

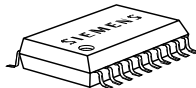
### Overview

### Features

- Delivers up to 0.8 A continuous
- Optimized for DC motor management applications
- Very low current consumption in stand-by (Inhibit) mode
- Low saturation voltage; typ. 1.2 V total @ 25 °C; 0.4 A
- Output protected against short circuit
- Error flag diagnosis
- Overvoltage lockout and diagnosis
- Undervoltage lockout
- CMOS/TTL compatible inputs with hysteresis
- No crossover current
- Internal clamp diodes
- Overtemperature protection with hysteresis and diagnosis
- Enhanced power P-DSO-Package



**P-DSO-14-4**



**P-DSO-20-6**

| Type        | Ordering Code | Package    |
|-------------|---------------|------------|
| TLE 4207 G  | Q67006-A9275  | P-DSO-14-4 |
| TLE 4207 GL | on request    | P-DSO-20-6 |

### Description

The TLE 4207 is a fully protected **Dual-Half-Bridge-Driver** designed specially for automotive and industrial motion control applications.

The part is built using the Siemens bipolar high voltage power technology DOPL.

The actuator (DC motor) can be connected direct between the halfbridges. Operation modes forward (cw), reverse (ccw), brake and high impedance are invoked from a standard interface. The standard enhanced power P-DSO-14 package meets the application requirements and saves PCB-board space and costs.

Furthermore the built in features like diagnosis, over- and undervoltage-lockout, short-circuit-protection, over-temperature-protection and the very low quiescent current in stand-by mode will open a wide range of automotive and industrial applications.

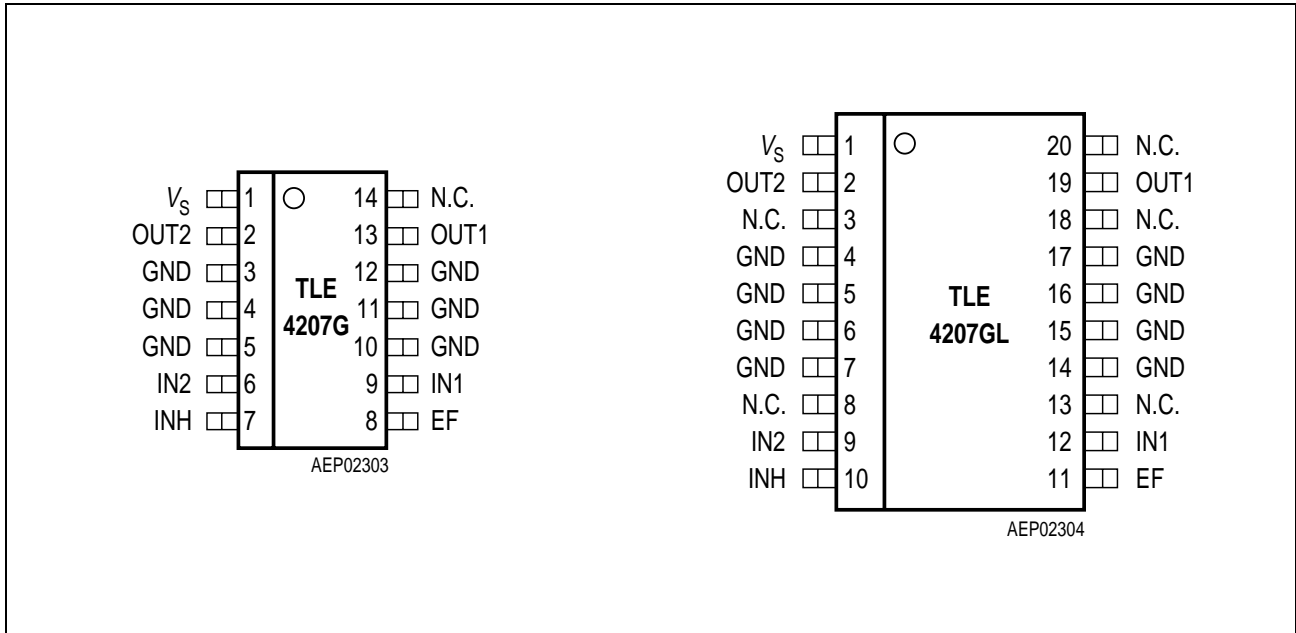


Figure 1 Pin Configuration (top view)

