



High Speed PWM Controller

FEATURES

- Compatible with Voltage or Current-Mode Topologies
- Practical Operation @ Switching Frequencies to 1.0MHz
- 50ns Propagation Delay to Output
- High Current Totem Pole Output (1.5A peak)
- Wide Bandwidth Error Amplifier
- Fully Latched Logic with Double Pulse Suppression
- Pulse-by-Pulse Current Limiting
- Soft Start/Max. Duty Cycle Control
- Under-Voltage Lockout with Hysteresis
- Low Start Up Current (1.1mA)
- Trimmed Bandgap Reference (5.1V \pm 1%)

DESCRIPTION

The UC1823 family of PWM control ICs is optimized for high frequency switched mode power supply applications. Particular care was given to minimizing propagation delays through the comparators and logic circuitry while maximizing bandwidth and slew rate of the error amplifier. This controller is designed for use in either current-mode or voltage-mode systems with the capability for input voltage feed-forward.

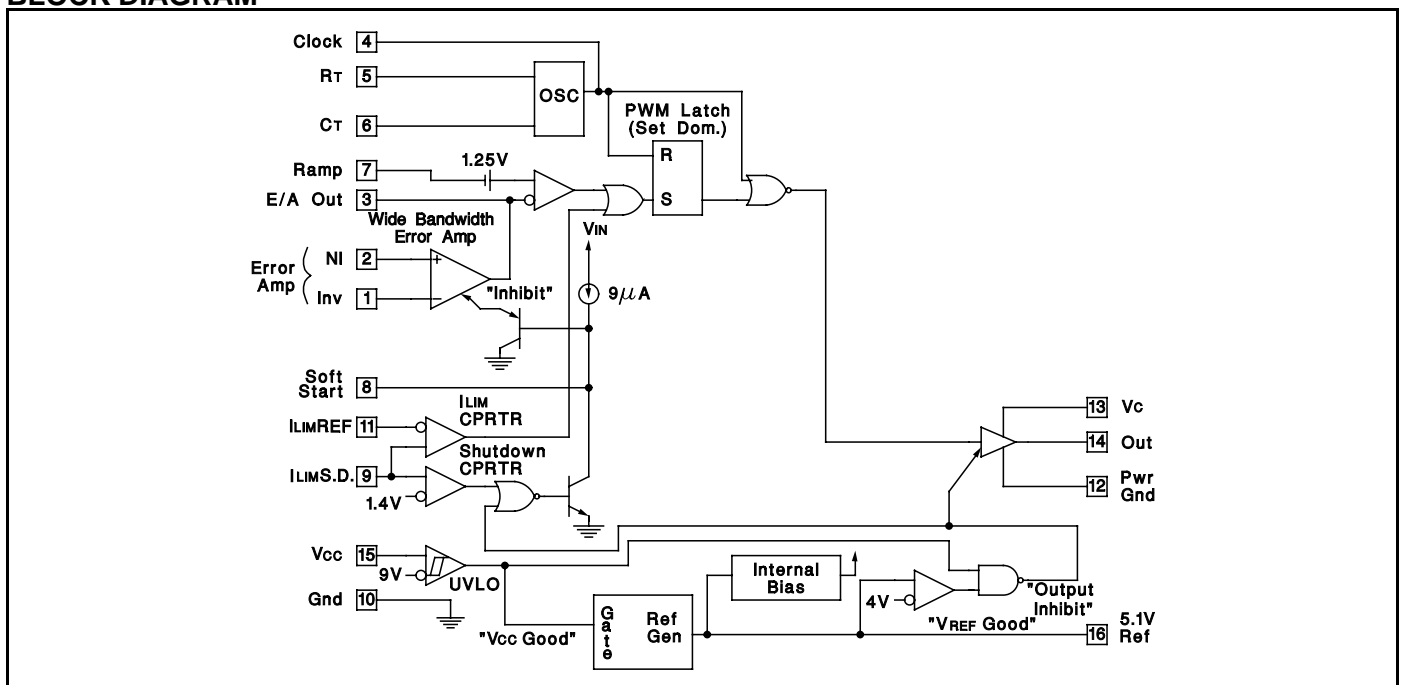
Protection circuitry includes a current limit comparator, a TTL compatible shutdown port, and a soft start pin which will double as a maximum duty cycle clamp. The logic is fully latched to provide jitter free operation and prohibit multiple pulses at the output. An under-voltage lockout section with 800mV of hysteresis assures low start up current. During under-voltage lockout, the output is high impedance. The current limit reference (pin 11) is a DC input voltage to the current limit comparator. Consult specifications for details.

