LAB ANALYSIS REPORT

Company : MMDC-TECH SCIENCE INC. *6050 W Eastwood Ave, Chicago IL60630, USA* *TEL： (310) 561-1088 FAX：(310) 862-5399*	Date : October 21, 2005 Report No.:25-0639 P.O.No.: 10237 Page : 1 of 16

IDENTIFICATION

Vendor : MMDC-TECH SCIENCE INC.

Part number: WU33AM ,WU50AM

Description:Oscillators (9.8304MHz / 10MHz / 15MHz / 16MHz / 20MHz / 32MHz)

Quantity Received: 21 (3 each)

Quote No. : 2254

BACKGROUND INFORMATION

Received a total of 21 surface mount oscillators (ceramic package / metal lid) for the following analysis :

1) External visual per MIL-STD-883F, Method 2009
2) X-ray per MIL-STD-883F , Method 2012
3) PINd per MIL-STD-883F , Method 2020
4) Seal (gross / fine) per MIL-STD-883F , Method 2014
5) Internal Water Vapor per MIL-STD-883F , Method 1018
6) Internal visual per MIL-STD-883F , Method 2010 and 2017
7) Wire Bond Pull Test per MIL-STD-883F , Method 2011
8) SEM Metal Step Coverage per MIL-STD-883F , Method 2018
9) Die Shear Test per MIL-STD-883F , Method 2019

SUMMARY OF ANALYSIS PROCESS

___	Electrical Test °C	4	Detailed Internal/External Analysis
___	Curve Tracer	5	Scanning Electron Microscope (SEM)
___	Bake and Retest Hours at °C	6	Energy Dispersive X-Ray (EDX) Analysis
1	X-Ray	___	Cross-Section
3	Decapsulate x Mechanical ___Chemical	2	Tests Listed Above

C:\2005 reports\MMDC-TECH\25-0639\25-0639.doc

PREPARED BY:	REVIEWED BY
Larry Bross	*Hong Chen*
Failure Analysis Engineer *(651)635-5925*	*Metallurgical Engineer*

C:\2005 reports\MMDC-TECH\25-0639\25-0639.doc

ANALYSIS

Performed the tests listed per MIL-STD-883F on each part type.

See attached data.

CONCLUSION/COMMENTS

The test results did not reveal any obvious problems/defects with either oscillator type.They both revealed excellent vendor workmanship and passed all tests that were performed.

1.0 Analysis

1.1 External Visual

A. No cracks in the ceramic package or solder seal areas of either oscillator type.

1.2 X-ray

A. No obvious internal abnormalities noted with either oscillator type.

1.3 Particle Impact Noise Detection (PIND)

A. Three parts of each oscillator type, all passed PIND testing.

Equipment used: B and W PIND tester, Model BW-LPD-D4000 S/N10220, Cal Due 4/5/06

1.4 Hermeticity (Gross/Fine)

A. Fine seal (all passed).

	15MHz	32MHz
1	$.3X10^{-9}$ cc/sec	$.5X10^{-9}$cc/sec
2	$.3X10^{-9}$cc/sec	$.4X10^{-9}$cc/sec
3	$.3X10^{-9}$cc/sec	$.4X10^{-9}$cc/sec

B. Gross Seal (all passed)

1.5 Internal Water Vapor

A. Excellent (see attached data sheets).

1.6 Internal Visual

A. 15MHz oscillator/32MHz oscillator

Die size: 35X47 mils
Die attach material: Silver Epoxy
Wire Type: Gold
Wire Size: 1 Mil
Wire Bond Type: Thermal Compression Ball Bond
Crystal Attachment: Silver Epoxy

No internal visual defects were noted with either oscillator type (15MHz/32MHz).

1.7 Bond Strength

A. Crystal Attachment

Two samples of each type (15MHz/32MHz) were subjected to pull testing. All of the crystal silver epoxy bonds were fine. They were still firmly attached with a force ≥ 20 grams.

