

High Voltage High Current LED Driver Controller for Boost or Buck-Boost Topology

General Description

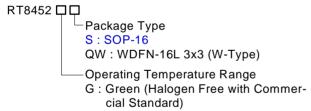
The RT8452 is a current mode PWM controller designed to drive an external MOSFET for high current LED applications. With a current sense amplifier threshold of 180mV, the LED current is programmable with one external current sense resistor and the power loss is minimized. With the maximum operating input voltage of 40V and output voltage up to 60V, the RT8452 is ideal for boost or buck-boost operation. (See RT8450 and RT8451 for buck mode LED driver application.)

With 1MHz operating frequency, the external inductor and capacitors can be small while mainteining high efficiency.

Dimming can be either analog or PWM digital. The unique built-in clampping comparator and filter allow easy low noise analog dimming conversion from PWM signal with only one external capacitor. PWM dimming control is made easy with a build in FET driver dedicated for the external dimming MOSFET.

The RT8452 is available in WQFN-16L 3x3 and SOP-16 packages.

Ordering Information



Note:

Richtek Green products are :

- RoHS compliant and compatible with the current requirements of IPC/JEDEC J-STD-020.
- }Suitable for use in SnPb or Pb-free soldering processes. }100% matte tin (Sn) plating.

Marking Information

For marking information, contact our sales representative directly or through a Richtek distributor located in your area, otherwise visit our website for detail.

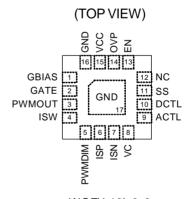
Features

- $\scriptstyle\rm I$ High Voltage Capability : V_{IN} Up to 40V, V_{OUT} Up to 60V
- Boost or Buck-Boost Operation
- Current Mode PWM with 1MHz Switching Frenquency
- Easy Dimming: Analog, PWM Digital or PWM Converting to Analog with One External Capacitor
- Programmable Soft Start to Avoid Inrush Current
- Programmable Over Voltage Protection to Limit Output Voltage
- 1 16-Lead WDFN and SOP Packages.
- RoHS Compliant and 100% Lead (Pb)-Free

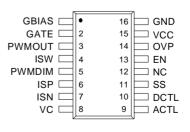
Applications

- ı General Industrial High Power LED Lighting
- ı Desk Lights and Room Lighting
- Building and Street Lighting
- ı Industrial Display Backlight

