UG0817
User Guide
Programming and Functional Failure Guidelines

Microsemi

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Contents

Tables

1 Revision History

The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the current publication.

1.1 Revision 7.0

Revision 7.0 was published in Mar 2018.The following is a summary of changes made in revision 7.0 of this document.

- The document is updated with RTAX part numbers and obsolete part numbers are deleted. For more information, see Table 8, page 13.
- Support for Silicon Sculptor, Silicon Sculptor II devices is removed in this release.
- Silicon Sculptor 3 Device Support, page 5 is updated to add the families in which Silicon Sculptor 3 device support is available.
- Other Device Programmers, page 6 is updated to add a detail about BP Microsystems.
- Microsemi SoC Technical Support contact details are updated to *http://soc.microsemi.com/mycases*.

1.2 Revision 6.0

Revision 6.0 was published in Sep 2012. The following is a summary of the changes made in revision 6.0 of this document.

- Added a new section Return Material Authorization RMA Policies – Replacement Units, page 7 under Return Material Authorization (RMA) Procedures, page 6.
- Modified RMA Policies – Replacement Units, page 7 (SAR 38003).

1.3 Revision 5.0

Revision 5.0 was published in May 2012. A new section, RMA Policies – Replacement Units, page 7 (SAR 38003) was added in this revision.

1.4 Revision 4.0

Revision 4.0 was published in Oct 2011. The following is a summary of the changes made in revision 4.0 of this document.

- The programming yield for A54SX32A and A54SX72A devices was changed from 70% or better to 85% or better. Table 3: SX32A and SX72A (all speed grades) Maximum Allowed Programming Failures was updated accordingly.
- The Silicon Sculptor Device Support section was revised to state that software support for the Silicon Sculptor I and Silicon Sculptor 6X programmers was actively disabled in Silicon Sculptor software v4.70 (August 2007).
- Radiation-tolerant (RT) ProASIC3 devices were added to the document. Microsemi accepts 0.5% fallout for RT ProASIC3 devices, regardless of the sample size or volume (SAR 29759).

1.5 Revision 3.0

Revision 3.0 was published in Dec 2010. The following is a summary of the changes made in revision 3.0 of this document.

- Updated programming guidelines to reflect current yields for A54SX72A and A54SX32A.
- RTAX2000D and RTAX4000D were added to the document and listed in Table 8: Commercial Equivalent Devices.

1.6 Revision 2.0

Revision 2.0 was published in Aug 2010. SmartFusion® and FlashPro4 devices are added to the document. Updated the Silicon Sculptor Device Support section and FlashPro3/3x Device Support sections.

1.7 Revision 1.0

Revision 1.0 was published in Feb 2010. It was the first publication of the document.

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2   Commercial and Standard Military Products

Microsemi SoC Products Group programs significant volumes of devices each month for its customer base. The programming yield for anti-fuse devices normally averages from 98% to 99%. However, the yield can show a lot-to-lot spread, which generally ranges from 97% to 100%, based on volumes greater than 100 units. For volumes less than 100 units, see Table 1, page 3, Table 2, page 4, or Table 3, page 4 for maximum expected failures. Devices labeled as -F are not screened as closely for programming yield, so expected yield is 88% or better (Table 4, page 4).

For anti-fuse device failures within these guidelines, submit an Return Material Authorization (RMA) request form to the Microsemi SoC products group customer service (*rma@microsemi.com*). Customers experiencing a programming failure greater than the sample sizes provided in the following tables must suspend programming, open a technical support case at *http://soc.microsemi.com/mycases,* and submit the completed, *Programming Failure Checklist*, along with the programming error log.

Since IGLOO®/e (including ARM-enabled), IGLOO nano, IGLOO® PLUS, ProASIC®3/E (including ARMenabled), Military ProASIC3/EL, ProASIC3 nano, ProASIC3L, SmartFusion®, Fusion (including ARMenabled), ProASIC^{PLUS}®, and ProASIC devices are reprogrammable, Microsemi tests the 100% programmability of these products. Although no failures are expected on these devices, Microsemi accepts 0.5% fallout from IGLOO/e (including ARM-enabled), IGLOO nano, IGLOO PLUS, ProASIC3/E (including ARM-enabled), Military ProASIC3/EL, ProASIC3 nano, ProASIC3L, SmartFusion, and Fusion (including ARM-enabled) devices regardless of the sample size or the volume. For ProASIC and ProASIC^{PLUS} (including -F) devices, Microsemi accepts up to 1% for quantities below 1000, and up to 0.5% for a larger volume. If the failure quantity is greater, fill out the programming failure checklist and submit it along with the programming error log at *http://soc.microsemi.com/mycases*.

Programming yield for anti-fuse FPGAs must normally be over 97% for devices other than Axcelerator® (88 to 92%) or A54SX32A and A54SX72A (85% or better). With a smaller number of units programmed, you may experience a larger percentage of fallout due to statistical fluctuations attributable to the small quantities. See Table 1, page 3, Table 2, page 4, Table 3, page 4, or Table 4, page 4 to determine acceptable levels. If higher programming failures occur than provided below, stop programming the device and submit the programming failure checklist along with the programming error log to the Microsemi SoC Technical Support at *http://soc.microsemi.com/mycases*.

