

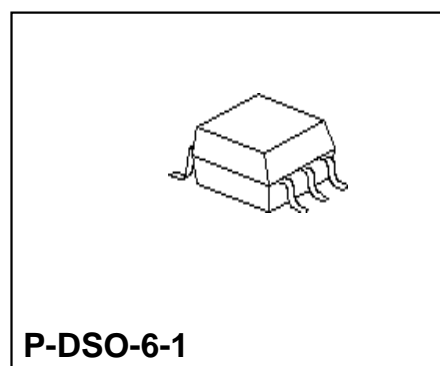
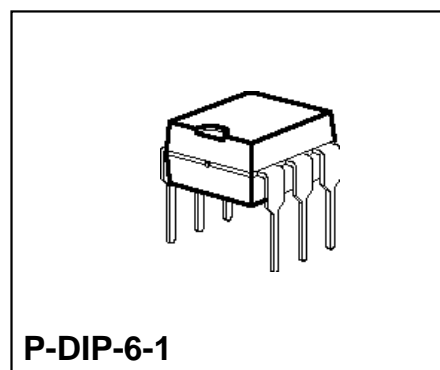
### Bipolar IC

#### Features

- PNP input
- Supply voltage range between 3 V and 36 V
- Low current consumption, 0.25 mA typ.
- Extremely large control range
- Low output saturation voltage, almost independent of load current
- Output current up to 70 mA (100 mA max.)
- Wide common-mode range
- Wide operating temperature range (TAF 1453)
- Pin-compatible to TAA 765
- Open collector output

#### Applications

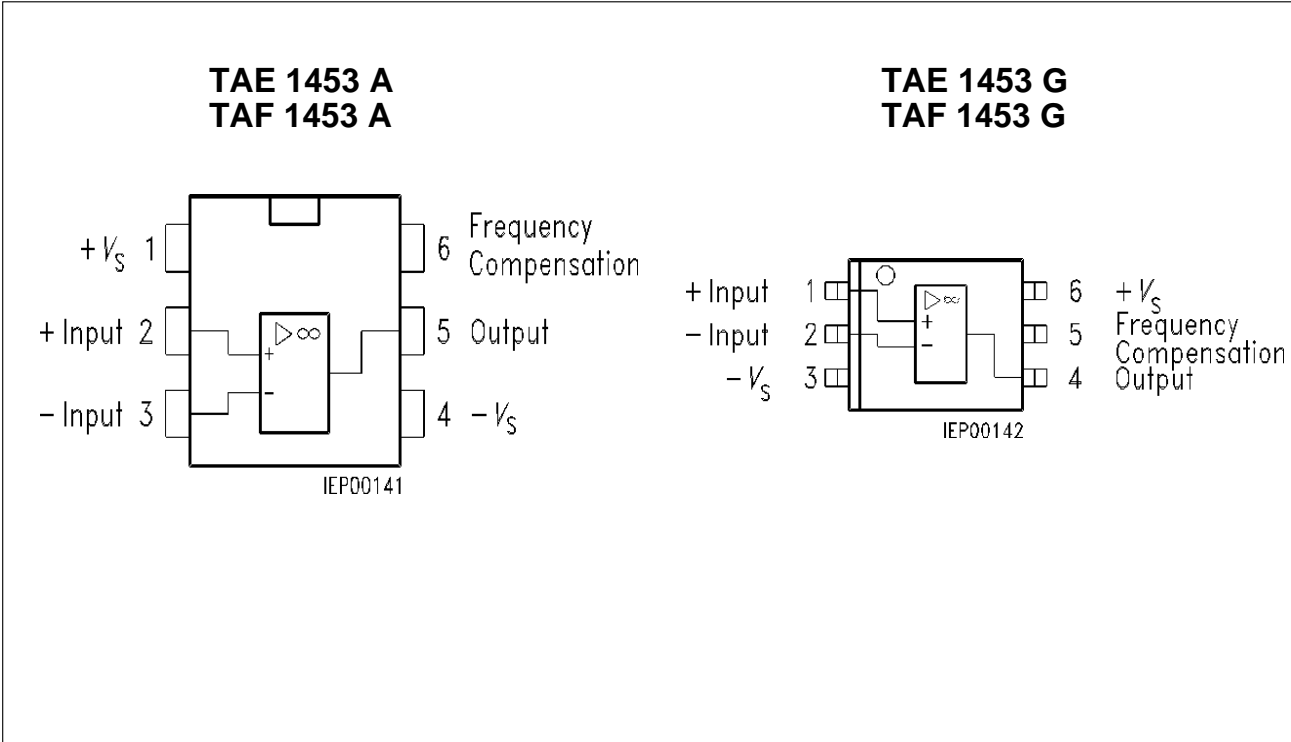
- Amplifier
- Level converter
- Driver
- Zero voltage switch
- Comparator

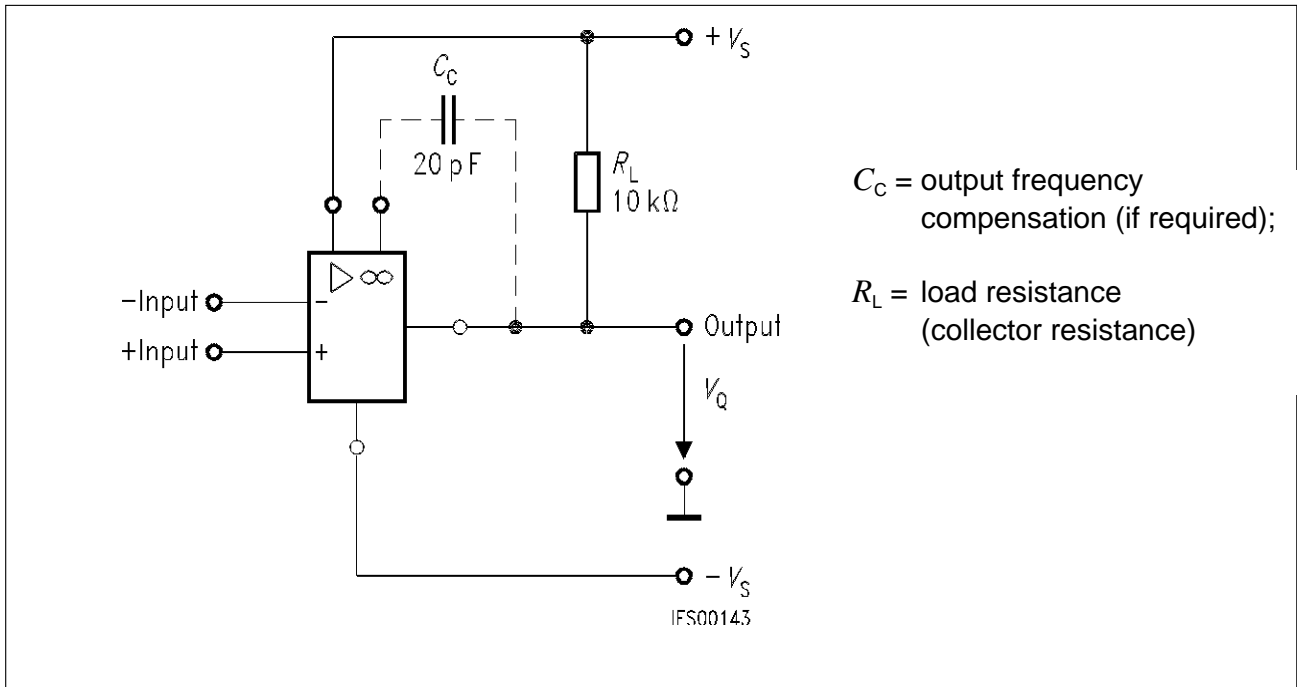


| Type       | Ordering Code | Package         |
|------------|---------------|-----------------|
| TAE 1453 A | Q67000-A2017  | P-DIP-6-1       |
| TAE 1453 G | Q67000-A2106  | P-DSO-6-1 (SMD) |
| TAF 1453 A | Q67000-A2269  | P-DIP-6-1       |
| TAF 1453 G | Q67000-A2209  | P-DSO-6-1 (SMD) |

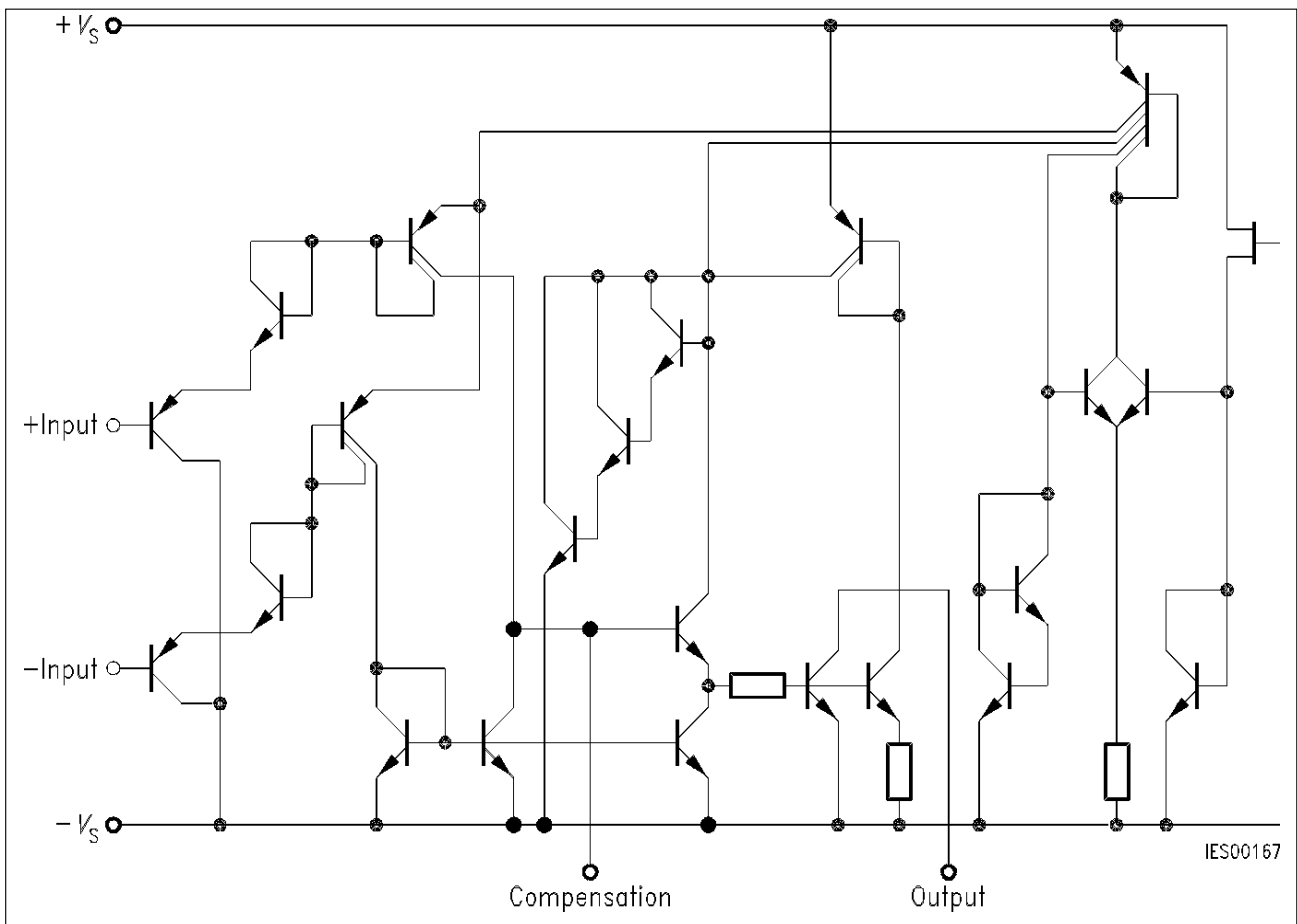
These operational amplifiers are circuits for universal applications having a PNP-input differential stage and an open collector output. Apart from one resistor, only active components are used. The integrated regulator provides for all parameters a large degree of independence from the supply voltage.

