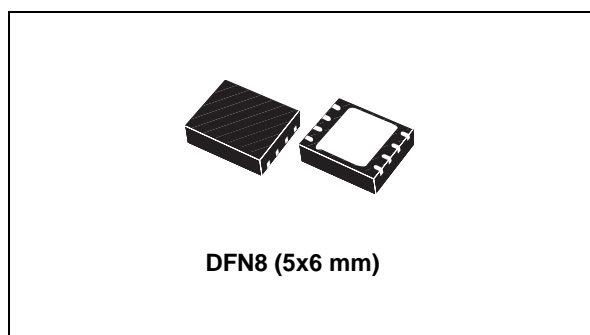


Very low quiescent current dual voltage regulator

Datasheet - production data



Description

Specifically designed for data storage applications, this device integrates two voltage regulators, each capable of supplying 1 A of current. It is assembled in an 8-pin DFN8 5x6 mm surface mounting package. One regulator block supplies 3.3 V and, on request, 1.5 V, 1.8 V, 2.5 V, 2.8 V and 3.0 V. The other is adjustable from 1.25 V to $V_I - V_{DROP}$, which is suitable for powering several different types of microcontroller. Both outputs are current-limited and overtemperature protected. Also noteworthy is the very good thermal performance of the DFN package, with only 2 °C/W of thermal resistance junction-to-case.

Features

- V_{O1} : fixed
- V_{O2} : adjustable from 1.25 to $V_I - V_{DROP}$
- Guaranteed current of output 1: 1 A
- Guaranteed current of output 2: 1 A
- $\pm 2\%$ output tolerance (at 25 °C)
- $\pm 3\%$ output tolerance at overtemperature
- Typical dropout 1.1 V ($I_{O1} = I_{O2} = 1$ A)
- Internal power and thermal limit
- Good stability with low ESR output capacitor
- Operating temperature range: 0 °C to 125 °C
- Very low quiescent current: 7 mA max overtemperature
- Available in DFN8 5x6 mm package

Applications

- Hard disk drives
- CD/DVD-ROMs
- CD/DVD-R/RWs
- COMBO® (DVD-ROM+CD-R/RW)

Table 1. Device summary

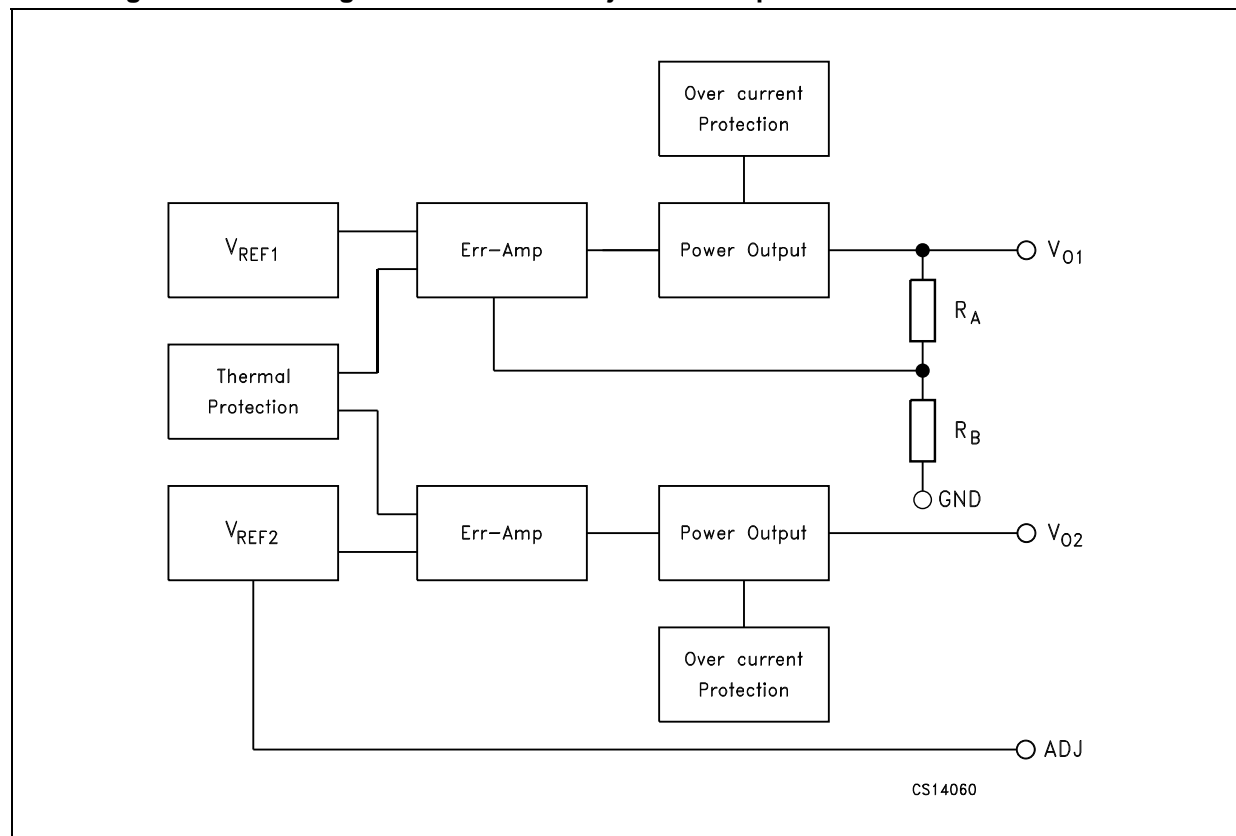
| Order code | Package | Output voltage |
|---------------|---------------|----------------|
| ST2L05R3300PS | DFN8 (5x6 mm) | Adjustable |

Contents

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1 Block diagram

Figure 1. Block diagram of the fixed / adjustable output version of the ST2L05-3300



2 Pin configuration

Figure 2. Pin connection (top through view)

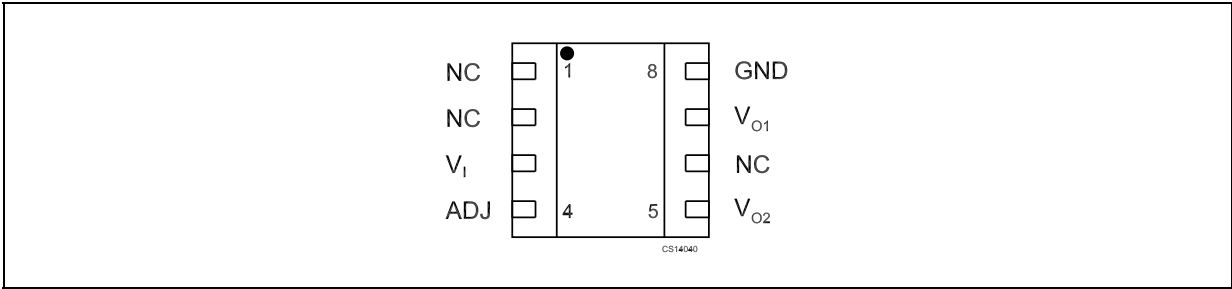


Table 2. Pin description

| Pin n° | Symbol | Name and function |
|---------|----------|---|
| 3 | V_I | Bypass with a 4.7 μ F capacitor to GND |
| 4 | ADJ | Resistor divider connection |
| 8 | GND | Ground |
| 5 | V_{O2} | Adjustable output voltage: bypass with a 4.7 μ F capacitor to GND |
| 7 | V_{O1} | Fixed output voltage: bypass with a 4.7 μ F capacitor to GND |
| 1, 2, 6 | NC | Not connected |

3 Maximum ratings

Table 3. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|------------|--|--------------------|------|
| V_I | Operating input voltage | 10 | V |
| P_D | Power dissipation | Internally limited | |
| I_{OSH} | Short circuit output current - 3.3 V and adjustable output | Internally limited | |
| T_{OP} | Operating junction temperature range | 0 to 150 | °C |
| T_{STG} | Storage temperature range ⁽¹⁾ | - 65 to 150 | °C |
| T_{LEAD} | Lead temperature (soldering) 10 sec. | 260 | °C |

1. Storage temperatures > 125°C are only acceptable if the dual regulator is soldered to a PCBA.

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

Table 4. Recommended operating conditions

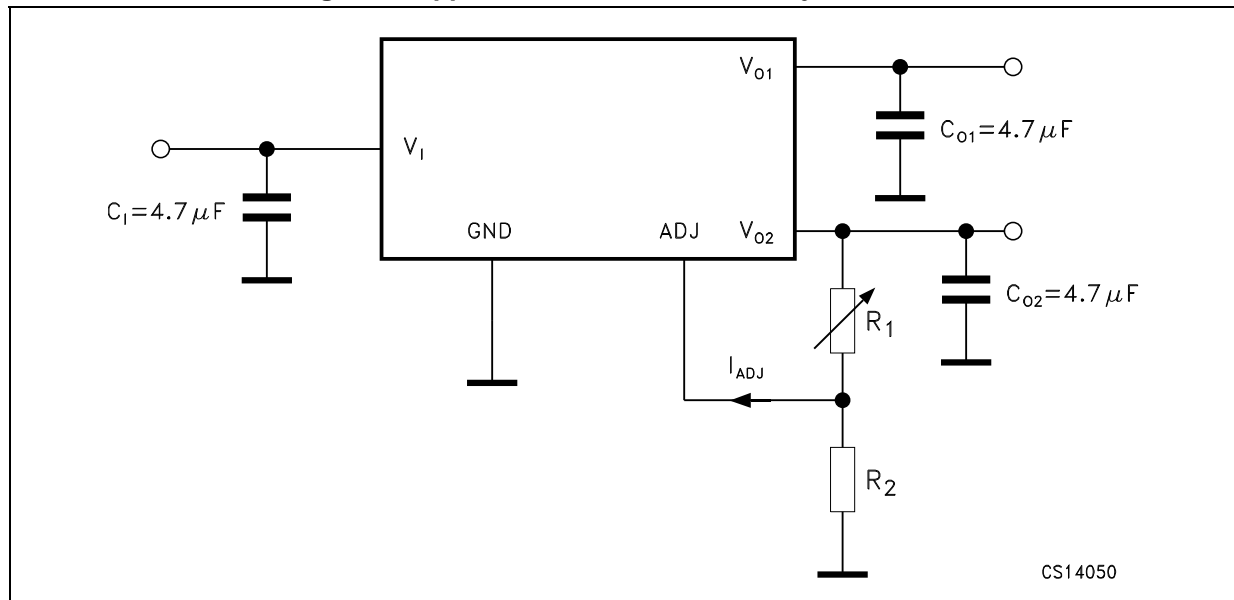
| Symbol | Parameter | Value | Unit |
|--------------|---|------------|---------|
| V_I | Input voltage | 4.5 to 7 | V |
| ΔV_I | Input voltage ripple | ± 0.15 | V |
| t_{RISE} | Input voltage rise time (from 10% to 90%) | ≥ 1 | μs |
| t_{FALL} | Input voltage fall time (from 10% to 90%) | ≥ 1 | μs |

