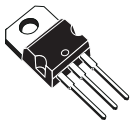
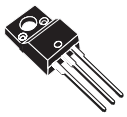
life.augmented

# L78

Datasheet

## Positive voltage regulator ICs


TO-220


TO-220FP


DPAK


D²PAK

| Maturity status link |
| --- |
| L78 |

### Features

- Output current up to 1.5 A
- Output voltages of 5; 6; 8; 8.5; 9; 12; 15; 18; 24 V
- Thermal overload protection
- Short circuit protection
- Output transition SOA protection
- 2 % output voltage tolerance (A version)
- Guaranteed in extended temperature range (A version)

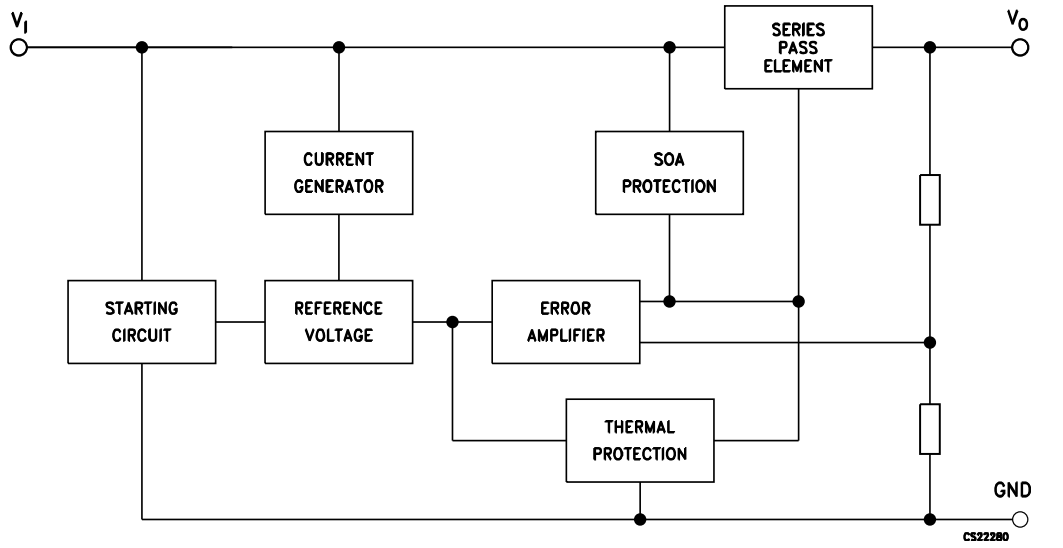
### Description

The L78 series of three-terminal positive regulators is available in TO-220, TO-220FP, D²PAK and DPAK packages and several fixed output voltages, making it useful in a wide range of applications.

These regulators can provide local on-card regulation, eliminating the distribution problems associated with single point regulation. Each type embeds internal current limiting, thermal shut-down and safe area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1 A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltage and currents.

# 1 Diagram

Figure 1. **Block diagram**

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# 2 Pin configuration

**Figure 2. Pin connections (top view)**

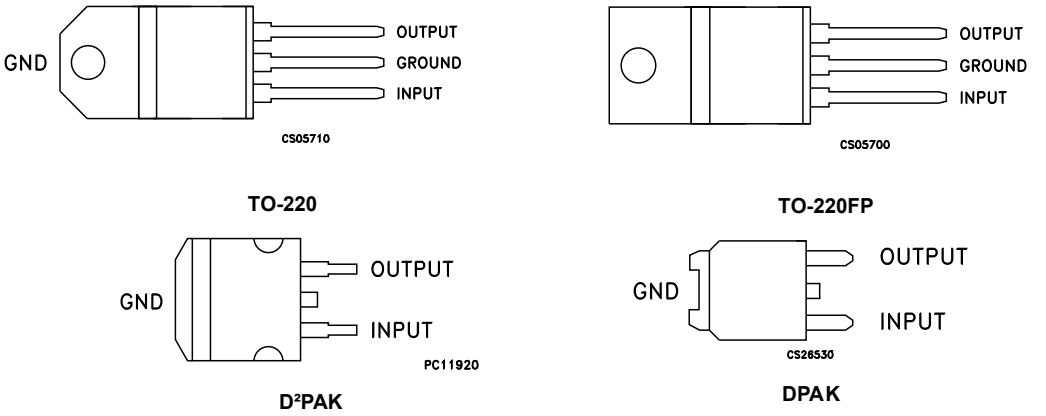


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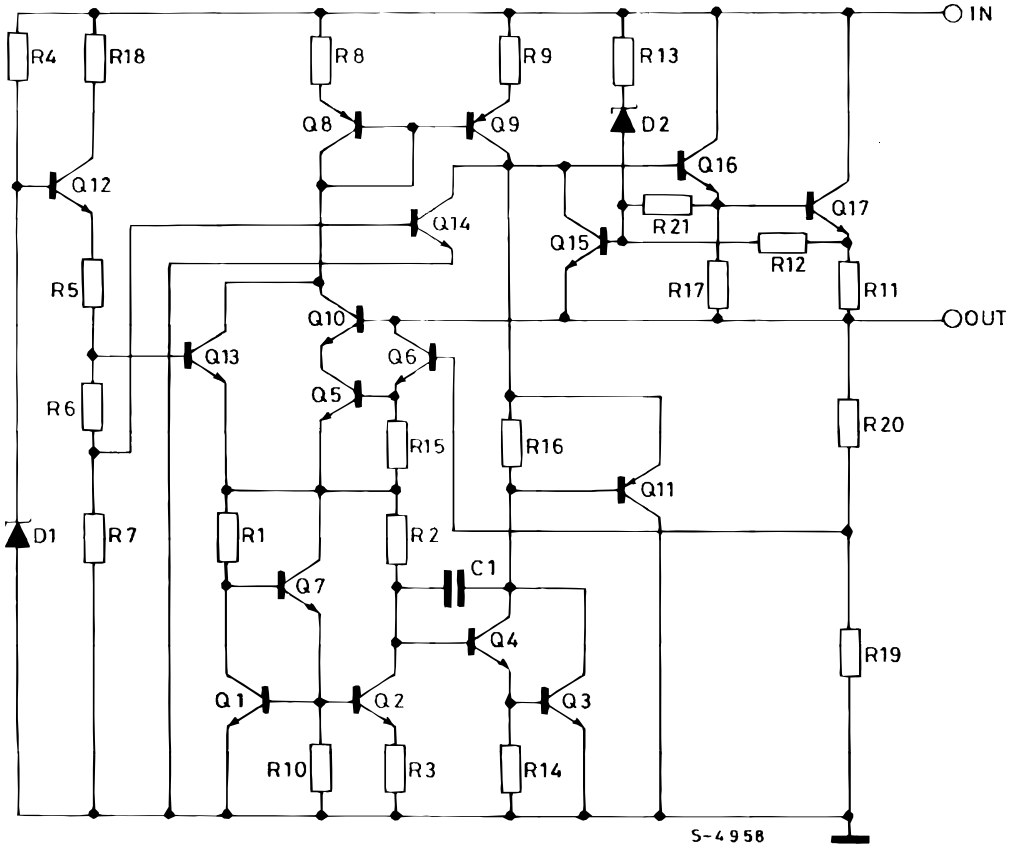
**Figure 3. Schematic diagram**

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# 3 Maximum ratings

**Table 1. Absolute maximum ratings**

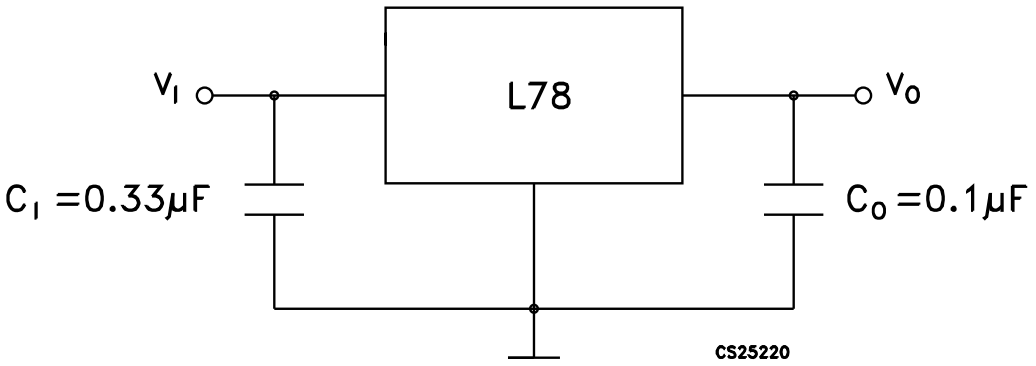
| Symbol | Parameter | | Value | Unit |
|---|---|---|---|---|
| $V_I$ | DC input voltage | for $V_O$= 5 to 18 V | 35 | V |
| | | for $V_O$= 20, 24 V | 40 | |
| $I_O$ | Output current | | Internally limited | |
| $P_D$ | Power dissipation | | Internally limited | |
| $T_{STG}$ | Storage temperature range | | -65 to 150 | °C |
| $T_{OP}$ | Operating junction temperature range | for L78xxC, L78xxAC | 0 to 125 | °C |
| | | for L78xxAB | -40 to 125 | |

*Note: Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.*

**Table 2. Thermal data**

| Symbol | Parameter | D²PAK | DPAK | TO-220 | TO-220FP | Unit |
|---|---|---|---|---|---|---|
| $R_{thJC}$ | Thermal resistance junction-case | 3 | 8 | 5 | 5 | °C/W |
| $R_{thJA}$ | Thermal resistance junction-ambient | 62.5 | 100 | 50 | 60 | °C/W |

**Figure 4. Application circuits**

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# 4 Test circuits

Figure 5. DC parameter

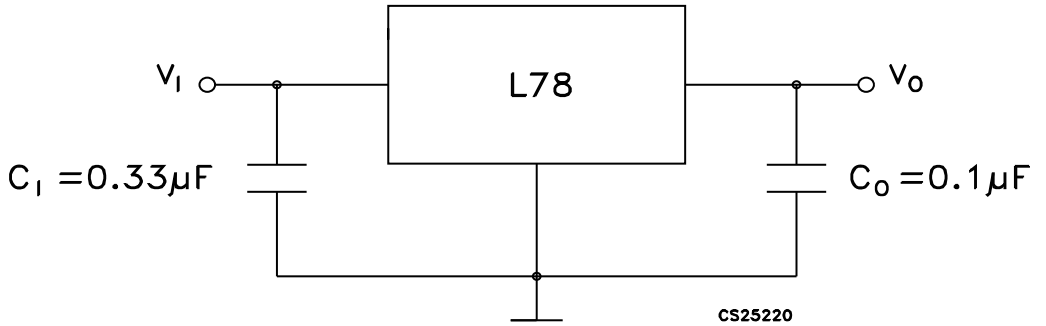


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Figure 6. Load regulation

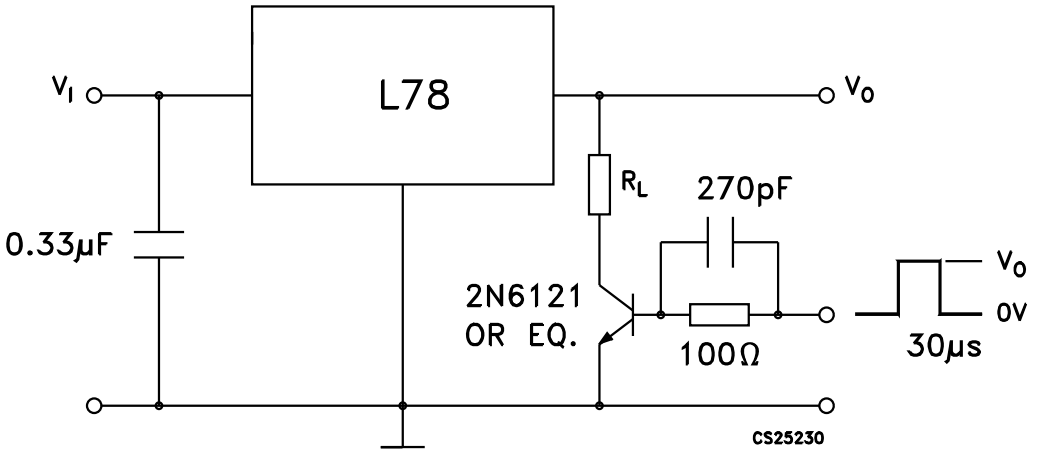


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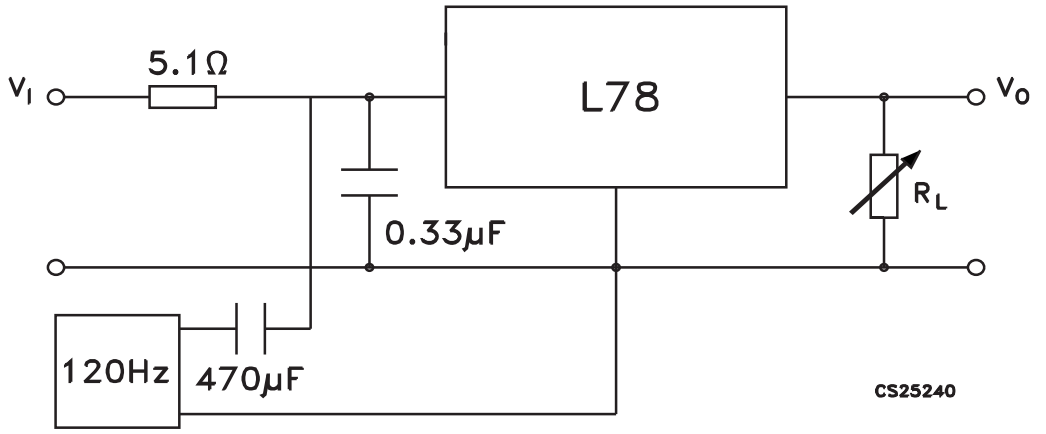
Figure 7. Ripple rejection

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# 5 Electrical characteristics

$V_I$ = 10 V, $I_O$ = 1 A, $T_J$ = 0 to 125 °C (L7805AC), $T_J$ = -40 to 125 °C (L7805AB), unless otherwise specified.

**Table 3. Electrical characteristics of L7805A**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage | $T_J$ = 25 °C | 4.9 | 5 | 5.1 | V |
| $V_O$ | Output voltage | $I_O$ = 5 mA to 1 A, $V_I$ = 7.5 to 18 V | 4.8 | 5 | 5.2 | V |
| $V_O$ | Output voltage | $I_O$ = 1 A, $V_I$ = 18 to 20 V, $T_J$ = 25 °C | 4.8 | 5 | 5.2 | V |
| $\Delta V_O$ (1) | Line regulation | $V_I$ = 7.5 to 25 V, $I_O$ = 500 mA, $T_J$ = 25 °C | | 7 | 50 | mV |
| | | $V_I$ = 8 to 12 V | | 10 | 50 | mV |
| | | $V_I$ = 8 to 12 V, $T_J$ = 25 °C | | 2 | 25 | mV |
| | | $V_I$ = 7.3 to 20 V, $T_J$ = 25 °C | | 7 | 50 | mV |
| $\Delta V_O$ (1) | Load regulation | $I_O$ = 5 mA to 1 A | | 25 | 100 | mV |
| | | $I_O$ = 5 mA to 1.5 A, $T_J$ = 25 °C | | 30 | 100 | |
| | | $I_O$ = 250 to 750 mA | | 8 | 50 | |
| $I_q$ | Quiescent current | $T_J$ = 25 °C | | 4.3 | 6 | mA |
| | | | | | 6 | mA |
| $\Delta I_q$ | Quiescent current change | $V_I$ = 8 to 23 V, $I_O$ = 500 mA | | | 0.8 | mA |
| | | $V_I$ = 7.5 to 20 V, $T_J$ = 25 °C | | | 0.8 | mA |
| | | $I_O$ = 5 mA to 1 A | | | 0.5 | mA |
| SVR | Supply voltage rejection | $V_I$ = 8 to 18 V, f = 120 Hz, $I_O$ = 500 mA | | 68 | | dB |
| $V_d$ | Dropout voltage | $I_O$ = 1 A, $T_J$ = 25 °C | | 2 | | V |
| eN | Output noise voltage | $T_A$ = 25 °C, B =10 Hz to 100 kHz | | 10 | | $\mu V/V_O$ |
| $R_O$ | Output resistance | f = 1 kHz | | 17 | | mΩ |
| $I_{sc}$ | Short circuit current | $V_I$ = 35 V, $T_A$ = 25 °C | | 0.2 | | A |
| $I_{scp}$ | Short circuit peak current | $T_J$ = 25 °C | | 2.2 | | A |
| $\Delta V_O/\Delta T$ | Output voltage drift | | | -1.1 | | mV/°C |

1. *Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.*

*Note: Minimum load current for regulation is 5 mA.*

$V_I$ = 11 V, $I_O$ = 1 A, $T_J$ = 0 to 125 °C (L7806AC), $T_J$ = -40 to 125 °C (L7806AB), unless otherwise specified.

