Nano Power Hall-Effect Switch IC

General Description

The ET3718A Series is produced with CMOS technology, which internally includes high sensitivity horizontal hall plates, sleep/awake logics for mode control, a low-power on-chip oscillator, low noise analog signal chain with dynamic offset cancellation, hysteresis comparators and an output driver.

The product responds to North pole or South pole magnetic fields. When the magnetic flux density (B) is larger than the operating point (BOP), the output will be turned on (Low). And the output will be turned off (High) when the magnetic flux density (B) is lower than the releasing point (BRP).

The ET3718A family provides a variety of packages to customers: DFN4 & SSOT-23 for surface mount and flat TO-92S for through-hole mount. All packages are RoHS compliant.

Features

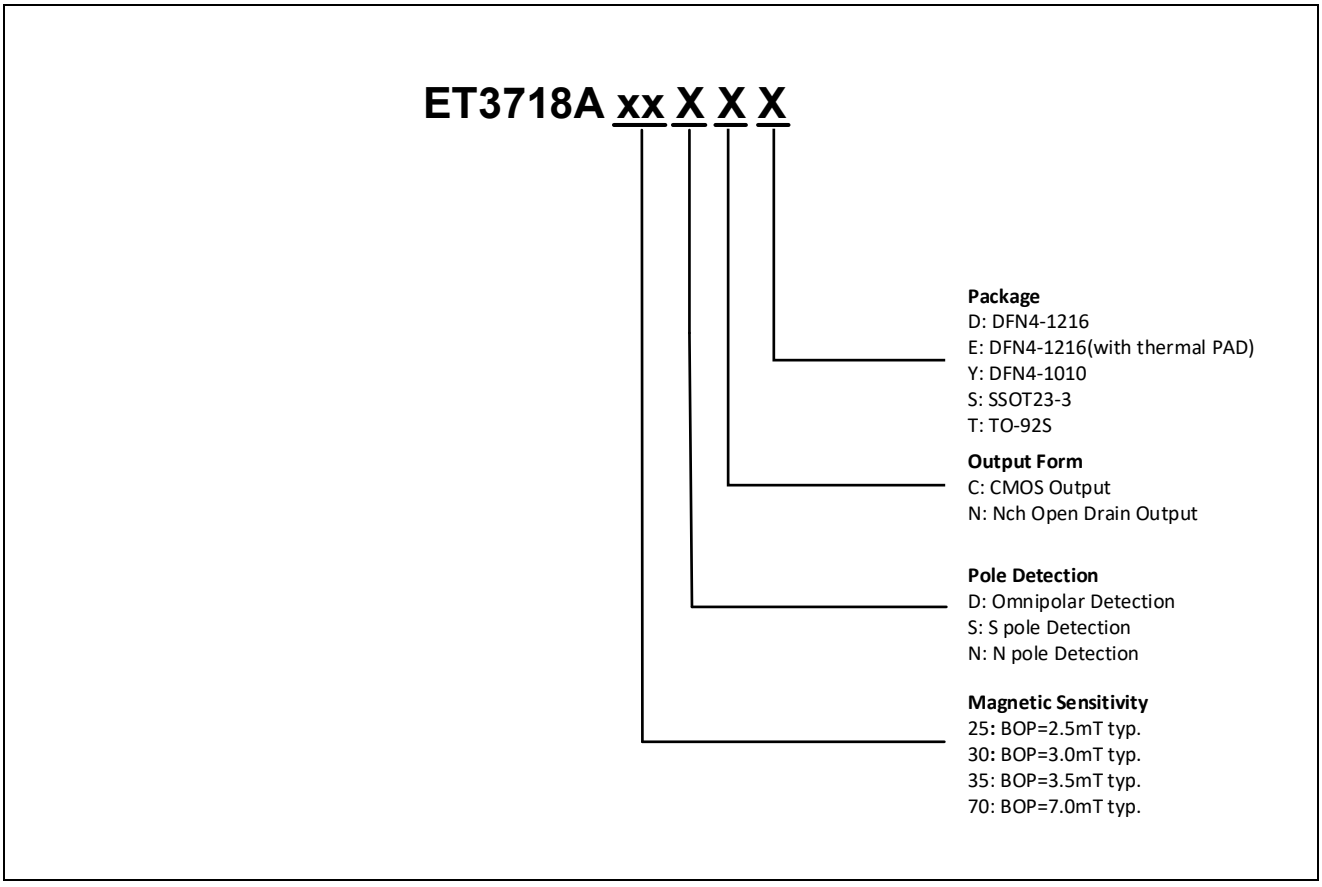
- CMOS Technology
- Pole detection: Detection of Omnipolar, S pole or N pole
- 1.65~5.5V Operating VCC Range
- -40°C to +85°C Operating Temperature
- Package Option:
  - -- DFN4(1.2×1.6)
  - -- DFN4(1.2×1.6) (with Thermal PAD)
  - -- DFN4(1.0×1.0)
  - -- SSOT23-3
  - -- Flat TO-92S
- Magnetic Sensitivity Option:
  - -- BOP=2.5 mT typ.
  - -- BOP=3.0 mT typ.
  - -- BOP=3.5 mT typ.
  - -- BOP=7.0 mT typ.
- Output form: Nch open-drain output, CMOS output
- Nano Power Consumption:
- Average Supply Current =500nA (V_{CC} = 1.8V)
- RoHS Compliant

