Negative Adjustable Low-Dropout Regulator

Features

- Output Voltage Adjustable from -3V to -24V
- Output Current in Excess of 1A
- Low Quiescent Current
- Drop-out Voltage Typically 0.6V at 1A Load
- Internal Short Circuit Current Limit
- Internal Thermal Shutdown with Hysteresis
- CMOS, TTL Compatible ON/OFF Switch
- Extended Temperature Ranges From -40°C to +125°C
- Available in Green TO-263, TO-247 and TO-220 Packages

Applications

- Industrial
- Battery-Powered Equipment
- High-Efficiency Linear Power Supplies
- Instrumentation
- High-Efficiency Post-Regulator for Switching Supply

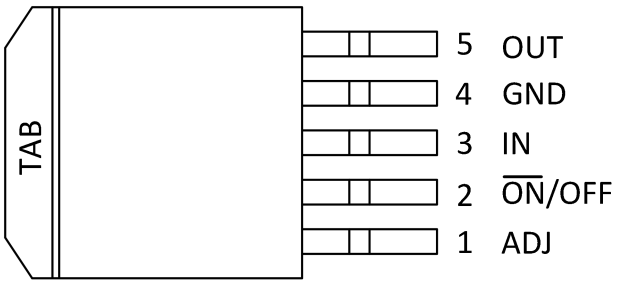
Rev1.0

General Description

The COS2991 is a five-pin, low-dropout, 1-A negative adjustable voltage regulator and negative power supply, ideally suited for a dual-supply system when using together with COS29152 series. The device may also be used as an adjustable current-sink load. The COS2991 provides an output voltage range between −3V to −24V, and features a turn off pin for remote shutdown capability.

The COS2991 provides a low dropout voltage, low quiescent current and low temperature coefficient precision reference. The dropout voltage at 1-A load current is typically 0.6 V and an ensured worst-case maximum of 1 V over the entire operating temperature range. The quiescent current is typically 1mA with a 1-A load current and an input-output voltage differential greater than 3V. A unique circuit design of the internal bias supply limits the quiescent current to only 9 mA (typical) when the regulator is in the dropout mode ($V_{OUT} - V_{IN} \leq 3V$). The COS2991 are fully protected against overcurrent faults and over temperature operation with a hysteresis to enhance the reliability of the device when inadvertently overloaded for extended periods.

1 Pin Configuration and Functions



Pin Functions

Pin No	Pin Name	I/O	Description
1	ADJ	I	ADJUST: Adjustable regulator feedback input that connects to the resistor voltage divider that is placed from OUT to GND in order to set the output voltage.
2	OFF	I	CMOS compatible control input. Logic-high=OFF(shutdown), logic-low=ON OFF pin can be tied to GND if it is not required for ON/OFF control.
3	IN	I	INPUT: Negative input voltage. Internally connected directly to the thermal tab
4	GND	-	GROUND
5	OUT	O	OUTPUT: The regulator output voltage.
-	TAB	I	Negative Input voltage. Internally connected directly to the device pin3. The thermal tab must be connected to a copper area on the PCB at the same potential as device pin3 (IN) to assure thermal performance, or leave the thermal tab floating. Do NOT connect the thermal tab to any potential other than the same potential at device pin 3. Do NOT connect the thermal tab to ground.

2 Package and Ordering Information

Model	Order Number	Package	Package Option	Marking Information
COS2991	COS2991S	TO-263-5	Tape and Reel, 800	COS2991S

3 Product Specification

3.1 Absolute Maximum Ratings (1)

Parameter	Rating	Units
Maximum Input Voltage: V_{IN}	-26 to +0.3	V
Power Dissipation	Internally limited	
Storage Temperature Range	-55 to +150	°C
Operating Junction Temperature Range	-40 to +125	°C
ESD Susceptibility, HBM	2000	V

(1) Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

3.2 Thermal Data

Parameter	Rating	Unit
Package Thermal Resistance, $R_{\theta JC}$ (Juntion-to-case)	2 (TO-220) 2 (TO-263) 1.5 (TO-247) 3 (TO-252)	°C/W

3.3 Recommended Operating Conditions

Parameter	Rating	Unit
Input Supply Voltage	-25 to -5	V
Operating ambient temperature	-40 to +85	°C

