High end microprocessors with Space reliability at Teledyne e2v

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Processors for Space

Different approaches serve different needs

Custom design

Standard design

- Rad-hard
- specific

Mission Critical Processors

4 to 7 years to FM

- Rad-tolerant
- High speed / high performances
- Aerospace proven
- Wide choice of IP, qualified OS and trusted partners

Payload Critical Processors

2 to 3 years to FM

- Known and qualified assembly flow
- Full visibility on each step

Custom package

Commercial Space Processors

18 months to FM

- A posteriori qualification
- Cost effective approach

Standard package

Teledyne e2v Space Processors

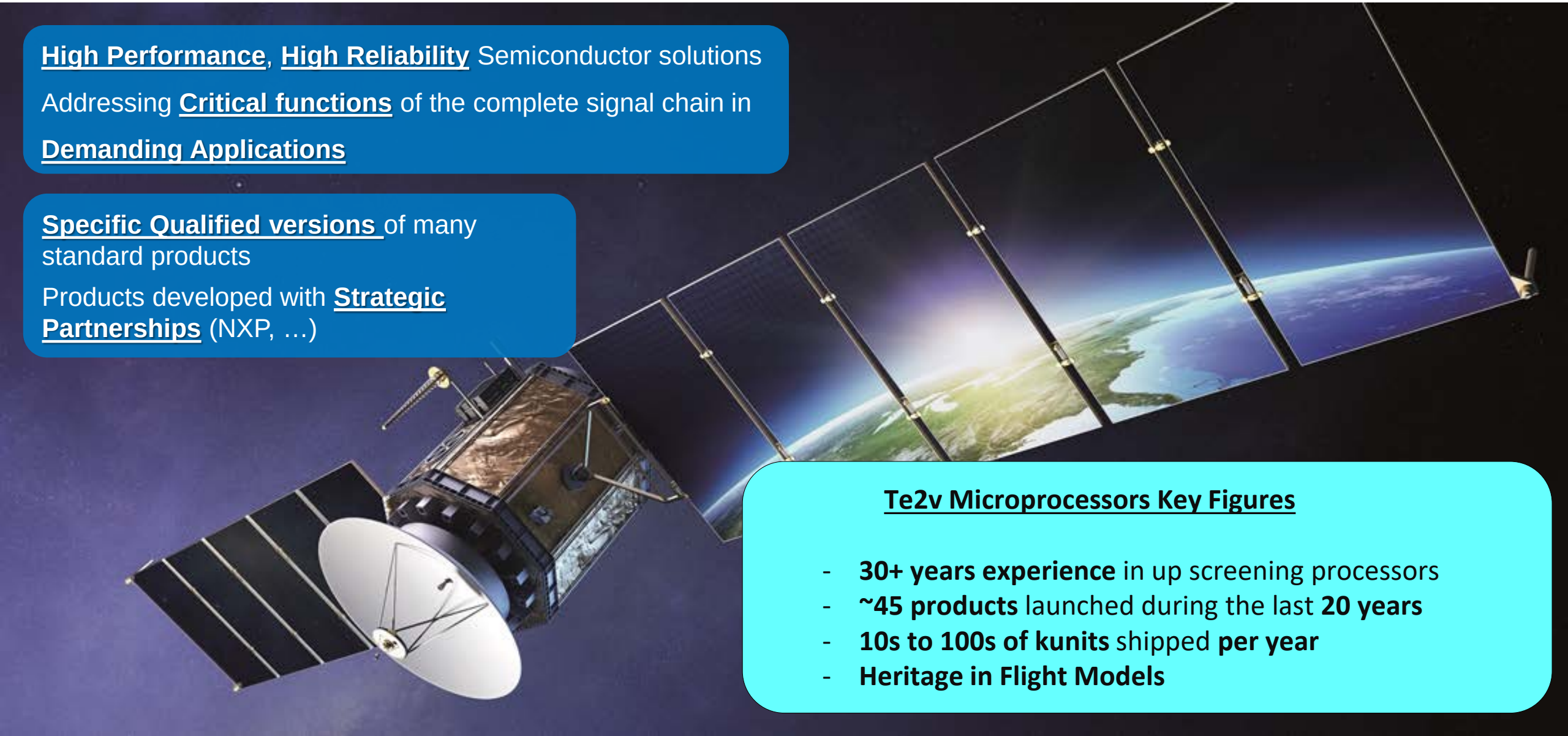
High Performance, **High Reliability** Semiconductor solutions

Addressing **Critical functions** of the complete signal chain in

Demanding Applications

Specific Qualified versions of many standard products

Products developed with **Strategic Partnerships** (NXP, …)



Te2v Microprocessors Key Figures

- **30+ years experience** in up screening processors
- **~45 products** launched during the last **20 years**
- **10s to 100s of kunits** shipped **per year**
- **Heritage in Flight Models**

Payload critical processors

Value proposition

Radiation Tolerant Technology

- ✓ 90nm SOI with proven radiation tolerance & flight history
- ✓ GHz+ processors bringing high perf computing into Space

High-Reliability Assembly

- ✓ Space level Assy including specific package materials
- ✓ HiTCE Ceramic BGA package

