

## CC6430

## 5V/12V/24V 350mA Single Coil Intelligent Fan Driver with Blocked Rotation Protection

### FEATURES

- ◆ Built-in high sensitivity Hall sensor
- ◆ With blocking protection function, it will not destroy the IC or coil when blocking.
- ◆ Integrated power reverse protection
- ◆ Strong driving ability, can output up to 350mA continuous current
- ◆ Low power consumption, quiescent current 2mA
- ◆ Excellent temperature stability ensures that the IC can withstand extreme environments
- ◆ Resistant to mechanical stress, the magnetic sensitivity will not be offset by external pressure.
- ◆ ESD (HBM) 6kV, LU 200mA

### APPLICATION

- ◆ Single Coil DC Brushless Fans
- ◆ Single Coil DC Brushless Motors

### GENERAL DESCRIPTION

The CC6430 is a high performance, single coil, brushless DC motor (fan) driver. The chip is designed and manufactured with an innovative advanced high-voltage BiCMOS process that is optimised for Hall sensors and motor drives.

The chip contains a high sensitivity Hall sensor, chopper offset module, Hall temperature compensation unit, voltage regulator and low RDSON full-bridge driver, etc. The CC6430's low power consumption, with a quiescent current of only 2mA, is much lower than similar products in the market, which helps to improve fan efficiency as well as fan reliability.

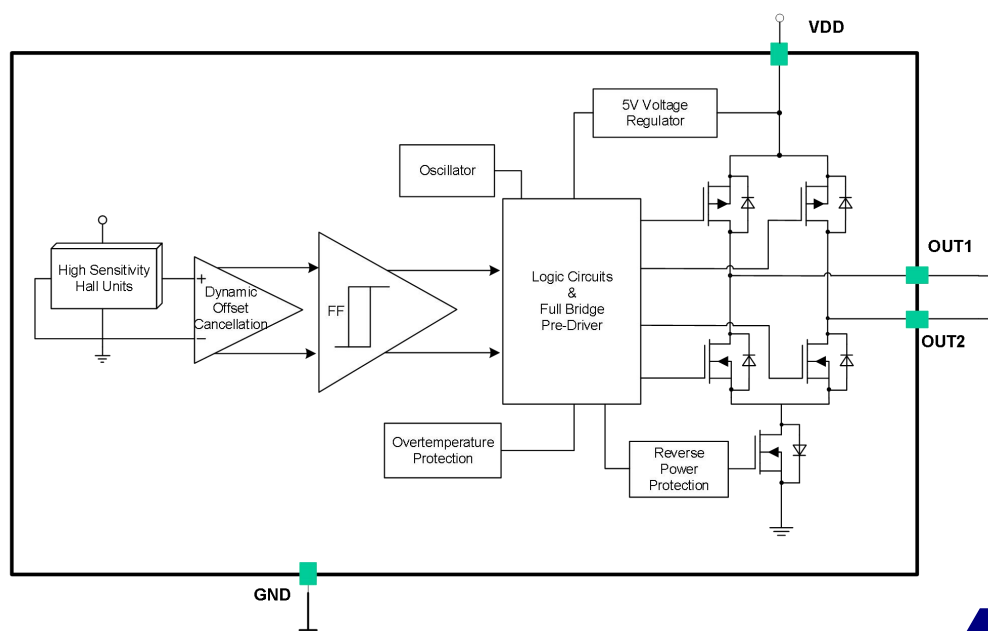
The CC6430 integrates an internal blocking protection function, which automatically stops supplying power to the coil and enters a self-starting state when the fan is blocked. This method can reduce the power consumption and ensure that the fan will not be damaged during the fan jamming, and greatly improves the reliability of the fan.

The CC6430 is capable of withstanding instantaneous high voltage of 40V, ensuring the reliability of the fan in a wide range of applications.

The CC6430 has an integrated reverse connection protection function, eliminating the need for external reverse protection diodes and saving costs for customers.

CC6430 is available in TO-94 and SOT335 package. It's operating ambient temperature range is -40~125°C. Comply with RoHS requirements.

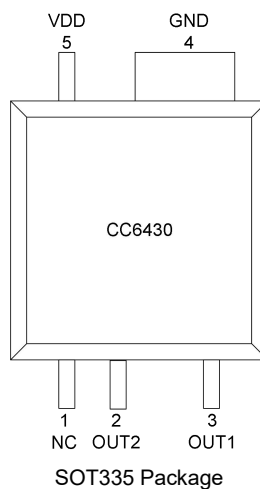
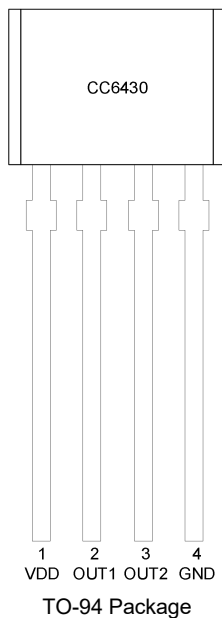
### FUNCTION BLOCK DIAGRAM



