Document identifier: FRDM-KE17ZUM
Rev. 0, 15 October 2021

FRDM-KE17Z Board User Manual

Contents

Chapter 1
Overview

The Kinetis KE17Z freedom (FRDM-KE17Z) board is a standalone development platform that supports two microcontrollers (MCUs): the target MCU and an open-standard serial and debug adapter (OpenSDA) MCU. The target MCU is MKE17Z256VLL7, which is a part of Kinetis E series of Arm® Cortex®-M0+ MCU product family. The OpenSDA MCU is a Kinetis K Series K20 family device, MK20DX128VFM5.

The FRDM-KE17Z board is compatible with the Arduino shields, the NXP FRDM-TOUCH board, and the NXP FRDM-MC-LVBLDC board.

The FRDM-KE17Z board comes preloaded with the bubble peripheral demo. The demo is available at the `boards\frdmke17z\demo_apps\bubble_peripheral` folder of MCUXpresso SDK. The board is lead-free and RoHS-compliant.

This document provides detailed information about the FRDM-KE17Z board interfaces, power supplies, clocks, LEDs, sensors, and other interfaces.

1.1 Acronyms

The table below lists and explains the acronyms and abbreviations used in this document.

Table 1. Acronyms and abbreviations

Term	Description
AWIC	Asynchronous Wake-up Interrupt Controller
ADC	Analog-to-digital converter
CLK	Clock
DIO	Data input/output
LPI2C	Low-power Inter-Integrated Circuit (I2C)
MCU	Microcontroller Unit
NMI	Non-maskable interrupt
OpenSDA	Open-standard serial and debug adapter
PWM	Pulse Width Modulation
SWD	Serial Wire Debug
TSI	Touch Sensing Input
USB	Universal Serial Bus
UART	Universal Asynchronous Receiver Transmitter
DNP	Do not populate

1.2 Related documentation

The table below lists and explains the additional documents and resources that you can refer to for more information on FRDM-KE17Z. Some of the documents listed below may be available only under a non-disclosure agreement (NDA). To request access to these documents, contact your local field applications engineer (FAE) or sales representative.

Table 2. Related documentation

Document	Description	Link/how to access
Kinetis KE17Z/13Z/12Z with up to 256 KB Flash Reference Manual	Intended for system software and hardware developers and applications programmers who want to develop products with this device.	Contact NXP FAE/sales representative
Kinetis KE17Z/13Z/12Z with up to 256 KB Flash Data Sheet	Provides information about electrical characteristics, hardware design considerations, and ordering information	Contact NXP FAE/sales representative
MCUXpresso Software Development Kit (SDK) documentation	MCUXpresso Software Development Kit (SDK) is a comprehensive software enablement package designed to simplify and accelerate application development with NXP MCUs based on Arm® Cortex® -M cores.	MCUXpresso Software Development Kit (SDK) documentation

1.3 Kit contents

The table below lists the items included in the FRDM-KE17Z kit.

Table 3. Hardware kit contents

Item	Quantity
FRDM-KE17Z board hardware assembly	1
USB Type A to micro-AB cable	1

1.4 Block diagram

The figure below shows the FRDM-KE17Z block diagram.

