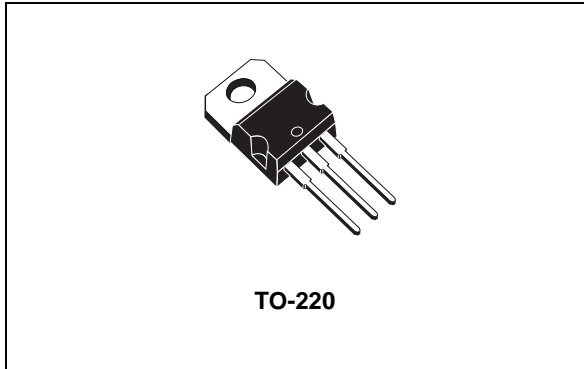


2 A positive voltage regulator IC

Datasheet - production data



Description

The L78S series of three-terminal positive regulators is available in TO-220 package 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 2 A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

Features

- Output current up to 2 A
- Output voltages of 5; 7.5; 9; 10; 12; 15; 18; 24 V
- Thermal protection
- Short circuit protection
- Output transition SOA protection

Table 1. Device summary

| Part numbers | TO-220 packages | | Output voltage |
|--------------|-----------------|--------------|----------------|
| | Dual gauge | Single gauge | |
| L78S05C | L78S05CV-DG | L78S05CV | 5 V |
| L78S75C | L78S75CV-DG | L78S75CV | 7.5 V |
| L78S09C | L78S09CV-DG | L78S09CV | 9 V |
| L78S10C | L78S10CV-DG | L78S10CV | 10 V |
| L78S12C | L78S12CV-DG | L78S12CV | 12 V |
| L78S15C | L78S15CV-DG | L78S15CV | 15 V |
| L78S18C | | L78S18CV | 18 V |
| L78S24C | | L78S24CV | 24 V |

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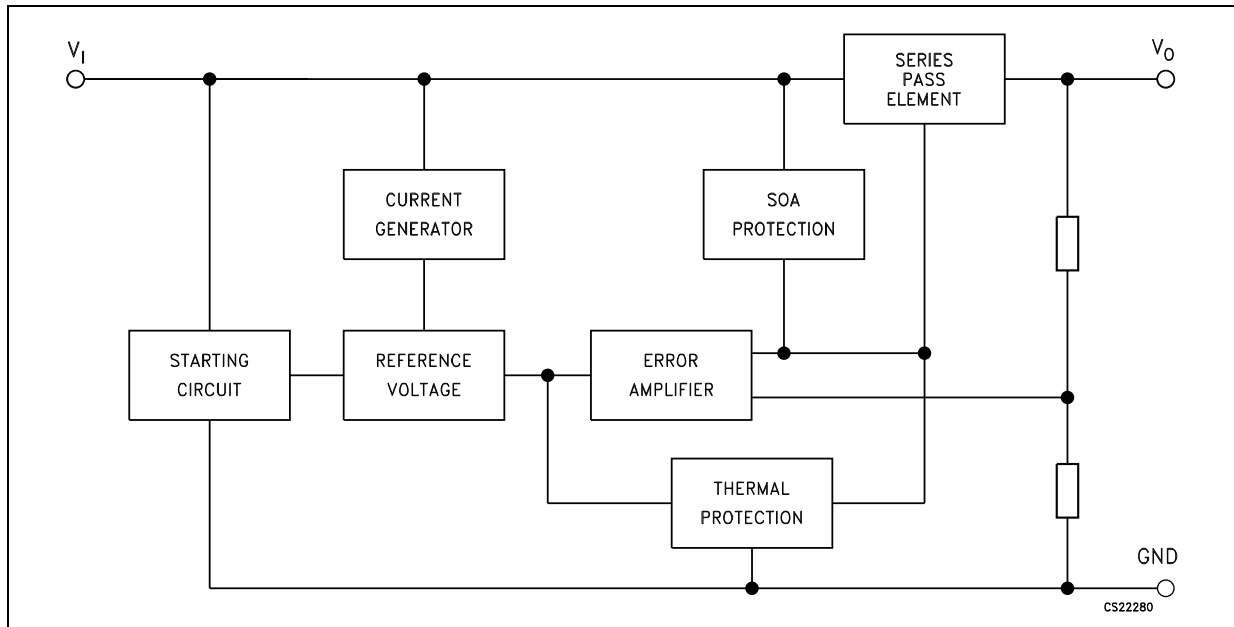
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1 Diagram

Figure 1. Block diagram



2 Pin configuration

Figure 2. Pin connections (top view)

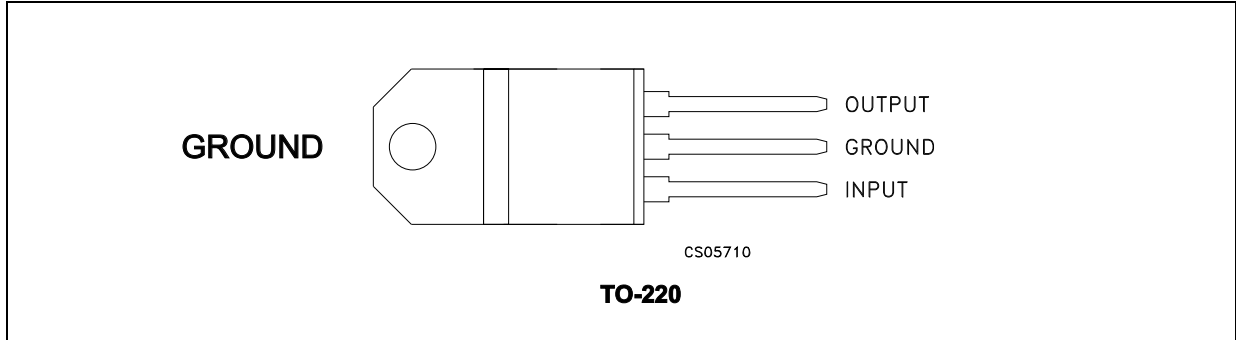
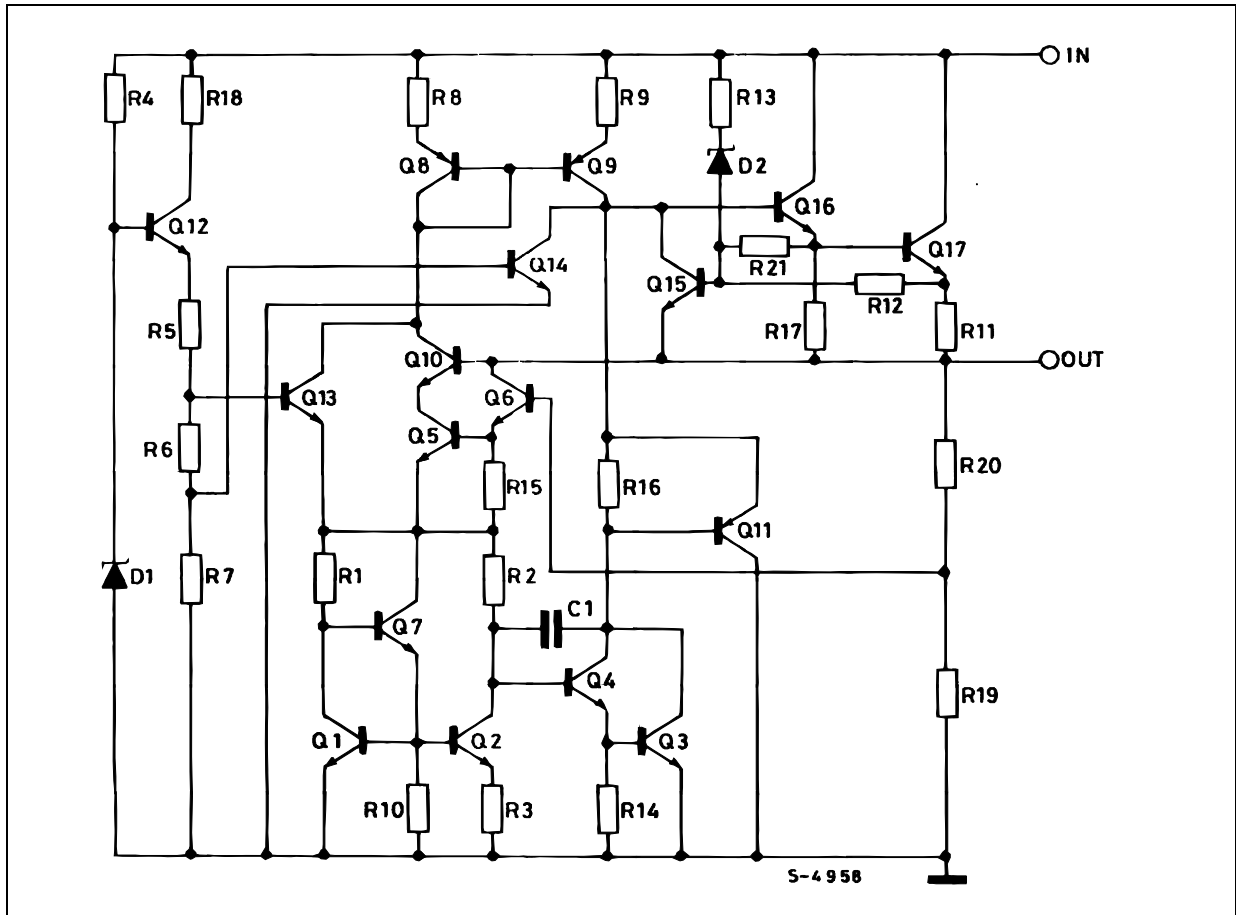


Figure 3. Schematic diagram



3 Maximum ratings

Table 2. Absolute maximum ratings

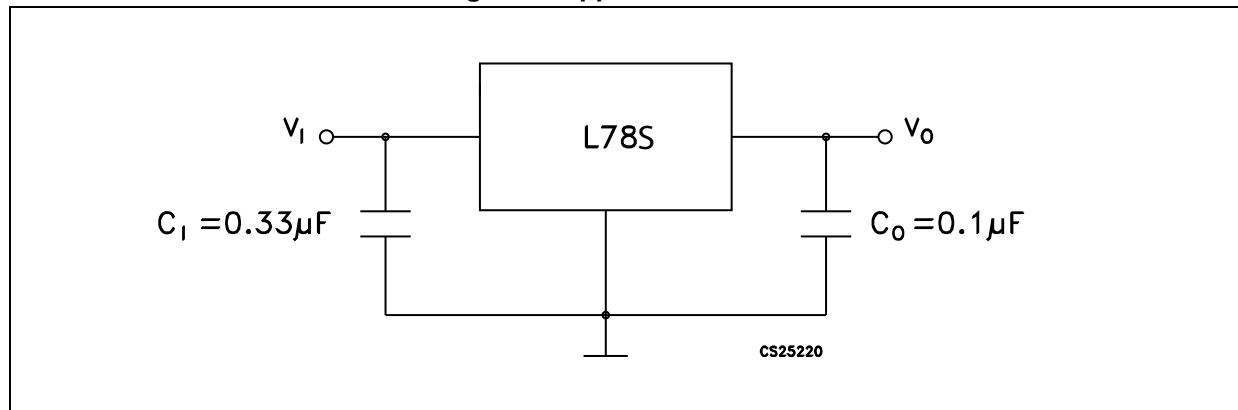
| Symbol | Parameter | | Value | Unit |
|-----------|--------------------------------------|------------------------|--------------------|------|
| V_I | DC input voltage | for $V_O = 5$ to $18V$ | 35 | V |
| | | for $V_O = 24V$ | 40 | |
| I_O | Output current | | Internally limited | |
| P_D | Power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

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

Table 3. Thermal data

| Symbol | Parameter | TO-220 | Unit |
|------------|-------------------------------------|--------|------|
| R_{thJC} | Thermal resistance junction-case | 5 | °C/W |
| R_{thJA} | Thermal resistance junction-ambient | 50 | °C/W |