Table 1 •   **Anti-fuse FPGAs (non -F speed grade) Maximum Allowed Programming Failures[1]**

Sample Size	Maximum Number of Programming Failures Allowed
<10	1
10-18	2
19-30	3
31-45	5
46-60	7
61-75	8
76-99	10
100	3%

1.   For SX32A and SX72A, see Table 4, page 3.

Table 2 • **Axcelerator Family (all speed grades) Maximum Allowed Programming Failures**

Guidelines for AX125, AX250, and AX500		Guidelines for AX1000 and AX2000	
Sample Size	Maximum Number of Failures Allowed	Sample Size	Maximum Number of Programming Failures Allowed
<10	2	<10	3
10-18	3	10-18	5
19-30	4	19-30	6
31-45	8	31-45	8
46-60	10	46-60	11
61-75	12	61-75	13
76-99	15	76-99	15
>100	8%	>100	12%

Table 3 • **SX32A and SX72A (all speed grades) Maximum Allowed Programming Failures**

Sample Size	Maximum Number of Programming Failures Allowed
<10	4
10-18	6
19-30	8
31-45	11
46-60	14
61-75	16
76-99	19
100	15%

Programming yield for -F devices must normally be over 88%. The sample sizes provided in the following table allow a larger percentage due to statistical fluctuations attributable to the small quantities. If higher programming failures occur than provided in the table, stop programming the device and submit the programming failure checklist along with the programming error log to the Microsemi SoC Technical Support at *http://soc.microsemi.com/mycases.*

Table 4 • **-F Anti-fuse (other than SX32A and SX72A) FPGAs Maximum Allowed Programming Failures**

Sample Size	Maximum Number of Programming Failures Allowed
<10	3
10-18	5
19-30	7
31-45	10
46-60	12

Table 4 • **-F Anti-fuse (other than SX32A and SX72A) FPGAs Maximum Allowed Programming Failures** *(continued)*

Sample Size	Maximum Number of Programming Failures Allowed
61-75	14
76-99	15
100	12%

2.1 Activator 2 and Activator 2S Device Support

These programmers are discontinued (*PDN 0201*, 2/1/2002). Customers must upgrade their programmer to Silicon Sculptor 3. Programming failures from Activator programmers will not be accepted for RMA.

2.2 Silicon Sculptor 3 Device Support

The Silicon Sculptor 3 programmer is designed to program: ACT 1, ACT 2, 1200XL, ACT 3, 3200DX, 40MX, 42MX, SX, SX-A, eX, Axcelerator, MX, IGLOO/e (including ARM-enabled), IGLOO nano, IGLOO PLUS, ProASIC3, ProASIC3/E (including ARM-enabled), ProASIC3 nano, ProASIC3L, SmartFusion, SmartFusion®2, Fusion (including ARM-enabled), ProASIC^{PLUS}, ProASIC devices, RT ProASIC3, RTAX-S/SL,RTAX-DSP and RTSX-SU devices. No other FPGAs can be programmed on the Silicon Sculptor 3 programmer.

2.3 FlashPro Device Support

The FlashPro in-system programmer is designed to program ProASIC and ProASIC^{PLUS} devices.

No other FPGAs must be programmed on the FlashPro programmer. The FlashPro programmer was discontinued (*PDN 0906*, August 2009). While software updates are no longer offered for this programmer, software support for the FlashPro programmer will continue.

2.4 FlashPro Lite Device Support

The FlashPro Lite in-system programmer is designed to program the ProASIC^{PLUS} devices. No other FPGAs must be programmed on the FlashPro Lite programmer.

2.5 FlashPro3/3x Device Support

The FlashPro3 in-system programmer is designed to program the IGLOO/e (including ARM - enabled),

IGLOO nano, IGLOO PLUS, ProASIC3/E (including ARM-enabled), ProASIC3 nano, ProASIC3L, SmartFusion, and Fusion (including ARM-enabled). No other FPGAs must be programmed on the FlashPro3 programmer. FlashPro3/3x was discontinued (*PDN 0910*, November 2009); however, software support for the FlashPro3/3x programmer will continue.

2.6   FlashPro4 Device Support

FlashPro4 is a programmer, supporting all FPGAs in the IGLOO series and ProASIC3 series (including RT ProASIC3), SmartFusion and Fusion families, and future generation flash FPGAs.

FlashPro4 replaces FlashPro3 and FlashPro3X and is backward-compatible, supporting additional features such as lower cost, smaller form factor and the latest flash FPGA families. Libero® Integrated Design Environment (IDE) v8.6 SP1 or FlashPro v8.6 SP1 is the minimum software and version required to use FlashPro4. See, *AC357: FlashPro4 Backward Compatibility with FlashPro3 App Brief* for more information on FlashPro3 and FlashPro4 compatibility.