Table 5. Thermal data

| Symbol | Parameter | Value | Unit |
|------------|-------------------------------------|-------|------|
| R_{thJC} | Thermal resistance junction-case | 2 | °C/W |
| R_{thJA} | Thermal resistance junction-ambient | 36 | °C/W |

4 Application circuits

Figure 3. Application circuit of fixed / adj. version (1)



1. In the fixed / adj. version, the adjustable output voltage V_{O2} is designed to support output voltages from 1.25 V to $V_I - V_{DROF}$. The adjustable output voltage V_{O2} is set using a resistor divider connected between V_{O2} (pin 4) and ground (pin 3) with its center tap connected to V_{O2} ADJ (pin 2). The voltage divider resistors are: R_1 connected to V_{O2} and V_{O2} ADJ and R_2 connected to V_{O2} ADJ and GND. V_{O2} is determined by V_{REF} , R_1 , R_2 , and I_{ADJ} as follows (for more details see the application hints section):

$$V_{O2} = V_{REF} (1 + R_1 / R_2) + I_{ADJ} R_1$$

5 Electrical characteristics

$I_O = 10 \text{ mA to } 1 \text{ A}$, $T_J = 0 \text{ to } 125 \text{ }^\circ\text{C}$, $V_I = 4.5 \text{ V to } 7 \text{ V}$, $C_I = 4.7 \text{ } \mu\text{F}$, $C_{O1} = C_{O2} = 4.7 \text{ } \mu\text{F}$, unless otherwise specified.

Table 6. Output 1 and output 2 dual specification

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|--------------------|---------------------------------------|---|------|------|------|------------------|
| I_{GND} | Quiescent current (fixed / adj.) | $V_I \leq 7 \text{ V}$, $I_{\text{OUT}1,2} = 5 \text{ mA to } 1 \text{ A}$ | | | 5 | mA |
| I_{ST} | Total current limit $I_{O1} + I_{O2}$ | | 2 | | | A |
| T_{SHDN} | Thermal shutdown | | | 175 | | $^\circ\text{C}$ |
| DT_{SHDN} | Thermal shutdown hysteresis | | | 5 | | $^\circ\text{C}$ |

$I_O = 10 \text{ mA to } 1 \text{ A}$, $T_J = 0 \text{ to } 125 \text{ }^\circ\text{C}$, $V_I = 4.5 \text{ V to } 7 \text{ V}$, $C_I = 4.7 \text{ } \mu\text{F}$, $C_{O1} = C_{O2} = 4.7 \text{ } \mu\text{F}$, unless otherwise specified.

Table 7. Electrical characteristics of fixed output 1.5 V

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|----------------------------|---|--|-------|-------|------------|------|
| V_O | Output voltage 1.5V | $I_O = 5\text{mA to } 1\text{A}$, $V_I = 4.75 \text{ to } 5.25\text{V}$ $T = 25^\circ\text{C}$ | 1.47 | 1.5 | 1.53 | V |
| V_O | Output voltage 1.5V | $I_O = 5\text{mA to } 1\text{A}$, $V_I = 4.75 \text{ to } 5.25\text{V}$ | 1.455 | 1.5 | 1.545 | V |
| ΔV_O | Line regulation | $V_I = 4.75 \text{ to } 5.25\text{V}$, $I_O = 5\text{mA to } 1\text{A}$ | | | 15 | mV |
| ΔV_O | Load regulation | $V_I = 4.75\text{V}$, $I_O = 10\text{mA to } 1\text{A}$ | | | 12 | mV |
| V_D | Dropout voltage $\Delta V_O = -1\%$ | $I_O = 1\text{A}$ | | | 1.3 | V |
| I_S | Current limit | $V_I = 5.5\text{V}$ | 1 | | | A |
| I_{OMIN} | Min. output current for regulation | | | | 0 | mA |
| e_N | RMS output noise ^{(1) (5)} | $T = 25^\circ\text{C}$ | | 0.003 | | % |
| SVR | Supply voltage rejection ⁽²⁾⁽⁵⁾ | $V_I = 5\text{V}$ | 60 | | | dB |
| $\Delta V_O/\Delta I_O$ | Transient response change of V_O with step load change ⁽³⁾⁽⁵⁾ | $V_I = 5\text{V}$, $I_O = 1\text{mA to } 1\text{A}$, $t_r \geq 1\mu\text{s}$ | | | $10^{(4)}$ | % |
| | | $V_I = 5\text{V}$, $I_O = 1\text{A to } 1\text{mA}$, $t_f \geq 1\mu\text{s}$ | | | $10^{(4)}$ | |
| $\Delta V_{O1}/\Delta V_I$ | Transient response change of V_{OUT1} with application of V_I ⁽³⁾⁽⁵⁾ | 0 to 5V step input, $I_O = 1\text{mA to } 1\text{A}$, $t_r \geq 1\mu\text{s}$ | | | $10^{(4)}$ | % |
| $\Delta V_O/\Delta I_O$ | Transient response short circuit removal response ⁽³⁾⁽⁵⁾ | $V_I = 5\text{V}$, $I_O = \text{short to } I_O = 10\text{mA}$ | | | $20^{(4)}$ | % |
| T_R | Thermal regulation ⁽⁵⁾ | $I_O = 1\text{A}$, $t_{PULSE} = 30\text{ms}$ | | 0.1 | | %/W |
| S | Temperature stability ⁽⁵⁾ | | | 0.5 | | % |
| S | Long-term stability ⁽⁵⁾ (1000hrs) | $T_J = 125^\circ\text{C}$ | | 0.3 | | % |

1. Bandwidth of 10 Hz to 10 kHz.
2. 120 Hz input ripple.
3. $C_I = 20 \text{ } \mu\text{F}$, C_{O1} and $C_{O2} = 10 \text{ } \mu\text{F}$. C_I , C_{O1} and C_{O2} are all X7R ceramic capacitors.
4. % undershoot or overshoot of V_O
5. Guaranteed by design, not tested in production.

$I_O = 10\text{ mA to }1\text{ A}$, $T_J = 0\text{ to }125\text{ }^\circ\text{C}$, $V_I = 4.5\text{ V to }7\text{ V}$, $C_I = 4.7\text{ }\mu\text{F}$, $C_{O1} = C_{O2} = 4.7\text{ }\mu\text{F}$, unless otherwise specified.

Table 8. Electrical characteristics of fixed output 1.8 V

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|----------------------------|---|--|-------|-------|------------|------|
| V_O | Output voltage 1.8V | $I_O = 5\text{ mA to }1\text{ A}$, $V_I = 4.75\text{ to }5.25\text{ V}$ $T = 25^\circ\text{C}$ | 1.764 | 1.8 | 1.836 | V |
| V_O | Output voltage 1.8V | $I_O = 5\text{ mA to }1\text{ A}$, $V_I = 4.75\text{ to }5.25\text{ V}$ | 1.746 | 1.8 | 1.854 | V |
| ΔV_O | Line regulation | $V_I = 4.75\text{ to }5.25\text{ V}$, $I_O = 5\text{ mA to }1\text{ A}$ | | | 15 | mV |
| ΔV_O | Load regulation | $V_I = 4.75\text{ V}$, $I_O = 10\text{ mA to }1\text{ A}$ | | | 12 | mV |
| V_D | Dropout voltage $\Delta V_O = -1\%$ | $I_O = 1\text{ A}$ | | | 1.3 | V |
| I_S | Current limit | $V_I = 5.5\text{ V}$ | 1 | | | A |
| I_{OMIN} | Min. output current for regulation | | | | 0 | mA |
| e_N | RMS output noise ^{(1) (5)} | $T = 25^\circ\text{C}$ | | 0.003 | | % |
| SVR | Supply voltage rejection ⁽²⁾⁽⁵⁾ | $V_I = 5\text{ V}$ | 60 | | | dB |
| $\Delta V_O/\Delta I_O$ | Transient response change of V_O with step load change ⁽³⁾⁽⁵⁾ | $V_I = 5\text{ V}$, $I_O = 1\text{ mA to }1\text{ A}$, $t_r \geq 1\text{ }\mu\text{s}$ | | | $10^{(4)}$ | % |
| | | $V_I = 5\text{ V}$, $I_O = 1\text{ A to }1\text{ mA}$, $t_f \geq 1\text{ }\mu\text{s}$ | | | $10^{(4)}$ | |
| $\Delta V_{O1}/\Delta V_I$ | Transient response change of V_{OUT1} with application of V_I ⁽³⁾⁽⁵⁾ | 0 to 5V step input, $I_O = 1\text{ mA to }1\text{ A}$, $t_r \geq 1\text{ }\mu\text{s}$ | | | $10^{(4)}$ | % |
| $\Delta V_O/\Delta I_O$ | Transient response short circuit removal response ⁽³⁾⁽⁵⁾ | $V_I = 5\text{ V}$, $I_O = \text{short to } I_O = 10\text{ mA}$ | | | $20^{(4)}$ | % |
| T_R | Thermal regulation ⁽⁵⁾ | $I_O = 1\text{ A}$, $t_{PULSE} = 30\text{ ms}$ | | 0.1 | | %/W |
| S | Temperature stability ⁽⁵⁾ | | | 0.5 | | % |
| S | Long-term stability ⁽⁵⁾ (1000hrs) | $T_J = 125^\circ\text{C}$ | | 0.3 | | % |

1. Bandwidth of 10 Hz to 10 kHz.
2. 120 Hz input ripple.
3. $C_I = 20\text{ }\mu\text{F}$, C_{O1} and $C_{O2} = 10\text{ }\mu\text{F}$. C_I , C_{O1} and C_{O2} are all X7R ceramic capacitors.
4. % undershoot or overshoot of V_O
5. Guaranteed by design, not tested in production.

$I_O = 10 \text{ mA to } 1 \text{ A}$, $T_J = 0 \text{ to } 125 \text{ }^\circ\text{C}$, $V_I = 4.5 \text{ V to } 7 \text{ V}$, $C_I = 4.7 \text{ } \mu\text{F}$, $C_{O1} = C_{O2} = 4.7 \text{ } \mu\text{F}$, unless otherwise specified.