**Table 4. Electrical characteristics of L7806A**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage | $T_J$ = 25 °C | 5.88 | 6 | 6.12 | V |
| $V_O$ | Output voltage | $I_O$ = 5 mA to 1 A, $V_I$ = 8.6 to 19 V | 5.76 | 6 | 6.24 | V |
| $V_O$ | Output voltage | $I_O$ = 1 A, $V_I$ = 19 to 21 V, $T_J$ = 25 °C | 5.76 | 6 | 6.24 | V |
| $\Delta V_O$ (1) | Line regulation | $V_I$ = 8.6 to 25 V, $I_O$ = 500 mA, $T_J$ = 25 °C | | 9 | 60 | mV |
| | | $V_I$ = 9 to 13 V | | 11 | 60 | mV |
| | | $V_I$ = 9 to 13 V, $T_J$ = 25 °C | | 3 | 30 | mV |
| | | $V_I$ = 8.3 to 21 V, $T_J$ = 25 °C | | 9 | 60 | mV |
| $\Delta V_O$ (1) | Load regulation | $I_O$ = 5 mA to 1 A | | 25 | 100 | mV |
| | | $I_O$ = 5 mA to 1.5 A, $T_J$ = 25 °C | | 30 | 100 | |
| | | $I_O$ = 250 to 750 mA | | 10 | 50 | |
| $I_q$ | Quiescent current | $T_J$ = 25° C | | 4.3 | 6 | mA |
| | | | | | 6 | mA |
| $\Delta I_q$ | Quiescent current change | $V_I$ = 9 to 24 V, $I_O$ = 500 mA | | | 0.8 | mA |
| | | $V_I$ = 8.6 to 21 V, $T_J$ = 25 °C | | | 0.8 | mA |
| | | $I_O$ = 5 mA to 1 A | | | 0.5 | mA |
| SVR | Supply voltage rejection | $V_I$ = 9 to 19 V, f = 120 Hz, $I_O$ = 500 mA | | 65 | | dB |
| $V_d$ | Dropout voltage | $I_O$ = 1 A, $T_J$ = 25 °C | | 2 | | V |
| eN | Output noise voltage | $T_A$ = 25 °C, B =10 Hz to 100 kHz | | 10 | | $\mu V/V_O$ |
| $R_O$ | Output resistance | f = 1 kHz | | 17 | | mΩ |
| $I_{sc}$ | Short circuit current | $V_I$ = 35 V, $T_A$ = 25 °C | | 0.2 | | A |
| $I_{scp}$ | Short circuit peak current | $T_J$ = 25 °C | | 2.2 | | A |
| $\Delta V_O/\Delta T$ | Output voltage drift | | | -0.8 | | mV/°C |

1. *Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.*

*Note: Minimum load current for regulation is 5 mA.*

$V_I$ = 14 V, $I_O$ = 1 A, $T_J$ = 0 to 125 °C (L7808AC), $T_J$ = -40 to 125 °C (L7808AB), unless otherwise specified.

**Table 5. Electrical characteristics of L7808A**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage | $T_J$ = 25 °C | 7.84 | 8 | 8.16 | V |
| $V_O$ | Output voltage | $I_O$ = 5 mA to 1 A, $V_I$ = 10.6 to 21 V | 7.7 | 8 | 8.3 | V |
| $V_O$ | Output voltage | $I_O$ = 1 A, $V_I$ = 21 to 23 V, $T_J$ = 25 °C | 7.7 | 8 | 8.3 | V |
| $\Delta V_O$ (1) | Line regulation | $V_I$ = 10.6 to 25 V, $I_O$ = 500 mA, $T_J$ = 25 °C | | 12 | 80 | mV |
| | | $V_I$ = 11 to 17 V | | 15 | 80 | mV |
| | | $V_I$ = 11 to 17 V, $T_J$ = 25 °C | | 5 | 40 | mV |
| | | $V_I$ = 10.4 to 23 V, $T_J$ = 25 °C | | 12 | 80 | mV |
| $\Delta V_O$ (1) | Load regulation | $I_O$ = 5 mA to 1 A | | 25 | 100 | mV |
| | | $I_O$ = 5 mA to 1.5 A, $T_J$ = 25 °C | | 30 | 100 | |
| | | $I_O$ = 250 to 750 mA | | 10 | 50 | |
| $I_q$ | Quiescent current | $T_J$ = 25 °C | | 4.3 | 6 | mA |
| | | | | | 6 | mA |
| $\Delta I_q$ | Quiescent current change | $V_I$ = 11 to 23 V, $I_O$ = 500 mA | | | 0.8 | mA |
| | | $V_I$ = 10.6 to 23 V, $T_J$ = 25 °C | | | 0.8 | mA |
| | | $I_O$ = 5 mA to 1 A | | | 0.5 | mA |
| SVR | Supply voltage rejection | $V_I$ = 11.5 to 21.5 V, f = 120 Hz, $I_O$ = 500 mA | | 62 | | dB |
| $V_d$ | Dropout voltage | $I_O$ = 1 A, $T_J$ = 25 °C | | 2 | | V |
| eN | Output noise voltage | $T_A$ = 25 °C, B =10 Hz to 100 kHz | | 10 | | $\mu V/V_O$ |
| $R_O$ | Output resistance | f = 1 kHz | | 18 | | mΩ |
| $I_{sc}$ | Short circuit current | $V_I$ = 35 V, $T_A$ = 25 °C | | 0.2 | | A |
| $I_{scp}$ | Short circuit peak current | $T_J$ = 25 °C | | 2.2 | | A |
| $\Delta V_O/\Delta T$ | Output voltage drift | | | -0.8 | | mV/°C |

1. *Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.*

*Note: Minimum load current for regulation is 5 mA.*

$V_I$ = 15 V, $I_O$ = 1 A, $T_J$ = 0 to 125 °C (L7809AC), $T_J$ = -40 to 125 °C (L7809AB), unless otherwise specified(Minimum load current for regulation is 5 mA.)

**Table 6. Electrical characteristics of L7809A**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage | $T_J$ = 25 °C | 8.82 | 9 | 9.18 | V |
| $V_O$ | Output voltage | $I_O$ = 5 mA to 1 A, $V_I$ = 11.5 to 22 V | 8.65 | 9 | 9.35 | V |
| $V_O$ | Output voltage | $I_O$ = 1 A, $V_I$ = 22 to 24 V, $T_J$ = 25 °C | 8.65 | 9 | 9.35 | V |
| $\Delta V_O$ (1) | Line regulation | $V_I$ = 10.6 to 25 V, $I_O$ = 500 mA, $T_J$ = 25 °C | | 12 | 90 | mV |
| | | $V_I$ = 11 to 17 V | | 15 | 90 | mV |
| | | $V_I$ = 11 to 17 V, $T_J$ = 25 °C | | 5 | 45 | mV |
| | | $V_I$ = 11.4 to 23 V, $T_J$ = 25 °C | | 12 | 90 | mV |
| $\Delta V_O$ (1) | Load regulation | $I_O$ = 5 mA to 1 A | | 25 | 100 | mV |
| | | $I_O$ = 5 mA to 1.5 A, $T_J$ = 25 °C | | 30 | 100 | |
| | | $I_O$ = 250 to 750 mA | | 10 | 50 | |
| $I_q$ | Quiescent current | $T_J$ = 25 °C | | 4.3 | 6 | mA |
| | | | | | 6 | mA |
| $\Delta I_q$ | Quiescent current change | $V_I$ = 11 to 25 V, $I_O$ = 500 mA | | | 0.8 | mA |
| | | $V_I$ = 10.6 to 23 V, $T_J$ = 25 °C | | | 0.8 | mA |
| | | $I_O$ = 5 mA to 1 A | | | 0.5 | mA |
| SVR | Supply voltage rejection | $V_I$ = 11.5 to 21.5 V, f = 120 Hz, $I_O$ = 500 mA | | 61 | | dB |
| $V_d$ | Dropout voltage | $I_O$ = 1 A, $T_J$ = 25 °C | | 2 | | V |
| eN | Output noise voltage | $T_A$ = 25 °C, B =10 Hz to 100 kHz | | 10 | | $\mu V/V_O$ |
| $R_O$ | Output resistance | f = 1 kHz | | 18 | | mΩ |
| $I_{sc}$ | Short circuit current | $V_I$ = 35 V, $T_A$ = 25 °C | | 0.2 | | A |
| $I_{scp}$ | Short circuit peak current | $T_J$ = 25 °C | | 2.2 | | A |
| $\Delta V_O/\Delta T$ | Output voltage drift | | | -0.8 | | mV/°C |

1. *Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.*

*Note: Minimum load current for regulation is 5 mA.*

$V_I$ = 19 V, $I_O$ = 1 A, $T_J$ = 0 to 125 °C (L7812AC), $T_J$ = -40 to 125 °C (L7812AB), unless otherwise specified.

**Table 7. Electrical characteristics of L7812A**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage | $T_J$ = 25 °C | 11.75 | 12 | 12.25 | V |
| $V_O$ | Output voltage | $I_O$ = 5 mA to 1 A, $V_I$ = 14.8 to 25 V | 11.5 | 12 | 12.5 | V |
| $V_O$ | Output voltage | $I_O$ = 1 A, $V_I$ = 25 to 27 V, $T_J$ = 25 °C | 11.5 | 12 | 12.5 | V |
| $\Delta V_O$ (1) | Line regulation | $V_I$ = 14.8 to 30 V, $I_O$ = 500 mA, $T_J$ = 25 °C | | 13 | 120 | mV |
| | | $V_I$ = 16 to 12 V | | 16 | 120 | mV |
| | | $V_I$ = 16 to 12 V, $T_J$ = 25 °C | | 6 | 60 | mV |
| | | $V_I$ = 14.5 to 27 V, $T_J$ = 25 °C | | 13 | 120 | mV |
| $\Delta V_O$ (1) | Load regulation | $I_O$ = 5 mA to 1 A | | 25 | 100 | mV |
| | | $I_O$ = 5 mA to 1.5 A, $T_J$ = 25 °C | | 30 | 100 | |
| | | $I_O$ = 250 to 750 mA | | 10 | 50 | |
| $I_q$ | Quiescent current | $T_J$ = 25 °C | | 4.4 | 6 | mA |
| | | | | | 6 | mA |
| $DI_q$ | Quiescent current change | $V_I$ = 15 to 30 V, $I_O$ = 500 mA | | | 0.8 | mA |
| | | $V_I$ = 14.8 to 27 V, $T_J$ = 25 °C | | | 0.8 | mA |
| | | $I_O$ = 5 mA to 1 A | | | 0.5 | mA |
| SVR | Supply voltage rejection | $V_I$ = 15 to 25 V, f = 120 Hz, $I_O$ = 500 mA | | 60 | | dB |
| $V_d$ | Dropout voltage | $I_O$ = 1 A, $T_J$ = 25 °C | | 2 | | V |
| eN | Output noise voltage | $T_A$ = 25 °C, B = 10 Hz to 100 kHz | | 10 | | $\mu V/V_O$ |
| $R_O$ | Output resistance | f = 1 kHz | | 18 | | mΩ |
| $I_{sc}$ | Short circuit current | $V_I$ = 35 V, $T_A$ = 25 °C | | 0.2 | | A |
| $I_{scp}$ | Short circuit peak current | $T_J$ = 25 °C | | 2.2 | | A |
| $\Delta V_O/\Delta T$ | Output voltage drift | | | -1 | | mV/°C |

1. *Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.*

*Note: Minimum load current for regulation is 5 mA.*

$V_I$ = 23 V, $I_O$ = 1 A, $T_J$ = 0 to 125 °C (L7815AC), $T_J$ = -40 to 125 °C (L7815AB), unless otherwise specified.

**Table 8. Electrical characteristics of L7815A**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage | $T_J$ = 25 °C | 14.7 | 15 | 15.3 | V |
| $V_O$ | Output voltage | $I_O$ = 5 mA to 1 A, $V_I$ = 17.9 to 28 V | 14.4 | 15 | 15.6 | V |
| $V_O$ | Output voltage | $I_O$ = 1 A, $V_I$ = 28 to 30 V, $T_J$ = 25 °C | 14.4 | 15 | 15.6 | V |
| $\Delta V_O$ (1) | Line regulation | $V_I$ = 17.9 to 30 V, $I_O$ = 500 mA, $T_J$ = 25 °C | | 13 | 150 | mV |
| | | $V_I$ = 20 to 26 V | | 16 | 150 | mV |
| | | $V_I$ = 20 to 26 V, $T_J$ = 25 °C | | 6 | 75 | mV |
| | | $V_I$ = 17.5 to 30 V, $T_J$ = 25 °C | | 13 | 150 | mV |
| $\Delta V_O$ (1) | Load regulation | $I_O$ = 5 mA to 1 A | | 25 | 100 | mV |
| | | $I_O$ = 5 mA to 1.5 A, $T_J$ = 25 °C | | 30 | 100 | |
| | | $I_O$ = 250 to 750 mA | | 10 | 50 | |
| $I_q$ | Quiescent current | $T_J$ = 25 °C | | 4.4 | 6 | mA |
| | | | | | 6 | mA |
| $\Delta I_q$ | Quiescent current change | $V_I$ = 17.5 to 30 V, $I_O$ = 500 mA | | | 0.8 | mA |
| | | $V_I$ = 17.5 to 30 V, $T_J$ = 25 °C | | | 0.8 | mA |
| | | $I_O$ = 5 mA to 1 A | | | 0.5 | mA |
| SVR | Supply voltage rejection | $V_I$ = 18.5 to 28.5 V, f = 120 Hz, $I_O$ = 500 mA | | 58 | | dB |
| $V_d$ | Dropout voltage | $I_O$ = 1 A, $T_J$ = 25 °C | | 2 | | V |
| eN | Output noise voltage | $T_A$ = 25 °C, B = 10Hz to 100 kHz | | 10 | | $\mu V/V_O$ |
| $R_O$ | Output resistance | f = 1 kHz | | 19 | | mΩ |
| $I_{sc}$ | Short circuit current | $V_I$ = 35 V, $T_A$ = 25 °C | | 0.2 | | A |
| $I_{scp}$ | Short circuit peak current | $T_J$ = 25 °C | | 2.2 | | A |
| $\Delta V_O/\Delta T$ | Output voltage drift | | | -1 | | mV/°C |

1. *Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.*

*Note: Minimum load current for regulation is 5 mA.*

$V_I$ = 33 V, $I_O$ = 1 A, $T_J$ = 0 to 125 °C (L7824AC), $T_J$ = -40 to 125 °C (L7824AB), unless otherwise specified.

**Table 9. Electrical characteristics of L7824A**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage | $T_J$ = 25 °C | 23.5 | 24 | 24.5 | V |
| $V_O$ | Output voltage | $I_O$ = 5 mA to 1 A, $V_I$ = 27.3 to 37 V | 23 | 24 | 25 | V |
| $V_O$ | Output voltage | $I_O$ = 1 A, $V_I$ = 37 to 38 V, $T_J$ = 25 °C | 23 | 24 | 25 | V |
| $\Delta V_O$ (1) | Line regulation | $V_I$ = 27 to 38 V, $I_O$ = 500 mA, $T_J$ = 25 °C | | 31 | 240 | mV |
| | | $V_I$ = 30 to 36 V | | 35 | 200 | mV |
| | | $V_I$ = 30 to 36 V, $T_J$ = 25 °C | | 14 | 120 | mV |
| | | $V_I$ = 26.7 to 38 V, $T_J$ = 25 °C | | 31 | 240 | mV |
| $\Delta V_O$ (1) | Load regulation | $I_O$ = 5 mA to 1 A | | 25 | 100 | mV |
| | | $I_O$ = 5 mA to 1.5 A, $T_J$ = 25 °C | | 30 | 100 | |
| | | $I_O$ = 250 to 750 mA | | 10 | 50 | |
| $I_q$ | Quiescent current | $T_J$ = 25 °C | | 4.6 | 6 | mA |
| | | | | | 6 | mA |
| $\Delta I_q$ | Quiescent current change | $V_I$ = 27.3 to 38 V, $I_O$ = 500 mA | | | 0.8 | mA |
| | | $V_I$ = 27.3 to 38 V, $T_J$ = 25 °C | | | 0.8 | mA |
| | | $I_O$ = 5 mA to 1 A | | | 0.5 | mA |
| SVR | Supply voltage rejection | $V_I$ = 28 to 38 V, f = 120 Hz, $I_O$ = 500 mA | | 54 | | dB |
| $V_d$ | Dropout voltage | $I_O$ = 1 A, $T_J$ = 25 °C | | 2 | | V |
| eN | Output noise voltage | $T_A$ = 25 °C, B = 10 Hz to 100 kHz | | 10 | | $\mu V/V_O$ |
| $R_O$ | Output resistance | f = 1 kHz | | 20 | | m |
| $I_{sc}$ | Short circuit current | $V_I$ = 35 V, $T_A$ = 25 °C | | 0.2 | | A |
| $I_{scp}$ | Short circuit peak current | $T_J$ = 25 °C | | 2.2 | | A |
| $\Delta V_O/\Delta T$ | Output voltage drift | | | -1.5 | | mV/°C |

1. *Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.*

*Note: Minimum load current for regulation is 5 mA.*

Refer to the test circuits, $T_J$ = 0 to 125 °C, $V_I$ = 10 V, $I_O$ = 500 mA, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF unless otherwise specified.

