



Apalis TK1

Errata Document



Document Revision History

Date	Doc. Rev.	Notes
2016-06-08	Rev. 1.0	Initial Release
2016-07-07	Rev. 1.1	Errata #3: added
2016-09-16	Rev. 1.2	Errata #4: added Errata #2: modified
2016-10-26	Rev. 1.3	Errata #5: added
2017-05-31	Rev. 1.4	Errata #6: added
2017-06-01	Rev. 1.5	Errata #6: updated table in Appendix (removed modules that have been fixed at the warehouse)
2017-06-06	Rev. 1.6	Errata #7: added
2017-11-07	Rev. 1.7	Errata #5: updated Errata #7: updated
2018-08-03	Rev. 1.8	Errata #7: removed the software patch from this document and added a link to the knowledge base article which contains the patch.
2022-05-17	Rev. 1.9	Update company address and email contact Errata #8: added Update disclaimer Minor changes
2022-10-07	Rev 1.10	Errata #8: Correction of temperature sensor part number

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Errata #1: SD Card: SD Card does not work due to a wrong pinout

Affected Version: **Apalis TK1 V1.0**

Fixed in: **Apalis TK1 V1.1**

1.1 Description

The Apalis SD1 interface (interfaced named SDMM3 on the SoC) features a clock loopback. This signal is looped from the SDMMC3_CLK_LB_OUT to the SDMMC3_CLK_LB_IN pin of the SoC on the Jetson board. On the Apalis TK1, the loop is configured to be done internally in the SoC to be able to use these two pins as GPIO.

The internal loopback works, and the SDMMC3_CLK_LB_IN can be used as GPIO. Unfortunately, the internal loopback is routed over the output driver of the SDMMC3_CLK_LB_OUT pin, which means the clock signal is outputted to this pin regardless of the internal loopback mode. This leads to two problems: SDMMC3_CLK_LB_OUT is driven and might cause problems depending on the connection implemented on the carrier board. And secondly, the pin cannot be used as GPIO.

On the Apalis TK1 V1.0 modules, the SDMMC3_CLK_LB_OUT SoC pin is connected to the MXM3 edge connector pin 190 as the SD1_CD# signal. The intended function of this pin is the card insert detection. For this function, the pin is intended to be used as GPIO, which is not possible.

Carrier Board designs such as the Apalis Evaluation Board as well as the Ixora route the SD1_CD# signal to the card socket or a card detect circuit. The extra load on the SDMMC3_CLK_LB_OUT reduces the signal level on the internal loopback. This can cause issues in the communication with the interface. The SD cards sometimes are not detected.

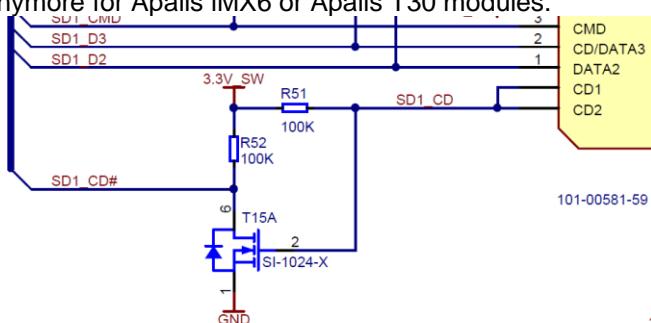
The Apalis MMC1 interface (SoC name: SDMMC1) is not affected by this issue. This interface does not feature a clock loopback. The issue will be resolved in the next version (V1.1) of the Apalis TK1 module by using a different SoC pin for the SD1_CD# signal.

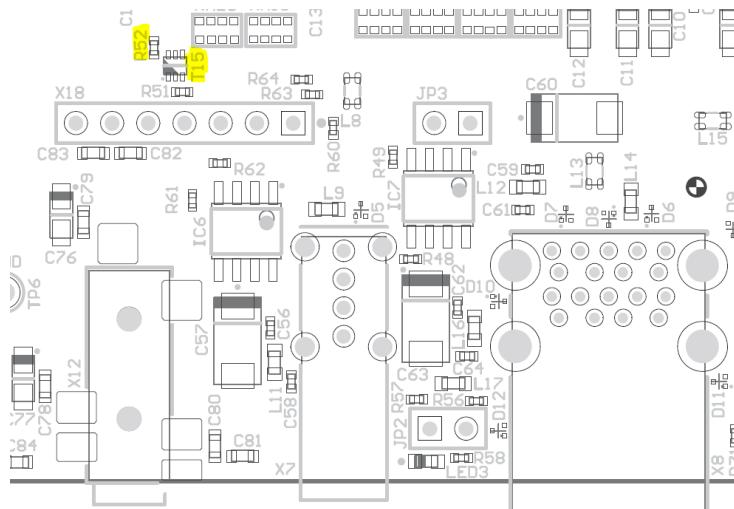
1.2 Workaround

Use the MMC1 (SDMMC1) interface instead of the SD1 (SDMMC3). Other workarounds are needed if that is not possible (on the Ixora V1.0 modules, MMC1 is not available). First of all, the card detect function needs to be disabled. Instead, use a polling function for detecting the insertion of a card. The Toradex Linux BSP has implemented this polling function.

