PREPARED BY: C. DAVIDSON	***Multiband Imaging Photometer*** ***for SIRTF***	NUMBER M11P70	
APPROVALS	University of Arizona Steward Observatory, IR Group	TYPE PROCEDURE	
ENGINEERING		DATE 07/10/97	
QUALITY	**SPECIFICATION**	SUPERSEDES SPEC. DATED	
PI/DEPUTY PI		REV. NEW	PAGE 1 of 9

TITLE

SAWING OF CRC 696 READOUT WAFER INTO DISCRETE DIE, PROCEDURE FOR

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1.0 SCOPE

This specification defines the equipment, materials and procedure for sawing the CRC 696 silicon readout wafer into discrete readout die for use in the build of focal plane assemblies for the MIPS program.

2.0 APPLICABLE DOCUMENTS

The following documents form a part of this specification to the extent specified herein. In the event of conflict between the requirements of this specification and the documents calling out this specification, the requirements of this specification shall take precedence. Unless otherwise specified, the most recent revision of the documents identified herein shall apply.

Non-Government Documents
Manuals
Disco Corporation Operation Manual & Technical Guide, Automatic Dicing Saw/Cutting Saw 300 Series, First Edition, July 1994

Drawings

- Drawing Number MIPSD-065, CRC 696 Readout Wafer
- Drawing Number MIPSD-027, CRC 696 Readout Die

3.0 REQUIREMENTS .0 REQUIREMENTS

3.1 Equipment

Acceptable results are contingent upon the use the recommended equipment listed below or equivalent equipment. Equivalent equipment may be substituted for the recommended equipment if and only if effectiveness and accuracy are not decreased by its use.

Item	Quantity	Description
1	1 ea.	Microscope, binocular, 10-70X magnification
2	1 ea.	Photo resist spinner, Hamlin Model 5701 with Headway Research, Inc. spin meter
3	1 ea.	Spin chuck, 4-inch diameter
4	1 ea.	Oven, laboratory, Cole Palmer Model 82320
5	1 ea.	Automatic dicing saw, Disco Model DAD320, machine version 1.0, software version 1.095, machine no. X01308
6	1 ea.	Dicing blade, Dynatex International, S1635
7	1 ea.	Flange
8	1 ea.	Feed pump, Pulsafeeder, Model SR 110 with flow indicator, Mec-O-Matic Model 818980
9	1 ea.	Caliper
10	1 ea.	Blow gun, nitrogen or air

3.2 Materials

Item	Quantity	Description
1	1 ea.	Silicon wafer, part number CRC696
2	1 ea.	Mounting medium, plastic with medium tack adhesive, Semiconductor Equipment, no. 18131
3	1 ea.	Pipette, transfer, disposable, 7.5ml total capacity
4	as required	Photo resist, positive, KTI 820 or AZ 1512
5	as required	Acetone
6	as required	Methyl alcohol (methanol)
7	as required	Isopropyl alcohol (isopropanol, 2-propanol)
8	1 ea.	Silicon wafer (scrap), mounted on mounting material
9	as required	Lubricating fluid, Dynatex Kerf Aid
10	1 ea.	Tweezers
11	as required	Swab, cotton
12	as required	Filter paper
13	as required	Dish, petri, glass
14	as required	Gloves, PVC, clean room, powder free; or finger cots
15	as required	Clean room wipe
16	as required	Deionized water supply
17	as required	Nitrogen gas supply
18	as required	Air supply

4.0 PROCEDURE.

Caution: Readout die can be damaged by electrostatic discharge. Precautions are to taken to prevent the occurrence of ESD damage. As a minimum, a ground strap is to be worn at all times when handling the readout wafer and die.

4.1 Apply Photo Resist to Readout Wafer

Note: This work is to performed in a class 10,000 or better clean room.

4.1.1 Turn oven on and allow to stabilize at $92^0 \pm 3^0$C for a minimum of 15 minutes.

4.1.2 Clean the spin chuck by flushing it with acetone, then blow chuck dry with dry nitrogen or air.

4.1.3 Inspect readout wafer for gross defects, scratches, chips or cracks. If wafer acceptable, center wafer onto spin chuck. Turn vacuum on. Set spinner for 3500 rpm.

4.1.4 Fill a clean pipette with photo resist and apply the entire volume of photo resist to the wafer. Spin wafer at 3500 ± 200 rpm for 20 ± 3 seconds.

4.1.5 Insert a razor blade between the spin chuck and silicon wafer, then gently pry wafer up from the chuck. With tweezers or a gloved hand, remove the wafer from the chuck.

4.1.6 Set wafer onto back surface of inverted petri dish in the oven. Bake resist for 35 ± 5 minutes.

4.1.7 Inspect resist for particulates which might cause saw blade damage and for defects in the photo resist. As necessary, strip photo resist by flushing wafer with acetone. Then without allowing wafer to dry, flush with acetone, methanol and isopropanol and repeat paragraphs 4.1.2 to 4.1.7.

