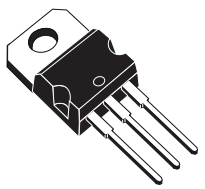
# L78MxxC

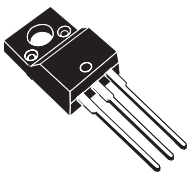
## Positive voltage regulators

### Features

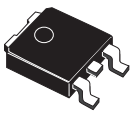
- Output current to 0.5 A
- Output voltages of 5; 6; 8; 9; 12; 15; 24 V
- Thermal overload protection
- Short circuit protection
- Output transition SOA protection



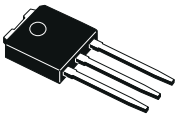
TO-220



TO-220FP



DPAK



IPAK

### Description

The L78Mxx series of three-terminal positive regulators is available in TO-220, TO-220FP, DPAK and IPAK packages and with 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 employs internal current limiting, thermal shut-down and safe area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 0.5 A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltage and currents.

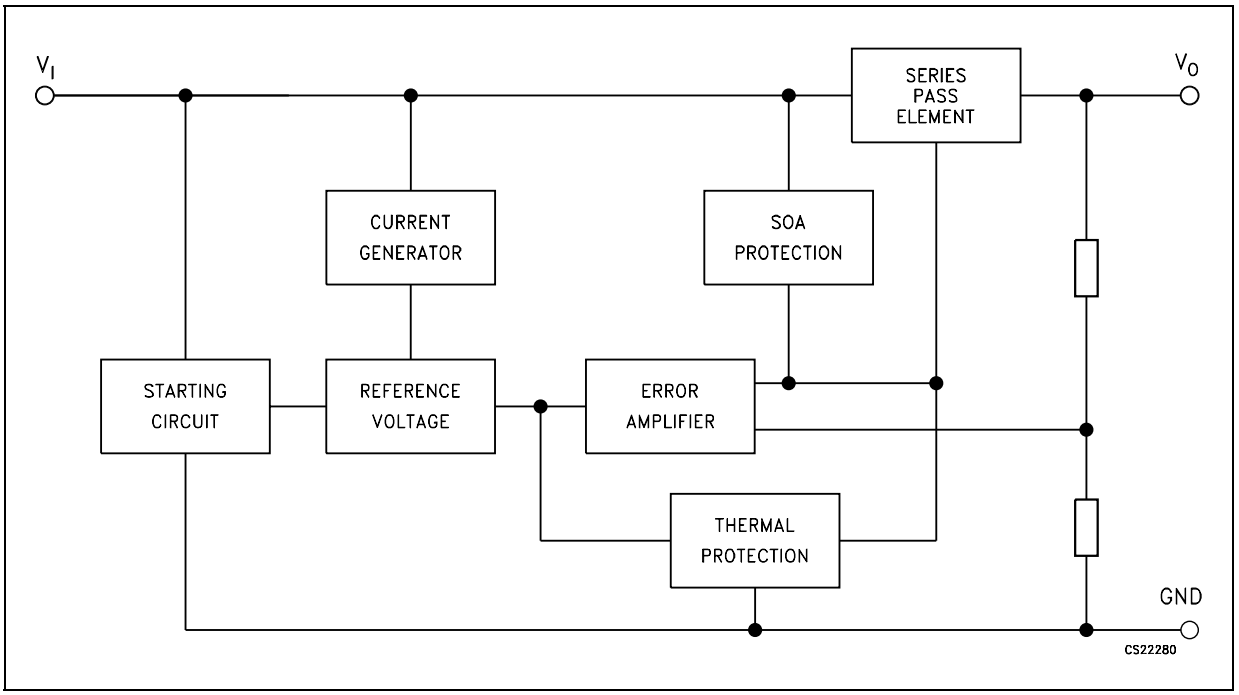
**Table 1. Device summary**

| Part numbers | |
|---|---|
| L78M05C | L78M12C |
| L78M06C | L78M15C |
| L78M08C | L78M24C |
| L78M09C | |

# Contents

# 1 Diagram

**Figure 1. Block diagram**



# 2 Pin configuration

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

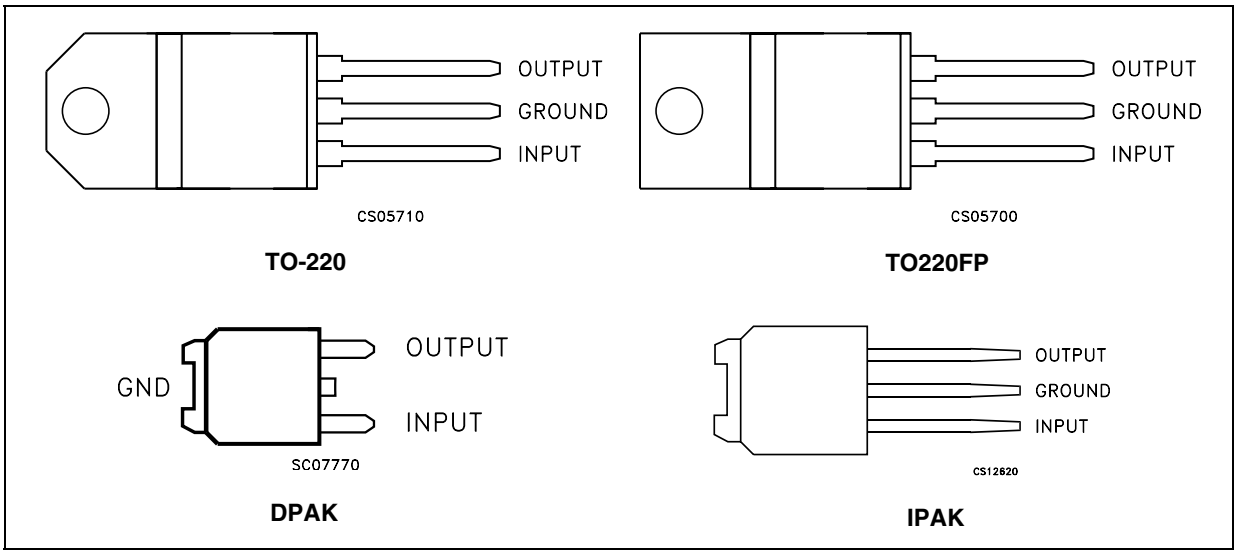
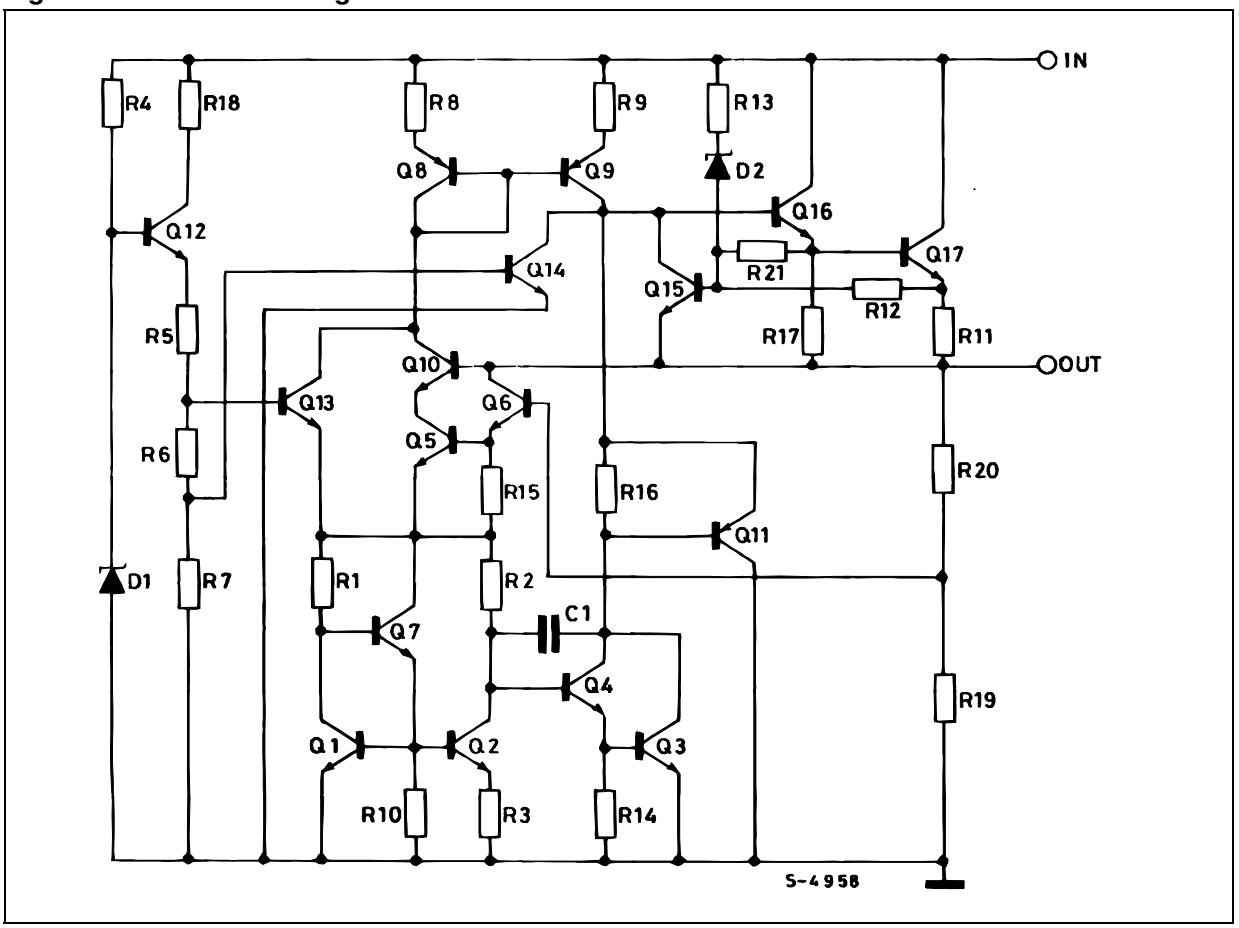



**Figure 3. Schematic diagram**



# 3 Maximum ratings

**Table 2. Absolute maximum ratings**

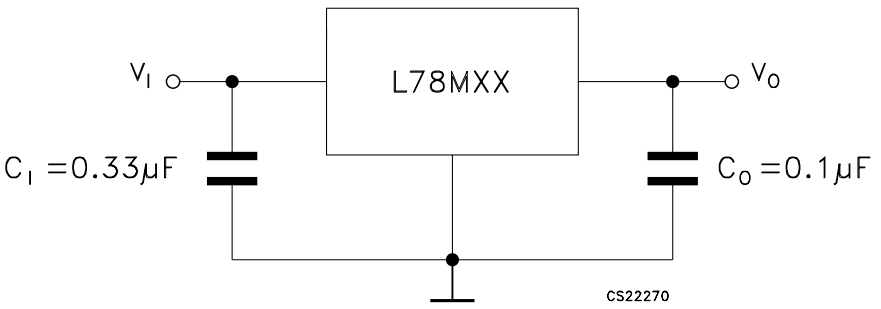
| Symbol | Parameter | | Value | Unit |
|---|---|---|---|---|
| $V_I$ | DC input voltage | for $V_O$= 5 to 18V | 35 | V |
| | | for $V_O$= 20, 24V | 40 | |
| $I_O$ | Output current | | Internally limited | mA |
| $P_D$ | Power dissipation | | Internally limited | mW |
| $T_{STG}$ | Storage temperature 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 | TO-220FP | DPAK | IPAK | Unit |
|---|---|---|---|---|---|---|
| $R_{thJC}$ | Thermal resistance junction-case | 3 | 5 | 8 | | °C/W |
| $R_{thJA}$ | Thermal resistance junction-ambient | 50 | 60 | 100 | | °C/W |

