

ESP8089M16

Datasheet



Version 1.0
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About This Guide

This document provides introduction to the specifications of ESP8089M16 module.

Release Notes

Date	Version	Release notes
2017.07	V1.0	First release.

Documentation Change Notification

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1.

Overview

ESP8089M16 is the small-sized low-power module for IEEE 802.11b/g/n wireless LAN. ESP8089M16 is based on the ESP8089 solution. (More information on ESP8089 can be found in the [ESP8089 Datasheet](#).)

ESP8089M16 features a small size of 12.0 (\pm 0.1) x 12.0 (\pm 0.1) x 1.5 (\pm 0.1) mm, making it an ideal choice for space-constrained applications.

1.1. Features

- IEEE 802.11 b/g/n single ANT WLAN infrastructure
- Wi-Fi Direct (P2P)
- Built-in TCP/IP protocol stack
- Built-in TR switch, balun, LAN power amplifier and matching network
- Built-in PLL voltage regulator and power management module
- Power-off leakage current is less than 4 μ A
- Built-in low-power 32-bit CPU: can be used as an application processor
- SDIO 11, SPI, UART
- Collaborated 22 ms wake-up ,within the connection and transmission of data packets
- Standby power consumption is less than 1.0 mW (DTIM3)
- 2.4 GHz internal PA

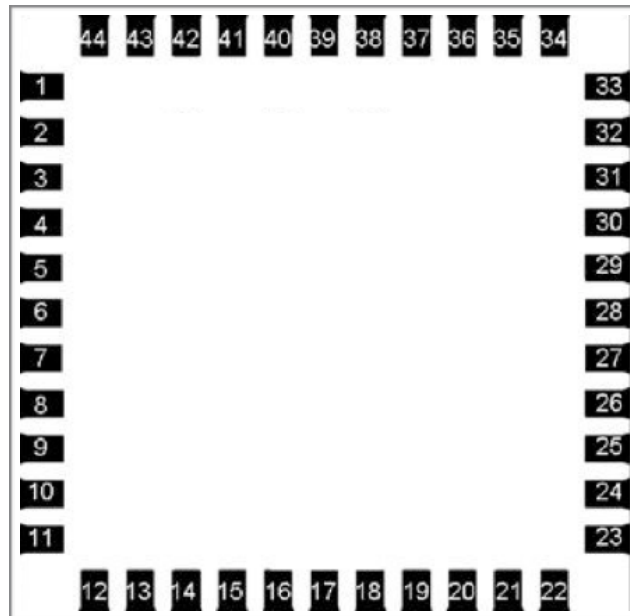
1.2. Applications

- Digital Television (DTV)
- Digital Video Recorder (DVR)
- HD DVD Player
- Blue-ray Disk Player
- Set Top Box (STB)
- Mobile Internet Device (MID)
- Over The Top (OTT)



2. Pin Assignments

2.1. PCB Pin Outline



2.2. Pin Definition

Table 2-1. Pin Definition

No.	Pin Name	Type	Description
1	GND	-	Ground connection
2	WL_BT_ANT	I/O	RF I/O port
3	GND	-	Ground connection
4	NC	-	Floating (Don't connect to ground)
5	NC	-	Floating (Don't connect to ground)
6	NC	-	Floating (Don't connect to ground)
7	NC	-	Floating (Don't connect to ground)
8	NC	-	Floating (Don't connect to ground)
9	VBAT	P	Main power voltage source input
10	XTAL_IN	I	XTAL oscillator input
11	XTAL_OUT	O	XTAL oscillator output

