

S-5741 B Series

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125°C OPERATION HIGH-WITHSTAND VOLTAGE HIGH-SPEED BIPOLAR HALL EFFECT LATCH IC

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This IC, developed by CMOS technology, is a bipolar Hall effect latch IC with high-withstand voltage, high-speed detection and high-accuracy magnetic characteristics.

The output voltage changes when this IC detects the intensity level of magnetic flux density and a polarity change. Using this IC with a magnet makes it possible to detect the rotation status in various devices. This IC includes an output current limit circuit.

High-density mounting is possible by using the small SOT-23-3S package.

Due to its high-accuracy magnetic characteristics, this IC can make operation's dispersion in the system combined with magnet smaller.

ABLIC Inc. offers a "magnetic simulation service" that provides the ideal combination of magnets and our Hall effect ICs for customer systems. Our magnetic simulation service will reduce prototype production, development period and development costs. In addition, it will contribute to optimization of parts to realize high cost performance.

For more information regarding our magnetic simulation service, contact our sales office.

■ Features

Pole detection:
 Bipolar latch

• Output logic*1: $V_{OUT} = "L"$ at S pole detection $V_{OUT} = "H"$ at S pole detection

• Output form*1: Nch open-drain output

Nch driver + built-in pull-up resistor

 $B_{OP} = 1.8 \text{ mT typ.}$ $B_{OP} = 3.0 \text{ mT typ.}$ $B_{OP} = 6.0 \text{ mT typ.}$

• Chopping frequency: $f_C = 500 \text{ kHz typ.}$ • Output delay time: $t_D = 8.0 \text{ } \mu \text{s typ.}$

• Power supply voltage range: V_{DD} = 3.5 V to 26.0 V

• Built-in regulator

Magnetic sensitivity*1:

• Built-in output current limit circuit

• Operation temperature range: Ta = -40°C to +125°C

• Lead-free (Sn 100%), halogen-free

■ Applications

- Home appliance
- DC brushless motor
- Housing equipment
- · Industrial equipment

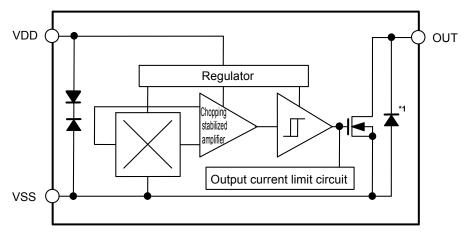
■ Package

• SOT-23-3S

^{*1.} The option can be selected.

■ Block Diagrams

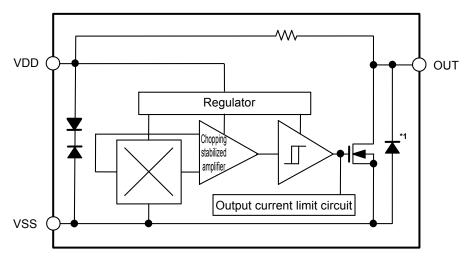
1. Nch open-drain output product



*1. Parasitic diode

Figure 1

2. Nch driver + built-in pull-up resistor product



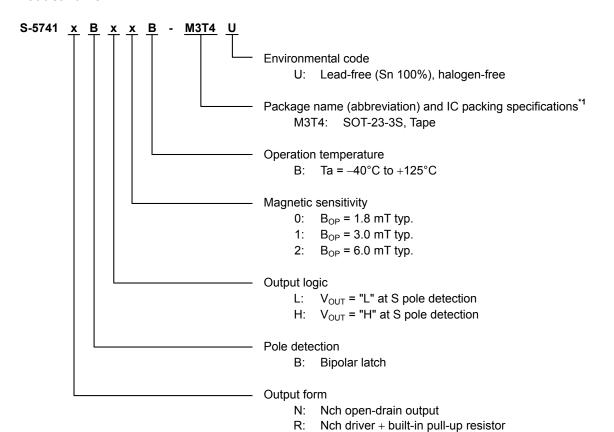
*1. Parasitic diode

Figure 2

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■ Product Name Structure

1. Product name



^{*1.} Refer to the tape drawing.

