High Voltage 6-CH LED Driver Controller

General Description

The RT8488 is a 6-CH LED driver controller that delivers well matched LED current to each channel of LED string. With external current sources, the number of LEDs per string is only limited by the current source and the V_{IN}/ V_{OUT} conditions. The current mode PWM boost type controller operates at a programmable switching frequency of up to 1MHz, with a wide V_{IN} range covering from 7V to 28V. The switch driver is designed to drive industrial grade high power MOSFETs.

The PWM loop selects and regulates the LED string with the highest voltage string to 0.7V, thus allowing voltage mismatches between the LED strings. The RT8488 automatically detects and excludes any open and/or broken strings during operation from the PWM loop to prevent V_{OUT} from over voltage.

The LED currents on all channels are simply programmed with a resistor on each channel. Three convenient dimming methods are provided : 1. Analog dimming is linearly controlled by an external voltage. 2. True digitally controlled PWM dimming can regulate the duty cycle of the LED current. 3. For noise free PWM dimming, use an on board output clamping amplifier as a low pass filter to convert PWM dimming signals into analog dimming signals.

Other protection features include programmable output over voltage protection, PWM switch current limit and thermal shutdown.

Marking Information

RT8488 GQWYMDNN •	RT8488GQW : Product Number YMDNN : Date Code

Features

- **Wide Operation Voltage Range : 7V to 28V**
- **Programmable Channel Current**
- **3% Current Matching Accuracy between Channels**
- **Programmable Switching Frequency**
- **Easy Analog and Digital Dimming Control**
- **Programmable Soft-Start**
- **Automatic Open Channel Detection**
- **Programmable Output Over Voltage Protection**
- **Under Voltage Lockout and Thermal Shutdown**
- **32-Lead WQFN Package**

Applications

- Building and Street Lighting
- LED TV Backlight
- LED Monitor Backlight
- Industrial Display Backlight

Ordering Information

RT8488 □□

Package Type
QW : WQFN-32L 5x5 (W-Type)

Lead Plating System
G : Green (Halogen Free and Pb Free)

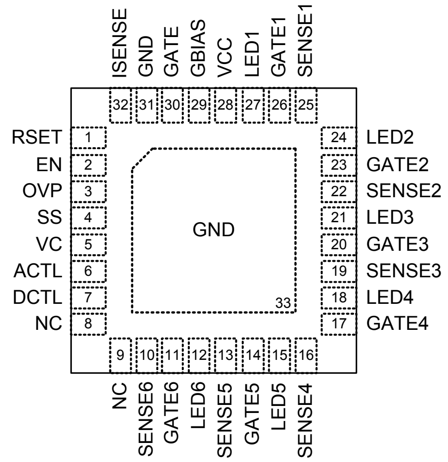
Note :

Richtek 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.

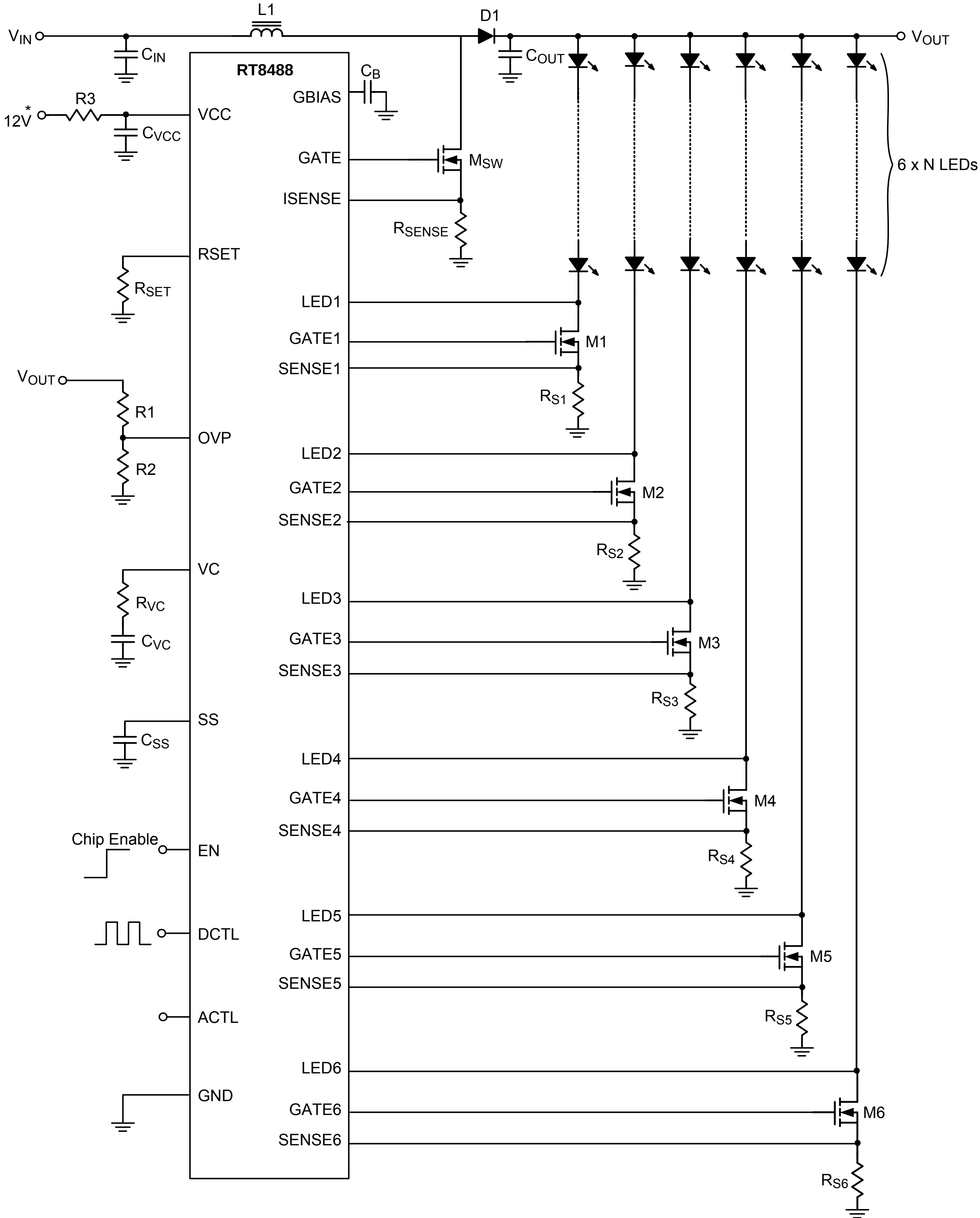
Pin Configurations

(TOP VIEW)



