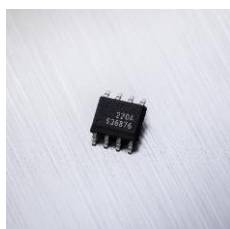


MLX91221 Integrated Current Sensor IC

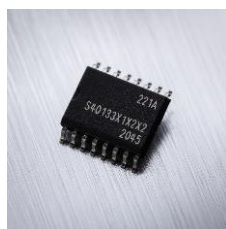
Datasheet

Features and Benefits

- Factory trimmed AC and DC current sensor
- Analog ratiometric or fixed output voltage
- Combining sensing element, signal conditioning & isolation in SOIC package
- No application programming required
- High speed sensing
 - DC to 300kHz bandwidth
 - 2μs response time
- Robust against external magnetic fields
- No magnetic hysteresis
- Double overcurrent detection (SOIC-16)
- Low ohmic losses of integrated conductor
 - 1.09mΩ SOIC-8 / 0.89mΩ SOIC-16
- SOIC-8 narrow body and SOIC-16 wide body package, RoHS compliant
- Lead free component, suitable for lead free soldering profile up to 260°C, MSL3
- Rated voltage isolation
 - 2.4kV_{RMS} for SOIC-8
 - 4.8kV_{RMS} for SOIC-16



SOIC-8



SOIC-16



IEC/UL 62368-1:2014
(2nd edition)

Applications

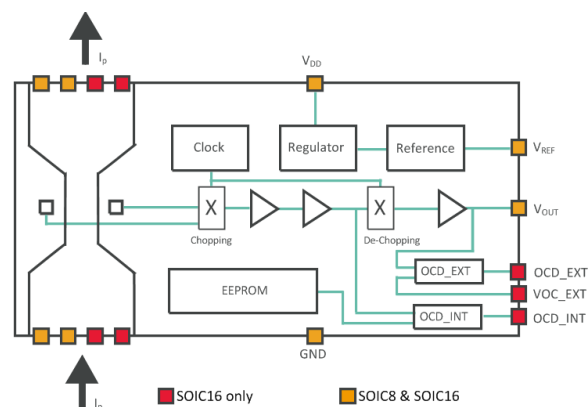
- AC and DC Chargers
- Electric Drives
- DCDC converters
- Solar
- Power Supplies
- Demand/Load control

Description

The MLX91221 is an Integrated Current Sensor that senses the current flowing through the low impedance leadframe of the SOIC package. By virtue of fixing the current conductor position with respect to the monolithic CMOS sensor, a fully integrated Hall-effect current sensor is obtained, that is factory calibrated.

Inside the package, the magnetic flux density generated by the current flow is sensed differentially by two sets of Hall plates. As a result the influence of external disturbing fields is minimized in the fast analog front-end. The residual signal is amplified to provide a high-speed linear analog output voltage.

The close proximity of the Hall plates to the current conductor ensures a high signal-to-noise ratio and an accurate signal over temperature. With this miniaturization, high voltage isolation ratings are still maintained between the primary and their opposing secondary side leads of the package.



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1. Ordering Information

Product Code	Package	Current Measurement Range	Output Type	Sensitivity	OCD level
MLX91221KDC-ABR-020-RE	SOIC8	20 A	Ratiometric	62.5 mV/A	
MLX91221KDC-ABF-025-RE	SOIC8	25 A	Fixed	50 mV/A	
MLX91221KDC-ABR-038-RE	SOIC8	38 A	Ratiometric	33.3 mV/A	
MLX91221KDC-ABF-050-RE	SOIC8	50 A	Fixed	25 mV/A	
MLX91221KDC-ABR-050-RE	SOIC8	50 A	Ratiometric	25 mV/A	
MLX91221KDF-ABF-010-RE	SOIC16	10 A	Fixed	120 mV/A	10.0 A
MLX91221KDF-ABF-020-RE	SOIC16	20 A	Fixed	62.5 mV/A	20.1 A
MLX91221KDF-ABR-020-RE	SOIC16	20 A	Ratiometric	62.5 mV/A	20.1 A
MLX91221KDF-ABF-120-RE	SOIC16	20 A	Fixed	62.5 mV/A	28.0 A
MLX91221KDF-ABF-025-RE	SOIC16	25 A	Fixed	50 mV/A	25.1 A
MLX91221KDF-ABR-050-RE	SOIC16	50 A	Ratiometric	25 mV/A	57.0 A
MLX91221KDF-ABF-050-RE	SOIC16	50 A	Fixed	25 mV/A	57.0 A
MLX91221KDF-ABF-075-RE	SOIC16	75 A	Fixed	16.67 mV/A	85.6 A

Table 1: Ordering information

Legend:

Temperature Code:	K: from -40°C to 125°C ambient temperature
Package Code:	“DC” for SOIC-8 NB (Narrow Body – 150mils) package “DF” for SOIC-16 WB (Wide Body – 300mils) package
Option Code:	Axx-xxx: die version xBx-xxx: “B” for bipolar ⁽¹⁾ and “U” for unipolar xxF-xxx: “F” for fixed mode output and “R” for ratiometric output xxx-0xx: “0” for default trimming xxx-x50: “50” for Full Scale current measurement (corresponding to 1.25V excursion from V_{OQ} in bipolar case)
Packing Form:	“RE” for Reel
Ordering Example:	MLX91221KDC-ABF-050-RE

Table 2: Legend

- (1) Bipolar output indicates that the sensor provides a symmetrical output around the 0A point which is set at half the output voltage (50% V_{DD}) in case of ratiometric mode, and V_{REF} equals 50% V_{DD} in case of fixed mode. Both designs imply sensing of positive and negative currents.

Melexis is continuously expanding its product portfolio by adding new option codes to better meet the needs of our customer’s applications. This table is being updated frequently, please go to the [Melexis website](#) to download the latest version of this datasheet. For custom transfer characteristics, please contact your local Melexis Sales representative or distributor.

2. Functional Diagram

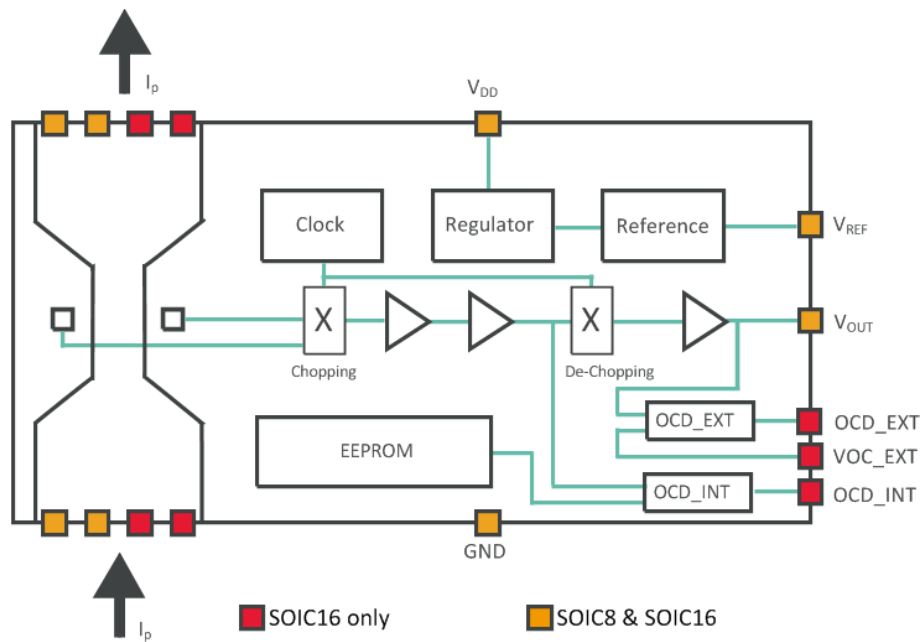


Figure 1: Functional Diagram for MLX91221

The sensor can be used in 2 different modes, depending on the application. Both modes rely on the output voltage of the sensor being proportional to the flow of current, but the difference resides in the signal reconstruction.

