

0.8-A, Single-Input, Single-Cell Li-Ion Battery Charger

This user's guide describes the bq24050/2/5 evaluation module (EVM), how to perform a stand-alone evaluation or interface with a host or system. The charger is designed to deliver up to 800mA of continuous current to the battery output when programmed with a resistor on the ISET pin and is programmed for ~540mA at the factory. The USB current limit modes are selected by the ISET2 pin and limits current to a maximum of 500mA (logic high) or 100mA (float or high impedance). A low on the ISET2 pin programs the charge current using the ISET resistor.

Contents

1	Introduction	2
2	Considerations With Evaluating the bq24050/2/5	2
3	Performance Specification Summary	2
4	Test Summary	2
4.1	Equipment	3
4.2	Equipment and EVM Setup	3
4.3	Test Procedure Using a Single Cell Li-Ion Battery	3
4.4	Alternate Test Methods	4
5	Schematics, Physical Layouts, and Bill of Materials	5
5.1	Schematics – HPA388A	5
5.2	Physical Layouts – HPA388A	6
5.3	Bill of Materials – HPA388A	7
5.4	Schematics – HPA379A	9
5.5	Physical Layouts – HPA379A	10
5.6	Bill of Materials – HPA379A	11

List of Figures

1	bq24050/2/5 Setup Schematic	3
2	bq24050/2 EVM Schematic.....	6
3	Top Assembly	6
4	Top View	7
5	Bottom View	7
6	bq24055 EVM Schematic.....	9
7	Top Assembly.....	10
8	Top View.....	11
9	Bottom View.....	11

List of Tables

1	HPA388A BOM – bq24050/2.....	7
2	HPA379A BOM – bq24055.....	11

1 Introduction

The bq2405x series of devices are highly integrated Li-ion linear chargers devices targeted at space-limited portable applications. The devices operate from either a USB port or AC adapter.

The bq2405x has a single power output that charges the battery. A system load can be placed in parallel with the battery as long as the average system load does not keep the battery from charging fully during the 10 hour safety timer.

The bq24050/2/5 have an integrated USB detect routine that looks for an USB connection on power-up and initially sets the charge input control to either the programmed ISET level, if an adaptor is detected, or to USB100 mode if an USB port is detected. This aides in a faster charge if the battery is discharged and the USB device transceiver is not powered and an adaptor is connected.

The battery is charged in three phases: conditioning, constant current and constant voltage. In all charge phases, an internal control loop monitors the IC junction temperature and reduces the charge current if an internal temperature threshold is exceeded.

The charger power stage and charge current sense functions are fully integrated. The charger function has high accuracy current and voltage regulation loops, charge status display, and charge termination. The pre-charge current and termination current threshold are programmed via an external resistor on the bq24050/2/5. The fast charge current value is also programmable via an external resistor

2 Considerations With Evaluating the bq24050/2/5

Refer to the data sheet for specific details on the charger ICs. The main differences between the bq24050/2/5 spins is: (1) The '50 uses a 10k NTC thermistor, (2) the '52 uses a 100k NTC thermistor, and (3) the '55 uses a 10k NTC thermistor and has a PG pin.

The ISET current control loop sets the maximum charge current. This maximum programmed current level can be further reduced by entering a USB mode, selected by the ISET2 pin.

A system load may be connected to the OUT pin which will take away some of the charge current. Normally it is not recommended to operate the system in pre-charge mode since the system load keeps the battery from recovering, but since the PRE_TERM pin can program a higher pre-charge current this restriction is not necessary.

3 Performance Specification Summary

Specifacaton	Test Conditions	Min	Typ	Max	Units
Input DC voltage, V_{in}	Recommended input voltage range	4.45		6.45	V
Reduced Performance, $V_{in}^{(1)}$	Will not charge with Over Voltage input condition. Limited charging with under voltage input.	3.5		28	V
Power Dissipation ⁽²⁾	$P_{DISS} = (V_{IN} - V_{OUT}) \times I_{OUT}$			1.5	W
I_{OUT}	RISET = 1k		0.54	0.8	A

- ⁽¹⁾ Input voltage range is specified for normal operation. Input voltage between UVLO and 4.75 V has limited functionality, but does not damage the IC nor present any safety issue with the battery. Input voltage above OVP and less than 30 Vdc has no operation and will not damage the IC. Lower input voltage (closer to dropout operation) produces less heat dissipation and potentially better performance.
- ⁽²⁾ The junction temperature rise above ambient is proportional to the power dissipation. Once the junction temperature reaches ~125°C, thermal regulations reduces the programmed charge current.

4 Test Summary

The bq24050/2/5 EVM board requires a 5-VDC, 1-A power source to provide input power and a single-cell Li-ion or Li-polymer battery pack. The test setup connections and jumper setting selections are configured for a stand-alone evaluation but can be changed to interface with external hardware such as a microcontroller.

4.1 Equipment

- Power supply +5.1 ±0.1 V, current limit set to 1.5 ±0.1 A
- Battery: 4.2 V LiCoO2 or equivalent
- Two Fluke 75 DMMs (equivalent or better)
- Oscilloscope, Model TDS220 (equivalent or better)

4.2 Equipment and EVM Setup

Jack/Component	Connect or Adjustment To:
J1-DC+	Power supply positive, preset to 5 VDC, 1-A current limit.
J1-DC-	Power supply ground
J2-BAT+	Positive Battery Pack Terminal
J2-BAT-	Negative Battery Pack Terminal
JMP1	Apply shunt between IN_IC and DC+; allows use of J1 input.
JMP2	Apply shunt for Pre-Term connection.
JMP3	Remove shunt for USB100 mode operation.
JMP4	Apply shunt for CHG LED connection.
JMP5	Apply shunt for TS potentiometer connection.
JMP6 (bq24050/2)	Apply shunt to simulate an adaptor connection when using J1 as an input.
JMP6 (bq24055)	Apply shunt for PG LED connection.
JMP7 (bq24055)	Apply shunt to simulate an adaptor connection when using J1 as an input.
R2 (R _{ISET})	Adjust R2 for 1k between TP2 and GND
R4 (R _{PRE-TERM})	Adjust R3 for 2k between TP4 and GND
R8 (R _{TS})	Adjust R11 for 10k between TP9 and GND

