

## N-Channel Enhancement Mode Power MOSFET

### General Description

The series of Power MOSFETs use advanced technology and design. This high voltage MOSFET fits Switched applications.

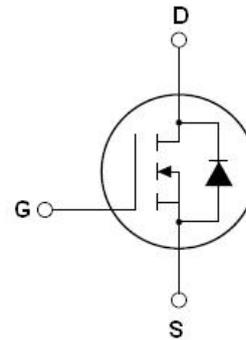
### Features

- High speed switching
- Intrinsic capacitances and Qg minimized
- 100% Avalanche Tested

### Application

- Switched applications

$V_{DS\ min@T_{jmax}}$	1850	V
$R_{DS(ON)TYP}$	6	$\Omega$
$I_D$	2.9	A
$Q_g$	33	nC



Schematic diagram

### Package Marking And Ordering Information

Device	Device Package	Marking
NCE3N170D	TO-263	NCE3N170D



TO-263

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

Parameter	Symbol	NCE3N170D	Unit
Drain-Source Voltage ( $V_{GS}=0V$ )	$V_{DS}$	1700	V
Gate-Source Voltage ( $V_{DS}=0V$ ) DC	$V_{GS}$	$\pm 30$	V
Continuous Drain Current at $T_c=25^\circ\text{C}$	$I_{D(DC)}$	2.9	A
Continuous Drain Current at $T_c=100^\circ\text{C}$	$I_{D(DC)}$	2.03	A
Pulsed drain current (Note 1)	$I_{DM(pluse)}$	8.7	A
Maximum Power Dissipation ( $T_c=25^\circ\text{C}$ )	$P_D$	187	W
Derate above $25^\circ\text{C}$		1.24	W/ $^\circ\text{C}$
Single pulse avalanche energy (Note 2)	$E_{AS}$	210	mJ
Single pulse avalanche current (Note 2)	$I_{AS}$	2.9	A
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55...+175	$^\circ\text{C}$

\* limited by maximum junction temperature

**Table 2. Thermal Characteristic**

Parameter	Symbol	NCE3N170D	Unit
Thermal Resistance, Junction-to-Case (Maximum)	$R_{thJC}$	0.8	$^{\circ}\text{C}/\text{W}$
Thermal Resistance, Junction-to-Ambient (Maximum)	$R_{thJA}$	50	$^{\circ}\text{C}/\text{W}$

**Table 3. Electrical Characteristics ( $T_J=25^{\circ}\text{C}$  unless otherwise noted)**

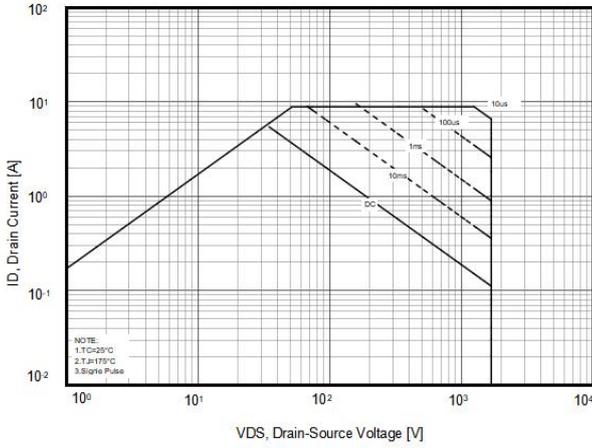
Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>On/off states</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=1\text{mA}$	1700			V
Zero Gate Voltage Drain Current( $T_c=25^{\circ}\text{C}$ )	$I_{DSS}$	$V_{DS}=1700V, V_{GS}=0V$			1	$\mu\text{A}$
Zero Gate Voltage Drain Current( $T_c=125^{\circ}\text{C}$ )	$I_{DSS}$	$V_{DS}=1700V, V_{GS}=0V$			100	$\mu\text{A}$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 30V, V_{DS}=0V$			$\pm 100$	nA
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu\text{A}$	3	4	5	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=1.45A$		6	8	$\Omega$
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{iss}$	$V_{DS}=40V, V_{GS}=0V,$ $F=1.0\text{MHz}$		1700		pF
Output Capacitance	$C_{oss}$			60		pF
Reverse Transfer Capacitance	$C_{rss}$			3.3		pF
Total Gate Charge	$Q_g$	$V_{DS}=1350V, I_D=1.45A,$ $V_{GS}=10V$		33		nC
Gate-Source Charge	$Q_{gs}$			7.7		nC
Gate-Drain Charge	$Q_{gd}$			14		nC
Intrinsic gate resistance	$R_G$	$f = 1 \text{ MHz open drain}$		2		$\Omega$
<b>Switching times</b>						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=850V, I_D=1.45A,$ $R_G=3\Omega, V_{GS}=10V$		22		nS
Turn-on Rise Time	$t_r$			8		nS
Turn-Off Delay Time	$t_{d(off)}$			48		nS
Turn-Off Fall Time	$t_f$			49		nS
<b>Source- Drain Diode Characteristics</b>						
Source-drain current(Body Diode)	$I_{SD}$	$T_C=25^{\circ}\text{C}$			2.9	A
Pulsed Source-drain current(Body Diode)	$I_{SDM}$				8.7	A
Forward On Voltage	$V_{SD}$	$T_J=25^{\circ}\text{C}, I_{SD}=2.9A, V_{GS}=0V$		0.8	1.1	V
Reverse Recovery Time	$t_{rr}$	$T_J=25^{\circ}\text{C}, I_F=2.9A,$ $di/dt=100A/\mu\text{s}$		1500		nS
Reverse Recovery Charge	$Q_{rr}$				5.6	$\mu\text{C}$
Peak Reverse Recovery Current	$I_{rrm}$				7.5	A

