PRODUCT/PROCESS CHANGE NOTIFICATION

PCN HED-AUD/08/3768
Notification Date 06/05/2008

PENTAWATT/HEPTAWATT ASSEMBLY & TESTING TRANSFER FROM TOA-PAYOH TO BOUSKOURA

AUD - AUDIO

Table 1. Change Implementation Schedule

Forecasted implementation date for change	06-Aug-2008
Forecasted availabillity date of samples for customer	25-Jun-2008
Forecasted date for **STMicroelectronics** change Qualification Plan results availability	29-May-2008
Estimated date of changed product first shipment	04-Sep-2008

Table 2. Change Identification

Product Identification (Product Family/Commercial Product)	ALL PRODUCTS IN PENTAWATT & HEPTAWATT PACKAGE
Type of change	Package assembly location change
Reason for change	ASSY LINE CLOSURE IN TOA-PAYOH
Description of the change	Pentawatt & Heptawatt production transfer from Toa-Payoh plant (Singapore) to Bouskoura 2000 plant (Morocco). Production in Bouskoura will be leadfree.
Product Line(s) and/or Part Number(s)	See attached
Description of the Qualification Plan	See attached
Change Product Identification	"CZ" AS PRODUCTION AREA FOR BOUSKOURA
Manufacturing Location(s)	

Table 3. List of Attachments

Customer Part numbers list	
Qualification Plan results	

- -

Customer Acknowledgement of Receipt	**PCN HED-AUD/08/3768**
Please sign and return to STMicroelectronics Sales Office	**Notification Date 06/05/2008**
☐ Qualification Plan Denied	Name:
☐ Qualification Plan Approved	Title:
	Company:
☐ Change Denied	Date:
☐ Change Approved	Signature:

Remark

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DOCUMENT APPROVAL

Name	Function
Angelici, Marco	Division Marketing Manager
Onetti, Andrea Mario	Division Product Manager
Piccoli, Massimo	Division Q.A. Manager

PENTAWATT / HEPTAWATT ASSEMBLY & TESTING TRANSFER FROM TOA-PAYOH TO BOUSKOURA

WHAT:

Following Company package roadmap to concentrate in Bouskoura 2000 plant the small watt assembly activity, we are on going to transfer there the assembly & testing of the Pentawatt & Heptawatt products (all splittings: vertical, horizontal and in line)

In 2004, STM already completed a first transfer of Pentawatt/Heptawatt products to Bouskoura (PCN HPC-AUD/06/1627 & HED-AUD/07/2239) and the plant is fully operative since middle of 2004. The products involved in this second transfer are the last ones remaining in Toa-Payoh for the Audio Division.

Due to the changes introduced on Pentawatt/Heptawatt after 2004, production in Bouskoura for all the involved products will be 2 mils copper wires and leadfree pure tin post plating (RoHS compliant – e3 marking on the parts).

In addition, we will change the frames from the actual bicomponent frames (slug & frame welded together before assy) to monocomponent frame (one piece frame) as per attached pictures.
This frame is already qualified in Bouskoura.

WHY:

Company package roadmap

HOW:

Reliability evaluation report ER002107AG6053 covers all the type of products involved in this PCN.

WHEN:

We will start to deliver from Bouskoura from beginning of September 2008.

SMALL-WATT PACKAGES WITH “MONOCOMPONENT” LEADFRAME

RELIABILITY EVALUATION REPORT

Abstract

HEPTAWATT and PENTAWATT packages assembled in BOUSKOURA with the new MONOCOMPONENT lead-frame have been successfully evaluated on two APG test-vehicles.

Main aim of the reliability exercise was to complete the set of results collected by HPC Group, with the addition of temperature cycling performed in conformity with AEC-Q100 “grade 1” requirements.

Conclusion

On the basis of the results summarized in the present report, HEPTAWATT and PENTAWATT packages assembled in BOUSKOURA with the new MONOCOMPONENT lead-frame can be qualified as far as reliability is concerned.

ATTACHMENT 1: RELIABILITY TESTS DESCRIPTION

TEST NAME	DESCRIPTION	PURPOSE
TCT: Temperature Cycles Test	The device is submitted to cycled temperature excursions, between a hot and a cold chamber in air atmosphere.	To investigate failure modes related to the thermo-mechanical stress induced by the different thermal expansion of the materials interacting in the die-package system. Typical failure modes are linked to metal displacement, dielectric cracking, moulding compound delamination, wire-bonds failure, die-attach layer degradation.
HTS: High Temperature Storage	The device is stored in unbiased condition at the max. temperature allowed by the package materials, sometimes higher than the max. operative temperature.	To investigate the failure mechanisms activated by high temperature, typically wire-bonds solder joint ageing, data retention faults, metal stress-voiding.

ATTACHMENT 2: RESULTS FROM HPC QUALIFICATION

TEST NAME	CONDITIONS [SPEC]	STV8172A REJ./SS	STV9302A REJ./SS	NOTES
TCT	Ta=-40/+150°C, 1000 cycles	0/50	0/(50x2)	-
PPT	P=2atm, Ta=121°, 240h	0/50	0/(50x2)	-
HTS	Ta=175°C, 500h	0/50	0/(50x2)	1
HTRB	Ta=85°C, Tj=150°C, 1000h	-	0/(20x2)	2

NOTES:

[1] HTS test has been continued up to 1000h in order to investigate the wear-out curve. One parametric failure has been found on the 2nd lot of STV9302A. Being the failure root-cause identified in the molding-compound stress and taking into account that the concerned material does not have stable and controlled mechanical properties above 150°C (max. operative temperature) , the failure mechanism is not realistic in the field application environment.

