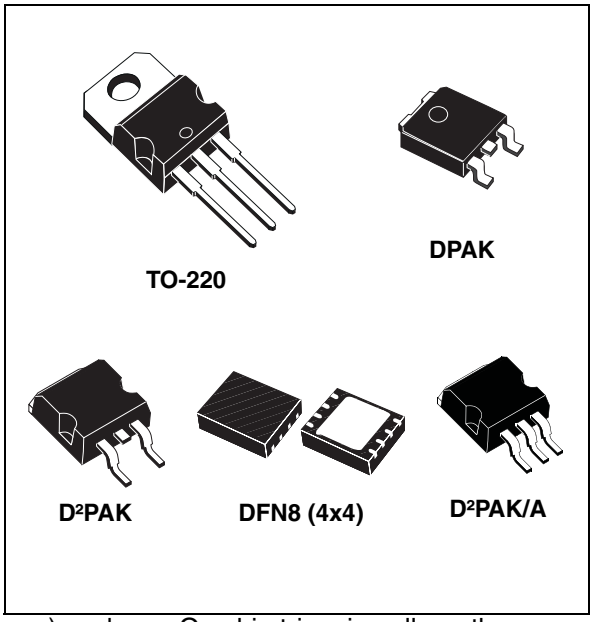
# LD1086xx

## 1.5 A adjustable and fixed low drop positive voltage regulator

**Datasheet – production data**

## Features

- Typical dropout: 1.3 V at 1.5 A
- Three-terminal adjustable or fixed output voltage: 1.8 V, 2.5 V, 3.3 V, 5 V, 12 V
- Automotive grade (adjustable $V_{OUT}$ in TO-220 and DPAK packages only)
- Output current guaranteed up to 1.5 A
- Output tolerance: ± 1 % at 25 °C and ± 2 % in full temperature range
- Internal power and thermal limit
- Wide operating temperature range - 40 °C to 125 °C
- Package available: TO-220, D²PAK, D²PAK/A, DPAK and DFN8 (4x4 mm)
- Pinout compatibility with standard adjustable voltage regulators




## Description

The LD1086xx is a low drop voltage regulator capable of providing up to 1.5 A of output current. Dropout is guaranteed at a maximum of 1.2 V at the maximum output current, decreasing at lower loads. The LD1086xx is pin-to-pin compatible with older 3-terminal adjustable regulators, but has better performance in terms of drop and output tolerance. The 2.85 V output version is suitable for SCSI-2 active terminations. Unlike PNP regulators, where a part of the output current is wasted as quiescent current, the LD1086xx quiescent current flows into the load, increasing efficiency. Only a 10 µF (minimum) capacitor is needed for stability. The device is available in a TO-220, D²PAK, D²PAK/A, DPAK or DFN8 (4x4 mm) package. On-chip trimming allows the regulator to reach a very tight output voltage tolerance; within ± 1 % at 25 °C. The LD1086xx is available as automotive grade for adjustable output voltages in the TO-220 and DPAK packages. The PAT, SYL, SBL statistical tests have been performed, and the devices are qualified according to the AEC-Q100 specification for the automotive market in the temperature range of - 40 °C to 125 °C.

**Table 1. Device summary**

| Part numbers | | |
|---|---|---|
| LD1086XX | LD1086XX18 | LD1086XX33 |
| LD1086XX12 | LD1086XX25 | LD1086XX50 |

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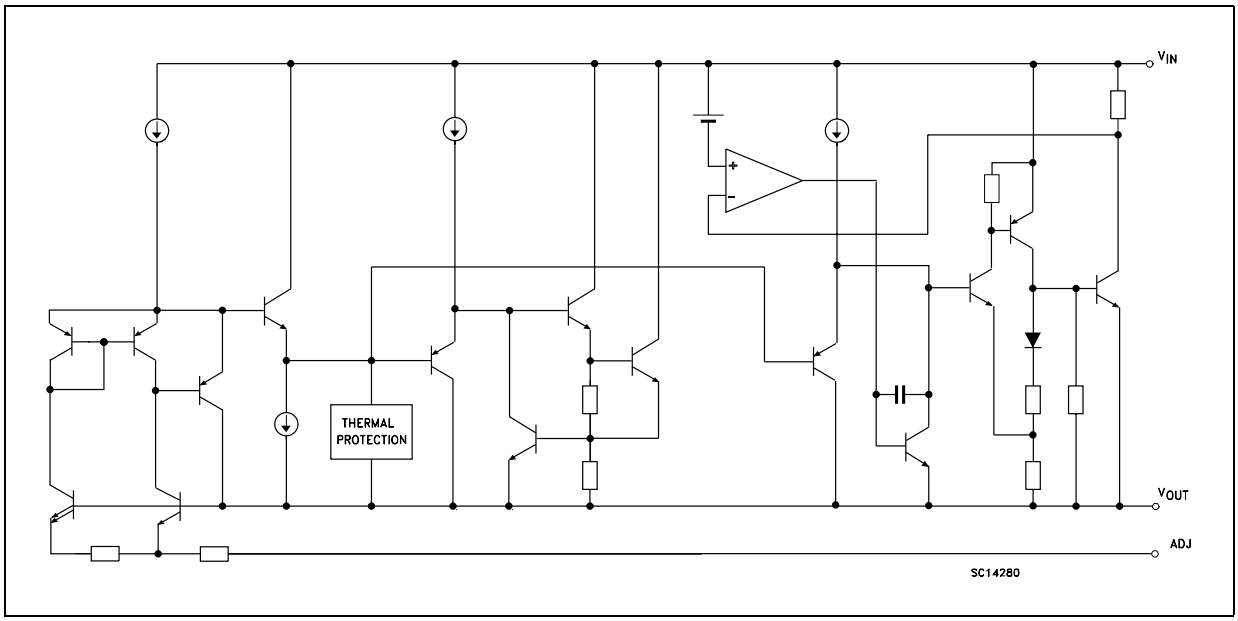
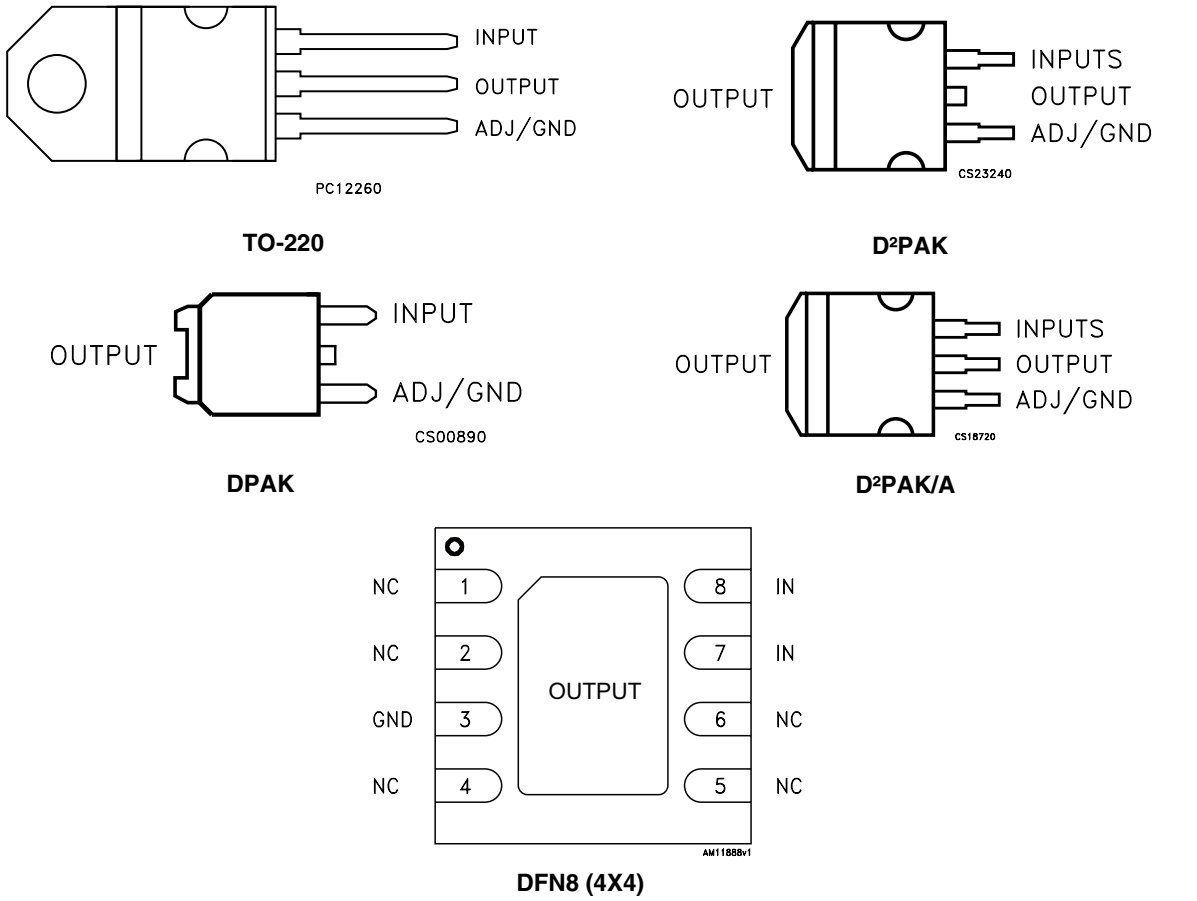
# 1 Diagram

**Figure 1. Schematic diagram**



# 2 Pin configuration

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




*Note: The TAB is physically connected to the output (this is valid for the TO-220 package too).*

# 3 Maximum ratings

**Table 2. Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_I$ | DC input voltage | 30 | V |
| $I_O$ | Output current | Internally Limited | mA |
| $P_D$ | Power dissipation | Internally Limited | mW |
| $T_{STG}$ | Storage temperature range | -55 to +150 | °C |
| $T_{OP}$ | Operating junction temperature range | -40 to +125 | °C |

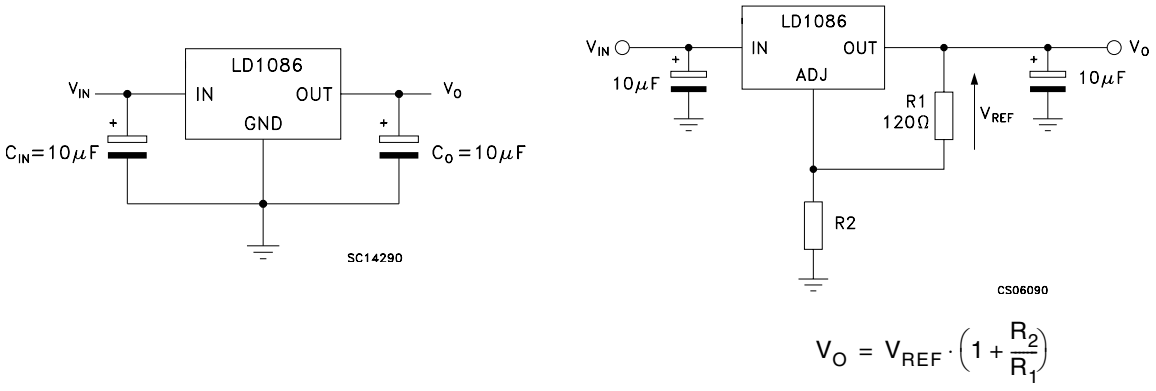
*Note: Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.*

**Table 3. Thermal data**

| Symbol | Parameter | TO-220 | D²PAK D²PAK/A | DPAK | DFN8 | Unit |
|---|---|---|---|---|---|---|
| $R_{thJC}$ | Thermal resistance junction-case | 5 | 3 | 8 | 1.5 | °C/W |
| $R_{thJA}$ | Thermal resistance junction-ambient | 50 | 62.5 | | 33 | °C/W |

# 4 Schematic application

**Figure 3. Application circuit**



# 5 Electrical characteristics

$V_I$ = 4.8 V, $C_I$ = $C_O$ =10 µF, $T_A$ = -40 to 125 °C, unless otherwise specified.

**Table 4. Electrical characteristics of LD1086#18**

| Symbol | Parameter | Test condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage (1) | $I_O$ = 0 mA, $T_J$ = 25°C | 1.782 | 1.8 | 1.818 | V |
| | | $I_O$ = 0 to 1.5A, $V_I$ = 3.4 to 30V | 1.764 | 1.8 | 1.836 | V |
| $\Delta V_O$ | Line regulation | $I_O$ = 0 mA, $V_I$ = 3.4 to 18V, $T_J$ = 25°C | | 0.2 | 4 | mV |
| | | $I_O$ = 0 mA, $V_I$ = 3.4 to 15V | | 0.4 | 4 | mV |
| $\Delta V_O$ | Load regulation | $I_O$ = 0 to 1.5A, $T_J$ = 25°C | | 0.5 | 8 | mV |
| | | $I_O$ = 0 to 1.5A | | 1 | 16 | mV |
| $V_d$ | Dropout voltage | $I_O$ = 1.5A | | 1.3 | 1.5 | V |
| $I_q$ | Quiescent current | $V_I \leq$ 30V | | 5 | 10 | mA |
| $I_{sc}$ | Short circuit current | $V_I$ - $V_O$ = 5V | 1.5 | 2 | | A |
| | | $V_I$ - $V_O$ = 25V | 0.05 | 0.02 | | A |
| | Thermal regulation | $T_A$ = 25°C, 30ms pulse | | 0.01 | 0.04 | %/W |
| SVR | Supply voltage rejection | f = 120 Hz, $C_O$ = 25 µF, $I_O$ = 1.5A $V_I$ = 6.8 ± 3V | 60 | 82 | | dB |
| eN | RMS Output noise voltage (% of $V_O$) | $T_A$ = 25°C, f =10Hz to 10kHz | | 0.003 | | % |
| S | Temperature stability | | | 0.5 | | % |
| S | Long term stability | $T_A$ = 125°C, 1000Hrs | | 0.5 | | % |

1. See short-circuit current curve for available output current at fixed dropout.

$V_I$ = 5.5 V, $C_I$ = $C_O$ =10 µF, $T_A$ = -40 to 125 °C, unless otherwise specified.

**Table 5. Electrical characteristics of LD1086#25**

| Symbol | Parameter | Test condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage (1) | $I_O$ = 0 mA, $T_J$ = 25°C | 2.475 | 2.5 | 2.525 | V |
| | | $I_O$ = 0 to 1.5A, $V_I$ = 4.1 to 30V | 2.45 | 2.5 | 2.55 | V |
| $\Delta V_O$ | Line regulation | $I_O$ = 0 mA, $V_I$ = 4.1 to 18V, $T_J$ = 25°C | | 0.2 | 4 | mV |
| | | $I_O$ = 0 mA, $V_I$ = 4.1 to 18V | | 0.4 | 4 | mV |
| $\Delta V_O$ | Load regulation | $I_O$ = 0 to 1.5A, $T_J$ = 25°C | | 0.5 | 8 | mV |
| | | $I_O$ = 0 to 1.5A | | 1 | 16 | mV |
| $V_d$ | Dropout voltage | $I_O$ = 1.5A | | 1.3 | 1.5 | V |
| $I_q$ | Quiescent current | $V_I \leq$ 30V | | 5 | 10 | mA |
| $I_{sc}$ | Short circuit current | $V_I$ - $V_O$ = 5V | 1.5 | 2 | | A |
| | | $V_I$ - $V_O$ = 25V | 0.05 | 0.2 | | A |
| | Thermal regulation | $T_A$ = 25°C, 30ms pulse | | 0.008 | 0.04 | %/W |
| SVR | Supply voltage rejection | f = 120 Hz, $C_O$ = 25 µF, $I_O$ = 1.5A $V_I$ = 7.5 ± 3V | 60 | 81 | | dB |
| eN | RMS Output noise voltage (% of $V_O$) | $T_A$ = 25°C, f =10Hz to 10kHz | | 0.003 | | % |
| S | Temperature stability | | | 0.5 | | % |
| S | Long term stability | $T_A$ = 125°C, 1000Hrs | | 0.5 | | % |

1. See short-circuit current curve for available output current at fixed dropout.

$V_I$ = 6.3 V, $C_I$ = $C_O$ =10 µF, $T_A$ = -40 to 125 °C, unless otherwise specified.