4.2 Mount Wafer In Preparation for Dicing

Place wafer onto rough, adhesive side of mounting material. Using cotton swab, gently press wafer into adhesive. Turn wafer/mounting material upside down and gently rub backside of mounting material-on-wafer to adhere wafer to mounting material.

4.3 Prepare Saw for Dicing

Notes:

1. This procedure is to be performed by an experienced operator familiar with the safety precautions and operation of the saw as described in the Disco Operations Manual and Technical Guide. The manual is to be retained in close proximity to the saw for ready access by the operator.
2. For convenience, the Basic Operating Procedures Section of the Disco Operations Manual, pages A-21 through A-31, is provided as Appendix A to this Specification.

Important: In case of emergency push (EM-OFF) switch, a red mushroom-shaped switch mounted on the front right-hand side of the saw machine. This will move the z-axis to upper end, bring the x, y, and θ axes to an immediate stop, stop spindle rotation and shut off the power supply.

4.3.1 Install Saw Blade

4.3.1.1 Under 10X-40X magnification, inspect for particulates, chips and cracks. Discard blade if extent of these is sufficient to potentially damage wafer and dressing of the blade is not expected to correct the problem(s).

4.3.1.2 Install blade on spindle per procedures on pages A-131 through A-133 of Disco Saw Operations Manual.

4.3.2 Perform Pre-operational Checks. Perform the checks listed on page A-22 of the Disco Saw Operations Manual to ensure the machine is properly connected to the utilities and is in its normal condition.

4.3.3 Start Up. Follow directions on pages A-22 to A-23 of Disco Saw Operations Manual to supply air, N_2 gas, wheel coolant with Kerf Aid, and spindle coolant. Verify power-receiving lamp (white) is illuminated then turn on power to machine: Turn circuit breaker switch to the ON position; insert key into POWER switch behind machine front right, turn key from OFF to ON position then to START position and release key.

Verify display lamp (green) above key switch lights, that monitor display shows MAIN MENU following Disco logo display, and that signal tower lamp (yellow) lights.

Caution: When power is to be turned on again after power turn-off, allow at least one minute before turning on power. Turning on power immediately after power off may cause machine breakdown.

4.3.4 Initialize Processing. Press the (SYS INIT) key on the saw keyboard, this will return all axes (x, y, z and θ) to their zero point positions.

4.3.5 Warm-up/Run-in (Y-axis Idling). Follow directions of paragraph 4.0 on page A-24 of Disco Saw Operations Manual to rotate the spindles at pre-selected cutting speeds, supply wheel coolant and bring the cutting chamber to thermal equilibrium.

Notes:

1. Verify wheel coolant supply rate is 4.5 liters/min. or higher.
2. Be certain to allow spindle to rotate a minimum of 30 minutes before cutting.

Set the number of y-axis idling operation to: 20; the x-axis travel speed at: 0.05 inch/sec.

4.3.6 Dress Blade. If a new blade has been installed, or if inspection of the blade shows material on the blade tip, dress the blade per directions and procedures on pages A-142 through A-148. With the calipers, carefully measure the thickness of the readout wafer and the thickness of the mounting material. Following the directions in the manual, determine the thickness of material to be left uncut in the z direction. Enter this value into Device Data (1). Set for A DOWN cutting mode. Here cutting is performed only when the chuck table moves from right to left.

4.3.7 Setup. Follow the procedure for setup on pages A-26 of the Disco Saw Operations Manual to detect and set the reference position (setup point) for determining the work amount left uncut in the z-direction.

Confirm that on the chuck table setup screen (5.3.2) the blade outer diameter is: 55.560mm and the chuck table size is: 6 inches.

4.3.8 Setup Cutting Data.

Notes:

1. The Main Menu is the initial screen (0.0) displayed after power turn on.
2. The cutting parameters to be used for dicing the silicon wafer into discrete readout die have been previously defined and need not be reset here, with the exceptions noted below. A unique device data number, 696 , and device I.D., CRC696, have been ascribed to this set of cutting parameters.

Press the (F3) key to call up the device data list screen (3.0). Verify that "696" is listed under DATA No. and "CRC696" is its corresponding identifier under DATA I.D. Press the (SHIFT) key and type 696. Press the (SHIFT) key again, then press the (ENTER) key. The device data (1) screen (1.2) will appear. A representation of this screen is shown in Figure 4.3.8-1.

The significant features of the figure are the input values for the various parameters.

Verify that the device data in the actual display are the same as those shown in Figure 4.3.8-1.

Note: The measured thickness of the readout wafer as well as the total thickness of the wafer and mounting material may require that the blade height and work thickness input data be changed. Reference Section V of the Disco Saw Operations Manual for procedure to make these changes.

Setup is now complete. Press the (F7) Semi-Auto key. The semi automation screen will appear.