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

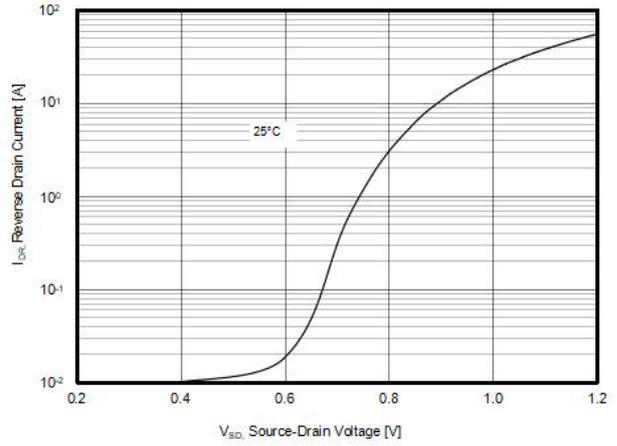
2.  $T_J=25^{\circ}\text{C}, V_{DD}=50V, V_G=10V, R_G=25\Omega$

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)

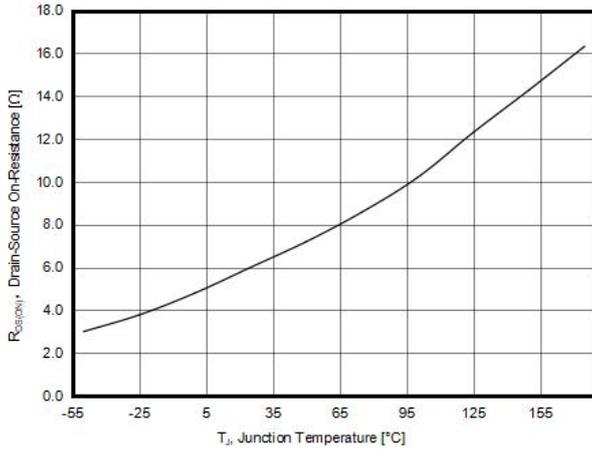
**Figure1. Safe operating area**



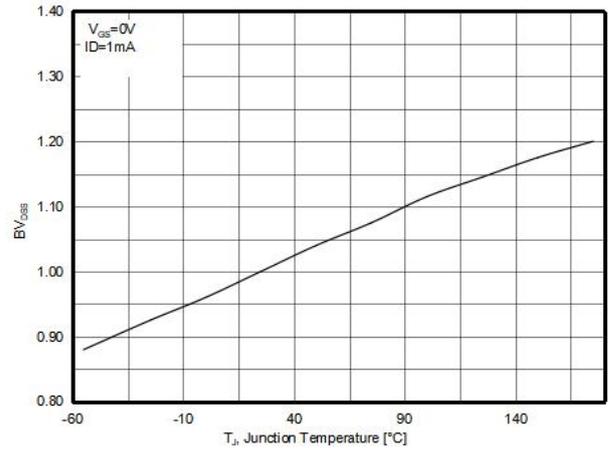
**Figure2. Source-Drain Diode Forward Voltage**



