

NCE N-Channel Super Trench II Power MOSFET

Description

The series of devices uses **Super Trench II** 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.

Application

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

General Features

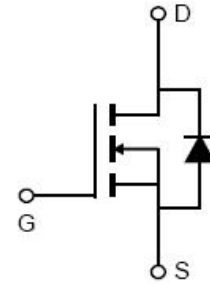
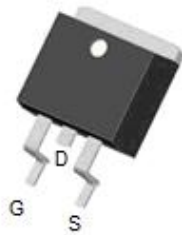
- $V_{DS} = 120V, I_D = 130A$
 $R_{DS(ON)} = 4.5m\Omega$, typical (TO-220) @ $V_{GS} = 10V$
 $R_{DS(ON)} = 4.3m\Omega$, typical (TO-263) @ $V_{GS} = 10V$
- Excellent gate charge x $R_{DS(on)}$ product(FOM)
- Very low on-resistance $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating

100% UIS TESTED!
100% ΔVds TESTED!

TO-220



TO-263



Schematic Diagram

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
NCEP050N12	NCEP050N12	TO-220	-	-	-
NCEP050N12D	NCEP050N12D	TO-263	-	-	-

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	120	V
Gate-Source Voltage	V_{GS}	± 20	V
Drain Current-Continuous	I_D	130	A
Drain Current-Continuous($T_c = 100^\circ C$)	$I_D(100^\circ C)$	93	A
Pulsed Drain Current	I_{DM}	520	A
Maximum Power Dissipation	P_D	220	W
Derating factor		1.47	W/ $^\circ C$
Single pulse avalanche energy (Note 1)	E_{AS}	1050	mJ
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 175	$^\circ C$

Thermal Characteristic

Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	0.68	$^{\circ}C/W$
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Electrical Characteristics ($T_C=25^{\circ}C$ unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit	
Off Characteristics							
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=250\mu A$	120		-	V	
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=120V, V_{GS}=0V$	-	-	1	μA	
Gate-Body Leakage Current	I_{GSS}	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	± 100	nA	
On Characteristics							
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2.0	3.0	4.0	V	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=65A$	TO-220	-	4.5	5.0	m Ω
			TO-263		4.3	5.0	m Ω
Forward Transconductance	g_{FS}	$V_{DS}=5V, I_D=65A$	85	-	-	S	
Dynamic Characteristics							
Input Capacitance	C_{iss}	$V_{DS}=60V, V_{GS}=0V,$ $F=1.0MHz$	-	6880	-	PF	
Output Capacitance	C_{oss}		-	450	-	PF	
Reverse Transfer Capacitance	C_{riss}		-	22	-	PF	
Switching Characteristics (Note 2)							
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=60V, I_D=65A$ $V_{GS}=10V, R_G=1.6\Omega$	-	20	-	nS	
Turn-on Rise Time	t_r		-	11.5	-	nS	
Turn-Off Delay Time	$t_{d(off)}$		-	48	-	nS	
Turn-Off Fall Time	t_f		-	10	-	nS	
Total Gate Charge	Q_g	$V_{DS}=60V, I_D=65A,$ $V_{GS}=10V$	-	112	-	nC	
Gate-Source Charge	Q_{gs}		-	36		nC	
Gate-Drain Charge	Q_{gd}		-	27		nC	
Drain-Source Diode Characteristics							
Diode Forward Voltage	V_{SD}	$V_{GS}=0V, I_S=65A$	-		1.2	V	
Diode Forward Current	I_S		-	-	130	A	
Reverse Recovery Time	t_{rr}	$T_J = 25^{\circ}C, I_F = I_S$ $di/dt = 100A/\mu s$	-	76	-	nS	
Reverse Recovery Charge	Q_{rr}		-	150	-	nC	

Notes:

1. EAS condition : $T_J=25^{\circ}C, V_{DD}=50V, V_G=10V, L=0.5mH, R_G=25\Omega$
2. Guaranteed by design, not subject to production
3. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink k, assuming a maximum junction temperature of $T_J(MAX)=175^{\circ}C$. The SOA curve provides a single pulse rating.

