MLX91206

Triaxis Current Sensor IC

Features and Benefits

- Programmable high speed current sensor IC
- Wideband: DC to 90kHz
- Short response time
- Tria⊗is™ hall technology
- Programmable linear transfer characteristic
- Selectable
  - analog ratiometric output
  - PWM output with 12 bit resolution
- Thermometer output
- 17 bit ID Number
- SOIC8 package RoHS compliant
- Lead free component, suitable for lead free soldering profile 260°C (target), MSL3

Application Examples

- Contact-less Current Measurement
- DC-DC and DC-AC Converters
- HEV / EV Inverters (Motor Controller)
- Battery Current Monitoring
- Battery Charger
- Power Monitoring (Server, Telecommunication)
- Power Supplies (UPS and SMPS)
- Smart Fuse, Over-Current Protection
- Magnetic Field Monitoring

Ordering Information

Part No.	Temperature Code	Package Code	Option code	Sensitivity Range (Typ.)
MLX91206	L (-40°C to 150°C)	DC (SOIC)	CALA (10mT)	460-700mV/mT (580mV/mT)
MLX91206	L (-40°C to 150°C)	DC (SOIC)	CALB (10mT)	300-470mV/mT (380mV/mT)
MLX91206	L (-40°C to 150°C)	DC (SOIC)	CALC (10mT)	200-310mV/mT (250mV/mT)
MLX91206	L (-40°C to 150°C)	DC (SOIC)	CAHA (25mT)	210-330mV/mT (270mV/mT)
MLX91206	L (-40°C to 150°C)	DC (SOIC)	CAHB (25mT)	130-220mV/mT (170mV/mT)
MLX91206	L (-40°C to 150°C)	DC (SOIC)	CAHC (25mT)	80-140mV/mT (110mV/mT)

1 Functional Diagram

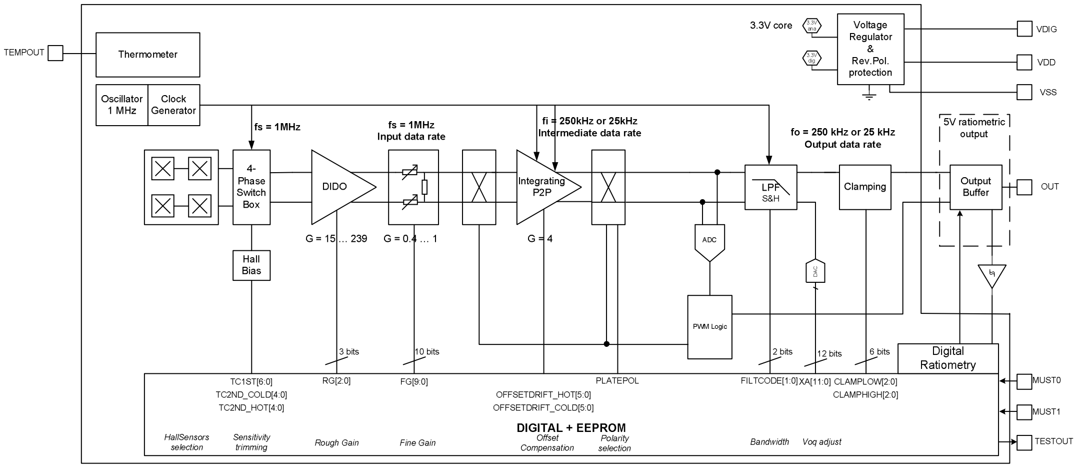


Figure 1: Block diagram

2 General Description

The MLX91206 is a monolithic sensor IC featuring the Tria⊗is™ Hall technology. Conventional planar Hall technology is only sensitive to the flux density applied orthogonally to the IC surface. The Tria⊗is™ Hall sensor is sensitive to the flux density applied parallel to the IC surface. This is obtained through an Integrated Magneto-Concentrator (IMC®) which is deposited on the CMOS die (as an additional back-end step). The IMC technology is automotive qualified.

The product is a single chip Hall sensor which provides an output signal which is proportional to the flux density applied horizontally and is therefore suitable for current measurement. It is ideally used as an open loop current sensor for PCB mounting. (see figure 2). It features small size application design and a simple construction for various current ranges.

The transfer characteristic of the MLX91206 is programmable (offset, gain, clamping levels, diagnostic functions…). The output is selectable between analog and PWM. The linear analog output is used for application where a very fast response (<10 µsec) is required, whereas the PWM output is used for application where low speed but high output signal robustness is required.

