MP1010B
Cold Cathode Fluorescent Lamp Driver

Monolithic Power Systems

MPS CONFIDENTIAL PRELIMINARY INFORMATION – SPECIFICATIONS SUBJECT TO CHANGE

DESCRIPTION

The MP1010B is a power solution IC that offers a true complete solution for driving a Cold Cathode Fluorescent Lamps (CCFL). This Power IC converts unregulated DC voltage to a nearly pure sine wave required to ignite and operate the CCFL. Based on proprietary power topology and control techniques it greatly increases the power conversion efficiency.

EVALUATION BOARD REFERENCE

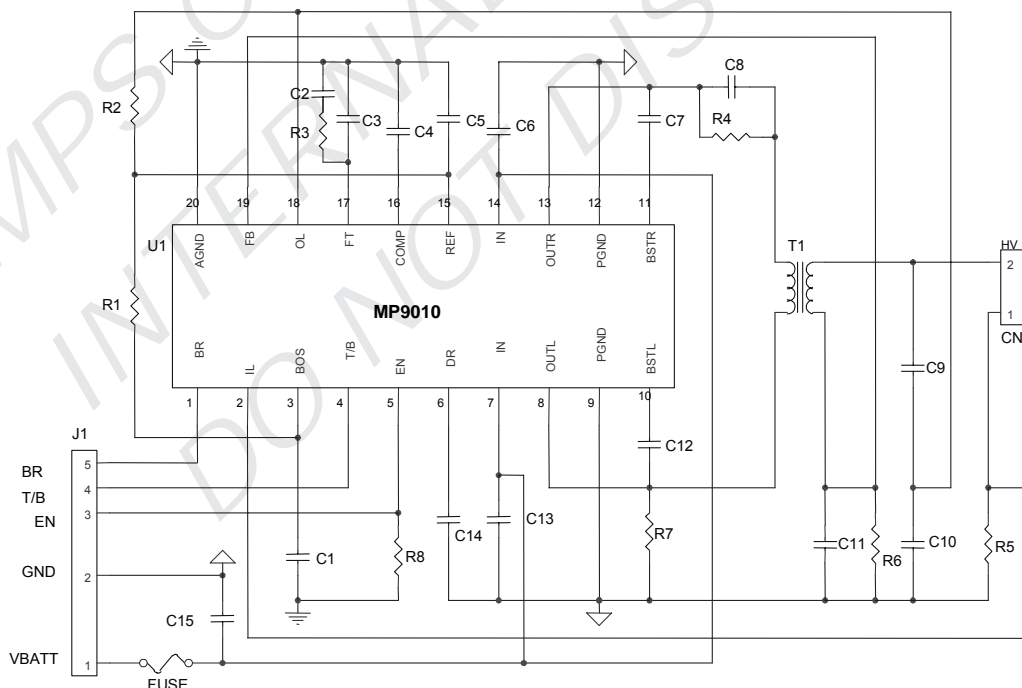| Board Number	Dimensions
EV0037	4.00"X x 0.50"Y x 0.37"Z

FEATURES

- Integrated Power Switches
- 6.0V to 23V Variable Supply Voltage with Regulated Lamp Current.
- Rated 12W Power Output at 12V Input
- Open Lamp Regulation
- Current and Voltage Feedback Control
- Logic Level Burst Mode Control
- Supports Open/Short Lamp Protection
- Soft-Start
- Short Circuit Protected Output
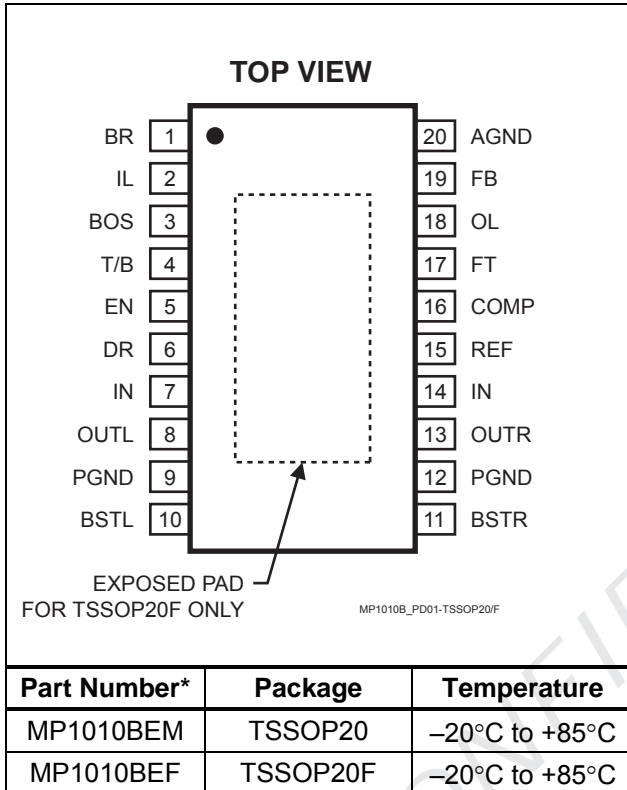- High Energy Start Pulse
- Analog and Burst Mode Dimming

