



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

## Memory Micromodules

### General Information for D1, D2 and C Packaging

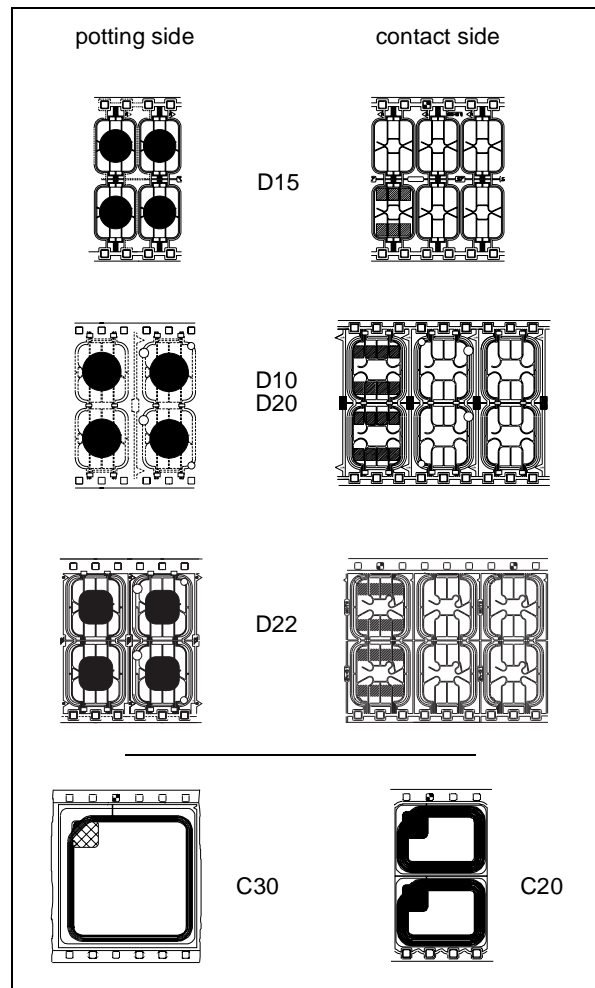
- Micromodules were developed specifically for embedding in Smartcards and Memory Cards
- The Micromodule provides:
  - Support for the chip
  - Electrical contacts
  - Suitable embedding interface for gluing the module to the plastic package
- Physical dimensions and contact positions compliant to the 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 <sup>2</sup> C Bus EEPROM	1.2 μm	CMOS	D15, D20
M14C04	Memory Card IC, 4 Kbit Serial I <sup>2</sup> C Bus EEPROM	0.6 μm	CMOS	D20
M14C16	Memory Card IC, 16 Kbit Serial I <sup>2</sup> C Bus EEPROM	0.6 μm	CMOS	D20
M14C32	Memory Card IC, 32 Kbit Serial I <sup>2</sup> C Bus EEPROM	0.6 μm	CMOS	D20
M14C64	Memory Card IC, 64 Kbit Serial I <sup>2</sup> C Bus EEPROM	0.6 μm	CMOS	D22
M14128	Memory Card IC, 128 Kbit Serial I <sup>2</sup> C Bus EEPROM	0.6 μm	CMOS	D22
M14256	Memory Card IC, 256 Kbit Serial I <sup>2</sup> C 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
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,

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**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
<b>Tape</b>	
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
<b>Chip Interconnect</b>	
Dice bonding	Silver epoxy
Bonding wire	Gold 25 µm
Ring (D22 only)	Bronze
<b>Protective coating</b>	
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 <sup>1</sup>	Die bond strength	Die shear force < 10 N
4 <sup>1</sup>	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.