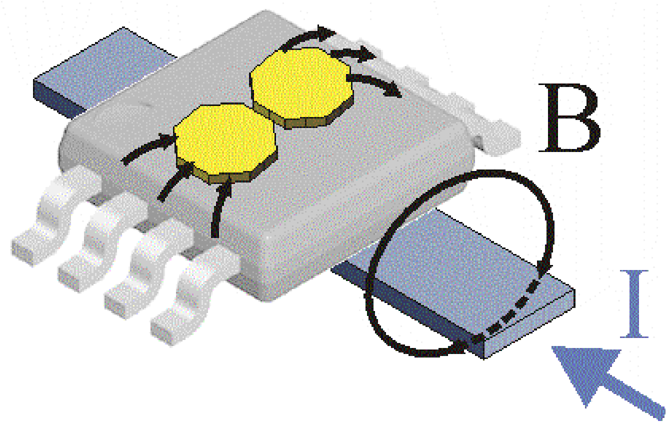


Figure 2: Typical application of MLX91206

Table of Contents

1 Functional Diagram ... 1
2 General Description ... 2
3 Glossary of Terms ... 4
4 Absolute Maximum Ratings ... 4
5 Pin Definitions and Descriptions ... 4
6 General Electrical Specifications ... 5
7 Magnetic specification ... 6
  7.1 25 mT version (marking xxH) ... 6
  7.2 10 mT version (marking xxL) ... 6
8 Analog output specification ... 7
  8.1 Timing specification ... 7
  8.2 Accuracy specification ... 7
  8.3 Remarks to the achievable accuracy ... 7
9 PWM output specification ... 8
  9.1 Timing specification for the PWM output ... 8
  9.2 Accuracy specification transfer characteristic PWM ... 9
10 Thermometer output specification ... 9
11 Programmable items ... 10
  11.1 Parameter table ... 10
  11.2 Output mode configuration (DSPMODE, OUTMODE) ... 11
  11.3 Output impedance mode (DIAGINFAULT) ... 11
  11.4 Reference edge (REFEDGE) – only in PWM mode ... 11
  11.5 PWM/switch mode (SWITCH) ... 11
  11.6 Platepol (PLATEPOL) ... 12
  11.7 Sensitivity programming (ROUGHGAIN, FINEGAIN) ... 12
  11.8 Offset / output quiescent voltage programming (XA, YA) ... 12
  11.9 Clamping level programming (CLAMPLOW, CLAMPHIGH) ... 13
  11.10 Bandwidth and filter programming (FILTCODE) ... 14
  11.11 Power limitation / PWM rise and fall time (OUTSLOPE) ... 15
  11.12 PWM Mode duty cycle definition (DCDEF) ... 15
  11.13 Output Ratiometry (RATIODIS) ... 15
  11.14 Sensitivity and temperature drift programming (TC1ST, TC2ND_COLD, TC2ND_HOT) ... 16
  11.15 Offset temperature drift programming (OFFDRIFT_COLD, OFFDRIFT_HOT) ... 16
  11.16 Product Identification (MLXID, CSTID) ... 16
12 Self-diagnostic ... 17
13 Application information ... 18
  13.1 Low current measurement up to ±2 A ... 18
  13.2 Medium current up to ±30 A ... 18
  13.3 High current measurement up to ±600 A ... 18
14 Recommended Application Diagrams ... 19
  14.1 Resistor and capacitor values ... 19
  14.2 Fast analog application, pull-down resistor for diagnostic low ... 19
  14.3 Fast analog application, pull-up resistor for diagnostic high ... 20
  14.4 Robust PWM application, (pull-up load only) ... 20
15 Standard information regarding manufacturability of Melexis products with different soldering processes ... 21
16 ESD Precautions ... 21
17 Package Information ... 22
  17.1 SOIC8 Package dimensions ... 22
  17.2 SOIC8 Pinout and Marking ... 22
  17.3 SOIC8 Hall plate position ... 23
  17.4 IMC Position and sensors active measurement direction ... 23
18 Disclaimer ... 24

3 Glossary of Terms

Tesla	Units for the magnetic flux density, 1 mT = 10 Gauss
TC	Temperature Coefficient in ppm/deg C
NC	Not Connected
PWM	Pulse Width Modulation
%DC	Duty Cycle of the output signal i.e. T_{ON} /(T_{ON} + T_{OFF})
ADC	Analog to Digital Converter
DAC	Digital to Analog Converter
LSB	Least Significant Bit
MSB	Most Significant Bit
DNL	Differential Non Linearity
INL	Integral Non Linearity
IMC	Integrated Magneto Concentrator (IMC®)
PTC	Programming Through Connector

4 Absolute Maximum Ratings

Parameter	Symbol	Value	Units
Positive Supply Voltage (overvoltage)	Vdd	+20	V
Reverse Supply Voltage Protection		-10	V
Positive Output Voltage		+10 +14 (200 s max, T_A = +25℃)	V
Output Current	Iout	±300	mA
Reverse Output Voltage		-0.3	V
Reverse Output Current		-50	mA
Operating Ambient Temperature Range	T_A	-40 to +150	℃
Storage Temperature Range	T_S	-55 to +165	℃
Magnetic Flux Density		±0.2	T

Table 1: Absolute maximum ratings

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

5 Pin Definitions and Descriptions

Pin №	Name	Type	Function
1	VDD	Supply	Supply Voltage
2	VSS	Ground	Supply Voltage
3	VDIG	Supply	Digital supply voltage, 3.3 V, internal regulated
4	MUST1	Digital	Test pin
5	OUT / PWM	Analog/Digital	Current sensor output
6	TESTOUT	Digital	Test pin
7	MUST0	Digital	Test pin
8	TEMPOUT	Analog	Temperature Sensor Output

Table 2: Pin definition and description

It is recommended to connect the unused pins to the Ground (see section 16) for optimal EMC results.

6 General Electrical Specifications

Operating Parameters : T_A = -40 to 125degC, Vdd = 4.5 V to 5.5 V, Iout = -2 mA to +2 mA, recommended application diagram in section 16, unless otherwise specified. All mentioned component values can have a ±20% tolerance

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Nominal Supply Voltage	Vdd		4.5	5	5.5	V
Supply Current	Idd	W/o output load & T_A = -40 to 150°C - ROUGHGAIN ≤ 3 - ROUGHGAIN > 3		 7 9	 10 12	 mA mA
Output Current	Iout		-2		2	mA
Output Resistance		Vout = 50% Vdd, R_L = 5kΩ		1	5	Ω
Output Capacitive Load	C_{load}	Analog Mode	5	10	50	nF
		PWM Mode	0	10	50	nF
Output Short Circuit Current	I_{short}	Output shorted to Vdd- Permanent	Not Destroyed			
		Output shorted to Vss - Permanent	Not Destroyed			
Leakage current	I_{leak}	High impedance mode (2)			5	uA
Output Voltage Swing (Linear Range)	V_{out_pd}	pull down ≥ 10 kΩ	5		95	%Vdd
	V_{out_pu}	pull up ≥ 10 kΩ	5		95	%Vdd
High-impedance mode levels(2)	$V_{out\_HiZ\_pu}$	pull-up R_L ≤ 30 kΩ	97			%Vdd
	$V_{out\_HiZ\_pd}$	pull-down R_L ≤ 30 kΩ			3	%Vdd
BrokenVss Output Levels(2)	OUT with pull-down R_L ≤ 10 kΩ (3)				3	%Vdd
	OUT with pull-up R_L ≤ 30 kΩ (3)		97			%Vdd
BrokenVdd Output Levels(2)	OUT with pull-down R_L ≤ 30 kΩ (3)				3	%Vdd
	OUT with pull-up R_L ≤ 30 kΩ (3)		97			%Vdd
Under-voltage detection (2) (4)	V_{dd_uvd}	Detected Voltage (Low to High)	3.15	3.3	3.45	V
	V_{dd_uvh}	Hysteresis	0.25	0.3	0.4	V
Over-voltage detection mode 1 (2) (4)	V_{dd_ovd1}	Detected Voltage (Low to High)	7.9		9.5	V
	V_{dd_ovh1}	Hysteresis	0.8		1.6	V
Over-voltage detection mode 2 (2) (4)	V_{dd_ovd2}	Detected Voltage (Low to High)	6.7		7.6	V
	V_{dd_ovh2}	Hysteresis	0.05		0.5	V
Clamped Output Level	Clamp_lo	Trimming Range	5 (1)		10	%Vdd
	Clamp_hi	Trimming Range	90		95 (1)	%Vdd