APPLICATIONS

- LCD Backlight Inverter for Notebook Computers
- Web Pads, GPS, Desktop Displays, Portable DVD, Car Video Display Systems

TYPICAL APPLICATION

PACKAGE REFERENCE

TOP VIEW

```
        BR   1  ●        20  AGND
        IL   2           19  FB
       BOS   3           18  OL
       T/B   4           17  FT
        EN   5           16  COMP
        DR   6           15  REF
        IN   7           14  IN
      OUTL   8           13  OUTR
      PGND   9           12  PGND
      BSTL  10           11  BSTR
```

EXPOSED PAD
FOR TSSOP20F ONLY

MP1010B_PD01-TSSOP20/F

Part Number*	Package	Temperature
MP1010BEM	TSSOP20	−20°C to +85°C
MP1010BEF	TSSOP20F	−20°C to +85°C

* For Tape & Reel, add suffix –Z (eg. MP1010BEM–Z)
  For Lead Free, add suffix –LF (eg. MP1010BEM–LF–Z)

ABSOLUTE MAXIMUM RATINGS [1]

Input Voltage (V_{IN}) 25V
IL, FB Input Voltages (V_{IL}, V_{FB}) .... ±6V
OL Input Voltage (V_{OL}) .... −0.3V to +12V
Logic Input Voltages .... −0.3V to +6.8V
Power Dissipation 1.0W
Operating Frequency 150kHz
Junction Temperature .... 150°C
Lead Temperature (Solder) .... 260°C
Storage Temperature ....−55°C to +150°C

Recommended Operating Conditions [2]

Input Voltage (V_{IN}) .... 6V to 23V
Analog Brightness Voltage (V_{BR}) .... 0V to 1.9V
Digital Brightness Voltage ($V_{T/B}$) .... 0V to 1.8V
Enable (V_{EN}) .... 0V to 5V
Operating Frequency (Typical) 60kHz
Ambient Operating Temperature ...−20°C to +85°C

Thermal Resistance [3] Θ_{JA} Θ_{JC}

TSSOP .... 90° ..... 25° .... C/W
TSSOPF .... 40° ...... 6° ..... C/W

Notes:
1) Exceeding these ratings may damage the device.
2) The device is not guaranteed to function outside of its operating conditions.
3) Measured on approximately 1" square of 1 oz copper.

ELECTRICAL CHARACTERISTICS

V_{IN} = 12V, T_A = 25°C, unless otherwise noted.

Parameter	Symbol	Condition	Min	Typ	Max	Units
Reference Voltage						
Output Voltage	V_{REF}	I_{REF} = 3mA	4.75	5.0	5.25	V
Reference Current	I_{REF}				3.0	mA
Line Regulation		6.5V < V_{IN} < 23V			30	mV
Load Regulation		0 < I_{REF} < 3.0mA			30	mV
Output Drivers						
Switch On Resistance[4]	$R_{(ON)}$		0.08	0.11	0.14	Ω
Short Circuit Current	I_{SC}			4		A
Ton(min)		V_{COMP} = 0V, V_{IN} = 23V		435	550	ns
Ton(min)		V_{COMP} = 0V, V_{IN} = 6V		1750	2100	ns
Battery Supply						
Supply Current (Quiescent)	$I_{CC(OFF)}$				10	µA
Supply Current (Operating)	$I_{CC(ON)}$	V_{IN} = 23V		1.8	2.5	mA

ELECTRICAL CHARACTERISTICS *(continued)*

V_{IN} = 12V, T_A = 25°C, unless otherwise noted.

