

# AUTOMOTIVE CURRENT TRANSDUCER

## HAB 100-S/SP1



### Introduction

The HAB Family is best suited for DC, AC or pulsed currents measurement in high power and low voltage automotive applications. It contains galvanic isolation between the primary circuit (high power) and the secondary circuit (electronic circuit).

The HAB family gives you a choice of having different current measuring ranges in the same housing (from  $\pm 20$  A up to  $\pm 100$  A).

### Features

- Open Loop transducer using the Hall effect sensor
- Low voltage application
- Unipolar + 5 V DC power supply
- Primary current measuring range  $\pm 100$  A
- Maximum RMS primary current limited by the busbar, the magnetic core or the ASIC temperature  $T^\circ < + 150^\circ\text{C}$
- Operating temperature range:  $- 40^\circ\text{C} < T^\circ < + 125^\circ\text{C}$
- Output voltage: full ratiometric (in sensitivity and offset).

### Advantages

- Good accuracy for high and low current range
- Good linearity
- Low thermal offset drift
- Low thermal gain drift
- Hermetic package.

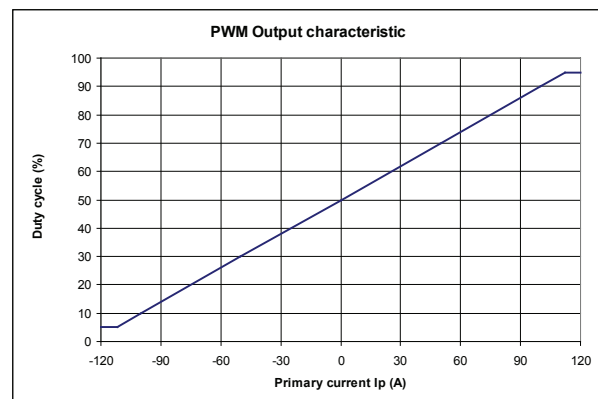
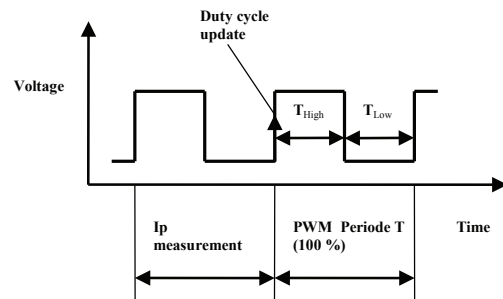
### Automotive applications

- Battery Pack Monitoring
- Hybrid Vehicles
- EV and Utility Vehicles.

### Principle of HAB xxx-S Family

The transducer uses open loop Hall effect technology. It provides a **Pulse Width Modulated** output signal proportional to the magnetic induction  $B$  generated by the primary current  $I_p$  to be measured.

The **PWM** principle is described as follow:



$$PWM \text{ period } T_{Period} = T_{High} + T_{Low}$$

$$PWM \text{ frequency} = \frac{1}{T_{Period}} = 125 \text{ Hz}$$

$$DutyCycle(\%) = \frac{T_{High}}{T_{Period}} \times 100$$

$$DutyCycle(\%) = 50\% + G \times I_p \text{ with } G = \text{Sensitivity } (\%/A)$$

The **PWM** period  $T_{period}$  starts on the rising edge of the output signal. The output signal of the duty cycle given during the  $T_{period}$  is the image of the primary current during the  $T_{period}$  period.

# HAB 100-S/SP1

## Dimensions HAB 100-S/SP1 family (in mm.)

**Rear view**

**Right view**

**Side view**

**ELECTRICAL DIAGRAM**

| Components list |                  |
|-----------------|------------------|
| IC1             | Hall sensor ASIC |
| C1              | 100nF-+10%-X7R   |
| C2              | 10nF-+10%-X7R    |
| R1              | 51 ohms +5%      |

