

Description

Ideally suited for IoT applications the Lantronix® xPico® Wi-Fi® embedded device servers are a family of extremely compact low power networking solution that enables IEEE 802.11 wireless LAN connectivity on virtually any solution with a SPI or serial interface. Lantronix' industry-proven device server application and full IP stack allows seamless remote access to device data simplifying design integration while providing robust connectivity.



The xPico Wi-Fi device servers are members of the Lantronix xPico product family providing unmatched flexibility whether it is Wi-Fi or Ethernet when it comes to choosing the right network device for your application. This document describes the xPico Wi-Fi surface mount technology versions. The xPico family also includes a functionally equivalent version of the Wi-Fi device (XPW1001000-01) that is provided in board to board connector that enables the interchangeability with the xPico embedded wired server (XPC1001000-01).

As one of the smallest embedded device server in the world, xPico Wi-Fi device server can be utilized in designs typically intended for chip solutions, benefitting in advantages to cost and time to market.

xPico Wi-Fi device servers are state-of-the-art and innovative solutions, that set new standards in reliability and functionality and offers all the capabilities one can expect including a unique simultaneous Soft-AP and Client mode.

A key benefit with xPico Wi-Fi device server is that there is virtually no need to write a single line of code, translating to a much lower development cost and faster time-to-market

xPico Wi-Fi device server are module approved, FCC Class B, UL and EN EMC and safety compliant.

Applications

Suitable example applications for the xPico Wi-Fi device server include such IoT applications as:

- ♦ Industrial
 - valve and sensor control,
 - Lock and access systems,
- ♦ Energy Management
 - Smart Meter Connectivity
- ♦ Medical
 - Connecting Infusion pumps to hospital IT
- ♦ Home Automation
 - water softening devices networking
 - Controlling home appliances from mobile devices

Features

- ♦ Serial to Wi-Fi device server module with 802.11 b/g/n at 2.4GHz
- ♦ ARM Cortex M3 processor
- ♦ xPico SMT-76 castellation Form Factor
 - With on-board Antenna (est. 31.1mm x 18.3mm)
 - Without on-board Antenna (est. 26.1 mm x 18.31mm)
- ♦ Simultaneous SoftAP and client modes
- ♦ Supports Roaming, QuickConnect,
- ♦ Power Management Framework
- ♦ Low power of approximately 6µA standby
- ♦ Two serial ports (921Kbps) , SPI (30 MHz) , and up to 8 GPIO¹
- ♦ USB. 2.0 Full Speed device port with integrated PHY.
- ♦ Feature-rich device server application suite, Full IP stack, and web server
- ♦ 256-bit AES Encryption, WPA2-Personal
- ♦ Industrial operating temperature of -40° to +85° C
- ♦ 5-Year Warranty

¹ Some interfaces share module pins.

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1: Introduction

This data sheet describes the SMT models, xPico W1002 and W1003, which are all referred to generally as the Lantronix® xPico® Wi-Fi SMT family of embedded Wi-Fi device servers in this document.

The xPico W1002 and W1003 provide much of the circuitry and all of the software required to connect a micro controller or similar host device to an IEEE 802.11 b/g/n Wireless local area network (WLAN). The xPico W1000 family of device servers are available either in a very small and attractive 76-pad castellation surface mount package (SMT), or a connector version (xPico Wi-Fi device server, XPW1001000-01). The SMT form factor is itself available in two versions, with or without an onboard ceramic chip antenna.

For the purposes of this document the xPico W1002 and xPico W1003 modules will be referred to collectively as xPico Wi-Fi SMT embedded device servers.

For an embedded solution an external controller can connect through industry standard interfaces such as serial, SPI or USB 2.0 (Device) and with very little to no driver effort have the ability to connect and communicate to either an IEEE 802.11 b/g/n Access Point or Client.

The xPico Wi-Fi SMT device server is targeted for applications that have a need to be Wi-Fi enabled with requirements of low power, single channel 802.11 b/g/n, industrial ready and ready to go solution at a very competitive price.

The xPico Wi-Fi SMT device server is easy to integrate as Lantronix removes much of the design headaches by providing a platform with proven reliability with most of the necessary certification aspects taken care of and with very minimal software to develop.

The xPico Wi-Fi SMT device server supports the unique mode of simultaneous Soft Access Point (Soft-AP) and Client. As a device server the device provides all the necessary functional programmability and protocols to maintain an efficient and robust WLAN connection.

- ◆ no additional code needed on MCU (Zero Host Load)
- ◆ MAC address included
- ◆ Little to no software integration needed

The xPico Wi-Fi SMT device server benefits from the many years of experience Lantronix has with device servers, both wired and wireless. The xPico W1000 is easy to maintain. With technical support available and failsafe firmware upgrades from a remote manager.

Key features of the xPico Wi-Fi SMT device server include:

- ◆ Lantronix Feature-rich device server application suite
- ◆ Wi-Fi Client
- ◆ Soft AP with DHCP server
- ◆ Lantronix QuickConnect,
- ◆ Industrial Temperature Operation (-40° to +85° C)
- ◆ Robust and reliable firmware upgradability
- ◆ Web server
- ◆ DHCP & DNS server in AP mode
- ◆ Serial Tunnel

2: Hardware and Software Description

The xPico Wi-Fi SMT embedded device server is a complete solution (hardware and software). This powerful device server comes with a connection manager, a reliable and proven operating system stored in flash memory, an embedded web server, a full TCP/IP protocol stack, and standards-based (AES) encryption.

The xPico Wi-Fi SMT software runs on an ARM Cortex M3 controller and has an IEEE 802.11 b/g/n radio. The xPico Wi-Fi SMT device server communicates to the edge device through a serial, SPI or USB interface. The xPico Wi-Fi SMT device server runs on 3.3V, and has a built-in voltage supervisory circuit that will trigger a reset if the supply voltage drops to unreliable levels.

3: Package Description and Mechanical Footprint

The xPico Wi-Fi SMT device server is available in two package options.

xPico W1002 and xPico W1003 Device Servers

The xPico W1002 and XPCW1003 device servers are both surface mount modules that has the following dimensions and pad layout. The primary difference is the xPico W1003 module has an increase in size to accommodate the on-module antenna. Both devices have the same castellation and pad configuration and footprint.

Figure 1: xPico W1002 (XPC W1002) Embedded Device Server



Figure 2: xPico W1003 (XPC W1003) Embedded Device Server



Dimensions

The size and thickness of the xPico W1002 device server SMT module is without the on-module antenna is (estimated) 26.1 mm (L) x 18.3 mm (W) x 4.0mm (H) +/- 0.1 mm (including shielding). The PCB footprint is shown in [Figure 34](#).

Figure 3: Mechanical Footprint for xPico W1002 (without On-Module Antenna) Device Server

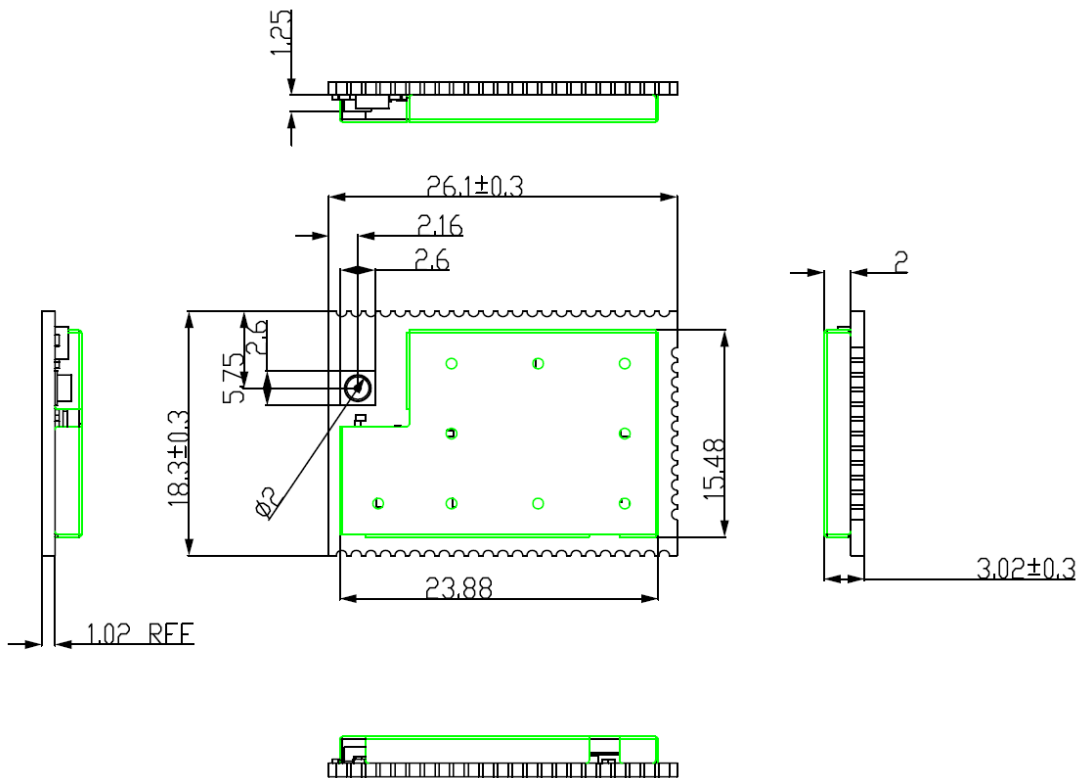
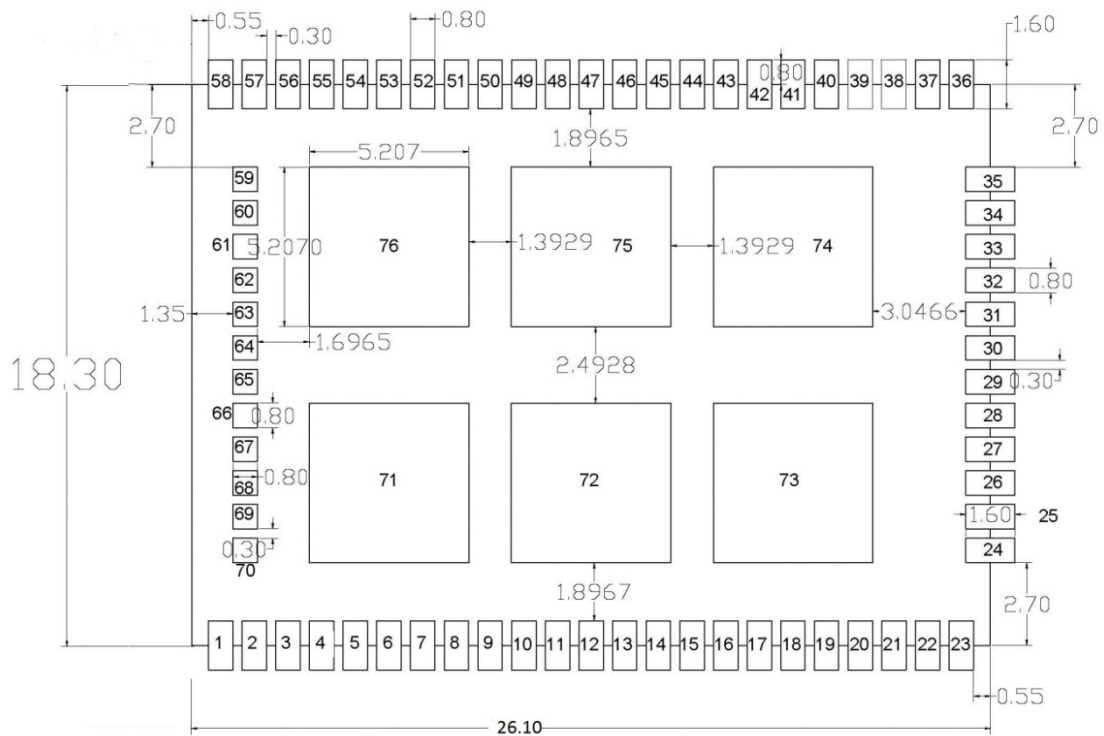


