BCT2031
Low Power, Low Dropout, RF-Linear Regulators

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 UTDFN-1x1-4L 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 UTDFN-1x1-4L Package

APPLICATIONS

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

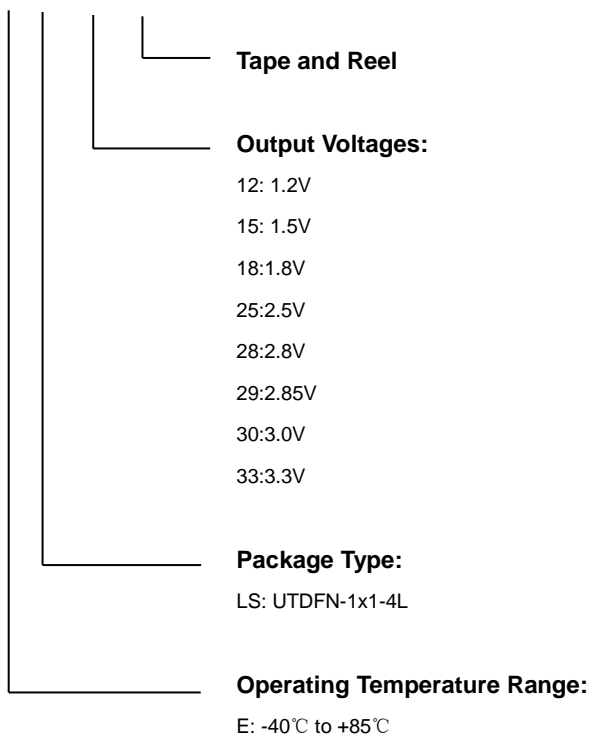## ORDERING INFORMATION

Order Number	V_{OUT}(V)	Package Type	Temperature Range	Marking	QTY/Reel
BCT2031ELS12-TR	1.2	UTDFN-1x1-4L	-40°C to +85°C	XXA	10000
BCT2031ELS15-TR	1.5	UTDFN-1x1-4L	-40°C to +85°C	XXB	10000
BCT2031ELS18-TR	1.8	UTDFN-1x1-4L	-40°C to +85°C	XXC	10000
BCT2031ELS25-TR	2.5	UTDFN-1x1-4L	-40°C to +85°C	XXD	10000
BCT2031ELS28-TR	2.8	UTDFN-1x1-4L	-40°C to +85°C	XXE	10000
BCT2031ELS29-TR	2.85	UTDFN-1x1-4L	-40°C to +85°C	XXF	10000
BCT2031ELS30-TR	3	UTDFN-1x1-4L	-40°C to +85°C	XXG	10000
BCT2031ELS33-TR	3.3	UTDFN-1x1-4L	-40°C to +85°C	XXH	10000

ORDER NUMBER
BCT2031 X XX XX -TR

Tape and Reel

Output Voltages:

12: 1.2V

15: 1.5V

18:1.8V

25:2.5V

28:2.8V

29:2.85V

30:3.0V

33:3.3V

Package Type:

LS: UTDFN-1x1-4L

Operating Temperature Range:

