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Connection of NC/NC1 Pins on AURIX™ TC3xx BGA packages

AURIX™ 32-bit microcontroller family

About this document

Scope and purpose

This Application note gives additional information to the TC3xx Data sheets for the listed devices regarding the handling of the balls marked as NC and NC1.

- TC336
- TC356
- TC366
- TC337
- TC357
- TC367
- TC377
- TC387
- TC397
- TC389
- TC399

In the Data sheet for the listed AURIX™ devices, the 'no connect' balls have been classified as:

- NC - These pins are reserved for future extensions and shall not be connected externally.
- NC1 - These pins are not connected on package level and will not be used for future extensions.

The general rule is that balls defined as NC or NC1 (Not Connected) must not be connected to any net including power supply or ground connections in the PCB routing. This rule is required because:

- To ensure compatibility across the AURIX™ product platforms.
- Because the connection of high-speed signals to NC balls may cause unwanted cross coupling effects in the BGA package interposer layer.
- Some balls should not be connected for package soldering reliability reasons.

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1 Introduction

For the TC3xx devices mentioned, static and dynamic analyses have been performed to allow the data sheet constraints to be relaxed such that some of the 'no connect' balls can be connected to PCB signals. This information has been provided to help to simplify common PCB designs for applications that wish to take advantage of the AURIX™ family platform approach.

The ball out for different variants has been shown and the NC and NC1 ball have been marked in different colors, depicting the routability of each of these balls. The color codes are as follows:

To be avoided for routing

Allowed for routing

Attention: *General layout precautions for example for critical signal routing, are the responsibility of the customer. Infineon take no liability for signal integrity on a system level.*

Attention: *This Application Note is primarily intended for hardware designers involved in PCB routing.*

2 TC336 I/O ball configuration in the LFBGA180 package variant

TC336L and LP

	A	B	C	D	E	F	G	H	J	K	L	M	N	P
14	NC	P20_14	P20_10	P20_11	ESR0_N	P21_7	TCK	P21_5	P21_3	VSSOSC	XTAL1	VEXT_OSC	P23_1	NC
13	P15_0	VSS	P20_13	P20_12	PORST_N	P21_6	P20_2	P20_0	P21_4	P21_2	XTAL2	VDDOSC	VSSSCDCDC	NC
12	P15_1	P15_2	VSS	P20_9	P20_7	P20_8	P20_3	P21_0	P22_3	TRST_N	P22_1	VSSEXT	VCAPP	VCAPN
11	P15_6	P15_4	P14_3	VSS	ESR1_N	P20_6	TMS	P22_2	P22_0	NC	VSSEXT	NC	P33_10	VEXT
10	P15_3	P14_1	P14_4	P15_5	VSS					VSSEXT	P33_7	P33_12	P33_11	P33_9
9	P14_0	P14_5	P14_6	P14_2		VDD	VDD	VEVRSB	VEXT		P33_8	P33_0	P33_5	P33_6
8	P13_2	P13_3	NC	P15_7		VEXT	VSS	VSS	VDDO_BGA		P33_4	P33_1	P33_3	P33_2
7	P13_0	P13_1	NC	P15_8		VDDP3	VSS	VSS	VDD		AN0	P34_1	P34_2	P34_3
6	P11_2	P11_3	P11_6	P11_8		VEXT	VEXT	VDD	VSS		AN2	AN3	AN4	AN1
5	P11_9	P11_10	P11_11	VFLEX	VSSEXT					VSS	AN5	AN6	AN8	AN7
4	P11_12	P10_4	NC	VSSEXT	P10_6	P10_5	P00_0	P00_1	P40_9	AN35	AN14	AN10	AN11	VAREF1
3	P10_2	P10_1	VSSEXT	P02_3	P02_8	P00_2	P00_6	P00_5	P40_8	AN34	NC	AN12	AN9	VDDM
2	P10_3	VSSEXT	P02_2	P02_4	P02_7	P00_3	P00_7	P00_9	P40_7	P40_5	NC	NC	AN13	VSS
1	NC	P02_0	P02_1	P02_5	P02_6	P00_4	P00_8	P00_12	P40_6	P40_4	NC	NC	AN15	NC

Figure 1   **TC336 L and LP I/O Configuration** [1]

- There are total of 15 NC balls.

