SC4809A/B
High Performance Current Mode PWM Controller

Description

The SC4809A/B is a 10 pin BICMOS primary side current mode controller for use in Isolated DC-DC and off-line switching power supplies. It is a highly integrated solution, requiring few external components. It features a high frequency of operation, accurately programmable maximum duty cycle, current mode control, line voltage monitoring, supply UVLO, low start-up current, and programmable soft start with user accessible reference. It operates in a fixed frequency, highly desirable for Telecom applications. Features a separate sync pin which simplifies synchronization to an external clock. Feeding the oscillator of one device to the sync of another forces biphase operation which reduces input ripple and filter size.

The SC4809A has a turn-on threshold of 4.5V and the SC4809B has a turn-on threshold of less than 12 volts. These devices are available in the MSOP–10 lead package.

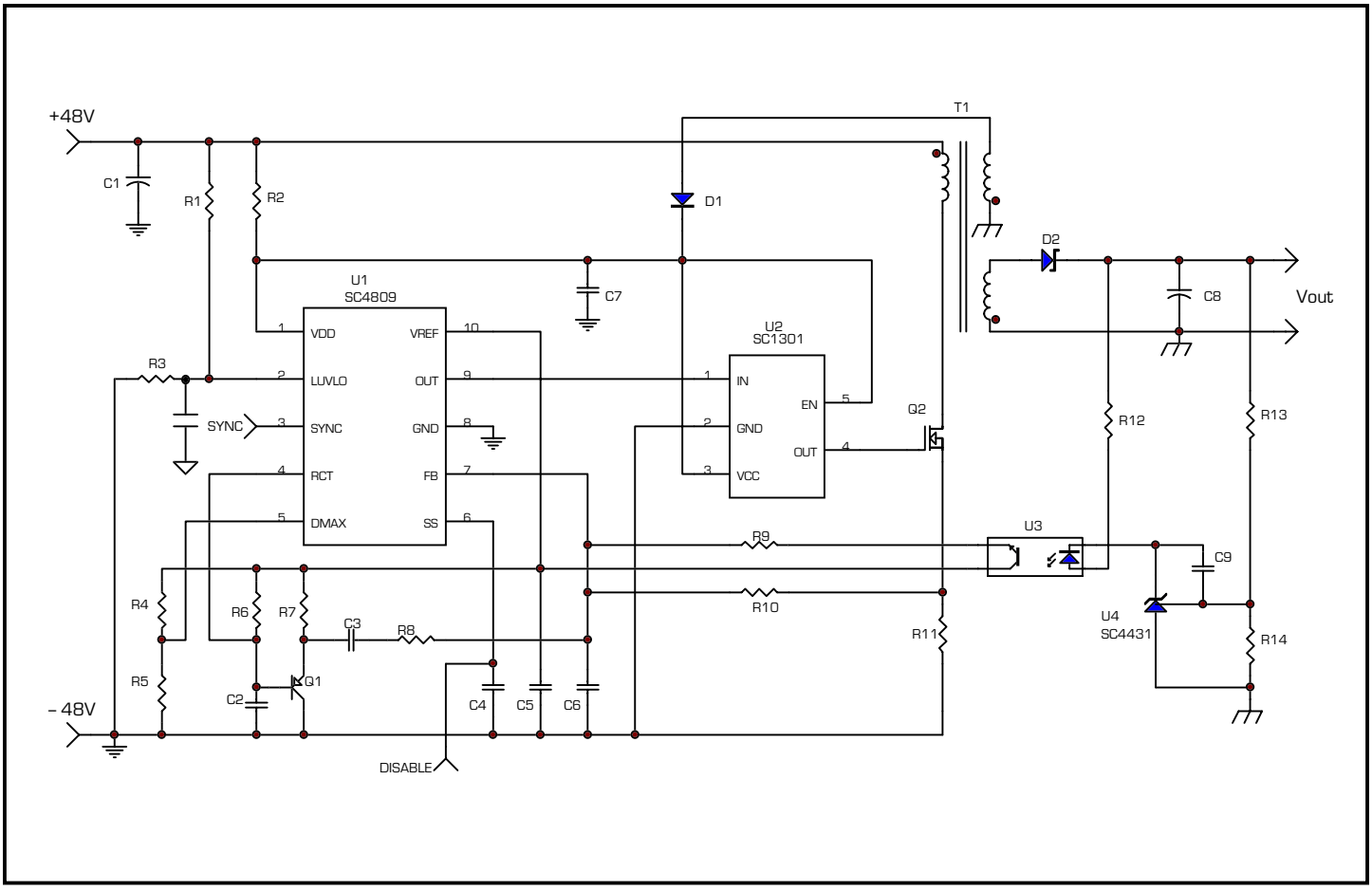
Features

- Operation to 1MHz
- Accurate programmable maximum duty cycle
- Line voltage monitoring
- External frequency synchronization
- **Bi-phase mode of operation for low ripple**
- Under 100µA start-up current
- Accessible reference voltage
- VDD undervoltage lockout
- -40°C to 105°C operating temperature
- 10 lead MSOP package

