MLX81106/7/8/9
Micro/Mini LIN Slave Controller

Features

Application Controller
- o Internal RC-Oscillator (12..24 Mhz programmable)
- o 16-bit RISC MCU with 24kB..32kB User Flash, 1kByte RAM, 384 Byte EEPROM with ECC

LIN Protocol Controller according to LIN 2.x and SAE J2602
- o Baudrate up to 19.2 kBaud
- o Frame processing
- o Low interrupt load to the application

LIN Transceiver according to LIN 2.x and SAE J2602
- o Support for Autoconfig according bus shunt

IO Configuration
- o Up to 12 IOs (MLX81107/9) or 4 IOs (MLX81106/8)
- o 4 programmable constant current (max 30mA)/high voltage capable IOs
- o 4 times 16-bit PWM outputs
- o Interrupt capable Inputs
- o 10-bit ADC with integrated pre-divider connected to all IOs,
- o Battery and LED threshold voltage monitor via ADC
    - o can be used for aging and temperature compensation of LEDs
- o Integrated temperature sensor for thermal management
- o Configurable Wake up sources (LIN and IOs)
- o Serial Interface (SPI)
- o Voltage output for supply external 5V loads via npn transistor (MLX81107)

Voltage Regulator
- o Low standby current consumption of typ 25µA (max 30 µA) in sleep mode
- o Over-temperature shutdown, 40V load dump protected

Other Features
- o Automotive Temperature Range of –40°C to 125°C
- o MLX81106/8 – Thermally enhanced SOIC8 Package
- o MLX81107/9 – QFN5x5 20 pins

Short Description

This IC is a fully integrated low end LIN Slave for switch and PWM applications in automotive environment. It is suitable for bus systems according to LIN 2.x as well as SAE J2602.

The combination of physical layer LIN transceiver and LIN protocol controller in combination with easy to configure switch inputs and PWM outputs make it possible to develop in a short timeframe simple, but powerful and cheap switch slave nodes for LIN Bus systems.