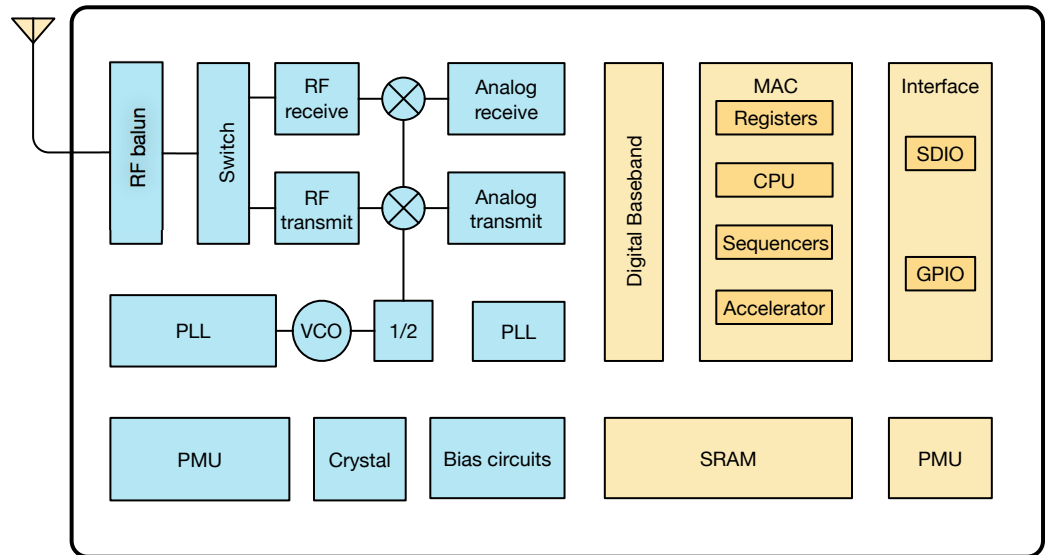


No.	Pin Name	Type	Description
12	WL_REG_ON	I	WIFI_EN
13	WL_HOST_WAKE	O	WLAN_INT
14	SDIO_DATA_2	I/O	SDIO data line 2
15	SDIO_DATA_3	I/O	SDIO data line 3
16	SDIO_DATA_CMD	I/O	SDIO command line
17	SDIO_DATA_CLK	I/O	SDIO CLK line
18	SDIO_DATA_0	I/O	SDIO data line 0
19	SDIO_DATA_1	I/O	SDIO data line 1
20	GND	-	Ground connection
21	VIN_LDO_OUT	P	NC
22	VDDIO	P	I/O voltage supply input
23	VIN_LDO	P	Internal buck voltage generation pin
24	LPO	I	External low-power clock input (32.768 KHz)
25	NC	-	Floating (Don't connect to ground)
26	NC	-	Floating (Don't connect to ground)
27	NC	-	Floating (Don't connect to ground)
28	NC	-	Floating (Don't connect to ground)
29	NC	-	Floating (Don't connect to ground)
30	NC	-	Floating (Don't connect to ground)
31	GND	-	Ground connection
32	NC	-	Floating (Don't connect to ground)
33	GND	-	Ground connection
34	NC	-	Floating (Don't connect to ground)
35	NC	-	Floating (Don't connect to ground)
36	GND	-	Ground connection
37	NC	-	Floating (Don't connect to ground)
38	NC	-	Floating (Don't connect to ground)
39	NC	-	Floating (Don't connect to ground)
40	NC	-	Floating (Don't connect to ground)
41	NC	-	Floating (Don't connect to ground)
42	NC	-	Floating (Don't connect to ground)
43	NC	-	Floating (Don't connect to ground)
44	NC	-	Floating (Don't connect to ground)



3. Functional Description

3.1. Block Diagram



3.2. External Clock Reference

Table 3-1. External Clock Signal Characteristics

No.	Item	Symb.	Electrical specification			Unit	Remark
			Min.	Type	Max.		
1	Nominal frequency	F0	40			MHz	-
2	Mode of vibration	-	Fundamental				-
3	Frequency tolerance	$\Delta F/F_0$	-10	-	10	ppm	At 25±3°C
4	Operating temperature range	T _{OPR}	-40	-	85	°C	-
5	Frequency stability	TC	-10	-	10	ppm	-
6	Storage temperature	T _{STG}	-40	-	85	°C	-
7	Load capacitance	CL	-	15	-	pF	-
8	Drive level	DL	-	100	200	μW	-
9	Insulation resistance	IR	500	-	-	MΩ	At 100 V _{DC}
10	Shunt capacitance	C0	-	-	7	pF	-
11	Aging per year	Fa	-3	-	3	ppm	First year



4. Peripheral Interface

4.1. SDIO Pin Description

The module supports SDIO version 2.0 for 4-bit mode. It has the ability to stop the SDIO clock and map the interrupt signal into a GPIO pin. This 'out-of-band' interrupt signal notifies the host when the WLAN device wants to turn on the SDIO interface. The ability to force the control of the gated clocks from within the WLAN chip is also provided.