**Pin Configurations**  
(top view)





**Connection Diagram**



**Circuit Diagram**

## Absolute Maximum Ratings (TAE 1453)

| Parameter                          | Symbol      | Limit Values | Unit |
|------------------------------------|-------------|--------------|------|
| Supply voltage                     | $V_S$       | $\pm 18$     | V    |
| Output current                     | $I_Q$       | 100          | mA   |
| Differential input voltage         | $V_{ID}$    | $\pm V_S$    | V    |
| Junction temperature               | $T_j$       | 150          | °C   |
| Storage temperature range          | $T_{stg}$   | - 55 to 150  | °C   |
| Thermal resistance<br>system - air | $R_{th SA}$ | 135          | K/W  |
| TAE 1453 A                         | $R_{th SA}$ | 200          | K/W  |
| TAE 1453 G                         |             |              |      |

## Operating Range (TAE 1453)

|                     |       |  |    |
|---------------------|-------|--|----|
| Supply voltage      | $V_S$ | $\pm 2$ to $\pm 18$<br>( $\pm 1.5$ V with<br>slightly increased<br>offset voltage) | V  |
| Ambient temperature | $T_A$ | - 25 to 85   | °C |

## Characteristics (TAE 1453)

$V_S = \pm 5$  V to  $\pm 15$  V;  $R_L = 10$  k $\Omega$ , unless otherwise specified

| Parameter                                 | Symbol   | Limit Values<br>$T_A = 25$ °C |      |      | Limit Values<br>$T_A = - 25$<br>to 85 °C |      | Unit |
|---|----------|-------------------------------|------|------|--|------|------|
|   |          | min.                          | typ. | max. | min.                                     | max. |      |
| Open-loop<br>current consumption          | $I_S$    |                               | 0.25 | 0.4  |  | 0.45 | mA   |
| Input offset voltage, $R_G = 50$ $\Omega$ | $V_{IO}$ | - 5.5                         |      | 5.5  | - 7                                      | 7    | mV   |
| Input offset current                      | $I_{IO}$ | - 15                          |      | 15   | - 100                                    | 100  | nA   |
| Input current                             | $I_I$    |                               | 40   | 150  |  | 200  | nA   |

## Characteristics (TAE 1453) (cont'd)

$V_S = \pm 5 \text{ V}$  to  $\pm 15 \text{ V}$ ;  $R_L = 10 \text{ k}\Omega$ , unless otherwise specified

| Parameter  | Symbol           | Limit Values<br>$T_A = 25 \text{ }^\circ\text{C}$ |      |               | Limit Values<br>$T_A = -25$<br>to $85 \text{ }^\circ\text{C}$ |               | Unit             |
|--|------------------|---|------|---------------|---|---------------|------------------|
|  |                  | min.  | typ. | max.          | min.  | max.          |                  |
| Control range  |                  |   |      |               |   |               |                  |
| $R_L = 2 \text{ k}\Omega$ , $V_S = \pm 15 \text{ V}$                         | $V_{Q\text{pp}}$ | 14.9  |      | -14.7         | 14.9  | -14.7         | V                |
| $R_L = 620 \text{ }\Omega$ , $V_S = \pm 15 \text{ V}$                        | $V_{Q\text{pp}}$ | 14.9  |      | -14.5         | 14.9  | -14.4         | V                |
| $R_L = 2 \text{ k}\Omega$ , $V_S = \pm 15 \text{ V}$ , $f = 100 \text{ kHz}$ | $V_{Q\text{pp}}$ | 10  |      | -10           |   |               | V                |
| Input impedance, $f = 1 \text{ kHz}$   | $Z_i$            |   | 200  |               |   |               | k $\Omega$       |
| Open-loop voltage gain   | $G_{V0}$         | 78  | 85   |               | 78  |               | dB               |
| Output reverse current   | $I_{QR}$         |   |      | 10            |   | 20            | $\mu\text{A}$    |
| Common-mode input voltage range  | $V_{IC}$         | $-V_S$<br>-0.2                                    |      | $V_S$<br>-1.8 | $-V_S$  | $V_S$<br>-2.0 | V                |
| Common-mode rejection  | $k_{\text{CMR}}$ | 75  | 80   |               | 75  |               | dB               |
| Supply voltage rejection<br>$G_V = 100$                                      | $k_{\text{SVR}}$ |   | 25   | 100           |   | 120           | $\mu\text{V/V}$  |
| Temperature coefficient of $I_{IO}$<br>$R_G = 50 \text{ }\Omega$             | $\alpha_{IIO}$   |   | 0.1  |               |   |               | nA/K             |
| Temperature coefficient of $V_{IO}$<br>$R_G = 50 \text{ }\Omega$             | $\alpha_{VIO}$   |   | 6    |               |   |               | $\mu\text{V/K}$  |
| Slew rate<br>for non-inverting operation                                     | $SR$             |   | 20   |               |   |               | V/ $\mu\text{s}$ |
| Slew rate<br>for inverting operation   | $SR$             |   | 30   |               |   |               | V/ $\mu\text{s}$ |

## Characteristics (TAE 1453)

$V_S = \pm 2.5 \text{ V}$ ,  $R_L = 10 \text{ k}\Omega$

| Parameter                                       | Symbol   | Limit Values<br>$T_A = 25 \text{ }^\circ\text{C}$ |      |      | Limit Values<br>$T_A = -25$<br>to $85 \text{ }^\circ\text{C}$ |      | Unit |
|---|----------|---|------|------|---|------|------|
|   |          | min.  | typ. | max. | min.  | max. |      |
| Input offset voltage, $R_G = 50 \text{ }\Omega$ | $V_{IO}$ | -6  |      | 6    | -7.5  | 7.5  | mV   |
| Input offset current                            | $I_{IO}$ | -75   |      | 75   | -100  | 100  | nA   |
| Input current                                   | $I_I$    |   | 40   | 150  |   | 200  | nA   |
| Open-loop voltage gain                          | $G_{V0}$ | 70  |      |      | 70  |      | dB   |

## Absolute Maximum Ratings (TAF 1453)

| Parameter                          | Symbol      | Limit Values | Unit             |
|------------------------------------|-------------|--------------|------------------|
| Supply voltage                     | $V_S$       | $\pm 18$     | V                |
| Output current                     | $I_Q$       | 100          | mA               |
| Differential input voltage         | $V_{ID}$    | $\pm V_S$    | V                |
| Junction temperature               | $T_j$       | 150          | $^\circ\text{C}$ |
| Storage temperature range          | $T_{stg}$   | -55 to 125   | $^\circ\text{C}$ |
| Thermal resistance<br>system - air | $R_{th SA}$ | 135          | K/W              |
| TAF 1453 A                         | $R_{th SA}$ | 200          | K/W              |
| TAF 1453 G                         |             |              |                  |

## Operating Range (TAF 1453)

|                     |       |  |                  |
|---------------------|-------|--|------------------|
| Supply voltage      | $V_S$ | $\pm 2$ to $\pm 18$<br>( $\pm 1.5 \text{ V}$ with<br>slightly increased<br>offset voltage) | V                |
| Ambient temperature | $T_A$ | -55 to 125   | $^\circ\text{C}$ |

## Characteristics (TAF 1453)

$V_S = \pm 5\text{ V}$  to  $\pm 15\text{ V}$ ;  $R_L = 10\text{ k}\Omega$ , unless otherwise specified

| Parameter   | Symbol            | Limit Values<br>$T_A = 25\text{ }^\circ\text{C}$ |      |               | Limit Values<br>$T_A = -55$<br>to $125\text{ }^\circ\text{C}$ |               | Unit             |
|---|-------------------|--|------|---------------|---|---------------|------------------|
|   |                   | min.   | typ. | max.          | min.  | max.          |                  |
| Open-loop current consumption<br>(Output in H state)                      | $I_S$             |  | 0.25 | 0.35          |   | 0.45          | mA               |
| Input offset voltage, $R_G = 50\text{ }\Omega$                            | $V_{IO}$          | -4   |      | 4             | -6  | 6             | mV               |
| Input offset voltage  | $I_{IO}$          | -10  |      | 10            | -75   | 75            | nA               |
| Input current   | $I_I$             |  | 40   | 100           |   | 150           | nA               |
| Control range   |                   |  |      |               |   |               |                  |
| $R_L = 2\text{ k}\Omega$ , $V_S = \pm 15\text{ V}$                        | $V_{Q\text{ pp}}$ | 14.9   |      | -14.7         | 14.9  | -14.7         | V                |
| $R_L = 620\text{ }\Omega$ , $V_S = \pm 15\text{ V}$                       | $V_{Q\text{ pp}}$ | 14.9   |      | -14.5         | 14.9  | -14.4         | V                |
| $R_L = 2\text{ k}\Omega$ , $V_S = \pm 15\text{ V}$ , $f = 100\text{ kHz}$ | $V_{Q\text{ pp}}$ | 10   |      | -10           |   |               | V                |
| Input impedance, $f = 1\text{ kHz}$                                       | $Z_I$             |  | 200  |               |   |               | k $\Omega$       |
| Open-loop voltage gain  | $G_{V0}$          | 80   | 85   |               | 75  |               | dB               |
| Output reverse current  | $I_{QR}$          |  |      | 1             |   | 5             | $\mu\text{A}$    |
| Common-mode input<br>voltage range  | $V_{IC}$          | $-V_S$<br>-0.3                                   |      | $V_S$<br>-1.5 | $-V_S$  | $V_S$<br>-1.8 | V                |
| Common-mode rejection   | $k_{CMR}$         | 80   | 85   |               | 75  |               | dB               |
| Supply voltage rejection<br>$G_V = 100$                                   | $k_{SVR}$         |  | 25   | 100           |   | 100           | $\mu\text{V/V}$  |
| Temperature coefficient of $I_{IO}$<br>$R_G = 50\text{ }\Omega$           | $\alpha_{IIO}$    |  | 0.1  | 0.8           |   |               | nA/K             |
| Temperature coefficient of $V_{IO}$<br>$R_G = 50\text{ }\Omega$           | $\alpha_{VIO}$    |  | 6    | 25            |   |               | $\mu\text{V/K}$  |
| Slew rate<br>for non-inverting operation                                  | $SR$              |  | 20   |               |   |               | V/ $\mu\text{s}$ |
| Slew rate<br>for inverting operation                                      | $SR$              |  | 30   |               |   |               | V/ $\mu\text{s}$ |

