MLX92216/MLX92217

3-wire µPower Low Voltage Hall Effect Latch/Switch/Omnipolar
Datasheet

1. Features and Benefits

- µPower operation
  - 0.9µA at 1.8V/11Hz
  - 1.2µA at 3.3V/11Hz
  - 1.2µA at 1.8V/22Hz
  - 1.6µA at 3.3V/22Hz
- 1 microwatt power consumption with enable pin (200nA at 5V in disabled state)
- Typical sleep current 0.65 µA at 1.8V
- Best in class min/max I_{DD} tolerances for a stable and predictable power budget
- Operating voltage range from 1.6V to 5.5V
- Push-pull or Open Drain output type
- No external components required
- Selectable Sleep time 0.6ms to 800ms
- Ambient temperature from -40°C to 85°C
- Chopper stabilized very sensitive Hall sensor
- Selectable magnetic thresholds and temperature coefficient
- Various magnetic functions: Unipolar, Omnipolar Switch or Latch
- Under-Voltage Reset protection
- Packages, RoHS compliant
  - DFN-4L (LQ) 1.2mm x 1.6mm
  - TSOT-3L (SE) 2.8mm x 2.9mm

2. Application Examples

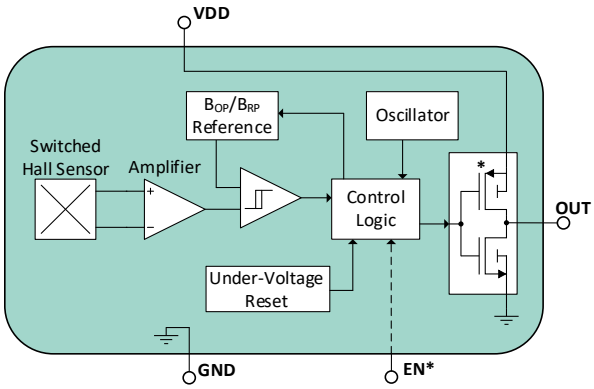
- Consumer electronics (i.e. TWS)
- Battery powered, Handheld devices
- Industrial & medical appliances
- White goods, smart lock & IoT devices
- Proximity sensor, Reed switch replacement, open/close detection
- Energy & Flow metering

3. Description

The MLX92216/17 is a monolithic magnetic sensor IC utilizing a Hall Effect sensor technology.

It has an integrated logic for automatic Sleep/Awake sequencing enabling 1µA average current consumption without any action from the user (depending on the selected product). During the Awake state the chip is comparing the applied magnetic field to the predefined magnetic thresholds and updates its output accordingly. By using the EN pin (available on MLX92217), the user can further reduce the current consumption of the chip by disabling the automatic Sleep/Awake logic and the related analog blocks. During Sleep or Disable state the OUT state remains unchanged regardless of the magnetic field. The OUT state will be refreshed during the next Enable/Awake period. The MLX92216/17 can be selected with various functions: magnetic thresholds, magnetic functions and sleep times.

The MLX92216/17 can be used as general replacement of reed switches having the advantage of solid-state reliability. The MLX92216/17 is suitable for battery-powered devices, lid open/close detection, wake-up switches and other low voltage applications where ultra-low current consumption is critical.



Push-pull output available on some versions
Enable pin available on MLX92217

MLX92216/17 functional diagram Push-pull

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4. Version and ordering Information

4.1. Production version

Product code	Enable pin	Output type	Sleep time (ms)	Magnetic function	Magnetic thresholds B_{OP}/B_{RP} (mT)
MLX92216ELQ-AAC-001	No	Push-Pull	90	Unipolar Direct South Switch	4.0/2.5
MLX92216ESE-AAC-001	No	Push-Pull	90	Unipolar Direct South Switch	4.0/2.5
MLX92216ESE-AAC-003	No	Push-Pull	45	Unipolar Direct South Switch	2.3/1.3
MLX92216ESE-AAC-101	No	Push-Pull	45	Omnipolar Direct Switch	±2.8/±1.8
MLX92216ESE-AAB-101	No	Open-Drain	90	Omnipolar Direct Switch	±3.0/±2.0

4.2. Engineering versions

Engineering samples available for prototyping. Contact your local sales representative for industrialization or different product variants (Magnetic thresholds, Sleep time, Average consumption, Output type).

Product code	Enable pin	Output type	Sleep time (ms)	Magnetic function	Magnetic thresholds B_{OP}/B_{RP} (mT)
MLX92216ELQ-AAC-002 (1)	No	Push-Pull	90	Unipolar Direct South Switch	4.9/3.2
MLX92216ELQ-AAC-003	No	Push-Pull	45	Unipolar Direct South Switch	2.3/1.3
MLX92216ELQ-AAB-001 (1)	No	Open-Drain	4.8	Unipolar direct South switch	3.3/2.3
MLX92216ELQ-AAC-101	No	Push-Pull	45	Omnipolar Direct Switch	±2.8/±1.8
MLX92216ELQ-AAB-101	No	Open-Drain	90	Omnipolar direct switch	±3.0/±2.0
MLX92216ELQ-AAC-201 (1)	No	Push-Pull	1.6	South Latch	1.5/-1.5
MLX92217ELQ-AAC-001	Yes	Push-Pull	1.1	Unipolar direct North switch	-2.7/-1.7
MLX92217ELQ-AAC-002	Yes	Push-Pull	360	Unipolar direct South Switch	3.3/2.3
MLX92217ELQ-AAC-101	Yes	Push-Pull	1.1	Omnipolar direct switch	±3.6/±2.2
MLX92217ELQ-AAC-102	Yes	Push-Pull	180	Omnipolar direct switch	±3.1/±2.1
MLX92217ELQ-AAB-201	Yes	Open-Drain	0.54	North Latch	-2.3/2.3

[1] Available in TSOT-3L package as well. For example: MLX92216ELQ-AAC-002 will become MLX92216ESE-AAC-002. Only available for variants without Enable f.unctionality/pin

Legend:

All ordering codes are starting with MLX92216Exx-AAy-zzz-RE or MLX92217Exx-AAy-zzz-RE followed by the ordering code details. MLX92217 has an integrated Enable functionality. MLX92216 is without the Enable function/pin.

Temperature Code:	E = -40°C to 85°C
Package Code:	Exx = LQ: DFN-4L, SE: TSOT-3L
Option Code:	AAy = B: Open-Drain, C: Push-Pull
	zzz = 0zz: Unipolar switch, 1zz: Omnipolar switch, 2zz: Latch
Packing Form:	RE = Reel
Ordering example:	MLX92216ELQ-AAC-001-RE

5. Glossary of Terms

Gauss: G, Tesla: T	Units for the magnetic flux density: 1 mT = 10 G
TC	Temperature Coefficient of the magnetic threshold (in ppm/°C)
B_{OP}, B_{RP}	Operating/Release magnetic threshold

6. Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Supply voltage[1]	V_{DD}	6	V
Supply current[1,2]	I_{DD}	10	mA
Reverse supply voltage[1]	V_{DDREV}	-0.5	V
Reverse supply current[1, 3]	I_{DDREV}	-10	mA
Open Drain Output voltage[1]	V_{OUTOD}	6	V
Push-Pull Output voltage[1]	V_{OUTPP}	V_{DD} + 0.5	V
Output current[1,2]	I_{OUT}	10	mA
Reverse Output voltage[1]	V_{OUTREV}	-0.5	V
Reverse Output current[1,2]	I_{OUTREV}	-10	mA
Enable voltage[1]	V_{EN}	6	V
Enable current[1,3]	I_{EN}	10	mA
Reverse Enable voltage[1]	V_{ENREV}	-0.5	V
Reverse Enable current[1,3]	I_{ENREV}	-10	mA
Maximum junction temperature	T_J	+125	°C
ESD – HBM[4]	-	3.5	kV
ESD – CDM[5]	-	500	V

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

[1] For maximum 1 hour
[2] Including the current through the protection device
[3] Current through the protection device
[4] Human Body Model according or ANSI/ESDA/JEDEC JS-001 standard
[5] Charged Device Model according or ANSI/ESDA/JEDEC JS-002 standard

7. General Electrical Specifications

Operating conditions V_{DD} = 1.6V to 5.5V, T_A = -40°C to 85°C (unless otherwise specified)

Electrical Parameter	Symbol	Condition	Min	Typ[1]	Max	Unit
Under Voltage Reset threshold	V_{UVR}		–	1.2	1.4	V
Disable Supply Current	I_{DD_DIS}	EN=0, V_{DD}=3.3V	–	0.2	–	µA
Awake Supply Current	I_{DD_AWK}	V_{DD} = 1.8V	–	1.7	2.1	mA
		V_{DD} = 3.3V	–	2.4	2.9	mA
		V_{DD} = 5.0V	–	3.2	3.9	mA
Sleep Supply Current	I_{DD_SLP}	V_{DD} = 1.8V	–	0.65	1.3	µA
		V_{DD} = 3.3V	–	0.85	1.7	µA
		V_{DD} = 5.0V	–	1.3	2.5	µA
Output-High voltage[3]	V_{OH}	I_{OUT} = -1mA	V_{DD} - 0.4	V_{DD} - 0.13	–	V
Output-Low voltage	V_{OL}	I_{OUT} = 1mA	–	0.1	0.3	V
Output turned-on resistance - NMOS	R_{ON_NMOS}	I_{OUT} = 1mA	–	100	300	Ω
Output turned-on resistance - PMOS[3]	R_{ON_PMOS}	I_{OUT} = -1mA	–	130	400	Ω
Open drain output leakage	I_{OFF}	V_{OUT} = 5.5V	–	–	1	µA
Output rise time[2,3]	t_R	C_{LOAD} = 50pF	–	0.1	–	µs
Output fall time[2]	t_F	C_{LOAD} = 50pF	–	0.1	–	µs
Enable leakage	I_{EN_OFF}	V_{DD} = 5.5V			1	µA
Enable input Low voltage [4,7]	V_{IL}	V_{DD} = 3.3V	0.6	1.0	–	V
Enable input High voltage [4,7]	V_{IH}	V_{DD} = 3.3V	–	1.2	1.6	V
Enable High pulse duration [4]	t_{IH}	V_{DD}=3.3V EN=1.6V	5	–	–	µs
Enable rising edge to Output refresh time [4,8]	t_{EO}		–	21	70	µs
Power-On time[5,6,8]	t_{ON}	V_{DD} = 1.6V $\Delta V_{DD}/\Delta t \geq 2V/\mu s$	–	35	80	µs
Power-On state	–	Output state during t_{ON}		High		–
Awake time	t_{AWK}		10	14	18	µs
LQ package thermal resistance	R_{THJA}	Single layer PCB, JEDEC standard test boards, still air (LFPM=0)	–	250	–	°C/W
SE package thermal resistance	R_{THJA}	Single layer PCB, JEDEC standard test boards, still air (LFPM=0)	–	300	–	°C/W

[1] Unless otherwise specified the typical values are defined at T_A = +25°C and V_{DD} = 3.3V
[2] Guaranteed by design and verified by characterization, not production tested
[3] Only valid for versions with Push-Pull output type
[4] Only valid for versions with Enable pin
[5] The Power-On Time represents the time from reaching V_{DD} = 1.6V to the first refresh of output state, with EN pin tied to VDD or held at high state during the Power-On.
[6] Power-On Slew Rate is not critical for the proper device start-up.
[7] Detailed graph over supply voltage can be found in section 11.4
[8] For omnipolar devices and MLX92217ELQ-AAC-001 one sleep time period has to be added on top of the t_{ON}/t_{EO}.

