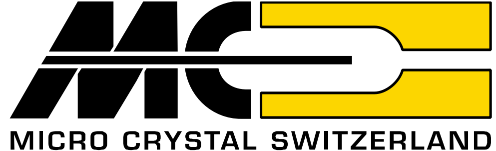


Application Manual

MCSO

Clock Oscillator
10 kHz – 225 MHz

TABLE OF CONTENTS

1. OVERVIEW 3

1.1. GENERAL DESCRIPTION 3

1.2. APPLICATIONS 3

1.3. ORDERING INFORMATION 4

2. BLOCK DIAGRAM 5

2.1. PINOUT 5

2.2. PIN DESCRIPTION 5

3. ELECTRICAL SPECIFICATIONS 6

3.1. ABSOLUTE MAXIMUM RATINGS 6

3.2. OPERATING PARAMETERS 7

3.3. TYPICAL CHARACTERISTICS 8

3.4. OSCILLATOR PARAMETERS 9

3.4.1. FREQUENCY VS. TEMPERATURE CHARACTERISTICS 9

4. PACKAGE 10

4.1. DIMENSIONS AND SOLDER PAD LAYOUT 10

4.1.1. PACKAGE WITH J-LEADS 10

4.1.2. PACKAGE WITH AU PLATED PADS 11

4.2. MARKING AND PIN #1 INDEX 12

5. MATERIAL COMPOSITION DECLARATION & ENVIRONMENTAL INFORMATION 13

5.1. HOMOGENOUS MATERIAL COMPOSITION DECLARATION (OPTION 2 = J/L) 13

5.2. RECYCLING MATERIAL INFORMATION (OPTION 2 = J/L) 14

5.3. ENVIRONMENTAL PROPERTIES & ABSOLUTE MAXIMUM RATINGS (OPTION 2 = J/L) 15

5.4. HOMOGENOUS MATERIAL COMPOSITION DECLARATION (OPTION 2 = GJ/L) 16

5.5. RECYCLING MATERIAL INFORMATION (OPTION 2 = GJ/L) 17

5.6. ENVIRONMENTAL PROPERTIES & ABSOLUTE MAXIMUM RATINGS (OPTION 2 = GJ/L) 18

5.7. HOMOGENOUS MATERIAL COMPOSITION DECLARATION (OPTION 2 = BLANK) 19

5.8. RECYCLING MATERIAL INFORMATION (OPTION 2 = BLANK) 20

5.9. ENVIRONMENTAL PROPERTIES & ABSOLUTE MAXIMUM RATINGS (OPTION 2 = BLANK) 21

6. APPLICATION INFORMATION 22

6.1. TEST CIRCUIT 22

6.2. OUTPUT WAVEFORM 23

6.3. SOLDERING INFORMATION 24

6.4. HANDLING PRECAUTIONS FOR MODULES WITH EMBEDDED CRYSTALS 25

7. PACKING & SHIPPING INFORMATION 26

8. COMPLIANCE INFORMATION 27

9. DOCUMENT REVISION HISTORY 27

MCSO

Clock Oscillator 10 kHz – 225 MHz

1. OVERVIEW

- Oscillator with built-in AT-cut crystal, operating in fundamental mode
- Overall frequency stability over temperature range: ≤ ±50 ppm or ≤ ±100 ppm
- Very fast start-up: typ.1 ms at 25°C
- Output signal HCMOS compatible
- High shock and vibration resistance
- Operating voltage: 2.5 V, 3.3 V or 5.0 V
- Power consumption: < 5 mA at V_{DD} = 3.3 V, F ≤ 20 MHz
- Operating temperature range:
    - A = 0 to +70°C
    - B = -40 to +85°C
    - C = -55 to +125°C
    - X = Custom
- Enable/Disable function (option 1)
- Low aging rate
- Ceramic SMD package with metal lid (14.1 x 9.5 mm), RoHS-compliant and 100% lead-free

1.1. GENERAL DESCRIPTION

The MCSO combines a High Frequency HCMOS oscillator circuitry together with an AT-cut quartz crystal in a hermetically sealed ceramic package with metal lid. No external components are required.
The frequency output 500 kHz – 225 MHz on F_{OUT} pin can be enabled / disabled by the E/D pin (option 1)*. The F_{OUT} frequency is enabled when E/D pin is connected to V_{DD} or when it is left open (not connected). When the E/D pin is tied to GND the frequency is disabled and the F_{OUT} pin is in high impedance state (Hi-Z).
* E/D option not available for F < 500 kHz

1.2. APPLICATIONS

The MCSO clock oscillator module combines outstanding performance and robustness in a standard ceramic package:

- Oscillator module (embedded XTAL) in a standard 14.1 x 9.5 mm lead-free ceramic package
- High shock and vibration resistant

The robust construction and high performances make this product perfectly suitable for many high reliability applications:

- Avionics / Aerospace: Airborne Equipment / Engine Control / Actuator Controller / Temperature Controller / Instrumentation / Navigation and Guidance Systems
- Instrumentation: Field Test Instrument / Automotive Test Equipment
- Communication: Optical Network / Wireless Communication System
- Security / Safety: Survival and Protection System / Railway Security System / Fire Fighter Equipment
- Industrial: Telemetry / A/C Controller / Hydraulic Sensor

1.3. ORDERING INFORMATION

Example: MCSO F H V T – C 40.000 MHz E/D GJ/L XXX

Code	**Package Size**
MCSO	14.1 x 9.5 mm

Code	**Jitter**
F	Low jitter *
Blank	Standard

Code	**Frequency range**
H	> 20 MHz
Blank	≤ 20 MHz

Code	**Supply voltage**
W	V_{DD} = 2.5 V
V	V_{DD} = 3.3 V
Blank	V_{DD} = 5.0 V **

Code	**Frequency stability**
T	±50 ppm
Blank	±100 ppm

Code	**Temperature range**
A	0 to +70°C
B	-40 to +85°C
C	-55 to +125°C
X	Custom

Code	**Frequency**
40.000 MHz	40.000 MHz

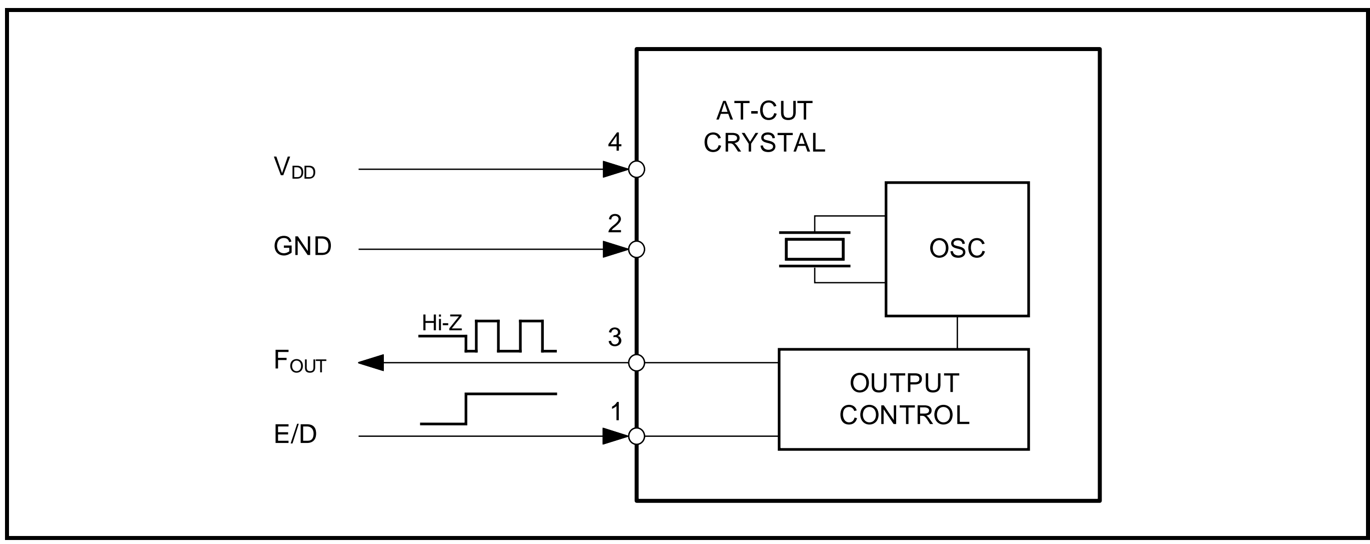
Code	**Option 1**
E/D	Enable/Disable ***
Blank	No function

Code	**Option 2**
J/L	SnAgCu solder dipped J-Leads
GJ/L	Au plated J-Leads
Blank	Au plated pads

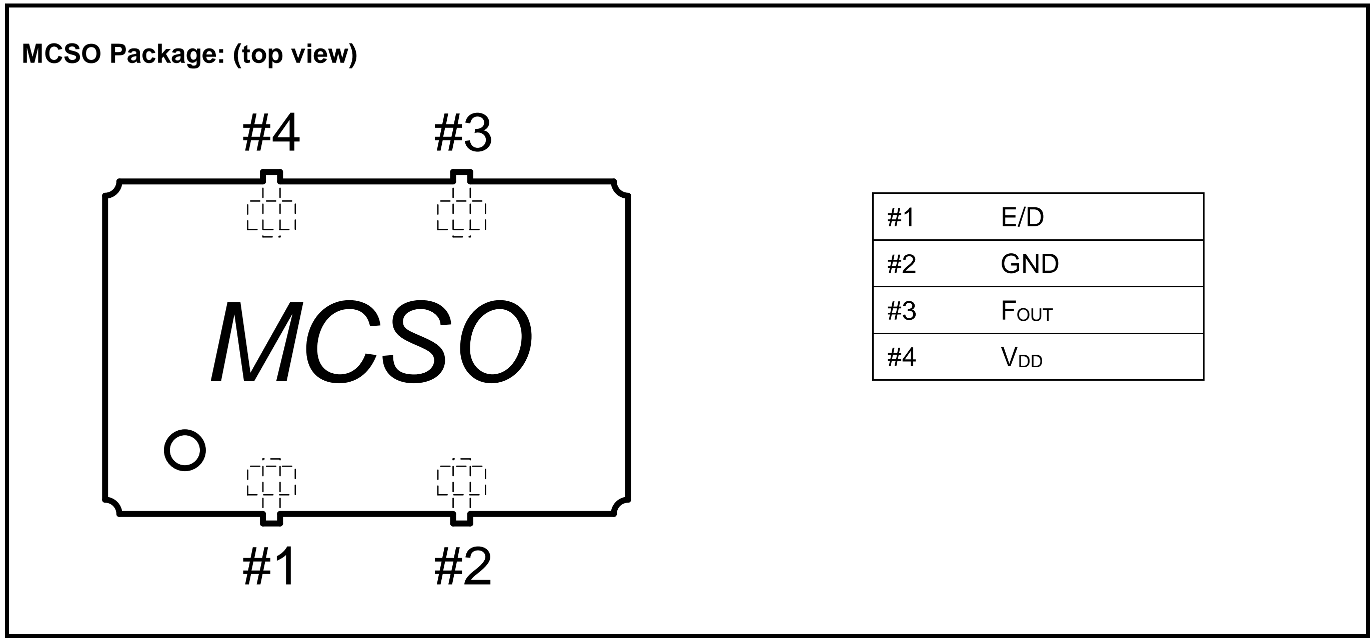
Code	**Customer specification N°**
XXX	XXX

* One-sigma jitter for low jitter version (F):
t_{RMS} < 2 ps for F ≤ 20 MHz
t_{RMS} < 10 ps for F > 20 MHz
** 5.0 V version not available for low jitter version (F)
*** E/D option not available for F < 500 kHz

2. BLOCK DIAGRAM



2.1. PINOUT



#1	E/D
#2	GND
#3	F_{OUT}
#4	V_{DD}

2.2. PIN DESCRIPTION

Symbol	Pin #	Description
E/D	1	Input to enable/disable the F_{OUT} pin (option 1). If E/D is HIGH or floating (V_{IH} or open), the F_{OUT} pin is in output mode. When E/D is tied to Ground (V_{IL}), the F_{OUT} pin is disabled (Hi-Z).
GND	2	Ground.
F_{OUT}	3	Clock Output; three-state; controlled by E/D. If E/D is HIGH (V_{DD}) or floating, the F_{OUT} pin drives the square wave of the frequency. When E/D is tied to Ground, the F_{OUT} pin is disabled (Hi-Z).
V_{DD}	4	Power Supply Voltage.

