Power IC Technology

APEC 2019

Efficiently Provided Power for Ubiquitous Growth in Electronic Devices

THE PROBLEM

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Problem Facing Us All

- Power demand GROWING!!!
- Industry & regulatory pressure
- Historic design methods
- WASTED POWER

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Saving the World – One Milliwatt at a Time

SOLUTION

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MuxCAP™ - Patented & Unique

- ✓ MUXCAP-enabled = Highest Efficiency
  - ✓ Highest Power Density
  - ✓ Minimum Energy Waste
  - ✓ High Efficiency – At all loads
  - ✓ Consistent Efficiency Across Many Power Ranges

A BREAK from TRADITION is needed

Innovative Power Technology

Maximum Power Density

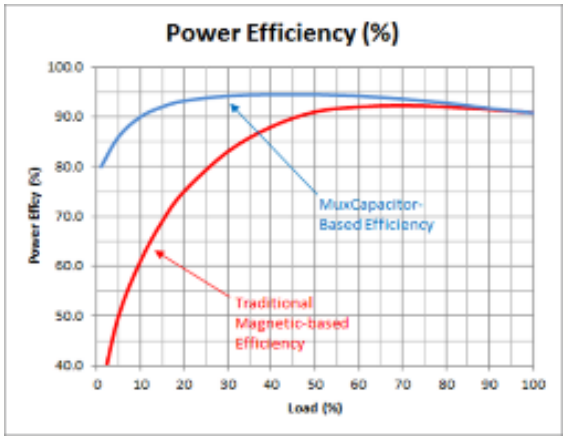
✓ Capacitive Power Conversion – High Efficiency MuxCap™

+

✓ Capacitive Isolation – No Transformers Required CapIso™

=

✓ **Highly Efficient, Small and Simple Solutions**



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MuxCap – Patented Approach to Voltage Conversion

TECHNOLOGY INTRODUCTION

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MuxCap™

- Switched-Capacitor Charge Pump Technology
  - Per Stage Voltage Conversion at 98%+ Efficiency
- Integrated Silicon-on-Insulator (SOI) process
- Isolated/Non-Isolated Converter Solutions
- AC-DC & DC-DC Solutions
- MuxCapacitor®, MuxCap™, MxC®, CapISO™

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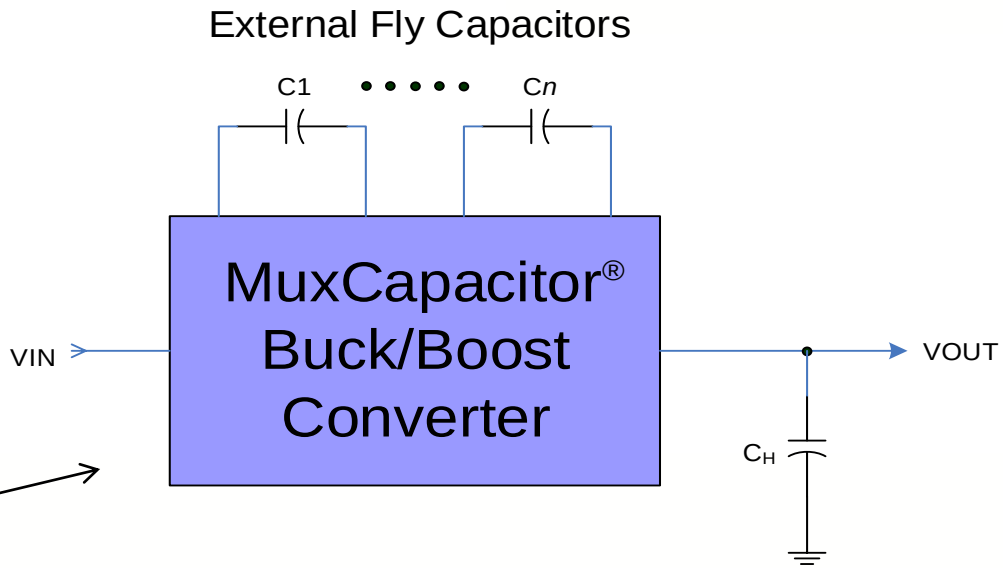
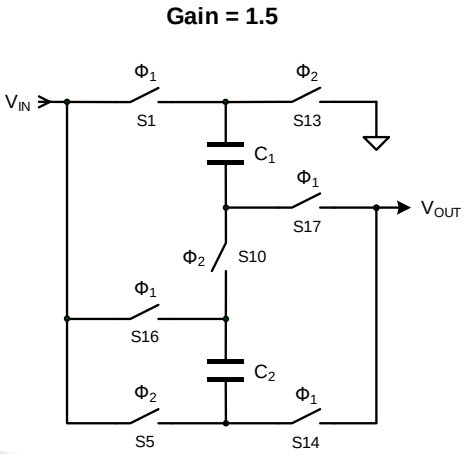
Switched Capacitor Charge Pump

