REGULATING PULSE WIDTH MODULATORS

CURRENT MODE IP1842, IP2842, IP3842, IP1843, IP2843, IP3843

DESCRIPTION

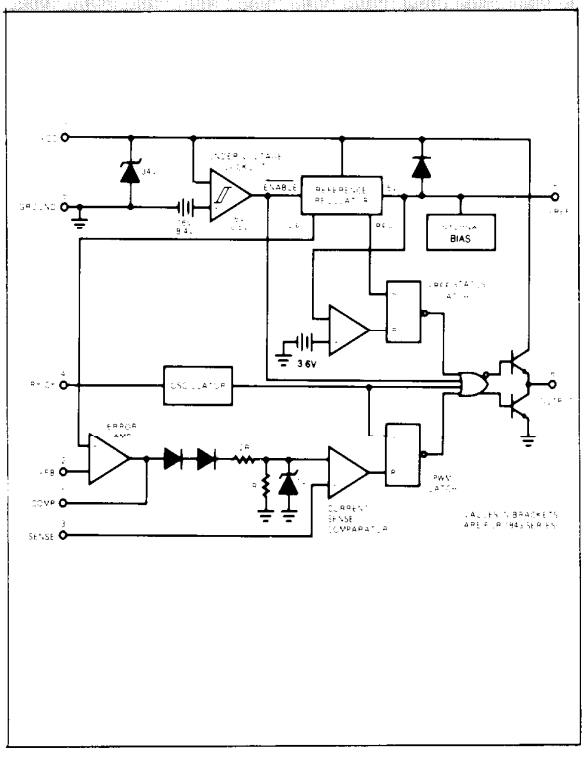
The IP1842 and IP1843 series of switching regulator control circuits contain all the functions necessary to implement off-line, current mode switching regulators, using a minimum number of external parts. Functions included are voltage reference, error amplifier, current sense comparator, oscillator, totem-pole output driver and under-voltage lockout circuitry.

Although pin compatible with the UC1842 and UC1843 series, Seagate Microelectronics has incorporated several improvements in the IP1842 and IP1843 series allowing tighter and more complete specification of electrical performance.

FEATURES

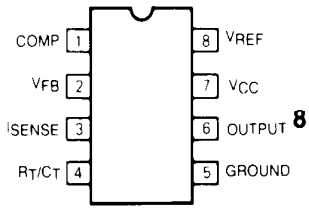
- Guaranteed ±1% reference voltage tolerance
- Guaranteed ±10% frequency tolerance
- Low start-up current (<500 µA)
- Under voltage lockout with hysteresis
- Output state completely defined for all supply and input conditions
- Interchangeable with UC1842 and UC1843 series for improved operation
- 500 kHz operation

BLOCK DIAGRAM

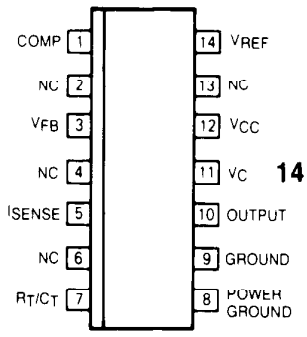


CONNECTIONS

(Top View)



N and J Package
8 Pin D (150) Package



14 Pin D (150) Package

REGULATING PULSE WIDTH MODULATORS

ABSOLUTE MAXIMUM RATINGS

Supply Voltage ($+V_{CC}$) (low impedance source) +30V

Supply Voltage (V_{CC}) (I_{CC} <30mA) Self limiting

Output Current ±1A

Output Energy (capacitive load) µJ

Analog Inputs (pins 2 and 3) −0.3V to $+V_{CC}$

Error Amp Output Sink Current 10mA

Power Dissipation at

T_A = +25°C (Note 1) 1000mW

T_C = +25°C (Note 2) 2000mW

Storage Temperature Range −65°C to +150°C

Lead Temperature (Soldering, 10 seconds) +300°C

Absolute maximum ratings are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the device should be operated at these limits. The electrical characteristics provide conditions for actual device operation.

RECOMMENDED OPERATING CONDITIONS (Note 3)

Supply Voltage ($+V_{CC}$) (Note 4) ⩽30V

Output Current 0 to ±200mA

Analog Inputs (pins 2 and 3) −0.3 to 3 V

Error Amp Output Sink Current 0 to 2mA

Operating Ambient Temperature Range:

IP1842, IP1843 −55°C to +125°C

IP2842, IP2843 −25°C to +85°C

IP3842, IP3843 0°C to +70°C

Note 1. Derate at 10 mW/°C for ambient temperatures above +50°C.
Note 2. Derate at 24 mW/°C for case temperatures above +25°C.
Note 3. Range over which the device is functional and parameter limits are guaranteed.
Note 4. Lower limit set by under voltage lockout specification.