Pin Definitions and Functions

| Pin No.<br>P-DSO-14-4  | Pin No.<br>P-DSO-20-6            | Symbol | Function   |
|------------------------|----------------------------------|--------|--|
| 1                      | 1                                | $V_S$  | <b>Power supply voltage;</b><br>positive reference potential for blocking capacitor  |
| 2                      | 2                                | OUT2   | <b>Power-output 2;</b> full short circuit protected;<br>with integrated clamp diodes |
| 3, 4, 5,<br>10, 11, 12 | 4, 5, 6, 7,<br>14, 15, 16,<br>17 | GND    | <b>Ground;</b><br><b>negative</b> reference potential for blocking<br>capacitor      |
| 6                      | 9                                | IN2    | <b>Input channel 2;</b> controls OUT2 (not inverted)                                 |
| 7                      | 10                               | INH    | <b>Inhibit input;</b> low = IC in stand-by   |
| 8                      | 11                               | EF     | <b>Error Flag output;</b> open collector; low = error                                |
| 9                      | 12                               | IN1    | <b>Input channel 1;</b> controls OUT1 (not inverted)                                 |
| 13                     | 19                               | OUT1   | <b>Power output 1;</b> full short circuit protected;<br>with integrated clamp diodes |
| 14                     | 3, 8,<br>13, 18, 20              | N.C.   | <b>Not connected</b>   |

