CHT-LDN-DATASHEET

Version: 1.6
5-Nov-10
(Last Modification Date)

High-Temperature, Negative 3.3V; 5V; 5.5V; 9V; 10V; 12V; 13V or 15V, Low-Dropout SOI-CMOS Voltage Regulator.

General Description

The CHT-LDN is a 1A, low-dropout negative linear voltage regulator compatible with high-temperature environments. Typical operation temperature range extends from -30°C to 225°C.

The circuit is stable throughout the whole temperature range and under a large choice of capacitive loads.

The minimum dropout voltage (V_{in}-V_{out}) is -1.5V for load current up to 1A. The dropout voltage can span from -1.5 Volt down to -20 Volts(1).

The circuit is a one-die solution.

CHT-LDN is available as die or packaged (currently TO-3 and TO-254) on demand.

<u>Related documents:</u>

- ***AN-06016**: "Selecting correct CISSOID regulator depending on your application"*
- ***AN-06002:** "Voltage regulator short-circuit protection and associated potential startup problem".*

Applications

Power supplies for high-temperature electronic systems used in Well logging, Automotive, Aeronautics or Aerospace applications.

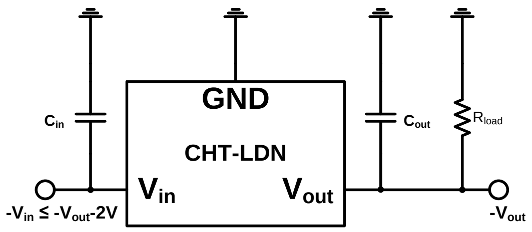
Features

- -1.5V to -20V(1) dropout Voltage
- Max 1A output current @ 225°C
- 60dB input ripple rejection (0-200Hz)
- C_{load} from 100nF to 1000µF, large ESR range
- Available as die or in custom package on demand. (3-pin compatible)
- The start-up is operative over the whole temperature range
- Latch-up free

Available voltages:

- CHT-LDN-033: -3.3V
- CHT-LDN-050: -5.0V
- CHT-LDN-055 : -5.5V
- CHT-LDN-090 : -9.0V
- CHT-LDN-100 : -10.0V
- CHT-LDN-120: -12.0V
- CHT-LDN-130: -13.0V
- CHT-LDN-150: -15.0V

Typical application



Absolute Maximum Ratings

Supply Voltage Vin	0.3…-40V
Junction Temperature(2) (Tj)	300°C
Power dissipation (3)	

Operating Conditions

Supply Voltage	-1.5 to -20V dropout(1)
Junction temperature	-30°C to 225°C
Power Dissipation (3)	

ESD Rating (expected)

Human Body Model	>1kV

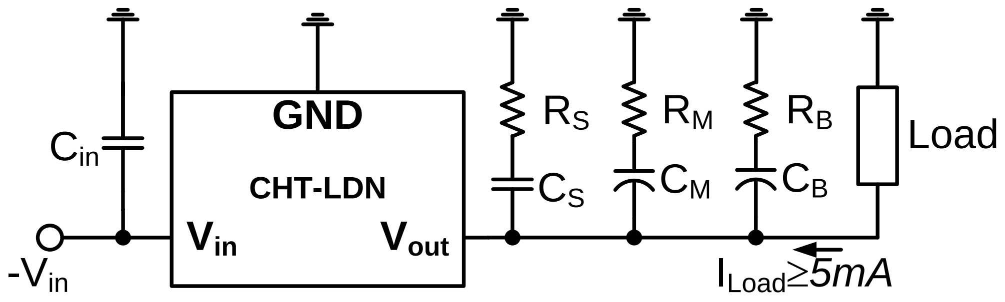
Electrical Characteristics

The following table is relative to the -5V mode (CHT-LDN-050) with Vin=-7V (-Vout-2V). For other nominal voltage, see notes under this table.