**Table 10. Electrical characteristics of L7805C**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage | $T_J$ = 25 °C | 4.8 | 5 | 5.2 | V |
| $V_O$ | Output voltage | $I_O$ = 5 mA to 1 A, $V_I$ = 7 to 18 V | 4.75 | 5 | 5.25 | V |
| $V_O$ | Output voltage | $I_O$ = 1 A, $V_I$ = 18 to 20V, $T_J$ = 25 °C | 4.75 | 5 | 5.25 | V |
| $\Delta V_O$ (1) | Line regulation | $V_I$ = 7 to 25 V, $T_J$ = 25 °C | | 3 | 100 | mV |
| | | $V_I$ = 8 to 12 V, $T_J$ = 25 °C | | 1 | 50 | |
| $\Delta V_O$ (1) | Load regulation | $I_O$ = 5 mA to 1.5 A, $T_J$ = 25 °C | | | 100 | mV |
| | | $I_O$ = 250 to 750 mA, $T_J$ = 25 °C | | | 50 | |
| $I_d$ | Quiescent current | $T_J$ = 25° C | | | 8 | mA |
| $\Delta I_d$ | Quiescent current change | $I_O$ = 5 mA to 1 A | | | 0.5 | mA |
| | | $V_I$ = 7 to 23 V | | | 0.8 | |
| $\Delta V_O/\Delta T$ | Output voltage drift | $I_O$ = 5 mA | | -1.1 | | mV/°C |
| eN | Output noise voltage | B = 10 Hz to 100 kHz, $T_J$ = 25 °C | | 40 | | $\mu V/V_O$ |
| SVR | Supply voltage rejection | $V_I$ = 8 to 18 V, f = 120 Hz | 62 | | | dB |
| $V_d$ | Dropout voltage | $I_O$ = 1 A, $T_J$ = 25 °C | | 2 | | V |
| $R_O$ | Output resistance | f = 1 kHz | | 17 | | mΩ |
| $I_{sc}$ | Short circuit current | $V_I$ = 35 V, $T_J$ = 25 °C | | 0.75 | | A |
| $I_{scp}$ | Short circuit peak current | $T_J$ = 25 °C | | 2.2 | | A |

1. *Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.*

*Note: Minimum load current for regulation is 5 mA.*

Refer to the test circuits, $T_J$ = 0 to 125 °C, $V_I$ = 11 V, $I_O$ = 500 mA, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF unless otherwise specified.

**Table 11. Electrical characteristics of L7806C**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage | $T_J$ = 25 °C | 5.75 | 6 | 6.25 | V |

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage | $I_O$ = 5 mA to 1 A, $V_I$ = 8 to 19 V | 5.7 | 6 | 6.3 | V |
| $V_O$ | Output voltage | $I_O$ = 1 A, $V_I$ = 19 to 21 V, $T_J$ = 25 °C | 5.7 | 6 | 6.3 | V |
| $\Delta V_O$ (1) | Line regulation | $V_I$ = 8 to 25 V, $T_J$ = 25 °C | | | 120 | mV |
| | | $V_I$ = 9 to 13 V, $T_J$ = 25 °C | | | 60 | |
| $\Delta V_O$ (1) | Load regulation | $I_O$ = 5 mA to 1.5 A, $T_J$ = 25 °C | | | 120 | mV |
| | | $I_O$ = 250 to 750 mA, $T_J$ = 25 °C | | | 60 | |
| $I_d$ | Quiescent current | $T_J$ = 25 °C | | | 8 | mA |
| $DI_d$ | Quiescent current change | $I_O$ = 5 mA to 1 A | | | 0.5 | mA |
| | | $V_I$ = 8 to 24 V | | | 1.3 | |
| $\Delta V_O/\Delta T$ | Output voltage drift | $I_O$ = 5 mA | | -0.8 | | mV/°C |
| eN | Output noise voltage | B = 10 Hz to 100 kHz, $T_J$ = 25 °C | | 45 | | $\mu V/V_O$ |
| SVR | Supply voltage rejection | $V_I$ = 9 to 19 V, f = 120 Hz | 59 | | | dB |
| $V_d$ | Dropout voltage | $I_O$ = 1 A, $T_J$ = 25 °C | | 2 | | V |
| $R_O$ | Output resistance | f = 1 kHz | | 19 | | mΩ |
| $I_{sc}$ | Short circuit current | $V_I$ = 35 V, $T_J$ = 25 °C | | 0.55 | | A |
| $I_{scp}$ | Short circuit peak current | $T_J$ = 25 °C | | 2.2 | | A |

1. *Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.*

*Note: Minimum load current for regulation is 5 mA.*

Refer to the test circuits, $T_J$ = 0 to 125 °C, $V_I$ = 14 V, $I_O$ = 500 mA, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF unless otherwise specified.

**Table 12. Electrical characteristics of L7808C**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage | $T_J$ = 25 °C | 7.7 | 8 | 8.3 | V |

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage | $I_O$ = 5 mA to 1 A, $V_I$ = 10.5 to 21 V | 7.6 | 8 | 8.4 | V |
| $V_O$ | Output voltage | $I_O$ = 1 A, $V_I$ = 21 to 25 V, $T_J$ = 25 °C | 7.6 | 8 | 8.4 | V |
| $\Delta V_O$ (1) | Line regulation | $V_I$ = 10.5 to 25 V, $T_J$ = 25 °C | | | 160 | mV |
| | | $V_I$ = 11 to 17 V, $T_J$ = 25 °C | | | 80 | |
| $\Delta V_O$ (1) | Load regulation | $I_O$ = 5 mA to 1.5 A, $T_J$ = 25 °C | | | 160 | mV |
| | | $I_O$ = 250 to 750 mA, $T_J$ = 25 °C | | | 80 | |
| $I_d$ | Quiescent current | $T_J$ = 25 °C | | | 8 | mA |
| $\Delta I_d$ | Quiescent current change | $I_O$ = 5 mA to 1 A | | | 0.5 | mA |
| | | $V_I$ = 10.5 to 25 V | | | 1 | |
| $\Delta V_O/\Delta T$ | Output voltage drift | $I_O$ = 5 mA | | -0.8 | | mV/°C |
| eN | Output noise voltage | B = 10 Hz to 100 kHz, $T_J$ = 25 °C | | 52 | | $\mu V/V_O$ |
| SVR | Supply voltage rejection | $V_I$ = 11.5 to 21.5 V, f = 120 Hz | 56 | | | dB |
| $V_d$ | Dropout voltage | $I_O$ = 1 A, $T_J$ = 25 °C | | 2 | | V |
| $R_O$ | Output resistance | f = 1 kHz | | 16 | | mΩ |
| $I_{sc}$ | Short circuit current | $V_I$ = 35 V, $T_J$ = 25 °C | | 0.45 | | A |
| $I_{scp}$ | Short circuit peak current | $T_J$ = 25 °C | | 2.2 | | A |

1. *Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.*

*Note: Minimum load current for regulation is 5 mA.*

Refer to the test circuits, $T_J$ = 0 to 125 °C, $V_I$ = 14.5 V, $I_O$ = 500 mA, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF unless otherwise specified.

**Table 13. Electrical characteristics of L7885C**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage | $T_J$ = 25 °C | 8.2 | 8.5 | 8.8 | V |
| $V_O$ | Output voltage | $I_O$ = 5 mA to 1 A, $V_I$ = 11 to 21.5 V | 8.1 | 8.5 | 8.9 | V |
| $V_O$ | Output voltage | $I_O$ = 1 A, $V_I$ = 21.5 to 26 V, $T_J$ = 25 °C | 8.1 | 8.5 | 8.9 | V |
| $\Delta V_O$ (1) | Line regulation | $V_I$ = 11 to 27 V, $T_J$ = 25 °C | | | 160 | mV |
| | | $V_I$ = 11.5 to 17.5 V, $T_J$ = 25 °C | | | 80 | |
| $\Delta V_O$ (1) | Load regulation | $I_O$ = 5 mA to 1.5 A, $T_J$ = 25 °C | | | 160 | mV |
| | | $I_O$ = 250 to 750 mA, $T_J$ = 25 °C | | | 80 | |
| $I_d$ | Quiescent current | $T_J$ = 25 °C | | | 8 | mA |
| $\Delta I_d$ | Quiescent current change | $I_O$ = 5 mA to 1 A | | | 0.5 | mA |
| | | $V_I$ = 11 to 26 V | | | 1 | |
| $\Delta V_O/\Delta T$ | Output voltage drift | $I_O$ = 5 mA | | -0.8 | | mV/°C |
| eN | Output noise voltage | B = 10 Hz to 100 kHz, $T_J$ = 25 °C | | 55 | | $\mu V/V_O$ |
| SVR | Supply voltage rejection | $V_I$ = 12 to 22 V, f = 120 Hz | 56 | | | dB |
| $V_d$ | Dropout voltage | $I_O$ = 1 A, $T_J$ = 25 °C | | 2 | | V |
| $R_O$ | Output resistance | f = 1 kHz | | 16 | | mΩ |
| $I_{sc}$ | Short circuit current | $V_I$ = 35 V, $T_J$ = 25 °C | | 0.45 | | A |
| $I_{scp}$ | Short circuit peak current | $T_J$ = 25 °C | | 2.2 | | A |

1. *Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.*

*Note: Minimum load current for regulation is 5 mA.*

Refer to the test circuits, $T_J$ = 0 to 125 °C, $V_I$ = 15 V, $I_O$ = 500 mA, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF unless otherwise specified.

**Table 14. Electrical characteristics of L7809C**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage | $T_J$ = 25 °C | 8.64 | 9 | 9.36 | V |
| $V_O$ | Output voltage | $I_O$ = 5 mA to 1 A, $V_I$ = 11.5 to 22 V | 8.55 | 9 | 9.45 | V |
| $V_O$ | Output voltage | $I_O$ = 1 A, $V_I$ = 22 to 26 V, $T_J$ = 25 °C | 8.55 | 9 | 9.45 | V |
| $\Delta V_O$ (1) | Line regulation | $V_I$ = 11.5 to 26 V, $T_J$ = 25 °C | | | 180 | mV |
| | | $V_I$ = 12 to 18 V, $T_J$ = 25 °C | | | 90 | |
| $\Delta V_O$ (1) | Load regulation | $I_O$ = 5 mA to 1.5 A, $T_J$ = 25 °C | | | 180 | mV |
| | | $I_O$ = 250 to 750 mA, $T_J$ = 25 °C | | | 90 | |
| $I_d$ | Quiescent current | $T_J$ = 25 °C | | | 8 | mA |
| $\Delta I_d$ | Quiescent current change | $I_O$ = 5 mA to 1 A | | | 0.5 | mA |
| | | $V_I$ = 11.5 to 26 V | | | 1 | |
| $\Delta V_O/\Delta T$ | Output voltage drift | $I_O$ = 5 mA | | -1 | | mV/°C |
| eN | Output noise voltage | B = 10 Hz to 100 kHz, $T_J$ = 25 °C | | 70 | | $\mu V/V_O$ |
| SVR | Supply voltage rejection | $V_I$ = 12 to 23 V, f = 120 Hz | 55 | | | dB |
| $V_d$ | Dropout voltage | $I_O$ = 1 A, $T_J$ = 25 °C | | 2 | | V |
| $R_O$ | Output resistance | f = 1 kHz | | 17 | | mΩ |
| $I_{sc}$ | Short circuit current | $V_I$ = 35 V, $T_J$ = 25 °C | | 0.40 | | A |
| $I_{scp}$ | Short circuit peak current | $T_J$ = 25 °C | | 2.2 | | A |

1. *Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.*

*Note: Minimum load current for regulation is 5 mA.*

Refer to the test circuits, $T_J$ = 0 to 125 °C, $V_I$ = 19 V, $I_O$ = 500 mA, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF unless otherwise specified.

**Table 15. Electrical characteristics of L7812C**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage | $T_J$ = 25 °C | 11.5 | 12 | 12.5 | V |
| $V_O$ | Output voltage | $I_O$ = 5 mA to 1 A, $V_I$ = 14.5 to 25 V | 11.4 | 12 | 12.6 | V |
| $V_O$ | Output voltage | $I_O$ = 1 A, $V_I$ = 25 to 27 V, $T_J$ = 25 °C | 11.4 | 12 | 12.6 | V |
| $\Delta V_O$ (1) | Line regulation | $V_I$ = 14.5 to 30 V, $T_J$ = 25 °C | | | 240 | mV |
| | | $V_I$ = 16 to 22 V, $T_J$ = 25 °C | | | 120 | |
| $\Delta V_O$ (1) | Load regulation | $I_O$ = 5 mA to 1.5 A, $T_J$ = 25 °C | | | 240 | mV |
| | | $I_O$ = 250 to 750 mA, $T_J$ = 25 °C | | | 120 | |
| $I_d$ | Quiescent current | $T_J$ = 25 °C | | | 8 | mA |
| $\Delta I_d$ | Quiescent current change | $I_O$ = 5 mA to 1 A | | | 0.5 | mA |
| | | $V_I$ = 14.5 to 30 V | | | 1 | |
| $\Delta V_O/\Delta T$ | Output voltage drift | $I_O$ = 5 mA | | -1 | | mV/°C |
| eN | Output noise voltage | B = 10 Hz to 100 kHz, $T_J$ = 25 °C | | 75 | | $\mu V/V_O$ |
| SVR | Supply voltage rejection | $V_I$ = 15 to 25 V, f = 120 Hz | 55 | | | dB |
| $V_d$ | Dropout voltage | $I_O$ = 1 A, $T_J$ = 25 °C | | 2 | | V |
| $R_O$ | Output resistance | f = 1 kHz | | 18 | | mΩ |
| $I_{sc}$ | Short circuit current | $V_I$ = 35 V, $T_J$ = 25 °C | | 0.35 | | A |
| $I_{scp}$ | Short circuit peak current | $T_J$ = 25 °C | | 2.2 | | A |

1. *Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.*

*Note: Minimum load current for regulation is 5 mA.*

Refer to the test circuits, $T_J$ = 0 to 125 °C, $V_I$ = 23 V, $I_O$ = 500 mA, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF unless otherwise specified.

**Table 16. Electrical characteristics of L7815C**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage | $T_J$ = 25 °C | 14.4 | 15 | 15.6 | V |
| $V_O$ | Output voltage | $I_O$ = 5 mA to 1 A, $V_I$ = 17.5 to 28 V | 14.25 | 15 | 15.75 | V |
| $V_O$ | Output voltage | $I_O$ = 1 A, $V_I$ = 28 to 30 V, $T_J$ = 25 °C | 14.25 | 15 | 15.75 | V |
| $\Delta V_O$ (1) | Line regulation | $V_I$ = 17.5 to 30 V, $T_J$ = 25 °C | | | 300 | mV |
| | | $V_I$ = 20 to 26 V, $T_J$ = 25 °C | | | 150 | |
| $\Delta V_O$ (1) | Load regulation | $I_O$ = 5 mA to 1.5 A, $T_J$ = 25 °C | | | 300 | mV |
| | | $I_O$ = 250 to 750 mA, $T_J$ = 25 °C | | | 150 | |
| $I_d$ | Quiescent current | $T_J$ = 25 °C | | | 8 | mA |
| $\Delta I_d$ | Quiescent current change | $I_O$ = 5 mA to 1A | | | 0.5 | mA |
| | | $V_I$ = 17.5 to 30 V | | | 1 | |
| $\Delta V_O/\Delta T$ | Output voltage drift | $I_O$ = 5 mA | | -1 | | mV/°C |
| eN | Output noise voltage | B = 10 Hz to 100kHz, $T_J$ = 25 °C | | 90 | | $\mu V/V_O$ |
| SVR | Supply voltage rejection | $V_I$ = 18.5 to 28.5 V, f = 120 Hz | 54 | | | dB |
| $V_d$ | Dropout voltage | $I_O$ = 1 A, $T_J$ = 25 °C | | 2 | | V |
| $R_O$ | Output resistance | f = 1 kHz | | 19 | | mΩ |
| $I_{sc}$ | Short circuit current | $V_I$ = 35 V, $T_J$ = 25 °C | | 0.23 | | A |
| $I_{scp}$ | Short circuit peak current | $T_J$ = 25 °C | | 2.2 | | A |

1. *Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.*

*Note: Minimum load current for regulation is 5 mA.*

Refer to the test circuits, $T_J$ = 0 to 125 °C, $V_I$ = 26 V, $I_O$ = 500 mA, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF unless otherwise specified.

