TINY-Tiger® *plus* - Data Sheet (V12)

Tiny-Tiger® *plus* Generation 3

Tiny, high speed multitasking computers in the size of a component. Tiny-Tiger® *plus* are universal, full featured control computers used in numerous projects and series products as:

- medical equipment
- GPS systems
- communication equipment
- industrial control
- alarm systems
- vending machines
- container tracking
- power plants ... and many more

Tiny-Tiger® *plus* offers

- short development cycles
- highest product reliability
- low cost
- innovative features

For further information, detailed literature and manuals in printed or downloadable formats visit:

https://www.wilke.de/
or
https://www.wilke.de/en.html

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Content

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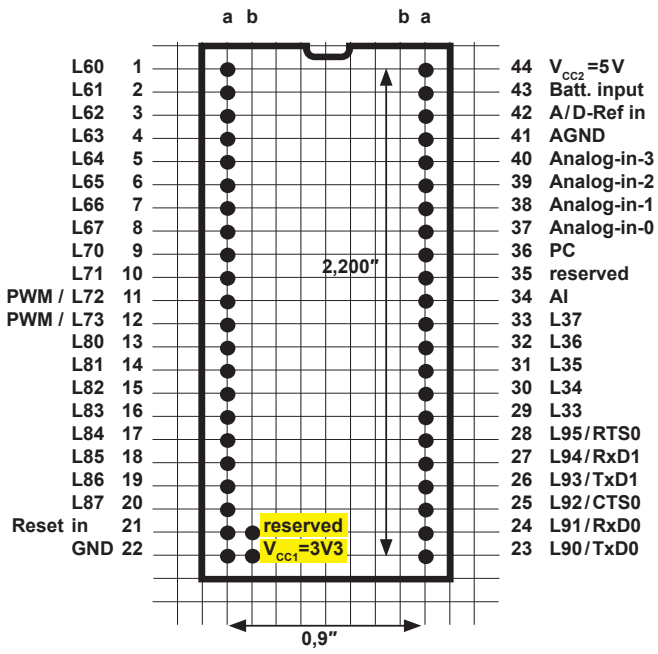
Pinout



Yellow Areas changed compared to TTI-TCN-X/X-R

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Electrical Specifications

• **Operating voltage:** a) V_{CC2}=5 V (integrated regulator to 3.3 V) to pin 44a
abs. max. rating +5.5 V
b) Alternatively V_{CC1}=3.3 V to pin 22b 3.5 V_{max}

• **Typ. power draw:** max. 300 mA (for power supply layout incl. external load on module pins)

Syntax/Pseudo code	Speed	Typ. power consumption*)		
		Tiger 1	Tiger 2	Tiger plus
Default ▶ USER_FREQUENCY SPEED_25	25%	36 mA 180 mW	82 mA 410 mW	44 mA 220mW
USER_FREQUENCY SPEED_50	50%			74 mA 370mW
USER_FREQUENCY SPEED_100	100%			135 mA 675 mW

*) with no external load.

Depends on application from 50 to 200 mA

Absolut max. ratings:		
	Max. sink capability:	-5 mA per pin (5.0 V tolerant output) -3 mA @ Alarm pin
	Max. sink over all pins:	-25 mA (5.0 V tolerant output)
	Max. source/sink capability:	±25mA per pin (3.3 V output)
	Max. source/sink over all pins:	±125 mA (3.3 V output) -0.3 V to + 5.5 V in I/O mode 3 mA @ Alarm pin
	Max. voltage	-0.3 V to +5.5 V in I/O mode
	Pin 37-40 used as Analog-IN:	-0.3 V .. 5.5 V
	Analog Reference:	+3.3 V .. 5.5 V
	RTC-Sleep	1-2µA typ.
	RAM-Sleep	200-500µA typ.

