Freescale Semiconductor User's Guide

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Using the High Input Voltage Charger for Single Cell Li-Ion Batteries (KIT34676EPEVBE)

1 Purpose

This User Guide helps the Lithium-Ion (Li-Ion) battery charger designer understand the MC34676B and its evaluation board. It illustrates the design procedure when using the MC34676B to design a Li-Ion battery charger, and the way to get the best performance from the MC34676B.

2 Scope

The 34676 is a dual 28V input voltage and fully-integrated single cell Li-Ion battery charger, targeting smart handheld applications. One of the inputs is optimized for charging with a USB port, and the second is optimized for an AC/DC adapter power source. The charger has two 28V power devices, to eliminate the need of any external power source selection and input over-voltage protection circuitry. Each of the power devices independently controls the charge current from the input, and performs as an independent charger. Only one of the two chargers operate at a time. The AC charger current and the USB charger current are programmable, up to 1.2A and 400mA, with an external resistor respectively. The voltage across the two external resistors is also used to monitor the actual charge current through each charger respectively. The EOC current of both chargers is the same, and programmable by an external resistor. The 4.85V regulator can be used to power a sub-system directly. The 34676 has a 5% constant current accuracy for the AC

Charger over -40 to 85° C, and a 1.0% constant voltage accuracy over -40 to 85° C. A charge current thermal foldback feature, limits the charge current when the IC internal temperature rises to a preset threshold.

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Application Diagram

3 Application Diagram

3.1 Dual-Input Standalone Charger

The MC34676B can be used as a dual-input standalone Li-Ion charger. **Figure 1** is the typical application circuit. Two LEDs indicate the charge status.

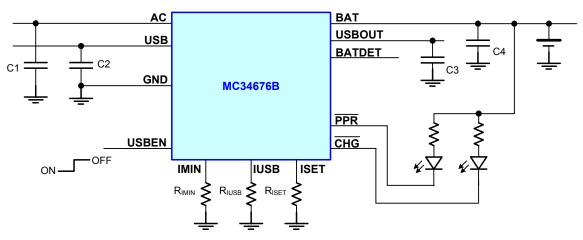


Figure 1. The dual-input Li-lon Charger

3.2 Embedded Charger

When the MC34676B is embedded in the system, the system MCU can control the charger through the USBEN pin and get the charge status through PPR and CHG pins. **Figure 2** is the typical application circuit.

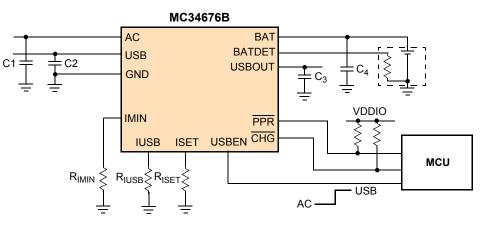


Figure 2. The Li-Ion Charger Embedded in the Hand Held System

Evaluation Board Specification

4 Evaluation Board Specification

The evaluation board is designed to work as a standalone charger, or as an embedded charger in a handheld system. Figure 3 shows its schematic circuit. The normal operation range of the evaluation board is:

For AC charger:

 $V_{AC_MIN} = 4.3V, V_{AC_MAX} = 6.8V$ $I_{AC_MAX} = 1200mA$ For USB charger: $V_{USB_MIN} = 4.3V, V_{USB_MAX} = 5.85V$ $I_{USB_MAX} = 400mA$

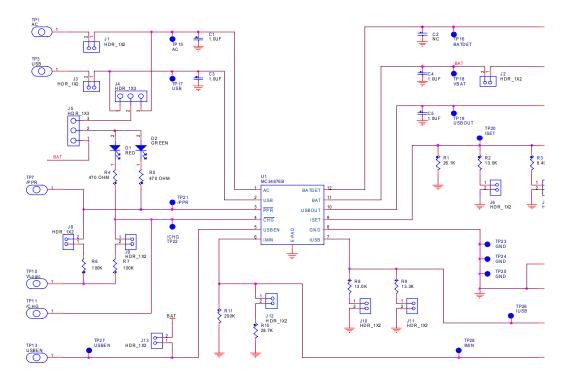


Figure 3. The Schematic Circuit of the Evaluation Board

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5 Component Selection

5.1 Input capacitors C1 and C3

The input capacitor is used to minimize the input voltage transient that may cause instability. A ceramic capacitor of 1.0μ F or above is required for most applications. X5R and X7R dielectrics have better temperature stability. The evaluation board uses 1.0μ F X5R ceramic capacitors. Considering the maximum input voltage rating of the MC34676B is 28V, the input capacitor must have 16V DC rated voltage.

