

NEGATIVE VOLTAGE REGULATORS

- OUTPUT CURRENT UP TO 1.5A
- OUTPUT VOLTAGES OF -5; -6; -8; -12; -15; -18; -20; -24V
- THERMAL OVERLOAD PROTECTION
- SHORT CIRCUIT PROTECTION
- OUTPUT TRANSITION SOA PROTECTION

DESCRIPTION

The L7900 series of three-terminal negative regulators is available in TO-220, TO-220FP, TO-3 and D²PAK 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; furthermore, having the same voltage option as the L7800 positive standard series, they are particularly suited for split power supplies. If adequate heat sinking is provided, they can deliver over 1.5A output current.

Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

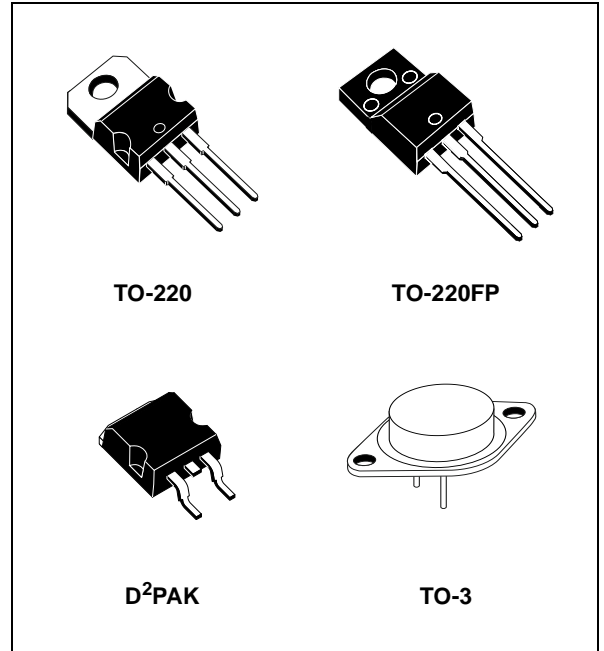


Figure 1: Schematic Diagram

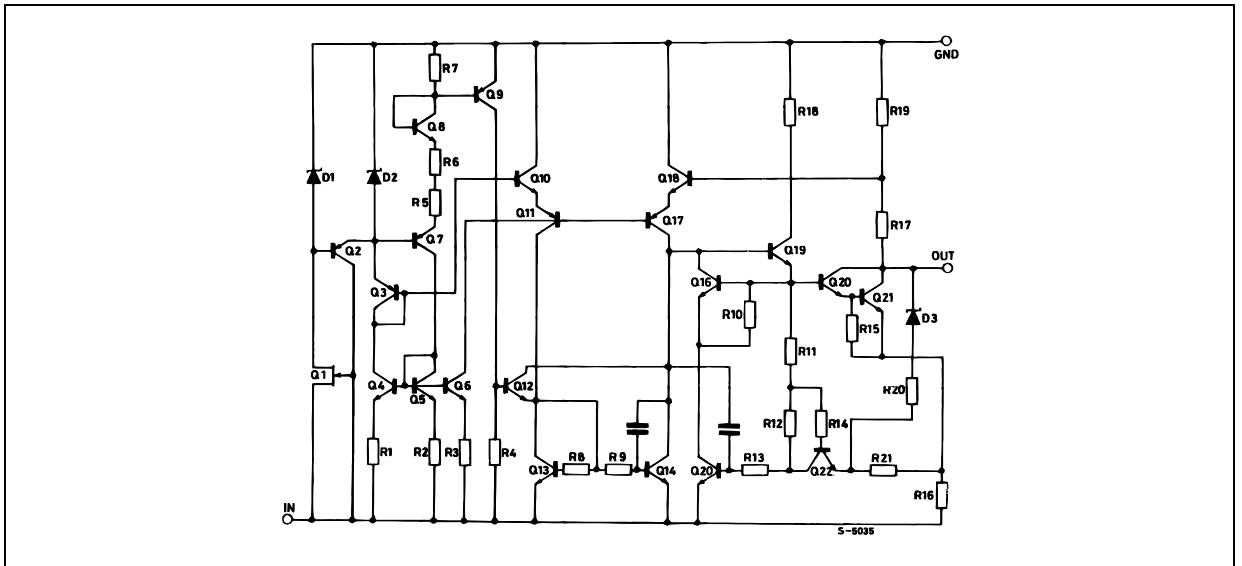


Table 1: Absolute Maximum Ratings

| Symbol | Parameter | | Value | Unit |
|-----------|--------------------------------------|------------------------|--------------------|------|
| V_I | DC Input Voltage | for $V_O = 5$ to $18V$ | -35 | V |
| | | for $V_O = 20, 24V$ | -40 | |
| I_O | Output Current | | Internally Limited | |
| P_{tot} | Power Dissipation | | Internally Limited | |
| T_{stg} | Storage Temperature Range | | -65 to 150 | °C |
| T_{op} | Operating Junction Temperature Range | | 0 to 150 | °C |

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 | | D ² PAK | TO-220 | TO-220FP | TO-3 | Unit |
|----------------|-------------------------------------|-----|--------------------|--------|----------|------|------|
| $R_{thj-case}$ | Thermal Resistance Junction-case | Max | 3 | 3 | 5 | 4 | °C/W |
| $R_{thj-amb}$ | Thermal Resistance Junction-ambient | Max | 62.5 | 50 | 60 | 35 | °C/W |

Figure 2: Connection Diagram (top view)

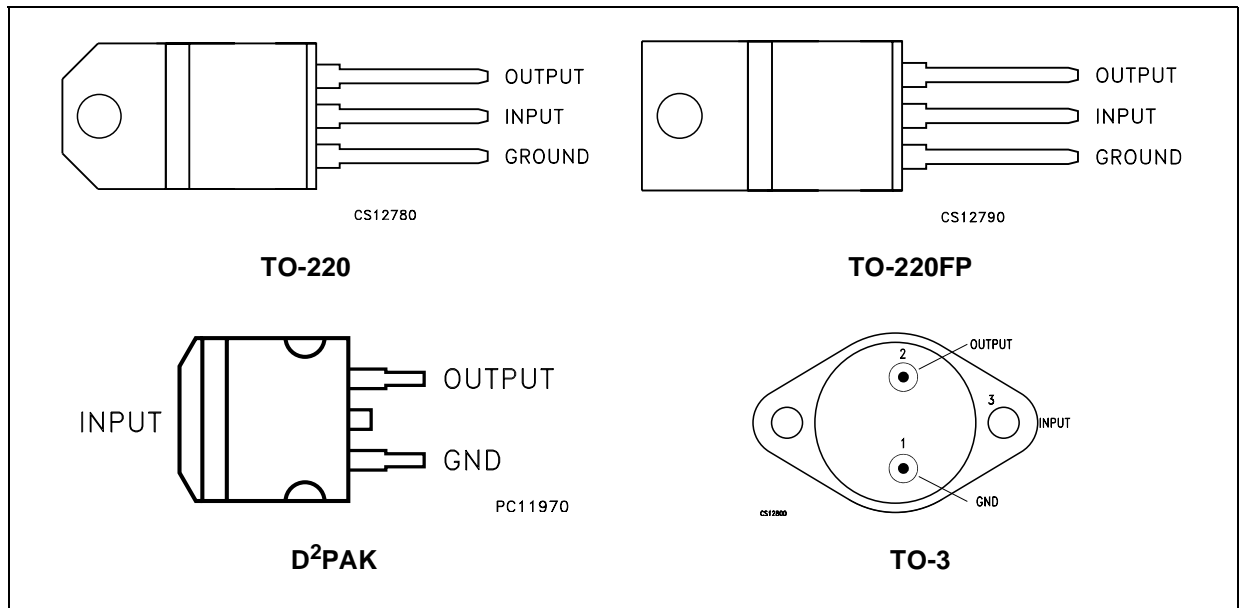


Table 3: Order Codes

| TYPE | TO-220 (A Type) | TO-220 (C Type) | TO-220 (E Type) | D ² PAK (A Type) (#) | D ² PAK (C Type) (T & R) | TO-220FP | TO-3 | OUTPUT VOLTAGE |
|--------|-----------------|-----------------|-----------------|---------------------------------|-------------------------------------|-------------|-------------|----------------|
| L7905C | L7905CV | L7905C-V | L7905CV1 | L7905CD2T | L7905C-D2TR | L7905CP | L7905CT (*) | -5 V |
| L7906C | L7906CV | | | L7906CD2T | | L7906CP (*) | L7906CT (*) | -6 V |
| L7908C | L7908CV | | | L7908CD2T | | L7908CP (*) | L7908CT (*) | -8 V |
| L7912C | L7912CV | L7912C-V | L7912CV1 | L7912CD2T | | L7912CP | L7912CT (*) | -12 V |
| L7915C | L7915CV | | | L7915CD2T | | L7915CP | L7915CT | -15 V |
| L7918C | L7918CV | | | L7918CD2T(*) | | L7918CP (*) | L7918CT (*) | -18 V |
| L7920C | L7920CV | | | L7920CD2T(*) | | L7920CP (*) | L7920CT (*) | -20 V |
| L7924C | L7924CV | | | L7924CD2T(*) | | L7924CP (*) | L7924CT | -24 V |

(#) Available in Tape & Reel with the suffix "-TR".