Applications

- Telecom equipment and power supplies
- Networking power supplies
- Power over LAN applications
- Industrial power supplies
- Isolated power supplies

Typical Application Circuit



Absolute Maximum Ratings

Exceeding the specifications below may result in permanent damage to the device, or device malfunction. Operation outside of the parameters specified in the Electrical Characteristics section is not implied.

Parameter	Symbol	Maximum	Units
Supply Voltage	V_{DD}	19	V
Supply Current	I_{DD}	25	mA
SS, UVLO, DMAX, RCT		-0.3V to V_{REF} + 0.3V	V
Current VREF	I_{REF}	15	mA
Current LUVLO	I_{LUVLO}	-1	mA
Storage Temperature Range	T_{STG}	-65 to +150	°C
Junction Temperature	T_J	-40 to +125	°C
Operating Temperature	T_A	-40 to +105	°C
Lead Temperature (Soldering) 10 Sec.	T_{LEAD}	+300	°C
ESD Rating (Human body model)	ESD	2	kV

Electrical Characteristics

Unless specified: V_{DD} = 12V, C_{SS} =1nF, F_{OSC} = 500kHz, R_T = 10K, C_T = 100pF, D_{MAX} = 2V, T_A = 25°C

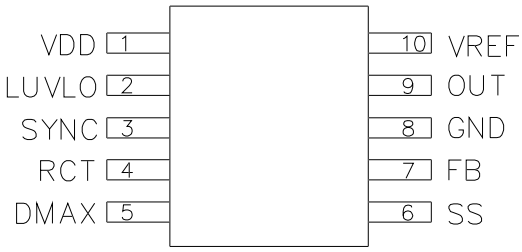
Parameter	Test Conditions	Min	Typ	Max	Unit
Supply Section					
VDD Clamp	I_{VDD} = 10mA	16	17.5	19	V
I_{DD}	f = 500k, No Load		1.5	2.5	mA
I_{DD} Starting				100	µA
UVLO Section (A version)					
Start Threshold		4.35		4.5	V
Hysteresis				0.3	V
UVLO Section (B version)					
Start Threshold		11		12	V
Hysteresis				4	V
VREF Section					
VREF (A version)	0 - 5mA	-3%	4	+3%	V
VREF (B version)	0 - 5mA	-3%	5	+3%	V
Line Under Voltage Lockout					
Start Threshold	R_A = 61.9k, R_B = 10k	-3%	3	+3%	V
Hysteresis	R_A = 61.9k, R_B = 10k		150		mV
Input Bias Current	LUVLO = 3.2V		-100	-250	nA

Electrical Characteristics (Cont.)

Unless specified: V_{DD} = 12V, C_{SS} =1nF, F_{OSC} = 500kHz, R_T = 10K, C_T = 100pF, D_{MAX} = 2V, T_A = 25°C

Parameter	Test Conditions	Min	Typ	Max	Unit
Comparator Section					
IFB	Output Off		-100		nA
Comparator Threshold		570	600	630	mV
OUT Propagation Delay (No Load)	V_{FB} = 0.8V to 1.2V at T_R = 10ns		75	100	ns
Soft Start Section					
I_{SS}	V_{SS} = 0V; -40 °C <T_a +105°C	-6	-8	-10.0	µA
Shutdown Threshold		300			mV
Oscillator Section					
Frequency range		50		1100	kHz
RCT Peak Voltage			3.00		V
RCT Valley Voltage			0.05		V
Minimum Duty Cycle Pulse Width	V_{FB} = 2V		50		ns
Maximum Duty Cycle			90		%
Frequency	R_T = 10K, C_T = 100pF	450	500	550	kHz
Duty Cycle	R_T = 10K, C_T = 100pF		90		%
Sync/CLOCK					
Clock SYNC Threshold	Positive Edge Triggered		2.1		V
Minimum Sync Input Pulse Width	F_{SYNC} > Fosc			50	ns
Output Section					
Output VSAT Low	I_{OUT} = 1mA			500	mV
Output VSAT High	I_{OUT} = 1mA	V_{REF} - 0.5			V
Rise Time	C_{OUT} = 20pF		10	25	ns
Fall Time	C_{OUT} = 20pF		10	25	ns

Pin Configuration



MSOP-10

Ordering Information

Part Number	Package	Temp. Range (T_J)
SC4809AIMSTR	MSOP-10	-40°C to 125°C
SC4809BIMSTR		

Note:
Only available in tape and reel packaging. A reel contains 2500 devices.

