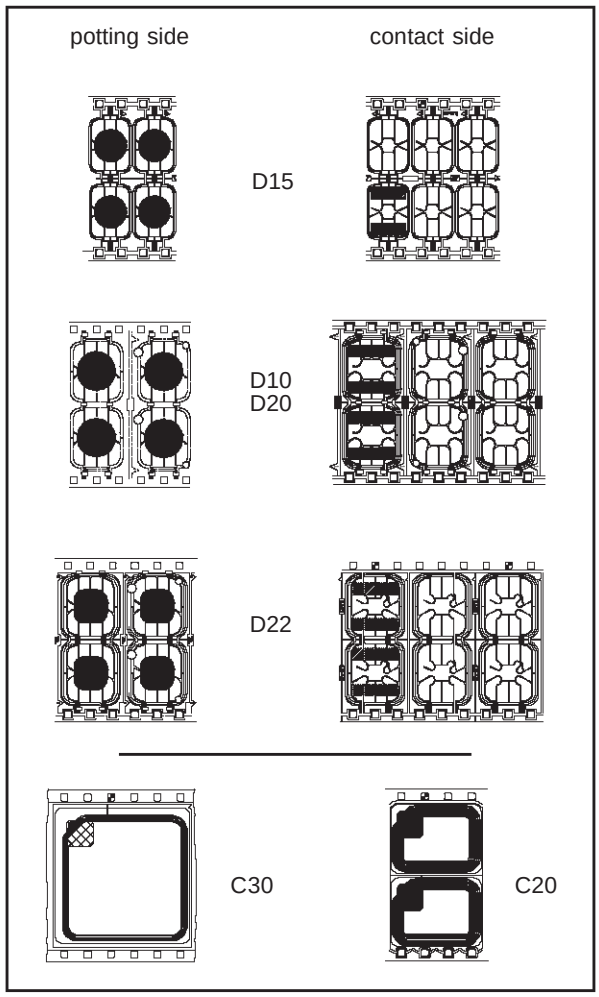
# D10, D15, D20, D22, C20, C30 MICROMODULES

## Memory Micromodules

## General Information for D1, D2 and C Packaging

- Micromodules were developed specifically for embedding in Smartcards and Memory Cards
- The Micromodule provides:
  - Support for the chip
  - Electrical contacts
  - Suitable embedding interface for gluing the module to the plastic package
- Physical dimensions and contact positions compliant to the ISO 7816 standard
- Micromodules delivered as a continuous Super 35 mm tape. (This differs from the standard 35 mm tape in the spacing distance between the indexing holes.)




### DESCRIPTION

Memory Cards consist of two main parts: the plastic card, and the embedded Micromodule (which, in turn, carries the silicon chip).

The plastic card is made of PVC, ABS or similar material, and can be over-printed with graphics, text, and magnetic strips. The Micromodule is embedded in a cavity in the plastic card.

The Micromodules are mounted on Super 35 mm metallized epoxy tape, and are delivered on reels. These contain all of the chips from a number of wafers, including those chips that were found to be non-functioning during testing. Traceability is ensured by a label fixed on the reel.

**Table 1. Memory Card and Memory Tag Integrated Circuits**

| Module | Please see the data briefing sheets of these products for example illustrations of these micromodules |
|---|---|
| D10 | ST1200, ST1305B, ST1331, ST1333, ST1335, ST1336, ST1353, ST1355 |
| D15 | ST14C02, ST1305B, ST1335, ST1336, ST1355 |
| D20 | ST14C02, M14C04, M14C16, M14C32 |
| D22 | M14C64, M14128, M14256 |
| C30 | M35101, M35102 |
| C20 | M35101, M35102 |

**Table 2. Memory Card Products**

| Type | Description (please see the individual product data sheets for full specifications) | Process | Technology | Module Style |
|---|---|---|---|---|
| ST14C02C | Memory Card IC, 2 Kbit (256 x 8) Serial $I^2C$ Bus EEPROM | 1.2 µm | CMOS | D15, D20 |
| M14C04 | Memory Card IC, 4 Kbit Serial $I^2C$ Bus EEPROM | 0.6 µm | CMOS | D20 |
| M14C16 | Memory Card IC, 16 Kbit Serial $I^2C$ Bus EEPROM | 0.6 µm | CMOS | D20 |
| M14C32 | Memory Card IC, 32 Kbit Serial $I^2C$ Bus EEPROM | 0.6 µm | CMOS | D20 |
| M14C64 | Memory Card IC, 64 Kbit Serial $I^2C$ Bus EEPROM | 0.6 µm | CMOS | D22 |
| M14128 | Memory Card IC, 128 Kbit Serial $I^2C$ Bus EEPROM | 0.6 µm | CMOS | D22 |
| M14256 | Memory Card IC, 256 Kbit Serial $I^2C$ Bus EEPROM | 0.6 µm | CMOS | D22 |
| ST1200 | Memory Card IC, 256 bit OTP EPROM with Lock-Out | 3.5 µm | NMOS | D10 |
| ST1305B | Memory Card IC, 192 bit High Endurance EEPROM with Secure Logic Access Control | 1.5 µm | CMOS | D10, D15 |
| ST1331 | Memory Card IC, 272 bit High Endurance EEPROM with Advanced Security Mechanisms | 1.2 µm | CMOS | D10 |
| ST1333 | | 1.2 µm | CMOS | D10 |
| ST1335 | | 1.2 µm | CMOS | D10, D15 |
| ST1336 | | 1.2 µm | CMOS | D10, D15 |
| M35101 | Contactless Memory Chip, 13.56 MHz, 2048 bit EEPROM | 0.6 µm | CMOS | C20, C30 |
| M35102 | Contactless Memory Chip with 64-bit Unique ID, 13.56 MHz, 2048 bit EEPROM | 0.6 µm | CMOS | C20, C30 |

The assembly flows is as follows:

1. Dice sawing
2. Dice attach
3. Wire bonding
4. Potting
5. Milling (depending on product)

The range of products and types of Micromodule are summarized in Table 1 and Table 2. For large volumes, ST is able to offer customized module tape.