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Electrical Specifications

Impedance digital Inputs:	Pull-up resistor:	40 kΩ typ.
Digital Inputs:	Input voltage „high“:	2.0 Vmin
	Input voltage „low“:	0.8 Vmax
Analog:	Inputs:	4 channels
	Vref Input:	3.5 V .. 5.0 V
	Impedance inputs:	375 kΩ typ.
	Input Range:	0 .. 5 V (abs. max. = -0.3 .. 5.5 V)
	Input resolution:	to be selected by the according device driver 12 bit (physical resolution of A/D converter) 10 bit 8 bit 14 bit (oversample)
	Input accuracy:	typ. ± 2 LSB, ± Vref accuracy
	Sampling rate:	up to ~160 kS/sec depending on Device Driver used

USER_FREQUENCY SPEED_25	80 kS/sec. max
USER_FREQUENCY SPEED_50	160 kS/sec. max
USER_FREQUENCY SPEED_100	160 kS/sec. max

Sampling buffer:	up to 2 MB

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Electrical Specifications

- Serial channels: 2 UART channels:
  - CH-0: RxD, TxD, CTS, [RTS]
    Baudrates: up to 614 400 Bd
    Data/Parity: 7E, 7O, 8N, 8E, 8O, 9N
  - CH-1: as above, RxD and TxD lines
  - Level systems: 3.3 V TTL level, 5 V tolerant
  - Variable buffer-size: Up to 8 KB
- Serial channels (soft UARTs): Up to 8 additional serial I/O channels through software driver SER2_pp_xx.TD3.
  Selectable PIN functions: RxD, TxD, RxD + TxD, RTS, CTS, TE (RS 485)
- System timebase accuracy: ± 50 ppm base tolerance,
  ± 30 ppm over temp. range -20 °C to +70 °C add.drift.
  ± 5 ppm per year max. aging
- Reset: Reset input: LOW-active, internal pull-up R = 10 kΩ typ.
- I/O pins: 36 universal I/O-pins

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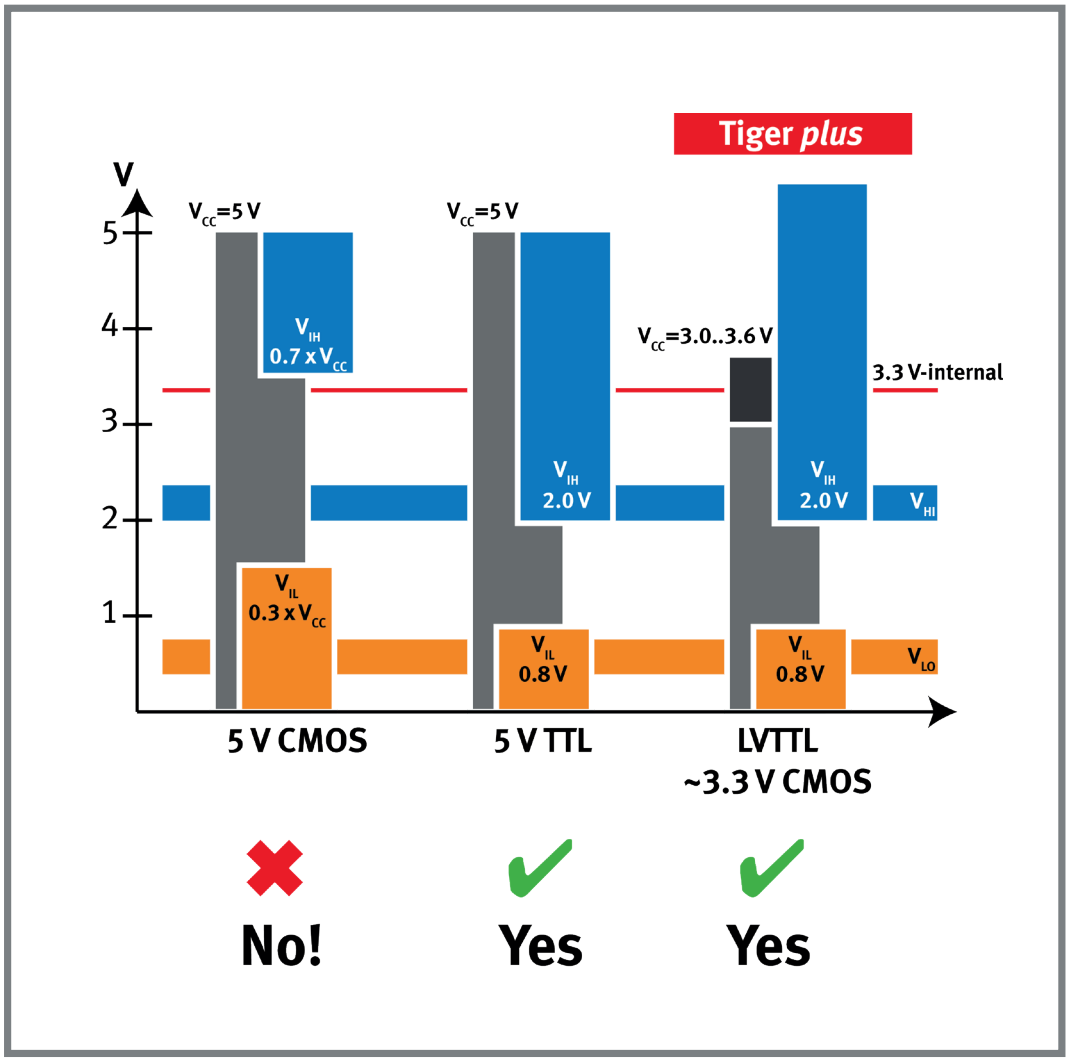
Specifications of Signal Levels



