CC6403/4

5V/12V/24V 450mA Single Coil Fan Driver with Auto-start and FG or RD

General Description

CC6403/4 is a one-chip solution for driving single-coil brushless DC fans and motors， which is fabricated with innovative high voltage BiCMOS process. It includes high sensitivity hall sensor, chopper stabilized amplifier, dynamic offset cancellation, thermal protection and a low R_{DSON} full bridge driver. With the benefit of the advanced process, the chip consumed power is very low, just only 2mA, much smaller than the drivers fabricated by bipolar process. Its robustness perfectly suits for consumer applications.

CC6403/4 has auto-restart function. When the fan is mechanically blocking, IC will shutdown the coil current and restart every time until the blocking release. Thus, the current flow the coil is low enough and protect the fan from over-heating. CC6403/4 can withstand the instantaneous 40V high voltage to ensure the reliability of the fan in various application environments.

CC6403 has Speed counting function (Tachometer Output FG), CC6404 has Locking alarm function (Alarm Output RD).

CC6403/4 is available in two packages, which are SOT89-5 and SOT335. The operation temperature range is -40~125°C.

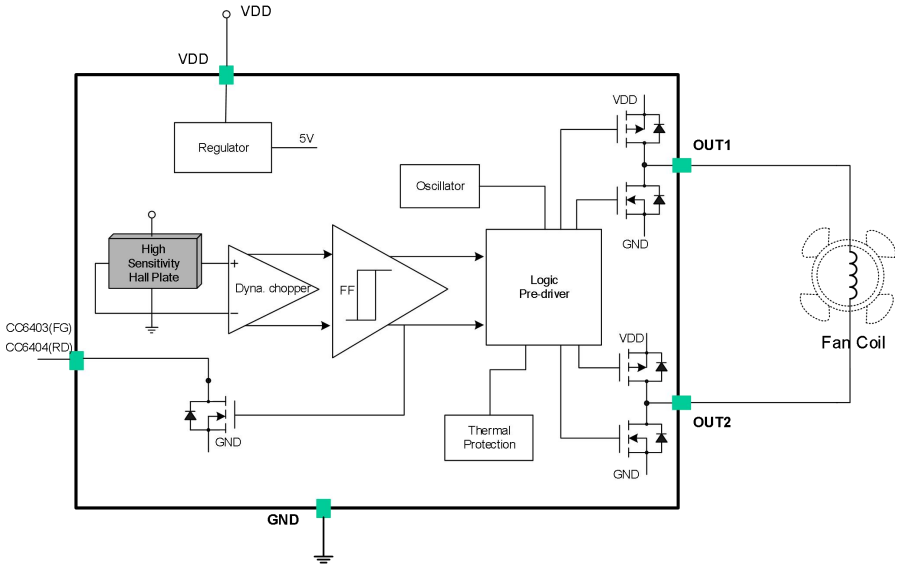
Features

- Built-in High Sensitivity Hall Sensor
- Low Rdson with 1.5Ω
- Low Power Consumption, Typical 2mA
- Locked Rotor Protection and Auto-restart
- Driving Capability:
  - Maximum Continuous Current: 450mA
  - Peak Output Current: 1500mA
- Tachometer Output FG(CC6403) or Alarm Output RD(CC6404)
- Superior Temperature Stability
- Resistant to Physical Stress
- ESD (HBM) 6000V

Application

- Single Phase BLDC Fans
- Single Phase BLDC Motors

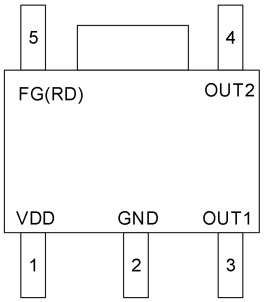
Function Block Diagram



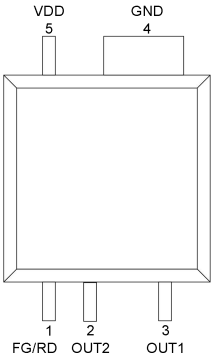
Ordering Information

Part No.	Description	Package Code
CC6403ST	SOT89-5	Tape reel, 1000pcs/reel
CC6404ST	SOT89-5	Tape reel, 1000pcs/reel
CC6403SS	SOT335	Tape reel, 10000pcs/reel
CC6404SS	SOT335	Tape reel, 10000pcs/reel

