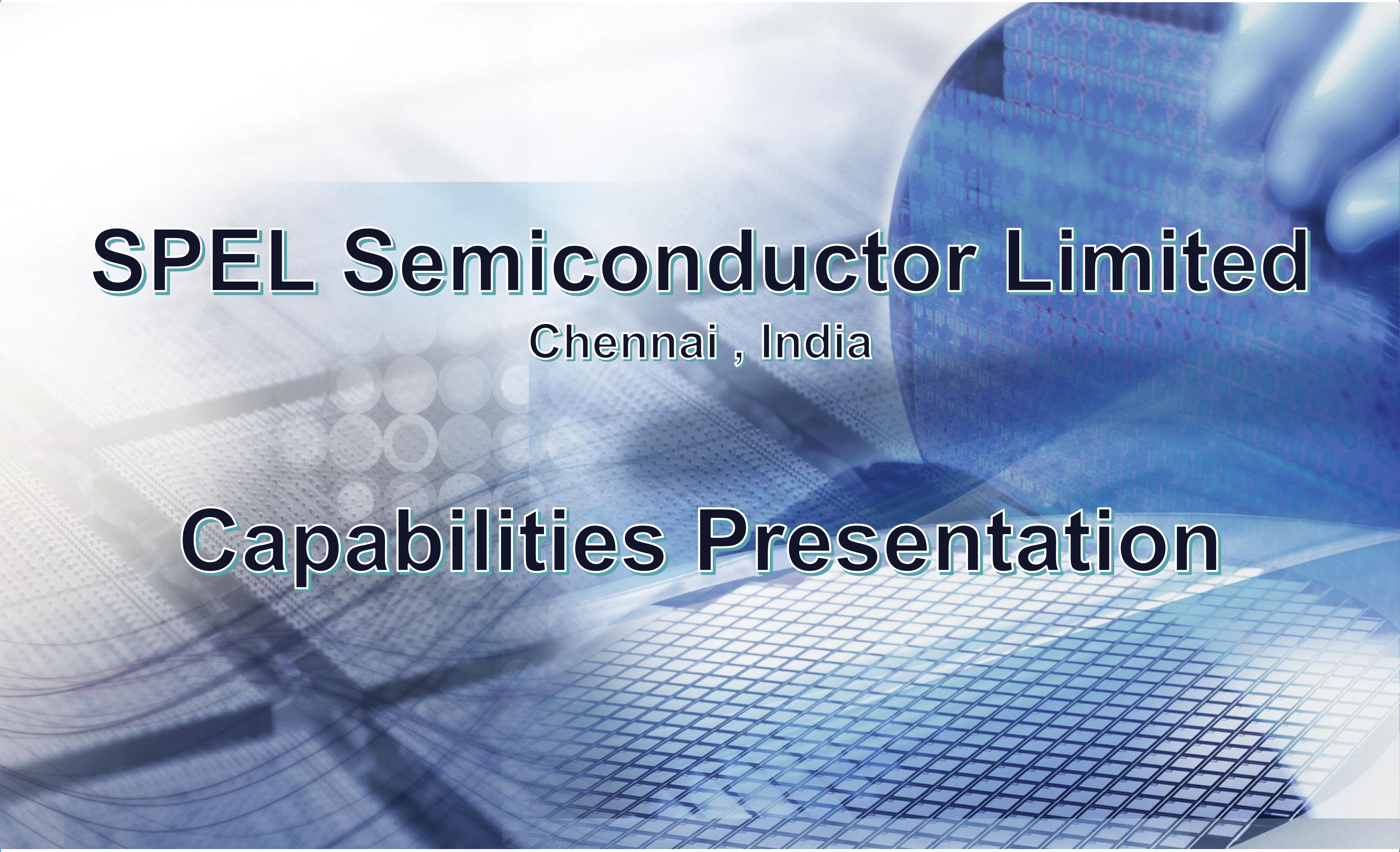


SPEL Semiconductor Limited

Chennai , India

Capabilities Presentation

Apr 6, 2023

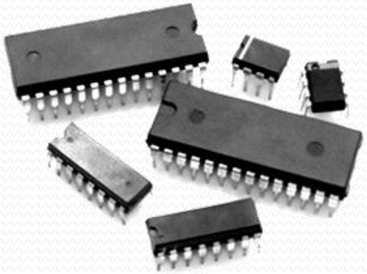
Content

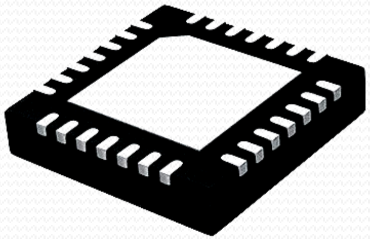
About Us

- Valingro is involved in creating companies concentrating on global competitiveness, leveraging global opportunities and acquiring global capabilities
- Natronix Semiconductor Technology Private Limited headquartered in Singapore is a member of the Valingro Group
- Natronix Semiconductor Technology Private Limited has its OSAT presence in India through its subsidiary SPEL Semiconductor Limited
- SPEL is the first IC Assembly & Test facility in India which commenced commercial production in 1989
- SPEL has customers covering all major application segments
- SPEL is ISO 9001, ISO 14001 & IATF (TS) 16949 Certified and 100% Export Oriented unit.
- Natronix-Sg has targeted further acquisitions within OSAT and D&V segments.

OSAT Services

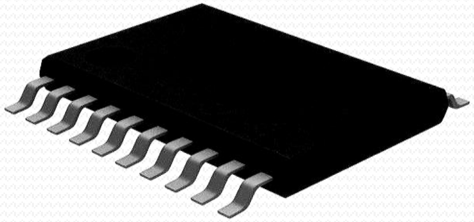
Full Turnkey Solutions





- Wafer sort
- Assembly
- Testing & Packing

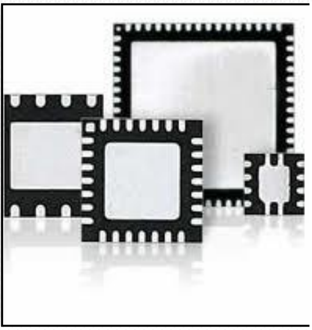