**Table 6. Electrical characteristics of LD1086#33**

| Symbol | Parameter | Test condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage (1) | $I_O$ = 0 mA, $T_J$ = 25°C | 3.267 | 3.3 | 3.333 | V |
| | | $I_O$ = 0 to 1.5A, $V_I$ = 4.9 to 30V | 3.234 | 3.3 | 3.366 | V |
| $\Delta V_O$ | Line regulation | $I_O$ = 0 mA, $V_I$ = 4.9 to 18V, $T_J$ = 25°C | | 0.5 | 6 | mV |
| | | $I_O$ = 0 mA, $V_I$ = 4.9 to 18V | | 1 | 6 | mV |
| $\Delta V_O$ | Load regulation | $I_O$ = 0 to 1.5A, $T_J$ = 25°C | | 1 | 10 | mV |
| | | $I_O$ = 0 to 1.5A | | 7 | 25 | mV |
| $V_d$ | Dropout voltage | $I_O$ = 1.5A | | 1.3 | 1.5 | V |
| $I_q$ | Quiescent current | $V_I \leq$ 30V | | 5 | 10 | mA |
| $I_{sc}$ | Short circuit current | $V_I$ - $V_O$ = 5V | 1.5 | 2 | | A |
| | | $V_I$ - $V_O$ = 25V | 0.05 | 0.2 | | A |
| | Thermal regulation | $T_A$ = 25°C, 30ms pulse | | 0.008 | 0.04 | %/W |
| SVR | Supply voltage rejection | f = 120 Hz, $C_O$ = 25 µF, $I_O$ = 1.5A $V_I$ = 8.3 ± 3V | 60 | 79 | | dB |
| eN | RMS Output noise voltage (% of $V_O$) | $T_A$ = 25°C, f =10Hz to 10kHz | | 0.003 | | % |
| S | Temperature stability | | | 0.5 | | % |
| S | Long term stability | $T_A$ = 125°C, 1000Hrs | | 0.5 | | % |

1. See short-circuit current curve for available output current at fixed dropout.

$V_I$ = 6.6 V, $C_I$ = $C_O$ =10 µF, $T_A$ = -40 to 125 °C, unless otherwise specified.

**Table 7. Electrical characteristics of LD1086#36**

| Symbol | Parameter | Test condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage (1) | $I_O$ = 0 mA, $T_J$ = 25°C | 3.564 | 3.6 | 3.636 | V |
| | | $I_O$ = 0 to 1.5A, $V_I$ = 5.2 to 30V | 3.528 | 3.6 | 3.672 | V |
| $\Delta V_O$ | Line regulation | $I_O$ = 0 mA, $V_I$ = 5.2 to 18V, $T_J$ = 25°C | | 0.5 | 10 | mV |
| | | $I_O$ = 0 mA, $V_I$ = 5.2 to 18V | | 1 | 10 | mV |
| $\Delta V_O$ | Load regulation | $I_O$ = 0 to 1.5A, $T_J$ = 25°C | | 3 | 15 | mV |
| | | $I_O$ = 0 to 1.5A | | 7 | 25 | mV |
| $V_d$ | Dropout voltage | $I_O$ = 1.5A | | 1.3 | 1.5 | V |
| $I_q$ | Quiescent current | $V_I \leq$ 30V | | 5 | 10 | mA |
| $I_{sc}$ | Short circuit current | $V_I$ - $V_O$ = 5V | 1.5 | 2 | | A |
| | | $V_I$ - $V_O$ = 25V | 0.05 | 0.2 | | A |
| | Thermal regulation | $T_A$ = 25°C, 30ms pulse | | 0.01 | 0.04 | %/W |
| SVR | Supply voltage rejection | f = 120 Hz, $C_O$ = 25 µF, $I_O$ = 1.5A $V_I$ = 8.6 ± 3V | 60 | 78 | | dB |
| eN | RMS Output noise voltage (% of $V_O$) | $T_A$ = 25°C, f =10Hz to 10kHz | | 0.003 | | % |
| S | Temperature stability | | | 0.5 | | % |
| S | Long term stability | $T_A$ = 125°C, 1000Hrs | | 0.5 | | % |

1. See short-circuit current curve for available output current at fixed dropout.

$V_I$ = 8 V, $C_I$ = $C_O$ =10 µF, $T_A$ = -40 to 125 °C, unless otherwise specified.

**Table 8. Electrical characteristics of LD1086#50**

| Symbol | Parameter | Test condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage (1) | $I_O$ = 0 mA, $T_J$ = 25°C | 4.95 | 5 | 5.05 | V |
| | | $I_O$ = 0 to 1.5A, $V_I$ = 6.6 to 30V | 4.9 | 5 | 5.1 | V |
| $\Delta V_O$ | Line regulation | $I_O$ = 0 mA, $V_I$ = 6.6 to 20V, $T_J$ = 25°C | | 0.5 | 10 | mV |
| | | $I_O$ = 0 mA, $V_I$ = 6.6 to 20V | | 1 | 10 | mV |
| $\Delta V_O$ | Load regulation | $I_O$ = 0 to 1.5A, $T_J$ = 25°C | | 5 | 20 | mV |
| | | $I_O$ = 0 to 1.5A | | 10 | 35 | mV |
| $V_d$ | Dropout voltage | $I_O$ = 1.5A | | 1.3 | 1.5 | V |
| $I_q$ | Quiescent current | $V_I \leq$ 30V | | 5 | 10 | mA |
| $I_{sc}$ | Short circuit current | $V_I$ - $V_O$ = 5V | 1.5 | 2 | | A |
| | | $V_I$ - $V_O$ = 25V | 0.05 | 0.2 | | A |
| | Thermal regulation | $T_A$ = 25°C, 30ms pulse | | 0.01 | 0.04 | %/W |
| SVR | Supply voltage rejection | f = 120 Hz, $C_O$ = 25 µF, $I_O$ = 1.5A $V_I$ = 10 ± 3V | 60 | 75 | | dB |
| eN | RMS Output noise voltage (% of $V_O$) | $T_A$ = 25°C, f =10Hz to 10kHz | | 0.003 | | % |
| S | Temperature stability | | | 0.5 | | % |
| S | Long term stability | $T_A$ = 125°C, 1000Hrs | | 0.5 | | % |

1. See short-circuit current curve for available output current at fixed dropout.

$V_I$ = 15 V, $C_I$ = $C_O$ =10 µF, $T_A$ = -40 to 125 °C, unless otherwise specified.

**Table 9. Electrical characteristics of LD1086#12**

| Symbol | Parameter | Test condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage (1) | $I_O$ = 0 mA, $T_J$ = 25°C | 11.88 | 12 | 12.12 | V |
| | | $I_O$ = 0 to 1.5A, $V_I$ = 13.8 to 30V | 11.76 | 12 | 12.24 | V |
| $\Delta V_O$ | Line regulation | $I_O$ = 0 mA, $V_I$ = 13.8 to 25V, $T_J$ = 25°C | | 1 | 25 | mV |
| | | $I_O$ = 0 mA, $V_I$ = 13.8 to 25V | | 2 | 25 | mV |
| $\Delta V_O$ | Load regulation | $I_O$ = 0 to 1.5A, $T_J$ = 25°C | | 12 | 36 | mV |
| | | $I_O$ = 0 to 1.5A | | 24 | 72 | mV |
| $V_d$ | Dropout voltage | $I_O$ = 1.5A | | 1.3 | 1.5 | V |
| $I_q$ | Quiescent current | $V_I \leq$ 30V | | 5 | 10 | mA |
| $I_{sc}$ | Short circuit current | $V_I$ - $V_O$ = 5V | 1.5 | 2 | | A |
| | | $V_I$ - $V_O$ = 25V | 0.05 | 0.2 | | A |
| | Thermal regulation | $T_A$ = 25°C, 30ms pulse | | 0.01 | 0.04 | %/W |
| SVR | Supply voltage rejection | f = 120 Hz, $C_O$ = 25 µF, $I_O$ = 1.5A $V_I$ = 17 ± 3V | 54 | 66 | | dB |
| eN | RMS Output noise voltage (% of $V_O$) | $T_A$ = 25°C, f =10Hz to 10kHz | | 0.003 | | % |
| S | Temperature stability | | | 0.5 | | % |
| S | Long term stability | $T_A$ = 125°C, 1000Hrs | | 0.5 | | % |

1. See short-circuit current curve for available output current at fixed dropout.

$V_I$ = 4.25 V, $C_I$ = $C_O$ =10 µF, $T_A$ = -40 to 125 °C, unless otherwise specified.

**Table 10. Electrical characteristics of LD1086#**

| Symbol | Parameter | Test condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage (1) | $I_O$ = 10mA $T_J$ = 25°C | 1.237 | 1.25 | 1.263 | V |
| | | $I_O$ = 10mA to 1.5A, $V_I$ = 2.85 to 30V | 1.225 | 1.25 | 1.275 | V |
| $\Delta V_O$ | Line Regulation | $I_O$ = 10mA, $V_I$ = 2.8 to 16.5V, $T_J$ = 25°C | | 0.015 | 0.2 | % |
| | | $I_O$ = 10mA, $V_I$ = 2.8 to 16.5V | | 0.035 | 0.2 | % |
| $\Delta V_O$ | Load Regulation | $I_O$ = 10mA to 1.5A, $T_J$ = 25°C | | 0.1 | 0.3 | % |
| | | $I_O$ = 0 to 1.5A | | 0.2 | 0.4 | % |
| $V_d$ | Dropout Voltage | $I_O$ = 1.5A | | 1.3 | 1.5 | V |
| $I_{O(min)}$ | Minimum Load Current | $V_I$ = 30V | | 3 | 10 | mA |
| $I_{sc}$ | Short Circuit Current | $V_I$ - $V_O$ = 5V | 1.5 | 2.3 | | A |
| | | $V_I$ - $V_O$ = 25V | 0.05 | 0.2 | | A |
| | Thermal Regulation | $T_A$ = 25°C, 30ms pulse | | 0.01 | 0.04 | %/W |
| SVR | Supply Voltage Rejection | f = 120 Hz, $C_O$ = 25 µF,$C_{ADJ}$ = 25 µF, $I_O$ = 1.5A, $V_I$ = 6.25 ± 3V | 60 | 88 | | dB |
| $I_{ADJ}$ | Adjust Pin Current | $V_I$ = 4.25V, $I_O$ = 10 mA | | 40 | 120 | µA |
| $\Delta I_{ADJ}$ | Adjust Pin Current Change (1) | $I_O$ = 10mA to 1.5A, $V_I$ = 2.8 to 16.5V | | 0.2 | 5 | µA |
| eN | RMS Output Noise Voltage (% of $V_O$) | $T_A$ = 25°C, f =10Hz to 10kHz | | 0.003 | | % |
| S | Temperature Stability | | | 0.5 | | % |
| S | Long Term Stability | $T_A$ = 125°C, 1000Hrs | | 0.5 | | % |

1. See short-circuit current curve for available output current at fixed dropout.

$V_I$ = 4.25 V, $C_I$ = $C_O$ =10 µF, $T_A$ = -40 to 125 °C, unless otherwise specified.

**Table 11. Electrical characteristics of LD1086DTTRY and LD1086VY (Automotive Grade)**

| Symbol | Parameter | Test condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_O$ | Output voltage (1) | $I_O$ = 10 mA $T_A$ = 25°C | 1.237 | 1.25 | 1.263 | V |
| | | $I_O$ = 10 mA to 1.5 A, $V_I$ = 2.85 to 30 V | 1.225 | 1.25 | 1.275 | V |
| $\Delta V_O$ | Line regulation | $I_O$ = 10 mA, $V_I$ = 2.8 to 16.5 V | | 0.035 | 0.2 | % |
| $\Delta V_O$ | Load regulation | $I_O$ = 0 to 1.5 A | | 0.2 | 0.4 | % |
| $V_d$ | Dropout voltage | $I_O$ = 1.5 A | | 1.3 | 1.5 | V |
| $I_{O(min)}$ | Minimum load current | $V_I$ = 30 V | | 3 | 10 | mA |
| $I_{sc}$ | Short circuit current | $V_I$ - $V_O$ = 5 V, $T_A$ = 25°C | 1.5 | 2.3 | | A |
| | | $V_I$ - $V_O$ = 25 V, $T_A$ = 25°C | 0.05 | 0.2 | | A |
| | Thermal regulation | $T_A$ = 25°C, 30ms pulse | | 0.01 | 0.04 | %/W |
| SVR | Supply voltage rejection | f = 120 Hz, $C_O$ = 25 µF,$C_{ADJ}$ = 25 µF, $I_O$ = 1.5 A, $V_I$ = 6.25 ± 3 V, $T_A$ = 25°C | 60 | 88 | | dB |
| $I_{ADJ}$ | Adjust pin current | $V_I$ = 4.25 V, $I_O$ = 10 mA | | 40 | 120 | µA |
| $\Delta I_{ADJ}$ | Adjust pin current change (1) | $I_O$ = 10 mA to 1.5 A, $V_I$ = 2.8 to 16.5 V | | 0.2 | 5 | µA |
| eN | RMS output noise voltage (% of $V_O$) | $T_A$ = 25°C, f =10 Hz to 10 kHz | | 0.003 | | % |
| S | Temperature stability | | | 0.5 | | % |
| S | Long term stability | $T_A$ = 125°C, 1000 Hrs | | 0.5 | | % |

1. See short-circuit current curve for available output current at fixed dropout.

# 6 Typical application

Unless otherwise specified $T_J$ = 25 °C, $C_I$ = $C_O$ = 10 µF.