## DELIVERY

The Super 35mm metallized epoxy tape is delivered on reels, as shown in Figure 1. These contain all of the chips from a number of wafers, including those chips that were found to be non-functioning during testing. Traceability is ensured by a label fixed on the reel.

The typical quantity is 10,000 modules per reel, with priority given to lot integrity on the reel. The maximum quantity is 15,000 per reel.

Parts which are faulty (mechanically or electrically defective) are identified by punch holes. The specification for the reject punch holes is shown in Figure 4 for the D10 micromodule, in Figure 5 for the D15 micromodule, in Figure 6 for the D20 micromodule, and in Figure 7 for the D22 micromodule.

Tape joins (tape splicing) are never more than 10 per 10 metre length, as shown in Figure 2 and Figure 3.

At least 2.1 m of leader, and 2.1 m of trailer is included on each reel. Each is made of PVC Super 35 mm tape, without metalisation, and is opaque to infrared and white light.

A “failure” marking of reject holes is included at the beginning and end of the tape of a minimum of 5 consecutive module pitches (double positions).

Modules should be stored within the temperature range -40 °C to + 85 °C, for no more than 1 year.

Each reel is packed in an antistatic bag, along with a desiccant bag, and a humidity indicator card. This card indicates the level of humidity as follows:

30 - Blue: protection assured

40 - Pink: renew the desiccant bag

50 - Pink: protection no longer ensured

Three self adhesive plastic identification labels are attached: one to the reel, one to the antistatic bag,

**Table 3. Manufacturing Flow and Manufacturing Facility Locations**

| Operation | Location and Facility |
|---|---|
| Wafer Diffusion | Rousset, France. 6” wafer fab. |
| | Agrate, Italy. 6” wafer fab.: standard EEPROM only |
| Electrical Wafer Test | Rousset, France. |
| | Agrate, Italy: standard EEPROM only |
| Assembly | Casablanca, Morocco. |
| Final Test | Rousset, France. |
| | Casablanca, Morocco. |

**Table 4. Material Specification**

| Material | Description |
|---|---|
| **Tape** | |
| Basic material | MCTS T2 or IBIDEN rough, typical thickness 120 µm |
| Adhesive | Modified epoxy, typical thickness 18 µm |
| Laminated copper foil | Typical thickness 35 µm |
| Adhesive strength | > 0.8 N/mm at room temperature. Monitored by the tape manufacturer using appropriate test methods |
| Tape Surface | The whole epoxy adhesive surface is controlled to be free of dirt, grease, cleaning compounds and parting compounds |
| Surface roughness | Typically Rz: 3-12 µm at first accepted delivery |
| Contact surface | Nickel-gold, galvanised treatment |
| Nickel thickness | 2 µm (min.) |
| Gold thickness | contact side, 0.1 µm (min.) |
| Total tape thickness | 160 ± 30 µm |
| Control, Palmer | “Special flat” diameter 3 mm, F = 1.5 N |
| **Chip Interconnect** | |
| Dice bonding | Silver epoxy |
| Bonding wire | Gold 25 µm |
| Ring (D22 only) | Bronze |
| **Protective coating** | |
| Material | UV epoxy, Black epoxy |
| Assembly | Casablanca, Morocco. |

and one to the reel box. Each label carries the following information:

– PRODUCT: sales type
– LOT NUMBER: reel number
– POS: total number of positions
– GOOD: number of good positions
– FAIL: number of fail positions
– DATE: date of sealing

In addition, the antistatic bag and the delivery box carry a self adhesive plastic “ESD” warning label, 85 x 38 mm in size, indicating “Electrostatic sensitive devices”.

Each reel is packed in a reel box, made of recycled cardboard. The size of the reel box depends on its origin. Several reel boxes are packed in a delivery box, which is also made of recycled cardboard.

A delivery note is provided, listing the following information:

– Date of sealing
– Reel numbers
– Total number of positions, with the details of positions per reel
– Order number and customer name
– Sales type
– Tape type

## RECOMMENDED ACCEPTANCE CRITERIA

The product identity should be checked against the delivery documentation, and the quantity of good positions on the reel recorded. The product may be tested in accordance with the appropriate data sheet, the conditions depending on the product type, and the ISSUER or USER mode (for ST13xx products).

For delivery acceptance, ST recommends sampling the Micromodules from the beginning of the reel. The sampling AQL should be applied, to the ISO 2859 standard (test level II, normal test).

**Table 5. Size of the Reel Box**

| Manufacturing Location | Size of Reel Box |
|---|---|
| Rousset | 370 x 390 x 80 mm |
| Casablanca | 373 x 370 x 78 mm |

**Table 6. AQL Levels**

| Defect | AQL |
|---|---|
| Total defects - mechanical and electrical | 0.65 |
| Mechanical defects | 0.65 |
| Electrical defects | 0.65 |

Any observed discrepancies should be reported in writing to the ST quality department. Table 6 shows the recommended AQL levels.