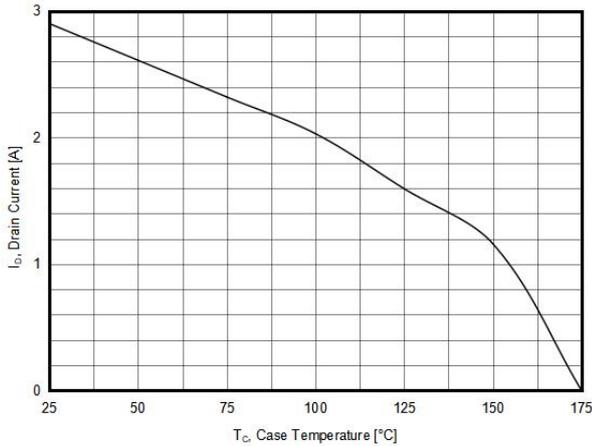
**Figure3. R<sub>DS(ON)</sub> vs Junction Temperature**



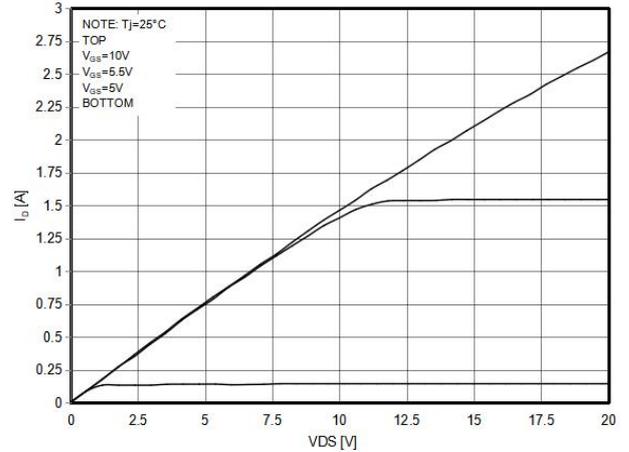
**Figure4. BV<sub>DSS</sub> vs Junction Temperature**



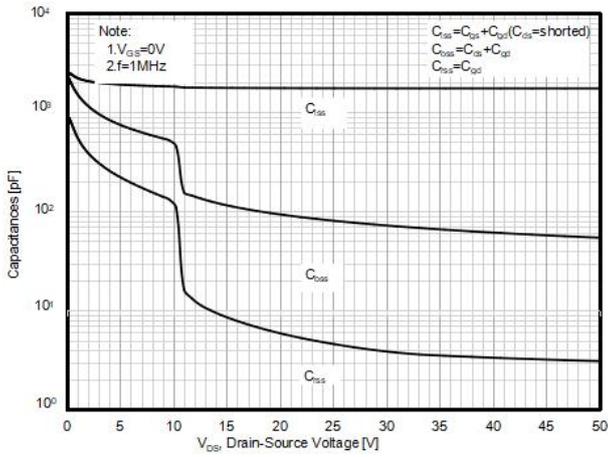
**Figure5. Maximum ID vs Junction Temperature**



