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Single-Ended Bus Transceiver with Triple Buffer

Description

The U6812B is a bipolar monolithic K-line bus transceiver designed to provide bidirectional serial communication in automotive diagnostic applications. The standard K-line is ISO 9141 compatible for Baud rates up to 250 kBaud.

The IC provides additionally three universally applicable 40-mA open collector buffers, which can be used for signal decoupling. The U6812B is built on Atmel Wireless & Microcontrollers' bipolar process and has been developed and approved in line with the automotive industry specifications.The U6812B is an ideal grouping of low-power drivers in an SO package, thus meeting user demand for space-saving and cost-reduction in the area of circuit board assembly.

Features

- Wide power-supply voltage range
- Short-circuit protected K-interface ISO9141 compatible
- Three short-protected 40-mA open-collector buffers
- All low-power outputs with built-in 28-V clamping
- CMOS compatible digital inputs with hysteresis
- Digital 1-mA push-pull "RxD" K-line output
- Channel-specific over-temperature switch off in event of short circuit
- Load-dump protection and interference protection similar to ISO 7637–1/4 (DIN 40839)

Block Diagram

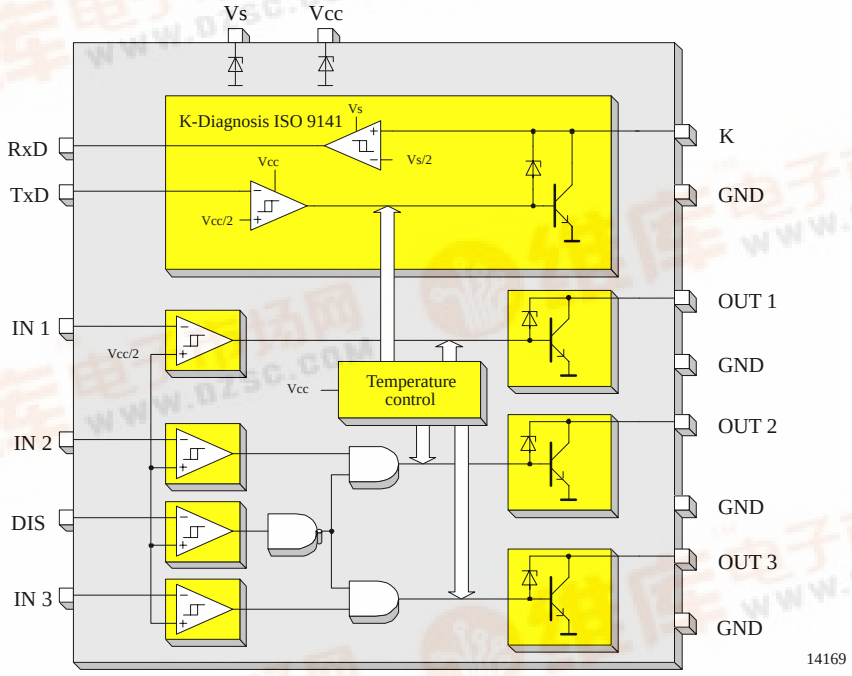

Figure 1. Block diagram

Ordering Information

Extended Type Number	Package	Remarks
