

## Features

- Push-pull Output Stage for 4A Peak Current
- Low  $R_{dson} < 2\Omega$
- 12V Push-pull Output Stage for Pulse Shaping
- Super Short Propagation Delay Input-output 50 ns
- Super Fast Rise/Fall Time of Output Stage 12 ns
- Monitoring Circuit with 60 ns Switch-off Delay and 20 ms Lockout
- Undervoltage Lockout 40 ms
- Wide Supply Voltage Range from 16V up to 30V
- Fully Integrated Charge Pump



Electrostatic sensitive device.  
Observe precautions for handling.



## 1. Description

The ATA6821 is a single-channel high-speed power driver IC designed with Atmel's 0.8  $\mu\text{m}$  BCDMOS technology. With its extremely short propagation delay and super fast slew rates, the ATA6821 is ideally suited to control MOSFETs or IGBTs in a wide range of automotive and industrial high-speed applications. The push-pull output stage is capable of driving peak currents of 4A.

The ATA6821 is designed to control high currents as they can be found in electrical machines or in power converters. The ATA6821 is tailored to control low resistance switching devices by a potential-free input signal.

The ATA6821's full automotive qualification, ESD protection and protection against transients according to ISO/TR 7637/1 guarantees security for all kind of applications.



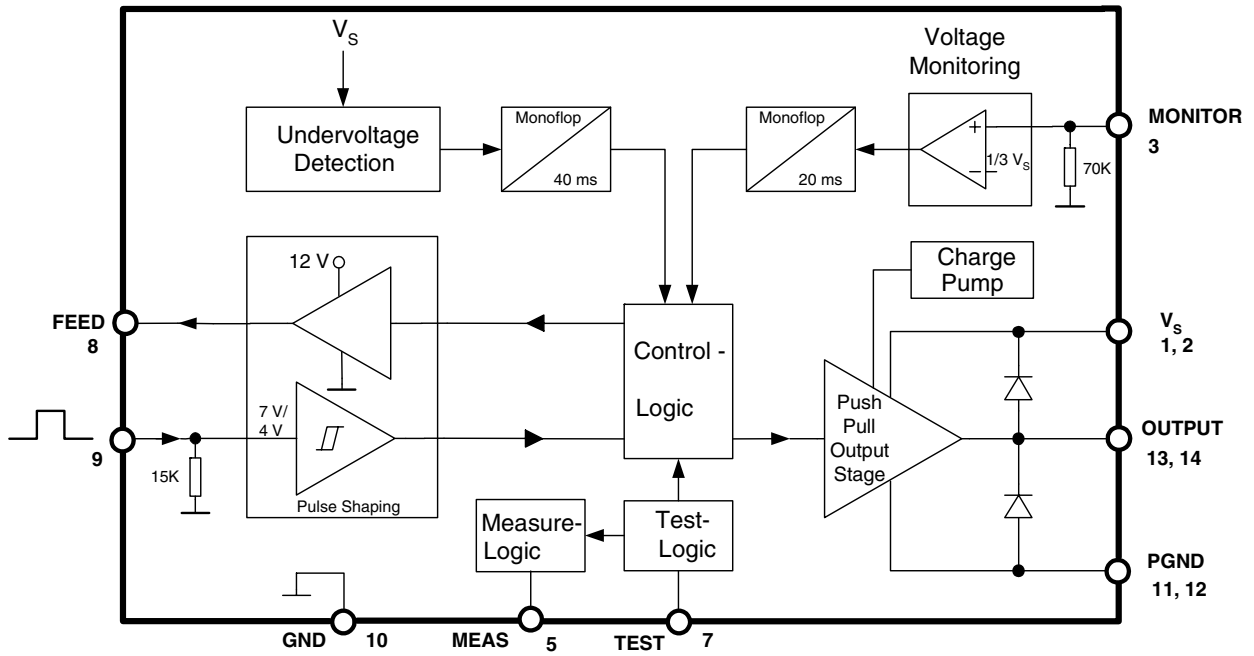
## High Speed Power Driver IC

## ATA6821

Rev. 4778B-AUTO-09/05



Figure 1-1. Block Diagram



## 2. Pin Configuration

Figure 2-1. Pinning SO14

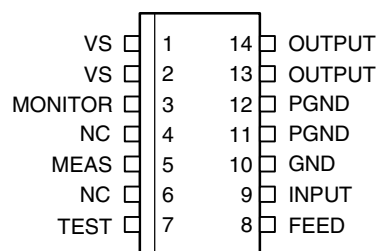


Table 2-1. Pin Description

| Pin | Symbol  | Function                    |
|-----|---------|-----------------------------|
| 1   | VS      | Supply voltage              |
| 2   | VS      | Supply voltage              |
| 3   | MONITOR | Voltage monitoring input    |
| 4   | NC      | Not connected               |
| 5   | MEAS    | Measurement pin             |
| 6   | NC      | Not connected               |
| 7   | TEST    | Test pin                    |
| 8   | FEED    | Feed output                 |
| 9   | INPUT   | Input                       |
| 10  | GND     | Ground <sup>(1)</sup>       |
| 11  | PGND    | Power ground <sup>(1)</sup> |
| 12  | PGND    | Power ground <sup>(1)</sup> |
| 13  | OUTPUT  | Output                      |
| 14  | OUTPUT  | Output                      |

Note: 1. All ground pins must be connected together by short external connections.  
The measurement pin (pin 5) and the test pin (pin 7) must be connected to the ground pins.