Value Added Services



1. Design :
    - Package design
    - Lead frame design
2. Assembly :
    - Tin / Lead plating
    - Open Cavity Packaging
    - Wettable Flank in 9 TDFN, 32 QFN, 52 QFN Assembly
    - Die level Tape and reel process
3. Others :
    - Failure analysis & Reliability testing
    - Test Program Development & Product Characterization
    - Drop shipments across the globe

Package Portfolio

QFN Capability

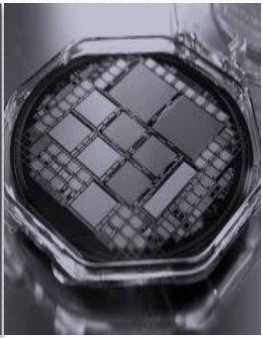


Process	Package Thickess	Body Size in mm	Lead-Pitch	Lead-Count
Saw Singulated QFN / DFN	0.40 mm 0.50 mm 0.75 mm 0.90 mm	0.6 x 1 to 12 x 12	0.40 mm 0.50 mm 0.65 mm	4 ~ 100 pins

Leaded

PACKAGE	LEAD COUNT	JEDEC STANDARD
150 MIL ; 300 MIL SOIC	7/8/14/16; 16/20	MS-012 ; MS-013
150 MIL QSOP ; VSOP	16/20/24/28; 40/48	MS-137 ; MS-154
173; 240 MIL TSSOP	8/20/24/38; 48/56/64	MO-153
300 MIL SSOP	48/56	MO-118
150 MIL MILLIPAQ	80	MO-154
300 MIL PDIP	8/14/16	MS-001
225 MIL SIP	8	NA

Test Platforms

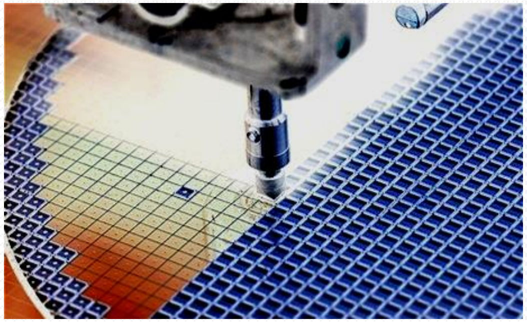


TEST PLATFORM	Credence ASL 1000	Eagle ETS 364 / 88	Verigy V50
DIGITAL	✓	✓	✓
MIXED SIGNAL	✓	✓	✓
ANALOG	✓	✓	

