



Universal Advanced Front-End  
For  
Automotive Electronics and Electrical Power

[www.emcignal.com](http://www.emcignal.com)  
P.O.B 94, Yavne 81101 Israel  
Tel: +972-8-932-7907 Fax: +972-8-858-0980

## 1 Background

EMCignal has developed a smart front-end electrical power & electronic interface unit for a military automotive application. This unit functions as an interface between any electronic equipment installed in the vehicle and the surrounding environment. It handles all the RFI and EMI issues, as well as any electrical power irregularities in the vehicle that can affect the electronic units. It also prevents the undesirable emission of radiation from the electronic units through the I/O interface.

EMCignal is converting this interface solution from a military application into an automotive standard chip-set solution that enables automotive electronic units to comply with today's challenging EMI and power protection design standards. This chip-set family will replace the traditional discrete components based automotive interface units.

## 2 Description

The specific unit described herein is an example, which illustrates the concept described above.

The unit is fed from several power sources, such as: main vehicle battery, back-up battery or other possible sources.

It provides three outputs; two of them are regulated and controlled (Vo1 and Vo2 in Fig 1) for the vehicle computer, while the third (Vch in Fig 1) is only protected and reserved for other functions.

The product contains protection against spikes, surges as well as RFI filtering against interference that is inherent in the vehicle power bus.

One of important features is "No power drop" for computer smooth operation. The unit performs a "make before break" method by sensing the main source and connecting the backup source upon incipient development of any power failure.,

The power front-end unit contains logic circuitry to control its' functions. The logic control-circuitry selects the proper input and determines the needed output power to the system. It also provides indication signals to be used by the user system.

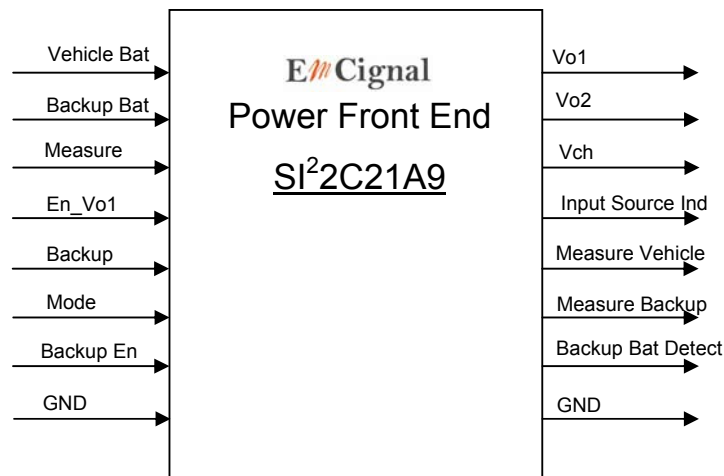


Fig 1

### 3 International Standards and Specifications

This front end family withstands and complies with the following international standards:

- ISO 7637.2 1990 class A
- SAE-J1211 table 3 and table 4
- SAE-J1113 paragraph 2
- EN55022, EN55024
- EN61000

### 4 Product Specifications

#### 4.1 Power inputs

The SI<sup>2</sup>C21A9 is fed from two power sources:

1.	Vehicle Bat	9V to 36V vehicle power bus
2.	Backup Bat	4.5V to 8.5V

#### 4.2 Power outputs

The SI<sup>2</sup>C21A9 supplies three power outputs:

1.	Vo1	4.05V – 4.35V, when operating from Vehicle Bat Or: 3.4V – 3.6V, when operating from Backup Bat
2.	Vo2	3.2V – 3.4V @ Vehicle Bat & Backup Bat input power
3.	Vch	Vehicle Bat after protection : 9V to 36V

#### 4.3 Input signals

The SI<sup>2</sup>C21A9 receives:

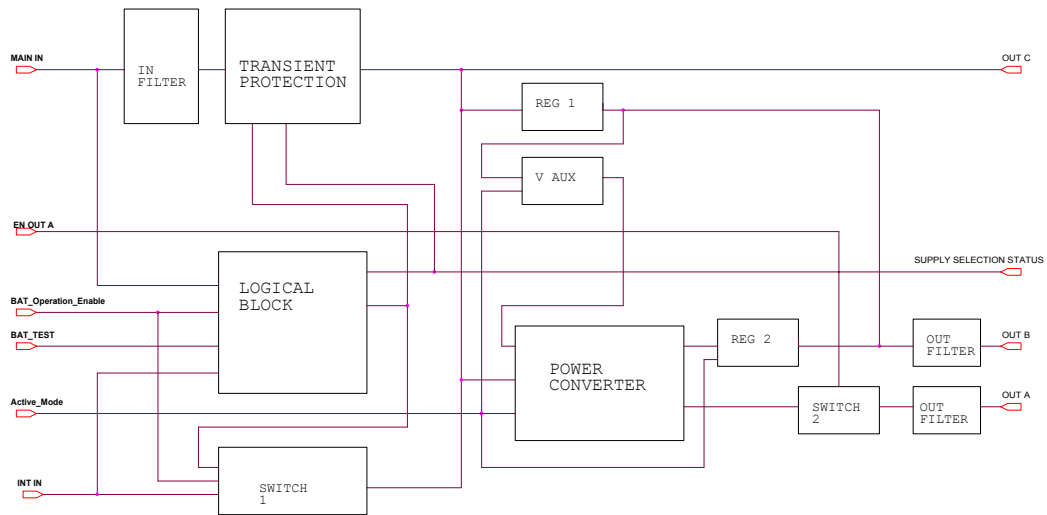
En_Vo1	Turns on Vo1.
Backup Test	Enables the backup-battery power supply even if External power supply is ok
Mode	Enables full power on or full power down
Backup En	Enables the backup-battery power supply when external power supply fails or is disconnected

