Ultra-Low Voltage Operation Omnipolar / Unipolar Detection Type Hall Effect Switch IC

General Description

The ET3715A Series are a high sensitivity and high-accuracy Hall effect switch IC that operates at a ultra-low voltage and low current consumption. The output voltage will be pulled low when this IC detects the magnetic flux density is larger than operate point(B_{OP}) and the output voltage will recover to high until the magnetic flux density is smaller than the release point(B_{RP}). Using this IC with a magnet makes it possible to detect the open / close status in various applications.

Due to its ultra-low voltage operation and low current consumption the ET3715A Series are suitable for battery powered portable devices such as mobile phones and portable PCs etc.

Features

- Pole detection: Detection of omnipolar, S pole or N pole
- Output logic: Active "Low" or active "High"
- Output form: Nch open-drain output or CMOS output
- Magnetic sensitivity:
  - B_{OP} = 3.0 mT typ.
  - B_{OP} = 4.5 mT typ.
  - B_{OP} = 7.0 mT typ.
- Operating cycle (current consumption):
  - -- Product with omnipolar detection
    - t_{CYCLE} = 0.1 ms (I_{DD} = 1000 μA @ 1.2V) typ.
    - t_{CYCLE} = 5.70 ms (I_{DD} = 12.0 μA @ 1.2V) typ.
    - t_{CYCLE} = 50.50 ms (I_{DD} = 2.5 μA @ 1.2V) typ.
    - t_{CYCLE} = 204.10 ms (I_{DD} = 1.5 μA @ 1.2V) typ.
  - -- Product with S pole or N pole detection
    - t_{CYCLE} = 0.05 ms (I_{DD} = 1000 μA @ 1.2V) typ.
    - t_{CYCLE} = 6.05 ms (I_{DD} = 8.0 μA @ 1.2V) typ.
    - t_{CYCLE} = 50.85 ms (I_{DD} = 2.0 μA @ 1.2V) typ.
- Power supply voltage range: V_{DD} = 1.0 V to 3.5 V
- Operation temperature range: T_A = -40°C to +85°C
- Lead-free (Sn 100%), halogen-free packages

Application

- Open/Close detection for flip mobile phones
- Smart cover for smart phones
- Smart cover for portable PCs, tablet PCs
- Digital video cameras and portable game consoles
- Home appliances

Device Information

Device Naming Rules

ET3715A xx X X X X X

Package
D: DFN4(1.2x1.6)
E: DFN4(1.2x1.6 with TP)
Y: DFN4(1.0x1.0)
S: SOT23-3
T: TO-92S
H: SOT-553

Output Logic
L: Low Active
H: High Active

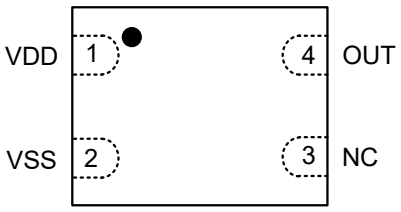
Output Form
C: CMOS Output
N: Nch Open Drain Output

Pole Detection
D: Omnipolar Detection
S: S pole Detection
N: N pole Detection

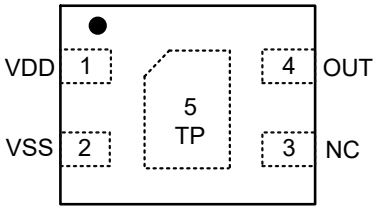
Operation Cycle
A: t_{CYCLE} =5.70 ms typ. (Omnipolar Detection Product)
t_{CYCLE} =6.05 ms typ. (S pole or N pole Detection Product)
B: t_{CYCLE} =50.50 ms typ. (Omnipolar Detection Product)
t_{CYCLE} =50.85 ms typ. (S pole or N pole Detection Product)
C: t_{CYCLE} =0.10 ms typ. (Omnipolar Detection Product)
t_{CYCLE} =0.05 ms typ. (S pole or N pole Detection Product)
D: t_{CYCLE} =204.10 ms typ. (Omnipolar Detection Product)

Magnetic Sensitivity
30: BOP=3.0 mT typ.
45: BOP=4.5 mT typ.
70: BOP=7.0 mT typ.

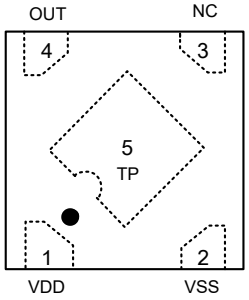
Pin Configuration



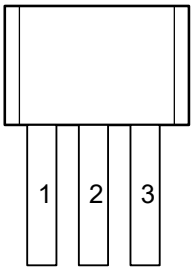
DFN4 (D package)



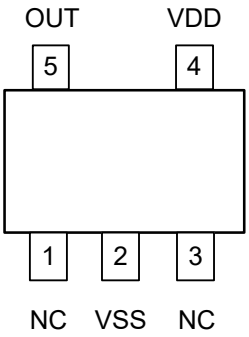
DFN4 (E package)



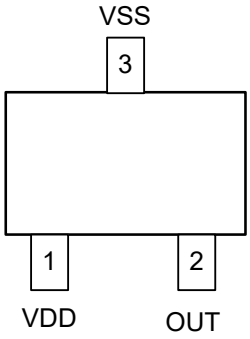
DFN4 (Y package)



TO-92S (T package)



SOT-553 (H package)



SOT23-3 (S package)