**Figure 4. Application circuit**



# 4 Test circuits

**Figure 5. DC parameter**

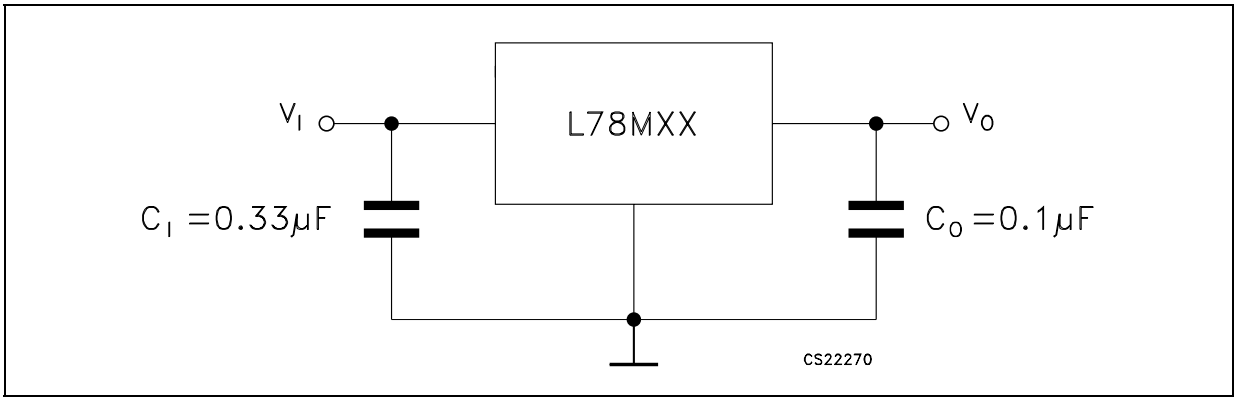



**Figure 6. Load regulation**

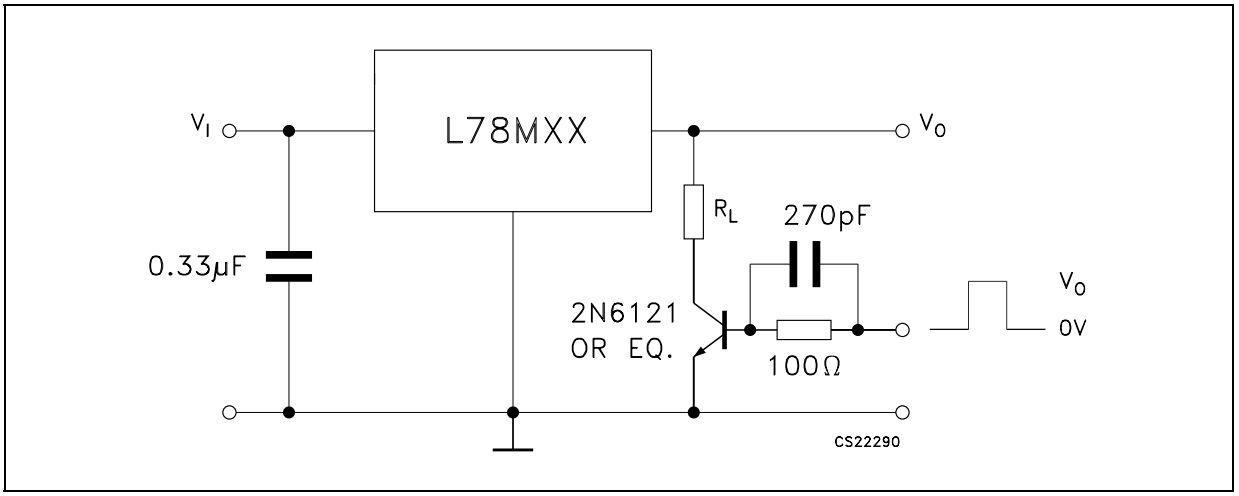
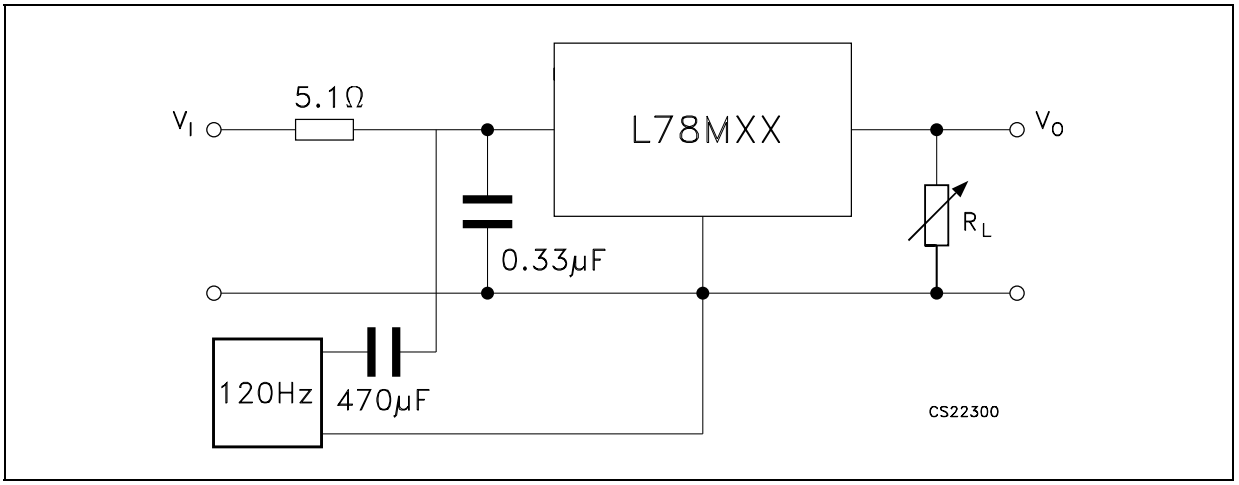



**Figure 7. Ripple rejection**



# 5 Electrical characteristics

**Table 4. Electrical characteristics of L78M05C** (refer to the test circuits, $T_J$ = 25 °C, $V_I$ = 10 V, $I_O$ = 350 mA, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF unless otherwise specified)

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage | | 4.8 | 5 | 5.2 | V |
| $V_O$ | Output voltage | $I_O$ = 5 to 350 mA, $V_I$ = 7 to 20 V | 4.75 | 5 | 5.25 | V |
| $\Delta V_O$ | Line regulation | $V_I$ = 7 to 25 V, $I_O$ = 200 mA | | | 100 | mV |
| | | $V_I$ = 8 to 25 V, $I_O$ = 200 mA | | | 50 | |
| $\Delta V_O$ | Load regulation | $I_O$ = 5 to 500 mA, $T_J$ = 25°C | | | 100 | mV |
| | | $I_O$ = 5 to 200 mA, $T_J$ = 25°C | | | 50 | |
| $I_d$ | Quiescent current | | | | 6 | mA |
| $\Delta I_d$ | Quiescent current change | $I_O$ = 5 to 350 mA | | | 0.5 | mA |
| | | $I_O$ = 200 mA, $V_I$ = 8 to 25 V | | | 0.8 | |
| $\Delta V_O/\Delta T$ | Output voltage drift | $I_O$ = 5 mA, $T_J$ = 0 to 125°C | | -0.5 | | mV/°C |
| SVR | Supply voltage rejection | $V_I$ = 8 to 18 V, f = 120Hz, $I_O$ = 300mA | 62 | | | dB |
| eN | Output noise voltage | B =10Hz to 100kHz | | 40 | | µV |
| $V_d$ | Dropout voltage | | | 2 | | V |
| $I_{sc}$ | Short circuit current | $V_I$ = 35 V | | 300 | | mA |

**Table 5. Electrical characteristics of L78M06C** (refer to the test circuits, $T_J$ = 25 °C, $V_I$ = 11 V, $I_O$ = 350 mA, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF unless otherwise specified)

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage | | 5.75 | 6 | 6.25 | V |
| $V_O$ | Output voltage | $I_O$ = 5 to 350 mA, $V_I$ = 8 to 21 V | 5.7 | 6 | 6.3 | V |
| $\Delta V_O$ | Line regulation | $V_I$ = 8 to 25 V, $I_O$ = 200 mA | | | 100 | mV |
| | | $V_I$ = 9 to 25 V, $I_O$ = 200 mA | | | 50 | |
| $\Delta V_O$ | Load regulation | $I_O$ = 5 to 500 mA, $T_J$ = 25°C | | | 120 | mV |
| | | $I_O$ = 5 to 200 mA, $T_J$ = 25°C | | | 60 | |
| $I_d$ | Quiescent current | | | | 6 | mA |
| $\Delta I_d$ | Quiescent current change | $I_O$ = 5 to 350 mA | | | 0.5 | mA |
| | | $I_O$ = 200 mA, $V_I$ = 9 to 25 V | | | 0.8 | |
| $\Delta V_O/\Delta T$ | Output voltage drift | $I_O$ = 5 mA, $T_J$ = 0 to 125°C | | -0.5 | | mV/°C |
| SVR | Supply voltage rejection | $V_I$ = 9 to 19 V, f = 120Hz, $I_O$ = 300mA | 59 | | | dB |
| eN | Output noise voltage | B =10Hz to 100kHz | | 45 | | µV |
| $V_d$ | Dropout voltage | | | 2 | | V |
| $I_{sc}$ | Short circuit current | $V_I$ = 35 V | | 270 | | mA |

**Table 6.** **Electrical characteristics of L78M08C** (refer to the test circuits, $T_J$ = 25 °C, $V_I$ = 14 V, $I_O$ = 350 mA, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF unless otherwise specified)

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage | | 7.7 | 8 | 8.3 | V |
| $V_O$ | Output voltage | $I_O$ = 5 to 350 mA, $V_I$ = 10.5 to 23 V | 7.6 | 8 | 8.4 | V |
| $\Delta V_O$ | Line regulation | $V_I$ = 10.5 to 25 V, $I_O$ = 200 mA | | | 100 | mV |
| | | $V_I$ = 11 to 25 V, $I_O$ = 200 mA | | | 50 | |
| $\Delta V_O$ | Load regulation | $I_O$ = 5 to 500 mA, $T_J$ = 25°C | | | 160 | mV |
| | | $I_O$ = 5 to 200 mA, $T_J$ = 25°C | | | 80 | |
| $I_d$ | Quiescent current | | | | 6 | mA |
| $\Delta I_d$ | Quiescent current change | $I_O$ = 5 to 350 mA | | | 0.5 | mA |
| | | $I_O$ = 200 mA, $V_I$ = 10.5 to 25 V | | | 0.8 | |
| $\Delta V_O/\Delta T$ | Output voltage drift | $I_O$ = 5 mA, $T_J$ = 0 to 125°C | | -0.5 | | mV/°C |
| SVR | Supply voltage rejection | $V_I$ = 11.5 to 21.5 V, f = 120Hz, $I_O$ = 300mA | 56 | | | dB |
| eN | Output noise voltage | B =10Hz to 100kHz | | 52 | | µV |
| $V_d$ | Dropout voltage | | | 2 | | V |
| $I_{sc}$ | Short circuit current | $V_I$ = 35 V | | 250 | | mA |

**Table 7.** **Electrical characteristics of L78M09C** (refer to the test circuits, $T_J$ = 25 °C, $V_I$ = 15 V, $I_O$ = 350 mA, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF unless otherwise specified)

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage | | 8.65 | 9 | 9.35 | V |
| $V_O$ | Output voltage | $I_O$ = 5 to 350 mA, $V_I$ = 11.5 to 24 V | 8.55 | 9 | 9.45 | V |
| $\Delta V_O$ | Line regulation | $V_I$ = 11.5 to 25 V, $I_O$ = 200 mA | | | 100 | mV |
| | | $V_I$ = 12 to 25 V, $I_O$ = 200 mA | | | 50 | |
| $\Delta V_O$ | Load regulation | $I_O$ = 5 to 500 mA, $T_J$ = 25°C | | | 180 | mV |
| | | $I_O$ = 5 to 200 mA, $T_J$ = 25°C | | | 90 | |
| $I_d$ | Quiescent current | | | | 6 | mA |
| $\Delta I_d$ | Quiescent current change | $I_O$ = 5 to 350 mA | | | 0.5 | mA |
| | | $I_O$ = 200 mA, $V_I$ = 11.5 to 25 V | | | 0.8 | |
| $\Delta V_O/\Delta T$ | Output voltage drift | $I_O$ = 5 mA, $T_J$ = 0 to 125°C | | -0.5 | | mV/°C |
| SVR | Supply voltage rejection | $V_I$ = 12.5 to 23 V, f = 120Hz, $I_O$ = 300mA | 56 | | | dB |
| eN | Output noise voltage | B =10Hz to 100kHz | | 58 | | µV |
| $V_d$ | Dropout voltage | | | 2 | | V |
| $I_{sc}$ | Short circuit current | $V_I$ = 35 V | | 250 | | mA |