The visual and mechanical test specification and test conditions are described in Table 7.

### Defect Acceptance Rate

Each reel contains the stated number of defective devices, distributed so that no more than 20% of them are found in a contiguous block on the tape. ST’s own quality acceptance standard guarantees that the customer will be informed when the electrical yield is less than 90%.

The part numbers and re-ordering information will be set according to ST’s current product coding policy, as shown on the individual product data sheets, or as agreed with the customer.

Reels that do not pass inspection should be returned to ST within 15 working days after delivery.

**Table 7. Visual and Mechanical Specification and Test Conditions**

| Test | Description and Method | Reject Criteria |
|---|---|---|
| 1 | Contact area | Glue or particles, scratches print, sever defects on contact area damaging the gold layer. Visual test distance 30 cm, naked eye. |
| 2 | Chip covering | Thickness and external dimension measurement exceeding total thickness, or other dimensions not complying to the drawings |
| 3[1] | Die bond strength | Die shear force < 10 N |
| 4[1] | Wire bonding | Wire lift or broken at pull test with < 4 g |

Note: 1. Test 3 and 4 are conducted in accordance with MIL-STD-833.

## RELIABILITY

Product qualification and on-going reliability monitoring is performed by ST. The principal steps are listed in Table 8 and Table 9.

**Table 8. Package Related Tests**

| Test | Description | Method | Condition | LPTD | Criteria (note 1) |
|---|---|---|---|---|---|
| 1 | Geometry | ST Specification | Monitoring/Lot | 5 | 0/45 |
| 2 | Visual inspection | ST Specification | Outgoing/Lot | AQL= 0.040 | 0/315 |
| 3 | Temperature cycling | MIL-STD-883 Method 1010 | -40 °C to 150 °C, 100 cycles | 5 | 0/45 |
| 4 | Salt atmosphere corrosion of contacts | MIL-STD-883 Method 1009 | 35 °C, 5% NaCl, 24 hour | 15 | 0/15 |
| 5 | Moisture resistance | MIL-STD-883 Method 1004 | 85 °C, 85% HR Biased 5.5 V, 168 hour | 7 | 0/32 |
| 6 | Vibration with electrical measurement | ISO/IEC 10373 | 1 octave/minute, acceleration up to 10 G (repeated 20 times) measurement memory check at 25 °C | 20 | 0/11 |
| 7 | Bending properties | ISO/IEC 7816-1 | Long side: deflection 2 cm<br>Short side: deflection 1 cm<br>30 bendings per minute | 20 | 0/11 |
| 8 | Torsion properties | ISO/IEC 7816-1 | Maximum displacement 15° ±1°<br>1000 torsions, 30 torsions per minute applied on long side only | 20 | 0/11 |

Note: 1. The notation *m/n* means: reject the whole lot if more than *m* devices fail from a sample of *n* devices. For instance, 0/45 means a sample of 45 devices taken from a lot, with the whole lot only accepted if every one of the 45 sample devices passed the test.

**Table 9. Product Related Tests**

| Test | Description | Method | Condition | LPTD | Criteria |
|---|---|---|---|---|---|
| 1 | Life test | MIL-STD-883 Method 1005 | 140 °C, 6 V, 504 hours measurement memory check at 25 °C | 3 | 0/76 |
| 2 | Electrostatic discharge | MIL-STD-883 Method 3015 | Human body model:<br>1.5 kΩ, 100 pF, ± 5000 V | n/a | 0/9 |
| | Electrostatic discharge | MIL-STD-883 Method 3015 | Machine model: 0 Ω, 200 pF, ± 200 V measurement memory check at 25 °C | n/a | 0/9 |
| 3 | Data retention, Temperature storage | MIL-STD-883 Method 1005 | 150 °C, 1000 hours, no bias measurement memory check at 25 °C | 5 | 0/45 |
| 4 | Write/Erase cycles | ST Specification | 100,000 Cycles | 200 ppm/ 1024 byte/ 1000 cycle | 0/32 |
| 5 | Magnetic field, memory check | ISO IEC 10373 | 79,500 A/m | 15 | 1/25 |
| 6 | X-rays, memory check | ISO IEC 10373 | 70 kV, 0.1 Grey | 15 | 1/25 |
| 7 | UV light, memory check | ISO IEC 10373 | 15 W.s/cm$^2$, 30 minutes maximum | 15 | 1/25 |

