



BCT2031

Low Power, Low Dropout, RF-Linear Regulators

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GENERAL DESCRIPTION

The BCT2031 series low-power, low-noise, low-dropout, CMOS linear voltage regulators operate from a 2.5V to 5.5V input voltage. They are the perfect choice for low voltage, low power applications. A low ground current makes this part attractive for battery operated power systems. The BCT2031 series also offer ultra-low dropout voltage to prolong battery life in portable electronics. Systems requiring a quiet voltage sources, such as RF applications, will benefit from the BCT2031 series ultra-low output noise and high PSRR.

Other features include the output quick discharge function when in shutdown mode, the fold-back current limit and thermal shutdown protection.

The BCT2031 is available in Green UTDFN1x1-4L package. It operates over an ambient temperature range of -40°C to +85°C.

FEATURES

- Low Output Noise
- Low Dropout Voltage
- Thermal-Overload Protection
- Output Current Limit
- High PSRR(74dB at 1kHz)
- Output quick discharge in shutdown mode
- Available in Multiple output Voltage Versions
- Fixed Outputs of 1.2V, 1.5V, 1.8V, 2.5V, 2.8V, 2.85V, 3.0V and 3.3V
- -40°C to 85°C Operating Temperature Range
- Available in Green UTDFN1x1-4L Package

APPLICATIONS

Cellular Telephones
Cordless Telephones
PCMCIA Cards
Modems
MP3 Player
Hand-Held Instruments
Portable/Battery-Powered Equipment



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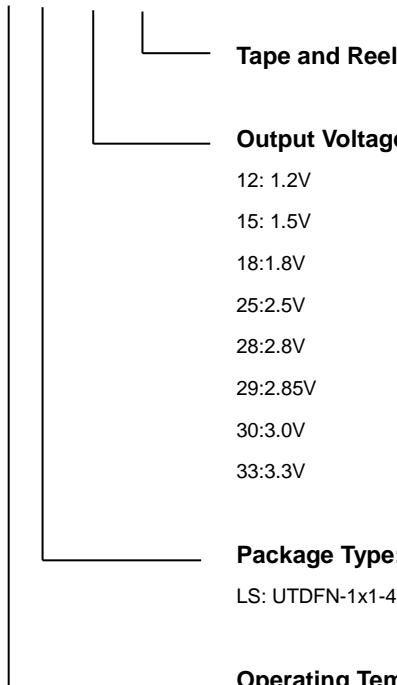
ORDERING INFORMATION

Order Number	V _{OUT} (V)	Package Type	Temperature Range	Marking	QTY/Reel
BCT2031ELS12-TR	1.2	UTDFN1x1-4L	-40°C to +85°C	AAX	10000
BCT2031ELS15-TR	1.5	UTDFN1x1-4L	-40°C to +85°C	ABX	10000
BCT2031ELS18-TR	1.8	UTDFN1x1-4L	-40°C to +85°C	ACX	10000
BCT2031ELS25-TR	2.5	UTDFN1x1-4L	-40°C to +85°C	ADX	10000
BCT2031ELS28-TR	2.8	UTDFN1x1-4L	-40°C to +85°C	AEX	10000
BCT2031ELS29-TR	2.85	UTDFN1x1-4L	-40°C to +85°C	AFX	10000
BCT2031ELS30-TR	3	UTDFN1x1-4L	-40°C to +85°C	AGX	10000
BCT2031ELS33-TR	3.3	UTDFN1x1-4L	-40°C to +85°C	AHX	10000

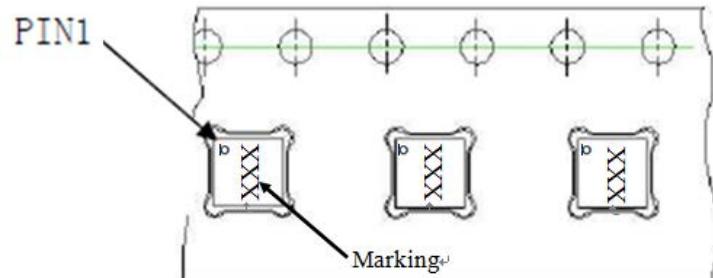
Note: "X" in Marking will be appeared as the batch code.

