H3842S

HIGH PERFORMANCE CURRENT MODE CONTROLERS

Description

The H3842S is high performance fixed frequency current mode controllers. That is specifically designed for Off-Line and DC To DC converter applications offering the designer a costeffective solution with minimal external components. These integrated circuits feature a trimmed oscillator for precise duty cycle control. A temperature compensated reference, high gain error amplifier, current sensing compara-tor, and a high current totem pole output ideally suited for driving a power MOSFET. Also included are protective features consisting of input and reference undervoltage lockouts each with hysteresis, cycle-by-cycle current limiting, programmable output deadtime, and a latch for single pulse metering.

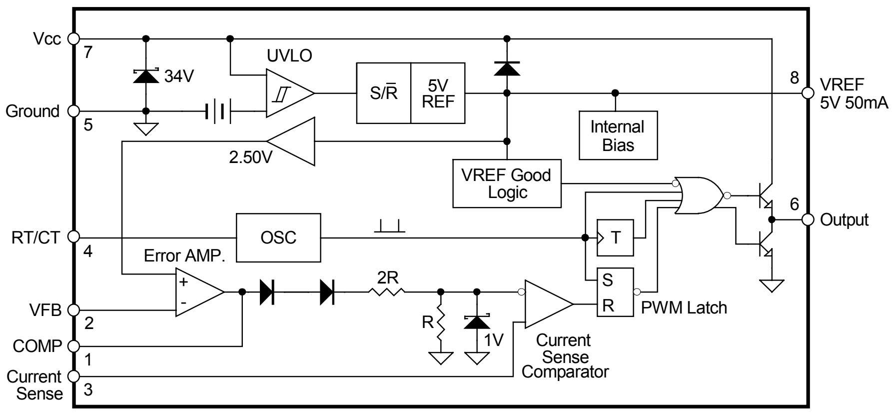
Features

- Trimmed Oscillator for Precise Frequency Control
- Oscillator Frequency Guaranteed at 250 kHz
- Current Mode Operation to 500 kHz
- Automatic Feed Forward Compensation
- Latching PWM for Cycle-By-Cycle Current Limiting
- Internally Trimmed Reference with Undervoltage Lockout
- High Current Totem Pole Output
- Undervoltage Lockout with Hysteresis
- Low Startup and Operating Current

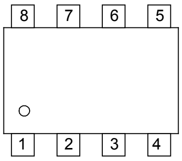
Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
Vi	Supply Voltage (low impedance source)	30	V
Vi	Supply Voltage (Ii<30mA)	Self Limiting	
Io	Output Current	±1	A
Eo	Output Energy (capacitive load)	5	uJ
	Analog Inputs (pin 2, 3)	-0.3 to 5.5	V
	Error Amplifier Output Sink Current	10	mA
Ptot	Power Dissipation at Tamb≤25°C	800	mW
Tstg	Storage Temperature Range	-65 to 150	°C
TJ	Junction Operating Temperature	-40 to 150	°C
TL	Lead Temperature (soldering 10s)	300	°C

Block Diagram



Pin Connection (Top View)

SOP-8P	Function	Description
	Pin1: Compensation	This pin is the Error Amplifier output and is made available for loop compensation.
	Pin2: Voltage Feedback	This is the inverting input of the Error Amplifier. It's normally connected to the switching power supply output through a resistor divider.
	Pin3: Current Sense	A voltage proportional to inductor current is connected to this input. The PWM uses this information to terminate the output switch conduction.
	Pin4: RT/CT	The oscillator frequency and maximum output duty cycle are programmed by connecting resistor RT to Vref and cpacitor CT to ground. Operation to 500kHz is possible.
	Pin5: Ground	This pin is the combined control circuitry and power ground.
	Pin6: Output	This output directly drives the gate of a power MOSFET. Peak currents up to 1A are sourced and sunk by this pin.
	Pin7: Vcc	This pin is the positive supply of the control IC.
	Pin8: Vref	This is the reference output. It provides charging current for capacitor CT through resistor RT.

Thermal Data

Symbol	Description	Max.	Units
Rth j-amb	Thermal Resistance Junction-ambient	100	°C/W

Electrical Specifications

Parameter	Test Conditions	Min.	Typ.	Max.	Units
Under-Voltage Lockout Section					
Start Threshold		14.5	16	17.5	V
Min. Operating Voltage	After Turn On	8.5	10	11.5	V

Electrical Characteristics

Unless otherwise stated, specifications apply for 0≤Ta≤70°C Vcc =15V (Note 1); RT=680Ω, CT=0.022uF for triangular mode, RT=10k, CT=3.3nf for sawtooth mode

Parameter	Test Conditions	Min.	Typ.	Max.	Units
Reference Section					
Reference Output Voltage	Tj=25°C,Io=1mA	4.90	5	5.1	V
Line Regulation	12V≤Vin≤25V	-	2.0	20	mV
Load Regulation	1mA≤Io≤20mA	-	3.0	25	mV
Temperature. Stability	(Note 2)	-	0.2	-	mV/°C
Total Output Variation	Line , Load , Temp (Note 2)	4.82	-	5.18	V
Output Noise Voltage	10Hz≤f≤10kHz,Tj=25°C (Note 2)	-	50	-	uV
Long Term Stability	Ta=125°C,1000Hrs (Note 2)	-	5	-	mV
Output Short current	Ta=25°C	-30	-100	-180	mA
Oscillator Section					
Frequency	Tj=25°C	47	52	57	KHz
	Tlow≤Ta≤Thigh	46	52	60	KHz
Frequency Chnge with Temperature	12V≤Vcc≤25V	-	0.2	1	%
Frequency Change with Temperature	Tlow≤Ta≤Thigh (Note 2)	-	5	-	%
	Tj=25°C	-	0.5	-	%
Oscillator Voltage Swing	Peak to Peak	-	1.7	-	V
Discharge Current	Tj=25°C	7.8	8.3	9.3	mA
	Tlow≤Ta≤Thigh	7.2	-	9.5	mA

