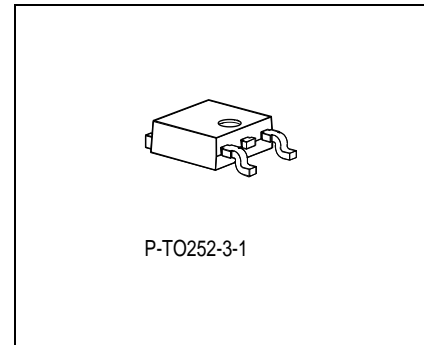


## Target Data Sheet

### Features

- Fixed output voltage regulator 2.5 V, 3.3 V or 5 V
- Adjustable output down to 1.25 V
- 800 mA output current
- 80 dB ripple rejection
- No output capacitor necessary
- Suitable for automotive application
- Short circuit protected
- Overtemperature protected



| Type            | Ordering Code | Package     |
|-----------------|---------------|-------------|
| ▼ TLE 4284 DV   | Q67000-A9480  | P-TO252-3-1 |
| ▼ TLE 4284 DV33 | Q67000-A9482  | P-TO252-3-1 |
| ▼ TLE 4284 DV50 | Q67000-A9481  | P-TO252-3-1 |

▼ New device

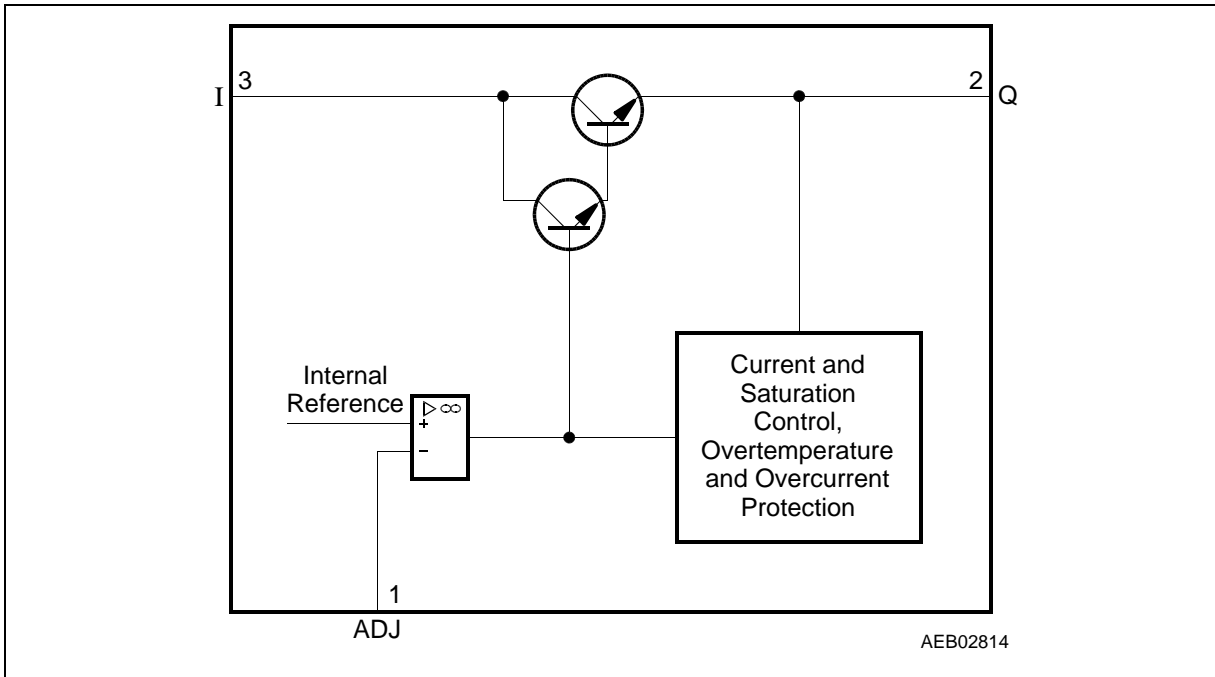
### Functional Description

The TLE 4284 is a monolithic integrated fixed or adjustable NPN type voltage regulator that can supply loads up to 800 mA. The device is housed in the surface mounted P-TO252-3-1 package (D-Pak). It is designed to supply microprocessor systems under the severe conditions of automotive applications and therefore it is equipped with additional protection against over load, short circuit and overtemperature.

