Programming Antifuse Devices

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Introduction

This document provides an overview of the various programming options available for the Microsemi® SoC Products Group antifuse families. In addition, it provides helpful information relating to programming failures, including measures you can take to increase programming yield and actions that you should take in the event of programming failures. A summary of SoC Products Group Return Material Authorization (RMA) policies and procedures is also included. The electronic version of this document includes active links to all programming resources, which are available at *www.microsemi.com/soc/products/hardware/default.aspx*. This document describes only the recommended programming practices for antifuse devices. For SoC Products Group flash devices, refer to the "Programming Flash Devices" chapter of the appropriate FPGA fabric user's guide.

General Antifuse Programming Information

Programming Features for SoC Products Group Devices

SoC Products Group provides two types of FPGAs: antifuse and flash. Some programming methods are common to both and some are exclusive to flash. This document describes only the programming solutions supported for antifuse devices.

Antifuse Technology

The antifuse architecture is OTP by design. Antifuse devices are not in-system programmable. For details on the antifuse architectures, refer to *www.microsemi.com/soc/products/devices.aspx*.

Antifuse technology is nonvolatile, so it is live at power-up and inherently very secure. Security types and implementation are discussed in the *Implementation of Security in Microsemi Antifuse FPGAs* application note.

Antifuse devices are mainly programmed using single-site or multi-site programmers. Volume-programming services, either from SoC Products Group or from other vendors, are also used.

Types of Programming for Antifuse Devices

Depending on the number of devices you wish to program and the type of device, you can choose from the following programming methods.

- Device programmers
  - Single-site programmers
  - Multi-site programmers, batch programmers or gang programmers
- Volume programming services
  - SoC Products Group in-house programming (IHP)
  - Programming centers

Device Programmers

Device programmers are used to program a device before it is mounted on the system board. It can either be programmed before being soldered (usually done in production), or programmed before putting it into a socket (used for prototyping).

The advantage of using device programmers is that no programming hardware is required on your system board. Therefore, no additional components or board space are required.

If you intend to program devices frequently with different programs, or if you program relatively small volumes of devices, buying a single-site device programmer is the simplest solution. For some military or space designs, you may also want to use programming onsite to maintain control of the devices at all times.

Adapter modules are purchased with the programmers to support the FPGA packages you intend to use. When you receive the FPGA, place it in the adapter module and run the programming software from a PC. SoC Products Group supplies the programming software for all the SoC Products Group programmers. The software enables you to select your device, programming files, program, and verify the device.

- Single-Site Programmers

  A single-site programmer programs one device at a time. SoC Products Group offers Silicon Sculptor II and Silicon Sculptor 3 as single-site programmers.

  - Advantages: Lower cost than multi-site programmers. No additional overhead for programming on the system board. Allows local control of programming and data files for maximum security. Allows on-demand programming onsite.
  - Limitations: Only programs one device at a time.

- Multi-Site Programmers

  Often referred to as batch or gang programmers, multi-site programmers can program multiple devices at the same time using the same programming file. This is often used for large volume programming and by programming houses. The sites often have independent processors and memory enabling the sites to operate concurrently, meaning each site may start programming the same file independently enabling the operator to change one device while the other sites continue programming, which increases throughput. You need to buy multiple adapter modules for the same package when using a multi-site programmer. Silicon Sculptor II and 3 programmers can be cascaded to program multiple devices in a chain. Multi-site programmers can also be purchased from BP Microsystems.

  - Advantages: Provides the capability of programming multiple devices at the same time. No additional overhead for programming on the system board. Allows local control of programming and data files for maximum security.
  - Limitations: More expensive than a single-site programmer.

Volume Programming Services

When you are ready to run your design in production, you can buy large volumes of parts and have them programmed before you receive them.

– Advantages: This is much easier than having a large programming capability in-house, since programming centers will have multiple programmers running in parallel and can deliver programmed parts more cost effectively.

