

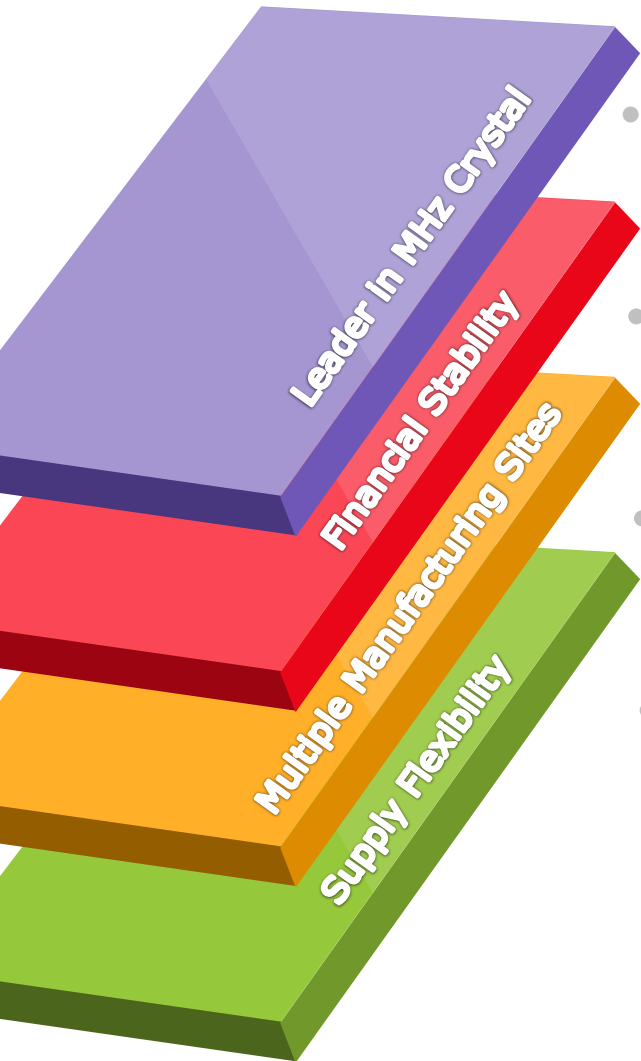


Company Overview

Q3 2019



TXC Competitive Advantages



No. 1 Largest Supplier in MHz Crystal for 7 Consecutive Years and Leading Edge Technology in Crystal Miniaturization.



Out of Top 5 Ranking Suppliers TXC is the only Profitable and Financially Healthy with Organic Growth without acquisitions.



TXC Manufactures MHz Crystal in all three manufacturing facilities to offset potential impacts caused by natural disasters.



Quick response and fulfillment to customer requirements

No. 1 Largest Supplier in MHz Crystals

TXC is Currently the No. 1 Largest Suppliers in the World for MHz Crystal alone.

No. 1 Largest Supplier Outside Japan

TXC is Currently No. 1 Largest Supplier in Frequency Control Products outside of Japan and introduced healthy competition into the Frequency market.

TXC over 36 years **in Timing Industry**

Facts

- **Founded in 1983**, Headquarters in Taiwan
- **Listed in Taiwan Stock Exchange**, 2000
- **Ranked No. 4 in Worldwide Timing Market**, CS&A 2012 ~ 2018
- **Ranked No. 1 in Worldwide MHz Crystal Market**, CS&A 2012 ~ 2018
- **Preferred Supplier for Tier 1 in Network and Telecom Markets**, 2008 ~ 2019
- **Steady Growth in Automotive Market, 11% CAGR**, 2018
- **Smallest and Innovative Sensors Integration by Ceramic Packaging**, 2013
- **Market Leader in Product Miniaturization**, 2012 ~ 2019

Mission

To achieve a **Win-Win-Win** partnership
in the **Supplier-TXC-Customer** relationships