**Table 17. Electrical characteristics of L7818C**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage | $T_J$ = 25 °C | 17.3 | 18 | 18.7 | V |
| $V_O$ | Output voltage | $I_O$ = 5 mA to 1 A, $V_I$ = 21 to 31 V | 17.1 | 18 | 18.9 | V |
| $V_O$ | Output voltage | $I_O$ = 1 A, $V_I$ = 31 to 33 V, $T_J$ = 25 °C | 17.1 | 18 | 18.9 | V |
| $\Delta V_O$ (1) | Line regulation | $V_I$ = 21 to 33 V, $T_J$ = 25 °C | | | 360 | mV |
| | | $V_I$ = 24 to 30 V, $T_J$ = 25 °C | | | 180 | |
| $\Delta V_O$ (1) | Load regulation | $I_O$ = 5 mA to 1.5 A, $T_J$ = 25 °C | | | 360 | mV |
| | | $I_O$ = 250 to 750 mA, $T_J$ = 25 °C | | | 180 | |
| $I_d$ | Quiescent current | $T_J$ = 25 °C | | | 8 | mA |
| $\Delta I_d$ | Quiescent current change | $I_O$ = 5 mA to 1 A | | | 0.5 | mA |
| | | $V_I$ = 21 to 33 V | | | 1 | |
| $\Delta V_O/\Delta T$ | Output voltage drift | $I_O$ = 5 mA | | -1 | | mV/°C |
| eN | Output noise voltage | B = 10 Hz to 100 kHz, $T_J$ = 25 °C | | 110 | | $\mu V/V_O$ |
| SVR | Supply voltage rejection | $V_I$ = 22 to 32 V, f = 120 Hz | 53 | | | dB |
| $V_d$ | Dropout voltage | $I_O$ = 1 A, $T_J$ = 25 °C | | 2 | | V |
| $R_O$ | Output resistance | f = 1 kHz | | 22 | | mΩ |
| $I_{sc}$ | Short circuit current | $V_I$ = 35 V, $T_J$ = 25 °C | | 0.20 | | A |
| $I_{scp}$ | Short circuit peak current | $T_J$ = 25 °C | | 2.1 | | A |

1. *Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.*

*Note: Minimum load current for regulation is 5 mA.*

Refer to the test circuits, $T_J$ = 0 to 125 °C, $V_I$ = 33 V, $I_O$ = 500 mA, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF unless otherwise specified.

**Table 18. Electrical characteristics of L7824C**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage | $T_J$ = 25 °C | 23 | 24 | 25 | V |
| $V_O$ | Output voltage | $I_O$ = 5 mA to 1 A, $V_I$ = 27 to 37 V | 22.8 | 24 | 25.2 | V |
| $V_O$ | Output voltage | $I_O$ = 1 A, $V_I$ = 37 to 38 V, $T_J$ = 25 °C | 22.8 | 24 | 25.2 | V |
| $\Delta V_O$ (1) | Line regulation | $V_I$ = 27 to 38 V, $T_J$ = 25 °C | | | 480 | mV |
| | | $V_I$ = 30 to 36 V, $T_J$ = 25 °C | | | 240 | |
| $\Delta V_O$ (1) | Load regulation | $I_O$ = 5 mA to 1.5 A, $T_J$ = 25 °C | | | 480 | mV |
| | | $I_O$ = 250 to 750 mA, $T_J$ = 25 °C | | | 240 | |
| $I_d$ | Quiescent current | $T_J$ = 25 °C | | | 8 | mA |
| $\Delta I_d$ | Quiescent current change | $I_O$ = 5 mA to 1 A | | | 0.5 | mA |
| | | $V_I$ = 27 to 38 V | | | 1 | |
| $\Delta V_O/\Delta T$ | Output voltage drift | $I_O$ = 5 mA | | -1.5 | | mV/°C |
| eN | Output noise voltage | B = 10 Hz to 100 kHz, $T_J$ = 25 °C | | 170 | | $\mu V/V_O$ |
| SVR | Supply voltage rejection | $V_I$ = 28 to 38 V, f = 120 Hz | 50 | | | dB |
| $V_d$ | Dropout voltage | $I_O$ = 1 A, $T_J$ = 25 °C | | 2 | | V |
| $R_O$ | Output resistance | f = 1 kHz | | 28 | | mΩ |
| $I_{sc}$ | Short circuit current | $V_I$ = 35 V, $T_J$ = 25° C | | 0.15 | | A |
| $I_{scp}$ | Short circuit peak current | $T_J$ = 25 °C | | 2.1 | | A |

1. *Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.*

*Note: Minimum load current for regulation is 5 mA.*

# 6 Application information

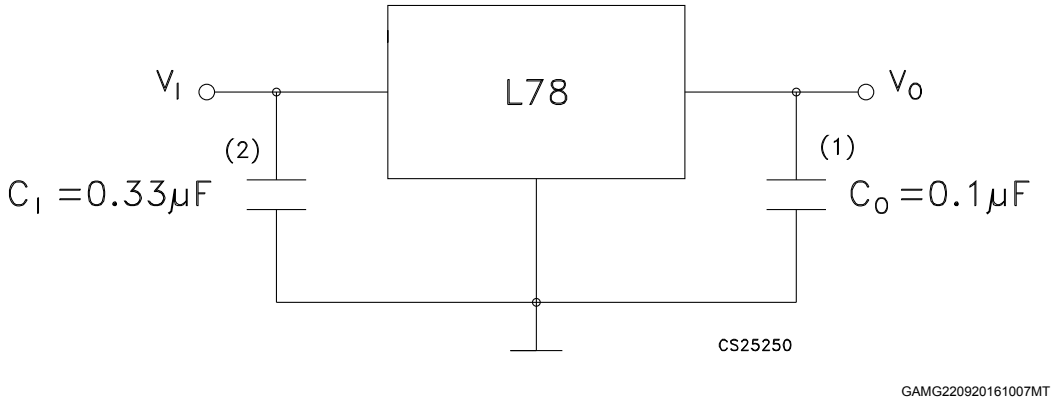
## 6.1 Design consideration

The L78 Series of fixed voltage regulators are designed with thermal overload protection that shuts down the circuit when subjected to an excessive power overload condition, internal short-circuit protection that limits the maximum current the circuit will pass, and output transistor safe-area compensation that reduces the output short-circuit current as the voltage across the pass transistor is increased. In many low current applications, compensation capacitors are not required. However, it is recommended that the regulator input be bypassed with capacitor if the regulator is connected to the power supply filter with long lengths, or if the output load capacitance is large. An input bypass capacitor should be selected to provide good high frequency characteristics to insure stable operation under all load conditions. A 0.33 µF or larger tantalum, mylar or other capacitor having low internal impedance at high frequencies should be chosen. The bypass capacitor should be mounted with the shortest possible leads directly across the regulators input terminals. Normally good construction techniques should be used to minimize ground loops and lead resistance drops since the regulator has no external sense lead.

The addition of an operational amplifier allows adjustment to higher or intermediate values while retaining regulation characteristics. The minimum voltage obtained with the arrangement is 2 V greater than the regulator voltage.

The circuit of Figure 13. High current voltage regulator can be modified to provide supply protection against short circuit by adding a short circuit sense resistor, RSC, and an additional PNP transistor. The current sensing PNP must be able to handle the short circuit current of the three terminal regulator Therefore a four ampere plastic power transistor is specified.

**Figure 8. Fixed output regulator**




GAMG220920161007MT

1. *Although no output capacitor is need for stability, it does improve transient response.*
2. *Required if regulator is located an appreciable distance from power supply filter.*

Figure 9. **Current regulator**

$I_O = V_{XX}/R_1 + I_d$

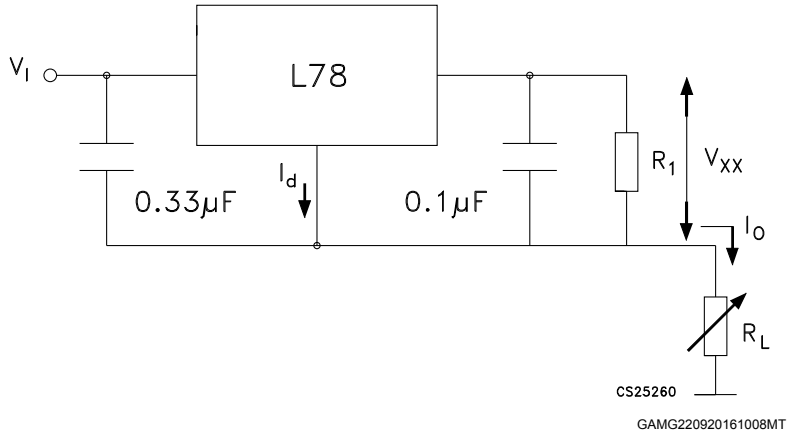



Figure 10. **Circuit for increasing output voltage**

$I_{R1} \geq 5\ I_d$

$V_O = V_{XX}(1+R_2/R_1) + I_d R_2$

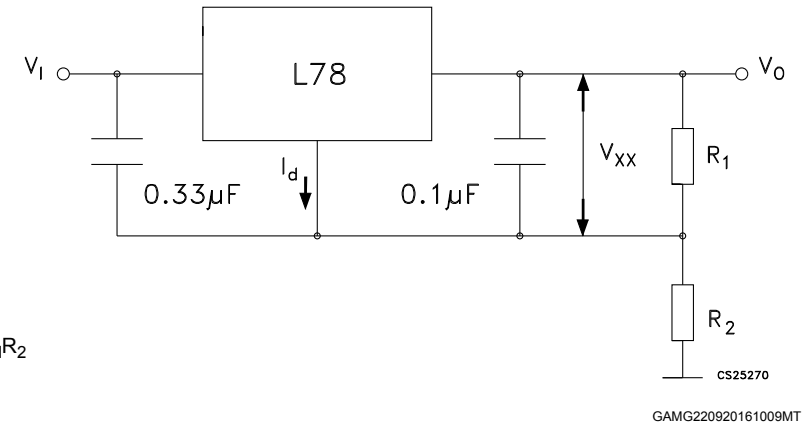



Figure 11. **Adjustable output regulator (7 to 30 V)**

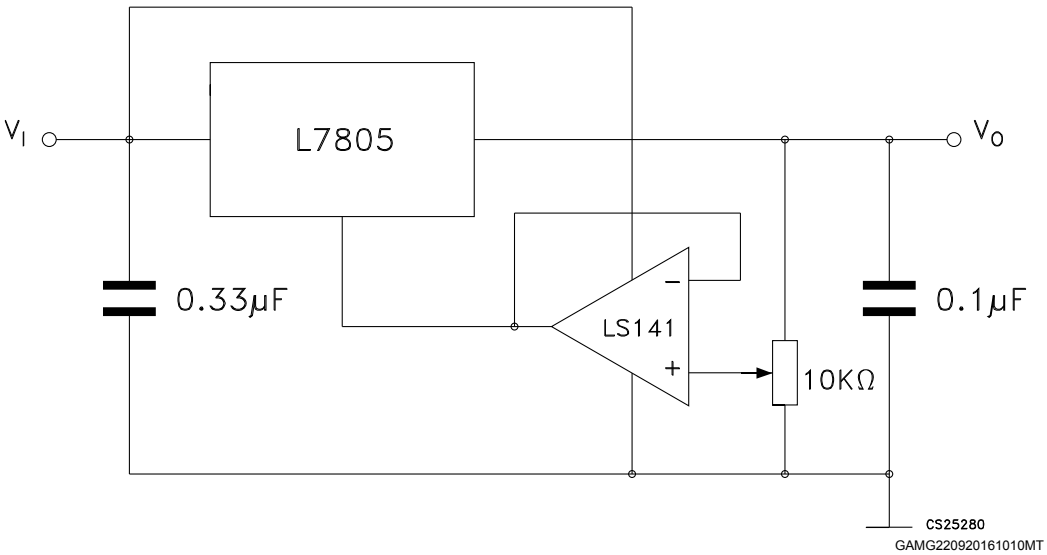
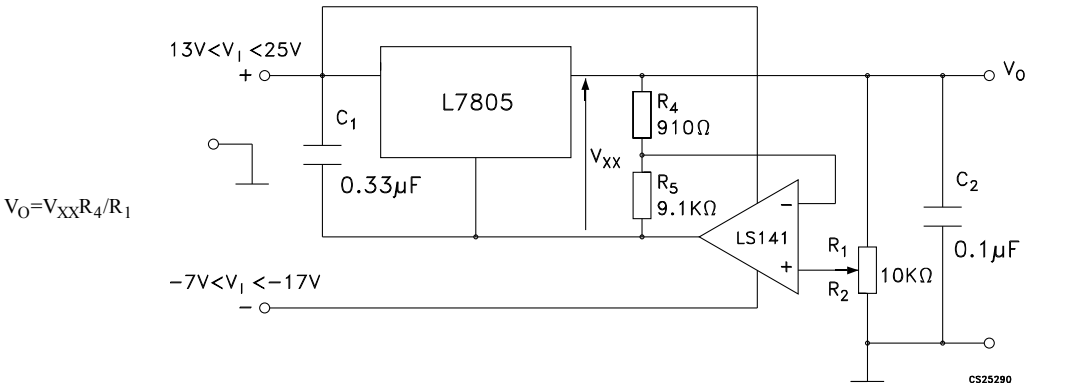


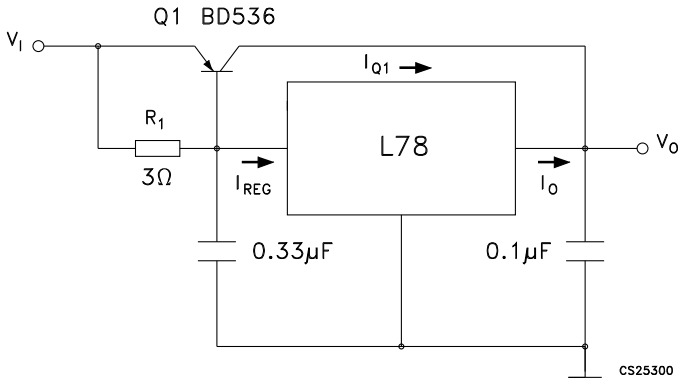
Figure 12. **0.5 to 10 V regulator**




$V_O = V_{XX} R_4 / R_1$

GAMG220920161011MT

Figure 13. **High current voltage regulator**

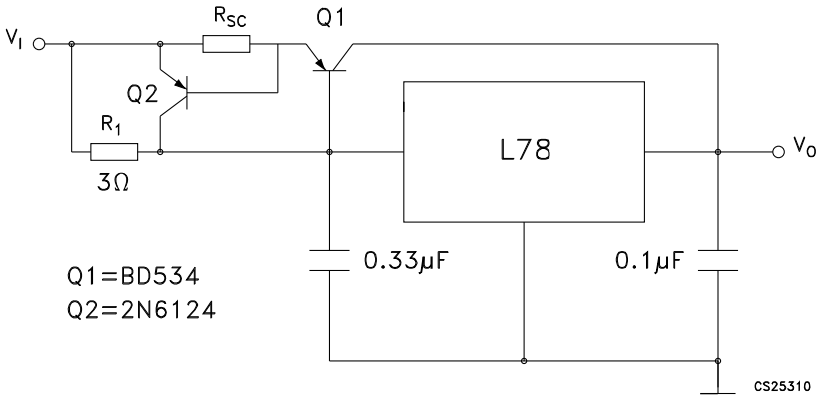



$$R_1 = \frac{V_{BEQ1}}{I_{REQ}(I_{Q1}/b_{Q1})}$$

$$I_O = I_{REG} + Q_1(I_{REG}\frac{V_{BEQ1}}{R_1})$$

GAMG220920161012MT

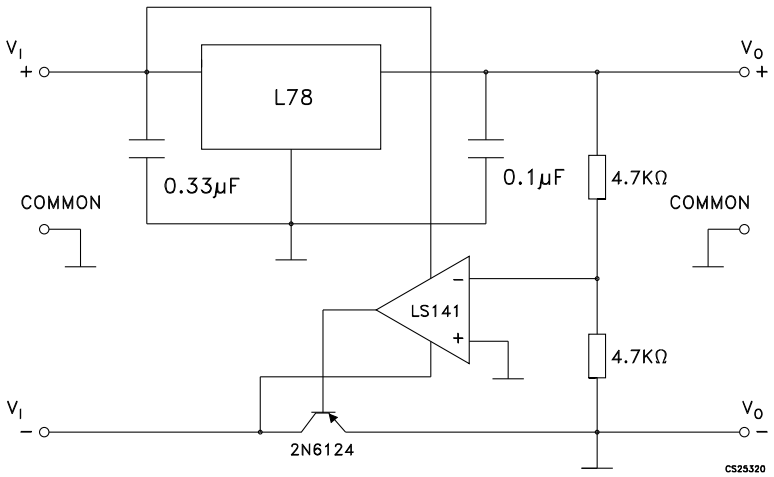
Figure 14. **High output current with short circuit protection**