Ratiometric Mode

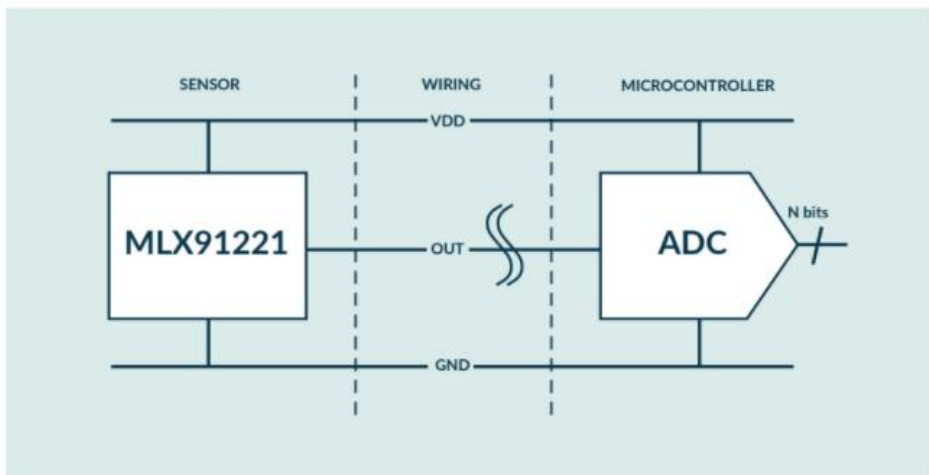


Figure 2: Schematic of ratiometric mode

No matter if the V_{DD} line is at 3.3V or deviating $\pm 5\%$, the ADC code for a given measured current will always be the same as the ADC is supplied by the same voltage as the sensor. The sensor has a sensitivity expressed in $\%V_{DD}/A$.

Differential or Fixed Mode⁽¹⁾

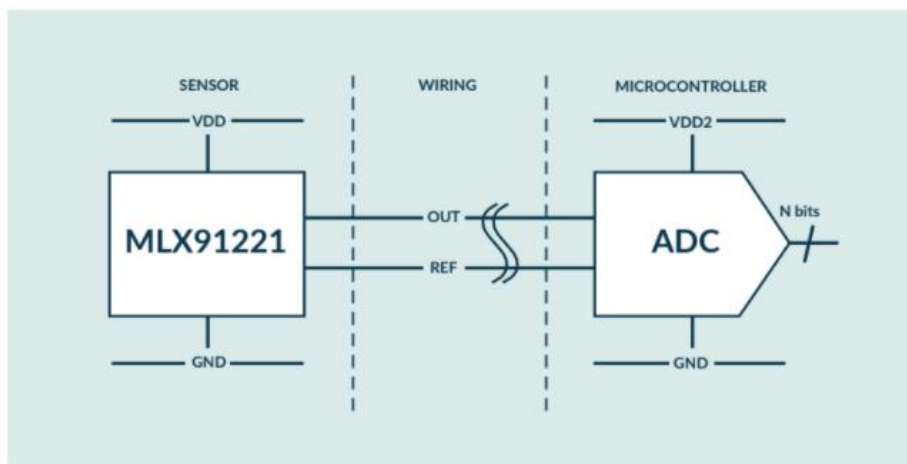


Figure 3: Schematic of fixed mode

In this particular case the ADC does not necessarily share the same supply voltage with the sensor. For this reason, the sensor is calibrated with an absolute sensitivity regardless of the actual supply voltage. The output signal can be reconstructed by taking the difference between the output and the reference voltage from the IC. The ADC gets these two signals as inputs for establishing the sensed current accurately, and is not influenced by the supply voltage differences between both sensor and microcontroller, if applicable.

Parameter	Ratiometric Mode	Differential or Fixed Mode
Output Signal	$V_{OUT} [\%V_{DD}]$ Example: output is 1.65V when supply is 3.3 V $\rightarrow$ output is then 50% V_{DD} . If the supply (V_{DD}) increases with 5% to 3.465 V the sensor output will (for the same measured input current) scale ratiometrically with the supply voltage, becoming 1.733 V which is a different voltage than when the supply was 3.3 V, but as a percentage (i.e. ratiometrically seen) it remains at the same level of 50% of V_{DD} .	$V_{OUT} - V_{REF} [V]$ Example: output is 1.651 and V_{REF} is 1.651V when supply is 3.3 V. When the supply voltage is increasing to 3.4 V due to supply system variation over temperature, the sensor will still maintain the same “fixed” output values V_{OUT} and V_{REF} .
Offset	$V_{OUT}[0A] = 50 [\%V_{DD}]$ (programmable)	$V_{REF} = 1.65 [V]$ (Melexis programmable) $V_{OUT}[0A] - V_{REF} = 0 [V]$
Offset ratiometric	Yes	No
Sensitivity	$[\%V_{DD}/A]$	$[mV/A]$
Sensitivity ratiometric	Yes	No
Measured Current	$(V_{OUT} - V_{OUT}[0A]) / \text{Sensitivity}$	$(V_{OUT} - V_{REF}) / \text{Sensitivity}$

Table 3: Parameters of differential and fixed modes

⁽¹⁾ More information can be found in Application Note AN91220_ReferencePin on www.melexis.com

3. Glossary of Terms

Gauss (G), Tesla (T)	Units for the magnetic flux density - 1 mT = 10 G
TC	Temperature Coefficient (in ppm/°C)
NC	Not Connected
IP	Integrated Primary
ASP	Analog Signal Processing
DSP	Digital Signal Processing
AC	Alternate Current
DC	Direct Current
RAM	Random Access Memory
EMC	Electro-Magnetic Compatibility
FS	Full Scale
OCD	OverCurrent Detection

Table 4: Glossary of Terms

4. Pinout

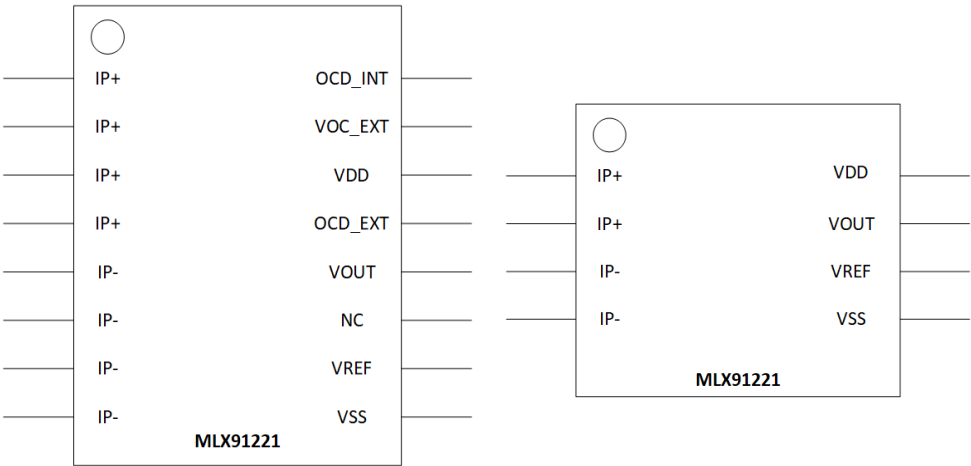


Figure 4: SOIC-16 and SOIC-8 pinouts

PIN	SOIC-8		SOIC-16	
	Pin	Function	Pin	Function
1	IP+	Primary Current Path Input	IP+	Primary Current Path Input
2				
3	IP-	Primary Current Path Output	IP-	Primary Current Path Output
4				
5	V _{SS}	Ground Voltage		
6	V _{REF}	Reference Voltage		
7	V _{OUT}	Output Voltage		
8	V _{DD}	Supply Voltage		
9			V _{SS}	Ground Voltage
10			V _{REF}	Reference Voltage
11			NC	Not connected
12			V _{OUT}	Output Voltage
13			OCD _{EXT}	External Overcurrent detection
14			V _{DD}	Supply Voltage
15			VOC _{EXT}	External Overcurrent threshold voltage
16			OCD _{INT}	Internal Overcurrent Detection

Table 5: Pinout definition

For optimal EMC behavior, it is recommended to connect the unused pin (NC) to the Ground.

5. Absolute Maximum Ratings

Parameter	Value
Positive Supply Voltage (overvoltage)	+ 8 V
Positive Supply Voltage (maintaining application mode)	+ 6.5 V
Reverse Supply Voltage	- 0.3 V
Positive Pin Voltage ⁽¹⁾	VDD + 0.3 V
Output Sourcing Current	+ 25 mA
Reverse Pin Voltage ⁽¹⁾	- 0.3 V
Output Sinking Current	+50 mA
Operating Ambient Temperature Range, T _A	- 40°C to + 125°C
Storage Temperature Range, T _S	- 40°C to + 150°C
Maximum Junction Temperature, T _J ⁽²⁾	+ 165°C

Table 6: Absolute maximum ratings

(1) Except for V_{DD} and V_{SS}

(2) For more information on how the junction temperature relates to the applied current and ambient temperature range, please refer to section 7

6. MLX91221 General Electrical Specifications

DC Operating Parameters at $V_{DD} = 3.3\text{ V}$ (unless otherwise specified) and for T_A as specified by the Temperature suffix (K).