Contents

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1. General Overview

1.1 Memory Configuration

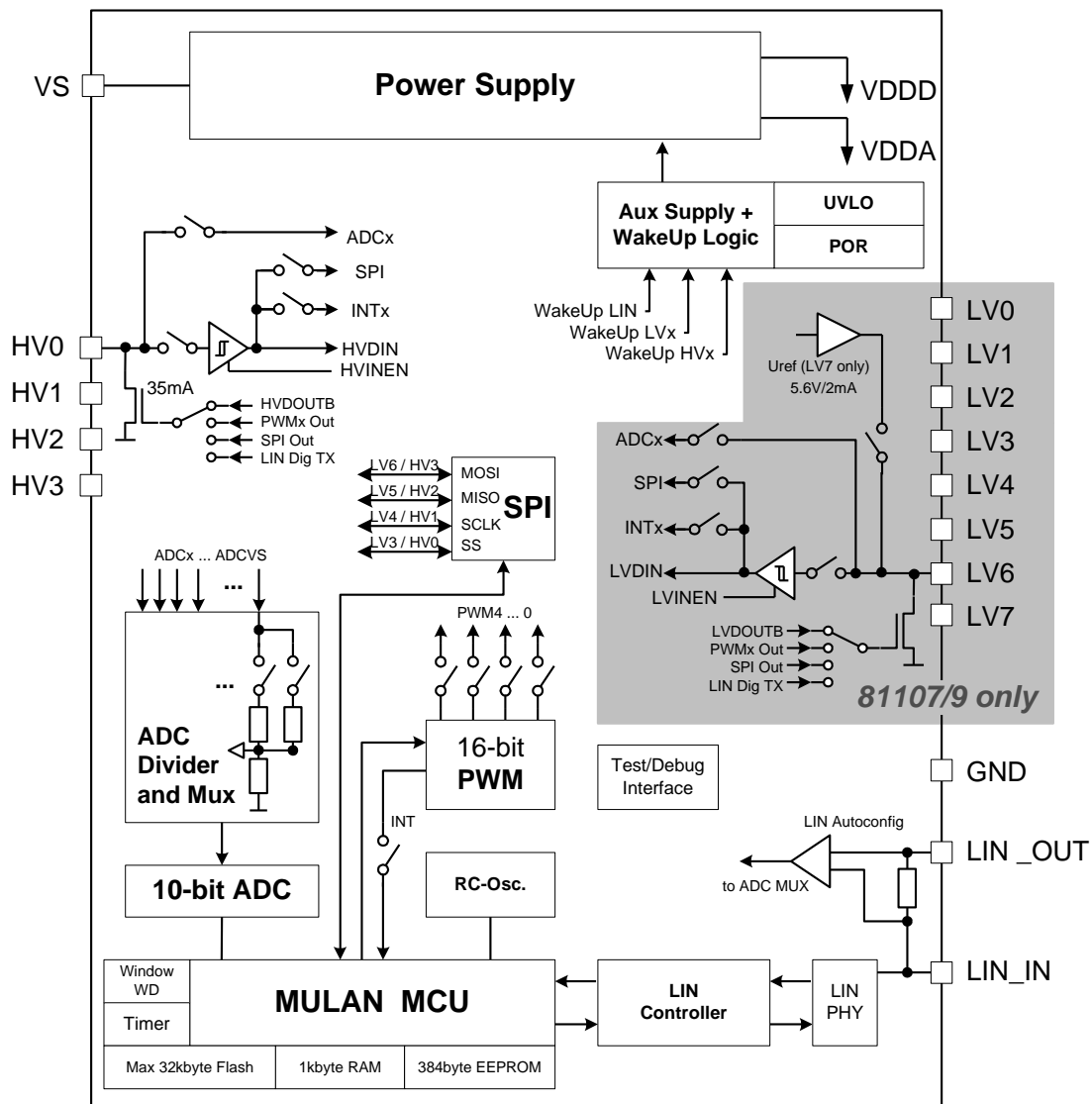| Part	Flash	User EEPROM	RAM	Package
MLX81106	24kByte	384Byte	1kByte	SOIC8
MLX81107	24kByte	384Byte	1kByte	QFN 5x5
MLX81108	32kByte	384Byte	1kByte	SOIC8
MLX81109	32Kbyte	384Byte	1kByte	QFN 5x5

1.2 Block Diagram

Figure 1 - Block Diagram

2. Electrical Characteristics

All voltages are referenced to ground (GND). Positive currents flow into the IC.

2.1 Absolute Maximum Ratings

In accordance with the Absolute Maximum Rating System (IEC60134). The absolute maximum ratings given in the table below are limiting values that do not lead to a permanent damage of the device but exceeding any of these limits may do so. Long term exposure to limiting values may affect the reliability of the device. Reliable operation is only specified within the limits shown in „Operating conditions".

Parameter	Symbol	Condition	Min	Max	Unit
Battery Supply Voltage	V_S		-0.3	40	V
Short term supply voltage	V_{S_ld}	ISO 7637/2 pulse 5; t < 400 ms	-0.3	40	V
Transients at supply voltage	V_{S_tr1}	ISO 7637/2 pulse 1[1]	-100		V
Transients at supply voltage	V_{S_tr2}	ISO 7637/2 pulses 2 [1]		+50	V
Transients at high voltage signal pins	V_{LINx_tr1}	ISO 7637/3 pulse 1 [2]	-100		V
Transients at high voltage signal pins	V_{LINx_tr2}	ISO 7637/3 pulses 2 [2]		+50	V
Transient at high voltage signal and power supply pins	V_{HV_tr3}	ISO 7637/2 pulses 3A, 3B [3]	-150	+100	V
DC voltage on LIN, HVx	V_{LIN_DC}	T<500ms	-22	40	V
DC voltage on D0..7	V_{logic_DC}		-0.3	7	V
ESD voltage	V_{ESDIEC}	IEC 61000-4-2 Pin BUS, VS to GND	-6	6	kV
	V_{ESDHBM}	HBM (CDF-AEC-Q100-002) [4] Pin BUS, VS to GND Other pins	-6 -2	6 2	kV kV
	V_{ESDCDM}	CDM (AEC-Q100-011) Pin BUS, VS to GND	-750	750	V
	V_{ESDMM}	MM (AEC-Q100-003) Pin BUS, VS to GND	-100	100	V
Maximum latch – up free current at any pin	I_{LATCH}		-500	500	mA
Storage temperature	T_{stg}		-55	+150	°C
Junction temperature	T_{vj}		-40	+150	°C