Equipment used: Dage Bond Tester, BT-22, 6587, Cal Due 10/27/05

B. Wire Bond Pull Test

Wire #	15MHz (#1)	15MHz (#2)	32MHz (#1)	32MHz (#2)
1	6.6	6.3	7.3	6.9
2	5.8	5.9	5.9	7.2
3	7.0	7.2	6.4	6.6
4	7.7	6.4	7.6	7.1
5	7.3	6.8	7.8	5.4

*All readings in grams

1.7 Bond Strength (continued)

B. Wire Bond Pull Test (continued)

The specification limit (1 mil Gold/Post Seal) is 2.5 grams minimum. They were all good with the break occurring at the wire.

Equipment used: Dage Bond Tester, BT-22, 6587, Cal Due 10/27/05

1.8 Metal Step Coverage (SEM)

A. The die surface metal step coverage was excellent on both oscillator types.

1.9 Die Shear Test

	15MHz (#1)	**15MHz (#2)**	**32MHz (#1)**	**32MHz (#2)**
Force	3.2Kgrams	2.4Kgrams	2.8Kgrams	3.4Kgrams

Two oscillators of each type were tested.

Equipment used: ANZATECH 52 Tester, Cal Due 10/26/05.

All of the samples passed by a factor of at least four. The minimum is .6Kgrams.

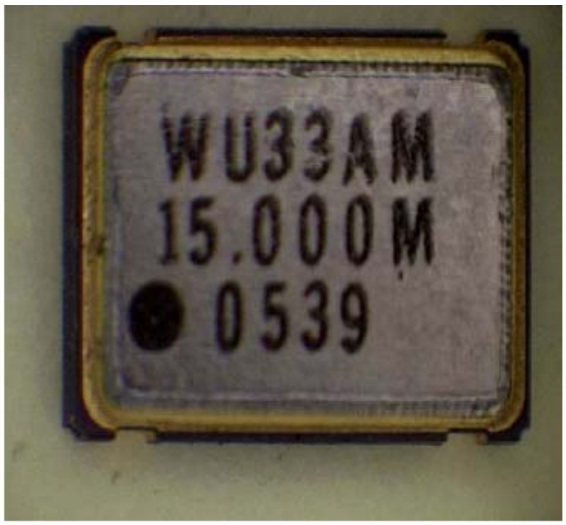

Figure 1.

Optical view of the package/markings of the 15MHz oscillator.

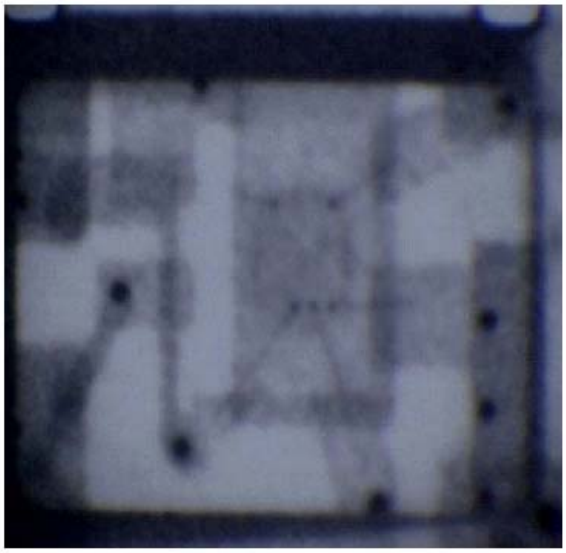

Figure 2.

X-ray view of a typical 15MHz oscillator. No defects were noted.