8. Version specific parameters

8.1. Production version

8.1.1. MLX92216ELQ-AAC-001 / MLX92216ESE-AAC-001

Operating conditions V_{DD} = 3.3V, T_A = -40°C to 85°C (unless otherwise specified)

Parameter	Symbol	Condition	Min	Typ[1]	Max	Unit
Operating Point	B_{OP}		2.9	4.0	5.0	mT
Release Point	B_{RP}		1.5	2.5	3.5	mT
Hysteresis	B_{HYST}		1.0	1.5	2.2	mT
Active Pole			South			–
Magnetic Function			Direct Unipolar Switch			–
Output Type			Push-Pull			–
Sleep time	t_{SL}		65	90	110	ms
Average Supply Current	I_{DD_AVG}	V_{DD} = 1.8V	-	0.9	1.5	µA
		V_{DD} = 3.3V	-	1.2	2.0	µA
		V_{DD} = 5.0V	-	1.7	2.8	µA

8.1.2. MLX92216ESE-AAC-003

Operating conditions V_{DD} = 3.3V, T_A = -40°C to 85°C (unless otherwise specified)

Parameter	Symbol	Condition	Min	Typ[1]	Max	Unit
Operating Point	B_{OP}		1.3	2.3	3.4	mT
Release Point	B_{RP}		0.3	1.3	2.4	mT
Hysteresis	B_{HYST}		0.5	1.0	1.5	mT
Active Pole			South			–
Magnetic Function			Direct Unipolar Switch			–
Output Type			Push-Pull			–
Sleep time	t_{SL}		32	45	55	ms
Average Supply Current	I_{DD_AVG}	V_{DD} = 1.8V	-	1.2	2.0	µA
		V_{DD} = 3.3V	-	1.6	2.6	µA
		V_{DD} = 5.0V	-	2.2	3.6	µA

8.1.3. MLX92216ESE-AAC-101

Operating conditions V_{DD} = 3.3V, T_A = -40°C to 85°C (unless otherwise specified)

Parameter	Symbol	Condition	Min	Typ[1]	Max	Unit
Operating Point South Pole	B_{OP_SOUTH}		1.8	2.8	4.0	mT
Release Point South Pole	B_{RP_SOUTH}		0.8	1.8	3.0	mT
Operating Point North Pole	B_{OP_NORTH}		-4.0	-2.8	-1.8	
Release Point North Pole	B_{RP_NORTH}		-2.9	-1.8	-0.8	
Hysteresis	B_{HYST}		0.5	1.0	1.5	mT
Active Pole			South & North			–
Magnetic Function			Direct Omnipolar Switch			–
Output Type			Push-Pull			–
Sleep time [2]	t_{SL}		32	45	55	ms
Average Supply Current	I_{DD_AVG}	V_{DD} = 1.8V	-	1.2	2.0	µA
		V_{DD} = 3.3V	-	1.6	2.6	µA
		V_{DD} = 5.0V	-	2.2	3.6	µA

[1] Unless otherwise specified the typical values are defined at T_A = +25°C and V_{DD} = 3.3V
[2] The total update rate for omnipolar devices and MLX92217ELQ-AAC-001 is twice the defined sleep time

8.1.4. MLX92216ESE-AAB-101

Operating conditions V_{DD} = 3.3V, T_A = -40°C to 85°C (unless otherwise specified)

Parameter	Symbol	Condition	Min	Typ[1]	Max	Unit
Operating Point South Pole	B_{OP_SOUTH}		2.0	3.0	4.3	mT
Release Point South Pole	B_{RP_SOUTH}		1.0	2.0	3.2	mT
Operating Point North Pole	B_{OP_NORTH}		-4.3	-3.0	-2.0	
Release Point North Pole	B_{RP_NORTH}		-3.2	-2.0	-1.0	
Hysteresis	B_{HYST}		0.5	1.0	1.5	mT
Active Pole			South & North			–
Magnetic Function			Direct Omnipolar Switch			–
Output Type			Open-Drain			–
Sleep time [2]	t_{SL}		65	90	110	ms
Average Supply Current	I_{DD_AVG}	V_{DD} = 1.8V	-	0.9	1.5	µA
		V_{DD} = 3.3V	-	1.2	2.0	µA
		V_{DD} = 5.0V	-	1.7	2.8	µA

[1] Unless otherwise specified the typical values are defined at T_A = +25°C and V_{DD} = 3.3V
[2] The total update rate for omnipolar devices and MLX92217ELQ-AAC-001 is twice the defined sleep time

8.2. Engineering versions

Engineering samples available for prototyping. Contact your local sales representative for industrialization or different product variants (Magnetic thresholds, Sleep time, Average consumption, Output type).

8.2.1. MLX92216ELQ-AAC-002 / MLX92216ESE-AAC-002

Operating conditions V_{DD} = 3.3V, T_A = -40°C to 85°C (unless otherwise specified)

Parameter	Symbol	Condition	Min	Typ[1]	Max	Unit
Operating Point	B_{OP}		3.6	4.9	6.2	mT
Release Point	B_{RP}		2.0	3.2	4.4	mT
Hysteresis	B_{HYST}		1.1	1.7	2.5	mT
Active Pole			South			–
Magnetic Function			Direct Unipolar Switch			–
Output Type			Push-Pull			–
Sleep time	t_{SL}		65	90	110	ms
Average Supply Current	I_{DD_AVG}	V_{DD} = 1.8V	-	0.9	1.5	µA
		V_{DD} = 3.3V	-	1.2	2.0	µA
		V_{DD} = 5.0V	-	1.7	2.8	µA

8.2.2. MLX92216ELQ-AAC-003

Operating conditions V_{DD} = 3.3V, T_A = -40°C to 85°C (unless otherwise specified)

Parameter	Symbol	Condition	Min	Typ[1]	Max	Unit
Operating Point	B_{OP}		1.3	2.3	3.4	mT
Release Point	B_{RP}		0.3	1.3	2.4	mT
Hysteresis	B_{HYST}		0.5	1.0	1.5	mT
Active Pole			South			–
Magnetic Function			Direct Unipolar Switch			–
Output Type			Push-Pull			–
Sleep time	t_{SL}		32	45	55	ms
Average Supply Current	I_{DD_AVG}	V_{DD} = 1.8V	-	1.2	2.0	µA
		V_{DD} = 3.3V	-	1.6	2.6	µA
		V_{DD} = 5.0V	-	2.2	3.6	µA

8.2.3. MLX92216ELQ-AAB-001 / MLX92216ESE-AAB-001

Operating conditions V_{DD} = 3.3V, T_A = -40°C to 85°C (unless otherwise specified)

Parameter	Symbol	Condition	Min	Typ[1]	Max	Unit
Operating Point	B_{OP}		2.2	3.3	4.5	mT
Release Point	B_{RP}		1.3	2.3	3.4	mT
Hysteresis	B_{HYST}		0.5	1.0	1.5	mT
Active Pole			South			–
Magnetic Function			Direct Unipolar Switch			–
Output Type			Open-Drain			–
Sleep time	t_{SL}		3.4	4.8	5.9	ms
Average Supply Current	I_{DD_AVG}	V_{DD} = 1.8V	-	5.7	8.0	µA
		V_{DD} = 3.3V	-	7.8	11.0	µA
		V_{DD} = 5.0V	-	10.6	17.6	µA

[1] Unless otherwise specified the typical values are defined at T_A = +25°C and V_{DD} = 3.3V

8.2.4. MLX92216ELQ-AAC-101

Operating conditions V_{DD} = 3.3V, T_A = -40°C to 85°C (unless otherwise specified)

Parameter	Symbol	Condition	Min	Typ[1]	Max	Unit
Operating Point South Pole	B_{OP_SOUTH}		1.8	2.8	4.0	mT
Release Point South Pole	B_{RP_SOUTH}		0.8	1.8	3.0	mT
Operating Point North Pole	B_{OP_NORTH}		-4.0	-2.8	-1.8	mT
Release Point North Pole	B_{RP_NORTH}		-2.9	-1.8	-0.8	mT
Hysteresis	B_{HYST}		0.5	1.0	1.5	mT
Active Pole			South & North			–
Magnetic Function			Direct Omnipolar Switch			–
Output Type			Push-Pull			–
Sleep time [2]	t_{SL}		32	45	55	ms
Average Supply Current	I_{DD_AVG}	V_{DD} = 1.8V	-	1.2	2.0	µA
		V_{DD} = 3.3V	-	1.6	2.6	µA
		V_{DD} = 5.0V	-	2.2	3.6	µA

8.2.5. MLX92216ELQ-AAB-101

Operating conditions V_{DD} = 3.3V, T_A = -40°C to 85°C (unless otherwise specified)

Parameter	Symbol	Condition	Min	Typ[1]	Max	Unit
Operating Point South Pole	B_{OP_SOUTH}		2.0	3.0	4.3	mT
Release Point South Pole	B_{RP_SOUTH}		1.0	2.0	3.2	mT
Operating Point North Pole	B_{OP_NORTH}		-4.3	-3.0	-2.0	mT
Release Point North Pole	B_{RP_NORTH}		-3.2	-2.0	-1.0	mT
Hysteresis	B_{HYST}		0.5	1.0	1.5	mT
Active Pole			South & North			–
Magnetic Function			Direct Omnipolar Switch			–
Output Type			Open-Drain			–
Sleep time [2]	t_{SL}		65	90	110	ms
Average Supply Current	I_{DD_AVG}	V_{DD} = 1.8V	-	0.9	1.5	µA
		V_{DD} = 3.3V	-	1.2	2.0	µA
		V_{DD} = 5.0V	-	1.7	2.8	µA

8.2.6. MLX92216ELQ-AAC-201 / MLX92216ESE-AAC-201

Operating conditions V_{DD} = 3.3V, T_A = -40°C to 85°C (unless otherwise specified)

Parameter	Symbol	Condition	Min	Typ[1]	Max	Unit
Operating Point	B_{OP}		0.5	1.5	2.5	mT
Release Point	B_{RP}		-2.5	-1.5	-0.5	mT
Hysteresis	B_{HYST}		2.1	3.0	4.0	mT
Active Pole			South			–
Magnetic Function			Latch			–
Output Type			Push-Pull			–
Sleep time	t_{SL}		1.1	1.6	2	ms
Average Supply Current	I_{DD_AVG}	V_{DD} = 1.8V	-	16.0	20.0	µA
		V_{DD} = 3.3V	-	22.0	27.0	µA
		V_{DD} = 5.0V	-	29.0	48.0	µA

[1] Unless otherwise specified the typical values are defined at T_A = +25°C and V_{DD} = 3.3V
[2] The total update rate for omnipolar devices and MLX92217ELQ-AAC-001 is twice the defined sleep time

8.2.7. MLX92217ELQ-AAC-001

Operating conditions V_{DD} = 3.3V, T_A = -40°C to 85°C (unless otherwise specified)

Parameter	Symbol	Condition	Min	Typ[1]	Max	Unit
Operating Point	B_{OP}		-3.8	-2.7	-1.6	mT
Release Point	B_{RP}		-2.8	-1.7	-0.6	mT
Hysteresis	B_{HYST}		0.5	1.0	1.5	mT
Active Pole			North			–
Magnetic Function			Direct Unipolar Switch			–
Output Type			Push-Pull			–
Sleep time	t_{SL}		0.8	1.1	1.3	ms
Average Supply Current	I_{DD_AVG}	V_{DD} = 1.8V	-	23.0	38.0	µA
		V_{DD} = 3.3V	-	32.0	53.0	µA
		V_{DD} = 5.0V	-	42.0	70.0	µA

8.2.8. MLX92217ELQ-AAC-002

Operating conditions V_{DD} = 3.3V, T_A = -40°C to 85°C (unless otherwise specified)

Parameter	Symbol	Condition	Min	Typ[1]	Max	Unit
Operating Point	B_{OP}		2.2	3.3	4.5	mT
Release Point	B_{RP}		1.3	2.3	3.4	mT
Hysteresis	B_{HYST}		0.5	1.0	1.5	mT
Active Pole			South			–
Magnetic Function			Direct Unipolar Switch			–
Output Type			Push-Pull			–
Sleep time	t_{SL}		260	360	440	ms
Average Supply Current	I_{DD_AVG}	V_{DD} = 1.8V	-	0.75	1.3	µA
		V_{DD} = 3.3V	-	0.95	1.6	µA
		V_{DD} = 5.0V	-	1.5	2.5	µA

8.2.9. MLX92217ELQ-AAC-101

Operating conditions V_{DD} = 3.3V, T_A = -40°C to 85°C (unless otherwise specified)

Parameter	Symbol	Condition	Min	Typ[1]	Max	Unit
Operating Point South Pole	B_{OP_SOUTH}		2.2	3.6	5.0	mT
Release Point South Pole	B_{RP_SOUTH}		1.0	2.2	3.5	mT
Operating Point North Pole	B_{OP_NORTH}		-5.0	-3.6	-2.2	mT
Release Point North Pole	B_{RP_NORTH}		-3.5	-2.2	-1.0	mT
Hysteresis	B_{HYST}		0.8	1.4	2.1	mT
Active Pole			South & North			–
Magnetic Function			Direct Omnipolar Switch			–
Output Type			Push-Pull			–
Sleep time [2]	t_{SL}		0.8	1.1	1.3	ms
Average Supply Current	I_{DD_AVG}	V_{DD} = 1.8V	-	23.0	38.0	µA
		V_{DD} = 3.3V	-	32.0	53.0	µA
		V_{DD} = 5.0V	-	42.0	70.0	µA

[1] Unless otherwise specified the typical values are defined at T_A = +25°C and V_{DD} = 3.3V
[2] The total update rate for omnipolar devices and MLX92217ELQ-AAC-001 is twice the defined sleep time

8.2.10. MLX92217ELQ-AAC-102

Operating conditions V_{DD} = 3.3V, T_A = -40°C to 85°C (unless otherwise specified)

Parameter	Symbol	Condition	Min	Typ[1]	Max	Unit
Operating Point South Pole	B_{OP_SOUTH}		2.0	3.1	4.3	mT
Release Point South Pole	B_{RP_SOUTH}		1.0	2.1	3.2	mT
Operating Point North Pole	B_{OP_NORTH}		-4.3	-3.1	-2.0	mT
Release Point North Pole	B_{RP_NORTH}		-3.2	-2.1	-1.0	mT
Hysteresis	B_{HYST}		0.5	1.0	1.5	mT
Active Pole			South & North			–
Magnetic Function			Direct Omnipolar Switch			–
Output Type			Push-Pull			–
Sleep time [2]	t_{SL}		130	180	220	ms
Average Supply Current	I_{DD_AVG}	V_{DD} = 1.8V	-	0.8	1.4	µA
		V_{DD} = 3.3V	-	1.05	1.8	µA
		V_{DD} = 5.0V	-	1.6	2.6	µA

