

Programming Antifuse Devices

Introduction

This document provides an overview of the various programming options available for the Actel 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 Actel 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 <http://www.actel.com/products/hardware/default.aspx>. This document describes only the recommended programming practices for antifuse devices. For Actel flash devices, refer to the *Programming Flash Devices* document.

General Antifuse Programming Information

Programming Features for Actel Devices

Actel 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 <http://www.actel.com/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 Actel Antifuse FPGAs* application note.

Antifuse devices are mainly programmed using single-site or multi-site programmers. Volume-programming services, either from Actel 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
 - Actel 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 on-site 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.

Actel supplies the programming software for all the Actel 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. Actel 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 on-site.
- **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.

- **Actel In-House Programming (IHP)**

When you purchase your Actel 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 Actel. You will receive sample parts that were programmed with your design. Once you approve the First Articles, Actel will proceed with programming the remainder of the order. To request Actel IHP, contact your local Actel 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 only specialize only in programming and are not directly affiliated with Actel or our distributors. These programming centers must follow the guidelines for programming Actel devices and be using certified programmers to program the Actel devices. Actel does not have recommendations for external programming centers. Refer to [Table 1 on page 1-3](#) for more information regarding programming services.

Table 1 • Volume Programming Services

Programmer	Vendor	Availability
In-House Programming	Actel	Contact Actel 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 15.

All of the antifuse programmers require adapter modules, which are designed to support device packages. The modules are all listed on the Actel website at http://www.actel.com/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*	Actel	Yes	Cascade option (up to 12)	Available
Silicon Sculptor II	Actel	Yes	Cascade option (up to two)	Available
Silicon Sculptor	Actel	Yes	Cascade option (up to four)	Discontinued
Sculptor 6X	Actel	Yes	Yes	Discontinued
Activator	Actel	Yes	Activator 2 only	Discontinued
BP Micro Programmers	BP Microsystems	Yes	Yes	Contact BP Microsystems at http://www.bpmicro.com

Note: *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).

Programmer Ordering Codes

The products shown below can be ordered through Actel sales and are shipped directly from Actel direct. Products can also be ordered from Actel distributors but are shipped directly from Actel. 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 Actel website at http://www.actel.com/products/hardware/program_debug/ss/modules.aspx.

Table 3 • Programmer Ordering Codes

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

Programmer Device Support

The devices described below are categorized as follows: General Purpose, RadHard/RadTolerant, and Legacy. To see the complete list of device support in latest programming software please refer to http://actel.com/download/program_debug/ss/device_list.aspx.

General Purpose Actel Devices

Refer to Table 4 to determine which general purpose devices have programmer device support. To learn more about the different Actel families, refer to the Actel website: <http://www.actel.com/products/devices.aspx>.

Table 4 • Programmer Device Support

Actel 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	A54SX08A A54SX16A 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 6 for more information on programmer support.



RadHard and RadTolerant Devices

Since RadHard and RadTolerant 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 indicates which RadHard and RadTolerant devices have programmer support.

Table 5 • Programmer Support for RadHard and RadTolerant Devices

Actel 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 6 for more information on programmer support.
2. Refer to the Actel Recommendations for Programming RTSX-S and RTSX-SU technical brief for more information.
3. For RTAX-S devices, check the Actel website for future documents that provide programming guidelines.

Legacy Actel Devices

Actel legacy devices are listed in [Table 6](#).

Table 6 • Programmer Support for Legacy Actel Devices

Actel 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 on page 6 for more information on programmer support.

Certified Programming Solutions

The Actel certified programmers for antifuse devices are Silicon Sculptor I and II, Activator, and any programmer that is built by BP Microsystems. 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 Actel programmers. It replaces Silicon Sculptor I as the Actel programmer of choice.

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

Actel no longer sells Silicon Sculptor I and Silicon Sculptor 6X; both items have been discontinued. Actel has also discontinued the software support for these programmers, starting with v4.70. Actel recommends all customers upgrade to a Silicon Sculptor 3 or a BP multi-site programmer. Actel will



normally reject any RMA requests for devices programmed by these discontinued programmers. In addition, Actel will not perform any engineering analysis of programming failures.