[2] High Temperature Reverse Bias test, devices biased in static configuration at their maximum allowed supply voltage.

Construction note

Technical code :	STV8172A	STV9302A
Diffusion process :	B50II	B50II
Wafer diameter :	6”	6”
Diffusion site :	Ang Mo-Kio	Ang Mo-Kio
Die size (mm^2) :	2.71 x 1.88	2.10x2.30
Passivation :	SiN	SiN
Back finishing :	Cr/Ni/Au	Cr/Ni/Au
Package name :	HEPTAWATT	HEPTAWATT
Assembly site :	BOUSKOURA	BOUSKOURA
Leadframe :	HW 7L Mon bare copper	HW 7L Mon bare copper
Die attach :	Pb/Ag/Sn	Pb/Ag/Sn
Wire bonding :	Cu, 2 mil	Cu, 2 mil
Molding compound :	SUMITOMO 6300HR	SUMITOMO 6300HR
Lead finishing :	Matte tin	Matte tin

Reliability test conditions and results

TEST NAME	CONDITIONS [SPEC]	REJ./S.S.	NOTES
TCT	Ta=-65/+150°C, 1000 cycles	L570 lot 1 0/50 L570 lot 2 0/50 L540 lot 3 0/50	1, 2, 3
HTS	Ta=150°C, 1000h	L570 lot 1 0/45 L570 lot 2 0/45 L540 lot 3 0/45	2

NOTES:

[1] SAM analysis did not show any remarkable delamination at the die-molding compound interface, on the lead tips and through the die-attach layer. Detail in attachment n.3.

[2] Wire bonding strength after the stress has been successfully verified through wire-pull test, performed in accordance with AEC-Q100 requirement. A few bonds failed in ball-lift mode, but the relevant residual pull loads are still high, especially taking into account the impact of the molding compound decap etch which is not selective to copper. Detail in attachment n.3.

[3] Visual and SEM inspections after the stress test have pointed out no remarkable degradation of silicon passivation, metal interconnects, stitch bonds on internal lead-tips. Detail in attachment n.3.

Construction note

	TV1	TV2
Technical code :	K87X*L570TOX	K87E*L540DAX
Diffusion process :	BIP	BIP
Wafer diameter :	5”	5”
Diffusion site :	Ang Mo-Kio	Ang Mo-Kio
Die size (mm^2) :	1.39 x 1.43	1.86 x 2.30
Metal levels :	1,Al	1,Al
Passivation :	SiN	SiN
Back finishing :	Cr/Ni/Au	Cr/Ni/Au
Package name :	HEPTAWATT	PENTAWATT
Assembly site :	BOUSKOURA	BOUSKOURA
Leadframe :	HW 7L Mon bare copper	PW 5L Mon bare copper
Die attach :	Pb/Ag/Sn	Pb/Ag/Sn
Wire bonding :	Cu,2 mil	Cu,2 mil
Molding compound :	SUMITOMO 6300HR	SUMITOMO 6300HR
Lead finishing :		
Lot_id :	CZ6160630 (sub-lots 1 and 2)	CZ61605PZY

Attachments

1) Reliability tests description
2) Results from HPC Group qualification
3) Physical analysis report

ATTACHMENT 3: PHYSICAL ANALYSIS REPORT

Technical code : K87X*L570TOX
K87E*L540DAX

Package : HEPTAWATT (HW)
PENTAWATT (PW)

Lot(s)_id : Lot 1 CZ6160630
Lot 2 CZ6160630
Lot 3 CZ61605PZY

Evaluation subject : Small-WATT packages with Mono-component lead-frame

Author : D. Casiraghi

Analysis status: ☐ RUNNING ☒ COMPLETED

ANALYSIS PROGRAM

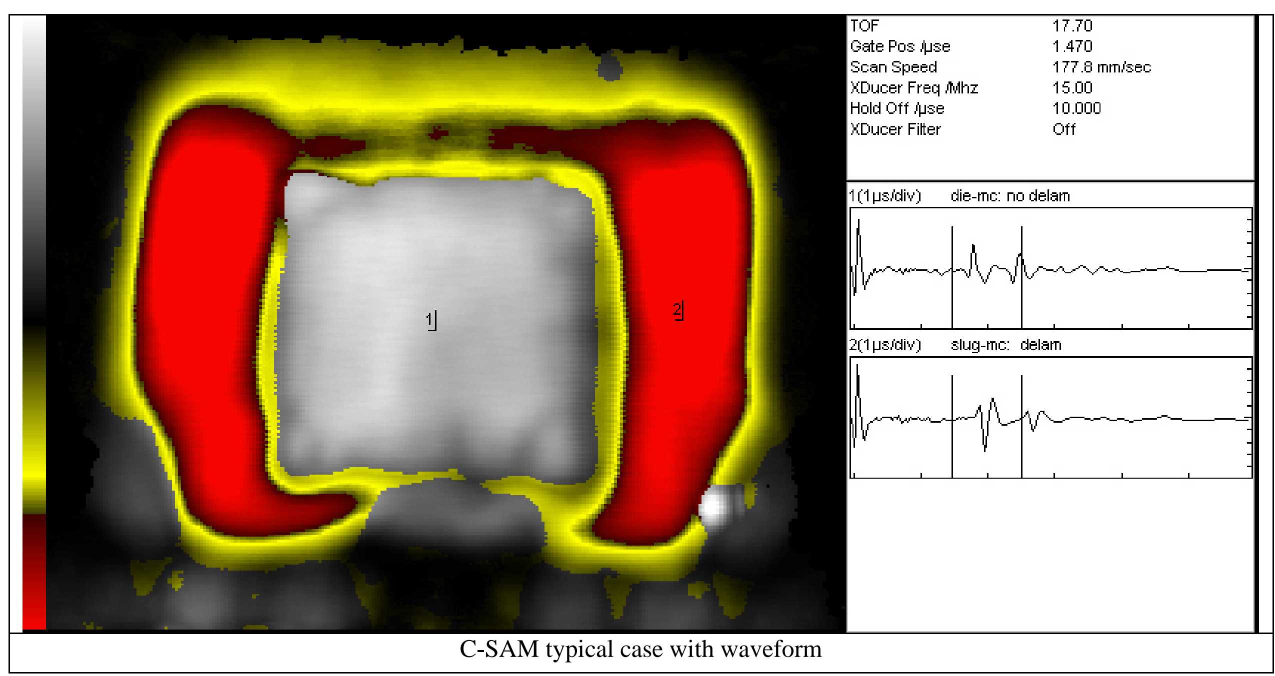
DESTRUCTIVE ITEMS				NON DESTRUCTIVE ITEMS		WHEN
Wire pull test	Ball Shear test	Internal visual	SEM inspection	SAM inspection	Other	
X		X	X	X		1000 TC
X						1000h HTS