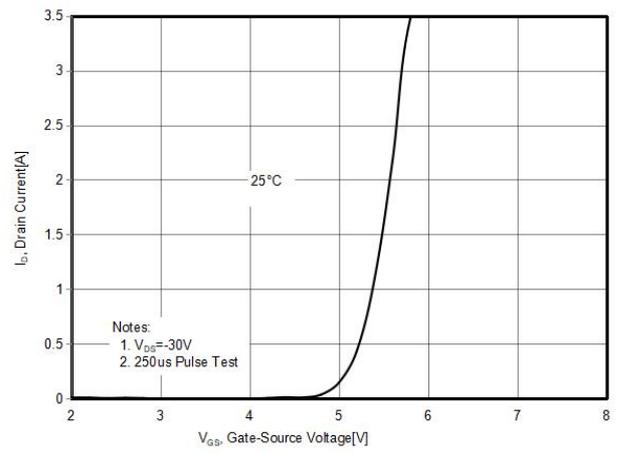
**Figure6. Output characteristics**



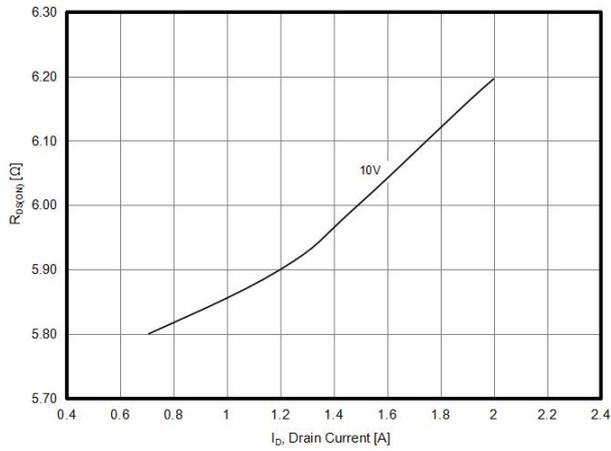
**Figure7. Capacitance**



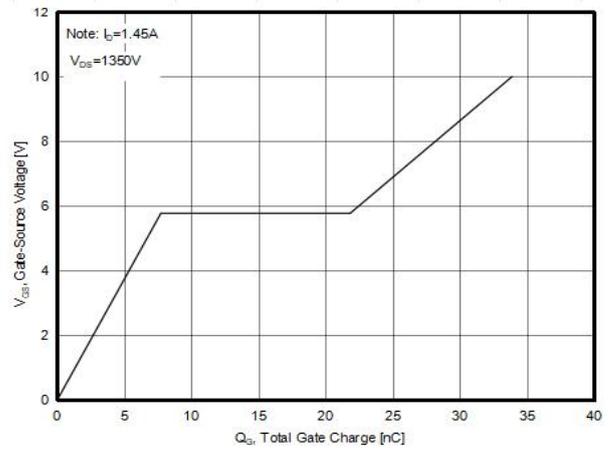
**Figure8. Transfer characteristics**



**Figure9. Static drain-source on resistance**

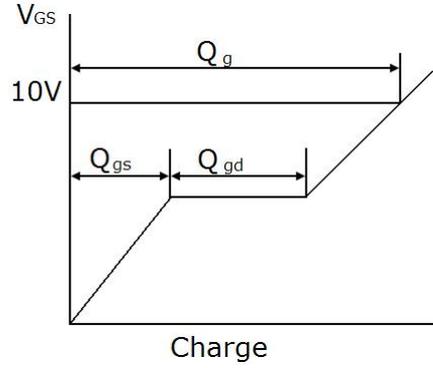
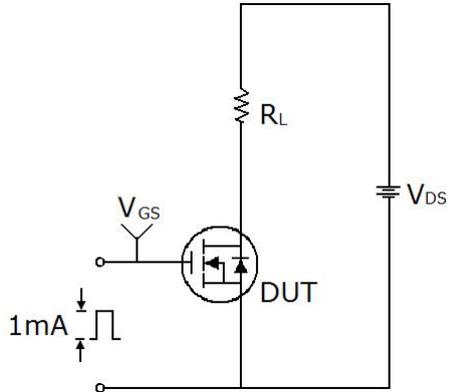


