❯❯Danville Signal Processing, Inc.

dspblok™ 21479u8a

EEProm

USB UAC2

CORE PS

Flash

ADSP-21479

JTAG

60.00 [2.36]

60.00 [2.36]

User Manual

Version 1.10

Danville Signal Processing, Inc.
dspblok™ 21479u8a
User Manual

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Overview

Danville Signal's dspblok™ family of products delivers the power of digital signal processing in a small 60mm x 60mm form factor. Connections are brought out to standard 2mm dual row headers. The dspblok reduces development costs, risk and time.

Danville's dspblok DSP function modules are often incorporated directly into larger custom embedded systems. By taking advantage of pretested signal processing modules, pc board layouts become simpler and projects are completed quickly and cost effectively. Danville's dspblok DSP Engines are largely pin compatible. This allows your application to take advantages of new processor technology and extended features in the future.

Each dspblok DSP module includes a core switching supply, flash and EEprom memory and the Danville dspBootloader application. Most dspblok DSP modules also include a USB transceiver. Some dspbloks also include external DDR SDRAM and/or external data buses.

There are two broad categories of dspbloks: standard and USB audio.

The standard dspbloks maximize the I/O that is available from the SHARC DSP. This translates to 12 of 14 DPI lines and all 20 DAI lines.

The USB Audio dspbloks have a companion processor that supports USB Audio Class 2 (UAC2). These are supplied with Windows device drivers and are supported natively by Apple OS X and Linux. Since the USB audio requires streaming and control connections, the amount of external I/O is restricted to a subset of the standard dspbloks.

You can learn more about these differences by reviewing the "dspblok Designing for Compatibility" manual.

Danville dspblok DSP Engines are the driving force behind many of Danville's standalone products such as our dspstak™, dspMusik™ and dspInstrument™ product lines.

dspblok™ 21479u8a

The dspblok™ 21479u8a is a highly integrated, low power DSP module that incorporates an Analog Devices' ADSP-21479 SHARC DSP operating at 250 MHz with flash and EEProm. An onboard switching power supply supports the core voltage requirements of the DSP so that only 3.3V is required to power the dspblok. The ADSP-21479 peripherals include SPORTS (8), SPI(2), TWI (I2C), UART, timers, PWMs and a JTAG port. USB is provided by an XMOS XS1-U8A, which is a high speed USB device that supports USB Audio Class 2. Each dspblok 21479u8a also includes a unique MAC address (IEEE EUI-48™).

These peripherals are available via 2mm headers on the dspblok.

Intended Audience

The dspblok 21479u8a requires an understanding of the Analog Devices' ADSP-21479 and the associated tools used for development. If the dspblok 21479u8a is going to be integrated into a larger hardware design, then it is also assumed that the user is familiar with basic hardware design.

If you do not have a background with these skills, you may want to check out our web site (http://www.danvillesignal.com) as well as the Analog Devices web site for links to useful references. Danville engineers are also available to discuss your application.

Getting Started

Danville's customer base is quite diverse. Our customers range from embedded systems hardware designers to system integrators looking for complete turnkey solutions. We often work with embedded systems engineers who may not have specific expertise in digital signal processing.

Regardless of your background, you will need the right tools. This means either Visual DSP++5.1.2 for SHARC or CrossCore Embedded Studio for the software development along an ADI emulator.

VisualDSP++5.1.2 versus CrossCore Embedded Studio:

VisualDSP++ has been ADI's DSP software environment for many years. In many ways, it has a similar look and feel to Microsoft's' Visual Studio Tools. There are separate licenses for SHARC and Blackfin so customers that need to support both families often need to buy two full licenses. In our view, the full version of VisualDSP++ is expensive, about $3500 US. However, once you own VisualDSP++, you can continue updating for free. Version 1.0 customers can now be using Version 5.1.2 without incurring any maintenance charges. There are also KIT and TESTDRIVE licenses, which are free.

