

### SFP-25GB-DW-C-15-I-N3-C

Alcatel-Lucent Nokia® Compatible TAA 10/25GBase-DWDM SFP28 Transceiver Dual-Rate 100GHz (SMF, Tunable, 15km, LC, DOM, -40 to 85C)

#### Features:

- SFF-8402 and SFF-8690 Compliant
- Duplex LC Connector
- 100GHz Channel Spacing
- Supports 9.8Gb/s to 25.78Gb/s
- Industrial Temperature -40 to 85 Celsius
- Single-mode Fiber
- Hot Pluggable
- Excellent ESD Protection
- Metal with Lower EMI
- RoHS Compliant and Lead Free



#### Applications:

- 25GBase
- Access, Metro and Enterprise

#### Product Description

This Alcatel-Lucent Nokia® SFP28 transceiver provides 10/25GBase-DWDM throughput up to 15km over single-mode fiber (SMF) using a tunable wavelength via an LC connector. It is guaranteed to be 100% compatible with the equivalent Alcatel-Lucent Nokia® transceiver. This easy to install, hot swappable transceiver has been programmed, uniquely serialized and data-traffic and application tested to ensure that it will initialize and perform identically. Digital optical monitoring (DOM) support is also present to allow access to real-time operating parameters. This transceiver is Trade Agreements Act (TAA) compliant. We stand behind the quality of our products and proudly offer a limited lifetime warranty.

ProLabs' transceivers are RoHS compliant and lead-free.

TAA refers to the Trade Agreements Act (19 U.S.C. & 2501-2581), which is intended to foster fair and open international trade. TAA requires that the U.S. Government may acquire only "U.S. – made or designated country end products."



## Regulatory Compliance

- ESD to the Electrical PINs: compatible with MIL-STD-883E Method 3015.4.
- ESD to the LC Receptacle: compatible with IEC 61000-4-3.
- EMI/EMC: compatible with FCC Part 15 Subpart B Rules, EN55022:2010.
- Laser Eye Safety: compatible with FDA 21CFR, EN60950-1& EN (IEC) 60825-1, 2.
- RoHS: compliant with EU RoHS 2.0 directive 2015/863/EU.

## DWDM Wavelength ITU Channels - 100 GHz Spacing

| ITU Channel | Center Wavelength (nm) | Frequency (THz) | ITU Channel | Center Wavelength (nm) | Frequency (THz) |
|-------------|------------------------|-----------------|-------------|------------------------|-----------------|
| 14          | 1566.31                | 191.4           | 38          | 1546.92                | 193.8           |
| 15          | 1565.50                | 191.5           | 39          | 1546.12                | 193.9           |
| 16          | 1564.68                | 191.6           | 40          | 1545.32                | 194.0           |
| 17          | 1563.86                | 191.7           | 41          | 1544.53                | 194.1           |
| 18          | 1563.05                | 191.8           | 42          | 1543.73                | 194.2           |
| 19          | 1562.23                | 191.9           | 43          | 1542.94                | 194.3           |
| 20          | 1561.42                | 192.0           | 44          | 1542.14                | 194.4           |
| 21          | 1560.61                | 192.1           | 45          | 1541.35                | 194.5           |
| 22          | 1559.79                | 192.2           | 46          | 1540.56                | 194.6           |
| 23          | 1558.98                | 192.3           | 47          | 1539.77                | 194.7           |
| 24          | 1558.17                | 192.4           | 48          | 1538.98                | 194.8           |
| 25          | 1557.36                | 192.5           | 49          | 1538.19                | 194.9           |
| 26          | 1556.55                | 192.6           | 50          | 1537.4                 | 195.0           |
| 27          | 1555.75                | 192.7           | 51          | 1536.61                | 195.1           |
| 28          | 1554.94                | 192.8           | 52          | 1535.82                | 195.2           |
| 29          | 1554.13                | 192.9           | 53          | 1535.04                | 195.3           |
| 30          | 1553.33                | 193.0           | 54          | 1534.25                | 195.4           |
| 31          | 1552.52                | 193.1           | 55          | 1533.47                | 195.5           |
| 32          | 1551.72                | 193.2           | 56          | 1532.68                | 195.6           |
| 33          | 1550.92                | 193.3           | 57          | 1531.9                 | 195.7           |
| 34          | 1550.12                | 193.4           | 58          | 1531.12                | 195.8           |
| 35          | 1549.32                | 193.5           | 59          | 1530.33                | 195.9           |
| 36          | 1548.51                | 193.6           | 60          | 1529.55                | 196.0           |
| 37          | 1547.72                | 193.7           | 61          | 1528.77                | 196.1           |