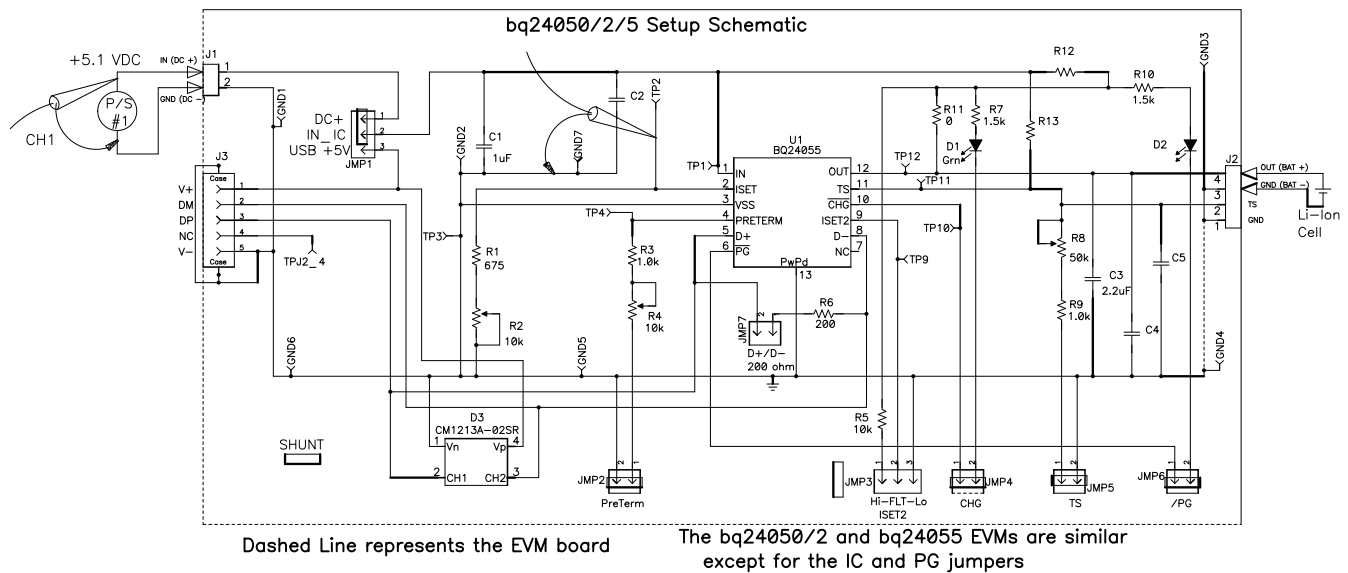


Figure 1. bq24050/2/5 Setup Schematic

4.3 Test Procedure Using a Single Cell Li-Ion Battery

1. Connect one DMM across the BAT+ to BAT- connection at J2. Since this is a linear charger the output current display on the input power supply is approximately the current delivered to the OUT pin. The charge current may be monitored independently by placing a 100mΩ resistor in the battery pack return and using a DMM to monitor the sense resistor.

2. Verify that the setup was performed correctly and turn on the power supply, which was preset to 5 VDC, and 1 A for the current-limit setting. The current was programmed for ~540 mA fast charge, or ~108 mA if in pre-charge, from the factory.
3. Shunt JMP6 (bq24050/2) and JMP7 (bq24055) short the D+ and D- input together simulating an adaptor connection. After applying input power the USB detection routine will detect an adaptor and start charging as if an adaptor is applied. One will notice about 540ma once the battery voltage charges above the $V_{(LOWV)}$ threshold. The ISET2 pin voltage is proportional to the amount of programmed current delivered to the OUT pin. The voltage on the ISET2 pin is 1.5V when the output current is 100% of the programmed value.
4. The bq24050/2/5 enters preconditioning mode if the battery is below the $V_{(LOWV)}$ threshold. In this mode, the bq24050/2/5 pre-charges the battery with a low current programmed by the PRE-TERM resistor (typically set to 10% of fast charge) until the battery voltage reaches the $V_{(LOWV)}$ threshold or until the pre-charge timer expires. If the timer expires, then the charge current is terminated and the bq24050/2/5 enters fault mode. The CHG LED turns off when in timer fault mode (Toggling input power, toggling TS low or battery replacement resets fault mode).
5. Once the battery voltage is above the $V_{(LOWV)}$ threshold, the battery enters fast-charge constant current mode. This EVM is programmed, by the ISET resistor for 0.54 A of fast-charging current. The IC should be in this mode since the USB detection routine detected an adaptor.
6. Apply a shunt to JMP3 ISET2-HI and see (charge current drops) the IC go into USB500 mode, remove the shunt and see the mode change to USB100, place the shunt between ISET2 and GND to see the programmed current mode. The USB detection routine always sets the mode at power-up and the user (processor) has to change the state of the ISET2 pin for the IC to unlatch the charge mode and set according to the ISET2 pin.
7. Once the battery reaches the voltage regulation threshold (4.2 V), the voltage control loop takes over and the current tapers down as the battery reaches its full capacity.
8. The battery remains at the fast charge mode until either the charge timer expires or the charge termination current threshold is reached.
9. Once the charge terminates, the CHG LED will turn off.
10. Remove JMP5 (TS) and the charger will turn on. This mode is Termination and Timer Disable Mode (TTDM). This allows continuous power applied from the input to the output, regulated to 4.2V with a maximum current programmed by the ISET resistor (may be restricted further if in USB mode). The system can operate without a battery in this mode as long as the system does not exceed the supplied input current.
11. If the battery discharges to the recharge threshold, the charger starts fast charging, but the CHG LED will not come on for the subsequent chargers. Cycling the input power, replacing the battery, or toggling the TS pin low will start a new charge with the CHG LED on.
12. Discharge the battery below 4.0 V and above 3.0 V, remove Shunt 6 (bq24050/2) or Shunt 7 (bq24055). Remove and re-apply input power and verify the USB mode is detected. Remove shunt from JMP3 and replace on JMP3: ISET2-GND. Verify current is set to the ISET resistor programmed level.
13. Procedure may be repeated using a mini USB cable connected to J3 on the EVM, and to either a USB port or adapter for the power source. Remove shunt JMP6 (bq24050/2) or JMP7 (bq24055), and move JMP1 to IN_IC / USB +5V prior to applying power with the USB mini cable.

