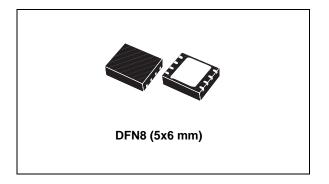


# Very low quiescent current dual voltage regulator

Datasheet - production data



#### **Features**

- V<sub>O1</sub>: fixed
- V<sub>O2</sub>: adjustable from 1.25 to V<sub>I</sub> V<sub>DROP</sub>
- · Guaranteed current of output 1: 1 A
- Guaranteed current of output 2: 1 A
- ± 2% output tolerance (at 25 °C)
- ± 3% output tolerance at overtemperature
- Typical dropout 1.1 V (I<sub>O1</sub> = I<sub>O2</sub> = 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<sup>®</sup> (DVD-ROM+CD-R/RW)

#### **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<sub>I</sub> - V<sub>DROP</sub>, 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.

**Table 1. Device summary** 

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

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ST2L05-3300 Block diagram

# 1 Block diagram

Over current Protection

VREF1

Err-Amp

Power Output

R<sub>A</sub>

R<sub>B</sub>

GND

V<sub>REF2</sub>

Err-Amp

Power Output

Over current Protection

Protection

V<sub>REF2</sub>

V<sub>O2</sub>

Over current Protection

O ADJ

CS14060

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

Pin configuration ST2L05-3300

# 2 Pin configuration

Figure 2. Pin connection (top through view)

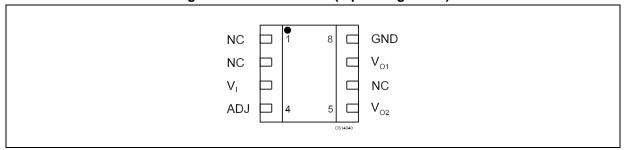


Table 2. Pin description

Pin n°	Symbol	Name and function
3	V <sub>I</sub>	Bypass with a 4.7 μF capacitor to GND
4	ADJ	Resistor divider connection
8	GND	Ground
5	V <sub>O2</sub>	Adjustable output voltage: bypass with a 4.7 µF capacitor to GND
7	V <sub>O1</sub>	Fixed output voltage: bypass with a 4.7 µF capacitor to GND
1, 2, 6	NC	Not connected

ST2L05-3300 Maximum ratings

# 3 Maximum ratings

Table 3. Absolute maximum ratings

Symbol	Parameter	Value	Unit
VI	Operating input voltage	10	V
P <sub>D</sub>	Power dissipation	Internally limited	
I <sub>OSH</sub>	Short circuit output current - 3.3 V and adjustable output	Internally limited	
T <sub>OP</sub>	Operating junction temperature range	0 to 150	°C
T <sub>STG</sub>	Storage temperature range <sup>(1)</sup>	- 65 to 150	°C
T <sub>LEAD</sub>	Lead temperature (soldering) 10 sec.	260	°C

<sup>1.</sup> 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
VI	Input voltage	4.5 to 7	V
$\Delta V_{I}$	Input voltage ripple	± 0.15	V
t <sub>RISE</sub>	Input voltage rise time (from 10% to 90%)	≥1	μs
t <sub>FALL</sub>	Input voltage fall time (from 10% to 90%)	≥1	μs

Table 5. Thermal data

Symbol	Parameter	Value	Unit
R <sub>thJC</sub>	Thermal resistance junction-case	2	°C/W
R <sub>thJA</sub>	Thermal resistance junction-ambient	36	°C/W

**Application circuits** ST2L05-3300

#### **Application circuits** 4

 $V_{01}$ GND  $\mathsf{ADJ}$  $V_{02}$  $C_{02} = 4.7 \,\mu\,F$  $I_{\mathsf{ADJ}}$  $R_2$ CS14050

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

In the fixed / adj. version, the adjustable output voltage  $V_{O2}$  is designed to support output voltages from 1.25 V to  $V_1$  -  $V_{DROP}$ . 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  $V_{O2}$  and  $V_{O2}$  is determined by  $V_{REF}$ ,  $V_{O2}$ , and  $V_{O2}$  and  $V_{O2}$  are the application hints section):  $V_{O2} = V_{REF} (1 + R_1/R_2) + I_{ADJ}R_1$ 

## 5 Electrical characteristics

Table 6. Output 1 and output 2 dual specification

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
I <sub>GND</sub>	Quiescent current (fixed / adj.)	$V_1 \le 7 \text{ V}, I_{OUT1,2} = 5 \text{ mA to } 1 \text{ A}$			5	mA
I <sub>ST</sub>	Total current limit I <sub>O1</sub> + I <sub>O2</sub>		2			Α
T <sub>SHDN</sub>	Thermal shutdown			175		°C
DT <sub>SHDN</sub>	Thermal shutdown hysteresis			5		°C