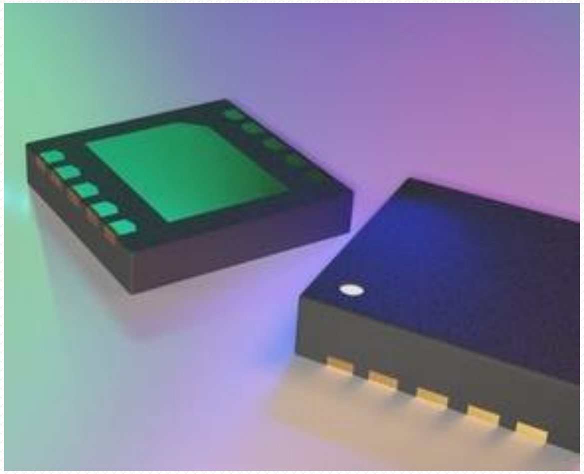
Bill of Material

Material	**Leaded / QFN / DFN**	**Supplier**
Lead frame	C7025, Olin 194, EFTECH & NiPdAu Pre-plated	DCI (Malaysia), QPL (HK), NKQ (China), Fullriver (China)
Die Attach Epoxy	CRM1076NS	Sumitomo (Singapore)
Screen print Epoxy	Non Conductive 8006 Conductive 8008	Henkel (Korea)
Gold Wire	0.8 to 2.0 mil	Tanaka, Heraeus (Singapore)
Bare Copper wire / PdCu wire	0.8 to 2.0 mil	Tanaka (Singapore), Heraeus (Malaysia)
Mold Compound	G600, G633 & G770HCD	Sumitomo (Singapore)

Technical Capabilities



- Minimum die size : 10 Mils square
- 12” wafer assembly capability
- Epoxy screen print capability
- Copper wire bonding (Bare Cu & Pd Coated) – 0.8 mil to 2.0 mil
- Bond Pad Pitch : 40 microns
- Low loop bonding : 4 mils
- Ultra Thin packages : 0.4mm
- Wafer mapping at Die Attach
- Multi-die package assembly
- Multi-site Test capability