**Figure 1. Reel and Winding Direction**

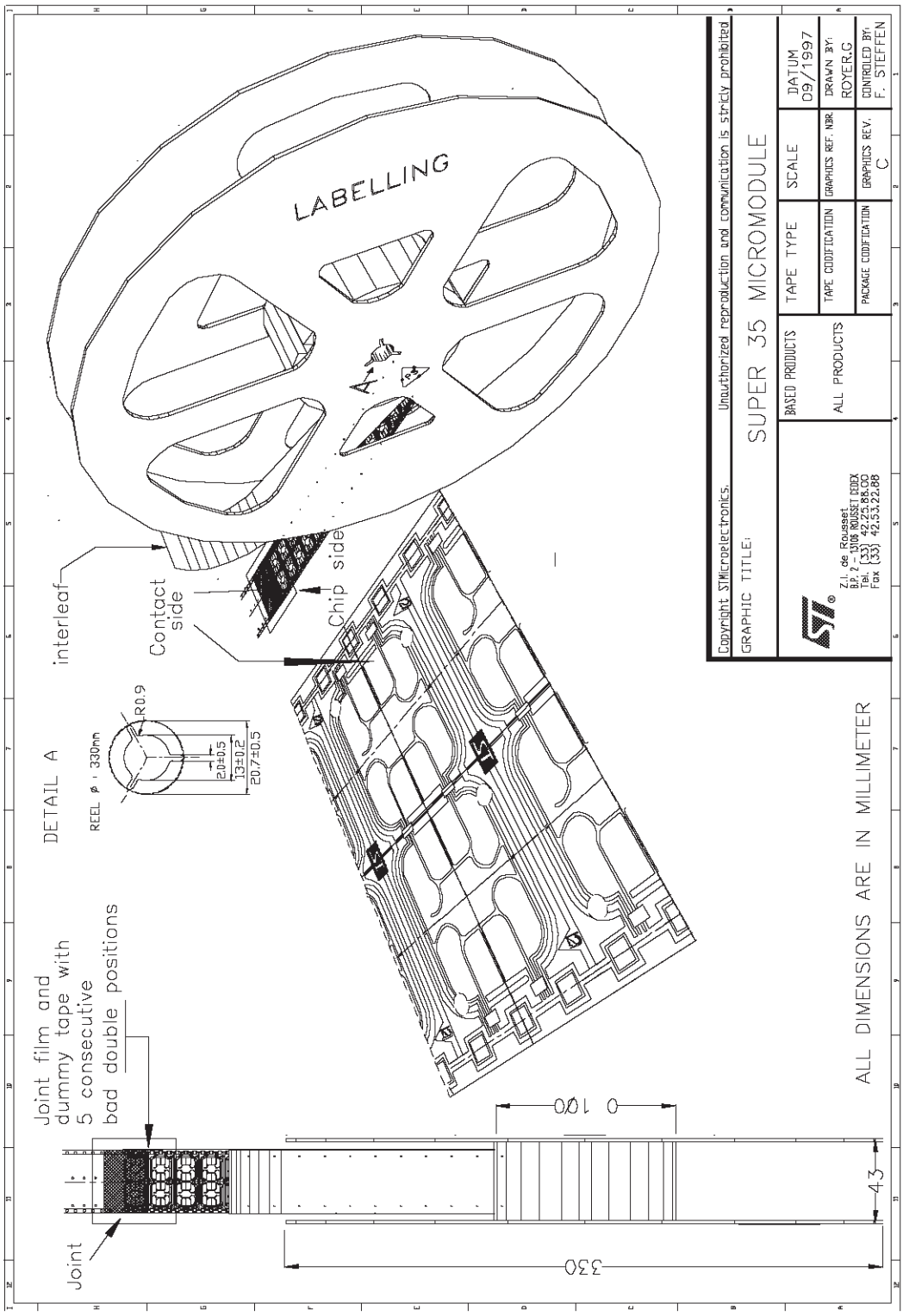


**Figure 2. D10, D20, D22 