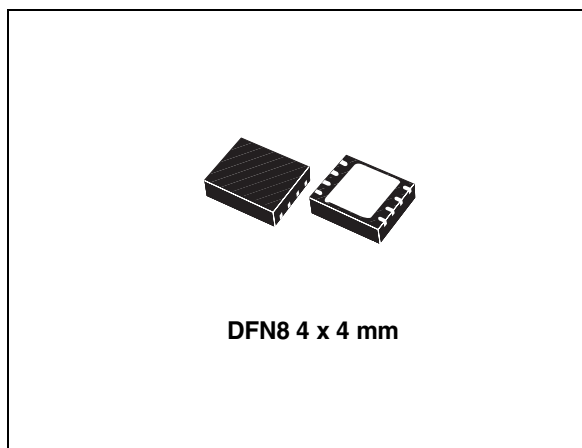


## Micropower 1 A synchronous step-up DC-DC converter

### Features

- Output voltage adjustable from 6 V to 12 V
- Output voltage accuracy:  $\pm 2\%$
- Output current up to 1 A
- Low ripple voltage: 5 mV (typ.)
- Synchronous rectification
- High 90% efficiency:  $V_O = 9\text{ V}$  (typ.)
- Few external components
- Thermal shutdown protection
- Very small DFN8 (4 x 4 mm) package



### Description

The ST8R00 is a synchronous PWM step-up DC-DC converter. The device is able to provide an output voltage in the range of 6 to 12 V with an input voltage from 4 to 6 V. The high switching frequency (1.7 MHz) permits the use of tiny surface-mount components. In addition to the resistor divider to set the output voltage value, only an inductor and two capacitors are required. Moreover, a low output ripple is guaranteed by the current mode PWM topology and by the use of low ESR SMD ceramic capacitors. The device is available in a very small DFN8 (4 x 4 mm) package.

**Table 1. Device summary**

| Part number | Order code | Output voltage |
|-------------|------------|----------------|
| ST8R00      | ST8R00WPUR | ADJ            |

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2      **Pin configuration** ..... 4

3      **Typical application circuit** ..... 5

4      **Maximum ratings** ..... 6

5      **Electrical characteristics** ..... 7

6      **Typical characteristics** ..... 8

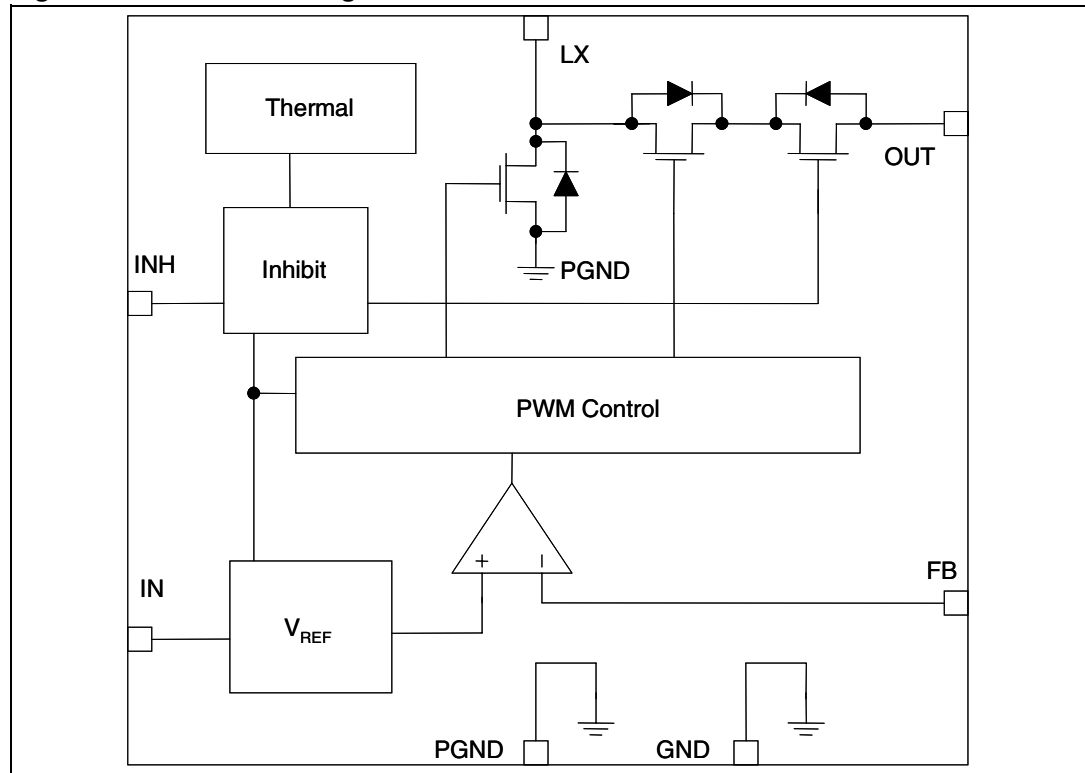
7      **Package mechanical data** ..... 13

8      **Revision history** ..... 17



# 1 Block diagram

Figure 1. Schematic diagram



## 2 Pin configuration

Figure 2. Pin connections (top view)