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Nominal Supply Voltage	V_{DD}		3.135	3.3	3.465	V
Supply Current	I_{DD}	Without RLOAD, in application mode		20	26	mA
V_{out} output resistance	R_{OUT}	$V_{OUT} = 50\%V_{DD}$, $I_{LOAD} = 10\text{ mA}$		1	5	Ω
Voltage Reference Output Resistance	R_{REF}	$V_{REF} = 50\%V_{DD}$, $I_{SINK} = 5\text{ mA}$ or $I_{SOURCE} = 0.2\text{ mA}$	120	200	333	Ω
Output Capacitive Load	C_{LOAD}	Output amplifier stability is optimized for this typical value	0	4.7	6	nF
Common Mode Field Sensitivity ⁽¹⁾	CMFS	For SOIC16		0.4		mA/G
		For SOIC8		0.4		mA/G
Output Short Circuit Current	I_{SHORT}	Output shorted to V_{DD} or V_{SS} - Permanent			180	mA
Output Leakage current	I_{LEAK}	High impedance mode, $T_A = 125^\circ\text{C}$ $T_J < 150^\circ\text{C}$		2	20	μA
Output Voltage Linear Swing	V_{OUT_LSW}	$V_{DD} > 4.6\text{ V}$ for Fixed Mode versions	10		90	$\%V_{DD}$

Table 7: General electrical specifications

- (1) Common Mode Field Sensitivity expresses the sensor's susceptibility to a homogeneously applied field perpendicular to the package surface. The differential measurement cancels out such common mode magnetic fields, but due to the matching between both Hall plate clusters flanking the current conductor, this is not perfect. This parameter expresses the mA output error as a result of such 1 mT applied field. It has to be noted, that magnetic fields generated by nearby conductors are not homogenous but introduce gradients. More information in this regard can be found in Application Note AN91220_ExternalFieldImmunity on www.melexis.com

7. MLX91221 General Current Specifications

DC Operating Parameters at $V_{DD} = 3.3V$ (unless otherwise specified) and for T_A as specified by the Temperature suffix (K).

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Electrical Resistance of the Primary Current Path	R_{IP_SOIC8} R_{IP_SOIC16}	$T_A = 25^\circ C$		1.09 0.89		m Ω m Ω
Measurement Range	IP_{MAX}	Option Code ABx-x10 Option Code ABx-x20 Option Code ABx-x25 Option Code ABx-x38 Option Code ABx-x50 Option Code ABx-x75		10 20 25 38 50 75		A A A A A A
Nominal Current	IP_{NOM}	Option Code ABx-x10 Option Code ABx-x20 Option Code ABx-x25 Option Code ABx-x38 Option Code ABx-x50 Option Code ABx-x75		4 8 10 15 20 30		A A A A A A
Linearity Error	NL	Current in range IP_{NOM} , $T_A = 25^\circ C$			± 0.3	%FS
	NL	Current in range IP_{MAX} , $T_A = 25^\circ C$			± 0.6	%FS
Current Capability ⁽¹⁾	IP_{C85_SOIC8}	Continuous, $T_A = -40$ to $85^\circ C$			± 25	A
	IP_{C25_SOIC8}	Continuous, $T_A = 25^\circ C$			± 40	A
	IP_{C85_SOIC16}	Continuous, $T_A = -40$ to $85^\circ C$			± 30	A
	IP_{C25_SOIC16}	Continuous, $T_A = 25^\circ C$			± 45	A

Table 8: General current specifications

- (1) Current capability based on the reference Melexis PCB made of 2x 105 μm copper layer without any forced air or other form of cooling. Continuous or RMS current ranges in application are typically higher than this. More information can be found in Application Notes AN91220_FuseCurrent Capability and AN91220_ThermalManagement on www.melexis.com.

8. MLX91221 Voltage Isolation Specifications

Parameter	Symbol	Test Conditions	Rating	Units
Dielectric Strength Test Voltage ⁽¹⁾⁽²⁾	V _{ISO_SOIC8}	IEC 62368-1:2014 (second edition)	2400	V _{RMS}
	V _{ISO_SOIC16}		4800	
Clearance (primary to secondary)	d _{cl}	Shortest distance through air. SOIC8 package.	4	mm
Creepage distance (primary to secondary)	d _{cp}	Shortest path along body. SOIC8 package.	3.6	mm
Clearance (primary to secondary)	d _{cl}	Shortest distance through air. SOIC16 package.	8.1	mm
Creepage distance (primary to secondary)	d _{cp}	Shortest path along body. SOIC16 package.	7.1	mm
Comparative tracking index	CTI		600	
Working Voltage for Basic Isolation ⁽³⁾	V _{WV_SOIC8}	IEC 62368-1:2014 (second edition)	500	V _{RMS}
		Based on Pollution degree 2, material group II	707	V _{DC}
	V _{WV_SOIC16}		1000	V _{RMS}
			1414	V _{DC}

Table 9: Voltage isolation specifications

- (1) Agency type tested, measured between IP (pin 1-4 on SOIC8, pin 1-8 on SOIC16) and Secondary side (pin 5-8 on SOIC8, pin 9-16 on SOIC16).
- (2) Melexis performs routine production-line tests, for all SOIC8 & SOIC16 devices produced.
- (3) Tension de service pour une isolation principale spécifiée pour un Degré de Pollution 2 et un groupe de matériau II selon la norme IEC-62368-1 :2014 (2^{ème} édition)

9. MLX91221 Timing Specifications

DC Operating Parameters at $V_{DD} = 3.3V$ (unless otherwise specified) and for T_A as specified by the Temperature suffix (K).

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Step Response Time	T_{RESP}	Delay between the input signal reaching 90% and the output reaching 90% (see Figure 5)			2	μs
Bandwidth	BW	-3dB, $T_A = 25^\circ C$		300		kHz
Power on Delay ⁽¹⁾	T_{POD}	V_{REF} capacitor = 47nF			0.6	ms

Table 10: Timing specifications

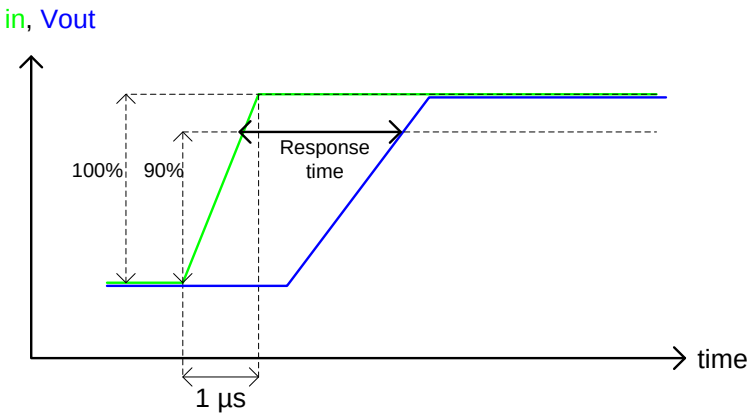


Figure 5: Response Time definition

(1) During the Power-on delay, the output will remain within the 10% fault band at all time.

10. MLX91221 Accuracy Specifications

10.1. Definitions

Thermal Reference Drift

The thermal reference drift is the variation of the reference voltage (VREF) in temperature. It is expressed in ppm/°C.

$$+ \Delta T_{VREF} = \left(\frac{V_{ref}[125^{\circ}\text{C}]}{V_{ref}[35^{\circ}\text{C}]} - 1 \right) \cdot \frac{1}{(125 - 35)} \cdot 10^6$$

$$- \Delta T_{VREF} = \left(\frac{V_{ref}[-40^{\circ}\text{C}]}{V_{ref}[35^{\circ}\text{C}]} - 1 \right) \cdot \frac{1}{(-40 - 35)} \cdot 10^6$$

Voltage Output Quiescent

V_{OQ} corresponds to the output when no current is flowing through the MLX91221 at TA=25°C.

Ratiometry Offset and Sensitivity Error

In Ratiometric mode, VOUT and VREF are scaled with the supply voltage. $V_{DDnom} = 3.3 \text{ V}$

Ratiometric VOQ Error:

$$\Delta R_{VOQ} = V_{OQ} [V_{DDnom}] - V_{OQ} [V_{DDnom} \pm 5\%] \cdot \frac{V_{DDnom}}{V_{DDnom} \pm 5\%} \text{ [mV]}$$

Ratiometric Sensitivity Error:

$$\Delta R_S = 100 \cdot \left(1 - \frac{S[V_{DDnom} \pm 5\%]}{S[V_{DDnom}]} \cdot \frac{V_{DDnom}}{V_{DDnom} \pm 5\%} \right) \text{ [%]}$$

In Fixed mode, VOUT and VREF are not scaled with the supply voltage. Ideally, they do not vary. $V_{DDnom} = 3.3 \text{ V}$

Non-Ratiometric VOQ Error:

$$\Delta R_{VOQ} = V_{OQ} [V_{DDnom} \pm 5\%] - V_{OQ} [V_{DDnom}] \text{ [mV]}$$

Non-Ratiometric Sensitivity Error:

$$\Delta R_S = \left(\frac{S[V_{DDnom} \pm 5\%]}{S[V_{DDnom}]} - 1 \right) \cdot 100 \text{ [%]}$$

Thermal Offset Drift

ΔT_{VOQ} corresponds to variation of V_{OQ} in temperature.

