TEXAS INSTRUMENTS

bq2430x/1x/8x DSG EVM (HPA245) for Li+ Charger Front-End Protection IC

The bq2430x/1x/8x evaluation module is a complete charger module for evaluating a charger front-end protection and charger solution using the bq2430x/1x/8x and bq24080 devices. This user's guide presents test summary information, printed-circuit board layout guidelines, bill of materials, board layout, and schematics.

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- Evaluation module for bq2430x/1x/8x and bq24080 chipset solution
- Input operating range for bq2430x/1x/8x 4.5 V–26 V
- Input operating range for bq24080 4.5 V–6.5 V
- Input overvoltage protection
- Input overcurrent protection
- Battery overvoltage protection
- Input reverse voltage protection for bq2430x
- LED indication for status signals
- Test points for key signals available for testing purpose. Easy probe hook-up
- Jumpers available. Easy to change connections

1.2 General Description

The bq2430x/1x/8x evaluation module is a complete charger module for evaluating a charger front-end protection and charger solution using the bq2430x/1x/8x and bq24080 devices. It is designed to deliver up to 200 mA (bq2430x) or 700 mA (bq2431x/8x) of charge current to Li-ion or Li-polymer applications. The charger front-end protection current is designed to 300 mA (bq2430x) or 1000 mA (bq2431x) or no limit (bq2438x).

The bq2430x/1x8x protects the charging system against three types of failures: input overvoltage when the AC adapter fails to regulate its voltage; load overcurrent when failures such as a short-circuit occurs in the charging system; and battery overcharge.

In addition, bq2430x provide a PFET gate drive signal to an external PFET for input reverse-polarity protection.

For details, see the relevant bq2430x/1x/8x data sheet.

1.3 I/O Description

Jack	Description
J1-DC+	AC adapter, positive output
J1-DC–	AC adapter, negative output, ground
J2-OUT	CFE OUT pin
J2-DC–	CFE VSS pin, ground
J2-BAT+	Connect to battery positive output
J2-$\overline{\text{FAULT}}$	CFE $\overline{\text{FAULT}}$ pin
J3-CHGIN	bq24080 IN pin, connect to external power supply positive output
J3-DC–	bq24080 VSS pin, ground
J4-BAT+	Connect to battery positive output
J4-BAT–	Connect to battery negative output, ground

1.4 Controls and Key Parameters Setting

Jack	Description	Factory Setting
JMP1	CFE input voltage is indicated by LED.	Jumper On
JMP2	CFE output voltage is indicated by LED.	Jumper On
JMP3	CFE $\overline{\text{CE}}$ pin is connected to 5 V.	Jumper On
JMP4	bq24080 STAT1 pin is indicated by LED.	Jumper On
JMP5	bq24080 STAT2 pin is indicated by LED.	Jumper On
JMP6	bq24080 $\overline{\text{PG}}$ pin is indicated by LED	Jumper On
JMP7	bq24080 $\overline{\text{CE}}$ pin is connected to 5 V.	Jumper On
JMP8	CFE OUT pin is connected to bq24080 IN pin.	Jumper Off

1.5 Recommended Operating Conditions

Symbol	Description	Min	Typ	Max	Unit	Notes
Supply voltage, V_{IN}	Input voltage from ac adapter input	4.5	5	26	V	
Battery voltage, V_{BAT}	Voltage applied at VBAT terminal of J4	0	3-4.2	5	V	
Supply current, I_{AC}	Maximum input current from ac adapter input	0		1.5	A	
Charge current, I_{chrg}	Battery charge current	0.02–0.07	0.2–0.7	1	A	
Operating junction temperature range, T_J		0		125	℃	

2   Test Summary

2.1   Definitions

This procedure details how to configure the evaluation board. On the test procedure, the following naming conventions are followed. See

the schematic for details.

VXXX :	External voltage supply name (VIN, VBAT, VOUT)
LOADW:	External load name (LOADR, LOADI)
V(TPyyy) :	Voltage at internal test point TPyyy. For example, V(TP1) means the voltage at TP1.
V(Jxx):	Voltage at jack terminal Jxx.
V[TP(XXXXX)]:	Voltage at test point *XXXXX*. For example, V(ACDET) means the voltage at the test point which is marked as *ACDET*.
V(XXX, YYY):	Voltage across point XXX and YYY.
I[JXX(YYY)]:	Current going out from the YYY terminal of jack XX.
Jxx(BBB):	Terminal or pin BBB of jack xx
Jxx ON :	Internal jumper Jxx terminals are shorted
Jxx OFF:	Internal jumper Jxx terminals are open
Jxx (-YY-) ON:	Internal jumper Jxx adjacent terminals marked as *YY* are shorted
Measure:	A,B Check specified parameters A, B. If measured values are not within specified limits, the unit under test has failed.
Observe:	A,B Observe if A, B occur. If they do not occur, the unit under test has failed.

Assembly drawings have location for jumpers, test points, and individual components.

2.2   Equipment

2.2.1   Power Supplies

Power Supply #1 (PS#1): a power supply capable of supplying 20 V at 2 A is required.
Power Supply #2 (PS#2): a power supply capable of supplying 5 V at 1 A is required.

2.2.2   Load #1

A 10-V (or above), 2-A (or above) electronic load that can operate at constant current mode.

2.2.3   Load #2

A 10-V (or above), 2-A (or above) electronic load that can operate at constant voltage mode.

2.2.4   Meters

Four Fluke 75 multimeters, (equivalent or better)
Or: Three equivalent voltage meters and one equivalent current meter. The current meters must be capable of measuring 2-A+ current.