Typical Electrical and Thermal Characteristics

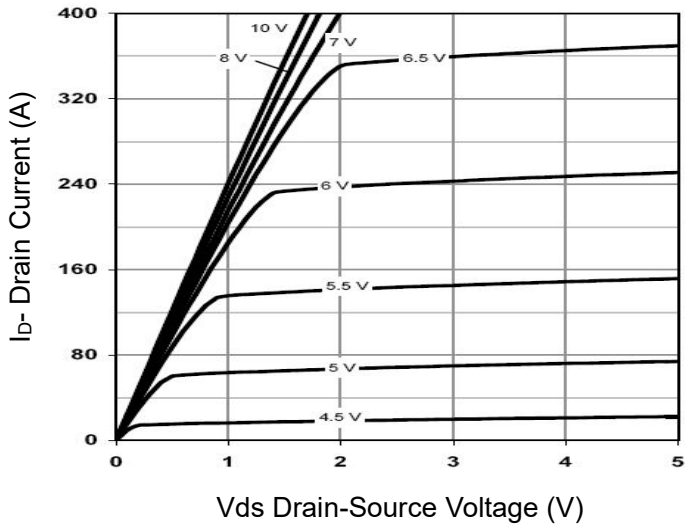


Figure 1 Output Characteristics

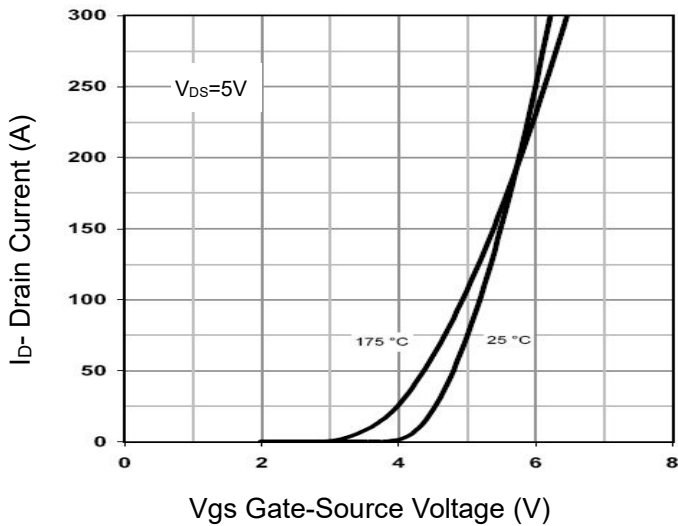


Figure 2 Transfer Characteristics

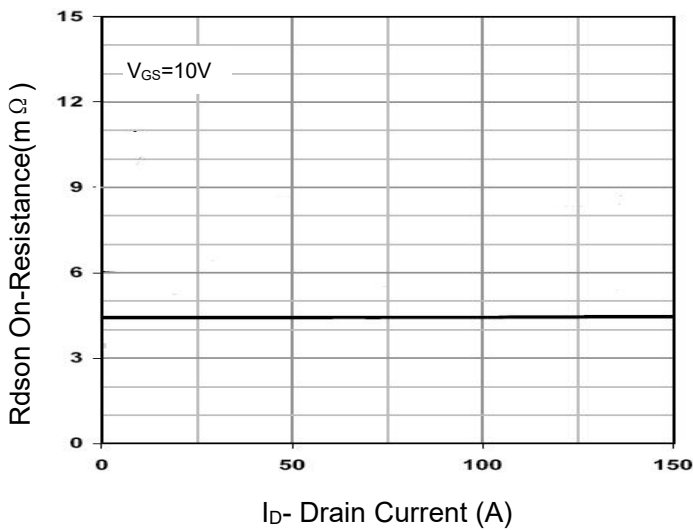