Pin Configurations



WQFN-16L 3x3



SOP-16



Typical Application Circuit

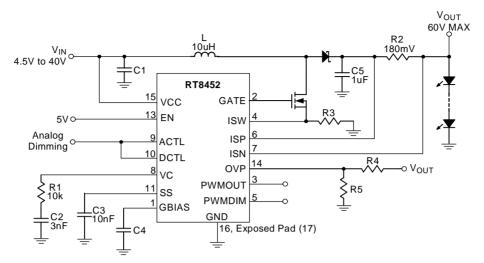


Figure 1. Analog Dimming in Boost Configuration

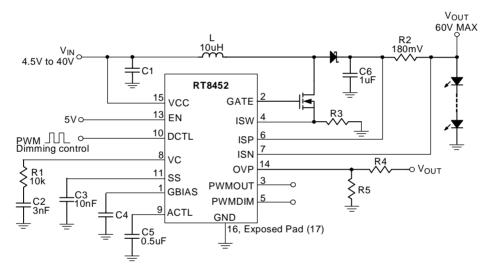


Figure 2. PWM to Analog Dimming in Boost Configuration

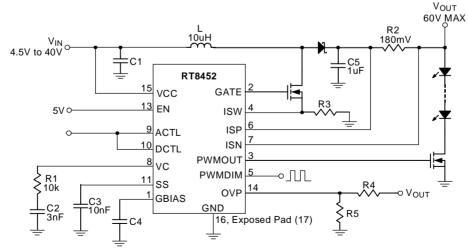


Figure 3. True PWM Dimming in Boost Configuration

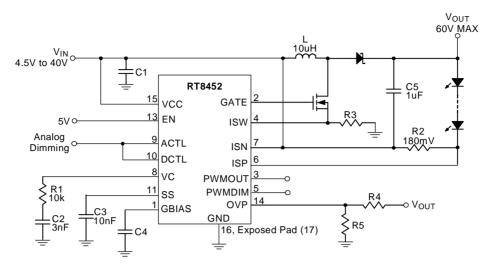


Figure 4. Analog Dimming in Buck-Boost Configuration

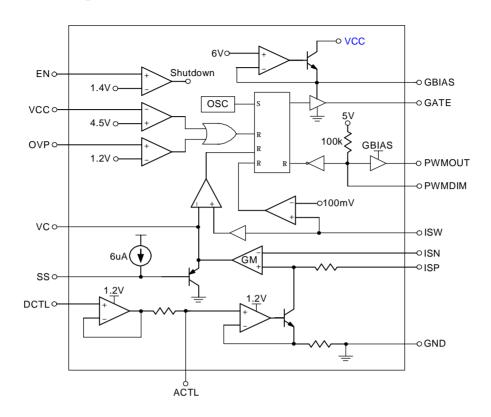
Functional Pin Description

SOP-16	QFN3X3-16	Pin Name	Pin Function	
1	1	GBIAS	The Internal Gate Driver Bias Pin.A good bypass capacitor is require	
2	2	GATE	The External MOSFET Switch Gate Driver Output Pin.	
3	3	PW MOUT	The Output Pin for the PWM Dimming FET Driver.	
4	4	ISW	The External MOSFET Switch Current Sense Pin. Connect the current sense resistor between external N-MOSFET switch and the ground.	
5	5	PWMDIM	The Control Input Pin for the PWM Dimming FET Driver.	
6	6	ISP	The LED Current Sense Amplifier Positive Input.	
7	7	ISN	The LED Current Sense Amplifier Negative Input. Voltage threshold between ISP and ISN is 180mV.	
8	8	VC	The PWM Control Loop Compensation Pin.	
9	9	ACTL	The Analog Dimming Control Pin. The effective programming voltage range of the pin is between 0.3V and 1.2V.	
10	10	DCTL	By adding a 0.1uF filtering capacitor on ACTL pin, the PWM dimming signal on DCTL pin can be averaged and converted into analog dimming signal on the ACTL pin following the formula below. VACTL = 1.2V x PWM Dimming Duty Cycle.	
11	11	SS	The Soft-Start Pin. A capacitor of at least 10nF is required for proper soft start.	
12	12	NC	No Internal Connection.	
13	13	EN	The Chip Enable (Active High) Pin. When this pin voltage is low, the chip is in shutdown mode.	
14	14	OVP	The Over Voltage Protection Pin. The PWM converter turns off when The voltage of the pin goes higher than 1.2V.	
15	15	VCC	The Power Supply Pin of the Chip. For good bypass, a low ESR Capacitor is required.	
16	16 Exposed Pad (17)	GND	The Ground Pin. The exposed pad must be soldered to a large PCB And connected to GND for maximum power dissipation.	

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Function Block Diagram



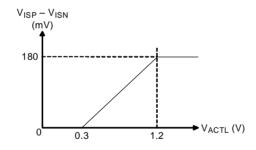


Figure 5



Absolute Maximum Ratings (Note 1)

ı Supply Input Voltage, V _{CC}	- 45V
ı GBIAS, GATE, PWMDIM, PWMOUT, ISW	- 10V
ı ISP, ISN	- 65V
ı DCTL, ACTL, OVP, EN	- 20V
Power Dissipation, P _D @ T _A = 25°C	
SOP-16	- 1.053W
WQFN-16L 3x3	- 1.471W
Package Thermal Resistance (Note 4)	
SOP-16, θ _{JC}	- 95°C/W
SOP-16, θ _{JC}	- 45°C/W
WQFN-16L 3x3, θ_{JA}	- 68°C/W
WQFN-16L 3x3, θ_{JC}	- 7.5°C/W
ı Junction Temperature	
ı Lead Temperature (Soldering, 10 sec.)	- 260°C
ı Storage Temperature Range	- −65°C to 150°C
ı ESD Susceptibility (Note 2)	
HBM (Human Body Mode)	- 2kV
MM (Machine Mode)	- 200V
Recommended Operating Conditions (Note 3)	
ı Junction Temperature Range	40°C to 125°C

Electrical Characteristics

(V_{CC} = 24V, No Load on any Output, T_A = 25°C, unless otherwise specified)

Parameter	Symbol	Conditions	Min	Тур	Max	Unit
Overall						
Supply Voltage	V _{CC}		4.5		40	V
Supply Current	l _{VCC}	VC ≤ 0.4V (Switching off)		4	6	mA
Shutdown Current	I _{SHDN}	$V_{EN} \le 0.7V$		12		uA
Shutdown Threshold	V _{EN}			1.4		V
EN Input Current		V _{EN} ≤ 5V			0.5	uA
Current Sense Amplifier						
Input Threshold (V _{ISP} – V _{ISN})		4.5V ≤ common mode ≤ 40V	170	180	190	mV
ISP / ISN Input Current	I _{ISP} / I _{ISN}	$4.5V \le V_{ISP} = V_{ISN} \le 60V$		140	-	uA
VC Output Current	I _{VC}	$V_{ISP} - V_{ISN} = 120$ mV, 0.5 V $\leq V_C \leq 2.4$ V		±20	1	uA
VC Threshold for PWM Switch Off				0.7	1	V
LED Dimming						
Analog Dimming ACTL Pin Input Current	I _{ACTL}	0.3V ≤ V _{ACTL} ≤ 1.3V			1	uA