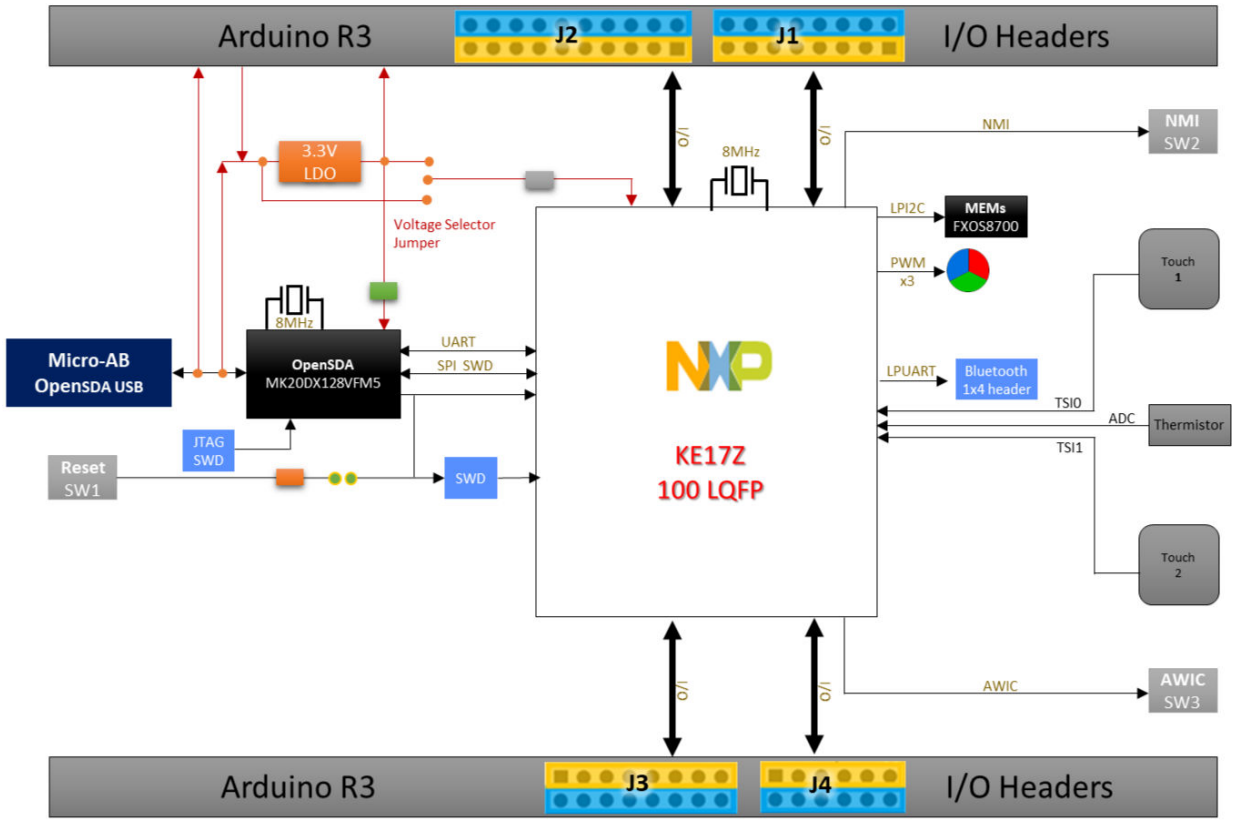

Figure 1. FRDM-KE17Z block diagram

1.5 Board pictures

The figure below shows the top-side view of FRDM-KE17Z.

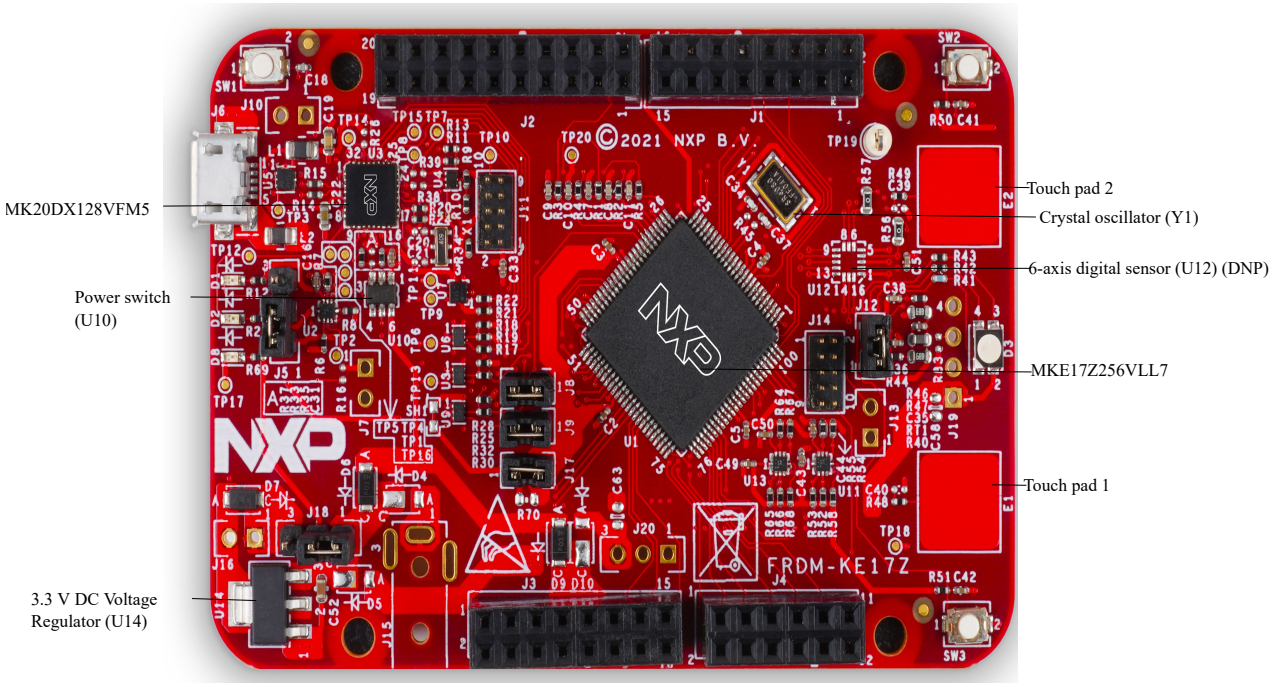

Figure 2. FRDM-KE17Z top view

The figure below shows the onboard jumpers and connectors on FRDM-KE17Z.