### 3. Functional Description

The ATA6821 controls a push-pull power output stage for an external power device and a feedback output stage. If the voltage at the input pin is  $> 7V$ , both outputs are at “high-level”, if the input voltage falls below the switch-off threshold of  $4V$ , both outputs are switched to ground.

If a rectangular input signal is fed to the input, the feedback output “Feed” is not used and pin 8 needs no external connection.

In case the input signal, however, comes from a transformer (potential-free control; see [Figure 7-5 on page 12](#)), the integrated pulse shaping circuit is used to achieve a reliable feedback configuration at the input. This ensures correct switching of the output stage even if the input signal is very noisy.

For the timing of input and output signals and the slew rates, please refer to [Figure 7-1 on page 9](#). The timing diagram is based on the following test conditions: A  $2\text{ k}\Omega$  resistor is connected between pin 8 and ground; a  $2\text{ k}\Omega$  resistor and a  $1\text{ nF}$  capacitor are used as load for the power output (pins 13 and 14) simulating identical conditions as a power MOSFET, which is usually connected to the output.

#### 3.1 Undervoltage Detection

During power-up and power-down of the supply voltage, the internal undervoltage circuit suppresses uncontrolled output pulses. In case of undervoltage ( $V_S < 16V$ ), the feedback output and the power output are switched off and locked for  $40\text{ ms}$ .

When the supply voltage has reached the switch-on-threshold of about  $17V$ , both output stages are enabled after a delay time of  $40\text{ ms}$ .

#### 3.2 Voltage Monitoring

An effective short-circuit detection of the external device is achieved by a drain-source voltage monitor.

The voltage monitor comparator (pin 3) has a threshold of  $1/3 \times V_S$ . If the voltage applied to pin 3 exceeds this voltage, both output stages are switched off immediately and locked for  $20\text{ ms}$ . With a hysteresis of  $200\text{ mV}$ , the outputs are enabled again after a delay time of  $20\text{ ms}$ . A voltage divider connected to  $V_S$  is used to feed the input voltage to pin 3. A decoupling diode is recommended if the external power device’s drain source voltage exceeds  $30V$  (see [Figure 7-3 on page 10](#)).

With the help of an external capacitor, connected to pin 3, the switching characteristic of the voltage monitor comparator can be varied according to the rising edge of the input signal at pin 9. During the off cycle, the capacitor is discharged, during the on-cycle, it is charged again.

If the voltage monitoring function is not used, pin 3 should be connected to ground (see [Figure 7-2 on page 10](#)).

### **3.3 Application Hints**

Due to high peak output currents, the layout of the PC board is essential. Appropriate decoupling capacitors should be used, otherwise, the performance of the driver degrades severely. It is strongly recommended to connect the blocking capacitors (low ESR types) as close as possible to the power supply and the ground pins. If necessary, two or more capacitors of different types may be connected in parallel.

The two power ground pins, the ground pin, the two output pins and the two supply pins should be externally connected together as close as possible to the pins.

The measurement pin (pin 5) and the test pin (pin 7) must not be used in any application and need to be tied to ground.

## 4. Absolute Maximum Ratings

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

| Parameters                        | Pin    | Symbol        | Min.        | Max.        | Unit |
|-----------------------------------|--------|---------------|-------------|-------------|------|
| Supply voltage                    | 1, 2   | $V_S$         | -0.3        | 30          | V    |
| Input voltage, voltage monitoring | 3      | $V_{Monitor}$ | -0.3        | $V_S + 0.3$ | V    |
| Output voltage                    | 13, 14 | $V_{Out}$     | -0.3        | $V_S + 0.3$ | V    |
| Output voltage FEED               | 8      | $V_{FEED}$    | -0.3        | 15          | V    |
| Input voltage                     | 9      | $V_{Input}$   | -0.3        | 40          | V    |
| Input voltage measurement         | 5      | $V_{Meas}$    | -0.3        | $V_S + 0.3$ | V    |
| Input voltage TEST pin            | 7      | $V_{Test}$    | -0.3        | 5           | V    |
| Output current FEED               | 8      | $I_{FEED}$    | -10         | 10          | mA   |
| Output current                    | 13, 14 | $I_{Out}$     | -200        | 200         | mA   |
| Output current $t \leq 100 \mu s$ | 13, 14 | $i_{Out}$     | -4          | 4           | A    |
| Ambient temperature range         |        | $T_{amb}$     | -40 to +100 |             | °C   |
| Junction temperature range        |        | $T_j$         | -40 to +150 |             | °C   |
| Storage temperature range         |        | $T_{stg}$     | -40 to +150 |             | °C   |

