"Tech Refresh" P/N 4289 Technical Discussion

Background

In 1998, Technobox, Inc. introduced a 32-channel RS422/485 product using the Altera FLEX10K70 core FPGA, known as P/N 2674. Subsequently, after the FLEX10K70 FPGA began increasing in cost and became more difficult to procure, a re-spin was introduced known as P/N 4289. First shipped in 2004, the 4289 enjoyed tremendous sales volume and customer demand for this function. Technobox, Inc. is yet again faced with an FPGA obsolescence issue, as well as several other EOL part shortages for this design.

Intel/Altera announced discontinuation of the Cyclone I family in July 2018, allowing little time to consider alternatives (last time buy date was December 13, 2018). In order to continue supplying our customers with the 4289, Technobox, Inc. purchased a substantial quantity of obsolete parts. These will be available to 4289 builds on a first-come-first-served basis.

In an effort to support our customers, Technobox, Inc. is introducing a "Tech Refresh" version of the 4289, known as P/N 9136. The "Tech Refresh" board maintains 100% functional equivalence of the 4289, while making it easy for users to seamlessly migrate their 4289-based FPGA designs to the new 9136 products.

PLEASE NOTE:

1. All FPGA ball functionality is **IDENTICAL** to the 4289, **EXCEPT** ball numbers have changed - requiring a re-compile of designs to the new FPGA.
   a. The Technobox, Inc. "migration tool" is provided to assist renumbering FPGA balls from the 4289 design to the 9136. In principle, users run the migration tool against the .QSF file and the ball numbers are changed for a subsequent recompile with the new FPGA.
2. The fundamental architecture of a PLX 9656 connection to the PCI bus, a pre-programmed PLD for downloading FPGA images over the PCI bus and identical RS485 transceivers with the identical termination configurations remains the same. The peripherals of the 4289 (temperature sensor, delay lines, user oscillator, EEPROM, etc.) also remain intact.
3. Methods of programming the FPGA via Byte/USB blaster cables remain the same.
4. The PCI Vendor/Device ID is the same to avoid driver reassignment in the host. There will be a revision change (or equivalent) in the PCI configuration space to indicate the new board, but these items are generally ignored by drivers.

Specific Details of the Product Changes are as Follows:

CHANGE #1: FPGA from EP1C12F324C8/EP1C20F324C8 to Cyclone V (5CGXFC4C6F23I7N)

The new FPGA is in a 484-ball package, compared to the original 324-ball package. We chose this replacement FPGA because it's used in other Technobox, Inc. products. Note that the 672-ball version of the 5CGXFC4C6F23I7N (i.e., 5CGXFC4C6F27I7N) is used on the 7757 XMC product discussed below. However, there is no use of the hardcore PCI Express interface for the "Tech Refresh" 9136. Ball functionality has been retained, and users must recompile their FPGA design for the new FPGA using our migration tool, as noted above.

CHANGE #2: MAX3064 control PLD to MAX 5 5M570ZT100I5N/A5N

As another Intel/Altera action, the MAX3000 family was discontinued in late 2017 - motivating the use of a newer PLD. The PLD permits the FPGA image to download over the PCI bus and is 100% functionally compatible with the 4289 design, just in a different PLD. **There is no functional impact on users with this change.** However, the new PLD is seen in the JTAG daisy chain along with the FPGA. Users generally "skip" programming the PLD.

CHANGE #3: Local bus clock generator from CY2907F8 to SI5351A

As of October 2018, Cypress could no longer supply CY2907F8, therefore action was needed for the "Tech Refresh" re-spin. The original 2674 board had a 24MHz local oscillator for the PLX local bus clock. As an enhancement, the 4289 incorporated a CY2907F8 PLL clock generator to provide 24MHz backward compatibility, but also through zero-ohm jumper configuration provides a choice of 24, 33, 50 or 66MHz for the local bus clock. Operation at only 24Mhz (default) is recommended.

CHANGE #4: Discontinue use of ICS1522 PLL in favor of internal Cyclone FPGA PLLs

The 2674 incorporated an external ICS1522 chip that carried over to the 4289 design for backward compatibility. It was recommended to 4289 customers who have been using the ICS1522 PLL to move their clock requirements to the PLLs inside the Cyclone I FPGA. The ICS1522 is discontinued and Technobox, Inc. purchased an ample supply of ICS1522 chips for manufacturing, which was perceived as enough for the lifetime of the product.

