

UC184xA/284xA/384xA

CURRENT MODE PWM CONTROLLER

PRODUCTION DATA SHEET

ABSOLUTE MAXIMUM RATINGS (Note 1)

Supply Voltage (Low Impedance Source) (V_{CC})	30V
Supply Voltage ($I_{CC} < 30mA$)	Self Limiting
Output Current	$\pm 1A$
Output Energy (Capacitive Load)	5 μJ
Analog Inputs (V_{FB} & I_{SENSE})	-0.3V to +6.3V
Error Amp Output Sink Current	10mA
Power Dissipation at $T_A = 25^\circ C$ (M Package)	1W
Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 10 Seconds)	300°C
Peak Package Solder Reflow Temp. (40 second max. exposure)	260°C (+0, -5)

Note 1. Exceeding these ratings could cause damage to the device. All voltages are with respect to Ground. Currents are positive into, negative out of the specified terminal. Pin numbers refer to DIL packages only.

THERMAL DATA

M PACKAGE:

THERMAL RESISTANCE-JUNCTION TO AMBIENT, θ_{JA}	95°C/W
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DM PACKAGE:

THERMAL RESISTANCE-JUNCTION TO AMBIENT, θ_{JA}	165°C/W
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D PACKAGE:

THERMAL RESISTANCE-JUNCTION TO AMBIENT, θ_{JA}	120°C/W
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Y PACKAGE:

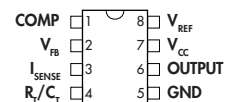
THERMAL RESISTANCE-JUNCTION TO AMBIENT, θ_{JA}	130°C/W
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Junction Temperature Calculation: $T_J = T_A + (P_D \times \theta_{JA})$.

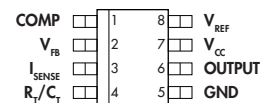
The θ_{JA} numbers are guidelines for the thermal performance of the device/pc-board system.

All of the above assume no ambient airflow

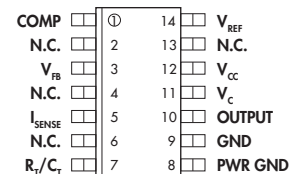
PACKAGE PIN OUTS



M & Y PACKAGE
(Top View)



DM PACKAGE
(Top View)



D PACKAGE
(Top View)

RoHS / Pb-free 100% Matte Tin Lead Finish

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ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, these specifications apply over the operating ambient temperatures for UC384xA with $0^{\circ}\text{C} \leq T_A \leq 70^{\circ}\text{C}$, UC284xA with $-40^{\circ}\text{C} \leq T_A \leq 85^{\circ}\text{C}$, UC184xA with $-55^{\circ}\text{C} \leq T_A \leq 125^{\circ}\text{C}$; $V_{CC}=15\text{V}$; $R_T=10\text{K}$; $C_T=3.3\text{nF}$. Low duty cycle pulse testing techniques are used which maintains junction and case temperatures equal to the ambient temperature.)