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### 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**

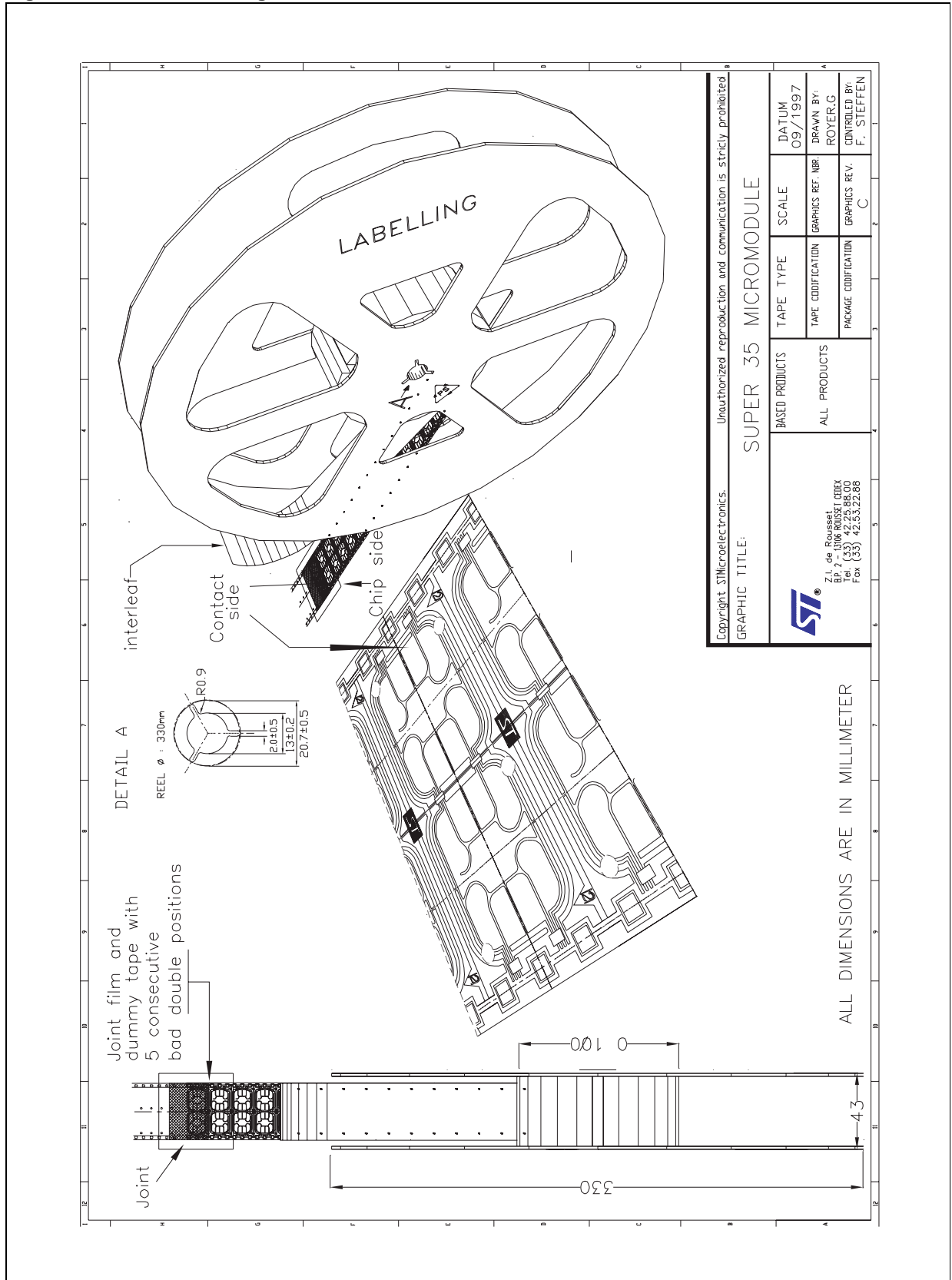
Test	Description	Method	Condition	LPTD	Criteria (note 1)
1	Geometry	ST Specification	Monitoring/Lot	5	0/45
2	Visual inspection	ST Specification	Outgoing/Lot	AQL= 0.040	0/315
3	Temperature cycling	MIL-STD-883 Method 1010	-40 °C to 150 °C, 100 cycles	5	0/45
4	Salt atmosphere corrosion of contacts	MIL-STD-883 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 Short side: deflection 1 cm 30 bendings per minute	20	0/11
8	Torsion properties	ISO/IEC 7816-1	Maximum displacement 15° ±1° 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: 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 <sup>2</sup> , 30 minutes maximum	15	1/25

