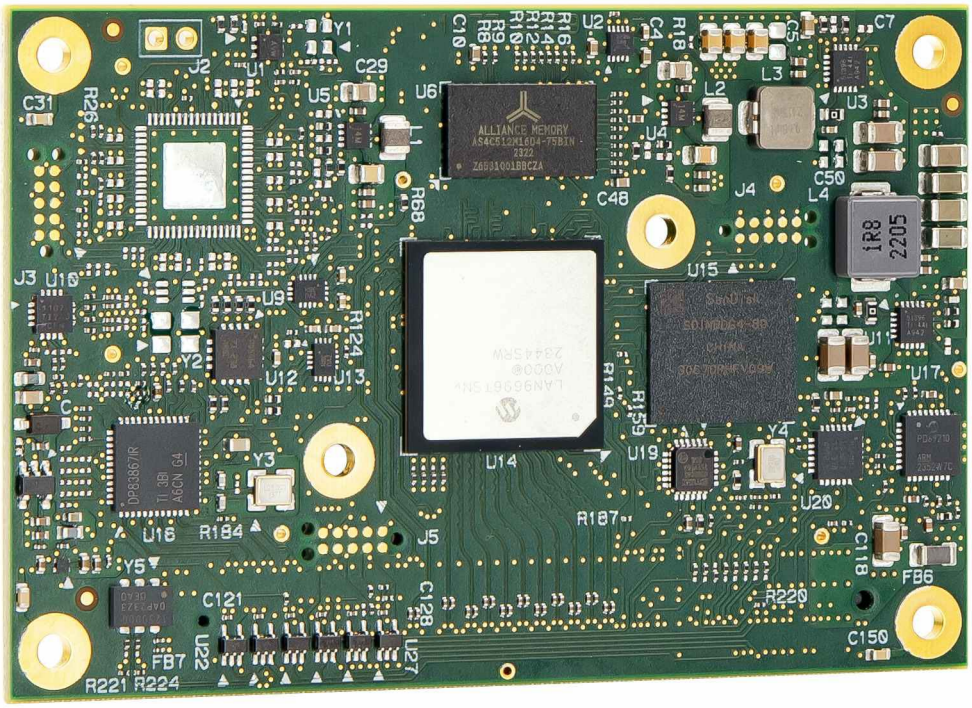

KSwitch M20 Embedded Ethernet Switch Module

Preliminary User Guide Rev. 0.6

Doc. ID 1080-1661

The Power of IoT

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KSwitch M20 – User Guide

Disclaimer

Kontron would like to point out that the information contained in this user guide may be subject to alteration, particularly as a result of the constant upgrading of Kontron products. This document does not entail any guarantee on the part of Kontron with respect to technical processes described in the user guide or any product characteristics set out in the user guide. Kontron assumes no responsibility or liability for the use of the described product(s), conveys no license or title under any patent, copyright or mask work rights to these products and makes no representations or warranties that these products are free from patent, copyright or mask work right infringement unless otherwise specified. Applications that are described in this user guide are for illustration purposes only. Kontron makes no representation or warranty that such application will be suitable for the specified use without further testing or modification. Kontron expressly informs the user that this user guide only contains a general description of processes and instructions which may not be applicable in every individual case. In cases of doubt, please contact Kontron.

Kontron Europe GmbH
Gutenbergstraße 2
85737 Ismaning
Germany
www.kontron.com

Intended Use

This device and associated software are not designed, manufactured or intended for use or resale for the operation of nuclear facilities, the navigation, control or communication systems for aircraft or other transportation, air traffic control, life support or life sustaining applications, weapons systems, or any other application in a hazardous environment, or requiring fail-safe performance, or in which the failure of products could lead directly to death, personal injury, or severe physical or environmental damage (collectively, "high risk applications").

You understand and agree that your use of Kontron devices as a component in High Risk Applications is entirely at your risk. To minimize the risks associated with your products and applications, you should provide adequate design and operating safeguards. You are solely responsible for compliance with all legal, regulatory, safety, and security related requirements concerning your products. You are responsible to ensure that your systems (and any Kontron hardware or software components incorporated in your systems) meet all applicable requirements. Unless otherwise stated in the product documentation, the Kontron device is not provided with error-tolerance capabilities and cannot therefore be deemed as being engineered, manufactured or setup to be compliant for implementation or for resale as device in High Risk Applications. All application and safety related information in this document (including application descriptions, suggested safety measures, suggested Kontron products, and other materials) is provided for reference only.

NOTICE	You find the most recent version of the "General Safety Instructions" online in the download area of this product.

NOTICE	This product is not intended for use or suited for storage or operation in corrosive environments, in particular under exposure to sulfur and chlorine and their compounds. For information on how to harden electronics and mechanics against these stress conditions, contact Kontron Support.

Revision History

Revision	Brief Description of Changes	Date of Issue	Author
0.1	Initial Issue	09-Aug-2025	CW
0.2	Added module photo. K1 added to compliance	14-Jan-2025	CW
0.3	Added new block diagrams and hardware updates	16-Sept-2025	CW
0.4	Added new type label.	24-Sept-2025	CW
0.5	Power information updates and EN62368-1 confirmed, removed the variant 1073-5326 and, updated figures 3 and 4 (module views top and bottom, updated table 23 and 24 the Carrier interface connector pinout, updated table 6 the GPIO mapping table with more information, and removed the software interface information.	26-Nov-2025	CW
0.6	Added MTBF and a new heatspeader plate diagram. Changed COMe Interface connector to Carrier Interface connector. Updated USB 2.0 as for Switch Auto-configuration only. Changed the signal name for pin-B-20/22. Changed eMMC to 8 GB and DDR4 to 1 GB only with ECC. Updated Ch. 4.5 clock distribution and Ch. 4.8 I2C bus. Updated Table 27 Statement of Memory volatility. Included more information with the customer section link to give the location of the carrier board design guide.	17-Dec-2025	CW

Terms and Conditions

Kontron warrants products in accordance with defined regional warranty periods. For more information about warranty compliance and conformity, and the warranty period in your region, visit www.kontron.com/terms-and-conditions.
Kontron sells products worldwide and declares regional General Terms & Conditions of Sale, and Purchase Order Terms & Conditions. Visit www.kontron.com/terms-and-conditions.
For contact information, refer to the corporate offices contact information on the last page of this user guide or visit our website CONTACT US.

Customer Support

Find Kontron contacts by visiting www.kontron.com/support-and-services.

Customer Service

As a trusted technology innovator and global solutions provider, Kontron extends its embedded market strengths into a services portfolio allowing companies to break the barriers of traditional product lifecycles. Proven product expertise coupled with collaborative and highly-experienced support enables Kontron to provide exceptional peace of mind to build and maintain successful products.
For more details on Kontron's service offerings such as: enhanced repair services, extended warranty, Kontron training academy, and more visit www.kontron.com/support-and-services.

Customer Comments

If you have any difficulties using this user guide, discover an error, or just want to provide some feedback, contact Kontron support. Detail any errors you find. We will correct the errors or problems as soon as possible and post the revised user guide on our website.

Symbols

The following symbols may be used in this user guide

⚠DANGER	**DANGER** indicates a hazardous situation which, if not avoided, will result in death or serious injury.
⚠WARNING	**WARNING** indicates a hazardous situation which, if not avoided, could result in death or serious injury.
NOTICE	**NOTICE** indicates a property damage message.
⚠CAUTION	**CAUTION** indicates a hazardous situation which, if not avoided, may result in minor or moderate injury **ATTENTION** indique une situation dangereuse qui, si elle n'est pas évitée, peut entraîner des blessures mineures ou modérées.
	**Electric Shock!** This symbol and title warn of hazards due to electrical shocks (> 60 V) when touching products or parts of products. Failure to observe the precautions indicated and/or prescribed by the law may endanger your life/health and/or result in damage to your material.
	**ESD Sensitive Device!** This symbol and title inform that the electronic boards and their components are sensitive to static electricity. Care must therefore be taken during all handling operations and inspections of this product in order to ensure product integrity at all times.
	**Caution: HOT Surface!** Do NOT touch! Allow to cool before servicing. **Attention : Surface CHAUDE !** Ne pas toucher ! Laissez refroidir avant de procéder à l'entretien.
	**Caution: Laser!** This symbol inform of the risk of exposure to laser beam and light emitting devices (LEDs) from an electrical device. Eye protection per manufacturer notice shall review before servicing.
	**Caution: High Sound Pressure!** This symbol and title indicate that high sound pressure is possible with headphones. There is a risk of hearing damage. Do not listen at high volume levels for long periods of time.

Security

This symbol and title indicate general information and guidelines regarding the product's cyber security to ensure secure installation, operation, maintenance and disposal of the product within the user's end environment.

This symbol indicates general information about the product and the user guide.

This symbol precedes helpful hints and tips for daily use.

For Your Safety

Your new Kontron product was developed and tested carefully to provide all features necessary to ensure its compliance with electrical safety requirements. It was also designed for a long fault-free life. However, the life expectancy of your product can be drastically reduced by improper treatment during unpacking and installation. Therefore, in the interest of your own safety and of the correct operation of your new Kontron product, you are requested to conform with the following guidelines.

High Voltage Safety Instructions

As a precaution and in case of danger, the power connector must be easily accessible. The power connector is the product's main disconnect device.

⚠CAUTION

Warning

All operations on this product must be carried out by sufficiently skilled personnel only.

⚠CAUTION

Electric Shock!

Before installing a non hot-swappable Kontron product into a system always ensure that your mains power is switched off. This also applies to the installation of piggybacks. Serious electrical shock hazards can exist during all installation, repair, and maintenance operations on this product. Therefore, always unplug the power cable and any other cables which provide external voltages before performing any work on this product.

Earth ground connection to vehicle's chassis or a central grounding point shall remain connected. The earth ground cable shall be the last cable to be disconnected or the first cable to be connected when performing installation or removal procedures on this product.

Special Handling and Unpacking Instruction

NOTICE

ESD Sensitive Device!

Electronic boards and their components are sensitive to static electricity. Therefore, care must be taken during all handling operations and inspections of this product, in order to ensure product integrity at all times.

⚠CAUTION

Handling and operation of the product is permitted only for trained personnel within a work place that is access controlled. Follow the "General Safety Instructions" supplied with the product.

Do not handle this product out of its protective enclosure while it is not used for operational purposes unless it is otherwise protected.
Whenever possible, unpack or pack this product only at EOS/ESD safe work stations. Where a safe work station is not guaranteed, it is important for the user to be electrically discharged before touching the product with his/her hands or tools. This is most easily done by touching a metal part of your system housing.
It is particularly important to observe standard anti-static precautions when changing piggybacks, ROM devices, jumper settings etc. If the product contains batteries for RTC or memory backup, ensure that the product is not placed on conductive surfaces, including anti-static plastics or sponges. They can cause short circuits and damage the batteries or conductive circuits on the product.

Lithium Battery Precautions

If your product is equipped with a lithium battery, take the following precautions when replacing the lithium battery.

⚠CAUTION	Risk of Explosion if the lithium Battery is replaced by an incorrect Type. Dispose of used lithium batteries According to the instructions. Risque d'explosion si la pile au lithium est remplacée par une pile de type incorrect. Éliminez les piles au lithium usagées conformément aux instructions.

General Instructions on Usage

In order to maintain Kontron's product warranty, this product must not be altered or modified in any way. Changes or modifications to the product, that are not explicitly approved by Kontron and described in this user guide or received from Kontron Support as a special handling instruction, will void your warranty.

This product should only be installed in or connected to systems that fulfill all necessary technical and specific environmental requirements. This also applies to the operational temperature range of the specific board version that must not be exceeded. If batteries are present, their temperature restrictions must be taken into account.

In performing all necessary installation and application operations, only follow the instructions supplied by the present user guide.

Keep all the original packaging material for future storage or warranty shipments. If it is necessary to store or ship the product then re-pack it in the same manner as it was delivered.

Special care is necessary when handling or unpacking the product. See Special Handling and Unpacking Instruction.

Quality and Environmental Management

Kontron aims to deliver reliable high-end products designed and built for quality, and aims to complying with environmental laws, regulations, and other environmentally oriented requirements. For more information regarding Kontron's quality and environmental responsibilities, visit www.kontron.com/about-kontron/corporate-responsibility/quality-management.

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List of Figures

1/Introduction

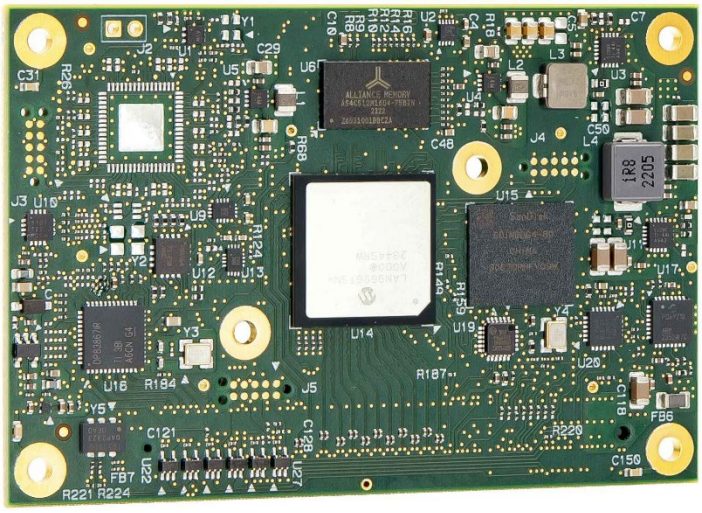
This user guide describes the KSwitch M20 embedded Ethernet Switch module, also known as KSwitch M20 Module within this user guide. This user guide focuses on describing the KSwitch M20 module's special features and how to set up, install, operate, maintain and dispose of the KSwitch M20 module properly. New users are recommended to study the instructions within this user guide before connecting the KSwitch M20 module to power.

The Kontron KSwitch M20 module is a modular non blocking fully managed 1/2.5/5/10 Gigabit Ethernet Switch supporting flexible port configuration via 10x 10G SerDes, up to 28 ports. The Kontron KSwitch M20 module with Precision Time Protocol (PTP) and Time Sensivive Network (TSN) provides a rich and versatile feature set to integrate Ethernet switching functions on custom carrier board designs. The IEEE1588v2 features enable precise timing synchronization and packet time stamping for time sensitive applications. It also supports intelligent Power Over Ethernet devices by built in firmware. The KSwitch M20 module is designed for future oriented applications that require out-standing bandwidth and communication safety.

The KSwitch M20 module is based on the PICMG COM Express® Rev 3.0 mini standard and can be integrated on compliant COM Express® mini carrier boards.

The KSwitch M20 module is designed for use within railway and rolling stock equipment according to EN 50155 and operation in industrial grade temperatures. Whatever you need to integrate, the KSwitch M20 module is the ideal fit for all kinds of high performance Ethernet switching, either in military, avionics or industrial applications.

Figure 1: KSwitch M20 Embeded Ethernet Switch Module



General KSwitch M20 module features are:

- Managed Time Sensitive Networking (TSN) Ethernet switch based on the LAN969xTSN family
  - Non blocking fully managed L2/L3 1/2.5/5/10 Gigabit Ethernet Switch
  - 44 GBps tp 100 Gbps scalable bandwidth
  - Flexible Ethernet port configuration via 10x 10G SerDes, up to 28 ports
  - 10/100/1000BASSE-T MDI IF (optional)
  - MIIM Interfaces for CL22 and CL45 devices
  - Non blocking fully managed L2/L3 1/2.5/5/10 Gigabit Ethernet Switch
  - Precision Time Protocol (PTP), and Reference and Synchronization clock distribution interfaces
  - Ethernet Physical interface
- Swtich Auto-Configuration USB 2.0 Physical interface
- IEEE1588v2 and PoE PSE support
- Smart serial LED bus distribution

- Clock distribution
- Real Time Clock (RTC) supported with Supercap or battery on the carrier board
- Compliance
  - According to EN 50155:2021 Railway and Rolling stock
  - CE
- Environmental
  - Industrial grade, and highly reliable and shock and vibration resistant
  - Extended Temperature Range
- Module Form-factor
  - PICMG COM Express® Rev 3.0 mini module:
  - Size (84 mm x 55 mm)
  - Single 220 pin Carrier interface connector
  - Input power supply 12 VDC (wide range)
  - 5mm and 8mm stack height options (module bottom to carrier board top)
  - Reduced Z height for components

1.1. Carrier Board

A carrier board is not included in the KSwitch M20 module's delivery. Kontron provides a Design Guide for a KSwitch M20 Carrier Board, to aid the development of a custom carrier board designed for the user's application.