Parameter	Symbol	Test Conditions	UC184xA/284xA			UC384xA			Units
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Reference Section									
Output Voltage	V_{REF}	$T_J = 25^{\circ}\text{C}$, $I_L = 1\text{mA}$	4.95	5.00	5.05	4.90	5.00	5.10	V
Line Regulation		$12 \leq V_N \leq 25\text{V}$		6	20		6	20	mV
Load Regulation		$1 \leq I_O \leq 20\text{mA}$		6	25		6	25	mV
Temperature Stability (Note 2 & 7)				0.2	0.4		0.2	0.4	mV/ $^{\circ}\text{C}$
Total Output Variation		Over Line, Load, and Temperature	4.9		5.1	4.82		5.18	V
Output Noise Voltage (Note 2)	V_N	$10\text{Hz} \leq f \leq 10\text{kHz}$, $T_J = 25^{\circ}\text{C}$		50			50		μV
Long Term Stability (Note 2)		$T_A = 125^{\circ}\text{C}$, $t = 1000\text{hrs}$		5	25		5	25	mV
Output Short Circuit Current	I_{SC}		-30	-100	-180	-30	-100	-180	mA
Oscillator Section									
Initial Accuracy (Note 6)		$T_J = 25^{\circ}\text{C}$	47	52	57	47	52	57	kHz
Voltage Stability		$12 \leq V_{CC} \leq 25\text{V}$		0.2	1		0.2	1	%
Temperature Stability (Note 2)		$T_{MIN} \leq T_A \leq T_{MAX}$		5			5		%
Amplitude (Note 2)				1.7			1.7		V
Discharge Current		$T_J = 25^{\circ}\text{C}$, $V_{PIN4} = 2\text{V}$	7.8	8.3	8.8	7.8	8.3	8.8	mA
		$V_{PIN4} = 2\text{V}$, $T_{MIN} \leq T_A \leq T_{MAX}$	7.5		8.8	7.6		8.8	mA
Error Amp Section									
Input Voltage		$V_{PIN1} = 2.5\text{V}$	2.45	2.50	2.55	2.42	2.50	2.58	V
Input Bias Current	I_B			-0.3	-1		-0.3	-2	μA
Open Loop Gain	A_{VOL}	$2 \leq V_O \leq 4\text{V}$	65	90		65	90		dB
Unity Gain Bandwidth (Note 2)	UGBW	$T_J = 25^{\circ}\text{C}$	0.7	1		0.7	1		MHz
Power Supply Rejection Ratio (Note 3)	PSRR	$12 \leq V_{CC} \leq 25\text{V}$	60	70		60	70		dB
Output Sink Current	I_{OL}	$V_{PIN2} = 2.7\text{V}$, $V_{PIN1} = 1.1\text{V}$	2	6		2	6		mA
Output Source Current	I_{OH}	$V_{PIN2} = 2.3\text{V}$, $V_{PIN1} = 5\text{V}$	-0.5	-0.8		-0.5	-0.8		mA
Output Voltage High Level	V_{OH}	$V_{PIN2} = 2.3\text{V}$, $R_L = 15\text{K}$ to ground	5	6		5	6		V
Output Voltage Low Level	V_{OL}	$V_{PIN2} = 2.7\text{V}$, $R_L = 15\text{K}$ to V_{REF}		0.7	1.1		0.7	1.1	V
Current Sense Section									
Gain (Note 3 & 4)	A_{VOL}		2.85	3	3.15	2.85	3	3.15	V/V
Maximum Input Signal (Note 3)		$V_{PIN1} = 5\text{V}$	0.9	1	1.1	0.9	1	1.1	V
Power Supply Rejection Ratio (Note 3)	PSRR	$12 \leq V_{CC} \leq 25\text{V}$		70			70		dB
Input Bias Current	I_B			-2	-10		-2	-10	μA
Delay to Output (Note 2)	T_{pd}	$V_{PIN3} = 0$ to 2V		150	300		150	300	ns
Output Section									
Output Low Level	V_{OL}	$I_{SINK} = 20\text{mA}$		0.1	0.4		0.1	0.4	V
		$I_{SINK} = 200\text{mA}$		1.5	2.2		1.5	2.2	V
Output High Level	V_{OH}	$I_{SOURCE} = 20\text{mA}$	13	13.5		13	13.5		V
		$I_{SOURCE} = 200\text{mA}$	12	13.5		12	13.5		V
Rise Time (Note 2)	T_R	$T_J = 25^{\circ}\text{C}$, $C_L = 1\text{nF}$		50	150		50	150	ns
Fall Time (Note 2)	T_F	$T_J = 25^{\circ}\text{C}$, $C_L = 1\text{nF}$		50	150		50	150	ns
UVLO Saturation	V_{SAT}	$V_{CC} = 5\text{V}$, $I_{SINK} = 10\text{mA}$		0.7	1.2		0.7	1.2	V

(Electrical Characteristics continue next page.)

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ELECTRICAL CHARACTERISTICS (Con't.)

Parameter	Symbol	Test Conditions	UC184xA/284xA			UC384xA			Units
			Min.	Typ.	Max.	Min.	Typ.	Max.	
► Under-Voltage Lockout Section									
Start Threshold		x842A/4A	15	16	17	14.5	16	17.5	V
		x843A/5A	7.8	8.4	9.0	7.8	8.4	9.0	V
Min. Operation Voltage After Turn-On		x842A/4A	9	10	11	8.5	10	11.5	V
		x843A/5A	7.0	7.6	8.2	7.0	7.6	8.2	V
► PWM Section									
Maximum Duty Cycle		x842A/3A	94	96	100	94	96	100	%
		x844A/5A	47	48	50	47	48	50	%
Minimum Duty Cycle					0			0	%
► Total Standby Section									
Start-Up Current				0.3	0.5		0.3	0.5	mA
Operating Supply Current	I _{CC}			11	17		11	17	mA
Zener Voltage	V _Z	I _{CC} = 25mA	30	35		30	35		V

Notes: 2. These parameters, although guaranteed, are not 100% tested in production.