ORDER NUMBER

BCT2031 X XX XX -TR



TAPING DESCRIPTION





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ABSOLUTE MAXIMUM RATINGS

IN to GND.....	-0.3V to 6V
EN to GND.....	-0.3V to V_{IN}
OUT to GND.....	-0.3V to ($V_{IN}+0.3V$)
Output Short-Circuit Duration.....	Infinite
Power Dissipation, $P_D@T_A=25^\circ C$	
UTDFN1x1-4L.....	0.4W
Package Thermal Resistance	
UTDFN1x1-4L, θ_{JA}	280°C/W
Junction Temperature.....	150°C
Operating Temperature Range.....	-40°C to +85°C
Storage Temperature Range.....	-65°C to 150°C
Lead Temperature (Soldering, 10 sec).....	260°C
ESD Susceptibility	
HBM.....	4000V
MM.....	400V

NOTE:

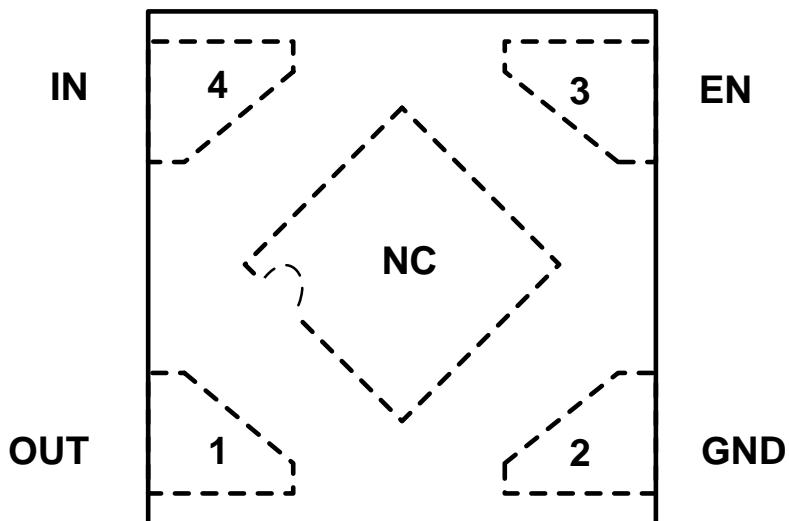
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

CAUTION

This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. Broadchip recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

Broadchip reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time. Please contact Broadchip sales office to get the latest datasheet.

PIN CONFIGURATION(Top View)



PIN DESCRIPTION

PIN	NAME	FUNCTION
1	OUT	Regulator Output.
2	GND	Ground.
3	EN	Shutdown Input. Connect to IN for normal operation.
4	IN	Regulator Input. Supply voltage can range from 2.5V to 5.5V. Bypass with a 1uF capacitor to GND.
Exposed Pad	NC	No connection.



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ELECTRICAL CHARACTERISTICS

($V_{IN} = V_{OUT(NOMINAL)} + 0.5V^{(1)}$, $T_A = -40^\circ C$ to $+85^\circ C$, unless otherwise specified.)

PARAMETER	SYM	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage	V_{IN}		2.5		5.5	V
Output Voltage Accuracy ⁽¹⁾		$I_{OUT}=0.1mA$	-3		+3	%
Maximum Output Current			300			mA
Current Limit	I_{LIM}		350			mA
Ground Pin Current	I_Q	No load, EN=VIN		70	100	uA
Dropout Voltage ⁽²⁾		$I_{OUT}=1mA$		0.9		mV
		$I_{OUT}=300mA$		200	400	
Line Regulation	ΔV_{LNR}	$V_{IN}=2.5V$ or $(V_{OUT}+0.5V)$ to $5.5V$, $I_{OUT}=1mA$		0.02	0.05	%/V
Load Regulation	ΔV_{LDR}	$I_{OUT}=0.1mA$ to $300mA$, $C_{OUT}=1\mu F$, $V_{OUT}>2V$		0.002	0.005	%/mA
		$I_{OUT}=0.1mA$ to $300mA$, $C_{OUT}=1\mu F$, $V_{OUT}\leq 2V$		0.004	0.008	
Output Voltage Noise	e_n	$f=10Hz$ to $100kHz$, $C_{OUT}=10\mu F$		140		uV _{RMS}
Power Supply Rejection Ratio	PSRR	$I_{LOAD}=50mA$, $f=217Hz$		74		dB
		$C_{OUT}=1\mu F$, $V_{IN}=V_{OUT}+1V$, $f=1kHz$			74	

