

# **TPS650240EVM-331**

This User's Guide describes the characteristics, operation, and use of the TPS650240EVM-331 evaluation module (EVM). This EVM is designed to help the user evaluate the TPS650240 and the TPS79901 in a configuration for powering the iMX31 Processor. This User's Guide includes setup instructions for the hardware, a schematic diagram, a bill of materials (BOM), and PCB layout drawings for the evaluation module.

### **Contents**

1	Introduction .....	1
	1.1 Requirements .....	1
	1.2 Power Sequencing.....	2
	1.3 Related Documentation From Texas Instruments .....	2
2	Setup .....	2
	2.1 Input / Output Connector Descriptions .....	2
	2.2 Setup .....	3
3	Board Layout .....	4
	3.1 Layout .....	4
4	Schematic and Bill of Materials .....	5
	4.1 Schematic.....	6
	4.2 Bill of Materials .....	7

### **List of Figures**

1	Assembly Layer .....	4
2	Top Layer Routing .....	5
3	Bottom Layer Routing .....	5

### **List of Tables**

1	TPS650240EVM-331 Bill of Materials.....	7
---	---	---

## **1 Introduction**

The Texas Instruments TPS650240EVM-331 uses the TPS650240 Power Management IC and the TPS79901 LDO in a configuration designed to meet the requirements for powering an iMX31 application. The default settings of the EVM meet the voltage settings and the power sequencing requirements for the iMX31 processor

### **1.1 Requirements**

In order for this EVM to operate properly, the following components must be connected and properly configured.

#### **1.1.1 Printed Circuit Board Assembly**

The TPS650240EVM-331 PCB contains the TPS650240 IC and its required external components along with the TPS79901. This board contains several jumpers and connectors that allow the user to customize the board for specific operating conditions.

## 1.2 Power Sequencing

The TPS650240EVM-331 has been designed to allow DCDC3 of the TPS650240 device to power up as soon as the input voltage has been applied. Once DCDC3 powers up, the TPS650240 DCDC1 output is enabled at the same time that LDO1 and LDO2 are enabled. Upon DCDC1 powering up, the TPS650240 DCDC2 output is enabled along with the TPS79901 device.

## 1.3 Related Documentation From Texas Instruments

TPS650240 data sheet ([SLVS774](#))

## 2 Setup

This chapter describes the jumpers and connectors on the EVM as well as how to properly connect, setup, and use the TPS650240EVM-331

### 2.1 Input / Output Connector Descriptions

#### 2.1.1 J1 –VIN and GND

Input voltage from external power supply, recommended max 5.5V. Input current is dependent on load but will typically be below 2A.

#### 2.1.2 J2–VINLDO and GND

Input voltage from external power supply, recommended max 5.5V. Input current is dependent on load but will typically be below 2A. The EVM has this connected to VIN via R7.

#### 2.1.3 J3–DEFDCDC1

Sets default voltage for DCDC1, 2.8V or 3.3V.

#### 2.1.4 J4–DEFDCDC2

Sets default voltage for DCDC2, 1.8V or 2.5V.

#### 2.1.5 J5–DEFDCDC3

Sets default voltage for DCDC3, 1.0V or 1.3V.

#### 2.1.6 J6–Vout Ext LDO and GND

The output from the TPS79901 LDO with a max output current of 0.2mA and a 1.4V voltage setting.

#### 2.1.7 J7–EN\_LDO

Enable for both the LDO1 and LDO2 regulators.

#### 2.1.8 J8–EN\_DCDC3

Enable for the DCDC3 converter.

#### 2.1.9 J9–EN\_DCDC2

Enable for the DCDC2 converter.

### 2.1.10 J10–EN\_DCDC1

Enable for the DCDC1 converter.

### 2.1.11 J11–PWM/PFM MODE

PWM or PFM Mode jumper, default setting is PWM.

### 2.1.12 J12–VDCDC1 and GND

The output from the DCDC1 switching regulator with a max output current of 1.0A and a default voltage setting of 2.7V.

### 2.1.13 J13–VDCDC2 and GND

The output from the DCDC2 switching regulator with a max output current of 0.8A and a default voltage setting of 1.8V.

### 2.1.14 J14–VDCDC3 and GND

The output from the DCDC3 switching regulator with a max output current of 0.8A and a default voltage setting of 1.3V.

### 2.1.15 J15–VLDO1 and GND

The output from the low drop out regulator, VLDO1, which has a max output current of 200mA and a default voltage setting of 1.8V.

### 2.1.16 J16–VLDO2 and GND

The output from the low drop out regulator, VLDO2, which has a max output current of 200mA and a default voltage setting of 1.8V.

### 2.1.17 J17–VDD\_ALIVE and GND

The output from the VDD\_ALIVE low drop out regulator with a max output current of 30mA and a default voltage setting of 1.2V.