– Limitations: Programming files must be sent to the programming service provider. Nondisclosure Agreements (NDAs) can be signed to help ensure that your data will be protected. Any programs that will not allow files to be sent off-site will not be able to use this approach.

• SoC Products Group In-House Programming (IHP)

When you purchase your SoC Products Group devices in volume, you can request IHP as part of your purchase. If you choose this option, there is a small charge for each device you want programmed. Each device is marked with a special mark to distinguish it from blank parts. When you have your programming files ready, send them to SoC Products Group.
You will receive sample parts that were programmed with your design. Once you approve the First Articles, SoC Products Group will proceed with programming the remainder of the order. To request SoC Products Group IHP, contact your local SoC Products Group representative.

• Distributor Programming Centers

Many distributors provide programming for their customers. This can be an advantage when looking at yield and RMA requirements for antifuse devices. Consult with your preferred distributor about this option.

• Independent Programming Centers

There are many programming centers that specialize only in programming and are not directly affiliated with SoC Products Group or our distributors. These programming centers must follow the guidelines for programming SoC Products Group devices and be using certified programmers to program the SoC Products Group devices. SoC Products Group does not have recommendations for external programming centers. Refer to Table 1 on page 3 for more information regarding programming services.

Table 1 • **Volume Programming Services**

Programmer	Vendor	Availability
In-House Programming	SoC Products Group	Contact SoC Products Group Sales
Distributor Programming Centers	Memec Unique	Contact Distribution
Independent Programming Centers	Various	Contact Vendor

Programming Solutions

Details for the available programmers can be found in the programmer user's guides listed in the "Related Documents" section on page 13.

All of the antifuse programmers require adapter modules, which are designed to support device packages. The modules are all listed on the SoC Products Group website:
www.microsemi.com/soc/products/hardware/program_debug/ss/modules.aspx

They are not listed in this application note, since this list is updated frequently with new package options and any upgrades required to improve programming yield or support new families.

Table 2 • **Programming Solutions**

Programmer	Vendor	Single Device	Multi Device	Availability
SIlicon Sculptor 3[1]	SoC Products Group	Yes	Cascade option (up to 12)	Available
Silicon Sculptor II	SoC Products Group	Yes	Cascade option (up to two)	Available
Silicon Sculptor	SoC Products Group	Yes	Cascade option (up to four)	Discontinued
Sculptor 6X	SoC Products Group	Yes	Yes	Discontinued
Activator	SoC Products Group	Yes	Activator 2 only	Discontinued
BP Micro Programmers[2]	BP Microsystems	Yes	Yes	Contact BP Microsystems at www.bpmicro.com

Notes:

1. *Refer to the* Silicon Sculptor II and Silicon Sculptor 3 User's Guide *for details on cascading (discussed in the Multi-Site Programming Introduction section).*
2. *Refer to the* "Certified Programming Solutions" section on page 7 *for more information.*

Programmer Ordering Codes

The products shown below can be ordered through SoC Products Group sales and are shipped directly from SoC Products Group direct. Products can also be ordered from SoC Products Group distributors but are shipped directly from SoC Products Group. Table 3 includes ordering codes for the full kit, as well as codes for replacement items and any related hardware. Some additional products can be purchased from external suppliers for use with the programmers. Ordering codes for adapter modules used with Silicon Sculptor are available on the SoC Products Group website at *www.microsemi.com/soc/products/hardware/program_debug/ss/modules.aspx.*