Parameter	Symbol	Condition	Min	Typ	Max	Units
Brightness Control						
Sense Full Brightness	V_{IL}	V_{BR} = 2.0V	360	379	400	mV
Sense Full Dim	V_{IL}	V_{BR} = 0V	105	117	130	mV
Lamp Current Regulation		7V < V_{IN} < 23V		2	5	%
Burst Oscillator Peak Voltage	V_{BOS}		1.70	1.78	1.86	V
Digital Brightness Offset Voltage	$V_{(OS) T/B}$		-50	5	50	mV
Fault Detect						
Open Lamp Threshold	$V_{(TH)OL}$			0		V
Secondary Current Threshold	$V_{(TH)FB}$			1.2		V
Fault Mode COMP Current	I_{COMP}	V_{OL} < 0V, V_{FB} > 1.2V		475		µA
Shutdown Logic						
Fault Timer Threshold	$V_{(TH)FT}$		1.1	1.2	1.3	V
Fault Timer Sink Current		V_{OL} > 0, V_{FB} < 1.2V		1		µA
Fault Timer Source Current						
Open Lamp		V_{OL} < 0, V_{FB} < 1.2V		1		µA
Secondary Overload		V_{FB} > 1.2V		120		µA
Enable Voltage Low	$V_{(L)EN}$				0.5	V
Enable Voltage High	$V_{(H)EN}$		2.0			V

Note:
4) This parameter is guaranteed by design.

PIN FUNCTIONS

Pin #	Name	Description
1	BR	Analog Dimming
2	IL	Lamp Current Feedback Sense Input
3	BOS	Burst Oscillator Timing
4	T/B	Test/Burst Mode Dimming
5	EN	Chip Enable. ***Do not float this pin.***
6	DR	Internally Generated MOSFET Gate Drive Supply Voltage (6V)
7	IN	Power Supply Input
8	OUTL	Output to Load (Tank Circuit)
9	PGND	Power Ground
10	BSTL	Regulated Output Voltage for Bootstrap Capacitor on Phase L
11	BSTR	Regulated Output Voltage for Bootstrap Capacitor on Phase R
12	PGND	Power Ground
13	OUTR	Output to Load (Tank Circuit)
14	IN	Power Supply Input
15	REF	Internally Generated Reference Voltage Output (5V)
16	COMP	Loop Compensation Capacitor
17	FT	Fault Timer
18	OL	Open Lamp Detect (Lamp Voltage Feedback)
19	FB	Shorted Lamp Detect (Secondary Current Feedback)
20	AGND	Small Signal Ground[5]

Note:
5) For the MP1010BEF, connect the exposed paddle to AGND (Pin 20).

FEATURE DESCRIPTION

Brightness Control
The MP1010B can operate in three modes:
- Analog Mode
- Burst Mode with a DC input
- Burst Mode with an external PWM

The three modes are dependent on the pin connections as per Table 1. The MP1010B has a Soft-on and Soft-off feature to reduce noise, when using burst mode dimming.

Table 1—Function Mode

Function	Pin Connection		
	Pin 1	Pin 4	Pin 3
	BR	**T/B**	**BOS**
Analog Mode	0V – 1.9V	V_{REF}	AGND
Burst Mode with DC Input Voltage	V_{REF}	0V – 1.8V	R1, C1
Burst Mode from External Source	V_{REF}	PWM	1.5V

Brightness Polarity:
Burst: 100% duty cycle is at 1.8V
Analog: 1.9V is maximum brightness

Choosing the required burst repetition frequency can be achieved by an RC combination, as defined in component selection.

Chip Enable
The chip has an on/off function, which is controlled by the EN pin (#5). The enable signal goes directly to a Schmitt trigger. The chip will turn ON with an EN = High and OFF with an EN = Low.

Fault Protection
Open Lamp: The OL pin (#18) is used to detect whether an open lamp condition has occurred. During normal operation the OL pin is typically at 5V DC with an AC swing of +/- 2V. If an open lamp condition exists then the AC voltage on the OL line will swing below zero volts.

MPS CONFIDENTIAL PRELIMINARY INFORMATION – SPECIFICATIONS SUBJECT TO CHANGE

When that occurs, the IC regulates the OL voltage to 10V p-p and a 1µA current source will inject into the FT pin. If the voltage at the FT pin exceeds 1.2V, the chip will shut down.