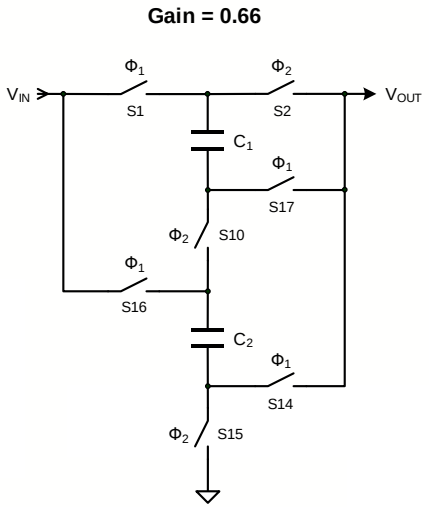
Single stage converter

On chip high voltage switch network including;
- High voltage switches
- Gate drivers
- Control



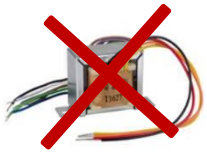
Example MuxCap™ Networks

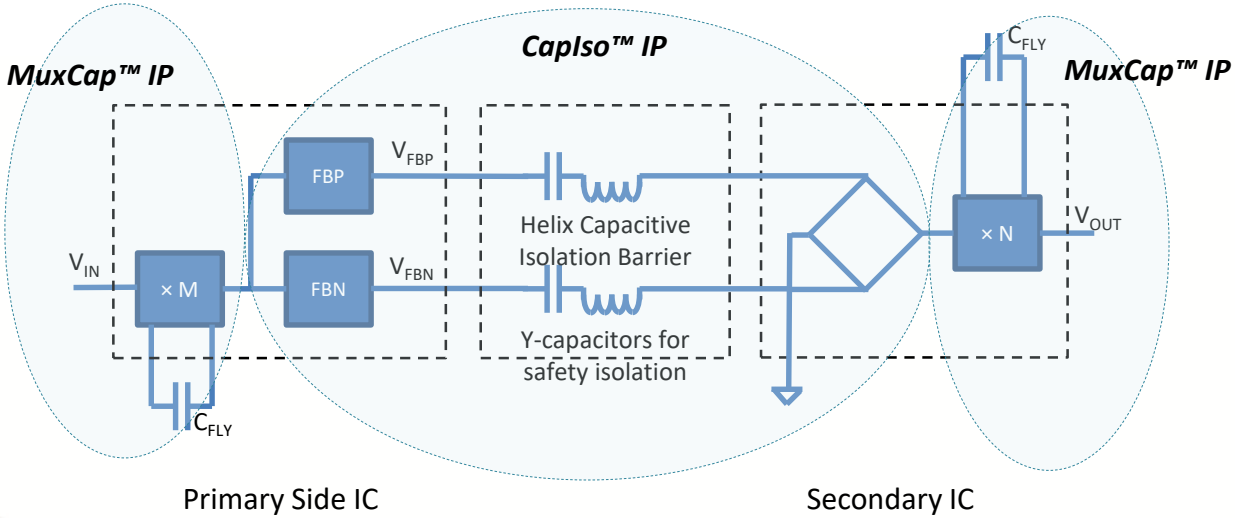




CapIso™

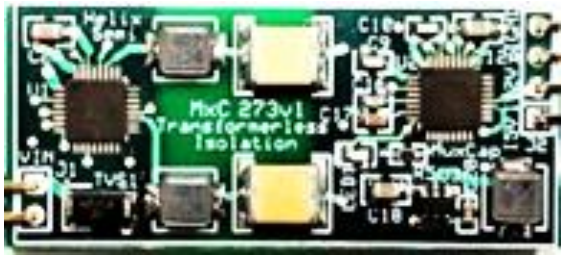
- State-of-the-Art in Power Conversion
- Underwriters Laboratories (UL) Approved for Safety





Typical Isolation Transformer vs. None

Transformer based DC-DC Converter
5-10W 36VIN



MxC 273-EB-C
5-10W 48VIN to Isolated ±12V & 5Vreg

MxC(R)200 DC-DC Family

- 5 application focused parts
- Isolated and Non-isolated solutions
- Targeted for
  - Machine Vision
  - Cameras
  - PoE
  - Telecom
  - Industrial Control

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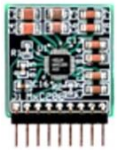
MXC200
A02

DC-DC Eval Boards

Demonstration of MxC® 200 products used in non-isolated applications
(Reference designs available)