WQFN-32L 5x5

Typical Application Circuit

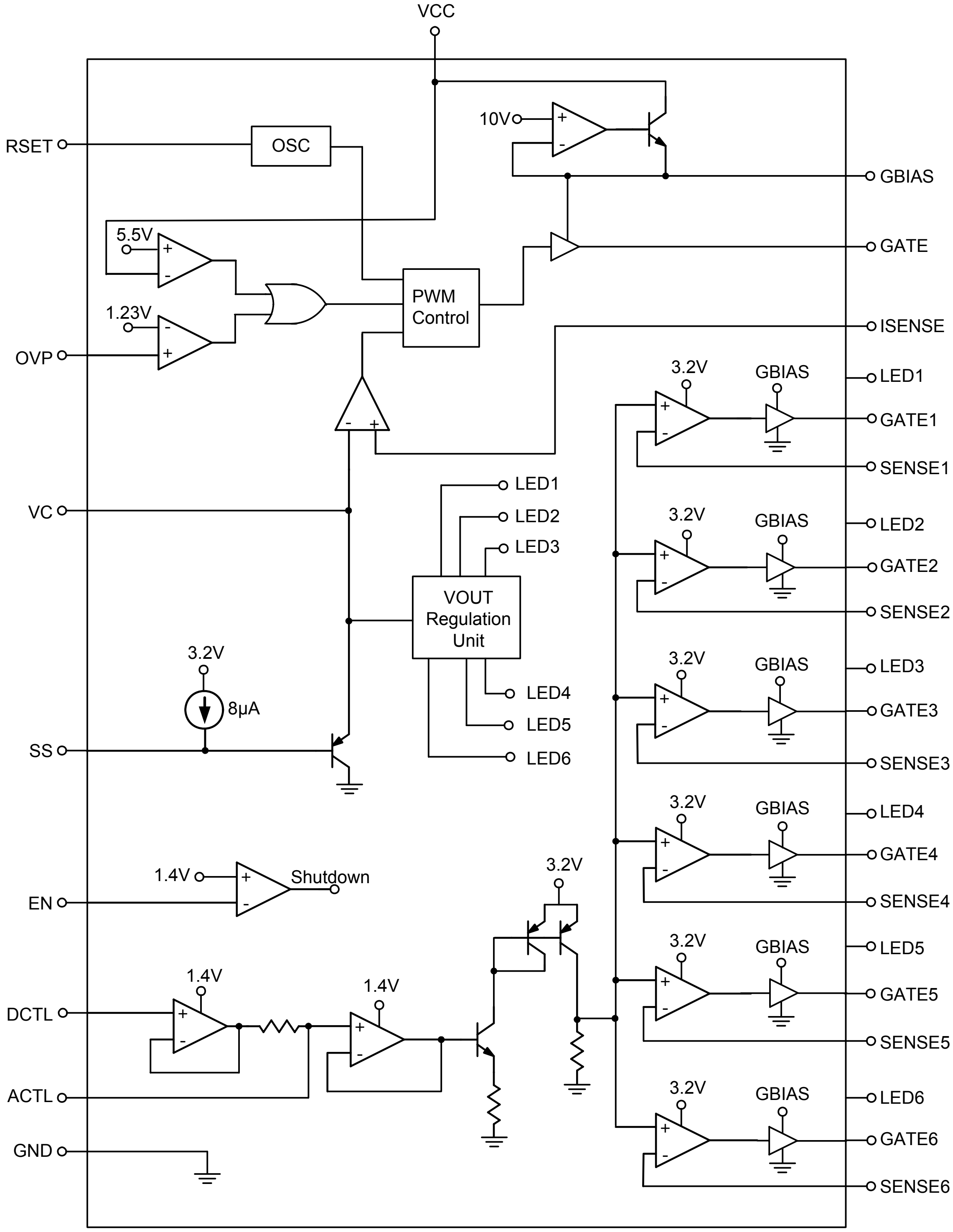


* : If V_{IN} is operated above 12V, it is recommended to keep the V_{CC} at 12V for optimal application

Functional Pin Description

Pin No.	Pin Name	Pin Function
1	RSET	Switching Frequency Set Pin. Put a resistor from RSET to GND to program the switching frequency. f_{SW} = 310kHz when R_{SET} = 40kΩ.
2	EN	Chip Enable (Active High).
3	OVP	Over Voltage Protection Pin. OVP pin threshold is around 1.23V. Use a resistor divider from Output to GND to program the OVP level.
4	SS	Soft-Start Pin. Use a soft start cap from SS pin to GND to program the soft start time period. Around 5.5μA is sourcing out of SS pin.
5	VC	Loop Compensation Pin.
6	ACTL	Analog/PWM Dimming Control Pin. When used in analog dimming, ACTL control range is from 0.5V to 1.4V.
7	DCTL	Digital PWM Dimming Control Pin. By adding a 0.1μF filter capacitor on the ACTL pin, the PWM dimming signal on the DCTL pin will be averaged out and converted into analog dimming signal on the ACTL pin.
8, 9	NC	No Internal Connection.
25, 22, 19 16, 13, 10	SENSEx	Source Pin of External MOSFETx (x = 1 to 6). The SENSEx pins are regulated around 225mV. Connect a sense resistor from this pin to GND. The LED current is programmed by I_{LED} = 225mV / (sense resistance) when V_{ACTL} is greater than 1.4V.
26, 23, 20 17, 14, 11	GATEx	Gate Pin of External MOSFETx (x = 1 to 6). For LED drivers.
27, 24, 21 18, 15, 12	LEDx	Drain Pin of External MOSFETx (x = 1 to 6). For LED drivers. Short the pin to GND if not used.
28	VCC	Power Supply Pin. For good bypass, a low ESR capacitor is needed between this pin and GND.
29	GBIAS	Internal Gate Driver Bias Voltage (around 10V) Pin. Need a good bypass capacitor between this pin and GND.
30	GATE	Gate Pin of External MOSFET. For the Boost PWM control loop.
31, 33 (Exposed Pad)	GND	Ground Pin. The exposed pad must be soldered to a large PCB and connected to GND for maximum power dissipation.
32	ISENSE	Switch Current Sense Pin. Connect a sense resistor from this pin to GND. The switch current sense signal is used for boost current mode PWM loop control and power switch over current protection.

Function Block Diagram



Absolute Maximum Ratings (Note 1)

- VCC ---------- 32V
- ISENSE
  DC ---------- 2V
  < 200ns ---------- 6V
- GBIAS ---------- 14V
- SENSE1 to SENSE6
  DC ---------- 1V
  < 200ns ---------- 6V
- LED1 - LED6 (Note 5) ---------- 20V
- DCTL, ACTL, EN, OVP ---------- 10V
- Power Dissipation, P_D@T_A = 25°C
  WQFN-32L 5x5 ---------- 2.778W
- Package Thermal Resistance (Note 2)
  WQFN-32L 5x5, θ_{JA} ---------- 36°C/W
  WQFN-32L 5x5, θ_{JC} ---------- 6°C/W
- Junction Temperature ---------- 150°C
- Storage Temperature Range ---------- −65°C to 150°C
- Lead Temperature (Soldering, 10 sec.) ---------- 260°C
- ESD Susceptibility (Note 3)
  HBM (Human Body Mode) ---------- 2kV
  MM (Machine Mode) ---------- 200V

Recommended Operating Conditions (Note 4)

- Supply Voltage, V_{CC} ---------- 7V to 28V
- Junction Temperature Range ---------- −40°C to 125°C

Electrical Characteristics

(V_{CC} = 12V, No Load, T_A = 25°C, unless otherwise specified)

Parameter		Symbol	Test Conditions	Min	Typ	Max	Unit
Overall							
Supply Current		I_{VCC}	$V_{VC} \le 0.4V$ (Switching off)	--	5	8	mA
Shutdown Current		I_{SHDN}	$V_{EN} \le 1.2V$	--	5	--	μA
EN Threshold Voltage	Logic-High	V_{IH}		2	--	--	V
	Logic-Low	V_{IL}		--	--	0.5	
EN Input Current		I_{EN}	$V_{EN} \le 3.3V$	--	2	--	μA
LED Current Programming							
SENSE1-SENSE6 Threshold			6V > V_{GATEx} > 2V	214	225	236	mV
SENSE Voltage CH to CH Matching			$\frac{V_{(MAX)} - V_{(MIN)}}{2 \times V_{(avg)}}$	--	1.5	3	%
Analog Dimming ACTL Input Current		I_{ACTL}	$V_{ACTL} \leqq 6V$	--	--	10	μA
LED Current Off Threshold at ACTL		V_{ACTL_OFF}		--	0.4	--	V

