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KIT33730EKEVBE Evaluation Board

Figure 1. KIT33730EKEVBE Evaluation Board

Table of Contents

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1 Kit Contents / Packing List

- KIT33730EKEVBE evaluation board
- CD33730EKEVBE

2 Important Notice

Freescale provides the enclosed product(s) under the following conditions:

This evaluation kit is intended for use of ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY. It is provided as a sample IC pre-soldered to a printed circuit board to make it easier to access inputs, outputs, and supply terminals. This EVB may be used with any development system or other source of I/O signals by simply connecting it to the host MCU or computer board via off-the-shelf cables. This EVB is not a Reference Design and is not intended to represent a final design recommendation for any particular application. Final device in an application will be heavily dependent on proper printed circuit board layout and heat sinking design as well as attention to supply filtering, transient suppression, and I/O signal quality.

The goods provided may not be complete in terms of required design, marketing, and or manufacturing related protective considerations, including product safety measures typically found in the end product incorporating 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. In order to minimize risks associated with the customers applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards. For any safety concerns, contact Freescale sales and technical support services.

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3 Introduction

KIT33730EKEVBE Evaluation Board (EVB) is an easy-to-use circuit board used to exercise all the functions of the MC33730 multiple output switching power supply. The EVB can be used to easily manipulate the MC33730 functions and validate the capabilities of the IC. The board provides connections that allow the user to supply MPCxx MCUs via hard wired connections.

3.1 EVB Features

- Provides all regulated voltages for MPC5XX MCUs and other MCUs logic and analog functions
- Adjustable frequency switching buck regulator with slew-rate control provided by jumpers
- Power sequencing provided
- Programmable voltages VDDL, VDD3 - 3% accuracy (P1, P2, and P3 jumpers)
- Programmable standby regulator VKAM - (P1, P2, and P3 jumpers) operating down to 4.5V at KA_VBAT pin
- VDD3 can be programmed as an optional second standby regulator (P1, P2, and P3 jumpers)
- Provides two 5.0V protected supplies for sensors
- Provides reverse battery protection FET gate drive (either a diode or PFD gate drive)
- Provides necessary MCU monitoring and fail-safe support
- Pb-free packaging designated by suffix code EK

3.2 Required Equipment

Minimum required equipment: Power supply: 4.5 to 26.5V

4 Using Hardware

This EVB consists of a MC33730 switching power supply, power conditioning circuitry, and a set of Input Select Jumpers. MC33730 Circuit.

4.1 LED Display

Seven LED's are provided as visual output devices for the MC33730 EVB board. A list of the LED devices is shown below:

1. VDDH LED - Indicates when VDDH supply is operating.
2. VDDL LED - Indicates that the VDDL supply is operating.
3. VDD3 LED - Indicates that the VDD3 supply is operating.
4. VREF1 LED - Indicates that the VREF1 reference is operating.
5. VREF2 LED - Indicates that the VREF2 reference is operating.
6. IGN LED - Indicates Battery supplied to Vign.
7. IGNSW LED - Indicates that the VDD3 supply is operating.

4.2 Selection Jumper Definitions

The EVB contains four jumpers that provide certain selections for the MC33730 as follows (Bold = default factory setting):

4.2.1 P1, P2, P3 Jumpers

The P1, P2, and P3 jumpers are used to determine what voltage levels will be supplied by the VDD3, VDDL and VKAM supplies. The pins are used to hardwire the settings with the MC33730 reading the values at startup. The table below shows the various conditions that can be set.

P1	P2	P3	VDD3	VDDL	VKAM
High	High	High	3.3V	2.6V	2.6V
High	High	Low	3.3V	3.3V	3.3V
High	**Low**	**High**	3.3V	1.5V	1.0V
High	Low	Low	3.3V	3.3V	1.0V
Low	High	High	3.3V Standby	3.3V	1.0V
Low	High	Low	2.0	3.15V	5.0V
Low	Low	High	2.6V Standby	3.3V	1.0V
Low	Low	Low	2.6V Standby	3.3V	1.5V

4.2.2 VDD3 Jumper

In the state where VDD3 is desired to be in standby, the VDD3 jumper is used to short the Base of the VDD3 transistor to ground. The default case (**Normal**) is to leave the base connected to VDD3_B.

