2014 POLY eRACING CAR

BMS Slave
Electrical Inputs/Outputs
Interface Control Document

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<Power Electronics>	Interface Control Document	Internal	In Preparation

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Revision Log

Revision	Date	Description of Changes
1.1	22 dec. 2013	Pin out error corrected for temperature and voltage connector.
1.2	2 jan. 2014	Pin out changes for discharge connector. MCU programmer connector changed. Corrections in connector references to match with references in schematic and layout.

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1. Introduction

1.1 Document Overview

This document covers every connection interfaces of the BMS Slave circuit. It includes the pinout configuration of each connector, description of its functions and physical characteristics and limits.

1.2 Acronyms and definitions

- **BMS** : Battery Management System, also known as Accumulator Management System (AMS)
- **CAN** : Controller Area Network (a communication protocol often used in automotive for communication between different modules (boards or systems))
- **MCU** : Micro controller
- **PCB** : Printed circuit board
- **LTC** : Refers to the LTC chip used in the circuit
- **SPI** : Serial Peripheral Interface (a communication protocol)
- **ICD** : Interface Control Document (this document)

2. References

Ref. #	Document ID	Description
1	2014_fsae_rules.pdf	Formula SAE Rules 2014

3. System Components

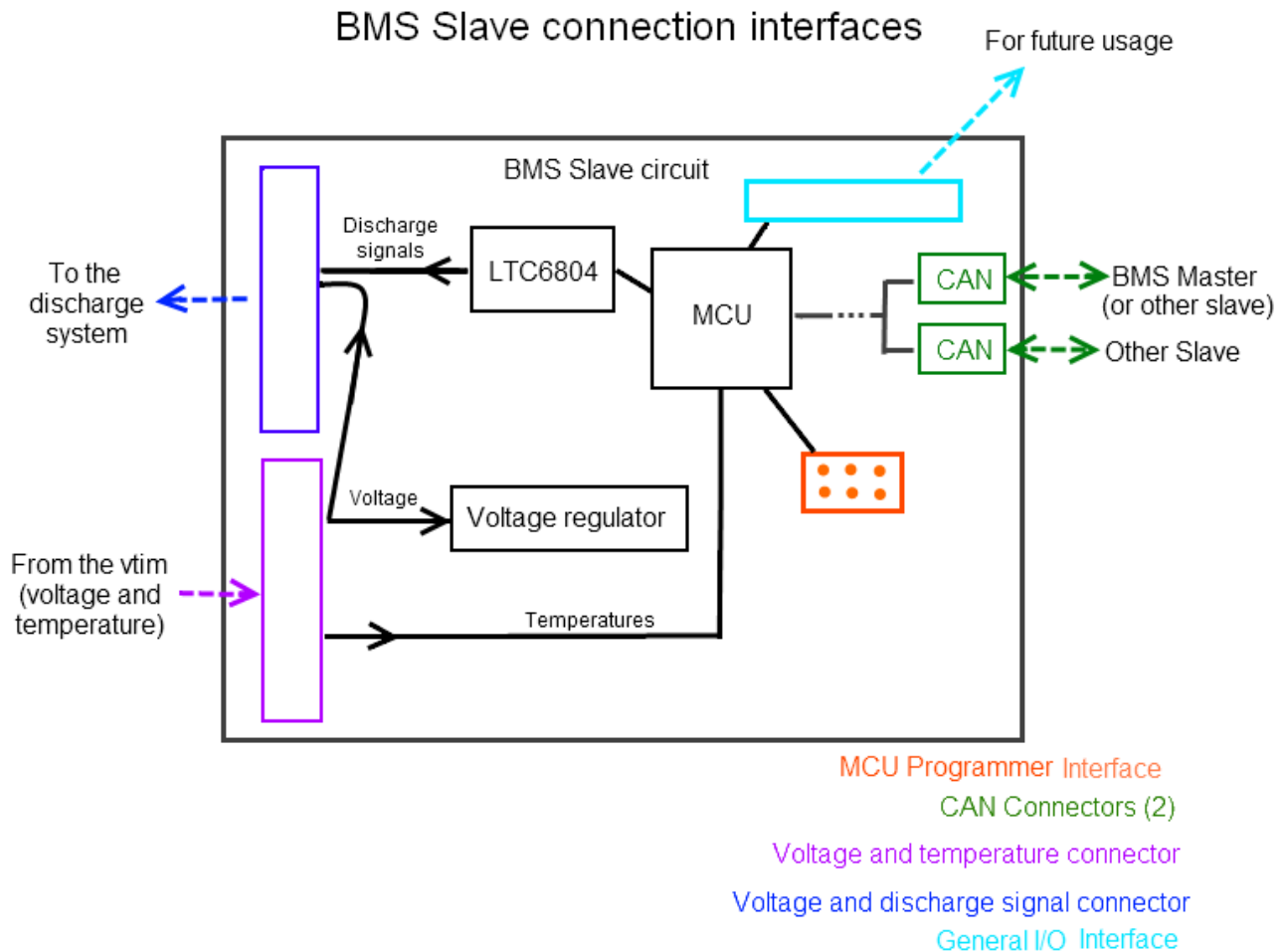### 3.1 Block Diagram, Schematic and/or PCB Layout