2.2.5   Wire Gauge

All wires connected to EVM input power supply and output load should use at least AWG 22. The maximum current is up to 1 A.

2.3   Equipment Setup

(A) Set the power supply #1 for 0 V ± 100 mVDC, 2 ± 0.1-A current limit and then disable the output.
(B) Connect the output of power supply #1 to J1 (DC+, DC–)

(C) Connect a voltage meter across J1 (DC+, DC–).

(D) Set the power supply #2 for 3.7 V ± 100 mVDC, 0.2 ± 0.1-A current limit and then disable the output.

(E) Connect power supply #2 to J2 (BAT+, DC–).

(F) Connect a voltage meter across J2 (BAT+, DC–).

(G) Connect the output of the Load #1 in series with a current meter (multimeter) to J2 (OUT, DC–). Ensure that a voltage meter is connected across J2 (OUT, DC–). Turn on the power of the Load #1. Set the load current to 0.2 A ±50 mA but disable the output.

(H) JMP1: ON, JMP2: ON, JMP3: ON, JMP4: ON, JMP5: ON, JMP6: ON, JMP7: ON, JMP8: OFF.

After the preceding steps, the test setup for HPA245 (bq2430x/1x/8x DSG EVM) is shown in Figure 1.

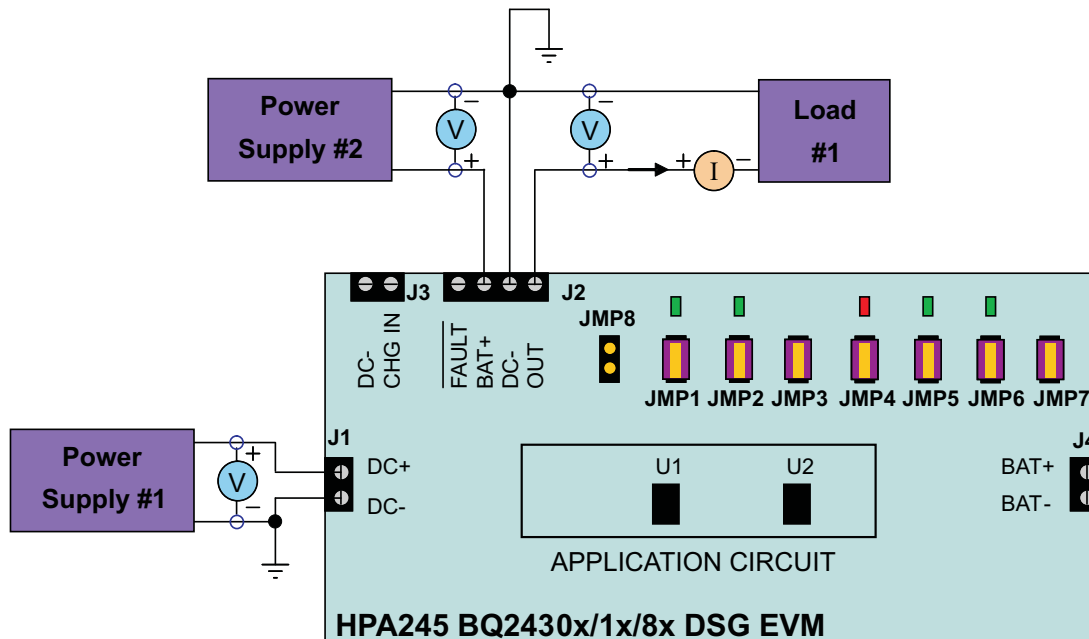**Figure 1. Original Test Setup for HPA245 (bq2430x/1x/8x DSG EVM)**

2.4 Procedure

2.4.1 CFE ENABLE and Voltage Regulation

1. Ensure that the preceding Equipment Setup steps are followed.
2. Enable output of PS#2.
3. Enable output of PS#1.
4. **(For HPA245-001, -002, -003, -004, -009, -010, -013 only)** Increase the output voltage of PS#1 to 6 V± 0.1 V.

   Measure → V(J2(OUT)) = 0 V ± 500 mV

   Observe → D2 on, D3 off.
5. **(For HPA245-005, -006, -007, -008, -011, -012 only)** Increase the output voltage of PS#1 to 5 V ± 0.1 V.

   Measure → V(J2(OUT)) = 0 V ± 500 mV

   Observe → D2 on, D3 off.
6. Uninstall JMP3 (enable U1).

   Measure → V(J2(OUT)) = 5.5 V ± 200 mV **(For HPA245-001, -002, -009 only)**

   Measure → V(J2(OUT)) = 4.5 V ± 200 mV **(For HPA245-003 only)**

   Measure → V(J2(OUT)) = 5 V ± 200 mV **(For HPA245-004, -005, -006, -007, -008, -010, -011, 012, -**

013 only)

Observe → D2 on, D3 on.

2.4.2 CFE Input Overvoltage Protection

1. **(For HPA245-001, -002, -003, -004, -013 only)** Increase the voltage of PS#1 to 11V ±0.1V

   Measure → V(J2(OUT)) = 0 V ± 500 mV

   Observe → D2 on, D3 off.

2. **(For HPA245-005, -006, -007, -008, -009, -010, -011, -012 only)** Increase the voltage of PS#1 to 8 V ±0.1 V.

   Measure → V(J2(OUT)) = 0 V ± 500 mV

   Observe → D2 on, D3 off.