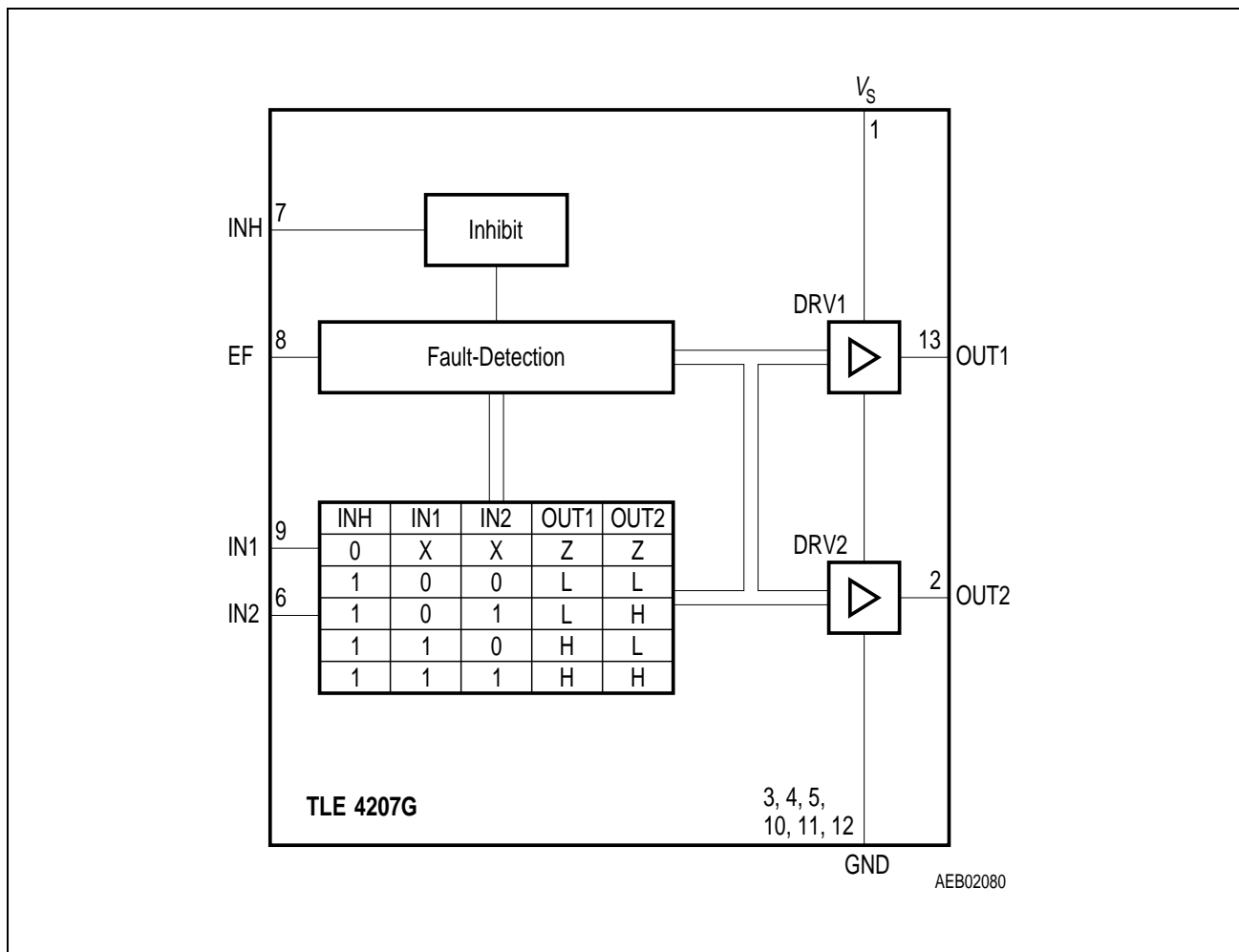


Figure 2 Block Diagram

Functional Truth Table

| INH | IN1 | IN2 | OUT1 | OUT2 | Mode     |
|-----|-----|-----|------|------|----------|
| 0   | X   | X   | Z    | Z    | Stand-By |
| 1   | 0   | 0   | L    | L    | Brake LL |
| 1   | 0   | 1   | L    | H    | CW       |
| 1   | 1   | 0   | H    | L    | CCW      |
| 1   | 1   | 1   | H    | H    | Brake HH |

IN:

0 = Logic LOW  
1 = Logic HIGH  
X = don't care

OUT:

Z = Output in tristate condition  
L = Output in sink condition  
H = Output in source condition

Diagnosis

| EF | Error            |
|----|------------------|
| 1  | no error         |
| 0  | over temperature |
| 0  | over voltage     |

Electrical Characteristics

Absolute Maximum Ratings

| Parameter | Symbol | Limit Values |      | Unit | Remarks |
|-----------|--------|--------------|------|------|---------|
|           |        | min.         | max. |      |         |

Voltages

|                                      |          |       |    |   |  |
|--------------------------------------|----------|-------|----|---|--|
| Supply voltage                       | $V_S$    | - 0.3 | 45 | V | –  |
| Supply voltage                       | $V_S$    | - 1   | –  | V | $t < 0.5 \text{ s}; I_S > - 2 \text{ A}$ |
| Logic input voltages (IN1; IN2; INH) | $V_I$    | - 5   | 20 | V | $0 \text{ V} < V_S < 45 \text{ V}$       |
| Logic output voltage (EF)            | $V_{EF}$ | - 0.3 | 20 | V | $0 \text{ V} < V_S < 45 \text{ V}$       |

Currents

|                        |              |     |   |    |                    |
|------------------------|--------------|-----|---|----|--------------------|
| Output current (cont.) | $I_{OUT1-2}$ | –   | – | A  | internally limited |
| Output current (peak)  | $I_{OUT1-2}$ | –   | – | A  | internally limited |
| Output current (diode) | $I_{OUT1-2}$ | - 1 | 1 | A  | –                  |
| Output current (EF)    | $I_{OUT1-2}$ | - 2 | 5 | mA | –                  |

Temperatures

|                      |           |      |     |    |   |
|----------------------|-----------|------|-----|----|---|
| Junction temperature | $T_j$     | - 40 | 150 | °C | – |
| Storage temperature  | $T_{stg}$ | - 50 | 150 | °C | – |

Thermal Resistances

|                  |               |   |    |     |                   |
|------------------|---------------|---|----|-----|-------------------|
| Junction pin     | $R_{thj-pin}$ | – | 25 | K/W | measured to pin 5 |
| Junction ambient | $R_{thjA}$    | – | 65 | K/W | –                 |

*Note: Maximum ratings are absolute ratings; exceeding any one of these values may cause irreversible damage to the integrated circuit.*

Operating Range

| Parameter                              | Symbol | Limit Values  |               | Unit | Remarks                               |
|--|--------|---------------|---------------|------|---------------------------------------|
|  |        | min.          | max.          |      |                                       |
| Supply voltage                         | $V_S$  | $V_{UV\ OFF}$ | 18            | V    | After $V_S$ rising above $V_{UV\ ON}$ |
| Supply voltage increasing              | $V_S$  | - 0.3         | $V_{UV\ ON}$  | V    | Outputs in tristate                   |
| Supply voltage decreasing              | $V_S$  | - 0.3         | $V_{UV\ OFF}$ | V    | Outputs in tristate                   |
| Logic input voltage<br>(IN1; IN2; INH) | $V_I$  | - 2           | 18            | V    | -                                     |
| Junction temperature                   | $T_j$  | - 40          | 150           | °C   | -                                     |