## 5. Thermal Resistance

| Parameters          | Symbol     | Value | Unit |
|---------------------|------------|-------|------|
| Junction to ambient | $R_{thJA}$ | 130   | K/W  |

## 6. ESD Protection

| Parameters                     | Test Conditions            | Value                           |
|--------------------------------|----------------------------|---------------------------------|
| ESD (Human Body Model)         | MIL-STD-883D Method 3015.7 | $\pm 2$ kV (pins 3 and 9: 1 kV) |
| ESD CDM (Charged Device Model) | STM 5.3.1 - 1999           | $\pm 500$ V                     |

## 7. Electrical Characteristics

Conditions:

$16V < V_S < 30V$ ;  $-40^{\circ}C < T_A < 100^{\circ}C$

$V_1 = V_2 = V_S$ ,  $V_{13} = V_{14} = V_{Out}$ ,  $V_4 = V_5 = V_6 = V_7 = 0V$

$V_{10} = V_{11} = V_{12} = GND$  = Reference point, unless otherwise specified

| No.      | Parameters                                     | Test Conditions   | Pin         | Symbol         | Min.          | Typ.    | Max.          | Unit       | Type* |
|----------|--|---|-------------|----------------|---------------|---------|---------------|------------|-------|
| <b>1</b> | <b>Supply Voltage Range</b>                    |   |             |                |               |         |               |            |       |
| 1.1      | Supply voltage                                 |   | 1, 2        | $V_S$          | 16            |         | 30            | V          | C     |
| 2        | Current Consumption                            | $V_S \leq 30V$ ; no load at "Feed" and "Output"                         | 1, 2        | $I_{VS}$       |               |         | 6             | mA         | A     |
| <b>3</b> | <b>Undervoltage Detection (UVD)</b>            |   |             |                |               |         |               |            |       |
| 3.1      | Switch-on threshold UVD                        |   | 1, 2        | $V_{Son}$      | 16            | 17      | 18            | V          | A     |
| 3.2      | Hysteresis UVD                                 |   | 1, 2        | $dV_{Son}$     |               | 300     |               | mV         | A     |
| 3.3      | Timeout after undervoltage                     |   | 1, 2        | $t_{offUVD}$   | 30            | 40      | 50            | ms         | A     |
| <b>4</b> | <b>Voltage Monitoring (VM)</b>                 |   |             |                |               |         |               |            |       |
| 4.1      | Input Resistance                               |   | 3           | $R_{iVM}$      | 30            | 70      | 150           | k $\Omega$ | A     |
| 4.2      | Switch-off threshold VM                        |   | 3           | $V_{Toff}$     | $V_S/3 - 2\%$ | $V_S/3$ | $V_S/3 + 4\%$ | V          | A     |
| 4.3      | Hysteresis VM                                  |   | 3           | $dV_S$         |               | 200     |               | mV         | A     |
| 4.4      | Switch-off-delay monitor-output                |   | 3 to 13, 14 | $t_{doffVM}$   |               | 60      |               | ns         | A     |
| 4.5      | Timeout after switch-off by voltage monitoring |   | 3 to 13, 14 | $t_{offVM}$    | 15            | 20      | 25            | ms         | A     |
| <b>5</b> | <b>Input Stage</b>                             |   |             |                |               |         |               |            |       |
| 5.1      | Input Resistance                               |   | 9           | $R_{iInput}$   |               | 15      |               | k $\Omega$ | A     |
| 5.2      | Switch-on-threshold                            |   | 9           | $V_{INON}$     | 6             |         | 8             | V          | A     |
| 5.3      | Switch-off-threshold                           |   | 9           | $V_{INOFF}$    | 3             |         | 5             | V          | A     |
| 5.4      | Propagation delay-time "Input - Feed"          |   | 8, 9        | $t_{dIn-Feed}$ |               | 30      |               | ns         | A     |
| 5.5      | Propagation delay-time "Input - Output"        |   | 9 to 13     | $t_{dIn-Out}$  |               | 50      |               | ns         | A     |
| <b>6</b> | <b>Feed Output</b>                             |   |             |                |               |         |               |            |       |
| 6.1      | High voltage Feed, no load                     | Pin 8 open, $V_9 \geq 8V$   | 8           | $V_{Feed0}$    |               | 13      |               | V          | A     |
| 6.2      | Output resistance high                         | $I_{Feed} = -5 \text{ mA}$ , $V_9 \geq 8V$                              | 8           | $R_{FeedHi}$   |               | 500     | 1000          | $\Omega$   | A     |
| 6.3      | Output resistance low                          | $I_{Feed} = 5 \text{ mA}$ , $V_9 \leq 3V$                               | 8           | $R_{FeedLo}$   |               | 100     | 500           | $\Omega$   | A     |
| 6.4      | Rise time (10% to 90%)                         | $R_{Feed \text{ external}} = 2 \text{ k}\Omega$ , Rising edge at pin 9  | 8           | $t_{rFeed}$    |               | 20      |               | ns         | A     |
| 6.5      | Fall time (10% to 90%)                         | $R_{Feed \text{ external}} = 2 \text{ k}\Omega$ , Falling edge at pin 9 | 8           | $t_{fFeed}$    |               | 10      |               | ns         | A     |