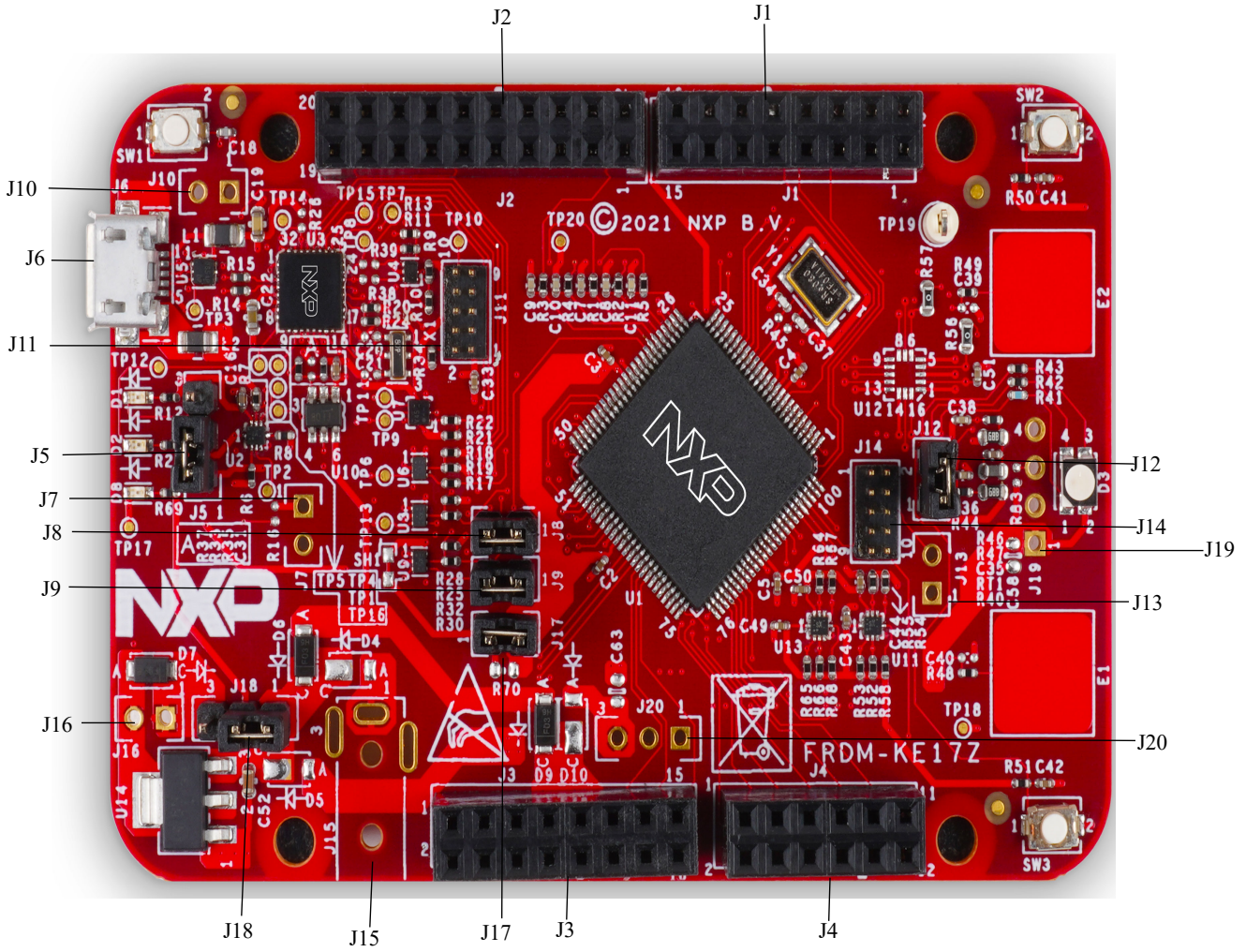

Figure 3. FRDM-KE17Z jumpers and connectors

The figure below shows the LEDs and push buttons on FRDM-KE17Z.