U6812B	SO16/ 150 mil	

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Pin Desciption

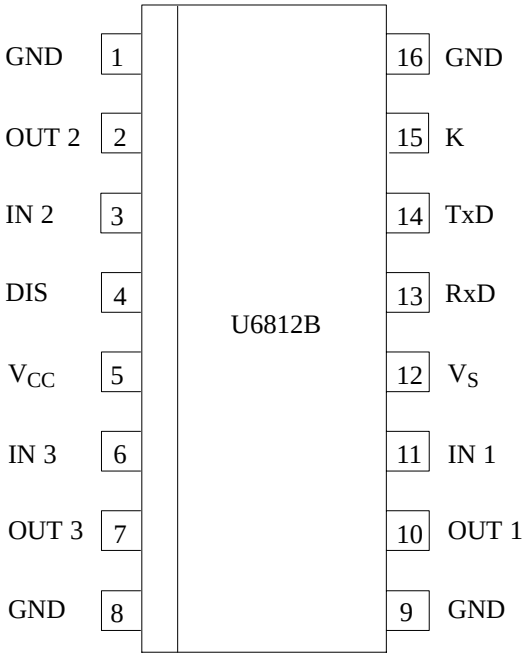


Figure 2. Pinning

Pin	Name	Type	Function
1	GND	Supply	Ground; all ground pins are directly connected to the lead frame
2	OUT 2	Open-collector output	Protected output of driver #2 (faced to: outside)
3	IN 2	Digital input	Input of protected driver #2 (faced to: µP)
4	DIS	Digital input	Disable input for OUT 2 and OUT 3, ”H”=enable, ”L”=disable
5	V_{CC}	Supply	+5-V supply
6	IN 3	Digital input	Input of protected driver #3 (faced to: µP)
7	OUT 3	Open-collector output	Protected output of driver #3 (faced to: outside)
8	GND	Supply	Ground
9	GND	Supply	Ground
10	OUT 1	Open-collector output	Protected output of driver #1 (faced to: outside)
11	IN 1	Digital input	Input of protected driver #1 (faced to: µP)
12	V_S	Supply / reference	+12-V reference for K-line level
13	RxD	Digital output	Diagnosis receive line (faced to: µP)
14	TxD	Digital input	Diagnosis transmit line (faced to: µP)
15	K	12-V input & O.C. output	Bidirectional diagnosis line (faced to: outside)
16	GND	Supply	Ground

Basic Application Circuit

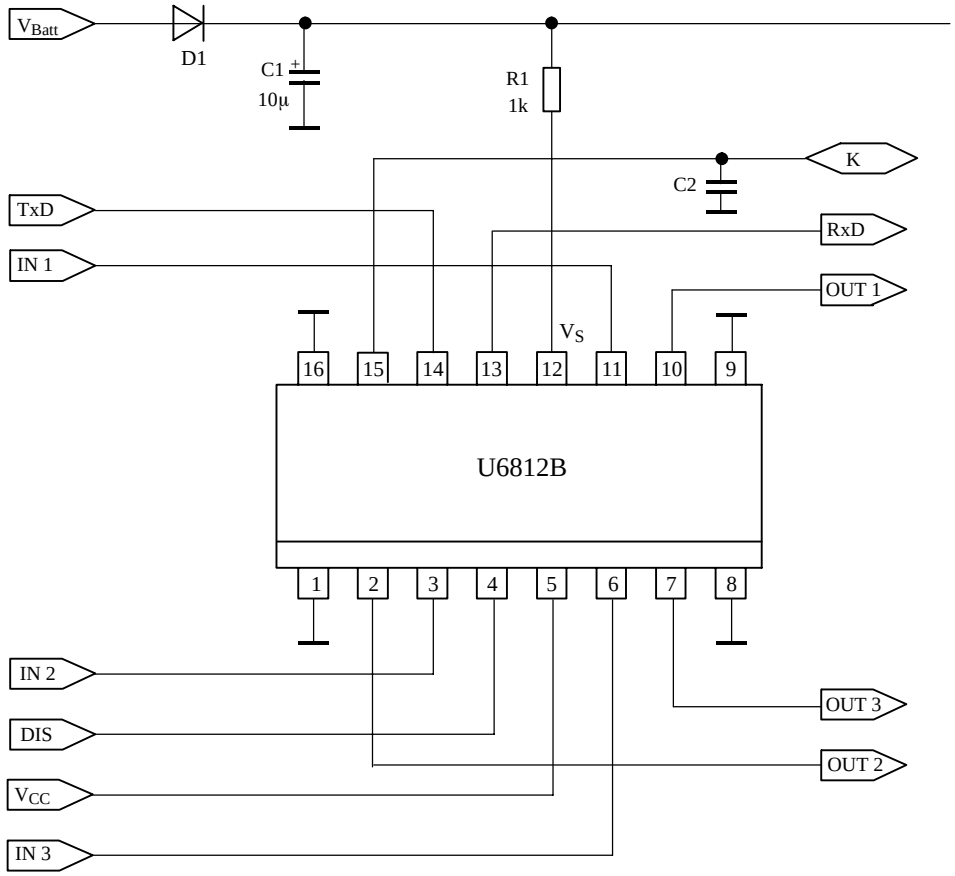


Figure 3. Basic application circuit

Functional Description

K-Interface

The K-interface is equipped with a 40-mA open-collector driver. The current is determined by the external pull-up resistor. The saturation voltage is below 0.6 V