## Absolute Maximum Ratings

| Parameter                  | Symbol           | Min. | Typ. | Max.  | Unit | Notes   |
|----------------------------|------------------|------|------|-------|------|---------|
| Maximum Supply Voltage     | Vcc              | 0    |      | 4     | V    |         |
| Storage Temperature        | Tstg             | -40  |      | 85    | °C   |         |
| Operating Case Temperature | Tc               | -40  |      | 85    | °C   |         |
| Ambient Humidity           | RH               | 5    |      | 95    | %    | w/o dew |
| Data Rate                  | DR <sub>25</sub> | 24.3 |      | 25.78 | Gbps |         |
|                            | DR <sub>10</sub> | 9.8  | 10.3 | 12.5  | Gbps |         |
| Receiver Damage Threshold  | THd              | 3    |      |       | dBm  |         |

## Electrical Characteristics

| Parameter                     | Symbol            | Min.   | Typ. | Max.    | Unit    | Notes                  |                        |
|-------------------------------|-------------------|--------|------|---------|---------|------------------------|------------------------|
| Power Supply Voltage          | Vcc               | +3.135 | +3.3 | +3.465  | V       |                        |                        |
| Power Dissipation             | P <sub>DISS</sub> |        |      | 2.5     | W       | 1                      |                        |
| Power Supply Noise Tolerance  | PSNT              |        |      | 66      | mVp-p   | 2                      |                        |
| <b>Transmitter</b>            |                   |        |      |         |         |                        |                        |
| Data Rate                     | DR <sub>25</sub>  | 24.3   |      | 25.78   | Gbps    | RS1 High Logic         |                        |
|                               | DR <sub>10</sub>  | 9.8    | 10.3 | 12.5    | Gbps    | RS1 Low Logic          |                        |
| Differential Input Voltage    | VIN               | 190    |      | 700     | mV      | AC Coupled             |                        |
| Differential Input Impedance  | ZIN               | 90     | 100  | 110     | Ω       |                        |                        |
| Tx_Disable                    | Input_Low         | VIL    | -0.3 |         | 0.8     | V                      | 3                      |
|                               | Input_High        | VIH    | 2.0  |         | Vcc+0.3 | V                      | 3                      |
|                               | Assert Time       | tOFF   |      |         | 100     | us                     | High                   |
|                               | Negate Time       | tON    |      |         | 2.0     | ms                     | Low                    |
| Tx_Disable to Start Reset     | tReset            | 10     |      |         | us      | High                   |                        |
| Time to Initialize            | tInit             |        |      | 90      | s       | 4                      |                        |
| Tx_Fault                      | Output_Low        | VFOL   | -0.3 |         | 0.4     | V                      | LVTTTL - Low is Normal |
|                               | Output_High       | IFOH   | -50  |         | 37.5    | uA                     |                        |
| RS1 (Rate Select for Tx)      | VIL               | -0.3   |      | 0.8     | V       | Internally pulled down |                        |
|                               | VIH               | 2.0    |      | Vcc+0.3 | V       |                        |                        |
| <b>Receiver</b>               |                   |        |      |         |         |                        |                        |
| Data Rate                     | DR <sub>25</sub>  | 24.3   |      | 25.78   | Gbps    | RS0 High Logic         |                        |
|                               | DR <sub>10</sub>  | 9.8    | 10.3 | 12.5    | Gbps    | RS0 Low Logic          |                        |
| Differential Output Voltage   | VOUT              | 300    |      | 850     | mV      | AC Coupled             |                        |
| Differential Output Impedance | ZOUT              | 90     | 100  | 110     | Ω       |                        |                        |

|                                    |                       |               |      |  |         |    |                        |
|------------------------------------|-----------------------|---------------|------|--|---------|----|------------------------|
| <b>Rx_LOS<br/>(Loss of Signal)</b> | <b>Output_Low</b>     | $V_{LOS_L}$   | -0.3 |  | 0.4     | V  | LVTTL - Low is Normal  |
|                                    | <b>Output_High</b>    | $I_{LOS_H}$   | -50  |  | 37.5    | uA |                        |
|                                    | <b>Assert Time</b>    | $t_{LOS-ON}$  |      |  | 100     | us | High@S                 |
|                                    | <b>De-Assert Time</b> | $t_{LOS-OFF}$ |      |  | 100     | us | Low@S                  |
| <b>RS0 (Rate Select for Rx)</b>    |                       | VIL           | -0.3 |  | 0.8     | V  | Internally pulled down |
|                                    |                       | VIH           | 2    |  | Vcc+0.3 | V  |                        |

