

GPS Engine Board

EB-800 / EB-800L / EB-800S

EB-800 series is a miniature 13 x15 mm² **GPS** engine that is capable of receiving GPS signal with single RF input and high receiving sensitivity.

With up to **-165dBm** superior tracking sensitivity, EB-800 enables better satellite coverage and superior position accuracy for your navigation need under dynamic conditions in areas with limited sky view like urban canyons.

EB-800 series is pin compatible with TSI's popular EB-500, it provides best migration path for your embedded applications.

Key Features :

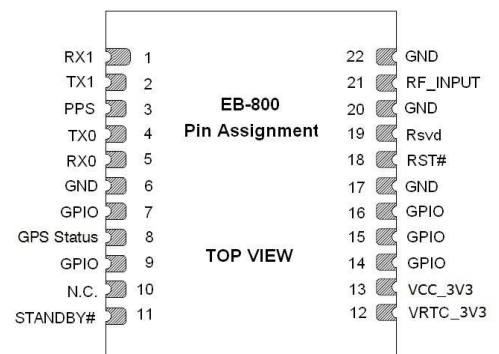
- Small form factor: 13 x 15 x 2.2 mm
- Support GPS system
- Lead-Free – RoHS/WEEE compliant
- High sensitivity -165dBm
- Tracks 66-Channel of satellites
- Support QZSS and SBAS
- WAAS/EGNOS/MSAS/GAGAN supported
- RTCM ready
- AlwaysLocate™ location awareness technology
- EPO™ / HotStill™ orbit prediction (Not for EB-800S)
- EASY™ self-generated orbit prediction (Not for EB-800S)
- Fast Position Fix
- Ultra low power consumption
- FCC E911 compliance and A-GPS support
- EB-800 w/ LNA, EB-800L w/o LNA
- EB-800 can match w/ passive antenna
- EB-800L recommend match w/ active antenna
- EB-800S is ROM FW
- Backward compatible with EB-500

Applications :

- Handheld devices
- Automotive and Marine Navigation
- Automotive Navigator Tracking
- Emergency Locator
- Geographic Surveying
- Personal Positioning
- Sporting and Recreation
- Embedded applications : PDA, DSC, Smart phone, UMPC, PND, MP4



PIN Definition :



Ultimate



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An A+ supplier of RF microwave & GPS products

EB

Ver 0.4

Revision History

Rev.	Date	Description
0.4	04-10-2013	Add EB-800L / EB-800S info & pin 19 description
0.3	12-25-2012	Update the description of GPS status, standby pin, VCC_3V3 power supply voltage. Add the notice for supplying voltage to VRTC_3V3 / VCC_3V3.
0.2	09-17-2012	Revise GPIO pin description, tracking current and peak current. Add package info, and pin coordinates.
0.1	09-03-2012	Initial draft
	MM-DD-YYYY	



EB-800 is ESD (electrostatic discharge) sensitive device and may be damaged with ESD or spike voltage. Please handle with care to avoid permanent malfunction or performance degradation.

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1 Introduction

EB-800 is an ultra miniature 13 x15 x 2.2mm GPS engine board. It provides superior navigation performance under dynamic conditions in areas with limited sky view like urban canyons. High sensitivity up to -165dBm for weak signal operation without compromising accuracy. EB-800 series are your best choice for embedded applications.

1.1 Key Features

- Small form factor: 13 x 15 x 2.2 mm
- Lead-Free – RoHS/WEEE compliant
- High sensitivity -165dBm
- Tracks 66-Channel of satellites
- Fast Position Fix, 35/ 34/ 1.5s for Cold/ Warm/ Hot start
- Low power consumption