Jumper should be connected to Normal except for the cases where P1, P2, and P3 are as follows:

P1	P2	P3	VDD3
Low	High	High	3.3V Standby
Low	Low	High	2.6V Standby
Low	Low	Low	2.6V Standby

4.2.3 Slew Rate (SR) Jumper

The Slew Rate Control Jumper Allows For Configurable Slew Rates For The Switching Regulator. Connected To Boot The Slow Slew Rate Is Active And Connected To Sw The Fast Slew Rate Is Selected. The Pin Can Be Left Open Which Results In The Medium Slew Rate Control.

SR	CONDITION FOR SLEW RATE
Boot	Slow Slew rate
Open	Medium Slew rate
SW	Fast Slew rate

Setup Pins

The 33730 has multiple pins used to do initial setup for the IC. When the IC is powered up a series of checks are done to determine the P1, P2, P3, HRT, SR and FREQ state.

The P1, P2, and P3 states are connected to jumpers to allow the user to configure the supply rails easily. Once the IC has determined their state at startup, the status is latched into registers and changing the jumpers does not affect the operation until the next POR or start up occurs.

The HRT pin is set to 10k. The resistor connected to HRT is R1.

The SR state is determined by the SR jumper. The slew rate of the switching regulator can be selected to range from slow, medium and fast depending on the location (or open) of the jumper.

The FREQ pin is connected to ground via a 10kohm resistor. This pin resistance to ground determines the frequency operation of the switching regulator. The resistor connected to FREQ is R9.

Output Supply Pins

There are multiple output power supplies integrated into the integrated circuit.

The main switching regulator, VDDH, uses a fixed frequency PWM voltage mode control. It has a 3.5A current limit (typical) and the slew-rate is adjustable via a control pin to reduce switching noise. The switching regulator has an adjustable frequency oscillator, which allows the user to optimize its operation over a wide range of input voltages and component values. The VDDH regulator supplies a 5v rail and is used as the internal power supply for VREF1 and VREF2 along with the external rail for VDD3 and VDDL.

Associated with the VDDH regulator is the INV and VCOMP pins which have been connected to optimize the compensation for the step down regulator. A bootstrap capacitor is connected from the VSW pin to the BOOT pin.

The linear regulators can be configured either as two normal mode regulators (VDD3, VDDL) and one standby regulator (VKAM), or as one normal mode linear regulator (VDDL) and two standby regulators (VKAM and VDD3 Standby). Two protected outputs, VREF1 and VREF2, are used to provide power to external sensors.

All of the output supplies have been brought out to two sets of connectors. The SV1 is available to monitor the output voltages while SV3 is designed to connect to the loads or a micro motherboard.

The SV1 connector is pinned out as follows:

PIN	NODE
1	AGND
2	VREF2
3	VREF1
4	VKAM
5	N/C
6	VDDH
7	VDDL
8	VDD3

The SV3 connector is pinned out as follows:

PIN	NODE
1	Battery
2	Battery
3	VDDH
4	VDDH
5	VDD3
6	VDD3
7	VDDL
8	VDDL
9	N/C
10	AGND
11	VKAM
12	RST3
13	VDDA
14	RSTKAM
15	VREF1
16	RSTL
17	VREF2
18	RSTH
19	N/C
20	REGON
21	IGN_ON
22	IGN
23	KA
24	AGND
25	AGND
26	AGND

The SV3 connector also contains a number of other pin functions including the reset pins, the REGON pin and the IGN_ON and IGN pins.

4.2.4 MC33730 EVB Setup

To use the evaluation board the Battery connection must be made to the +12v and GND connector. Turn on the power supply and ensure the voltage is in the normal operating range.

To apply IGN, move the slider switch to the On position (slider toward Battery connection). Ensure the IGN_ON and IGNSW LED's are lit.

The LED's for the voltage rails will also turn on and the user can monitor the voltages and apply loads via the connectors.

***Note**: The silkscreen on the PCB board is incomplete, please see Assembly Drawing on page 11 for the complete silkscreen.*