ELECTRICAL CHARACTERISTICS

V_{CC} = 15V,f = 52kHz, R_T = 10k, C_T = 3.3nF unless otherwise specified (Note 6)

Parameter	Test Conditions		IP1842/IP1843 IP2842/IP2843			IP3842/IP3843			Units
			Min	Typ	Max	Min	Typ	Max	
Reference Section									
Output Voltage	I_O = 1mA		4.95	5.00	5.05	4.90	5.00	5.10	V
Input Regulation	V_{CC} = 12 to 25V	●		6	20		6	20	mV
Output Regulation	I_O = 1 to 20mA	●		6	25		6	25	mV
Temperature Stability	(Note 5)	●		0.2	0.4		0.2	0.4	mV/°C
Total Output Variation	Line, Load, Temp	●	4.90		5.10	4.82		5.18	V
Output Noise Voltage	f = 10Hz to 10kHz (Note 5)			50			50		µV
Long Term Stability	T_J = 125°C 1000 Hrs (Note 5)			5	25		5	25	mV
Output Short Circuit Current	V_{REF} = 0	●	30	80	160	30	80	160	mA
Oscillator Section									
Frequency			47	52	57	47	52	57	kHz
Voltage Stability	V_{CC} = 12 to 25V	●		0.2	1		0.2	1	%
Temperature Stability	$\triangle T_A$ = Min to Max (Note 5)	●		5			5		%
Amplitude	$V_{PIN\ 4}$ Peak to Peak	●		1.7			1.7		V
Discharge Current				8.3			8.3		mA
	$\triangle T_A$ = Min to Max (Note 5)			8			8		%

REGULATING PULSE WIDTH MODULATORS

ELECTRICAL CHARACTERISTICS (CONTINUED)

Parameter	Test Conditions		IP1842/IP1843 IP2842/IP2843 Min	Typ	Max	IP3842/IP3843 Min	Typ	Max	Units
Error Amp Section									
Input Voltage	$V_{PIN\ 1}$ = 2.5V	●	2.45	2.50	2.55	2.42	2.50	2.58	V
Input Bias Current		●		-0.3	-1		-0.3	-2	µA
Open Loop Voltage Gain	V_O = 2 to 4V	●	65	90		65	90		dB
Unity Gain Bandwith	(Note 5)	●	0.7	1		0.7	1		MHz
Supply Voltage Rejection	V_{CC} = 12 to 25V	●	60	70		60	70		dB
Output Sink Current	$V_{PIN\ 2}$ = 2.7V, $V_{PIN\ 1}$ = 1.1V	●	2	6		2	6		mA
Output Source Current	$V_{PIN\ 2}$ = 2.3V, $V_{PIN\ 1}$ = 4.6V	●	-0.5	-0.8		-0.5	-0.8		mA
V_{OUT}High	$V_{PIN\ 2}$ = 2.3V, R_L = 15k	●	4.6	4.8		4.6	4.8		V
V_{OUT}Low	$V_{PIN\ 2}$ = 2.7V, R_L = 15k	●		0.7	1.1		0.7	1.1	V
Current Sense Section									
Gain	(Notes 7 and 8)	●	2.85	3	3.15	2.85	3	3.15	V/V
Maximum Input Signal	$V_{PIN\ 1}$ = 4.6V (Note 7)	●	0.9	1	1.1	0.9	1.0	1.1	V
Supply Voltage Rejection	V_C = 12 to 25V	●	60	70		60	70		dB
Input Bias Current		●		-2	-10		-2	-10	µA
Delay to Output		●		200	400		200	400	ns
Output Section									
Output Low Level	I_{SINK} = 20mA	●		0.1	0.4		0.1	0.4	V
	I_{SINK} = 200mA	●		1.5	2.2		1.5	2.2	V
Output High Level	I_{SOURCE} = 20mA	●	13	13.5		13	13.5		V
	I_{SOURCE} = 200mA	●	12	13.5		12	13.5		V
Rise Time	C_L = 1nF			50	150		50	150	ns
Fall Time	C_L = 1nF			50	150		50	150	ns
UVLO Saturation	V_{CC} = 6V, I_L = 1mA	●		0.7	1.1		0.7	1.1	V
Under-voltage Lockout Section									
Upper Threshold	1842 Series	●	15	16	17	14.5	16	17.5	V
(V_{CC})	1843 Series	●	7.8	8.4	9	7.8	8.4	9	V
Lower Threshold	1842 Series	●	9	10	11	8.5	10	11.5	V
(V_{CC})	1843 Series	●	7	7.6	8.2	7	7.6	8.2	V
Total Standby Current									
Start-Up Current		●		0.3	0.5		0.3	0.5	mA
Operating Supply Current	$V_{PIN\ 2}$ = 0V 1842 Series	●		11	15		11	15	mA
	$V_{PIN\ 3}$ = 0V 1843 Series	●		14	17		14	17	mA
V_{CC} Zener Voltage	I_{CC} = 25mA	●	30	34	40	30	34	40	V