Pin Descriptions

FB: This pin is the summing node for current sense feedback, voltage sense feedback (by optocoupler) and slope compensation. Slope compensation is derived from the rising voltage at the time capacitor and can be buffered with an external small signal NPN transistor. External high frequency filter capacitance applied from this node to GND is discharged by an internal 250Ω on-resistance NMOS FET during PWM off -time and offers effective leading edge blanking set by the RC time constant of the feedback resistance from the current sense resistor to the FB input and the high frequency filter capacitor capacitance at this node to GND.

GND: Reference ground and power ground for all functions.

OUT: This pin is the logic level drive output to the external MOSFET driver circuit (similar to SC1301).

VREF: The internal 4V (A) / 5V (B) reference output. This reference is buffered and is available on the VREF pin. VREF should be bypassed with a 0.47 - 1.0µF ceramic capacitor.

RCT: The oscillator frequency is configured by connecting resistor RT from VREF to RCT and capacitor CT from RCT to ground. Using the equation below values for RT and CT can be selected to provide the desired OUT frequency.

$$F = \frac{1}{-\left[RT \bullet CT \bullet \ln\left(1 - \frac{V_{P-K}}{V_{REF}}\right)\right]}$$

where V_{P-K} = RCT peak voltage

DMAX: Duty cycle up to 98% can be programmed via R4 and R5 (the resistor divider from Vref in the Application Circuit). When DMAX pin is taken above 3V, 100% duty cycle is achieved.

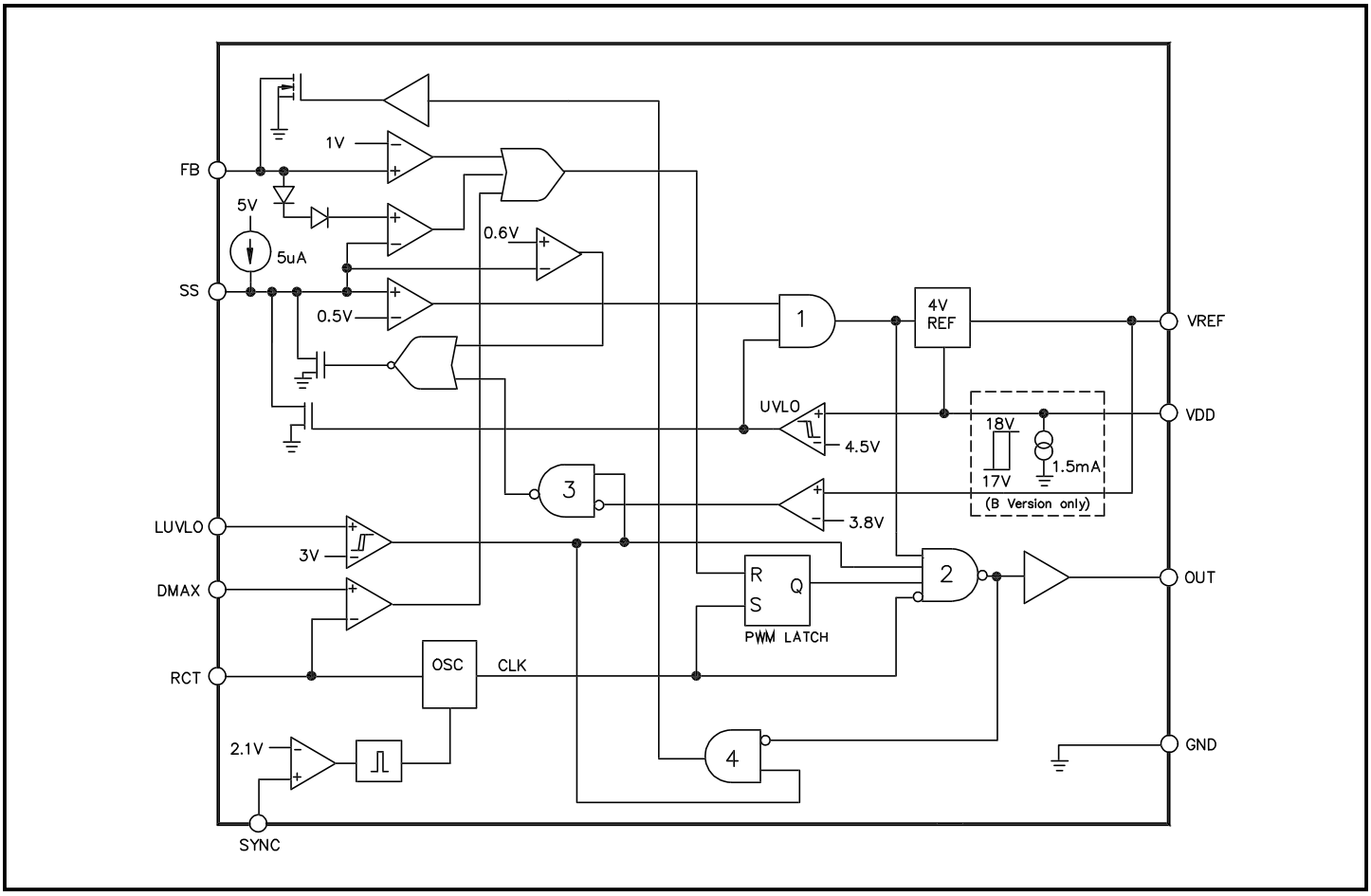
SS: This pin serves two functions. The soft start timing capacitor connects to SS and is charged by an internal 8µA current source. Under normal soft start SS is discharged to less than 1V and then ramps positive to 1V during which time the output driver is held low. As SS charges from 1V to 2V, soft start is implemented by an increasing output duty cycle. If SS is taken below 0.5V, the output driver is inhibited and held low. The user accessible 4V (A) or 5V (B) voltage reference also goes low and IDD < 100µA.