#### Notes:

1. Conditions: @3.3V and -40°C to 85°C.
2. From 10Hz to 10MHz.
3. LVTTL – “Low” at normal operation and “High” at shutdown (Poff).
4. Including reset of Tx\_Fault.

#### Optical Characteristics

| Parameter                     |                   | Symbol             | Min.  | Typ.        | Max.    | Unit  | Notes                      |
|-------------------------------|-------------------|--------------------|---|-------------|---------|-------|----------------------------|
| <b>Transmitter</b>            |                   |                    |   |             |         |       |                            |
| Average Launch Power          |                   | $P_{avg}$          | -1.0  |             | +3.0    | dBm   |                            |
| Optical Power Flatness        |                   | $\Delta PO$        | -1.0  |             | +1.0    | dB    | All Channels               |
| Transmitter Disabled Power    |                   | Poff               |   |             | -30     | dBm   | @Tx_Disable is High        |
| Optical Center Wavelength     |                   | $\lambda_C$        | 1528.77   |             | 1566.31 | nm    | 1                          |
| Optical Center Frequency      |                   |                    | 191.40  |             | 196.10  | THz   | 1                          |
| Center Wavelength Spacing     |                   |                    | 100   |             |         | GHz   | 1                          |
| Wavelength Stability          | Beginning of Life | $\lambda_{p\_BOL}$ | -1.7  | $\lambda_C$ | +1.7    | GHz   | 2                          |
|                               | End of Life       | $\lambda_{p\_EOL}$ | -2.5  | $\lambda_C$ | +2.5    | GHz   | 2                          |
| Wavelength Tuning Speed       |                   | $T_{TUNE}$         |   |             | 30      | ms    | 3                          |
| Spectral Width                |                   | $\sigma$           |   |             | 0.5     | nm    | @-20dB                     |
| Side-Mode Suppression Ratio   |                   | SMSR               | 30  |             |         | dB    |                            |
| Extinction Ratio              |                   | ER                 | 8.0   |             |         | dB    | PRBS 2 <sup>31</sup> -1    |
| Relative Intensity Noise      |                   | $RIN_{20OMA}$      |   |             | -130.0  | dB/Hz |                            |
| Optical Return Loss Tolerance |                   | ORLT               |   |             | 20.0    | dB    |                            |
| Transmitter Reflectance       |                   |                    |   |             | -26.0   | dB    |                            |
| Optical Eye Mask              |                   |                    | IEEE 802.3cc 114.6 25GBASE- LR/ER<br>{X1, X2, X3, Y1, Y2, Y3} =<br>{0.31, 0.40, 0.45, 0.34, 0.38, 0.40} |             |         |       | Hit ratio 5E <sup>-5</sup> |

| Receiver                                 |                             |                    |       |      |       |     |                      |
|--|-----------------------------|--------------------|-------|------|-------|-----|----------------------|
| Optical Sensitivity                      | 25.78Gbps or 24.33Gbps      | S1                 |       |      | -19.0 |     | 4                    |
|  | 10.7Gbps, 10.3Gbps, 9.8Gbps | S2                 |       |      | -19.0 |     | 5                    |
|  | 11.3 - 11.1Gbps             | S3                 |       |      | -19.0 |     | 6                    |
| Optical Overload                         |                             |                    | -4.0  |      |       | dBm | 7                    |
| Operating Wavelength                     |                             | $\lambda$          | 1525  |      | 1575  | nm  |                      |
| Rx_LOS (Loss of Signal)                  | Assert                      | LOSA               | -30.0 |      |       | dBm | Rx Squelch Activated |
|  | De-Assert                   | LOSD               |       |      | -23.0 | dBm |                      |
|  | Hysteresis                  | LOSH               | 0.5   |      | 5.0   | dB  |                      |
| Return Loss of Receiver                  |                             |                    |       |      | -26.0 | dB  |                      |
| Auxiliary Management and Control Channel |                             |                    |       |      |       |     |                      |
| Bit Rate                                 |                             | BR <sub>AMCC</sub> |       | 1200 |       | bps |                      |
| Modulation Depth                         |                             | AMCC <sub>MD</sub> | 5     |      | 10    | %   |                      |
| Dynamic Range                            |                             | DR <sub>AMCC</sub> | -4    |      | -24   | dBm | 8                    |