### 2.1.18 J18– $\overline{\text{PWRFAIL}}$

The  $\overline{\text{PWRFAIL}}$  output will assert low when the PWRFAIL comparator indicates a low  $V_{in}$

### 2.1.19 J19–EN\_VDD\_ALIVE

Enable for the VDD\_ALIVE low dropout regulator.

## 2.2 Setup

The EVM comes from the factory with the following default settings on the jumpers.

Jumper	Shunt Location
J4	Between V-LO and DEFDCDC2
J5	Between V-HI and DEFDCDC3
J8	Between EN_DCDC3 and ON
J11	Between PWM and MODE
J19	Between ON and EN_VDD_ALIVE

### 3 Board Layout

This chapter provides the TPS650240EVM-331 board layout and illustrations.

#### 3.1 Layout

Board layout is critical for all switch mode power supplies. The following figure shows the board layout for the TPS650240EVM-331 PWB. The nodes with high switching frequencies and currents are short and are isolated from the noise sensitive feedback circuitry. Careful attention has been given to the routing of high frequency current loops. Refer to the datasheet for specific layout guidelines.

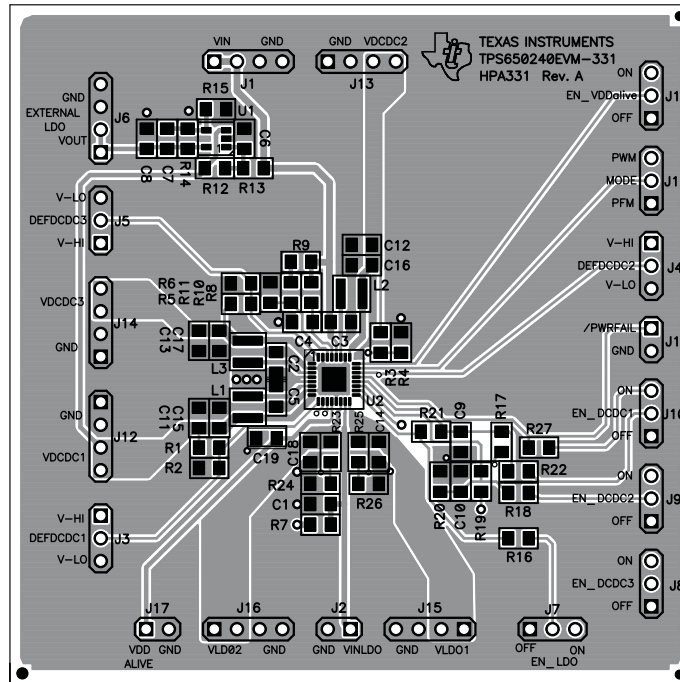


Figure 1. Assembly Layer

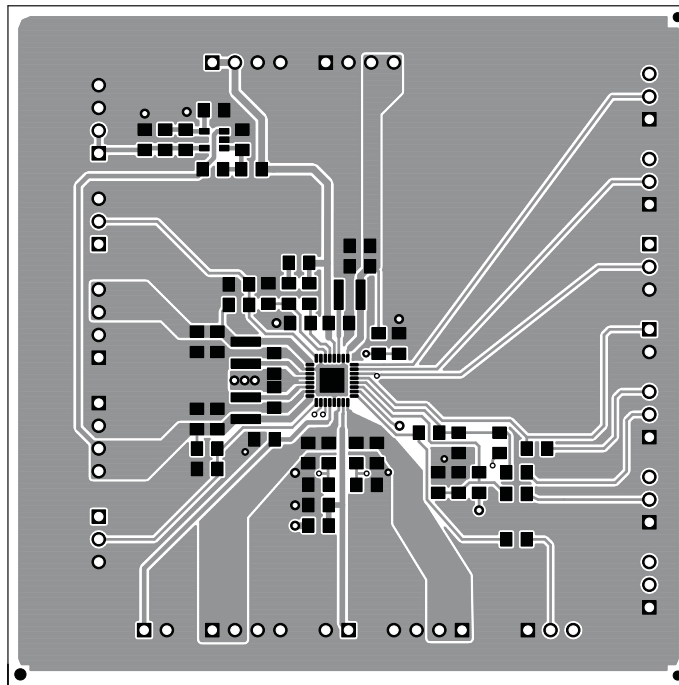


Figure 2. Top Layer Routing

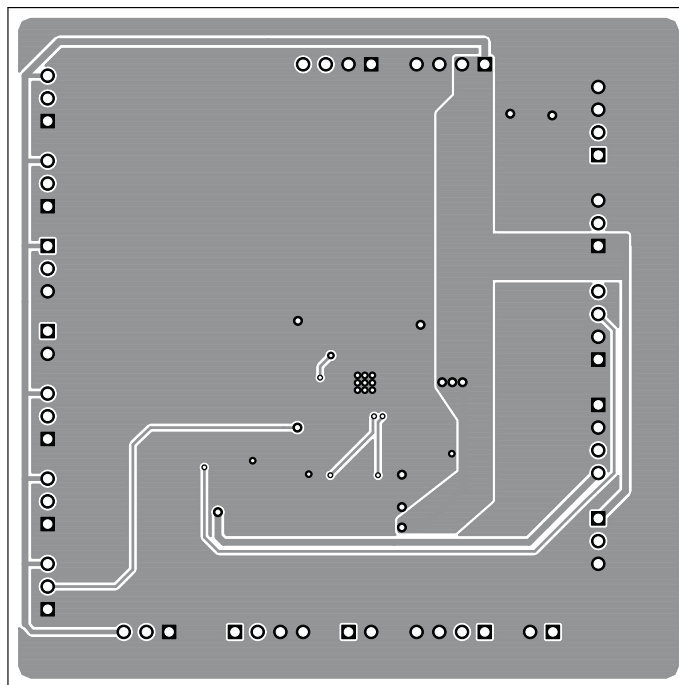
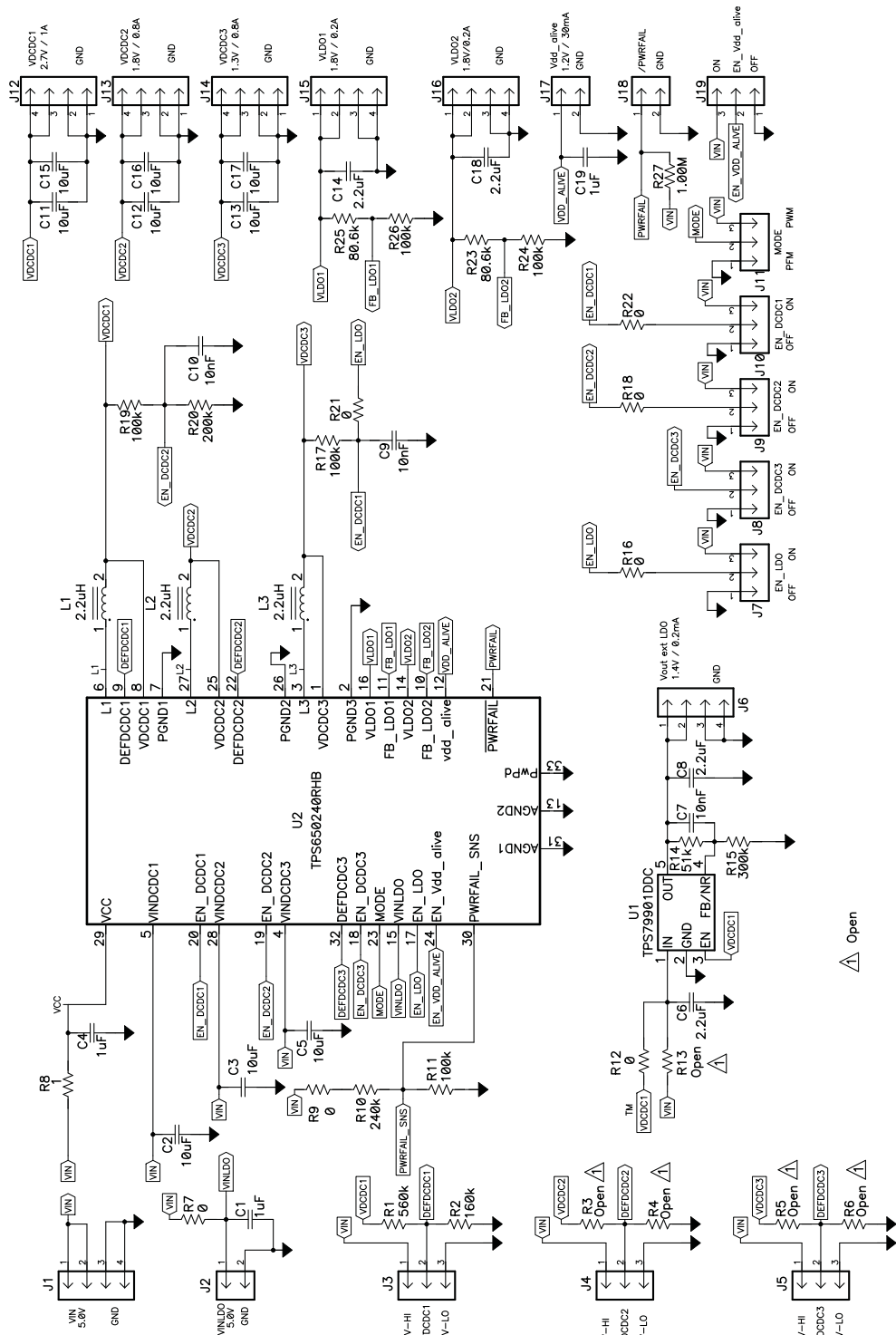


Figure 3. Bottom Layer Routing

#### 4 Schematic and Bill of Materials

This chapter provides the TPS650240EVM-331 schematic and bill of materials.