Figure 3 Rdson- Drain Current

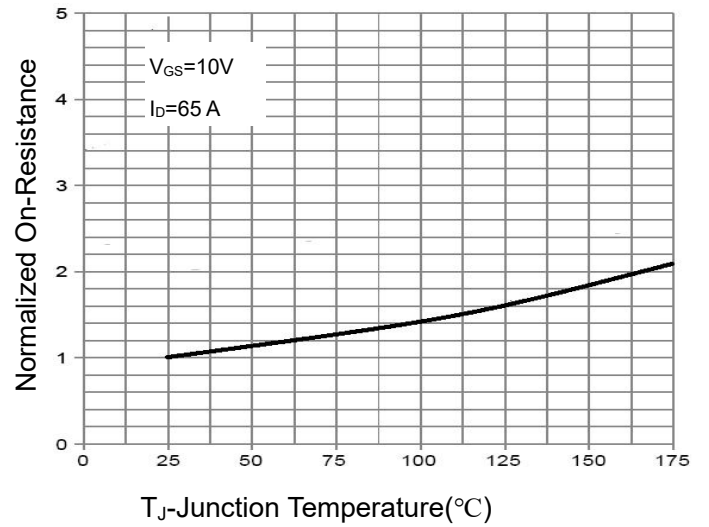


Figure 4 Rdson-Junction Temperature

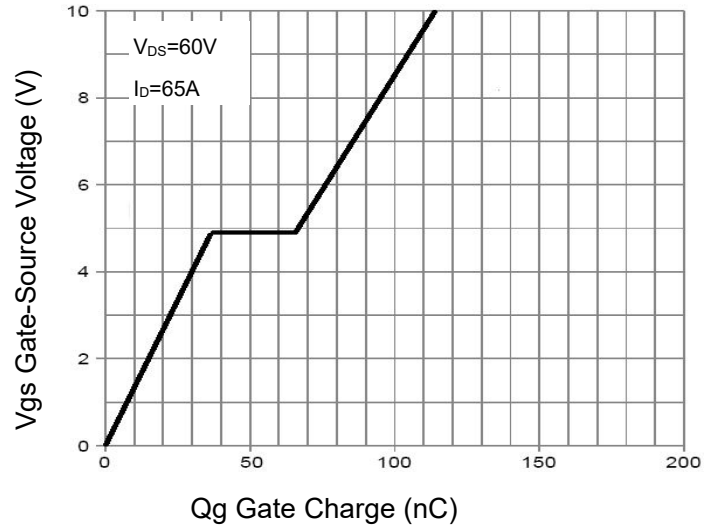


Figure 5 Gate Charge

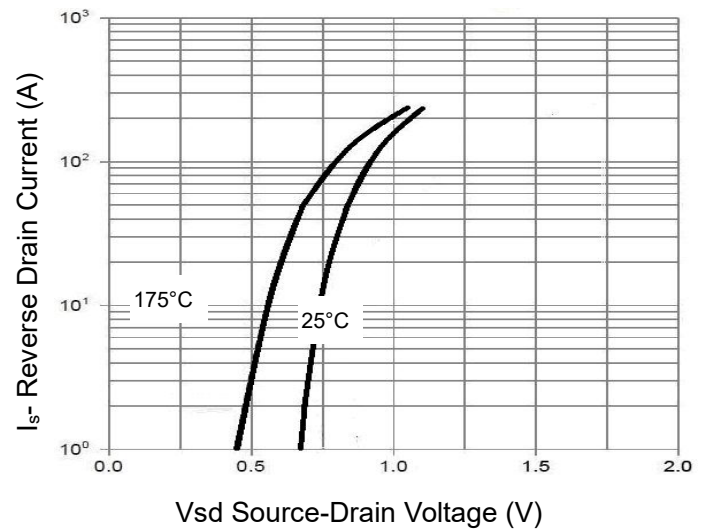
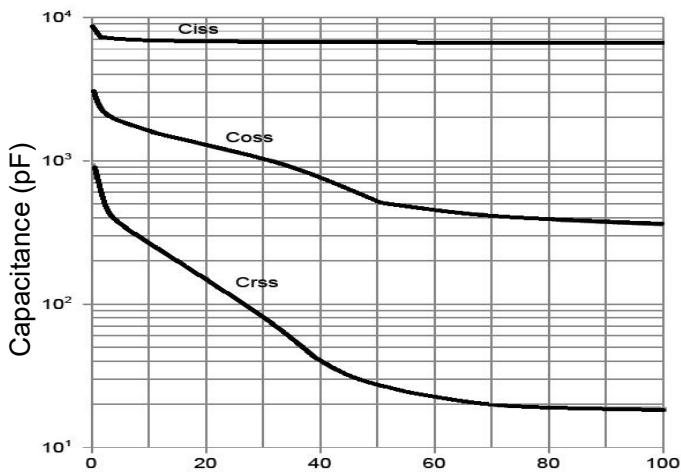