3. ELECTRICAL SPECIFICATIONS

3.1. ABSOLUTE MAXIMUM RATINGS

Absolute Maximum Ratings according to IEC 60134:

SYMBOL	PARAMETER	CONDITIONS	MIN	MAX	UNIT
V_{DD}	Power supply voltage	Nominal V_{DD} = 2.5 V	-0.3	3	V
		Nominal V_{DD} = 3.3 V	-0.3	3.8	
		Nominal V_{DD} = 5.0 V	-0.3	5.5	
V_I	Input voltage		-0.3	V_{DD}	V
V_O	Output voltage		-0.3	V_{DD}	V
V_{ESD}	ESD voltage	HBM (1)		±2000	V
		MM (2)		±200	
T_A	Operating temperature range A		0	70	°C
T_B	Operating temperature range B		-40	85	°C
T_C	Operating temperature range C		-55	125	°C
T_{STO}	Storage temperature	Stored as bare product	-65	125	°C
T_{PEAK}	Maximum reflow condition	JEDEC J-STD-020C		265	°C

(1) HBM: Human Body Model, according to JESD22-A114.
(2) MM: Machine Model, according to JESD22-A115.

3.2. OPERATING PARAMETERS

For this Table, V_{DD} = nominal voltage; GND = 0 V; T_A = 25 °C; unless otherwise indicated.

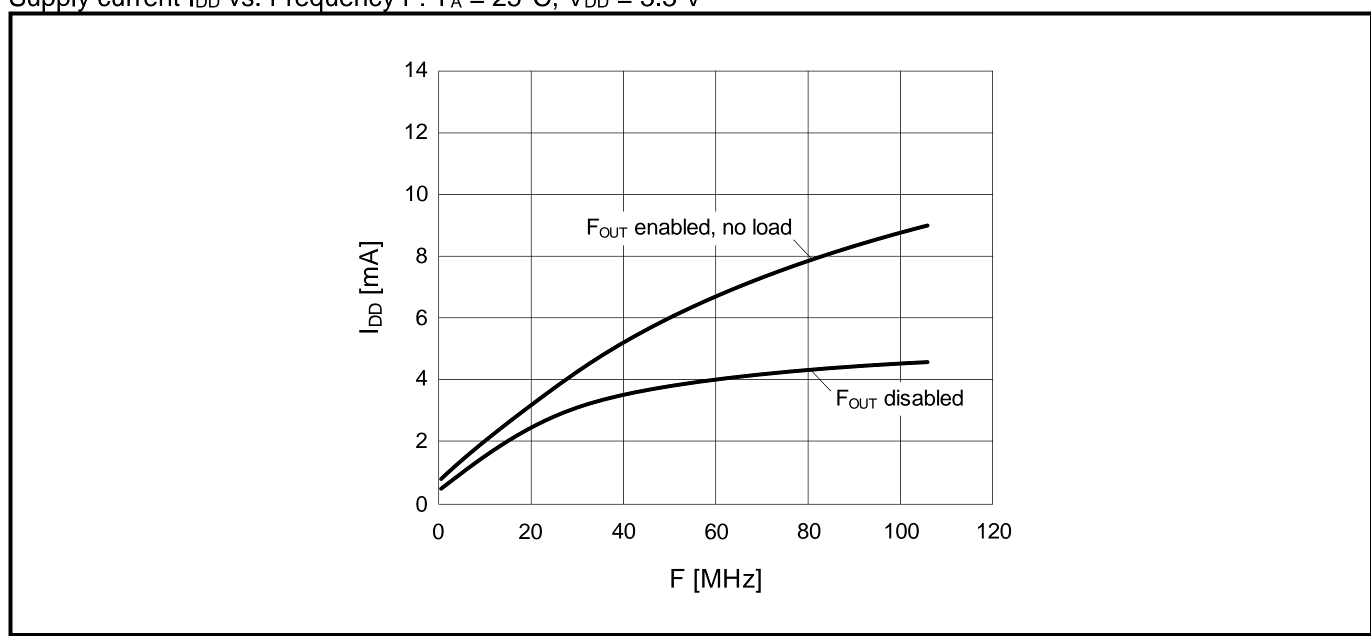
Operating Parameters:

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Supply						
V_{DD}	Power supply voltage (1) (2)	Nominal V_{DD} = 2.5 V	2.25		2.75	V
		Nominal V_{DD} = 3.3 V	2.97		3.63	
		Nominal V_{DD} = 5.0 V	4.5		5.5	
I_{DD}	Input current. V_{DD} = 2.5 V F_{OUT} enabled, no load	10 kHz ≤ F ≤ 10 MHz			2	mA
		10 MHz < F ≤ 20 MHz			3	
		20 MHz < F ≤ 225 MHz			25	
	Input current. V_{DD} = 3.3 V F_{OUT} enabled, no load	10 kHz ≤ F ≤ 10 MHz			4	
		10 MHz < F ≤ 20 MHz			5	
		20 MHz < F ≤ 225 MHz			30	
	Input current. V_{DD} = 5.0 V F_{OUT} enabled, no load	10 kHz ≤ F ≤ 10 MHz			6	
		10 MHz < F ≤ 20 MHz			7	
		20 MHz < F ≤ 225 MHz			40	
Input E/D (3)						
V_I	Input voltage		GND -0.3		V_{DD} +0.3	V
V_{IL}	LOW level input voltage		GND		0.3 V_{DD}	V
V_{IH}	HIGH level input voltage		0.7 V_{DD}		V_{DD}	V
t	Reaction time				1	µs
Output F_{OUT} (HCMOS compatible)						
V_{OH}	HIGH level output voltage		V_{DD} -0.5			V
V_{OL}	LOW level output voltage				0.4	V
C_L	Output load capacitance	HCMOS	3	15	47	pF
t_r / t_f	Rise & fall time	F ≤ 20 MHz, C_L = 15 pF, 20% to 80% V_{DD}			7	ns
		F > 20 MHz, C_L = 15 pF, 10% to 90% V_{DD}			3	

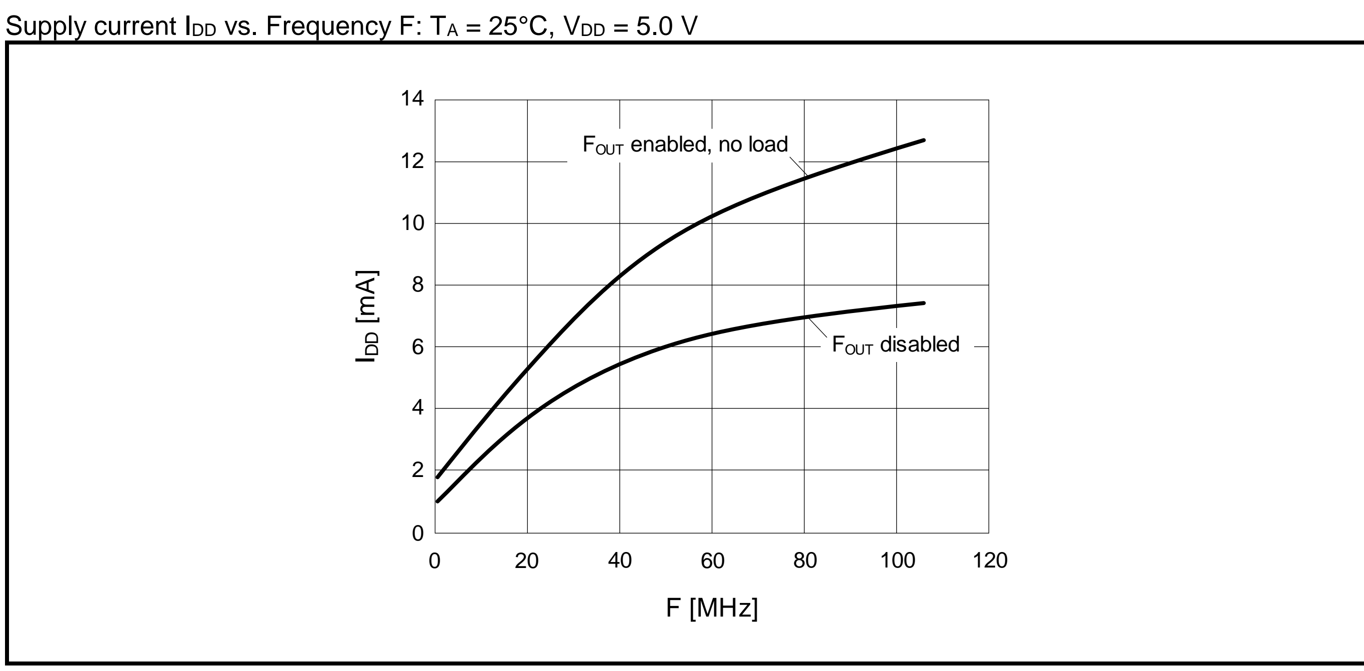
(1) A 47 nF decoupling capacitor has to be connected between V_{DD} and GND.
(2) 5.0 V version not available for low jitter version (F).
(3) E/D option not available for F < 500 kHz

3.3. TYPICAL CHARACTERISTICS

Supply current I_{DD} vs. Frequency F: T_A = 25°C, V_{DD} = 3.3 V



Supply current I_{DD} vs. Frequency F: T_A = 25°C, V_{DD} = 5.0 V



3.4. OSCILLATOR PARAMETERS

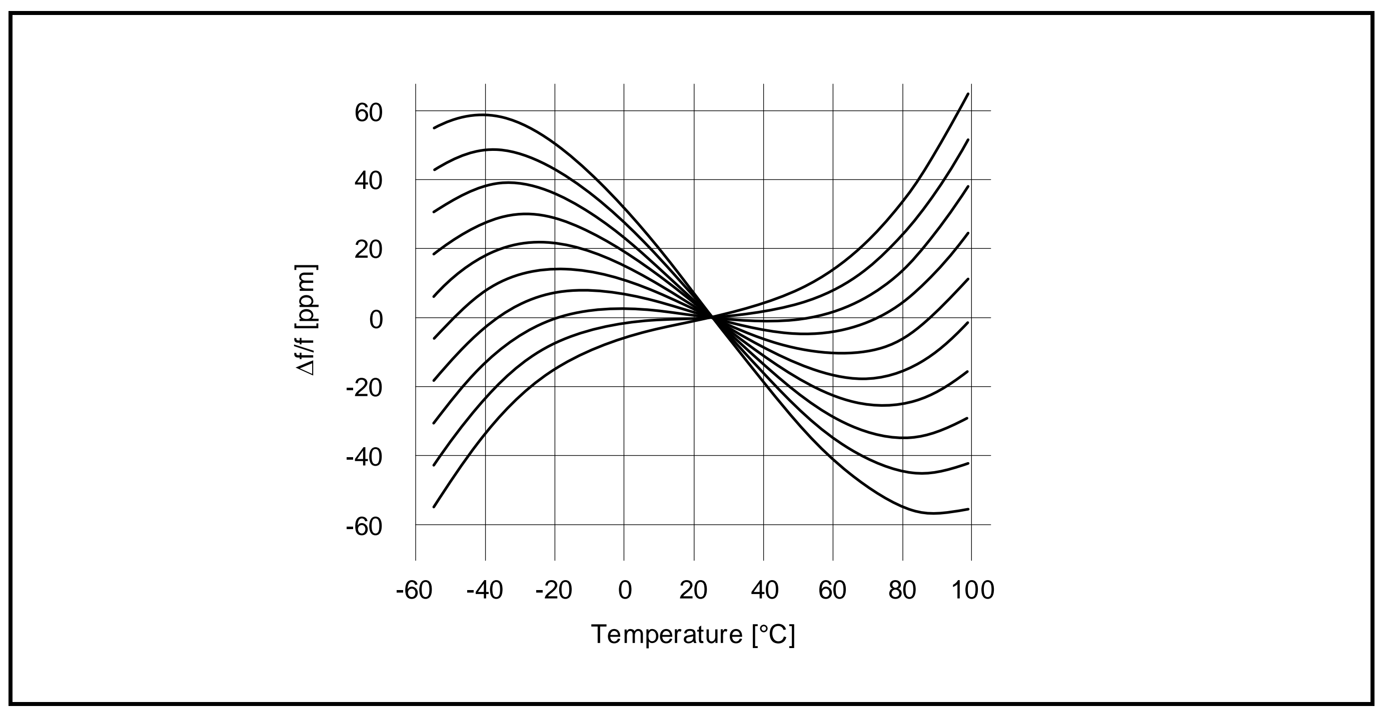
For this Table, V_{DD} = nominal voltage; GND = 0 V; T_A = 25 °C; unless otherwise indicated.