VDD: The power input connection for this device. This pin is shunt regulated at 17.5V which is sufficiently below the voltage rating of the DMOS output driver stage. VDD should be bypassed with a 1µF ceramic capacitor.

LUVLO: Line undervoltage lock out pin. An external resistive divider will program the undervoltage lock out level. During the LUVLO, the Driver outputs are disabled and the softstart is reset.

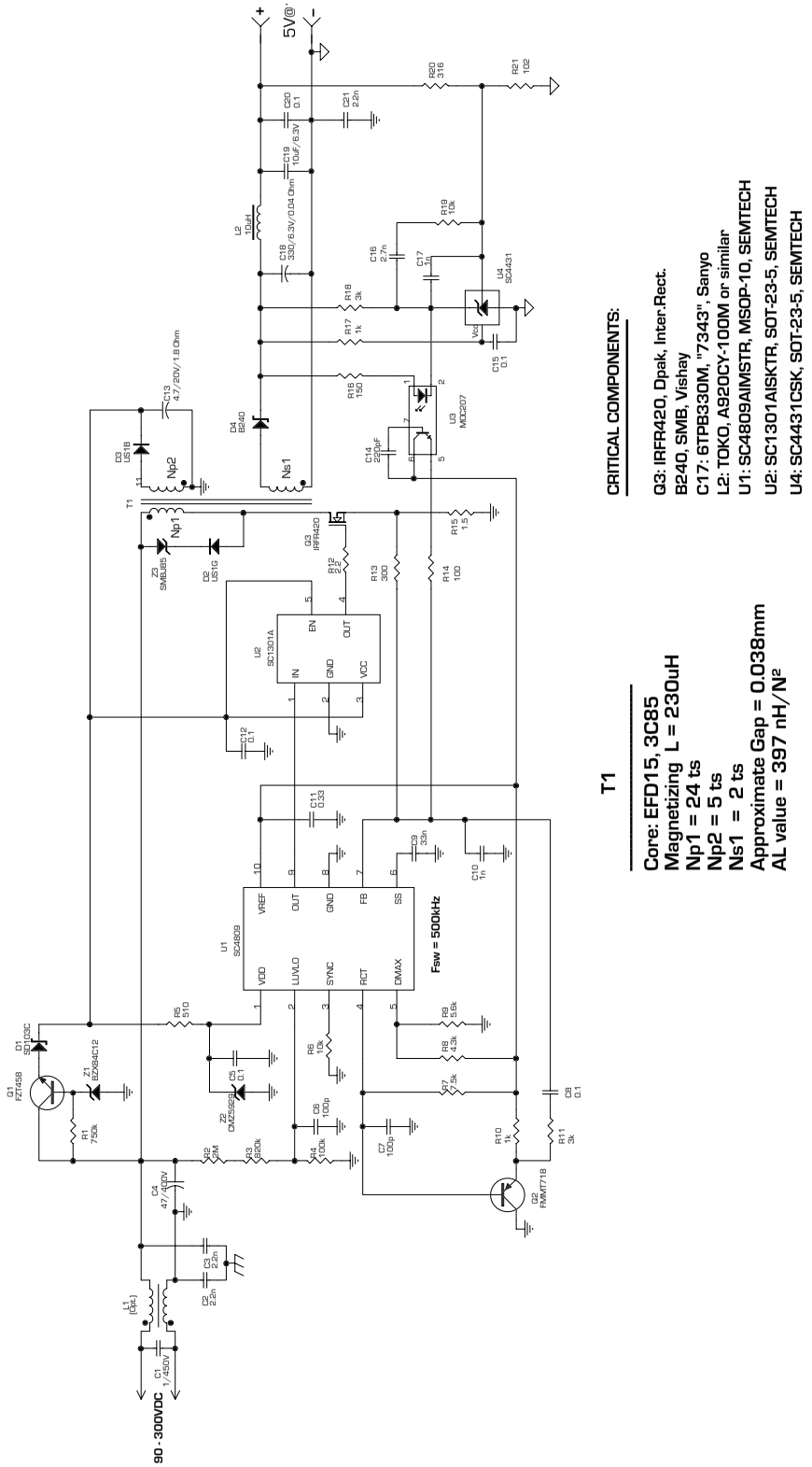
SYNC: SYNC is a positive edge triggered input with a threshold precisely set to 2.1V. In the Bi-Phase operation mode SYNC pin should be connected to the CT (Timing Capacitor) of the second controller. This will force a 180° out of phase operation. In a single controller operation, SYNC could be grounded or connected to an external synchronization clock with a frequency higher than the on-board oscillator frequency. The external OSC frequency should be 30% greater for guaranteed SYNC operation.