3. Decrease the voltage of PS#1 to 5 V ±0.1 V.

   Observe → D2 on, D3 on

2.4.3 CFE Load Overcurrent Protection

1. **(For HPA245-009, -010, skip 2.4.3 test and go to 2.4.4 test.)**

2. Enable the output of the Load #1.

   Observe → D2 on, D3 on.

3. **(For HPA245-001, -002, -003, -004, -013 only)** Increase the current of Load #1 to 0.5A ±0.1A

   Observe → D2 on, D3 off.

4. **(For HPA245-005, -006, -007, -008, -011, -012 only)** Increase the current of Load #1 to 1.2 A ±0.1 A.

   Observe → D2 on, D3 off.

5. Turn off Load #1.

6. Decrease the voltage of PS#1 to 0 V ±0.1 V.

2.4.4 CFE Battery Overvoltage Protection

1. Increase the output voltage of PS#1 to 5 V ±0.1V.

   Observe → D2 on, D3 on

2. Increase the voltage of PS #2 to 4.6 V ±0.1V.

   Observe → D2 on, D3 off.

3. Decrease the voltage of PS #2 to 3.7 V ±0.1V.

   Observe → D2 on, D3 on.

4. Turn off all the power supplies and loads. Remove all connection between test board and power supplies or loads.

2.4.5 Charge IC Test Setup

1. Set the power supply #1 for 0 V ±100 mVDC, 2-A ±0.1-A current limit and then disable the output.

2. Connect the output of power supply #1 to J3 (CHG IN, DC−).

3. Connect a voltage meter across J3 (CHG IN, DC−).

4. Set the voltage of Load #2 to 3.6 V ±0.1 V, disable output of Load #2.

5. Connect output of the Load #2 in series with a current meter (multimeter) to J4 (BAT+, BAT−). Ensure that a voltage meter is connected across J4 (BAT+, BAT−).

6. JMP1: ON, JMP2: ON, JMP3: ON, JMP4: ON, JMP5: ON, JMP6: ON, JMP7: ON, JMP8: OFF

7. After the preceding steps, the test setup for HPA245 (bq2430x/1x/8x DSG EVM) is shown in Figure 2.
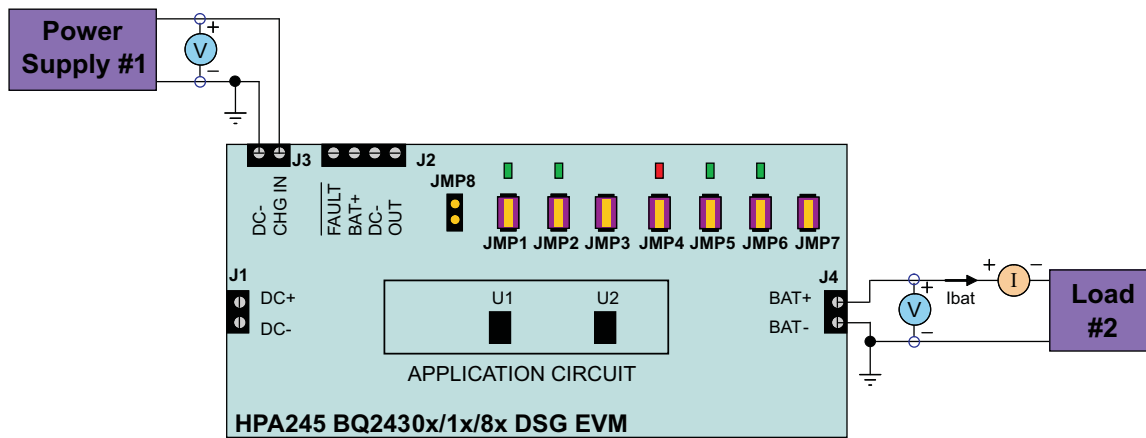
Figure 2. Charger IC Test Setup for HPA245 (bq2430x/1x/8x DSG EVM)

2.4.6 Charge IC Test

1. Enable output of Load #2
2. Enable output of PS#1
3. Increase the voltage of PS #1 to 5 V ±0.1 V.

   Observe → D4 off, D5 off, D6 on.
4. Uninstall JMP7 (enable U2).

   Measure → Ibat = 200 mA ±20 mA **(For HPA245-001, -002, -003, -004, -013 only)**.

   Measure → Ibat = 700 mA ±70 mA **(For HPA245-005, -006, -007, -008, -009, -010, -011, -012 only)**.

   Observe → D4 on, D5 off, D6 on.
5. Disable the output of Load #2.
6. Disable the output of PS#1 and remove PS #1 from J3

2.4.7 CFE and Charge IC Chipset Test Setup

1. Connect the output of power supply #1 to J1 (DC+, DC–).
2. Connect a voltage meter across J1 (DC+, DC–).
3. JMP1: ON, JMP2: ON, JMP3: OFF, JMP4: ON, JMP5: ON, JMP6: ON, JMP7: OFF, JMP8: ON.
4. After the preceding steps, the test setup for HPA245 (bq2430x/1x/8x DSG EVM) is shown in Figure 3.
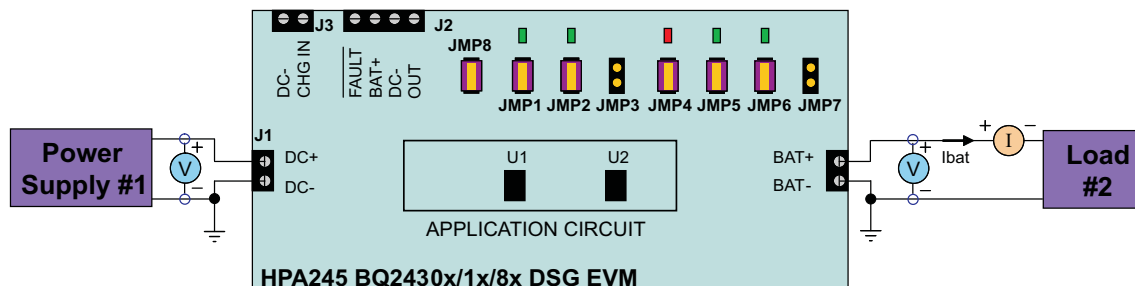
Figure 3. Chipset Test Setup for HPA245 (bq2430x/1x/8x DSG EVM)