\*) Type means: A = 100% tested, B = 100% correlation tested, C = Characterized on samples, D = Design parameter

## 7. Electrical Characteristics (Continued)

Conditions:

$16V < V_S < 30V$ ;  $-40^{\circ}C < T_A < 100^{\circ}C$

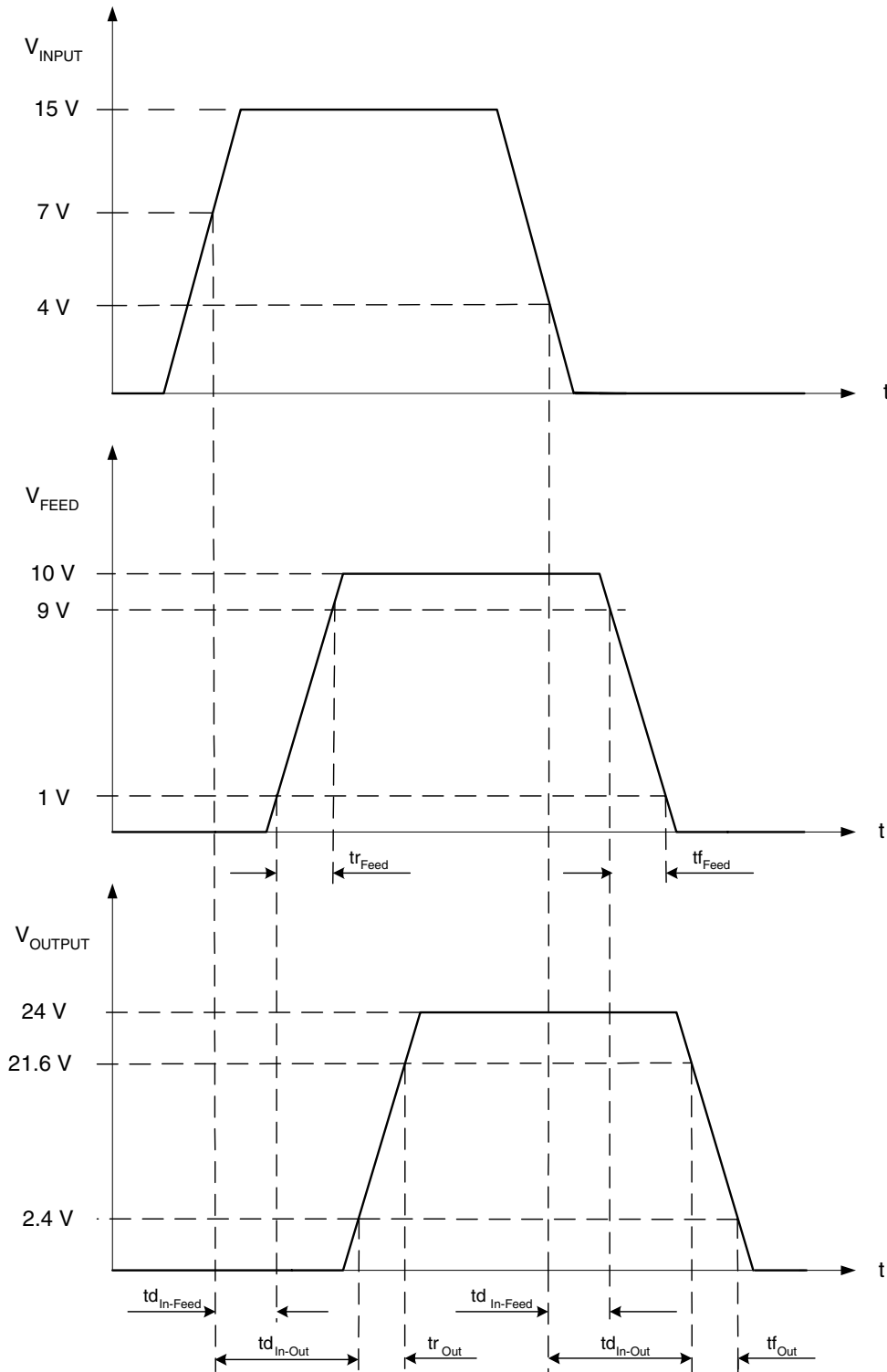
$V_1 = V_2 = V_S$ ,  $V_{13} = V_{14} = V_{Out}$ ,  $V_4 = V_5 = V_6 = V_7 = 0V$