- Function 0: Standard SDIO function (Max BlockSize/ByteCount = 32B)
- Function 1: Backplane function to access the internal System-on-Chip (SoC) address space (Max BlockSize/ByteCount = 64B)
- Function 2: WLAN function for efficient WLAN packet transfer through DMA (Max BlockSize/ByteCount=512B)

The SDIO 4-bit mode is shown as follows:

DATA0	Data line 0
DATA1	Data line 1 or interrupt
DATA2	Data line 2 or read wait
DATA3	Data line 3
CLK	Clock
CMD	Command line



4.2. SDIO Default Mode Timing Diagram

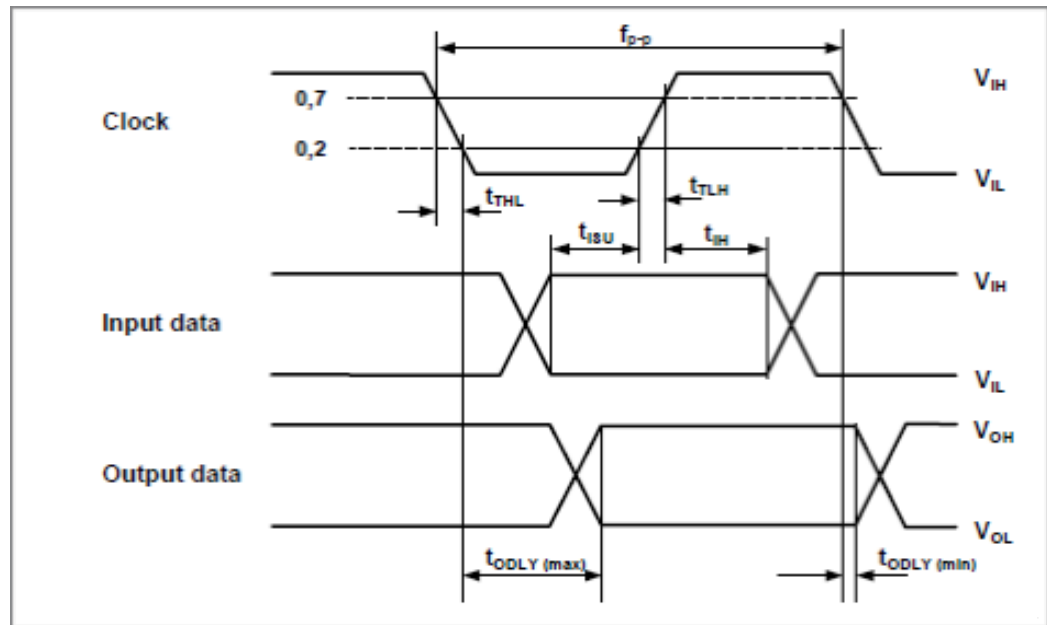


Figure 4-1. SDIO Default Mode Timing Diagram

Table 4-1. SDIO Timing Characteristics

Parameter	Symbol	Min	Max	Unit
Input setup time	t_{ISU}	6	-	ns
Input hold time	t_{IH}	2.5	-	ns
Clock falling time	t_{THL}	-	3	ns
Clock rising time	t_{TLH}	-	3	ns
Output delay	t_{DLY}	2	12	ns



5. Electrical Characteristics

5.1. Absolute Maximum Ratings

Note:

The specifications in the table below define levels at which permanent damage to the device can occur. Function operation is not guaranteed under these conditions. Operating at absolute maximum conditions for extend periods can adversely affect the long-term reliability of the device.

Table 5-1. Absolute Maximum Ratings

Parameter	Min	Max	Unit
Storage temperature	-40	85	°C
Storage humidity (40°C)	-	90%	%

- Do not use or store modules in the corrosive atmosphere, especially where chloride gas, sulfide gas, acid, alkali, salt or the like are contained. Also, avoid exposure to moisture.
- Store the modules where the temperature and relative humidity do not exceed 5 to 40°C and 20 to 60%.
- Assemble the modules within six months. Check the soldering ability in case of over six months.