Page 6

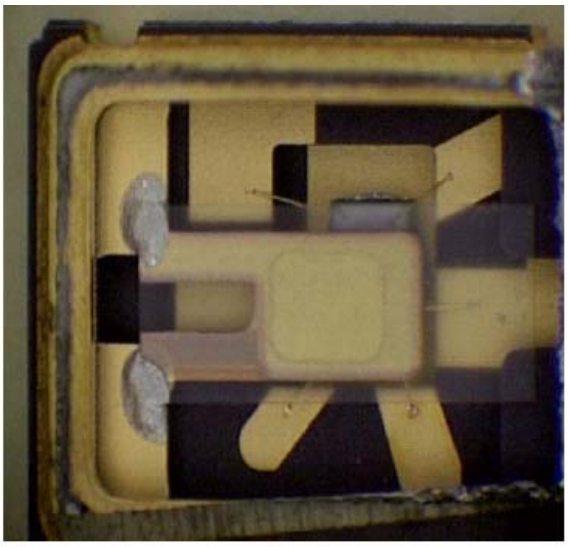

Figure 3.

Decapped view of the internal package of the 15MHz oscillator. No defects were noted.

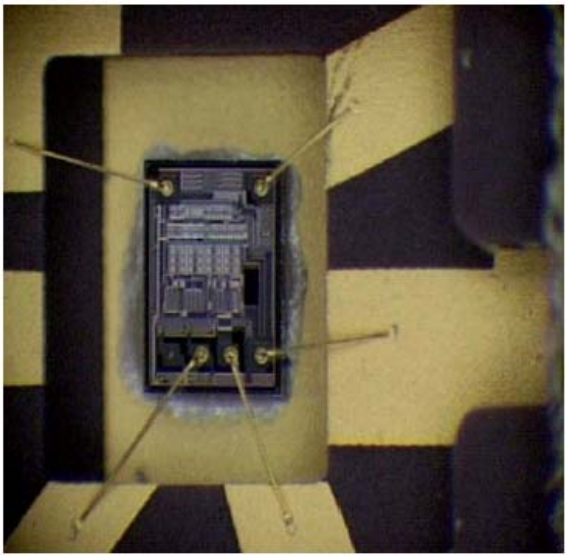

Figure 4.

Optical view of the die surface/wire attachment of the 15MHz oscillator IC.

Page 7

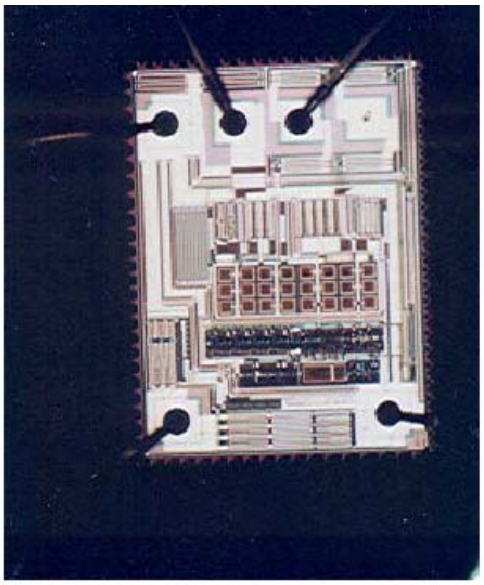

Figure 5.

Optical view (bright field) of the die surface of a typical 15MHz oscillator.

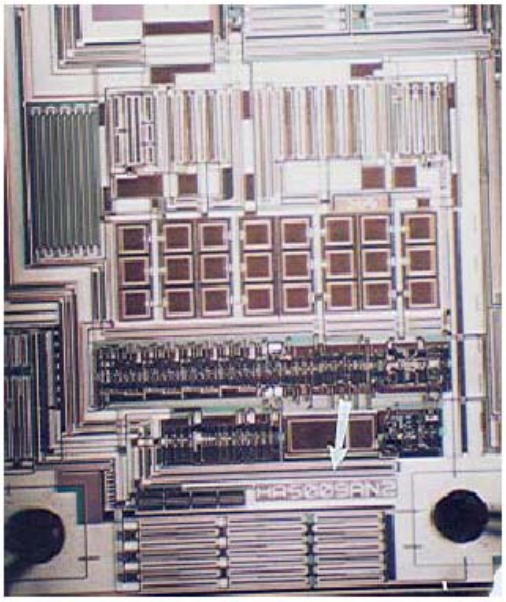

Figure 6.

