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**BCT2020****Low Power, Low Dropout, RF-Linear Regulators****GENERAL DESCRIPTION**

The BCT2020 series low-power, low-dropout, CMOS linear voltage regulators operate from a 1.6V to 5.5V input voltage and deliver up to 300mA output current. 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 BCT2020 series also offer low dropout voltage to prolong battery life in portable electronics. Systems requiring a quiet voltage source, such as RF applications, will benefit from the BCT2020 series low output noise and high PSRR.

Other features include a 10nA logic-controlled shutdown mode, short current limit and thermal shutdown protection.

The BCT2020 has auto-discharge function to quickly discharge VOUT in the disable status.

The BCT2020 is available in Green SOT23-5 , SC70-5, UTDFN1X1-4L packages. It operates over an ambient temperature range of -40°C to +85°C .

**FEATURES**

- Low Dropout Voltage
- Thermal Overload Protection
- Built-In Fold Back Protection Circuit
- 20μA Low Supply Current
- 10nA Logic-Controlled Shutdown
- 1.6V to 5.5V Input Voltage Range
- Fixed Outputs of 1.2V, 1.8V, 2.8V, 3.0V, and 3.3V
- Adjustable Output from 0.8V to 5.0V
- Short Auto-Discharge Function
- 300mA Output Current
- High Output Voltage Accuracy
- Quick Start-Up Time
- -40°C to +85°C Operating Temperature Range
- Available in Green SOT23-5 , SC70-5, UTDFN1X1-4L Packages

**APPLICATIONS**

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

### ORDERING INFORMATION

Order Number	V <sub>OUT</sub> (V)	Package Type	Temperature Range	Marking	QTY/Reel
BCT2020EUK12-TR	1.2	SOT23-5	-40°C to +85°C	K2XX	3000
BCT2020EUK18-TR	1.8	SOT23-5	-40°C to +85°C	K8XX	3000
BCT2020EUK28-TR	2.8	SOT23-5	-40°C to +85°C	K8XX	3000
BCT2020EUK30-TR	3.0	SOT23-5	-40°C to +85°C	K0XX	3000
BCT2020EUK33-TR	3.3	SOT23-5	-40°C to +85°C	K3XX	3000
BCT2020EUKAJ-TR	ADJ	SOT23-5	-40°C to +85°C	KJXX	3000
BCT2020EXK12-TR	1.2	SC70-5	-40°C to +85°C	K2XX	3000
BCT2020EXK18-TR	1.8	SC70-5	-40°C to +85°C	K8XX	3000
BCT2020EXK28-TR	2.8	SC70-5	-40°C to +85°C	K8XX	3000
BCT2020EXK30-TR	3.0	SC70-5	-40°C to +85°C	K0XX	3000
BCT2020EXK33-TR	3.3	SC70-5	-40°C to +85°C	K3XX	3000
BCT2020EXKAJ-TR	ADJ	SC70-5	-40°C to +85°C	KJXX	3000
BCT2020ELS12-TR	1.2	UTDFN1x1-4L	-40°C to +85°C	B2X	10000
BCT2020ELS18-TR	1.8	UTDFN1x1-4L	-40°C to +85°C	B8X	10000
BCT2020ELS28-TR	2.8	UTDFN1x1-4L	-40°C to +85°C	B8X	10000
BCT2020ELS30-TR	3.0	UTDFN1x1-4L	-40°C to +85°C	B0X	10000
BCT2020ELS33-TR	3.3	UTDFN1x1-4L	-40°C to +85°C	B3X	10000

**Note:**

"XX" in Marking will be appeared as the batch code.



# BCT2020

## Low Power, Low Dropout RF-Linear Regulators

### ABSOLUTE MAXIMUM RATINGS

IN to GND.....	-0.3V to 6.0V
Output Short-Circuit Duration.....	Infinite
EN to GND.....	-0.3V to 6.0V
OUT,BP/FB to GND.....	-0.3V to (VIN +0.3V)
Power Dissipation, $P_D$ @ $T_A=25^{\circ}\text{C}$	
SOT23-5.....	0.48W
SC70-5.....	0.38W
UTDFN1x1-4L.....	0.45W
Package Thermal Resistance	
SOT23-5, $\theta_{JA}$ .....	$260^{\circ}\text{C/W}$
SC70-5, $\theta_{JA}$ .....	$330^{\circ}\text{C/W}$
UTDFN1x1-4L, $\theta_{JA}$ .....	$280^{\circ}\text{C/W}$
Junction Temperature.....	$150^{\circ}\text{C}$
Storage Temperature Range.....	$-65^{\circ}\text{C}$ to $150^{\circ}\text{C}$
Lead Temperature (Soldering, 10 sec).....	$260^{\circ}\text{C}$
ESD Susceptibility	
HBM.....	4000V
MM.....	400V

### RECOMMENDED OPERATING CONDITIONS

Operating Voltage Range.....	1.6V to 5.5V
Operating Temperature Range .....	$-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$

### OVERSTRESS CAUTION

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.

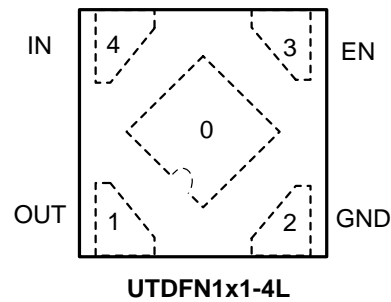
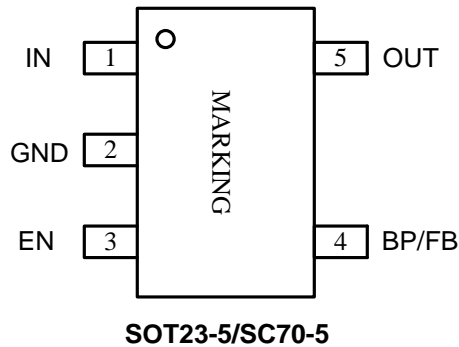
### ESD SENSITIVITY CAUTION

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.