**Table 8. Electrical characteristics of L78M12C** (refer to the test circuits, $T_J$ = 25 °C, $V_I$ = 19 V, $I_O$ = 350 mA, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF unless otherwise specified)

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage | | 11.5 | 12 | 12.5 | V |
| $V_O$ | Output voltage | $I_O$ = 5 to 350 mA, $V_I$ = 14.5 to 27 V | 11.4 | 12 | 12.6 | V |
| $\Delta V_O$ | Line regulation | $V_I$ = 14.5 to 30 V, $I_O$ = 200 mA | | | 100 | mV |
| | | $V_I$ = 16 to 30 V, $I_O$ = 200 mA | | | 50 | |
| $\Delta V_O$ | Load regulation | $I_O$ = 5 to 500 mA, $T_J$ = 25°C | | | 240 | mV |
| | | $I_O$ = 5 to 200 mA, $T_J$ = 25°C | | | 120 | |
| $I_d$ | Quiescent current | | | | 6 | mA |
| $\Delta I_d$ | Quiescent current change | $I_O$ = 5 to 350 mA | | | 0.5 | mA |
| | | $I_O$ = 200 mA, $V_I$ = 14.5 to 30 V | | | 0.8 | |
| $\Delta V_O/\Delta T$ | Output voltage drift | $I_O$ = 5 mA, $T_J$ = 0 to 125°C | | -1 | | mV/°C |
| SVR | Supply voltage rejection | $V_I$ = 15 to 25 V, f = 120Hz, $I_O$ = 300mA | 55 | | | dB |
| eN | Output noise voltage | B =10Hz to 100kHz | | 75 | | µV |
| $V_d$ | Dropout voltage | | | 2 | | V |
| $I_{sc}$ | Short circuit current | $V_I$ = 35 V | | 240 | | mA |

**Table 9. Electrical characteristics of L78M15C** (refer to the test circuits, $T_J$ = 25 °C, $V_I$ = 23 V, $I_O$ = 350 mA, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF unless otherwise specified)

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage | | 14.4 | 15 | 15.6 | V |
| $V_O$ | Output voltage | $I_O$ = 5 to 350 mA, $V_I$ = 17.5 to 30 V | 14.25 | 15 | 15.75 | V |
| $\Delta V_O$ | Line regulation | $V_I$ = 17.5 to 30 V, $I_O$ = 200 mA | | | 100 | mV |
| | | $V_I$ = 20 to 30 V, $I_O$ = 200 mA | | | 50 | |
| $\Delta V_O$ | Load regulation | $I_O$ = 5 to 500 mA, $T_J$ = 25°C | | | 300 | mV |
| | | $I_O$ = 5 to 200 mA, $T_J$ = 25°C | | | 150 | |
| $I_d$ | Quiescent current | | | | 6 | mA |
| $\Delta I_d$ | Quiescent current change | $I_O$ = 5 to 350 mA | | | 0.5 | mA |
| | | $I_O$ = 200 mA, $V_I$ = 17.5 to 30 V | | | 0.8 | |
| $\Delta V_O/\Delta T$ | Output voltage drift | $I_O$ = 5 mA, $T_J$ = 0 to 125°C | | -1 | | mV/°C |
| SVR | Supply voltage rejection | $V_I$ = 18.5 to 28.5 V, f = 120Hz, $I_O$ = 300mA | 54 | | | dB |
| eN | Output noise voltage | B =10Hz to 100kHz | | 90 | | µV |
| $V_d$ | Dropout voltage | | | 2 | | V |
| $I_{sc}$ | Short circuit current | $V_I$ = 35 V | | 240 | | mA |

**Table 10. Electrical characteristics of L78M24C** (refer to the test circuits, $T_J$ = 25 °C, $V_I$ = 23 V, $I_O$ = 350 mA, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF unless otherwise specified)

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage | | 23 | 24 | 25 | V |
| $V_O$ | Output voltage | $I_O$ = 5 to 350 mA, $V_I$ = 27 to 38 V | 22.8 | 24 | 25.2 | V |
| $\Delta V_O$ | Line regulation | $V_I$ = 27 to 38 V, $I_O$ = 200 mA | | | 100 | mV |
| | | $V_I$ = 28 to 38 V, $I_O$ = 200 mA | | | 50 | |
| $\Delta V_O$ | Load regulation | $I_O$ = 5 to 500 mA, $T_J$ = 25°C | | | 480 | mV |
| | | $I_O$ = 5 to 200 mA, $T_J$ = 25°C | | | 240 | |
| $I_d$ | Quiescent current | | | | 6 | mA |
| $\Delta I_d$ | Quiescent current change | $I_O$ = 5 to 350 mA | | | 0.5 | mA |
| | | $I_O$ = 200 mA, $V_I$ = 27 to 38 V | | | 0.8 | |
| $\Delta V_O/\Delta T$ | Output voltage drift | $I_O$ = 5 mA, $T_J$ = 0 to 125°C | | -1.2 | | mV/°C |
| SVR | Supply voltage rejection | $V_I$ = 28 to 38 V, f = 120Hz, $I_O$ = 300mA | 50 | | | dB |
| eN | Output noise voltage | B =10Hz to 100kHz | | 170 | | µV |
| $V_d$ | Dropout voltage | | | 2 | | V |
| $I_{sc}$ | Short circuit current | $V_I$ = 35 V | | 240 | | mA |