CrossCore Embedded Studio is ADI's replacement for VisualDSP++. Unlike VDSP++, it is Eclipse based. It has a much lower entry cost: $1000 US. It will likely have upgrade costs as new processors are added. This may not matter at all if you are not migrating to newer DSPs. CrossCore supports both Blackfin and SHARC DSP with a single license. ADI offers a free 90 day TESTDRIVE version.

dspblok 21479u8a with an ADI ICE:

You will want to connect to the dspblok 21479u8a via an Analog Devices emulator. Analog Devices offers two versions: the ICE-1000 and the ICE-2000. We prefer the faster ICE-2000, which is nearly 10 times faster and also supports background telemetry. You will also need a Danville JTAG adapter kit (P/N A.08153), which converts the Danville JTAG 2mm header to the larger ADI JTAG connector.

You will also need a FULL VisualDSP++ 5.1.2 or CrossCore Embedded Studio license after 90 days.

Development Boards:

If you are designing your own companion board, we strongly recommend that you use a dspblok dev board (P/N A.08102A) as an initial development platform. This will give you a solid footing for development before you incorporate the dspblok into your own target.

If you are laying out your own pc board, we can provide you with PCB footprints and schematic symbols (Gerber & Altium Designer) to help you avoid simple mistakes.

Regardless of your situation, Danville engineers are available to help you with your application. We may have solutions that are not yet on our web site. We also provide many solutions that are specifically tailored to customer needs. Contact us about turnkey solutions.

We recommend that you have the documents:

- Danville Signal Designing for Compatibility Manual
- Danville Signal dspBootloader Manual
- Analog Devices ADSP-21477/21478/21479 SHARC Processor Data Sheet
- Analog Devices ADSP-214xx SHARC Processor Hardware Reference Manual
- Analog Devices SHARC Processor Programming Reference Manual
- Analog Devices VisualDSP++ 5.0 or CrossCore Embedded Studio Manual Set

We recommend that you have the tools:

- Analog Devices VisualDSP++ 5.1.2 for SHARC or CrossCore Embedded Studio
- Analog Devices ICE-1000 or ICE-2000 and Danville JTAG Adapter P/N A.08153

Our website (www.danvillesignal.com) has downloads and links to these tools and documents.

The dspblok 21479u8a includes the following:
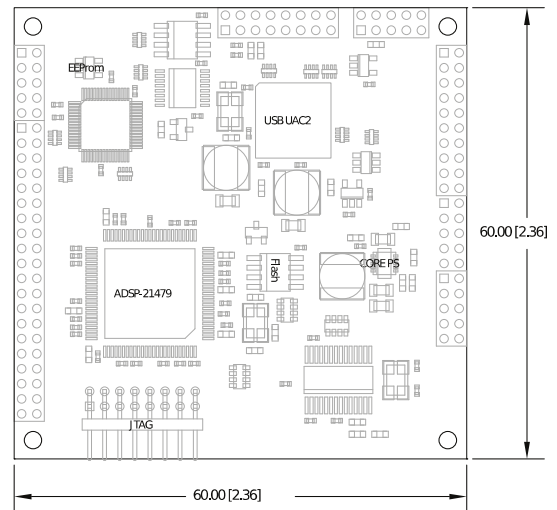
>   **Hardware:**
>
>   - dspblok 21479u8a Module
>
>   **Documents (Email or Dropbox):**
>
>   - This Manual
>   - CAD footprints (Gerber & Altium formats)
>   - Schematics
>   - Sample Programs

Hardware Overview

The dspblok 21479u8a is a small module measuring 60mm x 60mm (2.36" x 2.36"). JH2, JH4, JH5 and JH8 are 2mm male headers that are installed on the bottom side of the pc assembly. JH1 (JTAG) is mounted on the top side of the pc assembly. There are also two factory programming headers on the top side of the pc assembly. If mating 2mm female headers (4.3mm ht.) are used, the pc assembly will be about ¼" above the mating pc board. This allows standard (0.250") standoffs to be used with the corner mounting holes if desired. The hole size is 2.3mm – suitable for 2-56 or M2 screws.
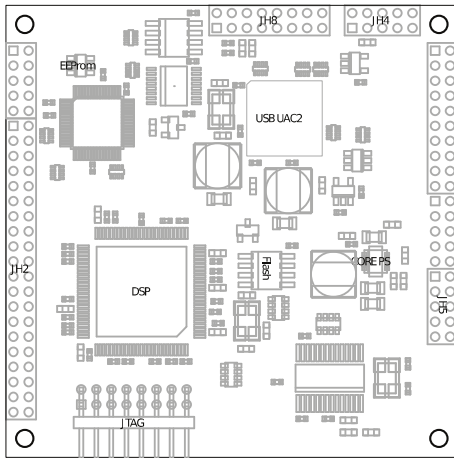
- JH1 – JTAG (connects to external ICE) (Top Side)