*Note: In the operating range the functions given in the circuit description are fulfilled.*

Electrical Characteristics

8 V < V<sub>S</sub> < 18 V; INH = High; I<sub>OUT1-2</sub> = 0 A; – 40 °C < T<sub>j</sub> < 150 °C;  
unless otherwise specified

| Parameter | Symbol | Limit Values |      |      | Unit | Test Condition |
|-----------|--------|--------------|------|------|------|----------------|
|           |        | min.         | typ. | max. |      |                |

Current Consumption

|                   |                |   |    |    |    |  |
|-------------------|----------------|---|----|----|----|--|
| Quiescent current | I <sub>S</sub> | – | 20 | 50 | μA | INH = LOW  |
| Quiescent current | I <sub>S</sub> | – | 20 | 30 | μA | INH = LOW;<br>V <sub>S</sub> = 13.2 V;<br>T <sub>j</sub> = 25 °C |
| Supply current    | I <sub>S</sub> | – | 10 | 20 | mA | –  |
| Supply current    | I <sub>S</sub> | – | –  | 30 | mA | I <sub>OUT1</sub> = 0.4 A<br>I <sub>OUT2</sub> = – 0.4 A         |
| Supply current    | I <sub>S</sub> | – | –  | 50 | mA | I <sub>OUT1</sub> = 0.8 A<br>I <sub>OUT2</sub> = – 0.8 A         |

Over- and Under Voltage Lockout

|                       |                     |      |      |     |   |  |
|-----------------------|---------------------|------|------|-----|---|--|
| UV Switch ON voltage  | V <sub>UV ON</sub>  | –    | 6.5  | 7.5 | V | V <sub>S</sub> increasing                |
| UV Switch OFF voltage | V <sub>UV OFF</sub> | 5.0  | 6    | –   | V | V <sub>S</sub> decreasing                |
| UV ON/OFF hysteresis  | V <sub>UV HY</sub>  | –    | 0.5  | –   | V | V <sub>UV ON</sub> – V <sub>UV OFF</sub> |
| OV Switch OFF voltage | V <sub>OV OFF</sub> | –    | 20   | 24  | V | V <sub>S</sub> increasing                |
| OV Switch ON voltage  | V <sub>OV ON</sub>  | 18.0 | 19.5 | –   | V | V <sub>S</sub> decreasing                |
| OV ON/OFF hysteresis  | V <sub>OV HY</sub>  | –    | 0.5  | –   | V | V <sub>OV OFF</sub> – V <sub>OV ON</sub> |

**Electrical Characteristics (cont'd)**

8 V <  $V_S$  < 18 V; INH = High;  $I_{OUT1-2} = 0$  A;  $-40\text{ °C} < T_j < 150\text{ °C}$ ;  
unless otherwise specified

| Parameter | Symbol | Limit Values |      |      | Unit | Test Condition |
|-----------|--------|--------------|------|------|------|----------------|
|           |        | min.         | typ. | max. |      |                |

**Outputs OUT1-2****Saturation Voltages**

|                                      |              |   |      |      |   |                      |
|--------------------------------------|--------------|---|------|------|---|----------------------|
| Source (upper)<br>$I_{OUT} = -0.2$ A | $V_{SAT\ U}$ | – | 0.85 | 1.15 | V | $T_j = 25\text{ °C}$ |
| Source (upper)<br>$I_{OUT} = -0.4$ A | $V_{SAT\ U}$ | – | 0.90 | 1.20 | V | $T_j = 25\text{ °C}$ |
| Sink (upper)<br>$I_{OUT} = -0.8$ A   | $V_{SAT\ U}$ | – | 1.10 | 1.50 | V | $T_j = 25\text{ °C}$ |
| Sink (lower)<br>$I_{OUT} = 0.2$ A    | $V_{SAT\ L}$ | – | 0.15 | 0.23 | V | $T_j = 25\text{ °C}$ |
| Sink (lower)<br>$I_{OUT} = 0.4$ A    | $V_{SAT\ L}$ | – | 0.25 | 0.40 | V | $T_j = 25\text{ °C}$ |
| Sink (lower)<br>$I_{OUT} = 0.8$ A    | $V_{SAT\ L}$ | – | 0.45 | 0.75 | V | $T_j = 25\text{ °C}$ |

|            |                   |           |   |     |     |   |                                     |
|------------|-------------------|-----------|---|-----|-----|---|-------------------------------------|
| Total Drop | $I_{OUT} = 0.2$ A | $V_{SAT}$ | – | 1   | 1.4 | V | $V_{SAT} = V_{SAT\ U} + V_{SAT\ L}$ |
| Total Drop | $I_{OUT} = 0.4$ A | $V_{SAT}$ | – | 1.2 | 1.7 | V | $V_{SAT} = V_{SAT\ U} + V_{SAT\ L}$ |
| Total Drop | $I_{OUT} = 0.8$ A | $V_{SAT}$ | – | 1.6 | 2.5 | V | $V_{SAT} = V_{SAT\ U} + V_{SAT\ L}$ |