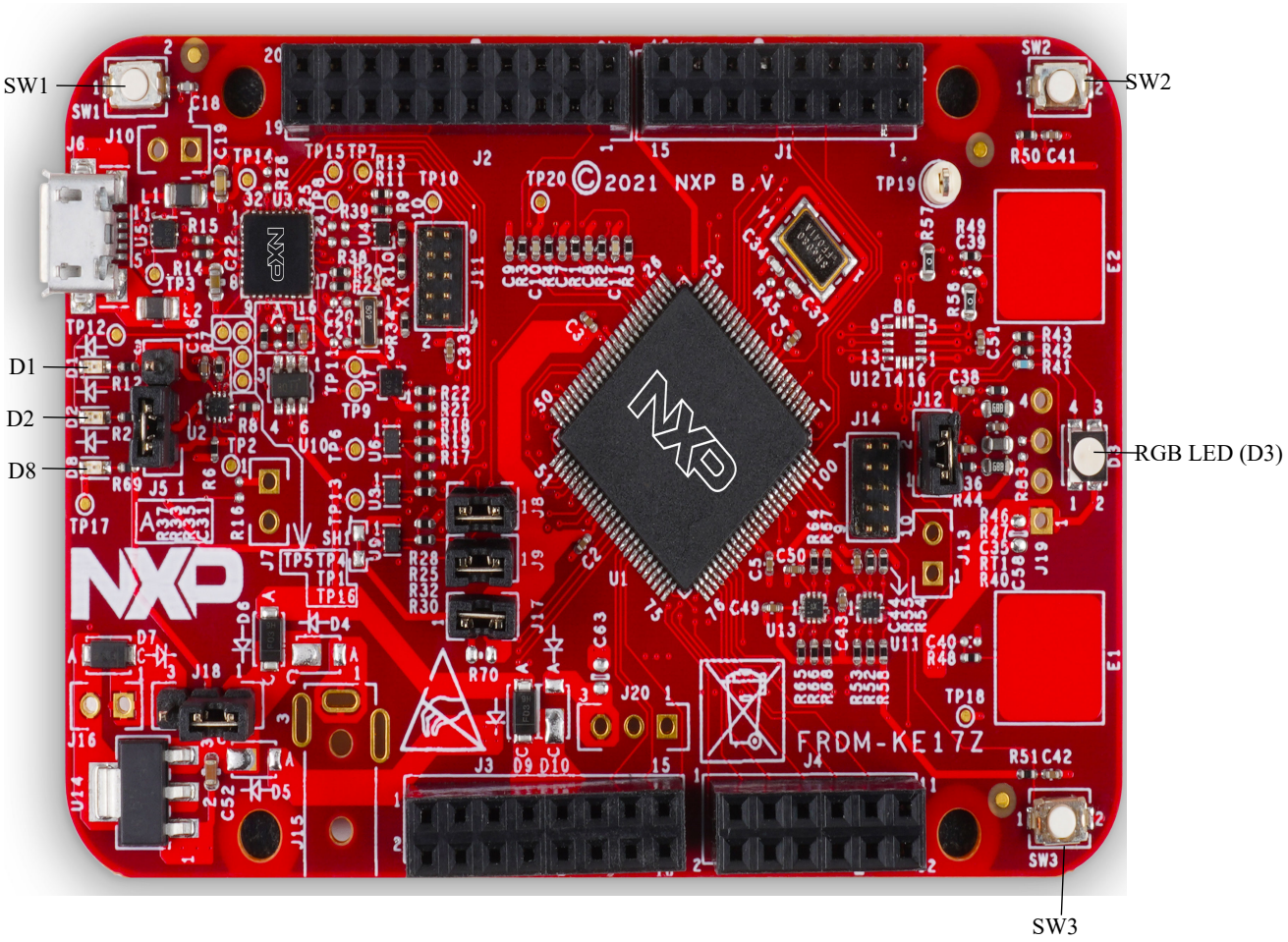

Figure 4. FRDM-KE17Z LEDs and push buttons

1.6 Board features

The table below lists the features of FRDM-KE17Z. Figure 2 shows different components of FRDM-KE17Z.

Table 4. FRDM-KE17Z features

FRDM-KE17Z feature	Processor feature used	Description
MCU		MKE17Z256VLL7, 32-bit MCU core from Arm Cortex-M0+ class, 72 MHz CPU frequency **NOTE** For details on the MKE17Z256VLL7 MCU, see *Kinetis KE17Z/13Z/12Z with up to 256 KB Flash Reference Manual*. .
Power supply		• 5 V input power via an external DC power supply, OpenSDA USB micro-AB connector, or I/O header, J3

Table continues on the next page...

Table 4. FRDM-KE17Z features (continued)

FRDM-KE17Z feature	Processor feature used	Description
		• 3.3 V or 5 V for MKE17Z256VLL7 by setting J18 • 3.3 V for MK20DX128VFM5
Clock		• 8 MHz crystal clock for MKE17Z256VLL7 • 8 MHz crystal clock for MK20DX128VFM5 • SWD_CLK for MKE17Z256VLL7 • SDA_JTAG_TCLK for JTAG connector • SWD_CLK_TGTMCU for SWD connector
TSI touch pad	Touch Sensing Input (TSI) module	• Includes two touch electrodes to support TSI functions • Electrode 1 is connected to TSI0 Channel 8 and electrode 2 is connected to TSI1 Channel 20
6-axis digital sensor (DNP)	Low-power Inter-Integrated Circuit (LPI2C) module	NXP FXOS8700CQ: • Supports motion sensing with NXP FXOS8700CQ • 6-axis sensor with integrated linear accelerometer and magnetometer
Thermistor	High-speed analog-to-digital converter (ADC)	• Positive Temperature Coefficients (PTC) thermistor • Supports temperature from 90 °C to -20 °C
Debug		• Onboard OpenSDA circuit provides an SWD debug interface to MKE17Z256VLL7 • Supports micro-AB USB port to access serial port as console for debug • Supports JTAG connector to program and debug MK20DX128VFM5 • Supports SWD connector to program and debug MKE17Z256VLL7
Interrupt buttons		Supports 2 interrupt push buttons: • SW2/Button 0 is used to issue non-maskable interrupt (NMI) signal to MKE17Z256VLL7 • SW3/Button 1 is used to issue Asynchronous Wake-up Interrupt Controller (AWIC) interrupt signal to MKE17Z256VLL7
I/O headers		Headers compatible with: • Arduino shields • NXP FRDM-TOUCH • NXP FRDM-MC-LVBLDC

Table continues on the next page...

Table 4. FRDM-KE17Z features (continued)

FRDM-KE17Z feature	Processor feature used	Description
RGB LED	Pulse Width Modulation (PWM)	• Supports RGB LED controlled by the embedded software application
Bluetooth header	LPUART	• Supports Bluetooth connectivity via Bluetooth header, J19

1.7 Push buttons

In addition to a Reset button for manually triggering a system reset, FRDM-KE17Z supports 2 interrupt push buttons. The following table explains the push buttons on FRDM-KE17Z. Figure 4 shows push buttons on FRDM-KE17Z.