8.2.11. MLX92217ELQ-AAB-201

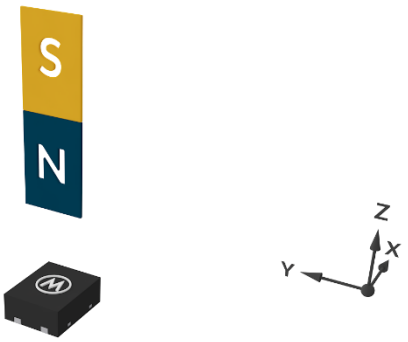
Operating conditions V_{DD} = 3.3V, T_A = -40°C to 85°C (unless otherwise specified)

Parameter	Symbol	Condition	Min	Typ[1]	Max	Unit
Operating Point	B_{OP}		-3.7	-2.3	-1.0	mT
Release Point	B_{RP}		1.0	2.3	3.7	mT
Hysteresis	B_{HYST}		3.7	4.6	6.2	mT
Temperature compensation	TC			-2000		ppm/˚C
Active Pole			North			–
Magnetic Function			Latch			–
Output Type			Open Drain			–
Sleep time	t_{SL}		0.39	0.54	0.66	ms
Average Supply Current	I_{DD_AVG}	V_{DD} = 1.8V	-	45.0	56.0	µA
		V_{DD} = 3.3V	-	62.0	77.0	µA
		V_{DD} = 5.0V	-	82.0	136.0	µA

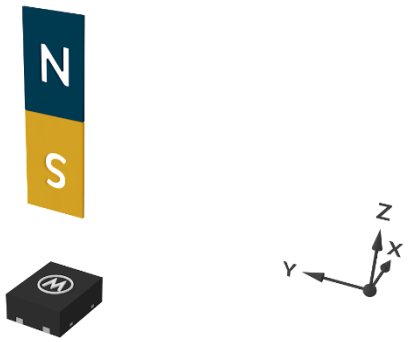
[1] Unless otherwise specified the typical values are defined at T_A = +25°C and V_{DD} = 3.3V
[2] The total update rate for omnipolar devices and MLX92217ELQ-AAC-001 is twice the defined sleep time

9. Detailed Description

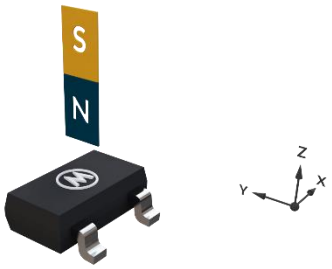
9.1. Active magnetic pole definition



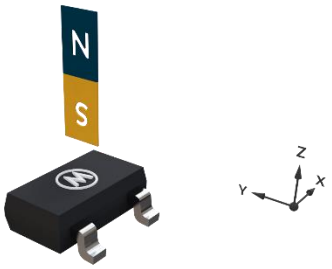
LQ package – North Pole Active



LQ package – South Pole Active



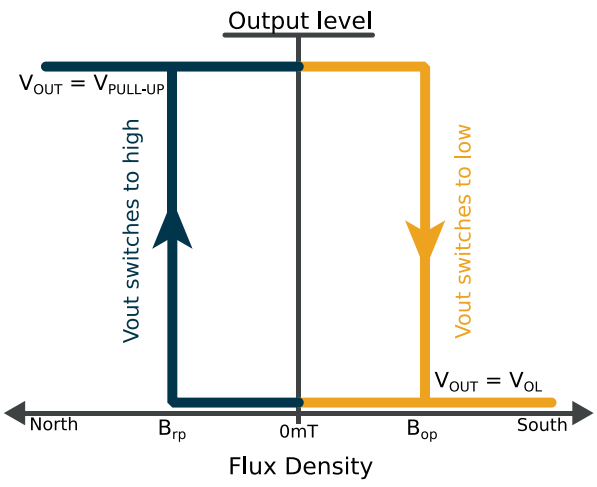
SE package – North pole active



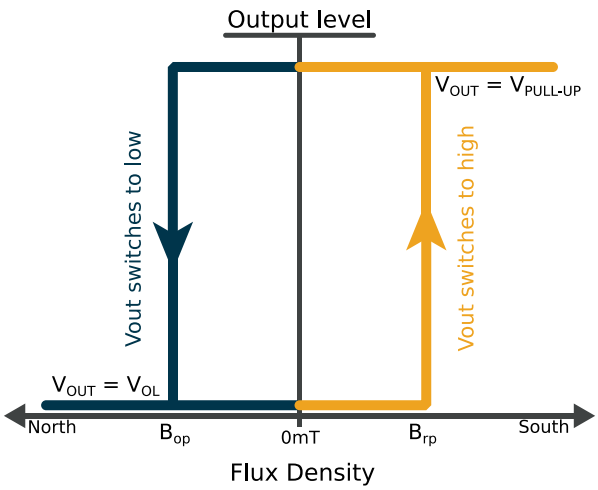
SE package – South pole active

10. Magnetic Behavior

10.1. Latch Sensor

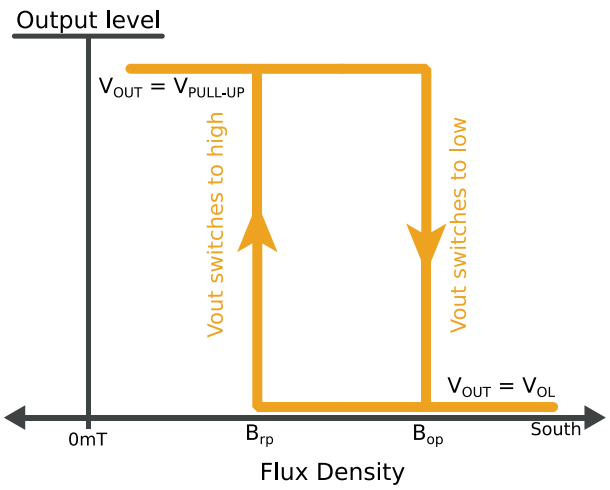


South Pole Active Latch

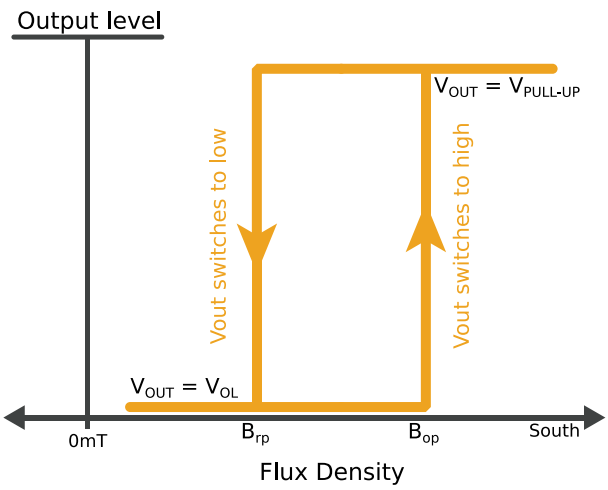


North Pole Active Latch

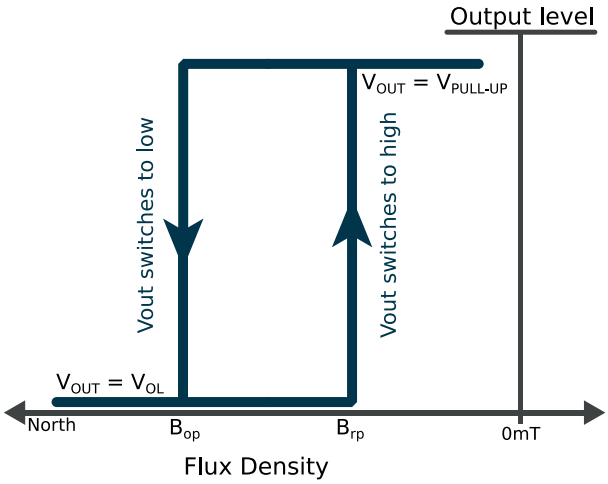
10.2. Unipolar Switch Sensor



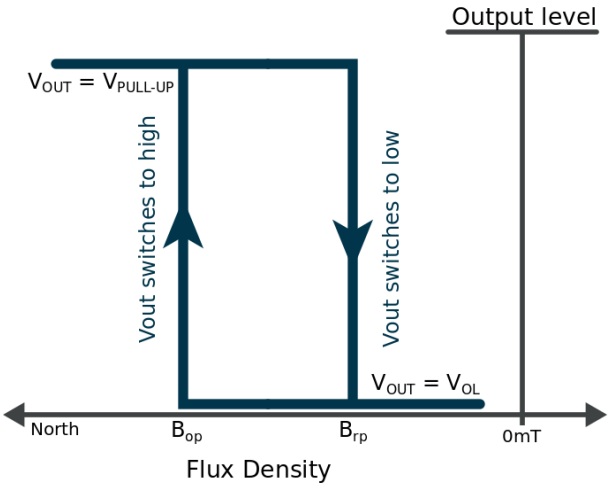
Direct South Pole Active Switch



Inverted South Pole Active Switch

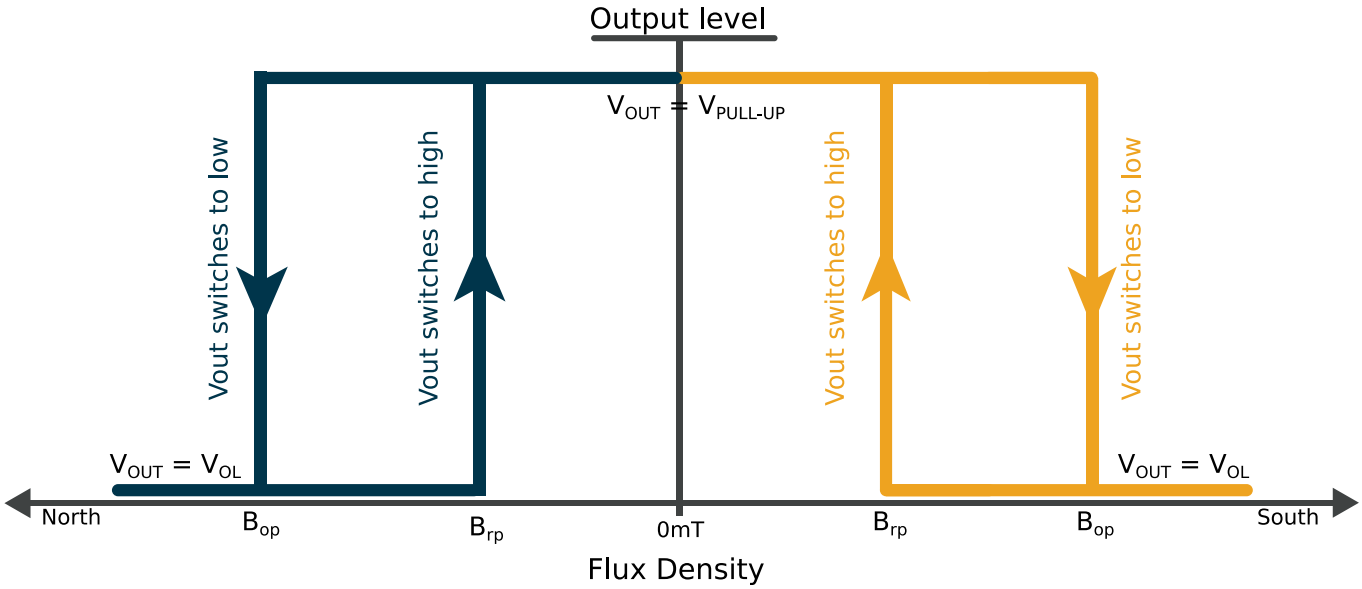


Direct North Pole Active Switch



Inverted North Pole Active Switch

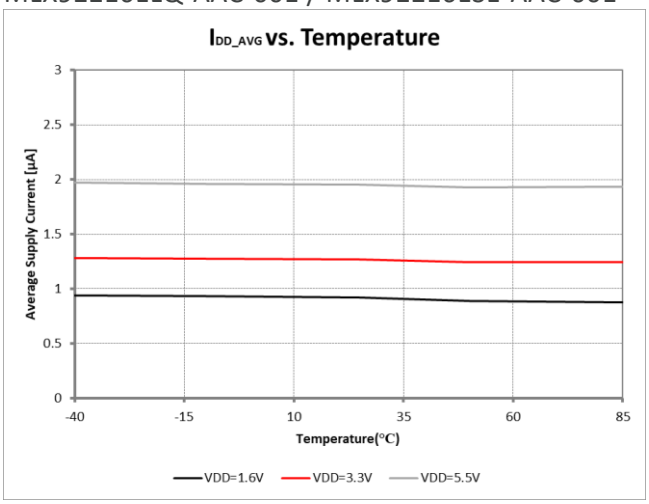
10.3. Omnipolar Switch Sensor



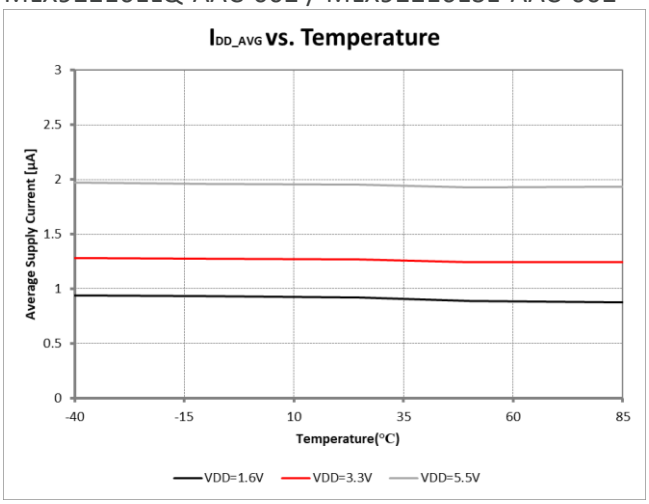
11. Performance graphs

11.1. I_{DD_AVG} vs. Temperature

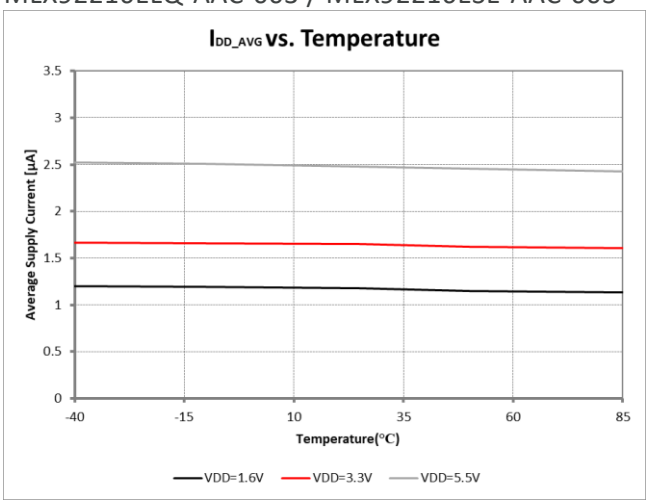
MLX92216ELQ-AAC-001 / MLX92216ESE-AAC-001