Tape Join Specification**

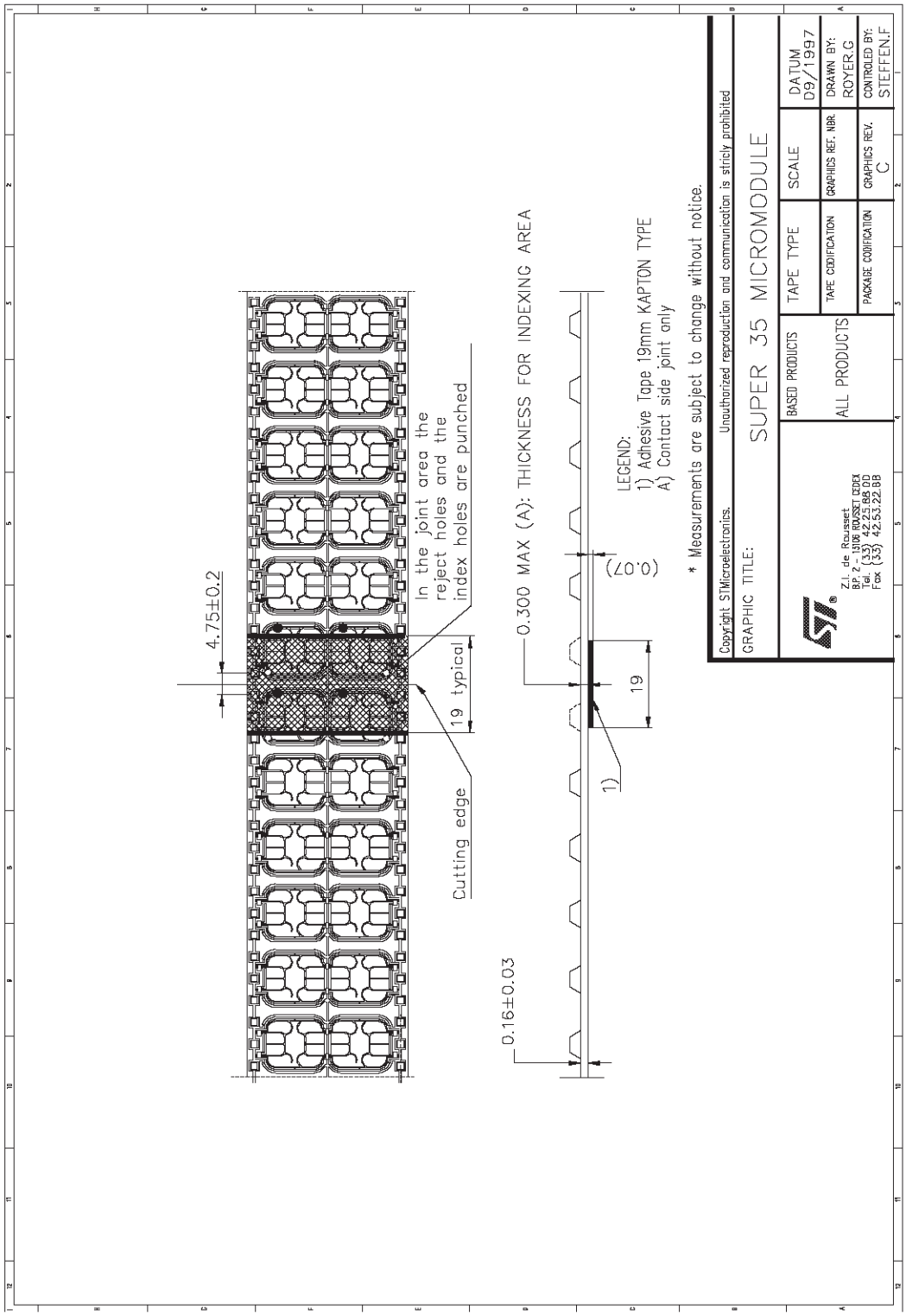


**Figure 3. D15 Tape Join