Oscillator Parameters:

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
General						
F	Frequency range		0.01		225	MHz
t_{START}	Oscillator start-up time			1	5	ms
δ_{FOUT}	F_{OUT} duty cycle @ $V_{DD}/2$		40		60	%
Frequency Characteristics						
ΔF/F	**Overall frequency stability over temperature range** (see ORDERING INFORMATION) Standard version (1) T version (2)	Including adjustment at +25°C, V_{DD} variations ±5% and C_L variations min. to max.			 ±100 ±50	ppm
Low jitter version F						
t_{RMS}	One-sigma jitter	F ≤ 20 MHz			2	ps RMS
		F > 20 MHz			10	ps RMS

(1) Including long term aging 10 years.
(2) Including long term aging 1 year.

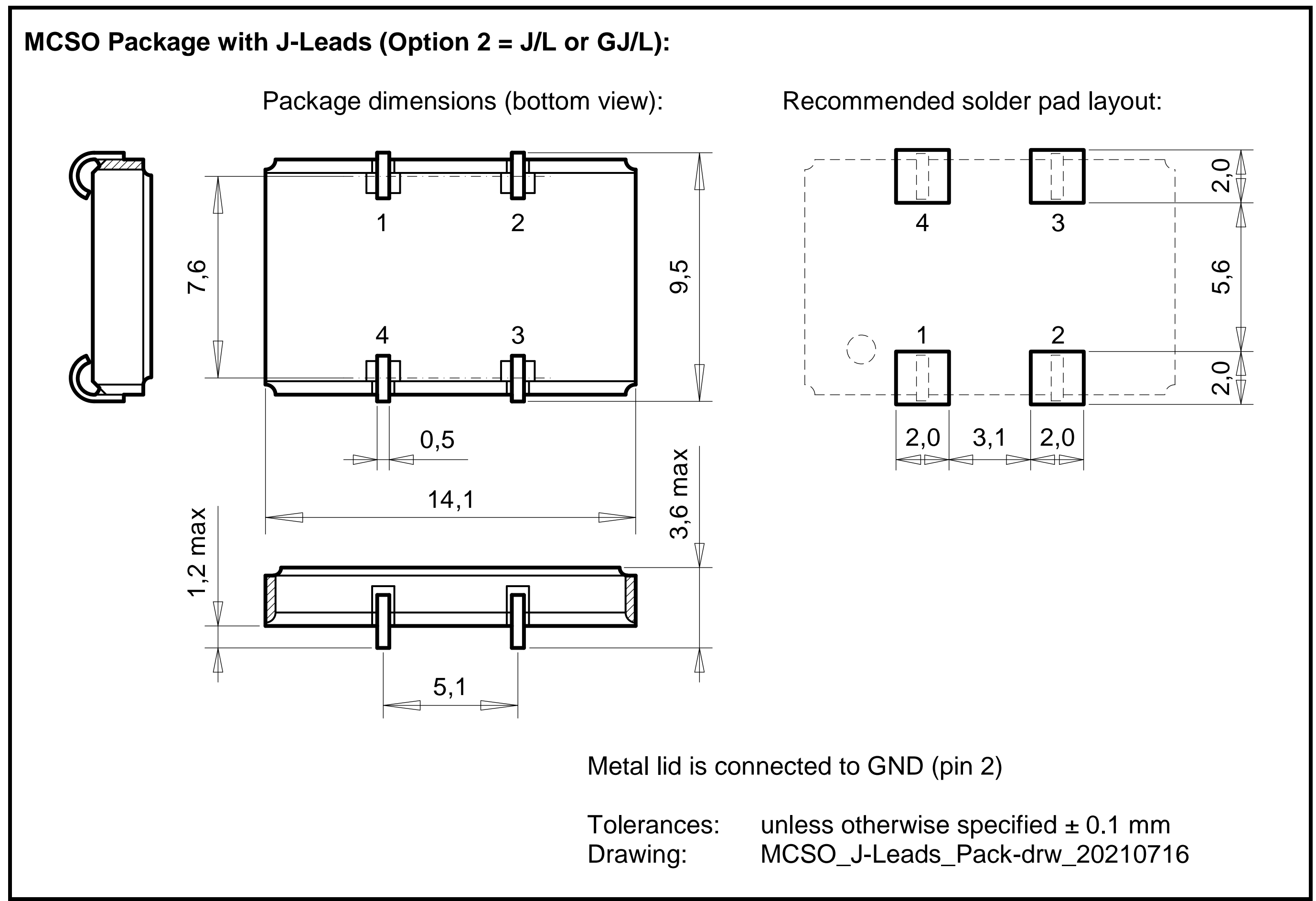
3.4.1. FREQUENCY VS. TEMPERATURE CHARACTERISTICS



4. PACKAGE

4.1. DIMENSIONS AND SOLDER PAD LAYOUT

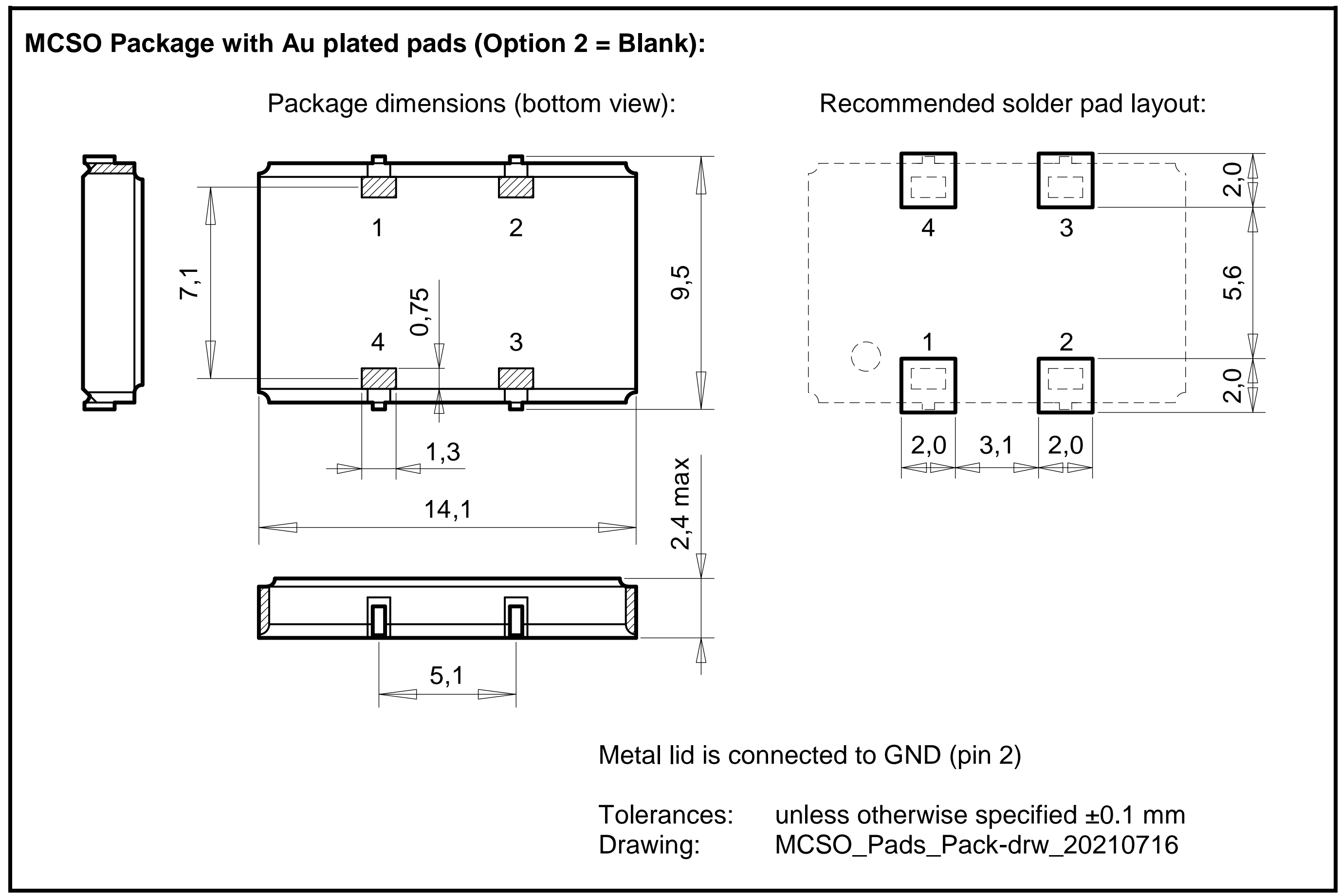
4.1.1.PACKAGE WITH J-LEADS



All dimensions in mm typical.