Figure 1. Reel and Winding Direction



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

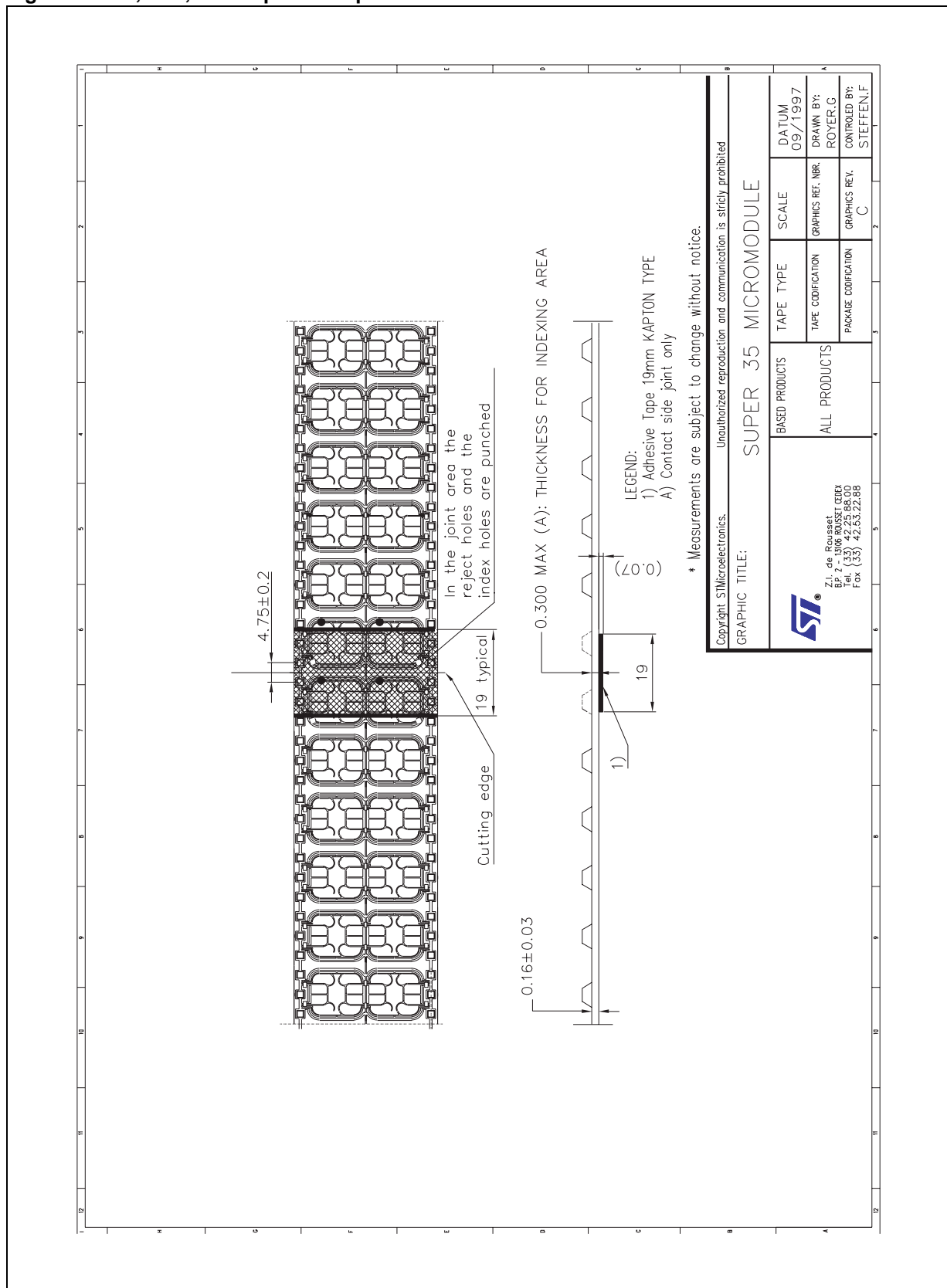


Figure 3. D15 Tape Join Specification