### DISCLAIMER

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
SOT23-5 SC70-5	UTDFN 1X1-4L		
1	4	IN	Regulator Input. Supply voltage can range from 1.6V to 5.5V. Bypass with a 1 $\mu$ F capacitor to GND.
2	2	GND	Ground.
3	3	EN	Enable Pin. This pin has an internal pull-down resistor. A logic low reduces the supply current to less than 1 $\mu$ A. Connect to IN for normal operation.
4	-	BP	Reference-Noise Bypass Pin (fixed voltage version only). Bypass with a low-leakage 0.01 $\mu$ F ceramic capacitor for reduced noise at the output. The capacitor is recommended to be placed very close to the pin for high PSRR. (Note, It can be floated, but don't connect the BP pin to any DC Voltage.)
		FB	Adjustable Voltage Version Only. This is used to set the output voltage of the device.
5	1	OUT	Regulator Output.
-	0	Exposed Pad	The exposed pad should be connected to a large ground plane to maximize thermal performance.

### ELECTRICAL CHARACTERISTICS

(( $V_{IN} = V_{OUT(NOMINAL)} + 0.5V$  or  $1.6V$ , whichever is greater, Full =  $-40^{\circ}C$  to  $+85^{\circ}C$ , unless otherwise noted.))

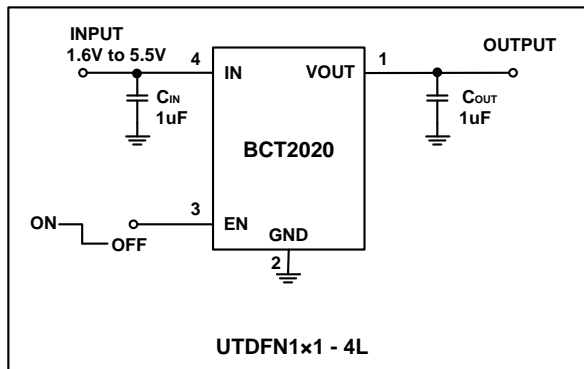
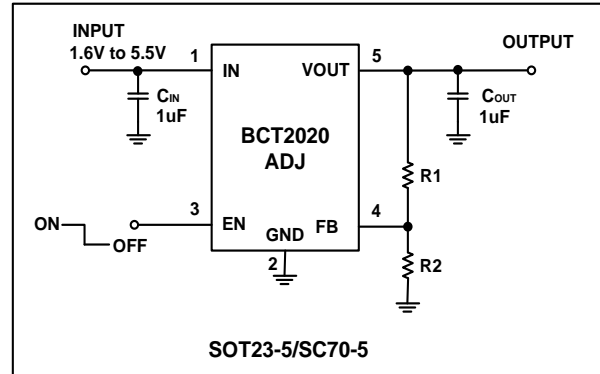
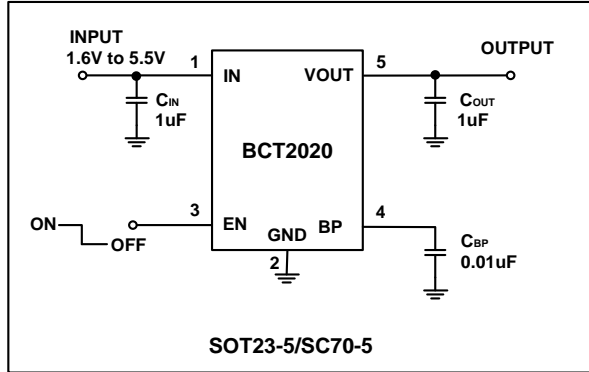
PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
Input Voltage	$V_{IN}$			$+25^{\circ}C$	1.6		5.5	V
Output Voltage Accuracy		$I_{OUT} = 0.1mA$		$+25^{\circ}C$	-2.5		+2.5	%
Feedback Voltage	$V_{FB}$	$I_{OUT} = 0.1mA$ , BCT2020-ADJ		$+25^{\circ}C$	0.78	0.8	0.82	V
Maximum Output Current (1)				$+25^{\circ}C$	300			mA
Current Limit	$I_{LIM}$			$+25^{\circ}C$	360	560		mA
Supply Pin Current	$I_Q$	No Load, $V_{EN} = V_{IN}$		$+25^{\circ}C$		20	26	$\mu A$
Dropout Voltage (2)	$V_{DROP}$	$I_{OUT} = 300mA$	$1.2V \leq V_{OUT} < 1.8V$	$+25^{\circ}C$		590	800	mV
			$1.8V \leq V_{OUT} < 2.5V$	$+25^{\circ}C$		320	420	
			$2.5V \leq V_{OUT} < 3.0V$	$+25^{\circ}C$		215	280	
			$3.0V \leq V_{OUT} < 3.6V$	$+25^{\circ}C$		190	250	
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	$V_{IN} = 1.6V$ or $(V_{OUT} + 0.5V)$ to $5.5V$ , $I_{OUT} = 1mA$	$1.8V \leq V_{OUT} \leq 3.3V$	$+25^{\circ}C$		0.01	0.06	% / V
			$V_{OUT} < 1.8V$ or $V_{OUT} > 3.3V$	$+25^{\circ}C$		0.01	0.1	
Load Regulation	$\Delta V_{OUT}$	$I_{OUT} = 0.1mA$ to $300mA$		$+25^{\circ}C$		12	40	mV
Short Current Limit	$I_{SHORT}$	$V_{OUT} = 0V$		$+25^{\circ}C$		200		mA
Power Supply Rejection Ratio	PSRR	$C_{BP} = 0\mu F$ , $I_{OUT} = 30mA$ , $C_{OUT} = 1\mu F$ , $V_{IN} = V_{OUT} + 1V$ , $\Delta V_{RIPPLE} = 0.2V_{P-P}$	$f = 217Hz$	$+25^{\circ}C$		80		dB
			$f = 1kHz$	$+25^{\circ}C$		70		
		$C_{BP} = 0.01\mu F$ , $I_{OUT} = 30mA$ , $C_{OUT} = 1\mu F$ , $V_{IN} = V_{OUT} + 1V$ , $\Delta V_{RIPPLE} = 0.2V_{P-P}$	$f = 217Hz$	$+25^{\circ}C$		82		
			$f = 1kHz$	$+25^{\circ}C$		70		
Output Voltage Noise	$e_n$	$C_{BP} = 0\mu F$ , $f = 10Hz$ to $100kHz$ , $C_{OUT} = 1\mu F$ , $V_{OUT} = 1.8V$	$I_{OUT} = 0mA$	$+25^{\circ}C$		100		$\mu V_{RMS}$
			$I_{OUT} = 30mA$	$+25^{\circ}C$		200		
		$C_{BP} = 0.01\mu F$ , $f = 10Hz$ to $100kHz$ , $C_{OUT} = 1\mu F$ , $V_{OUT} = 1.8V$	$I_{OUT} = 0mA$	$+25^{\circ}C$		30		
			$I_{OUT} = 30mA$	$+25^{\circ}C$		75		
Output Voltage Temperature Coefficient (3)	$\frac{\Delta V_{OUT}}{\Delta T_A \times V_{OUT}}$	$I_{OUT} = 0.1mA$		Full		30		ppm/ $^{\circ}C$