For the Carrier Board Design Guide, visit Kontron's Customer Section .

In the Customer Section click on Switches > TSN Network > KSwitch M20 > KSwitch M20 Design Information > Design Guide KSwitch_M20-xxxT.

For more information on the carrier board design, contact Kontron Support.

Preliminary Version of the User Guide!

This preliminary version of the user guide may contain information requiring rework. Yellow highlighted item may be subject to change and figures may not represent the final product.

2/General Safety Instructions

Please read this passage carefully and take careful note of the instructions, which have been compiled for your safety and to ensure to apply in accordance with intended regulations. If the following general safety instructions are not observed, it could lead to injuries to the operator and/or damage of the product; in cases of non-observance of the instructions Kontron Europe is exempt from accident liability, this also applies during the warranty period.

The product has been built and tested according to the basic safety requirements for low voltage (LVD) applications and has left the manufacturer in safety-related, flawless condition. To maintain this condition and to also ensure safe operation, the operator must not only observe the correct operating conditions for the product but also the following general safety instructions:

- The product must be used as specified in the product documentation, in which the instructions for safety for the product and for the operator are described. These contain guidelines for setting up, installation and assembly, maintenance, transport or storage.
- The on-site electrical installation must meet the requirements of the country's specific local regulations.
- If a power cable comes with the product, only this cable should be used. Do not use an extension cable to connect the product.
- To guarantee that sufficient air circulation is available to cool the product, please ensure that the ventilation openings are not covered or blocked. If a filter mat is provided, this should be cleaned regularly. Do not place the product close to heat sources or damp places. Make sure the product is well ventilated.
- Only connect the product to an external power supply providing the voltage type (AC or DC) and the input power (max. current) specified on the Kontron Product Label and meeting the requirements of the Limited Power Source (LPS) and Power Source (PS2) of UL/IEC 62368-1 .
- Only products or parts that meet the requirements for Power Source (PS1) of UL/IEC 62368-1 may be connected to the product’s available interfaces (I/O).
- Before opening the product, make sure that the product is disconnected from the mains.
- Switching off the product by its power button does not disconnect it from the mains. Complete disconnection is only possible if the power cable is removed from the wall plug or from the product. Ensure that there is free and easy access to enable disconnection.
- The product may only be opened for the insertion or removal of add-on cards (depending on the configuration of the product). This may only be carried out by qualified operators.
- If extensions are being carried out, the following must be observed:
  - all effective legal regulations and all technical data are adhered to
  - the power consumption of any add-on card does not exceed the specified limitations
  - the current consumption of the product does not exceed the value stated on the product label
- Only original accessories that have been approved by Kontron Europe can be used.
- Please note: safe operation is no longer possible when any of the following applies:
  - the product has visible damages or
  - the product is no longer functioning
    In this case the product must be switched off and it must be ensured that the product can no longer be operated.
- Handling and operation of the product is permitted only for trained personnel within a workplace that is access controlled.
- CAUTION: Risk of explosion if the lithium battery is replaced incorrectly (short-circuited, reverse-poled, wrong lithium battery type). Dispose of used lithium batteries according to the manufacturer’s instructions.
- This product is not suitable for use in locations where children are likely to be present

Additional Safety Instructions for DC Power Supply Circuits

- To guarantee safe operation, please observe that:
  - the external DC power supply must meet the criteria for LPS and PS2 (UL/IEC 62368-1)

- no cables or parts without insulation in electrical circuits with dangerous voltage or power should be touched directly or indirectly
- a reliable functional earth connection is provided
- a suitable, easily accessible disconnecting device is used in the application (e.g. overcurrent protective device), if the product itself is not disconnect able
- a disconnect device, if provided in or as part of the product, shall disconnect both poles simultaneously
- interconnecting power circuits of different products cause no electrical hazards

- A sufficient dimensioning of the power cable wires must be selected – according to the maximum electrical specifications on the product label – as stipulated by EN62368-1 or VDE0100 or EN60204 or UL61010-1 regulations.

For the General Safety Instruction in German or French, visit Kontron's product web page> Downloads> Manuals> General Safety Instructions.

2.1. Instructions générales de sécurité

Veuillez lire attentivement ce passage et prendre bonne note des instructions, qui ont été compilées pour votre sécurité et pour assurer une application conforme aux réglementations prévues. Le non-respect des consignes de sécurité générales suivantes peut entraîner des blessures pour l'utilisateur et/ou des dommages pour le produit. En cas de non-respect des consignes, Kontron Europe est exonéré de la responsabilité en cas d'accident, ceci s'applique également pendant la période de garantie.

Le produit a été construit et testé conformément aux exigences de sécurité de base pour les applications basse tension (DBT) et a quitté le fabricant dans un état impeccable en matière de sécurité. Pour maintenir cet état et pour garantir également un fonctionnement sûr, l'opérateur doit non seulement respecter les conditions d'utilisation correctes du produit, mais aussi les consignes de sécurité générales suivantes :

- Le produit doit être utilisé conformément à la documentation du produit, dans laquelle sont décrites les instructions de sécurité pour le produit et pour l'opérateur. Celles-ci contiennent des directives pour la mise en place, l'installation et le montage, la maintenance, le transport ou le stockage.
- L'installation électrique sur place doit répondre aux exigences des réglementations locales spécifiques du pays.
- Si un câble d'alimentation est fourni avec le produit, seul ce câble doit être utilisé. N'utilisez pas de rallonge pour connecter le produit.
- Afin de garantir une circulation d'air suffisante pour refroidir le produit, veuillez vous assurer que les ouvertures de ventilation ne sont pas couvertes ou obstruées. Si un élément filtrant est fourni, celui-ci doit être nettoyé régulièrement. Ne placez pas le produit à proximité de sources de chaleur ou d'endroits humides. Veillez à ce que le produit soit bien ventilé.
- Ne connectez le produit qu'à une alimentation externe fournissant le type de tension (AC ou DC) et la puissance d'entrée (courant max.) spécifiés sur le Label Produit Kontron et répondant aux exigences de la source d'alimentation limitée (LPS) et de la source d'alimentation (PS2) de la norme UL/IEC 62368-1 .
- Seuls les produits ou les pièces qui répondent aux exigences de la source d'alimentation (PS1) de la norme UL/IEC 62368-1 peuvent être connectés aux interfaces (E/S) disponibles du produit.
- Avant d'ouvrir le produit, assurez-vous qu'il est bien débranché du secteur.
- Le fait d'éteindre le produit par son bouton de mise en marche ne le déconnecte pas du secteur. Une déconnexion complète n'est possible que si le câble d'alimentation est retiré de la prise murale ou du produit. Veillez à ce que l'accès soit libre et facile pour permettre la déconnexion.
- Le produit ne peut être ouvert que pour l'insertion ou le retrait de cartes supplémentaires (selon la configuration du produit). Cette opération ne peut être effectuée que par des opérateurs qualifiés.
- Si des extensions sont effectuées, les points suivants doivent être respectés :
  - toutes les réglementations légales en vigueur et toutes les données techniques sont respectées
  - la consommation électrique d'une carte supplémentaire ne dépasse pas les limites spécifiées
  - la consommation actuelle du produit ne dépasse pas la valeur indiquée sur l'étiquette du produit.
- Seuls les accessoires d'origine approuvés par Kontron Europe peuvent être utilisés.
- Veuillez noter que la sécurité des opérations n'est plus possible lorsque l'une des conditions suivantes s'applique.

- le produit présente des dommages visibles ou
- le produit ne fonctionne plus. Dans ce cas, le produit doit être éteint et il faut s'assurer que le produit ne puisse plus être utilisé.

- La manipulation et le fonctionnement du produit ne sont autorisés que pour le personnel formé dans un lieu de travail dont l'accès est contrôlé.
- ATTENTION: Risque d'explosion en cas de remplacement incorrect de la pile au lithium (court-circuit, inversion de polarité, mauvais type de pile au lithium). Éliminez les piles au lithium usagées conformément aux instructions du fabricant.
- Ce produit n'est pas adapté à une utilisation dans des endroits où des enfants sont susceptibles d'être présents
- Instructions de sécurité supplémentaires pour les circuits d'alimentation en courant continu
- Pour garantir un fonctionnement sûr, veuillez observer ce qui suit:
  - l'alimentation électrique externe en courant continu doit répondre aux critères des LPS et PS2 (UL/IEC 62368-1)
  - aucun câble ou pièce non isolée dans les circuits électriques ayant une tension ou une puissance dangereuse ne doit être touché directement ou indirectement
  - une connexion à la terre fonctionnelle fiable est fournie
  - un dispositif de déconnexion approprié et facilement accessible est utilisé dans l'application (par exemple, un dispositif de protection contre les surintensités), si le produit lui-même n'est pas en mesure d'être déconnecté.
  - un dispositif de déconnexion, s'il est prévu dans le produit ou s'il en fait partie, doit déconnecter les deux pôles simultanément
  - l'interconnexion des circuits électriques de différents produits ne présente aucun risque électrique
- Un dimensionnement suffisant des fils du câble d'alimentation doit être choisi - en fonction des spécifications électriques maximales figurant sur l'étiquette du produit - comme stipulé par les réglementations EN62368-1 ou VDE0100 ou EN60204 ou UL61010-1.

2.2. Electrostatic Discharge (ESD)

A sudden discharge of electrostatic electricity can destroy static-sensitive devices or micro-circuitry. Therefore, proper packaging and grounding techniques are necessary precautions to prevent damage.
Always take the following precautions:

ESD Sensitive Device!
Keep electrostatic sensitive parts in their containers until they arrive at the ESD-safe workplace. Always be properly grounded when touching a sensitive board, component, or assembly.

For more Information, see the Special Handling and Unpacking Instruction within this user guide and Chapter 2.3: Grounding Methods.

2.3. Grounding Methods

The following measures help to avoid electrostatic damages to the device:

1. Cover workstations with approved antistatic material. Always wear a wrist strap connected to the workplace, as well as properly grounded tools and equipment.
2. Use antistatic mats, heel straps, or air ionizers for more protection.
3. Always handle electrostatically sensitive components by their edge or by their casing.
4. Avoid contact with pins, leads, or circuitry.
5. Switch off power and input signals before inserting and removing connectors or connecting test equipment.
6. Keep the work area free of non-conductive materials such as ordinary plastic assembly aids and styrofoam.
7. Use field service tools such as cutters, screwdrivers, and vacuum cleaners that are conductive.
8. Always place drives and boards with the PCB-assembly-side down on the foam.

3/Shipment and Packaging

3.1. Packaging

The KSwitch M20 Embedded Ethernet switch module is packaged together with all parts, in a specific cardboard package designed to provide adequate protection and absorb shock.

3.2. Unpacking

To unpack the KSwich M20 module perform the following:

1. Remove packaging.
2. Do not discard the original packaging. Keep the original packaging for future transportation or storage.
3. Check the delivery for completeness by comparing the delivery with the original order.
4. Keep the associated paperwork. It contains important information for handling the switch.
5. Check the switch for visible shipping damage.

If you notice shipping damage or inconsistencies between the contents and the original order, contact your dealer.

3.3. Switch Variants

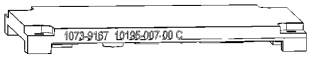
This scope of delivery describes the parts included in your delivery. Check that the delivery is complete and contains the items listed. If damaged or missing items are discovered, contact your dealer.

Table 1: KSwitch M20 Module Variants

Part	Quantity	Part Number	Part Description
KSwitch M20 M100T	1	1074-2710	Module KSwitch M20, 100Gbps, TSN Support
KSwitch M20 M64T	1	1074-2711	Module KSwitch M20, 64Gbps, TSN Support

3.4. Accessories

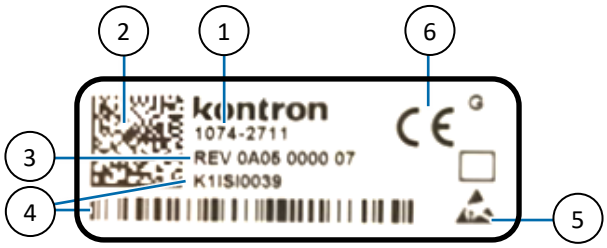
Table 2: List of Accessories

Part	Part Name	Part Number	Description
	Heatspreader Plate	1073-9167	COMe form-factor Module Heatspreader plate

3.5. Type Label and Product Identification

The type label contains specific KSwitch M20 module identification information and technical information.

Figure 2: Type Label Example



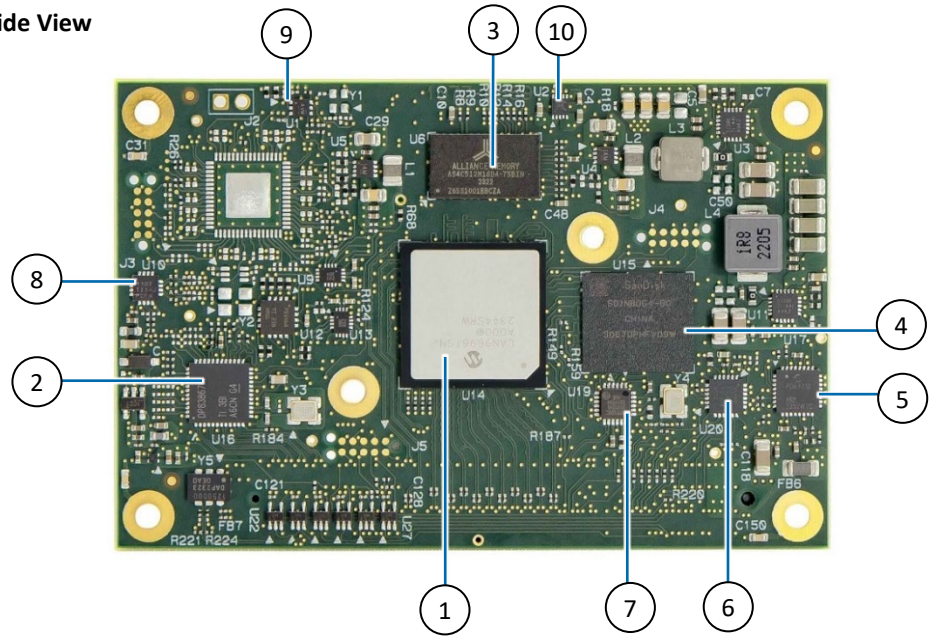
1. Part Number
2. QR Code
3. Revision
4. Serial Number and bar code
5. ESD Warning
6. Compliance

4/Switch Interfaces

Before implementing the KSwitch M20 Embedded Ethernet switch module, Kontron recommends new users to take a few minutes to learn about the KSwitch M20 module features.

