

NCE Automotive P-Channel Super Trench Power MOSFET

Description

The NCEAP40PT15G 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

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

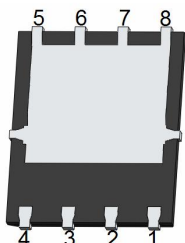
General Features

- $V_{DS} = -40V, I_D = -160A$
- $R_{DS(ON)} = 2.8m\Omega$ (typical) @ $V_{GS} = -10V$
- $R_{DS(ON)} = 3.9m\Omega$ (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
- 100% UIS tested
- 100% ΔV_d s tested
- **AEC-Q101 qualified**

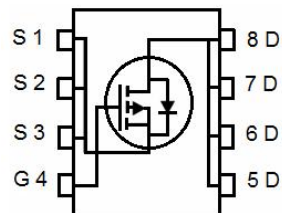
DFN 5X6



Top View



Bottom View



Schematic Diagram

Package Marking and Ordering Information

| Device Marking | Device | Device Package | Reel Size | Tape width | Quantity |
|----------------|--------------|----------------|-----------|------------|----------|
| AP40PT15G | NCEAP40PT15G | DFN5X6-8L | - | - | - |

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

| Parameter | Symbol | Limit | Unit |
|---|------------------------|------------|---------------|
| Drain-Source Voltage | V_{DS} | -40 | V |
| Gate-Source Voltage | V_{GS} | ± 20 | V |
| Drain Current-Continuous | I_D | -160 | A |
| Drain Current-Continuous($T_c=100^\circ C$) | $I_D(T_c=100^\circ C)$ | -113 | A |
| Pulsed Drain Current | I_{DM} | -640 | A |
| Maximum Power Dissipation($T_c=25^\circ C$) | P_D | 180 | W |
| Derating factor | | 1.2 | W/ $^\circ C$ |
| Single pulse avalanche energy ^(Note 1) | E_{AS} | 1076 | mJ |
| Operating Junction and Storage Temperature Range | T_J, T_{STG} | -55 To 175 | $^\circ C$ |

Thermal Characteristic

| | | | |
|--------------------------------------|-----------------|------|--------------|
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | 0.83 | $^\circ C/W$ |
|--------------------------------------|-----------------|------|--------------|

Electrical Characteristics (T_c=25°C unless otherwise noted)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|---------------------|--|------|-------|------|------|
| Off Characteristics | | | | | | |
| Drain-Source Breakdown Voltage | BV _{DSS} | V _{GS} =0V I _D =-250μA | -40 | - | - | V |
| Zero Gate Voltage Drain Current | I _{DSS} | V _{DS} =-40V, V _{GS} =0V | - | - | 1 | μA |
| Gate-Body Leakage Current | I _{GSS} | V _{GS} =±20V, V _{DS} =0V | - | - | ±100 | nA |
| On Characteristics | | | | | | |
| Gate Threshold Voltage | V _{GS(th)} | V _{DS} =V _{GS} , I _D =-250μA | -0.8 | -1.2 | -1.8 | V |
| Drain-Source On-State Resistance | R _{DS(ON)} | V _{GS} =-10V, I _D =-20A | - | 2.8 | 3.5 | mΩ |
| | | V _{GS} =-4.5V, I _D =-20A | - | 3.9 | 6.0 | mΩ |
| Gate resistance | R _G | F=1.0MHz | - | 5.5 | - | Ω |
| Forward Transconductance | g _{FS} | V _{DS} =-5V, I _D =-20A | - | 30 | - | S |
| Dynamic Characteristics | | | | | | |
| Input Capacitance | C _{iss} | V _{DS} =-20V, V _{GS} =0V, F=1.0MHz | - | 8940 | - | pF |
| Output Capacitance | C _{oss} | | - | 1900 | - | pF |
| Reverse Transfer Capacitance | C _{rss} | | - | 45 | - | pF |
| Switching Characteristics (Note 2) | | | | | | |
| Turn-on Delay Time | t _{d(on)} | V _{DD} =-20V, I _D =-20A V _{GS} =-10V, R _G =1.6Ω | - | 18 | - | nS |
| Turn-on Rise Time | t _r | | - | 13 | - | nS |
| Turn-Off Delay Time | t _{d(off)} | | - | 90 | - | nS |
| Turn-Off Fall Time | t _f | | - | 15 | - | nS |
| Total Gate Charge | Q _g | V _{DS} =-20V, I _D =-20A, V _{GS} =-10V | - | 104.4 | - | nC |
| Gate-Source Charge | Q _{gs} | | - | 20.8 | - | nC |
| Gate-Drain Charge | Q _{gd} | | - | 13.5 | - | nC |
| Drain-Source Diode Characteristics | | | | | | |
| Diode Forward Voltage | V _{SD} | V _{GS} =0V, I _S =-20A | - | - | -1.2 | V |
| Diode Forward Current | I _S | | - | - | -160 | A |
| Reverse Recovery Time | t _{rr} | T _J = 25°C, I _F = -20A | - | 35 | - | nS |
| Reverse Recovery Charge | Q _{rr} | di/dt = 100A/μs | - | 85 | - | nC |