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
<b>SHUTDOWN</b>							
EN Input Threshold	$V_{IH}$	$V_{IN} = 1.6V \text{ to } 5.5V$	Full	1.5			V
	$V_{IL}$		Full			0.4	
EN Input Bias Current	$I_{BH}$	$V_{EN} = 5.5V$	Full		0.8	2	$\mu A$
	$I_{BL}$	$V_{EN} = 0V$	Full		0.01	1	
Shutdown Supply Current	$I_{SHDN}$	$V_{EN} = 0V$	Full		0.01	1	$\mu A$
Start-Up Time <sup>(4)</sup>	$t_{STR}$	$C_{OUT} = 1\mu F$ , No Load, $C_{BP} = 0\mu F$	+25°C		30		$\mu s$
$R_{ON}$ of Discharge MOSFET		$V_{IN} = 4.0V$ , $V_{EN} = 0V$	+25°C		50		$\Omega$
<b>THERMAL PROTECTION</b>							
Thermal Shutdown Temperature	$T_{SHDN}$				140		°C
Thermal Shutdown Hysteresis	$\Delta T_{SHDN}$				15		°C

**NOTES:**

- Maximum output current is affected by the PCB layout, size of metal trace, the thermal conduction path between metal layers, ambient temperature and the other environment factors of system. Attention should be paid to the dropout voltage when  $V_{IN} < V_{OUT} + V_{DROP}$ .
- The dropout voltage is defined as  $V_{IN} - V_{OUT}$ , when  $V_{OUT}$  is 100mV below the value of  $V_{OUT}$ .
- Output voltage temperature coefficient is defined as the worst-case voltage change divided by the total temperature range.
- Time needed for  $V_{OUT}$  to reach 90% of final value.

### TYPICAL APPLICATION CIRCUIT

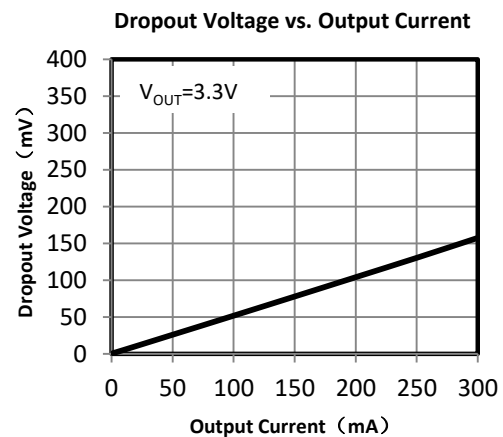
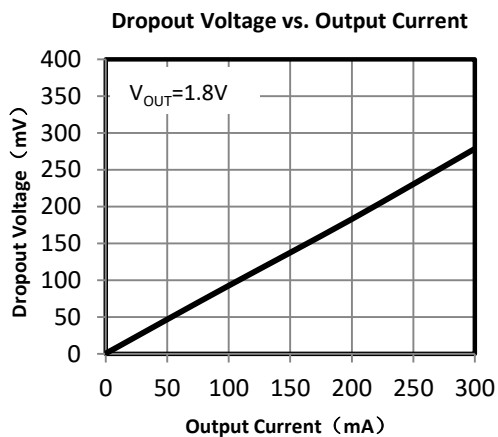
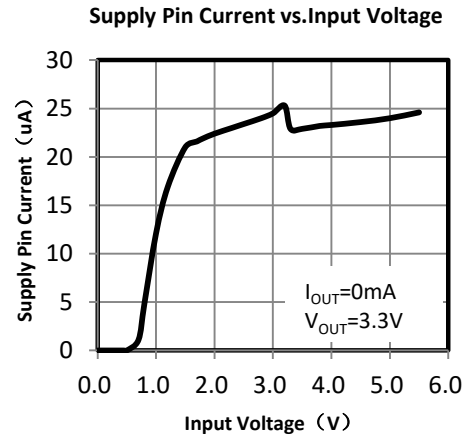
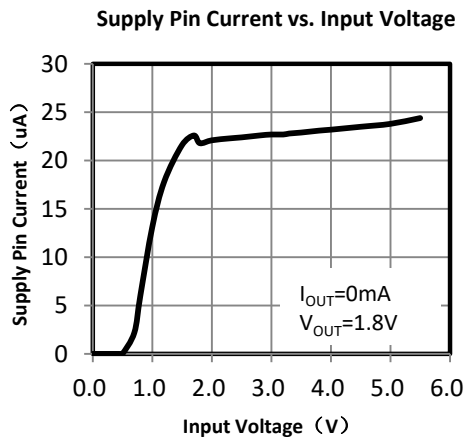
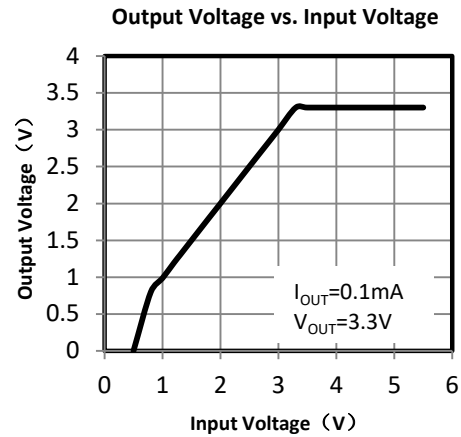
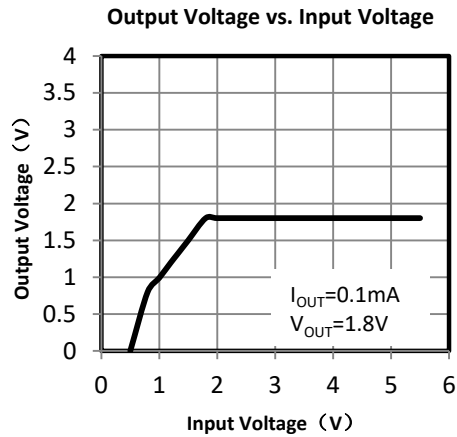