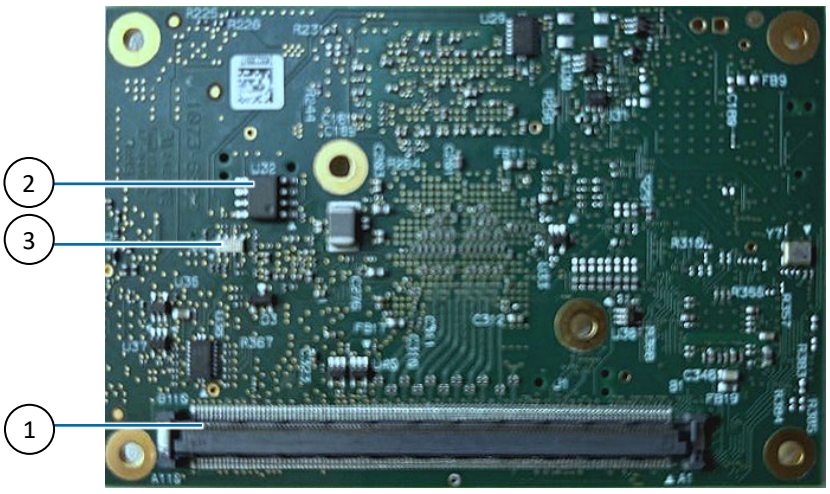
4.1. KSwitch M20 Module Views

Figure 3: Top Side View



1. Microchip LAN969x Ethernet controller (U14)
2. Ethernet Physical Layer transceiver (U16)
3. DDR4 (8 Gbits) memory down (U6)
4. eMMC storage (U15)
5. PoE+ controller (U17)
6. Micro Controller Unit (MCU) (U20)
7. USB 2.0 Physical Layer (U19)
8. Clock (U10)
9. Reset (U1)
10. Reset 2nd stage (U2)

Figure 4: Bottom Side View



1. Mini 220-pin carrier interface connector
2. SPI Nor Flash (U32)
3. RTC device (U34)

4.2. Ethernet Controller

The KSwitch M20 module implements the Microchip LAN969x TSN Switch featuring the following:

- 10x 10Gbps SerDes for various physical interfaces configurations.
- Flexible port configuration via 10x 10G SerDes, up to 28 ports with default port configuarion is:
  - 6x QSGMII (24x 10/100/1000BASE-T) and
  - 4x 10G-USXGMII (4x 1/2.5/5G/10GBASE-T)
  - Up to 28 x 1Gb/s ports or 10x10GBASE-T can be supported (Project request only)
- Managed Time Sensitive Networking (TSN) and Precision Time Protocol (PTP)
- 44 Gbps to 102 Gbps scalable bandwidth
- Ethernet MDI
- 10/100/1000BASE-T MDI IF (optional)
- MIIM Interfaces for CL22 and CL45 devices

Table 3: Ethernet Port and Controller Signals on the Carrier Interface Connector

Pin	Signal	Description	Type	Comment
B2/B3	PHY_MDI0+/-	Ethernet PHY MDI 0+/-	In/Out	MDI lanes, Physical Layer signals
B5/B6	PHY_MDI1+/-	Ethernet PHY MDI 1+/-	In/Out	
B8/B9	PHY_MDI2+/-	Ethernet PHY MDI 2+/-	In/Out	
B12/B13	PHY_MDI3+/-	Ethernet PHY MDI 3+/-	In/Out	
B39/B40	SW_ETH_S0_RX-/+	Differential receive lanes [0]	In	Microchip LAN969xTSN Ethernet SerDes receiver lanes. AC coupled on module.
B43/B44	SW_ETH_S1_RX-/+	Differential receive lanes [1]	In	
B46/B47	SW_ETH_S2_RX-/+	Differential receive lanes [2]	In	
B40/B50	SW_ETH_S3_RX-/+	Differential receive lanes [3]	In	
B52/B53	SW_ETH_S5_RX-/+	Differential receive lanes [4]	In	
B55/B56	SW_ETH_S5_RX-/+	Differential receive lanes [5]	In	
B58/B59	SW_ETH_S6_RX-/+	Differential receive lanes [6]	In	
B61/B62	SW_ETH_S7_RX-/+	Differential receive lanes [7]	In	
B64/B65	SW_ETH_S8_RX-/+	Differential receive lanes [8]	In	
B67/B68	SW_ETH_S9_RX-/+	Differential receive lanes [9]	In	
A39/A40	SW_ETH_S0_TX-/+	Differential transmit lanes [0]	Out	Microchip LAN969xTSN Ethernet SerDes transmit lanes. AC coupled on module.
A43/A44	SW_ETH_S1_TX-/+	Differential transmit lanes [1]	Out	
A46/A47	SW_ETH_S2_TX-/+	Differential transmit lanes [2]	Out	
A49/A50	SW_ETH_S3_TX-/+	Differential transmit lanes [3]	Out	
A52/A53	SW_ETH_S4_TX-/+	Differential transmit lanes [4]	Out	
A55/A56	SW_ETH_S5_TX-/+	Differential transmit lanes [5]	Out	
A58/A59	SW_ETH_S6_TX-/+	Differential transmit lanes [6]	Out	
A61/A62	SW_ETH_S7_TX-/+	Differential transmit lanes [7]	Out	
A64/A65	SW_ETH_S8_TX-/+	Differential transmit lanes [8]	Out	
A67/A68	SW_ETH_S9_TX-/+	Differential transmit lanes [9]	Out	
B20	SW_MDC0_1V8	MIIM data clock	Out	Microchip LAN969xTSN MIIM controller [0/1] Media Dependent Clock
B22	SW_MDC1_1V8	MIIM data clock	Out	
A20	SW_MDIO0_1V8	Switch MIIM data input/output	In/Out	Microchip LAN969xTSN MIIM controller [0/1] Media Dependent Data Input Output
A22	SW_MDIO1_1V8	Switch MIIM data input/output	In/Out	

Pin	Signal	Description	Type	Comment
B15	SW_IRQ2_MIIM_1V8#	Interrupt pin	In	Microchip LAN969xTSN Interrrupt. Signal is active low.

4.3. PoE/PoE+ Controller

The KSwitch M20 module supports enhanced mode PoE capabilities, as specified in IEEE® 802.3af, IEEE 802.3at, IEEE 802.3bt, and PoE standards, on all KSwitch M20 module external Ethernet ports.

The PoE/PoE+ power distribution is achieved using an on module Microchip PD69210 PoE/PoE+ PSE controller and external PSE device(s) such as Microchip PD69208T4, PD69204T4, or PD69208M PoE manager. The PoE/PoE+ PSE controller uses the ESPI interface with 3.3 VIO signals to communicate with one or more PoE PSE managers. The PoE/PoE+ PSE controller supports 28 KSwitch M20 4-pair or 2-pair logical ports.

Table 4: PoE PSE Controller Signals on the Carrier Interface Connector

Pin	Signal	Description	Type	Comment
A78	POE_CON_ESPI_MISO_3V3	eSPI Master In Slave Out	In	Microchip PD69210 eSPI Master In Slave Out for external PoE PSE manager.
B76	POE_CON_ESPI_SCK_3V3	eSPI Chip Select	Out	Microchip PD69210 eSPI Serial Clock for external PoE PSE manager.
B77	POE_CON_ESPI_CS_3V3#	eSPI Chip Select	Out	Microchip PD69210 eSPI Chip select for external PoE PSE manager. Signal is active low.
B78	POE_CON_ESPI_MOSI_3V3	eSPI Master Out Slave In	Out	Microchip PD69210 eSPI Master Out Slave In for external PoE PSE manager.
B83	POE_DIS_PORTS_3V3#	Disable all PoE ports	In	Microchip PD69210 input signal disable all PoE ports. Signal is active low.
B84	POE_SYS_OK_3V3	System OK for PoE ports	Out	Microchip PD69210 PoE system okay signal. Used to drive Healthy led.

The PSE controller provides a system OK signal that can be used to drive an external healthy LED signal.

Note: In case the user defined carrier board does not support a POE subsystem, the carrier board must handle the POE PSE module interface as defined in the Design Guide for a KSwitch M20 Carrier Board.

For the Carrier Board Design Guide, visit Kontron's Customer Section .

In the Customer Section click on Switches > TSN Network > KSwitch M20 > KSwitch M20 Design Information > Design Guide KSwitch_M20-xxxT.

4.4. Memory

4.4.1. System Memory

The KSwitch M20 module supports 1 GByte DDR4 system memory on the KSwitch M20 module (memory down). The DDR4 memory is accessed via the Ethernet controller's 16-bit DDR4 interface using inband ECC.

The DDR4 memory device is soldered down on the switch and cannot be exchanged.

4.4.2. eMMC Storage

The KSwitch M20 module supports 4 GByte pseudoSLC embedded Multimedia Card (eMMC) memory with Failsafe Boot/Firmware ROM functionality. The eMMC memory is accessed for programming via the Ethernet controller's Secure Digital Multimedia Card Controller (SDMMC) bus. The Ethernet controller's SDMMC0 and SDMMC1 signals support the eMMC Specification V5.01, the SDIO V3.0 Specification and the SD memory card specification V3.0. With eMMC Boot mode the SDMMC0 controller connects to the eMMC memory that stores the stage two firmware and configuration data.

4.4.3. UBoot NOR Flash Memory

The KSwitch M20 module supports up to 2 MByte NOR Flash memory. The Flash memory is accessed for reading and programing via the Ethernet controller's Quad SPI (QSPI) bus and supports a Failsafe Boot firmware.

With NOR Flash Boot mode the Ethernet Controller's QSPI0 acts as a serial Flash memory controller and connectors to the NOR Flash controller as a secondary bootloader.

4.5. Clock Distribution

The KSwitch M20 module complies with the IEEE-802.1 Time Sensitive Networking (TSN) standard and IEEE1588v2 Precision Time Protocol (PTP) standard for precise time and frequency synchronization that reduce inaccuracy between devices over a network. The PTP pins are used to synchronize the Ethernet PHY TimeOfDay, and to synchronize the implemented carrier board via the Carrier interface connector.

The KSwitch M20 module's clock distribution supports 125 MHZ for GE PHYs such as Microchip LAN8814 as well as 156.25 MHz for 10 GB PHYs such as Broadcom BCM84891LM.

Table 5: PTP and Clock Signals on the Carrier Interface Connector

Pin	Signal	Description	Type	Comment
A27	CAR_1PPS_IN_1V8	Clock input signal.	In	For external PHY time synchronization, on the carrier board.
B27	CAR_1PPS_OUT_1V8	Single ended pulse per second output	Out	For external PHY time synchronization, on the carrier board.
A28	CAR_1PPS_FB_COMP_1V8	Clock pulse per second signal	In	For external PHY time synchronization, on the carrier board.
A36	REFCLK_125M00-	125 MHz Reference clock-	Out	Differential 125 MHz Reference clock for external PHYs
A37	REFCLK_125M00+	125 MHz Reference clock+	Out	
B24	REFCLK_156M25-	156.25 MHz Reference clock-	Out	Differential 156.25 MHz Reference clock for external PHYs
B25	REFCLK_156M25+	156.25 MHz Reference clock+	Out	

4.6. GPIO

The KSwitch M20 module supports GPIO pins mapped to perform various features. The following table provides an overview of the GPIO mapping for KSwitch M20 module' GPIO supported features. For more information, refer to the relevant chapter(s) within this user guide.

Table 6: GPIO LAN 969xTSN Mapping Overview

Feature	GPIO Pin	GPIO Function	Description		
			Signal	Type	Description
Reset	0	ALT2	SW_FSD0_PCIE_PERST_1V8	In	PCIe Reset from external host to Switch LAN9696TSN
	2	GPIO	SW_PUSHB_RST_IN_1V8#	In	If reset button is held, reset is released, and the state of the reset button can be read by Switch
	29	GPIO	SW_PHY_RST_1V8#	Out	Not part of reference implementation. Reset signal to local and external PHYs.
	60	GPIO	SW_BRD_RST_1V8#	Out	Resets LAN9696TSN & peripherals.
USB 2.0 (clock and data control)	1	ALT3	USB_POWER_E_O	In	USB Power Enable
	12	ALT3	USB2PHY_RESET_O	Out	USB PHY reset ouput
	13		USB_OVER_DETECT	In	USB fault/overcurrent detect input
	30	ALT 2	USB_CLK	In	60 MHz ULPI clk from local USB 2.0 PHY
	31	ALT 2	USB_D0	In/Out	ULPI interface data IO
	32	ALT 2	USB_D1	In/Out	ULPI interface data IO
	33	ALT 2	USB_D2	In/Out	ULPI interface data IO
	34	ALT 2	USB_D3	In/Out	ULPI interface data IO
	35	ALT 2	USB_D4	In/Out	ULPI interface data IO
	36	ALT 2	USB_D5	In/Out	ULPI interface data IO
	37	ALT 2	USB_D6	In/Out	ULPI interface data IO
	38	ALT 2	USB_D7	In/Out	ULPI interface data IO
	39	ALT 2	USB_STP	Out	Link asserts STP for one clock cycle to stop the data stream currently on the bus. If the Link is sending data to the PHY, STP indicates the last byte of data was on the bus in the previous cycle.
	40	ALT 2	USB-DIR	In	Controls the direction of the data bus. When the PHY has data to transfer to the Link, it drives DIR high to take ownership of the bus. When the PHY has no data to transfer it drives DIR low and monitors the bus for commands from the Link.
	41	ALT 2	USB_NXT	In	Local USB PHY asserts NXT to throttle the data. When the Link is sending data to the PHY, NXT indicates when the current byte has been accepted by PHY.
FLEX0	3	ALT1	FLEX0_RXD	In	FLEX0 UART receiver input
	4		FLEX0_TXD	Out	FLEX0 UART transmitter output
SG0	5	ALT1	SGO_CLK	Out	Serial GPIO interface clock
	6		SGO_DO	Out	Serial GPIO interface data out
	7		SGO-DI	In	Serial GPIO interface data in

Feature	GPIO Pin	GPIO Function	Description		
			Signal	Type	Description
	8		SGO-LD	In	Serial GPIO interface load
MIIM	9	ALT1	MIIM0_MDC	Out	First MIIM Controller MIIM0. MIIM0 management clock.
	10		MIIM0_MDIO	In/Out	First MIIM Controller MIIM0. MIIM0 management data
	61	ALT1	MIIM1_MDC		Not part of the reference implementation. Second MIIM Controller: MIIM1 Management Clock, if KSwitch M20 module requires second MIIM Controller MIIM1. MIIM 1 Management Clock.
	62		MIIM1_MDIO		Not part of the reference implementation. Second MIIM Controller: MIIM1 Management Clock, if KSwitch M20 module requires second MIIM Controller MIIM1. MIIM 1 Management Data.
Interrupt	11	ALT1	IRQ2_IO/MIIM0_IRQ	In	IRQ2 interrupt pin
eMMC	14	ALT1	SDMMMC0_CMD	In/Out	eMMC command IO
	15		SDMMC0_CK	In/Out	eMMC clock
	16		SDMMC0_D0	In/Out	eMMC data 0
	17		SDMMC0_D1	In/Out	eMMC data 1
	18		SDMMC0_D2	In/Out	eMMC data 2
	19		SDMMC0_D3	In/Out	eMMC data 3
	20		SDMMC0_D4	In/Out	eMMC data 4
	21		SDMMC0_D5	In/Out	eMMC data 5
	22		SDMMC0_D6	In/Out	eMMC data 6
	23		SDMMC0_D7	In/Out	eMMC data 7
	24		SDMMC0_RSTN	In/Out	eMMC reset
MCU	25	GPIO	MCU_RST#	Out	Micro Controller Unit (MCU) rest pin
	26		MCU_BSL_INVOKE_PA18_1V8	Out	Micro Controller Unit (MCU) programming pin.
SYNCE CLK	27	ALT1	SYNCE_RC0	Out	SyncE recovered clock 0 from internal PHY.
	28	ALT3	SYNCE_RC1	Out	SyncE recovered clock 1 from internal PHY.
RGMII	42	RGMII1	RGMII1_RXD0	In	RGMII1 Receive Data 0
	43	RGMII1	RGMII1_RXD1	In	RGMII1 Receive Data 1
	44	RGMII1	RGMII1_RXD2-RXER	In	RGMII1 Receive Data 2
RGMII	45	RGMII1	RGMII1_RXD3	In	RGMII1 Receive Data 3
	46	RGMII1	RGMII1_RXC-REFCLK	In	RGMII1 Receive Reference Clock
	47	RGMII1	RGMII1_RXCTL-CRS_DV	In	RGMII1 Receive Data Valid
	48	RGMII1	RGMII1_TXD0	Out	RGMII1 Transmit Data 0
	49	RGMII1	RGMII1_TXD1	Out	RGMII1 Transmit Data 1

Feature	GPIO Pin	GPIO Function	Description		
			Signal	Type	Description
	50	RGMII1	RGMII1_TXD2	Out	RGMII1 Transmit Data 2
	51	RGMII1	RGMII1_TXD3	Out	RGMII1 Transmit Data 3
	52	RGMII1	RGMII1_TXC-REFCLK	Out	RGMII1 Transmit Reference Clock
	53	RGMII1	RGMII1_TXCTL-TX_DV	Out	RGMII1 Transmit Data Valid
I2C	54	ALT2	I2C_INT#	In	I2C interrupt signal
	55	ALT2	I2C_SCL_1V8	Out	I2C serial clock (+1.8 V)
	56	ALT2	I2C_SDA_1V8	In/Out	I2C serial data (+1.8 V)
PTP	57	ALT4	PTPSYNC3	Out	PHY RC0/1 (1PPS) output for the Ethernet PHYs to synchronize the TimeOfDay counters in the PHYs and the switch.
	58		PTPSYNC4	Out	PTP OUT (1PPS) on carrier board connector.
	59		PTPSYNC5	In	PTP IN (1PPS) from the carrier board connector or RTC
DPLL	63	ALT1	SPARE_IRQ5/DPLL_CS#	Out	DPLL Chip select, active low (optional)
	64	ALT1	FLEX2_SCK/DPLL_SCK	Out	DPLL Chip serial, clock (optional)
	65	ALT1	FLEX2_RXD/DPLL_RXD	In	DPLL serial data input (optional)
	66	ALT1	FLEX2_TXD/DPLL_TXD	Out	DPLL serial data output (optional)

4.7. Interrupt (IRQ)

The KSwitch M20 module supports an interrupt signal from the carrier board. The carrier board's PHYs interrupt signal is multiplexed via an I2C expander to the KSwitch M20 module's Pin-B15, SW_IRQ2_MIIM_1V8# signal.