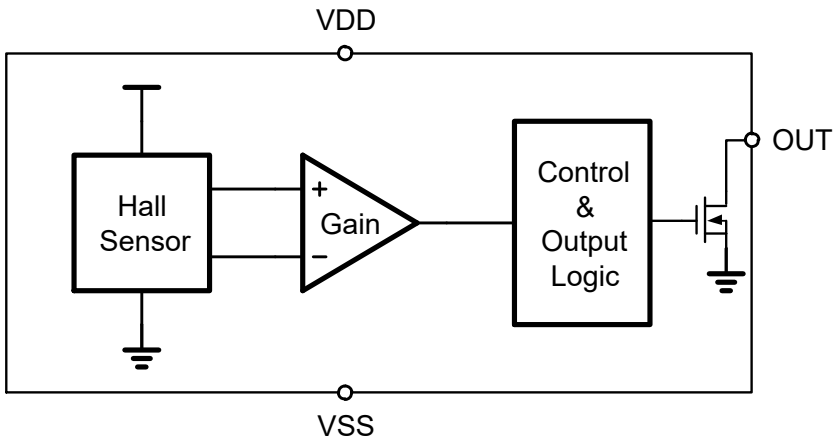
TOP VIEW

Pin Function

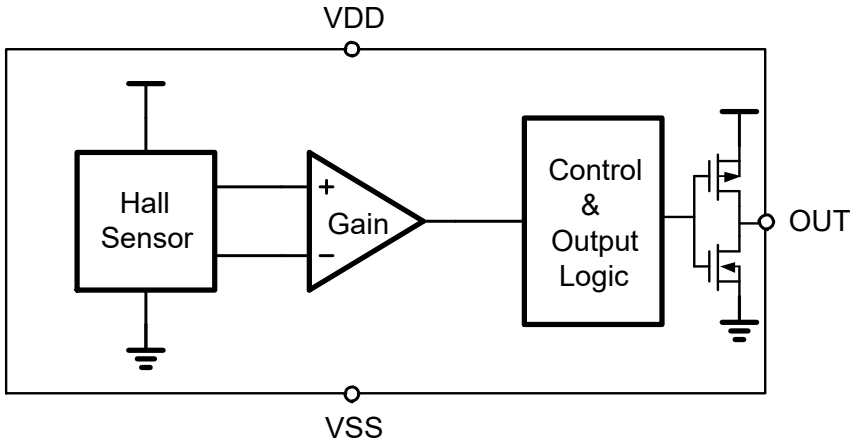
Pin No.				Pin Name	Pin Function
DFN4(D/Y/E)	SOT23-3	TO-92S	SOT-553		
1	1	1	4	VDD	Power supply pin
2	3	2	2	VSS	Ground Pin
3	-	-	1,3	NC	No connection
4	2	3	5	OUT	Output pin

Block Diagram

1.Open Drain Output Products



2.CMOS Output Products



Functional Description

Applied magnetic flux

The magnetic flux applied to ET3715A Series should on the vertical direction on marking surface. If not, the horizontal component has no effect to detection.

If the product is omnipolar type detector, the output voltage (VOUT) is inverted when the S or N type magnetic flux is applied to IC.

If the product is S pole type detector, the output voltage (VOUT) is inverted when the S type magnetic flux is applied to IC.

If the product is N pole type detector, the output voltage (VOUT) is inverted when the N type magnetic flux is applied to IC.

Below shows the direction in which magnetic flux should be applied.

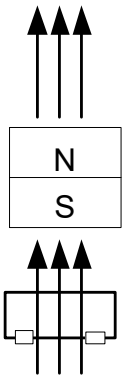


Figure1. Magnetic flux direction

Hall sensor Position

The Hall sensor embedded in ET3715A Series is at the center of IC using DFN4 or SOT23-3 or TO-92S or SOT-553 package. As show below, the position of this Hall sensor is located in the area indicated by a circle.

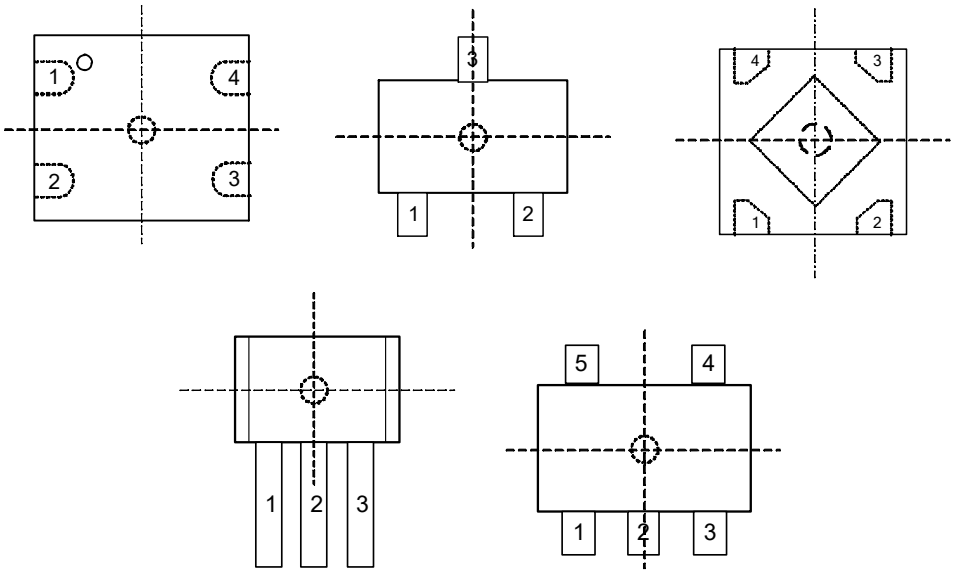


Figure2. Hall sensor position

Detecting Operation

1. Product with omnipolar detection

ET3715A Series detects magnetic field periodically. When vertical component of the magnetic flux applied to IC exceeds the operating point (B_{OPN} or B_{OPS}) such as the S or N pole of a magnet is moved closer to IC, V_{OUT} changes from "H" to "L". On the contrary, if magnetic flux is lower than the release point (B_{RPN} or B_{RPS}), V_{OUT} changes from "L" to "H".

The relationship between the magnetic flux density and V_{OUT} is shown below.

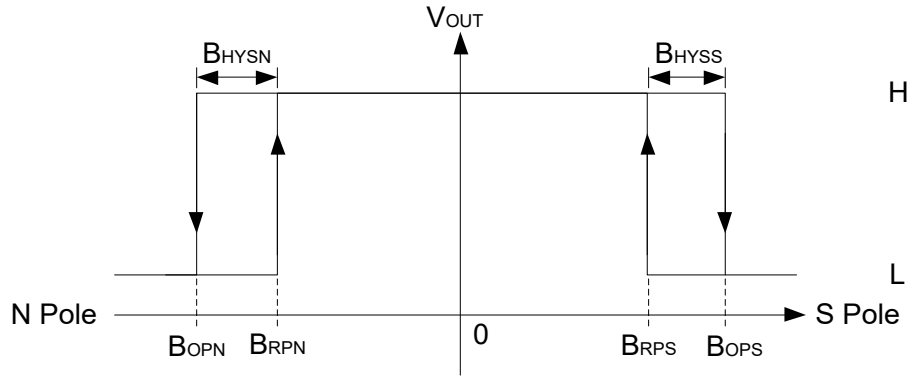


Figure3. Magnetic flux density vs V_{OUT}

2. Product with S pole detection

ET3715A Series detects magnetic field periodically. When vertical component of the magnetic flux applied to IC exceeds the operating point (B_{OPN} or B_{OPS}) such as the S pole of a magnet is moved closer to IC, V_{OUT} changes from "H" to "L". On the contrary, if magnetic flux is lower than the release point (B_{RPN} or B_{RPS}), V_{OUT} changes from "L" to "H".

