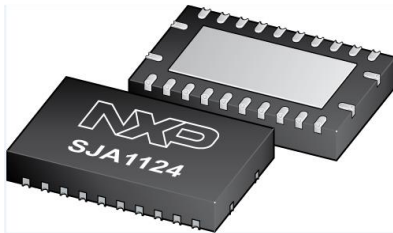


# NXP Communicator

**SJA1124** 

SPI-to-Quad LIN Bridge with integrated Master Termination



Communicator Finalization Date: May 2018

Communicator Updated: June 2018

Global Full Market Launch Date: June 2018



## **SJA1124**

### **1. General Description**

The SJA1124 is a quad Local Interconnect Network (LIN) master channel device. Each of the four channels contains a LIN master controller and LIN transceiver with master termination. LIN master frames are transferred to the physical LIN bus via the LIN physical layer. The SJA1124 is primarily intended for in-vehicle subnetworks using baud rates up to 20 kBd and is compliant with LIN 2.0, LIN 2.1, LIN 2.2, LIN 2.2A, ISO 17987-4:2016(12 V LIN) and SAE J2602-1.

A Serial Peripheral Interface (SPI) and an interrupt output provide the interface between the SJA1124 and a microcontroller.

Transmit data streams received on the SPI are converted by the SJA1124 into LIN master frames transmitted on the LIN bus. The LIN master frames are transmitted as optimized bus signals shaped to minimize ElectroMagnetic Emission (EME). The LIN bus output pins are pulled HIGH via internal LIN master termination resistors. Data streams received on the LIN bus input pins can be read by the microcontroller via the SPI.

Power consumption is very low in Low Power mode. However, the SJA1124 can still be woken up via the LIN pins and the SPI interface.

### **2. Features and Benefits**

#### **2.1 General**

- Four LIN master channels:
  - LIN master controller
  - LIN transceiver
  - LIN master termination consisting of a diode and a 1 kΩ ±10 % resistor
- Compliant with:
  - LIN 2.0, LIN 2.1, LIN 2.2, LIN 2.2A
  - ISO 17987-3:2016, ISO 17987-4:2016 (12 V LIN)
  - SAE J2602-1
- Very low current consumption in Low Power mode with wake-up via SPI or LIN
- Option to control an external voltage regulator via the INHN output
- Bus signal shaping optimized for baud rates up to 20 kBd
- SPI for communicating with the microcontroller:
- Interrupt output pin: interrupts can be configured individually
- Facilitates synchronous LIN frame transmission across multiple SJA1124 devices
- VIO input for direct interfacing with 3.3 V and 5 V microcontrollers
- On-chip Phase-Locked Loop (PLL) for LIN master controller
- Passive behavior in unpowered state
- Undervoltage detection
- Leadless DHVQFN24 package (3.5 mm × 5.5 mm) supporting improved Automated Optical Inspection (AOI) capability