RESULTS SUMMARY

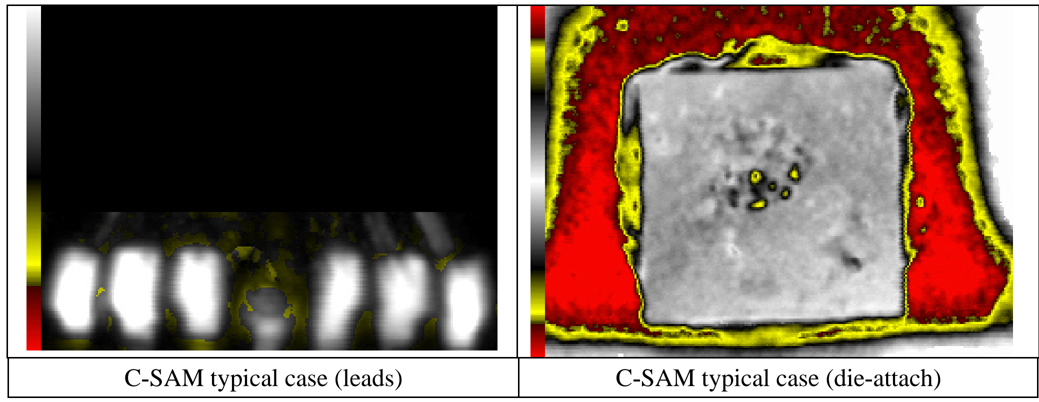
- SAM analysis did not show any remarkable delamination at the die-molding compound interface, on the lead tips and through the die-attach layer.
- Wire bonding strength after TC and HTS stress has been successfully verified through wire-pull test, performed in accordance with AEC-Q100 requirement. A few bonds failed in ball-lift mode, but the relevant residual pull loads are still high, especially taking into account the impact of the molding compound decap etch which is not selective to copper.
- Visual and SEM inspections after TC stress have pointed out no remarkable degradation of silicon passivation, metal interconnects, stitch bonds on internal lead-tips.

TECHNICAL CODE	PACKAGE	ANALYSIS ITEM	STRESS TEST
K87X*L570TOX	HEPTAWATT	SAM inspection	1000 TC (-65/+150°C)

TEST EQUIPMENT: SONOSCAN D9000 (Scanning Acoustic Microscope)



C-SAM typical case with waveform

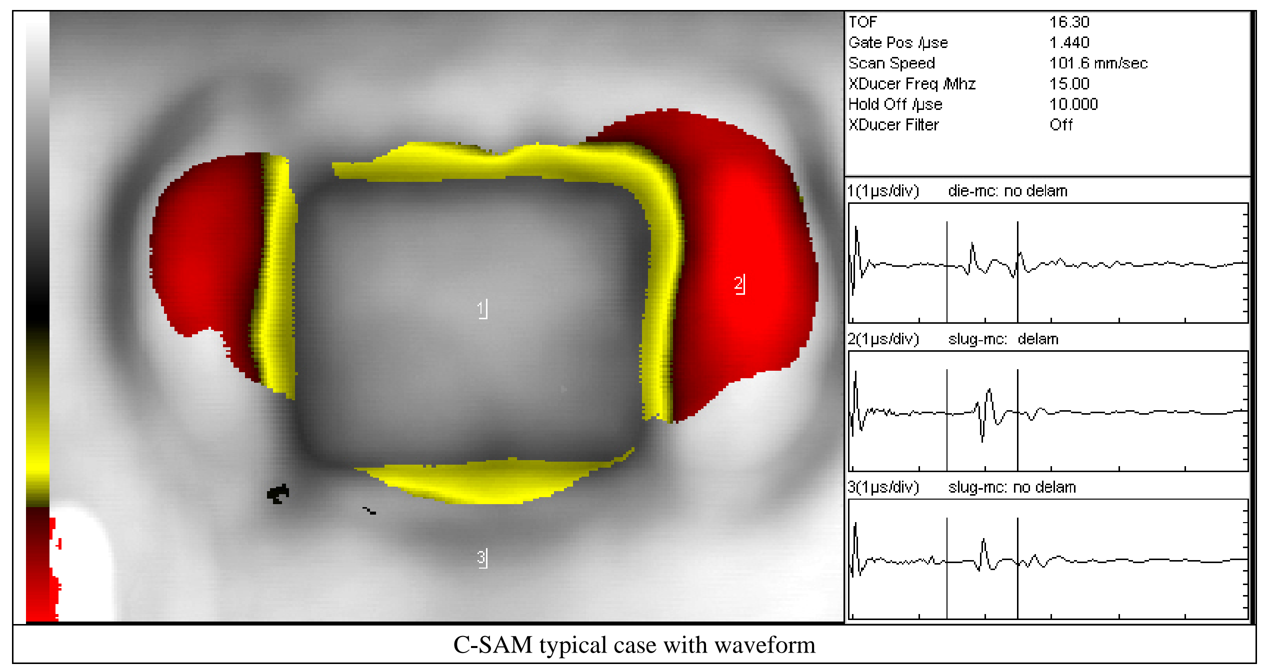


C-SAM typical case (leads) | C-SAM typical case (die-attach)