4.1.2.PACKAGE WITH AU PLATED PADS

MCSO Package with Au plated pads (Option 2 = Blank):



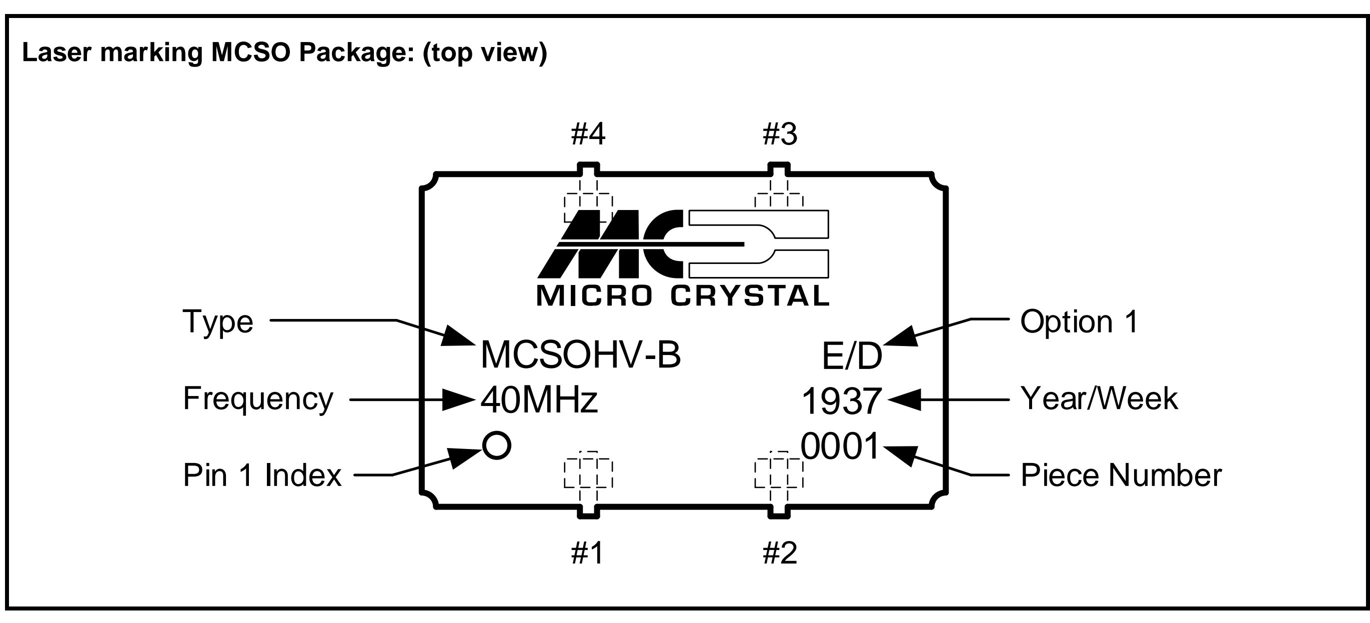
Metal lid is connected to GND (pin 2)

Tolerances: unless otherwise specified ±0.1 mm
Drawing: MCSO_Pads_Pack-drw_20210716

All dimensions in mm typical.

4.2. MARKING AND PIN #1 INDEX

Laser marking MCSO Package: (top view)

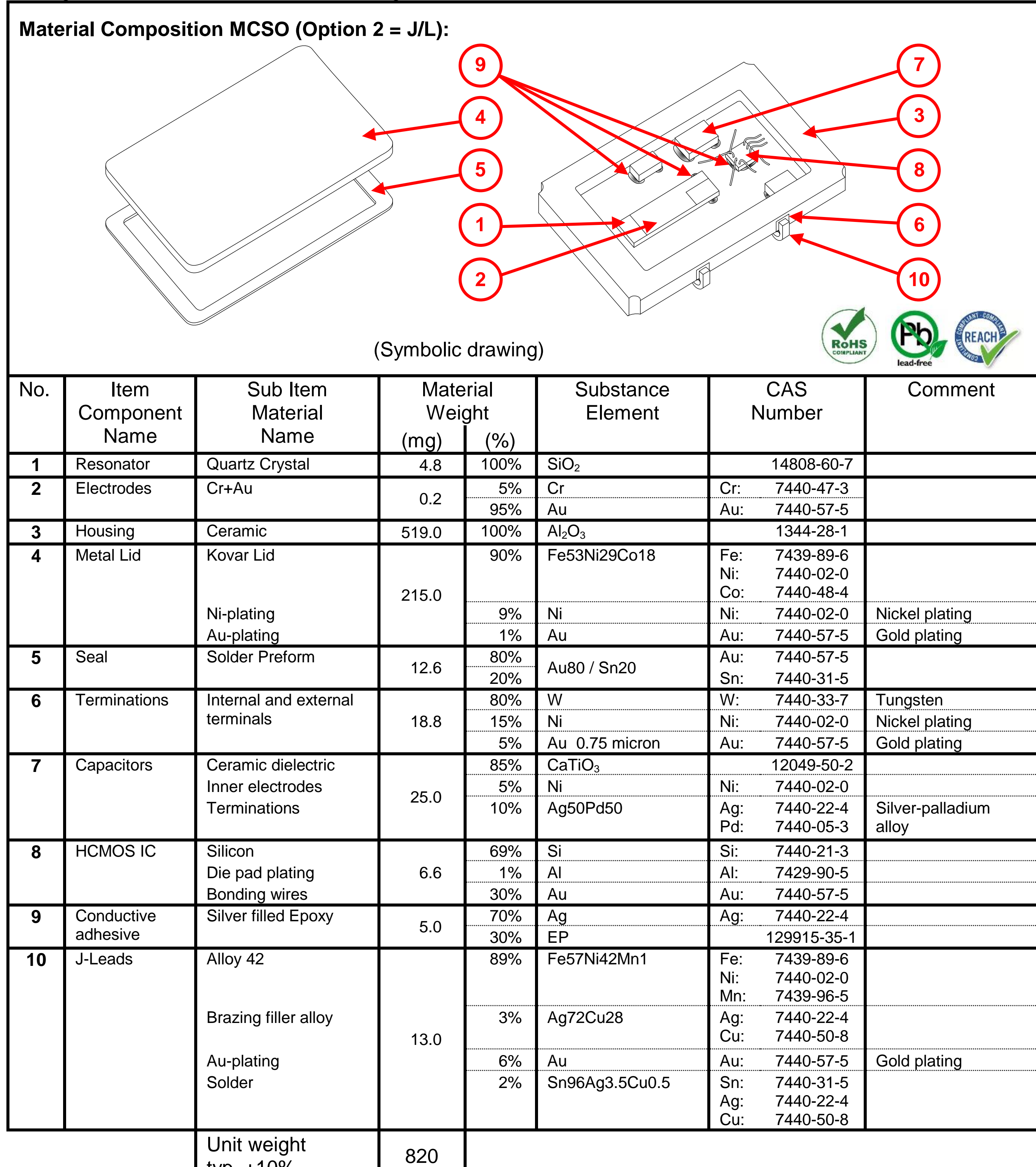


5. MATERIAL COMPOSITION DECLARATION & ENVIRONMENTAL INFORMATION

5.1. HOMOGENOUS MATERIAL COMPOSITION DECLARATION (OPTION 2 = J/L)

Homogenous material information according to IPC-1752 standard

Material Composition MCSO (Option 2 = J/L):



(Symbolic drawing)

No.	Item Component Name	Sub Item Material Name	Material Weight (mg)	(%)	Substance Element	CAS Number	Comment
1	Resonator	Quartz Crystal	4.8	100%	SiO_2	14808-60-7	
2	Electrodes	Cr+Au	0.2	5%	Cr	Cr: 7440-47-3	
				95%	Au	Au: 7440-57-5	
3	Housing	Ceramic	519.0	100%	Al_2O_3	1344-28-1	
4	Metal Lid	Kovar Lid	215.0	90%	Fe53Ni29Co18	Fe: 7439-89-6 Ni: 7440-02-0 Co: 7440-48-4	
		Ni-plating		9%	Ni	Ni: 7440-02-0	Nickel plating
		Au-plating		1%	Au	Au: 7440-57-5	Gold plating
5	Seal	Solder Preform	12.6	80%	Au80 / Sn20	Au: 7440-57-5	
				20%		Sn: 7440-31-5	
6	Terminations	Internal and external terminals	18.8	80%	W	W: 7440-33-7	Tungsten
				15%	Ni	Ni: 7440-02-0	Nickel plating
				5%	Au 0.75 micron	Au: 7440-57-5	Gold plating
7	Capacitors	Ceramic dielectric	25.0	85%	$CaTiO_3$	12049-50-2	
		Inner electrodes		5%	Ni	Ni: 7440-02-0	
		Terminations		10%	Ag50Pd50	Ag: 7440-22-4 Pd: 7440-05-3	Silver-palladium alloy
8	HCMOS IC	Silicon	6.6	69%	Si	Si: 7440-21-3	
		Die pad plating		1%	Al	Al: 7429-90-5	
		Bonding wires		30%	Au	Au: 7440-57-5	
9	Conductive adhesive	Silver filled Epoxy	5.0	70%	Ag	Ag: 7440-22-4	
				30%	EP	129915-35-1	
10	J-Leads	Alloy 42	13.0	89%	Fe57Ni42Mn1	Fe: 7439-89-6 Ni: 7440-02-0 Mn: 7439-96-5	
		Brazing filler alloy		3%	Ag72Cu28	Ag: 7440-22-4 Cu: 7440-50-8	
		Au-plating		6%	Au	Au: 7440-57-5	Gold plating
		Solder		2%	Sn96Ag3.5Cu0.5	Sn: 7440-31-5 Ag: 7440-22-4 Cu: 7440-50-8	
		Unit weight typ. ±10%	820				

5.2. RECYCLING MATERIAL INFORMATION (OPTION 2 = J/L)

Recycling material information according to IPC-1752 standard.
Element weight is accumulated and referenced to the unit weight of 820 mg.

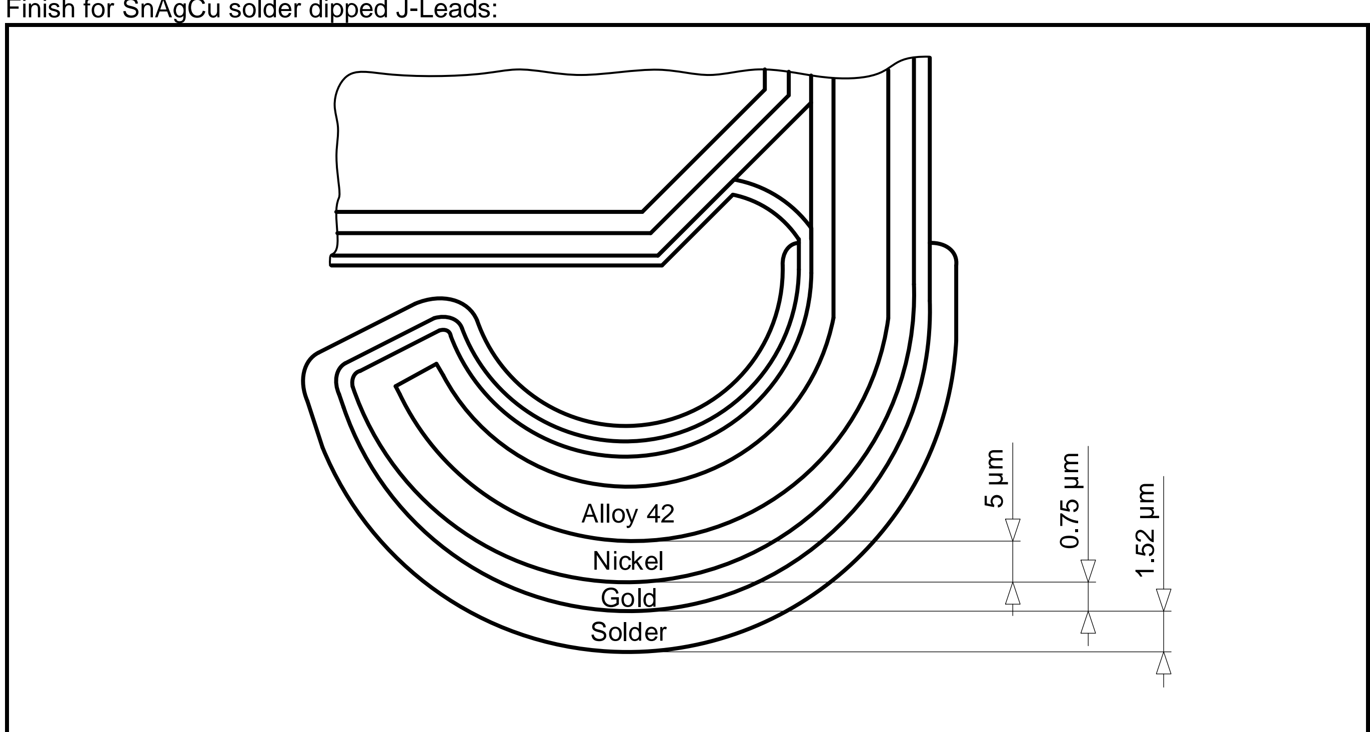
Item Material Name	No.	Item Component Name	Material Weight (mg)	Material Weight (%)	Substance Element	CAS Number	Comment
Quartz Crystal	1	Resonator	4.8	0.59	SiO_2	14808-60-7	
Chromium	2	Electrodes	0.01	0.001	Cr	Cr: 7440-47-3	
Ceramic	3	Housing	519.0	63.30	Al_2O_3	1344-28-1	
Gold	2 4 5 6 8c 10c	Electrodes Metal Lid Seal Terminations HCMOS IC J-Leads	16.1	1.97	Au	Au: 7440-57-5	
Tin	5	Seal	2.52	0.31	Sn	Sn: 7440-31-5	
Nickel	4 6 7b	Metal Lid (Plating) Terminations Capacitors	23.4	2.86	Ni	Ni: 7440-02-0	
Tungsten	6	Terminations	15.04	1.83	W	W: 7440-33-7	
Kovar	4	Metal Lid	193.5	23.60	Fe53Ni29Co18	Fe: 7439-89-6 Ni: 7440-02-0 Co: 7440-48-4	
Ceramic Diel.	7a	Capacitors	21.25	2.59	$CaTiO_3$	12049-50-2	
Ag-Pd-Alloy	7c	Capacitors	2.5	0.30	Ag50Pd50	Ag: 7440-22-4 Pd: 7440-05-3	
Silicon	8a	HCMOS IC	4.55	0.56	Si	Si: 7440-21-3	
Aluminum	8b	HCMOS IC	0.07	0.008	Al	Al: 7429-90-5	
Silver	9a	Conductive adhesive	3.5	0.43	Ag	Ag: 7440-22-4	
Epoxy	9b	Conductive adhesive	1.5	0.18	EP	129915-35-1	
Alloy 42	10a	J-Leads	11.6	1.41	Fe57Ni42Mn1	Fe: 7439-89-6 Ni: 7440-02-0 Mn: 7439-96-5	
Brazing filler	10b	J-Leads	0.39	0.048	Ag72Cu28	Ag: 7440-22-4 Cu: 7440-50-8	
Solder	10d	J-Leads	0.26	0.032	Sn96Ag3.5Cu0.5	Sn: 7440-31-5 Ag: 7440-22-4 Cu: 7440-50-8	
	Unit weight (total) typ. ±10%		820	100			