5.2 Output capacitors C4 and C5

The charger output capacitor is used for stable operation. An X5R ceramic capacitor minimum of a 1.0μ F is required for the charger output. Depending on the load transient current, a larger capacitance may be required. Because the highest output voltage of the MC34676B is 4.2V, a 6.3V DC rated voltage is high enough for the output capacitor.

The regulator output capacitor is used for stable operation, too. An X5R ceramic capacitor minimum of a 1.0μ F is required for the regulator output. A 6.3V DC rated voltage is high enough for the regulator output capacitor because the highest output voltage of the output regulator is 5V.

5.3 AC CC-mode charge current setting resistors R1, R2, and R3

The resistor between the ISET pin and GND sets the AC CC-mode charge current by the following equation:

$$I_{AC} = \frac{3950}{R_{ISET}}$$
 Eqn. 1

where R_{ISET} is in units of Ω , I_{AC} is in units of amps. A metal film with a 1% tolerance resistor should be used for temperature stability. As a result, the charge current will be accurate over the whole temperature range.

On the evaluation board, three resistors with two pin header jumpers are used for the user to conveniently configure different charge current values. **Table 1** shows the charge current with the different settings of pin headers J6 and J7.

J6	J7	Charge Current
Open	Open	150mA
Short	Open	450mA
Open	Short	750mA
Short	Short	1050mA

Table 1. The AC CC-mode Charge Current Settings

5.4 USB CC-mode charge current setting resistors R8 and R9

The resistor between the IUSB pin and GND sets the USB CC-mode charge current by the following equation:

$$I_{\rm USB} = \frac{1975}{R_{\rm IUSB}}$$

Egn. 2

where R_{USB} is in units of Ω , I_{USB} is in units of amps. A metal film with a 1% tolerance resistor should be used for temperature stability. As a result, the charge current will be accurate over the whole temperature range.

On the evaluation board, two resistors with two pin header jumpers are used for the user to conveniently configure different charge current values. Table 2 shows the charge current with the different settings of pin headers J10 and J11.

J10	J11	Charge Current
-----	-----	----------------

Component Selection

Open	Open	400mA
Short	Open	150mA
Open	Short	150mA
Short	Short	300mA

Table 2. The USB CC-mode Charge Current Settings

5.5 End-of-charge current setting resistors R10 and R11

The end-of-charge (EOC) current for both the AC charger and the USB charger can be set by the resistors R10 and R11.

On the evaluation board, two resistors with one pin header jumper are used for the user to conveniently configure different EOC current values. **Table 3** shows the EOC current with the different settings of pin header J12.

J12	Charge Current
Open	10mA
Short	80mA

Table 3. The EOC Current Settings

6 Layout Design

6.1 Layout

The KIT34676EPEVBE PCB board has two copper layers. The component side of the KIT34676EPEVBE is provided to locate all components. **Figure 4** is an overview of the board, followed by the layout of each layer.