Notes:

1. EAS condition : T_J=25°C, V_{DD}=-20V, V_G=-10V, L=0.5mH, R_G=25Ω
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, assuming a maximum junction temperature of T_J(MAX)=175°C. The SOA curve provides a single pulse rating.

Typical Electrical and Thermal Characteristics

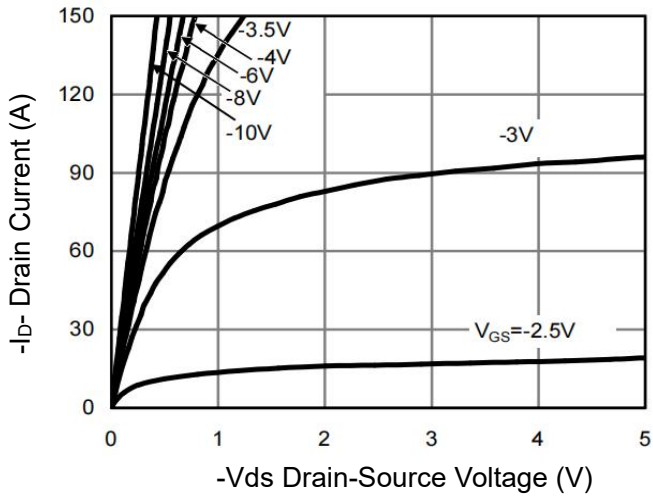