2.7   FlashPro5 Device Support

FlashPro5 is the newest programmer, which along with Windows, supports Linux platforms also such as RedHat Enterprise Linux 6 and CentOS 6, in conjunction with FlashPro Express software. It supports all FPGA devices in PolarFire®, SmartFusion2, IGLOO2, RTG4™, SmartFusion, Fusion, IGLOO, ProASIC3 and RT ProASIC3 series.This is completely backward compatible and complies with the requirements specified in EMC Directive 2004/108/IEC and RoHS Directive 2011/65/EU.The minimum version requirements to run FlashPro5, on Windows and Linux, are Libero SoC, Libero SoC PolarFire v1.1 or FlashPro v11.4.

2.8   Other Device Programmers

BP Microsystems' programmers that are equivalent to Silicon Sculptor 3 (1610/2610/1710/2710) are fully supported by BPM and endorsed by Microsemi. BPM automated programmers 3600/4600/3610/4610/3700/4700/3710 and MK2/4710 also support Microsemi devices and are endorsed by the Microsemi SoC Products Group. Where an automated programmer is used, the appropriate open-top adapter module from BPM Microsystems must be used. Any BP programmers including automated programmers are not to be used for programming RT devices such as RTSX-SU and RTAX-S.

No other programming hardware is endorsed by the Microsemi at this time. All failures outside of the expected fallout, as noted in Table 1, page 3 through Table 4, page 4, must be handled with the vendor of that programming hardware. Functional failures may be rejected by Microsemi if the programmer is suspected to be the cause of the failure and the programmer is not listed above.

2.9   Microprocessor Programming

In-system programming (ISP) with a microprocessor applies to IGLOO/e (including M1AGLe), IGLOO nano, IGLOO PLUS, ProASIC3/E (including M1A3P/E), ProASIC3 nano, ProASIC3L, SmartFusion, SmartFusion2, IGLOO2, PolarFire, RTG4, Fusion (including M1AFS and P1AFS), and ProASIC^{PLUS} devices only. See the application notes, available on the SoC Product Group's website, for details on ISP. See the FlashPro page for the device list. Customers must use the latest version of DirectC, available from the SoC Products Group website.

www.microsemi.com/soc/download/program_debug/directc/default.aspx

2.10   Return Material Authorization (RMA) Procedures

The following actions must be performed for programming failures.

1. All devices submitted for an RMA must be within the Microsemi warranty period (one year from date of shipment for direct customers). Microsemi rejects devices that are no longer under warranty.
2. All devices returned must be in their original packaging and must have a Microsemi SoC Products Group RMA number.
3. For normal programming fallout of 0 to 3% (12% for –F), return the parts for replacement by requesting an RMA number through Microsemi sales representatives, distributors, or customer service.
4. Normal programming failures are sent to *rma@microsemi.com.*The distributors submit through the online rma site, *https://ops.microsemi.com/newrma/*

5. For fallout of greater than 3% (12% for –F), or greater than that shown in Table 1, page 3, Table 2, page 4, or Table 3, page 4, contact Microsemi SoC Technical Support to investigate the issue further, as documented below.

6. RMAs are authorized for current Microsemi devices only. Devices which are discontinued will not be accepted for RMA.

7. All functional failure requests must be initiated by opening a case with Microsemi SoC Technical Support at *http://soc.microsemi.com/mycases*. See the following instructions.

8. If the devices were programmed using programmers not certified by the SoC Products Group or discontinued programmers, Microsemi reserves the right to reject failure analysis and/or RMA requests.

9. For users who experience long programming time, contact Microsemi SoC Technical Support at *http://soc.microsemi.com/mycases* for help. It must be noted that programming times for –F material are longer than for other speed grade material.

2.11 RMA Policies – Replacement Units

1. SoC Products Group does not guarantee the availability of units from the same wafer lot and/or date code as originally purchased. Customers with Single Wafer Lot and/or Single Lot Date Code requirements, or any other "add-on" special testing or service requirements, are advised to order additional units at the time of order placement to account for normal programming fallout.

2. As per SoC Products Group standard warranty, "SELLER shall repair or replace any such defective goods and return the repaired or replacement goods to CUSTOMER". If any "add-on" special testing requirements or services were ordered, SoC Products Group is responsible to replace the standard parts only.

3. "Credit only" requests for RMAs are not accepted.

2.12 Programming Failure Policies

The following are Microsemi's policies on supporting programming failures. Failure analysis requests can only be approved by Microsemi SoC Technical Support. For all excessive programming failures, submit the programming failure checklist along with the programming error log to your Microsemi SoC Technical Support at *http://soc.microsemi.com/mycases*.

The term "customer" refers to any person or company programming Microsemi devices.

*   Customers may request programming failure analysis on devices only when programming failures exceed the limits of Table 1, page 3, Table 2, page 4, or Table 3, page 4, and software or programmer issues are eliminated as a cause of the failure.