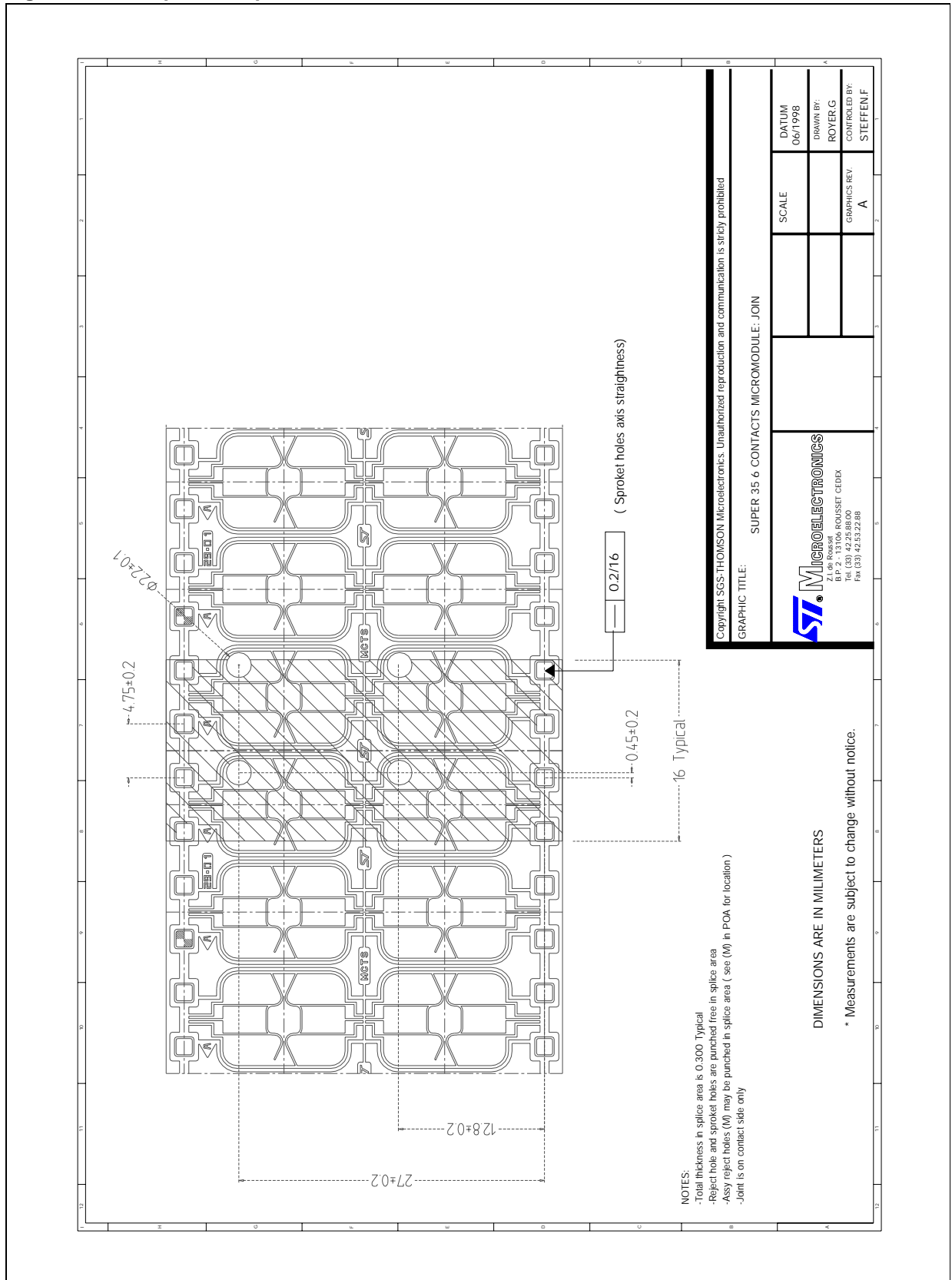




Figure 4. D10 Micromodule Outline

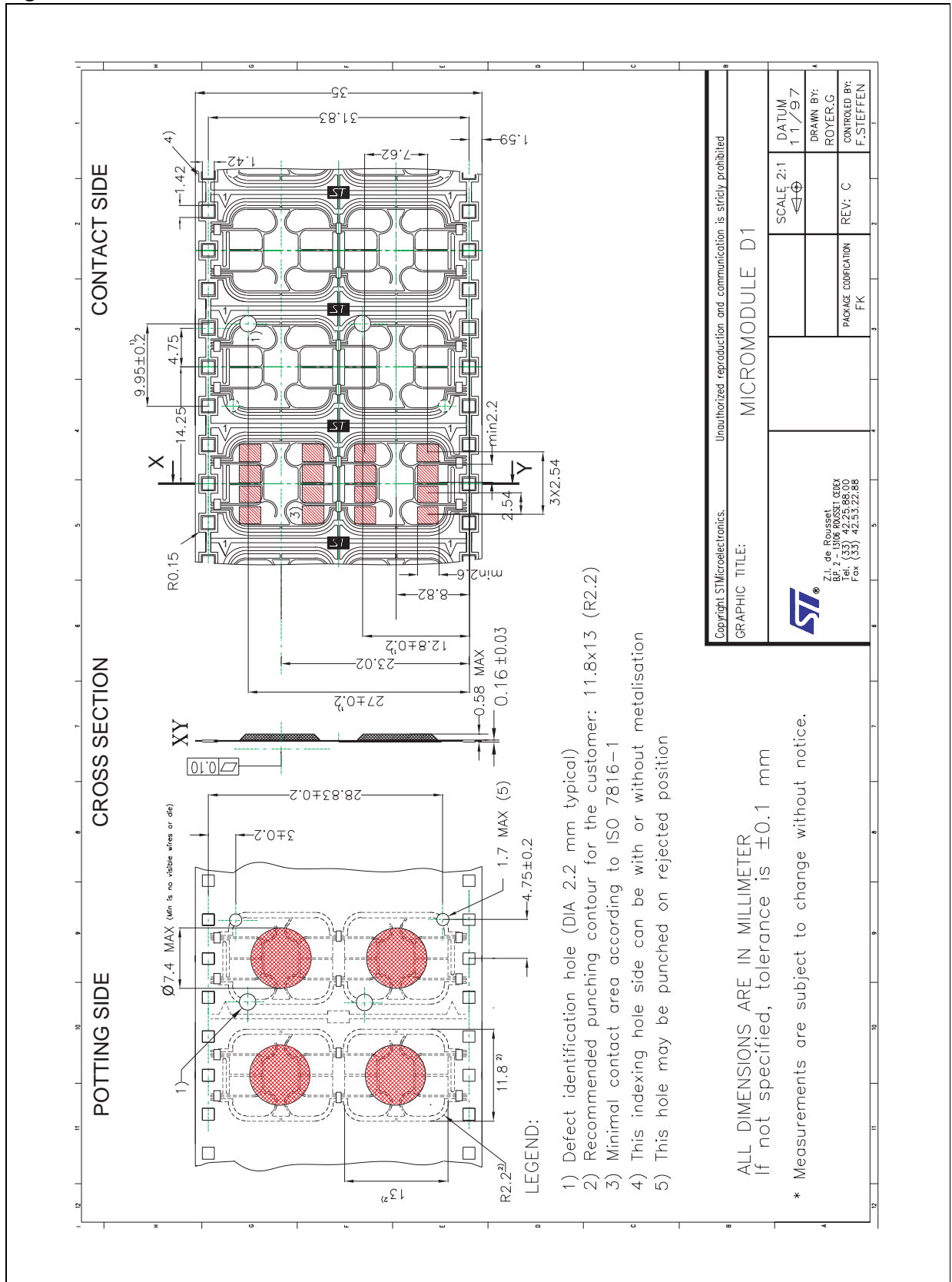