Worldwide Timing Market Shares

Strong Market Penetration

Facts

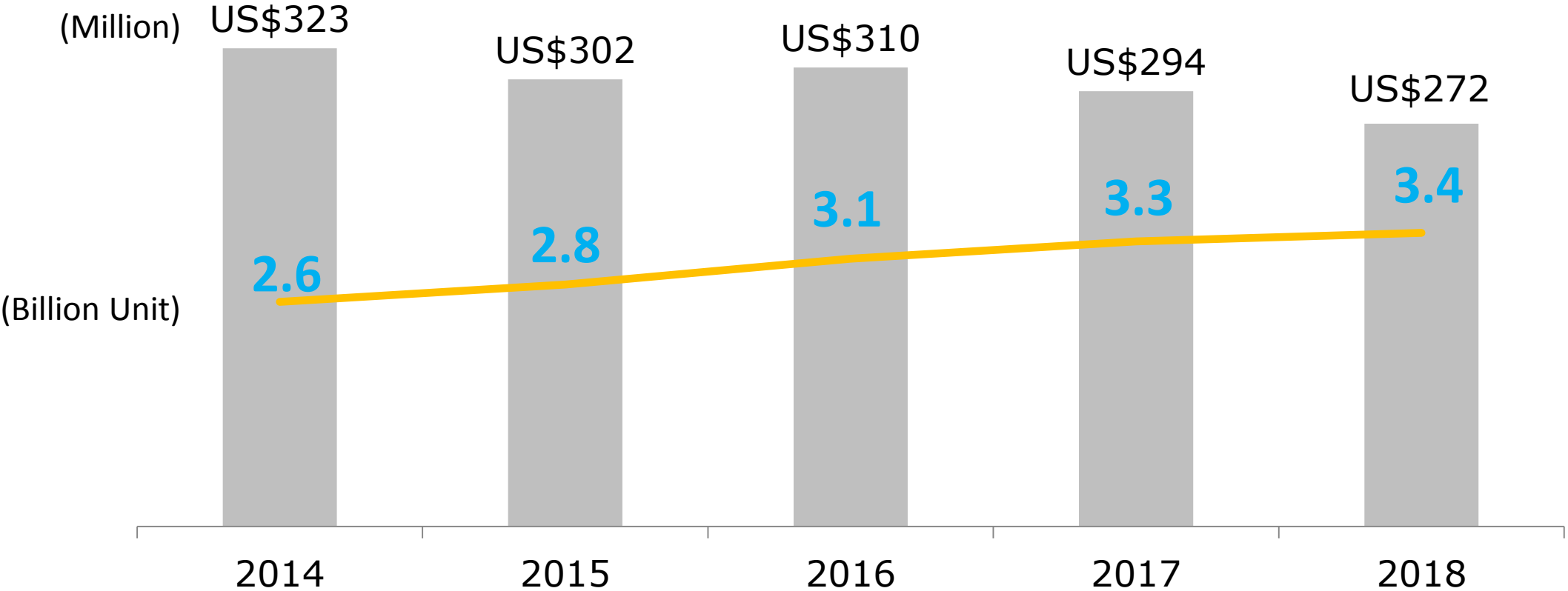
Source: CS&A 2019

2017 Rank	2018 Rank	Company Name	Revenue(M)			Market Share(%)	
			2017	2018	Percent Change	2017	2018
1	1	Seiko Epson	382	365	-4.6%	11.7%	11.7%
2	2	NDK	354	358	1.2%	10.8%	11.5%
3	3	KCD	344	285	-17.2%	10.5%	9.1%
4	4	TXC	294	272	-7.5%	9.0%	8.7%
5	5	KDS	205	191	-6.9%	6.3%	6.1%
6	6	Microchip (Vectron)	168	176	5.0%	5.1%	5.7%
9	7	Murata	100	94	-6.0%	2.1%	3.0%
9	8	Hosonic	98	94	-4.1%	3.0%	3.0%
10	9	Harmony	98	92	-6.0%	3.0%	2.9%
7	10	SIWARD	104	89	-14.4%	3.2%	2.9%
Other Companies			1123	1105	-1.6%	35.3%	35.4%
Total Revenue			3271	3122	-4.5%	100.0%	100.0%

