



CDT2301

150KHz Step-Down DC/DC Converter

● Features

- 3.3V, 5V, 12V and Adjustable Output
- Adjustable Version Output Voltage Range 1.23V to 18V \pm 4%
- Available in TO-220 and TO-263 Packages
- Output Load Current 3A
- Input Voltage Range up 22V
- 150KHz \pm 15% Fixed Frequency
- Low Power Standby Mode
- Thermal Shutdown and Current Limited Protection
- TTL Shutdown Capability

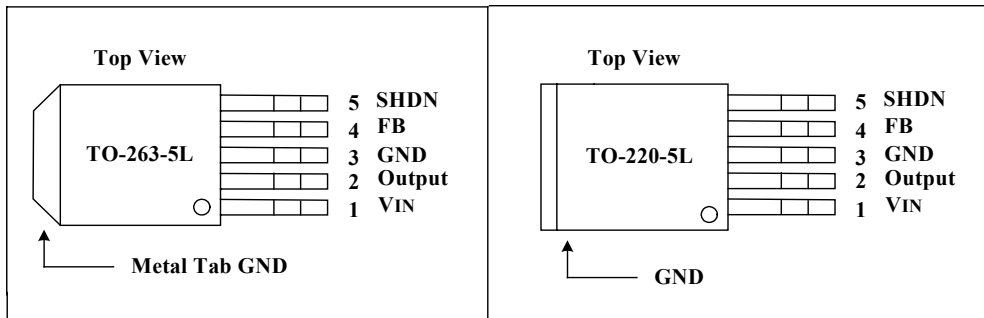
● General Description

The CDT2301 series are monolithic integrated circuits that provide a step-down switching regulator, and capable of driving a 3A load with excellent line and load regulation. These devices are available in fixed output voltage of 3.3V, 5V, 12V, and adjustable output version. Requiring a minimum number of external components, these regulators are simple to use and include internal frequency compensation and a fixed-frequency oscillator. The CDT2301 operates at a switching frequency of 150 kHz thus allowing smaller sized filter components than what would be needed with lower frequency switching regulators. The device features include a guaranteed \pm 4% tolerance on output voltage under specified input voltage and output load conditions, and \pm 15% on the oscillator frequency. It does also provide external shutdown, current limited and over temperature shutdown functions for complete protection under fault conditions. The packages are available in a standard 5-lead TO-220 and 5-lead TO-263 package.

● Applications

- On-card switching regulators
- Simple high efficiency step-down (buck) regulator
- Positive to negative converter

● Pin Assignment



● Ordering Information

CDT2301-X XX

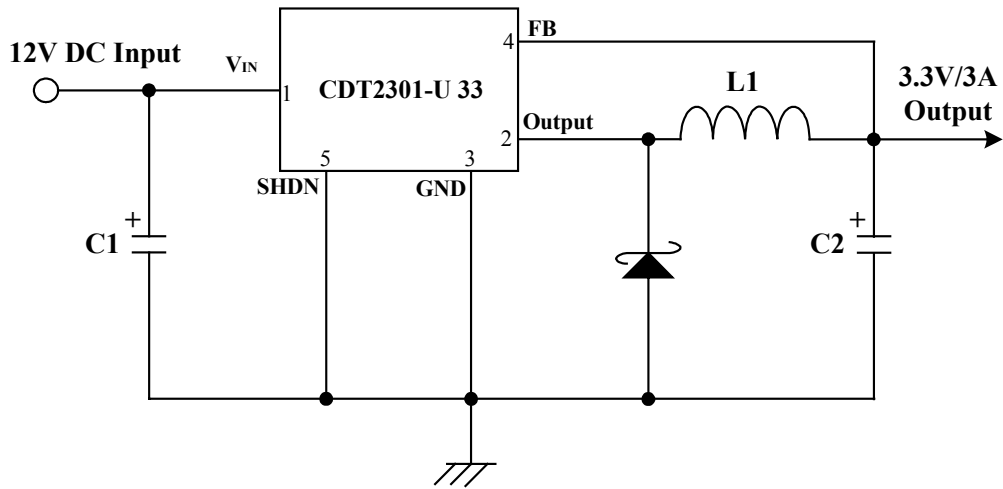
Package Type
 V: TO-220-5L
 U: TO-263-5L