## Characteristics (TAF 1453)

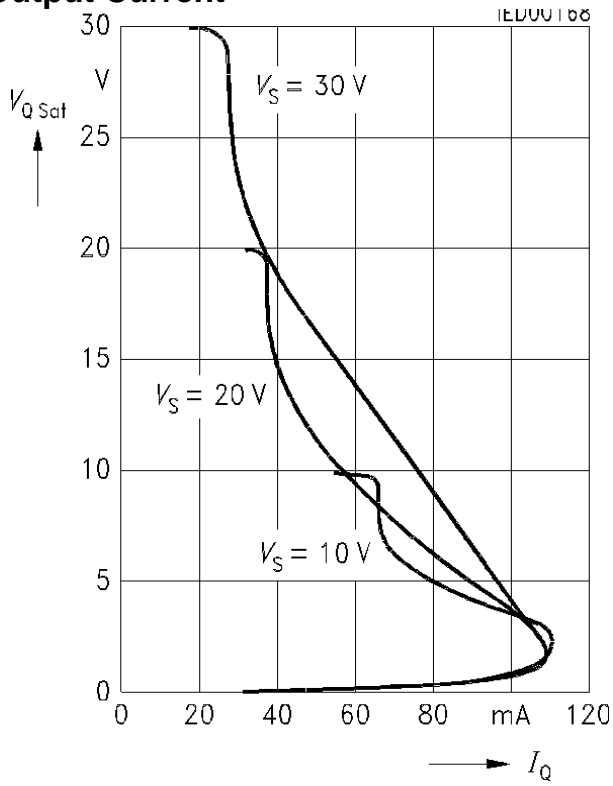
$V_S = \pm 2.5 \text{ V}$ ,  $R_L = 10 \text{ k}\Omega$

| Parameter                                       | Symbol   | Limit Values<br>$T_A = 25 \text{ }^\circ\text{C}$ |      |      | Limit Values<br>$T_A = -55$<br>to $125 \text{ }^\circ\text{C}$ |      | Unit |
|---|----------|---|------|------|--|------|------|
|   |          | min.  | typ. | max. | min.   | max. |      |
| Input offset voltage, $R_G = 50 \text{ }\Omega$ | $V_{IO}$ | -4  |      | 4    | -6   | 6    | mV   |
| Input offset voltage                            | $I_{IO}$ | -50   |      | 50   | -75  | 75   | nA   |
| Input current                                   | $I_I$    |   | 40   | 100  |  | 150  | nA   |
| Open-loop voltage gain                          | $G_{V0}$ | 75  |      |      | 70   |      | dB   |

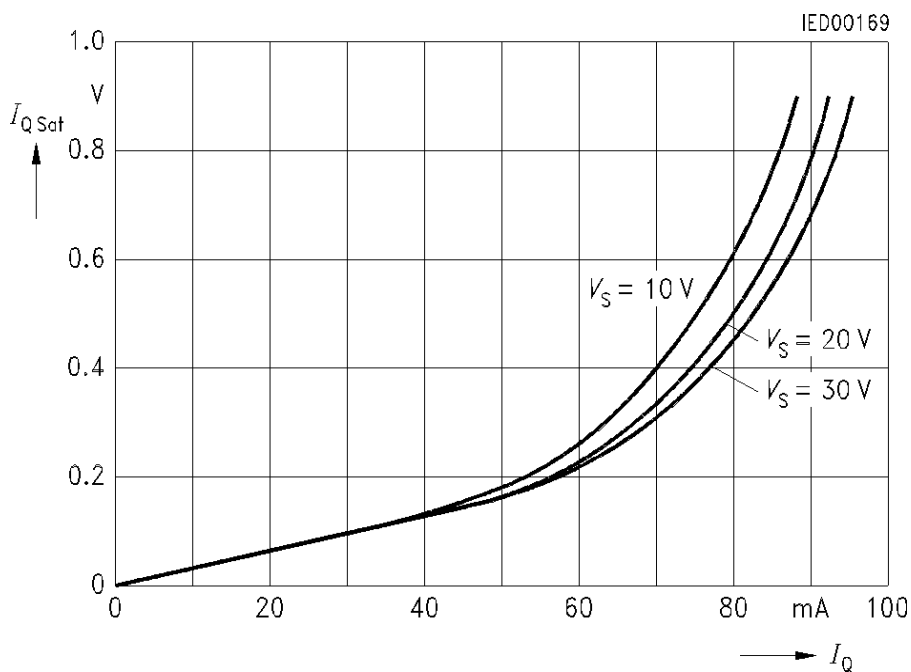


## Typical Characteristics of Electrical Parameters

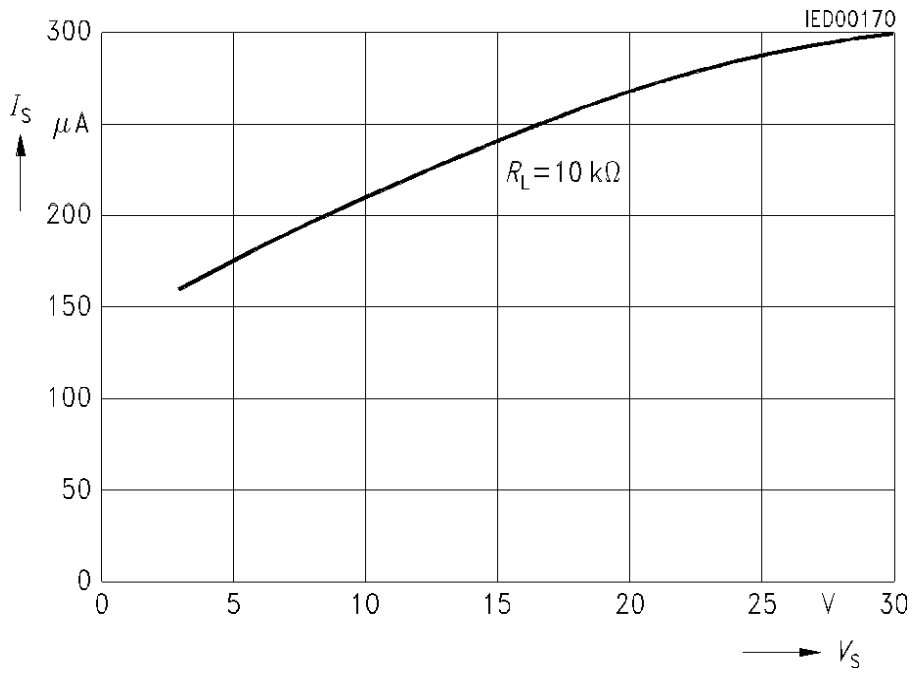
### Load Characteristics Output Saturation Voltage versus Output Current



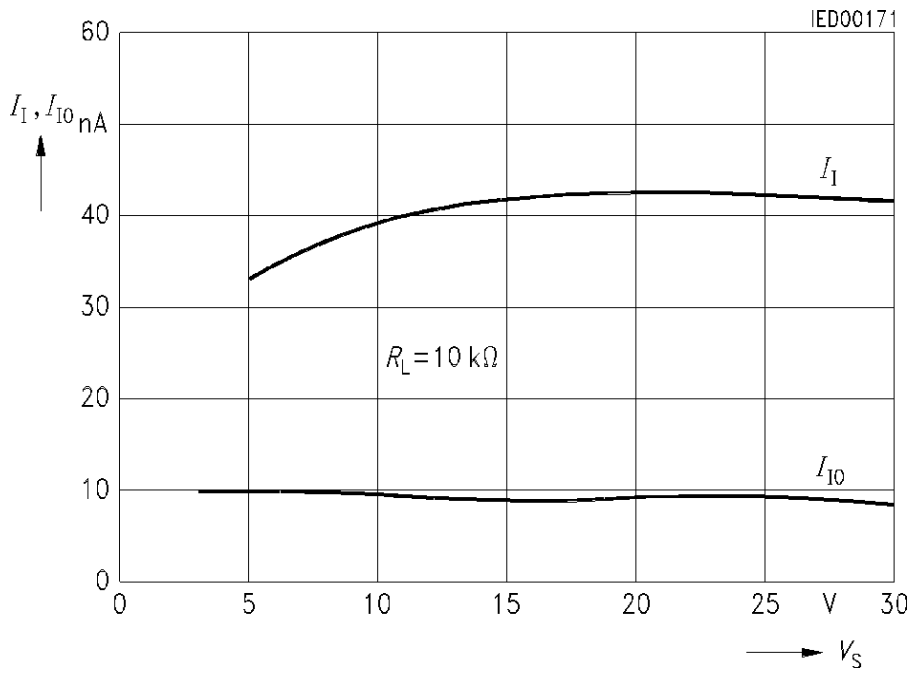
### Output Saturation Voltage versus Output Current