5.2. Operating Conditions

Table 5-2. Operating Conditions

Parameter	Min	Typ	Max	Unit
Operating temperature	-40	-	85	°C
Operating humidity	-	-	85	%
VBAT	2.7	3.3	3.6	V
VIO	1.8	2.8	-	V

5.3. RF Characteristics for IEEE802.11b/g/n

The test for electrical specification shall be performed under the following conditions unless otherwise specified.



- Ambient conditions:
 - Temperature : $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$
 - Humidity: $65\% \pm 5\%$ R.H.
- Power supply voltages:
 - 3.3V input power at the module
- Current consumption over recommended range of supply voltage and operating conditions is like below:
 - When it's tested, it must be supplied more than two times of maximal current.

Table 5-3. RF Characteristics

Items	Description
Host interface	SDIO
Channel frequency	2412 ~ 2462 MHz
Modulation	802.11b: DQPSK, DBPSK, CCK 802.11g/n: OFDM /64-QAM, 16-QAM, QPSK, BPSK
TX characteristics power level	
802.11b/1 Mbps	20 dBm \pm 1.0 dB @ EVM -20 dB
802.11g/6 Mbps	20 dBm \pm 1.0 dB @ EVM -28 dB
802.11n/MCS0	20 dBm \pm 1.0 dB @ EVM -28 dB
Receive sensitivity (11n, 20 MHz) @ 10% PER	
MCS = 0	PER @ -85 \pm 1 dBm, typical
MCS = 1	PER @ -84 \pm 1 dBm, typical
MCS = 2	PER @ -82 \pm 1 dBm, typical
MCS = 3	PER @ -80 \pm 1 dBm, typical
MCS = 4	PER @ -77 \pm 1 dBm, typical
MCS = 5	PER @ -73 \pm 1 dBm, typical
MCS = 6	PER @ -71 \pm 1 dBm, typical
MCS = 7	PER @ -70 \pm 1 dBm, typical
Receive sensitivity (11g) @ 10% PER	
6 Mbps	PER @ -87 \pm 1 dBm, typical
9 Mbps	PER @ -86 \pm 1 dBm, typical
12 Mbps	PER @ -85 \pm 1 dBm, typical
18 Mbps	PER @ -83 \pm 1 dBm, typical