Non-Isolated Unregulated PoL Evaluation Boards



MxC 290C-EB9P-1
48VIN to 24V, 12V, 6V
12W

MxC 291C-EB3P-1
48VIN to 12V
12W

Non-Isolated Regulated PoL Reference Designs

MxC 292C-EB3P-1
48VIN to 5Vreg
10W

MxC 284C-EB2P-1
9VIN to 32V LED
1W

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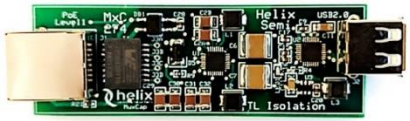
48VDC DC-DC “TL” EVB

TL Isolated Unregulated Evaluation Boards

MxC 270C-EB-1
48VIN to Isolated 12V
10W

TL Isolated Regulated Reference Design



MxC 274-EB-C
PoE Level 1 to Isolated USB-A (5Vreg)
5W

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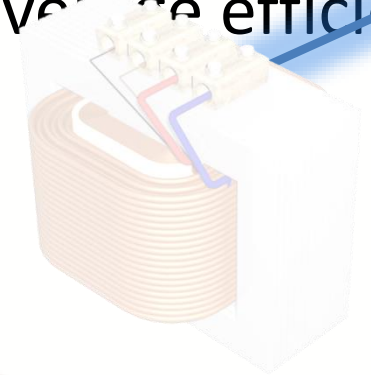
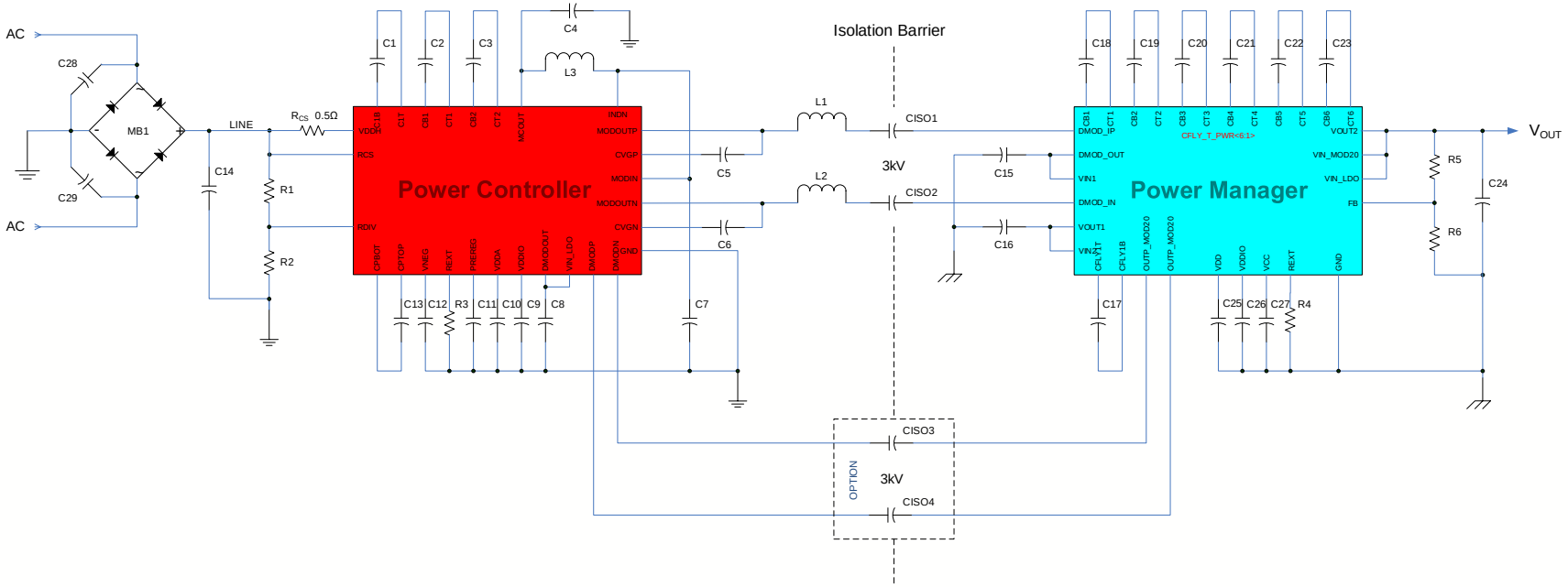
MxC(R)300 Family - AC-DC Converters

✓ ***Capacitive Isolation means no transformer needed!***

- ✓2 chip set solution
- ✓UL approved CapIso™
- ✓Up to 65W
- ✓>95% av[illegible] efficie[illegible]

