Clock and Timing Solution Update

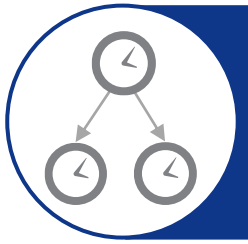
A Leading Provider of Smart, Connected and Secure Embedded Control Solutions

SMART | CONNECTED | SECURE

TW Disti Training

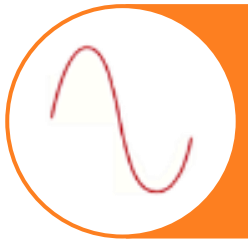
Sep 2022

Industry's Broadest Clock and Timing Portfolio



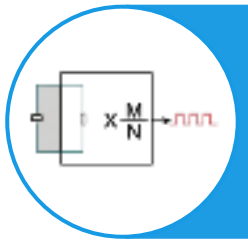
Network Synchronization

- IEEE-1588 & Synchronous Ethernet Compliant Solutions
- PTP and Servo Algorithm Software
- Sub 100fs Jitter
- Multi-channel PLLs with Up to 20 Outputs



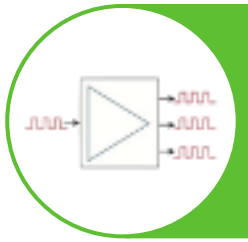
Oscillators

- Precision OCXO/TCXO/VCSO/VCXO
- Low-Cost Crystals and MEMS
- Low Noise
- Low-Power OCXO & TCXO



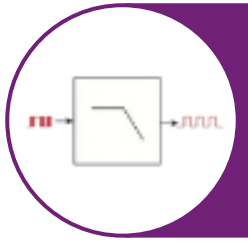
Clock Generation

- As Low as 78 fs Phase Noise
- Preconfigurable with up to 20 Outputs
- Crystal-less™ PCIe® Clock Generators



Fan Out Buffers

- Low-Additive Jitter
- Any Format In/Any Format Out
- Gen 1-5 Compliant PCIe HCSL & LPHCSL Buffers
- Up to 22 Outputs



Jitter Attenuators

- Single and Multi-channel solutions
- Any Format In/Any Format Out
- Sub 100fs Jitter Performance

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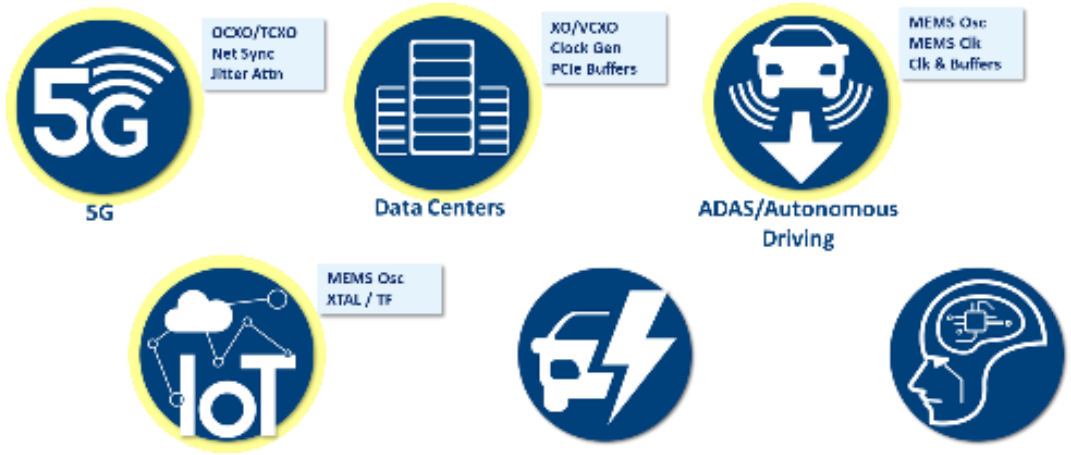
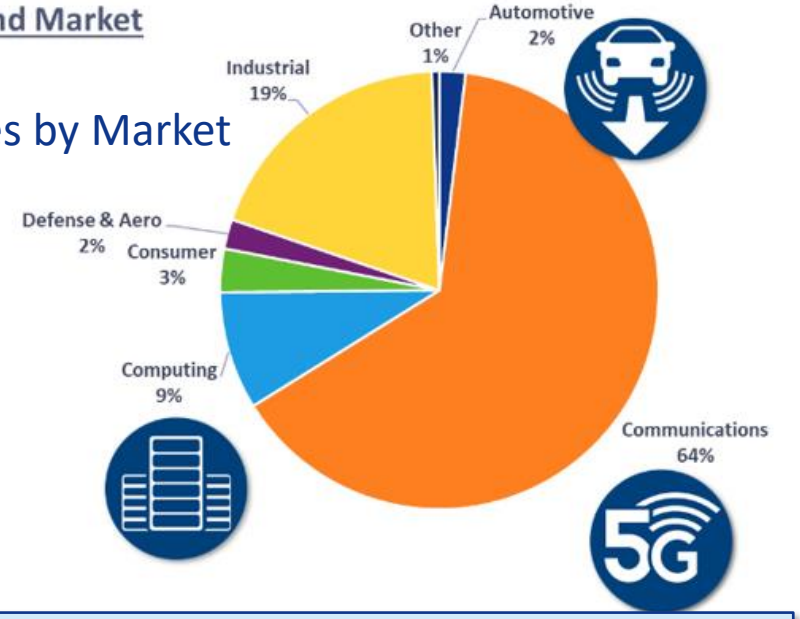
Megatrend Alignment

5G Communications | Data Center | Networking | Automotive | Industrial and IoT | Healthcare | Aerospace | Military



End Market

TCG Revenues by Market



Growth Opportunities

- Large potential in **Automotive**
  - AEC-Q100 qualified MEMS & Buffers
  - Capture 5G growth in **Communications**
- **Data Center**/Computing
  - New products for PCIE Gen 4 & 5

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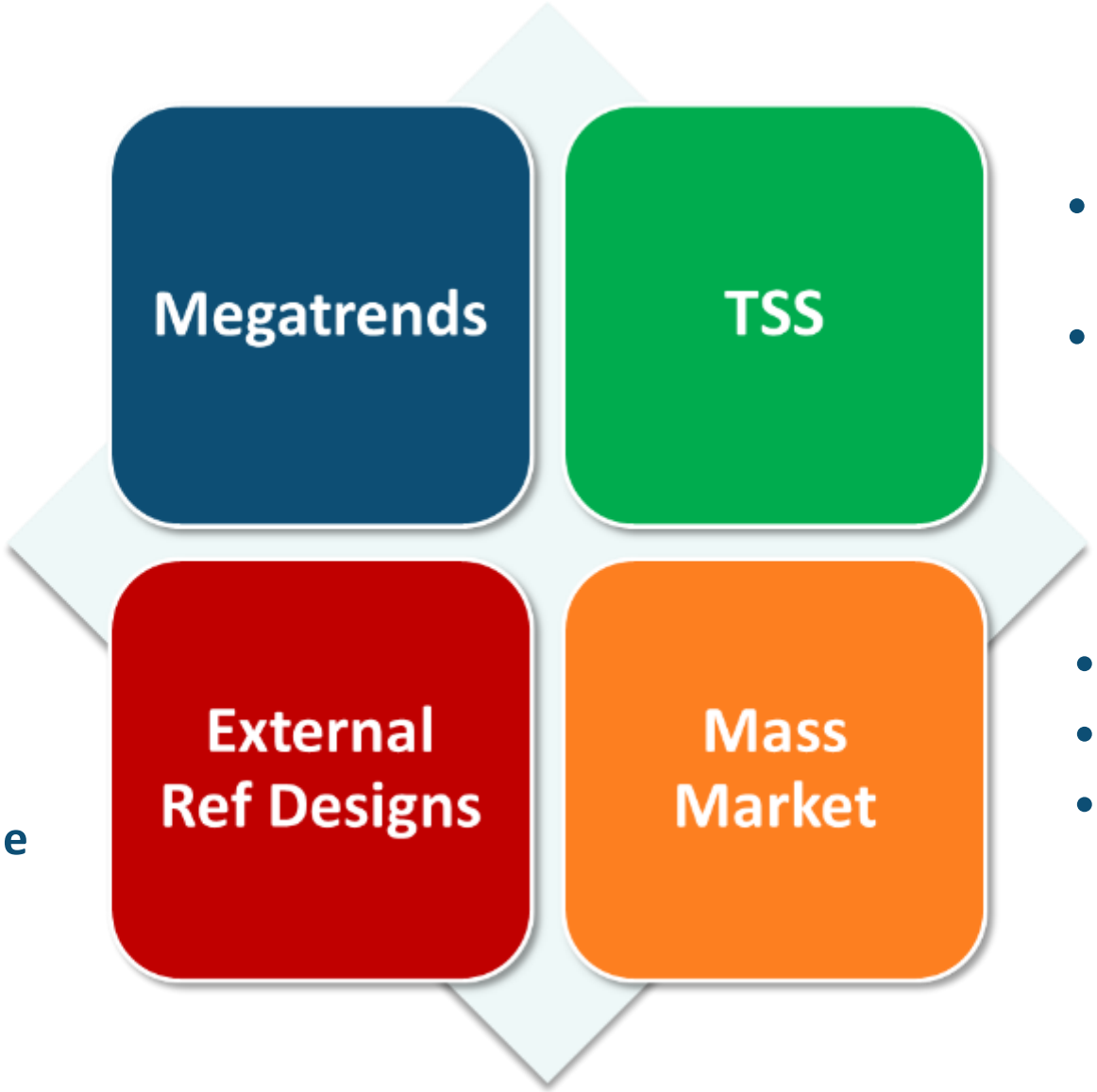
Key Growth Pillars

- Focus on 5G, Data Center and ADAS
- Align with key clients in target markets



- Dedicated team & align with internal clients
- Track, retain, drive revenue

- Focus on Megatrends SoC partners & designs
- Track, retain, drive revenue

- Best-in-class website
- Promotion, awareness
- Easy-to-use tools

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Clock and Timing for Communications

Timing for Communications

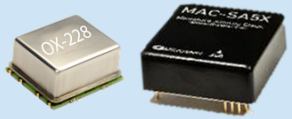
Trend / Requirement	Microchip Timing Solution
Data rates continue increasing from 100G to 400G & 800G, demanding high-quality system clocks	Microchip's Clock & Timing solutions have the Stability, Jitter and Phase Noise needed required by these demanding environments
5G is driving a X10 improvement in Synchronization performance throughout the Network	Microchip's Network Synchronization and Precision Oscillator solutions are industry leaders in performance and are the most widely deployed and trusted

PLLs for Time Network Synchronization

ZL3073x/63x/64x
Released
July 2021

- 1 to 5 channels in single package
- Lower power
- Small: 9x9mm & 7x7mm options
- More outputs, up to 10D/20SE
- Lower jitter: 100fs$_{RMS}$ typical @ 156.25MHz
- Ultra fast lock to PPS reference, <30s lock time
- Advanced chip-to-chip interfaces