**Notes:**

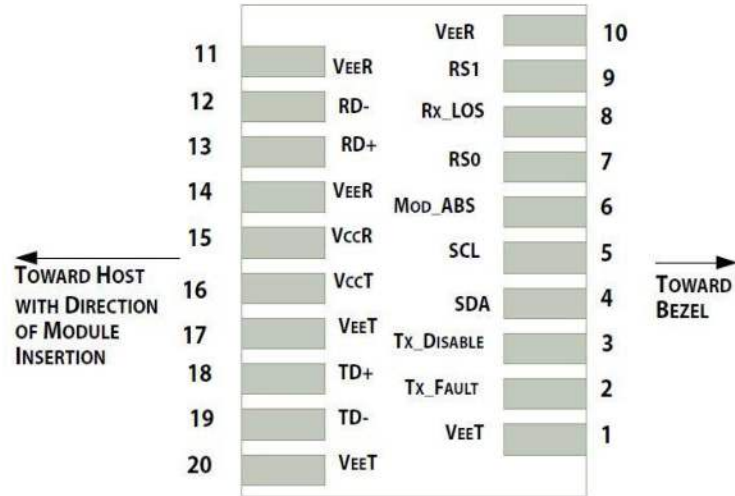
1. ITU-T 694.1 Grid Wavelength.
2.  $\lambda_C$  = ITU Grid Wavelength.
3. From any CH to any other CH. ASP Disable.
4. PRBS  $2^{31}$ , BER  $5 \times 10^{-5}$ , Source ER=8.0dB, SMF 15km, G.652.
5. PRBS  $2^{31}$ , BER  $5 \times 10^{-12}$ , Source ER=8.0dB, SMF 15km, G.652.
6. PRBS  $2^{31}$ , BER  $1 \times 10^{-4}$ , Source ER=8.0dB, SMF 15km, G.652.
7. PRBS  $2^{31}$ , Source ER=8.0dB.
8. AMCC<sub>MD</sub> : 5%, 1200bps.

## Pin Descriptions

| Pin | Symbol     | Name   | Ref. |
|-----|------------|--|------|
| 1   | VeeT       | Transmitter Ground.  | 1    |
| 2   | Tx_Fault   | Transmitter Fault Indication.  |      |
| 3   | Tx_Disable | Disables the transmitter or laser output.  | 2    |
| 4   | SDA        | 2-Wire Serial Interface Data.  | 2    |
| 5   | SCL        | 2-Wire Serial Interface Clock.   | 2    |
| 6   | Mod_ABS    | Indicates the module online state. This pin is connected to the VeeT or VeeR pin.  |      |
| 7   | RS0        | Selects a rate for the module. This pin is connected to the 33k $\Omega$ resistor. |      |
| 8   | LOS        | Indicates a loss of received signals.  | 2    |
| 9   | RS1        | Selects a rate for the module. This pin is connected to the 33k $\Omega$ resistor. |      |
| 10  | VeeR       | Receiver Ground.   | 1    |
| 11  | VeeR       | Receiver Ground 1.   | 1    |
| 12  | RD-        | Inverse Received Data Output.  |      |
| 13  | RD+        | Received Data Output.  |      |
| 14  | VeeR       | Receiver Ground.   | 1    |
| 15  | VccR       | +3.3V Receiver Power.  | 1    |
| 16  | VccT       | +3.3V Transmitter Power.   | 1    |
| 17  | VeeT       | Transmitter Ground.  | 1    |
| 18  | TD+        | Transmit Data Input.   |      |
| 19  | TD-        | Inverse Transmit Data Input.   |      |
| 20  | VeeT       | Transmitter Ground.  | 1    |