Sales & Shipping Records

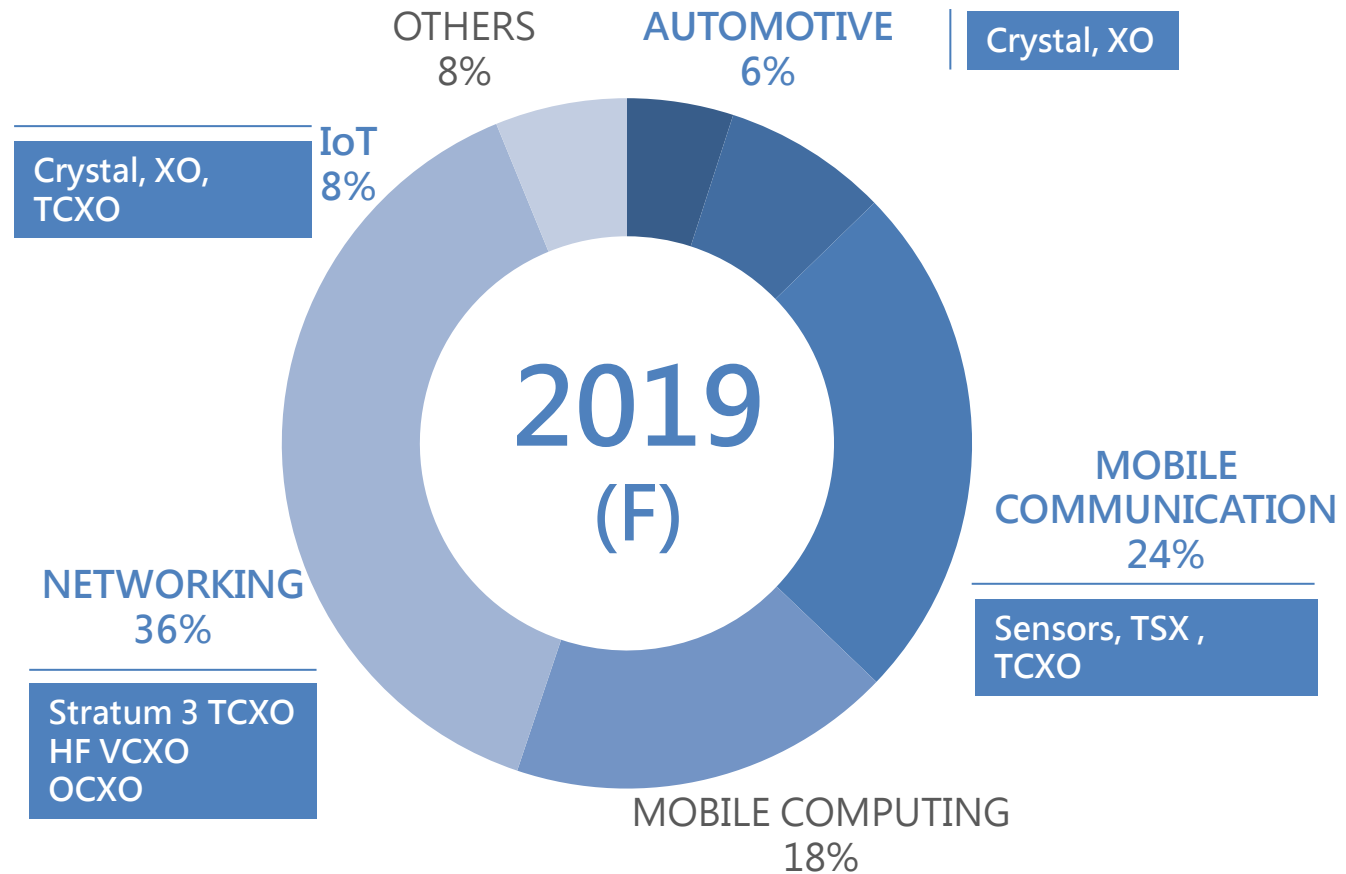
Steady and Organic Volume Growth

Facts



Sales by Segments

Actual and Forecast (F)



Sales & Labs

Localized Service, Responsive and Dedicate



Manufacturing Facilities

Economy of Scale Productions

1991



- MHz Crystal

- TSX

- OSC

- TCXO

- VCXO

- OCXO

- Sensors (10M/m)

