NuMicro® Family

Based on Arm® Cortex®-M4

MotorKit Nu-KT-MTR_M4BF54K User Manual

NuMicro® KM1M4BF Series

For additional information or question, please contact Nuvoton Technology Corporation Japan.

www.nuvoton.co.jp

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Rev1.00

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1. OVERVIEW

Nu-KT-MTR_M4BF54K is an inverter control MCU borad equipped with KM1M4BF54K.
By connecting this board to the inverter boards Nu-KE-MTR_LV001 or Nu-KE-MTR_HV001,
it is possible to develop motor control applications using the KM1M4BF54K.

[Spec]

Product name：KM1M4BF series MotorKit MCU board

Board product No.：Nu-KT-MTR_M4BF54K

Supported Inverter board：Nu-KE-MTR-LV001(Low voltage), Nu-KE-MTR-HV001(High voltage)

Target MCU：KM1M4BF54K

[CPU] ARM Cortex-M4

[CPU max. operating frequency] 120 MHz

[Package / Pin count]：TQFP / 64 pins

[ROM] Instruction:264 KB, Data:32 KB

[RAM] Data:16 KB

MCU input clock：Crystal Oscillator 10 MHz

Supported debugger：I-Jet, ULINK2, ULINKplus

2. HARDWARE CONFIGURATION

2.1 Top View

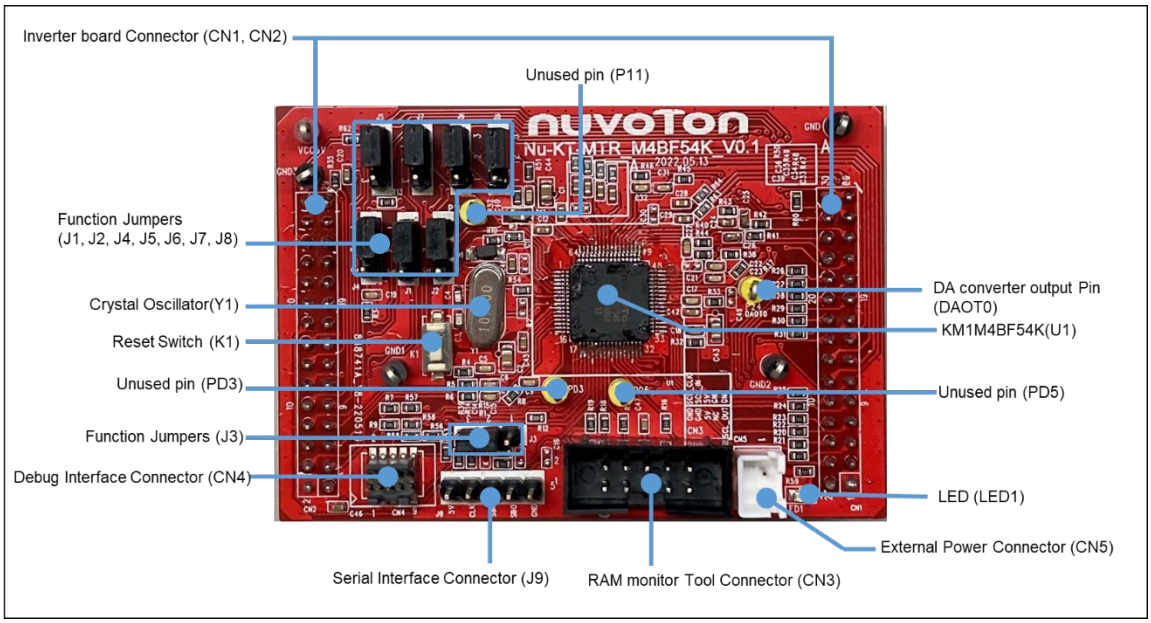


Figure 2-1 Top View of Nu-KT-MTR-M4BF54K

Figure 2-1 shows the main components and connectors at the top side of Nu-KT-MTR_M4BF54K.