Table 3: General electrical parameter

(1) Factory programmed clamping level
(2) Refer to chapter ***Self-diagnostic, table 21.***
(3) Valid for TEMPOUT with pull-up (min. 30kΩ), pull-down (min. 30kΩ) or not connected
(4) According to the figure below

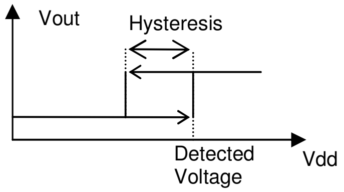


Figure “Detected voltage and hysteresis definitions”

7 Magnetic specification

7.1 25 mT version (marking xxH)

Operating Parameters T_A = -40 to 125degC, Vdd = 4.5 V to 5.5 V, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Nominal Field Range	Bnom		-20		+20	mT
Operational Field Range (1)	Bop		-25		+25	mT
Linearity Error	NL	Nominal Field Range (25°C)	-0.5		+0.5	%FS
		Operational Field Range (25°C)	-0.75		+0.75	%FS
Hysteresis, remanent Field	Br	B = Bop	-25		+25	uT
Programmable Sensitivity (2)	S	B = Bop , PWM Mode	1	2	6	%DC/mT
		B = Bop , Analog Mode	80		330	mV/mT
Sensitivity programming Resolution	Sres	B = Bop		0.1		%

Table 4: Magnetic specification 25mT version (high-field version)

(1) Above 25 mT, the IMC starts saturating yielding to an increase of the linearity error.
(2) The specified programmable sensitivity range is covered by 3 different versions (option codes)

Option code (25mT)	**Programmed Sensitivity**	**Sensitivity Range**
A	270mV/mT	210-330mV/mT
B	170mV/mT	130-220mV/mT
C	110mV/mT	80-140mV/mT

7.2 10 mT version (marking xxL)

Operating Parameters T_A = -40 to 125degC, Vdd = 4.5 V to 5.5 V (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Nominal Field Range	Bnom		-7.5		+7.5	mT
Operational Field Range (3)	Bop		-10		+10	mT (2)
Linearity Error	NL	Nominal Field Range (25°C)	-0.5		+0.5	%FS
		Operational Field Range (25°C)	-0.75		+0.75	%FS
Hysteresis, remanent Field	Br	B = Bop	-10		+10	uT
Programmable Sensitivity (4)	S	B = Bop , PWM Mode	2	5	14	%DC/mT
		B = Bop , Analog Mode	200		700	mV/mT
Sensitivity programming Resolution	Sres	B = Bop		0.1		%

Table 5: Magnetic specification 10mT version (low-field version)

(3) Above 10 mT, the IMC starts saturating yielding to an increase of the linearity error.
(4) The specified programmable sensitivity range is covered by 3 different versions (option codes)

Option code (10mT)	**Programmed Sensitivity**	**Sensitivity Range**
A	580mV/mT	460-700mV/mT
B	380mV/mT	300-470mV/mT
C	250mV/mT	200-310mV/mT

8 Analog output specification

8.1 Timing specification

Operating Parameters T_A = -40 to 125degC, Vdd = 4.5 V to 5.5 V (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Step Response Time	Tresp	Voq ± 2 V		8	10	µs
Bandwidth	BW	Full Range	50	70	90	kHz
Power on Delay	T_{POD}	Vout =100% of FS (BW = 100 Hz) (BW = 1000 Hz) (BW = 10 kHz) (BW = 100 kHz – No filter)			 100 10 5 5	 ms ms ms ms
Ratiometry Cut-off Frequency	Fratio			250		Hz

Table 6: Timing specification high speed analog output

8.2 Accuracy specification

Operating Parameters T_A = -40 to 125degC, Vdd = 4.5 V to 5.5 V (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Thermal Offset Drift	$\Delta^T Voq$	MLX91206H	-0.4		+0.4	%Vdd
		MLX91206L	-0.4		+0.4	
Thermal Sensitivity Drift	TC		-150		+150	ppm/°C
RMS Output noise	N_{rms}	S = 6 %Vdd/mT (= 300 mV/mT @ Vdd=5V)			0.1	%Vdd
Voq Ratiometry	ΔVoq	Voq = 50%Vdd ΔVdd = 10%Vdd	9.8		10.2	%
Sensitivity Ratiometry	ΔS	ΔVdd = 10%Vdd B = Bop	9.8		10.2	%
Clamped output accuracy	Clamp_lo Clamp_hi	Trimming range: 5-10%Vdd Trimming range: 90-95%Vdd	-1		1	%Vdd

Table 7: Accuracy specific parameter analog output

8.3 Remarks to the achievable accuracy

The achievable target accuracy is dependent on users end-of-line calibration. The resolution for the offset and offset drift calibration is better than 0.1%Vdd. Trimming capability is higher the measurement accuracy. End-user calibration can increase the accuracy of the system.

9 PWM output specification

9.1 Timing specification for the PWM output

Operating Parameters T_A = -40 to 125degC, Vdd = 4.5 V to 5.5 V (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Main Oscillator Frequency	F_{OSC}	Tolerance ± 10%	900	1024	1100	kHz
PWM Output Frequency	F_{PWM}		110	125	140	Hz
Tick Time (resolution in time domain)	t_{TICK}			1		µs
PWM Output Resolution	R(PWM)	12 Bit, Theoretical Jitter free		0.025		%DC
PWM Jitter (1 Sigma)	J (PWM)	FILTCODE = 5 (70 Hz Digital LowPass Filter)		0.01		%DC (1 Sigma)
Output Rise Time (10%-90%)	t_{RISEOD}	Push-pull mode R_L = 4.7 kΩ to 5 V, C_L = 10 nF OUTSLOPE = 0		11		µs
		OUTSLOPE = 1		7		µs
		OUTSLOPE = 2		4		µs
		OUTSLOPE = 3		2.5		µs
Output Fall Time (90%-10%)	T_{FALLOD}	Push-pull or open-drain mode R_L = 4.7 kΩ to 5 V, C_L = 10 nF OUTSLOPE = 0		14		µs
		OUTSLOPE = 1		8		µs
		OUTSLOPE = 2		4.5		µs
		OUTSLOPE = 3		2.5		µs
Clamped Output Level	Clamp_lo	Programmable	1		10	%DC
	Clamp_hi	Programmable	90		99	%DC
Power-on delay	T_{POD}				11	ms