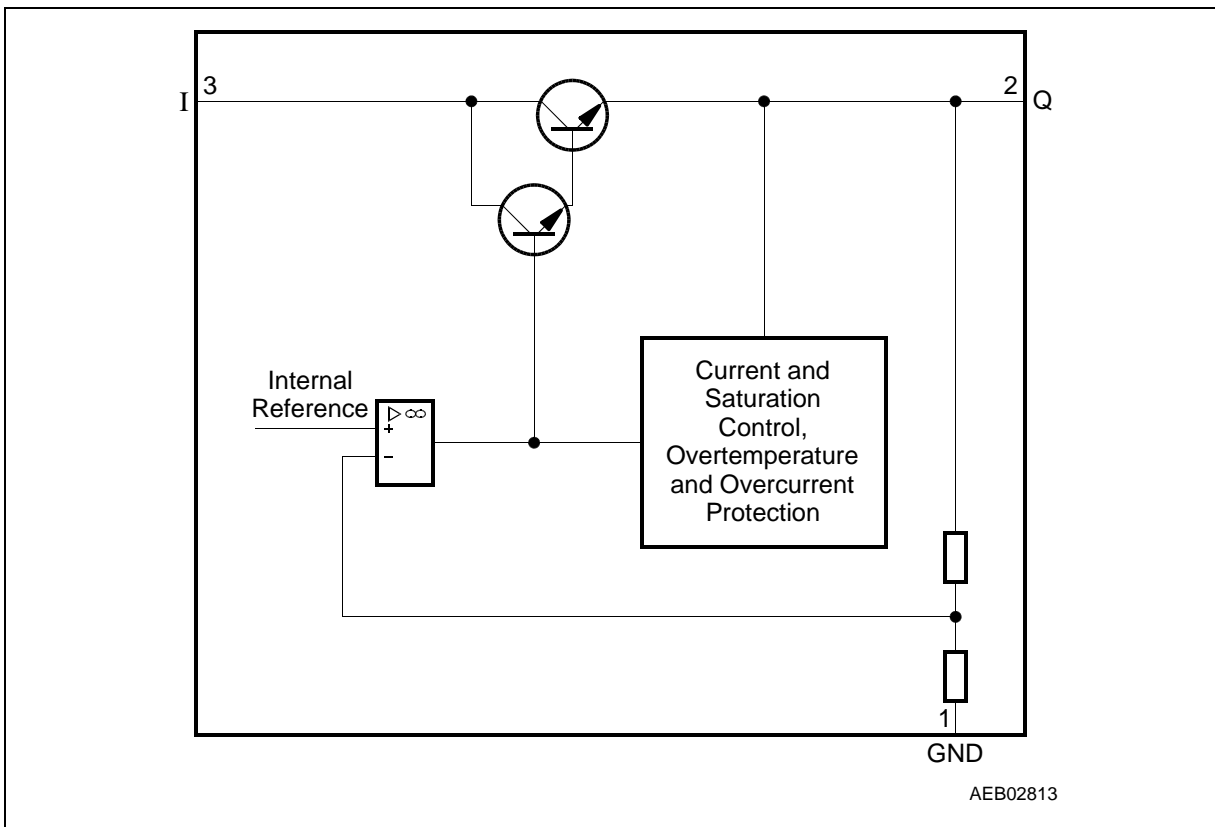
An input voltage  $V_i$  in the range of  $(V_Q + 2 \text{ V}) < V_i < 45 \text{ V}$  is regulated to  $V_Q$ .

The device operates in the temperature range of  $T_j = -40$  to  $150 \text{ }^\circ\text{C}$ .

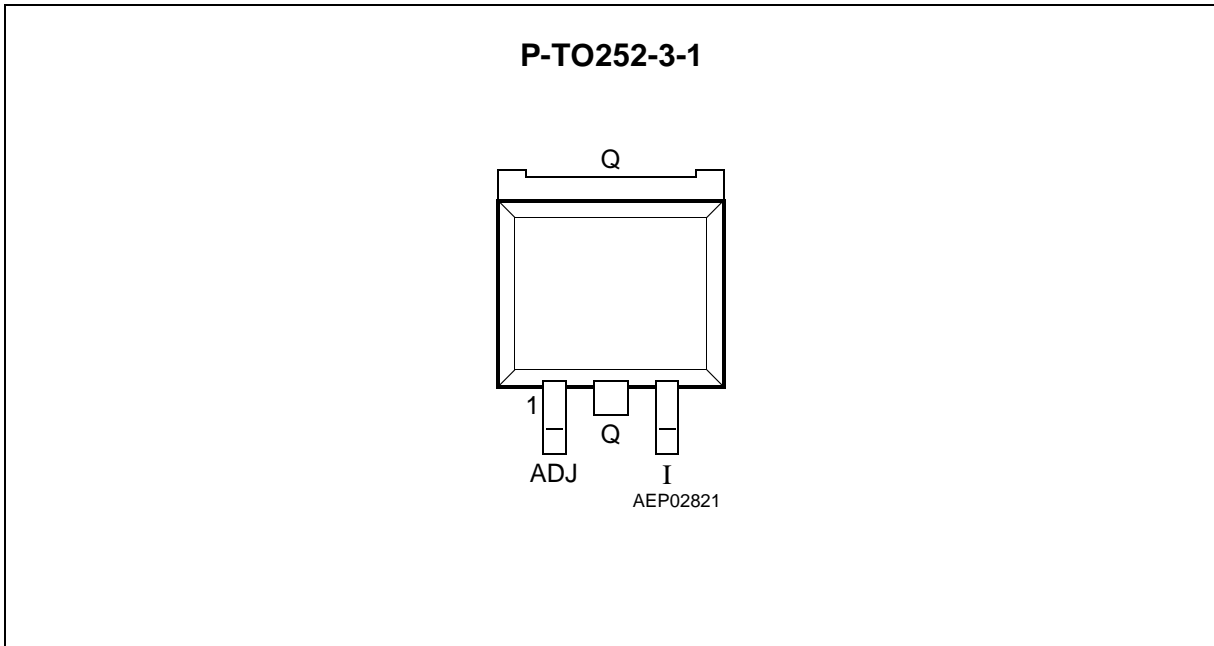
The device is available for adjustable output voltage as well as in fixed voltage versions for 3.3 V and 5.0 V (2.5 V on demand).