4.1 Schematic



## 4.2 Bill of Materials

**Table 1. TPS650240EVM-331 Bill of Materials**

Count	Ref Des	Value	Description	Size	Part Number	MFR
3	C1, C4, C19	1 $\mu$ F	Capacitor, Ceramic, 10V, X5R, 10%	0805	Std	Std
9	C2, C3, C5, C11–C13, C15–C17	10 $\mu$ F	Capacitor, Ceramic, 10V, X5R, 10%	0805	Std	Std
4	C6, C8, C14, C18	2.2 $\mu$ F	Capacitor, Ceramic, 10V, X5R, 10%	0805	Std	Std
3	C7, C9, C10	10 nF	Capacitor, Ceramic, 10V, X5R, 10%	0805	Std	Std
7	J1, J6, J12–J16	PTC36SAAN	Header, 4-pin, 100mil spacing, (36-pin strip)	0.100 $\times$ 4	PTC36SAAN	Sullins
3	J2, J17, J18	PTC36SAAN	Header, 2-pin, 100mil spacing, (36-pin strip)	0.100 $\times$ 2	PTC36SAAN	Sullins
9	J3–J5, J7 - J11, J19	PTC36SAAN	Header, 3-pin, 100mil spacing, (36-pin strip)	0.100 $\times$ 3	PTC36SAAN	Sullins
3	L1, L2, L3	2.2 $\mu$ H	Inductor, SMT, 2.0A, 110m $\Omega$	0.118 $\times$ 0.118 inch	LPS3015-222ML	Coilcraft
1	R1	560k	Resistor, Chip, 1/10-W, 1%	0805	Std	Std
1	R10	240k	Resistor, Chip, 1/10-W, 1%	0805	Std	Std
5	R11, R17, R19, R24, R26	100k	Resistor, Chip, 1/10-W, 1%	0805	Std	Std
1	R14	51k	Resistor, Chip, 1/10-W, 1%	0805	Std	Std
1	R15	300k	Resistor, Chip, 1/10-W, 1%	0805	Std	Std
1	R2	160k	Resistor, Chip, 1/10-W, 1%	0805	Std	Std
1	R20	200k	Resistor, Chip, 1/10-W, 1%	0805	Std	Std
2	R23, R25	80.6k	Resistor, Chip, 1/10-W, 1%	0805	Std	Std
1	R27	1.00M	Resistor, Chip, 1/10-W, 1%	0805	Std	Std
0	R3 - R6, R13	Open	Resistor, Chip, 1/10-W, 1%	0805	Std	Std
7	R7, R9, R12, R16, R18, R21, R22	0	Resistor, Chip, 1/10-W, 1%	0805	Std	Std
1	R8	1	Resistor, Chip, 1/10-W, 1%	0805	Std	Std
1	U1	TPS79901DDC	IC, Ultra-low Noise, High PSRR 200 mA, LDO Regulators	SOT23-5	TPS79901DDC	TI
1	U2	TPS650240RHB	IC, 3 DC-DC Converters	QFN-32[RTV]	TPS650240RHB	TI
9	—		Shunt, 100-mil, Black	0.100	929950-00	3M
4	—		Bumper foot - clear	0.44" $\times$ 0.20"	SJ-5303	3M
1	—		PCB, 3.0" $\times$ 3.0" $\sqrt$ 0.062"		HPA331	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. Add self-adhesive bumper feet to each corner of PCB after final assembly and wash

## 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](http://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 input voltage range of 5.5 V max. at 2 A (typ), and the default output voltage of 2.7 V at 1.0 A.

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.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2007-2008, Texas Instruments Incorporated



## 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	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
RF/IF and ZigBee® Solutions	<a href="http://www.ti.com/lprf">www.ti.com/lprf</a>

### Applications

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Automotive	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Broadband	<a href="http://www.ti.com/broadband">www.ti.com/broadband</a>
Digital Control	<a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Military	<a href="http://www.ti.com/military">www.ti.com/military</a>
Optical Networking	<a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Telephony	<a href="http://www.ti.com/telephony">www.ti.com/telephony</a>
Video & Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>
Wireless	<a href="http://www.ti.com/wireless">www.ti.com/wireless</a>

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2008, Texas Instruments Incorporated



Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

**Телефон:** 8 (812) 309 58 32 (многоканальный)

**Факс:** 8 (812) 320-02-42

**Электронная почта:** [org@eplast1.ru](mailto:org@eplast1.ru)

**Адрес:** 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.