Specification**

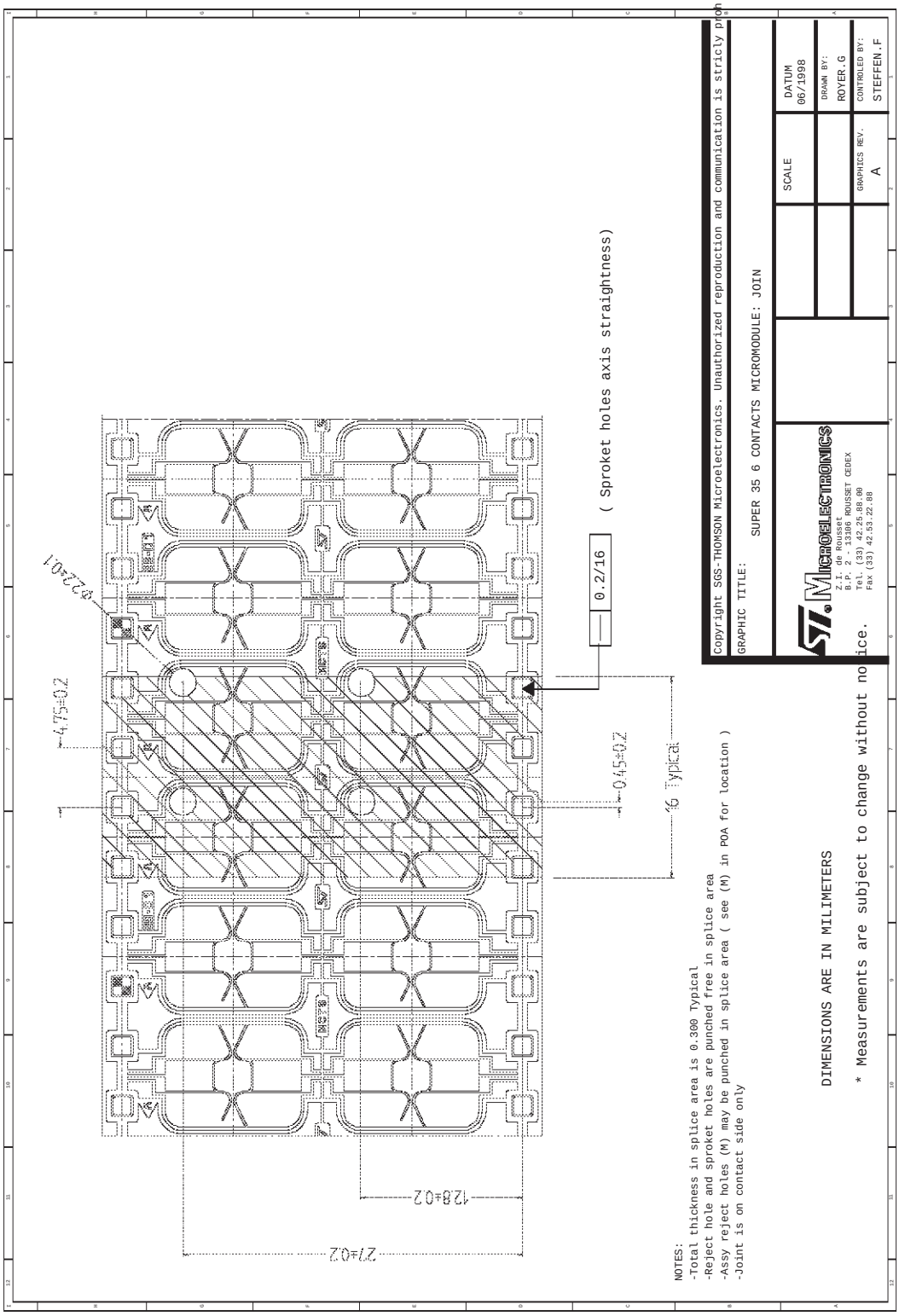
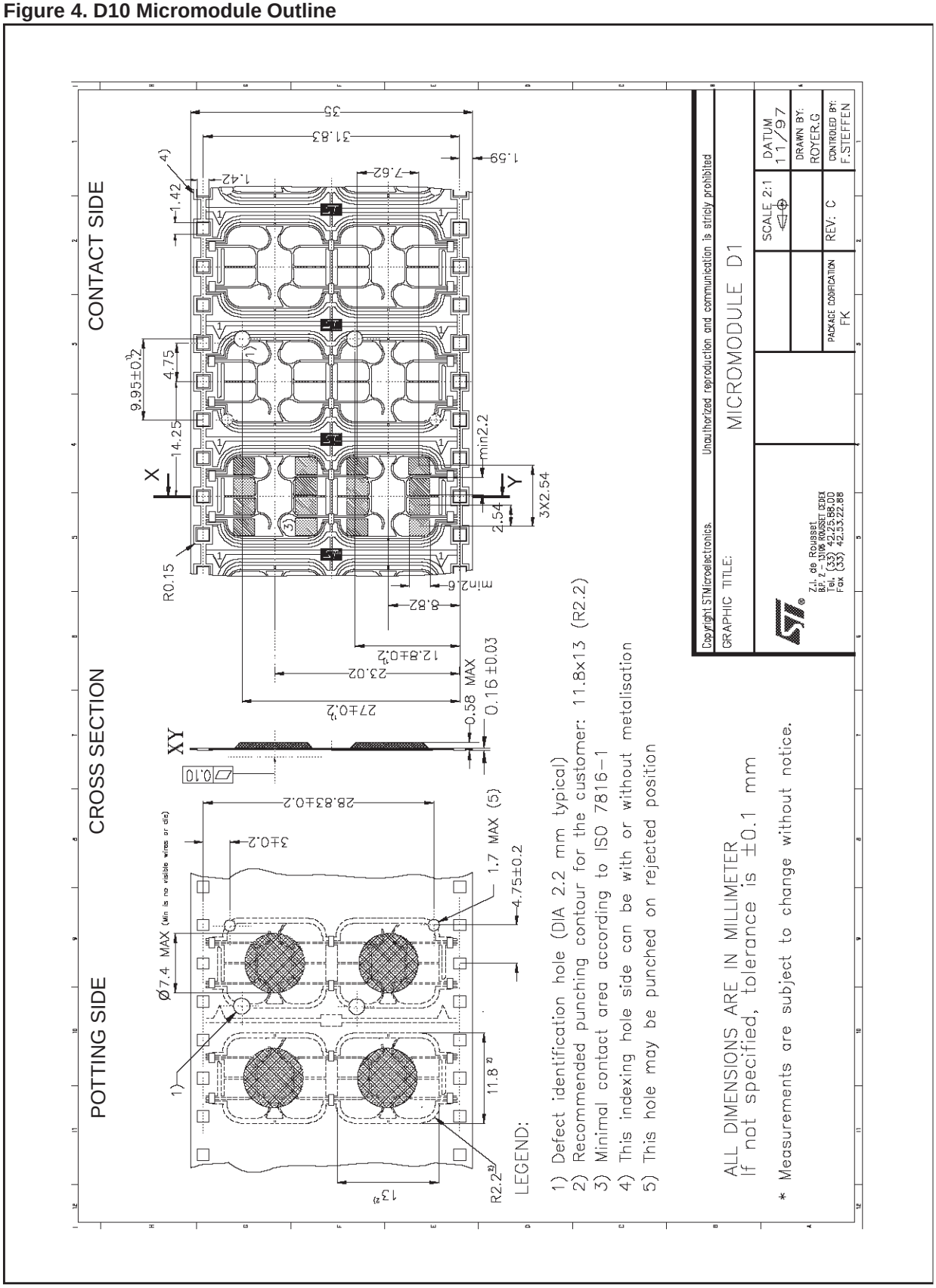