Parameter	Condition	Min	Typ	Max	Units	*note*
Output voltage accuracy	I_L=10mA -30°C <Tj <225°C	-2	0	2	%	
Output voltage T° drift	I_L=10mA -30°C <Tj <225°C	0	40	80	ppm	(4)
Output voltage line regulation	|Vin|=|Vout|+2V to 14V I_L=60mA, -30°C <Tj <225°C	0		3	mV/V	(5)
	|Vin|>14V I_L=60mA, -30°C <Tj <225°C	-1		1	mV/V	(5)
Output voltage load regulation (i.e. R_{out})	I_L=10mA to 1A |Vin|=|Vout|+2V -30°C <Tj <225°C		0.05	0.1	V/A	(6)
|Vin|-|Vout| *(droupout)*	I_L=1A, -30°C <Tj <225°C	1.5			V	
Quiescent Ground Pin current	0 < I_L <1A -30°C 225°C		 2.45 2.63		mA	(7)
Power supply rejection ratio	f=0Hz ..200Hz; |Vin|>14V I_{load}=100mA	60			dB	(8)
Foldback current			2.7	3	A	
Short-circuit current	-20°C <Tj <225°C			200	mA	
Output noise	10Hz-1kHz I_L=100mA, 25°C		680		μV_{RMS}	(9)

Notes:
(1) |Vin| max=30V
(2) Above 225°C (T_j), a minimum load current of 10 mA could be required.
(3) Max Power dissipation depends on packaging. CHT-LDN in TO-3 or TO-254 packages presents a "junction-to-case" thermal resistance of maximum 5°C/W (Rth).
(4) ppm are defined as [d(Vout)/d(T)]/Vout. For -5V mode, 40ppm correspond to -200µV/°C.
(5) Defining "***x***" as the nominal voltage, the line regulation is better than ***x***/5 mV/V for |Vin|>14V and better than 3***x***/5 mV/V for |Vin|≤14V
(6) This includes the packaging parasitic resistor.
(7) Defining "***x***" as the nominal voltage, the typical quiescent current at 2V dropout can be approximated as 2.275+ ***x*** *0.035 (mA) @ -30°C and 2.345+ ***x*** *0.057 (mA) @ 225°C.
(8) Defining "***x***" as the nominal voltage, the minimum power supply rejection ratio is 66-1.2***x*** for |Vin|>14V and better than 56-1.2***x*** for |Vin|≤14V
(9) Defining "***x***" as the nominal voltage, typical noise level is (***x***/15)*680µV.

Output Load, recommended specifications



A minimum load current of 5mA is required. Bellow this value, a small oscillation of a few tens of mV can occur at the regulator output.

Resistances in series with capacitors represent the internal ESR of these capacitors.

For large capacitors:

C_B= 0 to 1000µF

R_B= 0.2 to ∞ Ω

For medium capacitors:

C_M= 0 to 6µF

R_M=0.1 to 1 Ω

For small capacitors:

C_S= 100n to 220nF

R_S=10m to 50m Ω

Operating Conditions

Start-up conditions

The start-up is operative over the whole temperature range as long as all loads are connected to ground. The start-up is not guaranteed if the positive regulator output has a current path directly connected to a negative voltage. Indeed, such load condition can lead to wrong activation of the short-circuit protection, i.e. a bad start-up or a bad recovering after short-circuit. In this case, it is recommended to use our CHT-LDOS regulator family instead of CHT-LDOP regulator family.
Please refer to our application notes for more details:

- ***AN-06016***: *"Selecting correct CISSOID regulator depending on your application"*
- ***AN-06002:*** *"Voltage regulator short-circuit protection and associated potential startup problem".*

Fast load current transients

Output voltage overshoots and undershoots are ~10% of the nominal regulated voltage when C_{Load}>22µF (ESR<1ohm) and load current transients (10mA↔1A) within 1µs. For transients longer than 10µs, load capacitance of 1µF is enough.

Power dissipation considerations

When determining the maximum power dissipated by the regulator, not only the dissipation during normal operation must be considered, but also the power dissipated during any eventual short circuit or overload.