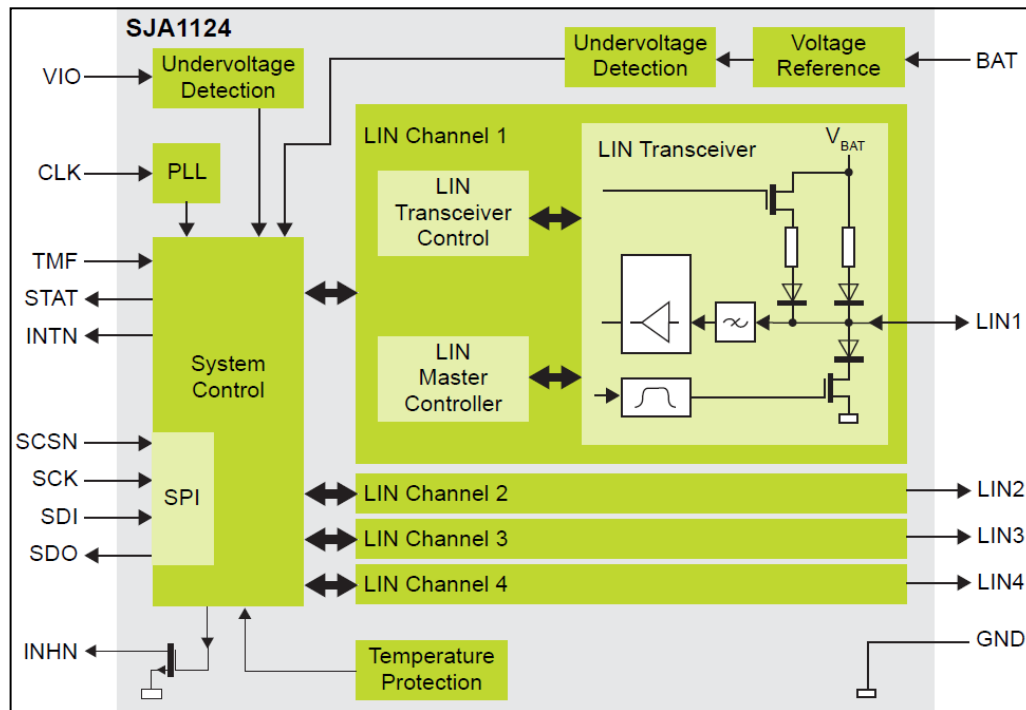
## 2.2 LIN master controllers

- Independent per LIN channel:
  - Baud rate
  - Operating mode
  - Status and interrupt
- Complete LIN frame handling and transfer
- One interrupt per LIN frame
- Slave response timeout detection
- Programmable break length
- Automatic sync field generation
- Programmable stop bit length
- Hardware parity generation
- Hardware or software checksum generation
- Fault confinement
- Fractional baud rate generator