5 Schematic

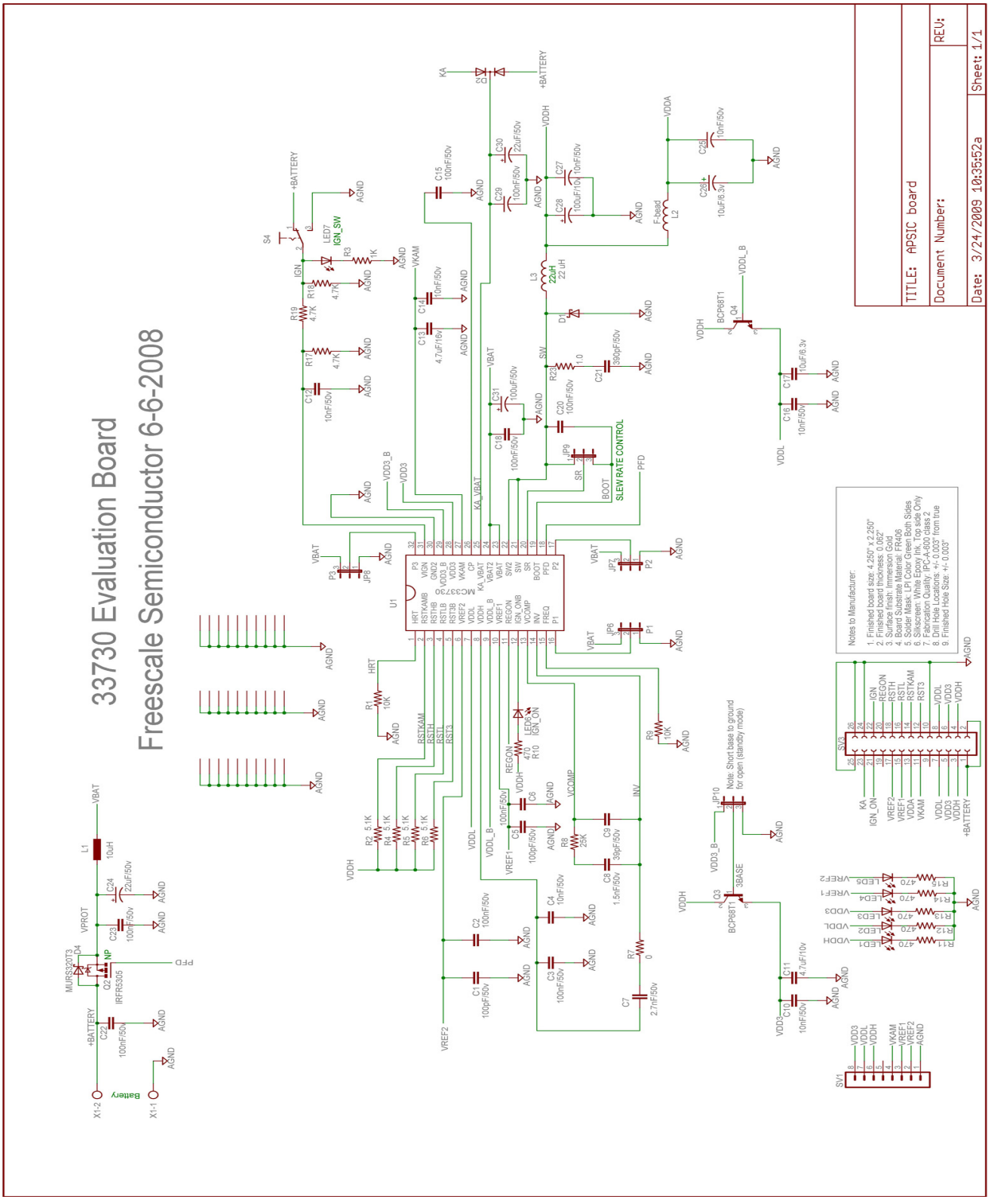

Figure 2. The MC33730 Schematic of the KIT33730EKEVBE Evaluation Board

6 KIT33730EKEVBE Board Layout

6.1 Top Layer

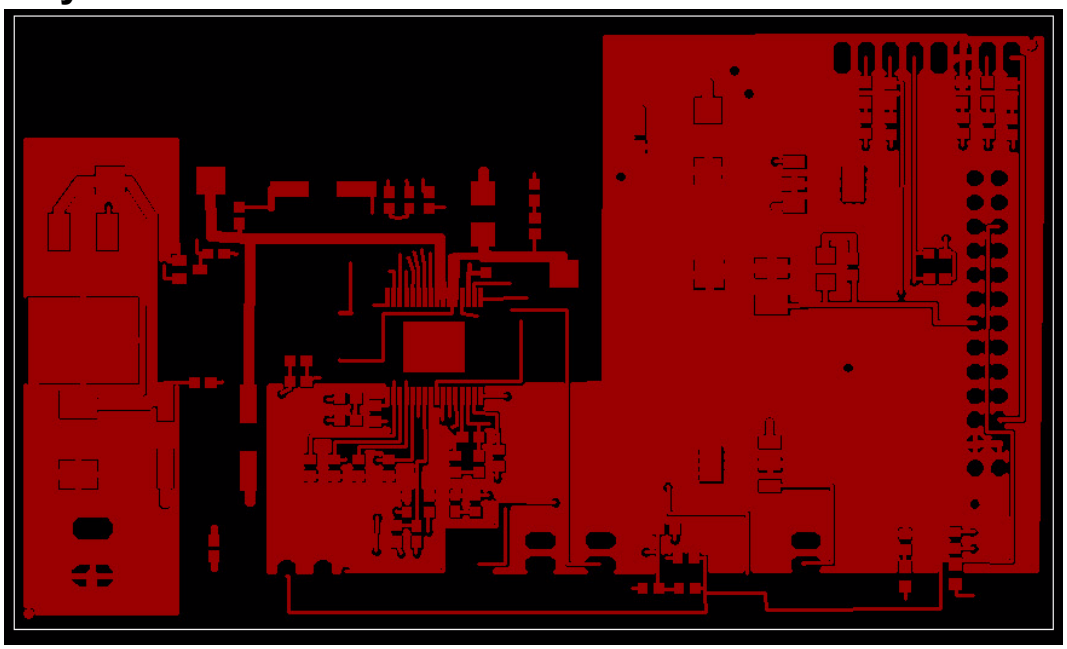

Figure 3. The Top Layer of the KIT33730EKEVBE Evaluation Board

6.2 Second Layer

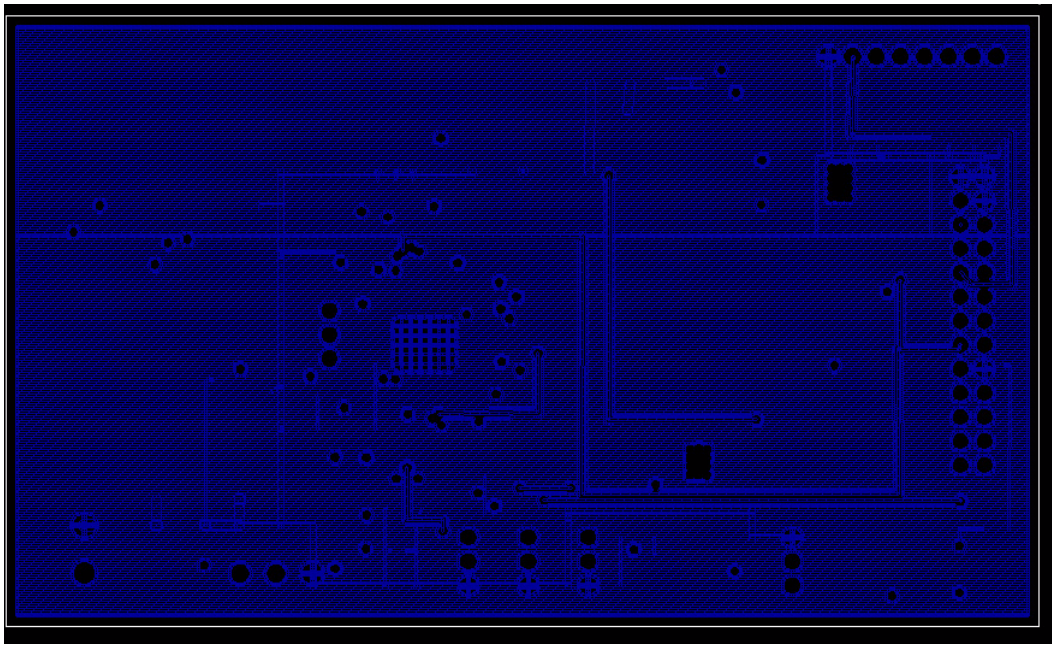

Figure 4. Top Layer of the KIT33730EKEVBE Evaluation Board

6.3 Bottom Layer

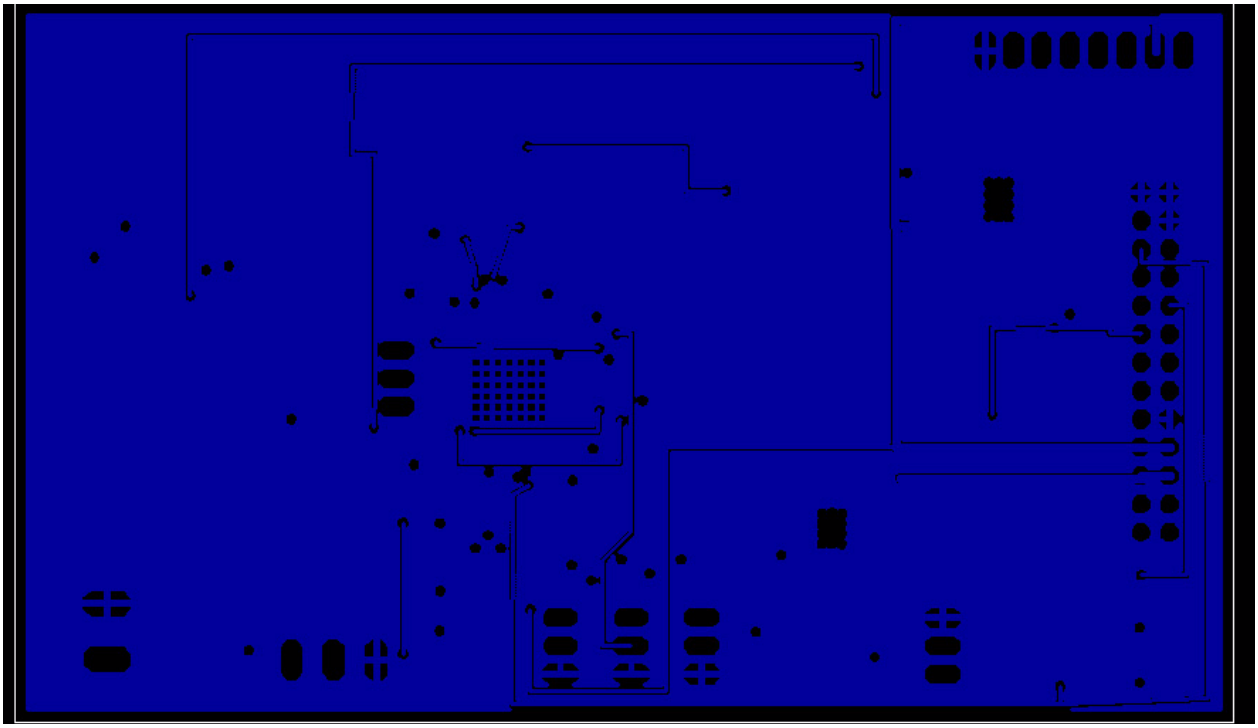

Figure 5. The Bottom Layer of the KIT33730EKEVBE Evaluation Board

6.4 Assembly Drawing

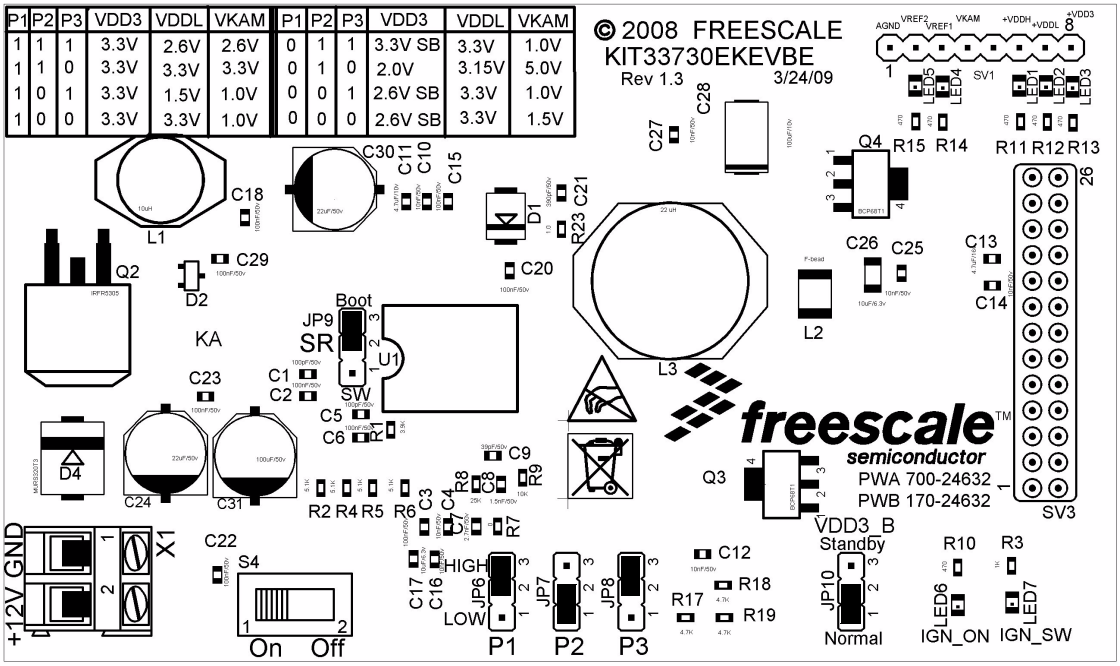

Figure 6. The Assembly Drawing of the KIT33730EKEVBE Evaluation Board

7 KIT33730EKEVBE Evaluation Board Bill of Material

Part	Value	Description	Mfg.	Mfg. PN	Location	Orientation	Qty
Integrated Circuit							
