



FULLY PROTECTION BALLAST CONTROLLER

GENERAL DESCRIPTION

The M8145 is a fully integrated, fully protected ballast control IC designed to drive all types of fluorescent lamps. The M8145 features include programmable preheat and run frequencies, programmable preheat time, programmable dead-time, programmable over-current protection, and programmable end-of-life protection. Comprehensive protection features such as protection from failure of a lamp to strike, filament failures, end-of-life protection, DC bus under voltage reset as well as an automatic restart function, have been included in the design.

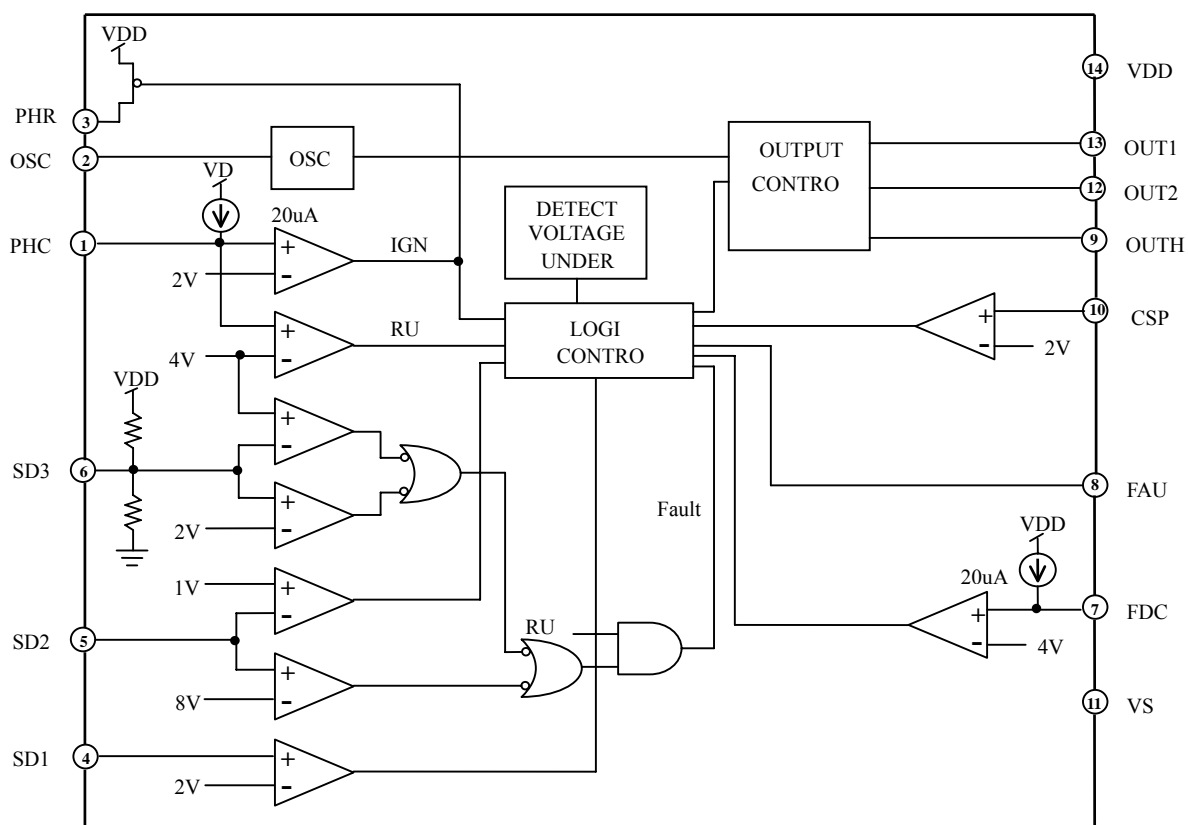
FEATURES

- Programmable preheat frequency.
- Programmable preheat time.
- Programmable over-current protection.
- Programmable run frequency.
- Programmable dead time.
- Lamp ignition fault protection.
- Lamp Leakage Protection.
- Lamp filament sensing & protection.
- Lamp end-of-life detect.
- Rectification effect protection.
- Auto Restart function.
- Under-voltage detect.
- DIP-14 or SOP-16.