Table 8: Timing specification for the PWM output

9.2 Accuracy specification transfer characteristic PWM

Operating Parameters T_A = -40 to 125degC, Vdd = 5.0 V (unless otherwise specified), S = 4%DC/mT

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Thermal Offset Drift	$\Delta^T Voq$		-0.4		+0.4	%DC
Thermal Sensitivity Drift	TC		-150		+150	ppm/°C

Table 9: Accuracy specific parameter PWM output

10 Thermometer output specification

The thermometer output voltage is in the range from 367mV to 2930mV for temperatures ranging from -40 to 150degC. The accuracy is better than 5degC. The pin shall be able to sustain a low impedance connection to maximum 14V. This output is not ratiometric**.**

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Offset	T_{35}	Output voltage with T = 35degC		1.38		V
Slope	T_{slope}			13.5		mV/degC
Accuracy	T_{acc}		-5		5	degC
Load capacitor	$C_{loadTherm}$	External through bonding wire		1	50	nF
Output current	$I_{outtherm}$		-0.1		+0.1	mA

Table 10: Thermometer output specification

11 Programmable items

11.1 Parameter table

Depending on PWM/Analog mode (DSPMODE) some parameters have different functions.

Parameter	Bits	Factory Setting	Comment
DSPMODE	1	0	Selection analog or PWM output
OUTMODE	1	1	Capacitive load selection in analog mode
		N/A	Push pull or open drain output drive in PWM mode
DIAGINFAULT	1	0	Output impedance setting
REFEDGE	1	0	Not used in analog mode
			Diagnostic level & reference edge
SWITCH	1	0	Not used in analog mode
			PWM or SWITCH output selection
PLATEPOL	1	0	Change of sensitivity sign
ROUGHGAIN	3	Trimmed	Rough gain preamplifier
FINEGAIN	10	Trimmed	Fine gain from 0.4 to 1.0 in analog mode
	13	Trimmed	Fine gain from -3.999 to +3.999 in PWM mode
XA	12	Trimmed	Offset compensation VOQ in analog mode
	14	Trimmed	Digital offset in PWM mode
YA	9	N/A	Not used in analog mode
		32	Rough offset compensation in PWM mode
CLAMPLOW	3	Trimmed	Clamping low level in analog mode
		N/A	Not used in PWM mode
CLAMPHIGH	3	Trimmed	Clamping high level in analog mode
		2	Clamping high and low level for PWM output
FILTCODE	3	0	Analog filter in analog mode
	4	2	Digital filter in PWM mode
OUTSLOPE	2	3	Power limitation of the output driver on high frequencies in analog mode
			Output slope control for PWM mode
DCDEF	1	0	Not used in analog mode
		1	PWM duty cycle definition
RATIODIS	1	0	Disable ratiometry between output signal and supply
		N/A	Not used in PWM mode
TC1ST	7	Trimmed	Sensitivity temperature drift correction first order
TC2ND_COLD	5	Trimmed	Sensitivity temperature drift correction second order for cold temperatures
TC2ND_HOT	5	Trimmed	Sensitivity temperature drift correction second order for hot temperatures
OFFDRIFT_COLD	6	Trimmed	Offset temperature drift correction for cold temperatures
OFFDRIFT_HOT	6	Trimmed	Offset temperature drift correction for hot temperatures
MLXID	48	Programmed	MLX ID
CSTID	17	N/A	Customer ID

Table 11: Customer programmable items

11.2 Output mode configuration (DSPMODE, OUTMODE)

DSPMODE activates the PWM or the analog mode for the output signal. OUTMODE configures the output driver.

DSPMODE	OUTMODE	Output Driver
0	0	Fast analog mode, C_L = 1nF..10nF(1) (2)(3)
0	1	Normal analog mode, C_L = 5nF..50nF (1) (2)(4)
1	0	PWM mode – Open drain
1	1	PWM mode – Push pull

Table 12: Output configuration

(1) See section 16, $C_L = C_4$.
(2) Factory setting: DSPMODE = 0, OUTMODE = 1.
OUTMODE = 1 is recommended due to better EMC robustness
(3) For applications directly integrated on a PCB, smaller capacitors are allowed at the output pins.
(4) For a standalone application where a cable is connected at the output of the sensor.

11.3 Output impedance mode (DIAGINFAULT)

DIAGINFAULT sets the output impedance mode.

DIAGINFAULT	Output impedance
0	Low impedance mode (normal mode)
1	High impedance mode (diagnostic level)

11.4 Reference edge (REFEDGE) – only in PWM mode

REFEDGE defines the diagnostic level and sets the reference edge.

REFEDGE	Reference edge (PWM)
0	Falling edge
1	Rising edge

11.5 PWM/switch mode (SWITCH)

In PWM mode, the output can be configured to switch mode.

SWITCH	Operating mode
0	Disable switch mode
1	Enable switch mode

11.6 Platepol (PLATEPOL)

The polarity of the Hall plate versus the output signal is programmable by the PLATEPOL parameter.

PLATEPOL	Polarity
0	Positive
1	Negative

11.7 Sensitivity programming (ROUGHGAIN, FINEGAIN)

The sensitivity is programmable with 3 bits for ROUGHGAIN and 10 bits for FINEGAIN in analog output application from 50 to 300 V/T (91206-High-Field version) and from 100 to 700 V/T (Low-Field version). The FINEGAIN resolution depends on the programmed ROUGHGAIN setting. It typically ranges from 0.25V/T (ROUGHGAIN=7) up to 0.01V/T (ROUGHGAIN=0)

Note: Power consumption is 2mA less if ROUGHGAIN ≤ 3

11.8 Offset / output quiescent voltage programming (XA, YA)

XA

In analog mode

- 12-bit register
- Offset compensation before gain
- @ 0 Gauss w/o offset & @Vdd=5V → Vout = 6.25 * (VOQ Code) / 4096 (clipping can occur!)
- Programming resolution:1.5mV per LSB over the full output range. This corresponds to a calibration resolution of 0.03%Vdd