5.3. ENVIRONMENTAL PROPERTIES & ABSOLUTE MAXIMUM RATINGS (OPTION 2 = J/L)

Package	Description
SOJ-4 ceramic package	Small Outline J-leaded (SOJ), hermetically sealed ceramic package with metal lid

Parameter	Directive	Conditions	Value
Product weight (total)			820 mg
Storage temperature		Store as bare product	-65 to +125°C
Moisture sensitivity level (MSL)	IPC/JEDEC J-STD-020D		MSL1
MTTF			> 100 years

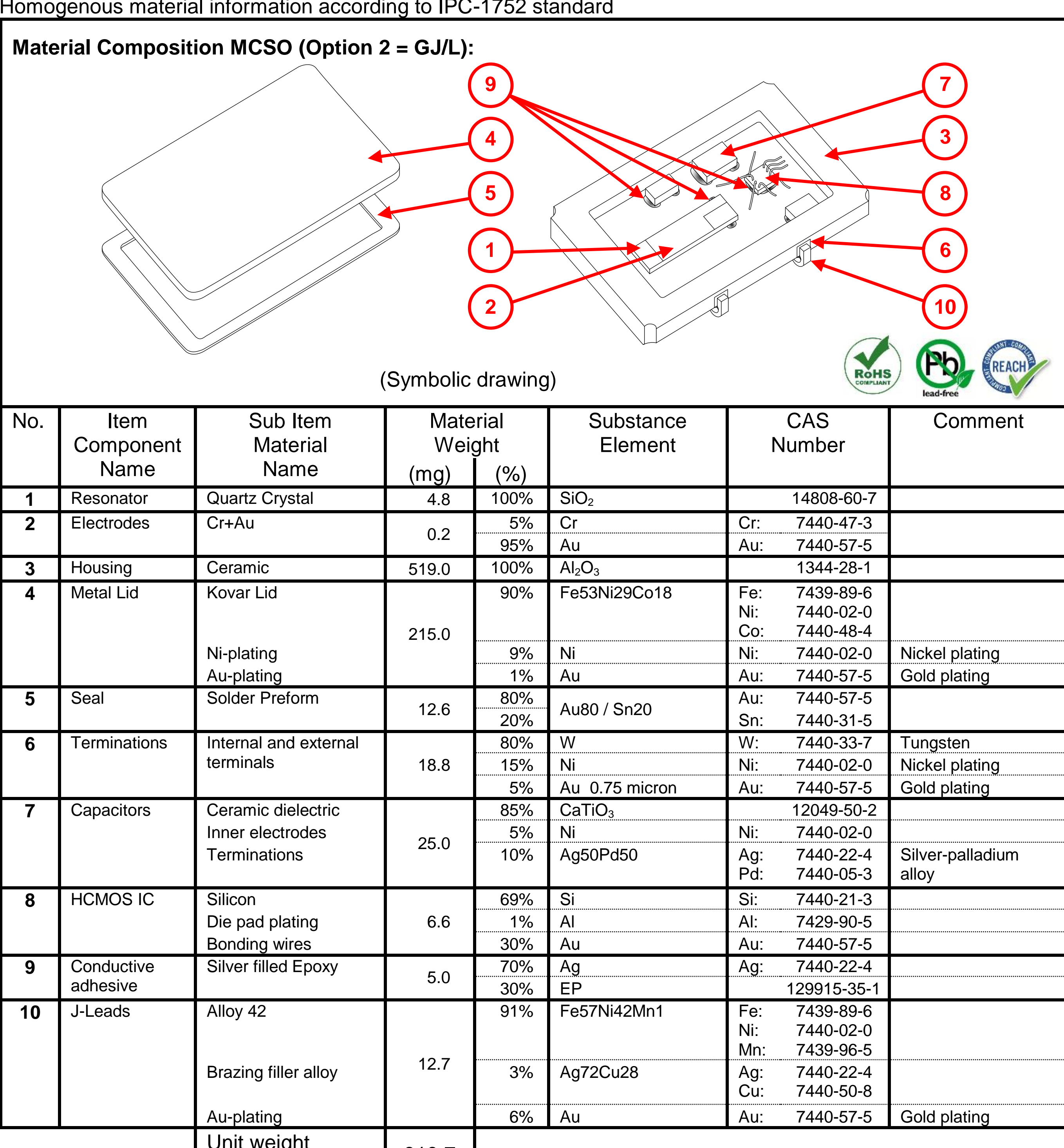
Finish for SnAgCu solder dipped J-Leads:



5.4. HOMOGENOUS MATERIAL COMPOSITION DECLARATION (OPTION 2 = GJ/L)

Homogenous material information according to IPC-1752 standard

Material Composition MCSO (Option 2 = GJ/L):



(Symbolic drawing)

No.	Item Component Name	Sub Item Material Name	Material Weight (mg)	(%)	Substance Element	CAS Number	Comment
1	Resonator	Quartz Crystal	4.8	100%	SiO_2	14808-60-7	
2	Electrodes	Cr+Au	0.2	5%	Cr	Cr: 7440-47-3	
				95%	Au	Au: 7440-57-5	
3	Housing	Ceramic	519.0	100%	Al_2O_3	1344-28-1	
4	Metal Lid	Kovar Lid	215.0	90%	Fe53Ni29Co18	Fe: 7439-89-6 Ni: 7440-02-0 Co: 7440-48-4	
		Ni-plating		9%	Ni	Ni: 7440-02-0	Nickel plating
		Au-plating		1%	Au	Au: 7440-57-5	Gold plating
5	Seal	Solder Preform	12.6	80%	Au80 / Sn20	Au: 7440-57-5	
				20%		Sn: 7440-31-5	
6	Terminations	Internal and external terminals	18.8	80%	W	W: 7440-33-7	Tungsten
				15%	Ni	Ni: 7440-02-0	Nickel plating
				5%	Au 0.75 micron	Au: 7440-57-5	Gold plating
7	Capacitors	Ceramic dielectric	25.0	85%	$CaTiO_3$	12049-50-2	
		Inner electrodes		5%	Ni	Ni: 7440-02-0	
		Terminations		10%	Ag50Pd50	Ag: 7440-22-4 Pd: 7440-05-3	Silver-palladium alloy
8	HCMOS IC	Silicon	6.6	69%	Si	Si: 7440-21-3	
		Die pad plating		1%	Al	Al: 7429-90-5	
		Bonding wires		30%	Au	Au: 7440-57-5	
9	Conductive adhesive	Silver filled Epoxy	5.0	70%	Ag	Ag: 7440-22-4	
				30%	EP	129915-35-1	
10	J-Leads	Alloy 42	12.7	91%	Fe57Ni42Mn1	Fe: 7439-89-6 Ni: 7440-02-0 Mn: 7439-96-5	
		Brazing filler alloy		3%	Ag72Cu28	Ag: 7440-22-4 Cu: 7440-50-8	
		Au-plating		6%	Au	Au: 7440-57-5	Gold plating
		Unit weight typ. ±10%	819.7				

5.5. RECYCLING MATERIAL INFORMATION (OPTION 2 = GJ/L)

Recycling material information according to IPC-1752 standard.
Element weight is accumulated and referenced to the unit weight of 819.7 mg.