# 6 Typical performance

**Figure 8. Dropout voltage vs junction temp.**

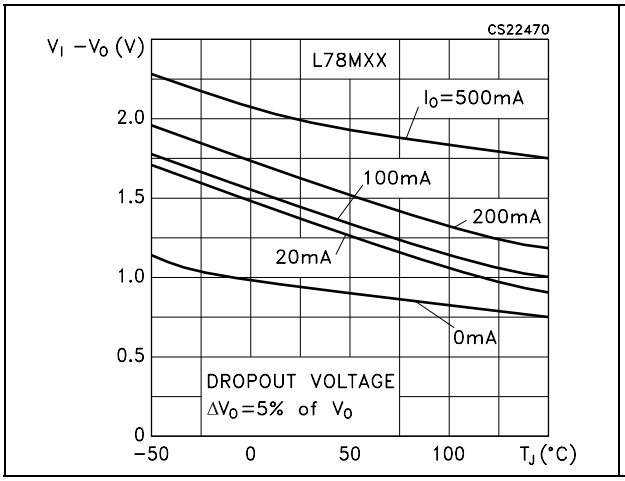



**Figure 9. Dropout characteristics**

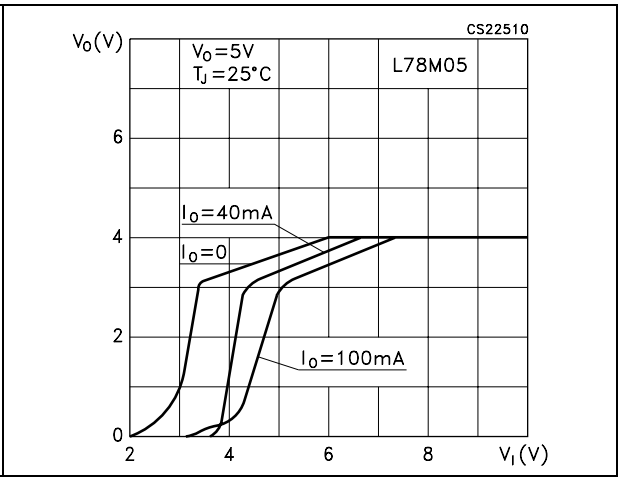



**Figure 10. Peak output current vs input-output differential voltage**

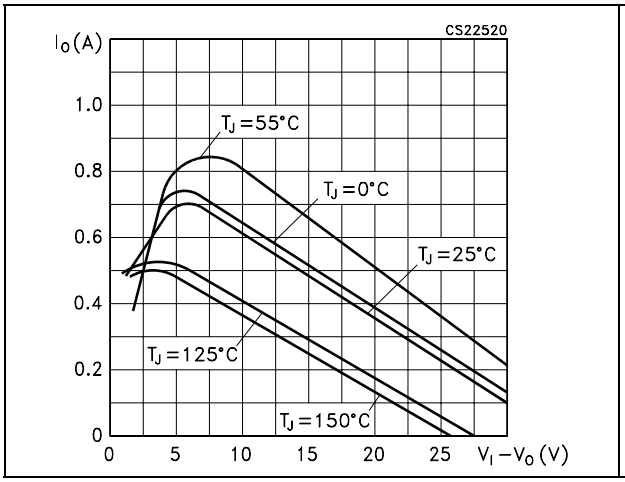



**Figure 11. Output voltage vs junction temperature**

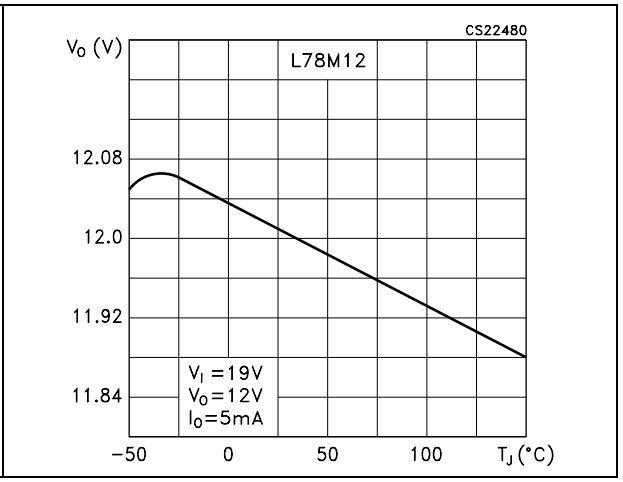



**Figure 12. Supply voltage rejection vs freq.**

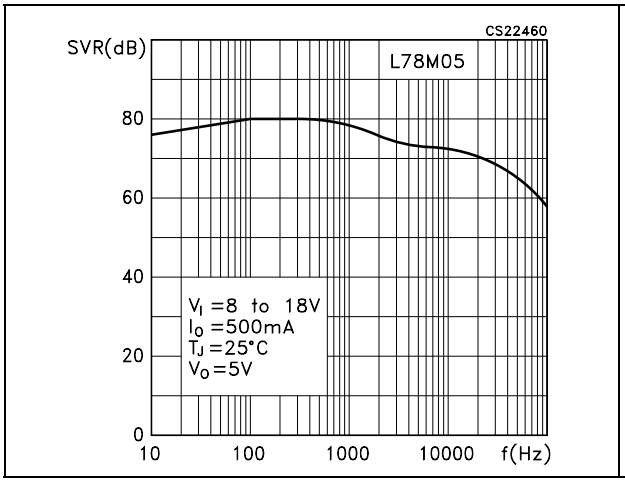



**Figure 13. Quiescent current vs junction temp.**

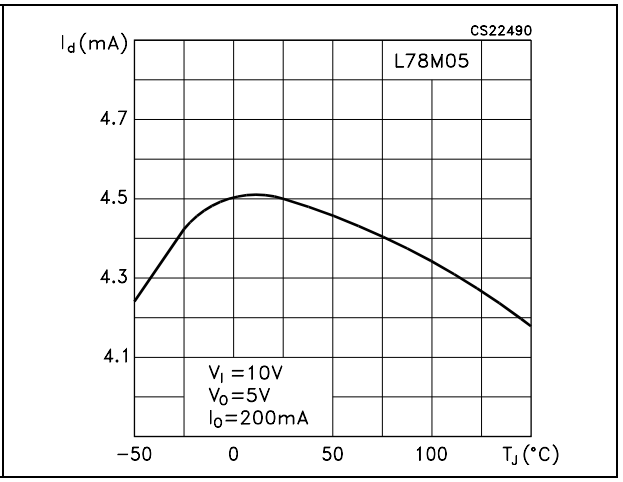


**Figure 14. Load transient response**

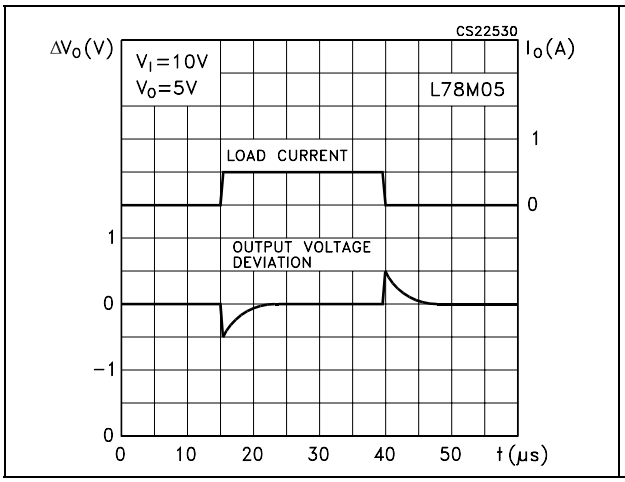



**Figure 15. Line transient response**

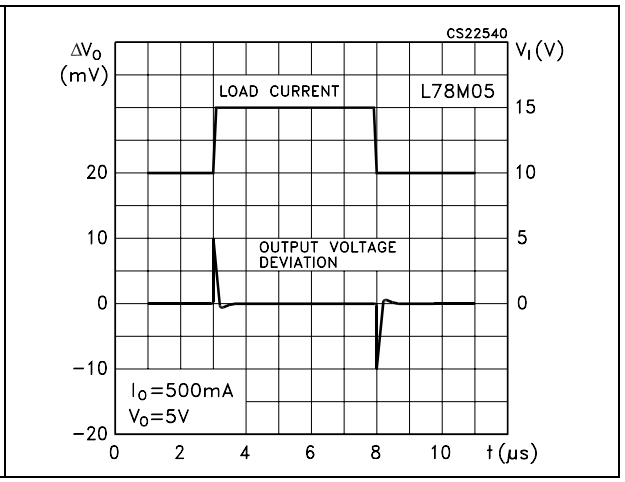



**Figure 16. Quiescent current vs input voltage**

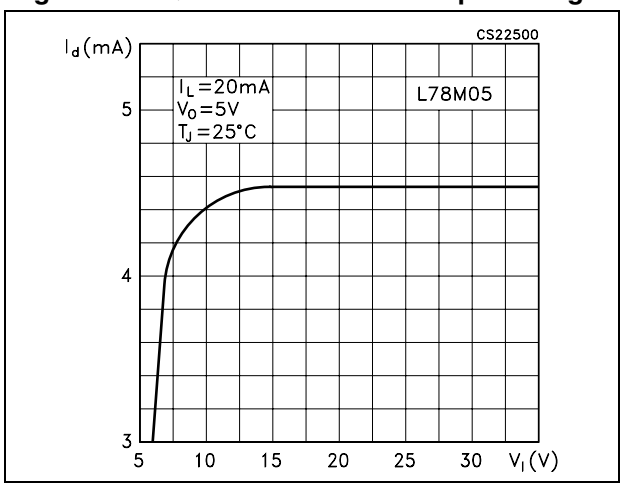
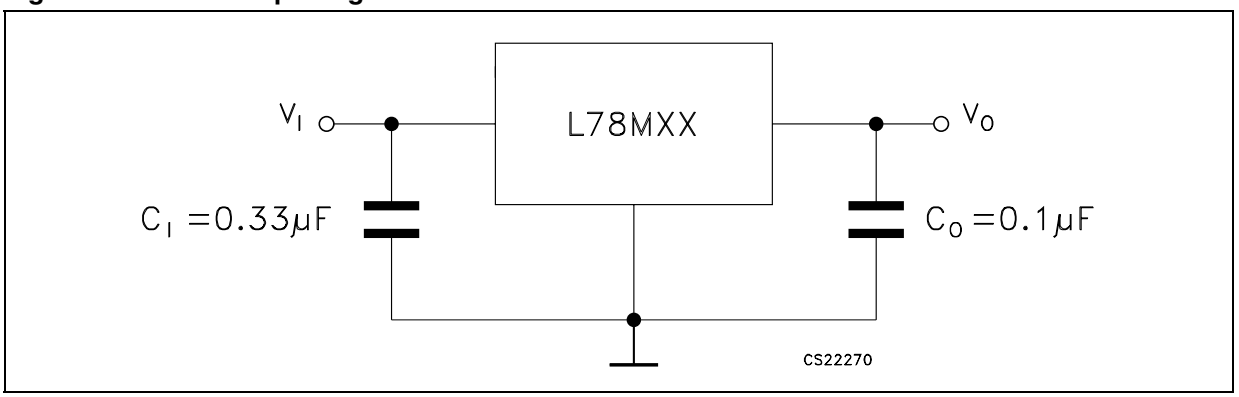



**Figure 17. Fixed output regulator**




1. To specify an output voltage, substitute voltage value for "XX".
2. Although no output capacitor is need for stability, it does improve transient response.
3. Required if regulator is locate an appreciable distance from power supply filter.