Table 3 • **Programmer Ordering Codes**

Description	Vendor	Ordering Code	Availability
Silicon Sculptor 3	SoC Products Group	SILICON-SCULPTOR 3	Requires add-on adapter modules to support devices
Silicon Sculptor II	SoC Products Group	SILICON-SCULPTOR II	Requires add-on adapter modules to support devices
Concurrent Programming Cable	SoC Products Group	SS-EXPANDER	Used to cascade Silicon Sculptor programmers together
Software for Silicon Sculptor	SoC Products Group	SCULPTOR-SOFTWARE-CD	*www.microsemi.com/soc/custsup/updates/silisculpt/*
Vacuum Pen for PQ, TQ, VQ fewer than 208 pins	SoC Products Group	PENVAC	
Vacuum Pen for PQ, TQ, VQ greater/equal to 208 pins	SoC Products Group	PENVAC-HD	Heavy-duty, provides stronger vacuum

Programmer Device Support

The devices described below are categorized as follows: General Purpose, RadHard (RH)/RTolerant (RT), and Legacy. To see the complete list of device support in latest programming software, please refer to the SoC Products Group website:

www.microsemi.com/soc/download/program_debug/ss/device_list.aspx.

General Purpose SoC Products Group Devices

Refer to Table 4 to determine which General Purpose devices have programmer device support. To learn more about the different SoC Products Group families, refer to the SoC Products Group website: www.microsemi.com/soc/products/devices.aspx.

Table 4 • **Programmer Device Support**

SOC Products Group Family	Device	Silicon Sculptor 3	Silicon Sculptor II	Silicon Sculptor I*	Silicon Sculptor 6X*	Activator*
Axcelerator	AX125 AX250 AX500 AX1000 AX2000	Yes	Yes	No	No	No
SX-A	A54SX08AA54SX16A A54SX32A A54SX72A	Yes	Yes	Yes	Yes	No
eX	eX64 eX128 eX256	Yes	Yes	Yes	Yes	No
SX	A54SX08 A54SX16 A54SX16P A54SX32	Yes	Yes	Yes	Yes	Yes
42MX	A42MX16 A42MX24 A42MX36	Yes	Yes	Yes	Yes	Yes
40MX	A40MX02 A40MX04 A40MX09	Yes	Yes	Yes	Yes	Yes

Note: *Refer to the "Certified Programming Solutions" section on page 7 for more information on programmer support.*

RadHard and RadTolerant Devices

Since RH and RT devices are one-time programmable and expensive, it is important to verify the correct functioning of your programming equipment prior to programming. Refer to the *RadHard/RadTolerant Programming Guide* for instructions on correct calibration and programming procedures. Table 5 on page 6 indicates which RH and RT devices have programmer support.

Table 5 • **Programmer Support for RH and RT Devices**

SoC Products Group Device	Silicon Sculptor 3	Silicon Sculptor II	Silicon Sculptor I[1]	Sculptor 6X[1]	Activator[1]
RH1020	Yes	Yes	Yes	Yes	Yes
RH1280	Yes	Yes	Yes	Yes	Yes
RT1020	Yes	Yes	Yes	Yes	Yes
RT1280	Yes	Yes	Yes	Yes	Yes
RT1425	Yes	Yes	Yes	Yes	Yes
RT1460	Yes	Yes	Yes	Yes	Yes
RT14100	Yes	Yes	Yes	Yes	Yes
RT54SX16 (discontinued)	No	No	No	No	Yes
RT54SX32 (discontinued)	No	No	No	No	Yes
RT54SX32S / RT54SX32SU[2]	Yes	Yes	No	No	No
RT54SX72S / RT54SX72SU[2]	Yes	Yes	No	No	No
RTAX250S[3]	Yes	Yes	No	No	No
RTAX1000S[3]	Yes	Yes	No	No	No
RTAX2000S[3]	Yes	Yes	No	No	No
RTAX4000S[3]	Yes	Yes	No	No	No

Notes:

1. *Refer to the "Certified Programming Solutions" section on page 7 for more information on programmer support.*
2. *Refer to the Recommendations for Programming RTSX-S and RTSX-SU technical brief for more information.*
3. *For RTAX-S devices, check the SoC Products Group website for future documents that provide programming guidelines.*

Legacy SoC Products Group Devices

SoC Products Group legacy devices are listed in Table 6.