Figure 1 : BMS Slave connection interfaces

3.2 BMS Slave Inputs/Outputs

List of necessary connectors:

X1 - 1 x 28 positions for **voltage** (14) and **discharge signal** output (12 or 14)

X2 - 1 x 28 positions for **voltage** (14) and **temperature** input (12)

X3,X4 - 2 x 6 positions (minimum) connectors for **CAN** (4 wires) and **shutdown signal** (2 wires)

X5 - 1 x 6 positions interface for **MCU programmer** (only used to program the MCU)

X6 - 1 x N positions **general inputs and outputs** interface

Signal description

Temperatures (T0 to T11)
T0 (thermistor signal of the last cell), T1, T2,…, T10, T11 (thermistor signal of the last cell, higher voltage).

Voltage (V0 to V12)
V0 (lower voltage of the battery pack, GND), V1, V2, …, V11, V12 (higher voltage of the pack)

Discharge signal (S1 to S12)
Outputs of the LTC6804 chip. These signals indicate which cell needs to be discharged.

Discharge circuit plugged signal
This signal gives the possibility to the BMS Slave to see if the discharge circuit is plugged to the slave or not.

Con-nector ref.	Destination	Description	Type of component	Pinout
X1	Discharge circuit	Brings the voltage and discharge signals (from LTC chip) to the discharge circuit.	Samtec IPL1-116-01-L-D-K[2]	Pin 21 to 32 : S1 to S21 Pin 4 to 16 : V0 to V12 Pin 1 and 10 : Tight to GND (V0) Pin 16 : *Discharge circuit plugged* signal Other : unused (see figure 3)
X2	Vtim board	Voltage and temperature inputs.	Samtec IPL1-115-01-L-D-RA-K[1]	Pin 4 to 15 : T0 to T11 Pin 18 to 30 : V0 to V12 Other : unused (see figure 2)
X3,X4	BMS Master / other BMS slave	Connectors used for CAN signals	IPL1-102-01-L-D-RA-K[3]	Pin 1 : VCC (5V) Pin 2 : GND Pin 3 : CAN Low Pin 4 : CAN High
X5	Programmer	This connection is used to program the MCU with a specific programmer board	Harting 09185066324	Pin 1: BKGD Pin 2: GND (Ground) Pin 3: - Pin 4: Reset Pin 5: - Pin 6: VCC (Power)
X6	General I/O	General I/O reserved	4-array jumper	N/A

[1] Use with IPD1-15-D-K-M or MMSD (with wires)

[2] Use with IPD1-16-D-K-M or MMSD (with wires)

[3] Use with IPD1-02-D-K-M

[4] Use with Samtec IDSD-03-D-XX.XX-T

Notes

X1: On the discharge circuit, pins 1 (GND) and 17 (*Discharge circuit plugged* signal) must be tight together.

X2: During the discharge, the current will be around 2.1 A. The connectors are rated for 3A and the circuit traces will be thick enough to support this current.

X3, X4: The VCC (pin 1) has two functions. It powers an isolated CAN transceiver (ISO1050) and is used as a shutdown signal for the slaves (VCC = 5V >> slaves are ON, VCC = 0V >> slaves are OFF). The current in the pin 1 varies a lot depending on the transmission. We can estimate the maximum current to about 100 mA.
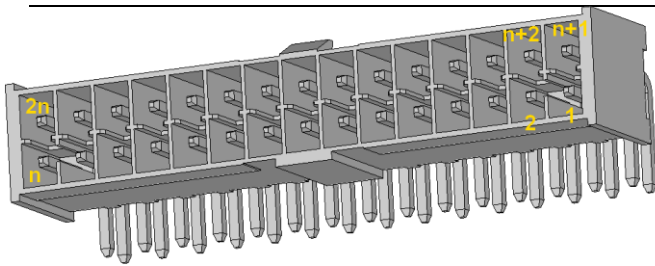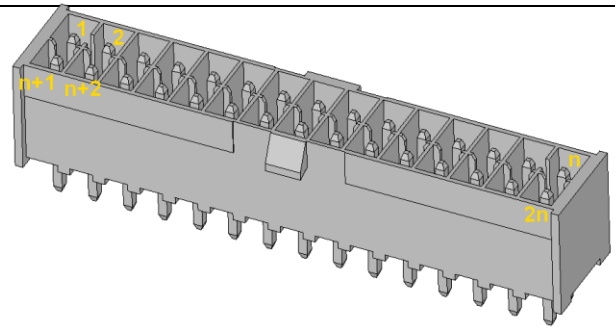
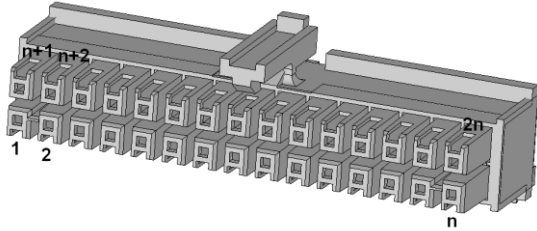**Figure 8 :** Samtec IPL1 for X2 (right angle)