2. Package

Table 1 Package Drawing Codes

Package Name	Dimension	Tape	Reel	
SOT-23-3S	MP003-D-P-SD	MP003-D-C-SD	MP003-D-R-SD	

3. Product name list

Table 2

Product Name*1	Output Form	Pole Detection	Output logic	Magnetic Sensitivity (B _{OP})
S-5741NBL0B-M3T4U	Nch open-drain output	Bipolar latch	V _{OUT} = "L" at S pole detection	1.8 mT typ.
S-5741NBL1B-M3T4U	Nch open-drain output	Bipolar latch	V _{OUT} = "L" at S pole detection	3.0 mT typ.
S-5741NBL2B-M3T4U	Nch open-drain output	Bipolar latch	V _{OUT} = "L" at S pole detection	6.0 mT typ.
S-5741RBL0B-M3T4U	Nch driver + built-in pull-up resistor	Bipolar latch	V _{OUT} = "L" at S pole detection	1.8 mT typ.
S-5741RBL1B-M3T4U	Nch driver + built-in pull-up resistor	Bipolar latch	V _{OUT} = "L" at S pole detection	3.0 mT typ.
S-5741RBL2B-M3T4U	Nch driver + built-in pull-up resistor	Bipolar latch	V _{OUT} = "L" at S pole detection	6.0 mT typ.
S-5741RBH0B-M3T4U	Nch driver + built-in pull-up resistor	Bipolar latch	V _{OUT} = "H" at S pole detection	1.8 mT typ.
S-5741RBH1B-M3T4U	Nch driver + built-in pull-up resistor	Bipolar latch	V _{OUT} = "H" at S pole detection	3.0 mT typ.

Remark Please contact our sales office for products other than the above.

■ Pin Configuration

1. SOT-23-3S

Top view



Pin No. Symbol Description

1 VSS GND pin

2 VDD Power supply pin

3 OUT Output pin

Table 3

Figure 3

■ Absolute Maximum Ratings

Table 4

(Ta = +25°C unless otherwise specified)

	Item	Symbol	Absolute Maximum Rating	Unit
Power supply voltage		V _{DD}	$V_{\text{SS}} - 0.3$ to $V_{\text{SS}} + 28.0$	V
Output current		I _{OUT}	20	mA
Output voltage	Nch open-drain output product	V	$V_{\text{SS}} - 0.3$ to $V_{\text{SS}} + 28.0$	V
Output voltage	Nch driver + built-in pull-up resistor product	V _{OUT}	$V_{SS}-0.3$ to $V_{DD}+0.3$	V
Operation ambient temperature		T _{opr}	-40 to +125	°C
Storage temperature		T _{stg}	-40 to +150	°C

Caution The absolute maximum ratings are rated values exceeding which the product could suffer physical damage. These values must therefore not be exceeded under any conditions.

■ Thermal Resistance Value

Table 5

		1 4610 0					
Item	Symbol	mbol Condition		Min.	Тур.	Max.	Unit
	θ_{JA}		Board A	-	200	1	°C/W
Junction-to-ambient thermal resistance ^{*1}			Board B	1	165	I	°C/W
		SOT-23-3S	Board C	1	I	I	°C/W
			Board D	1	I	I	°C/W
			Board E	1	1	-	°C/W

^{*1.} Test environment: compliance with JEDEC STANDARD JESD51-2A

Remark Refer to "■ Power Dissipation" and "Test Board" for details.

■ Electrical Characteristics

Table 6 (Ta = +25°C, V_{DD} = 12.0 V, V_{SS} = 0 V unless otherwise specified)

Item	Symbol	Condition	Min.	Тур.	Max.	Unit	Test Circuit
Power supply voltage	V_{DD}	-	3.5	12.0	26.0	V	_
Current consumption		Nch open-drain output product Average value	_	3.0	4.0	mA	1
Current consumption	I _{DD}	Nch driver + built-in pull-up resistor product Average value, V _{OUT} = "H"	-	3.0	4.0	mA	1
Output voltage	\	Nch open-drain output product Output transistor Nch, V _{OUT} = "L", I _{OUT} = 10 mA	_	-	0.4	V	2
Output voltage	V _{OUT}	Nch driver + built-in pull-up resistor product Output transistor Nch, V _{OUT} = "L", I _{OUT} = 10 mA	_	1	0.5	V	2
Output drop voltage	V_D	Nch driver + built-in pull-up resistor product V_{OUT} = "H", $V_D = V_{DD} - V_{OUT}$	_	1	20	mV	2
Leakage current	I _{LEAK}	Nch open-drain output product Output transistor Nch, V _{OUT} = "H" = 26.0 V	-	-	10	μА	3
Output limit current	I _{OM}	V _{OUT} = 12.0 V	22	-	70	mA	3
Output delay time	t_{D}	1	_	8.0	-	μS	_
Chopping frequency	f_{C}	-	_	500	-	kHz	_
Start up time	t _{PON}	1	_	20	-	μS	4
Output rise time	4	Nch open-drain output product $C = 20 \text{ pF}, R = 820 \Omega$	_	-	2.0	μS	5
Output rise time	t _R	Nch driver + built-in pull-up resistor product C = 20 pF		_	6.0	μS	5
Output fall time	t _F	C = 20 pF, R = 820 Ω	_	-	2.0	μS	5
Pull-up resistor	R_L	Nch driver + built-in pull-up resistor product	7	10	13	kΩ	_