SHUTDWON⁽³⁾

EN Input Threshold	V_{IH}	$V_{IN}=2.5V$ to $5.5V$,	1.5			V
	V_{IL}	$V_{EN}=-0.3V$ to V_{IN}			0.3	
EN Input Bias Current	$I_{B(SHDN)}$	$EN=0V$ or $EN=5.5V$		0.01	1	uA
Shutdown Supply Current	$I_{Q(SHDN)}$	$EN=0.4V$		0.01		uA
Shutdown Exit Delay ⁽⁴⁾		$C_{OUT}=1\mu F$, No Load		10		us

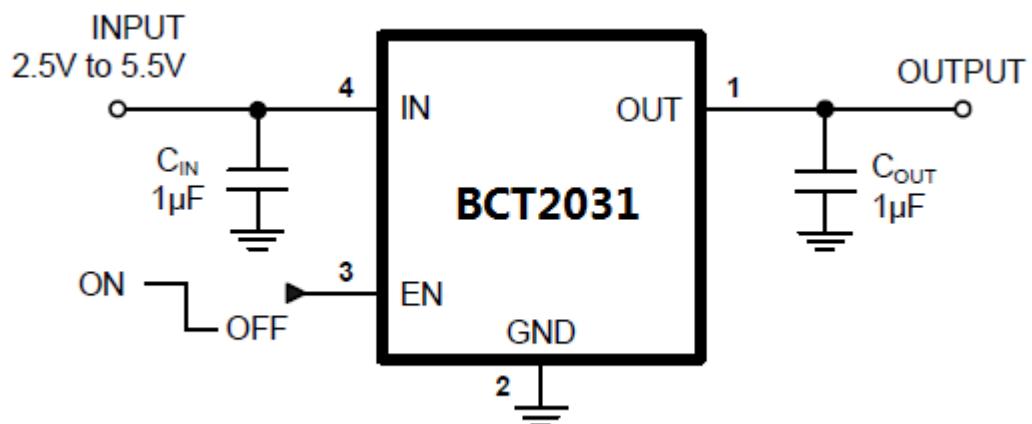
THERMAL PROTECTION

Thermal Shutdown Temperature	T_{SHDN}			150		°C
Thermal Shutdown Hysteresis	ΔT_{SHDN}			15		°C

NOTES:

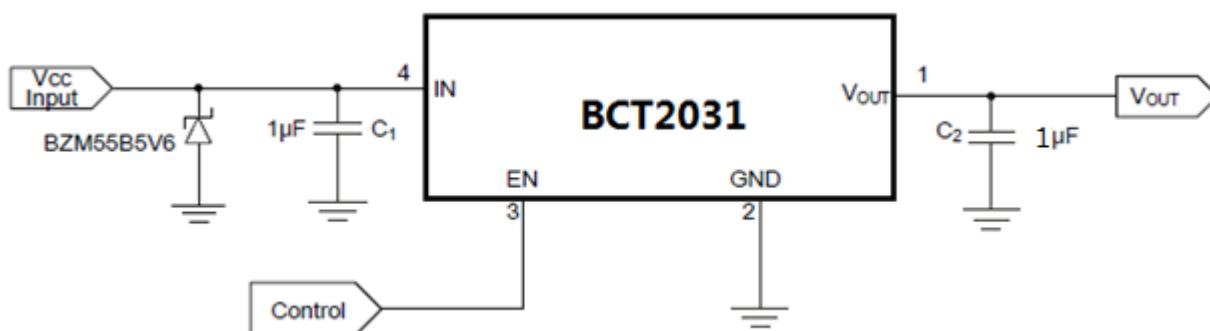
- $V_{IN} = V_{OUT(NOMINAL)} + 0.5V$ or $2.5V$, whichever is greater.
- The dropout voltage is defined as $V_{IN} - V_{OUT}$, when V_{OUT} is $100mV$ below the value of V_{OUT} for $V_{IN} = V_{OUT} + 0.5V$.
(Only applicable for $V_{OUT} = +2.5V$ to $+5.0V$.)
- $V_{EN} = -0.3V$ to V_{IN}
- Time needed for V_{OUT} to reach 90% of final value.