During short circuit or overload, worst case conditions are normally found for maximum Vin and a shorting resistance in the order of few Ohms.

Entering into short-circuit or overload conditions with high input voltages Vin may lead to extreme overheating, placing the part above Absolute Maximum Rating conditions.

Please refer to our application note for more detail:

- ***AN-090477***: *"Power Dissipation Considerations During Short Circuit Conditions"*

Shorting the regulator input

If the input terminal is shorted to ground once the output capacitance has been charged, a large current corresponding to the discharge of the output capacitor will flow from the output to the input through the drain-body diode of the internal pass transistor. This large current may cause the permanent damage of the part.

Sinking current or raising the output voltage above the input voltage can cause permanent damage to the part.

Regulator floating ground

When the ground becomes disconnected, the output voltage gets unregulated, causing possible damage to other circuits connected to Vout. If the ground terminal is reconnected while Vin is applied, permanent damage may also occur to the regulator. If a regulator needs to be reconnected with the power supply on, then connect the ground terminal first.

Measurements (CHT-LDN-150)

Note : Temperatures hereafter are ambient temperatures.

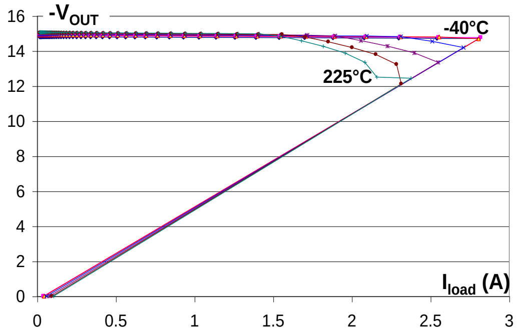


Figure 1: -V_{out} vs.I_{Load} (@2V dropout)

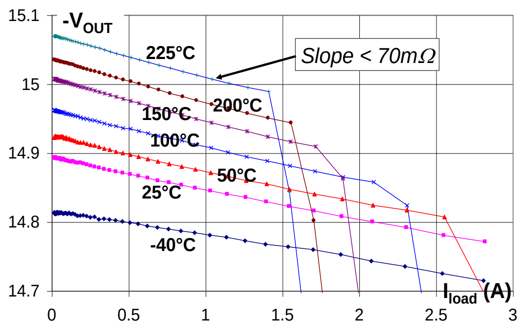


Figure 2: Zoom on figure 1

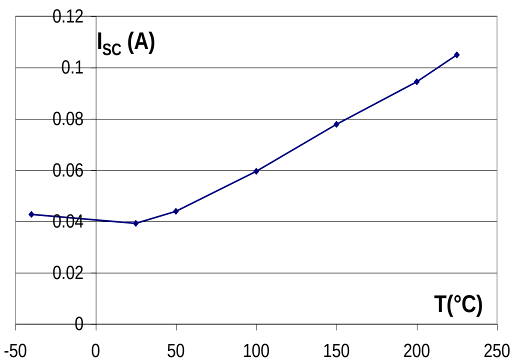


Figure 3:Short-circuit current vs. T°

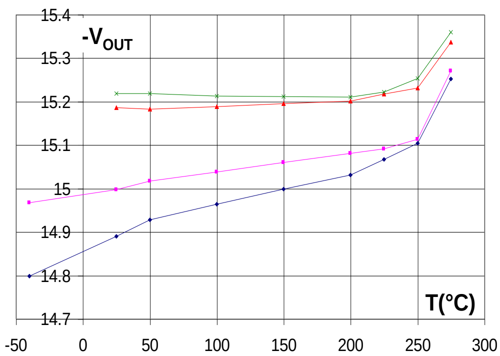


Figure 4: -V_{out} vs. T° (dropout=2V ; I_{load}=60mA, 4 samples)