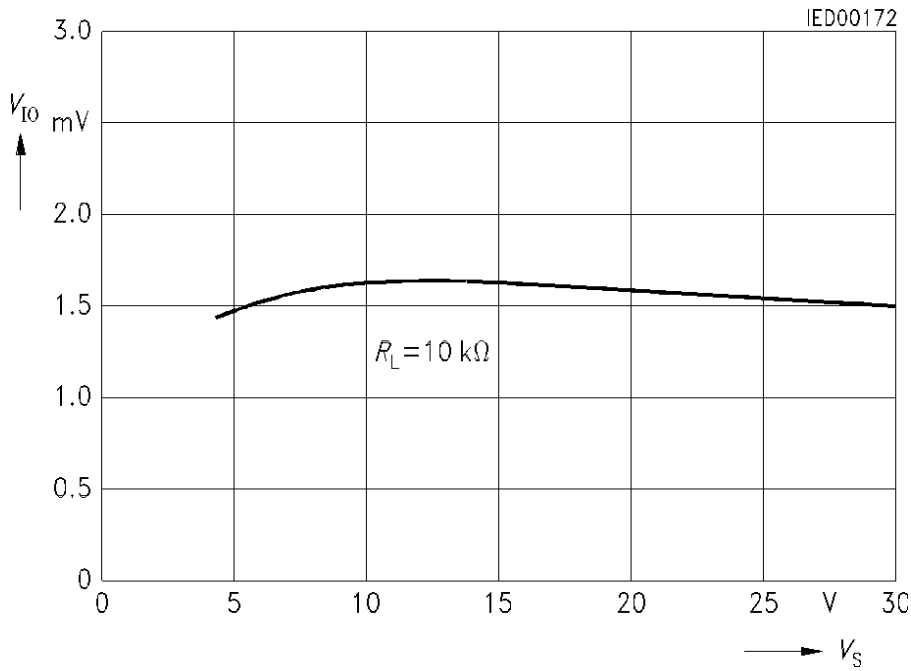
Supply Current versus Supply Voltage



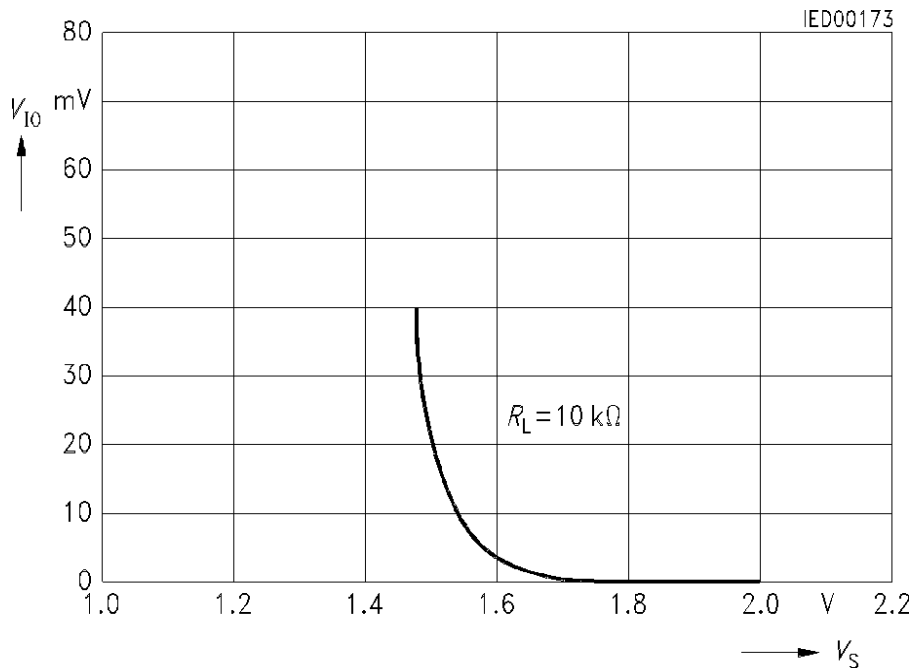
Input Current and Input Offset Current versus Supply Voltage



**Input Offset Voltage versus Supply Voltage**



**$V_{10}$  Behavior at Low Operating Voltages  
Input Offset Voltage versus Supply Voltage**



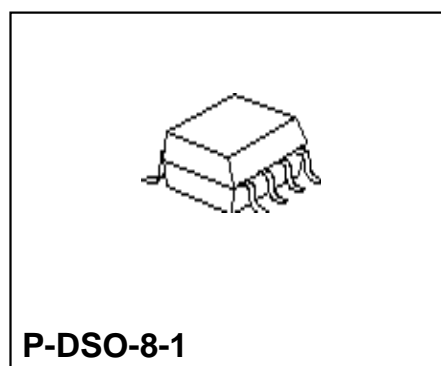
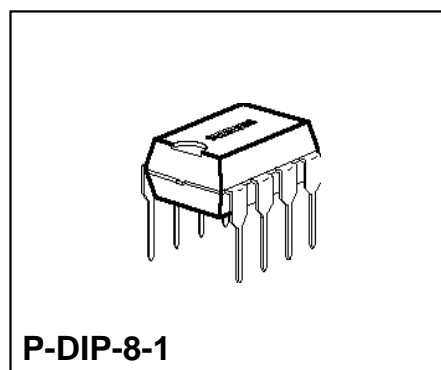
### Bipolar IC

#### Features

- Supply voltage range between 3 V and 36 V
- Low current consumption, 0.8 mA typ.
- Extremely large control range
- Low output saturation voltage, almost independent of load current
- Output current up to 70 mA (max. 100 mA)
- Output virtually short-circuit proof
- Wide common-mode voltage range
- Wide operating temperature range (TAF 2453 A; G)
- Pin-compatible to TBB 1458 B
- The characteristic curves of the electric parameters correspond to those of type TAE 1453 A; G

#### Applications

- Amplifier
- Level converter
- Driver
- Zero voltage switch
- Comparator



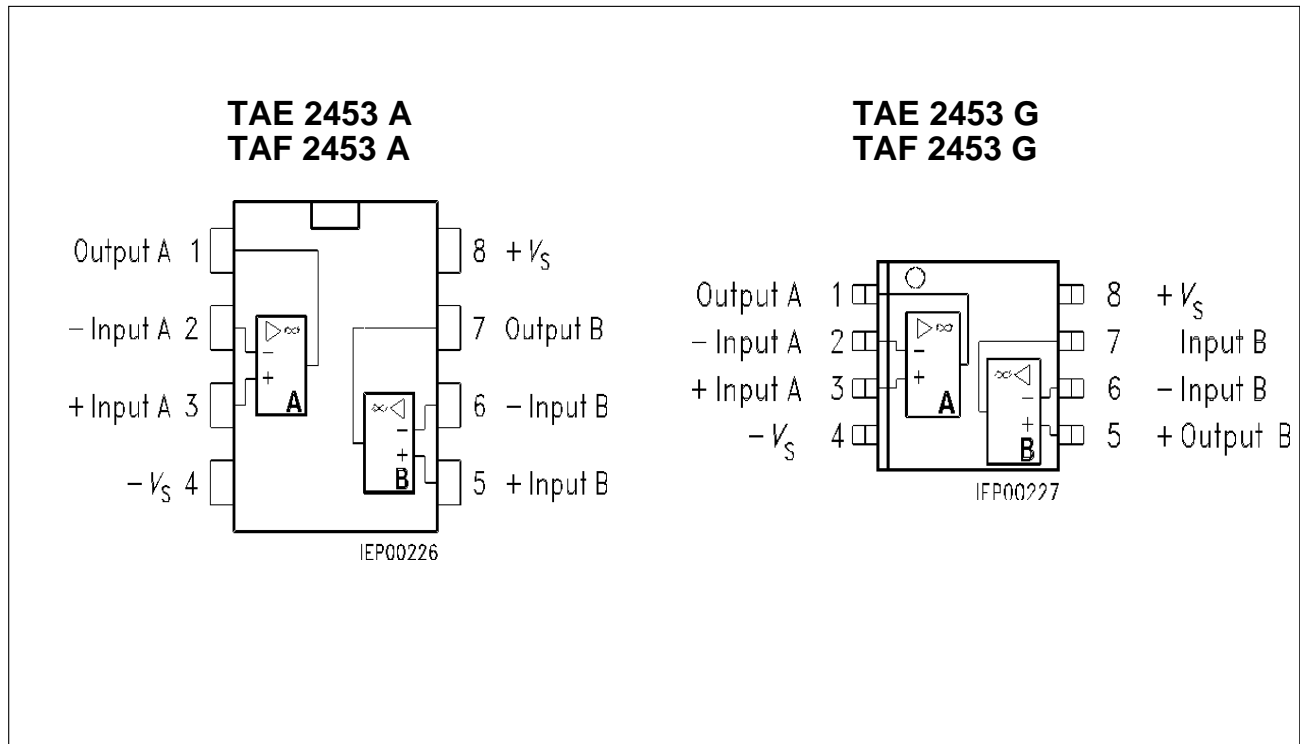
| Type         | Ordering Code | Package         |
|--------------|---------------|-----------------|
| ■ TAE 2453 A | Q67000-A2107  | P-DIP-8-1       |
| TAE 2453 G   | Q67000-A2108  | P-DSO-8-1 (SMD) |
| ■ TAF 2453 A | Q67000-A2210  | P-DIP-8-1       |
| TAF 2453 G   | Q67000-A2211  | P-DSO-8-1 (SMD) |

