# Contract Low Dose Rate Irradiation Services

Intersil introduces low dose rate irradiation services at 0.01 rad(Si)/s on a contract basis, using a panoramic $^{60}$Co irradiator in the Palm Bay, FL facility.


*External view of the low dose rate $^{60}$Co irradiator.*

## Introduction

This document provides procedures, conditions and technical details for access to the Intersil low dose rate irradiation facility.

Construction and activation of the Intersil low dose rate facility in Palm Bay, Florida is now complete. The panoramic 50 Curie (Ci) $^{60}$Co source is located in a concrete vault, and the facility is fully commissioned and performing routine low dose rate irradiations.

The device under test (DUT) board fixturing is designed to accommodate 64 9”x12” PCB DUT boards. All boards are enclosed in a spectrum hardening PbAl box to filter out secondary radiation. The fixture approximates an isodose sphere centered on the source pellet and consists of sixteen ‘wings’ each holding one PbAl box enclosing four DUT board holders. The design dose rate is 0.01rad(Si)/s at the DUT board location. The calculated total dose uncertainty is +/- 3% or better, and all irradiations are overtested by 3% to compensate for this uncertainty. The calculated field uniformity within the irradiator test volume is +/-2.5%. The yearly irradiator calibration procedure uses ion chamber dosimeters and is fully automated.

Most irradiator operations are under computer control, and each DUT board is uniquely identified by a bar-coded label. System features include automatic scheduling, dose rate calculation and source decay correction. The irradiator has 64 DUT board positions that are divided into 4 quadrants. Each quadrant has 8 programmable power supply voltages available. The DUT board could have all 8 power supplies available to it. A dedicated power supply control computer determines and controls the supply voltages and power sequencing to each DUT board.

## Contract irradiation services:

Access to the Intersil Palm Bay low dose rate irradiator by outside customers is provided under contract including terms and conditions, and with various options for electrical testing, dosimetry and shipping.

To support this work, Intersil has developed a low dose rate irradiation guideline document for customer use. These guidelines are based on the requirements of MIL-STD-883, ASTM F1892 and ESA specification 22900 and are available on a no cost basis as part of the marketing information package. Intersil will also provide expert radiation effects consultation on an as-required basis, especially during the test plan development by the customer.

Intersil will irradiate both non-Intersil and Intersil parts. All irradiation services will be performed under a nondisclosure agreement (NDA) as a part of the contract. There are no limits on the part types or technologies that can be irradiated other than those imposed by physical size, power supply current limitations and operator safety. Parts will be tracked by a process traveler and will be under control at all times. Any ITAR or other security restrictions must be resolved before a contract is entered into. Intersil has an on-site ITAR compliance officer.

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**Fig. 1:** Image showing a single vertical test board holder and PbAl spectrum hardening filter box with the access door open. The holder is on rails and can be moved towards the centrally located source as the source loses activity. The curvature of the DUT rack can be clearly seen.

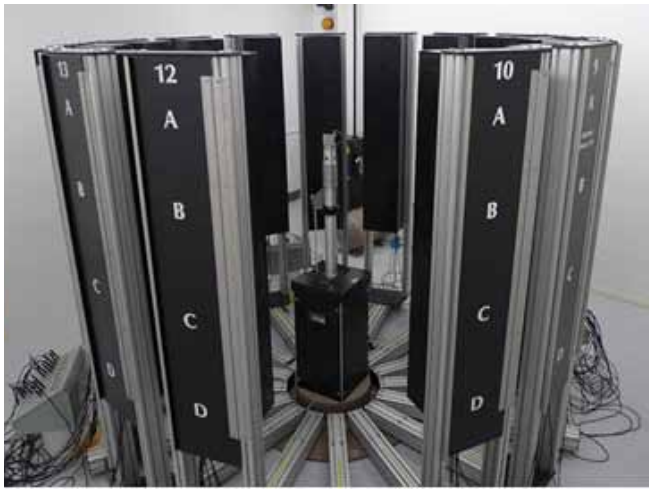


**Fig. 2:** View of the 'pop-up' $^{60}$Co source (center) and surrounding test racks. The board holders are arranged in an approximate sphere surrounding the source. All DUT boards are enclosed in PbAl spectrum hardening boxes to filter out secondary radiation. The total DUT board capacity is 64.

## Limits of liability:

Intersil is excluded from liability for losses or damage to samples as a result of low dose irradiation exposure or any other damage unless such damages are a result of intentional misprocessing or mishandling by Intersil. In the event that Intersil does damage any units through misprocessing or mishandling, the limit of the liability will be held to the cost of the individual affected unit(s) and will not exceed the Purchase Order amount for contracted services under any circumstance. Units failing as a result of the contracted services are excluded from Intersil liability. Additional terms are provided in the Intersil ELDRS Service Agreement.

## Test plan development:

The customer will generate a complete test plan based on the Intersil guidance document and a detailed checklist. Elements of this test plan shall include but not be limited to dose rate, downpoints, bias configurations, supply voltages and currents, absolute maximum supply currents, power supply ramping and sequencing requirements, socket details, DUT board electrical design, DUT board layout and DUT board functional checkout procedures. Intersil radiation effects engineering will conduct a detailed review of the customer-generated test plan, and a contract will not be entered into until and unless the test plan has been mutually agreed upon by the customer and Intersil radiation effects engineering.