Output Voltage
 33 : 3.3V
 50 : 5.0V
 12 : 12V
 ADJ : Adjustable

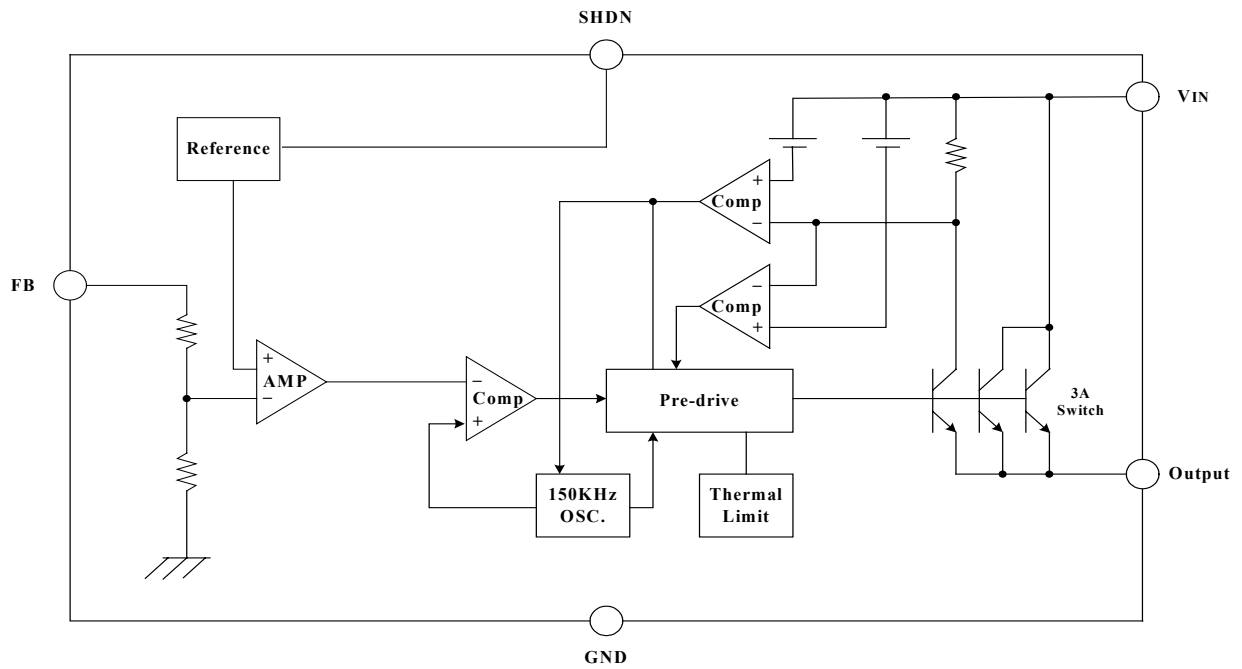
● Pin Description

NO.	PIN_NAME	FUNCTION
1	VIN	Supply Voltage Pin.
2	Output	Switch Pin. Connect inductor/diode here.
3	GND	Ground Pin.
4	FB	Feedback Pin.
5	SHDN	Shutdown Control Pin. Active-Low into shutdown mode.

● Typical Application Circuit



● Block Diagram



● Absolute Maximum Ratings

- Supply Voltage ----- -0.3V to 22V
- Input Voltage ----- -0.3V to $V_{IN}+0.3V$
- Operating Temperature ----- -40°C to 125°C
- Storage Temperature----- -50°C to 125°C

