

## NCE N-Channel Super Trench Power MOSFET

### Description

The VCRRP1545AK 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.

### Application

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

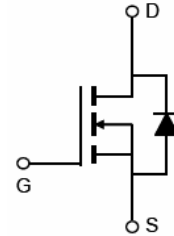
### General Features

- $V_{DS} = 150V, I_D = 45A$   
 $R_{DS(ON)} = 26m\Omega$  (typical) @  $V_{GS} = 10V$   
 $R_{DS(ON)} = 30m\Omega$  (typical) @  $V_{GS} = 4.5V$
- Excellent gate charge x  $R_{DS(on)}$  product(FOM)
- Very low on-resistance  $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating

**TO-252**



**Top View**



**Schematic Diagram**

### Package Marking and Ordering Information

Device Marking	Device	Device Package
VCRRP1545AK		TO-252-2L

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	150	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	45	A
Drain Current-Continuous( $T_C = 100^\circ C$ )	$I_D(100^\circ C)$	31.8	A
Pulsed Drain Current	$I_{DM}$	180	A
Maximum Power Dissipation	$P_D$	130	W
Derating factor		0.88	W/ $^\circ C$
Single pulse avalanche energy <sup>(Note 5)</sup>	$E_{AS}$	100	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 175	$^\circ C$

### Thermal Characteristic

Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup>	$R_{\theta JC}$	1.15	$^\circ C/W$
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### Electrical Characteristics ( $T_A=25^{\circ}\text{C}$ unless otherwise noted)

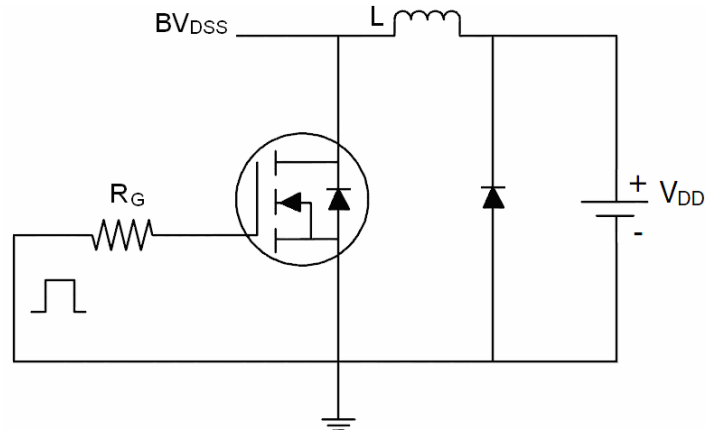
Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	150	-	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=150V, V_{GS}=0V$	-	-	1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
<b>On Characteristics</b> (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	1.2	1.7	2.5	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=20A$	-	26	35	m $\Omega$
		$V_{GS}=4.5V, I_D=20A$	-	30	45	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=5V, I_D=20A$	15	-	-	S
<b>Dynamic Characteristics</b> (Note 4)						
Input Capacitance	$C_{ISS}$	$V_{DS}=75V, V_{GS}=0V,$ $F=1.0MHz$	-	1935		PF
Output Capacitance	$C_{OSS}$		-	145		PF
Reverse Transfer Capacitance	$C_{RSS}$		-	11		PF
<b>Switching Characteristics</b> (Note 4)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=75V, R_L=7.5\Omega$ $V_{GS}=10V, R_G=3\Omega$	-	10	-	nS
Turn-on Rise Time	$t_r$		-	6.5	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	16	-	nS
Turn-Off Fall Time	$t_f$		-	7	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=75V, I_D=20A,$ $V_{GS}=10V$	-	33	-	nC
Gate-Source Charge	$Q_{gs}$		-	7.2	-	nC
Gate-Drain Charge	$Q_{gd}$		-	5.0	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage (Note 3)	$V_{SD}$	$V_{GS}=0V, I_S=20A$	-	-	1.2	V
Diode Forward Current (Note 2)	$I_S$		-	-	45	A
Reverse Recovery Time	$t_{rr}$	$T_J = 25^{\circ}\text{C}, I_F = I_S$ $di/dt = 100A/\mu s$ (Note 3)	-	30	-	nS
Reverse Recovery Charge	$Q_{rr}$		-	135	-	nC