TYPICAL APPLICATION CIRCUIT



APPLICATION NOTE

When LDO is used in handheld products, attention must be paid to voltage spikes which could damage BCT2031. In such applications, voltage spikes will be generated at charger interface and VBUS pin of USB interface when charger adapters and USB equipments are hot-plugged. Besides this, handheld products will be tested on the production line without battery. Test engineer will apply power from the connector pin which connects with positive pole of the battery. When external power supply is turned on suddenly, the voltage spikes will be generated at the battery connector. The voltage spikes will be very high, and it always exceeds the absolute maximum input voltage (6.0V) of LDO. In order to get robust design, design engineer needs to clear up this voltage spike. Zener diode is a cheap and effective solution to eliminate such voltage spike. For example, BZM55B5V6 is a 5.6V small package Zener diode which can be used to remove voltage spikes in cell phone designs. The schematic is shown below.



Enable Function

The BCT2031 features an LDO regulator en-able/disable function. To assure the LDO regulator will switch on; the EN turn on control level must be greater than 1.5 volts. The LDO regulator will go into the shutdown mode when the voltage on the EN pin falls below 0.3 volts. For to protect the system, the BCT2031 have a quick discharge function. If the enable function is not needed in a specific application, it may be tied to VIN to keep the LDO regulator in a continuously on state.

Thermal Considerations

Thermal protection limits power dissipation in BCT2031. When the operation junction temperature exceeds 150°C, the OTP circuit starts the thermal shutdown function turn the pass element off. The pass element turns on again after the junction temperature cools by 15°C.

For continue operation, do not exceed absolute maximum operation junction temperature 125°C. The power dissipation definition in device is:



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$$P_D = (V_{IN} - V_{OUT}) \times I_{OUT} + V_{IN} \times I_Q$$

The maximum power dissipation depends on the thermal resistance of IC package, PCB layout, the rate of surroundings airflow and temperature difference between junction to ambient. The maximum power dissipation can be calculated by following formula:

$$P_D(\text{MAX}) = (T_J(\text{MAX}) - T_A) / \theta_{JA}$$

Where $T_J(\text{MAX})$ is the maximum operation junction temperature 125°C, T_A is the ambient temperature and the θ_{JA} is the junction to ambient thermal resistance. For recommended operating conditions specification of BCT2031, where $T_J(\text{MAX})$ is the maximum junction temperature of the die (125°C) and T_A is the maximum ambient temperature. The junction to ambient thermal resistance (θ_{JA} is layout dependent) for UTDFN1x1-4L package is 280°C/W, on standard JEDEC 51-3 thermal test board. The maximum power dissipation at $T_A = 25^\circ\text{C}$ can be calculated by following formula:

$$P_D(\text{MAX}) = (125^\circ\text{C} - 25^\circ\text{C}) / 280 = 357\text{mW}$$

The maximum power dissipation depends on operating ambient temperature for fixed $T_J(\text{MAX})$ and thermal resistance θ_{JA} . It is also useful to calculate the junction of temperature of the BCT2031 under a set of specific conditions. In this example let the Input voltage $V_{IN}=3.3\text{V}$, the output current $I_O=300\text{mA}$ and the case temperature $T_A=40^\circ\text{C}$ measured by a thermal couple during operation. The power dissipation for the $V_O=2.8\text{V}$ version of the BCT2031 can be calculated as:

$$\begin{aligned} P_D &= (3.3\text{V} - 2.8\text{V}) \times 300\text{mA} + 3.3\text{V} \times 100\text{uA} \\ &= 150\text{mW} \end{aligned}$$

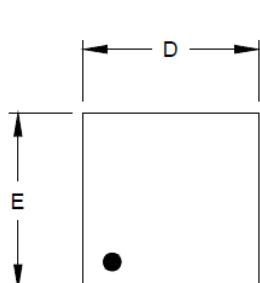
And the junction temperature, T_J , can be calculated as follows:

$$\begin{aligned} T_J &= T_A + P_D \times \theta_{JA} = 40^\circ\text{C} + 0.15\text{W} \times 280^\circ\text{C/W} \\ &= 40^\circ\text{C} + 42^\circ\text{C} = 82^\circ\text{C} < T_J(\text{MAX}) = 125^\circ\text{C} \end{aligned}$$