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Oscillator Section					
Frequency	Tj=25°C	47	52	57	KHz
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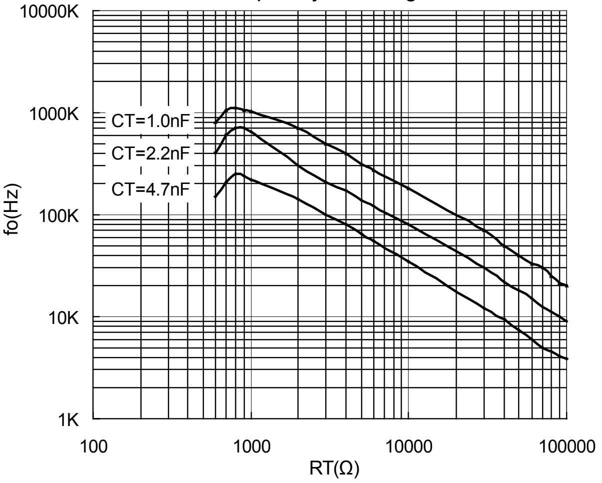
Discharge Current	Tj=25°C	7.8	8.3	9.3	mA
	Tlow≤Ta≤Thigh	7.2	-	9.5	mA
Error Amplifier Section					
Voltage Feedback Input	Vo=2.5V	2.42	2.50	2.58	V
Input Bias Current	VFB=5.0V	-	-0.1	-2.0	uA
Open Loop Voltage Gain	2≤Vo≤4 V	65	90	-	dB
Unity Gain Bandwidth	Tj=25°C (Note 2)	0.7	1.0	-	MHz
Power Supply Rejection Ratio	12V≤Vcc≤25V	60	70	-	dB
Output Current	Sink (Vo=1.1V, VFB=2.7V)	2.0	12	-	mA
	Source (Vo=5.0V, VFB=2.3V)	-0.5	-1.0	-	mA
Output Voltage Swing High State	VFB=2.3V, RL=15K to ground	5	6	-	V
Low State	VFB=2.7V, RL=15K to Vref	-	0.7	1.1	V
Current Sense Section					
Current Sense Input Voltage Gain	(Notes 3 & 4)	2.85	3.0	3.15	V/V
Maximum Current Sense Input Thresold	(Note 3)	0.9	1.0	1.1	V
Ppwer Supply Rejection Ratio	12V≤Vcc≤25V (Note 3)	-	70	-	dB
Input Bias Current		-	-2.0	-10	uA
Propagation Delay	Tj=25°C (Note 2)	-	150	300	nS
Output Section					
Output Voltage	Low State (Isink=20mA)	-	0.1	0.4	V
	Low State (Isink=200mA)	-	1.5	2.2	V
	High State (Isource=20mA)	13	13.5	-	V
	High State (Isource=200mA)	12	13.4	-	V
Output Voltage Rise Time	Tj=25°C, CL=1.0nF (Note 2)	-	50	150	nS
Output Voltage Fall Time	Tj=25°C, CL=1.0nF (Note 2)	-	50	150	nS
Output Voltage with UVLO Activated	Vcc=6V , Isink=1.0mA	-	-0.1	-1.1	V
Total Device					
Start-Up Current		-	0.1	0.5	mA
Operating Supply Current	Vpin2=Vpin3=0, RT=10K, CT=3.3nF	-	11	17	mA
Vcc Zener Voltage	Icc=25 mA	-	34	-	V

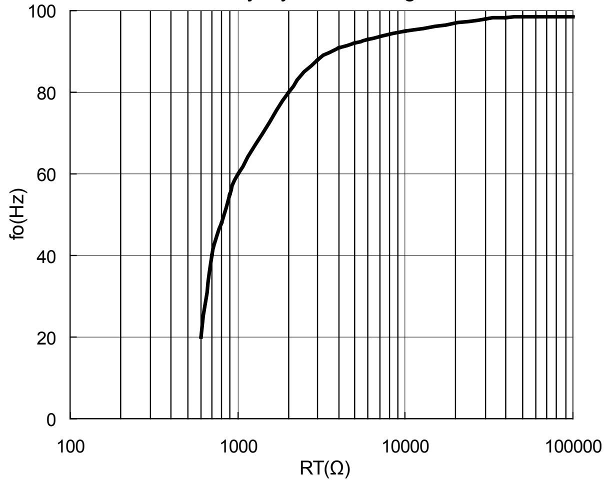
Note 1: Adjust Vcc above the start threshold before setting at 15V.
Note 2: These parameters, although guaranteed are not 100% tested in production.
Note 3: Parameter measured at trip point of latch with Vpin2=0.
Note 4: Gain defined as: A=Vpin1/Vpin3, 0≤Vpin3≤0.8V