#### Notes:

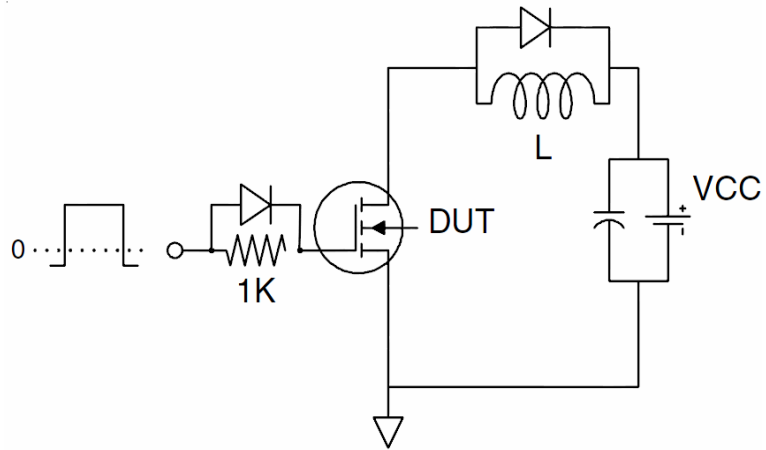
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS condition :  $T_J=25^{\circ}\text{C}, V_{DD}=75V, V_G=10V, L=0.5mH, R_g=25\Omega$