Figure 5. D15 Micromodule Outline

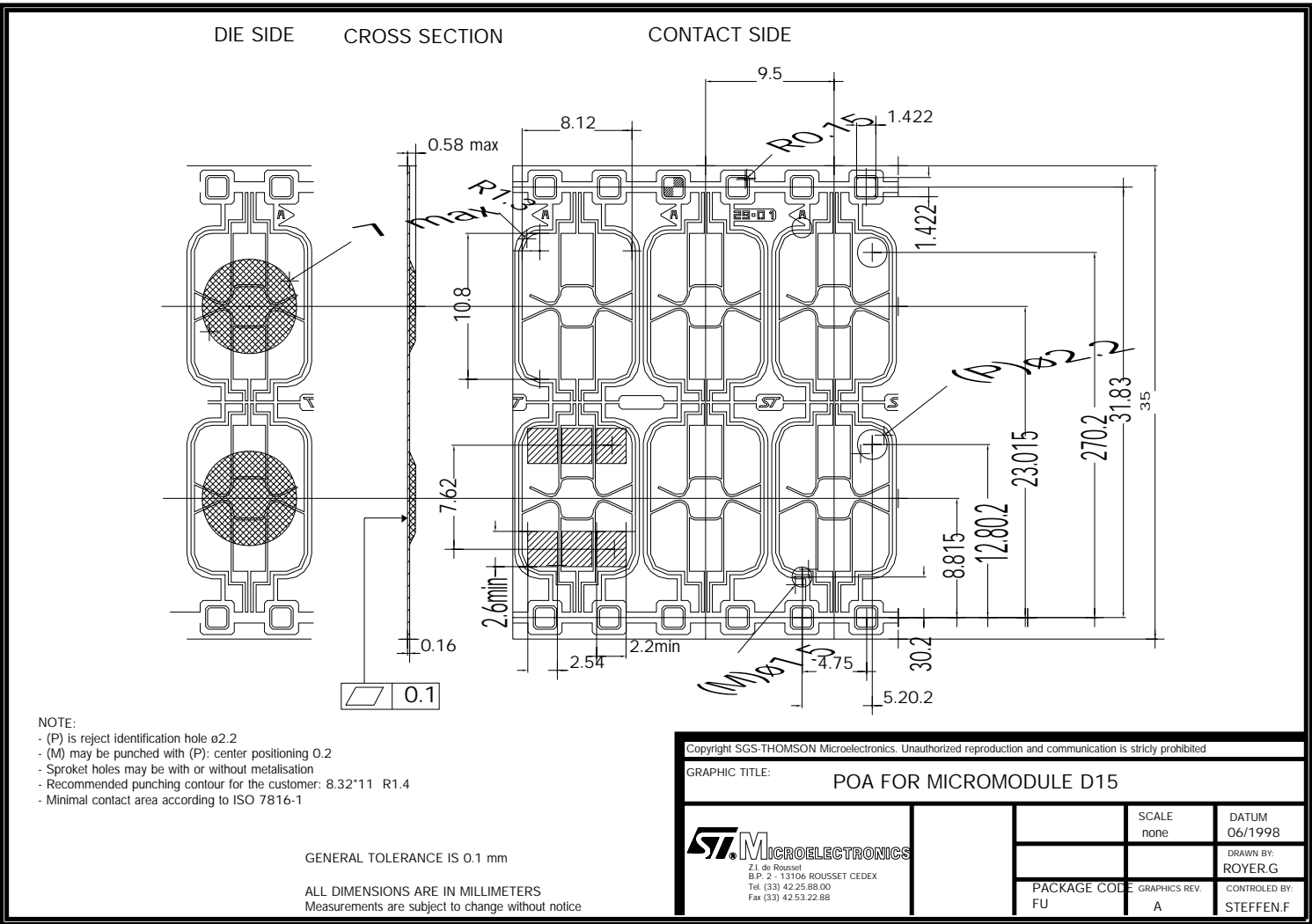