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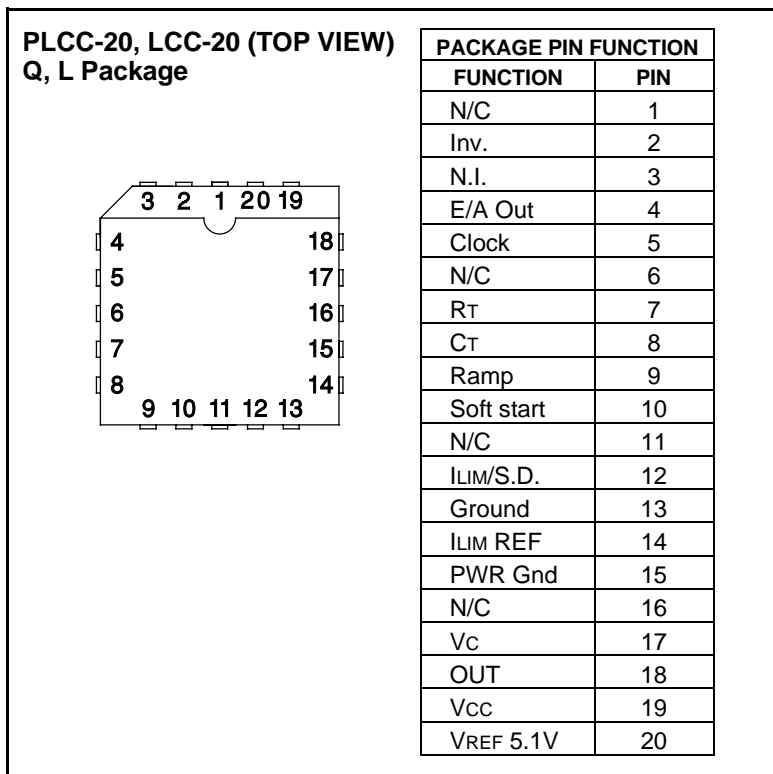
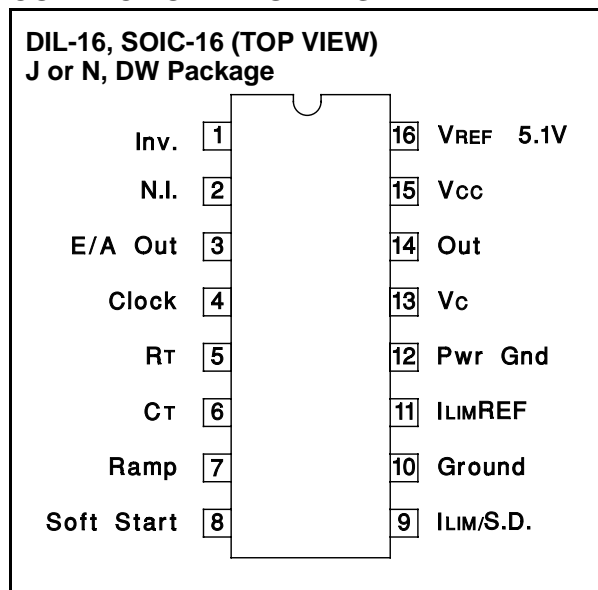
ABSOLUTE MAXIMUM RATINGS

Supply Voltage (Pins 15, 13)	30V	Oscillator Charging Current (Pin 5)	-5mA
Output Current, Source or Sink (Pin14)		Power Dissipation at $T_A = 60^\circ\text{C}$	1W
DC	0.5A	Storage Temperature Range	-65°C to +150°C
Pulse (0.5 μ s)	2.0A	Lead Temperature (Soldering, 10 seconds)	300°C
Analog Inputs (Pins 1, 2, 7, 8, 9, 11)	-0.3V to +6V	Note: All voltages are with respect to ground, Pin 10.	
Clock Output Current (Pin 4)	-5mA	Currents are positive into the specified terminal.	
Error Amplifier Output Current (Pin 3)	5mA	Consult Packaging Section of Databook for thermal	
Soft Start Sink Current (Pin 8)	20mA	limitations and considerations of packages.	