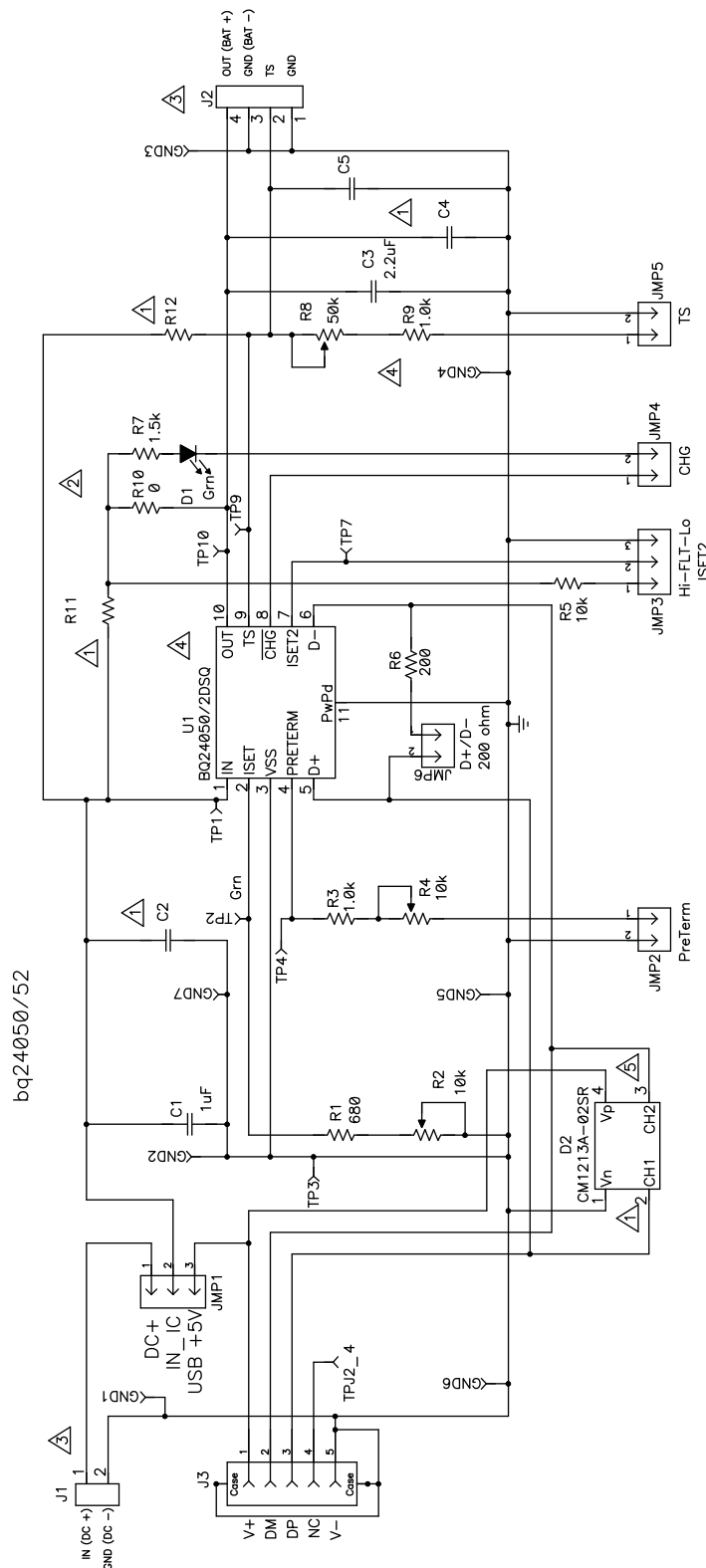
NOTE: Loads across the battery can affect termination. The pre-term pin can be adjusted to offset the system current. See data sheet for more details.

4.4 Alternate Test Methods

A 4 quadrant power supply which can source and sink current can be used in place of the battery pack to evaluate the charger. It will allow each transfer between pre-charge, constant-current and constant voltage fast charge. Keep leads short to avoid adding too much inductance which make cause an interaction between the power supply and charger. A large capacitor across the output will help cancel the inductance if long leads are necessary.

5 Schematics, Physical Layouts, and Bill of Materials

5.1 Schematics – HPA388A



- 1 R11, R12, D2, C2, C4 and C5 not installed.
- 2 R10 connects OUTpull-up for the LED and ISET2s.
Can move R10 to R11 if Vin is desired as the pull-up source (note Vin should be <7V for this configuration).
R12 may be used in a future development.
- 3 Input Voltage: 4.5V to 5.5VDC Typical, Consider Thermal Issues for > 5.5V to OVP; No charging above OVP.
- 4 OUT is a 4.2V regulated output with a programmable output current of 1A maximum.
- 5 TP1 → TP10 are associated with U1 pin out. TP5,6,8 are omitted.
bq24050 uses the 50k potentiometer, R8. Remove jumper JMP5 to use external 10k thermistor.
bq24052 use the 500k potentiometer, R8. Remove jumper JMP5 to use external 100k thermistor.
D2: A USB ESD protection component may be installed here for ESD strikes above the 2kV HBM IC rating.