$R_{SC} = V_{BEQ2}/I_{SC}$

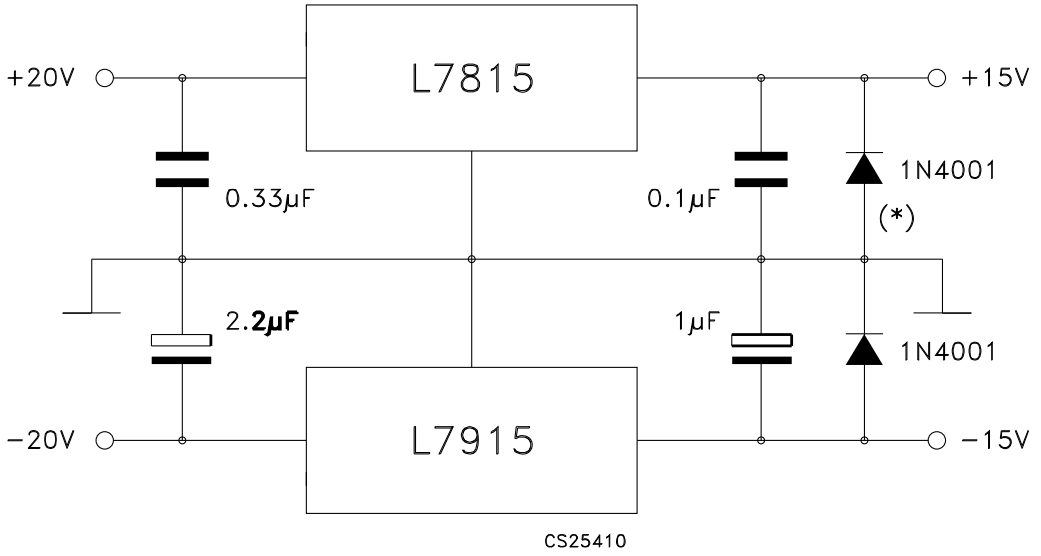
GAMG220920161013MT

Figure 15. **Tracking voltage regulator**




GAMG220920161014MT

Figure 16. **Split power supply (± 15 V - 1 A)**




GAMG220920161015MT

*Note:* ** Against potential latch-up problems.*

Figure 17. **Negative output voltage circuit**

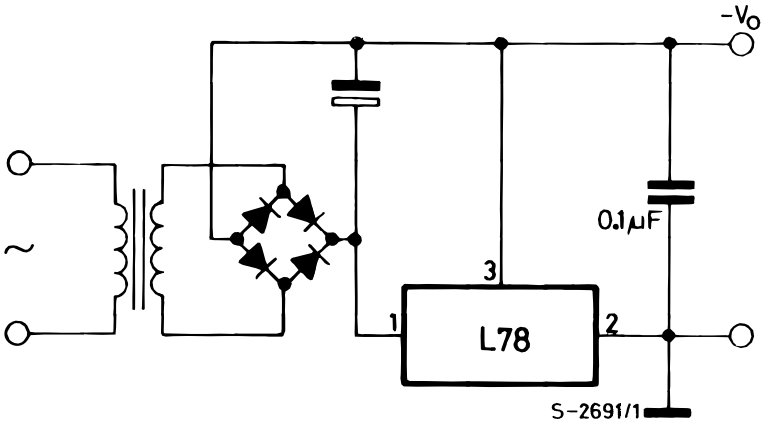



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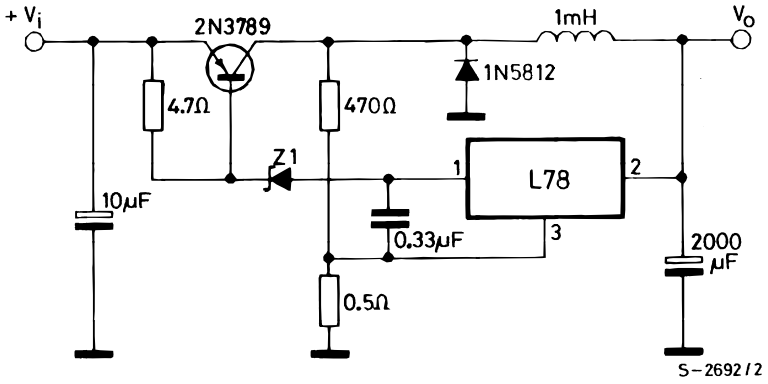
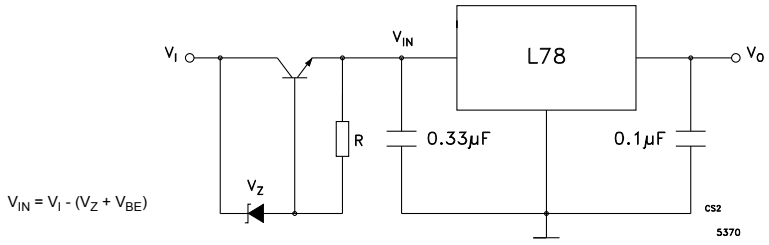
Figure 18. **Switching regulator**



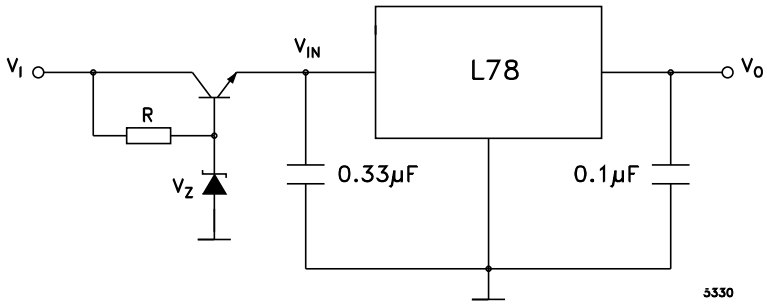

GAMG220920161017MT

Figure 19. **High input voltage circuit (configuration 1)**



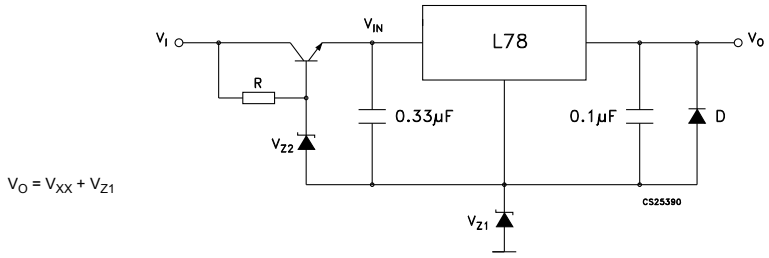

GAMG220920161018MT

Figure 20. **High input voltage circuit (configuration 2)**



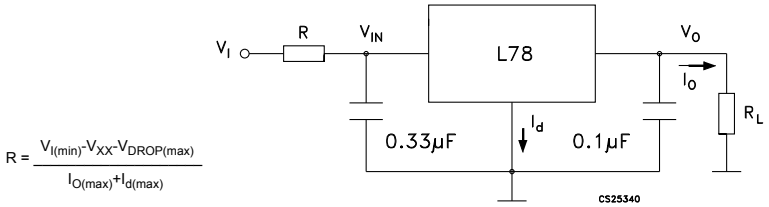

GAMG220920161019MT

Figure 21. **High input and output voltage**



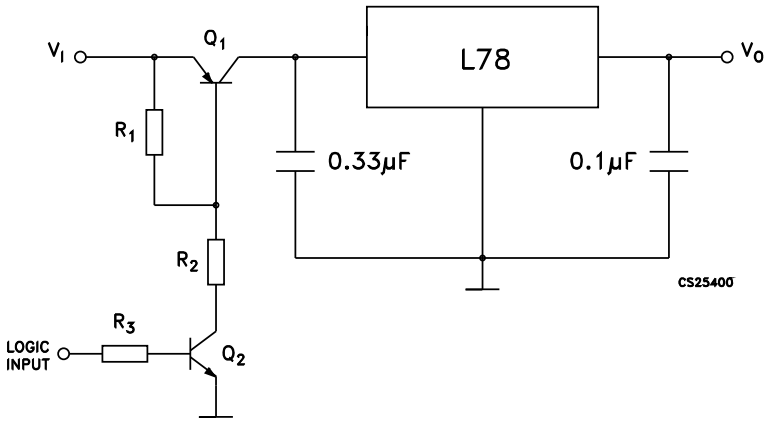

GAMG220920161020MT

Figure 22. **Reducing power dissipation with dropping resistor**



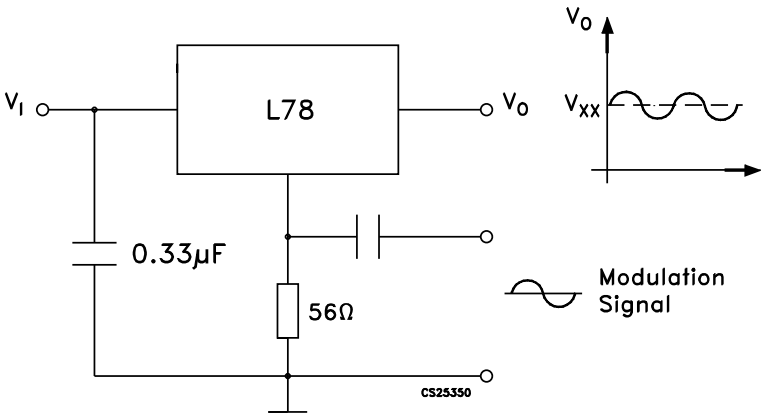

GAMG220920161021MT

Figure 23. **Remote shutdown**




GAMG220920161022MT

Figure 24. **Power AM modulator (unity voltage gain, $I_O \leq 0.5$)**

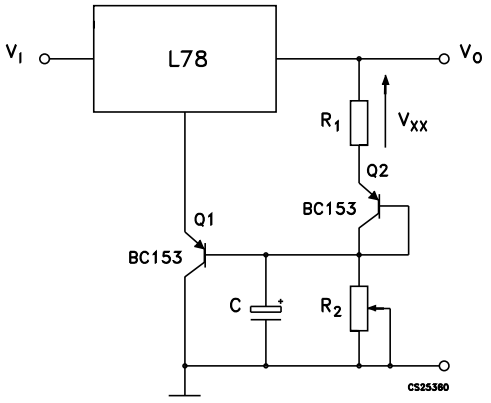



GAMG220920161023MT

*Note: The circuit performs well up to 100 kHz.*

Figure 25. **Adjustable output voltage with temperature compensation**

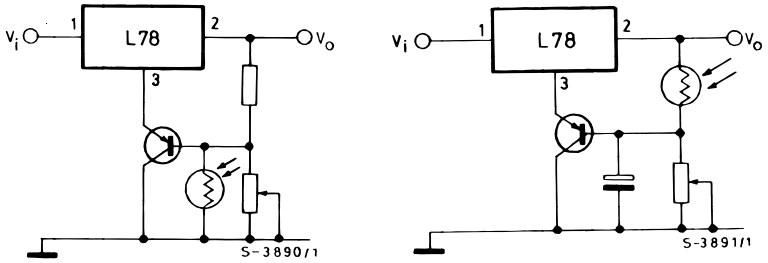
$V_O = V_{XX} (1+R_2/R_1) + V_{BE}$




GAMG220920161024MT

*Note: $Q_2$ is connected as a diode in order to compensate the variation of the $Q_1$ $V_{BE}$ with the temperature. C allows a slow rise time of the $V_O$.*

Figure 26. **Light controllers ($V_{O(min)} = V_{XX} + V_{BE}$)**

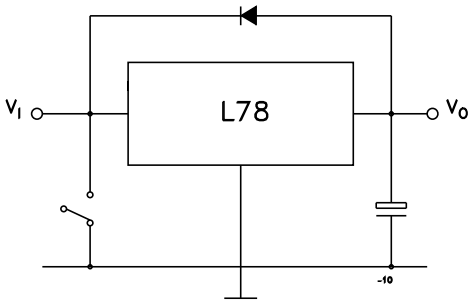



$V_O$ falls when the light goes up

$V_O$ rises when the light goes up

GAMG220920161025MT

Figure 27. **Protection against input short-circuit with high capacitance loads**

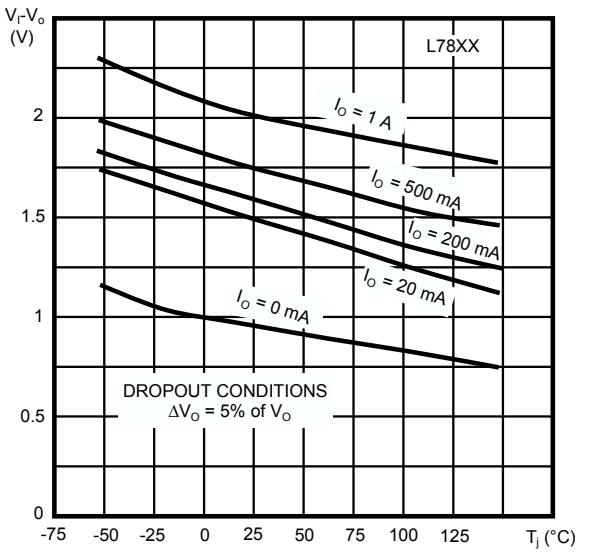



GAMG220920161026MT

*Note: Application with high capacitance loads and an output voltage greater than 6 volts need an external diode (see Figure 22. Reducing power dissipation with dropping resistor) to protect the device against input short circuit. In this case the input voltage falls rapidly while the output voltage decrease slowly. The capacitance discharges by means of the base-emitter junction of the series pass transistor in the regulator. If the energy is sufficiently high, the transistor may be destroyed. The external diode by-passes the current from the IC to ground.*