**Figure9. Gate charge waveforms**

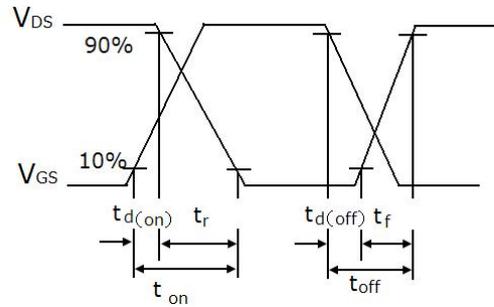
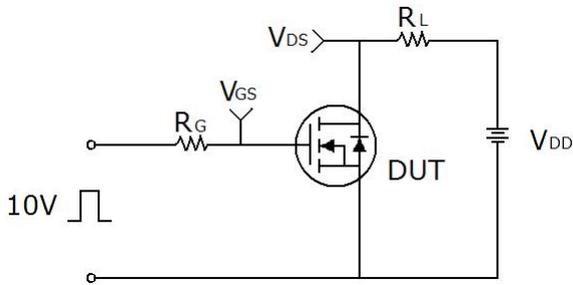


## Test circuit

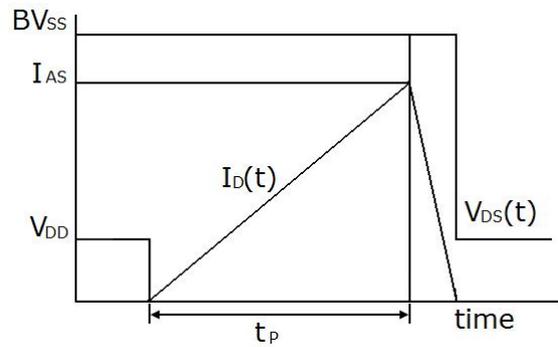
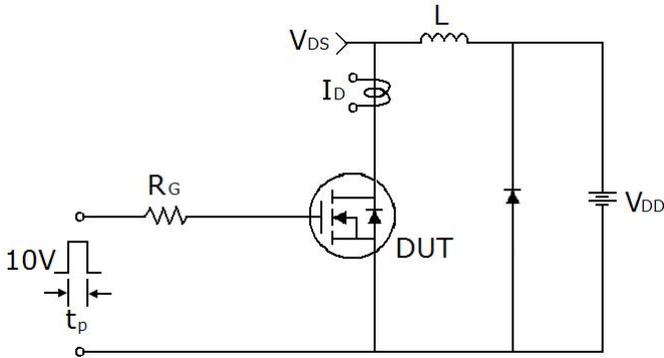
### 1) Gate charge test circuit & Waveform



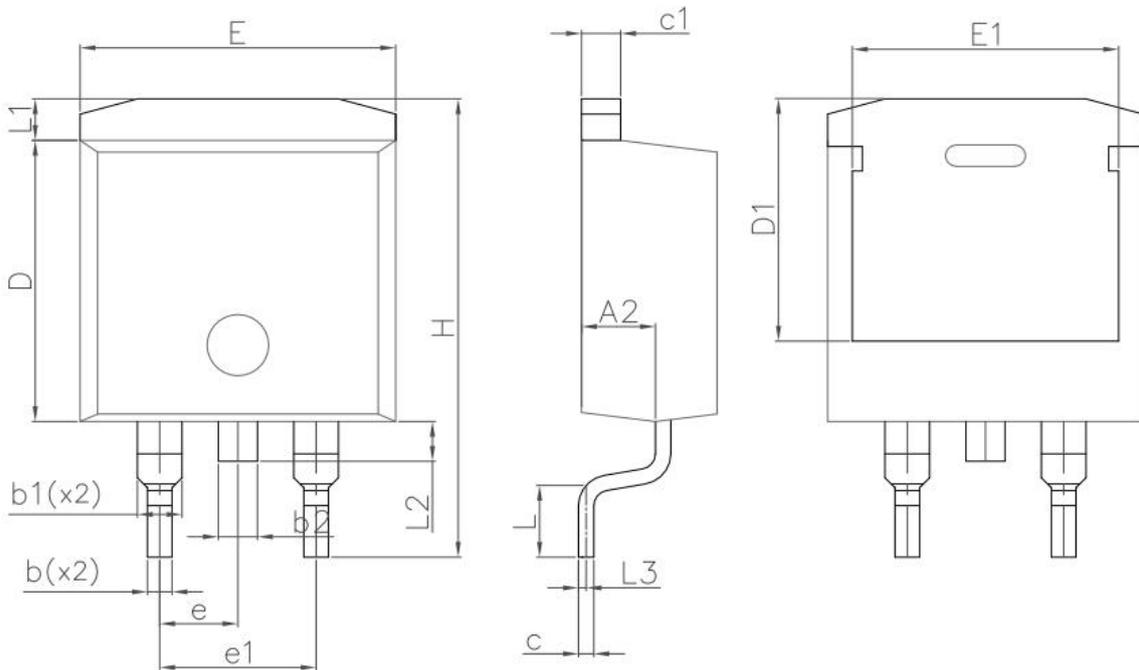
### 2) Switch Time Test Circuit:



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

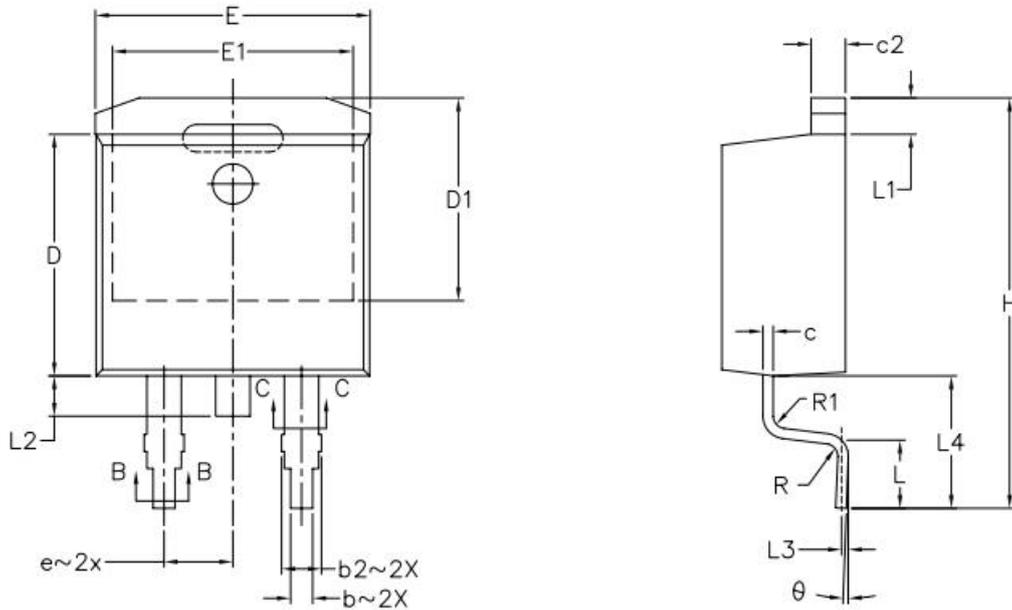


## TO-263-E Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.20	4.60	0.165	0.181
A2	2.20	2.60	0.087	0.102
b	0.70	0.90	0.028	0.035
b1	1.20	1.75	0.047	0.069
b2	1.17	1.37	0.046	0.054
c	0.40	0.60	0.016	0.024
c1	1.15	1.40	0.045	0.055
D	9.10	9.30	0.358	0.366
D1	7.63	8.23	0.300	0.324
E	10.05	10.45	0.396	0.411
E1	8.35	8.95	0.329	0.352
e	2.54BSC		0.100BSC	
e1	5.08BSC		0.200BSC	
H	14.61	15.88	0.575	0.625
L	1.78	2.79	0.070	0.110
L1	1.36REF		0.054REF	
L2	1.30REF		0.051REF	

## TO-263-J Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.06	4.83	0.160	0.190
A1	0.00	0.25	0.000	0.010
b	0.51	0.99	0.020	0.039
b1	0.51	0.89	0.020	0.035
b2	1.14	1.78	0.045	0.070
b3	1.14	1.73	0.045	0.068
c	0.38	0.74	0.015	0.029
c1	0.38	0.58	0.015	0.023
c2	1.14	1.65	0.045	0.065
D	8.38	9.65	0.330	0.380
D1	6.86		0.270	
E	9.65	10.00	0.380	0.394
E1	6.22		0.245	
e	2.54BSC		0.100BSC	
H	14.61	15.88	0.575	0.625
L	1.78	2.79	0.070	0.110
L1		1.68		0.066
L2		1.78		0.070
L3	0.25BSC		0.101BSC	
L4	4.78	5.28	0.188	0.208

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