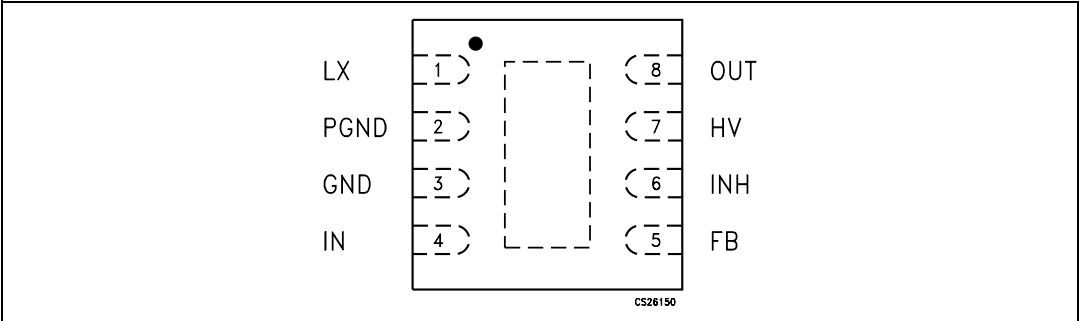
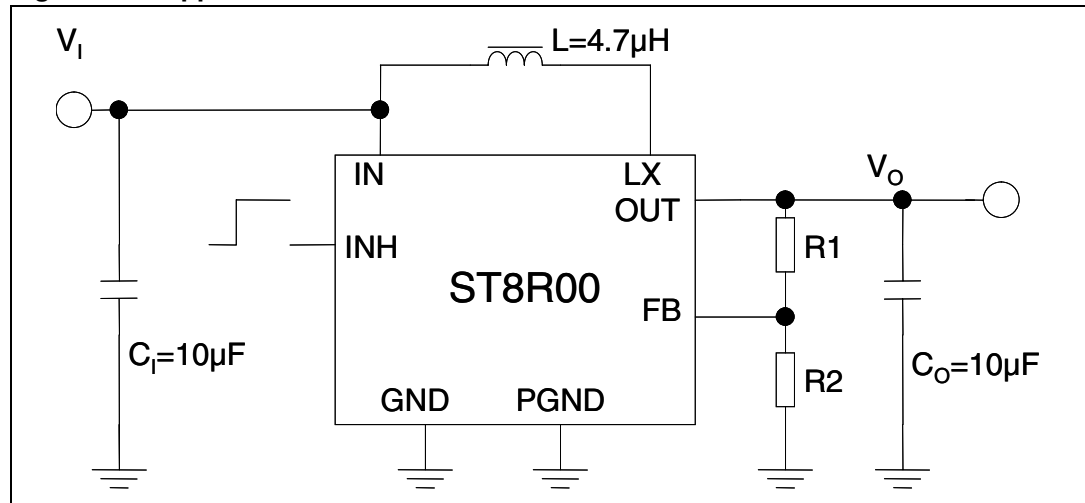


Table 2. Pin description

| Pin n°  | Symbol | Name and function                                                                                                                                                                   |
|---------|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | LX     | Switching output                                                                                                                                                                    |
| 2       | PGND   | Power ground                                                                                                                                                                        |
| 3       | GND    | Analog ground                                                                                                                                                                       |
| 4       | IN     | Power input for analog circuit                                                                                                                                                      |
| 5       | FB     | Feedback                                                                                                                                                                            |
| 6       | INH    | Inhibit. Connecting the pin to a voltage higher than 2 V = device ON.<br>Connecting the pin to a voltage lower than 0.8 V = device OFF,<br>resulting in no current flow to the load |
| 7       | HV     | Trimming (floating or connected to GND)                                                                                                                                             |
| 8       | OUT    | Output voltage                                                                                                                                                                      |
| EXP pad | GND    | Exposed pad. Must be connected to GND                                                                                                                                               |

### 3 Typical application circuit

Figure 3. Application circuit



## 4 Maximum ratings

**Table 3. Absolute maximum ratings**

| Symbol    | Parameter                            | Value              | Unit |
|-----------|--------------------------------------|--------------------|------|
| $V_O$     | Output voltage                       | 16                 | V    |
| $V_I$     | Input voltage                        | 6                  | V    |
| $V_{INH}$ | Inhibit voltage                      | 6                  | V    |
| $V_{LX}$  | LX pin voltage                       | 16                 | V    |
| $I_{LX}$  | LX pin output current                | Internally limited |      |
| $T_{STG}$ | Storage temperature range            | -50 to 150         | °C   |
| $T_{OP}$  | Operating junction temperature range | -25 to 125         | °C   |

**Table 4. Thermal Data**

| Symbol     | Parameter                           | Value | Unit |
|------------|-------------------------------------|-------|------|
| $R_{thJC}$ | Thermal resistance junction-case    | 10    | °C/W |
| $R_{thJA}$ | Thermal resistance junction-ambient | 50    | °C/W |

**Table 5. ESD Performance**

| Symbol | Parameter              | Test conditions | Value | Unit |
|--------|------------------------|-----------------|-------|------|
| ESD    | ESD protection voltage | HBM             | 4     | KV   |
| ESD    | ESD protection voltage | MM              | 500   | V    |

## 5 Electrical characteristics

$V_I = 5\text{ V}$ ,  $V_{INH} = 2\text{ V}$ ,  $I_O = 100\text{ mA}$ ,  $T_J = -25\text{ }^{\circ}\text{C}$  to  $125\text{ }^{\circ}\text{C}$ ,  $C_I = C_O = 10\text{ }\mu\text{F(X7R)}$ ,  $L = 4.7\text{ }\mu\text{H}$  unless otherwise specified.