2.4.8 CFE and Charge IC Chipset Test

1. Enable output of Load #2.
2. Enable output of PS#1.

   Measure → Ibat = 200 mA ±20 mA **(For HPA245-001, -002, -003, -004, -013 only)**.

Measure → Ibat = 700 mA ±70 mA **(For HPA245-005, -006, -007, -008, -009, -010, -011, -012 only).**

Observe → D2 on, D3 on, D4 on, D5 off, D6 on.

3   PCB Layout Guideline

1. It is critical that the exposed power pad on the backside of the bq2430x/1x/8x package be soldered to the PCB ground. Ensure that sufficient thermal vias are right underneath the IC, connecting to the ground plane on the other layers.

2. The high-current charge paths into IN and from OUT pins must be sized appropriately for the maximum charge current in order to avoid voltage drops in these traces.

3. Decoupling capacitors for IN and OUT pins should be placed on the board and the interconnections to the IC made as short as possible.

4. Resistors for ILIM and VLIM must be placed close to the corresponding IC pins and the interconnections to the IC made as short as possible.

4   Bill of Materials, Board Layout, and Schematics

4.1   Bill of Materials — bq24300/02/04/10/14/16

bq24300-0001	bq24302-0002	bq24304-0003	bq24308-0004	bq24310-0005	bq24312-0006	bq24314-0007	bq24316-0008	RefDes	Value	Description	Size	Part Number	MFR
1	1	1	1	0	0	0	0	C1	1 µF	Capacitor, Ceramic, 35-V, X7R, 10%	805	Std	Std
1	1	1	1	1	1	1	1	C2	1 µF	Capacitor, Ceramic, 35-V, X7R, 10%	805	Std	Std
3	3	3	3	3	3	3	3	C3–C5	1 µF	Capacitor, Ceramic, 16-V, X7R, 10%	805	Std	Std
1	1	1	1	1	1	1	1	D1	BZT52C5V1S	Diode, Zener, 200mW, 5.1V	SOD-323	BZT52C5V1S	General
4	4	4	4	4	4	4	4	D2, D3, D5, D6	LTST-C190GKT	Diode, LED, Green, 2.1-V, 20-mA, 6-mcd	603	LTST-C190GKT	Liteon
1	1	1	1	1	1	1	1	D4	LTST-C190CKT	Diode, LED, Red, 1.8-V, 20-mA, 20-mcd	603	LTST-C190CKT	Liteon
3	3	3	3	3	3	3	3	J1–J4	ED1514	Terminal Block, 2-pin, 6-A, 3,5mm	0.27 x 0.25 in	ED1514	OST
1	1	1	1	1	1	1	1	J2	ED1516	Terminal Block, 4-pin, 6-A, 3,5mm	0.55 x 0.25 in	ED1516	OST
8	8	8	8	8	8	8	8	JMP1–JMP8	PTC36SAAN	Header, 2-pin, 100mil spacing, (36-pin strip)	0.100 in x 2	PTC36SAAN	Sullins
8	8	8	8	8	8	8	8	JMP1–JMP8	929950-00	Shorting jumpers, 2-pin, 100mil spacing		929950-00	3M/ESD
1	1	1	1	0	0	0	0	Q1	Si2343DS	MOSFET, Pch, –30 V, 4 A, 53 mΩ	SOT23	Si2343DS	Vishay
1	1	1	1	0	0	0	0	R1	100k	Resistor, Chip, 1/16W, 5%	603	Std	Std
0	0	0	0	1	1	1	1	R2	0	Resistor, Chip, 1/8W, 5%	1206	Std	Std
1	1	1	1	1	1	1	1	R3	20k	Resistor, Chip, 1/16W, 5%	603	Std	Std
0	0	0	1	0	0	0	0	R4	113k	Resistor, Chip, 1/16W, 1%	603	Std	Std
0	0	0	0	1	1	1	1	R5	24.9k	Resistor, Chip, 1/16W, 1%	603	Std	Std
1	0	1	1	1	1	1	1	R6	100k	Resistor, Chip, 1/16W, 5%	603	Std	Std
1	1	1	1	1	1	1	1	R7	6.2k	Resistor, Chip, 1/16-W, 5%	603	Std	Std
1	1	1	1	1	1	1	1	R9	20k	Resistor, Chip, 1/16-W, 5%	603	Std	Std
5	5	5	5	5	5	5	5	R8, R11–R14	1.5k	Resistor, Chip, 1/16-W, 5%	603	Std	Std
0	0	0	0	1	1	1	1	R10	1.13k	Resistor, Chip, 1/16-W, 1%	603	Std	Std
1	1	1	1	0	0	0	0	R10	4.02k	Resistor, Chip, 1/16-W, 1%	603	Std	Std
0	0	0	0	1	1	0	0	R15	137k	Resistor, Chip, 1/16-W, 1%	603	Std	Std
0	0	0	0	1	1	1	1	R16	100k	Resistor, Chip, 1/16-W, 5%	603	Std	Std
1	0	0	0	0	0	0	0	U1	bq24300DSG	IC, Li+ Charger Front-End Protection	DSG8	bq24300DSG	TI
0	1	0	0	0	0	0	0	U1	bq24302DSG	IC, Li+ Charger Front-End Protection	DSG8	bq24302DSG	TI
0	0	1	0	0	0	0	0	U1	bq24304DSG	IC, Li+ Charger Front-End Protection	DSG8	bq24304DSG	TI
0	0	0	1	0	0	0	0	U1	bq24308DSG	IC, Li+ Charger Front-End Protection	DSG8	bq24308DSG	TI
0	0	0	0	1	0	0	0	U1	bq24310DSG	IC, Li+ Charger Front-End Protection	DSG8	bq24310DSG	TI
0	0	0	0	0	1	0	0	U1	bq24312DSG	IC, Li+ Charger Front-End Protection	DSG8	bq24312DSG	TI
0	0	0	0	0	0	1	0	U1	bq24314DSG	IC, Li+ Charger Front-End Protection	DSG8	bq24314DSG	TI
0	0	0	0	0	0	0	1	U1	bq24316DSG	IC, Li+ Charger Front-End Protection	DSG8	bq24316DSG	TI
1	1	1	1	1	1	1	1	U2	bq24080DRC	IC, Single Chip, Li Ion/Li POL, Charger	DRC10	bq24080DRC	TI
1	1	1	1	1	1	1	1	—	HPA245	PCB, 1.2 In x 3 In x 0.031 In		PCB	Any