Sensitivity

The sensitivity is the ratio between the output of the MLX91221 and the input current.

For ratiometric devices, as the output will scale with the supply, sensitivity is expressed as [%VDD]/A.

For fixed devices, the output does not vary with the VDD, sensitivity is thus expressed as mV/A.

Linearity Error

The linearity error is the deviation of the output from the expected linear behaviour. To obtain the linearity error, the current is swept from $-I_{PM}$ to I_{PM} . To decorrelate the thermal drift from the linearity error, the junction temperature should be fixed below 50°C.

$$NL = \frac{V_{out}[I] - BESTFIT(V_{out}[I])}{V_{out}[I_{PM}] - V_{out}[-I_{PM}]} \cdot 100 \text{ [%FS]}$$

10.2. MLX91221KDx-ABF-010 Specifications

DC Operating Parameters at $V_{DD} = 3.3V$ (unless otherwise specified), for T_A as specified by the Temperature suffix (K) and for $T_j < 150\text{ }^{\circ}\text{C}$.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Primary current	I_{PM}		-10		10	A
Voltage Reference	V_{REF}	$T_A=25^{\circ}\text{C}$	1.63	1.65	1.67	V
Thermal Reference Drift	ΔT_{VREF}	Variation versus 25°C			± 150	ppm/ $^{\circ}\text{C}$
Voltage Output Quiescent	V_{OQ}	No current flowing through IP, $V_{OUT}-V_{REF}$, $T_A=25^{\circ}\text{C}$ No resistive load on V_{OUT} and V_{REF}	-7.5 -62.5		7.5 62.5	mV mA
Ratiometry Offset Error	ΔR_{VOQ}	$T_A=25^{\circ}\text{C}$ and for $\pm 5\% V_{DD}$	-5		5	mV
Thermal Offset Drift	ΔT_{VOQ}	Referred to $T_A=25^{\circ}\text{C}$, IP = 0A		± 5 ± 41.7	± 10 ± 83.4	mV mA
Lifetime Offset Drift	ΔL_{VOQ}			± 2		mV
Sensitivity	S	At $T_A=25^{\circ}\text{C}$ For $T_j < 50\text{ }^{\circ}\text{C}$	-1 118.8		1 121.2	% mV/A
Ratiometry Sensitivity Error	ΔR_S	$T_A=25^{\circ}\text{C}$ and for $\pm 5\% V_{DD}$	-0.6		0.6	%
Thermal Sensitivity Drift	ΔT_S	Current range IP_{MAX}		± 1	± 1.5	%S
Sensitivity Drift over lifetime	ΔL_S			± 1	± 2	%S
Output Noise Spectral Density	N_{SD}	IP = 0 A, $T_A=25^{\circ}\text{C}$ within BW = 1 ... 100kHz		178		$\mu\text{A}/\sqrt{\text{Hz}}$
Output RMS Noise	N_{RMS}	IP = 0 A, $T_A=25^{\circ}\text{C}$ BW = 300kHz		115		mA_{RMS}
OCD _{INT} Threshold Current ⁽¹⁾	I_{OCD}			10		A
OCD _{INT} Accuracy ⁽¹⁾	ϵ_{IOCD}	$T_A=25^{\circ}\text{C}$ $T_A=-40^{\circ}\text{C}$ to 85°C		9.7 17.6		% %
OCD _{EXT} threshold error ⁽¹⁾	ϵ_{EOCD}		-6		6	%

Table 11: MLX91221KDx-ABF-010 specifications

(1) For SOIC16 version

10.3. MLX91221KDx-ABR-020 Specifications

DC Operating Parameters at $V_{DD} = 3.3V$ (unless otherwise specified), for T_A as specified by the Temperature suffix (K) and for $T_j < 150\text{ }^{\circ}C$.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Primary current	I_{PM}		-20		20	A
Voltage Output Quiescent	V_{OQ}	No current flowing through IP, $V_{OUT} = -V_{DD}/2$, $T_A = 25^{\circ}C$ No resistive load on V_{OUT} and V_{REF}	-7.5 -120		7.5 120	mV mA
Ratiometry Offset Error	ΔR_{VOQ}	$T_A = 25^{\circ}C$ and for $\pm 5\% V_{DD}$	-7.5		7.5	mV
Thermal Offset Drift	ΔT_{VOQ}	Referred to $T_A = 25^{\circ}C$, $I_P = 0A$		± 5 ± 80	± 7.5 ± 120	mV mA
Lifetime Offset Drift	ΔL_{VOQ}			± 2		mV
Sensitivity	S	At $T_A = 25^{\circ}C$ For $T_j < 50\text{ }^{\circ}C$	-1 61.8	62.5	1 63.2	% mV/A
Ratiometry Sensitivity Error	ΔR_S	$T_A = 25^{\circ}C$ and for $\pm 5\% V_{DD}$		± 0.3		%
Thermal Sensitivity Drift	ΔT_S	Current range $I_{P_{MAX}}$		± 1	± 1.5	%S
Sensitivity Drift over lifetime	ΔL_S			± 1	± 2	%S
Output Noise Spectral Density	N_{SD}	$I_P = 0A$, $T_A = 25^{\circ}C$ within BW = 1 ... 100kHz		206		$\mu A/\sqrt{Hz}$
Output RMS Noise	N_{RMS}	$I_P = 0A$, $T_A = 25^{\circ}C$ BW = 300kHz		136		mA_{RMS}
OCD _{INT} Threshold Current ⁽¹⁾	I_{OCD}			20.1		A
OCD _{INT} Accuracy ⁽¹⁾	ϵ_{IOCD}	$T_A = 25^{\circ}C$ $T_A = -40^{\circ}C$ to $85^{\circ}C$		6 11		% %
OCD _{EXT} threshold error ⁽¹⁾	ϵ_{EOCD}		-6		6	%

Table 12: MLX91221KDx-ABR-020 specifications

(1) For SOIC16 version

10.4. MLX91221KDx-ABF-020 Specifications

DC Operating Parameters at $V_{DD} = 3.3V$ (unless otherwise specified), for T_A as specified by the Temperature suffix (K) and for $T_j < 150^\circ C$.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Primary current	I_{PM}		-20		20	A
Voltage Reference	V_{REF}	$T_A = 25^\circ C$	1.63	1.65	1.67	V
Thermal Reference Drift	ΔT_{VREF}	Variation versus $25^\circ C$			± 150	ppm/ $^\circ C$
Voltage Output Quiescent	V_{OQ}	No current flowing through IP, $V_{OUT} - V_{REF}$, $T_A = 25^\circ C$ No resistive load on V_{OUT} and V_{REF}	-7.5 -120		7.5 120	mV mA
Ratiometry Offset Error	ΔR_{VOQ}	$T_A = 25^\circ C$ and for $\pm 5\% V_{DD}$	-5		5	mV
Thermal Offset Drift	ΔT_{VOQ}	Referred to $T_A = 25^\circ C$, IP = 0A		± 5 ± 80	± 7.5 ± 120	mV mA
Lifetime Offset Drift	ΔL_{VOQ}			± 2		mV
Sensitivity	S	At $T_A = 25^\circ C$ For $T_j < 50^\circ C$	-1 61.8	62.5	1 63.2	% mV/A
Ratiometry Sensitivity Error	ΔR_S	$T_A = 25^\circ C$ and for $\pm 5\% V_{DD}$	-0.6		0.6	%
Thermal Sensitivity Drift	ΔT_S	Current range IP_{MAX}		± 1	± 1.5	%S
Sensitivity Drift over lifetime	ΔL_S			± 1	± 2	%S
Output Noise Spectral Density	N_{SD}	IP = 0 A, $T_A = 25^\circ C$ within BW = 1 ... 100kHz		206		$\mu A/\sqrt{Hz}$
Output RMS Noise	N_{RMS}	IP = 0 A, $T_A = 25^\circ C$ BW = 300kHz		136		mA_{RMS}
OCD _{INT} Threshold Current ⁽¹⁾	I_{OCD}			20.1		A
OCD _{INT} Accuracy ⁽¹⁾	ϵ_{IOCD}	$T_A = 25^\circ C$ $T_A = -40^\circ C$ to $85^\circ C$		6 11		% %
OCD _{EXT} threshold error ⁽¹⁾	ϵ_{EOCD}		-6		6	%