Precision Oscillators for Desired Holdover Performance



High Precision Holdover Oscillators
- Highly Stable references capable of 10 minutes to several day holdover
- Temperature Stability <2ppb
- Operating Requirements as high as 95 °C

Cost effective Solutions
- Low stability OCXO or High Stability TCXO
- Require high-frequency low-phase noise VCXO or VCSO in TX chain
- Low Power Solutions required

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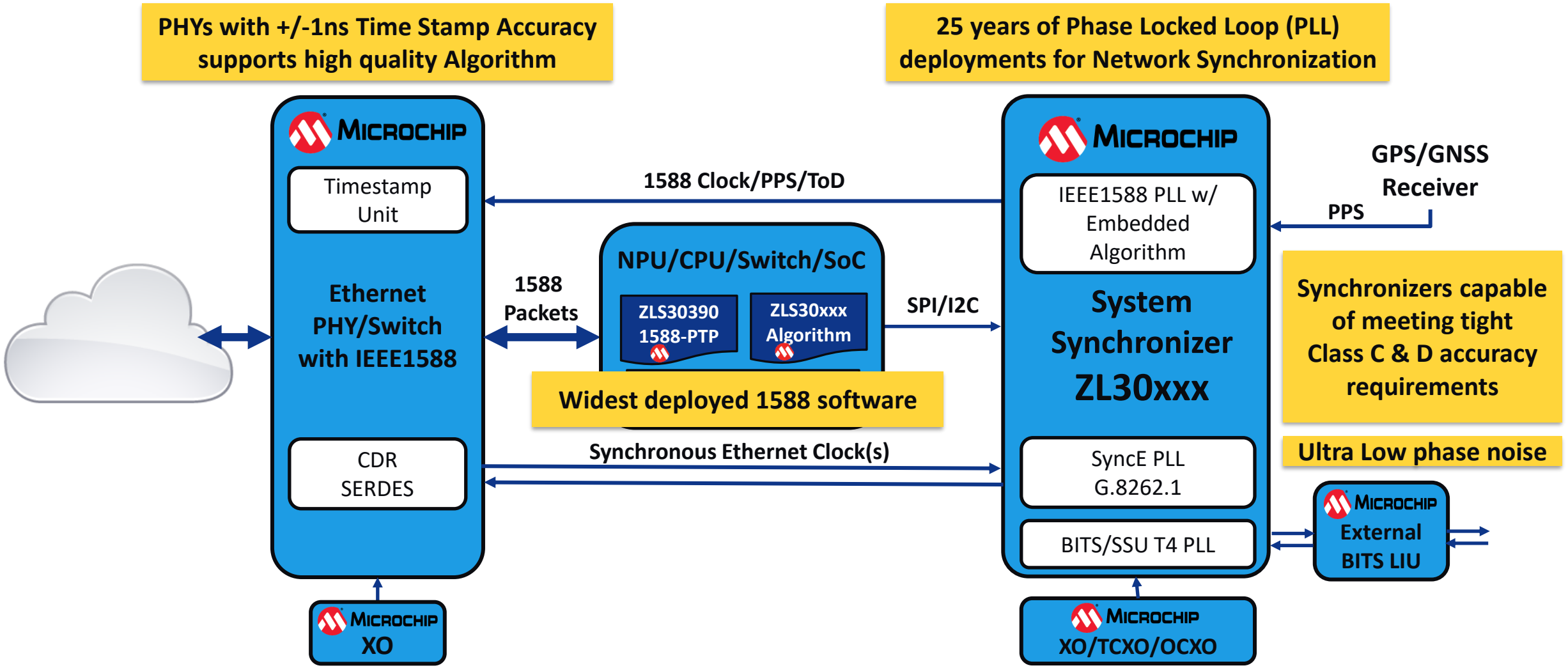
Market Leader in Network Synchronization



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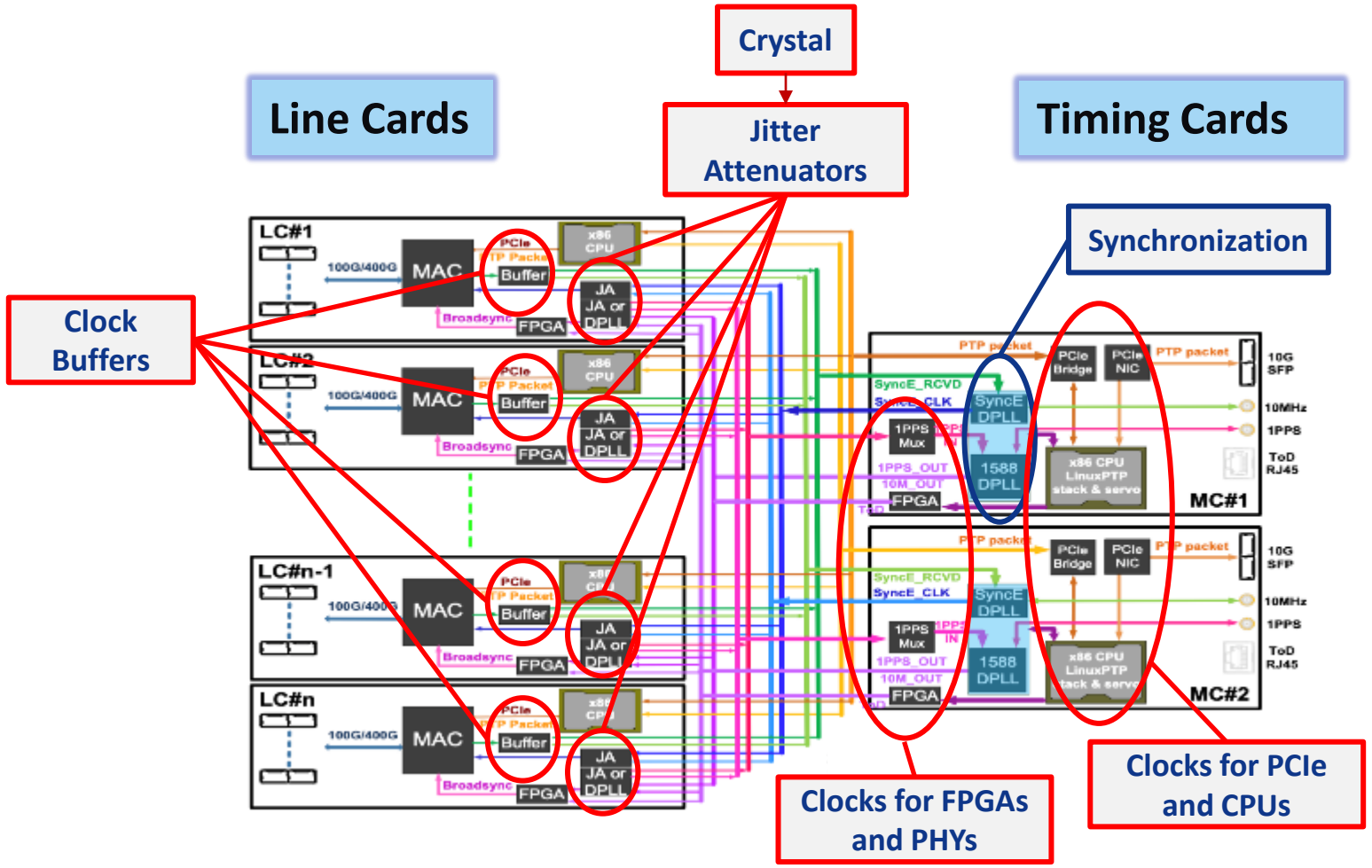
Leverage Synchronization Success

Win customer with the strength of Microchip Synchronization solutions

Find the other timing opportunities in the system



Many Additional Timing Opportunities in Timing Cards and Line Cards

- Precision Oscillators
- Jitter Attenuators
- Clock Buffers
- PCIe timing
- Clocking FPGA
- Clocking PHYs
- Clocking CPUs

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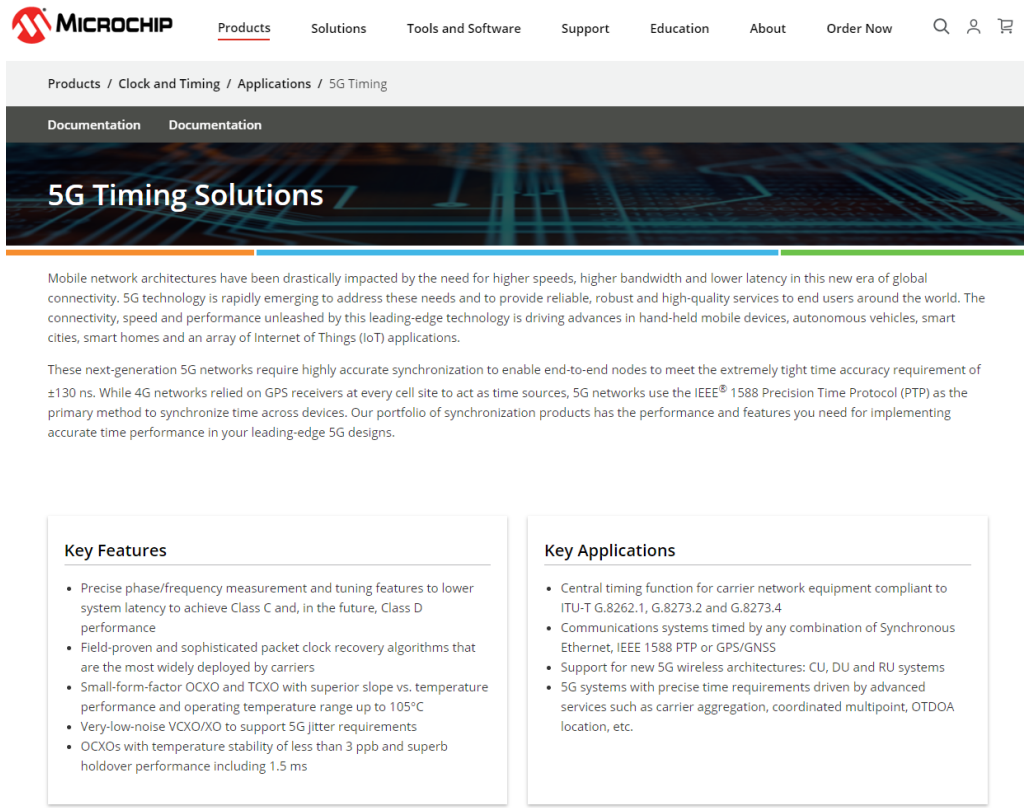
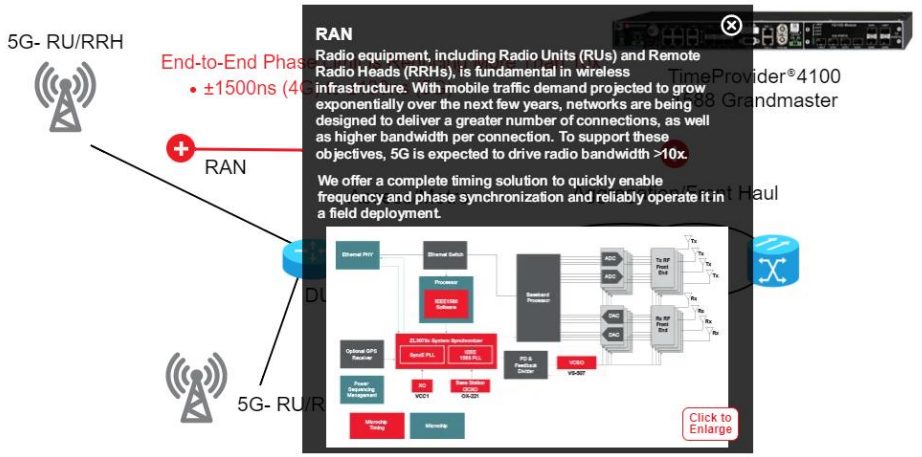
5G Timing Solutions Landing Page

microchip.com/5GTiming

- Interactive Network Diagram with links to best timing solutions
- Product selection tables tailored for 5G system requirements