Table 1 - Absolute Maximum Ratings

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[1]   ISO 7637/2 test pulses are applied to VS via a reverse polarity diode and >2uF blocking capacitor.
[2]   ISO 7637/3 test pulses are applied to LIN via a coupling capacitance of 100nF.
[3]   ISO 7637/3 test pulses are applied to LIN via a coupling capacitance of 1nF.
       ISO 7637/2 test pulses are applied to VS via a reverse polarity diode and >2uF blocking capacitor.
[4]   Equivalent to discharging a 100pF capacitor through a 1.5kΩ resistor conforms to MIL STD 883 method 3015.7.

2.2   Operating Conditions

Parameter	Symbol	Min	Max	Unit
Battery supply voltage [1]	V_S	5.5	18	V
High battery supply voltage	V_{S_S}	18	27	V
Operating ambient temperature	T_{amb}	-40	+125	°C

Table 2 - Operating Conditions

1) V_s is the IC supply voltage including voltage drop of reverse battery protection diode, V_{DROP} = 0.4…1V, V_{BAT_ECU} = 6…27V.

3. Functional Description

3.1 MCU

- 16-bit RISC MCU

3.2 LIN Transceiver and Controller

- Support for LIN 2.x and J2602
- Support Autoconfig according bus shunt

3.3 Memory

- 24kByte User Flash MLX81106/7
- 32kByte User Flash MLX81108/9
- 1kByte RAM
- 384Byte User EEPROM
- 128byte MLX EEPROM for LIN IDs, Calibration data

3.4 HV0..3 IO

- High voltage capable open drain output (max 60Ohm RDSON)
- High voltage capable constant current output of max. 30mA per IO (max. 48mA short term)
- 16-bit PWM Output
- Digital output (5V)
- High voltage capable input
- Digital (5V) input
- 10-bit ADC Input inc.pre-devider for direct measurement of VS
- Differential SC-Amplifier for detection of very small voltage changes for LED threshold measurement
- SPI Interface
- Interrupt capable input

3.5 LV0..7 IO (MLX81107/9 only)

- Open drain output (3mA)
- PWM output
- Low voltage output (5V)
- Low voltage (5V) input
- ADC Input inc. pre-devider for direct measurement
- SPI Interface
- Interrupt capable input
- LV7 - Voltage output for supply external 5V loads via npn transistor (See appl example for details)

3.6 Software Debug Interface

- Available at HV0..3pins (MLX81106/8)
- Available at LV0..3pins (MLX81107/9)
- HV2(MLX81106/8) and LV2(MLX81107/9) needs pull up against 3.3V supplied from emulator
- For full debug function on 81106/8 the MLX81107/9 can be used as software development device.