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Battery Backup-Tiger Generations 1,2&3

Gen-1	Tiger A	ACN...	2,7...4,5 V	50...300 µA	1 pin	RTC	SRAM
		ANN...	2,7...4,5 V	50...300 µA	1 pin		SRAM
	TinyTiger	TCN...	2,7...4,5 V	50...300 µA	1 pin	RTC	SRAM
		TNN...	2,7...4,5 V	50...300 µA	1 pin		SRAM
Gen-2	TinyTiger 2	T2CI...	2,7...4,5 V	15...50 µA	1 pin	RTC	
			2,7...4,5 V	50...300 µA	1 pin		SRAM

								NRB models:					
Gen-3	Tiger A ***plus*** ACN... plus	2,3...3,5 V	1...2 µA	1 pin	RTC	SRAM		2,3...3,5 V	1...2 µA	1 pin	RTC	SRAM	
		3,0...3,3 V	200..500 µA			SDRAM		~~3,0...3,3 V~~	~~200..500 µA~~			~~SDRAM~~	
	TinyTiger ***plus*** TCN... plus	2,3...3,5 V	1...2 µA	1 pin	RTC	SRAM		2,3...3,5 V	1...2 µA	1 pin	RTC	SRAM	
		3,0...3,3 V	200..500 µA			SDRAM		~~3,0...3,3 V~~	~~200..500 µA~~			~~SDRAM~~	
	TinyTiger 2 ***plus*** T2CI... plus	2,3...3,5 V	1...2 µA	1 pin	RTC	SRAM		2,3...3,5 V	1...2 µA	2 pins	RTC	SRAM	
		3,0...3,3 V	200..500 µA	1 pin		SDRAM		~~3,0...3,3 V~~	~~200..500 µA~~			~~SDRAM~~	

Note: Generation 3 Tigers, the „plus“ series, use SRAM memory for backup only and SDRAM as (optionaly buffered) normal working memory

Important Note:
(… ignore, if you don't use any Battery Backup in your application)

Battery Backup has changed since Tiger 1 and Tiger 2 generations.
Now in Generation 3 products, the Tiger plus modules, we have 3 function groups, that can be buffered by a battery or another secondary power source.
These 3 function groups are:
A) RTC
B) Backup-RAM = SRAM
C) Main-RAM = SDRAM

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Tiger 1 and Tiger 2 generations had only 2 function groups:
a) RTC
b) Main-RAM = Backup-RAM = SRAM

In both product groups, Tiger 1 and Tiger 2, as well as in Generation 3 Tigers (Tiger plus) we have modules with 1 Battery-Input pin only and modules with 2 Battery-Input pins – see details below.

Your Application
Depending on your application you may want to:

1. Use Real Time Clock and optionally Sleep & Wake Up
Have the RTC running no matter if the system is powered or not.
Also, you may want to go to deep sleep with the whole system or parts of it and get wake ups once in a while or by event.

In this case the RTC needs to be powered, to enable the "Alarm"-Pin function for deep sleep/wake up. The RTC power requirement is < 2 µA, allowing long term operation with a small backup battery.

An additional feature of the RTC is the "Voltage-Low-Flag" that can be tested in a power on sequence of the Tiger Programm, to detect if the RTC was always powered properly or not. Any interruption of RTC-powering is detected and can be used in the application program for further program flow.