Notes:
1. Number 0 in left side columns means do not use this component.
2. OPEN in value column means do not use this component.
3. Std in part number column means standard manufacturer's part number
4. Std in MFR column means standard manufacturer

4.2   Bill of Materials — bq24380/1/14A/15/05

bq2 4380- 0009	bq2 4381- 0010	bq2 4314 A- 0011	bq2 4315- 0012	bq2 4305- 0013	RefDes	Value	Description	Size	Part Number	MFR
0	0	0	0	1	C1	1 µF	Capacitor, Ceramic, 35-V, X7R, 10%	805	Std	Std
1	1	1	1	1	C2	1 µF	Capacitor, Ceramic, 35-V, X7R, 10%	805	Std	Std
3	3	3	3	3	C3–C5	1 µF	Capacitor, Ceramic, 16-V, X7R, 5%	805	Std	Std
1	1	1	1	1	D1	BZT52C5V1S	Diode, Zener, 200mW, 5.1V	SOD-323	BZT52C5V1S	General
4	4	4	4	4	D2,D3,D5,D6	LTST-C190GKT	Diode, LED, Green, 2.1-V, 20-mA, 6-mcd	603	LTST-C190GKT	Liteon
1	1	1	1	1	D4	LTST-C190CKT	Diode, LED, Red, 1.8-V, 20-mA, 20-mcd	603	LTST-C190CKT	Liteon
3	3	3	3	3	J1, J3, J4	ED1514	Terminal Block, 2-pin, 6-A, 3.5mm	0.27 × 0.25 inch	ED1514	OST
1	1	1	1	1	J2	ED1516	Terminal Block, 4-pin, 6-A, 3.5mm	0.55 × 0.25 inch	ED1516	OST
8	8	8	8	8	JMP1–JMP8	PTC36SAAN	Header, 2-pin, 100mil spacing, (36-pin strip)	0.100 inch × 2	PTC36SAAN	Sullins
8	8	8	8	8	JMP1–JMP8	929950-00	Shorting jumpers, 2-pin, 100mil spacing		929950-00	3M/ESD
0	0	0	0	1	Q1	Si2343DS	MOSFET, Pch, –30 V, 4 A, 53 mΩ	SOT23	Si2343DS	Vishay
0	0	0	0	1	R1	100k	Resistor, Chip, 1/16W, 5%	603	Std	Std
1	1	1	1	0	R2	0	Resistor, Chip, 1/16W, 5%	1206	Std	Std
1	1	1	1	1	R3	20k	Resistor, Chip, 1/16W, 5%	603	Std	Std
0	0	0	0	0	R4	113k	Resistor, Chip, 1/16W, 1%	603	Std	Std
0	0	1	1	0	R5	24.9k	Resistor, Chip, 1/16W, 1%	603	Std	Std
1	1	1	1	1	R6	100k	Resistor, Chip, 1/16W, 5%	603	Std	Std
1	1	1	1	1	R7	6.2k	Resistor, Chip, 1/16W, 5%	603	Std	Std
1	1	1	1	1	R9	20k	Resistor, Chip, 1/16W, 5%	603	Std	Std
5	5	5	5	5	R8, R11–R14	1.5k	Resistor, Chip, 1/16W, 5%	603	Std	Std
1	1	1	1	0	R10	1.13k	Resistor, Chip, 1/16W, 1%	603	Std	Std
0	0	0	0	1	R10	4.02k	Resistor, Chip, 1/16W, 1%	603	Std	Std
0	0	0	0	0	R15	137k	Resistor, Chip, 1/16W, 5%	603	Std	Std
1	1	1	1	0	R16	100k	Resistor, Chip, 1/16W, 5%	603	Std	Std
1	0	0	0	0	U1	BQ24380DSG	IC, Li+ Charger Front-End Protection	DSG8	BQ24380DSG	TI
0	1	0	0	0	U1	BQ24381DSG	IC, Li+ Charger Front-End Protection	DSG8	BQ24381DSG	TI
0	0	1	0	0	U1	BQ24314ADSG	IC, Li+ Charger Front-End Protection	DSG8	BQ24314ADSG	TI
0	0	0	1	0	U1	BQ24315DSG	IC, Li+ Charger Front-End Protection	DSG8	BQ24315DSG	TI
0	0	0	0	1	U1	BQ24305DSG	IC, Li+ Charger Front-End Protection	DSG8	BQ24305DSG	TI
1	1	1	1	1	—	HPA245	PCB, 1.2 In × 3 In × 0.031 In		PCB	Any