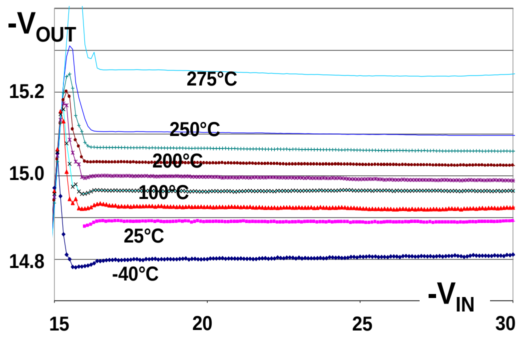


Figure 5: -V_{out} vs. -V_{in} over T° (I_{load}=60mA)

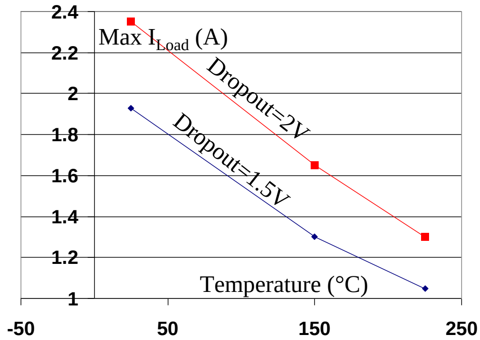


Figure 6: Typical max load current over T° vs. dropout

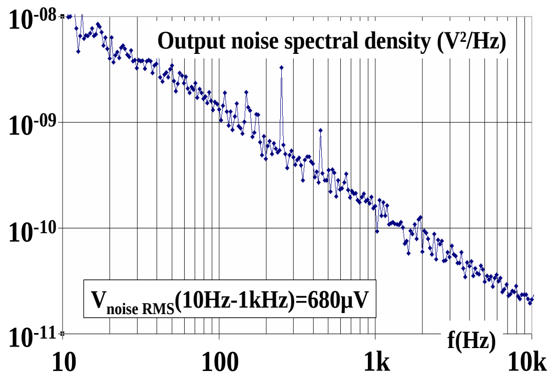


Figure 7: S_{Vout}(V²/Hz)@25°C, I_{load}=100mA

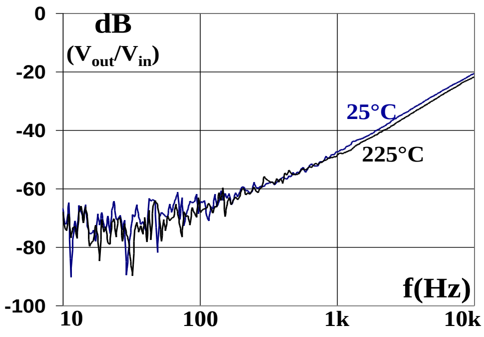
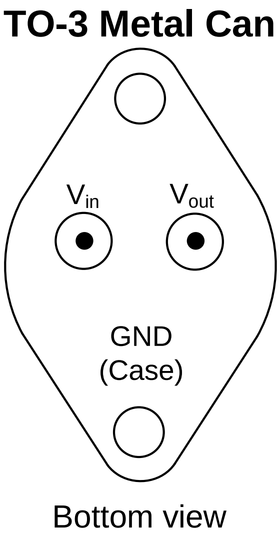
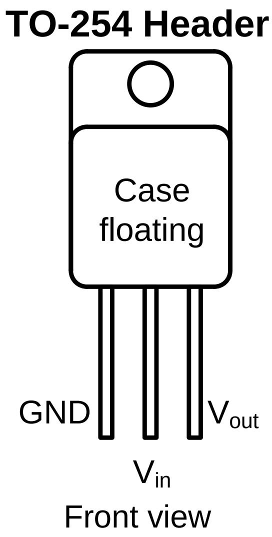