3. Parameter measured at trip point of latch with $V_{VFB} = 0$.

4. Gain defined as: $A_{VOL} = \frac{\Delta V_{COMP}}{\Delta V_{ISENSE}}$; $0 \leq V_{ISENSE} \leq 0.8\text{V}$.

5. Adjust V_{CC} above the start threshold before setting at 15V.

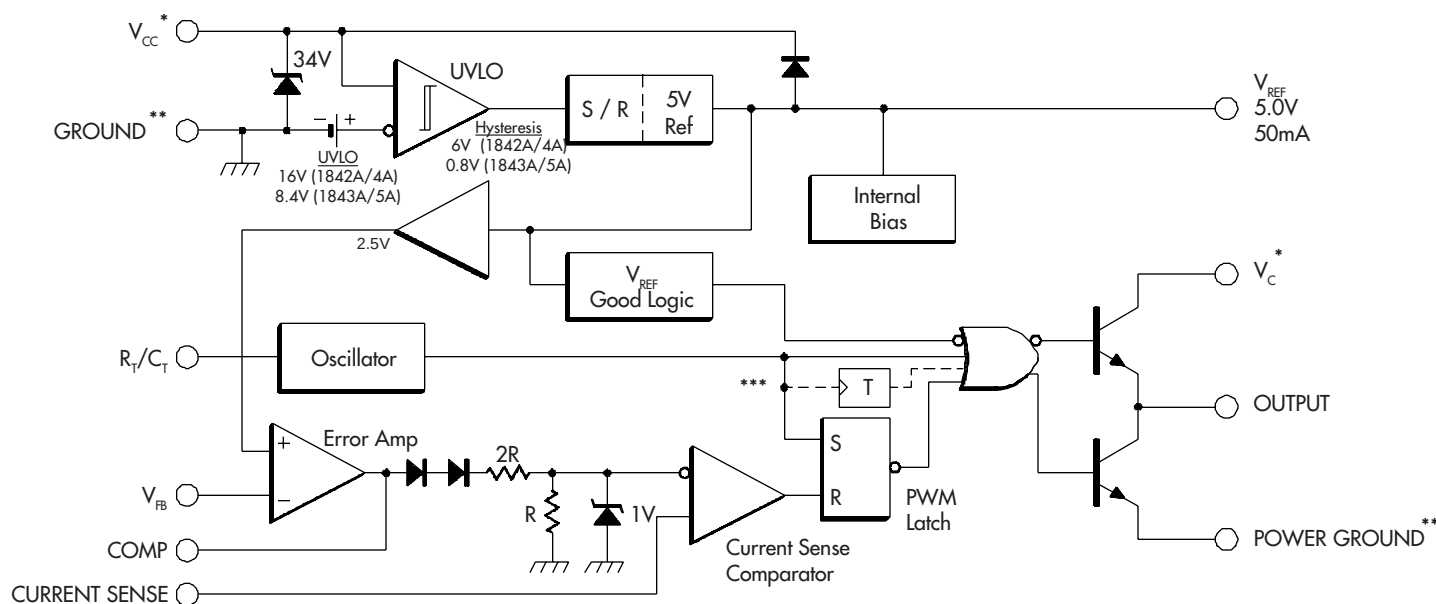
6. Output frequency equals oscillator frequency for the UC1842A and UC1843A. Output frequency is one half oscillator frequency for the UC1844A and UC1845A.

7. "Temperature stability, sometimes referred to as average temperature coefficient, is described by the equation:

$$\text{Temp Stability} = \frac{V_{REF}(\text{max.}) - V_{REF}(\text{min.})}{T_j(\text{max.}) - T_j(\text{min.})}$$

$V_{REF}(\text{max.})$ & $V_{REF}(\text{min.})$ are the maximum & minimum reference voltage measured over the appropriate temperature range. Note that the extremes in voltage do not necessarily occur at the extremes in temperature."