To be continued

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Parameter	Symbol	Conditions	Min	Тур	Max	Unit
LED Current Off Threshold at ACTL	V _{ACTL_Off}			0.2		V
DCTL Input Current	I _{DCTL}	$0.3V \le V_{DCTL} \le 6V$			0.5	uA
PWM Control						
Switching Frequency	f _{SW}		800k	1M	1.2M	Hz
Maximum Duty Cycle (Note 5)				86		%
Minimum on Time				200		ns
Switch Gate Driver	•	•	·			
GBIAS Voltage	V _{GBIAS}	I _{GBIAS} = 20mA		5.7		V
Coto Voltago Lligh		I _{Gate} = -50mA		4.2		V
Gate Voltage High	V _{Gate_H}	I _{Gate} = -100uA		5		
Gate Voltage Low	V _{Gate_L}	I _{Gate} = 50mA		0.25		V
Gale Vollage Low		I _{Gate} = 100uA		0.1		
GATE Drive Rise and Fall Time		1nF Load		15		ns
PWM Switch Current Limit Threshold	I _{SW_LIM}			100		mV
PWM Dimming Gate Driver						
PWMDIM Threshold (Low to High)				1.5		V
PWMDIM Threshold Hysteresis				0.5		V
PWMOUT Drive Rise and Fall Time		1nF Load		40		ns
OVP and Soft Start						
OVP Threshold	V_{OVP_th}			1.2		V
OVP Input Current	I _{OVP}	$0.7V \le V_{OVP} \le 1.5V$			0.1	uA
Soft Start Pin Current	I _{SS}	V _{SS} ≤ 2V		6		uA

- Note 1. Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device.

 These are stress ratings only, and 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 affect device reliability.
- **Note 2.** Devices are ESD sensitive. Handling precaution recommended. The human body model is a 100pF capacitor discharged through a $1.5k\Omega$ resistor into each pin.
- Note 3. The device is not guaranteed to function outside its operating conditions.
- Note 4. θ_{JA} is measured in the natural convection at $T_A = 25^{\circ}C$ on a high effective four layers thermal conductivity test board of JEDEC 51-7 thermal measurement standard.
- **Note 5.** When the natural maximum duty cycle of 1MHz switching frequency is reached, the switching cycle will be skipped (not reset) as the operating condition requires to effectively stretch and achieve higher on cycle than the natural maximum duty cycle set by the 1MHz switching frequency.

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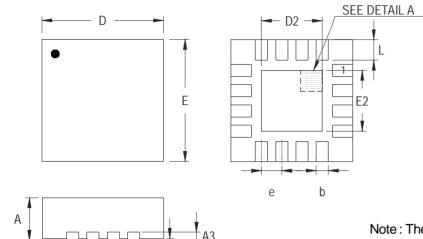
Datasheet Revision History

Version	Data	Page No.	Item	Description
00C	2008/2/22			first edition
01C	2008/2/27		Features Typical Application Circuit Functional Pin Description Function Block Diagram Electrical Characteristics	Modify
02C	2008/3/18		Ordering Information	Modify

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Outline Dimension





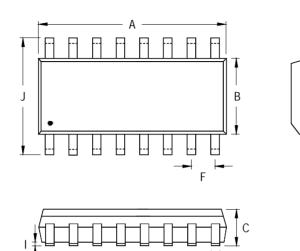
DETAIL APin #1 ID and Tie Bar Mark Options

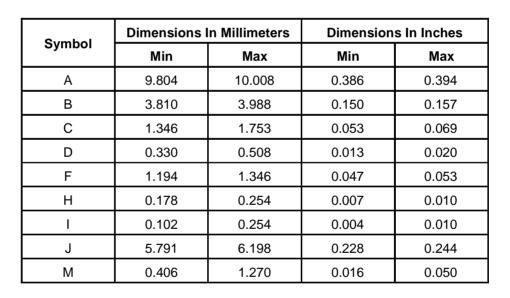
Note: The configuration of the Pin #1 identifier is optional, but must be located within the zone indicated.

Symbol	Dimensions I	n Millimeters	Dimensions In Inches		
Syllibol	Min	Max	Min	Max	
А	0.700	0.800	0.028	0.031	
A1	0.000	0.050	0.000	0.002	
A3	0.175	0.250	0.007	0.010	
b	0.180	0.300	0.007	0.012	
D	2.950	3.050	0.116	0.120	
D2	1.300	1.750	0.051	0.069	
Е	2.950	3.050	0.116	0.120	
E2	1.300	1.750	0.051	0.069	
е	0.500		0.0)20	
L	0.350	0.450	0.014	0.018	

W-Type 16L QFN 3x3 Package







16-Lead SOP Plastic Package

Richtek Technology Corporation

Headquarter

5F, No. 20, Taiyuen Street, Chupei City

Hsinchu, Taiwan, R.O.C.

Tel: (8863)5526789 Fax: (8863)5526611

Richtek Technology Corporation

Taipei Office (Marketing)

8F, No. 137, Lane 235, Paochiao Road, Hsintien City

Taipei County, Taiwan, R.O.C.

Tel: (8862)89191466 Fax: (8862)89191465

Email: marketing@richtek.com

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