Figure 4. Application circuits



4 Test circuits

Figure 5. DC parameter

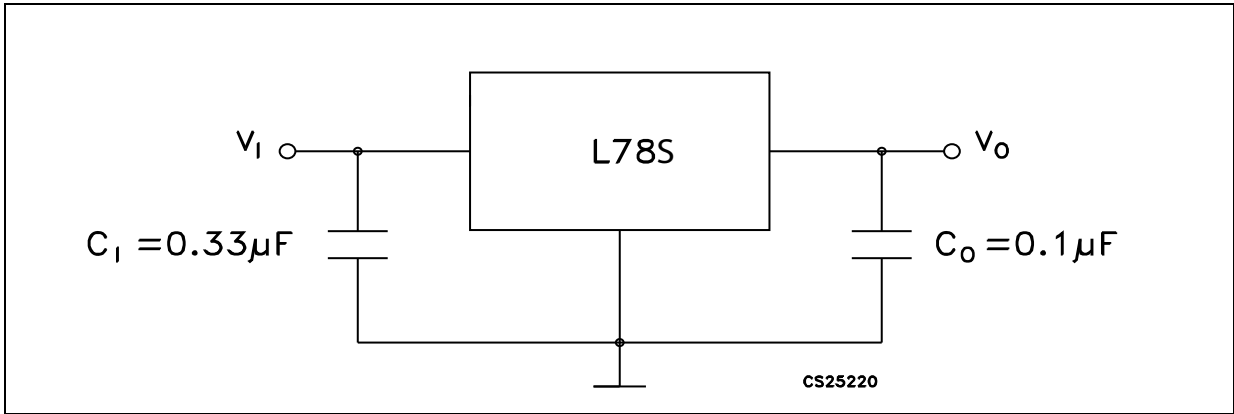


Figure 6. Load regulation

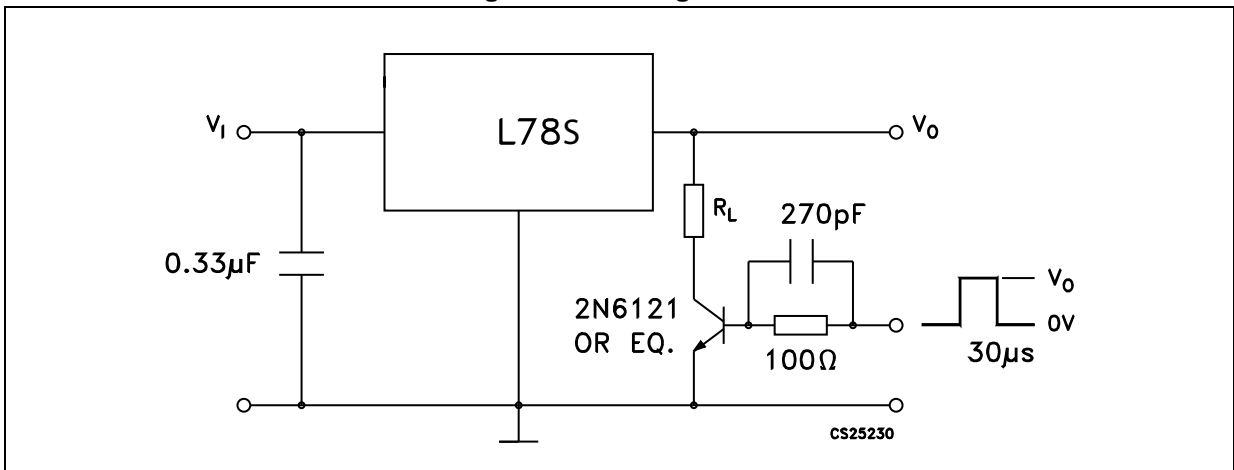
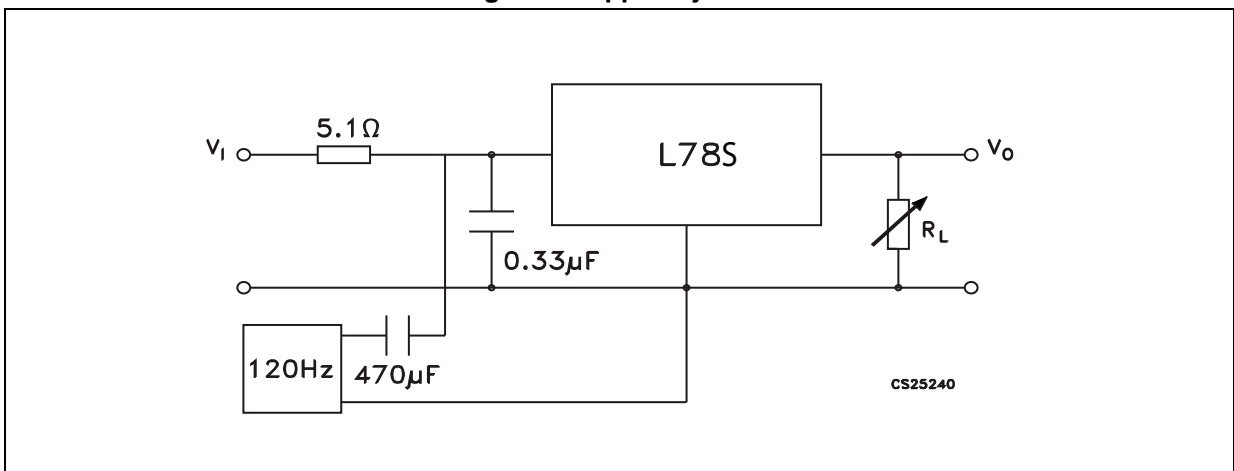


Figure 7. Ripple rejection



5 Electrical characteristics

Refer to the test circuits, $T_J = 25\text{ °C}$, $V_I = 10\text{ V}$, $I_O = 500\text{ mA}$, unless otherwise specified.

Table 4. Electrical characteristics of L78S05C

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------------|----------------------------|---|-------------------|------|------|---------------|
| V_O | Output voltage | | 4.8 | 5 | 5.2 | V |
| V_O | Output voltage | $I_O = 1\text{ A}$, $V_I = 7\text{ V}$ | 4.75 | 5 | 5.25 | V |
| ΔV_O | Line regulation | $V_I = 7\text{ to }25\text{ V}$ | | | 100 | mV |
| | | $V_I = 8\text{ to }25\text{ V}$ | | | 50 | |
| ΔV_O | Load regulation | $I_O = 20\text{ mA to }1.5\text{ A}$ | | | 100 | mV |
| | | $I_O = 2\text{ A}$ | | 80 | | |
| I_Q | Quiescent current | | | | 8 | mA |
| ΔI_Q | Quiescent current change | $I_O = 20\text{ mA to }1\text{ A}$ | | | 0.5 | mA |
| | | $V_I = 7\text{ to }25\text{ V}$, $I_O = 20\text{ mA}$ | | | 1.3 | |
| $\Delta V_O/\Delta T$ | Output voltage drift | $I_O = 5\text{ mA}$, $T_J = 0\text{ °C to }70\text{ °C}$ | | -1.1 | | mV/°C |
| eN | Output noise voltage | $B = 10\text{ Hz to }100\text{ kHz}$ | | 40 | | μV |
| SVR | Supply voltage rejection | $f = 120\text{ Hz}$ | 54 ⁽¹⁾ | | | dB |
| V_I | Operating input voltage | $I_O \leq 1\text{ A}$ | 8 | | | V |
| R_O | Output resistance | $f = 1\text{ kHz}$ | | 17 | | m Ω |
| I_{sc} | Short circuit current | $V_I = 27\text{ V}$ | | 500 | | mA |
| I_{scp} | Short circuit peak current | | | 3 | | A |

1. Guaranteed by design.

Refer to the test circuits, $T_J = 25\text{ °C}$, $V_I = 12.5\text{ V}$, $I_O = 500\text{ mA}$, unless otherwise specified.

Table 5. Electrical characteristics of L78S75C

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------------|----------------------------|---|-------------------|------|------|-------|
| V_O | Output voltage | | 7.15 | 7.5 | 7.9 | V |
| V_O | Output voltage | $I_O = 1\text{ A}$, $V_I = 9.5\text{ V}$ | 7.1 | 7.5 | 7.95 | V |
| ΔV_O | Line regulation | $V_I = 9.5\text{ to }25\text{ V}$ | | | 120 | mV |
| | | $V_I = 10.5\text{ to }20\text{ V}$ | | | 60 | |
| ΔV_O | Load regulation | $I_O = 20\text{ mA to }1.5\text{ A}$ | | | 140 | mV |
| | | $I_O = 2\text{ A}$ | | 100 | | |
| I_Q | Quiescent current | | | | 8 | mA |
| ΔI_Q | Quiescent current change | $I_O = 20\text{ mA to }1\text{ A}$ | | | 0.5 | mA |
| | | $V_I = 9.5\text{ to }25\text{ V}$, $I_O = 20\text{ mA}$ | | | 1.3 | |
| $\Delta V_O/\Delta T$ | Output voltage drift | $I_O = 5\text{ mA}$, $T_J = 0\text{ °C to }70\text{ °C}$ | | -0.8 | | mV/°C |
| eN | Output noise voltage | $B = 10\text{ Hz to }100\text{ kHz}$ | | 52 | | μV |
| SVR | Supply voltage rejection | $f = 120\text{ Hz}$ | 48 ⁽¹⁾ | | | dB |
| V_I | Operating input voltage | $I_O \leq 1\text{ A}$ | 10.5 | | | V |
| R_O | Output resistance | $f = 1\text{ kHz}$ | | 16 | | mΩ |
| I_{sc} | Short circuit current | $V_I = 27\text{ V}$ | | 500 | | mA |
| I_{scp} | Short circuit peak current | | | 3 | | A |

1. Guaranteed by design.

Refer to the test circuits, $T_J = 25\text{ °C}$, $V_I = 14\text{ V}$, $I_O = 500\text{ mA}$, unless otherwise specified.

Table 6. Electrical characteristics of L78S09C

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------------|----------------------------|---|-------------------|------|------|---------------|
| V_O | Output voltage | | 8.65 | 9 | 9.35 | V |
| V_O | Output voltage | $I_O = 1\text{ A}$, $V_I = 11\text{ V}$ | 8.6 | 9 | 9.4 | V |
| ΔV_O | Line regulation | $V_I = 11\text{ to }25\text{ V}$ | | | 130 | mV |
| | | $V_I = 11\text{ to }20\text{ V}$ | | | 65 | |
| ΔV_O | Load regulation | $I_O = 20\text{ mA to }1.5\text{ A}$ | | | 170 | mV |
| | | $I_O = 2\text{ A}$ | | 100 | | |
| I_Q | Quiescent current | | | | 8 | mA |
| ΔI_Q | Quiescent current change | $I_O = 20\text{ mA to }1\text{ A}$ | | | 0.5 | mA |
| | | $V_I = 11\text{ to }25\text{ V}$, $I_O = 20\text{ mA}$ | | | 1.3 | |
| $\Delta V_O/\Delta T$ | Output voltage drift | $I_O = 5\text{ mA}$, $T_J = 0\text{ °C to }70\text{ °C}$ | | -1 | | mV/°C |
| eN | Output noise voltage | $B = 10\text{ Hz to }100\text{ kHz}$ | | 60 | | μV |
| SVR | Supply voltage rejection | $f = 120\text{ Hz}$ | 47 ⁽¹⁾ | | | dB |
| V_I | Operating input voltage | $I_O \leq 1\text{ A}$ | 12 | | | V |
| R_O | Output resistance | $f = 1\text{ kHz}$ | | 17 | | m Ω |
| I_{sc} | Short circuit current | $V_I = 27\text{ V}$ | | 500 | | mA |
| I_{scp} | Short circuit peak current | | | 3 | | A |

1. Guaranteed by design.

Refer to the test circuits, $T_J = 25\text{ °C}$, $V_I = 15\text{ V}$, $I_O = 500\text{ mA}$, unless otherwise specified.

Table 7. Electrical characteristics of L78S10C

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------------|----------------------------|---|-------------------|------|------|-------|
| V_O | Output voltage | | 9.5 | 10 | 10.5 | V |
| V_O | Output voltage | $I_O = 1\text{ A}$, $V_I = 12.5\text{ V}$ | 9.4 | 10 | 10.6 | V |
| ΔV_O | Line regulation | $V_I = 12.5\text{ to }30\text{ V}$ | | | 200 | mV |
| | | $V_I = 14\text{ to }22\text{ V}$ | | | 100 | |
| ΔV_O | Load regulation | $I_O = 20\text{ mA to }1.5\text{ A}$ | | | 240 | mV |
| | | $I_O = 2\text{ A}$ | | 150 | | |
| I_Q | Quiescent current | | | | 8 | mA |
| ΔI_Q | Quiescent current change | $I_O = 20\text{ mA to }1\text{ A}$ | | | 0.5 | mA |
| | | $V_I = 12.5\text{ to }30\text{ V}$, $I_O = 20\text{ mA}$ | | | 1 | |
| $\Delta V_O/\Delta T$ | Output voltage drift | $I_O = 5\text{ mA}$, $T_J = 0\text{ °C to }70\text{ °C}$ | | -1 | | mV/°C |
| eN | Output noise voltage | $B = 10\text{ Hz to }100\text{ kHz}$ | | 65 | | µV |
| SVR | Supply voltage rejection | $f = 120\text{ Hz}$ | 47 ⁽¹⁾ | | | dB |
| V_I | Operating input voltage | $I_O \leq 1\text{ A}$ | 13 | | | V |
| R_O | Output resistance | $f = 1\text{ kHz}$ | | 17 | | mΩ |
| I_{sc} | Short circuit current | $V_I = 27\text{ V}$ | | 500 | | mA |
| I_{scp} | Short circuit peak current | | | 3 | | A |

1. Guaranteed by design.

Refer to the test circuits, $T_J = 25\text{ °C}$, $V_I = 19\text{ V}$, $I_O = 500\text{ mA}$, unless otherwise specified.