NOTES: Choose R2 = 160kΩ to maintain a 5μA minimum load.  
Calculate the value for R1 using the following equation:

$$R_1 = R_2 \times \left( \frac{V_{OUT}}{0.8V} - 1 \right)$$

### TYPICAL PERFORMANCE CHARACTERISTICS

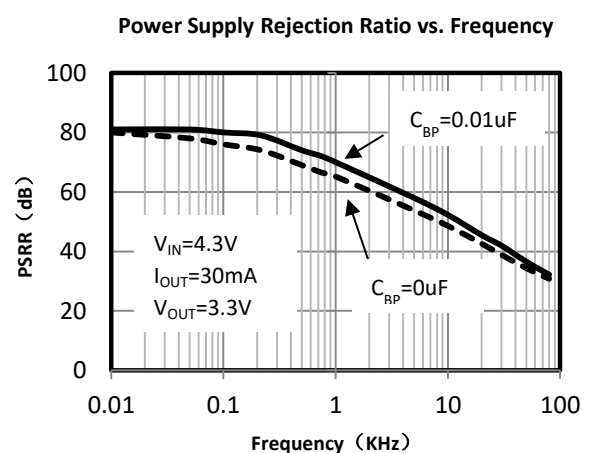
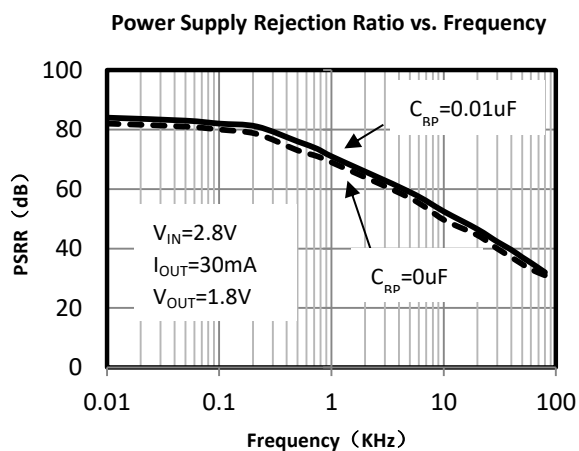
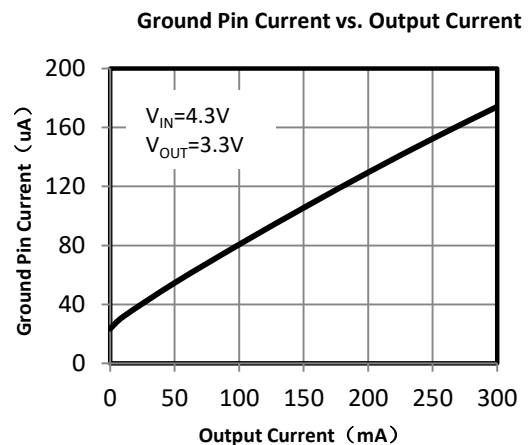
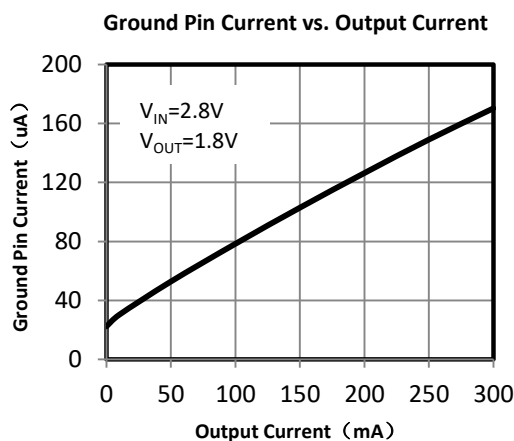
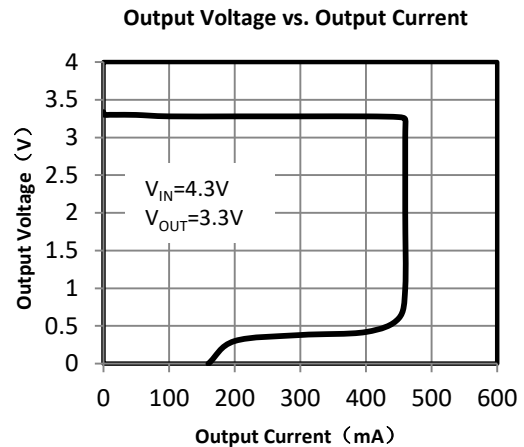
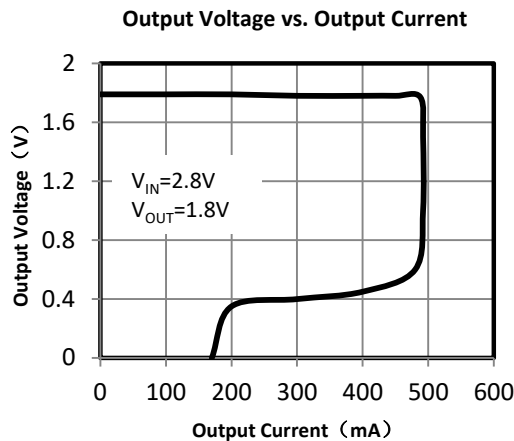
$V_{EN} = V_{IN}$ ,  $C_{IN} = 1\mu F$ ,  $C_{OUT} = 1\mu F$ ,  $C_{BP} = 0\mu F$ ,  $T_A = +25^\circ C$ , unless otherwise noted.





