Application Hint 47

High Output Voltage MIC2199

Description

The MIC2199 is a synchronous buck-switching regulator controller. An all N-Channel synchronous architecture and powerful output drivers allow up to a 20A output current capability. The MIC2199 operates from a 4.5V to a 32V input and can be programmed for output voltage from 0.8V to 6V. The 300kHz switching frequency allows the use of a smaller inductor and the external COMP pin allows for a different output capacitor to be used for optimum transient response.

Some applications may require an output voltage which is greater than 6V that is allowed by the MIC2199 controller due to common-mode-voltage limitation of the current sense amplifier. The circuit in Figure 1 shows an application circuit for V_{IN} = 19V and V_{OUT} = 12V for a load current of up to 6A using MIC2199 and MIC6211. The MIC2199 controller is configured in voltage mode by disabling the current sense amplifier by shorting CSH and V_{OUT} to V_{DD}(5V). Current limiting is done externally with an MIC6211(op-amp), a current sense resistor and a diode. During current limiting the output of the op-amp pulls high on the FB pin of the MIC2199 thru D3. The op-amp is configured as a difference amplifier with a gain of 10 to produce the following voltage on anode of D3:

Equation (1)

$$V\_ANODE\_D3 = \frac{R2}{R6} \times (VA - VB) = \frac{10k}{1k} \times \left(R_{SENSE} \times I_{LOAD}\right)$$

After substituting values, V_ANODE_D3 = 10 × (0.02 × 6A) = 1.2V.