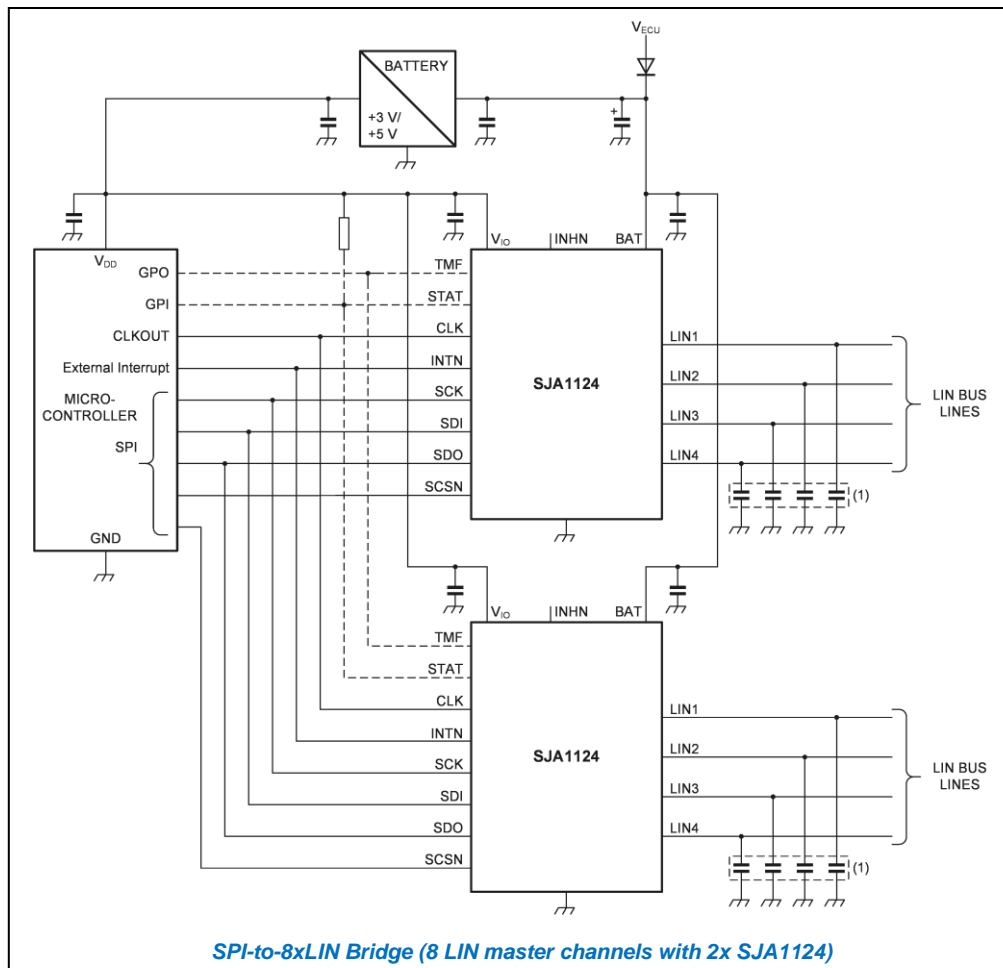
## 2.3 Protection

- Excellent ElectroMagnetic Immunity (EMI)
- Very high ESD robustness:  $\pm 6$  kV according to IEC61000-4-2 for pins LIN1 to LIN4 and BAT
- Bus terminal and battery pin protected against transients in the automotive environment (ISO 7637)
- Bus terminal short-circuit proof to battery and ground
- LIN dominant timeout function
- Thermal protection

## 3. Block Diagram



## 4. Typical Application Diagram



## 5. Competition Landscape – Quad LIN Transceivers

Function / Feature	E521.50	MLX80001	MLX80004	NCV7424	TJA1024	TJA1124	SJA1124
ISO 17897 (LIN 2.x) / SAE-J2602 compliancy	✓	✓	✓	✓	✓	✓	✓
Master termination (pull-up resistor + diode)	-	1kΩ±10%	1kΩ±10% (ON/OFF)	-	-	1kΩ±10%	1kΩ±10%
Slave termination (pull-up resistor + diode)	SPI configurable: 30kΩ pu or 100kΩ pd	-	30kΩ	30kΩ	30kΩ	30kΩ	30kΩ
SPI-to-LIN bridge (replacing TxD / RxD pins)	-	-	-	-	-	-	✓
High-speed LIN	115kbit/s	100kbit/s	100kbit/s	-	-	-	100kbit/s
Micromicrocontroller interface	3V3	3V3 / 5V	3V3 / 5V	3V3 / 5V	3V3 / 5V	3V3 / 5V	3V3 / 5V
INH	-	✓	✓	-	-	✓	✓
TxD dominant time-out function	✓	✓	✓	✓	✓	✓	✓
Wake-up source recognition	✓	✓	✓	✓	✓	✓	✓
Local wake	-	-	✓	-	-	✓	✓
Battery supply voltage range	5.5V to 18V LIN: 7V to 18V	5V to 26.5V LIN: 7V to 18V	5V to 27V LIN: 7V to 18V	5V to 27V LIN: 7V to 18V	5V to 18V LIN: 5V to 18V	5V to 28V LIN: 5V to 28V	5V to 28V LIN: 5V to 28V
LIN channel control	Globally	Globally	Globally	Globally	Individually	Globally	Individually
Max. voltage pins BAT and LIN	40V	45V	40V	45V	42V	43V	43V
ESD (pin LIN): HBM / IEC61000-4-2	±8kV / ?kV	±4kV / ?kV	±8kV / ±10kV	±8kV / ±10kV	±8kV / ±8kV	±6kV / ±6kV	±6kV / ±6kV
Sleep current (max.)	40µA / - (@ V <sub>BAT</sub> = 13.5V)	50µA	20µA (@ V <sub>BAT</sub> ≤ 18V & T <sub>J</sub> ≤ 125°C)	30µA (@ V <sub>BAT</sub> = 12V & T <sub>J</sub> < 85°C)	20µA	35µA (@ T <sub>J</sub> < 85°C)	35µA (@ T <sub>J</sub> < 85°C)
Package (AOI: Automatic Optical Inspection support)	TSSOP16 (5x6.4mm <sup>2</sup> ) DFN18 (5x4mm <sup>2</sup> )	QFN20 (5x5mm <sup>2</sup> )	QFN24; AOI (4x4mm <sup>2</sup> )	TSSOP16 (5x6.4mm <sup>2</sup> )	DHVQFN24; AOI (3.5x5.5mm <sup>2</sup> )	DHVQFN24; AOI (3.5x5.5mm <sup>2</sup> )	DHVQFN24; AOI (3.5x5.5mm <sup>2</sup> )

## 6. Target Applications

Multi LIN-master channel applications like:

- Body control
- HVAC
- Ambient mood lighting
- Park assist

The SJA1124 offers a way out in case the (preferred) MCU does not have sufficient on-chip SCIs to support the number of LIN channels of the application. The alternative would be a bigger - higher pin-count – MCU with more SCIs, so a more expensive type of MCU.