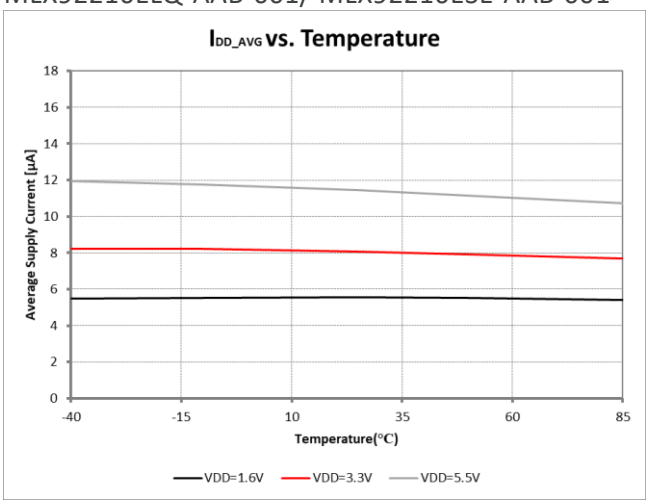
MLX92216ELQ-AAC-002 / MLX92216ESE-AAC-002



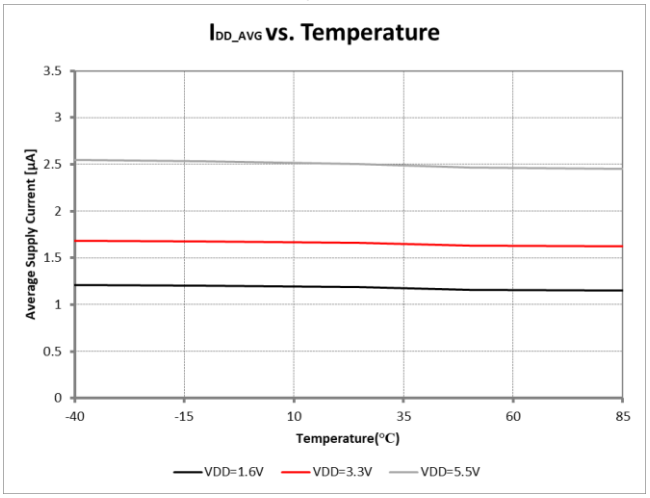
MLX92216ELQ-AAC-003 / MLX92216ESE-AAC-003



MLX92216ELQ-AAB-001/ MLX92216ESE-AAB-001



MLX92216ELQ-AAC-101 / MLX92216ESE-AAC-101



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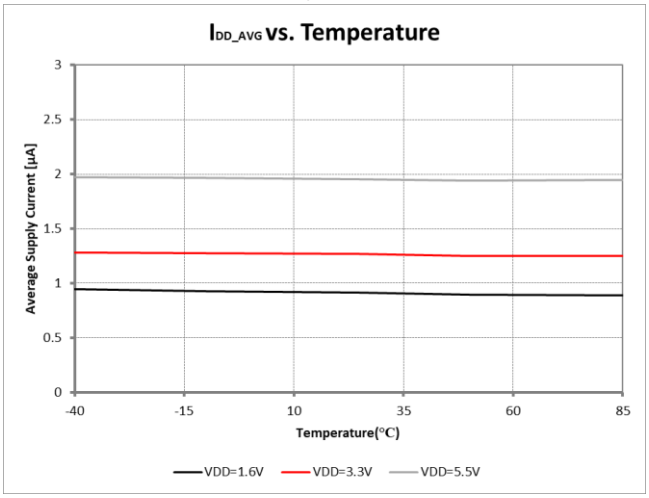
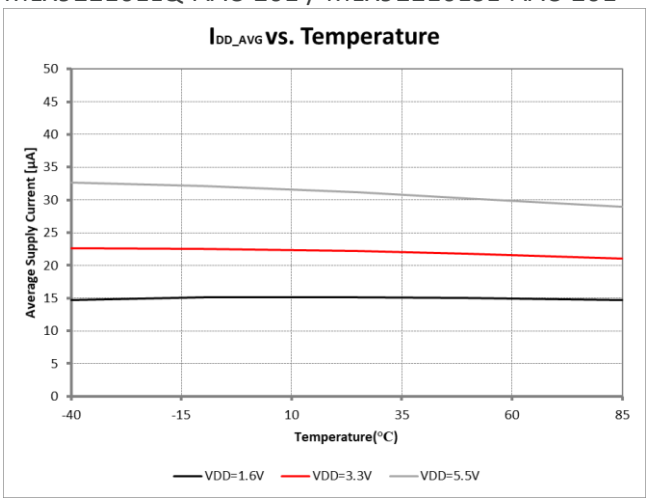


MLX92216ELQ-AAC-201 / MLX92216ESE-AAC-201



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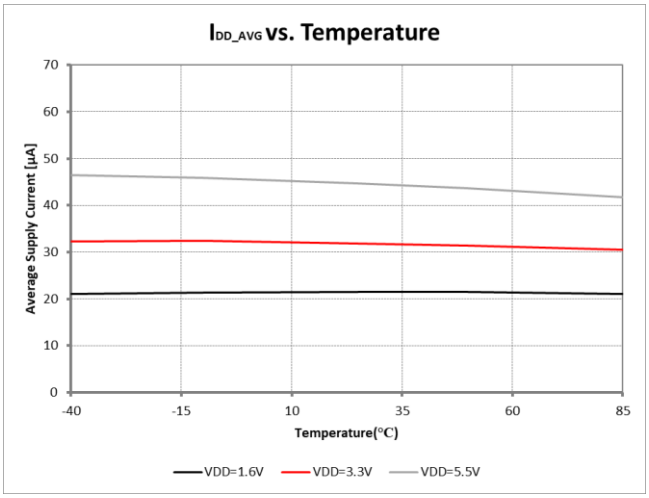

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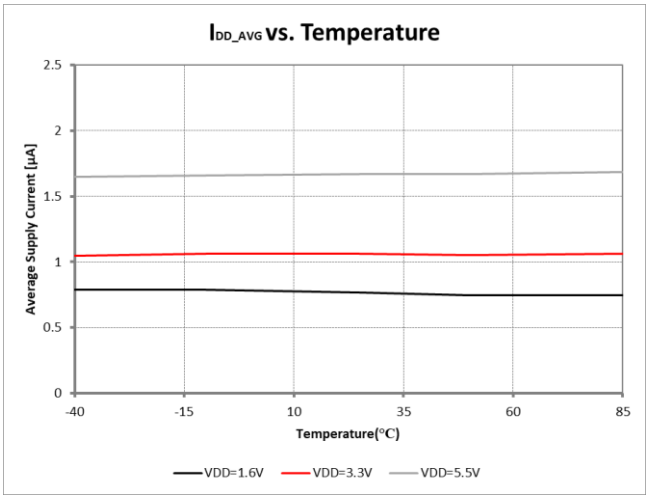

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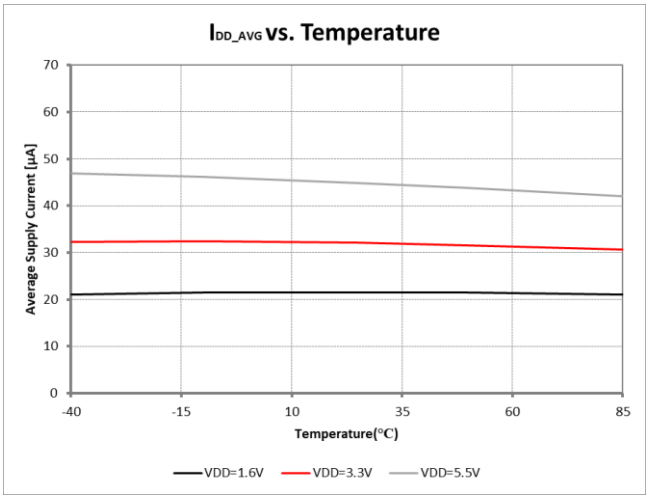
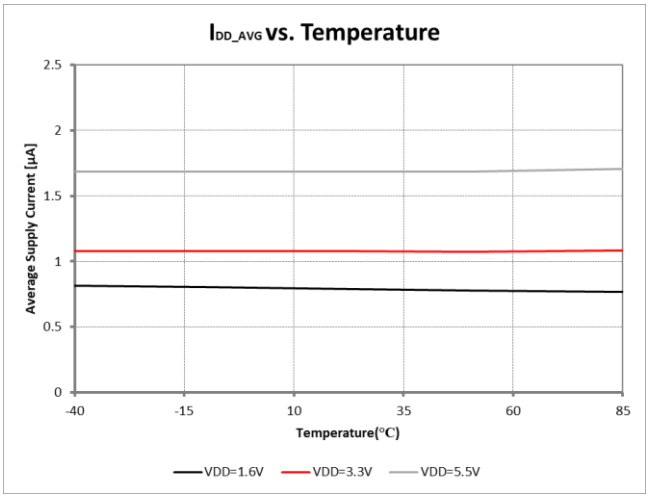
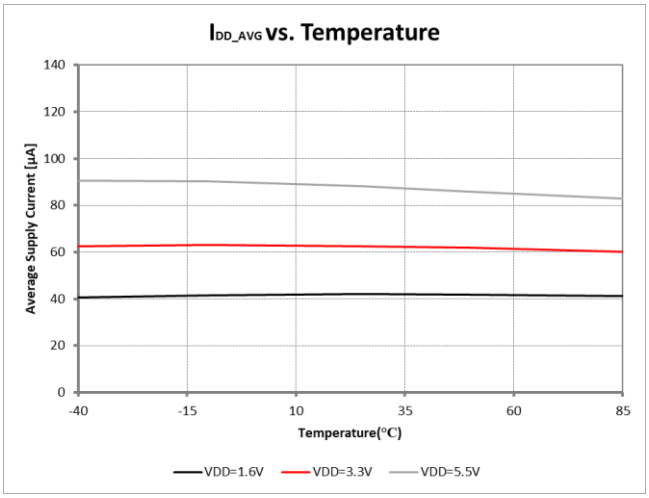


