



USR1051

Preliminary

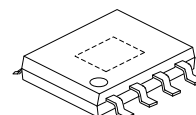
LINEAR INTEGRATED CIRCUIT

3 A SYNCHRONOUS BUCK REGULATOR

DESCRIPTION

The UTC **USR1051** is a high efficiency, 3A synchronous buck regulator. The UTC **USR1051** works from 5V to 23V input voltage range, and provides up to 3A of continuous output current with an output voltage adjustable down to 0.8V.

The UTC **USR1051** comes in an exposed pad HSOP-8 package and is rated over a -40°C~+85°C operating ambient temperature range.



HSOP-8

FEATURES

- * Synchronous Buck
- * 5V~23V operating input voltage range
- * High efficiency
- * Internal soft start
- * Output voltage adjustable to 0.8V
- * 3A continuous output current
- * Cycle-by-cycle current limit
- * 400kHz PWM operation
- * Pre-bias start-up
- * Thermal shutdown
- * Short-circuit protection
- * Exposed pad HSOP-8 package

ORDERING INFORMATION

Ordering Number		Package	Packing
Lead Free	Halogen Free		
USR1051L-SH2-T	USR1051G-SH2-T	HSOP-8	Tube
USR1051L-SH2-R	USR1051G-SH2-R	HSOP-8	Tape Reel

USR1051L-SH2-T	(1)Packing Type	(1) T: Tube, R: Tape Reel
	(2)Package Type	(2) HS2: HSOP-8
	(3)Halogen Free	(3) L: Lead Free, G: Halogen Free

Pin configuration diagram for the 8-pin package. The package is shown with pins 1 through 8. Pin 1 is PGND, Pin 2 is V_{IN} , Pin 3 is AGND, Pin 4 is FB, Pin 5 is COMP, Pin 6 is EN, Pin 7 is NC, and Pin 8 is NC. A dashed box labeled PAD (LX) is located between pins 4 and 6.

PIN NO.	PIN NAME	DESCRIPTION
1	PGND	Power ground
2	V _{IN}	Supply voltage input
3	AGND	Analog ground
4	FB	Feedback input
5	COMP	External loop compensation pin
6	EN	Enable pin
7	NC	No Connect Pin.
8	NC	No Connect Pin.
Exposed pad	LX	Switching node

The block diagram illustrates the internal control logic of the UCC28950B. Key components and their interconnections include:

- Inputs:** EN (Enable), FB (Feedback), V_{IN} (Input Voltage), and LX (Load Inductor).
- Control Blocks:**
 - Start Up:** Receives EN and initiates the control sequence.
 - VREF:** Provides a reference voltage to the Error Amplifier (EA) and the Current Source Bias.
 - REF_0.8V:** Provides a 0.8V reference to the Error Amplifier (EA).
 - Current Source Bias:** Receives VREF and provides a bias current to the Oscillator (OSC).
 - OSC:** Generates an oscillation signal for the Slope Comparator (SLOPE).
 - SLOPE:** Compares the feedback signal with the oscillator signal to generate a PWM signal.
 - EA (Error Amplifier):** Amplifies the difference between the feedback signal and the 0.8V reference.
 - SENSE:** Monitors the output voltage and provides feedback to the SLOPE comparator.
 - PWM LATCH:** Latches the PWM signal and provides it to the Driver blocks.
 - Driver:** Two driver blocks that drive the MOSFETs in the power stage.
 - Dead Time Control:** Manages the dead time between the two MOSFETs to prevent shoot-through.
- Outputs and Nodes:**
 - COMP:** The output of the Error Amplifier.
 - AGND:** Analog Ground.
 - PGND:** Power Ground.