APPLICATIONS

- Electronic ballast control.

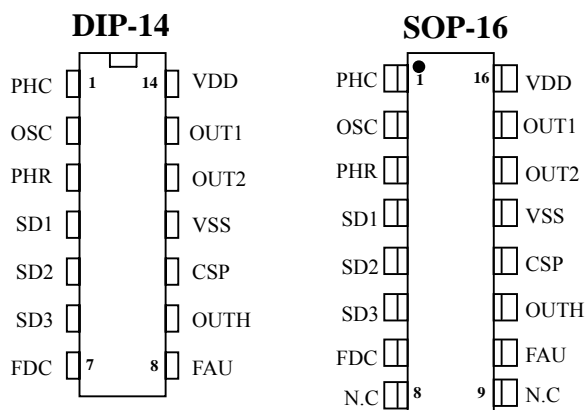
FUNCTIONAL BLOCK DIAGRAM





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PIN ASSIGNMENT



PIN DESCRIPTION

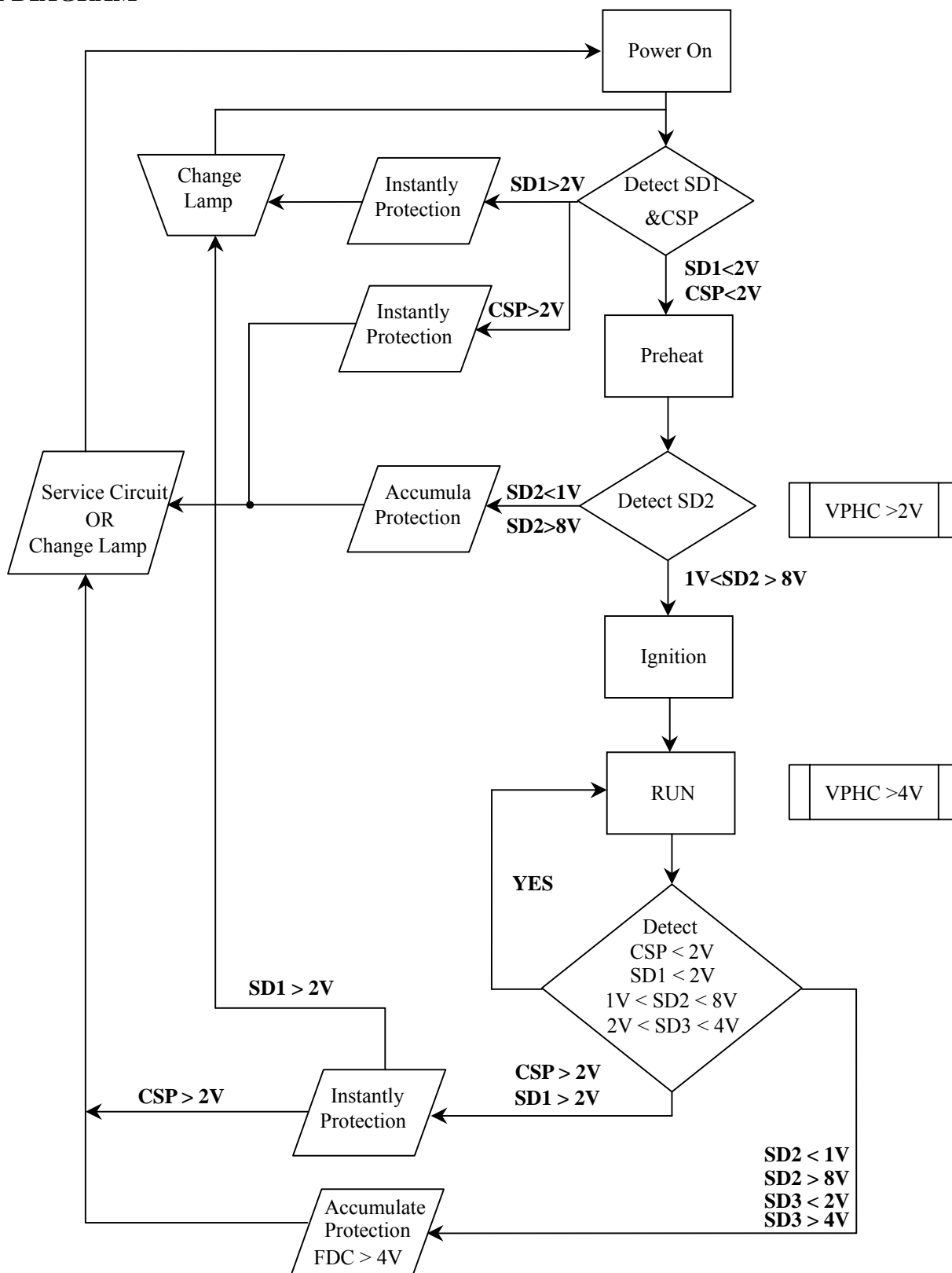
Pin No.		Pin Name	Description
DIP14	SOP16		
1	1	PHC	Preheat timing capacitor
2	2	OSC	Oscillator timing capacitor
3	3	PHR	Preheat frequency timing resistor
4	4	SD1	Shutdown input 1 ; open-lamp protection
5	5	SD2	Shutdown input 2 ; open-lamp protection & Lamp Leakage /Rectification effect/ End of Lamp Life Protection
6	6	SD3	Shutdown input 3 ;Lamp Leakage / Rectification effect / End of Lamp Life Protection
7	7	FDC	Fault signal accumulate input
	8	N.C	No connected
	9	N.C	No connected
8	10	FAU	Lamp ignition fault detect input
9	11	OUTH	To driving high side driver .
10	12	CSP	Current sensor input
11	13	VSS	The ground potential of all the pins.
12	14	OUT2	The output of a high-current power driver capable of driving the gate of a power MOSFET
13	15	OUT1	The output of a high-current power driver capable of driving the gate of a power MOSFET.
14	16	VDD	The logic and control power supply connection.