U1	MCZ33730	APSIC PMIC	Freescale Semiconductor	MCZ33730	(1.7251.17)	R90	1
Capacitors							
C1	100pF/50v	CAP CERAMIC 100PF 50V 0603 SMD	Panasonic ECG	ECJ-1VC1H101J	(1.1751.11)	R180	2
C2	100nF/50v	CAP CER .10UF 50V Y5V 0603	Taiyo Yuden	UMK107F104ZA-T	(1.1751.025)	R180	9
C3	100nF/50v	CAP CER .10UF 50V Y5V 0603	Taiyo Yuden	UMK107F104ZA-T	(1.6250.52)	R27	
C4	10nF/50v	CAP CERM .01UF 10% 50V X7R 0603	AVX Corporation	06035C103KAT2A	(1.716402 0.52)	R27	7
C5	100pF/50v	CAP CERAMIC 100PF 50V 0603 SMD	Panasonic ECG	ECJ-1VC1H101J	(1.380.955)	R180	
C6	100nF/50v	CAP CER .10UF 50V Y5V 0603	Taiyo Yuden	UMK107F104ZA-T	(1.380.865)	R180	
C7	2.7nF/16v	CAP .0027UF 16V PPS FILM 0603 5%	Panasonic ECG	ECH-U1C272JX5	(1.825303 0.521803)	R270	1
C8	1.5nF/16v	CAP .0015UF 16V PPS FILM 0603 2%	Panasonic ECG	ECH-U1C152GX5	(1.9210.685)	R90	1