To be continued

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
LED Current On Threshold at ACTL	V_{ACTL_ON}		--	1.4	--	V
DCTL Input Current	I_{DCTL}	$V_{DCTL} \leqq 6V$	--	--	1	μA
PWM Boost Converter						
Switching Frequency	f_{SW}	$R_{SET} = 40k\Omega$	220	280	340	kHz
Minimum Off-Time		$R_{SET} = 40k\Omega$	--	300	--	ns
VLED Threshold for No Connection	V_{LED}		--	0.1	--	V
Regulated V_{LED}	V_{LED}	Highest Voltage LED String	--	0.7	--	V
Amplifier Output Current	I_{VC}	$2.4V > V_{VC} > 0.2V$	--	±30	--	μA
VC Threshold for PWM Switch Off			--	0.7	--	V
Switch Gate Driver						
GBIAS Voltage	V_{GBIAS}	$I_{GBIAS} = 20mA$	--	10	--	V
GATE High Voltage	V_{GATE_H}	$I_{GATE} = -20mA$	--	7.7	--	V
		$I_{GATE} = -0.1mA$	--	8.2	--	
GATE Low Voltage	V_{GATE_L}	$I_{GATE} = 20mA$	--	0.7	--	V
		$I_{GATE} = 0.1mA$	--	0.4	--	
GATE Drive Rise and Fall Time		1nF load at Gate	--	20	--	ns
LED Current Sources Gate Driver						
GATE1 to 6 High Voltage	V_{GATEx_H}	$I_{GATEx} = -2mA$	--	8.1	--	V
		$I_{GATEx} = -0.1mA$	--	8.3	--	
GATE1 to 6 Low Voltage	V_{GATEx_L}	$I_{GATEx} = 2mA$	--	0.8	--	V
		$I_{GATEx} = 0.1mA$	--	0.6	--	
OVP and Soft-Start						
OVP Threshold	V_{OVP}		--	1.23	--	V
OVP Input Current	I_{OVP}	$V_{OVP} \leq 1.23V$	--	1	--	μA
Soft-Start Pin Current	I_{SS}	$V_{SS} \leq 3.2V$	--	8	--	μA
Thermal Protection						
Thermal Shutdown temperature	T_{SD}		--	150	--	°C
Thermal Shutdown Hysteresis	ΔT_{SD}		--	20	--	°C

Note 1. 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 possiblity to affect device reliability.

Note 2. θ_{JA} is measured in natural convection at T_A = 25°C on a high effective thermal conductivity four-layer test board of JEDEC 51-7 thermal measurement standard. The measurement case position of θ_{JC} is on the exposed pad of the package.

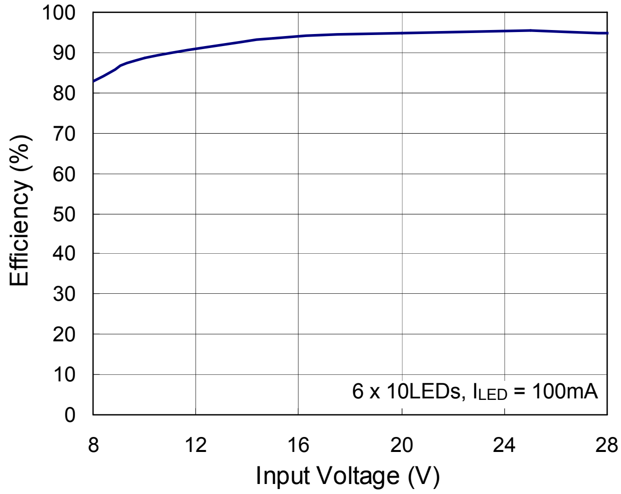
Note 3. Devices are ESD sensitive. Handling precaution is recommended.

Note 4. The device is not guaranteed to function outside its operating conditions.

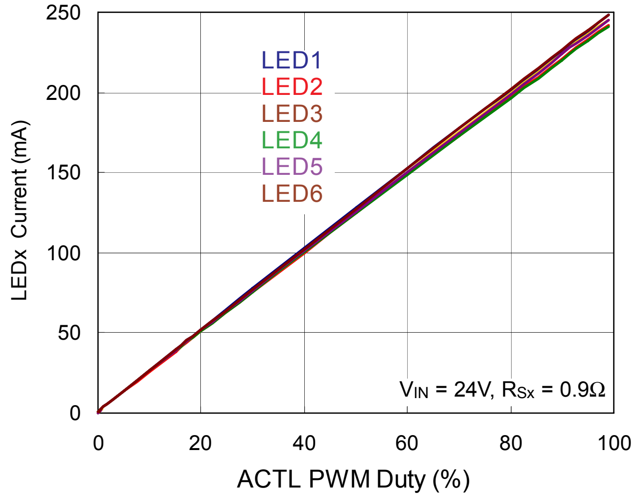
Note 5. Adding a series resistor of at least 20kΩ for higher pin voltage.