- JH2 – DAI, DPI, I/O, SPI & System (Bottom Side)

- JH4 – Power (Bottom Side)

- JH5 – ADC for DC measurements (Bottom Side)

- JH8 – USB Port & dspBootloader Mode (Bottom Side)

Power Supply

There are two power supply connections to the dspblok: DSP core (Vdd) and DSP I/O and Memory (Vd+3.3). The DSP core supply may range from 3.3V to 5V. This is the input to an on-board switching power supply that supplies 1.2V to the ADSP-21479. DO NOT use a higher voltage supply for the core supply input (JH4-Vdd).

A single 3.3V supply is all that is required to power the dspblok 21479u8a, but in some cases, a 5V supply may be more convenient. The DSP I/O and Memory supply must be 3.3V.

For example, a product may already have a switching supply that converts directly to 3.3V. In this case, it may be desirable to supply both the DSP core and the dspblok Vd+3.3 (I/O) from this supply.

Alternatively, a product might have a 5V supply (perhaps from an external power supply module). A simple LDO fixed regulator could be used to create 3.3V from this supply. Most high-speed devices, including the ADSP-21479, draw most of their power from their core supplies. In this scenario, it makes no sense to power the dspblok core with 3.3V since the LDO would be dissipating the excess voltage as heat. If the I/O requirements are modest, the power dissipation in the LDO might not be significant

Power consumption is largely a function of the temperature (due to leakage current) for most SHARC DSPs. Leakage current has been greatly reduced in the ADSP-21479. This makes it suitable for lower power applications. The trade off is that it cannot operate as fast as other SHARC DSPs. The Analog Devices' ADSP-21479 SHARC Processor Data Sheet has an excellent section on estimating power consumption of the DSP.

Memory

The ADSP-21479 includes 5Mbits of internal SRAM. This is 2.5 times more than the earlier third generation SHARC DSPs (ADSP-21369). We have found that most applications do not need more than the abundant internal memory of the ADSP-21479. Those applications that do require large blocks of memory are much better served by the largely pin compatible dspblok 21469uac2. The ADSP-21469 supports much faster DDR2 SDRAM with an independent interface.

A 16Mbit serial flash memory is used to bootload the DSP. There is a pre-installed bootloader (Danville dspBootloader™) program that resides in the flash. This program accepts standard ADI loader files (SPI, slave, binary, 8 bit) and can be uploaded with a dspblok development board, a dspstak 21479 or any Danville board that includes a USB connector. If you want to manage the flash memory yourself, you can overwrite the internal bootloader via the JTAG port.

EEProm memory (2kbits) is also available as byte addressable user memory. For example, you might store serial numbers, build versions or calibration values in this space.

DAI & DPI

The ADSP-21479 has 20 DAI lines and 14 DPI lines. Collectively these can be thought of as two sets of crossbar switches that connect to a wealth of peripherals. The dspblok 21479u8a brings out 11 of 20 DAI and 8 of 14 DPI lines to external connections.

The DPI is slightly restricted in that the primary SPI interface is assigned to DPI1 (MOSI), DPI2 (MISO), DPI3 (SCK), DPI5 (Flash SS) and DPI6 (Internal SS). With the exception of DPI6, these connections are necessary to support SPI master booting. The remaining DAI & DPI lines are used for internal communications between the XMOS USB processor and the SHARC.

Clocks

The dspblok 21479u8a has a 25.000 MHz crystal on the board to use as its clock source. The ADSP-21479 configures its internal PLL to create the core clock. The maximum speed of the ADSP-21479 in LQFP 100 is 266 MHz. The default configuration is 25.000M x 10 = 250 MHz. In many applications, you may want to reduce the clock for lowest power consumption.

MAC Address

Each dspblok 21479u8a has a unique IEEE EUI-48 address. This feature is part of the on-board EEProm (Microchip 25AA02E48).

Reset

On power up, the dspblok 21479u8a is automatically held in reset until the 3.3V power supply is stable. RESET# is active low and open drain. This means that an external device(s) may also reset the dspblok by pulling the reset line low. External devices should not drive RESET# high since this can cause contention with the on-board reset circuit. The external reset circuit is connected in a wired-OR configuration using an active

low – open drain configuration. A 74LVC125 or an open collector/drain transistor circuit is a possibility. You do not need an additional pull up resistor.