In PWM mode

- 14-bit register – digital offset VOQ
- Offset compensation before gain

YA

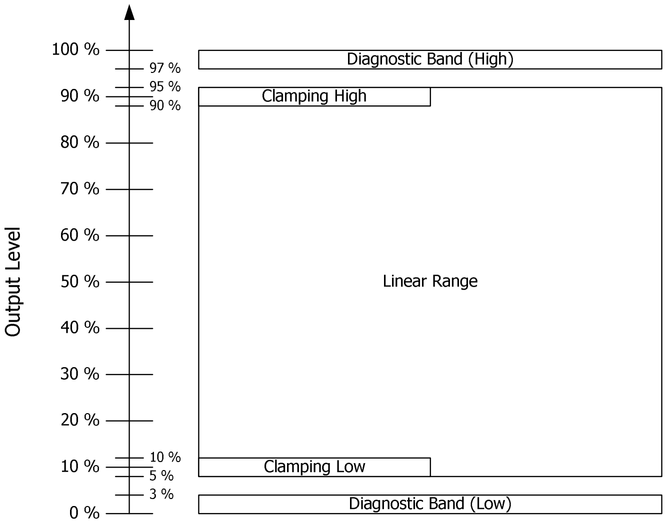
Not used in analog mode

In PWM mode

- 9-bit register
- Rough offset compensation (after gain)

11.9 Clamping level programming (CLAMPLOW, CLAMPHIGH)

The clamping levels limit the maximum and minimum output levels. The clamping levels are ratiometric (if RATIODIS = 0). The CLAMPLOW parameter adjusts the minimum output voltage level from 5%...10%Vdd. The CLAMPHIGH parameter sets the maximum output voltage level from 90...95%Vdd.



CLAMPLOW	Minimal output [%Vdd]
0	4.8
1	5.7
2	6.6
3	7.5
4	8.4
5	9.3
6	10.2
7	11.2

Table 13: Clamping low level table analog (typical values)

CLAMPHIGH	Maximal output [%Vdd]
0	90.6
1	91.4
2	92.4
3	93.3
4	94.3
5	95.2
6	96.1
7	97

Table 14: Clamping high level analog mode (typical values).

The clamping functionality can be disabled by programming CLAMPLOW=CLAMPHIGH=7

CLAMPHIGH	Minimal output [%DC]	Maximal output [%DC]
0	1	99
1	4	96
2	5	95
3	6	94
4	7	93
5	8	92
6	9	91
7	10	90

Table 15: Clamping low and high duty-cycle in PWM mode.

11.10 Bandwidth and filter programming (FILTCODE)

FILTCODE allows adjusting the internal bandwidth of the sensor in order to optimize for speed or resolution.

FILTCODE	Typical Bandwidth [kHz]
0	90 (1)
1	9
2	40
3	2
4	9
5	0.9
6	4
7	0.2

Table 16: FILTCODE settings analog mode

(1) Factory settings: FILTCODE = 0.

FILTCODE	Cut-off frequency [Hz]	Attenuation [dB]	Tau [ms]
2	557	-8.0	0.29
3	279	-11.2	0.57
4	139	-14.4	1.14
5	70	-18.1	2.29
6	35	-22.4	4.57
7	17	-27.1	9.14
8	9	-32.3	18.29
9	4	-38.1	36.57

Table 17: FILTCODE settings PWM mode

Note:

- In analog mode values above 7 are not used
- In PWM mode values below 2 and above 9 are not used

11.11 Power limitation / PWM rise and fall time (OUTSLOPE)

OUTSLOPE, in the analog mode case, defines the power limit above which the output driver turns off to prevent damages to the IC.

The power dissipated in the IC output driver is measured by the IC itself. The power is obtained by multiplying continuously the voltage across the conducting MOS driver by the output current I_{out}. When the power reaches the power limit, the output driver is switched off and on such that, on average, the measured power is maintained equal to the power limit. For OUTSLOPE = 3, the output driver is always enabled independently of the measured power.

Value	Power limitation [mW]
0	50
1	100
2	200
3	DISABLED(1)

Table 18: Output power limitation in analog mode

(1) Factory settings: OUTSLOPE = 3.

OUTSLOPE, in the PWM mode case, defines the rise and fall times of the PWM transients.

Value	Typical Rise Time	Typical Fall Time	Current Limitation [mA]
0	11	14	5
1	7	8.5	7
2	4	4.5	13
3	2.5	2.5	22

Table 19: PWM rise and fall time, Cout = 10nF, Rpullup = 4.7kOhms

11.12 PWM Mode duty cycle definition (DCDEF)

The PWM duty cycle definition is as follows.

DCDEF	PWM duty cycle definition
0	tLow / (tLow + tHigh)
1	tHigh / (tLow + tHigh)

Table 20: PWM duty cycle definition

11.13 Output Ratiometry (RATIODIS)

RATIODIS allows enabling and disabling the ratiometry of the output in reference to the supply voltage by setting a 1 as value. By default the MLX91207 is programmed in ratiometric mode

RATIODIS	Ratiometry
0	Enabled
1	Disabled

11.14 Sensitivity and temperature drift programming (TC1ST, TC2ND_COLD, TC2ND_HOT)

First order sensitivity temperature drift can be trimmed from -2000 to 2000 ppm/degC with TC1ST. The programming resolution is 40 ppm/degC.
Second order sensitivity temperature drift can be trimmed from -6 to 6 ppm/degC^2 with TC2ND. The programming resolution is 0.4/ppm/degC^2.The second order can also be seen as third order correction since cold and hot sides are independently adjusted.

11.15 Offset temperature drift programming (OFFDRIFT_COLD, OFFDRIFT_HOT)

Offset temperature drift can be trimmed from -2.25 to +2.25 mV/degC. The programming resolution is 0.075 mV/degC.
This first order correction is done independently for temperatures over 25degC and below 25degC.
The offset drift corrections are ratiometric (if RATIODIS = 0)

11.16 Product Identification (MLXID, CSTID)

MLXID
A 48-bit MLX ID is used to guarantee MLX traceability (lotnumber, wafernumber, wafer position & option code) and is split up in 3x a 16 bit register (MLXID1, MLXID2 & MLXID3)
The programmed option code is stored in MLXID3[2..0]:

MLXID3[2..0]	Option code
7	A
6	B
5	C

CSTID
A 17-bit customer ID is available to create a dedicated traceability system

12 Self-diagnostic

The MLX91206 provides numerous self-diagnostic features. Those features increase the robustness of the IC functionality as it prevents the IC to provide erroneous output signal in case of internal or external failure modes.