1999



- kHz/MHz Crystal

- TSX

- OSC

2013

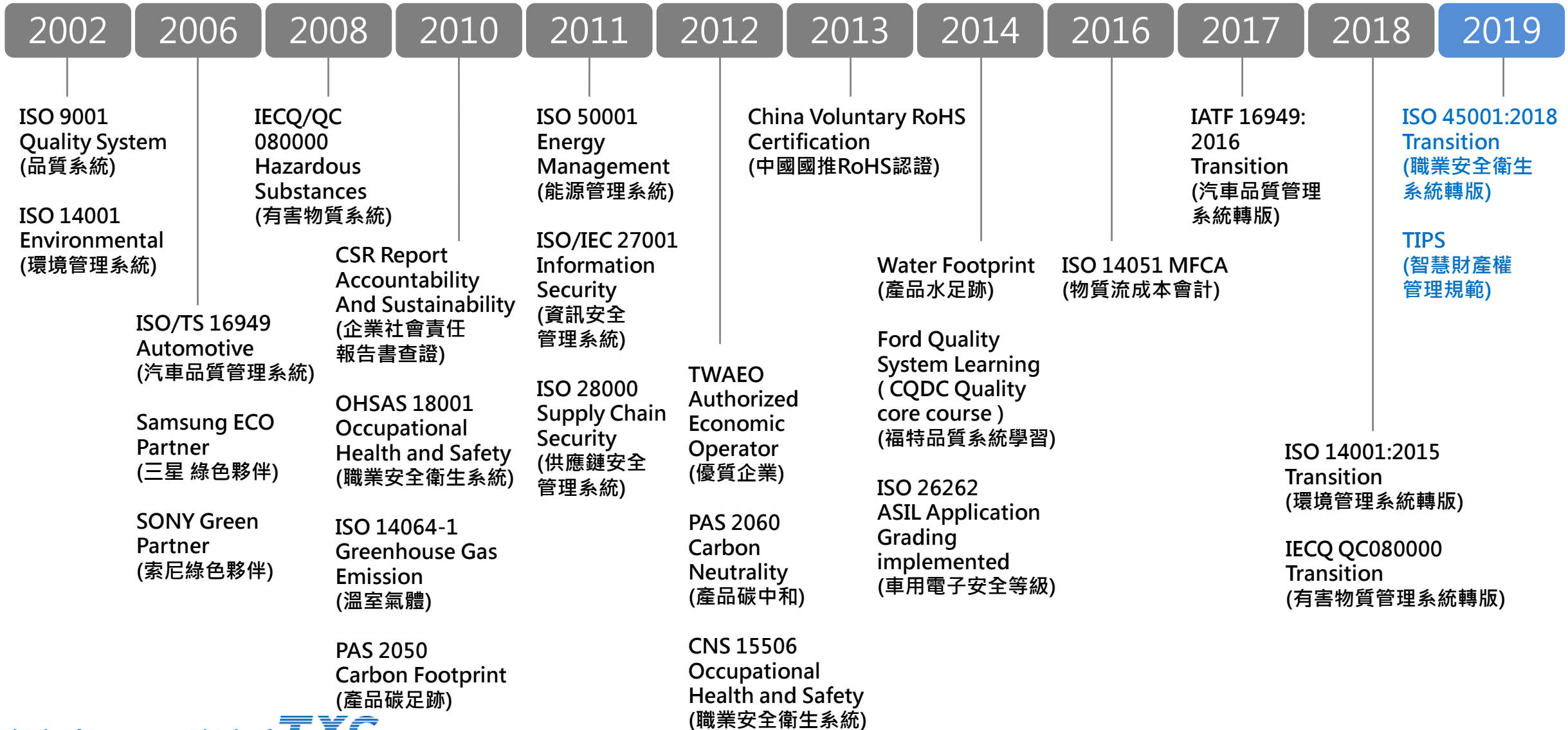


- MHz Crystal

- 3 manufacturing facilities
- 200+ automated production lines
- 330M+ monthly capacity(Timing Devices)
- 2 R&D centers (PCF, NGB)
- 400+ engineers

Quality Management Systems

Quality always 1st

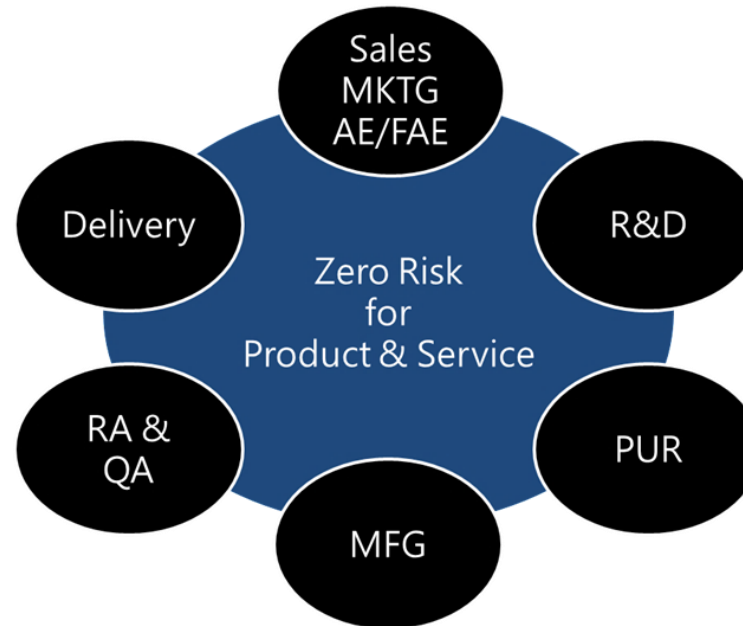


Systematic Management system

Zero Risk Approach Methods

- ISO 28001 Supply Chain Security Management System
- Shop Floor Management System
- Equipment Management System

- Voice of Customer
- Circuit Matching
- ISO 26262 ASIL Concept



- Robust Design
- APQP System
- VDA4.2 & AIAG Based DFMEA

- ISO 9001 Certified
- Supplier Early Involvement
- Frequently Technology Communication

- AEC Q100/Q200 Reliability Test
- ISO 16750 Reliability Test
- MIL-STD 1916 Zero-Based Sampling Plans

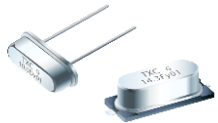
- VDA6.3 Production Management
- VDA4.2 & AIAG PFMEA
- PAT & SYA Control

Product Portfolios

Timing and Sensors

Timing (Crystals and Oscillators)

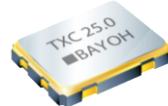
Metal Can



Glass Seal



Crystal Oscillators (XO)



SAW Oscillators (SO)



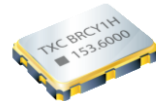
Seam Seal



Tuning Fork



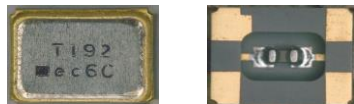
Voltage Controlled Oscillators (VCXO)



Temperature Compensated Oscillators (TCXO/S3TCXO)



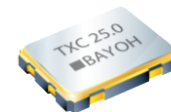
Temperature Sensor Crystal (TSX)



Oven Controlled Oscillators (OCXO)



Active Low EMI Oscillators (EMI XO)

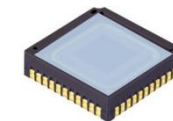


Sensors

Proximity and Light Sensor



μ Bolometer
Coming in 2020 2H



TXC Product Lineup

Quartz Crystal

PN Series	7B	7M	8Z	8Y	8Q	8J	8A	7A	7V	7R	9HT10	9HT11	9HT12	9HT13
Type	Seam Crystal 4 Pads							Glass Seal Crystal			Tuning Fork 2 Pads			Tuning Fork 4 Pads
Size (mm)	5.0x3.2	3.2x2.5	2.5x2.0	2.0x1.6	1.6x1.2	1.2x1.0	1.0x0.8	5.0x3.2	3.2x2.5	2.0x1.6	3.2x1.5	2.0x1.2	1.6x1.0	1.2x1.0
Freq. (MHz)	8~125	10~64	12~66	16~54	24~60	24~60	37.4~60	8~54	10~54	20~64	32.768KHz			

Crystal + Thermistor (TSX)







PN Series	OZ	OY	OW	OV
Type	Crystal + Thermistor			
Size (mm)	2.5x2.0	2.0x1.6	1.6x1.2	1.2x1.0
Freq. (MHz)	19.2~54	19.2~54	26~76.8	38.4 & 76.8