Table 9. Electrical characteristics of fixed output 2.5 V

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|----------------------------|---|--|-------|-------|------------|------|
| V_O | Output voltage 2.5V | $I_O = 5\text{mA to } 1\text{A}$, $V_I = 4.75 \text{ to } 5.25\text{V}$ $T = 25^\circ\text{C}$ | 2.45 | 2.5 | 2.55 | V |
| V_O | Output voltage 2.5V | $I_O = 5\text{mA to } 1\text{A}$, $V_I = 4.75 \text{ to } 5.25\text{V}$ | 2.425 | 2.5 | 2.575 | V |
| ΔV_O | Line regulation | $V_I = 4.75 \text{ to } 5.25\text{V}$, $I_O = 5\text{mA to } 1\text{A}$ | | | 15 | mV |
| ΔV_O | Load regulation | $V_I = 4.75\text{V}$, $I_O = 10\text{mA to } 1\text{A}$ | | | 12 | mV |
| V_D | Dropout voltage $\Delta V_O = -1\%$ | $I_O = 1\text{A}$ | | | 1.3 | V |
| I_S | Current limit | $V_I = 5.5\text{V}$ | 1 | | | A |
| I_{OMIN} | Min. output current for regulation | | | | 0 | mA |
| e_N | RMS output noise ^{(1) (5)} | $T = 25^\circ\text{C}$ | | 0.003 | | % |
| SVR | Supply voltage rejection ⁽²⁾⁽⁵⁾ | $V_I = 5\text{V}$ | 60 | | | dB |
| $\Delta V_O/\Delta I_O$ | Transient response change of V_O with step load change ⁽³⁾⁽⁵⁾ | $V_I = 5\text{V}$, $I_O = 1\text{mA to } 1\text{A}$, $t_r \geq 1\mu\text{s}$ | | | $10^{(4)}$ | % |
| | | $V_I = 5\text{V}$, $I_O = 1\text{A to } 1\text{mA}$, $t_f \geq 1\mu\text{s}$ | | | $10^{(4)}$ | |
| $\Delta V_{O1}/\Delta V_I$ | Transient response change of V_{OUT1} with application of V_I ⁽³⁾⁽⁵⁾ | 0 to 5V step input, $I_O = 1\text{mA to } 1\text{A}$, $t_r \geq 1\mu\text{s}$ | | | $10^{(4)}$ | % |
| $\Delta V_O/\Delta I_O$ | Transient response short circuit removal response ⁽³⁾⁽⁵⁾ | $V_I = 5\text{V}$, $I_O = \text{short to } I_O = 10\text{mA}$ | | | $20^{(4)}$ | % |
| T_R | Thermal regulation ⁽⁵⁾ | $I_O = 1\text{A}$, $t_{PULSE} = 30\text{ms}$ | | 0.1 | | %/W |
| S | Temperature stability ⁽⁵⁾ | | | 0.5 | | % |
| S | Long-term stability ⁽⁵⁾ (1000hrs) | $T_J = 125^\circ\text{C}$ | | 0.3 | | % |

1. Bandwidth of 10 Hz to 10 kHz.

2. 120 Hz input ripple.

3. $C_I = 20 \text{ } \mu\text{F}$, C_{O1} and $C_{O2} = 10 \text{ } \mu\text{F}$. C_I , C_{O1} and C_{O2} are all X7R ceramic capacitors.

4. % undershoot or overshoot of V_O

5. Guaranteed by design, not tested in production.

$I_O = 10 \text{ mA to } 1 \text{ A}$, $T_J = 0 \text{ to } 125^\circ\text{C}$, $V_I = 4.5 \text{ V to } 7 \text{ V}$, $C_I = 4.7 \mu\text{F}$, $C_{O1} = C_{O2} = 4.7 \mu\text{F}$, unless otherwise specified.

Table 10. Electrical characteristics of fixed output 2.8 V

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|----------------------------|--|--|-------|-------|------------|------|
| V_O | Output voltage 2.8V | $I_O = 5\text{mA to } 1\text{A}$, $V_I = 4.75 \text{ to } 5.25\text{V}$ $T = 25^\circ\text{C}$ | 2.744 | 2.8 | 2.856 | V |
| V_O | Output voltage 2.8V | $I_O = 5\text{mA to } 1\text{A}$, $V_I = 4.75 \text{ to } 5.25\text{V}$ | 2.716 | 2.8 | 2.884 | V |
| ΔV_O | Line regulation | $V_I = 4.75 \text{ to } 5.25\text{V}$, $I_O = 5\text{mA to } 1\text{A}$ | | | 15 | mV |
| ΔV_O | Load regulation | $V_I = 4.75\text{V}$, $I_O = 10\text{mA to } 1\text{A}$ | | | 12 | mV |
| V_D | Dropout voltage $\Delta V_O = -1\%$ | $I_O = 1\text{A}$ | | | 1.3 | V |
| I_S | Current limit | $V_I = 5.5\text{V}$ | 1 | | | A |
| $I_{O\text{MIN}}$ | Min. output current for regulation | | | | 0 | mA |
| e_N | RMS output noise ^{(1) (5)} | $T = 25^\circ\text{C}$ | | 0.003 | | % |
| SVR | Supply voltage rejection ⁽²⁾⁽⁵⁾ | $V_I = 5\text{V}$ | 60 | | | dB |
| $\Delta V_O/\Delta I_O$ | Transient response change of V_O with step load change ⁽³⁾⁽⁵⁾ | $V_I = 5\text{V}$, $I_O = 1\text{mA to } 1\text{A}$, $t_r \geq 1\mu\text{s}$ | | | $10^{(4)}$ | % |
| | | $V_I = 5\text{V}$, $I_O = 1\text{A to } 1\text{mA}$, $t_f \geq 1\mu\text{s}$ | | | $10^{(4)}$ | |
| $\Delta V_{O1}/\Delta V_I$ | Transient response change of $V_{O\text{UT}1}$ with application of V_I ⁽³⁾⁽⁵⁾ | 0 to 5V step input, $I_O = 1\text{mA to } 1\text{A}$, $t_r \geq 1\mu\text{s}$ | | | $10^{(4)}$ | % |
| $\Delta V_O/\Delta I_O$ | Transient response short circuit removal response ⁽³⁾⁽⁵⁾ | $V_I = 5\text{V}$, $I_O = \text{short to } I_O = 10\text{mA}$ | | | $20^{(4)}$ | % |
| T_R | Thermal regulation ⁽⁵⁾ | $I_O = 1\text{A}$, $t_{\text{PULSE}} = 30\text{ms}$ | | 0.1 | | %/W |
| S | Temperature stability ⁽⁵⁾ | | | 0.5 | | % |
| S | Long-term stability ⁽⁵⁾ (1000hrs) | $T_J = 125^\circ\text{C}$ | | 0.3 | | % |

1. Bandwidth of 10 Hz to 10 kHz.
2. 120 Hz input ripple.
3. $C_I = 20 \mu\text{F}$, C_{O1} and $C_{O2} = 10 \mu\text{F}$. C_I , C_{O1} and C_{O2} are all X7R ceramic capacitors.
4. % undershoot or overshoot of V_O
5. Guaranteed by design, not tested in production.

$I_O = 10\text{ mA to }1\text{ A}$, $T_J = 0\text{ to }125\text{ }^\circ\text{C}$, $V_I = 4.5\text{ V to }7\text{ V}$, $C_I = 4.7\text{ }\mu\text{F}$, $C_{O1} = C_{O2} = 4.7\text{ }\mu\text{F}$, unless otherwise specified.

Table 11. Electrical characteristics of fixed output 3.0 V

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|----------------------------|---|--|------|-------|------------|------|
| V_O | Output voltage 3.0V | $I_O = 5\text{ mA to }1\text{ A}$, $V_I = 4.75\text{ to }5.25\text{ V}$ $T = 25^\circ\text{C}$ | 2.94 | 3.0 | 3.06 | V |
| V_O | Output voltage 3.0V | $I_O = 5\text{ mA to }1\text{ A}$, $V_I = 4.75\text{ to }5.25\text{ V}$ | 2.91 | 3.0 | 3.09 | V |
| ΔV_O | Line regulation | $V_I = 4.75\text{ to }5.25\text{ V}$, $I_O = 5\text{ mA to }1\text{ A}$ | | | 15 | mV |
| ΔV_O | Load regulation | $V_I = 4.75\text{ V}$, $I_O = 10\text{ mA to }1\text{ A}$ | | | 12 | mV |
| V_D | Dropout voltage $\Delta V_O = -1\%$ | $I_O = 1\text{ A}$ | | | 1.3 | V |
| I_S | Current limit | $V_I = 5.5\text{ V}$ | 1 | | | A |
| I_{OMIN} | Min. output current for regulation | | | | 0 | mA |
| e_N | RMS output noise ^{(1) (5)} | $T = 25^\circ\text{C}$ | | 0.003 | | % |
| SVR | Supply voltage rejection ⁽²⁾⁽⁵⁾ | $V_I = 5\text{ V}$ | 60 | | | dB |
| $\Delta V_O/\Delta I_O$ | Transient response change of V_O with step load change ⁽³⁾⁽⁵⁾ | $V_I = 5\text{ V}$, $I_O = 1\text{ mA to }1\text{ A}$, $t_r \geq 1\text{ }\mu\text{s}$ | | | $10^{(4)}$ | % |
| | | $V_I = 5\text{ V}$, $I_O = 1\text{ A to }1\text{ mA}$, $t_f \geq 1\text{ }\mu\text{s}$ | | | $10^{(4)}$ | |
| $\Delta V_{O1}/\Delta V_I$ | Transient response change of V_{OUT1} with application of V_I ⁽³⁾⁽⁵⁾ | 0 to 5V step input, $I_O = 1\text{ mA to }1\text{ A}$, $t_r \geq 1\text{ }\mu\text{s}$ | | | $10^{(4)}$ | % |
| $\Delta V_O/\Delta I_O$ | Transient response short circuit removal response ⁽³⁾⁽⁵⁾ | $V_I = 5\text{ V}$, $I_O = \text{short to } I_O = 10\text{ mA}$ | | | $20^{(4)}$ | % |
| T_R | Thermal regulation ⁽⁵⁾ | $I_O = 1\text{ A}$, $t_{PULSE} = 30\text{ ms}$ | | 0.1 | | %/W |
| S | Temperature stability ⁽⁵⁾ | | | 0.5 | | % |
| S | Long-term stability ⁽⁵⁾ (1000hrs) | $T_J = 125^\circ\text{C}$ | | 0.3 | | % |

1. Bandwidth of 10 Hz to 10 kHz.

2. 120 Hz input ripple.

3. $C_I = 20\text{ }\mu\text{F}$, C_{O1} and $C_{O2} = 10\text{ }\mu\text{F}$. C_I , C_{O1} and C_{O2} are all X7R ceramic capacitors.

4. % undershoot or overshoot of V_O

5. Guaranteed by design, not tested in production.

$I_O = 10\text{ mA to }1\text{ A}$, $T_J = 0\text{ to }125\text{ }^\circ\text{C}$, $V_I = 4.5\text{ V to }7\text{ V}$, $C_I = 4.7\text{ }\mu\text{F}$, $C_{O1} = C_{O2} = 4.7\text{ }\mu\text{F}$, unless otherwise specified.