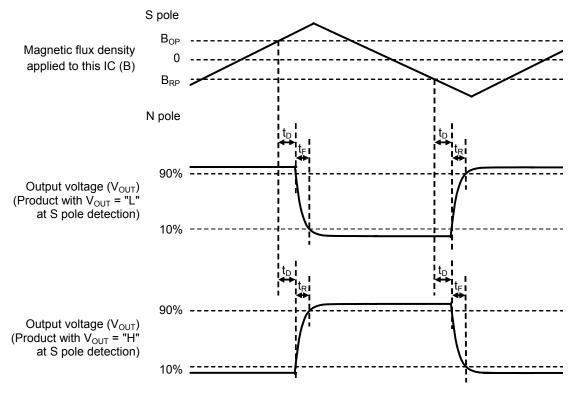


Figure 4 Operation Timing

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■ Magnetic Characteristics

1. Product with $B_{OP} = 1.8 \text{ mT typ.}$

Table 7

(Ta = +25°C, V_{DD} = 12.0 V, V_{SS} = 0 V unless otherwise specified)

					, 00			
Item		Symbol	Condition	Min.	Тур.	Max.	Unit	Test Circuit
Operation point*1	S pole	B _{OP}	_	0.3	1.8	3.3	mT	4
Release point*2	N pole	B _{RP}	_	-3.3	-1.8	-0.3	mT	4
Hysteresis width*3		B _{HYS}	$B_{HYS} = B_{OP} - B_{RP}$	_	3.6	ı	mT	4

2. Product with $B_{OP} = 3.0 \text{ mT typ.}$

Table 8

(Ta = +25°C, V_{DD} = 12.0 V, V_{SS} = 0 V unless otherwise specified)

			\	- 7 00	- , 00			
Item		Symbol	Condition	Min.	Тур.	Max.	Unit	Test Circuit
Operation point*1	S pole	B _{OP}	_	1.5	3.0	4.5	mT	4
Release point*2	N pole	B _{RP}	_	-4.5	-3.0	-1.5	mT	4
Hysteresis width*3		B _{HYS}	$B_{HYS} = B_{OP} - B_{RP}$	-	6.0	_	mT	4

3. Product with $B_{OP} = 6.0 \text{ mT typ.}$

Table 9

(Ta = +25°C, V_{DD} = 12.0 V, V_{SS} = 0 V unless otherwise specified)

Item		Symbol	Condition	Min.	Тур.	Max.	Unit	Test Circuit
Operation point*1	S pole	B _{OP}	-	3.0	6.0	9.0	mT	4
Release point*2	N pole	B _{RP}	_	-9.0	-6.0	-3.0	mT	4
Hysteresis width*3		B _{HYS}	$B_{HYS} = B_{OP} - B_{RP}$	_	12.0	_	mT	4

^{*1.} B_{OP}: Operation point

 B_{OP} is the value of magnetic flux density when the output voltage (V_{OUT}) changes after the magnetic flux density applied to this IC by the magnet (S pole) is increased (by moving the magnet closer).

V_{OUT} retains the status until a magnetic flux density of the N pole higher than B_{RP} is applied.

*2. B_{RP}: Release point

 B_{RP} is the value of magnetic flux density when the output voltage (V_{OUT}) changes after the magnetic flux density applied to this IC by the magnet (N pole) is increased (by moving the magnet closer).

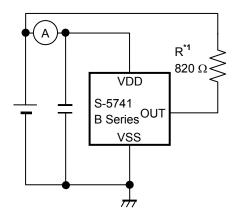
V_{OUT} retains the status until a magnetic flux density of the S pole higher than B_{OP} is applied.