Table 5. Reset and Interrupt push buttons

Part identifier	Switch type	Description
SW1	Push button	When pressed, resets MKE17Z256VLL7. Also, used to enter the OpenSDA bootloader mode.
SW2	Push button	When pressed, generates non-maskable interrupt (NMI) signal to MKE17Z256VLL7. SW2/Button 0 is connected to the PTD3 pin on MKE17Z256VLL7.
SW3	Push button	When pressed, issues Asynchronous Wake-up Interrupt Controller (AWIC) interrupt signal to MKE17Z256VLL7. SW3/Button 1 is connected to the PTE14 pin on MKE17Z256VLL7.

1.8 Connectors

Connectors are onboard devices that allow to connect external devices to the board. Figure 3 shows the FRDM-KE17Z connectors. The table below describes the connectors.

Table 6. FRDM-KE17Z connectors

Part identifier	Connector type	Description	Typical connection
J1	2x8 connector	I/O headers compatible with the Arduino shields, the NXP FRDM-TOUCH board, and the NXP FRDM-MC-LVBLDC board	
J2	2x10 connector		
J3	2x8 connector		
J4	2x6 connector		
J6	USB 2.0 micro-AB connector	Console port (port for connection with host computer)	Connects to USB Type A to micro-AB cable to connect to host computer
J19	1x4 connector	Bluetooth header	
J15	DC power jack	Power connector	Connects to 5 V power adapter
J11	2x5 connector	OpenSDA JTAG connector	Debug interface to program and debug MK20DX128VFM5
J14	2x5 connector	SWD connector	OpenSDA debug interface for target MCU, MKE17Z256VLL7

1.9 Jumpers

Jumpers (or shorting headers) are small connectors that allow to choose from two or more options available. Jumpers are installed during board assembly and do not require any changes. In FRDM-KE17Z, all jumpers are 2/3-pin connectors with two settings: open and shorted. Figure 3 highlights the FRDM-KE17Z jumpers available for use. The table below describes the jumpers.

The following is a list of all of the jumper options on FRDM-KE17Z.

Table 7. FRDM-KE17Z jumpers

Part identifier	Jumper type	Description	Jumper settings
J5	1x3 header	Reset selection	• 1-2: OpenSDA sends reset to MKE17Z256VLL7 (default setting) • 2-3: SW1 sends reset to MKE17Z256VLL7. This setting is to be used when OpenSDA is not powered
J8	1x2 header	MCU SWD DIO signal	• Open: Disconnect MCU SWD_DIO to OpenSDA • Shorted: Connect MCU SWD_DIO to OpenSDA (default setting)
J9	1x2 header	MCU SWD CLK signal	• Open: Disconnect MCU SWD_CLK to OpenSDA • Shorted: Connect MCU SWD_CLK to OpenSDA (default setting)
J12	1x2 header	Thermistor	• Open: Test MCU current consumption • Shorted: Power supply for thermistor (default setting)
J13	1x2 header	OpenSDA debug interface	• Open: Isolates the onboard MCU from OpenSDA debug interface • Shorted (by a cut-trace on bottom layer): Connect the SWD_CLK signal from the SWD connector or OpenSDA to the MCU
J17	1x2 header	MCU VDD current measurement	• Open: Allow current measurement on MCU VDD • Shorted: Connect VDD to VDD_KE17Z (default setting)
J18	1x3 header	Power supply	• 1-2: MKE17Z256VLL7 MCU is 5 V powered (default setting) • 2-3: MKE17Z256VLL7 MCU is 3.3 V powered

1.10 LEDs

FRDM-KE17Z has light-emitting diodes (LEDs) to monitor system functions, such as power-on, reset, board faults, and so on. The information collected from LEDs can be used for debugging purposes.

LEDs are highlighted in Figure 4. The table below describes the FRDM-KE17Z LEDs.

Table 8. FRDM-KE17Z LEDs

Part identifier	LED color	LED name	Description (When LED in ON)
D2	Yellow	SDA	Indicates OpenSDA status • Blinks: If MKE17Z256VLL7 is in Bootloader mode • ON: If an OpenSDA application is running
D1	Red	Reset	Indicates Reset command is sent to MKE17Z256VLL7 via OpenSDA or when SW1 is pressed

Table continues on the next page...

Table 8. FRDM-KE17Z LEDs (continued)

Part identifier	LED color	LED name	Description (When LED in ON)
D3	Red/Green/Blue	RGB	Controlled by the embedded software application. IC pins connected to RGB LED: • PTD11: RGB_GREEN • PTD12: RGB_BLUE • PTD10: RGB_RED
D8	Green	Power	Indicates that FRDM-KE17Z is powered on

Chapter 2
FRDM-KE17Z Functional Description

This chapter describes the features and functions of FRDM-KE17Z. For details of the MKE17Z256VLL7 MCU features, see *Kinetis KE17Z/13Z/12Z with up to 256 KB Flash Reference Manual*.