Table 12. Electrical characteristics of fixed output 3.3 V

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|----------------------------|--|--|-------|-------|------------|------|
| V_O | Output voltage 3.3V | $I_O = 5\text{ mA to }1\text{ A}$, $V_I = 4.75\text{ to }5.25\text{ V}$ $T = 25^\circ\text{C}$ | 3.234 | 3.3 | 3.366 | V |
| V_O | Output voltage 3.3V | $I_O = 5\text{ mA to }1\text{ A}$, $V_I = 4.75\text{ to }5.25\text{ V}$ | 3.2 | 3.3 | 3.4 | V |
| ΔV_O | Line regulation | $V_I = 4.75\text{ to }5.25\text{ V}$, $I_O = 5\text{ mA to }1\text{ A}$ | | | 15 | mV |
| ΔV_O | Load regulation | $V_I = 4.75\text{ V}$, $I_O = 10\text{ mA to }1\text{ A}$ | | | 12 | mV |
| V_D | Dropout voltage $\Delta V_O = -1\%$ | $I_O = 1\text{ A}$ | | | 1.3 | V |
| I_S | Current limit | $V_I = 5.5\text{ V}$ | 1 | | | A |
| $I_{O\text{MIN}}$ | Min. output current for regulation | | | | 0 | mA |
| e_N | RMS output noise ^{(1) (5)} | $T = 25^\circ\text{C}$ | | 0.003 | | % |
| SVR | Supply voltage rejection ⁽²⁾⁽⁵⁾ | $V_I = 5\text{ V}$ | 60 | | | dB |
| $\Delta V_O/\Delta I_O$ | Transient response change of V_O with step load change ⁽³⁾⁽⁵⁾ | $V_I = 5\text{ V}$, $I_O = 1\text{ mA to }1\text{ A}$, $t_r \geq 1\text{ }\mu\text{s}$ | | | $10^{(4)}$ | % |
| | | $V_I = 5\text{ V}$, $I_O = 1\text{ A to }1\text{ mA}$, $t_f \geq 1\text{ }\mu\text{s}$ | | | $10^{(4)}$ | |
| $\Delta V_{O1}/\Delta V_I$ | Transient response change of $V_{O\text{UT}1}$ with application of V_I ⁽³⁾⁽⁵⁾ | 0 to 5V step input, $I_O = 1\text{ mA to }1\text{ A}$, $t_r \geq 1\text{ }\mu\text{s}$ | | | $10^{(4)}$ | % |
| $\Delta V_O/\Delta I_O$ | Transient response short circuit removal response ⁽³⁾⁽⁵⁾ | $V_I = 5\text{ V}$, $I_O = \text{short to } I_O = 10\text{ mA}$ | | | $20^{(4)}$ | % |
| T_R | Thermal regulation ⁽⁵⁾ | $I_O = 1\text{ A}$, $t_{\text{PULSE}} = 30\text{ ms}$ | | 0.1 | | %/W |
| S | Temperature stability ⁽⁵⁾ | | | 0.5 | | % |
| S | Long-term stability ⁽⁵⁾ (1000hrs) | $T_J = 125^\circ\text{C}$ | | 0.3 | | % |

1. Bandwidth of 10 Hz to 10 kHz.
2. 120 Hz input ripple.
3. $C_I = 20\text{ }\mu\text{F}$, C_{O1} and $C_{O2} = 10\text{ }\mu\text{F}$. C_I , C_{O1} and C_{O2} are all X7R ceramic capacitors.
4. % undershoot or overshoot of V_O
5. Guaranteed by design, not tested in production.

$I_O = 10\text{ mA to }1\text{ A}$, $T_J = 0\text{ to }125\text{ }^\circ\text{C}$, $V_I = 4.5\text{ V to }7\text{ V}$, $C_I = 4.7\text{ }\mu\text{F}$, $C_{O1} = C_{O2} = 4.7\text{ }\mu\text{F}$, unless otherwise specified.

Table 13. Electrical characteristics of adjustable output

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-------------------------------|---|---|-------|-------|------------|---------------|
| V_O | Reference voltage | $I_O = 5\text{ mA to }1\text{ A}$, $V_I = 4.75\text{ to }5.25\text{ V}$, $T = 25^\circ\text{C}$ | 1.225 | 1.25 | 1.275 | V |
| V_O | Reference voltage | $I_O = 5\text{ mA to }1\text{ A}$, $V_I = 4.75\text{ to }5.25\text{ V}$ | 1.212 | 1.25 | 1.287 | V |
| ΔV_{O2} | Line regulation 2 | $V_I = 4.75\text{ to }5.25\text{ V}$, $I_O = 5\text{ mA to }1\text{ A}$ | | | 0.35 | % |
| ΔV_{O2} | Load regulation 2 | $V_I = 4.75\text{ V}$, $I_O = 10\text{ mA to }1\text{ A}$ | | | 0.4 | % |
| V_D | Dropout voltage $\Delta V_O = -1\%$ | $I_O = 1\text{ A}$ | | | 1.3 | V |
| I_S | Current limit | $V_I = 5.5\text{ V}$ | 1 | | | A |
| I_{ADJ} | Adjustable current (sinking) | | | | 1 | μA |
| $I_{\Delta ADJ}$ | Adjustable current change | $I_O = 10\text{ mA to }1\text{ A}$ | | | 200 | nA |
| I_{OMIN} | Min. output current for regulation | | | | 2 | mA |
| e_N | RMS output noise ^{(1) (5)} | $T = 25^\circ\text{C}$ | | 0.003 | | % |
| SVR | Supply voltage rejection ⁽²⁾⁽⁵⁾ | $V_I = 5\text{ V}$ | 60 | | | dB |
| $\Delta V_{O2}/\Delta I_{O2}$ | Transient response change of V_O with step load change ⁽³⁾⁽⁵⁾ | $V_I = 5\text{ V}$, $I_O = 1\text{ mA to }1\text{ A}$, $t_r \geq 1\text{ }\mu\text{s}$ | | | $10^{(4)}$ | % |
| | | $V_I = 5\text{ V}$, $I_O = 1\text{ A to }1\text{ mA}$, $t_r \geq 1\text{ }\mu\text{s}$ | | | $10^{(4)}$ | |
| $\Delta V_{O2}/\Delta V_I$ | Transient response change of V_{OUT1} with application of V_I ⁽³⁾⁽⁵⁾ | 0 to 5V step input, $I_O = 1\text{ mA to }1\text{ A}$, $t_r \geq 1\text{ }\mu\text{s}$ | | | $10^{(4)}$ | % |
| $\Delta V_{O2}/\Delta I_{O2}$ | Transient response short circuit removal response ⁽³⁾⁽⁵⁾ | $V_I = 5\text{ V}$, $I_O = \text{short to } I_O = 10\text{ mA}$ | | | $20^{(4)}$ | % |
| T_R | Thermal regulation ⁽⁵⁾ | $I_O = 1\text{ A}$, $t_{PULSE} = 30\text{ ms}$ | | 0.1 | | %/W |
| S | Temperature stability ⁽⁵⁾ | | | 0.5 | | % |
| S | Long-term stability ⁽⁵⁾ (1000hrs) | $T_J = 125^\circ\text{C}$ | | 0.3 | | % |

1. Bandwidth of 10 Hz to 10 kHz.

2. 120 Hz input ripple.

3. $C_I = 20\text{ }\mu\text{F}$, C_{O1} and $C_{O2} = 10\text{ }\mu\text{F}$. C_I , C_{O1} and C_{O2} are all X7R ceramic capacitors.

4. % undershoot or overshoot of V_O

5. Guaranteed by design, not tested in production.

6 Application hints

6.1 External capacitors

Like any low-dropout regulator, the ST2L05-3300 requires external capacitors for stability. It is recommended to solder both capacitors as close as possible to the relative pins (1, 4 and 5).

6.2 Input capacitor

An input capacitor with a value of at least 2.2 μF is required. The amount of input capacitance can be increased without limit if a good quality tantalum or aluminium capacitor is used. SMD X7R or Y5V ceramic multilayer capacitors may not ensure stability in any condition due to the variability of their frequency and temperature characteristics. The use of this capacitor type is strictly related to the use of the output capacitors. For additional details, please read the [Output capacitor](#) section below. The input capacitor must be located at a distance of not more than 0.5" from the input pin of the device and returned to a clean analog ground.

6.3 Output capacitor

The ST2L05-3300 is designed specifically to work with ceramic and tantalum capacitors. Special care must be taken when a ceramic multilayer capacitor is used. Due to their characteristics, this type of capacitor can sometimes have an ESR value lower than the minimum required by the ST2L05-3300, and their relatively large capacitance can vary greatly depending on the ambient temperature. The test results for the stability of the ST2L05-3300 using multilayer ceramic capacitors show that a minimum value of 2.2 μF is needed for both regulators. This value can be increased without limit if the input capacitor value is greater than or equal to 4.7 μF , and up to 10 μF if the input capacitor is less than 4.7 μF . Surface-mountable solid tantalum capacitors offer a good combination of small physical size, capacitance value and ESR in the range needed for the ST2L05-3300. Test results show good stability for both outputs with values of at least 1 μF . The value can be increased without limit for even better performance in areas such as transient response and noise.

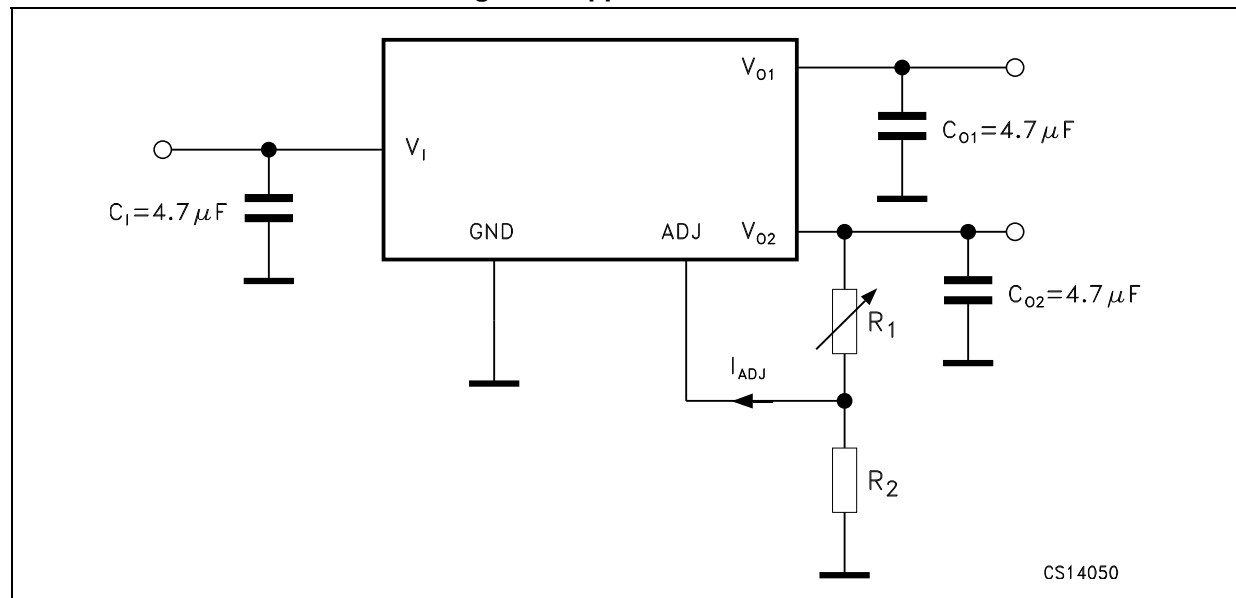
Important:

The output capacitor must maintain an ESR in the stable region over the full operating temperature to assure stability. Moreover, capacitor tolerance and variations due to temperature must be considered to assure that the minimum amount of capacitance is provided at all times. For this reason, when a ceramic multilayer capacitor is used, the better choice for temperature coefficient is the X7R type, which holds the capacitance within $\pm 15\%$. The output capacitor should be located not more than 0.5" from the output pins of the device and returned to a clean analog ground.

