ALTERA®

Technical Brief

Stratix III Military Temperature Range Support

Introduction

As part of Altera® initiative to provide enhanced commercial off-the-shelf (COTS) devices for military applications, the temperature range for the Stratix® III device family has been extended to enable operation across the military temperature range (-55°C to 125°C). This allows military programs to benefit from the new technology and economies of scale by using commercially available Stratix III FPGAs.

Stratix III FPGAs are extremely robust devices capable of operating across a wide temperature range with excellent reliability characteristics. This technical brief describes Altera's support for Stratix III military temperature range operation with appropriate background information. It also explains how to use Stratix III devices across military temperature range operation and any limitations in operation that affect the datasheet specifications.

Military Temperature Support

Military temperature operation requires additional timing margin over industrial temperature operation to compensate for the potentially increased variation of f_{MAX} across temperature. With Altera devices, increased timing margin is achieved by compiling the design using an industrial I3 part and setting the temperature range to -55°C to 125°C in the Quartus® II software. The Quartus II software provides separate timing models for 125°C at slow corner and -55°C at fast and slow corners. This technique can be used to increase the timing margin of an industrial device to meet the constraints of military temperature range operation in Stratix III devices (shown in Table 1).

Table 1. Stratix III Military Temperature Device Support

Stratix III Device	Military Temp Support	Package	Type
EP3SL50	Yes	All	Industrial –3 devices (I3)
EP3SE50	Yes	All	Industrial –3 devices (I3)
EP3SL70	Yes	All	Industrial –3 devices (I3)
EP3SE80	Yes	All	Industrial –3 devices (I3)
EP3SL110	Yes	All	Industrial –3 devices (I3)
EP3SE110	Yes	All	Industrial –3 devices (I3)
EP3SL150	Yes	All	Industrial –3 devices (I3)
EP3SL200	No	—	—
EP3SE260	No	—	—
EP3SL340	No	—	—

Datasheet Specifications

Characterization results show that Stratix III operation across the military temperature range is bounded by the commercial C4 speed operation of the datasheet specifications and any relevant errata except where noted below.

- Device operation at V_{CCL}=0.9V is not supported in Stratix III military temperature range
- Non-calibrated on-chip termination (OCT) is not supported in Stratix III military temperature range
- On-chip termination (OCT) is bounded to ±10% for series resistance
- For military temperature static power, the Stratix III PowerPlay Early Power Estimator or PowerPlay Power Analyzer version 9.0 or later must be used

Software Support

The Quartus II software version 9.0 and later fully supports military temperature range operation for Stratix III devices. Select the industrial I3 speed grade device and set the low and high operating temperature conditions to -55°C and 125°C, respectively.

Conclusion

These guidelines have been determined through additional characterization of Stratix III devices on samples of production silicon across military temperature ranges (125°C and -55°C). While the characterizations demonstrate correct operation across military temperatures by design, production testing of industrial grade devices for military temperatures range operation is performed at 100°C.

Further Information

- Detailed characterization reports are available to qualified customers. Contact an Altera sales representative for access to these reports:
  www.altera.com/corporate/contact/con-index.html

- Stratix III PowerPlay Early Power Estimator:
  www.altera.com/support/devices/estimator/pow-powerplay.html

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