Typical Operating Characteristics

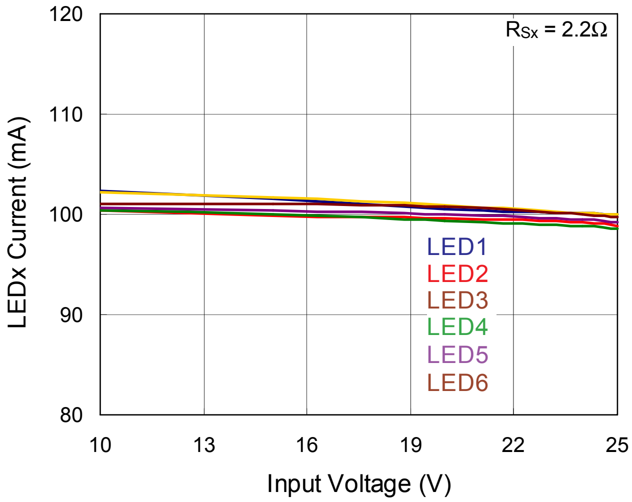
Efficiency vs. Input Voltage



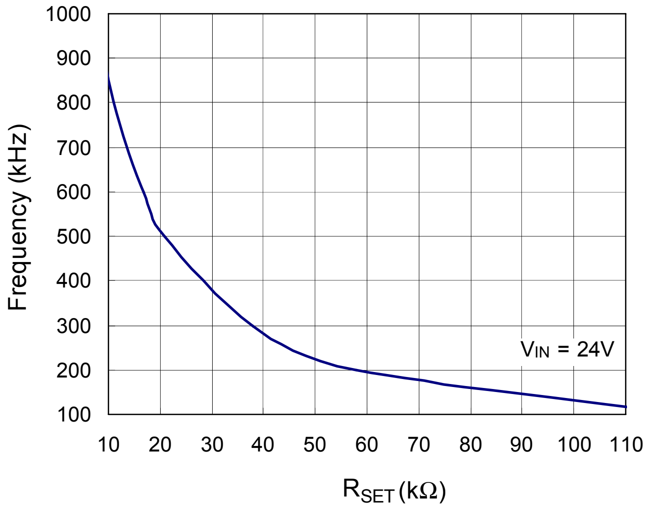
LED Current vs. ACTL PWM Duty



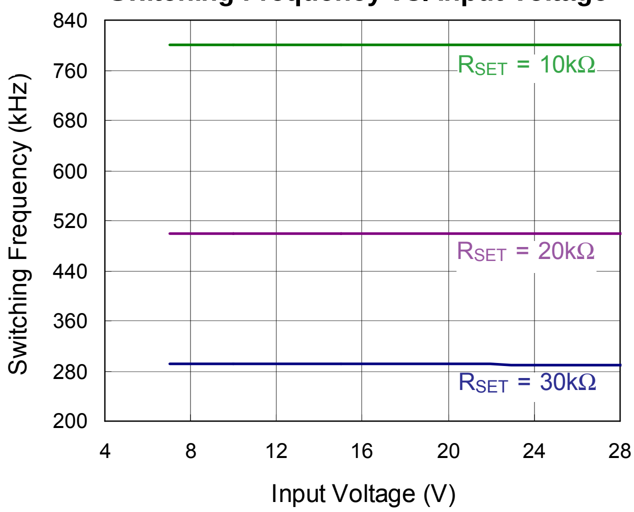
LED Current vs. Input Voltage



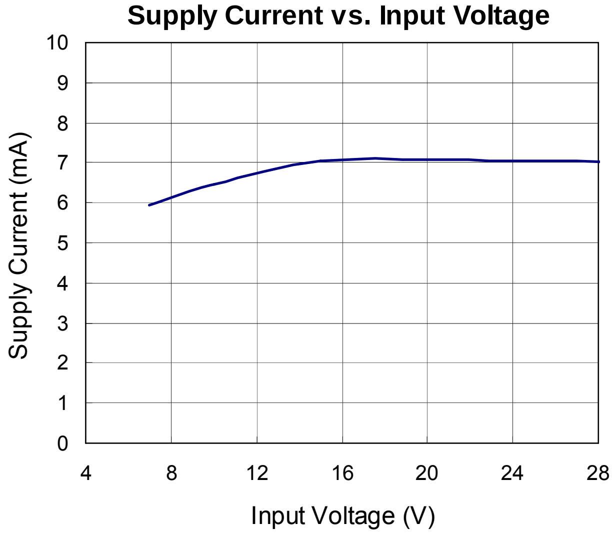
Frequency vs. R_{SET} Resistance



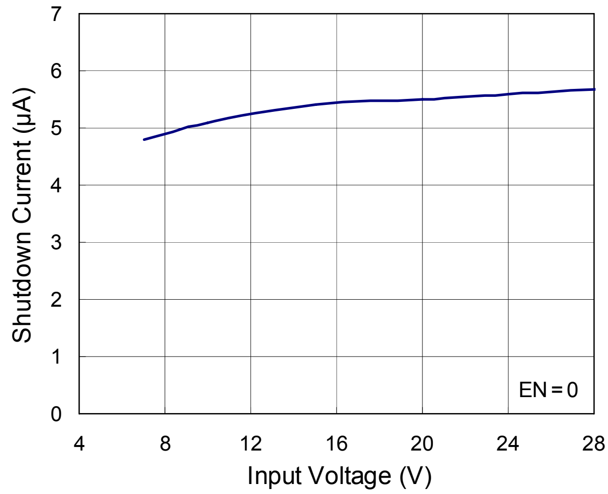
Switching Frequency vs. Input Voltage



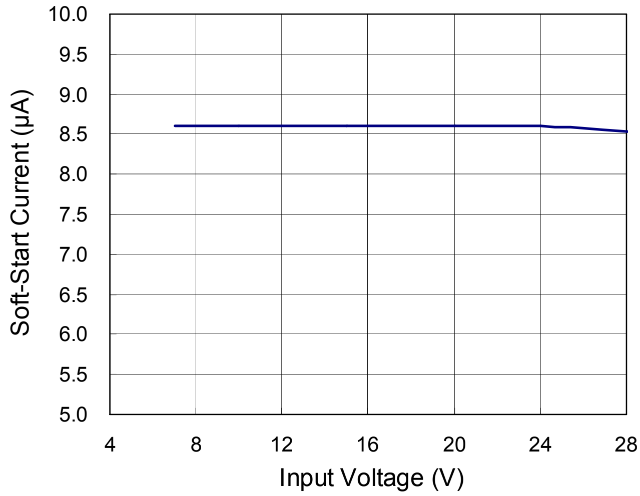
Supply Current vs. Input Voltage



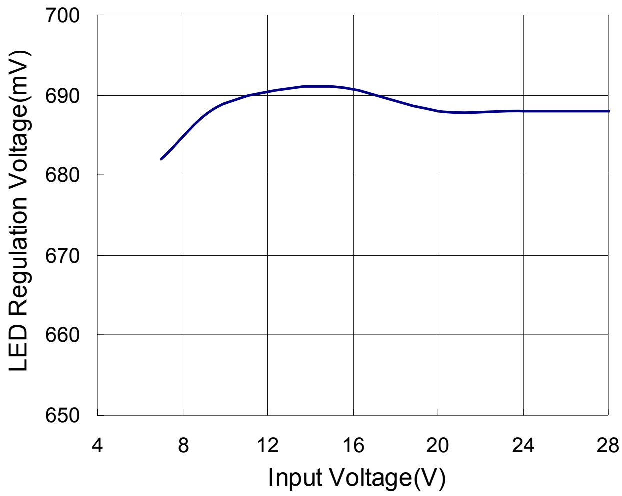
Shutdown Current vs. Input Voltage



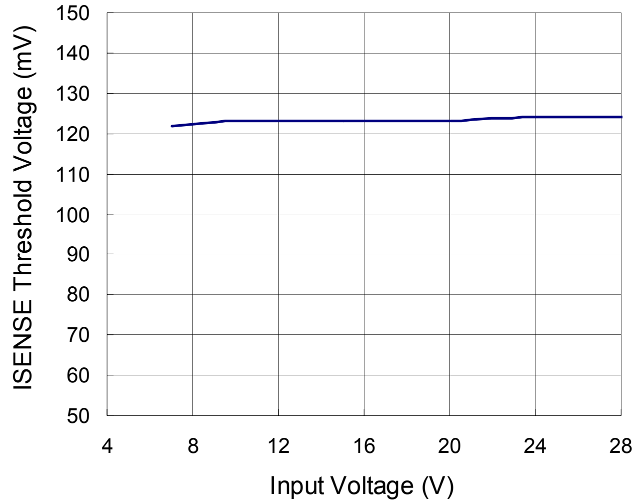
Soft-Start Current vs. Input Voltage



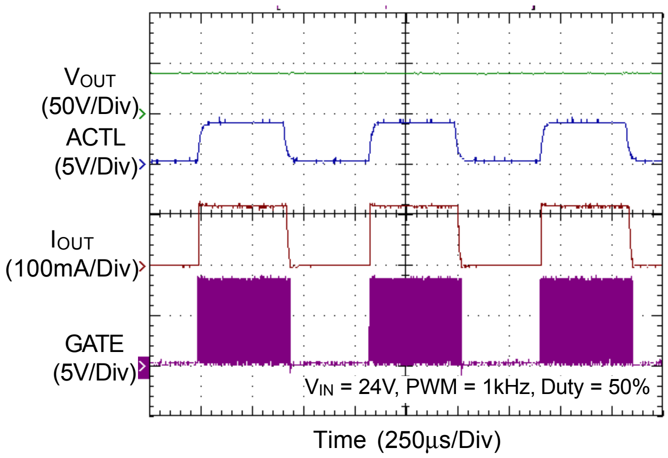
LED Regulated Voltage vs. Input Voltage



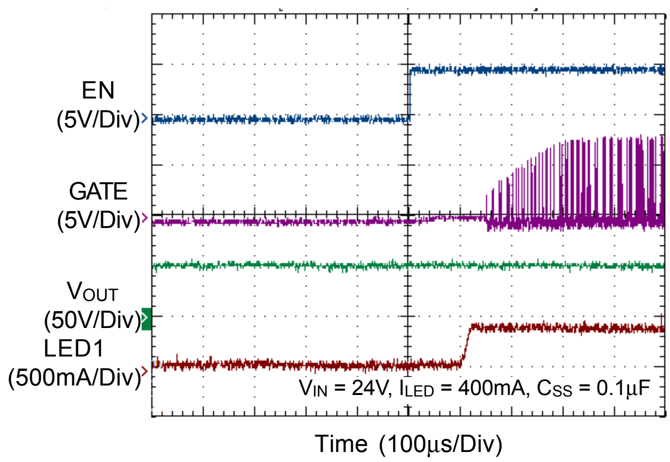
ISENSE Threshold Voltage vs. Input Voltage



Load Transient Response



Power On from EN



Application Information

The RT8488 is a 6-CH programmable current source controller for LED backlight or lighting application.