MLX92217ELQ-AAC-102

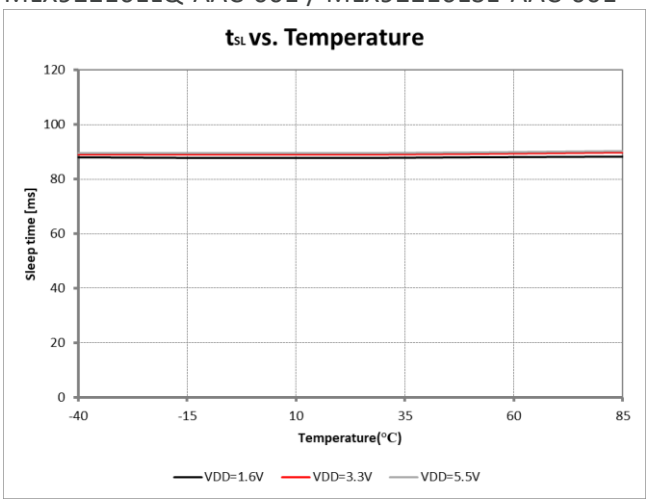


MLX92217ELQ-AAB-201

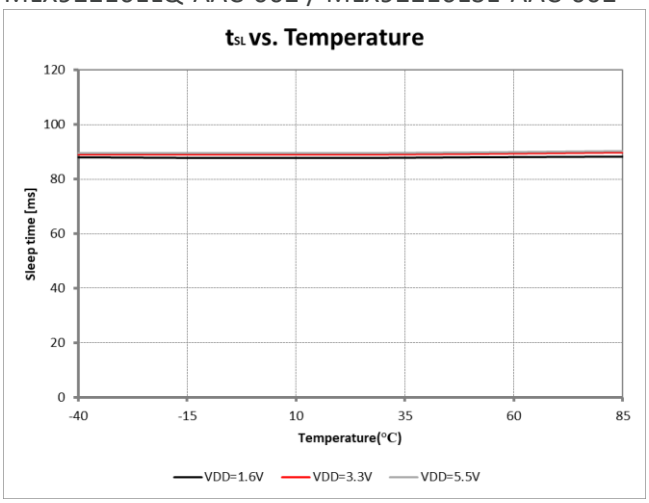


11.2. T_{SL} vs. Temperature

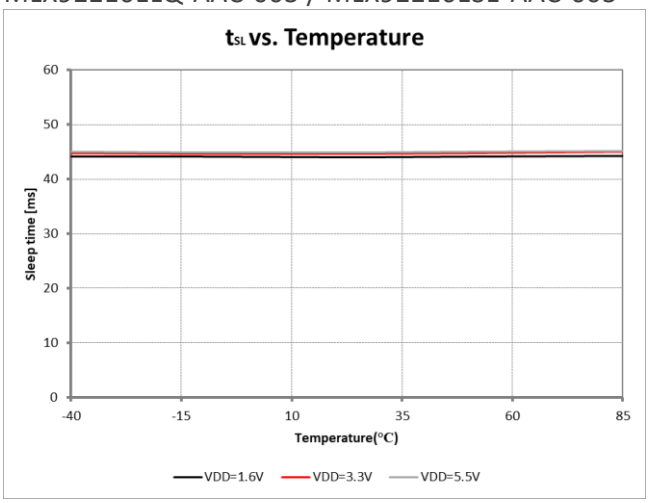
MLX92216ELQ-AAC-001 / MLX92216ESE-AAC-001



MLX92216ELQ-AAC-002 / MLX92216ESE-AAC-002



MLX92216ELQ-AAC-003 / MLX92216ESE-AAC-003



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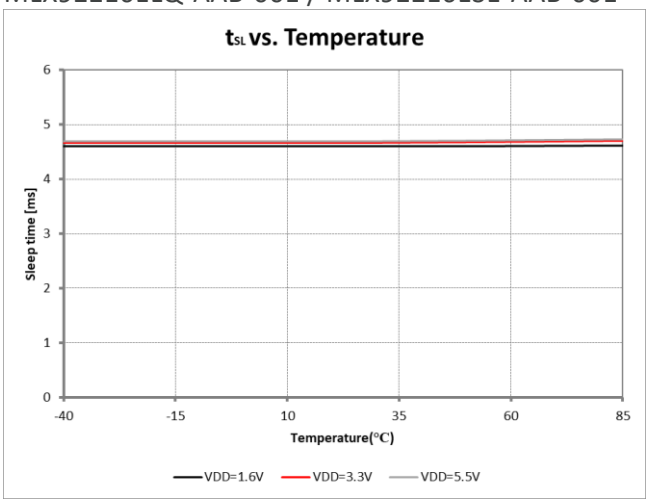
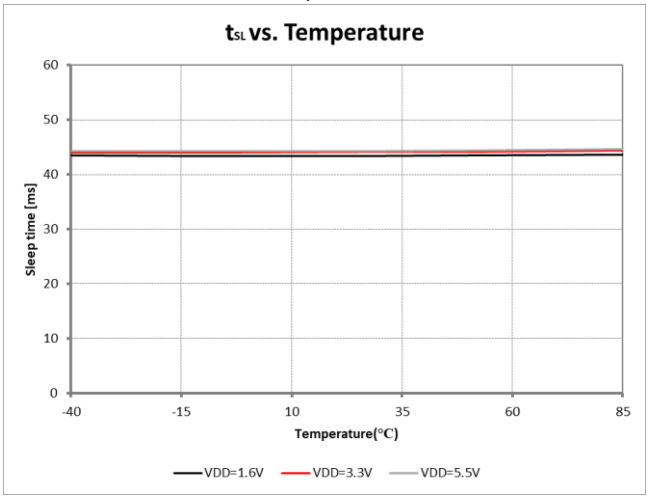
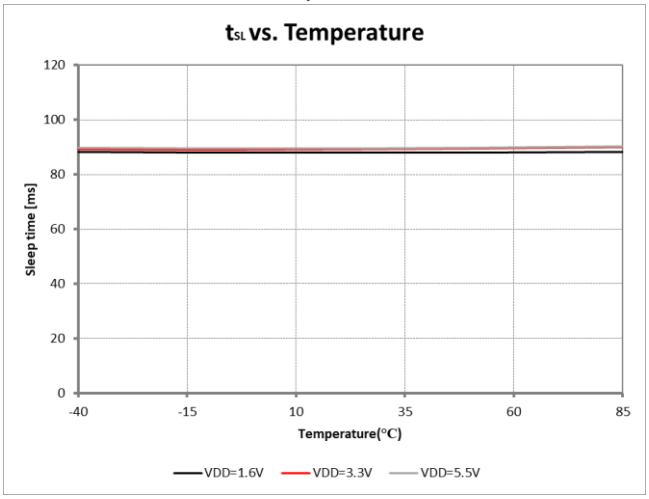


MLX92216ELQ-AAC-101 / MLX92216ESE-AAC-101



MLX92216ELQ-AAB-101 / MLX92216ESE-AAB-101



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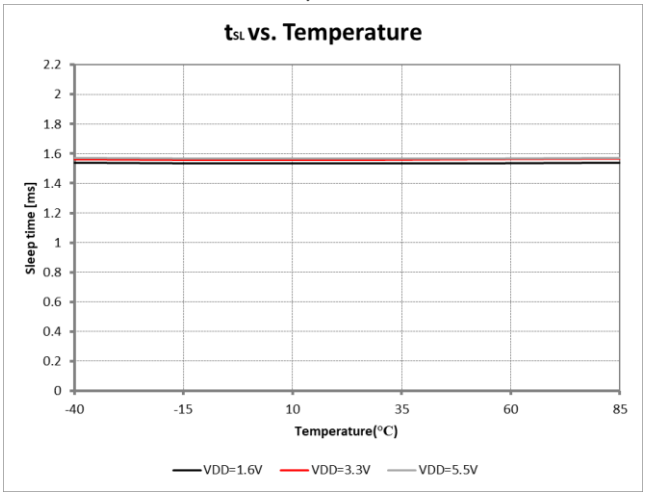

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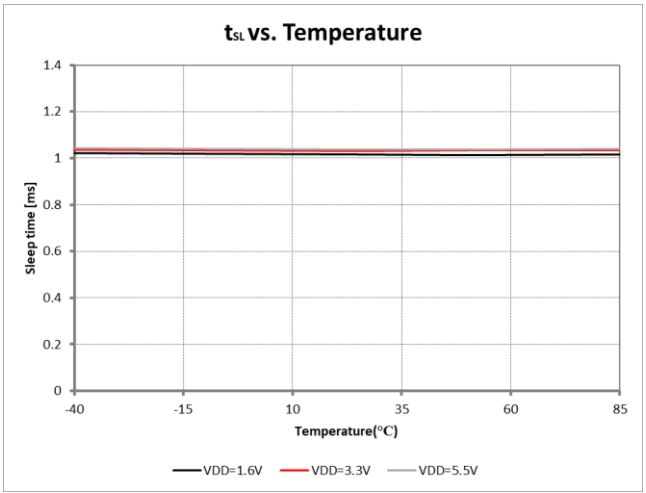

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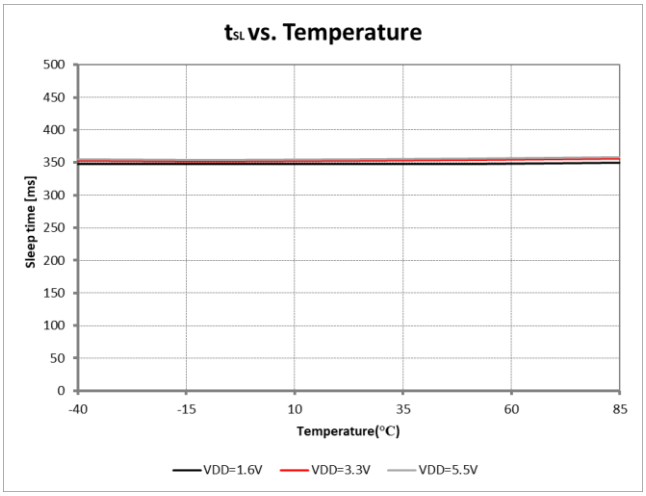

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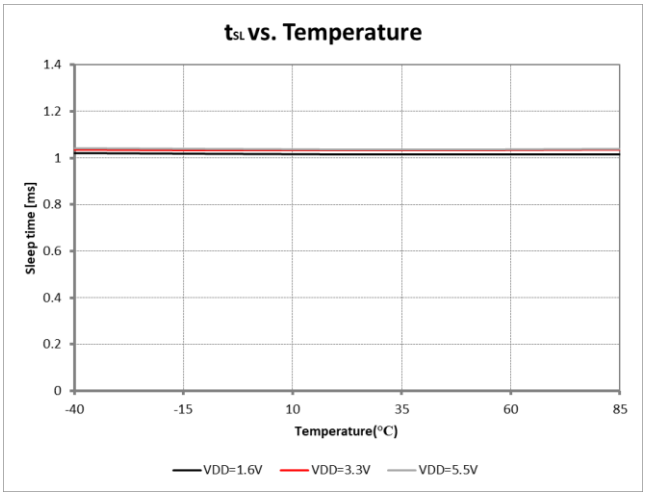

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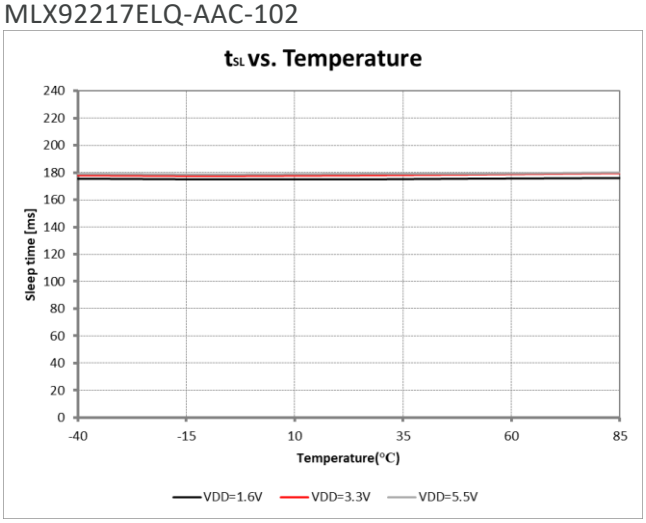
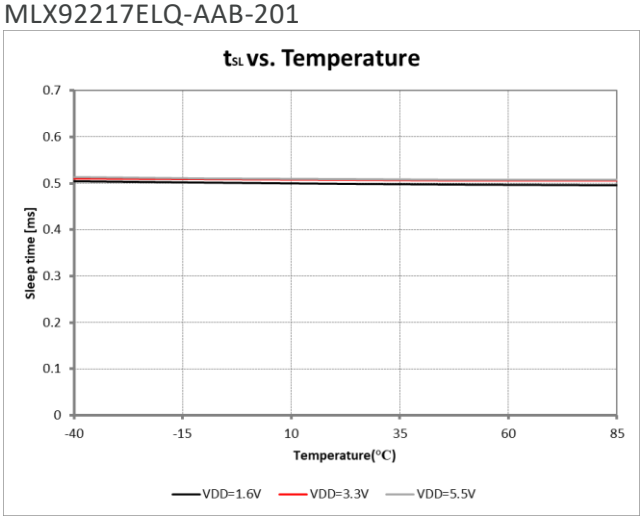
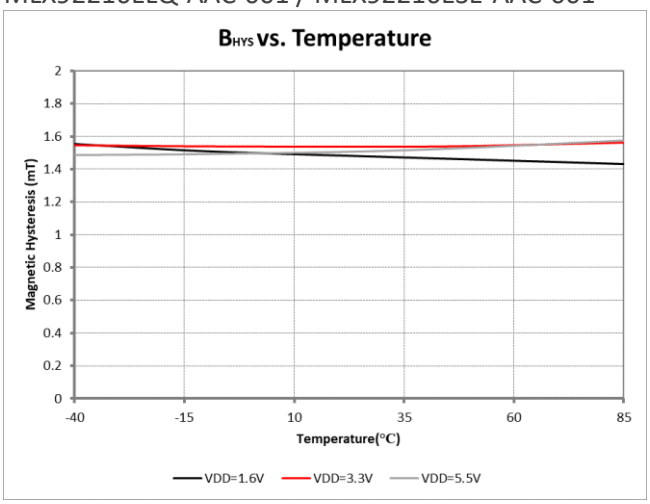