(*) Available on Request.

Figure 3: Test Circuit

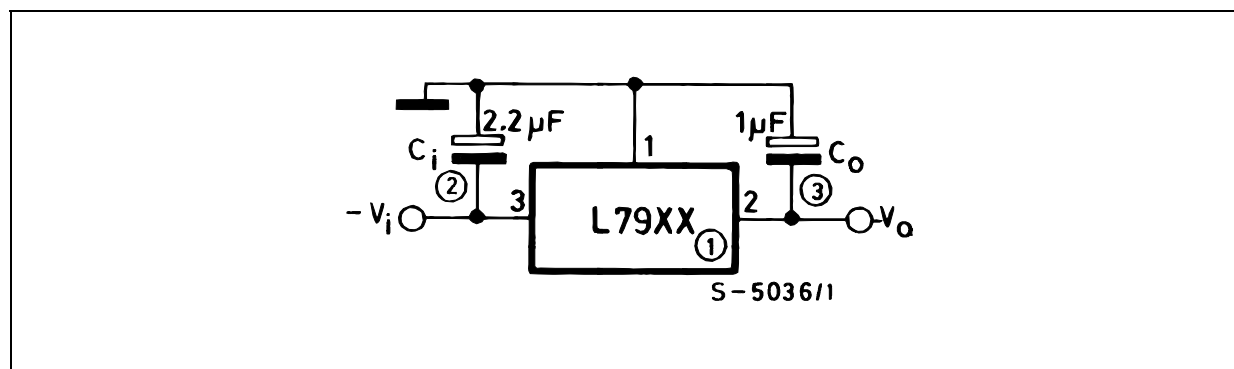


Table 4: Electrical Characteristics Of L7905C (refer to the test circuits, $T_J = 0$ to 125°C , $V_I = -10\text{V}$, $I_O = 500$ mA, $C_I = 2.2$ μF , $C_O = 1$ μF unless otherwise specified).

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|-----------------------|--------------------------|--|-------|------|-------|----------------------|
| V_O | Output Voltage | $T_J = 25^\circ\text{C}$ | -4.8 | -5 | -5.2 | V |
| V_O | Output Voltage | $I_O = -5$ mA to -1 A $P_O \leq 15$ W $V_I = 8$ to 20 V | -4.75 | -5 | -5.25 | V |
| ΔV_O (*) | Line Regulation | $V_I = -7$ to -25 V $T_J = 25^\circ\text{C}$ | | | 100 | mV |
| | | $V_I = -8$ to -12 V $T_J = 25^\circ\text{C}$ | | | 50 | |
| ΔV_O (*) | Load Regulation | $I_O = 5$ mA to 1.5 A $T_J = 25^\circ\text{C}$ | | | 100 | mV |
| | | $I_O = 250$ to 750 mA $T_J = 25^\circ\text{C}$ | | | 50 | |
| I_d | Quiescent Current | $T_J = 25^\circ\text{C}$ | | | 3 | mA |
| ΔI_d | Quiescent Current Change | $I_O = 5$ mA to 1 A | | | 0.5 | mA |
| | | $V_I = -8$ to -25 V | | | 1.3 | |
| $\Delta V_O/\Delta T$ | Output Voltage Drift | $I_O = 5$ mA | | -0.4 | | mV/ $^\circ\text{C}$ |
| eN | Output Noise Voltage | $B = 10\text{Hz}$ to 100KHz $T_J = 25^\circ\text{C}$ | | 100 | | μV |
| SVR | Supply Voltage Rejection | $\Delta V_I = 10$ V $f = 120\text{Hz}$ | 54 | 60 | | dB |
| V_d | Dropout Voltage | $I_O = 1$ A $T_J = 25^\circ\text{C}$ $\Delta V_O = 100$ mV | | 1.4 | | V |
| I_{sc} | Short Circuit Current | | | 2.1 | | A |

(*) 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.

Table 5: Electrical Characteristics Of L7906C (refer to the test circuits, $T_J = 0$ to 125°C , $V_I = -11\text{V}$, $I_O = 500\text{ mA}$, $C_I = 2.2\text{ }\mu\text{F}$, $C_O = 1\text{ }\mu\text{F}$ unless otherwise specified).

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|-----------------------|--------------------------|---|-------|------|-------|----------------------|
| V_O | Output Voltage | $T_J = 25^\circ\text{C}$ | -5.75 | -6 | -6.25 | V |
| V_O | Output Voltage | $I_O = -5\text{ mA to } -1\text{ A}$ $P_O \leq 15\text{ W}$ $V_I = -9.5\text{ to } -21.5\text{ V}$ | -5.7 | -6 | -6.3 | V |
| $\Delta V_{O(*)}$ | Line Regulation | $V_I = -8.5\text{ to } -25\text{ V}$ $T_J = 25^\circ\text{C}$ | | | 120 | mV |
| | | $V_I = -9\text{ to } -15\text{ V}$ $T_J = 25^\circ\text{C}$ | | | 60 | |
| $\Delta V_{O(*)}$ | Load Regulation | $I_O = 5\text{ mA to } 1.5\text{ A}$ $T_J = 25^\circ\text{C}$ | | | 120 | mV |
| | | $I_O = 250\text{ to } 750\text{ mA}$ $T_J = 25^\circ\text{C}$ | | | 60 | |
| I_d | Quiescent Current | $T_J = 25^\circ\text{C}$ | | | 3 | mA |
| ΔI_d | Quiescent Current Change | $I_O = 5\text{ mA to } 1\text{ A}$ | | | 0.5 | mA |
| | | $V_I = -9.5\text{ to } -25\text{ V}$ | | | 1.3 | |
| $\Delta V_O/\Delta T$ | Output Voltage Drift | $I_O = 5\text{ mA}$ | | -0.6 | | mV/ $^\circ\text{C}$ |
| eN | Output Noise Voltage | $B = 10\text{Hz to } 100\text{KHz}$ $T_J = 25^\circ\text{C}$ | | 144 | | μV |
| SVR | Supply Voltage Rejection | $\Delta V_I = 10\text{ V}$ $f = 120\text{Hz}$ | 54 | 60 | | dB |
| V_d | Dropout Voltage | $I_O = 1\text{ A}$ $T_J = 25^\circ\text{C}$ $\Delta V_O = 100\text{ mV}$ | | 1.4 | | V |
| I_{sc} | Short Circuit Current | | | 2 | | A |

(*) 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.

Table 6: Electrical Characteristics Of L7908C (refer to the test circuits, $T_J = 0$ to 125°C , $V_I = -14\text{V}$, $I_O = 500\text{ mA}$, $C_I = 2.2\text{ }\mu\text{F}$, $C_O = 1\text{ }\mu\text{F}$ unless otherwise specified).

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|-----------------------|--------------------------|--|------|------|------|----------------------|
| V_O | Output Voltage | $T_J = 25^\circ\text{C}$ | -7.7 | -8 | -8.3 | V |
| V_O | Output Voltage | $I_O = -5\text{ mA to } -1\text{ A}$ $P_O \leq 15\text{ W}$ $V_I = -11.5\text{ to } -23\text{ V}$ | -7.6 | -8 | -8.4 | V |
| $\Delta V_{O(*)}$ | Line Regulation | $V_I = -10.5\text{ to } -25\text{ V}$ $T_J = 25^\circ\text{C}$ | | | 160 | mV |
| | | $V_I = -11\text{ to } -17\text{ V}$ $T_J = 25^\circ\text{C}$ | | | 80 | |
| $\Delta V_{O(*)}$ | Load Regulation | $I_O = 5\text{ mA to } 1.5\text{ A}$ $T_J = 25^\circ\text{C}$ | | | 160 | mV |
| | | $I_O = 250\text{ to } 750\text{ mA}$ $T_J = 25^\circ\text{C}$ | | | 80 | |
| I_d | Quiescent Current | $T_J = 25^\circ\text{C}$ | | | 3 | mA |
| ΔI_d | Quiescent Current Change | $I_O = 5\text{ mA to } 1\text{ A}$ | | | 0.5 | mA |
| | | $V_I = -11.5\text{ to } -25\text{ V}$ | | | 1 | |
| $\Delta V_O/\Delta T$ | Output Voltage Drift | $I_O = 5\text{ mA}$ | | -0.6 | | mV/ $^\circ\text{C}$ |
| eN | Output Noise Voltage | $B = 10\text{Hz to } 100\text{KHz}$ $T_J = 25^\circ\text{C}$ | | 175 | | μV |
| SVR | Supply Voltage Rejection | $\Delta V_I = 10\text{ V}$ $f = 120\text{Hz}$ | 54 | 60 | | dB |
| V_d | Dropout Voltage | $I_O = 1\text{ A}$ $T_J = 25^\circ\text{C}$ $\Delta V_O = 100\text{ mV}$ | | 1.1 | | V |
| I_{sc} | Short Circuit Current | | | 1.5 | | A |

(*) 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.