Figure 4: Layout Footprint for xPico W1002 (without On-Module Antenna) Device Server



xPico Wi-Fi SMT Package Pad Layout

Table 1 below contains the definition of the xPico Wi-Fi SMT pads and signals.

Table 1: xPico Wi-Fi SMT Package Pad Layout and Signals

PAD#	xPico® Wi-Fi SMT	PAD#	xPico® Wi-Fi SMT	PAD#	xPico® Wi-Fi SMT	PAD#	xPico® Wi-Fi SMT
1	GND	2	RF1	3	GND	4	RESERVED
5	GND	6	RESERVED	7	RESERVED	8	RESERVED
9	RESERVED	10	RESERVED	11	RESERVED	12	CP3/MISO
13	CP4/MOSI	14	CP7/SCK	15	CP8/CS	16	CP5
17	CP6	18	USB1+	19	USB1-	20	GND
21	RESERVED	22	RESERVED	23	GND	24	GND
25	RESERVED	26	RESERVED	27	GND	28	RESERVED
29	RESERVED	30	RESERVED	31	RESERVED	32	GND
33	RESERVED	34	RESERVED	35	GND	36	GND
37	RESERVED	38	RESERVED	39	WAKE	40	DEFAULT#
41	SYS_LED	42	CP2/INT	43	RESERVED	44	RESERVED
45	CP1	46	RESERVED	47	LED0/LNK	48	VCC
49	VCC	50	VCC	51	RESET#	52	RXD2
53	TXD2	54	CTS1	55	RTS1	56	RXD1
57	TXD1	58	GND	59	RF1_CTL	60	GND
61	GND	62	RESERVED	63	RESERVED	64	GND
65	GND	66	RESERVED	67	RESERVED	68	RESERVED
69	GND	70	GND	71	GND	72	GND
73	GND	74	GND	75	GND	76	GND

Pin and Pad Definitions

Table 2 describes the xPico Wi-Fi interface signal definitions as used in the SMT modules. The Signal Name column identifies the signal pin being described while the Description column provides definitions of the signal pin depending upon the member of the xPico family being used. Differentiating the signal pins is beneficial when using multiple xPico device types on a single platform.

Table 2: xPico Wi-Fi Interface Signal Definitions:

SMT Pad Number	Signal Name	Description	Reset State	Internal Pull-up/Pull Down	Drive Strength
1, 3, 5, 20, 23, 24, 27, 32, 35, 36, 58, 60, 61, 64, 65, 69, 70, 71, 72, 73, 74, 75, 76	GND	Signal Ground			
2	RF1	RF antenna pad			
4, 6, 7, 8, 9, 10, 11, 21, 22, 25, 26, 28, 31, 33, 34, 46, 30, 29, 37, 38, 43, 44, 62, 63, 66, 67, 68	RESERVED	No Connect, Reserved for Future Use			
12	CP3/MISO	Configurable GPIO / SPI Master serial data input, SPI Slave serial data output	Input, Floating	30K to 50K	8mA
13	CP4/MOSI	Configurable GPIO / SPI Master serial data output, SPI Slave serial data input	Input, Floating	30K to 50K	8mA
14	CP7/SPI_CLK	Configurable GPIO / SPI clock	Input, Floating	30K to 50K	8mA
15	CP8/SPI_CS	Configurable I/O, multiplexed with SPI interface Chip Select	Input, Floating	30K to 50K	8 mA
16	CP5	Configurable GPIO	Input, Floating	30K to 50K	8mA
17	CP6	Configurable GPIO	Input, Floating	30K to 50K	8mA
18	USB1+	USB (Positive)			
19	USB1-	USB (Negative)			
39	WAKE	System Wake Up or Shutdown	Input, Floating	30K to 50K	
40	DEFAULT#	Unit reset to default, active low. Drive low to reset unit to default settings.	Input, Floating	30K to 50K	
41	SYSTEM_LED	System Status LED, Active High	Input, Floating	30K to 50K	8mA

SMT Pad Number	Signal Name	Description	Reset State	Internal Pull-up/Pull Down	Drive Strength
42	CP2/SPI_INT	Configurable GPIO / SPI interrupt External Interrupt input	Input, Floating	30K to 50K	8mA
45	CP1	GPIO	Input, Floating	30K to 50K	8mA
47	Wi-Fi LED	LED function for WLAN Link indication, Active Low	Input, Floating	30K to 50K	8 mA
48, 49, 50	VCC	3.3V Power Input			
51	RESET#	Unit hardware reset, active low. Drive low to reboot unit	Input Pull up	30K to 50K	
52	RXD2	UART2 serial receive data input	Input, Floating	30K to 50K	
53	TXD2	UART2 serial transmit data output	Input, Floating	30K to 50K	8mA
54	CTS1	UART1 clear to send	Input, Floating	30K to 50K	
55	RTS1	UART1 serial ready to send (DTE)	Input, Floating	30K to 50K	8mA
56	RXD1	UART1 Serial receive data input	Input, Floating	30K to 50K	
57	TXD1	UART1 serial transmit data output	Input, Floating	30K to 50K	8mA
59	RF1_CTL	Antenna Switch control. Pull low to select an external antenna connected to the RF1 pad (pin 2). Note XPCW1002 only.	Input Pull up	100K	

MSL Handling Instructions

CAUTION: THIS BAG CONTAINS MOISTURE-SENSITIVE DEVICES.

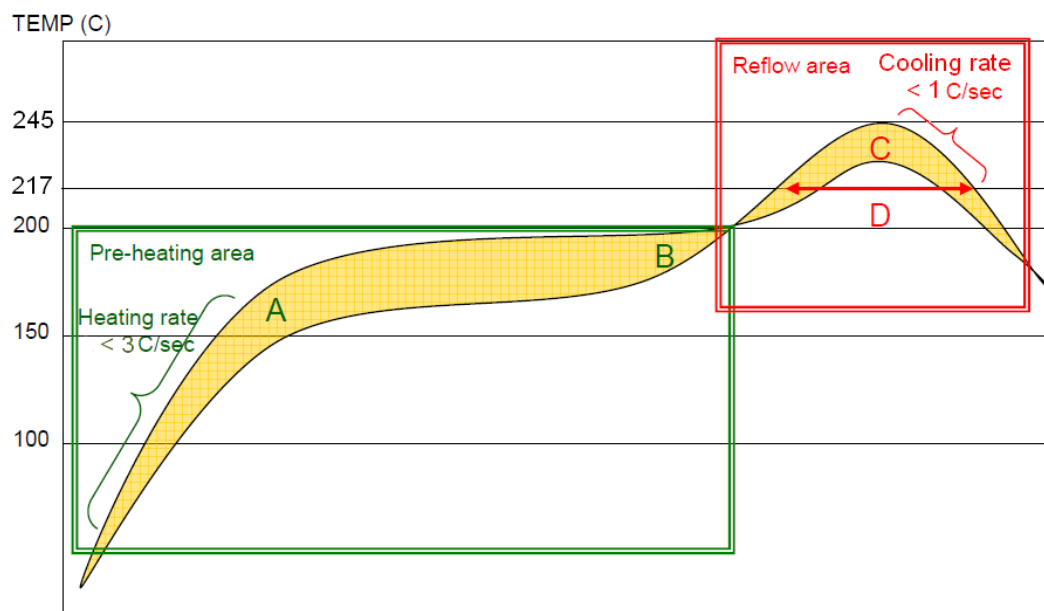
- Shelf life in sealed bag: 12 months at <40°C and <90% relative humidity (RH)
- After this bag is opened, devices that will be subject to reflow solder or equivalent processing (peak package body temperature of 250°C) must be:
 - Mounted within 168 hours at factory conditions of <30°C, 60% RH,
 - Stored at per J-STD-033
- Devices require bake, before mounting, if:
 - Humidity Indicator Card reads >10% when read at 23°C +/- 5°C,
 - Condition 2a or 2b are not met
- If baking is required, refer to IPC/JEDEC JSTD 033 for bake procedure. If the product is baked, it shall be for 16 hours.

