

## DESCRIPTION

The Flash Memory Vpp Generator demonstration circuit is a complete, functional DC-to-DC converter capable of supplying 12V  $\pm$ 5% at up to 60mA from a 5V  $\pm$ 10% input. The 60mA output current is sufficient to drive two Flash Memory devices. A logic controlled SHUTDOWN input provides on-off control of the converter.

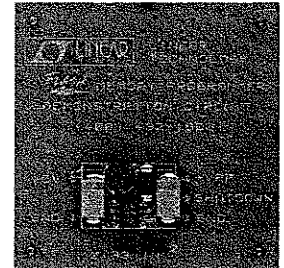
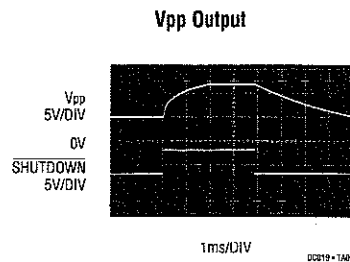
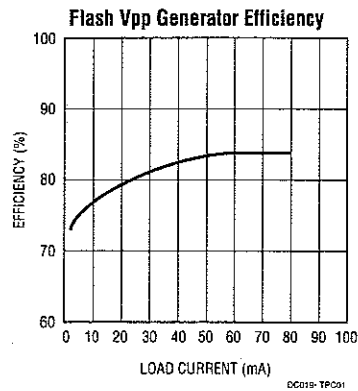
The circuit uses only two capacitors, a diode and an inductor in addition to the LT1109CS8-12 converter IC. All components are standard products, available off-the-shelf and are surface-mountable.

Up to 120mA output current is available using the LT1109A in the same configuration. Contact LTC factory for details.

## PERFORMANCE SUMMARY $0^{\circ}\text{C} \leq T_A \leq 70^{\circ}\text{C}$

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Output Voltage	$V_{\text{SHUTDOWN}} \geq 2.0\text{V}$	11.45	12.00	12.55	V
Guaranteed Output Current	$4.5\text{V} \leq V_{\text{IN}} \leq 5.5\text{V}$	60			mA
Vpp Rise Time			2		ms
Quiescent Current	$V_{\text{SHUTDOWN}} \leq 0.8\text{V}$		320	450	$\mu\text{A}$
Efficiency			84		%
Line Regulation	$4.5\text{V} \leq V_{\text{IN}} \leq 5.5\text{V}$		1		%
Load Regulation	$0\text{mA} \leq I_{\text{OUT}} \leq 60\text{mA}$		1		%

## TYPICAL PERFORMANCE CHARACTERISTICS AND BOARD PHOTO



## PACKAGE AND SCHEMATIC DIAGRAMS

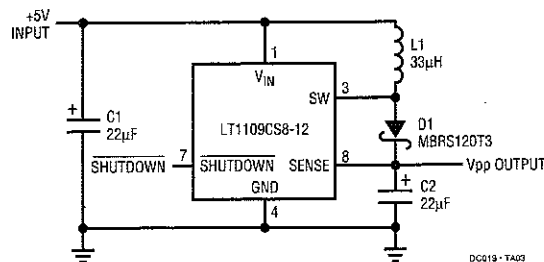
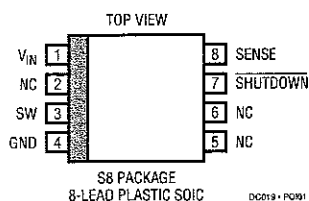


Figure 1. V<sub>pp</sub> Generator

## PARTS LIST

REFERENCE DESIGNATOR	QUANTITY	PART NUMBER	DESCRIPTION	VENDOR	PHONE NO.
C2, C3	2	CSTD226M016TC or 498C226P016MOAD	Cap., 22µF, 16V Cap., 22µF, 16V	Hilton Philips MEPCO	813-371-2600 407-881-3200
D1	1	MBRS120T3	Diode, Schottky	Motorola	—
L1	1	CD54-330K	Inductor, 33µH	Sumida	708-956-0666
U1	1	LT1109CS8-12	IC, SO-8	LTC	408-432-1900

## DC019 OPERATION

### LT1109CS8-12 V<sub>pp</sub> Generator

The circuit shown in Figure 1 details a simple +5V to +12V step-up DC-DC converter suitable for driving Flash Memory. Up to 60mA is available from the V<sub>pp</sub> output, enough to drive two Flash devices at 30mA each. The circuit contains only five components. Values, vendors and the PC board layout shown are recommended by LTC. In most cases the layout can be copied exactly onto the system PC board. The area taken by the V<sub>pp</sub> Generator board measures 0.70 x 0.47 or 0.33 sq. in.