**Figure 1** Block Diagram for Adjustable Output Voltage TLE 4284 DV



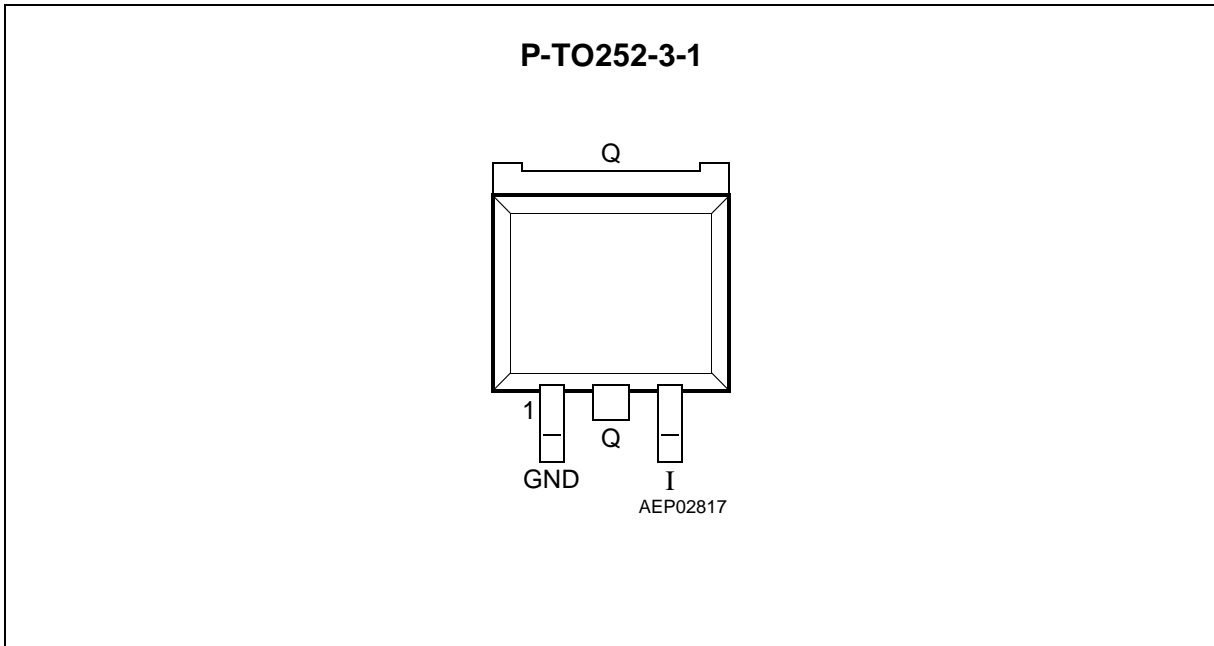
**Figure 2** Block Diagram for Fixed Output Voltage TLE 4284 DV33, 50



**Figure 3 Pin Configuration** (top view)

**Pin Definitions and Functions for Adjustable Output Voltage TLE 4284 DV**

| Pin No. | Symbol | Function  |
|---------|--------|---|
| 1       | ADJ    | <b>Adjust</b> ; defines output voltage by external voltage divider between Q, ADJ and GND.                  |
| 2       | Q      | <b>Output</b> ; the output voltage is defined by the external voltage divider between Q, Adjust and Ground. |
| 3       | I      | <b>Input</b>  |



**Figure 4 Pin Configuration** (top view) (cont'd)

**Pin Definitions and Functions for Fixed Voltage TLE 4284 DVxx**

| Pin No. | Symbol | Function                                       |
|---------|--------|--|
| 1       | GND    | <b>Ground</b>                                  |
| 2       | Q      | <b>Output</b> ; Output voltage is 3.3 V or 5 V |
| 3       | I      | <b>Input</b>                                   |

### Absolute Maximum Ratings

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

#### Voltage Regulator

##### Input - Output Voltage Difference (variable device only)

|         |             |       |    |   |   |
|---------|-------------|-------|----|---|---|
| Voltage | $V_I - V_Q$ | - 0.3 | 40 | V | - |
|---------|-------------|-------|----|---|---|

##### Input Voltage (fixed voltage version only)

|         |       |       |    |   |   |
|---------|-------|-------|----|---|---|
| Voltage | $V_I$ | - 0.3 | 40 | V | - |
|---------|-------|-------|----|---|---|

##### Output (fixed voltage version only)

|         |       |       |    |   |                    |
|---------|-------|-------|----|---|--------------------|
| Voltage | $V_Q$ | - 0.3 | 40 | V | -                  |
| Current | $I_Q$ | -     | -  | - | Internally limited |

##### Adjust (variable version only)

|         |           |       |    |   |                    |
|---------|-----------|-------|----|---|--------------------|
| Voltage | $V_{ADJ}$ | - 0.3 | 40 | V | -                  |
| Current | $I_{ADJ}$ | -     | -  | - | Internally limited |

##### Ground (fixed voltage version only)

|         |           |   |   |    |   |
|---------|-----------|---|---|----|---|
| Current | $I_{GND}$ | - | 2 | mA | - |
|---------|-----------|---|---|----|---|

#### Temperature

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

*Note: Stresses above those listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.*

**Operating Range**

| Parameter                         | Symbol      | Limit Values |                    | Unit | Remarks       |
|-----------------------------------|-------------|--------------|--------------------|------|---------------|
|                                   |             | min.         | max.               |      |               |
| Input Voltage                     | $V_I$       | 6.3          | 40                 | V    | TLE 4284 DV33 |
| Input Voltage                     | $V_I$       | 8.0          | 40                 | V    | TLE 4284 DV50 |
| Input - Output Voltage Difference | $V_I - V_Q$ | 3            | 40                 | V    | TLE 4284 DV   |
| Load Current Range                | $I_Q$       | 10           | Internally limited | mA   | –             |
| Junction temperature              | $T_j$       | – 40         | 150                | °C   | –             |

**Thermal Resistance**

|                  |            |   |     |     |   |
|------------------|------------|---|-----|-----|---|
| Junction ambient | $R_{thja}$ | – | 144 | K/W | P-TO252-3-1<br>zero airflow,<br>zero heat sink area |
| Junction case    | $R_{thjc}$ | – | 4   | K/W | –   |