The relationship between the magnetic flux density and V_{OUT} is shown below.

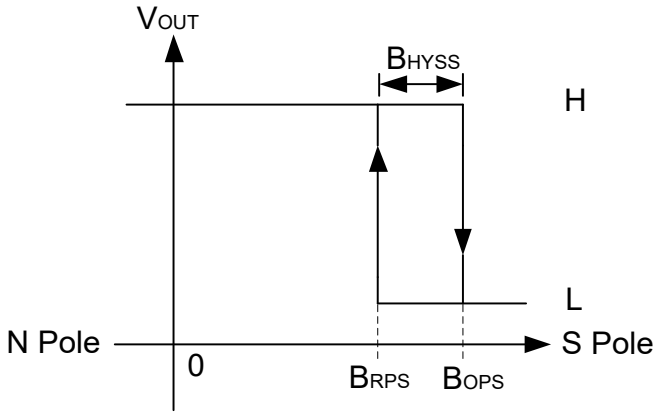


Figure4. S Pole magnetic flux density vs V_{OUT}

3. Product with N pole detection

ET3715A Series detects magnetic field periodically. When vertical component of the magnetic flux applied to IC exceeds the operating point (B_{OPN} or B_{OPS}) such as the N pole of a magnet is moved closer to IC, V_{OUT} changes from "H" to "L". On the contrary, if magnetic flux is lower than the release point (B_{RPN} or B_{RPS}), V_{OUT} changes from "L" to "H".

The relationship between the magnetic flux density and V_{OUT} is shown below.

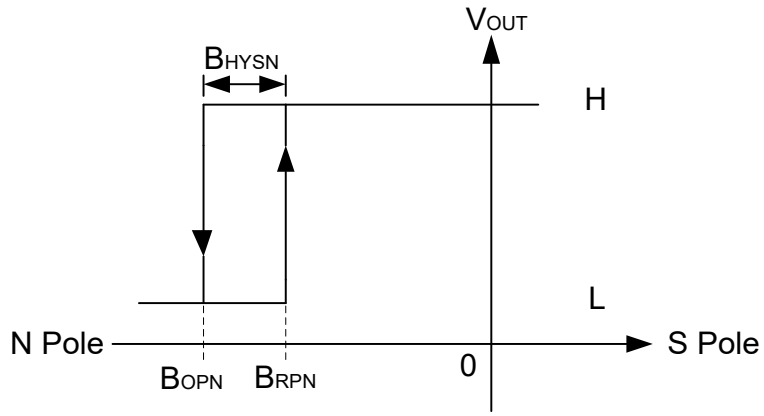


Figure5. N Pole magnetic flux density vs V_{OUT}

Operating Current

ET3715AxxA/B/D Series perform the intermittent operation, therefore the average current consumption depends on the current in active mode, the active period (t_{AW}), the current in sleep mode, and sleep period (t_{SL}). The active current is about 1000 μA typically, and 0.5 μA at sleep mode. Please refer to electrical characteristic table for detail. ET3715AxxC Series perform the continuous operation, therefore no sleep period exists and current consumption is about 1000uA typically continuously.

The time dependency of the current consumption is shown below.

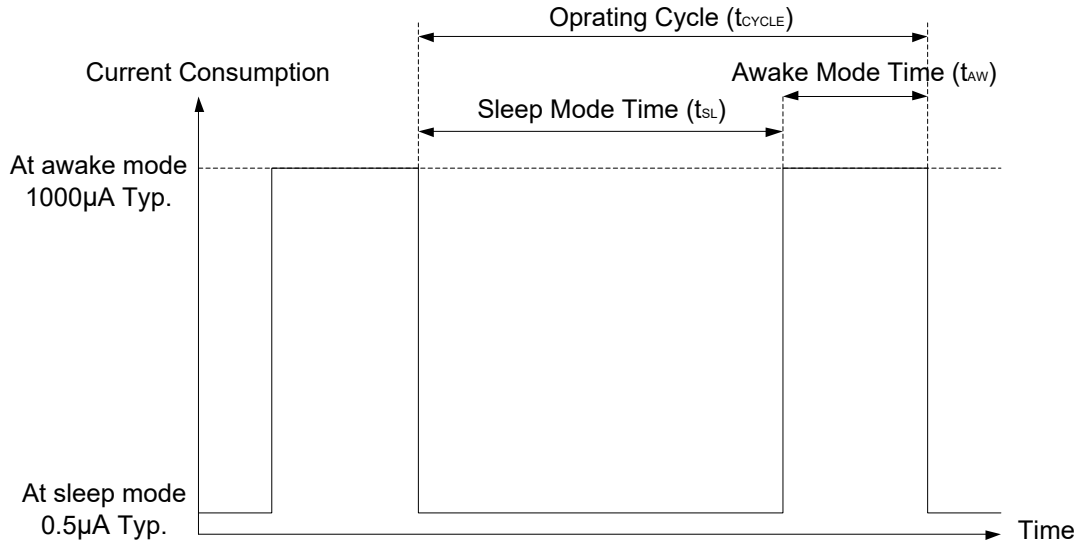


Figure6. Operating current

Timing Diagram

The operation timing of this IC is shown below.