Table 8. Electrical characteristics of L78S12C

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------------|----------------------------|---|-------------------|------|------|---------------|
| V_O | Output voltage | | 11.5 | 12 | 12.5 | V |
| V_O | Output voltage | $I_O = 1\text{ A}$, $V_I = 14.5\text{ V}$ | 11.4 | 12 | 12.6 | V |
| ΔV_O | Line regulation | $V_I = 14.5\text{ to }30\text{ V}$ | | | 240 | mV |
| | | $V_I = 16\text{ to }22\text{ V}$ | | | 120 | |
| ΔV_O | Load regulation | $I_O = 20\text{ mA to }1.5\text{ A}$ | | | 240 | mV |
| | | $I_O = 2\text{ A}$ | | 150 | | |
| I_Q | Quiescent current | | | | 8 | mA |
| ΔI_Q | Quiescent current change | $I_O = 20\text{ mA to }1\text{ A}$ | | | 0.5 | mA |
| | | $V_I = 14.5\text{ to }30\text{ V}$, $I_O = 20\text{ mA}$ | | | 1 | |
| $\Delta V_O/\Delta T$ | Output voltage drift | $I_O = 5\text{ mA}$, $T_J = 0\text{ °C to }70\text{ °C}$ | | -1 | | mV/°C |
| eN | Output noise voltage | B = 10 Hz to 100 kHz | | 75 | | μV |
| SVR | Supply voltage rejection | f = 120 Hz | 47 ⁽¹⁾ | | | dB |
| V_I | Operating input voltage | $I_O \leq 1\text{ A}$ | 15 | | | V |
| R_O | Output resistance | f = 1 kHz | | 18 | | m Ω |
| I_{sc} | Short circuit current | $V_I = 27\text{ V}$ | | 500 | | mA |
| I_{scp} | Short circuit peak current | | | 3 | | A |

1. Guaranteed by design.

Refer to the test circuits, $T_J = 25\text{ °C}$, $V_I = 23\text{ V}$, $I_O = 500\text{ mA}$, unless otherwise specified.

Table 9. Electrical characteristics of L78S15C

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------------|----------------------------|---|-------------------|------|-------|---------------|
| V_O | Output voltage | | 14.4 | 15 | 15.6 | V |
| V_O | Output voltage | $I_O = 1\text{ A}$, $V_I = 17.5\text{ V}$ | 14.25 | 15 | 15.75 | V |
| ΔV_O | Line regulation | $V_I = 17.5\text{ to }30\text{ V}$ | | | 300 | mV |
| | | $V_I = 20\text{ to }26\text{ V}$ | | | 150 | |
| ΔV_O | Load regulation | $I_O = 20\text{ mA to }1.5\text{ A}$ | | | 300 | mV |
| | | $I_O = 2\text{ A}$ | | 150 | | |
| I_Q | Quiescent current | | | | 8 | mA |
| ΔI_Q | Quiescent current change | $I_O = 20\text{ mA to }1\text{ A}$ | | | 0.5 | mA |
| | | $V_I = 17.5\text{ to }30\text{ V}$, $I_O = 20\text{ mA}$ | | | 1 | |
| $\Delta V_O/\Delta T$ | Output voltage drift | $I_O = 5\text{ mA}$, $T_J = 0\text{ °C to }70\text{ °C}$ | | -1 | | mV/°C |
| eN | Output noise voltage | $B = 10\text{ Hz to }100\text{ kHz}$ | | 90 | | μV |
| SVR | Supply voltage rejection | $f = 120\text{ Hz}$ | 46 ⁽¹⁾ | | | dB |
| V_I | Operating input voltage | $I_O \leq 1\text{ A}$ | 18 | | | V |
| R_O | Output resistance | $f = 1\text{ kHz}$ | | 19 | | m Ω |
| I_{sc} | Short circuit current | $V_I = 27\text{ V}$ | | 500 | | mA |
| I_{scp} | Short circuit peak current | | | 3 | | A |

1. Guaranteed by design.

Refer to the test circuits, $T_J = 25\text{ °C}$, $V_I = 26\text{ V}$, $I_O = 500\text{ mA}$, unless otherwise specified.

Table 10. Electrical characteristics of L78S18C

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------------|----------------------------|---|-------------------|------|------|-------|
| V_O | Output voltage | | 17.1 | 18 | 18.9 | V |
| V_O | Output voltage | $I_O = 1\text{ A}$, $V_I = 20.5\text{ V}$ | 17 | 18 | 19 | V |
| ΔV_O | Line regulation | $V_I = 20.5\text{ to }30\text{ V}$ | | | 360 | mV |
| | | $V_I = 22\text{ to }28\text{ V}$ | | | 180 | |
| ΔV_O | Load regulation | $I_O = 20\text{ mA to }1.5\text{ A}$ | | | 360 | mV |
| | | $I_O = 2\text{ A}$ | | 200 | | |
| I_Q | Quiescent current | | | | 8 | mA |
| ΔI_Q | Quiescent current change | $I_O = 20\text{ mA to }1\text{ A}$ | | | 0.5 | mA |
| | | $V_I = 20.5\text{ to }30\text{ V}$, $I_O = 20\text{ mA}$ | | | 1 | |
| $\Delta V_O/\Delta T$ | Output voltage drift | $I_O = 5\text{ mA}$, $T_J = 0\text{ °C to }70\text{ °C}$ | | -1 | | mV/°C |
| eN | Output noise voltage | $B = 10\text{ Hz to }100\text{ kHz}$ | | 110 | | μV |
| SVR | Supply voltage rejection | $f = 120\text{ Hz}$ | 43 ⁽¹⁾ | | | dB |
| V_I | Operating input voltage | $I_O \leq 1\text{ A}$ | 21 | | | V |
| R_O | Output resistance | $f = 1\text{ kHz}$ | | 22 | | mΩ |
| I_{sc} | Short circuit current | $V_I = 27\text{ V}$ | | 500 | | mA |
| I_{scp} | Short circuit peak current | | | 3 | | A |

1. Guaranteed by design.

Refer to the test circuits, $T_J = 25\text{ °C}$, $V_I = 33\text{ V}$, $I_O = 500\text{ mA}$, unless otherwise specified.

Table 11. Electrical characteristics of L78S24C

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------------|----------------------------|---|-------------------|------|------|-------|
| V_O | Output voltage | | 23 | 24 | 25 | V |
| V_O | Output voltage | $I_O = 1\text{ A}$, $V_I = 27\text{ V}$ | 22.8 | 24 | 25.2 | V |
| ΔV_O | Line regulation | $V_I = 27\text{ to }38\text{ V}$ | | | 480 | mV |
| | | $V_I = 30\text{ to }36\text{ V}$ | | | 240 | |
| ΔV_O | Load regulation | $I_O = 20\text{ mA to }1.5\text{ A}$ | | | 480 | mV |
| | | $I_O = 2\text{ A}$ | | 300 | | |
| I_Q | Quiescent current | | | | 8 | mA |
| ΔI_Q | Quiescent current change | $I_O = 20\text{ mA to }1\text{ A}$ | | | 0.5 | mA |
| | | $V_I = 27\text{ to }38\text{ V}$, $I_O = 20\text{ mA}$ | | | 1 | |
| $\Delta V_O/\Delta T$ | Output voltage drift | $I_O = 5\text{ mA}$, $T_J = 0\text{ °C to }70\text{ °C}$ | | -1.5 | | mV/°C |
| eN | Output noise voltage | $B = 10\text{ Hz to }100\text{ kHz}$ | | 170 | | μV |
| SVR | Supply voltage rejection | $f = 120\text{ Hz}$ | 42 ⁽¹⁾ | | | dB |
| V_I | Operating input voltage | $I_O \leq 1\text{ A}$ | 27 | | | V |
| R_O | Output resistance | $f = 1\text{ kHz}$ | | 28 | | mΩ |
| I_{sc} | Short circuit current | $V_I = 27\text{ V}$ | | 500 | | mA |
| I_{scp} | Short circuit peak current | | | 3 | | A |