**Figure 4. Output voltage vs. temp. ($V_I$ = 5 V)**

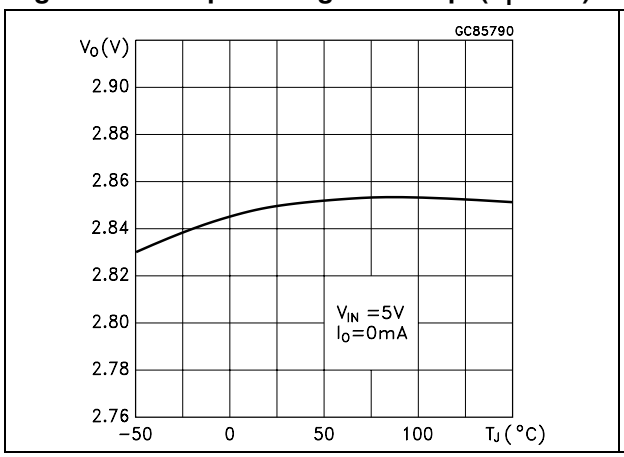



**Figure 5. Output voltage vs. temp. ($V_I$ = 15 V)**

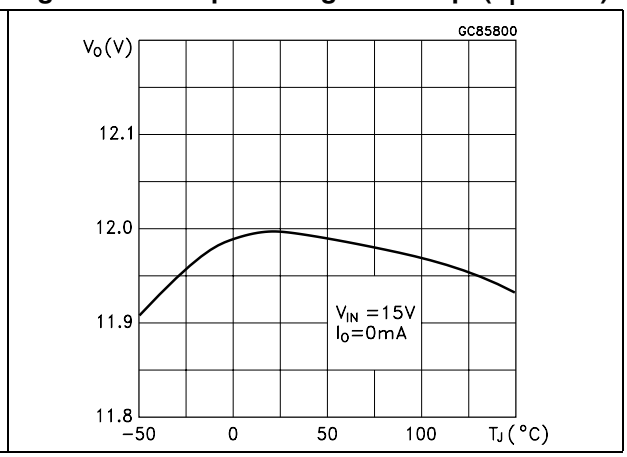



**Figure 6. Output voltage vs. temperature ($V_I$ = 4.25 V)**

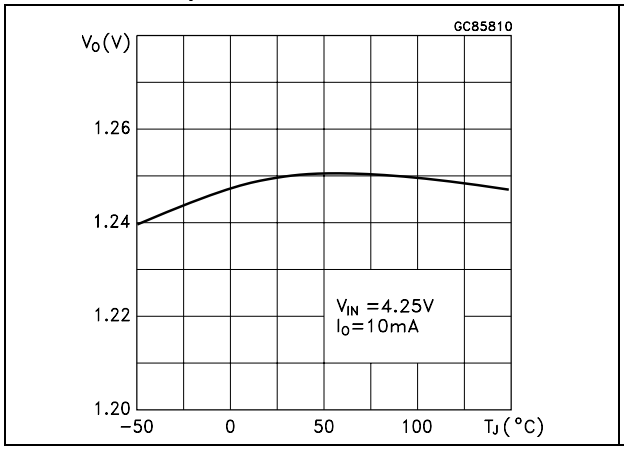



**Figure 7. Short circuit current vs. dropout voltage**

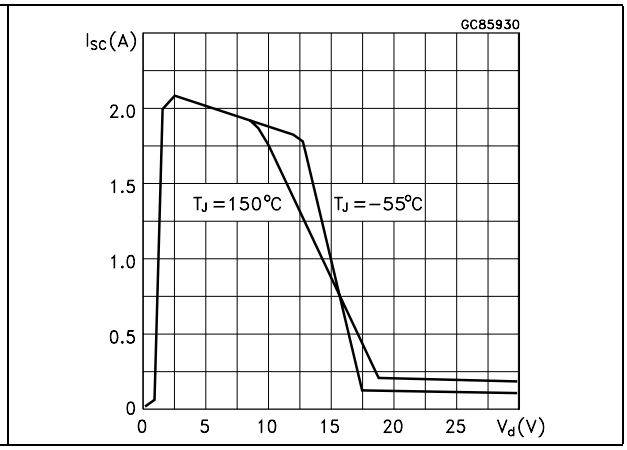



**Figure 8. Line regulation vs. temperature**

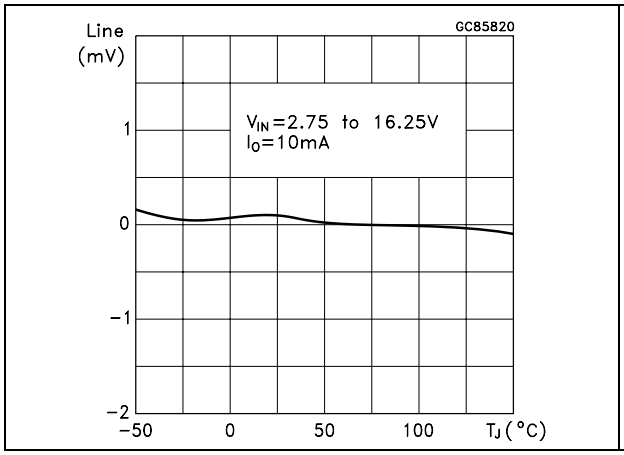



**Figure 9. Load regulation vs. temperature**

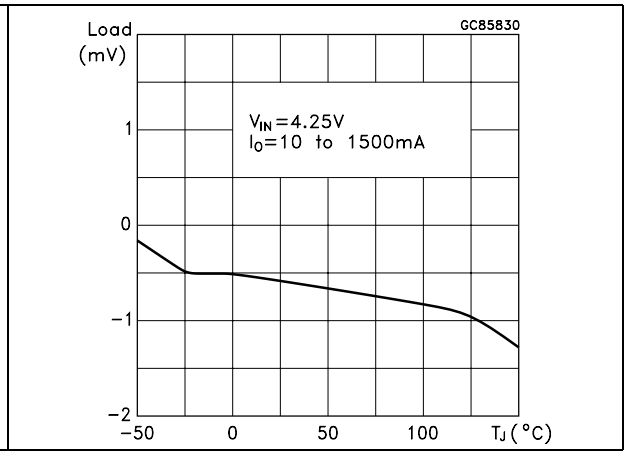


**Figure 10. Dropout voltage vs. temperature**

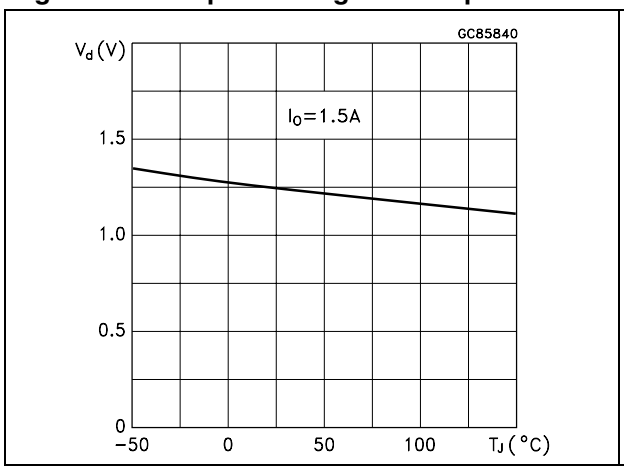



**Figure 11. Dropout voltage vs. output current**

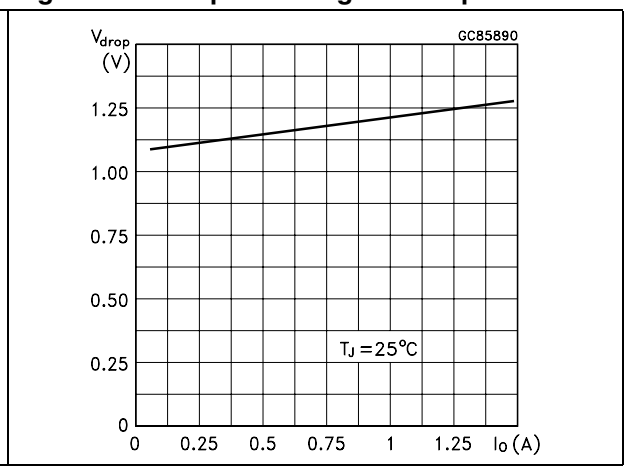



**Figure 12. Adjust pin current vs. input voltage**

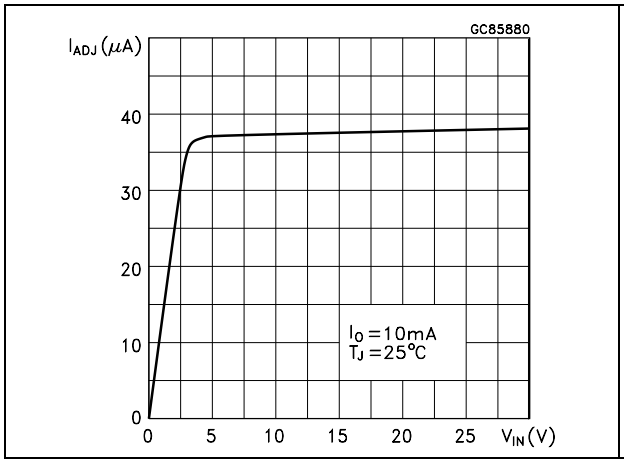



**Figure 13. Adjust pin current vs. temperature**

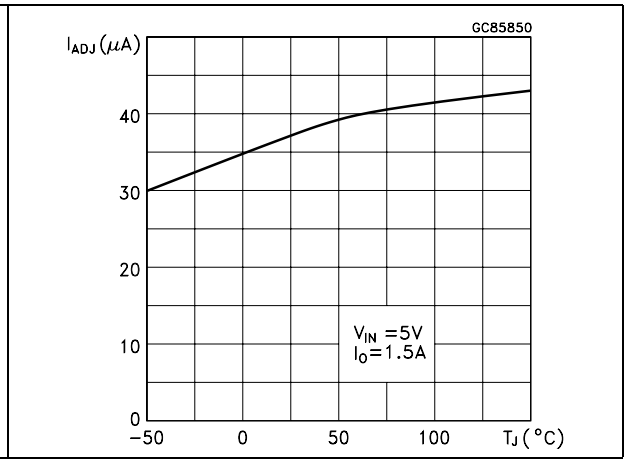



**Figure 14. Adjust pin current vs. output current**

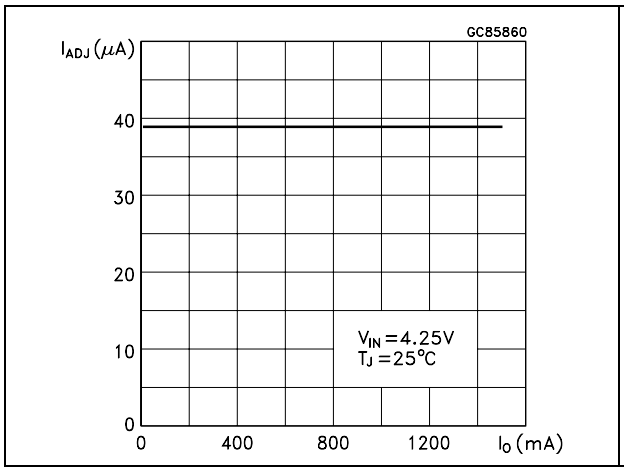



**Figure 15. Quiescent current vs. output current**

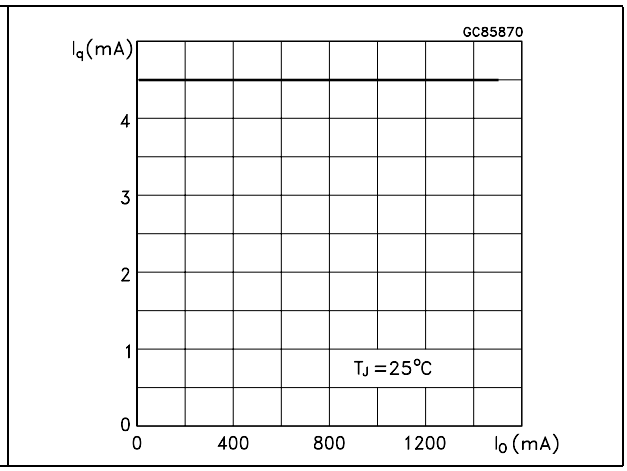


**Figure 16. Quiescent current vs. input voltage**

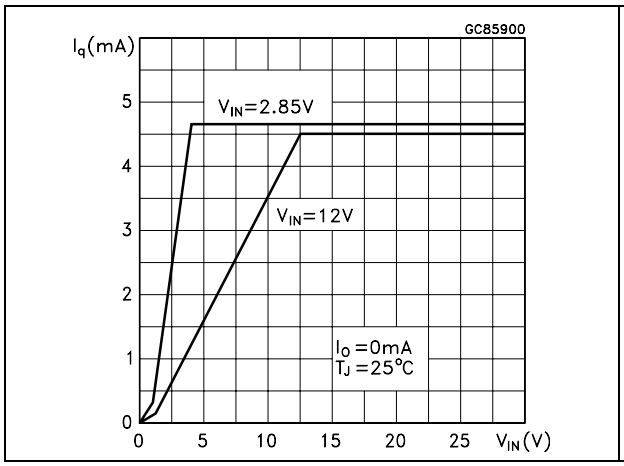



**Figure 17. Supply voltage rejection vs. output current**

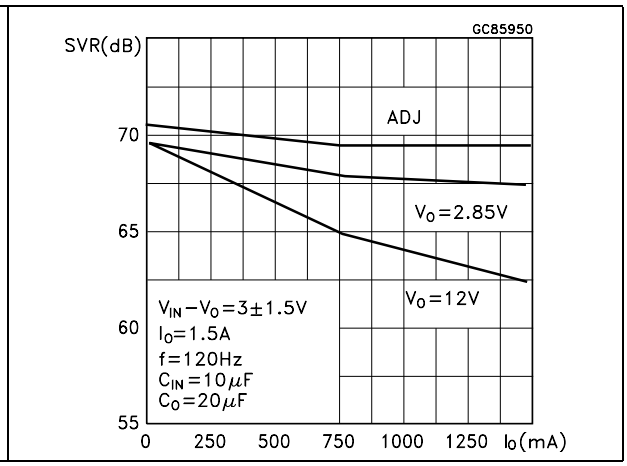



**Figure 18. Supply voltage rejection vs. frequency**

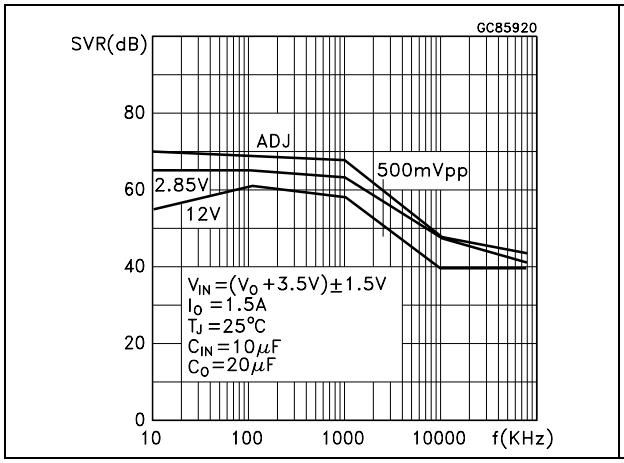



**Figure 19. Supply voltage rejection vs. temperature**

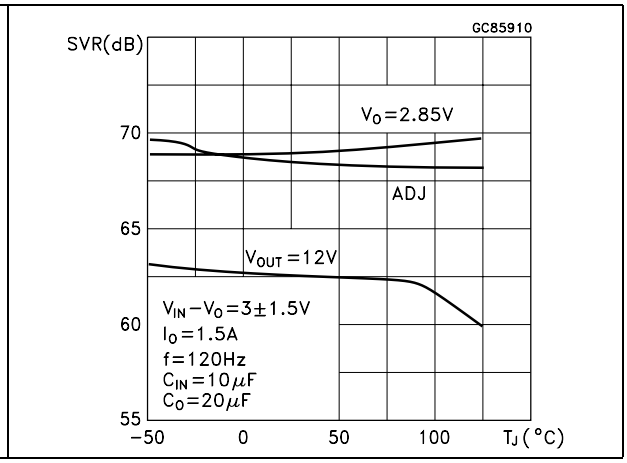