Characteristics Curve

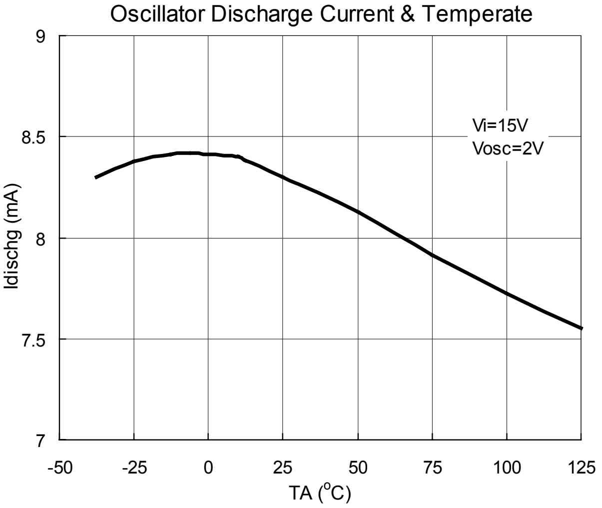
Oscillator Frequency & Timing Resistance



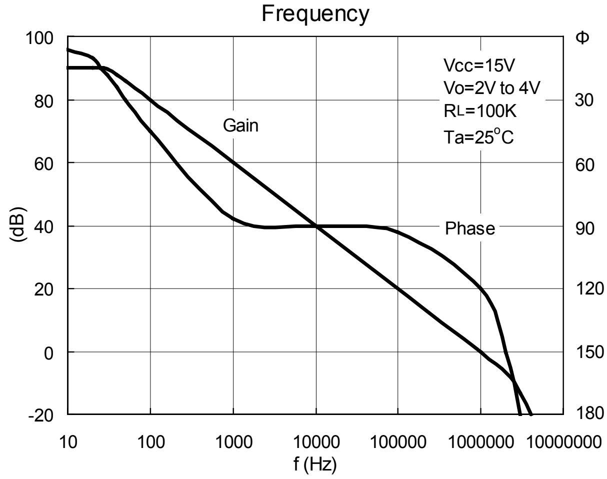
Maximum Duty Cycle & Timing Resistance



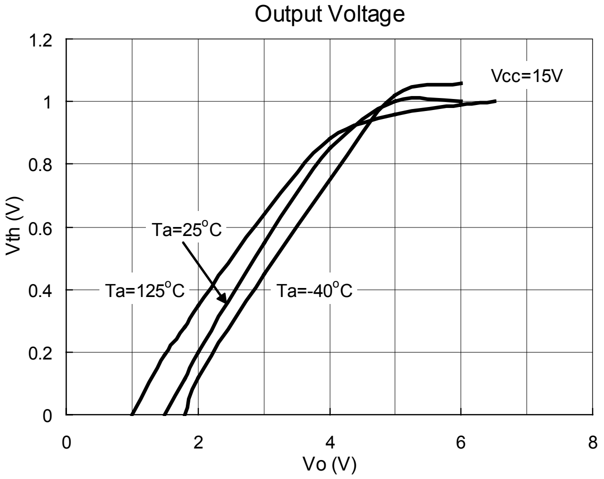
Oscillator Discharge Current & Temperate



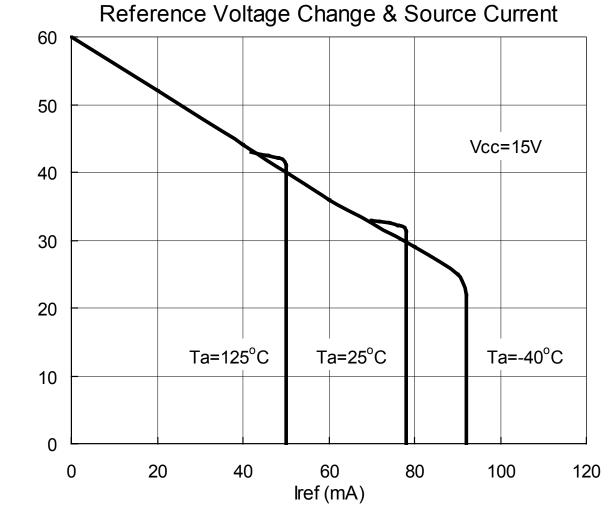
Error Amp Open-Loop Gain and Phase & Frequency