To remove the extra load on the SD1_CD# signal, ensure that this pin is not connected to anything. The solution depends on the type of carrier board:

- For the Apalis **Evaluation Board**, remove the Jumper between the MXM3_190 and the SD1_CD# signal (Jumper A11/B11 of connector X6).
- For the **Ixora V1.0** Carrier Board, remove transistor T15. Additionally, also R52 should be removed. **IMPORTANT:** After this modification, the carrier board's SD Card cannot be used anymore for Apalis iMX6 or Apalis T30 modules.





- No modification is needed for the Ixora V1.1 Carrier Board (or newer). This board uses the MMC1 interface instead of the SD1 for the micro SD interface. The SD1_CD# is already floating.

Errata #2: Power: Power consumption exceeds the power specification of certain carrier boards

Affected Version: **Apalis TK1 V1.0**

Fixed in: **Apalis TK1 V1.1**

2.1 Description

The power supply on the Apalis Evaluation Board (V1.1 and older) and the Ixora Carrier Board (V1.0) are designed for a maximum output current on the 3.3V rail of 5A. The buck converter features an over-current sense resistor. This function shuts the supply down immediately if the current exceeds 5A.

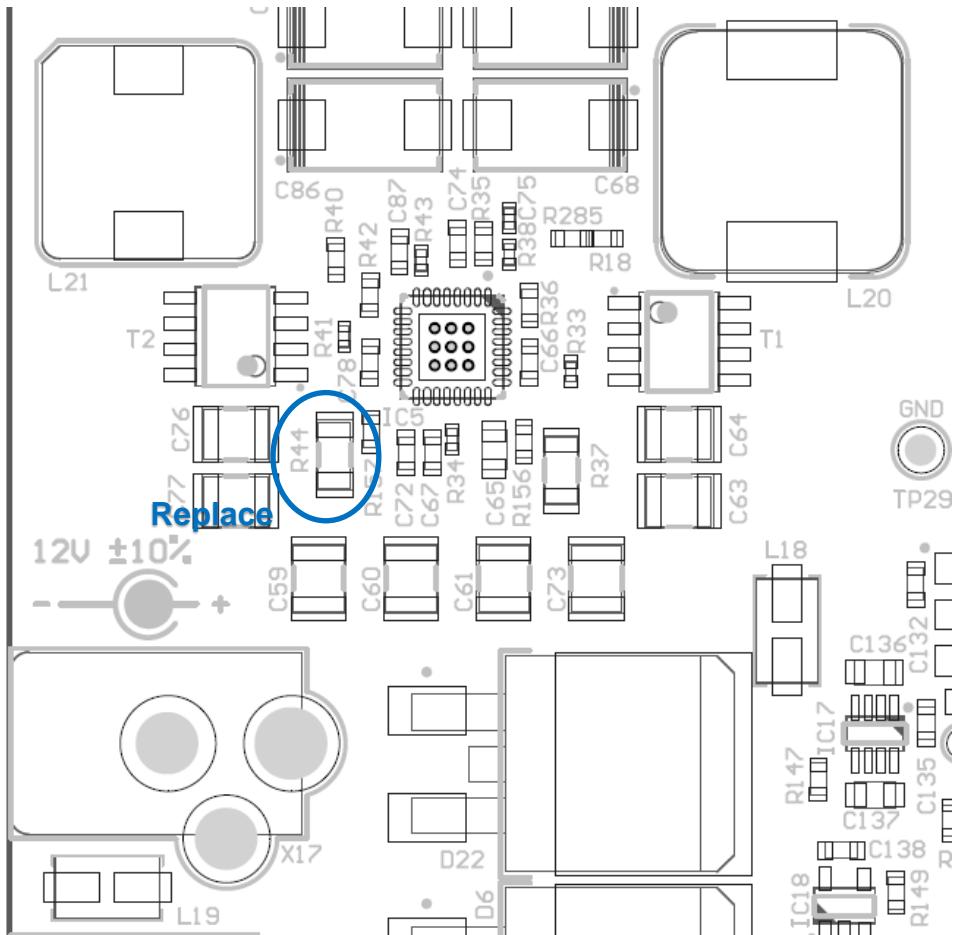
The peak current consumption of the Apalis TK1 V1.0 module can be higher than 5A due to an issue with the on-module power supply (see Errata #4:). This can occur if all CPU cores are used at full load and high GPU load. Also, intensive use of peripheral devices can increase consumption. The consumption of the module also increases with its temperature.