The open-collector output is protected by a 28-V Z-diode. The collector current is permanently monitored for short circuits via a built-in shunt. In the event of a short circuit occurring at V_{Batt}, collector current is held at approx. I_{creg} = 80 mA; accompanied by a rise in chip temperature due to power loss. This status is maintained until the detection of over temperature causes the K-line output to be disabled and stored to memory. The internal short-circuit detection threshold is $I_{sc} > 0.8 \times I_{creg}$. The output remains disabled until a falling edge of a pulse is available to its input. Any further attempt to connect with the short circuit still present causes the above sequence to be repeated. The output can be activated normally once the short circuit has been removed. The maximum Baud rate is 250 kBaud.

The K-line permits bidirectional communication with the µC. When output K is disabled, information can be transferred to the processor via the input comparator at Pin RxD.

The digital output RxD is a push-pull output stage with a driver power of 1 mA.

In the event of a line break at the K-line, output K is connected to GND via the built-in 85-kΩ pull-down resistor, thus allowing the µC to detect this fault. The maximum sampling frequency is 250 kBaud.

Open-Collector Driver OUT x

The outputs are designed for a maximum static current of 40 mA, which is determined by the external pull-up resistor. The saturation voltage is below 0.6 V

The three OUTx-driver outputs are activated with ”active low” at the corresponding input. Outputs OUT2 and OUT3 can also be disabled with ”active low” at the dis-

able input, regardless of their input signal. The outputs are released with open disable input or use of high potential.

The open-collector outputs are connected to a 28-V Z-diode. The collector current is permanently monitored via a built-in shunt circuit to permit the detection of short circuits. In the event of a short circuit occurring at V_{Batt}, collector current is held at approx. I_{creg} = 80 mA; accompanied with a rise of chip temperature due to power loss. This status is maintained until the detection of over temperature causes the output affected by the short circuit to be selectively disabled and stored to memory. The internal short-circuit detection threshold is $I_{sc} > 0.8 \times I_{creg}$. The affected output remains disabled until a falling edge of a pulse is available to its input. Any further attempt to connect with the short circuit still present causes the above sequence to be repeated. The output can be activated normally once the short circuit has been removed.

Power Supply

The IC must be equipped with external R/C circuitry to limit voltage in the event of power surges (see figure 3). This prevents the circuit from being damaged or destroyed and provides a buffer in the event of power fluctuations at V_{Batt}. The RxD comparator is powered via Pin V_S, producing its reference voltage of 1/2 V_S, while all other blocks are supplied via V_{CC}.

Operating voltage can vary between V_S= 7 V and 26 V. Resistor R_1 at Pin V_S limits the current via the built-in 28-V Z-diode between V_S and GND.

Application note:
It is recommended to use the external components as shown in figure 3 with reverse battery protection diode D1 and buffer capacitor C1 = 10 µF.

Digital Inputs (DIS, IN 1, IN 2, IN 3 and TxD)

The digital inputs are CMOS-compatible and equipped with a built-in pull–up resistor with a typical rating of 85 kΩ to V_{CC}. The input threshold totals $V_{TH} = 0.57 \times V_{CC}$ with a typical hysteresis of 100 mV. The inputs are designed for an input voltage of –0.2 V to V_{CC} + 0.6 V.

For a proper activation of the output stages it is mandatory that the inputs are kept low as long as the supply voltage not applied. After supply voltage is on, all inputs need to have a falling edge (see timing diagram).

Digital Output (RxD)

The digital output RxD is a push-pull output stage with driver power of I_{RxD} = 1 mA

Interference Voltages and Load Dump (defined in DIN40839 or ISO7637)

The U6812B is protected from the interference pulses usually present in the wiring by the recommended R_1/C_1 circuitry and the integrated elements (28-V Z-diodes, both at the supply pin and at the output pins and two diodes connected to V_{CC} and GND at the digital inputs). All transient pulses which appear on the supply line (V_{Batt}), should not effect the function of the IC (see table 1).