1. Guaranteed by design.

6 Typical performance

Figure 8. Dropout voltage vs. junction temperature

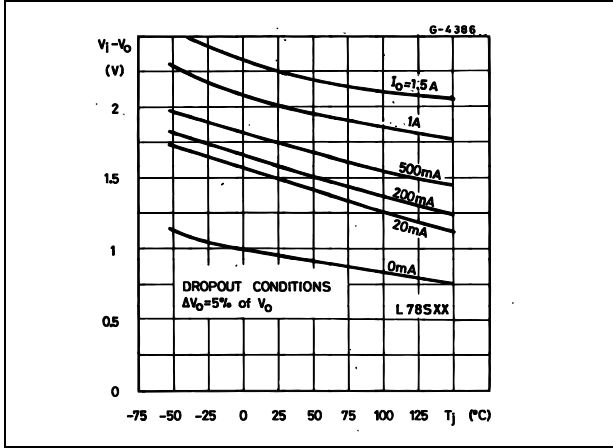


Figure 9. Peak output current vs. input/output differential voltage

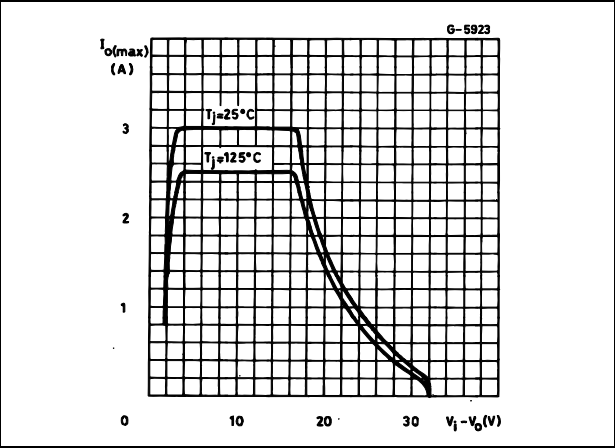


Figure 10. Output impedance vs. frequency

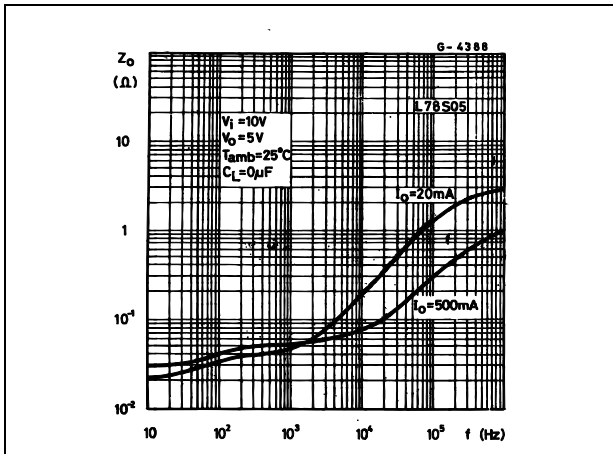


Figure 11. Output voltage vs. junction temperature

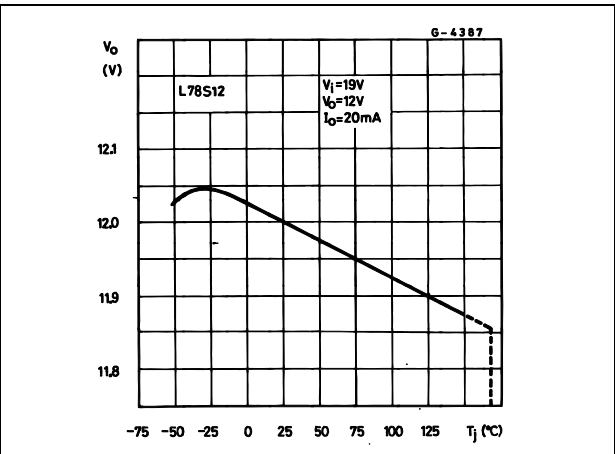


Figure 12. Supply voltage rejection vs. frequency

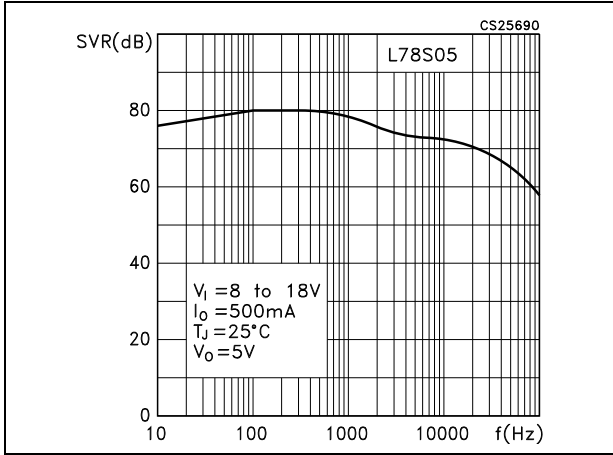


Figure 13. Quiescent current vs. junction temperature

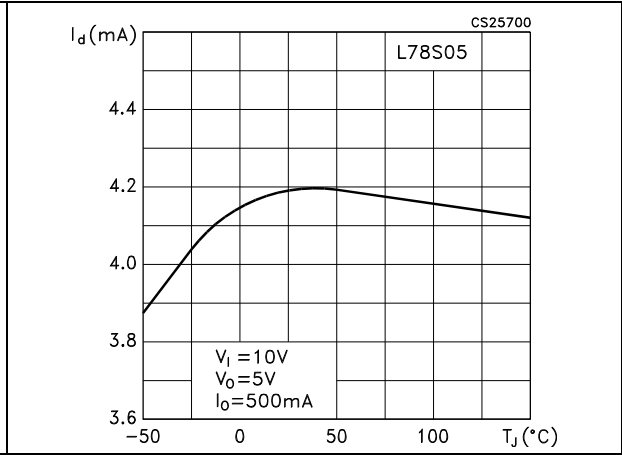


Figure 14. Load transient response

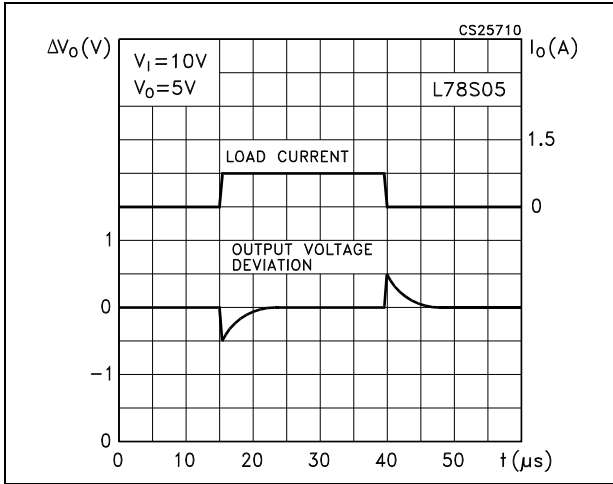


Figure 15. Line transient response

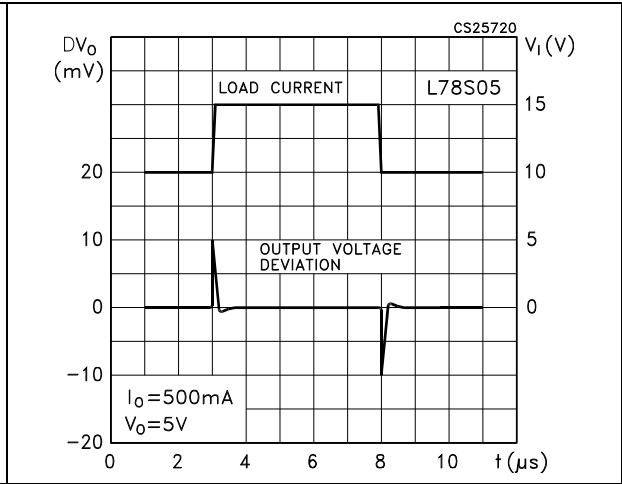


Figure 16. Quiescent current vs. input voltage

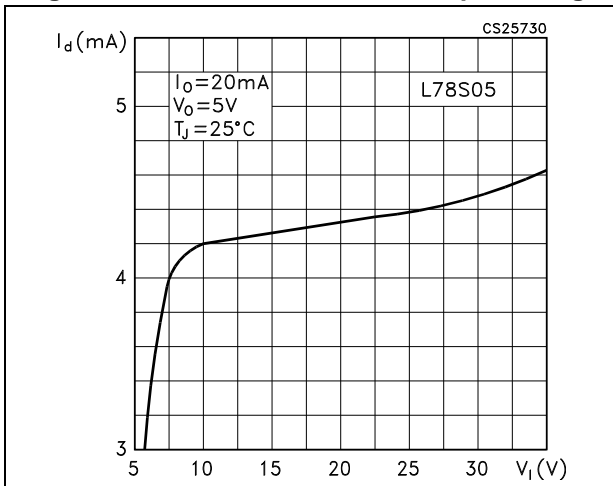
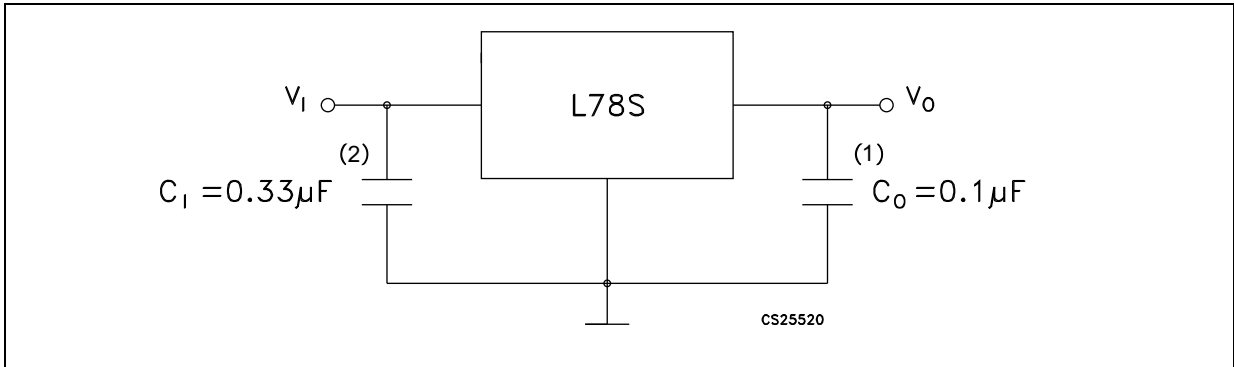
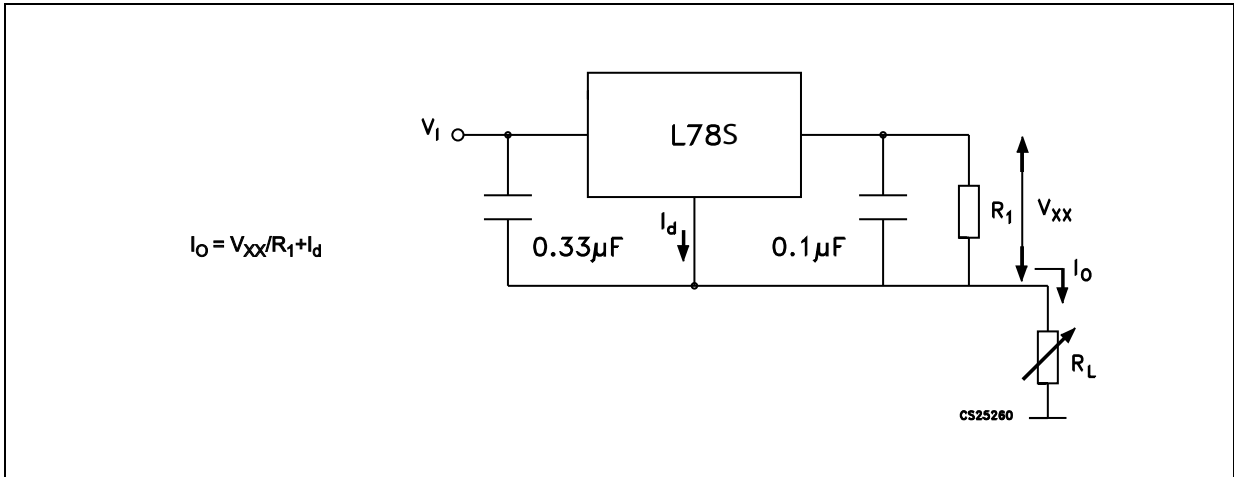


Figure 17. Fixed output regulator



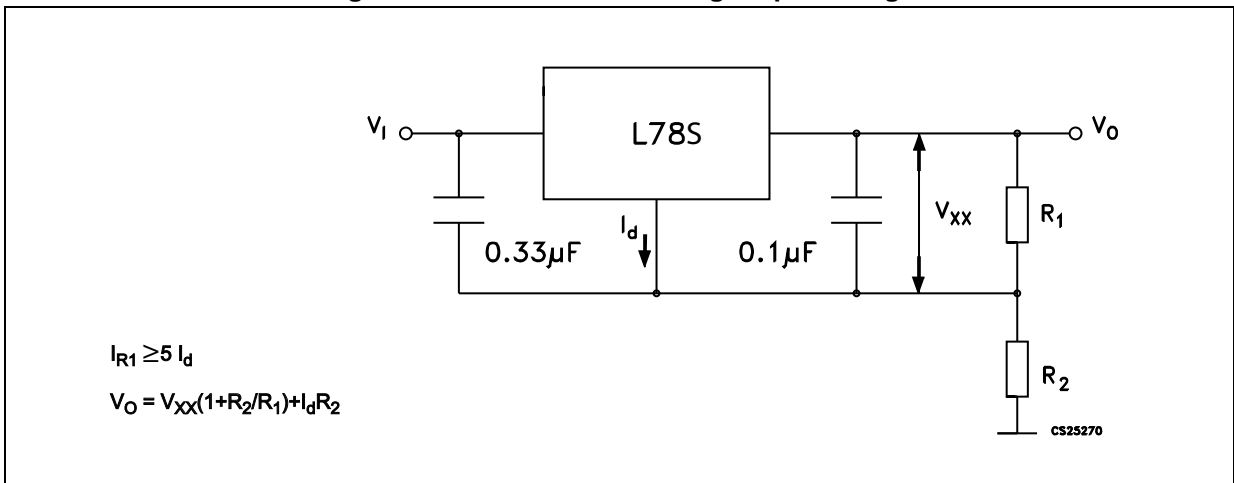
1. Although no output capacitor is need for stability, it does improve transient response.
2. Required if regulator is located an appreciable distance from power supply filter.

Figure 18. Constant current regulator



$$I_o = V_{xx}/R_1 + I_d$$

Figure 19. 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 20. Adjustable output regulator (7 to 30 V)

