

# Constant Current Constant Voltage Buck Converter with LM25085, or, Implementing Accurate Current Limit with LM25085

National Semiconductor  
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LM25085 Constant-On-Time (COT) PFET controller provides an easy, cost-effective buck converter solution with excellent transient response. The high side PFET switch makes hundred percent duty cycle operation possible. Non-synchronous operation results in higher efficiency at low load.

In many applications a constant-current constant-voltage (CC/CV) dc source is needed. The I-V characteristic of a con-

stant-current constant-voltage (CC/CV) source is shown in [Figure 1](#). This application note presents an external op-amp based accurate current limit circuit suitable for CC/CV operation when the required constant current range is very narrow.

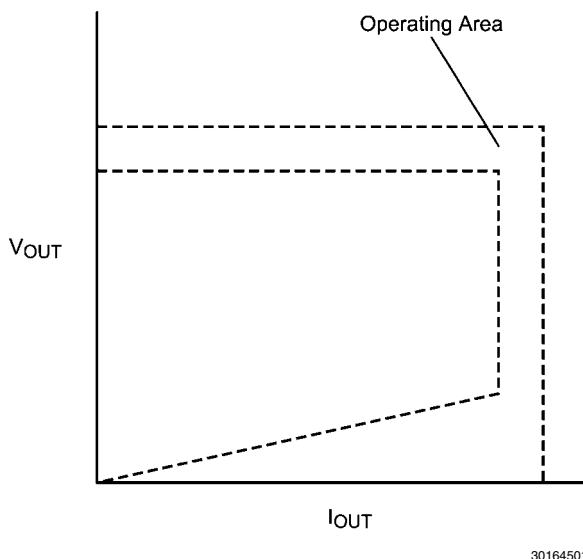
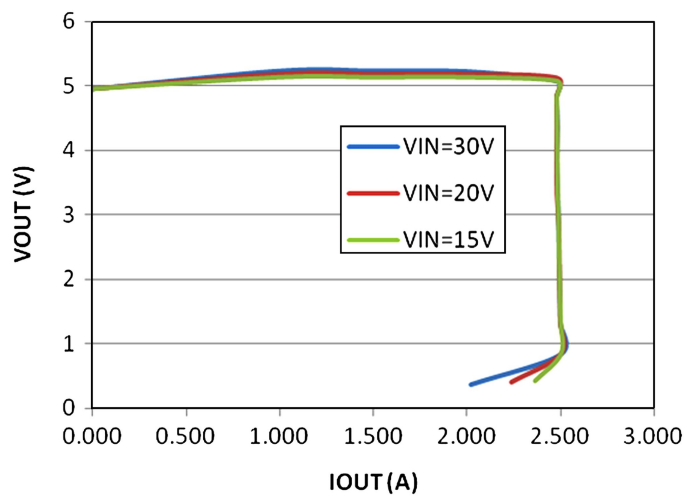


FIGURE 1. CC/CV Output Characteristic

An external current limit circuit ([Figure 2](#)) can be implemented for accurate control of LM25085 output current. The parts needed for external current limit are highlighted in blue. The operational amplifier LM321 is used in difference amplifier configuration to sense the voltage across a  $20\text{m}\Omega$  sense resistor in series with the load. The amplified current sense signal is compared to the internal reference of the LMV431A shunt regulator. If the amplified sensed signal amplitude exceeds the internal reference (1.2V) of LMV431A, the shunt

regulator pulls down the current sense (ISEN) pin of LM25085, thereby, terminating the 'ON' pulse. A proportional-integral (PI) type compensation is used with the shunt regulator to provide low current sense error. The operation should be experimentally verified over the input voltage and load current range of the application. [Figure 3](#) shows the resulting I-V characteristics of the converter output for different input voltages. The external current sense circuit results in a sharp knee in I-V curve and very accurate current limit.

**FIGURE 2. LM25085 with Accurate Current Limit Circuit Based on LM321 and LMV431A**



**FIGURE 3. I-V Characteristics of LM25085 with Accurate Current Limit Circuit**

## Notes

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LDOs	<a href="http://www.national.com/ldo">www.national.com/ldo</a>	Quality and Reliability	<a href="http://www.national.com/quality">www.national.com/quality</a>
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