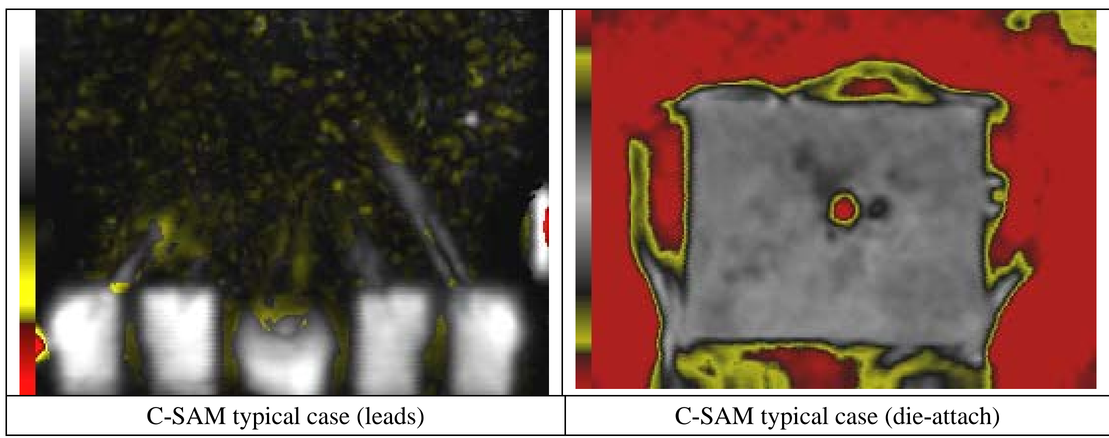
Lot	Sample size	Defective parts (delamination)			
		die-mold (C-scan)	die-attach (C-scan)	l/f-mold (C-scan)	diepad-mold (C-scan)
CZ6160630-1	5	0/5	0/5	0/5	5/5
CZ6160630-2	5	0/5	0/5	0/5	5/5
Transducer frequency (MHz)		15	50	15	15

TECHNICAL CODE	PACKAGE	ANALYSIS ITEM	STRESS TEST
K87E*L540DAX	PENTAWATT	SAM inspection	1000 TC (65/+150°C)

TEST EQUIPMENT: SONOSCAN D9000 (Scanning Acoustic Microscope)



C-SAM typical case with waveform



C-SAM typical case (leads) | C-SAM typical case (die-attach)

Lot	Sample size	Defective parts (delamination)			
		die-mold (C-scan)	die-attach (C-scan)	l/f-mold (C-scan)	diepad-mold (C-scan)
CZ61605PZY	5	0/5	0/5	0/5	5/5
Transducer frequency (MHz)		15	50	15	15

TECHNICAL CODE	PACKAGE	LOTS	ANALYSIS ITEM
L570TOX - L540DAX	HW - PW	CZ6160630-1, CZ6160630-2, CZ61605PZY	Internal visual

ANALYSIS SUMMARY:

WHAT	WHEN	SAMPLE SIZE /LOTS	RESULT
Passivation and metal	ES(100TC+168PP)	5pcs /Lot1	Minor passivation crack (photo 1-3)
Passivation and metal	ES(100TC+168PP	5pcs /Lot2	Minor passivation crack (photo 4-6)
Passivation and metal	ES(100TC+168PP	5pcs /Lot3	Minor passivation crack (photo 7-9)

DOCUMENTATION:

Photo 1 Photo 2 Photo 3

Photo 4 Photo 5 Photo 6

Photo 7 Photo 8 Photo 9

TEST EQUIPMENT: LEICA (Optical Microscope)

TECHNICAL CODE	PACKAGE	LOT	ANALYSIS ITEM
L570TOX - L540DAX	HW - PW	CZ6160630-1, CZ6160630-2, CZ61605PZY	SEM inspection

ANALYSIS SUMMARY:

WHAT	WHEN	SAMPLE SIZE	RESULT
Stitch-bond on lead	JL3+1000TC (-55/+150°C)	5pcs/lot	No visible degradation
Stitch-bond on lead	JL3+1000TC (-55/+150°C)	5pcs/lot	No visible degradation
Stitch-bond on lead	JL3+1000TC (-55/+150°C)	5pcs/lot	No visible degradation

DOCUMENTATION:

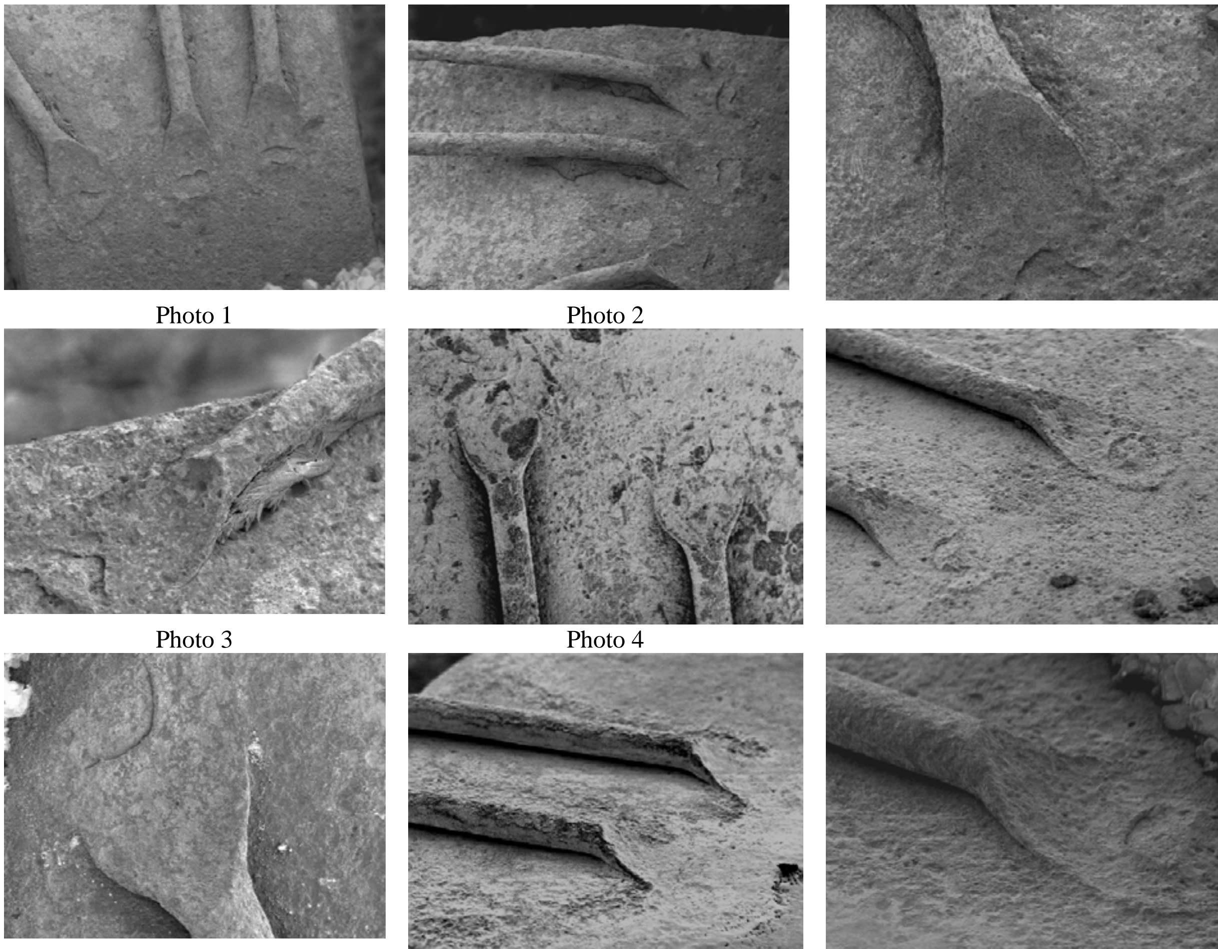


Photo 1 Photo 2

Photo 3 Photo 4

TEST EQUIPMENT: HITACHI (Scanning Electron Microscope)

TECHNICAL CODE	PACKAGE	LOT	ANALYSIS ITEM
L570TOX - L540DAX	HW - PW	CZ6160630-1, CZ6160630-2, CZ61605PZY	Wire pull-test

Wire type : Cu, 2 mil

LSL (g) : 10.50

Sample size (pcs) : 5

Sample size (wires) : 60

Failure mode		1000 TC (-65+150°C)		
		L570 lot1	**L570 lot2**	**L540 lot3**
1: BALL LIFT	**mean (g)**	-	-	-
	stdev (g)	-	-	-
	min (g)	-	-	19.07
	max (g)	-	-	19.07
	occurrence	-	-	3%
2: BALL NECK	**mean (g)**	34.28	30.88	30.63
	stdev (g)	2.30	5.16	2.75
	min (g)	32.65	22.92	27.10
	max (g)	35.90	36.51	35.29
	occurrence	3%	14%	30%
3: LOOP CENTRE	**mean (g)**	30.32	30.27	35.51
	stdev (g)	6.22	4.68	6.07
	min (g)	11.68	19.13	23.95
	max (g)	44.42	44.08	47.02
	occurrence	95%	86%	64%
4: BROKEN WELD	**mean (g)**	-	-	-
	stdev (g)	-	-	-
	min (g)	22.86	-	36.65
	max (g)	22.86	-	36.65
	occurrence	2%	-	3%

Remarks: neither abnormal break loads, nor forbidden failure modes. AEC-Q100 criteria after TC passed.