6.4 Adjustable regulator

The ST2L05-3300 has a 1.25 V reference voltage between the output and the adjust pin (pins 4 and 2, respectively). When resistor R_1 is placed between these two terminals, a constant current flows through R_1 and down to R_2 to set the overall (V_{O2} to GND) output voltage. Minimum load current is 2 mA max in all temperature conditions.

Figure 4. Application circuit



$$V_O = V_{REF} (1 + R_1 / R_2) + I_{ADJ} R_1$$

I_{ADJ} is very small (typically 35 μA) and constant: in the V_O calculation it can be ignored.

7 Typical characteristics

Figure 5. Reference voltage vs. temperature

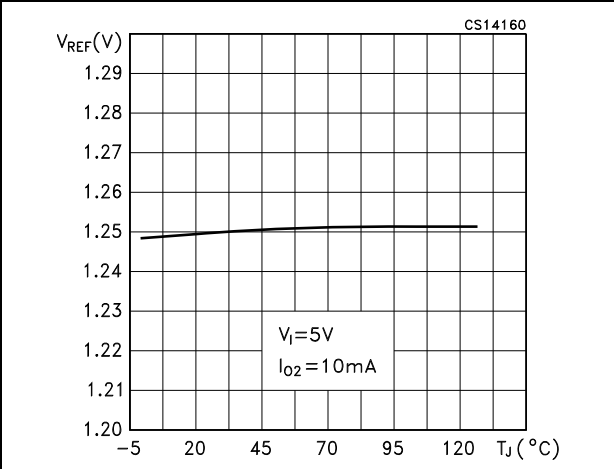


Figure 6. Reference line regulation vs. temperature

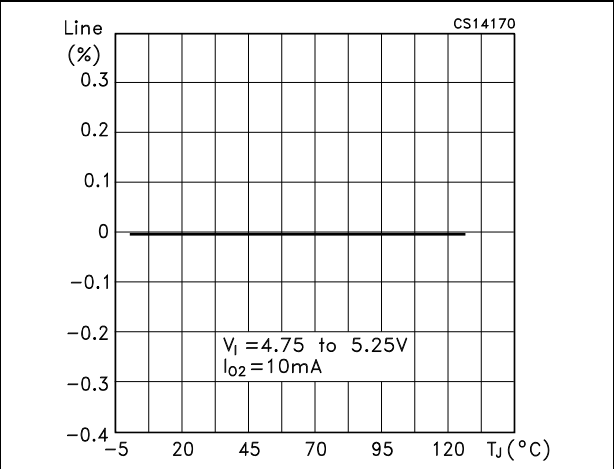


Figure 7. Reference load regulation vs. temperature

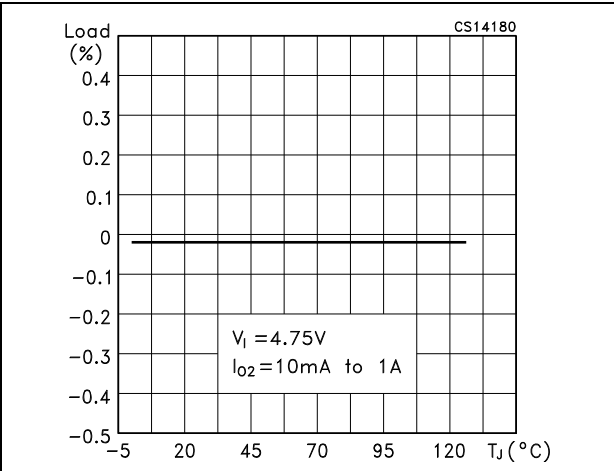


Figure 8. Reference voltage vs. input voltage

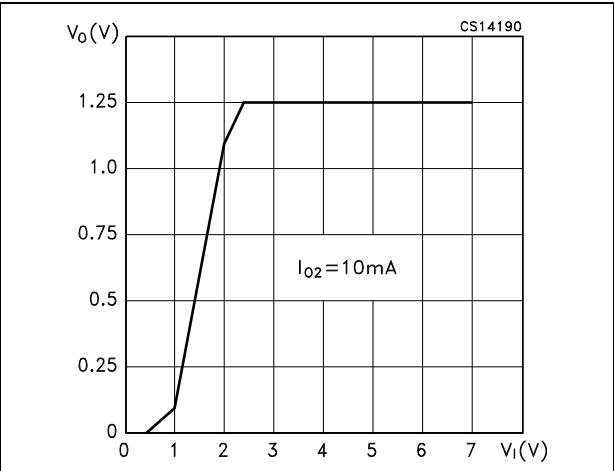


Figure 9. Dropout voltage vs. temperature (adjustable output)

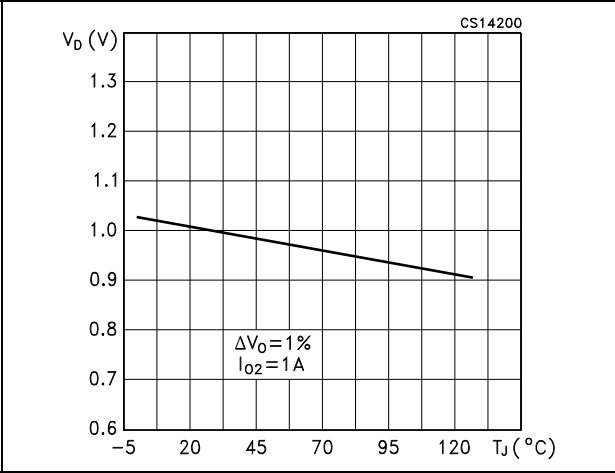


Figure 10. Dropout voltage vs. input voltage (adjustable output)

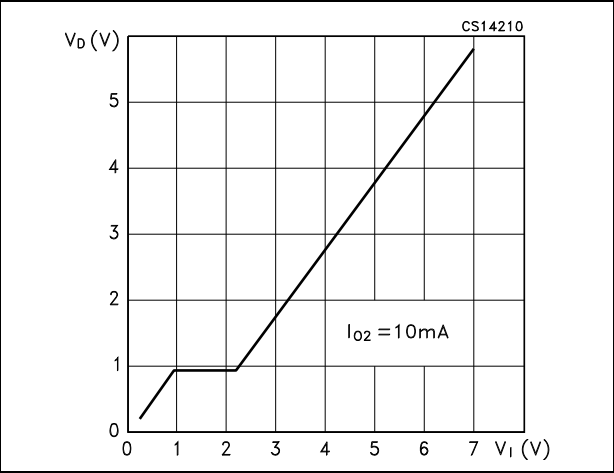


Figure 11. Minimum load current vs. temperature (adjustable output)

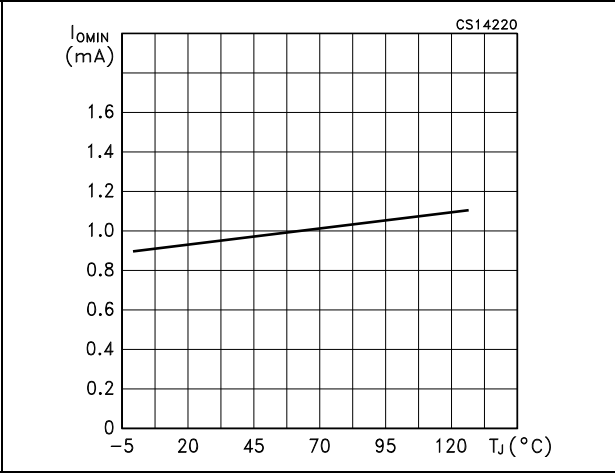


Figure 12. Adjust pin current vs. temperature (adjustable output)