Closer view of the die surface of the 15MHz oscillator, illustrating the die marking (arrow).

Page 8

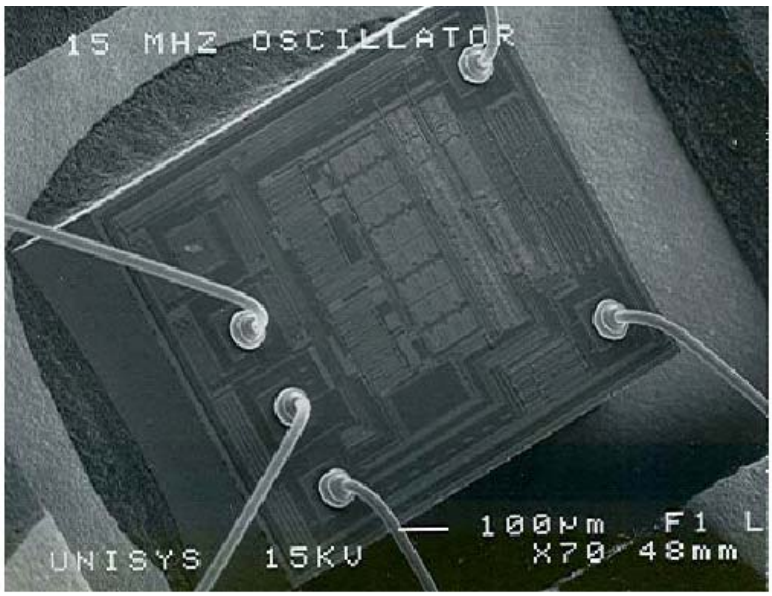

Figure 7.
70X

SEM view of the die geometry of the 15MHz IC.

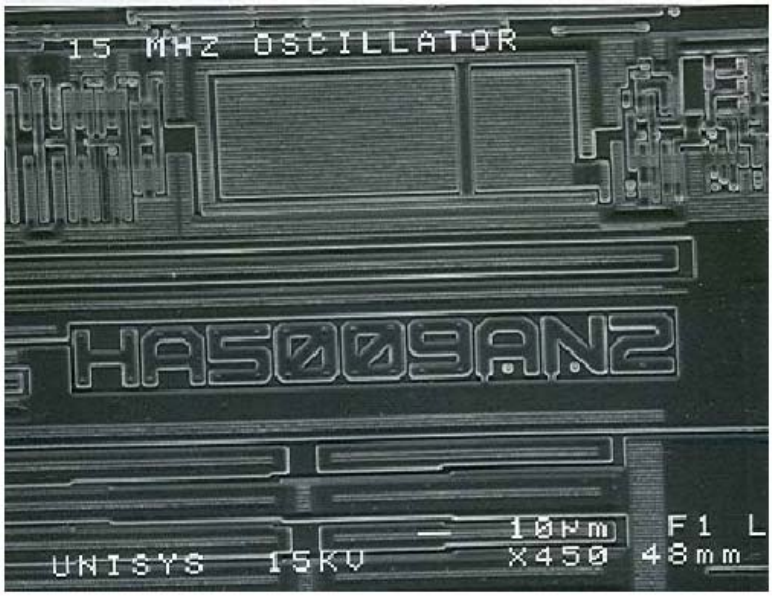

Figure 8.
450X

SEM view of the die marking of the IC of the 15MHz oscillator.