Figure 8: Input ripple rejection

Packaging and Pinout

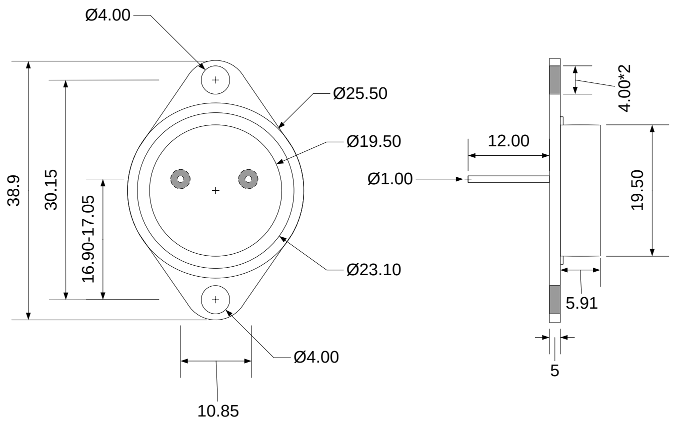




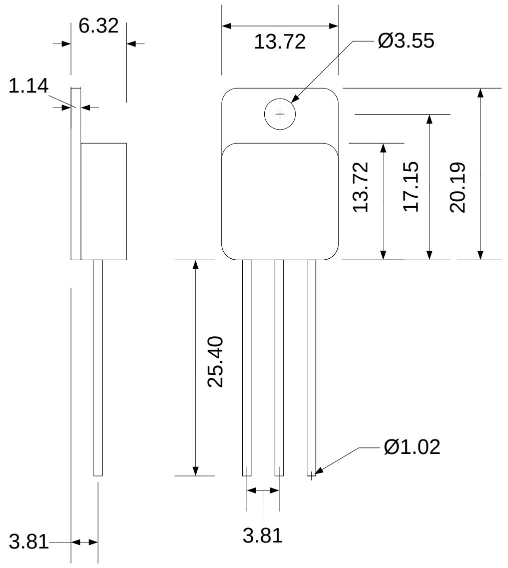
Ordering Information

Ordering Reference	Package	Output Voltage	Temperature Range	Marking
CHT-LDN-033-TO3-T	Metal TO3	3.3V	-55°C to +225°C	CHT-LDN-033
CHT-LDN-033- TO254-T	Metal TO254	3.3V	-55°C to +225°C	CHT-LDN-033
CHT-LDN-050-TO3-T	Metal TO3	5V	-55°C to +225°C	CHT-LDN-050
CHT-LDN-050- TO254-T	Metal TO254	5V	-55°C to +225°C	CHT-LDN-050
CHT-LDN-055-TO3-T	Metal TO3	5.5V	-55°C to +225°C	CHT-LDN-055
CHT-LDN-055- TO254-T	Metal TO254	5.5V	-55°C to +225°C	CHT-LDN-055
CHT-LDN-090-TO3-T	Metal TO3	9V	-55°C to +225°C	CHT-LDN-090
CHT-LDN-090-TO254-T	Metal TO254	9V	-55°C to +225°C	CHT-LDN-090
CHT-LDN-100-TO3-T	Metal TO3	10V	-55°C to +225°C	CHT-LDN-100
CHT-LDN-100-TO254-T	Metal TO254	10V	-55°C to +225°C	CHT-LDN-100
CHT-LDN-120-TO3-T	Metal TO3	12V	-55°C to +225°C	CHT-LDN-120
CHT-LDN-120-TO254-T	Metal TO254	12V	-55°C to +225°C	CHT-LDN-120
CHT-LDN-130-TO3-T	Metal TO3	13V	-55°C to +225°C	CHT-LDN-130
CHT-LDN-130-TO254-T	Metal TO254	13V	-55°C to +225°C	CHT-LDN-130
CHT-LDN-150-TO3-T	Metal TO3	15V	-55°C to +225°C	CHT-LDN-150
CHT-LDN-150-TO254-T	Metal TO254	15V	-55°C to +225°C	CHT-LDN-150

Package Dimensions



Drawing TO3 (mm +/- 10%)



Drawing TO254 (mm +/- 10%)

Contact & Ordering

CISSOID S.A.

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