2.2 Workaround

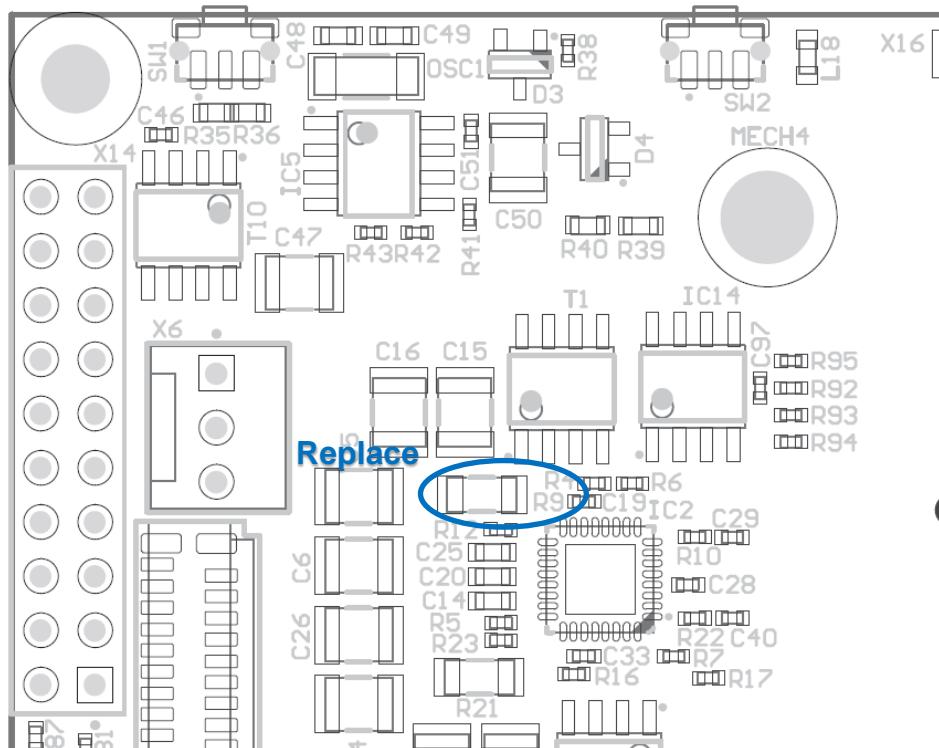
To run the Apalis TK1 V1.0 module on the Evaluation Board and the Ixora, the module performance needs to be reduced by ensuring that the CPU is not fully loaded while the GPU is extensively used. If the full performance is required, the current sense circuit on the carrier boards needs to be modified to increase the threshold for the over-current shutdown.

The described patch for the carrier boards only changes the current sense resistor, not the current rating of the inductor. Therefore, the buck converter's actual maximum output current capability is not changed. The original current sense resistor was calculated to protect the converter from continuous overcurrent. By changing the sense resistor, the buck convert could be thermally overloaded by the continuous current. This is not an issue for the high peak current of the Apalis TK1 V1.0 since the average (continuous) current is still within the specifications.

- On the **Apalis Carrier Board V1.1A** (and older), change R44 from $15\text{m}\Omega$ to $12\text{m}\Omega$ ($12\text{m}\Omega$, 1%, 250mW, 1206)



- On the **Ixora V1.0A**, change R9 from 15mΩ to 12mΩ
(12mΩ, 1%, 250mW, 1206)



Errata #3: Operation Temperature Limited to 0°C - 70°C

Affected Version: **Apalis TK1 V1.0A**
Apalis TK1 V1.0B

Fixed in: **Apalis TK1 V1.0C**
Apalis TK1 V1.1

3.1 Description

All components on the Apalis TK1 V1.0A and V1.0B have at least a temperature range of -25°C to 85°C, except for the Intel Ethernet controller. The controller is only specified for 0°C to 70°C. This limits the temperature range of the whole module. The Apalis TK V1.0C and all future modules will be assembled with an IT version of the Intel Ethernet controller to meet the -25°C to 85°C temperature range for the entire module. Please note that for reaching the 85°C environment temperature, a suitable cooling solution is required. The actual maximum environment temperature of the system depends on the efficiency of the cooling solution and the maximum expected power consumption of the SoC.

3.2 Workaround

If the Ethernet is not used, it is allowed to use also the A and B versions of the TK1 modules in the temperature range of -25°C to 85°C. If the Ethernet controller is needed, limit your environment temperature between 0°C and 70°C or use a newer module.

Errata #4: Increased Power Consumption

Affected Version: **Apalis TK1 V1.0**

Fixed in: **Apalis TK1 V1.1**

4.1 Description

The power consumption of the module is higher than expected. The buck converters for the CPU and Core rail are very inefficient since the PMIC is set to the wrong mode. The GPU rail is not affected by this issue. Only CPU and Core rail are affected. While the CPU rail is switched off during CPU idle, the Core rail is always on. The CPU rail is used for the Main Cortex A15 cores (four cores). The Core voltage is used for the low-power Cortex A15 core (fifth core), the AVP subsystem, and some other SoC internal blocks.

First non-verified tests show that the module's power consumption can be reduced by more than 1W (from 3.7W to 2.6W) in idle. During a CPU stress test that fully loads all four A15 cores at the maximum CPU frequency, the power consumption decreases from 7.8W to 4.9W.