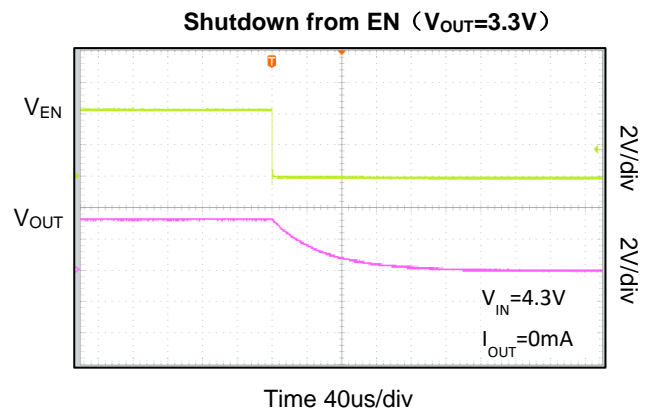
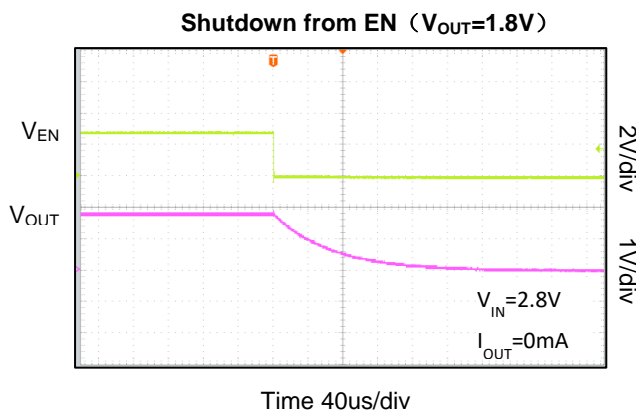
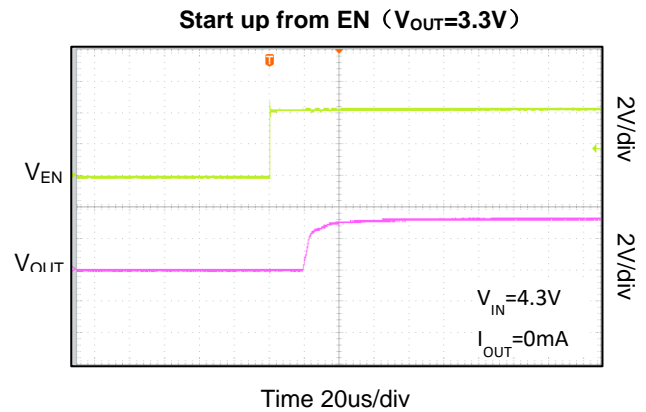
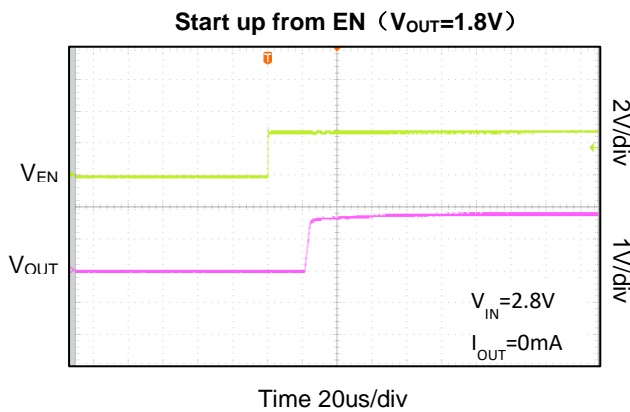
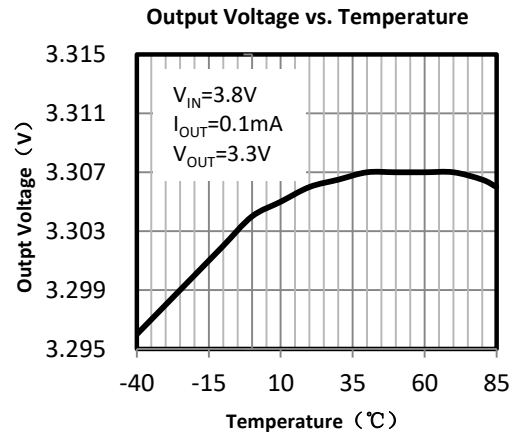
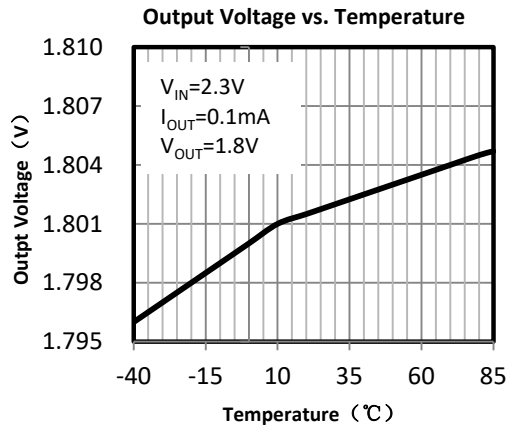
### TYPICAL PERFORMANCE CHARACTERISTICS (continued)

$V_{EN} = V_{IN}$ ,  $C_{IN} = 1\mu F$ ,  $C_{OUT} = 1\mu F$ ,  $C_{BP} = 0\mu F$ ,  $T_A = +25^\circ C$ , unless otherwise noted.



### TYPICAL PERFORMANCE CHARACTERISTICS (continued)

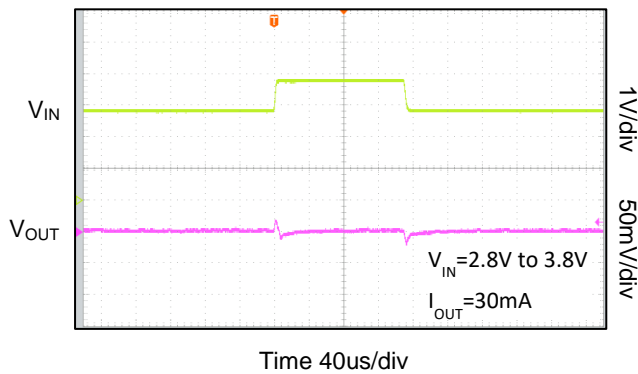
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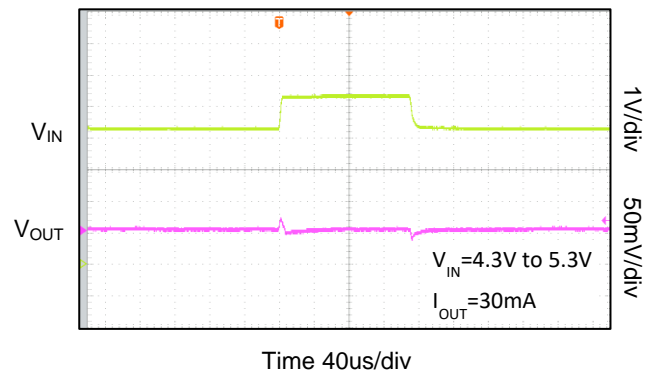
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$V_{EN} = V_{IN}$ ,  $C_{IN} = 1\mu F$ ,  $C_{OUT} = 1\mu F$ ,  $C_{BP} = 0\mu F$ ,  $T_A = +25^\circ C$ , unless otherwise noted.