PIN Configurations



SOT89-5



SOT335

Pin Name	Number		Function
	SOT89-5	SOT335	
VDD	1	5	Supply Voltage
OUT1	3	3	H bridge output 1
OUT2	4	2	H bridge output 2
GND	2	4	GND
FG/RD	5	1	Tachometer/Alarm

Absolute Maximum Ratings

Parameter	symbol		value	unit
Fan Supply Voltage	V_{DD}		40	V
Peak Output Current	I_{OUTP}		1500	mA
Continuous Output Current	I_{CONT}		450	mA
withstand voltage of FG/RD	$V_{(FG/RD)\ MAX}$		40	V
withstand current of FG/RD	$I_{(FG/RD)\ MAX}$		10	mA
Operating Temperature Range	T_A		-40~125	°C
Junction Temperature	T_J		160	°C
Thermal Resistance Junction - Ambient	R_{thJA}	SOT335	195	°C/W
		SOT89-5	63	
Storage Temperature	T_S		-55~150	°C
Magnetic Flux Density	B		Unlimited	mT
ESD Susceptibility (HBM)	ESD(HBM)		6000	V

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}	2.8	32	V
Continuous Output Current	I_{OUTC}	-	400	mA
Ambient Temperature	T_A	-20	125	°C

Electrical Parameters (VDD=18V @ 25°C room temperature, unless specified otherwise)

Parameter	Symbol	Condition	Min	Typ.	Max	Unit
Fan Supply Voltage	V_{DD}	-	2.8	-	36	V
Supply Current	I_{DD}	-	-	2	4	mA
Output V_{SAT}（sink）	V_{SAT}	V_{DD}=14V, I_{OUT}=200mA	-	0.15	-	V
Output V_{SAT}（source）		V_{DD}=14V, I_{OUT}=200mA	-	V_{DD}-0.25	-	V
Output Rise Time	t_r	R_L=820Ω，C_L=20pF	-	7	-	us
Output Fall Time	t_f	R_L=820Ω，C_L=20pF	-	7	-	us
Output Dead Time	t_{DEAD}	R_L=820Ω，C_L=20pF	-	60	-	us
Locked Rotor ON Time	T_{ON}	V_{DD}>7V	-	0.33	-	s
Locked Rotor OFF Time	T_{OFF}	V_{DD}>7V	-	2	-	s

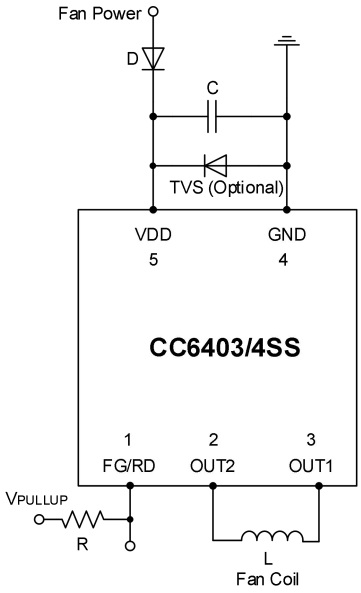
Magnetic Specifications

Parameter	Symbol	Min	Typ.	Max	Unit
Operate Point	B_{OP}	15	30	45	Gauss
Release Point	B_{RP}	-45	-30	-15	Gauss
Hysteresis	B_{HYS}	30	60	90	Gauss

Driver Output vs. Magnetic Pole

Parameter	Test Condition	OUT1	OUT2
North Pole	B< B_{OP}	High	Low
South Pole	B> B_{RP}	Low	High