**Table 6. Electrical characteristics**

| Symbol                    | Parameter                                   | Test conditions                                                                                       | Min.  | Typ. | Max.  | Unit               |
|---------------------------|---------------------------------------------|-------------------------------------------------------------------------------------------------------|-------|------|-------|--------------------|
| $V_O$                     | Output voltage                              | <sup>(1)</sup>                                                                                        | 6     |      | 12    | V                  |
| $V_{\text{START-UP}}$     | Start-up voltage                            | $I_O = 400\text{ mA}$ , $V_I$ rising                                                                  |       | 3    | 3.5   | V                  |
| $V_I$                     | Input voltage range                         |                                                                                                       | 4     |      | 6     | V                  |
| $V_{\text{FB}}$           | Feedback voltage                            | $I_O = 50\text{ mA}$                                                                                  | 1.195 | 1.22 | 1.245 | V                  |
| $V_{\text{FB\_OFF}}$      | Feedback voltage                            | $I_O = 0$ , $V_{INH} = 0$                                                                             |       | 0    |       | V                  |
| $I_{\text{FB}}$           | Feedback current                            | $V_{\text{FB}} = 0$ , $V_{INH} = 2\text{ V}$                                                          |       | 600  |       | nA                 |
| $I_{\text{SUPPLY}}$       | Supply current                              | To be measured at $V_I$ , $V_O = 7\text{ V}$ , no load                                                |       | 10   |       | mA                 |
| $R_{\text{DS(on)_N}}$     | Internal N channel $R_{\text{DS(on)}}$      | $I_{\text{LX}} = 400\text{ mA}$                                                                       |       | 300  |       | m $\Omega$         |
| $R_{\text{DS(on)_P}}$     | Internal P channel $R_{\text{DS(on)}}$      | $I_{\text{LX}} = 400\text{ mA}$                                                                       |       | 300  |       |                    |
| $I_{\text{LX(leak)}}$     | Internal leakage current                    | $V_{\text{LX}} = 4\text{ V}$ , $V_{\text{FB}} = 2\text{ V}$ , $V_{INH} = 0$                           |       |      | 0.5   | $\mu\text{A}$      |
| $I_{\text{LX(LIM)}}$      | LX current limitation                       | $V_{\text{LX}} = 4\text{ V}$                                                                          |       | 3    |       | A                  |
| $f_{\text{OSC}}$          | Oscillator frequency                        | To be measured on LX pin                                                                              | 0.8   | 1.2  | 1.4   | MHz                |
| $D_{\text{TY}}$           | Max. oscillator duty cycle                  | To be measured on LX pin                                                                              |       | 90   |       | %                  |
| Eff                       | Efficiency                                  | $I_O = 50\text{ mA}$ , $V_O = 7\text{ V}$                                                             |       | 85   |       | %                  |
|                           |                                             | $I_O = 500\text{ mA}$ , $V_O = 9\text{ V}$                                                            |       | 90   |       |                    |
|                           |                                             | $I_O = 1\text{ A}$ , $V_O = 9\text{ V}$                                                               |       | 90   |       |                    |
| $V_{INH\_H}$              | Inhibit threshold high                      |                                                                                                       | 2     |      |       | V                  |
| $V_{INH\_L}$              | Inhibit threshold low                       | $V_I = 4$ to $6\text{ V}$ , $I_O = 50\text{ mA}$                                                      |       |      | 0.8   |                    |
| $I_{INH}$                 | Inhibit pin current                         | $V_{INH} = V_I = 5\text{ V}$                                                                          |       |      | 2     | $\mu\text{A}$      |
| $T_{\text{SHDN}}$         | Thermal shut down <sup>(2)</sup>            |                                                                                                       | 130   | 150  |       | $^{\circ}\text{C}$ |
| $T_{\text{HYS}}$          | Thermal shut down hysteresis <sup>(2)</sup> |                                                                                                       |       | 15   |       | $^{\circ}\text{C}$ |
| $\Delta V_O / \Delta V_I$ | Line transient response                     | $V_I$ from 4 to $5.5\text{ V}$ , $I_O = 500\text{ mA}$ <sup>(2)</sup>                                 | -5    |      | 5     | % $V_O$            |
| $\Delta V_O / \Delta I_O$ | Load transient response                     | $V_I = 5\text{ V}$ , $I_O$ from $10\text{ mA}$ to $500\text{ mA}$ , $V_O = 7\text{ V}$ <sup>(2)</sup> | -5    |      | 5     | % $V_O$            |
| $\Delta V_O / \Delta V_I$ | Start-up transient                          | $V_I$ from 0 to $5\text{ V}$ , $I_O = 500\text{ mA}$                                                  | -10   |      | 10    | % $V_O$            |
| $T_{\text{START}}$        | Start-up time                               | $V_{INH}$ from 0 to $5\text{ V}$ , $I_O = 100\text{ mA}$                                              |       | 500  |       | $\mu\text{s}$      |

1. For  $V_O$  higher than  $9\text{ V}$  the maximum output current capability is reduced according to LX current limitation

2. Guaranteed by design

## 6 Typical characteristics

$L = 4.7 \mu\text{H}$ ,  $C_I = C_O = 10 \mu\text{F}$ .

Figure 4. Voltage feedback vs. temperature

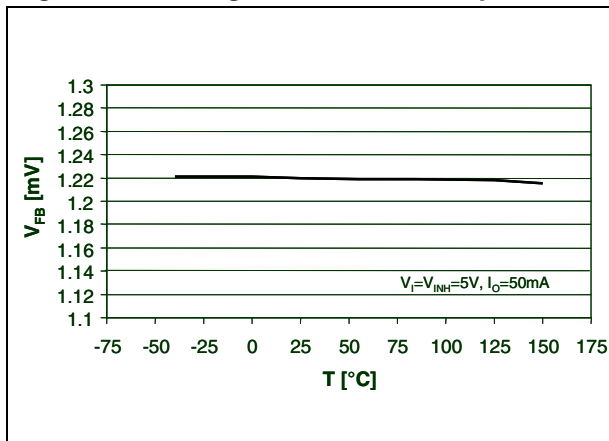


Figure 5. Feedback current vs. temperature

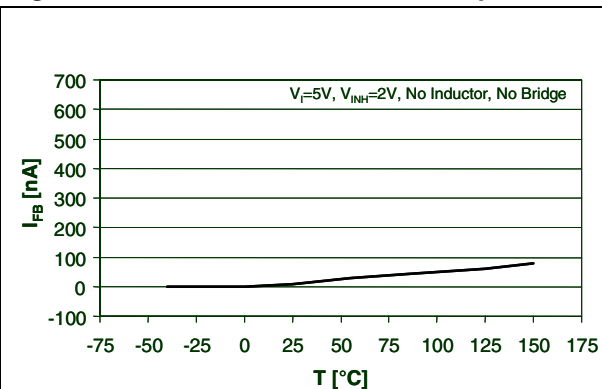


Figure 6. Supply current vs. temperature  
( $V_I = V_{INH} = 5 \text{ V}$ )

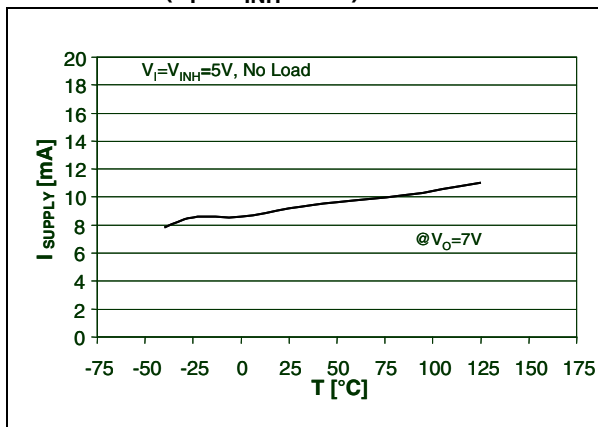


Figure 7. Supply current vs. temperature  
( $V_{INH} = 2 \text{ V}$ )

