Step-Down DC/DC Controller with Shutdown

FEATURES

- Operation Voltage up to 15V
- Voltage-Mode Operation
- Fast Transient Response
- Built In Accurate 1.3V Voltage Reference
- Adjustable Over Current Protection using $R_{DS(ON)}$ No External Current Sense Resistor Required
- Low Shutdown Current
- 200KHz Free-Running Oscillator
- Built in Soft Start.

APPLICATIONS

- Notebook PC
- Advanced PC Mboards
- Information PCs
- Servers and Workstations
- PC Add-On Cards

DESCRIPTION

The SS**6**401 is a high efficiency, PWM step-down, voltage-mode, switching controller. It is suitable for IA, Notebook, LCD PC and LCD monitor main power applications.

The built-in high voltage CMOS driver drives an external N-channel MOSFET for replacing the higher cost P-channel MOSFET in a standard buck topology.

The 200KHz switching frequency allows using smaller external components while maintaining high conversion efficiency. The 11MHz bandwidth and 6V/us slew rate of the error amplifier ensures the higher converter bandwidth and the fast transient response.

The SS**6**401 also features over current protection. It provides adjustable over current trigger point and short-circuit protections by sensing the output current across the on resistance of the external N-channel MOSFET rather then an expensive external low value sense resistor.

ORDERING INFORMATION

SS6401CXXX

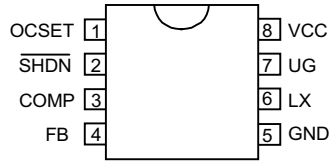
- PACKING TYPE
  TR: TAPE & REEL
  TB: TUBE
- PACKAGE TYPE
  S: SMALL OUTLINE

Example: **SS6401CSTR**

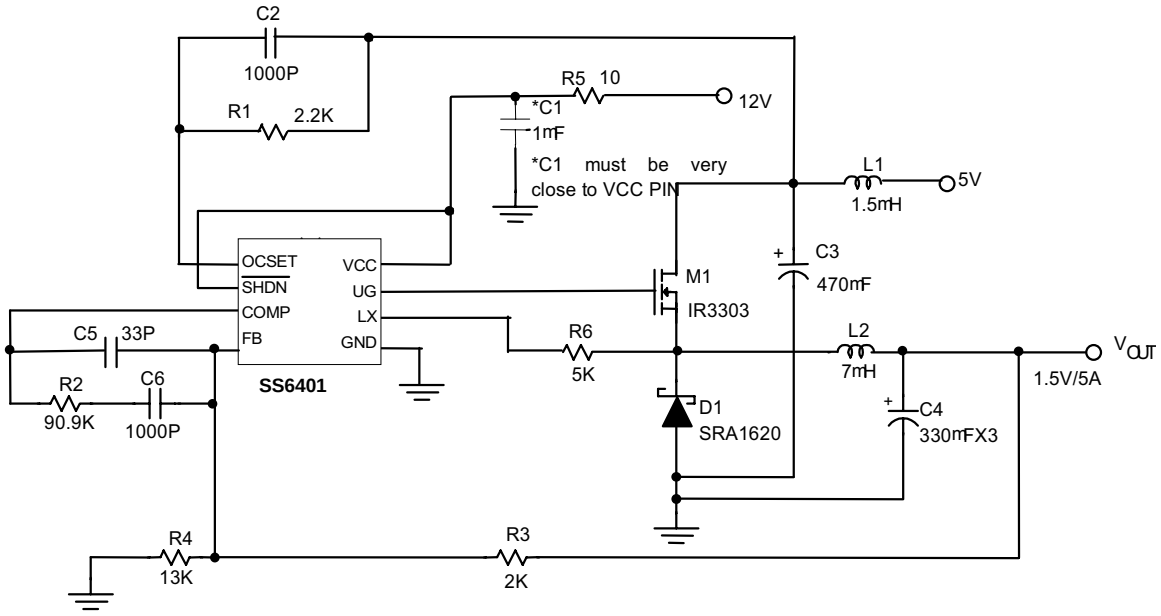
→ in SO-8 Package & Taping & Reel Packing Type