Electrical characteristics ST2L05-3300

Table 7. Electrical characteristics of fixed output 1.5 V

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
V <sub>O</sub>	Output voltage 1.5V	$I_O = 5$ mA to 1A, $V_I = 4.75$ to 5.25V T = 25°C	1.47	1.5	1.53	V
Vo	Output voltage 1.5V	$I_{O} = 5$ mA to 1A, $V_{I} = 4.75$ to 5.25V	1.455	1.5	1.545	V
ΔV <sub>O</sub>	Line regulation	$V_{I} = 4.75 \text{ to } 5.25 \text{V}, I_{O} = 5 \text{mA to } 1 \text{A}$			15	mV
ΔV <sub>O</sub>	Load regulation	$V_{I} = 4.75V$ , $I_{O} = 10$ mA to 1A			12	mV
V <sub>D</sub>	Dropout voltage $\Delta V_O = -1\%$	I <sub>O</sub> = 1A			1.3	V
I <sub>S</sub>	Current limit	V <sub>I</sub> = 5.5V	1			Α
I <sub>OMIN</sub>	Min. output current for regulation				0	mA
e <sub>N</sub>	RMS output noise (1) (5)	T = 25°C		0.003		%
SVR	Supply voltage rejection <sup>(2)(5)</sup>	V <sub>I</sub> = 5V	60			dB
	Transient response	$V_I = 5V$ , $I_O = 1$ mA to 1A, $t_r \ge 1$ µs			10 <sup>(4)</sup>	
$\Delta V_{O}/\Delta I_{O}$	change of V <sub>O</sub> with step load change <sup>(3)(5)</sup>	$V_I = 5V$ , $I_O = 1A$ to 1mA, $t_f \ge 1\mu s$			10 <sup>(4)</sup>	%
$\Delta V_{O1}/\Delta V_{I}$	Transient response change of V <sub>OUT1</sub> with application of V <sub>I</sub> <sup>(3)(5)</sup>	0 to 5V step input, $I_O = 1$ mA to 1A, $t_r \ge 1 \mu s$			10 <sup>(4)</sup>	%
$\Delta V_{O}/\Delta I_{O}$	Transient response short circuit removal response (3)(5)	$V_I = 5V$ , $I_O = $ short to $I_O = 10$ mA			20 <sup>(4)</sup>	%
T <sub>R</sub>	Thermal regulation <sup>(5)</sup>	I <sub>O</sub> = 1A, t <sub>PULSE</sub> = 30ms		0.1		%/W
S	Temperature stability (5)			0.5		%
S	Long-term stability <sup>(5)</sup> (1000hrs)	T <sub>J</sub> = 125°C		0.3		%

<sup>1.</sup> Bandwidth of 10 Hz to 10 kHz.

<sup>2. 120</sup> Hz input ripple.

<sup>3.</sup>  $C_l$  = 20  $\mu$ F,  $C_{O1}$  and  $C_{O2}$  = 10  $\mu$ F.  $C_l$ ,  $C_{O1}$  and  $C_{O2}$  are all X7R ceramic capacitors.

<sup>4. %</sup> undershoot or overshoot of  $V_{O}$ 

<sup>5.</sup> Guaranteed by design, not tested in production.

Table 8. Electrical characteristics of fixed output 1.8 V

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
Vo	Output voltage 1.8V	$I_O = 5$ mA to 1A, $V_I = 4.75$ to 5.25V T = 25°C	1.764	1.8	1.836	V
Vo	Output voltage 1.8V	$I_{O} = 5$ mA to 1A, $V_{I} = 4.75$ to 5.25V	1.746	1.8	1.854	V
$\Delta V_{O}$	Line regulation	$V_{I} = 4.75 \text{ to } 5.25 \text{V}, I_{O} = 5 \text{mA to } 1 \text{A}$			15	mV
$\Delta V_{O}$	Load regulation	$V_{I} = 4.75V$ , $I_{O} = 10mA$ to 1A			12	mV
V <sub>D</sub>	Dropout voltage $\Delta V_O = -1\%$	I <sub>O</sub> = 1A			1.3	V
I <sub>S</sub>	Current limit	V <sub>I</sub> = 5.5V	1			Α
I <sub>OMIN</sub>	Min. output current for regulation				0	mA
e <sub>N</sub>	RMS output noise (1) (5)	T = 25°C		0.003		%
SVR	Supply voltage rejection <sup>(2)(5)</sup>	V <sub>I</sub> = 5V	60			dB
	Transient response	$V_I = 5V$ , $I_O = 1$ mA to 1A, $t_r \ge 1$ µs			10 <sup>(4)</sup>	
$\Delta V_{O}/\Delta I_{O}$	change of V <sub>O</sub> with step load change <sup>(3)(5)</sup>	$V_I = 5V$ , $I_O = 1A$ to 1mA, $t_f \ge 1\mu s$			10 <sup>(4)</sup>	%
$\Delta V_{O1}/\Delta V_{I}$	Transient response change of V <sub>OUT1</sub> with application of V <sub>I</sub> <sup>(3)(5)</sup>	0 to 5V step input, $I_O = 1$ mA to 1A, $t_r \ge 1 \mu s$			10 <sup>(4)</sup>	%
$\Delta V_{O}/\Delta I_{O}$	Transient response short circuit removal response (3)(5)	$V_I = 5V$ , $I_O = $ short to $I_O = 10$ mA			20 <sup>(4)</sup>	%
$T_{R}$	Thermal regulation <sup>(5)</sup>	$I_O = 1A$ , $t_{PULSE} = 30$ ms		0.1		%/W
S	Temperature stability (5)			0.5		%
S	Long-term stability <sup>(5)</sup> (1000hrs)	T <sub>J</sub> = 125°C		0.3		%

<sup>1.</sup> Bandwidth of 10 Hz to 10 kHz.