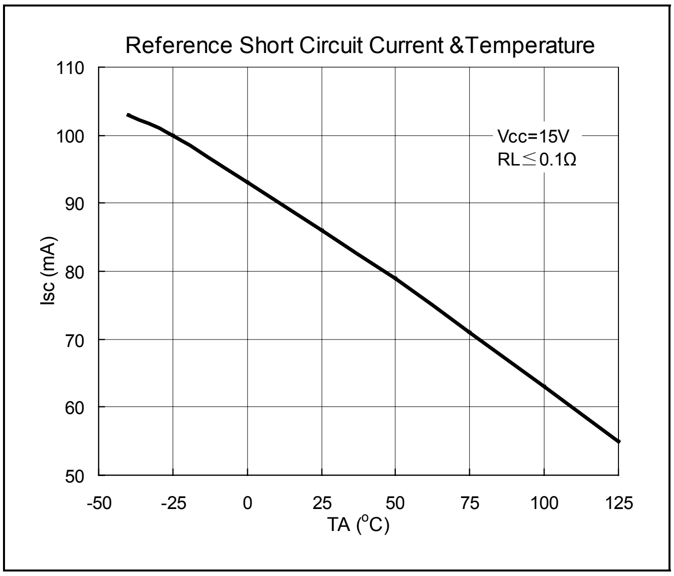


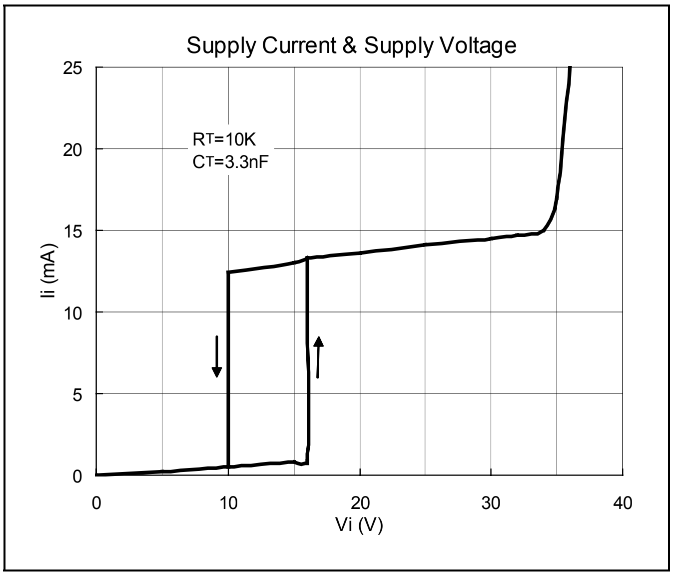
Current Sense Input Threshold & Error Amp Output Voltage

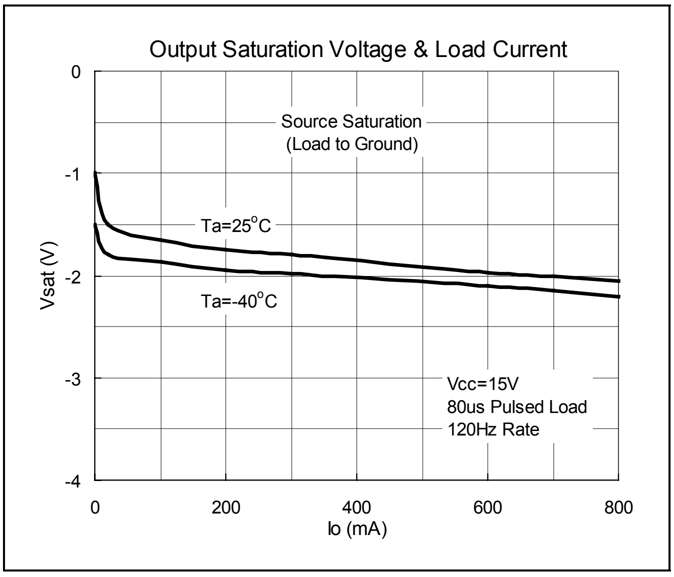


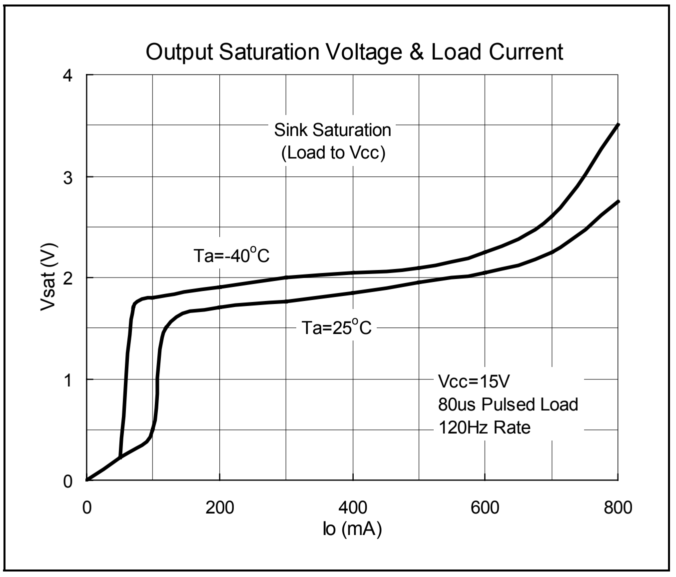
Reference Voltage Change & Source Current




Reference Short Circuit Current &Temperature
Vcc=15V
RL≤0.1Ω
Isc (mA)
TA (°C)
110
100
90
80
70
60
50
-50
-25
0
25
50
75
100
125

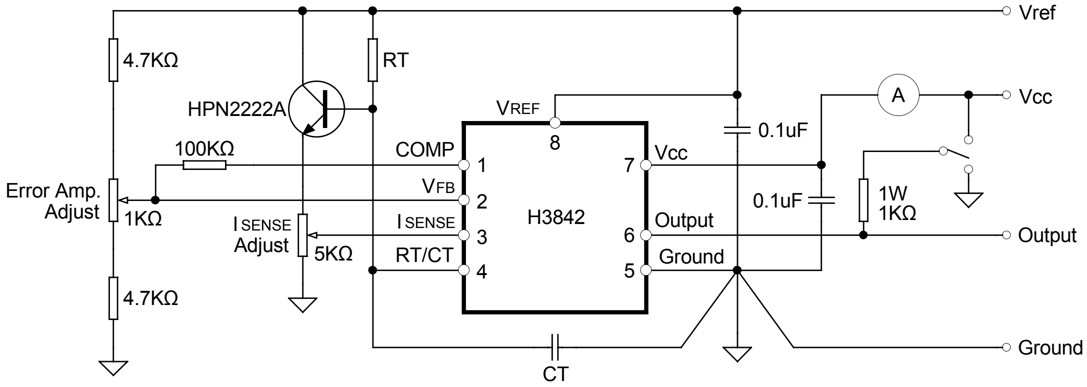

Supply Current & Supply Voltage
RT=10K
CT=3.3nF
Ii (mA)
Vi (V)
25
20
15
10
5
0
10
20
30
40