Error	Action	Effect on Outputs	Remarks
Calibration Data CRC Error (at power up and in normal working mode)	Fault mode	High Impedance mode (1)	Pull down resistive load => Diag Low Pull up resistive load => Diag High
Power On delay		High Impedance mode (1)	1 ms max in high impedance followed by settling
Undervoltage Mode (4)	IC is reset (7)	High Impedance mode (1)	300mV Hysteresis
Overvoltage detection Mode 1 (5) (Threshold : min 7.9 V – max 9.5 V)	IC is switched off (internal supply)	High Impedance mode (1)	Idd < 1mA 500 to 1500mV Hysteresis
Overvoltage detection Mode 2 (6) (Threshold : min 6.8V – max 7.5V)	IC is reset (7)	High Impedance mode (1)	100mV Hysteresis
Broken Vss	IC is switched off	High Impedance (2)	With some restrictions on pull-up/pull-down resistors on OUT and TEMPOUT, see Chap. 6 ,Table 3
Broken Vdd	IC is switched off	High Impedance (3)	With some restrictions on pull-up/pull-down resistors on OUT, see Chap. 6 , Table 3

Table 21: Self diagnostic

(1) Refer to Table 3: General electrical parameter, parameter High-impedance modes levels
(2) Refer to Table 3: General electrical parameter, parameter BrokenVss Output Level
(3) Refer to Table 3: General electrical parameter, parameter BrokenVdd Output Level
(4) Refer to Table 3: General electrical parameter, parameter Under-voltage detection
(5) Refer to Table 3: General electrical parameter, parameter Over-voltage detection mode 1
(6) Refer to Table 3: General electrical parameter, parameter Over-voltage detection mode 2
(7) The internal supply is regulated but the digital sequencer (hall element spinning) is stopped

13 Application information

13.1 Low current measurement up to ±2 A

Low currents can be measured with the MLX91206 by increasing the magnetic field via a coil around the sensor. The sensitivity (output voltage vs. current in coil) of the measurement will depend on the size of coil and number of turns. Additional sensitivity and increased immunity to external fields can be gained by adding a shield around the coil. The bobbin provides very high dielectric isolation making this a suitable solution for high voltage power supplies with relative low currents. The output should be scaled to obtain the maximum voltage for the highest current to be measured in order to obtain the best accuracy and resolution.

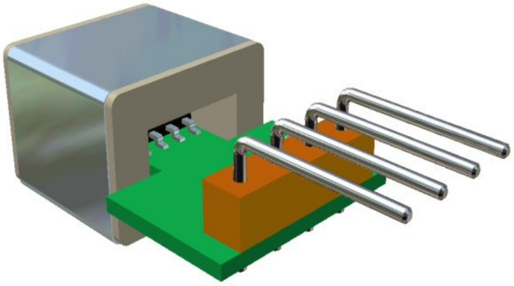


Figure 3: Low current application

13.2 Medium current up to ±30 A

With a single conductor located on the PCB, currents in the range of up to 30 amps can be measured. The sizing of the PCB trace needs to take into account the current handling capability and the total power dissipation. The PCB trace needs to be thick enough and wide enough to handle the RMS current continuously.

The differential output voltage for this configuration can be approximated by the following equation:

Vout = 35 mV/A * I

For a current level of 30 A, the output will be approximately 1050 mV.

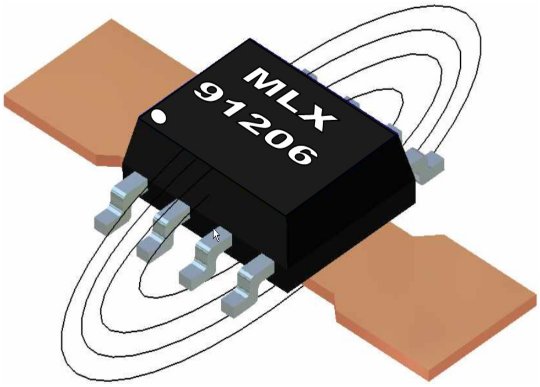


Figure 4: Medium current application

13.3 High current measurement up to ±600 A

Another method of measuring high currents on PCB’s is to use a large thick gauge copper trace capable of carrying the current on the opposite side of the PCB. The MLX91206 should be located near the centre of the trace, however because the trace is wide, the output is less sensitive to location on the PCB. This configuration also has less sensitivity due to the distance and width of the conductor.

Figure 5: High current application

14 Recommended Application Diagrams

14.1 Resistor and capacitor values

All mentioned component values can have a ±20% tolerance

Part	Description	Value	Unit
C1	Supply capacitor, EMI, ESD	10 - 220	nF
C2	Regulator buffer capacitor, decoupling, EMI, ESD	10 - 220	nF
C3	Decoupling, EMI, ESD	5 - 50	nF
C4	Decoupling, EMI, ESD	5 – 50 (1)	nF
R1	Pull up or pull down load resistor	10 - 30	kΩ

Table 22: Resistor and capacitor value

(1) When OUTMODE=0, which we do not advice in application, capacitor C4 should be 1nF or less.