<sup>2. 120</sup> Hz input ripple.

<sup>3.</sup>  $C_l$  = 20  $\mu$ F,  $C_{O1}$  and  $C_{O2}$  = 10  $\mu$ F.  $C_l$ ,  $C_{O1}$  and  $C_{O2}$  are all X7R ceramic capacitors.

<sup>4. %</sup> undershoot or overshoot of  $V_{O}$ 

<sup>5.</sup> Guaranteed by design, not tested in production.

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Table 9. Electrical characteristics of fixed output 2.5 V

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
Vo	Output voltage 2.5V	$I_O = 5$ mA to 1A, $V_I = 4.75$ to 5.25V T = 25°C	2.45	2.5	2.55	V
Vo	Output voltage 2.5V	$I_{O} = 5$ mA to 1A, $V_{I} = 4.75$ to 5.25V	2.425	2.5	2.575	V
$\Delta V_{O}$	Line regulation	$V_{I} = 4.75 \text{ to } 5.25 \text{V}, I_{O} = 5 \text{mA to } 1 \text{A}$			15	mV
$\Delta V_{O}$	Load regulation	$V_{I} = 4.75V$ , $I_{O} = 10$ mA to 1A			12	mV
V <sub>D</sub>	Dropout voltage $\Delta V_O = -1\%$	I <sub>O</sub> = 1A			1.3	V
I <sub>S</sub>	Current limit	V <sub>I</sub> = 5.5V	1			Α
I <sub>OMIN</sub>	Min. output current for regulation				0	mA
e <sub>N</sub>	RMS output noise (1) (5)	T = 25°C		0.003		%
SVR	Supply voltage rejection <sup>(2)(5)</sup>	V <sub>I</sub> = 5V	60			dB
	Transient response	$V_I = 5V$ , $I_O = 1$ mA to 1A, $t_r \ge 1$ µs			10 <sup>(4)</sup>	
$\Delta V_{O}/\Delta I_{O}$	change of V <sub>O</sub> with step load change <sup>(3)(5)</sup>	$V_I = 5V$ , $I_O = 1A$ to 1mA, $t_f \ge 1\mu s$			10 <sup>(4)</sup>	%
$\Delta V_{O1}/\Delta V_{I}$	Transient response change of V <sub>OUT1</sub> with application of V <sub>I</sub> (3)(5)	0 to 5V step input, $I_O$ = 1mA to 1A, $t_r \ge 1 \mu s$			10 <sup>(4)</sup>	%
$\Delta V_{O}/\Delta I_{O}$	Transient response short circuit removal response (3)(5)	$V_I = 5V$ , $I_O = $ short to $I_O = 10$ mA			20 <sup>(4)</sup>	%
$T_{R}$	Thermal regulation <sup>(5)</sup>	I <sub>O</sub> = 1A, t <sub>PULSE</sub> = 30ms		0.1		%/W
S	Temperature stability (5)			0.5		%
S	Long-term stability (5) (1000hrs)	T <sub>J</sub> = 125°C		0.3		%

<sup>1.</sup> Bandwidth of 10 Hz to 10 kHz.

<sup>2. 120</sup> Hz input ripple.

<sup>3.</sup>  $C_l$  = 20  $\mu$ F,  $C_{O1}$  and  $C_{O2}$  = 10  $\mu$ F.  $C_l$ ,  $C_{O1}$  and  $C_{O2}$  are all X7R ceramic capacitors.

<sup>4. %</sup> undershoot or overshoot of  $V_{O}$ 

<sup>5.</sup> Guaranteed by design, not tested in production.