## ORDERING INFORMATION

| Part No. | Packing Code | Package Form              |
|----------|--------------|---------------------------|
| CC6430TO | TO-94        | bulk, 1000 pcs/bulk       |
| CC6430SS | SOT335       | tape reel, 10000 pcs/reel |

## PIN CONFIGURATIONS



| Pin Name | Pin NO. |          | Function             |
|----------|---------|----------|----------------------|
|          | TO-94封装 | SOT335封装 |                      |
| VDD      | 1       | 5        | Supply Voltage       |
| OUT1     | 2       | 3        | Full Bridge Output 1 |
| OUT2     | 3       | 2        | Full Bridge Output 2 |
| GND      | 4       | 4        | GND                  |
| NC       | -       | 1        | NC                   |

## ABSOLUTE MAXIMUM RATINGS

| Parameter                             | Symbol            |        | Value     | Unit |
|---------------------------------------|-------------------|--------|-----------|------|
| Fan Supply Voltage                    | V <sub>DD</sub>   |        | 40        | V    |
| Reverse Voltage                       | V <sub>REV</sub>  |        | -40       | V    |
| Peak Output Current                   | I <sub>PEAK</sub> |        | 1000      | mA   |
| Continuous Output Current             | I <sub>CONT</sub> |        | 350       | mA   |
| Ambient Temperature                   | T <sub>A</sub>    |        | -40~125   | °C   |
| Junction Temperature                  | T <sub>J</sub>    |        | 160       | °C   |
| Thermal Resistance Junction - Ambient | R <sub>thJA</sub> | TO-94  | 227       | °C/W |
|                                       |                   | SOT335 | 195       | °C/W |
| Storage Temperature                   | T <sub>S</sub>    |        | -55~150   | °C   |
| Magnetic Flux Density                 | B                 |        | Unlimited | mT   |
| Electrostatic Discharge               | ESD(HBM)          |        | 6         | kV   |
| Latch-Up                              | LU                |        | 200       | mA   |

**Note:** Exceeding the absolute maximum ratings may cause permanent damage. Exposure to absolute-maximum rated conditions for extended periods may degrade device reliability.

## RECOMMENDED OPERATION CONDITIONS

| Parameter              | Symbol     | Min. | Max. | Unit |
|------------------------|------------|------|------|------|
| Fan Supply Voltage     | $V_{DD}$   | 3    | 32   | V    |
| Fan Continuous Current | $I_{OUTC}$ | -    | 300  | mA   |
| Ambient Temperature    | $T_A$      | -40  | 125  | °C   |

## ELECTRICAL CHARACTERISTICS ( $V_{DD}=18V$ @ $T_A=25^{\circ}C$ , unless specified otherwise)

| Parameter                                  | Symbol            | Condition                    | Min | Typ. | Max | Unit |
|--------------------------------------------|-------------------|------------------------------|-----|------|-----|------|
| Fan Supply Voltage                         | $V_{DD}$          | -                            | 3   | -    | 36  | V    |
| Quiescent Current                          | $I_{DD}$          | -                            | -   | 2    | 4   | mA   |
| Output Saturation Voltage Drop             | $V_{SAT\_SINK}$   | $I_{OUT}=200mA$              | -   | 0.28 | -   | V    |
|                                            | $V_{SAT\_SOURCE}$ | $I_{OUT}=200mA$              | -   | 0.28 | -   | V    |
| Output Rising Time                         | $t_r$             | $R_L=820\Omega$ , $C_L=20pF$ | -   | 30   | -   | ns   |
| Output Falling Time                        | $t_f$             | $R_L=820\Omega$ , $C_L=20pF$ | -   | 30   | -   | ns   |
| Dead Time                                  | $t_{DEAD}$        | $R_L=820\Omega$ , $C_L=20pF$ | -   | 10   | -   | us   |
| Locked Rotor ON Time                       | $T_{ON}$          | $V_{DD}>7V$                  | -   | 0.45 | -   | s    |
| Locked Rotor OFF Time                      | $T_{OFF}$         | $V_{DD}>7V$                  | -   | 2.85 | -   | s    |
| Reverse Current                            | $I_{REV}$         | $V_{DD} = -36V$              | -   | -    | 100 | uA   |
| Over Temperature Protection <sup>[1]</sup> | $T_{SD}$          |                              |     | 160  |     | °C   |
| OTP Hysteresis                             | $\Delta T_{SD}$   |                              |     | 50   |     | °C   |

