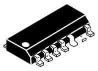
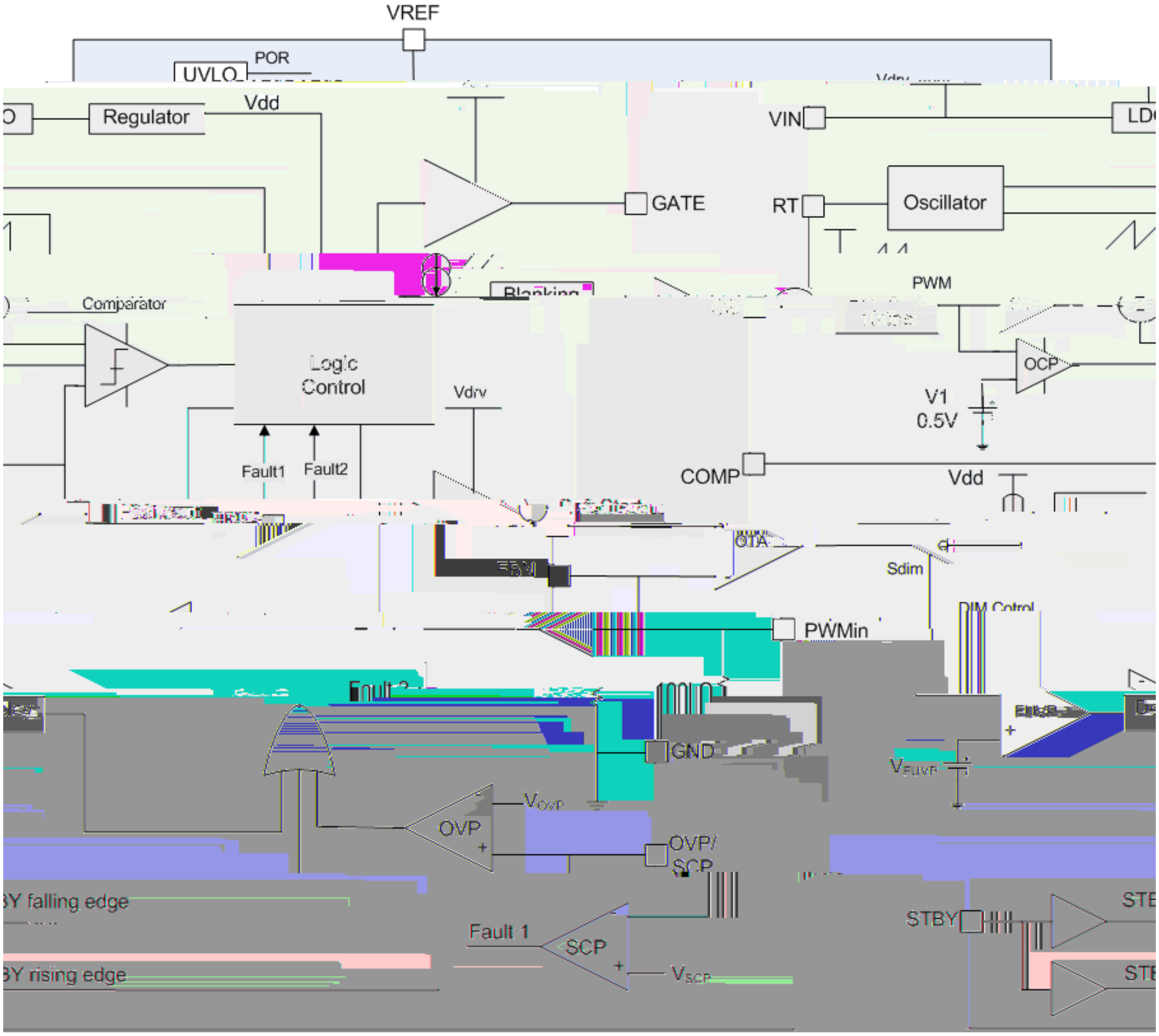
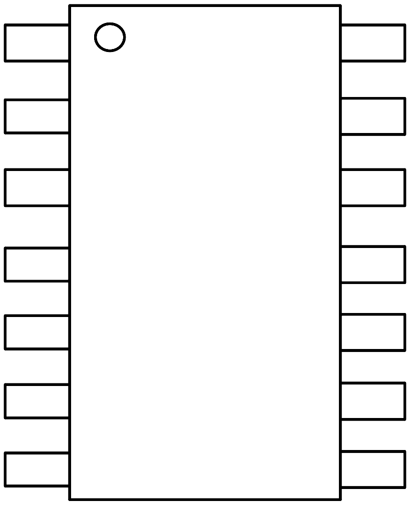