2. Save Data
You may want to save data, as parameter settings, calibration data, life status information etc. in a secure, battery buffered RAM space.

Buffered RAM space is the Backup-RAM in Tiger plus series, which is powered together with the RTC, consuming in total < 2 µA. The available space in Backup-RAM is typically 2 kBytes.

To access this memory – see programming guide with examples: READ_BACKUP_RAM / WRITE_BACKUP_RAM.

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Secure storing of data in the Backup-RAM may be done under normal program control or, combined with a power fail detect signal and the execution of an interrupt task, to save important values when the system is powered down hard / unintentionally.

As Backup-RAM and RTC are powered always together, the "Voltage-Low-Flag" also is used to check reliably, if data in this memory is valid or not. No other CRC check or similar is needed.

3. Save Mass Data

You may want to save mass data on a regular or intermittent basis into the internal RAM. That can be done by powering the Main-RAM / SDRAM of Tiger plus modules.

The power requirements for the internal SDRAM are significantly higher than for the Backup-RAM, typically by a factor of 1.000 to 5.000 and a backup battery design has to be done accordingly.

Also, the SDRAM has 2 requirements to be fulfilled for proper operation:
- the battery voltage must not exceed 3,3 V
- during initial assembly the battery must never be connected to the battery input pin when the Tiger module is not powered. This would bring the SDRAM into an undefined state, instead of a defined sleep mode that is entered under system control of the Tiger Module in the power down phase.

To allow the system a controlled shut down, do not exceed the gradient of power supply voltage drop during power down of -1 kV/s, what normally is provided in all systems.
This requirement needs some attention to be met under all possible conditions:
(i) in the manufacturing process of your series product
(ii) as well as in any situation, when a Tiger Module gets removed from and re-plugged into the socket in your PCB.

Make sure, that the Tiger Module can bring the SDRAM into proper Sleep Mode through a power down sequence always.

Finally – you may consider data storage is also possible in the internal Data-FLASH as well as in external storage devices through I^2C / SPI Interfaces.

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Serial channels

Baudrates

	Syntax	Setting [Bd]	Actual Value	Deviation [%]
	BD_1_800	1 800	1 800,02	0,00
	BD_2_400	2 400	2 400,10	0,00
	BD_3_600	3 600	3 600,04	0,00
	BD_4_800	4 800	4 800,20	0,00
	BD_7_200	7 200	7 200,72	0,01
	BD_9_600	9 600	9 601,54	0,20
	BD_10_400	10 400	10 400,42	0,00
	BD_14_400	14 400	14 404,03	0,03
	BD_19_200	19 200	19 203,72	0,02
	BD_26_040	26 040	26 041,67	0,01
	BD_28_800	28 800	28 818,44	0,06
	BD_31_250	31 250	31 250,00	0,00
	BD_38_400	38 400	38 424,59	0,06
	BD_41_600	41 600	41 623,31	0,06
	BD_57_600	57 600	57 636,89	0,06
	BD_62_500	62 500	62 500,00	0,00
	BD_76_800	76 800	76 923,08	0,16
PC-Mode/	BD_100_000	100 000	100 000,00	0,00
Standard Download ▶	BD_115_200	115 200	115 273,78	0,06
	BD_153_600	153 600	153 846,15	0,16
	BD_230_400	230 400	231 213,87	0,35
	BD_250_000	250 000	250 000,00	0,00
	BD_307_200	307 200	307 692,31	0,16
Fast Download ▶	BD_312_500	312 500	312 500,00	0,00
	BD_614_400	614 400	615 384,62	0,16
xFast Download ▶	BD_625_000	625 000	625 000,00	0,00
	BD_631_579	631 579	634 920,63	0,53

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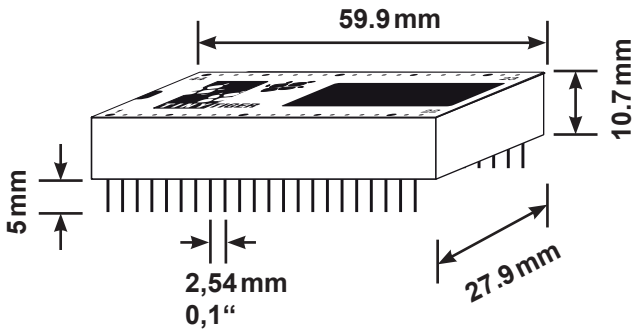
Physical Specifications