Table 10. Electrical characteristics of fixed output 2.8 V

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
Vo	Output voltage 2.8V	$I_O = 5$ mA to 1A, $V_I = 4.75$ to 5.25V T = 25°C	2.744	2.8	2.856	V
Vo	Output voltage 2.8V	$I_{O} = 5$ mA to 1A, $V_{I} = 4.75$ to 5.25V	2.716	2.8	2.884	V
$\Delta V_{O}$	Line regulation	$V_{I} = 4.75 \text{ to } 5.25 \text{V}, I_{O} = 5 \text{mA to } 1 \text{A}$			15	mV
$\Delta V_{O}$	Load regulation	$V_{I} = 4.75V$ , $I_{O} = 10mA$ to 1A			12	mV
V <sub>D</sub>	Dropout voltage $\Delta V_O = -1\%$	I <sub>O</sub> = 1A			1.3	V
I <sub>S</sub>	Current limit	V <sub>I</sub> = 5.5V	1			Α
I <sub>OMIN</sub>	Min. output current for regulation				0	mA
e <sub>N</sub>	RMS output noise (1) (5)	T = 25°C		0.003		%
SVR	Supply voltage rejection <sup>(2)(5)</sup>	V <sub>I</sub> = 5V	60			dB
	Transient response	$V_I = 5V$ , $I_O = 1$ mA to 1A, $t_r \ge 1$ µs			10 <sup>(4)</sup>	
$\Delta V_{O}/\Delta I_{O}$	change of V <sub>O</sub> with step load change <sup>(3)(5)</sup>	$V_I = 5V$ , $I_O = 1A$ to 1mA, $t_f \ge 1\mu s$			10 <sup>(4)</sup>	%
$\Delta V_{O1}/\Delta V_{I}$	Transient response change of V <sub>OUT1</sub> with application of V <sub>I</sub> <sup>(3)(5)</sup>	0 to 5V step input, $I_O$ = 1mA to 1A, $t_r \ge 1 \mu s$			10 <sup>(4)</sup>	%
$\Delta V_{O}/\Delta I_{O}$	Transient response short circuit removal response (3)(5)	$V_I = 5V$ , $I_O = $ short to $I_O = 10$ mA			20 <sup>(4)</sup>	%
T <sub>R</sub>	Thermal regulation <sup>(5)</sup>	I <sub>O</sub> = 1A, t <sub>PULSE</sub> = 30ms		0.1		%/W
S	Temperature stability (5)			0.5		%
S	Long-term stability <sup>(5)</sup> (1000hrs)	T <sub>J</sub> = 125°C		0.3		%

<sup>1.</sup> Bandwidth of 10 Hz to 10 kHz.

<sup>2. 120</sup> Hz input ripple.

<sup>3.</sup>  $C_l$  = 20  $\mu$ F,  $C_{O1}$  and  $C_{O2}$  = 10  $\mu$ F.  $C_l$ ,  $C_{O1}$  and  $C_{O2}$  are all X7R ceramic capacitors.

<sup>4. %</sup> undershoot or overshoot of  $V_{O}$ 

<sup>5.</sup> Guaranteed by design, not tested in production.

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Table 11. Electrical characteristics of fixed output 3.0 V

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
Vo	Output voltage 3.0V	$I_{O}$ = 5mA to 1A, $V_{I}$ = 4.75 to 5.25V T = 25°C	2.94	3.0	3.06	V
Vo	Output voltage 3.0V	$I_O = 5$ mA to 1A, $V_I = 4.75$ to 5.25V	2.91	3.0	3.09	V
$\Delta V_{O}$	Line regulation	$V_I = 4.75 \text{ to } 5.25 \text{V}, I_O = 5 \text{mA to } 1 \text{A}$			15	mV
$\Delta V_{O}$	Load regulation	V <sub>I</sub> = 4.75V, I <sub>O</sub> = 10mA to 1A			12	mV
V <sub>D</sub>	Dropout voltage $\Delta V_O = -1\%$	I <sub>O</sub> = 1A			1.3	V
Is	Current limit	V <sub>I</sub> = 5.5V	1			Α
I <sub>OMIN</sub>	Min. output current for regulation				0	mA
e <sub>N</sub>	RMS output noise (1) (5)	T = 25°C		0.003		%
SVR	Supply voltage rejection (2)(5)	V <sub>I</sub> = 5V	60			dB
	Transient response	$V_I = 5V$ , $I_O = 1$ mA to 1A, $t_r \ge 1$ µs			10 <sup>(4)</sup>	
$\Delta V_{O}/\Delta I_{O}$	change of V <sub>O</sub> with step load change <sup>(3)(5)</sup>	$V_I = 5V$ , $I_O = 1A$ to 1mA, $t_f \ge 1\mu s$			10 <sup>(4)</sup>	%
$\Delta V_{O1}/\Delta V_{I}$	Transient response change of V <sub>OUT1</sub> with application of V <sub>I</sub> (3)(5)	0 to 5V step input, $I_O$ = 1mA to 1A, $t_r \ge 1 \mu s$			10 <sup>(4)</sup>	%
$\Delta V_{O}/\Delta I_{O}$	Transient response short circuit removal response (3)(5)	$V_I = 5V$ , $I_O = $ short to $I_O = 10$ mA			20 <sup>(4)</sup>	%
T <sub>R</sub>	Thermal regulation <sup>(5)</sup>	I <sub>O</sub> = 1A, t <sub>PULSE</sub> = 30ms		0.1		%/W
S	Temperature stability (5)			0.5		%
S	Long-term stability <sup>(5)</sup> (1000hrs)	T <sub>J</sub> = 125°C		0.3		%

<sup>1.</sup> Bandwidth of 10 Hz to 10 kHz.

<sup>2. 120</sup> Hz input ripple.

<sup>3.</sup>  $C_l$  = 20  $\mu$ F,  $C_{O1}$  and  $C_{O2}$  = 10  $\mu$ F.  $C_l$ ,  $C_{O1}$  and  $C_{O2}$  are all X7R ceramic capacitors.

<sup>4. %</sup> undershoot or overshoot of  $V_{O}$ 

<sup>5.</sup> Guaranteed by design, not tested in production.