1.2 Applications

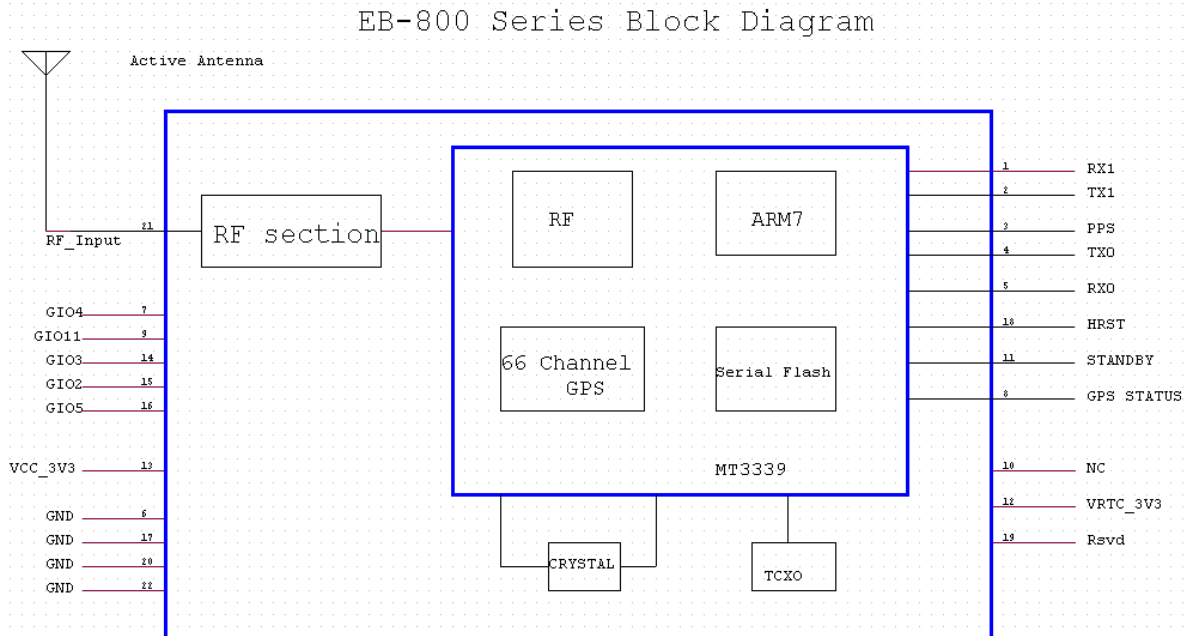
- Handheld devices
- Automotive and Marine Navigation
- Automotive Navigator Tracking
- Emergency Locator
- Geographic Surveying
- Personal Positioning
- Sporting and Recreation
- Embedded applications such as: PDA, DSC, Smart phone, UMPC, PND, MP4

1.3 Look & Feel



2 Technical Description

2.1 Block Diagram



2.2 Pin Definition

Pin#	Signal Name	Type	Description
1	RX1	I	UART port 1 input
2	TX1	O	UART port 1 output
3	PPS	O	Pulse per second output when GPS has position fix, 10% duty cycle
4	TX0	O	UART port 0 output for NMEA
5	RX0	I	UART port 0 input
6	GND	P	Ground
7	GPIO	I/O*	General input/ output, leave open if not used
8	GPS status	O	When GPS is position fix, pin 8 alternates between High/Low. When no fix, pin8 always goes low.
9	GPIO	I/O*	General input/ output, leave open if not used
10	NC	I	NC
11	Standby	I	Falling-edge to enter standby mode. Raising-edge to enter normal mode. Leave open if not used
12	VRTC_3V3	P	RTC power 2.0~4.3V Quiescent current 2.0uA max
13	VCC_3V3	P	Power Supply 2.8~4.3V DC
14	GPIO	I/O*	General input / output, leave open if not used
15	GPIO	I/O*	General input / output ; leave open if not used
16	GPIO	I/O*	General input / output; leave open if not used

EB-800 Series Data Sheet

17	GND	P	Ground
18	HRST	I	GPS reset, active low. Internal pull high leave open if not used
19	Rsvd	I/O*	Reserve for future use, leave open if not used
20	GND	P	Ground
21	RF Input	I	Antenna port, L1, 1575.42MHz, 50 ohm
22	GND	P	Ground

- Note :
- 1) P: Power, I: Input, O: Output, I/O: Input or Output
 - 2) GPIO current output default : 4mA, Max : 16mA
 - 3) Please supply VRTC_3V3 / VCC_3V3 voltage simultaneously or supply VRTC voltage first when powering on the module.