Notes:
1. Number 0 in left side columns means do not use this component.
2. OPEN in value column means do not use this component.
3. Std in part number column means standard manufacturer's part number
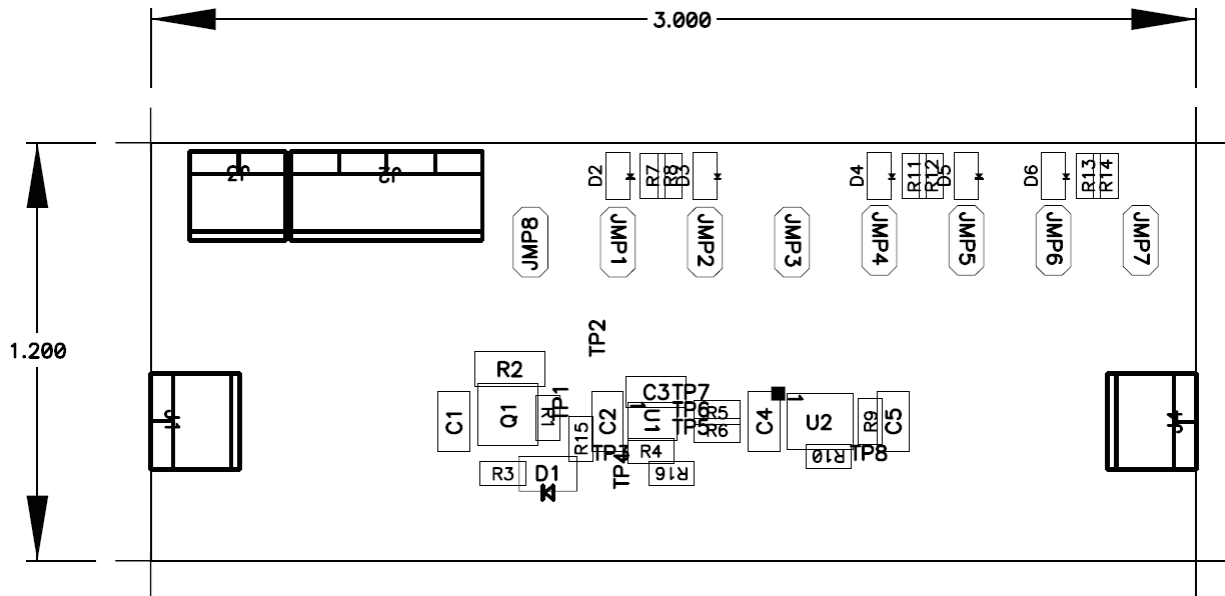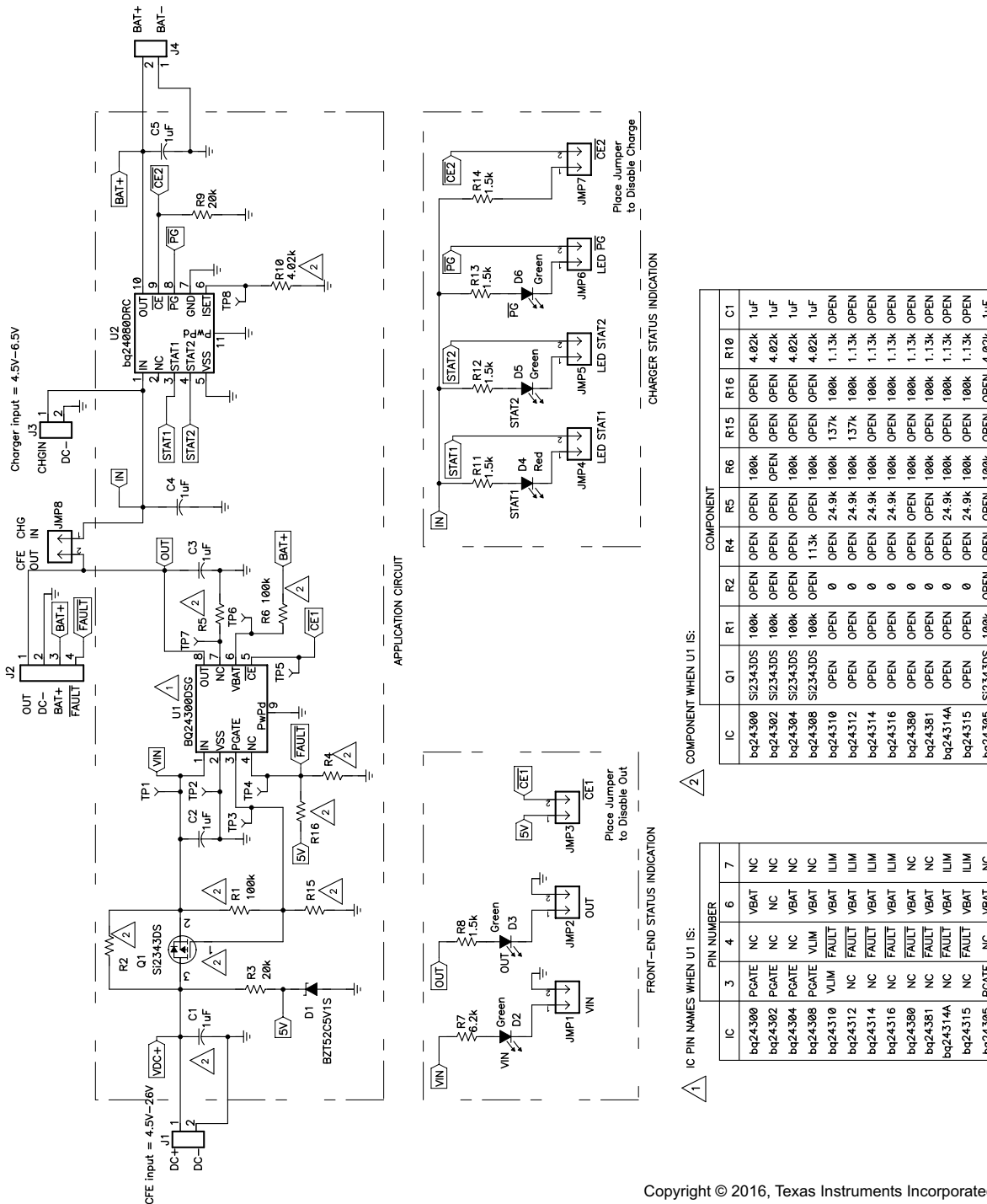4. Std in MFR column means standard manufacturer .