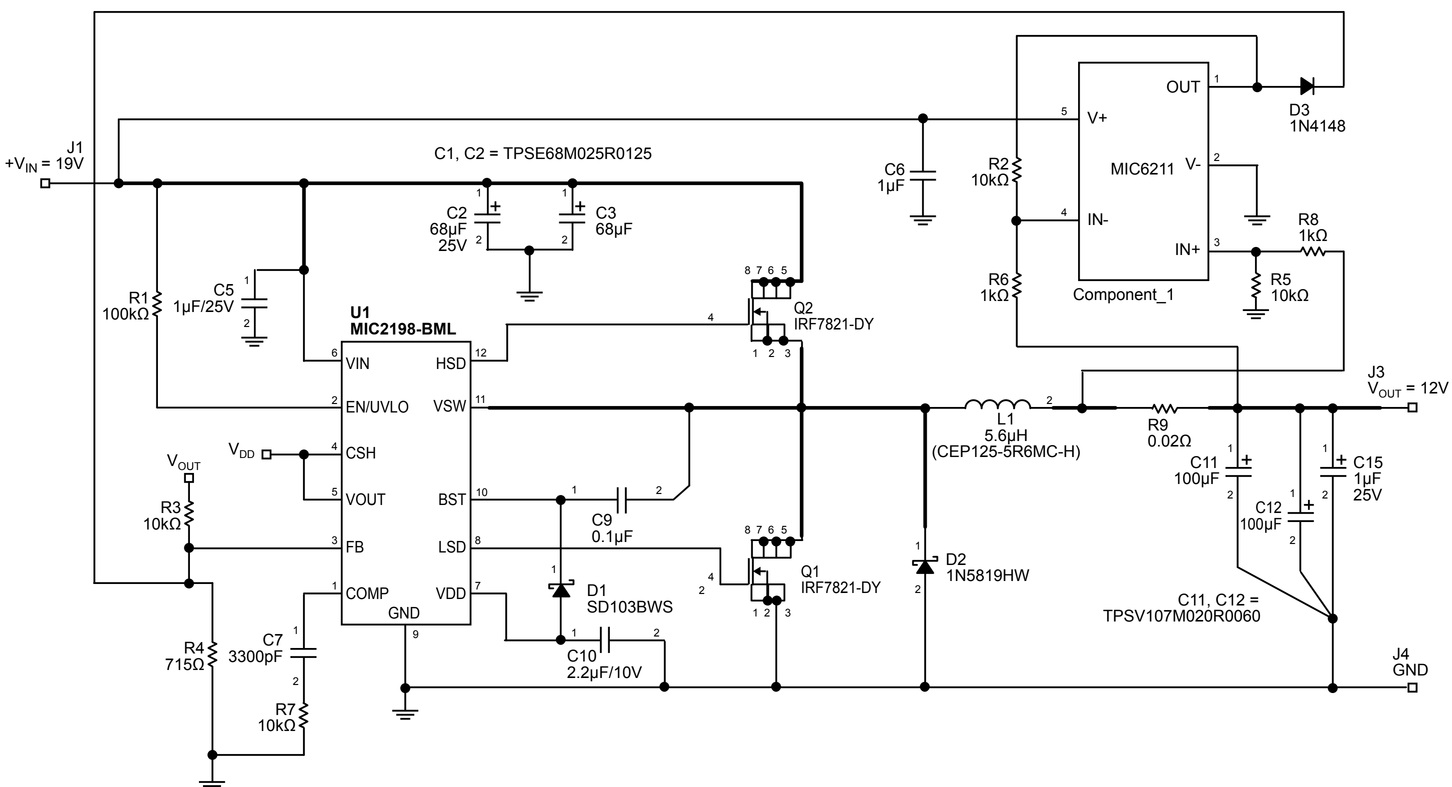

Figure 1. MIC2199 V_{IN} = 19V, V_{OUT} = 12V, I_{LOAD} = 6A Application Schematic

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The voltage on cathode of D3 is the FB voltage of the MIC2199, which is 0.8V. Now as the load current increases to say 7.75A, V_{OUT_ANODE} jumps to 1.55V, this forward biases D3 and pulls the FB pin to 0.85V(1.55V-0.7V(diode drop)). By pulling the FB pin to 0.85V, the MIC2199 starts cutting back on the duty cycle and that limits the supplied load current from the input supply. As the load current increases further, the MIC2199 cuts back on the duty cycle even more to protect the MOSFETs from an overcurrent failure, which would occur during a hard short of output to GND. The circuit can easily be modified to declare current limit for a different load current by changing R2 and R5 to set a different gain factor in equation (1).

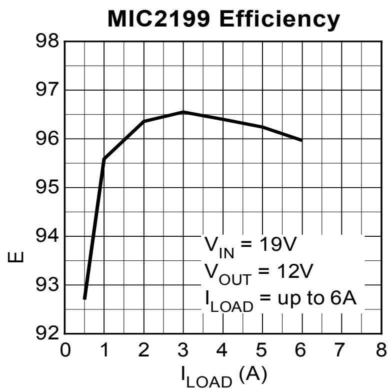

Figure 2. MIC2199 Efficiency for V_{IN} = 19V to V_{OUT} = 12V

The circuit can easily be modified to declare current limit for a different load current by changing the resistor ratio in equation 1, that is by changing resistor ratio R2/R6 and R5/R8.

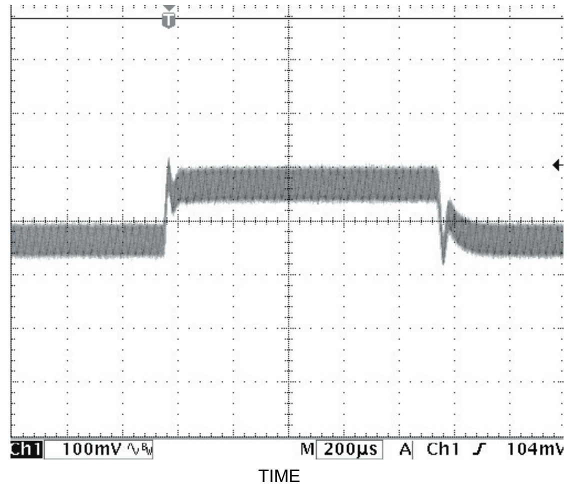

Figure 3. MIC2199 Transient Response for I_{LOAD} = 0.5A to 5.5A

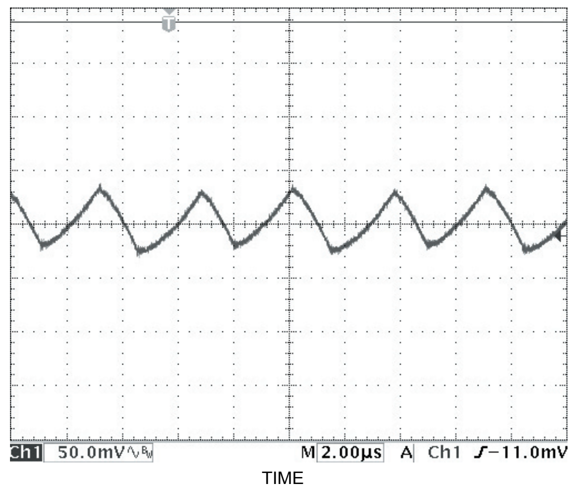

Figure 4. MIC2199 Output Voltage Ripple for I_{LOAD} = 6A

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