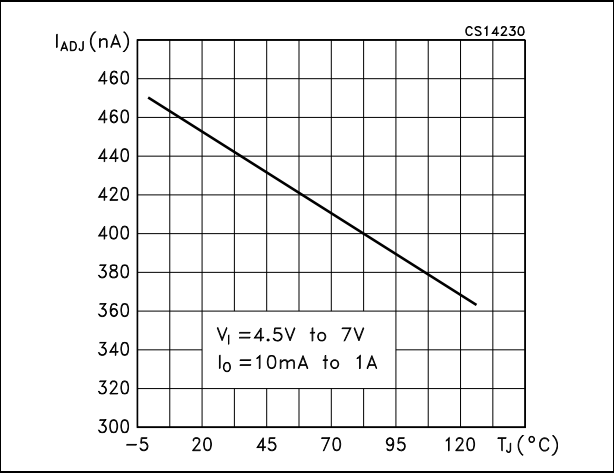


Figure 13. Output voltage vs. temperature

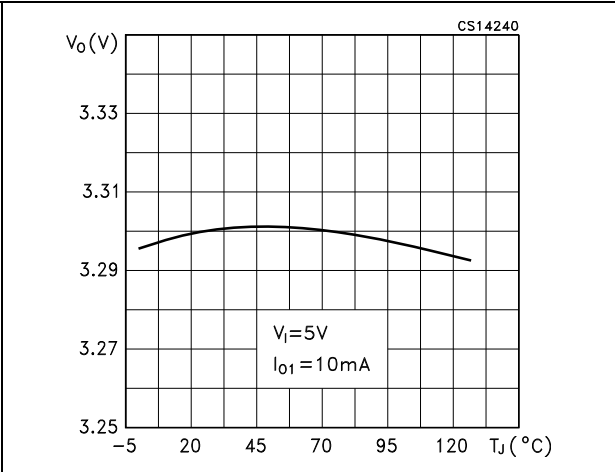


Figure 14. Line regulation vs. temperature

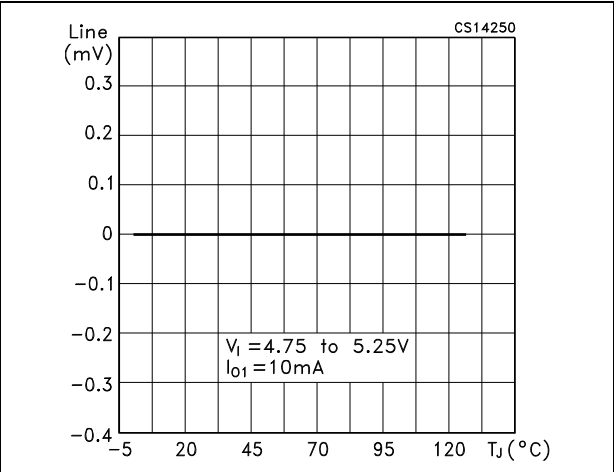


Figure 15. Load regulation vs. temperature

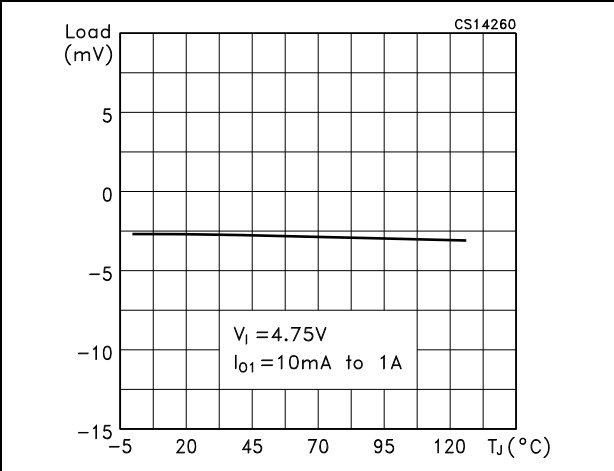


Figure 16. Output voltage vs. input voltage

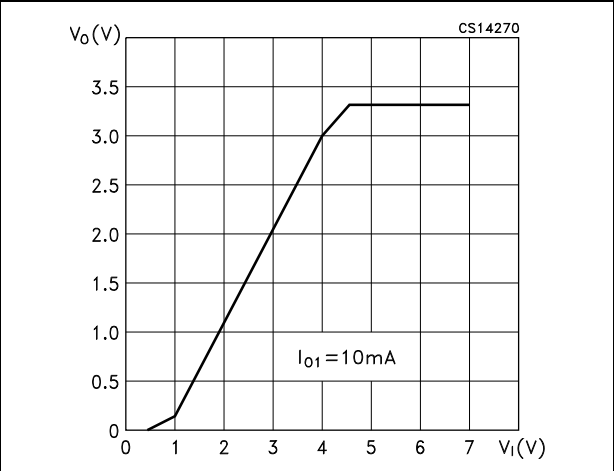


Figure 17. Dropout voltage vs. temperature (fixed output)

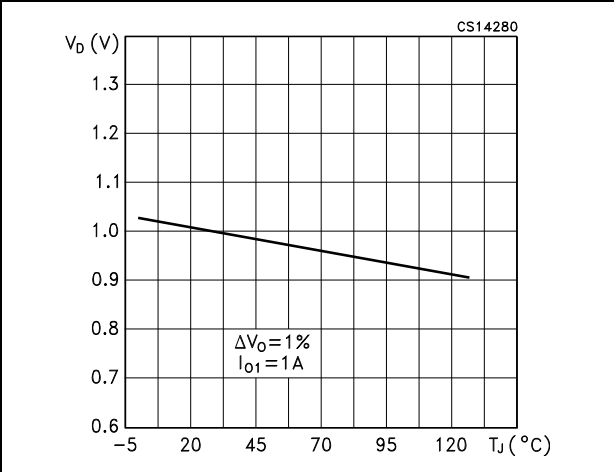


Figure 18. Dropout voltage vs. input voltage

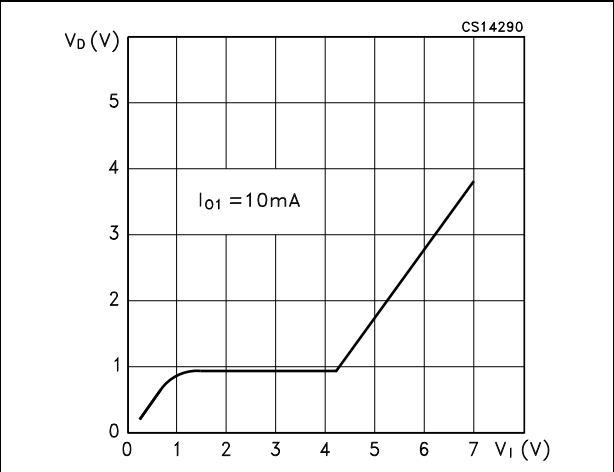


Figure 19. Supply voltage rejection vs. temperature

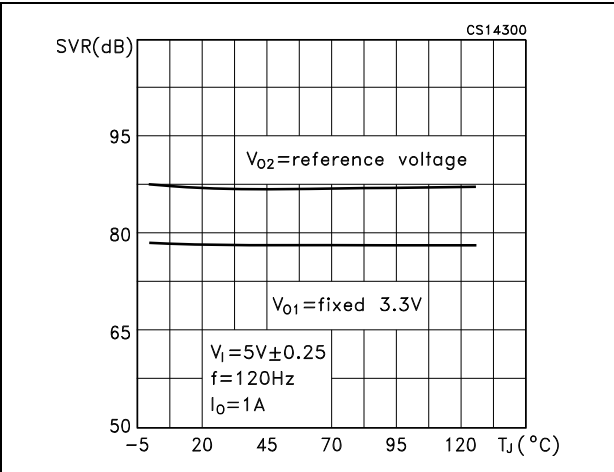


Figure 20. Supply voltage rejection vs. frequency

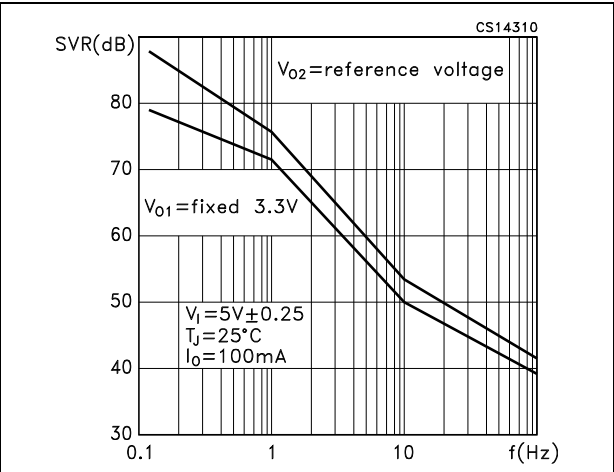


Figure 21. Quiescent current vs. temperature (fixed/adj. version)

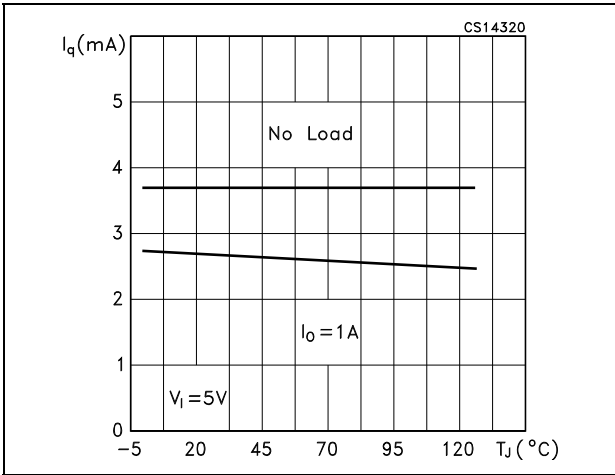


Figure 22. Quiescent current vs. temperature (fixed/fixed version)