Figure 1 Output Characteristics

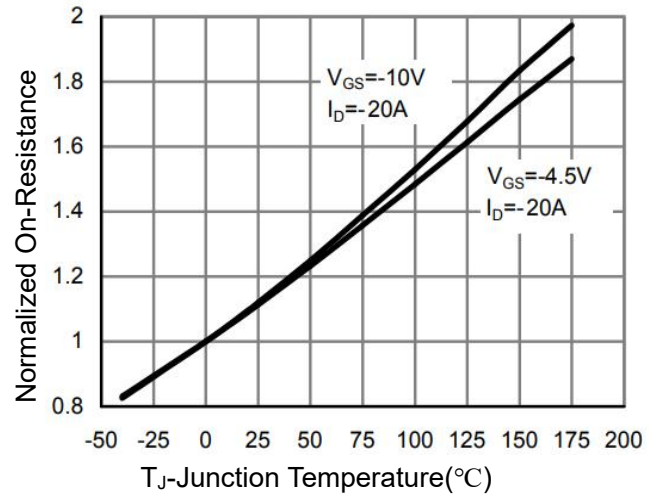


Figure 4 R_{dson} -Junction Temperature

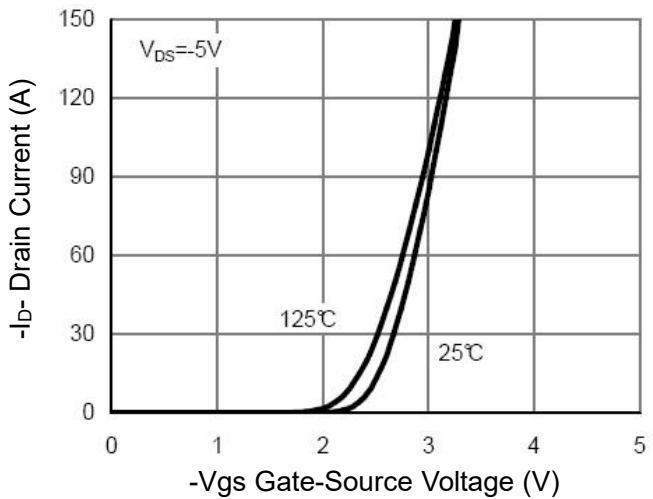


Figure 2 Transfer Characteristics

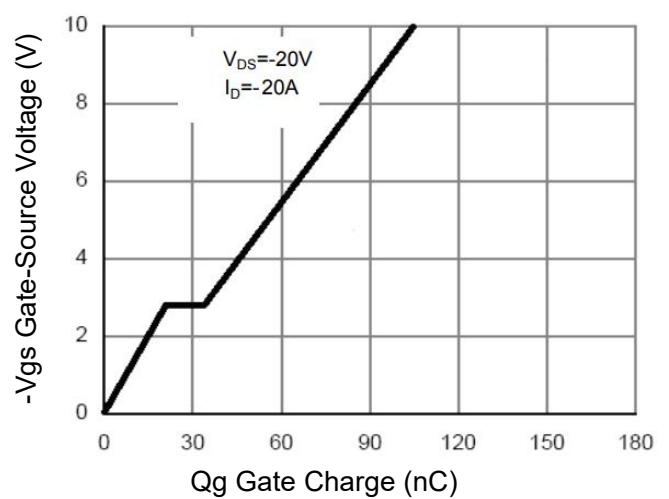


Figure 5 Gate Charge

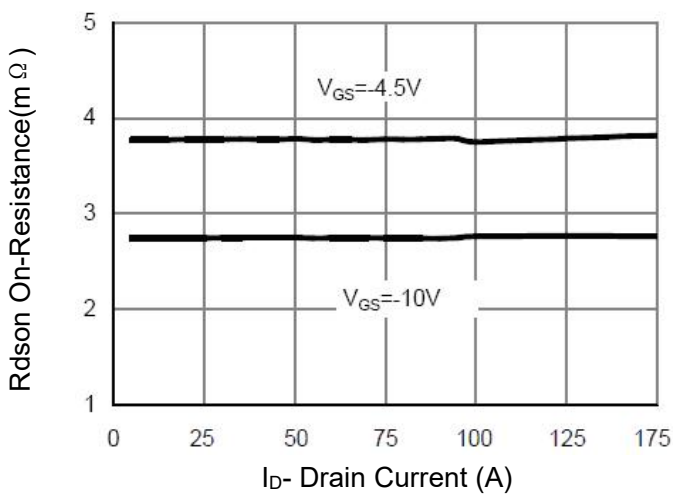