• Dimensions:	approx. 28.1 x 59.8 x 10.7 mm / 1.11 x 2.35 x 0.42“ 46-pin DIP type case
• Case type	pin to pin clearance 2.54 mm / 0.10“, row distance 22.86 mm / 0.9“
• Pin size	square pins 0.64 x 0.64 mm / 0.025 x 0.025“
• Case Dimensions:	



Dimensions identical with Tiny Tiger moduls of Generation 1 Product

Weight:	approx. 26 g / 0,92 ounces
• Operating temperature:	-40 to 85 °C Expanded: expanded temperature ranges on request
• Flash erase cycles:	Min. 10.000 cycles, typ. ~ 500.000
• Flash data retention:	› 10 years
• Flash sector size:	64 kB

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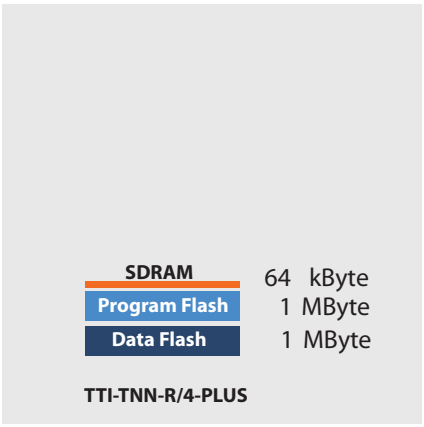
Physical Specifications

Memory constellation overview for TINY-Tiger plus module types

TNN-series	TCN-series	TINY-Tiger Pico



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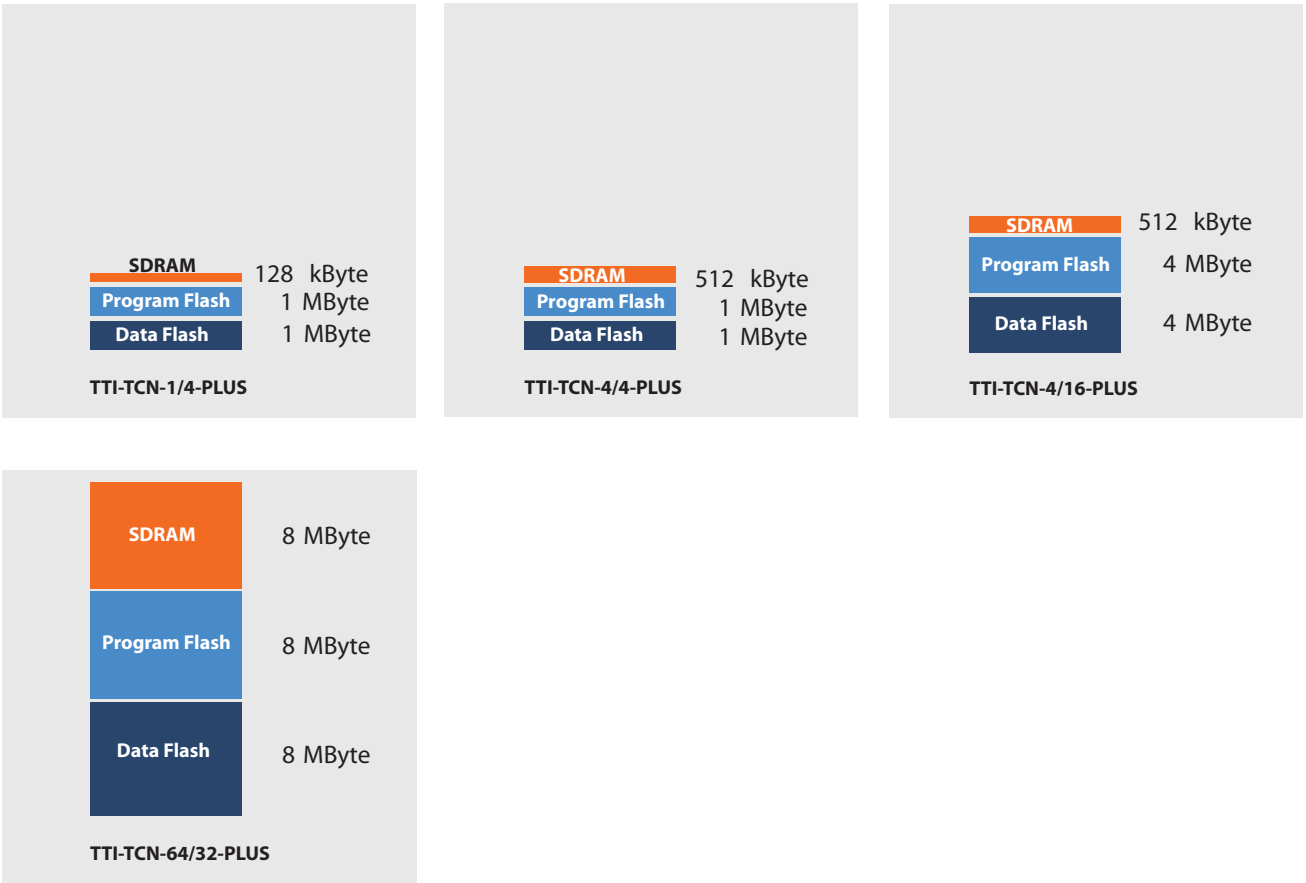
Physical Specifications