The following lists components and connectors from the top view:

- Target chip : KM1M4BF54K (U1)
- Inverter board Connector (CN1, CN2)
- Function Jumper (J1, J2, J3, J4, J5, J6, J7, J8)
- DA converter output Pin (DAOT0)
- Unused pins (P11, PD3, PD5)
- External Power Connector (CN5)
- Debug Interface Connector (CN4)
- RAM monitor Tool Connector (CN3)
- Serial Interface Connector (J9)
- LED (LED1)
- Reset Switch (K1)
- Crystal Oscillator(Y1)

2.2 Bottom View

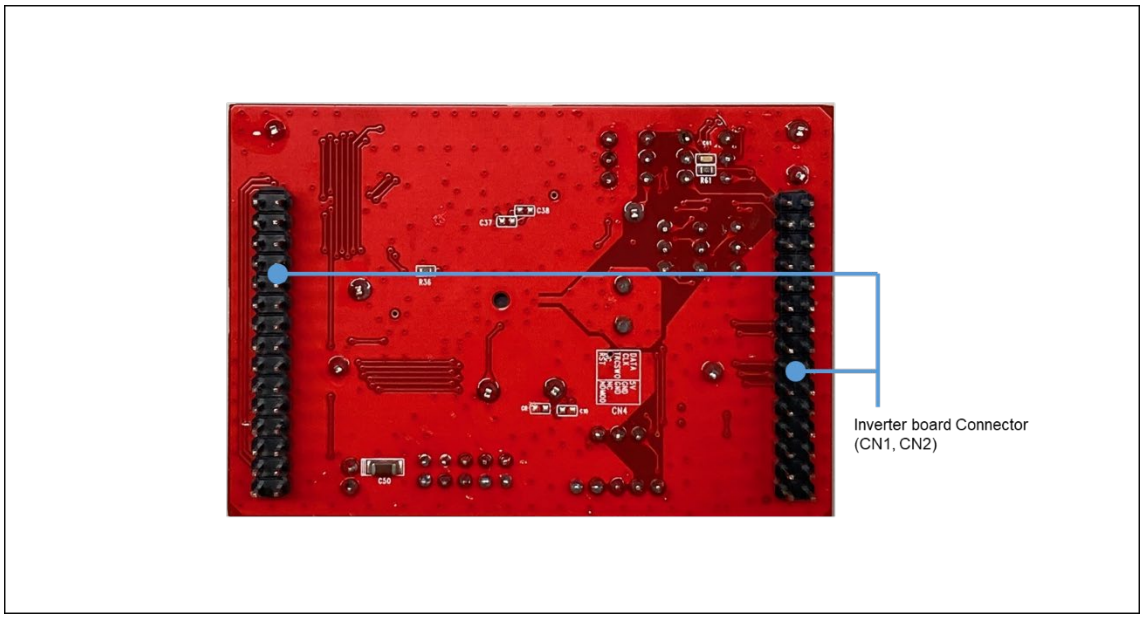


Figure 2-2 Bottom View of Nu-KT-MTR_M4BF54K

Figure 2-2 shows the main components and connectors at the bottom side of Nu-KT-MTR_M4BF54K.

The following lists components and connectors from the bottom view:

- Inverter board Connector (CN1, CN2)

2.3 Inverter board Connectors

Table 2-1 shows the Inverter board Connectors.

Connector	Description
CN1, CN2	Inverter board Connectors for Motor Control on the Nu-KT-MTR_M4BF54K. This connectors connect to the inverter board connector of Nu-KE-MTR_LV001(CN1, CN2) or Nu-KE-MTR_HV001(CN1, CN2).

Table 2-1 Inverter board Connectors

2.3.1 Pin Assignment for Inverter board Connectors

Inverter board Connectors(CN1,CN2) provide inferface to KM1M4BF54K MCU on Nu-KT-MTR_M4BF54K.

The Table 2-2, Table 2-3 shows the KM1M4BF54K assignment to Inverter board Connectors.