**Figure 18. Constant current regulator**

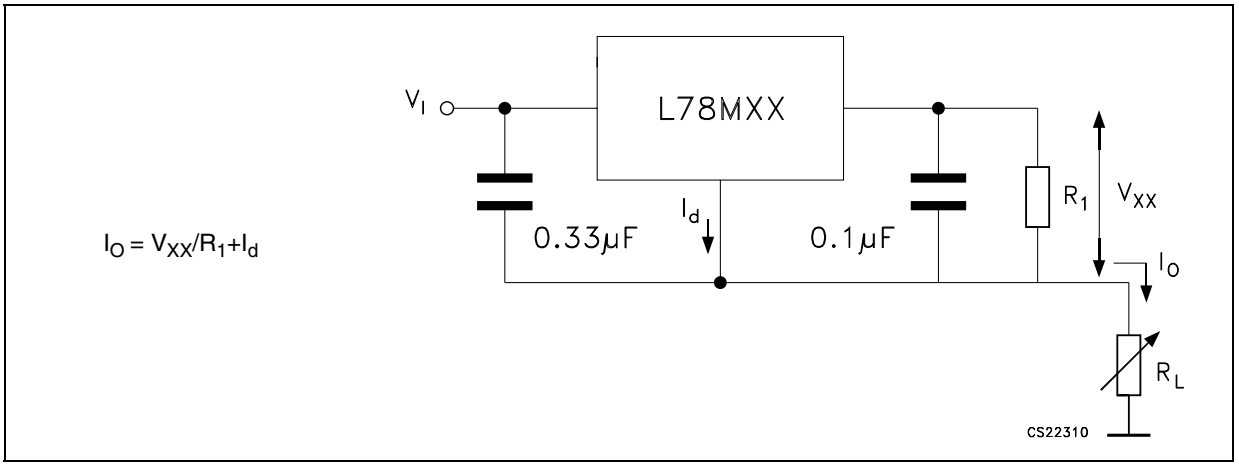



**Figure 19. Circuit for increasing output voltage**

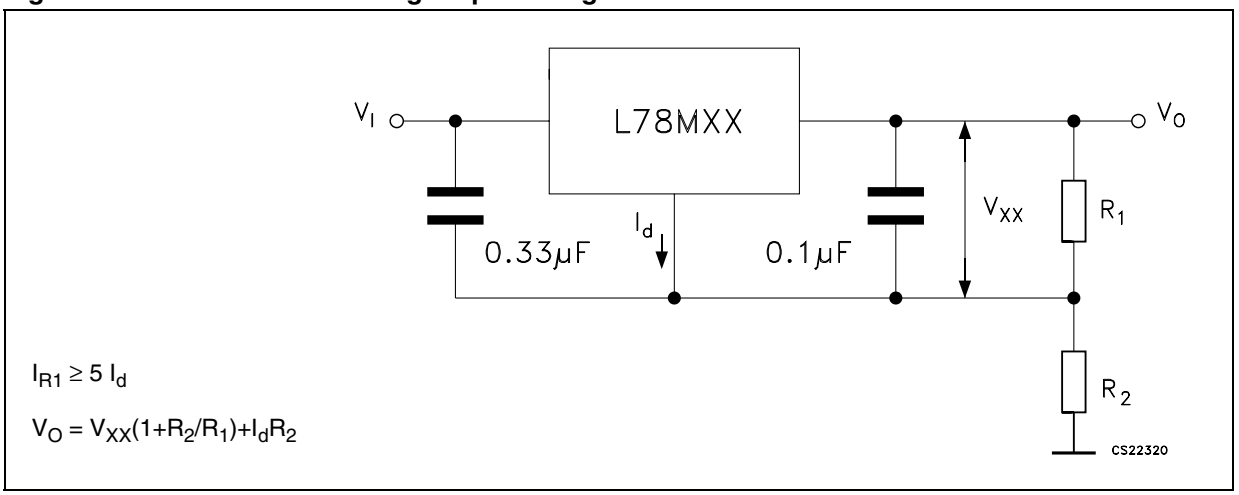



**Figure 20. Adjustable output regulator (7 to 30 V)**

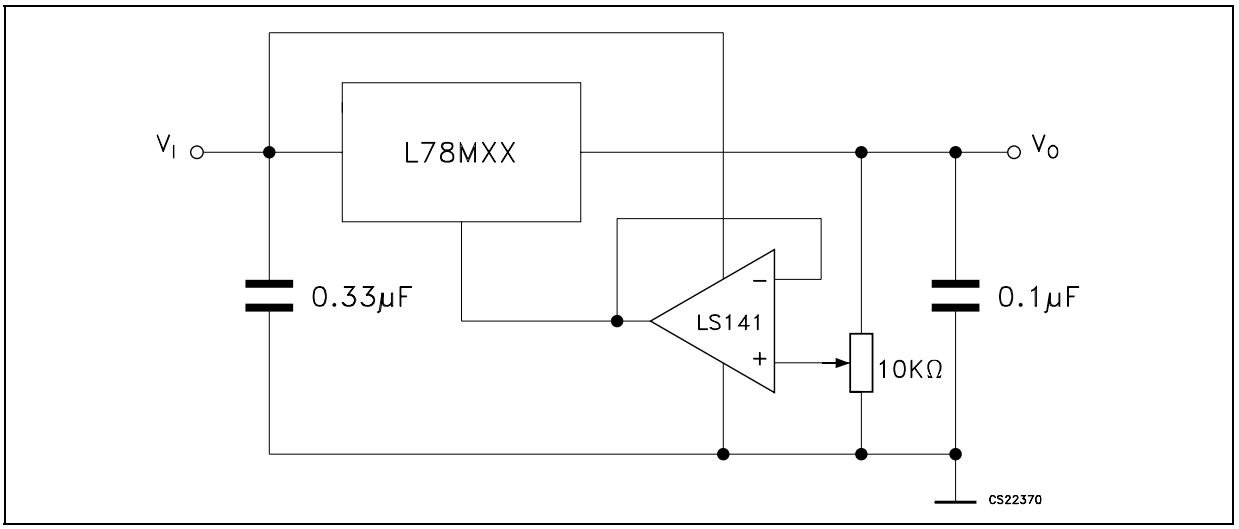


**Figure 21. 0.5 to 10 V regulator**

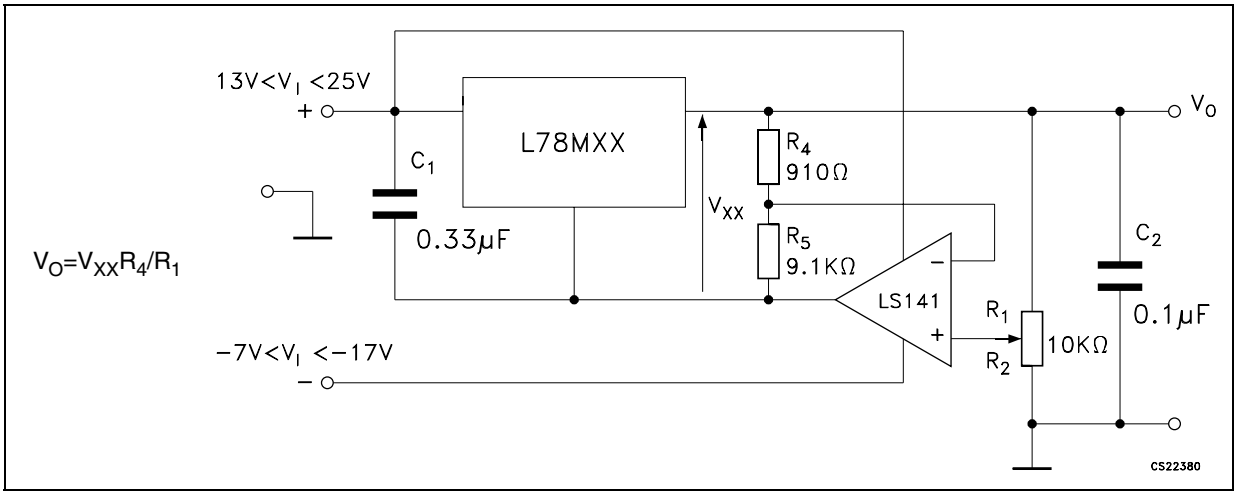



**Figure 22. High current voltage regulator**

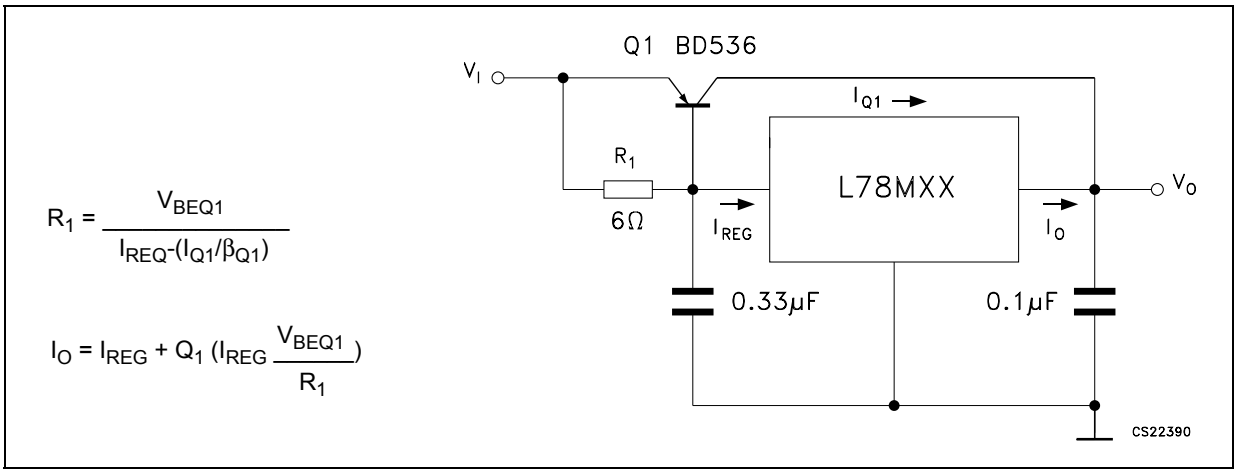



**Figure 23. High output current with short circuit protection**

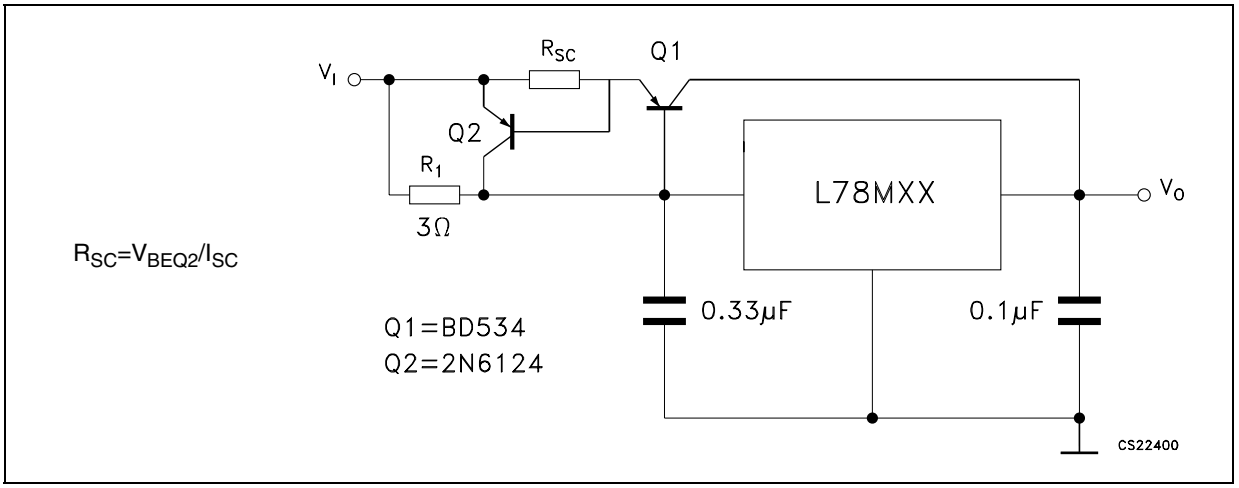


**Figure 24. Tracking voltage regulator**

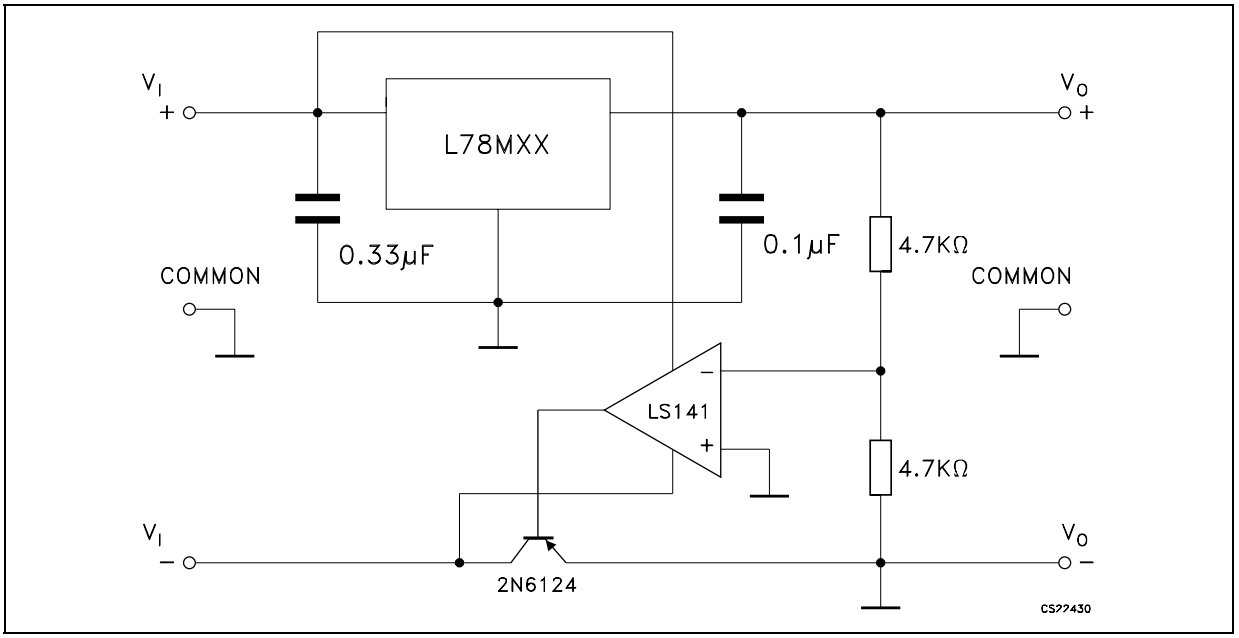



**Figure 25. High input voltage circuit**

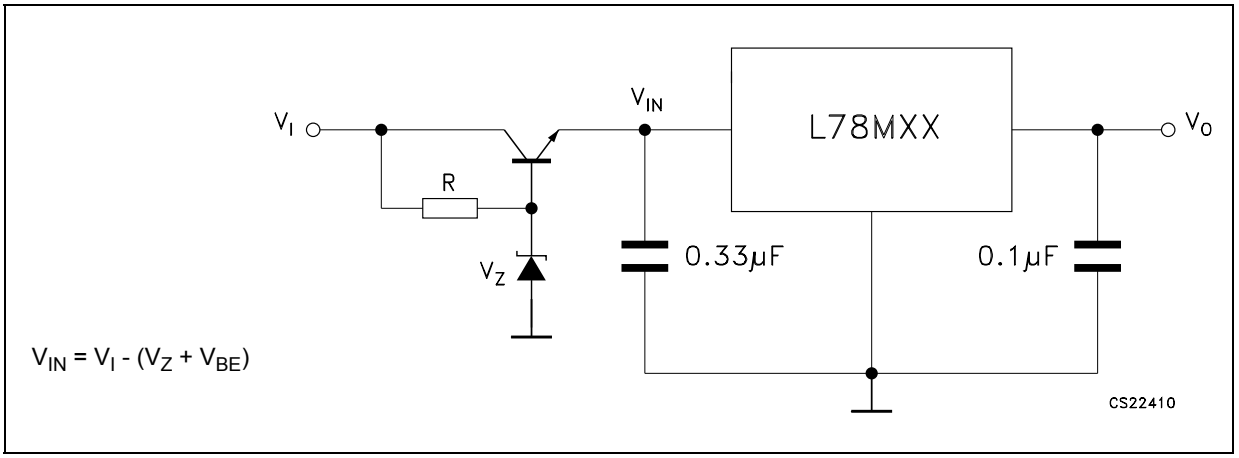



**Figure 26. Reducing power dissipation with dropping resistor**

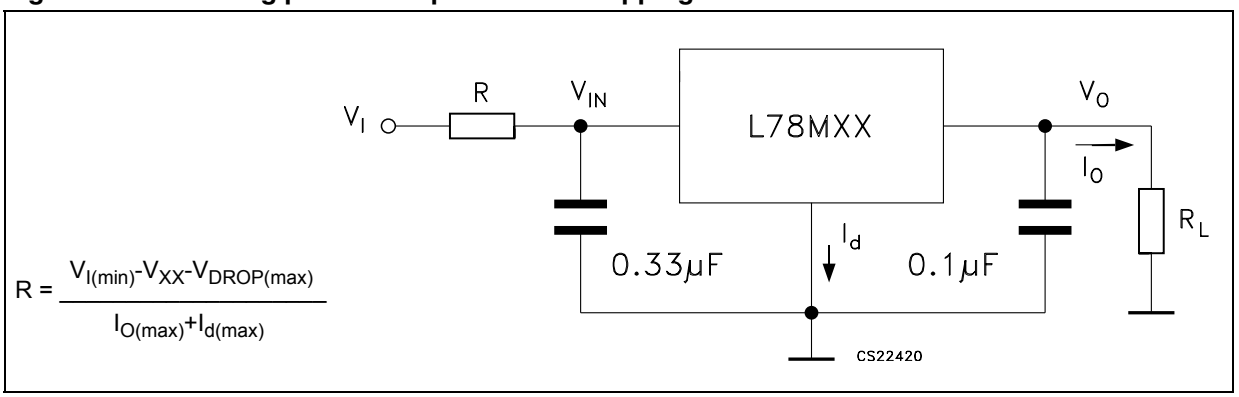
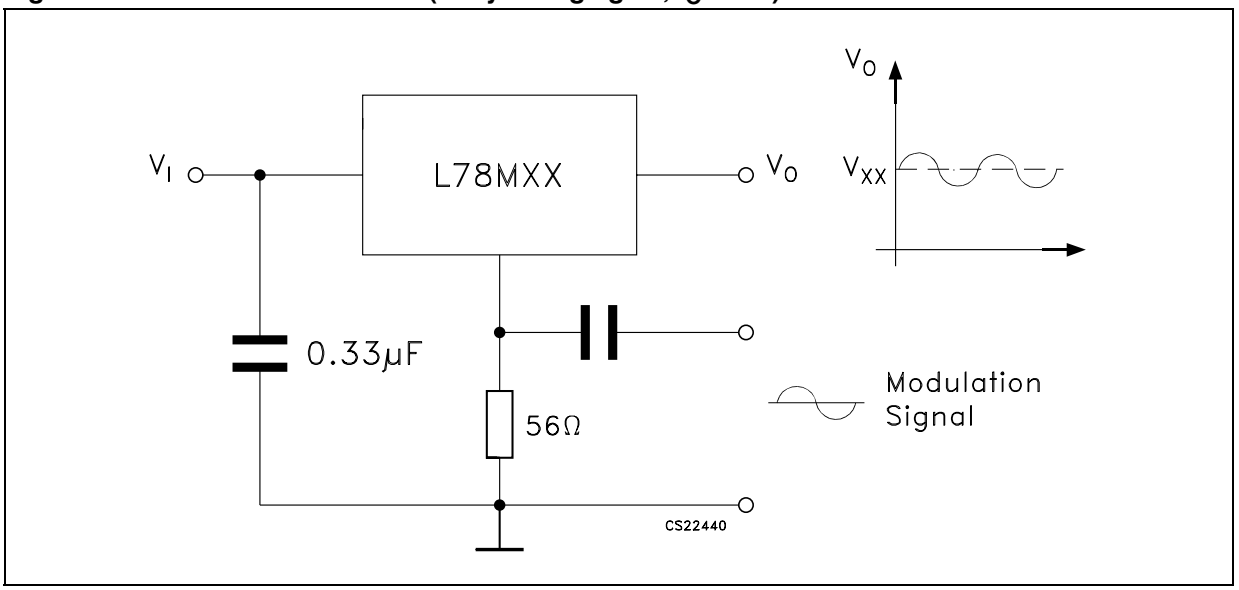
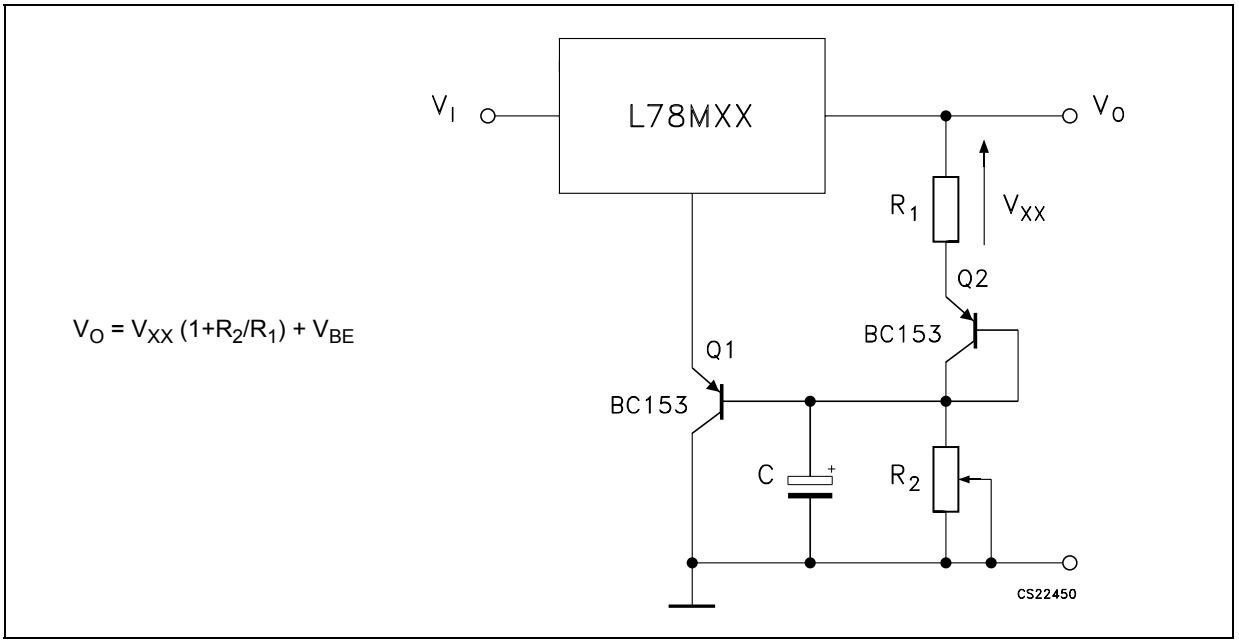


**Figure 27. Power AM modulator (unity voltage gain, $I_O \leq 0.5$)**




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

**Figure 28. Adjustable output voltage with temperature compensation**




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

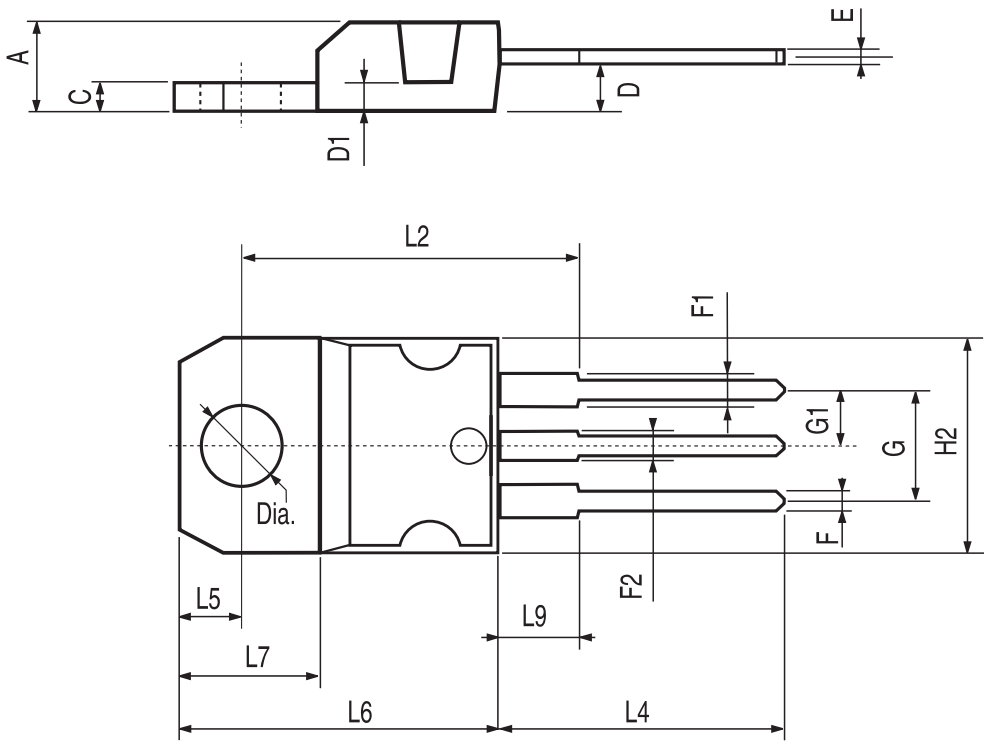