2 TC336 I/O ball configuration in the LFBGA180 package variant

TC336 DA

	A	B	C	D	E	F	G	H	J	K	L	M	N	P
14	NC	P20_14	P20_10	P20_11	ESR0_N	P21_7	TCK	P21_5	P21_3	VSSOSC	XTAL1	VEXT_OSC	P23_1	NC
13	P15_0	VSS	P20_13	P20_12	PORST_N	P21_6	P20_2	P20_0	P21_4	P21_2	XTAL2	VDDOSC	VSSEXT	P32_4
12	P15_1	P15_2	VSS	P20_9	P20_7	P20_8	P20_3	P21_0	NC	TRST_N	NC	VSSEXT	P32_1	P32_0
11	P15_6	P15_4	P14_3	VSS	ESR1_N	P20_6	TMS	NC	NC	NC	VSSEXT	P33_13	P33_10	VEXT
10	P15_3	P14_1	P14_4	P15_5	VSS					VSSEXT	P33_7	P33_12	P33_11	P33_9
9	P14_0	P14_5	P14_6	P14_2		VDD	VDD	VEVRSB	VEXT		P33_8	P33_0	P33_5	P33_6
8	P12_1	P11_14	P12_0	NC		VEXT	VSS	VSS	VDD		P33_4	P33_1	P33_3	P33_2
7	P11_0	P11_1	P11_13	NC		VDDP3	VSS	VSS	VDD		NC	NC	NC	NC
6	P11_2	P11_4	P11_15	P11_11		VEXT	VEXT	VDD	VSS		AN2	AN3	AN0	AN1
5	P11_6	P11_5	P11_3	VFLEX	VSSEXT					VSS	AN4	AN5	AN8	AN10
4	P11_9	P11_7	P11_12	VSSEXT	P10_6	P10_5	P10_3	P02_1	AN17	AN16	AN9	AN12	AN11	VAREF1
3	P11_10	P11_8	VSSEXT	NC	P10_1	P10_2	P10_8	P10_7	P02_2	AN20	NC	AN21	AN13	VDDM
2	NC	VSSEXT	P50_1	P50_3	P50_5	P50_7	P50_9	P50_11	P02_5	P02_7	P02_6	P00_0	AN14	VSS
1	NC	NC	P50_0	P50_2	P50_4	P50_6	P50_8	P50_10	P02_4	P02_0	P02_8	P02_3	AN15	NC

Figure 2   TC336DA I/O Configuration [2]

- There are total of 19 NC balls.