**Figure 20. Minimum load current vs. temperature**

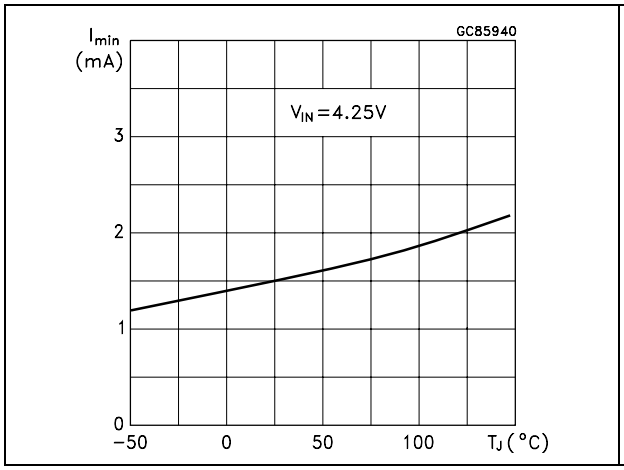



**Figure 21. Stability for adjustable**

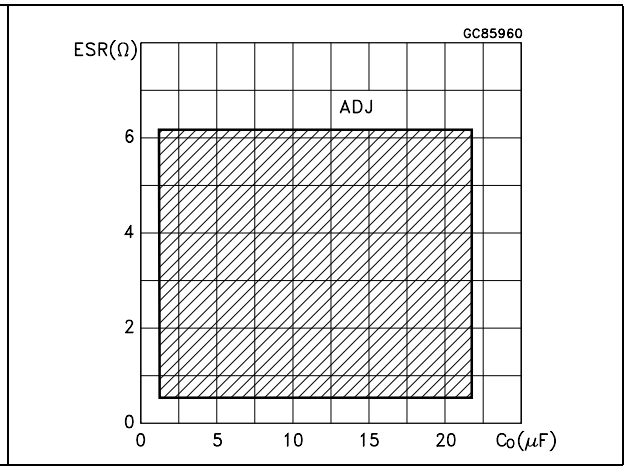


**Figure 22. Stability for 2.85 V**

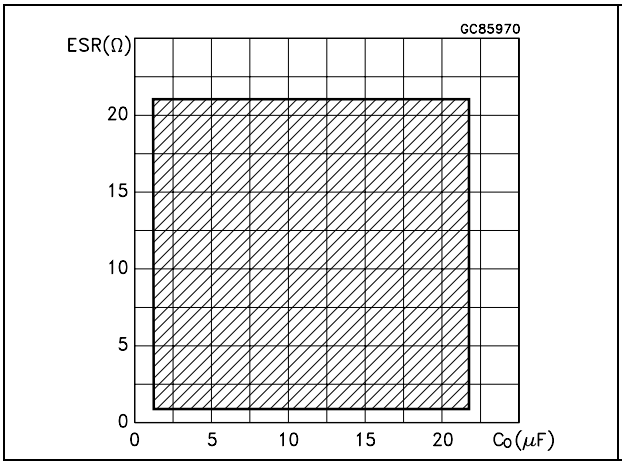



**Figure 23. Stability for 12 V**

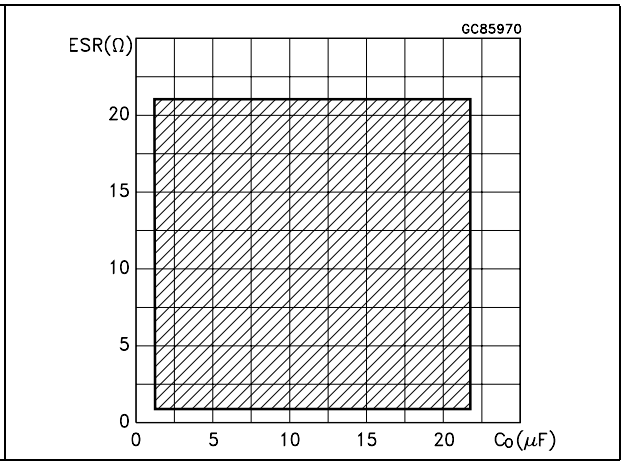
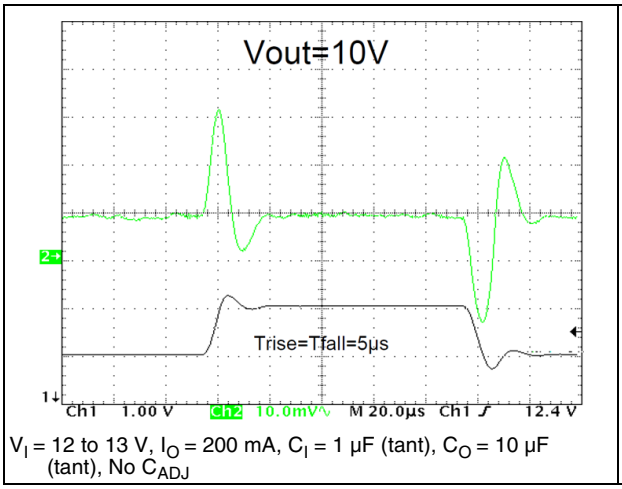
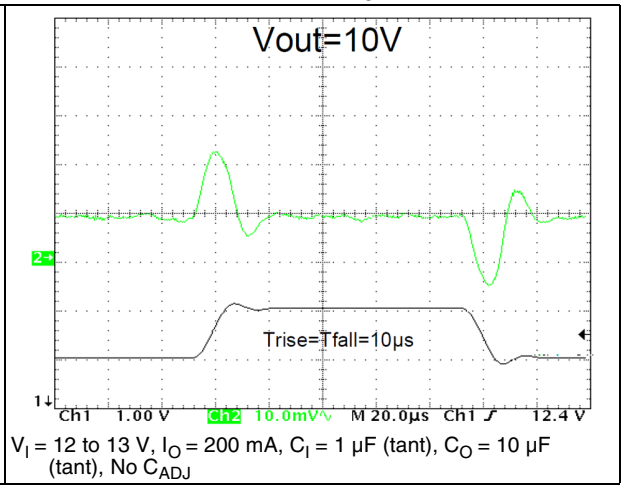



**Figure 24. Line transient ($V_I$ = 12 to 13 V)**



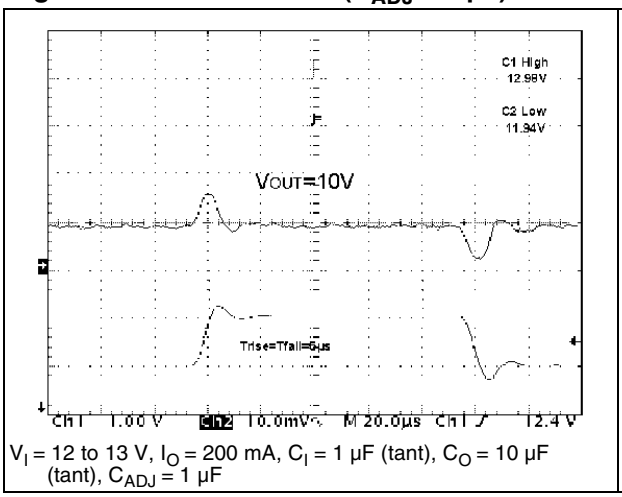

$V_I$ = 12 to 13 V, $I_O$ = 200 mA, $C_I$ = 1 µF (tant), $C_O$ = 10 µF (tant), No $C_{ADJ}$

**Figure 25. Line transient ($I_O$ = 200 mA)**



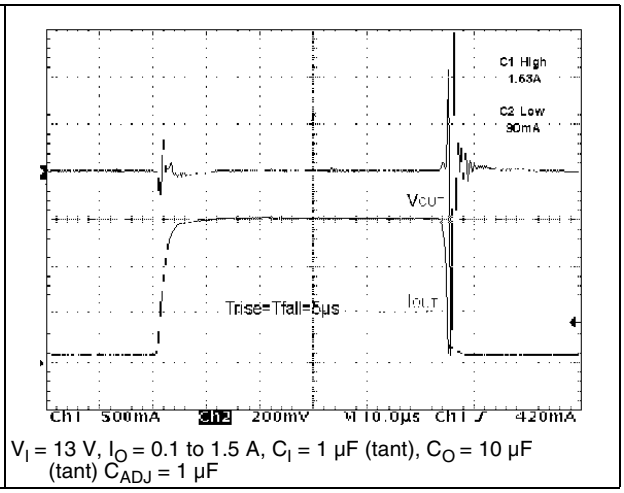

$V_I$ = 12 to 13 V, $I_O$ = 200 mA, $C_I$ = 1 µF (tant), $C_O$ = 10 µF (tant), No $C_{ADJ}$

**Figure 26. Line transient ($C_{ADJ}$ = 1 µF)**



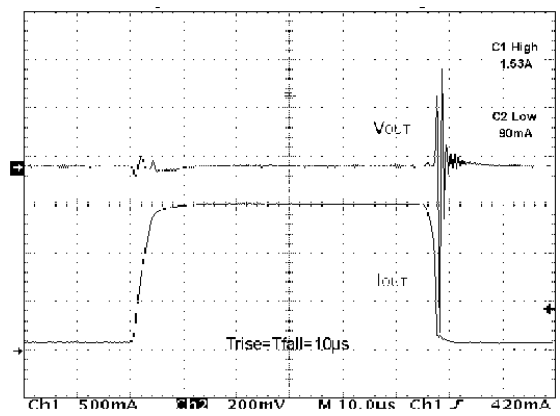

$V_I$ = 12 to 13 V, $I_O$ = 200 mA, $C_I$ = 1 µF (tant), $C_O$ = 10 µF (tant), $C_{ADJ}$ = 1 µF

**Figure 27. Load transient**



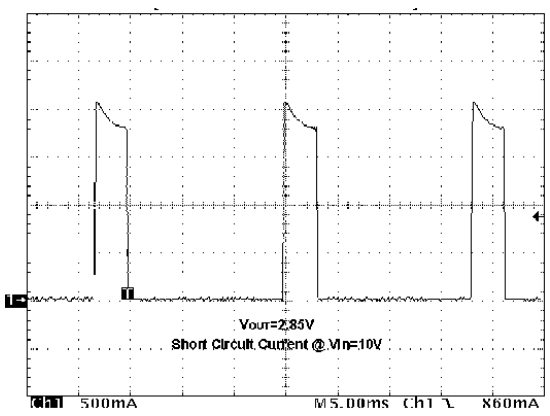

$V_I$ = 13 V, $I_O$ = 0.1 to 1.5 A, $C_I$ = 1 µF (tant), $C_O$ = 10 µF (tant) $C_{ADJ}$ = 1 µF

**Figure 28. Load transient ($T_{rise}$ = $T_{fall}$ = 10 µs)**




$V_I$ = 13 V, $I_O$ = 0.1 to 1.5 A, $C_I$ = 1 µF (tant), $C_O$ = 10 µF (tant), $C_{ADJ}$ = 1 µF

**Figure 29. Thermal protection**




$V_O$ = 2.85 V

# 7 Package mechanical data

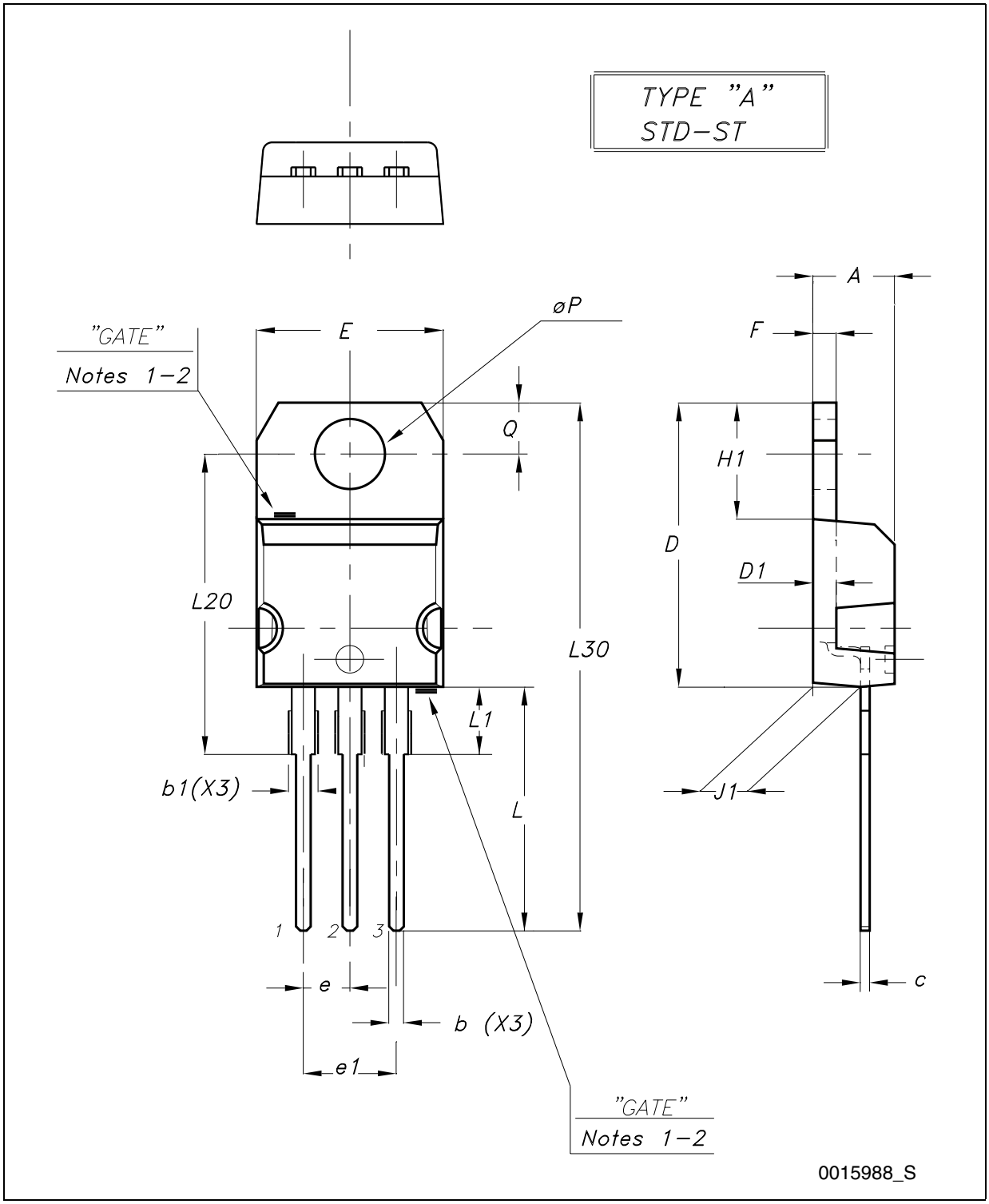
In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: *www.st.com*. ECOPACK® is an ST trademark.