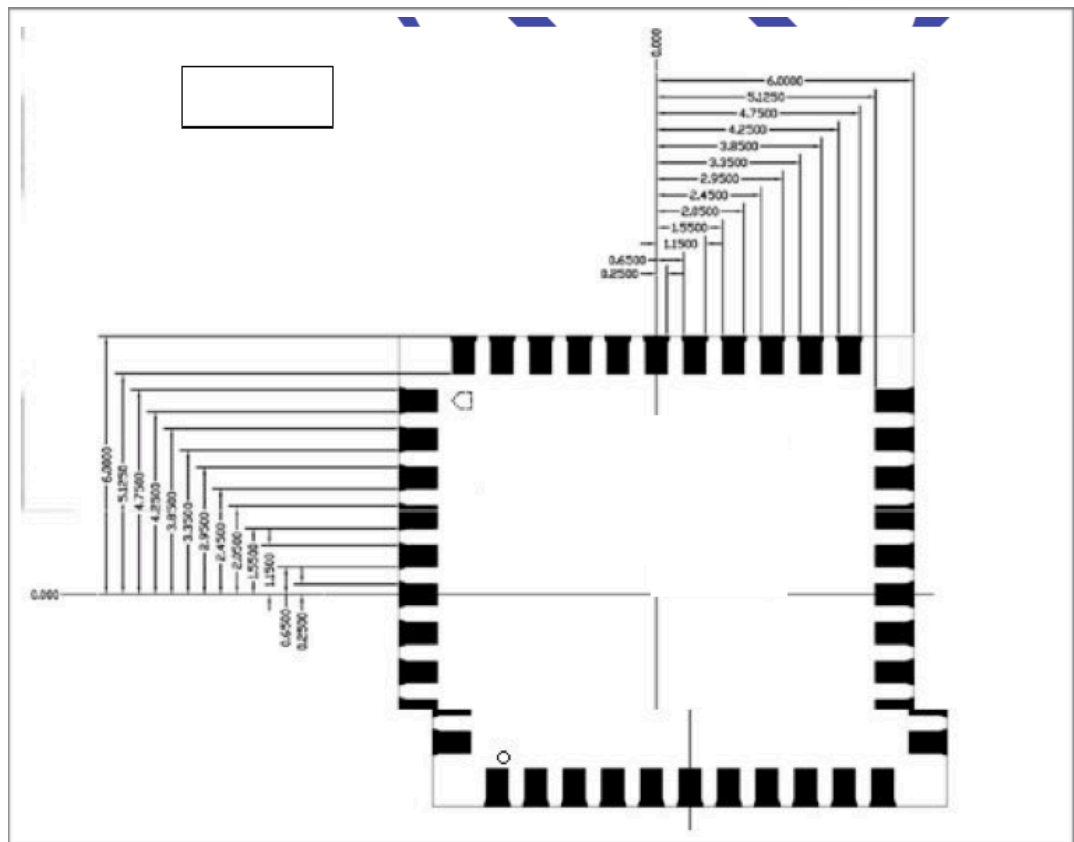
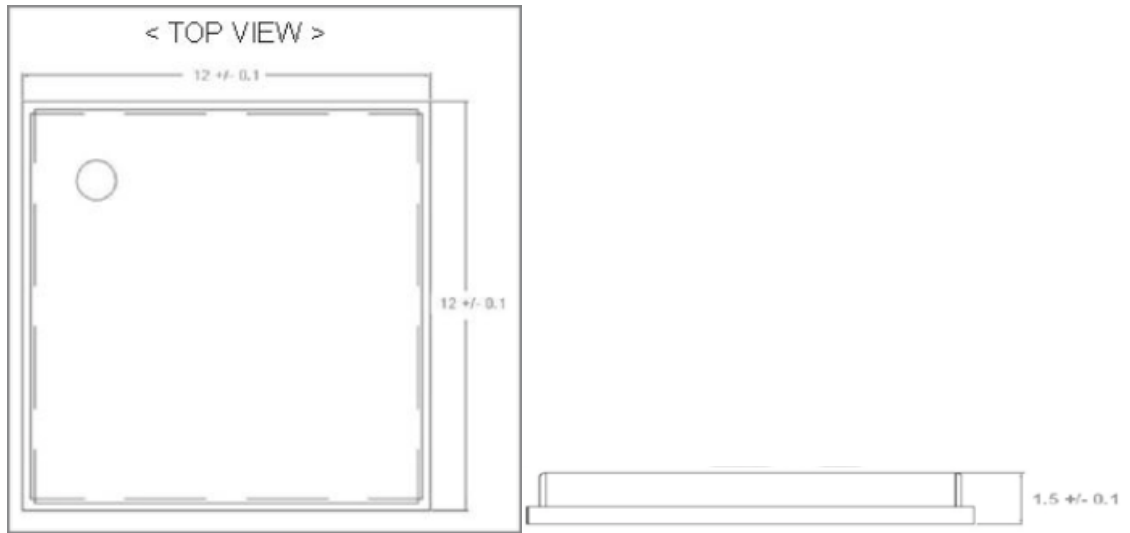


24 Mbps	PER @ -81 ± 1 dBm, typical
36 Mbps	PER @ -78 ± 1 dBm, typical
48 Mbps	PER @ -74 ± 1 dBm, typical
54 Mbps	PER @ -72 ± 1 dBm, typical
Receive sensitivity (11b) @ 8% PER	
1 Mbps	PER @ -90 ± 1 dBm, typical
2 Mbps	PER @ -89 ± 1 dBm, typical
5.5 Mbps	PER @ -87 ± 1 dBm, typical
11 Mbps	PER @ -84 ± 1 dBm, typical