Block Diagram



Applications Information

Flyback, 90V - 300V to 5V @ 1A typ.



CRITICAL COMPONENTS:

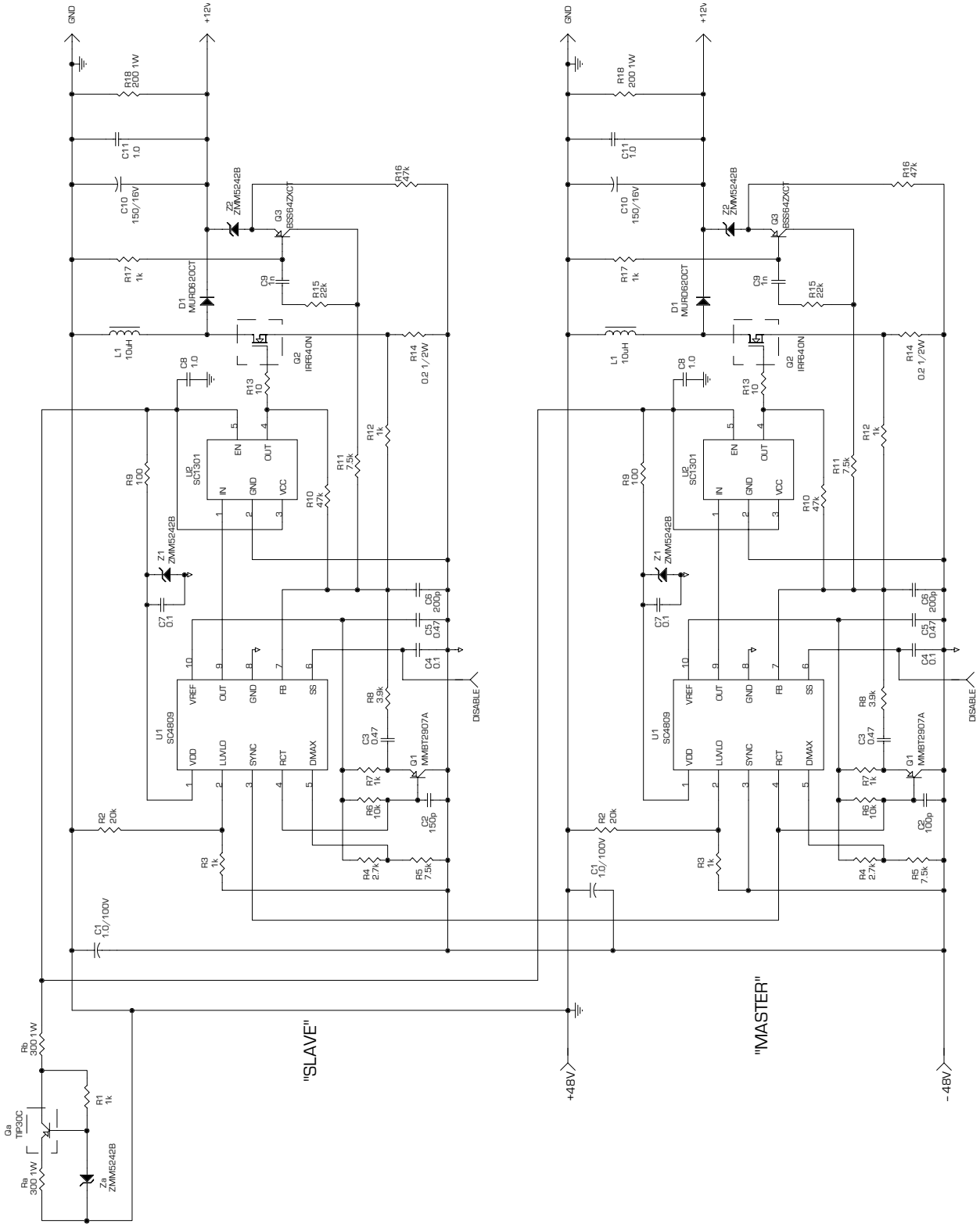
Q3: IRFR420, Dpak, Inter.Rect.
B240, SMB, Vishay
C17: 6TPB330M, "7343", Sanyo
L2: TOKO, A920CY-100M or similar
U1: SC4809AIMSTR, MSOP-10, SEMTECH
U2: SC1301AISKTR, SOT-23-5, SEMTECH
U4: SC4431CSK, SOT-23-5, SEMTECH