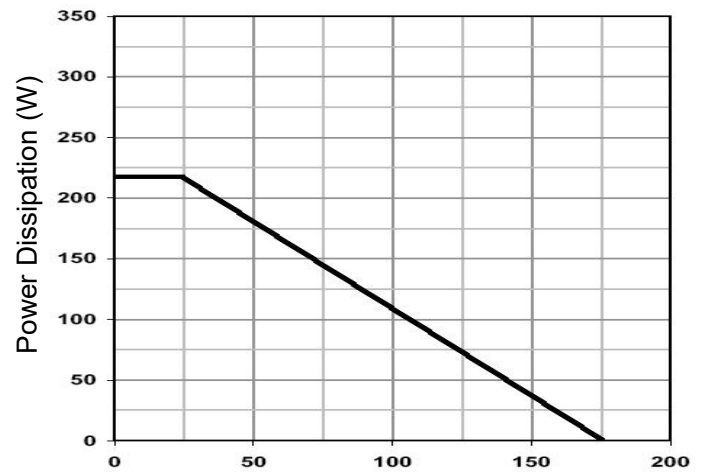


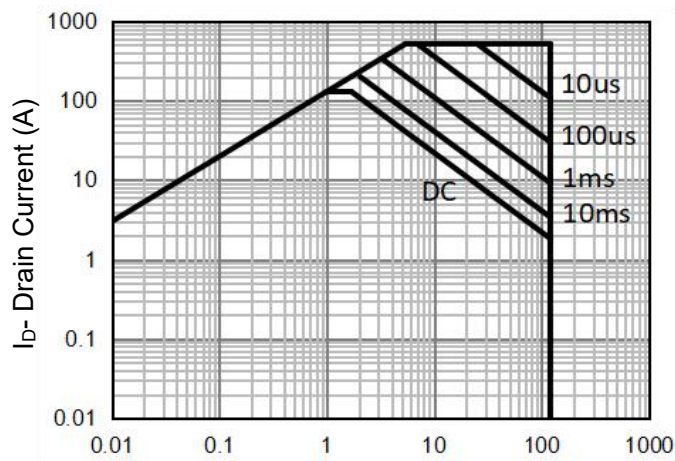
Figure 6 Source- Drain Diode Forward



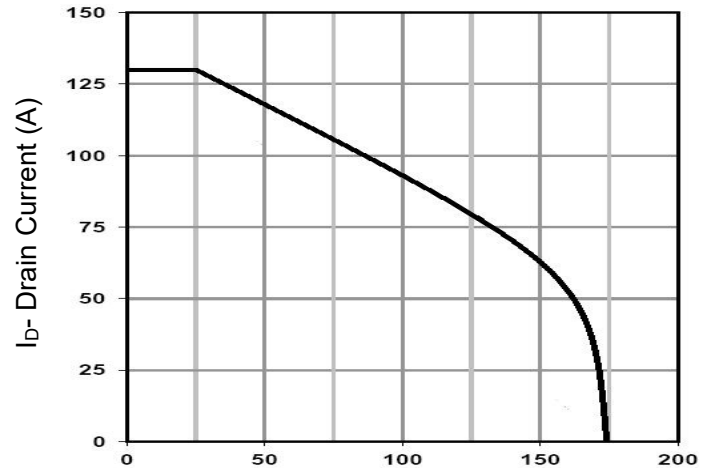
Vds Drain-Source Voltage (V)
Figure 7 Capacitance vs Vds