Temperature Compensated Oscillator (TCXO)





PN Series	7Q	7L	7Z	8P	8M	7N	7N	7P
Type	SMD TCXO					4 Pads Stratum-3 TCXO	10 Pads Stratum-3 TCXO	6 Pads Stratum-3 TCXO
Size (mm)	3.2x2.5	2.5x2.0	2.0x1.6	1.6x1.2	1.2x1.0	7.0x5.0	7.0x5.0	5.0x3.2
Freq. (MHz)	13~52	13~52	26~52	26~52	26~52	10~52	10~52	10~52

TXC Product Lineup













CMOS Oscillator

PN Series	7W 	7C 	7X 	8W 	8N 	8R 
Type	CMOS					
Size (mm)	7.0x5.0	5.0x3.2	3.2x2.5	2.5x2.0	2.0x1.6	1.6X1.2
Freq. (MHz)	1~170	1~150	1~125	4~75	4~60	4~54

SAW Differential Oscillator (LVPECL/LVDS)











PN Series	BS 	BT 	CS 	CT 
Type	LVPECL	LVDS	LVPECL	LVDS
Size (mm)	7.0x5.0		5.0x3.2	
Freq. (MHz)	150~700			

Differential Oscillator (LVPECL/ LVDS/ HCSL)

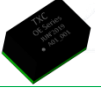

PN Series	BA/BB/BC 	BE/BF/BG 	BX 	CA/CB/CC 	CE/CF/CG 	CX 	DA/DB/DC 	DE/DF/DG 	DH 	EA 	EB 	EC 
Type	LVPECL	LVDS	HCSL	LVPECL	LVDS	HCSL	LVPECL	LVDS	HCSL	LVPECL LVDS HCSL	LVPECL LVDS HCSL	LVPECL LVDS HCSL
Oscillation Type	Fundamental 3 rd Overtone PLL		Fundamental 3 rd Overtone PLL			Fundamental 3 rd Overtone PLL			Fundamental	3 rd Overtone	PLL	
Size (mm)	7.0x5.0		5.0x3.2			3.2x2.5			2.5x2.0			
Freq. (MHz)	10~2100		10~2100			10~2100			10~200	50~156.25	10~1500	

TXC Product Lineup

Voltage Controlled Oscillator (VCXO)

PN Series	6U/BR 	BJ/BK 	BN/BP 	CR 	CJ/CK 	CN/CP 	DR 	DJ 	DN 	ED 
Type	CMOS	LVPECL	LVDS	CMOS	LVPECL	LVDS	CMOS	LVPECL	LVDS	CMOS
Oscillation Type	Fundamental	Fundamental PLL	Fundamental PLL	Fundamental	Fundamental PLL	Fundamental PLL	Fundamental	Fundamental	Fundamental	Fundamental
Size (mm)	7.0x5.0			5.0x3.2			3.2x2.5			2.5x2.0
Freq. (MHz)	1~200	10~2100		50~200	50~2100		50~200		25~156.25	

Oven Controlled Oscillator (OCXO)













PN Series	OE 	OG 
Type	CMOS / Clipped Sinewave	
Size (mm)	14x9	9.7x7.5
Freq. (MHz)	10, 19.2, 20, 25, 30.72, 40	

Ambient Light & Proximity Sensor









PN Series	PA122 	PA224 	PA22A 	PA22C 
Type	ALS+PS	PS Only	ALS+ PS	CS+ ALS+ PS
Size (mm)	2.5x2.0			
Freq. (MHz)	10, 19.2, 20, 25, 30.72, 40			

TXC Automotive **Product Lineup**

Crystal Product Series

MFG location: Ping Chen, Taiwan (PCF Factory)								MFG location: Ningbo, China (NGB factory)				
PN Series	AB 	AM 	AZ 	AY 	AJ 	AE 	AF 	A2/ AX 	AA 	AV/ A3 	AR 	AH 
Type	Seam 4 Pads					TSX		Glass 2 Pads		Glass 2&4 Pads	Glass 2 Pads	TF
						4 Pads						2 Pads
Size (mm)	5.0x3.2	3.2x2.5	2.5x2.0	2.0x1.6	1.6x1.2	2.5x2.0	2.0x1.6	8.0x4.5	5.0x3.2	3.2 x 2.5	2.2X1.65	3.2 x 1.5
Freq. (MHz)	8~50	10~80	16~80	16~80	26~50	19.2	38.4	4~40	7.2~48	9.84~62.4	16~50	32.768KHz
Op. Temp.	G1	G1	G1	G1	G1	G2	G2	G0	G1	G1	G1	G1