Table 7: Electrical Characteristics Of L7912C (refer to the test circuits, $T_J = 0$ to 125°C , $V_I = -19\text{V}$, $I_O = 500\text{ mA}$, $C_I = 2.2\ \mu\text{F}$, $C_O = 1\ \mu\text{F}$ unless otherwise specified).

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|-----------------------|--------------------------|--|-------|------|-------|----------------------|
| V_O | Output Voltage | $T_J = 25^\circ\text{C}$ | -11.5 | -12 | -12.5 | V |
| V_O | Output Voltage | $I_O = -5\text{ mA to } -1\text{ A}$ $P_O \leq 15\text{ W}$ $V_I = -15.5\text{ to } -27\text{ V}$ | -11.4 | -12 | -12.6 | V |
| $\Delta V_{O(*)}$ | Line Regulation | $V_I = -14.5\text{ to } -30\text{ V}$ $T_J = 25^\circ\text{C}$ | | | 240 | mV |
| | | $V_I = -16\text{ to } -22\text{ V}$ $T_J = 25^\circ\text{C}$ | | | 120 | |
| $\Delta V_{O(*)}$ | Load Regulation | $I_O = 5\text{ mA to } 1.5\text{ A}$ $T_J = 25^\circ\text{C}$ | | | 240 | mV |
| | | $I_O = 250\text{ to } 750\text{ mA}$ $T_J = 25^\circ\text{C}$ | | | 120 | |
| I_d | Quiescent Current | $T_J = 25^\circ\text{C}$ | | | 3 | mA |
| ΔI_d | Quiescent Current Change | $I_O = 5\text{ mA to } 1\text{ A}$ | | | 0.5 | mA |
| | | $V_I = -15\text{ to } -30\text{ V}$ | | | 1 | |
| $\Delta V_O/\Delta T$ | Output Voltage Drift | $I_O = 5\text{ mA}$ | | -0.8 | | mV/ $^\circ\text{C}$ |
| eN | Output Noise Voltage | $B = 10\text{Hz to } 100\text{KHz}$ $T_J = 25^\circ\text{C}$ | | 200 | | μV |
| SVR | Supply Voltage Rejection | $\Delta V_I = 10\text{ V}$ $f = 120\text{Hz}$ | 54 | 60 | | dB |
| V_d | Dropout Voltage | $I_O = 1\text{ A}$ $T_J = 25^\circ\text{C}$ $\Delta V_O = 100\text{ mV}$ | | 1.1 | | V |
| I_{sc} | Short Circuit Current | | | 1.5 | | A |

(*) 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.

Table 8: Electrical Characteristics Of L7915C (refer to the test circuits, $T_J = 0$ to 125°C , $V_I = -23\text{V}$, $I_O = 500\text{ mA}$, $C_I = 2.2\ \mu\text{F}$, $C_O = 1\ \mu\text{F}$ unless otherwise specified).

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|-----------------------|--------------------------|--|-------|------|-------|----------------------|
| V_O | Output Voltage | $T_J = 25^\circ\text{C}$ | -14.4 | -15 | -15.6 | V |
| V_O | Output Voltage | $I_O = -5\text{ mA to } -1\text{ A}$ $P_O \leq 15\text{ W}$ $V_I = -18.5\text{ to } -30\text{ V}$ | -14.3 | -15 | -15.7 | V |
| $\Delta V_{O(*)}$ | Line Regulation | $V_I = -17.5\text{ to } -30\text{ V}$ $T_J = 25^\circ\text{C}$ | | | 300 | mV |
| | | $V_I = -20\text{ to } -26\text{ V}$ $T_J = 25^\circ\text{C}$ | | | 150 | |
| $\Delta V_{O(*)}$ | Load Regulation | $I_O = 5\text{ mA to } 1.5\text{ A}$ $T_J = 25^\circ\text{C}$ | | | 300 | mV |
| | | $I_O = 250\text{ to } 750\text{ mA}$ $T_J = 25^\circ\text{C}$ | | | 150 | |
| I_d | Quiescent Current | $T_J = 25^\circ\text{C}$ | | | 3 | mA |
| ΔI_d | Quiescent Current Change | $I_O = 5\text{ mA to } 1\text{ A}$ | | | 0.5 | mA |
| | | $V_I = -18.5\text{ to } -30\text{ V}$ | | | 1 | |
| $\Delta V_O/\Delta T$ | Output Voltage Drift | $I_O = 5\text{ mA}$ | | -0.9 | | mV/ $^\circ\text{C}$ |
| eN | Output Noise Voltage | $B = 10\text{Hz to } 100\text{KHz}$ $T_J = 25^\circ\text{C}$ | | 250 | | μV |
| SVR | Supply Voltage Rejection | $\Delta V_I = 10\text{ V}$ $f = 120\text{Hz}$ | 54 | 60 | | dB |
| V_d | Dropout Voltage | $I_O = 1\text{ A}$ $T_J = 25^\circ\text{C}$ $\Delta V_O = 100\text{ mV}$ | | 1.1 | | V |
| I_{sc} | Short Circuit Current | | | 1.3 | | A |

(*) 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.

Table 9: Electrical Characteristics Of L7918C (refer to the test circuits, $T_J = 0$ to 125°C , $V_I = -27\text{V}$, $I_O = 500\text{ mA}$, $C_I = 2.2\ \mu\text{F}$, $C_O = 1\ \mu\text{F}$ unless otherwise specified).

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|-----------------------|--------------------------|--|-------|------|-------|----------------------|
| V_O | Output Voltage | $T_J = 25^\circ\text{C}$ | -17.3 | -18 | -18.7 | V |
| V_O | Output Voltage | $I_O = -5\text{ mA to } -1\text{ A}$ $P_O \leq 15\text{ W}$ $V_I = -22\text{ to } -33\text{ V}$ | -17.1 | -18 | -18.9 | V |
| $\Delta V_{O(*)}$ | Line Regulation | $V_I = -21\text{ to } -33\text{ V}$ $T_J = 25^\circ\text{C}$ | | | 360 | mV |
| | | $V_I = -24\text{ to } -30\text{ V}$ $T_J = 25^\circ\text{C}$ | | | 180 | |
| $\Delta V_{O(*)}$ | Load Regulation | $I_O = 5\text{ mA to } 1.5\text{ A}$ $T_J = 25^\circ\text{C}$ | | | 360 | mV |
| | | $I_O = 250\text{ to } 750\text{ mA}$ $T_J = 25^\circ\text{C}$ | | | 180 | |
| I_d | Quiescent Current | $T_J = 25^\circ\text{C}$ | | | 3 | mA |
| ΔI_d | Quiescent Current Change | $I_O = 5\text{ mA to } 1\text{ A}$ | | | 0.5 | mA |
| | | $V_I = -22\text{ to } -33\text{ V}$ | | | 1 | |
| $\Delta V_O/\Delta T$ | Output Voltage Drift | $I_O = 5\text{ mA}$ | | -1 | | mV/ $^\circ\text{C}$ |
| eN | Output Noise Voltage | $B = 10\text{Hz to } 100\text{KHz}$ $T_J = 25^\circ\text{C}$ | | 300 | | μV |
| SVR | Supply Voltage Rejection | $\Delta V_I = 10\text{ V}$ $f = 120\text{Hz}$ | 54 | 60 | | dB |
| V_d | Dropout Voltage | $I_O = 1\text{ A}$ $T_J = 25^\circ\text{C}$ $\Delta V_O = 100\text{ mV}$ | | 1.1 | | V |
| I_{sc} | Short Circuit Current | | | 1.1 | | A |

(*) 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.