BLOCK DIAGRAM



CONNECTION DIAGRAMS



ELECTRICAL CHARACTERISTICS: Unless otherwise noted, these specifications apply for $R_T = 3.65k$, $C_T = 1nF$, $V_{CC} = 15V$, $0^\circ C < T_A < +70^\circ C$ for the UC3823, $-25^\circ C < T_A < +85^\circ C$ for the UC2823, and $-55^\circ C < T_A < +125^\circ C$ for the UC1823, $T_A = T_J$.

PARAMETER	TEST CONDITIONS	UC1823 UC2823			UC3823			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
Reference Section								
Output Voltage	$T_J = 25^\circ C$, $I_o = 1mA$	5.05	5.10	5.15	5.00	5.10	5.20	V
Line Regulation	$10 < V_{CC} < 30V$		2	20		2	20	mV
Load Regulation	$1 < I_o < 10mA$		5	20		5	20	mV
Temperature Stability*	$T_{MIN} < T_A < T_{MAX}$		0.2	0.4		0.2	0.4	mV/ $^\circ C$
Total Output Variation*	Line, Load, Temp.	5.00		5.20	4.95		5.25	
Output Noise Voltage*	$10Hz < f < 10kHz$		50			50		μV
Long Term Stability*	$T_J = 125^\circ C$, 1000 hrs.		5	25		5	25	mV
Short Circuit Current	$V_{REF} = 0V$	-15	-50	-100	-15	-50	-100	mA
Oscillator Section								
Initial Accuracy*	$T_J = 25^\circ C$	360	400	440	360	400	440	kHz
Voltage Stability*	$10 < V_{CC} < 30V$		0.2	2		0.2	2	%
Temperature Stability*	$T_{MIN} < T_A < T_{MAX}$		5			5		%
Total Variation*	Line, Temp.	340		460	340		460	kHz
Clock Out High		3.9	4.5		3.9	4.5		V
Clock Out Low			2.3	2.9		2.3	2.9	V
Ramp Peak*		2.6	2.8	3.0	2.6	2.8	3.0	V
Ramp Valley*		0.7	1.0	1.25	0.7	1.0	1.25	V
Ramp Valley to Peak*		1.6	1.8	2.0	1.6	1.8	2.0	V

* These parameters are guaranteed by design but not 100% tested in production.

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PARAMETER	TEST CONDITIONS	UC1823 UC2823			UC3823			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
Error Amplifier Section								
Input Offset Voltage				10			15	mV
Input Bias Current			0.6	3		0.6	3	μA
Input Offset Current			0.1	1		0.1	1	μA
Open Loop Gain	$1 < V_O < 4V$	60	95		60	95		dB
CMRR	$1.5 < V_{CM} < 5.5V$	75	95		75	95		dB
PSRR	$10 < V_{CC} < 30V$	85	110		85	110		dB
Output Sink Current	$V_{PIN 3} = 1V$	1	2.5		1	2.5		mA
Output Source Current	$V_{PIN 3} = 4V$	-0.5	-1.3		-0.5	-1.3		mA
Output High Voltage	$I_{PIN 3} = -0.5mA$	4.0	4.7	5.0	4.0	4.7	5.0	V
Output Low Voltage	$I_{PIN 3} = 1mA$	0	0.5	1.0	0	0.5	1.0	V
Unity Gain Bandwidth*		3	5.5		3	5.5		MHz
Slew Rate*		6	12		6	12		V/ μS
PWM Comparator Section								
Pin 7 Bias Current	$V_{PIN 7} = 0V$		-1	-5		-1	-5	μA
Duty Cycle Range		0		80	0		85	%
Pin 3 Zero D.C. Threshold	$V_{PIN 7} = 0V$	1.1	1.25		1.1	1.25		V
Delay to Output*			50	80		50	80	ns
Soft-Start Section								
Charge Current	$V_{PIN 8} = 0.5V$	3	9	20	3	9	20	μA
Discharge Current	$V_{PIN 8} = 1V$	1			1			mA
Current Limit/Shutdown Section								
Pin 9 Bias Current	$0 < V_{PIN 9} < 4V$			± 10			± 10	μA
Current Limit Offset	$V_{PIN 11} = 1.1V$			15			15	mV
Current Limit Common Mode Range ($V_{PIN 11}$)		1.0		1.25	1.0		1.25	V
Shutdown Threshold		1.25	1.40	1.55	1.25	1.40	1.55	V
Delay to Output*			50	80		50	80	ns
Output Section								
Output Low Level	$I_{OUT} = 20mA$		0.25	0.40		0.25	0.40	V
	$I_{OUT} = 200mA$		1.2	2.2		1.2	2.2	V
Output High Level	$I_{OUT} = -20mA$	13.0	13.5		13.0	13.5		V
	$I_{OUT} = -200mA$	12.0	13.0		12.0	13.0		V
Collector Leakage	$V_C = 30V$		100	500		100	500	μA
Rise/Fall Time*	$C_L = 1nF$		30	60		30	60	ns
Under-Voltage Lockout Section								
Start Threshold		8.8	9.2	9.6	8.8	9.2	9.6	V
UVLO Hysteresis		0.4	0.8	1.2	0.4	0.8	1.2	V
Supply Current								
Start Up Current	$V_{CC} = 8V$		1.1	2.5		1.1	2.5	mA
I_{CC}	$V_{PIN 1}, V_{PIN 7}, V_{PIN 9} = 0V, V_{PIN 2} = 1V$		22	33		22	33	mA