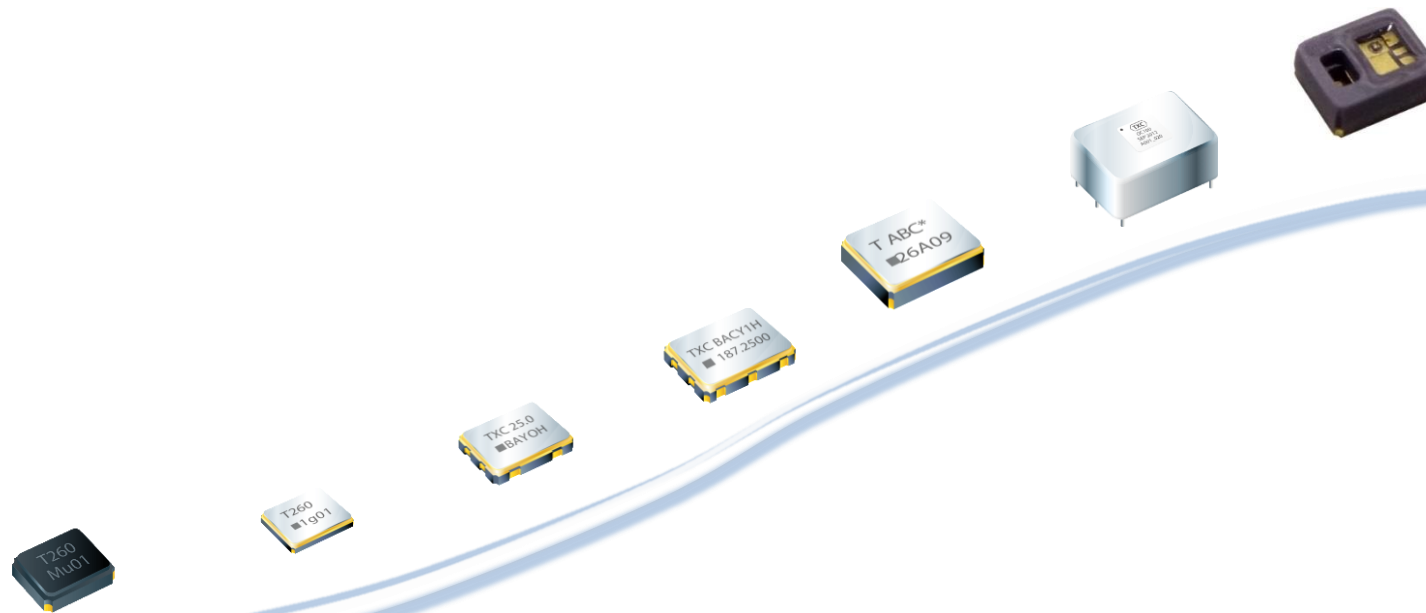
Oscillator Product Series

MFG location: Ping Chen, Taiwan (PCF Factory)									
PN Series	AC 	AU 	AW 	AN 	A5 	AQ 	AL 	AK 	
Type	CMOS Oscillator					TCXO			
Size (mm)	5.0 x 3.2	3.2 x 2.5	2.5 x 2.0	2.0 x 1.6	1.65 X 1.25	3.2 x 2.5	2.5 x 2.0	2.0 x 1.6	
Freq. (MHz)	1~70	1~70	1~80	4~54		6~52			
Op. Temp.	G2	G1					G2		

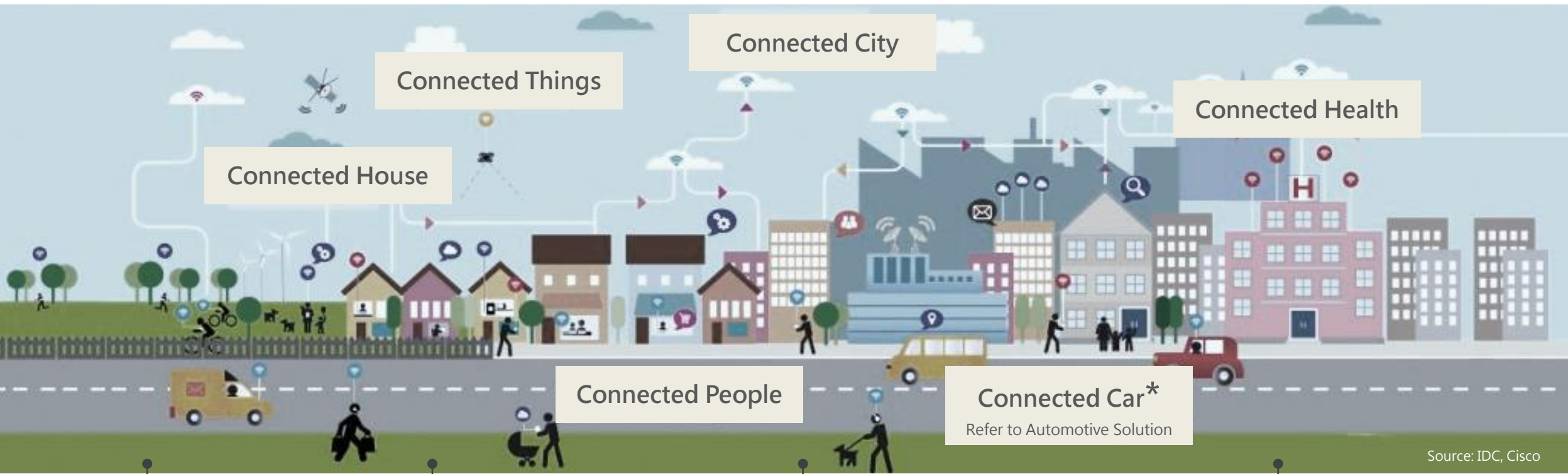
Notes: G3: -40~85°C | G2: -40~105°C | G1: -40~125°C | G0: -40~150°C