TECHNICAL CODE	PACKAGE	LOT	ANALYSIS ITEM
L570TOX - L540DAX	HW - PW	CZ6160630-1, CZ6160630-2, CZ61605PZY	Wire pull-test

Wire type : Cu, 2 mil

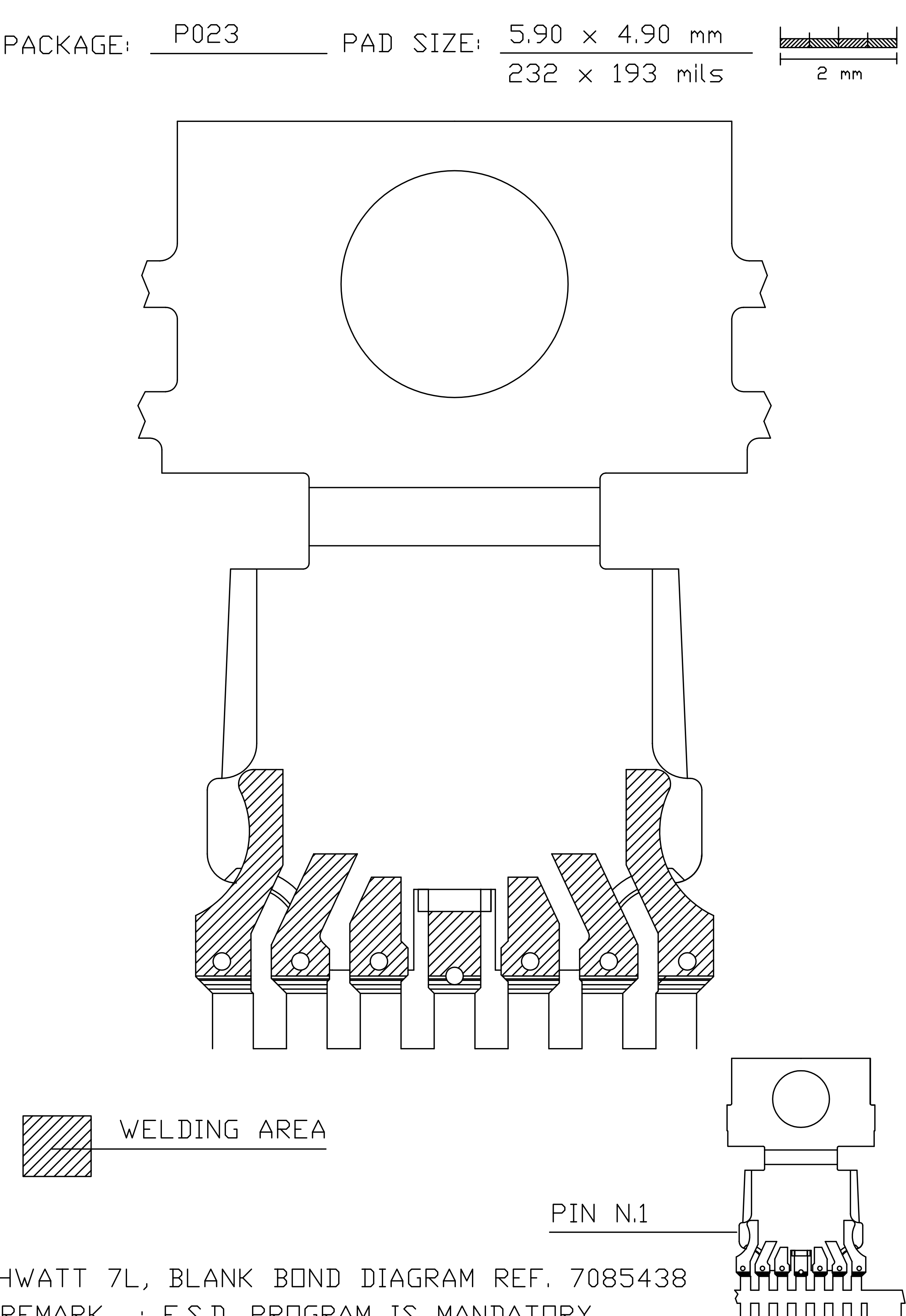
LSL (g) : 10.50

Sample size (pcs) : 5

Sample size (wires) : 60

Failure mode		1000h HTS		
		L570 lot1	**L570 lot2**	**L540 lot3**
1: BALL LIFT	**mean (g)**	-	-	19.96
	stdev (g)	-	-	0.15
	min (g)	-	-	19.85
	max (g)	-	-	20.07
	occurrence	-	-	5%
2: BALL NECK	**mean (g)**	58.54	61.49	36.36
	stdev (g)	6.81	11.80	3.10
	min (g)	53.21	49.40	34.73
	max (g)	66.22	72.97	41.01
	occurrence	8%	4%	9%
3: LOOP CENTRE	**mean (g)**	38.93	38.06	38.26
	stdev (g)	11.22	11.48	11.15
	min (g)	12.15	24.52	26.80
	max (g)	66.92	78.25	73.51
	occurrence	92%	96%	86%