$V_{10} = V_{11} = V_{12} = GND$  = Reference point, unless otherwise specified

| No.      | Parameters                   | Test Conditions   | Pin       | Symbol        | Min. | Typ. | Max. | Unit     | Type* |
|----------|------------------------------|---|-----------|---------------|------|------|------|----------|-------|
| <b>7</b> | <b>Push-pull-outputstage</b> |   |           |               |      |      |      |          |       |
| 7.1      | On-resistance high           | $I_{Out} = -1 A$ , $V_g \geq 8V$  | 13 - 1, 2 | $R_{OutHigh}$ |      |      | 2    | $\Omega$ | A     |
| 7.2      | On-resistance low            | $I_{Out} = 1A$ , $V_g \leq 3V$  | 13        | $R_{OutLow}$  |      |      | 2    | $\Omega$ | A     |
| 7.3      | Peak output current high     | $t \leq 100 \mu s$ , rising edge at pin 9   | 13,14     | $-i_{Out}$    |      |      | 4    | A        | D     |
| 7.4      | Peak output current low      | $t \leq 100 \mu s$ , falling edge at pin 9  | 13,14     | $i_{Out}$     |      |      | 4    | A        | D     |
| 7.5      | Rise time (10% to 90%)       | Rising edge at pin 9<br>external load:<br>$C_{Out} = 1 nF$ , $R_{Out} = 2 k\Omega$  | 13,14     | $t_{rOut}$    |      | 12   |      | ns       | A     |
| 7.6      | Fall time (10% to 90%)       | Falling edge at pin 9<br>external load:<br>$C_{Out} = 1 nF$ , $R_{Out} = 2 k\Omega$ | 13,14     | $t_{fOut}$    |      | 12   |      | ns       | A     |

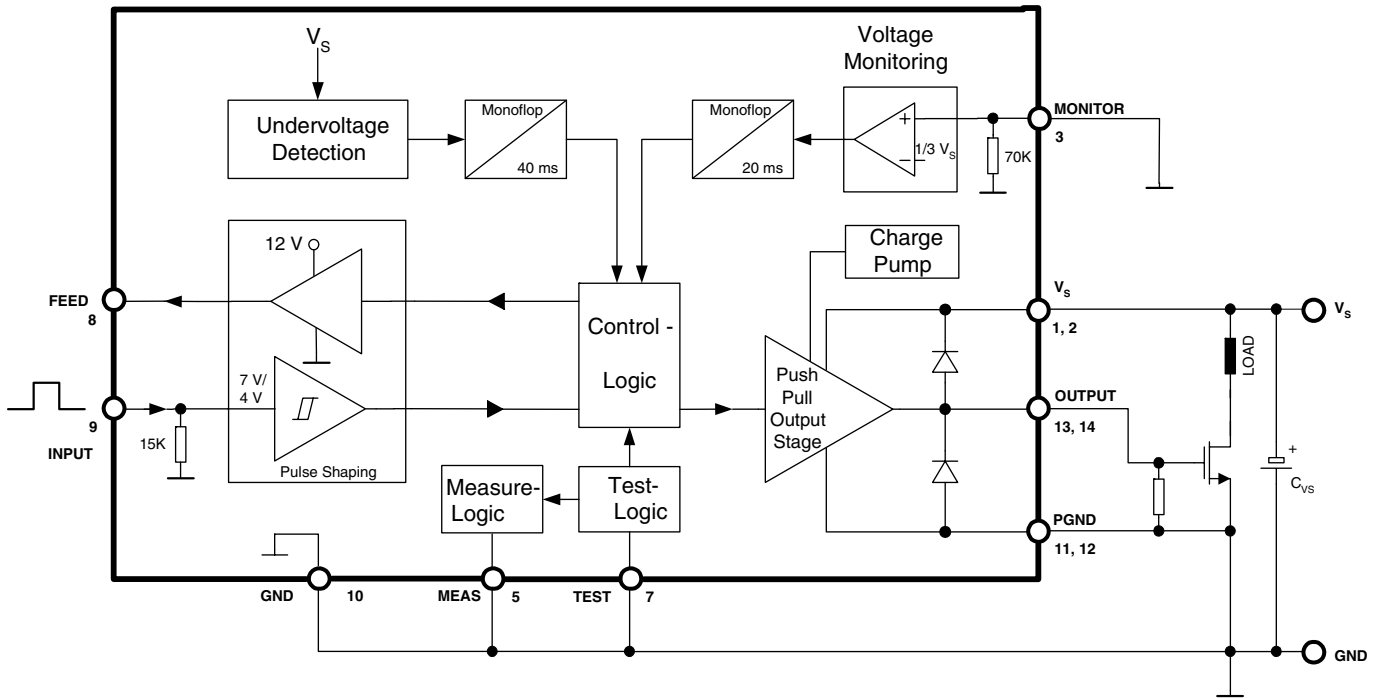
\*) Type means: A = 100% tested, B = 100% correlation tested, C = Characterized on samples, D = Design parameter