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DISCO DICER SERIES      <DAD320>                                           YY-MM-DD
[         ]                                                                1.2
                                          DEVICE   DATA
                                          (1)

DEVICE DATA NO.         696                             DEVICE I.D.        CRC696


UNIT                    INCH              RND WORK SIZE                    3.999998

CUT MODE                A                 SQR WORK SIZE          CH 1      0.000000

CUT SHAPE               ROUND                                    CH 2      0.000000
                                          WORK
                                          THICKNESS                        0.060000
BLADE HEIGHT            0.002500          Y INDEX                CH 1      0.121260

FEED SPEED              0.50000 INCH/SEC                         CH 2      0.260433


BLADE WEAR ADJUSTMENT   0.0/0.000

SPINDLE REVOLUTIONS     30.000 RPM

PRECUT PROCESS NO.      1

F1 : SELECT             F2:               F3:  DATA         F4: PRECUT     PROC
F5 : KERF CHECK         F6:  F_AUTO                       F7: S_AUTO
F8 : MEASURE            F9:  PRECUT ON                      F10: AUTO      SETUP
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Figure 4.3.8-1. Representation of Device Data (1) Screen (1.2) with Input Parameters

4.4 Set the Readout Wafer onto Chuck Table.

4.4.1 Make sure the chuck table (x-axis) is stopped.

Caution: Since the spindle rotates in this state, do not put your hands in the cutting room. Remove water drops with the air injection gun wherever possible.

4.4.2 Place the mounted readout wafer onto the chuck table.

Notes:

1. If the work cannot easily be set due to the microscope or spindle shaft positioned above the work, move the y-axis with the manual axis operation key.
2. In positioning the wafer on the chuck table, consider which direction was identified as channel 1 when the Y index values were input, keeping in mind that cutting is carried out in the order of channel 2 , channel 1.

4.4.3 When the wafer is properly positioned, press the (C/T VAC) key to let the chuck table vacuum retain the work.

4.5 Align the Readout Wafer

Note: Alignment of the wafer must be completed prior to cutting. Alignment defines the cutting position setup.

4.5.1 With the microscope in split field view, align the channel 1 y axis and θ axis. Alignment is complete when the kerf line on the monitor tracks the wafer saw lane as travel is effected across the entire distance of the wafer. Once alignment is complete, verify the channel 1 Y index (or step value) displayed on the device data (1) screen 1.2 is correct by indexing (stepping over) to adjacent wafer saw lanes and confirming the dashed kerf lines on the monitor align to the wafer saw lanes. Follow procedures in Disco Saw Operations Manual to make any necessary adjustments.

Important: To eliminate backlash, be certain to complete y-axis positioning with the $(^{Y}\Delta)$ key and θ-axis positioning with the $(^{\theta}\Leftarrow)$.

4.5.2 With the (INDEX) key on, rotate the θ axis with the $(^{\theta}\Leftarrow)$ key and similarly effect channel 2 alignment and verify the channel 2 Y index, or stepping value.

4.6 Initiate Cutting. Insert the Kerf Aid pump plug into an electrical outlet and press the (CUT WATER) key to let the Kerf Aid coolant flow over the wheel. Initiate cutting by pressing the (START/STOP) key. The cutting status screen then appears.

4.7 Remove Wafer from Chuck Table When cutting is completed and the y axis has moved to the chuck table center and stopped, blow wafer off with the air injection gun. Turn off the vacuum to the chuck table and remove the wafer.

4.8 Shut Down Saw .8 Shut Down Saw.8 Shut Down Saw

4.8.1 Stop Operation. Press the (EXIT) key to return the system to the device data (1) screen (1.2). Press the (EXIT) key again to return the system to the main menu screen (0.0). Press the (CUT WATER) key to shut off the wheel coolant supply. Unplug the pump to the Kerf Aid.

Caution: Before stopping the spindle, idle the spindle with wheel coolant flowing for 5 to 15 minutes and with wheel coolant stopped for 15 to 20 minutes.

After idling, press the (SPINDL) key to stop spindle rotation.

4.8.2 Turn Off Power and Close Main Valves.

Verify machine function keys are off. Check that spindle is at rest, then turn the machine front right (POWER SW) key to "off" position.

Important: If the power is turned off during spindle rotation, the spindle system may enter the free-running state.

In sequence, turn off the breaker switch, then close the wheel coolant main supply valve, the spindle coolant main supply valve and the air main supply valve.

Caution: If the power is turned off without stopping the spindles, the spindles will seize up. Therefore, be sure to stop spindle rotation before shutting off the air supply.

4.9 Remove Readout Die from Mounting Material

Notes:
1. Readout die identification must be retained.
2. Each readout die is identified by the unique row/column position it occupies in wafer form with respect to the wafer major flat.

Using tweezers, remove die from mounting material. Place die in petri dish of acetone until photo resist dissolves. Note: Do not allow die surfaces to dry prior to blow dry with dry nitrogen or air.

While lifting die out of dish of acetone with tweezers, flush die with acetone from a squeeze bottle, then with methanol and, finally, with isopropanol. Blow die dry with dry nitrogen or air.

Place readout die into conductive container, cover container and transport to microscope.

4.10 Verify Readout Die Meet Visual and Dimensional Requirements

Inspect readout die for cleanliness, scratches, chips, and cracks. Measure readout die to verify dimensions meet specifications of drawing number MIPSD-027. Place acceptable die in properly labeled conductive container, and store container in clean room desiccator.