Table 10: Electrical Characteristics Of L7920C (refer to the test circuits, $T_J = 0$ to 125°C , $V_I = -29\text{V}$, $I_O = 500\text{ mA}$, $C_I = 2.2\ \mu\text{F}$, $C_O = 1\ \mu\text{F}$ unless otherwise specified).

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|-----------------------|--------------------------|--|-------|------|-------|----------------------|
| V_O | Output Voltage | $T_J = 25^\circ\text{C}$ | -19.2 | -20 | -20.8 | V |
| V_O | Output Voltage | $I_O = -5\text{ mA to } -1\text{ A}$ $P_O \leq 15\text{ W}$ $V_I = -24\text{ to } -35\text{ V}$ | -19 | -20 | -21 | V |
| $\Delta V_{O(*)}$ | Line Regulation | $V_I = -23\text{ to } -35\text{ V}$ $T_J = 25^\circ\text{C}$ | | | 400 | mV |
| | | $V_I = -26\text{ to } -32\text{ V}$ $T_J = 25^\circ\text{C}$ | | | 200 | |
| $\Delta V_{O(*)}$ | Load Regulation | $I_O = 5\text{ mA to } 1.5\text{ A}$ $T_J = 25^\circ\text{C}$ | | | 400 | mV |
| | | $I_O = 250\text{ to } 750\text{ mA}$ $T_J = 25^\circ\text{C}$ | | | 200 | |
| I_d | Quiescent Current | $T_J = 25^\circ\text{C}$ | | | 3 | mA |
| ΔI_d | Quiescent Current Change | $I_O = 5\text{ mA to } 1\text{ A}$ | | | 0.5 | mA |
| | | $V_I = -24\text{ to } -35\text{ V}$ | | | 1 | |
| $\Delta V_O/\Delta T$ | Output Voltage Drift | $I_O = 5\text{ mA}$ | | -1.1 | | mV/ $^\circ\text{C}$ |
| eN | Output Noise Voltage | $B = 10\text{Hz to } 100\text{KHz}$ $T_J = 25^\circ\text{C}$ | | 350 | | μV |
| SVR | Supply Voltage Rejection | $\Delta V_I = 10\text{ V}$ $f = 120\text{Hz}$ | 54 | 60 | | dB |
| V_d | Dropout Voltage | $I_O = 1\text{ A}$ $T_J = 25^\circ\text{C}$ $\Delta V_O = 100\text{ mV}$ | | 1.1 | | V |
| I_{sc} | Short Circuit Current | | | 0.9 | | A |

(*) 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.

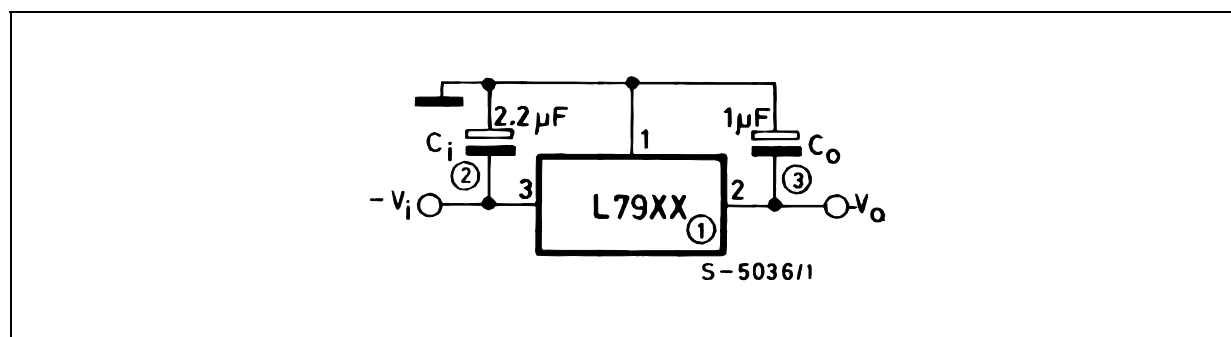
Table 11: Electrical Characteristics Of L7924C (refer to the test circuits, $T_J = 0$ to 125°C , $V_I = -33\text{V}$, $I_O = 500\text{ mA}$, $C_I = 2.2\ \mu\text{F}$, $C_O = 1\ \mu\text{F}$ unless otherwise specified).

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|-----------------------|--------------------------|--|-------|------|-------|----------------------|
| V_O | Output Voltage | $T_J = 25^\circ\text{C}$ | -23 | -24 | -24.5 | V |
| V_O | Output Voltage | $I_O = -5\text{ mA to } -1\text{ A}$ $P_O \leq 15\text{ W}$ $V_I = -27\text{ to } -38\text{ V}$ | -22.8 | -24 | -25.2 | V |
| $\Delta V_{O(*)}$ | Line Regulation | $V_I = -27\text{ to } -38\text{ V}$ $T_J = 25^\circ\text{C}$ | | | 480 | mV |
| | | $V_I = -30\text{ to } -36\text{ V}$ $T_J = 25^\circ\text{C}$ | | | 240 | |
| $\Delta V_{O(*)}$ | Load Regulation | $I_O = 5\text{ mA to } 1.5\text{ A}$ $T_J = 25^\circ\text{C}$ | | | 480 | mV |
| | | $I_O = 250\text{ to } 750\text{ mA}$ $T_J = 25^\circ\text{C}$ | | | 240 | |
| I_d | Quiescent Current | $T_J = 25^\circ\text{C}$ | | | 3 | mA |
| ΔI_d | Quiescent Current Change | $I_O = 5\text{ mA to } 1\text{ A}$ | | | 0.5 | mA |
| | | $V_I = -27\text{ to } -38\text{ V}$ | | | 1 | |
| $\Delta V_O/\Delta T$ | Output Voltage Drift | $I_O = 5\text{ mA}$ | | -1 | | mV/ $^\circ\text{C}$ |
| eN | Output Noise Voltage | $B = 10\text{Hz to } 100\text{KHz}$ $T_J = 25^\circ\text{C}$ | | 400 | | μV |
| SVR | Supply Voltage Rejection | $\Delta V_I = 10\text{ V}$ $f = 120\text{Hz}$ | 54 | 60 | | dB |
| V_d | Dropout Voltage | $I_O = 1\text{ A}$ $T_J = 25^\circ\text{C}$ $\Delta V_O = 100\text{ mV}$ | | 1.1 | | V |
| I_{sc} | Short Circuit Current | | | 1.1 | | A |

(*) 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.

APPLICATIONS INFORMATION

Figure 4: Fixed Output Regulator



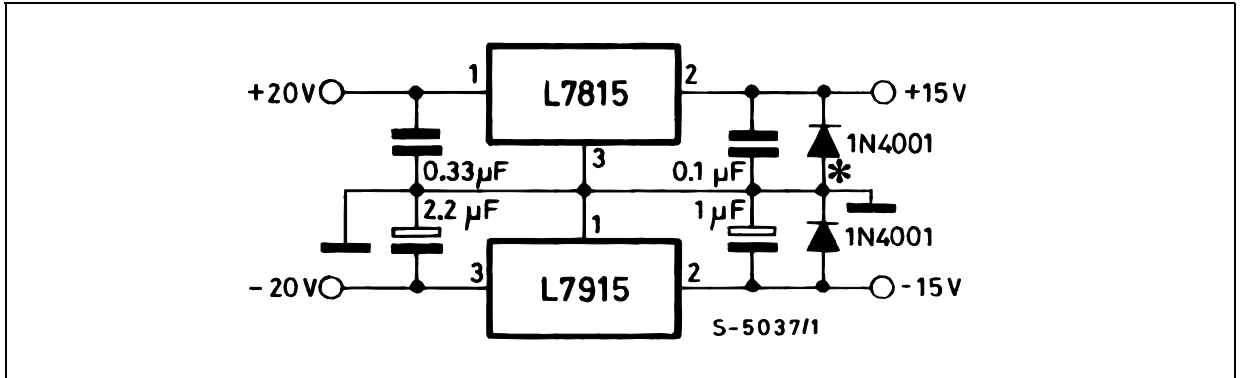
NOTE:

1. To specify an output voltage, substitute voltage value for "XX".

2. Required for stability. For value given, capacitor must be solid tantalum. If aluminium electrolytics are used, at least ten times value should be selected. C1 is required if regulator is located an appreciable distance from power supply filter.