**Test Circuit**

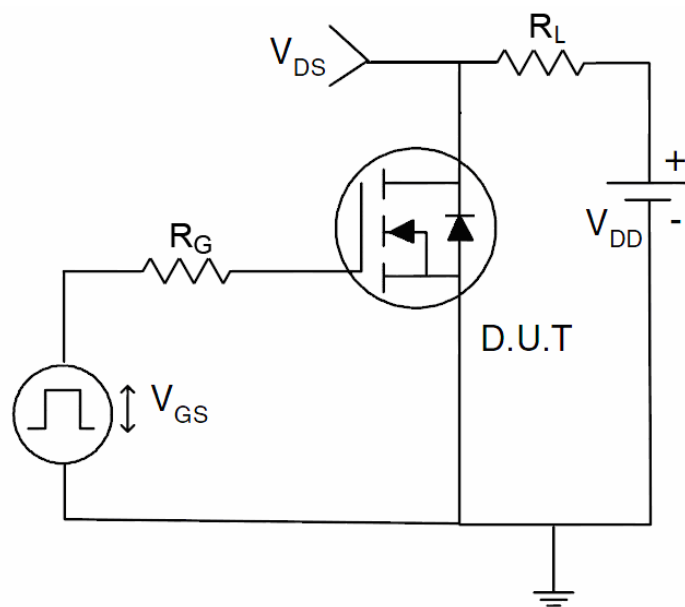
**1)  $E_{AS}$  test Circuit**



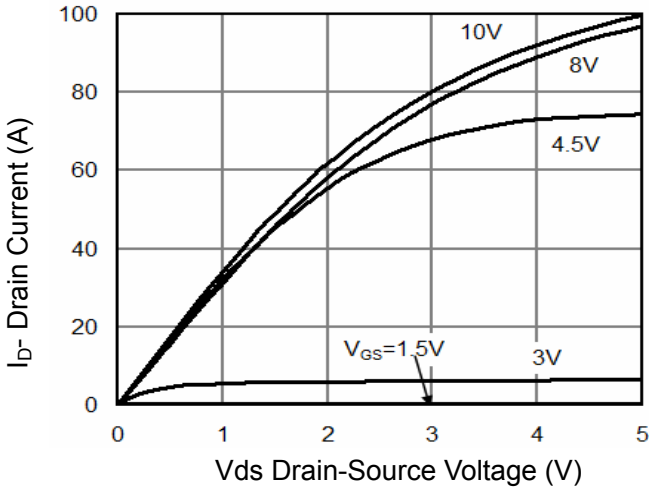
**2) Gate charge test Circuit**



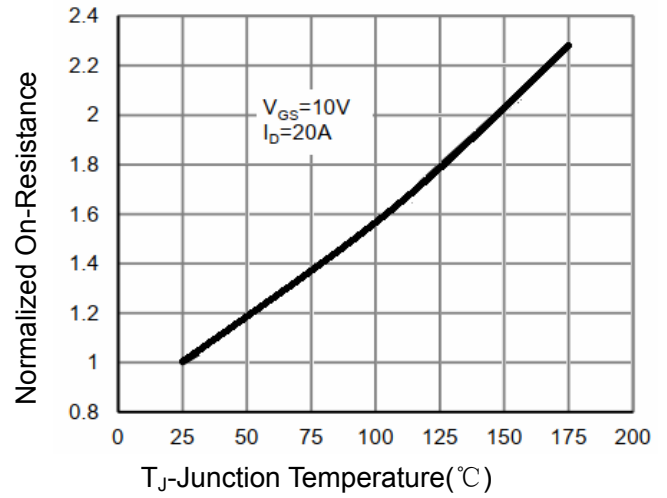
**3) Switch Time Test Circuit**



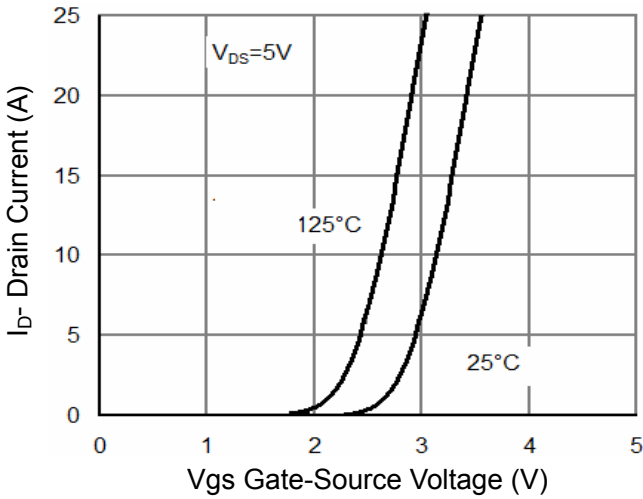
**Typical Electrical and Thermal Characteristics**