MLX92217ELQ-AAB-201

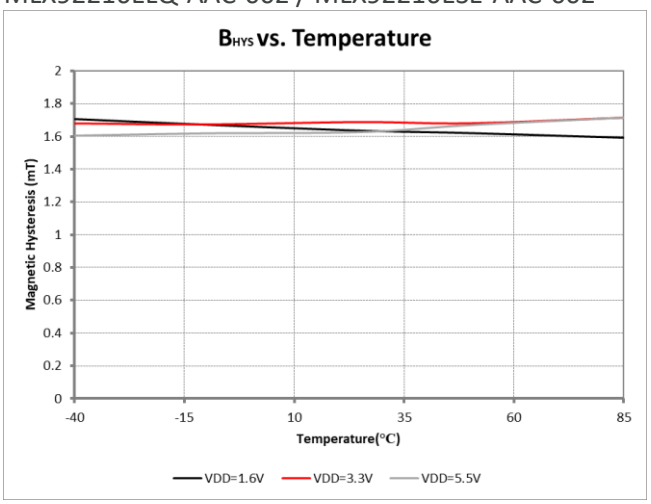


11.3. B_{HYST} vs. Temperature

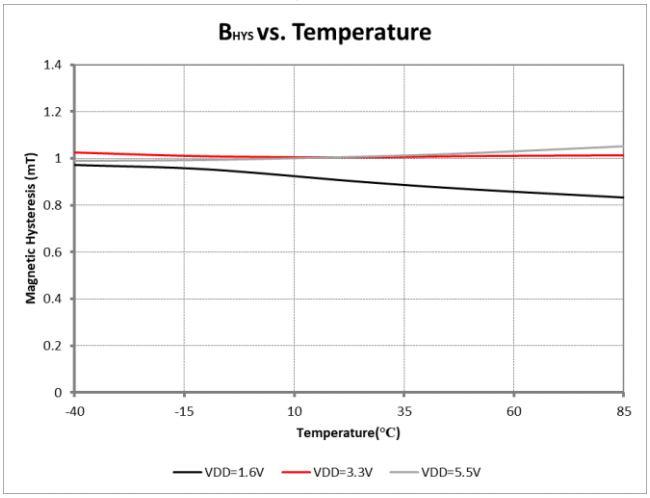
MLX92216ELQ-AAC-001 / MLX92216ESE-AAC-001



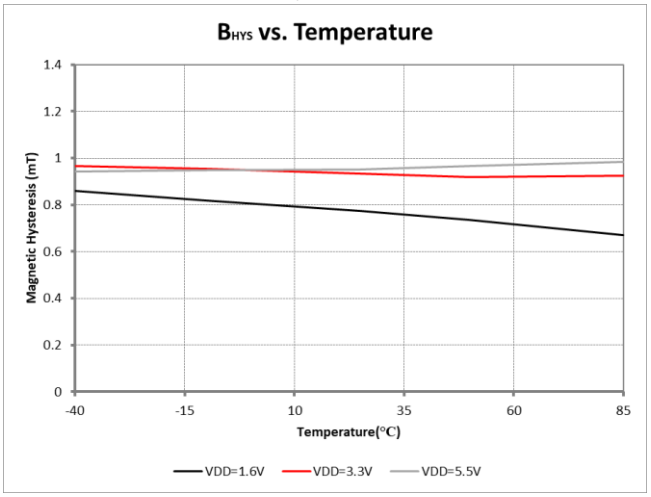
MLX92216ELQ-AAC-002 / MLX92216ESE-AAC-002



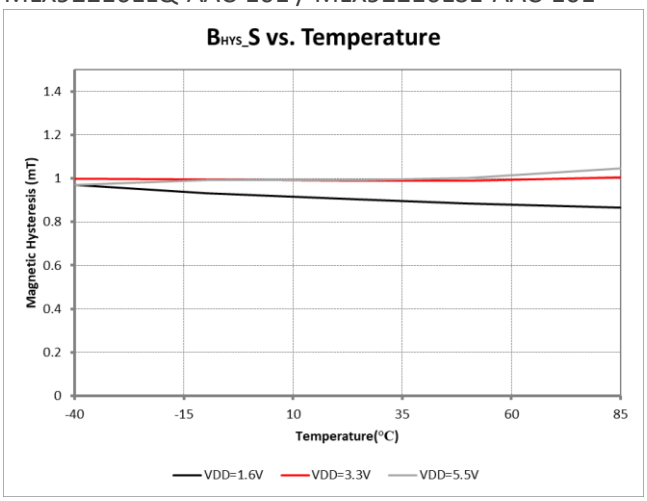
MLX92216ELQ-AAC-003 / MLX92216ESE-AAC-003



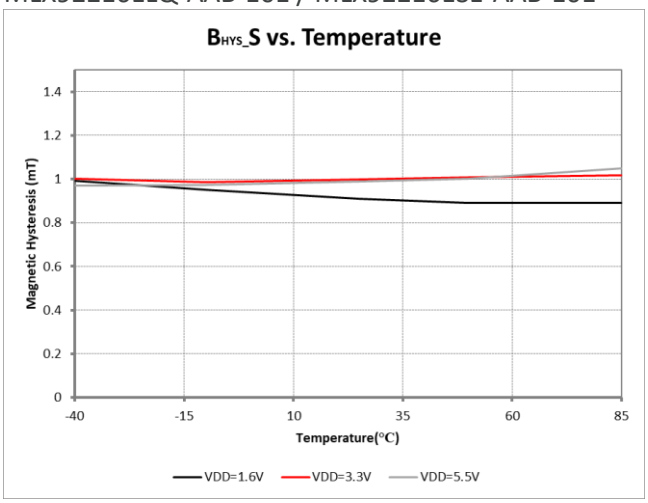
MLX92216ELQ-AAB-001 / MLX92216ESE-AAB-001



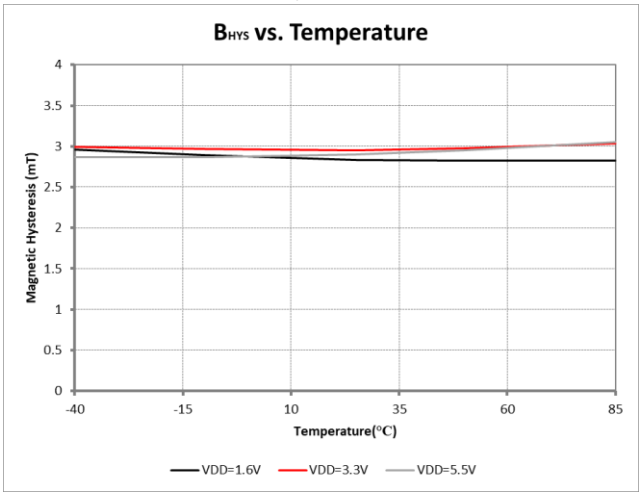
MLX92216ELQ-AAC-101 / MLX92216ESE-AAC-101



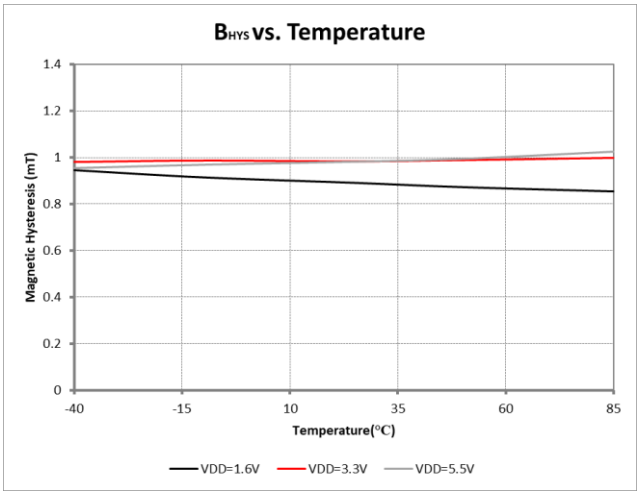
MLX92216ELQ-AAB-101 / MLX92216ESE-AAB-101



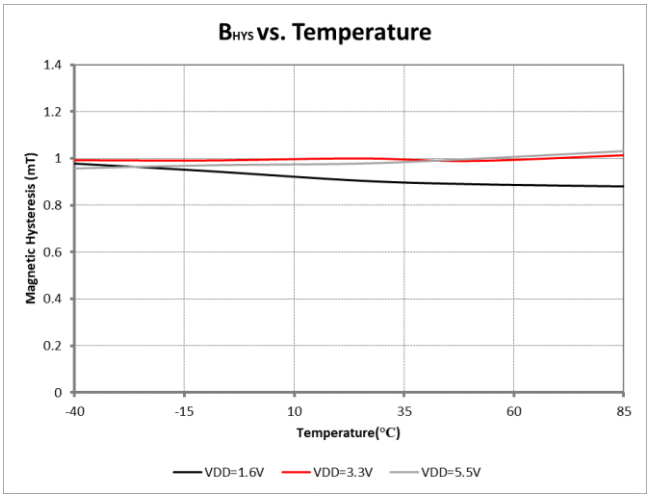
MLX92216ELQ-AAC-201 / MLX92216ESE-AAC-201