BLOCK DIAGRAM



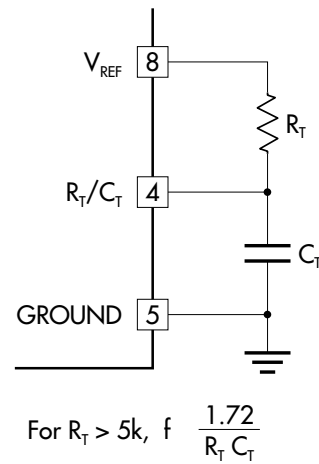
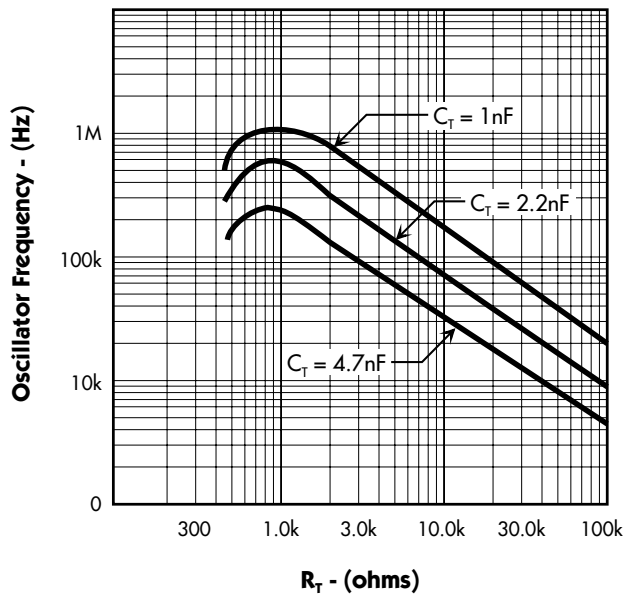
* - V_{CC} and V_C are internally connected for 8 pin packages.