Reflow Profile Guideline

The reflow profile is dependent on many factors including flux selection, solder composition, and the capability of user's reflow equipment.

USI does not recommend a specific reflow profile but provides the following general guidelines:

- ◆ The solder composition typically sets the peak temperatures of the profile.
- ◆ Recommend lead free solder pastes SAC305: Type 4, water soluble or no clean are acceptable.
- ◆ Reflow equipment needed at least nine heater zones. Recommend forced air type reflow oven with Nitrogen.
- ◆ It is recommended that the peak temperature at the solder joint be within 235°C ~ 245°C and the maximum component temperature should not exceed 245°C.
- ◆ It is recommended that time above 217°C for the solder joints is between 40-90s, and with a minimum of 40s.
- ◆ Excessive ramp/cooling rates ($>3^{\circ}\text{C/s}$) should be avoided.
- ◆ To develop the reflow profile, it is recommended that the user place thermocouples at various locations on the assembly to confirm that all locations meet the profile requirements. The critical locations are the solder joints of SiP Module.
- ◆ When developing the reflow profile, it is recommended that the actual fully loaded assembly be used to make sure that the total thermal mass is accounted for.



- (1) Solder paste alloy: SAC305(Sn96.5/Ag3.0/Cu0.5)(Lead Free solder paste is recommended by USI.)
- (2) A-B. Temp.(Pre-heat): 150~200°C; soak time:60~120sec.
- (3) C. Peak temp: <245°C
- (4) D. Time above 217 °C: 40~90sec.
- (5) Suggestion: Optimal cooling rate is <1°C/sec. from peak to 217 °C.
- (6) Nine heater zones at least for Reflow equipment.
- (7) Nitrogen usage is recommended and the oxygen concentration is controlled less than 1500 ppm.

Note: Need to inspect solder joint by X-ray post reflow.

4: Host Interfaces

The xPico Wi-Fi SMT device server offers a number of industry common interfaces to allow for easy connectivity to the module. These include UART for asynchronous serial communication, serial peripheral interface, for synchronous formatted data and USB host interface.

UART

- ◆ The xPico Wi-Fi SMT device server supports two UART interfaces (UART1, UART2)
- ◆ Both UARTs support asynchronous data rate up to 921 Kbps, with Odd/Even parity, and 1 & 2 stop bits
- ◆ Software flow control (XON, XOFF) for both UART1 and UART2
- ◆ Modem control (DTR, DCD) pins for UART1 only. Enabled by device configuration as pins are shared with configurable pins (CPs)
- ◆ Operational mode as a DTE device
- ◆ UART1 – supports TX, RX, RTS, CTS (hardware flow control)
- ◆ UART2 – supports TX, RX functions only. Hardware flow control is supported by using software controlled configurable pins.

Table 3: xPico UART Signal Definitions

Signal	SMT Pin	Description
TXD1	57	Serial Port 1 Transmit Data output
RXD1	56	Serial Port 1 Receive Data Input
RTS1	55	Serial Port 1 Ready-to-Send/ Serial Transmit Enable
CTS1	54	Serial Port 1 Clear to Send
TXD2	53	Serial Port 2 Transmit Data output
RXD2	52	Serial Port 2 Receive Data Input
RTS2	*	Serial Port 2 Ready-to-Send/ Serial Transmit Enable
CTS2	*	Serial Port 2 Clear to Send
* Note: Serial Port 2 Flow Control uses Configurable Pins, which can be shared with other functions. Refer to the xPico Wi-Fi Embedded Device Server User Guide for more information.		

Note: For xPico Wi-Fi 5V tolerant pins, in order to sustain a voltage higher than $V_{cc}+0.3$, the internal pull-up/pull-down resistors must be disabled. Refer to the xPico Integration Guide for more detail.

Serial Peripheral Interface (SPI)

The xPico Wi-Fi SMT device server has available a slave/master SPI interface that can be clocked at 30MHz. The SPI is multiplexed with five configurable GPIO pins and is managed by configuration at system initialization.

- ◆ Five Wire Interface consisting of Serial In, Serial Out, Chip Select, Serial Clock and Interrupt
- ◆ Configurable Master and Slave mode

Table 4: xPico W1001 UART Signal Definitions

Signal	SMT Pin	Description
SPI_INT	42	SPI interrupt External Interrupt input
SPI_CLK	14	SPI clock
MISO	12	SPI Master serial data input, SPI Slave serial data output
MOSI	13	SPI Master serial data output, SPI Slave serial data input
SPI_CS	15	SPI Chip Select

Note: For xPico Wi-Fi 5V tolerant pins, in order to sustain a voltage higher than $V_{cc}+0.3$, the internal pull-up/pull-down resistors must be disabled. Refer to the xPico Integration Guide for more detail.

Figure 8 shows the relative timings on the SPI interface of the xPico Wi-Fi module.

Figure 7: SPI Timing Diagram - Slave Mode

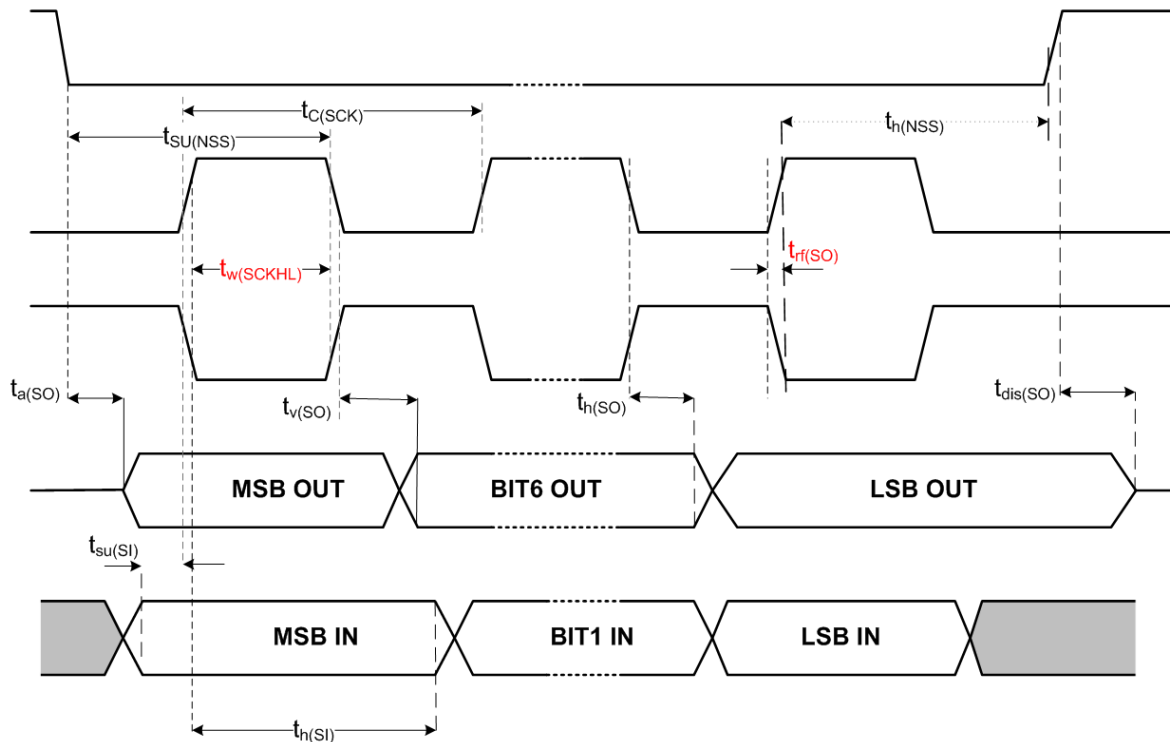
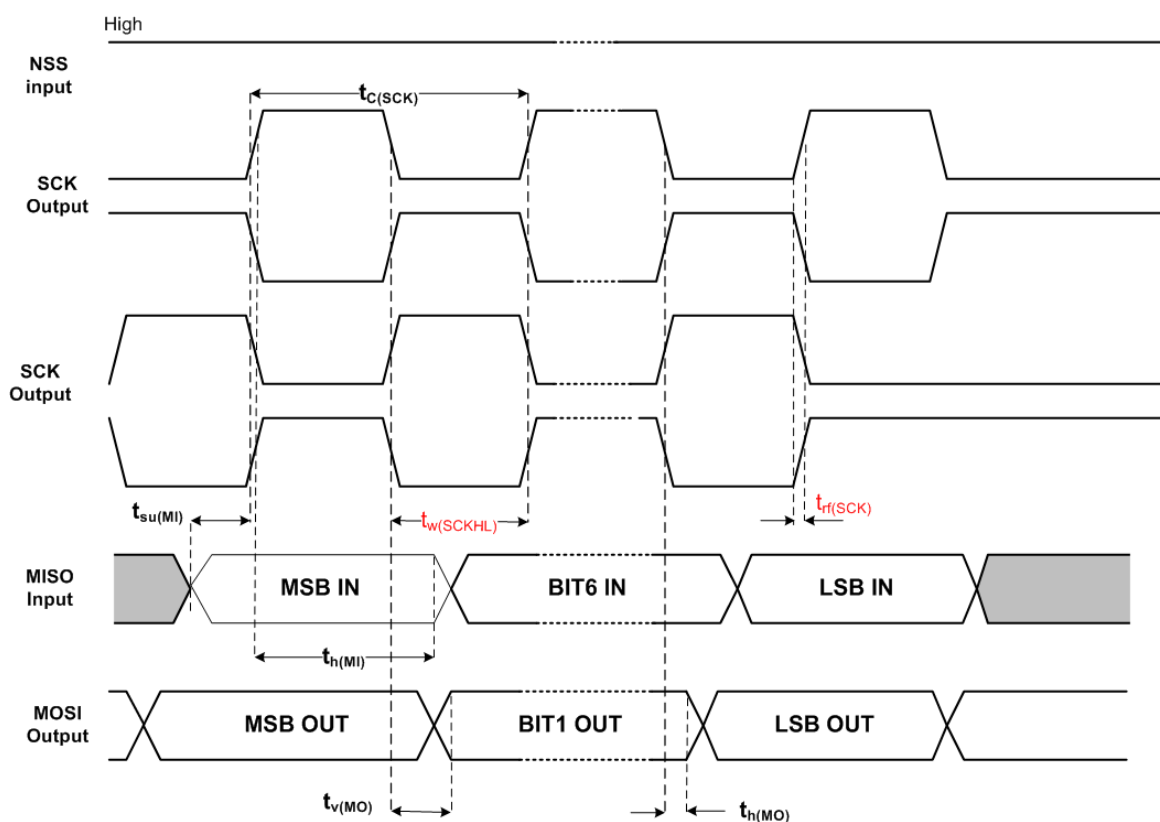


Figure 8: SPI Timing Diagram – Master Mode



See the *xPico Wi-Fi Embedded Device Server User Guide* for information on how to configure and use the SPI interface and its modes.