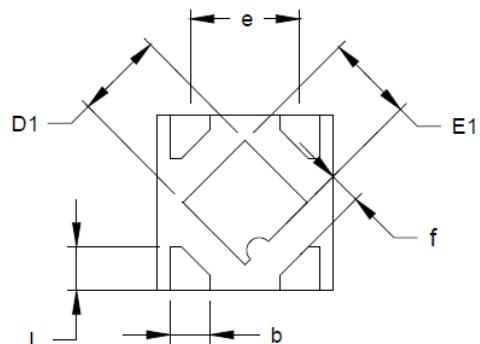
For this operating condition, T_J is lower than the absolute maximum operating junction temperature, 125°C, so it is safe to use the BCT2031 in this configuration.

PACKAGE OUTLINE DIMENSIONS

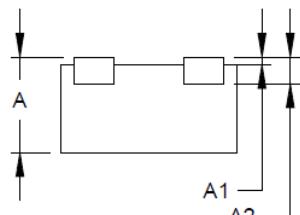
UTDFN1x1-4L



TOP VIEW



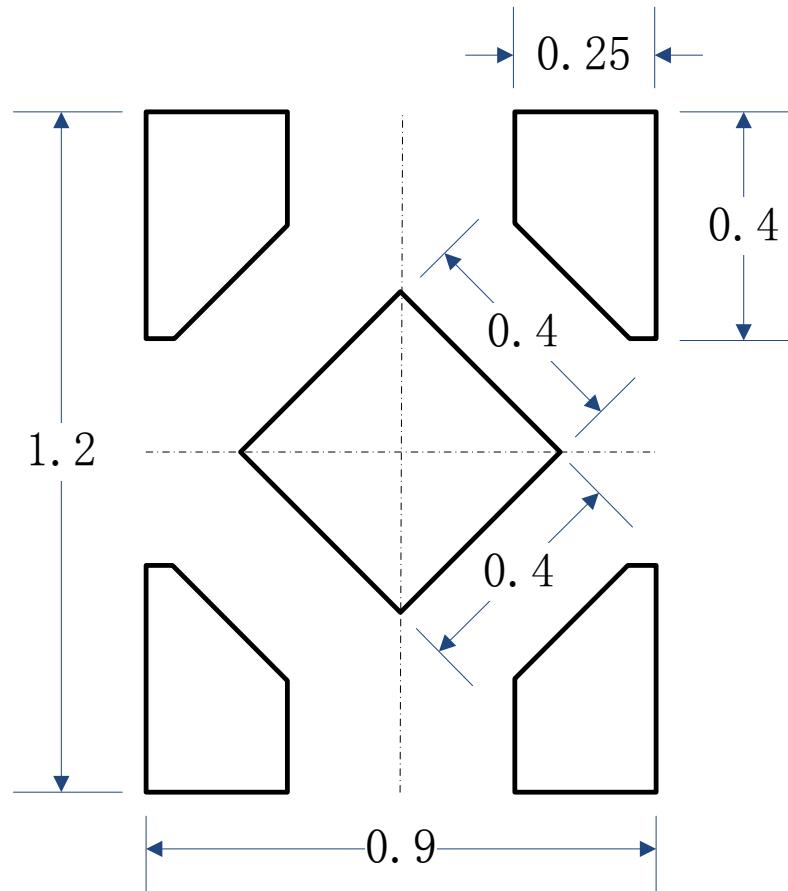
BOTTOM VIEW



SIDE VIEW

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.335	0.405	0.013	0.016
A1	0.000	0.050	0.000	0.002
A2	0.100 REF		0.004 REF	
D	0.950	1.050	0.037	0.041
D1	0.450	0.550	0.018	0.022
E	0.950	1.050	0.037	0.041
E1	0.450	0.550	0.018	0.022
b	0.175	0.275	0.007	0.011
e	0.575	0.675	0.023	0.027
f	0.195 REF		0.0077 REF	
L	0.200	0.300	0.008	0.012

PCB Layout Pattern



RECOMMENDED PCB LAYOUT PATTERN (Unit: mm)