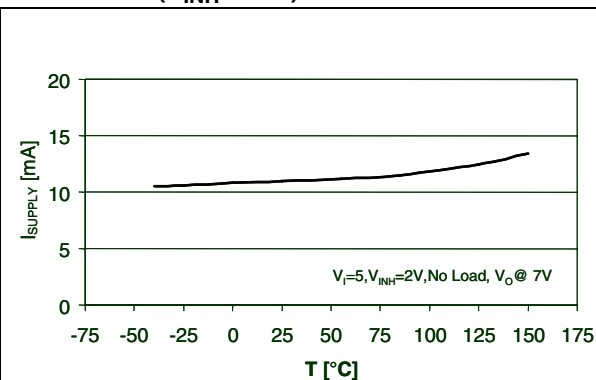


Figure 8. Supply current vs. temperature  
( $V_{FB} = 2 \text{ V}$ )

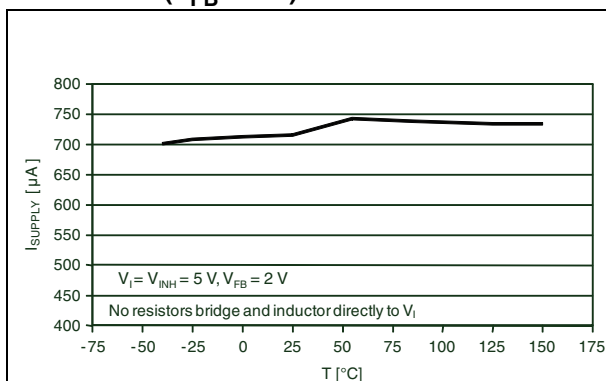


Figure 9. LX current limitation vs. temperature

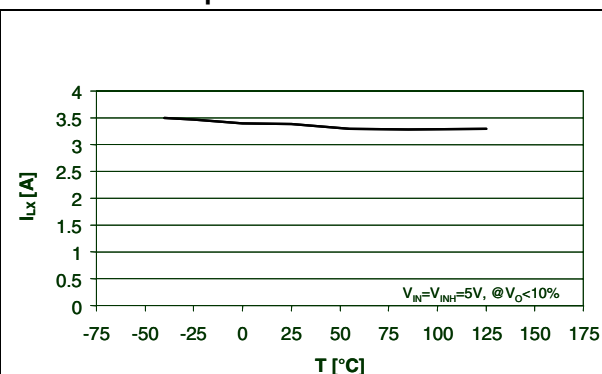




Figure 10. Inhibit voltage vs. temperature  
( $V_I = 4\text{ V}$ )

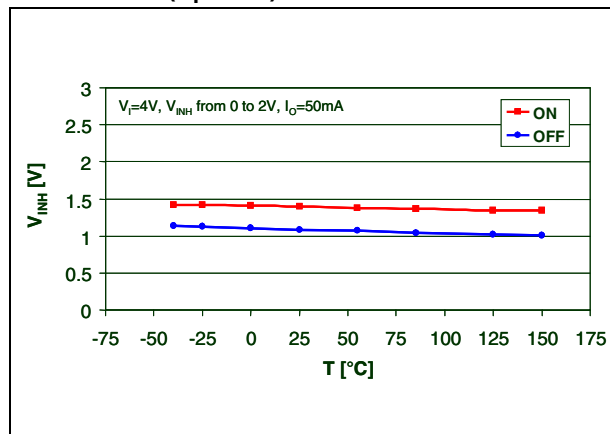


Figure 11. Inhibit voltage vs. temperature  
( $V_I = 6\text{ V}$ )