Network Synchronization Products

We serve the 5G market with our leading-edge network synchronization timing IC and

Oscillators

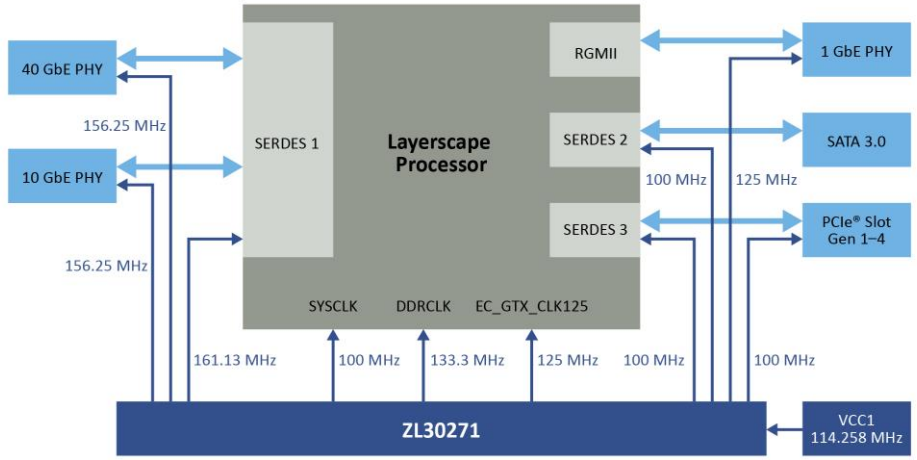
We offer the most complete line of oscillator timing solutions with best-in-class phase noise, stability, operating temperature and

Clock Management Products

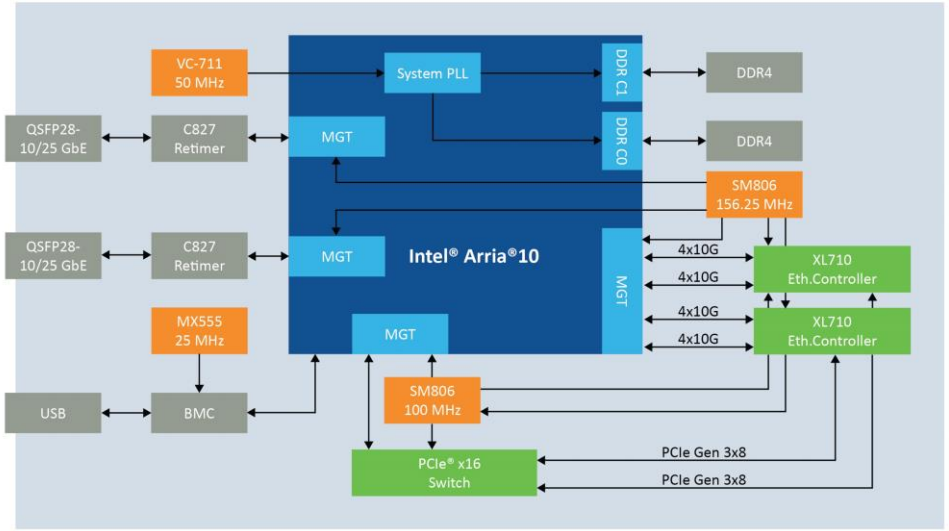
Our broad portfolio of clock generation, buffer and jitter attenuator products combines ultra-low jitter generation,

Typical Reference Clock Frequency for Comm

Protocol	Typ. Freq.	OX	CLK Gen	Jitter Atn.
PCI Express	100 MHz	MX55/57 VC-711 MX77 VC-830	ZL3025x ZL3026x SM803 SM806	ZL30253 ZL30256 ZL3027x
DDR2/3 DDR4/5	200 MHz 300 MHz			
SAS/SATA	75/150MHz			
Serdes/2.5G, 5G Ethernet	125 MHz 156.25MHz			
CPRI	122.88 MHz			
Wireless BS	153.6 MHz			
SONET/SDH	155.52 MHz 311.04 MHz 622.08 MHz		ZL3025x ZL3026x SM803/806 ZL30270/1	
USB 2.0	40/48MHz CMOS	MX85	ZL30267	
USB 3.0	26MHz		ZL30267	



SmartNIC for Network Acceleration



Source: Ref guide with Intel, Xilinx , Broadcom and NXP

Clock and Timing for Data Center

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Timing for Data Center and Enterprise

Trend / Requirement	Microchip Timing Solution
PCIe Gen 5 interconnect speed needed for next generation applications and hardware	Oscillators, Clock generators and Clock Buffers that exceed PCIe Gen5 requirements giving extra system design margin
Reduced design risk and vendor count	Synergy with Datacenter PCIe switch and SAS controllers

NEW

Intel DB2000 Buffers

ZL4029x

- Intel-Qualified for next-gen data centers
- PCIe Gen 4- & 5-compliant
- Ultra-low additive jitter: 15 fs typical

PCIe Gen4/5 MEMS Oscillator

DSC1203/04

- Smallest package size: 2.5x2.0 mm
- PCIe Gen 4- & 5-compliant
- Wide temp range: -40 to 105°C

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PCI Express® Market Landscape

- PCIe has been widely adopted as a popular high-speed serial interface in computing, consumer, and communications markets
- Available in most processors, FPGAs, SoC's, and chipsets
- Most applications require a timing product


Enterprise Computing

- Server
- Storage
- Datacenter
- Workstation
- SSD Memory
- Cloud Computing


Communications

- Access Points
- Routers
- Line Cards
- Switches
- Hubs
- SOHO


Consumer/Embedded

- DTV
- STB/BDR
- Gaming
- Printer
- Audio/Video
- Gateways

www.microchip.com/timing/PCIe

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PCIe Timing Overview & Tools

Increasing

PCIe® Version (Year Introduced)	Maximum Allowed PCIe Post-Filtered Jitter Measured in the [fs, rms]
2.0 (2007)	3100
3.0 (2010)	1000
4.0 (2017)	500
5.0 (2019)	150
6.0 (2021)	100

Decreasing

- **TCG Cross Reference**

Search Result for "": Records 3576 to 3577 of 3577 Back to Search

Competitor Part	Competitor	Microchip Part	Cross Type
LMK00304	TI	ZL40234	Pin-to-Pin
853S111	IDT	ZL40260	Pin-to-Pin

« first ‹ previous ... 136 137 138 139 140 141 142 143 **144**

Search Result for "9FG430": Records 1 to 2 of 2 Back to Search

Competitor Part	Competitor	Microchip Part	Cross Type
9FG430/830	IDT	DSC557-03	Functional
9FG430	IDT	DSC557-03	Functional

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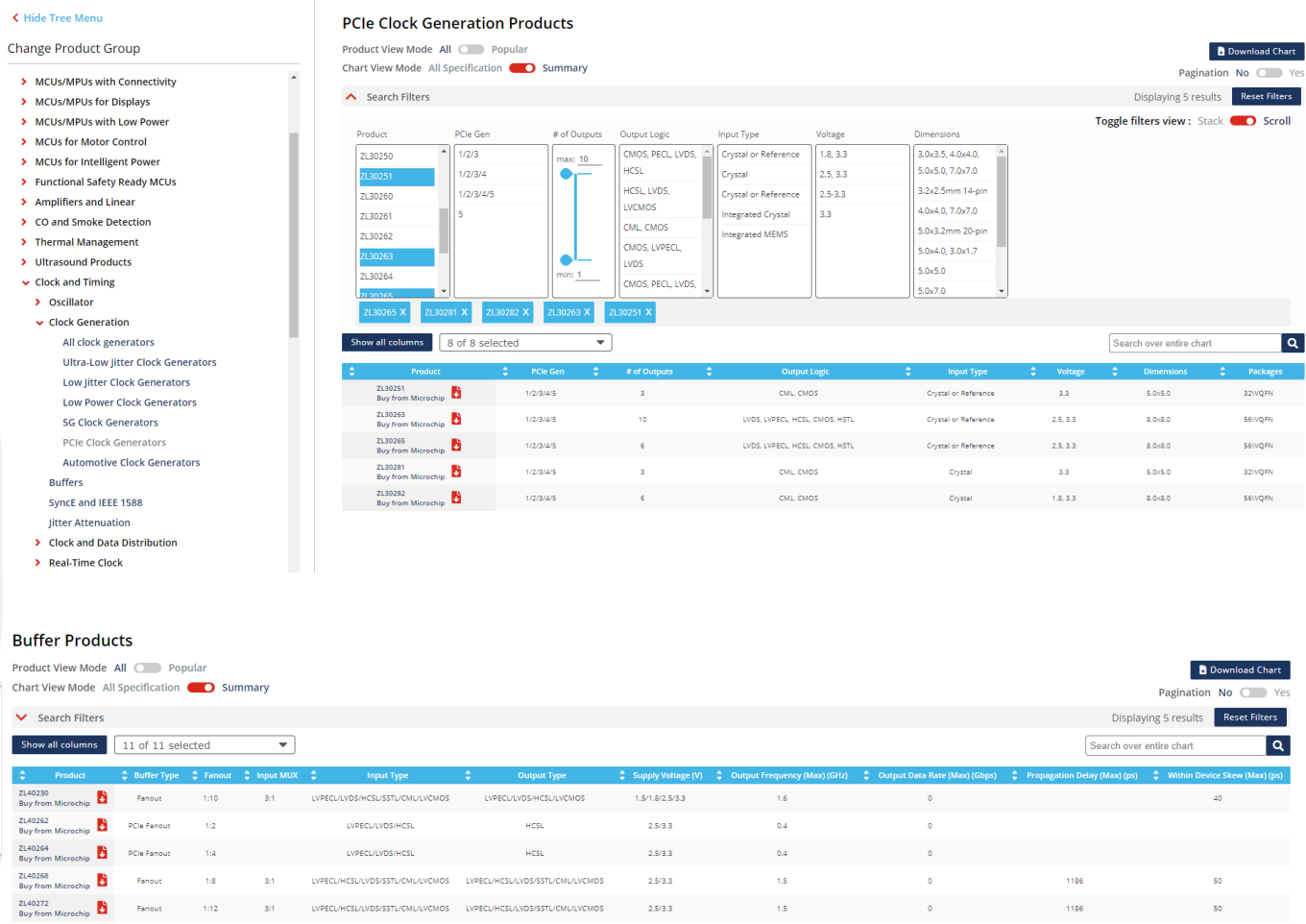
- **Product Parametric Search**