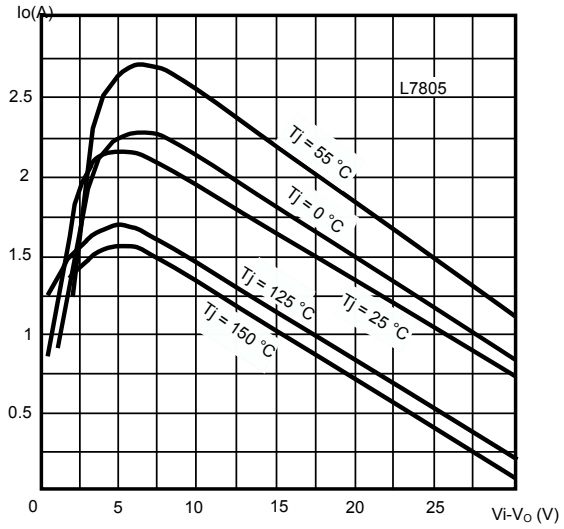
# 7 Typical performance

**Figure 28. Dropout voltage vs junction temperature**



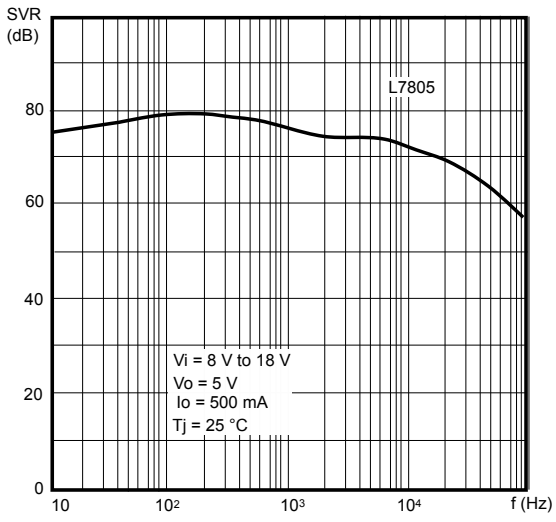

GAMG200920161325MT

**Figure 29. Peak output current vs input/output differential voltage**



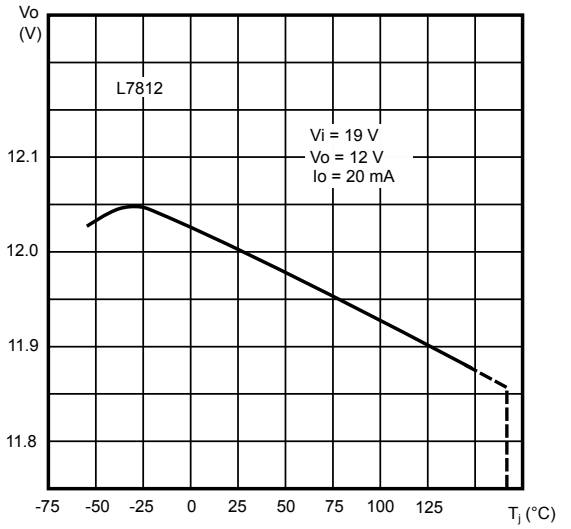

GAMG200920161324MT

**Figure 30. Supply voltage rejection vs frequency**



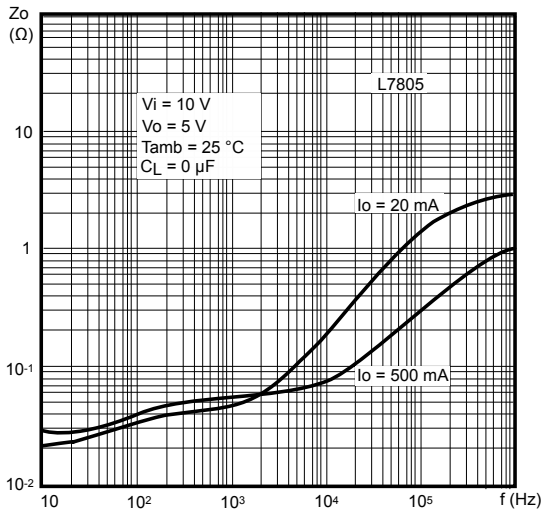

GAMG200920161322MT

**Figure 31. Output voltage vs junction temperature**



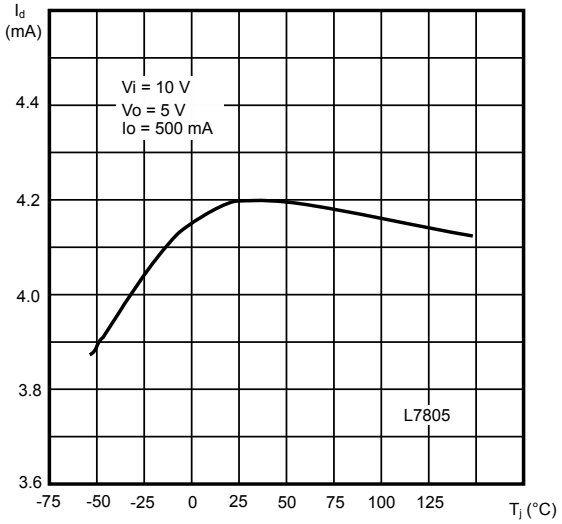

GAMG200920161323MT

**Figure 32. Output impedance vs frequency**



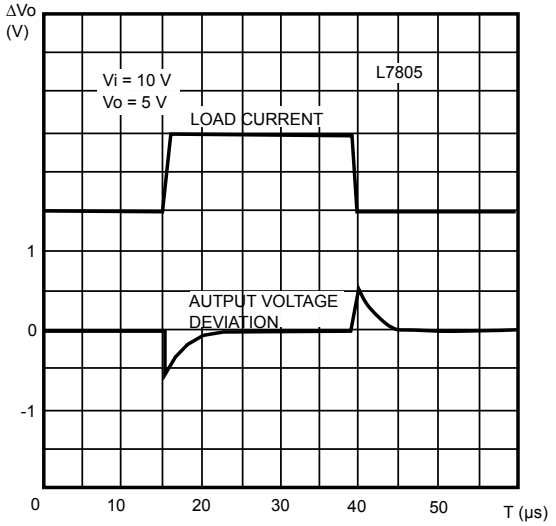

GAMG200920161320MT

**Figure 33. Quiescent current vs junction temp.**



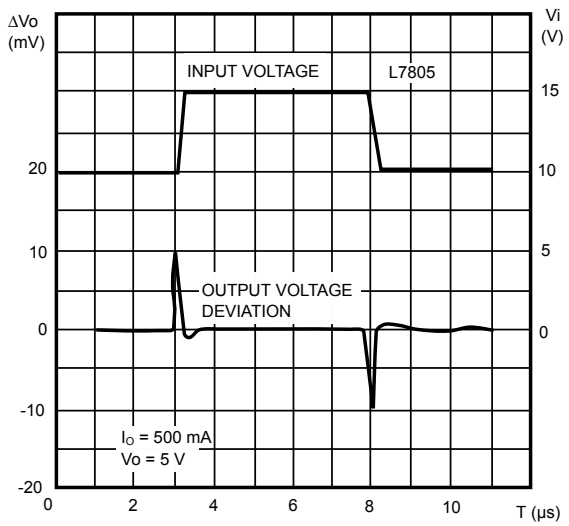

GAMG200920161321MT

**Figure 34. Load transient response**



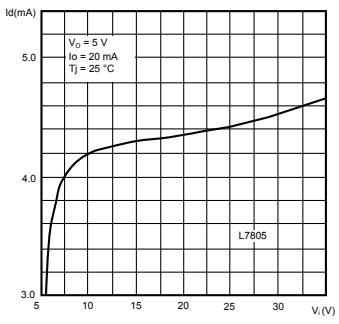

GAMG200920161326MT

**Figure 35. Line transient response**




GAMG200920161328MT

**Figure 36. Quiescent current vs. input voltage**



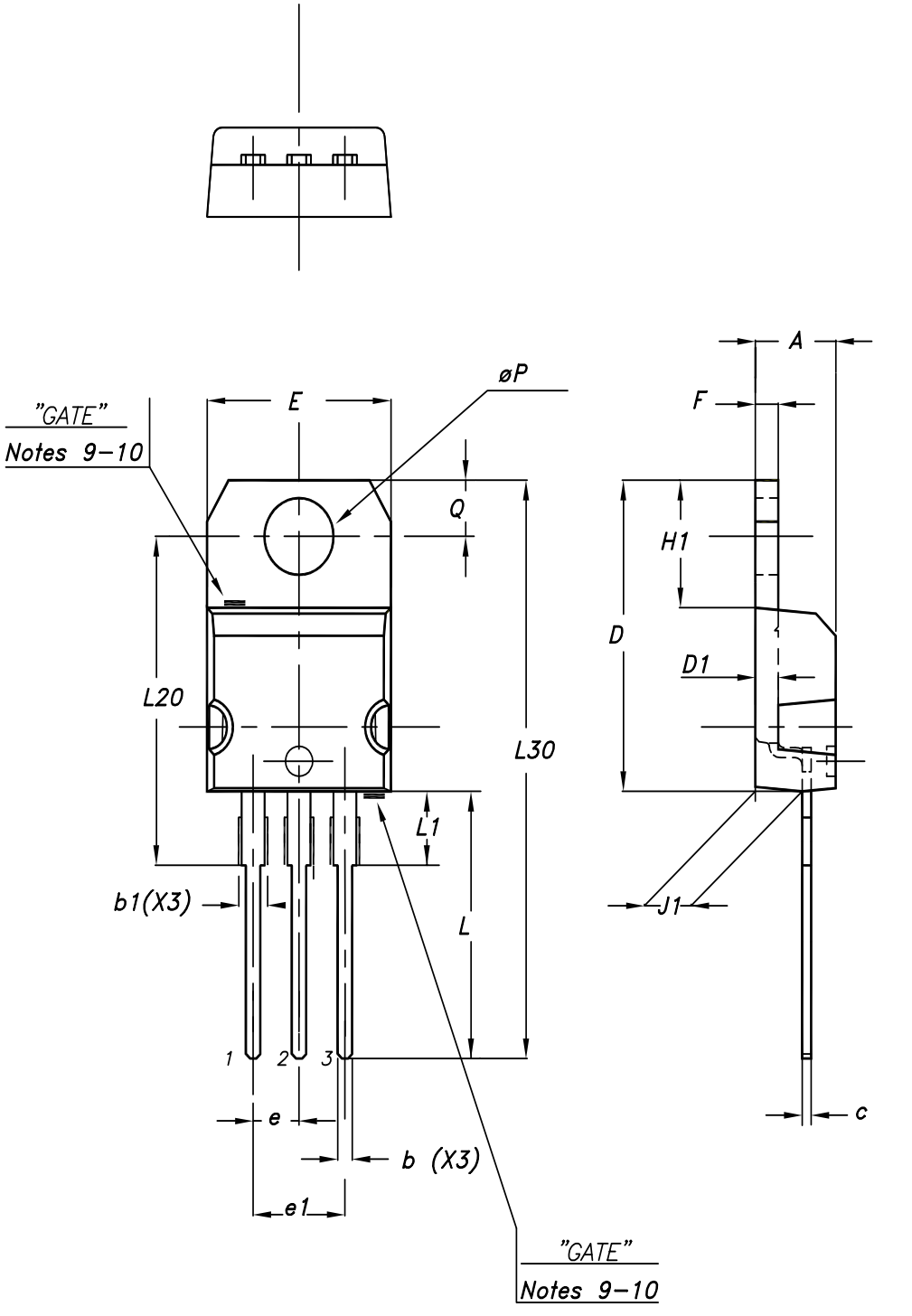

GAMG200920161329MT

# 8 Package information

To meet environmental requirements, ST offers these devices in different grades of ECOPACK packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions, and product status are available at: www.st.com. ECOPACK is an ST trademark.

## 8.1 TO-220 (dual gauge) package information

Figure 37. **TO-220 (dual gauge) package outline**




0015988_21_Type A

Table 19. **TO-220 (dual gauge) mechanical data**

| Dim. | mm | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 4.40 | | 4.60 |
| b | 0.61 | | 0.88 |
| b1 | 1.14 | | 1.70 |
| c | 0.48 | | 0.70 |
| D | 15.25 | | 15.75 |
| D1 | | 1.27 | |
| E | 10 | | 10.40 |
| e | 2.40 | | 2.70 |
| e1 | 4.95 | | 5.15 |
| F | 1.23 | | 1.32 |
| H1 | 6.20 | | 6.60 |
| J1 | 2.40 | | 2.72 |
| L | 13 | | 14 |
| L1 | 3.50 | | 3.93 |
| L20 | | 16.40 | |
| L30 | | 28.90 | |
| ∅P | 3.75 | | 3.85 |
| Q | 2.65 | | 2.95 |

## 8.2 TO-220 (single gauge) package information

Figure 38. **TO-220 (single gauge) package outline**

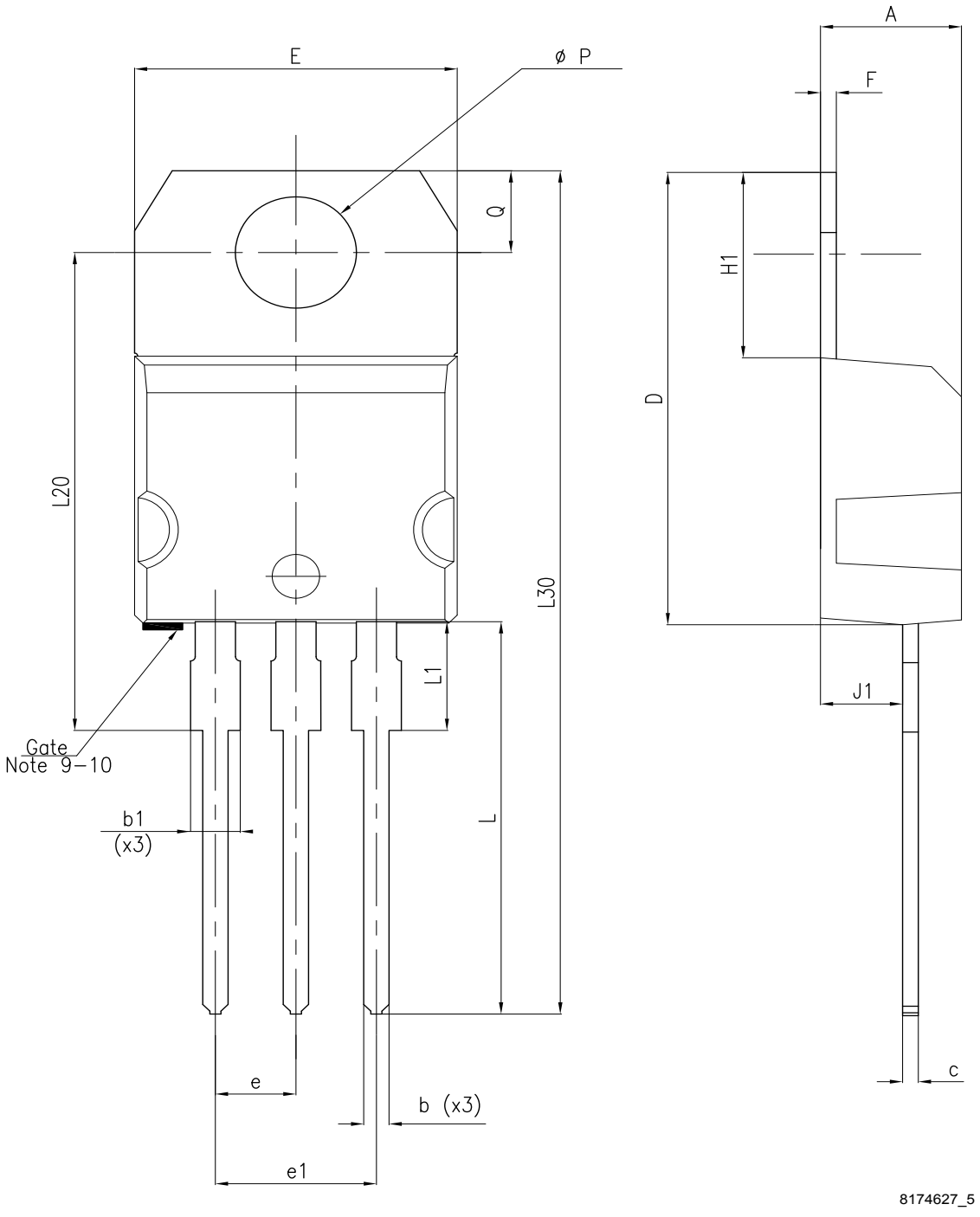



Table 20. **TO-220 (single gauge) mechanical data**

| Dim. | mm | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 4.40 | | 4.60 |

| Dim. | mm | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| b | 0.61 | | 0.88 |
| b1 | 1.14 | | 1.70 |
| c | 0.48 | | 0.70 |
| D | 15.25 | | 15.75 |
| E | 10.00 | | 10.40 |
| e | 2.40 | | 2.70 |
| e1 | 4.95 | | 5.15 |
| F | 0.51 | | 0.60 |
| H1 | 6.20 | | 6.60 |
| J1 | 2.40 | | 2.72 |
| L | 13.00 | | 14.00 |
| L1 | 3.50 | | 3.93 |
| L20 | | 16.40 | |
| L30 | | 28.90 | |
| ∅P | 3.75 | | 3.85 |
| Q | 2.65 | | 2.95 |

## 8.3 TO-220FP type A package information

Figure 39. **TO-220FP package outline**

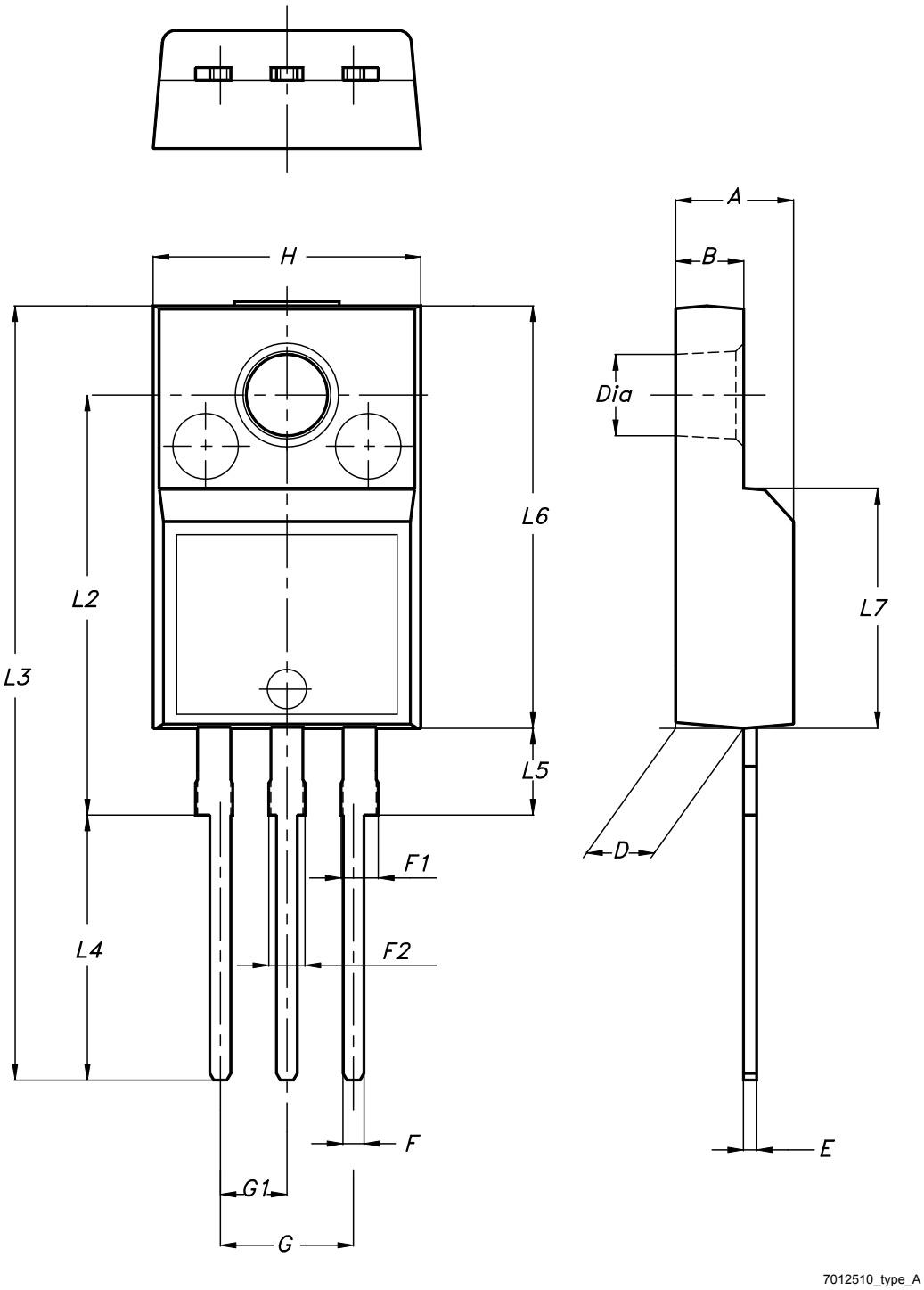


Table 21. **TO-220FP package mechanical data**

| Dim. | mm | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 4.4 | | 4.6 |
| B | 2.5 | | 2.7 |
| D | 2.5 | | 2.75 |
| E | 0.45 | | 0.7 |
| F | 0.75 | | 1 |
| F1 | 1.15 | | 1.70 |
| F2 | 1.15 | | 1.70 |
| G | 4.95 | | 5.2 |
| G1 | 2.4 | | 2.7 |
| H | 10 | | 10.4 |
| L2 | | 16 | |
| L3 | 28.6 | | 30.6 |
| L4 | 9.8 | | 10.6 |
| L5 | 2.9 | | 3.6 |
| L6 | 15.9 | | 16.4 |
| L7 | 9 | | 9.3 |
| Dia | 3 | | 3.2 |