The chapter is divided into the following sections:

- Power supplies
- Clocking
- TSI
- 6-axis digital sensor
- Thermistor
- OpenSDA
- Input/Output headers
- Bluetooth

2.1 Power supplies

FRDM-KE17Z can be powered with 5 V power supply via:

- an external DC power supply
- OpenSDA USB micro-AB connector
- I/O header, J3

The power supply devices on the board use the 5 V power to generate required power supplies for MKE17Z256VLL7, SWD interface, I/O headers for Arduino shields, NXP FRDM-TOUCH board, and NXP FRDM-MC-LVBLDC, and numerous other peripherals.

Since, MKE17Z256VLL7 supports 2.7 V to 5.5 V power supply, MKE17Z256VLL7 can be powered 3.3 V or 5 V by setting J18. For details about setting J18, see Jumpers. However, OpenSDA MK20DX128VFM5 is always 3.3 V powered.

2.1.1 Primary power supply

FRDM-KE17Z can be powered up using one of the following ways:

Table 9. Primary power supply

Part number	Description	Output power specifications
J15	5 V DC power jack	DC_JACK_5V_INPUT
ZX62-AB-5P (J6)	OpenSDA micro-AB USB connector provides 5 V power supply via power switch (U10)	P5V_SDA_PSW 5 V DC, 450 mA
J3	I/O header provides 5 V power supply via a 5 V DC voltage regulator	P5V_LDO_OUT 5 V DC

2.1.2 Secondary power supplies

The table below describes the FRDM-KE17Z power supply devices that generate secondary power supplies for the board.

Reference designator	Device	Power supply voltage	Description
J6	ZX62-AB-5P	P5V_SDA	• Power supply for power switch, MIC2005-0.8YM6 (P5V_SDA) • OpenSDA (P5V_SDA) • Unregulated power supply for MK20DX128VFM5[U3] (P5V_SDA)
U10	MIC2005-0.8YM6 (Microchip Technology)	P5V_SDA_PSW	• Power supply for FRDM-KE17Z (P5V_SDA_PSW). This power rail provides up to 450 mA of power at 5 V DC to FRDM-KE17Z • Power supply for I/O header, J3 (P5V_SDA_PSW)
	(From 5 V power adapter, OpenSDA micro-AB USB connector, or I/O header)	VDD_5V (5 V DC)	• Power supply for 3.3 V DC voltage regulator, NCP1117ST33T3G [U14] • 5 V power supply for VDD if J18 is 1-2
U14	NCP1117ST33T3G (On Semiconductor)	P3V3	• 3.3 V power supply for VDD if J18 is 2-3 • I/O header, J3 (P3V3) • 3.3 V power supply for voltage level translator, NTSX2102GU8H [U11, U13] (P3V3) • Power supply for FXOS8700CQ sensor
J18	VDD = 5 V, if J18 is 1-2 VDD = 3.3 V, if J18 is 2-3	VDD	• Power supply for Bluetooth header (VDD) • Power supply for interrupt push buttons (VDD) • Power supply for voltage level translator, NTSX2102GU8H [U11, U13] (VDD) • Power supply for I/O header, J3 (VDD)
J17		VDD_KE17Z	• Power supply for MCU KE17Z (VDD_KE17Z) • Power supply for SWD connector (VDD_KE17Z)
SH1		V_TGTMCU	• Power supply for I/O, NTSX2102GU8H[U2], 74LVCH1T45[U6], 74LVC2T45GM,125[U7], 74LVCH1T45[U8], 74LVCH1T45[U9] (V_TGTMCU)
L3		VDDA	• Power supply for MCU KE17Z analog circuits (VDDA) • Power supply for thermistor RT1 (VDDA)
L4		VREFH	• Supply reference voltage for MCU KE17Z (VREFH)
R71		AREF	• Supply reference voltage for I/O header, J2 (AREF)

Table continues on the next page...

Table continued from the previous page...

Reference designator	Device	Power supply voltage	Description
U3	MK20DX128VFM5	SDA_VOUT33	• Regulator output voltage of MK20DX128VFM5 (SDA_VOUT33) • Power supply for OpenSDA (P3V3_SDA) • Power supply for OpenSDA JTAG connector (P3V3_SDA) • Power supply for voltage level translators, NTSX2102GU8H [U2], NL27WZ14MU1TCG [U4], 74LVCH1T45 [U6, U8, U9], 74LVC2T45GM [U7] (P3V3_SDA)

2.2 Clocking

FRDM-KE17Z has the capability to run up to 72 MHz.

The table below provides details of different clocks of FRDM-KE17Z.

Table 10. FRDM-KE17Z clocks

Clock generator	Clocks	Specifications	Destination
Crystal oscillator, Y1	Crystal8M_XTAL Crystal8M_EXTAL	Frequency: 8 MHz	MKE17Z256VLL7: • Crystal8M_XTAL is connected to MKE17Z256VLL7 pin PTB6 • Crystal8M_EXTAL is connected to MKE17Z256VLL7 pin PTB7
Crystal oscillator, X1	SDA_XTAL SDA_EXTAL	Frequency: 8 MHz	OpenSDA: • SDA_XTAL is connected to MK20DX128VFM5 pin PTA19 • SDA_EXTAL is connected to MK20DX128VFM5 pin PTA18
SWD connector	SWD_CLK		MKE17Z256VLL7: • Connected to MKE17Z256VLL7 pin PTC4
OpenSDA circuit	SDA_JTAG_TCLK		JTAG connector
	SWD_CLK_TGTMCU		SWD connector

2.3 TSI

MKE17Z256VLL7 includes the Touch Sensing Input (TSI) module to detect capacitive touch sensor.