** - POWER GROUND and GROUND are internally connected for 8 pin packages.

*** - Toggle flip flop used only in x844A and x845A series.

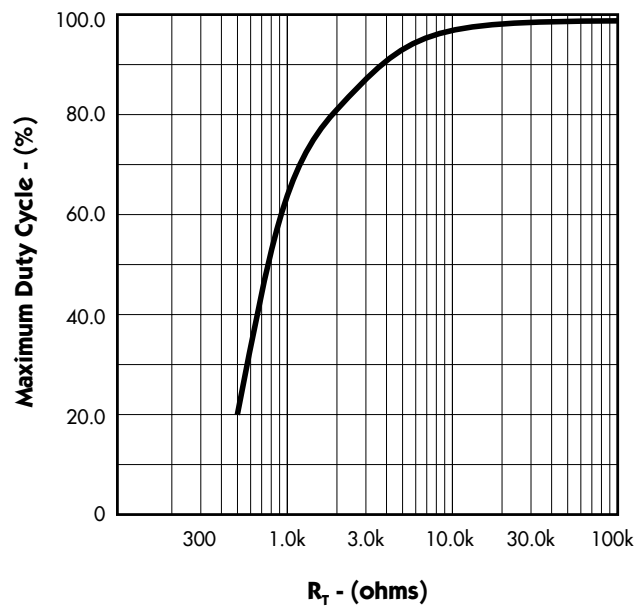
CHARACTERISTIC CURVES

FIGURE 1. — OSCILLATOR FREQUENCY vs. TIMING RESISTOR



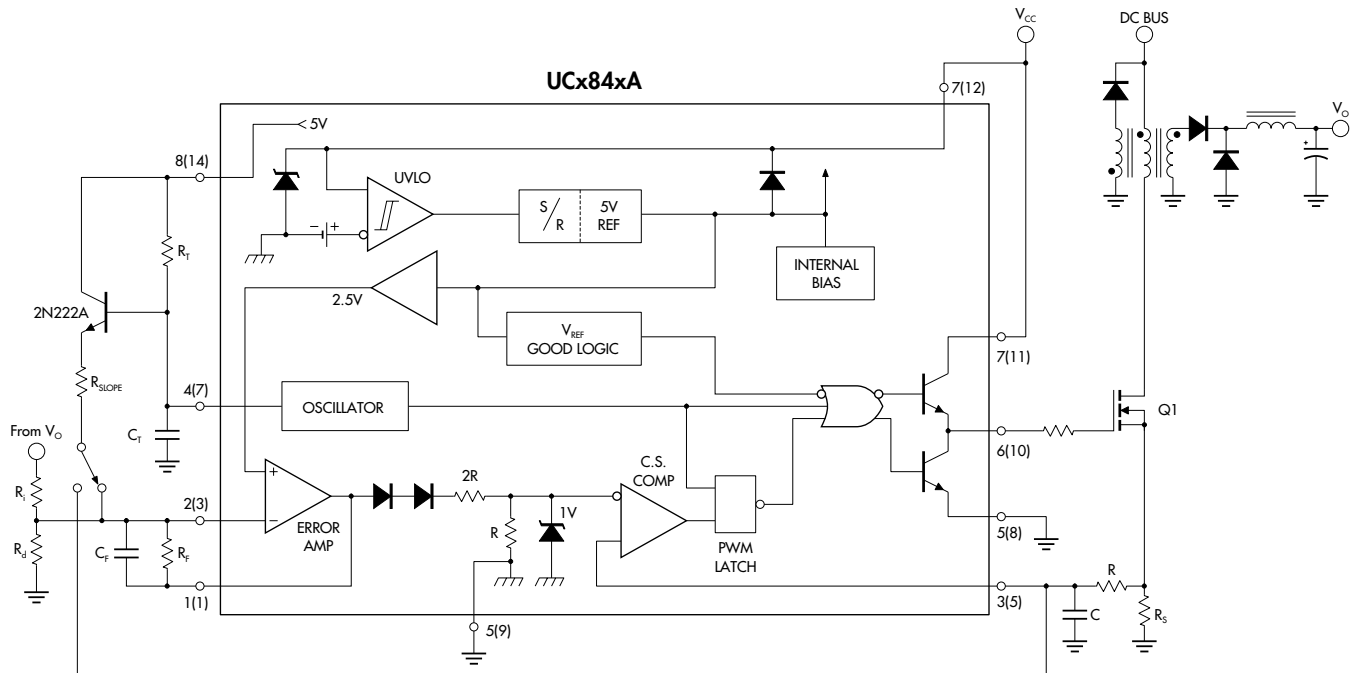
Note: Output drive frequency is half the oscillator frequency for the UCx844A/5A devices.

FIGURE 2. — MAXIMUM DUTY CYCLE vs. TIMING RESISTOR



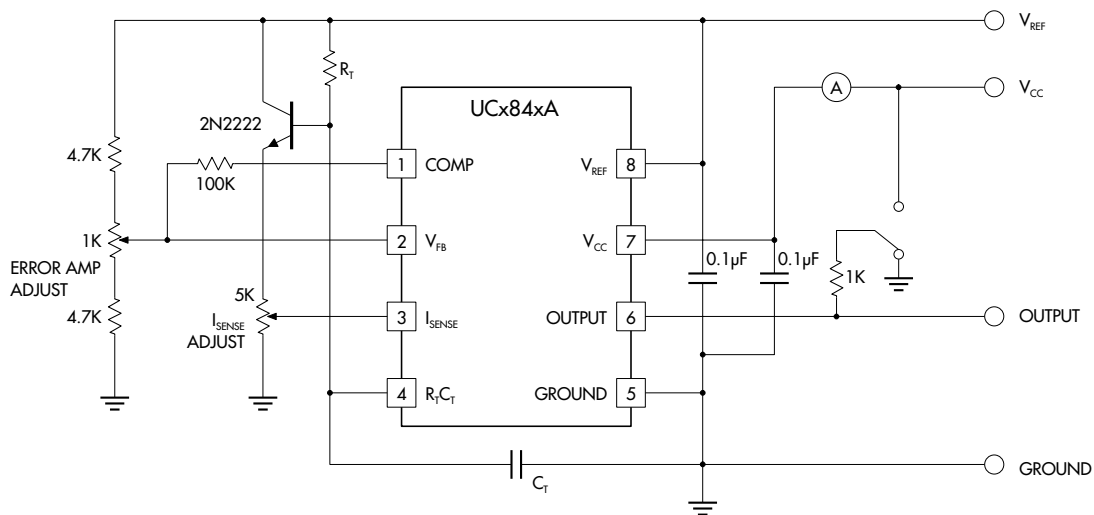
TYPICAL APPLICATION CIRCUITS (continued)

FIGURE 6. — SLOPE COMPENSATION



Due to inherent instability of current mode converters running above 50% duty cycle, slope compensation should be added to either the current sense pin or the error amplifier. Figure 6 shows a typical slope compensation technique.