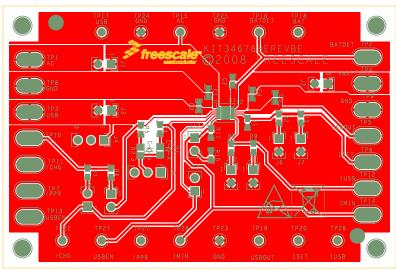


Figure 4. The Overview of the Evaluation Board

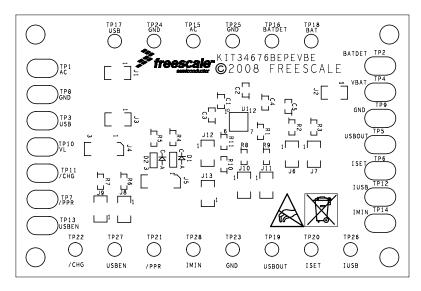


Figure 5. The Component Side Silkscreen Layer of the Evaluation Board

Using the Dual 28V Input Voltage Charger with Linear Regulator, Rev. 1.0

Layout Design

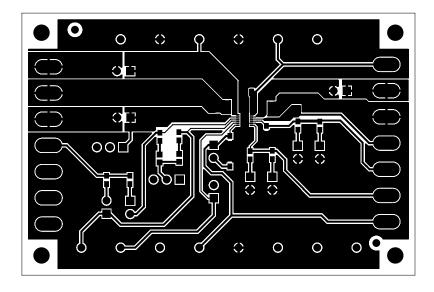


Figure 6. The Component Side Layer of the Evaluation Board

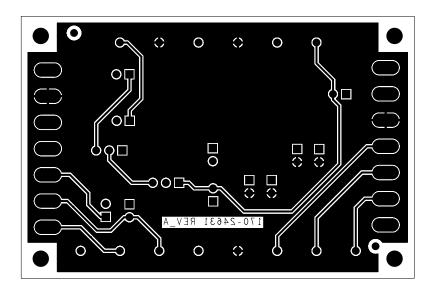


Figure 7. The Solder Side Layer of the Evaluation Board

Using the Dual 28V Input Voltage Charger with Linear Regulator, Rev. 1.0

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6.2 Layout considerations

- Place decoupling capacitors C1, C3 and C4 as close as possible to the AC pin, USB pin and BAT pin respectively.
- Place the charge current setting resistor as close as possible to the current setting pin to minimize the parasitic capacitance between the current setting pin and ground.
- · Use wide traces to connect input power source to the AC pin and USB pin, and BAT pin to the battery.
- To get better thermal performance, put the EPAD pin of the MC34676B on a large ground plane on the component side, and use a via array to connect the EPAD pin to the ground layer, or the large ground plane on the other layer.

7 Evaluation Board Configuration

7.1 Pin Headers

The J1 and J3 pin headers link the external power source to the AC pin or USB pin of the MC34676B respectively. It allows the user to measure the current from the power source to the evaluation board when using a current meter between pin 1 and pin 2 of J1 or J3. The default setting of the two pin headers is to short pins 1 and 2 of J1, and open pins 1 and 2 of J3.

The J2 pin header links the BAT pin and the external battery connector. It allows the user to measure the charging current from the MC34676B into the battery with a current meter between pin 1 and pin 2. The default setting is to short pins 1 and 2.

The J4 and J5 pin headers select the voltage to supply the D1 and D2 LED indicator. Shorting pins 2 and 3 of J4 and pins 2 and 3 of J5 select AC to power the LEDs. Shorting pins 1 and 2 of J4 and pins 2 and 3 of J5 select USB to power the LEDs. Shorting pins 1 and 2 of J5 and let all pins of J4 open select BAT to power the LEDs. The default settings of J4 and J5 are to short pins 2 and 3 of J4 and pins 2 and 3 of J5.

IMPORTANT: DO NOT APPLY HIGHER THAN A 12V DC INPUT VOLTAGE TO AC OR USB WHEN AC OR USB IS SELECTED TO POWER THE LEDS.

The absolute maximum voltage at the PPR pin and CHG pin is 12V. When applying higher than a 12V input voltage, select BAT to power the LEDs.

J6 and J7 set the AC CC-mode charge current. The current values related to J6 and J7 settings are shown in Table 1.

J8 and J9 are used to let the user supply an I/O logic voltage to the PPR pin and the CHG pin, so the system can interface the PPR and CHG signals with the same voltage level. When using LEDs to indicate the charging status, leave J8 and J9 open. When interfacing the PPR and CHG signals to the system, short pins 1 and 2 of J8 and J9 and leave J5 open.

J10 and J11 set the USB CC-mode charge current. The current values related to J10 and J11 settings are shown in **Table 2**.

J12 sets the end-of-charge (EOC) current. The current values related to J12 settings are shown in Table 3.

The J13 pin header allows the user to choose the AC charger when leaving it open, the USB charger is chosen when shorting pins 1 and 2.

The default settings of the evaluation board are shown in Table 4, which selects the AC charger of MC34676B.

