

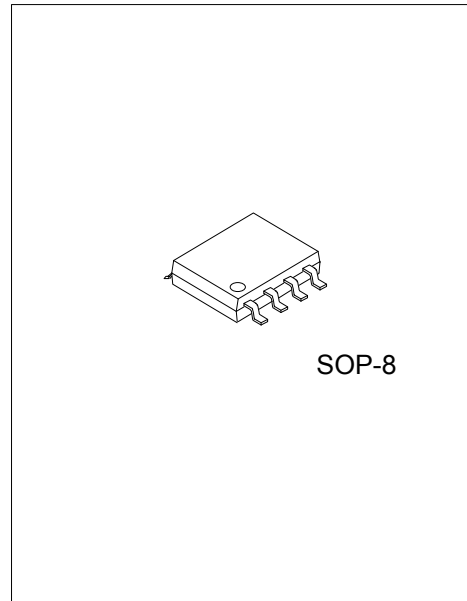


## UL13A

Preliminary

CMOS IC

### PRIMARY SIDE CONTROL CONSTANT CURRENT POWER SWITCH



#### DESCRIPTION

The **UL13A** is a high performance primary-side controller for low power AC/DC off-line applications. It can provide accurate constant current regulation without the need of an opto-coupler or reference device.

Built-in safe operation circuitry is provided such as cycle-by-cycle current limit, output short-circuit/open-circuit protection and soft start.

#### FEATURES

- \*Primary-side Control No Opto -Coupler And TL431 Needed
- \*Application Voltage Range:90Vac~264Vac
- \*Internal Integration 730V Power MOSFET
- \*Accurate Constant-Current(CC) Control , Output Current in  $\pm 5\%$
- \*Lowest Component Number Needed
- \* Internal LEB
- \* Open/Short-LED Protection
- \*V<sub>DD</sub> Over-Voltage Protection (OVP)
- \*V<sub>DD</sub> Under-Voltage Lockout (UVLO)

#### APPLICATIONS

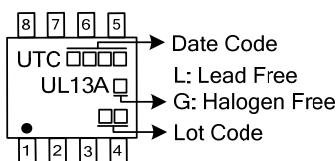
- \* LED Lighting System

#### ORDERING INFORMATION

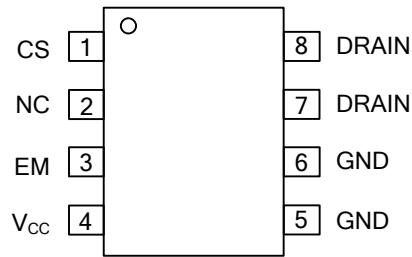
Ordering Number		Package	Packing
Lead Free	Halogen Free		
UL13AL-S08-R	UL13AG-S08-R	SOP-8	Tape Reel

<p>UL13AG-S08-R</p> <ul style="list-style-type: none"> <li>(1) Packing Type</li> <li>(2) Package Type</li> <li>(3) Green Package</li> </ul>	<ul style="list-style-type: none"> <li>(1) R: Tape Reel</li> <li>(2) S08: SOP-8</li> <li>(3) G: Halogen Free and Lead Free, L: Lead Free</li> </ul>
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#### MARKING