**Table 12. TO-220 mechanical data**

| Dim. | Type STD - ST Dual Gauge | | | Type STD - ST Single Gauge | | |
|---|---|---|---|---|---|---|
| | mm. | | | mm. | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 4.40 | | 4.60 | 4.40 | | 4.60 |
| b | 0.61 | | 0.88 | 0.61 | | 0.88 |
| b1 | 1.14 | | 1.70 | 1.14 | | 1.70 |
| c | 0.48 | | 0.70 | 0.48 | | 0.70 |
| D | 15.25 | | 15.75 | 15.25 | | 15.75 |
| D1 | | 1.27 | | | | |
| E | 10.00 | | 10.40 | 10.00 | | 10.40 |
| e | 2.40 | | 2.70 | 2.40 | | 2.70 |
| e1 | 4.95 | | 5.15 | 4.95 | | 5.15 |
| F | 1.23 | | 1.32 | 0.51 | | 0.60 |
| H1 | 6.20 | | 6.60 | 6.20 | | 6.60 |
| J1 | 2.40 | | 2.72 | 2.40 | | 2.72 |
| L | 13.00 | | 14.00 | 13.00 | | 14.00 |
| L1 | 3.50 | | 3.93 | 3.50 | | 3.93 |
| L20 | | 16.40 | | | 16.40 | |
| L30 | | 28.90 | | | 28.90 | |
| ∅P | 3.75 | | 3.85 | 3.75 | | 3.85 |
| Q | 2.65 | | 2.95 | 2.65 | | 2.95 |

*In spite of some difference in tolerances, the packages are compatible.*

**Figure 30. Drawing dimension TO-220 (type STD-ST Dual Gauge)**




*Note: 1 Maximum resin gate protrusion: 0.5 mm.*

*2 Resin gate position is accepted in each of the two positions shown on the drawing, or their symmetrical.*

**Figure 31. Drawing dimension TO-220 (type STD-ST Single Gauge)**

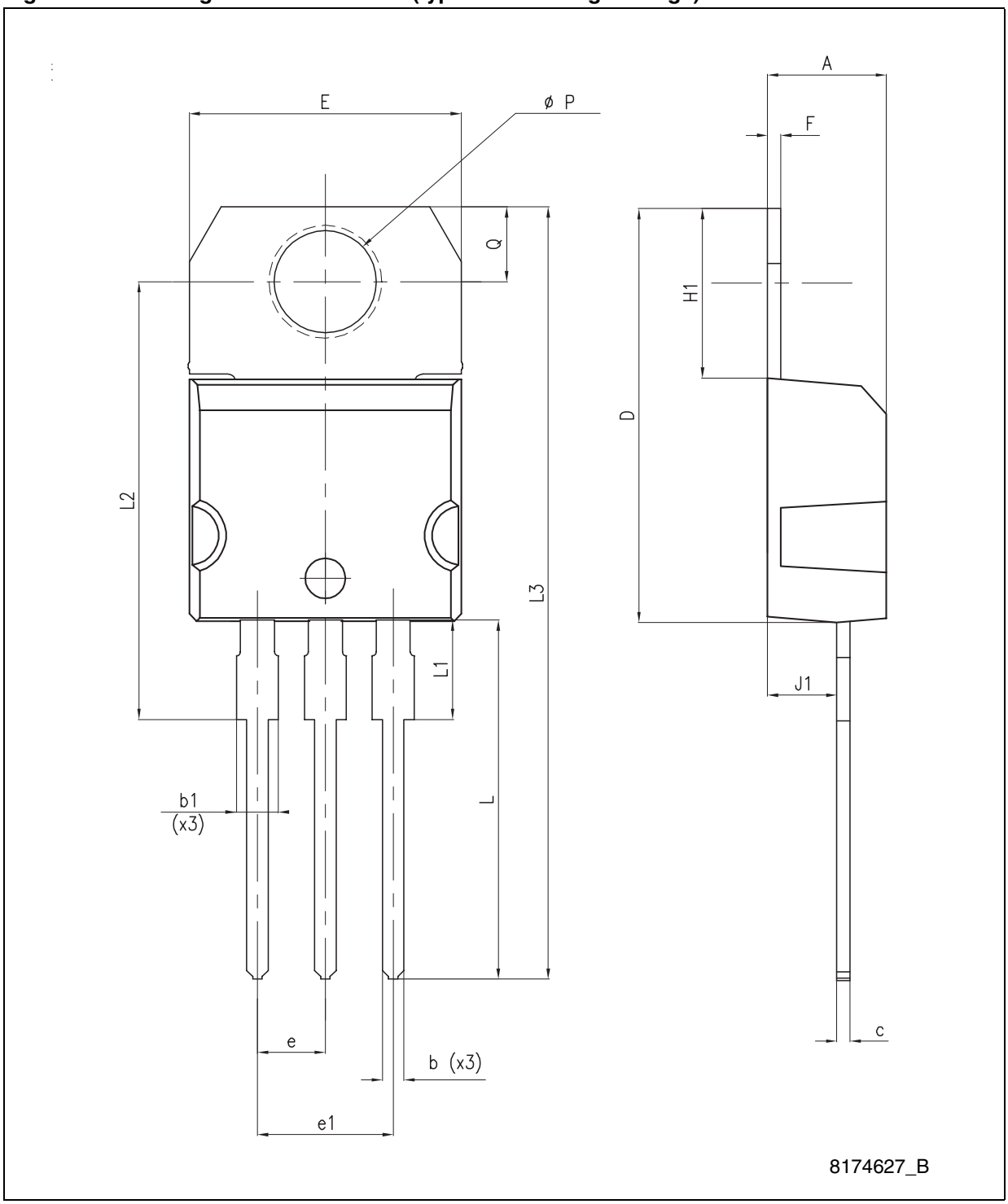


**Figure 32. Drawing dimension tube for TO-220 Dual Gauge (mm.)**

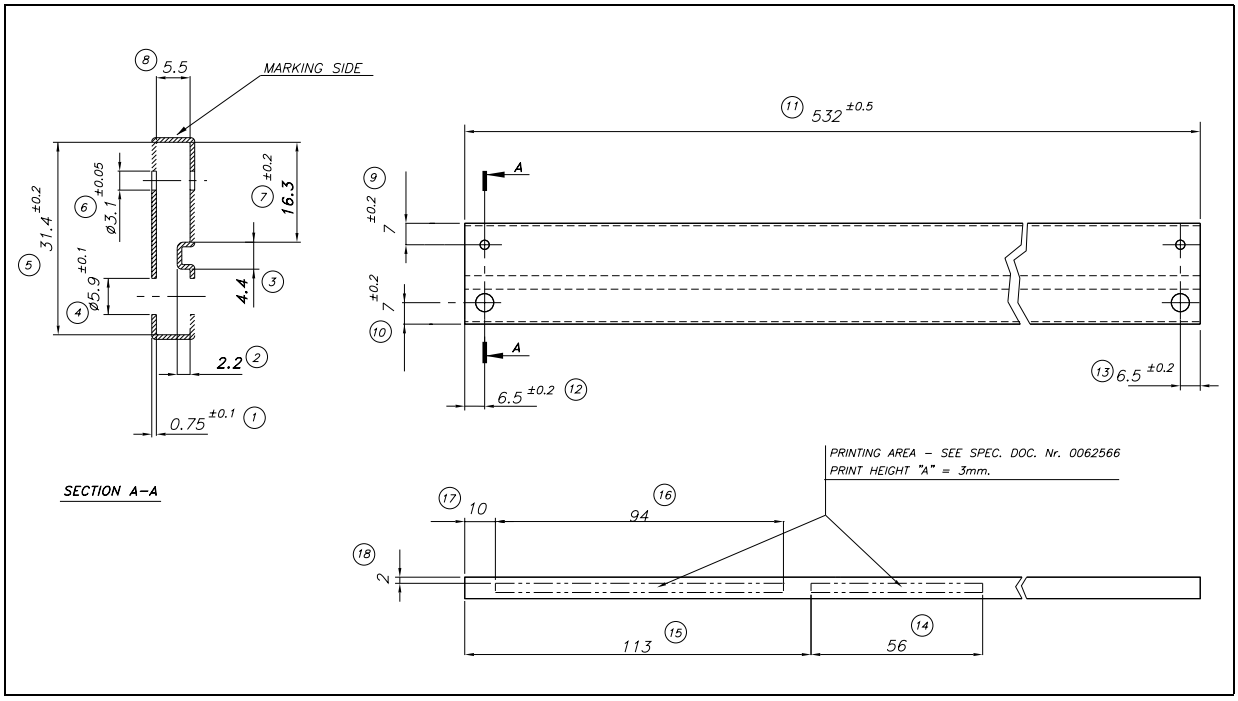
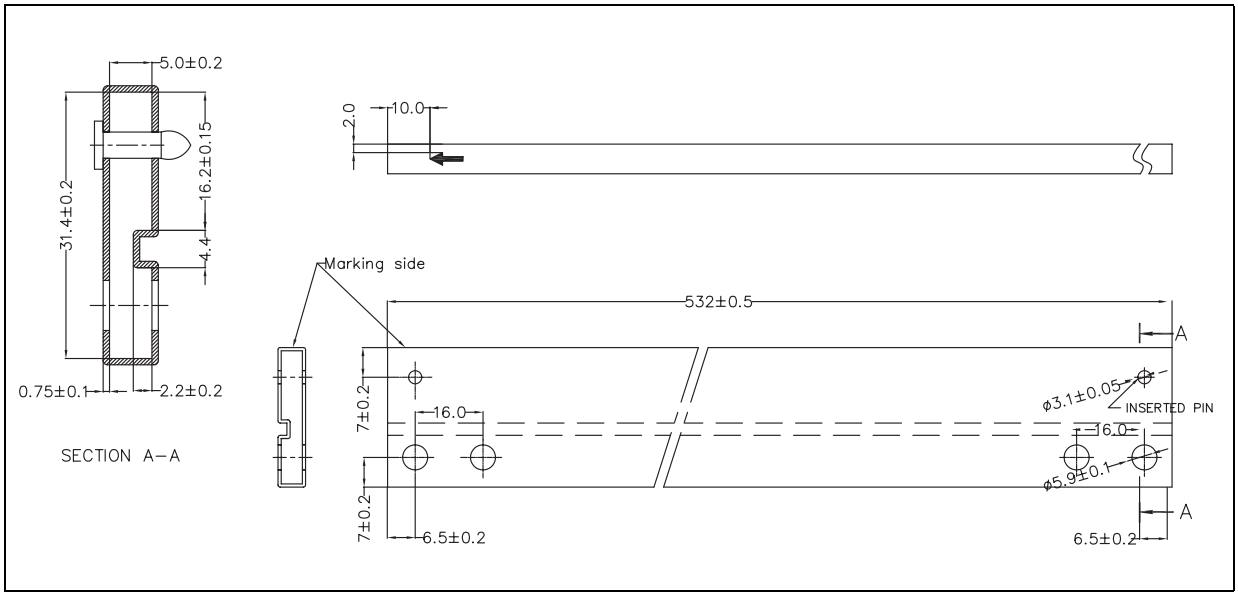



**Figure 33. Drawing dimension tube for TO-220 Single Gauge (mm.)**



## DPAK 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 |
| A2 | 0.03 | | 0.23 | 0.001 | | 0.009 |
| B | 0.64 | | 0.9 | 0.025 | | 0.035 |
| b4 | 5.2 | | 5.4 | 0.204 | | 0.212 |
| 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 |
| D1 | | 5.1 | | | 0.200 | |
| E | 6.4 | | 6.6 | 0.252 | | 0.260 |
| E1 | | 4.7 | | | 0.185 | |
| e | | 2.28 | | | 0.090 | |
| e1 | 4.4 | | 4.6 | 0.173 | | 0.181 |
| H | 9.35 | | 10.1 | 0.368 | | 0.397 |
| L | 1 | | | 0.039 | | |
| (L1) | | 2.8 | | | 0.110 | |
| L2 | | 0.8 | | | 0.031 | |
| L4 | 0.6 | | 1 | 0.023 | | 0.039 |
| R | | 0.2 | | | 0.008 | |
| V2 | 0° | | 8° | 0° | | 8° |

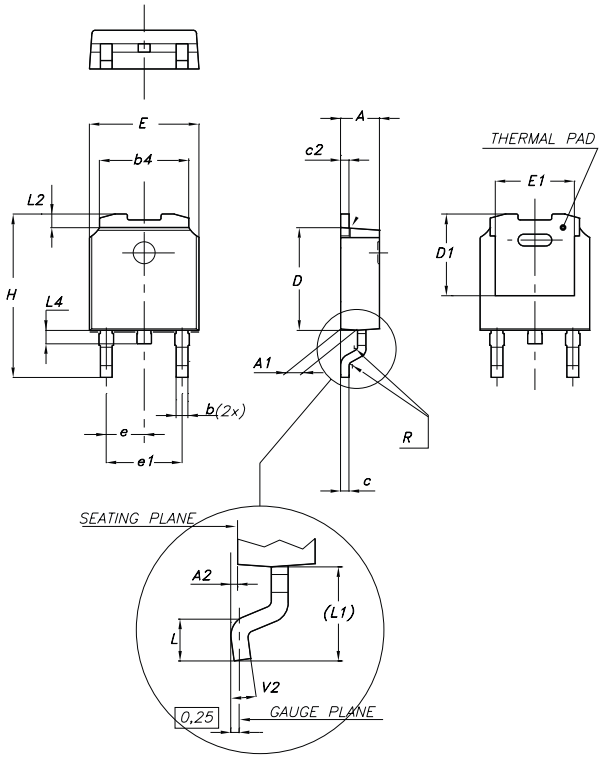



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**Figure 34. Drawing dimension D²PAK (type STD-ST)**