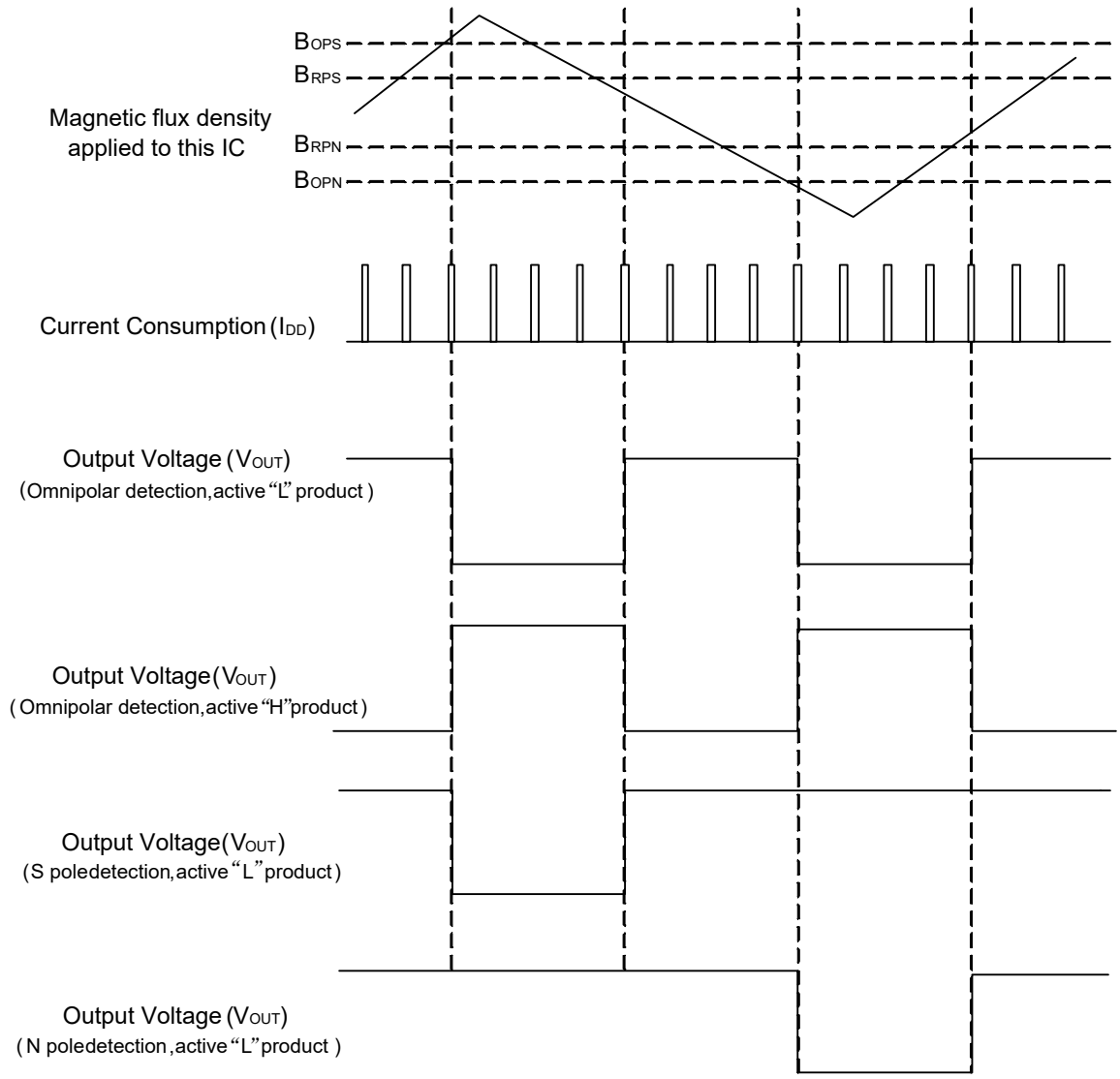


Figure7. Timing diagram

Precautions

- The power supply for this IC should has low impedance, the IC may malfunction due to a supply voltage drop caused by feed through current.
- Power supply voltage rapidly changing may cause IC malfunction.
- Large stress on this IC may affect the magnetic characteristics. Avoid large stress applied to the IC on a board.

Absolute Maximum Ratings

(T_A = +25°C unless otherwise specified)

Symbol	Parameters		Rating	Unit
V_{DD}	Power supply voltage		V_{SS}-0.3 ~ V_{SS}+4.5	V
I_{OUT}	Output current		±1.0	mA
V_{OUT}	Output voltage	Nch open-drain output product	V_{SS}-0.3 ~ V_{SS}+4.5	V
		CMOS output product	V_{SS}-0.3 ~ V_{DD}+0.3	
T_A	Operation ambient temperature		-40 ~ +85	°C
T_{STG}	Storage temperature		-40 ~ +125	°C
θ_{JA}	Junction-to-ambient thermal resistance		300	°C/W
V_{ESD}	HBM	ESDA/JEDEC JS-001-2017	±4000	V
	CDM	ESDA/JEDEC JS-002-2014	±1500	V
	MM	JESD22-A115C	±300	V

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.

Electrical Characteristics

- **Product with omnipolar detection**

1. ET3715AxxADXXX

(T_A = +25°C, V_{DD} = 1.2V, V_{SS} = 0V,unless otherwise specified)

Symbol	Parameters	Conditions		Min	Typ	Max	Unit
V_{DD}	Power supply voltage	-		1.0	1.2	3.5	V
I_{DD}	Current consumption	Average value			12.0	18.0	μA
V_{OUT}	Output voltage	Nch open-drain output product	Output transistor Nch,I_{OUT} = 0.5 mA				
		CMOS output product	Output transistor Nch,I_{OUT} = 0.5 mA			0.4	V
			Output transistor Pch,I_{OUT} = −0.5 mA	V_{DD}−0.4			V
I_{LEAK}	Leakage current	Nch open-drain output product Output transistor Nch,V_{OUT} = 5.5 V				1	μA
t_{AW}	Awake mode time				0.10		ms
t_{SL}	Sleep mode time				5.60		ms
t_{CYCLE}	Operating cycle	t_{AW} + t_{SL}			5.70	12.0	ms

2. ET3715AxxBDXXX

(T_A = +25°C, V_{DD} = 1.2V, V_{SS} = 0V,unless otherwise specified)

Symbol	Parameters	Conditions		Min	Typ	Max	Unit
V_{DD}	Power supply voltage	-		1.0	1.2	3.5	V
I_{DD}	Current consumption	Average value			2.5	5.0	μA
V_{OUT}	Output voltage	Nch open-drain output product	Output transistor Nch,I_{OUT} = 0.5 mA			0.4	V
		CMOS output product	Output transistor Nch,I_{OUT} = 0.5 mA			0.4	V
			Output transistor Pch,I_{OUT} = −0.5 mA	V_{DD}−0.4			V
I_{LEAK}	Leakage current	Nch open-drain output product Output transistor Nch,V_{OUT} = 5.5 V				1	μA
t_{AW}	Awake mode time				0.10		ms
t_{SL}	Sleep mode time				50.40		ms
t_{CYCLE}	Operating cycle	t_{AW} + t_{SL}			50.50	100.0	ms

3. ET3715AxxCDXXX

(T_A = +25°C, V_{DD} = 1.2V, V_{SS} = 0V,unless otherwise specified)

Symbol	Parameters	Conditions		Min	Typ	Max	Unit
V_{DD}	Power supply voltage	-		1.0	1.2	3.5	V
I_{DD}	Current consumption	Average value			1000	1800	μA
V_{OUT}	Output voltage	Nch open-drain output product	Output transistor Nch,I_{OUT} = 0.5 mA			0.4	V
		CMOS output product	Output transistor Nch,I_{OUT} = 0.5 mA			0.4	V
			Output transistor Pch,I_{OUT} = −0.5 mA	V_{DD}−0.4			V
I_{LEAK}	Leakage current	Nch open-drain output product Output transistor Nch,V_{OUT} = 5.5 V				1	μA
t_{CYCLE}	Operating cycle	-			0.10	0.20	ms

