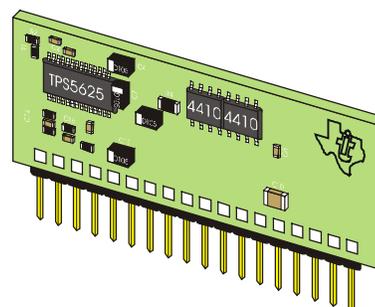


DESIGNER'S NOTEBOOK



The TPS56xx family of power supply controllers are designed to deliver the performance DSPs demand.



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Design Problem

Develop a power supply controller that elegantly addresses the high slew rate load transients demanded by high performance DSP and memory applications.

Solution

The TPS56xx family of switching regulator controllers was specifically designed to provide an accurate supply voltage for systems using Digital Signal Processors. Complete Evaluation Modules (EVM) have been developed as the reference design to demonstrate the performance of these controllers. The EVM is a synchronous-buck switch-mode regulator including input and output filtering and voltage sense pins for remote load. Sufficient capacity is available to power both the DSP as well as associated on-board support circuitry.

The TPS56xx is a hysteretic or ripple regulator controller with a user-selectable hysteresis range. A hysteretic regulator has the fastest load transient response in comparison with other controllers. It has a practically constant peak to peak output voltage ripple that is defined by the hysteresis level. This controller does not require feedback compensation circuitry. In order to meet the transient voltage requirements of the new processors, the controller maintains static regulation within a set point of $\pm 1\%$ over line, load, and temperature variations.

The TPS56XX controller requires 12Vdc (20mA maximum) for the control functions and 5Vdc for powering the switching converter. In applications where 12Vdc is not available, a simple boost circuit could be added externally to provide the relatively low power required for the 12Vdc control circuitry (TPS6734 data sheet includes an EVM application note for a 5Vdc input to 12Vdc output boost converter).

The different output voltage versions of the TPS56xx based EVM modules are shown in the Table. The modules have the same schematic except for the controller. They are configured on a 0.75" high by a 2" long printed board with surface mount components on one side and through hole components on the opposite side. All connections are on one edge of the printed board. In this fashion the module could be mounted as a Single In-line Package

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(SIP) to minimize real-estate needs of the converter, or horizontally to the user card to minimize height (see Figure).

EVM Part Number	Controller	Output Voltage	Max. Output Current
SLVP104	TPS5633CPWP	3.3Vdc	8Adc ¹
SLVP105	TPS5625CPWP	2.5Vdc	8Adc ¹
SLVP106	TPS5618CPWP	1.8Vdc	8Adc ¹
SLVP115	TPS5615CPWP	1.5Vdc	8Adc ¹

¹ Thermal performance may be limited by the temperature rise of the power FETs chosen.

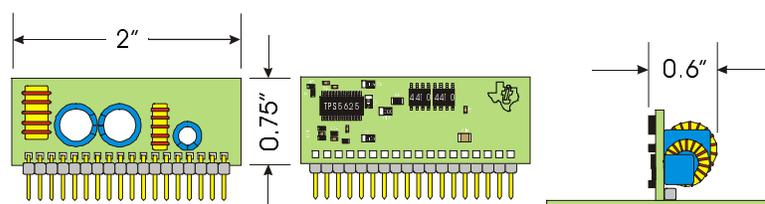
Basic Features

- Programmable hysteretic range
- 2 -A dual output drives with an active deadtime circuit can source up to three paralleled FETs
- Up to 95% efficiency
- Latched overvoltage shutdown
- Latched, programmable overcurrent shutdown
- Overtemperature shutdown with auto recovery
- Power good signal
- Inhibit (LO, converter OFF; HI, converter ON)
- Low 12-Vdc input undervoltage lockout
- 28-pin TSSOP PowerPAD™ package

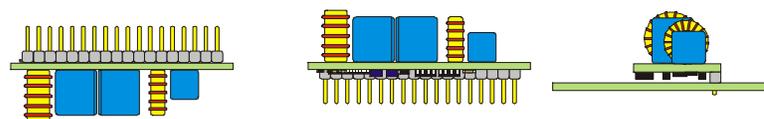
EVM Intent

Texas Instruments (TI) has developed these EVM modules as reference circuits to assist in the development of timely applications utilizing the TPS56xx family of power supply controllers. Although it is not TI's intent to manufacture completed power supply modules, TI will provide samples of the reference designs for customer evaluation.