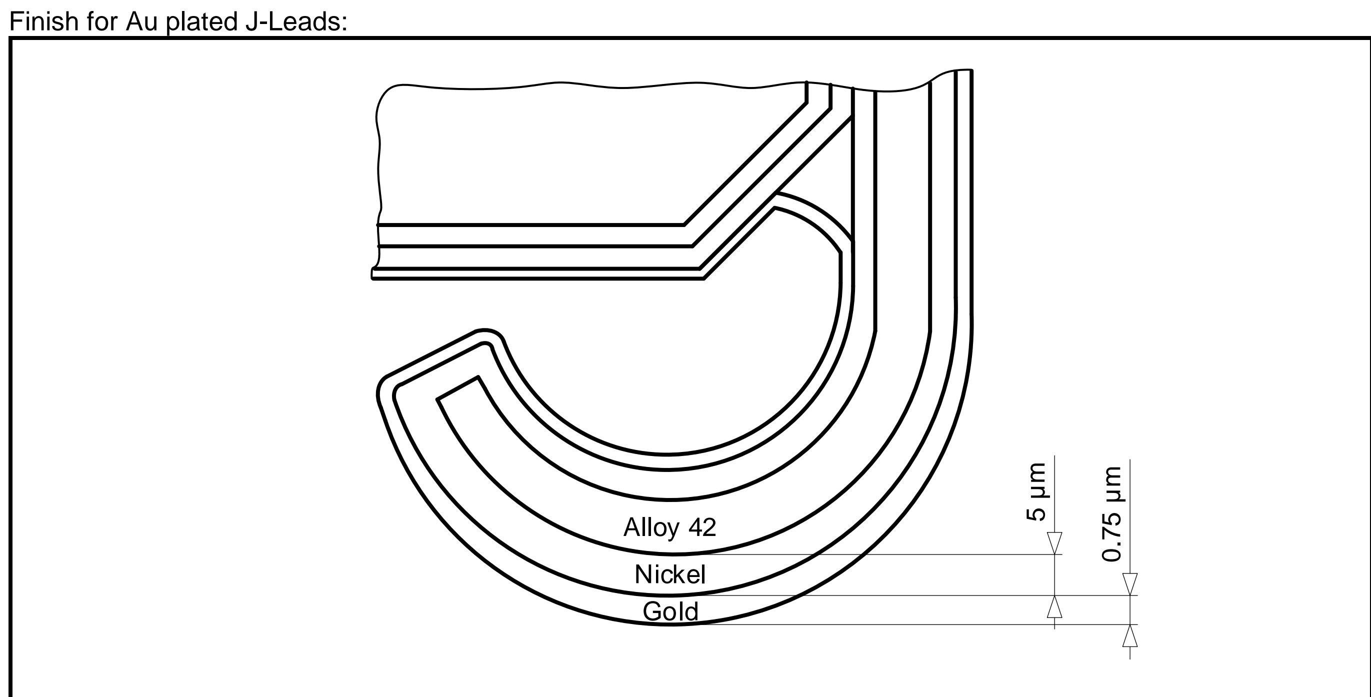
Item Material Name	No.	Item Component Name	Material Weight (mg)	(%)	Substance Element	CAS Number	Comment
Quartz Crystal	1	Resonator	4.8	0.59	SiO_2	14808-60-7	
Chromium	2	Electrodes	0.01	0.001	Cr	Cr: 7440-47-3	
Ceramic	3	Housing	519.0	63.30	Al_2O_3	1344-28-1	
Gold	2 4 5 6 8c 10c	Electrodes Metal Lid Seal Terminations HCMOS IC J-Leads	16.1	1.97	Au	Au: 7440-57-5	
Tin	5	Seal	2.52	0.31	Sn	Sn: 7440-31-5	
Nickel	4 6 7b	Metal Lid (Plating) Terminations Capacitors	23.4	2.86	Ni	Ni: 7440-02-0	
Tungsten	6	Terminations	15.04	1.83	W	W: 7440-33-7	
Kovar	4	Metal Lid	193.5	23.60	Fe53Ni29Co18	Fe: 7439-89-6 Ni: 7440-02-0 Co: 7440-48-4	
Ceramic Diel.	7a	Capacitors	21.25	2.59	$CaTiO_3$	12049-50-2	
Ag-Pd-Alloy	7c	Capacitors	2.5	0.30	Ag50Pd50	Ag: 7440-22-4 Pd: 7440-05-3	
Silicon	8a	HCMOS IC	4.55	0.56	Si	Si: 7440-21-3	
Aluminum	8b	HCMOS IC	0.07	0.008	Al	Al: 7429-90-5	
Silver	9a	Conductive adhesive	3.5	0.43	Ag	Ag: 7440-22-4	
Epoxy	9b	Conductive adhesive	1.5	0.18	EP	129915-35-1	
Alloy 42	10a	J-Leads	11.6	1.41	Fe57Ni42Mn1	Fe: 7439-89-6 Ni: 7440-02-0 Mn: 7439-96-5	
Brazing filler	10b	J-Leads	0.39	0.048	Ag72Cu28	Ag: 7440-22-4 Cu: 7440-50-8	
	Unit weight (total) typ. ±10%		819.7	100			

5.6. ENVIRONMENTAL PROPERTIES & ABSOLUTE MAXIMUM RATINGS (OPTION 2 = GJ/L)

Package	Description
SOJ-4 ceramic package	Small Outline J-leaded (SOJ), hermetically sealed ceramic package with metal lid

Parameter	Directive	Conditions	Value
Product weight (total)			819.7 mg
Storage temperature		Store as bare product	-65 to +125°C
Moisture sensitivity level (MSL)	IPC/JEDEC J-STD-020D		MSL1
MTTF			> 100 years

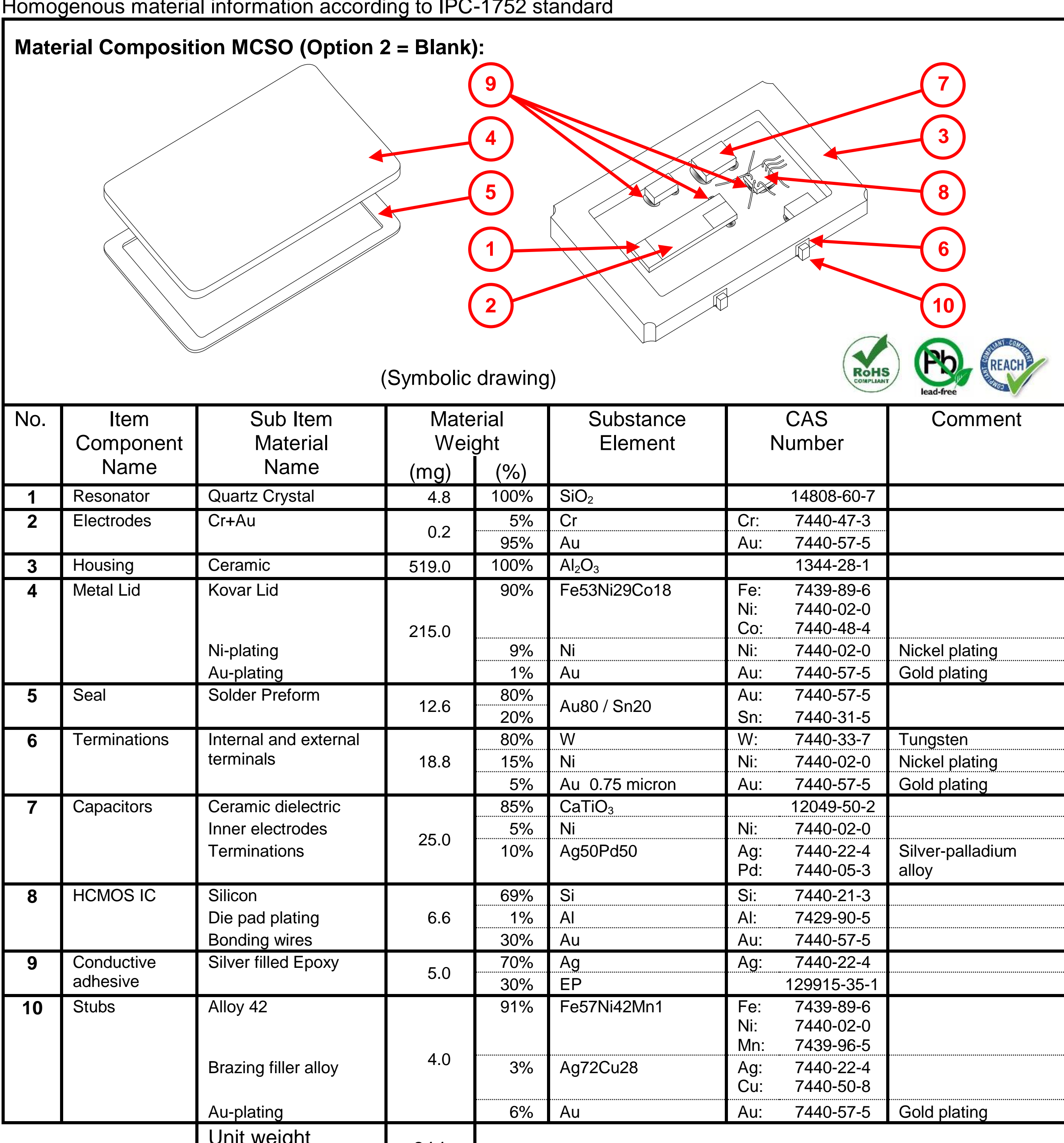
Finish for Au plated J-Leads:



5.7. HOMOGENOUS MATERIAL COMPOSITION DECLARATION (OPTION 2 = BLANK)

Homogenous material information according to IPC-1752 standard

Material Composition MCSO (Option 2 = Blank):



(Symbolic drawing)

No.	Item Component Name	Sub Item Material Name	Material Weight (mg)	(%)	Substance Element	CAS Number	Comment
1	Resonator	Quartz Crystal	4.8	100%	SiO_2	14808-60-7	
2	Electrodes	Cr+Au	0.2	5%	Cr	Cr: 7440-47-3	
				95%	Au	Au: 7440-57-5	
3	Housing	Ceramic	519.0	100%	Al_2O_3	1344-28-1	
4	Metal Lid	Kovar Lid	215.0	90%	Fe53Ni29Co18	Fe: 7439-89-6 Ni: 7440-02-0 Co: 7440-48-4	
		Ni-plating		9%	Ni	Ni: 7440-02-0	Nickel plating
		Au-plating		1%	Au	Au: 7440-57-5	Gold plating
5	Seal	Solder Preform	12.6	80%	Au80 / Sn20	Au: 7440-57-5	
				20%		Sn: 7440-31-5	
6	Terminations	Internal and external terminals	18.8	80%	W	W: 7440-33-7	Tungsten
				15%	Ni	Ni: 7440-02-0	Nickel plating
				5%	Au 0.75 micron	Au: 7440-57-5	Gold plating
7	Capacitors	Ceramic dielectric	25.0	85%	$CaTiO_3$	12049-50-2	
		Inner electrodes		5%	Ni	Ni: 7440-02-0	
		Terminations		10%	Ag50Pd50	Ag: 7440-22-4 Pd: 7440-05-3	Silver-palladium alloy
8	HCMOS IC	Silicon	6.6	69%	Si	Si: 7440-21-3	
		Die pad plating		1%	Al	Al: 7429-90-5	
		Bonding wires		30%	Au	Au: 7440-57-5	
9	Conductive adhesive	Silver filled Epoxy	5.0	70%	Ag	Ag: 7440-22-4	
				30%	EP	129915-35-1	
10	Stubs	Alloy 42	4.0	91%	Fe57Ni42Mn1	Fe: 7439-89-6 Ni: 7440-02-0 Mn: 7439-96-5	
		Brazing filler alloy		3%	Ag72Cu28	Ag: 7440-22-4 Cu: 7440-50-8	
		Au-plating		6%	Au	Au: 7440-57-5	Gold plating
		Unit weight typ. ±10%	811				

5.8. RECYCLING MATERIAL INFORMATION (OPTION 2 = BLANK)

Recycling material information according to IPC-1752 standard.
Element weight is accumulated and referenced to the unit weight of 811 mg.

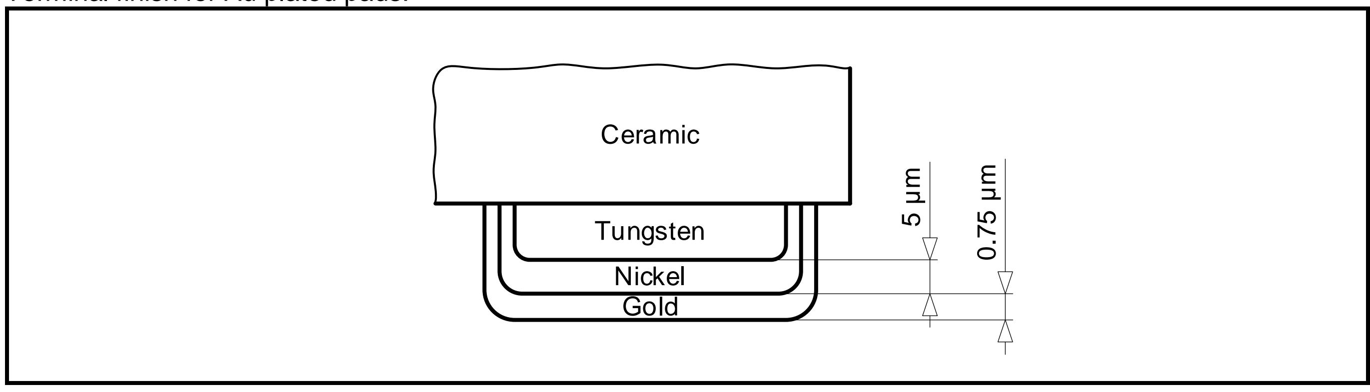
Item Material Name	No.	Item Component Name	Material Weight (mg)	Material Weight (%)	Substance Element	CAS Number	Comment
Quartz Crystal	1	Resonator	4.8	0.59	SiO_2	14808-60-7	
Chromium	2	Electrodes	0.01	0.001	Cr	Cr: 7440-47-3	
Ceramic	3	Housing	519.0	64.00	Al_2O_3	1344-28-1	
Gold	2 4 5 6 8c 10c	Electrodes Metal Lid Seal Terminations HCMOS IC Stubs	15.6	1.92	Au	Au: 7440-57-5	
Tin	5	Seal	2.52	0.31	Sn	Sn: 7440-31-5	
Nickel	4 6 7b	Metal Lid (Plating) Terminations Capacitors	23.4	2.89	Ni	Ni: 7440-02-0	
Tungsten	6	Terminations	15.04	1.85	W	W: 7440-33-7	
Kovar	4	Metal Lid	193.5	23.90	Fe53Ni29Co18	Fe: 7439-89-6 Ni: 7440-02-0 Co: 7440-48-4	
Ceramic Diel.	7a	Capacitors	21.25	2.62	$CaTiO_3$	12049-50-2	
Ag-Pd-Alloy	7c	Capacitors	2.5	0.31	Ag50Pd50	Ag: 7440-22-4 Pd: 7440-05-3	
Silicon	8a	HCMOS IC	4.55	0.56	Si	Si: 7440-21-3	
Aluminum	8b	HCMOS IC	0.07	0.008	Al	Al: 7429-90-5	
Silver	9a	Conductive adhesive	3.5	0.43	Ag	Ag: 7440-22-4	
Epoxy	9b	Conductive adhesive	1.5	0.18	EP	129915-35-1	
Alloy 42	10a	Stubs	3.64	0.45	Fe57Ni42Mn1	Fe: 7439-89-6 Ni: 7440-02-0 Mn: 7439-96-5	
Brazing filler	10b	Stubs	0.12	0.015	Ag72Cu28	Ag: 7440-22-4 Cu: 7440-50-8	
	Unit weight (total) typ. ±10%		811	100			