■ Not for new design

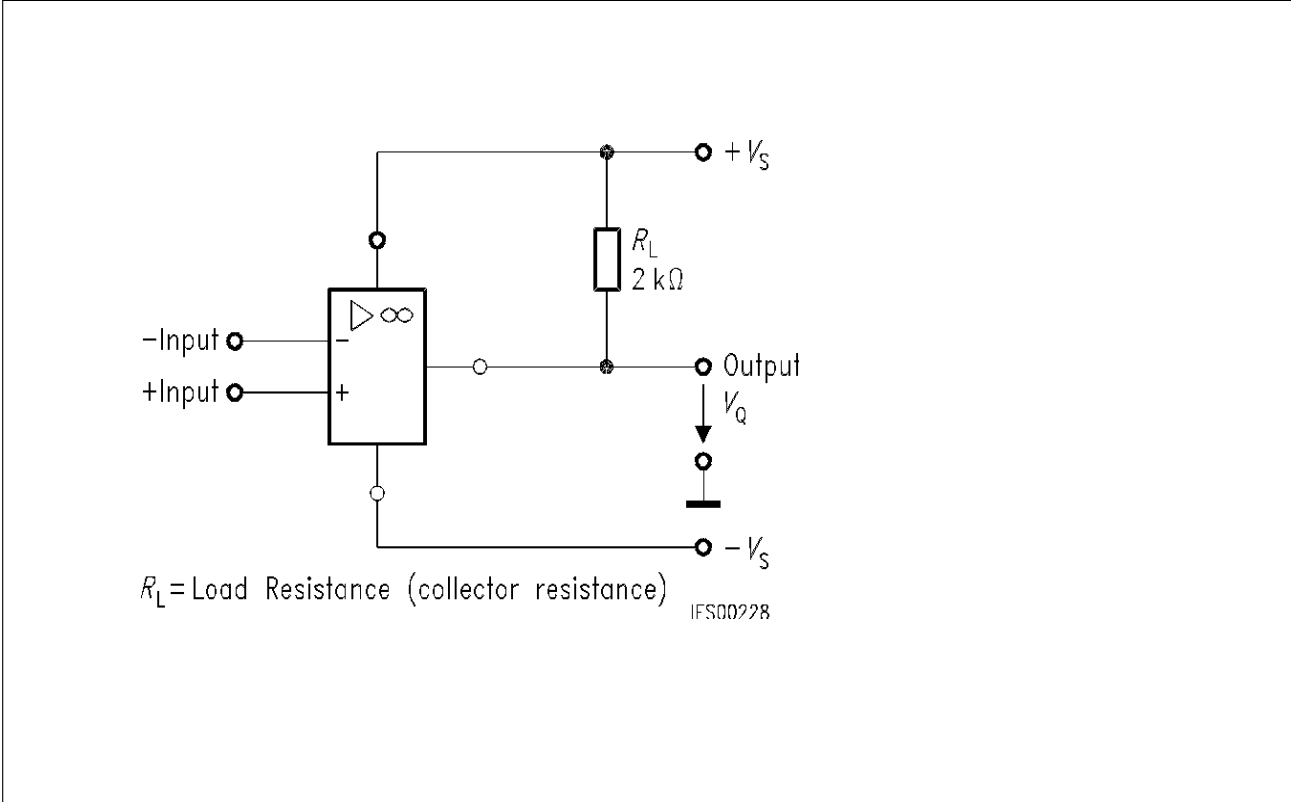
The TAF 2453 / TAE 2453 consists of two independent, frequency-compensated op amps, each having a PNP-input differential stage and an open collector output. The

integrated regulator provides for all parameters a large degree of independence from the supply voltage.

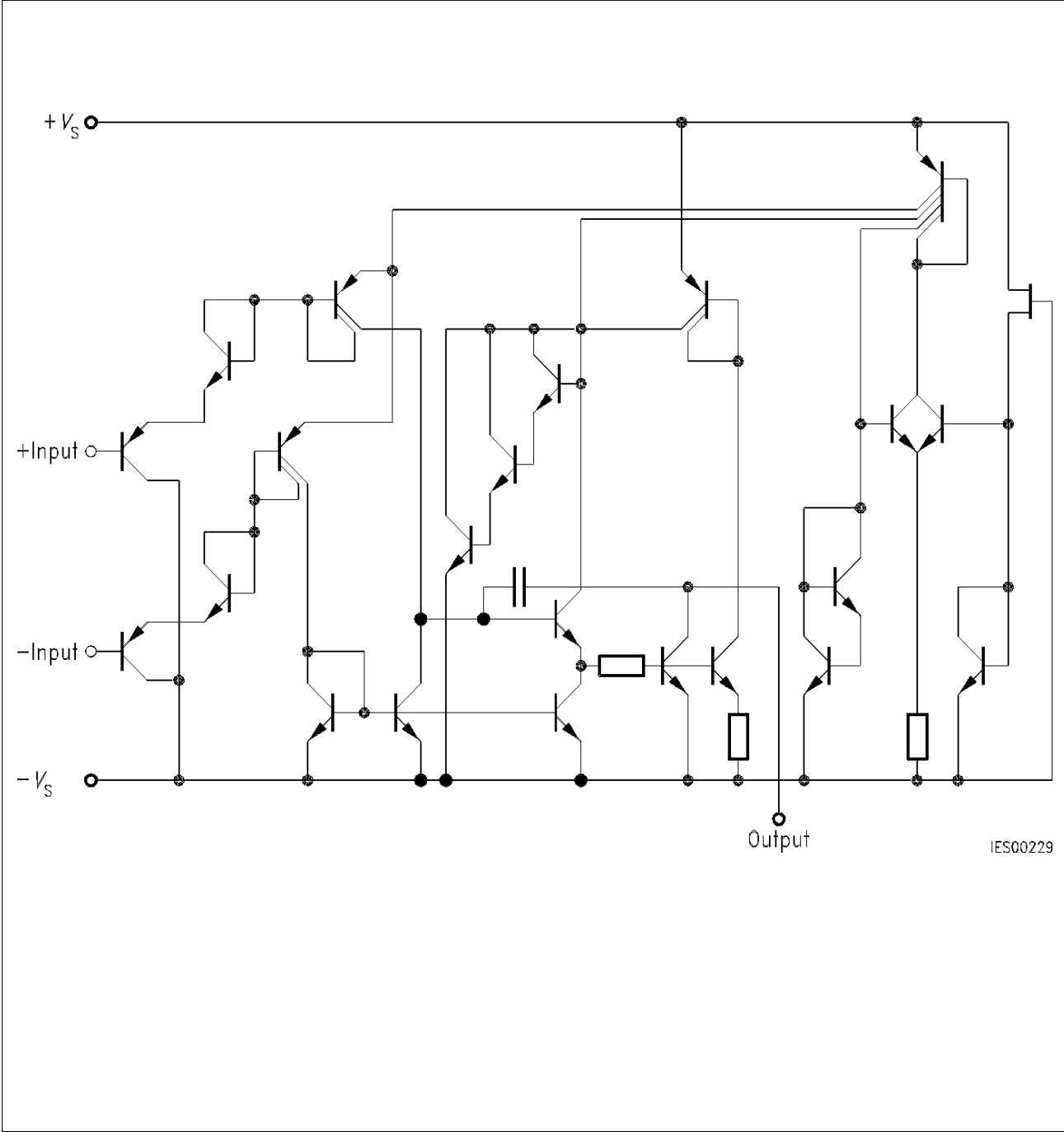
### Pin Configurations (top view)



$R_L$  = load resistance  
(collector resistance)



Connection Diagram



Circuit Diagram

## Absolute Maximum Ratings (TAE 2453)

| Parameter                          | Symbol      | Limit Values | Unit |
|------------------------------------|-------------|--------------|------|
| Supply voltage                     | $V_S$       | $\pm 18$     | V    |
| Output current                     | $I_Q$       | 100          | mA   |
| Differential input voltage         | $V_{ID}$    | $\pm V_S$    | V    |
| Junction temperature               | $T_j$       | 150          | °C   |
| Storage temperature range          | $T_{stg}$   | - 55 to 125  | °C   |
| Thermal resistance<br>system - air |             |              |      |
| TAE 2453 A                         | $R_{th SA}$ | 100          | K/W  |
| TAE 2453 G                         | $R_{th SA}$ | 170          | K/W  |

## Operating Range (TAE 2453)

|                     |       |   |    |
|---------------------|-------|---|----|
| Supply voltage      | $V_S$ | $\pm 2$ to $\pm 18$<br>( $\pm 1.5$ V with slightly<br>increased offset voltage) | V  |
| Ambient temperature | $T_A$ | - 25 to 85  | °C |

## Characteristics (TAE 2453)

$V_S = \pm 5$  V to  $\pm 15$  V;  $R_L = 10$  k $\Omega$ ,  
unless otherwise specified

| Parameter                                      | Symbol   | Limit Values<br>$T_A = 25$ °C |      |      | Limit Values<br>$T_A = - 25$<br>to 85 °C |      | Unit |
|--|----------|-------------------------------|------|------|--|------|------|
|  |          | min.                          | typ. | max. | min.                                     | max. |      |
| Open-loop supply<br>current consumption, total | $I_S$    |                               | 0.8  | 1.5  |  | 1.8  | mA   |
| Input offset voltage<br>$R_G = 50$ $\Omega$    | $V_{IO}$ | - 5.5                         |      | 5.5  | - 7                                      | 7    | mV   |
| Input offset current                           | $I_{IO}$ | - 15                          |      | 15   | - 100                                    | 100  | nA   |
| Input current                                  | $I_I$    |                               | 40   | 150  |  | 200  | nA   |



## Characteristics (TAE 2453) (cont'd)

$V_S = \pm 5\text{ V}$  to  $\pm 15\text{ V}$ ;  $R_L = 10\text{ k}\Omega$ ,  
unless otherwise specified

| Parameter   | Symbol            | Limit Values<br>$T_A = 25\text{ }^\circ\text{C}$ |      |                | Limit Values<br>$T_A = -25$<br>to $85\text{ }^\circ\text{C}$ |                | Unit             |
|---|-------------------|--|------|----------------|--|----------------|------------------|
|   |                   | min.   | typ. | max.           | min.   | max.           |                  |
| Control range<br>$R_L = 2\text{ k}\Omega$ , $V_S = \pm 15\text{ V}$ | $V_{Q\text{ pp}}$ | 14.9   |      | - 14.7         | 14.9   | - 14.7         | V                |
| $R_L = 620\text{ }\Omega$ , $V_S = \pm 15\text{ V}$                 | $V_{Q\text{ pp}}$ | 14.9   |      | - 14.5         | 14.9   | - 14.4         | V                |
| Input impedance, $f = 1\text{ kHz}$                                 | $Z_i$             |  | 200  |                |  |                | $\text{k}\Omega$ |
| Open-loop voltage gain,<br>$R_L = 2\text{ k}\Omega$                 | $G_{V0}$          | 80   | 85   |                | 80   |                | dB               |
| Output reverse current  | $I_{QR}$          |  |      | 10             |  | 20             | $\mu\text{A}$    |
| Common-mode input<br>voltage range, $R_L = 2\text{ k}\Omega$        | $V_{IC}$          | $-V_S$<br>- 0.2                                  |      | $V_S$<br>- 1.8 | $-V_S$   | $V_S$<br>- 2.0 | V                |
| Common-mode rejection,<br>$R_L = 2\text{ k}\Omega$                  | $k_{CMR}$         | 75   | 80   |                | 75   |                | dB               |
| Supply voltage rejection<br>$G_V = 100$                             | $k_{SVR}$         |  | 25   | 100            |  | 100            | $\mu\text{V/V}$  |
| Temperature coefficient of $I_{IO}$<br>$R_G = 50\text{ }\Omega$     | $\alpha_{IIO}$    |  | 0.1  |                |  |                | nA/K             |
| Temperature coefficient of $V_{IO}$<br>$R_G = 50\text{ }\Omega$     | $\alpha_{VIO}$    |  | 6    |                |  |                | $\mu\text{V/K}$  |
| Slew rate for<br>non-inverting operation                            | $SR$              |  | 1    |                |  |                | V/ $\mu\text{s}$ |
| Slew rate for<br>inverting operation                                | $SR$              |  | 1    |                |  |                | V/ $\mu\text{s}$ |