By detecting the minimum voltage required to drive each LED string and hence to set the boost output accordingly, this topology reduces power dissipation and increases overall efficiency of the LED lighting system.

The individual current source channel regulates the current flow to give accurate current sinking for each LED string.

The external N-MOSFET current source will accommodate the power dissipation difference among channels resulting from the forward voltage difference between the LED strings.

Both digital PWM dimming signal and analog voltage signal can be used to control the LED current of each channel.

With high speed current source N-MOSFET drivers, the RT8488 features highly accurate current matching of ±3 percent, while also providing very fast turn-on and turn-off times. This allows a very narrow minimum on or off pulse, which increases dimming range and provides higher linearity.

The RT8488 integrates adjustable switching frequency and soft-start, and provides the circuitry for over temperature, over voltage and current limit protection features.

Input UVLO

The input operating voltage range of the RT8488 is 7V to 28V. An input capacitor at the VCC pin can reduce ripple voltage. It is recommended to use a ceramic 10µF or larger capacitance as the input capacitor. This IC provides an Under Voltage Lockout (UVLO) function to enhance the stability when start-up. The UVLO rising input voltage threshold is set at 5.5V typically with a 0.7V hysteresis.

Power Sequence

Refer to below Figure 1 and 2. The recommended power on sequence states that the PWM signal should be ready before EN and/or V_{IN} is ready. Otherwise, the soft-start function will be disabled. As for power off sequence, EN/ V_{IN} must be pulled low within 10ms to prevent "hard-start" as shown as Figure 3.

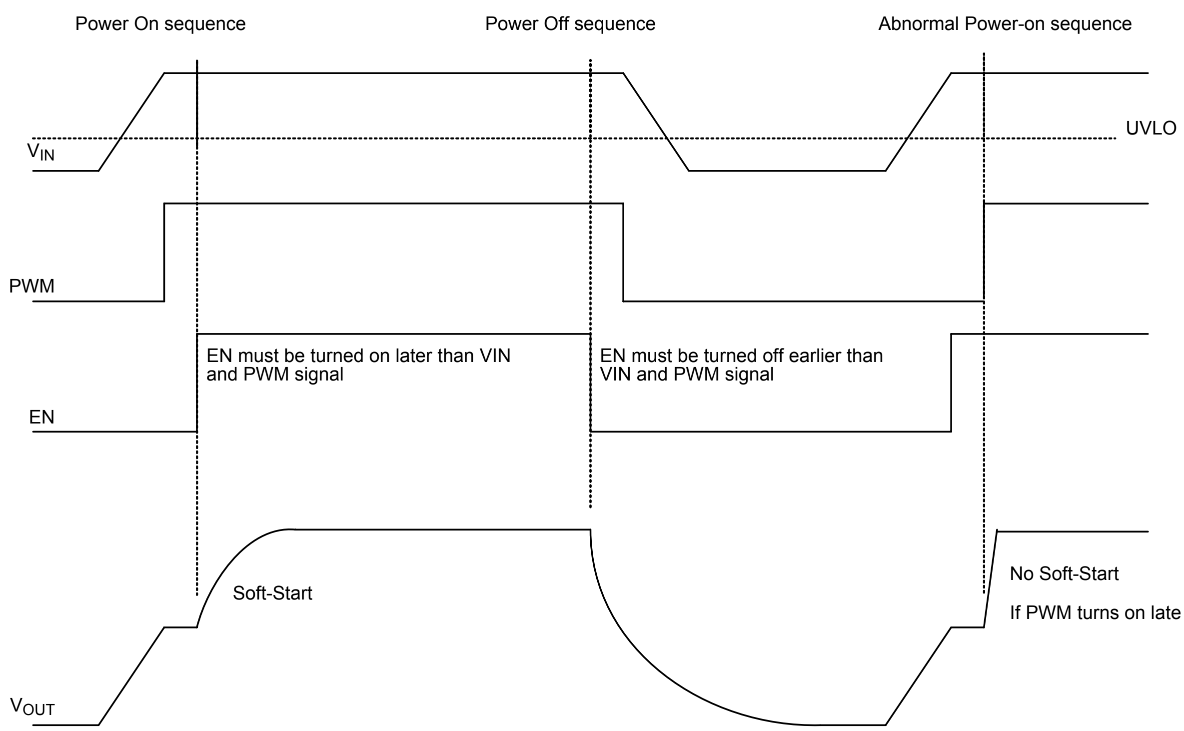


Figure 1. Power On Sequence Control by EN

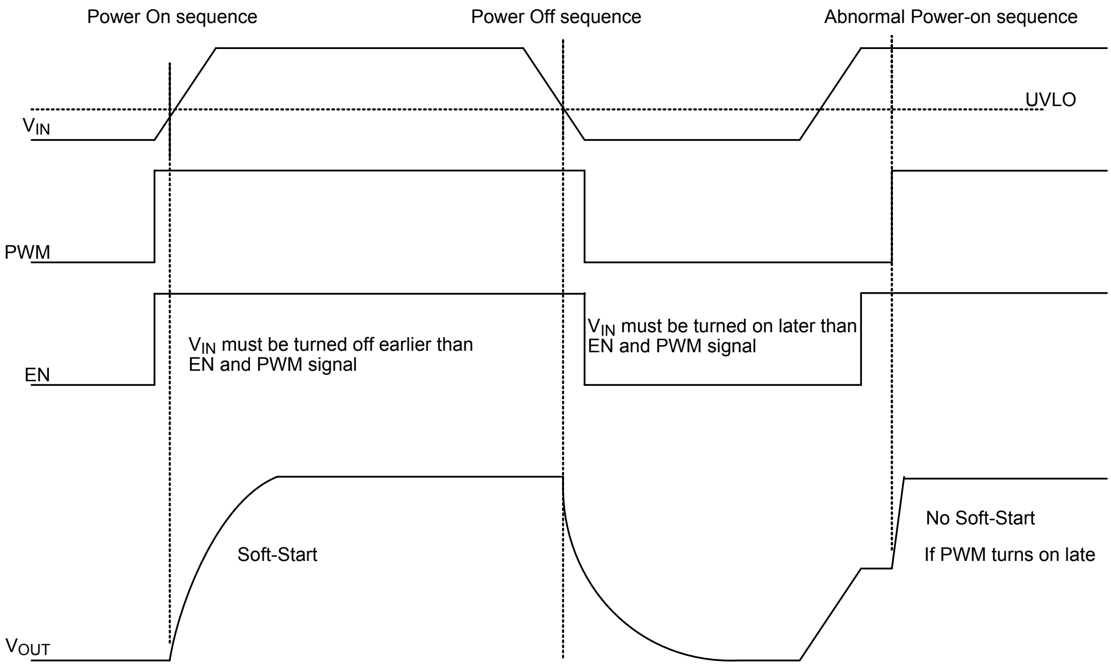


Figure 2. Power On Sequence Control by V_{IN}

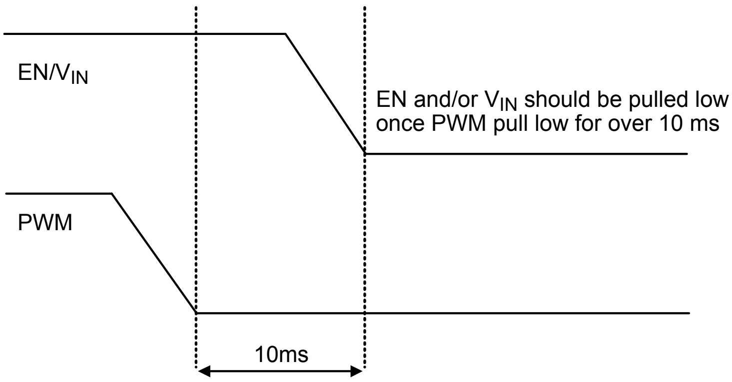


Figure 3. To Prevent "hard-start" Sequence

Soft-Start

The soft-start of the RT8488 can be achieved by connecting a capacitor from the SS pin to GND. The built in soft-start circuit reduces the start up current spike and output voltage overshoot. The soft-start time is determined by the external capacitor charged by an internal 8μA constant charging current. The SS pin directly limits the rate of voltage rise on the VC pin, which in turn limits the peak switch current.