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STAGE DIAGRAM





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ELECTRICAL CHARACTERISTICS

VCC = 12V +/- 0.25V , RT = 43K , RPHR = 43K , CT = 270 pF , VPHC = 0.0V , TA = 25°C unless otherwise specified.

Symbol	Definition	Min.	Typ.	Max.	Units	Test Conditions
Oscillator, Ballast Control, I/O Characteristics						
Fosc	Oscillator frequency	41	42	43	KHz	RT=43K, RPHR = 43K CT = 270pF (see Figure1)
D	Oscillator duty cycle	—	50	—	%	
VCTFLT	Fault-mode CT pin voltage	—	0	—	mV	
Fss	Soft start frequency	75	80	85	KHz	VDD=12V, RT=43K
Preheat Characteristics						
IPHC	PHC pin charging current	15	20	25	μA	VPHC=10V, CT =10V
VPHCFLT	Fault-mode PHC pin voltage	—	0	—	mV	
Output Characteristics						
Tr	Rising time (note)	—	100	—	ns	Load = 2000pF
Tf	Falling time (note)	—	100	—	ns	Load = 2000pF
IOMAX	Maximum allowable output current (OUT1,OUT2)	—	200	—	mA	VDD=12V
UNDER VOLTAGE LOCK OUT Characteristics						
VTH(st)	Upper threshold voltage	8	—	10	V	Ta = 25°C
HY(st)	Hysteresis	—	2	—	V	Ta = 25°C