Typical Application Circuit



CC6403/4 Typical Application Circuit

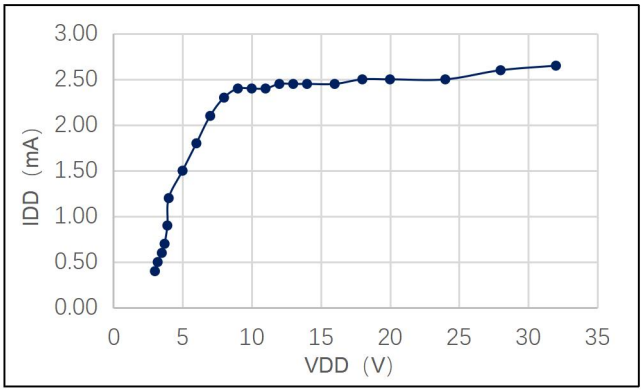
NOTE:

a) Capacitor C can improve the reliability and efficiency of fans. Schottky diode D can decrease the operation voltage.

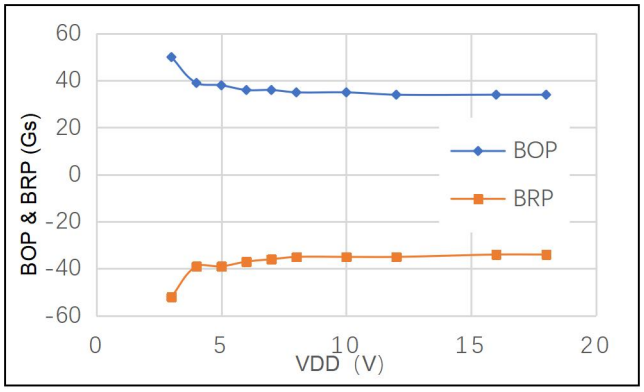
b) Capacitor C can decrease the noise of fan and decrease the spike of outputs.

c) TVS is optional, which can improve the ability to absorb external abnormal conditions.