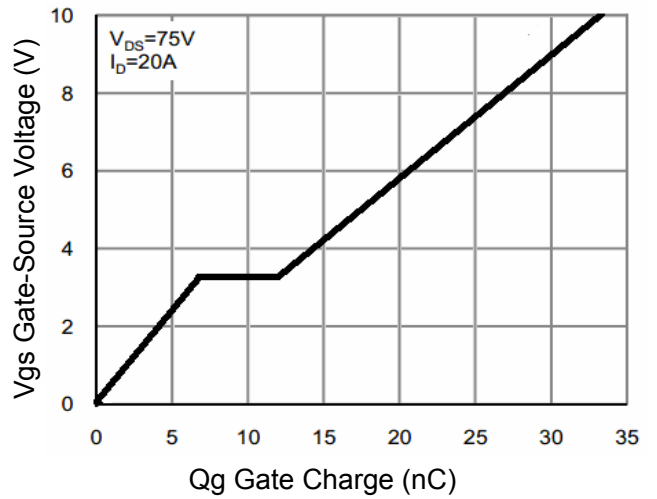
**Figure 1 Output Characteristics**



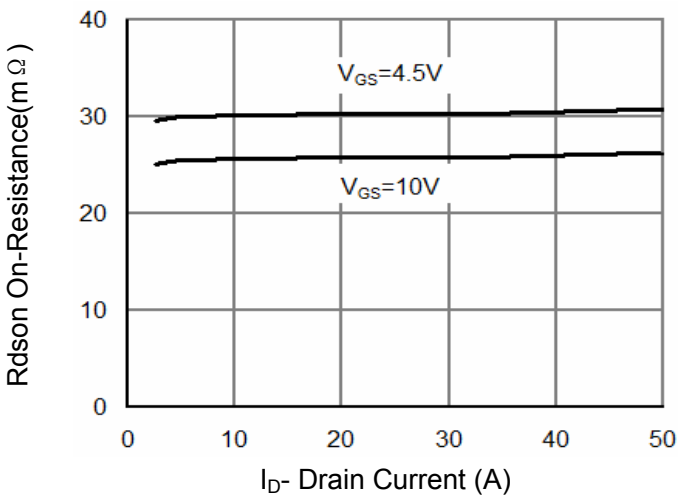
**Figure 4  $R_{dson}$ -Junction Temperature**



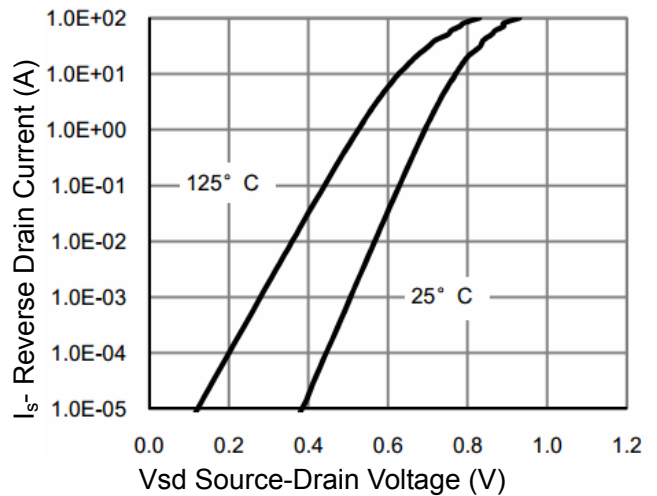
**Figure 2 Transfer Characteristics**



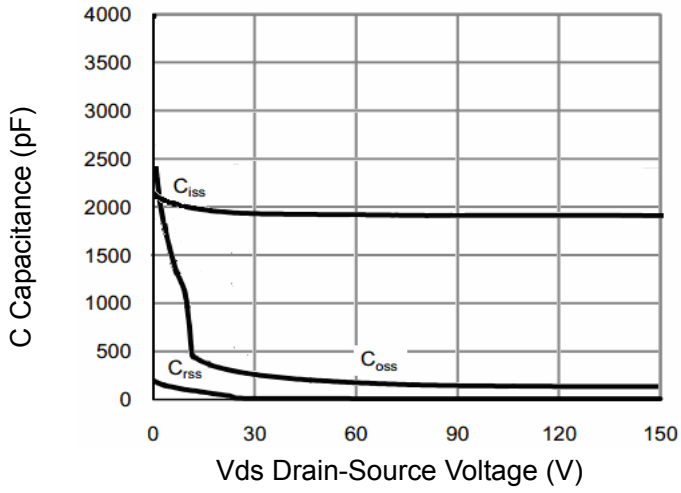
**Figure 5 Gate Charge**



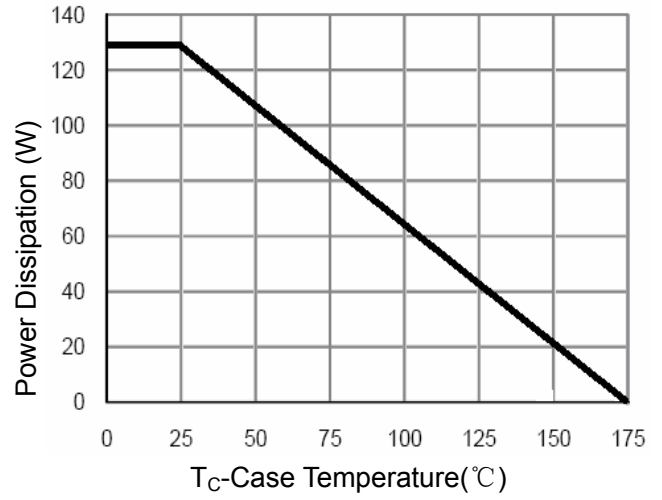
**Figure 3  $R_{dson}$ - Drain Current**