Table 7: Interrupt Signals on the Carrier Interface Connector

Pin	Signal	Description	Type	Comment
B15	SW_IRQ2_MIIM_1V8#	Interrupt	In	Microchip LAN969xTSN interrupt signal is active low.
B16	CAR_I2C_INT_1V8#	I2C/SMB interrupt /SMB Alert	In	Microchip LAN969xTSN I2C/SMB interrupt /SMB Alert signal.

4.8. I2C Bus

The KSwitch M20 module's embedded I2C controller connects to the Carrier interface connector and transfers I2C serial data at the set I2C clock frequency (Standard mode 100 kHz, Fast Mode 400 kHz and Fast mode Plus 1 MHz) between the KSwitch M20 module and the carrier board.

The two-wire interface (TWI) I2C bus uses bi-directional 1.8 V signaling and can be used by any I2C compatible devices

The Ethernet controller's FLEXCOM interface 3 is configured to use the I2C interface.

Table 8: I2C Signals on the Carrier Interface Connector

Pin	Signal	Description	Type	Comment
A30	CAR_I2C_SDA	I2C/SMB Serial Data	In/ Out	Microchip LAN969xTSN I2C/SMB serial data. Add 10K pull-up resistor, Kontron recommends a pull-up voltage between 1.8V and 3.3V.
B16	CAR_I2C_INT_1V8#	I2C/SMB Interrupt /SMB Alert	In	Microchip LAN969xTSN I2C/SMB interrupt /SMB Alert signal.
B30	CAR_I2C_SCL	I2C/SMB Serial Data	Out	Microchip LAN969xTSN I2C/SMB serial clock. Add 10K pull-up resistor, Kontron recommends a pull-up voltage between 1.8V and 3.3V.
B79	SW_I2C_RST_3V3#	I2C/SMB Reset Output	Out	Active low signal

4.9. PCIe

The KSwitch M20 module supports a PCIe 3.0 x1 interface accessable via the external PCIe Host. The PCIe reference clock frequency is 100 MHZ.

Table 9: PCIe Signals on the Carrier Interface Connector

Pin	Signal	Description	Type	Comment
A33	PCIE-TX+	PCIE Transmit Data+	Out	PCIE differential transmit data positive, to external Root Complex, AC-Coupled on KSwitch M20 module. Reserved, leave pin open.
A34	PCIE-TX-	PCIE Transmit Data-	Out	
B33	PCIE-RX+	PCIE Receive data	In	PCIE differential receive data positive, to external Root Complex, AC-Coupled on KSwitch M20 module. Reserved, leave pin open.
B34	PCIE-RX-	PCIE Receive data	In	
B36	PCIE-CLK+	PCIe clock +	In	PCIE 100MHz differential reference clock +
B37	PCIE-CLK-	PCIe clock -	In	PCIE 100MHz differential reference clock -

Pin	Signal	Description	Type	Comment
A19	SW_FSD0_PCIE_PERST_1V8#	PCIE fundamental Reset	In	Reset from external host to LAN9696TSN Reserved, leave pin open. (1K pull-up to 1.8 V on module)

4.10. Real Time Clock (RTC)

The KSwitch M20 module supports a Real Time Clock (RTC) device (RV-8803-C7) including an integrated CMOS circuit with a XTAL to keep track of the current time accurately. If the primary source of power is switched off or unavailable, the RTC's low power consumption enables the RTC to continue to keep time using a lower secondary source of power to be supported on the carrier board.

Kontron recommends supplying enough power to the RTC device (RV-8803-C7) to retain the time accurately using a Supercap buffer with a 72 hour lifetime or a 3V Lithium battery on the implemented carrier board.

Table 10: RTC Signal on the Carrier Interface Connector

Pin	Signal	Description	Type	Comment
A-101	V_3V0_VBAT	Power In	PWR-In	Power in from the RTC battery (Lithuum battery or Supercap)

Kontron recommends supplying the RTC (RV-8803-C7) device using one of the following on the carrier board:

- Supercap buffer with a 72-hour lifetime
- 3V Lithium battery

4.11. Reset

The KSwitch M20 module does not include a reset. If a reset is required, Kontron recommends implementing the Ethernet controller's reset signal on the carrier board.

The reset signals are overlaid on the GPIO pins-[0, 2, 29, 60]. For more information see the GPIO mapping overview Table 6: GPIO LAN 969xTSN Mapping Overview.

Table 11: Reset Signals Carrier Interface Connector

Pin	Signal	Description	Type	Comment
A16	SW_PUSHB_RST_IN_1V8#	Reset button	In	Push-Button Reset input from carrier board, active low. A high to low transition leads to a warm reset of the module. If held reset is released and the reset button state can be read by switch.
A19	SW_FSD0_PCIE_PERST_1V8#	PCIE fundamental Reset	In	Reset from external host to LAN9696TSN Reserved, leave pin open. (1K pull-up to 1.8 V on module)
B79	SW_I2C_RST_3V3#	I2C/SMB reset output	Out	Active low signal
B82	SW_PHY_RST_1V8#	Reset	Out	Reset signal to local and external PHYs

4.12. Smart LEDs

The KSwitch M20 module includes a Smart LED bus micro controller (IT MSPM0L1304T) that merges the Ethernet controller and PSE controller as well as the input power states information to a single programmable LED bit stream. The Ethernet port, PoE/PoE+ port and power states signals are distributed to the carrier board using the SMART_LED signals.

Table 12: Smart LED Signal on the Carrier Interface Connector

Pin	Signal	Description	Type	Comment
B89	SMART_LED_DO_1V8	Smart LED	Out	SMART LED for the serial data stream
B84	POE_SYS_OK_3V3#	PoE System OK	Out	Microchip PD69210 PoE system OK signal. Used to drive healthy LED.
B91	CAR_STATUS_L2_1V8	Carrier board status L2 inputs signal.	In	MCU carrier board status L2 input signal The status can be integrated into the SMART LED datastream. Add 10K pull down to carrier board if not used
B92	CAR_STATUS_L3_1V8	Carrier board status L3 input signal.	In	MCU carrier board status L3 input signal. The status can be integrated into the SMART LED datastream. Add 10K pull down to carrier board if not used

4.13. UART0/1

The KSwitch M20 module supports serial communications with serial RX/TX ports supplied by the Ethernet controller, with the option for a second UART port, on the carrier board.

The KSwitch M20 module#s UART0 (FLEXCOM0) interface delivers the boot trace or TF-A monitor and offers management via the UART0 115200baud/8/N serial interface.

TF-A (Trusted Firmware A) and boot trace UART modes are configured for 115200baud/8/N.

Table 13: UART Interface Signals on the Carrier Interface Connector

Pin	Signal	Description	Type	Comment
A17	SW_FC0_UART_TXD_5V0	UART Transmit interface	In	LAN969xTSN FLEXCOM0 UART interface
B17	SW_FC0_UART_RXD_5V0	UART Receive interface	Out	LAN969xTSN FLEXCOM0 UART interface
A74	SW_GPIO66_FLEX2_TXD_1V8	FLEX2_Transmit	In/Out	LAN969xTSN GPIO(63:66) usable as FLEXCOM2 UART interface. Reserved without DPLL, leave pin open.
A75	SW_GPIO65_FLEX2_RXD_1V8	FLEX2_Receive	In/Out	LAN969xTSN GPIO(63:66) usable as FLEXCOM2 UART interface. Reserved without DPLL, leave pin open.

Pin	Signal	Description	Type	Comment
A76	SW_GPIO64_FLEX2_SCK_ 1V8	FLEX2_SCK/DPLL_SCK	In/Out	LAN969xTSN GPIO(63:66) usable as FLEXCOM2 UART interface. Reserved without DPLL, leave pin open.
A77	SW_GPIO63_1V8	SPARE_IRQ5/DPLL_CS#	In/Out	LAN969xTSN GPIO(63:66) usable as FLEXCOM2 UART interface. Reserved without DPLL, leave pin open.

4.14. USB 2.0 Host

The KSwitch M20 module supports a USB 2.0 Host acting as a physical layer (PHY) and supports configuration of the host using USB 2.0 signaling. The USB 2.0 host uses the Ethernet Controller's UTMI+ low-pin interface (ULPI) interface at 1.8 V.

The USB 2.0 host supports standard USB compliant functions such as VBUS sense, fault detection and power enable. Whereby the USB 2.0 host signals are overlaid on the GPIO pins-[30-41]. For more information see the GPIO mapping overview Table 6: GPIO LAN 969xTSN Mapping Overview.

Table 14: USB 2.0 Host on the Carrier Interface Conector Signals

Pin	Signal	Description	Type	Comment
A71	SW_USB_PWR_OC_DET_1V8#	USB overcurrent/fault detection	In	
B71	USB_UD+	USB 2.0	In/Out	USB 2.0 data signals
B72	USB_UD-	USB 2.0	In/Out	USB 2.0 data signals
B73	V_5V_USB_VBUS	USB 5.0 V power distribution	Power In	For external device.
B74	SW_USB_PWR_EN_1V8	USB power enable	Out	For external device.

Note: In case the user defined carrier board does not support USB. The carrier board must handle the USB module interface as defined in the Design Guide for the Design Guide for a KSwitch M20 Carrier Board.

For the Carrier Board Design Guide, visit Kontron's Customer Section .
In the Customer Section click on Switches > TSN Network > KSwitch M20 > KSwitch M20 Design Information > Design Guide KSwitch_M20-xxxT.

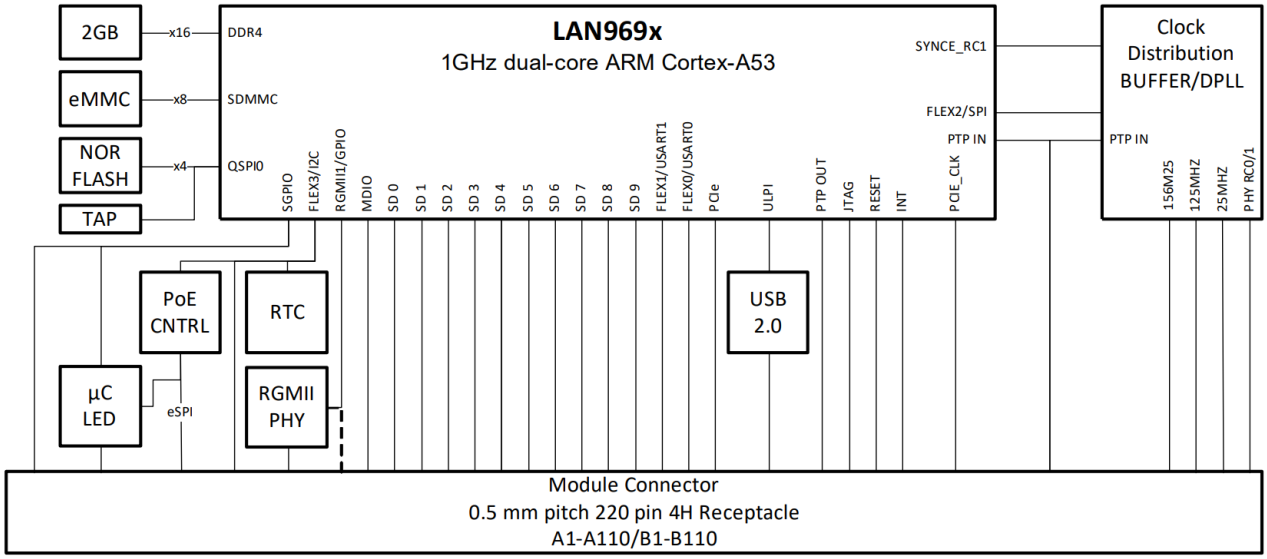
5/Switch Specification

Before implementing the KSwitch M20 Embedded Ethernet switch module, Kontron recommends new users to take a few minutes to learn about the KSwitch M20 module's technical specification requirements.

5.1. Functional Block Diagram

The following diagram provides additional information concerning board functionality and component layout.

Figure 5: KSwitch M20 Embedded Ethernet Switch Block Diagram



5.2. Hardware Specification

Table 15: KSwitch M20 Module Hardware Specification

Network	
Device	Microchip LAN969x TSN Switch Family with 1GHz dual core ARM Cortex-A53
OS	Microchip iStaX
Operating Mode	Store and forward, full wire-speed, Non-blocking switch core. Low latency cut-through forwarding mode
Memory	
System	Up to 2 GB DDR4 memory down (1 GB/2 GB options)
Storage	8 GB eMMC for Failsafe boot firmware
U-Boot Flash	2 MB NOR QSPI Flash QSPI interface Tag connector footprint allows initial programming of the QSPI NOR Flash.
Controllers	
Poe PSE Controller	Microchip PD69210 PoE PSE controller IC. Supporting up to 30 W per port. Complies with IEEE® 802.3af/at Controls and monitors external PoE manager devices (such as PD69204T4) via the SPI bus.
LED Controller	TI MSPM0L1304TRGER LED controller Supports LED options for the user designed carrier board: › Link/Activity LED: Indicated the Ethernet port's activity and link › PoE Power LED: Indicates if power is supplies or delivered at the port › Speed LED: Indicates the Ethernet port's speed
USB PHY Tranceiver	Microchip USB3343-CP enhanced single supply Hi-Speed USB 2.0 ULPI transceiver Provides a physical layer (PHY) USB Link Power Management support
Ethernet (RGMII) PHY Tranceiver	TI DP83867ISRGZT I Interface to the MAC : RGMII, SGMII Speed: 10Base-Te/100BaseTX/1000Base-T
Interfaces	
Ethernet SerDes	Flexible port configuration via 10x 10Gpbs SerDes: - 10GBASE-KR - 10GBASE-R - 10G-USXGMII - 5GBASE-KR - 5GBASE-R - 5G-USXGMII - QSGMII - 2.5GBASE-KX - 2.5GBASE-X - 2.5G SGMII - 1000BASE-KX - 1000BASE-X - SGMII - 100BASE-FX
	Initial Port Mapping 6x QSGMII (24x 10/100/1000BASE-T) 4x 10G-USXGMII (4x 10GBASE-T) Other port maps on request
Ethernet MDI	10/100/1000BASE-T MDI (Optional) / Shared with GPIO/RGMII
PCIe Endpoint	External PCIe Host can access the LAN969xTSN via PCIe 3.0 x1 interface (option) Note: LAN9696TSN Endpoint requires an external PCIe 100MHz clock.