## Irradiation conditions:

All irradiations are performed per the latest revision of MIL-STD-883 TM 1019. The routinely supported dose rate is 0.01rad(Si)/s. The actual dose rate varies over time and can range from 0.007 to 0.0097rad(Si)/s but will be less than or equal to 0.01rad(Si)/s at all times. At its option, Intersil will optimize the dose rate to minimize the test cycle time, while remaining within the 0.01rad(Si)/s maximum dose rate. High dose rate testing is not available at this time.

Downpoints are determined by the customer and documented in the Test Plan. The standard downpoints are 0 krad(Si), 25 krad(Si), 50 krad(Si), 100 krad(Si) and 150 krad(Si). Downpoint of less than 25krad(Si) are difficult to manage without incurring overtime costs, but Intersil will support these nonstandard downpoints on an NRE charge basis. An overtest of 3% is routinely performed to compensate for dose rate variations and equipment tolerances within the irradiator. The total dose at each downpoint will thus be the required value

plus 3%, as a minimum, with minor additional overtests as a result of holidays and equipment downtime.

## Test fixturing:

The customer will build the DUT board(s) based on an IO pin protocol, board dimensions and height limits as supplied by Intersil. Conformance with the Intersil-supplied board dimensions and form factor is mandatory, and boards outside these dimensions will not be accepted. There are no restrictions on the number or configuration of test sockets per board as long as the height limit is within the specified maximum. Intersil will review the board design as a part of the test plan review before commencing the tests. As an alternative, Intersil will execute the DUT board construction on an NRE charge basis.

The board design will include all drivers and biasing networks; only DC power will be supplied to the DUT board during irradiation. The customer is cautioned to use radiation-resistant materials, hardware, passive components and driver and biasing network parts in order to avoid radiation damage to these support components during long-duration irradiation. Intersil assumes no responsibility for DUT, materials, hardware, passive component and driver and biasing network parts failures of any kind during irradiation.

Up to eight power supplies are available, and more are available on an NRE charge basis. Supply voltage ranges are +/- 20V at 2.0A and up to +/- 50V at 0.8 A, with limited capability at +/- 150V at 0.2A. The customer will supply test points for voltage monitoring and expected current for each supply input to DUT board. The board design including schematics, mechanical drawings, supply voltages and supply currents will be covered as part of the test plan review.

Intersil will monitor all power supply currents and voltages before and during the test. An absolute maximum value for all power supply currents will be supplied by the customer as part of the Test Plan. If any power supply currents into the DUT board exceed this limit at any time during the test the board will be removed from the irradiator at the next irradiator opening and the customer will be notified for disposition direction.

In-flux testing involves electrical characterization testing of the device samples while in the irradiator and is not supported by Intersil.

## Characterization testing:

The customer will normally perform all electrical characterization testing of samples. As an alternative, Intersil will perform the electrical characterization testing; such testing is limited to current Intersil-manufactured parts and will use Intersil automated test equipment (ATE) running the current production room temperature ATE program and test fixturing. Any modifications to these conditions will incur a further NRE charge. At the conclusion of the test Intersil will ship the variables data in Comma Separated Variables (CSV) format as part of the data package. Data analysis is the responsibility of the customer, and Intersil will not determine pass/fail statistics.

## Radiation test logistics:

If Intersil is performing the electrical characterization, Intersil will load and check out the DUT boards before the irradiation, and no shipping off site will be required. In all other cases the customer will load and check out the DUT boards before shipment to Intersil, who will irradiate to the specified total dose and return the board. This procedure will be repeated until the last downpoint. Intersil will not handle individual test samples unless absolutely required in order to execute the test and will perform photographic documentation of any handling that has to be performed.

Timing of sample shipments in an off-site situation is critical and is rigorously controlled by MIL-STD-883 Method 1019. The customer response time will usually have to support the 120 hour MIL-STD-883 limit after removal from the chamber, including shipping, handling, electrical characterization, board loading and board checkout. The customer is referred to the Intersil guidelines and their reference documents. Intersil will ship the irradiated DUT boards and samples back to the customer in a foam container, along with two frozen Gelpacks™ in order to insure compliance with the 40°C limits imposed by MIL-STD-883 Test Method 1019.

## Dosimetry:

The dose rate of the Intersil low dose rate irradiator is calibrated annually with periodic calibration checks to insure the dose rate remains compliant to Test Method 1019. Dose rates are determined by continuous calculations that include the predicted $^{60}Co$ source degradation curve. The accumulated total dose is obtained using these calculations. Intersil can also perform dosimetry on an NRE basis.

Customer-supplied dosimeters such as TLD's or ionization chambers may be used as long as these devices fit within the board form factor limits, including the maximum height. These dosimeters must be securely attached to the DUT board using radiation-resistant mechanical fixturing. Facilities for reading customer-supplied dosimeters are not available at Intersil.

## Data requirements:

A standardized Intersil traveler will be used, with all steps signed off by a trained and certified Intersil radiation technologist. At the completion of the test a complete data package will be shipped to the customer along with the irradiated samples and the DUT boards.

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