E: -40℃ to +85℃

MARKING DESCRIPTION

X X X
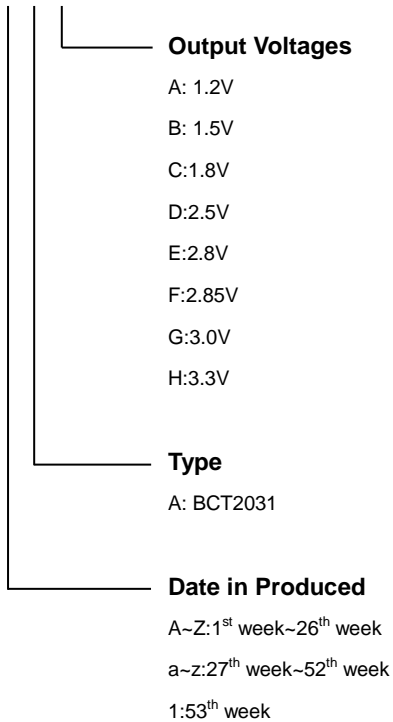
Output Voltages

A: 1.2V

B: 1.5V

C:1.8V

D:2.5V

E:2.8V

F:2.85V

G:3.0V

H:3.3V

Type

A: BCT2031

Date in Produced

A~Z:1st week~26th week

a~z:27th week~52th week

1:53th week

TAPING DESCRIPTION
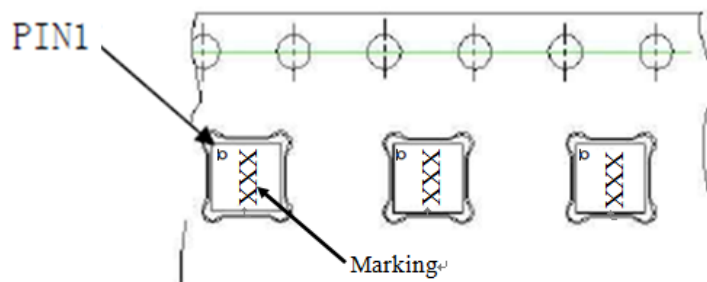
ABSOLUTE MAXIMUM RATINGS

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℃

UTDFN-1x1-4L...0.4W

Package Thermal Resistance

UTDFN-1x1-4L, θ_{JA}...280℃/W

Junction Temperature...150℃

Operating Temperature Range.................-40℃ to +85℃

Storage Temperature Range....................-65℃ to 150℃

Lead Temperature (Soldering, 10 sec).....................260℃

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)

IN   4   NC   3   EN

OUT   1   2   GND
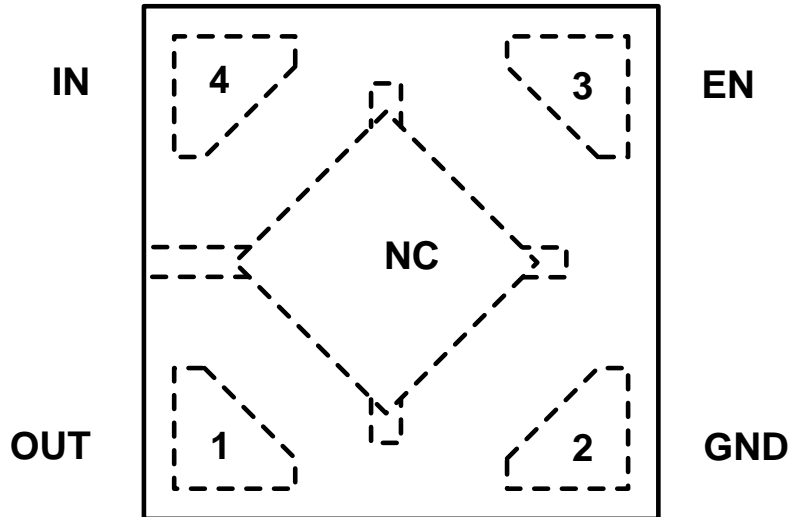
PIN DESCRIPTION

| 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.

ELECTRICAL CHARACTERISTICS

(V_{IN}= $V_{OUT(NOMINAL)}$+0.5V[1], T_A = -40℃ to +85℃, 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	$\triangle V_{LNR}$	V_{IN}=2.5V or (V_{OUT}+0.5V) to 5.5V, I_{OUT}=1mA			0.02	0.05	%/V
Load Regulation	$\triangle V_{LDR}$	I_{OUT}=0.1mA to 300mA, C_{OUT}=1uF, V_{OUT}>2V			0.002	0.005	%/mA
		I_{OUT}=0.1mA to 300mA, C_{OUT}=1uF, V_{OUT}≤2V			0.004	0.008	
Output Voltage Noise	e_n	f=10Hz to 100kHz, C_{OUT}=10uF			140		uV$_{RMS}$
Power Supply Rejection Ratio	PSRR	I_{LOAD}=50mA, C_{OUT}=1uF, V_{IN}=V_{OUT}+1V	f=217Hz		74		dB
			f=1kHz		74		
SHUTDWON[3]							
EN Input Threshold	V_{IH}	V_{IN}=2.5V to 5.5V, V_{EN}=-0.3V to V_{IN}		1.5			V
	V_{IL}					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}=1uF, No Load			10		us
THERMAL PROTECTION							
Thermal Shutdown Temperature	T_{SHDN}				150		°C
Thermal Shutdown Hysteresis	$\triangle T_{SHDN}$				15		°C

NOTES:

1. V_{IN} = $V_{OUT (NOMINAL)}$ + 0.5V or 2.5V, whichever is greater.

2. 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.)

