Application Note
AN-06016

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Selecting correct CISSOID's regulator depending on application

Introduction

In order to protect serial voltage regulators against short-circuit events, CISSOID's regulator families are internally protected in order to limit the short-circuit current. In our application note AN-06002, it is explained that if a regulator is charged by load acting like an ideal current source or if a resistive load is connected to an opposite voltage, then there exist some constraints on the regulator short-circuit current for correct startup of this device.
In order for customers to easily choose the most appropriate regulator for their applications, the next section presents a table summarizing available CISSOID's voltage regulators with key points to take into account for optimal selection.

All these regulators, either positive or negative output voltage, are available in 2.5V; 3.3V; 5V; 5.5V; 9V; 10V; 12V; 13V and 15V versions. All of our regulators are currently available as die or in TO-3 or T0-254 packages. Some additional nominal voltages between 2.5V and 15V can be obtained when using only the TO-254 package. Please contact CISSOID if you have a special voltage request.

Related document: **AN-06002**: *"Voltage regulator short-circuit protection and associated potential startup problem"*

Selecting the most appropriate regulator

Figure 1 sketches respectively the use of a positive (CHT-LDOX) and a negative (CHT-LDNX) voltage regulator with a generic load consisting of a grounded resistor (R_L), an ideal current source (I_0) and a resistor (R_D) connected to an opposite voltage, giving rise to a current I_D. The sum of these last two currents is defined as I_1.

Table 1 summarizes the different regulator versions and their main differences. More details can be found in respective datasheets on CISSOID's website.

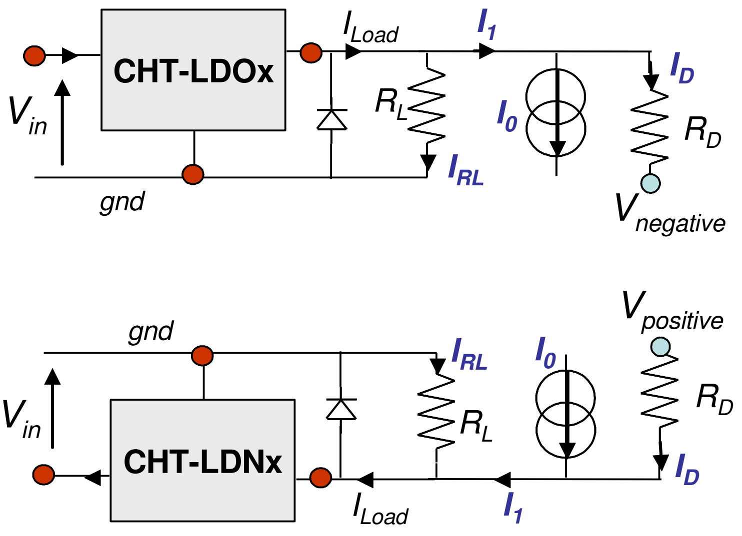

Figure 1: CISSOID's "CHT" family of positive (top) and negative (bottom) voltage regulator on a generic load.

Positive regulators	Max I_1 before startup[a]	I_{SC} *(typical)*	I_{FB} *(typical)*	Static current consumption	Line Regulation (5V mode, typical)
CHT-LDO-xxx[b]	*0 mA*	*80 mA*	*2.5A*	*10mA*	*0.5mV/V*
CHT-LDOS-xxx	*200 mA*	*300mA*	*2.5A*	*3.15mA*	*1mV/V*
CHT-LDOP-xxx	*0 mA*	*80mA*	*2.5A*	*3.3mA*	*1mV/V*

Negative regulators	Max I_1 before startup (*note1*)	I_{SC} *(typical)*	I_{FB} *(typical)*	Static current consumption	Min dropout	Line Reg (5V mode typical)
CHT-LDN-xxx	*0 mA*	*80 mA*	*2.5A*	*2.5mA*	*1.5V*	*1mV/V*
CHT-LDNS-xxx	*200 mA*	*700mA*	*2.5A*	*2.75mA*	*2.0V*	*1mV/V*

Table 1: Different available regulators and their main differences (5V mode).

NOTES:

[a] I_1 in table 1 is the current **BEFORE** the regulator startup. I_1 is therefore calculated assuming that the regulator output voltage is equal to zero and assuming that the external opposite voltage ($V_{negative}$ or $V_{positive}$) is already in steady state. See below for an example of correct selection of CISSOID's voltage regulators.