SPI Interface Characteristics

Unless otherwise specified, the parameters given in *the table below* for SPI are derived from tests performed under the ambient temperature of +25C, and VCC = 3.3V.

Table 5: SPI Characteristic

Symbol	Parameter	Conditions	Min	Max	Unit
f_{SCK} $1/t_{c(SCK)}$	SPI clock frequency	Master mode	-	30	MHz
		Slave mode	-	30	
$t_{r(SCL)}$ $t_{f(SCL)}$	SPI clock rise and fall time	Capacitive load: C=30pF		8	Ns
DuCy(SCK)	SPI slave input clock duty cycle	Slave mode	30	70	%
$t_{su(NSS)}^{(2)}$	NSS setup time	Slave mode	$4t_{PCLK}$	-	Ns
$t_{h(NSS)}^{(2)}$	NSS Hold time	Slave mode	$2t_{PCLK}$	-	

Symbol	Parameter	Conditions	Min	Max	Unit
$t_{w(SCLH)}^{(2)}$ $t_{w(SCLL)}^{(2)}$	SCK high and low time	Master mode, $f_{PCLK}=30\text{ MHz}$, $presc=2$	$t_{PCLK}-3$	$t_{PCLK}+3$	
$t_{SU(MI)}^{(2)}$ $t_{SU(SI)}^{(2)}$	Data input setup time	Master mode	5	-	
		Slave mode	5	-	
$t_{h(MI)}^{(2)}$ $t_{h(SI)}^{(2)}$	Data input hold time	Master mode	5	-	
		Slave mode	4	-	
$t_{a(SO)}^{(2)(3)}$	Data output access time	Slave mode, $f_{PCLK}=20\text{ MHz}$,	0	$3t_{PCLK}$	
$t_{dis(SO)}^{(2)(4)}$	Data output disable time	Slave mode	2	10	
$t_{v(SO)}^{(2)(1)}$	Data output valid time	Slave mode (after enable edge)	-	25	
$t_{v(MO)}^{(2)(1)}$	Data output valid time	Master mode (after enable edge)	-	5	
$t_{h(SO)}^{(2)}$	Data output hold time	Slave mode (after enable edge)	15	-	
$t_{h(MO)}^{(2)}$		Master mode (after enable edge)	2	-	
1. Remapped SPI1 characteristics to be determined.					
2. Based on characterization, not tested in production.					
3. Min. time is for the minimum time to drive the output and the max time is for the maximum time to put data in Hi-Z.					
4. Min time is for the minimum time to invalidate the output and the max time is for the maximum time to put the data in Hi-Z.					

USB Device

The xPico Wi-Fi SMT device server has one certified USB 2.0 Full Speed (12MHz) Device port interface for connection to an upstream USB device. The port uses an integrated PHY and provides a differential pair, signals DDP and DDM.

- ◆ Support for USB CDC/ACM Serial profile² which will have the xPico Wi-Fi module appear as a CDC/ACM device enumerated as a virtual COM port.

Table 6: xPico USB Signal Definitions

Signal	SMT Pin	Description
USB1+	18	USB1 Device Port Positive Pin
USB1-	19	USB1 Device Port Negative Pin

² Available in a future software release.

Configurable General Purpose I/O Pins (GPIO)

The xPico Wi-Fi SMT device server provides up to eight configurable General Purpose Input/Output (GPIO) pins. Certain of the GPIOs are multiplexed with other interface functions (e.g. SPI). Mapping of these functions to CPs will be driven via configuration and applied at system initialization.

Each CP can be configured as a general purpose input, general purpose output, microcontroller peripheral block or a soft function (e.g. modem control). These pins are 3.3V CMOS logic level and 5V input tolerant. For more information on how to use, configure and manage the utilization of the available GPIO please refer to the section on Configurable Pins in the *xPico Wi-Fi Embedded Device Server User Guide*.

Note: For xPico Wi-Fi 5V tolerant pins, in order to sustain a voltage higher than $V_{cc}+0.3$, the internal pull-up/pull-down resistors must be disabled. Refer to the *xPico Integration Guide* for more detail.

Table 7: xPico GPIO Signal Definitions

Signal	SMT Pin	Description
CP1	45	Configurable I/O
CP2	42	Configurable I/O-SPI interrupt input
CP3	12	Configurable I/O- SPI MISO
CP4	13	Configurable I/O-SPI MOSI
CP5	16	Configurable I/O
CP6	17	Configurable I/O
CP7	14	Configurable I/O-SPI Clock
CP8	15	Configurable I/O-SPI Chip Select

System Pins

The following system pins are available in the product

Table 8: xPico System Signal Definitions

Signal	SMT Pin	Description
WLAN LED	47	LED function for WLAN Link indication, Active Low. This signal is intended to drive an external LED. The blink patterns of the LED denote various WLAN states.
SYSTEM_LED	41	System Status LED, Active High. This signal is intended to drive an external LED. The blink patterns of the LED denote various system states.

Reset Pins

xPico Wi-Fi device server has two signals that can be used as reset signals.

Table 9: xPico Reset Signal Definitions

Signal Name	SMT Pin	Description
DEFAULT#	40	Unit reset to default, active low. While device is running, drive low for greater than 6 seconds, then release to reset unit to factory defaults. While device is held in reset(EXT_RESET# low), drive low, release reset to boot device with Line 1 CLI default settings (original configuration is preserved), then release DEFAULT# after CLI session is established.
EXT_RESET#	51	Unit hardware reset, active low. Assert low for a minimum of 50ms to reboot unit. Signal may be left floating.
WKUP	39	Toggle signal from low to high can wake device from Sleep or Standby mode. Hold low to allow device to enter Sleep or Standby mode. Subject to configuration settings. Signal may be left floating.

5: Power, Reset, Wake, and Default Timing

Figure 9: Timing Requirements for VCC, Reset, Default and Wake below shows the timing requirement for VCC, RESET#, DEFAULT#, and WAKE.

Figure 9: Timing Requirements for VCC, Reset, Default and Wake

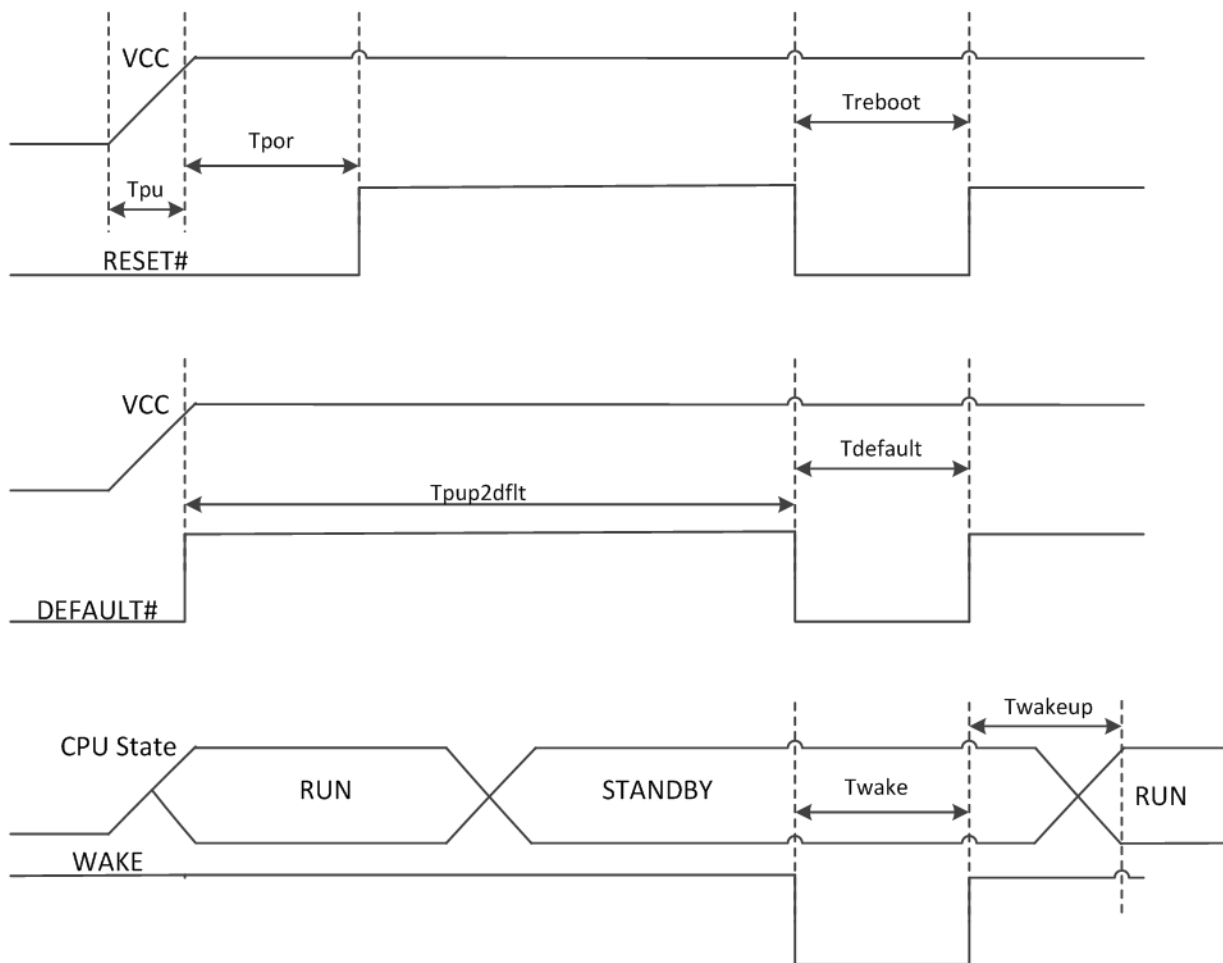


Table 10 below lists the various power sequence timing requirements.