Table 6 • **Programmer Support for Legacy SoC Products Group Devices**

SoC Products Group Family	Device	Silicon Sculptor 3	Silicon Sculptor II	Silicon Sculptor I*	Silicon Sculptor 6X*	Activator*
ACT1	A1010 A1020 A1010A A1020A A1010B A1020B	Yes	Yes	Yes	Yes	Yes
ACT2	A1225 A1240 A1280 A1225A A1240A A1280A	Yes	Yes	Yes	Yes	Yes
ACT3	A1415A A1425A A1440A A1460A A14100A	Yes	Yes	Yes	Yes	Yes
1200XL	A1225XL A1240XL A1280XL	Yes	Yes	Yes	Yes	Yes
3200DX	A3265DX A32100DX A32140DX A32200DX A32300DX	Yes	Yes	Yes	Yes	Yes

Note: *Refer to the "Certified Programming Solutions" section for more information on programmer support.

Certified Programming Solutions

Following are the certified programmers for antifuse devices. All other programmers are considered noncertified programmers.

- **Silicon Sculptor 3**

  Silicon Sculptor 3 is an easy-to-use FPGA programming tool that delivers high data throughput while lowering the overall cost of ownership. Silicon Sculptor 3 includes a high-speed USB 2.0 interface that allows a customer to connect as many as 12 programmers to a single PC. Furthermore, Silicon Sculptor 3 is compatible with adapter modules from Silicon Sculptor II, thereby preserving a customer's investment and enabling a seamless upgrade to this latest generation of the tool.

- **Silicon Sculptor II**

  Silicon Sculptor II is a robust, compact, single-device programmer with standalone software for the PC. It is designed to enable concurrent programming of multiple units from the same PC with speeds equivalent to or faster than previous SoC Products Group programmers. It replaces Silicon Sculptor I as the SoC Products Group programmer of choice.

- **Silicon Sculptor I and Silicon Sculptor 6X**

    SoC Products Group no longer sells Silicon Sculptor I and Silicon Sculptor 6X; both items have been discontinued. SoC Products Group has also discontinued the software support for these programmers, starting with v4.70. SoC Products Group recommends all customers upgrade to a Silicon Sculptor 3 or a BP multi-site programmer. SoC Products Group normally rejects any RMA requests for devices programmed by these discontinued programmers. In addition, SoC Products Group will not perform any engineering analysis of programming failures.

- **Supported BP Programmers**

    BPM Microsystems programmers that are equivalent to Silicon Sculptor II and 3 (BP1610 and BP1710) are fully supported. Multi-site BP programmers BP2610 and BP2710 also support SoC Products Group devices. BP auto-programmers BP4710, BP4610, BP3710 MK2, and BP3610 support SoC Products Group devices. However, SoC Products Group adapter modules must be used to program SoC Products Group devices. Where an auto-programmer is used, the appropriate open-top adapter module from BPM Microsystems must be used. Auto-programmers are not to be used for programming RT devices such as RTSX-SU and RTAX-S.

- **Activator**

    Activator has been discontinued, and SoC Products Group no longer provides software updates. SoC Products Group recommends that all customers upgrade to Silicon Sculptor 3. SoC Products Group normally rejects any RMA requests for devices programmed by Activator. In addition, SoC Products Group will not perform any engineering analysis of programming failures.

- **Noncertified Programmers**

    SoC Products Group does not test programming solutions from other vendors, and cannot guarantee programming yields on noncertified programmers. SoC Products Group normally rejects any RMA requests for devices programmed on hardware from other vendors. In addition, SoC Products Group will not perform any failure analysis on devices programmed by hardware from other vendors.

- **Programming Centers**

Our programming hardware policy also applies to programming centers. SoC Products Group expects all programming centers to use certified programmers to program SoC Products Group devices. If a programming center uses noncertified programmers to program SoC Products Group devices, then the "Noncertified Programmers" policy will apply.