Space Grade Qualification

- ✓ QML-Y manufacturing and qualification flows

Commercial space processors

Value Proposition

State of the Art Commercial Technology

- ✓ 45nm SOI Technology
- ✓ NXP QorIQ Commercial multicore Processors (T, LS families)
- ✓ Proven radiation performance (SEE, TID)

Space Level Devices Screening

- ✓ Ruggedized to high-reliability to ensure defect-free flight units
- ✓ Lot by lot Qualification for compliance with Space Grade

3 Reliability Options

- ✓ Matching all programs requirements
- ✓ Constellations, Commercial communication, Cubesats, …

Space Microprocessors

Currents and roadmap

New Space / Commercial Space

Ruggedized radiation tolerant technology
Standard plastic package
Device selection and lot validation

TELEDYNE e2v
Everywhereyoulook™

Commercial Space Grade by Te2v

(Based on ECSS-Q-ST-60-13C & NASA EEE-INST-002 - Section M4 – PEMs)

P2020

P5020

LS1046

Qormino LS1046 4GB

Payload Critical

Ruggedized radiation tolerant technology
Advanced packaging on ceramic
Standardized quality grade

TELEDYNE e2v
Everywhereyoulook™

Microprocessors based on QML-Y Standard

PC7448

PC8548

Under definition

Qualification Options for Commercial Space

Default Features

Space Level Screening

- Serialization
  - ✓ *Clearly identify every device manufactured*
- Ruggedized to Hi-Reliability
  - ✓ *-55C to +125C*
  - ✓ *Non-RoHS*
- 100% inspection
  - ✓ *X-rays, CSAM, visual, dimensional ensuring defect-free flight units*
- Advanced dynamic & static burn-in
  - ✓ *To eliminate infant failures*

Lot by lot Qualification

- Life test, Temp. cycling, HAST testing
  - ✓ *On every lot manufactured*
  - ✓ *Guarantee compliance with Space Grade*
- **DPA performed on every lot**

NASA Levels

Level 1

- *Commercial communication satellites*
- *Weather monitoring and Earth observation satellites*
- *Launch Vehicles*
- *Manned Space Flight*

Level 2

- *Cubsesats and Satellite Constellations*
- *Science missions*

Level 3

- *Cubsesats*
- *Short space missions*

T e2v's view

Reliability

High end Space Qualification

Higher Samples lot
Increased Life Cycle Tests
Increased Test Hours

Entry level

Lower Samples Lot
Reduced Life Cycle Tests

TELEDYNE e2v
Everywhereyoulook™

Understanding customers' requirements is key

To find the best reliability versus € compromise

Download our poster describing the different screening and qualification flows at :

https://www.e2v.com/products/semiconductors/space-semiconductors/

Teledyne e2v Space Flows Comparison Chart

Overview and comparison chart of globally recognised and Teledyne e2v's own space flows, including military, industrial and commercial flows, to help our customers find the most suitable quality grade.

For an overview of space devices and individual flows, visit e2v.com/Semis/Space

FLOW CHARTS

Main Process Flow Steps	Method / Condition	CERAMIC HERMETIC							CERAMIC			
		ESCC 9000	QML-V		QML-Q	Enhanced		Standard	QML-Y	"-Nx" NASA level		
		(wired)	(wired)	(Flip Chip)	(wired)	B/T	D/T	M, V, C	(Flip Chip)	Level 1	Level 2	Level 3
	Specification reference	ESCC 9000	MIL-PRF-38535		MIL-PRF-38535	INTERNAL PROCEDURE		INTERNAL PROCEDURE	MIL-PRF-38535	EEE-INST-002 / PEM-INST-001		
Wafer Lot Acceptance	MIL-STD-883 TM5007 / QM Plan	✓	✓	✓	✓	If appl.	If appl.	If appl.	✓			
Die Sawing / Select	Internal proced. / MIL-STD-883 TM2010 / ESCC 20400	Cond A	Cond A	Cond A	Cond B	Cond B	Cond B	Cond B	Cond A			
Die attach / cure	Internal or Subcontractor procedure	✓	✓		✓	✓	✓	✓				
Internal Visual Inspection	MIL-STD-883 TM2010 / ESCC 20400			✓					✓			
T-e2v Precap (flip chip)	MIL-STD-883 TM2010 / ESCC 20400			✓					✓			
Flip Chip die attach / cure	Internal or Subcontractor procedure			✓					✓			
Wire bonding	Internal or Subcontractor procedure	✓	✓		✓	✓	✓	✓				
Underfill dispense / cure / C-SAM	Internal procedure / MIL-STD-883 TM 2030			✓					✓			
SMD report / reflow	Internal procedure			If appl.					If appl.			
Molding / Dam & Fill / Cure	Internal or Subcontractor procedure											
Solder balls report / reflow	Internal or Subcontractor procedure			If appl.					If appl.			
Internal Visual Inspection	MIL-STD-883 TM2010 / ESCC 20400	✓	✓	✓	✓	✓	✓	✓	✓			
T-e2v Precap	MIL-STD-883 TM2010 / ESCC 20400	✓	✓	✓					✓			
Heat sink attach	Internal Procedure								If appl.			
Lid report / Sealing	Internal Procedure	✓	✓	✓	✓	✓	✓	✓				

Internal or Subcontractor procedure

THANK YOU FOR YOUR ATTENTION

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