PIN CONFIGURATION

SO8
TOP VIEW



TYPICAL APPLICATION CIRCUIT



DC/DC Converter

ABSOLUTE MAXIMUM RATINGS

Supply Voltage, V_{CC} 15V

Input, Output, or I/O Voltage ..... GND -0.3V to VCC+0.3V

ESD Classification ..... Class 2

Recommended Operating Conditions

Supply Voltage, V_{CC} ..... 12V ±10%

Ambient Temperature Range ..... 0°C~70°C

Junction Temperature Range ..... 0°C~ 100°C

Thermal Information

Thermal Resistance, θ_{JA} (Typical, Note 1)

SOIC Package ..... 100°C/W

SOIC Package (with 3 in^2 of Copper) ..... 90°C/W

Maximum Junction Temperature (Plastic Package) ..... 150°C

Maximum Storage Temperature Range ..... –65°C~150°C

Maximum Lead Temperature (Soldering 10 Sec) ..... 300°C

Note 1: θ_{JA} is measured with the component mounted on an evaluation PC board in free air.

TEST CIRCUIT

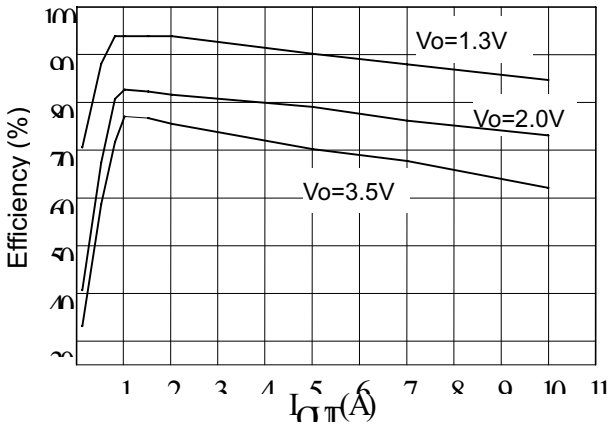
Refer to TYPICAL APPLICATION CIRCUIT.

ELECTRICAL CHARACTERISTICS (VCC= 12V, T_A=25°C, unless otherwise specified.)

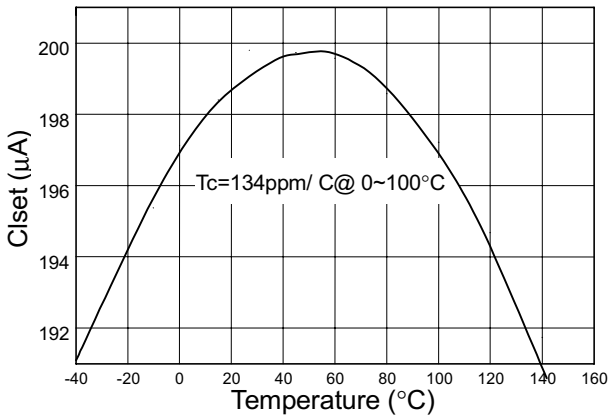
PARAMETER	TEST CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
VCC Supply Current						
Nominal Supply	UGATE Open	I_{VCC}		2		mA
Power-On Reset						
V_{CC} Threshold	V_{OCSET}=4.5V			9.5		V
Oscillator						
Frequency				200		KHz
Duty Cycle				88		%
Internal Reference Voltage						
Reference Voltage			1.27	1.30	1.33	V
Error Amplifier						
DC Gain				76		dB
Gain-Bandwidth Product		GBW		11		MHz
Slew Rate		SR		6		V/µS
Gate Driver						
Upper Gate Source		R_{UGATE}		7		Ω
Upper Gate Sink		R_{UGATE}		5		Ω
Protection						
OCSET Current Source	V_{OCSET} =4.5VDC	I_{OCSET}		200		µA
SS Current		I_{SS}		10		µA
Shutdown						
Shutdown Low Input		$V_{IN}L$			0.35	V
Shutdown High Input		$V_{IN}H$	2			V
Shutdown Mode Current					1	µA