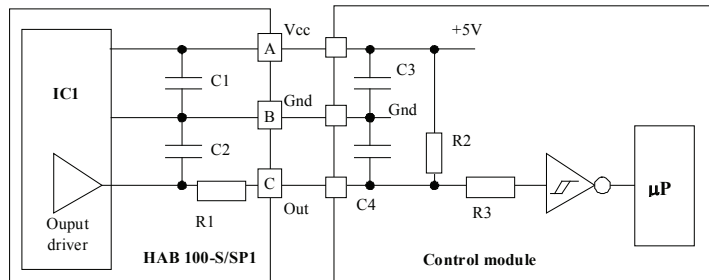
| Pin out |                        |
|---------|------------------------|
| A       | DC supply voltage (5V) |
| B       | Ground                 |
| C       | PWM output signal      |

| Ip (A) | PWM output signal (%) |
|--------|-----------------------|
| +100   | 90                    |
| 0      | 50                    |
| -100   | 10                    |

**BT4T-14B357-AA: Engineering Part Number.**  
 -FORD: Trademark "FORD"  
 -FWHJA: Supplier Code  
 -XX: Error Code  
 -Date code: 0=Production Center .  
 YY=Year  
 DDD=Day of the year.  
 HH=Hour.  
 MM=Minute.  
 SS=Seconde.  
 ... = Identification code for jig.

## Bill of materials

- Plastic case                    Technyl A218V25 black
- Magnetic core                FeNi alloy
- Pins                                Brass tin plated
- *m*                                 24.5 g



| HAB 100 components |                  | Control module components |                           |          |
|--------------------|------------------|---------------------------|---------------------------|----------|
| IC1                | Hall sensor ASIC | C3                        | 100 nF X7R                |          |
| C1                 | 100 nF X7R       | C4                        | 1 nF X7R                  | Optional |
| C2                 | 10 nF X7R        | R2                        | 4.7 kΩ                    | Optional |
| R1                 | 51 Ω             | R3                        | High impedance protection | Optional |

The optional components are needed if current sensor is outside the control module circuit.

## HAB 100-S/SP1

### Absolute maximum ratings (not operating)

| PARAMETER                                 | Symbol          | Min   | Max      | Unit |
|---|-----------------|-------|----------|------|
| Maximum primary current                   | $I_P$           |       | Infinite | A    |
| Supply voltage                            | $V_C$           | - 8.5 | 8.5      | V    |
| Supply voltage (over voltage $t < 1$ min) |                 | - 14  | 14       | V    |
| Current consumption ( $t < 1$ min)        | $I_C$           |       | 50       | mA   |
| Output voltage ( $t < 1$ min)             | $V_{out}$       | - 5   | 14       | V    |
| Output voltage over supply voltage        | $V_{out} - V_C$ |       | 2        | V    |
| Output current                            | $I_{out}$       | - 10  | 10       | mA   |
| Output short-circuit duration             | $t_c$           |       | 10       | min  |
| Ambiant storage temperature               | $T_S$           | - 40  | 125      | °C   |

### Operating conditions

| PARAMETER                                      | Symbol | Min  | Typical | Max  | Unit       |
|--|--------|------|---------|------|------------|
| Supply voltage                                 | $V_C$  | 4.5  | 5.00    | 5.5  | V          |
| Supply voltage (accurate range)                | $V_C$  | 4.75 | 5.00    | 5.25 | V          |
| Pull up load resistor                          | $R_L$  | 2.2  | 4.7     |      | K $\Omega$ |
| Capacitive loading                             | $C_L$  |      |         | 1    | nF         |
| Ambient operation temperature                  | $T_A$  | - 40 | 25      | 125  | °C         |
| Ambient operation temperature (accurate range) | $T_A$  | - 10 | 25      | 65   | °C         |