Table 12. Electrical characteristics of fixed output 3.3 V

Symbol	Parameter	Test Conditions Min.		Тур.	Max.	Unit	
Vo	Output voltage 3.3V	$I_O = 5$ mA to 1A, $V_I = 4.75$ to 5.25V T = 25°C	3.234	3.3	3.366	V	
Vo	Output voltage 3.3V	$I_{O} = 5$ mA to 1A, $V_{I} = 4.75$ to 5.25V	3.2	3.3	3.4	V	
$\Delta V_{O}$	Line regulation	$V_{I} = 4.75 \text{ to } 5.25 \text{V}, I_{O} = 5 \text{mA to } 1 \text{A}$			15	mV	
$\Delta V_{O}$	Load regulation	$V_{I} = 4.75V$ , $I_{O} = 10mA$ to 1A			12	mV	
V <sub>D</sub>	Dropout voltage $\Delta V_O = -1\%$	I <sub>O</sub> = 1A			1.3	V	
I <sub>S</sub>	Current limit	V <sub>I</sub> = 5.5V	1			Α	
I <sub>OMIN</sub>	Min. output current for regulation				0	mA	
e <sub>N</sub>	RMS output noise (1) (5)	T = 25°C		0.003		%	
SVR	Supply voltage rejection <sup>(2)(5)</sup>	V <sub>I</sub> = 5V	60			dB	
	Transient response	$V_I = 5V$ , $I_O = 1mA$ to $1A$ , $t_r \ge 1\mu s$			10 <sup>(4)</sup>		
$\Delta V_{O}/\Delta I_{O}$	change of V <sub>O</sub> with step load change (3)(5)	$V_I = 5V$ , $I_O = 1A$ to 1mA, $t_f \ge 1\mu s$			10 <sup>(4)</sup>	%	
$\Delta V_{O1}/\Delta V_{I}$	Transient response change of V <sub>OUT1</sub> with application of V <sub>I</sub> <sup>(3)(5)</sup>	0 to 5V step input, $I_O$ = 1mA to 1A, $t_r \ge 1 \mu s$			10 <sup>(4)</sup>	%	
$\Delta V_{O}/\Delta I_{O}$	Transient response short circuit removal response (3)(5)	$V_I = 5V$ , $I_O = $ short to $I_O = 10$ mA			20 <sup>(4)</sup>	%	
$T_{R}$	Thermal regulation <sup>(5)</sup>	$I_O = 1A$ , $t_{PULSE} = 30$ ms		0.1		%/W	
S	Temperature stability (5)			0.5		%	
S	Long-term stability <sup>(5)</sup> (1000hrs)	T <sub>J</sub> = 125°C		0.3		%	

<sup>1.</sup> Bandwidth of 10 Hz to 10 kHz.

<sup>2. 120</sup> Hz input ripple.

<sup>3.</sup>  $C_l$  = 20  $\mu$ F,  $C_{O1}$  and  $C_{O2}$  = 10  $\mu$ F.  $C_l$ ,  $C_{O1}$  and  $C_{O2}$  are all X7R ceramic capacitors.

<sup>4.</sup>  $\,$ % undershoot or overshoot of  $V_O$ 

<sup>5.</sup> Guaranteed by design, not tested in production.

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Table 13. Electrical characteristics of adjustable output

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit	
Vo	Reference voltage	$I_O = 5$ mA to 1A, $V_I = 4.75$ to 5.25V, $T = 25$ °C	1.225	1.25	1.275	V	
Vo	Reference voltage	$I_O = 5$ mA to 1A, $V_I = 4.75$ to 5.25V	1.212	1.25	1.287	V	
ΔV <sub>O2</sub>	Line regulation 2	$V_1 = 4.75$ to 5.25V, $I_0 = 5$ mA to 1A			0.35	%	
$\Delta V_{O2}$	Load regulation 2	$V_{I} = 4.75V$ , $I_{O} = 10mA$ to 1A			0.4	%	
V <sub>D</sub>	Dropout voltage $\Delta V_O = -1\%$	I <sub>O</sub> = 1A			1.3	V	
I <sub>S</sub>	Current limit	V <sub>I</sub> = 5.5V	1			Α	
I <sub>ADJ</sub>	Adjustable current (sinking)				1	μΑ	
$I_{\Delta ADJ}$	Adjustable current change	I <sub>O</sub> = 10mA to 1A			200	nA	
I <sub>OMIN</sub>	Min. output current for regulation				2	mA	
e <sub>N</sub>	RMS output noise (1) (5)	T = 25°C		0.003		%	
SVR	Supply voltage rejection (2)(5)	V <sub>I</sub> = 5V	60			dB	
$\Delta V_{O2}/\Delta I_{O}$	Transient response	$V_I = 5V$ , $I_O = 1$ mA to 1A, $t_r \ge 1$ $\mu$ s			10 <sup>(4)</sup>	%	
2	change of V <sub>O</sub> with step load change (3)(5)	$V_{I} = 5V, I_{O} = 1A \text{ to } 1mA, t_{f} \ge 1\mu s$			10 <sup>(4)</sup>		
$\Delta V_{O2}/\Delta V_{I}$	Transient response change of V <sub>OUT1</sub> with application of V <sub>I</sub> <sup>(3)(5)</sup>	0 to 5V step input, $I_O$ = 1mA to 1A, $t_r \ge 1 \mu s$			10 <sup>(4)</sup>	%	
$\Delta V_{O2}/\Delta I_{O}$	Transient response short circuit removal response (3)(5)	$V_I = 5V$ , $I_O = $ short to $I_O = 10$ mA			20 <sup>(4)</sup>	%	
T <sub>R</sub>	Thermal regulation <sup>(5)</sup>	I <sub>O</sub> = 1A, t <sub>PULSE</sub> = 30ms		0.1		%/W	
S	Temperature stability (5)			0.5		%	
S	Long-term stability <sup>(5)</sup> (1000hrs)	T <sub>J</sub> = 125°C		0.3		%	

<sup>1.</sup> Bandwidth of 10 Hz to 10 kHz.