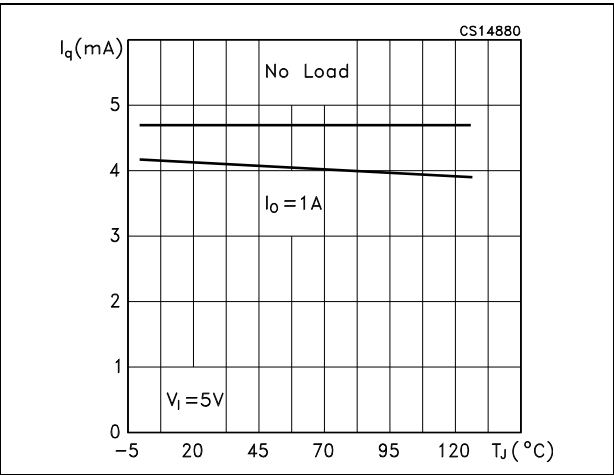


Figure 23. Short-circuit removal response

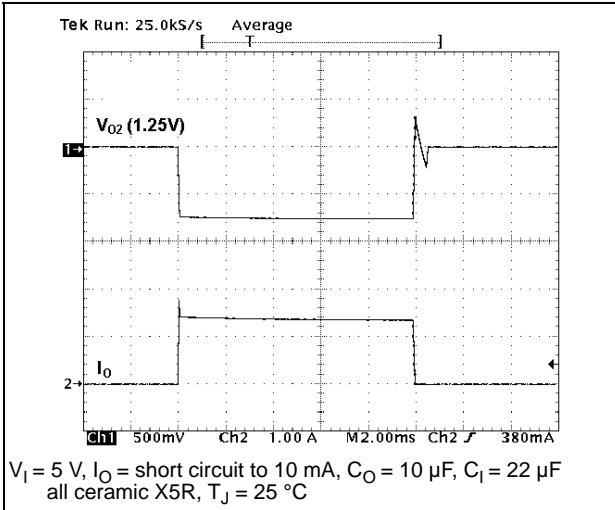


Figure 24. Change of V_O with step load change

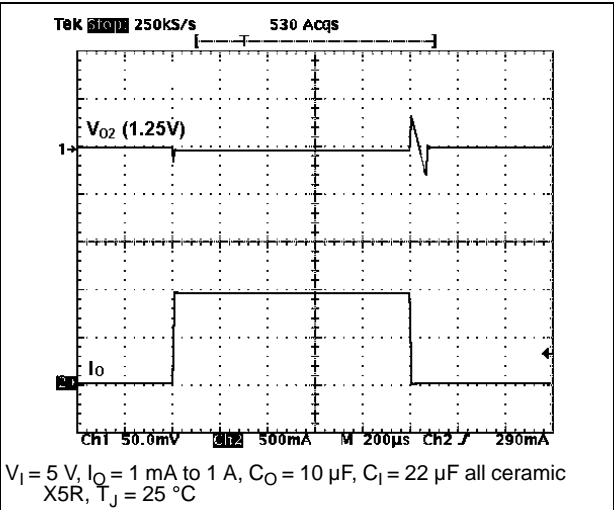


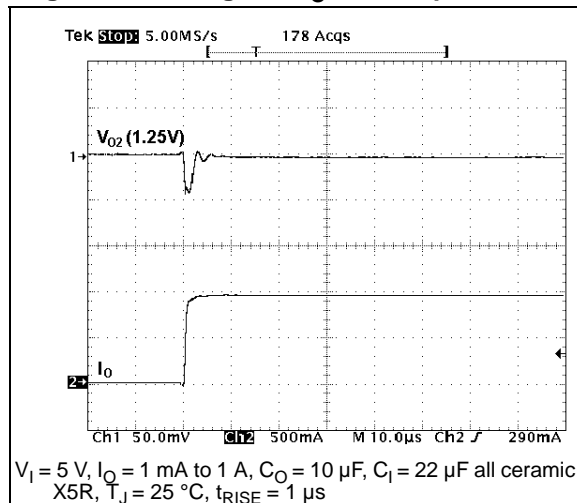
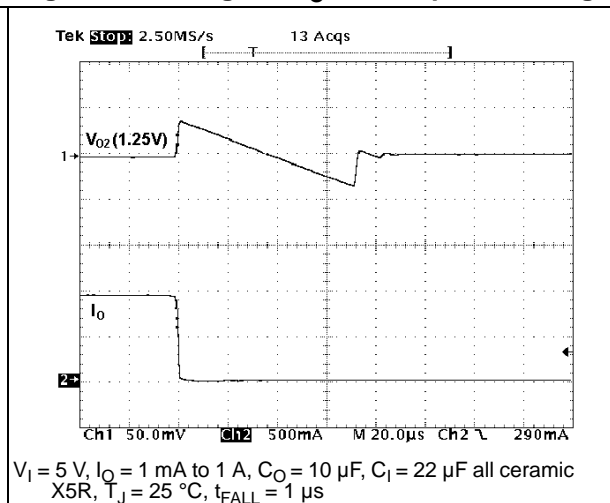
Figure 25. Change of V_O with step load changeFigure 26. Change of V_O with step load change

Figure 27. Short-circuit removal response

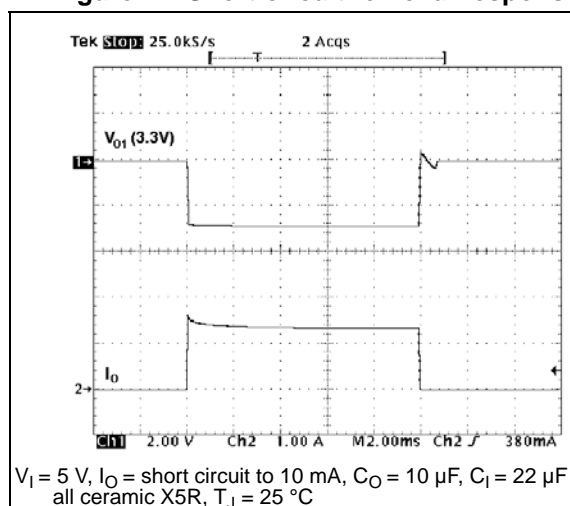
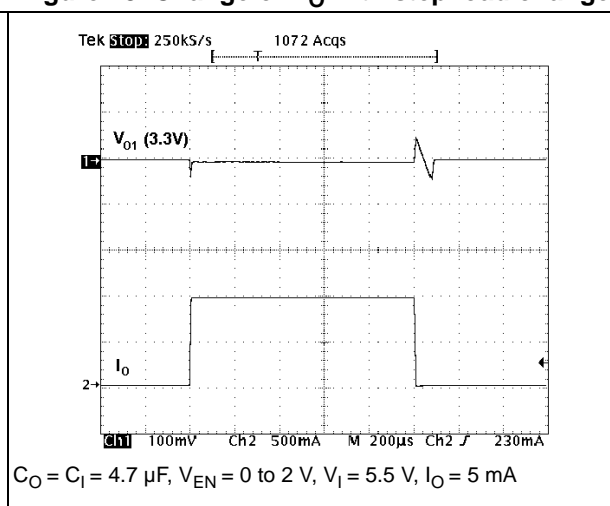
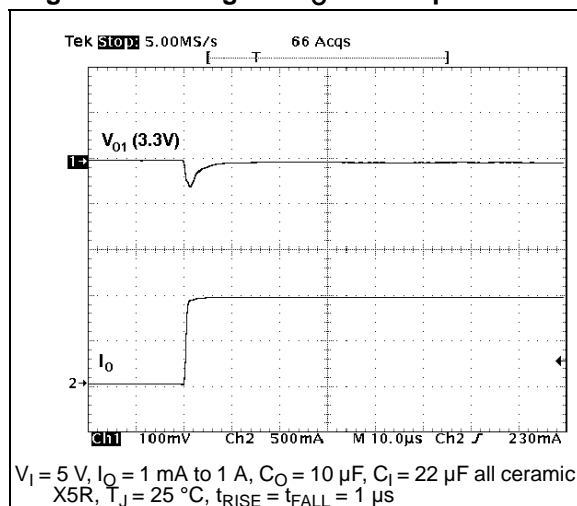
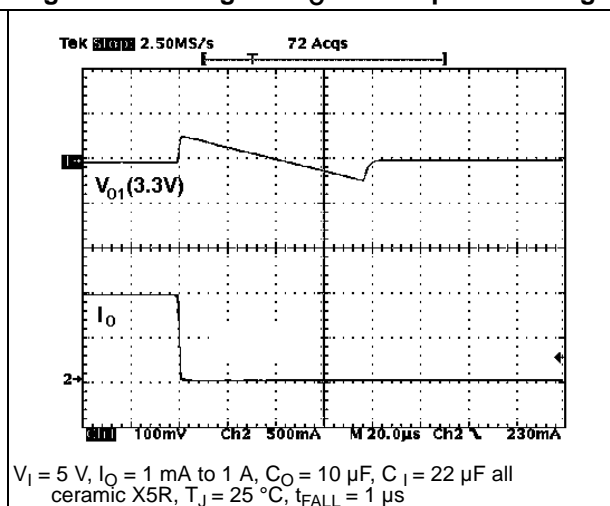
Figure 28. Change of V_O with step load changeFigure 29. Change of V_O with step load changeFigure 30. Change of V_O with step load change

Figure 31. Start-up transient

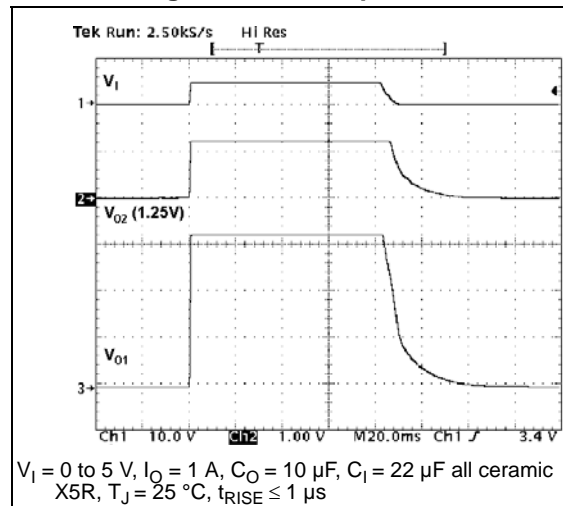
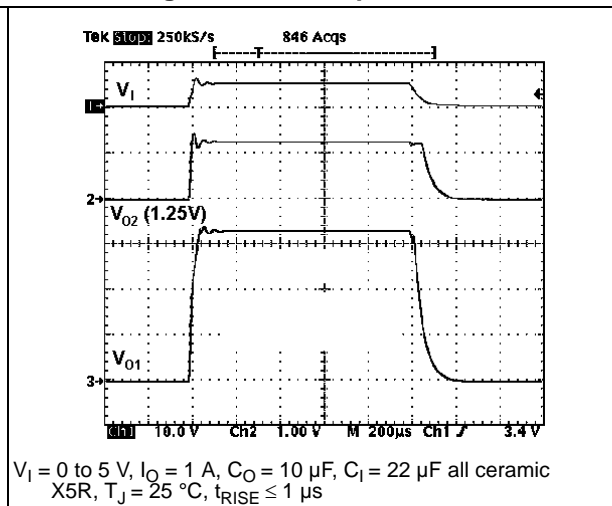