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

**Characteristics Adjustable Output Voltage Device TLE 4284 DV**
**– 40 °C < T<sub>j</sub> < 150 °C; V<sub>I</sub> – V<sub>Q</sub> = 5 V, I<sub>Q</sub> = 10 mA; unless otherwise specified**

| Parameter  | Sym-<br>bol                    | Limit Values |       |      | Unit | Measuring Conditions   |
|--|--------------------------------|--------------|-------|------|------|--|
|  |                                | min.         | typ.  | max. |      |  |
| Reference voltage  | V <sub>REF</sub> <sup>1)</sup> | 1.20         | 1.25  | 1.30 | V    | –  |
| Line regulation  | ΔV <sub>Q</sub>                | –            | 0.3   | 1.0  | %    | 3 V ≤ (V <sub>I</sub> – V <sub>Q</sub> ) ≤ 40 V  |
| Load regulation  | ΔV <sub>Q</sub>                | –            | 0.3   | 1.5  | %    | 10 mA ≤ I <sub>Q</sub> ≤ 800 mA;<br>V <sub>I</sub> = 4.25 V; V <sub>Q</sub> = V <sub>REF</sub>                                   |
| Drop voltage   | V <sub>DR</sub>                | –            | 2.1   | –    | V    | I <sub>Q</sub> = 100 mA <sup>2)</sup>  |
| Drop voltage   | V <sub>DR</sub>                | –            | 2.15  | –    | V    | I <sub>Q</sub> = 500 mA <sup>2)</sup>  |
| Drop voltage   | V <sub>DR</sub>                | –            | 2.2   | –    | V    | I <sub>Q</sub> = 800 mA <sup>2)</sup>  |
| Current consumption;<br>I <sub>q</sub> = I <sub>I</sub> – I <sub>Q</sub> | I <sub>q</sub>                 | –            | 100   | 120  | μA   | I <sub>Q</sub> = 10 mA   |
| Adjust current   | I <sub>ADJ</sub>               | –            | 100   | 120  | μA   | I <sub>Q</sub> = 10 mA   |
| Adjust current change  | ΔI <sub>ADJ</sub>              | –            | ± 0.2 | ± 1  | μA   | 10 mA ≤ I <sub>Q</sub> ≤ 800 mA;<br>3 V ≤ (V <sub>I</sub> – V <sub>Q</sub> ) ≤ 20 V  |
| Adjust current change  | ΔI <sub>ADJ</sub>              | –            | ± 0.2 | ± 1  | μA   | 10 mA ≤ I <sub>Q</sub> ≤ 200 mA;<br>3 V ≤ (V <sub>I</sub> – V <sub>Q</sub> ) ≤ 40 V  |
| Temperature stability  | –                              | –            | 1     | –    | %    | <sup>3)</sup>  |
| Minimum load current   | I <sub>Q</sub>                 | –            | 3.5   | 10   | mA   | V <sub>I</sub> – V <sub>Q</sub> = 40 V   |
| Current limit  | I <sub>Qmax</sub>              | 1000         | –     | 2200 | mA   | V <sub>I</sub> = 13.5 V  |
| Current limit  | I <sub>Qmax</sub>              | 50           | 200   | –    | mA   | V <sub>I</sub> – V <sub>Q</sub> = 40 V; T <sub>j</sub> = 25 °C   |
| RMS Output Noise   | –                              | –            | 3     | –    | ppm  | ppm of V <sub>Q</sub> ; 10 Hz ≤ f ≤ 10k;<br>T <sub>j</sub> = 25 °C <sup>1)</sup>   |
| Power Supply Ripple Rejection  | PSRR                           | –            | 65    | –    | dB   | V <sub>Q</sub> = 10 V, f <sub>r</sub> = 120 Hz,<br>V <sub>r</sub> = 0.5 V <sub>PP</sub> , C <sub>ADJ</sub> = 0 μF <sup>1)</sup>  |
| Power Supply Ripple Rejection  | PSRR                           | 65           | 80    | –    | dB   | V <sub>Q</sub> = 10 V, f <sub>r</sub> = 120 Hz,<br>V <sub>r</sub> = 0.5 V <sub>PP</sub> , C <sub>ADJ</sub> = 10 μF <sup>1)</sup> |
| Long Term Stability  | ΔV <sub>Q</sub>                | –            | 0.3   | 1    | %    | T <sub>j</sub> = 125 °C, 1000 h <sup>1)</sup>  |

<sup>1)</sup> V<sub>REF</sub> = V<sub>Q</sub> – V<sub>ADJ</sub>
<sup>2)</sup> Drop voltage measured when the output voltage has dropped 100 mV from the nominal value obtained at V<sub>Q</sub> = V<sub>REF</sub>.

<sup>3)</sup> Guaranteed by design.

**Characteristics 3.3 V Fixed Output Voltage Device TLE 4284 DV33**
 $-40\text{ }^{\circ}\text{C} < T_j < 150\text{ }^{\circ}\text{C}$ ;  $V_I = 8.5\text{ V}$ ,  $I_Q = 10\text{ mA}$ ; unless otherwise specified.