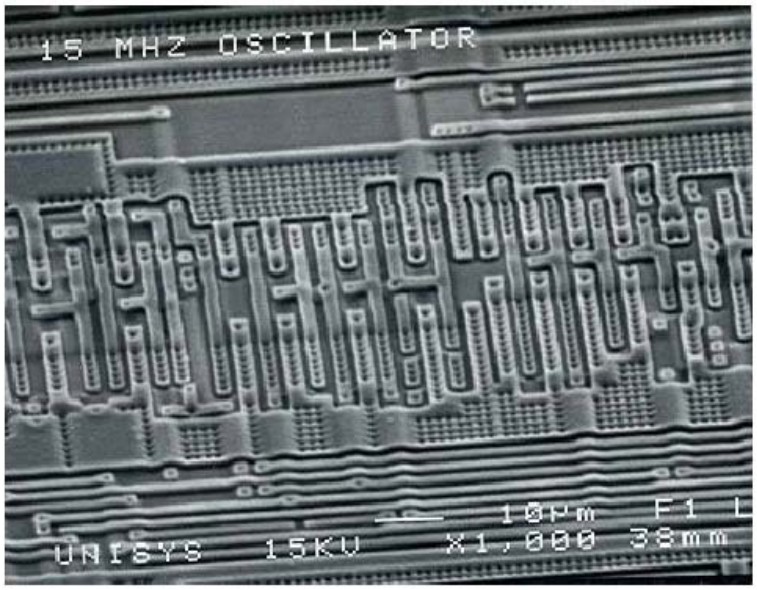

Figure 9.
1000X

SEM view of typical IC die surface metal (excellent) of the 15MHz oscillator.

Figure 10.
2500X

Closer SEM view of typical die surface metal/step coverage.

Figure 11.
6000X

SEM view of excellent die surface meta/step coverage of the 15MHz IC.

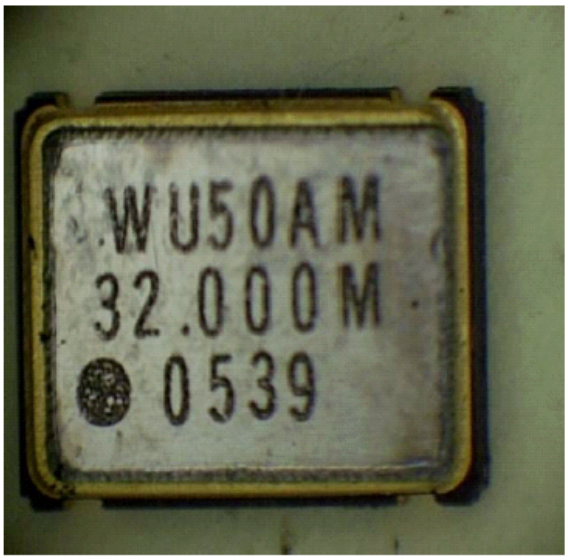

Figure 12.

Optical view of the package/markings of the 32MHz oscillator.

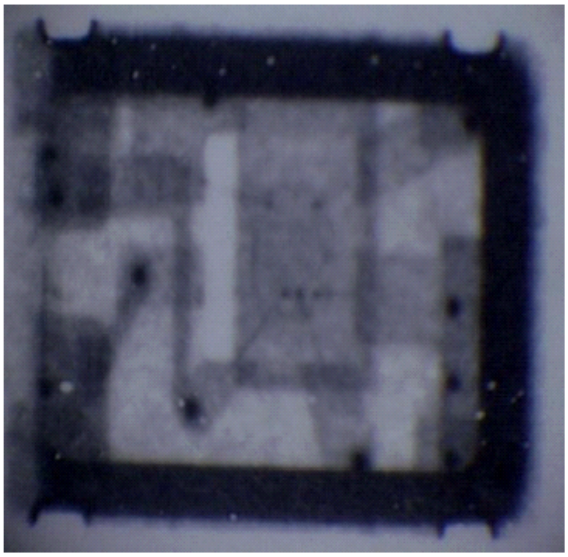

Figure 13.