Microchip Proprietary and Confidential

Total System Solutions for Data Center

MCU8
MCU32
WSG
UNG
TCG
APID
CPG
DCS
MSLD

Front Panel

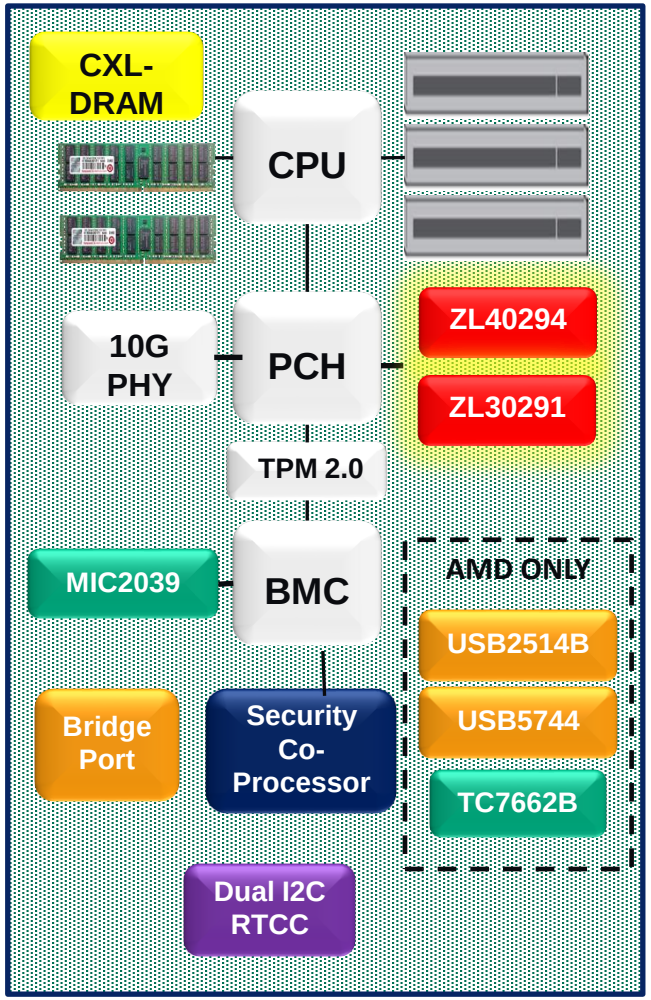
Quick Sync 2

WILC3000
SAMS70

OR

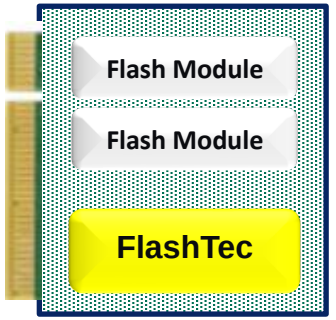
Display

Motherboard

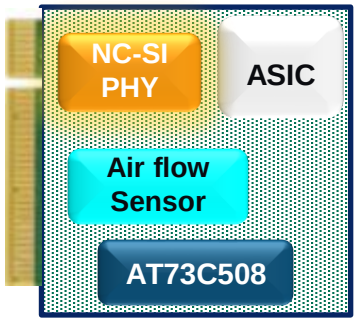


PCIe Cards

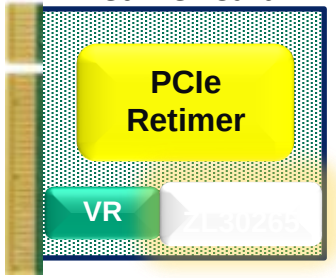
Boot Drive



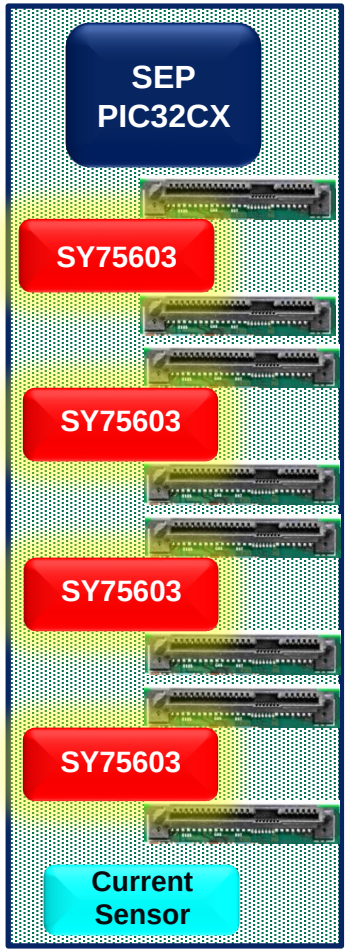
NIC Cards



Retimer Card



Backplanes



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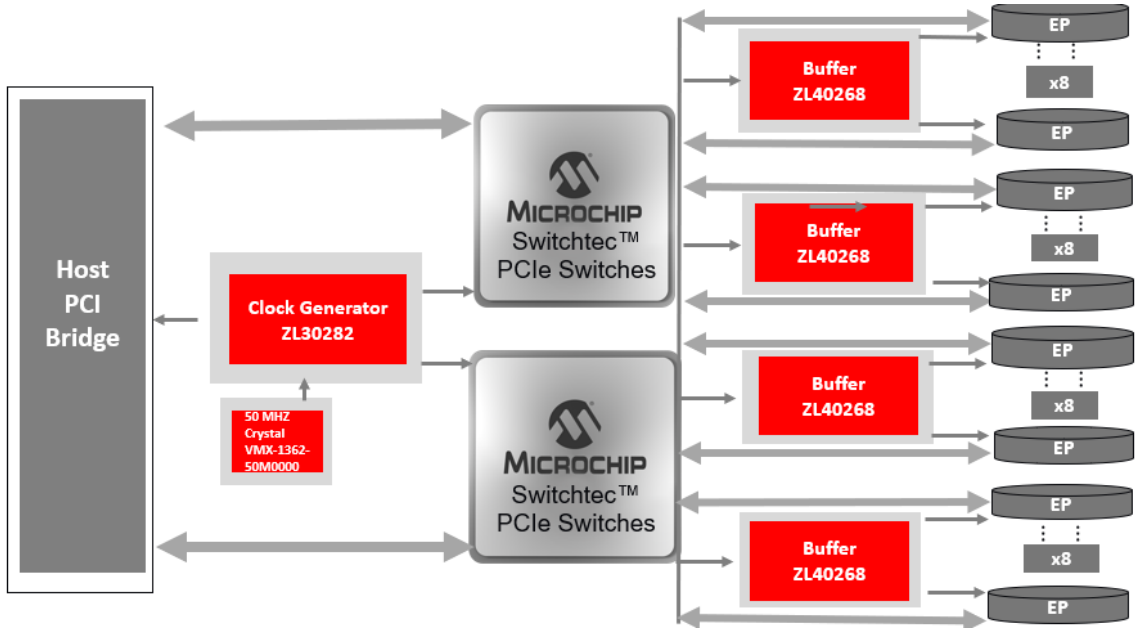
PCIe Switchtec Reference Designs

- **Clock Generators for Switchtec PCIe Switches**
  - Approved and pre-configured timing solutions for use with Switchtec devices reducing design risks:
    - Saratoga PCIe Gen 3 -- **ZL30281LDG1**
    - Trident PCIe Gen 4 -- **ZL30265LDG1Q033**
    - Harpoon PCIe Gen 5 -- **ZL30265LDG1Q05N**
    - PCIe Gen 5 Clock Gen -- **ZL30282LDG1**
    - PCIe Gen 5 MEMS OSC -- **DSC1123DI2-100M0000**



Timing solutions PCIe Switches

- **Buffers for Switchtec PCIe Switches**
  - PCIe Gen 1-5 LPHCSSL buffers with superior Jitter performance, on chip termination saves boards space and gives extra timing margin.
    - **ZL4029x** 20 output LPHCSL output buffers
    - **SY756xx** Series of PCIe Gen 1-5 LPHCSL buffers 2, 4, 8 and 12 outputs with on chip termination
  - Waverider Retimer: **ZL30265LDG1Q03V**

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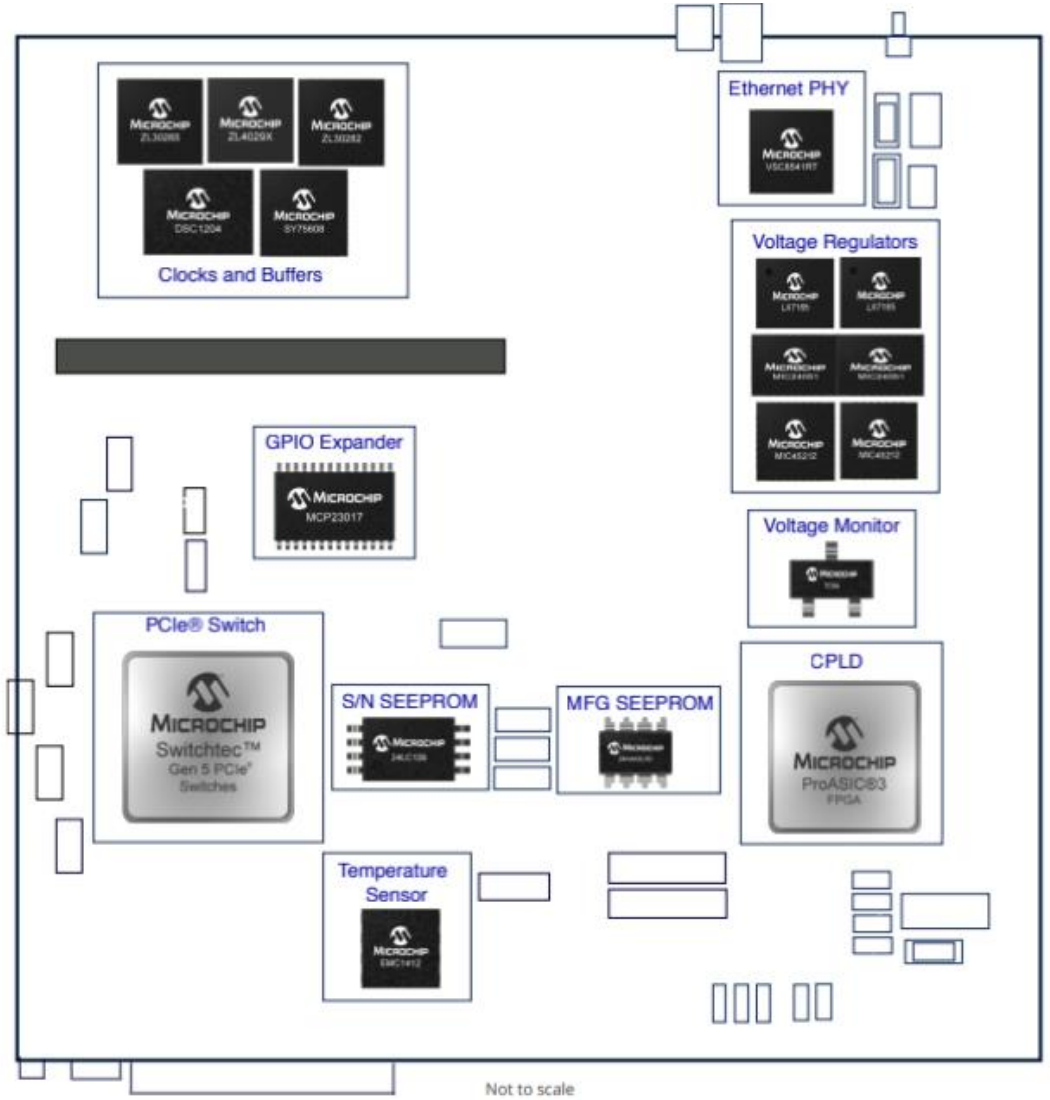
Total System Solution: Gen 5 Reference Design