4.2 Workaround

There is no software or hardware patch available for resolving the issue on V1.0 modules. Nevertheless, the V1.0 modules can still be used with a suitable cooling solution. Since the module's power consumption at a high CPU load can exceed the carrier board limits, modifications of the carrier board power supplies might be necessary (see Errata #2: for more information).

Errata #5: Limited Output Capabilities of GPIO3 and GPIO4

Affected Version: **Apalis TK1 V1.0**
Apalis TK1 V1.1

Fixed in: **Apalis TK1 V1.2**

5.1 Description

The GPIO3 (MXM3 pin 5) and GPIO4 (MXM3 pin 7) are pins of the Nvidia TK1 SoC (DDC_SCL, respectively DDC_SDA). Unlike most other SoC pins, these pins feature the pad type "open-drain". These two pins cannot be used in push-pull output mode. The pins can be used as CMOS type input signal but do not feature the Schmitt-Trigger input function. It is impossible to output a standard high-level (3.3V) signal. It is also impossible to enable any internal pull-up resistors. Only the internal pull-down resistors can be enabled.

The GPIO1 to GPIO8 pins of the Apalis module family are intended to be used either as general-purpose input or output signals. For the GPIO3 and GPIO4, only the general-purpose input function is available. A general-purpose output is not possible. In a future PCB update, we plan to replace the currently used TK1 signals with other signals which provide the complete GPIO feature set.

5.2 Workaround

As long as GPIO3 and GPIO4 are only used as inputs, the only limitation is the absence of the optional Schmitt-Trigger function. If the two pins need to be used as output signals, it is possible to configure them as an open drain, requiring external pull-up resistors.

5.3 Fix

The issue is fixed in version 1.2. The GPIO3 and GPIO4 pins have been changed in this version. Check the datasheet or the Pinout Designer for more information about the pins connected to these module edge pins.

Errata #6: Missing Config Block Data

Affected Version: **Apalis TK1 V1.1 (only specific modules, see Appendix for Errata #6)**

Fixed in: **All not affected modules (see Appendix for Errata #6)**

6.1 Description

The config block is a data structure that gets typically programmed during factory programming and contains the exact product version and the product's serial number. The serial number is also used as the MAC address. The affected modules don't have the config block pre-programmed. The whole config block is missing on the affected modules, leading to all affected modules using the same default MAC address.

Since all affected modules have the same default MAC address, it will lead to problems when using more than one of these modules in the same Ethernet network. The Ethernet specification doesn't allow multiple devices with the same MAC address in the same network.

6.2 Workaround

u-boot provides a command to restore corrupt or missing config blocks: "*cfgblock create*". To use the command, access the u-boot via serial console. By default, u-boot is accessible on UART1 @115200 baud.

1. Using a barcode scanner

The barcode on each module contains all the data needed to restore the config block. The barcode consists of a 16-digit decimal number, including the product number, version, and serial number. Just enter the command "cfgblock create," followed by the barcode scan. The respective u-boot command looks as follows:

```
Apalis TK1 # cfgblock create 0034110002911973
Toradex config block successfully written
```

2. Manually

The config block can also be restored without a barcode scanner by manually adding the required data. Just enter the command "cfg block create" followed by <ENTER>. The command will request the product version and serial number. You can follow the example below and just use the serial number mentioned on the barcode label in plain text instead of the serial number mentioned here:

```
Apalis TK1 # cfgblock create
Is the module an IT version? [y/N] n
Enter the module version (e.g. V1.1B): V1.1A
Enter module serial number: 02911973
Toradex config block successfully written
```

If a config block already exists, u-boot will output the message below. We recommend entering "n" not to overwrite existing config block data.

```
Apalis TK1 # cfgblock create 0034110002911973
A valid Toradex config block is present, still recreate? [y/N] n
```

Errata #7: HDMI DDC issues with Apalis TK1

Affected Version: **Apalis TK1 V1.0**
 Apalis TK1 V1.1

Fixed in: **Apalis TK1 V1.2**

7.1 Description

The Apalis TK1 module, combined with the Ixora carrier board, shows issues with some HDMI monitors. In case of failure, the module cannot read the monitor's DDC information and will not show any picture. It depends on the monitor whether the issue appears. In some module/monitor combinations, the issue appears only when hot-plugging the HDMI cable, while in other cases, the issue also appears when booting the module. The issue only appears if the Apalis TK1 module is combined with the Ixora Carrier Board. Apalis T30 and Apalis iMX6 are not affected by this erratum.

The issue is caused by an incompatible low logic level of the DDC interface. The Ixora board features the Nexperia IP4791CZ12 HDMI ESD protection and level shifter. This device is used for level shifting the 5V HDMI DDC signals to the 3.3V level of the Apalis module. According to the datasheet, the maximum output low-level of this device is 0.92V for the 3.3V level output. The maximum input low-level of the Apalis TK1 2GB V1.1A DDC signals is 0.45V.