C9	39pF/25v	CAP CER 39PF 25V NP0 0603	AVX Corporation	06033A390JAT2A	(1.890.795)	R0	1
C10	10nF/50v	CAP CERM .01UF 10% 50V X7R 0603	AVX Corporation	06035C103KAT2A	(1.635201 1.776598)	R90	
C11	4.7uF/10v	CAP CER 4.7UF 10V Y5V 0603	Murata Electronics NA	GRM188F51A475 ZE20D	(1.554406 1.776602)	R90	2
C12	10nF/50v	CAP CERM .01UF 10% 50V X7R 0603	AVX Corporation	06035C103KAT2A	(2.700598 0.415)	R0	
C13	4.7uF/10v	CAP CER 4.7UF 10V Y5V 0603	Murata Electronics NA	GRM188F51A475 ZE20D	(3.821.555)	R0	
C14	10nF/50v	CAP CERM .01UF 10% 50V X7R 0603	AVX Corporation	06035C103KAT2A	(3.821 1.451299)	R0	
C15	100nF/50v	CAP CER .10UF 50V Y5V 0603	Taiyo Yuden	UMK107F104ZA-T	(1.717295 1.776898)	R90	
C16	10nF/50v	CAP CERM .01UF 10% 50V X7R 0603	AVX Corporation	06035C103KAT2A	(1.6650.395)	R27	