**Clamp Diodes**

|                        |           |   |     |     |    |                           |
|------------------------|-----------|---|-----|-----|----|---------------------------|
| Forward voltage; upper | $V_{FU}$  | – | 1   | 1.5 | V  | $I_F = 0.4$ A             |
| Upper leakage current  | $I_{LKU}$ | – | –   | 5   | mA | $I_F = 0.4\text{ A}^{1)}$ |
| Forward voltage; lower | $V_{FL}$  | – | 0.9 | 1.4 | V  | $I_F = 0.4$ A             |

Notes see page 10.



Electrical Characteristics (cont'd)

8 V <  $V_S$  < 18 V; INH = High;  $I_{OUT1-2} = 0$  A;  $-40\text{ }^{\circ}\text{C} < T_j < 150\text{ }^{\circ}\text{C}$ ;  
unless otherwise specified

| Parameter | Symbol | Limit Values |      |      | Unit | Test Condition |
|-----------|--------|--------------|------|------|------|----------------|
|           |        | min.         | typ. | max. |      |                |

Input-Interface

Logic Inputs IN1; IN2

|                             |           |       |      |     |               |                    |
|-----------------------------|-----------|-------|------|-----|---------------|--------------------|
| H-input voltage             | $V_{IH}$  | –     | 2    | 3   | V             | –                  |
| L-input voltage             | $V_{IL}$  | 1     | 1.5  | –   | V             | –                  |
| Hysteresis of input voltage | $V_{IHY}$ | –     | 0.5  | –   | V             | –                  |
| H-input current             | $I_{IH}$  | – 2   | –    | 10  | $\mu\text{A}$ | $V_I = 5\text{ V}$ |
| L-input current             | $I_{IL}$  | – 100 | – 20 | – 5 | $\mu\text{A}$ | $V_I = 0\text{ V}$ |

Logic Input INH

|                             |           |      |     |     |               |                        |
|-----------------------------|-----------|------|-----|-----|---------------|------------------------|
| H-input voltage             | $V_{IH}$  | –    | 2.7 | 3.5 | V             | –                      |
| L-input voltage             | $V_{IL}$  | 1    | 2   | –   | V             | –                      |
| Hysteresis of input voltage | $V_{IHY}$ | –    | 0.7 | –   | V             | –                      |
| H-input current             | $I_{IH}$  | –    | 100 | 250 | $\mu\text{A}$ | $V_{INH} = 5\text{ V}$ |
| L-input current             | $I_{IL}$  | – 10 | –   | 10  | $\mu\text{A}$ | $V_{INH} = 0\text{ V}$ |

Error-Flag EF

|                        |            |   |     |     |               |                                    |
|------------------------|------------|---|-----|-----|---------------|------------------------------------|
| L-output voltage level | $V_{EFL}$  | – | 0.2 | 0.4 | V             | $I_{EF} = 2\text{ mA}$             |
| Leakage current        | $I_{EFLK}$ | – | –   | 10  | $\mu\text{A}$ | $0\text{ V} < V_{EF} < 7\text{ V}$ |

Electrical Characteristics (cont'd)

8 V <  $V_S$  < 18 V; INH = High;  $I_{OUT1-2} = 0$  A;  $-40\text{ }^{\circ}\text{C} < T_j < 150\text{ }^{\circ}\text{C}$ ;  
unless otherwise specified

| Parameter | Symbol | Limit Values |      |      | Unit | Test Condition |
|-----------|--------|--------------|------|------|------|----------------|
|           |        | min.         | typ. | max. |      |                |

Thermal Shutdown

|  |            |     |     |     |                    |   |
|--|------------|-----|-----|-----|--------------------|---|
| Thermal shutdown junction temperature  | $T_{jSD}$  | 150 | 175 | 200 | $^{\circ}\text{C}$ | – |
| Thermal switch-on junction temperature | $T_{jSO}$  | 120 | –   | 170 | $^{\circ}\text{C}$ | – |
| Temperature hysteresis                 | $\Delta T$ | –   | 30  | –   | K                  | – |

1) Guaranteed by design.

