MLX91220 Application Note

Fuse Current Capability

Contents

1. Scope

The MLX91220 is an Integrated Current Sensor that senses the current flowing through the 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.

This application note aims to present the overcurrent capability and destructive current limits for MLX91220 product family.

2. Current specification

DC Operating Parameters for T_A as specified by the Temperature suffix (K).

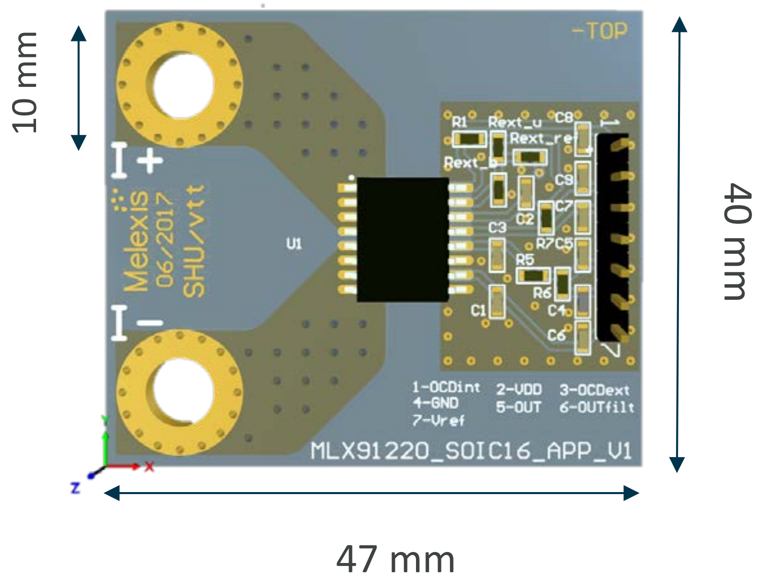
Table 1: Current specifications based on MLX91220_Datasheet_rev1.0

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Electrical Resistance of the Primary Current Path	R_{IP_SOIC8} R_{IP_SOIC16}	T_A=25°C		0.9 0.75		mΩ mΩ
Measurement Range	IP_{MAX}	Option Code ABx-x10 Option Code ABx-x20 Option Code ABx-x25 Option Code ABx-x30 Option Code ABx-x38 Option Code ABx-x50 Option Code ABx-x75		10 20 25 30 38 50 75		A 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-x30 Option Code ABx-x38 Option Code ABx-x50 Option Code ABx-x75		4 8 10 12 15 20 30		A A A A A A A
Linearity Error	NL	Current in range IP_{NOM}, T_A=25°C			±0.3	%FS
Linearity Error	NL	Current in range IP_{MAX}, T_A=25°C			±0.6	%FS
Current Capability (1)	IP_{C85_SOIC8} IP_{C25_SOIC8}	Continuous, T_A=-40 to 85°C Continuous, T_A=25°C			±25 ±35	A A
	IP_{C85_SOIC16} IP_{C25_SOIC16}	Continuous, T_A=-40 to 85°C Continuous, T_A=25°C			±30 ±40	A A

(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.

3. Hardware

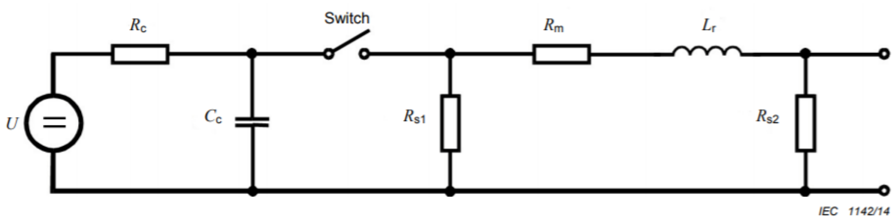
All the tests are performed with SOIC-16 package and the standard evaluation board displayed below. It is a 2 layers PCB with a 3 oz (105 µm) copper thickness each.



4. Surge Current Test

4.1. Standard

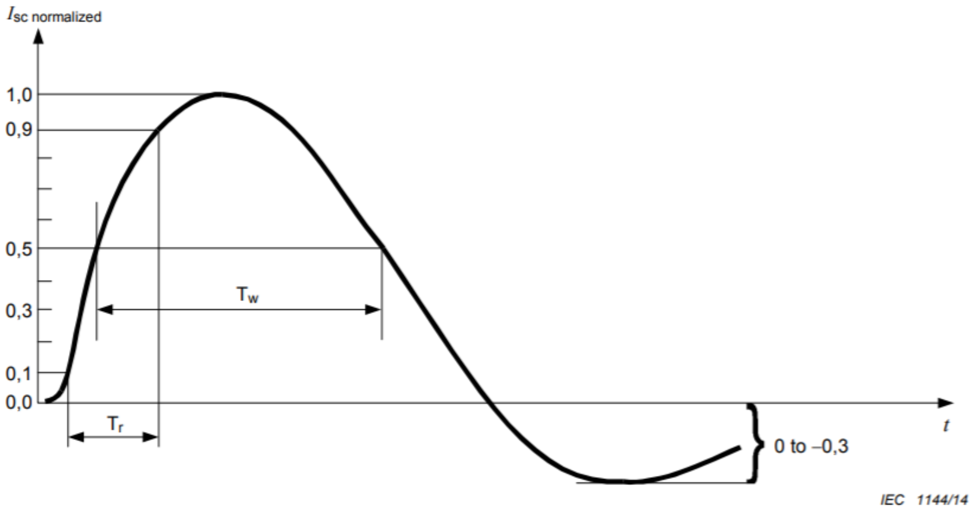
The standard IEC 61000-4-5 specifies testing and measurements techniques for surge immunity tests. For current surge testing, the generator is set to deliver an 8/20 µs current surge.