Reference Design Component	Microchip Component
Aux Clock Source	Microsemi ZL30265
Reference Crystal for Clock source	Microsemi VXM7-1362-50M000000
DUT Clock Fanout	Microsemi ZL40293
Serial EEPROM	Microchip 24LC128
Electronic Serial Number (Board)	Microchip 24AA02UID (2 kbit)
Temperature Sensor	Microchip EMC1412
Ethernet PHY	Microsemi VSC8541XMV-01
Reference Crystal for Ethernet phy	Microsemi VXM7
CPLD	Microsemi ProASIC3L
FPGA	A3PE3000L-FG896
Reset Monitor	Microchip MIC6315
Regulator - VDDO	Microchip MIC24051
Regulator - 3.3V	Microchip MIC45212
Regulator - FPGA	Microchip MIC24051
Regulator - Ethernet	Microchip MIC24051
Analog-Digital Converter	Microchip PAC1934
Voltage Reference	
Current Sense Amplifier	

Link to reference design:

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New Timing for Intel Data Center Roadmap

New

Coming Soon

DB2000 Buffer (ZL4029x)

- 20 LPHCSL output buffer
- PCIe Gen 4- & 5-compliant
- Ultra-low additive jitter: 15 fs typical for extra margin
- **In Production**

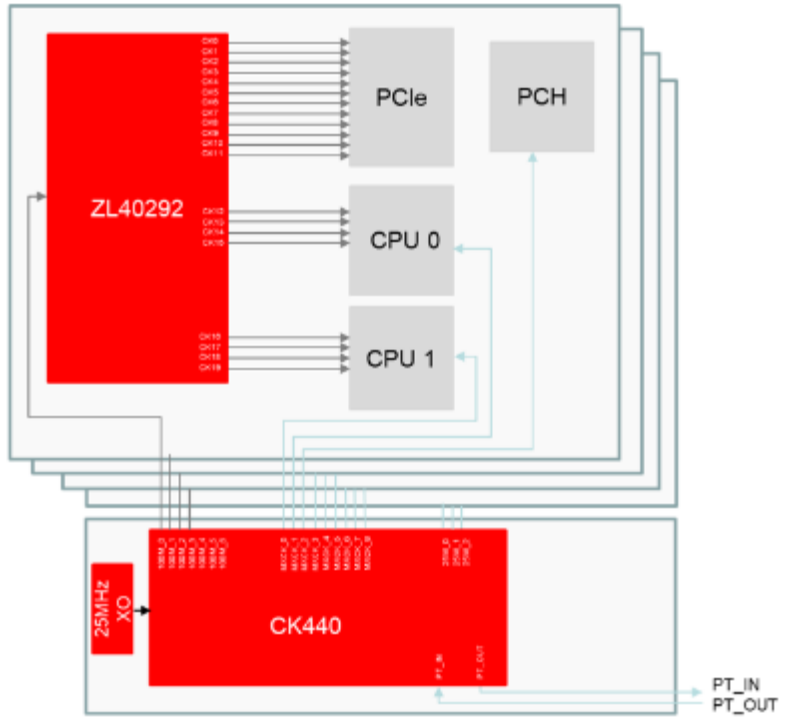
CK440 Clock Generator (ZL30291)

- 19 LPHCSL output clock gen
- Generates PCIe (100MHz) and Platform Timing (25MHz)
- Jitter less than 40 fs
- VXM7-9039-25M000 Reference
- **Samples Now, RTP Q4 CY21**

Whitley platform - PCIe 4
- Cooper Lake (14nm)
- Ice Lake (10nm)
- **DB2000** Revenue Ramp

Eaglestream platform – PCIe 5
- Sapphire Rapids (10nm)
- Granite Rapids (7nm)
- **CK440** target

The Intel Skylake platform introduced scalability allowing multiple processors to be meshed in 2/4/8 device topology for increased computing power



Server with eight Sapphire Rapids CPUs showing CK440+DB2000 can address these meshed architectures

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Message: ZL30291 Order/Sample before RTP

NEW

- **Blue Book**
  - Expectations are that our team will be communicating with Intel early in August to achieve Blue Book status by the end of Oct.

- **Pre-Rel Samples**
  - **For small quantities (<500 units)**
    - We will continue to support small quantity samples (LDG1s) at no cost (UNC) to continue to secure sockets and wins
  - **For larger quantities (>500 units)**
    - We will allow both LDF1 and LDG1 orders to be supported with USC orders in conjunction with a waiver supported by a near REL test program

Complete PCIe Clocking Solutions

	1-Output	2-Output	3-Output	4-Output	6-Output	8-Output	10-Output	12-Output	20-Output
PCIe Clock Generators	Microchip PL602-2x Gen 2 • 6-SOT/8-SOP • 2.5V ~ 3.3V • 25/ 100/ 125/ 200MHz	Microchip SM802181 G4 • 16-QFN • 3x3.5mm • 100MHz Microchip SM806031 G5 • 24-QFN • 4x4mm • 100MHz	Microchip SM806032 Gen 5 • 48-QFN 7x7mm • 2.5V ~ 3.3V • 100MHz	Microchip PL602041 G4 • 24-QFN • 25/100/ 125/200 Microchip SM806033 G5 • 48-QFN • 100MHz	Microchip SM806034 G5 • 48-QFN 7x7mm • 2.5V ~ 3.3V • 100MHz	Microchip PL602081 Gen 4 • 44-QFN • 2.5V ~ 3.3V • 25/100/125/200			
PCIe Clock Generators with SSC			Microchip ZL30281 Gen 5 • 32/56-QFN • 3/6 Outputs • Programmable SST	Microchip PL60704x Gen 4 • 24-QFN, 2.5V ~ 3.3V • 25/100/125/200 • Programmable SST	Microchip ZL30265 ZL30282 Gen 5 • 56-QFN • Ind Output Enable • 170fs Phase Jitter • Programmable SST	Microchip PL60708x Gen 4 • 44-QFN, 2.5V ~ 3.3V • 25/100/125/200 • Programmable SST	Microchip ZL30267 Gen 5 • 56-QFN • Ind Output Enable • 170fs Phase Jitter • Programmable SST		Microchip ZL30291 Gen 5 • 40fs Phase Jitter • **CK440** Compliant
Crystal-Less PCIe Clock Generators	Microchip DSC1224 Gen 5 • 6-pin DFN, 2.5x2.0mm • 2.5V ~ 3.3V • 100-460MHz	Microchip DSC557-03 Gen 4 • 14-QFN • 2.5V ~ 3.3V • 100-460MHz	Microchip DSC557-04 Gen 4 • 14-QFN • 2.5V ~ 3.3V • 100-460MHz	Microchip DSC557-05 Gen 4 • 20QFN • 2.5V ~ 3.3V • 100-460MHz	Microchip MX875BB0023 Gen5 • 48-QFN 7x7mm • 2.5V ~ 3.3V • 100MHz				
PCIe Buffers LPHCSL		Microchip SY75602 SY75603 Gen 5 • 16-QFN, 1.8V ~ 3.3V • Ind Output Enable • 24fs Additive Phase Jitter		Microchip SY75604 Gen 5 • 16-QFN, 1.8V ~ 3.3V • Ind Output Enable • 24fs Additive Phase Jitter		Microchip SY75608 Gen 5 • 48-QFN, 1.8V ~ 3.3V • Ind Output Enable • 24fs Additive Phase Jitter		Microchip SY75612 Gen 5 • 56-QFN, 1.8V ~ 3.3V • Ind Output Enable • 24fs Additive Phase Jitter	Microchip ZL4029x Gen 5 • 72/80-QFN • Ind Output Enable • 15fs Additive Phase • **DB2000** Compliant

Automotive Qualified Versions Available

NEW

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Clock and Timing for Automotive

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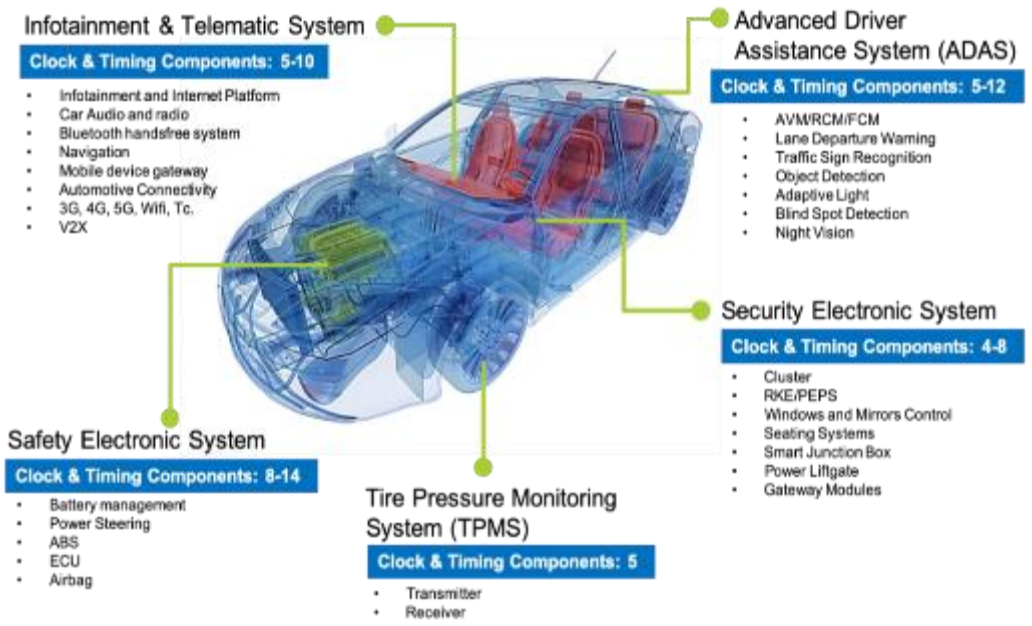
Timing for Automotive