TYPICAL PERFORMANCE CHARACTERISTICS

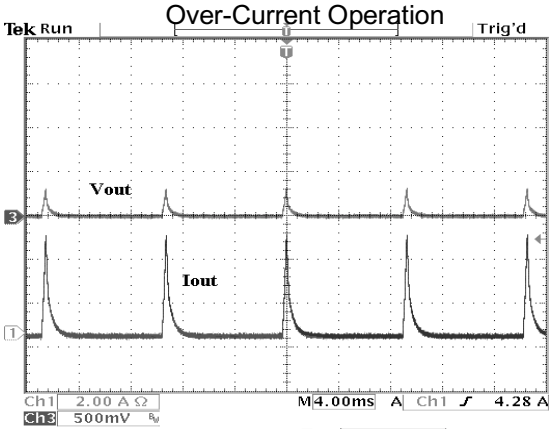
Efficiency vs. Load Current



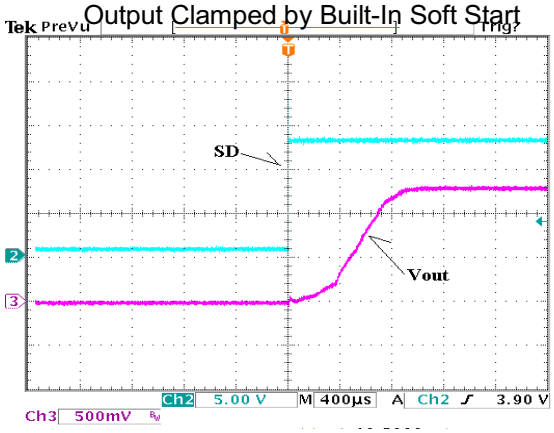
OCSET Current vs. Temperature



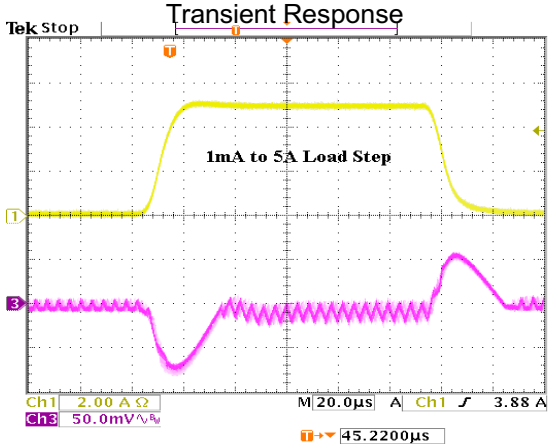
Over-Current Operation



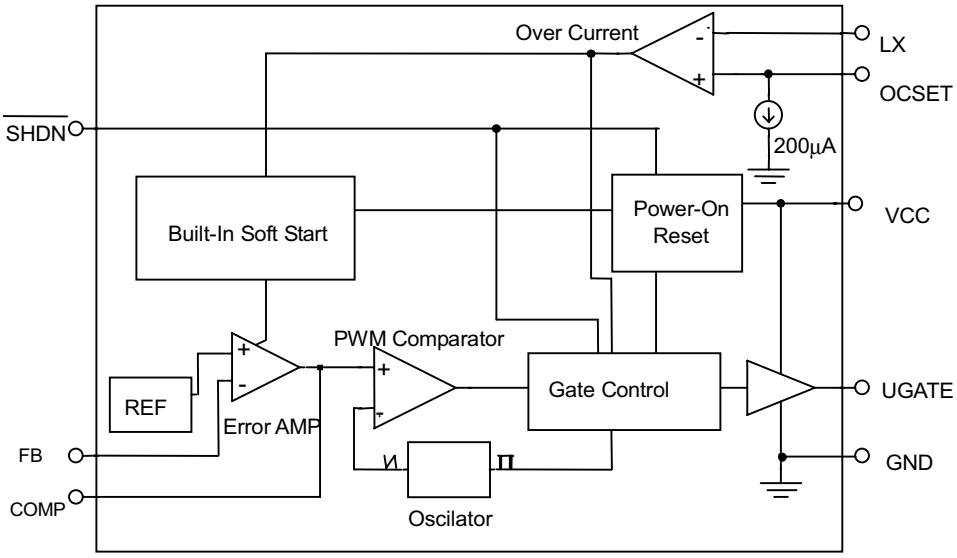
Output Clamped by Built-In Soft Start



Transient Response



BLOCK DIAGRAM



PIN DESCRIPTIONS

PIN 1: OCSET - Current limit sense pin. Connect a resistor R_{OCSET} from this pin to the drain of the external MOSFET. R_{OCSET}, an internal 200µA current source (I_{OCSET}), and the external MOSFET on-resistance ($R_{DS(ON)}$) jointly set the overcurrent trip point according to the following equation:

$$I_{PEAK} = \frac{I_{OCSET}}{R_{DS(ON)}}$$

PIN 2: $\overline{SHDN}$ - Shutdown pin. Connect this pin to ground for shutdown.

PIN 3: COMP - External compensation pin. This pin is connected to error amplifier output and PWM comparator. A RC network is connected to FB pin to compensate the voltage-control feedback loop of the converter.

PIN 4: FB - The error amplifier inverting input pin. The FB pin and COMP pin are used to compensate the voltage-control feedback loop.

PIN 5: GND - Ground pin.

PIN 6: LX - Overcurrent detection pin. Connect the LX pin to source of the external N-MOSFET. This pin detects the voltage drop across the MOSFET $R_{DS(ON)}$ for overcurrent protection.