2.3 Specification

Item	Description
General	L1 frequency, C/A code (SPS) 66 independent tracking channels
Sensitivity	-165dBm /Tracking; -148dBm /Acquisition
Update Rate	Up to 10Hz
Accuracy	<3m CEP (50%) without SA (horizontal) DGPS (WAAS, EGNOS, MSAS, RTCM): 2.5m
Acquisition (open sky)	Cold Start: <35sec Warm Start: <34sec Hot Start: <1.5sec
Reacquisition	< 1sec
Dynamics	Altitude : 18000m (max.) Velocity : 515m/sec (max.) Vibration : 4G (max.)
Supply Voltage	DC 2.8~4.3V
Power Consumption	EB-800 / EB-800S: < 18 mA @ 3.3V (w/o Active ANT) / Tracking EB-800L: < 16 mA @ 3.3V (w/o Active ANT) / Tracking
Backup Battery	DC 2~4.3V, 20 uA@3.3V typical
NMEA Message	NMEA0183 v3.1 baud rate 4800/9600/.../115200, default 9600 Selectable Output: GGA, GLL, GSA, GSV, RMC, and VTG
Datum	Default WGS-84
Antenna	External Active Antenna Output Voltage: 2.8 VDC or Passive Antenna
Serial Interface	UART
Operating Temp.	-40°C to 85°C
Storage Temp.	-40°C to 85°C
Operating Humidity	≤ 95%, non condensing
Mounting	SMT Type, 22 Pin
Dimension	13 x 15 x 2.2(H) mm

3 Electrical Characteristics

3.1 Absolute maximum ratings

Symbol	Parameter	Min	Max	Unit
Vcc	power supply	-0.3	+4.3	V
Vin	voltage to any pin	-0.3	+3.6	V
Iov	input current on any pin	-10	10	mA
Itdv	absolute sum of all input currents during overload condition		200	mA
Tst	storage temperature	-40	85	°C
Iant	antenna supply current	0	50	mA

Table 3-1 Absolute maximum ratings

Note:

- (1) Stresses beyond absolute maximum ratings may cause permanent damage to the device.
- (2) Exposure to absolute maximum rating conditions for extended period may affect device reliability.

3.2 Operating Conditions

Pin	Description	Min	Typical	Max	Unit
4	V_RTC_3V3	2.0	2.8	4.3	V
	Tracking Current (2)		20		uA
	Quiescent Current		2		uA
2	VCC_3V3	2.8	3.3	4.3	V
	Peak Acquisition Current (1)			22	mA
	Tracking Current (2)		18		mA
	Standby Current		150		uA

Table 3-2 Operating Conditions

Note:

- (1) Peak acquisition current is the maximum current with passive antenna.
- (2) Tracking current is the average current with passive antenna includes tracking and post acquisition portion.

3.3 DC Electrical Characteristics

Symbol	Parameter	Min	Max	Unit
1PPS, GPS Status, TX1, TX0, GPIO 2,3,4,5	Voh	2.4	VDD28+0.3	V
	Vol	-0.3	0.4	V
RX1, RX0, STANDBY#, HRST#	Vih	2.0	3.6	V
	Vil	-0.3	0.8	V

Table 3-3 DC Electrical characteristics

4 Serial Port Interface

EB-800 provides 2- wire digital UART port for communication of GPS position data using NMEA protocol or MTK extension protocol. UART port is capable of 4800 to 115200 baud rate.

4.1 Protocol

EB-800 is default to support standard NMEA-0183 protocol. In addition, a series of MTK extensions (PMTK messages) have been developed that can be used to provide extended capabilities common to many applications. Please refer to “GPS Engine Board UART Port Command” for detailed command information.

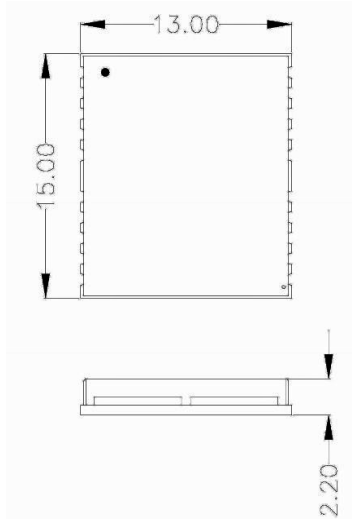
4.1.1 NMEA Protocol

EB-800 is capable of supporting following NMEA formats:

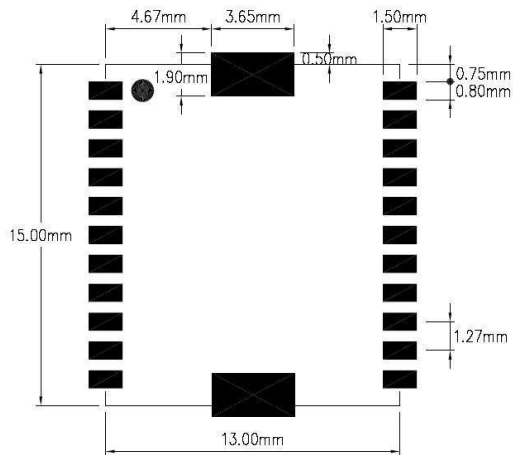
NMEA Prefix	Format	Direction
\$GPGGA	GPS fix data	Out
\$GPGLL	Geographic position Latitude / Longitude	Out
\$GPGSA	GNSS DOP and active satellites	Out
\$GPGSV	Satellites in view	Out
\$GPRMC	Recommended minimum specific GNSS data	Out
\$GPVTG	Velocity and track over ground	Out
\$GPZDA	Date and time	Out

5 Dimension and Package

5.1 Mechanical Dimension



5.2 Recommend Layout Pattern



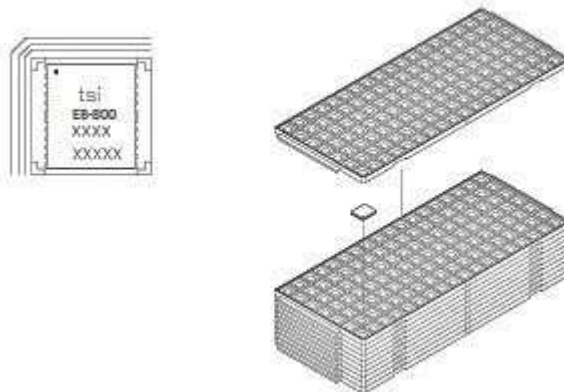
5.3 PIN Coordinates

Unit:mm

Pin #	X	Y	Pin #	X	Y
1	0.00	0.00	12	13.0	12.7
2	0.00	1.27	13	13.0	11.43
3	0.00	2.54	14	13.0	10.16
4	0.00	3.81	15	13.0	8.89
5	0.00	5.08	16	13.0	7.62
6	0.00	6.35	17	13.0	6.35
7	0.00	7.62	18	13.0	5.08
8	0.00	8.89	19	13.0	3.81
9	0.00	10.16	20	13.0	2.54
10	0.00	11.43	21	13.0	1.27
11	0.00	12.7	22	13.0	0.00

5.4 Package

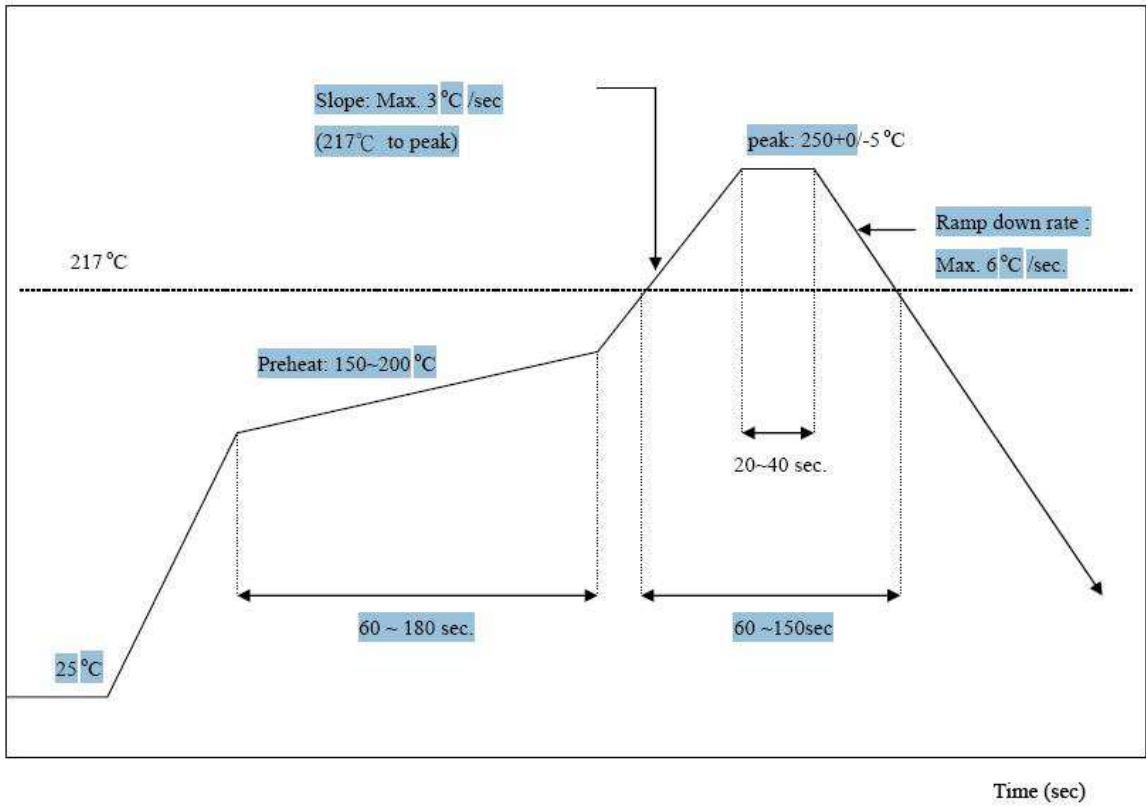
EB-800 GPS modules come in tray package suitable for pick and place machines. Each tray contains total 96 pieces of EB-800 and maximum 10 trays are stacked together before sealed in ESD protective vacuum dry pack to provide protection against moisture and ESD during storage and shipment.