Figure 2. bq24050/2 EVM Schematic

5.2 Physical Layouts – HPA388A

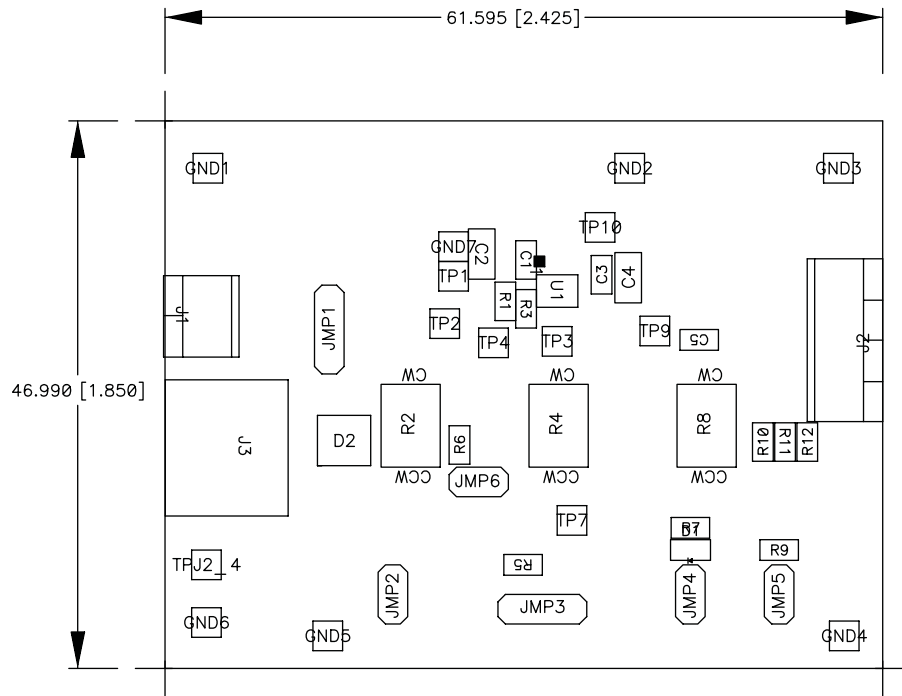


Figure 3. Top Assembly

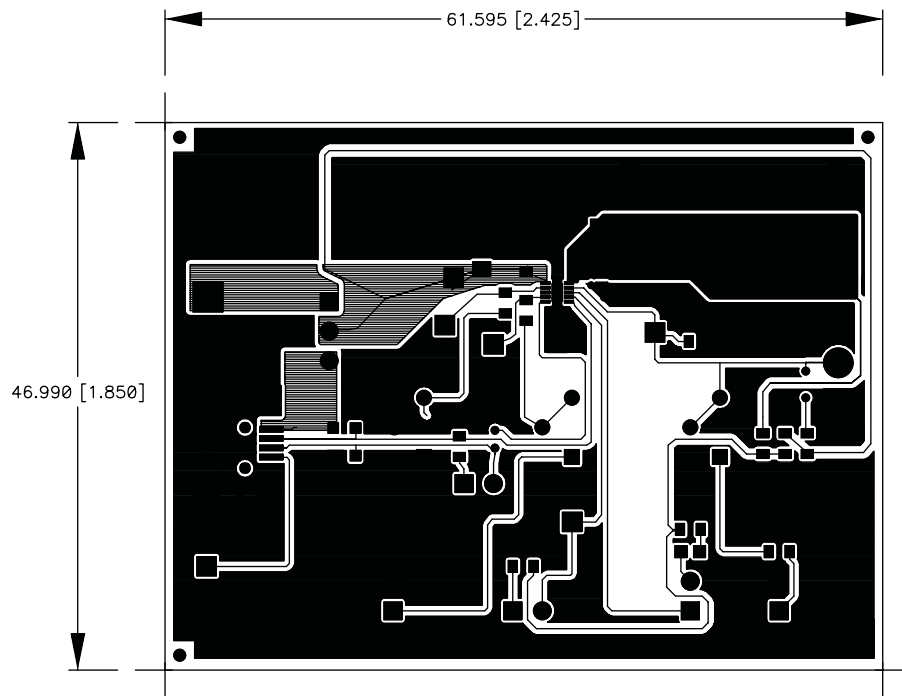
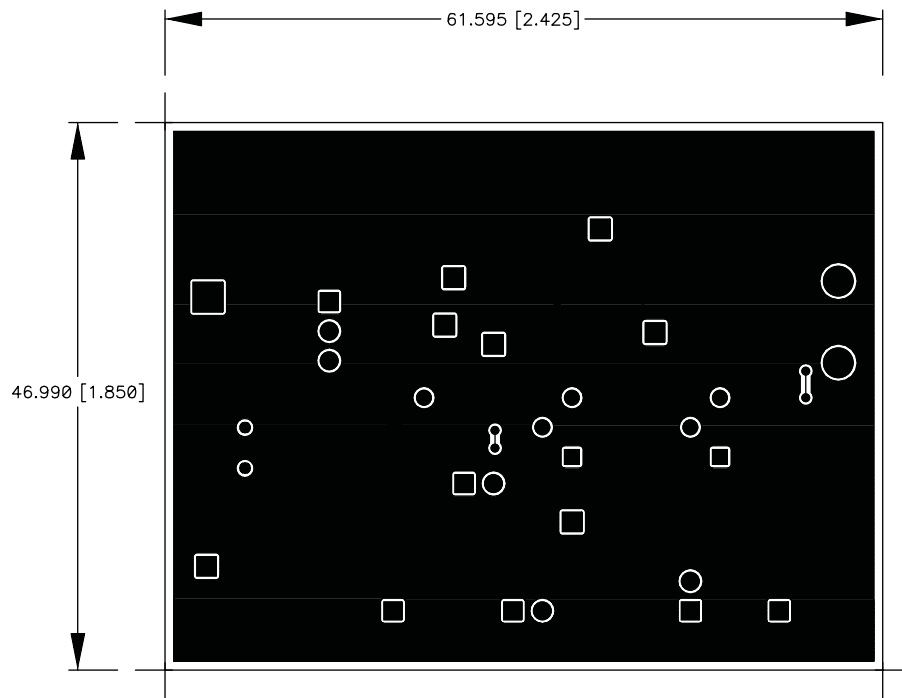