C17	10uF/6.3v	CAP CERAMIC 10UF 6.3V X5R 0603	Panasonic ECG	ECJ-1VB0J106M	(1.582402 0.396402)	R270	2
C18	100nF/50v	CAP CER .10UF 50V Y5V 0603	Taiyo Yuden	UMK107F104ZA-T	(0.9325 1.7145)	R90	
C20	100nF/50v	CAP CER .10UF 50V Y5V 0603	Taiyo Yuden	UMK107F104ZA-T	(1.9551.51)	R270	
C21	390pF/50v	CAP CER 390PF 50V X7R 0603	AVX Corporation	06035C391JAT2A	(2.1551.81)	R90	1
C22	100nF/50v	CAP CER .10UF 50V Y5V 0603	Taiyo Yuden	UMK107F104ZA-T	(0.8250.335)	R90	
C23	100nF/50v	CAP CER .10UF 50V Y5V 0603	Taiyo Yuden	UMK107F104ZA-T	(0.779299 1.023402)	R0	
C24	22uF/50v	CAP 22UF 50V ELECT FK SMD	Panasonic ECG	EEV-FK1H220P	(0.6250.805)	R90	2
C25	10nF/50v	CAP CERM .01UF 10% 50V X7R 0603	AVX Corporation	06035C103KAT2A	(3.47 1.5)	R90	
C26	10uF/6.3v	CAP CERAMIC 10UF 6.3V X5R 0603	Panasonic ECG	ECJ-1VB0J106M	(3.358299 1.493)	R90	