**Note:** [1] Design values, not actual test values.

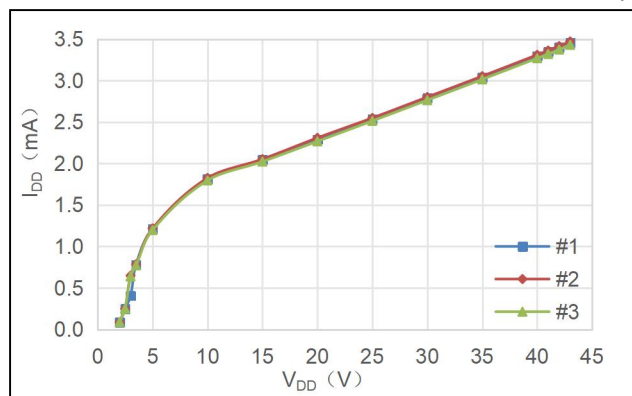
## MAGNETIC PARAMETER

| Parameter     | Symbol           | Min | Typ. | Max. | Unit  |
|---------------|------------------|-----|------|------|-------|
| Operate Point | B <sub>OP</sub>  | 5   | 25   | 45   | Gauss |
| Release Point | B <sub>RP</sub>  | -45 | -25  | -5   | Gauss |
| Hysteresis    | B <sub>HYS</sub> | 20  | 50   | 80   | Gauss |

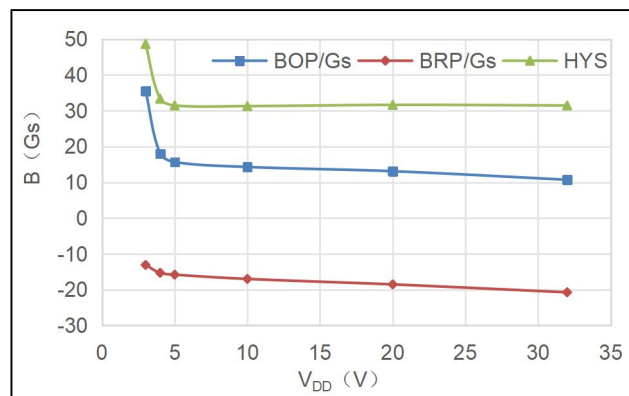
## DRIVER OUTPUT VS. MAGNETIC POLE

| Parameter  | Test Condition      | OUT1 | OUT2 |
|------------|---------------------|------|------|
| North Pole | B < B <sub>RP</sub> | High | Low  |
| South Pole | B > B <sub>OP</sub> | Low  | High |

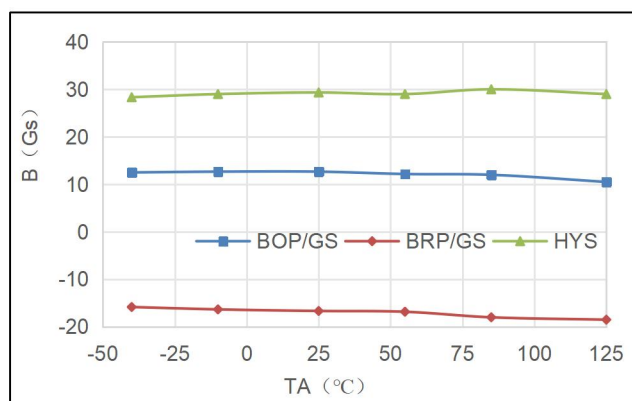
**CURVE & WAVEFORM** ( $V_{DD}=18V$  @  $T_A=25^\circ C$ , unless specified otherwise)



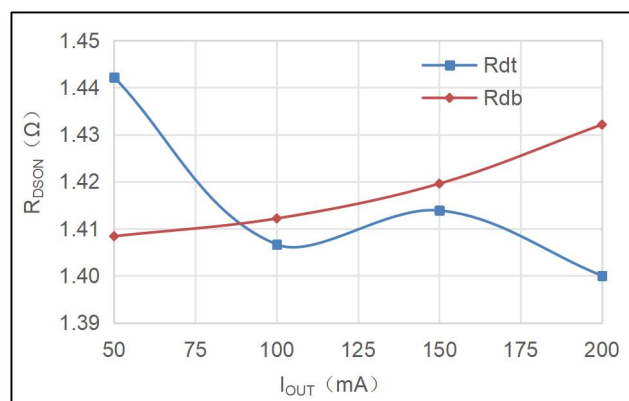
$I_{DD}$  vs.  $V_{DD}$



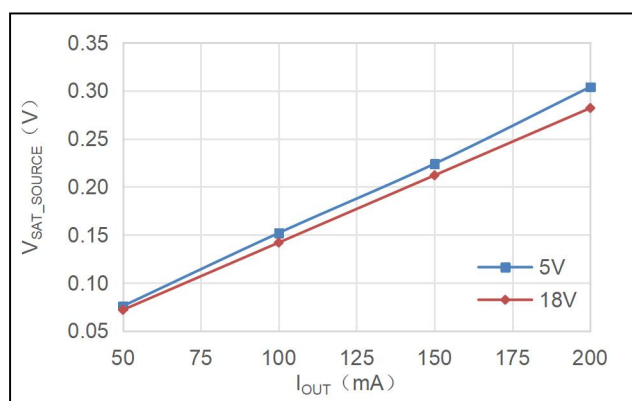
BOP & BRP & B<sub>HYS</sub> vs.  $V_{DD}$