BOND DIAGRAM FOR BICOMPONENT FRAME

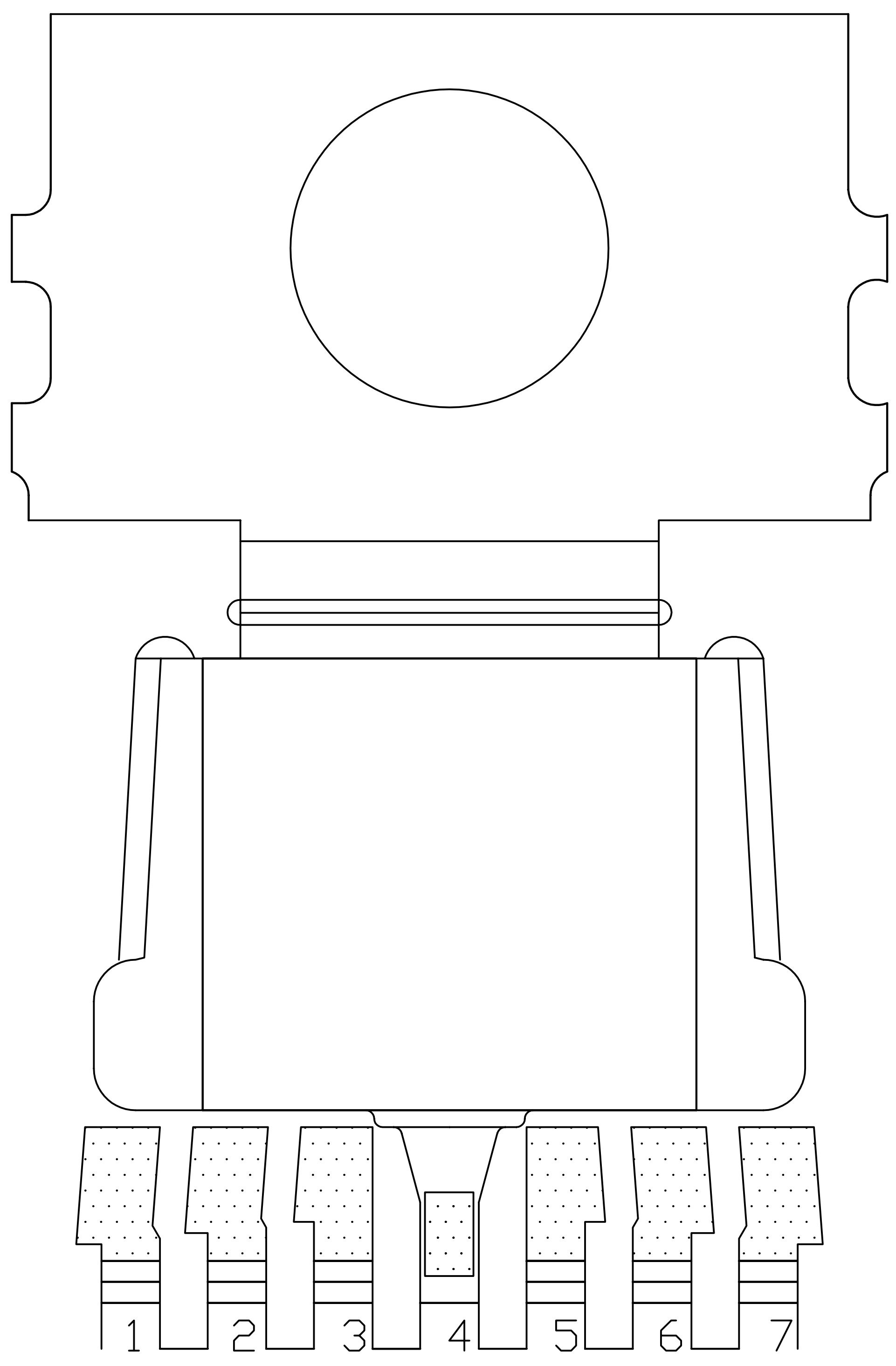


HWATT 7L, BLANK BOND DIAGRAM REF. 7085438

REMARK : E.S.D. PROGRAM IS MANDATORY

BONDING DIAGRAM FOR MONOCOMPONENT

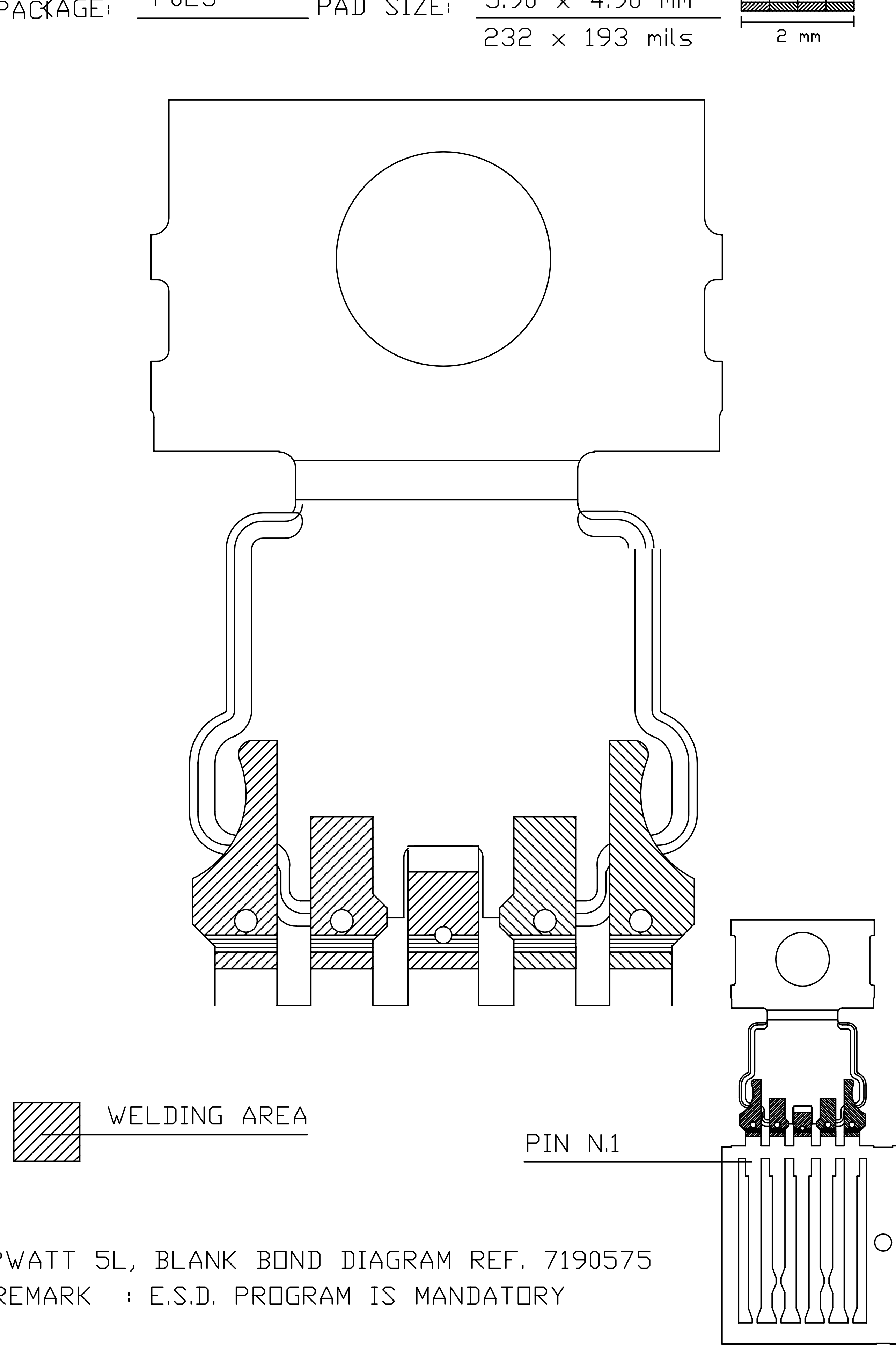
PAD SIZE: $\frac{232 \times 212 \text{ mils}}{5.90 \times 5.40 \text{ mm}}$