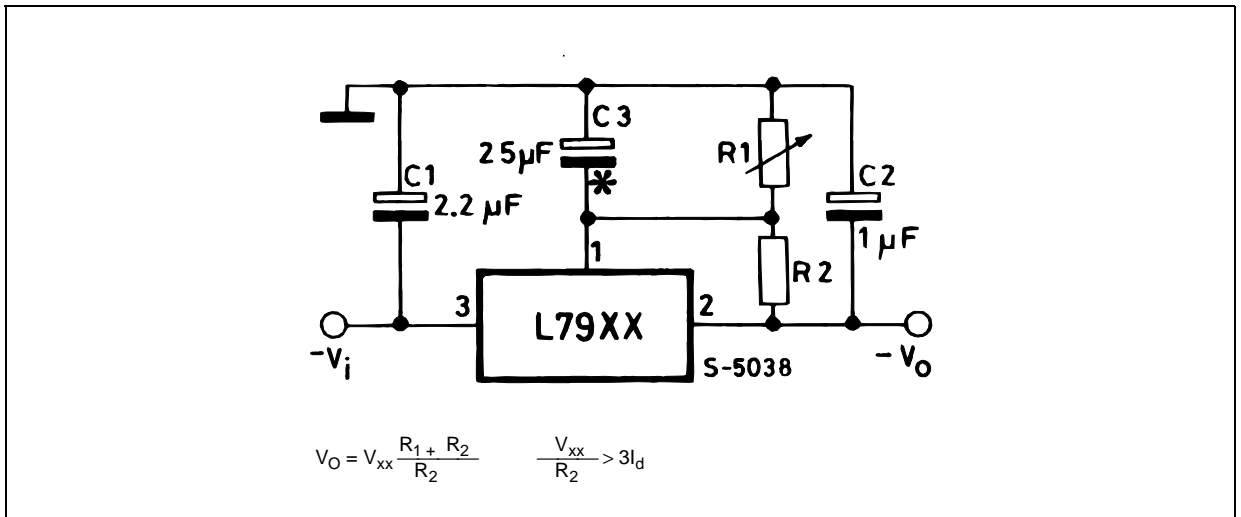
3. To improve transient response. If large capacitors are used, a high current diode from input to output (1N4001 or similar) should be introduced to protect the device from momentary input short circuit.

Figure 5: Split Power Supply ($\pm 15V/1A$)



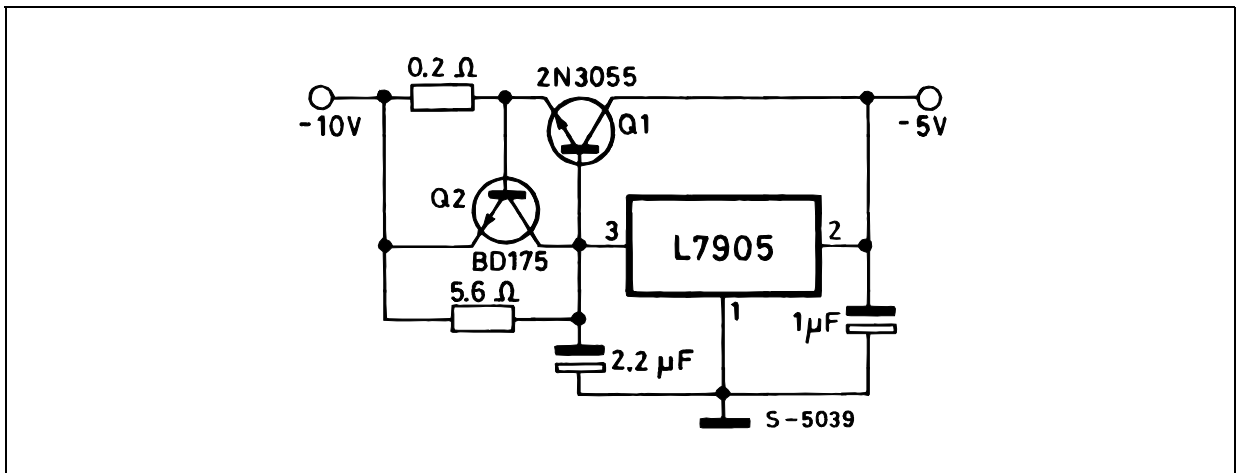
Against potential latch-up problems.

Figure 6: Circuit for Increasing Output Voltage



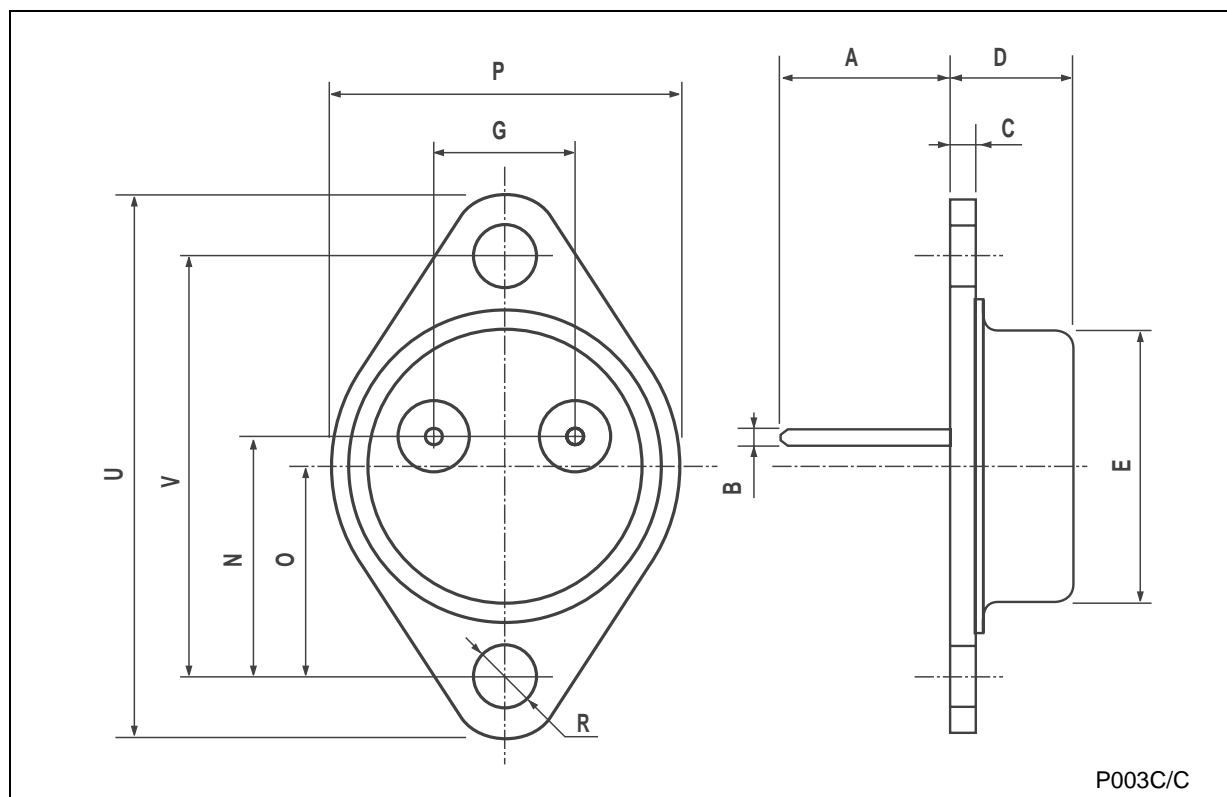
C3 Optional for improved transient response and ripple rejection.

Figure 7: High Current Negative Regulator ($-5V/4A$ with 5A current limiting)