Antifuse Programming Guidelines

Preprogramming Setup

Before programming, several steps are required to ensure an optimal programming yield.

Use Proper Handling and Electrostatic Discharge (ESD) Precautions

SoC Products Group FPGAs are sensitive electronic devices that are susceptible to damage from ESD and other types of mishandling. For more information about ESD, refer to the *Microsemi Quality and Reliability Guide* beginning on page 41.

Use the Latest Version of the Designer Software to Generate Your Programming File (Recommended)

The files used to program SoC Products Group antifuse devices (*.afm, *.fus) contain important information about the fuses that will be programmed in the FPGA. Find the latest version and corresponding release notes at *www.microsemi.com/soc/custsup/updates/designer/index.html*. Also, programming files must always be zipped during file transfer to avoid the possibility of file corruption.

Use the Latest Version of the Silicon Sculptor Software

The programming software is frequently updated to accommodate yield enhancements in FPGA manufacturing. These updates ensure maximum programming yield and minimum programming times. Before programming, always check that the version of the Silicon Sculptor software you are using is the most recent by visiting *www.microsemi.com/soc/custsup/updates/silisculpt/*.

Use the Most Recent Adapter Module

Occasionally, SoC Products Group makes modifications to their modules to improve programming yields and programming times. To identify the latest version of each module before programming, visit *www.microsemi.com/soc/products/hardware/program_debug/ss/modules.aspx*.

Check Insertion Limit of the Adapter Module

Before programming with any adapter module, make sure the insertion limit is within the range specified on the SoC Products Group website:
www.microsemi.com/soc/products/hardware/program_debug/ss/modules.aspx.

The number of socket module insertion can be found by selecting **Info** > **SocketModCount** in the DOS version and if you are using Microsoft® Windows® select **Socket Module Counter** in the **Tools** menu.

Perform Routine Hardware Self-Diagnostic Test

The self-diagnostic test verifies correct operation of the pin drivers, power supply, CPU, memory, and adapter module. This test should be performed before every programming session. At minimum, the test must be executed every week. To perform self-diagnostic testing using the Silicon Sculptor software, perform the following steps depending on the operating system:

- DOS: From anywhere in the software, type **ALT-D**.
- Windows: Click **Device** > select **SoC Products Group Diagnostic** > select the **Test** tab > click **OK**.

Perform Routine Hardware Verification and Calibration

The verification and calibration procedure ensures that the test limits used during the self-diagnostic test are accurate. SoC Products Group recommends periodic verification of the calibration of the programmer, especially when you observe higher than normal programming failures. For RH and RT devices, SoC Products Group requires verification of the calibration of the programmer to be performed prior to each programming session. For verification and calibration instructions, refer to the *Silicon Sculptor Programmer Calibration Verification Procedure*.

If the programmer fails the calibration, contact SoC Products Group Technical Support and send the log file.

Programming Antifuse FPGAs

The following steps are required to program SoC Products Group antifuse FPGAs.

Setup

In the programming software, select the device you want to program and load the Data Pattern with the programming file.

Perform Blankcheck (recommended)

This test confirms that the actual device about to be programmed matches the device selected and is completely blank. This helps to prevent mixing up programming failures with blank devices. SoC Products Group recommends performing this step before each programming session.

Program

During this step, the actual programming file is mapped into the device. Remember to enable programming of the security fuses if necessary. If broadcasting, press **Start** to program each site.

Checksum (recommended)

This step confirms that the FPGA was programmed correctly.

*Save the *.txt file (RH/RT only – required)*

During programming of all RH and some RT FPGAs (excluding RTSX, RTSX-S/RTSX-SU, and RTAX-S), important programming information is automatically stored in a *.txt file located in the programming file directory. Every time a new device is programmed, this file is overwritten. Therefore, it is mandatory to save this file under a different name after the programming of every RH or RT FPGA (SoC Products Group recommends using the device serial number as the file name). Programming failures will not be accepted for return if this file is not available for the corresponding failed device. For more information, refer to the *RadHard/RadTolerant Programming Guide*.