*   The customer must use the latest version of the programming software available at the time of programming. The latest version is available at, *https://www.microsemi.com/products/fpga-soc/design-resources/programming-debug-tools*. If Microsemi discovers that the programming failures were caused by the use of an earlier version of programming software, the SoC Products Group reserves the right to reject the request for programming failure analysis and/or RMA request.

*   The customer must ensure that all programming hardware is in good, working condition. This requires regular execution of the hardware self-diagnostic test, and maintaining valid calibration of the programming hardware. The self-diagnostic test must be performed before every programming session. As a minimum, the test must be executed every week. Hardware calibration must be performed every 12 months. Information on running the self-diagnostic tests and calibration can be found at *Silicon Sculptor Verification of Calibration Guide*. Microsemi may reject an RMA if the hardware is found to be poorly maintained, and is the cause of the failures.

*   The customer must use the latest revision of the adapter modules available at the time of programming. The latest revision of the adaptor modules are available on the SoC Products Group's website under "Adapter Modules" *www.microsemi.com/soc/products/hardware/program_debug/ss/modules.aspx*

*   As a new version of a module is available, Microsemi will issue a Product Discontinuation Notice for the previous module, instructing the customer that the new version is available and must be used for programming as soon as possible. Support for discontinued the module will be removed from the programming software. If the SoC Products Group concludes that the programming failures were caused by the use of an earlier revision of an adapter module and/or the adapter module's insertion limit is exceeded, Microsemi reserves the right to reject the request for programming failure analysis and/or RMA request. The insertion limit is available on the SoC Products Group website,

*www.microsemi.com/soc/products/ hardware/program_debug/ss/modules.aspx.*The limit can be checked from the Silicon Sculptor software (Tools > **Socket Module Counter**).For ISP of flash devices, customers are expected to follow the board-level guidelines provided on the SoC Products Group website. These guidelines are discussed in the datasheets and application notes (refer to the "Related Documents" section of the datasheet for application note links). Customers are also expected to troubleshoot board-level signal integrity issues by measuring voltages and taking scope plots. Microsemi has the right to reject an RMA for programming failures due to any type of board-level issue.

*   The SoC Products Group only tests the programming of Microsemi devices on the FlashPro and Silicon Sculptor 3. Each release of the Silicon Sculptor and FlashPro, FlashPro Lite, and FlashPro3/3x/4 software goes through a rigorous testing procedure to ensure the best programming yield possible. This test procedure includes programming of devices and functional testing of theFP5 devices. Activator and FlashPro programmers (not including FlashPro Lite and FlashPro3/3x/4) are discontinued. Software updates are no longer offered for these programmers; however, software support for the FlashPro programmer will continue.
*   The SoC Products Group does not test programming hardware or software from any other vendors, and cannot guarantee programming yield. Microsemi may accept programming failure RMAs up to the allowed fallout, but reserves the right to reject any RMA requests if the fallout is excessive. Microsemi will not perform failure analysis on devices programmed by hardware from other vendors.
*   Programming failure analysis will not be performed on –F devices.
*   The SoC Products Group will respond within two business days and do everything feasible to find an immediate workaround for the customer. If a programming failure analysis is required, this could take up to several weeks.
*   Customers must use the latest version of Silicon Sculptor (SculptW) software to program Microsemi FPGAs. Although Microsemi FPGAs are supported in the BPWin software from BPM Microsystems, most recent Silicon Sculptor fixes are not always included in the latest BPWin software. BPM customers must always check SoC Products Group and BPM websites or contact Tech Support to ensure they are using the latest software that includes the latest requirements from the SoC Products Group. Customers failing to use the latest version of the Silicon Sculptor software from the SoC Products Group, or its BPM equivalent, risk losing the ability to return FPGA product. If customers use BPWin to program any Microsemi device and encounter programming failures higher than the Microsemi guideline (refer to the appropriate table in this document), contact *tech@bpmicro.com.*

2.13   Functional Failure Policies

The following are Microsemi's policies on supporting functional failures.

*   Functional failure analysis is not performed on –F devices.
*   The customer is responsible for providing all the design files necessary to perform the failure analysis. This includes, but is not limited to, source files (schematic or HDL), Designer database file (*.adb), board schematics, test vectors and testbench, programming files, and timing analysis results. Additional files may be requested by Microsemi SoC Technical Support. If any of these files are missing, it may hinder or impede our ability to perform a failure analysis.
*   The customer is responsible for providing an adequate description of the failure mode. This includes Silicon Explorer probing results (if available), an explanation of the failure mechanisms along with logic analyzer/scope plots of the failure mode, test methods used, device and board configuration, and any additional information requested by Technical Support. If any of this information is missing, it may hinder or impede the ability to perform a failure analysis.
*   If the security fuse is programmed (anti-fuse FPGAs), the SoC Products Group cannot perform failure analysis. Programming of the security fuse restricts our ability to locate the source of the failure within the device.
*   If a flash FPGA is submitted for functional failure analysis, the customer must provide the security key if the device is secured. Without the security key, there will be no way to locate the source of the failure within the device.
*   The SoC Products Group cannot perform failure analysis on flash FPGA devices that are permanently locked. It restricts the ability to locate the source of the failure within the device.
*   Microsemi's policy in accepting products for failure analysis is conditional upon the acceptance of the physical condition of the returned part. No returns shall be accepted if any evidence of tampering or removing sections or layers of the part is evident. Microsemi will not accept a part for failure

analysis if the customer has already started his own failure analysis efforts and has changed the physical dimensions or characteristics of the initial device or product.