| Parameter                                 | Symbol       | Limit Values |      |      | Unit | Measuring Conditions   |
|---|--------------|--------------|------|------|------|--|
|   |              | min.         | typ. | max. |      |  |
| Output voltage                            | $V_Q$        | 3.23         | 3.3  | 3.37 | V    | $T_j = 25\text{ }^{\circ}\text{C}$ , $I_Q = 10\text{ mA}$  |
| Output voltage                            | $V_Q$        | 3.20         | 3.3  | 3.40 | V    | $10\text{ mA} \leq I_Q \leq 800\text{ mA}$ ;<br>$8\text{ V} \leq V_I \leq 14\text{ V}$             |
| Output voltage                            | $V_Q$        | –            | 3.3  | –    | V    | $10\text{ mA} \leq I_Q \leq 800\text{ mA}$ ;<br>$14\text{ V} \leq V_I \leq 40\text{ V}$            |
| Line regulation                           | $\Delta V_Q$ | –            | 3    | 10   | mV   | $6.5\text{ V} \leq V_I \leq 40\text{ V}$   |
| Load regulation                           | $\Delta V_Q$ | –            | 10   | 50   | mV   | $10\text{ mA} \leq I_Q \leq 800\text{ mA}$ ;<br>$T_j = 25\text{ }^{\circ}\text{C}$                 |
| Drop voltage                              | $V_{DR}$     | –            | 2.10 | –    | V    | $I_Q = 100\text{ mA}^{1)}$   |
| Drop voltage                              | $V_{DR}$     | –            | 2.15 | –    | V    | $I_Q = 500\text{ mA}^{1)}$   |
| Drop voltage                              | $V_{DR}$     | –            | 2.20 | –    | V    | $I_Q = 800\text{ mA}^{1)}$   |
| Current consumption;<br>$I_q = I_I - I_Q$ | $I_q$        | –            | 1.1  | 2.0  | mA   | $I_Q = 10\text{ mA}$   |
| Temperature stability                     | –            | –            | 3    | –    | mV   | <sup>2)</sup>  |
| Minimum load current                      | $I_Q$        | –            | 3.5  | 10   | mA   | $V = 40\text{ V}$  |
| Current limit                             | $I_{Qmax}$   | 1000         | –    | 2200 | mA   | –  |
| Current limit                             | $I_{Qmax}$   | 50           | 200  | –    | mA   | $V_I = 40\text{ V}$ , $T_j = 25\text{ }^{\circ}\text{C}$   |
| RMS Output Noise                          | –            | –            | 3    | –    | ppm  | ppm of $V_Q$ , $T_j = 25\text{ }^{\circ}\text{C}^{2)}$<br>$10\text{ Hz} \leq f \leq 10\text{ kHz}$ |
| Supply Voltage Ripple Rejection           | $PSRR$       | –            | 65   | –    | dB   | $f_r = 120\text{ Hz}$ , $V_r = 0.5 V_{SS}$<br>$C_{ADJ} = 0\text{ }\mu\text{F}^{2)}$                |
| Supply Voltage Ripple Rejection           | $PSRR$       | 65           | 80   | –    | dB   | $f_r = 120\text{ Hz}$ , $V_r = 0.5 V_{SS}$<br>$C_{ADJ} = 10\text{ }\mu\text{F}^{2)}$               |
| Long Term Stability                       | $\Delta V_Q$ | –            | 0.3  | 1    | %    | $T_j = 125\text{ }^{\circ}\text{C}$ , $1000\text{ h}^{2)}$   |

<sup>1)</sup> Drop voltage measured when the output voltage has dropped 100 mV from the nominal value obtained at  $V_I = 8.5\text{ V}$ .

<sup>2)</sup> Guaranteed by design.



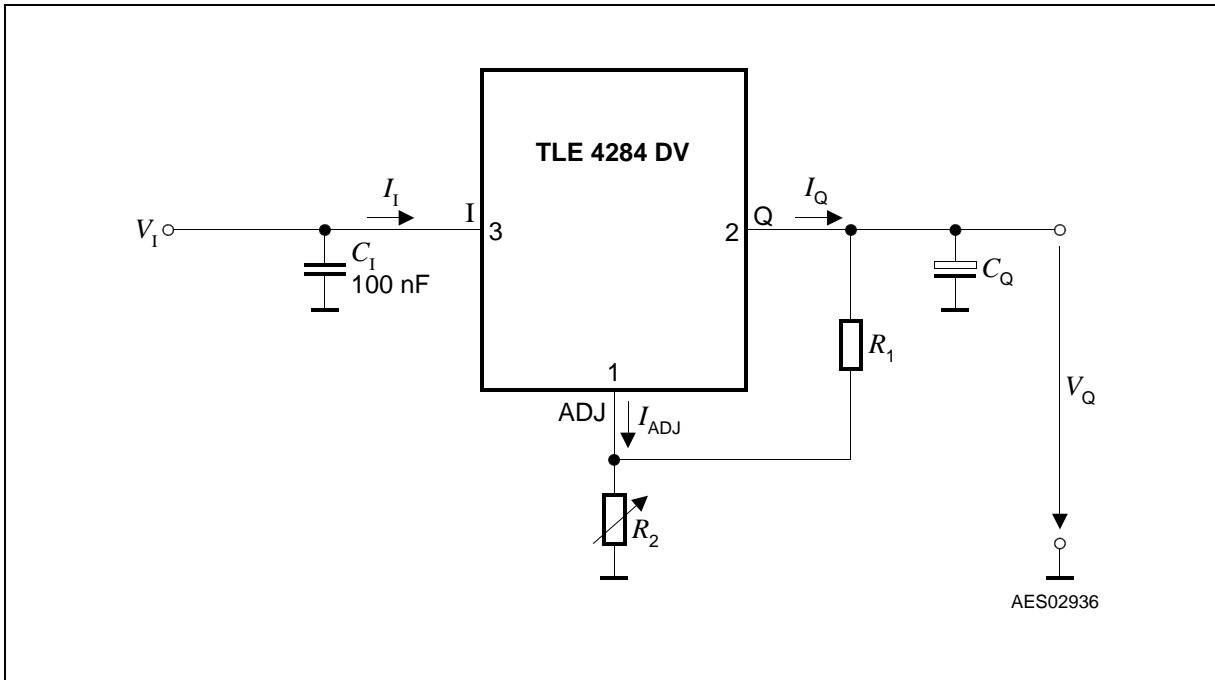
**Characteristics 5.0 V Fixed Output Voltage Device TLE 4284 DV50**
 $-40\text{ }^{\circ}\text{C} < T_j < 150\text{ }^{\circ}\text{C}$ ;  $V_I = 10\text{ V}$ ,  $I_Q = 10\text{ mA}$ ; unless otherwise specified