3.4 Electrical Characteristics

(V_{IN}=-10V, V_{OUT}=-3V, I_{OUT}=1A, C_{OUT}=47μF, R1=2.7K, T_J=+25°C, unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V_{OUT}		-24		-3	V
Line Regulation		I_{OUT}=10mA		0.004	0.04	%/V
Load Regulation		10mA≦I_{OUT}≦1.5A		0..04	0.4	%
Dropout Voltage		I_{OUT} = 0.1 A, ΔV_{OUT}≤ 100 mV			0.3	V
		I_{OUT} = 1 A, ΔV_{OUT}≤ 100 mV			1	V
Current Limit	I_{LIM}	V_{OUT}=0V	1.5	2		A
Quiescent Current	I_Q		-	0.7	5	mA
Regulator Output Current in Shutdown		V_{IN}=−25 V, V_{OFF}=2.4 V, V_{OUT} = 0 V	-	-	1	μA
Output Noise	e_n	I_L=100mA, 10Hz to 100kHz	-	390	-	μVrms
Reference						
Reference Voltage	V_{REF}	5 mA ≤ IOUT ≤ 1 A	-1.24	-1.21	-1.18	V
Reference Voltage Temperature Coefficient	Δ Vo/ Δ T		-	20	-	ppm/°C
Adjust Pin Bias Current			-	-	100	pA
OFF Input						
Input Logic Voltage Low (ON)			-	0	0.1	V
Input Logic Voltage High (OFF)			1.2	-	-	V
OFF Pin Input Current		V_{OFF}=0V, V_{OUT}: ON	-	100	150	μA
		V_{OFF}=2.4V, V_{OUT}: OFF	-	-	10	nA

4 Application Notes

The COS2991 is a 1-A negative adjustable voltage regulator with an operating V_{IN} range of –5V to –25V, and a regulated V_{OUT} having 5% accuracy with a maximum rated I_{OUT} current of 1 A. The COS2991 is ideally suited for a dual-supply system when using together with COS29152 series. The device may also be used as an adjustable current-sink load.

4.1 Typical Application Circuit

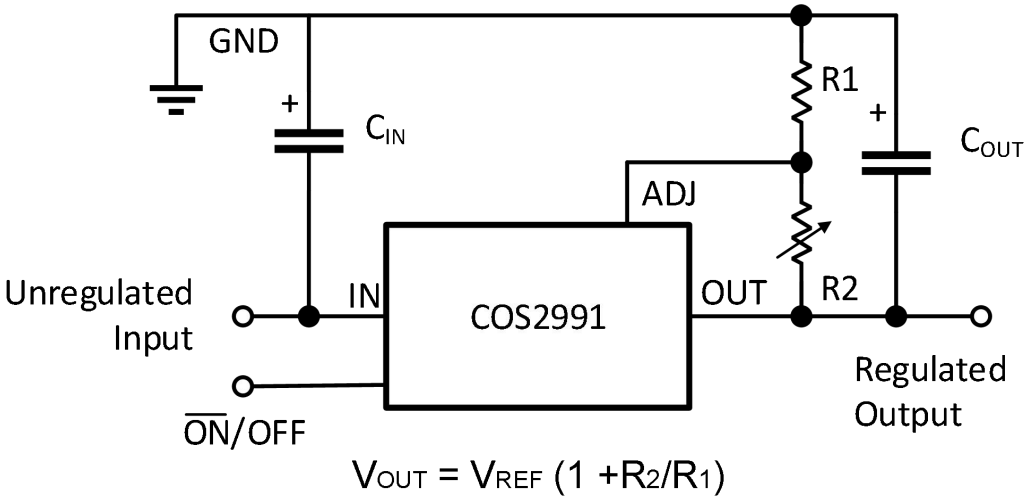


Figure 1 Typical Application Circuit

4.2 Setting The Output Voltage

The output voltage of the COS2991 is set externally by a resistor divider using following Equation:

$$V_{OUT} = V_{REF} \times (1 + R_2/R_1)$$

Where V_{REF} = −1.21 V. The output voltage can be programmed within the range of −3V to −24V.

4.3 Output Capacitor Requirements

For stability and minimum output noise, a capacitor on the regulator output is necessary. The output capacitor must be at least 10μF aluminum electrolytic or 1μF solid tantalum. The equivalent series resistance (ESR) of the output capacitor must be between about 25mΩ and 10Ω, or the zero added to the regulator frequency response by the ESR could reduce the phase margin, creating oscillations.

4.4 Input Capacitor Requirements

An input capacitor, of at least 1μF solid tantalum or 10μF aluminum electrolytic, is also needed if the regulator is situated more than 6 inches from the input power supply filter. However, aluminum electrolytic types should not be used in applications where the ambient temperature can drop below 0°C because their internal impedance increases significantly at cold temperatures.

4.5 Minimum Load Current

A minimum load current of 500μA is required for proper operation. The external resistor divider can provide the minimum load, with the resistor from the adjust pin to ground set to 2.4 kΩ.