3 TC356 I/O ball configuration in the LFBGA180 package variant

	A	B	C	D	E	F	G	H	J	K	L	M	N	P
14	NC	P20_14	P20_10	P20_11	ESR0_N	P21_7	TCK	P21_5	P21_3	VSSOSC	XTAL1	VEXT_OSC	P23_1	NC
13	P15_0	VSS	P20_13	P20_12	PORST_N	P21_6	P20_2	P20_0	P21_4	P21_2	XTAL2	VDDOSC	VSSEXT	P32_4
12	P15_1	P15_2	VSS	P20_9	P20_7	P20_8	P20_3	P21_0	NC	TRST_N	NC	VSSEXT	P32_1	P32_0
11	P15_6	P15_4	P14_3	VSS	ESR1_N	P20_6	TMS	NC	NC	NC	VSSEXT	P33_13	P33_10	VEXT
10	P15_3	P14_1	P14_4	P15_5	VSS					VSSEXT	P33_7	P33_12	P33_11	P33_9
9	P14_0	P14_5	P14_6	P14_2		VDD	VDD	VEVRSB	VEXT		P33_8	P33_0	P33_5	P33_6
8	P12_1	P11_14	P12_0	NC		VEXT	VSS	VSS	VDD		P33_4	P33_1	P33_3	P33_2
7	P11_0	P11_1	P11_13	NC		VDDP3	VSS	VSS	VDD		NC	NC	NC	NC
6	P11_2	P11_4	P11_15	P11_11		VEXT	VEXT	VDD	VSS		AN2	AN3	AN0	AN1
5	P11_6	P11_5	P11_3	VFLEX	VSSEXT					VSS	NC	NC	AN8	AN10
4	P11_9	P11_7	P11_12	VSSEXT	P10_6	P10_5	P10_3	P02_1	NC	NC	NC	AN12	AN11	VAREF1
3	P11_10	P11_8	VSSEXT	NC	P10_1	P10_2	P10_8	P10_7	P02_2	NC	NC	NC	NC	VDDM
2	NC	VSSEXT	P50_1	P50_3	P50_5	P50_7	P50_9	P50_11	P02_5	P02_7	P02_6	P00_0	NC	VSS
1	NC	NC	P50_0	P50_2	P50_4	P50_6	P50_8	P50_10	P02_4	P02_0	P02_8	P02_3	NC	NC

Figure 3   **TC356 I/O Configuration** [3]

- There are total of 28 NC balls.

4 TC366 I/O ball configuration in the LFBGA180 package variant

	A	B	C	D	E	F	G	H	J	K	L	M	N	P
14	NC	P20_14	P20_10	P20_11	ESR0_N	P21_7	TCK	P21_5	P21_3	VSSOSC	XTAL1	VEXT_OSC	P23_1	NC
13	P15_0	VSS	P20_13	P20_12	PORST_N	P21_6	P20_2	P20_0	P21_4	P21_2	XTAL2	VDDOSC	VSSEXT	P32_4
12	P15_1	P15_2	VSS	P20_9	P20_7	P20_8	P20_3	P21_0	P22_3	TRST_N	P22_1	VSSEXT	P32_1	P32_0
11	P15_6	P15_4	P14_3	VSS	ESR1_N	P20_6	TMS	P22_2	P22_0	P23_3	VSSEXT	P33_13	P33_10	VEXT
10	P15_3	P14_1	P14_4	P15_5	VSS					VSSEXT	P33_7	P33_12	P33_11	P33_9
9	P14_0	P14_5	P14_6	P14_2		VDD	VDD	VEVRSB	VEXT		P33_8	P33_0	P33_5	P33_6
8	P13_2	P13_3	P14_10	P15_7		VEXT	VSS	VSS	VDD		P33_4	P33_1	P33_3	P33_2
7	P13_0	P13_1	P14_8	P15_8		VDDP3	VSS	VSS	VDD		AN0	NC	NC	NC
6	P11_2	P11_3	P11_6	P11_8		VEXT	VEXT	VDD	VSS		AN2	AN3	AN4	AN1
5	P11_9	P11_10	P11_11	VFLEX	VSSEXT					VSS	AN5	AN6	AN8	AN7
4	P11_12	P10_4	P10_0	VSSEXT	P10_6	P10_5	P00_0	P00_1	P40_9	AN35	AN14	AN10	AN11	VAREF1
3	P10_2	P10_1	VSSEXT	P02_3	P02_8	P00_2	P00_6	P00_5	P40_8	AN34	NC	AN12	AN9	VDDM
2	P10_3	VSSEXT	P02_2	P02_4	P02_7	P00_3	P00_7	P00_9	P40_7	P40_5	P40_1	AN17	AN13	VSS
1	NC	P02_0	P02_1	P02_5	P02_6	P00_4	P00_8	P00_12	P40_6	P40_4	P40_0	AN16	AN15	NC

Figure 4   **TC366 I/O ball configuration** [4]

- There are total of 8 NC balls.