TO-3 MECHANICAL DATA

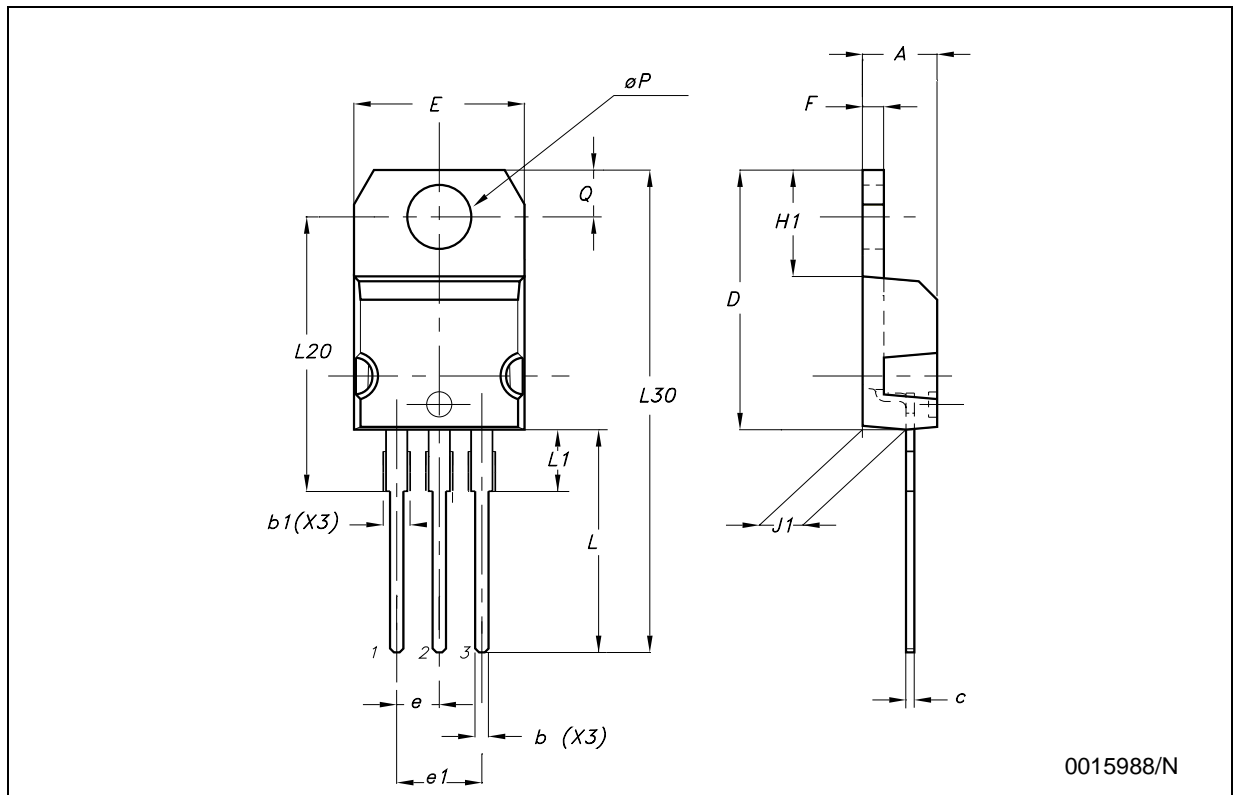
| DIM. | mm. | | | inch | | |
|------|------|-------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | 11.85 | | | 0.466 | |
| B | 0.96 | 1.05 | 1.10 | 0.037 | 0.041 | 0.043 |
| C | | | 1.70 | | | 0.066 |
| D | | | 8.7 | | | 0.342 |
| E | | | 20.0 | | | 0.787 |
| G | | 10.9 | | | 0.429 | |
| N | | 16.9 | | | 0.665 | |
| P | | | 26.2 | | | 1.031 |
| R | 3.88 | | 4.09 | 0.152 | | 0.161 |
| U | | | 39.5 | | | 1.555 |
| V | | 30.10 | | | 1.185 | |



P003C/C

TO-220 (A TYPE) MECHANICAL DATA

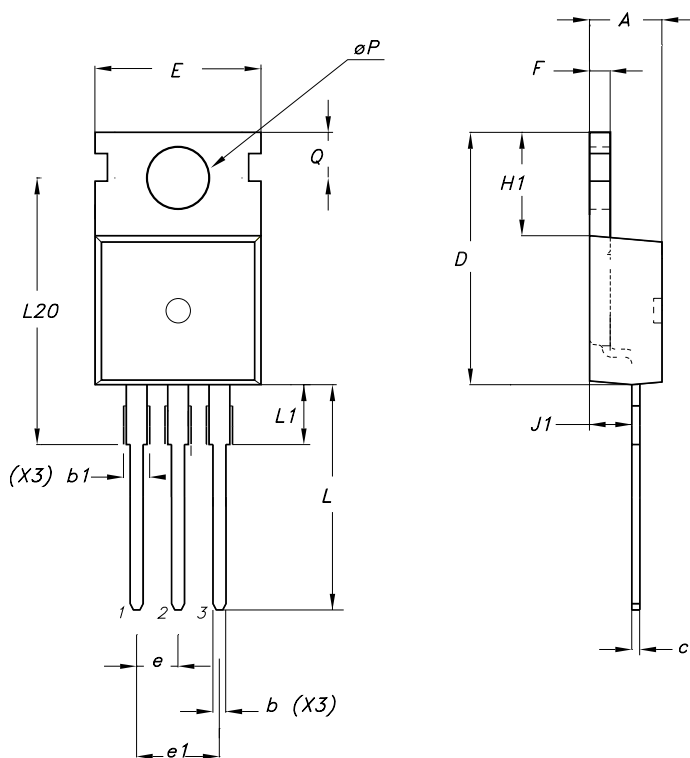
| DIM. | mm. | | | inch | | |
|------|-------|------|-------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.40 | | 4.60 | 0.173 | | 0.181 |
| b | 0.61 | | 0.88 | 0.024 | | 0.034 |
| b1 | 1.15 | | 1.70 | 0.045 | | 0.067 |
| c | 0.49 | | 0.70 | 0.019 | | 0.027 |
| D | 15.25 | | 15.75 | 0.600 | | 0.620 |
| E | 10.0 | | 10.40 | 0.393 | | 0.409 |
| e | 2.4 | | 2.7 | 0.094 | | 0.106 |
| e1 | 4.95 | | 5.15 | 0.194 | | 0.203 |
| F | 1.23 | | 1.32 | 0.048 | | 0.051 |
| H1 | 6.2 | | 6.6 | 0.244 | | 0.260 |
| J1 | 2.40 | | 2.72 | 0.094 | | 0.107 |
| L | 13.0 | | 14.0 | 0.511 | | 0.551 |
| L1 | 3.5 | | 3.93 | 0.137 | | 0.154 |
| L20 | | 16.4 | | | 0.645 | |
| L30 | | 28.9 | | | 1.138 | |
| φP | 3.75 | | 3.85 | 0.147 | | 0.151 |
| Q | 2.65 | | 2.95 | 0.104 | | 0.116 |



0015988/N

TO-220 (C TYPE) MECHANICAL DATA

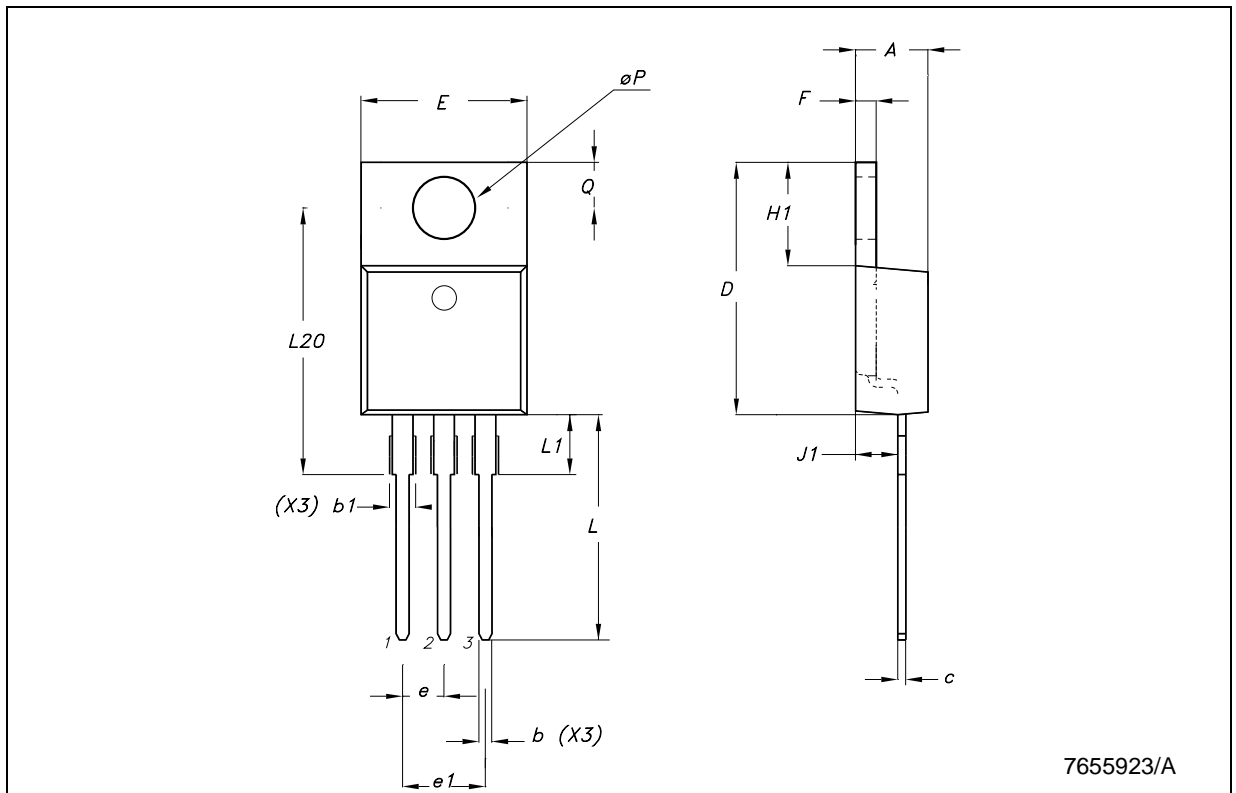
| DIM. | mm. | | | inch | | |
|----------|-------|-------|-------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.30 | | 4.70 | 0.169 | | 0.185 |
| b | 0.70 | | 0.90 | 0.028 | | 0.035 |
| b1 | 1.42 | | 1.62 | 0.056 | | 0.064 |
| c | 0.45 | | 0.60 | 0.018 | | 0.024 |
| D | | 15.70 | | | 0.618 | |
| E | 9.80 | | 10.20 | 0.386 | | 0.402 |
| e | | 2.54 | | | 0.100 | |
| e1 | | 5.08 | | | 0.200 | |
| F | 1.25 | | 1.39 | 0.049 | | 0.055 |
| H1 | | 6.5 | | | 0.256 | |
| J1 | 2.20 | | 2.60 | 0.087 | | 0.202 |
| L | 12.88 | | 13.28 | 0.507 | | 0.523 |
| L1 | | 3 | | | 0.118 | |
| L20 | 15.70 | | 16.1 | 0.618 | | 0.634 |
| L30 | | 28.9 | | | 1.138 | |
| ϕP | 3.50 | | 3.70 | 0.138 | | 0.146 |
| Q | 2.70 | | 2.90 | 0.106 | | 0.114 |