Applications

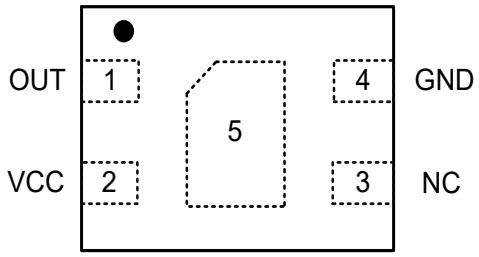
- Home appliances, Industrial
- Position Detection
- Solid-State Switch
- Proximity Switch
- Smart Meter
- Handheld Device

Device Information

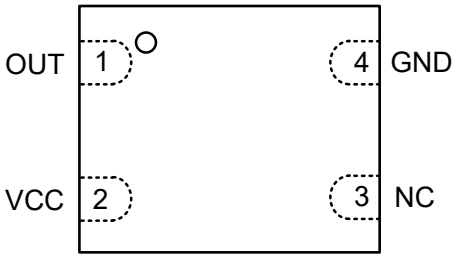
Device naming rules



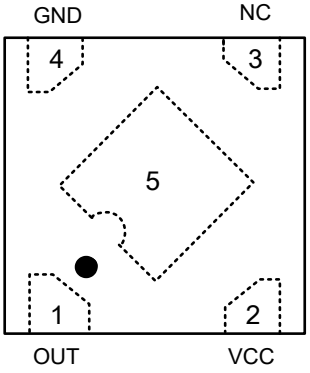
Pin Configuration



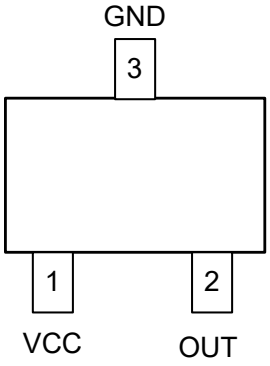
XXE package
DFN4(1.2×1.6,with TP)



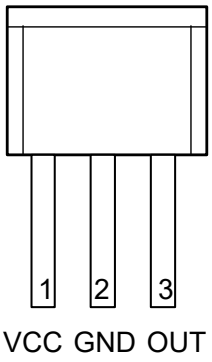
XXD package
DFN4(1.2×1.6)



XXY package
DFN4(1.0×1.0)



XXS package
SSOT-23



XXT package
TO-92S

Top View

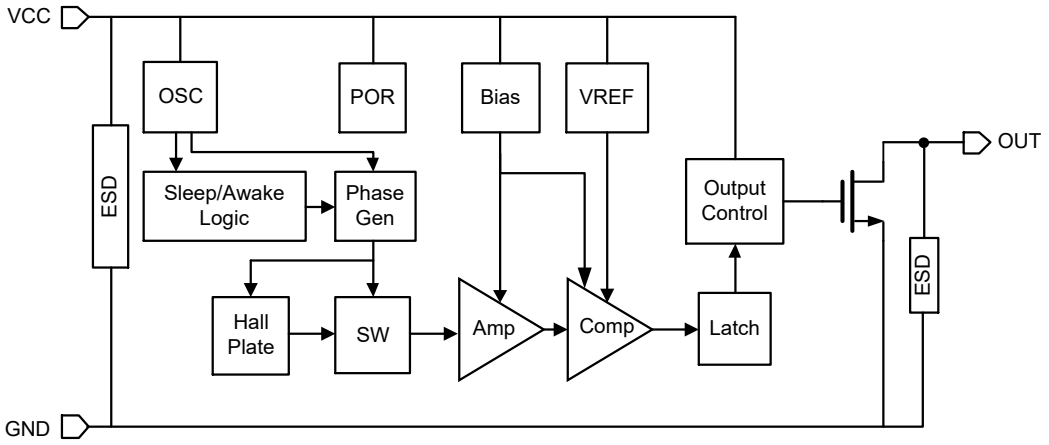
Pin Function

Part	VCC	OUT	GND
SSOT-23	1	2	3
TO-92S	1	3	2
DFN4	2	1	4
Description	Power	Output	Ground

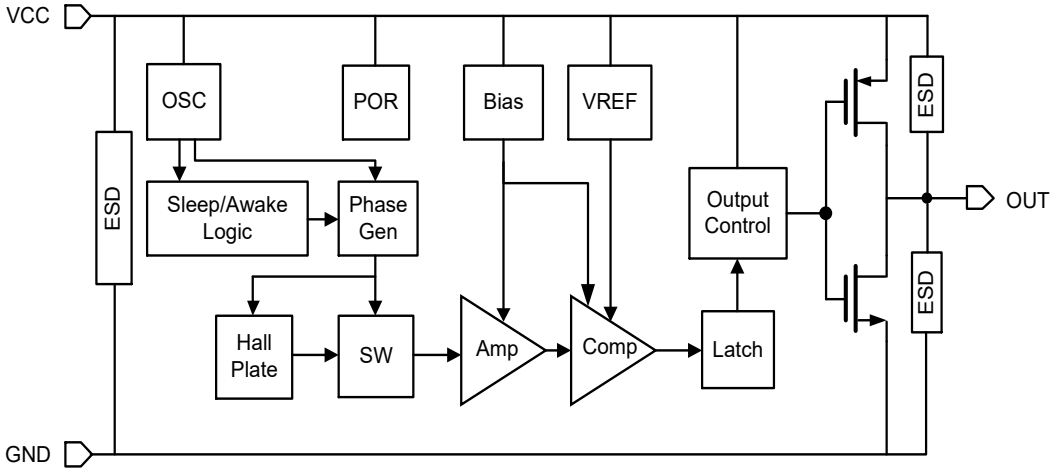
*: Thermal PAD Suggest floating or connecting to GND.