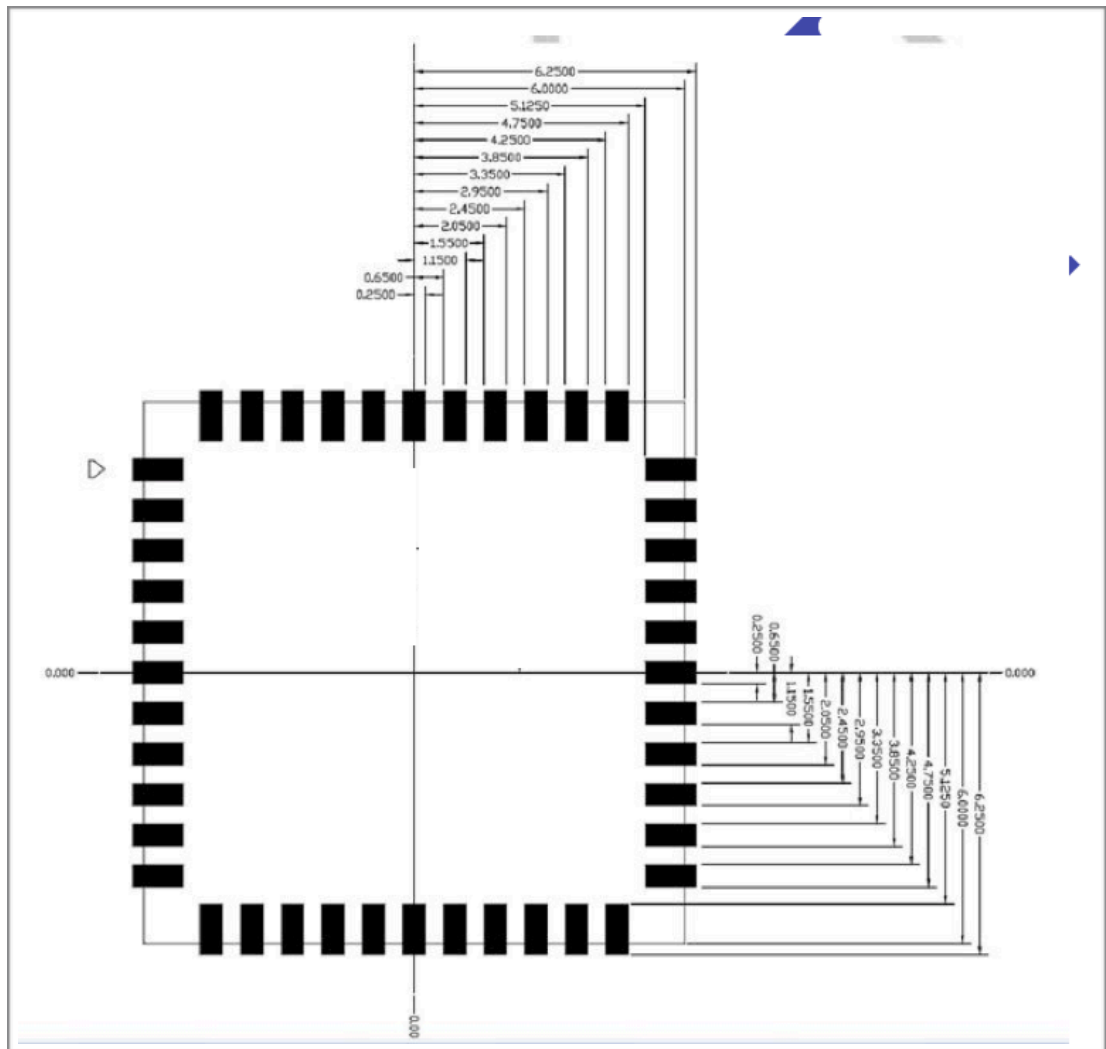
6. Module Dimensions

6.1. Top View and Side View



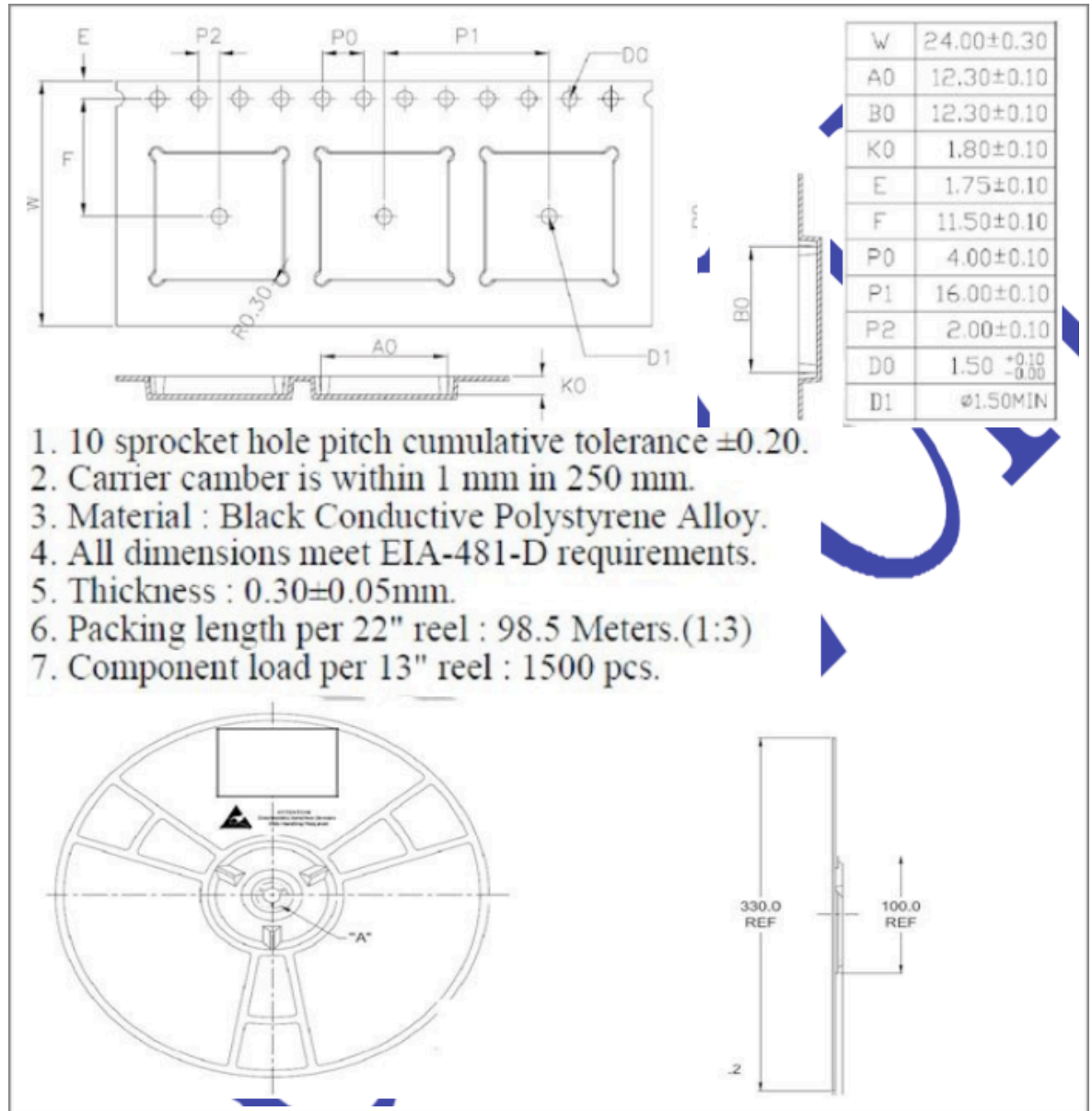


6.2. Recommended Footprint





7. Packing Information



FCC Statement

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received, including interference that may cause undesired operation.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment .This equipment should be installed and operated with minimum distance 20cm between the radiator& your body.

FCC Label Instructions

The outside of final products that contains this module device must display a label referring to the enclosed module. This exterior label can use wording such as: "Contains Transmitter Module

FCC ID:2AC7Z-ESP8089M16"Contains FCC ID:2AC7Z-ESP8089M16 Any similar wording that expresses the same meaning may be used.



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