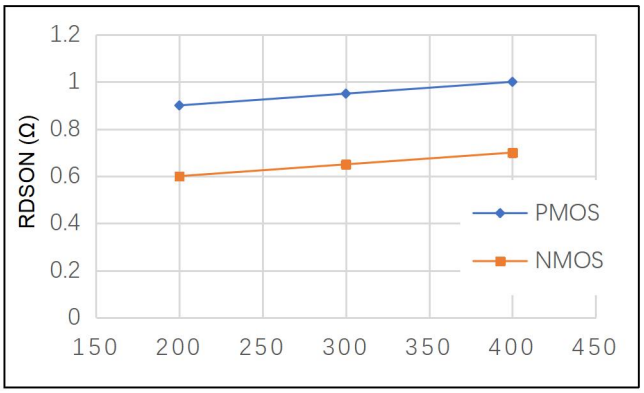
Waveform



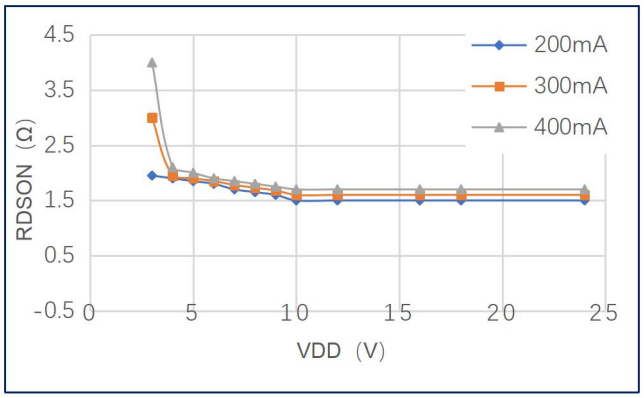
IDD vs. VDD



B_{OP}&B_{RP} vs. VDD



R_{DSON} vs. I_{OUT}

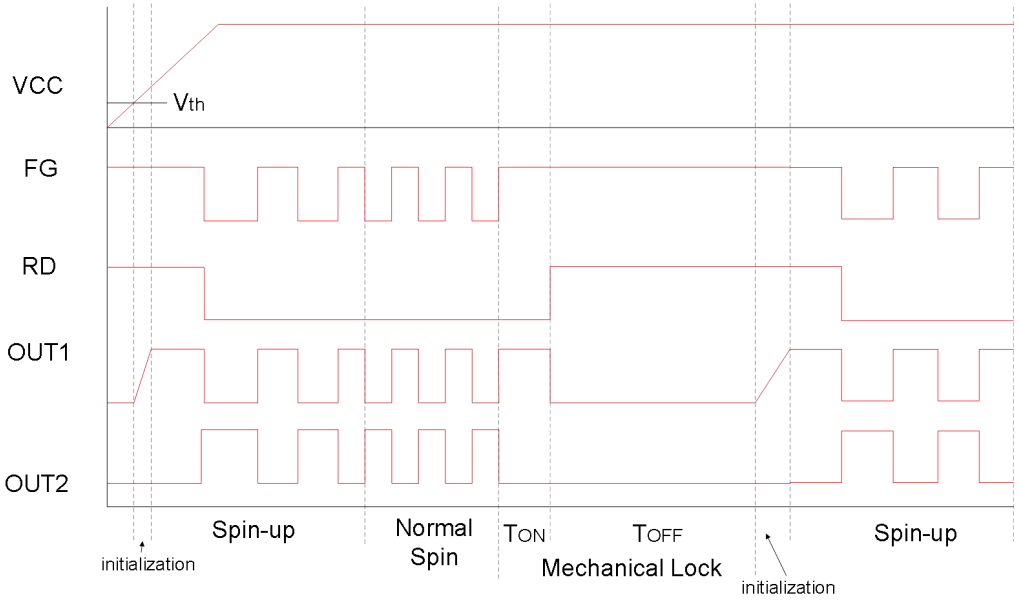


R_{DSON} vs. VDD

Typical Application Waveform

CC6403/4 is an efficient one-chip solution for driving single-coil brushless DC fans and motors. CC6403 has an open-drain tachometer output FG and CC6404 has an open-drain blocking alarm.

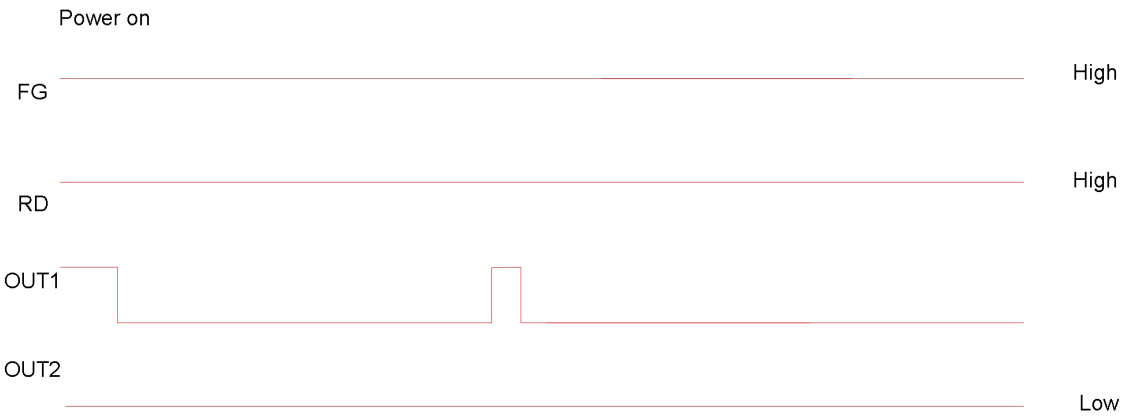
The locked rotor protection will shutdown the coil current when the rotor is mechanically blocked over 0.33s. And try to restart every 2s until the locking is released. It can prevent fans from the damage of overheat. (The following figure is the start sequence diagram, OUT1 and OUT2 only indicate the level is high or low).



Note: After initialization, the RD signal is pulled down after the first OUT waveform is reversed.

Keep Locked Rotor Waveform

The waveform on the keep locked rotor is shown in the figure below. The states of OUT1 and OUT2 may be interchanged, depending on whether the magnetic field on the chip surface is the south pole or the north pole. The magnetic field on the chip surface corresponding to the state of the picture below is the North Pole.