Figure 4. Top View


Figure 5. Bottom View

5.3 Bill of Materials – HPA388A

Table 1. HPA388A BOM – bq24050/2

-001	-002	RefDes	Value	Description	Size	Part Number	MFR
1	1	C1	1 μ F	Capacitor, Ceramic, 25V, X5R, 10%	0603	ECJ-1VB1E105K	Panasonic
0	0	C2	Optional	Capacitor, Ceramic, 25V, X5R, 10%	0805	ECJ-2FB1E***K	Panasonic
1	1	C3	2.2 μ F	Capacitor, Ceramic, 10V, X5R, 10%	0603	ECJ-1VB1A225K	Panasonic
0	0	C4	Optional	Capacitor, Ceramic, 10V, X5R, 10%	0805	ECJ-2FB1A***K	Panasonic
0	0	C5	Optional	Capacitor, Ceramic, 25V, X5R, 10%	0603	ECJ-1VB1E224K	Std
1	1	D1	LTST-C190GKT	Diode, LED, Green, 2.1-V, 20-mA, 6-mcd	0603	LTST-C190GKT	Lite On
0	0	D2	CM1213A-02SR	Diode, ESD Protection Arrays, 2 Channel	SOT143	CM1213A-02SR	CMD
1	1	J1*	ED555/2DS	Terminal Block, 2-pin, 6-A, 3.5mm	0.27 x 0.25 inch	ED555/2DS	OST
1	1	J2*	ED555/4DS	Terminal Block, 4-pin, 6-A, 3.5mm	0.55 x 0.25 inch	ED555/4DS	OST
1	1	J3	UX60-MB-5ST	Connector, Recpt, USB-B, Mini, 5-pins, SMT	0.354 x 0.303 Inches	UX60-MB-5ST	
2	2	JMP1, JMP3	PEC03SAAN	Header, Male 3-pin, 100mil spacing	0.100 inch x 3	PEC03SAAN	Sullins
4	4	JMP2, JMP4, JMP5, JMP6	PTC02SAAN	Header, Male 2-pin, 100mil spacing	0.100 inch x 2	PEC02SAAN	Sullins
1	1	R1	680	Resistor, Chip, 1/16W, 1%	0603	Std	Std
1	1	R10	0	Resistor, Chip, 1/16W, 1%	0603	Std	Std
0	0	R11, R12	DNI	Resistor, Chip, 1/16W, 1%	0603	Std	Std
2	2	R2, R4	10k Ω	Potentiometer, 1/4 in. Cermet, 12-Turn, Top-Adjust	0.25x0.17	3266W-103LF	Bourns
2	2	R3, R9	1.0k Ω	Resistor, Chip, 1/16W, 1%	0603	Std	Std
1	1	R5	10k Ω	Resistor, Chip, 1/16W, 1%	0603	Std	Std
1	1	R6	200 Ω	Resistor, Chip, 1/16W, 1%	0603	Std	Std
1	1	R7	1.5k Ω	Resistor, Chip, 1/16W, 1%	0603	Std	Std
1	0	R8	50k Ω	Potentiometer, 1/4 in. Cermet, 12-Turn, Top-Adjust	0.25x0.17	3266W-503LF	Bourns

Table 1. HPA388A BOM – bq24050/2 (continued)

-001	-002	RefDes	Value	Description	Size	Part Number	MFR
0	1	R8	500kΩ	Potentiometer, 1/4 in. Cermet, 12-Turn, Top-Adjust	0.25x0.17	3266W-504LF	Bourns
1	0	U1	BQ24050DSQ	IC, 750mA, Single-Input, Single Cell Li-Ion BATTERY CHARGER	SON-10	BQ24050DSQ	TI
0	1	U1	BQ24052DSQ	IC, 750mA, Single-Input, Single Cell Li-Ion BATTERY CHARGER	SON-10	BQ24052DSQ	TI
6	6	Shunt (Note 5)		Shunt, 100-mil, Black	0.1	929950-00	3M
1		–		PCB, 2.45 In x 1.85 In x 0.031 In		HPA388	Any

- Notes:
1. These assemblies are ESD sensitive, ESD precautions shall be observed.
 2. These assemblies must be clean and free from flux and all contaminants. Use of no clean flux is not acceptable.
 3. These assemblies must comply with workmanship standards IPC-A-610 Class 2.
 4. Ref designators marked with an asterisk (***) cannot be substituted. All other components can be substituted with equivalent MFG's components.
 5. Apply shunt to JMP2/4/5/6 and JMP1:1/2 and JMP3:2/3.