**Figure 4. D10 Micromodule Outline**



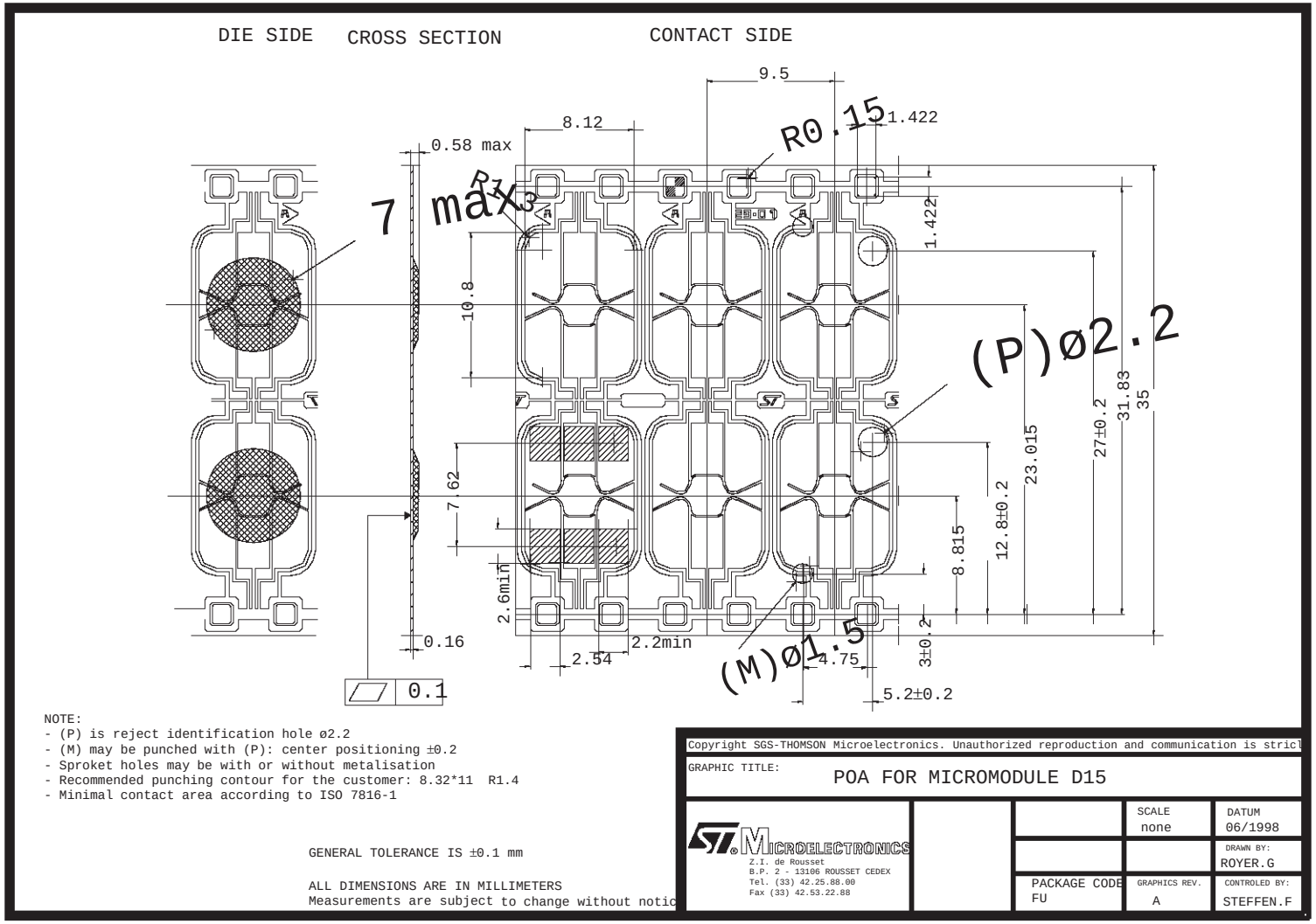



Figure 5. D15 Micromodule Outline

**Figure 6. D20 Micromodule Outline**