### Operation

Figures 2A, 2B and 2C show the simplified operation of the demonstration circuit. For the purpose of this explanation assume the output is a constant +12V DC, the input voltage is +5V DC and transistor Q1 in the LT1109-12 is equivalent to a switch.

In this type of converter circuit (boost converter) the output voltage is always greater than the input voltage. Referring to Figures 2A and 2B the circuit functions as follows;

1. The switch, Q1, turns on (Figure 2B) allowing the battery voltage to be impressed across the inductor L1. The inductor current builds (energy storage) until the switch turns off.
2. When the switch turns off (Figure 2C) the field in the inductor collapses, the voltage across the inductor inverts and is added to the battery voltage. Diode D1 becomes forward biased and allows the current to flow to the filter capacitor and the load.

This type of converter is not a pulse width modulator but a "burst modulator," which depends on a ripple voltage on the output to regulate. Referring to Figure 2A, when the output voltage is below the set point of the comparator (1.25V) the output of the comparator is "high" turning the oscillator on. The oscillator then drives the switch, Q1, at a 120kHz rate charging up the output capacitor C2 as well as transferring energy to the load.

When the output voltage across C2 rises above the comparator set point the oscillator is turned off and the capacitor is left to supply the load with current.

## DC019 OPERATION

Some period of time later, depending on the load, the capacitor discharges below the hysteresis value of the comparator and the whole cycle starts again. No frequency compensation is required as the "loop" is non-linear and has no effective gain.

Shutdown is accomplished by pulling the SHUTDOWN pin to a logic "0." This action disables the oscillator, causing  $V_{pp}$  to fall to  $V_{IN}$  minus  $D1$ 's drop. This condition is acceptable to Flash Memory. In shutdown mode, quiescent current decreases to  $320\mu A$ .

### COMPONENTS

#### Capacitors

The capacitors specified have been chosen on the basis of voltage rating and Equivalent Series Resistance (ESR). Alternate source capacitors can be used if they are "equivalent" to the ones specified. Aluminum electrolytic capacitors may also be used subject to the ESR and voltage rating constraints.

#### Inductors

The Sumida CD54-330 inductor is a low-cost, ferrite, unshielded unit. Wire resistance (DCR) is specified at  $0.24\Omega$ . Other inductors will work as long as they have equal or lower DCR, can handle peak current of  $600mA$  and have adequate Q at  $120kHz$ . Ferrite core units will work at  $120kHz$ , although some iron-powder cores show considerable losses at this frequency. In some cases, a toroidal core inductor may be preferred due to its inherent superiority of flux containment (and therefore RFI/EMI suppression).

#### Diodes

The MBRS120T3 Schottky diode specified has low forward drop ( $<500mV$ ) and  $20V$  breakdown. The leaded 1N5818 can be used instead. Standard fast-recovery silicon types such as 1N4933 can also be used although efficiency will drop a percent or two.