The soft-start interval is set by the soft-start capacitor selection according to the equation :

$$t_{SS} = C_{SS} \times \frac{3.2V}{8\mu A} \quad (s)$$

A typical value for the soft-start capacitor is 0.1μF. The soft-start pin reduces the oscillator frequency and the maximum current in the switch. The soft-start capacitor is discharged when EN/UVLO falls below its threshold, during an over-temperature event, or during a GBIAS under voltage event.

GBIAS Regulator Operation

The GBIAS pin requires a capacitor for stable operation and also to store the charge for the large GATE switching currents. Choose a 10V rated low ESR, X7R or X5R ceramic capacitor for best performance. The value of the capacitor is determined primarily by the stability of the regulator rather than the gate charge of the switching N-MOSFET. A 1μF capacitor will be adequate for most applications.

Place the capacitor close to the IC to minimize the trace length to the GBIAS pin and also to the IC ground. An internal current limit on the GBIAS protects the RT8488 from excessive on chip power dissipation.

If the input voltage, V_{IN}, does not exceed 10V, then the GBIAS pin should be connected to the input supply. Be aware that a typical 20mA current will load the GBIAS to shutdown.

Loop Compensation

The RT8488 uses an internal error amplifier, in which through its compensation pin (VC) the loop response is optimized for specific applications. The external inductor, output capacitor, compensation resistor, and compensation capacitor determine the loop stability. The inductor and output capacitor are chosen based on performance, size and cost. The compensation resistor and capacitor at VC are selected to optimize control loop response and stability.

The compensation resistor and capacitor are connected in series from the VC pin to GND to provide a pole and a zero for proper loop compensation. The typical compensation values for RT8488 is 1.8kΩ and 3.3nF.

LED Current Setting

The maximum current of channel 1 to 6 is programmed by placing an appropriate sense resistor at each LED string. When the voltage of ACTL is higher than 1.4V, the LED current can be calculated by the following equation :

$$I_{LED,\ MAX} = \frac{225mV}{R_{Sx}} \quad (mA)$$

where, R_{Sx} is the resistor between external regulating N-MOSFET and GND.

The ACTL pin should be tied to a voltage higher than 1.4V to get the full scale 225mV (typical) threshold across the sense resistor. The ACTL pin can also be used to dim the LED current to zero, although relative accuracy decreases with the decreasing voltage sense threshold. When the ACTL pin voltage is less than 1.4V, the LED current is :

$$I_{LED} = \frac{(V_{ACTL} - 0.4) \times 225mV}{R_{Sx}} \quad (mA)$$

The ACTL pin can also be used in conjunction with a thermistor to provide over temperature protection for the LED load, or with a resistive voltage divider to V_{IN} to reduce output power and switching current when V_{IN} is low.

Brightness Control

For LED applications where a wide dimming range is required, two methods are available: analog dimming and PWM dimming. The easiest method is to simply vary the DC current through the LED by analog dimming.

However, a better dimming method is PWM dimming, which switches the LED on and off via different duty cycle to control the average LED current. The PWM dimming offers several advantages over analog dimming and is more preferred by LED manufacturers. One advantage is the chromaticity of the LEDs which remains unchanged since the LED current is either zero or at the programmed current. Another advantage of PWM dimming over analog dimming is that a wider dimming range is possible.

The RT8488 features both analog and digital dimming control. Analog dimming is linearly controlled by an external voltage (0.4V to 1.4V) at the ACTL pin. A very high contrast ratio is true digital PWM dimming which can be achieved by driving the ACTL pin with a PWM signal at a recommended PWM frequency of 100Hz to 10kHz.

Dimming frequency can be sufficiently adjusted from 100Hz to 30kHz. However, LED current cannot be 100% proportional to the duty cycle, especially for high frequency and low duty ratio, because of physical limitation caused by internal switching frequency. Referring to Figure 4, the minimum dimming duty can be as low as 1% for the frequency range from 100Hz to 300Hz. For the dimming frequency from 300Hz to 1kHz, the minimum dimming duty is about 5%. If the frequency is increased from 1kHz to 30kHz, the minimum dimming duty will be about 10%.

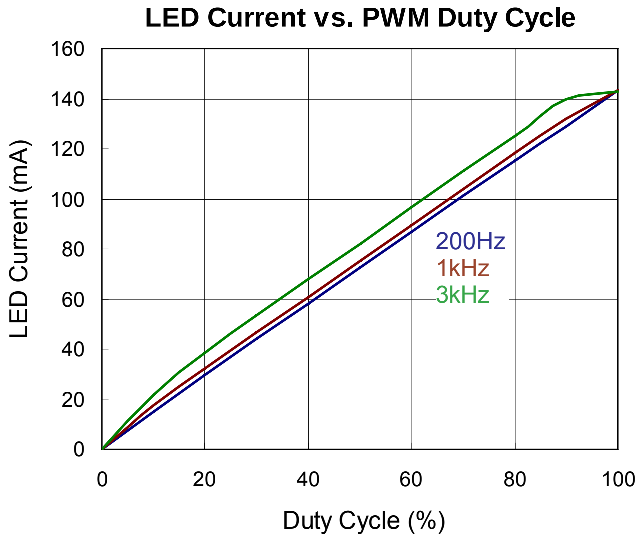


Figure 4. LED Current vs. PWM Dimming Duty Cycle

Programmable Switching Frequency

The RSET frequency adjust pin allows the user to program the switching frequency from 100kHz to 1MHz in order to optimize efficiency and performance or minimize external component size. Higher frequency operation yields smaller component size but increases switching losses and gate driving current, and may not allow sufficiently high or low duty cycle operation. Lower frequency operation gives better performance, but is more costly with larger external component size. An external resistor from the RSET pin to GND is required do not leave this pin open. For an appropriate R_{SET} value, refer to Figure 5.

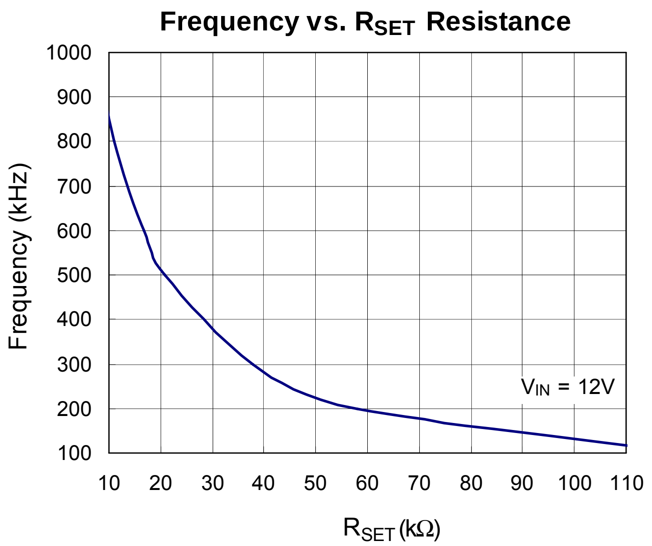


Figure 5. Switching Frequence vs R_{SET}

LED Pin External Resistor Connection

The RT8488 equips 6 channel LED drivers and each channel supports numerous LEDs. The 6 LED strings are connected from V_{OUT} to pin LEDx (x = 1 to 6) respectively. If one of the LED channel is not used, the LEDx (x = 1 to 6) pins should be connected to ground directly.