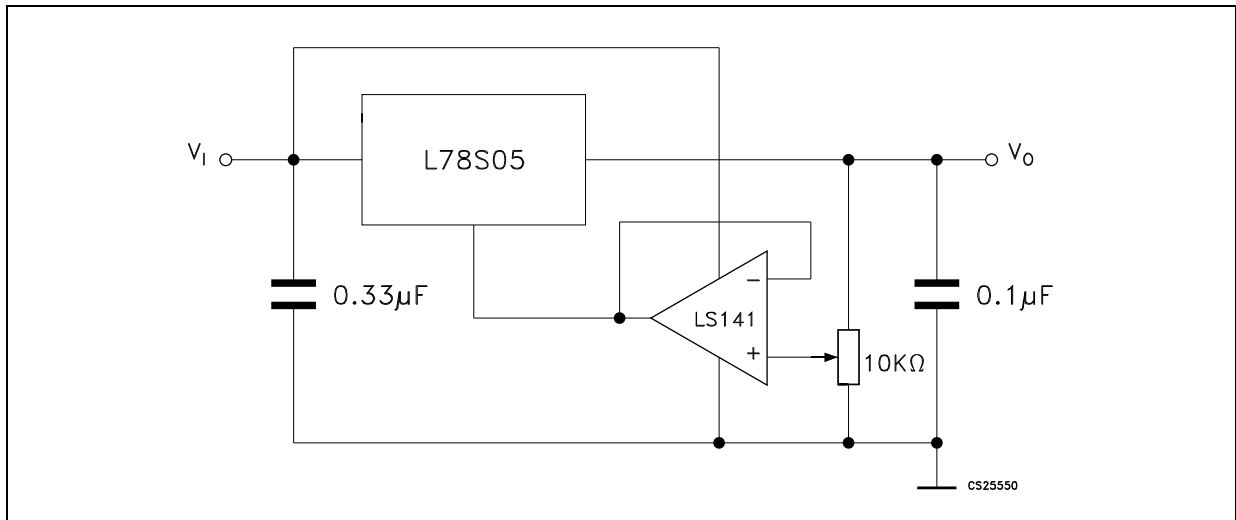


Figure 21. 0.5 to 10 V regulator

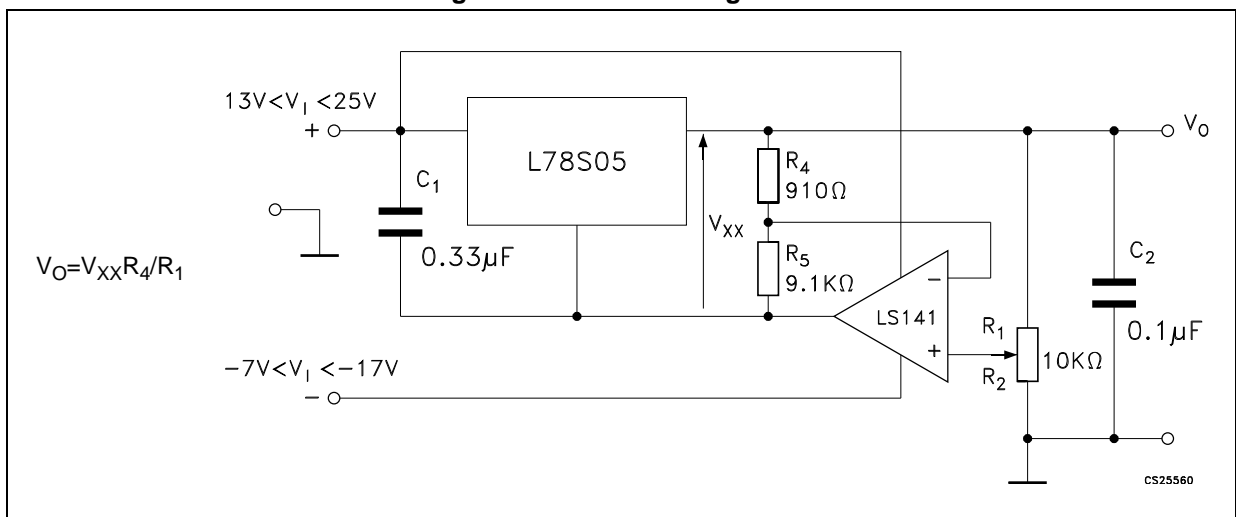


Figure 22. High current voltage regulator

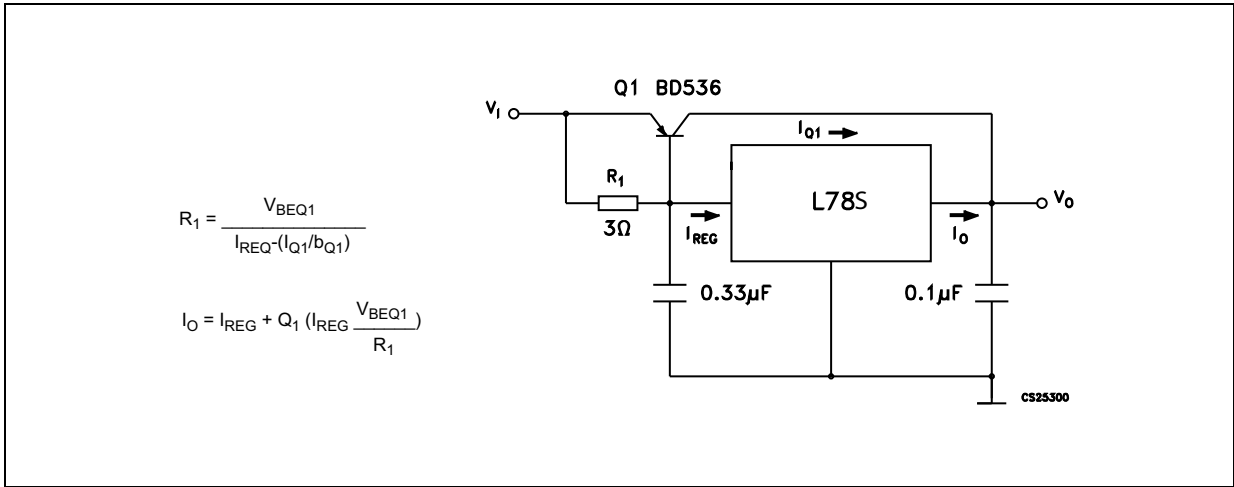


Figure 23. High output current with short circuit protection

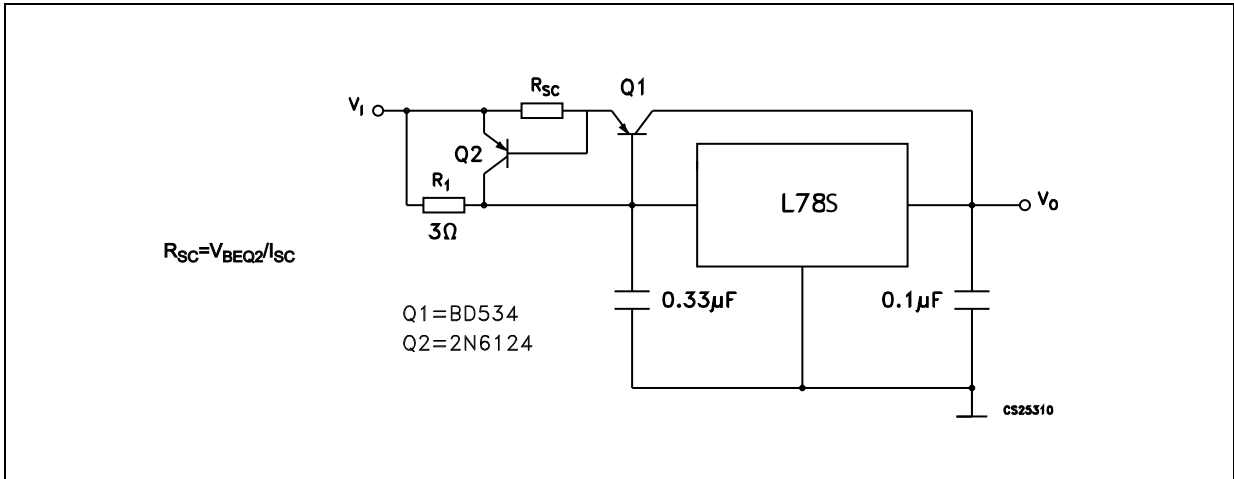


Figure 24. Tracking voltage regulator

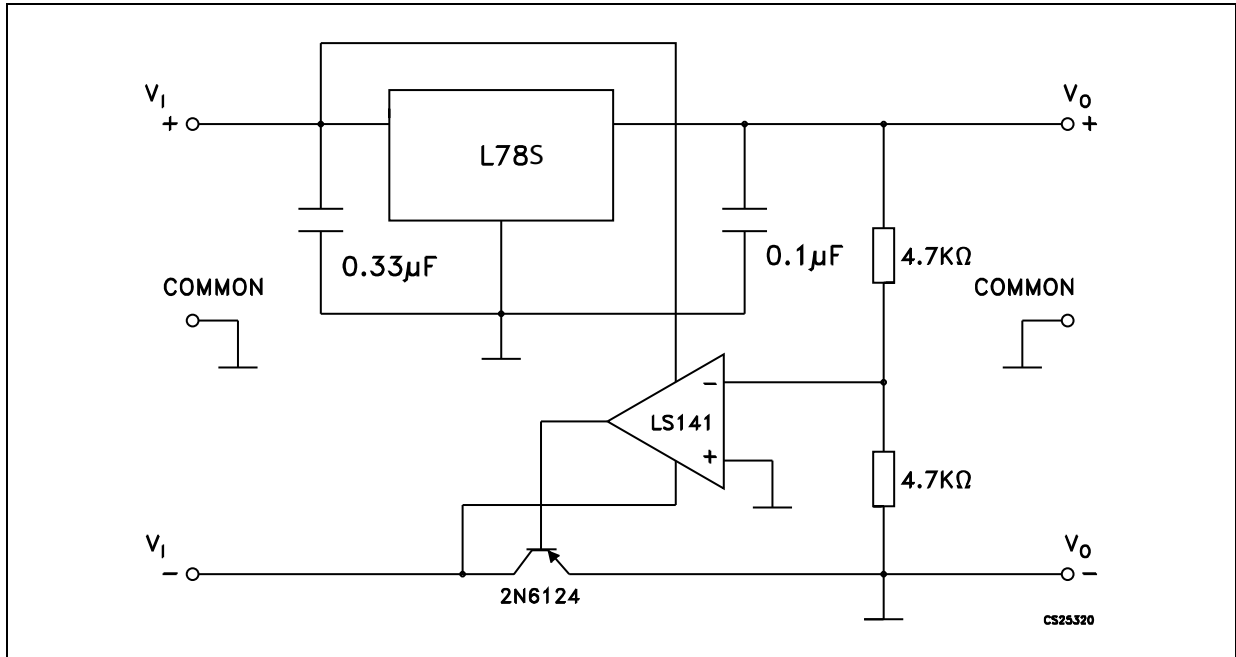


Figure 25. Positive and negative regulator

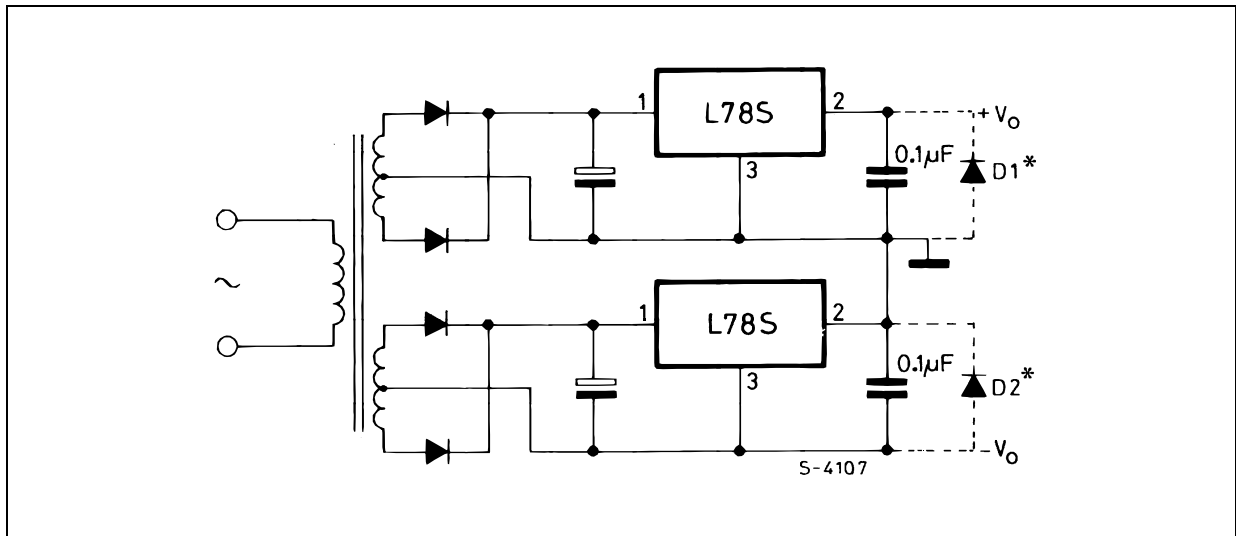


Figure 26. Negative output voltage circuit

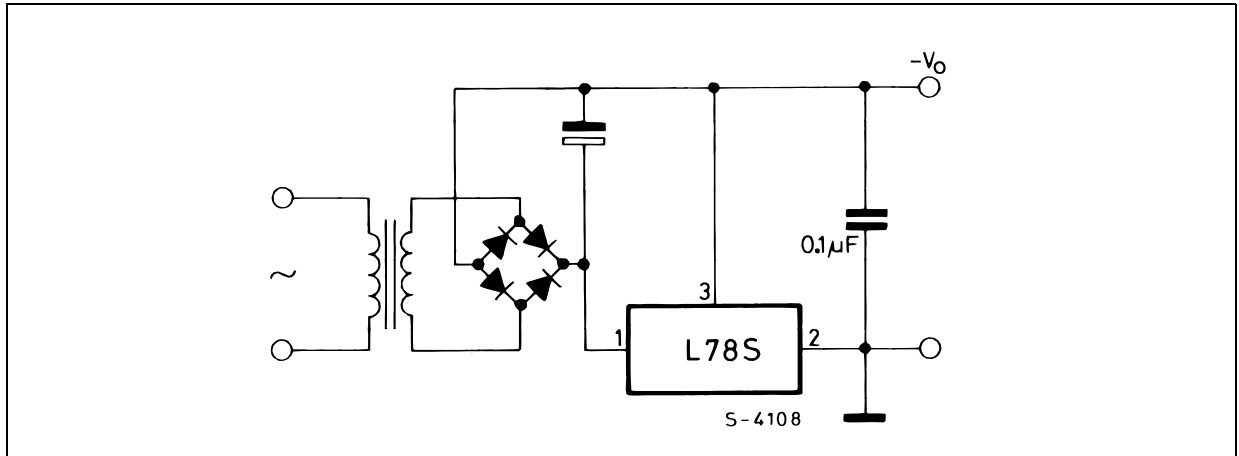


Figure 27. Switching regulator

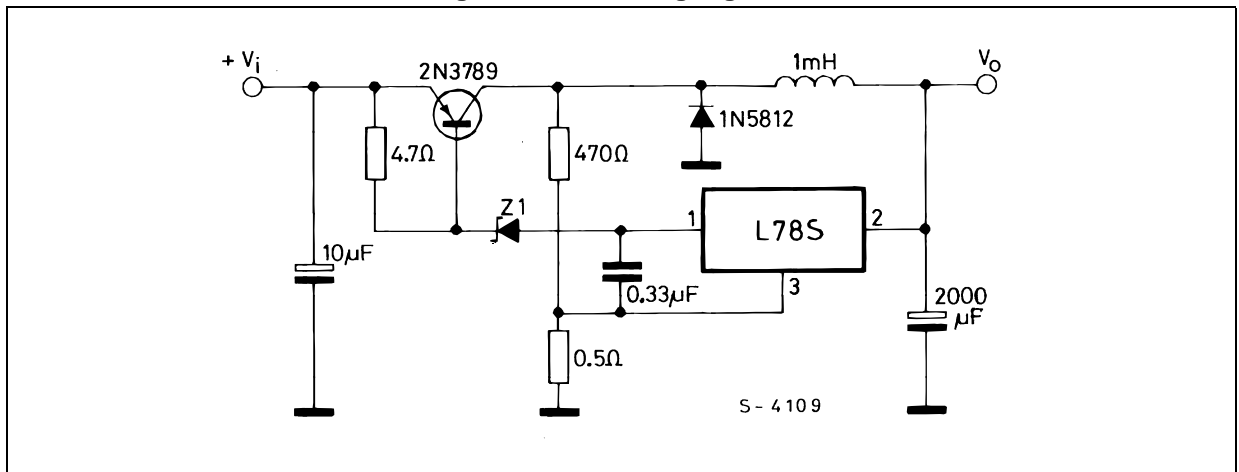


Figure 28. High input voltage circuit

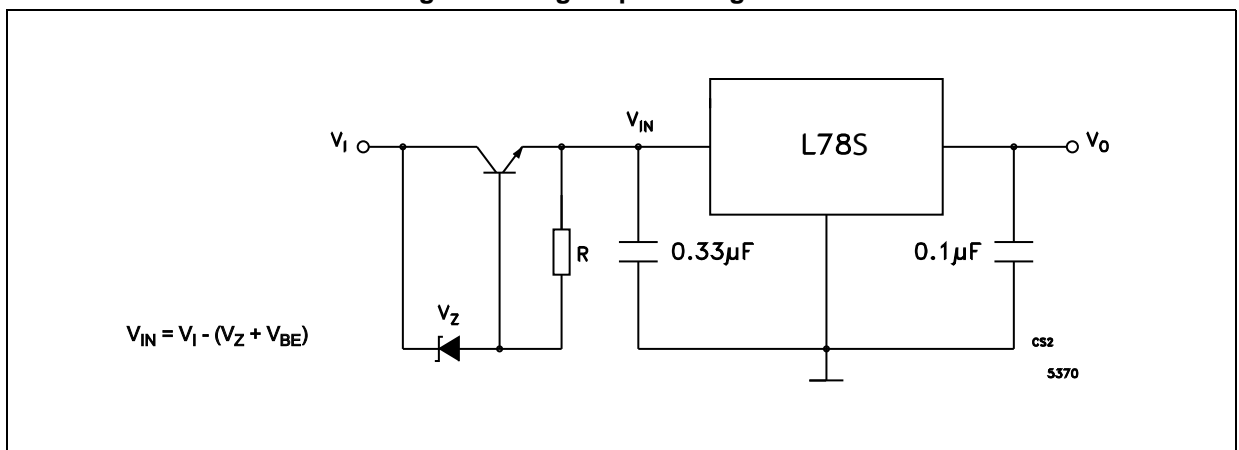