Header		Pin Name	KM1M4BF54K	
			Pin No.	Function
CN1	CN1.1	VSS	-	VSS
	CN1.2	CT1_A+	54	P46/ADIN06/VGAP10/CMPIN11
	CN1.3	CT1_A-	53	P50/ADIN08/VGAN1/CMPIN10/CMPREF10
	CN1.4	EMG_1	38	P70/IRQ05/IRQ10
	CN1.5	Z1	32	P76/GPWM21/TM05A
	CN1.6	Y1	33	P75/TM04A/GPWM11
	CN1.7	X1	34	P74/TM03A/GPWM01
	CN1.8	W1	35	P73/TM02A/GPWM20
	CN1.9	V1	36	P72/TM01A/GPWM10
	CN1.10	U1	37	P71/TM00A/GPWM00
	CN1.11	TEMP1	56	P44/ADIN04/VGAP12/CMPIN10/CMPIN11
	CN1.12	CT2_A-	60	PF4/ADIN22/VGAN0/CMPIN00/CMPREF00
	CN1.13	CT2_U	59	P40/ADIN00/VGAP00/CMPIN01
	CN1.14	CT2_V	58	P41/ADIN01/VGAP01
	CN1.15	CT2_W	57	P42/ADIN02/VGAP02
	CN1.16	EMG_2	40	P31/IRQ06/IRQ36/TM10A/TM12A/TRCCLK
	CN1.17	Z2	31	P90/SBO6/SBI6/GPWM51
	CN1.18	Y2	30	P91/SBO6/SBI6/GPWM41
	CN1.19	X2	29	P92/SBT6/GPWM31
	CN1.20	W2	28	P93/SBCS6/GPWM50
	CN1.21	V2	27	P94/GPWM40
	CN1.22	U2	26	P95/GPWM30

	CN1.23	TEMP2	55	P45/ADIN05/VGAP11/CMPIN00/CMPIN01
	CN1.24	DC1_V_CHECK	49	P54/IRQ02/ADIN12
	CN1.25	PFC_AD_CT	51	P52/IRQ00/ADIN10
	CN1.26	PFC_AD_VL	50	P53/IRQ01/ADIN11
	CN1.27	PFC_RST	2	P00/ADST1/SBO4/SBI4/IRQ02
	CN1.28	PFC_ZERO	52	P51/IRQ33/ADIN09
	CN1.29	PFC_FO	11	PE2/IRQ13/NMI
	CN1.30	VDD5V	-	VDD50

Table 2-2 Inverter board Connector and KM1M4BF54K Mapping GPIO List

Header		Pin Name	KM1M4BF54K	
			Pin No.	Function
CN2	CN2.1	-	-	N.C.
	CN2.2	VSS	-	VSS
	CN2.3	HALL_U	15	PD4/SBT1/SBO1/TM06B/TM00B/IRQ02
	CN2.4	HALL_V	13	PD6/ADST0/SBCS3/SBCS1/TM15A/TM01A/IRQ05/GPWM71
	CN2.5	HALL_W	12	PD7/SBCS3/TM14A/IRQ35/IRQ31/GPWM70
	CN2.6	-	-	N.C.
	CN2.7	ENC_A	45 64	P22/IRQ22/IRQ32/TM04A/TM13A/SBI3/SBO3/CMPOT00/CMPOT01/TRCD2 P11/IRQ01/TM03A/TM12A/GPWM00
	CN2.8	ENC_B	46 52	P21/IRQ06/IRQ21/TM04B/TM11A/TM14A/ADIN21/CMPREF11/TRCD3 P52/IRQ00/ADIN10
	CN2.9	ENC_Z	5	P01/SBT4/ADST2/GPWMST6/IRQ15/IRQ04
	CN2.10	SRV_FR	44	P23/TM02A/TM07A/SBI3/SBO3/GPWMST2/GPWMST5/CMPOT10/CMPOT11/CKMREF/TRCD1
	CN2.11	SRV_STMP	43	P24/TM02B/TM06A/SBT3/GPWMST1/GPWMST4/CMPOT00/CMPOT01/DAOT0/TRCD0
	CN2.12	TP0	1	P02/ADST0/SBO4/SBI4/SBCS1/TM15B/IRQ05
	CN2.13	TP1	2	P00/ADST1/SBO4/SBI4/IRQ02
	CN2.14	TP2	5	P01/SBT4/ADST2/GPWMST6/IRQ15/IRQ04
	CN2.15	TP3	-	N.C.
	CN2.16	TM_PWM0	43	P24/TM02B/TM06A/SBT3/GPWMST1/GPWMST4/CMPOT00/CMPOT01/DAOT0/TRCD0
	CN2.17	TM_PWM1	1	P02/ADST0/SBO4/SBI4/SBCS1/TM15B/IRQ05
	CN2.18	TM_PWM2	20	PB3/CKMREF/SBT3/SBT2/TM10A/GPWM60