4.3   Board Layout

Figure 4. Top Layer

Figure 5. Bottom Layer

Figure 6. Top Silkscreen

Figure 7. Top Assembly

4.4 Schematics

The bq2430x/1x/8x DSG EVM schematic follows.

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IC PIN NAMES WHEN U1 IS:

IC	PIN NUMBER			
	3	4	6	7
bq24300	PGATE	NC	VBAT	NC
bq24302	PGATE	NC	NC	NC
bq24304	PGATE	NC	VBAT	NC
bq24308	PGATE	VLIM	VBAT	NC
bq24310	VLIM	FAULT	VBAT	ILIM
bq24312	NC	FAULT	VBAT	ILIM
bq24314	NC	FAULT	VBAT	ILIM
bq24316	NC	FAULT	VBAT	ILIM
bq24380	NC	FAULT	VBAT	NC
bq24381	NC	FAULT	VBAT	NC
bq24314A	NC	FAULT	VBAT	ILIM
bq24315	NC	FAULT	VBAT	ILIM
bq24305	PGATE	NC	VBAT	NC

COMPONENT WHEN U1 IS:

IC	Q1	R2	R1	R4	R5	R6	R15	R16	R10	C1
bq24300	Si2343DS	OPEN	100k	OPEN	OPEN	100k	OPEN	OPEN	4.02k	1uF
bq24302	Si2343DS	OPEN	100k	OPEN	OPEN	100k	OPEN	OPEN	4.02k	1uF
bq24304	Si2343DS	OPEN	100k	OPEN	OPEN	100k	OPEN	OPEN	4.02k	1uF
bq24308	Si2343DS	OPEN	100k	113k	OPEN	100k	OPEN	OPEN	4.02k	1uF
bq24310	OPEN	0	OPEN	OPEN	24.9k	100k	137k	100k	1.13k	OPEN
bq24312	OPEN	0	OPEN	OPEN	24.9k	100k	137k	100k	1.13k	OPEN
bq24314	OPEN	0	OPEN	OPEN	24.9k	100k	137k	100k	1.13k	OPEN
bq24316	OPEN	0	OPEN	OPEN	24.9k	100k	OPEN	100k	1.13k	OPEN
bq24380	OPEN	0	OPEN	OPEN	24.9k	100k	OPEN	100k	1.13k	OPEN
bq24381	OPEN	0	OPEN	OPEN	24.9k	100k	OPEN	100k	1.13k	OPEN
bq24314A	OPEN	0	OPEN	OPEN	24.9k	100k	OPEN	100k	1.13k	OPEN
bq24315	OPEN	OPEN	OPEN	OPEN	24.9k	100k	OPEN	100k	1.13k	OPEN
bq24305	Si2343DS	OPEN	100k	OPEN	OPEN	100k	OPEN	OPEN	4.02k	1uF

Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from A Revision (April 2008) to B Revision **Page**

STANDARD TERMS AND CONDITIONS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including demonstration software, components, and/or documentation which may be provided together or separately (collectively, an "EVM" or "EVMs") to the User ("User") in accordance with the terms and conditions set forth herein. Acceptance of the EVM is expressly subject to the following terms and conditions.

    1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM ("Software") shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms and conditions that accompany such Software

    1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.

2 *Limited Warranty and Related Remedies/Disclaimers*:

    2.1 These terms and conditions do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.

    2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for any defects that are caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI. Moreover, TI shall not be liable for any defects that result from User's design, specifications or instructions for such EVMs. Testing and other quality control techniques are used to the extent TI deems necessary or as mandated by government requirements. TI does not test all parameters of each EVM.