Figure 3 R_{dson} - Drain Current

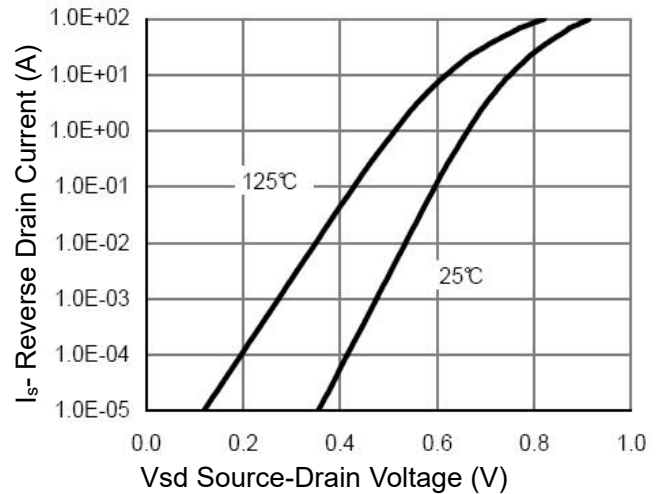


Figure 6 Source- Drain Diode Forward

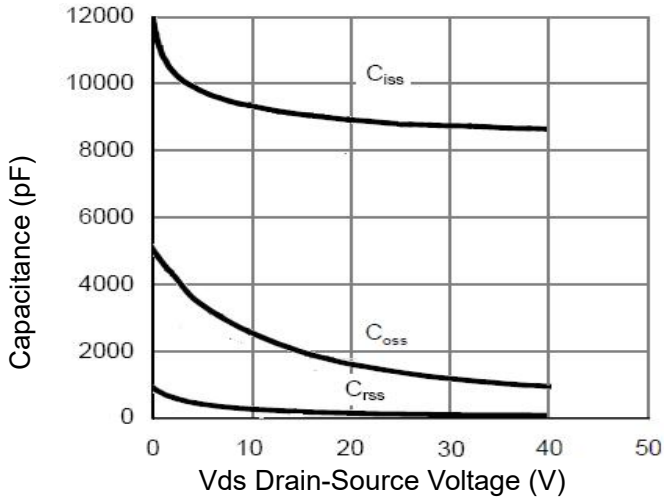


Figure 7 Capacitance vs Vds

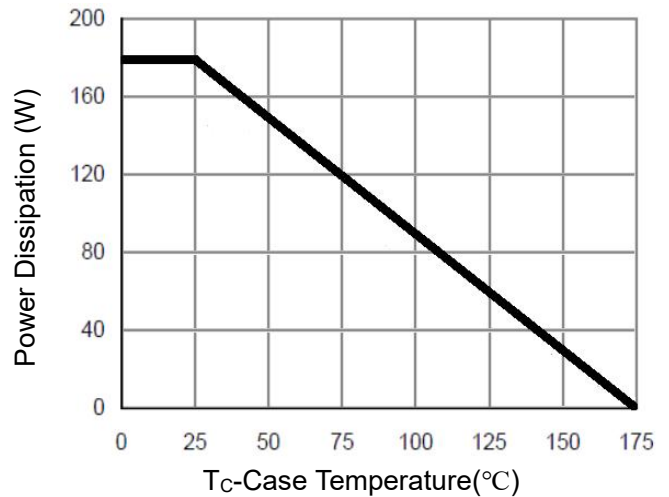


Figure 9 Power De-rating

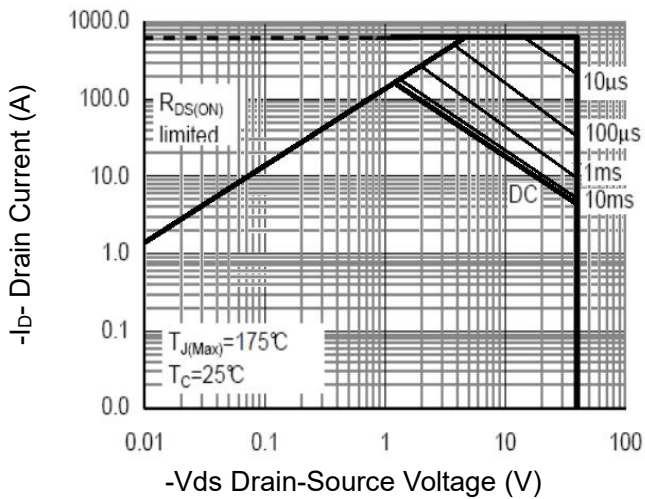


Figure 8 Safe Operation Area (Note3)