Block Diagram

1. Open Drain Output Products



2. CMOS Output Products



Definition of Switching Function

ET3718A 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".

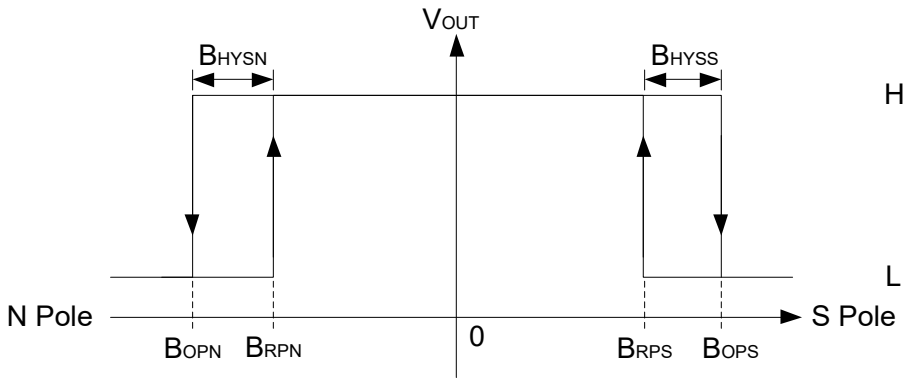


Figure 1. Omnipolar Functionality

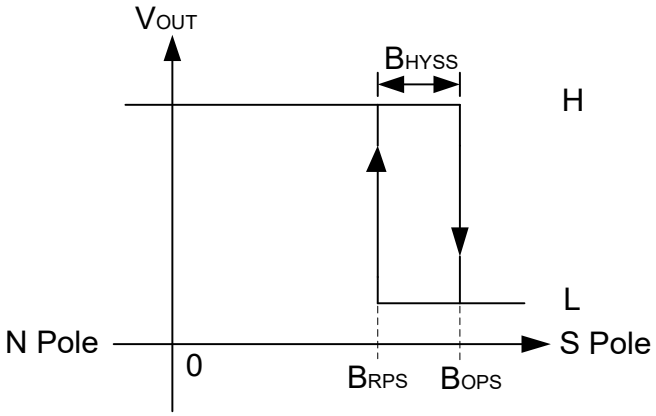


Figure 2. S polar Functionality

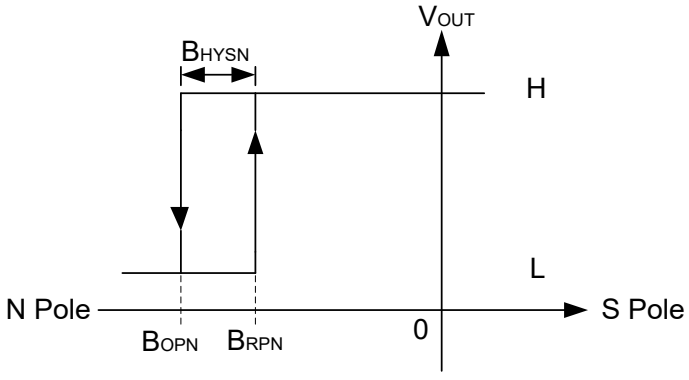


Figure 3. N polar Functionality

Function Description

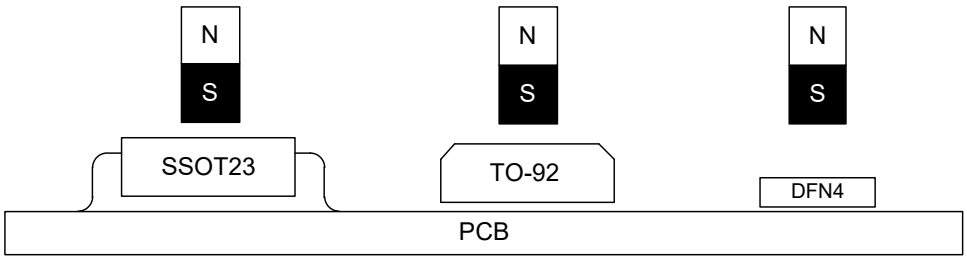
Operating points (B_{OPN}, B_{OPS}): B_{OPN} and B_{OPS} are the values of magnetic flux density triggers the output voltage (V_{OUT}) to low by increasing the N pole or S pole magnetic flux density applied to this IC. Even when the magnetic flux density is larger than B_{OPN} or B_{OPS}, V_{OUT} status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

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.

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

Operating Description

The ET3718A device is sensitive to the magnetic field component that is perpendicular to the top of the package.