    2.3 If any EVM fails to conform to the warranty set forth above, TI's sole liability shall be at its option to repair or replace such EVM, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

3 *Regulatory Notices:*

    3.1 *United States*

        3.1.1 *Notice applicable to EVMs not FCC-Approved:*

        This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

        3.1.2 *For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:*

        CAUTION

        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.

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

        FCC Interference Statement for Class A EVM devices

        NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- *Reorient or relocate the receiving antenna.*
- *Increase the separation between the equipment and receiver.*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- *Consult the dealer or an experienced radio/TV technician for help.*

3.2 *Canada*

  3.2.1 *For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210*

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur

3.3 *Japan*

  3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。
    http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page

  3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required by Radio Law of Japan to follow the instructions below with respect to EVMs:

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,

2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or

3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

【無線電波を送信する製品の開発キットをお使いになる際の注意事項】 開発キットの中には技術基準適合証明を受けて
いないものがあります。 技術適合証明を受けていないもののご使用に際しては、電波法遵守のため、以下のいずれかの
措置を取っていただく必要がありますのでご注意ください。

1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用
いただく。
2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。

なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとします。
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ンスツルメンツ株式会社
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3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_02.page
電力線搬送波通信についての開発キットをお使いになる際の注意事項については、次のところをご覧ください。http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_02.page

4 *EVM Use Restrictions and Warnings:*

4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

4.3 *Safety-Related Warnings and Restrictions:*

4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user 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, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.

6. *Disclaimers:*

   6.1 EXCEPT AS SET FORTH ABOVE, EVMS AND ANY WRITTEN DESIGN MATERIALS PROVIDED WITH THE EVM (AND THE DESIGN OF THE EVM ITSELF) ARE PROVIDED "AS IS" AND "WITH ALL FAULTS." TI DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING SUCH ITEMS, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADE SECRETS OR OTHER INTELLECTUAL PROPERTY RIGHTS.

   6.2 EXCEPT FOR THE LIMITED RIGHT TO USE THE EVM SET FORTH HEREIN, NOTHING IN THESE TERMS AND CONDITIONS SHALL BE CONSTRUED AS GRANTING OR CONFERRING ANY RIGHTS BY LICENSE, PATENT, OR ANY OTHER INDUSTRIAL OR INTELLECTUAL PROPERTY RIGHT OF TI, ITS SUPPLIERS/LICENSORS OR ANY OTHER THIRD PARTY, TO USE THE EVM IN ANY FINISHED END-USER OR READY-TO-USE FINAL PRODUCT, OR FOR ANY INVENTION, DISCOVERY OR IMPROVEMENT MADE, CONCEIVED OR ACQUIRED PRIOR TO OR AFTER DELIVERY OF THE EVM.

7. *USER'S INDEMNITY OBLIGATIONS AND REPRESENTATIONS.* USER WILL DEFEND, INDEMNIFY AND HOLD TI, ITS LICENSORS AND THEIR REPRESENTATIVES HARMLESS FROM AND AGAINST ANY AND ALL CLAIMS, DAMAGES, LOSSES, EXPENSES, COSTS AND LIABILITIES (COLLECTIVELY, "CLAIMS") ARISING OUT OF OR IN CONNECTION WITH ANY HANDLING OR USE OF THE EVM THAT IS NOT IN ACCORDANCE WITH THESE TERMS AND CONDITIONS. THIS OBLIGATION SHALL APPLY WHETHER CLAIMS ARISE UNDER STATUTE, REGULATION, OR THE LAW OF TORT, CONTRACT OR ANY OTHER LEGAL THEORY, AND EVEN IF THE EVM FAILS TO PERFORM AS DESCRIBED OR EXPECTED.

8. *Limitations on Damages and Liability:*

   8.1 *General Limitations.* IN NO EVENT SHALL TI BE LIABLE FOR ANY SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF THESE TERMS ANDCONDITIONS OR THE USE OF THE EVMS PROVIDED HEREUNDER, REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. EXCLUDED DAMAGES INCLUDE, BUT ARE NOT LIMITED TO, COST OF REMOVAL OR REINSTALLATION, ANCILLARY COSTS TO THE PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, RETESTING, OUTSIDE COMPUTER TIME, LABOR COSTS, LOSS OF GOODWILL, LOSS OF PROFITS, LOSS OF SAVINGS, LOSS OF USE, LOSS OF DATA, OR BUSINESS INTERRUPTION. NO CLAIM, SUIT OR ACTION SHALL BE BROUGHT AGAINST TI MORE THAN ONE YEAR AFTER THE RELATED CAUSE OF ACTION HAS OCCURRED.

   8.2 *Specific Limitations.* IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY WARRANTY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS AND CONDITIONS, OR ANY USE OF ANY TI EVM PROVIDED HEREUNDER, EXCEED THE TOTAL AMOUNT PAID TO TI FOR THE PARTICULAR UNITS SOLD UNDER THESE TERMS AND CONDITIONS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM AGAINST THE PARTICULAR UNITS SOLD TO USER UNDER THESE TERMS AND CONDITIONS SHALL NOT ENLARGE OR EXTEND THIS LIMIT.

9. *Return Policy.* Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.

10. *Governing Law:* These terms and conditions shall be governed by and interpreted in accordance with the laws of the State of Texas, without reference to conflict-of-laws principles. User agrees that non-exclusive jurisdiction for any dispute arising out of or relating to these terms and conditions lies within courts located in the State of Texas and consents to venue in Dallas County, Texas. Notwithstanding the foregoing, any judgment may be enforced in any United States or foreign court, and TI may seek injunctive relief in any United States or foreign court.

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

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

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In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have *not* been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

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