5.4 Schematics – HPA379A

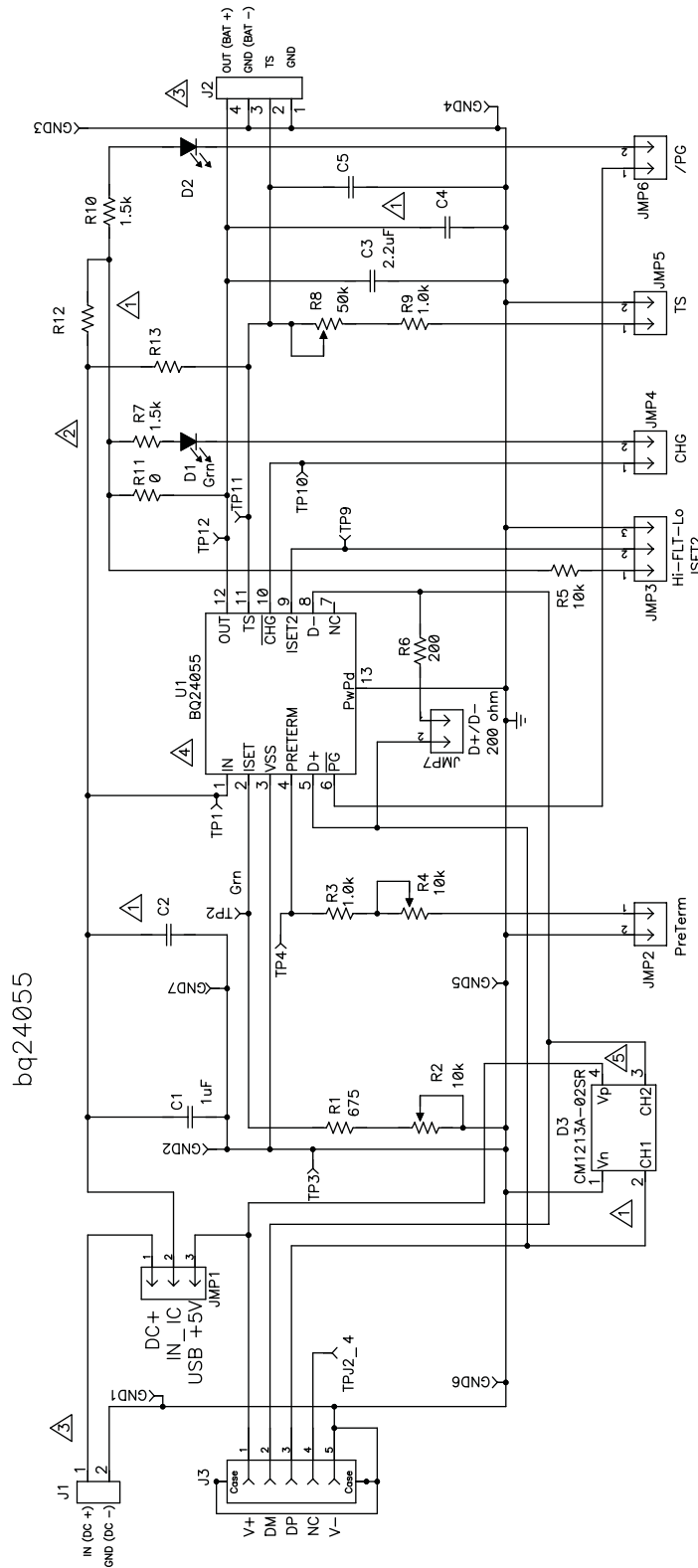


Figure 6. bq24055 EVM Schematic

- ⚠ R12, R13, D3, C2, C4 and C5 not installed.
- ⚠ R11 connects OUT pull-up for the LED and ISET2.
Can move R11 to R12; if Vin is desired as the pull-up source (note Vin should be <7V for this configuration).
R13 may be used in a future development.
- ⚠ Input Voltage: 4.5V to 5.5VDC Typical, Consider Thermal Issues for > 5.5V to OVP.
OUT is a 4.2V regulated output with a programmable output current of 1A maximum.
- ⚠ TP1→TP10 are associated with U1 pin out. TP5,6,7 & 8 are omitted.
- ⚠ A USB ESD protection component may be installed here for ESD strikes above the 2kV HBM IC rating.