<sup>2. 120</sup> Hz input ripple.

<sup>3.</sup>  $C_l$  = 20  $\mu$ F,  $C_{O1}$  and  $C_{O2}$  = 10  $\mu$ F.  $C_l$ ,  $C_{O1}$  and  $C_{O2}$  are all X7R ceramic capacitors.

<sup>4. %</sup> undershoot or overshoot of V<sub>O</sub>

<sup>5.</sup> Guaranteed by design, not tested in production.

ST2L05-3300 Application hints

### 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  $2.2~\mu F$  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  $\mu F$  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  $\mu F$ , and up to 10  $\mu F$  if the input capacitor is less than 4.7  $\mu F$ . 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  $\mu F$ . 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 ± 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.

Application hints ST2L05-3300

 $V_{01}$   $V_{01}$   $C_{01}=4.7\mu F$   $C_{01}=4.7\mu F$   $C_{02}=4.7\mu F$   $R_{1}$   $R_{2}$   $C_{03}=4.7\mu F$ 

Figure 4. Application circuit

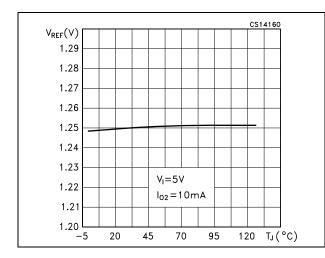
 $V_{O} = V_{REF} (1 + R_{1} / R_{2}) + I_{ADJ}R_{1}$ 

 $I_{\mbox{\scriptsize ADJ}}$  is very small (typically 35  $\mbox{\scriptsize \mu A})$  and constant: in the  $V_{\mbox{\scriptsize O}}$  calculation it can be ignored.

## 7 Typical characteristics

Figure 5. Reference voltage vs. temperature

Figure 6. Reference line regulation vs. temperature



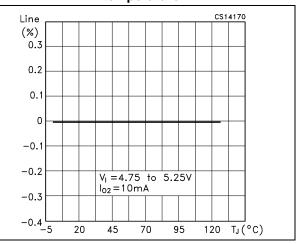
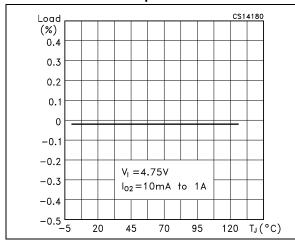


Figure 7. Reference load regulation vs. temperature

Figure 8. Reference voltage vs. input voltage



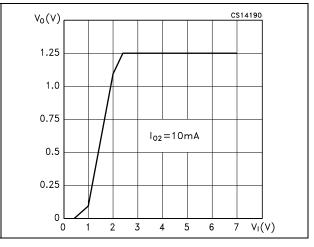
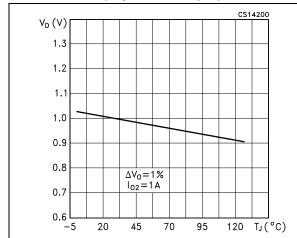


Figure 9. Dropout voltage vs. temperature (adjustable output)

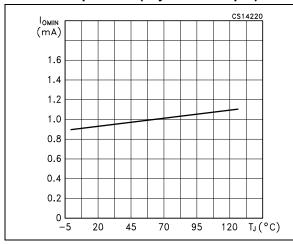
Figure 10. Dropout voltage vs. input voltage (adjustable output)  $V_D(V)$ 



CS14210 5 3 2  $I_{02} = 10 \text{mA}$ 0 2 3 5 0 4 6  $7 V_1(V)$ 

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

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



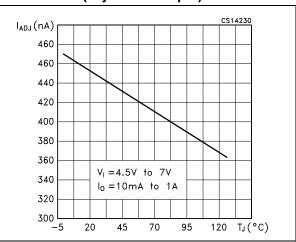
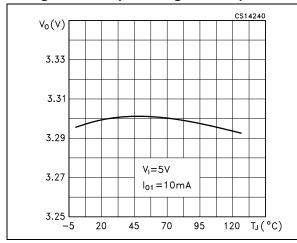
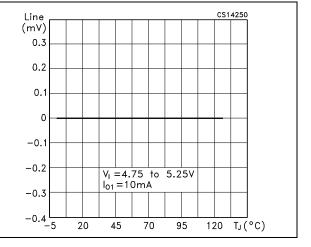