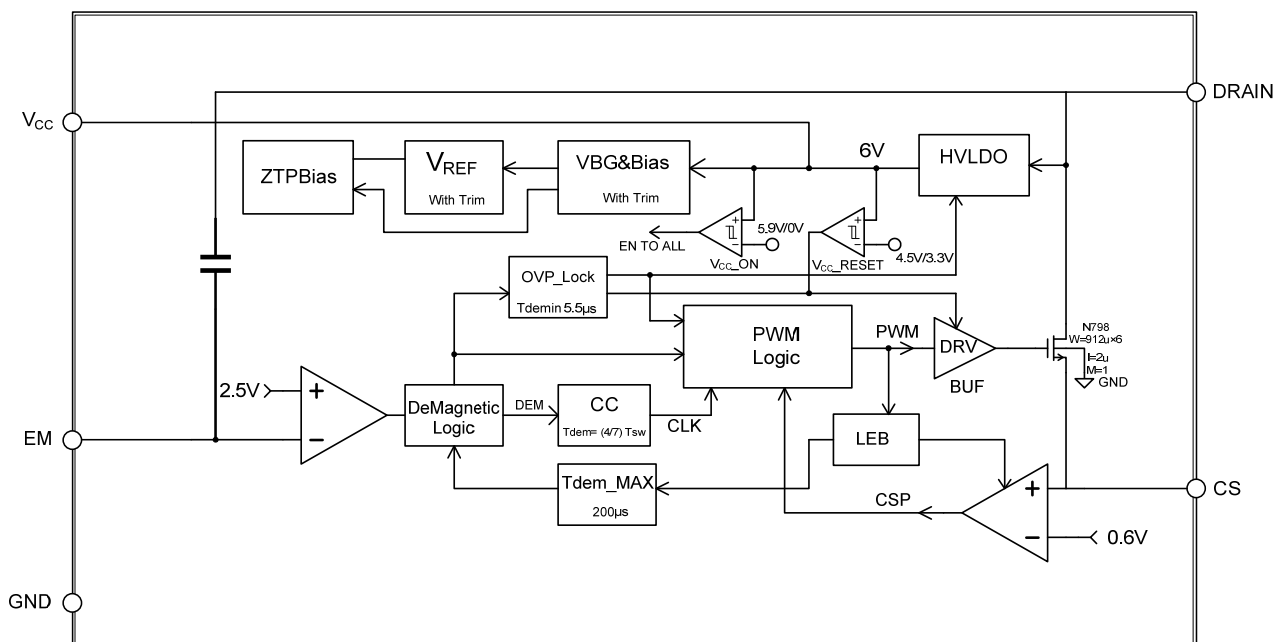
### ■ PIN CONFIGURATION



### ■ PIN DESCRIPTION

PIN NO	PIN Name	DESCRIPTION
1	CS	Primary side peak current sense
2	NC	No connection
3	EM	Improve signal sense
4	V <sub>CC</sub>	Power supply
5, 6	GND	Ground
7, 8	DRAIN	Power MOS drain side

### ■ BLOCK DIAGRAM



### ■ ABSOLUTE MAXIMUM RATING

PARAMETER	SYMBOL	RATINGS	UNIT
V <sub>CC</sub> to GND Voltage	V <sub>CC</sub>	-0.3 ~ 6	V
EM to GND Voltage	V <sub>EM</sub>	-0.3 ~ 6	V
CS to GND Voltage	V <sub>SC</sub>	-0.3 ~ 7	V
Drain to GND Voltage	V <sub>DRAIN</sub>	-0.3 ~ 730	V
Junction Temperature	T <sub>J</sub>	+150	°C
Operating Temperature	T <sub>OPR</sub>	-20 ~ +125	°C
Storage Temperature	T <sub>STG</sub>	-55 ~ +150	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

### ■ THERMAL CHARACTERISTICS

PARAMETER	SYMBOL	RATINGS	UNIT
Junction to Ambient	θ <sub>JA</sub>	100	°C/W

### ■ ELECTRICAL CHARACTERISTICS (V<sub>CC</sub>=6V, T<sub>A</sub> = 25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Supply current	I <sub>CC</sub>	I <sub>OUT</sub> = 10mA		-250		uA
Internal power supply Voltage	V <sub>CC</sub>			6		V
Current Sense threshold Voltage	V <sub>CS</sub>			620		mV
Leading edge blank time	T <sub>LEB</sub>			450		ns
Minus demagnetize Time	T <sub>DEM MIN</sub>			5		uS
Maximum duty cycle	D <sub>MAX</sub>			42		%
Power MOS on resistance	R <sub>DS(ON)</sub>			30		Ω
Power MOS drain to source break Down Voltage	B <sub>VD_SS</sub>			730		V
V <sub>CC</sub> under voltage lock out Voltage	V <sub>UVLO</sub>			4		V
Maximum demagnetize Time	T <sub>DEM(MAX)</sub>			150		us

## ■ FUNCTIONAL DESCRIPTION

The **UL13A** is a precision AC-DC PWM controller for offline constant current LED lighting. Application voltage range is 90Vac ~ 264Vac. It can provide accurate constant current regulation (<math>\pm 5\%</math>) through primary-side control, with intergrated 730V Power MOSFET and without the need of an opto-coupler and TL431.