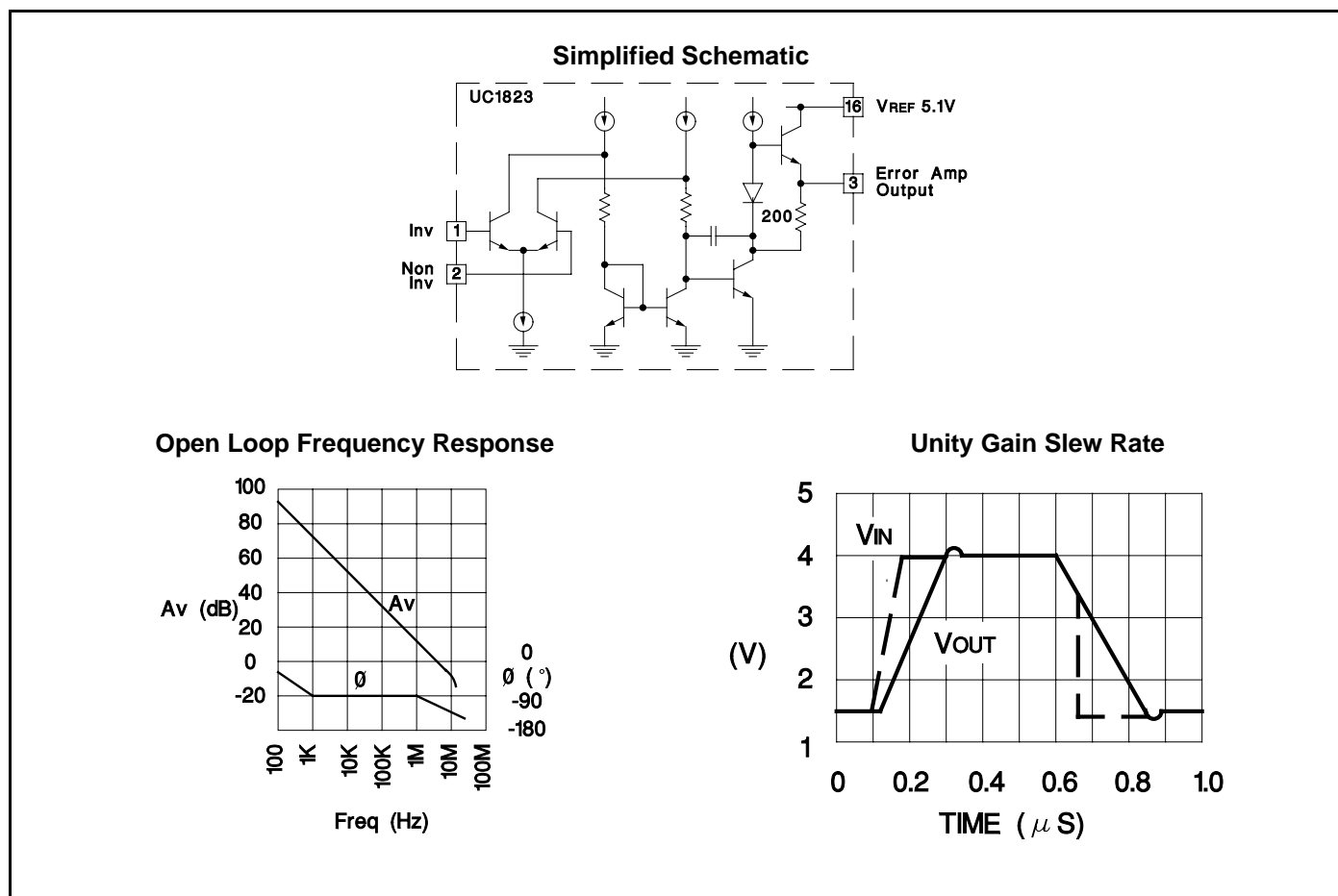
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UC1823 PRINTED CIRCUIT BOARD LAYOUT CONSIDERATIONS