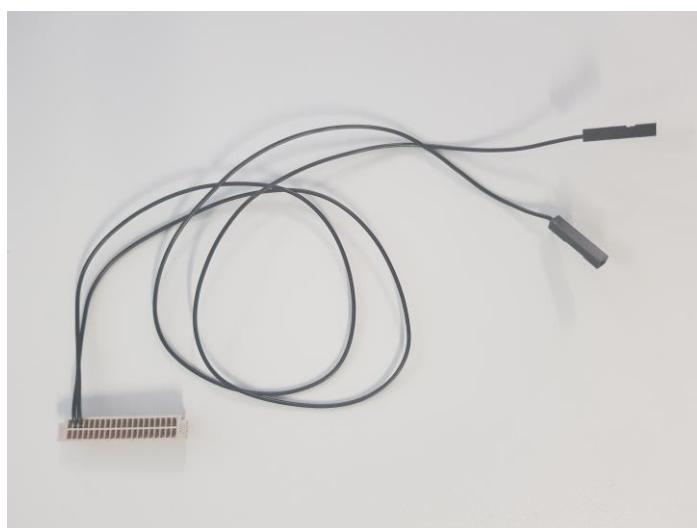
The Apalis Evaluation board features a dedicated I²C level shifter for shifting the signals from the Apalis module level to 5V for HDMI. This TI PCA9306DCTT is not causing any incompatibility with the maximum low level.

7.2 Workaround

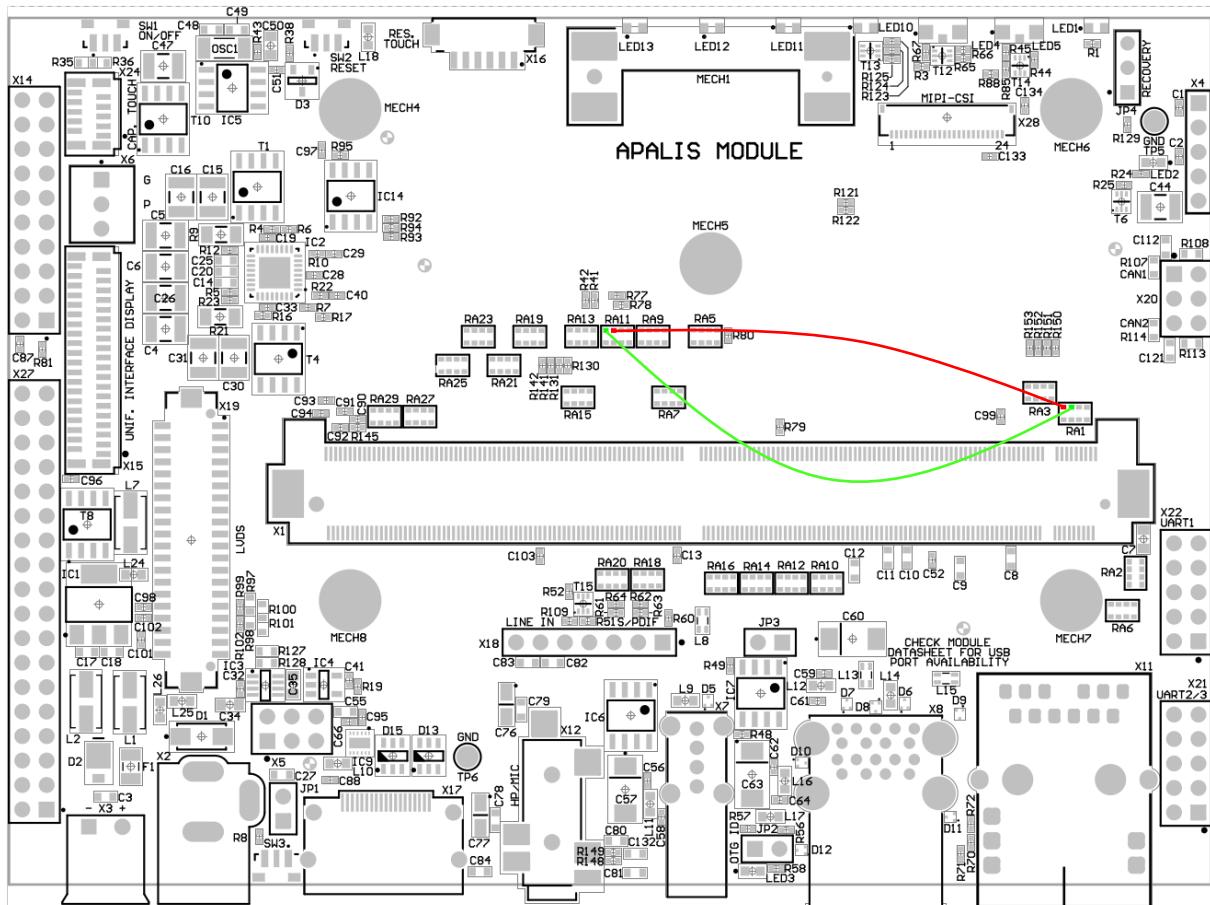
As a temporary workaround for evaluation purposes, using Ixora V1.0 or V1.1 in combination with Apalis TK1 2GB V1.1A, it is possible to patch the DDC signals from the Nexperia level shifter to the GPIO3 (MXM pin 5, DDC_SCL) and GPIO4 (MXM pin 7, DDC_SDA) of the Apalis module. The device tree and kernel needs to be patched to use these pins as DDC channel for HDMI. Please don't implement this workaround as a permanent solution, as MXM pins 5 and 7 are not DDC signals by default and might not be available in potential future redesigns of the Apalis TK1 module anymore.