Programming Failure Allowances

Even though it is impossible for SoC Products Group to screen 100% of potential programming failures on antifuse FPGAs, SoC Products Group does screen for low programming yields by programming a sample of devices from every lot that is shipped. The test sample size is chosen so there is a high level of confidence that 97% (most antifuse devices) programming yield criteria is met. As long as all the requirements listed above are satisfied, SoC Products Group will replace 100% of field programming rejects. Please refer to

www.microsemi.com/soc/documents/FA_Policies_Guidelines_5-06-00002.pdf for programming failure allowance tables.

If the programming yield is lower than expected (failure quantity exceeds those listed in the allowance tables), SoC Products Group will perform an investigation to determine if the high failure rate is caused by the system used to program the devices or can be attributed to the devices themselves.

For a complete procedure on handling programming failures, refer to the "Guidelines for Handling Programming Failures" section.

Guidelines for Handling Programming Failures

The following sections provide specific guidelines on handling programming failures with SoC Products Group FPGAs.

Antifuse FPGAs (Non-RadHard/RadTolerant)

1. Debug the Error Message

Any time you encounter a failure:

- Record the error message. It is important that the message is recorded exactly as it appears. The detailed error message can be found in the programming log file generated by the software. The default location for these log files is C:\BP\DATALOG\. The log file for the current programming session will be named as BlackBox.log. Previous programming sessions will be saved to log files named bp<#>.log.

- Compare your error message to those listed in the "Common Programming Failure Modes" section on page 12. Try to resolve the problem based on the given suggestions.

If failures continue, proceed to Step 2.

2. Check the Programming Setup

- Record the version of the software you are using. Then upgrade to the latest version: *www.microsemi.com/soc/custsup/updates/silisculpt.*

- Perform the self-diagnostic test.

- Record the exact part number of the adapter module(s) you are using. Then upgrade to the latest version: *www.microsemi.com/soc/products/hardware/program_debug/ss/modules.aspx.*

Continue programming and proceed to Step 3.

3. Check the Programming Yield

Compare your programming fallout with the appropriate tables listed in *www.microsemi.com/soc/documents/FA_Policies_Guidelines_5-06-00002.pdf*. Continue programming if you are within the guidelines. Contact your distributor or sales office to return devices, and provide failure rates along with your request.

If the failure rate exceeds expected fallout, proceed to Step 4.

4. Record Device Details

Record the following for all failures and programmed devices:

- Date code (four digit number on top of device)
- Lot code (alphanumeric usually on underside of device)
- Number of devices that failed and number that passed programming, from each lot

5. Contact SoC Products Group Technical Support

Complete the Programming FA checklist for antifuse devices and contact SoC Products Group Technical Support. Request a copy of the FA checklist from your distributor, sales representative, or FAE. Make sure to include following information:

- Specific error message obtained
- Software version used
- Adapter module part number
- Date and lot code
- Failure rates for each lot

RadHard and RadTolerant FPGAs

1. Debug the Error Message and Check the Programming Setup

Stop programming immediately.

Due to the high cost of RH/RT devices, it is important to verify that the software and hardware are up-to-date and are in good working condition. It is also important to provide detailed information about the failure to SoC Products Group. Refer to the *RadHard/RadTolerant Programming Guide* for more detailed information about programming RH and RT devices. For RTAX-S devices, check the SoC Products Group website for future documents that provide programming guidelines.