Trend / Requirement	Microchip Timing Solution
Increasing demand for timing components driven by autonomous driving and in-cabin experience	Broad automotive timing portfolio including Oscillators, Clock Generators and Buffers, AEC-Q100 qualified for automotive grade 1 and 2 up to 125ºC
ADAS sensors need compact and robust clock source	MEMS oscillator offer smallest package size and best shock and vibration resistance
Next level Autonomous driving requires more complex clock tree and lower jitter reference clock	Automotive grade clock generator and buffer products support high frequency differential clock that meet PCIe Gen 4 requirement



NEW

Crystal-less MEMS Clock Generator

DSA400

- Multiple clock outputs with no external crystal
- Robust performance in harsh environments
- PCIe Gen1/2/3/4
- AEC-Q100 qualified -40 to 105°C

CMOS Clock Buffers

PLA133

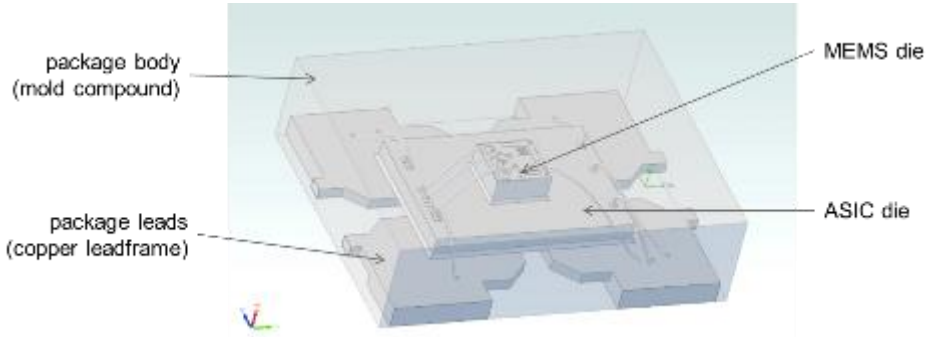
- 4, 6 and 9 output buffers with low additive jitter
- AEC-Q100 qualified -40 to 125ºC
- Leaded and wettable flank packages for reliable soldering

Automotive MEMS Oscillators / Clock Generators

- **Problem:**
  - Increasing silicon content within cars has increased the number and complexity of timing components required. Reliability is critical, board space is limited
- **Solution:**
  - MEMS offers far superior performance in harsh environments across wide temperature range both for Frequency stability and reliability

MEMS Advantages

- Rugged - 50k G Shock / 70 G vibration
- Reliable – AEC-Q100 automotive grade 1
- Stable –
  - ±10 ppm over -40 to 105°C
  - ±20 ppm over -55 to 125°C
- Small - 1.6x.12mm CMOS / 2.5x2.0mm Differential
- Flexible – Any-rate frequency output
- Fast - 48hrs Sample / 4 - 6 weeks production



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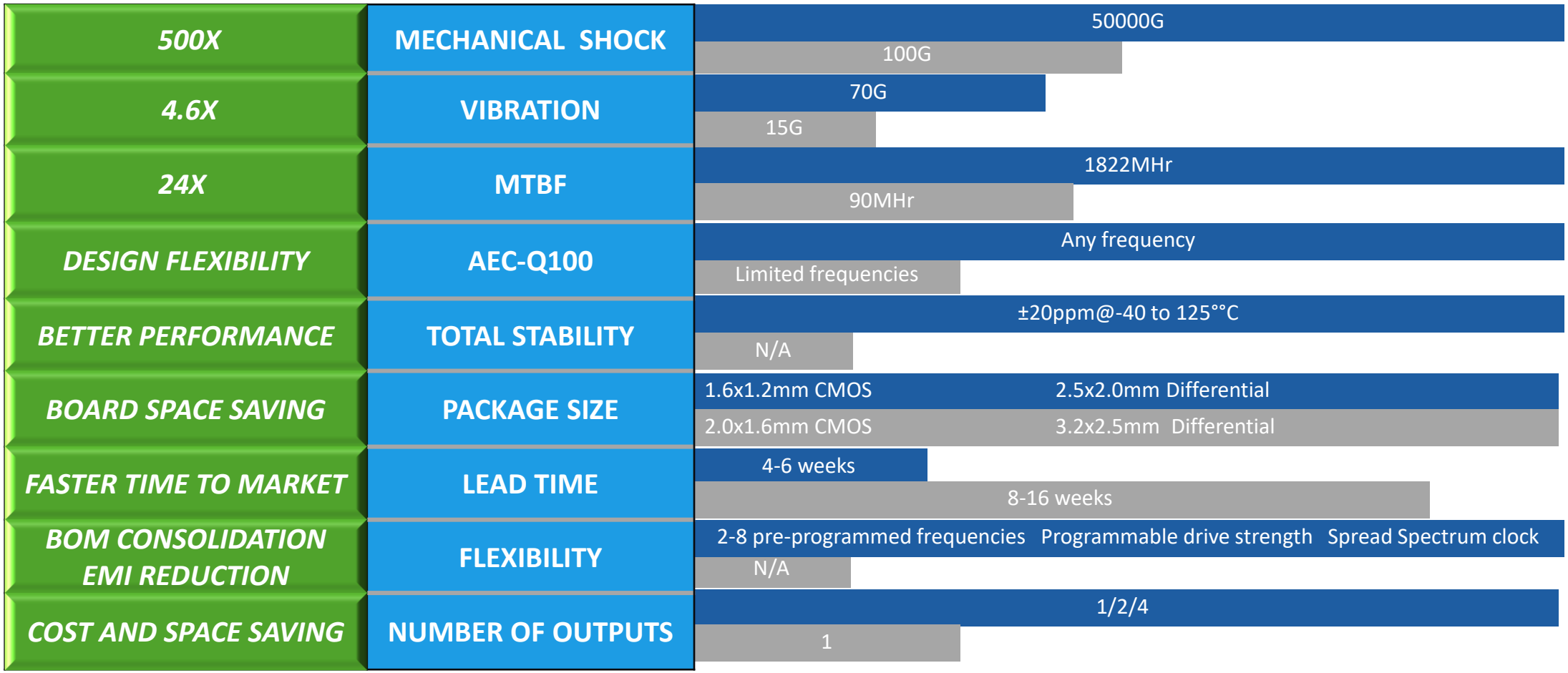
Higher Reliability and Flexibility over Quartz



Broad Automotive MEMS Portfolio

Automotive G1: -40 to 125°C
Automotive G2: -40 to 105°C

Low Power Oscillator

~1.3 mA
1.6x1.2mm Package
1.8-3.3V Supply Voltage

DSA1001/3/4
(CMOS)
1-150MHz
AEC-Q100 Automotive G2

DSA6xxx
(CMOS)
0.002-100MHz
AEC-Q100 Automotive G1

DSA15xx
CMOS~1ps Phase Jitter
1MHz-170MHz
AEC-Q100 Automotive G1

Low Jitter Oscillator

~0.65ps rms Phase Jitter (12k-20MHz)
2.5-3.3V Supply Voltage

DSA1101/21/05/25
(CMOS)
2.3MHz-170MHz
AEC-Q100 Automotive G1

DSA1103/23/04/24
Differential
2.3MHz-460MHz
AEC-Q100 Automotive G1

DSA12x1/x3/x4/x5
CMOS/ Differential
2.3MHz-450MHz
AEC-Q100 Automotive G1

Spread Spectrum Oscillator

~4mA,
±2.0% to -3.0% SST
up to 15dB EMI reduction
1.8-3.3V Supply Voltage

DSA63xx
(CMOS)
1-100MHz
AEC-Q100 Automotive G1

Crystal-less Clock Generator

Up to 4 Outputs
Any Output Format
LVPECL/LVDS/HCSL/ CMOS

DSA2311
2 CMOS Outputs
2.3-170MHz
AEC-Q100 Automotive G1

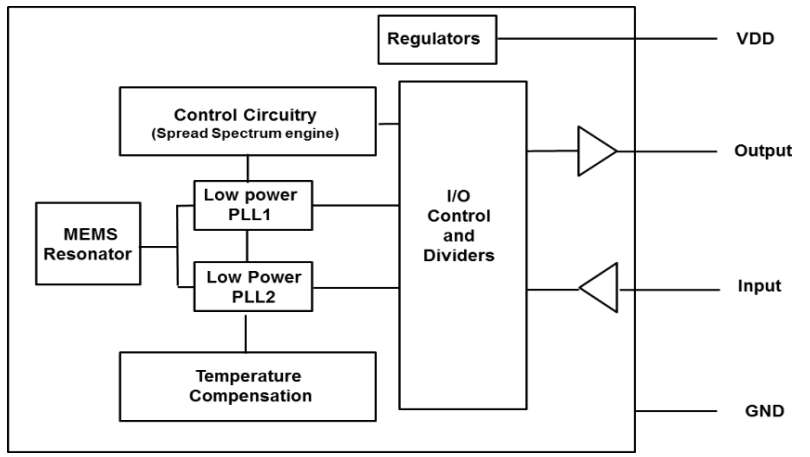
DSA557-03/04/05
2-4 100MHz HCSL/LVDS
14-pin 3.2x2.5/20-pin, 5.0x3.2
AEC-Q100 Automotive G2

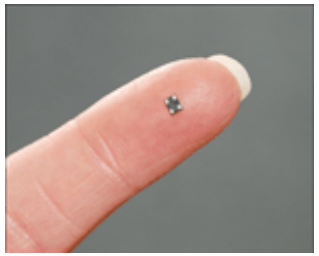
DSA612/613
2 /3 CMOS Outputs
2kHz -100MHz, 1.6x1.2mm
AEC-Q100 Automotive G1