	CN2.19	LED0	-	N.C.
	CN2.20	LED1	-	N.C.
	CN2.21	SW0	-	N.C.
	CN2.22	SW1	-	N.C.
	CN2.23	SW2	-	N.C.
	CN2.24	SW3	-	N.C.
	CN2.25	-	-	N.C.
	CN2.26	GPIO	44	P23/TM02A/TM07A/SBI3/SBO3/GPWMST2/GPWMST5/CMPOT10/CMPOT11/CKMREF/TRCD1
	CN2.27	PFC_PWM0	19 62	PB4/SBCS0/IRQ12/IRQ03/GPWM70 PF5/IRQ34/TM03B/TM12B/GPWM01
	CN2.28	-	-	N.C.
	CN2.29	VDD5V	-	VDD50
	CN2.30	-	-	N.C.

Table 2-3 Inverter board Connector and KM1M4BF54K Mapping GPIO List

2.4 Function Jumpers

Table 2-4 shows the Function Jumpers.

Connector	Description
J1, J2, J3, J4 J5, J6, J7, J8	A jumpers for selecting functions such as Encoder and unused pins.

Table 2-4 Function Jumpers

2.4.1 Setting for Function Jumpers

Table 2-5 shows the KM1M4BF54K Function Jumpers.

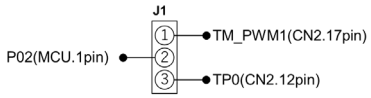
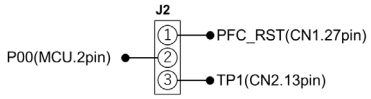
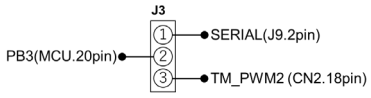
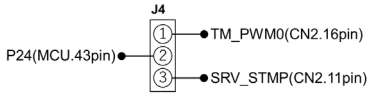
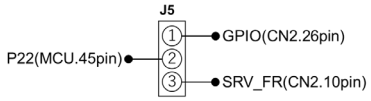
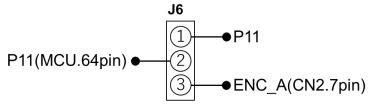
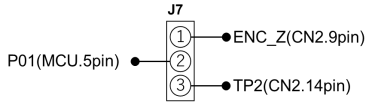
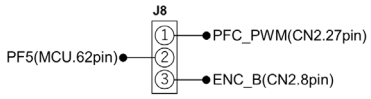
Connector		Description
J1		J1(1-2) : Timer PWM output1 J1(2-3) : Test pin0 (TP0)
J2		J2(1-2) : PFC reset output for HV borad* J2(2-3) : Test pin1 (TP1)
J3		J3(1-2) : Serial port J3(2-3) : Timer PWM output2
J4		J4(1-2) : Timer PWM output0 J4(2-3) : Servo (SRV_STMP)
J5		J5(1-2) : Relay control for HV borad* J5(2-3) : Servo (SRV_FR)
J6		J6(1-2) : Unused pin (P11) J6(2-3) : Encoder (ENC_A)
J7		J7(1-2) : Encoder (ENC_Z) J7(2-3) : Test pin2 (TP2)
J8		J8(1-2) : PFC PWM output for HV board* J8(2-3) : Encoder (ENC_B)

Table 2-5 Function Jumper setting

*HV board is high voltage inverter board (Nu-KE-MTR_HV001).

2.5 RAM monitor Tool Connector

Table 2-6 shows the RAM monitor Tool Connector.

Connector	Description
CN3	RAM monitor Tool Connector for connecting RAM monitor Tool (Power Debugger, Debug Oscilloscope) made by Nuvoton Technology Corporation Japan(NTCJ).