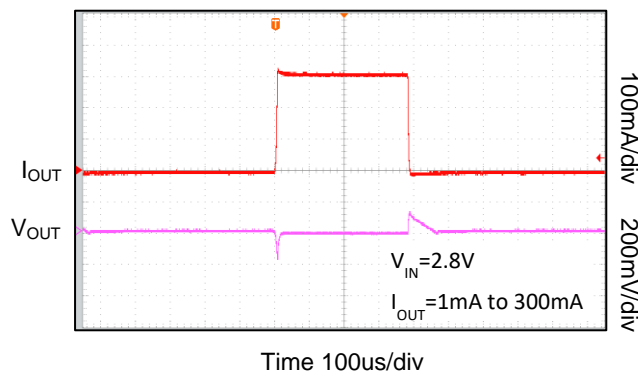
Line Transient Response ( $V_{OUT}=1.8V$ )



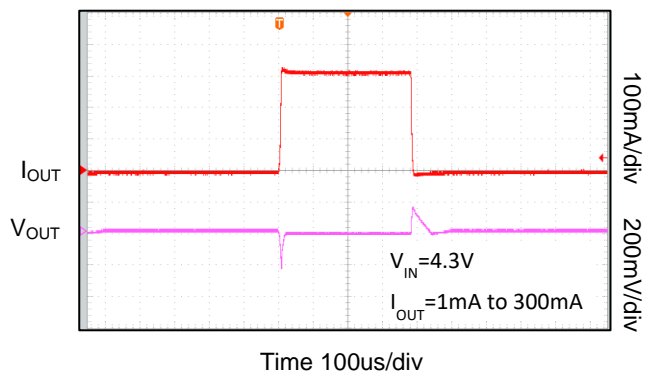
Line Transient Response ( $V_{OUT}=3.3V$ )



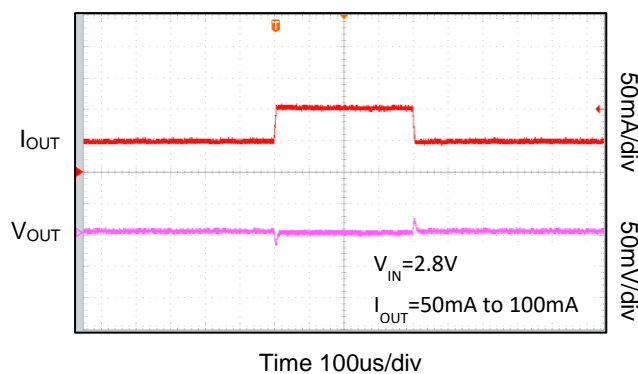
Load Transient Response ( $V_{OUT}=1.8V$ )



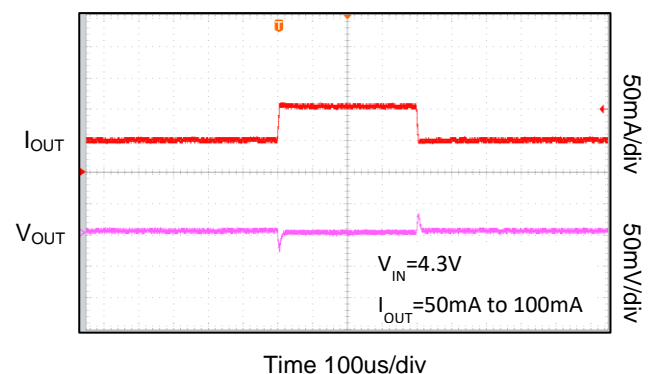
Load Transient Response ( $V_{OUT}=3.3V$ )



Load Transient Response ( $V_{OUT}=1.8V$ )

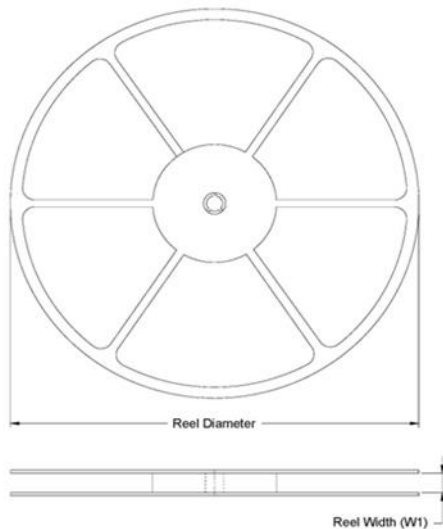


Load Transient Response ( $V_{OUT}=3.3V$ )