4. ET3715AxxDDXXX

(T_A = +25°C, V_{DD} = 1.2V, V_{SS} = 0V,unless otherwise specified)

Symbol	Parameters	Conditions		Min	Typ	Max	Unit
V_{DD}	Power supply voltage	-		1.0	1.2	3.5	V
I_{DD}	Current consumption	Average value			1.5	3.0	μA
V_{OUT}	Output voltage	Nch open-drain output product	Output transistor Nch,I_{OUT} = 0.5 mA			0.4	V
		CMOS output product	Output transistor Nch,I_{OUT} = 0.5 mA			0.4	V
			Output transistor Pch,I_{OUT} = −0.5 mA	V_{DD}−0.4			V
I_{LEAK}	Leakage current	Nch open-drain output product Output transistor Nch,V_{OUT} = 5.5 V				1	μA
t_{AW}	Awake mode time				0.10		ms
t_{SL}	Sleep mode time				204.0		ms
t_{CYCLE}	Operating cycle	t_{AW} + t_{SL}			204.1	400.0	ms

- **Product with S pole or N pole detection**

1. ET3715AxxASXXX,ET3715AxxANXXX

(T_A = +25°C, V_{DD} = 1.2V, V_{SS} = 0V,unless otherwise specified)

Symbol	Parameters	Conditions		Min	Typ	Max	Unit
V_{DD}	Power supply voltage	-		1.0	1.2	3.5	V
I_{DD}	Current consumption	Average value			8.0	16.0	μA
V_{OUT}	Output voltage	Nch open-drain output product	Output transistor Nch,I_{OUT} = 0.5 mA			0.4	V
		CMOS output product	Output transistor Nch,I_{OUT} = 0.5 mA			0.4	V
			Output transistor Pch,I_{OUT} = −0.5 mA	V_{DD}−0.4			V
I_{LEAK}	Leakage current	Nch open-drain output product Output transistor Nch,V_{OUT} = 5.5 V				1	μA
t_{AW}	Awake mode time				0.05		ms
t_{SL}	Sleep mode time				6.00		ms
t_{CYCLE}	Operating cycle	t_{AW} + t_{SL}			6.05	12.00	ms

2. ET3715AxxBSXXX,ET3715AxxBNXXX

(T_A = +25°C, V_{DD} = 1.2V, V_{SS} = 0V,unless otherwise specified)

Symbol	Parameters	Conditions		Min	Typ	Max	Unit
V_{DD}	Power supply voltage	-		1.0	1.2	3.5	V
I_{DD}	Current consumption	Average value			2.0	4.0	μA
V_{OUT}	Output voltage	Nch open-drain output product	Output transistor Nch,I_{OUT} = 0.5 mA			0.4	V
		CMOS output product	Output transistor Nch,I_{OUT} = 0.5 mA			0.4	V
			Output transistor Pch,I_{OUT} = −0.5 mA	V_{DD}−0.4			V
I_{LEAK}	Leakage current	Nch open-drain output product Output transistor Nch,V_{OUT} = 5.5 V				1	μA
t_{AW}	Awake mode time				0.05		ms
t_{SL}	Sleep mode time				50.80		ms
t_{CYCLE}	Operating cycle	t_{AW} + t_{SL}			50.85	100.0	ms

3. ET3715AxxCSXXX,ET3715AxxCSXXX

(T_A = +25°C, V_{DD} = 1.2V, V_{SS} = 0V,unless otherwise specified)

Symbol	Parameters	Conditions		Min	Typ	Max	Unit
V_{DD}	Power supply voltage	-		1.0	1.2	3.5	V
I_{DD}	Current consumption	Average value			1000	1800	μA
V_{OUT}	Output voltage	Nch open-drain output product	Output transistor Nch,I_{OUT} = 0.5 mA			0.4	V
		CMOS output product	Output transistor Nch,I_{OUT} = 0.5 mA			0.4	V
			Output transistor Pch,I_{OUT} = −0.5 mA	V_{DD}−0.4			V
I_{LEAK}	Leakage current	Nch open-drain output product Output transistor Nch,V_{OUT} = 5.5 V				1	μA
t_{CYCLE}	Operating cycle	-			0.05	0.10	ms

Magnetic Characteristics

- **Product with omnipolar detection**

1. Product with B_{OP} = 3.0 mT typ.

(T_A = +25°C, V_{DD} = 1.2V, V_{SS} = 0V,unless otherwise specified)

Parameters		Symbol	Conditions	Min	Typ	Max	Unit
Operation point(1)	S pole	B_{OPS}		1.4	3.0	4.0	mT(4)
	N pole	B_{OPN}		-4.0	-3.0	-1.4	mT
Release point(2)	S pole	B_{RPS}		1.1	2.2	3.7	mT
	N pole	B_{RPN}		-3.7	-2.2	-1.1	mT
Hysteresis width(3)	S pole	B_{HYSS}	$B_{HYSS} = B_{OPS} - B_{RPS}$		0.8		mT
	N pole	B_{HYSN}	$B_{HYSN} = \lvert B_{OPN} - B_{RPN} \rvert$		0.8		mT

2. Product with B_{OP} = 4.5 mT typ.

(T_A = +25°C, V_{DD} = 1.2V, V_{SS} = 0V,unless otherwise specified)

Parameters		Symbol	Conditions	Min	Typ	Max	Unit
Operation point	S pole	B_{OPS}		2.5	4.5	6.0	mT
	N pole	B_{OPN}		-6.0	-4.5	-2.5	mT
Release point	S pole	B_{RPS}		2.0	3.5	5.5	mT
	N pole	B_{RPN}		-5.5	-3.5	-2.0	mT
Hysteresis width	S pole	B_{HYSS}	$B_{HYSS} = B_{OPS} - B_{RPS}$		1.0		mT
	N pole	B_{HYSN}	$B_{HYSN} = \lvert B_{OPN} - B_{RPN} \rvert$		1.0		mT

3. Product with B_{OP} = 7.0 mT typ.

(T_A = +25°C, V_{DD} = 1.2V, V_{SS} = 0V,unless otherwise specified)

Parameters		Symbol	Conditions	Min	Typ	Max	Unit
Operation point	S pole	B_{OPS}		4.5	7.0	9.0	mT
	N pole	B_{OPN}		-9.0	-7.0	-4.5	mT
Release point	S pole	B_{RPS}		3.7	5.5	7.5	mT
	N pole	B_{RPN}		-7.5	-5.5	-3.7	mT
Hysteresis width	S pole	B_{HYSS}	$B_{HYSS} = B_{OPS} - B_{RPS}$		1.5		mT
	N pole	B_{HYSN}	$B_{HYSN} = \lvert B_{OPN} - B_{RPN} \rvert$		1.5		mT