Figure 13. Output voltage vs. temperature

Figure 14. Line regulation vs. temperature

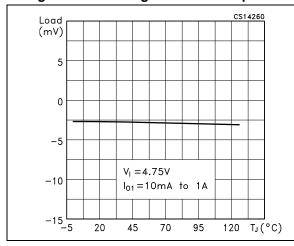




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Figure 15. Load regulation vs. temperature

Figure 16. Output voltage vs. input voltage



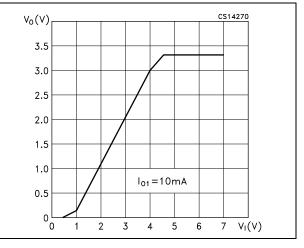
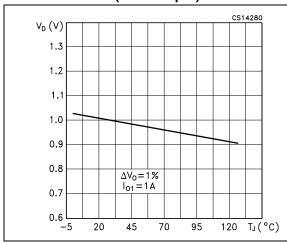


Figure 17. Dropout voltage vs. temperature (fixed output)

Figure 18. Dropout voltage vs. input voltage



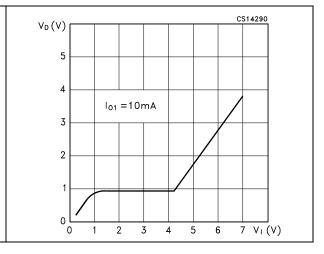
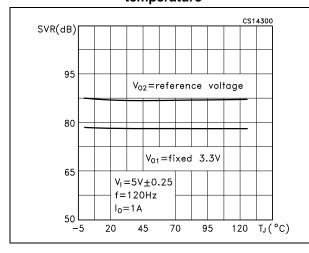


Figure 19. Supply voltage rejection vs. temperature

Figure 20. Supply voltage rejection vs. frequency



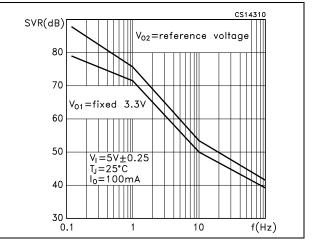
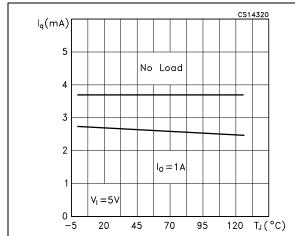




Figure 21. Quiescent current vs. temperature (fixed/adj. version)

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



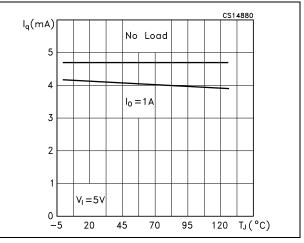
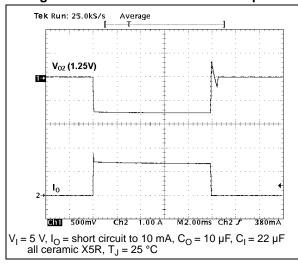
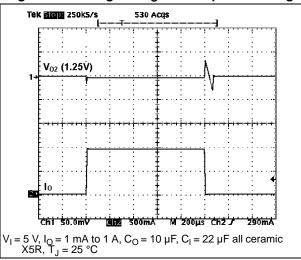


Figure 23. Short-circuit removal response

Figure 24. Change of V<sub>O</sub> with step load change





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Figure 25. Change of V<sub>O</sub> with step load change Figure 26. Change of V<sub>O</sub> with step load change

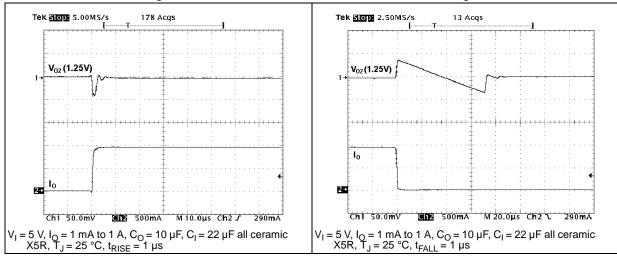


Figure 27. Short-circuit removal response

Figure 28. Change of V<sub>O</sub> with step load change

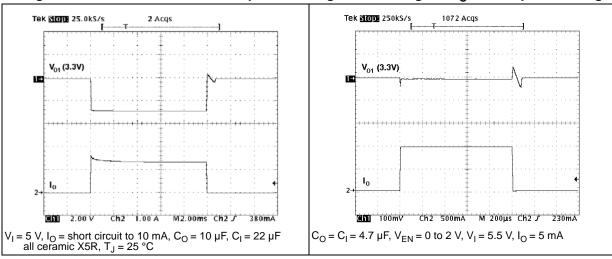


Figure 29. Change of V<sub>O</sub> with step load change Figure 30. Change of V<sub>O</sub> with step load change

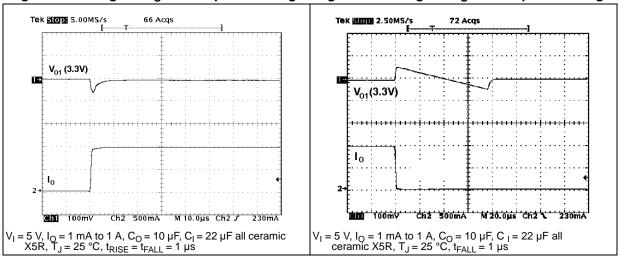
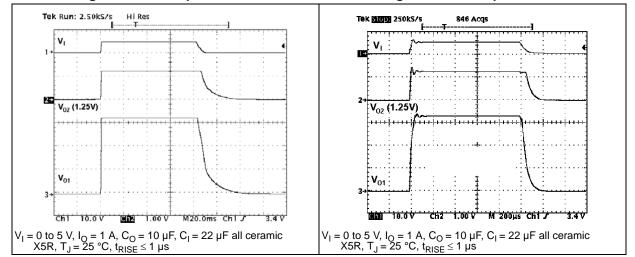




Figure 31. Start-up transient

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.