We believe most customers no longer use the ICS1522 PLL and have moved their designs inside the FPGA. Thus, the "standard" 9136 "Tech Refresh" board will **NOT** have the ICS1522 chip populated. The footprint and connections to the FPGA are retained and available for those who need the ICS1522 chip, but treated as a derived product and assigned an orderable P/N. Customers should review their utilization of the ICS1522 chip. If needed, Technobox, Inc. has an ample supply of ICS1522 chips that may be used on a first-come-first-served basis, with a suitable premium incurred.

CHANGE #5: Move from leaded to RoHS solder

It's clear that component manufactures are not interested in having dual-package availability for both leaded and RoHS - most leaded parts have been EOL'd. When RoHS was announced in 2005, we moved to SAC 305 alloy, which is commonly used in the industry and have seen no issues. The 4289 will likely be the last leaded build Technobox, Inc. implements with everything moving to RoHS. RoHS is the prevalent industry manufacturing technique used today.

CHANGE #6: FPGA core voltage generation from LM1963A-1.5 to LT3088

The Cyclone I family had a core voltage of 1.5V. The Cyclone V is 1.1V, which is not within the capability of the LT1963 family. A new regulator is used, the LT3088. The LT3088 is driven from another linear regulator source on the board with 2.5V to mitigate power dissipation issues with linear regulators. Technobox, Inc. studied the core current requirements of Cyclone V, running simulations well above what is expected with the use of this product and expect no issues or impact on our customers.

CHANGE #7: "Tech Refresh" is a 12-layer board instead of 8-layer.

    For signal integrity and ease of routing, the "Tech Refresh" board consists of 12-layers. 6-signal, 4-GND and 2 split voltage planes sandwiched between GND planes. Clock signals are series terminated.

Derivatives

Throughout the years, Technobox, Inc. has manufactured many "derivatives" of the 4289. These products were populated with different termination values (or removing them entirely), specific user oscillators or a different sized Cyclone I FPGA. Each 4289-derived product received a unique orderable Technobox, Inc. part number. The same philosophy will apply to 9136 derivatives; orderable part numbers will be established as the need arises. Please note only one size of FPGA for the 9136 will be available to customers due to the fact that the 9136 FPGA is considerably larger than the 4289 FPGA.

XMC Equivalent

In 2015, Technobox, Inc. introduced an XMC (VITA 42) version of the 4289 family, orderable as P/N 7757. An architectural redesign incorporated a hardcore PCI Express interface inside the FPGA, rather than a separate PLX interface chip. Additionally, it offers different RS422/485 transceiver chips to achieve industrial temperature range, a new download of FPGA code over the PCI Express bus scheme and many other subtle design changes. However, many of the 4289 peripherals are retained in the 7757 product such as temperature sensor, external SRAM and EEPROM.

Customer Action Required

Although moving to the 7757 as the replacement solution for the 4289 is the preferred long-term solution, we understand customers may have hesitation. Some challenges include older carriers not having an XMC site or the difficulty of moving the 4289 designs to the XMC 7757 because of the difference in the PLX interface between the FPGAs - requiring significant engineering. It is for this reason we decided to provide our customer with a PMC based "Tech Refresh" version to help bridge the gap before they are ready to commit to the XMC version.

Technobox, Inc. is dedicated to outstanding product quality and service. We trust our customers understand EOL is an unfortunate reality of the industry, and we will address these problems proactively as they arise. We believe either solution outlined above allow our customers to move forward from the 4289. Depending on each specific application, customers will need to decide whether to:

    A. Migrate to the XMC 7757 product, or start with the 7757 for NEW designs.
    B. Recompile FPGA code for "Tech Refresh" board 9136 or derivatives.

Life Cycle Notice

As noted in the beginning of this document and repeated throughout, component EOL issues are a persistent risk. Original component manufacturer product life cycles are constantly in flux and distribution channels can be unreliable, being subject to major marketing distributions such as mergers and acquisitions or fundamental technology shifts.

Our policy is to build a product as long as components and production facilities are available. However, it must be understood that a product may be discontinued at any time – AND WITHOUT NOTICE – due to EOL issues or any other disruption that precludes sustainability and/or manufacturability.