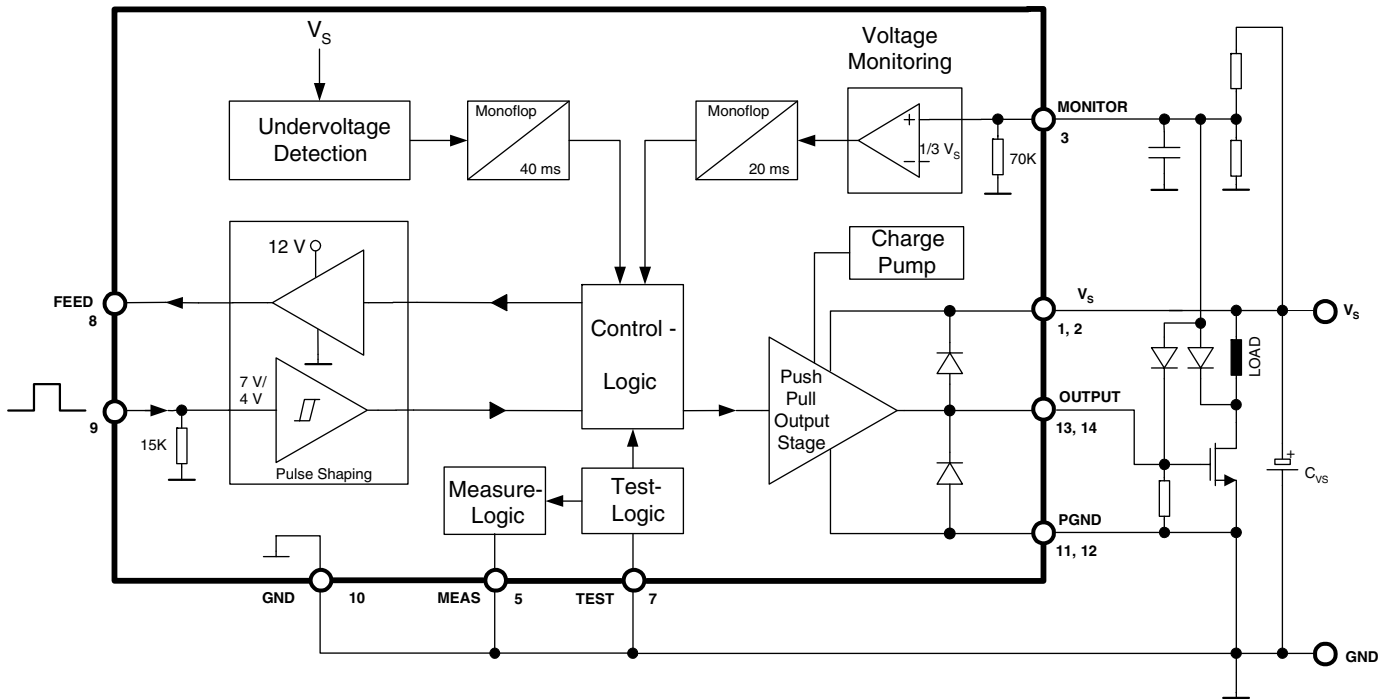
Figure 7-1. Timing Diagram<sup>(1)</sup> 1