## 7. Part Attributes

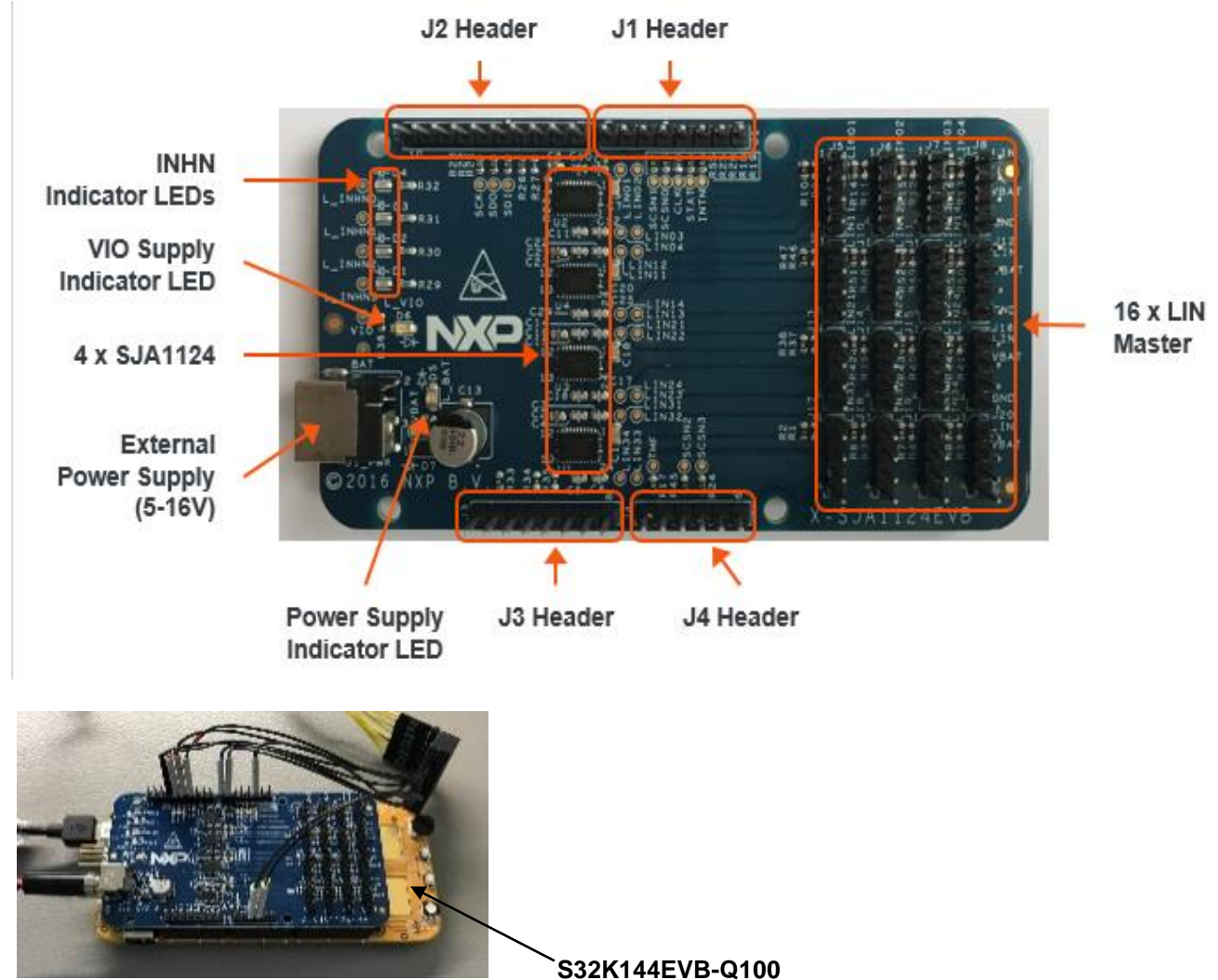
Feature / requirement	SJA1124
Supported LIN standards	ISO 17987-4:2016 (12 V LIN), LIN 2.x and SAE J2602
# LIN channels	4
LIN master controller (per channel)	Yes
Integrated master termination (per channel)	Yes
LIN communication interface	SPI-to-LIN bridge concept
High speed LIN mode	Yes
TXD dominant time-out timer	Yes
INH / Wake	Yes / No
Low power modes	Low power
Mode control	SPI
Battery supply voltage	5 V – 28 V
Standby / Sleep current (@ $T_{vj \text{ max.}} = 85^{\circ}\text{C}$ )	- / 15 $\mu\text{A}$
Data rate (kb/s)	2.4 – 20
Max. voltage on bus pins	$\pm 43 \text{ V}$
$V_{\text{ESD}}$ HBM on bus pins	$\pm 6 \text{ kV}$
$V_{\text{ESD}}$ IEC-61000-4-2 on bus pins	$\pm 6 \text{ kV}$
Auto I/O-level adaptation to host/controller interface ( $V_{\text{IO}}$ )	Yes
$T_{vj}$ (virtual junction temperature)	-40 $^{\circ}\text{C}$ to +125 $^{\circ}\text{C}$
$R_{\text{th(j-a)}}$ - Four-layer board	- 51 K/W
Undervoltage detection	Yes
Overtemperature detection	Yes
Package (leadless with A.O.I. support)	DHVFNQ24 (3.5 mm x 5.5 mm)