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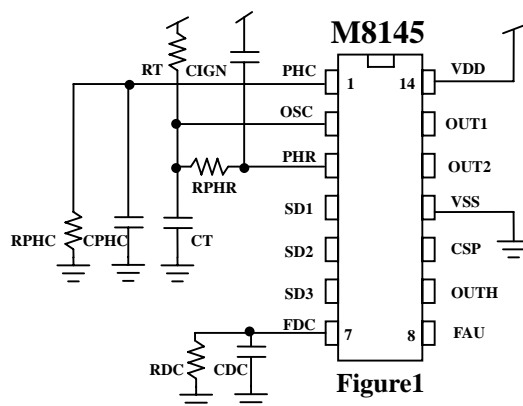
FUNCTIONAL DESCRIPTION

Under-voltage Lock-Out Mode (UVLO)

The under-voltage lock-out mode (UVLO) is defined as the state the IC is in when VDD is below the turn-on threshold of the IC. The M8145 under voltage lock-out is designed to maintain an ultra low supply current of less than 200uA, and to guarantee the IC is fully functional before the output drivers are activated.

Preheat Mode (PH)

The preheat mode is defined as the state the IC is in when the lamp filaments are being heated to their correct emission temperature. This is necessary for maximizing lamp life and reducing the required ignition voltage. The M8145 enters preheat mode when VDD exceeds the UVLO positive-going threshold. OUT1 and OUT2 begin to oscillate at the preheat frequency with 50% duty cycle, and with a dead-time which is set by the value of the external timing capacitor, C_T , and internal dead-time resistor, preheat frequency which is set by the value of the external R_{PHC} & C_{PHC} (see Figure1)



Ignition Mode (IGN)

The ignition mode is defined as the state the IC is in when a high voltage is being established across the lamp necessary for igniting the lamp. The M8145 enters ignition mode when the voltage on pin#1(PHC) exceeds 2V. The operating frequency to ramp smoothly from the preheat frequency, through the ignition frequency, to the final run frequency. The ignition mode oscillating frequency is determined by the timing resistor R_T and timing capacitor C_{IGN} (see Figure1)

Run Mode (RUN)

Once the lamp has successfully ignited, the ballast enters run mode. The run mode is defined as the state the IC is in when the lamp arc is established and the lamp is being driven to a given power level. The run mode oscillating frequency is determined by the timing resistor R_T and timing capacitor C_T (see Figure1). Should hard-switching occur at the half-bridge at any time due to an open-filament or lamp removal, the voltage across the current sensing resistor, R_{DC} (see Figure1), will exceed the internal threshold of 4.0 volts and the IC will enter FAULT mode and gate driver outputs OUT1, OUT2 and PFC IC will be latched low.