X-ray view of a typical 32MHz oscillator. No defects were noted.

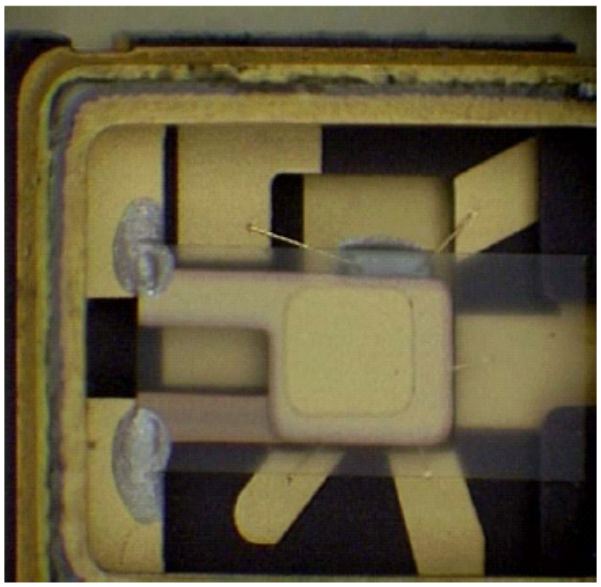

Figure 14.

Decap view of the internal construction of a typical 32MHz oscillator.

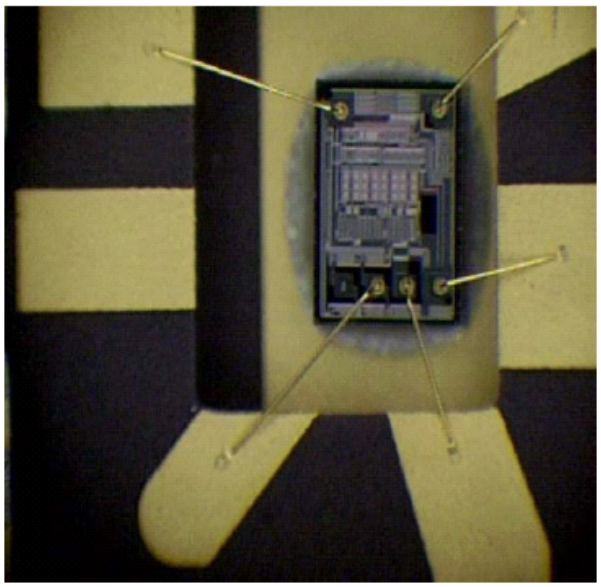

Figure 15.

View of the die surface of the 32MHz oscillator IC with the crystal removed. No defects were noted.

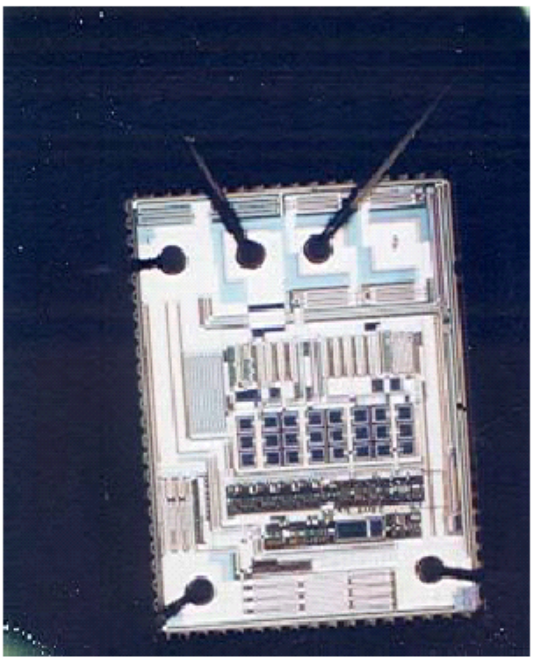

Figure 16.