*Note: $Q_2$ is connected as a diode in order to compensate the variation of the $Q_1$ $V_{BE}$ with the temperature. C allows a slow rise time of the $V_O$.*

# 7 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a lead-free second level interconnect. The category of second Level Interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com.

## TO-220 mechanical data

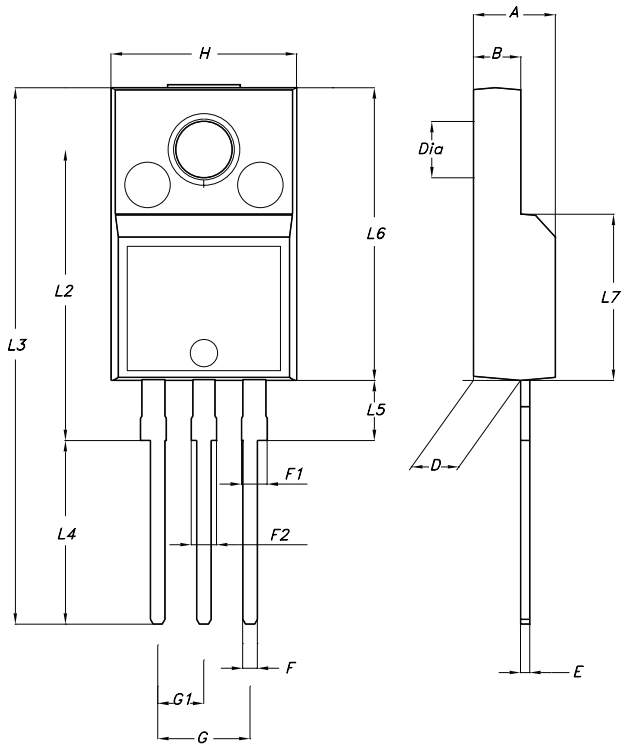
| Dim. | mm. | | | inch. | | |
|---|---|---|---|---|---|---|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 4.40 | | 4.60 | 0.173 | | 0.181 |
| C | 1.23 | | 1.32 | 0.048 | | 0.051 |
| D | 2.40 | | 2.72 | 0.094 | | 0.107 |
| D1 | | 1.27 | | | 0.050 | |
| E | 0.49 | | 0.70 | 0.019 | | 0.027 |
| F | 0.61 | | 0.88 | 0.024 | | 0.034 |
| F1 | 1.14 | | 1.70 | 0.044 | | 0.067 |
| F2 | 1.14 | | 1.70 | 0.044 | | 0.067 |
| G | 4.95 | | 5.15 | 0.194 | | 0.203 |
| G1 | 2.4 | | 2.7 | 0.094 | | 0.106 |
| H2 | 10.0 | | 10.40 | 0.393 | | 0.409 |
| L2 | | 16.4 | | | 0.645 | |
| L4 | 13.0 | | 14.0 | 0.511 | | 0.551 |
| L5 | 2.65 | | 2.95 | 0.104 | | 0.116 |
| L6 | 15.25 | | 15.75 | 0.600 | | 0.620 |
| L7 | 6.2 | | 6.6 | 0.244 | | 0.260 |
| L9 | 3.5 | | 3.93 | 0.137 | | 0.154 |
| DIA. | 3.75 | | 3.85 | 0.147 | | 0.151 |