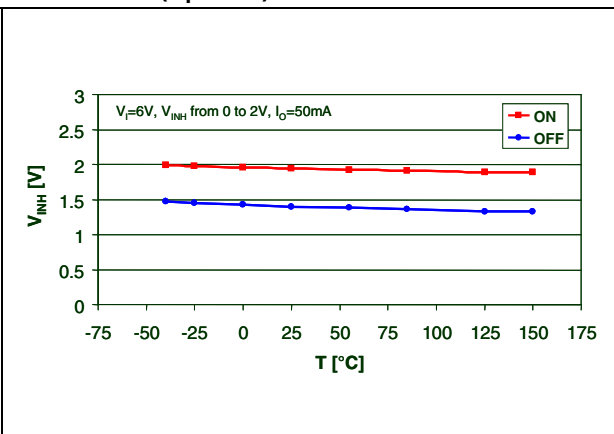


Figure 12. Line regulation vs. temperature

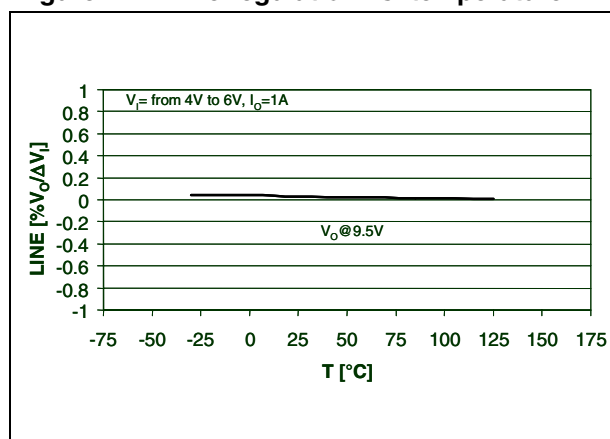


Figure 13. Load regulation vs. temperature

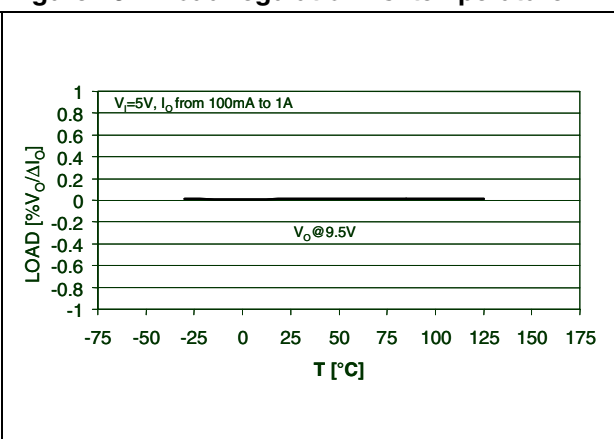


Figure 14. Oscillator frequency vs. temperature

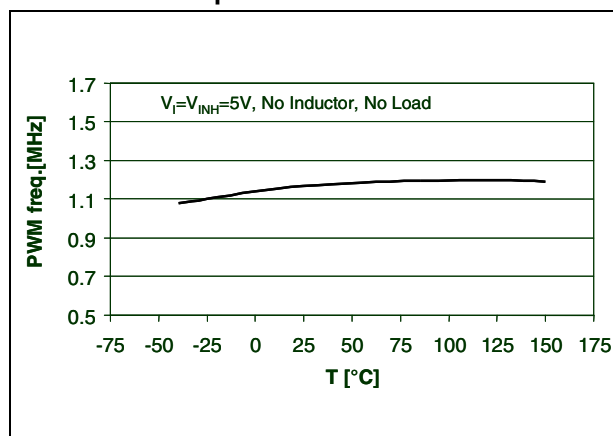


Figure 15. Max oscillator duty cycle vs. temperature

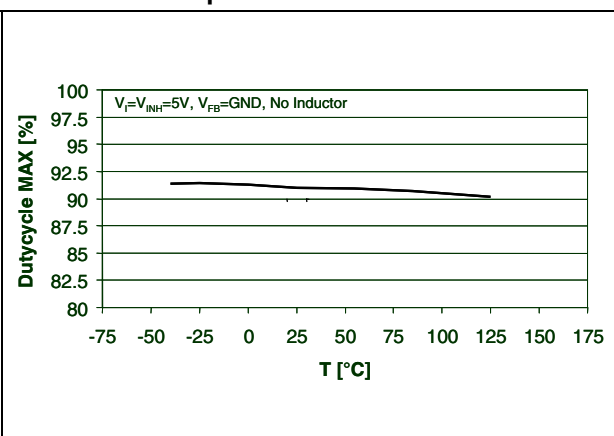


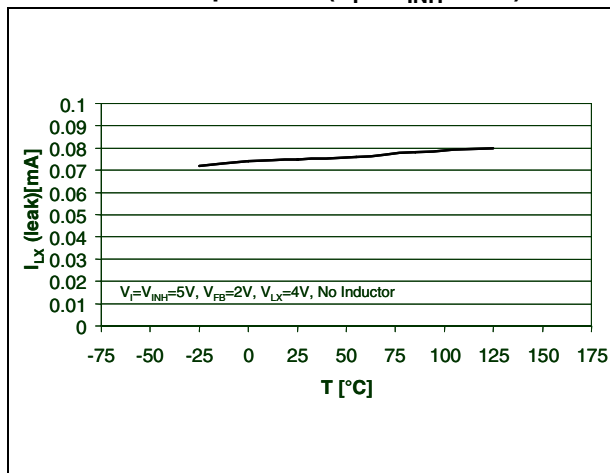
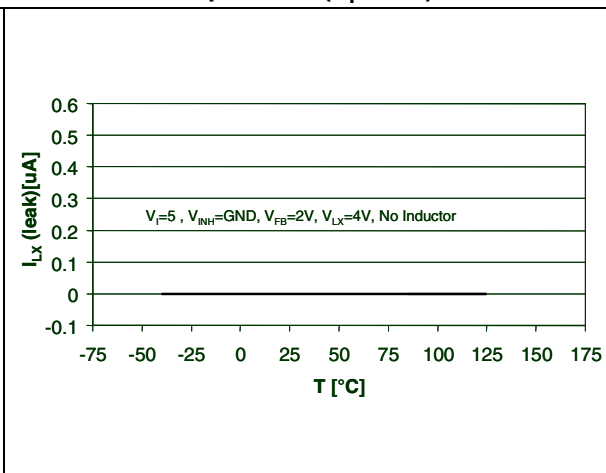
Figure 16. Internal leakage current vs. temperature ( $V_I = V_{INH} = 5\text{ V}$ )Figure 17. Internal leakage current vs. temperature ( $V_I = 5\text{ V}$ )

Figure 18. NMOS switch on resistance vs. temperature

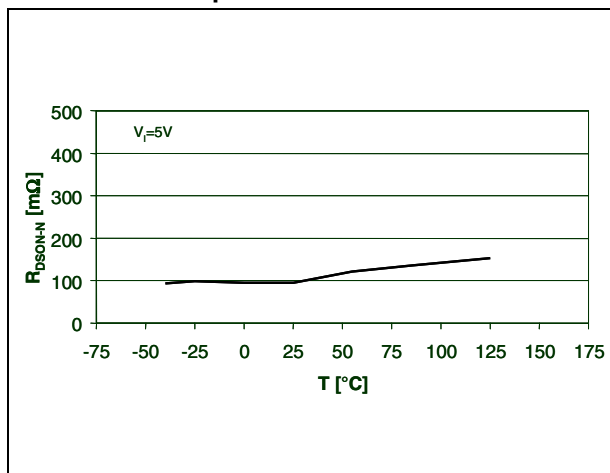


Figure 19. PMOS switch on resistance vs. temperature

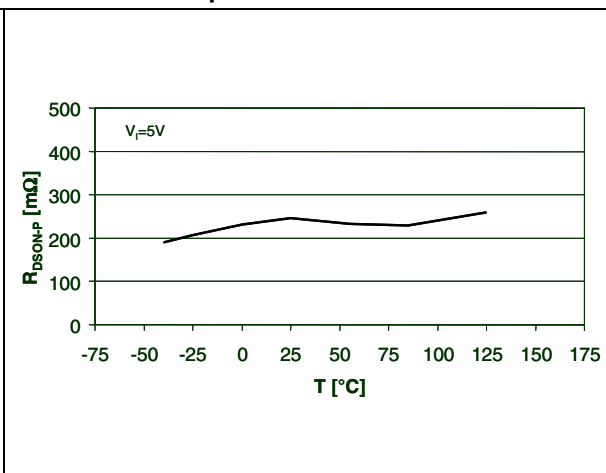
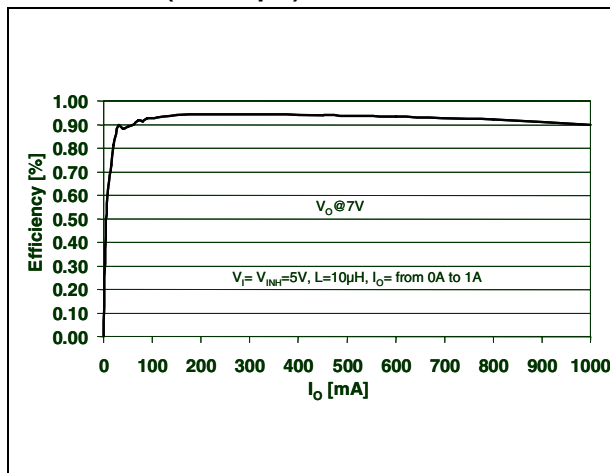
Figure 20. Efficiency vs. output current ( $L = 10\text{ }\mu\text{H}$ )