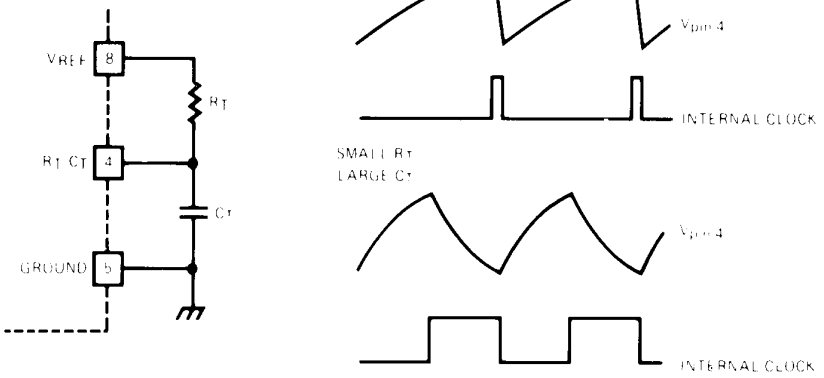
The ● denotes the specifications which apply over the full operating temperature range, all others apply at T_j = 25°C unless otherwise specified.
Note 5. These parameters, although guaranteed over the recommended conditions,are not 100% tested in production.
Note 6. Adjust V_{CC} above start threshold before setting at required level.
Note 7. Parameter measured at trip point of latch with $V_{PIN\ 2}$ = 0V.
Note 8. Gain defined as

$$A = \frac{\triangle V_{PIN\ 1}}{\triangle V_{PIN\ 3}} \quad ;0 \leq V_{PIN\ 3} \leq 0.8$$

REGULATING PULSE WIDTH MODULATORS

APPLICATIONS INFORMATION

Oscillator Waveforms and Maximum Duty Cycle



Oscillator timing capacitor, C_T is charged by V_{REF} through R_T and discharged by an internal current source. During the discharge time, the internal clock signal blanks the output to the low state. Selection of R_T and C_T therefore determines both oscillator frequency and maximum duty cycle. Charge and discharge times are determined by the formulas:

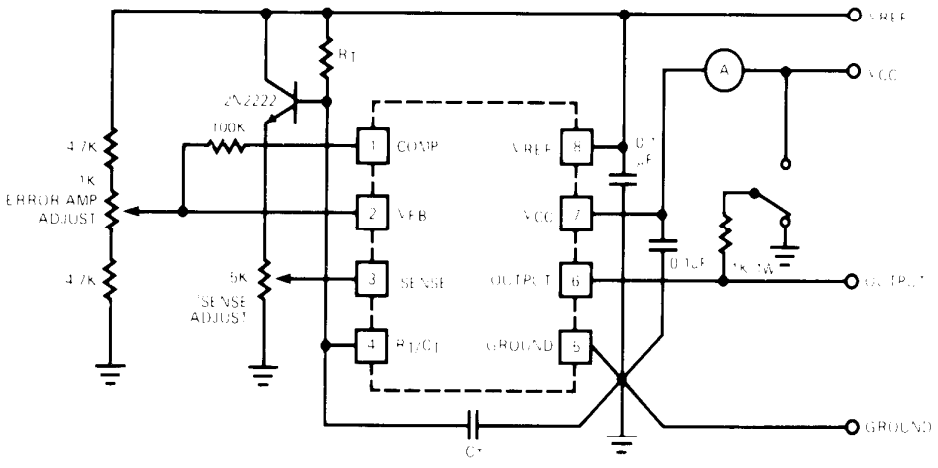
$$t_C \approx 0.55\, R_T C_T$$

$$t_d \approx R_T C_T \ln\left(\frac{.0063\, R_T - 2.3}{.0063 - 4}\right)$$

Frequency, then is: $f \approx (t_C + t_d)^{-1}$

For $R_T > 5k$, $f \approx \dfrac{1.8}{R_T C_T}$

Open-Loop Laboratory Test Fixture



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

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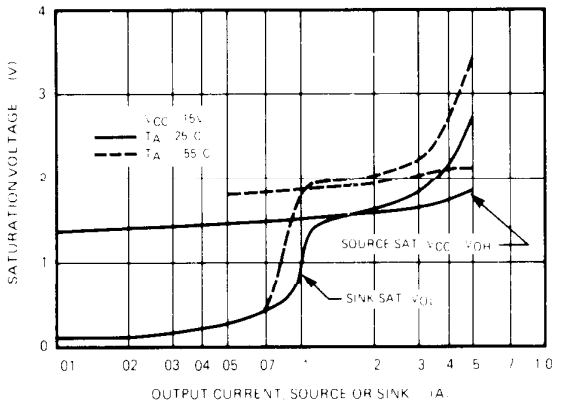
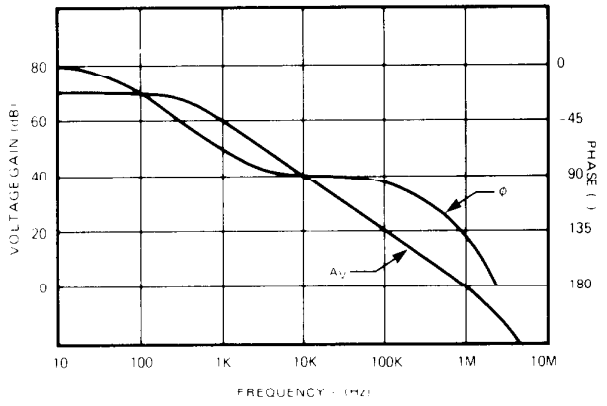
TYPICAL PERFORMANCE CHARACTERISTICS

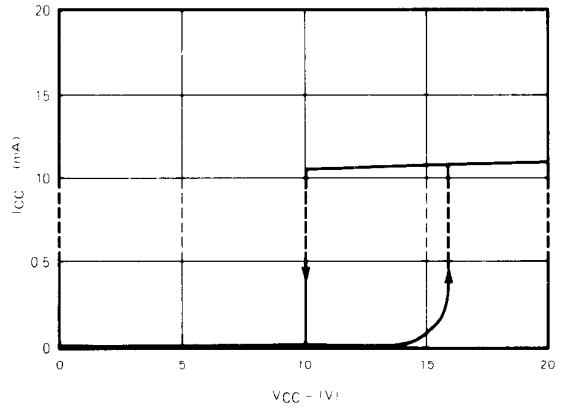
Output Saturation Characteristics



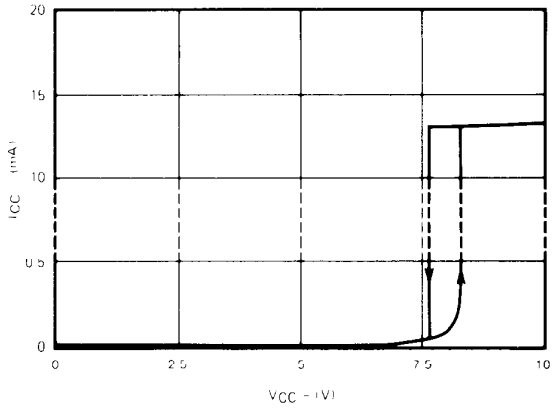
Error Amplifier Open-Loop Frequency Response



Under Voltage Lockout 1842 Series



Under Voltage Lockout 1843 Series



ORDER INFORMATION

Part Number	Temperature Range	Package
IP1842J	−55°C to +125°C	8 Pin Ceramic DIP
IP2842J	−25°C to + 85°C	8 Pin Ceramic DIP
IP2842N	−25°C to + 85°C	8 Pin Plastic DIP
IP2842D	−25°C to + 85°C	8 Pin Plastic (150) SOIC
IP2842D-14	−25°C to + 85°C	14 Pin Plastic (150)SOIC
IP3842J	0°C to + 70°C	8 Pin Ceramic DIP
IP3842N	0°C to + 70°C	8 Pin Plastic DIP
IP3842D	0°C to + 70°C	8 Pin Plastic (150) SOIC
IP3842D-14	0°C to + 70°C	14 Pin Plastic (150) SOIC
IP1843J	−55°C to +125°C	8 Pin Ceramic DIP
IP2843J	−25°C to + 85°C	8 Pin Ceramic DIP
IP2843N	−25°C to + 85°C	8 Pin Plastic DIP
IP2843D	−25°C to + 85°C	8 Pin Plastic (150) SOIC
IP2843D-14	−25°C to + 85°C	14 Pin Plastic (150) SOIC
IP3843J	0°C to + 70°C	8 Pin Ceramic DIP
IP3843N	0°C to + 70°C	8 Pin Plastic DIP
IP3843D	0°C to + 70°C	8 Pin Plastic (150) SOIC
IP3843D-14	0°C to + 70°C	14 Pin Plastic (150) SOIC