Information on the recommended mounting arrangement, schematic, parts list, and board layout recommendations are documented below. The main test results and waveforms also are represented. A complete characterization application note will be issued shortly documenting the performance of the reference EVM board.



SIP mounted board layout

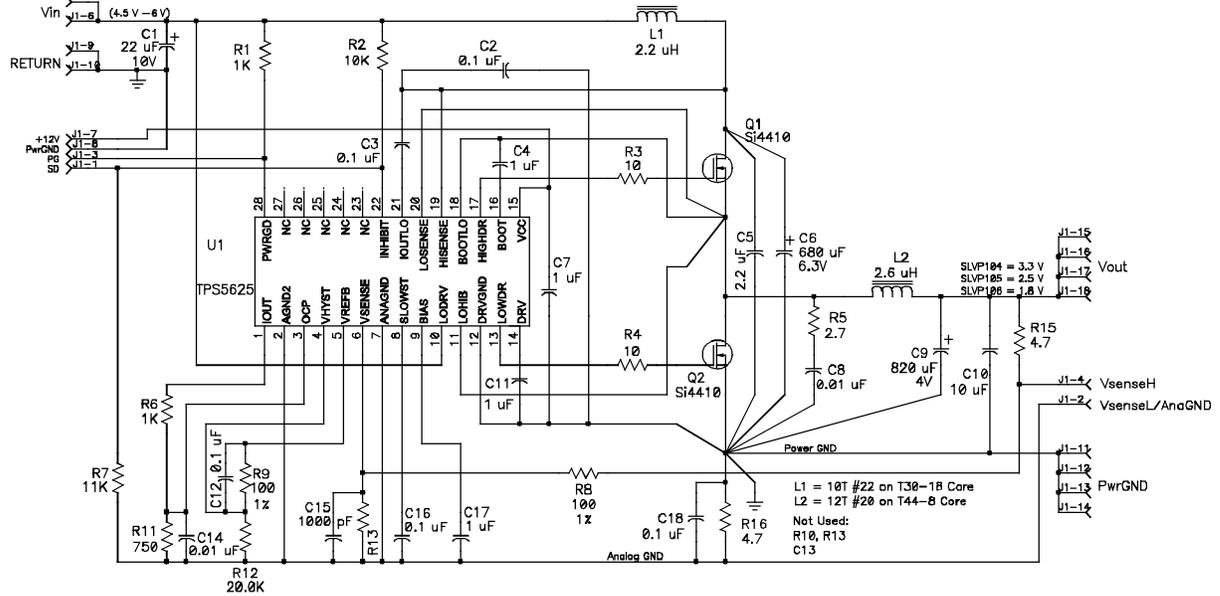


Flat mounted Board layout

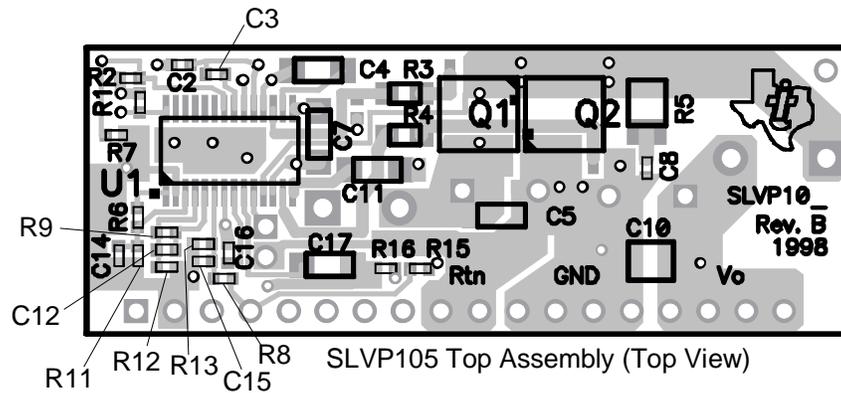
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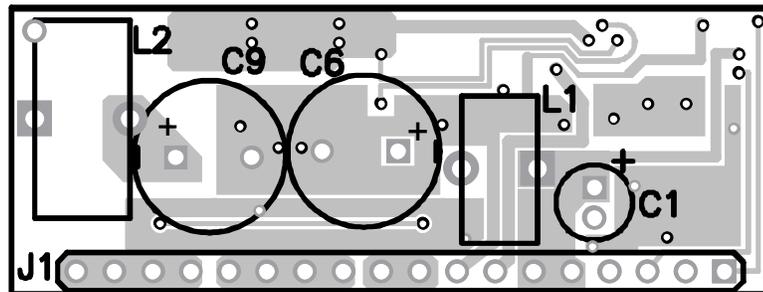
Support Information