## Characteristics (TAE 2453)

$V_S = \pm 2 \text{ V}$ ,  $R_L = 10 \text{ k}\Omega$

| Parameter  | Symbol   | Limit Values<br>$T_A = 25 \text{ }^\circ\text{C}$ |      |      | Limit Values<br>$T_A = -25$<br>to $85 \text{ }^\circ\text{C}$ |      | Unit |
|--|----------|---|------|------|---|------|------|
|  |          | min.  | typ. | max. | min.  | max. |      |
| Input offset voltage,<br>$R_G = 50 \text{ }\Omega$ | $V_{IO}$ | -6  |      | 6    | -7.5  | 7.5  | mV   |
| Input offset current                               | $I_{IO}$ | -75   |      | 75   | -100  | 100  | nA   |
| Input current                                      | $I_I$    |   | 40   | 150  |   | 200  | nA   |
| Open-loop voltage gain                             | $G_{V0}$ | 70  |      |      | 70  |      | dB   |

## Absolute Maximum Ratings (TAF 2453)

| Parameter                          | Symbol      | Limit Values | Unit             |
|------------------------------------|-------------|--------------|------------------|
| Supply voltage                     | $V_S$       | $\pm 18$     | V                |
| Output current                     | $I_Q$       | 100          | mA               |
| Differential input voltage         | $V_{ID}$    | $\pm V_S$    | V                |
| Junction temperature               | $T_j$       | 150          | $^\circ\text{C}$ |
| Storage temperature range          | $T_{stg}$   | -55 to 150   | $^\circ\text{C}$ |
| Thermal resistance<br>system - air |             |              |                  |
| TAF 2453 A                         | $R_{th SA}$ | 100          | K/W              |
| TAF 2453 G                         | $R_{th SA}$ | 170          | K/W              |

## Operating Range (TAF 2453)

|                     |       |   |                  |
|---------------------|-------|---|------------------|
| Supply voltage      | $V_S$ | $\pm 2$ to $\pm 18$<br>( $\pm 1.5 \text{ V}$ with slightly<br>increased offset voltage) | V                |
| Ambient temperature | $T_A$ | -55 to 125  | $^\circ\text{C}$ |

## Characteristics (TAF 2453)

$V_S = \pm 5 \text{ V}$  to  $\pm 15 \text{ V}$ ;  $R_L = 2 \text{ k}\Omega$ ,  
unless otherwise specified

| Parameter   | Symbol    | Limit Values<br>$T_A = 25 \text{ }^\circ\text{C}$ |      |               | Limit Values<br>$T_A = -55$<br>to $125 \text{ }^\circ\text{C}$ |               | Unit            |
|---|-----------|---|------|---------------|--|---------------|-----------------|
|   |           | min.  | typ. | max.          | min.   | max.          |                 |
| Open-loop supply current consumption total                            | $I_S$     |   | 0.8  | 1.5           |  | 1.8           | mA              |
| Input offset voltage,<br>$R_G = 50 \text{ }\Omega$                    | $V_{IO}$  | -4  |      | 4             | -6   | 6             | mV              |
| Input offset current  | $I_{IO}$  | -10   |      | 10            | -75  | 75            | nA              |
| Input current   | $I_I$     |   | 40   | 100           |  | 150           | nA              |
| Control range<br>$R_L = 2 \text{ k}\Omega$ , $V_S = \pm 15 \text{ V}$ | $V_{Qpp}$ | 14.9  |      | -14.7         | 14.8   | -14.7         | V               |
| $R_L = 620 \text{ }\Omega$ , $V_S = \pm 15 \text{ V}$                 | $V_{Qpp}$ | 14.9  |      | -14.5         | 14.8   | -14.4         | V               |
| Input impedance,<br>$f = 1 \text{ kHz}$                               | $Z_I$     |   | 200  |               |  |               | k $\Omega$      |
| Open-loop voltage gain<br>$R_L = 2 \text{ k}\Omega$                   | $G_{V0}$  | 85  | 87   |               | 80   |               | dB              |
| Output reverse current  | $I_{QR}$  |   |      | 1             |  | 5             | $\mu\text{A}$   |
| Common-mode input voltage range                                       | $V_{IC}$  | $-V_S$<br>-0.3                                    |      | $V_S$<br>-1.5 | $-V_S$   | $V_S$<br>-1.8 | V               |
| Common-mode rejection,<br>$R_L = 2 \text{ k}\Omega$                   | $k_{CMR}$ | 80  | 85   |               | 75   |               | dB              |
| Supply voltage rejection<br>$G_V = 100$                               | $k_{SVR}$ |   | 25   | 100           |  | 100           | $\mu\text{V/V}$ |

**Characteristics (TAF 2453) (cont'd)**

$V_S = \pm 5 \text{ V to } \pm 15 \text{ V}$ ;  $R_L = 2 \text{ k}\Omega$ ,  
unless otherwise specified

| Parameter   | Symbol         | Limit Values<br>$T_A = 25 \text{ }^\circ\text{C}$ |      |      | Limit Values<br>$T_A = -55$<br>to $125 \text{ }^\circ\text{C}$ |      | Unit             |
|---|----------------|---|------|------|--|------|------------------|
|   |                | min.  | typ. | max. | min.   | max. |                  |
| Temperature coefficient of $I_{IO}$<br>$R_G = 50 \text{ } \Omega$ | $\alpha_{IIO}$ |   | 0.1  | 0.8  |  | 0.8  | nA/K             |
| Temperature coefficient of $V_{IO}$<br>$R_G = 50 \text{ } \Omega$ | $\alpha_{VIO}$ |   | 6    | 25   |  | 25   | $\mu\text{V/K}$  |
| Slew rate for<br>non-inverting operation                          | $SR$           |   | 1    |      |  |      | V/ $\mu\text{s}$ |
| Slew rate for<br>inverting operation                              | $SR$           |   | 1    |      |  |      | V/ $\mu\text{s}$ |

**Characteristics (TAF 2453)**

$V_S = \pm 2 \text{ V}$

| Parameter  | Symbol   | Limit Values<br>$T_A = 25 \text{ }^\circ\text{C}$ |      |      | Limit Values<br>$T_A = -55$<br>to $125 \text{ }^\circ\text{C}$ |      | Unit |
|--|----------|---|------|------|--|------|------|
|  |          | min.  | typ. | max. | min.   | max. |      |
| Input offset voltage,<br>$R_G = 50 \text{ } \Omega$  | $V_{IO}$ | -4  |      | 4    | -6   | 6    | mV   |
| Input offset current                                 | $I_{IO}$ | -50   |      | 50   | -75  | 75   | nA   |
| Input current  | $I_I$    |   | 40   | 100  |  | 150  | nA   |
| Open-loop voltage gain,<br>$R_L = 2 \text{ k}\Omega$ | $G_{V0}$ | 75  |      |      | 70   |      | dB   |

**Note:** For typical performance curves, please refer to the data sheets of TAE 1453 and TAF 1453.

# SIEMENS

## Quad PNP-Operational Amplifier

TAE 4453  
TAF 4453

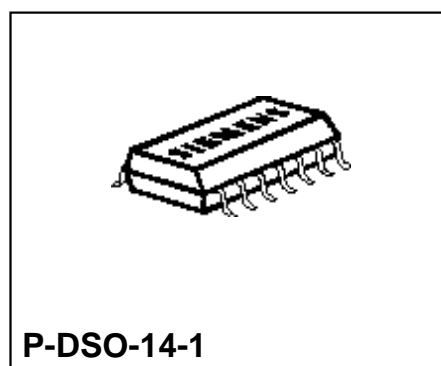
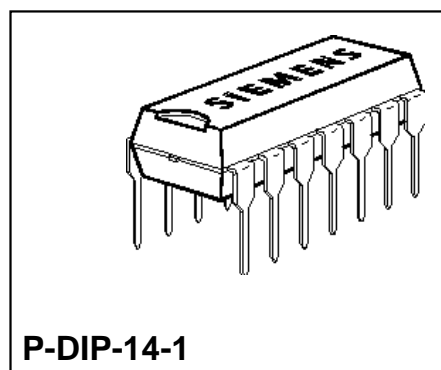
### Bipolar IC

#### Features

- Supply voltage range between 3 V and 36 V
- Low current consumption, 1.6 mA typ.
- Extremely large control range
- Low output saturation voltage, almost independent of load current
- Output current up to 70 mA (100 mA max.)
- Output virtually short-circuit proof
- Wide common-mode range
- Wide temperature range (TAF 4453 A; G)
- Pin-compatible to LM 324
- The typical characteristics of the electric parameters correspond to those of the TAE 1453 A; G

#### Applications

- Amplifier
- Level converter
- Driver
- Offset voltage switch
- Comparator



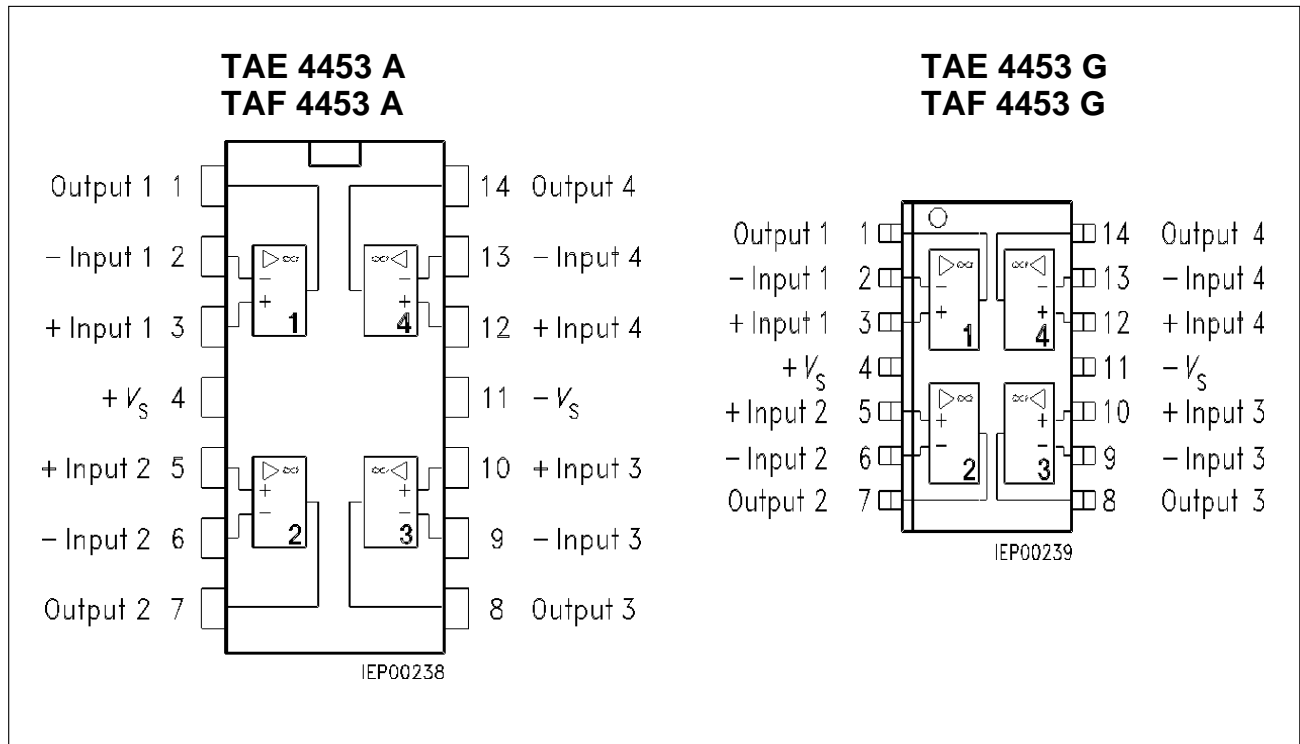
| Type         | Ordering Code | Package          |
|--------------|---------------|------------------|
| ■ TAE 4453 A | Q67000-A2109  | P-DIP-14-1       |
| TAE 4453 G   | Q67000-A2152  | P-DSO-14-1 (SMD) |
| ■ TAF 4453 A | Q67000-A2212  | P-DIP-14-1       |
| TAF 4453 G   | Q67000-A2213  | P-DSO-14-1 (SMD) |