T1

Core: EFD15, 3C85
Magnetizing L = 230uH
Np1 = 24 ts
Np2 = 5 ts
Ns1 = 2 ts
Approximate Gap = 0.038mm
AL value = 397 nH/N²

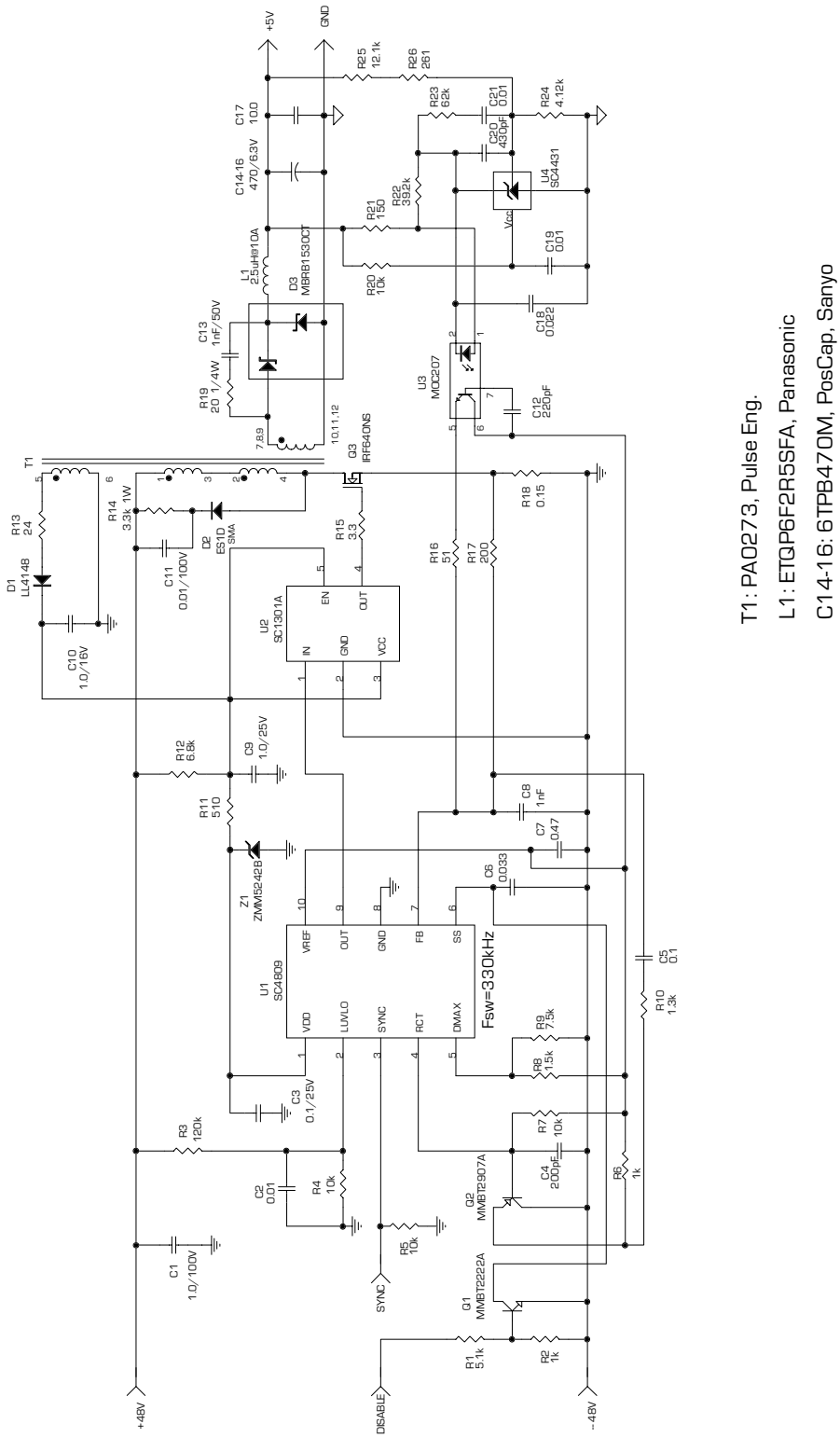
Applications Information (Cont.)