- **Activator**

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

- **Noncertified Programmers**

Actel does not test programming solutions from other vendors, and CANNOT guarantee programming yields on noncertified programmers. Actel will normally reject any RMA requests for devices programmed on hardware from other vendors. In addition, Actel 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. Actel expects all programming centers to use certified programmers to program Actel devices. If a programming center uses non certified programmers to program Actel 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

Actel 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 [Actel 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 Actel 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 <http://www.actel.com/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 <http://www.actel.com/custsup/updates/silisculpt/>.

Use the Most Recent Adapter Module

Occasionally, Actel makes modifications to their modules to improve programming yields and programming times. To identify the latest version of each module before programming, visit http://www.actel.com/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 Actel website: http://www.actel.com/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 **Actel 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. Actel recommends periodic verification of the calibration of the programmer specially when you observe higher than normal programming failures. For RadHard and RadTolerant devices, Actel 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 Actel Technical Support and send the log file.

Programming Antifuse FPGAs

The following steps are required to program Actel 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. Actel 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 RadHard and some RadTolerant 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 RadHard or RadTolerant FPGA (Actel 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 Actel to screen 100% of potential programming failures on antifuse FPGAs, Actel 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 a 95% programming yield criteria is met. As long as all the requirements listed above are satisfied, Actel will replace 100% of field programming rejects. If the programming yield is lower than expected, Actel 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. The sample sizes shown in [Table 7 on page 1-9](#), [Table 8 on page 1-9](#), and [Table 9 on page 1-10](#) allow larger percentage fallout for smaller sample sizes due to statistical fluctuations attributable to the small quantities.

Table 7 • Programming Failure Allowance (except -F)

Parts Programmed	Number of Failures Allowed
2-9	2
10-16	3
17-24	4
25-33	5
34-43	6
44-53	7
54-64	8
65-75	9
76-87	10
88-99	11
> 100	5%

Table 8 • -F Programming Failure Allowance

Parts Programmed	Number of Failures Allowed
4-8	4
9-11	5
12-15	6
16-18	7
19-22	8
23-26	9
37-30	10
31-34	11
35-38	12
39-43	13
44-47	14
48-51	15
52-56	16
57-60	17
61-65	18
66-70	19
71-74	20
75-79	21
80-84	22
85-89	23
90-93	24
94-100	25
> 100	15%

Table 9 • Axcelerator Family Programming Failure Allowance

AX125, AX250, and AX500 Devices		AX1000 and AX2000 Devices	
Parts Programmed	Number of Failures Allowed	Parts Programmed	Number of Failures Allowed
1-8	3	1-9	6
9-17	5	10-21	11
18-27	7	22-32	15
28-38	9	33-49	21
39-50	11	50-61	25
51-56	12	62-67	27
57-63	13	68-73	29
64-69	14	74-79	31
70-76	15	80-85	33
77-82	16	86-92	35
83-89	17	93-98	37
90-100	19	99-100	38
> 100	10%	> 100	15%

Note: For RTAX-S devices, check the Actel website for future documents that provide programming guidelines.

If the number of programming failures exceeds the values listed in [Table 7 on page 1-9](#), [Table 8 on page 1-9](#), and [Table 9](#), stop programming.

Scenario: You require 50 programmed A42MX16-PQ208 devices.

- You begin programming and out of 9 devices, 2 have failed programming. You may continue programming because [Table 7 on page 1-9](#) indicates that 2 failures are allowable for a sample size of 9.
- After 16 programming attempts, a total of 3 devices have failed programming. Again 3 failures out of 16 is within the allowable fallout and you may continue programming.
- The next 3 devices fail programming. The failure rate is now 6 out of 19. Referring to [Table 7 on page 1-9](#), notice that for a sample size of 10 the maximum allowed number of failures is 4. At this point you must stop programming.

In cases where the programming failure rate exceeds those listed as allowable, Actel 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 Actel 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 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: <http://www.actel.com/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: http://www.actel.com/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 table (Table 7 on page 1-9, Table 8 on page 1-9, and Table 9 on page 1-10). 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 Actel Technical Support

Complete the Programming FA checklist for antifuse devices and contact Actel 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 RadHard/RadTolerant 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 Actel. Refer to the *RadHard/RadTolerant Programming Guide* for more detailed information about programming RadHard and RadTolerant devices. For RTAX-S devices, check the Actel 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:\BPDATALOG\. The log file for the current programming session will be named 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: <http://www.actel.com/custsup/updates/silisculpt>.
- Record the exact part number of the adapter module(s) being used, then upgrade to the latest version: http://www.actel.com/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 ([Table 7](#), [Table 8](#), and [Table 9 on page 1-10](#)). 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 Actel Technical Support

Complete the Programming FA checklist for antifuse devices and contact Actel 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
- Date and lot code
- Failure rates for each lot

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

Actel consistently strives to exceed customer expectations by continuing to improve the quality of our products and our quality management system. Actel has Return Material Authorization (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 Actel warranty period of one year from date of shipment.