P011C

## 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

**Figure 29. Drawing dimension DPAK (type STD-ST)**

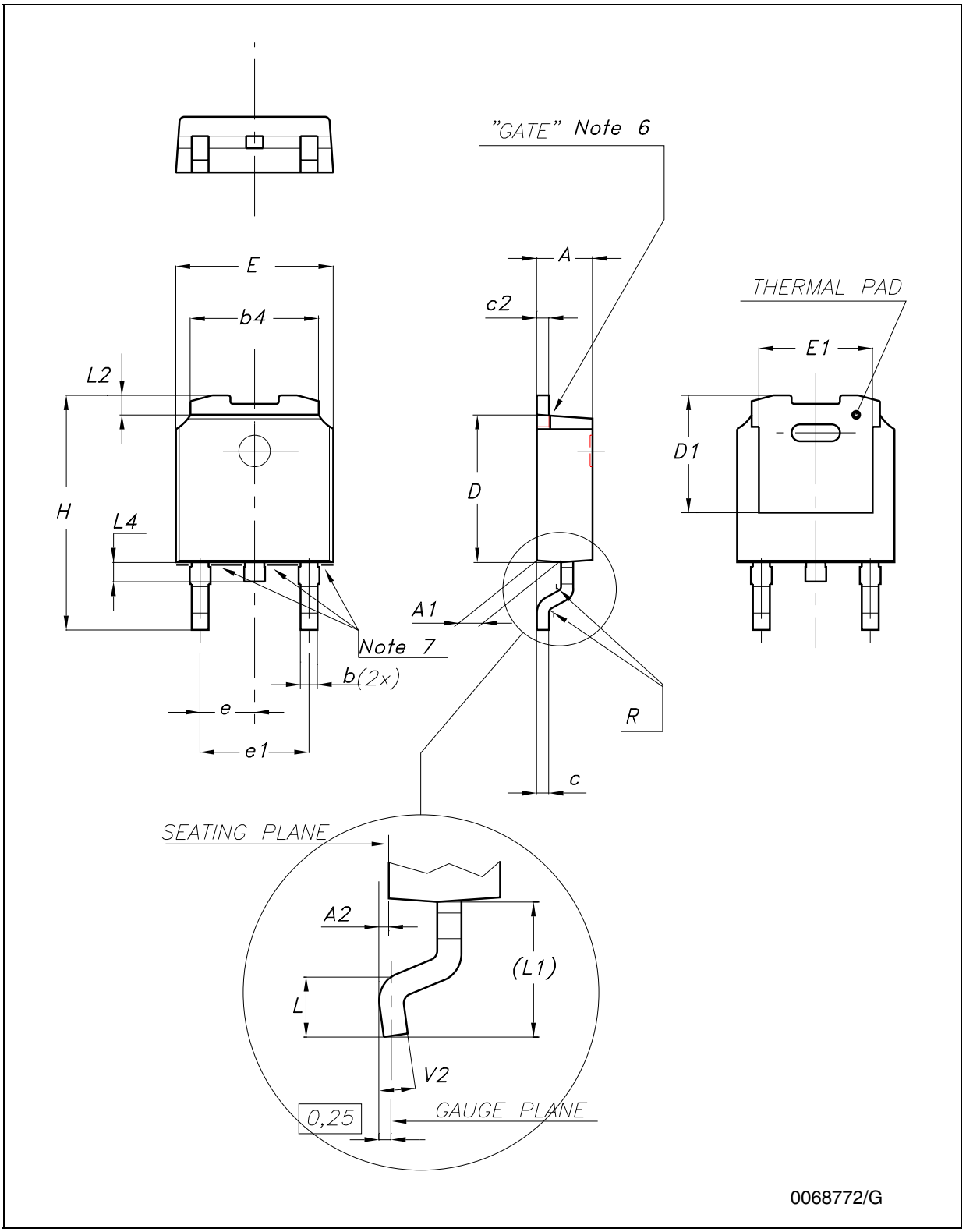


**Figure 30. Drawing dimension DPAK (type FUJITSU-subcon.)**

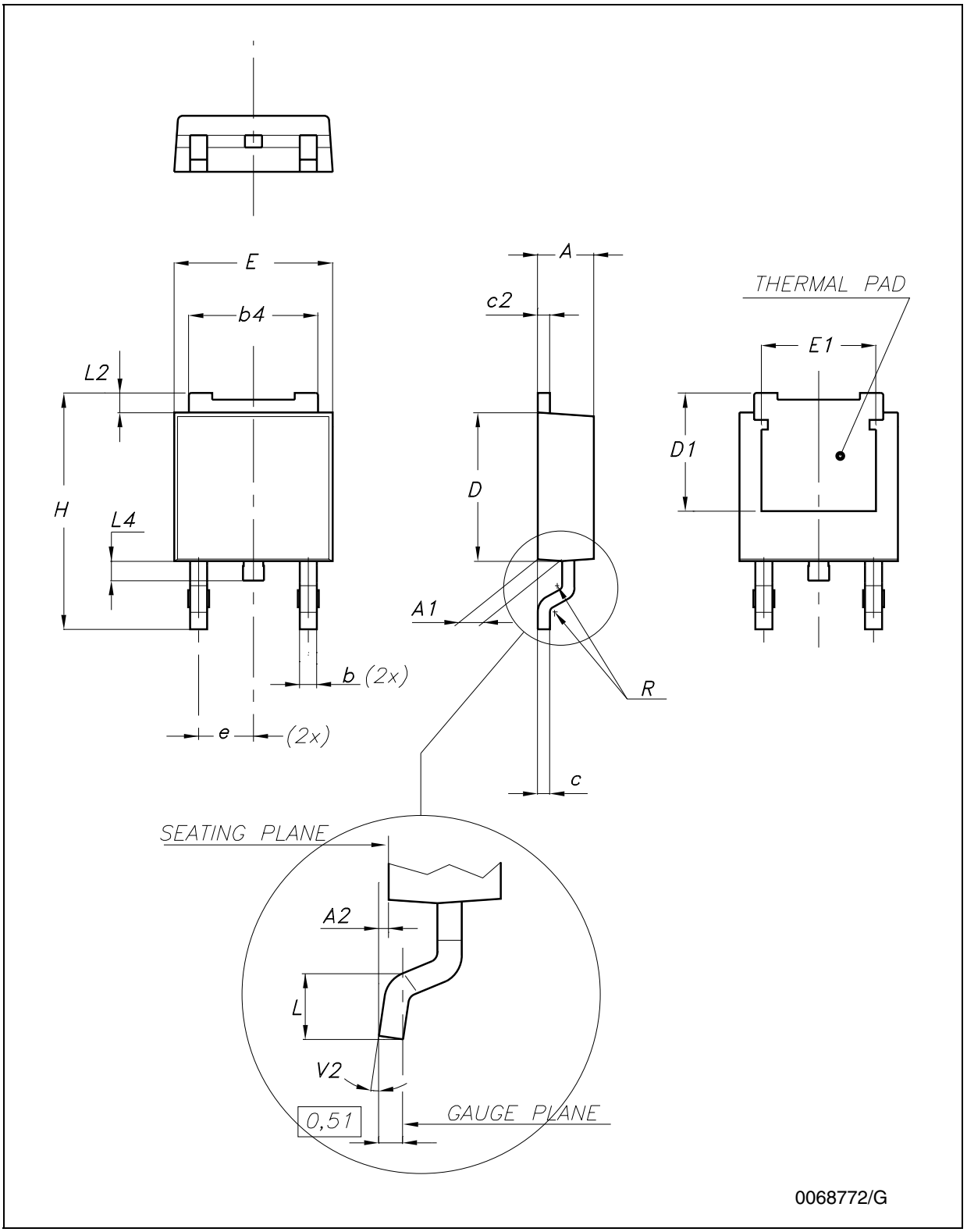


**Figure 31. Drawing dimension DPAK (type IDS-subcon.)**

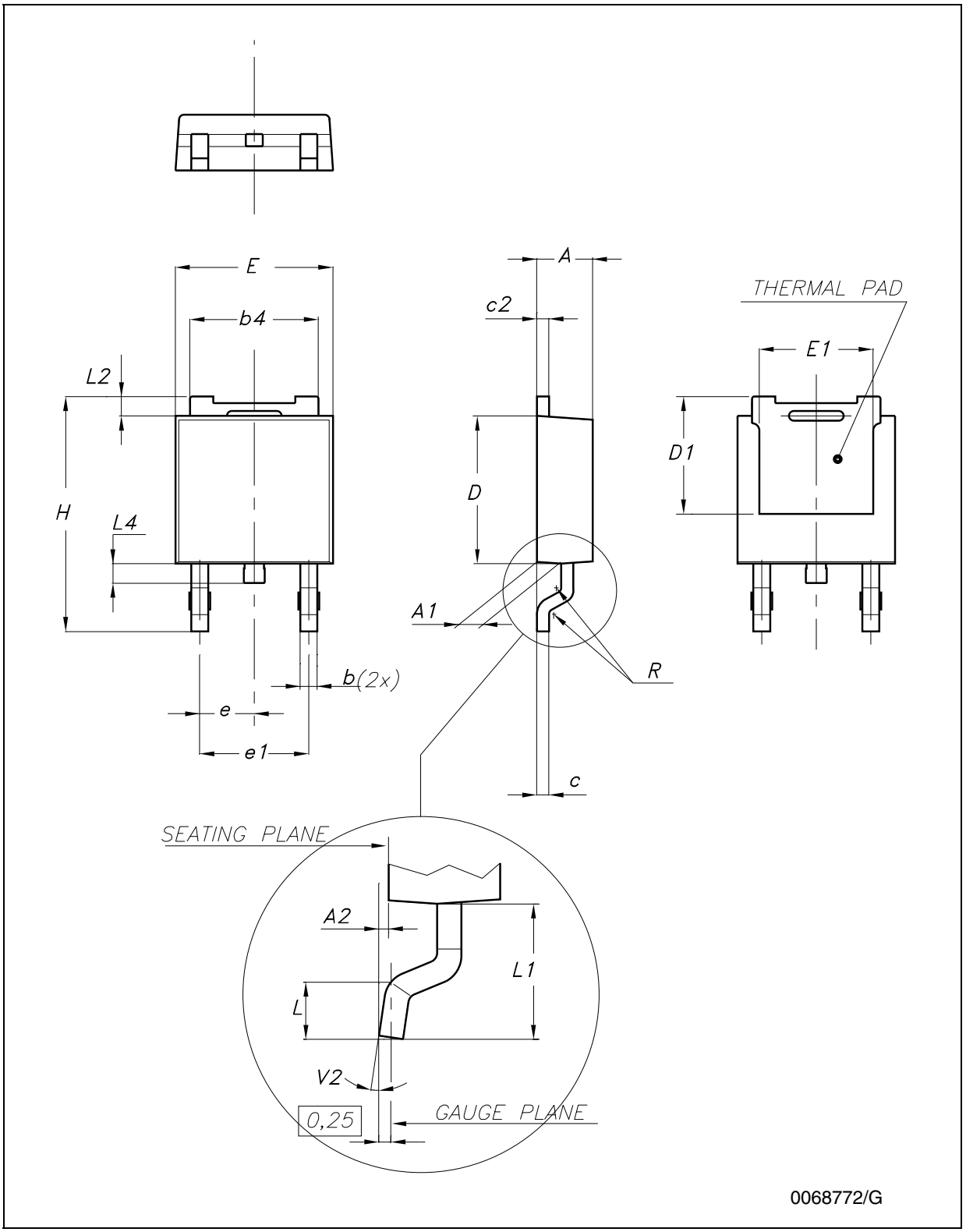


**Table 11. DPAK mechanical data**

| Dim. | Type STD-ST | | | Type FUJITSU-Subcon. | | | Type IDS-Subcon | | |
|---|---|---|---|---|---|---|---|---|---|
| | mm. | | | mm. | | | mm. | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 2.20 | | 2.40 | 2.25 | 2.30 | 2.35 | 2.19 | | 2.38 |
| A1 | 0.90 | | 1.10 | 0.96 | | 1.06 | 0.89 | | 1.14 |
| A2 | 0.03 | | 0.23 | 0 | | 0.10 | 0.03 | | 0.23 |
| b | 0.64 | | 0.90 | 0.76 | | 0.86 | 0.64 | | 0.88 |
| b4 | 5.20 | | 5.40 | 5.28 | | 5.38 | 5.21 | | 5.46 |
| c | 0.45 | | 0.60 | 0.46 | | 0.56 | 0.46 | | 0.58 |
| c2 | 0.48 | | 0.60 | 0.46 | | 0.56 | 0.46 | | 0.58 |
| D | 6.00 | | 6.20 | 6.05 | | 6.15 | 5.97 | | 6.22 |
| D1 | | 5.10 | | 5.27 | | 5.47 | | 5.20 | |
| E | 6.40 | | 6.60 | 6.55 | 6.60 | 6.65 | 6.35 | | 6.73 |
| E1 | | 4.70 | | | 4.77 | | | 4.70 | |
| e | | 2.28 | | 2.23 | 2.28 | 2.33 | | 2.28 | |
| e1 | 4.40 | | 4.60 | | | | 4.51 | | 4.61 |
| H | 9.35 | | 10.10 | 9.90 | | 10.30 | 9.40 | | 10.42 |
| L | 1.00 | | | 1.40 | | 1.60 | 0.90 | | |
| L1 | | 2.80 | | | | | 2.50 | | 2.65 |
| L2 | | 0.80 | | 1.03 | | 1.13 | 0.89 | | 1.27 |
| L4 | 0.60 | | 1.00 | 0.70 | | 0.90 | 0.64 | | 1.02 |
| R | | 0.20 | | | 0.40 | | | 0.20 | |
| V2 | 0° | | 8° | 0° | | 8° | 0° | | 8° |