DSA400
4 Any Format Outputs
2.3-460MHz
20-pin, 5.0x3.2
AEC-Q100 Automotive G2

MICROCHIP

DSA6000 Family: Ultra-Low Power Oscillators





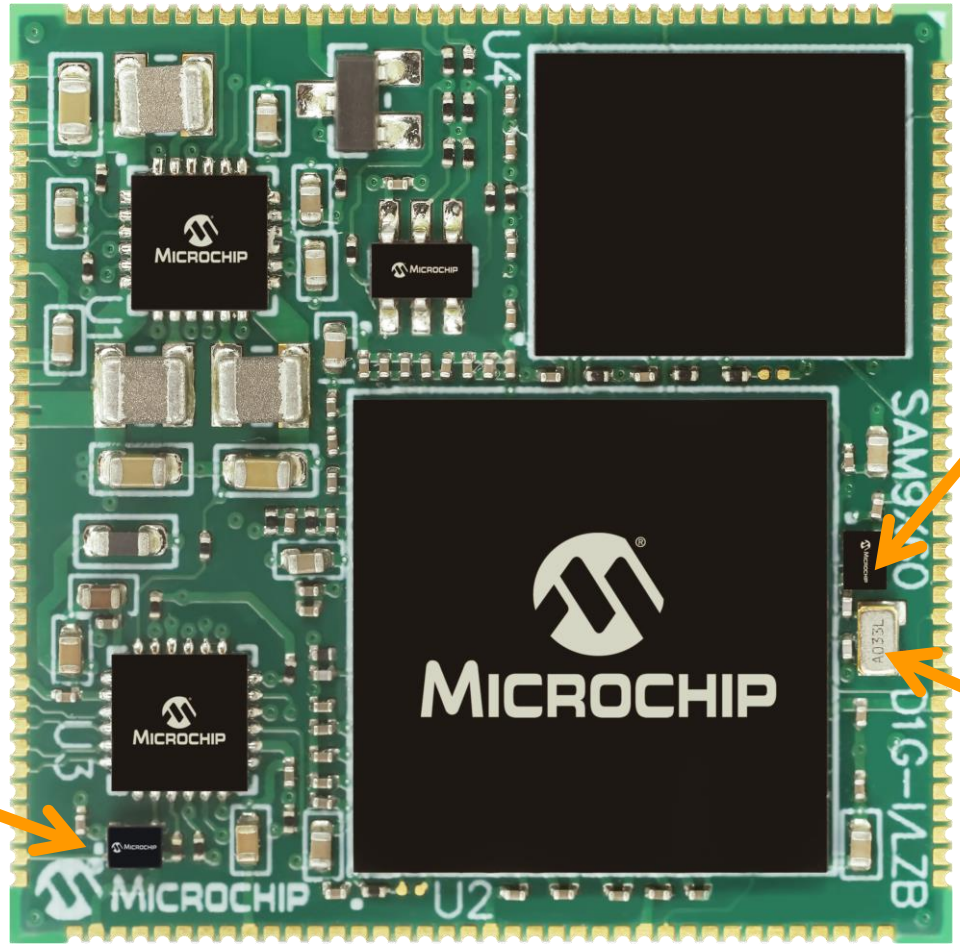
- Output frequency range: 2k~100MHz (include 32.768KHz)
- Ultra-low power consumption:
  - ~1mA (active), ~10uA (standby)
- Ultra-small package size:
  - 1.6x 1.2mm, 2.0x1.6mm, 2.5x2.0mm, 3.2x2.5mm
- Wide temperature range: -40°C to 125°C
- High stability: ±15/25/50ppm
- Supply voltage: 1.8/2.5/3.3V
- Fast startup time: 1.3ms
- Supports Spread Spectrum ±0.25 to ±2.5% , FS, OE functions
- Package: 3.2x2.5mm, 2.5x2.0mm, 2.0x1.6mm, 1.6x1.2mm

Key Features	Benefits to system
• Ultra-low power, low voltage operation	• Extends battery life / Green initiative
• Smallest package size	• Saves board space
• Spread Spectrum/FSEL function with fast start up time	• EMI reduction • Flexible system design • Supports quick wake up or deep sleep

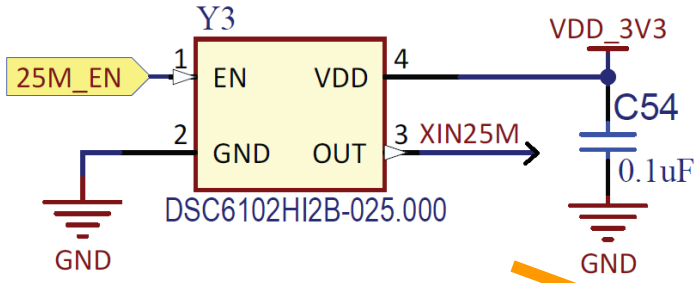
MICROCHIP

Total System Solutions

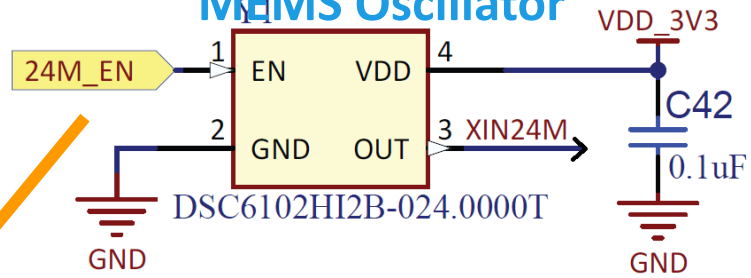
Clock Generation Implementation



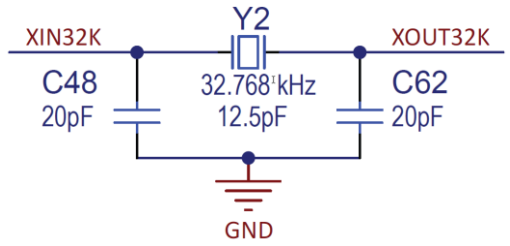
Ethernet PHY Clock
25 MHz
MEMS Oscillator



MPU Clock
24 MHz
MEMS Oscillator



RTCC
32.768 kHz
Crystal



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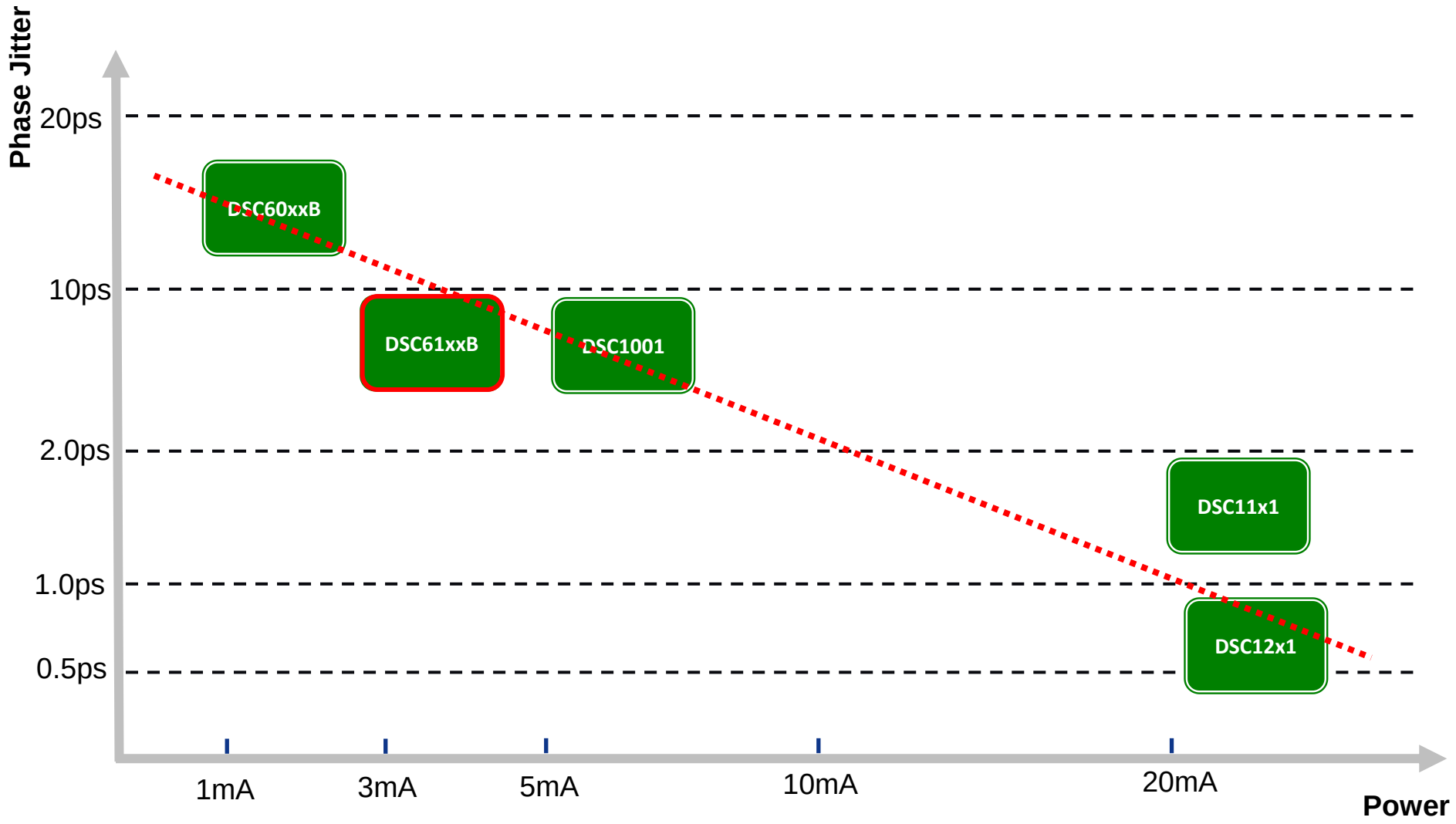
LVCOMS MEMS Osc. Jitter vs Power