Table 13: MLX91221KDx-ABF-020 specifications

(1) For SOIC16 version

10.5. MLX91221KDx-ABF-120 Specifications

DC Operating Parameters at $V_{DD} = 3.3V$ (unless otherwise specified), for T_A as specified by the Temperature suffix (K) and for $T_j < 150^\circ C$.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Primary current	I_{PM}		-20		20	A
Voltage Reference	V_{REF}	$T_A = 25^\circ C$	1.63	1.65	1.67	V
Thermal Reference Drift	ΔT_{VREF}	Variation versus $25^\circ C$			± 150	ppm/ $^\circ C$
Voltage Output Quiescent	V_{OQ}	No current flowing through IP, $V_{OUT} - V_{REF}$, $T_A = 25^\circ C$ No resistive load on V_{OUT} and V_{REF}	-7.5 -120		7.5 120	mV mA
Ratiometry Offset Error	ΔR_{VOQ}	$T_A = 25^\circ C$ and for $\pm 5\% V_{DD}$	-5		5	mV
Thermal Offset Drift	ΔT_{VOQ}	Referred to $T_A = 25^\circ C$, IP = 0A		± 5 ± 80	± 7.5 ± 120	mV mA
Lifetime Offset Drift	ΔL_{VOQ}			± 2		mV
Sensitivity	S	At $T_A = 25^\circ C$ For $T_j < 50^\circ C$	-1 61.8	62.5	1 63.2	% mV/A
Ratiometry Sensitivity Error	ΔR_S	$T_A = 25^\circ C$ and for $\pm 5\% V_{DD}$	-0.6		0.6	%
Thermal Sensitivity Drift	ΔT_S	Current range IP_{MAX}		± 1	± 1.5	%S
Sensitivity Drift over lifetime	ΔL_S			± 1	± 2	%S
Output Noise Spectral Density	N_{SD}	IP = 0 A, $T_A = 25^\circ C$ within BW = 1 ... 100kHz		206		$\mu A/\sqrt{Hz}$
Output RMS Noise	N_{RMS}	IP = 0 A, $T_A = 25^\circ C$ BW = 300kHz		136		mA_{RMS}
OCD _{INT} Threshold Current ⁽¹⁾	I_{OCD}			28		A
OCD _{INT} Accuracy ⁽¹⁾	ϵ_{IOCD}	$T_A = 25^\circ C$ $T_A = -40^\circ C$ to $85^\circ C$		6 11		% %
OCD _{EXT} threshold error ⁽¹⁾	ϵ_{EOCD}		-6		6	%

Table 14: MLX91221KDx-ABF-120 specifications

(1) For SOIC16 version

10.6. MLX91221KDx-ABF-025 Specifications

DC Operating Parameters at $V_{DD} = 3.3V$ (unless otherwise specified), for T_A as specified by the Temperature suffix (K) and for $T_j < 150\text{ }^{\circ}\text{C}$.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Primary current	I_{PM}		-25		25	A
Voltage Reference	V_{REF}	$T_A = 25^{\circ}\text{C}$	1.63	1.65	1.67	V
Thermal Reference Drift	ΔT_{VREF}	Variation versus 25°C			± 150	ppm/ $^{\circ}\text{C}$
Voltage Output Quiescent	V_{OQ}	No current flowing through IP, $V_{OUT} - V_{REF}$, $T_A = 25^{\circ}\text{C}$ No resistive load on V_{OUT} and V_{REF}	-7.5 -150		7.5 150	mV mA
Ratiometry Offset Error	ΔR_{VOQ}	$T_A = 25^{\circ}\text{C}$ and for $\pm 5\% V_{DD}$	-5		5	mV
Thermal Offset Drift	ΔT_{VOQ}	Referred to $T_A = 25^{\circ}\text{C}$, $IP = 0A$		± 5 ± 100	± 7.5 ± 150	mV mA
Lifetime Offset Drift	ΔL_{VOQ}			± 2		mV
Sensitivity	S	At $T_A = 25^{\circ}\text{C}$ For $T_j < 50\text{ }^{\circ}\text{C}$	-1 49.5	50	1 50.5	% mV/A
Ratiometry Sensitivity Error	ΔR_S	$T_A = 25^{\circ}\text{C}$ and for $\pm 5\% V_{DD}$	-0.6		0.6	%
Thermal Sensitivity Drift	ΔT_S	Current range IP_{MAX}		± 1	± 1.5	%S
Sensitivity Drift over lifetime	ΔL_S			± 1	± 2	%S
Output Noise Spectral Density	N_{SD}	$IP = 0A$, $T_A = 25^{\circ}\text{C}$ within $BW = 1 \dots 100\text{kHz}$		202		$\mu\text{A}/\sqrt{\text{Hz}}$
Output RMS Noise	N_{RMS}	$IP = 0A$, $T_A = 25^{\circ}\text{C}$ $BW = 300\text{kHz}$		136		mA_{RMS}
OCD _{INT} Threshold Current ⁽¹⁾	I_{OCD}			25.1		A
OCD _{INT} Accuracy ⁽¹⁾	ϵ_{IOCD}	$T_A = 25^{\circ}\text{C}$ $T_A = -40^{\circ}\text{C}$ to 85°C		5.5 10.2		% %
OCD _{EXT} threshold error ⁽¹⁾	ϵ_{EOCD}		-6		6	%

Table 15: MLX91221KDx-ABF-025 specifications

(1) For SOIC16 version

10.7. MLX91221KDx-ABR-038 Specifications

DC Operating Parameters at $V_{DD} = 3.3V$ (unless otherwise specified), for T_A as specified by the Temperature suffix (K) and for $T_j < 150\text{ }^{\circ}C$.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Primary current	I_{PM}		-38		38	A
Voltage Output Quiescent	V_{OQ}	No current flowing through IP, $V_{OUT} = V_{DD}/2$, $T_A = 25^{\circ}C$ No resistive load on V_{OUT} and V_{REF}	-7.5 -225		7.5 225	mV mA
Ratiometry Offset Error	ΔR_{VOQ}	$T_A = 25^{\circ}C$ and for $\pm 5\% V_{DD}$	-7.5		7.5	mV
Thermal Offset Drift	ΔT_{VOQ}	Referred to $T_A = 25^{\circ}C$, $I_P = 0A$		± 5 ± 150	± 7.5 ± 225	mV mA
Lifetime Offset Drift	ΔL_{VOQ}			± 2		mV
Sensitivity	S	At $T_A = 25^{\circ}C$ For $T_j < 50\text{ }^{\circ}C$	-1 33.0	33.3	1 33.6	% mV/A
Ratiometry Sensitivity Error	ΔR_S	$T_A = 25^{\circ}C$ and for $\pm 5\% V_{DD}$		± 0.3		%
Thermal Sensitivity Drift	ΔT_S	Current range $I_{P_{MAX}}$		± 1	± 1.5	%S
Sensitivity Drift over lifetime	ΔL_S			± 1	± 2	%S
Output Noise Spectral Density	N_{SD}	$I_P = 0A$, $T_A = 25^{\circ}C$ within BW = 1 ... 100kHz		207		$\mu A/\sqrt{Hz}$
Output RMS Noise	N_{RMS}	$I_P = 0A$, $T_A = 25^{\circ}C$ BW = 300kHz		140		mA_{RMS}
OCD _{INT} Threshold Current ⁽¹⁾	I_{OCD}			42.8		A
OCD _{INT} Accuracy ⁽¹⁾	ϵ_{IOCD}	$T_A = 25^{\circ}C$ $T_A = -40^{\circ}C$ to $85^{\circ}C$		5 10		% %
OCD _{EXT} threshold error ⁽¹⁾	ϵ_{EOCD}		-6		6	%

Table 16: MLX91221KDx-ABR-038 specifications

(1) For SOIC16 version

10.8. MLX91221KDx-ABF-050 Specifications

DC Operating Parameters at $V_{DD} = 3.3V$ (unless otherwise specified), for T_A as specified by the Temperature suffix (K) and for $T_j < 150\text{ }^{\circ}\text{C}$.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Primary current	I_{PM}		-50		50	A
Voltage Reference	V_{REF}	$T_A=25^{\circ}\text{C}$	1.63	1.65	1.67	V
Thermal Reference Drift	ΔT_{VREF}	Variation versus 25°C			± 150	ppm/ $^{\circ}\text{C}$
Voltage Output Quiescent	V_{OQ}	No current flowing through IP, $V_{OUT}-V_{REF}$, $T_A=25^{\circ}\text{C}$ No resistive load on V_{OUT} and V_{REF}	-7.5 -300		7.5 300	mV mA
Ratiometry Offset Error	ΔR_{VOQ}	$T_A=25^{\circ}\text{C}$ and for $\pm 5\% V_{DD}$	-5		5	mV
Thermal Offset Drift	ΔT_{VOQ}	Referred to $T_A=25^{\circ}\text{C}$, IP = 0A		± 5 ± 200	± 7.5 ± 300	mV mA
Lifetime Offset Drift	ΔL_{VOQ}			± 2		mV
Sensitivity	S	At $T_A=25^{\circ}\text{C}$ For $T_j < 50\text{ }^{\circ}\text{C}$	-1 24.75	25	1 25.25	% mV/A
Ratiometry Sensitivity Error	ΔR_S	$T_A=25^{\circ}\text{C}$ and for $\pm 5\% V_{DD}$	-0.6		0.6	%
Thermal Sensitivity Drift	ΔT_S	Current range IP_{MAX}		± 1	± 1.5	%S
Sensitivity Drift over lifetime	ΔL_S			± 1	± 2	%S
Output Noise Spectral Density	N_{SD}	IP = 0 A, $T_A=25^{\circ}\text{C}$ within BW = 1 ... 100kHz		210		$\mu\text{A}/\sqrt{\text{Hz}}$
Output RMS Noise	N_{RMS}	IP = 0 A, $T_A=25^{\circ}\text{C}$ BW = 300kHz		143		mA_{RMS}
OCD _{INT} Threshold Current ⁽¹⁾	I_{OCD}			57		A
OCD _{INT} Accuracy ⁽¹⁾	ϵ_{IOCD}	$T_A=25^{\circ}\text{C}$ $T_A=-40^{\circ}\text{C}$ to 85°C		4 6		% %
OCD _{EXT} threshold error ⁽¹⁾	ϵ_{EOCD}		-6		6	%