0015988/N

TO-220 (E TYPE) MECHANICAL DATA

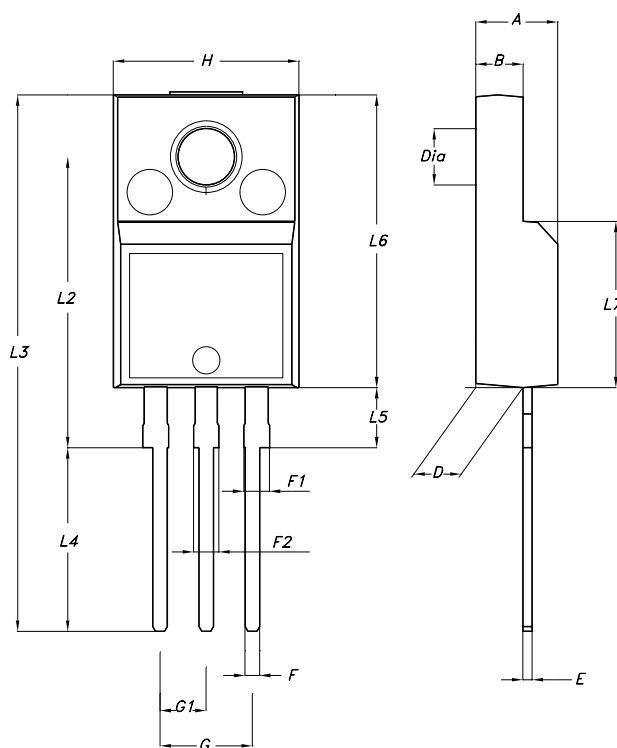
| DIM. | mm. | | | inch | | |
|----------|-------|------|-------|-------|-------|-------|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | 4.47 | | 4.67 | 0.176 | | 0.184 |
| b | 0.70 | | 0.91 | 0.028 | | 0.036 |
| b1 | 1.17 | | 1.37 | 0.046 | | 0.054 |
| c | 0.31 | | 0.53 | 0.012 | | 0.021 |
| D | 14.60 | | 15.70 | 0.575 | | 0.618 |
| E | 9.96 | | 10.36 | 0.392 | | 0.408 |
| e | | 2.54 | | | 0.100 | |
| e1 | | 5.08 | | | 0.200 | |
| F | 1.17 | | 1.37 | 0.046 | | 0.054 |
| H1 | 6.1 | | 6.8 | 0.240 | | 0.268 |
| J1 | 2.52 | | 2.82 | 0.099 | | 0.111 |
| L | 12.70 | | 13.80 | 0.500 | | 0.543 |
| L1 | 3.20 | | 3.96 | 0.126 | | 0.156 |
| L20 | 15.21 | | 16.77 | 0.599 | | 0.660 |
| ϕP | 3.73 | | 3.94 | 0.147 | | 0.155 |
| Q | 2.59 | | 2.89 | 0.102 | | 0.114 |



7655923/A

TO-220FP MECHANICAL DATA

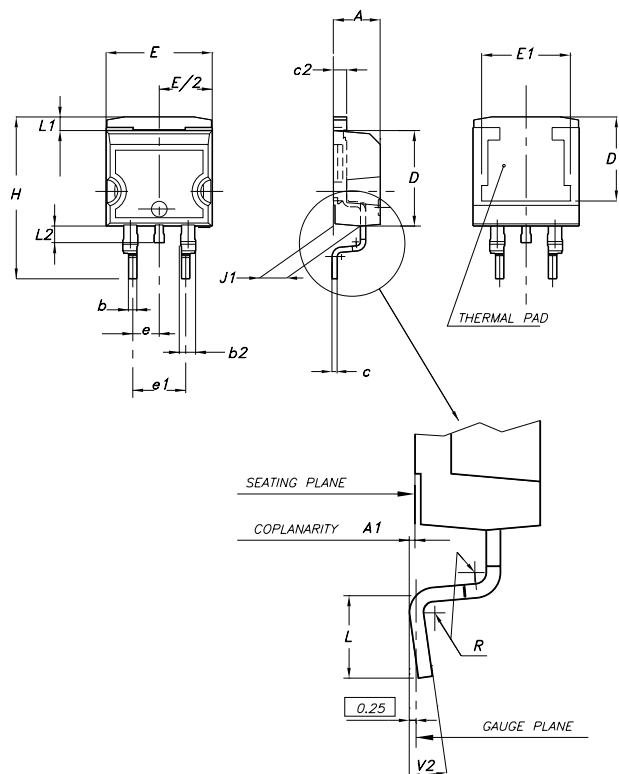
| DIM. | mm. | | | inch | | |
|------|------|------|-------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.40 | | 4.60 | 0.173 | | 0.181 |
| B | 2.5 | | 2.7 | 0.098 | | 0.106 |
| D | 2.5 | | 2.75 | 0.098 | | 0.108 |
| E | 0.45 | | 0.70 | 0.017 | | 0.027 |
| F | 0.75 | | 1 | 0.030 | | 0.039 |
| F1 | 1.15 | | 1.50 | 0.045 | | 0.059 |
| F2 | 1.15 | | 1.50 | 0.045 | | 0.059 |
| G | 4.95 | | 5.2 | 0.194 | | 0.204 |
| G1 | 2.4 | | 2.7 | 0.094 | | 0.106 |
| H | 10.0 | | 10.40 | 0.393 | | 0.409 |
| L2 | | 16 | | | 0.630 | |
| L3 | 28.6 | | 30.6 | 1.126 | | 1.204 |
| L4 | 9.8 | | 10.6 | 0.385 | | 0.417 |
| L5 | 2.9 | | 3.6 | 0.114 | | 0.142 |
| L6 | 15.9 | | 16.4 | 0.626 | | 0.645 |
| L7 | 9 | | 9.3 | 0.354 | | 0.366 |
| DIA. | 3 | | 3.2 | 0.118 | | 0.126 |