- ±1% Vref Voltage Accuracy to set LED Current
- PWM Controlled Dimming
- Soft Start Limits In−Rush Current
- Open Feedback Protection
- Open LED Protection
- Short LED Protection
- LED String Cathode Short to ground Protection
- Max Duty Cycle Above 90%
- SOIC−14 Package
- This is a Pb−Free Device

- TFT−LCD TV Panels
- LCD Monitor Panels


VREF
POR
UVLO
Vdrv
Regulator
Vdd
VIN
GATE
RT
Oscillator
Blanking
PWM
Comparator
Logic
Control
OCP
V1
0.5V
Vdrv
Fault1
Fault2
COMP
Vdd
OTA
Sdim
PWMin
DIM Cotrol
Fault 2
GND
V_{FUVP}
V_{OVP}
OVP
OVP/
SCP
Fault 1
SCP
V_{SCP}
STBY



			μ
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						Ω
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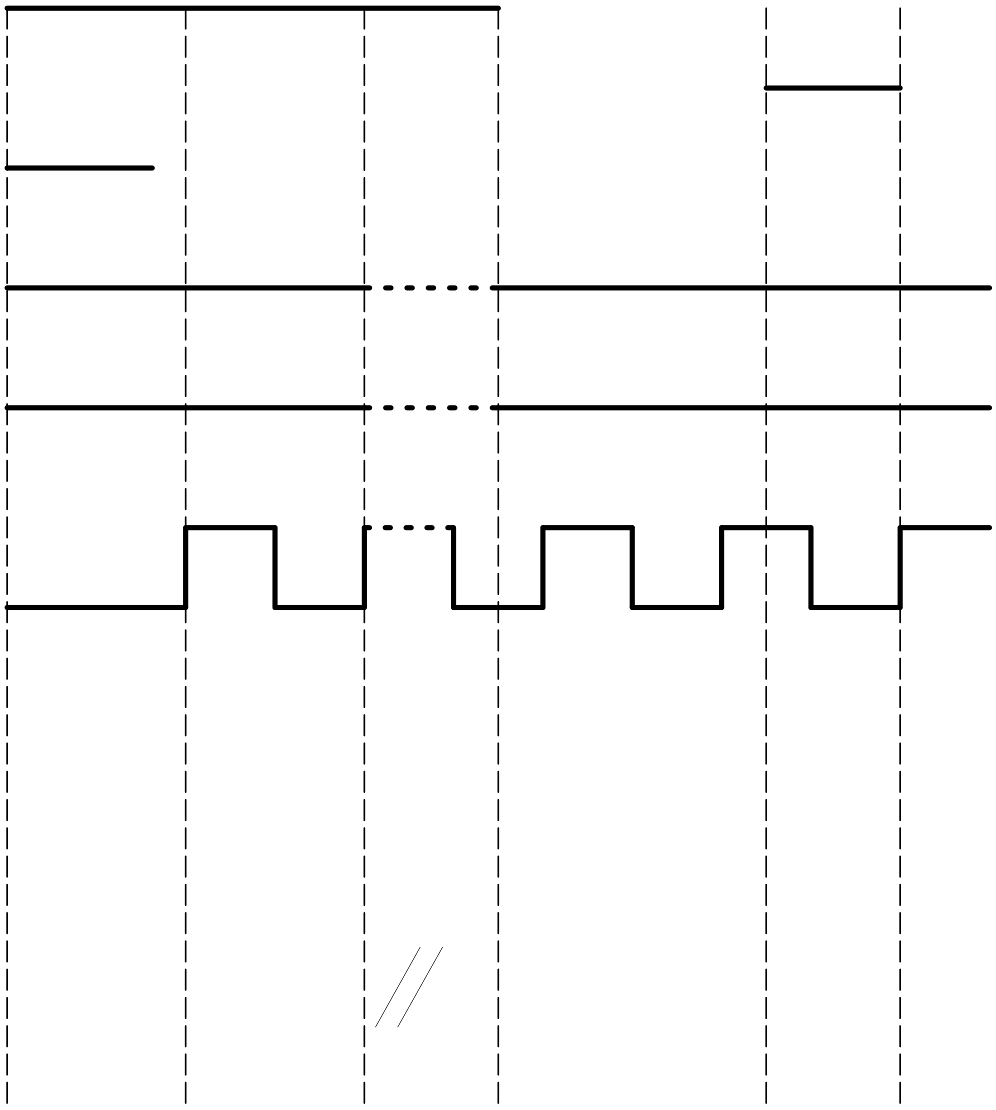