Part	Value	Description	Mfg.	Mfg. PN	Location	Orientation	Qty
Capacitors (Continued)							
C27	10nF/50v	CAP CERM .01UF 10% 50V X7R 0603	AVX Corporation	06035C103KAT2A	(2.592.035)	R90	
C28	100uF/10v	CAPACITOR TANT 100UF 10V 20% SMD	Kemet	T525D107M010ATE025	(2.872.025)	R270	1
C29	100nF/50v	CAP CER .10UF 50V Y5V 0603	Taiyo Yuden	UMK107F104ZA-T	(0.8351.555)	R0	
C30	22uF/50v	CAP 22UF 50V ELECT FK SMD	Panasonic ECG	EEV-FK1H220P	(1.278201 1.8235)	R0	
C31	100uF/50v	CAP 100UF 50V ELECT FK SMD	Panasonic ECG	EEV-FK1H101P	(0.97 0.795)	R90	
Inductors							
L1	10uH	SMT POWER INDUCTOR 22 uH	Coilcraft	DO3316T-223MLB	(0.605 1.86)	R0	
L2	F-bead	FERRITE CHIP 120 OHMS 400MA 1812	Steward	LI1812D121R-10	(3.135 1.42)	R270	
L3	22 uH	SMT POWER INDUCTOR 10 uH	Coilcraft	DO5022P-103MLB	(2.575 1.47)	R0	
Resistors							
R1	10K	RES 10K OHM 1/10W 5% 0603 SMD	Panasonic ECG	ERJ-3GEYJ103V	(1.4950.895)	R90	2
R2	5.1K	RES 5.1K OHM 1/10W 5% 0603 SMD	Panasonic ECG	ERJ-3GEYJ512V	(1.2250.67)	R90	4
R3	1K	RES 1.0K OHM 1/10W 5% 0603 SMD	Panasonic ECG	ERJ-3GEYJ102V	(3.8950.37)	R270	1
R4	5.1K	RES 5.1K OHM 1/10W 5% 0603 SMD	Panasonic ECG	ERJ-3GEYJ512V	(1.3250.67)	R90	
R5	5.1K	RES 5.1K OHM 1/10W 5% 0603 SMD	Panasonic ECG	ERJ-3GEYJ512V	(1.4250.67)	R90	
R6	5.1K	RES 5.1K OHM 1/10W 5% 0603 SMD	Panasonic ECG	ERJ-3GEYJ512V	(1.550.67)	R90	
R7	0	RES 0.0 OHM 1/10W 5% 0603 SMD	Yageo	RC0603JR-070RL	(1.908299 0.521398)	R90	1
R8	25K	RES 24.9K OHM 1/10W 1% 0603 SMD	Panasonic ECG	ERJ-3EKF2492V	(1.8250.685)	R90	1
R9	10K	RES 10K OHM 1/10W 5% 0603 SMD	Panasonic ECG	ERJ-3GEYJ103V	(2.0050.71)	R90	
R10	470	RES 470 OHM 1/10W .1% 0603 SMD	Panasonic ECG	ERA-3AEB471V	(3.686598 0.363201)	R270	6
R11	470	RES 470 OHM 1/10W .1% 0603 SMD	Panasonic ECG	ERA-3AEB471V	(3.929398 2.085)	R90	
R12	470	RES 470 OHM 1/10W .1% 0603 SMD	Panasonic ECG	ERA-3AEB471V	(4.032799 2.0845)	R90	
R13	470	RES 470 OHM 1/10W .1% 0603 SMD	Panasonic ECG	ERA-3AEB471V	(4.132197 2.081102)	R90	
R14	470	RES 470 OHM 1/10W .1% 0603 SMD	Panasonic ECG	ERA-3AEB471V	(3.628902 2.083299)	R90	
R15	470	RES 470 OHM 1/10W .1% 0603 SMD	Panasonic ECG	ERA-3AEB471V	(3.524402 2.085799)	R90	
R17	4.7K	RES 4.7K OHM 1/10W 5% 0603 SMD	Panasonic ECG	ERJ-3GEYJ472V	(2.6350.17)	R0	3
R18	4.7K	RES 4.7K OHM 1/10W 5% 0603 SMD	Panasonic ECG	ERJ-3GEYJ472V	(2.780.295)	R0	
R19	4.7K	RES 4.7K OHM 1/10W 5% 0603 SMD	Panasonic ECG	ERJ-3GEYJ472V	(2.7850.17)	R180	
R23	1	RESISTOR 1.0 OHM 1/10W 5% 0603	Panasonic ECG	ERJ-3GEYJ1R0V	(2.1551.67)	R270	1