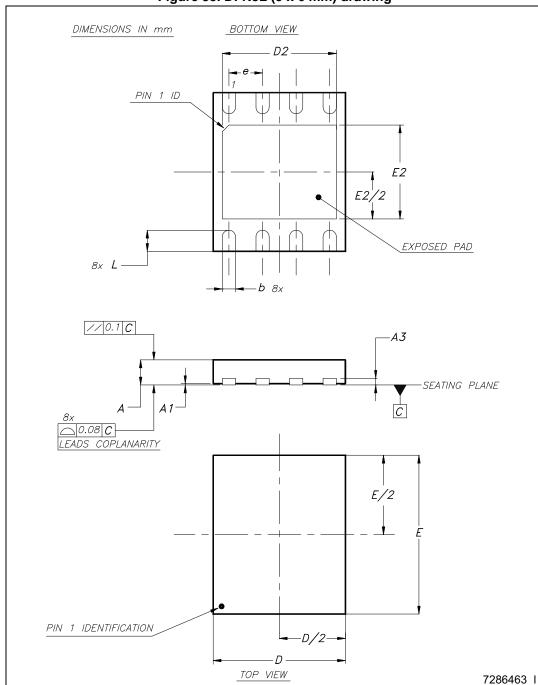
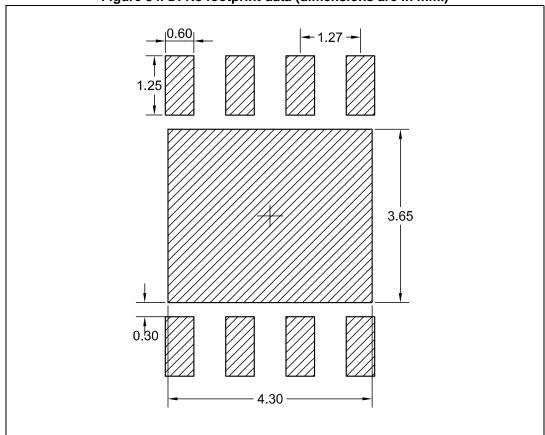


Figure 33. DFN8L (5 x 6 mm) drawing

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

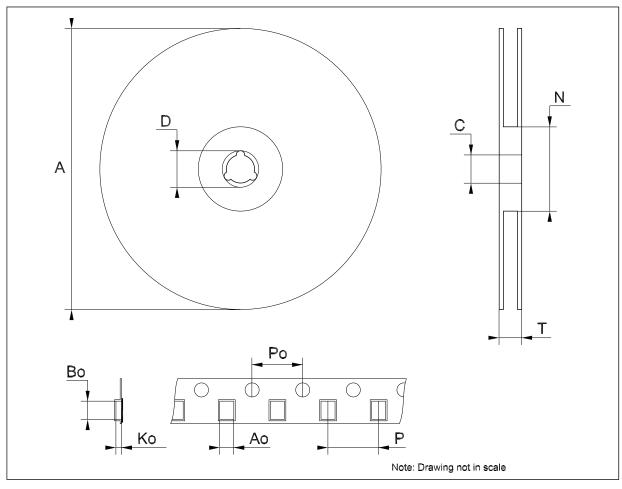
Dim.	mm				
Diiii.	Min.	Тур.	Max.		
А	0.80	0.90	1.00		
A1	0	0.02	0.05		
А3		0.20			
b	0.35	0.40	0.47		
D		5.00			
D2	4.05	4.20	4.30		
E		6.00			
E2	3.40	3.55	3.65		
е		1.27			
L	0.70	0.80	0.90		

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



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

Dim.	mm.			inch.		
	Min.	Тур.	Max.	Min.	Тур.	Max.
А			330			12.992
С	12.8		13.2	0.504		0.520
D	20.2			0.795		
N	99		101	3.898		3.976
Т			14.4			0.567
Ao		5.30			0.209	
Во		6.30			0.248	
Ko		1.20			0.047	
Po		4			0.157	
Р		8			0.315	



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

Table 15. Options available on request

V <sub>O1</sub>	V <sub>O2</sub>	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

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ST2L05-3300 Revision history

# 10 Revision history

**Table 16. Document revision history** 

Date	Revision	Changes	
18-Nov-2004	4	Removed PPAK version.	
24-Nov-2004	004 5 Added new mechanical data.		
06-Dec-2004 6 Modified mechanical data.		Modified mechanical data.	
13-Feb-2009	9 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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