Interfaces	
USB Host	USB 2.0 with VBUS sense, fault detection and power enable
I2C	Two Wire Bus Bi-directional with one data (Bi-directional) and one clock line.
GPIO	General Purpose IO, 1.8 VIO
POE ESPI	PoE Controller ESPI interface, 3.3 VIO
UART	1x UART 1.8V onboard connector, X1, X1b Note: A second UART may be offered for debugging on the carrier board.
LEDS	
Power	Power Good
Ethernet	Link/Act/Speed
Poe/Poe+	Off/On/Fail
Timer	
RTC	Micro Christal RTC RV8803 holds time of day information over a reset. No RTC Battery on the module. Carrier board must provide RTC hold up Supercap Buffer with a 72-hour (approx.) lifetimeor battery.
Thermal	
Temperature Sensors	Internal Microchip LAN9696TSN temperature sensors External sensors may be offered for temperature control on the carrier board.
Heatspreader plate	Mounted on module
Misc.	
Watchdog timer	Internal Microchip LAN9696TSN Watchdog.
Tag Connect	Tag connector provides programming interfcase for the DPLL Initial programming of the QSPI Flash
Option	
SyncE & IEEE 1588 DPLL	Microchip ZL30732

Table 16: KSwitch M20 Module Ethernet Specification

Bridge, VLAN, Protocols	
Switching	IPv4/IPv6 unicast and multicast L2 switching
Routing	IPv4/IPv6 unicast and multicast L3 forwarding with RPF
Flow Control	IEEE 802.3x (full duplex) and back-pressure (half duplex)
Max VLANS	4095
VLAN Types	Port-based VLAN, IEEE 802.1Q tag-based VLAN
Multicast Protocols	IGMPv1, IGMPv2, IGMPv3, MLDv1 MLDv2
	Up to 255 multicast groups
	IGMP snooping, querying
Network Discovery	IEEE 802.1ab LLDP
Traffic Management & QoS	Traffic Management & QoS
Priority	IEEE 802.1p QoS
No. of queues per port	8
Scheduling schemes	Strict Priority Queuing (SPQ) Deficit-Weighted Round Robin Queuing (DWRR)

Time Sensitive Networking	
Shaping & Fillter	IEEE 802.1Qbv-2015 Time Aware Shaping IEEE 802.1Qbu/802.3br – Frame Preemption IEEE 802.1Qav AVB traffic shaping IEEE 802.1Qci-2017 per Stream Filtering and Policing
Redundancy/ Reliability	Redundancy with IEEE 802.1CB Frame Replication and Elimination for Reliability (FRE) Protection switching (line or ring)
Forwarding Scheme	Cut-through option per TSN Stream and Store and Forward
Timing and Synchronization	IEEE 802.1AS-2020 1-step and 2-step IEEE 1588v2 1-step and 2-step for Ordinary Clock, Boundary Clock and Transparent Clock.
Network Redundancy	
Spanning Tree Protocol	IEEE 802.1D/1w/1S, STP/RSTP/MSTP
Port Trunk / LACP	Static trunk or LACP (Link Aggregation Control Protocol) G.8032, MRP IEC-62439-2 2016
Security	
Port Security	IP and MAC-based Access Control/Filter, Auth. User / Privilege Level Control, IEEE802.1X
Storm Control	Multicast / Broadcast / Flooding Storm Control / Port Access Control / Limiters
Management	
User Management	Web-based management, Command Line Interface (CLI)
Interfaces	SNMP v1/v2c, Trap, Telnet (5 sessions) RFC 3411 SNMP Management Frameworks RFC 3414 User-based Security Model for SNMPv3 RFC 3415 View-based access Control Model for SNMP RFC 2613 SMON - PortCopy
Management Security	HTTPs, SSH, Access Management, Loop Protection
Upgrade & Restore	TFTP/HTTP for configuration import / export TFTP/HTTP for firmware upgrade
Diagnostic	Syslog, Level Info / Warning / Error
	Port Mirror, Per VLAN mirroring, CPU Load Monitor, Traffic Counter, ICMP Ping
DHCP	Client Mode, Server Mode, Relay Mode, Snooping
Network Time Synchronozation	NTP client
System Status	Device info/status; Ethernet port status
Green Ethernet	Port power savings

5.3. Power Specification

The KSwitch M20 module receives power from a customized carrier board via the Carrier interface connector and must be connected to a carrier to power on. The Carrier interface connector limits the amount of power received by the KSwitch M20 module. Supply the KSwitch M20 module with enough power to guarantee stable functionality. It is recommended to provide more power than the KSwitch M20 module requires from a stable power source.

⚠CAUTION

Carrier Board Switched Off

Before connecting the KSwitch M20 module to a carrier board using the Carrier interface connector, ensure that the carrier board is switch off and disconnected from the main power supply. Failure to disconnect the main power supply could result in personal injury and damage to the KSwitch M20 module and/or carrier board.

⚠CAUTION

Handle Carefully

Handling and operation of the KSwitch M20 module is permitted only for skilled personnel within an access controlled workspace.

ESD Sensitive Device!

Keep electrostatic sensitive parts in their containers until they arrive at the ESD-safe workplace. Always be properly grounded when touching a sensitive board, component, or assembly.

5.3.1. Power Supply Specification

The KSwitch M20 module supports a 12 VDC +/- 20% single supply voltage and supplies two output voltages (3.3 VDC & 1.8 VDC) on the Carrier interface connector.

Table 17: KSwitch M20 Electrical specification

Electrical	Description	Note
Input Voltage	12 VDC +/- 20% Wide range (4.75 VDC up to 20 VDC)	Carrier board power to M20 module.
Output Voltage	3.3 VDC +/- 3% @1A 1.8 VDC +/- 3% @0.5A	VIO power distribution to the carrier board.
Power Consumption	5 W	M20 Module

⚠CAUTION

Only connect to an external power supply delivering the specified input rating and complying with the requirements of Safety Extra Low Voltage (SELV) and Limited Power Source (LPS) or (PS2) of UL/IEC 62368-1.

NOTICE

If any of the supply voltages drops below the allowed operating level longer than the specified hold-up time, all the supply voltages should be shut down and left OFF for a time long enough to allow the internal board voltages to discharge sufficiently.

If the OFF time is not observed, parts of the board or attached peripherals may work incorrectly or even suffer a reduction of MTBF. The minimum OFF time depends on the implemented PSU model and other electrical factors and must be measured individually for each case.

NOTICE

To protect external power lines of peripheral devices, make sure that the wires have the right diameter to withstand the maximum available current and the enclosure of the peripheral device fulfils the fire-protection requirements of IEC/EN 62368-1.

5.3.2. Protective Earth Digital Ground

The KSwitch M20 module supports a digital ground that acts as a reference point for a single ground connection to reduce noise and other unintended interference. This digital ground must be connected to the carrier board's ground plane!

The KSwitch M20 module's digital ground must be connected to the carrier board's ground plane!

5.4. Environmental Specification

Table 18: KSwitch M20 Module Environmental Specification

Environment	Description
Temperature	Temp. Class OT4: -40°C to +85°C (-40°F to 158°F) Temp. Class ST1: OT4 +15°C (duration: 10 min.) Temp. Class TX: -40°C to +85°C
	According to: EN 50155: Rolling stock- electronic equipment
Temperature	Extended temperatre range: -40°C to +85°C
	According to: IEC 60068-2-1: Cold and IEC 60068-2-2: Dry heat
Humidity	+25°C/+55°C, 100 % Relative Humidity (max.)
	According to: EN 50125-1: Railway applications - Environmental conditions for equipment - Part 1: Rolling stock and on-board equipment
Humidity	93% at 40°C, non-condensing
	According to: EN 60068-2-78: Damp heat, steady state
Shock (non-operating)	Category: 1, class B Severity: 50 m/s^2 Duration: 30 ms
	According to: EN 61373 :2010/AC:2017-09: Rolling stock equipment- Shock and vibration tests
Vibration (non-operating)	Category: 1, Class B Severity: 11.44 m/s2 (long-life) Duration: 5 hr.
	According to: EN 61373 :2010/AC:2017-09: Rolling stock equipment- Shock and vibration tests
Vibration (operating)	Category: 1, Class B Severity: 2.02 m/s^2 (functional) Duration: 10 min.
	According to: EN 61373 :2010/AC:2017-09: Rolling stock equipment- Shock and vibration test
Altitude	+3,000 m max.
MTBF	1395631.30 hours @ 40°C Ground Benign (GB) for the: KSwitch M20-M100T & KSwitch M20-M64T

5.5. Thermal Specification

The KSwitch M20 module supports an extended temperature range. For thermal management a heatspreader plate is available and a thermal sensor. The operating temperature with the heatspreader plate is the maximum measurable temperature on any part on the heatspreader's surface and without the heatspreader plate the maximum measurable temperature on any spot on the KSwitch M20 module's surface.

Table 19: KSwitch M20 Thermal Specification

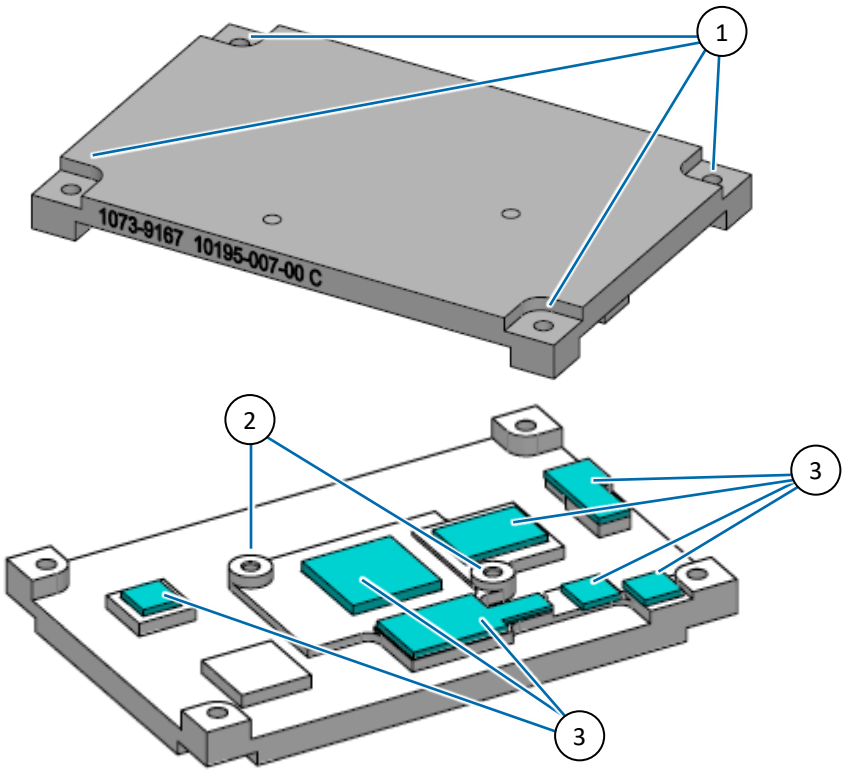
Thermal	Description
Temperature Sensors	One temperature sensor on Microchip LAN969xTSN device. Additional temperature sensors must be implemeneted on a custom carrier board.
Heatspreader	Standard mini heatspreader

5.5.1. Heatspreader Plate

The KSwitch M20 module supports a standard PICMG COM.0 COM Express® Revision 3.0 mini heatspreader plate. All KSwitch M20 module critical components are located on the top side and connect to the heatspreader plate. The heatspreader plate shares the same dimension as the KSwitch M20 module and attaches to the KSwitch M20 module using two screws with 4.5 mm threaded M2.5 or clear 2.7 mm standoffs (Figure 6. Pos. 4.). The heatspreader plate includes thermal pad on the underside (Figure 6. Pos. 5.), designed to aid heat dissipation away from critical thermal components on the KSwitch M20 module.

The heatspreader plate assembly is NOT a heat sink. Kontron recommends using the heatspreader plate in conjunction with a heat sink or external cooling device to support thermal dissipation and maintain the heatspreader plate at the specified operating temperatures. The required cooling solution depends on the KSwitch M20 module's application and environmental conditions. Under worst-case conditions, the external cooling must maintain an ambient air and heatspreader plate temperature on any spot of the heatspreader's surface.

Figure 6: Heatspreader Plate (top and bottom sides)



1. 4x Mounting opening for standoffs (KSwitch M20 to carrier board)
2. 2x Mounting holes for standoffs (KSwitch M20 to heatspreader plate)
3. Thermal pads

5.5.2. Internal Temperature sensor

The KSwitch M20 module provides an internal temperature sensor signal.

Additional external temperature control sensors must be implemented on the user defined carrier board.

5.6. Mechanical Specification

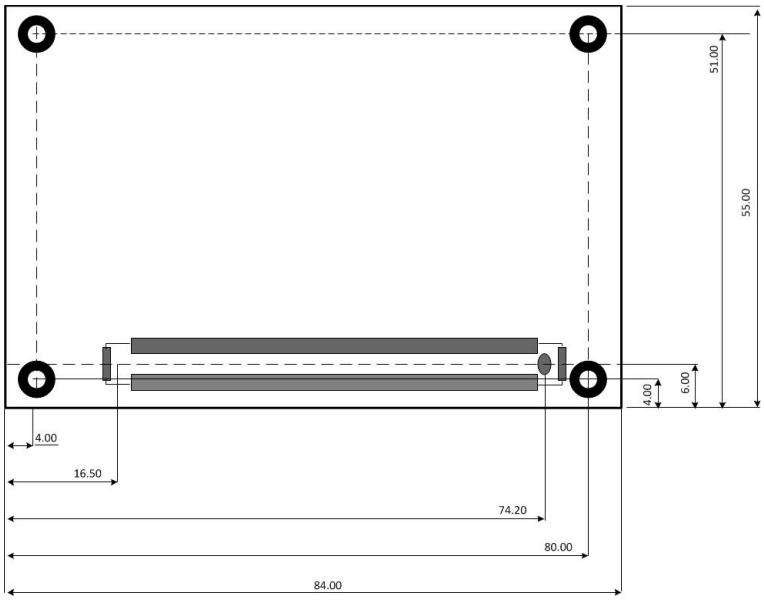
The KSwitch M20 module is based on the PICMG COM.0 COM Express Rev 3.0 mini module form-factor.

Table 20: KSwitch M20 Mechanical Specification

Mechanical	Description
Dimension	84 mm x 55 mm (3.3 inch x 2.17 inch)
Form-factor	COMexpress mini module
Height	13 mm (0.51 inch) module bottom to heatspreader plate top 18 mm (0.71 inch) carrier board bottom to heastspredered plate top (with 5 mm stack height) 21 mm (0.83 inch) carrier board bottom to heastspredered plate top (with 8 mm stack height)
Weight	50 g (approx.)
Installation	4 x Mounting holes (KSwitch M20 module to carrier board) 2 x Mounting holes (KSwitch M20 module to heatspreader plate)

5.6.1. Module Dimensions

Figure 7: KSwitch M20 Dimensions (mm)



The Carrier interface connector as seen through the KSwitch M20 module on the rear side.

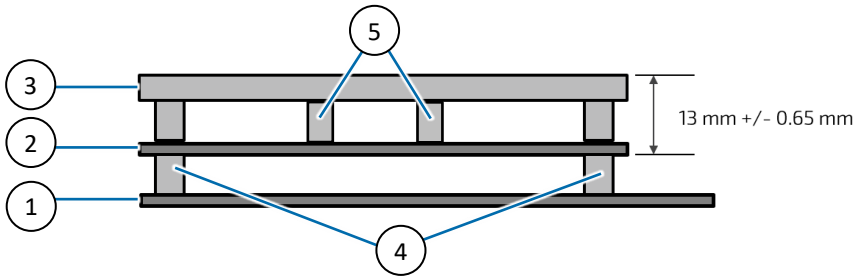
5.6.2. Module Height

The COM Express® specification defines a module height of approximately 13 mm, when measured from the bottom of the module's PCB board, to the top of the heatspreader.

The overall module height depends two additional factors:

- Module cooling solution.
  - The height of the implemented cooling solution is not specified in the COM Express® specification. The cooling solution height is defined by the user
- Standoff stack height 5mm or 8 mm.
  - If 5 mm standoff are used, the overall assembly height is 18.00 mm and if 8 mm standoff are used, the overall assembly height increases to 21.00 mm

Figure 8: Height of Module with Heatspreader (side view)



1. Carrier board
2. KSwitch M20
3. Heatspreader plate
4. 4x Standoffs base to module (5 mm to 8 mm)
5. 2x Heatspreader plate standoffs heatspreader plate to module

The heatspread plate's standoffs are four 4.5 mm threaded M2.5 or clear 2.7 mm.

5.7. Compliance

The KSwitch M20 module plans to comply with the requirements and the approximation of the laws relating to compliance for EN50155:2021, and the standards (or later thereof) that are constitutional parts of the declaration.

Table 21: Railway Compliance

KSwitch M20	Railway
General	**EN 50155** Railway Applications- Rolling stock- electronic equipment Class K1: Sockets for integrated circuits and/or edge connectors are permitted
EMC	**EN 50121-3-2** Railway applications - Electromagnetic compatibility – Part 3-2: Rolling stock – Apparatus
Safety (CB Scheme)	**EN 50153** Railway applications - Rolling stock - Protective provisions relating to electrical hazards **EN 50124-1** Railway applications - Insulation coordination – Part 1: Basic requirements - Clearances and creepage distances for all electrical and electronic equipment **EN ISO 13732-1** Ergonomics of the thermal environment - Methods for the assessment of human responses to contact with surfaces – Part 1: Hot surfaces (ISO 13732-1:2006) **EN 45545-1** Railway applications - Fire protection on railway vehicles - Part 1: General
Environment	**EN 50125-1** Railway applications - Environmental conditions for equipment - Part 1: Rolling stock and on-board equipment **EN 61373** Railway applications - Rolling stock equipment - Shock and vibration tests

The KSwitch M20 module plans to comply with the requirements and the approximation of the laws relating to compliance for CE and the standards (or later thereof) that are constitutional parts of the declaration.

Table 22: CE Compliance

KSwitch M20	CE Mark
Directives	**2014/30/EU** Electromagnetic Compatibility **2014/35/EU** Low Voltage **2011/65/EU** RoHS II
EMC	**EN 55032** Electromagnetic compatibility of multimedia equipment- Emission Requirements **EN 55035** Electromagnetic compatibility of multimedia equipment - Immunity requirements **EN 61000-6-2** Electromagnetic compatibility (EMC) – Part 6-2: Generic standards - Immunity standard for industrial environments
Safety (CB Scheme)	**EN62368-1** Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements

The KSwitch M20 module plans to comply with the following country specific certifications (or later thereof). If the product is modified, the prerequisites for specific approvals may no longer apply.