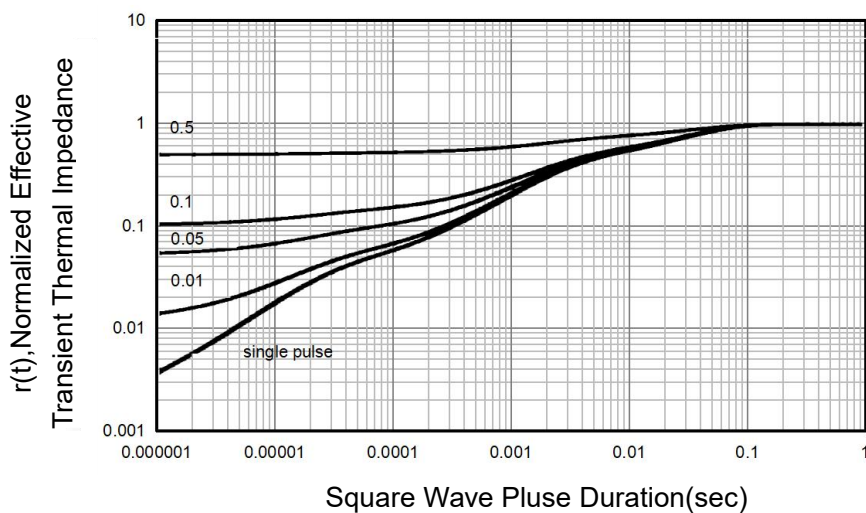
TA-Case Temperature(°C)
Figure 9 Power De-rating



Vds Drain-Source Voltage (V)
Figure 8 Safe Operation Area^(Note 3)