■ ABSOLUTE MAXIMUM RATING

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V_{IN}	23	V
LX to AGND		$-0.7 \sim V_{IN} + 0.3$	V
LX to AGND (20ns)		-5~22	V
EN to AGND		$-0.3 \sim V_{IN} + 0.3$	V
FB, SS, COMP to AGND		-0.3~6.0	V
PGND to AGND		$-0.3 \sim +0.3$	V
Ambient Temperature	T_A	-40~+85	°C
Junction Temperature	T_J	+150	°C
Storage Temperature	T_{STG}	-65~+150	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ THERMAL DATA

PARAMETER	SYMBOL	RATING	UNIT
Junction to Ambient (Note 2)	θ_{JA}	50	°C/W

■ RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V_{IN}	5~23	V
Output Voltage	V_{OUT}	$0.8 \sim 0.85 \times V_{IN}$	V

■ ELECTRICAL CHARACTERISTICS (Note 3)

($T_A = 25^\circ\text{C}$, $V_{IN} = V_{EN} = 12\text{V}$, $V_{OUT} = 3.3\text{V}$, unless otherwise specified)

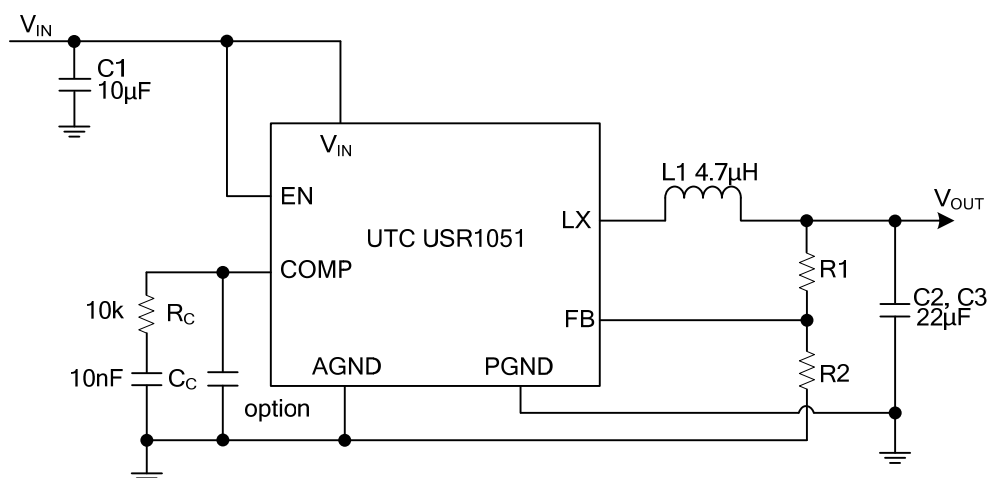
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Supply Voltage	V_{IN}		5		23	V
Supply Current (Quiescent)	I_{IN}	$I_{OUT} = 0$, $V_{FB} = 1.2\text{V}$, $V_{EN} > 2\text{V}$		3.5	5	mA
Shutdown Supply Current	I_{OFF}	$V_{EN} = 0\text{V}$		1	10	μA
Feedback Voltage	V_{FB}	$T_A = 25^\circ\text{C}$	0.788	0.8	0.812	V
Load Regulation				0.5		%
Line Regulation				1		%
Feedback Voltage Input Current	I_{FB}				200	nA
EN Input Threshold	V_{EN}	Off Threshold			0.6	V
		On Threshold	2			V
SS Time		$C_{SS} = 16\text{nF}$		2		ms
MODULATOR						
Frequency	f_O		380	450	550	kHz
Maximum Duty Cycle	D_{MAX}		85			%
Controllable Minimum On Time	T_{MIN}				150	ns
Current Sense Transconductance				7		A/V
Error Amplifier Transconductance				180		$\mu\text{A/V}$
PROTECTION						
Current Limit			3.5	4.5		A
Over-Temperature Shutdown Limit		T_J Rising		150		°C
		T_J Falling		100		°C

Notes: 1. Devices are inherently ESD sensitive, handling precautions are required. Human body model rating: 1.5 k Ω in series with 100pF.

2. The value of θ_{JA} is measured with the device mounted on a 1-in² FR-4 board with 2oz. Copper, in a still air environment with $T_A = 25^\circ\text{C}$. The value in any given application depends on the user's specific board design.

3. Specification in BOLD indicate an ambient temperature range of $-40^\circ\text{C} \sim +85^\circ\text{C}$. These specifications are guaranteed by design.

■ TYPICAL APPLICATION CIRCUIT



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