Table 23: Country Compliance

KSwitch M20	International Mark
EMC	**IEC 55032** Electromagnetic compatibility of multimedia equipment- Emission Requirements **IEC 55035** Electromagnetic compatibility of multimedia equipment - Immunity requirements **IEC 61000-6-2** Electromagnetic compatibility (EMC) – Part 6-2: Generic standards - Immunity standard for industrial environments
Safety (CB Scheme)	**IEC 62368-1 (designed to meet UL)** Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements

Kontron is not responsible for any radio television interference caused by unauthorized modifications of the delivered KSwitch M20 module. The correction of interference is the users's responsibility.

The transmission and reception of data cannot be guaranteed and corruption may occur or data may be lost. The KSwitch M20 module should not be used in environments where the failure to send data could result in personal injury or damage. Kontron is not responsible for personal injuries or damages caused by delays, errors or failures to transmitted or received data using the KSwitch M20 module.

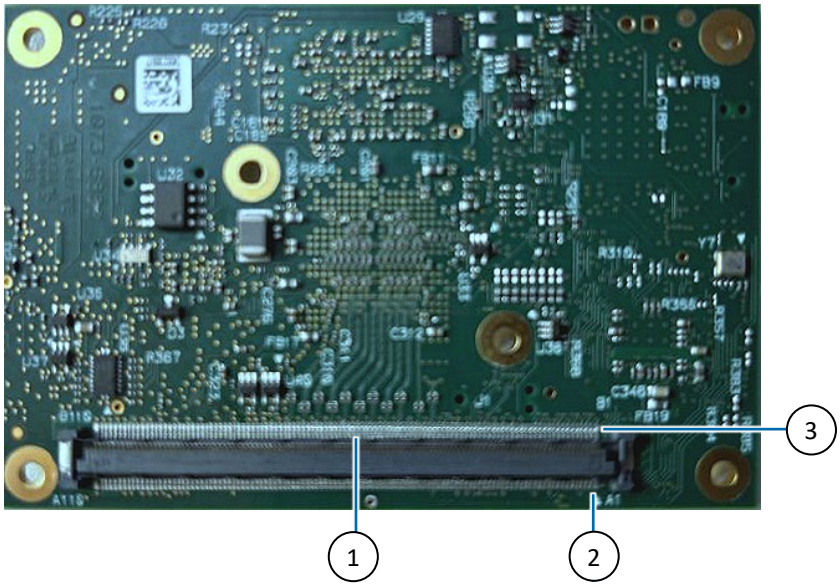
6/Carrier Interface Connector

The Carrier interface connector is located on the rear side of the KSwitch M20 module. The carrier interface connector contains 220-pins with two rows (row A and row B). Row A contains pins A1 to A110 and row B contains B1 to B110.

The Carrier interface connector inserts into a corresponding interface connector on the implemented carrier board. The carrier board supplies the KSwitch M20 module with power and interface signals.

The carrier board's corresponding interface connector must comply with the KSwitch M20 module's (0.5 mm pitch free height 220 pin 4H) carrier interface connector, with a stack height of 5 mm min.

Figure 9: Carrier Interface Connector and Mounting



1. 220-pin Carrier interface connector
2. Pin-A1
3. Pin B1

6.1. Carrier Interface Connector Pin Assignments

The terms used in the Carrier Interface connector pin assignment tables and a description of the signal type can be found below.

Table 24: General Signal Description

Type	Description	Type	Description
NC	Not Connected (on this product)	**Out**	Output
I/O	Input/Output (Bi-directional)	**PWR**	Power Connection
In	Input	**PWR-In**	Power Input
+ and -	Differential Pair Differentiator	**PWR-Out**	Power Output
GND	Power Ground Connection	**GND**	Power Ground Connection
SW	Indicates a switch signal	**CAR**	Indicates a carrier board signal

The following table lists the pin assignment of the KSwitch M20 module's Carrier interface connector pins A (1-110).

Table 25: Carrier Interface Connector Row A (1 to 110) Pin Assignment

Pin	Signal	Description	Type	Comment
A1	GND	Ground	GND	Ground
A2	SW_GPIO42_1V8		In/Out	Reserved w/o RGMII PHY
A3	SW_GPIO43_1V8		In/Out	Reserved w/o RGMII PHY
A4	SW_GPIO44_1V8		In/Out	Reserved w/o RGMII PHY
A5	SW_GPIO45_1V8		In/Out	Reserved w/o RGMII PHY
A6	SW_GPIO46_1V8		In/Out	Reserved w/o RGMII PHY
A7	SW_GPIO47_1V8		In/Out	Reserved w/o RGMII PHY
A8	GND	Ground	GND	Ground
A9	SW_GPIO48_1V8		In/Out	Reserved w/o RGMII PHY
A10	SW_GPIO49_1V8		In/Out	Reserved w/o RGMII PHY
A11	GND	Ground	GND	Ground
A12	SW_GPIO50_1V8		In/Out	Reserved w/o RGMII PHY
A13	SW_GPIO51_1V8		In/Out	Reserved w/o RGMII PHY
A14	SW_GPIO52_1V8		In/Out	Reserved w/o RGMII PHY
A15	SW_GPIO53_1V8		In/Out	Reserved w/o RGMII PHY
A16	SW_PUSHB_RST_IN_1V8#	Reset button	In	Push-Button Reset input from Carrier, low active. A high to low transition leads to a warm reset of the module. If held reset is released and the reset button state can be read by switch.
A17	SW_FC0_UART_RXD_1V8	Serial UART Receiver input	In	LAN969xTSN FLEXCOM0 UART interface
A18	NC	-	-	Not Connected
A19	SW_FSD0_PCIE_PERST_1V8#	PCIE fundamental Reset	In	Reset from external host to LAN9696TSN Reserved, leave pin open. (1K pull-up to 1.8 V on module)
A20	SW_MDIO0_1V8	MIIM data input/output 0	In/Out	Microchip LAN969xTSN MIIM controller 0 Media Dependent Data Input Output.
A21	GND	Ground	GND	
A22	SW_MDIO1_1V8	MIIM data input/output 1	In/Out	Microchip LAN969xTSN MIIM controller 1 Media Dependent Data Input Output.
A23	GND	Ground	GND	Ground
A24	DPLL_RCLK_PHY0_1V8	DPLL reference clock PHY0	In	SyncE & IEEE 1588 DPLL clock channel. Reserved, leave pin open.

Pin	Signal	Description	Type	Comment
A25	DPLL_RCLK_PHY1_1V8	DPLL reference clock PHY1	In	SyncE & IEEE 1588 DPLL clock channel 1 Reserved, leave pin open.
A26	GND	Ground	GND	Ground
A27	CAR_1PPS_IN_1V8	Clock input signal	In	For external PHY time synchronization, on the carrier.
A28	CAR_1PPS_FB_COMP_1V8	Clock pulse per second signal	In	For external PHY time synchronization, on the carrier.
A29	GND	Ground	GND	Ground
A30	CAR_I2C_SDA	I2C/SMB serial data	In/Out	Microchip LAN969xTSN I2C/SMB serial data. Add 10K pull-up resistor, Kontron recommends a pull-up voltage between 1.8V and 3.3V.
A31	GND	Ground	GND	Ground
A32	GND	Ground	GND	Ground
A33	PCIE_TX+	PCIE Transmit Data+	Out	PCIE differential transmit data to external Root Complex, AC-Coupled on KSwitch M20 module. Reserved, leave pin open.
A34	PCIE_TX-	PCIE Transmit Data-	Out	
A35	GND	Ground	GND	Ground
A36	REF_CLK_125M00-	Differential Ethernet Reference clock 125 MHZ	Out	Differential 125 MHz Reference clock for external PHYs.
A37	REF_CLK_125M00+	Differential Ethernet Reference clock 125 MHZ	Out	
A38	GND	Ground	GND	Ground
A39	SW_ETH_S0_TX-	Differential Transmit Lane [0]-	Out	Microchip LAN969xTSN Ethernet Serdes lane. AC coupled on module.
A40	SW_ETH_S0_TX+	Differential Transmit Lane [0]+	Out	
A41	GND	Ground	GND	Ground
A42	GND	Ground	GND	Ground
A43	SW_ETH_S1_TX-	Differential Transmit Lane [1]-	Out	Microchip LAN969xTSN Ethernet Serdes lane. AC coupled on module.
A44	SW_ETH_S1_TX+	Differential Transmit Lane [1]+	Out	
A45	GND	Ground	GND	Ground
A46	SW_ETH_S2_TX-	Differential Transmit Lane [2]-	Out	Microchip LAN969xTSN Ethernet Serdes lane. AC coupled on module.
A47	SW_ETH_S2_TX+	Differential Transmit Lane [2]+	Out	
A48	GND	Ground	GND	Ground
A49	SW_ETH_S3_TX-	Differential Transmitr Lane [3]-	Out	Microchip LAN969xTSN Ethernet Serdes lane.

Pin	Signal	Description	Type	Comment
A50	SW_ETH_S3_TX+	Differential Transmitr Lane [3]+	Out	AC coupled on module.
A51	GND	Ground	GND	Ground
A52	SW_ETH_S4_TX-	Differential Transmit Lane [4]-	Out	Microchip LAN969xTSN Ethernet Serdes lane. AC coupled on module.
A53	SW_ETH_S4_TX+	Differential Transmit Lane [4+]	Out	
A54	GND	Ground	GND	Ground
A55	SW_ETH_S5_TX-	Differential Transmit Lane [5]-	Out	Microchip LAN969xTSN Ethernet Serdes lane. AC coupled on module.
A56	SW_ETH_S5_TX+	Differential Transmit Lane [5]+	Out	
A57	GND	Ground	GND	Ground
A58	SW_ETH_S6_TX-	Differential Transmit Lane [6]-	Out	Microchip LAN969xTSN Ethernet Serdes lane. AC coupled on module.
A59	SW_ETH_S6_TX+	Differential Transmit Lane [6]+	Out	
A60	GND	Ground	GND	Ground
A61	SW_ETH_S7_TX-	Differential Transmit Lane [7]-	Out	Microchip LAN969xTSN Ethernet Serdes lane. AC coupled on module.
A62	SW_ETH_S7_TX+	Differential Transmit Lane [7]+	Out	
A63	GND	Ground	GND	Ground
A64	SW_ETH_S8_TX-	Differential Transmit Lane [8]-	Out	Microchip LAN969xTSN Ethernet Serdes lane. AC coupled on module.
A65	SW_ETH_S8_TX+	Differential Transmit Lane [8]+	Out	
A66	GND	Ground	GND	Ground
A67	SW_ETH_S9_TX-	Differential Transmit Lane [9]-	Out	Microchip LAN969xTSN Ethernet Serdes lane. AC coupled on module.
A68	SW_ETH_S9_TX+	Differential Transmit Lane [9]+	Out	
A69	GND	Ground	GND	Ground
A70	GND	Ground	GND	Ground
A71	SW_USB_PWR_OC_DET_1V8#	USB overcurrent/fault detection	In	USB overcurrent/fault detect input, low active.
A72	SW_GPIO25_PWM_CON_1V8	MCU signal	In/Out	Reserved w/o MCU. Reserved leave pin open
A73	SW_GPIO26_TACH_CON_1V8	MCU signal	In/Out	
A74	SW_GPIO66_FLEX2_TXD_1V8	FLEX2_Transmit	In/Out	LAN969xTSN GPIO [63:66] usable as FLEXCOM2 UART interface. Reserved without DPLL, leave pin open.
A75	SW_GPIO65_FLEX2_RXD_1V8	FLEX2_Receive	In/Out	
A76	SW_GPIO64_FLEX2_SCK_1V8	FLEX2_SCK/DPLL_SCK	In/Out	
A77	SW_GPIO63_1V8	SPARE_IRQ5/DPLL_CS#	In/Out	
A78	POE_CON_ESPI_MISO_3V3	eSPI Master In Slave Out for external PoE PSE manager.	In	If the carrier does not support a POE subsystem. Leave unconnected, pull-up on switch module.

Pin	Signal	Description	Type	Comment
A79	NC	-	-	Not Connected
A80	GND	Ground	GND	Ground
A81	MCU_UART_RXD_CON_1V8	UART Receive	In	Debug only, leave unconnected
A82	SW_VCORE3_1V8	Reserved Debug	In	
A83	SW_VCORE2_1V8	Reserved Debug	In	
A84	SW_VCORE1_1V8	Reserved Debug	In	
A85	SW_VCORE0_1V8	Reserved Debug	In	
A86	SW_SGPIO_DI_CON_1V8	MCU signal	In	Reserved without MCU. Reserved, leave pin open.
A87	SW_SGPIO_LD_CON_1V8	MCU signal	Out	
A88	SW_SGPIO_DO_CON_1V8	MCU signal	Out	
A89	SW_SGPIO_CK_CON_1V8	MCU signal	Out	
A90	GND	Ground	GND	Ground
A91	JTAG_TCK_1V8	JTAG Test Clock, 1.8V	In	Production debugging only
A92	JTAG_TMS_1V8	JTAG Test Mode Select, 1.8V	In	
A93	JTAG_TDI_1V8	JTAG Test Data Input	In	
A94	JTAG_TRST_1V8	JTAG Test Reset,	In	
A95	JTAG_EN_1V8	JTAG chain enable	In	
A96	GND	Ground	GND	Ground
A97	V_1V8	Power Out (1.8 V)	PWR-Out	Power Out
A98	V_1V8	Power Out (1.8 V)	PWR-Out	Power Out
A99	V_1V8	Power Out (1.8 V)	PWR-Out	Power Out
A100	GND	Ground	GND	Ground
A101	V_3V0_VBAT	Power IN	PWR-In	Power IN from carrier board to the RTC device on the module.
A102	V_3V3	Power Out (3.3 V)	PWR-Out	Power Out
A103	V_3V3	Power Out (3.3 V)	PWR-Out	Power Out
A104	GND	Ground	GND	Ground
A105	VCC_12V	Power IN (12 V)	PWR-In	Power IN from carrier board
A106	VCC_12V	Power IN (12 V)	PWR-In	Power IN from carrier board
A107	VCC_12V	Power IN (12 V)	PWR-In	Power IN from carrier board
A108	VCC_12V	Power IN (12 V)	PWR-In	Power IN from carrier board
A109	VCC_12V	Power IN (12 V)	PWR-In	Power IN from carrier board
A110	GND	Ground	GND	Ground

The following table lists the pin assignment of the KSwitch M20 module's Carrier interface connector pins Row B (1-110)

Table 26: Interface Connector Row B (1 to 110) Pin Assignment

Pin	Signal	Description	Type	Comment
B1	GND	Ground	GND	Ground
B2	PHY_MDI0+	Ethernet PHY MDI0+	In/Out	Ethernet PHY MDI differencial pair 0
B3	PHY_MDI0-	Ethernet PHY MDI0-	In/Out	
B4	GND	Ground	GND	Ground
B5	PHY_MDI1+	Ethernet PHY MDI1+	In/Out	Ethernet PHY MDI differencial pair 1
B6	PHY_MDI1-	Ethernet PHY MDI1-	In/Out	
B7	GND	Ground	GND	Ground
B8	PHY_MDI2+	Ethernet PHY MDI2+	In/Out	Ethernet PHY MDI differencial pair 2
B9	PHY_MDI2-	Ethernet PHY MDI 2-	In/Out	
B10	GND	Ground	GND	Ground
B11	GND	Ground	GND	Ground
B12	PHY_MDI3+	Ethernet PHY MDI3+	In/Out	Ethernet PHY MDI differencial pair 2
B13	PHY_MDI3-	Ethernet PHY MDI3-	In/Out	
B14	GND	Ground	GND	Ground
B15	SW_IRQ2_MIIM_1V8#	Interrupt	In	Microchip LAN969xTSN interrupt signal is active low.
B16	CAR_I2C_INT_1V8#	I2C/SMB interrupt /SMB Alert	In	Microchip LAN969xTSN I2C/SMB interrupt /SMB Alert signal.
B17	SW_FC0_UART_TXD_1V8	FLEXCOM0 UART interface	Out	Serial UART transmitter output.
B18	NC	-	-	Not Connected
B19	GND	Ground	GND	Ground
B20	SW_MDC0_CON_1V8	Switch MIIM 0 data clock	Out	Microchip LAN969xTSN MIIM controller 0 Media Dependent Clock.
B21	GND	Ground	GND	Ground
B22	SW_MDC1_1V8	Switch MIIM 1 data clock	Out	Microchip LAN969xTSN MIIM controller 1 Media Dependent Clock.
B23	GND	Ground	GND	Ground
B24	REFCLK_156M25-	Reference clock 156.25 MHZ	Out	Differential 156.25 MHz Reference clock for external PHYs.
B25	REFCLK_156M25+	Reference clock 156.25 MHZ	Out	
B26	GND	Ground	GND	Ground
B27	CAR_1PPS_OUT_1V8	Single ended 1 pulse per second output	Out	For external PHY time synchronization, on the carrier.
B28	DPLL0_10MHZ_OUT_1V8	DPLL0 output signal 10 MHz	Out	Reserved DPLL, leave pin open.
B29	GND	Ground	GND	Ground