 B_{HYS} is the difference of magnetic flux density between B_{OP} and B_{RP} .

Remark The unit of magnetic flux density mT can be converted by using the formula 1 mT = 10 Gauss.

^{*3.} B_{HYS}: Hysteresis width

■ Test Circuits



*1. Resistor (R) is unnecessary for Nch driver + built-in pull-up resistor product.

Figure 5 Test Circuit 1

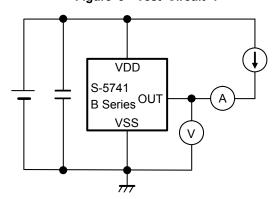


Figure 6 Test Circuit 2

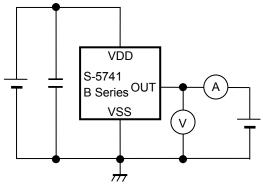
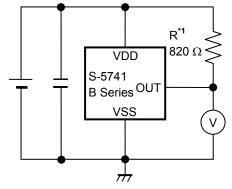
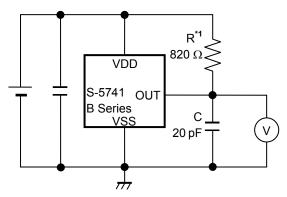


Figure 7 Test Circuit 3



*1. Resistor (R) is unnecessary for Nch driver + built-in pull-up resistor product.

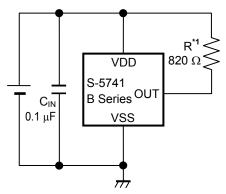
Figure 8 Test Circuit 4



*1. Resistor (R) is unnecessary for Nch driver + built-in pull-up resistor product.

Figure 9 Test Circuit 5

■ Standard Circuit



*1. Resistor (R) is unnecessary for Nch driver + built-in pull-up resistor product.

Figure 10

Caution The above connection diagram and constant will not guarantee successful operation. Perform thorough evaluation using the actual application to set the constant.

■ Operation

1. Direction of applied magnetic flux

This IC detects the magnetic flux density which is vertical to the marking surface.

Figure 11 shows the direction in which magnetic flux is being applied.

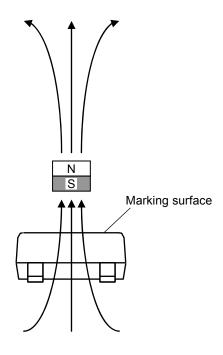


Figure 11

2. Position of Hall sensor

Figure 12 shows the position of Hall sensor.

The center of this Hall sensor is located in the area indicated by a circle, which is in the center of a package as described below.

The following also shows the distance (typ. value) between the marking surface and the chip surface of a package.

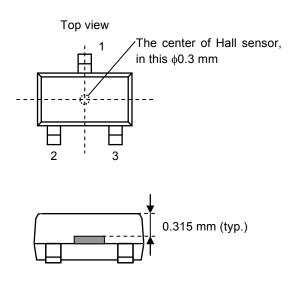


Figure 12

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3. Basic operation

This IC changes the output voltage (V_{OUT}) according to the level of the magnetic flux density and a polarity change (N pole or S pole) applied by a magnet.

3. 1 Product with V_{OUT} = "L" at S pole detection

When the magnetic flux density of the S pole perpendicular to the marking surface exceeds the operation point (B_{OP}) after the S pole of a magnet is moved closer to the marking surface of this IC, V_{OUT} changes from "H" to "L". When the N pole of a magnet is moved closer to the marking surface of this IC and the magnetic flux density of the N pole is higher than the release point (B_{RP}), V_{OUT} changes from "L" to "H". In case of $B_{RP} < B < B_{OP}$, V_{OUT} retains the status. **Figure 13** shows the relationship between the magnetic flux density and V_{OUT} .

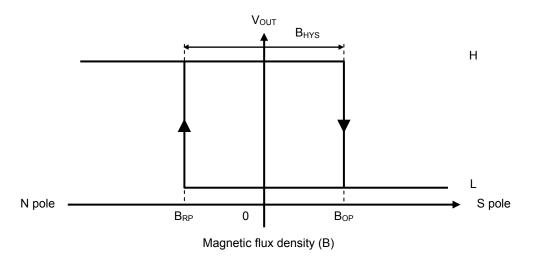


Figure 13

3. 2 Product with V_{OUT} = "H" at S pole detection

When the magnetic flux density of the S pole perpendicular to the marking surface exceeds B_{OP} after the S pole of a magnet is moved closer to the marking surface of this IC, V_{OUT} changes from "L" to "H". When the N pole of a magnet is moved closer to the marking surface of this IC and the magnetic flux density of the N pole is higher than B_{RP} , V_{OUT} changes from "H" to "L". In case of $B_{RP} < B < B_{OP}$, V_{OUT} retains the status.