Figure 7 : Samtec IPL1 for *X1*

Figure 6 : Samtec IPD1 for *X1* and X2

IPL1   IPD1

Figure 5 : Samtec IPL1 and IPD1 for *X3* and *X4*
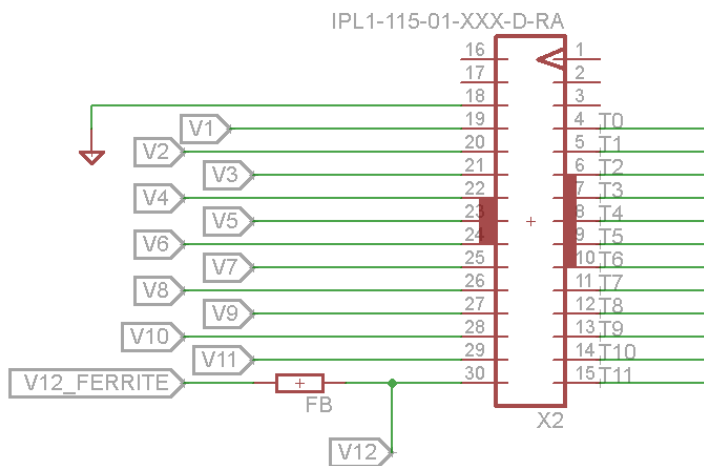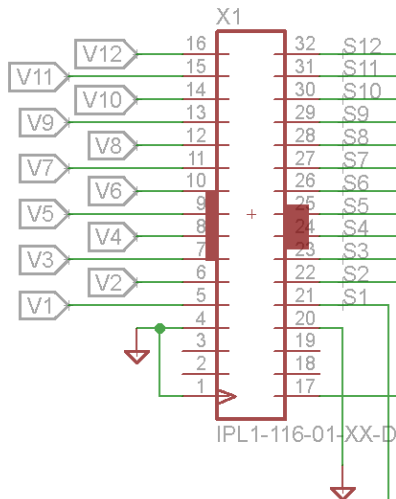
Figure 3 : *X2* connections
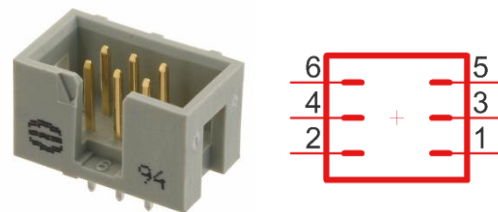

Figure 2 : Harting 09185066324 for *X5*

Figure 4 : *X1* connections

3.3 BMS Master Inputs/Outputs

Note : References in this section are proper only to this document. The connector reference in the circuit schematic and layout may not be the same.

In this section, only the relevant connectors of the BMS Master will be presented.
- CAN connector (*X01*)
- Shutdown signal interface (X0*1**)

Connector Reference	Destination	Type of connector	Pinout
X01	CAN Bus	TE Connectivity 6609208-4	Pin 1: - Pin 2: Vcc* (Power) +5V (10 mA**) Pin 3: CAN High +5V (< 1mA) Pin 4: CAN Low 0V (<1mA) Pin 5: GND* (Ground) 0V (10 mA**) Pin 6: -

Note : Pin 1 and 6 are unused

RJ-11-6
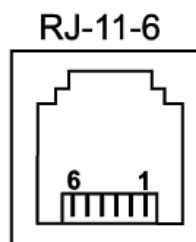
*These signals will also be used to power off the Slave automatically when the master is off.
** May be more (~ 50 mA) considering these pins will power an optoisolator and a isolated CAN Transceiver on each Slave circuit.
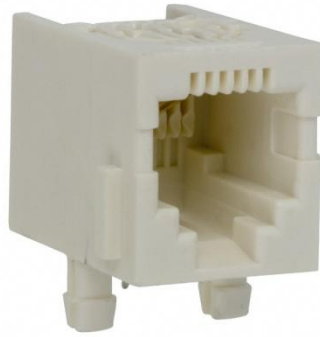
Description: CAN bus 2.0 information signal

Figure 9 - TE Connectivity 6609208-4 for X01

3.4   Vtim Inputs/Outputs

Refer to *X1* connector and connections in part 3.2. Use surface mount or trough hole version.