* Note : Stresses above those listed may cause permanent damage to the de

● Electrical Characteristic

(Specifications with standard type face are for $T_J=25^\circ\text{C}$, and those with **boldface type** apply over **full Operating Temperature Range**. Unless otherwise specified. $V_{IN}=12V$ for the 3.3V, 5V, Adjustable version and $V_{IN}=18V$ for the 12V Version $I_{LOAD}=500mA$)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_{FB}	Feedback bias Current	$V_{FB} = 1.3V$ (Adjustable Only)		40	60	nA
					100	
F_{OSC}	Oscillator Frequency		127	150	173	KHz
			110		173	
V_{SAT}	Saturation Voltage	$I_{OUT} = 3A$, No outside circuit and $V_{FB} = 0V$ force driver on		1.5	1.6	V
					1.7	
DC	Max. Duty Cycle (ON)	$V_{FB} = 0V$ force driver on		100		%
	Min. Duty Cycle (OFF)	$V_{FB} = 12V$ force driver off		0		%
I_{CL}	Current Limit	Peak current, No outside circuit and $V_{FB} = 0V$ force driver on	3.6	4	5.5	A
					6.5	
I_{LEAK}	Output Leakage Current	Output = 0V, No outside circuit and $V_{FB} = 12V$ force driver off			200	μA
		Output = - 0.8V, $V_{IN} = 20V$		10	30	mA
I_Q	Quiescent Current	$V_{FB} = 12V$ force driver off		5	10	mA
I_{STBY}	Standby Quiescent Current	SHDN Pin = 5V, $V_{IN} = 20V$		150	250 300	μA
V_L	SHDN Pin Logic Input Threshold Voltage	Low (Regulator ON)		1.3	0.6	V
V_H		High (Regulator OFF)	2.0			
I_H	SHDN Pin Logic Input Current	$V_{LOGIC} = 2.5V$ (OFF)		15	25	μA
I_L		$V_{LOGIC} = 0.5V$ (ON)		0.02	5	
θ_{JC}	Thermal Resistance, θ_{JC}	TO-220-5L	Junction to case		2.5	$^\circ C/W$
		TO-263-5L			3.5	
θ_{JA}	Thermal Resistance with Copper area of approximately 3 in ²	TO-220-5L	Junction to ambient		28	$^\circ C/W$
		TO-263-5L			23	

• **CDT2301-ADJ**

Symbol	Parameter	Conditions	Typ.	Limit	Unit
VFB	Output Feedback	$5V \leq V_{IN} \leq 20V$, $0.2A \leq I_{LOAD} \leq 3A$, VOUT programmed for 3V	1.23	1.193/ 1.18 1.267/ 1.28	V V _{MIN} V _{MAX}
η	Efficiency	$V_{IN} = 12V$, $I_{LOAD} = 3A$	74		%

• **CDT2301-3.3V**

Symbol	Parameter	Conditions	Typ.	Limit	Unit
Vout	Output Feedback	$5.5V \leq V_{IN} \leq 20V$, $0.2A \leq I_{LOAD} \leq 3A$,	3.3	3.168/ 3.135 13.432/ 3.465	V V _{MIN} V _{MAX}
η	Efficiency	$V_{IN} = 12V$, $I_{LOAD} = 3A$	75		%

• **CDT2301-5.0V**

Symbol	Parameter	Conditions	Typ.	Limit	Unit
Vout	Output Feedback	$8V \leq V_{IN} \leq 20V$, $0.2A \leq I_{LOAD} \leq 3A$,	5	4.8/ 4.75 5.2/ 5.25	V V _{MIN} V _{MAX}
η	Efficiency	$V_{IN} = 12V$, $I_{LOAD} = 3A$	80		%

• **CDT2301-12V**

Symbol	Parameter	Conditions	Typ.	Limit	Unit
Vout	Output Feedback	$15V \leq V_{IN} \leq 20V$, $0.2A \leq I_{LOAD} \leq 3A$,	12	11.52/ 11.4 12.48/ 12.6	V V _{MIN} V _{MAX}
η	Efficiency	$V_{IN} = 16V$, $I_{LOAD} = 3A$	89		%

(Specifications with standard type face for $T_J = 25^\circ C$, and those with boldface type apply over full operating temperature range)

● Operation Description

- **Pin Functions:**

VIN

This is the positive supply for the IC switching regulator. A suitable input bypass capacitor must be present at this pin to minimize voltage transients and to supply the switching currents needed by the regulator.