3. V_{EN} = -0.3V to V_{IN}

4. Time needed for V_{OUT} to reach 90% of final value.

TYPICAL APPLICATION CIRCUIT
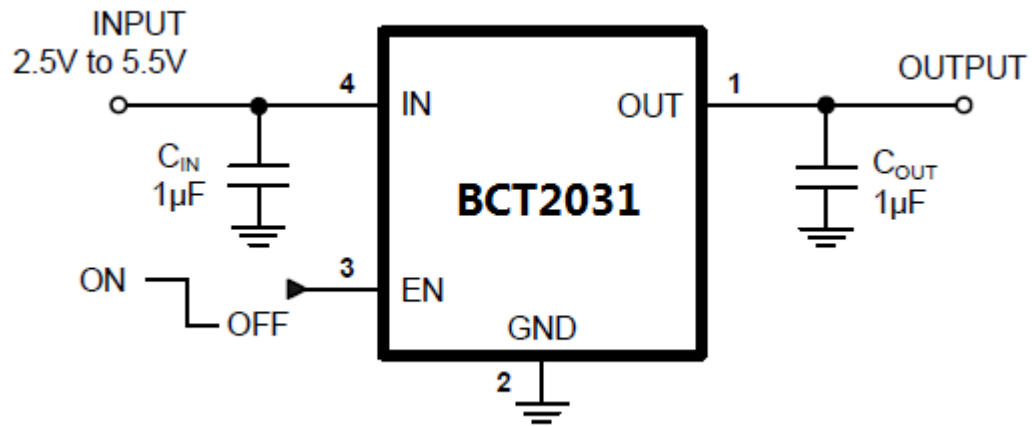
APPLICATION NOTE

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.
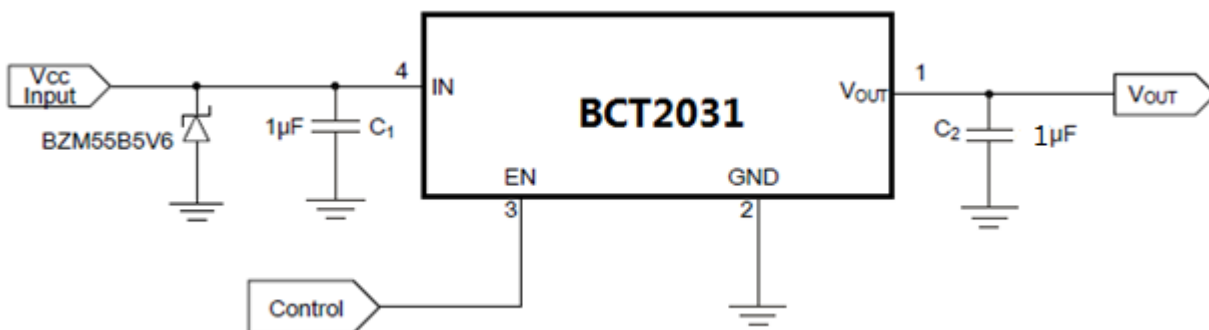
Enable Function

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:

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

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：

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

Where $T_J(MAX)$ 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 $T_J(MAX)$ 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 UTDFN-1x1-4L package is 280°C/W, on standard JEDEC 51-3 thermal test board. The maximum power dissipation at T_A= 25°C can be calculated by following formula:

$P_D(MAX) = (125°C - 25°C)/280 = 357mW$

The maximum power dissipation depends on operating ambient temperature for fixed $T_J(MAX)$ 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}=3.3V, the output current Io=300mA and the case temperature T_A=40°C measured by a thermal couple during operation. The power dissipation for the Vo=2.8V version of the BCT2031 can be calculated as:

$P_D = (3.3V - 2.8V) \times 300mA + 3.3V \times 100uA$
   $= 150mW$
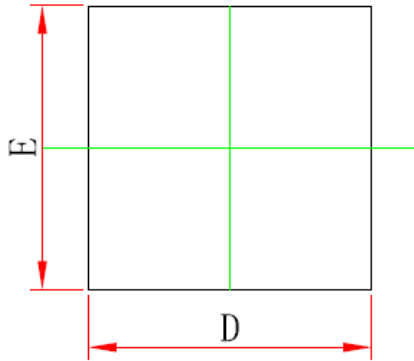
And the junction temperature, T_J, can be calculated as follows:

$T_J = T_A + P_D \times \theta_{JA} = 40°C + 0.15W \times 280°C/W$
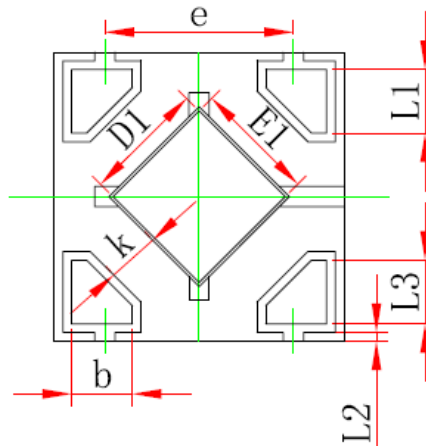 $= 40°C + 42°C = 82°C < T_J(MAX) = 125°C$

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.
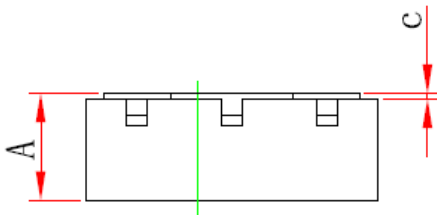
PACKAGE OUTLINE DIMENSIONS

UTDFN-1x1-4L

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
D	0.950	1.050	0.037	0.041
E	0.950	1.050	0.037	0.041
D1	0.370	0.470	0.015	0.019
E1	0.370	0.470	0.015	0.019
k	0.17MIN		0.007MIN	
b	0.160	0.260	0.006	0.010
c	0.010	0.090	0.000	0.004
e	0.600	0.700	0.024	0.028
L1	0.185	0.255	0.007	0.010
L2	0.030REF		0.001REF	
L3	0.185	0.255	0.007	0.010

PCB Layout Pattern
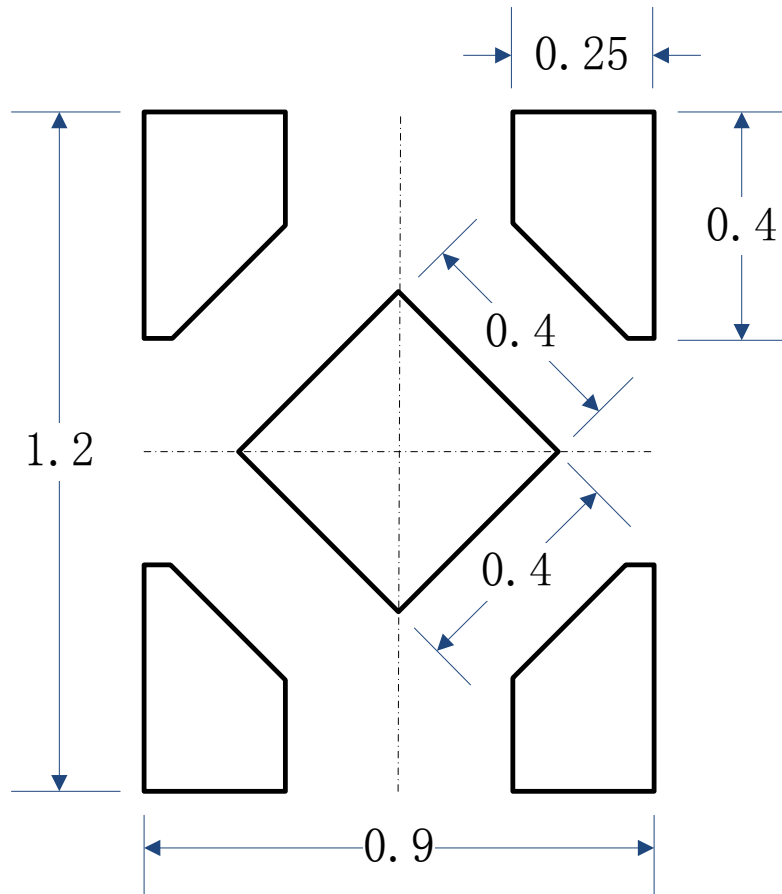
RECOMMENDED PCB LAYOUT PATTERN (Unit: mm)