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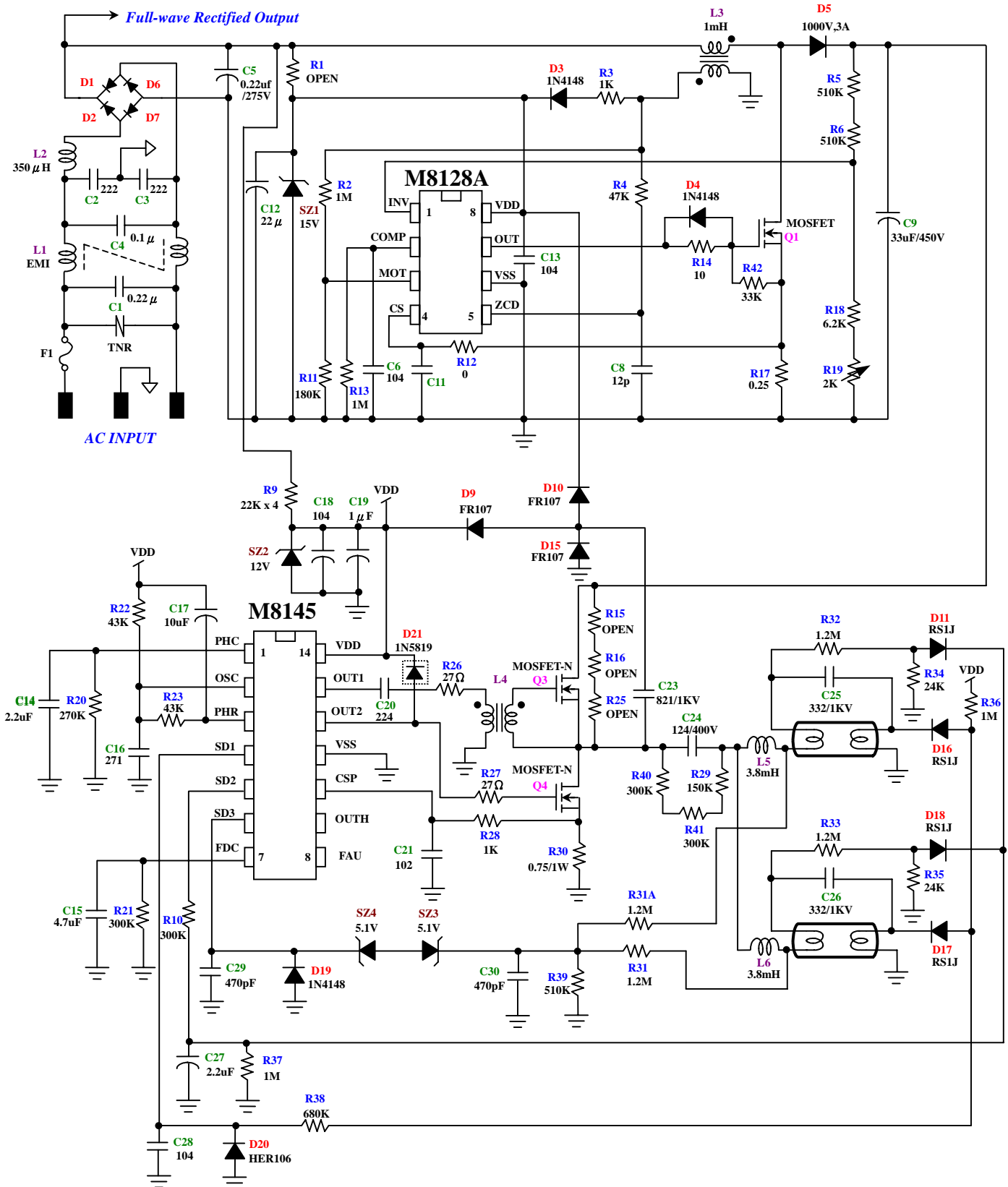
Fault Mode (FAULT)

Should the voltage at the Pin#4 (SD1), exceed 2.0 volts at any time after the preheat mode, the voltage at the Pin#5(SD2) below 2.0 volts at any time after the ignition mode, the voltage at the Pin#6(SD3) exceed 4 volts or decrease below 2 volts and SD2 exceed 8.0 volts or below 1.0 volts or SD1 exceed 2 volts during RUN mode, IC enters fault mode and both OUT1 and OUT2 driver outputs are latched in the 'low' state. is discharged to VSS for resetting the preheat time, and Pin#2 (OSC) is discharged to VSS for disabling the oscillator. To exit fault mode, VDD must be recycled back below the UVLO negative going turn-off threshold, or, the Pin#4 (SD1), must be pulled above 2.0 volts. Either of these will force the IC to enter UVLO mode. Once VDD is above UVLO the turn on threshold and SD1 is below 2.0 volts, the IC will begin oscillating again in the preheat mode. These over-currents must occur during the on-time of LO. During run mode, a single pulse on the CSP pin above 2.0 volts will force the IC to enter FAULT mode.