Table 10: Power Sequence Timing Requirements

Parameter	Description	Minimum	Maximum	Unit
T _{pu}	Time for VCC to reach 90% of its maximum value	20		us/V
T _{por}	Time from VCC to reach 90% of its maximum value and de-assertion of external reset. Note RESET# can be left floating if unused	0		S
T _{reboot}	Recommended reset pulse for system reboot	300		ns
T _{pup2dfit}	Time from VCC power up to DEFAULT# assertion. Note DEFAULT# can be left floating if unused.	0		ns
T _{default}	Assertion time for DEFAULT# to unit reset to default and reboot	6		S
T _{wake}	Wake pulse width. Note wakeup is triggered on the rising edge. Note, WAKE signal may be left floating if unused.	1		us
T _{wakeup}	Time from rising edge of WAKE signal to system up		TBD	

6: Module Specifications

The following sections provide the specification and performance attributes of the xPico Wi-Fi SMT device server module.

IEEE 802.11 Wireless LAN Specifications

[Table 11](#) shows the specifications for the xPico Wi-Fi SMT device server IEEE 802.11 radio.

Table 11: xPico Wi-Fi Device Server Radio Specification

Feature	Description
Frequency Band	2.412 – 2.484 GHz (Channels 1 – 14)
Supported Data Rates	802.11n: 6.5, 13, 19.5, 26, 39, 52, 58.5, 65 Mbps 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11b: 1, 2, 5.5, 11 Mbps
Modulation	OFDM with BPSK, QPSK, 16-QAM, 64-QAM 801.11b with CCK and DSSS
Preamble Modes	Long, Short, HT (800 ns) modes
802.11 MAC Features	A-MPDU (Tx/Rx), WMM-PS, PSMP, Multiphase PSMP, Block Ack policy, RIFS AES (CCMP), TKIP, WEP 64/128-bit, WPA, WPA2
802.11 PHY Features	802.11b, 802.11g, 802.11n (Single-Stream) STBC Reception for extended range and higher throughput Greenfield mode (Tx/Rx)
802.11 modes	b/d/g/h/i/j/k/n/w/r

7: Antenna Connection Options

The xPico W1002 embedded device server supports wireless connectivity via the u.fl connector on the module and one RF SMT pad for external PCB antenna connection.

The xPico W1003 embedded device server offers an on-module ceramic chip antenna option only. The xPico W1003 module does not have the u.fl option or RF SMT pad for an external PCB antenna connection. xPico Wi-Fi SMT device servers are certified using the antennas listed in [Table 12](#) and [Table 13](#) below.

Refer to the compliance section below for certification requirements related to antenna selection.

Table 12: xPico Wi-Fi SMT Device Server External Antenna Options

Antenna Type	Peak Gain Typical	Vendor	Vendor Part Number
Swivel type antenna, with RP-SMA(M) connector	2 dBi, 2.4 GHz to 2.5 GHz	Wanshih	WSS002
PCB Strip Antenna with 50mm cable to U.FL connector With tape backing	1.5-2.5 dBi 2.4 GHz to 2.5 GHz	Ethertronics	1001077

Table 13: xPico Wi-Fi SMT Device Server On-Module Antenna

Antenna Type	Peak Gain Typical
On module ceramic chip antenna	2.5 dBi 2.4Ghz to 2.5Ghz

The xPico W1002 module provides an RF Pad/external trace option to solder a custom antenna to the device. The *xPico Integration Guide* provides guidelines on how to connect an external antenna to the device through a RF PCB trace transmission line. The integration guide also provides a reference design. The RF signal is available on RF1, pin 2, when RF_CTL, pin 59, is pulled low with a low ohm resistor.

Note: The xPico Wi-Fi SMT module has been certified with the on module chip antenna and the antennas listed above connected to the on module U.FL connector. Use of antenna connections to RF1, pin 2, may require re-certification.

8: General Technical Data

Table 14: General Technical Data

Category	Description
Firmware	OTA Upgradable
Internal Web Server	Serves Web Pages Storage Capacity: 512 KB
Weight	2.6 grams (xPico W1002 embedded device server) 2.75 grams (xPico W1003 embedded device server)
Material	Metal Shell
Temperature	Operating Range: -40°C to +85°C (-40°F to +185°F) Storage Range: 40°C to +85°C (-40°F to +185°F)
Relative Humidity	Operating: 5% to 85% no- condensing
Shock/Vibration	Non-operational Shock: 500 g's. Non-operational vibration: 20 g's.

9: Electrical Characteristics

Absolute Maximum Ratings

[Table 15](#) shows the maximum rating as specified for the xPico Wi-Fi SMT device server module.

Table 15: Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Units
Supply Power	VCC	-0.3	3.6	V DC
Operating Temperature		- 40	85	°C
Storage Temperature		- 40	85	°C

Recommended Operating Conditions

[Table 16](#) specifies the recommended operation conditions and Parameters for optimum performance of the xPico Wi-Fi SMT device server module.

Table 16: Recommended Operating Conditions for xPico Wi-Fi Module

Parameter	Symbol	Min	Typ	Max	Units
Voltage	VCC	3.0	3.3	3.6	V DC
Supply Voltage Ripple	VCC pp			± 2%	
Operating Temperature	T _a	-20		+70	°C
Extended Operating Temperature **	T _a	-40		+85	°C
Humidity (non-condensing, relative)				85	%
**					

Dynamic Power Management Modes

[Table 17](#) below describes the four Power Management modes for the xPico Wi-Fi SMT device server, along with their typical and maximum current consumption values. The xPico Wi-Fi SMT device server supports three modes within its Dynamic Power Management Framework. Power-up, Sleep and Standby Modes. Refer to page 34 for further information.

**Table 17: xPico Wi-Fi Power Management Modes
(Preliminary Data Based upon Test Modes)**

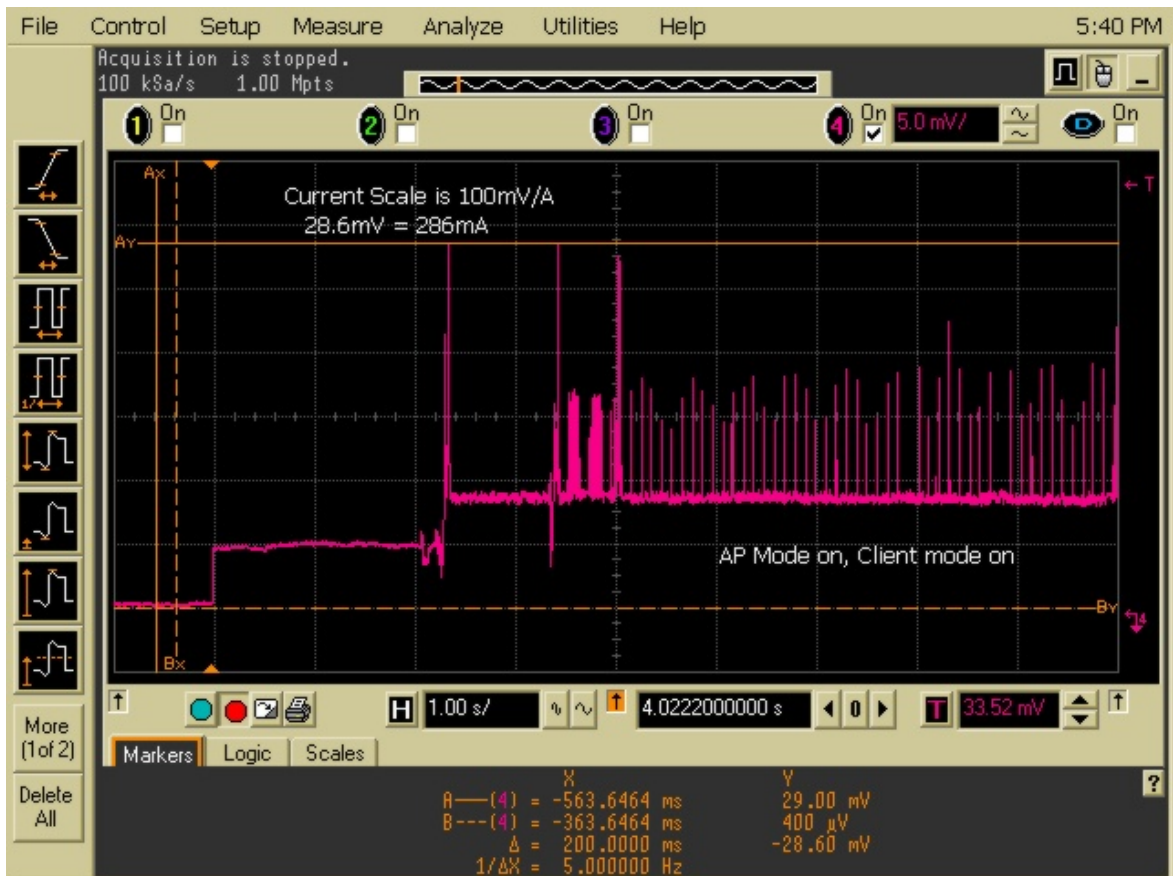
Parameter	Symbol	Min	Typical	Max	Units
AP mode enabled, WLAN0 connected to AP with ping. (Average current).	I _{CC}		90		mA
AP mode enabled WLAN0 disabled. (Average current)	I _{CC}		90		mA
Transmit surge current @ 16.5dBm, 802.11b, 11Mbps	I _{CC}		330	380	mA
Transmit surge current @ 15dBm, 802.11g, 6Mbps	I _{CC}		300	345	mA
Transmit surge current @ 13dBm, 802.11g, 54Mbps	I _{CC}		255	295	mA
Transmit surge current @ 14.5dBm, 802.11n, MCS0	I _{CC}		290	335	mA
Transmit surge current @ 12dBm, 802.11n, MCS7	I _{CC}		230	265	mA
AP mode enabled, WLAN0 connected to AP with 921Kbaud bi-directional serial traffic. (Average current)	I _{CC}		139		mA
WLAN0 power management enabled and connected to AP with no traffic , AP mode disabled (Average current)	I _{CC}		36		mA
WLAN0 power management enabled and connected to AP with bi-directional tunnel stream , AP mode disabled (Average current)	I _{CC}		76		mA
CPU Idle, RAM Contents Valid, Peripherals On, STA mode – connected to AP (PS-POLL active). (Average current)	I _{CC}		13.5		mA
Sleep Mode; CPU Sleep, RAM Contents Valid, Most peripherals ON, Radio – Deep Sleep (disconnected from AP). (Average current)	I _{CC}		3		mA
Standby Mode @ +25°C (Average current) Standby Mode – CPU Off, Radio Deep Sleep no association to AP, RTC Wake only. (Average current)	I _{CC}		6		uA
Standby Mode @ +85°C Standby Mode – CPU Off, Radio Deep Sleep no association to AP, RTC Wake only. (Average current)	I _{CC}		12		μA
Standby Mode @ -40°C Standby Mode – CPU Off, Radio Deep Sleep no association to AP, RTC Wake only. (Average current)	I _{CC}		5		μA