5.5 Physical Layouts – HPA379A

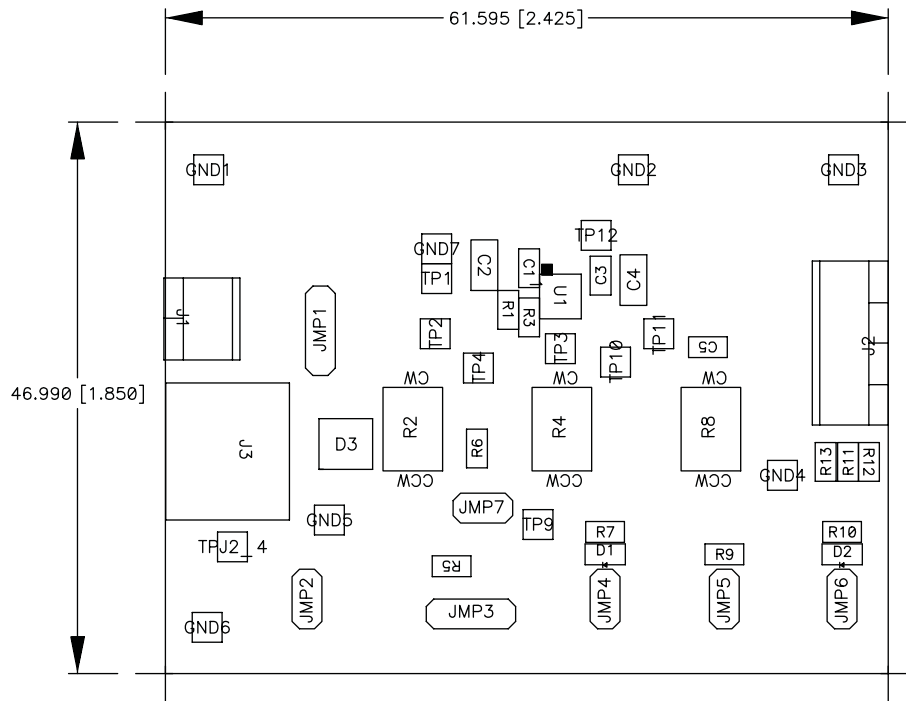


Figure 7. Top Assembly

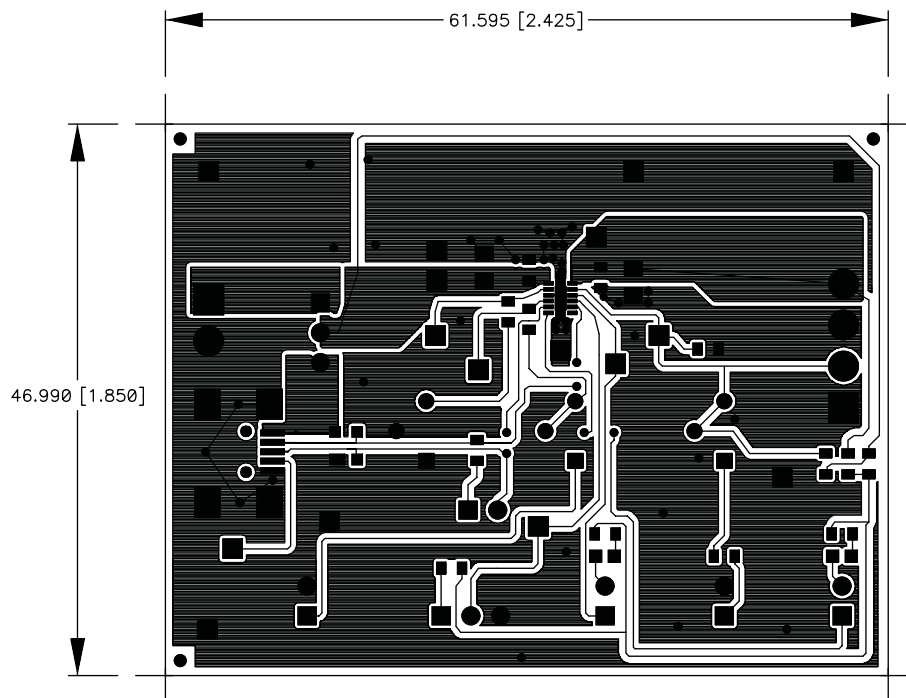


Figure 8. Top View

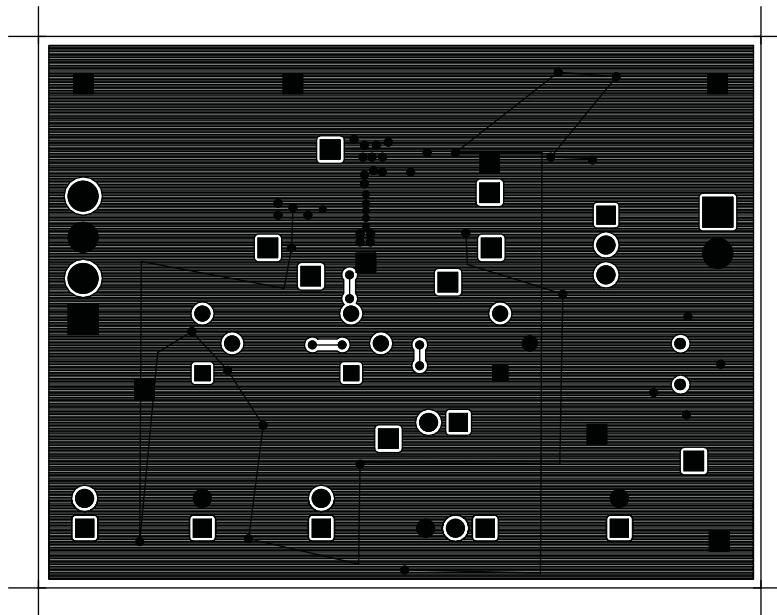


Figure 9. Bottom View

5.6 Bill of Materials – HPA379A

Table 2. HPA379A BOM – bq24055

Count	RefDes	Value	Description	Size	Part Number	MFR
1	C1	1 μ F	Capacitor, Ceramic, 25V, X5R, 10%	0603	ECJ-1VB1E105K	Panasonic
0	C2		Capacitor, Ceramic, 25V, X5R, 10%	0805		
1	C3	2.2 μ F	Capacitor, Ceramic, 10V, X5R, 10%	0603	ECJ-1VB1A225K	Panasonic
0	C4		Capacitor, Ceramic, 10V, X5R, 10%	0805		
0	C5		Capacitor, Ceramic, 10V, X5R, 10%	0603		
2	D1, D2	LTST-C190GKT	Diode, LED, Green, 2.1-V, 20-mA, 6-mcd	0603	LTST-C190GKT	Lite On
0	D3	CM1213A-02SR	Diode, ESD Protection Arrays, 2 Channel	SOT143	CM1213A-02SR	CMD
1	J1**	ED555/2DS	Terminal Block, 2-pin, 6-A, 3.5mm	0.27 x 0.25 inch	ED555/2DS	OST
1	J2**	ED555/4DS	Terminal Block, 4-pin, 6-A, 3.5mm	0.55 x 0.25 inch	ED555/4DS	OST
1	J3	UX60-MB-5ST	Connector, Recpt, USB-B, Mini, 5-pins, SMT	0.354 X 0.303 Inches	UX60-MB-5ST	Hirose Electric Co Ltd
2	JMP1, JMP3	PEC03SAAN	Header, Male 3-pin, 100mil spacing, (3-pin strip)	0.100 inch x 3	PEC03SAAN	Sullins
5	JMP2, JMP4, JMP5, JMP6, JMP7	PEC02SAAN	Header, Male 2-pin, 100mil spacing, (2-pin strip)	0.100 inch x 2	PEC02SAAN	Sullins
1	R1	675 Ω	Resistor, Chip, 1/16W, 1%	0603	Std	Std
1	R11	0	Resistor, Chip, 1/16W, 1%	0603	Std	Std
0	R12, R13	DNI	Resistor, Chip, 1/16W, 1%	0603	Std	Std
2	R2, R4	10k Ω	Potentiometer, 1/4 in. Cermet, 12-Turn, Top-Adjust	0.25x0.17	3266W-1-103LF	Bourns
2	R3, R9	1.0k Ω	Resistor, Chip, 1/16W, 1%	0603	Std	Std
1	R5	10k Ω	Resistor, Chip, 1/16W, 1%	0603	Std	Std
1	R6	200 Ω	Resistor, Chip, 1/16W, 1%	0603	Std	Std
2	R7, R10	1.5k Ω	Resistor, Chip, 1/16W, 1%	0603	Std	Std