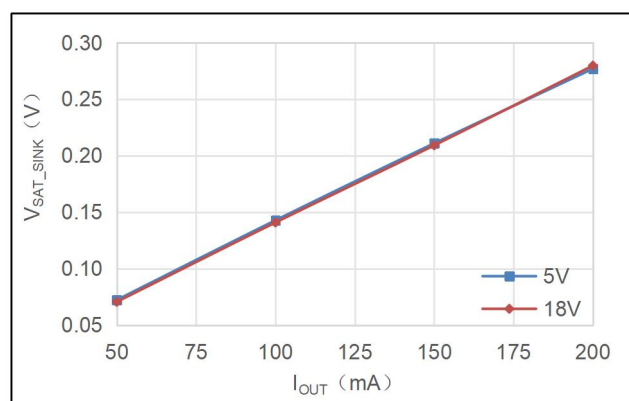
BOP & BRP vs.  $T_A$



$R_{DSON}$  vs.  $I_{OUT}$

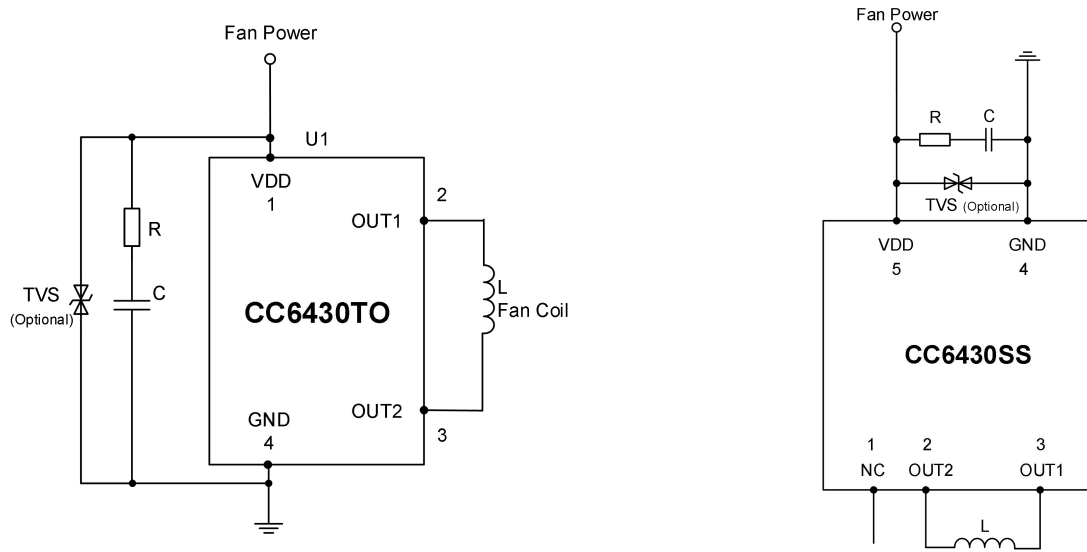


$V_{SAT\_SOURCE}$  vs.  $I_{OUT}$



$V_{SAT\_SINK}$  vs.  $I_{OUT}$

## TYPICAL APPLICATION CIRCUIT



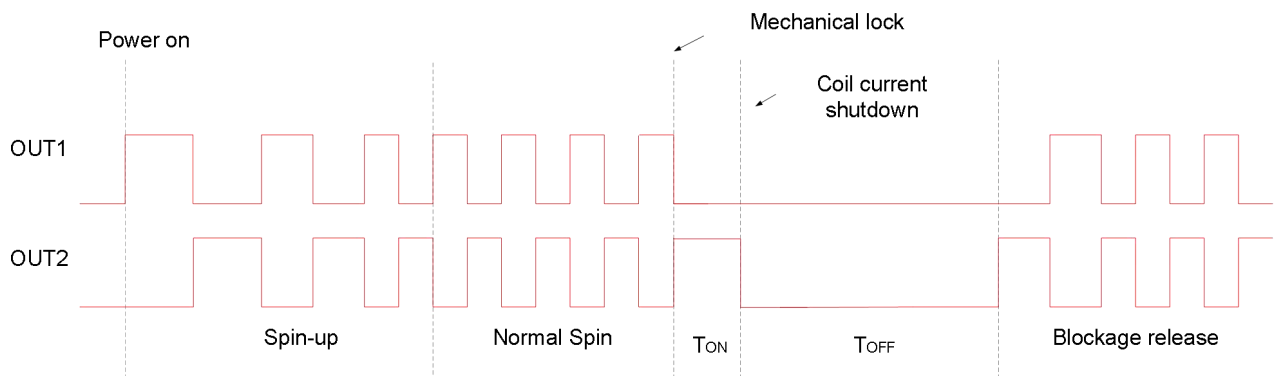
CC6430 typical application circuit

### Note:

- Bypass RC circuit (recommended) can absorb the fan coil current and improve the reliability of the fan, the specific parameters are related to the actual model, rotation current, start-up current and so on.
- Bidirectional TVS is optional and can enhance the ability to absorb external abnormalities. Unidirectional TVS can be used when there are additional terminals for physical anti-reverse connection.