Signal Levels

The dspblok 21479u8a uses standard 3.3V logic levels. These levels have become the defacto operating standard for many years now. DO NOT use 5V logic when interfacing to the dspblok. The inputs are not 5V tolerant. Most external devices requiring 5V TTL levels can be safely driven by the dspblok. If you have questions concerning interfacing external devices, please contact Danville for suggestions.

Connections

	Pin	Description			Pin	Description			Pin	Description
JH1		**JTAG**		**JH2**		**DAI, DPI, IO**		**JH4**		**Power**
	1	EMUSEL			1	GND			1	GND
	2	EMU			2	DPI8			2	NC
Note 1	3	Key (No Pin)			3	DPI4		Note 3	3	USB PE#
	4	GND			4	SS0#			4	NC
	5	Vd+3.3 Mon			5	SS1#		Note 4	5	Vd+3.3
	6	TMS			6	FLG0			6	NC
	7	GND			7	DPI7		Note 5	7	Vdd (3.3V or 5V)
	8	TCK			8	SS2#		Note 5	8	Vdd (3.3V or 5V)
	9	GND			9	SS3#			9	NC
	10	TRST#			10	DPI9			10	GND
	11	GND			11	DPI10				
	12	TDI			12	FLG1		**JH5**		**ADC**
	13	GND		Note 2	13	Reserved				
	14	TDO			14	MOSI			1	ADC VREF
	15	Vd+3.3			15	SCK			2	GND
	16	NC			16	MISO			3	ADC0
					17	RESET#			4	ADC1
JH8		**USB**		Note 2	18	Reserved			5	ADC2
					19	MCLK_USB			6	ADC3
	1	NC			20	OUT0			7	NC
	2	NC			21	RESET_EXT			8	NC
	3	USB VBUS			22	PS_SYNC			9	NC
	4	NC			23	DAI5			10	GND
	5	GND			24	DAI6				
	6	GND			25	DAI7				
	7	USB DP			26	DAI8				
	8	USB DM			27	DAI9				
	9	GND			28	DAI10				
	10	GND			29	DAI11				
	11	Reserved			30	DAI12				
	12	GND			31	DAI13				
	13	USER MODE 1			32	DAI14				
	14	GND			33	DAI15				
	15	USER MODE 0			34	Reserved				
	16	GND			35	Reserved				
					36	Reserved				
					37	Reserved				
					38	OUT1				
					39	GND				
					40	GND				

Note 1: Mating Plug is plugged to prevent misalignment.

Note 2: Leave Unconnected.
Note 3: Active after USB is enumerated.
Note 4: Normally connect Vd+3.3 Pins 5&6 together. Possible USB bus power with external circuits.
Note 5: Vdd is externally supplied: 3.3 to 5V (Vin for DSP Core Switching supply). Both connections must be the same voltage.

Connector Recommendations & Notes

Connector Specification

All dspblok connectors are gold plated 2mm dual row headers. Male connectors are mounted on the bottom side of the dspblok pc assembly. The plastic base of each male connector is 2mm. The height of the female headers is 4.3mm. This means that the inserted combined height of the two connectors is 6.3mm or approximately ¼ inch. Standard standoffs may be used to secure the dspblok to the target pc board. Mounting holes are 2.3mm dia. to accommodate a 2-56 or M2 screws or standoffs.

JH1 – JTAG

This connector is mounted on the top side of the dspblok. A 2mm right angle header is used instead of the larger ADI JTAG header. The connections on the JTAG header correspond with the connections on an ADI JTAG header. In addition, Vd+3.3 is also available. This addition allows an active buffer circuit to be added for JTAG chaining applications. Danville has an ADI JTAG adapter available (P/N A.08153).

JH2 – DAI, DPI, IO

Since the dspblok 21479u8a is a USB Audio oriented dspblok, JH2 departs from the standard dspblok assignments. This is discussed in the "Designing for Compatibility" Manual. This is because the dspblok 21479u8a has an XMOS processor used for USB. This requires connections for both control and data.