Table 2-6 RAM monitor Tool Connector

2.5.1 Pin Assignment for RAM monitor Tool Connector

The Nu-KT-MTR_M4BF54K provides RAM monitor Tool Connector(CN3).

Table 2-7 shows the pin assignment of RAM monitor Tool Connector.

Header		KM1M4BF54K	
		Pin No.	Function
CN3	CN3.1	-	VSS
	CN3.2	23	PF1/SBT5/TM02B/TM00A
	CN3.3	-	VSS
	CN3.4	24	P96/SBO5/SBI5/GPWMST7/IRQ11/IRQ04
	CN3.5	-	VDD50
	CN3.6	-	VDD50
	CN3.7	-	N.C.
	CN3.8	-	VSS
	CN3.9	25	PF2/SBO5/SBI5/IRQ37/IRQ20/IRQ14
	CN3.10	-	VSS

Table 2-7 RAM monitor Tool Connector and KM1M4BF54K Mapping GPIO List

2.6 Serial Interface Connector

Table 2-8 shows the Serial Interface Connector.

Connector	Description
J9	Connector for serial communication(UART/SPI/I2C).

Table 2-8 Serial Interface Connector

2.6.1 Pin Assignment for Serial Interface Connector

The Nu-KT-MTR_M4BF54K provides Serial Interface Connector(J9).

Table 2-9 shows the pin assignment of Serial Interface Connector.

Header		KM1M4BF54K	
		Pin No.	Function
J9	J9.1	-	VDD50
	J9.2	20	PB3/CKMREF/SBT3/SBT2/TM10A/GPWM60 *J3:Pin1-2 connected
	J9.3	21	PB2/SBO2/SBI2/TM10B/IRQ30
	J9.4	22	PB1/SBT2/SBO2/SBI2/TM11A/TM00B
	J9.5	-	VSS

Table 2-9 Serial Interface Connector and KM1M4BF54K Mapping GPIO List

2.7 DA converter output pin

Table 2-10 shows the DA converter output pin.

Connector	Description
DAOT0	Connector for DA converter output

Table 2-10 DA converter output pin

2.7.1 Pin Assignment for DA converter output pin

The Nu-KT-MTR_M4BF54K provides DA converter output pin(DAOT0).

Table 2-11 shows the DA converter output pin.

Header	KM1M4BF54K	
	Pin No.	Function
DAOT0	43	P24/TM02B/TM06A/SBT3/GPWMST1/GPWMST4/CMPOT00 /CMPOT01/DAOT0/TRCD0 *J4:Pin1-2, Pin2-3 open

Table 2-11 DA converter output pin and KM1M4BF54K Mapping GPIO List

2.8 Unused Pins connection

Table 2-12 shows the unused pins connection.

Header	Description
P11, PD3, PD5	The unused pins of the KM1M4BF54K are connected.

Table 2-12 Unused pins

2.8.1 Pin Assignment for Unused pins

The Nu-KT-MTR_M4BF54K provides connection for unused pins (P11, PD3, PD5).

Table 2-13 shows the KM1M4BF54K unused pins connection.

Header	KM1M4BF54K	
	Pin No.	Function
P11	64	P11/IRQ01/TM03A/TM12A/GPWM00 *J6:Pin1-2 connected
PD3	16	PD3/SBO1/SBI1/TM00A
PD5	14	PD5/SBT1/SBO1/SBI1/IRQ36/IRQ30/IRQ03

Table 2-13 Unused pins and KM1M4BF54K Mapping GPIO List

2.9 Debug Interface Connector

Table 2-14 shows the Debug Interface Connector.

Connector	Description
CN4	Debug interface connector for connecting Debugger(I-Jet or ULINK).

Table 2-14 Debug Interface Connector

2.9.1 Pin Assignment for Debug Interface Connector

The Nu-KT-MTR_M4BF54K provides Debug Interface Connector(CN4).

Table 2-15 shows the pin assignment of Debug Interface Connector.