5 TC337 I/O ball configuration in the LFBGA292 package variant

TC377LP

Figure 5 **TC337LP I/O ball configuration** [1]

- There are total of 68 NC balls and 3 NC1 balls.

5 TC337 I/O ball configuration in the LFBGA292 package variant

TC337DA and DZ

Figure 6   **TC337DA and DZ I/O ball configuration** [2]

• There are total of 49 NC balls and 3 NC1 balls.

6 TC357 I/O ball configuration in the LFBGA292 package variant

Figure 7   **TC357 I/O ball configuration** [3]

- There are total of 35 NC balls and 3 NC1 balls.

7 TC367 I/O ball configuration in the LFBGA292 package variant

Figure 8 **TC367 I/O ball configuration** [4]

• There are total of 34 NC balls and 3 NC1 balls.

8 TC377 I/O ball configuration in the LFBGA292 package variant

	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	T	U	V	W	Y
20	VSSEXT	P15_0	P20_14	P20_13	P20_11	P20_8	P20_3	P20_0	P21_5	P21_4	VSSOSC	XTAL1	VEXT_OSC	P22_0	P22_2	P23_4	P23_2	P23_0	VEXT	VSSEXT
19	VDDP3	VSSEXT	P15_2	P20_12	P20_10	P20_7	P20_1	P20_2	P21_3	P21_2	TRST_N	XTAL2	VDDOSC	P22_1	P22_3	P23_3	P23_1	VEXT	VSSEXT	P32_3
18	P15_1	VDDP3																	P32_4	P32_2
17	P15_4	P15_3		VSSEXT	P20_9	P20_6	PORST_N	P21_6	P21_1	P21_0	P22_11	P22_9	P22_7	P22_5	P23_6	P23_5	VSSEXT		P32_1	P32_0
16	P15_6	P14_0		VDD	VSSEXT	ESR0_N	ESR1_N	P21_7	TCK	TMS	P22_10	P22_8	P22_6	P22_4	P23_7	VSSEXT	P32_7		P33_12	P33_13
15	P14_1	P14_4		P15_7	VDD											P32_5	P32_6		P33_10	P33_11
14	P14_5	P14_3		P15_8	P15_5			VDD	VSS	NC	VSS	VSS	VDD			P33_14	P33_15		P33_8	P33_9
13	P14_8	P14_6		P14_7	P14_2		VDD		VSS	VSS	VSS	VSS		VDD		P34_4	P34_5		P33_6	P33_7
12	P13_1	P13_0		P14_9	P12_0		VSS	VSS		VSS	VSS		VSS	VSS		P34_2	P34_3		P33_4	P33_5
11	P13_3	P13_2		P14_10	P12_1		VSS	VSS	VSS	VSS	VSS	VSS	VSS	VSS		VEVRSB	P34_1		P33_2	P33_3
10	P11_2	P11_3		P11_4	P11_0		VSS	VSS	VSS	VSS	VSS	VSS	VSS	VSS		AN0	AN1		P33_0	P33_1
9	P11_9	P11_10		P11_6	P11_1		VSS	VSS		VSS	VSS		VSS	VSS		AN4	AN3		AN2	AN5
8	P11_11	P11_12		P11_5	P11_7		VDD		VSS	VSS	VSS	VSS		VDD		AN6	AN7		AN8	AN10
7	P10_0	P10_1		P11_14	P11_8			VDD	VSS	VSS	VSS	VSS	VDD			AN12	AN9		AN11	VSS
6	P10_3	P10_4		P11_15	P11_13											AN15	AN14		AN13	VAREF1
5	P10_2	P10_5		VFLEX	VSSEXT	P02_10	P01_3	P01_5	P01_7	P00_10	AN42	AN40	P40_8	AN34	AN23	AN22	P40_10		AN16	VDDM
4	P10_6	P10_8		VSSEXT	P02_9	P02_11	P01_4	P01_6	P00_6	P00_8	AN43	AN41	P40_6	P40_4	AN31	AN30	NC1		P40_11	VSS
3	P10_7	VEXT																	P40_12	AN20
2	VEXT	VSSEXT	P02_1	P02_3	P02_5	P02_7	P00_1	P00_3	P00_5	P00_9	P00_12	AN47	AN45	P40_7	AN35	VSS	P40_13	P40_2	P40_0	AN21
1	NC1	P02_0	P02_2	P02_4	P02_6	P02_8	P00_0	P00_2	P00_4	P00_7	P00_11	AN46	AN44	P40_9	P40_5	VAREF2_NET	P40_14	P40_3	P40_1	NC1