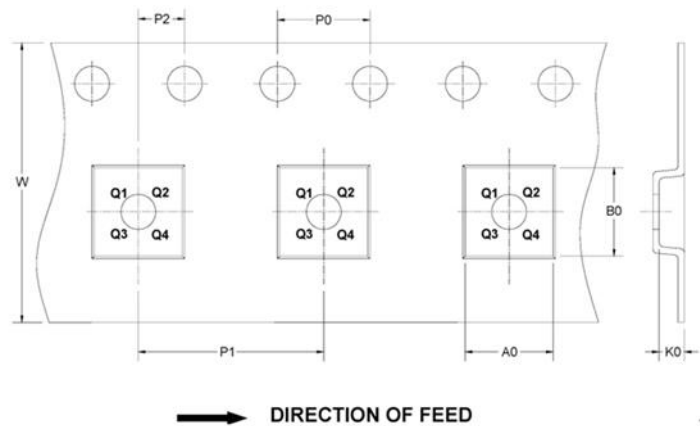


### TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS

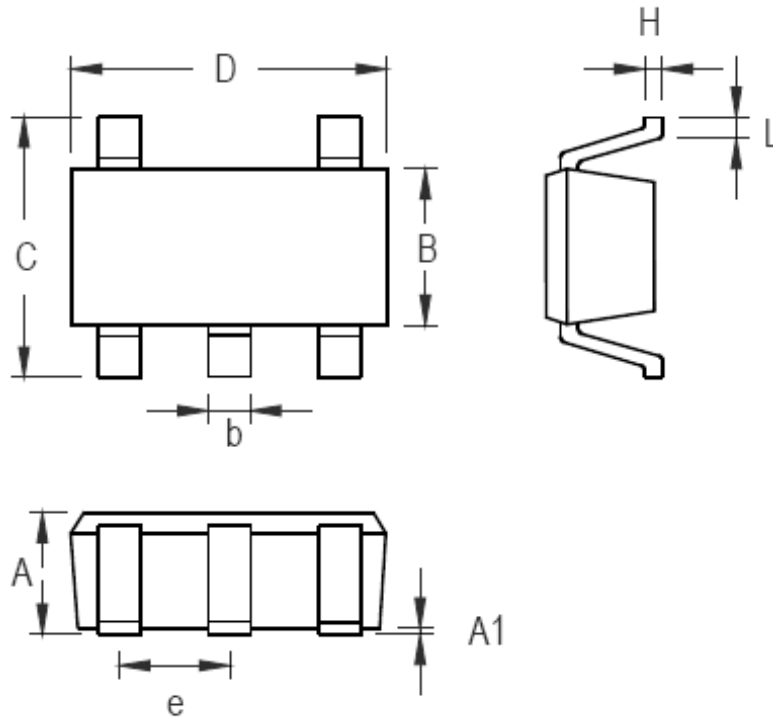


### KEY PARAMETER LIST OF TAPE AND REEL

Device Name	Package Type	Reel Diameter	Unit: mm								Pin 1 Quadrant	Reel Q'ty
			Reel Width W1	A0	B0	K0	P0	P1	P2	W		
BCT2020EUKXX-TR	SOT23-5	7"	9	3.2	3.18	1.38	4	4	2	8	Q3	3000
BCT2020EXKXX-TR	SC70-5	7"	9.5	2.3	2.3	1.1	4	4	2	8	Q3	3000
BCT2020ELSXX-TR	UTDFN1x1-4L	7"	9.5	1.16	1.16	0.5	4	2	2	8	Q1	10000

## PACKAGE OUTLINE DIMENSIONS

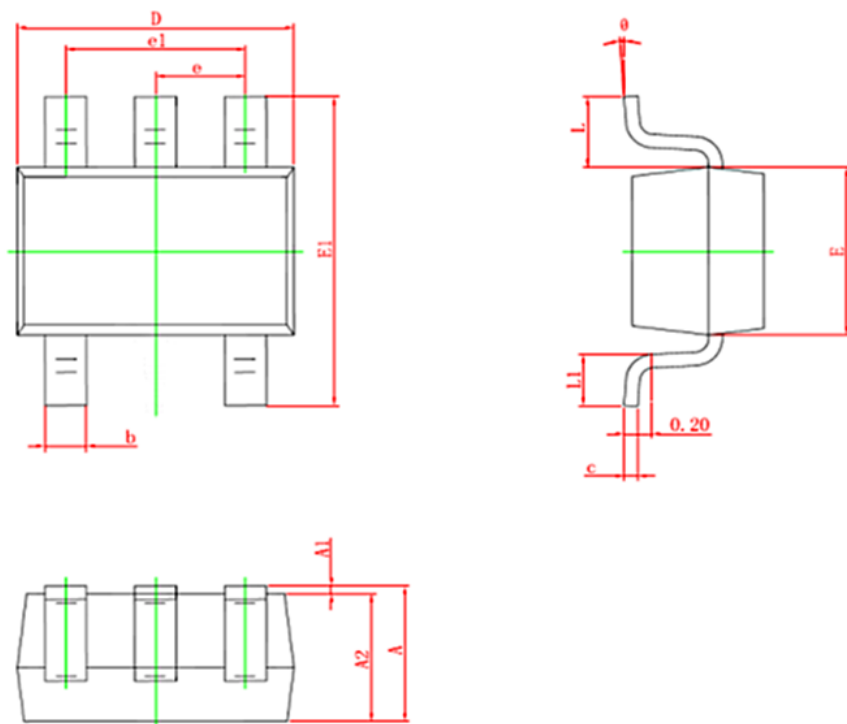
SOT23-5



Symbol	Dimensions In Millimeters	
	Min	Max
A	1.05	1.15
A1	0.03	0.15
B	1.5	1.7
b	0.28	0.45
C	2.75	3.05
D	2.82	3.02
e	0.95(BSC)	
H	0.12	0.23
L	0.35	0.55

SOT23-5 Surface Mount Package

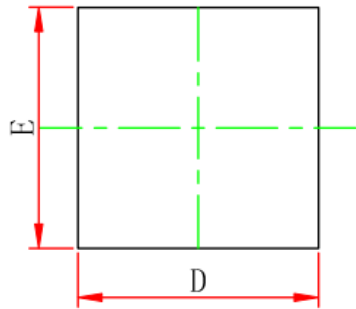
### SC70-5



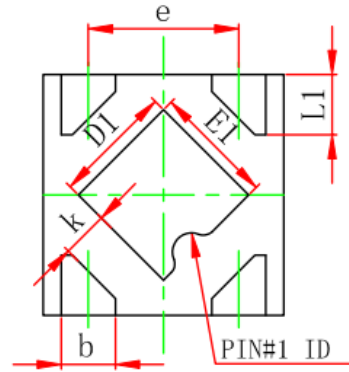
Symbol	Dimensions In Millimeters	
	Min.	Max.
A	0.900	1.100
A1	0.000	0.100
A2	0.900	1.000
b	0.150	0.350
c	0.110	0.175
D	2.000	2.200
E	1.150	1.350
E1	2.150	2.450
e	0.650 TYP.	
e1	1.200	1.400
L	0.525 REF.	
L1	0.260	0.460
$\theta$	0°	8°