Built-in safe operation circuitry is provided such as cycle-by-cycle current limit, output short-circuit/open-circuit protection and soft start.

### Start Up and Control

There is a high voltage JFET in **UL13A**. After system powered up, the JFET is opened, Internal  $V_{CC}$  is charged up. When the  $V_{CC}$  pin voltage reaches the turn on threshold, the internal circuits start working. Then the **UL13A** starts the MOSFET driver.

**UL13A** works under Discontinuous Conduction Mode (DCM). The output current is controlled by the response Voltage of primary side.

$$I_O = 2/7 \times N \times I_P$$

$I_O$ : output current,  $N$ : transformer circle ratio,  $I_P$ : primary side peak current

### Work frequency

The switch frequency is controlled by the load. No external component needed. Under the DCM, the maximum output power is :

$$P_O = 1/2 \times L_P \times F_{SW} \times I_P^2$$

$$F_{SW} = \frac{4}{7 \times T_{DEMAG}}$$

$I_P$ : primary side peak current

$L_P$ : primary side inductance value

$F_{SW}$ : Work frequency

$P_O$ : output power

$T_{DEMAG}$ : demagnetize time

### Current detection and LEB

The inductor current is sensed through sensing resistor connected to CS pin, thus achieves high precision output current control, excellent line and load regulation and cycle-by-cycle current limit. The peak current of Power MOSFET can be calculated by the equation:

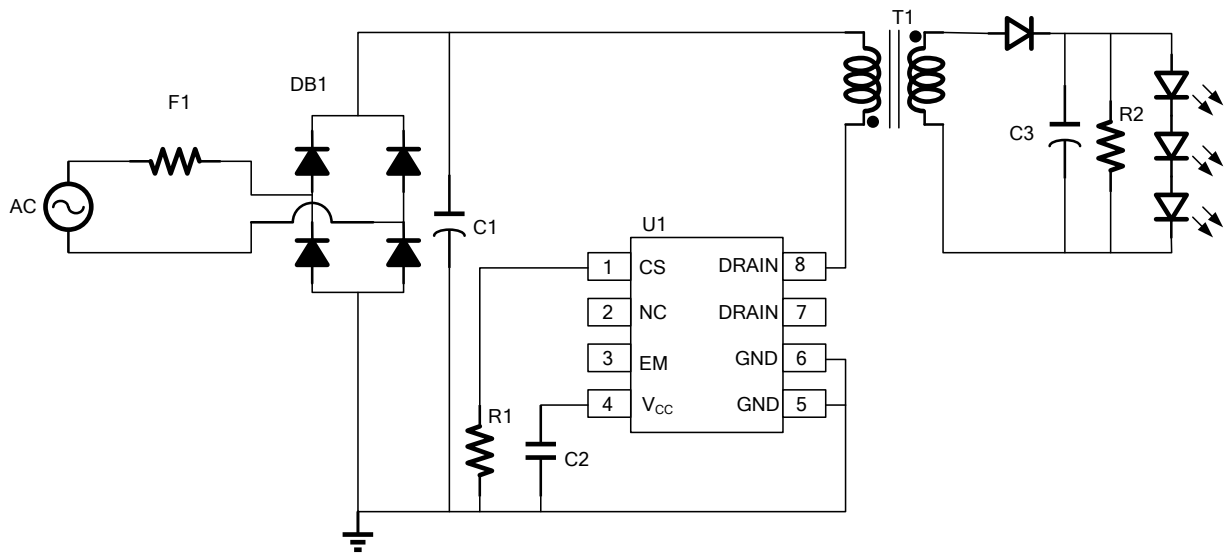
$$I_P \approx \frac{V_{REF}}{R_{CS}}$$

$V_{REF}$ : Internal reference voltage, typically 0.6V

$R_{CS}$ : The current sensing resistor value

Internal LEB (Leading edge blank) circuit. remove interference of the peak current at powering-on moment.

■ TYPICAL APPLICATION CIRCUIT



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