■ Not for new design

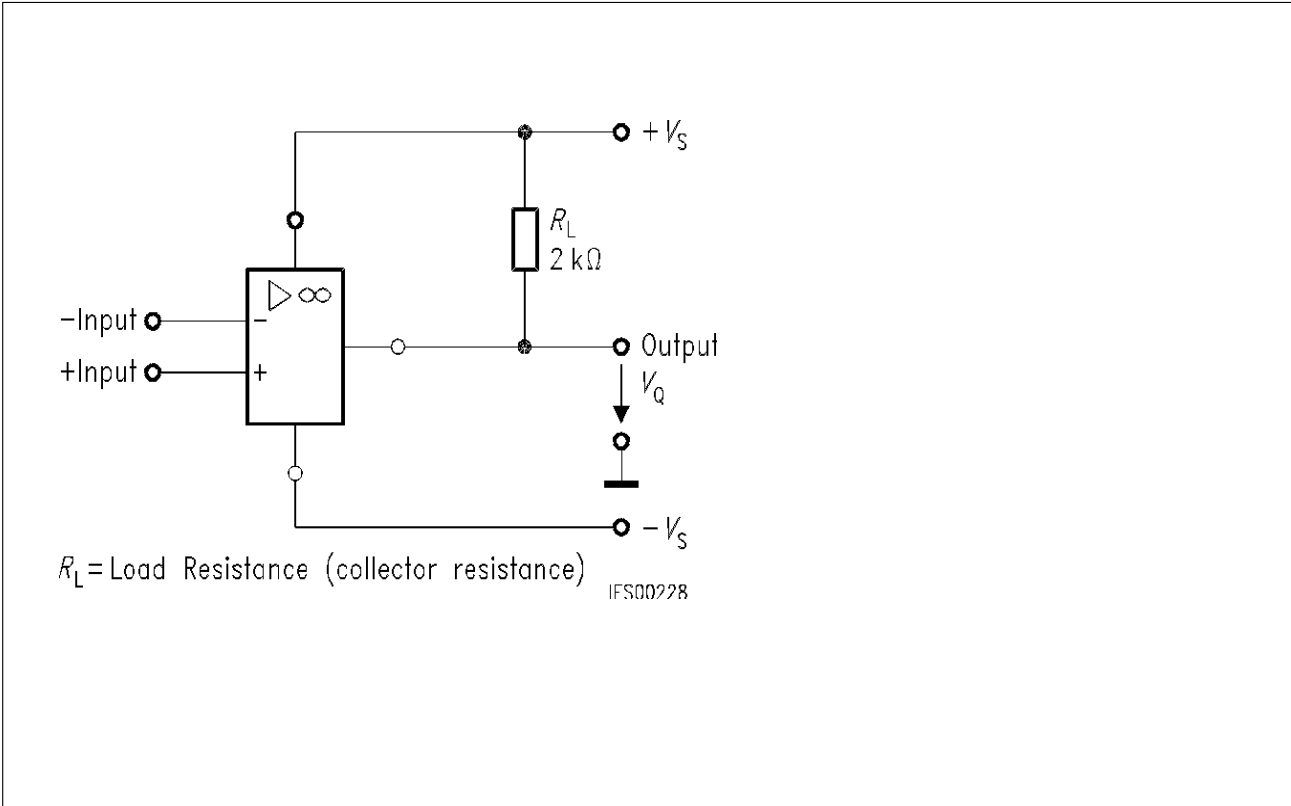
The TAE 4453 / TAF 4453 consists of four independent, frequency-compensated op amps, each having a PNP-input differential stage and an open collector output. The

integrated regulator provides for all parameters a large degree of independence of the supply voltage.

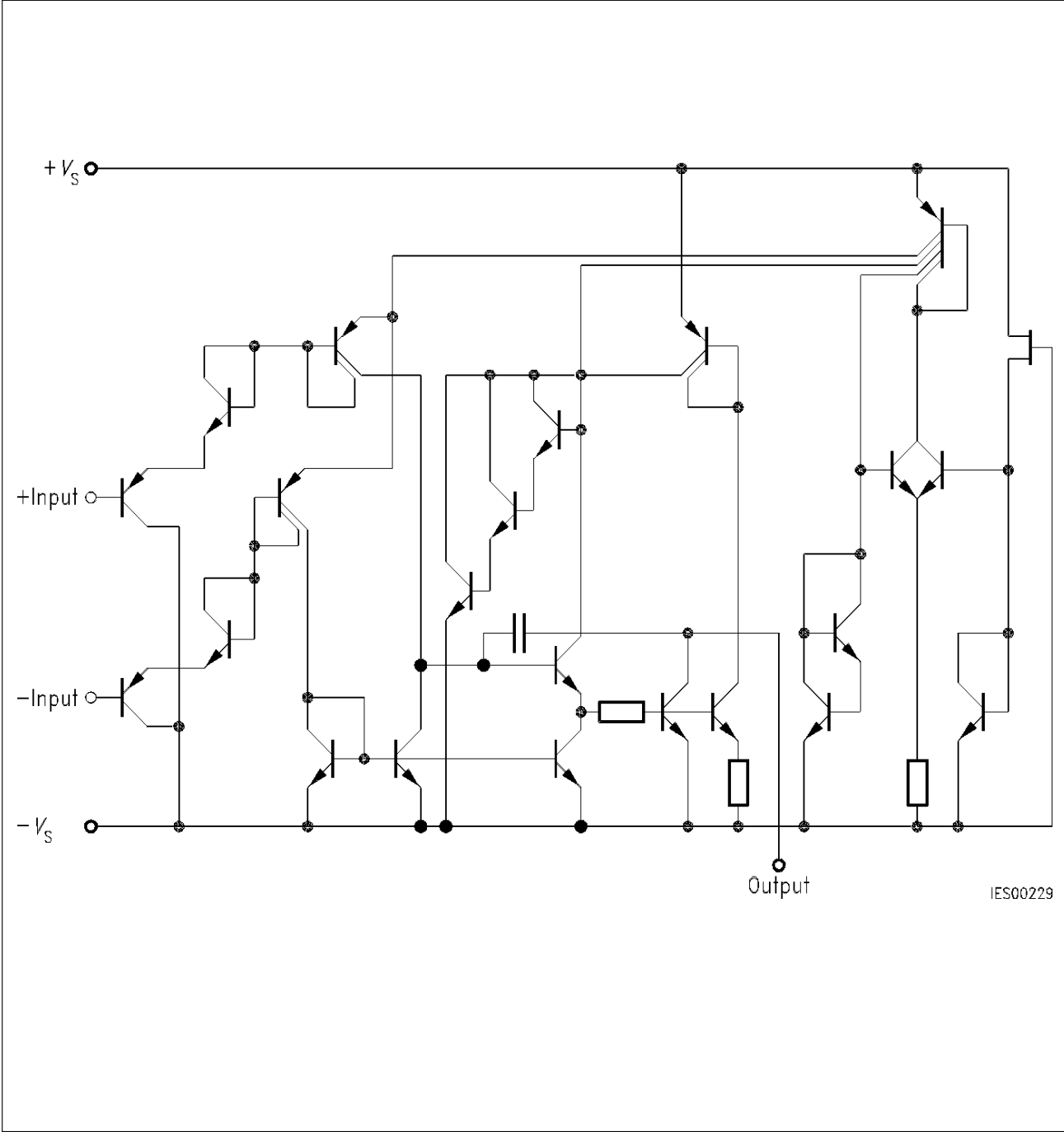
**Pin Configurations**  
(top view)



$R_L$  = load resistance (collector resistance)



Connection Diagram



Circuit Diagram of One Op Amp



## Absolute Maximum Ratings (TAE 4453)

| Parameter                          | Symbol      | Limit Values | Unit |
|------------------------------------|-------------|--------------|------|
| Supply voltage                     | $V_S$       | $\pm 18$     | V    |
| Output current                     | $I_Q$       | 100          | mA   |
| Differential input voltage         | $V_{ID}$    | $\pm V_S$    | V    |
| Junction temperature               | $T_j$       | 150          | °C   |
| Storage temperature range          | $T_{stg}$   | - 55 to 125  | °C   |
| Thermal resistance<br>system - air |             |              |      |
| TAE 4453 A                         | $R_{th SA}$ | 80           | K/W  |
| TAE 4453 G                         | $R_{th SA}$ | 120          | K/W  |

## Operating Range (TAE 4453)

|                     |       |   |    |
|---------------------|-------|---|----|
| Supply voltage      | $V_S$ | $\pm 2$ to $\pm 18$<br>( $\pm 1.5$ V with slightly<br>increased offset voltage) | V  |
| Ambient temperature | $T_A$ | - 25 to 85  | °C |