5.9. ENVIRONMENTAL PROPERTIES & ABSOLUTE MAXIMUM RATINGS (OPTION 2 = BLANK)

Package	Description
DFN-4 ceramic package	Dual Flat No Leads (DFN), hermetically sealed ceramic package with metal lid

Parameter	Directive	Conditions	Value
Product weight (total)			811 mg
Storage temperature		Store as bare product	-65 to +125°C
Moisture sensitivity level (MSL)	IPC/JEDEC J-STD-020D		MSL1
MTTF			> 100 years

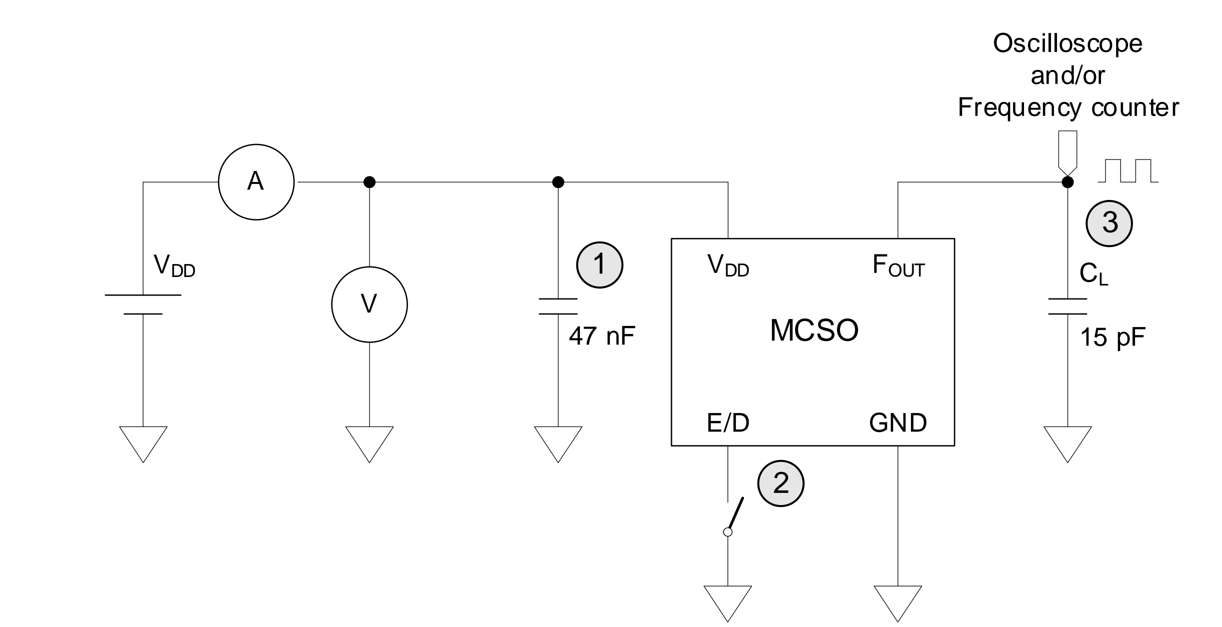
Terminal finish for Au plated pads:



6. APPLICATION INFORMATION

6.1. TEST CIRCUIT

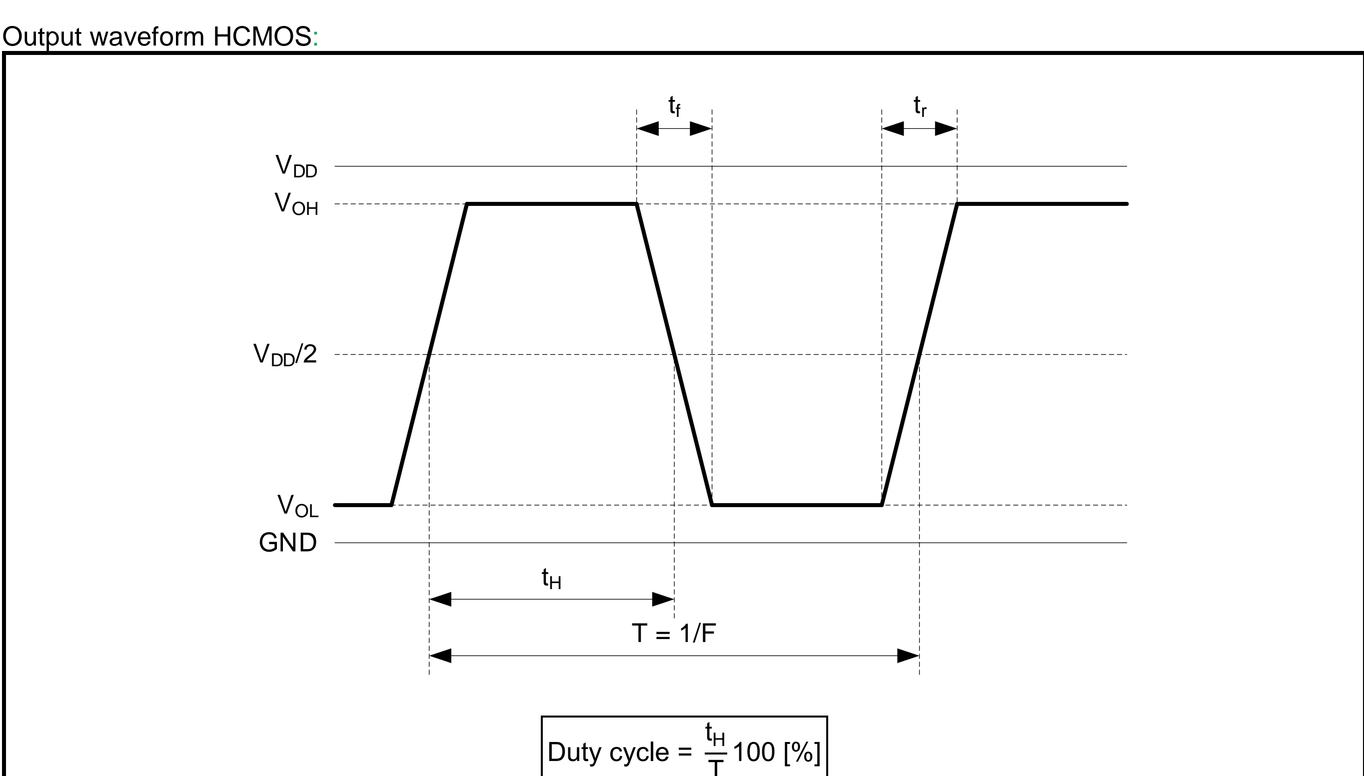
Test circuit HCMOS:



1. A 47 nF decoupling capacitor is recommended close to the device.
2. If E/D is HIGH or floating (V_{IH} or open), the F_{OUT} pin is in output mode. When E/D is tied to Ground (V_{IL}), the F_{OUT} pin is disabled (Hi-Z).
   No E/D function before V_{DD} is set.
3. C_L includes probe and fixture capacitance.

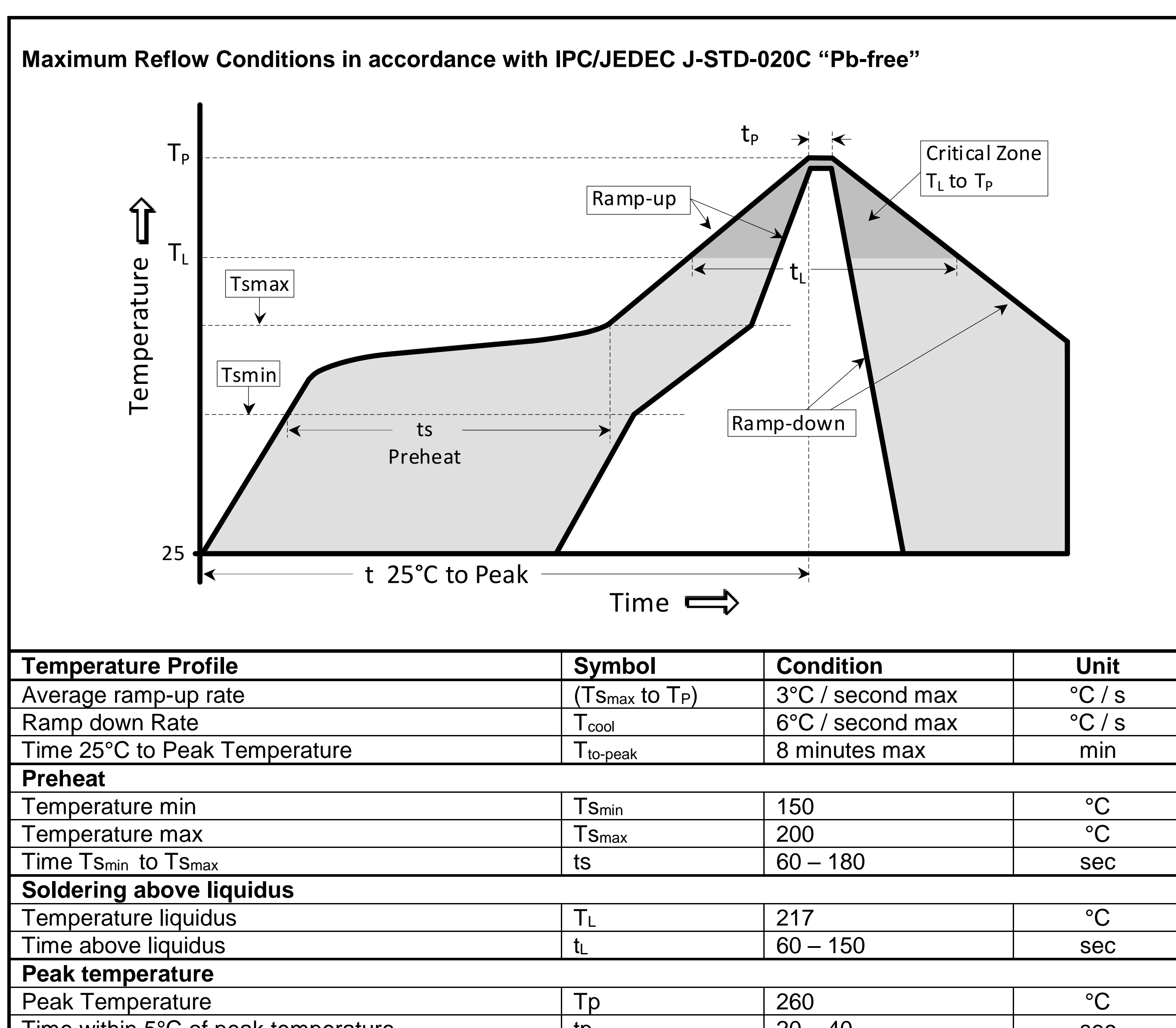
6.2. OUTPUT WAVEFORM

Output waveform HCMOS:



6.3. SOLDERING INFORMATION

Maximum Reflow Conditions in accordance with IPC/JEDEC J-STD-020C "Pb-free"



Temperature Profile	Symbol	Condition	Unit
Average ramp-up rate	(Ts_{max} to T_P)	3°C / second max	°C / s
Ramp down Rate	T_{cool}	6°C / second max	°C / s
Time 25°C to Peak Temperature	$T_{to\text{-}peak}$	8 minutes max	min
Preheat			
Temperature min	Ts_{min}	150	°C
Temperature max	Ts_{max}	200	°C
Time Ts_{min} to Ts_{max}	ts	60 – 180	sec
Soldering above liquidus			
Temperature liquidus	T_L	217	°C
Time above liquidus	t_L	60 – 150	sec
Peak temperature			
Peak Temperature	Tp	260	°C
Time within 5°C of peak temperature	tp	20 – 40	sec

6.4. HANDLING PRECAUTIONS FOR MODULES WITH EMBEDDED CRYSTALS

The built-in AT-cut crystal consists of pure Silicon Dioxide in crystalline form. The cavity inside the package is evacuated and hermetically sealed in order for the crystal blank to function undisturbed from air molecules, humidity and other influences.

Shock and vibration:

Keep the crystal / module from being exposed to **excessive mechanical shock and vibration**. Micro Crystal guarantees that the crystal / module will bear a mechanical shock of 5000 g / 0.3 ms.

The following special situations may generate either shock or vibration:

Multiple PCB panels - Usually at the end of the pick & place process the single PCBs are cut out with a router. These machines sometimes generate vibrations on the PCB that have a fundamental or harmonic frequency close to the resonance frequency of the crystal unit. This might cause breakage of crystal blanks due to resonance. Router speed should be adjusted to avoid resonant vibration.

Ultrasonic cleaning - Avoid cleaning processes using ultrasonic energy. These processes can damage the crystals due to the mechanical resonance frequencies of the crystal blank.

Overheating, rework high temperature exposure:

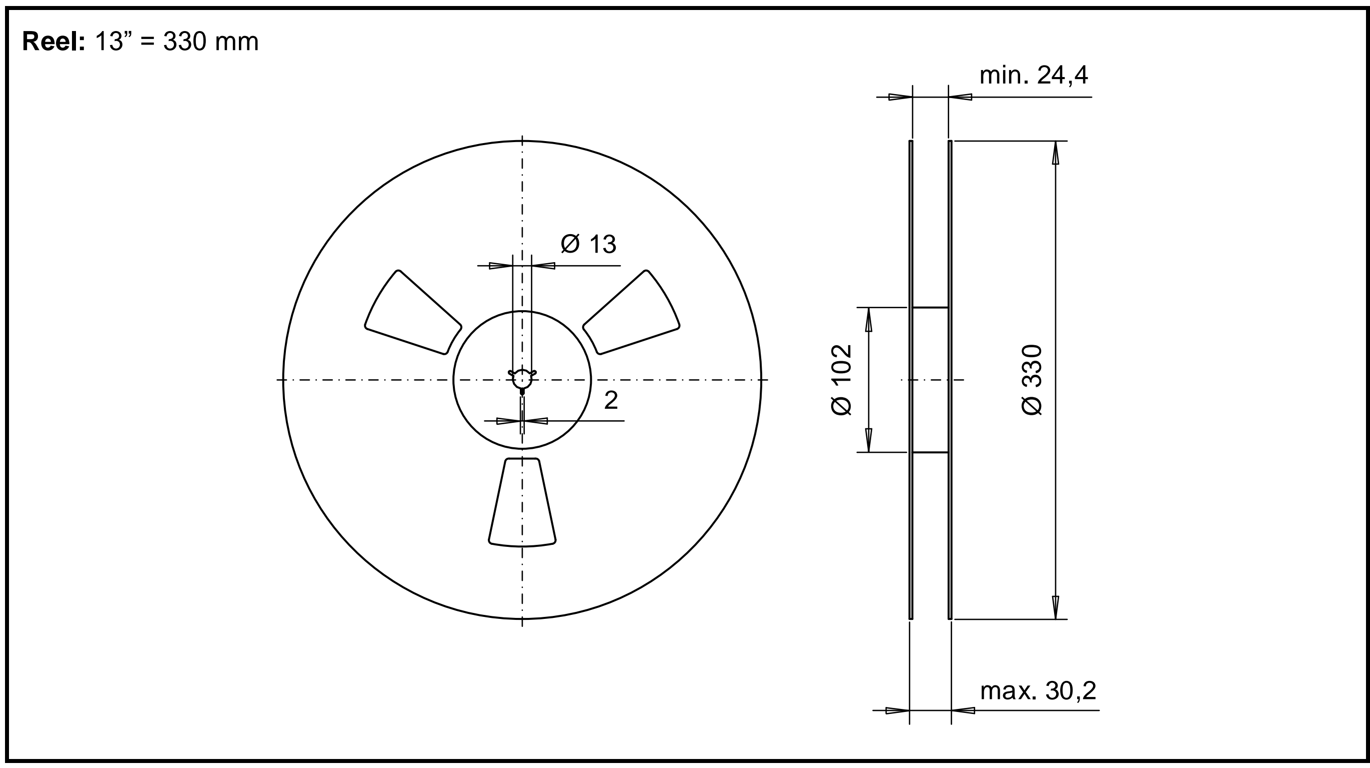
Avoid overheating the package. The package is sealed with a seal ring consisting of 80% Gold and 20% Tin. The eutectic melting temperature of this alloy is at 280°C. Heating the seal ring up to >280°C will cause melting of the metal seal which then, due to the vacuum, is sucked into the cavity forming an air duct. This happens when using hot-air-gun set at temperatures >280°C.

Use the following methods for rework:

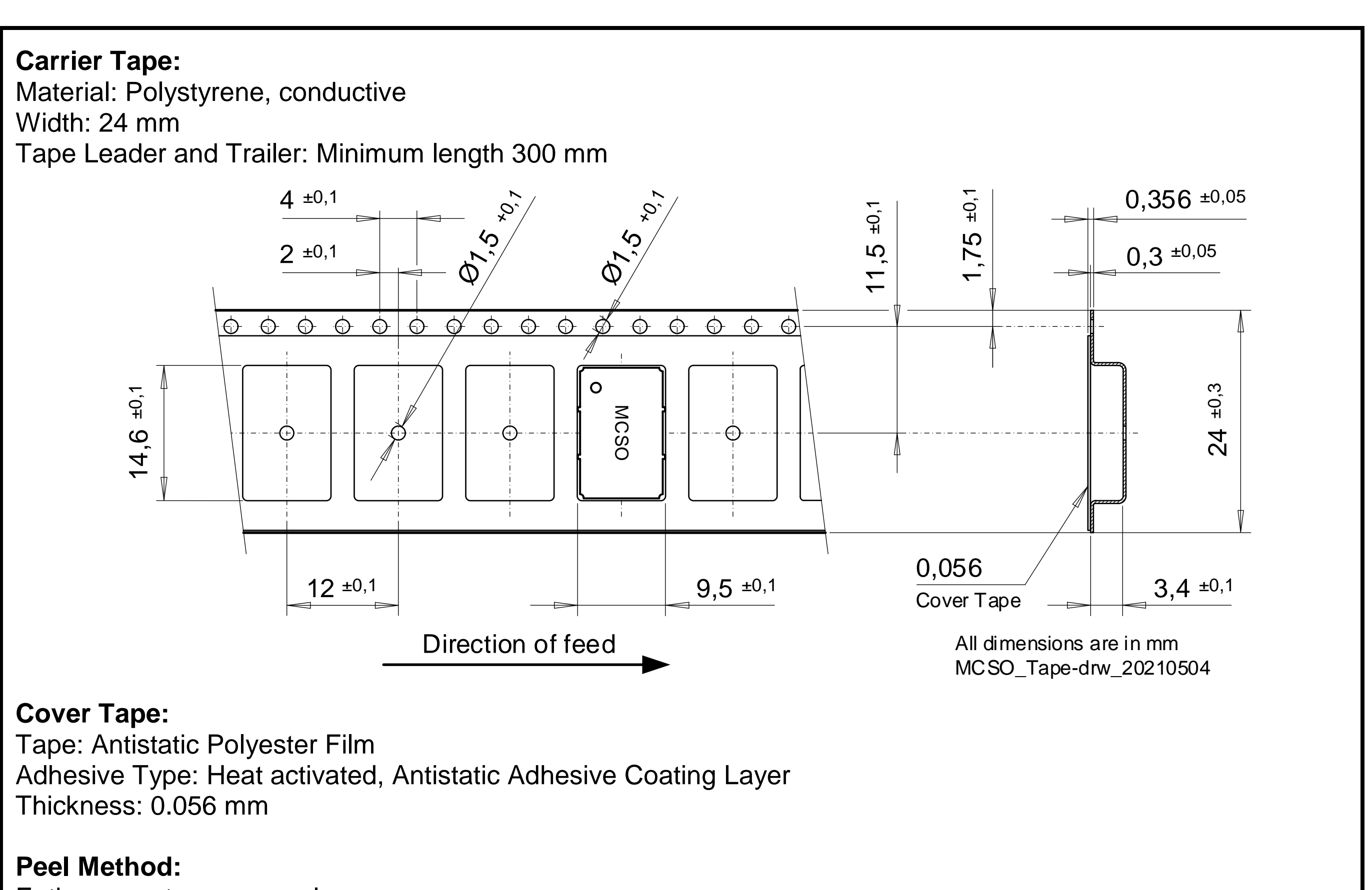
- Use a hot-air-gun set at 270°C.
- Use 2 temperature controlled soldering irons, set at 270°C, with special-tips to contact all solder-joints from both sides of the package at the same time, remove part with tweezers when pad solder is liquid.

7. PACKING & SHIPPING INFORMATION

Reel: 13" = 330 mm



Carrier Tape:
Material: Polystyrene, conductive
Width: 24 mm
Tape Leader and Trailer: Minimum length 300 mm



Cover Tape:
Tape: Antistatic Polyester Film
Adhesive Type: Heat activated, Antistatic Adhesive Coating Layer
Thickness: 0.056 mm

Peel Method:
Entire cover tape removal.

8. COMPLIANCE INFORMATION

Micro Crystal confirms that the standard product Clock Oscillator MCSO is compliant with “EU RoHS Directive” and “EU REACh Directives”.
Please find the actual Certificate of Conformance for Environmental Regulations on our website:
CoC_Environment_MCSO-Series.pdf

9. DOCUMENT REVISION HISTORY

Date	Revision #	Revision Details
November 2012	9.0	Initial version
August 2021	10.0	New extended version

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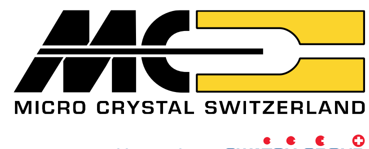

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