## FEATURES

This product has built-in card blocking protection. When the fan is blocked, the blocking protection shuts off the fan coil current and then tries to restart it every 2 seconds. The cycling of the switch reduces the average current to 1/7th of normal card blocking, enough to protect the fan from damage due to overheating



## MAXIMUM DRIVE CURRENT

The maximum heat dissipation power of the CC6430 package is determined by the following equation ( Note: K is the recommended coefficient ):

$$P_{D(MAX)} = \frac{T_J - T_A}{R_{thJA}} \times K$$

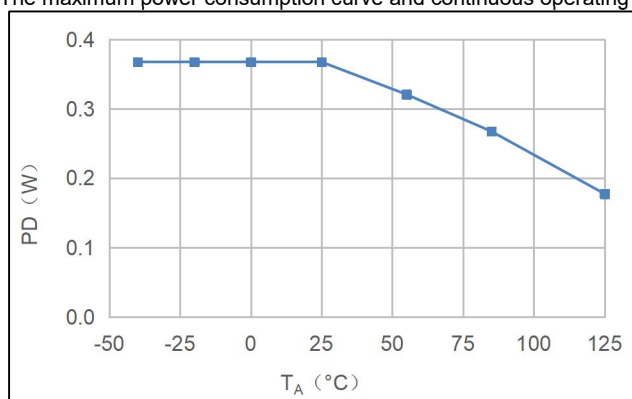
While normal operation, the power dissipated in CC6430:

$$P = I_{OUT}^2 \times R_{ON} + V_{DD} \times I_{DD}$$

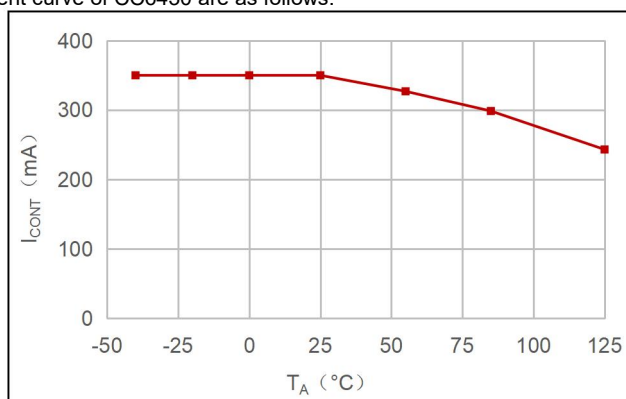
The maximum output current  $I_{MAX}$ :

$$I_{MAX} = \sqrt{\frac{(P_{D(MAX)} - V_{DD} \times I_{DD})}{R_{ON}}}$$

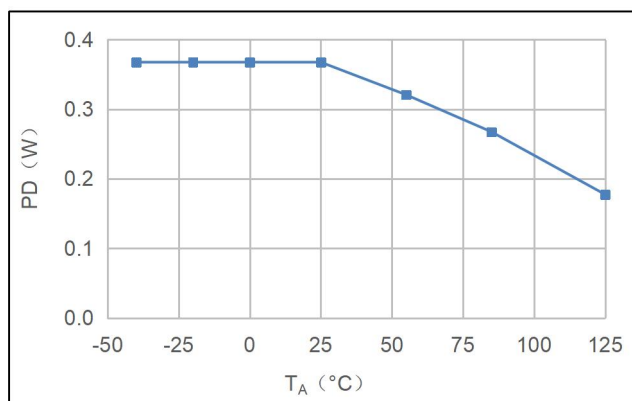
The maximum power consumption curve and continuous operating current curve of CC6430 are as follows:



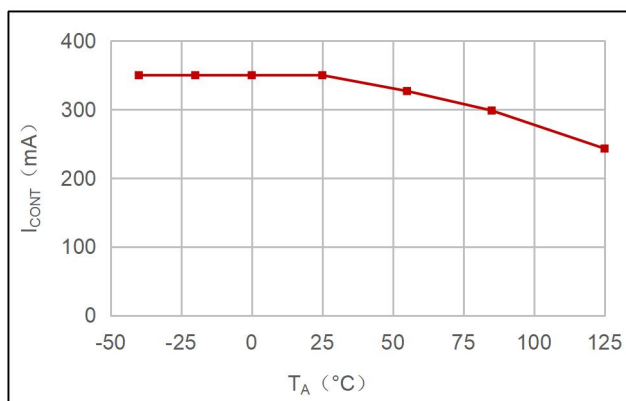
maximum power consumption curve (TO-94)



continuous operating current curve (TO-94)