Out of Phase, Synchronized, Dual Converter



Evaluation Board Schematic

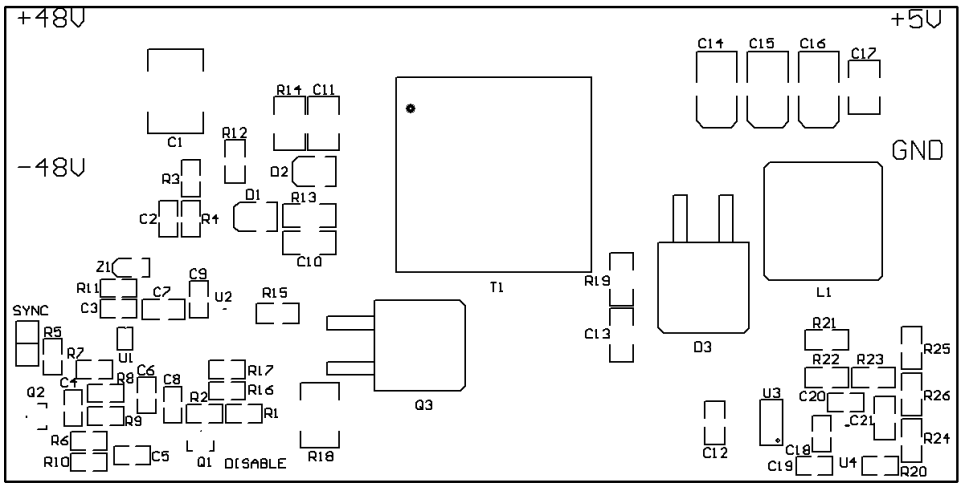
50W Forward Converter



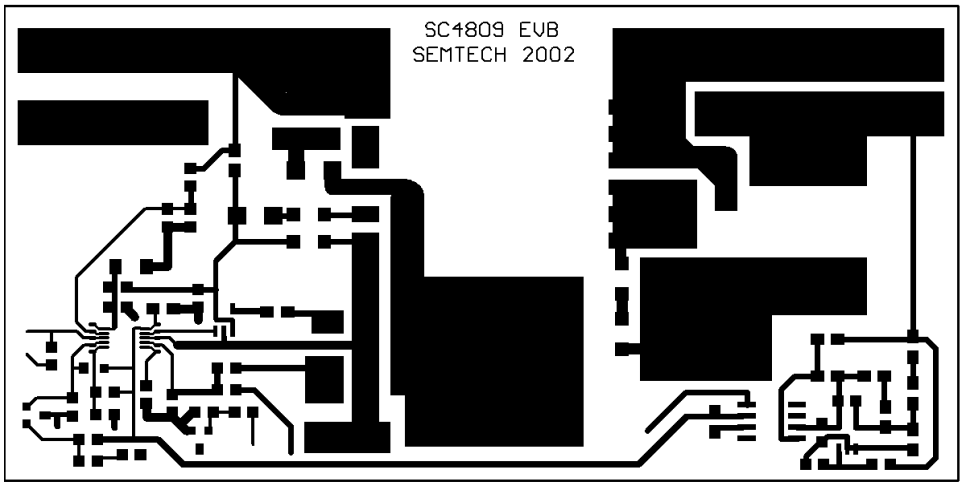
T1: PA0273, Pulse Eng.
L1: ETQP6F2R5SFA, Panasonic
C14-16: 6TPB470M, PosCap, Sanyo