Table 17: MLX91221KDx-ABF-050 specifications

(1) For SOIC16 version

10.9. MLX91221KDx-ABR-050 Specifications

DC Operating Parameters at $V_{DD} = 3.3V$ (unless otherwise specified), for T_A as specified by the Temperature suffix (K) and for $T_j < 150\text{ }^{\circ}\text{C}$.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Primary current	I_{PM}		-50		50	A
Voltage Output Quiescent	V_{OQ}	No current flowing through IP, $V_{OUT} = V_{DD}/2$, $T_A = 25^{\circ}\text{C}$ No resistive load on V_{OUT} and V_{REF}	-7.5 -300		7.5 300	mV mA
Ratiometry Offset Error	ΔR_{VOQ}	$T_A = 25^{\circ}\text{C}$ and for $\pm 5\% V_{DD}$	-7.5		7.5	mV
Thermal Offset Drift	ΔT_{VOQ}	Referred to $T_A = 25^{\circ}\text{C}$, $I_P = 0A$		± 5 ± 200	± 7.5 ± 300	mV mA
Lifetime Offset Drift	ΔL_{VOQ}			± 2		mV
Sensitivity	S	At $T_A = 25^{\circ}\text{C}$ For $T_j < 50\text{ }^{\circ}\text{C}$	-1 24.75	25.0	1 25.25	% mV/A
Ratiometry Sensitivity Error	ΔR_S	$T_A = 25^{\circ}\text{C}$ and for $\pm 5\% V_{DD}$		± 0.3		%
Thermal Sensitivity Drift	ΔT_S	Current range $I_{P_{MAX}}$		± 1	± 1.5	%S
Sensitivity Drift over lifetime	ΔL_S			± 1	± 2	%S
Output Noise Spectral Density	N_{SD}	$I_P = 0A$, $T_A = 25^{\circ}\text{C}$ within BW = 1 ... 100kHz		210		$\mu\text{A}/\sqrt{\text{Hz}}$
Output RMS Noise	N_{RMS}	$I_P = 0A$, $T_A = 25^{\circ}\text{C}$ BW = 300kHz		143		mA_{RMS}
OCD _{INT} Threshold Current ⁽¹⁾	I_{OCD}			57		A
OCD _{INT} Accuracy ⁽¹⁾	ϵ_{IOCD}	$T_A = 25^{\circ}\text{C}$ $T_A = -40^{\circ}\text{C}$ to 85°C		4 6		% %
OCD _{EXT} threshold error ⁽¹⁾	ϵ_{EOCD}		-6		6	%

Table 18: MLX91221KDx-ABR-050 specifications

(1) For SOIC16 version

10.10. MLX91221KDx-ABF-075 Specifications

DC Operating Parameters at $V_{DD} = 3.3V$ (unless otherwise specified), for T_A as specified by the Temperature suffix (K) and for $T_j < 150\text{ }^{\circ}\text{C}$.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Primary current	I_{PM}		-75		75	A
Voltage Reference	V_{REF}	$T_A=25^{\circ}\text{C}$	1.63	1.65	1.67	V
Thermal Reference Drift	ΔT_{VREF}	Variation versus 25°C			± 150	ppm/ $^{\circ}\text{C}$
Voltage Output Quiescent	V_{OQ}	No current flowing through IP, $V_{OUT}-V_{REF}$, $T_A=25^{\circ}\text{C}$ No resistive load on V_{OUT} and V_{REF}	-7.5 -450		7.5 450	mV mA
Ratiometry Offset Error	ΔR_{VOQ}	$T_A=25^{\circ}\text{C}$ and for $\pm 5\% V_{DD}$	-5		5	mV
Thermal Offset Drift	ΔT_{VOQ}	Referred to $T_A=25^{\circ}\text{C}$, $IP = 0A$		± 5 ± 300	± 7.5 ± 450	mV mA
Lifetime Offset Drift	ΔL_{VOQ}			± 2		mV
Sensitivity	S	At $T_A=25^{\circ}\text{C}$ For $T_j < 50\text{ }^{\circ}\text{C}$	-1 16.5	16.67	1	% mV/A
Ratiometry Sensitivity Error	ΔR_S	$T_A=25^{\circ}\text{C}$ and for $\pm 5\% V_{DD}$	-0.6		0.6	%
Thermal Sensitivity Drift	ΔT_S	Current range IP_{MAX}		± 1	± 1.5	%S
Sensitivity Drift over lifetime	ΔL_S			± 1	± 2	%S
Output Noise Spectral Density	N_{SD}	$IP = 0A$, $T_A=25^{\circ}\text{C}$ within $BW = 1 \dots 100\text{kHz}$		221		$\mu\text{A}/\sqrt{\text{Hz}}$
Output RMS Noise	N_{RMS}	$IP = 0A$, $T_A=25^{\circ}\text{C}$ $BW = 300\text{kHz}$		149		mA_{RMS}
OCD _{INT} Threshold Current ⁽¹⁾	I_{OCD}			85.6		A
OCD _{INT} Accuracy ⁽¹⁾	ϵ_{IOCD}	$T_A=25^{\circ}\text{C}$ $T_A=-40^{\circ}\text{C}$ to 85°C		4 6		% %
OCD _{EXT} threshold error ⁽¹⁾	ϵ_{EOCD}		-6		6	%

Table 19: MLX91221KDx-ABF-075 specifications

(1) For SOIC16 version

11. MLX91221 Overcurrent Detection

11.1. General

The MLX91221 provides two OCD features that allow detecting overcurrent applied on the integrated sensor primary. In case of OCD detection, the OCD_{INT} or OCD_{EXT} is pulled to ground. During normal operation the OCD voltage remains at V_{DD}. This OCD feature is available for SOIC16 version only.

The two OCD functions are able to react to an overcurrent event within few us of response time. To avoid false alarm, the overcurrent has to be maintained at least 1µs for the detection to occur. After detection by the sensor the output flag is maintained for 10µs of dwell time. This allows the overcurrent to be easily detected at microcontroller level. More information can be found in Application Note AN91220_OverCurrentDetection on www.melexis.com

The following table offers a comparison between OCD_{INT} and OCD_{EXT}:

	OCD _{INT}		OCD _{EXT}	
	Min	Max	Min	Max
Typical Application	Short-circuit detection		Out-of-range detection	
Overcurrent effect	OCD _{INT} pin to V _{SS}		OCD _{EXT} pin to V _{SS}	
Detection mode	Bidirectional		Unidirectional / bidirectional	
Accuracy	Lower		Higher	
Threshold trimming	EEPROM		Voltage divider on VOC _{EXT}	
Response time	1.4µs	2.1µs	10µs typical	
Required Input holding time	0.5µs		10µs minimum	
OCD output dwell time	7 µs	14 µs	10µs typical	

Table 20: Comparison between OCD_{INT} and OCD_{EXT} performances

11.2. Electrical Specifications

DC Operating Parameters at $V_{DD} = 3.3V$ (unless otherwise specified) and for T_A as specified by the Temperature suffix (K).

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
OCD_INT Internal ON Resistance	$R_{ON_OCD_INT}$	$I_{SINK} = 1 \text{ mA}$	60	90	150	Ω
OCD_EXT Internal ON Resistance	$R_{ON_OCD_EXT}$	$I_{SINK} = 1 \text{ mA}$	160	190	280	Ω
VOC_EXT Voltage Range	VOC_EXT		0.3		1.2	V

Table 21: OCD_{INT} and OCD_{EXT} electrical specifications

11.3. Internal Overcurrent Detection Principle

The internal OCD takes fixed threshold voltage values predefined in the EEPROM and do not require any extra components. The OCD_{INT} implementation allows detecting overcurrent outside of the output measurement range of the sensor and is therefore suitable for large current peaks as occurring during short-circuit. If the theoretical sensor output overcomes the OCD_{INT} voltage threshold, the overcurrent event is flagged on OCD_{INT} pin. The default OCD threshold voltages are defined as follow, but other values can be set on request. The overcurrent threshold in ampere is deduced from the sensitivity of the sensor [mV/A] and the OCD_{INT} threshold voltage.