Excessive Secondary Current: (Shorted Lamp and UL safety specs): The FB pin (#19) is used to detect whether excessive secondary current has occurred. During normal operation the FB voltage is a 1V p-p AC signal centered at zero volts D.C. If a fault condition occurs that increases the secondary current, then the voltage at FB will be greater than 1.2V. When that occurs, the IC regulates the FB voltage to 2.4V p-p and a 120µA current source will inject into the FT pin. If the voltage at the FT pin exceeds 1.2V, the chip will shut down.

Lamp Startup
The strike voltage of the lamp will always be guaranteed at any temperature because the MP1010B uses a resonant topology for switching the outputs. The device will continue to switch at the resonant frequency of the tank until the strike voltage is achieved. This eliminates the need for external ramp timing circuits to ensure startup.

Fault Timer
The timing for the fault timer will depend on the sourcing current, as described above, and the capacitor on the FT pin. The user can program the time for the voltage to rise before the chip detects a "real" fault. When a fault is triggered, then the internal drive voltage (VDR) will collapse from 6.2V to 0V. The reference voltage will stay high at 5.0V.

PACKAGE INFORMATION

TSSOP20 OR TSSOP20F (EXPOSED PAD)

NOTE:
1) Control dimension is in inches. Dimension in bracket is millimeters.
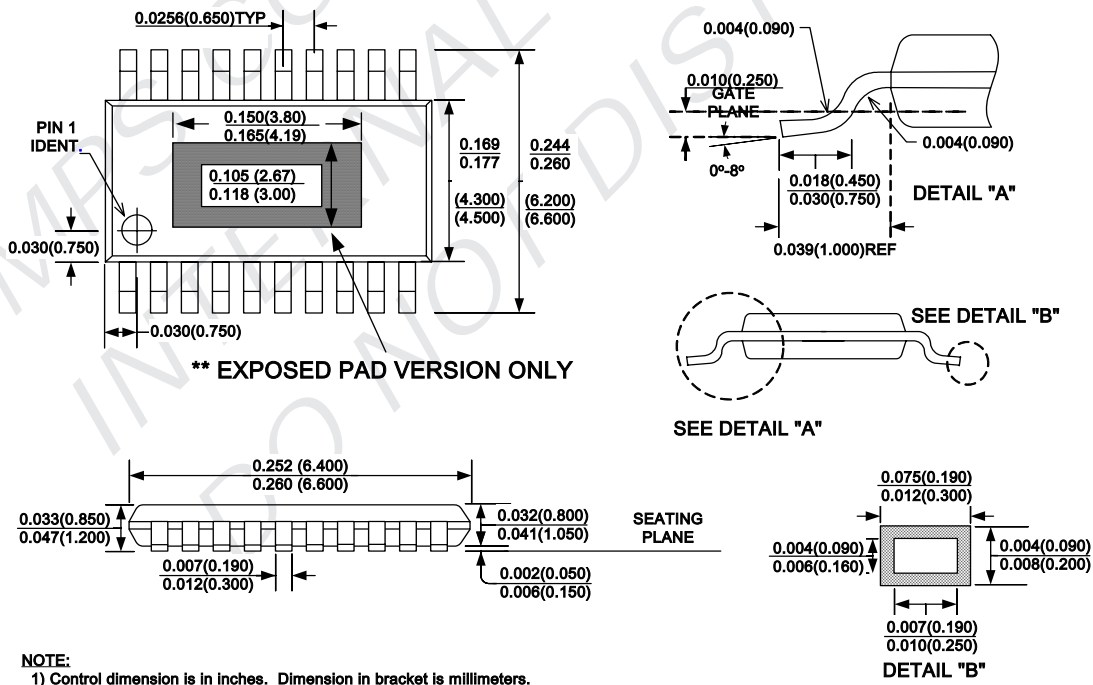
NOTICE: MPS believes the information in this document to be accurate and reliable. However, it is subject to change without notice. Contact MPS for current specifications. MPS encourages users of its products to ensure that third party Intellectual Property rights are not infringed upon when integrating MPS products into any application. MPS cannot assume any legal responsibility for any said applications.

MP1010B Rev. 1.7
10/8/04
© 2004 MPS, Inc.

Monolithic Power Systems, Inc.
983 University Avenue, Building A, Los Gatos, CA 95032 USA
Tel: 408-357-6600 ♦ Fax: 408-357-6601 ♦ www.MonolithicPower.com

5