| Parameter                                 | Symbol       | Limit Values |      |      | Unit | Measuring Conditions   |
|---|--------------|--------------|------|------|------|--|
|   |              | min.         | typ. | max. |      |  |
| Output voltage                            | $V_Q$        | 4.90         | 5.0  | 5.10 | V    | $T_j = 25\text{ }^{\circ}\text{C}$ , $I_Q = 10\text{ mA}$  |
| Output voltage                            | $V_Q$        | 4.85         | 5.0  | 5.15 | V    | $10\text{ mA} \leq I_Q \leq 800\text{ mA}$ ;<br>$8\text{ V} \leq V_I \leq 14\text{ V}$             |
| Output voltage                            | $V_Q$        | –            | 5.0  | –    | V    | $10\text{ mA} \leq I_Q \leq 800\text{ mA}$ ;<br>$14\text{ V} \leq V_I \leq 40\text{ V}$            |
| Line regulation                           | $\Delta V_Q$ | –            | 3    | 10   | mV   | $8\text{ V} \leq V_I \leq 40\text{ V}$   |
| Load regulation                           | $\Delta V_Q$ | –            | 10   | 75   | mV   | $10\text{ mA} \leq I_Q \leq 800\text{ mA}$ ;<br>$T_j = 25\text{ }^{\circ}\text{C}$                 |
| Drop voltage                              | $V_{DR}$     | –            | 2.10 | –    | V    | $I_Q = 100\text{ mA}^{1)}$   |
| Drop voltage                              | $V_{DR}$     | –            | 2.15 | –    | V    | $I_Q = 500\text{ mA}^{1)}$   |
| Drop voltage                              | $V_{DR}$     | –            | 2.20 | –    | V    | $I_Q = 800\text{ mA}^{1)}$   |
| Thermal regulation                        | –            | –            | 0.04 | 0.07 | %/W  | 20 ms pulses   |
| Current consumption;<br>$I_q = I_I - I_Q$ | $I_q$        | –            | 1.1  | 2.0  | mA   | $I_Q = 10\text{ mA}$   |
| Temperature stability                     | –            | –            | 1    | –    | %    | <sup>2)</sup>  |
| Minimum load current                      | $I_Q$        | –            | 3.5  | 10   | mA   | $V_I = 40\text{ V}$  |
| Current limit                             | $I_{Qmax}$   | 1000         | –    | 2200 | mA   | –  |
| Current limit                             | $I_{Qmax}$   | 50           | 200  | –    | mA   | $V_I = 40\text{ V}$ , $T_j = 25\text{ }^{\circ}\text{C}$   |
| RMS Output Noise                          | –            | –            | 3    | –    | ppm  | ppm of $V_Q$ , $T_j = 25\text{ }^{\circ}\text{C}^{2)}$<br>$10\text{ Hz} \leq f \leq 10\text{ kHz}$ |
| Supply Voltage Ripple Rejection           | $PSRR$       | –            | 65   | –    | dB   | $f_r = 120\text{ Hz}$ , $V_r = 0.5 V_{SS}$<br>$C_{ADJ} = 0\text{ }\mu\text{F}^{2)}$                |
| Supply Voltage Ripple Rejection           | $PSRR$       | 65           | 80   | –    | dB   | $f_r = 120\text{ Hz}$ , $V_r = 0.5 V_{SS}$<br>$C_{ADJ} = 10\text{ }\mu\text{F}^{2)}$               |
| Long Term Stability                       | $\Delta V_Q$ | –            | 0.3  | 1    | %    | $T_j = 125\text{ }^{\circ}\text{C}$ , 1000 h <sup>2)</sup>   |

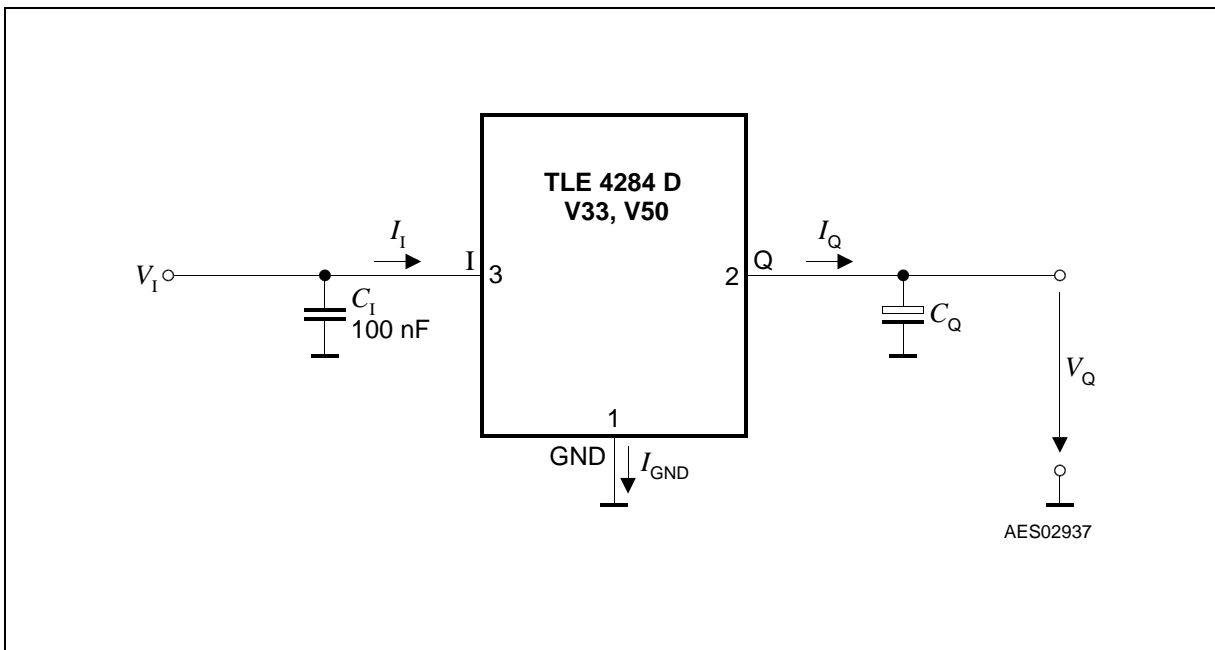
<sup>1)</sup> Drop voltage measured when the output voltage has dropped 100 mV from the nominal value obtained at  $V_I = 10\text{ V}$ .