- All information relating to the failure analysis testing or results of such analysis is considered proprietary and confidential information and must not be disclosed to other parties without Microsemi's written consent to such disclosure.

Improper programming setup is a potential cause of functional failures. Therefore, the following rules apply.

- The customer must use the latest version of the programming software available at the time of programming. The latest version is available at, *https://www.microsemi.com/products/fpga-soc/design-resources/programming-debug-tools*.If Microsemi discovers that the functional failures were caused by the use of an earlier version of programming software, the customer will be liable for all failures.
- The customer is responsible for using the latest revision of the adapter modules available at the time of programming. The latest revision is available at the SoC Products Group's website under "Adapter Modules", at *http://www.microsemi.com/soc/products/hardware/program_debug/ss/modules.aspx.* If Microsemi discovers that the failures were caused by the use of an earlier revision of an adapter module, the customer will be liable for all failures.
- The customer must ensure that all programming hardware is in good, working condition. This requires regular execution of the hardware self-diagnostic test, and maintaining valid calibration of the programming hardware. The self-diagnostic test must be performed before every programming session. As a minimum, the test must be executed every week. Hardware calibration should be performed every 12 months. Information on running the self-diagnostic tests and calibration is available at, *Silicon Sculptor Verification of Calibration Guide*. Microsemi may reject an RMA if the hardware is found to be poorly maintained, and is the cause of the failures.
- The SoC Products Group only tests the programming of Microsemi devices on the FlashPro, Silicon Sculptor, and BP Microsystem programmers. Each release of the Silicon Sculptor and FlashPro, FlashPro Lite, and FlashPro3/3x/4 software go through a rigorous testing procedure to ensure the best programming yield possible. This test procedure includes programming of devices and functional testing of these devices. Activator and FlashPro programmers (not including FlashPro Lite and FlashPro3/3x/4) are discontinued. Software updates are no longer offered for these programmers, however software support for the FlashPro programmer will continue.
- The SoC Products Group does not test programming solutions from any other vendors, and cannot guarantee programming yield. Programming failure RMAs are accepted up to the allowed fallout, but Microsemi reserves the right to reject any RMA requests if the fallout is excessive. Microsemi will not perform failure analysis on devices programmed by hardware from other vendors.

3   RadHard and RadTolerant Products

3.1   Background

Microsemi's RadHard (RH), RadTolerant (RT), and RT ProASIC3 FPGAs require special considerations due to the reliability and high cost associated with each unit. All of the policies and procedures of handling commercial, industrial, and military FPGA device failures apply to RH, RT, and RT ProASIC3 FPGAs with the following exceptions. For more information about programming RH and RT devices, see *RadHard/RadTolerant Programming Guide.*

Microsemi accepts 0.5% fallout for RT ProASIC3 devices, regardless of the sample size or volume. The following guidelines are the expected programming fallout for other RT/RH devices per programming session for the volumes shown. If programming failures, higher than the values provided in the following tables, occur, or two successive failures occur in a row, stop programming and contact Microsemi SoC Technical Support immediately at *http://soc.microsemi.com/mycases*.

Table 5 •   **RH/RT Flight Unit and PROTO (except RTAX-S/SL) Maximum Allowed Programming Failures**

Sample Size	Maximum Number of Programming Failures Allowed
<10	2
10-18	3
19-30	4
30-50	5
> 50	5%

Table 6 •   **RTAX250S/SL Flight Unit and PROTO Maximum Allowed Programming Failures**

Sample Size	Maximum Number of Programming Failures Allowed
<10	2
10-18	3
19-30	4
30-50	5
> 50	5%

Table 7 •   **RTAX1000S/SL, RTAX2000S/SL/DSP and RTAX4000S/SL/DSP Flight Unit and Proto Maximum Allowed Programming Failures**

Sample Size	Maximum Number of Programming Failures Allowed
<10	3
10-18	5
19-30	6
30-50	7
>50	10%

Note: Programming yield must normally be over 95%. These sample sizes allow a larger percentage due to statistical fluctuations attributable to the small quantities. Since these devices are costly, contact SoC Products Group Technical Support at *http://soc.microsemi.com/mycases,* if you encounter any programming failures. Also submit the programming failure checklist and error log to start the investigation. SoC Products Group Technical Support will contact you to get relevant information and then advise you on the next step.

3.2 Activator 2 and Activator 2S Device Support

These programmers are discontinued (PDN 0201, 2/1/2002). Customers must upgrade to Silicon Sculptor 3. Programming failures from Activator programmers will not be accepted for RMA.

