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INTRODUCTION : THE FORDAHL GROUP

The Fordahl Group, founded in 1981, has grown to become one of a few truly global oscillator manufacturers.

Located in Switzerland, **Fordahl SA** is the corporate headquarters for the group as well as the main production facility. Situated in the heartland of the time and frequency region of central Europe, the availability of skilled labour has allowed Fordahl to specialise in miniature ultra stable oscillators. The products of today and for the future are almost exclusively evolving around the needs of the telecommunication market.

Dedication to supplying quality products has reflected in Fordahl's ISO 9001 certification. Efficiency and time management has led to the implementation of all procedures on Intranet, focusing on accessibility and user-friendliness.

The emphasis in research and design continues to be driven by the need to reduce size and power requirements and at the same time maintain or increase performance levels. For this reason the 'S' series of SMD devices includes every class of crystal oscillator from simple clocks (CXO) up to tight voltage controlled temperature compensated oscillators (VC-TCXO).

The Fordahl Group's overall strategy has demanded expansion over the years. To enable us to be both a manufacturer and to provide the high level of service necessary since our products and clients needs are undeniably high tech, Fordahl has grown in both directions.

Matel-Fordahl, in France, has enabled us to profit from having an in-house crystal manufacturing capability. It has provided us the opportunity to have a local and well-known outlet for our products and services, in addition to these gains, there are two main advantages from this expansion.

First, we have access to crystals for manufacturing design oscillator samples and small quantities quickly. This is important as it allows us to respond quickly to our customer's needs and aids the ramp up to full volume manufacture. Secondly, it allows us to offer CXO's using ceramic substrates with a service level that in most cases offsets the competitive prices of the mainly Far Eastern manufacturers.

The Fordahl Group has actively moved into the global market focusing on service. Proximity to the customer and complete traceability when projects move across international boundaries are essential ingredients for a continued growth in our industry.

Fordahl GB Ltd., located in Southampton, England is the sales and logistics centre for the United Kingdom and Ireland. The staff has many years experience from within the industry serving the local and international markets. Additionally many companies enter the European market via the UK, therefore, the position and function of this office is important to the groups overall performance.

In keeping with our commitment to service, **Fordahl Deutschland** is a recent addition to the group. Its primary function is to better serve and support the local market. This territory has become the cornerstone of several global telecommunication companies. Proximity and technical understanding improve response time, allowing faster and more efficient time to market.

Fordahl USA, Inc. is the main co-ordination centre for our North American operations, located near Atlanta. It is responsible for leading a team of independent representatives that provide technical and logistic support across the continent. Managing the flow of inter-continental opportunities makes this centre here instrumental for our future.

Our primary activity is designing and manufacturing quartz crystal oscillators. With our products aimed at the telecommunications market, quality standards and equally service, demand a serious commitment.

The Fordahl Group has been working steadily towards fulfilling these needs of the market over the last 20 years.

In the following pages, you will find a detailed description of our standard generic products. We extend an invitation to you to discuss your requirements and welcome your comments. Please feel free to use our contact information so that we can respond to you, our customers.

QUARTZ CRYSTAL OSCILLATORS

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APPLICATION NOTES AND STANDARDS

Crystal oscillators require some precautions for users. Test conditions and test equipment calibration are of primary importance because of the problems associated with measuring high frequencies.

Interference from other frequency sources is to be expected implying care and attention of board design and decoupling of the power supply. Power supply noise and long lines are undesired in high frequency products.

This section provides some helpful advice to design and production engineers who use oscillators. It should assist in avoiding common problems that occur with these relatively sensitive products. It will also briefly describe the international and in-house standards that apply to our recommended testing methods.

INTERNATIONAL STANDARDS

Our test procedures are based on several internationally recognised standards:

- IEC
- ISO
- CECC
- MIL-STD

MIL standard screening is available upon request. Please consult factory. Some national standards such as the British BS and French UTE can also be applied when requested.

MTBF values are calculated using the British **BT HRD4** standard.

IN-HOUSE STANDARDS

In addition to maintaining and continually upgrading our production systems all of our products undergo regular re-evaluation. This ensures continued process and product development to the highest standard.

CALIBRATION CONDITIONS

All oscillators are calibrated at 25°C ± 5°C ambient unless otherwise stated. The barometric pressure is within 970 and 1040 hPa and Relative Humidity is from 30 to 60%. When not specified, the supply voltage is nominal and 1/2 the load is used.