Operation Triger Direction (Vout = Low)

Figure 4. Magnetic flux direction

Absolute Maximum Ratings

Symbol	Parameters		Rating	Units
V_{CC}	Supply Voltage		V_{GND}-0.3 ~ V_{GND} +7	V
V_{OUT}	Output Voltage		V_{GND} -0.3 ~ V_{GND} +7	V
I_{OUT}	Continuous Output Current		< 8	mA
T_A	Operating Ambient Temperature		-40 ~ 85	°C
T_S	Storage Temperature		-50 ~ 150	°C
T_J	Junction Temperature		<165	°C
θ_{JA}	Junction-to-Ambient Thermal Resistor	SSOT23-3	300	°C/W
		DFN4(1.2×1.6)	300	°C/W
		DFN4(1.2×1.6,with TP)	220	°C/W
		DFN4(1.0×1.0)	250	°C/W
		TO-92S	230	°C/W
B	Magnetic Flux Density		No Limit	mT

Electrical Characteristics

(T_A=+25°C, V_{CC}=3.6V, unless otherwise specified)

Symbol	Parameters	Test Condition	Min	Typ	Max	Unit
V_{CC}	Supply Voltage	Operating	1.65	3.6	5.5	V
I_{CC}	Average Supply Current	V_{CC}=3.6V	-	1.0	2.0	uA
		V_{CC}=1.8V	-	500	-	nA
I_{AW}	Awake Current (1)	V_{CC}=3.6V	-	1.5	3.0	mA
I_{SL}	Sleep Current (1)	V_{CC}=3.6V	-	0.6	1.8	uA
V_{OL}	Output Low Voltage	I_{OUT}=0.5mA, | B | > | B_{OP} |	-	-	0.2	V
V_{OH}	Output High Voltage	I_{OUT}=0.5mA, | B | < | B_{RP} |	V_{CC} -0.2	-	-	V
F_{SW}	Switching Frequency	V_{CC}=3.6V	10	20	40	Hz
T_{AW}	Awake Time	V_{CC}=1.7V to 5.5V	4	10	16	us
T_{SL}	Sleep Time	V_{CC}=1.7V to 5.5V	25	50	100	ms
D.C.	Duty Cycle	V_{CC}=1.7V to 5.5V	-	0.02	-	%
T_{PO}	Power on Time	dVcc/dt > 5V/us, | B | > | B_{OP} |	-	-	120	us

Note1: Guarantee by design

Magnetic Characteristics

- **Product with omnipolar detection**

1. Product with B_{OP} = 2.5 mT typ.

(T_A = +25°C, V_{CC} = 1.7V~5.5V, unless otherwise specified)

Parameters		Symbol	Conditions	Min	Typ	Max	Unit
Operation point	S pole	B_{OPS}		1.2	2.5	3.9	mT(2)
	N pole	B_{OPN}		-3.9	-2.5	-1.2	mT
Release point	S pole	B_{RPS}		0.9	1.8	3.0	mT
	N pole	B_{RPN}		-3.0	-1.8	-0.9	mT
Hysteresis width	S pole	B_{HYSS}	$B_{HYSS} = B_{OPS} - B_{RPS}$		0.7		mT
	N pole	B_{HYSN}	$B_{HYSN} = \| B_{OPN} - B_{RPN} \|$		0.7		mT

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

(T_A = +25°C, V_{CC} = 1.7V~5.5V, unless otherwise specified)

Parameters		Symbol	Conditions	Min	Typ	Max	Unit
Operation point	S pole	B_{OPS}		1.5	3.0	4.8	mT(2)
	N pole	B_{OPN}		-4.8	-3.0	-1.5	mT
Release point	S pole	B_{RPS}		1.0	2.0	3.2	mT
	N pole	B_{RPN}		-3.2	-2.0	-1.0	mT
Hysteresis width	S pole	B_{HYSS}	$B_{HYSS} = B_{OPS} - B_{RPS}$		1.0		mT
	N pole	B_{HYSN}	$B_{HYSN} = \| B_{OPN} - B_{RPN} \|$		1.0		mT

3. Product with B_{OP} = 3.5 mT typ.

(T_A = +25°C, V_{CC} = 1.7V~5.5V, unless otherwise specified)

Parameters		Symbol	Conditions	Min	Typ	Max	Unit
Operation point	S pole	B_{OPS}		1.5	3.5	5.5	mT(2)
	N pole	B_{OPN}		-5.5	-3.5	-1.5	mT
Release point	S pole	B_{RPS}		1.0	2.5	4.0	mT
	N pole	B_{RPN}		-4.0	-2.5	-1.0	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

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

(T_A = +25°C, V_{CC} = 1.7V~5.5V, unless otherwise specified)

Parameters		Symbol	Conditions	Min	Typ	Max	Unit
Operation point	S pole	B_{OPS}		4.0	7.0	9.5	mT(2)
	N pole	B_{OPN}		-9.5	-7.0	-4.0	mT
Release point	S pole	B_{RPS}		3.0	5.6	7.5	mT
	N pole	B_{RPN}		-7.5	-5.6	-3.0	mT
Hysteresis width	S pole	B_{HYSS}	$B_{HYSS} = B_{OPS} - B_{RPS}$		1.4		mT
	N pole	B_{HYSN}	$B_{HYSN} = \lvert B_{OPN} - B_{RPN} \rvert$		1.4		mT