7.2.1 Workaround for Ixora V1.1

The easiest way is to create a cable connecting pins 36 and 38 of the LVDS connector (X19 on Ixora V1.1, mating connector, e.g., Hirose DF13-40DS-1.25C) to the pins 16 and 15 of the connector X27 on Ixora V1.1 (using normal patch-cable like female connectors, see picture).

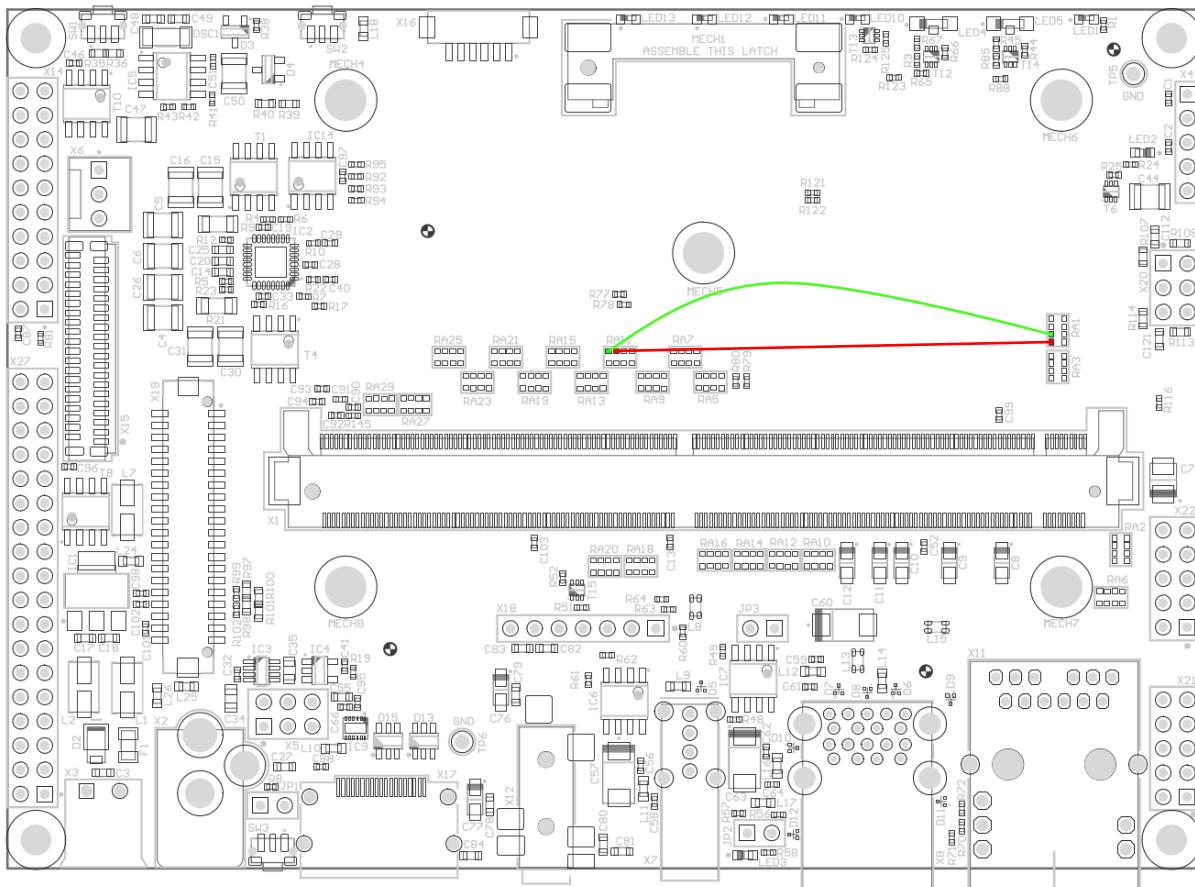


Alternatively, the first two pins of the resistor arrays RA11 and RA1 on Ixora V1.1 can be connected with soldered wires. See the diagram for more details (connect Green to Green, Red to Red):



7.2.2 Workaround for Ixora V1.0:

On Ixora V1.0, the I₂C bus connected to the HDMI level shifter is not accessible on any connector. Connecting the signals from the resistor array RA11 to RA1 is the only option. See the diagram for more details (connect Green to Green, Red to Red):



7.2.3 Patch for Apalis TK1 2GB 1.1A kernel & device tree:

A patch can be found on the Developer Website:

<https://developer.toradex.com/knowledge-base/ixora-hdmi-ddc-issues-with-apalis-tk1>

7.2.4 Custom Carrier Board Design

A different DDC level shifter than the Nexperia IP4791CZ12 should be used on a custom carrier board design. Ensure the maximum output low signal level of the selected level shifter is compatible with the Apalis TK1 module.