Memory constellation overview for TINY-Tiger plus module types

TNN-series | **TCN-series** | TINY-Tiger Pico



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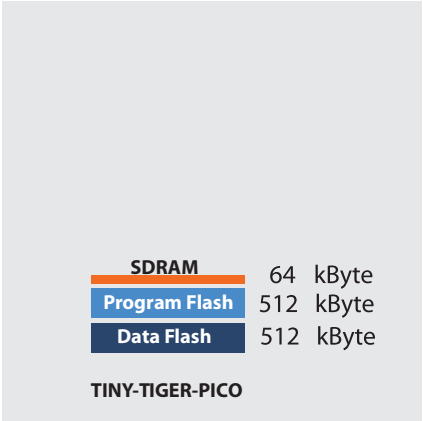
Physical Specifications

Memory constellation overview for TINY-Tiger Pico module types



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Cross References/Order Codes

Previous TINY-Tiger Modules

TINY-Tiger

Product Code	RAM	FLASH
TTI-TNN-R/4-R	32 kByte	512 kByte
TTI-TCN-1/4-R	128 kByte	512 kByte
TTI-TCN-4/4-R	512 kByte	512 kByte
TTI-TCN-4/16-R	512 kByte	2 MByte
New Module ⟶		
New Pico Module ⟶		

NEW TINY-Tiger Modules

TINY-Tiger ***plus***

Product-Code	RAM	Program Flash	Data Flash
TTI-TNN-R/4-PLUS	64 kByte	1 MByte	1 MByte
TTI-TCN-1/4-PLUS	128 kByte	1 MByte	1 MByte
TTI-TCN-4/4-PLUS	512 kByte	1 MByte	1 MByte
TTI-TCN-4/16-PLUS	512 kByte	4 MByte	4 MByte
TTI-TCN-64/32-PLUS	8 MByte	8 MByte	8 MByte
TINY-TIGER-PICO	64 kByte	512 kByte	512 kByte

Note: *plus* Series products offer and use more firmware resources, so at least use the recommended replacement type or larger part.
10+ years delivery guarantee.

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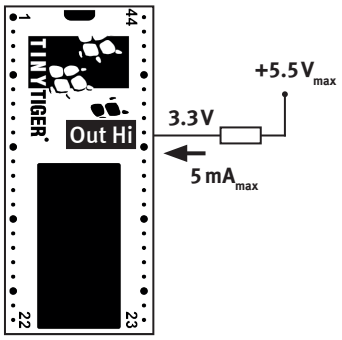
5 Volt I/O-Tolerance Conditions

V_{CC1} = +3.3V OR V_{CC2} = +5.0V



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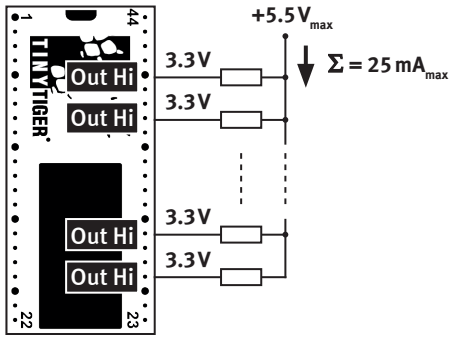