Wake to Ping Response Timing

Figure 10 shows the xPico Wi-Fi SMT device server current from initial power up to unit ping response.

Response time is typically 4 seconds. This includes all the start-up phases including network reconnection, receiving a ping and responding.

Figure 10: xPico Wi-Fi Current from WAKE from Standby to Ping Response (Preliminary)



Output Power

xPico Wi-Fi SMT device server module RF output power is listed in the [Table 18](#) below.

Table 18: RF Output Power (Preliminary)

Characteristics		TYP.	Criteria	Unit
RF Average Output Power, 802.11b CCK Mode	1 Mbps	16.5	± 1.5	dBm
	11 Mbps	16.5	± 1.5	dBm
RF Average Output Power, 802.11g OFDM Mode	6 Mbps	15	± 1.5	dBm
	54 Mbps	13	± 1.5	dBm
RF Average Output Power, 802.11n OFDM Mode	MCS0	14.5	± 1.5	dBm
	MCS7	12	± 1.5	dBm

EVM

xPico Wi-Fi SMT device server TX EVM follow the IEEE specification listed in [Table 19](#) below.

Table 19: xPico Wi-Fi EVM

Characteristics		EVM Value	Unit
RF Average Output EVM (11b)	1 Mbps	-10	dB
	11 Mbps	-10	dB
RF Average Output EVM (11g)	6 Mbps	-5	dB
	54 Mbps	-25	dB
RF Average Output EVM (11n)	MCS0	-5	dB
	MCS7	-28	dB

Receive Sensitivity

xPico Wi-Fi SMT device server module Rx sensitivity is listed in [Table 20](#) below.

Table 20: xPico Wi-Fi Device Server Module Rx Sensitivity

Receiver Characteristics	Minimum	TYP.
PER <8%, Rx Sensitivity @ 1 Mbps	-89	-93
PER <8%, Rx Sensitivity @ 11 Mbps	-84	-88
PER <10%, Rx Sensitivity @ 6 Mbps	-83	-87
PER <10%, Rx Sensitivity @ 54 Mbps	-70	-74
PER <10%, Rx Sensitivity @ MCS0	-83	-87
PER <10%, Rx Sensitivity @ MCS7	-67	-71

DC Characteristics – Digital I/O Signals

Table 21: xPico Wi-Fi SMT Device Server DC Characteristics

Symbol	Parameter	Conditions	Minimum	Typ	Maximum	Unit
VIL	Standard IO input low level voltage		-0.3		$0.28 (V_{DD} - 2) + 0.8$	V
	IO FT (1) input high level voltage		-0.3		$0.32 (V_{DD} - 2) + 0.75$	V
VIH	Standard IO input low level voltage		$0.41 (V_{DD} - 2) + 1.3$		$(V_{DD} + 0.3)$	V
	IO FT (1) input high level voltage	$(V_{DD} > 2)$	$0.42 (V_{DD} - 2) + 1.0$		5.5	V
		$(V_{DD} \leq 2)$			5.2	
Vhys	Standard IO Schmitt trigger voltage hysteresis(2)		200			mV
	IO FT Schmitt trigger voltage hysteresis		5% VDD (3)			
I _{lkg}	Input leakage current (4)	VSS ≤ VIN ≤ VDD Standard I/Os			±1	μA

Symbol	Parameter	Conditions	Minimum	Typ	Maximum	Unit
		VIN=5 V, I/O FT			3	
RPU	Weak pull-up equivalent resistor (5)	VIN=VSS	30	40	50	kΩ
RPD	Weak pull-down equivalent resistor (5)	VIN=VDD	30	40	50	kΩ
CIO	I/O pin capacitance			5		pF
FT = Five-volt tolerant. In order to sustain a voltage higher than VDD+0.3 the internal pullup/ pull-down resistors must be disabled. Hysteresis voltage between Schmitt trigger switching levels. Based on characterization, not tested in production. With a minimum of 100 mV. Leakage could be higher than max. if negative current is injected on adjacent pins. Pull-up and pull-down resistors are designed with a true resistance in series with a switchable PMOS/NMOS. This MOS/NMOS contribution to the series resistance is minimum (~10% order).						

Flash Memory

The xPico Wi-Fi SMT device server comes with the following memory profile:

MCU Embedded Flash Memory

The MCU embeds a 1Mbyte Flash memory. It is used to store the boot loader, production configuration data and program/firmware.

The firmware and production configuration data are programmed via the Firmware Upgrade application.

Additional SPI Flash

There is a separate on-module 1MByte SPI flash to extend the storage capacity. It is used as a file system store for customer files for serving via HTTP, logging files and for storing the firmware upgrade/recovery application.

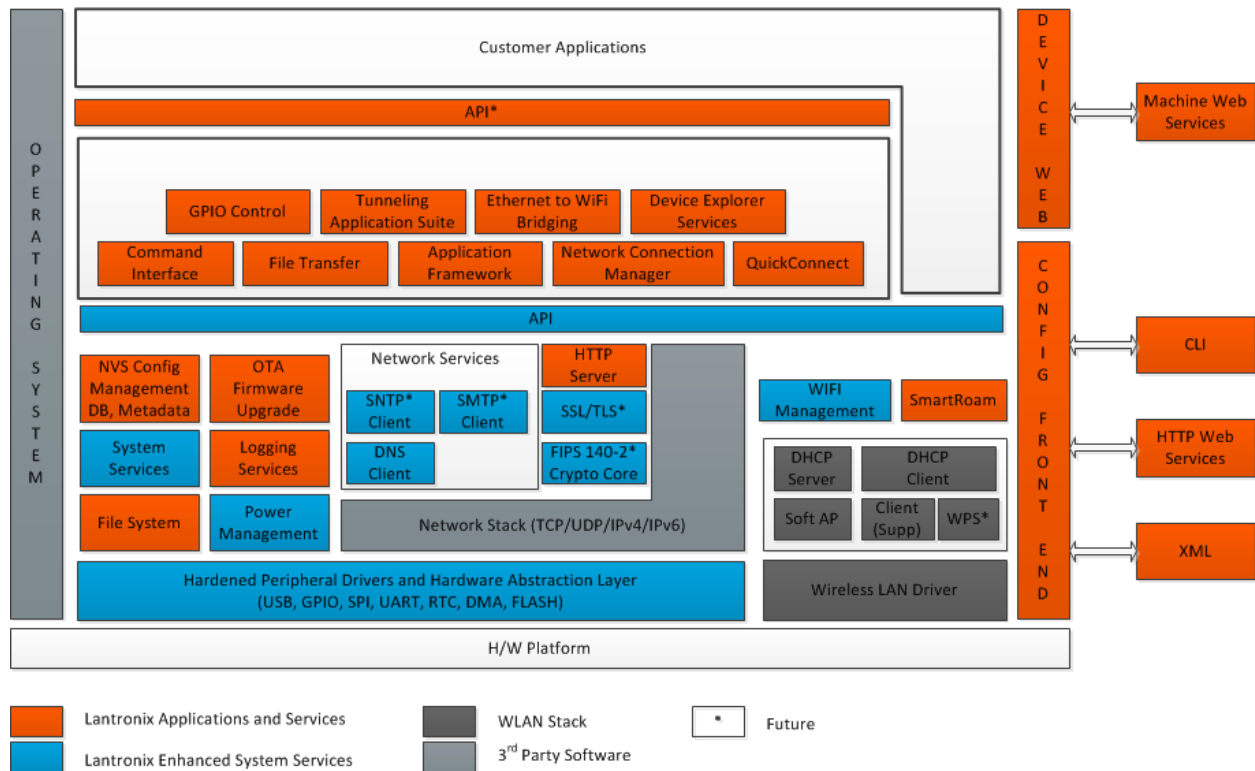
The features of the SPI Flash are as follows:

- ◆ 100,000 erase/program cycles (typical)
- ◆ 20 years data retention

10: Software Features

Software Architecture Overview

The following represents the functional block diagram and architecture of the Lantronix xPico Wi-Fi SMT family of embedded device servers.