3.7 ADC

- 10-bit ADC
- Up to 20 channels (HVO..3, LV0..7,VS, internal references, temp sensor)
- Full Scale 5V via internal pre-divider
- Continuous Mode: Automatic measuring of enabled channels. Result stored via DMA. If new result available old will be overwritten

3.8 PWM

- Max 16-bit resolution, min 370Hz
- Configurable from 8-bit to 16-bit, 8-bit mode with max possible frequency – approx 60kHz
- 4 undependent PWM channels
- Programmable PWM frequenz per channel
- Programmable interrupt generation at the beginning and/or end of every PWM period
- Synchronuous switch of duty cycle change

3.9 Power Supply

- Internal compensated
- Primary Cap min 2.2uF

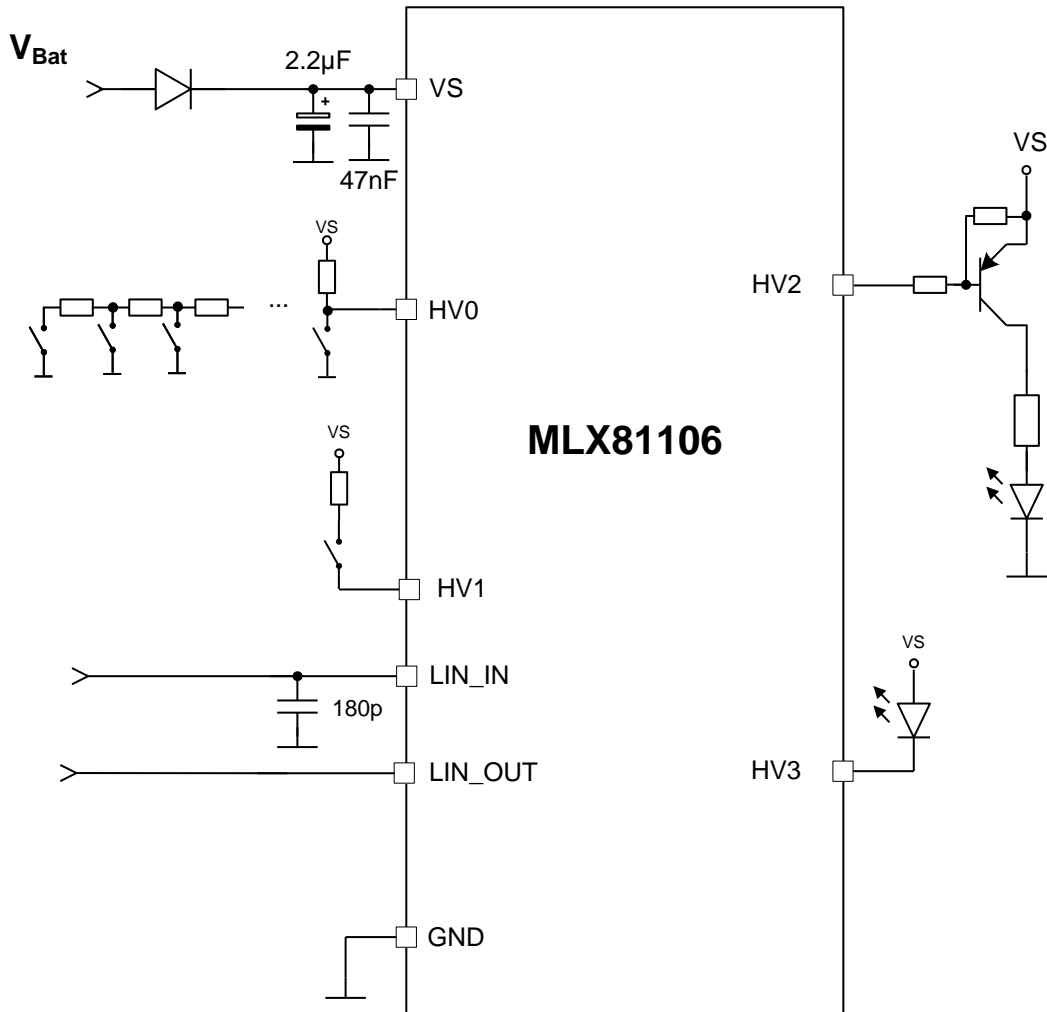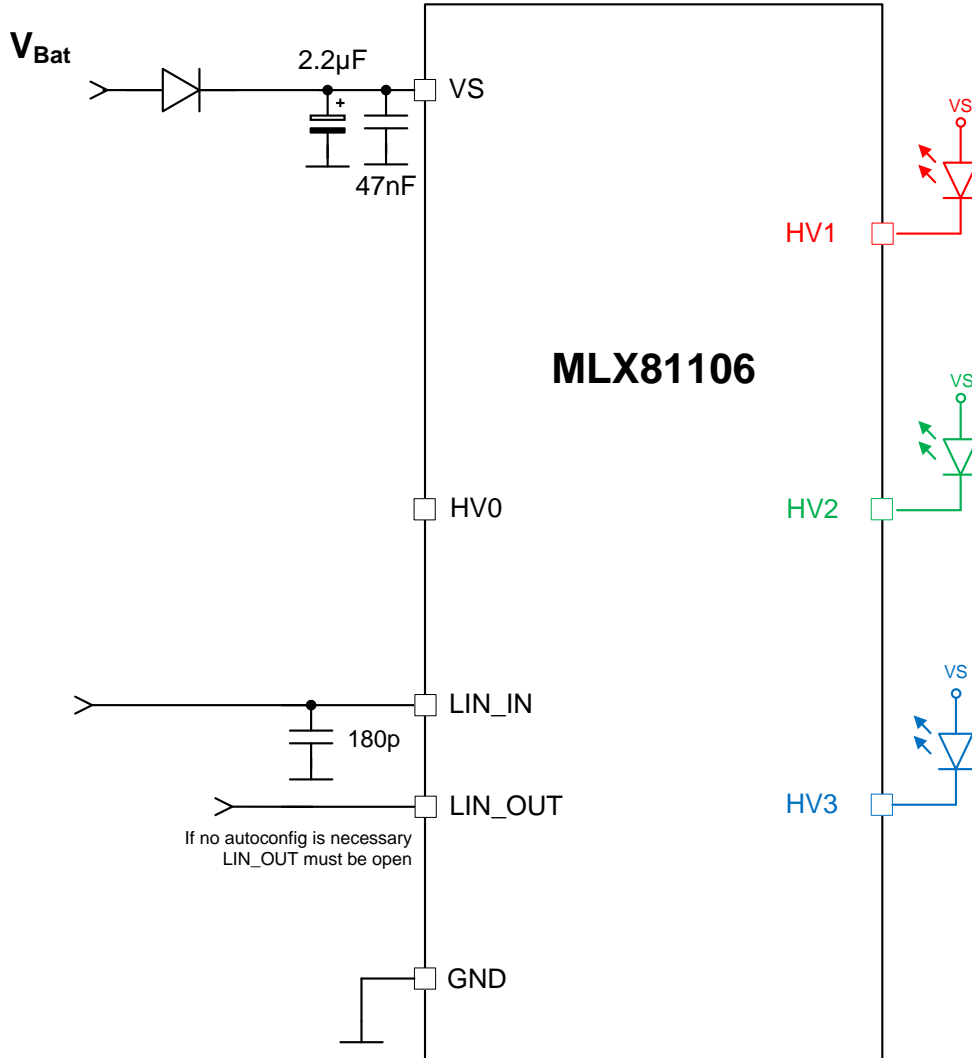# 4. Application Hints