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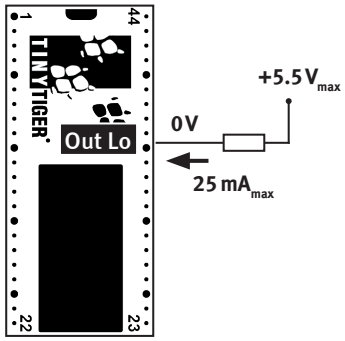

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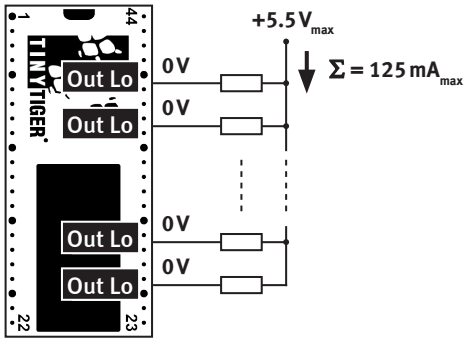

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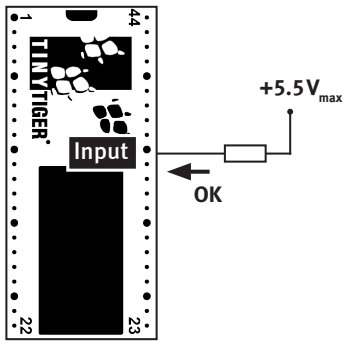
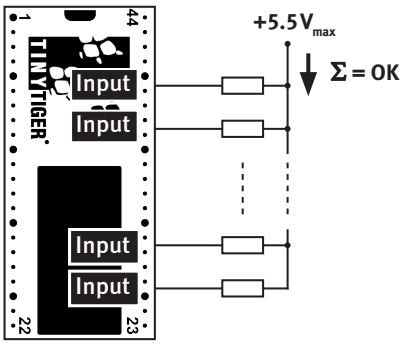


V_{CC1} = +3.3V OR V_{CC2} = +5.0V



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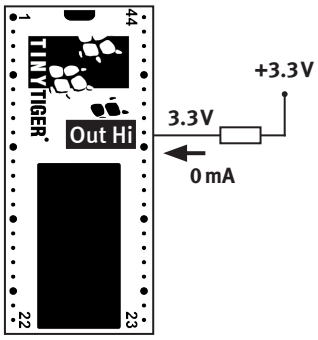
3.3 Volt I/O Conditions

V_{CC1} = +3.3V OR V_{CC2} = +5.0V



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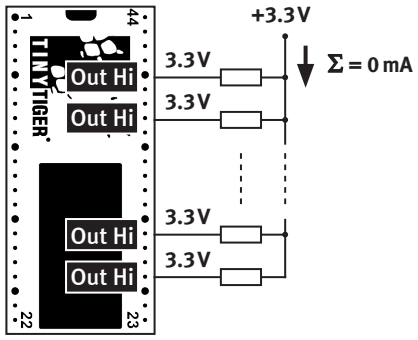

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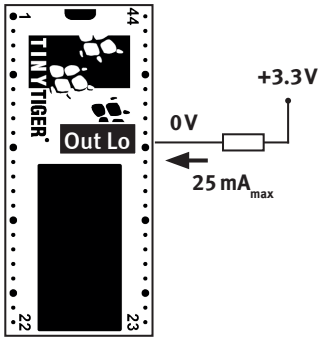

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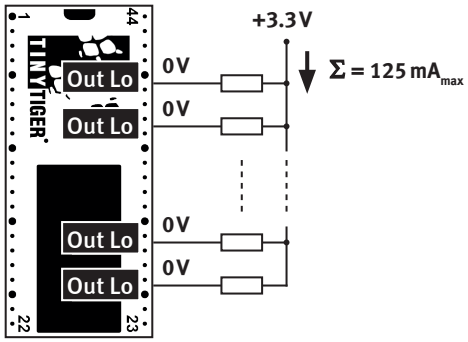

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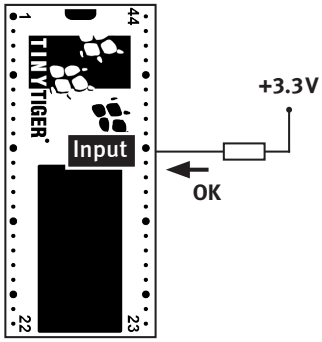

