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## 2A Buck (Step-down) WLED Driver

### DESCRIPTION

The TS19378 is a high voltage step-down converter designed for driving up to 10 series white LEDs from a 40V system input. The total LED driving current up to 2A, which is measured through an external current sense resistor. Its low 200mV feedback voltage reduces power loss and improves efficiency. The OVP pin monitors the output voltage and turns off the converter if an over-voltage condition is present due to an open circuit condition. The TS19378 includes current limit, short circuit protection and thermal shutdown protection preventing damage.

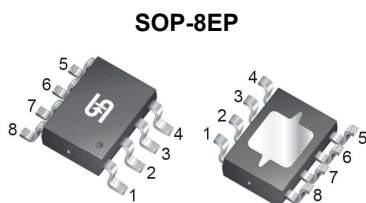
TS19378 provides high power, high efficiency, and excellent transient characteristics. The PWM control circuit is able to the duty ratio linearly from 0 up to 100%. Since this converter can accommodate an input voltage up to 40V, it is also suitable for the operation via an AC adapter.

### FEATURES

- Input Voltage Range 8V~40V
- Output voltage up to 38V
- 2A Switch Output Current
- Duty ratio: 0%~100% PWM control
- 300kHz Switching Frequency
- Enable/Disable Functions
- Soft Start Time Control
- Current limit and Thermal Shutdown
- Short Circuit Protections
- Built-in Internal SW P-CH MOSFET

### APPLICATION

- White LED Backlighting
- High Power LED Application
- Multiple LED Driving
- LED Lighting Equipment

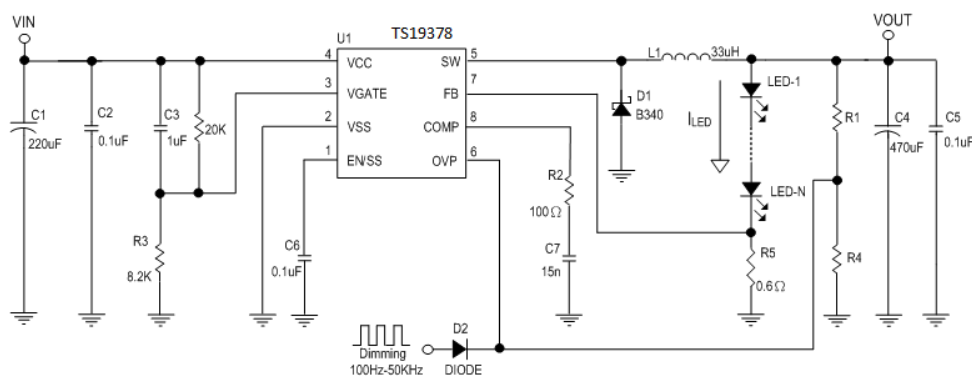


#### Pin Definition:

- |                      |                                  |
|----------------------|----------------------------------|
| 1. EN/SS             | 8. COMP                          |
| 2. GND               | 7. FB                            |
| 3. V <sub>GATE</sub> | 6. OVP                           |
| 4. V <sub>CC</sub>   | 5. SW (Connected to exposed pad) |

**Notes:** Moisture sensitivity level: level 3. Per J-STD-020

### TYPICAL APPLICATION CIRCUIT



$V_{FB} = 0.2V$   
 $I_{LED} = V_{FB}/R5$   
 $V_{OVP} (OVP) = 0.85 \times (1 + \frac{R1}{R4})$

C <sub>OUT</sub> ESR Range	R2	C7
30~80mΩ	470R	10nF
80~300mΩ	100R	15nF

<b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_A = 25^\circ\text{C}$ unless otherwise specified) <sup>(Note 1)</sup>			
PARAMETER	SYMBOL	LIMIT	UNIT
V <sub>CC</sub> Pin Voltage	V <sub>CC</sub>	V <sub>SS</sub> - 0.3 to V <sub>SS</sub> + 45	V
Feedback Pin Voltage	V <sub>FB</sub>	V <sub>SS</sub> - 0.3 to 6	V
EN/SS Pin Voltage	V <sub>EN/SS</sub>	V <sub>SS</sub> - 0.3 to 6	V
OVP Pin Voltage	V <sub>OVP</sub>	V <sub>SS</sub> - 0.3 to V <sub>CC</sub>	V
COMP Pin Voltage	V <sub>COMP</sub>	V <sub>SS</sub> - 0.3 to 6	V
VGATE Pin Voltage	V <sub>GATE</sub>	V <sub>SS</sub> - 0.3 to V <sub>CC</sub>	V
Switch Pin Voltage	V <sub>SW</sub>	V <sub>SS</sub> - 0.3 to V <sub>CC</sub> + 0.3	V
Power Dissipation	PD	Internally limited	mW
Storage Temperature Range	T <sub>ST</sub>	-65 to +150	°C
Operating Junction Temperature Range	T <sub>OJP</sub>	-40 to +125	°C
Operating Supply Voltage	V <sub>OP</sub>	8 to 40	V
Output Voltage	V <sub>OUT</sub>	38	V