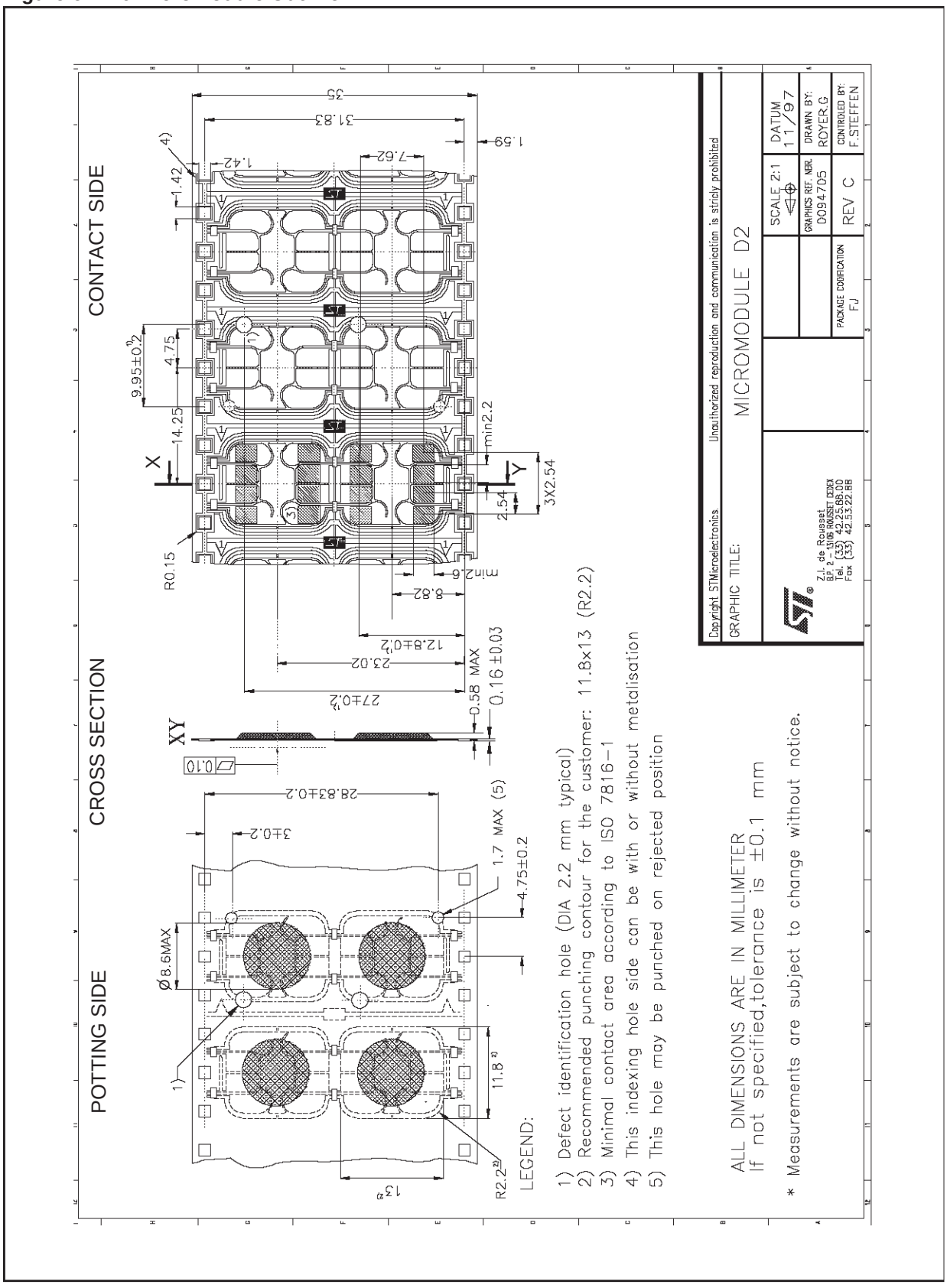
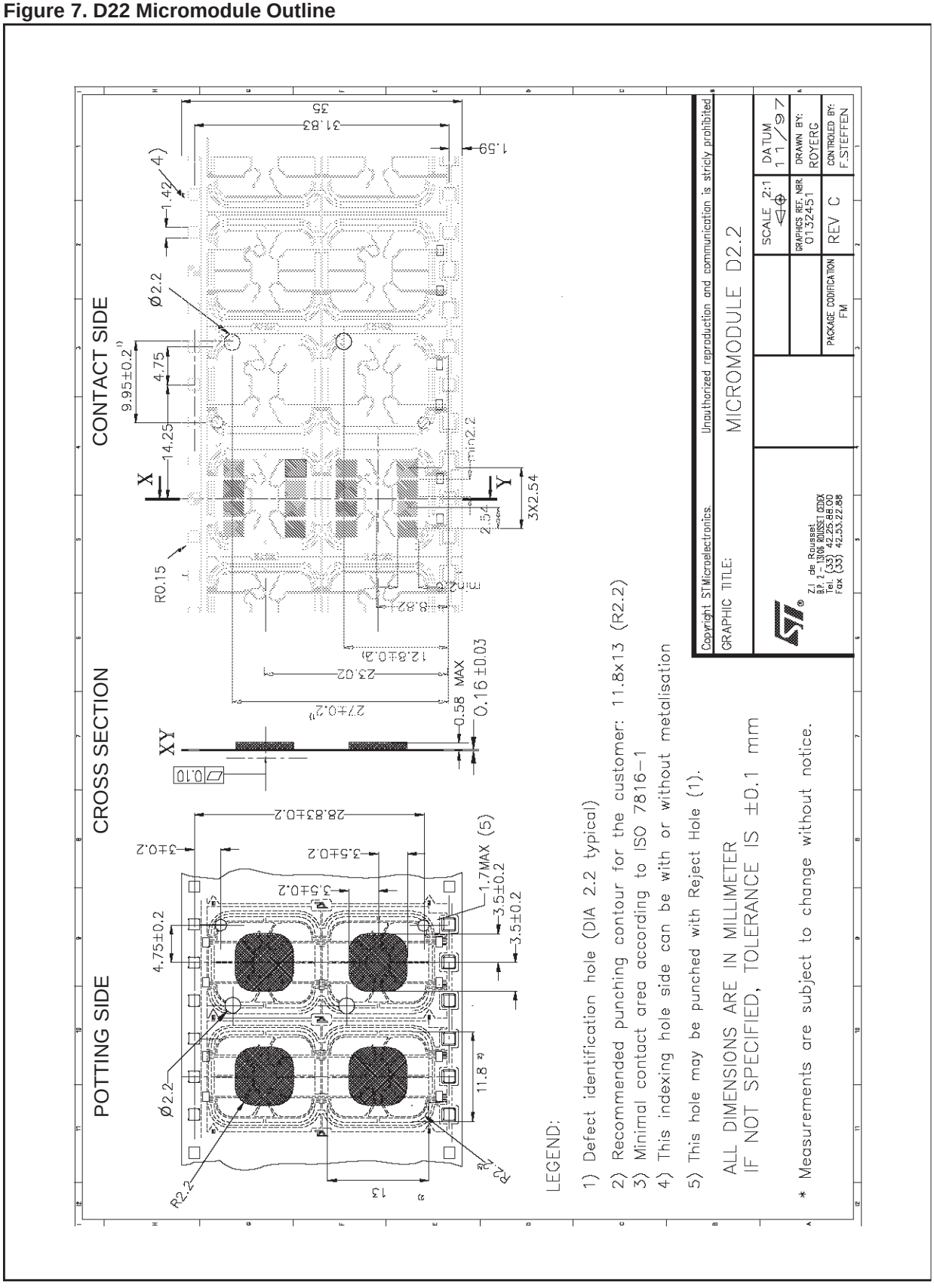


**Figure 7. D22 Micromodule Outline**



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