4.6 Thermal Shutdown

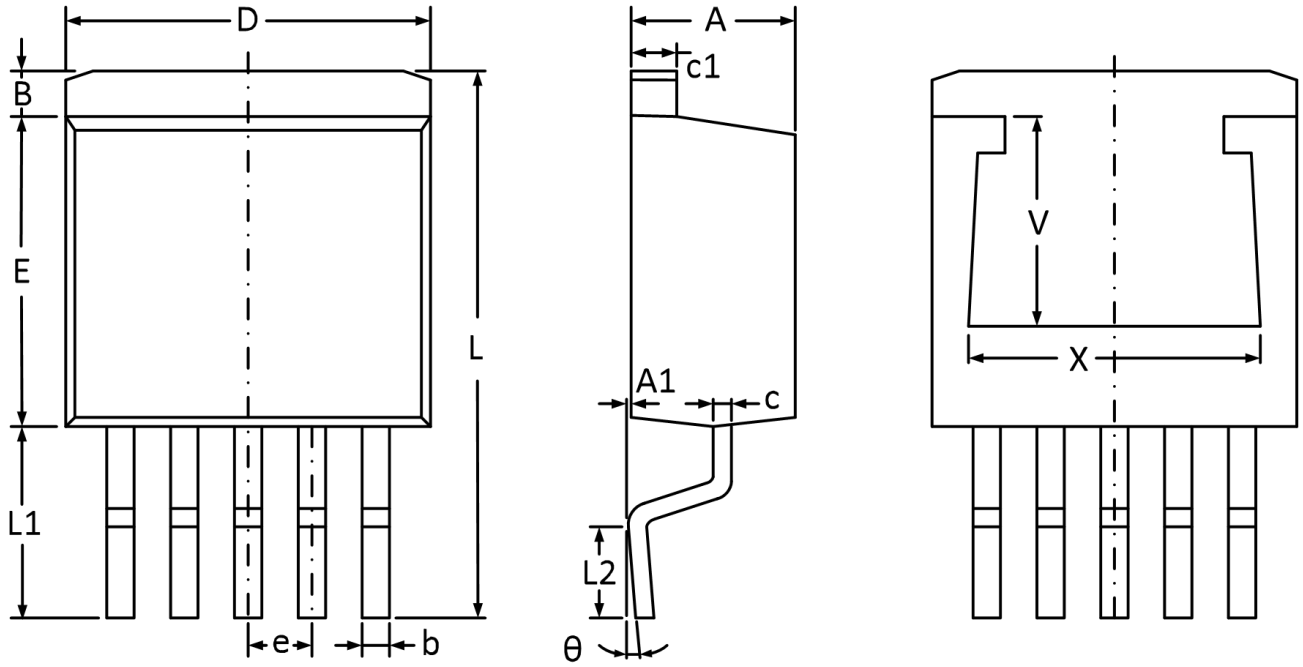
The COS2991 has an internally set thermal shutdown point of typically 160°C, with approximately 10°C of hysteresis. This thermal shutdown temperature point is outside the specified Recommended Operating Conditions range, above the Absolute Maximum Ratings, and is intended as a safety feature for momentary fault conditions only. Avoid continuous operation near the thermal shutdown temperature as it may have a negative effect on the life of the device.

4.7 OFF Pin

COS2991 versions feature a disable (OFF) input that allows ON/OFF control of the device. Special design allows “zero” current drain when the device is disabled; only micro-amperes of leakage current flows. The OFF input has TTL/CMOS compatible thresholds for simple interfacing with logic. If the ON/OFF function is not needed, connect the pin to GND. The ON/OFF pin should not be left floating, as this is not an ensured operating condition.

5 Package Information

5.1 TO-263-5 (Package Outline Dimensions)



Symbol	Dimensions In Millimeters			Dimensions In Inches		
	MIN	NOM	MAX	MIN	NOM	MAX
A	4.470	4.570	4.670	0.176	0.180	0.184
A1	0.000	0.60	0.150	0.000	0.002	0.006
B	1.120	1.270	1.420	0.044	0.050	0.056
b	0.710	0.810	0.910	0.028	0.032	0.036
c	0.310	0.380	0.530	0.012	0.015	0.021
c1	1.170	1.270	1.370	0.046	0.050	0.054
D	9.880	10.00	10.180	0.389	0.395	0.401
E	8.200	8.400	8.600	0.323	0.331	0.339
e	1.700 TYP			0.067 TYP		
L	15.140	15.340	15.540	0.596	0.604	0.612
L1	5.080	5.280	5.480	0.200	0.208	0.246
L2	2.340	2.540	2.740	0.092	0.100	0.108
θ	0°	2°	8°	0°	2°	8°
V	5.600 REF			0.220 REF		
X	7.800 REF			0.307 REF		