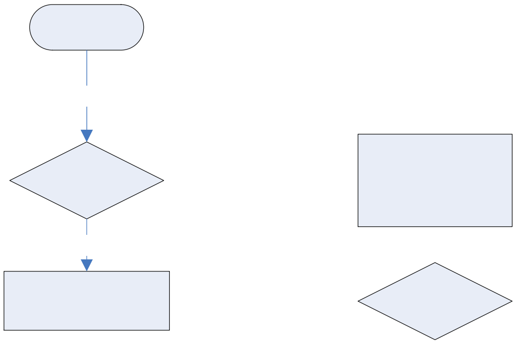
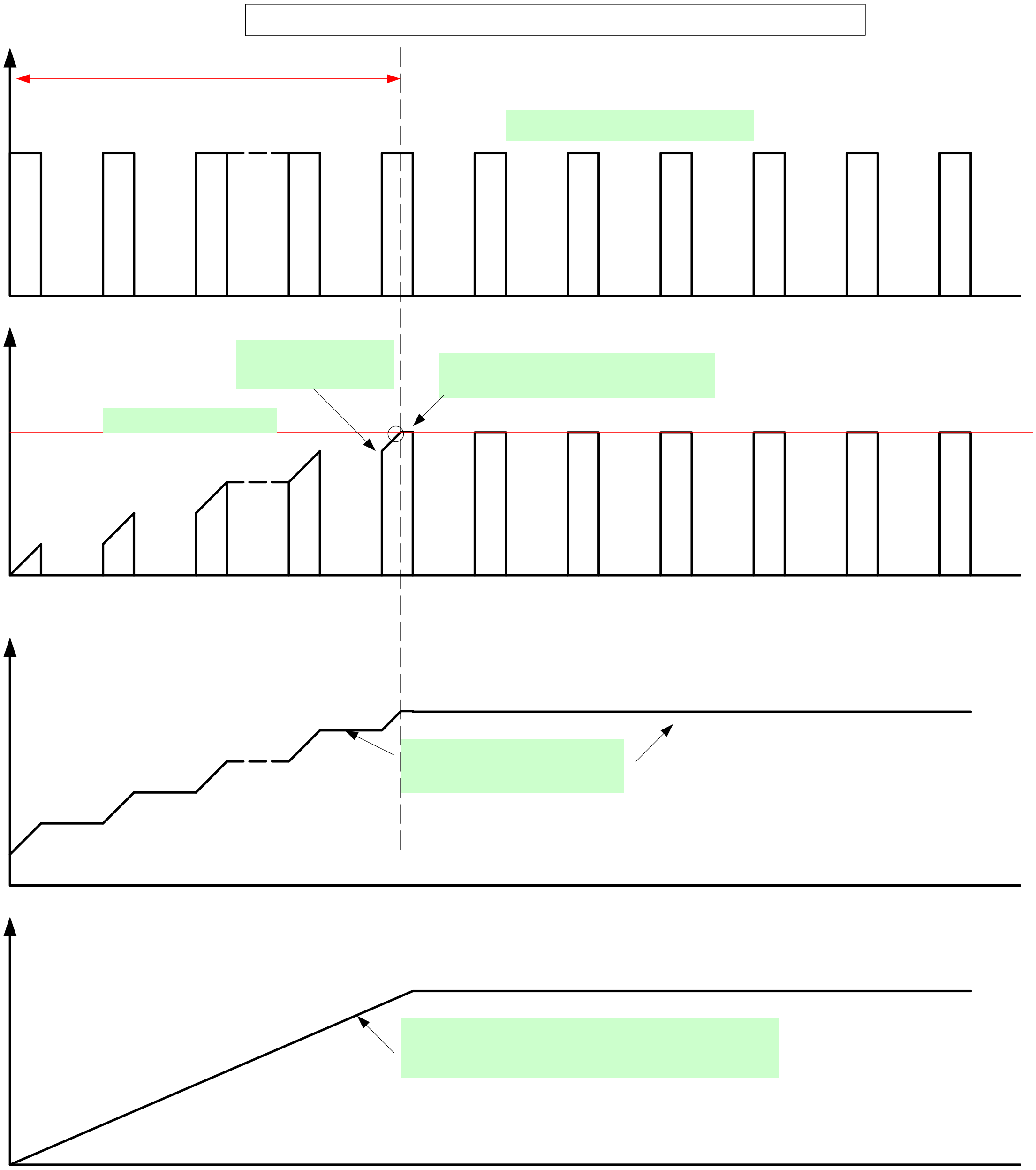