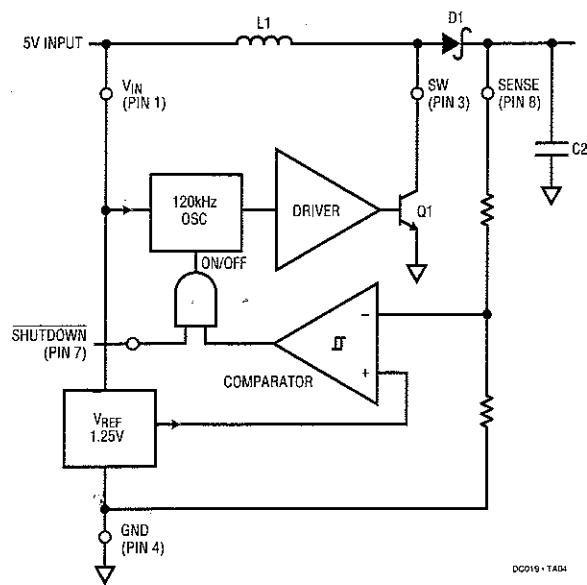


Figure 2A. LT1109-12 Block Diagram

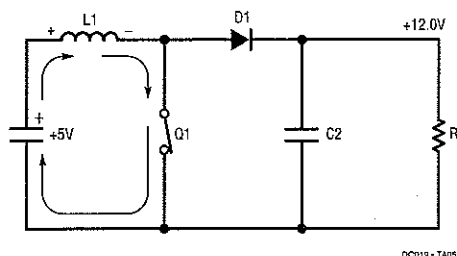


Figure 2B. Switch Closed

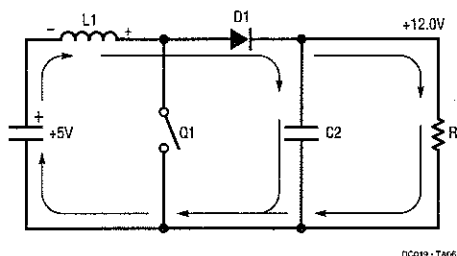
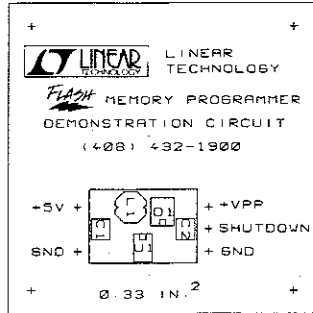


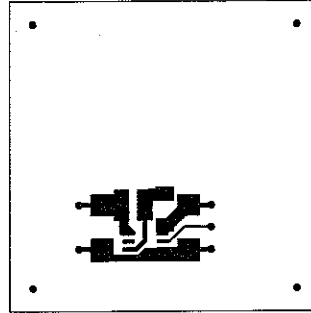
Figure 2C. Switch Open

DEMO MANUAL DC019  
FLASH MEMORY Vpp GENERATOR

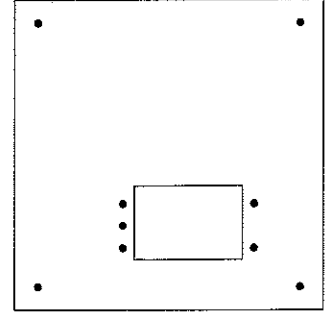
**PCB LAYOUT AND FILM**



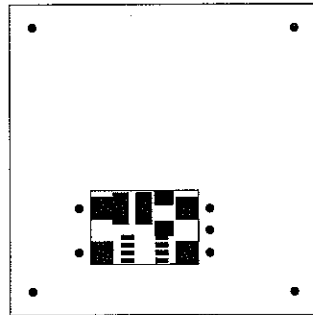
Component Side Silkscreen



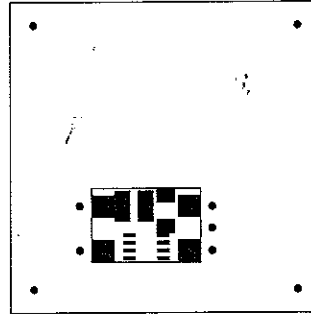
Component Side Traces



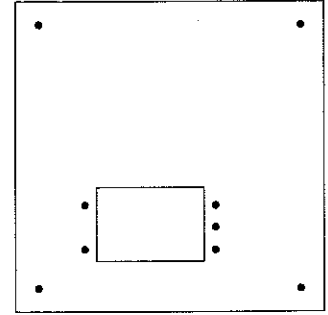
Solder Side Solder Mask



Component Side Solder Mask

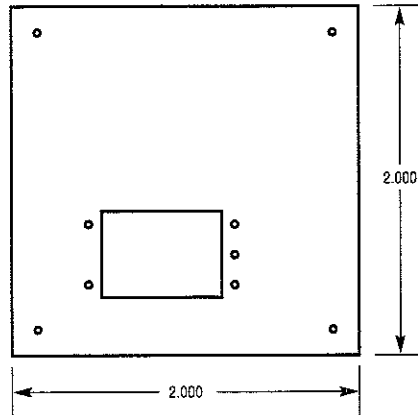


Component Side Solder Paste Template



Solder Side Traces

**PC FAB DRAWING**



NOTES:

1. MATERIAL IS FR4 0.062" THICK WITH 2 OUNCE COPPER.
2. PCB WILL BE DOUBLE SIDED WITH PLATED THROUGH HOLES.
3. HOLE SIZES ARE AFTER PLATING. PLATED THROUGH HOLE WALL THICKNESS MIN. 0.0014" (10Z).
4. TIN LEAD PLATE ALL TRACES.
5. SOLDER MASK BOTH SIDES WITH PC401 USING FILM PROVIDED.
6. SILKSCREEN COMPONENT SIDE ONLY USING FILM PROVIDED. USE YELLOW, NON-CONDUCTIVE INK.
7. ALL DIMENSIONS ARE IN INCHES.

HOLE CHART		
SYMBOL	DIAMETER	# OF HOLES
UNMARKED	0.030"	9
TOTAL HOLES		9

DC019 • PCB01