## 8. Evaluation Board

### 8.1 Brief description

The SJA1124 EVB has the standard-based form factor compatible with Arduino™ UNO pin layout, that enables rapid prototyping with a wide range of microcontroller development boards like the S32K144EVB-Q100 and provides 16 LIN master channels (SPI-to-16xLIN Bridge). For more details, please refer to the user guide.

### 8.2 Board Image and Description`



### 8.3 List kit contents

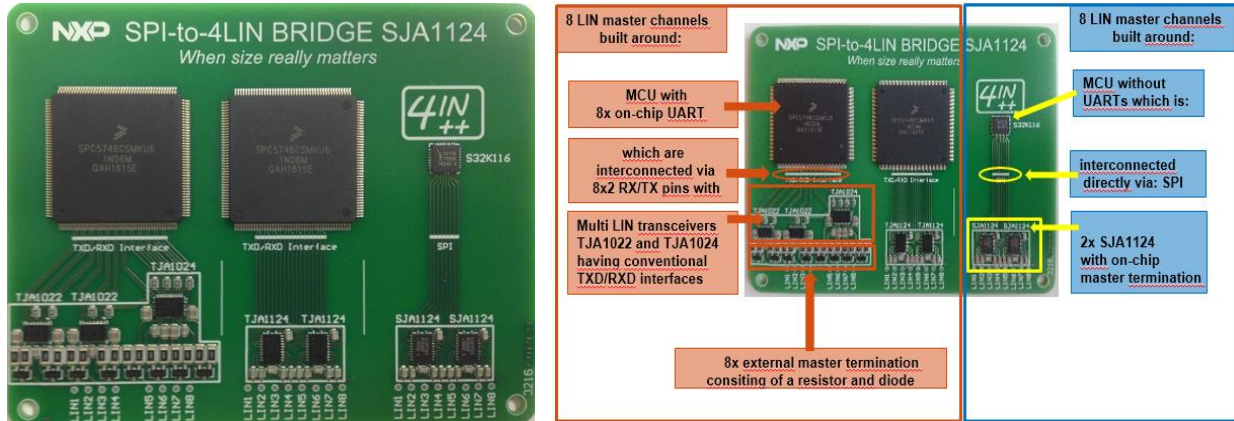
Together with the evaluation board, a DC power plug ([PP3-002A](#)) will be delivered.  
Board price: \$70,00.

## 9. Give-away PCB ('When size really matters')

### 9.1 Brief description

This give-away board ('When size really matters') shows in a glance the board space and BoM saving potential when building 8 LIN channels based on the SJA1124 with SPI based LIN communication and on-chip master termination, compared to the solution with multi-LIN transceivers using the classical TXD/RXD LIN interface pins and discrete master termination.

Moreover, it shows that just a small, low pin-count MCU is needed to serve 8 LIN master channels. The one used for this give-away is the S32K116 for cross-selling promotion.



This board can be used for promotion activities and shown/handed to customers and car OEMs during visits and TechDays.

The flip side of this board shows NXP's stand-alone LIN portfolio.