## 4.4 Output signals

The SI<sup>2</sup>C21A9 supplies:

Input Source Ind	Indicates if the power supply fed from vehicle battery or backup battery
Measure Vehicle Bat	Indicates the measured voltage of vehicle battery
Measure Backup Bat	Indicates the measured voltage of backup battery
Backup Bat Detect	Indicates whether the backup battery exists

## 4.5 Block Diagram



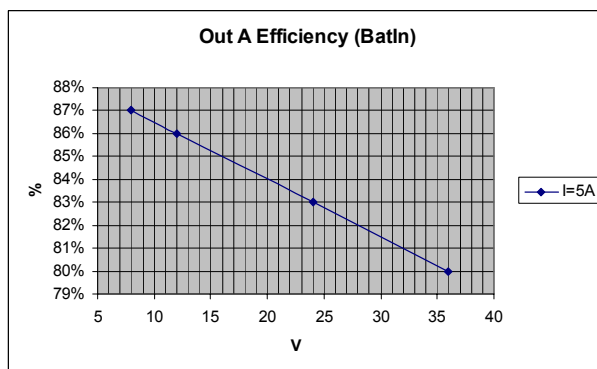
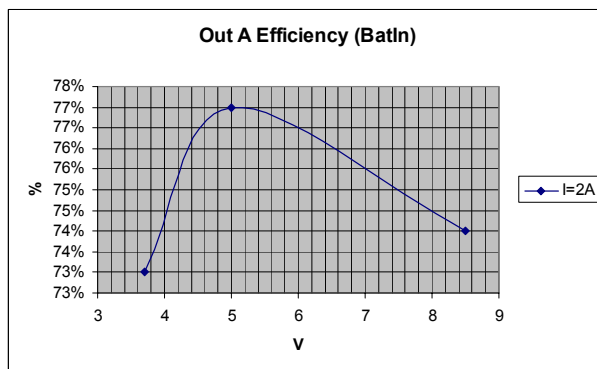
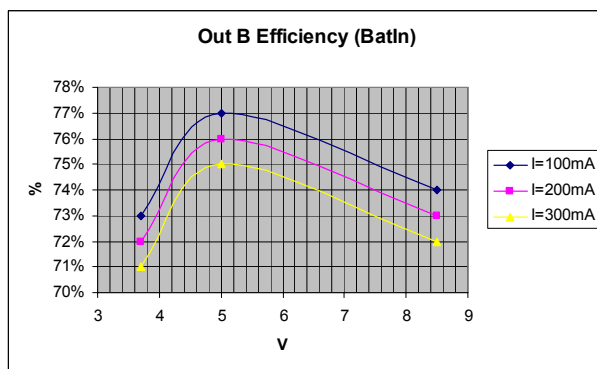
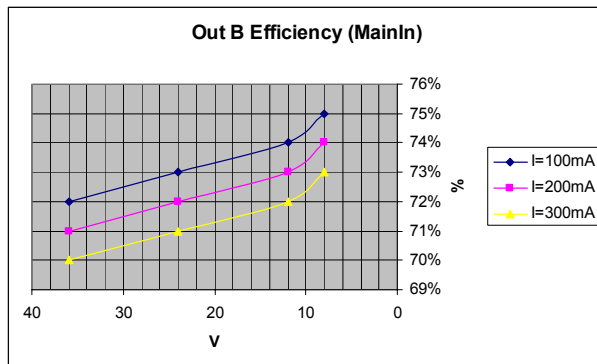
## 4.6 Interface

Pin assignment:

Pin No.	Signal description
1	Vehicle Bat
2	GND
3	Backup Bat
4	Backup En
5	Mode
6	Enable_Vo1
7	Backup Test
8	measure

Pin No.	Signal description
9	Backup Bat Detect
10	Input Source Indication
11	Measure Backup Bat
12	Measure Vehicle Bat
13	Vo2
14	GND
15	Vo1
16	Vch

## 4.7 Efficiency



#### 4.8 Electrical Performance

The SI<sup>2</sup>C21A9 unit operates in the conditions shown herein:

