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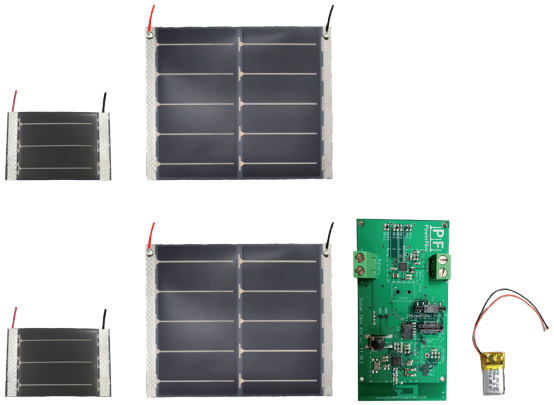
Solar Development Kit with TI BLE (DEV-BLE-TI)

System Overview

The Solar Development Kit with TI BLE extends the TI CC2650 Sensortag Bluetooth and data collection by integrating energy harvesting and flexible solar. This complete energy harvesting solution is capable of operating in dim indoor environments when using our Indoor Light panels, and outdoors using the Classic Application panels.

This development kit is designed to be fully customizable. DevPack and JTAG connectors are present for debugging and adding TI DevPack plug-in modules. All IO pins can be accessed via a 10 pin female header so that external sensors can easily be added. The current onboard sensors can be disconnected by cutting solder bridges to allow access to all 10 IO pins.

Software development can be done using Code Composer Studio and Android Studio, which are both free to use. EAGLE PCB files are also provided.



Solar panel leads cropped for photo

Kit Contents

- DEV-BLE-TI circuit board assembly
- (2) LL200-2.4-75 Indoor Solar Panel with 6" leads
- (2) ONP1.2-37x54 Classic Application Solar Panel with 6" leads
- 60mAh rechargeable Li-Polymer battery
- Instructions, hardware and software files, and product documentation

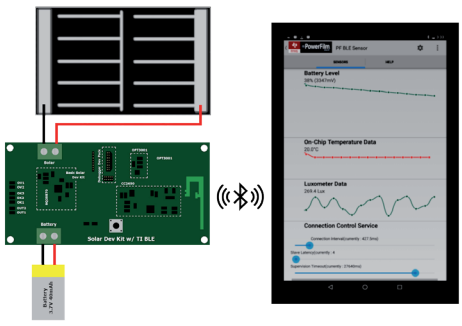
Panel Specifications

Indoor Series	Classic Application
LL200-2.4-75	ONP1.2-37x54
1000 lux:	100% Sun
• 1.899mW	• 70mW
• 0.904mA	• 50.8mA
• 2.1V	• 1.2V
200 lux:	25% Sun
• 0.289mW	• 13.7mW
• 0.181mA	• 11.4mA
• 1.6V	• 1.2V

Use Cases - Power Source For

- BLE Beacons and Tags
- E-Paper Displays
- Telematics
- Smart Locks
- Thermostats
- Smart Windows and Shades
- Wireless Sensors
- Wearables
- Field and Herd Monitoring
- Other Low Power Electronics

System Diagram



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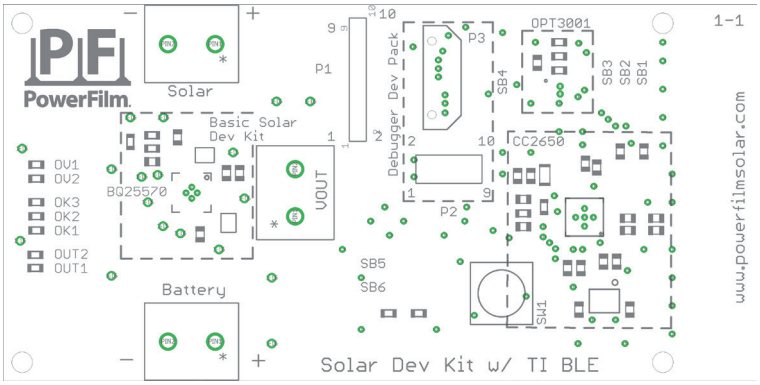
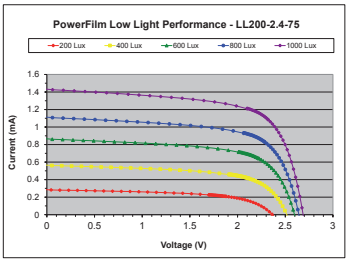
Board Layout

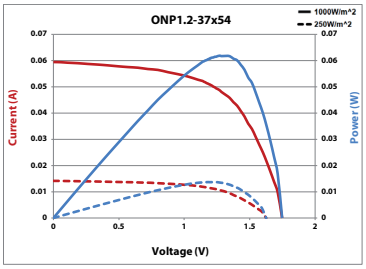


IV Curves

Indoor Series



Classic Application



Capacitor / Super Capacitor Storage Element Operation

The Basic Solar Dev Kit sub-circuit is capable of running and operating with a capacitor as the storage element instead of a rechargeable battery. The capacitor will maintain steady power to the system while light is available.

Charge and discharge rate will be greatly affected by the size of the capacitor. If the capacitor is completely discharged (0V) the charge rate will be slower because the harvester chip is not yet fully functional. Figures below show charge up times vs storage capacitance size for 0V-3V and 3V-4.2V. Capacitor must be rated for 6V or greater.

Board Configuration and Customization

The Solar Development Kit with TI BLE hardware is currently configured to charge a Li-Polymer type battery with max voltage of 4.2V and the output voltage set to 3.0V. The configuration can be customized by modifying SMT resistor dividers per the BQ25570 datasheet specifications which can be found under "Additional Resources" on the Solar Development Kit with TI BLE product page on our website.

Resistors OV1(2), OK1(2)(3), and OUT1(2) control the output voltage, charge configuration, and power management of the BQ25570 PMIC. Use the formulas below to determine appropriate 0603 package resistor values for your desired application.

Output Voltage: VOUT = 1.21 * (R_OUT2 + R_OUT1)/R_OUT1
Charge Termination Voltage: VBAT_OV = 1.815 * (1 + R_OV2/R_OV1)
Low Voltage Load Disconnect: VBAT_MIN = 1.21 * (1 + R_OK2/R_OK1)
Load Re-connect Hysteresis: VBAT_MIN_HYST = 1.21 * (1 + (R_OK2+R_OK3)/R_OK1)

For best results the sum of each resistor divider should be as close too but not exceeding 13Mohms. VOUT cannot exceed VBAT, VBAT_OV cannot exceed 5.5V, and VBAT_MIN cannot be less than 2V.

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