Figure 29. High input voltage circuit

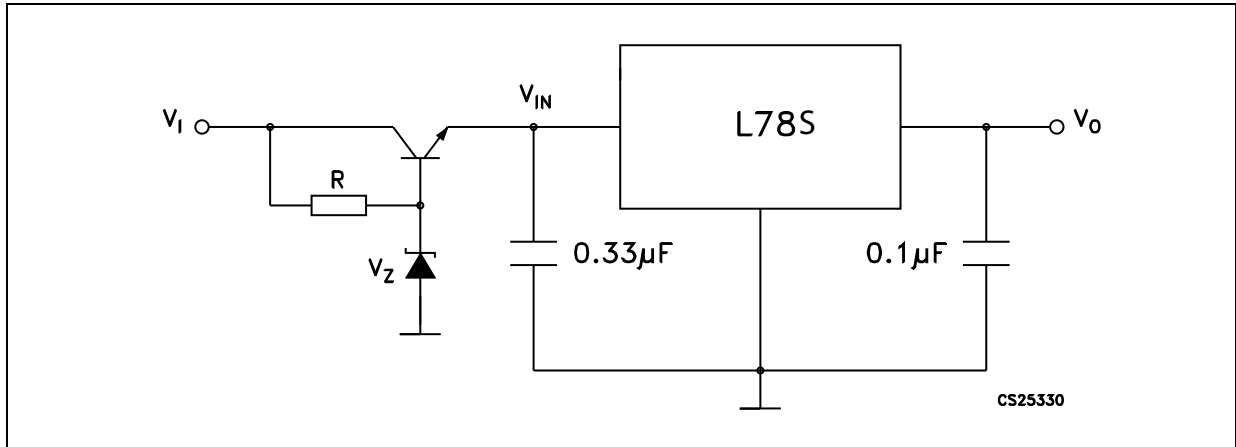


Figure 30. High output voltage regulator

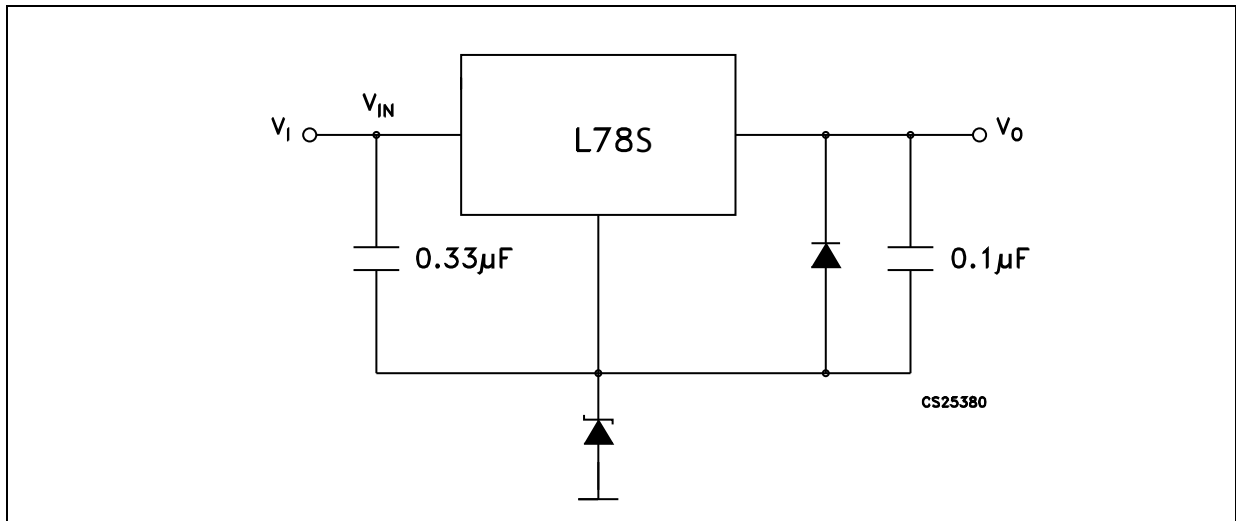


Figure 31. High input and output voltage

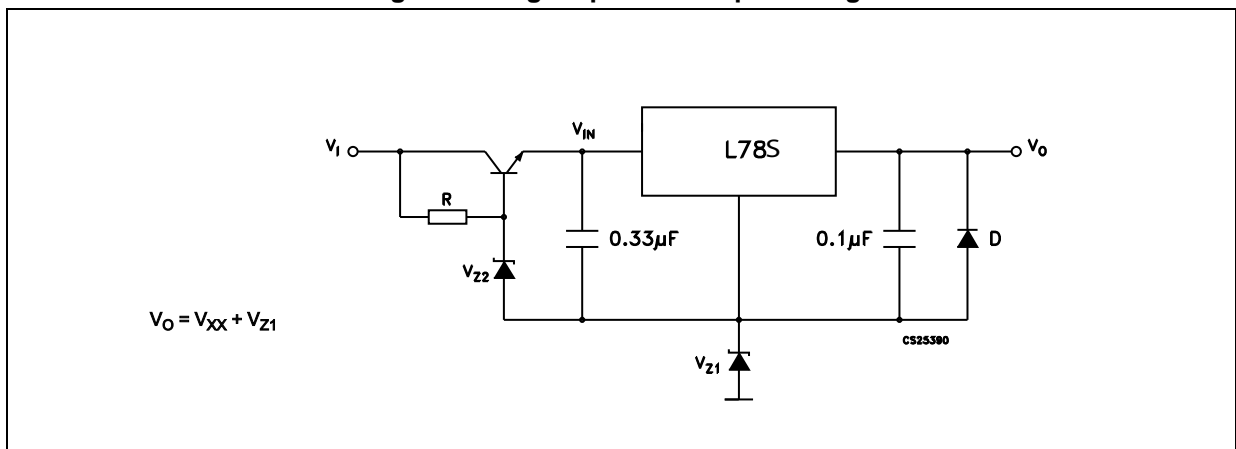


Figure 32. Reducing power dissipation with dropping resistor

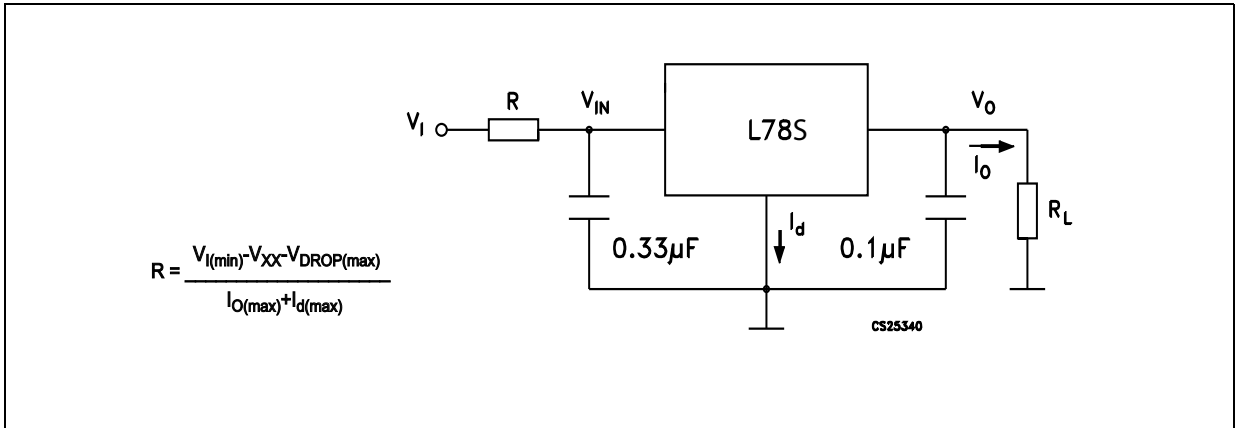


Figure 33. Remote shutdown

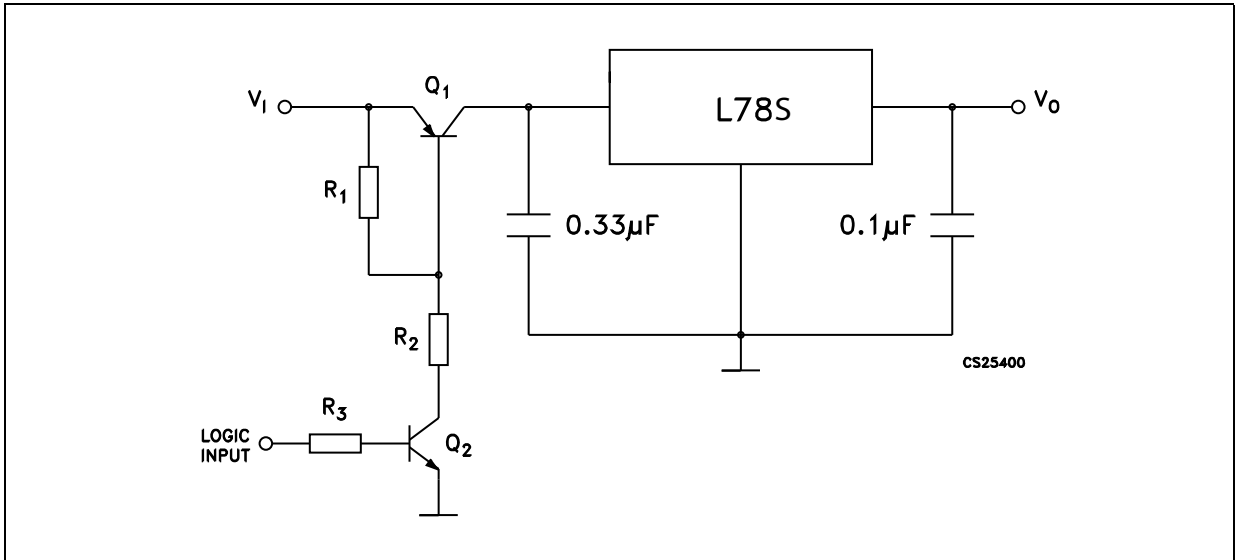
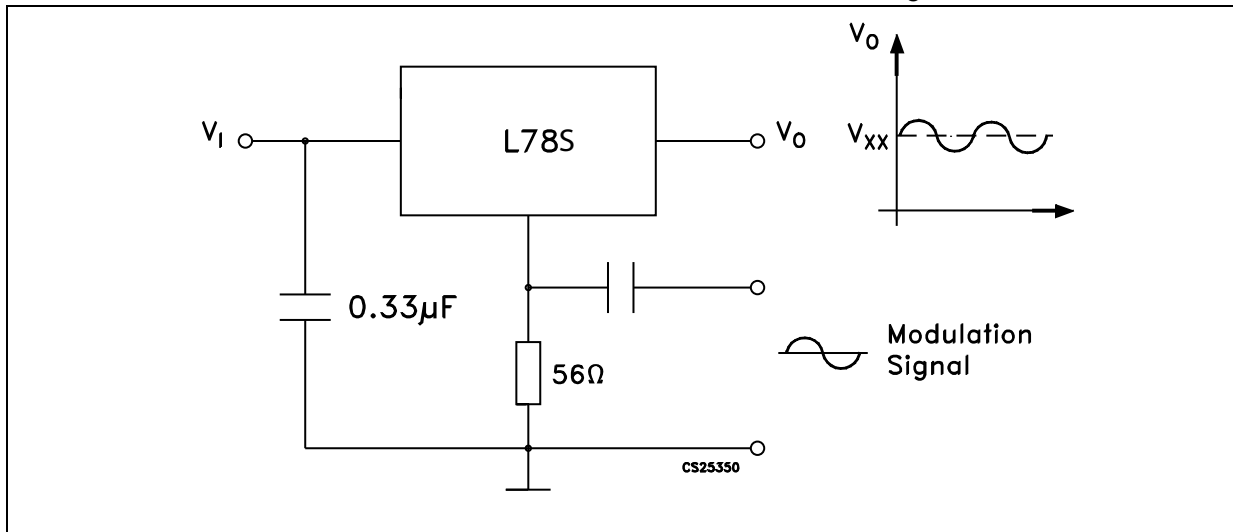
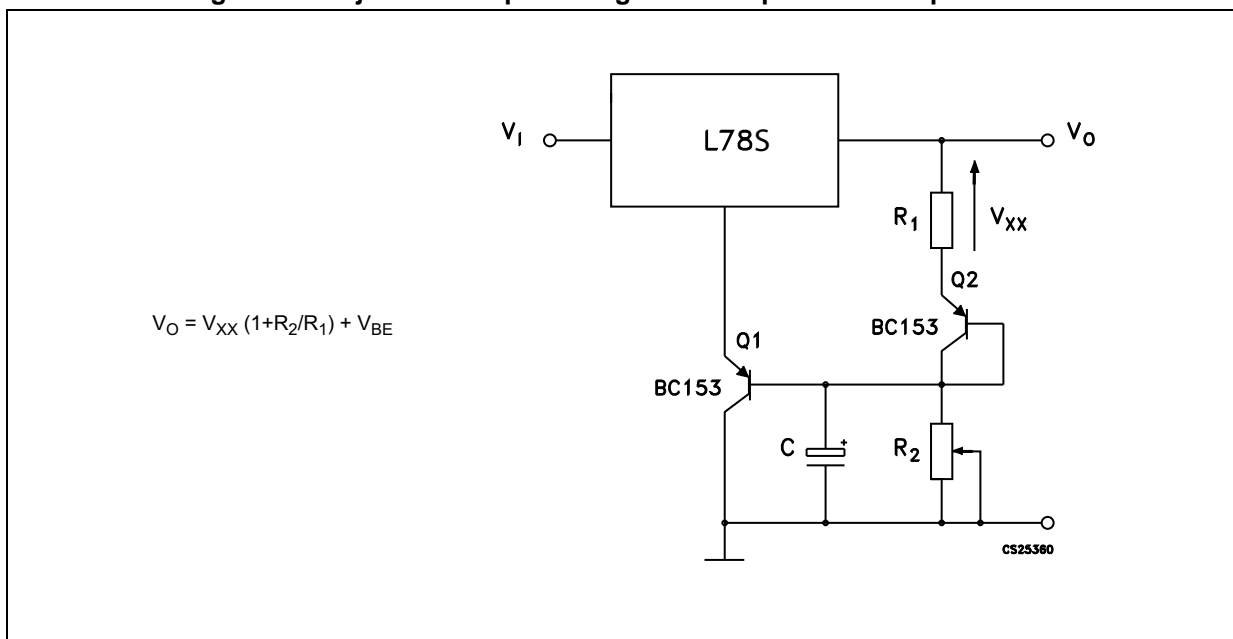


Figure 34. Power AM modulator (unity voltage gain, $I_O \leq 1\text{ A}$)



Note: The circuit performs well up to 100 kHz.

Figure 35. Adjustable output voltage with temperature compensation



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 .