14.2 Fast analog application, pull-down resistor for diagnostic low

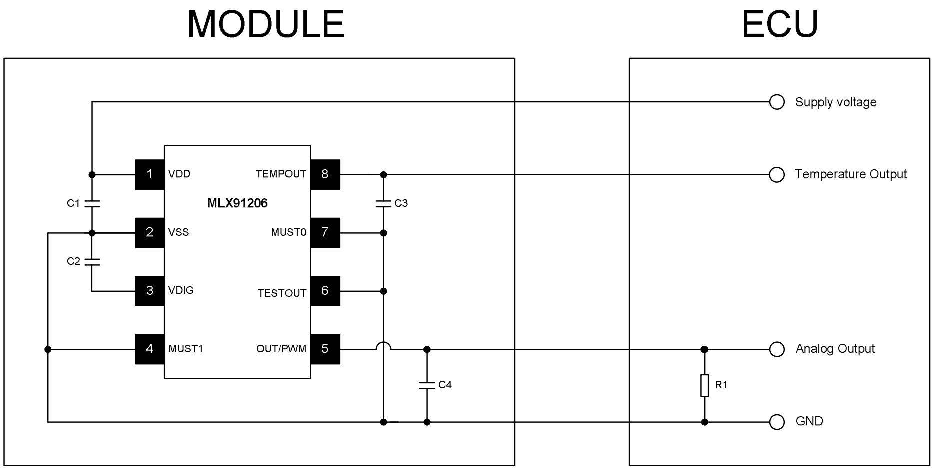


Figure 6: Fast analog application, Pull-down resistor

14.3 Fast analog application, pull-up resistor for diagnostic high

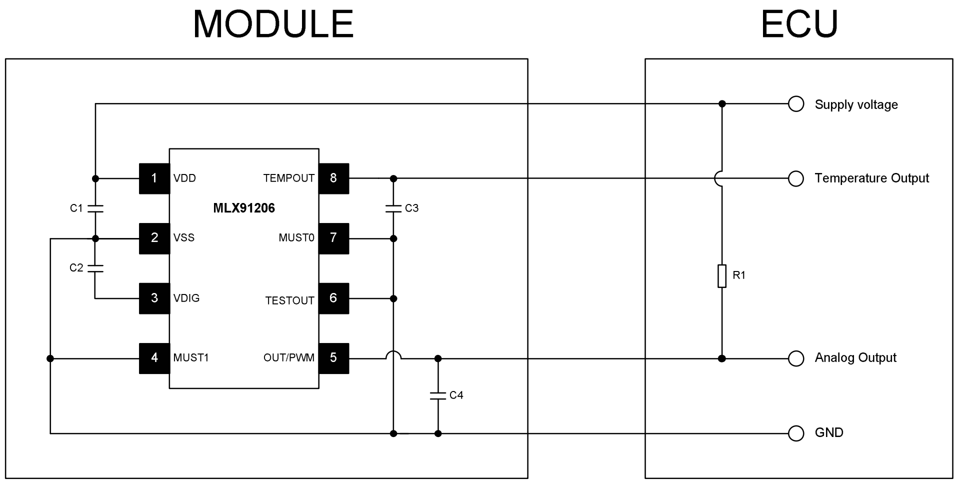


Figure 7: Fast analog application, Pull-up resistor

14.4 Robust PWM application, (pull-up load only)

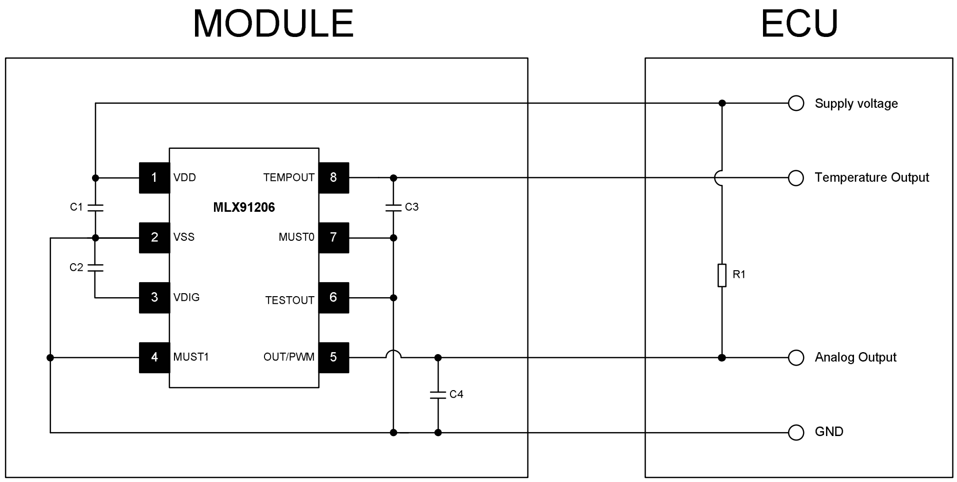


Figure 8: Robust PWM application with pull-up resistor

15 Standard information regarding manufacturability of Melexis products with different soldering processes

Melexis devices are qualified using state-of-the-art practices in accordance with automotive and environmental requirements.

Through qualifications, various soldering techniques are considered; please refer to “Soldering recommendations for Melexis products” for more information. (http://www.melexis.com/Asset/Soldering_Application_Note_and_Recommendations_DownloadLink_5446.aspx).

For components normally soldered using Surface Mounted Device techniques (eg: Reflow process), Melexis has defined and qualified Moisture Sensitivity Level and Peak Temperature in accordance with the Jedec J-STD-020 standard. Delivered material is conditioned accordingly. Moisture Sensitivity Level and Peak Temperature information can be found on the label identifying the material.

In case you intend to use a reflow soldering process for through hole devices (Melexis’ package codes: SA, UA, VA, VK, VM), please contact Melexis to verify your soldering process compatibility.

The application of Wave Soldering for SMD’s is allowed only after consulting Melexis regarding assurance of adhesive strength between device and board.

Based on Melexis commitment to environmental responsibility, Europe legislations (Direction on the Restriction of the Use of Certain Hazardous substances, RoHS) and customer requests, Melexis has deployed Pb free leadfinish (typically Matte Tin) on all ASSP products.

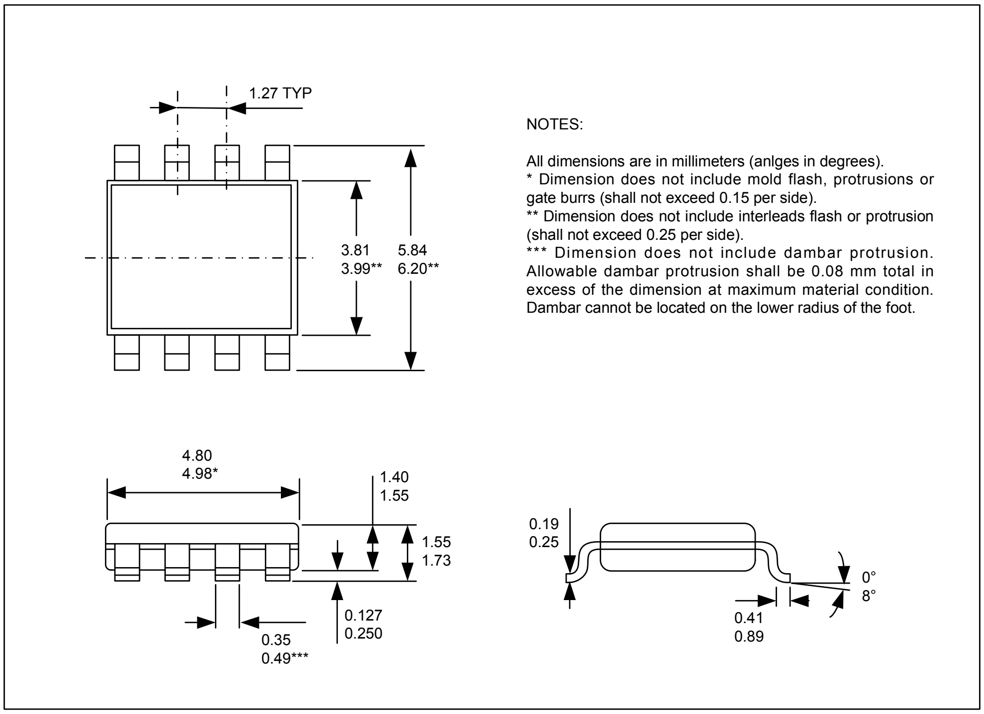
For through hole devices (Melexis’ package codes: SA, UA, VA, VK, VM) Trim&Form, please refer to “Trim & Form recommendations for Melexis products” for more information. (http://www.melexis.com/Assets/Trim_and_form_recommendations_DownloadLink_5565.aspx)