BOARD DESIGN CONSIDERATIONS

Crystal oscillators are sensitive to their environment and particularly to power supply noises and stray capacitance's. A few rules should always be kept in mind when designing the circuit :

- **Avoid long lines** (except ground lines) below the oscillator.
- **Avoid long lines** between the oscillator and its loads as they will damage the output signal due to the high stray capacitance's involved.
- **Decoupling capacitors** should be located as close as possible to the oscillator.
- When several frequency sources are connected to the same power supply, **RF chokes** should be used on the supply lines.
- If using external frequency adjustment, it should be located **as close as possible** to the input pin.

POWER SUPPLY DECOUPLING

Modern high speed technologies make decoupling even more important than former standard TTL devices. Each oscillator **must be decoupled individually**, even if a decoupling capacitor already exists on the board. **HC MOS** and **FAST TTL** devices exhibit **high switching currents** that can cause trouble if the decoupling is not sufficient. For all types of oscillators FORDAHL recommends the use of a **100 nF capacitor**, in parallel with a **10 nF ceramic capacitor** to prevent spikes.

TEST JIGS AND MEASUREMENT

Test jigs should be manufactured using the same care and attention to design as indicated above for the oscillator. The use of **multipurpose test plates** or **breadboards** is strongly **not recommended**. The measuring instruments should be calibrated or linked to a high stability frequency reference. Using a low capacitance (**10 pF**) **oscilloscope probe** is a **primary condition** for performing an accurate output signal test. With the exception of 50 Ω sine wave outputs, **coaxial cables** linked directly to the oscillator output should **never be used**.

GENERIC ORDERING CODES

| SOME EXAMPLES | | | | | | | | | | | | | |
|---------------|------|---|----|---|---|---|-----------|------------|-----|---|----|-----|-----|
| TYPE | 1 | 2 | 3 | 4 | 5 | 6 | FREQUENCY | 7 | 8 | 9 | 10 | 11 | |
| PXO | DFN | 1 | 14 | - | K | H | Z | 68.736 MHz | | X | H | 100 | |
| VCXO | DFV | | 14 | - | K | H | | 32.768 MHz | 100 | A | B | 25 | |
| TCXO | DFA | | S7 | - | K | O | A | 16.384 MHz | | | C | 1 | |
| VC-TCXO | DFAV | | 36 | - | M | H | | 10.000 MHz | 40 | | C | 2 | /12 |

| 1. TYPE CODE | 2. VERSION | 3. PACKAGE CODE | | 4. INTERNAL CODE | 5. OUTPUT CODE |
|---|-----------------------------------|--|--|----------------------|---|
| | | Trough hole | Surface mount | | |
| DFN = CXO/PXO DFV = VCXO DFA = TCXO DFAV = VC-TCXO | model no. not for customer use | 14 = DIL 14 4 = DIL 8 20 = 20 x 20 mm 36 = 36 x 27 mm | S1 = plastic/epoxy S2 = plastic/epoxy = metal/epoxy(DFA) S3 = metal/epoxy S5 = plastic S7 = metal/epoxy S8 = metal/epoxy S11 = ceramic S15 = ceramic | not for customer use | T = TTL H = HCMOS B = TTL & HCMOS E = Negative ECL 10KH EC = Positive ECL 10KH or 100K LEC = LVPECL 100K O = Clipped square wave S = Sine wave |