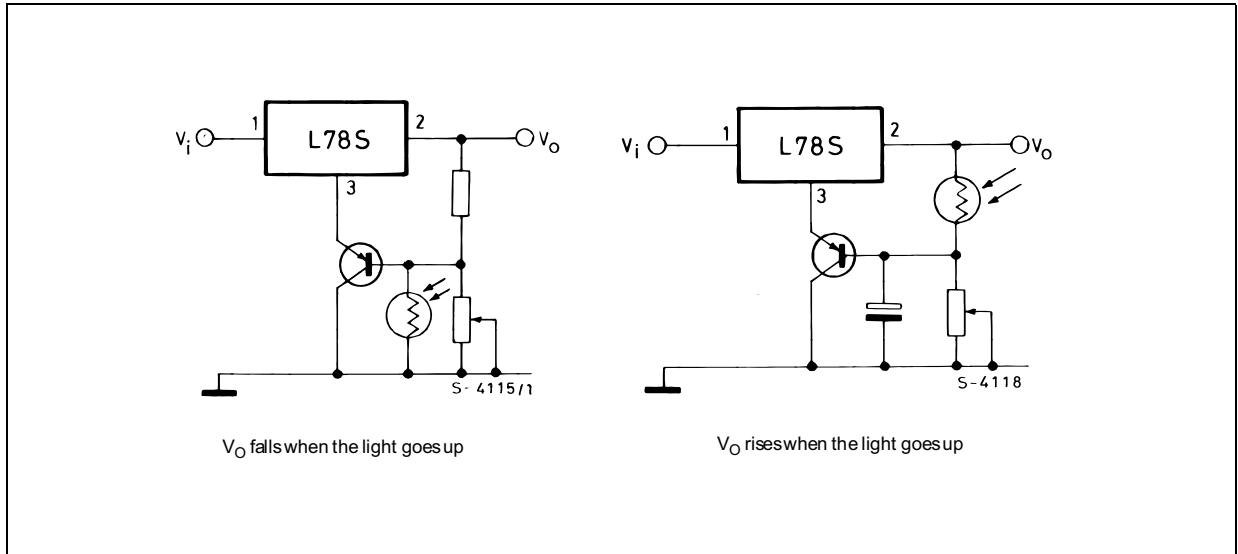
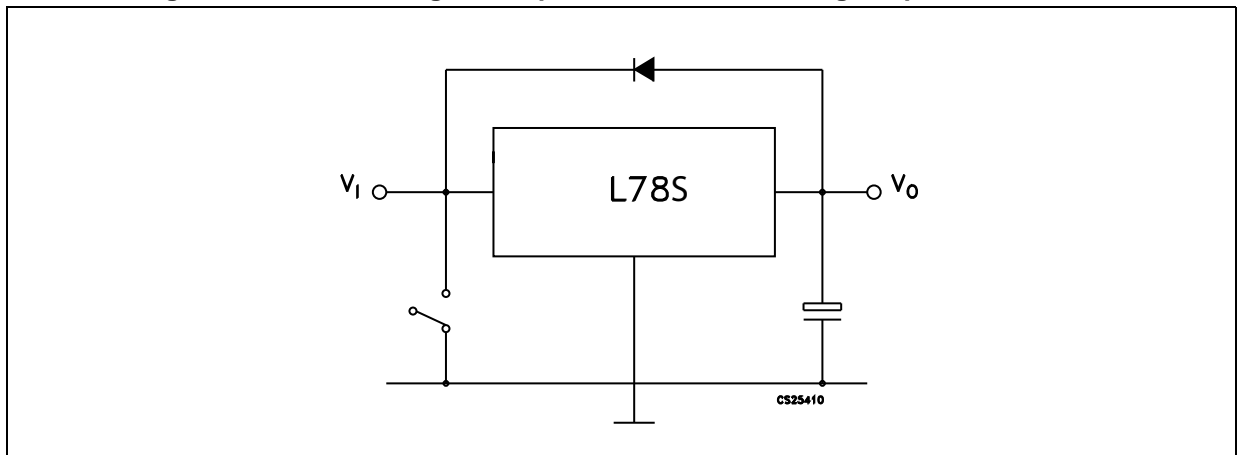
Figure 36. Light controllers ($V_{Omin} = V_{XX} + V_{BE}$)

Figure 37. Protection against input short-circuit with high capacitance loads

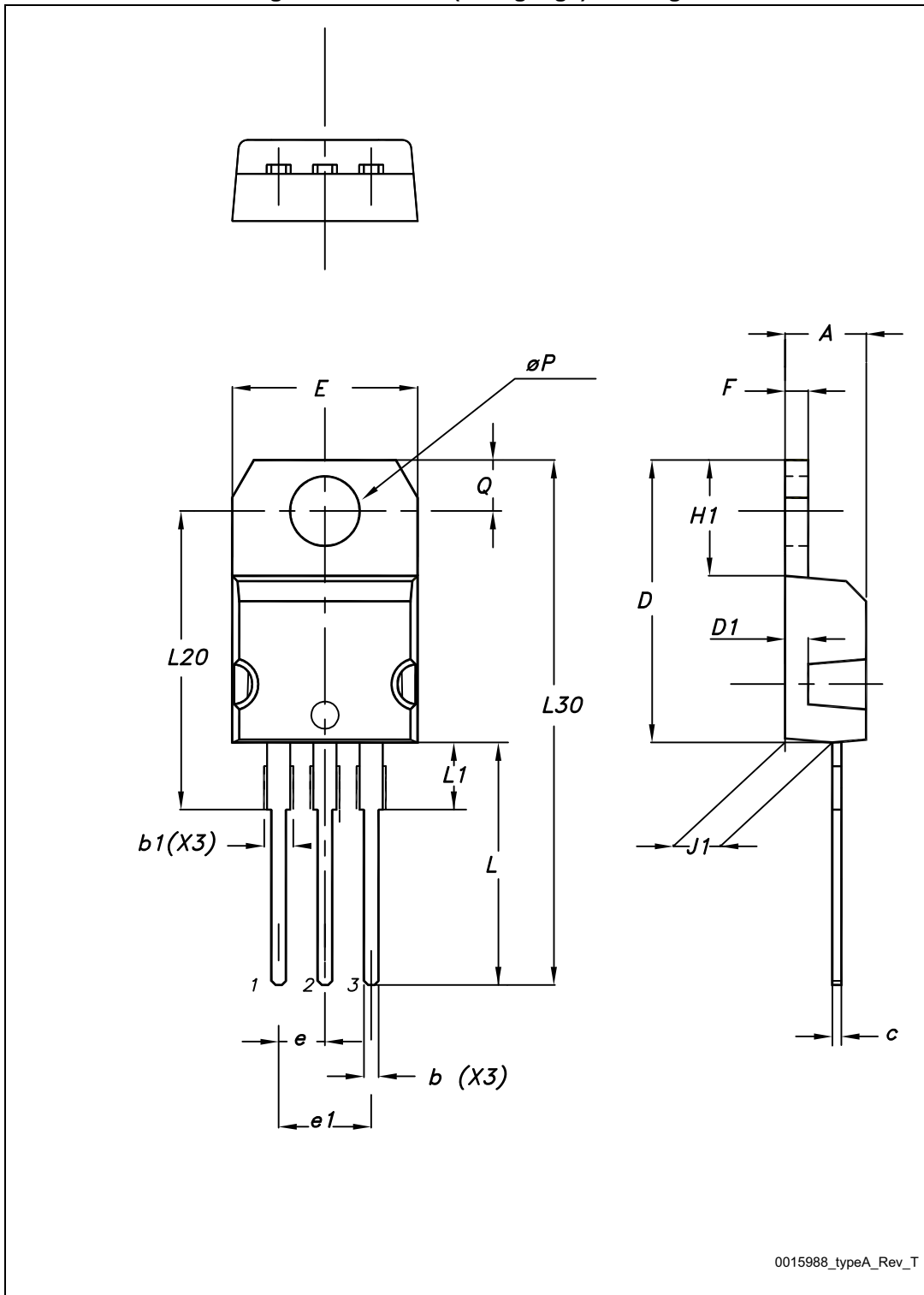


1. Application with high capacitance loads and an output voltage greater than 6 volts need an external diode (see [Figure 30 on page 24](#)) to protect the device against input short circuit. In this case the input voltage falls rapidly while the output voltage decrease slowly. The capacitance discharges 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 Package mechanical data

In order 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.