The following features are provided with the xPico Wi-Fi SMT device server software.

Soft AP Mode w/ DHCP Server

The xPico Wi-Fi SMT device server has the ability of allowing up to four Wi-Fi clients to connect to a Soft Access Point in a simple and standard manner. The SoftAP also includes a DNS to allow access to pages served by the on device web server.

Simultaneous Client and AP interfaces

The xPico Wi-Fi SMT device server has the ability to operate as Wi-Fi Client and provide a Soft Access Point mode both at the same time. This allows the device to communicate to a network access point, while simultaneously allowing up to four other clients to connect to it.

Service personnel do not need to determine the credentials of the network in which their product is deployed in order to wireless gain access to the service interface on the product. Device communication is maintained across both the AP and client interface without interruption.

WLAN Connection Management

Managing connectivity to wireless networks, retrying on lost connections, ensuring IP level connectivity is maintained, working across re-configurations are all tasks that the WLAN Connection Manager handles out of the box.

Combined with other features such as WLAN QuickConnect and WLAN Profiles, a robust and full featured WLAN connection manager reduces connection downtime, enables quicker deployment and eliminates the complicated state management that has to be implemented on connected microcontrollers/devices to support such functionality.

WLAN QuickConnect

WLAN QuickConnect allows users to add setup/provision the wireless network configuration for the WLAN client interface quickly by presenting an intuitive workflow and user interface that is familiar to Smartphone users. It also simplifies the process of connecting to legacy wireless networks that use WEP security via the EasyWEP capabilities built into QuickConnect and the WLAN Connection Manager.

WLAN Profiles

In many scenarios, it is essential to store and connect automatically to one of multiple wireless networks available. WLAN Profiles makes it easy to configure and store the settings associated with these multiple networks.

Together with WLAN QuickConnect and the bulk configuration via XML, it makes the provisioning process very straightforward.

Lantronix Serial to Wi-Fi Tunneling Application

Lantronix offers multiple modes for connected device data acquisition and control. Depending on the nature of the application running on the connected microcontroller, these modes offer a flexible and robust out-of-the-box solution that has been deployed across millions of units.

The xPico Wi-Fi SMT device server also support the ability to enable AES encryption of the users TCP data for both Accept and Connect Tunnel Modes.

Transparent Tunneling Mode

Legacy applications running on microcontrollers that cannot be modified or where the requirements for data communication are simple, Transparent Tunnel mode provides a rich set of configuration options and knobs to manage the connection management, data framing and transfer process to suit many application protocol requirements.

The various features of transparent tunnel mode are:

- ◆ Accept Mode (Server mode for incoming connections)
- ◆ Connect Mode (Client mode for outbound connections)
- ◆ Triggered Connect Modes
- ◆ Hostlist Mode* (Multiple virtual serial session connectivity)
- ◆ Disconnect Mode (Session teardown options)
- ◆ Data Framing/Packetizing Options
- ◆ Session Establishment and Teardown trigger actions
- ◆ Choice of TCP, UDP*, TCP-AES, UDP-AES* encapsulation protocol

Modem Emulation Mode

Modem Emulation Mode supports the more traditional AT-command driven interface for microcontrollers that can support interactive connection control and would like to switch between control interface and data interface on demand.

It increases the overall state management complexity on the connected microcontroller compared to Transparent Tunnel mode, but can be helpful where knowledge and usage of AT commands (even though more complicated) is absolutely necessary

AES Security

The xPico Wi-Fi embedded device server supports the use of 256-bit AES encryption in order to provide security protection of the User Data. Tunneling Security for TCP AES is enabled for both Accept and Connect Tunnel configurations.

Application Aware Power Management Framework

The xPico Wi-Fi SMT device server is intended to be used in products that require or are sensitive to the amount of power they consume, for example battery powered applications. Consequently the power management framework for the xPico Wi-Fi embedded device server is intended to provide a framework that users can manage their device power consumption dependent upon their needs and requirements.

The framework offers application aware power modes that allow the user to choose the method that meets their needs for a compromise between power consumption and the time to respond, wake up and reacquire connectivity. It is generally accepted that the lowest power consuming mode results in a longer response time from the power saving state to being fully active and connected. The power management framework includes the ability to be managed by using a dedicated Wake-Up System Pin.

The Power Management Framework consists of three modes of operation.

1. Power Up Mode
2. Sleep Mode
3. Standby Mode

Power Up Mode

This is the only mode available if the Access Point is enabled or if none of the other Power Saving modes are enabled for the WLAN interface. Even in the Fully Active mode, the xPico Wi-Fi embedded device server provides some form of power savings capability. The xPico Wi-Fi module supports “ps-poll” capability where a STA makes an initial association with an access point, it negotiates and informs of its ability of going into a low power mode and what that low power duration is. The Access Point must be capable of supporting the standard capabilities of Traffic Indication Map (TIM) and Power Save Poll (ps-poll). The xPico Wi-Fi module automatically manages this capability in the Fully Active Mode.

Sleep Mode

Sleep mode causes the xPico Wi-Fi device to power down the Wi-Fi radio and system clocks while preserving the system state. This mode offers a compromise of power versus wake response time for those applications that need reduced power consumption with a speedy wake up and connection reacquisition response time.

Standby Mode

Standby mode of operation provides the lowest power consumption. In this mode the xPico Wi-Fi has the only the RTC operating and the system runtime state is not preserved. This mode has the longest wake up response time, since the system state has to be reinitialized and connections reacquired.

Flexible Configuration Management Framework

The xPico Wi-Fi SMT device server provides a unified framework in how the device can be controlled, configured and managed. For full details refer to the *xPico Wi-Fi Embedded Device Server User Guide*.

- XML Import and Export
- Save/Restore configuration on Flash
- Reset to Defaults – Command and Hardware Pin
- OEM Configuration Management
- TLOG Display and Syslog Redirection

Web Page Customization

The xPico Wi-Fi embedded device server includes an embedded Web Server. This Web Server provides the user a browser based configuration tool. The unit's configuration is stored in nonvolatile memory and is retained without power.

The Web Server has the ability to support the use of a custom landing page, which can take precedence over the default home page. The pages can be modified to suit a customer's need in regard changing Logos, Background and Color Scheme, visible menus and options. Custom pages are supported with data being capable of being sent or received to a connected host device.

SNTP Client

The xPico Wi-Fi SMT device server provides support for Simple Network Timing Protocol. This easy to configure integrated Client allows the user to be always be synchronized to Internet time. Time can be synchronized either by using XML on the serial port or by using WebAPI.

Lantronix Application Toolbox for IoT solutions

Lantronix Application Toolbox for IoT solutions (LATIS) is an architecture that uses application tools to support a easy to use “Customization by configuration” paradigm. An on device Application Server facilitates the simple interfacing of network interfaces/Web server to Host processor/Client with a common database/cache.

LATIS enables the user to create application specific customization of the end user product without the need to use an SDK or write software.

Custom user Data from a Web Page can be stored and used via the on device FLASH File system. Changes to data can initiate an interrupt that notifies a connected device to fetch the updated data.

Serial Multiplexer

As an interface serial ports tend to be used as a dedicated data channel between two points. With data generally being asynchronous with a simple “character” format that indicates the start and stop and sometimes error checking. With the xPico Wi-Fi embedded device server there is a need to establish multiple data channels in order to support multiple applications simultaneously. This requires the need to create a protocol that supports the differentiation of data.

The xPico Wi-Fi embedded device server provides a “Mux” Line Protocol for the serial Line to manage and transfer data on multiple connections without requiring custom software on the device. A host processor that is connected to the device via the serial Line sees a simple command/response interface. There are no intentional delays required in the normal handshake.

Over-The-Air Updates

xPico Wi-Fi SMT device server provides a robust and secure method for the updating of device firmware over the internet. This update process uses the existing WLAN configuration and preserves the user configuration and profiles.

Using the embedded web interface makes the update process simple and is user friendly. For a more scripted and automated method the same updates can be done via the WebAPI.

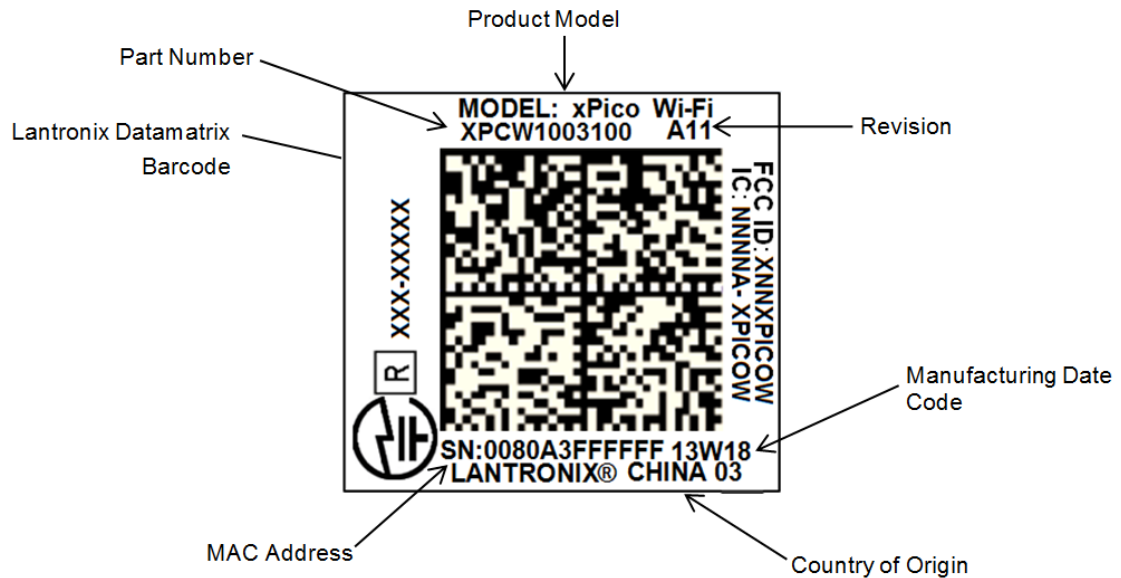
Lantronix Query Port

The xPico Wi-Fi embedded device server supports the Lantronix query Port discovery service. Query Port is a Lantronix proprietary protocol which implements a simple protocol on port 0x7FFE (30718). This service can be used by the Lantronix network tools such as Device Installer or ComPort Redirector.