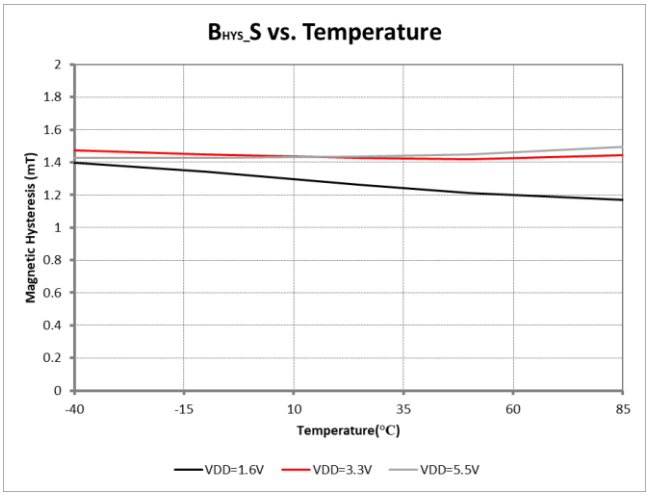
MLX92217ELQ-AAC-001



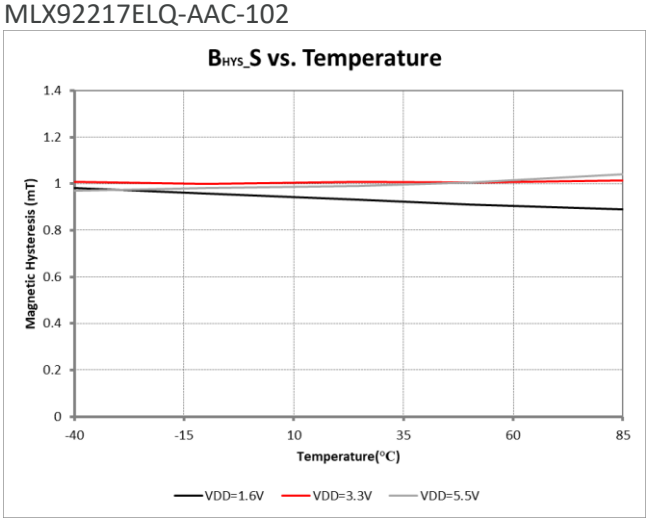
MLX92217ELQ-AAC-002



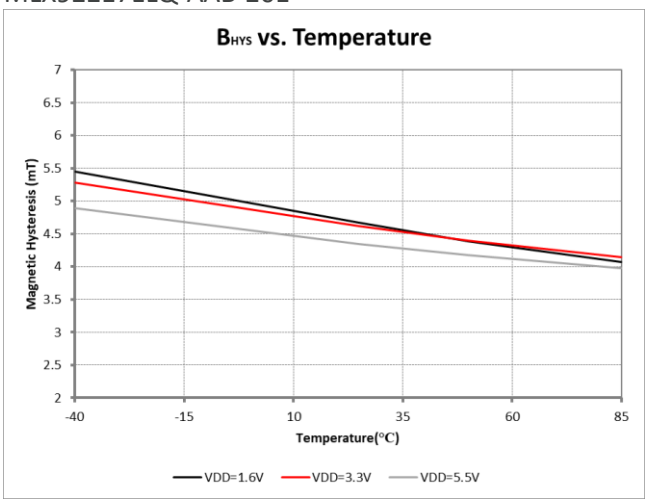
MLX92217ELQ-AAC-101



MLX92217ELQ-AAC-102

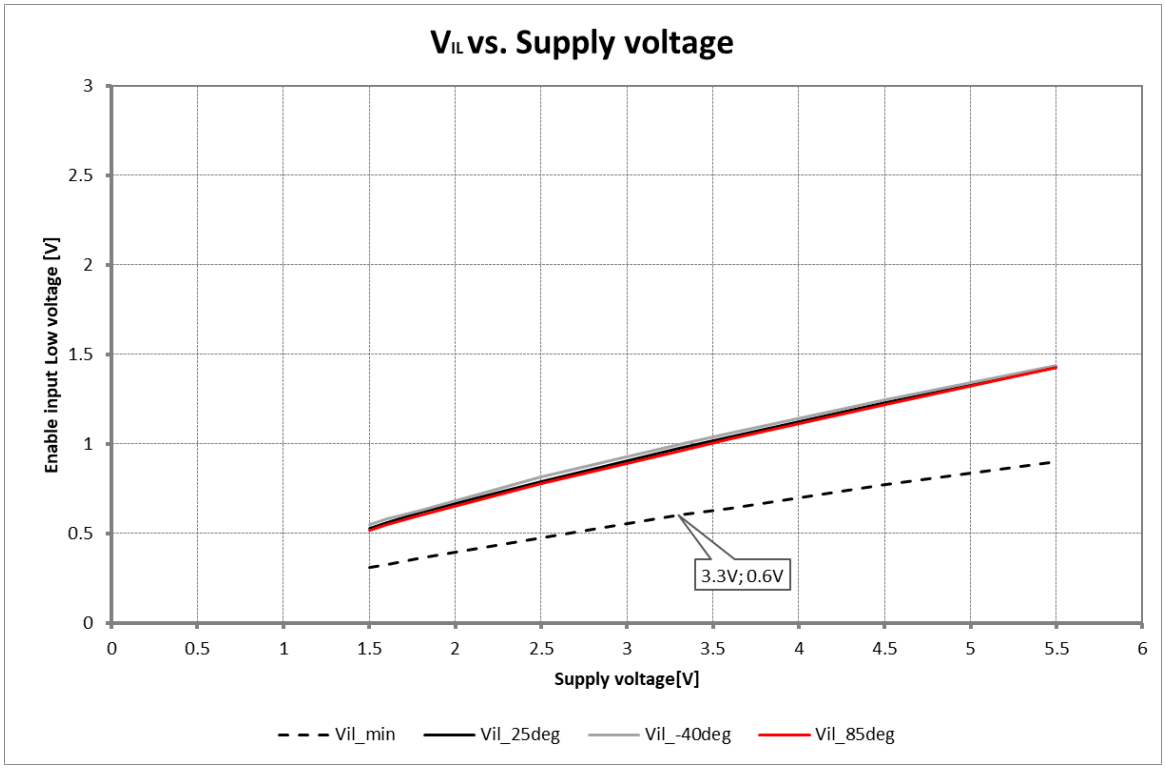


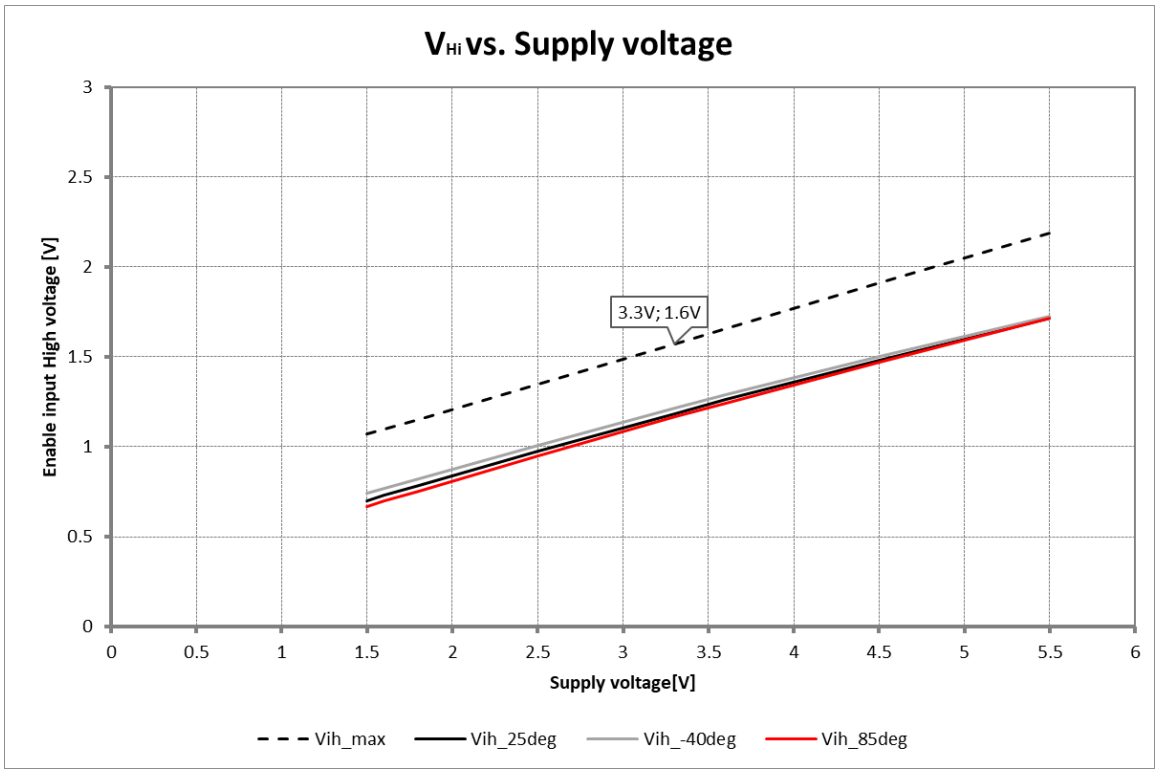
MLX92217ELQ-AAB-201[1]



[1] *Magnetic thresholds are based on a TC=-2000ppm/deg, therefore the hysteresis is influenced by the ambient temperature.*

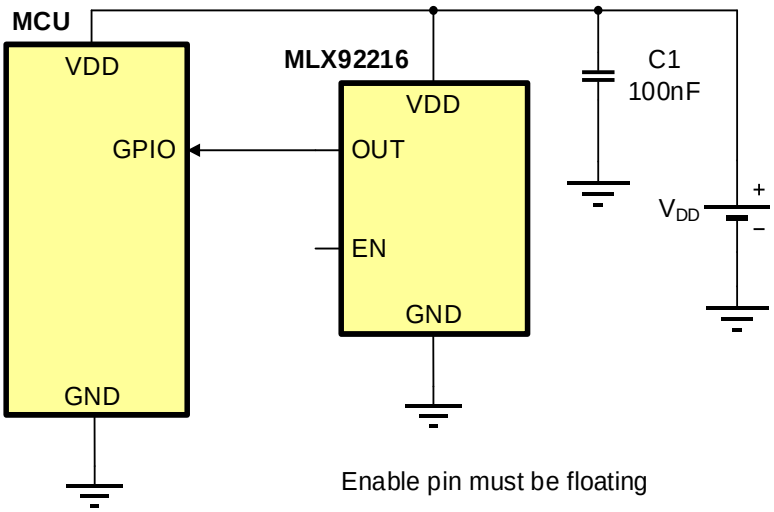
11.4. V_{IL} / V_{HI} Vs Supply voltage



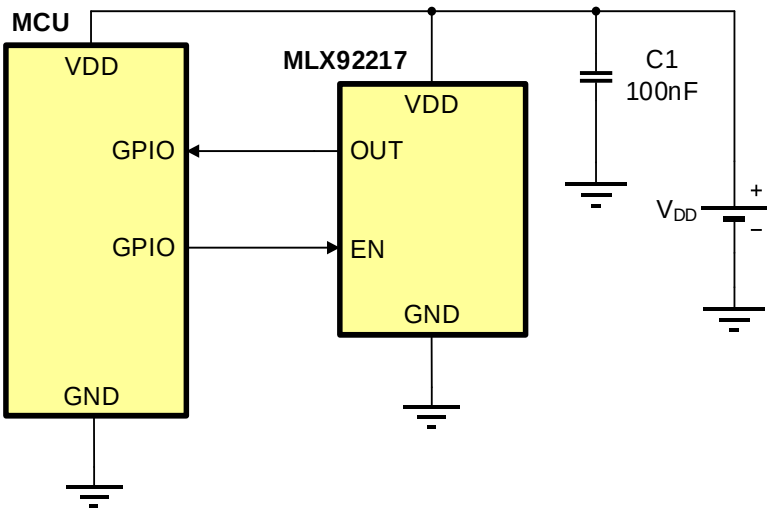


12. Typical application schematics

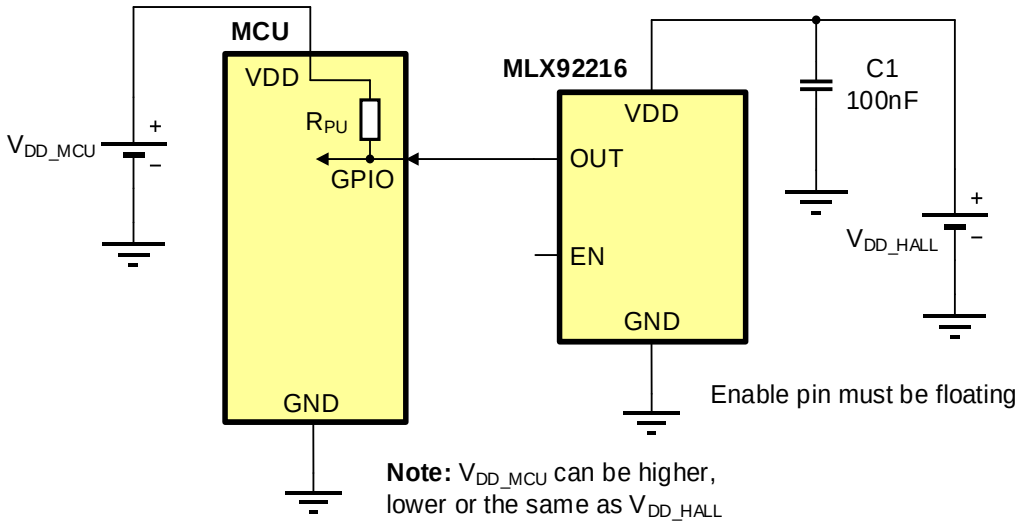
12.1. Push-Pull Output without Enable (MLX92216)



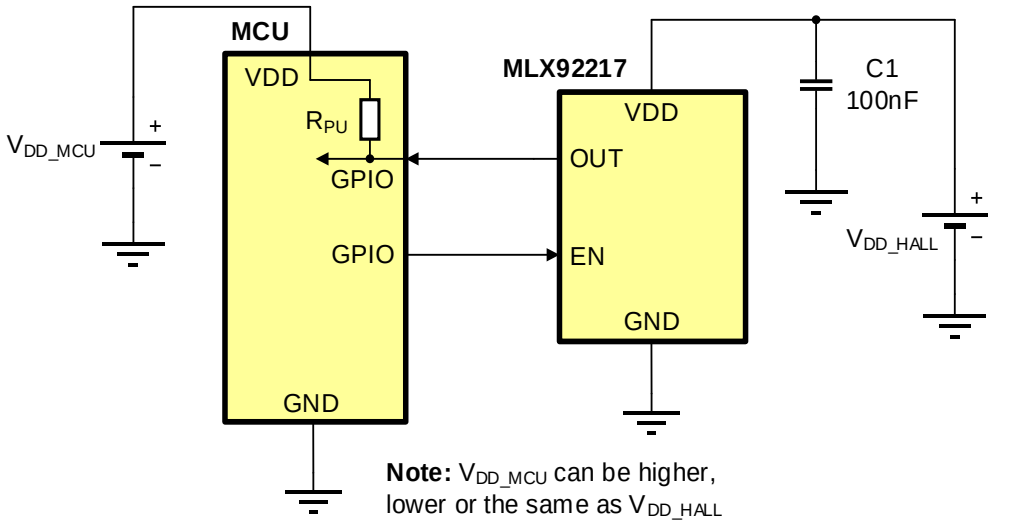
12.2. Push-Pull Output with Enable (MLX92217)



12.3. Open Drain Output without Enable (MLX92216)



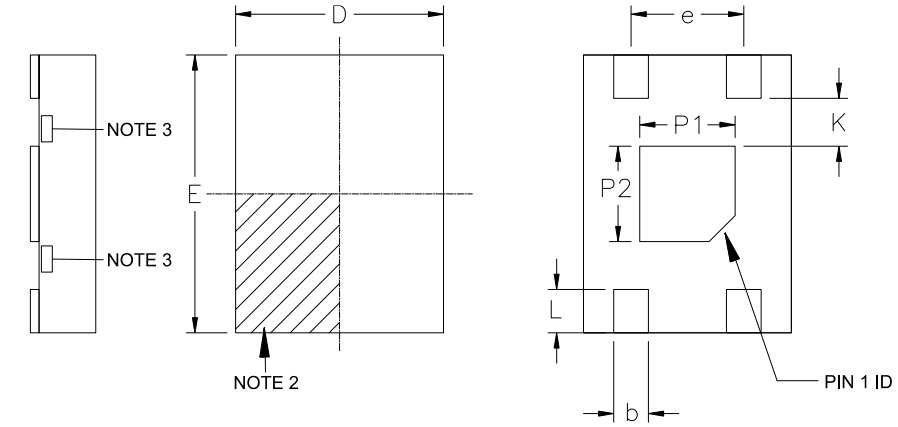
12.4. Open Drain Output with Enable (MLX92217)