- Record the error message. It is important that the message be recorded exactly as it appears. The detailed error message can be found in the programming log file generated by the software. The default location for these log files is C:\BP\DATALOG\. The log file for the current programming session will be named as BlackBox.log. Previous programming sessions will be saved to log files named bp<#>.log.
- Save the *.txt file under a different name, so it is not overwritten.
- Perform the self-diagnostic test.
- Record the version of the software being used, then upgrade to the latest version: *www.microsemi.com/soc/custsup/updates/silisculpt*.
- Record the exact part number of the adapter module(s) being used, then upgrade to the latest version: *www.microsemi.com/soc/products/hardware/program_debug/ss/modules.aspx*.

If failures continue, proceed to Step 2.

2. Check the Programming Yield

Compare your programming fallout to the appropriate table listed in *www.microsemi.com/soc/documents/FA_Policies_Guidelines_5-06-00002.pdf*. Continue programming if you are within the guidelines. Contact your distributor or sales office to return devices, and provide all of the above information with your request.

If the failure rate exceeds expected fallout, proceed to the next step.

3. Record Device Details

Record the following for all failures and programmed devices:

- Date code (four digit number on top of device)
- Lot code (alphanumeric usually on underside of device)
- Serial number (top of device)
- Number of devices that failed and number that passed programming, from each lot

4. Contact SoC Products Group Technical Support

Complete the Programming FA checklist for antifuse devices and contact SoC Products Group Technical Support. Request a copy of the FA checklist from your distributor, sales representative, or FAE. Make sure to include following information:

- Specific error message obtained
- The *.log file
- Software version used
- Adapter module part number
- Result of self-test with adapter module connected to programmer (provide log file)
- Last calibration date of the programmer
- Date and lot code
- Failure rates for each lot
- Number of devices still needing programming

Common Programming Failure Modes

For a list of common programming failure modes and suggested troubleshooting tips, refer to the *Silicon Sculptor Quick Reference Card*.

Return Material Authorization (RMA) Policies

SoC Products Group consistently strives to exceed customer expectations by continuing to improve the quality of our products and our quality management system. SoC Products Group has RMA procedures in place to address programming fallout. Customers should be mindful of the following RMA policies.

All devices, submitted for an RMA, must be within the SoC Products Group warranty period of one year from date of shipment.

For fallout greater than what is shown in the table listed in *www.microsemi.com/soc/documents/FA_Policies_Guidelines_5-06-00002.pdf* a case must be initiated with SoC Products Group technical support as per Step 5 in the "Antifuse FPGAs (Non-RadHard/RadTolerant)" section on page 10. For fallout within the guidelines shown, return the parts for credit and replacement by requesting an RMA number though an SoC Products Group sales representative or distributor.

RMAs will only be authorized for current SoC Products Group devices. Devices that have been discontinued will not receive RMAs.

If you experience long programming times, contact SoC Products Group technical support for assistance. Note that programming times for –F material may be longer than for other speed grades.

RMAs will only be authorized for current SoC Products Group devices. Devices that have been discontinued will not receive RMAs.

All devices returned for FA and Return should be in their original packaging and must have an RMA number.

Programming files (*.afm or *.def and *.fus) and *.txt files are mandatory. Any parts returned to SoC Products Group for Failure Analysis without a valid RMA number and programming/text files will be returned immediately to the customer at the customer's expense.

If during the FA process, SoC Products Group is able to successfully program the units, these units will be returned to the customer against the replacement order and the units will be labeled as programmed.

Related Documents

Below is a list of related documents, their location on the SoC Products Group website, and a brief summary of each document.

Silicon Sculptor II

www.microsemi.com/soc/products/hardware/program_debug/ss/default.aspx

Includes a description of both Silicon Sculptor I and II.

Silicon Sculptor Quick Reference Card

www.microsemi.com/soc/documents/SiliSculptQuickRef.pdf

This guide was designed as a reference to keep near your programming station and use as a training guide for programming operators.