Control is implemented as a dedicated SPI interface where the XMOS is the master and the DSP is the slave. This SPI interface should not be confused with the external SPI master interface that is available on JH2.

Since some of the DPI was used for this purpose, special SPI master slave select lines (SS0# to SS3#) have been added for SPI expansion. These lines are fanned out using an on board CPLD and automatically buffer and qualify SCK, MOSI & MISO. This allows local SPI to operate at higher speeds since bus loading is reduced. There are also two dedicated output ports OUT0 & OUT1 that can be used for general purpose interfacing. On a standard dspblok, unused DPI lines could have been used for these purposes.

DAI5 through DAI15 are available for external interfacing directly to the DSP. Remaining DAI is used for internal streaming for the USB interface.

Refer to the programming examples to understand the internal interfacing and protocols.

JH4 – Power

This connector is mounted on the bottom side of the dspblok. This is the main power feed to the dspblok, Vdd is the input to the core switching supply. Both Vdd pins should be connected to together and fed with either 5V or 3.3V. Likewise, Vd+3.3 should be connected together and fed with 3.3V.

JH5 – ADC

JH5 is generally part of the external data bus on other dspbloks. In the dspblok 21479u8a, this connection has been repurposed on the dspblok 21479u8a for DC ADC measurements. These connections are generally not in conflict with other 4th generation dspbloks (dspblok 214xx), but are incompatible with the earlier dspblok 21369zx. The on board XMOS processor manages this resource and the conversions are made available via the internal SPI XMOS/DSP interface. You should examine the sample code if you want to use this feature.

The main use for this interface is to monitor power supplies or simple external sensors.

This feature is not normally a standard dspblok feature, so you may want to avoid using it if you want to have a more universal dspblok footprint in your custom design.
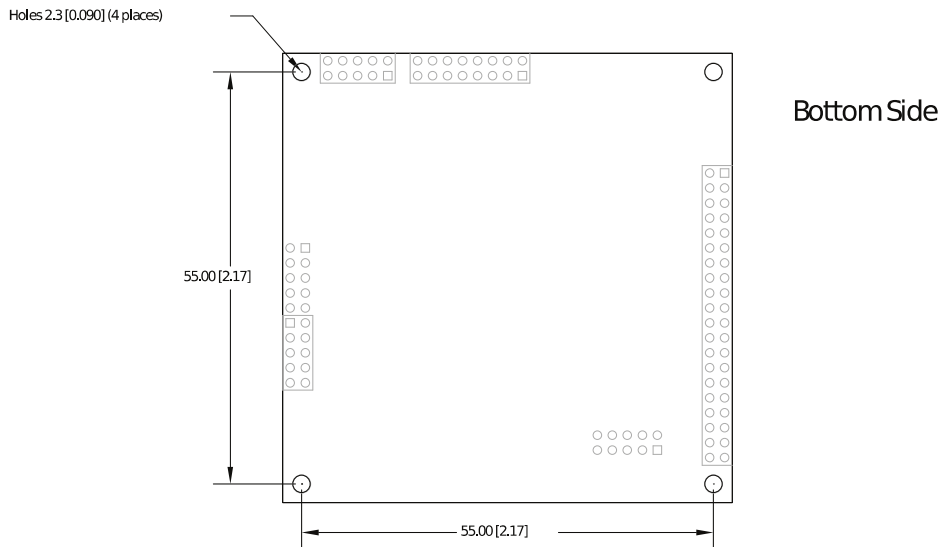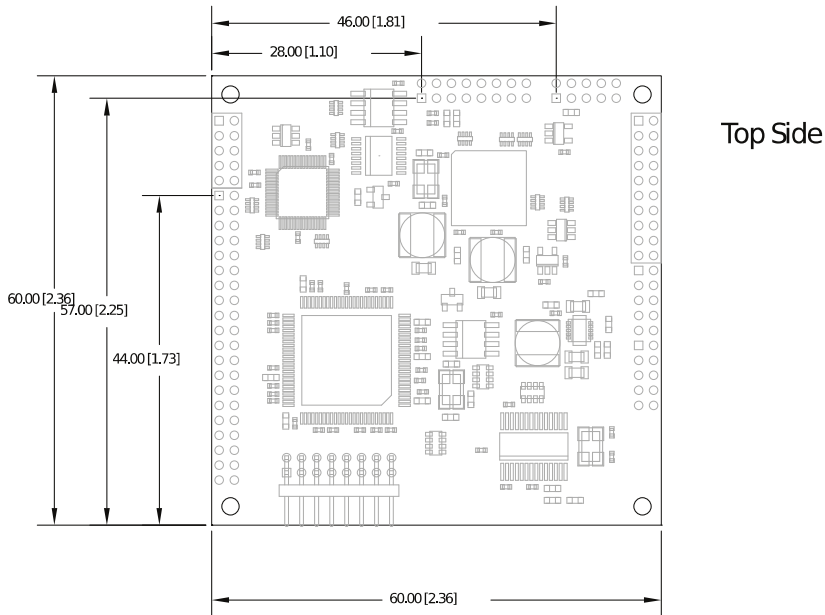
JH8 – USB & dspBootloader Mode