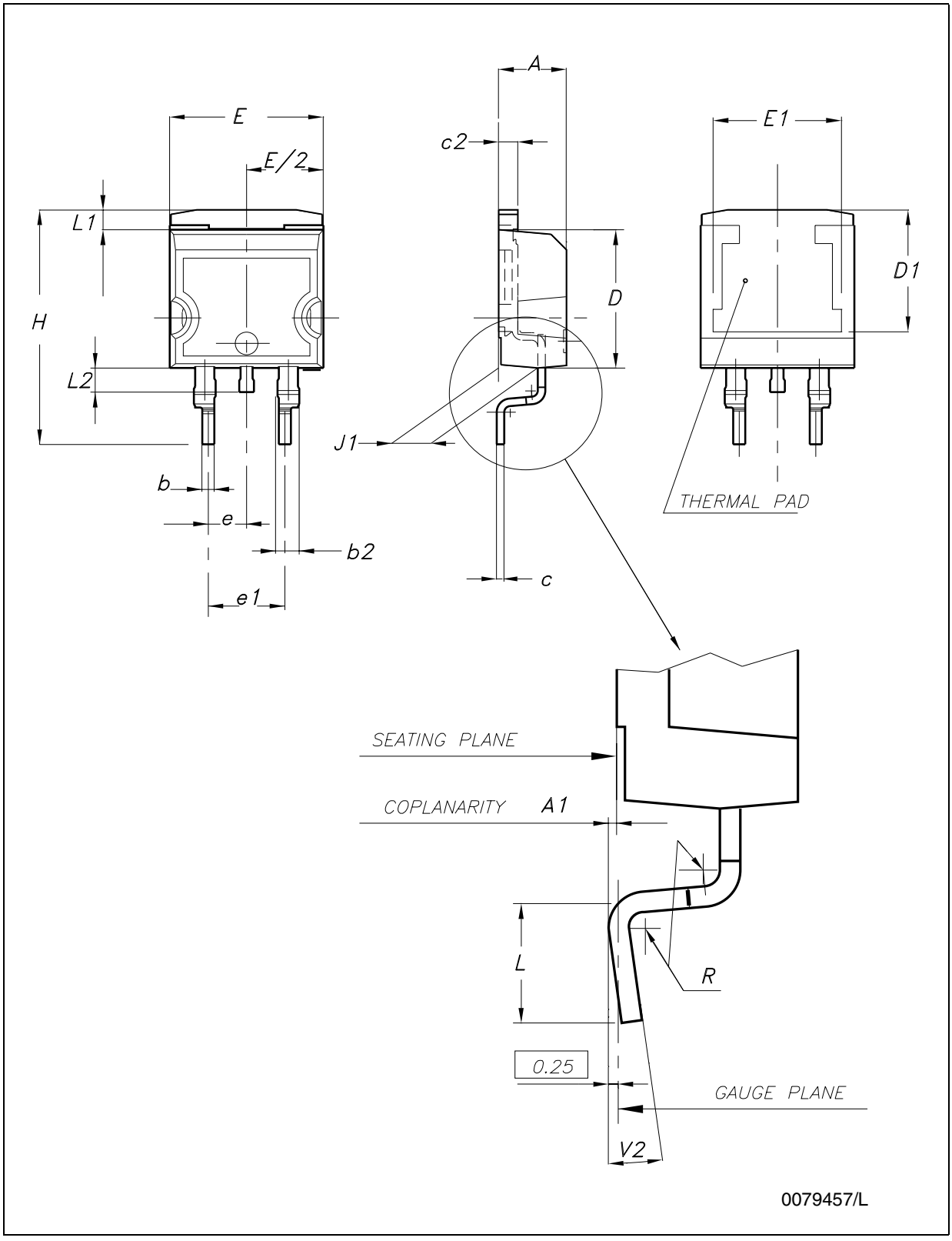


**Figure 35. Drawing dimension D²PAK (type WOOSEOK-SUBCON.)**

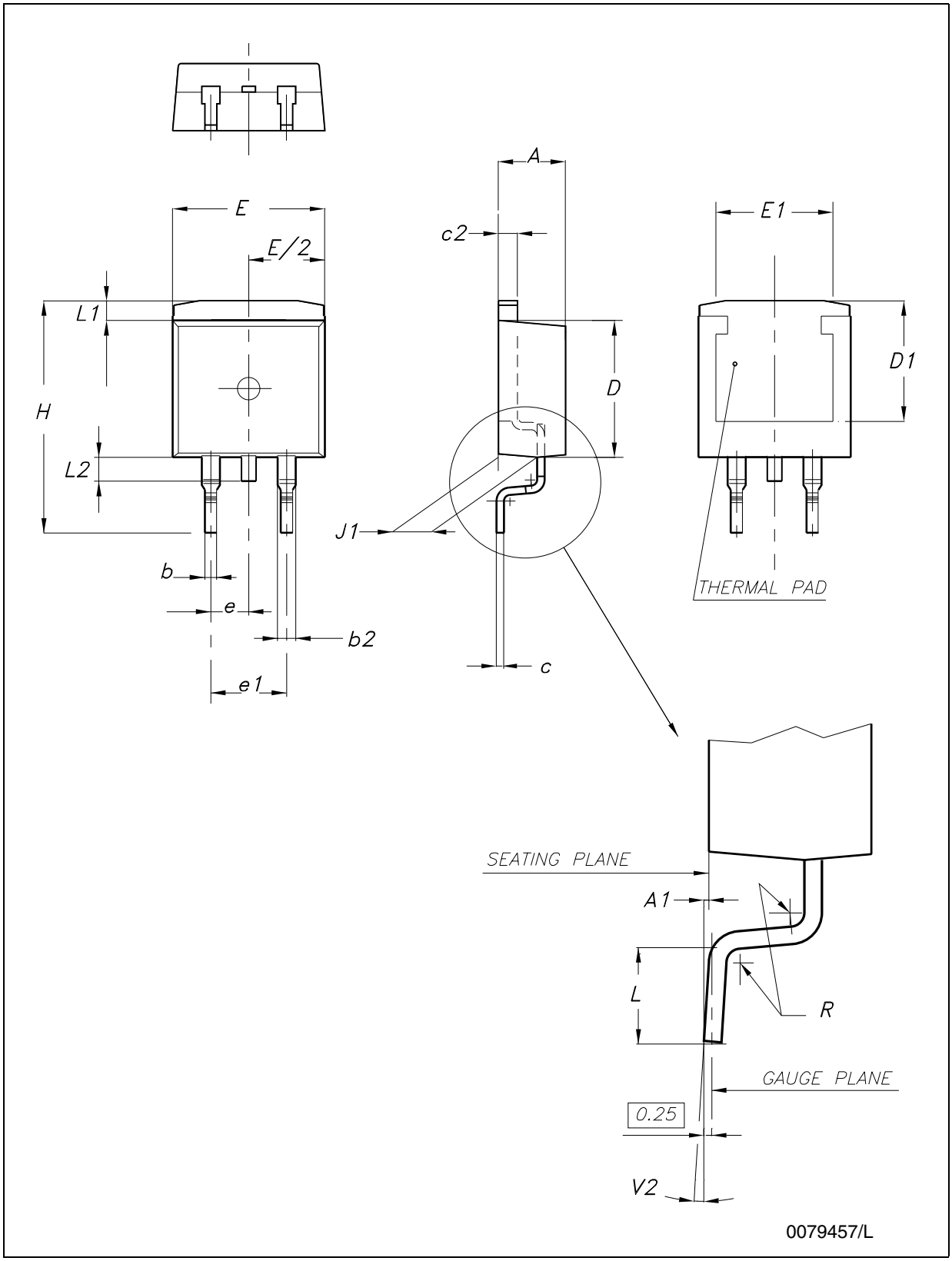


**Table 13. D²PAK mechanical data**

| Dim. | Type STD-ST | | | Type WOOSEOK-Subcon. | | |
|---|---|---|---|---|---|---|
| | mm. | | | mm. | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 4.40 | | 4.60 | 4.30 | | 4.70 |
| A1 | 0.03 | | 0.23 | 0 | | 0.20 |
| b | 0.70 | | 0.93 | 0.70 | | 0.90 |
| b2 | 1.14 | | 1.70 | 1.17 | | 1.37 |
| c | 0.45 | | 0.60 | 0.45 | 0.50 | 0.60 |
| c2 | 1.23 | | 1.36 | 1.25 | 1.30 | 1.40 |
| D | 8.95 | | 9.35 | 9 | 9.20 | 9.40 |
| D1 | 7.50 | | | 7.50 | | |
| E | 10 | | 10.40 | 9.80 | | 10.20 |
| E1 | 8.50 | | | 7.50 | | |
| e | | 2.54 | | | 2.54 | |
| e1 | 4.88 | | 5.28 | | 5.08 | |
| H | 15 | | 15.85 | 15 | 15.30 | 15.60 |
| J1 | 2.49 | | 2.69 | 2.20 | | 2.60 |
| L | 2.29 | | 2.79 | 1.79 | | 2.79 |
| L1 | 1.27 | | 1.40 | 1 | | 1.40 |
| L2 | 1.30 | | 1.75 | 1.20 | | 1.60 |
| R | | 0.4 | | | 0.30 | |
| V2 | 0° | | 8° | 0° | | 3° |

*Note: The D²PAK package coming from the subcontractor Wooseok is fully compatible with the ST's package suggested footprint.*

**Figure 36. D²PAK footprint recommended data**

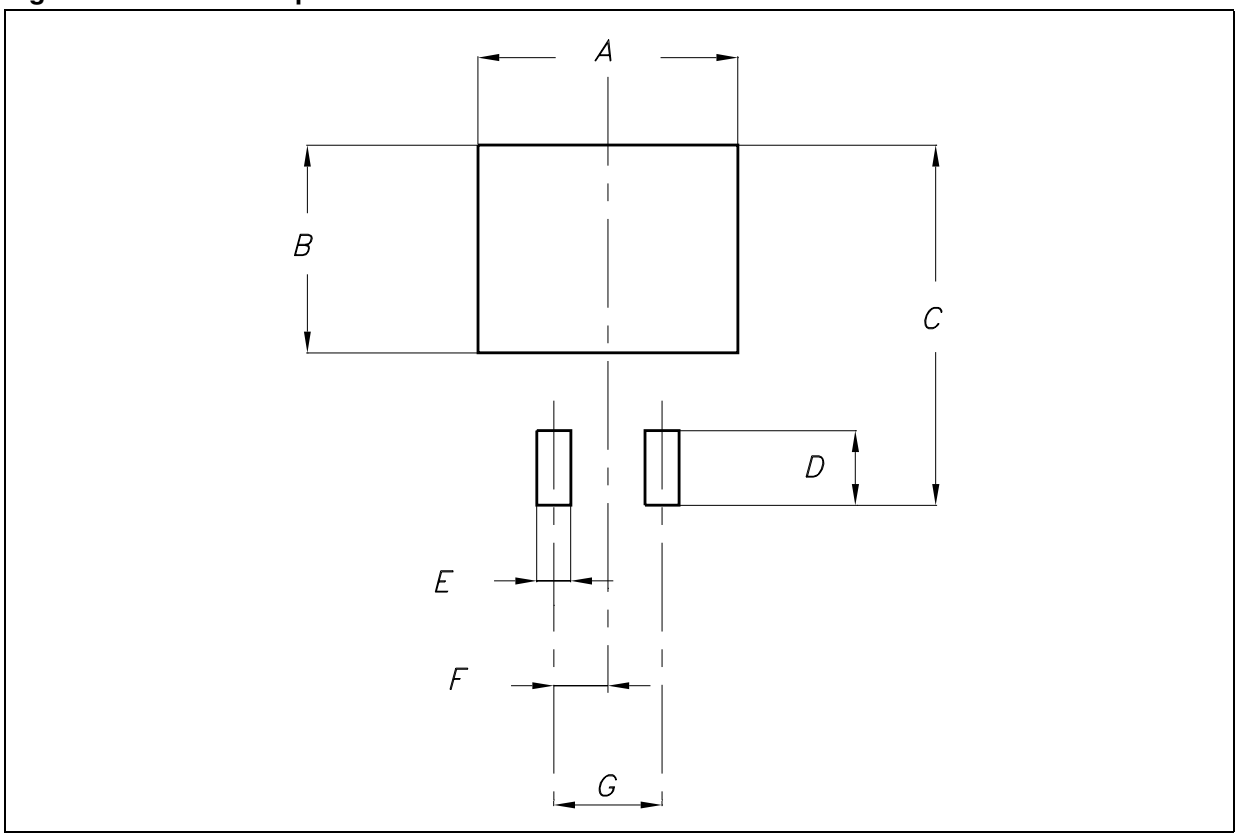



**Table 14. Footprint data**

| Values | | |
|---|---|---|
| | **mm.** | **inch.** |
| A | 12.20 | 0.480 |
| B | 9.75 | 0.384 |
| C | 16.90 | 0.665 |
| D | 3.50 | 0.138 |
| E | 1.60 | 0.063 |
| F | 2.54 | 0.100 |
| G | 5.08 | 0.200 |