Silicon Sculptor User's Guides

Microsemi Silicon Sculptor II and Silicon Sculptor 3 User's Guide

www.microsemi.com/soc/documents/SiliSculptII_Sculpt3_ug.pdf

Silicon Sculptor User's Guide (DOS)

www.microsemi.com/soc/documents/sculptor_DOS_ug.pdf

Silicon Sculptor Programmer Calibration Verification Procedure

www.microsemi.com/soc/documents/SiliSculptProgCali_UG.pdf

Includes hardware and software setup, calibration, use instructions, and troubleshooting/error message guide.

Application Notes

Implementation of Security in Microsemi Antifuse FPGAs

www.microsemi.com/soc/documents/Antifuse_Security_AN.pdf

Describes the different types of security available in antifuse devices and also how to implement the security.

Documentation for Discontinued Products

Since many of our customers are still using Silicon Sculptor I or Activator, SoC Products Group has included the following documentation for these products.

Programming Procedure for the 6X Silicon Sculptor in DOS

www.microsemi.com/soc/documents/prgrm6x.pdf

Activator and APS Programming System Installation and User's Guide

www.microsemi.com/soc/documents/Activator_UG.pdf

List of Changes

The following table lists critical changes that were made in each revision of the document.

Revision*	Changes	Page
Revision 5 (November 2011)	The "Certified Programming Solutions" section content was revised. (SAR 28917)	7
Revision 4 (April 2011)	The "Programming Failure Allowances" section content was revised and Table 7, Table 8, and Table 9 have been deleted. (SAR 31565)	10
Revision 2 (April 2009)	The "Supported BP Programmers" section is new.	8
	The "Programming Failure Allowances" section was updated to be consistent with the latest RMA policies. The text and Table 7 on page 9 to Table 9 on page 10.	10 to 10
	The "RadHard and RadTolerant FPGAs" section was revised. Three additional items were added to the list of required information to report to Technical Support in the event of programming failure.	11
	The "Return Material Authorization (RMA) Policies" section was updated to be consistent with the latest RMA policies.	12
Revision 1 (May 2008)	The "Return Material Authorization (RMA) Policies" section was updated to be consistent with the latest RMA policies.	12
Revision 0 (June 2005)	Programming Basics and the following subsections were deleted: Reprogrammable or One-Time Programmable (OTP), Device Programmer or In-System Programming (ISP), Live-at-Power-Up (LAPU) or Boot PROM, Design Security. All information regarding flash was removed since this application note only discusses antifuse. Table 1 was deleted.	N/A
	The "Device Programmers" section was updated to include Silicon Sculptor 3.	2
	Table 2 on page 4 was updated to include Silicon Sculptor 3.	4
	Table 3 on page 4 was updated to include Silicon Sculptor 3.	4
	Table 4 on page 5 was updated to include Silicon Sculptor 3.	5
	Table 5 on page 6 was updated to include the following changes: Silicon Sculptor 3 was added. Silicon Sculptor I support was changed to No for RT54SX16 and RT54SX32. RTAX4000S data is new. Note 3 is new.	6
	The "Silicon Sculptor 3" section is new.	7
	The "Silicon Sculptor I and Silicon Sculptor 6X" section was updated.	8
	The "Activator" section was updated.	8
	The "Noncertified Programmers" section was updated.	8
	The "Check Insertion Limit of the Adapter Module" section is new.	9
	The "Perform Routine Hardware Verification and Calibration" section was updated.	9

Note: *The revision number is located in the part number after the hyphen. The part number is displayed at the bottom of the last page of the document. The digits following the slash indicate the month and year of publication.

Revision*	Changes	Page
	The "Save the *.txt file (RH/RT only – required)" section was updated to include RTAX-S.	10
	Table 10 · Axcelerator Family Programming Failure Allowance was updated to include a footnote concerning RTAX-S programming guidelines.	10
	The "Number of devices that failed and number that passed programming, from each lot" section was updated.	11
	Information about RH and RT device failures was removed from the "Return Material Authorization (RMA) Policies" section.	12
	The "4. Contact SoC Products Group Technical Support" section was updated.	12

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