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APPLICATION DIAGRAM (85~265V V_{AC} Input , 400V_{DC}, 28W X2 T5 Lamps Ballast)





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COMPONENT LISTING

Designator	Value	Description	Quantity
C1, C5	0.22uF	BOX Capacitor, POLYPROPYLENE FILM Capacitor	2
C4	0.1uF	BOX Capacitor, POLYPROPYLENE FILM Capacitor	1
C2, C3	222	Y Capacitor	2
C8	12pF	Ceramic Capacitor	1
C9	33u/450V	Electrolytic Capacitor	1
C11	OPEN	Ceramic Capacitor	1
C12	22uF	Electrolytic Capacitor	1
C6, C13, C18, C28	104	Ceramic Capacitor	4
C15	4.7uF	Electrolytic Capacitor	1
C14, C27	2.2uF	Electrolytic Capacitor	2
C19	1uF	Electrolytic Capacitor	1
C16	271	Ceramic Capacitor	1
C17	10uF	Electrolytic Capacitor	1
C20	224	Ceramic Capacitor	1
C21	102	Ceramic Capacitor	1
C23	821/1KV	POLYPROPYLENE FILM Capacitor	1
C24	124/400V	POLYPROPYLENE FILM Capacitor	1
C25, C26	332/1KV	POLYPROPYLENE FILM Capacitor	2
C29, C30	470pF	Ceramic Capacitor	2
CNR1	10D511K	Varistor	1
D1, D2, D6, D7	1N4007	Diode 1000V, 1A	4
D3, D4, D11, D18, D19	1N4148	Diode 75V,1A	7
D5	HER306	Diode HIGH EFFICIENCY RECTIFIERS 600V, 3A	1
D9, D10, D15	FR107	Diode FAST RECOVERY RECTIFIER 700V,1A	3
D16, D17	S1M	Diode FAST RECOVERY RECTIFIER 700V,1A	2
D20	HER106	Diode HIGH EFFICIENCY RECTIFIERS 600V, 1A	1
D21	1N5819	1 Amp General Purpose Rectifier	1
F1	3.15A/250V	Fuse	1
L1		EE19 Inductor	1
L2	350uH	DR1012 Inductor	1
L3	1mH	EE25 Inductor	1
L4	40T:80T	EE08 Inductor	1
L5, L6	3.8mH	EE25 Inductor	2



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Designator	Value	Description	Quantity
Q1	2SK2996	Transistor, MOSFET 600V, 10A	1
Q3, Q4	2SK2628	Transistor, MOSFET 600V, 6A	2
R1, R15, R16, R25	OPEN	Resistor 1/4W	4
R2, R13, R36, R37	1M	Resistor 1/4W	4
R3, R28	1K	Resistor 1/4W	2
R4	47K	Resistor 1/4W	1
R5, R6, R39	510K	Resistor 1/4W	3
R9	22K x 4	Resistor 1/4W	4
R10, R21, R40, R41	300K	Resistor 1/4W	4
R11	180K	Resistor 1/4W	1
R12	0	Resistor 1/4W	1
R14, R26, R27	10Ω	Resistor 1/4W	3
R17	0.25/1W	Resistor 1W	1
R18	6.2K	Resistor 1/4W	1
R19	VR2K	VR Resistor	1
R20	270K	Resistor 1/4W	1
R22 , R23	43K	Resistor 1/4W	2
R42	33K	Resistor 1/4W	1
R29	150K	Resistor 1/4W	1
R30	0.75/1W	Resistor 1W	1
R31, R31A, R32, R33,	1.2MEG	Resistor 1/4W	4
R34, R35	24K	Resistor 1/4W	2
R38	680K	Resistor 1/4W	1
SZ1	15V	Zener Diode 1/2W	1
SZ2	12V	Zener Diode 1/2W	1
SZ3, SZ4	5.1V	Zener Diode 1/4W	2
U1	M8128A	IC, Power Factor Controller	1
U2	M8145	IC, Ballast Driver	1

* All specs and applications shown above subject to change without prior notice.