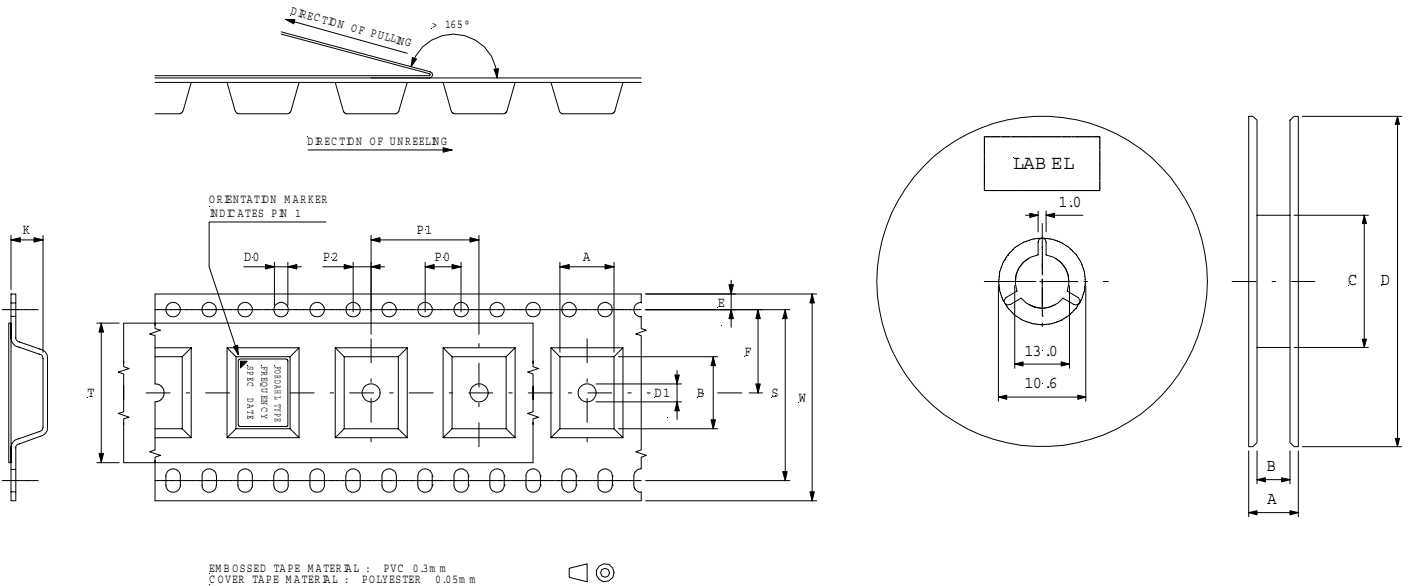
| 6. OPTION CODE (IF NEEDED) | 7. PULLING RANGE CODE | 8. INDICATION CODE | | 9. TEMPERATURE RANGE | |
|---|-----------------------|--|---|---|--|
| | | General | VCXO | | |
| Z = tri-state L = low power model R = Tight symmetry P = complimentary outputs G = Inverted pin-out T = External trimmer A = internal trimmer V = External control voltage Y = external potentiometer I = enable/disable | | X = overall frequency stability 1 year or long term ageing code void = temperature stability only | A= 0.5 to 4.5 V range center @ 2.5 V (only DIL-14) C= 0.5 to 10 V range center @ 4.25 V D= 0.3 to 3.0 V range center @ 1.65 V void = standard spec | A = 0 to 50°C L = 0 to 60°C B = 0 to 70°C M = -10 to 50°C D = -10 to 60°C I = -10 to 70°C Q = -20 to 60°C C = -20 to 70°C T = -30 to 85°C | P = -25 to 75°C K = -30 to 60°C R = -30 to 70°C N = -30 to 75°C F = -40 to 70°C E = -40 to 85°C G = -55 to 105°C H = -55 to 125°C |

| 10. FREQUENCY STABILITY | 11. SUPPLY VOLTAGE / LONG TERM AGEING CODE |
|--|---|
| frequency stability expressed in ppm, either as an overall tolerance or as temperature stability only. | indicates the supply voltage value in Volts for models offering different options of supply voltage for (VC)-TCXO indicates long term ageing for surface mount PXO |

NON-STANDARD SPECIFICATIONS

Specifications that cannot be covered by the above codes will be issued a unique specification number

FORDAHL SMD PRODUCTS : TAPE & REEL DIMENSIONS



| Product type | Oscil. | Tape [mm] | | | | | | | | | | | | | MOQ [pcs] | Reel [mm] | | | |
|--------------|-------------|-----------|------|------|------|------|------|------|----|------|-----|-----|----|-----|-----------|-----------|------|-----|-----|
| | | A | B | E | F | K | S | T | W | D0 | D1 | P0 | P1 | P2 | | A | B | C | D |
| S1 | PXO VCXO | 9.4 | 15 | 1.75 | 11.5 | 6.25 | - | 21.3 | 24 | 1.55 | 2.0 | 4.0 | 12 | 2.0 | 250 | 28 | 24.4 | 62 | 180 |
| | | | | | | | | | | | | | | | 1000 | 31 | | 100 | 330 |
| S2 | PXO | 5.5 | 8.7 | 1.75 | 7.5 | 3.6 | - | 13.3 | 16 | 1.55 | 1.5 | 4.0 | 8 | 1.5 | 1000 | 22.4 | 16.4 | 62 | 180 |
| | VCXO | | | | | | | | | | | | | | 3000 | 25.4 | | 100 | 330 |
| S3 | TCXO | 7.5 | 9.6 | 1.75 | 7.5 | 2.3 | - | 13.3 | 16 | 1.55 | 1.5 | 4.0 | 12 | 2.0 | 500 | 22.4 | 16.4 | 62 | 180 |
| | | | | | | | | | | | | | | | 2700 | 25.4 | | 100 | 330 |
| S7 | VCXO | 13.2 | 20.2 | 1.75 | 14.2 | 9.5 | 28.4 | 25.3 | 32 | 1.55 | 2.0 | 4.0 | 24 | 2.0 | 250 | 39 | 32.4 | 100 | 330 |
| | TCXO | | | | | 8.0 | | | | | | | 20 | | 450 | | | | |
| S8 | PXO | 13.2 | 20.2 | 1.75 | 14.2 | 9.5 | 28.4 | 25.3 | 32 | 1.55 | 2.0 | 4.0 | 24 | 2.0 | 250 | 39 | 32.4 | 100 | 330 |
| | VCXO | | | | | | | | | | | | | | 250 | | | | |

