



Cold Cathode Fluorescent Lamp Driver

General Description

The MP1011A is a Power IC offering a complete solution for driving one or more 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 patented control techniques, it greatly increases the power conversion efficiency. The MP1011A supports both analog and burst mode dimming without any additional external components. The MP1011A offers four distinct performance advantages:

1. More light for less power
2. Small board implementation
3. Low EMI emission
4. Low cost off the shelf components

Ordering Information

Part Number *	Package	Temperature
MP1011EMA	TSSOP20	-20°C to + 85°C
EV0014	Evaluation Board	

* For Tape & Reel use suffix - Z (e.g. MP1011EMA-Z)

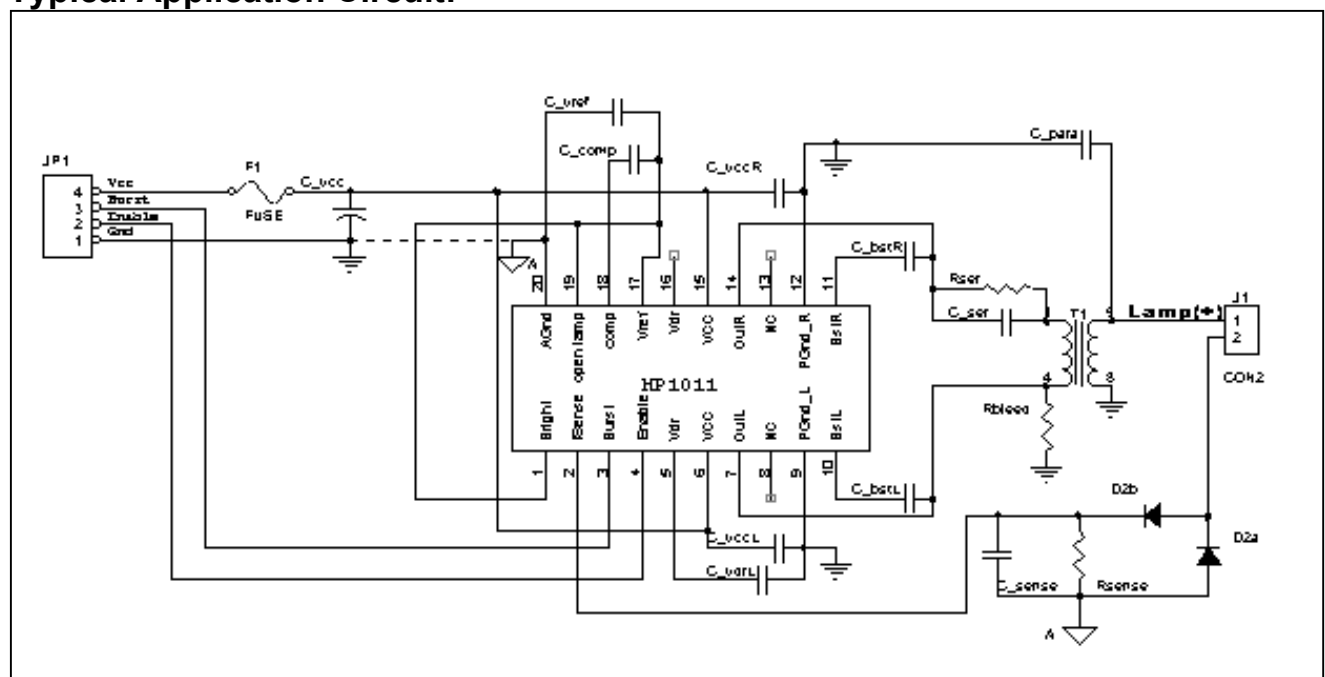
Features

- Integrated power switches
- 6.0 to 22V 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
- Thermal Shutdown
- Supports Open/Short Lamp protection
- Soft Start
- Output is short circuit protected
- Low lamp operating voltage for increasing transformer or using smaller transformer
- Allows Burst-Mode Operation
- No ballast capacitor required
- **Evaluation Board Available**

Applications

- LCD backlight inverter for large portable or desktop display.