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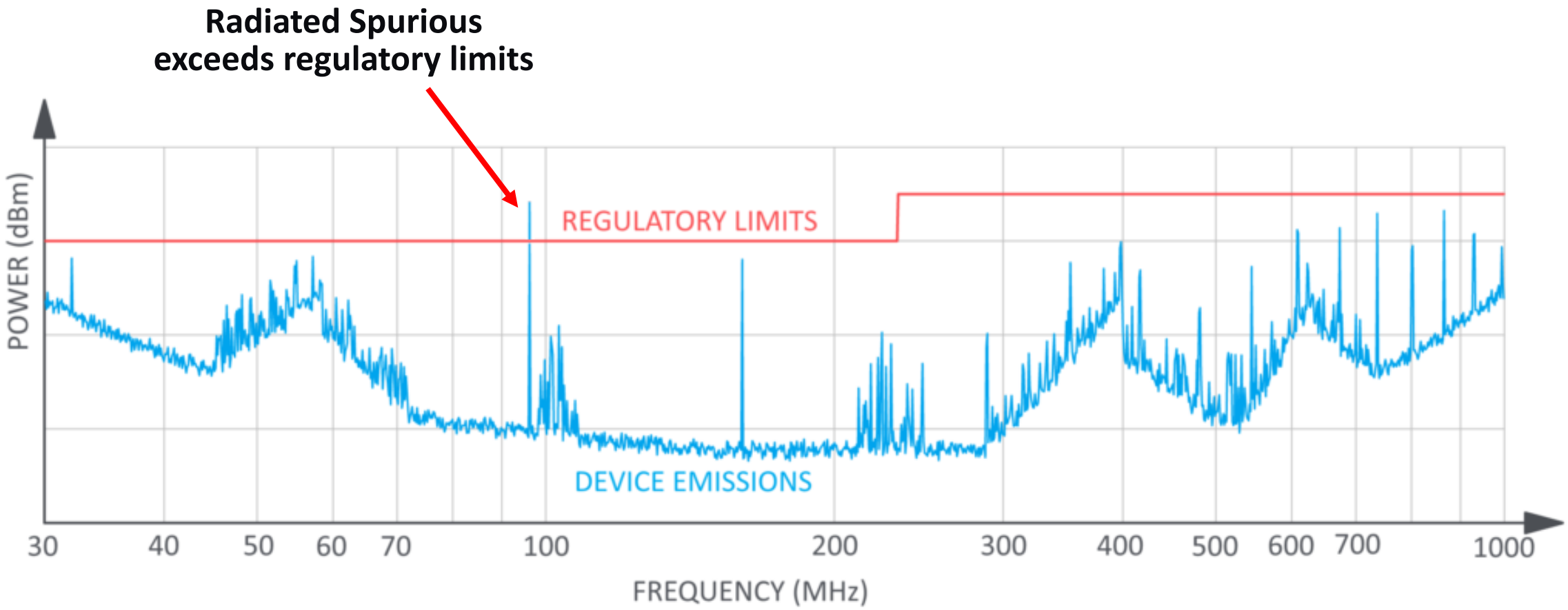
Facilitate EMC Certification

Using Spread Spectrum



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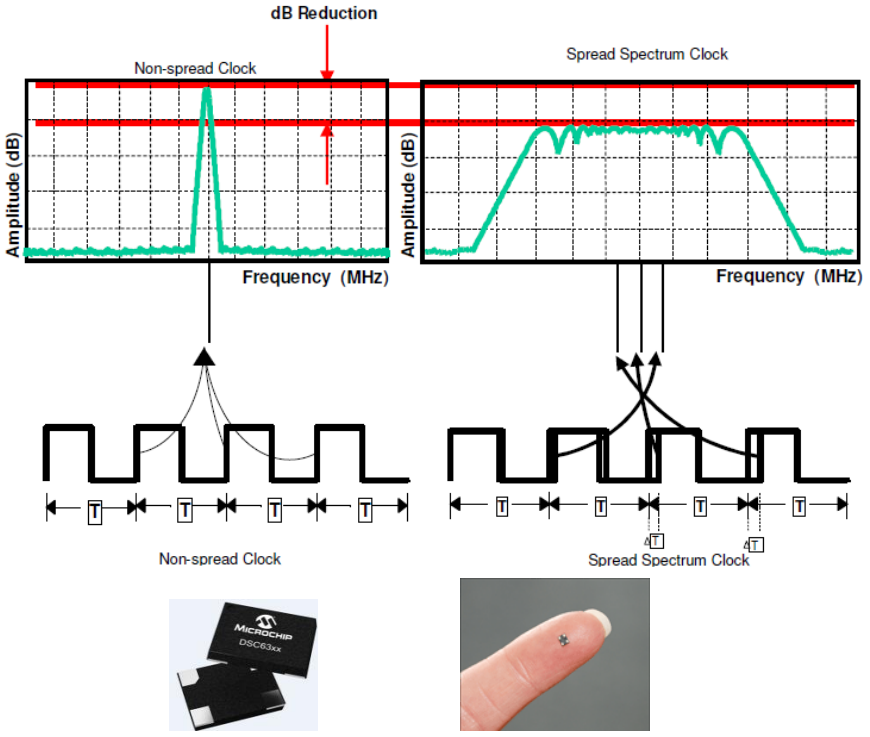
DSA63xx Spread Spectrum Oscillators

Standard pin out with spread spectrum clock output for EMI reduction



- Spread spectrum supports
  - ±0.25 to ±2.5% center spread
  - -0.5% to -5% down spread
- Enable/disable spread spectrum from pin1
- Output frequency range: 1MHz - 100MHz
- Ultra-low power consumption:
  - ~3mA (active), ~1uA (standby)
- Ultra-small package size:
  - 1.6x 1.2mm, 2.0x1.6mm, 2.5x2.0mm, 3.2x2.5mm
- Pin 1 supports spread enable/disable input
- Supply voltage: 1.8/2.5/3.3V
- Wide temperature range: -40ºC to 125ºC

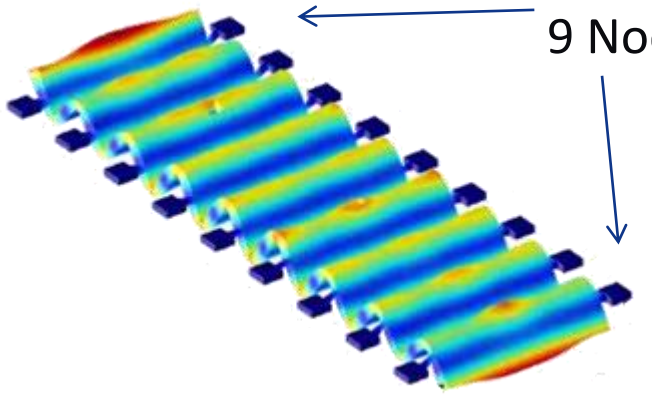
Key Features	Benefits to system
• Center/ down Spread Spectrum up to 3%	• EMI reduction in wide applications
• Standard oscillator pin out with spread spectrum on/off control pin	• Reduce EMI without board modification and addition component
• Smallest package size 1.6x1.2mm	• Saves board space

MICROCHIP

Low-Power Low-Jitter MEMS Oscillator

NEW

DSC1500



Key Features

- Any frequency between 2.3MHz to 170MHz
  - 2.3MHz to 125MHz for 1.8V
- LVCMOS output with 3 drive strength options
  - For signal integrity and EMI control
- **1ps RMS** phase jitter with only **6.5mA** power
- 1.8V or 2.5V to 3.3V supply voltage
- Excellent total stability as low as ±20ppm
- Wide operation temperature: -40°C to 125°C
- Standby enable input for longer battery life
- Fast Startup time (2.5ms)
- Industry standard packages:
  - 7.0x5.0, 2.5x2.0, 2.0x1.6mm
  - 5.0x3.2 and 3.2x2.5 soon will also be available
- Automotive grade DSA15xx available in Q1 2023

Applications

- MCU, FPGA reference clock
- USB, SATA, SAS Reference Clock
- 100M/1G/10G Ethernet Clock

- Drop-in Replacement to standard Oscillators like Epson SG-210 and SiTime SiT1602B

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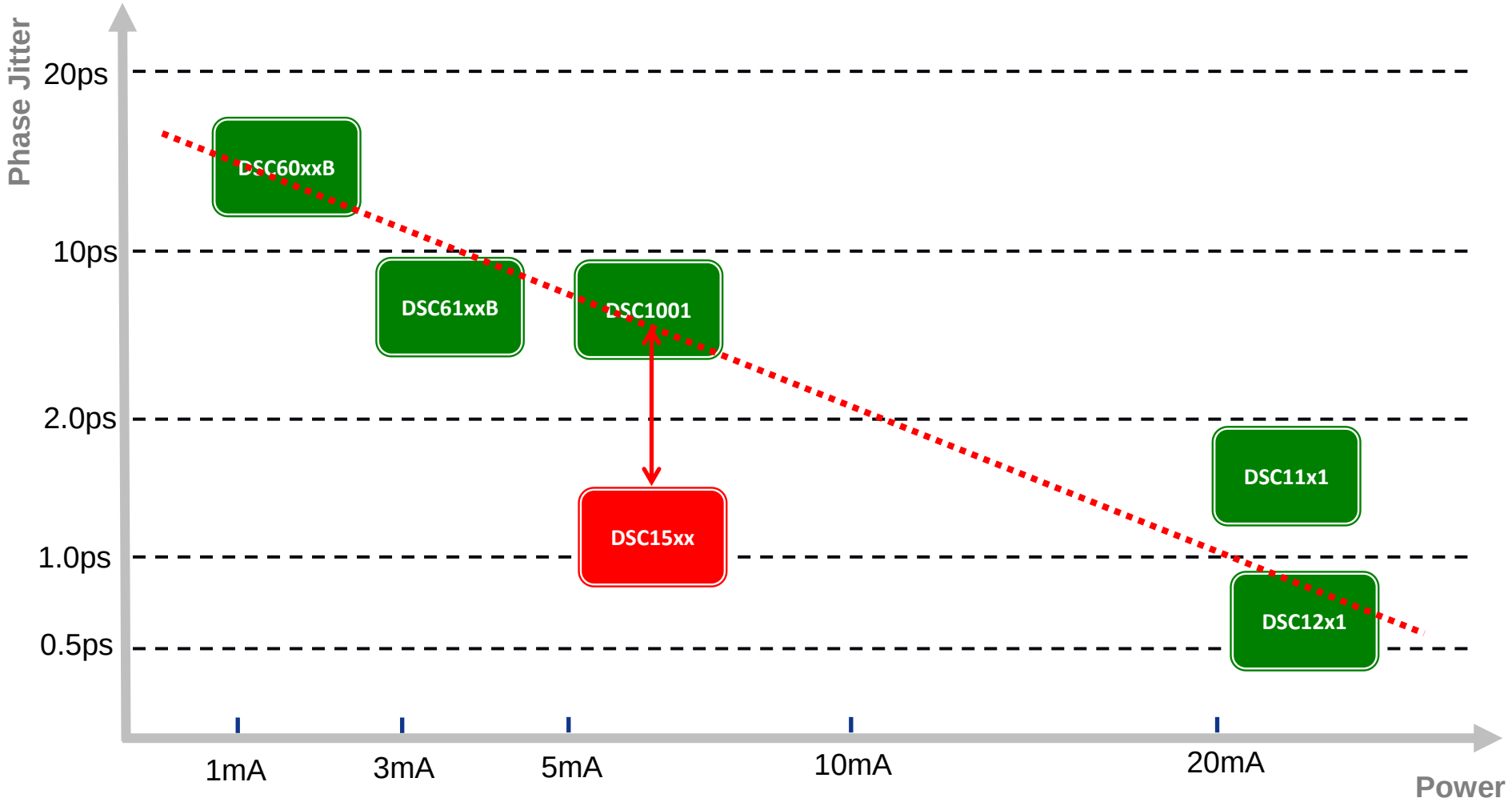
DSC1500 Jitter Performance

Lowest Power per Jitter Suppression Proportion



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Thank You