Figure 6. D20 Micromodule Outline

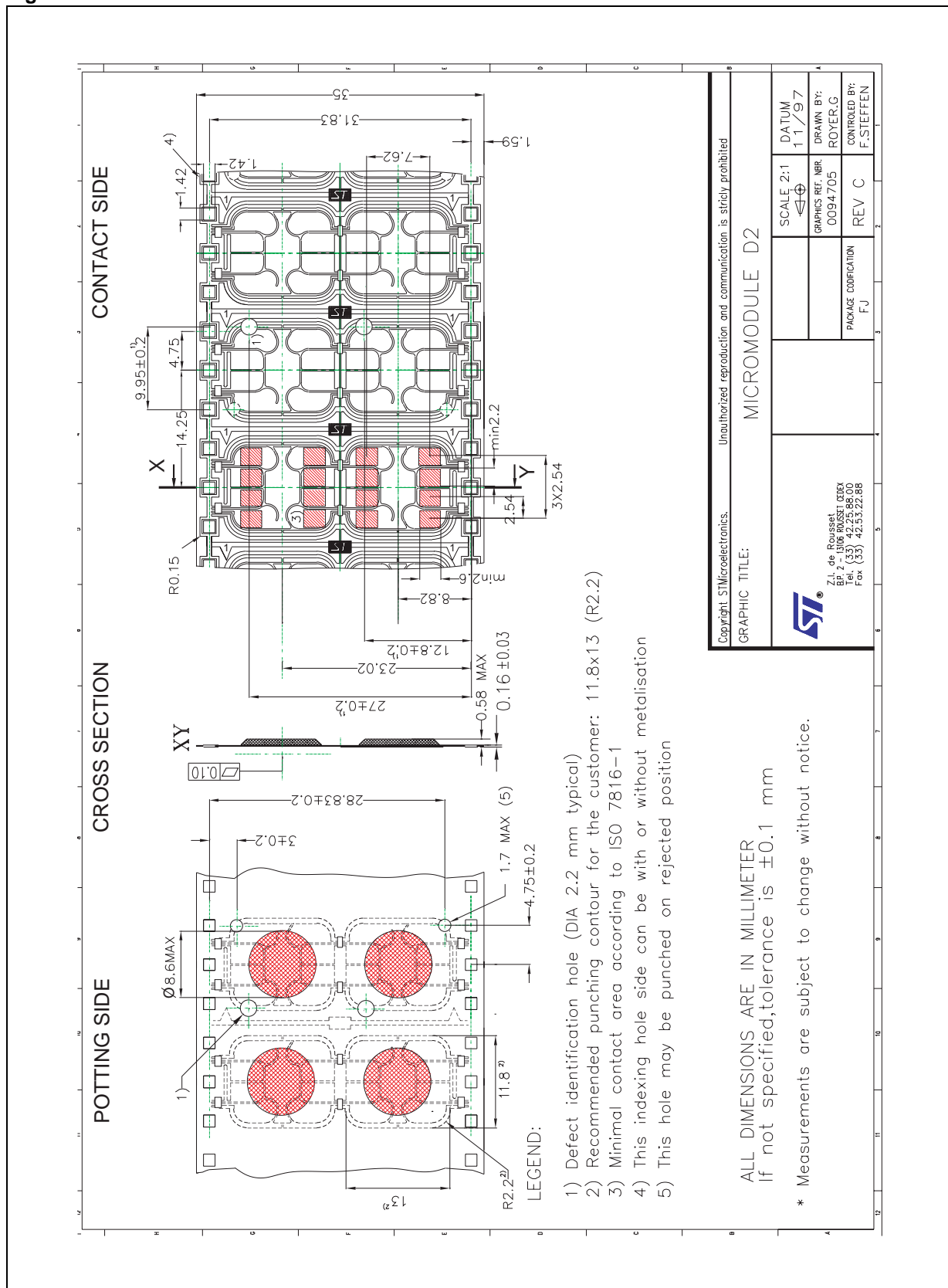
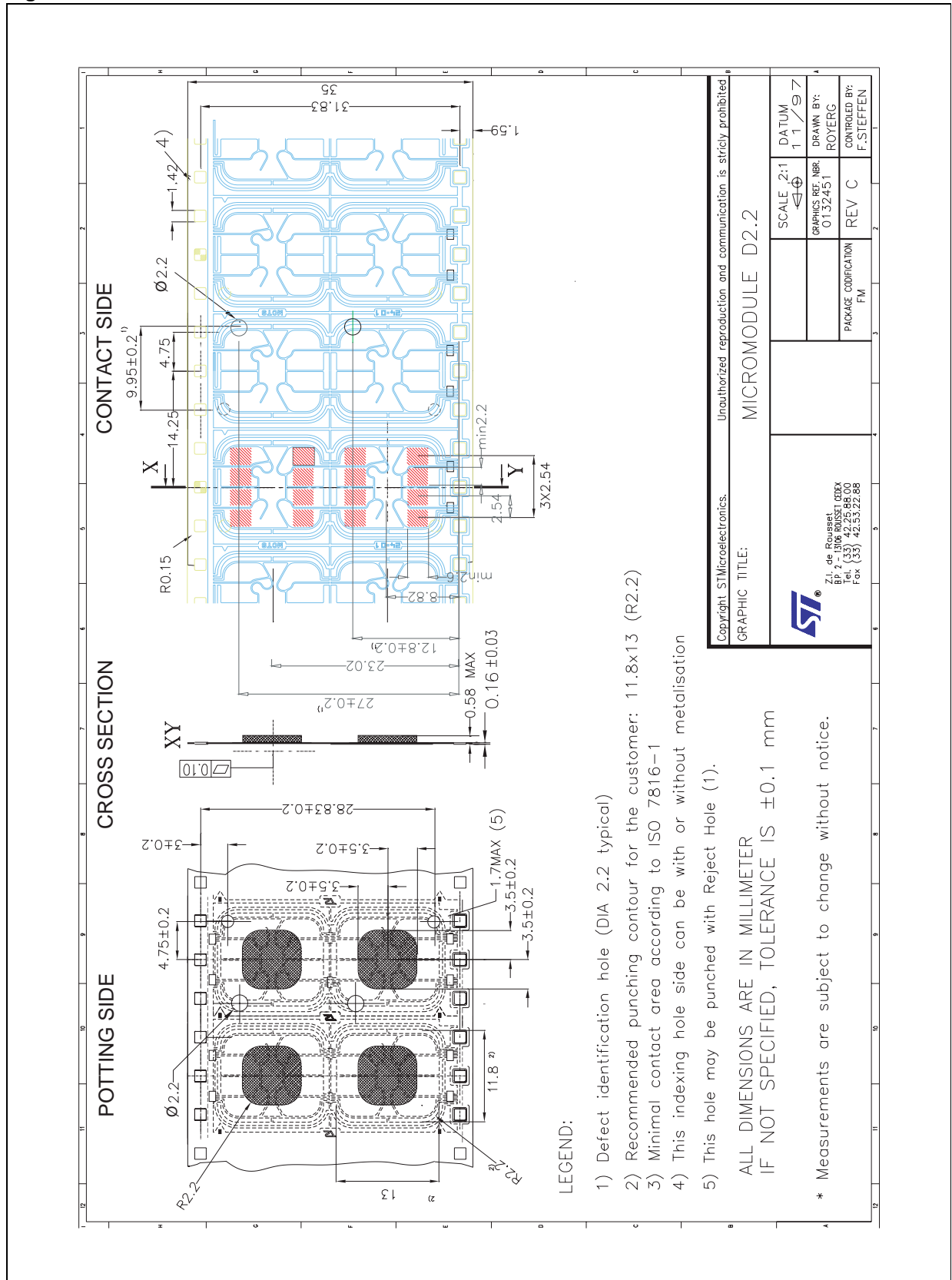


Figure 7. D22 Micromodule Outline



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