TXC Confidential & Proprietary | 15

New Product Introduction



Internet of Things Solutions



Source: IDC, Cisco

MHz Crystal
 Miniature & Low Profile
 1.0x0.8x0.30 (mm)

WiFi, BT, BLE, NFC

TSX (TH+Xtal)
 Miniature & Low Profile
 1.6x1.2x0.55 (mm)

LTE, 5G Modem

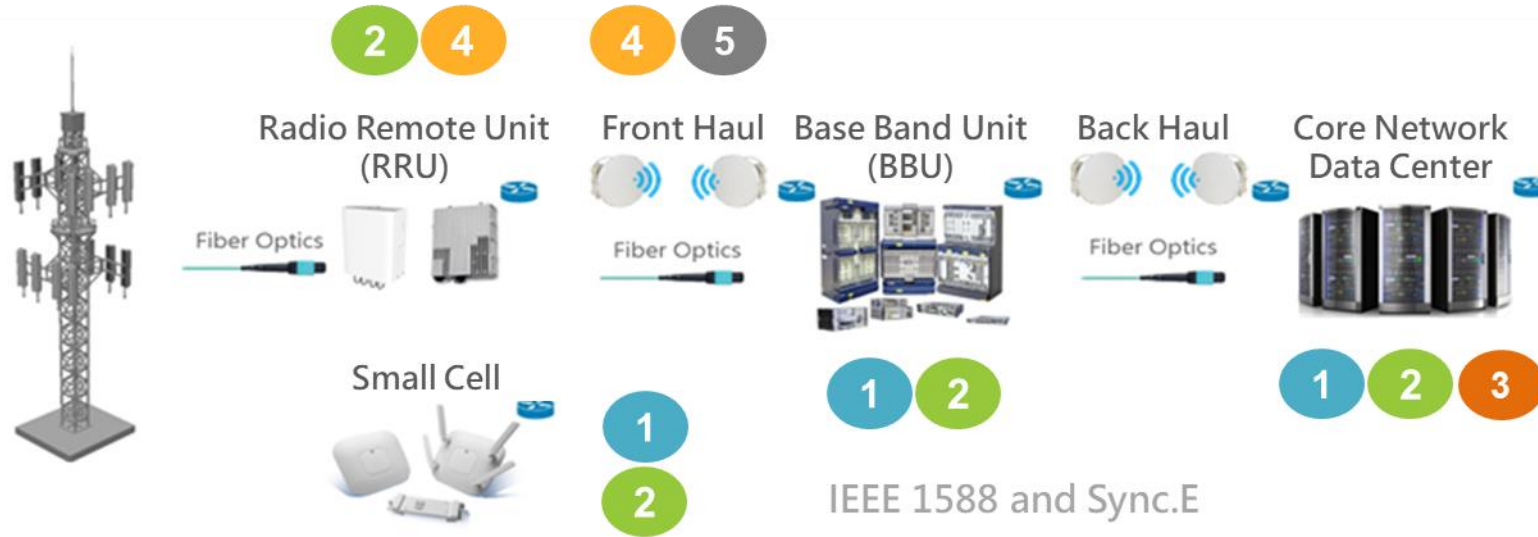
OSC (Differential/CMOS/HCSL)
 Low Phase Noise $\leq -100\text{dBc/Hz}$ @ 10Hz;
 Miniature 2.5x2.0x0.75 (mm)

High Speed, Low Noise Transmission

Active Low EMI CMOS OSC
 Reduced Electromagnetic Interference
 Miniature 2.0x1.6x0.75 (mm)