HWATT 7L, BLANK BOND DIAGRAM REF.: 7X BSK

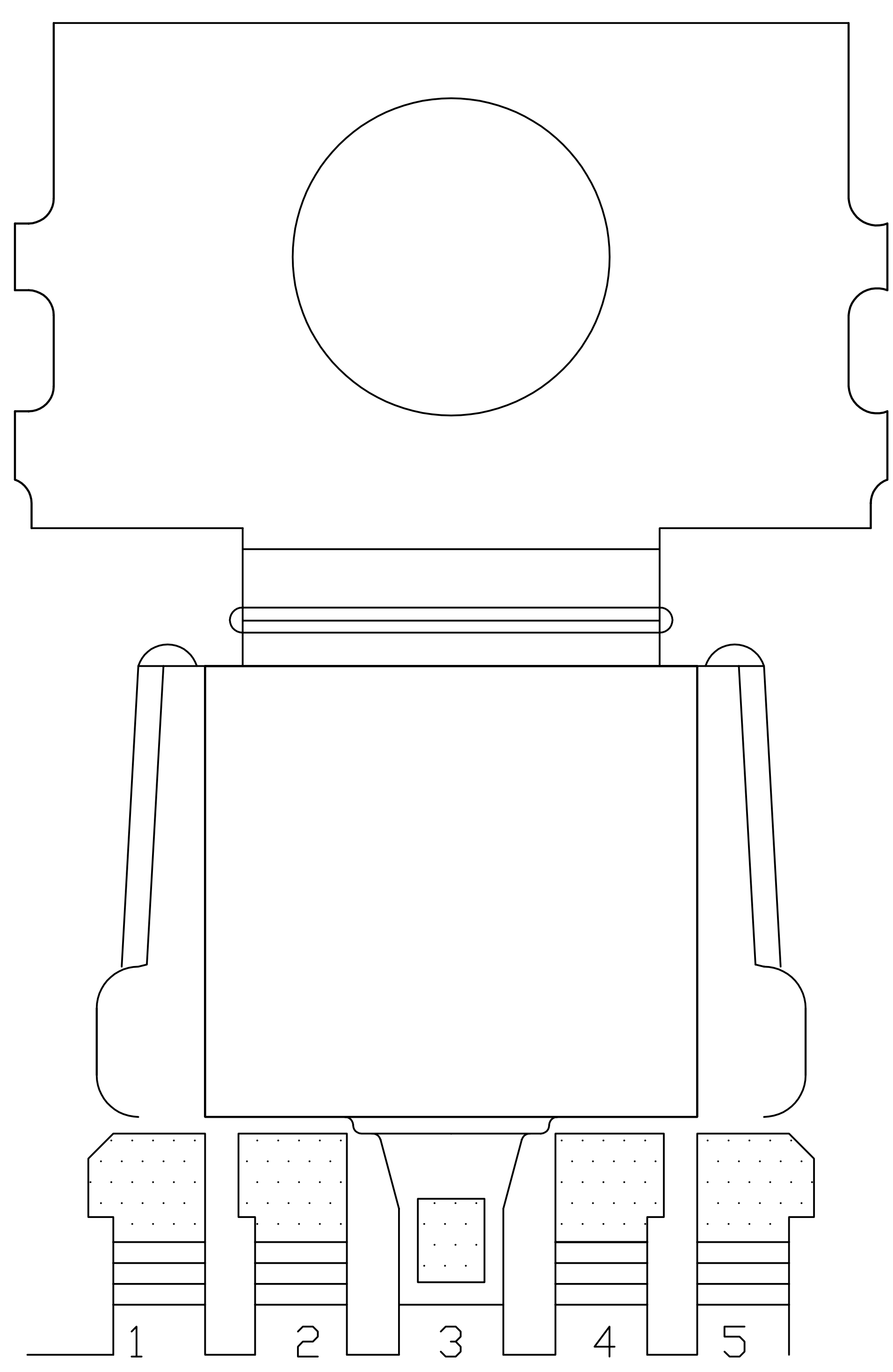
REMARK : E.S.D. PROGRAM IS MANDATORY

BOND DIAGRAM FOR BICOMPONENT FRAME



BONDING DIAGRAM FOR MONOCOMPONENT

PAD SIZE: $\frac{232 \times 212 \text{ mils}}{5.90 \times 5.40 \text{ mm}}$



PWATT 5L, BLANK BOND DIAGRAM REF.: 7E-7Q BSK

REMARK : E.S.D. PROGRAM IS MANDATORY

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