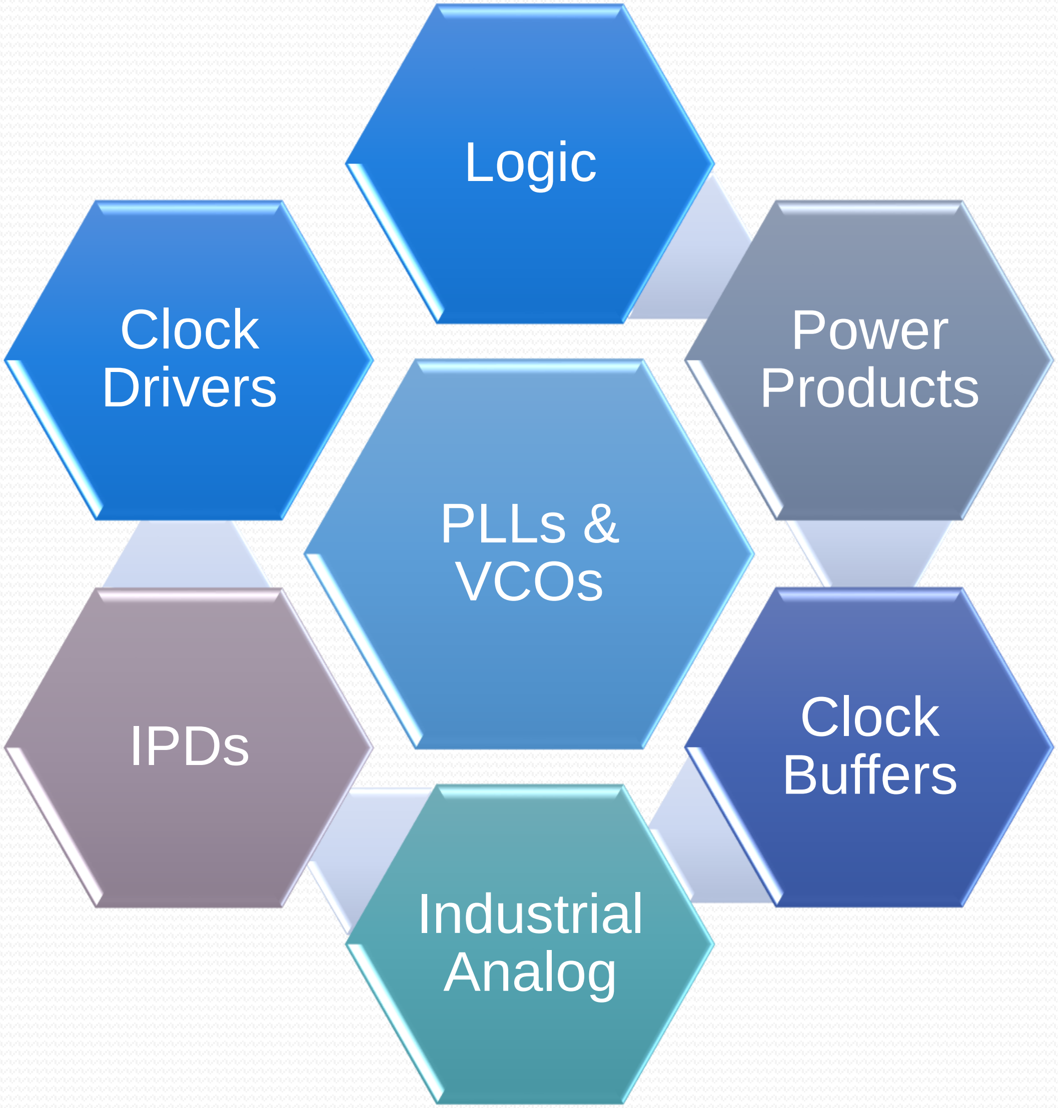


Capacity

Package Category	**Capacity / Month (Mln Units)**	**Remarks**
Leaded	1.7	Twenty Lead Equivalent
QFN / DFN	3.8	Three Sq.MM Equivalent

- 32% of the Total Capacity is available for Copper Bonding
- 100 % power backup

Test Capability



Logic

Clock Drivers

Power Products

PLLs & VCOs

IPDs

Clock Buffers

Industrial Analog

ATE & Handlers

Sl. #	Equipment	Manufacturer	Model
1	Testers	Verigy	V50
		Teradyne	ETS364/ETS88
		Credence	ASL1000
		MCT	2010, 2020
2	Handlers	Micro Comp Tech	MCT 3608E, 5105
		Micro Handling Corp	MH240, 245
		Tesec Mapper	3270-IH
		Multitest	8704, 9710 & 9928
		SRM	XD248, XD244

Reliability Test

Sl #	Reliability Test	Test Specifications	Jedec Standard
1	Burn-in Test	125°C, 1000 Hrs	JESD22-A108
2	Unbiased Temperature & Humidity	85°C, 85% RH, 1000 Hrs	JESD22-A101
3	Temperature Cycling Test	-65°C to 150°C, 500 cycles	JESD22-A104
4	High Temperature Storage Life Test	150°C, 1000 Hrs	JESD22-A103
5	Unbiased HAST (UHAST)	130°C , 85% RH, 96 Hrs	JESD22-A118
6	Autoclave Test	100% RH, 121°C, 96 Hrs	JESD22-A102
7	Preconditioning & MSL Tests	-	JESD22-A113 & JESD-020
8	Drop Test	-	JESD22-B111

Reliability Equipment

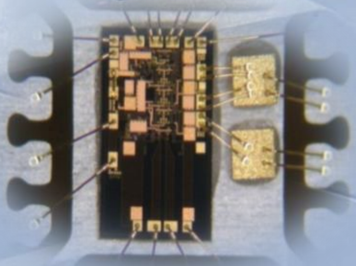
Sl #	Reliability Equipment	Manufacturer
1	Burn-in	Blue-M, USA
2	Temperature & Humidity	Blue-M, USA
3	Temperature Cycler	ESPEC, Japan
4	Dry Heat (Class 100) Oven	Lab line, USA
5	HAST	Hirayama, Japan
6	Autoclave	Hirayama, Japan
7	Solder Pot	HMP, USA
8	Reflow Oven	Heller, USA
9	Drop Test	Avex, USA