In this case, there should be a current limiting resistor between external MOSFET drain node and LEDx pin to limit the LEDx pin input current below 100μA.

The formula for this resistor is

$Rx = (V_{OUT} - |V_{LEDx(MAX)}|) / 100\mu A$

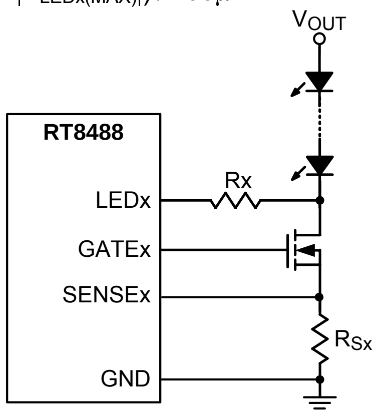


Figure 6. LED Pin External Resistor Connection

Input Over Current Protection

The resistor, R_{SENSE}, between the source of the external switching N-MOSFET and GND should be selected to provide adequate switch current.

The RT8488 senses the inductor current through ISENSE pin in the switch on period. The duty cycle depends on the current sense signal summed with the internal slope compensation and compared to the VC signal. The external N-MOSFET will be turned off when the current signal is larger than the VC signal. In the off period, the inductor current will descend. The external N-MOSFET is turned on by the oscillator in the next beginning cycle.To drive the application without exceeding the 120mV (typical) current limit threshold on the ISENSE pin of the RT8488. Select a resistor that gives a switch current of at least 20% greater than the required LED current according to :

$$R_{SENSE} = \left(\frac{V_{IN} \times 0.1V}{V_{OUT} \times I_{OUT}}\right) \quad (\Omega)$$

The ISENSE pin input to RT8488 should be a kelvin connection to the positive terminal of R_{SENSE}.

Output Over Voltage Protection Setting

The RT8488 is equipped with Over Voltage Protection (OVP) function. When the voltage at the OVP pin exceeds a threshold of approximately 1.23V, the power switch is turned off. The power switch can be turned on once again after the voltage at the OVP pin drops below 1.23V. The output voltage can be clamped at a certain voltage level set by the following equation :

$$V_{OUT,OVP} = 1.23 \times \left(1 + \frac{R1}{R2}\right)$$

where R1 and R2 make up the resistive voltage divider from V_{OUT} to GND with the divider center node connected to the OVP pin.

As long as one string is in normal operation, the controller will automatically ignore the open strings and continue to regulate the current for the string(s) in normal operation.

Over Temperature Protection

The RT8488 has an over temperature protection (OTP) function to prevent overheating caused by excessive power dissipation. The OTP function will shut down switching operation when the die junction temperature exceeds 150°C. The chip will automatically start to switch again once the die junction temperature starts cooling down by approximately 20°C.

Inductor Selection

The inductor for the RT8488 should have a saturation current rating appropriate to the maximum switch current. Choose an inductor value based on the operating frequency, input voltage and output voltage to provide a current mode ramp during the MOS switching. Allow the peak to peak inductor ripple to be ±30% of the output current.The following equations are useful to estimate the inductor value :

$$L = \frac{(V_{OUT} - V_{IN}) \times (V_{IN})^2}{2 \times I_{OUT} \times f \times (V_{OUT})^2 \text{ x } 0.3}$$

The inductor must be selected with a saturation current rating greater than the peak current provided by the following equation :

$$I_{PEAK} = \frac{V_{OUT} \times I_{OUT}}{\eta \times V_{IN}} + \frac{V_{IN} \times T}{2 \times L} \times \left(\frac{V_{OUT} - V_{IN}}{V_{OUT}}\right)$$

where

V_{OUT} = maximum output voltage.

V_{IN} = minimum input voltage.

f = operating frequency.

I_{OUT} = sum of current from all LED strings.

η is the efficiency of the power converter.

The boost converter operates in discontinuous conduction mode over the entire input voltage range when the L1 inductor value is less than this value L. With an inductance greater than L, the converter operates in continuous conduction mode at the minimum input voltage and may be discontinuous at higher voltages.

Power MOSFET Selection

For applications operating at high input or output voltages, the power N-MOSFET switch is typically chosen for drain voltage V_{DS} rating and low gate charge. Consideration of switch on resistance, $R_{DS(ON)}$, is usually secondary because switching losses dominate power loss. The GBIAS regulator on the RT8488 has a fixed current limit to protect the IC from excessive power dissipation at high V_{IN}, so the N-MOSFET should be chosen such that the product of Q_G at 7V and the switching frequency does not exceed the GBIAS current limit.

Schottky Diode Selection

The Schottky diode, with their low forward voltage drop and fast switching speed, is necessary for the RT8488 applications. In addition, power dissipation, reverse voltage rating and pulsating peak current are important parameters of the Schottky diode that must be considered. Choose a suitable Schottky diode whose reverse voltage rating is greater than the maximum output voltage. The diode's average current rating must exceed the average output current. The diode conducts current only when the power switch is turned off (typically less than 50% duty cycle). If using the PWM feature for dimming, it is important to consider diode leakage, which increases with the temperature, from the output during the PWM low interval. Therefore, choose the Schottky diode with sufficiently low leakage current.

Capacitor Selection

The input capacitor reduces current spikes from the input supply and minimizes noise injection to the converter. For most applications, a 10μF ceramic capacitor is sufficient. A value higher or lower may be used depending on the noise level from the input supply and the input current to the converter.

In boost applications, the output capacitor is typically a ceramic capacitor selected based on the output voltage ripple requirements. The minimum value of the output capacitor, C_{OUT}, is approximately given by the following equation :

$$C_{OUT} = \frac{I_{OUT} \times (V_{OUT} - V_{IN})}{\eta \times V_{RIPPLE} \times V_{OUT} \times f}$$

where V_{RIPPLE} is rhe output voltage ripple, for LED applications, the equivalent resistance of the LED is typically low and the output filter capacitor should be sized to attenuate the current ripple. Use of X7R type ceramic capacitors is recommended. Lower operating frequencies will require proportionately higher capacitor values.

Thermal Considerations

For continuous operation, do not exceed absolute maximum junction temperature. The maximum power dissipation depends on the thermal resistance of the IC package, PCB layout, rate of surrounding airflow, and difference between junction and ambient temperature. The maximum power dissipation can be calculated by the following formula :

$P_{D(MAX)} = (T_{J(MAX)} - T_A) / \theta_{JA}$

where $T_{J(MAX)}$ is the maximum junction temperature, T_A is the ambient temperature, and θ_{JA} is the junction to ambient thermal resistance.

For recommended operating condition specifications of the RT8488, the maximum junction temperature is 125°C and T_A is the ambient temperature. The junction to ambient thermal resistance, θ_{JA}, is layout dependent. For WQFN-32L 5x5 packages, the thermal resistance, θ_{JA}, is 36°C/W on a standard JEDEC 51-7 four-layer thermal test board. The maximum power dissipation at T_A = 25°C can be calculated by the following formula :

$P_{D(MAX)}$ = (125°C − 25°C) / (36°C/W) = 2.778W for WQFN-32L 5x5 package

The maximum power dissipation depends on the operating ambient temperature for fixed $T_{J(MAX)}$ and thermal resistance, θ_{JA}. For the RT8488 package, the derating curve in Figure 7 allows the designer to see the effect of rising ambient temperature on the maximum power dissipation.