- **Product with S pole detection**

1. Product with B_{OP} = 2.5 mT typ.

(T_A = +25°C, V_{CC} = 1.7V~5.5V, unless otherwise specified)

Parameters		Symbol	Conditions	Min	Typ	Max	Unit
Operation point	S pole	B_{OPS}		1.2	2.5	3.9	mT(2)
Release point	S pole	B_{RPS}		0.9	1.8	3.0	mT
Hysteresis width	S pole	B_{HYSS}	$B_{HYSS} = B_{OPS} - B_{RPS}$		0.7		mT

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

(T_A = +25°C, V_{CC} = 1.7V~5.5V, unless otherwise specified)

Parameters		Symbol	Conditions	Min	Typ	Max	Unit
Operation point	S pole	B_{OPS}		1.5	3.0	4.8	mT(2)
Release point	S pole	B_{RPS}		1.0	2.0	3.2	mT
Hysteresis width	S pole	B_{HYSS}	$B_{HYSS} = B_{OPS} - B_{RPS}$		1.0		mT

3. Product with B_{OP} = 3.5 mT typ.

(T_A = +25°C, V_{CC} = 1.7V~5.5V, unless otherwise specified)

Parameters		Symbol	Conditions	Min	Typ	Max	Unit
Operation point	S pole	B_{OPS}		1.5	3.5	5.5	mT(2)

Release point	S pole	B_{RPS}		1.0	2.5	4.0	mT
Hysteresis width	S pole	B_{HYSS}	$B_{HYSS} = B_{OPS} - B_{RPS}$		1.0		mT

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

(T_A = +25°C, V_{CC} = 1.7V~5.5V, unless otherwise specified)

Parameters		Symbol	Conditions	Min	Typ	Max	Unit
Operation point	S pole	B_{OPS}		4.0	7.0	9.5	mT(2)
Release point	S pole	B_{RPS}		3.0	5.6	7.5	mT
Hysteresis width	S pole	B_{HYSS}	$B_{HYSS} = B_{OPS} - B_{RPS}$		1.4		mT

- **Product with N pole detection**

1. Product with B_{OP} = 2.5 mT typ.

(T_A = +25°C, V_{CC} = 1.7V~5.5V, unless otherwise specified)

Parameters		Symbol	Conditions	Min	Typ	Max	Unit
Operation point	N pole	B_{OPN}		-3.9	-2.5	-1.2	mT(2)
Release point	N pole	B_{RPN}		-3.0	-1.8	-0.9	mT
Hysteresis width	N pole	B_{HYSN}	$B_{HYSN} = \lvert B_{OPN} - B_{RPN} \rvert$		0.7		mT

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

(T_A = +25°C, V_{CC} = 1.7V~5.5V, unless otherwise specified)

Parameters		Symbol	Conditions	Min	Typ	Max	Unit
Operation point	N pole	B_{OPN}		-4.8	-3.0	-1.5	mT(2)
Release point	N pole	B_{RPN}		-3.2	-2.0	-1.0	mT
Hysteresis width	N pole	B_{HYSN}	$B_{HYSN} = \lvert B_{OPN} - B_{RPN} \rvert$		1.0		mT

3. Product with B_{OP} = 3.5 mT typ.

(T_A = +25°C, V_{CC} = 1.7V~5.5V, unless otherwise specified)

Parameters		Symbol	Conditions	Min	Typ	Max	Unit
Operation point	N pole	B_{OPN}		-5.5	-3.5	-1.5	mT(2)
Release point	N pole	B_{RPN}		-4.0	-2.5	-1.0	mT
Hysteresis width	N pole	B_{HYSN}	$B_{HYSN} = \lvert B_{OPN} - B_{RPN} \rvert$		1.0		mT

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

(T_A = +25°C, V_{CC} = 1.7V~5.5V, unless otherwise specified)

Parameters		Symbol	Conditions	Min	Typ	Max	Unit
Operation point	N pole	B_{OPN}		-9.5	-7.0	-4.0	mT(2)
Release point	N pole	B_{RPN}		-7.5	-5.6	-3.0	mT
Hysteresis width	N pole	B_{HYSN}	$B_{HYSN} = \lvert B_{OPN} - B_{RPN} \rvert$		1.4		mT

Note2: The unit of magnetic density mT can be converted by using the formula 1 mT = 10 Gauss.

Timing Diagram

The operation timing of this IC is shown below.