<sup>2)</sup> 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  $T_A = 25\text{ }^{\circ}\text{C}$  and the given supply voltage.*



**Figure 5 Measuring Circuit Variable Output Voltage TLE 4284 DV**



**Figure 6 Measuring Circuit Fixed Output Voltage TLE 4284 DV33, 50**

Application Information

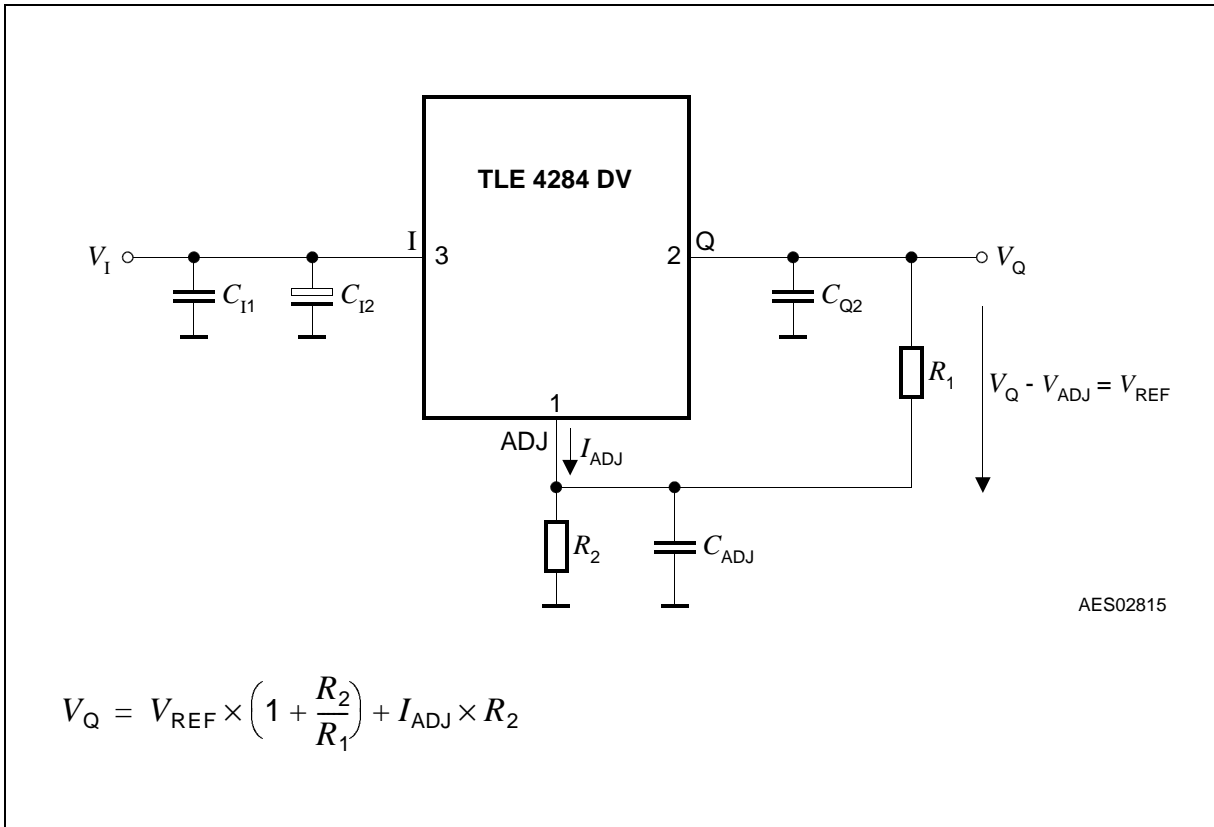


Figure 7 Application Circuit Variable Output Voltage TLE 4284 DV

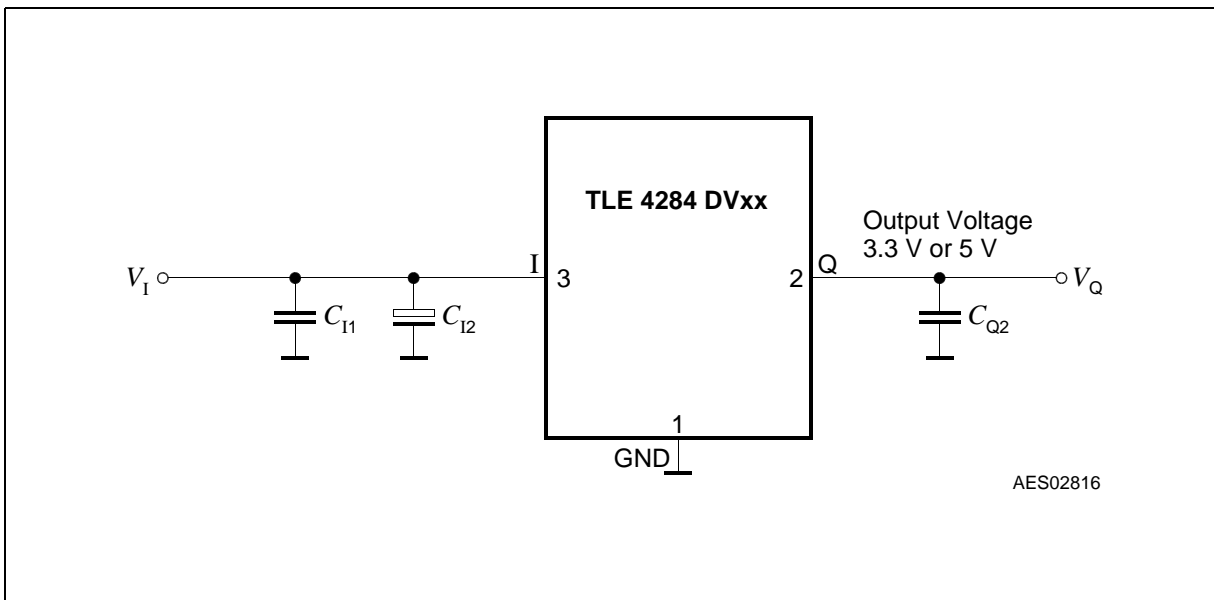


Figure 8 Application Circuit Fixed Output Voltage TLE 4284 DV33, 50

In the fixed voltage TLE 4284 devices the output voltage is divided internally and compared to an internal reference of 1.25 V typical. The regulation loop controls the output voltage to achieve the output voltage of 5 V, 3.3 V or 2.5 V. The variable device compares the voltage difference between the adjust pin ADJ and the output pin Q to the internal reference of 1.25 V; the output voltage is adjusted by an external voltage divider between Q, ADJ and GND (see equation in **Figure 7**).

## Output

The output current limitation is reduced as a function of the input voltage for high input voltages above 25 V.