Typical Application Circuit:



Absolute Maximum Ratings

Input Voltage V_{VCC}	25 V
Logic Inputs	-0.7V to 6.8V
Power Dissipation	1.0 W
Junction Temperature	150°C
Lead Temperature (Solder)	260°C
Operating Frequency	150KHz
Storage Temperature	-55°C to 150° C

Recommended Operating Conditions

Input Voltage V_{VCC}	6.0V to 22V
Brightness Voltage	0 to 2.0V
Enable	0 to 5.0V
Operating Frequency	20KHz to 90KHz
Operating Temperature	-20°C to + 85°C

Thermal Characteristics

Thermal resistance	140°C/W
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Electrical Characteristics (Unless otherwise specified $V_{VCC}=12V$, $T_A=25^\circ C$)

Parameters	Symbol	Condition	Min	Typ	Max	Units
Reference Voltage						
Output Voltage	V_{Vref}	$I_{Vref}=3mA$	4.85	5.1	5.35	V
Reference Current	I_{Vref}				3.0	mA
Line Regulation		$6.5V < V_{VCC} < 22V$			30	mV
Load Regulation		$0 < I_{Vref} < 3.0mA$			30	mV
Voltage Supply						
Supply Current (quiescent)	$I_{CC} (off)$				10	μA
Supply Current (operating)	$I_{CC} (on)$	$6.0V < V_{VCC} < 22V$		1.8	2.5	mA
Operating Range	V_{VCC}	(Note 2)	6.0		22	V
Shutdown Logic						
Thermal Shutdown				145		°C
Open Lamp Detect	V_{OL}		1.0	1.2	1.4	V
Enable Voltage Low	V_{IL}				0.6	V
Enable Voltage High	V_{IH}		2.0			V
Burst Voltage Low	V_{IL}				0.8	V
Burst Voltage High	V_{IH}		2.4			V
Output Drivers						
On Resistance	R_{ON}	(Note 1)	0.10	0.12	0.15	Ω
Short Circuit Current	I_{SC}			4		A
Operating Frequency			20	60	90	KHz
Zero-Crossing Voltage	V_{ZC}		0	6	10	mV
Ton(min)		$V_{Comp}=0V$, $V_{VCC} = 22V$	500	625	750	nS
Ton(min)		$V_{Comp}=0V$, $V_{VCC} = 6V$	900	1200	1500	nS
Brightness Control						
Sense Full Brightness	V_{Sense}	$V_{Bright} = 2.0V$	357	375	393	mV
Sense Full Dim	V_{Sense}	$V_{Bright} = 0V$	83	92	101	mV
Lamp Current Regulation		$6.0V < V_{VCC} < 22V$		2	5	%

Note 1: This parameter is guaranteed by design.

Note 2: See Leakage Inductance Guide lines for Minimum Operating Voltage (Table 2).

Table 1: Pin Description

Pin #	Pin Name	Pin Function
1	Bright	Dimming Control: 0 volts is full Dim and 2V is full brightness
2	I sense	Lamp current feedback sense input.
3	Burst	To use for burst mode, the pin is switched between 0V and 5V When not using burst mode, then pin must be tied to ground.
4	Enable	The enable will turn the chip on/off. Do not float this pin.
5	Vdr	Internally generated MOSFET gate drive supply voltage
6	Vcc	Power Supply input
7	OutL	Output to Load (tank circuit)
8	NC	No Connect
9	PGND	Power Ground
10	BstL	Regulated output voltage for boost cap on phase L
11	BstR	Regulated output voltage for boost cap on phase R
12	PGND	Power Ground
13	NC	No Connect
14	OutR	Output to Load (tank circuit)
15	Vcc	Power Supply input
16	Vdr	Internally connected to Vdr (pin 5). This pin must be left open.
17	Vref	Reference voltage output
18	Comp	Loop compensation cap
19	Open lamp	Latching shutdown for open lamp or low battery
20	AGND	Small signal ground