6 Recommended IR Profile

Follow below IR profile for reflow during SMT assembly for EB-800.

Cycle interval : 5 **minus**



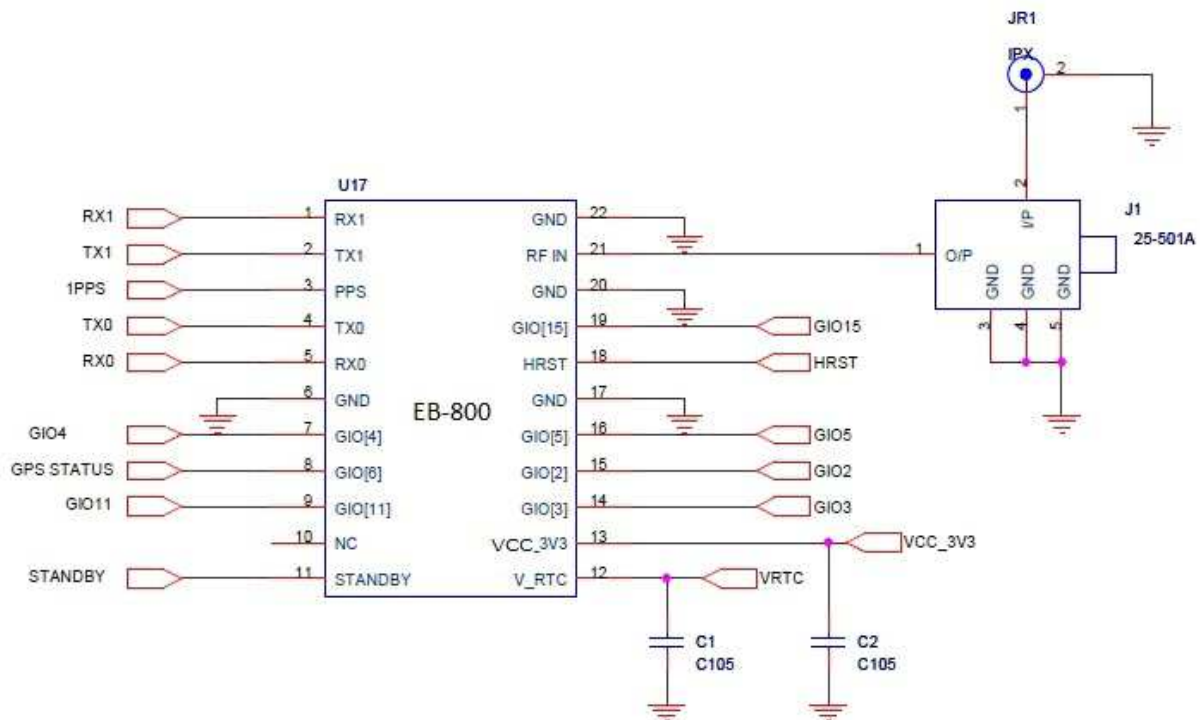
7 Application Information

7.1 GPS Antenna Recommendations

Follow below recommendations when choosing GPS antenna for EB-800 series for best system performance. Transystem also offers active antenna products for optimal performance with EB-800 series. For details, please contact your Transystem sales contact directly.