Pin Header Jumpers	Default Setting
J1	Shorted
J2	Shorted
J3	Open
J4	2-3 shorted
J5	2-3 shorted
J6	Shorted
J7	Shorted
J8	Open
J9	Open
J10	Open

Table 4. The Default Settings of the Pin Headers

J11	Open
J12	Shorted
J13	Open

7.2 Connector Pads

There are 14 connecting pads (TP1 to TP14 with corresponding names) on the evaluation board to let the user simply connect the board to their system. The GND pads link power ground of the MC34676B. The AC pad or USB pad connect an external power source to the evaluation board. The PPR, CHG, USBEN, BATDET, USBOUT, ISET, IUSB and the IMIN pads link to the corresponding pins of the MC34676B. The VL pad is for the user to supply a logic I/O voltage to the evaluation board, if that application system needs a logic voltage level to interface to the PPR and CHG pins of the MC34676B. The VBAT pad connects the positive pole of the Li+ battery being charged.

7.3 Test Points

The KIT34676EPEVBE evaluation board provides 11 signal test points and 3 ground test points for users to conveniently hook up multi-meters and oscilloscope probes to evaluate the MC34676B. The test points connect the pins of the MC34676B with the same names directly.

8 Test Setup with the Evaluation Board

The test setup is shown in **Figure 8** and **Figure 9**. Connect a DC power source with a larger than 2.0A current limit to the AC pad or a USB power port to the USB pad on the evaluation board. Connect the positive and negative polarities of the Li+ battery to the VBAT pad and the GND pad on the evaluation board respectively. Use a current meter and a voltage meter to measure the charge current and the voltage respectively. Turn on the power supply and let the V_{BATDET} is less than 1.75V to enable the MC34676B, then the evaluation board starts charging the battery.