Figure 38. TO-220 (dual gauge) drawing



0015988_typeA_Rev_T

Table 12. 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 | |
| ØP | 3.75 | | 3.85 |
| Q | 2.65 | | 2.95 |

Figure 39. TO-220 SG (single gauge) drawing

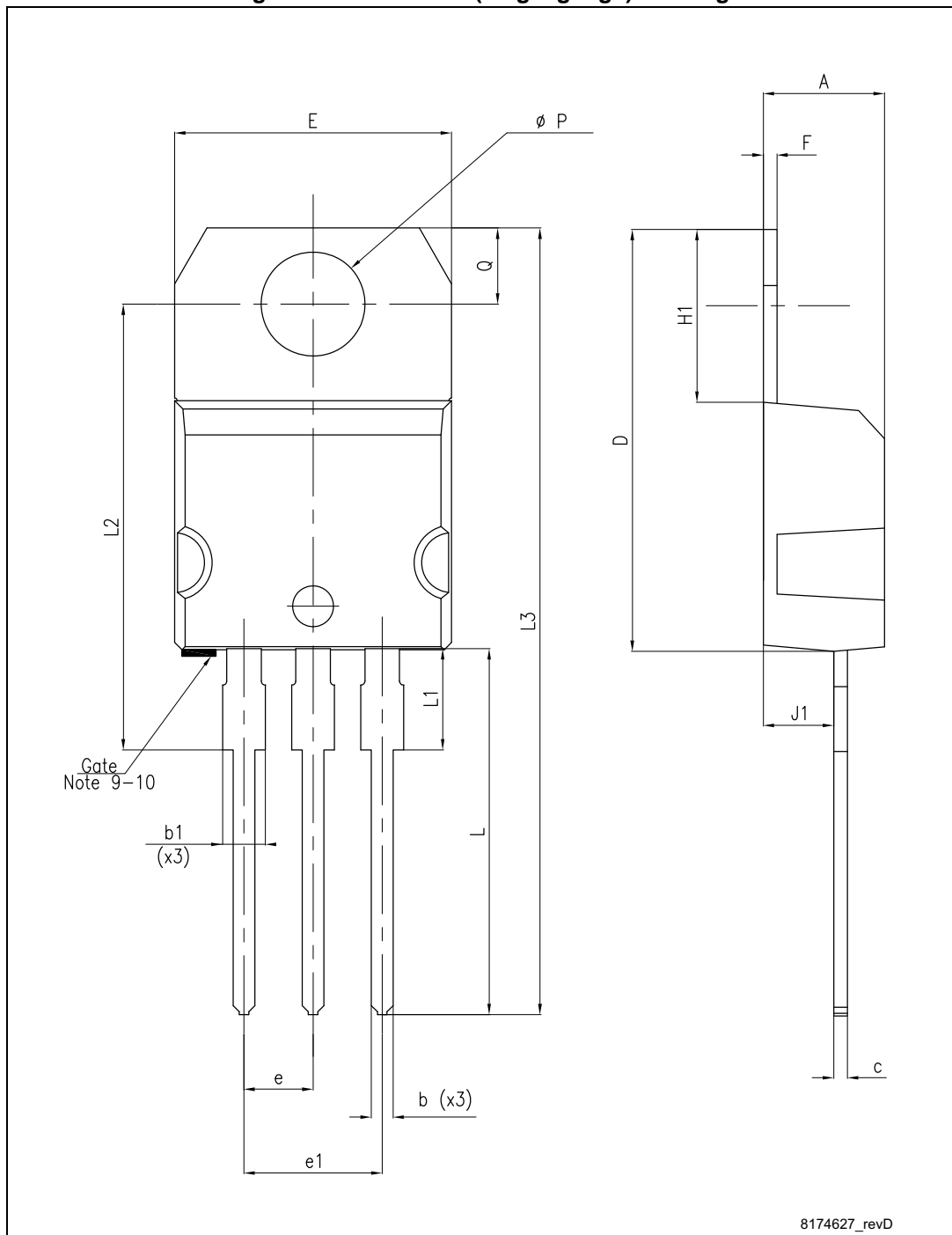


Table 13. TO-220 SG (single gauge) mechanical data

| 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 |
| E | 10 | | 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 | | 14 |
| L1 | 3.50 | | 3.93 |
| L20 | | 16.40 | |
| L30 | | 28.90 | |
| ØP | 3.75 | | 3.85 |
| Q | 2.65 | | 2.95 |

8 Packaging mechanical data

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

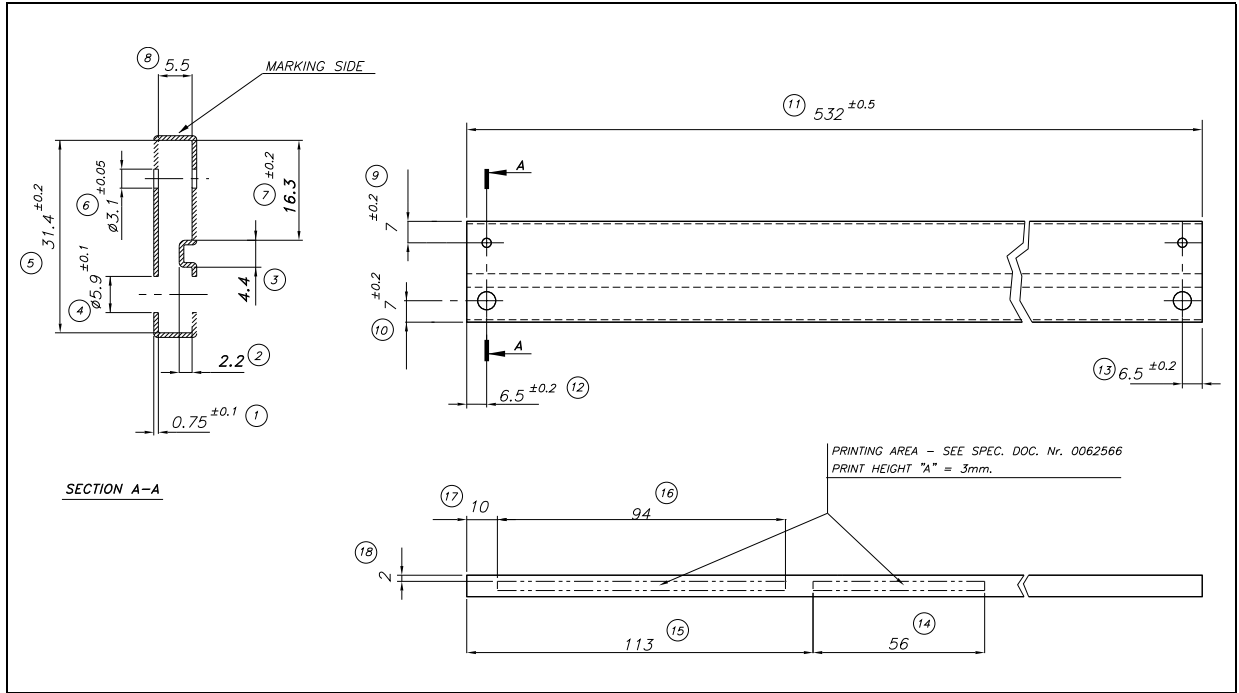
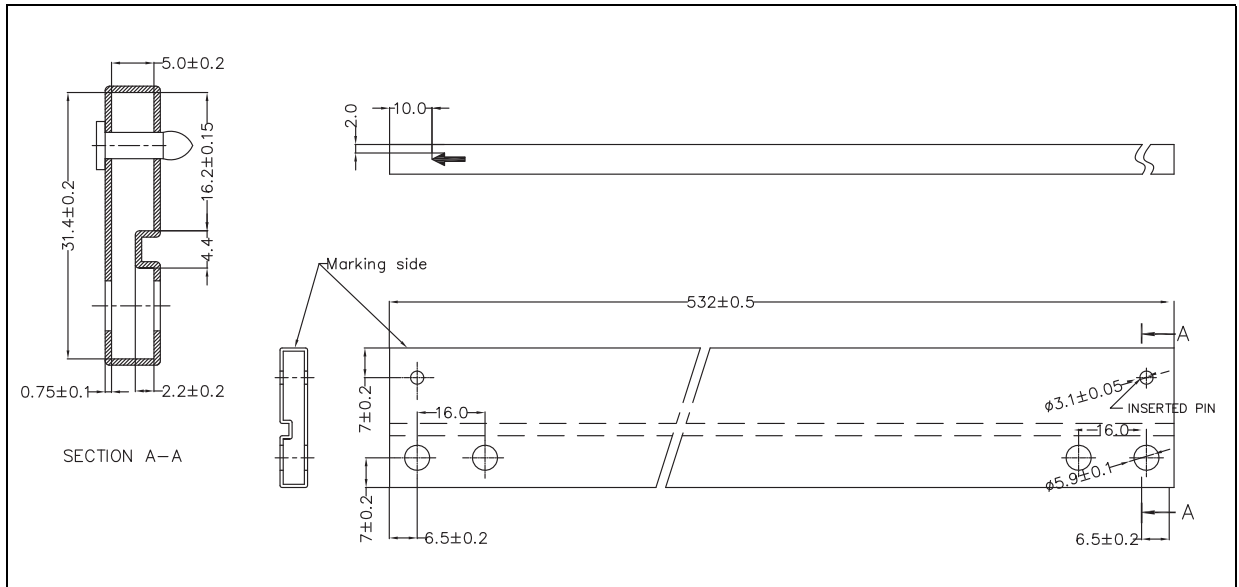


Figure 41. Tube for TO-220 (single gauge) (mm.)



9 Revision history

Table 14. Document revision history

| Date | Revision | Changes |
|-------------|----------|--|
| 07-Sep-2006 | 2 | Order codes updated. |
| 20-Mar-2008 | 3 | Added: Table 1 on page 1 . |
| 22-Mar-2010 | 4 | Added: Table 20 on page 32 , Figure 38 on page 33 , Figure 39 on page 34 , Figure 40 and Figure 41 on page 33 . |
| 08-Feb-2012 | 5 | Added: order codes L78S05CV-DG, L78S12CV-DG and L78S15CV-DG Table 13 on page 35 . |
| 09-Mar-2012 | 6 | Added: order codes L78S09CV-DG Table 13 on page 35 . |
| 15-May-2012 | 7 | Added: order codes L78S75CV-DG and L78S10CV-DG Table 13 on page 35 . |
| 10-Mar-2014 | 8 | Part numbers L78Sxx and L78SxxC changed to L78S. Modified the title, the features and the description in cover page. Removed TO-3 package. Updated Table 1: Device summary , Section 2: Pin configuration , Section 3: Maximum ratings , Section 4: Test circuits , Section 5: Electrical characteristics , Section 6: Typical performance , Section 7: Package mechanical data , Section 9: Order codes . Added Section 8: Packaging mechanical data . Minor text changes. |

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