Power Dissipation & Maximum Output Current

The power dissipation is determined by the following equation (Note: K is the recommended coefficient):

$$P_{D(MAX)} = (T_J - T_A)/\theta_J \times K$$

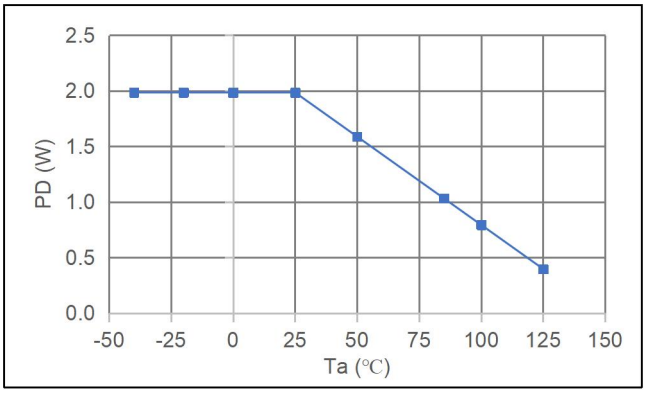
While normal operation, the power dissipated in CC6403/4:

$$P = {I_{CONT}}^2 \times R_{DSON} + V_{DD} \times I_{DD}$$

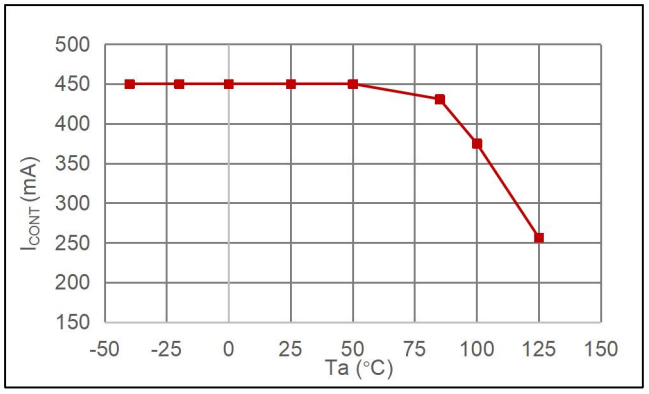
The maximum output current I_{MAX}:

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

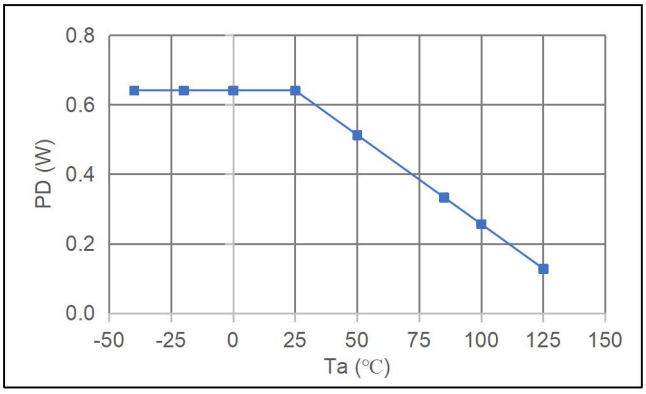
The PD curve and the output current curve