Table 1 Transient-test conditions

Name	Voltage	Source Resistance	Rise Time	Pulse Duration	Pulse Amount
DIN/ISO 1	–110 V	10 Ω	100 V/µs	2 ms	15000
DIN/ISO 2	110 V	10 Ω	100 V/µs	0.05 ms	15000
DIN/ISO 3a	–160 V	50 Ω	30 V/ns	0.1 µs	1 h (ref. ISO)
DIN/ISO 3b	150 V	50 Ω	20 V/ns	0.1 µs	1 h (ref. ISO)
DIN/ISO 5	55 V (total)	2 Ω	10 V/ms	500 ms	20

Table 2 Truth table

WSI-1	WSI-2	WSI-R	EN	TXD	K	WSO-1	WSO-2	WSO-R	RXD
L	L	X	H	X	X	L	L	X	X
H	H	X	X	X	X	Open	Open	X	X
L	L	X	L	X	X	Open	Open	X	X
X	X	H	X	H	Open	X	X	Open	H
X	X	L	X	L	L	L	X	L	L
X	X	X	X	X	H	X	X	X	H

Timing Diagrams

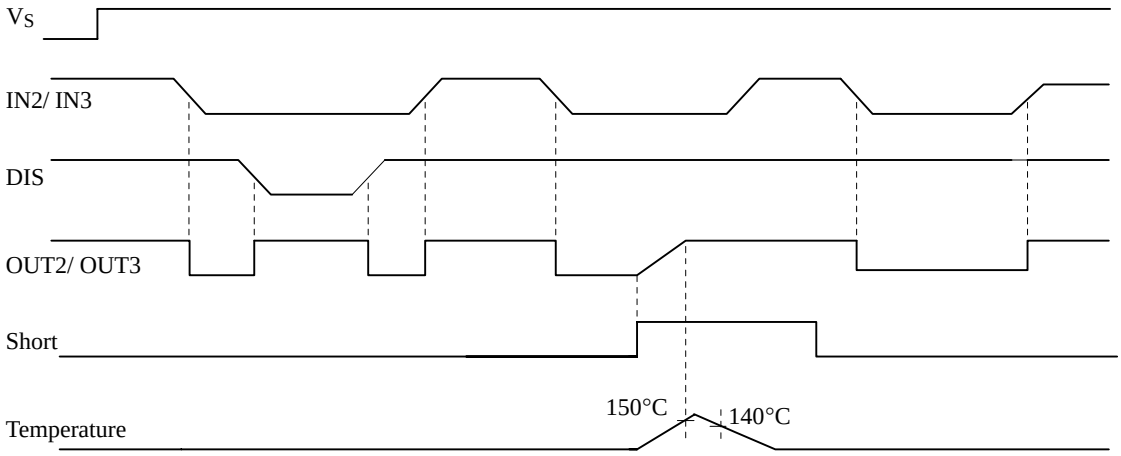


Figure 4. IN2 / IN3 – pulse diagram

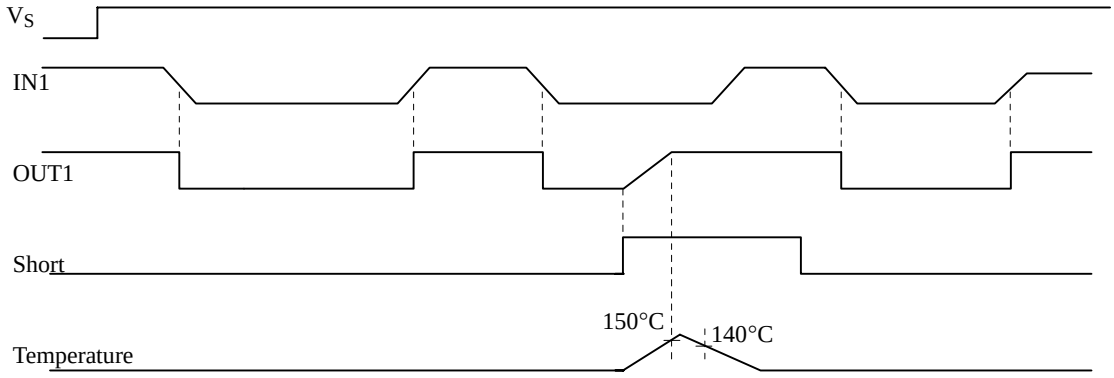


Figure 5. IN1 – pulse diagram

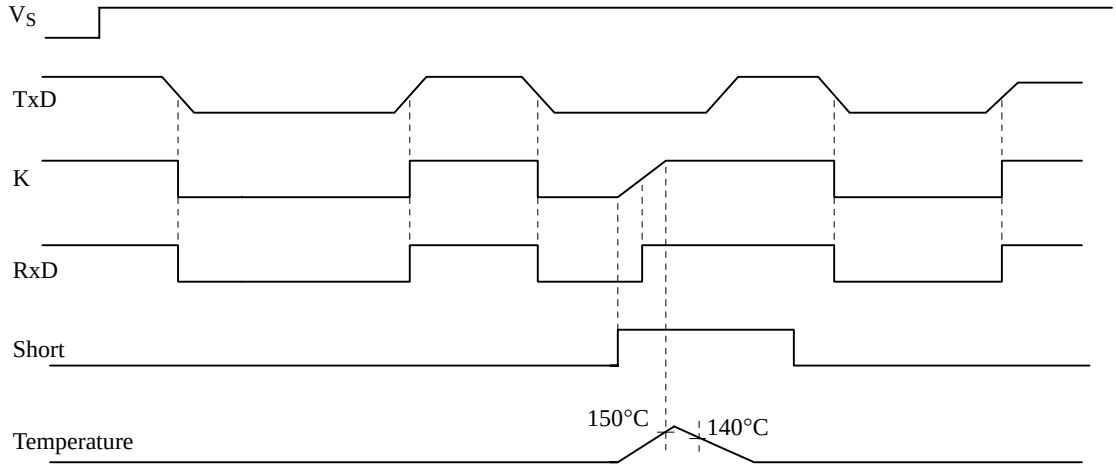


Figure 6. K-interface pulse diagram

Absolute Maximum Ratings

Parameters	Symbol	Value	Unit
Operating voltage	V_S	26	V
Operating voltage	V_{CC}	3 to 6	V
Voltage at Pins IN1,2,3; RxD, TxD, DIS	Vi	–0.2 to 6	V
Voltage at Pins OUT1,2,3; K	Vo	–1 to 26	V
Static collector current at Pins OUT1,2,3; K	Ix	45	mA
Ambient temperature	T_{amb}	–40 to 125	°C
Storage temperature range	T_{stg}	–55 to 150	°C
Max. junction temperature	T_j	150	°C

Thermal Resistance

Parameters	Symbol	Value	Unit