TSI is an electrode capacitive scan method based on the hardware. The basic element in capacitive touch sensing is the electrode. In this case, the electrode is an area of conductive material with dielectric material on the top, usually plastic or glass. This is what the user touches. This conductive area plus the dielectric material effectively create a capacitor referenced to the system ground. By touching the dielectric on top of the electrode, the user effectively changes the electrode capacitance both by adding a second conductive area that is grounded and by increasing the dielectric of the original capacitor. The sensor, or the TSI module in this case, uses a capacitive sensing method to measure changes in the electrode capacitance.

FRDM-TOUCH is a touch shield board for FRDM-KE17Z with capacitive touch buttons, slider, and rotary. This board can connect with FRDM-KE17Z and control the onboard RBG LED using keys, slider, and rotary touches.

FRDM-KE17Z includes two touch electrodes to support TSI functions in self-capacitive mode.

The touch electrode 1 is connected to TSI0 channel 8 and touch electrode 2 is connected to TSI1 channel 20.

Table 11. TSI touch pad connections

Touch electrode	Touch pad	MKE17Z256VLL7 pin
Electrode 1	TouchPad_0	PTC5
Electrode 2	TouchPad_1	PTC15

FRDM-KE17Z outputs TSI signals to headers J2 and J4 to support the FRDM-TOUCH board. FRDM-TOUCH includes four touch keys in a mutual-capacitive mode, touch slider, and rotary.

Table 12. TSI lane connections

TSI channel	I/O header	Description	MKE17Z256VLL7 pin
TSI0_CH0	J2[5]		PTE6
TSI0_CH1	J2[3]		PTE2
TSI0_CH2	J2[9]		PTA13
TSI0_CH3	J2[7]		PTA12
TSI0_CH4	J2[17]	TOUCH_M_TX_1	PTA11
TSI1_CH4			PTA2
TSI0_CH5	J2[15]	TOUCH_M_TX_0	PTA10
TSI1_CH5			PTA3
TSI0_CH6	J2[13]	TOUCH_M_RX_1	PTE1
TSI1_CH6			PTD2
TSI0_CH7	J2[11]	TOUCH_M_RX_0	PTE0
TSI1_CH7			PTD4
TSI0_CH10	J4[1]	TOUCH_S_0	PTE10
TSI1_CH10			PTE7
TSI0_CH11	J4[3]	TOUCH_S_1	PTD1
TSI1_CH11			PTA6

Table continues on the next page...

Table 12. TSI lane connections (continued)

TSI channel	I/O header	Description	MKE17Z256VLL7 pin
TSI0_CH12	J2[19]	GND	PTD0
TSI1_CH12			PTA7
TSI0_CH13	J4[5]	TOUCH_S_2	PTE16
TSI1_CH13			PTC8
TSI0_CH14	J4[7]	TOUCH_S_3	PTE15
TSI1_CH14			PTC9
TSI0_CH15	J4[9]	TOUCH_S_4	PTE13
TSI1_CH0			PTC6
TSI0_CH16	J4[11]	TOUCH_S_5	PTE5
TSI1_CH1			PTC7

2.4 6-axis digital sensor

FRDM-KE17Z reserves an area (U12) to support motion sensing with NXP FXOS8700CQ 6-axis sensor with integrated linear accelerometer and magnetometer. FXOS8700CQ is a small, low-power, 3-axis, linear accelerometer and 3-axis, magnetometer combined into a single package.

FXOS8700CQ is connected to MKE17Z256VLL7 through an I2C interface, LPI2C0. The I2C address for FXOS8700CQ is 0x1C. Since, MKE17Z256VLL7 is 5 V powered by default, voltage level translators (U11, U13) are connected between MKE17Z256VLL7 and FXOS8700CQ to provide 3.3 V power supply to FXOS8700CQ.

Table 13. FXOS8700CQ pin connections

FXOS8700CQ pin/signal	MKE17Z256VLL7 pin	Description
FXOS_SCL	PTB8	I2C serial clock
FXOS_SDA	PTA16	I2C serial data
FXOS_INT	PTB10	Interrupt
FXOS_RST	PTB9	Reset input

2.5 Thermistor

FRDM-KE17Z includes a Positive Temperature Coefficients (PTC) thermistor with following features:

- Supports temperature from 90 °C to -20 °C
- THERM_0 is connected to the PTC1 pin on MKE17Z256VLL7
- THERM_1 is connected to the PTC0 pin on MKE17Z256VLL7

2.6 OpenSDA

OpenSDA is an open-standard serial and debug adapter.

The onboard MK20DX128VFM5 OpenSDA circuit bridges serial and debug communications between the USB host and MKE17Z256VLL7. The OpenSDA circuit provides an SWD debug interface to MKE17Z256VLL7. A standard USB A male to micro-AB male cable is used for debugging via the USB connector (J6).