Figure 14 shows the relationship between the magnetic flux density and V_{OUT}.

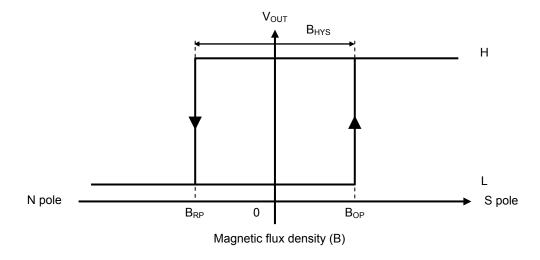


Figure 14

4. Timing chart

Figure 15 shows the operation timing at power-on.

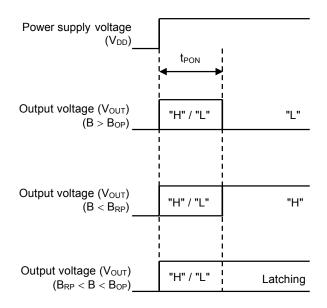
The initial output voltage at rising of power supply voltage (V_{DD}) is either "H" or "L".

In case of B > B_{OP} (operation point) or B < B_{RP} (release point) at the time when the start up time (t_{PON}) is passed after rising of V_{DD} , this IC outputs V_{OUT} according to the applied magnetic flux density.

In case of $B_{RP} < B < B_{OP}$ at the time when t_{PON} is passed after rising of V_{DD} , this IC maintains the initial output voltage.

Product with V_{OUT} = "L" at S pole detection

Product with V_{OUT} = "H" at S pole detection



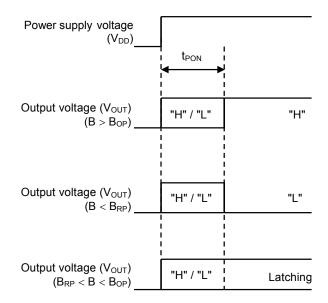


Figure 15

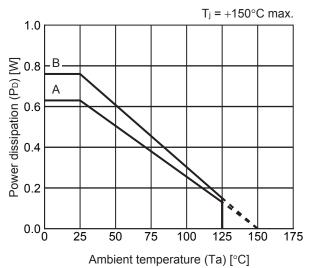
■ Precautions

- If the impedance of the power supply is high, the IC may malfunction due to a supply voltage drop caused by feedthrough current. Take care with the pattern wiring to ensure that the impedance of the power supply is low.
- Note that the IC may malfunction if the power supply voltage rapidly changes. When the IC is used under the
 environment where the power supply voltage rapidly changes, it is recommended to judge the output voltage of the IC
 by reading it multiple times.
- Do not apply an electrostatic discharge to this IC that exceeds the performance ratings of the built-in electrostatic protection circuit.
- Although this IC has a built-in output current limit circuit, it may suffer physical damage such as product deterioration under the environment where the absolute maximum ratings are exceeded.
- The application conditions for the power supply voltage, the pull-up voltage, and the pull-up resistor should not exceed the power dissipation.
- Large stress on this IC may affect on the magnetic characteristics. Avoid large stress which is caused by the handling during or after mounting the IC on a board.
- ABLIC Inc. claims no responsibility for any disputes arising out of or in connection with any infringement by products including this IC of patents owned by a third party.

■ Power Dissipation

Board

SOT-23-3S



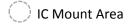
Power Dissipation (P_D)

Α	0.63 W
В	0.76 W
С	_
D	_
F	_

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SOT-23-3/3S/5/6 Test Board

(1) Board A





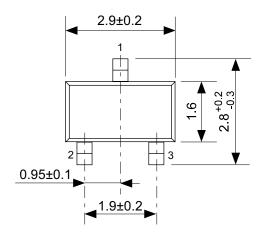
Item		Specification
Size [mm]		114.3 x 76.2 x t1.6
Material		FR-4
Number of copper foil layer		2
	1	Land pattern and wiring for testing: t0.070
Coppor foil lover [mm]	2	-
Copper foil layer [mm]	3	-
	4	74.2 x 74.2 x t0.070
Thermal via		-