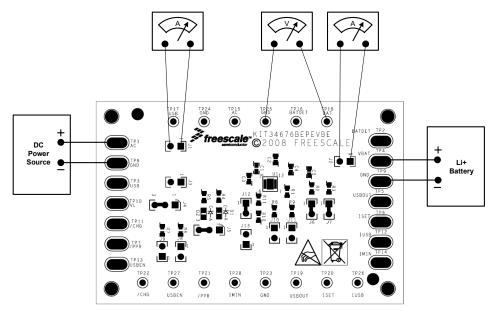


Figure 8. The AC Charger Set Up for the Evaluation Board

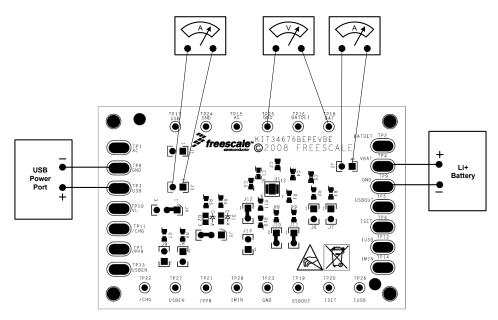


Figure 9. The USB Charger Set Up for the Evaluation Board

Using the Dual 28V Input Voltage Charger with Linear Regulator, Rev. 1.0

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9 Bill of Material

2 1 C2 NC No Connection CC0603 N/A N/A	ltem	Qty	Part Reference	Value	DESCRIPTION	Footprint	Mfr	PN
3 2 C4,C5 1.0UF CAP CER 1.0UF 10V 10% X5R 0603 CAP CER 1.0UF 6.3V 10% X5R 0603 CC0803 TDK MURATA TDK GRM188R61C105KA6 C1608X5R0J105K 4 1 D1 RED LED ULTA BRIGHT RED 30MA 5V LED_0603_ C1 LITE ON LTST-C190KRKT 5 1 D2 GREEN LED ULTA-BRIGHT GREEN SMT 0603 LED_0603_ C1 LITE ON LTST-C190KGKT 6 11 J1.J.2.J3.J6, J1.J.2.J3.J6, J1.J.2.J3.J6, J1.J.2.J3.J6, J1.J.2.J13 HDR_1X2 Th 100MIL SP 374.01H AU HDR102 TYCO ELEC- TRONICS B26629-2 7 2 J4.J5 HDR_1X3 HDR 1X3 TH 100MIL SP 374.01H AU HDR103 TYCO ELEC- TRONICS B26629-3 8 1 R1 26.1K RES MF 26.1K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD2612F 9 2 R2.R8 13.0K RES MF 26.1K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD1302F 10 1 R4.R5 470 OHM RES TF 470 1/10W 5% RC0603 RC0603 BOURNS CR0603.JW-104ELF 12 R6.R7 100K	1	2	C1,C3	1.0UF	CAP CER 1.0UF 16V 10% X5R 0603	CC0603	-	GRM188R61C105KA93 C1608X5R1C105K
Image: Constraint of the second sec	2	1	C2	NC	No Connection	CC0603	N/A	N/A
Image: Note of the image: No	3	2	C4,C5	1.0UF		CC0603	-	GRM188R61C105KA61 C1608X5R0J105K
Image: Constraint of the constratent of the constraint of the constraint of the constraint of the	4	1	D1	RED			LITE ON	LTST-C190KRKT
J7,J8,J9,J10 J11,J12,J13 - TRONICS TRONICS 7 2 J4,J5 HDR_1X3 HDR 1X3 TH 100MIL SP 374.01H AU HDR103 TYCO ELEC- TRONICS 826629-3 8 1 R1 26.1K RES MF 26.1K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD2612F 9 2 R2,R8 13.0K RES MF 13.0K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD1302F 10 1 R3 6.49K RES MF 6.49K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD40491F 11 2 R4,R5 470 0HM RES TF 470 1/10W 5% 0F003 RC0603 BOURNS CR0603JW-104ELF 12 2 R6,R7 100K RES MF 100K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD132F 14 1 R10 28.7K RES MF 20K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD2872F 15 1 R11 200K RES MF 200K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD203F 16 14 TP1,TP2,TP	5	1	D2	GREEN			LITE ON	LTST-C190KGKT
Image: Normal System Image: Normal System TRONICS 8 1 R1 26.1K RES MF 26.1K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD2612F 9 2 R2,R8 13.0K RES MF 13.0K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD6491F 10 1 R3 6.49K RES MF 6.49K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD6491F 11 2 R4,R5 470 OHM RES TF 470 1/10W 5% 0603 RC0603 BOURNS CR0603JW471E 12 2 R6,R7 100K RES MF 100K 1/10W 5% 0603 RC0603 BOURNS CR0603JW-104ELF 13 1 R9 13.3K RES MF 100K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD2872F 14 1 R10 28.7K RES MF 200K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD2037F 15 1 R11 200K RES MF 200K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD2037F 16 14 TP1,TP2,T TEST PAD </td <td>6</td> <td>11</td> <td>J7,J8,J9,J10</td> <td>HDR_1X2</td> <td>HDR 1X2 TH 100MIL SP 375H AU</td> <td>HDR102</td> <td></td> <td>826629-2</td>	6	11	J7,J8,J9,J10	HDR_1X2	HDR 1X2 TH 100MIL SP 375H AU	HDR102		826629-2