GND

Circuit ground

Output

Internal switch. The voltage at this pin switches between (+VIN – VSAT) and approximately –0.5V, with a duty cycle of approximately V_{OUT}/V_{IN} . To minimize coupling to sensitive circuitry, the PC board copper area connected to this pin should be kept a minimum.

SHDN

Allows the switching regulator circuit to be shutdown using logic level signals thus dropping the total input supply current to approximately 150 μ A. Pulling this pin below a threshold voltage of approximately 1.3V turns the regulator on, and pulling this pin above 1.3V (up to a maximum of 18V) shuts the regulator down. If this shutdown feature is not needed, the SHDN pin can be wired to the ground pin or it can be left open, in either case the regulator will be in the ON condition.

FB

Senses the regulated output voltage to complete the feedback loop.

- **Thermal Considerations:**

The CDT2301 is available in two packages, a 5-pin TO-220 and 5-pin surface mount TO-263. The TO-220 package needs a heat sink under most conditions. The size of the heatsink depends on the input voltage, the output voltage, the load current and the ambient temperature. The CDT2301 junction temperature rises above ambient temperature for a 3A load and different input and output voltage. The data for these curves was taken with the CDT2301 (TO-220 package) operating as a buck switching regulator in an ambient temperature of 25 °C (still air). These temperature rise numbers are all approximate and there are many factors that can affect these temperatures. Higher ambient temperature requires more heat sinking.

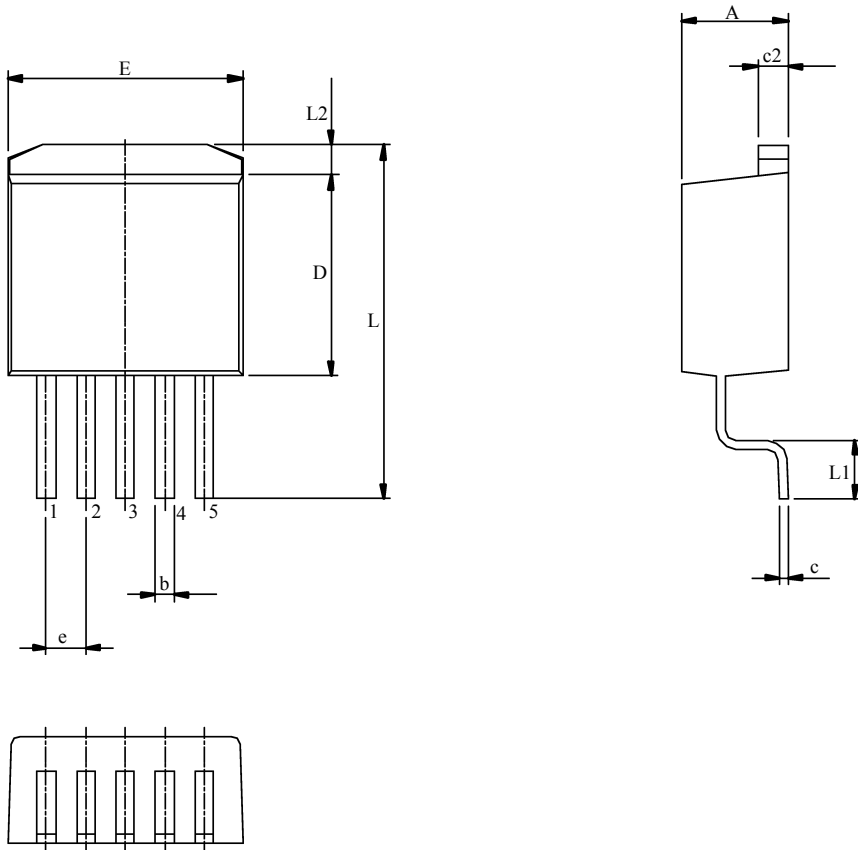
The TO-263 surface mount package tab is designed to be soldered to the copper on a printed circuit board. The copper and the board are the heat sink for this package and the other heat producing components, such as the catch diode and inductor. The PC board copper area that the package is soldered to should be at least 0.4 in², and ideally should have 2 or more square inches of 2 oz. Additional copper area improves the thermal characteristics, but with copper areas greater than approximately 6 in² only small improvements in heat dissipation are realized. If further thermal improvements are needed, double sided, multilayer PC board with large copper areas and/or airflow are recommended.