*Note: The DPAK package coming from the two subcontractors (Fujitsu and IDS) are fully compatible with the ST's package suggested footprint.*

**Figure 32. DPAK footprint recommended data**

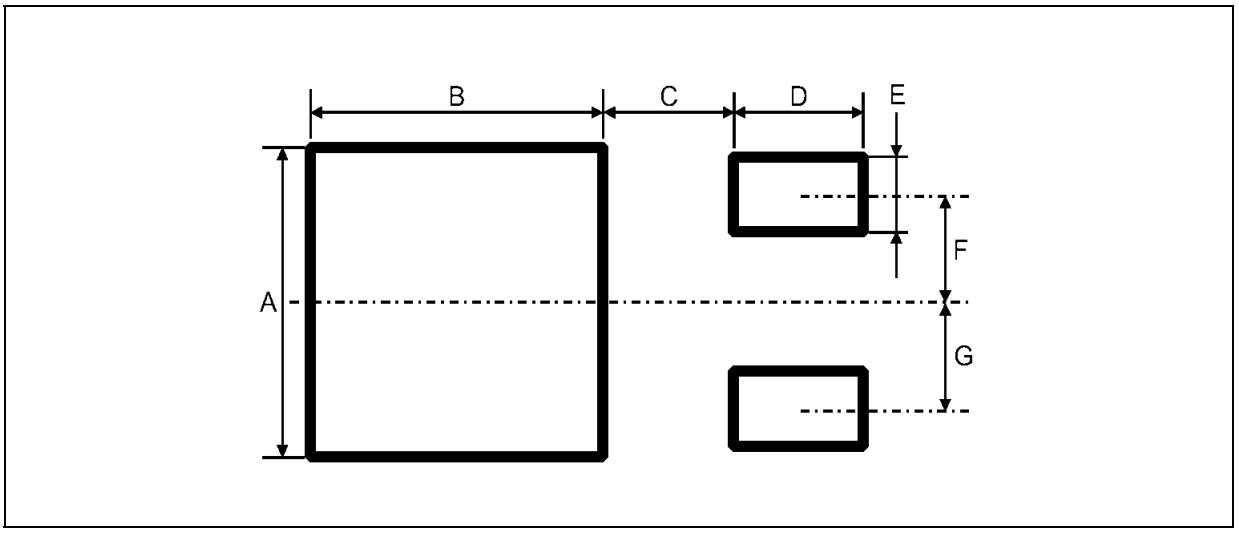
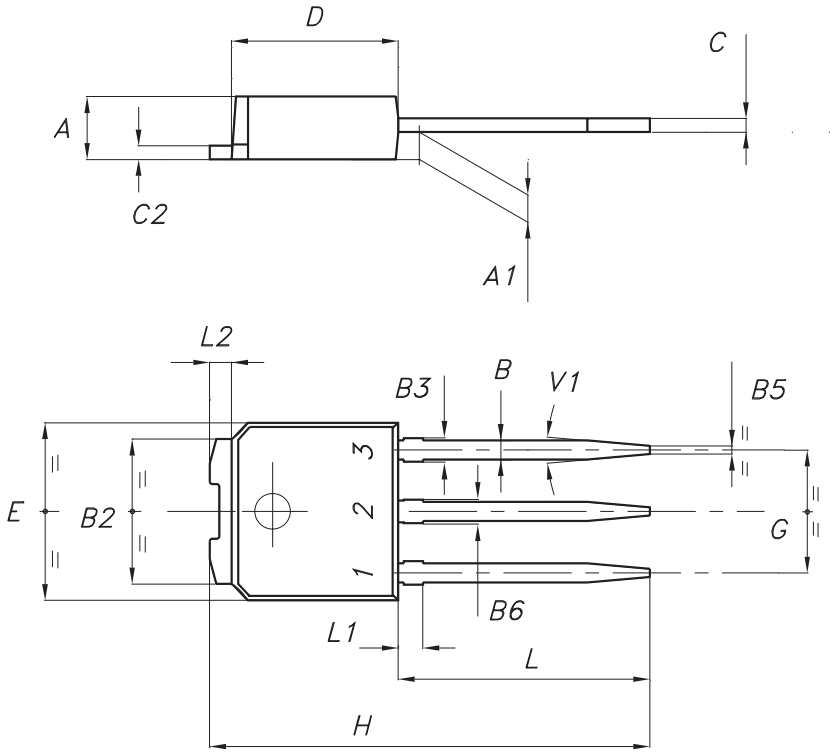



**Table 12. Footprint data**

| Values | | |
|---|---|---|
| **Dim.** | **mm.** | **inch.** |
| A | 6.70 | 0.264 |
| B | 6.70 | 0.64 |
| C | 1.8 | 0.070 |
| D | 3.0 | 0.118 |
| E | 1.60 | 0.063 |
| F | 2.30 | 0.091 |
| G | 2.30 | 0.091 |

## IPAK mechanical data

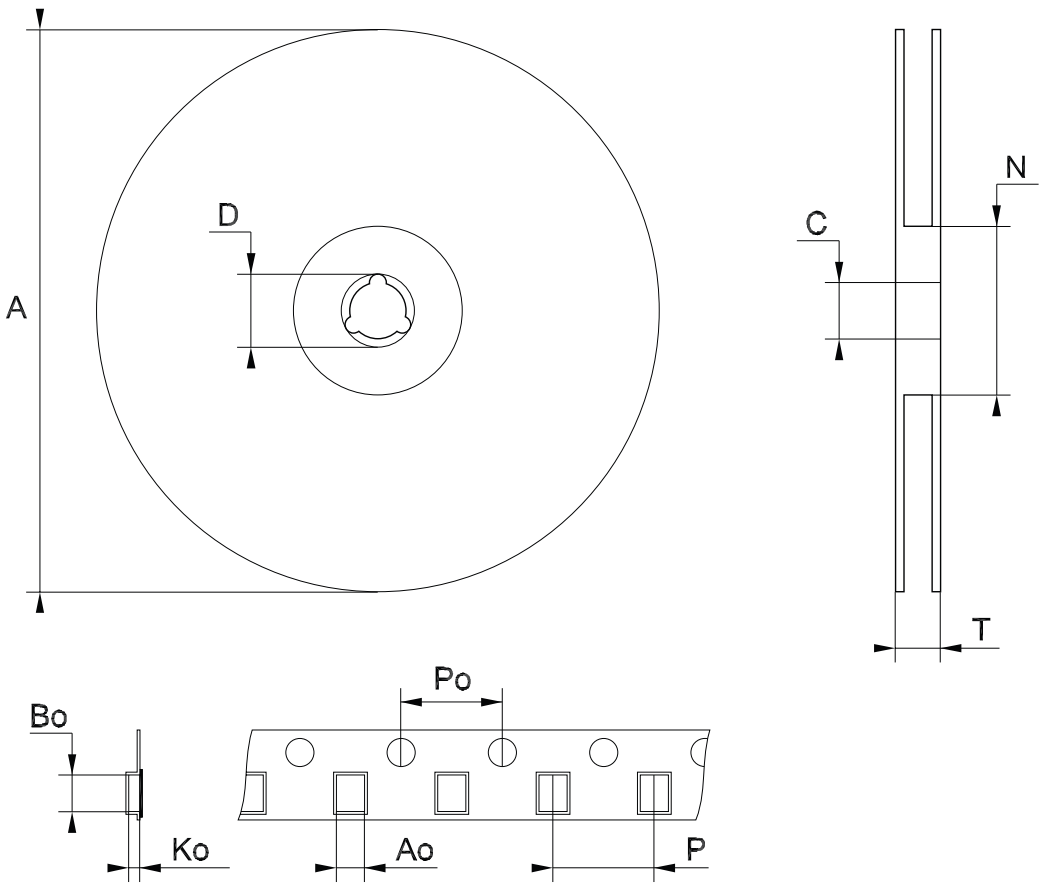
| Dim. | mm. | | | inch. | | |
|---|---|---|---|---|---|---|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 2.2 | | 2.4 | 0.086 | | 0.094 |
| A1 | 0.9 | | 1.1 | 0.035 | | 0.043 |
| B | 0.64 | | 0.9 | 0.025 | | 0.035 |
| B2 | 5.2 | | 5.4 | 0.204 | | 0.212 |
| B3 | | | 0.95 | | | 0.037 |
| B5 | | 0.3 | | | 0.012 | |
| B6 | | | 0.95 | | | 0.037 |
| C | 0.45 | | 0.6 | 0.017 | | 0.023 |
| C2 | 0.48 | | 0.6 | 0.019 | | 0.023 |
| D | 6 | | 6.2 | 0.236 | | 0.244 |
| E | 6.4 | | 6.6 | 0.252 | | 0.260 |
| G | 4.4 | | 4.6 | 0.173 | | 0.181 |
| H | 15.9 | | 16.3 | 0.626 | | 0.641 |
| L | 9 | | 9.4 | 0.354 | | 0.370 |
| L1 | 0.8 | | 1.2 | 0.031 | | 0.047 |
| L2 | | 0.8 | 1 | | 0.031 | 0.039 |




0068771-F

## Tape & reel DPAK-PPAK mechanical data

| Dim. | mm. | | | inch. | | |
|---|---|---|---|---|---|---|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | | | 330 | | | 12.992 |
| C | 12.8 | 13.0 | 13.2 | 0.504 | 0.512 | 0.519 |
| D | 20.2 | | | 0.795 | | |
| N | 60 | | | 2.362 | | |
| T | | | 22.4 | | | 0.882 |
| Ao | 6.80 | 6.90 | 7.00 | 0.268 | 0.272 | 0.2.76 |
| Bo | 10.40 | 10.50 | 10.60 | 0.409 | 0.413 | 0.417 |
| Ko | 2.55 | 2.65 | 2.75 | 0.100 | 0.104 | 0.105 |
| Po | 3.9 | 4.0 | 4.1 | 0.153 | 0.157 | 0.161 |
| P | 7.9 | 8.0 | 8.1 | 0.311 | 0.315 | 0.319 |




Note: Drawing not in scale

# 8 Order codes

**Table 13. Order codes**

| Packages | | | | |
|---|---|---|---|---|
| **TO-220** | **TO-220FP** | **DPAK** | **IPAK** | **Output voltage** |
| L78M05CV | L78M05CP | L78M05CDT-TR | L78M05CDT-1 | 5 V |
| | | L78M06CDT-TR | L78M06CDT-1 (1) | 6 V |
| L78M08CV | | L78M08CDT-TR | L78M08CDT-1 (1) | 8 V |
| L78M09CV | | L78M09CDT-TR | L78M09CDT-1 (1) | 9 V |
| L78M12CV | | L78M12CDT-TR | | 12 V |
| L78M15CV | | L78M15CDT-TR | | 15 V |
| L78M24CV | L78M24CP (1) | L78M24CDT-TR | L78M24CDT-1 (1) | 24 V |

1. Available on request

# 9 Revision history

**Table 14. Document revision history**

| Date | Revision | Changes |
|---|---|---|
| 21-Jun-2004 | 6 | Document updating. |
| 30-Aug-2006 | 7 | Order codes has been updated and new template. |
| 29-Nov-2006 | 8 | DPAK mechanical data has been updated and add footprint data. |
| 06-Jun-2007 | 9 | Order codes has been updated. |
| 10-Dec-2007 | 10 | Added *Table 1*. |
| 19-Feb-2008 | 11 | Modified: *Table 1 on page 1*. |
| 15-Jul-2008 | 12 | Modified: *Table 1 on page 1* and *Table 13 on page 27*. |

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