Output Saturation Voltage & Load Current
Source Saturation
(Load to Ground)
Ta=25°C
Ta=-40°C
Vcc=15V
80us Pulsed Load
120Hz Rate
Vsat (V)
Io (mA)
0
-1
-2
-3
-4
200
400
600
800


Output Saturation Voltage & Load Current
Sink Saturation
(Load to Vcc)
Ta=-40°C
Ta=25°C
Vcc=15V
80us Pulsed Load
120Hz Rate
Vsat (V)
Io (mA)
4
3
2
1
0
200
400
600
800

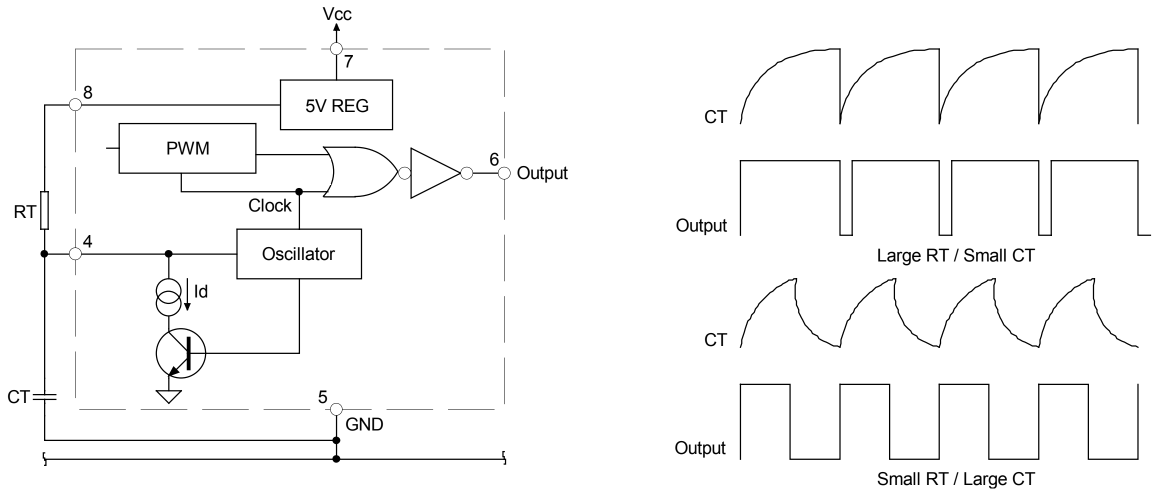
Application Information

Open Loop Test Circuit

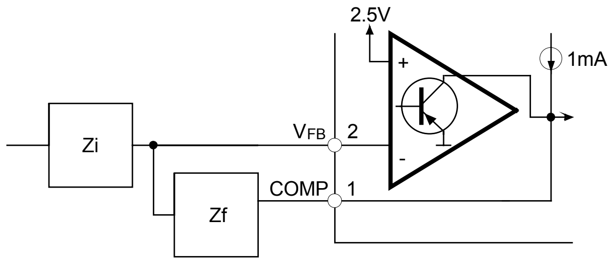


High peak currents associated with capacitive loads necessitate careful grounding techniques. Timing and bypass capacitors should be connected close to pin5 in a single point ground. The transistor and 5KΩ potentiometerare used to samplethe oscillator waveform and apply an adjustable ramp to pin3.