The CDT2301 (TO-263 package) junction temperature rise above ambient temperature with a 2A load for various input and output voltages. This data was taken with the circuit operating as a buck switching regulator with all components mounted on a PC board to simulate the junction temperature under actual operating conditions. This curve can be used for a quick check for the approximate junction temperature for various conditions, but be aware that there are many factors that can affect the junction temperature. When load currents higher than 2A are used, double sided or multilayer PC boards with large copper areas and/or airflow might be needed, especially for high ambient temperatures and high output voltage.

For the best thermal performance, wide copper traces and generous amounts of printed circuit board copper should be used in the board layout. (Once exception to this is the output (switch) pin, which should not have large areas of copper) Large areas of copper provide the best transfer of heat (lower thermal resistance) to the surrounding, and moving air lowers the thermal resistance even further.

● Package Information

• TO-263-5L outline dimensions



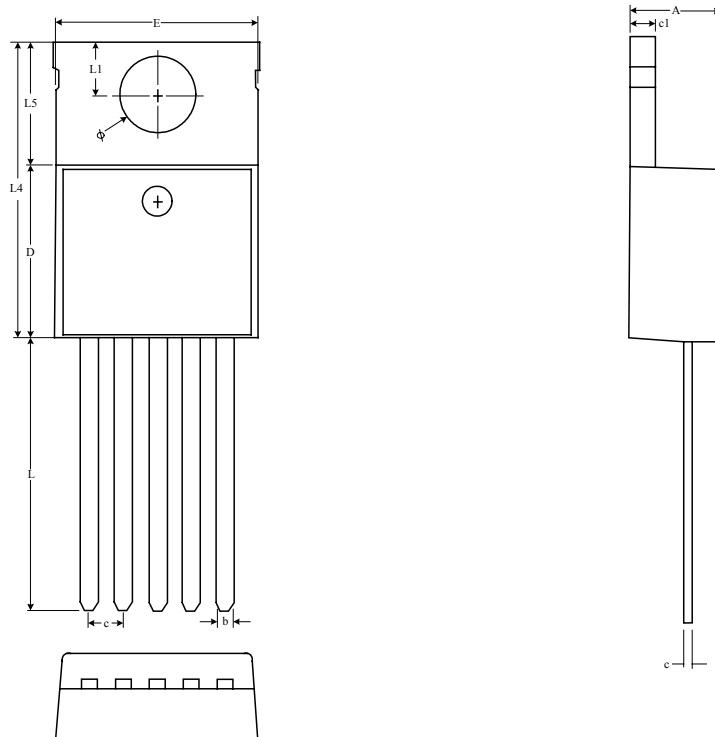
Symbols	MIN.	MAX.
A	0.160	0.190
b	0.027	0.037
c	0.015 TYP.	
c2	0.045	0.055
D	0.340	0.380
E	0.380	0.405
e	0.067 BSC.	
L	0.575	0.625
L1	0.090	0.110
L2	—	0.115

VARIATIONS (ALL DIMENSIONS SHOWN IN INCH)

NOTES.

1. JEDEC OUTLINE : N/A

• TO-220-5L outline dimensions



Symbols	MIN.	MAX.
A	4.40	4.80
b	0.76	1.00
D	8.60	9.00
c	0.36	0.50
E	9.80	10.40
L4	14.70	15.30
c1	1.25	1.45
L5	6.20	6.60
L	13.25	14.25
e	1.70 REF.	
L1	2.60	2.89
ϕ	3.71	3.96

Millimeter

* CDT assumes no responsibility for the use of the specification described. CDT reserves the right to modify the product specification without notice.

(以上規格僅供參考，本公司得逕行修正，不另通知)