Figure 9   **TC377 I/O ball configuration** [5] [6]

- There are total of 1 NC balls and 3 NC1 balls.
- The Ballout is from TC377TP. This analysis is also valid for TC377TE and TC377TX

9 TC387 I/O ball configuration in the LFBGA292 package variant

	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	T	U	V	W	Y
20	VSS	P15_0	P20_14	P20_13	P20_11	P20_8	P20_3	P20_0	P21_5	P21_4	VSSOSC	XTAL1	VEXT_OSC	P22_0	P22_2	P23_4	P23_2	P23_0	VEXT	VSSEXT
19	VDDP3	VSS	P15_2	P20_12	P20_10	P20_7	P20_1	P20_2	P21_3	P21_2	TRST_N	XTAL2	VDDOSC	P22_1	P22_3	P23_3	P23_1	VEXT	VSSEXT	P32_3
18	P15_1	VDDP3																	P32_4	P32_2
17	P15_4	P15_3		VSS	P20_9	P20_6	PORST_N	P21_6	P21_1	P21_0	P22_11	P22_9	P22_7	P22_5	P23_6	P23_5	VSSEXT		P32_1	P32_0
16	P15_6	P14_0		VDD	VSS	ESR0_N	ESR1_N	P21_7	TCK	TMS	P22_10	P22_8	P22_6	P22_4	P23_7	VSSEXT	P32_7		P33_12	P33_13
15	P14_1	P14_4		P15_7	VDD											P32_5	P32_6		P33_10	P33_11
14	P14_5	P14_3		P15_8	P15_5			VDD	VSS	NC	VSS	VSS	VDD			P33_14	P33_15		P33_8	P33_9
13	P14_8	P14_6		P14_7	P14_2		VDD		VSS	VSS	VSS	VSS		VDD		P34_4	P34_5		P33_6	P33_7
12	P13_1	P13_0		P14_9	P12_0		VSS	VSS		VSS	VSS		VSS	VSS		P34_2	P34_3		P33_4	P33_5
11	P13_3	P13_2		P14_10	P12_1		VSS	VSS	VSS	VSS	VSS	VSS	VSS	VSS		VEVRSB	P34_1		P33_2	P33_3
10	P11_2	P11_3		P11_4	P11_0		VSS	VSS	VSS	VSS	VSS	VSS	VSS	VSS		AN0	AN1		P33_0	P33_1
9	P11_9	P11_10		P11_6	P11_1		VSS	VSS		VSS	VSS		VSS	VSS		AN4	AN3		AN2	AN5
8	P11_11	P11_12		P11_5	P11_7		VDD		VSS	VSS	VSS	VSS		VDD		AN6	AN7		AN8	AN10
7	P10_0	P10_1		P11_14	P11_8		VDD	VSS	VSS	VSS	VSS	VDD				AN12	AN9		AN11	VSS
6	P10_3	P10_4		P11_15	P11_13											AN15	AN14		AN13	VAREF1
5	P10_2	P10_5		VFLEX	VSS	P02_10	P01_3	P01_5	P01_7	P00_10	AN42	AN40	P40_8	AN34	AN23	AN22	P40_10		AN16	VDDM
4	P10_6	P10_8		VSS	P02_9	P02_11	P01_4	P01_6	P00_6	P00_8	AN43	AN41	P40_6	P40_4	AN31	AN30	NC1		P40_11	VSS
3	P10_7	VEXT														P40_12				AN20
2	VEXT	VSS	P02_1	P02_3	P02_5	P02_7	P00_1	P00_3	P00_5	P00_9	P00_12	AN47	AN45	P40_7	AN35	VSS	P40_13	P40_2	P40_0	AN21
1	NC1	P02_0	P02_2	P02_4	P02_6	P02_8	P00_0	P00_2	P00_4	P00_7	P00_11	AN46	AN44	P40_9	P40_5	VAREF2	P40_14	P40_3	P40_1	NC1