- **Product with S pole detection**

1. Product with B_{OP} = 3.0 mT typ.

(T_A = +25°C, V_{DD} = 1.2V, V_{SS} = 0V,unless otherwise specified)

Parameters		Symbol	Conditions	Min	Typ	Max	Unit
Operation point	S pole	B_{OPS}		1.4	3.0	4.0	mT
Release point	S pole	B_{RPS}		1.1	2.2	3.7	mT
Hysteresis width	S pole	B_{HYSS}	$B_{HYSS} = B_{OPS} - B_{RPS}$		0.8		mT

2. Product with B_{OP} = 4.5 mT typ.

(T_A = +25°C, V_{DD} = 1.2V, V_{SS} = 0V,unless otherwise specified)

Parameters		Symbol	Conditions	Min	Typ	Max	Unit
Operation point	S pole	B_{OPS}		2.5	4.5	6.0	mT
Release point	S pole	B_{RPS}		2.0	3.5	5.5	mT
Hysteresis width	S pole	B_{HYSS}	$B_{HYSS} = B_{OPS} - B_{RPS}$		1.0		mT

3. Product with B_{OP} = 7.0 mT typ.

(T_A = +25°C, V_{DD} = 1.2V, V_{SS} = 0V,unless otherwise specified)

Parameters		Symbol	Conditions	Min	Typ	Max	Unit
Operation point	S pole	B_{OPS}		4.5	7.0	9.0	mT
Release point	S pole	B_{RPS}		3.7	5.5	7.5	mT
Hysteresis width	S pole	B_{HYSS}	$B_{HYSS} = B_{OPS} - B_{RPS}$		1.5		mT

- **Product with N pole detection**

1. Product with B_{OP} = 3.0 mT typ.

(T_A = +25°C, V_{DD} = 1.2V, V_{SS} = 0V,unless otherwise specified)

Parameters		Symbol	Conditions	Min	Typ	Max	Unit
Operation point	N pole	B_{OPN}		-4.0	-3.0	-1.4	mT
Release point	N pole	B_{RPN}		-3.7	-2.2	-1.1	mT
Hysteresis width	N pole	B_{HYSN}	$B_{HYSN} = \lvert B_{OPN} - B_{RPN} \rvert$		0.8		mT

2. Product with B_{OP} = 4.5 mT typ.

(T_A = +25°C, V_{DD} = 1.2V, V_{SS} = 0V,unless otherwise specified)

Parameters		Symbol	Conditions	Min	Typ	Max	Unit
Operation point	N pole	B_{OPN}		-6.0	-4.5	-2.5	mT
Release point	N pole	B_{RPN}		-5.5	-3.5	-2.0	mT
Hysteresis width	N pole	B_{HYSN}	$B_{HYSN} = \lvert B_{OPN} - B_{RPN} \rvert$		1.0		mT

3. Product with B_{OP} = 7.0 mT typ.

(T_A = +25°C, V_{DD} = 1.2V, V_{SS} = 0V,unless otherwise specified)

Parameters		Symbol	Conditions	Min	Typ	Max	Unit
Operation point	N pole	B_{OPN}		-9.0	-7.0	-4.5	mT
Release point	N pole	B_{RPN}		-7.5	-5.5	-3.7	mT
Hysteresis width	N pole	B_{HYSN}	B_{HYSN} = | B_{OPN} − B_{RPN} |		1.5		mT

Notes:

(1) Operating points (B_{OPN}, B_{OPS}): B_{OPN} and B_{OPS} are the values of magnetic flux density triggers the output voltage (V_{OUT}) to low by increasing the N pole or S pole magnetic flux density applied to this IC. Even when the magnetic flux density is larger than B_{OPN} or B_{OPS}, V_{OUT} status is held.

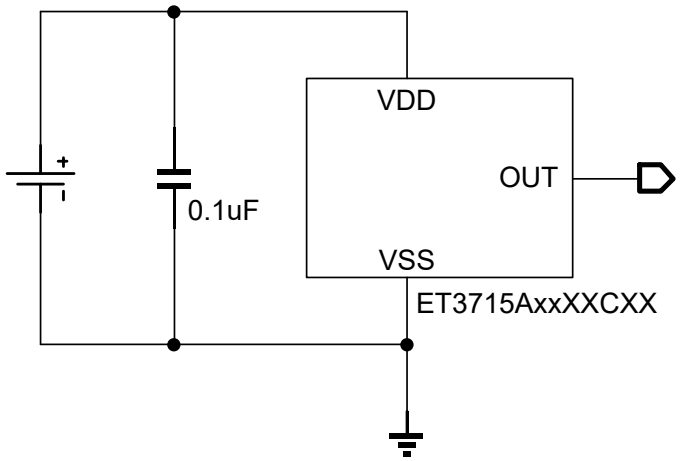
(2) Release points (B_{RPN}, B_{RPS}): B_{RPN} and B_{RPS} are the values of magnetic flux density makes the output voltage (V_{OUT}) recover to high by decreasing the N pole or S pole magnetic flux density applied to this IC. Even when the magnetic flux density is lower than B_{RPN} or B_{RPS}, V_{OUT} status is held.

(3) Hysteresis widths (B_{HN}, B_{HS}): B_{HN} and B_{HS} are the difference between B_{OPN} and B_{RPN}, and B_{OPS} and B_{RPS}, respectively.

(4) The unit of magnetic density mT can be converted by using the formula 1 mT = 10 Gauss.