**Figure 37. Drawing dimension D²PAK/A (type STD-ST)**

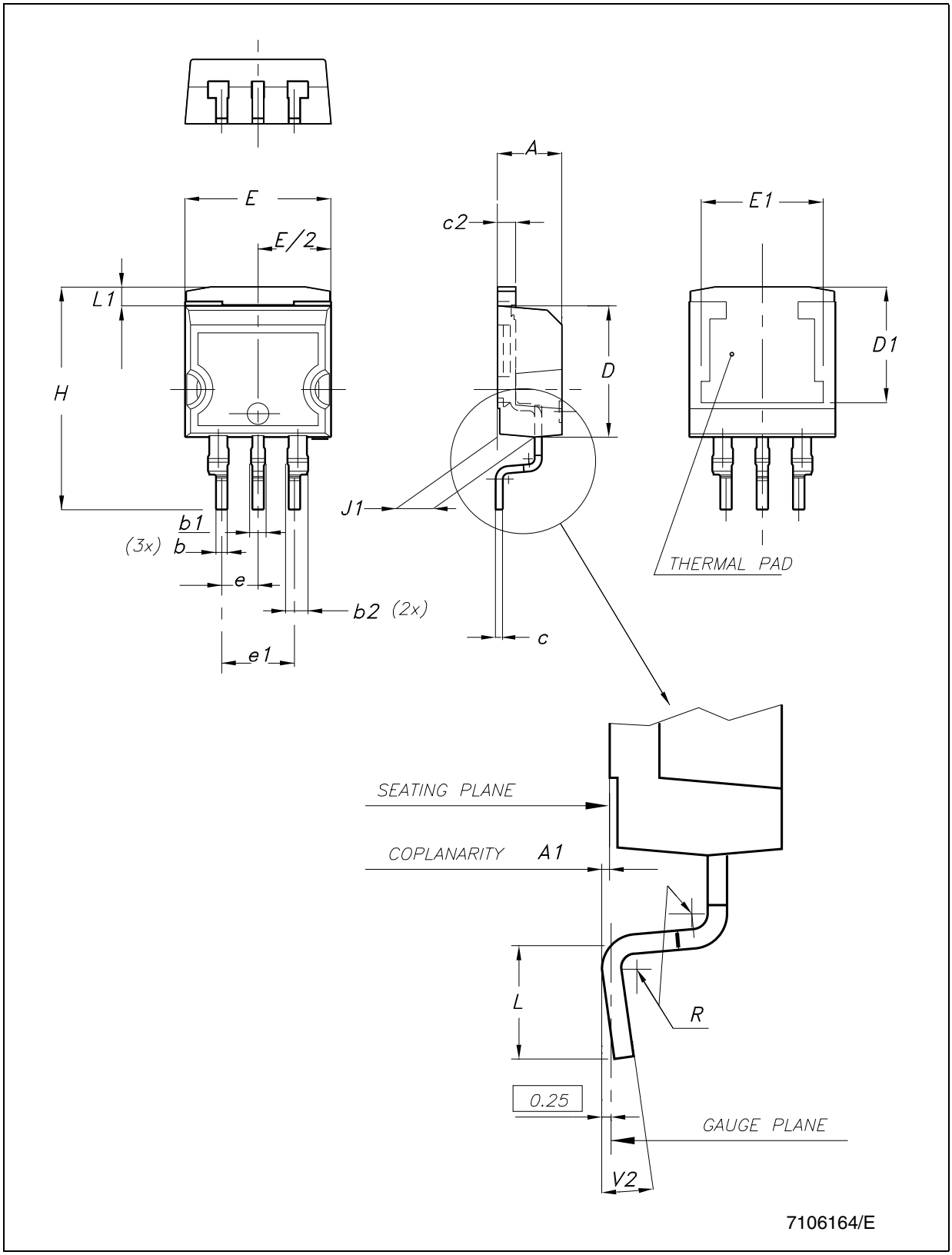


**Figure 38. Drawing dimension D²PAK/A (type WOOSEOK-Subcon.)**

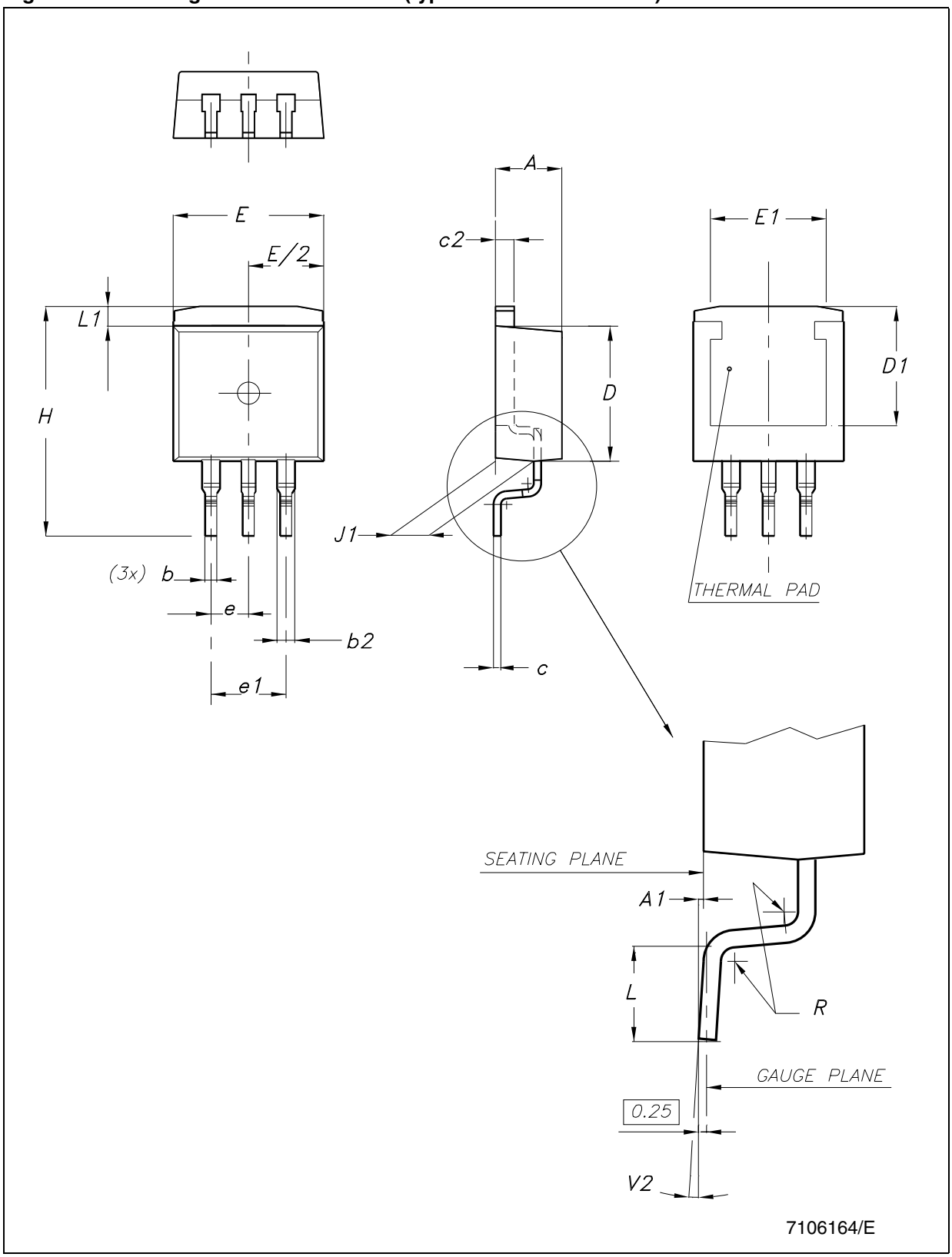


**Table 15. D²PAK/A mechanical data**

| Dim. | Type STD-ST | | | Type WOOSEOK-Subcon. | | |
|---|---|---|---|---|---|---|
| | mm. | | | mm. | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 4.40 | | 4.60 | 4.30 | | 4.70 |
| A1 | 0.03 | | 0.23 | 0 | | 0.20 |
| b | 0.70 | | 0.93 | 0.70 | | 0.90 |
| b1 | 0.80 | | 1.30 | | | |
| b2 | 1.14 | | 1.70 | 1.17 | | 1.37 |
| c | 0.45 | | 0.60 | 0.45 | 0.50 | 0.60 |
| c2 | 1.23 | | 1.36 | 1.25 | 1.30 | 1.40 |
| D | 8.95 | | 9.35 | 9 | 9.20 | 9.40 |
| D1 | 7.50 | | | 7.50 | | |
| E | 10 | | 10.40 | 9.80 | | 10.20 |
| E1 | 8.50 | | | 7.50 | | |
| e | | 2.54 | | | 2.54 | |
| e1 | 4.88 | | 5.28 | | 5.08 | |
| H | 15 | | 15.85 | 15 | 15.30 | 15.60 |
| J1 | 2.49 | | 2.69 | 2.20 | | 2.60 |
| L | 2.29 | | 2.79 | 1.79 | | 2.79 |
| L1 | 1.27 | | 1.40 | 1 | | 1.40 |
| R | | 0.4 | | | 0.30 | |
| V2 | 0° | | 8° | 0° | | 3° |

*Note: The D²PAK/A package coming from the subcontractor Wooseok is fully compatible with the ST's package suggested footprint.*

**Figure 39. D²PAK/A footprint recommended data**

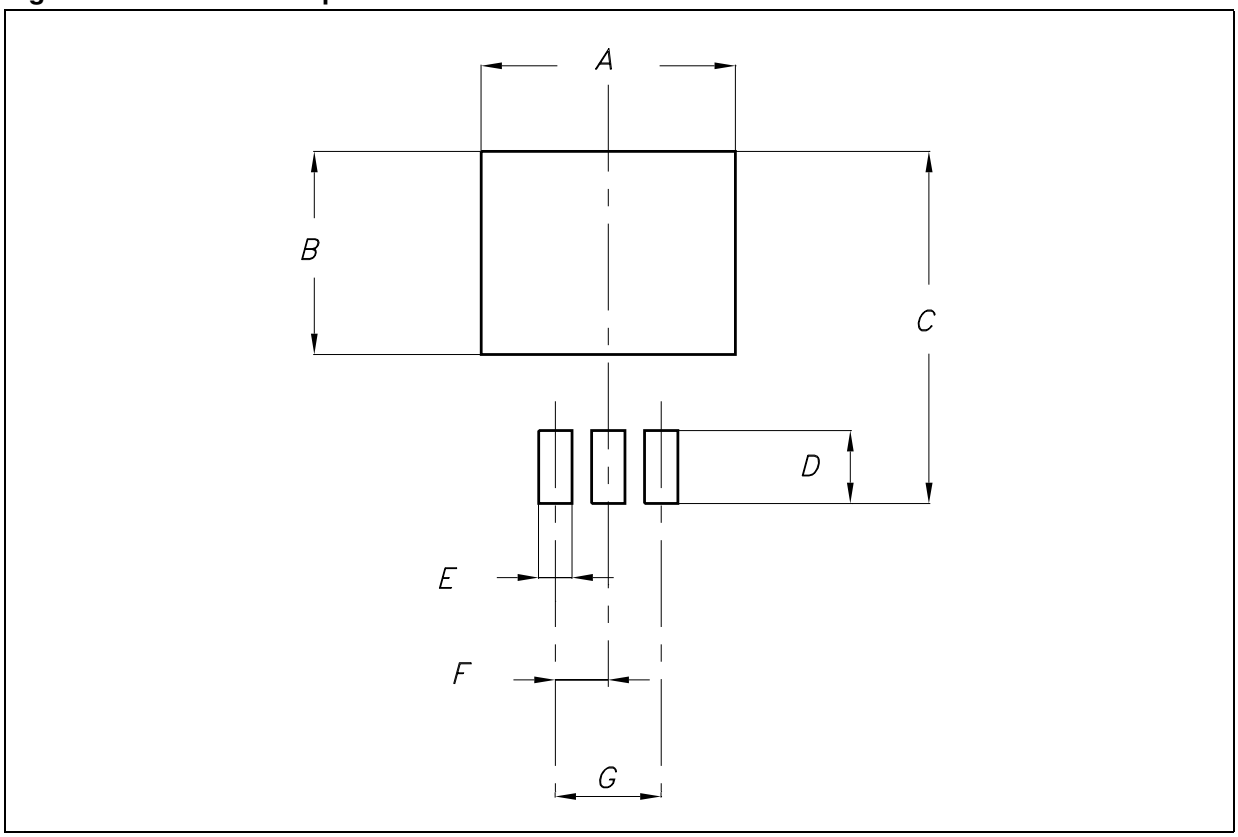



**Table 16. Footprint data**

| Values | | |
|---|---|---|
| | **mm.** | **inch.** |
| A | 12.20 | 0.480 |
| B | 9.75 | 0.384 |
| C | 16.90 | 0.665 |
| D | 3.50 | 0.138 |
| E | 1.60 | 0.063 |
| F | 2.54 | 0.100 |
| G | 5.08 | 0.200 |

Table 17. DFN8L (4x4 mm.) mechanical data

| Dim. | mm. | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 0.80 | 0.90 | 1 |
| A1 | 0 | 0.02 | 0.05 |
| A3 | | 0,20 | |
| b | 0.23 | 0.30 | 0.38 |
| D | 3.90 | 4 | 4.10 |
| D2 | 2.82 | 3 | 3.23 |
| E | 3.90 | 4 | 4.10 |
| E2 | 2.05 | 2.20 | 2.30 |
| e | | 0.80 | |
| L | 0.40 | 0.50 | 0.60 |