## 10. NXP Attach Opportunities

Device Type	Part Number	1 Piece	Availability
MCU	S32K144		✓

## 11. Suggested Stocking

All silicon part numbers are available for ordering today. A full list of orderable part numbers can be found in the distributor pricebook. Superset part numbers are available for stocking and orders can be placed immediately.

"Development boards" are included in Price Book. Those devices highlighted below are highest priority for stocking based on anticipated popularity.

NXP Part Number	1ku S/R *Check Web for Actual Price	Product Family	MOQ	Suggested Stocking	Order Priority and Comments
<b>SJA1124AHG</b> (9353 338 16431)	\$1.27	SJA1124	3000	3000	



## 12. Export Compliance

NXP Semiconductors, makes product Export Control Classification Number (ECCN) and Harmonized Tariff Schedule (HTS) classifications available for informational purposes only and the classifications are subject to change without notice. Anyone importing or exporting/re-exporting an NXP item is solely responsible for assuring the ECCN and HTS they use is correct. Further, NXP does not provide guidance regarding the exportability of its products, software or technology. Such questions should be directed to the exporter's internal Trade Compliance organization or legal counsel.

NXP Part Number	USHTS	ECCN	CCATS #	ENC Status	U.S. EAR - Regulatory Reference
<b>SJA1124AHG</b> (9353 338 16431)	854239 0001 US 854239 9000 EU	EAR99	N/A		

The extended ECCN for our 5A002 devices is both a.1.a and a.1.b since we have both symmetric and asymmetric algorithms in all of our encrypted products.

### 13. Available Documentation

Include direct links to high value assets as well as links to NXP.com, disty extranet and channel launch repository.

Distributor extranet: <https://nxp1.sharepoint.com/teams/ext96/SitePages/AAA%20Networking.aspx>

NXP.com: <https://www.nxp.com/products/analog/interfaces/in-vehicle-network/flexray-transceivers/flexray-node-transceiver-compliant-with-iso-17458-42013:SJA1124>

Datasheet: <https://www.nxp.com/docs/en/data-sheet/SJA1124.pdf>

\*Please note that the Channel Launch Repository is for marketing assets like high res block diagram and board photography. This same information is also posted to the “product” launch folder on the distributor extranet for others outside of marketing who may need it.

### 14. Appendix A Market Segment (Model N)

Leverage these market segments in Model N for identifying end applications to the distributors and their selling functions.

Functions
Automotive:-Battery management/ Battery charger
Automotive:-Car Entertainment
Automotive:-Diagnostic
Automotive:-Fleet management/GPS
<b>Automotive:-Connectivity</b>
Automotive:-Powertrain
Automotive:-Safety and Comfort
Automotive:-ADAS & Autonomous Driving
Automotive:-Telematics
Computing:-Accessories
Computing:-Desktop
Computing:-Netbook
Computing:-Notebook
Computing:-Power
Computing:-Server
Computing:-Storage
Consumer-Audio systems
Consumer-Fax and printing machines
Consumer-set top box
Consumer-Tablets
Consumer-TV
Healthcare:-Consumer Medical Devices
Healthcare:-Diagnostics
Healthcare:-Medical Imaging
Healthcare:-Medical Instruments

Industrial-Building Control - Home automation
Industrial-Embedded solutions
Industrial-HMI
Industrial-HVAC & boiler
Industrial-Industrial Controls
Industrial-Lighting
Industrial - Networking
Industrial-Motor control
Industrial-POS (Point of sales)
Industrial-Power supply/UPS
Industrial-Renewable energy (Solar)
Industrial-Security (sensors)
Industrial-Small appliance
Industrial-Smart grid (Smart Metering)
Industrial-White Goods
Portable-Mobile Handsets
Portable-Modules
Ref Designs
Secure Identity:-eGov
Secure Identity:-PayTV
Secure Transactions:-AFC
Secure Transactions:-Banking
Secure Transactions:-Infrastructure
Secure Transactions:-Mobile Transaction
Security: Access, Monitoring, Security and Management
Tagging & Authentication:-Authentication
Tagging & Authentication:-Tags and Labels
Wireless Infrastructure:-Basestation
Wireless Infrastructure:-Broadcast
Wireless Infrastructure:-Microwave
Other

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