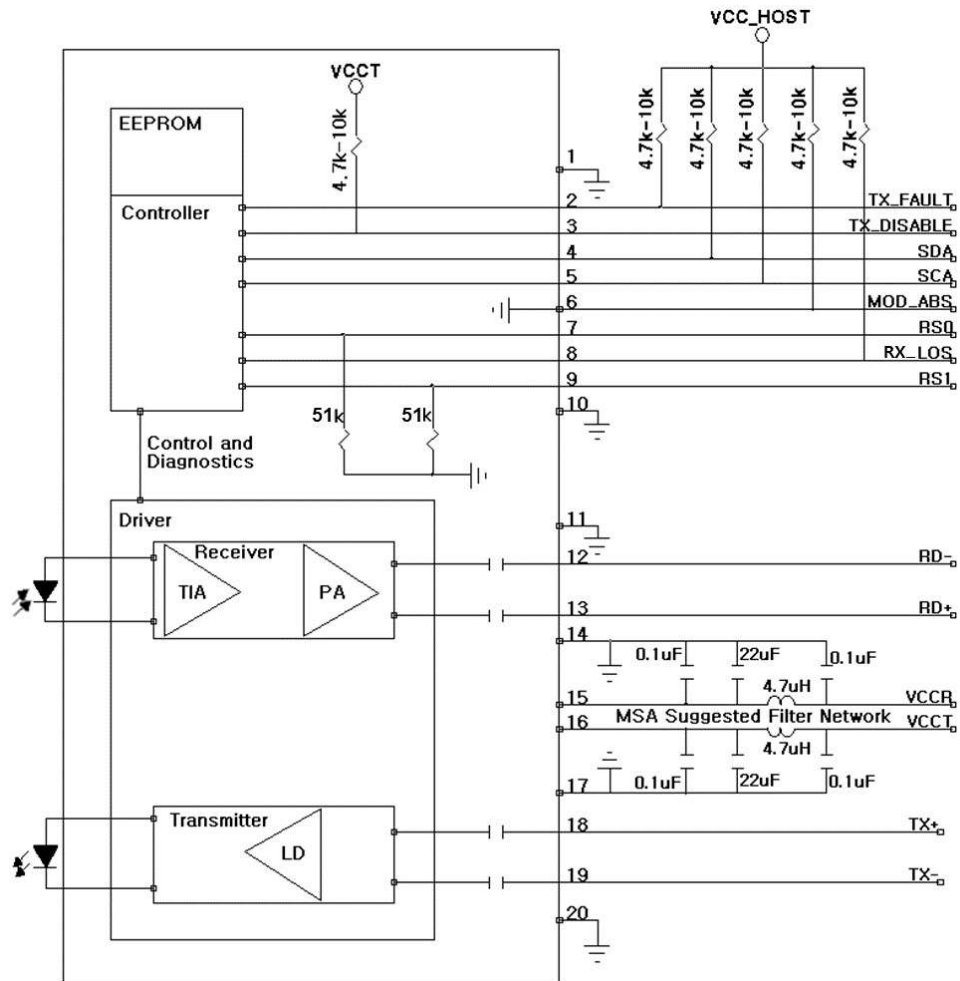
### Notes:

1. The ground of the module (operating module ground) and that of the module shell are separate from each other.
2. 4.7k $\Omega$ –10k $\Omega$  resistor is used on the module to pull the output up to 3.15–3.45V.