	Sensor configuration	Min.	Max.
OCD _{INT} Threshold [% FS]	$V_{DD} = 3.3V / V_{REF} = 1.65V$	40.8	344

Table 22: OCD_{INT} factory programmable range

Sensor reference	Sensitivity [mV/A]	OCD _{INT} Threshold Current [% FS]	OCD _{INT} Threshold Current [A]
MLX91221KDF-ABF-010	120	100	10
MLX91221KDF-ABF-020	62.5	100.4	20.1
MLX91221KDF-ABx-120	62.5	140	28
MLX91221KDF-ABF-025	50	100.4	20.1
MLX91221KDF-ABR-038	33.3	112.6	42.8
MLX91221KDF-ABx-050	25	114	57
MLX91221KDF-ABF-075	16.7	114	85.6

Table 23: OCD_{INT} threshold currents for SOIC-16 versions

11.4. External Overcurrent Detection Principle

The external OCD uses the voltage applied on VOC_{EXT} pin as threshold voltage. This translates into an overcurrent threshold in ampere depending on the sensitivity of the sensor. A voltage divider on VOC_{EXT} allows defining the threshold voltage in a custom way. Depending on the voltage divider configuration, the OCD_{EXT} can be used either in bidirectional or unidirectional mode. The External OCD threshold is defined within the measurement range of the sensor output. This feature is then suitable for out-of-range detection where the OCD threshold remains close to the nominal current. It offers a better accuracy than OCD_{INT} but the response is slower. The below table presents the unidirectional and bidirectional external OCD configurations. Please refer to section 12 for more details about the application diagram and the recommended resistances.

Bidirectional configuration	Unidirectional configuration
$VOC_{EXT} = V_{REF} * \frac{R_{ext_{bi}}}{R_{ext} + R_{ext_{bi}}}$ $VLocd = VOC_{EXT}$ $VHocd = 2 * V_{REF} - VLocd$	$VOC_{EXT} = V_{REF} + (V_{DD} - V_{REF}) * \frac{R_{ext}}{R_{ext} + R_{ext_{uni}}}$ $VHocd = VOC_{EXT}$

Table 24: OCD_{EXT} , bidirectionnal and unidirectional configurations

12. Recommended Application Diagrams

12.1. Resistor and Capacitor Values

Part	Description	Value	Unit
C ₁	Supply capacitor, EMI, ESD	47	nF
C ₂	Decoupling, EMI, ESD	47	nF
C ₃	Decoupling, EMI, ESD	4.7	nF
$R_{EXT} + R_{EXT_BI} / R_{EXT_UNI}$	External OCD Resistor	~200 ⁽¹⁾	kΩ
R_{EXT_BI} or R_{EXT_UNI}	External OCD Resistor	custom	-

Table 25: Resistor and Capacitor Values for Recommended Application Diagrams

(1) High impedance needed due to the current source/sink limitation of the V_{REF} pin.

12.2. SOIC8 Application Diagram

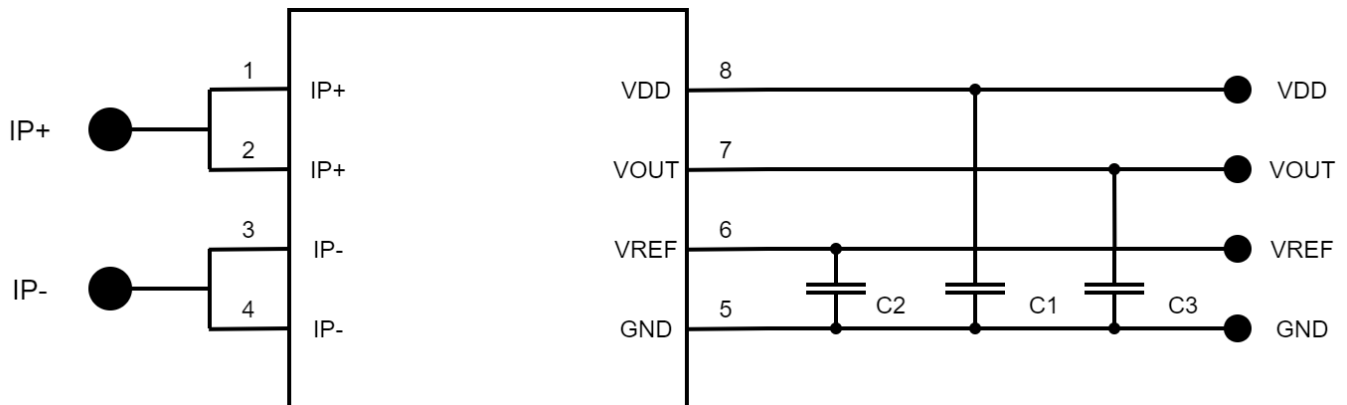


Figure 6: Recommended wiring for the MLX91221 in SOIC-8 package

12.3. SOIC16 Application Diagram

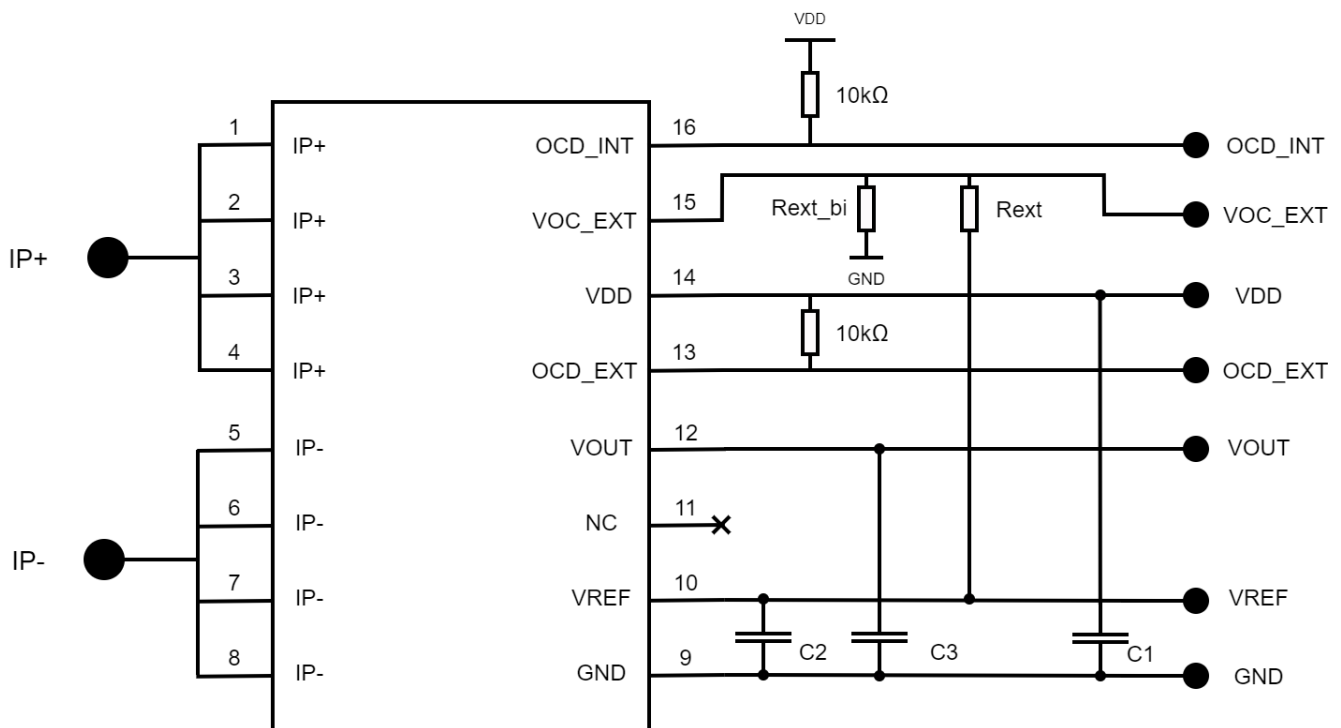


Figure 7: Recommended wiring for the MLX91221 with Bidirectionnal OCD_{EXT}



IP-

IP-

IP+



Figure 9 : Example of wiring in case of both OCD functions not needed

13. Standard information regarding manufacturability with different soldering processes

Our products are classified and qualified regarding soldering technology, solderability and moisture sensitivity level according to following test methods:

Reflow Soldering SMD's (Surface Mount Devices)

- IPC/JEDEC J-STD-020
Moisture/Reflow Sensitivity Classification for Nonhermetic Solid State Surface Mount Devices (classification reflow profiles according to table 5-2)
- EIA/JEDEC JESD22-A113
Preconditioning of Nonhermetic Surface Mount Devices Prior to Reliability Testing (reflow profiles according to table 2)

Wave Soldering SMD's (Surface Mount Devices) and THD's (Through Hole Devices)

- EN60749-20
Resistance of plastic- encapsulated SMD's to combined effect of moisture and soldering heat
- EIA/JEDEC JESD22-B106 and EN60749-15
Resistance to soldering temperature for through-hole mounted devices

Iron Soldering THD's (Through Hole Devices)

- EN60749-15
Resistance to soldering temperature for through-hole mounted devices

Solderability SMD's (Surface Mount Devices) and THD's (Through Hole Devices)

- EIA/JEDEC JESD22-B102 and EN60749-21
Solderability

For all soldering technologies deviating from above mentioned standard conditions (regarding peak temperature, temperature gradient, temperature profile etc) additional classification and qualification tests have to be agreed upon with Melexis.