Junction to case	R_{thJC}	36	K/W
Junction to ambient; strongly depending on the assembly	R_{thJA}	65 to 80	K/W

Electrical Characteristics

T_{amb} = – 40 to 125°C, V_{CC} = 4.75 V to 5.25 V (unless otherwise specified), reference point is GND (Pin 1,7,8,16). IC with recommended external components (see figure 3).

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Supply	**Pins 5 and 12**					
Supply voltage		V_S	7		26	V
Supply voltage		V_{CC}	4.5		5.5	V
Reduced supply voltage	V_{sat} = 0.6 V @ I_X = 20 mA	V_{CC}	3.0		4.5	V
Current consumption	All inputs open or high @ V_{CC} = 5.25 V	I_S			6	mA
	All inputs on (= low) @ V_{CC} = 5.25 V	I_S			20	mA
Protective resistor		R_1		1		kΩ
Smoothing capacitor		C_1		10		µF
Integrated Z-Diode	I_S = 20 mA	V_S	26	28	30	V
Quiescent current	All outputs low or open @ V_S = 18 V	I_{VS}			0.75	mA
Inputs IN 1, IN 2, IN 3, DIS, TxD	**Pins 11, 3, 6, 4, 14**					
Input voltage		V_i	–0.2		V_{CC}+0.6	V
Int. pull-up resistor		R_i	30	85	170	kΩ
Switchover threshold		V_{iTH}		0.57×V_{CC}		V
Hysteresis		V_{iHYS}		100		mV
Outputs OUT 1, OUT 2, OUT 3	**Pins 10, 2 and 7**					
Integrated Z-diode	I_{OUTx} = 20 mA	V_O	26	28	30	V
Current regulation		I_O	45		130	mA
Saturation voltage	I_{OUTx} = 40 mA	V_{OSAT}			0.6	V