## Characteristics (TAE 4453)

$V_S = \pm 5$  V to  $\pm 15$  V;  $R_L = 10$  k $\Omega$ , unless otherwise specified

| Parameter                                      | Symbol     | Limit Values<br>$T_A = 25$ °C |      |        | Limit Values<br>$T_A = - 25$<br>to 85 °C |        | Unit |
|--|------------|-------------------------------|------|--------|--|--------|------|
|  |            | min.                          | typ. | max.   | min.                                     | max.   |      |
| Open-loop supply<br>current consumption, total | $I_S$      |                               | 1.6  | 3.0    |  | 3.6    | mA   |
| Input offset voltage,<br>$R_G = 50$ $\Omega$   | $V_{IO}$   | - 5.5                         |      | 5.5    | - 7                                      | 7      | mV   |
| Input offset current                           | $I_{IO}$   | - 15                          |      | 15     | - 25                                     | 25     | nA   |
| Input current                                  | $I_I$      |                               | 40   | 150    |  | 200    | nA   |
| Control range                                  |            |                               |      |        |  |        |      |
| $R_L = 2$ k $\Omega$ , $V_S = \pm 15$ V        | $V_{Q pp}$ | 14.9                          |      | - 14.7 | 14.9                                     | - 14.7 | V    |
| $R_L = 620$ $\Omega$ , $V_S = \pm 15$ V        | $V_{Q pp}$ | 14.9                          |      | - 14.5 | 14.9                                     | - 14.4 | V    |

## Characteristics (TAE 4453) (cont'd)

$V_S = \pm 5\text{ V}$  to  $\pm 15\text{ V}$ ;  $R_L = 10\text{ k}\Omega$ , unless otherwise specified

| Parameter   | Symbol         | Limit Values<br>$T_A = 25\text{ }^\circ\text{C}$ |      |                  | Limit Values<br>$T_A = -25$<br>to $85\text{ }^\circ\text{C}$ |                  | Unit             |
|---|----------------|--|------|------------------|--|------------------|------------------|
|   |                | min.   | typ. | max.             | min.   | max.             |                  |
| Input impedance, $f = 1\text{ kHz}$                             | $Z_I$          |  | 200  |                  |  |                  | $\text{k}\Omega$ |
| Open-loop voltage gain<br>$R_L = 2\text{ k}\Omega$              | $G_{V0}$       | 80   | 85   |                  | 80   |                  | dB               |
| Output reverse current  | $I_{QR}$       |  |      | 10               |  | 20               | $\mu\text{A}$    |
| Common-mode input<br>voltage range<br>$R_L = 2\text{ k}\Omega$  | $V_{IC}$       | $-V_S$<br>$-0.2$                                 |      | $+V_S$<br>$-1.8$ | $-V_S$   | $+V_S$<br>$-2.0$ | V                |
| Common-mode rejection<br>$R_L = 2\text{ k}\Omega$               | $k_{CMR}$      | 75   | 80   |                  | 75   |                  | dB               |
| Supply voltage rejection<br>$G_V = 100$                         | $k_{SVR}$      |  | 25   | 100              |  | 100              | $\mu\text{V/V}$  |
| Temperature coefficient of $I_{IO}$<br>$R_G = 50\text{ }\Omega$ | $\alpha_{IIO}$ |  | 0.1  |                  |  |                  | nA/K             |
| Temperature coefficient of $V_{IO}$<br>$R_G = 50\text{ }\Omega$ | $\alpha_{VIO}$ |  | 6    |                  |  |                  | $\mu\text{V/K}$  |
| Slew rate<br>for non-inverting operation                        | $SR$           |  | 1    |                  |  |                  | V/ $\mu\text{s}$ |
| Slew rate<br>for inverting operation                            | $SR$           |  | 1    |                  |  |                  | V/ $\mu\text{s}$ |

## Characteristics (TAE 4453)

$$V_S = \pm 2 \text{ V}$$

| Parameter  | Symbol   | Limit Values<br>$T_A = 25 \text{ }^\circ\text{C}$ |      |      | Limit Values<br>$T_A = -25$<br>to $85 \text{ }^\circ\text{C}$ |      | Unit |
|--|----------|---|------|------|---|------|------|
|  |          | min.  | typ. | max. | min.  | max. |      |
| Input offset voltage,<br>$R_G = 50 \text{ } \Omega$  | $V_{IO}$ | -6  |      | 6    | -7.5  | 7.5  | mV   |
| Input offset current                                 | $I_{IO}$ | -75   |      | 75   | -100  | 100  | nA   |
| Input current  | $I_I$    |   | 40   | 150  |   | 200  | nA   |
| Open-loop voltage gain;<br>$R_L = 2 \text{ k}\Omega$ | $G_{V0}$ | 70  |      |      | 70  |      | dB   |

## Absolute Maximum Ratings (TAF 4453)

| Parameter                          | Symbol      | Limit Values | Unit             |
|------------------------------------|-------------|--------------|------------------|
| Supply voltage                     | $V_S$       | $\pm 18$     | V                |
| Output current                     | $I_Q$       | 100          | mA               |
| Differential input voltage         | $V_{ID}$    | $\pm V_S$    | V                |
| Junction temperature               | $T_j$       | 150          | $^\circ\text{C}$ |
| Storage temperature range          | $T_{stg}$   | -55 to 125   | $^\circ\text{C}$ |
| Thermal resistance<br>system - air | $R_{th SA}$ | 80           | K/W              |
| TAF 4453 A                         | $R_{th SA}$ | 120          | K/W              |
| TAF 4453 G                         |             |              |                  |

## Operating Range (TAF 4453)

|                     |       |   |                  |
|---------------------|-------|---|------------------|
| Supply voltage      | $V_S$ | $\pm 2$ to $\pm 18$<br>( $\pm 1.5$ V with slightly<br>increased offset voltage) | V                |
| Ambient temperature | $T_A$ | -55 to 125  | $^\circ\text{C}$ |

## Characteristics (TAF 4453)

$V_S = \pm 5 \text{ V}$  to  $\pm 15 \text{ V}$ ;  $R_L = 10 \text{ k}\Omega$ , unless otherwise specified

| Parameter   | Symbol           | Limit Values<br>$T_A = 25 \text{ }^\circ\text{C}$ |      |                  | Limit Values<br>$T_A = -55$<br>to $125 \text{ }^\circ\text{C}$ |                  | Unit             |
|---|------------------|---|------|------------------|--|------------------|------------------|
|   |                  | min.  | typ. | max.             | min.   | max.             |                  |
| Open-loop supply current consumption, total                           | $I_S$            |   | 1.6  | 3.0              |  | 3.6              | mA               |
| Input offset voltage,<br>$R_G = 50 \text{ }\Omega$                    | $V_{IO}$         | - 4   |      | 4                | - 6  | 6                | mV               |
| Input offset current  | $I_{IO}$         | - 10  |      | 10               | - 15   | 15               | nA               |
| Input current   | $I_I$            |   | 40   | 100              |  | 150              | nA               |
| Control range<br>$R_L = 2 \text{ k}\Omega$ , $V_S = \pm 15 \text{ V}$ | $V_{Q\text{pp}}$ | 14.9  |      | - 14.7           | 14.8   | - 14.7           | V                |
| $R_L = 620 \text{ }\Omega$ , $V_S = \pm 15 \text{ V}$                 | $V_{Q\text{pp}}$ | 14.9  |      | - 14.5           | 14.8   | - 14.4           | V                |
| Input impedance, $f = 1 \text{ kHz}$                                  | $Z_I$            |   | 200  |                  |  |                  | $\text{k}\Omega$ |
| Open-loop voltage gain<br>$R_L = 2 \text{ k}\Omega$                   | $G_{V0}$         | 85  | 87   |                  | 80   |                  | dB               |
| Output reverse current  | $I_{QR}$         |   |      | 1                |  | 5                | $\mu\text{A}$    |
| Common-mode input voltage range<br>$R_L = 2 \text{ k}\Omega$          | $V_{IC}$         | - $V_S$<br>- 0.3                                  |      | + $V_S$<br>- 1.5 | - $V_S$  | + $V_S$<br>- 1.8 | V                |
| Common-mode rejection,<br>$R_L = 2 \text{ k}\Omega$                   | $k_{\text{CMR}}$ | 80  | 85   |                  | 75   |                  | dB               |
| Supply voltage rejection,<br>$G_V = 100$                              | $k_{\text{SVR}}$ |   | 25   | 100              |  | 100              | $\mu\text{V/V}$  |

**Characteristics (TAF 4453) (cont'd)** $V_S = \pm 5 \text{ V to } \pm 15 \text{ V}; R_L = 10 \text{ k}\Omega$ , unless otherwise specified

| Parameter   | Symbol         | Limit Values<br>$T_A = 25 \text{ }^\circ\text{C}$ |      |      | Limit Values<br>$T_A = -55$<br>to $125 \text{ }^\circ\text{C}$ |      | Unit             |
|---|----------------|---|------|------|--|------|------------------|
|   |                | min.  | typ. | max. | min.   | max. |                  |
| Temperature coefficient of $I_{IO}$<br>$R_G = 50 \text{ } \Omega$ | $\alpha_{IIO}$ |   | 0.1  | 0.8  |  | 0.8  | nA/K             |
| Temperature coefficient of $V_{IO}$<br>$R_G = 50 \text{ } \Omega$ | $\alpha_{VIO}$ |   | 6    | 25   |  | 25   | $\mu\text{V/K}$  |
| Slew rate<br>for non-inverting operation                          | $SR$           |   | 1    |      |  |      | V/ $\mu\text{s}$ |
| Slew rate<br>for inverting operation                              | $SR$           |   | 1    |      |  |      | V/ $\mu\text{s}$ |

**Characteristics (TAF 4453)** $V_S = \pm 2 \text{ V}$ 

| Parameter   | Symbol   | Limit Values<br>$T_A = 25 \text{ }^\circ\text{C}$ |      |      | Limit Values<br>$T_A = -55$<br>to $125 \text{ }^\circ\text{C}$ |      | Unit |
|---|----------|---|------|------|--|------|------|
|   |          | min.  | typ. | max. | min.   | max. |      |
| Input offset voltage,<br>$R_G = 50 \text{ } \Omega$ | $V_{IO}$ | -4  |      | 4    | -6   | 6    | mV   |
| Input offset current                                | $I_{IO}$ | -50   |      | 50   | -75  | 75   | nA   |
| Input current                                       | $I_I$    |   | 40   | 100  |  | 150  | nA   |
| Open-loop voltage gain<br>$R_L = 2 \text{ k}\Omega$ | $G_{V0}$ | 75  |      |      | 70   |      | dB   |

**Note:** For typical performance curves, please refer to the data sheets of TAE 1453 and TAF 1453.