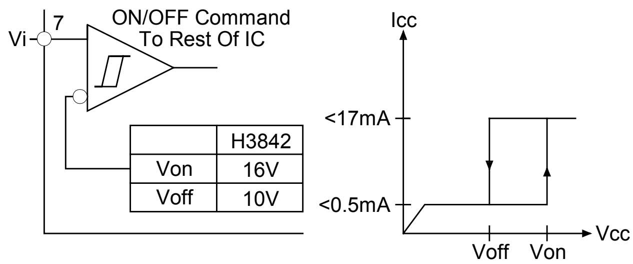
Oscillator and Output Waveforms



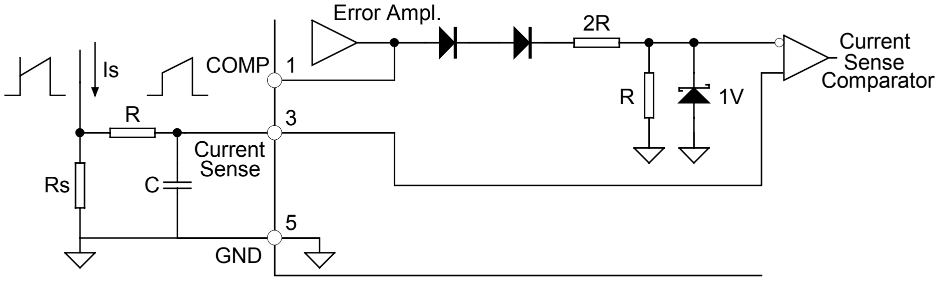
Error Amp Configuration



Under Voltage Lockout

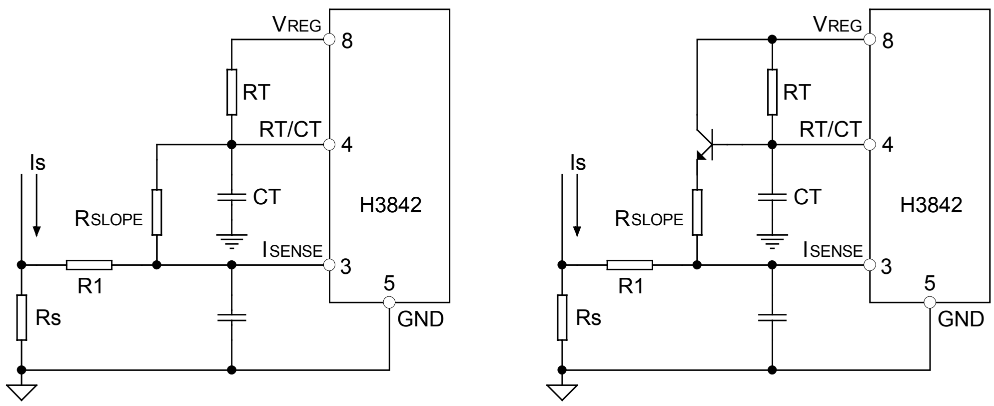


Current Sense Circuit

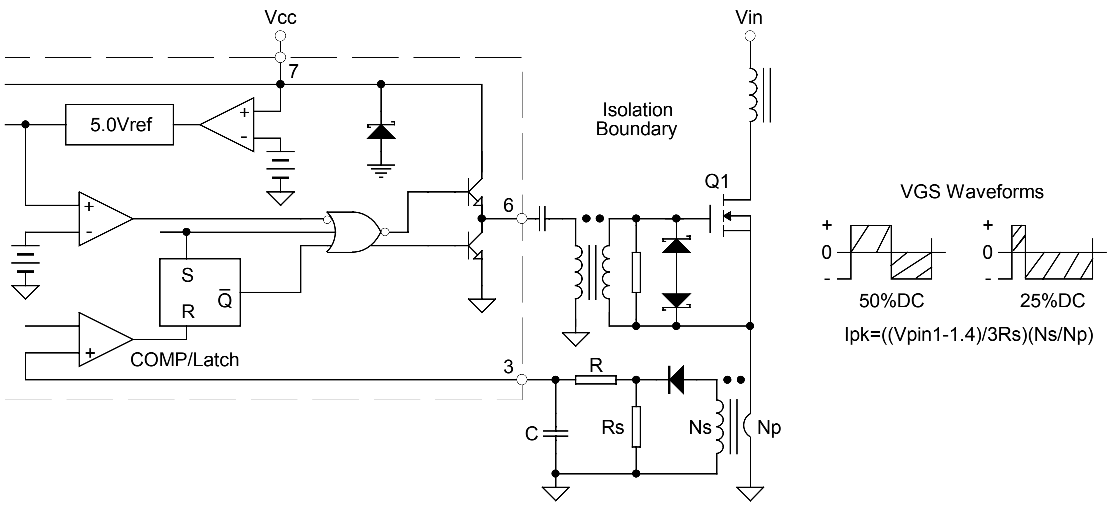


Peak current (Is) is determined by the formula
Is(max.) ≈ 1V/Rs
A small RC filter may be required to suppress switch transients.