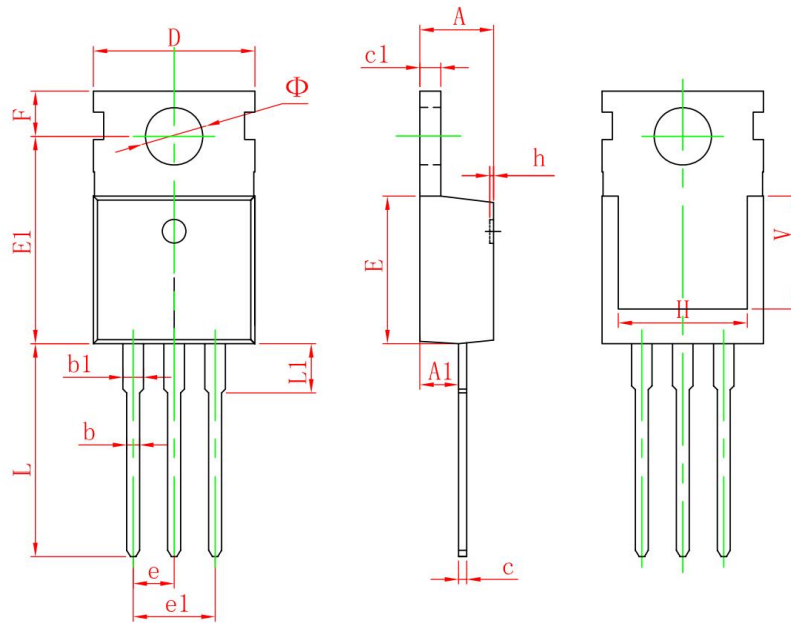


TA-Case Temperature (°C)
Figure 10 Current De-rating



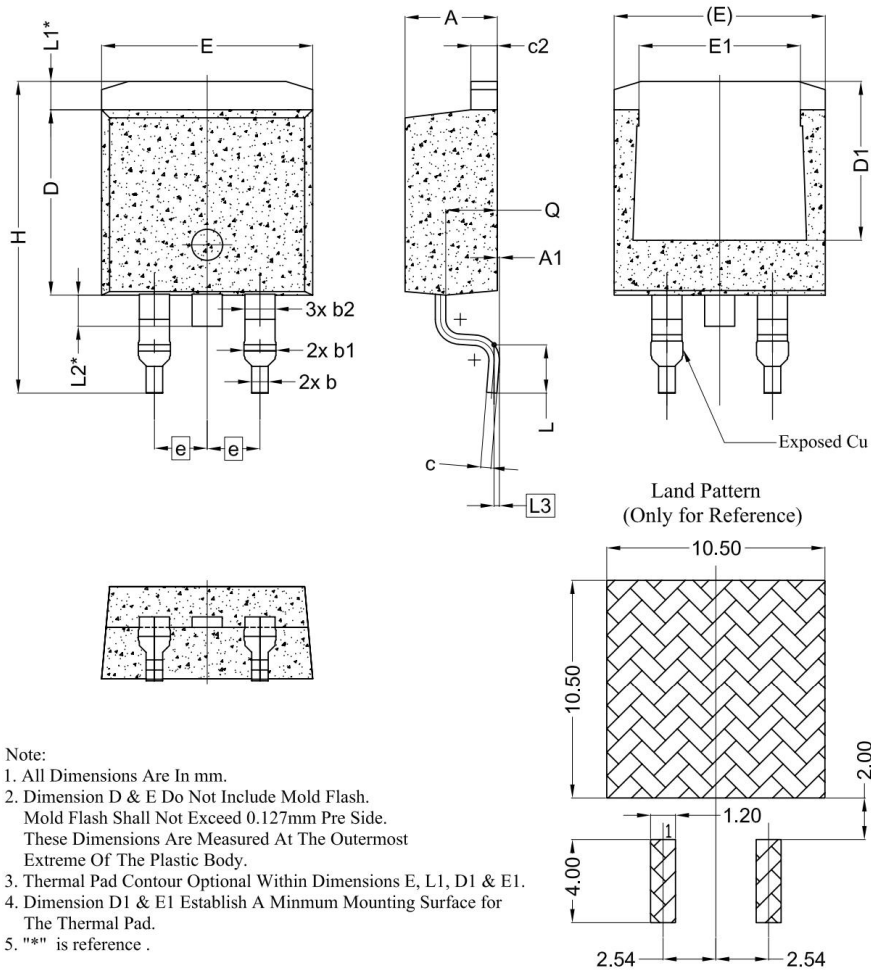
Square Wave Pluse Duration(sec)
Figure 11 Normalized Maximum Transient Thermal Impedance

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	8.950	9.750	0.352	0.384
E1	12.650	13.050	0.498	0.514
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	6.900 REF.		0.276 REF.	
Φ	3.400	3.800	0.134	0.150

TO-263-2L Package Information



- Note:
1. All Dimensions Are In mm.
 2. Dimension D & E Do Not Include Mold Flash.
Mold Flash Shall Not Exceed 0.127mm Pre Side.
These Dimensions Are Measured At The Outermost Extreme Of The Plastic Body.
 3. Thermal Pad Contour Optional Within Dimensions E, L1, D1 & E1.
 4. Dimension D1 & E1 Establish A Minmum Mounting Surface for The Thermal Pad.
 5. "*" is reference .

SYMBOL	DIMENSIONS		
	MIN.	NOM.	MAX.
A	4.24	4.44	4.64
A1	0.00	0.10	0.25
b	0.70	0.80	0.90
b1	1.20	1.55	1.75
b2	1.20	1.45	1.70
c	0.40	0.50	0.60
c2	1.15	1.27	1.40
D	8.82	8.92	9.02
D1	6.86	7.65	—
E	9.96	10.16	10.36
E1	6.89	7.77	7.89
e	2.54 BSC		
H	14.61	15.00	15.88
L	1.78	2.32	2.79
L1	1.36 REF.		
L2	1.50 REF.		
L3	0.25 BSC		
Q	2.30	2.48	2.70

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