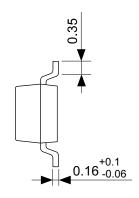
(2) Board B

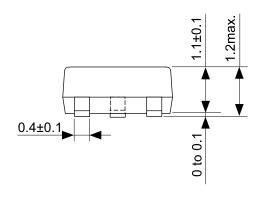


Item		Specification
Size [mm]		114.3 x 76.2 x t1.6
Material		FR-4
Number of copper foil layer		4
	1	Land pattern and wiring for testing: t0.070
Copper foil layer [mm]	2	74.2 x 74.2 x t0.035
Copper foil layer [min]	3	74.2 x 74.2 x t0.035
	4	74.2 x 74.2 x t0.070
Thermal via		-

No. SOT23x-A-Board-SD-2.0

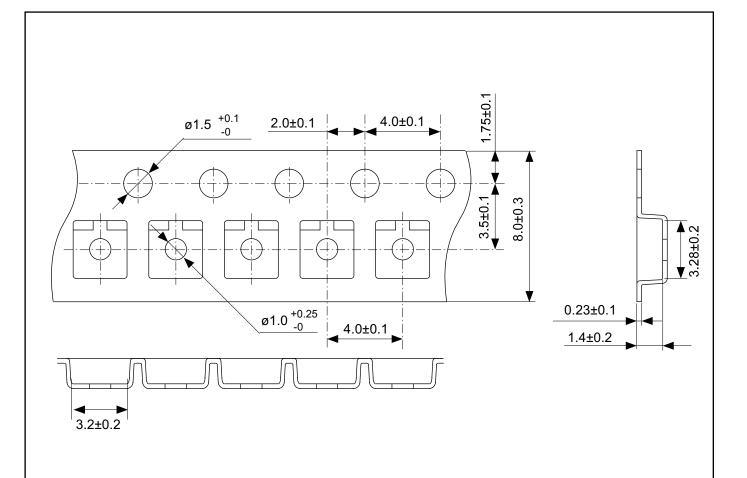


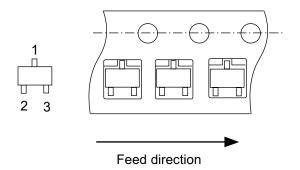




No. MP003-D-P-SD-1.1

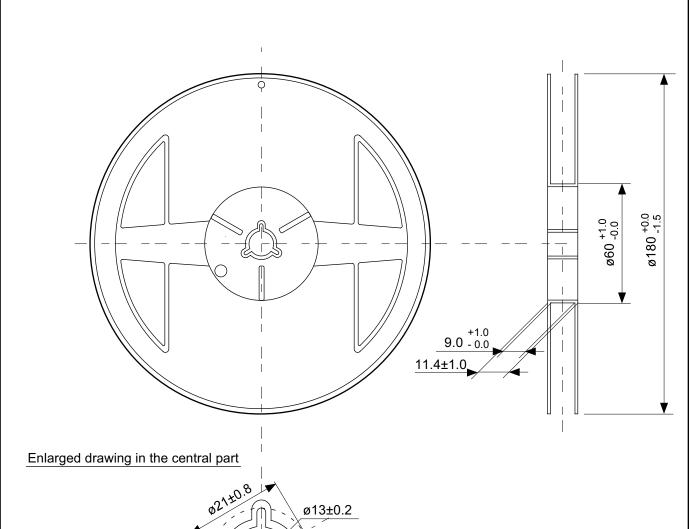
SOT233S-A-PKG Dimensions				
MP003-D-P-SD-1.1				
$\Phi \ominus$				
mm				
ABLIC Inc.				

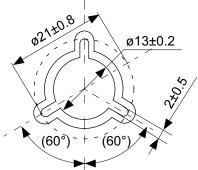




No. MP003-D-C-SD-1.0

TITLE	SOT233S-A-Carrier Tape			
No.	MP003-D-C-SD-1.0			
ANGLE				
UNIT	mm			
451101				
ABLIC Inc.				





No. MP003-D-R-SD-1.0

TITLE	SOT233S-A-Reel				
No.	MP003-D-R-SD-1.0				
ANGLE		QTY.	3,000		
UNIT	mm				
ABLIC Inc.					

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- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001:
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

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