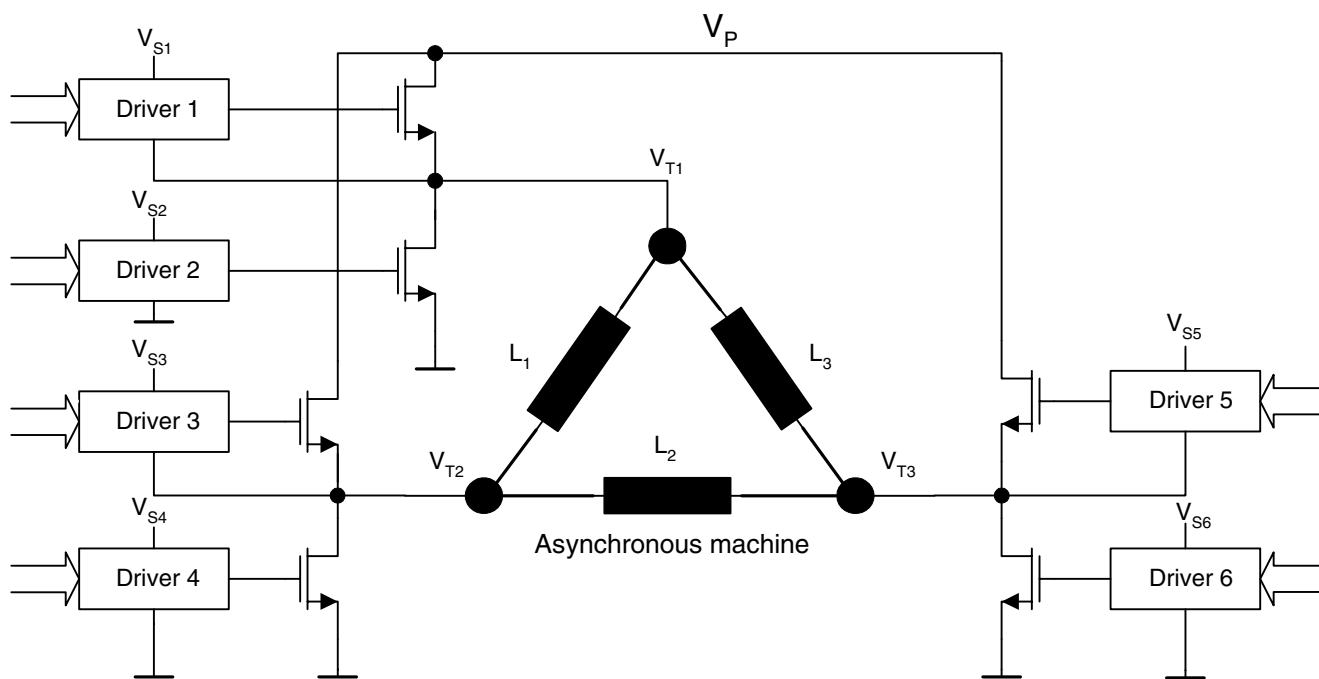
Note: 1. A 2 k $\Omega$  resistor is connected between pin 8 and ground; a 2 k $\Omega$  resistor and a 1 nF capacitor are used as load for the power output (pins 13 and 14), simulating identical conditions as a power MOSFET, which is usually connected to the output.

**Figure 7-2.** Application Circuit 1: Power Driver with Minimum External Components

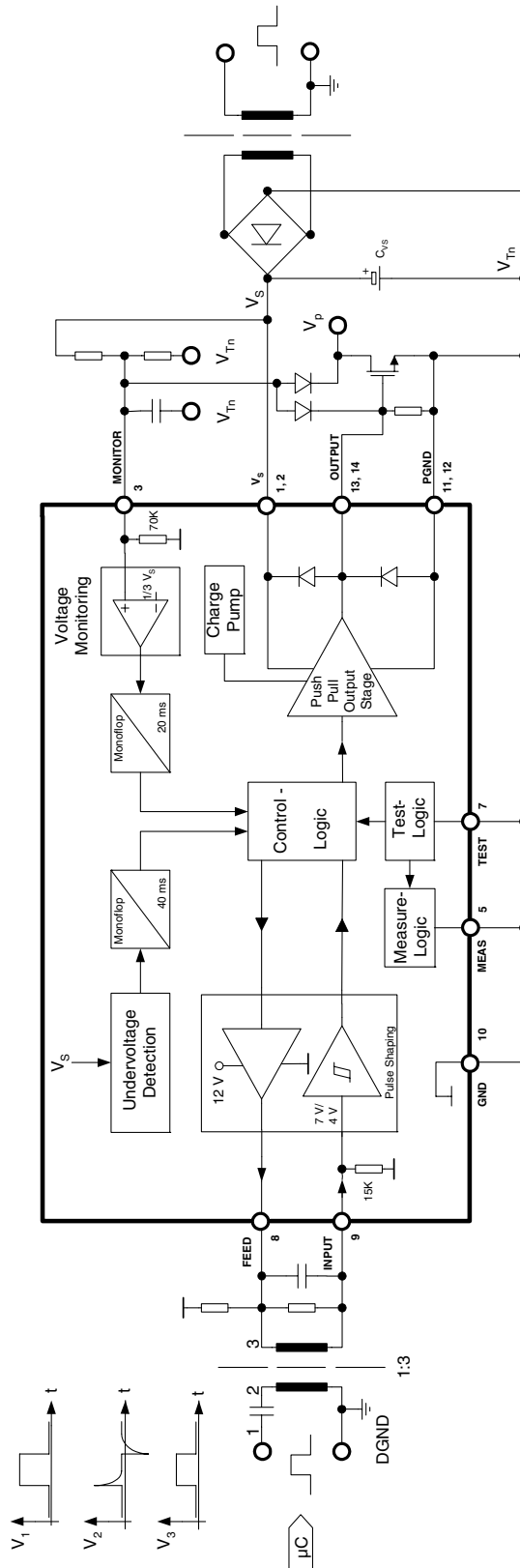


**Figure 7-3.** Application Circuit 2: Driver Circuit with Short-circuit Monitoring via the Drain-source Voltage of the Power Device