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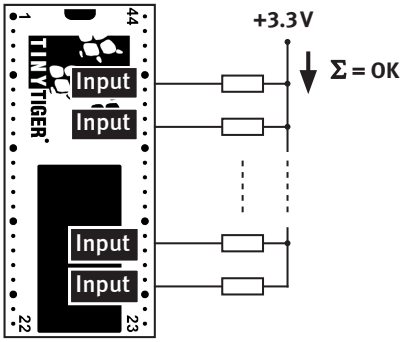

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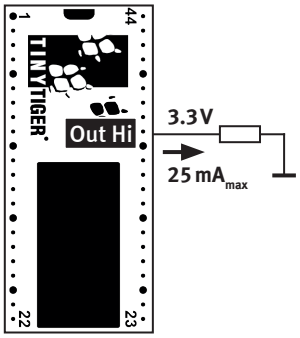
I/O Conditions to GND

V_{CC1} = +3.3V OR V_{CC2} = +5.0V



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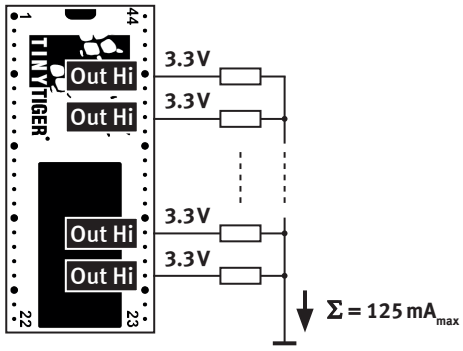

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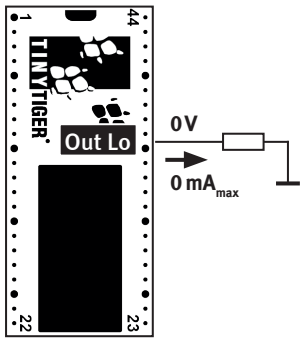

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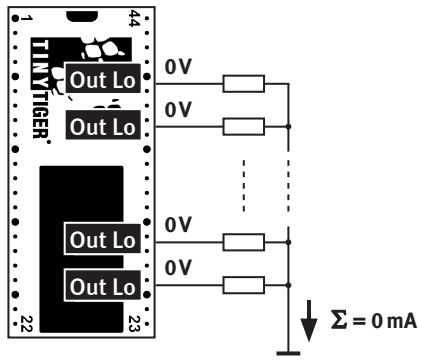

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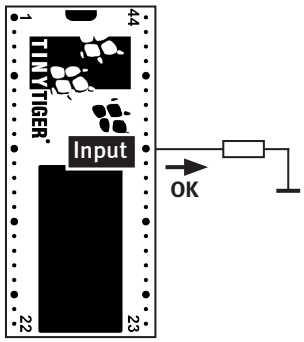

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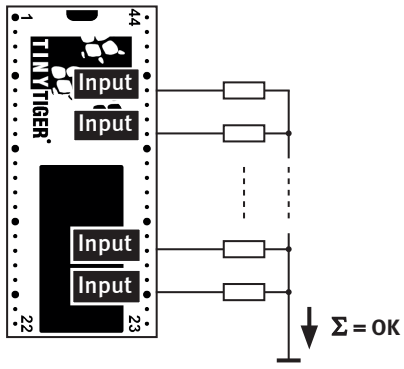

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Document Version History

V01	Electrical and physical specifications	November 3, 2015
V02	New electrical specifications	February 23, 2016
V03	Cross references	March 24, 2016
V04	Preliminary Data-Sheet	February 17, 2017
V05	First official release	September 20.2017
V06	Small Corrections an Design	October 27, 2017
V07	Design Corrections	November 09, 2017
V08	Corrections	August 13, 2018
V09	Physical Specifications: Flash sector size, Cross References/Order Codes	November 23, 2018
V10	Physical Specifications: Pico-series	April 18, 2019
V11	Corrections in Data Sheet	October 09, 2019
V12	New chapter added: Battery Backup-Tiger Generations 1,2&3. Physical specification correction: TTI-TNN-R/4-PLUS 32k -> 64k RAM. Version number added in the Header.	September 22, 2020

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