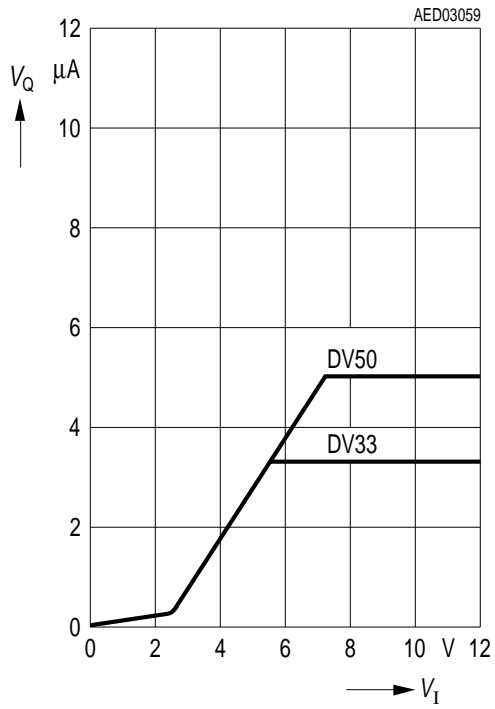
The TLE 4284 requires no output capacitor for stability, however we recommend to use a ceramic capacitor to filter any noise and improve the transient response.

At the input of the regulator a capacitor is necessary for compensation of line influences. A resistor of approx. 1  $\Omega$  in series with  $C_i$  can damp the LC of the input inductivity and the input capacitor. A serial diode should be used to eliminate negative voltages from the input.

For the variable voltage type an additional decoupling a capacitor  $C_{ADJ}$  at the adjust pin can improve the ripple rejection ratios.

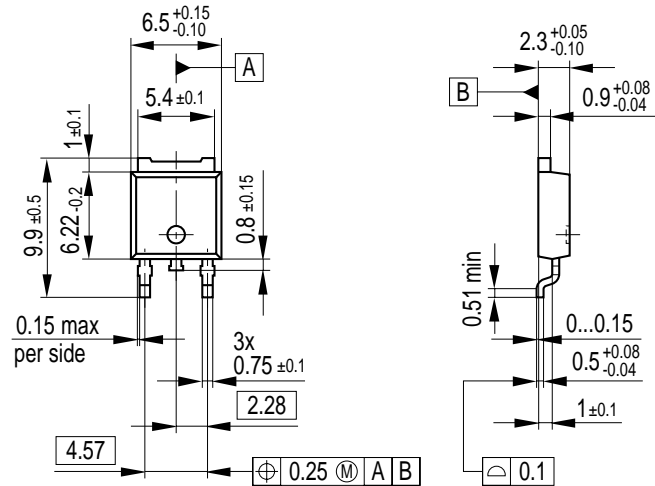
### Typical Performance Characteristics

#### Output Voltage $V_Q$ versus Input Voltage $V_I$



Package Outlines

**P-TO252-3-1**  
(Plastic Transistor Single Outline Package)



All metal surfaces tin plated, except area of cut.

**Sorts of Packing**

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

SMD = Surface Mounted Device

Dimensions in mm

**Edition 2000-10-06**

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