Figure 21. Efficiency vs. output current

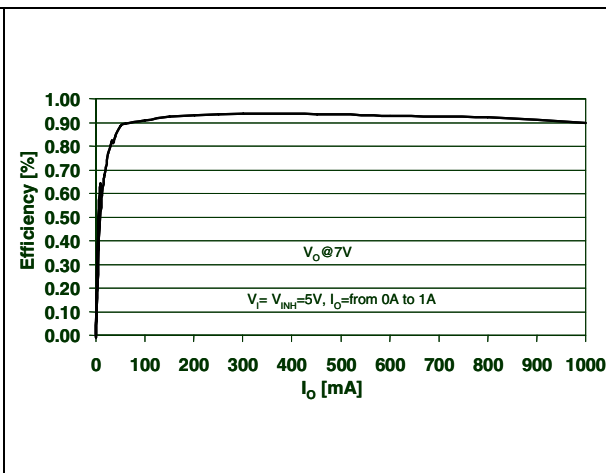


Figure 22. Output voltage vs. input voltage

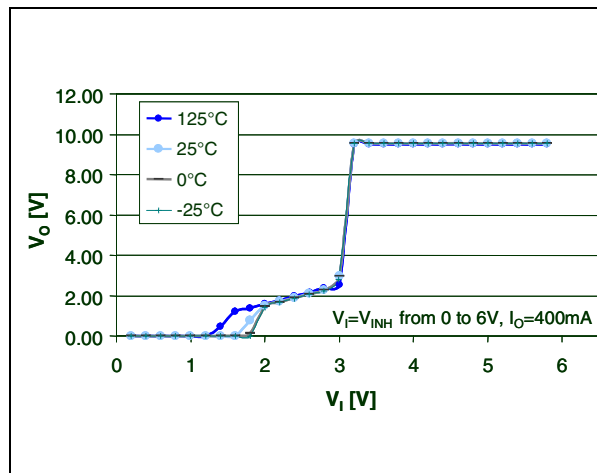


Figure 23. Maximum output current vs. output voltage

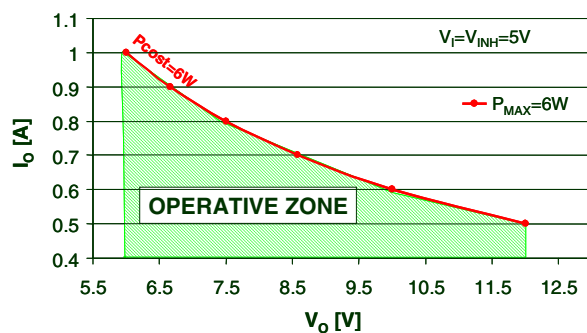
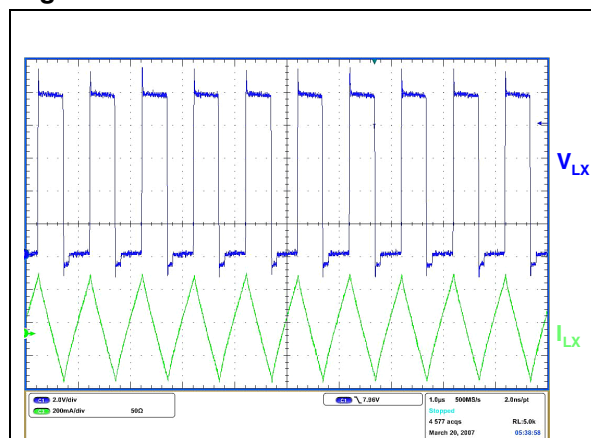
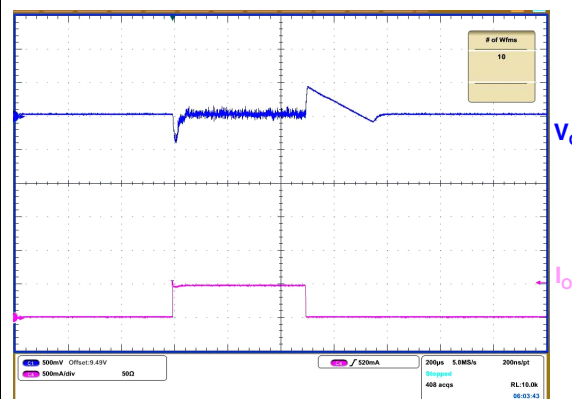


Figure 24. Inductor current



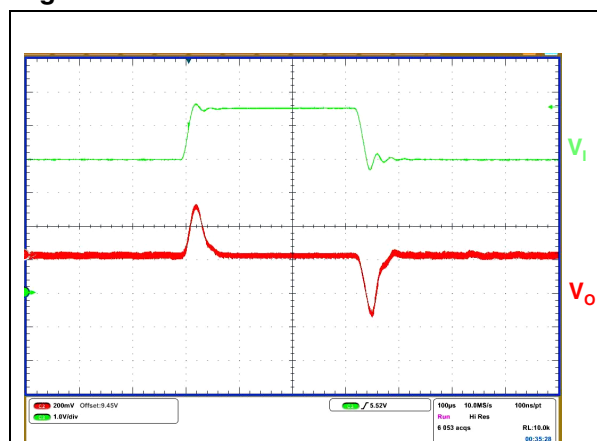
$V_i = 5V, V_{INH} = 2V, L = 4.7\mu H, C_i = C_o = 10\mu F, \text{No Load}, T = 25^\circ C$