For normal programming fallout of 0 to 5% (15% for -F), return the parts for credit or replacement by requesting an RMA number through an Actel sales representative or distributor. For quantities of 20 or less, Actel will issue credit only. For greater than 20, replacement parts will be provided.

For fallout greater than 5% (15% for -F), or greater than what is shown in [Table 7 on page 1-9](#), [Table 8 on page 1-9](#), and [Table 9 on page 1-10](#), a case must be initiated with Actel technical support as per Step 5 in the "[Antifuse FPGAs \(Non-RadHard/RadTolerant\)](#)" section on [page 10](#).

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

If you experience long programming times, contact Actel 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 Actel 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 Actel 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, Actel 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.

Contacting the Customer Support Group

Highly skilled engineers staff the Customer Applications Center from 7:00 A.M. to 6:00 P.M., Pacific time, Monday through Friday. You can contact the center by one of the following methods.

Electronic Mail

You can communicate your technical questions to our e-mail address and receive answers back by e-mail, fax, or phone. Also, if you have design problems, you can e-mail your design files to receive assistance. Actel monitors the e-mail account throughout the day. When sending your request to us, please be sure to include your full name, company name, and contact information for efficient processing of your request. The technical support e-mail address is tech@actel.com.

Telephone

Our Technical Support Hotline answers all calls. The center retrieves information, such as your name, company name, telephone number, and question. Once this is done, a case number is assigned. Then the center forwards the information to a queue where the first available applications engineer receives the data and returns your call. The phone hours are from 7:00 A.M. to 6:00 P.M., Pacific time, Monday through Friday.

The Technical Support Hotline number is (800) 262-1060.

European customers can call +44 (0) 1256 305 600.

List of Changes

The following table lists critical changes that were made in the current version of the document.

Previous Version	Changes in Current Version (51900100-1*)	Page
51900100-1/6.05	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.	1
	Table 2 · Programming Solutions was updated to include Silicon Sculptor 3.	3
	Table 3 · Programmer Ordering Codes was updated to include Silicon Sculptor 3.	3
	Table 4 · Programmer Device Support was updated to include Silicon Sculptor 3.	4
	Table 5 · Programmer Support for RadHard and RadTolerant Devices 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.	5
	The "Silicon Sculptor 3" section is new.	6
	The "Silicon Sculptor I and Silicon Sculptor 6X" section was updated.	6
	The "Activator" section was updated.	7
	The "Noncertified Programmers" section was updated.	7
	The "Check Insertion Limit of the Adapter Module" section is new.	7
	The "Perform Routine Hardware Verification and Calibration" section was updated.	8
	The "Save the *.txt File (RH/RT Only – Required)" section was updated to include RTAX-S.	8
	Table 9 · Axcelerator Family Programming Failure Allowance was updated to include a footnote concerning RTAX-S programming guidelines.	10
	The "5. Contact Actel Technical Support" section was updated.	11
	Information about RadHard and RadTolerant device failures was removed from the "Return Material Authorization (RMA) Policies" section.	12
	The "4. Contact Actel Technical Support" section was updated.	12

Note: *The part number is located on the last page of the document.

Related Documents

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

Silicon Sculptor II

http://www.actel.com/products/hardware/program_debug/ss/default.aspx

Includes a description of both Silicon Sculptor I and II.

Silicon Sculptor Quick Reference Card

www.actel.com/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

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

www.actel.com/documents/SiliSculptII_Sculpt3_ug.pdf

Silicon Sculptor User's Guide (DOS)

www.actel.com/documents/sculptor_DOS_ug.pdf

Silicon Sculptor Programmer Calibration Verification Procedure

www.actel.com/documents/SiliSculptProgCali_UG.pdf

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

Application Notes

Implementation of Security in Actel Antifuse FPGAs

http://www.actel.com/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, Actel has included the following documentation for these products.

Programming Procedure for the 6X Silicon Sculptor in DOS

www.actel.com/documents/prgrm6x.pdf

Activator and APS Programming System Installation and User's Guide

http://www.actel.com/documents/Activator_UG.pdf

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