- Use active / passive antenna that works with 2.8V power supply
- Receiving frequency $1575.42 \pm 1.032\text{MHz}$
- Polarization RHCP (right hand circular polarized)
- Output impedance = 50 Ohm
- $15\text{dB} \leq \text{LNA Gain} \leq 20\text{dB}$ (for EB-800L only)
- Noise figure $\leq 1.5\text{dB}$
- Connector: surface mounted on main PCB, Ipex or MMCX

7.2 Application Circuit



【Note1】 : GPIO[6] (pin#8) can be used as GPS position fix indicator.

【Note2】 : VRTC_3V3 (pin#12) could connect to 2.0~4.3V DC power supply or battery directly.

7.3 PPS pin

GPS also provides accurate timing information due to the synchronized atomic clocks in the GPS satellites. In addition to the current date and time is transmitted in NMEA sentences (UTC), an accurate timing signal is provided via the PPS pin (pin #3) of the EB-800 GPS receiver.

Under good signal conditions the 1PPS signal comes between 620ns and 710ns after the full GPS system second which is accurately (around 10ns) synchronized to UTC. Therefore the 1 second clock can be derived and maintained within around 90ns under good signal conditions.

The 1PPS signal accuracy directly relates to the position accuracy. The GPS signals travel at the speed of light, therefore a position inaccuracy directly translates into 1PPS inaccuracies.

10 m position deviation \approx 33 ns 1PPS deviation (typically)

100 m position deviation \approx 333 ns 1PPS deviation (typically)

The 1PPS signal is provided on an "as it is" basis with no accuracy specification.

7.4 Reset Signal

The HRST (pin #18) can be used to reset the EB-800 module. Resetting the module will result in a restart of the complete firmware.

The EB-800 is equipped with a voltage monitoring circuit that generates a proper power-on reset signal at the appropriate threshold and delay. Usually there is no need to deal with the reset input externally, thus the general advice is to leave this pin open.

7.5 Battery Back-up

VRTC_3V3 input (pin #12) provides back-up power for the RTC and SRAM of the GPS receiver module. Typical quiescent current 2uA allows the use of a separate battery or a "Supercap". The VRTC_3V3 pin draws 20uA typical under normal operation

7.6 General GPS Receiver User's Tips

- If the satellite signals can not be locked or experiencing receiving problem (while in urban area), following steps are suggested:
 - a) Please plug the external active antenna into GPS receiver and put the antenna outdoor or on the roof of the vehicle for better receiving performance.
 - b) Move to another open space or reposition GPS receiver toward the direction with least blockage.
 - c) Move the GPS receiver away from the interference sources.
 - d) Wait until the weather condition is improved.
- Some vehicles having heavy metallic sun protecting coating on windshields may affect signal receptions
- Driving in and around high buildings may affect signal reception.
- Driving under tunnels or in buildings may affect signal reception.
- In general, GPS receiver performs best in open space where it can see clean sky. Weather will affect GPS reception – rain & snow contribute to worsen sensitivity.
- When GPS receiver is moving, it will take longer time to get position fix. Wait for satellite signals to be locked at a fixed point when first power-on the GPS receiver to ensure quick GPS position fix.

8 Quality and Reliability

Each module is electrically tested prior to packing and shipping to ensure state of the art product quality and best GPS receiver performance and accuracy.

8.1 Environmental Conditions

Operating temperature	-40 ~ +85°C
Operating humidity	Max. 95%, non-condensing
MSL JEDEC (Moisture Sensitivity Level)	3
Storage temperature	-40 ~ +85°C
Storage	12 months in original package.

8.2 How to avoid ESD damage to module

- Any person handling the module should be grounded either with a wrist strap or ESD-protective footwear used in conjunction with a conductive or static-dissipative floor or floor mat.
- The work surface where devices are placed for handling, processing, testing, etc., must, be made of static-dissipative material and be grounded to ESD ground.
- All insulator materials must either be removed from the work area or must be neutralized with an ionizer. Static-generating clothing must be covered with an ESD-protective smock.
- When module are being stored, transferred between operations or workstations, or shipped, they must be kept in a Faraday shield container with inside surfaces (surfaces touching the module) that are static-dissipative.

Contact Information

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