16 ESD Precautions

Electronic semiconductor products are sensitive to Electro Static Discharge (ESD).
Always observe Electro Static Discharge control procedures whenever handling semiconductor products.

17 Package Information

17.1 SOIC8 Package dimensions



NOTES:

All dimensions are in millimeters (anlges in degrees).
* Dimension does not include mold flash, protrusions or gate burrs (shall not exceed 0.15 per side).
** Dimension does not include interleads flash or protrusion (shall not exceed 0.25 per side).
*** Dimension does not include dambar protrusion. Allowable dambar protrusion shall be 0.08 mm total in excess of the dimension at maximum material condition. Dambar cannot be located on the lower radius of the foot.

Figure 9: Package dimensions

17.2 SOIC8 Pinout and Marking

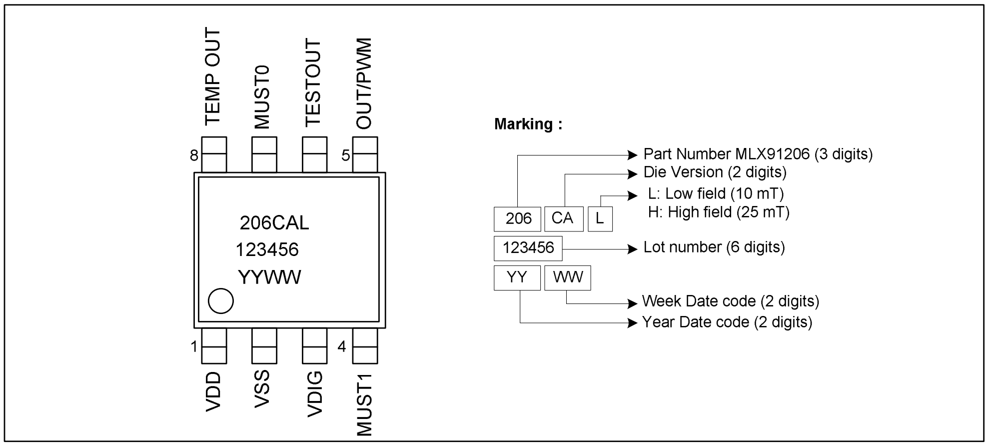


Figure 10: Pinout and marking

Note: the option code is not marked on the package. It can be found back in the EEPROM (see chapter 11.13) and on the tape-on-reel label information.

17.3 SOIC8 Hall plate position

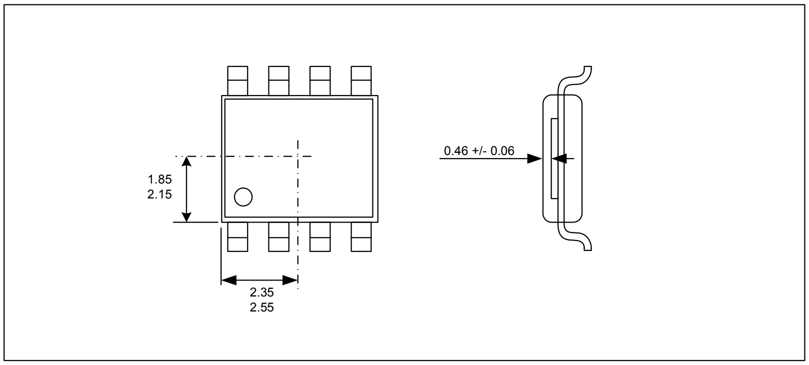


Figure 11: Hall Plate positioning

17.4 IMC Position and sensors active measurement direction

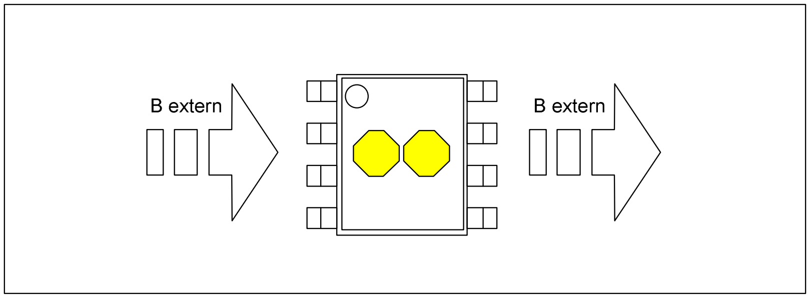


Figure 12: IMC position and geometry Low-Field version

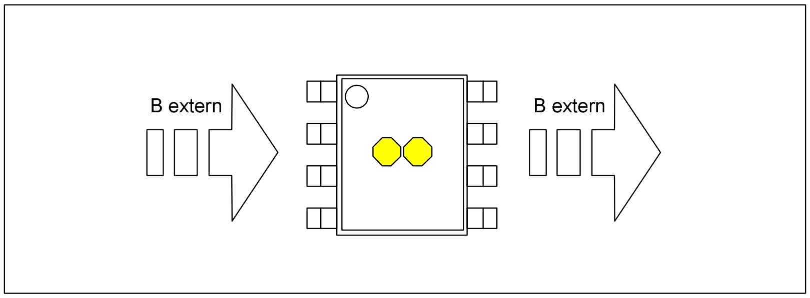


Figure 13: IMC position and geometry High-Field version

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