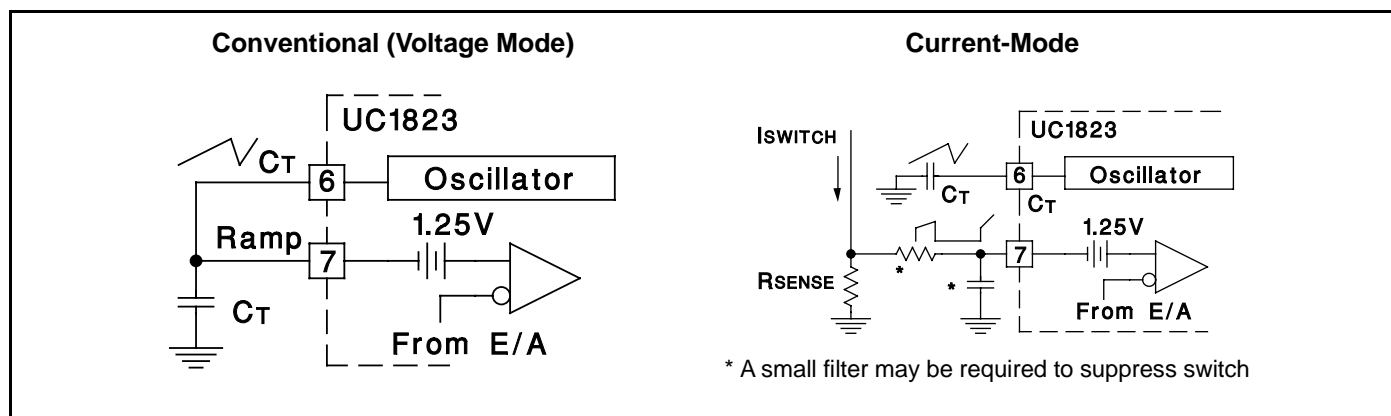
High speed circuits demand careful attention to layout and component placement. To assure proper performance of the UC1823, follow these rules. 1) Use a ground plane. 2) Damp or clamp parasitic inductive kick energy from the gate of driven MOSFET. Don't allow the output pins to ring below ground. A series gate resistor or a shunt 1 Amp Schottky diode at the output pin will serve

this purpose. 3) Bypass VCC, VC, and VREF. Use 0.1 μ F monolithic ceramic capacitors with low equivalent series inductance. Allow less than 1 cm of total lead length for each capacitor between the bypassed pin and the ground plane. 4) Treat the timing capacitor, CT, like a bypass capacitor.