*Note: The listed characteristics are ensured over the operating range of the integrated circuit. Typical characteristics specify mean values expected over the production spread. If not otherwise specified, typical characteristics apply at  $T_A = 25^{\circ}\text{C}$  and the given supply voltage.*

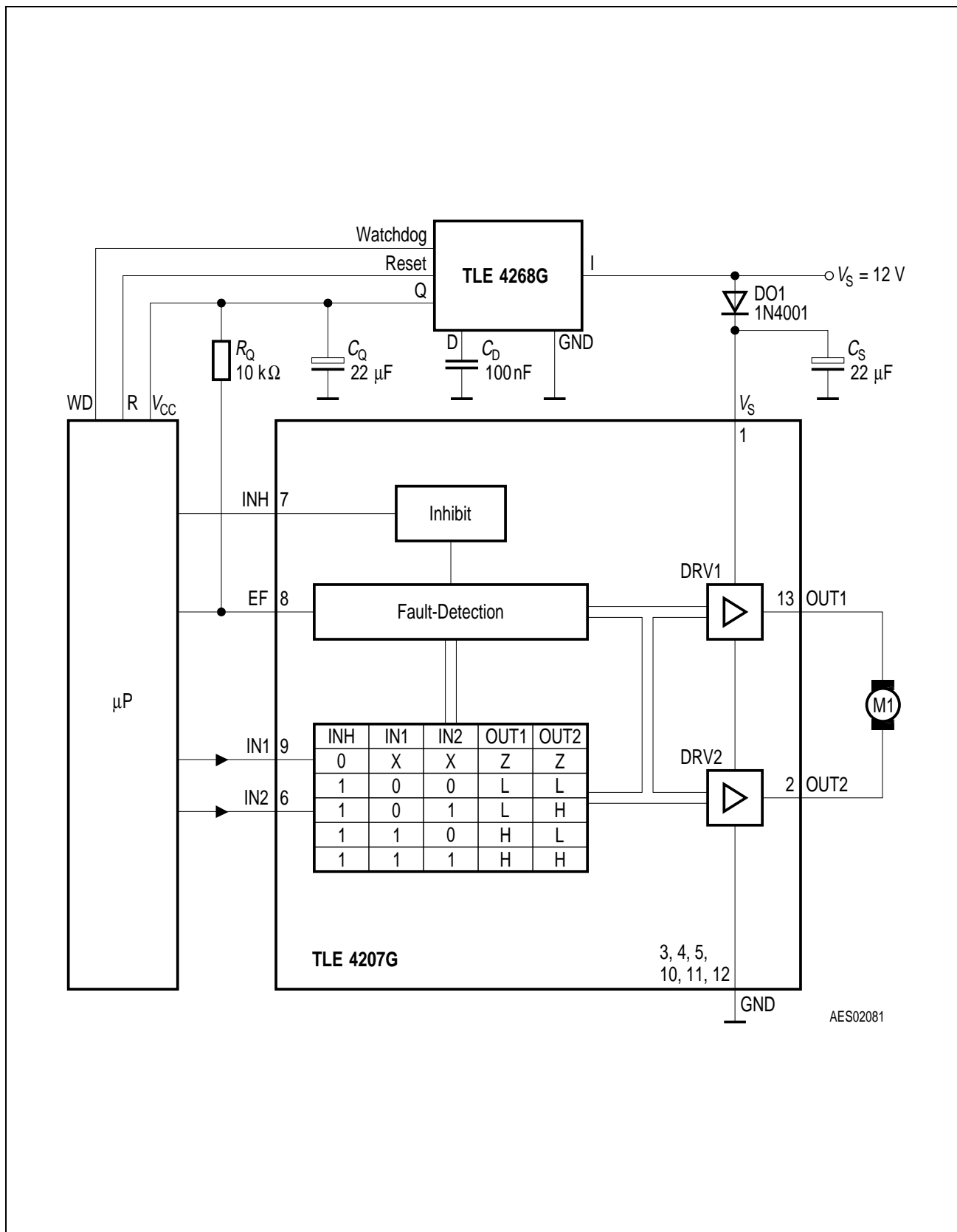
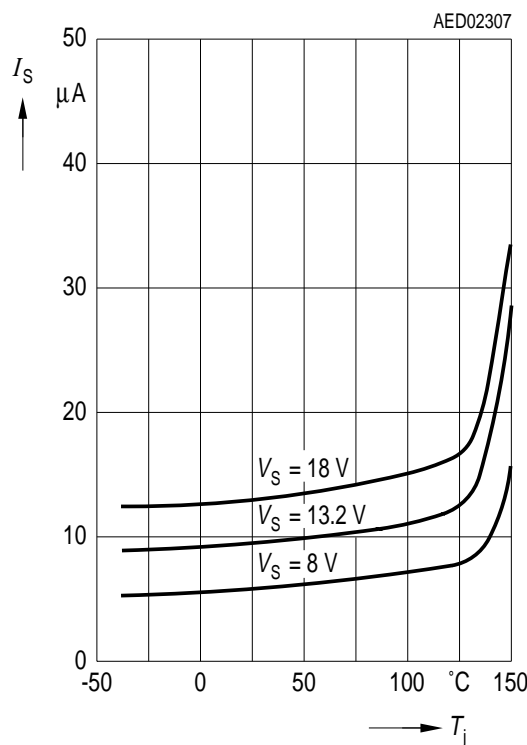