Figure 25. Load transient



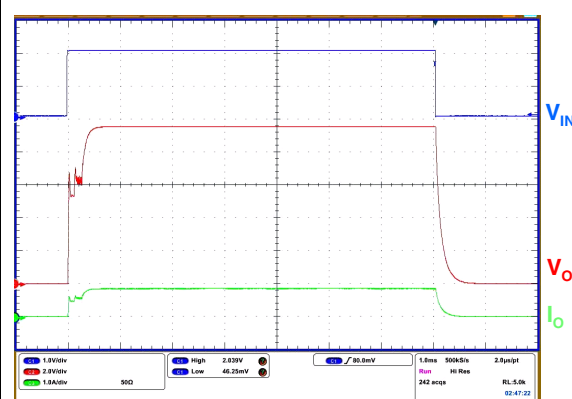
$V_i = V_{INH} = 5V, I_o = \text{from } 10\text{mA to } 500\text{mA}$

Figure 26. Line transient



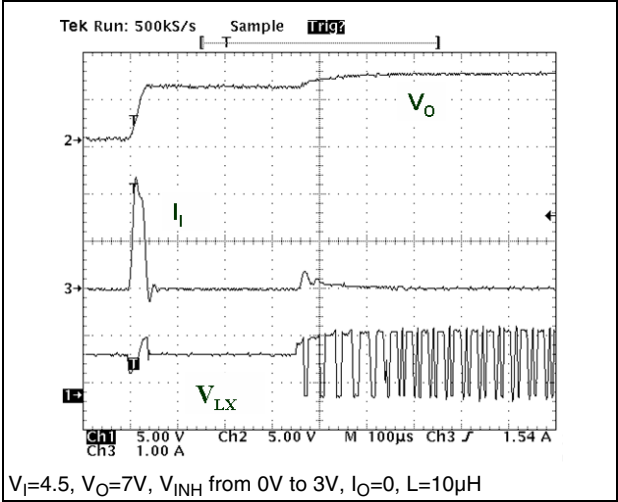
$V_i = V_{INH} \text{ from } 4V \text{ to } 5.5V, I_o = 500\text{mA}, 20\mu s$