**Figure 7-4.** Application Circuit 3: Six ATA6821 Used to Control a Three-phase Asynchronous Machine

**Figure 7-5.** External Components for one ATA6821 in Application Circuit 3: Potential-free Control of a Three-phase Asynchronous Machine

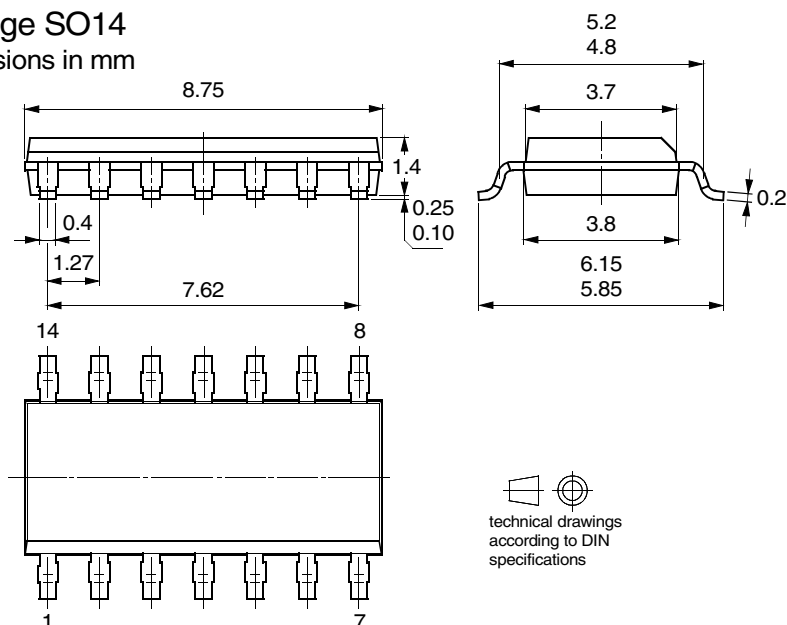


## 8. Ordering Information

| Extended Type Number | Package | Remarks                   |
|----------------------|---------|---------------------------|
| ATA6821-TUSY         | SO14    | Tubed, Pb-free            |
| ATA6821-TUQY         | SO14    | Taped and reeled, Pb-free |

## 9. Package Information

Package SO14  
Dimensions in mm



## 10. Revision History

Please note that the following page numbers referred to in this section refer to the specific revision mentioned, not to this document.

| Revision No.     | History  |
|------------------|--|
| 4778B-AUTO-09/05 | <ul style="list-style-type: none"> <li>Put datasheet in a new template</li> <li>Pb-free logo on page 1 added</li> <li>Ordering Information on page 13 changed</li> </ul> |



## Atmel Corporation

2325 Orchard Parkway  
San Jose, CA 95131, USA  
Tel: 1(408) 441-0311  
Fax: 1(408) 487-2600

## Regional Headquarters

### Europe

Atmel Sarl  
Route des Arsenaux 41  
Case Postale 80  
CH-1705 Fribourg  
Switzerland  
Tel: (41) 26-426-5555  
Fax: (41) 26-426-5500

### Asia

Room 1219  
Chinachem Golden Plaza  
77 Mody Road Tsimshatsui  
East Kowloon  
Hong Kong  
Tel: (852) 2721-9778  
Fax: (852) 2722-1369

### Japan

9F, Tonetsu Shinkawa Bldg.  
1-24-8 Shinkawa  
Chuo-ku, Tokyo 104-0033  
Japan  
Tel: (81) 3-3523-3551  
Fax: (81) 3-3523-7581

## Atmel Operations

### Memory

2325 Orchard Parkway  
San Jose, CA 95131, USA  
Tel: 1(408) 441-0311  
Fax: 1(408) 436-4314

### Microcontrollers

2325 Orchard Parkway  
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Fax: 1(408) 436-4314

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BP 70602  
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Fax: 1(719) 540-1759

Scottish Enterprise Technology Park  
Maxwell Building  
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Tel: (44) 1355-803-000  
Fax: (44) 1355-242-743

### RF/Automotive

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74025 Heilbronn, Germany  
Tel: (49) 71-31-67-0  
Fax: (49) 71-31-67-2340

1150 East Cheyenne Mtn. Blvd.  
Colorado Springs, CO 80906, USA  
Tel: 1(719) 576-3300  
Fax: 1(719) 540-1759

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38521 Saint-Egreve Cedex, France  
Tel: (33) 4-76-58-30-00  
Fax: (33) 4-76-58-34-80

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