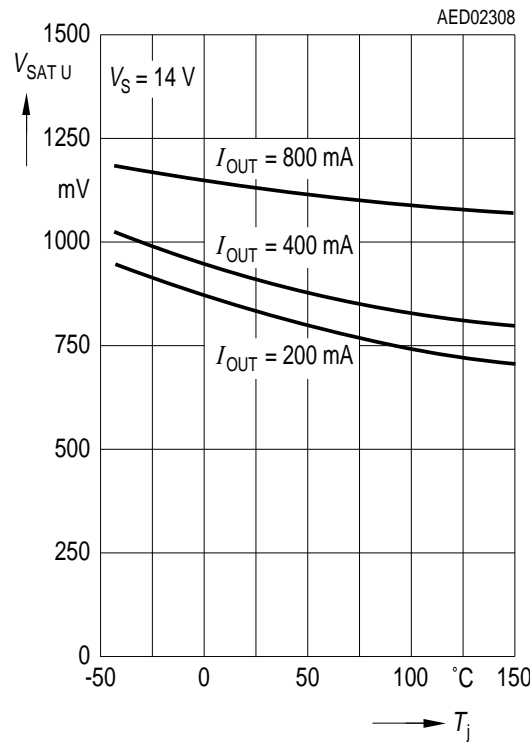
Figure 3 Application Circuit

Diagrams

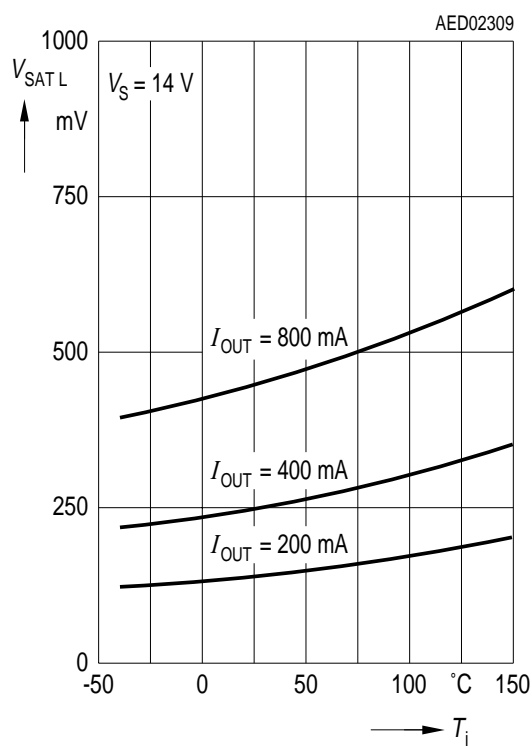
Quiescent current  $I_S$  over Temperature