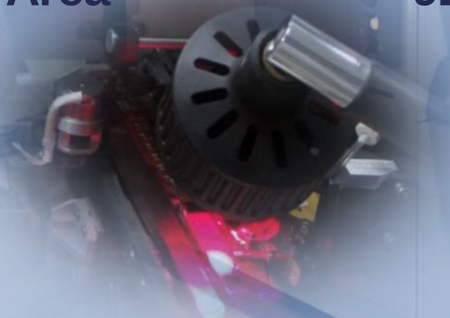
PC-422R8

FA Equipment

Sl #	Equipment	Manufacturer
1	LCR Meter	HP, USA
2	Data Acquisition Unit	HP, USA
3	RF MUX	HP, USA
4	40 Channel MUX	HP, USA
5	V/I Source Meter	Keithley, USA
6	Oscilloscope	Keithley, USA
7	Pulse Generator	HP, Singapore

Site Area	**856,550 Sq Ft**
Built Up Area	**92,191 Sq Ft**



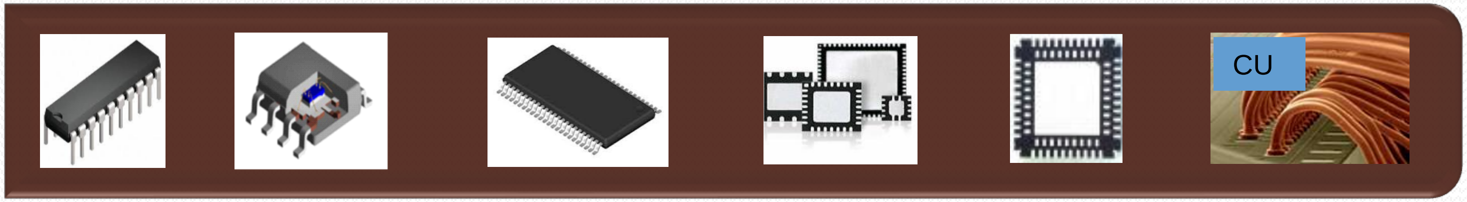


Package Roadmap

Planned
“2023-24”

WLCSP **BGA**

Existing



Leaded Package **QFN / DFN**

Cost Competitive

Packaging Cost

- Substantial Cost Savings
- Low Cost for new package development in QFN / DFN
- Attractive amortization proposals for new package tooling

Test Cost

- Low Development Charges – Onsite or Offshore
- Low Production Costs
- Attractive pricing for the consigned testers

Quality Policy

Consistently provide products and services that will exceed the quality expectations of our Customers.

Implement process improvement programs which will enable each Employee to do their job

Right the first time.

Work towards continual quality improvement through training and teamwork

- Quality methodologies are guided by International standards
- Quality endeavour is to deliver best in high-class, defect-free solutions and services
- Standardizing development activities to align with Customers requirements
- Process robustness are built through ISO 9001:2015 standards accreditation
- Zero Customer Return
- Continuous Improvements through Industry Benchmarking
- Effectively Implement PPAP, APQP, MSA, SPC & FMEA to ensure Outgoing Product Quality

Natronix

Customers

SPEL®

ON Semiconductor® ON

MICROCHIP

RENESAS

SYRMA SGS

Littelfuse®

IC LOGIC MICROCHIPS

NVE NVE CORPORATION

SYRMA SGS TECHNOLOGY LIMITED

TE connectivity

THAT Corporation Making Good Sound Better®

HMT microelectronic AG

LSI/CSI a Semiconductor Company

KOA® KOA SPEER ELECTRONICS, INC.

SERMA GROUP

kinetic technologies

HOLT INC. INTEGRATED CIRCUITS

MICRODUL Customized Swiss Microelectronics

JVD™

GStek

SENSONIX

DEVICE ENGINEERING INCORPORATED

RoodMicrotec

SILTERRA

Microelectronics COMPONENTS Corporation

VISHAY.

meticom

Key Design

CSS Custom Silicon Solutions, Inc.

E.K.S.S. Microelectronics Ltd Operating your Silicon to Success

SILICON LABS®

bruco INTEGRATED CIRCUITS

Defining The Future Through Partnerships

Natronix

Customer Audits

SPEL

End Customers

SAMSUNG

IBM

SONY
make.believe

Baumer

HITACHI
Inspire the Next

AVAGO
TECHNOLOGIES

Customers

ON Semiconductor®

ON

KOA
KOA SPEER ELECTRONICS, INC.