<b>THERMAL PERFORMANCE</b> <sup>(Note 2)</sup>			
PARAMETER	SYMBOL	LIMIT	UNIT
Thermal Resistance from Junction to Case	R <sub>θJC</sub>	15	°C/W
Thermal Resistance from Junction to Ambient	R <sub>θJA</sub>	40	°C/W

<b>ELECTRICAL SPECIFICATIONS</b> ( $T_A = 25^\circ\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Feedback Voltage	V <sub>FB</sub>	I <sub>OUT</sub> =0.2A	0.19	0.20	0.21	V
Quiescent Current	I <sub>CCQ</sub>	V <sub>FB</sub> =0.5V force driver off	--	3	6	mA
Feedback Bias Current	I <sub>FB</sub>	I <sub>OUT</sub> =0.1A	--	0.1	0.5	μA
Shutdown Supply Current	I <sub>SD</sub>	V <sub>EN</sub> =0V	--	150	300	μA
Switch Current Limit	I <sub>SWLIMIT</sub>		2.5	--	--	A
Oscillation Frequency	f <sub>OSC</sub>		240	300	360	kHz
Short Frequency	f <sub>OSC</sub>		--	50	--	kHz
EN/SS Pin Shutdown Logic input threshold voltage	V <sub>SL</sub>	Low (regulator OFF)	--	--	0.8	V
EN/SS Pin Input Current	I <sub>EN/SS</sub>	V <sub>EN</sub> =0V	--	5	--	μA
Internal MOSFET R <sub>DS(ON)</sub>	R <sub>DS(ON)</sub>	V <sub>CC</sub> =5V, V <sub>FB</sub> =0V	--	130	180	mΩ
OVP Sense Voltage	V <sub>OVP</sub>		0.833	0.850	0.867	V
Thermal shutdown Temp	T <sub>SD</sub>		--	150	--	°C
Thermal shutdown Hysteresis	T <sub>SH</sub>		--	40	--	°C

**Note:**

- Stresses listed as the above "Absolute Maximum Ratings" may cause permanent damage to the device. These are for stress ratings. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may remain possibility to affect device reliability.
- R<sub>θJA</sub> is measured with the PCB copper area(need connect to Exposed Pad) of approximately 1.5 in<sup>2</sup>(Multi-layer).

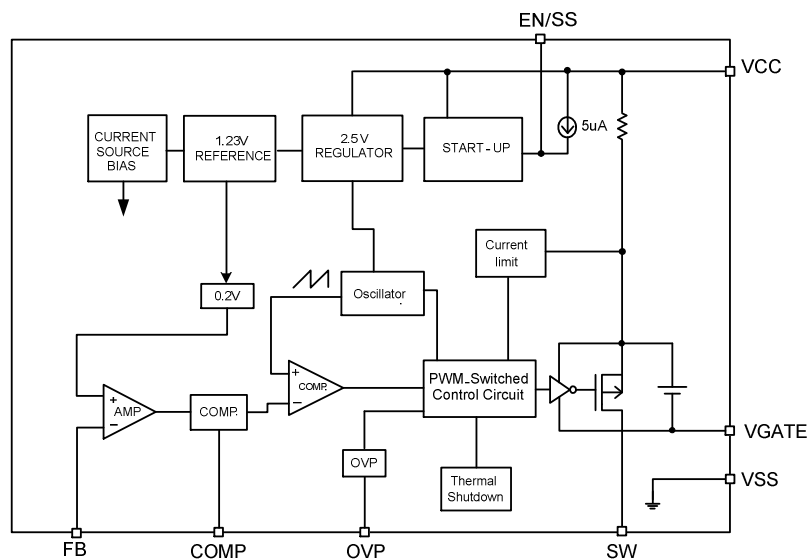
## ORDERING INFORMATION

PART NO.	PACKAGE	PACKING
TS19378CS RLG	SOP-8EP	2,500pcs / 13" Reel

**Note:**

- Compliant to RoHS Directive 2011/65/EU and in accordance to WEEE 2002/96/EC.
- Halogen-free according to IEC 61249-2-21 definition.