Optical view of the die geometry of a typical IC of the 32MHz oscillator.

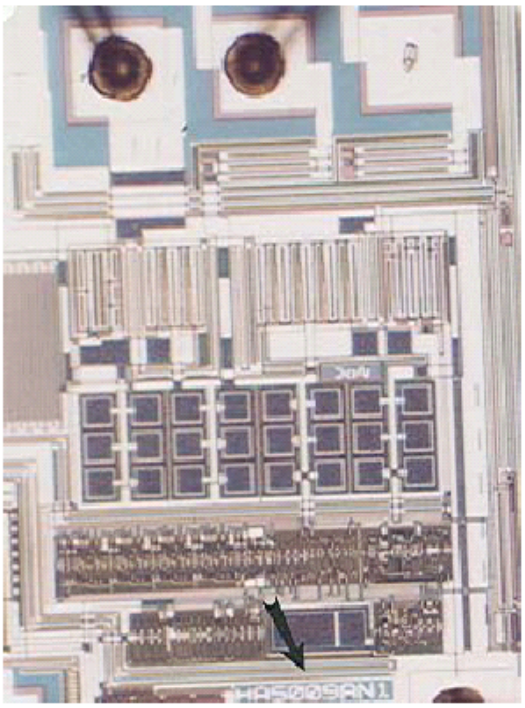

Figure 17.

Optical view of the IC die surface illustrating the die marking (arrow) of the 32MHz oscillator.

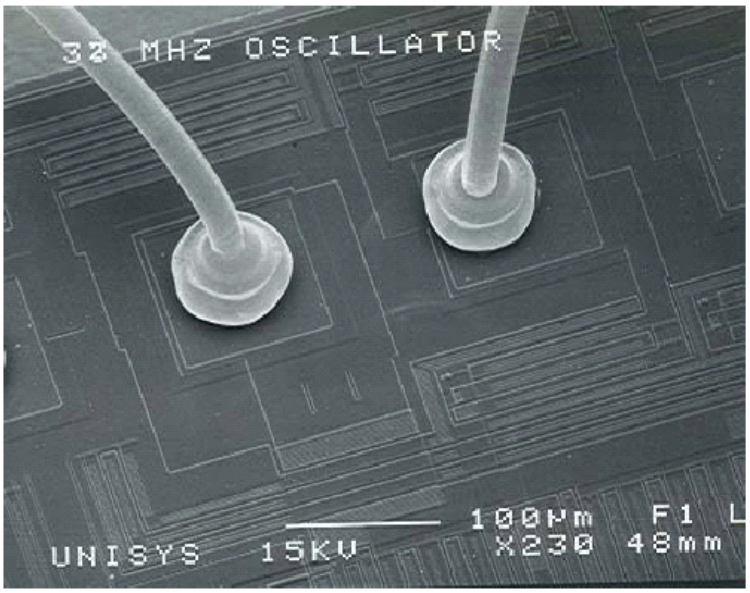

Figure 18.
230X

SEM view of typical (good) wire bonds on the die surface of the IC from the 32MHz oscillator.