Figure 1: Functional Block Diagram

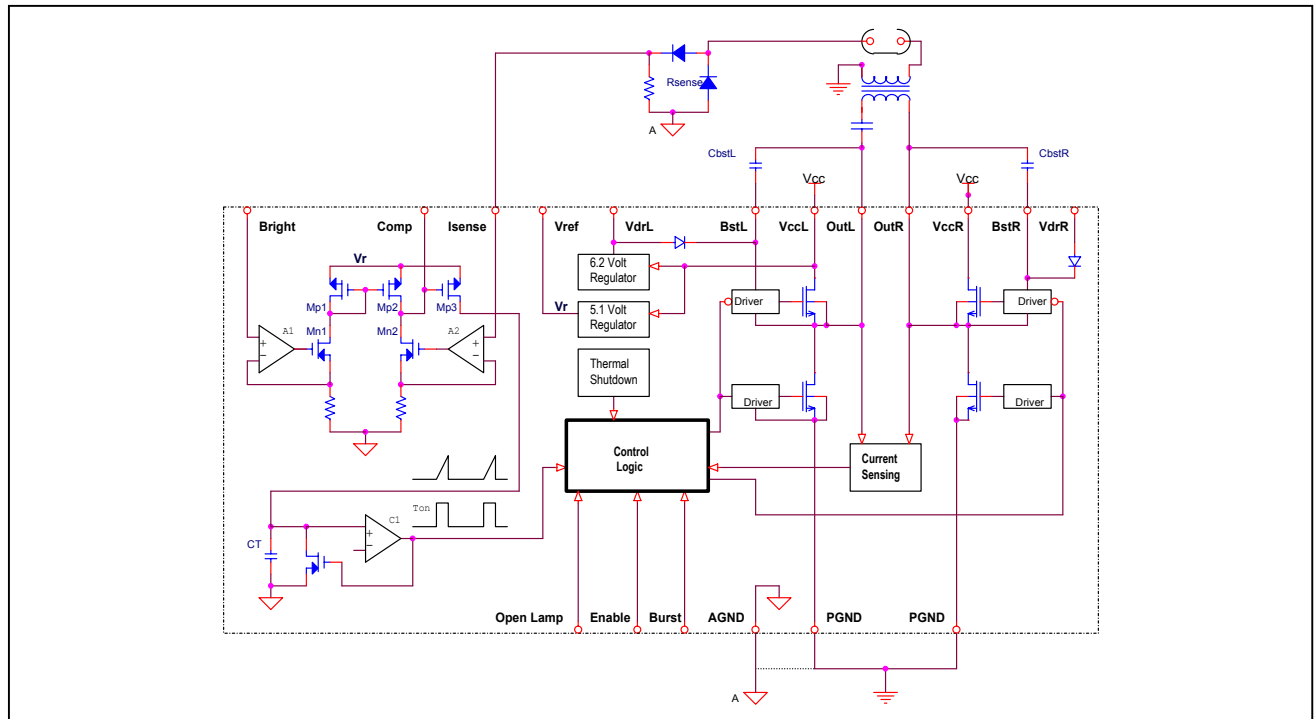
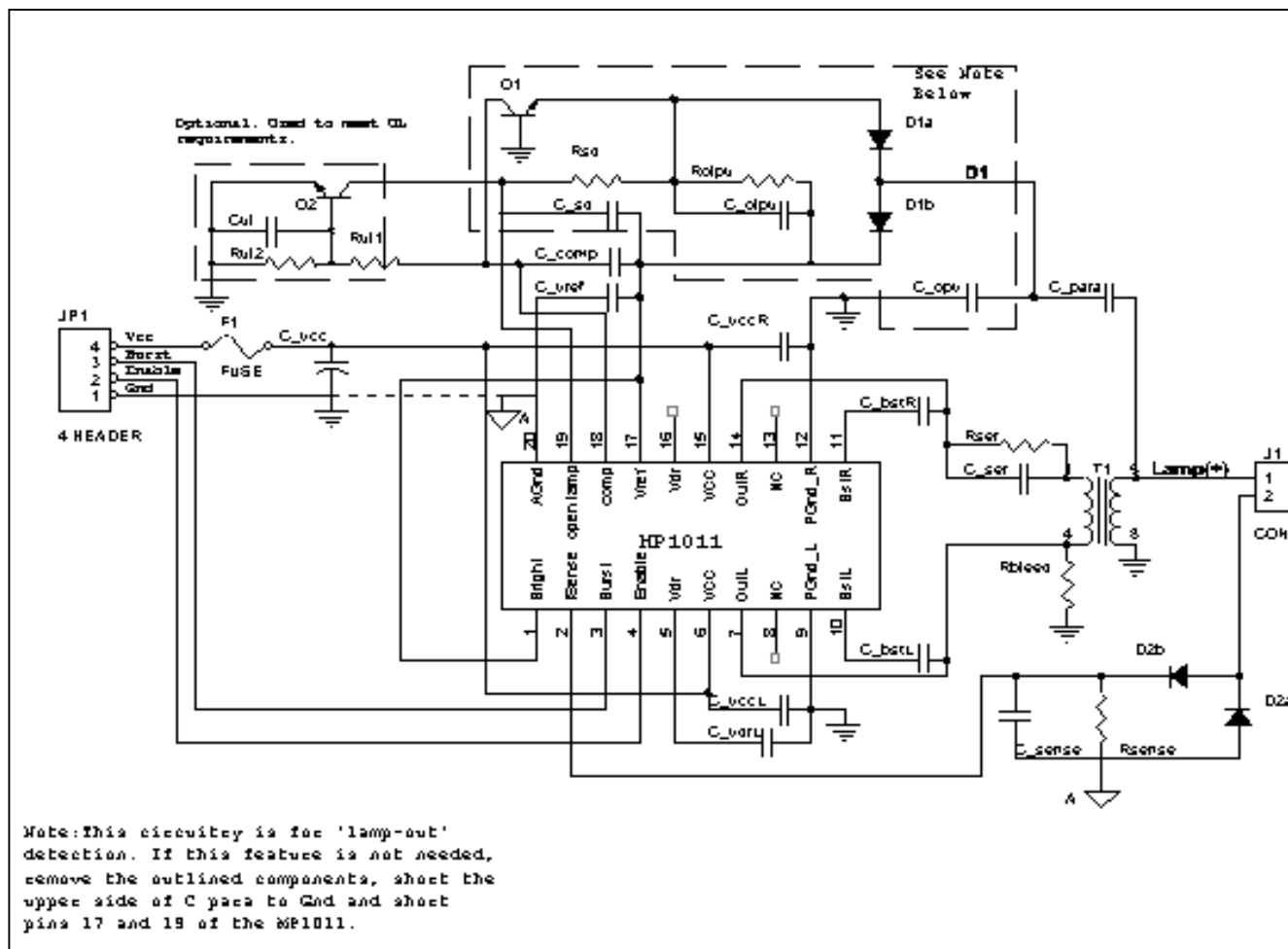