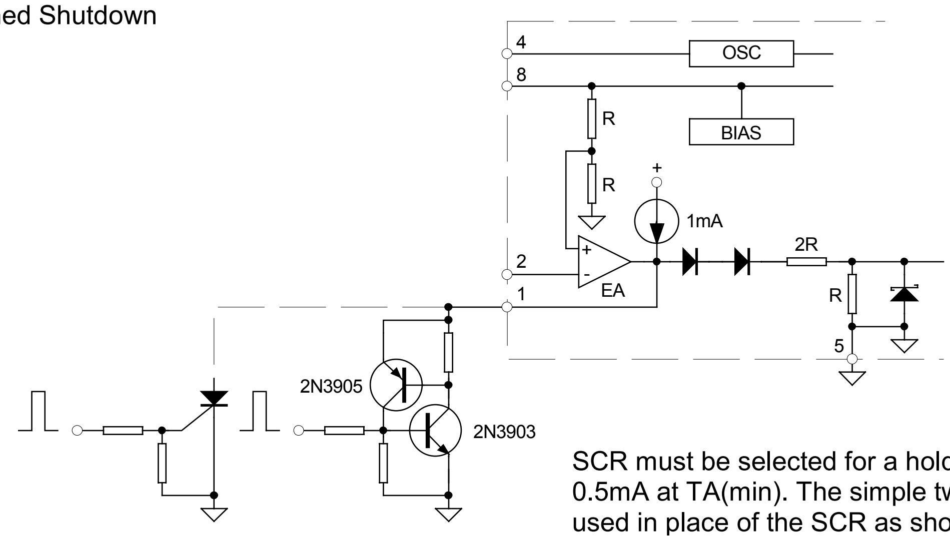
Slope Compensation Techniques



Isolated MOSFET Drive and Current Transformer Sensing

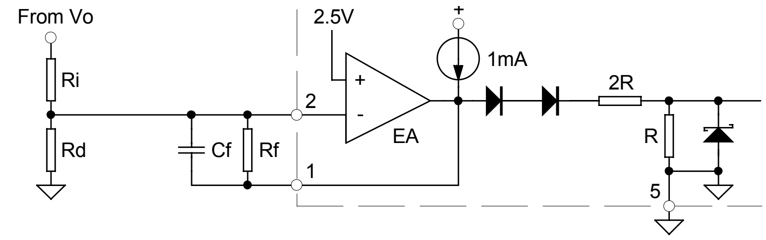


Latched Shutdown

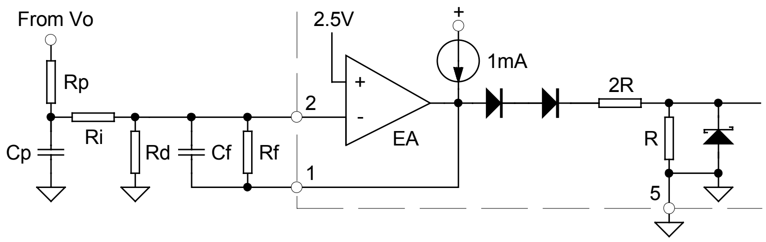


SCR must be selected for a holding current of less than 0.5mA at TA(min). The simple two transistor circuit can be used in place of the SCR as shown. All resistors are 10K.

Error Amplifier Compensation

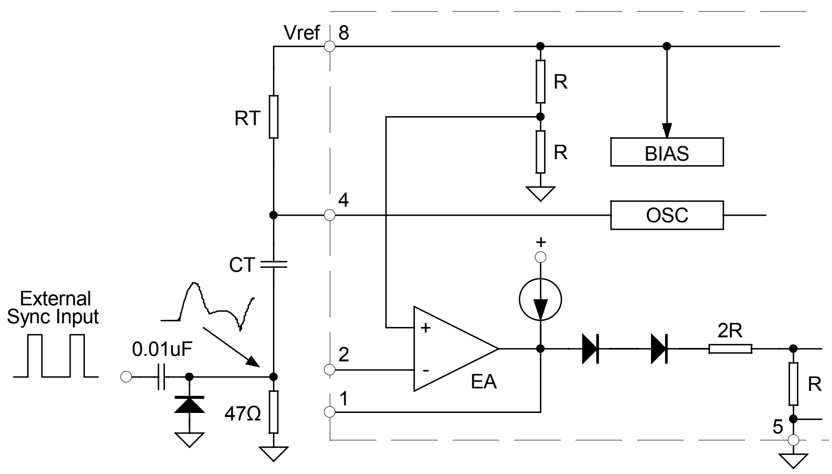


Error Amp compensation circuit for stabilizing any current-mode topology except for boost and flyback converters operating with continuous inductor current



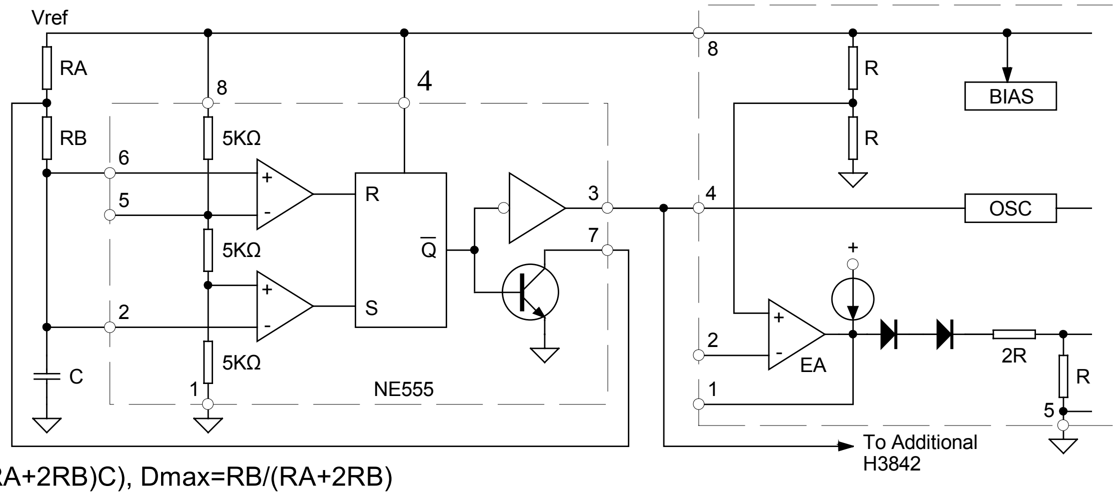
Error Amp compensation circuit for stabilizing current-mode boost and flyback topologies operating with continuous inductor current.

External Clock Synchronization



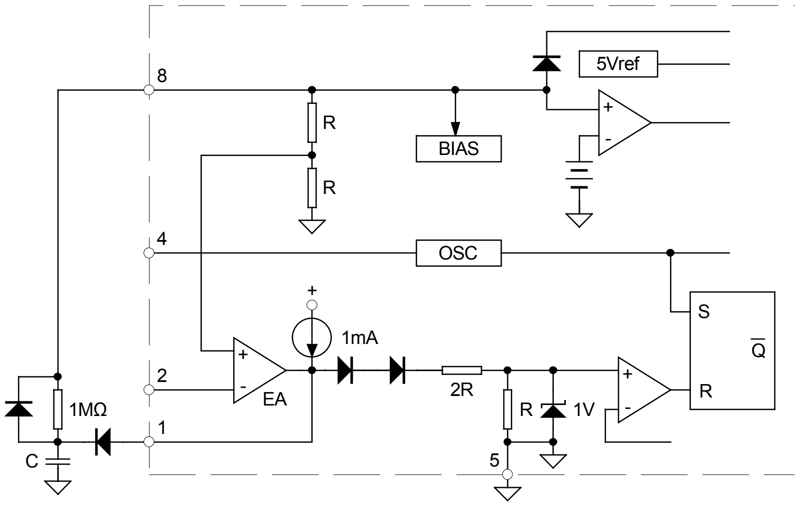
The diode clamp is required if the Sync amplitude is large enough to cause the bottom side of CT to go more than 300mV below ground