IDT

HOLT INC.
INTEGRATED CIRCUITS

rakon

kinetic
technologies

NVE
NVE CORPORATION

Manpower

- Technically qualified operators & technicians
- Skilled engineers & experienced Management
- With total manpower of 160+ Employees
- Low attrition rate (< 6%). Developed second-in-line in all functions starting from Supervisor level
- Strong engineering database ensures that any attrition will not affect any process
- Over 40% of the employees have over 15 years of service with SPEL
- Low direct labor cost & management provides various Employee welfare schemes as a motivational activity through Employee Welfare Committee
- Training cell providing comprehensive training (including soft skill & Customer focus) to all level at regular interval & conducts test to ensure the capability
- Talent pool available from Local universities with electronics/semiconductor background

Org Chart

- **P. Balamurugan** Head - Operations
  - **Integrated Manufacturing**
    - **M. Palaniappan** Engineering
    - **S. Senthil Kumar** Mfg.
    - **A. Ramesh** Quality Control
  - **Sales**
    - **C. Prince Sales**
  - **Special Projects**
    - **N.J. Chandrasekar**
  - **Support**
    - **G. Venkatesan** Finance
    - **A. Pandian** Facilities
    - **T. Kathiravan** IT

Logistics

- One Stop Turnkey Destination :

  Probe → B/G → Assembly → Test → T&R → Drop shipment

- Turnaround time
  - Assembly 5 days with Linear Loading
  - Testing : 2 days
  - Fast Track Assembly in 2 days with Premium Charge

- Factory Schedule : 24 x 7
- Drop Ship to End-Customers
- Daily Direct Flights to US, Europe & Asia Pacific :
  - 2days Transit (Inbound / Outbound)

- STAR eWIP - an online Semiconductor Tracking And Resourcing Software for regular Customer WIP update

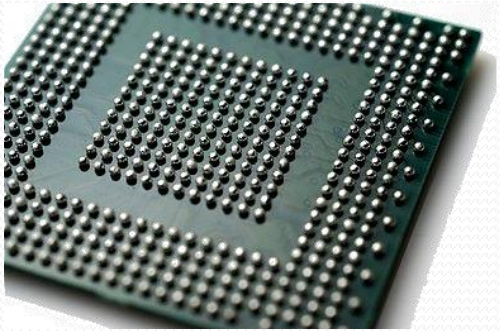
Connectivity

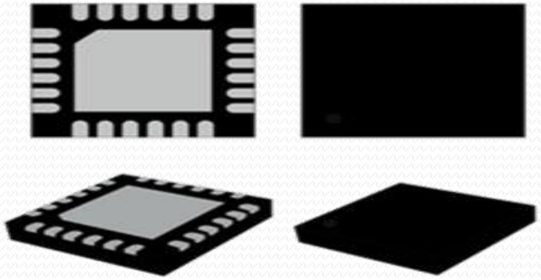
Quick Clearance

- SPEL is awarded AEO (Authorized Economic Operator) Certificate by Central Board of Excise & Customs
  - ✓ Green Channel Status for Imports & Exports
  - ✓ Zero Customs Duty & No Open Inspection
- Our Own Custom clearance office in Airport premises
- Clearance within 6 Working hrs.
- Easy Equipment Consignment In & Out of factory
- Certified as Star Export house by Ministry of Commerce & Industry, Govt. of India
- Accredited Client Programme (ACP) status from Board of Excise & Customs enables faster clearance

Recent Developments

- Adding few more QFN packages with minimum sizes
- Qualified for Silver bonding
- Packaged die to die bonding & PCB bonding for domestic Customers
- Working on Ceramic packages (Open cavity) for our Customers
- Pursuing to acquire assembly houses for BGA & WLCSP packages
- Increasing Cu volume to 32% and plan to improve further
- Added Wettable Flank packages for better solderability





Our USP

- Excellent Value proposition
- Low cost Turnkey services
  - ✓ Provides one stop solution for all QFN & Leaded packages
- Excellent Customer service
  - ✓ Dedicated Customer account engineers. Interacting on daily basis with Customers in real time basis. No need of any resident engineer for any of the Customer
- Package Portfolio covering major application segments
  - ✓ Has test platforms for all products
- New package development and prototype assembly
  - ✓ Has talented team to provide solutions
- Test engineering support
  - ✓ Developing test programs for all needs
- On-Time delivery
- Potential market growth in India
  - ✓ Govt's policy initiations, Incentive schemes, Encouraging indigenous manufacturing, Consumer consumptions growth etc.

Contacts

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eMail	sales-sg@natronix.net	sales-us@natronix.net	sales-eu@natronix.net	sales-in@natronix.net

Thank you