Evaluation Board Layout

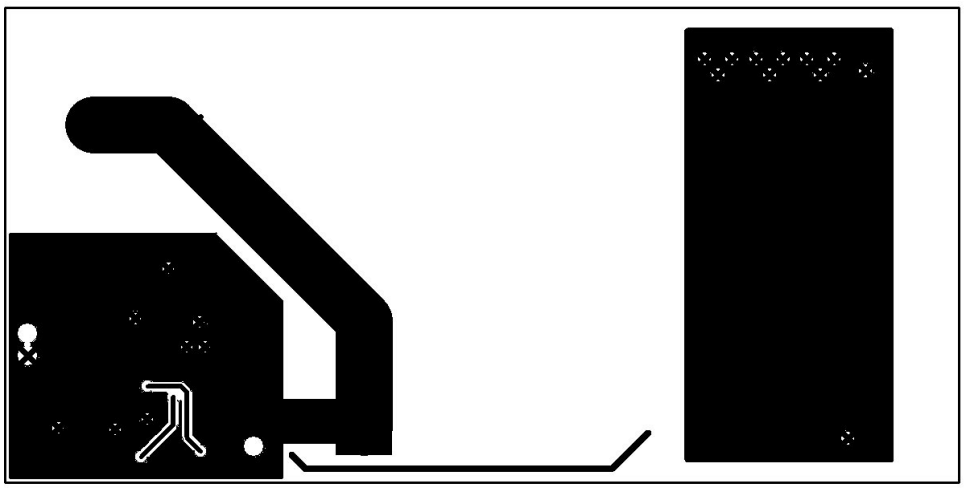
50W Forward Converter



Layout

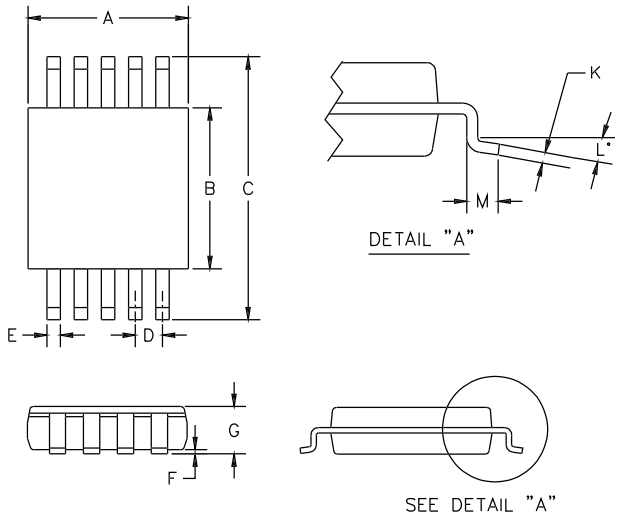


Top



Bottom

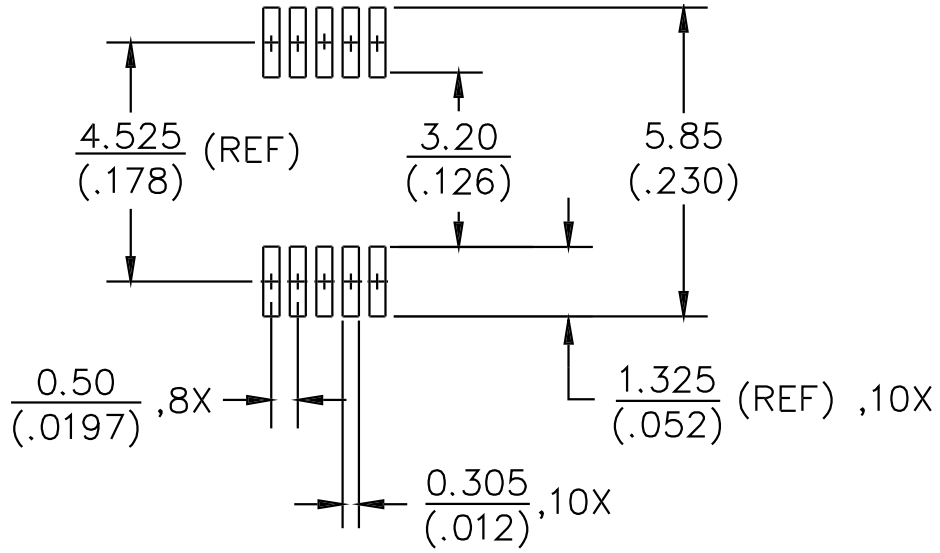
Outline Drawing - MSOP-10



DIMENSIONS					
DIM	INCHES		MM		NOTE
	MIN	MAX	MIN	MAX	
A	.114	.122	2.90	3.10	
B	.114	.122	2.90	3.10	
C	.187	.199	4.75	5.05	
D	.020 BSC		.50 BSC		
E	.006	.012	.15	.30	
F	.002	.006	.05	.15	
G	–	.043	–	1.10	
K	.005	.009	.13	.23	
L	0°	6°	0°	6°	
M	.016	.028	.40	.70	

[2] PACKAGE OUTLINE EXCLUSIVE OF MOLD FLASH AND METAL BURR.
[1] CONTROLLING DIMENSIONS: MILLIMETERS.

Land Pattern - MSOP-10



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