Table 2: Truth Table

Enable	Burst	Output L /Output R
L	X	High Z
H	H	0 volts (Standby)
L	X	High Z
H	L	Normal Operation

Figure 2: Reference Design for Burst Mode Operation with Open Lamp Regulation and Shutdown



For additional reference designs, please see EV0014 demo board user's guide

Table 3: Bill of Materials

Item	Qty	Description	Vendor / Part #	Designation
Resistors				
1	1	4.3K Ω , $\pm$ 5%, SMD, 0805		Rbleed
2	2	1M Ω , $\pm$ 5%, SMD, 0805		Rsd, Rolpu
3	1	140 Ω , $\pm$ 1%, SMD, 0805		Rsense
4	1	1K Ω , $\pm$ 5%, SMD, 0805		Rser
5	1	2M Ω , $\pm$ 5%, SMD, 0805	(For UL)	Rul1
6	1	280K Ω , $\pm$ 5%, SMD, 0805	(For UL)	Rul2
Capacitors				
7	2	10nF, 50V, Y5V, SMD		C_bstL, C_bstR
8	2	10nF, 16V, X7R, SMD		C_olpu, C_comp
9	1	1 μ F 6.3V X7R		C_sd
10	1	6.8nF 16V X7R		C_opv
11	1	10pF, 3KV		C_para
12	1	0.22 μ F, 16V, Y5V, (optional)		C_sense
13	1	2X.47 μ F 16V X7R		C_ser
14	2	1 μ F 25V Y5V		C_vccR, C_vccL
15	1	10 μ F, 25V, Y5U, SMD, 1210		C_vcc
16	1	220nF, 10V Y5V, SMD		C_vdrL
17	1	0.1 μ F, 10V, X7R, SMD		C_vref
18	1	100nF, 10V, Y5Y, SMD	(for UL)	Cul
Semiconductors				
19	4	Diode, BAV99L		D1b, D1a, D2b, D2a
20	2	Transistor, bipolar, 2N3904, SMD		Q1, Q2
Integrated Circuits				
21	1	MP1011EMAA, TSSOP20	Monolithic Power Systems	U2
Magnetics				
22	1	Transformer (see Table 4)		T1
Hardware				
23	1	Fuse, 1A		F1