Figure 32. Start-up transient



8 Package mechanical data

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

Figure 33. DFN8L (5 x 6 mm) drawing

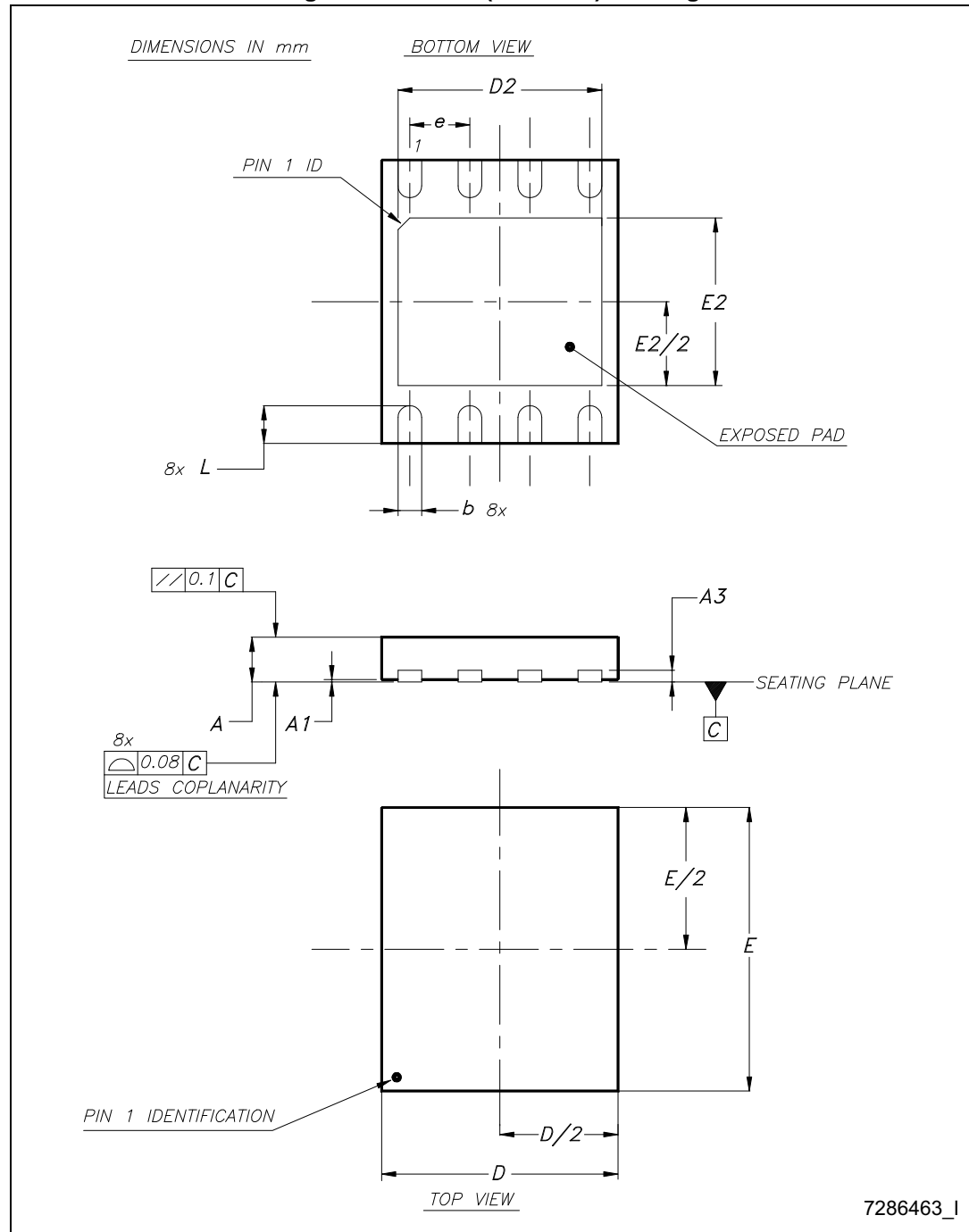
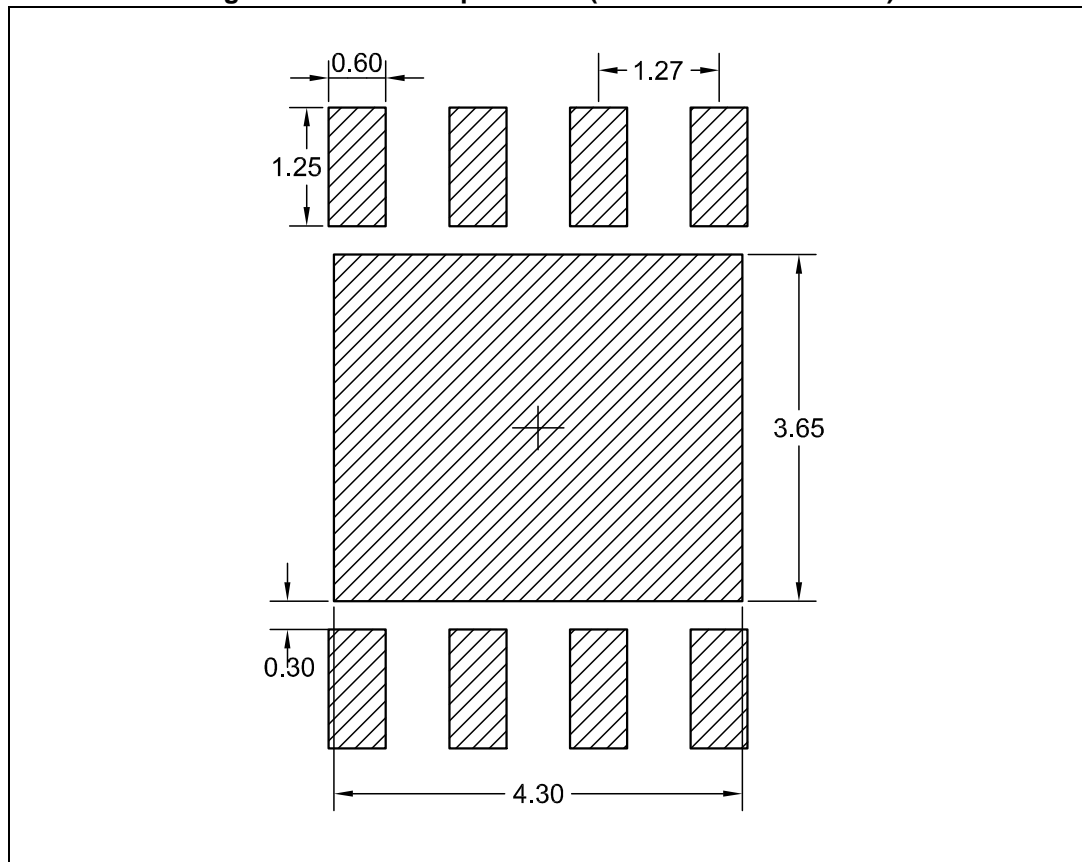


Table 14. DFN8 (5 x 6 mm) mechanical data

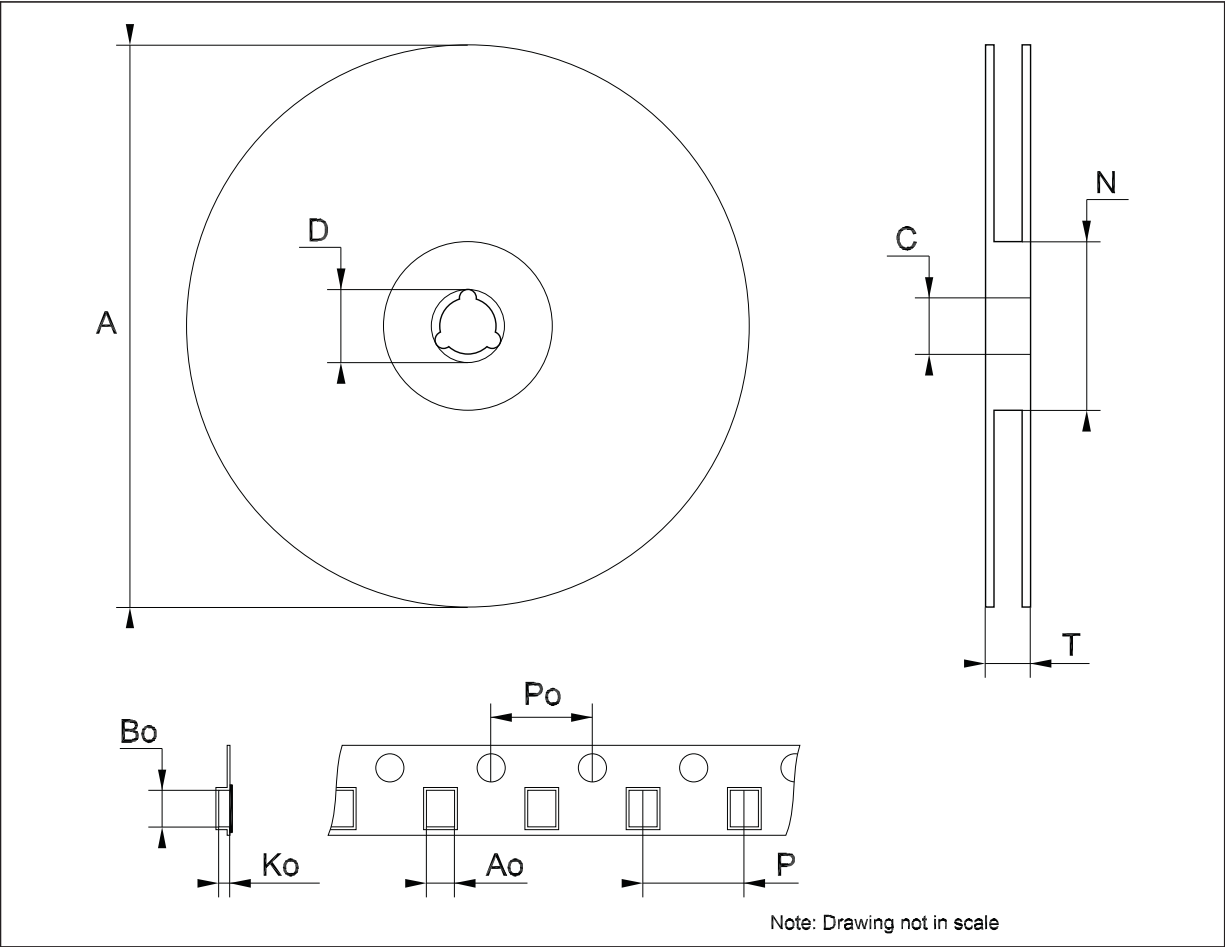
| Dim. | mm | | |
|------|------|------|------|
| | Min. | Typ. | Max. |
| A | 0.80 | 0.90 | 1.00 |
| A1 | 0 | 0.02 | 0.05 |
| A3 | | 0.20 | |
| b | 0.35 | 0.40 | 0.47 |
| D | | 5.00 | |
| D2 | 4.05 | 4.20 | 4.30 |
| E | | 6.00 | |
| E2 | 3.40 | 3.55 | 3.65 |
| e | | 1.27 | |
| L | 0.70 | 0.80 | 0.90 |

Figure 34. DFN8 footprint data (dimensions are in mm.)



Tape and reel QFNxx/DFNxx (5x6 mm) mechanical data

| Dim. | mm. | | | inch. | | |
|------|------|------|------|-------|-------|--------|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | | | 330 | | | 12.992 |
| C | 12.8 | | 13.2 | 0.504 | | 0.520 |
| D | 20.2 | | | 0.795 | | |
| N | 99 | | 101 | 3.898 | | 3.976 |
| T | | | 14.4 | | | 0.567 |
| Ao | | 5.30 | | | 0.209 | |
| Bo | | 6.30 | | | 0.248 | |
| Ko | | 1.20 | | | 0.047 | |
| Po | | 4 | | | 0.157 | |
| P | | 8 | | | 0.315 | |



9 Different output voltage versions of the ST2L05-3300 available on request

Table 15. Options available on request

| V _{O1} | V _{O2} | Order codes | Shipment |
|-----------------|-----------------|---------------|---------------|
| 1.8 V | ADJ | ST2L05R1800PS | Tape and reel |
| 2.5 V | ADJ | ST2L05R2500PS | Tape and reel |
| 2.8 V | ADJ | ST2L05R2800PS | Tape and reel |
| 3.0 V | 1.5 V | ST2L05R3015PS | Tape and reel |
| 3.0 V | ADJ | ST2L05R3000PS | Tape and reel |

10 Revision history

Table 16. Document revision history

| Date | Revision | Changes |
|-------------|----------|---|
| 18-Nov-2004 | 4 | Removed PPAK version. |
| 24-Nov-2004 | 5 | Added new mechanical data. |
| 06-Dec-2004 | 6 | Modified mechanical data. |
| 13-Feb-2009 | 7 | Removed SPAK5-L version. |
| 09-Oct-2018 | 8 | Updated Figure 33: DFN8L (5 x 6 mm) drawing and Table 14: DFN8 (5 x 6 mm) mechanical data . Added Figure 34: DFN8 footprint data (dimensions are in mm.) |

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