### Operating characteristics

| PARAMETER                                       | Symbol     | Min         | Typical | Max | Unit     |
|---|------------|-------------|---------|-----|----------|
| Primary current nominal range                   | $I_{PN}$   | -100        |         | 100 | A        |
| Maximum current measuring range (clamping)      | $I_{PM}$   | -112        |         | 112 | A        |
| Current consumption                             | $I_C$      | -           | 7.5     | 10  | mA       |
| Output PWM frequency                            | $f_{PWM}$  | 105         | 125     | 145 | Hz       |
| Output duty cycle sensitivity                   | $G$        |             | 0.4     |     | %/A      |
| Output duty cycle @ $I_p = 0$                   | $D_{OUT}$  |             | 50      |     | %        |
| Output duty clamping low                        |            | 4           | 5       | 6   | %        |
| Output duty clamping high                       |            | 94          | 95      | 96  | %        |
| Duty cycle resolution                           |            |             | 0.0125  |     | %        |
| Power-up time to reach valid duty cycle         |            |             |         | 25  | ms       |
| Setting time after over load                    |            |             |         | 25  | ms       |
| Output voltage high (pull up = 4.7 K $\Omega$ ) | $V_{OUTH}$ | $V_C - 0.2$ |         |     | V        |
| Output voltage low (pull up = 4.7 K $\Omega$ )  | $V_{OUTL}$ |             |         | 0.2 | V        |
| Output internal resistance                      | $R_{out}$  |             | 50      | 100 | $\Omega$ |
| Output PWM rise time                            | $t_{rise}$ |             |         | 10  | $\mu$ s  |
| Output PWM fall time                            | $t_{fall}$ |             |         | 10  | $\mu$ s  |

## HAB 100-S/SP1

### Accuracy

| PARAMETER  | Symbol       | Unit | Specification |         |     | Conditions  |
|--|--------------|------|---------------|---------|-----|---|
|  |              |      | Min           | Typical | Max |   |
| <b>PERFORMANCE DATA</b>  |              |      |               |         |     |   |
| Electric Offset Current @ 25 °C  | $I_{OE}$     | A    |               | ± 0.05  |     | @ $T_A = 25^\circ\text{C}$                          |
| Magnetic Offset Current @ 25 °C  | $I_{OM}$     | A    |               | ± 0.05  |     | @ $T_A = 25^\circ\text{C}$                          |
| Global offset current  | $I_O$        | A    |               | ± 0.10  |     | @ $T_A = 25^\circ\text{C}$                          |
|  |              |      |               | ± 0.15  |     | @ $-20^\circ\text{C} < T^\circ < 65^\circ\text{C}$  |
|  |              |      |               | ± 0.3   |     | @ $-40^\circ\text{C} < T^\circ < 125^\circ\text{C}$ |
| Sensitivity error  | $\epsilon_G$ | %    |               | ± 0.2   |     | @ $T_A = 25^\circ\text{C}$                          |
|  |              |      |               | ± 0.7   |     | @ $-20^\circ\text{C} < T^\circ < 65^\circ\text{C}$  |
|  |              |      |               | ± 1.5   |     | @ $-40^\circ\text{C} < T^\circ < 125^\circ\text{C}$ |
| Linearity @ $-80\text{A} < I_p < 80\text{A}$                               | $\epsilon_L$ | %    |               | 0.2     |     | of full range, @ $T_A = 25^\circ\text{C}$           |
| Linearity @ $-100 < I_p < -80\text{A}$ or $80\text{A} < I_p < 100\text{A}$ |              |      |               | 1       |     |   |

### Global error table

|                      | Symbol | Unit | Temperature $T^\circ$ (°C) |        |        |        |        |        |
|----------------------|--------|------|----------------------------|--------|--------|--------|--------|--------|
|                      |        |      | -40°C                      | -20°C  | 0°C    | 25°C   | 65°C   | 125°C  |
| Global error (A)     | X      | A    | -40°C                      | -20°C  | 0°C    | 25°C   | 65°C   | 125°C  |
| Global offset error  |        |      | ± 0.40                     | ± 0.34 | ± 0.28 | ± 0.20 | ± 0.34 | ± 0.55 |
| Global error at 50A  |        |      | ± 1.50                     | ± 1.41 | ± 1.32 | ± 1.20 | ± 1.24 | ± 1.30 |
| Global error at 100A |        |      | ± 3.70                     | ± 3.45 | ± 3.21 | ± 2.90 | ± 3.14 | ± 3.50 |