SC70-5 Surface Mount Package

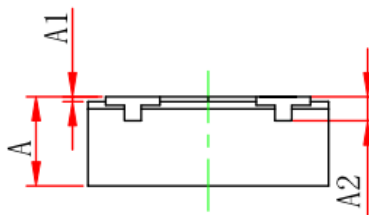
**UTDFN1x1-4L**



TOP VIEW



BOTTOM VIEW



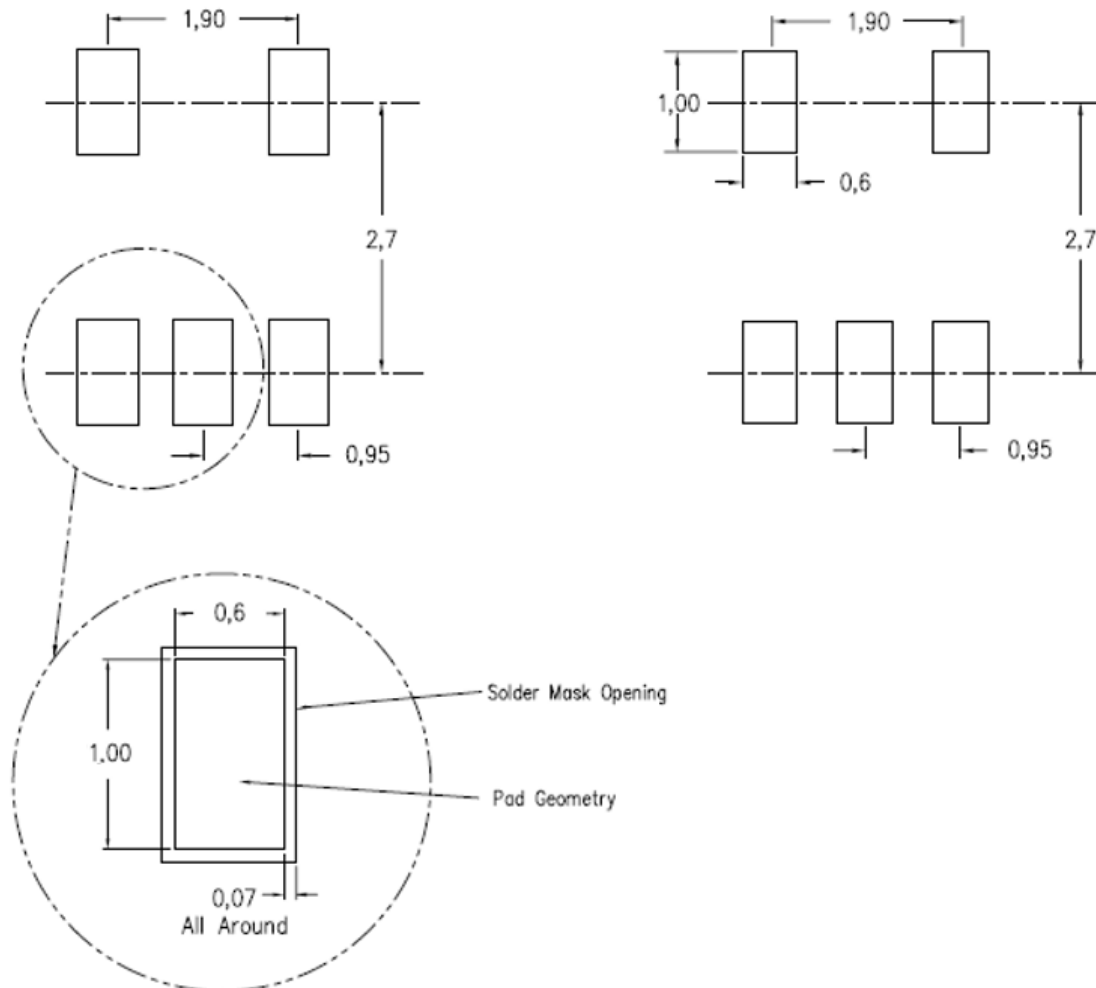
SIDE VIEW

Symbol	Dimensions In Millimeters	
	Min	Max
A	0.335	0.405
A1	0.000	0.050
A2	0.100 REF	
D	0.950	1.050
D1	0.450	0.550
E	0.950	1.050
E1	0.450	0.550
K	0.195 REF	
b	0.175	0.275
e	0.575	0.675
L	0.200	0.300

UTDFN1x1-4L Surface Mount Package

## LAND PATTERN DATA

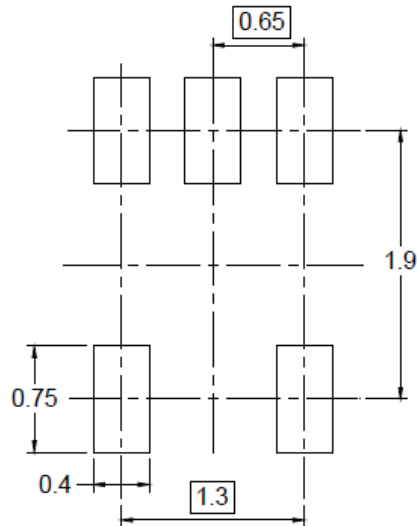
SOT23-5



**RECOMMENDED PCB LAYOUT PATTERN** (Unit: mm)

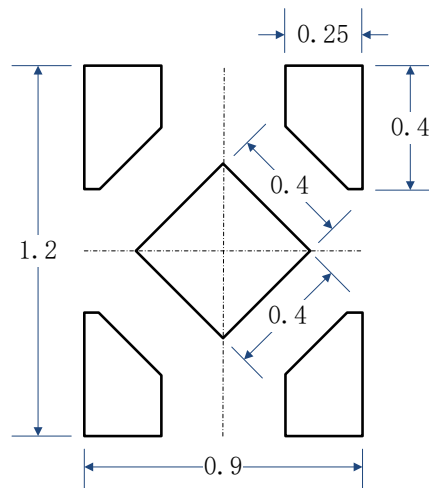


### SC70-5



**RECOMMENDED PCB LAYOUT PATTERN** (Unit: mm)

### UTDFN1x1-4L



**RECOMMENDED PCB LAYOUT PATTERN** (Unit: mm)