7012510A-H

D²PAK (A TYPE) MECHANICAL DATA

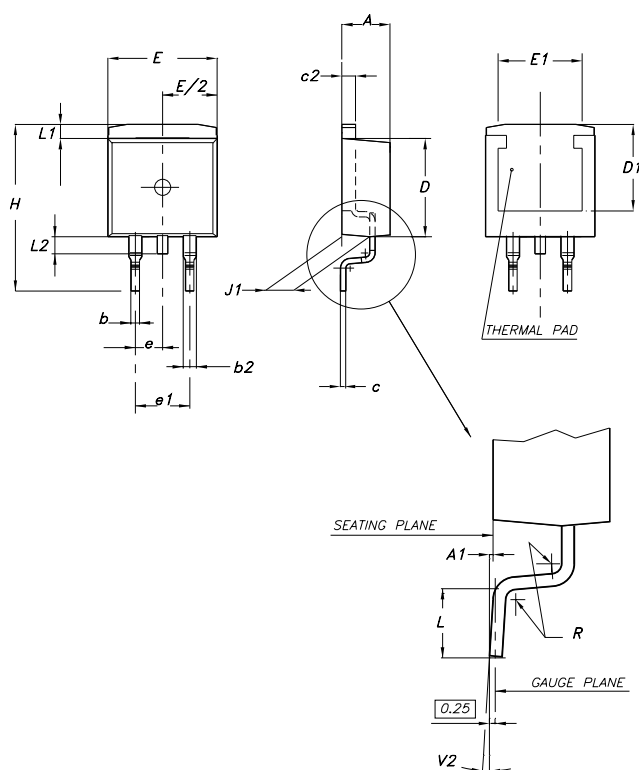
| DIM. | mm. | | | inch | | |
|------|------|------|-------|-------|-------|-------|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | 4.4 | | 4.6 | 0.173 | | 0.181 |
| A1 | 0.03 | | 0.23 | 0.001 | | 0.009 |
| b | 0.7 | | 0.93 | 0.027 | | 0.036 |
| b2 | 1.14 | | 1.7 | 0.044 | | 0.067 |
| c | 0.45 | | 0.6 | 0.017 | | 0.023 |
| c2 | 1.23 | | 1.36 | 0.048 | | 0.053 |
| D | 8.95 | | 9.35 | 0.352 | | 0.368 |
| D1 | 8 | | | 0.315 | | |
| E | 10 | | 10.4 | 0.393 | | 0.409 |
| E1 | 8.5 | | | 0.335 | | |
| e | | 2.54 | | | 0.100 | |
| e1 | 4.88 | | 5.28 | 0.192 | | 0.208 |
| H | 15 | | 15.85 | 0.590 | | 0.624 |
| J1 | 2.49 | | 2.69 | 0.098 | | 0.106 |
| L | 2.29 | | 2.79 | 0.090 | | 0.110 |
| L1 | 1.27 | | 1.4 | 0.050 | | 0.055 |
| L2 | 1.3 | | 1.75 | 0.051 | | 0.069 |
| R | | 0.4 | | | 0.016 | |
| V2 | 0° | | 8° | 0° | | 8° |



0079457/J

D²PAK (C TYPE) MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|------|------|-------|-------|-------|-------|-------|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | 4.3 | | 4.7 | 0.169 | | 0.185 |
| A1 | 0 | | 0.20 | 0.000 | | 0.008 |
| b | 0.70 | | 0.90 | 0.028 | | 0.035 |
| b2 | 1.17 | | 1.37 | 0.046 | | 0.054 |
| c | 0.45 | 0.50 | 0.6 | 0.018 | 0.020 | 0.024 |
| c2 | 1.25 | 1.30 | 1.40 | 0.049 | 0.051 | 0.055 |
| D | 9.0 | 9.2 | 9.4 | 0.354 | 0.362 | 0.370 |
| D1 | 7.5 | | | 0.295 | | |
| E | 9.8 | | 10.2 | 0.386 | | 0.402 |
| E1 | 7.5 | | | 0.295 | | |
| e | | 2.54 | | | 0.100 | |
| e1 | | 5.08 | | | 0.200 | |
| H | 15 | 15.30 | 15.60 | 0.591 | 0.602 | 0.614 |
| J1 | 2.20 | | 2.60 | 0.087 | | 0.102 |
| L | 1.79 | | 2.79 | 0.070 | | 0.110 |
| L1 | 1.0 | | 1.4 | 0.039 | | 0.055 |
| L2 | 1.2 | | 1.6 | 0.047 | | 0.063 |
| R | | 0.3 | | | 0.012 | |
| V2 | 0° | | 3° | 0° | | 3° |



0079457/J

Tape & Reel D²PAK-P²PAK-D²PAK/A-P²PAK/A MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|------|-------|-------|-------|-------|-------|-------|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | | | 180 | | | 7.086 |
| C | 12.8 | 13.0 | 13.2 | 0.504 | 0.512 | 0.519 |
| D | 20.2 | | | 0.795 | | |
| N | 60 | | | 2.362 | | |
| T | | | 14.4 | | | 0.567 |
| Ao | 10.50 | 10.6 | 10.70 | 0.413 | 0.417 | 0.421 |
| Bo | 15.70 | 15.80 | 15.90 | 0.618 | 0.622 | 0.626 |
| Ko | 4.80 | 4.90 | 5.00 | 0.189 | 0.193 | 0.197 |
| Po | 3.9 | 4.0 | 4.1 | 0.153 | 0.157 | 0.161 |
| P | 11.9 | 12.0 | 12.1 | 0.468 | 0.472 | 0.476 |

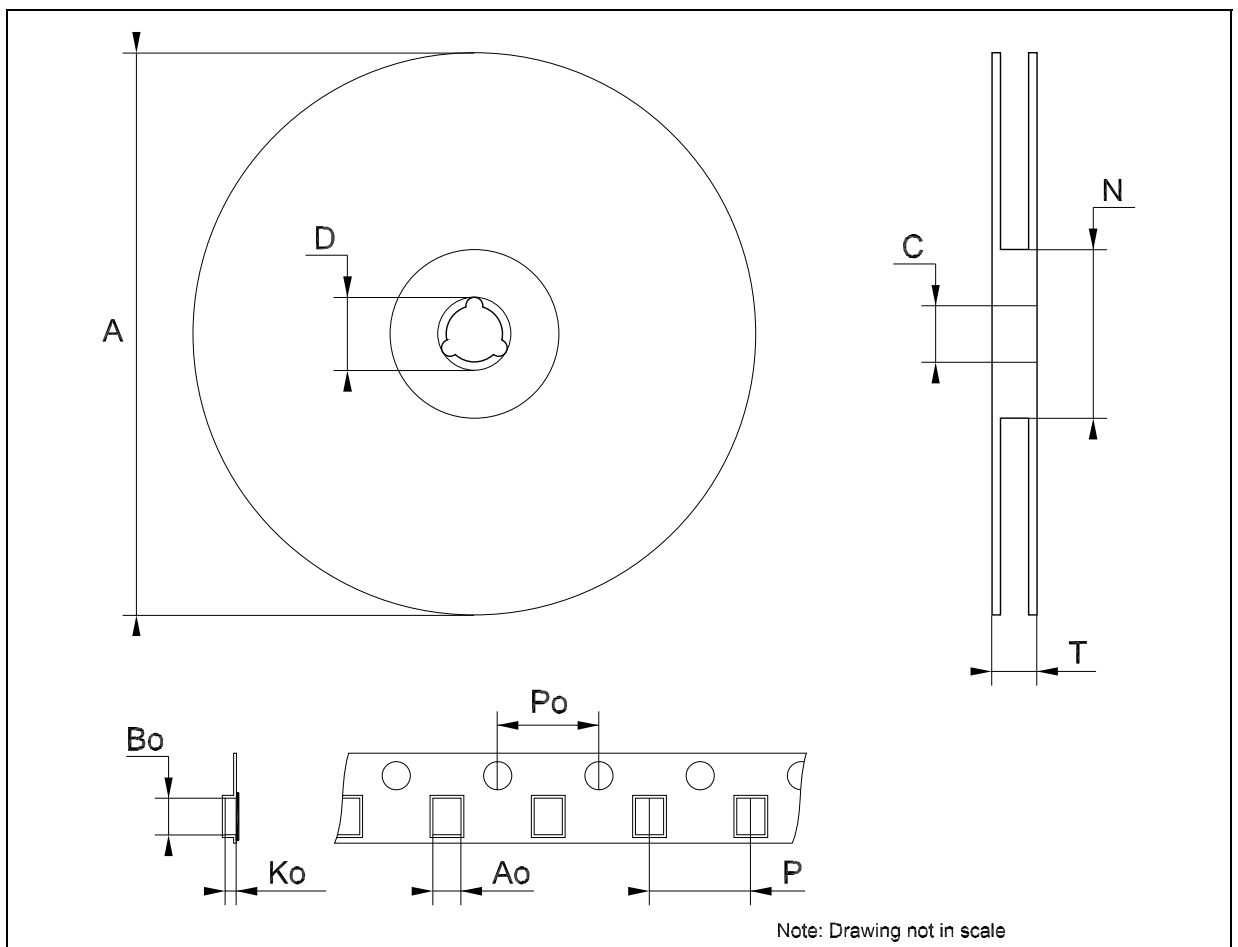


Table 12: Revision History

| Date | Revision | Description of Changes |
|-------------|----------|---|
| 22-Jun-2004 | 9 | Ordering Codes updated Table 3, pag. 3. |
| 31-Aug-2005 | 10 | Add new order codes (TO-220 E Type) on Table 3, pag. 3. |

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