For a possible solution, please have a look at the Toradex Apalis Evaluation Board design data:

<http://developer.toradex.com/products/apalis-evaluation-board#design-resources>

In the schematics <http://docs.toradex.com/102212-apalis-evaluation-board-v1-1-schematics.zip> you will find a level shifter solution for DDC signals which works with monitors which have a maximum low output value of 0.446V. This ensures that it remains below 0.45V after the level shifter, compliant with the Apalis TK1 V1.0 and V1.1 modules. All our available monitors work well with this circuit.

7.3 Fix

The issue is fixed in version 1.2. The new version used the dedicated DDC_SDA and DDC_SCL pins of the Nvidia TK1 SoC instead of the previously used GEN2_I2C_SDA and GEN2_I2C_SCL pins. The new pins are true 3.3V capable pins with a higher maximum input low level. This higher level does not cause any more issues with the Nexperia IP4791CZ12 HDMI ESD protection and level shifter. Check the datasheet or the Pinout Designer for more information about the pins that are now used as HDMI DDC interface.

Errata #8: HAR-8957 – Continuous Power Cycles if Module is Tried to Boot at 85°C

Affected Version: **Apalis TK1 V1.0**
 Apalis TK1 V1.1
 Apalis TK1 V1.2

Fixed in: **TBD**

8.1 Customer impact

If the module gets powered up at high ambient temperatures (around 85°C and above), the SoM can enter a continuous power cycle loop until the ambient temperature drops. The issue does not appear if the module is booted at lower temperatures.

8.2 Description

The module features an TMP451 temperature sensor that monitors the die temperature of the SoC and the local temperature of the temperature sensor itself (the latter used for representing the PCB temperature). By default, the over-temperature limit of the local temperature sensor is set to 85°C. This temperature threshold is set to a higher value during the boot process (to actually allow for booting at an ambient temperature of 85°C, assuming an even higher PCB temperature).

However, if the ambient temperature is already 85°C during the power-up of the module, the over-temperature output of the TMP451 (connected to the power disable input of the PMIC) may get triggered before the threshold gets updated. In this case, the SoM power supply is shut down immediately. This also removes power from the temperature sensor, which allows the PMIC to reenable the power rails. This cycle repeats until the local temperature falls below the default over-temperature threshold of 85°C.

8.3 Workaround

Ensure that the module gets powered up at an ambient temperature of 80°C or lower.

Appendix

Appendix for Errata #6

Serial numbers affected by Errata #6:

Module Name	PN	Serial #
Apalis TK1 2GB V1.1A	00341100	02864628
Apalis TK1 2GB V1.1A	00341100	02873446
Apalis TK1 2GB V1.1A	00341100	02873577
Apalis TK1 2GB V1.1A	00341100	02882327
Apalis TK1 2GB V1.1A	00341100	02882328
Apalis TK1 2GB V1.1A	00341100	02882329
Apalis TK1 2GB V1.1A	00341100	02882330
Apalis TK1 2GB V1.1A	00341100	02882331
Apalis TK1 2GB V1.1A	00341100	02882332
Apalis TK1 2GB V1.1A	00341100	02882333
Apalis TK1 2GB V1.1A	00341100	02882334
Apalis TK1 2GB V1.1A	00341100	02882335
Apalis TK1 2GB V1.1A	00341100	02882336
Apalis TK1 2GB V1.1A	00341100	02882337
Apalis TK1 2GB V1.1A	00341100	02882338
Apalis TK1 2GB V1.1A	00341100	02882339
Apalis TK1 2GB V1.1A	00341100	02882340
Apalis TK1 2GB V1.1A	00341100	02882342
Apalis TK1 2GB V1.1A	00341100	02882344
Apalis TK1 2GB V1.1A	00341100	02882345
Apalis TK1 2GB V1.1A	00341100	02882346
Apalis TK1 2GB V1.1A	00341100	02882350
Apalis TK1 2GB V1.1A	00341100	02882351
Apalis TK1 2GB V1.1A	00341100	02882356
Apalis TK1 2GB V1.1A	00341100	02882358
Apalis TK1 2GB V1.1A	00341100	02882359
Apalis TK1 2GB V1.1A	00341100	02882361
Apalis TK1 2GB V1.1A	00341100	02882362
Apalis TK1 2GB V1.1A	00341100	02882363
Apalis TK1 2GB V1.1A	00341100	02882364
Apalis TK1 2GB V1.1A	00341100	02882369
Apalis TK1 2GB V1.1A	00341100	02882372
Apalis TK1 2GB V1.1A	00341100	02882376
Apalis TK1 2GB V1.1A	00341100	02882377
Apalis TK1 2GB V1.1A	00341100	02882379
Apalis TK1 2GB V1.1A	00341100	02882381
Apalis TK1 2GB V1.1A	00341100	02882382
Apalis TK1 2GB V1.1A	00341100	02882383