**Figure 40. DFN8L package outline**

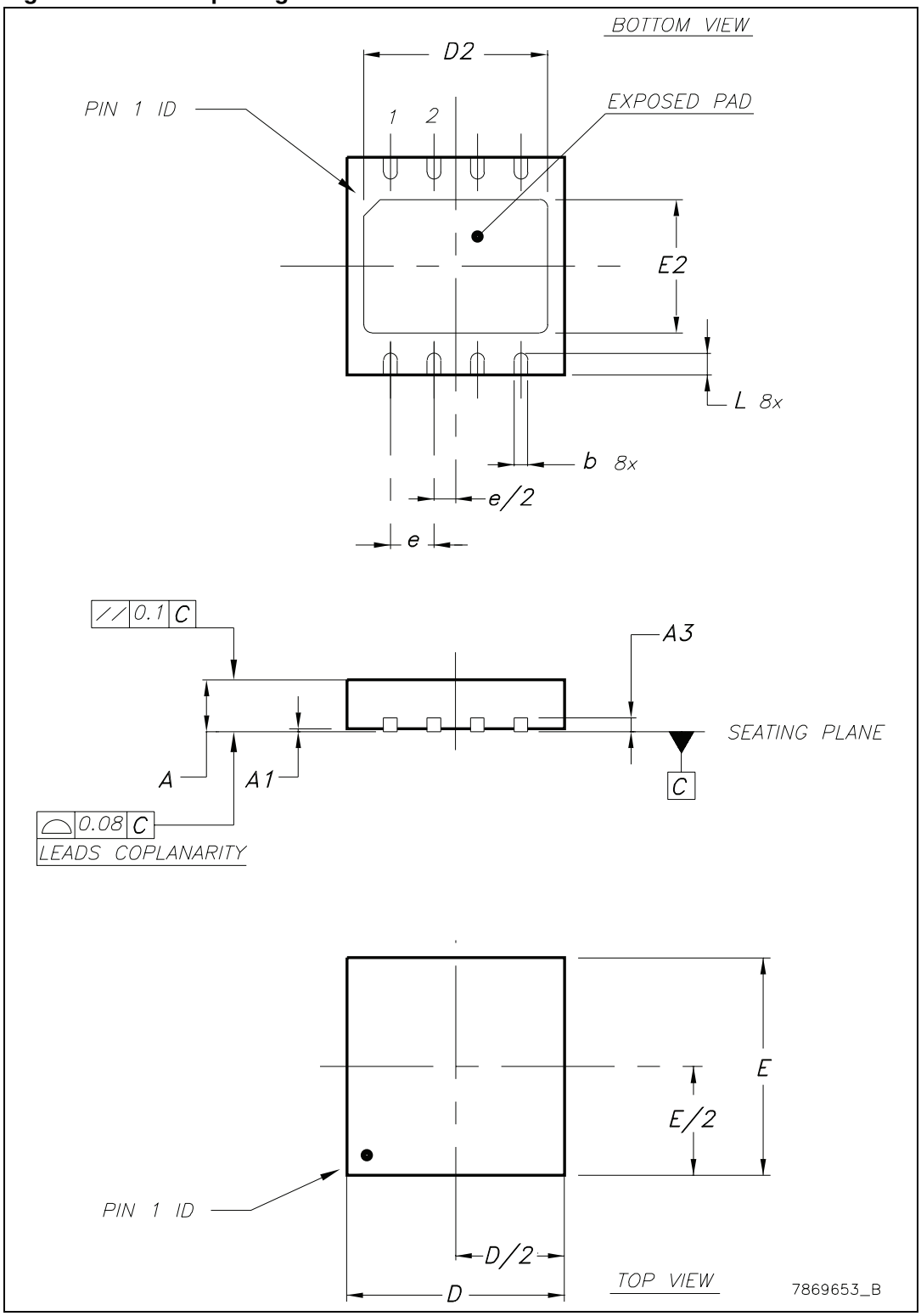


**Figure 41. DFN8L footprint - recommended data**

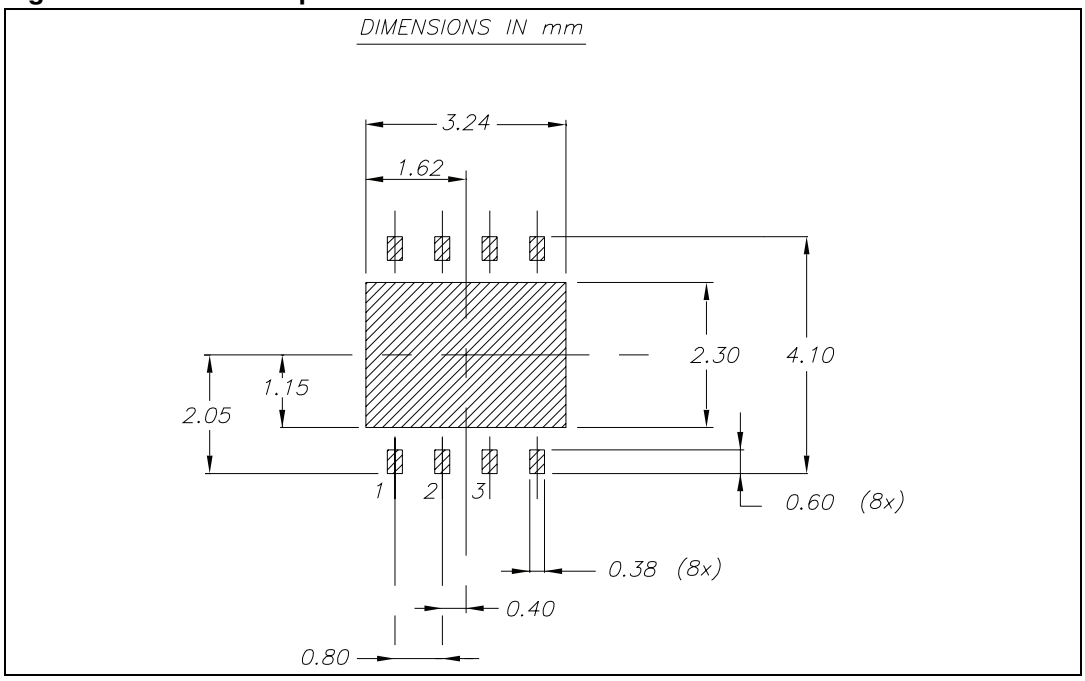
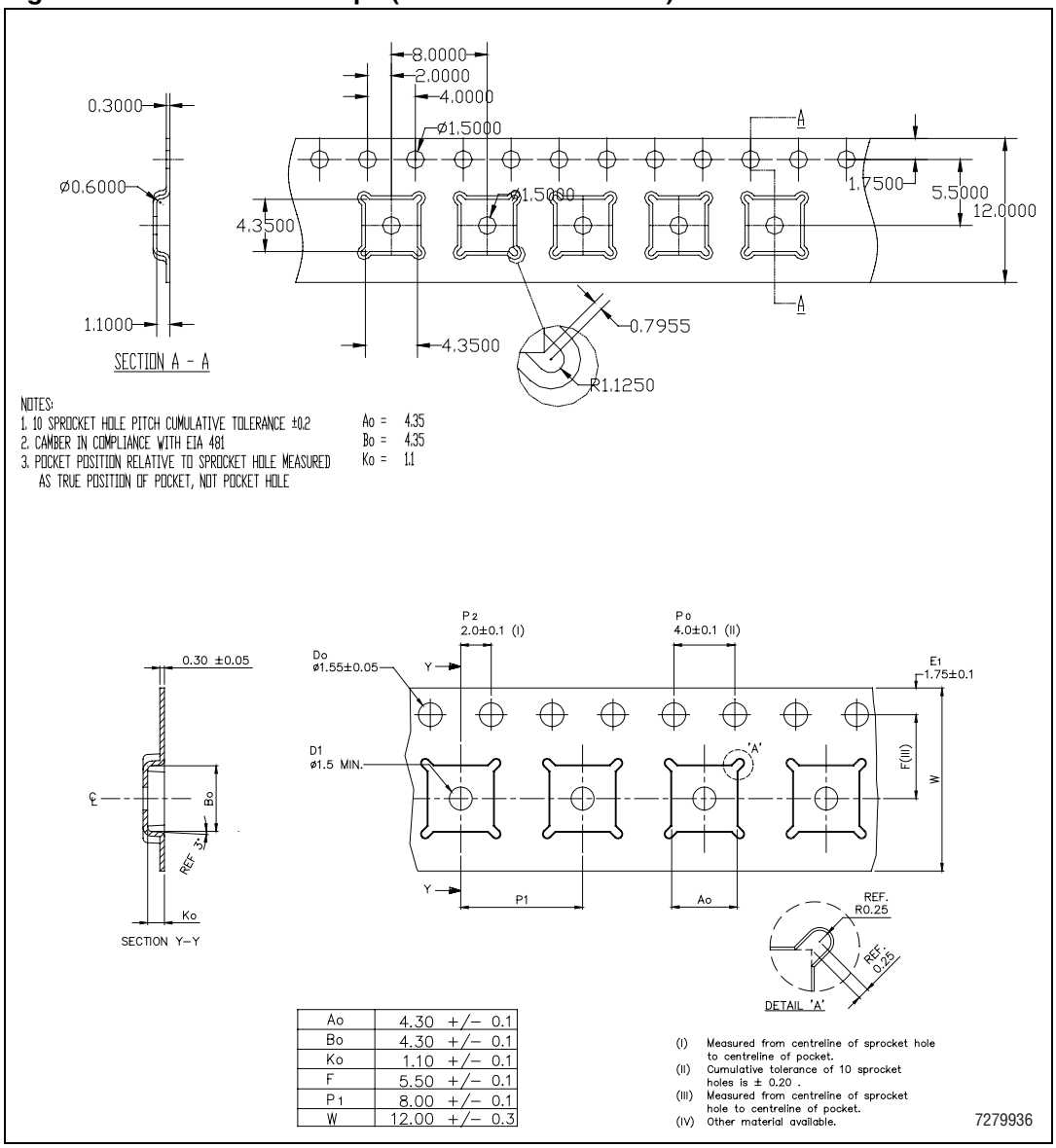


**Figure 42. DFN8L carrier tape (dimension are in mm.)**




| | |
|---|---|
| Ao | 4.30 +/− 0.1 |
| Bo | 4.30 +/− 0.1 |
| Ko | 1.10 +/− 0.1 |
| F | 5.50 +/− 0.1 |
| P1 | 8.00 +/− 0.1 |
| W | 12.00 +/− 0.3 |

**Figure 43. Reel DFN8L drawing**

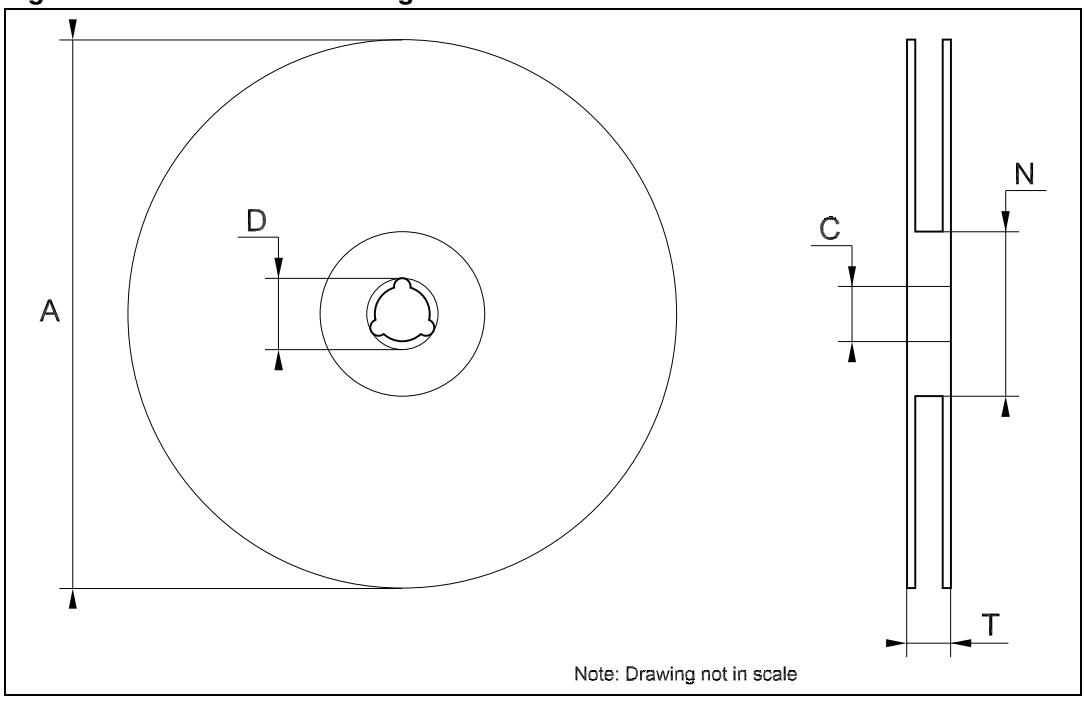
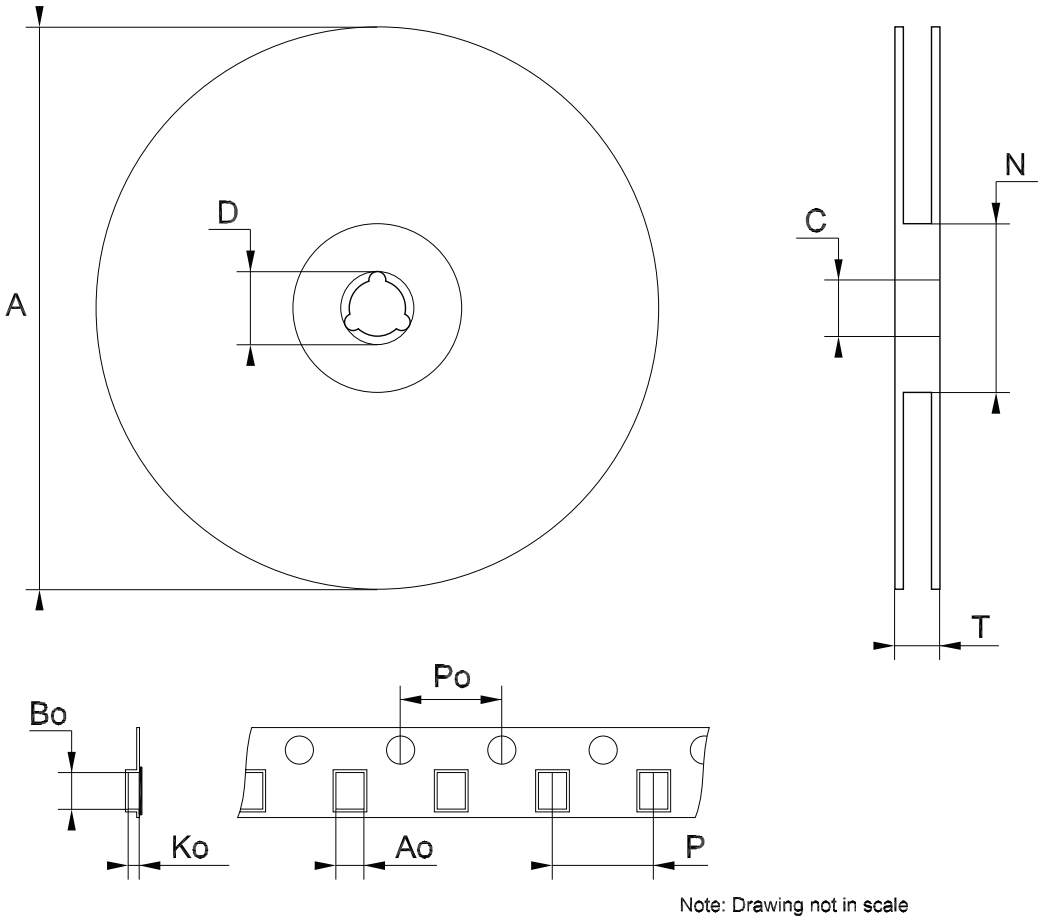



**Table 18. Reel DFN8L dimensions**

| 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 |

## Tape & reel DPAK-PPAK mechanical data

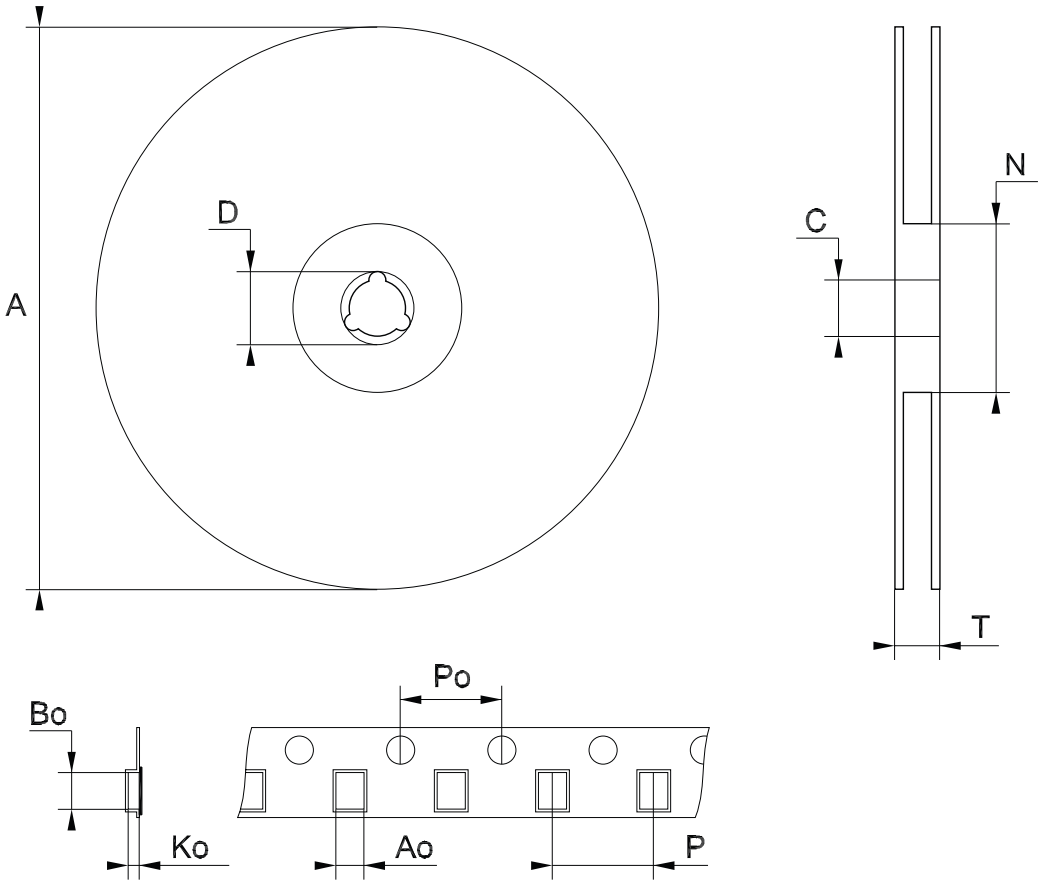
| Dim. | mm. | | | inch. | | |
|---|---|---|---|---|---|---|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | | | 330 | | | 12.992 |
| C | 12.8 | 13.0 | 13.2 | 0.504 | 0.512 | 0.519 |
| D | 20.2 | | | 0.795 | | |
| N | 60 | | | 2.362 | | |
| T | | | 22.4 | | | 0.882 |
| Ao | 6.80 | 6.90 | 7.00 | 0.268 | 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

## Tape & reel $D^2PAK$-$P^2PAK$-$D^2PAK/A$-$P^2PAK/A$ 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 |




Note: Drawing not in scale

# 8 Order codes

**Table 19. Order codes**

| Packages | | | | | |
|---|---|---|---|---|---|
| **TO-220** | **D²PAK** | **D²PAK/A** | **DPAK** | **DFN8** | **Output voltages** |
| LD1086V18 | LD1086D2T18TR | | LD1086DT18TR | | 1.8 V |
| | LD1086D2T25TR | | LD1086DT25TR | | 2.5 V |
| LD1086V33 | LD1086D2T33TR | LD1086D2M33TR | LD1086DT33TR | | 3.3 V |
| | LD1086D2T50TR | | LD1086DT50TR | | 5.0 V |
| | LD1086D2T12TR | | | | 12.0 V |
| LD1086V | LD1086D2TTR | LD1086D2MTR | LD1086DTTR | LD1086PUR | ADJ |
| LD1086V-DG (1) | | | | | ADJ |
| LD1086VY (2) | | | LD1086DTTRY (2) | | ADJ |

1. TO-220 Dual Gauge frame.
2. Automotive Grade products.

# 9 Revision history

**Table 20. Document revision history**

| Date | Revision | Changes |
|---|---|---|
| 16-May-2006 | 14 | Order codes updated and new template. |
| 19-Jan-2007 | 15 | D²PAK mechanical data updated and add footprint data. |
| 05-Apr-2007 | 16 | Order codes updated. |
| 07-Jun-2007 | 17 | Order codes updated. |
| 19-Jul-2007 | 18 | Add note on *Figure 2*. |
| 03-Dec-2007 | 19 | Modified: *Table 19*. |
| 31-Jan-2008 | 20 | Added new order codes for Automotive grade products. |
| 18-Feb-2008 | 21 | Modified: *Table 19 on page 42*. |
| 14-Jul-2008 | 22 | Modified: *Table 1 on page 1* and *Table 19 on page 42*. |
| 10-Mar-2010 | 23 | Added: *Table 12 on page 22*, *Figure 30 on page 23*, *Figure 31 on page 24*, *Figure 32* and *Figure 33 on page 25*. |
| 15-Nov-2010 | 24 | Modified: $R_{thJC}$ value for TO-220 *Table 3 on page 7*. |
| 11-Jul-2011 | 25 | Modified: *Figure 24*, *Figure 25 on page 20* and *Table 19 on page 42*. |
| 10-Feb-2012 | 26 | Added: order code LD1086V-DG *Table 19 on page 42*. |
| 15-Mar-2012 | 27 | Added: new order code LD1086PUR *Table 19 on page 42* and new package mechanical data DFN8 (4x4 mm) *Table 17 on page 35*, *Figure 40 on page 36*, *Figure 41 on page 37*, *Figure 42 on page 38* and *Figure 43 on page 39*. |

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