## FUNCTION BLOCK

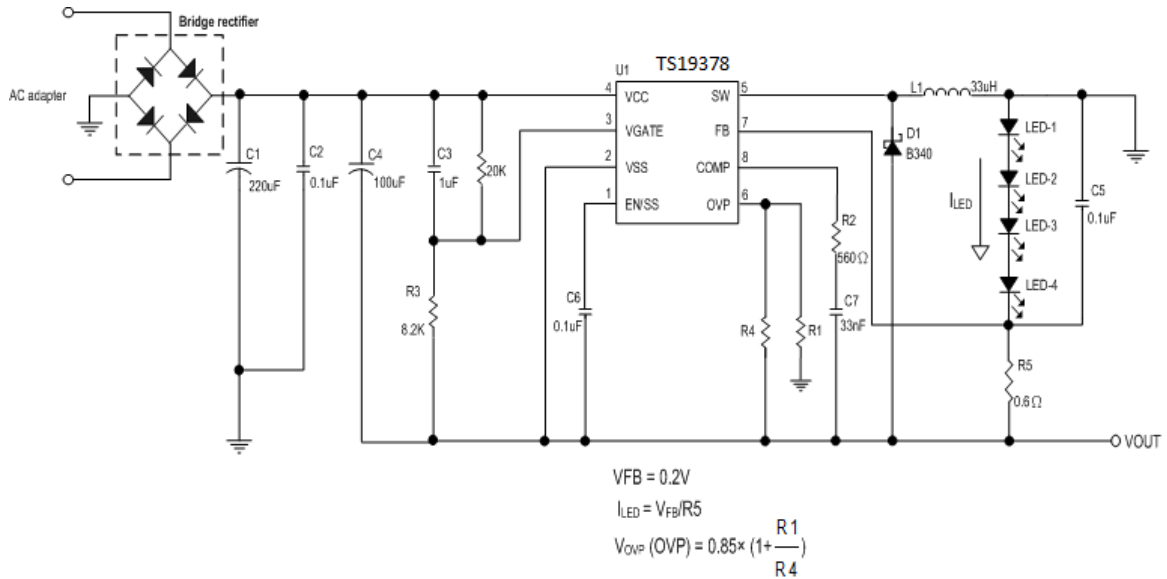


## PIN DESCRIPTION

PIN NO.	NAME	FUNCTION
1	EN/SS	EN: Output stage enable control pin. It can be left floating for normally on. SS: Supplied shutdown or soft start function.
2	GND	Ground return for all internal circuitry.
3	VGATE	Gate drive for external N-CH MOSFET.
4	V <sub>CC</sub>	Power supply pin for all internal circuitry.
5	SW	SW is the output of the internal driver switch. Connected for package exposed pad
6	OVP	Output voltage protection.
7	FB	Feedback pin. Reference voltage is $V_{FB}=0.2V$ .
8	COM	Output pin of error amplifier.

**TYPICAL APPLICATION CIRCUIT**

**AC Input Application Circuit**



$I_{LED}$	$R5$		$C1$	$L1$
350mA	0.570Ω	70mW	100μF	33μH
750mA	0.266Ω	150mW	220μF	
1000mA	0.200Ω	200mW	330μF	

**APPLICATION INFORMATION**

**PWM Control**

The TS19378 consists of DC/DC converters that employ a pulse-width modulation (PWM) system. In converters of the TS19378, the pulse width varies in a range from 0 to 100%, according to the load current. The ripple voltage produced by the switching can easily be removed through a filter because the switching frequency remains constant. Therefore, these converters provide a low-ripple power over broad ranges of input voltage and load current

**Setting ILED Current**

Application circuit item shows the basic application circuit with TS19378 adjustable output version. The external resistor sets the LED output current according to the following formula:

$$I_{LED} = (0.25V/R5), V_{FB} = 0.2V$$

Resistor select for LED output current setting

$I_{LED}$	$R2$	
350mA	0.57Ω	70mW
750mA	0.266Ω	150mW
1000mA	0.2Ω	200mW

**Current Limit**

The current limit threshold is setting by the internal circuit.