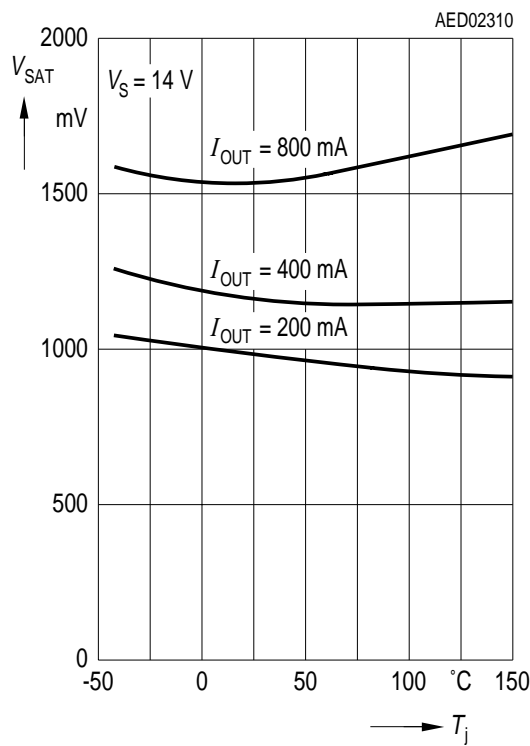
Saturation Voltage of Source  $V_{SAT U}$  over Temperature



Saturation Voltage of Sink  $V_{SAT L}$  over Temperature

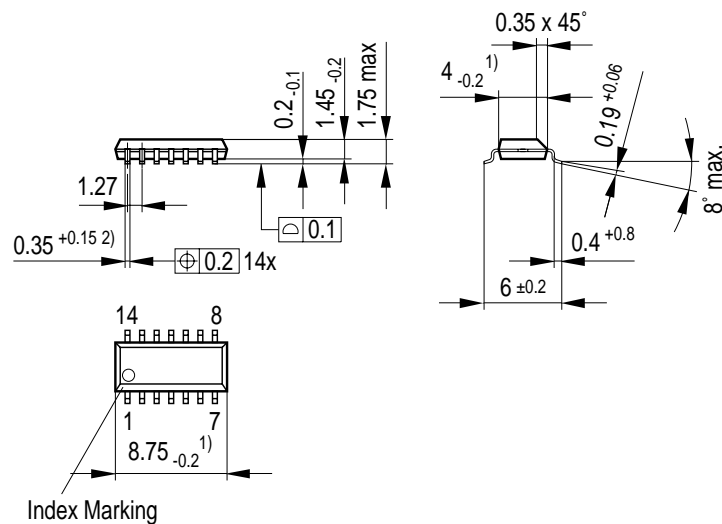


Total Drop at outputs  $V_{SAT}$  over Temperature



Package Outlines

P-DSO-14-4  
(Plastic Dual Small Outline Package)



- 1) Does not include plastic or metal protrusion of 0.15 max. per side
- 2) Does not include dambar protrusion of 0.05 max. per side

GPS05093

Sorts of Packing

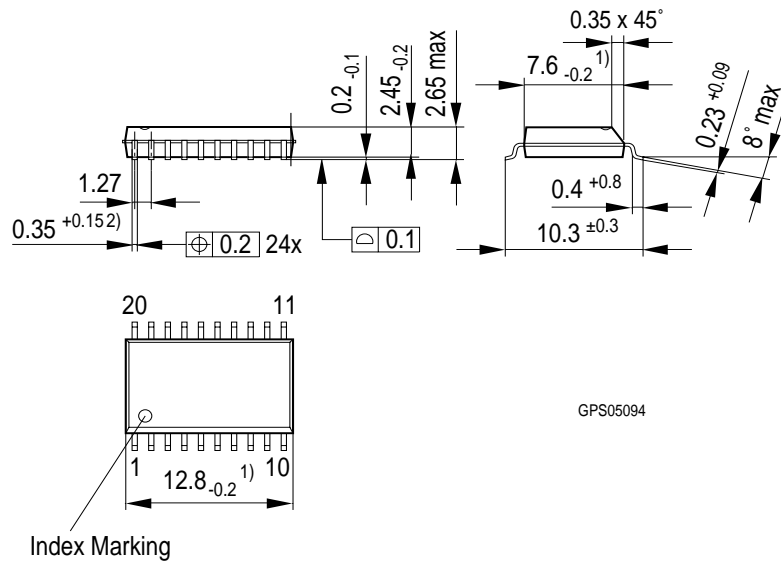
Package outlines for tubes, trays etc. are contained in our Data Book "Package Information".

SMD = Surface Mounted Device

Dimensions in mm

## P-DSO-20-6

(Plastic Dual Small Outline Package)



GPS05094

- 1) Does not include plastic or metal protrusions of 0.15 max per side
- 2) Does not include dambar protrusion of 0.05 max per side

## Sorts of Packing

Package outlines for tubes, trays etc. are contained in our Data Book "Package Information".

SMD = Surface Mounted Device

Dimensions in mm