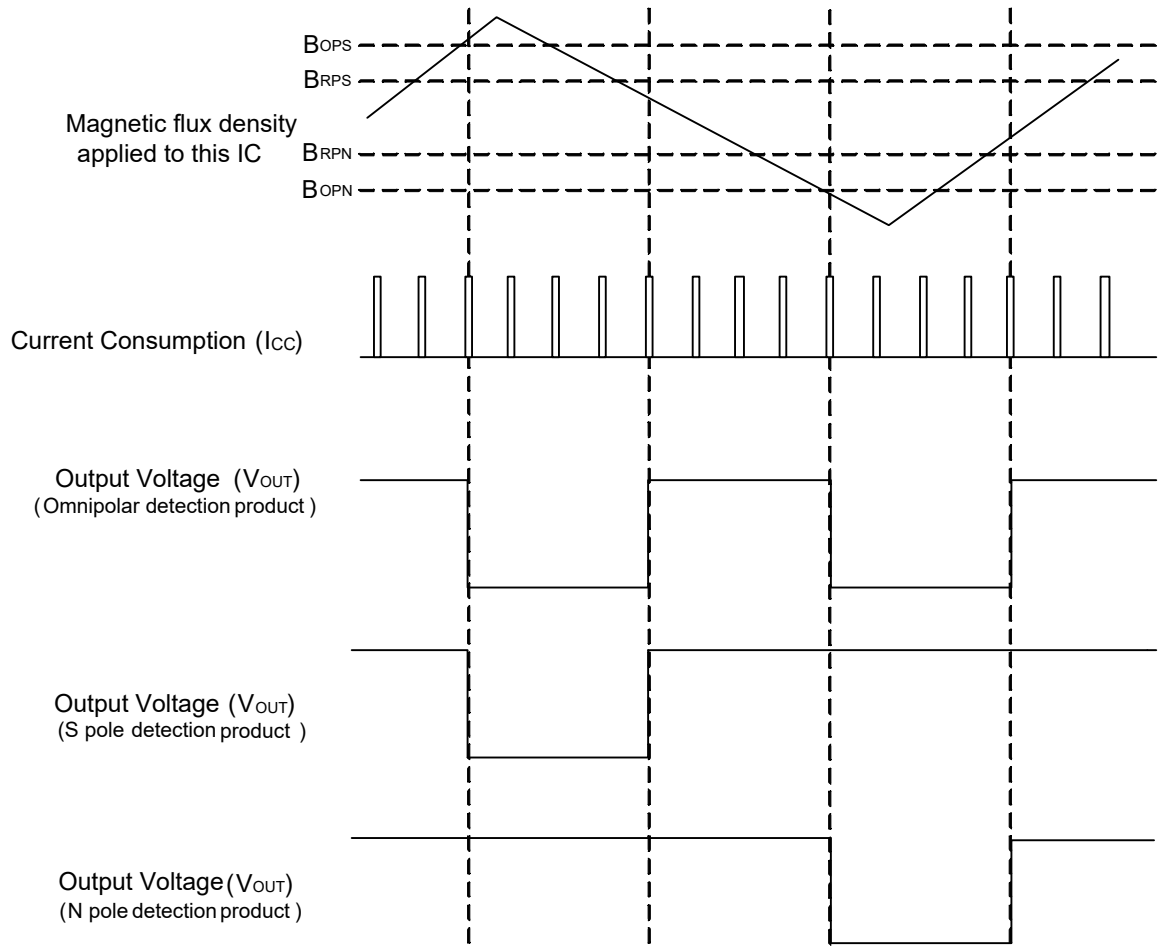
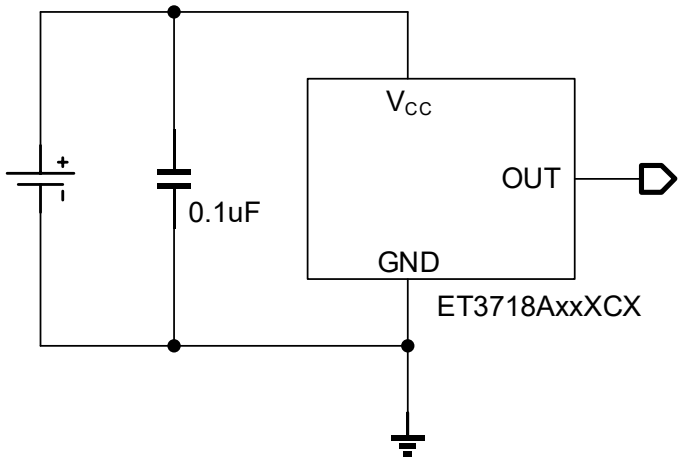


Figure7. Timing Diagram

Application Circuits

1. CMOS Output Product



2. Nch Open Drain Output Product

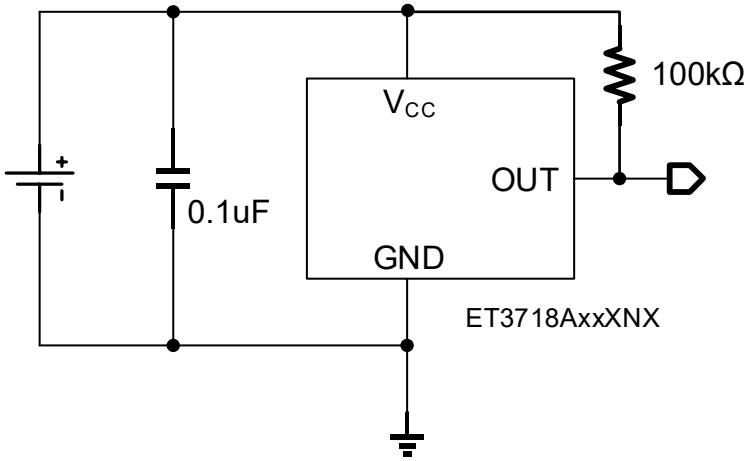
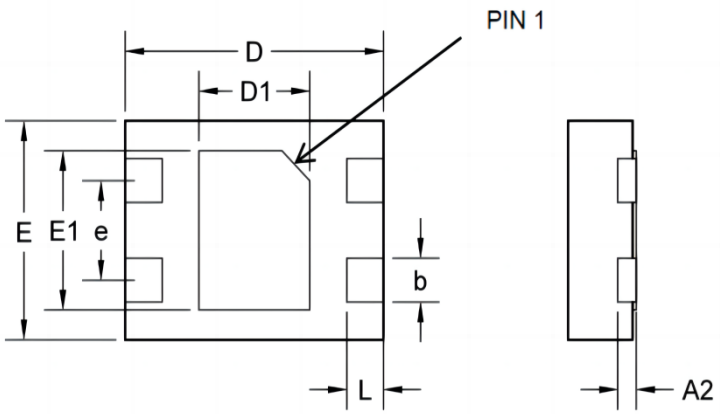