Figure 7 below shows an example of a soft start when the device is powered up from standby with a PWM input. The PWM signal here is at 100 Hz with a duty cycle of 30%. In this case the LED reaches 100% of its programmed value in 100 ms. This time can be decreased if the PWM signal runs at a higher duty cycle.



Since external transistors are required for the boost converter and PWM dimming functions, the device contains an internal 10 V regulator to drive the gate of these transistors. In the case of the PWM transistor this also functions as a level translator for the PWMin input pin. When selecting external components it is important that the transistor has enough gate drive to ensure low $R_{DS(on)}$ for the expected current.

The device contains an accurate 5 V reference that can supply up to 10 mA and can be accessed through the VREF pin. It can be used to program the LED feedback voltage by using a resistor divider on the FBP pin. This reference is only active when STBY = low. When the device is in standby mode the VREF pin voltage will drop to 4.2 V typical with a minimum of 3.5 V. The VREF will return to 5 V immediately when STBY is driven high.

If the steady state duty cycle and switching frequency combine to generate short Ton times (low VOUT/VIN converter ratio), the converter will skip some cycles to regulate V_{OUT} which will increase output voltage ripple. The timing limit is set by the intrinsic loop propagation delay and the switching frequency will be limited by the minimum ON time and OFF time.

For a given application, it is necessary to know the input voltage at the inductor ($VIN_{INDUCTOR}$), the output current (I_{OUT}) set by RFBN and the voltage on the FBP pin, and the switching frequency (F_{sw}). The inductor can be chosen using the formula below:

$$< \frac{\quad}{\times \quad \times} \times \left(\frac{\quad}{\quad}\right) \times \left(\quad - \quad \right)$$

The minimal inductor value is determined with the desired peak current flowing through the inductor. Using the chosen inductor value the steady state duty cycle and peak inductor current can be calculated:

$$= \frac{\sqrt{\times \quad \times \quad \times \quad \times \left(\quad - \quad \right)}}{\quad}$$

And the inductor peak current is now:

$$= \frac{\times}{\quad}$$

Calculating the output voltage ripple will size the output capacitor value. The output voltage ripple equation below takes into account the parasitic impedance (ESR) of this output capacitor:

$$\Delta \quad = \frac{\times \left(\quad - \quad \right)}{\times} + \quad \times$$

$$\Delta \quad = \frac{\quad}{\times} \times \left(\quad - \frac{\times \quad \times}{-} \right) + \quad \times$$

Combining Equations 2 and 16 gives the following expression for I_{OUT}:

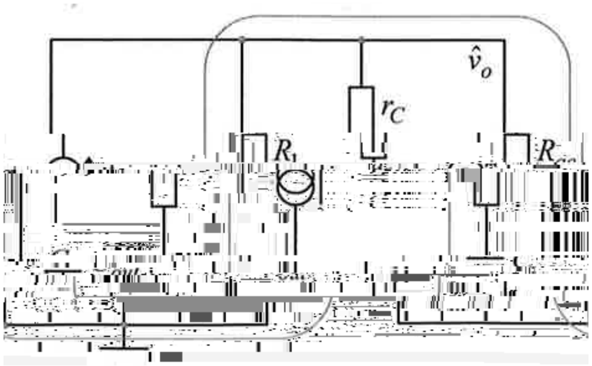
$$= \frac{\times \quad \times}{\times (\quad - \quad) \times (\quad \times \quad)}$$

To obtain the small signal equation, partial derivates of the output current are calculated with respect to the control voltage Vc and the output voltage V_{OUT}.