Table 4: Transformer Sources:

Company	Part #	Location	Contact Info
Toko	BLC103B	Saitama-Ken, Japan	www.toko.co.jp / +81-492-7916
Darfon Electronics Corp.	Contact Vendor	Taoyuan 333, Taiwan	+886-3-329-4141
FDK	CD-T-0836-520	Yamaguchi, Japan	www.fdk.co.jp
TMP	Contact Vendor	Taipei, Taiwan	+886-2-8667-2081
Sumida Electric 3302	CIUH8D43	Tokyo, Japan	www.sumida.com / +81-03-3667-

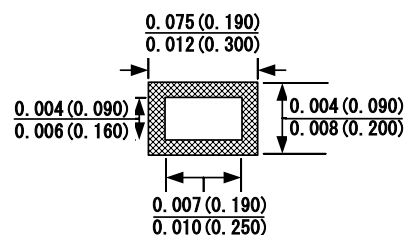
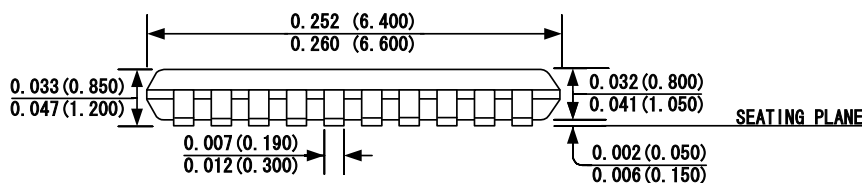
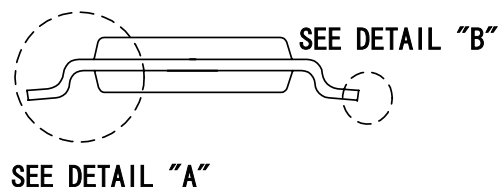
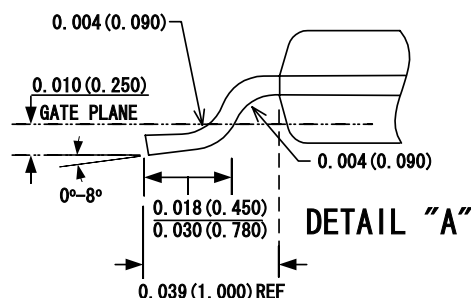
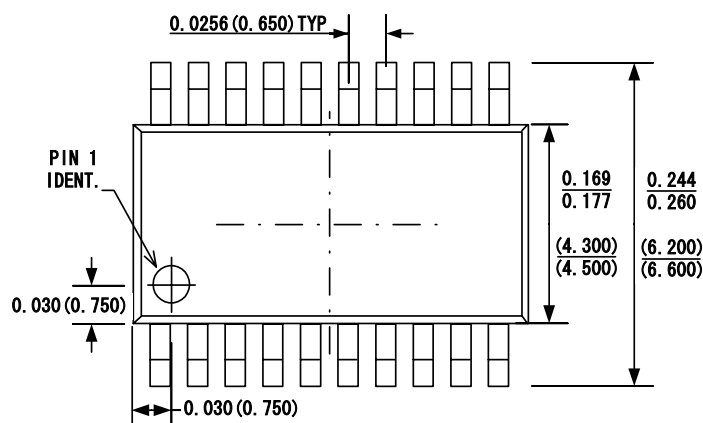
Table 5: Leakage Inductance Guide Lines for Minimum Operating Voltage

Minimum Operating Supply Voltage	Recommended Maximum Primary Leakage Inductance*
6	38 μ H
7	40 μ H
8	42 μ H
9	44 μ H
10	47 μ H

* If the maximum primary leakage cannot be met, consult factory for alternatives.

Packaging Information

20 Pin TSSOP



NOTE:

1) Control dimension is in inches. Dimension in blanket is millimeters.

NOTICE: MPS believes the information in this document to be accurate and reliable. However, it is subject to change without notice. Please contact the factory for current specifications. No responsibility is assumed by MPS for its use or fit to any application, nor for infringement of patent or other rights of third parties.