9 2 R2,R8 13.0K RES MF 13.0K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD1302F 10 1 R3 6.49K RES MF 6.49K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD6491F 11 2 R4,R5 470 OHM RES TF 470 1/10W 5% RC0603 RC0603 BOURNS CR0603JW471E 12 2 R6,R7 100K RES MF 100K 1/10W 5% 0603 RC0603 BOURNS CR0603JW471E 13 1 R9 13.3K RES MF 100K 1/10W 5% 0603 RC0603 KOA SPEER RK73H1JTTD1302F 14 1 R10 28.7K RES MF 28.7K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD2872F 15 1 R11 200K RES MF 200K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD2003F 16 14 TP1,TP2,TP TEST PAD PCB PAD OVAL DOUBLE SIDE WITH 200x1000ov N/A N/A 17 14 TP15,TP16, TP17,TP18, TP19,TP20, TP23,TP24, TP25,TP26, TP27,TP28 TEST POINT PIN .109 X .087 TH YEL- TP23,TP24, TP25,TP26, TP27,TP28	7	2	J4,J5	HDR_1X3	HDR 1X3 TH 100MIL SP 374.01H AU	HDR103		826629-3
10 1 R3 6.49K RES MF 6.49K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD6491F 11 2 R4,R5 470 OHM RES TF 470 1/10W 5% RC0603 RC0603 BOURNS CR0603JW471E 12 2 R6,R7 100K RES MF 100K 1/10W 5% RC0603 RC0603 BOURNS CR0603JW471E 13 1 R9 13.3K RES MF 100K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD1332F 14 1 R10 28.7K RES MF 28.7K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD2072F 15 1 R11 200K RES MF 200K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD203F 16 14 TP1,TP2,TP A,TP4,TP5,T P6,TP7,TP8, TP9,TP10,T P11,TP12,T TEST PAD PCB PAD OVAL DOUBLE SIDE WITH THRU HOLE 200x1000ov N/A N/A 17 14 TP15,TP16, TP17,TP18, TP17,TP18, TP13,TP24, TP23,TP24, TP23,TP24, TP23,TP24, TP23,TP24, TP25,TP26, TP27,TP28 TEST POINT PIN .109 X .087 TH YEL- LOW TEST_LOO COMPONENTS CORPORATION TP-105-01-00 18 1	8	1	R1	26.1K	RES MF 26.1K 1/10W 1% 0603	RC0603	KOA SPEER	RK73H1JTTD2612F
11 2 R4,R5 470 OHM RES TF 470 1/10W 5% RC0603 RC0603 BOURNS CR0603JW471E 12 2 R6,R7 100K RES MF 100K 1/10W 5% 0603 RC0603 BOURNS CR0603JW471E 13 1 R9 13.3K RES MF 13.3K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD1332F 14 1 R10 28.7K RES MF 28.7K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD2872F 15 1 R11 200K RES MF 200K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD2872F 16 14 TP1,TP2,TP 3,TP4,TP5,T P6,TP7,TP8, TP9,TP10,T P13,TP14 TEST PAD PCB PAD OVAL DOUBLE SIDE WITH THRU HOLE 200x1000ov N/A N/A 17 14 TP15,TP16, TP17,TP18, TP13,TP14 TEST TEST POINT PIN .109 X .087 TH YEL- LOW TEST_LOO P COMPONENTS CORPORATION TP-105-01-00 17 14 TP15,TP16, TP27,TP28 TEST TEST POINT PIN .109 X .087 TH YEL- LOW TEST_LOO P COMPONENTS CORPORATION TP-105-01-00	9	2	R2,R8	13.0K	RES MF 13.0K 1/10W 1% 0603	RC0603	KOA SPEER	RK73H1JTTD1302F
12 2 R6,R7 100K RES MF 100K 1/10W 5% 0603 RC0603 BOURNS CR0603-JW-104ELF 13 1 R9 13.3K RES MF 13.3K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD1332F 14 1 R10 28.7K RES MF 28.7K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD2872F 15 1 R11 200K RES MF 200K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD203F 16 14 TP1,TP2,TP 3,TP4,TP5,T TEST PAD PCB PAD OVAL DOUBLE SIDE WITH 9,TP9,TP10,T 200x1000ov N/A N/A 17 14 TP15,TP16, TP17,TP18, TP13,TP14 TEST POINT PIN .109 X .087 TH YEL- P13,TP14, TP13,TP14 TEST POINT PIN .109 X .087 TH YEL- TP21,TP22, TP23,TP24, TP23,TP24, TP25,TP26, TP27,TP28 TEST POINT PIN .109 X .087 TH YEL- TP27,TP28 TEST_P00, TP21,TP22, TP-105-01-00 TP-105-01-00 18 1 U1 MC34676B 3x3 Freescale Sx3	10	1	R3	6.49K	RES MF 6.49K 1/10W 1% 0603	RC0603	KOA SPEER	RK73H1JTTD6491F