Key

U	High-voltage source
R_c	Charging resistor
C_c	Energy storage capacitor
R_s	Impulse duration shaping resistors
R_m	Impedance matching resistor
L_r	Rise time shaping inductor

Figure 1: Simplified circuit diagram of the combination wave generator from IEC 61000-4-5



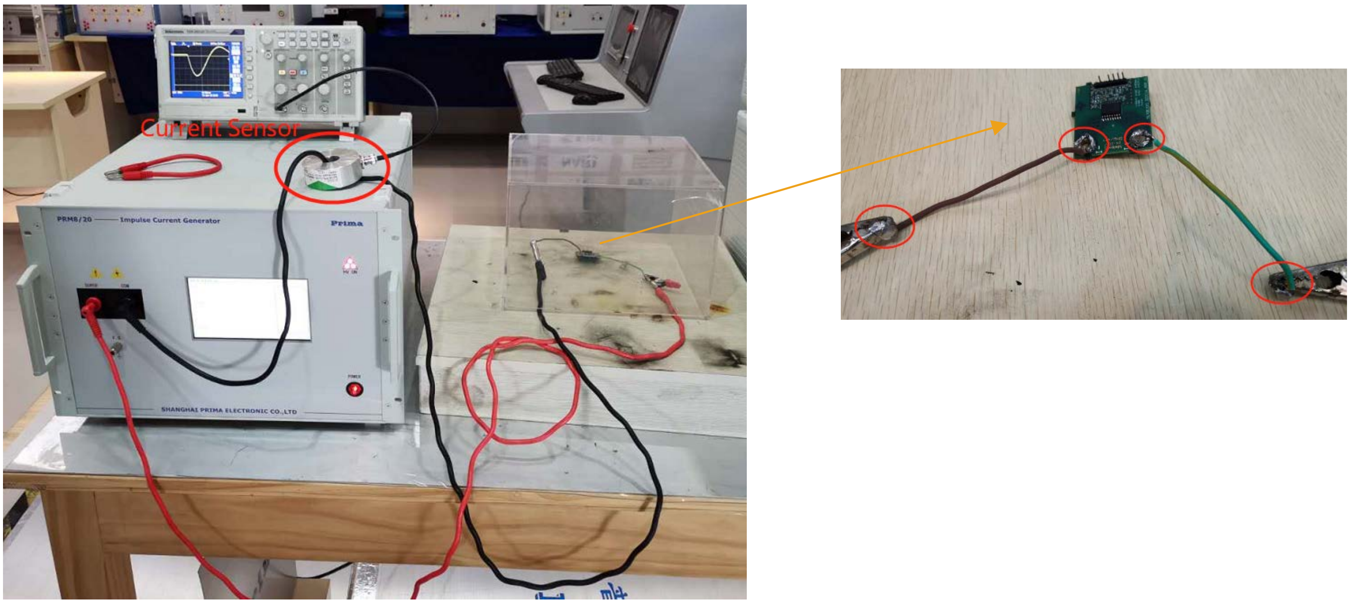
Front time: $T_f = 1,25 \times T_r = 8\ \mu s \pm 20\ \%$
Duration: $T_d = 1,18 \times T_w = 20\ \mu s \pm 20\ \%$

NOTE 1 The value 1,25 is the reciprocal of the difference between the 0,9 and 0,1 thresholds.

NOTE 2 The value 1,18 is derived from empirical data.

Figure 2: Waveform of short-circuit current (8/20 µs) at the output

4.2. Setup



4.3. Results

The IC can withstand **up to 4 kA** without destruction.