The P&E debug application is an OpenSDA application that provides debugging and a virtual serial port all in one application. USB drivers for all P&E Microcomputer Systems debug tools are available at http://www.pemicro.com/opensda.

For details about the JTAG and SWD connectors, see Connectors.

The following table explains the OpenSDA signals connected to the target MCU (MKE17Z256VLL7).

Table 14. OpenSDA interface signals

OpenSDA signals	MKE17Z256VLL7 pin	Description
RST_TGTMCU_b	PTA5	Reset to target MCU
UART0_RX_TGTMCU	PTB0	
UART0_TX_TGTMCU	PTB1	
SWD_DIO_TGTMCU	PTA4	Serial wire debug data input output
SWD_CLK_TGTMCU	PTC	Serial wire debug clock

2.7 Input/Output headers

FRDM-KE17Z supports I/O headers compatible with the Arduino shields, the NXP FRDM-TOUCH board, and the NXP FRDM-MC-LVBLDC board. The following tables explain the pinouts for Arduino on FRDM-KE17Z.

Table 15. J2 connector (at left-upper side) pinouts for Arduino

Pin	Arduino Functions	IC pin
2	Arduino_D8	PTE11
4	Arduino_D9	PTB11
6	Arduino_D10	PTB5
8	Arduino_D11	PTB4
10	Arduino_D12	PTB3
12	Arduino_D13	PTB2
18	Arduino_D14	PTA16
20	Arduino_D15	PTB8

Table 16. J1 connector (at right-upper side) pinouts for Arduino

Pin	Arduino Functions	IC pin
2	Arduino_D0	PTD17
4	Arduino_D1	PTE12
6	Arduino_D2	PTD8
8	Arduino_D3	PTD9
10	Arduino_D4	PTC14
12	Arduino_D5	PTA15

Table continues on the next page...

Table 16. J1 connector (at right-upper side) pinouts for Arduino (continued)

Pin	Arduino Functions	IC pin
14	Arduino_D6	PTA17
16	Arduino_D7	PTA14

Table 17. J3 connector (at left-lower side) pinouts for Arduino

Pin	Arduino Functions	IC pin
6	Arduino_RESET	PTA5

Table 18. J4 connector (at right-lower side) pinouts for Arduino

Pin	Arduino Functions	IC pin
2	Arduino_A0	PTC17
4	Arduino_A1	PTC16
6	Arduino_A2	PTD16
8	Arduino_A3	PTD15
10	Arduino_A4	PTA1
12	Arduino_A5	PTA0

2.8 Bluetooth

FRDM-KE17z supports 1x4 Bluetooth header, J19. J19 is connected to the MKE17Z256VLL7 through the LPUART1 interface. The following table shows the connections for the Bluetooth header Tx/Rx signals.

Table 19. Bluetooth header connections

Bluetooth signal	MKE17Z256VLL7 pin	MKE17Z256VLL7 interface
BLUETOOTH_TX	PTD14	LPUART1_TX
BLUETOOTH_RX	PTD13	LPUART1_RX

Appendix A
Revision History

The table below summarizes the revisions to this document.

Table 20. Revision history

Revision	Date	Topic cross-reference	Change description
Rev. 0	15 October 2021		Initial public release

How To Reach Us

Home Page:

nxp.com

Web Support:

nxp.com/support

Limited warranty and liability — Information in this document is provided solely to enable system and software implementers to use NXP products. There are no express or implied copyright licenses granted hereunder to design or fabricate any integrated circuits based on the information in this document. NXP reserves the right to make changes without further notice to any products herein.

NXP makes no warranty, representation, or guarantee regarding the suitability of its products for any particular purpose, nor does NXP assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. “Typical” parameters that may be provided in NXP data sheets and/or specifications can and do vary in different applications, and actual performance may vary over time. All operating parameters, including “typicals,” must be validated for each customer application by customer's technical experts. NXP does not convey any license under its patent rights nor the rights of others. NXP sells products pursuant to standard terms and conditions of sale, which can be found at the following address: nxp.com/SalesTermsandConditions.

Right to make changes - NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Security — Customer understands that all NXP products may be subject to unidentified or documented vulnerabilities. Customer is responsible for the design and operation of its applications and products throughout their lifecycles to reduce the effect of these vulnerabilities on customer’s applications and products. Customer’s responsibility also extends to other open and/or proprietary technologies supported by NXP products for use in customer’s applications. NXP accepts no liability for any vulnerability. Customer should regularly check security updates from NXP and follow up appropriately. Customer shall select products with security features that best meet rules, regulations, and standards of the intended application and make the ultimate design decisions regarding its products and is solely responsible for compliance with all legal, regulatory, and security related requirements concerning its products, regardless of any information or support that may be provided by NXP. NXP has a Product Security Incident Response Team (PSIRT) (reachable at PSIRT@nxp.com) that manages the investigation, reporting, and solution release to security vulnerabilities of NXP products.

For more information, please visit: http://www.nxp.com

For sales office addresses, please send an email to: salesaddresses@nxp.com

Date of release: 15 October 2021

Document identifier: FRDM-KE17ZUM

arm