13 1 R9 13.3K RES MF 13.3K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD1332F 14 1 R10 28.7K RES MF 28.7K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD2872F 15 1 R11 200K RES MF 200K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD2872F 16 14 TP1,TP2,TP 3,TP4,TP5,T P6,TP7,TP8, TP9,TP10,T TEST PAD PCB PAD OVAL DOUBLE SIDE WITH THRU HOLE 200x1000ov N/A N/A 17 14 TP15,TP16, TP17,TP18, TP17,TP18, TP19,TP20, TP21,TP22, TP23,TP24, TP25,TP26, TP27,TP28 TEST POINT PIN .109 X .087 TH YEL- LOW TEST_LOO P COMPONENTS CORPORATION TP-105-01-00 18 1 U1 MC34676B 3x3 Freescale 1	11	2	R4,R5	470 OHM	RES TF 470 1/10W 5% RC0603	RC0603	BOURNS	CR0603JW471E
14 1 R10 28.7K RES MF 28.7K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD2872F 15 1 R11 200K RES MF 20.0K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD2872F 16 14 TP1,TP2,TP 3,TP4,TP5,T P6,TP7,TP8, TP9,TP10,T P11,TP12,T TEST PAD PCB PAD OVAL DOUBLE SIDE WITH THRU HOLE 200x1000ov N/A N/A 17 14 TP15,TP16, TP17,TP18, TP19,TP20, TP21,TP22, TP23,TP24, TP25,TP26, TP27,TP28 TEST POINT PIN .109 X .087 TH YEL- LOW TEST_LOO P COMPONENTS CORPORATION TP-105-01-00 18 1 U1 MC34676B Sx3 Freescale Sx3	12	2	R6,R7	100K	RES MF 100K 1/10W 5% 0603	RC0603	BOURNS	CR0603-JW-104ELF
15 1 R11 200K RES MF 200K 1/10W 1% 0603 RC0603 KOA SPEER RK73H1JTTD2003F 16 14 TP1,TP2,TP 3,TP4,TP5,T P6,TP7,TP8, TP9,TP10,T P11,TP12,T P13,TP14 TEST PAD PCB PAD OVAL DOUBLE SIDE WITH THRU HOLE 200x1000ov N/A N/A 17 14 TP15,TP16, TP17,TP18, TP19,TP20, TP21,TP22, TP23,TP24, TP25,TP26, TP27,TP28 TEST POINT PIN .109 X .087 TH YEL- LOW TEST_LOO P COMPONENTS CORPORATION TP-105-01-00 18 1 U1 MC34676B MC34676B 3x3 Freescale	13	1	R9	13.3K	RES MF 13.3K 1/10W 1% 0603	RC0603	KOA SPEER	RK73H1JTTD1332F
1614TP1,TP2,TP 3,TP4,TP5,T P6,TP7,TP8, TP9,TP10,T P11,TP12,T P13,TP14TEST PAD PCB PAD OVAL DOUBLE SIDE WITH THRU HOLE200x1000ov N/AN/AN/A1714TP15,TP16, TP17,TP18, TP19,TP20, TP21,TP22, TP23,TP24, TP25,TP26, TP27,TP28TEST POINTTEST POINT PIN .109 X .087 TH YEL- LOWTEST_LOO PCOMPONENTS CORPORATIONTP-105-01-00181U1MC34676B3x3Freescale	14	1	R10	28.7K	RES MF 28.7K 1/10W 1% 0603	RC0603	KOA SPEER	RK73H1JTTD2872F
3,TP4,TP5,T P6,TP7,TP8, TP9,TP10,T P11,TP12,T P13,TP14THRU HOLEImage: Constraint of the second seco	15	1	R11	200K	RES MF 200K 1/10W 1% 0603	RC0603	KOA SPEER	RK73H1JTTD2003F
TP17,TP18, TP19,TP20, TP21,TP22, TP23,TP24, TP25,TP26, TP27,TP28 POINT LOW P CORPORATION 18 1 U1 MC34676B 3x3 Freescale	16	14	3,TP4,TP5,T P6,TP7,TP8, TP9,TP10,T P11,TP12,T	TEST PAD		200x1000ov	N/A	N/A
	17	14	TP17,TP18, TP19,TP20, TP21,TP22, TP23,TP24, TP25,TP26,	-		—		TP-105-01-00
	18	1	U1	MC34676B			Freescale	

* These are pads only. No component is populated

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10 References

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

Products	Links
Data Sheet MC34676	www.freescale.com/files/analog/doc/data_sheet/MC34676.pdf
Freescale's Web Site	www.freescale.com
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Using the Dual 28V Input Voltage Charger with Linear Regulator, Rev. 1.0

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