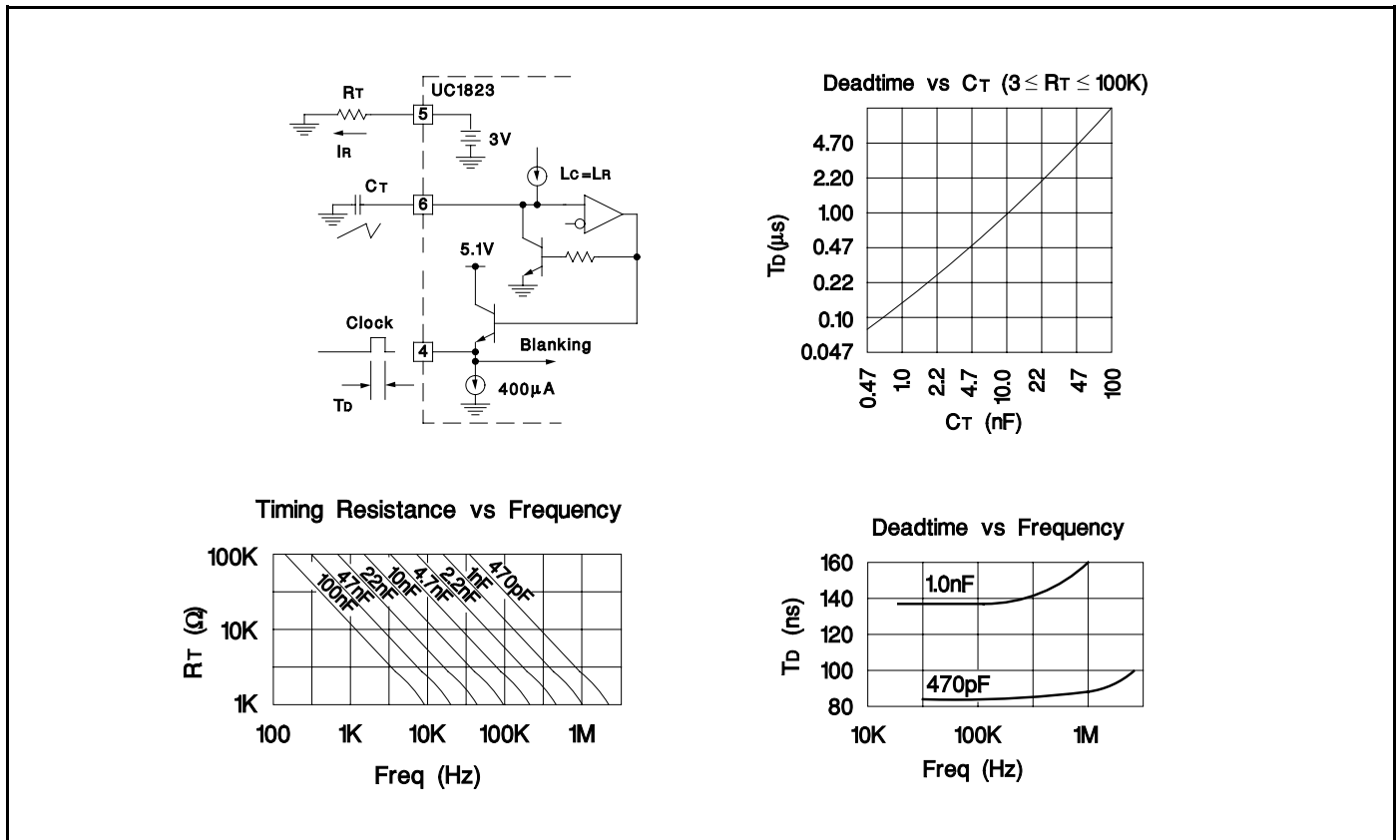
ERROR AMPLIFIER CIRCUIT



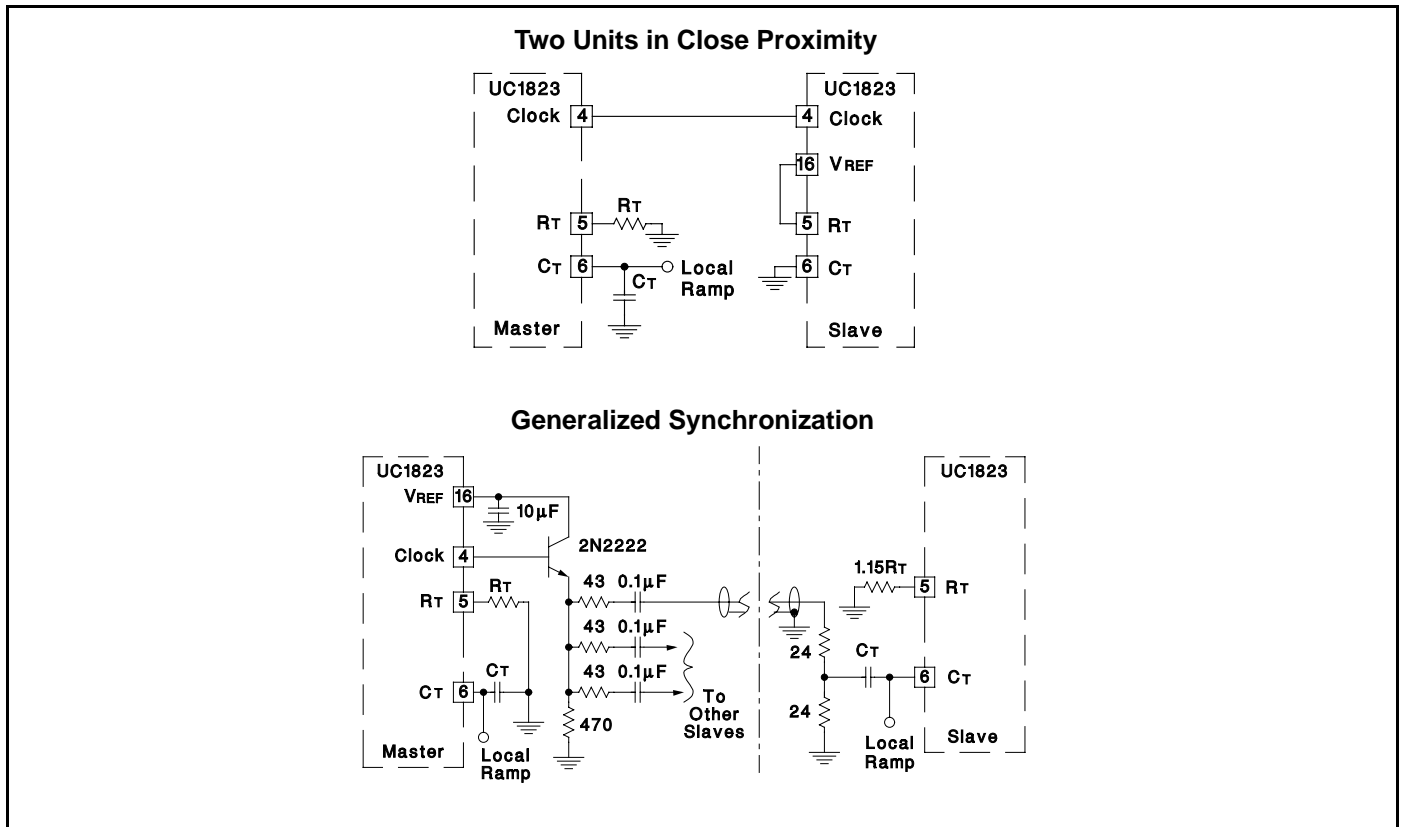
PWM APPLICATIONS



OSCILLATOR CIRCUIT

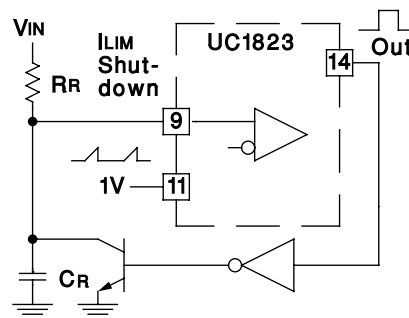


SYNCHRONIZED OPERATION



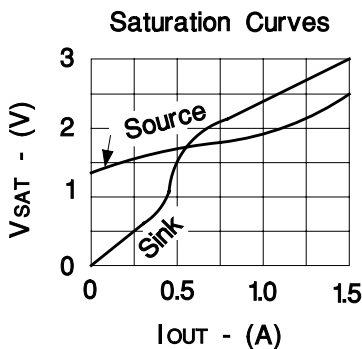
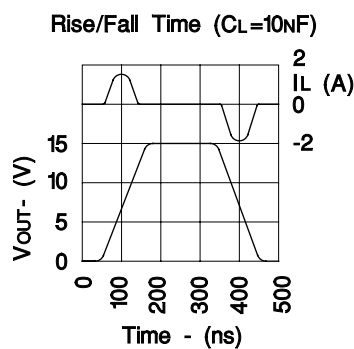
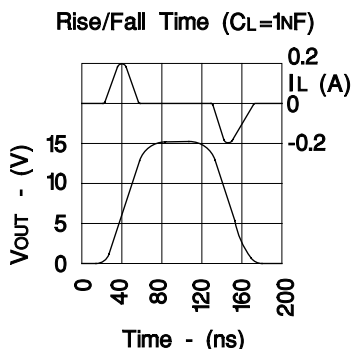
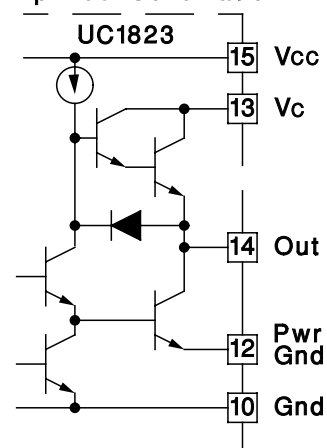
CONSTANT VOLT-SECOND CLAMP CIRCUIT

The circuit shown here will achieve a constant volt-second product clamp over varying input voltages. The ramp generator components, R_T and C_R are chosen so that the ramp at Pin 9 crosses the 1V threshold at the same time the desired maximum volt-second product is reached. The delay through the inverter must be such that the ramp capacitor can be completely discharged during the minimum deadtime.

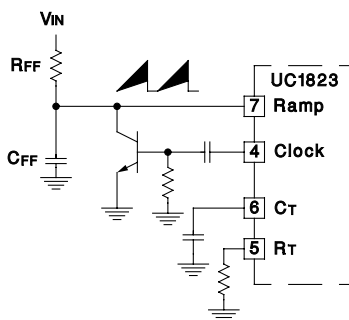


OUTPUT SECTION

Simplified Schematic



FEED FORWARD TECHNIQUE FOR OFF-LINE VOLTAGE MODE APPLICATION