Figure 27. INH transient



$V_i = 6, V_{INH} \text{ from } 0V \text{ to } 2V, I_o = 1A$

Figure 28. Inrush current

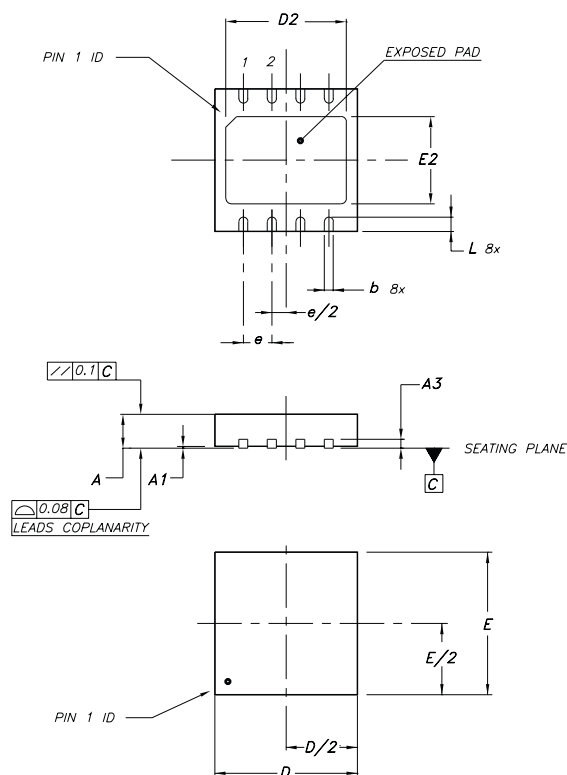


## 7 Package mechanical data

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

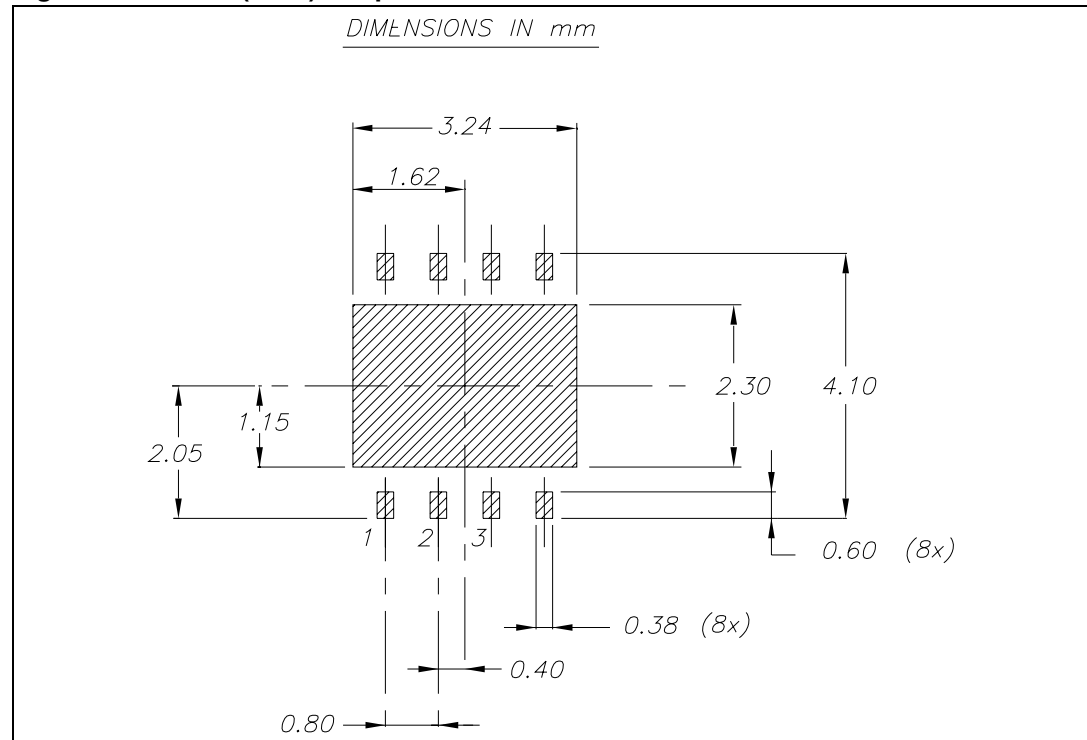
## DFN8 (4x4) Mechanical Data

| Dim. | mm.  |      |      | inch. |       |       |
|------|------|------|------|-------|-------|-------|
|      | Min. | Typ. | Max. | Min.  | Typ.  | Max.  |
| A    | 0.80 | 0.90 | 1.00 | 0.031 | 0.035 | 0.039 |
| A1   | 0    | 0.02 | 0.05 | 0     | 0.001 | 0.002 |
| A3   |      | 0.20 |      |       | 0.008 |       |
| b    | 0.23 | 0.30 | 0.38 | 0.009 | 0.012 | 0.015 |
| D    | 3.90 | 4.00 | 4.10 | 0.154 | 0.157 | 0.161 |
| D2   | 2.82 | 3.00 | 3.23 | 0.111 | 0.118 | 0.127 |
| E    | 3.90 | 4.00 | 4.10 | 0.154 | 0.157 | 0.161 |
| E2   | 2.05 | 2.20 | 2.30 | 0.081 | 0.087 | 0.091 |
| e    |      | 0.80 |      |       | 0.031 |       |
| L    | 0.40 | 0.50 | 0.60 | 0.016 | 0.020 | 0.024 |



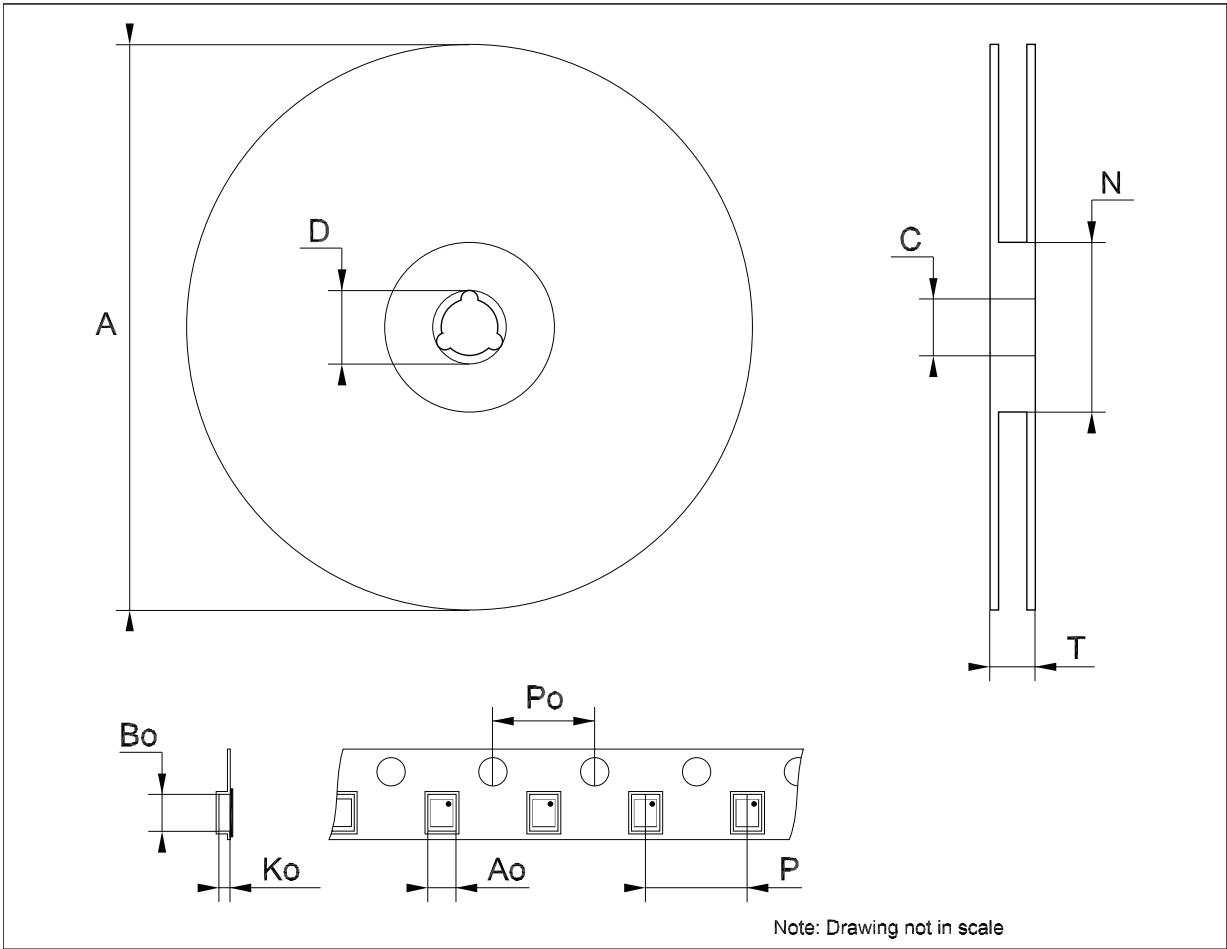
7869653B

**Figure 29. DFN8 (4 x 4) footprint recommended data**



Tape & Reel QFNxx/DFNxx (4x4) Mechanical Data

| Dim. | mm.  |      |      | inch. |       |        |
|------|------|------|------|-------|-------|--------|
|      | Min. | Typ. | Max. | Min.  | Typ.  | Max.   |
| A    |      |      | 330  |       |       | 12.992 |
| C    | 12.8 |      | 13.2 | 0.504 |       | 0.519  |
| D    | 20.2 |      |      | 0.795 |       |        |
| N    | 99   |      | 101  | 3.898 |       | 3.976  |
| T    |      |      | 14.4 |       |       | 0.567  |
| Ao   |      | 4.35 |      |       | 0.171 |        |
| Bo   |      | 4.35 |      |       | 0.171 |        |
| Ko   |      | 1.1  |      |       | 0.043 |        |
| Po   |      | 4    |      |       | 0.157 |        |
| P    |      | 8    |      |       | 0.315 |        |





## 8 Revision history

Table 7. Document revision history

| Date        | Revision | Changes                                                                                   |
|-------------|----------|-------------------------------------------------------------------------------------------|
| 24-May-2007 | 1        | Initial release.                                                                          |
| 01-Feb-2012 | 2        | Modified: <a href="#">Figure 8 on page 8.</a><br>Removed: Table 6, Figures 24, 25 and 26. |

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