3.3 Silicon Sculptor 3 Device Support

The Silicon Sculptor 3 programming platforms have been designed to program the following devices:

RTG4, RT1020, RH1020, RT1280A, RH1280, RT1425A, RT1460A, RT14100A, RT54SX32S, RTSX32SU, RTSX72SU, RTAX250S/SL, RTAX1000S/SL, RTAX2000S/SL/DSP, and RTAX4000S/SL/DSP.Other Programmers

All RT/RH customers must verify the calibration of the programmers whenever a programming failure is experienced, in addition to the annual calibration verification. The verification of the calibration requires a special adapter module (part number SM48DB). Customers must buy this adapter module during the purchase of any Microsemi or BP programmers. For information about the calibration verification procedure see, *Silicon Sculptor Verification of Calibration Guide.*Other guidelines are as follows:

- Run calibration verification test on the programmer, before programming every RTAXS job. For more details, see, *AC378: RTAX-S/SL/DSP Programming Guide App Note*
- Use a filtered, genuine sine-wave, uninterruptible power supply (UPS) with sufficient battery backup to allow for the entire programming time plus a safety margin of 20% (about 5 hours).
- Keep an extra programmer and adapter module as a back-up.
- Run self-test with the adapter module inserted on the programmer before programming every device.

No other programmers may be used to program RT or RH FPGA devices.

Note: Since RH/RT devices are expensive, a few additional measures must be taken in order to maximize the programming yield

3.4 RMA Procedures

The following actions must be performed for programming failures:

1. **For all programming failures on RH/RT devices, an FA is mandatory before any replacements are issued.** Only a maximum of three units is necessary to do a failure analysis. Request an RMA number through SoC Products Group's sales representatives, distributors, or customer service. RMAs for RH/RT devices will be processed as credit/replace only.

Note: The preceding step is not followed in case of common programming failures, that are determined by the Microsemi tech support team. Programming failures related to RH1020B and RH1280B sold by BAE are handled by BAE and not by Microsemi.

2. **Customers are advised to contact SoC Products Group Technical Support** at *http://soc.microsemi.com/mycases* to get a case number before requesting any programming or functional failure analysis request.
3. RMAs will only be authorized for current Microsemi devices. Devices that are discontinued will not be allowed for RMA.
4. All devices returned for failure analysis and returns must be in their original packaging and must have an RMA number.
5. If the devices were programmed using programmers not certified by the SoC Products Group or discontinued programmers, Microsemi reserves the right to reject the failure analysis and/or RMA request.
6. Programming Files (*.afm or [*.def and *.fus]) and *.avi files (*.txt on Sculptor) are required. Any parts returned to Microsemi for failure analysis without a valid RMA number and programming files or *.avi files will be returned immediately to the customer at the customer's expense.

3.5 RMA Policies - Replacement Units

1. SoC Products Group does not guarantee the availability of units from the same wafer lot and/or date code as originally purchased. Customers with Single Wafer Lot and/or Single Lot Date Code requirements, or any other "add-on" special testing or service requirements, are advised to order additional units at the time of order placement to account for normal programming fallout.
2. As per SoC Products Group standard warranty, "SELLER shall repair or replace any such defective goods and return the repaired or replacement goods to CUSTOMER". If any "add-on" special testing requirements or services were ordered, SoC Products Group is responsible to replace the standard parts only. For example (but not limited to), if a customer ordered add-on testing such as DPA or Lot Group B.5, SoC Products Group does not guarantee replacement of units which have had this testing; in addition, the replacement of units under an RMA does not include replacement of Data Packages, a Data Package must have been ordered.
3. "Credit only" requests for RMAs are not accepted.

3.6 Programming Failure Policies

All of the policies described for commercial and standard military products apply with the following exceptions.

- Customers must successfully program a commercial equivalent device before programming RT devices every time there is a hardware change. This will help to ensure that the hardware is in good working condition before programming the RH/RT devices. The following table lists the compatible devices.
- A failure analysis report may be requested by the customer.

All of the policies described for flash products apply for RT ProASIC3 devices. The following table lists the RH/RT commercial equivalent devices.