11: Product Information Label

The product information label contains important information about your specific unit, such as its part number, revision, manufacturing date code, product model, country of origin, datamatrix barcode and MAC address.

Figure 11: xPico Wi-Fi Label



The xPico Wi-Fi SMT embedded device server uses the Datamatrix ECC200 barcode standard. The field definitions are as follows

Field	Description	Example
V1	Barcode format revision	1
C1	Field count.	6
P1	Part number of the module	XPCW1003100
R1	Revision of the module	A11
D1	Manufacturing Datecode of the module	14W20
L1	Country and Factory ID# of who manufactured the module	CHINA 03
S1	Serial number	0080A3980404
M1	MAC address	0080A3980404
E1	End of Barcode	

12: Warranty

The xPico Wi-Fi SMT device server comes with an industry best 5-year Warranty. For more details on the Lantronix warranty replacement policy, please go to our web site at www.lantronix.com/support/warranty.

13: Evaluation Kit

An xPico Wi-Fi device server evaluation kit is available to provide a simple, quick and cost effective way to evaluate the xPico Wi-Fi device server. Use the evaluation kit to integrate the device into to your product design and find out how simple, easy it is to get started.

In order to evaluate the xPico Wi-Fi SMT embedded device server Lantronix provides two evaluation kits:

- ♦ The XPCW1003100K, is a single board with the xPico Wi-Fi W1003 module mounted. This allows the simple use of the device and using the on module antenna version. The Board includes the necessary keep out areas, so performance and positioning can be evaluated.
- ♦ The second option is the XPCW1002100K, which is a bundle of an evaluation board plus the xPico Wi-Fi W1002 module on a carrier board. This system mounts the carrier board onto a 40-pin Hirose connector (same as used for the xPico Wi-Fi B2B connector version).

Expansion Boards

The xPico Wi-Fi XPW1001 embedded device server is also available as an expansion board for several popular microprocessor development and prototype platforms. Please see the list below for general information or refer to the xPico Wi-Fi product web pages at <http://www.lantronix.com/device-networking/embedded-device-servers/xpico-wifi.html>

14: Compliance

xPico Wi-Fi and xPico Wi-Fi SMT compliance information can be found in the *xPico Wi-Fi Embedded Device Server User Guide*. Visit the Lantronix Web site at <https://www.lantronix.com/support/documentation> for the latest Lantronix documentation.

15: Ordering Information

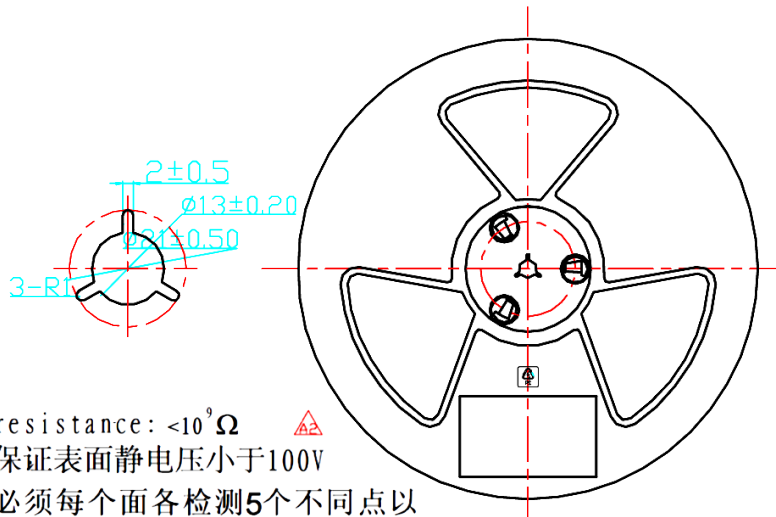
Part Number	Description
XPCW1002100B	xPico Wi-Fi Device Server, SMT, without on-module antenna, Bulk, MOQ 200
XPCW1002100S	xPico Wi-Fi Device Server, SMT, without on-module antenna, Sample
XPCW1003100B	xPico Wi-Fi Device Server, SMT, with on-module antenna, Bulk, MOQ 200
XPCW1003100S	xPico Wi-Fi Device Server, SMT, with on-module antenna, Sample
Evaluation and Expansion Boards	
XPCW1002100K	Evaluation kit including xPico Wi-Fi W1002 module on carrier board, power supply, PCB Strip antenna and whip antenna
XPCW1003100K	Evaluation kit including xPico Wi-Fi W1003 module, power supply
Accessories	
XPW100A003-01	PCB Strip Antenna

Packout Materials

REEL, PS, Black, 330*100*24 mm

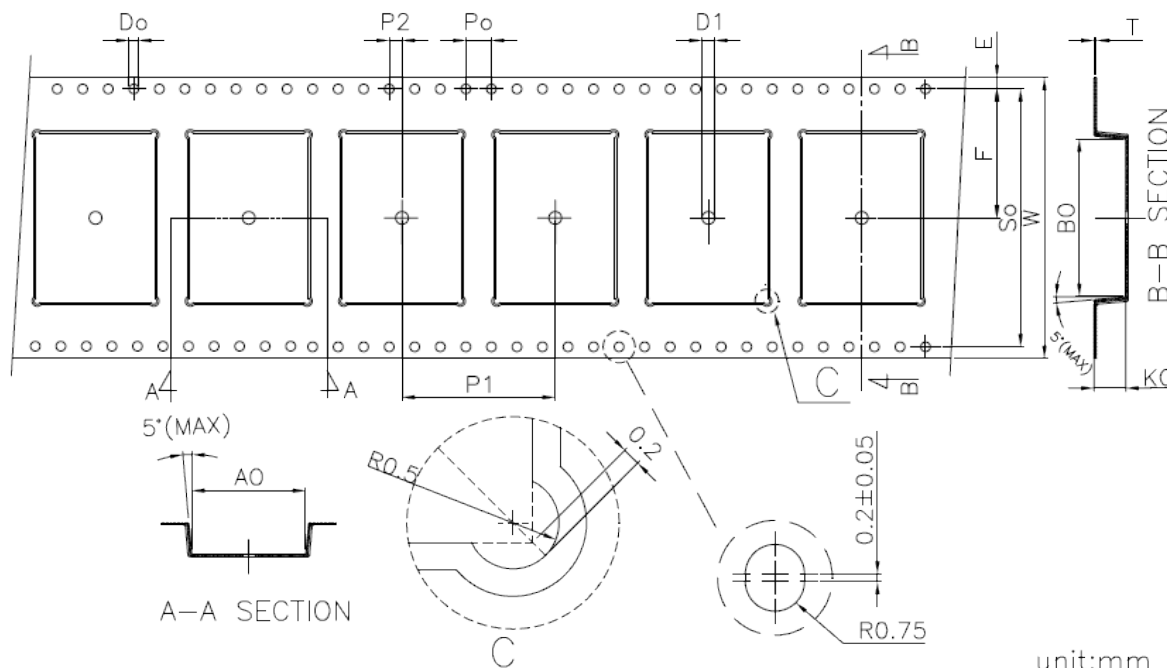
材料:

1. PS黑色
2. Surface resistance: $<10^9 \Omega$
3. 供应商须保证表面静电电压小于100V
进料检验必须每个面各检测5个不同点以上的静电电压值,电压值小于100V.



W	12mm	16mm	24mm	32mm	44mm	56mm	72mm	88mm
W1	13.5	17.5	25.5	33.5	45.5	57.5	74.0	90
W2	17.5	21.5	29.5	37.5	49.5	61.5	78.0	94

Carrier Tape, 18.3*26.1*3.02



unit:mm

symbol	Ao	Bo	Ko	Po	P1	P2	T
Spec	18.70±0.10	26.50±0.10	3.50±0.10	4.0±0.10	24.0±0.10	2.0±0.15	0.30±0.05
symbol	E	F	Do	D1	W	10Po	So
Spec	1.75±0.10	20.20±0.15	1.50 ^{+0.10} ₋₀	2.0(MIN)	44.0±0.30	40.0±0.20	40.40±0.20

NOTICE:

1. 10 Sprocket hole pitch cumulative tolerance is $\pm 0.20\text{mm}$.
2. Carrier camber shall be not more than 1mm per 100mm through a length of 250mm.
3. Ao & Bo measured on a place in the middle of corner radii.
4. Ko measured from a place on the inside bottom of the pocket to top surface of carrier.
5. Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole.
6. Surface resistivity: $< 10^9 \Omega/\text{square}$

Contact Information

For details contact your local Lantronix representative or Lantronix directly:

- ◆ Asia Pacific Region via e-mail at AsiaPacific_sales@lantronix.com
- ◆ Europe via e-mail at eu_sales@lantronix.com
- ◆ Japan via e-mail at japan_sales@lantronix.com
- ◆ United States via e-mail at sales@lantronix.com or call OEM sales support at 800-526-8764

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