Apalis TK1 2GB V1.1A	00341100	02882384
Apalis TK1 2GB V1.1A	00341100	02882385
Apalis TK1 2GB V1.1A	00341100	02882386
Apalis TK1 2GB V1.1A	00341100	02882387
Apalis TK1 2GB V1.1A	00341100	02882388
Apalis TK1 2GB V1.1A	00341100	02882395
Apalis TK1 2GB V1.1A	00341100	02882400
Apalis TK1 2GB V1.1A	00341100	02882428
Apalis TK1 2GB V1.1A	00341100	02882431
Apalis TK1 2GB V1.1A	00341100	02882434
Apalis TK1 2GB V1.1A	00341100	02882436
Apalis TK1 2GB V1.1A	00341100	02882438
Apalis TK1 2GB V1.1A	00341100	02882441
Apalis TK1 2GB V1.1A	00341100	02882444
Apalis TK1 2GB V1.1A	00341100	02882446
Apalis TK1 2GB V1.1A	00341100	02882449
Apalis TK1 2GB V1.1A	00341100	02882451
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Apalis TK1 2GB V1.1A	00341100	02882454
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Apalis TK1 2GB V1.1A	00341100	02882459
Apalis TK1 2GB V1.1A	00341100	02882460
Apalis TK1 2GB V1.1A	00341100	02882461
Apalis TK1 2GB V1.1A	00341100	02882463
Apalis TK1 2GB V1.1A	00341100	02882465
Apalis TK1 2GB V1.1A	00341100	02882469
Apalis TK1 2GB V1.1A	00341100	02882470
Apalis TK1 2GB V1.1A	00341100	02882471
Apalis TK1 2GB V1.1A	00341100	02882472
Apalis TK1 2GB V1.1A	00341100	02882475
Apalis TK1 2GB V1.1A	00341100	02882480
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Apalis TK1 2GB V1.1A	00341100	02882493
Apalis TK1 2GB V1.1A	00341100	02882494
Apalis TK1 2GB V1.1A	00341100	02882499
Apalis TK1 2GB V1.1A	00341100	02882501
Apalis TK1 2GB V1.1A	00341100	02882504
Apalis TK1 2GB V1.1A	00341100	02882505
Apalis TK1 2GB V1.1A	00341100	02882506

Apalis TK1 2GB V1.1A	00341100	02882514
Apalis TK1 2GB V1.1A	00341100	02882515
Apalis TK1 2GB V1.1A	00341100	02882518
Apalis TK1 2GB V1.1A	00341100	02882519
Apalis TK1 2GB V1.1A	00341100	02882521
Apalis TK1 2GB V1.1A	00341100	02882522
Apalis TK1 2GB V1.1A	00341100	02882523
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Apalis TK1 2GB V1.1A	00341100	02882662
Apalis TK1 2GB V1.1A	00341100	02882663
Apalis TK1 2GB V1.1A	00341100	02882665
Apalis TK1 2GB V1.1A	00341100	02882667
Apalis TK1 2GB V1.1A	00341100	02882668
Apalis TK1 2GB V1.1A	00341100	02882680
Apalis TK1 2GB V1.1A	00341100	02882690
Apalis TK1 2GB V1.1A	00341100	02882693
Apalis TK1 2GB V1.1A	00341100	02882695

Apalis TK1 2GB V1.1A	00341100	02882700
Apalis TK1 2GB V1.1A	00341100	02882702
Apalis TK1 2GB V1.1A	00341100	02882709
Apalis TK1 2GB V1.1A	00341100	02882714
Apalis TK1 2GB V1.1A	00341100	02882718
Apalis TK1 2GB V1.1A	00341100	02882730
Apalis TK1 2GB V1.1A	00341100	02882738
Apalis TK1 2GB V1.1A	00341100	02882745
Apalis TK1 2GB V1.1A	00341100	02882746
Apalis TK1 2GB V1.1A	00341100	02882748
Apalis TK1 2GB V1.1A	00341100	02882766
Apalis TK1 2GB V1.1A	00341100	02882778
Apalis TK1 2GB V1.1A	00341100	02882779
Apalis TK1 2GB V1.1A	00341100	02882781
Apalis TK1 2GB V1.1A	00341100	02882782
Apalis TK1 2GB V1.1A	00341100	02882784
Apalis TK1 2GB V1.1A	00341100	02882785
Apalis TK1 2GB V1.1A	00341100	02882794
Apalis TK1 2GB V1.1A	00341100	02882796
Apalis TK1 2GB V1.1A	00341100	02882803
Apalis TK1 2GB V1.1A	00341100	02882804
Apalis TK1 2GB V1.1A	00341100	02882806
Apalis TK1 2GB V1.1A	00341100	02882807
Apalis TK1 2GB V1.1A	00341100	02882812
Apalis TK1 2GB V1.1A	00341100	02882815
Apalis TK1 2GB V1.1A	00341100	02882816
Apalis TK1 2GB V1.1A	00341100	02882821

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