Table 2. HPA379A BOM – bq24055 (continued)

Count	RefDes	Value	Description	Size	Part Number	MFR
1	R8	50kΩ	Potentiometer, 1/4 in. Cermet, 12-Turn, Top-Adjust	0.25x0.17	3266W-1-503LF	Bourns
1	U1	BQ24055	IC, 800mA, Single-Input, Single Cell Li-Ion BATTERY CHARGER with Automatic AC/USB Detection	SON-12	BQ24055DSS	TI
6		929950-00	Shunts	100 mill	Black	3M
1	--		PCB, 2.4 In x 1.9 In x 0.031 In		HPA379	Any

- Notes:
1. These assemblies are ESD sensitive, ESD precautions shall be observed.
 2. These assemblies must be clean and free from flux and all contaminants. Use of no clean flux is not acceptable.
 3. These assemblies must comply with workmanship standards IPC-A-610 Class 2.
 4. Ref designators marked with an asterisk (***) cannot be substituted. All other components can be substituted with equivalent MFG's components.
 5. Apply shunt to JMP1:DC+/IN_IC; JMP2:GND/PreTerm; JMP3:GND/ISET2; JMP4:LED/CHG; JMP5:GND/TS; JMP6:LED/PG

EVALUATION BOARD/KIT IMPORTANT NOTICE

Texas Instruments (TI) provides the enclosed product(s) under the following conditions:

This evaluation board/kit is intended for use for **ENGINEERING DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY** and is not considered by TI to be a finished end-product fit for general consumer use. Persons handling the product(s) must have electronics training and observe good engineering practice standards. As such, the goods being provided are not intended to be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including product safety and environmental measures typically found in end products that incorporate such semiconductor components or circuit boards. This evaluation board/kit does not fall within the scope of the European Union directives regarding electromagnetic compatibility, restricted substances (RoHS), recycling (WEEE), FCC, CE or UL, and therefore may not meet the technical requirements of these directives or other related directives.

Should this evaluation board/kit not meet the specifications indicated in the User's Guide, the board/kit may be returned within 30 days from the date of delivery for a full refund. **THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.**

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies TI from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge.

EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

TI currently deals with a variety of customers for products, and therefore our arrangement with the user **is not exclusive**.

TI assumes **no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein.**

Please read the User's Guide and, specifically, the Warnings and Restrictions notice in the User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For additional information on TI's environmental and/or safety programs, please contact the TI application engineer or visit www.ti.com/esh.

No license is granted under any patent right or other intellectual property right of TI covering or relating to any machine, process, or combination in which such TI products or services might be or are used.

FCC Warning

This evaluation board/kit is intended for use for **ENGINEERING DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY** and is not considered by TI to be a finished end-product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the power supply voltage range of 4.45 V and 6.45 V. Input voltage range is specified for normal operation. Input voltage between UVLO and 4.75 V has limited functionality, but does not damage the IC nor present any safety issue with the battery. Input voltage above OVP and less than 30 Vdc has no operation and will not damage the IC. Lower input voltage (closer to dropout operation) produces less heat dissipation and potentially better performance.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

During normal operation, some circuit components may have case temperatures greater than 60°C. The EVM is designed to operate properly with certain components above 60°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products

Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
RF/IF and ZigBee® Solutions	www.ti.com/lprf

Applications

Audio	www.ti.com/audio
Automotive	www.ti.com/automotive
Broadband	www.ti.com/broadband
Digital Control	www.ti.com/digitalcontrol
Medical	www.ti.com/medical
Military	www.ti.com/military
Optical Networking	www.ti.com/opticalnetwork
Security	www.ti.com/security
Telephony	www.ti.com/telephony
Video & Imaging	www.ti.com/video
Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2009, Texas Instruments Incorporated

Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибьюторов Европы, Америки и Азии.

С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров

Мы предлагаем:

- Конкуренеспособные цены и скидки постоянным клиентам.
- Специальные условия для постоянных клиентов.
- Подбор аналогов.
- Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.
- Приемлемые сроки поставки, возможна ускоренная поставка.
- Доставку товара в любую точку России и стран СНГ.
- Комплексную поставку.
- Работу по проектам и поставку образцов.
- Формирование склада под заказчика.
- Сертификаты соответствия на поставляемую продукцию (по желанию клиента).
- Тестирование поставляемой продукции.
- Поставку компонентов, требующих военную и космическую приемку.
- Входной контроль качества.
- Наличие сертификата ISO.

В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- Регистрацию проекта у производителя компонентов.
- Техническую поддержку проекта.
- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



Тел: +7 (812) 336 43 04 (многоканальный)

Email: org@lifeelectronics.ru