FIGURE 7. — OPEN LOOP LABORATORY FIXTURE



High peak currents associated with capacitive loads necessitate careful grounding techniques. Timing and bypass capacitors should be connected to pin 5 in a single point ground. The transistor and 5k potentiometer are used to sample the oscillator waveform and apply an adjustable ramp to pin 3.

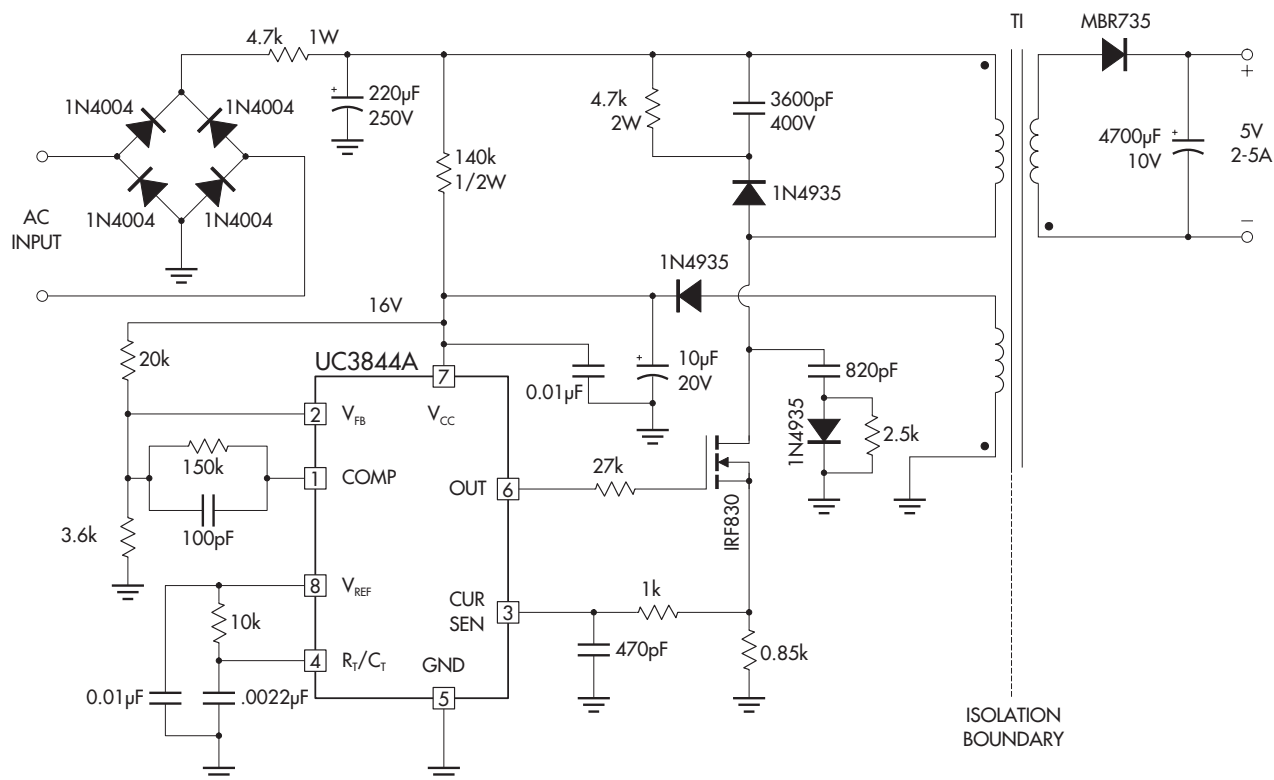
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TYPICAL APPLICATION CIRCUITS (continued)

FIGURE 8. — OFF-LINE FLYBACK REGULATOR



SPECIFICATIONS

Input line voltage:	90VAC to 130VAC
Input frequency:	50 or 60Hz
Switching frequency:	40KHz $\pm 10\%$
Output power:	25W maximum
Output voltage:	5V $\pm 5\%$
Output current:	2 to 5A
Line regulation:	0.01%/V
Load regulation:	8%/A*
Efficiency @ 25 Watts,	
$V_{IN} = 90VAC$:	70%
$V_{IN} = 130VAC$:	65%
Output short-circuit current:	2.5Amp average

* This circuit uses a low-cost feedback scheme in which the DC voltage developed from the primary-side control winding is sensed by the UC3844A error amplifier. Load regulation is therefore dependent on the coupling between secondary and control windings, and on transformer leakage inductance.