Schematic of TPS56XX controller EVM board



SLVP105 Top Assembly (Top View)



SLVP105 Bottom Assembly (Bottom View)

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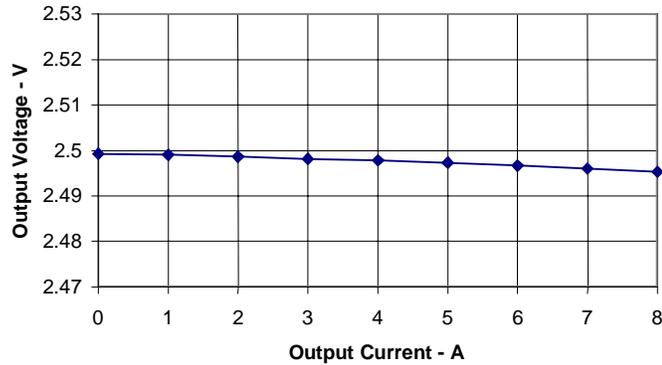
Advanced Information

Ref Des	Qty	Part Number	Description	MFG
C1	1	10SS22M	Capacitor, Os-Con, 22uF, 10V, 20%	Sanyo
C2	4	GRM39X7R104K016A	Capacitor, Ceramic, 0.1 uF, 16V, 10%, X7R	muRata
C3		GRM39X7R104K016A	Capacitor, Ceramic, 0.1 uF, 16V, 10%, X7R	muRata
C4	4	GRM42-6Y5V105Z016A	Capacitor, Ceramic, 1.0 uF, 16V, +80%-20%	muRata
C5	1	GRM42-6Y5V225Z016A	Capacitor, Ceramic, 2.2 uF, 16V, Y5V	muRata
C6	1	6SP680M	Capacitor, Os-Con, 680uF, 6.3V, 20%	Sanyo
C7		GRM42-6Y5V105Z016A	Capacitor, Ceramic, 1.0 uF, 16V, +80%-20%	muRata
C8	1	GRM39X7R103K025A	Capacitor, Ceramic, 0.01uF, 25V, 10%, X7R	muRata
C9	1	4SP820M	Capacitor, Os-Con, 820uF, 4V, 20%	Sanyo
C10	1	GRM235Y5V106Z016A	Capacitor, Ceramic, 10uF, 16V, Y5V	muRata
C11		GRM42-6Y5V105Z016A	Capacitor, Ceramic, 1.0 uF, 16V, +80%-20%	muRata
C12		GRM39X7R104K016A	Capacitor, Ceramic, 0.1 uF, 16V, 10%, X7R	muRata
C14	1	GRM39X7R103K025A	Capacitor, Ceramic, 0.01uF, 25V, 10%, X7R	muRata
C15	1	GRM39X7R102K050A	Capacitor, Ceramic, 1000 pF, 50V, 10%, X7R	muRata
C16		GRM39X7R104K016A	Capacitor, Ceramic, 0.1 uF, 16V, 10%, X7R	muRata
C17		GRM42-6Y5V105Z016A	Capacitor, Ceramic, 1.0 uF, 16V, +80%-20%	muRata
C18		GRM39X7R104K016A	Capacitor, Ceramic, 0.1 uF, 16V, 10%, X7R	muRata
J1	1	S1122-18-ND	Header, RA, 18-pin, 0.23 Posts x 0.20 Tails	Sullins
L1	1		Inductor, Filter, 2.2 uH, 10 A (10T #22 on T30-18 Core)	Core from Micrometals
L2	1		Inductor, Filter, 2.6 uH, 10 A (12T #20 on T44-8/90 Core)	Core from Micrometals
Q1	2	Si4410DY	FET, N-ch, 30-V, 10-A, 13-milliohm	Siliconix
Q2		Si4410DY	FET, N-ch, 30-V, 10-A, 13-milliohm	Siliconix
R1	2	Std	Resistor, Chip, 1.0K ohms, 1/16W, 5%	603
R2	1	Std	Resistor, Chip, 10K ohms, 1/16W, 1%	603
R3	2	Std	Resistor, Chip, 10 ohms, 1/10W, 5%	805
R4		Std	Resistor, Chip, 10 ohms, 1/10W, 5%	805
R5	1	Std	Resistor, Chip, 2.7 ohms, 1/4W, 5%	1210
R6		Std	Resistor, Chip, 1K ohms, 1/16W, 5%	603
R7	1	Std	Resistor, Chip, 11K ohms, 1/16W, 1%	603
R8	2	Std	Resistor, Chip, 100 ohms, 1/16W, 1%	603
R9		Std	Resistor, Chip, 100 ohms, 1/16W, 1%	603
R11	1	Std	Resistor, Chip, 750 ohms, 1/16W, 5%	603
R12	2	Std	Resistor, Chip, 20.0K ohms, 1/16W, 1%	603
R13		Std	Resistor, Chip, 20.0K ohms, 1/16W, 1%	603
R15	2	Std	Resistor, Chip, 4.7 ohms, 1/16W, 5%	603
R16	2	Std	Resistor, Chip, 4.7 ohms, 1/16W, 5%	603
U1A	1	TPS5633CPWP	IC, PWM Ripple Controller, 3.3-Vo, (SLVP104 only)	TI
U1B	1	TPS5625CPWP	IC, PWM Ripple Controller, 2.5-Vo, (SLVP105 only)	TI
U1C	1	TPS5618CPWP	IC, PWM Ripple Controller, 1.8-Vo, (SLVP106 only)	TI
U1D	1	TPS5615CPWP	IC, PWM Ripple Controller, 1.5-Vo, (SLVP115 only)	TI