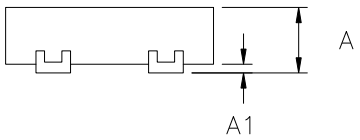
13. Package Information

13.1. DFN-4L (LQ Package)

13.1.1. DFN-4L – Package dimensions

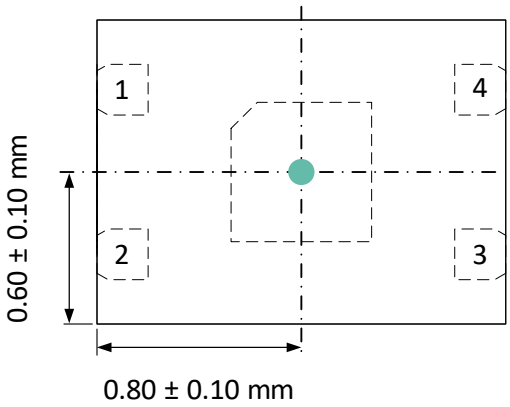


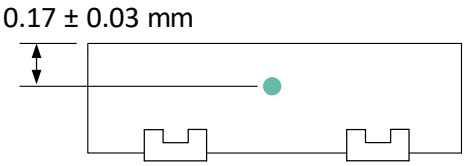
SYMBOL	MIN.	NOM.	MAX.
A	0.35	0.38	0.40
A1	0.00	---	0.05
D	1.15	1.20	1.25
E	1.55	1.60	1.65
P1	0.45	0.55	0.65
P2	0.45	0.55	0.65
L	0.15	0.25	0.35
K	0.275 REF		
b	0.15	0.20	0.25
e	0.65 BSC		



NOTE :
1. ALL DIMENSIONS IN MILLIMETERS (mm).
2. TERMINAL #1 IDENTIFIER AND TERMINAL NUMBERING CONVENTION SHALL CONFORM JEDEC PUBLICATION 95 SPP-002. DETAILS OF TERMINAL #1 IDENTIFIER ARE OPTIONAL, BUT MUST BE LOCATED WITHIN THE ZONE IDENTICATED. THE TERMINAL #1 IDENTIFIER MAY BE MARKED FEATURE.
3. EXPOSED TIE BAR SHOULD BE KEPT FREE FROM SOLDER.

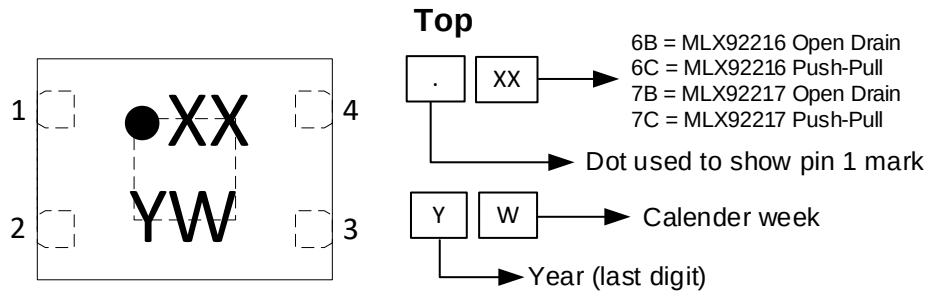
13.1.2. DFN-4L – Sensitive spot





Notes:
1. Terminals and exposed pad are for illustration only.
2. Hall plate center is aligned to package center.

13.1.3. DFN-4L – Package marking / Pin definition



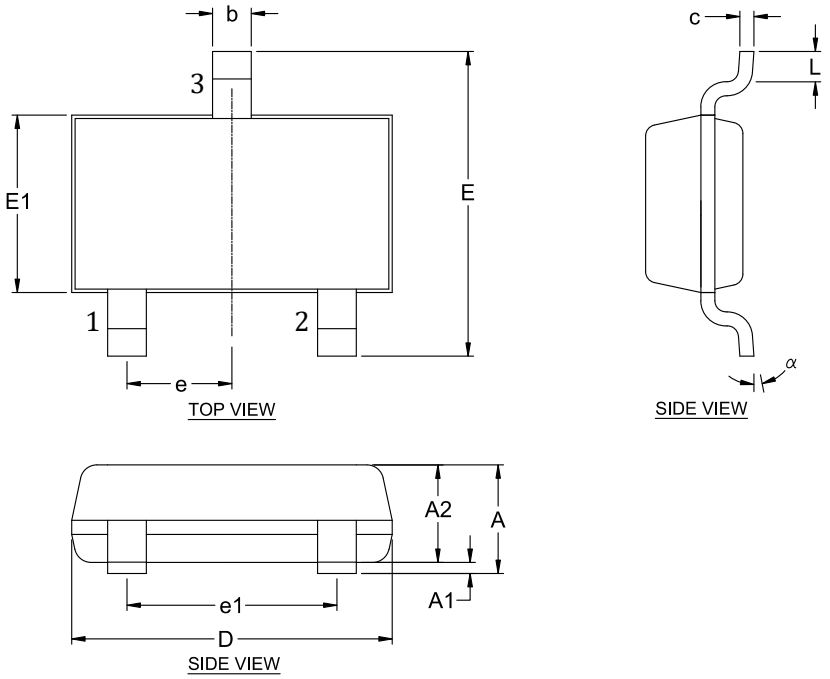
Pin #	Name	Type	Function
1	OUT	Output	Push-Pull or Open Drain
2	GND	Ground	Ground pin
3	EN*	Input	Chip Enable pin
4	VDD	Supply	Power supply pin

The exposed pad can be soldered to the PCB to improve thermal dissipation. Can be connected to the ground potential or left floating.

The Chip enable pin should be connected on MLX92217 versions, must be floating on MLX92216 versions.

13.2. TSOT-3L (SE package)

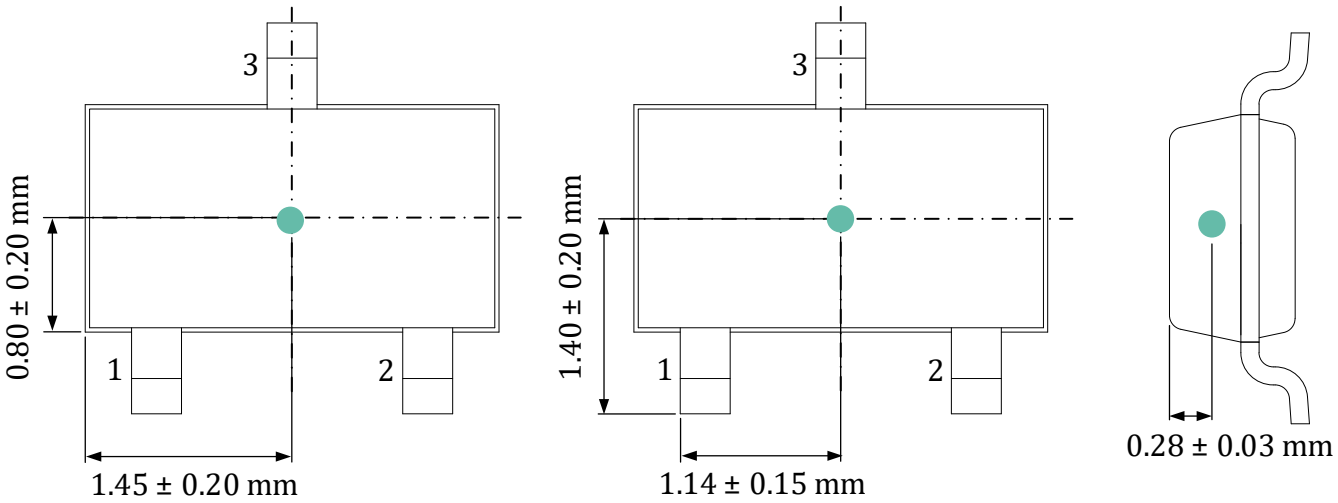
13.2.1. TSOT-3L – Package dimensions



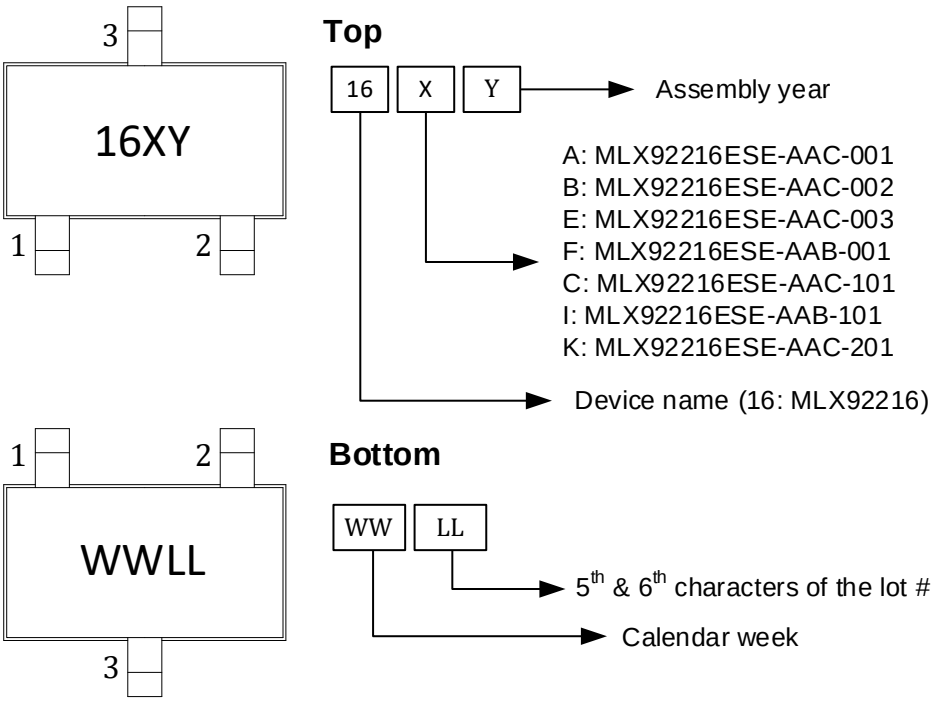
SYMBOL	MINIMUM	MAXIMUM
A	---	1.00
A1	0.025	0.10
A2	0.85	0.90
D	2.80	3.00
E	2.60	3.00
E1	1.50	1.70
L	0.30	0.50
b	0.30	0.45
c	0.10	0.20
e	0.95 BSC	
e1	1.90 BSC	
α	0°	8°

NOTE :
1. ALL DIMENSIONS IN MILLIMETERS (mm) UNLESS OTHERWISE STATED.
2. DIMENSION D DOES NOT INCLUDE MOLD FLASH OR PROTRUSIONS OF MAX 0.15 mm PER SIDE.
3. DIMENSION E DOES NOT INCLUDE MOLD FLASH OR PROTRUSIONS OF MAX 0.25 mm PER SIDE.
4. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION OF MAX 0.07 mm.
5. DIMENSION L IS THE LENGTH OF THE TERMINAL FOR SOLDERING TO A SUBTRATE.
6. FORMED LEAD SHALL BE PLANAR WITH RESPECT TO ONE ANOTHER WITH 0.076 mm SEATING PLANE.

13.2.2. TSOT-3L – Sensitive spot



13.2.3. TSOT-3L – Package marking/ Pin definition



Pin #	Name	Type	Function
1	VDD	Supply	Supply Voltage pin
2	OUT	Out	Open drain/ Push-Pull
3	GND	Ground	Ground pin

14. IC handling and assembly

14.1. Storage and handling of plastic encapsulated ICs

Plastic encapsulated ICs shall be stored and handled according to their MSL categorization level (specified in the packing label) as per J-STD-033.

Electronic semiconductor products are sensitive to Electro Static Discharge (ESD). The component assembly shall be handled in EPA (Electrostatic Protected Area) as per ANSI S20.20

For more information refer to Melexis *Guidelines for storage and handling of plastic encapsulated ICs*[1]

14.2. Assembly of encapsulated ICs

For Surface Mounted Devices (SMD, as defined according to JEDEC norms), the only applicable soldering method is reflow.

For Through Hole Devices (THD), the applicable soldering methods are reflow, wave, selective wave and robot point-to-point. THD lead pre-forming (cutting and/or bending) is applicable under strict compliance with Melexis *Guidelines for lead forming of SIP Hall Sensors*[1].

Melexis products soldering on PCB should be conducted according to the requirements of IPC/JEDEC and J-STD-001. Solder quality acceptance should follow the requirements of IPC-A-610.

For PCB-less assembly refer to the relevant application notes [1] or contact Melexis.

Electrical resistance welding or laser welding can be applied to Melexis products in THD and specific PCB-less packages following the *Guidelines for welding of PCB-less devices*[1].

Environmental protection of customer assembly with Melexis products for harsh media application, is applicable by means of coating, potting or overmolding considering restrictions listed in the relevant application notes [1]

For other specific process, contact Melexis via www.melexis.com/technical-inquiry

14.3. Environment and sustainability

Melexis is contributing to global environmental conservation by promoting non-hazardous solutions. For more information on our environmental policy and declarations (RoHS, REACH…) visit www.melexis.com/environmental-forms-and-declarations

[1] *www.melexis.com/ic-handling-and-assembly*

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