Header		KM1M4BF54K	
		Pin No.	Function
CN4	CN4.1	-	VDD50
	CN4.2	18	PB5/SWDD/SBO0/SBI0/GPWM61
	CN4.3	-	VSS
	CN4.4	17	PB6/SWDCLK/SBT0/SBO0/SBI0/IRQ05/GPWM71
	CN4.5	-	VSS
	CN4.6	42	P30/IRQ07/TM06B/TM10B/TM12B/SBCS3/GPWMST0/ GPWMST3/CMPOT10/CMPOT11/TRCSWO
	CN4.7	-	N.C.
	CN4.8	-	N.C.
	CN4.9	47	NDMOD
	CN4.10	6	NRST

Table 2-15 Debug Interface Connector and KM1M4BF54K Mapping GPIO List

2.10 LED

Table 2-16 shows LED function.

Component	Description
LED1	The power LED indicates that the Nu-KT-MTR_M4BF54K is powered.

Table 2-16 LED

2.11 External Power Connector

Table 2-17 shows the External Power Connector.

Component	Description
CN5	Apply 5V when operating withNu-KT-MTR-M4BF54K standalone. Note : When Nu-KT-MTR-M4BF54K is connected to the inverter board, 5V power is supplied from the inverter board.

Table 2-17 External Power Connector

2.12 Reset Switch

Table 2-18 shows the Reset Switch.

Component	Description
K1	Reset Switch to reset the target chip.

Table 2-18 Reset Switch

2.13 Crystal Oscillator

Table 2-19 shows the Crystal Oscillator.

Component	Description
Y1	10 MHz. Crystal Oscillator

Table 2-19 Crystal Oscillator

3. NU-KT-MTR_M4BF54K SCHEMATICS

3.1 Nu-KT-MTR_M4BF54K

Figure 3-1 shows the Nu-KT-MTR_M4BF54K schematic.