$$\frac{\partial}{\partial} = \frac{\times \quad \times}{(\quad - \quad) \times (\quad \times \quad)}$$

$$\frac{\partial}{\partial} = \frac{\times \quad \times}{\times (\quad - \quad) \times (\quad \times \quad)} = \frac{}{-}$$

From the AC model below the control to output transfer function can be calculated:



$$= \frac{}{} = \frac{}{} \times \frac{}{}$$

$$= \quad \times \frac{}{}$$

$$= \frac{\left(\quad + \frac{}{} \right) \times}{\left(\quad + \frac{}{} \right) +} = \quad \times \frac{+ \quad \times \quad \times}{+ \quad \times \quad (\quad + \quad)}$$

Where

$$= \frac{\times}{\times}$$

$$= \frac{}{\frac{}{}} = \frac{\times (\quad - \quad) \times (\quad \times \quad)}{\times \quad \times} = \frac{-}{}$$

The dynamic resistance $r_{AC(LED)}$ is evaluated using the LED specification.

$$= \quad + \quad \times$$

The control to output transfer function is expressed following the formula below:

$$ = \quad \times \frac{+ -}{+ -} $$

Where

$$ = \frac{\partial}{\partial} \times \qquad = \frac{\times \quad \times}{(\quad - \quad) \times (\quad \times \quad)} \times \frac{\times}{+} $$

$$ = \sqrt{\frac{\times \quad \times \quad \times}{(\quad - \quad)}} \times \frac{}{\times} \times \frac{\times}{+} $$

$$ = \frac{}{\pi \times (\quad + \quad) \times} $$

There is also a right half plane zero:

$$ = \frac{}{\pi \times \quad \times} $$

As the boost converter also operates in DCM, there is also a right half plane zero regulated to high frequency:

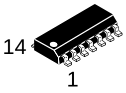
$$ = \frac{\times}{\pi \times} $$

Type II compensation is used to compensate the two dominant poles f_p of the control to output transfer function. The compensator zero has to be placer at the f_p frequency of the transfer function.

$$ = \frac{}{\pi \times \quad + \quad \times} = \quad = \frac{}{\pi \times \quad \times} $$

The simplified equation to set the switching frequency using resistor R_T:

$$=$$



SCALE 1:1

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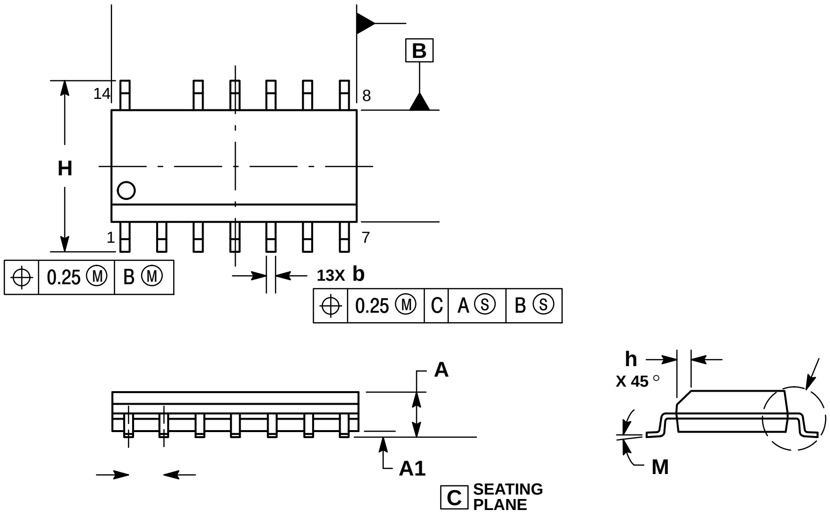
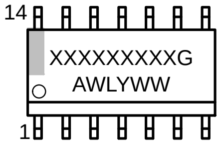


NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF AT MAXIMUM MATERIAL CONDITION.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSIONS.
5. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.

GENERIC MARKING DIAGRAM*



XXXXX = Specific Device Code
A = Assembly Location
WL = Wafer Lot
Y = Year
WW = Work Week
G = Pb−Free Package

STYLES ON PAGE 2

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STYLE 7:
PIN 1. ANODE/CATHODE
2. COMMON ANODE
3. COMMON CATHODE
4. ANODE/CATHODE
5. ANODE/CATHODE