External Duty Cycle Clamp and Multi Unit Synchronization

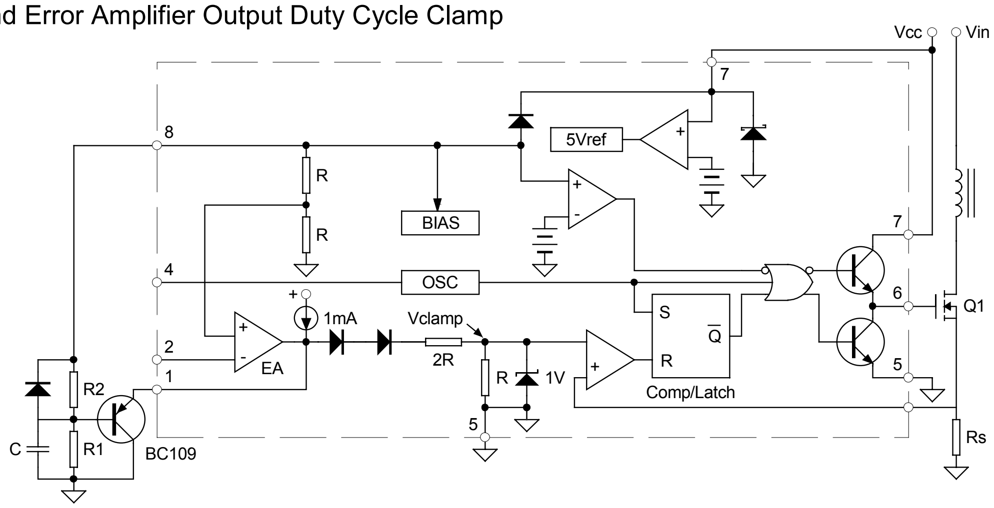


f=1.44/((RA+2RB)C), Dmax=RB/(RA+2RB)

Soft-Start Circuit

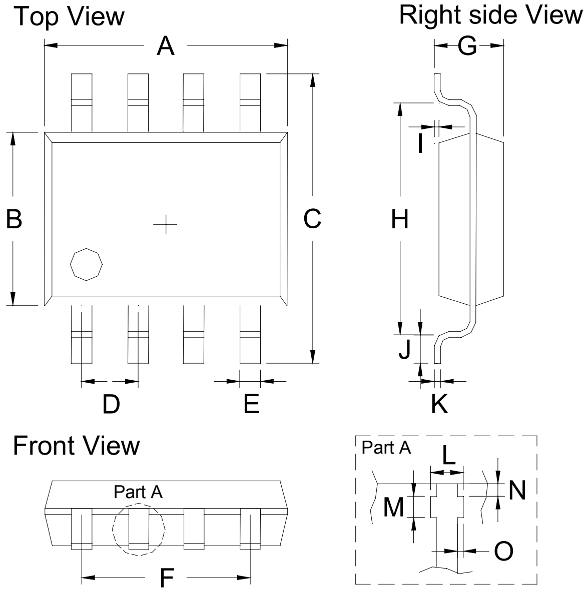


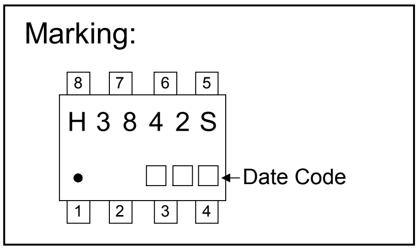
Soft-Start and Error Amplifier Output Duty Cycle Clamp



Vclamp=R1/(R1+R2) where 0<Vclamp<1V, Ipk(max)=Vclamp/RS

SO-8 Dimension





8-Lead SO-8 Plastic Package
HSMC Package Code: S

*: Typical

DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.1909	0.2007	4.85	5.10	I	0.0019	0.0078	0.05	0.20
B	0.1515	0.1555	3.85	3.95	J	0.0118	0.0275	0.30	0.70
C	0.2283	0.2441	5.80	6.20	K	0.0074	0.0098	0.19	0.25
D	0.0480	0.0519	1.22	1.32	L	0.0145	0.0204	0.37	0.52
E	0.0145	0.0185	0.37	0.47	M	0.0118	0.0197	0.30	0.50
F	0.1472	0.1527	3.74	3.88	N	0.0031	0.0051	0.08	0.13
G	0.0570	0.0649	1.45	1.65	O	0.0000	0.0059	0.00	0.15
H	0.1889	0.2007	4.80	5.10					

Notes: 1.Dimension and tolerance based on our Spec. dated Aug. 01,1999.
2.Controlling dimension: millimeters.
3.Maximum lead thickness includes lead finish thickness, and minimum lead thickness is the minimum thickness of base material.
4.If there is any question with packing specification or packing method, please contact your local HSMC sales office.

Material:

- Lead: 42 Alloy; solder plating
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

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- ***HSMC semiconductor products are not warranted to be suitable for use in Life-Support Applications, or systems.***
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