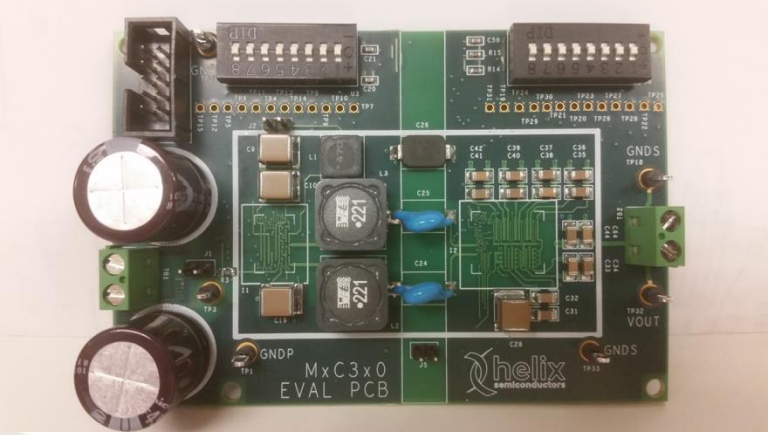


MxC 300 Converter Reference Design



Comparison of Power Density

Manufacturer	When Introduced	Power Density
Infineon IDP™ 65W	2016	0.93W/cm^3
POWI 30W	Q3 2017	1.2W/cm^3
Infineon XDP™ 65W	Q3 2017	1.5W/cm^3
TI TIDA-01622 65W	Q2 2018	1.8W/cm^3
Helix Semi 65W	Q2 2019	4.5W – 10W/cm^3



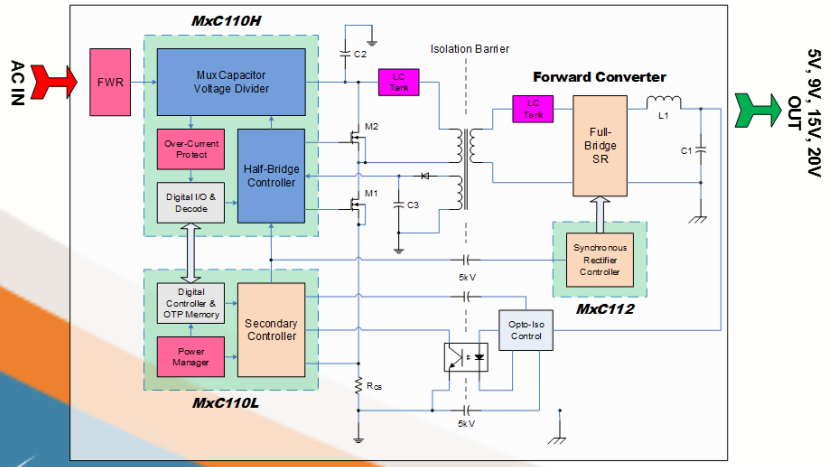
Maximum Power Density

- 65W Evaluation PCB
- MxC3x0 Chipset

4.5W – 10W/ cm^3

In Development - AC-DC w/Trans

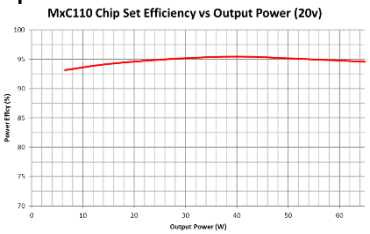
- ✓ *Transformer-based AC-DC Converter Family*
- ✓ *2-3 chip-set solution*
- ✓ Optimized for up to 65W AC-DC power supplies
- ✓ Compatible with all USB-C requirements



Overview

Key Differentiators:

- **Highly efficient MuxCap™** , no low load to full load
- **Integration** of switches, drivers and control
- **Simplified** converter development
- **True Zero Power**



Key Features

- 85-264VAC Input Voltage
- Soft-Start
- 20V, 65W Output
- 5V, 9V, 15V, 20V Output Voltages
  - Pin Configurable
- ±5% Output Voltage Regulation
- > 95% Average Efficiency
  - 25%, 50%, 75%, 100%
- < 5mW Zero-Power Mode Consumption
- I^2C Configuration Interface

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Where Does MuxCap Go Next

- AC-DC
  - **Lower Wattage** – 5W to 35W
  - **Higher Wattage** – 70W to 500W
  - **Data Center** – 1kW to 2.5kW
- DC-DC
  - **Higher Input Voltages** – up to 120V
  - **Higher Wattage** – 30W per IC, >1kW solutions
  - **New Markets** – eVehicles, Solar, Data Center

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Summary

- ✓ Helix offers patented, highest ***power density***, highly efficient ***capacitive*** power-transfer techniques for AC-DC and DC-DC applications

- ✓ "No Transformer Needed" solutions enabling ***disruptive improvements*** in power density

Helix enables innovation !

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efficiently powering the future

Thanks for your time

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