Application Circuit

1. CMOS Output Product



2. Nch Open Drain Output Product

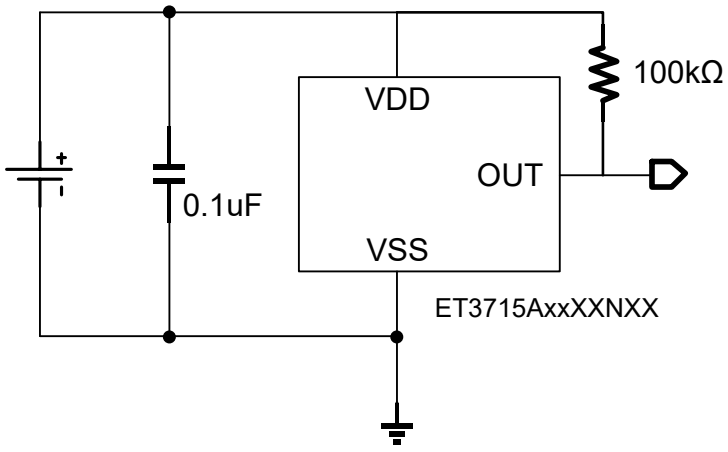
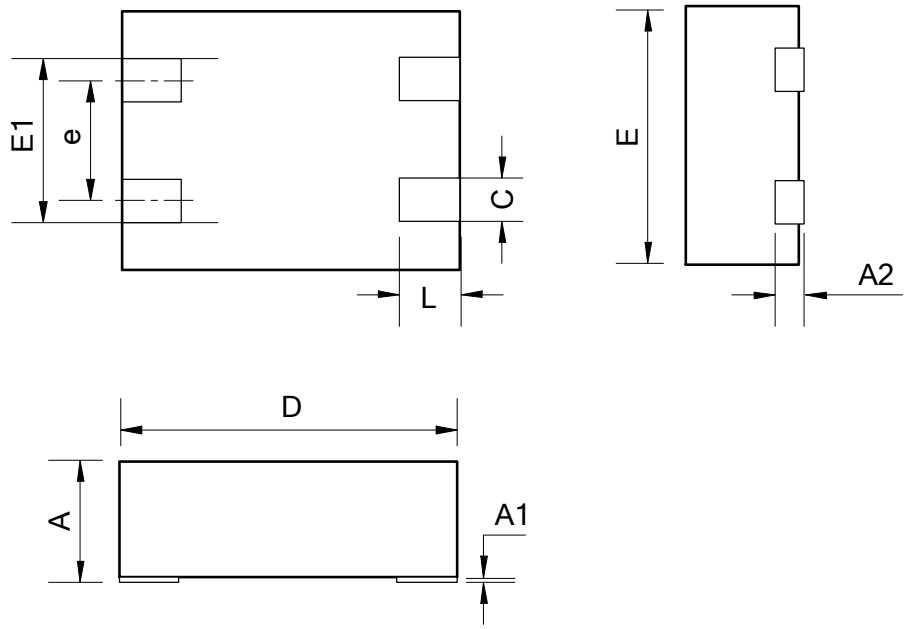


Figure8. Application circuit

Package Dimension

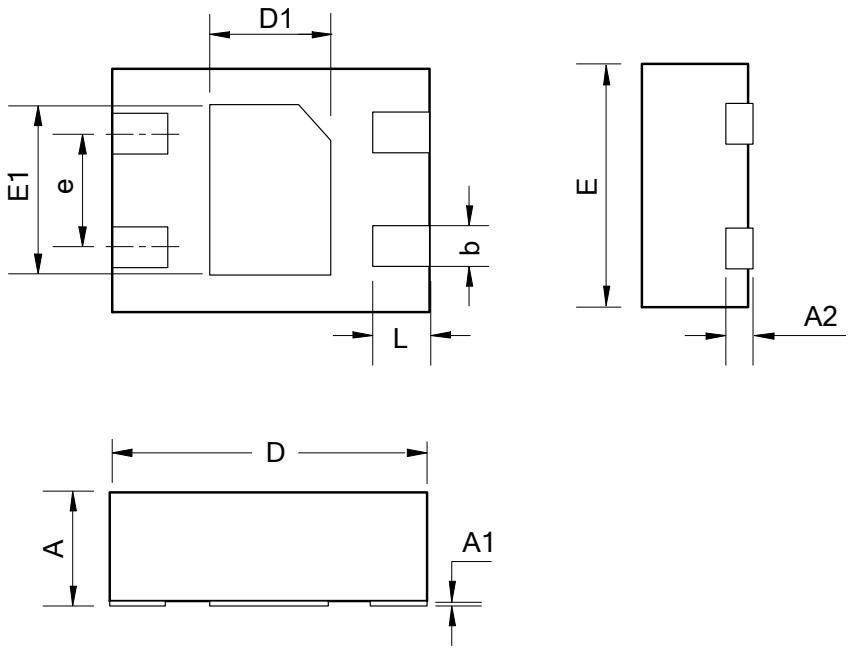
DFN4(1.2×1.6)



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	0.40	-	0.50
A1	0	-	0.05
A2		0.125 REF	
c	0.15	0.20	0.25
D	1.55	1.60	1.65
E	1.15	1.20	1.25
e		0.65 BSC	
L	0.15	0.20	0.25

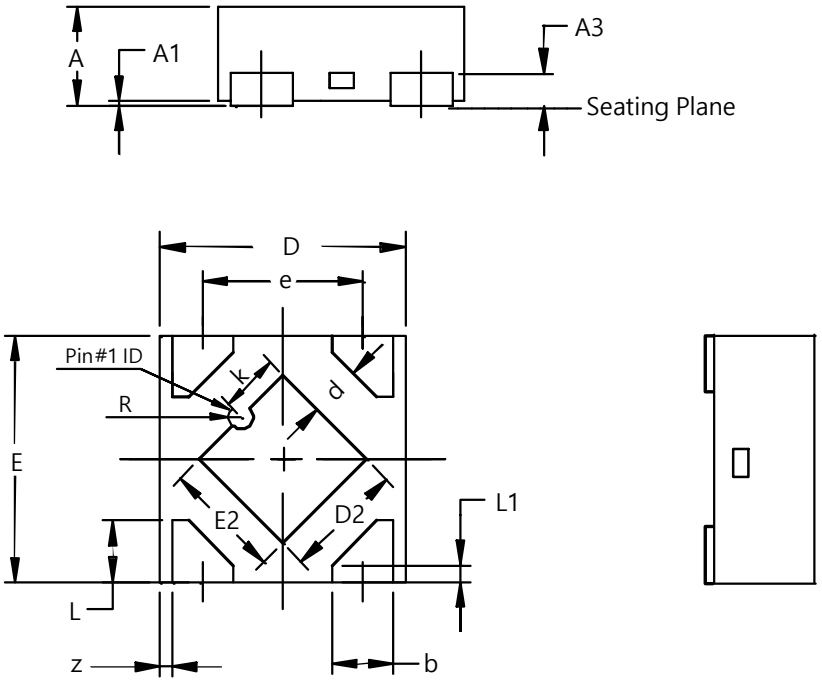
DFN4(1.2×1.6 with TP)



COMMON DIMENSIONS (Unit: mm)

SYMBOL	MIN	NOM	MAX
A	0.40	-	0.50
A1	0	-	0.05
A2		0.125 REF	
b	0.15	0.20	0.25
D	1.55	1.60	1.65
D1	0.60	0.65	0.70
E	1.15	1.20	1.25
E1	0.80	0.85	0.90
e		0.65 BSC	
L	0.15	0.25	0.35

