55
A2	1.50	2.00	2.49
b	1.12	1.20	1.33
b1	1.12	1.20	1.28
b2	1.91	2.00	2.39
b3	1.91	2.00	2.34
b4	2.87	3.00	3.22
b5	2.87	3.00	3.18
c	0.55	0.60	0.69
c1	0.55	0.60	0.65
D	20.80	20.95	21.1
D1	16.25	16.55	17.65
D2	0.51	1.19	1.35
E	15.75	15.94	16.13
E1	13.46	14.02	14.16
E2	4.32	4.91	5.49
L	19.81	20.07	20.32
L1	4.10	4.19	4.40
Q	5.39	5.79	6.20
ΦP	3.56	3.61	3.65
S	6.04	6.17	6.30

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