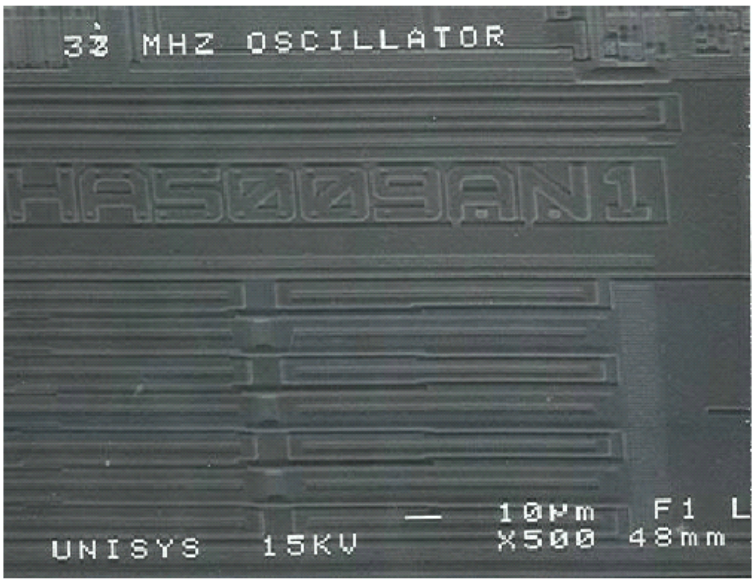

Figure 19.
500X

SEM view of IC die marking of the IC from the 32MHz oscillator.

Figure 20.
1000X

SEM view of typical (excellent) die surface metal of the IC from the 32MHz oscillator.

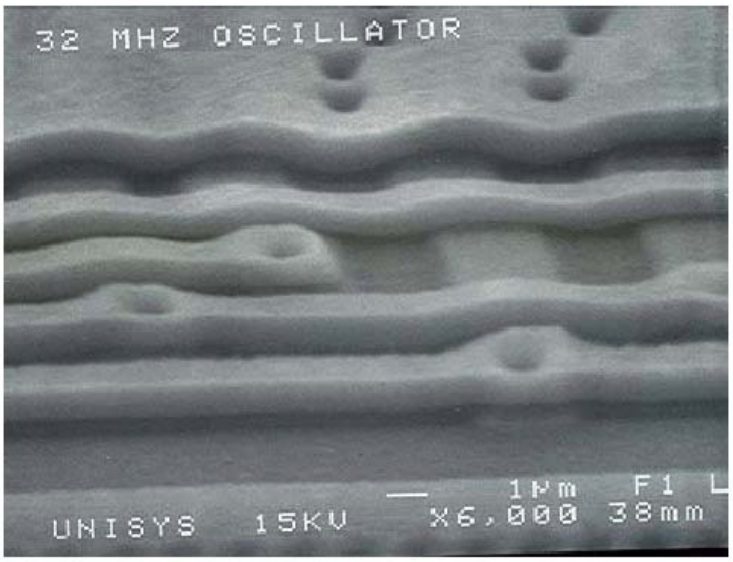

Figure 21.
6000X

Closer SEM view of the die surface metal (excellent).

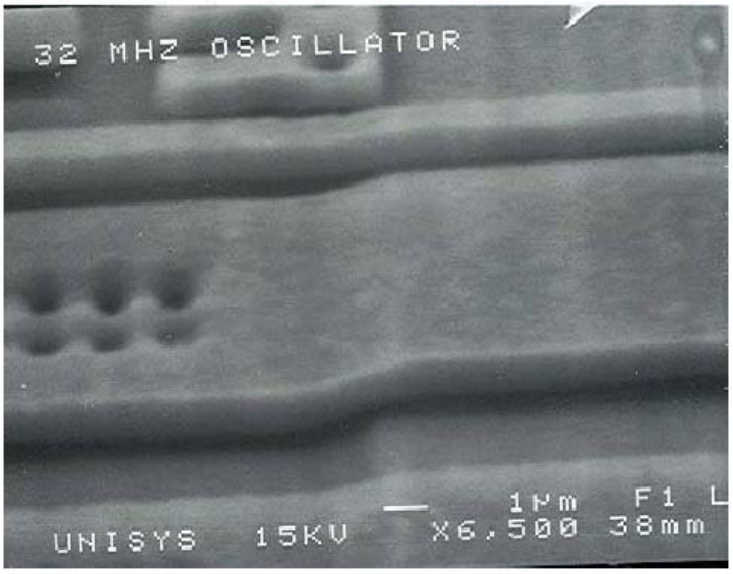

Figure 22.
6500X

Another SEM view of excellent metal/step coverage.