Figure 10 **TC387 I/O ball configuration** [7]

- There are total of 1 NC balls and 3 NC1 balls.

10 TC397 I/O ball configuration in the LFBGA292 package variant

	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	T	U	V	W	Y
20	VSS	P15_0	P20_14	P20_13	P20_11	P20_8	P20_3	P20_0	P21_5	P21_4	VSSOSC	XTAL1	VEXT_OSC	P22_0	P22_2	P23_4	P23_2	P23_0	VEXT	VSS
19	VDDP3	VSS	P15_2	P20_12	P20_10	P20_7	P20_1	P20_2	P21_3	P21_2	TRST_N	XTAL2	VDDOSC	P22_1	P22_3	P23_3	P23_1	VEXT	VSS	P32_3
18	P15_1	VDDP3																	P32_4	P32_2
17	P15_4	P15_3		VSS	P20_9	P20_6	PORST_N	P21_6	P21_1	P21_0	P22_11	P22_9	P22_7	P22_5	P23_6	P23_5	VSS		P32_1	P32_0
16	P15_6	P14_0		VDD	VSSEXT	ESR0_N	ESR1_N	P21_7	TCK	TMS	P22_10	P22_8	P22_6	P22_4	P23_7	VSS	P32_7		P33_12	P33_13
15	P14_1	P14_4		P15_7	VDD											P32_5	P32_6		P33_10	P33_11
14	P14_5	P14_3		P15_8	P15_5		VDD	VSS	DAPE0	ERR_SIG	VSS	VDD				P33_14	P33_15		P33_8	P33_9
13	P14_8	P14_6		P14_7	P14_2	VDD		VSS	VSS	VSS	VSS		VDD			P34_4	P34_5		P33_6	P33_7
12	P13_1	P13_0		P14_9	P12_0	VSS	VSS		VSS	VSS			VSS	VSS		P34_2	P34_3		P33_4	P33_5
11	P13_3	P13_2		P14_10	P12_1	DAPE1	VSS	VSS	VSS	VSS	VSS	VSS	TX_P			VEVRSB	P34_1		P33_2	P33_3
10	P11_2	P11_3		P11_4	P11_0	DAPE2	VSS	VSS	VSS	VSS	VSS	VSS	TX_N			AN0	AN1		P33_0	P33_1
9	P11_9	P11_10		P11_6	P11_1	VSS	VSS		VSS	VSS		VSS	VSS			AN4	AN3		AN2	AN5
8	P11_11	P11_12		P11_5	P11_7	VDDSB		VSS	VSS	VSS	VSS		VDD			AN6	AN7		AN8	AN10
7	P10_0	P10_1		P11_14	P11_8		VDDSB	VSS	CLK_P	CLK_N	VSS	VDD				AN12	AN9		AN11	VSS
6	P10_3	P10_4		P11_15	P11_13											AN15	AN14		AN13	VAREF1
5	P10_2	P10_5		VFLEX	VSSEXT	P02_10	P01_3	P01_5	P01_7	P00_10	AN42	AN40	P40_8	AN34	AN23	AN22	P40_10		AN16	VDDM
4	P10_6	P10_8		VSSEXT	P02_9	P02_11	P01_4	P01_6	P00_6	P00_8	AN43	AN41	P40_6	P40_4	AN31	AN30	NC1		P40_11	VSS
3	P10_7	VEXT																	P40_12	AN20
2	VEXT	VSS	P02_1	P02_3	P02_5	P02_7	P00_1	P00_3	P00_5	P00_9	P00_12	AN47	AN45	P40_7	AN35	VSS	P40_13	P40_2	P40_0	AN21
1	NC	P02_0	P02_2	P02_4	P02_6	P02_8	P00_0	P00_2	P00_4	P00_7	P00_11	AN46	AN44	P40_9	P40_5	VAREF2	P40_14	P40_3	P40_1	NC1