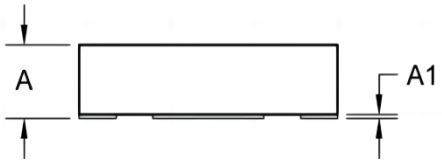
Figure8. Application circuit

Package Dimension

DFN4(1.2×1.6)



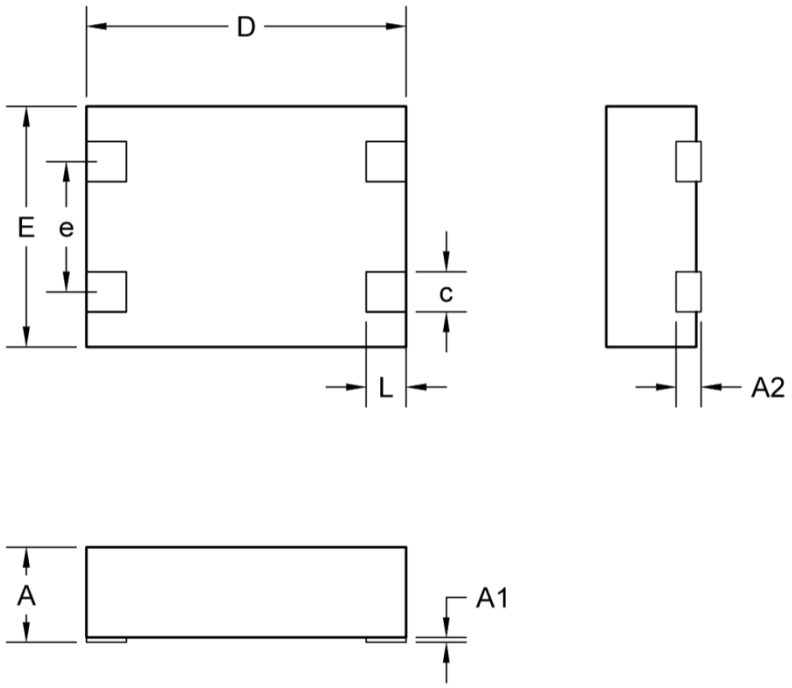
(Bottom View)



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

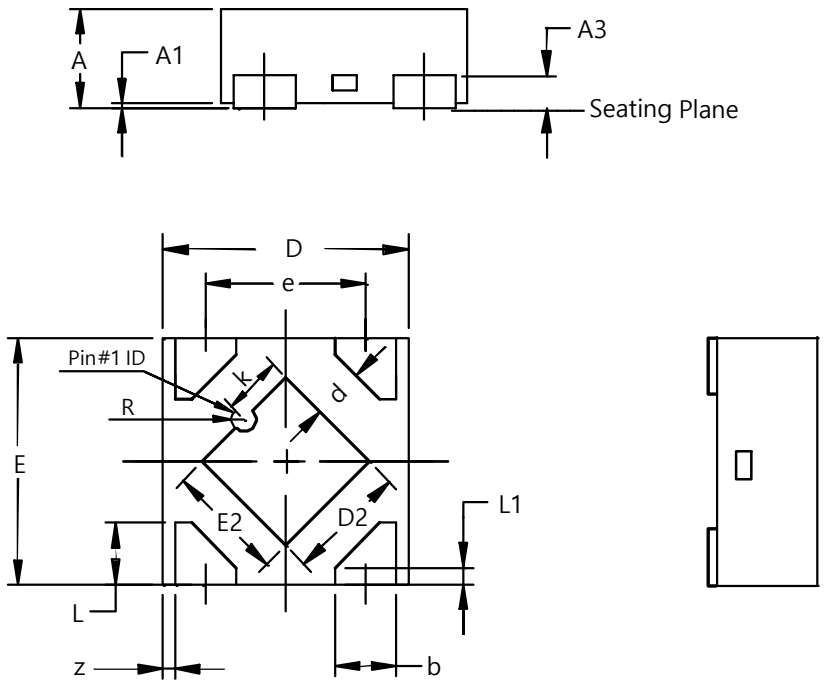
DFN4(1.2×1.6) - without thermal PAD



COMMON DIMENSIONS (Unit: mm)