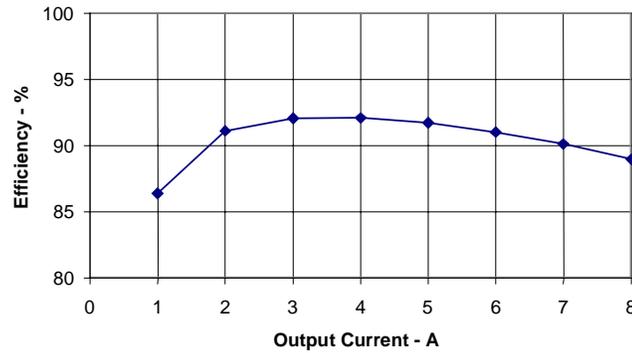
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SLVP105 Load Regulation, $V_i=5V$

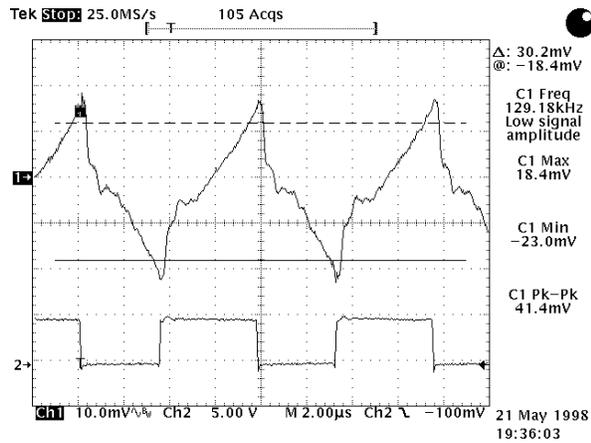


SLVP105 Efficiency vs. Output Current, $V_i=5V$



SLVP105 Output ripple and Switching waveforms at $V_i=5V$, $I_{out}=8A$

(Cursors show hysteresis levels)



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