5. Time to fuse

5.1. Measurement setup

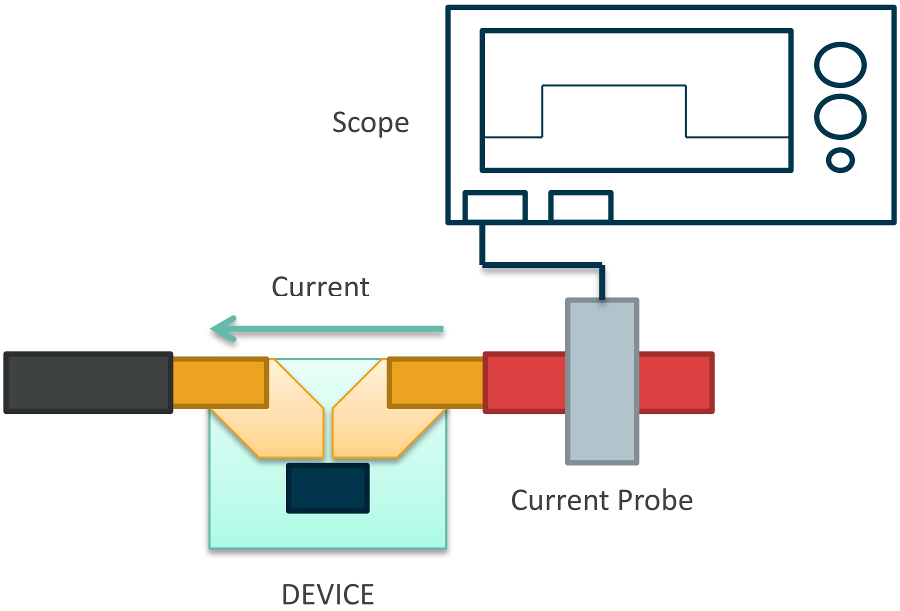


Figure 3: Measurement setup for fuse current capability

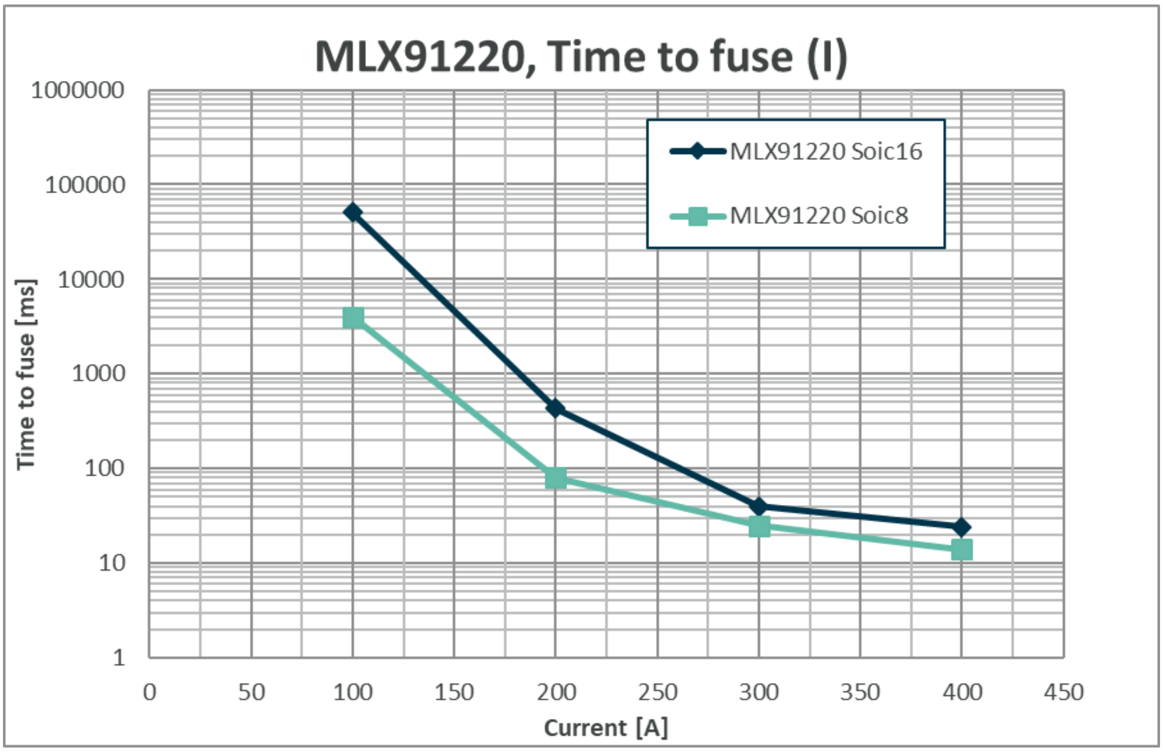
5.2. Measurement criteria

The criteria used to define the fuse current plot over time are of electrical nature, by measuring the time from applying the high current to the time the sensor output is faulty. This error is defined as a deviation of > 500 mV versus the expected output value. The measurements performed by Melexis have been conducted at room temperature and are based on a limited set of samples that are subject to process variability but the results showed consistency and are representative of the performance that can be expected using the DVK.

Repetitive exposure to current values just below the fuse current curve will induce degradation as the energetic dissipation $I^2.t$ will have a double effect:

- The temperature increase as a result of prior high current exposure will more easily increase the junction temperature above the absolute maximum rating defined in the datasheet
- Higher temperature of the leadframe increases the leadframe thermal resistance, at a typical rate of 35 %/°C.

5.3. Measurement results



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7. Revision history table

Revision	Date	Description/comments
1.0	December 2020	Initial release