Please consult factory for details on S5, S11 and S15

NOTICE

1. Storage

Please store the products in room where temperature / humidity is stable. Conditions should be :

Temperature : 5 to 35°C

Humidity : 30 to 60%RH

If products are stored for more than a year, solderability may be degraded. Please confirm it regularly.

If you transport the products, please pack them so that the package will not be damaged by mechanical vibration / shock and please educate and guide a carrier to prevent rough handling.

2. Transportation

| | | | | | | | | | |
|------|----------------|----------|----|---------|-----|------|------------|------|---|
| TYPE | T&R DIMENSIONS | REVISION | 01 | CHECKED | JYA | DATE | 24.01.2002 | PAGE | 6 |
|------|----------------|----------|----|---------|-----|------|------------|------|---|

FORDAHL SMD PRODUCTS HANDLING GUIDELINES

1. WASHING CONDITIONS

Internal construction utilises a hermetically sealed quartz crystal (S1, S2, S3, S7 and S8 packages) ensuring thermal and long-term stability requirements. Notice needs to be taken with cleaning solutions/solvents. Because it is possible for liquid cleaning solutions to penetrate the base to cap seal :

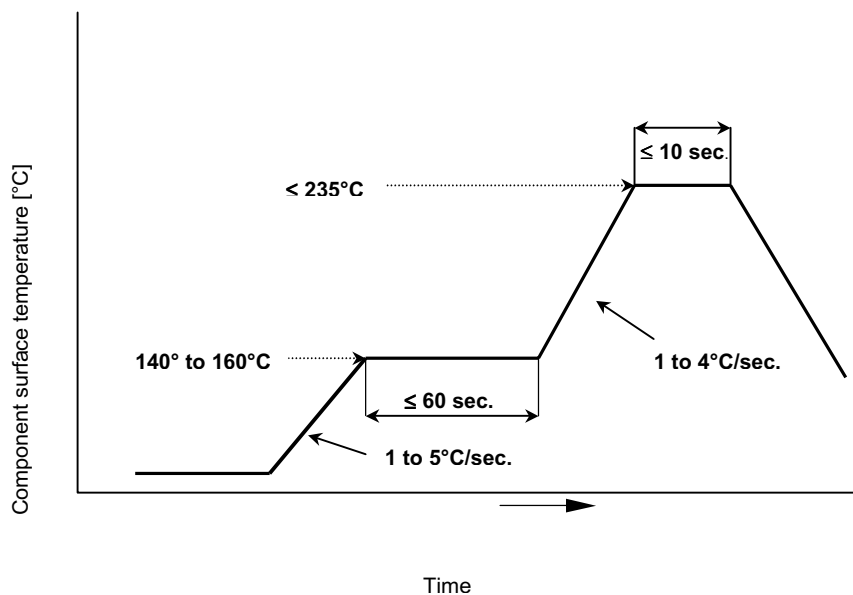
- do not clean with solvents or water based cleaning solutions
- do not use ultrasound washing process

CFC or HCFC cleaning is allowed as well as low-residue. No-washing type flux with no washing is highly recommended. Please consult factory for any other process.

2. SOLDERING CONDITIONS

Surface mount devices are designed primarily for mass production using pick and place technology and reflow soldering. We advise the following precautions to be taken during the soldering process:

Reflow soldering (see profile)



This profile is applicable for the following packages : S1, S2, S3, S5, S7, S8, S11, S15

Additional recommendations:

- do not vibrate during reflow soldering
- do not reflow solder on back side
- solder adhesion may vary depending on the motherboard's thermal capacity and other factors

Please consult factory for details

Hand soldering

Maximum temperature 300°C/5 sec.
Fine tipped soldering iron recommended.