[b] The "xxx" code at the end of the regulator type represents the nominal voltage in tenths of volt. For example, CHT-LDO-033 stands for a 3.3V version, while CHT-LDO-150 stands for a 15V version.

Example of CISSOID's regulator selection:

The objective of this example is to show how to choose both regulators in order to guarantee that they both will start-up correctly.

Figure 2 sketches an application requiring a positive 15V and a negative -10V regulator. Each regulator output is charged by a 50Ω resistive load to ground. Additionally, we assume a 100Ω resistive load connected directly between the positive and the negative regulator outputs. Note that decoupling capacitors are not shown here for simplicity, though in practice they are required, as mentioned in datasheets.

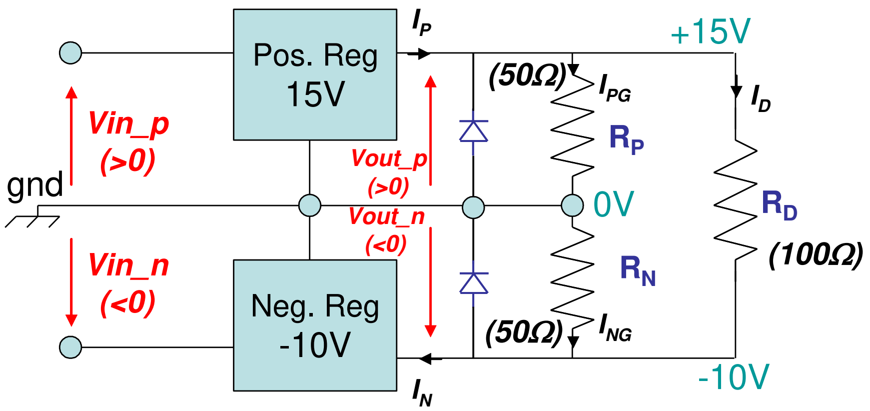

Figure 2: Example of positive and negative voltage regulator selection for a given load.

Positive regulator selection:

Based on figure 1 (top), we have to calculate I_1 assuming that Vout_p of figure 2 is equal to zero and assuming that Vout_n is already in steady state, i.e. -10V.
This leads to $\mathbf{I_1}$ **=** 10V/100Ω = **100mA** before the positive voltage regulator startup.
Based on table 1, as I_1 is greater than zero and smaller than 200mA, only **CHT-LDOS-150** guarantees the correct startup of the system and the correct recovering after a short-circuit. Startup or recovering after a short-circuit event is not guaranteed with other positive regulators, even if in most of cases, thanks to some transients (capacitors, ramp on supply voltage, etc), the voltage regulator could be working correctly.

In the example of figure 2, when both regulators are settled, I_1 is equal to 250mA. This is larger than the 200mA threshold from table 1, but this is not a problem as only I_1 **before** starting (i.e. 100mA in figure 2) must be considered for correct startup!

In normal operation, once both regulators are settled, the total current delivered by the positive voltage regulator is
(15V/50Ω)+(25V/100Ω)=0.55A.
This is OK as CHT-LDOS-150 can deliver up to 1A at 225°C (with 2V dropout)

Negative regulator selection:

Based on figure 1 (bottom), we calculate I_1 before the negative regulator startup, i.e. 15V/100Ω = 150mA. This is more than zero and less than 200mA. Looking in table 1, the regulator that will guarantee correct startup and correct recovering after short-circuit is the **CHT-LDNS-100**. The total output current of this regulator (after start-up) is 10V/50Ω+25V/100Ω = 450mA. This is OK as CHT-LDNS-100 can deliver up to 1A at 225°C (with 2V dropout).

Note in the example of figure 2 that if no resistor R_D is present, then it would be a better choice to select the CHT-LDO-150 (or CHT-LDOP-150 for lower power consumption at cost of slightly lower line regulation) and the CHT-LDN-100. Indeed, these regulators present lower short-circuit current than others. Of course, if the short-circuit current level is not critical for your application, CHT-LDOS and CHT-LDNS families are the most versatile choice as they will guarantee you correct startup, with or without R_D in figure 2.

Contact & Ordering

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