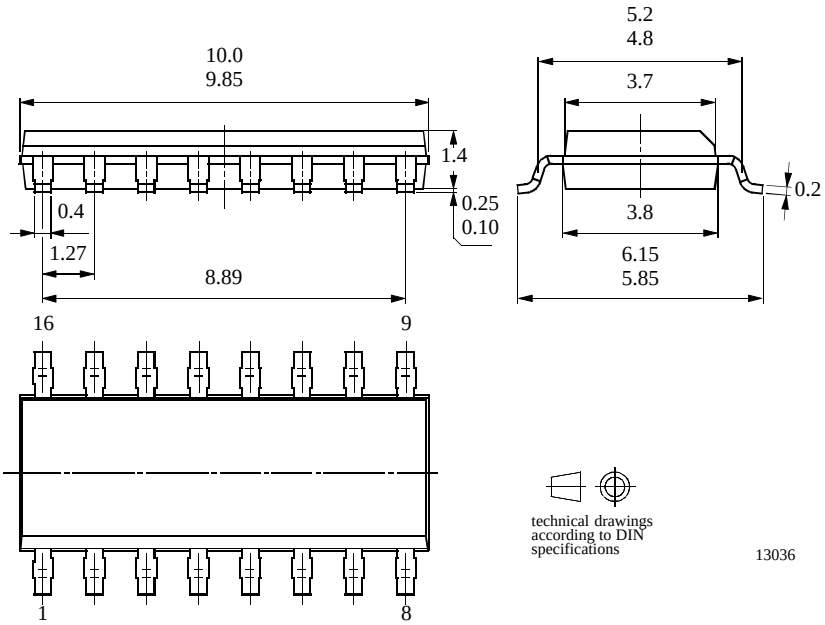
Electrical Characteristics (continued)

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Maximum voltage		V_{out}	– 1.0		26	V
Leakage current	Output open, V_S = 21 V	I_{Leak}			2	µA
Output RxD	**Pin 13**					
Integrated Z-diode	I_{RxD} = 20 mA	V_{RxD}	26	28	30	V
Output current		I_{RxD}			1	mA
Saturation voltage	I_{RxD} = 1 mA	V_{RxDSAT}			0.5	V
Rise time		t_R	0.01		5	µs
Fall time		t_F	0.01		5	µs
K-Line	**Pin 15**					
Threshold		V_K		0.57×V_S		V
Internal pull-down resistor		R_K	30	85	170	kΩ
Integrated Z-diode	I_K = 20 mA	V_K	26	28	30	V
Current regulation		I_K	45		130	mA
Saturation voltage	I_K = 40 mA	V_{Ksat}			0.6	V
Maximum voltage		V_{out}	– 1.0		26	V
Maximum Baud rate	I_K = 40 mA, C_2 = 20 nF C_2 = 470 pF		14.4 250			kBaud kBaud

Package Information

Package SO16

Dimensions in mm



Ozone Depleting Substances Policy Statement

It is the policy of **Atmel Germany GmbH** to

1. Meet all present and future national and international statutory requirements.

2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

Atmel Germany GmbH has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively

2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA

3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

Atmel Germany GmbH can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

We reserve the right to make changes to improve technical design and may do so without further notice.
Parameters can vary in different applications. All operating parameters must be validated for each customer application by the customer. Should the buyer use Atmel Wireless & Microcontrollers products for any unintended or unauthorized application, the buyer shall indemnify Atmel Wireless & Microcontrollers against all claims, costs, damages, and expenses, arising out of, directly or indirectly, any claim of personal damage, injury or death associated with such unintended or unauthorized use.

Data sheets can also be retrieved from the Internet: http://www.atmel–wm.com

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