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UC1823, High Speed PWM Controller

Device Status: Active

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- > [Features](#)
- > [Datasheets](#)
- > [Pricing/Samples/Availability](#)
- > [Application Notes](#)
- > [Applications](#)

Parameter Name	UC1823
Shutdown	Yes
Output Type	Single, Totem Pole
Output Current (mA)	1500
Frequency (max) (kHz)	1000
Pulse - by - Pulse Isense	Yes
Reference Voltage (V)	5.1
Vref tol (%)	1
Startup Current (uA)	1100
Duty Cycle (max) (%)	100
Operating Supply Current (mA)	22
Operating Supply (max) (V)	30
Operating Supply (min) (V)	8.4
PWM Outputs (#)	1
Error Amplifier GBW (mHz)	5.5

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To view the following documents, [Acrobat Reader 3.x](#) is required.

To download a document to your hard drive, right-click on the link and choose 'Save'.

Datasheets

Full datasheet in Acrobat PDF: [slus219.pdf](#) (409 KB)

Pricing/Samples/Availability

					Price/unit			
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<u>Orderable Device</u>	<u>Package</u>	<u>Pins</u>	<u>Temp (°C)</u>	<u>Status</u>	<u>Price/Unit USD (100-999)</u>	<u>Pack Qty</u>	<u>DSCC Number</u>	<u>Availability / Samples</u>
5962-89905012A	<u>L</u>	20	-55 TO 125	ACTIVE	50.74	1		<u>Check stock or order</u>
5962-8990501EA	<u>J</u>	16	-55 TO 125	ACTIVE	27.92	1		<u>Check stock or order</u>
UC1823J	<u>J</u>	16	-55 TO 125	ACTIVE	13.51	1		<u>Check stock or order</u>
UC1823J883B	<u>J</u>	16	-55 TO 125	ACTIVE	27.92	1		<u>Check stock or order</u>
UC1823L	<u>L</u>	20	-55 TO 125	ACTIVE	30.91	1		<u>Check stock or order</u>
UC1823L883B	<u>L</u>	20	-55 TO 125	ACTIVE	50.74	1	5962-89905012A	<u>Check stock or order</u>

Application Reports

- [U-131 Simple Switchmode Lead-Acid Battery Charger \(SLUA055 - Updated: 09/05/1999\)](#)

Table Data Updated on: 9/13/2000