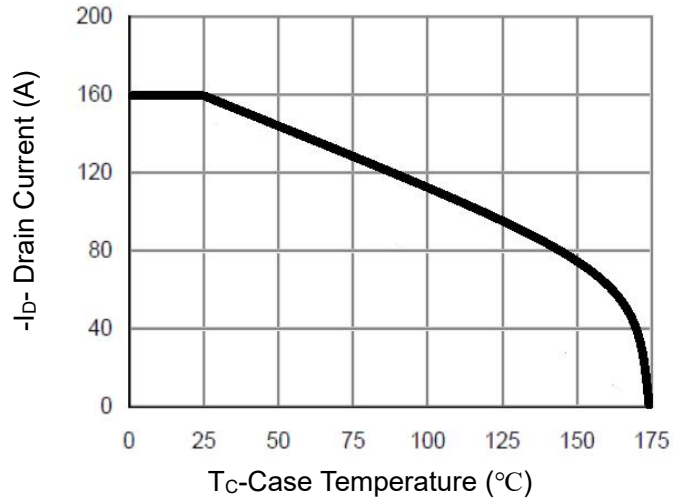


Figure 10 Current De-rating

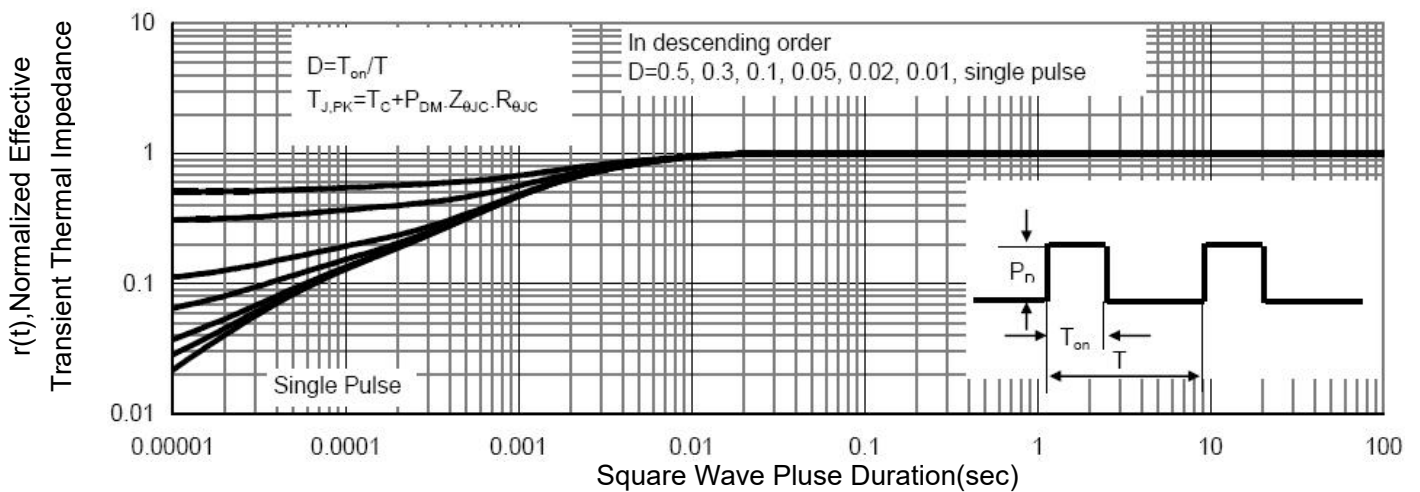
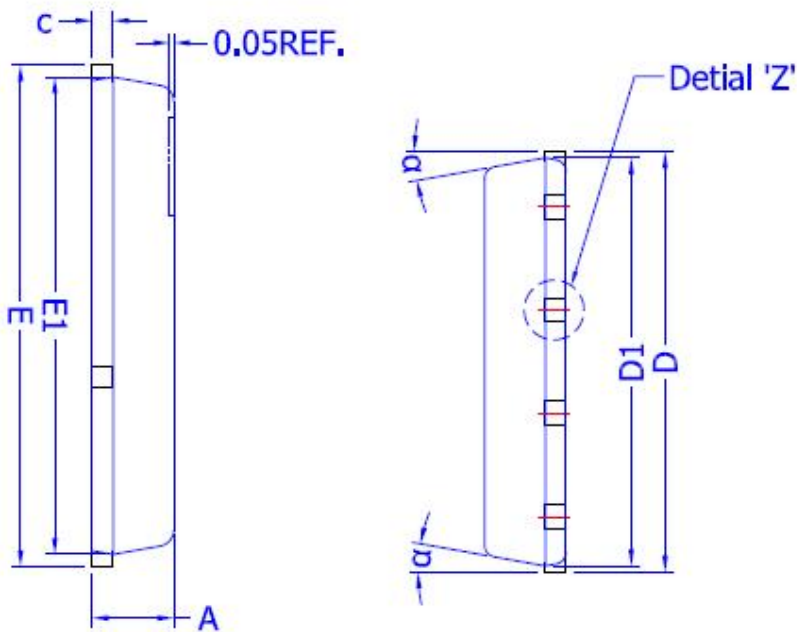
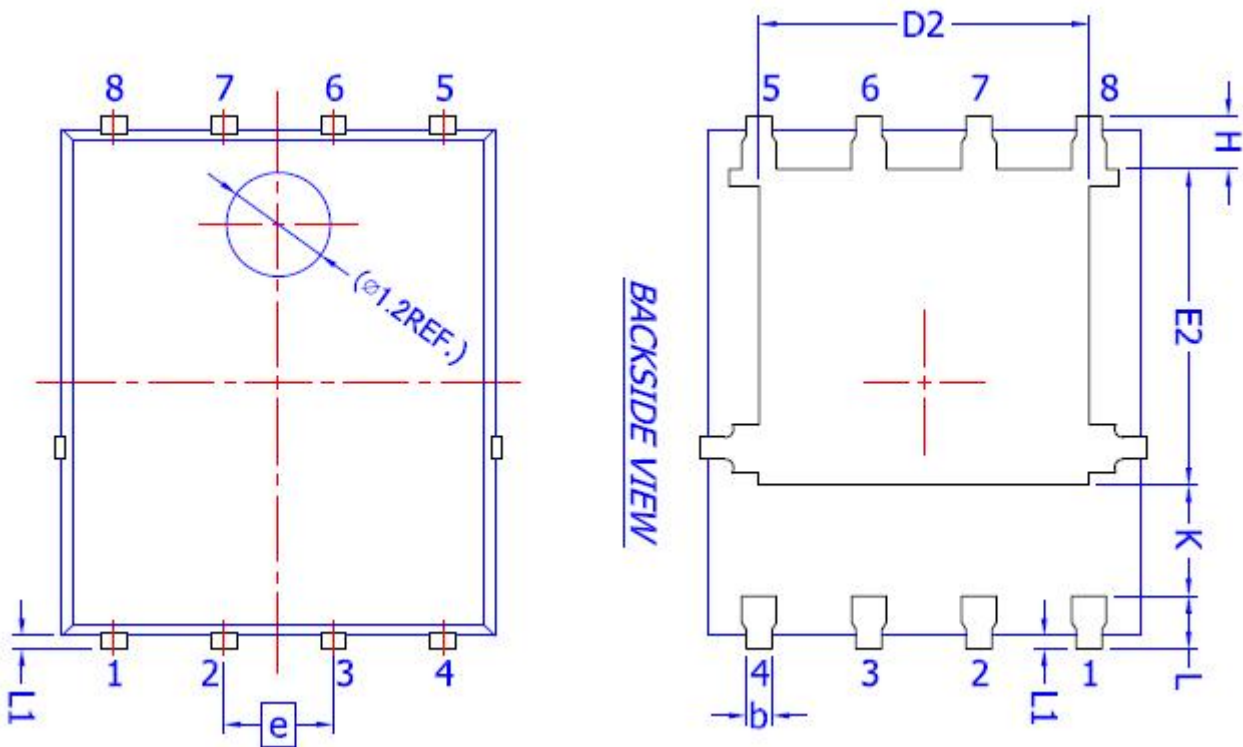


Figure 11 Normalized Maximum Transient Thermal Impedance

DFN5X6-8L Package Information



| DIM. | MILLIMETERS | | |
|------|-------------|------|------|
| | MIN. | NOM. | MAX. |
| A | 0.90 | 1.00 | 1.10 |
| A1 | 0 | - | 0.05 |
| b | 0.30 | 0.40 | 0.50 |
| c | 0.20 | 0.25 | 0.30 |
| D | 5.15 BSC | | |
| D1 | 5.00 BSC | | |
| D2 | 3.76 | 3.81 | 3.86 |
| E | 6.15 BSC | | |
| E1 | 5.80 | 5.85 | 5.90 |
| E2 | 3.45 | 3.65 | 3.85 |
| e | 1.27 BSC | | |
| H | 0.51 | 0.61 | 0.71 |
| K | 1.10 | - | - |
| L | 0.51 | 0.61 | 0.71 |
| L1 | 0.08 | 0.15 | 0.23 |
| α | 10° | 11° | 12° |

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