Pin	Signal	Description	Type	Comment
B30	CAR_I2C_SCL	I2C/SMB serial data	Out	Microchip LAN969xTSN I2C/SMB serial clock. Add 10K pull-up resistor, Kontron recommends a pull-up voltage between 1.8V and 3.3V.
B31	GND	Ground	GND	Ground
B32	GND	Ground	GND	Ground
B33	PCIE_RX+	PCIE differential receive data	In	Reserved, leave pin open.
B34	PCIE_RX-	PCIE differential receive data	In	Reserved, leave pin open.
B35	GND	Ground	GND	Ground
B36	PCIE_CLK+	PCIe clock positive	In	Reserved, leave pin open.
B37	PCIE_CLK-	PCIe clock negative	In	Reserved, leave pin open.
B38	GND	Ground	GND	Ground
B39	SW_ETH_S0_RX-	Differential Receive Lane [0]-	In	Microchip LAN969xTSN Ethernet Serdes receiver lane. AC coupled on module.
B40	SW_ETH_S0_RX+	Differential Receive Lane [0]+	In	
B41	GND	Ground	GND	Ground
B42	GND	Ground	GND	Ground
B43	SW_ETH_S1_RX-	Differential Receive Lane [1]-	In	Microchip LAN969xTSN Ethernet Serdes receiver lane. AC coupled on module.
B44	SW_ETH_S1_RX+	Differential Receive Lane [1]+	In	
B45	GND	Ground	GND	Ground
B46	SW_ETH_S2_RX-	Differential Receive Lane [2]-	In	Microchip LAN969xTSN Ethernet Serdes receiver lane. AC coupled on module.
B47	SW_ETH_S2_RX+	Differential Receive Lane [2]+	In	
B48	GND	Ground	GND	Ground
B49	SW_ETH_S3_RX-	Differential Receive Lane [3]-	In	Microchip LAN969xTSN Ethernet Serdes receiver lane. AC coupled on module.
B50	SW_ETH_S3_RX+	Differential Receive Lane [3]+	In	
B51	GND	Ground	GND	Ground
B52	SW_ETH_S4_RX-	Differential Receive Lane [4]-	In	Microchip LAN969xTSN Ethernet Serdes receiver lane. AC coupled on module.
B53	SW_ETH_S4_RX+	Differential Receive Lane [4]+	In	
B54	GND	Ground	GND	Ground
B55	SW_ETH_S5_RX-	Differential Receive Lane [5]-	In	Microchip LAN969xTSN Ethernet Serdes receiver lane. AC coupled on module.
B56	SW_ETH_S5_RX+	Differential Receive Lane [5]+	In	Microchip LAN969xTSN Ethernet Serdes receiver lane. AC coupled on module.

Pin	Signal	Description	Type	Comment
B57	GND	Ground	GND	Ground
B58	SW_ETH_S6_RX-	Differential Receive Lane [6]-	In	Microchip LAN969xTSN Ethernet Serdes receiver lane. AC coupled on module.
B59	SW_ETH_S6_RX+	Differential Receive Lane [6]+	In	Microchip LAN969xTSN Ethernet Serdes receiver lane. AC coupled on module.
B60	GND	Ground	GND	Ground
B61	SW_ETH_S7_RX-	Differential Receive Lane [7]-	In	Microchip LAN969xTSN Ethernet Serdes receiver lane. AC coupled on module.
B62	SW_ETH_S7_RX+	Differential Receive Lane [7]+	In	Microchip LAN969xTSN Ethernet Serdes receiver lane. AC coupled on module.
B63	GND	Ground	GND	Ground
B64	SW_ETH_S8_RX-	Differential Receive Lane [8]-	In	Microchip LAN969xTSN Ethernet Serdes receiver lane. AC coupled on module.
B65	SW_ETH_S8_RX+	Differential Receive Lane [8]+	In	Microchip LAN969xTSN Ethernet Serdes receiver lane. AC coupled on module.
B66	GND	Ground	GND	Ground
B67	SW_ETH_S9_RX-	Differential Receive Lane [9]-	In	Microchip LAN969xTSN Ethernet Serdes receiver lane. AC coupled on module.
B68	SW_ETH_S9_RX+	Differential Receive Lane [9]+	In	Microchip LAN969xTSN Ethernet Serdes receiver lane. AC coupled on module.
B69	GND	Ground	GND	Ground
B70	GND	Ground	GND	Ground
B71	USB_UD+	USB 2.0+	In/Out	USB 2.0 positive Data signals, bidirectional
B72	USB_UD-	USB 2.0-	In/Out	USB 2.0 negative Data signals, bidirectional
B73	V_5V_USB_VBUS	USB 5.0 V power distribution	Power-In	USB VBUS voltage sense input.
B74	SW_USB_PWR_EN_1V8	USB power enable	Out	USB Power enable for external devices. Active high.
B75	NC	-	-	Not Connected

Pin	Signal	Description	Type	Comment
B76	POE_CON_ESPI_SCK_3V3	eSPI Serial Clock	Out	Microchip PD69210 eSPI Serial Clock for external PoE PSE manager.
B77	POE_CON_ESPI_CS_3V3#	eSPI Chip Select	Out	Microchip PD69210 eSPI Chip select for external PoE PSE manager. Signal is active low.
B78	POE_CON_ESPI_MOSI_3V3	eSPI Master Out Slave In	Out	Microchip PD69210 eSPI Master Out Slave In for external PoE PSE manager.
B79	SW_I2C_RST_3V3#	I2C/SMB reset output	Out	Active low signal
B80	GND	Ground	GND	Ground
B81	MCU_UART_TXD_CON_1V8		Out	Reserved for debugging. Leave unconneted.
B82	SW_PHY_RST_1V8#	PHY Reset	Out	Microchip LAN969XTSN reset to external LAN PHYs, low active.
B83	POE_DIS_PORTS_3V3#	Disable all PoE ports	In	Microchip PD69210 input signal disable all PoE ports. Signal is active low.
B84	POE_SYS_OK_3V3#	PoE System OK	Out	Microchip PD69210 PoE system okay signal. Used to drive Healthy LED.
B85	MCU_DEBUG_CON_PA19_1V8	MCU Debug	In/Out	Reserved for debugging. Leave unconneted.
B86	MCU_CON_PA21_1V8	MCU Debug	In/Out	Reserved for debugging. Leave unconneted.
B87	MCU_CON_PA20_SWCLK_1V8	MCU Debug	In	
B88	MCU_CON_PA19_SWDIO_1V8	MCU Debug	In/Out	
B89	SMART_LED_DO_1V8	SMART LED	Out	Smart LED for the Serial data stream output. The KSwitch M20 module distributes a Smart LED bitstream.
B90	GND	Ground	GND	Ground
B91	CAR_STATUS_L2_1V8	Carrier status L2 inputs signal.	In	MCU carrier status L2 input signal. The status can be integrated into the SMART LED datastream. Add 10K pull down to carrier if not used
B92	CAR_STATUS_L3_1V8	Carrier status L3 input signal.	In	MCU carrier status L3 input signal. The status can be integrated into the SMART LED datastream. Add 10K pull down to carrier if not used
B93	JTAG_TDO_1V8	JTAG Test Data Output	Out	Reserves for debugging.

Pin	Signal	Description	Type	Comment
B94	SW_JTAG_CPU_RST	JTAG CPU Reset#	In	Reserved for debugging. Leave unconnected. Pull-up on module.
B95	SW_JTAG_SEL	JTAG select, selects between CPU and Test Tap controller	In	Reserved for debugging. Leave unconnected. Pull-up on module.
B96	GND	Ground	GND	Ground
B97	V_1V8	Power Out (1.8 V)	PWR-Out	Power Out
B98	V_1V8	Power Out (1.8 V)	PWR-Out	Power Out
B99	V_1V8	Power Out (1.8 V)	PWR-Out	Power Out
B100	GND	Ground	GND	Ground
B101	V_3V3	Power Out (3.3 V)	PWR-Out	Power Out
B102	V_3V3	Power Out (3.3 V)	PWR-Out	Power Out
B103	V_3V3	Power Out (3.3 V)	PWR-Out	Power Out
B104	GND	Ground	GND	Ground
B105	VCC_12V	Power In (12 V)	PWR-In	Power In
B106	VCC_12V	Power In (12 V)	PWR-In	Power In
B107	VCC_12V	Power In (12 V)	PWR-In	Power In
B108	VCC_12V	Power In (12 V)	PWR-In	Power In
B109	VCC_12V	Power In (12 V)	PWR-In	Power In
B110	GND	Ground	GND	Ground
MTG1	MTG1	Ground	GND	Ground
MTG2	MTG2	Ground	GND	Ground

7/Installation

The KSwitch M20 module inserts into a compatible PICMG 3.1 COM express mini standard single 220-pin Carrier interface connector on a carrier board and secured using four screws with standoffs.

7.1. Before Installing

Before installing the KSwitch M20 module on a carrier board, consider the following:

- Carrier board's components height on the top side
  - In applications where vibration on the KSwitch M20 module is important, the clearance between the carrier board topside components on the bottom side of the KSwitch M20 module must be restricted.
- Carrier board's interface connector height
  - The height of the carrier board's Carrier Interface connector determines the height of the stack option (5 mm or 8 mm). This defines the clearance between the carrier board's top side and the KSwitch M20 module's bottom side surface.

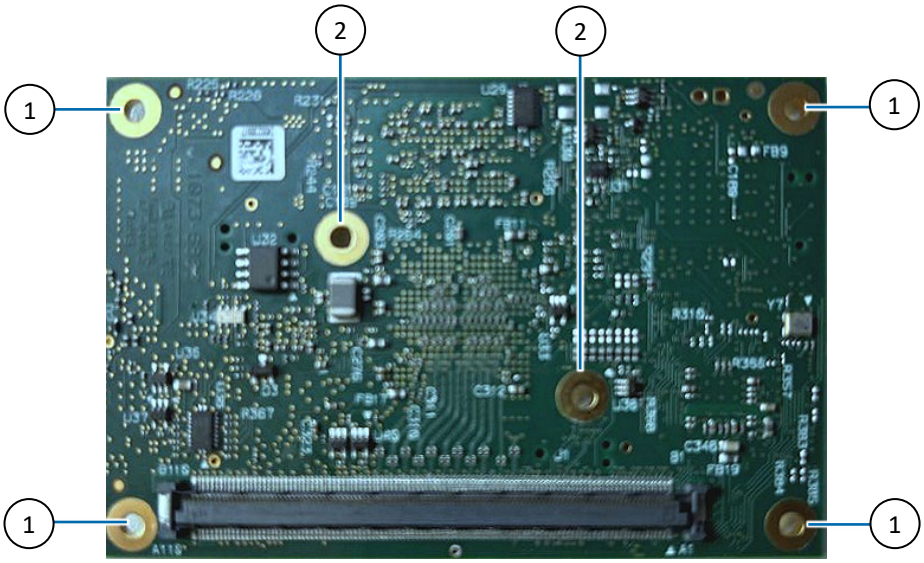
Ensure that the carrier is switched off and disconnected from the main power source. Failure to disconnect the carrier board from the main power source could result in personal injury and/or damage to the KSwitch M20 module and carrier board.

Oberserve the following safety precautions when installing or operating the KSwitch M20 module. Kontron assumes no responsibility for any damage resulting from failure to comply with these requirements.

⚠CAUTION	**Carrier Board Switched Off** Ensure that the carrier board is switched off and disconnected from the main power supply. Failure to disconnect the carrier board's main power supply could result in personal injury and damage to the KSwitch M20 module and/or carrier board.
⚠CAUTION	**Securly Fasten** Securely fastened the KSwitch M20 module to a carrier board using appropriate retaining screws and stand-offs to ensure proper grounding and avoid loosening caused by vibration or shock.
⚠CAUTION	**Handle Carefully** Handling and operation of the KSwitch M20 module is permitted only for skilled personnel within a workplace that is access controlled.
	**ESD Sensitive Device!** Keep electrostatic sensitive parts in their containers until they arrive at the ESD-safe workplace. Always be properly grounded when touching a sensitive board, component, or assembly.
	The KSwitch M20 module is installed on a user defined carrier board. The clearance distance between the carrier board and the KSwitch M20 module cannot be specified by Kontron.
	Carrier board's interface connector must be a COM0 0.5 mm pitch free height 220-pin, 4H plug, with a stack height of 5 mm or 8 mm.

7.2. Installation and Removal Procedure

Figure 10: Carrier Mounting Features



1. 4x Mounting holes for carrier board standoffs
2. 2x Mounting holes for Heatspreader plate

To install the KSwitch M20 module on a carrier board, perform the following:

1. Ensure that the carrier board is properly switched off and disconnected from the main power source.
2. Install the heatspreader plate to the top side of the KSwitch M20 module using the two screws provided with the heatspreader.
3. Insert the KSwitch M20 module's Carrier interface connector carefully into the carrier board's corresponding Interface connector and carefully press the connectors together to engage.
4. Fasten the KSwitch M20 module to the carrier board using four screws (4x M2.5) and threaded standoffs (M2.5) with the correct height for the carrierboard's connector (5 mm or 8 mm). This ensures proper grounding and avoids loosening caused by vibration or shock.
5. Remove the KSwitch M20 module from the carrier board by performing the previous steps in the reverse order.

For the Carrier Board Design Guide, visit Kontron's Customer Section .
In the Customer Section click on Switches > TSN Network > KSwitch M20 > KSwitch M20 Design Information > Design Guide KSwitch_M20-xxxT.

8/Starting up

The KSwitch M20 module receives power from the 220-pin Carrier interface connector. The KSwitch M20's Carrier interface connector inserts into a carrier board's compatible 220-pin interface connector to power up.

The KSwitch M20 module must be connected to a corresponding interface connector of the carrier board to power up.

8.1. Before Starting Up

Before connecting the KSwitch M20 module to a carrier board, ensure that the carrier board is switched off and disconnected from the main power supply at the time of connection. Failure to disconnect the main power supply from the carrier board could result in personal injury and damage to the KSwitch M20 module and/or carrier board.

The following safety precautions must be observed when starting up or operating the KSwitch M20 module. Kontron assumes no responsibility for any damage resulting from failure to comply with these requirements.

Carrier Board Switched Off

⚠CAUTION

Ensure that the carrier board is switched off and disconnected from the main power supply. Failure to disconnect the carrier board's main power supply could result in personal injury and damage to the KSwitch M20 module and/or carrier board.

Handle Carefully

⚠CAUTION

Handling and operation of the KSwitch M20 module is permitted only for skilled personnel within a workplace that is access controlled.

ESD Sensitive Device!

Keep electrostatic sensitive parts in their containers until they arrive at the ESD-safe workplace. Always be properly grounded when touching a sensitive board, component, or assembly.

8.2. Starting Up Procedure

To start the KSwitch M20 Module, perform the following:

1. Install the KSwitch M20 module on the carrier board as described in Chapter 7/ Installation.
2. Connect the carrier board to the main power supply.
3. The KSwitch M20 module starts automatically when the carrier board is powered on.

9/Software Interface

The KSwitch M20 module provides direct access to the Microchip LAN969xTSN Switch with Microchip iStaX OS via a 1.8V UART interface. The UART interface is the only active management interface when the KSwitch M20 module is delivered and vital for the KSwitch M20 module's initial setup. Kontron strongly recommends making the UART interface accessible for service usage as a Service Management Port on the user defined carrier board, for first time configuration and debugging.

Kontron strongly recommends making the UART interface accessible for service usage as a Service Management Port on the user defined carrier board, for first time configuration and debugging.

All software installed by the user is at the user's own risk. Kontron is not responsible for any malfunction, data loss, outage and other problems caused by software installed by the user.

Kontron is not responsible for the loss of stored, transmitted and received data. It is the user's responsibility to consider access control and protection measures required to prevent unwanted access.