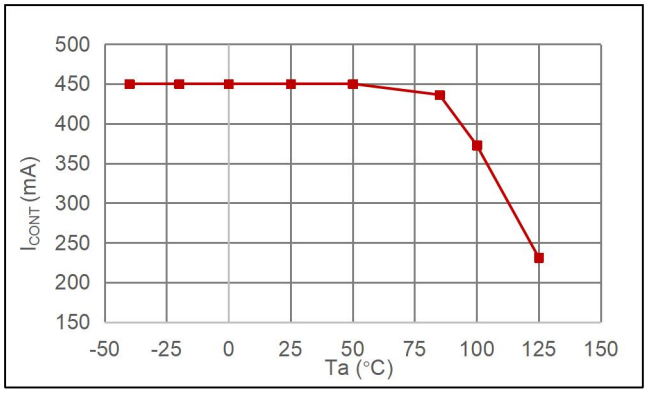
Power Dissipation of SOT89-5



Maximum Output Current of SOT89-5



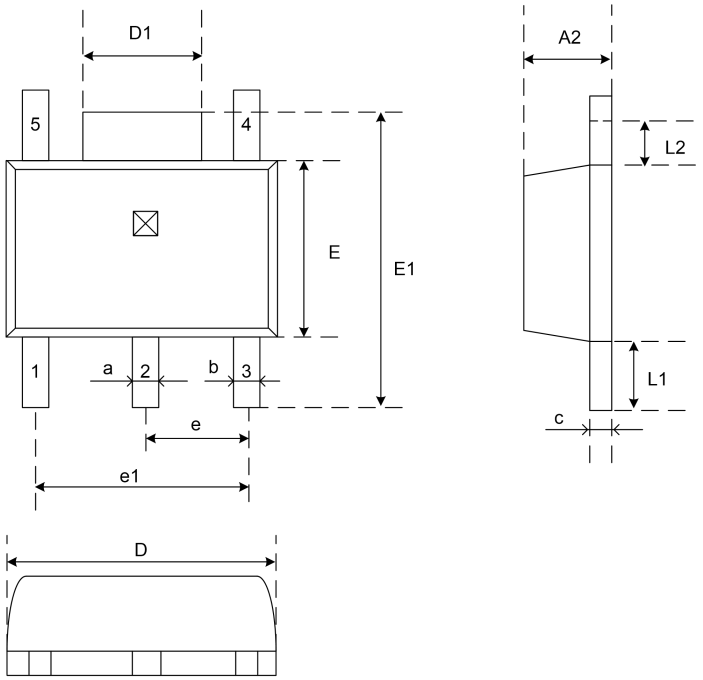
Power Dissipation of SOT335



Maximum Output Current of SOT335

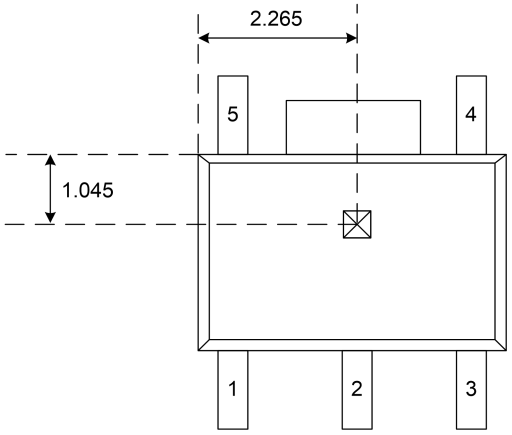
Package Information

(1) SOT89-5 package



Symbol	Millimeters	
	Min	Max
A2	1.4	1.6
a	0.45	0.55
b	0.38	0.47
c	0.36	0.46
D	4.40	4.60
D1	1.60	1.80
E	2.30	2.60
E1	4.10	4.30
e	1.00	2.00
e1	2.95	3.05
L1	0.95	1.05
L2	0.65	0.80

Hall location



Note:

1. All dimensions are millimeters

Marking:

1'st line: CC6403/4– product name

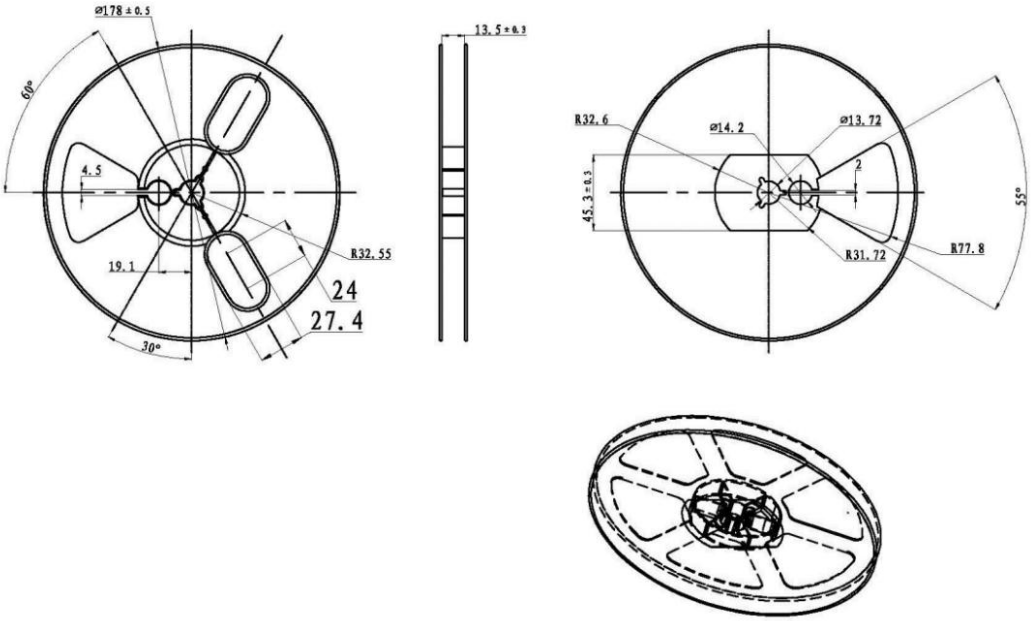
2'nd line: XXYYWW

XX – code

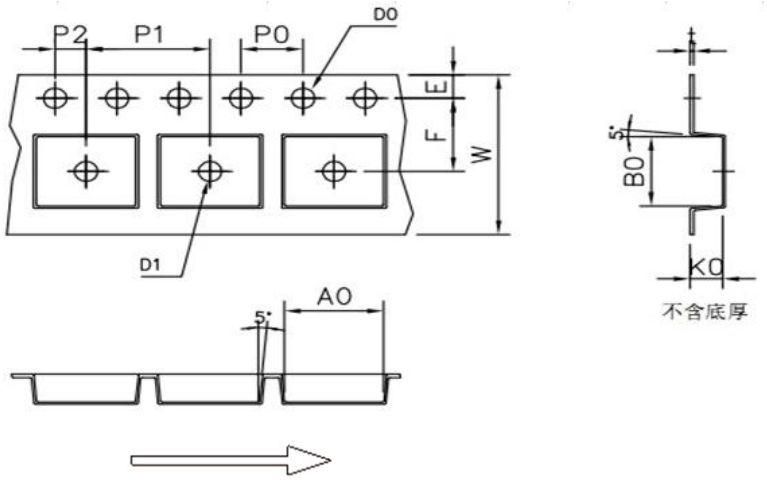
YY – last 2 digits of year

WW – week

Packaging & Tape reel



Information of Reel size



User Direction of Feed

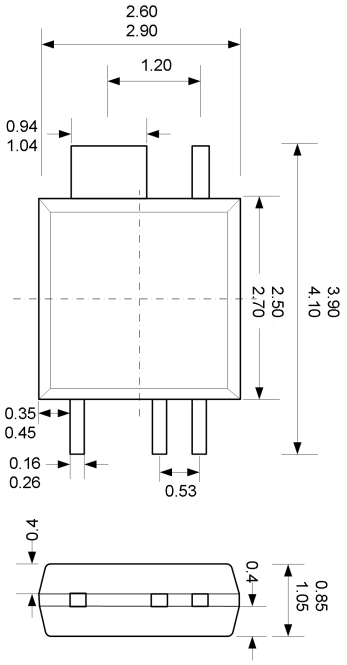
Note: Each plate has 24 ± 5 grids in front of the tape and 70 ± 5 in the tail

Symbol	Millimeters	
	Min	Max
W	11.85	12.15
E	1.65	1.85
F	5.45	5.55
D0	1.40	1.60
D1	1.40	1.60
P0	3.90	4.10
P1	7.90	8.10
P2	1.95	2.05
A0	4.60	4.80
B0	4.70	4.90
K0	1.60	1.80
t	0.19	0.21

Note:

1. All dimensions are millimeters

(2) SOT335 package



Note:

1. All dimensions are millimeters

Back Marking:

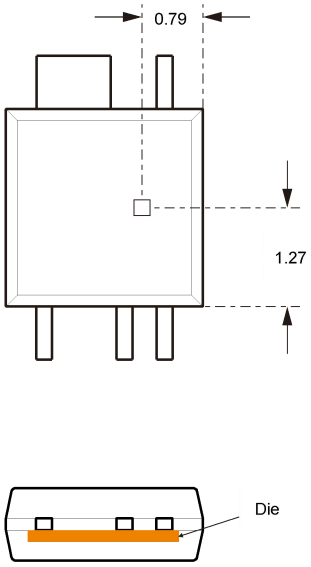
1'st line: 6403/4– product name

2'nd line: YYWW

YY – last 2 digits of year

WW – week

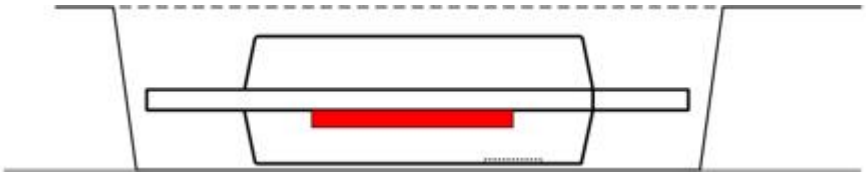
Hall location



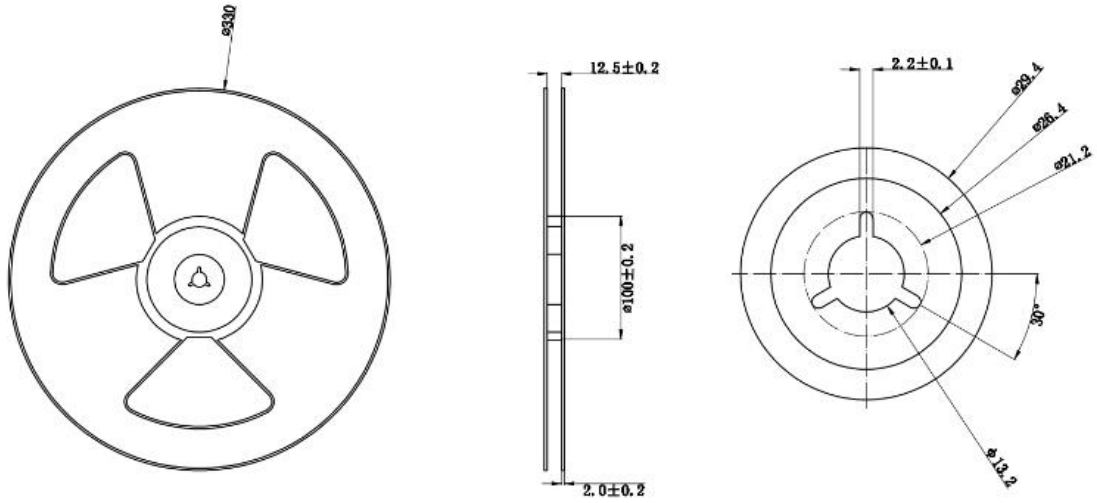
Note:

1. All dimensions are millimeters

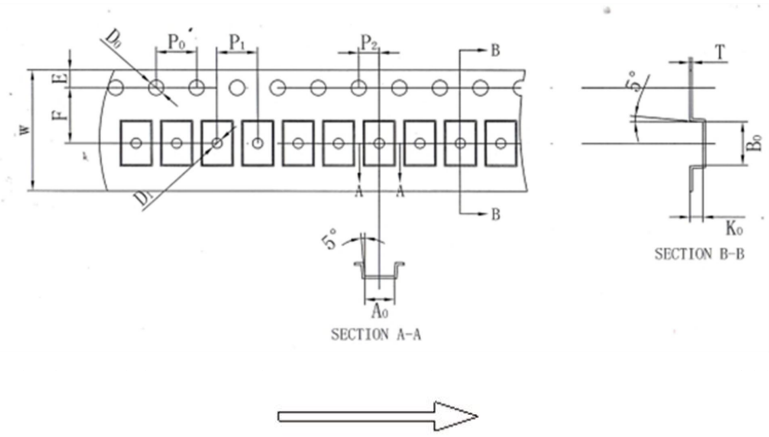
Information of carrier tape



Packaging & Tape reel



Information of Reel size



User Direction of Feed

Note: Each plate has 100 ± 5 grids in front of the tape and 100 ± 5 in the tail

Symbol	Millimeters		
	Min	Typical	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

Note:

1. All dimensions are millimeters

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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