PIN 7: UG - External MOSFET gate drive pin. Connect this pin to gate of the external MOSFET.

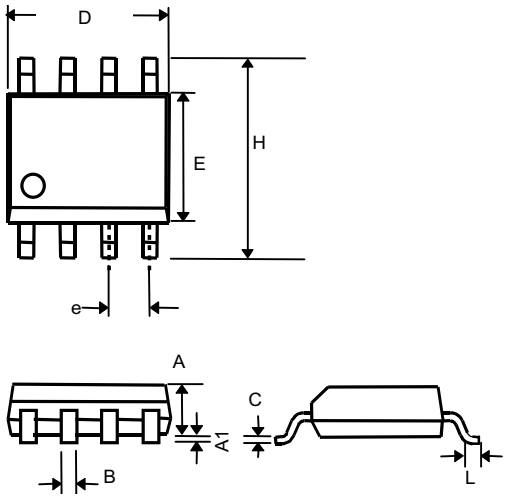
PIN 8: VCC - The chip power supply pin. Recommended supply voltage is 12V.

APPLICATION CIRCUIT

Refer to TYPICAL APPLICATION CIRCUIT

PHYSICAL DIMENSIONS

- **8 LEAD PLASTIC SO (unit: mm)**



SYMBOL	MIN	MAX
A	1.35	1.75
A1	0.10	0.25
B	0.33	0.51
C	0.19	0.25
D	4.80	5.00
E	3.80	4.00
e	1.27(TYP)	
H	5.80	6.20
L	0.40	1.27

Information furnished by Silicon Standard Corporation is believed to be accurate and reliable. However, Silicon Standard Corporation makes no guarantee or warranty, express or implied, as to the reliability, accuracy, timeliness or completeness of such information and assumes no responsibility for its use, or for infringement of any patent or other intellectual property rights of third parties that may result from its use. Silicon Standard reserves the right to make changes as it deems necessary to any products described herein for any reason, including without limitation enhancement in reliability, functionality or design. No license is granted, whether expressly or by implication, in relation to the use of any products described herein or to the use of any information provided herein, under any patent or other intellectual property rights of Silicon Standard Corporation or any third parties.