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

Melexis recommends reviewing on our web site the General Guidelines soldering recommendation (<https://www.melexis.com/en/quality-environment/soldering>).

Melexis is contributing to global environmental conservation by promoting **lead free** solutions. For more information on qualifications of **RoHS** compliant products (RoHS = European directive on the Restriction Of the use of certain Hazardous Substances) please visit the quality page on our website (<https://www.melexis.com/en/quality-environment>).

14. ESD Precautions

Electronic semiconductor products are sensitive to Electro Static Discharge (ESD).

Always observe Electro Static Discharge control procedures whenever handling semiconductor products.



Parameter	Symbol	Test Method	Value	Unit
Human Body ESD Protection	ESD_{HBM}	AEC-Q100-002 Rev D	2	kV
Charged Device Model ESD Protection	ESD_{CDM}	AEC-Q100-011 Rev B	500	V

Table 26: Electrostatic Discharge Ratings

15. Package Information

15.1. SOIC-8 150mils- Package Dimensions

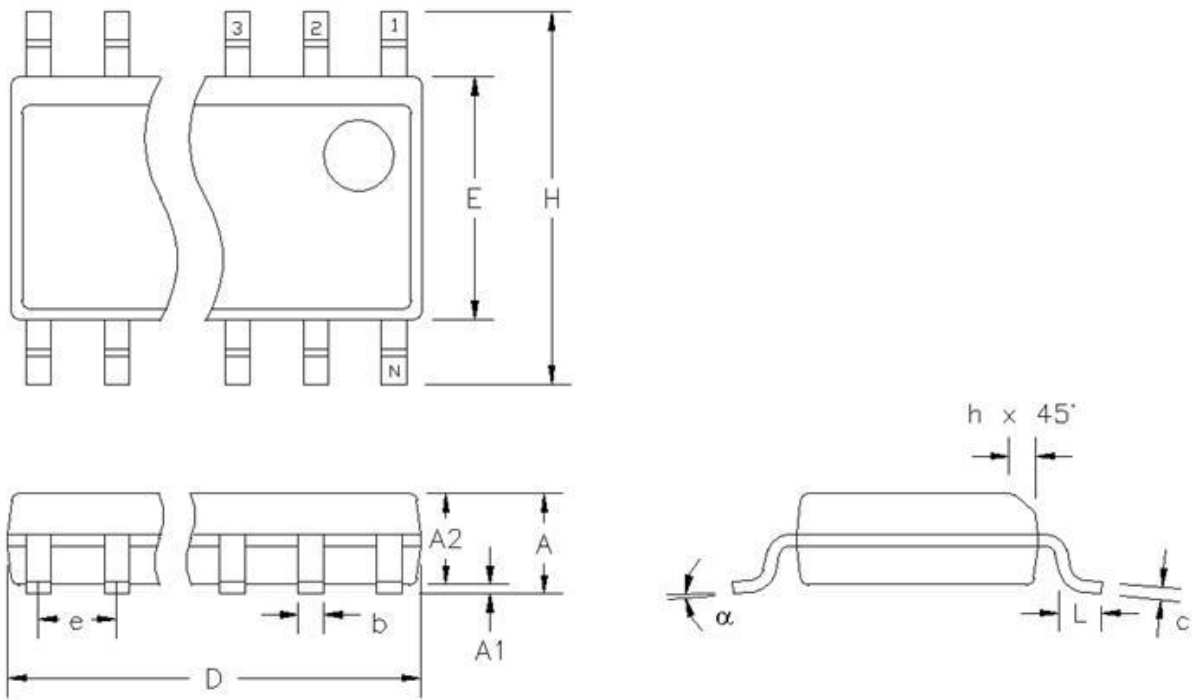


Figure 10 : SOIC8 Package Dimensions

[mm]	A	A1	A2	D	E	H	L	b	c	e	h	?
min	1.52	0.10	1.37	4.80	3.81	5.80	0.41	0.35	0.19	1.27	0.25	0°
max	1.73	0.25	1.57	4.98	3.99	6.20	1.27	0.49	0.25	BSC	0.50	8°

[inch]	A	A1	A2	D	E	H	L	b	c	e	h	?
min	.060	.004	.054	.189	.150	.228	.016	.014	.008	.050	.010	0°
max	.068	.010	.062	.196	.157	.244	.050	.019	.010	BSC	.020	8°

Table 27: SOIC8 package dimensions in millimeters and inches

15.2. SOIC-16 300mils- Package Dimensions

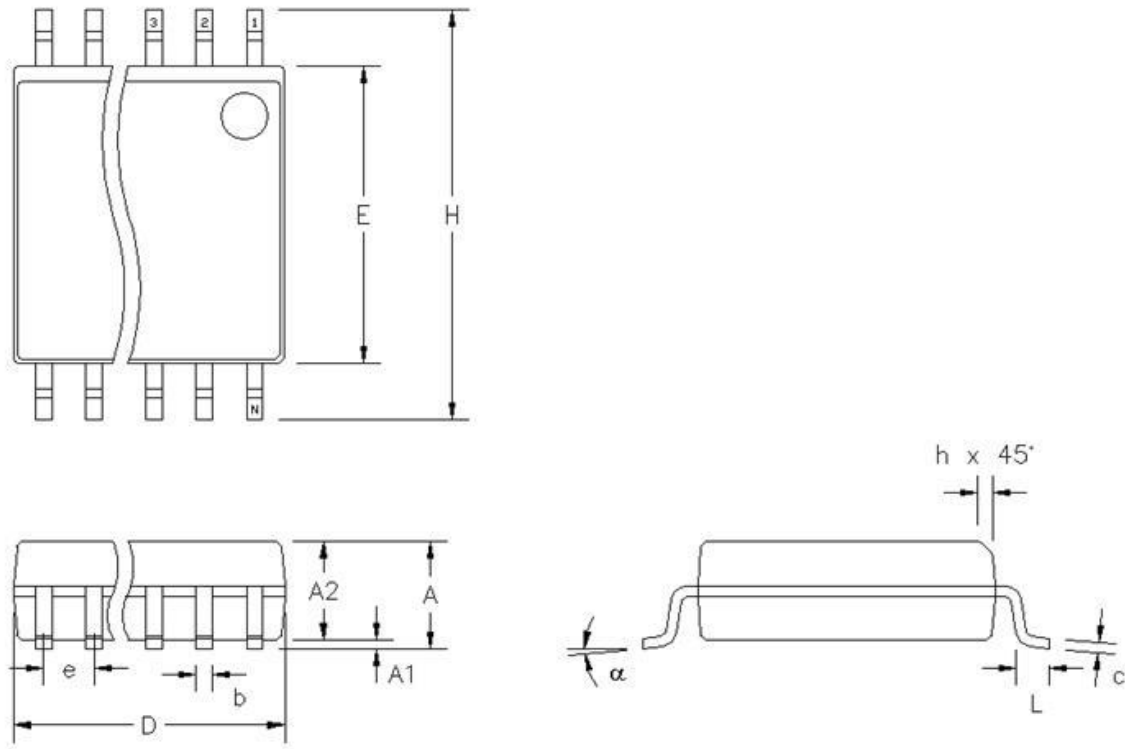


Figure 11 : SOIC16 Package Dimensions

[mm]	A	A1	A2	D	E	H	L	b	c	e	h	?
min	2.44	0.10	2.24	10.11	7.40	10.11	0.51	0.35	0.23	1.27	0.25	0°
max	2.64	0.30	2.44	10.46	7.60	10.51	1.02	0.48	0.32	BSC	0.71	8°

[inch]	A	A1	A2	D	E	H	L	b	c	e	h	?
min	.096	.004	.088	.398	.291	.398	.020	.014	.009	.050	.010	0°
max	.104	.012	.096	.412	.299	.414	.040	.019	.013	BSC	.028	8°

Table 28: SOIC16 package dimensions in millimeters and inches

15.3. Packaging marks

SOIC-8

1. Top mark

				2	2	1	A

Table 29: Package marking information

16. Contact

For additional information, please contact our Direct Sales team and get help for your specific needs:

Europe, Africa	Email : sales_europe@melexis.com
Americas	Email : sales_usa@melexis.com
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