JH8 supports the Danville dspBootloader. The dspBootloader allows you to upload your application and any supporting files via the USB port (and other ports as well). If the connections are left open, the dspBootloader will operate in its default setting. We recommend that you bring the mode pins out to an external configuration header or a dip switch.

You should review the dspBootloader manual for detailed information.

The USB portion of JH8 requires some attention to detail. Route closely spaced tracks on the top layer of the PCB with a corresponding ground plane layer on the next layer. You do not want discontinuities in this plane. Keep other traces away from the DM & DP lines. This is especially important if you plan on compatibility with other dspbloks that have high speed USB capability. You may also want to add a good transient suppressor. A Texas Instruments' TPD2E001 is good choice.

Mechanical Dimensions (dspblok 21479u8a)

46.00 [1.81]

28.00 [1.10]

Top Side

60.00 [2.36]
57.00 [2.25]

44.00 [1.73]

60.00 [2.36]

Holes 2.3 [0.090] (4 places)

Bottom Side

55.00 [2.17]

55.00 [2.17]

Mounting holes are equidistant from the center of the dspblok. These holes are 2.3mm in diameter, suitable for 2-56 or M2 screws. When 4.3mm height mating female connectors are used, the board will be 6.3mm (0.25 in) above the target board, therefore 0.250 standoffs may be used.

Component height above the board is 6mm (0.236 in). The board is 1.6mm (0.062 in) thick.

Product Warranty

Danville Signal Processing, Inc. products carry the following warranty:

Danville Signal Processing products are warranted against defects in materials and workmanship. If Danville Signal Processing receives notice of such defects during the warranty period, Danville Signal Processing shall, at its option, either repair or replace hardware products, which prove to be defective.

Danville Signal Processing software and firmware products, which are designated by Danville Signal Processing for use with our hardware products, are warranted not to fail to execute their programming instructions due to defects in materials and workmanship. If Danville Signal Processing receives notice of such defects during the warranty period, Danville Signal Processing shall, at its option, either repair or replace software media or firmware, which do not execute their programming instructions due to such defects. Danville Signal Processing does not warrant that operation of the software, firmware, or hardware shall be uninterrupted or error free.

The warranty period for each product is one year from date of installation.

Limitation of Warranty:

The forgoing warranty shall not apply to defects resulting from:

- Improper or inadequate maintenance by the Buyer;
- Buyer-supplied software or interfacing;
- Unauthorized modification or misuse;
- Operation outside the environmental specification of the product;
- Improper site preparation and maintenance.

Exclusive Remedies:

The remedies provided herein are the Buyer's sole and exclusive remedies. In no event shall Danville Signal Processing, Inc. be liable for direct, indirect, special, incidental or consequential damages (including loss of profits) whether based on contract, tort, or any other legal theory.

RoHS & WEEE Compliance

The European Union approved a directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment. This directive is commonly known as RoHS, EU Directive 2002/95/EC. This directive severely limits the amount of lead and 5 other substances that can be in contained in nonexempt products. The directive became European law in February 2003 and took effect July 1, 2006.

There are a number of important exemptions that affect many of our customers. The most important of these is Category 9, Control and Monitoring Instruments. You may wish to review your situation to see if this exemption applies to you. Military, medical and some other products are also exempt. We suggest that you make an appropriate assessment concerning your products.

The dspblok 21479u8a is RoHS compliant.

The dspblok 21479u8a is a subcomponent of a larger system; therefore it is not subject to the WEEE directive EU Directive 2002/96/EC.