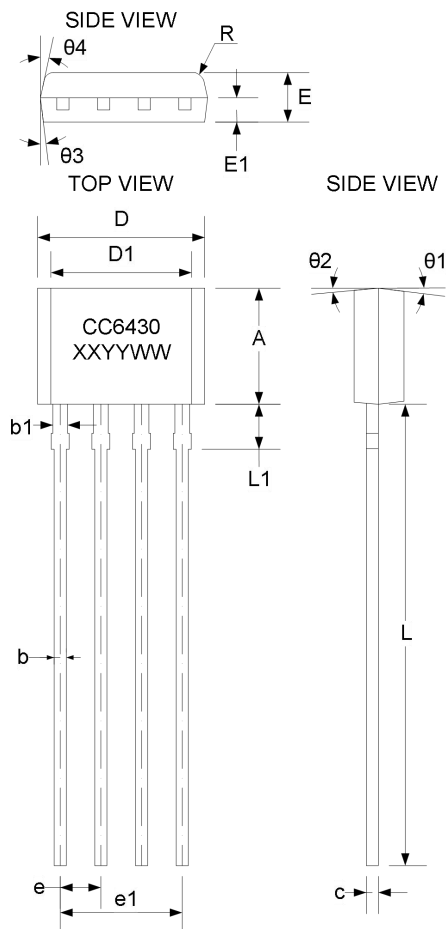
maximum power consumption curve (SOT335)



continuous operating current curve (SOT335)

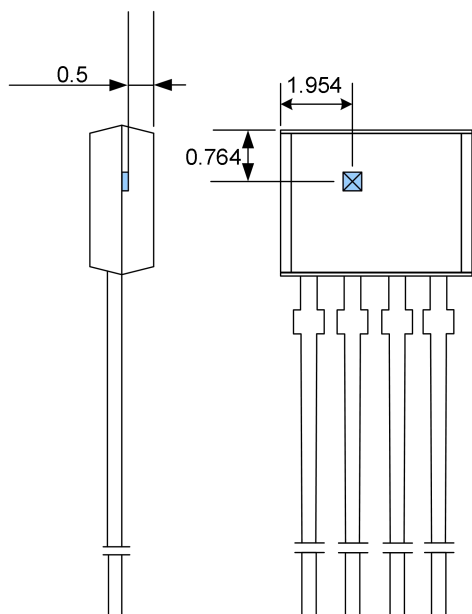
## PACKAGE INFORMATION

### 1) TO-94 Package



| Symbol     | Size (mm) |       |       |
|------------|-----------|-------|-------|
|            | Min.      | Typ.  | Max.  |
| A          | 3.55      | 3.65  | 3.75  |
| b          | 0.36      | 0.43  | 0.50  |
| b1         | 0.38      | 0.465 | 0.55  |
| c          | 0.36      | 0.38  | 0.51  |
| D          | 5.12      | 5.22  | 5.32  |
| D1         | 4.50      | 4.60  | 4.70  |
| E          | 1.46      | 1.56  | 1.66  |
| E1         | 0.71      | 0.76  | 0.81  |
| R          | -         | 0.3   | -     |
| e          | 1.27      |       |       |
| e1         | 3.81      |       |       |
| L          | 14.00     | 14.50 | 15.00 |
| L1         | 1.312     | 1.412 | 1.512 |
| $\theta 1$ | 5.19°     | -     | 7°    |
| $\theta 2$ | 3°        | -     | 5°    |
| $\theta 3$ | 5°        | -     | 7°    |
| $\theta 4$ | 10°       | -     | 12°   |

### Hall Location



### Note:

1. All Dimensions are in millimeters.
2. To maintain reliability, it is recommended that the pin length be greater than 2.5mm.

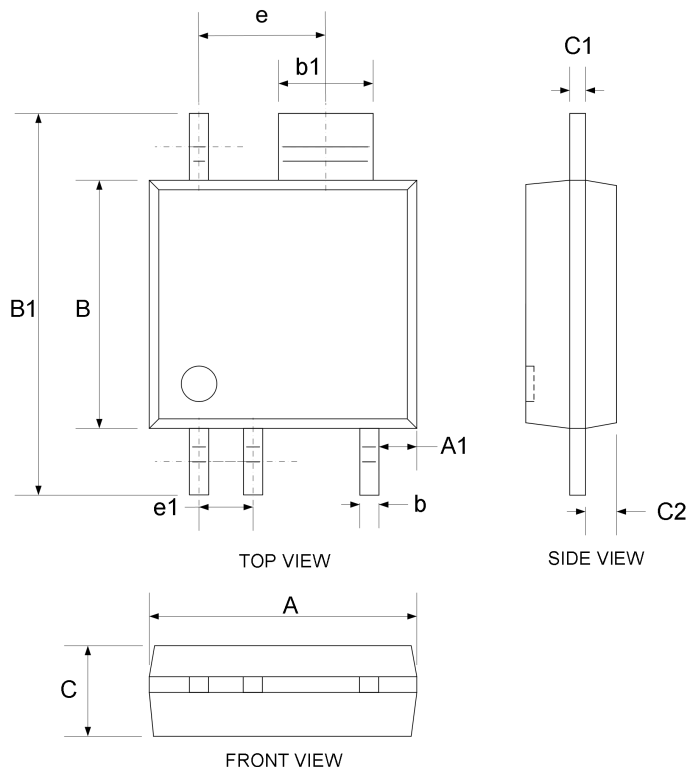
### Marking:

1<sup>st</sup> Line: CC6430 –Device Name

2<sup>nd</sup> Line: XYYWW – Batch No.

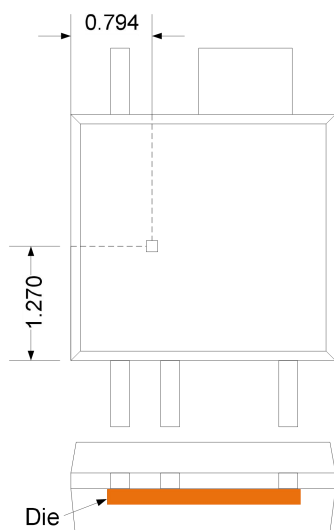
- XX – code
- YY – assembly year (last 2 digits)
- WW – assembly week number

## 2) SOT335 Package



| Symbol | Size (mm)  |       |      |
|--------|------------|-------|------|
|        | Min.       | Typ.  | Max. |
| A      | 2.60       | -     | 2.90 |
| A1     | 0.35       | 0.40  | 0.45 |
| e      | 1.20 (BSC) |       |      |
| e1     | 0.53 (BSC) |       |      |
| B      | 2.50       | 2.60  | 2.70 |
| B1     | 3.90       | 4.00  | 4.10 |
| b      | 0.16       | 0.21  | 0.26 |
| b1     | 0.94       | 0.99  | 1.04 |
| C      | 0.85       | 0.95  | 1.05 |
| C1     | 0.15       | 0.152 | 0.18 |
| C2     | 0.35       | 0.40  | 0.45 |

### Hall Location



### Back Marking:

1<sup>st</sup> Line: CC6430 – Device Name

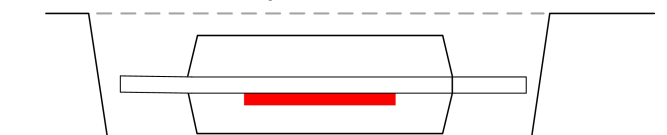
2<sup>nd</sup> Line: XYYWW – Batch No.

- XX – code
- YY – assembly year (last 2 digits)
- WW – assembly week number

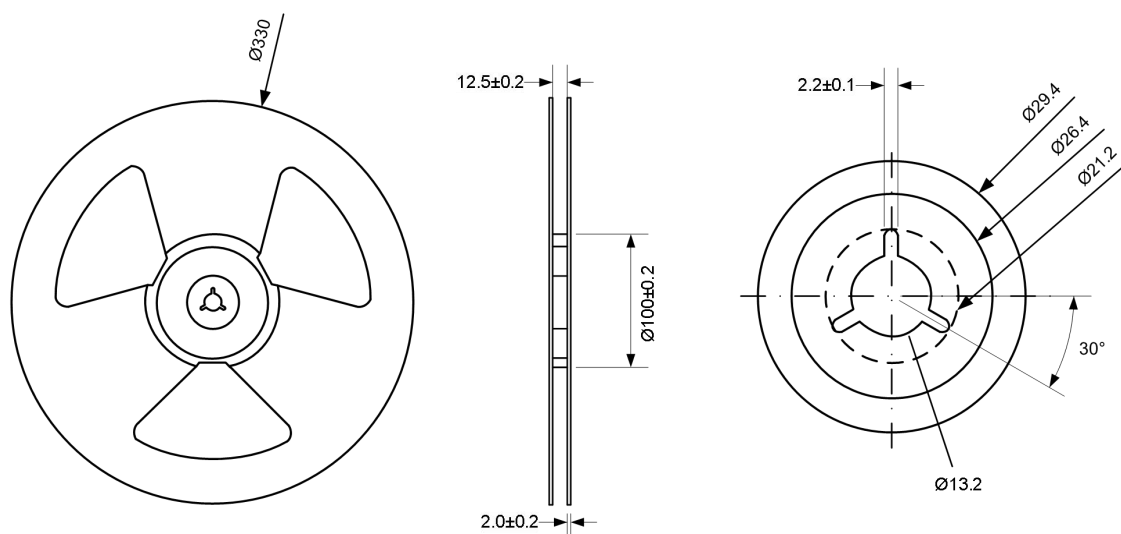
### Note:

1. All Dimensions are in millimeters.

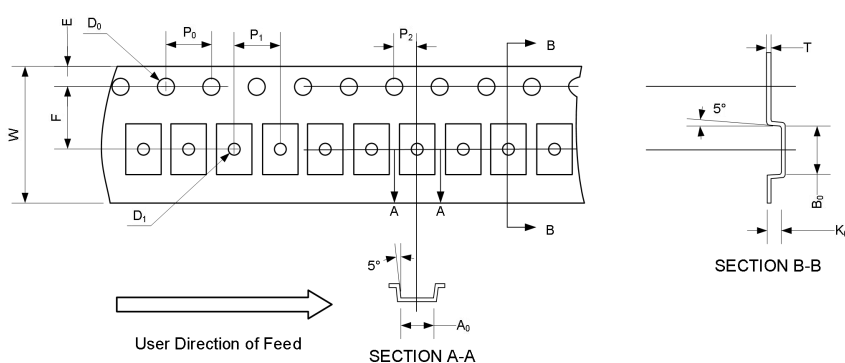
### Information of carrier tape



## Packaging & Tape reel (SOT335)



Information of Reel size

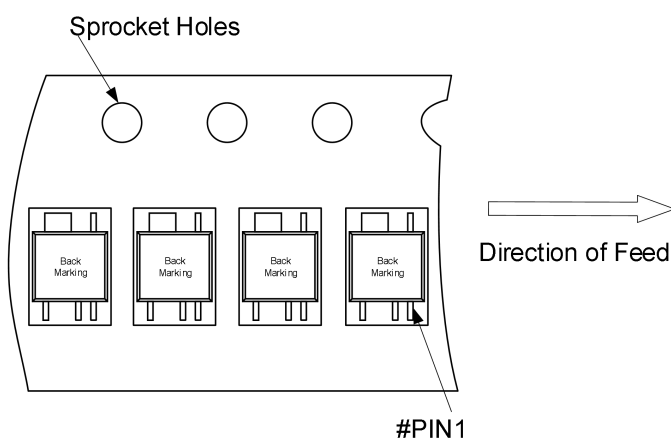


Information of Carrier Tape Size

Note: Each plate has  $100 \pm 5$  grids in front of the tape and  $100 \pm 5$  in the tail

| Symbol | Size (mm) |       |       |
|--------|-----------|-------|-------|
|        | Min.      | Typ.  | Max.  |
| W      | 11.90     | 12.00 | 12.05 |
| A0     | 2.90      | 2.95  | 3.00  |
| B0     | 4.30      | 4.35  | 4.40  |
| K0     | 1.30      | 1.35  | 1.40  |
| E      | 1.65      | 1.75  | 1.85  |
| F      | 5.40      | 5.50  | 5.60  |
| D1     | -         | 1.00  | 1.10  |
| D0     | -         | 1.50  | 1.60  |
| P0     | 3.90      | 4.00  | 4.10  |
| P1     | 3.90      | 4.00  | 4.10  |
| P2     | 1.95      | 2.00  | 2.05  |
| T      | 0.20      | 0.25  | 0.30  |

## QUADRANT ASSIGNMENTS FOR PIN1 ORIENTATION IN TAPE



**Note:** All dimensions are millimeters.

## REVISION HISTORY

| Revision Date | Description of Revision                                                                                                              | Revision |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------|----------|
| 2024.01.24    | Newly issued.                                                                                                                        | rev1.0   |
| 2024.01.25    | Modified the $T_{A\_MIN} = -40^{\circ}\text{C}$ ——Page3 in <b>RECOMMENDED OPERATION CONDITIONS</b> form.                             | rev1.1   |
| 2024.02.28    | ESD ( HBM ) changed from “4kV” to “6kV” .                                                                                            | rev1.2   |
| 2024.03.27    | Delete the FPWM parameter from the <b>RECOMMENDED OPERATION CONDITIONS</b> form.                                                     | rev1.3   |
| 2024.06.24    | Correct the electrical symbols of MOS devices in the <b>FUNCTION BLOCK DIAGRAM</b> .                                                 | rev1.4   |
| 2024.06.28    | Corrected silkscreen marking for SOT335 package to backside;<br>Correcting the location of the chip in the carrier tape information. | rev1.5   |
| 2024.08.20    | Supplementary maximum power curves and continuous current curves for TO-94 packages and SOT335 packages.                             | rev1.6   |

## CrossChip

CrossChip Microsystems Inc. was founded in 2013, is a national high-tech enterprise, engaged in integrated circuit design and sales. The company has strong technical strength, has more than 60 kinds of patents, mainly used in Hall sensor signal processing, with the following product lines:

- ✓ High precision linear Hall sensor
- ✓ All kinds of Hall switches
- ✓ Single phase motor drive
- ✓ Single chip current sensor
- ✓ AMR Magnetoresistance sensor
- ✓ Isolation drive class chip

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