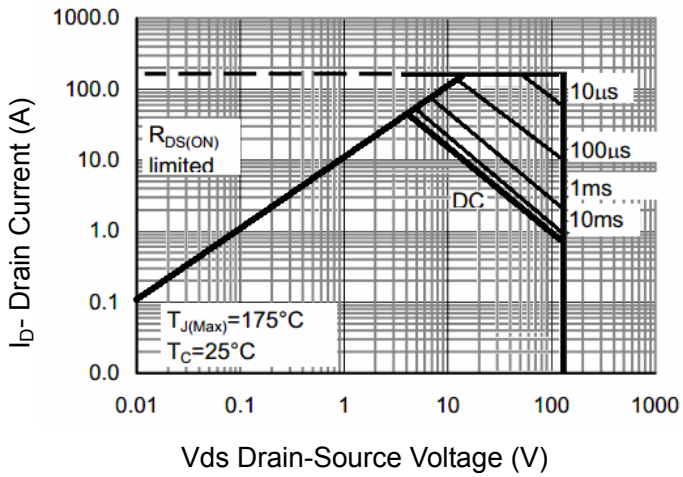
**Figure 6 Source- Drain Diode Forward**



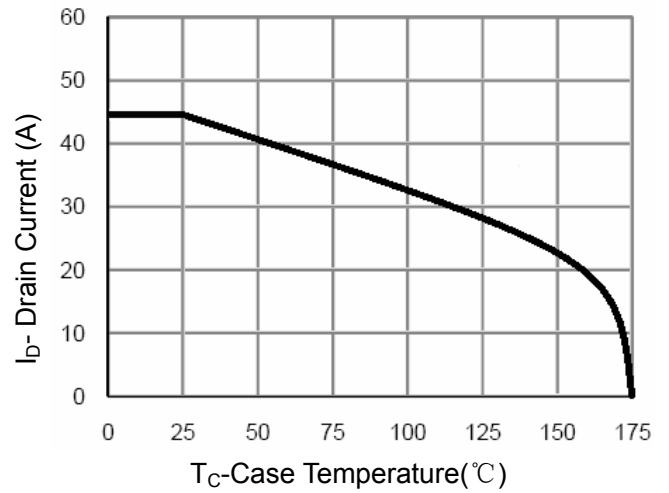
**Figure 7 Capacitance vs Vds**



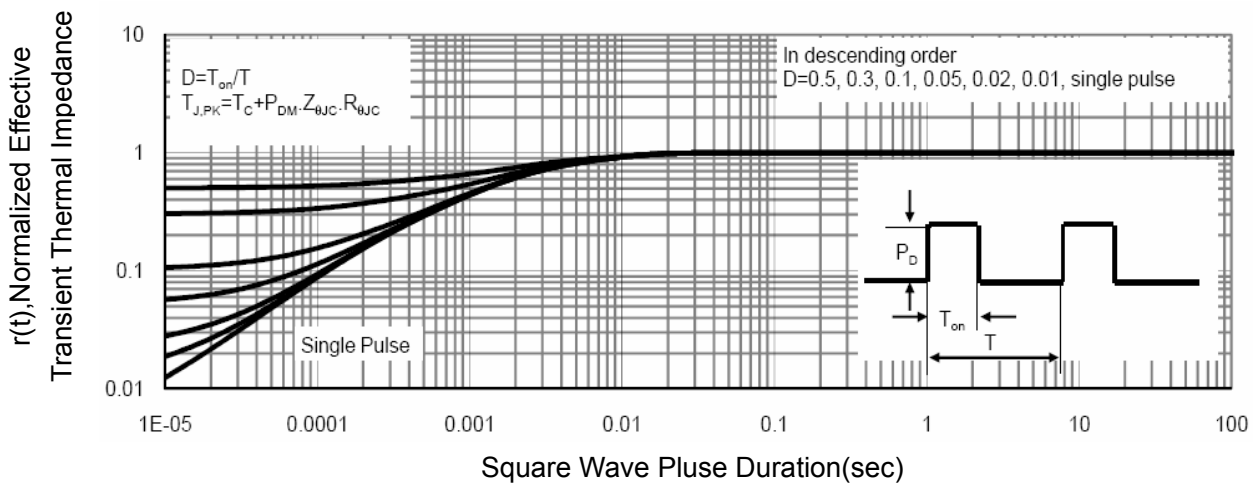
**Figure 9 Power De-rating**



**Figure 8 Safe Operation Area**

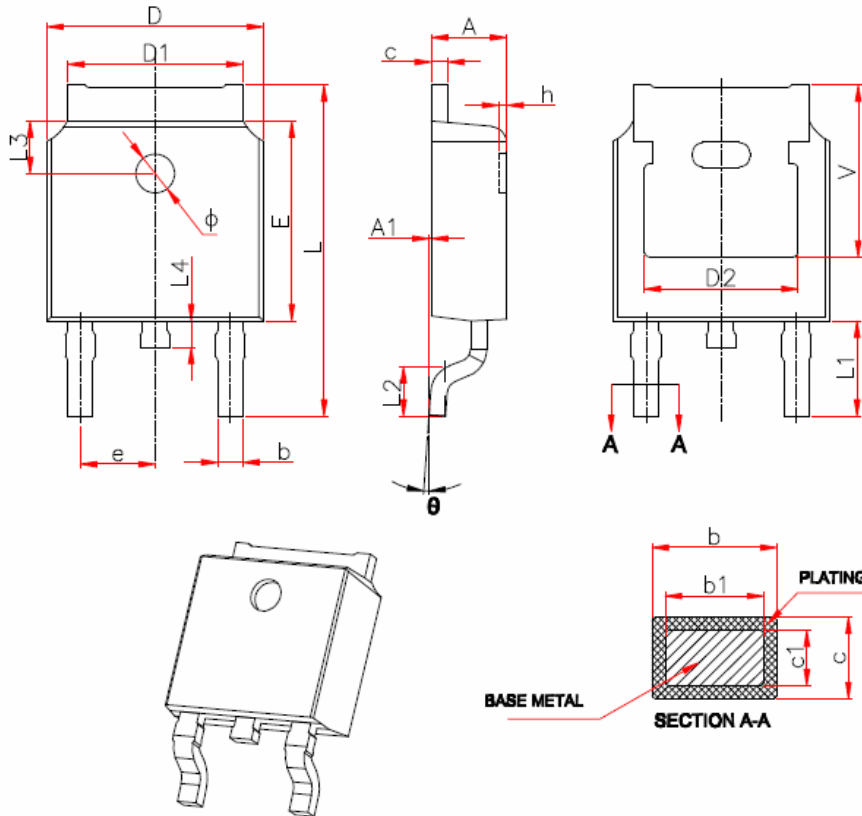


**Figure 10 Current De-rating**



**Figure 11 Normalized Maximum Transient Thermal Impedance**

## TO-252-2L Package Information



Symbol	Millimeters	
	Min.	Max.
A	2.20	2.40
A1	0.00	0.13
b	0.66	0.86
b1	0.73	0.79
c	0.46	0.58
c1	0.50	0.52
D	6.50	6.70
D1	5.10	5.46
D2	4.83 REF.	
E	6.00	6.20
e	2.19	2.39
L	9.80	10.40
L1	2.90 REF.	
L2	1.40	1.70
L3	1.60 REF.	
L4	0.60	1.00
Φ	1.10	1.30
θ	0°	8°

### **Attention**

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