9.1. Setting up the Service Management Port

To set up the KSwitch M20 module's UART interface the KSwitch M20 module must be connected to the user defined carrier board and powered up with user access to the Service Management Port on the carrier board. The Service Management Port (COM) is a serial port. The serial connection requirements for the Service Management Port (COM) are:

- Serial baud rate 115200
- 8-N-1
- No flow control

To set up the KSwitch M20 module's initial setup via the Service Management Port (COM) on the user's carrier board, connect the Service Management Port (COM) to a remote computer and use the Putty software to access the Service Management Port (COM) in the category window:

1. Select <Session> and specify the <Serial Line>, <Speed> 115200 and then <Connection Type> Serial. Click on <Open>.
2. Select <Keyboard> and click on <Options>. Click on <Open>.
3. Select <Serial> and then choose the serial line to connect to, baud rate of 11520, select 8-N-1 (8-bit data –No parity-1-bit stop). Click on <Open>.
4. The terminal displays the Service Management Port information.

Kontron recommends using PuTTY for Windows environments and telnet for Linux environments.

On delivery the default username is 'admin' and there is no password.

Username 'admin' cannot be removed or be changed, only its password.

Kontron strongly recommends assigning a strong password.

For the Carrier Board Design Guide, visit Kontron's Customer Section .

In the Customer Section click on Switches > TSN Network > KSwitch M20 > KSwitch M20 Design Information > Design Guide KSwitch_M20-xxxT.

9.2. Help Tools

9.2.1. Switch Web User Interface (UI) Help

The Web user interface (UI) supports a comprehensive help menu providing information about functions and corresponding configuration options.

9.2.2. Switch Command Line Interface (CLI) Help

The CLI contains a context-sensitive help feature. Use the <?> symbol to display the next possible parameters or commands and their descriptions.

9.3. Configuration Examples using the CLI

The following information explains how to setup dedicated CLI features and configurations.

For more information on additional CLI features and configuration options, refer to the CLI Help feature. For more information, see Chapter 9.2.2: Switch Command Line Interface (CLI) Help.

9.3.1. To Query DHCP assigned IP Address

The DHCP server provides the assigned IP address.

```
Starting kernel ...

00:00:00 Stage 1 booted. Starting stage2 boot @ 876 ms
/dev/mmcblk0p7: recovering journal
/dev/mmcblk0p7 primary superblock features different from backup, check forced.
/dev/mmcblk0p7: Feature orphan_present is set but orphan file is clean.
CLEARED.
/dev/mmcblk0p7: 30/90288 files (3.3% non-contiguous), 15030/360448 blocks
00:00:01 Starting application...
Using existing mount point for /switch/

Press ENTER to get started
Username: admin
Password: <CR>
#show ip interface
Interface Address            Method Status
--------- ------------------ ------ ------
VLAN 1    10.224.32.5/24     DHCP   UP
```

9.3.2. Set IP Address manually (and hostname) manually via CLI and Save

In case no DHCP server is present. Set the IP address (and hostname) manually via CLI and save both permanently.

```
Press ENTER to get started <CR>

Username: admin
Password: <CR>
#configure terminal
(config)# hostname KSwitch-M20-1
KSwitch-M20-1(config)#interface vlan 1
KSwitch-M20-1(config-if-vlan)# ip address 19exit
2.168.170.60 255.255.255.0
KSwitch-M20-1(config-if-vlan)# do show ip interface
Interface Address            Method Status
--------- ------------------ ------ ------
VLAN 1    192.168.170.60/24  Manual Up

KSwitch-M20-1(config-if-vlan)#
KSwitch-M20-1(config-if-vlan)# exit
KSwitch-M20-1(config)# exit
KSwitch-M20-1# copy running-config startup-config
Building configuration...
% Saving 1305 bytes to flash:startup-config
KSwitch-M20-1#
```

9.4. Firmware Update

Firmware updates can be implemented using Web UI or CLI. For both methods, network access must be configured.

For the Carrier Board Design Guide, visit Kontron's Customer Section .
In the Customer Section click on Switches > TSN Network > KSwitch M20 > KSwitch M20 Design Information > Design Guide KSwitch_M20-xxxT.

To update the firmware to the KSwitch M20 module on the user's carrier board using the Web-Interface, ensure that the firmware upgrade file *.gz from the firmware package is reachable on the system running the web browser.

To update the firmware, perform the following:

1. Access the Web Interface to discover the current firmware version.
   `Monitor -> System -> Information Page.`
2. Download the firmware upgrade file ***.gz**.
3. Execute the firmware update.
   `Maintenance -> Software -> Upload page.`
4. After installing the new firmware, the switch reboots.
5. Previous firmware is stored as '**Alternate Image**' and the new firmware is stored as '**Active Image**'.

10/ Maintenance

The KSwitch M20 module contains no user serviceable hardware parts. Return the KSwitch M20 module to Kontron for maintenance and repair, see Chapter 11.1:Returning Defective Merchandise.

The KSwitch M20 module's heatspreader plate and any possible additional cooling solution may become hot to touch and to avoid burn or personal injury Kontron recommends allowing the KSwitch M20 module to cool before handling the KSwitch M20 module.

⚠CAUTION

Handling and Operation

Handling and operation of the KSwitch M20 module is permitted only for skilled personnel aware of the associated dangers, within a workplace that is access-controlled and fulfills all necessary technical and environmental requirements.

Hot Surface

Heatspreader plate and additional cooling solution can get very hot. To avoid burns and personal injury:

- Do not touch when the KSwitch M20 module is in operation
- Allow the KSwitch M20 module to cool before handling
- Wear protective gloves

10.1. Hardware Reset

The KSwitch M20 module does not include a hardware reset function. This feature is only available if the Ethernet controller's reset signal is implemented on a custom carrier board.

To reset the KSwitch M20 module, switch off by disconnecting the power properly. Then wait approximately 10 seconds before reconnecting the KSwitch M20 module to power.

11/ Technical Support

For technical support contact our Support Department:

- E-mail: support@kontron.com
- Phone: +49-821-4086-888

Make sure you have the following information available when you call:

- Product ID Number (PN),
- Serial Number (SN)

The serial number can be found on the Type Label, located on the KSwitch M20 module's rear panel.

Be ready to explain the nature of your problem to the service technician.

11.1. Returning Defective Merchandise

All equipment returned to Kontron must have a Return of Material Authorization (RMA) number assigned exclusively by Kontron. Kontron cannot be held responsible for any loss or damage caused to the equipment received without an RMA number. The buyer accepts responsibility for all freight charges for the return of goods to Kontron's designated facility. Kontron will pay the return freight charges back to the buyer's location in the event that the equipment is repaired or replaced within the stipulated warranty period. Follow these steps before returning any product to Kontron.

1. Visit the RMA Information website: https://www.kontron.com/en/support/rma-information
2. Download the RMA Request sheet for Kontron Europe GmbH and fill out the form. Take care to include a short, detailed description of the observed problem or failure and to include the product identification Information (Name of product, Product number and Serial number). If a delivery includes more than one product, fill out the above information in the RMA Request form for each product. Send the completed RMA-Request form to the fax or email address given below at Kontron Europe GmbH. Kontron will provide an RMA-Number.
3. Kontron Europe GmbH
   RMA Support
   Phone: +49 (0) 821 4086-0
   Fax: +49 (0) 821 4086 111
   Email: service@kontron.com
4. The goods for repair must be packed properly for shipping, considering shock and ESD protection.

Goods returned to Kontron Europe GmbH in non-proper packaging will be considered as a customer caused faults and cannot be accepted as warranty repairs

5. Include the RMA-Number with the shipping paperwork and send the product to the delivery address provided in the RMA form or received from Kontron RMA Support.

12/ Storage and Transportation

12.1. Storage

If the KSwitch M20 module is not in use for an extended period time, disconnect the KSwitch M20 module from the power supply. If it is necessary to store the KSwitch M20 module, re-pack the KSwitch M20 module as originally delivered to avoid damage. The storage facility must meet the KSwitch M20 module's environmental storage requirements as stated within this user guide. Kontron recommends keeping the original packaging material for future storage or warranty shipments.

12.2. Transportation

To ship the KSwitch M20 module use the original packaging, designed to withstand impact and adequately protect the KSwitch M20 module.

When packing or unpacking the KSwitch M20 module, always take shock and ESD protection into consideration and use an EOS/ESD safe working area.

13/ Warranty

Due to their limited service life, parts that by their nature are subject to a particularly high degree of wear (wearing parts) are excluded from the warranty beyond that provided by law. This applies to the lithium battery, for example.

14/ Disposal

14.1. Disposal

Dispose of the product in accordance with country, state, or local regulations and requirements as part of your disposal and decommissioning policies or recycle the product or parts of the product for re-use after performing data sanitization to erase sensitive data stored on the product's memory devices.

When disposing of the product

- Remove any product labels from the product that could indicate ownership and provide a clue to the type of data stored on the memory device.
- Comply with your company's environmental requirements and the requirements of Waste Electrical and Electronic Equipment (WEEE) directive.
- Use data sanitization guidelines to ensure that data sensitive to your business and/or confidential or proprietary data and software is removed from the product using a data sanitization method that stops the data from being retrieved or reconstructed.

14.2. WEEE Compliance

The Waste Electrical and Electronic Equipment (WEEE) Directive aims to:

- Reduce waste arising from electrical and electronic equipment (EEE).
- Make producers of EEE responsible for the environmental impact of their products, especially when the product becomes waste.
- Encourage separate collection and subsequent treatment, reuse, recovery, recycling and sound environmental disposal of EEE.
- Improve the environmental performance of all those involved during the lifecycle of EEE.

Environmental protection is a high priority with Kontron.
Kontron follows the WEEE directive
You are encouraged to return our products for proper disposal.

14.3. Data Sanitization

Data sanitization is the process of permanently erasing or destroying sensitive data on the product's memory devices to prevent unauthorized access to data sensitive to your business and/or confidential/proprietary data stored on the memory devices.

When designing a system, the user must plan for data sanitization and design in memory devices that are easier to sanitize, memory devices from manufactures that provide an effective data erasure tool or a return to factory default command.

When performing data sanitization, the user must consider if the product's memory devices contain sensitive data and develop a data sanitization plan to erase all sensitive data in accordance with country, state, or local data sanitization regulations and requirements or as part of your disposal and decommissioning policies.

Data Sanitization

Users are responsible for erasing sensitive data on memory devices in accordance with country, state, or local data sanitization regulations and requirements, or as part of your disposal and decommissioning policies.

Kontron recommends performing data sanitization when reusing the product in a different user environment, sending the product in for repair, disposing of the product or decommissioning the product.

General guidelines when performing data sanitization on memory devices containing data sensitive to your business and/or confidential/proprietary data:

- Before powering down, consider if power is required to perform data sanitization on the product's memory devices.
- When disconnected from the power source, dismantle all removable memory devices from the product and erase sensitive data.
- Volatile memory devices only store data temporarily. Data on volatile memory can be erased easily by disconnecting the power/removing the battery for approximately 24 hours.
- Non-volatile memory devices store data permanently and retain information when disconnected from power. Data on von-volatile memory must be actively erased using one of the following methods:
  - Use an accredited third-party software tool that provides an audit trail, capable of performing a complete data clean including areas such as hidden data and bad blocks not accessed by general service-based utilities.
  - Use the physical destruction methods on memory devices that cannot be securely software erased. The aim of the destruction is to break the silicon die within the chips package into two or more parts to prevent reading data from the die. Fragments should be no longer than 6 mm. If this service is performed by a third party obtain destruction certificates for confirmation.
  - Use the manufacture's data erasure tool for sanitization or return to factory default command (if provided by the manufacturer). The manufactures tools and commands have been designed to fulfil the data sanitization requirement of the manufacture's specific memory device(s).
- Always verify that all sensitive data has been effectively sanitized.

Dismantle Removable Memory

Dismantle all removable memory devices and erase sensitive data for reuse by using:

- An accredited third-party software tool.
- Manufacture's data erasure tool' or 'return to factory default command'. (if provided)
- If the removable memory is not for reuse, physically destruct the memory according to data sanitization guidelines.

Erase Data

To ensure that forensic tools cannot be used to recover sensitive data:

- Use an accredited third-party software tool, with an audit trail, capable of performing a complete data clean, including areas such as hidden data and bad blocks not accessed by general service-based utilities.
- Use the manufacture's data erasure tool or return to factor default command designed to fulfil the data sanitization requirement of the manufacture's specific memory device(s).

Physical Destruction

When physically destructing the memory:

- Follow proper safety protocols.
- Break the chip packaged silicon die into two or more parts, fragments <= 6 mm.
- Check both sides as memory devices may be positioned on the rear side.
- Use a third-party destruction company providing certificates for confirmation.

14.4. Statement of Memory Volatility

The product's statement of memory volatility provides the user with a detailed list of the product's memory devices and their volatility, to enable the user to develop a suitable data sanitization plan.

In some cases, special tools and/or software are necessary to access the memory

Table 27: Statement of KSwitch M20 Memory Volatility

Memory	Ref. Design Location	Memory Size	Volatile	Alterable in Field	Battery Backed Up	Data Type	Write Protection	Emergency Erase	Process to Clear
NOR/ FLASH	U32	2 MB	No	Yes	No	User data	No	No	No
eMMC	U15	Up to 2GB	No	Yes	No	User data	No	No	No
DDR4	U6	Up to 2GB	Yes	Yes	No	User data	No	No	Disconnect from power

For the memory location on the KSwitch M20 modue, see Figure 3: Top Side View.

Users are responsible for memory devices such as the RTC battery location on the carrier board.

15/ Cyber Security

Cyber security is an important aspect to consider when installing, operating, maintaining and disposing of the product. This chapter provides cyber security guidelines for the user.

Security White Paper

For cyber security guidelines to protect your Kontron product from potential cyber security threats, refer to Kontron's Security White paper.

Security Measures

Kontron is not aware of the final target end user environment in which the product operates. It is not possible for Kontron to provide precise instructions for your cyber security measures. Kontron strives to provide hints for considerations for your threat analysis and to point out particular security mechanisms implemented in Kontron products.

15.1. Security Defense Strategy

When developing your security defense strategy consider implementing the following guidelines to help you effectively secure the product:

- Policies and procedures developed in association with the product's/end environment's security.
- Instructions and recommendations for periodic security maintenance activities and reporting product security incidents.
- Security network controls/setting such as firewall rules.
- Third party software tools that further protect the product.
- Authentication to access the product, limit user privileges and managing user accounts.
- Data encryption.
- Reduced number of potential security entry points.
- BIOS/OS and security updates that do not compromise the product's operation or defense in depth strategy.
- User accounts with length and complexity requirements.
- Supplied default passwords are changed.
- Limited network access (IP address range).
- Installation of anti-virus and malware software.
- Network access requirements such as VPN.

Appendix: List of Acronyms

AC	Alternating Current
bps	bits per second
CE	Conformitè Europëenne
COM	Communication port
DC	Direct Current
DHCP	Dynamic Host Configuration Protocol
DPLL	Digital Phase Loacked loop
EMC	ElectroMagnetic compatibility
ESD	ElectroStatic Discharge
FCC	Federal Communications Commission
FRU	Field Replaceable Units
GbE	Giga Bit Ethernet
IOT	Internet of Things
IP	Internet Protocol
LAN	Local Area Network
LED	Light Emitting Diode
LLC	Logical Link Control
LPC	Limited Power Source
MAC	Medium Access Control
MCU	Micro Controller Unit
MDI	Media Dependent Interface
MTBF	Mean Time Before Failure
OSI	Open Systems Interconnection
PERST	Power-On Rest
PPS	Packets per second
PS	Power Source
QSPI	Quad Serial Peripheral Interface
RMA	Return of Material Authorization
RoHS	Restriction of Hazardous Substances
RTC	Real Time Clock
SD card	Secure Digital Card
SPI	Serial Peripheral Interface
TPM	Trusted Platform Module
UEFI	Unified Extensible Firmware Interface
UL	Underwriters Laboratories
USB	Universal Serial Bus
VPD	Vital Product Data
VLAN	Virtual LAN

About Kontron

Kontron is a global leader in IoT/Embedded Computing Technology (ECT) and offers individual solutions in the areas of Internet of Things (IoT) and Industry 4.0 through a combined portfolio of hardware, software and services. With its standard and customized products based on highly reliable state-of-the-art technologies, Kontron provides secure and innovative applications for a wide variety of industries. As a result, customers benefit from accelerated time-to-market, lower total cost of ownership, extended product lifecycles and the best fully integrated applications.

For more information, please visit: www.kontron.com

Global Headquarters

Kontron Europe GmbH

Gutenbergstraße 2
85737 Ismaning, Germany
Tel.: +49 8214 4086-0
info@kontron.com

www.kontron.de

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