In-Circuit Test Support with MAX 7000 Devices
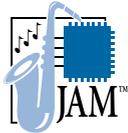
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Introduction

Altera® MAX® 7000S, MAX 7000A, and MAX 7000B devices support in-system programming with in-circuit test (ICT) equipment, offering significant time and cost benefits by integrating programmable logic devices (PLDs) into board-level testing. Altera provides software and device support that easily integrates in-system programmability (ISP) into test flows. This technical brief outlines ICT support and ISP methods for MAX 7000 devices.

ISP via In-Circuit Testers

ISP via in-circuit testers is accomplished with either an adaptive or constant algorithm. An adaptive algorithm reads information from a device and adapts subsequent programming steps to achieve the fastest possible programming time for that specific device. A constant algorithm uses a pre-defined (non-adaptive) programming sequence. Some tester platforms are well-suited to support adaptive algorithms while others are not. MAX 7000 devices can use adaptive or constant algorithms and work with either tester platform.

SVF vs. Jam STAPL

Serial Vector Format (**.svf**) files do not support adaptive programming algorithms. Consequently, testers using SVF files must program at the device's worst-case programming pulse width. For example, SVF-based testers program MAX 7000AE and MAX 7000B devices at their worst-case programming pulse width of 20 ms, yielding fast programming times. However, SVF-based testers program MAX 7000S devices at their worst-case programming pulse width of 200 ms, yielding less than optimal programming times.

To minimize SVF-based tester programming times for MAX 7000S devices, Altera offers MAX 7000S devices with a fixed programming pulse width of only 30 ms. These fixed programming devices have an "F" at the end of their ordering codes and are called "F" devices. To obtain production-worthy in-system programming times when using SVF-based testers such as HP 3070 and GenRad 228X, designers must use fixed programming MAX 7000S devices. Since MAX 7000AE and MAX 7000B devices have a worst-case programming pulse width of 20 ms, they do not require a fixed programming algorithm to achieve production-worthy programming times.

Unlike SVF, the Jam™ Standard Test and Programming Language (STAPL), JEDEC standard JESD-71, uses an adaptive algorithm, offering the ability to program devices faster than their worst-case programming pulse width. Jam STAPL allows each device to be programmed at its optimal programming pulse width. Moreover, testers that support the Jam STAPL format use smaller file sizes and have faster programming times than those that do not.

MAX 7000S In-Circuit Tester Support

MAX 7000S devices support SVF-based testers with "F" devices and most Jam STAPL-based testers with non-"F" devices. Table 1 lists in-circuit testers and their preferred programming methods when used with MAX 7000S devices.

Table 1. MAX 7000S ICT Programming Methods	
In-Circuit Tester	**Preferred Programming Method**
HP 3070 Series	SVF and "F" devices *(1)*
GenRad 228X Series	SVF and "F" devices *(1)*
Teradyne 1800 and Spectrum Series	Jam STAPL
Asset Intertech	Jam STAPL
Corelis ScanPlus	Jam STAPL
Goepel Electronic	Jam STAPL
Intellitech	SVF and "F" devices *(1)*
JTAG Technologies	Jam STAPL

Note:
(1)   Contact the vendor for future Jam STAPL support information.

MAX 7000A & MAX 7000B In-Circuit Tester Support

MAX 7000A and MAX 7000B devices support programming pulse widths of 20 ms or less and therefore can be used in constant algorithm platforms without the need for "F" devices. MAX 7000A devices requiring ICT support should use the MAX 7000AE device equivalents which have an enhanced ISP algorithm for faster programming. For example, you should use the EPM7128AE and EPM7256AE devices instead of the EPM7128A and EPM7256A devices for optimal programming times. Table 2 lists in-circuit testers and their preferred programming methods when used with MAX 7000A and MAX 7000B devices.

Table 2. MAX 7000A & MAX 7000B ICT Programming Methods	
In-Circuit Tester	**Preferred Programming Method**
HP 3070 Series	SVF *(1)*
GenRad 228X Series	SVF *(1)*
Teradyne 1800 and Spectrum Series	Jam STAPL
Asset Intertech	Jam STAPL
Corelis ScanPlus	Jam STAPL
Goepel Electronic	Jam STAPL
Intellitech	SVF *(1)*
JTAG Technologies	Jam STAPL

Note:
(1)   Contact the vendor for future Jam STAPL support information.

Conclusion

Altera provides complete ISP solutions for MAX 7000 devices using in-circuit testers. Altera's MAX 7000 devices and Jam STAPL offer fast, consistent programming times, thereby cutting costs and increasing manufacturing productivity for any ICT user.

References

The following documents provide more detailed information. The part numbers are in parentheses.

■ *Application Note 100: In-System Programmability Guidelines* (A-AN-100-03)
■ *Application Note 109: Using the HP 3070 Tester for In-System Programming* (A-AN-109-01)
■ *Technical Brief 28: Advantages of ISP-Based CPLDs* (M-TB-028-01)
■ *Technical Brief 32: ISP Programming Methods & Ordering Codes* (M-TB-032-01)

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