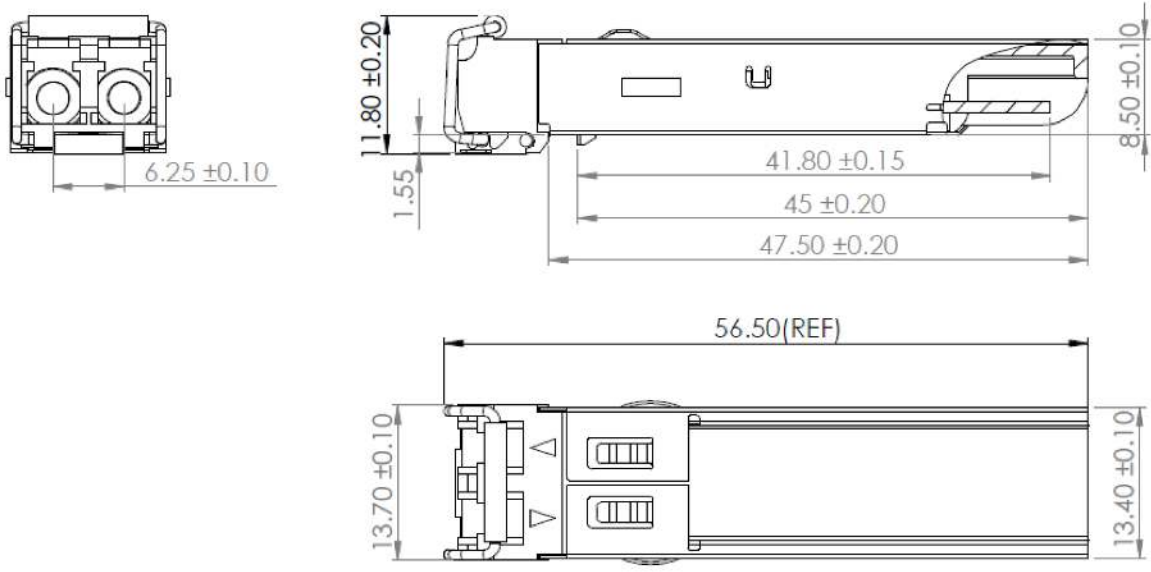
Pin-Out of Connector Block on the Host Board

### Recommended Circuit Schematic



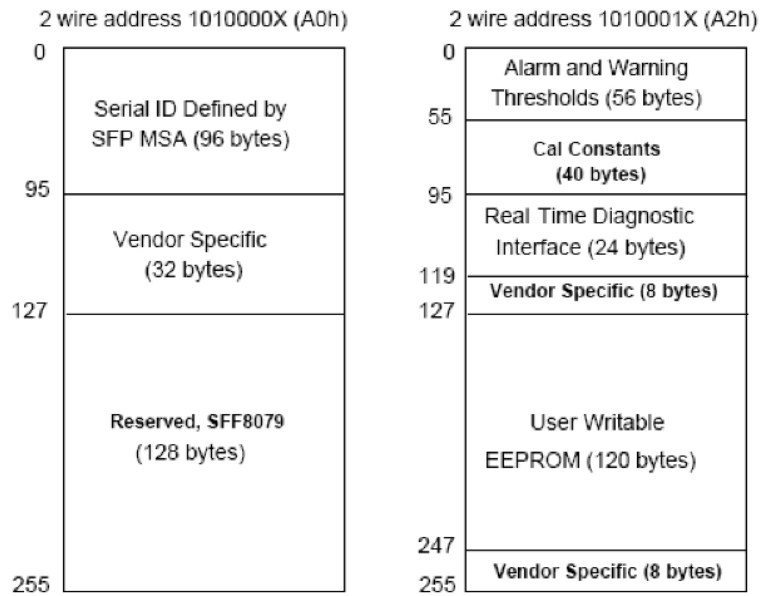
### Mechanical Specifications

Small Form Factor Pluggable (SFP) transceivers are compatible with the dimensions defined by the SFP Multi-Sourcing Agreement (MSA).



### EEPROM Information

EEPROM memory map-specific data field description is as below:





## **About ProLabs**

Our experience comes as standard; for over 15 years ProLabs has delivered optical connectivity solutions that give our customers freedom and choice through our ability to provide seamless interoperability. At the heart of our company is the ability to provide state-of-the-art optical transport and connectivity solutions that are compatible with over 90 optical switching and transport platforms.

## **Complete Portfolio of Network Solutions**

ProLabs is focused on innovations in optical transport and connectivity. The combination of our knowledge of optics and networking equipment enables ProLabs to be your single source for optical transport and connectivity solutions from 100Mb to 400G while providing innovative solutions that increase network efficiency. We provide the optical connectivity expertise that is compatible with and enhances your switching and transport equipment.

## **Trusted Partner**

Customer service is our number one value. ProLabs has invested in people, labs and manufacturing capacity to ensure that you get immediate answers to your questions and compatible product when needed. With Engineering and Manufacturing offices in the U.K. and U.S. augmented by field offices throughout the U.S., U.K. and Asia, ProLabs is able to be our customers best advocate 24 hours a day.

## **Contact Information**

ProLabs US

Email: [sales@prolabs.com](mailto:sales@prolabs.com)

Telephone: 952-852-0252

ProLabs UK

Email: [salessupport@prolabs.com](mailto:salessupport@prolabs.com)

Telephone: +44 1285 719 600