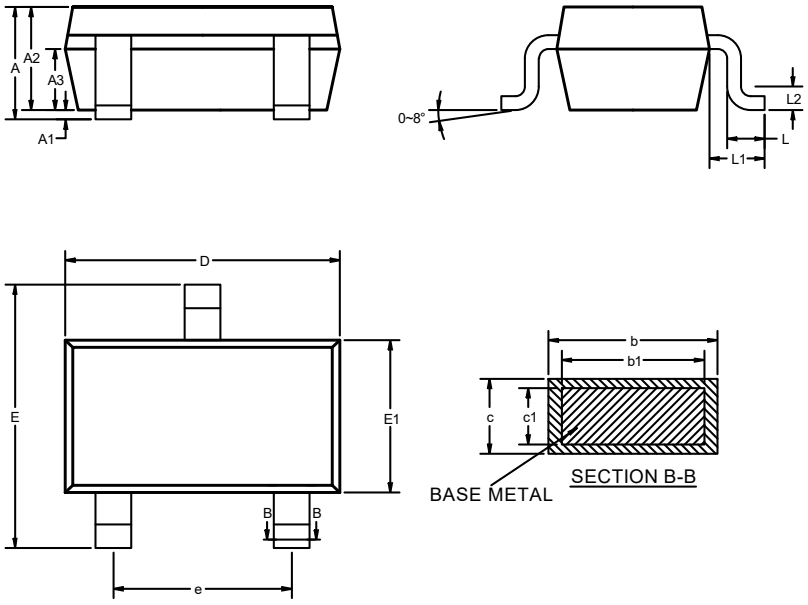
DFN4(1.0×1.0)



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	>0.3	0.38	0.40
A1	0.00	0.03	0.05
A3		0.127REF	
b	0.20	0.25	0.30
D	0.95	1.00	1.05
D2	0.43	0.48	0.53
E	0.95	1.00	1.05
E2	0.43	0.48	0.53
d	-	0.205	-
e		0.65BSC	
k	0.19	0.24	0.29
L	0.15	0.25	0.35
L1	0.02	0.07	0.12
R	0.02	0.05	0.08
z	-	0.050	-

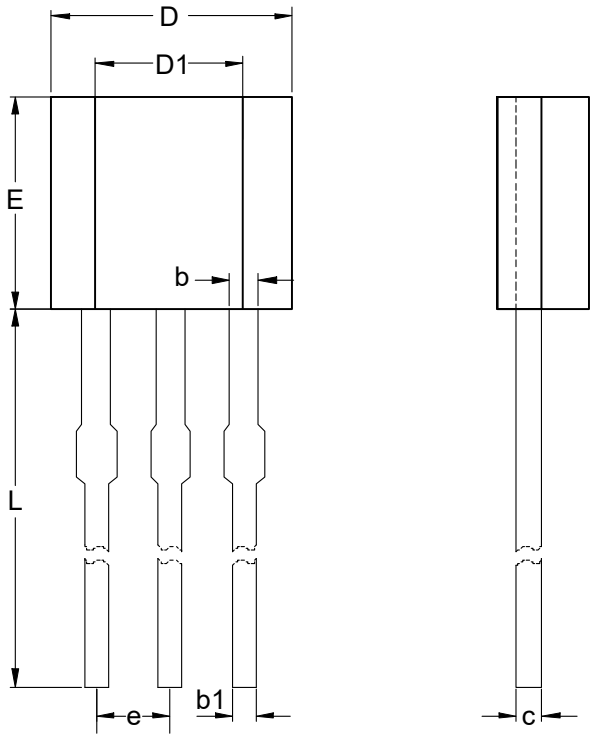
SOT23-3

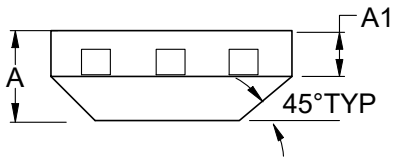


COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	-	-	1.25
A1	0.03	0.08	0.15
A2	1.05	1.10	1.15
A3	0.60	0.65	0.70
b	0.27	-	0.35
b1	0.26	0.285	0.31
c	0.135	-	0.23
c1	0.127	0.152	0.178
D	2.82	2.92	3.02
E	2.60	2.90	3.00
E1	1.60 BSC		
e	1.90 BSC		
L	0.35	0.45	0.55
L1	0.49	0.64	0.79
L2	0.25 BSC		

TO-92S

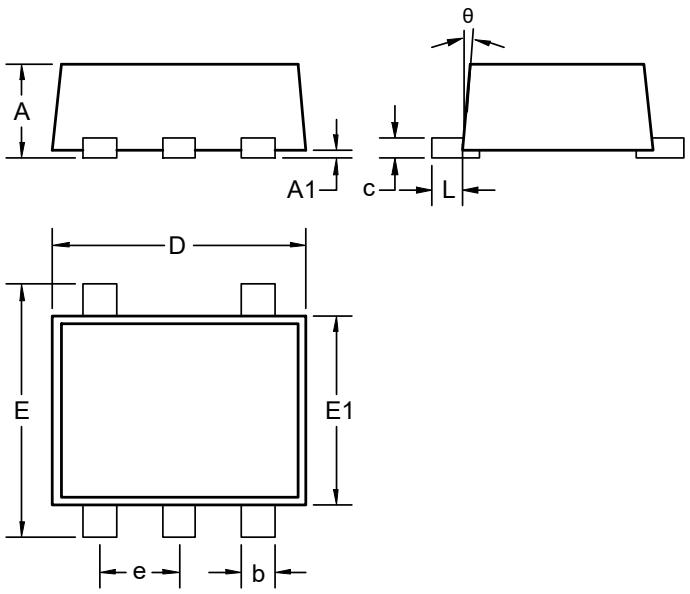




COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	1.420	-	1.620
A1	0.660	-	0.860
b	0.330	-	0.480
b1	0.400	-	0.510
c	0.330	-	0.510
D	3.900	-	4.100
D1	2.280	-	2.680
E	3.050	-	3.250
e	1.270 TYP.		
L	15.100	-	15.500

SOT-553



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	0.525	-	0.600
A1	0	-	0.050
e	0.450	0.500	0.550
c	0.090	-	0.160
D	1.500	1.600	1,700
b	1.700	2.200	2.700
E1	1.100	1.200	1.300
E	1.500	1.600	1.700
L	0.100	0.200	0.300
θ	7° REF		

Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
0.0	2023.6.26	Preliminary Version	Chenhui	Wanggp	Liujy
0.1	2023.8.20	Update package	Shibo	Chenh	Chenh
1.0	2024.2.6	Released Version	Shibo	Chenh	Chenh