Table 8 •   **Commercial Equivalent Devices**

RadHard/RadTolerant Device	Commercial Equivalent Device
RT1280A-CQ172B	A1280A-CQ172C
RTSX32SU-CQ84B	A54SX32A-CQ84
RTSX32SU-CQ84E	A54SX32A-CQ84
RTSX32SU-CQ84EV	A54SX32A-CQ84
RTSX32SU-CQ208B	A54SX32A-CQ208
RTSX32SU-CQ208E	A54SX32A-CQ208
RTSX32SU-CQ208EV	A54SX32A-CQ208
RTSX32SU-CQ256B	A54SX32A-CQ256
RTSX32SU-CQ256E	A54SX32A-CQ256
RTSX32SU-CQ256EV	A54SX32A-CQ256
RTSX32SU-CC256M	A54SX32A-FG256
RTSX32SU-CC256B	A54SX32A-FG256
RTSX32SU-CC256E	A54SX32A-FG256
RTSX32SU-CC256EV	A54SX32A-FG256
RTSX72SU-CQ208B	A54SX72A-CQ208
RTSX72SU-CQ208E	A54SX72A-CQ208
RTSX72SU-CQ208EV	A54SX72A-CQ208
RTSX72SU-CQ256B	A54SX72A-CQ256
RTSX72SU-CQ256E	A54SX72A-CQ256
RTSX72SU-CQ256EV	A54SX72A-CQ256
RTAX250S-CQ208B / RTAX250SL-CQ208B	AX250-CQ208M
RTAX250S-CQ208E / RTAX250SL-CQ208E	AX250-CQ208M
RTAX250S-CQ208V / RTAX250SL-CQ208V	AX250-CQ208M
RTAX250S-CQ352B / RTAX250SL-CQ352B	AX250-CQ352M
RTAX250S-CQ352E / RTAX250SL-CQ352E	AX250-CQ352M
RTAX250S-CQ352V / RTAX250SL-CQ352V	AX250-CQ352M
RTAX250S-CG624B / RTAX250SL-CG624B	AX250-CG624M
RTAX250S-CG624E / RTAX250SL-CG624E	AX250-CG624M
RTAX250S-CG624V / RTAX250SL-CG624V	AX250-CG624M

Table 8 • Commercial Equivalent Devices *(continued)*

RadHard/RadTolerant Device	Commercial Equivalent Device
RTAX1000S-CQ352B / RTAX1000SL-CQ352B	AX1000-CQ352M
RTAX1000S-CQ352E / RTAX1000SL-CQ352E	AX1000-CQ352M
RTAX1000S-CQ352V / RTAX1000SL-CQ352V	AX1000-CQ352M
RTAX1000S-CGB624B / RTAX1000SL-CGB624B	AX1000-CGB624M
RTAX1000S-CGB624E / RTAX1000SL-CGB624E	AX1000-CGB624M
RTAX1000S-CGB624V / RTAX1000SL-CGB624V	AX1000-CGB624M
RTAX1000S-CGS624B / RTAX1000SL-CGS624B	AX1000-CGS624M
RTAX1000S-CGS624E / RTAX1000SL-CGS624E	AX1000-CGS624M
RTAX1000S-CGS624V / RTAX1000SL-CGS624V	AX1000-CGS624M
RTAX1000S-LG624B / RTAX1000SL-LG624B	AX1000-LG624M
RTAX1000S-LG624E / RTAX1000SL-LG624E	AX1000-LG624M
RTAX1000S-LG624V / RTAX1000SL-LG624V	AX1000-LG624M
RTAX2000S-CQ256B / RTAX2000SL-CQ256B	AX2000-CQ256M
RTAX2000S-CQ256E / RTAX2000SL-CQ256E	AX2000-CQ256M
RTAX2000S-CQ256V / RTAX2000SL-CQ256V	AX2000-CQ256M
RTAX2000S-CQ352B / RTAX2000SL-CQ352B	AX2000-CQ352M
RTAX2000S-CQ352E / RTAX2000SL-CQ352E	AX2000-CQ352M
RTAX2000S-CQ352V / RTAX2000SL-CQ352V	AX2000-CQ352M
RTAX2000D-CQ352B	RTAX2000D-CQ352PROTO
RTAX2000D-CQ352E	RTAX2000D-CQ352PROTO
RTAX2000D-CQ352V	RTAX2000D-CQ352PROTO
RTAX2000S-CGB624B / RTAX2000SL-CGB624B	AX2000-CGB624M
RTAX2000S-CGB624E / RTAX2000SL-CGB624E	AX2000-CGB624M

Table 8 • **Commercial Equivalent Devices** *(continued)*

RadHard/RadTolerant Device	Commercial Equivalent Device
RTAX2000S-CGB624V / RTAX2000SL-CGB624V	AX2000-CGB624M
RTAX2000S-CGS624B / RTAX2000SL-CGS624B	AX2000-CGS624M
RTAX2000S-CGS624E / RTAX2000SL-CGS624E	AX2000-CGS624M
RTAX2000S-CGS624V / RTAX2000SL-CGS624V	AX2000-CGS624M
RTAX2000S-LG624B / RTAX2000SL-LG624B	AX2000-LG624M
RTAX2000S-LG624E / RTAX2000SL-LG624E	AX2000-LG624M
RTAX2000S-LG624V / RTAX2000SL-LG624V	AX2000-LG624M
RTAX2000S-CG1152B / RTAX2000SL-CG1152B	AX2000-FG1152M
RTAX2000S-CG1152E / RTAX2000SL-CG1152E	AX2000-FG1152M
RTAX2000S-CG1152V / RTAX2000SL-CG1152V	AX2000-FG1152M
RTAX2000S-LG1152B / RTAX2000SL-LG1152B	AX2000-FG1152M
RTAX2000S-LG1152E / RTAX2000SL-LG1152E	AX2000-FG1152M
RTAX2000S-LG1152V / RTAX2000SL-LG1152V	AX2000-FG1152M
RTAX2000D-CGD1272B	RTAX2000D-CGD1272PROTO
RTAX2000D-CGD1272E	RTAX2000D-CGD1272PROTO
RTAX2000D-CGD1272V	RTAX2000D-CGD1272PROTO
RTAX4000S-CG1272B / RTAX4000SL-CG1272B	RTAX4000S-CG1272PROTO
RTAX4000S-CG1272E / RTAX4000SL-CG1272E	RTAX4000S-CG1272PROTO
RTAX4000S-CG1272V / RTAX4000SL-CG1272V	RTAX4000S-CG1272PROTO
RTAX4000D-CGD1272B	RTAX4000D-CGD1272PROTO
RTAX4000D-CGD1272E	RTAX4000D-CGD1272PROTO
RTAX4000D-CGD1272V	RTAX4000D-CGD1272PROTO
RTAX4000S-CQ352B / RTAX4000SL-CQ352B	RTAX4000S-CQ352PROTO
RTAX4000S-CQ352E / RTAX4000SL-CQ352E	RTAX4000S-CQ352PROTO