* ADAS, Camera Module

Telecom and Networking Solutions



1

Ultra Stability SMD SC-Cut OCXO (9.7x7.5mm) +/-10ppb



2

Ultra Stability S3 TCXO (7.0x5.0mm, 5.0x3.2mm); +/-100ppb

3

High Frequency, XO/VCXO (7.0x5.0mm); Up to 2.1GHz, ultra low jitter 0.15pS

4

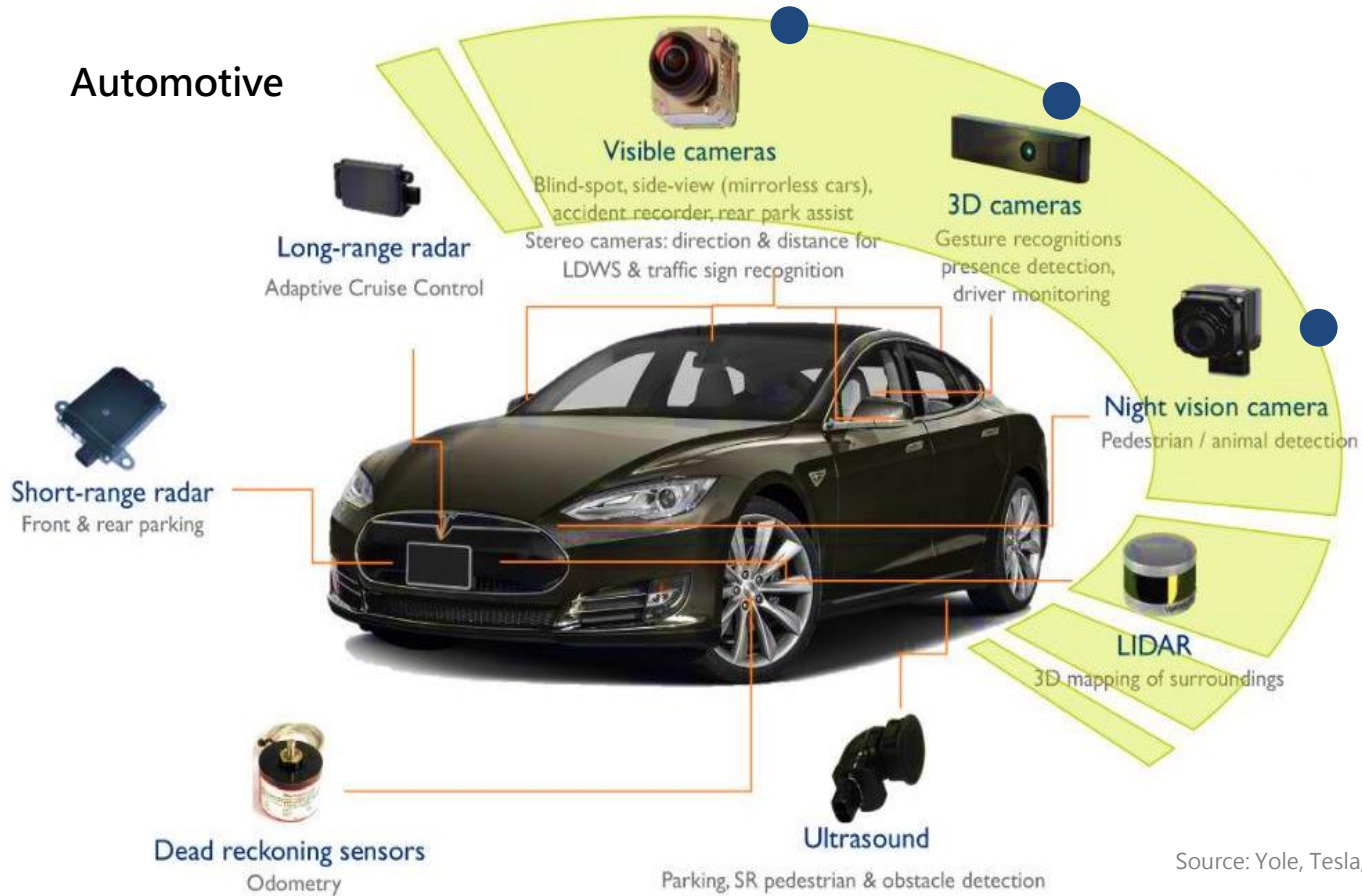
Ultra Low Phase Noise VCXO (3.2x2.5mm); Close-in phase noise -80dBc/Hz

5

High Frequency Crystal (MESA 3.2x2.5mm); 200MHz

Automotive Imaging Solutions

Automotive



Source: Yole, Tesla, Sony



- Active Low EMI OSC Module
- Automotive G1
- 2.5x2.0mm
- 2.0x1.6mm



Light Sensors

Single Aperture
Combo Light Sensor
(ALS/RGB+PS)
2.5x2.0mm



Slim Bezel
Combo Light Sensor
(ALS/RGB+PS)
3.4x1.2mm



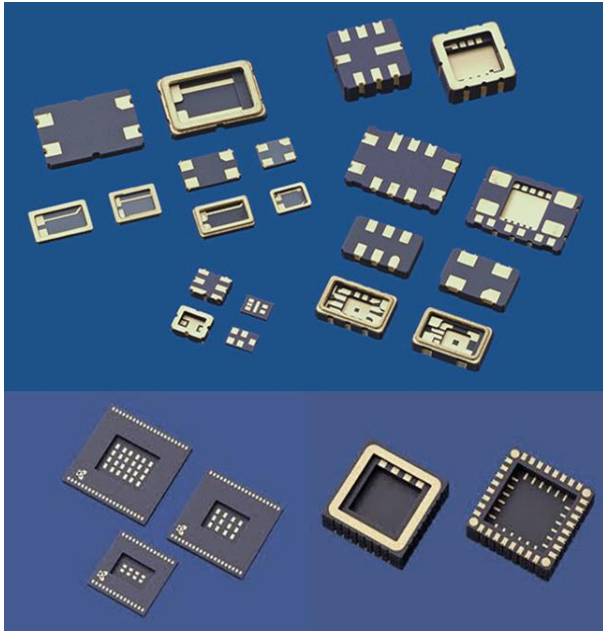
Miniature
Proximity Sensor
2.0x1.6mm



Ceramic Package Solutions

Ceramic Package Assembly & Contract Manufacturing

Type of Ceramic Packages



Source: Kyocera

Advantages of Ceramic Packaging

- Excellent mechanical stiffness, hardness and wear resistance
- Excellent isolators
- Coefficient of thermal expansion
- Good thermal conductivity, good thermal resistance
- High processing temperatures
- Ceramic Package is multilayer boards design, enable product stacking, integration, and miniaturization



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