Figure 11   **TC397 I/O ball configuration** [8]

- There are total of 1 NC balls and 2 NC1 balls.

11 TC389 I/O ball configuration in the LFBGA516 package variant

Figure 12   TC389 I/O ball configuration [7]

- There are total of 57 NC balls and 7 NC1 balls.

12   TC399 I/O ball configuration in the LFBGA292 package variant

	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	T	U	V	W	Y	AA	AB	AC	AD	AE	AF	AG	AH	AJ	AK
30	VSS	VSS	NC	NC	NC	NC	NC	VSS	VEBU	P24_15	P24_13	P24_11	P24_9	P24_7	P24_5	P24_3	P24_1	NC1	NC	P25_15	P25_13	P25_11	P25_9	P25_5	P25_3	P25_1	P25_0	VEBU	VEXT	VSS
29	VDDP3	VSS	NC	NC	NC	NC	NC	VSS	VEBU	P24_14	P24_12	P24_10	P24_8	P24_6	P24_4	P24_2	P24_0	NC1	P25_6	P25_14	P25_12	P25_10	P25_8	P25_7	P25_4	P25_2	P26_0	VEXT	VSS	VEBU
28	NC	VDDP3																											P30_14	P30_15
27	NC	NC																											P30_12	P30_13
26	NC	NC																											P30_10	P30_11
25	NC	NC				VSS	P15_0	P20_14	P20_13	P20_11	P20_8	P20_3	P20_0	P21_5	P21_4	VSS OSC	XTAL1	VEXT OSC	P22_0	P22_2	P23_4	P23_2	P23_0	VEXT	VSS				P30_8	P30_9
24	P15_11	P15_10				VDDP3	VSS	P15_2	P20_12	P20_10	P20_7	P20_1	P20_2	P21_3	P21_2	TRST_N	XTAL2	VDDOSC	P22_1	P22_3	P23_3	P23_1	VEXT	VSS	P32_3				P30_6	P30_7
23	P15_13	P15_12				P15_1	VDDP3																P32_4	P32_2					P30_4	P30_5
22	P15_15	P15_14				P15_4	P15_3		VSS	P20_9	P20_6	PORST_N	P21_6	P21_1	P21_0	P22_11	P22_9	P22_7	P22_5	P23_6	P23_5	VSS	P32_1	P32_0					P30_2	P30_3
21	NC	NC				P15_6	P14_0		VDD	VSSEXT	ESR0_N	ESR1_N	P21_7	TCK	TMS	P22_10	P22_8	P22_6	P22_4	P23_7	VSS		P33_12	P33_13					P30_0	P30_1
20	P14_11	NC				P14_1	P14_4	P15_7	VDD										P32_5	P32_6			P33_10	P33_11					NC	VEBU
19	P14_13	P14_12				P14_5	P14_3	P15_8	P15_5				VDD	VSS	DAPE0	ERR_SIG	VSS	VDD	P33_14	P33_15			P33_8	P33_9					P31_14	P31_15
18	P14_15	P14_14				P14_8	P14_6	P14_7	P14_2			VDD			VSS	VSS	VSS	VSS	VDD		P34_4	P34_5	P33_6	P33_7					P31_12	P31_13
17	NC	NC				P13_1	P13_0	P14_9	P12_0		VSS	VSS		VSS	VSS		VSS	VSS			P34_2	P34_3	P33_4	P33_5					P31_10	P31_11
16	P13_5	P13_4				P13_3	P13_2	P14_10	P12_1		DAPE1	VSS		VSS	VSS	VSS	TX_P	VSS		VEVRSB		P34_1	P33_2	P33_3					P31_8	P31_9
15	P13_7	P13_6				P11_2	P11_3	P11_4	P11_0		DAPE2	VSS		VSS	VSS	VSS	TX_N	VSS		AN0	AN1		P33_0	P33_1					P31_6	P31_7