**Compensation**

In all LED driver applications. Connecting a resistor (R2) and a capacitor (C7) from COMP pin to GND. Please refer the application circuit table to design.

## **APPLICATION INFORMATION (CONTINUE)**

### **EN/SS**

This pin can be supplied shutdown or soft start function. It is inside pull high function. For normal application, the pin must be connected a capacitor to ground. There is a 5μA current to charge this capacitor, vary the different capacitor value to control soft start time. Allow the switching regulator circuit to be shutdown pulling this pin below a 0.8V threshold voltage; the shutdown supply current is approximately 150μA

### **Inductor Selection**

For most designs, the different frequency can be reducing the inductor value; The TS19378 is suggested 33μH. Where is inductor Ripple Current. Large value inductors lower ripple current and small value inductors result in high ripple currents. Choose inductor ripple current approximately 20% of the maximum load current 2A, ΔIL=0.4A. The DC current rating of the inductor should be at least equal to the maximum load current plus half the ripple current to prevent core saturation (2A+0.2A).

### **Input Capacitor Selection**

This capacitor should be located close to the IC using short leads and the voltage rating should be approximately 1.5 times the maximum input voltage. The RMS current rating requirement for the input capacitor of a buck regulator is approximately 1/2 the DC load current. A low ESR input capacitor sized for maximum RMS current must be used. A 220μF low ESR capacitor for most applications is sufficient.

### **Over Voltage Protection**

The OVP voltage is set by outside resistance (R1 and R4). The external resistor sets the OVP voltage according to the following equation:

$$V_{OUT}(OVP) = V_{OVP} \times \left(1 + \frac{R4}{R1}\right)$$

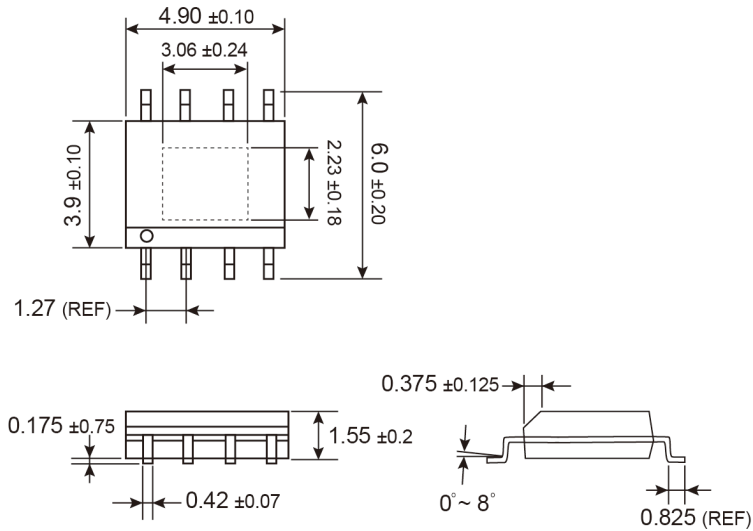
If  $V_{OVP} > 0.85V$ , The OVP is happened that to disable the driver until  $V_{OVP} < 0.85V$ .

### **Output Capacitor Selection**

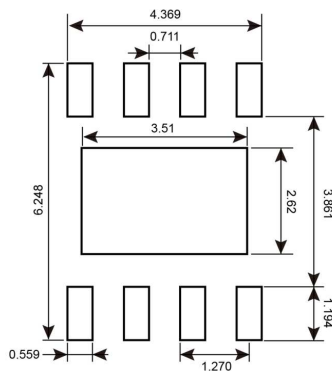
For lower output voltage ripple and more stable LED current, higher value output capacitor and low ESR is recommended. A 470μF electrolytic capacitor works for most of the applications.

**PACKAGE OUTLINE DIMENSIONS** (Unit: Millimeters)

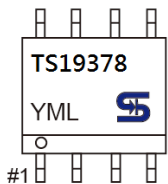
**SOP-8EP**



**SUGGESTED PAD LAYOUT** (Unit: Millimeters)



**MARKING DIAGRAM**



- Y** = Year Code
- M** = Month Code for Halogen Free Product
  - O** =Jan    **P** =Feb    **Q** =Mar    **R** =Apr
  - S** =May    **T** =Jun    **U** =Jul    **V** =Aug
  - W** =Sep    **X** =Oct    **Y** =Nov    **Z** =Dec
- L** = Lot Code (1~9, A~Z)

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