Description	Values @Temp. range
Input Voltage from Vehicle Battery	9V to 36V
Input Voltage from Backup Battery	4.5V to 8.5V
Output voltage Vo1 @ fed from "Vehicle Bat": Full load 5A – Low load –	4.05V to 4.3V 4.05V to 4.35V
Output voltage Vo1 @ fed from "Backup Bat" Load 2A –	3.4V to 3.6V
Output voltage Vo2 @ fed from any input source: "Mode" off – "Mode" on (300mA) –	3.2V to 3.4V 3.23V to 3.37V
Output current from Vo1 @ fed from " Vehicle Bat"	5A max @ 100ms
Output current from Vo1 @ fed from "Backup Bat"	2A max @ 100ms
Output current from Vo2 @ fed from any input source	300mA max.
Quiescent current @ fed from Vehicle Battery Mode = Active	2500µA @ 36V
Quiescent current @ fed from Backup Battery Mode = Active	2000µA @ 8.5V
Quiescent current @ fed from Vehicle Battery Mode = Passive,	1000µA @ 36V 500µA @ 12V
Quiescent current @ fed from Backup Battery Mode = Passive,	150µA @ 8.5V 100µA @ 4.5V
Leakage current @ shutdown	<1µA
Logic input signal levels Backup En En_Vo1 Backup Test Mode	2.7V min to Vbat+0.5V 2.7V min to 3.3V +5% 2.7V min to 3.3V +5% 2.7V min to 3.3V +5%
Efficiency (see figure #6 efficiency Vs input voltage and load) Vo1 @ 50% load Vo2 @ 50% load	80% minimum. 70% minimum.
Switching frequency	380KHz/500KHz
Ripple Vo1 Vo2	250mV <sub>p-p</sub> 50mV <sub>p-p</sub>
Line regulation Vehicle Bat Backup Bat	±1% ±1%
Load regulation Vo1 Vo2	±5% ±1%

## 4.9 Logic Performance

The SI<sup>2</sup>C21A9 unit will fully operate in the logic conditions shown in herein:

Description	Value
Backup En – enables the battery power supply when external power supply fails or is disconnected	"1"
Backup Test –enables the battery power supply even if external power supply is good (and Backup En='1')	"1"
En_Vo1 - Vo1 should be turned on.	"1"
Mode – loads are active and draw up to 250mA @ out B and up to 5A @output A.	"1"
Mode – loads are in Full Power Down mode and draw up to 10mA on output B	"0"
When connected to Vehicle Bat, the Power-Supply should be turned on automatically	
When operating from Vehicle Bat or Backup Bat inputs, the Power-Supply should be switched automatically to operate with the other input source due to power failure of the current input source	1μsec
The Power-Supply should operate from Backup Bat input when: <ul style="list-style-type: none"> <li>• Backup Test input and Backup En are "High" state.</li> <li>• Backup En at "High" state and Vehicle Bat voltage is 0V.</li> </ul> Due to vehicle battery power fail (Backup En ="High" state).	"1" "1" "1"
Input Source Ind @ the Power supply is operating from Vehicle Bat	"1"
Input Source Ind @ the Power supply is operating from Backup Bat	"0"

#### 4.10 Timing Performance

The SI<sup>2</sup>C21A9 unit will operate and have the timing conditions shown herein:

Description	Value (sec)
Backup En – enables the battery power supply when external power supply fails or is disconnected Out A Out B	40m 25m
Backup Test –enables the battery power supply even if external power supply is good (and Backup En='1') @ Vo2 without change “0” to “1” Vo1 change from 4V to 3.5V “1” to “0” Vo1 change from 3.5V to 4V	150μ 100μ
En_Vo1 - Vo1 should be turned on.	10μ
Vo <sub>1</sub> turns off	1.5m
Mode – loads are active and draw up to 250mA @ out B and up to 5A @output A.	10m
Mode – loads are in Full Power Down mode and draw up to 10mA on output B	5m
When connected to Vehicle Bat, the Power-Supply should be turned on automatically @ Vo2 without change while Backup Bat is connected	35m
When operating from Vehicle Bat or Backup Battery inputs, the Power-Supply should be switched automatically to operate with the other input source due to power fail of the current input source Backup battery to Vehicle Battery Vehicle battery to Backup Battery	35m 10m
The Power-Supply should operate from Backup battery input when: <ul style="list-style-type: none"> <li>• Backup Test input and Backup En are</li> <li>• Backup En and Vehicle battery voltage is 0V.</li> <li>• Due to Vehicle battery power fail (Backup En ='1').</li> </ul>	20m
Input Source Ind @ the Power supply is operating from vehicle battery	10m
Input Source Ind @ the Power supply is operating from Backup battery	5m

#### 4.11 Environmental Conditions

The SI<sup>2</sup>C21A9 will operate successfully in the operating environments conditions of a vehicle described herein:

Environment	Operating
Temperature	-40°C to 85°C
Vibration	Typical 10g RMS @ (5 to 500)Hz
Shock	4000 shocks of 15g x 6ms
Humidity	Up to 95% R.H. @ operating temps.