14	P13_9	NC				P11_9	P11_10	P11_6	P11_1		VSS	VSS		VSS	VSS		VSS	VSS		AN4	AN3		AN2	AN5					P31_4	P31_5
13	P13_11	P13_10				P11_11	P11_12	P11_5	P11_7		VDDSB			VSS	VSS	VSS	VSS		VDD	AN6	AN7		AN8	AN10					P31_2	P31_3
12	P13_13	P13_12				P10_0	P10_1	P11_14	P11_8		VDDSB	VSS	CLK_P	CLK_N	VSS	VDD				AN12	AN9		AN11	VSS					P31_0	P31_1
11	P13_15	P13_14				P10_3	P10_4	P11_15	P11_13											AN15	AN14		AN13	VAREF1					VEBU	VEBU
10	NC	NC				P10_2	P10_5	VFLEX	VSS	P02_10	P01_3	P01_5	P01_7	P00_10	AN42	AN40	P40_8	AN34	AN23	AN22	P40_10	AN16	VDDM						VSS	VSS
9	NC	NC				P10_6	P10_8	VSS	P02_9	P02_11	P01_4	P01_6	P00_6	P00_8	AN43	AN41	P40_6	AN31	AN30		P40_11	VSS	NC1						VDDM	VDDM
8	NC	P10_9				P10_7	VEXT														P40_12	AN20							VSSM	VSSM
7	P10_11	P10_10				VEXT	VSS		P02_1	P02_3	P02_5	P02_7	P00_1	P00_3	P00_5	P00_9	P00_12	AN47	AN45	P40_7	AN35	VSS	P40_13	P40_2	P40_0	AN21			AN49	AN48
6	P10_13	NC				NC1	P02_0	P02_2	P02_4	P02_6	P02_8	P00_0	P00_2	P00_4	P00_7	P00_11	AN46	AN44	P40_9	P40_5	VAREF2	P40_14	P40_3	P40_1	NC1				AN50	AN51
5	P10_15	P10_14																											AN52	AN53
4	NC	NC																											P41_4	P41_5
3	NC	VEXT																											NC	NC
2	VEXT	VSS	NC	NC	NC	P02_12	P02_14	NC	P01_0	P01_2	P01_9	P01_10	P01_12	P01_14	NC	P00_13	P00_14	AN73	P41_3	P41_1	AN66	P41_8	P41_6	AN61	AN58	AN57	VSS	NC	NC	NC
1	NC1	NC	NC	NC	NC	P02_13	P02_15	NC	NC	P01_1	P01_8	P01_11	P01_13	P01_15	NC	NC	P00_15	AN72	P41_2	P41_0	P40_15	AN65	P41_7	AN60	AN59	AN56	VAREF3	NC	NC	NC1

Figure 13   TC399 I/O ball configuration [8]

- There are total of 54 NC balls and 7 NC1 balls.

References

[1]   Infineon Technologies AG, Datasheet TC33x_TC32x 32-bit single chip microcontroller, Munich: Infineon Technologies AG.

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Revision history

Document version	Date of release	Description of changes
V1.0	2018-11	First release
V1.1	2019-01	Device TC356 added
V1.2	2021-04	Editorial Changes • Refurbished headings Devices added • TC337LP • TC337DA and DZ • TC367 • TC377 • TC336L and LP • TC336DA • TC356 updated • TC366
V1.3	2024-03-08	Template update; no content update.

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