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

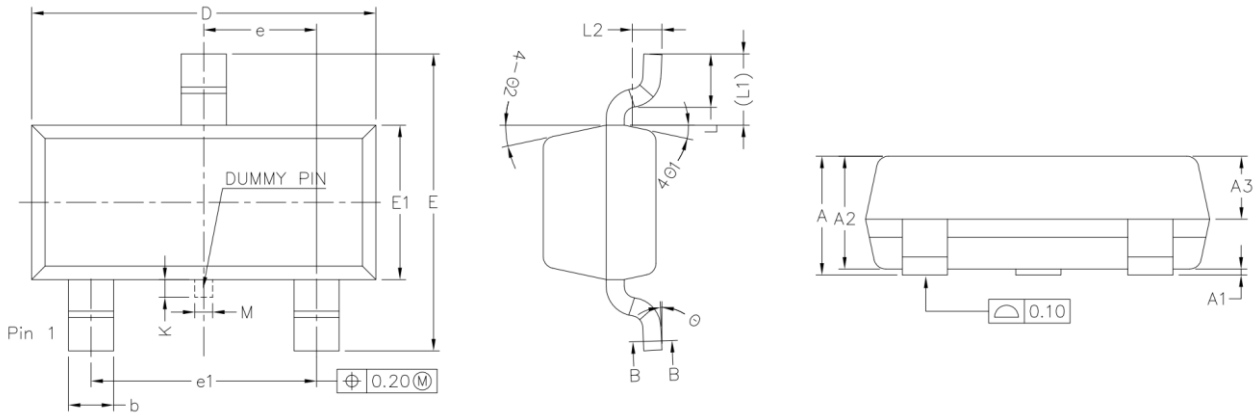
DFN4(1.0×1.0)



COMMON DIMENSIONS (Unit: mm)

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	-

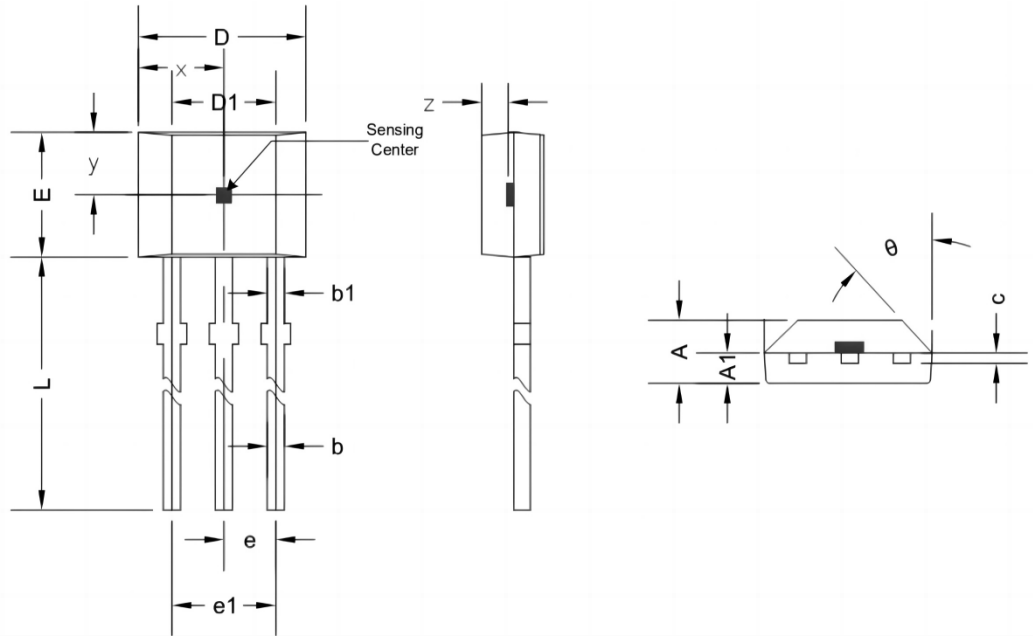
SSOT23-3



COMMON DIMENSIONS (Unit: mm)

SYMBOL	MIN	NOM	MAX
A	0.89	-	1.12
A1	0.01	-	0.10
A2	0.88	0.95	1.02
A3	0.43	0.53	0.63
b	0.36	-	0.50
b1	0.35	0.38	0.45
c	0.14	-	0.20
c1	0.14	0.15	0.16
D	2.80	2.90	3.00
E	2.35	2.50	2.64
E1	1.20	1.30	1.40
e	0.90	0.95	1.00
e1	1.80	1.90	2.00
L	0.40	0.45	0.60
L1	0.60 REF		
L2	0.25BSC		
M	0.10	0.15	0.25
K	0	-	0.25
θ1	0 °	-	8 °
θ1	10 °	12 °	14 °
θ2	10 °	12 °	14 °

TO-92S



COMMON DIMENSIONS (Unit: mm)

SYMBOL	MIN	MAX
A	1.420	1.620
A1	0.660	0.860
b	0.350	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	
e1	2.440	2.640
L	14.350	14.750
θ	45 ° TYP	
x	2.025 TYP	
y	1.545 TYP	
z	0.500 TYP	

Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
0.0	2021-06-07	Preliminary Version	Wanggp	Wanggp	Zhujl
0.1	2023-11-22	Update Package	Tianqh	Wanggp	Zhujl
1.0	2023-12-26	Formal Version	Shibo	Wanggp	Liujy