## 8.4 TO-220 (single/dual) packing information

Figure 40. **Tube for TO-220 (dual gauge) (mm.)**

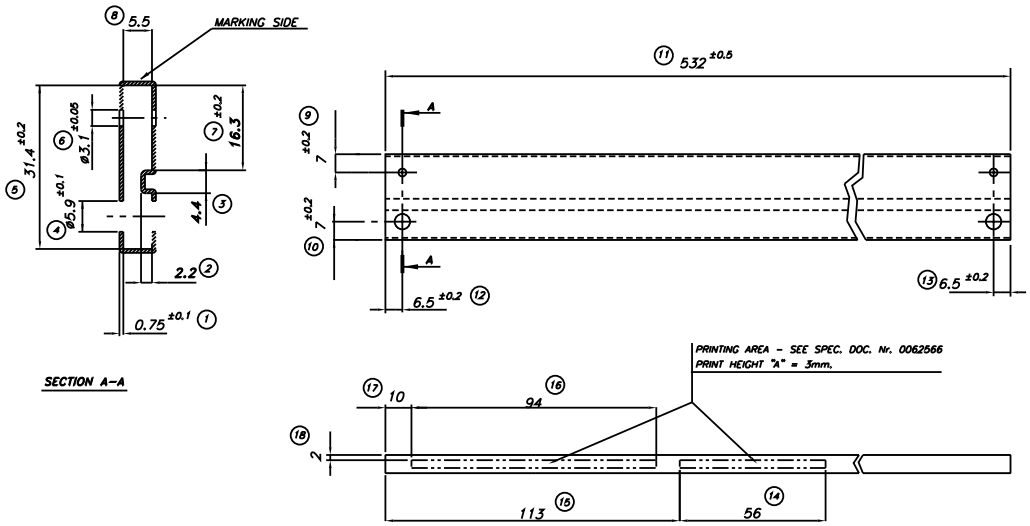
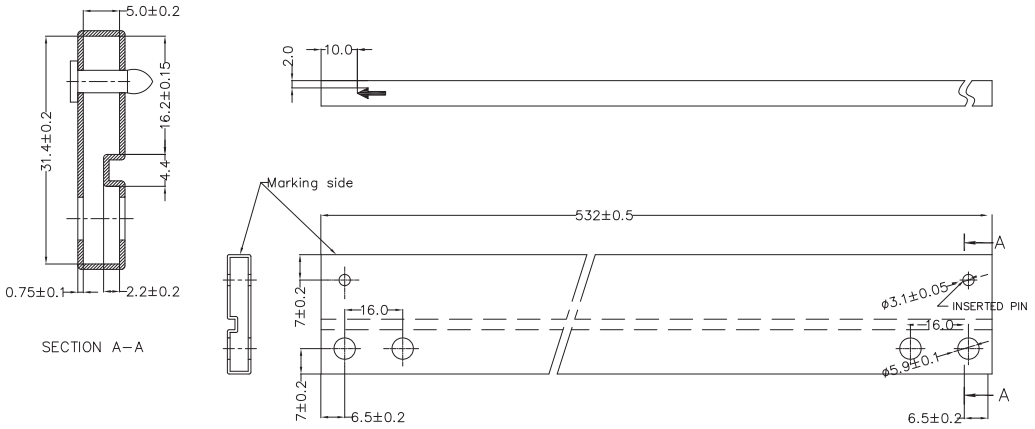


Figure 41. **Tube for TO-220 (single gauge) (mm.)**




## 8.5 DPAK package information

Figure 42. **DPAK package outline**

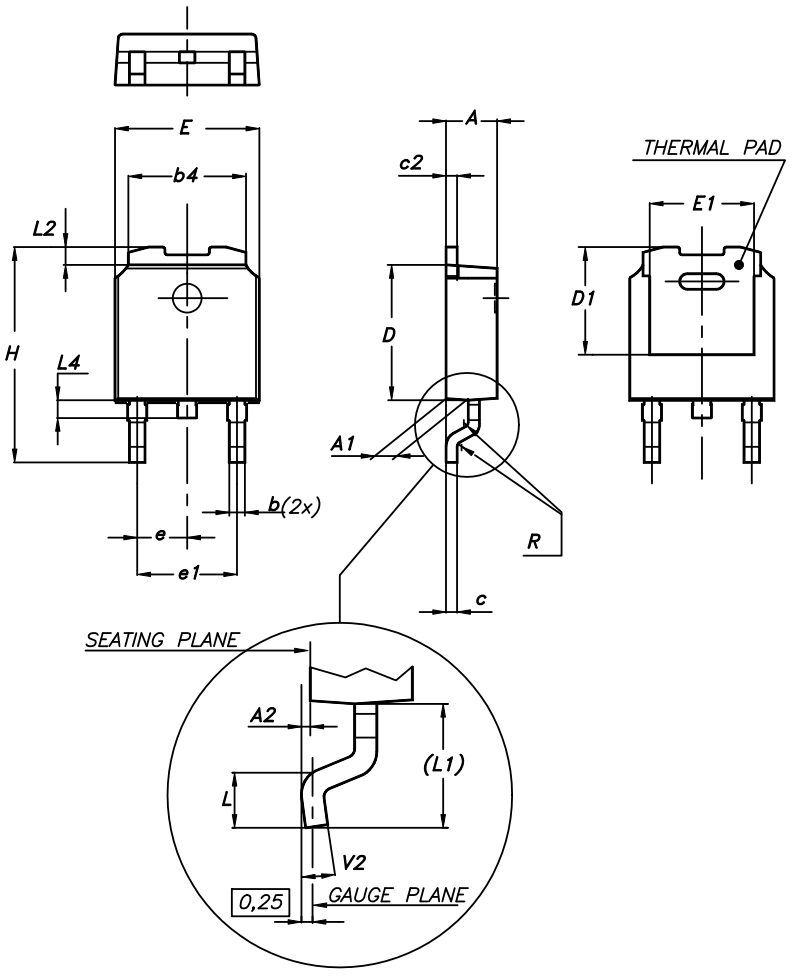
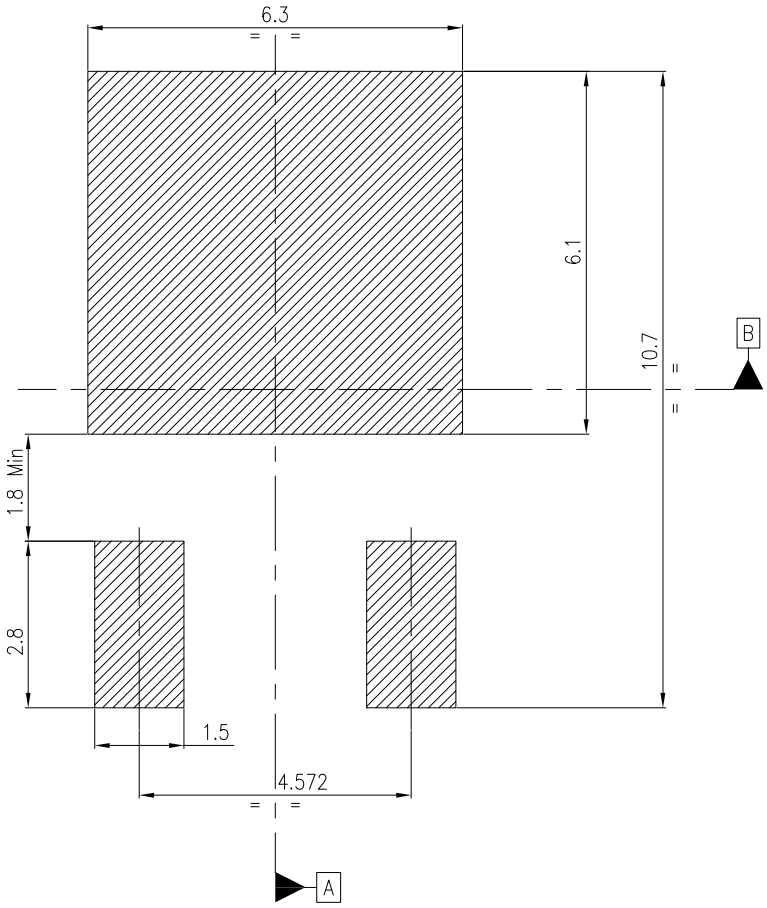


Table 22. **DPAK mechanical data**

| Dim. | mm | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 2.20 | | 2.40 |
| A1 | 0.90 | | 1.10 |
| A2 | 0.03 | | 0.23 |
| b | 0.64 | | 0.90 |
| b4 | 5.20 | | 5.40 |
| c | 0.45 | | 0.60 |
| c2 | 0.48 | | 0.60 |
| D | 6.00 | | 6.20 |
| D1 | | 5.10 | |
| E | 6.40 | | 6.60 |
| E1 | | 4.70 | |
| e | | 2.28 | |
| e1 | 4.40 | | 4.60 |
| H | 9.35 | | 10.10 |
| L | 1.00 | | 1.50 |
| (L1) | | 2.80 | |
| L2 | | 0.80 | |
| L4 | 0.60 | | 1.00 |
| R | | 0.20 | |
| V2 | 0° | | 8° |

Figure 43. **DPAK recommended footprint (dimensions are in mm)**



## 8.6 D²PAK (SMD 2L STD-ST) type A package information

Figure 44. D²PAK (SMD 2L STD-ST) type A package outline

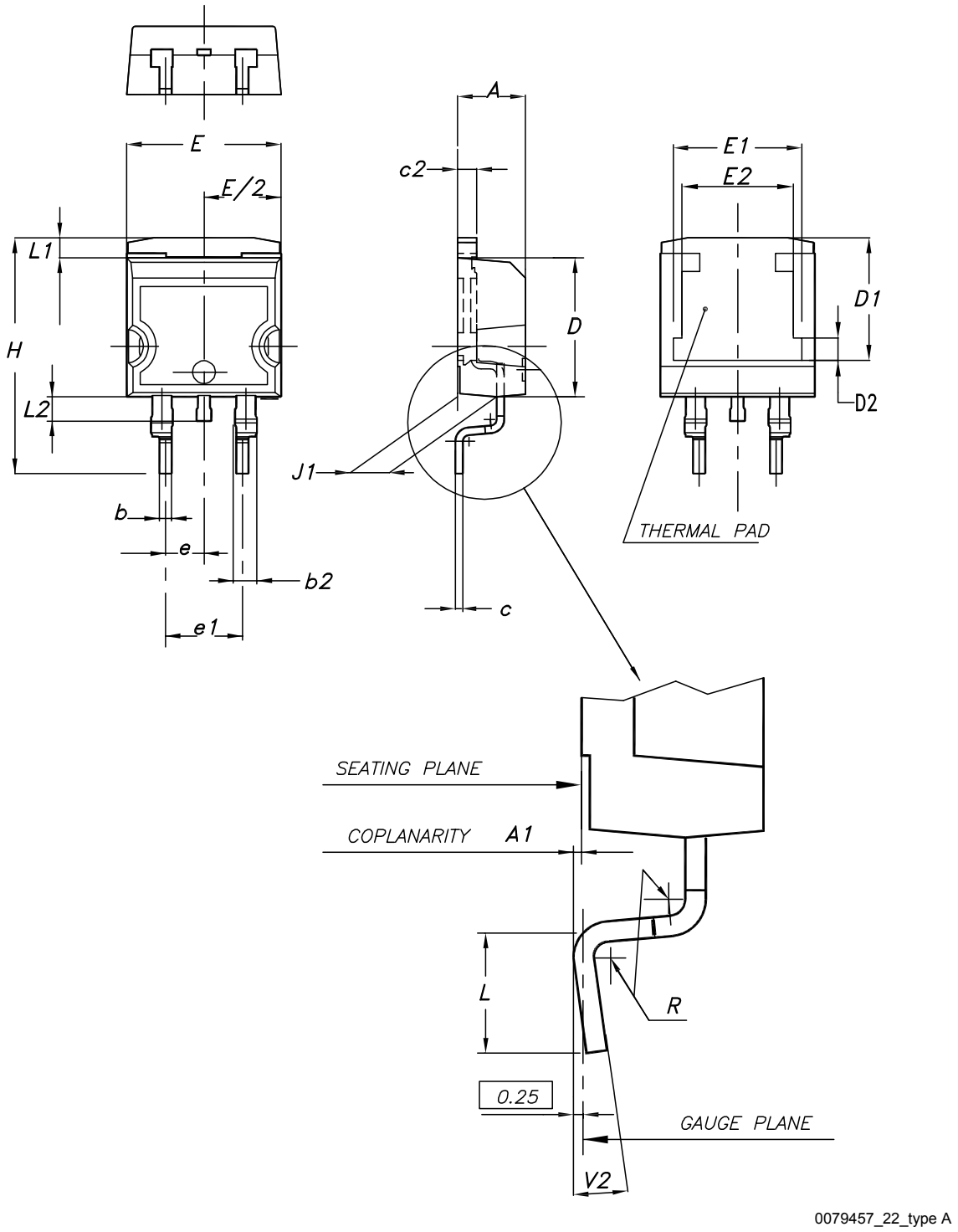
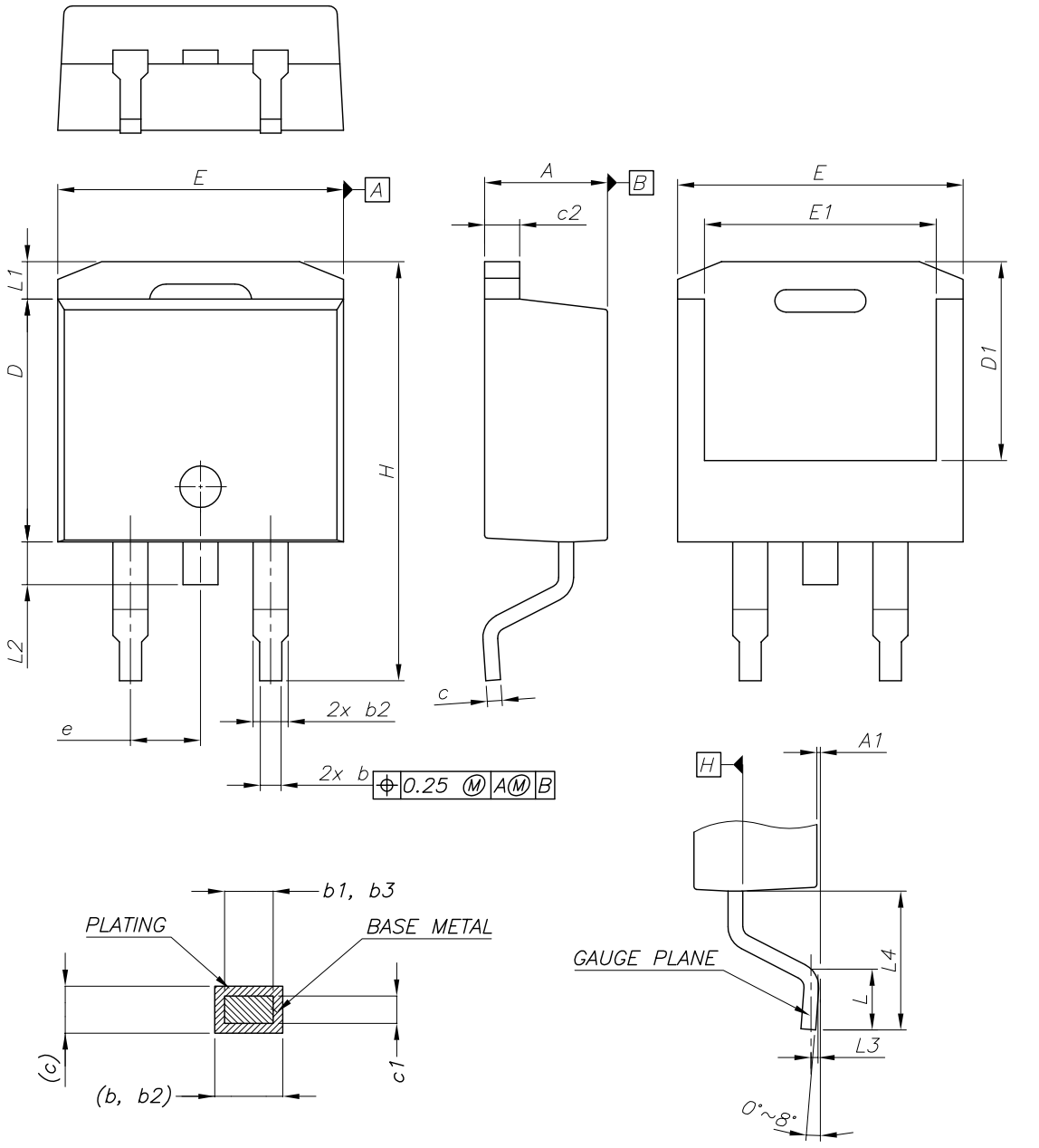