4.1 General Application Examples MLX81106/8

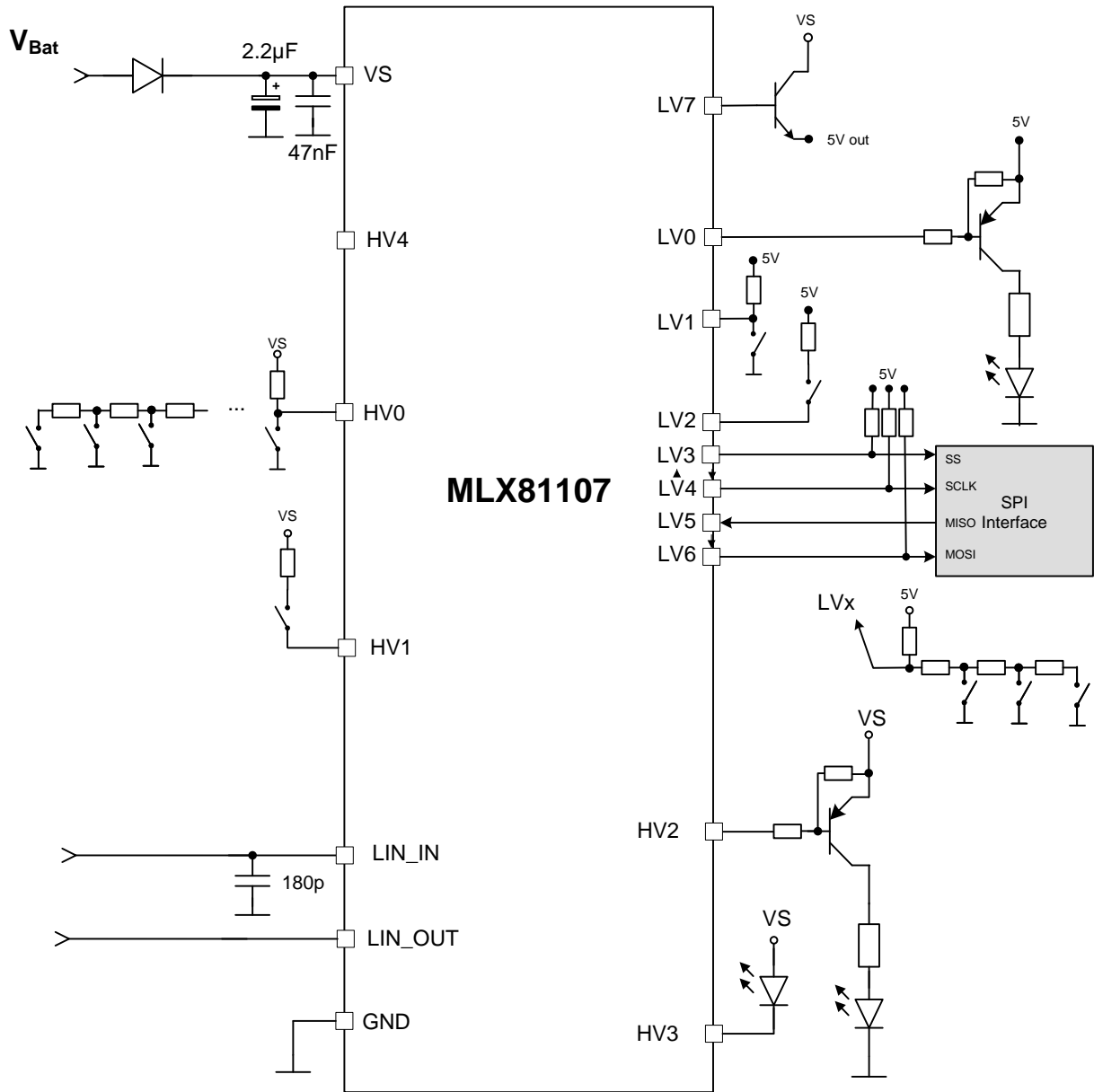**Figure 2 - Application schematic sample**

4.2 LIN RGB Application Examples MLX81106/8

Figure 3 - LIN RGB Slave

4.3 Application Examples MLX81107/9

Figure 4 - Application schematic sample

5. Soldering information

Please see

http://www.melexis.com/Assets/Soldering-Application-Note-and-Recommendations-5446.aspx

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