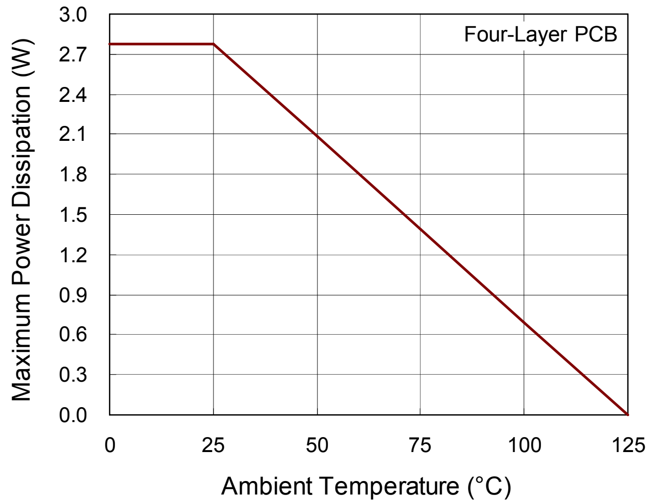


Figure 7. Derating Curves for RT8488 Package

Layout Consideration

PCB layout is very important when designing power switching converter circuits. Some recommended layout guidelines are suggested as follows :

- The power components L1, D1, C_{IN}, M_{SW} and C_{OUT} must be placed as close to each other as possible to reduce the ac current loop area. The PCB trace between power components must be as short and wide as possible due to large current flow through these traces during operation.
- Place L1 and D1, which are connected to N-MOSFET, as close as possible. The trace should be as short and wide as possible.
- The input capacitor, C_{VCC} must be placed as close to the VCC pin as possible.
- Place the compensation components to the VC pin as close as possible to avoid noise pick up.

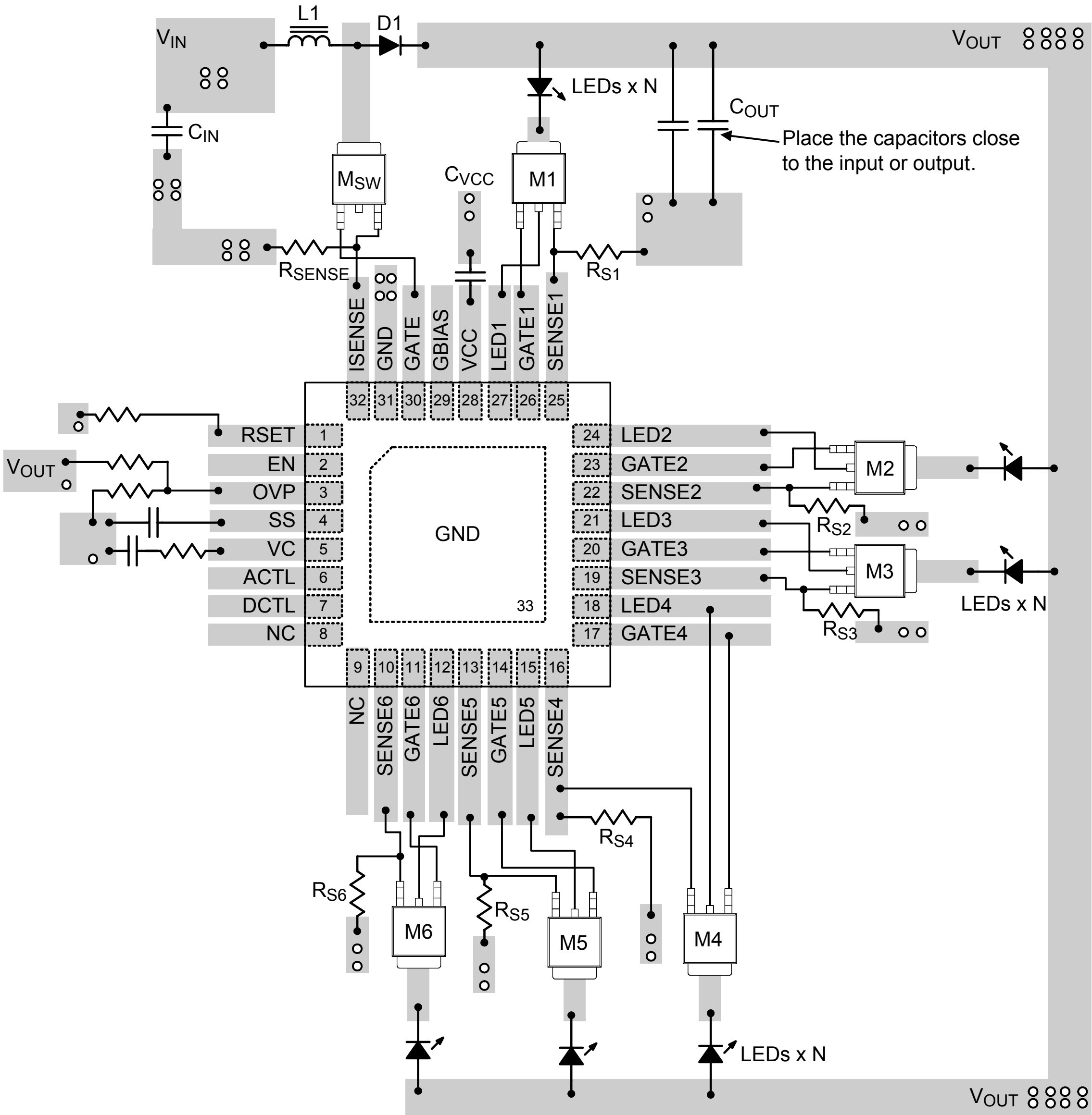
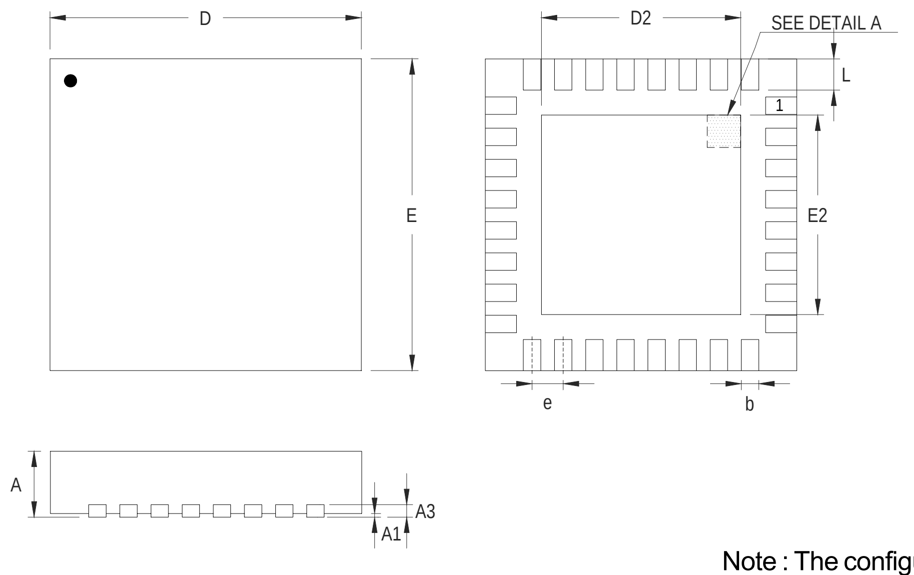
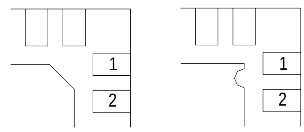


Figure 8. PCB Layout Guide

Outline Dimension





DETAIL A

Pin #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 In Millimeters		Dimensions In Inches	
	Min	**Max**	**Min**	**Max**
A	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	4.950	5.050	0.195	0.199
D2	3.400	3.750	0.134	0.148
E	4.950	5.050	0.195	0.199
E2	3.400	3.750	0.134	0.148
e	0.500		0.020	
L	0.350	0.450	0.014	0.018

W-Type 32L QFN 5x5 Package

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