Part	Value	Description	Mfg.	Mfg. PN	Location	Orientation	Qty
Headers & Jumpers							
SV1	----	CONN HEADER VERT .100 8POS 15AU	Tyco Electronics	87224-8	(3.775 2.37)	R0	1
SV3	----	CONN HDR BRKWAY .100 26POS VERT	Tyco Electronics	9-146261-0-13	(4.025 1.27)	R90	1
JP6		CONN HEADER VERT .100 2POS 15AU	Tyco Electronics	87224-2	(1.9250.27)	R90	5
JP7		CONN HEADER VERT .100 2POS 15AU	Tyco Electronics	87224-2	(2.1750.27)	R90	
JP8		CONN HEADER VERT .100 2POS 15AU	Tyco Electronics	87224-2	(2.4250.27)	R90	
JP9		CONN HEADER VERT .100 2POS 15AU	Tyco Electronics	87224-2	(1.346701 1.213398)	R90	
JP10		CONN HEADER VERT .100 2POS 15AU	Tyco Electronics	87224-2	(3.2750.27)	R90	
Connectors							
X1	AK300/2	CONN TERM BLOCK 2POS 5.08MM PCB	Phoenix Contact	1729128	(0.325 0.32)	R270	1
Switch							
S4	----	SW TOGGLE SPDT .221" ACT PC .4VA	Tyco Electronics	TT11DGPC104	(1.125 0.22)	R0	
Diodes							
D1	SMB	DIODE TVS 40V 600W UNIDIR 5% SMB	Little Fuse	SMBJ40A	(1.94 1.72)	R90	1
D2	SOT23	DIODE ULTRAFAST HI COND SOT-23	Fairchild Semiconductor	BAV74	(0.725 1.49)	R270	1
D4	MURS320 T3	DIODE ULTRA FAST 3A 200V SMC	ON Semiconductor	MURS320T3G	(0.265 0.785)	R270	1
LED1	GreenLED	LED PURE GREEN S-J TYPE 0805	Panasonic	LNJ306G5PRX	(3.924701 2.223602)	R180	7
LED2	GreenLED	LED PURE GREEN S-J TYPE 0805	Panasonic	LNJ306G5PRX	(4.027799 2.223398)	R180	
LED3	GreenLED	LED PURE GREEN S-J TYPE 0805	Panasonic	LNJ306G5PRX	(4.13 2.22)	R180	
LED4	GreenLED	LED PURE GREEN S-J TYPE 0805	Panasonic	LNJ306G5PRX	(3.628201 2.220406)	R180	
LED5	GreenLED	LED PURE GREEN S-J TYPE 0805	Panasonic	LNJ306G5PRX	(3.522701 2.223602)	R180	
LED6	GreenLED	LED PURE GREEN S-J TYPE 0805	Panasonic	LNJ306G5PRX	(3.686799 0.2185)	R180	
LED7	GreenLED	LED PURE GREEN S-J TYPE 0805	Panasonic	LNJ306G5PRX	(3.897 0.228398)	R180	
Transistors							
Q2	IRFR5305	MOSFET P-CH 55V 31A DPAK	International Rectifier	IRFR5305TRPBF	(0.285 1.295)	R180	1
Q3	BCP68T1	TRANS NPN AUDIO 1A 25V SOT223	ON Semiconductor	BCP68T1G	(2.905 0.685)	R90	2
Q4	BCP68T1	TRANS NPN AUDIO 1A 25V SOT223	ON Semiconductor	BCP68T1G	(3.45 1.845)	R270	

8 References

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

Description	URL
Data Sheet	www.freescale.com/files/analog/doc/data_sheet/MC33730.pdf
Freescale's Web Site	www.freescale.com
Freescale's Analog Web Site	www.freescale.com/analog
Freescale's Power Management Web Site	www.freescale.com/powermanagement
Freescale's Automotive Applications Web Site	www.freescale.com/automotive

9 Revision History

REVISION	DATE	DESCRIPTION OF CHANGES
1.0	9/2009	• Initial Release

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