Table 23. D²PAK (SMD 2L STD-ST) mechanical data

| Dim. | mm | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 4.40 | | 4.60 |
| A1 | 0.03 | | 0.23 |
| b | 0.70 | | 0.93 |
| b2 | 1.14 | | 1.70 |
| c | 0.45 | | 0.60 |
| c2 | 1.23 | | 1.36 |
| D | 8.95 | | 9.35 |
| D1 | 7.50 | 7.75 | 8.00 |
| D2 | 1.10 | 1.30 | 1.50 |
| E | 10 | | 10.40 |
| E1 | 8.50 | 8.70 | 8.90 |
| E2 | 6.85 | 7.05 | 7.25 |
| e | | 2.54 | |
| e1 | 4.88 | | 5.28 |
| H | 15 | | 15.85 |
| J1 | 2.49 | | 2.69 |
| L | 2.29 | | 2.79 |
| L1 | 1.27 | | 1.40 |
| L2 | 1.30 | | 1.75 |
| R | | 0.4 | |
| V2 | 0° | | 8° |

## 8.7 D²PAK (ASE) type B package information

Figure 45. D²PAK (ASE subcon) type B package outline

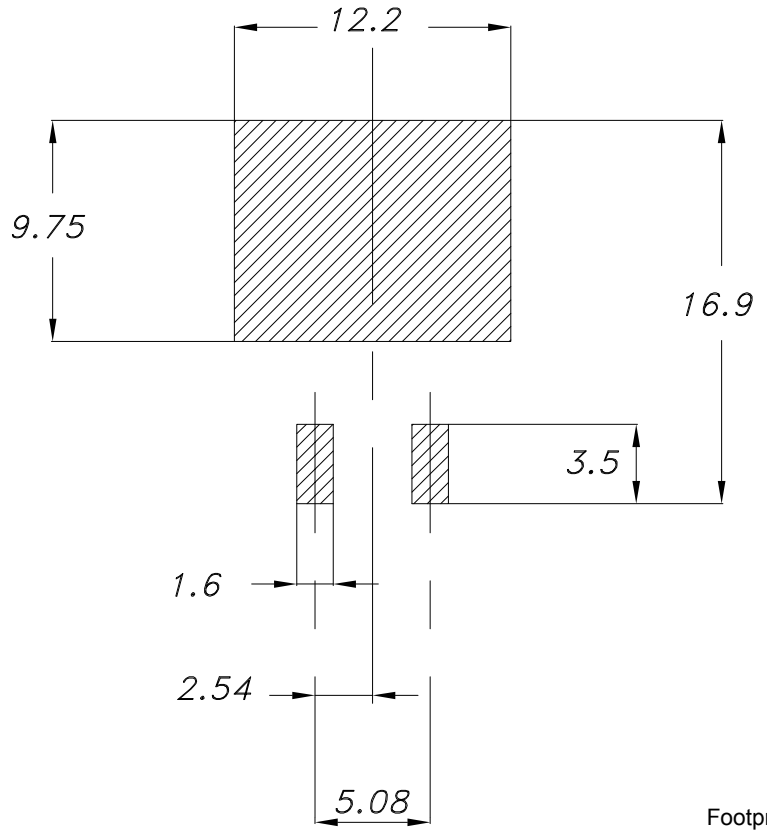



0079457_23_type B

Table 24. D²PAK (ASE) type B mechanical data

| Dim. | mm | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 4.36 | | 4.56 |
| A1 | 0 | | 0.25 |
| b | 0.70 | | 0.90 |
| b1 | 0.51 | | 0.89 |
| b2 | 1.17 | | 1.37 |
| b3 | 1.36 | | 1.46 |
| c | 0.38 | | 0.694 |
| c1 | 0.38 | | 0.534 |
| c2 | 1.19 | | 1.34 |
| D | 8.60 | | 9.00 |
| D1 | 6.90 | | 7.50 |
| E | 10.15 | | 10.55 |
| E1 | 8.10 | | 8.70 |
| e | | 2.54 | |
| H | 15.00 | | 15.60 |
| L | 1.90 | | 2.50 |
| L1 | | | 1.65 |
| L2 | | | 1.78 |
| L3 | | 0.25 | |
| L4 | 4.78 | | 5.28 |

Figure 46. D²PAK recommended footprint (dimensions are in mm)



## 8.8 D²PAK and DPAK packing information

Figure 47. **Tape outline**

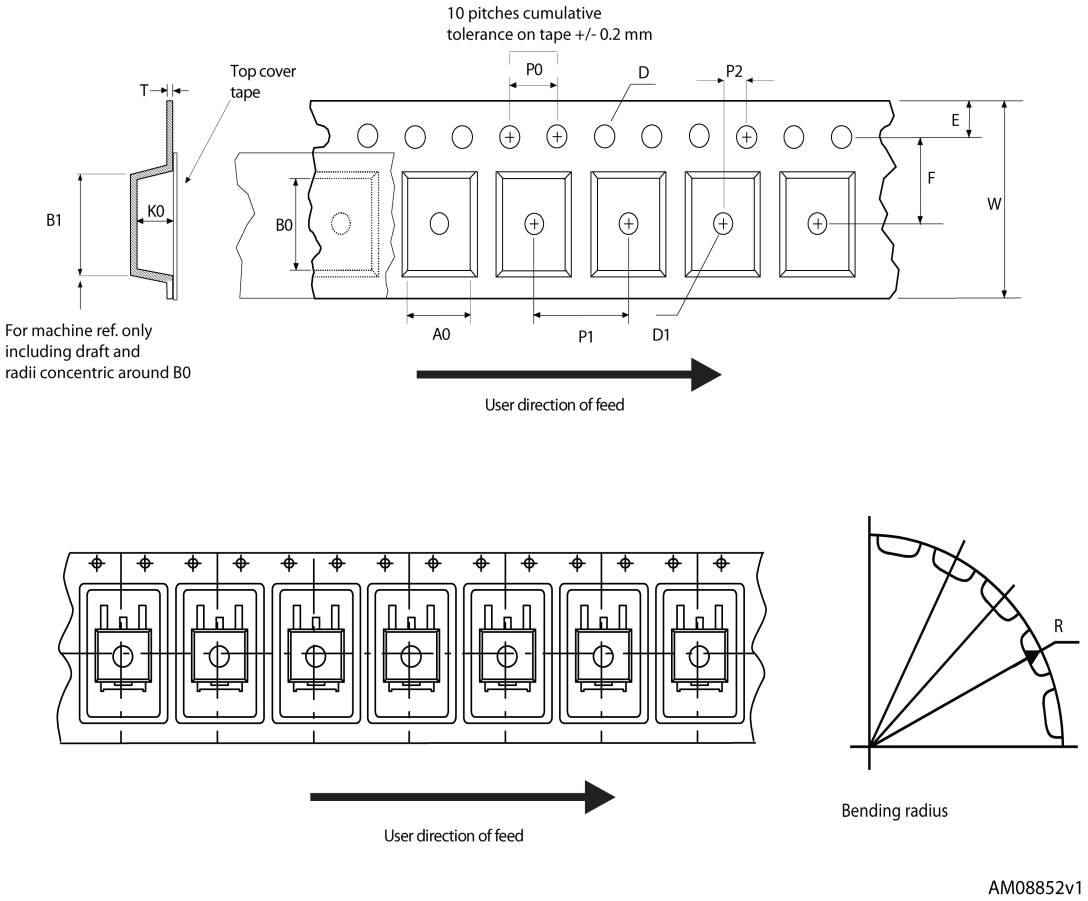


Figure 48. **Reel outline**

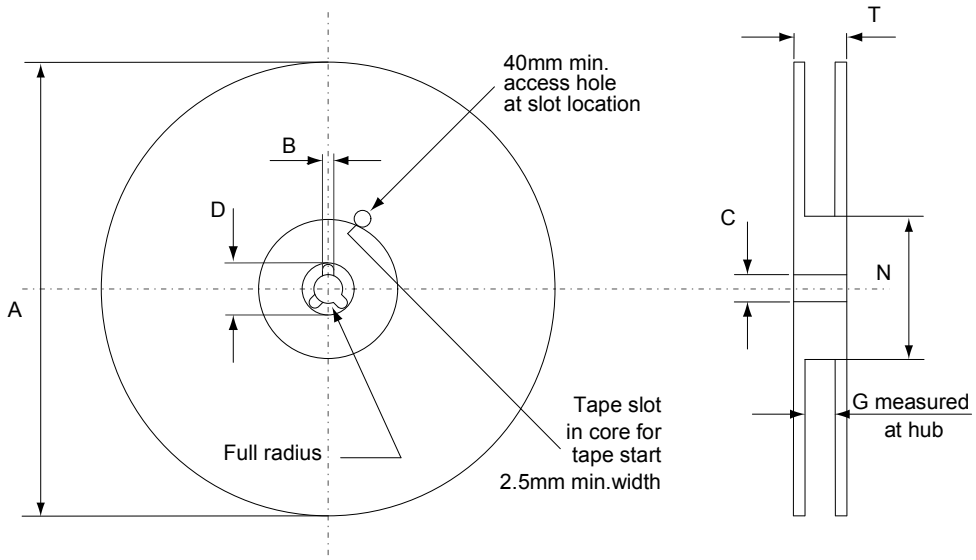



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Table 25. **D²PAK tape and reel mechanical data**

| Tape | | | Reel | | |
|---|---|---|---|---|---|
| Dim. | mm | | Dim. | mm | |
| | Min. | Max. | | Min. | Max. |
| A0 | 10.5 | 10.7 | A | | 330 |
| B0 | 15.7 | 15.9 | B | 1.5 | |
| D | 1.5 | 1.6 | C | 12.8 | 13.2 |
| D1 | 1.59 | 1.61 | D | 20.2 | |
| E | 1.65 | 1.85 | G | 24.4 | 26.4 |
| F | 11.4 | 11.6 | N | 100 | |
| K0 | 4.8 | 5.0 | T | | 30.4 |
| P0 | 3.9 | 4.1 | | | |
| P1 | 11.9 | 12.1 | Base quantity | | 1000 |
| P2 | 1.9 | 2.1 | Bulk quantity | | 1000 |
| R | 50 | | | | |
| T | 0.25 | 0.35 | | | |
| W | 23.7 | 24.3 | | | |

Table 26. **DPAK tape and reel mechanical data**

| Tape | | | Reel | | |
|---|---|---|---|---|---|
| Dim. | mm | | Dim. | mm | |
| | Min. | Max. | | Min. | Max. |
| A0 | 6.8 | 7 | A | | 330 |
| B0 | 10.4 | 10.6 | B | 1.5 | |
| B1 | | 12.1 | C | 12.8 | 13.2 |
| D | 1.5 | 1.6 | D | 20.2 | |
| D1 | 1.5 | | G | 16.4 | 18.4 |
| E | 1.65 | 1.85 | N | 50 | |
| F | 7.4 | 7.6 | T | | 22.4 |
| K0 | 2.55 | 2.75 | | | |
| P0 | 3.9 | 4.1 | Base qty. | | 2500 |
| P1 | 7.9 | 8.1 | Bulk qty. | | 2500 |
| P2 | 1.9 | 2.1 | | | |
| R | 40 | | | | |
| T | 0.25 | 0.35 | | | |
| W | 15.7 | 16.3 | | | |

# 9 Ordering information

Table 27. **Order codes**

| Part number | Order codes | | | | | |
|---|---|---|---|---|---|---|
| | TO-220 (single gauge) | TO-220 (dual gauge) | DPAK | D²PAK | TO-220FP | Output voltages |
| L7805C | L7805CV | L7805CV-DG | L7805CDT-TR | L7805CD2T-TR | L7805CP | 5 V |
| L7805AB | L7805ABV | L7805ABV-DG | | L7805ABD2T-TR | L7805ABP | 5 V |
| L7805AC | L7805ACV | L7805ACV-DG | | L7805ACD2T-TR | L7805ACP | 5 V |
| L7806C | L7806CV | L7806CV-DG | | L7806CD2T-TR | | 6 V |
| L7806AB | L7806ABV | L7806ABV-DG | | L7806ABD2T-TR | | 6 V |
| L7806AC | L7806ACV | L7806ACV-DG | | | | 6 V |
| L7808C | L7808CV | L7808CV-DG | | L7808CD2T-TR | | 8 V |
| L7808AB | L7808ABV | L7808ABV-DG | | L7808ABD2T-TR | | 8 V |
| L7808AC | L7808ACV | L7808ACV-DG | | | | 8 V |
| L7885C | L7885CV | | | | | 8.5 V |
| L7809C | L7809CV | L7809CV-DG | | L7809CD2T-TR | L7809CP | 9 V |
| L7809AB | L7809ABV | L7809ABV-DG | | L7809ABD2T-TR | | 9 V |
| L7809AC | L7809ACV | | | | | 9 V |
| L7812C | L7812CV | L7812CV-DG | | L7812CD2T-TR | L7812CP | 12 V |
| L7812AB | L7812ABV | L7812ABV-DG | | L7812ABD2T-TR | | 12 V |
| L7812AC | L7812ACV | L7812ACV-DG | | L7812ACD2T-TR | | 12 V |
| L7815C | L7815CV | L7815CV-DG | | L7815CD2T-TR | L7815CP | 15 V |
| L7815AB | L7815ABV | L7815ABV-DG | | L7815ABD2T-TR | | 15 V |
| L7815AC | L7815ACV | L7815ACV-DG | | L7815ACD2T-TR | | 15 V |
| L7818C | L7818CV | L7818CV-DG | | | | 18 V |
| L7824C | L7824CV | L7824CV-DG | | L7824CD2T-TR | L7824CP | 24 V |
| L7824AB | L7824ABV | L7824ABV-DG | | | | 24 V |
| L7824AC | L7824ACV | L7824ACV-DG | | | | 24 V |

## Revision history

Table 28. **Document revision history**

| Date | Revision | Changes |
|---|---|---|
| 21-Jun-2004 | 12 | Document updating. |
| 03-Aug-2006 | 13 | Order codes has been updated and new template. |
| 19-Jan-2007 | 14 | D²PAK mechanical data has been updated and add footprint data. |
| 31-May-2007 | 15 | Order codes has been updated. |
| 29-Aug-2007 | 16 | Added Table 1 in cover page. |
| 11-Dec-2007 | 17 | Modified: Table 27. |
| 06-Feb-2008 | 18 | Added: TO-220 mechanical data Figure 38 on page 38 , Figure 39 on page 39, and Table 23 on page 37. Modified: Table 27 on page 58. |
| 18-Mar-2008 | 19 | Added: Table 29: DPAK mechanical data on page 50, Table 30: Tape and reel DPAK mechanical data on page 52. Modified: Table 27 on page 58. |
| 26-Jan-2010 | 20 | Modified Table 1 on page 1 and Table 23 on page 37, added: Figure 38 on page 38 and Figure 39 on page 39, Figure 40 on page 45 and Figure 41 on page 45. |
| 04-Mar-2010 | 21 | Added notes Figure 38 on page 38. |
| 08-Sep-2010 | 22 | Modified Table 27 on page 58. |
| 23-Nov-2010 | 23 | Added: TJ = 25 °C test condition in DVO on Table 3, 4, 5, 6, 7, 8 and Table 9. |
| 16-Sep-2011 | 24 | Modified title on page 1. |
| 30-Nov-2011 | 25 | Added: order codes L7805CV-DG, L7806CV-DG, L7808ABV-DG, L7812CV-DG and L7815CV-DG Table 27 on page 58. |
| 08-Feb-2012 | 26 | Added: order codes L7805ACV-DG, L7805ABV-DG, L7806ABV-DG, L7808CV-DG, L7809CV-DG, L7812ACV-DG, L7818CV-DG, L7824CV-DG Table 27 on page 58. |
| 27-Mar-2012 | 27 | Added: order codes L7812ABV-DG, L7815ABV-DG Table 27 on page 58. |
| 27-Apr-2012 | 28 | Modified: VI = 10.4 to 23 V ==> VI = 11.4 to 23 V test conditon value Line regulation Table 6 on page 13. |
| 10-May-2012 | 29 | Added: order codes L7806ACV-DG, L7808ACV-DG, L7815ACV-DG, L7824ABV-DG and L7824ACV-DG Table 27 on page 58. |
| 19-Sep-2012 | 30 | Modified load regulation units from V to mV in Table 3 to Table 9. |
| 12-Mar-2013 | 31 | Modified: VO output voltage at 25 °C min. value 14.4 V Table 16 on page 23. |
| 04-Mar-2014 | 32 | Part numbers L78xx, L78xxC, L78xxAB, L78xxAC changed to L78.<br>Removed TO-3 package.<br>Updated the description in cover page, Section 2: Pin configuration, Section 3: Maximum ratings, Section 4: Test circuits, Section 5: Electrical characteristics, Section 6: Application information, Section 8: Package information and Table 27: Order codes.<br>Added Section 9: Packaging mechanical data.<br>Minor text changes. |
| 26-Feb-2016 | 33 | Updated Section 8: Package information.<br>Minor text changes. |
| 28-Nov-2016 | 34 | Updated Section 9: "Ordering information".<br>Minor text changes. |
| 25-May-2018 | 35 | Updated D²PAK package Section 8.7 D²PAK (ASE) type B package information. |
| 17-Sep-2018 | 36 | Updated Figure 29. Dropout voltage vs junction temperature. |
| 16-Oct-2024 | 37 | Updated Table 4 |

# Contents

# List of tables

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