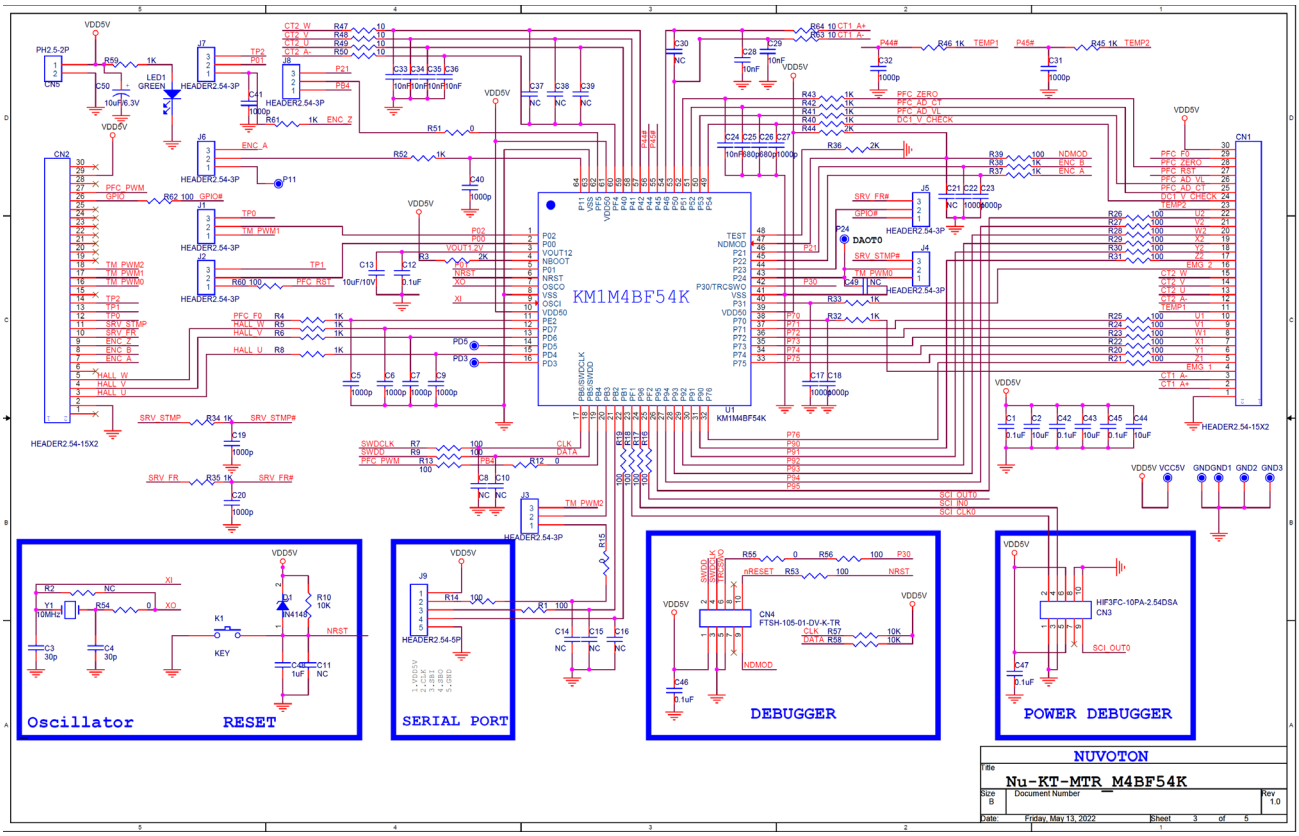


Figure 3-1 Nu-KT-MTR_M4BF54K Schematic

3.2 PCB Component Placement

Figure 3-2 and Figure 3-3 show the top and bottom placement of Nu-KT-MTR_M4BF54K.

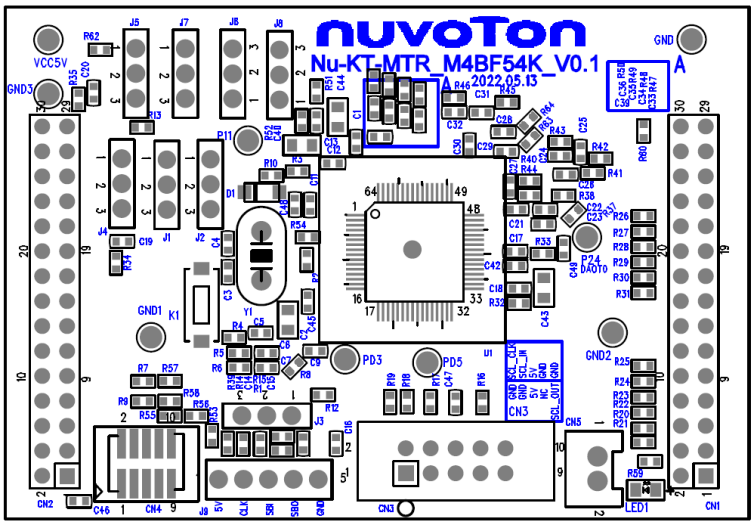


Figure 3-2 Top Placement

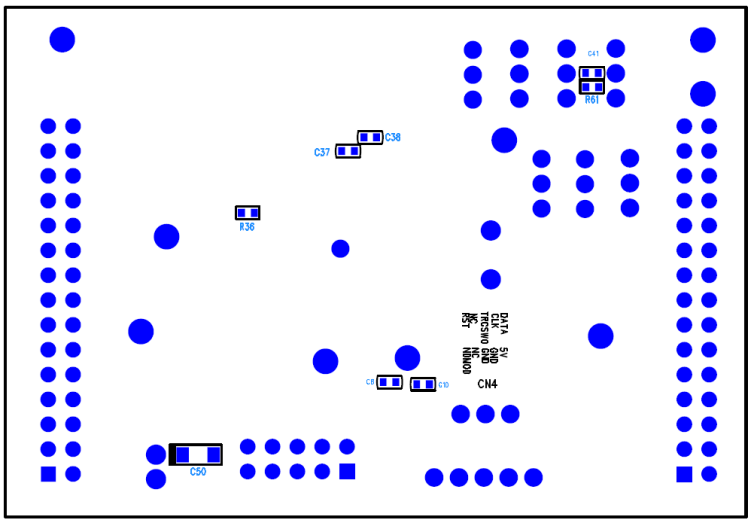


Figure 3-3 Bottom Placement

4. REVISION HISTORY

Date	Revision	Description
July 11, 2022	1.00	• Initial version

Important Notice

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