Table 8 • **Commercial Equivalent Devices** *(continued)*

RadHard/RadTolerant Device	Commercial Equivalent Device
RTAX4000S-CQ352V / RTAX4000SL-CQ352V	RTAX4000S-CQ352PROTO
RTAX4000D-CQ352B	RTAX4000D-CQ352PROTO
RTAX4000D-CQ352E	RTAX4000D-CQ352PROTO
RTAX4000D-CQ352V	RTAX4000D-CQ352PROTO

3.7 Functional Failure Policies

The following are the Microsemi's policies on supporting functional failures.

• The customer is responsible for providing all the design files required to perform the failure analysis. This includes, but is not limited to source files (schematic or HDL), Designer database file (*.adb), board schematics, test vectors and testbench, programming files, and timing analysis results. Additional files may be requested by SoC Products Group Technical Support. If any of these files are missing, it may hinder or impede the ability to perform a failure analysis.
• The customer is responsible for providing an adequate description of the failure mode. This includes Silicon Explorer probing results (if available), an explanation of the failure mechanisms along with logic analyzer/scope plots of the failure mode, test methods used, device and board configuration, and any additional information requested by Technical Support. If any of this information is missing, it may hinder or impede our ability to perform a failure analysis.
• If the security fuse is programmed (antifuse FPGAs), then the SoC Products Group will not be able to perform failure analysis. Programming of the security fuse restricts the ability to locate the source of the failure within the device.
• Microsemi's policy in accepting products for failure analysis is conditional to the acceptance of the physical condition of the returned part. No returns shall be accepted if any evidence of tampering or removing sections or layers of the part is evident. Microsemi will not accept a part for failure analysis if the customer has already started his own failure analysis efforts and has changed the physical dimensions or characteristics of the initial device or product.
• All information relating to the failure analysis testing or results of such analysis is considered proprietary and confidential information and must not be disclosed to other parties without Microsemi's written consent to such disclosure.

Improper programming setup is a potential cause of functional failures. Therefore, the following rules apply.

• The customer must use the latest version of the programming software available at the time of programming. The latest version is available on the SoC Products Group's website under "Software Updates" (*www.microsemi.com/soc/custsup/updates/index.html*). If Microsemi discovers that the functional failures were caused by the use of an earlier version of programming software, the customer will be liable for all failures.
• The customer must use the latest version of the adapter modules available at the time of programming. The latest version can be found on the SoC Products Group's website under "Adapter Modules" (*www.microsemi.com/soc/products/hardware/program_debug/ss/modules.aspx*). If Microsemi discovers that the failures were caused by the use of an old version of an adapter module, the customer will be liable for all failures.
• The customer must ensure that all programming hardware is in good, working condition. This requires regular execution of the hardware self-diagnostic test, and maintaining valid calibration of the programming hardware. The self-diagnostic test must be performed before every programming session. The test must be executed every week and the hardware calibration must be performed every 12 months. Information on running the self-diagnostic tests and calibration is available at *Silicon Sculptor Verification of Calibration Guide*. Microsemi may reject an RMA if the hardware is found to be poorly maintained, and is the cause of the failures.
• The SoC Products Group only tests the programming of Microsemi devices on the FlashPro and Silicon Sculptor 3. Each release of the Silicon Sculptor and FlashPro, FlashPro Lite, and FlashPro3 software go through a rigorous testing procedure to ensure the best programming yield possible.

This test procedure includes programming of devices and functional testing of these devices. Activator and FlashPro programmers (not including FlashPro Lite and FlashPro3/3x) are discontinued. Software updates are no longer offered for these programmers, however software support for the FlashPro programmer will continue.

*   Microsemi does not test programming solutions from any other vendor, and cannot guarantee programming yield. Microsemi accepts programming failure RMAs up to the allowed fallout, but reserves the right to reject any RMA requests if the fallout is excessive. Microsemi will not perform failure analysis on devices programmed by hardware from other vendors.