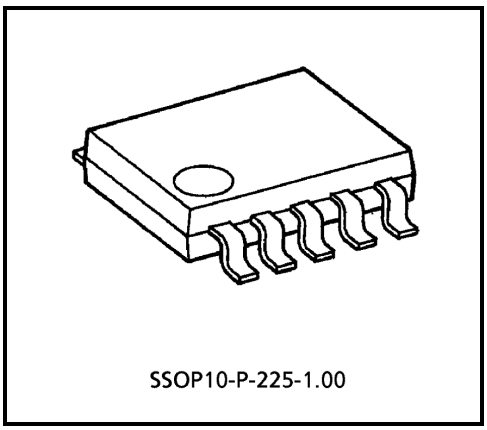
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

# TA8161F

DC / DC Converter System IC For Power Supply

The TA8161F is a DC / DC converter system IC, which is developed for supplying a voltage (for 2.5V or 5V) for CMOS IC etc.
It is especially suitable for low voltage operation, and for power supply and back−up of speech recording / playback LSIs, with only one or two dry batteries.

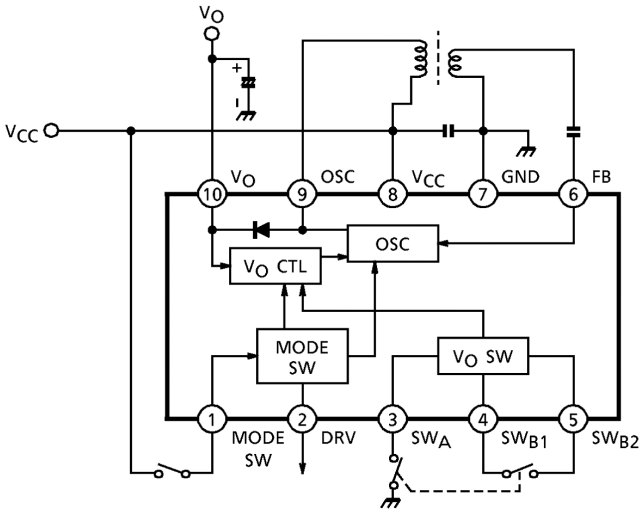



Weight: 0.09g (typ.)

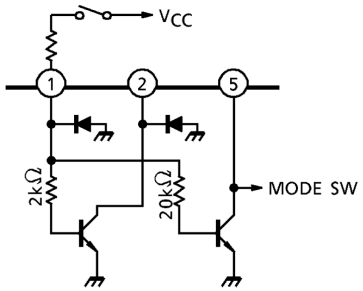
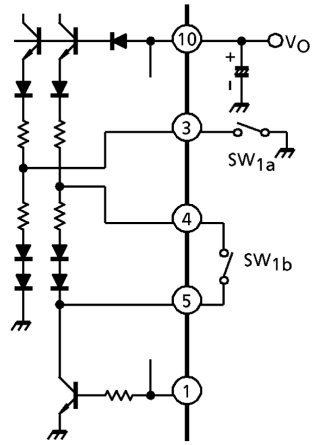
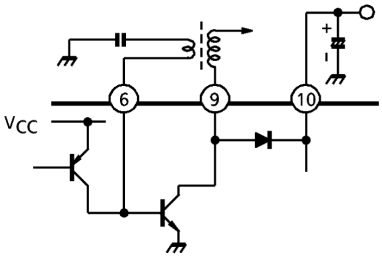
## Features

- Output voltage can be switched over to 2.5V or 5V
  $V_O$ = 2.5V mode (by one dry−battery)
  $V_O$ = 5V mode (by one or two dry−batteries)
- Built−in backup mode with a very low power dissipation
  $V_{CC}$ = 1.2V, Ta = 25°C, $I_O$ = 0
  $I_{CC1}$ = 50μA (typ.)..... $V_O$ = 5V mode
  $I_{CC2}$ = 30μA (typ.)..... $V_O$ = 2.5V mode
- Built−in mode switch (back up mode / power supply mode)
- Excellent power efficiency, by blocking oscillation
- Output current ($V_{CC}$ = 1.2V, Ta = 25°C)
  $I_{O1}$ = 11mA (typ.)..... $V_O$ = 5V mode
  $I_{O2}$ = 22mA (typ.)..... $V_O$ = 2.5V mode
- Operating supply voltage range (Ta = 25°C)
  $V_{CC2\ (opr)}$ = 0.9~4V ($V_O$ = 5V mode)
  $V_{CC1\ (opr)}$ = 0.9~2.2V ($V_O$ = 2.5V mode)

## Block Diagram



## Terminal Explanation

<table>
<tr><th colspan="2">Terminal</th><th rowspan="2">Function</th><th rowspan="2">Internal Circuit</th></tr>
<tr><th>No.</th><th>Name</th></tr>
<tr><td>1</td><td>Mode SW</td><td>Mode switch<br>$V_{CC}$: Power supply mode<br>GND / OPEN: Back up mode</td><td rowspan="2"> 
</td></tr>
<tr><td>2</td><td>DRV</td><td>Current driver<br>This terminal can be used for current driver, because it is synchronized with mode switch. In case that this circuit isn't used, this terminal should be connected with $SW_{B2}$ (pin(5)) terminal, as a result low voltage operation is improved.</td></tr>
<tr><td>3</td><td>$SW_A$</td><td rowspan="3">Change–over switch of output voltage.<br><table><tr><th></th><th>$SW_{1a}$</th><th>$SW_{1b}$</th></tr><tr><td>5V mode</td><td colspan="2">OPEN</td></tr><tr><td>2.5V mode</td><td colspan="2">Short</td></tr></table>To prevent parasitic oscillation, external capacitor should be connected between $SW_{B1}$ and $V_{CC}$. Because the $SW_{B1}$ terminal is high impedance.</td><td rowspan="3"> 
</td></tr>
<tr><td>4</td><td>$SW_{B1}$</td></tr>
<tr><td>5</td><td>$SW_{B2}$</td></tr>
<tr><td>6</td><td>FB</td><td rowspan="3">Flyback converter</td><td rowspan="3"> 
</td></tr>
<tr><td>9</td><td>OSC</td></tr>
<tr><td>10</td><td>$V_O$</td></tr>
<tr><td>7</td><td>GND</td><td>—</td><td>—</td></tr>
<tr><td>8</td><td>$V_{CC}$</td><td>—</td><td>—</td></tr>
</table>

## Application Note

1. Mode explanation

| IC Mode | | $V_O$ SW | | Mode SW | Current Driver Pin(2) |
|---|---|---|---|---|---|
| | | $SW_{1A}$ | $SW_{1B}$ | $SW_2$ | |
| $V_O$ = 2.5V | Power supply mode | GND | Short | $V_{CC}$ | ON |
| | Back up mode | | | OPEN / GND | OFF |
| $V_O$ = 5V | Power supply mode | OPEN | OPEN | $V_{CC}$ | ON |
| | Back up mode | | | OPEN / GND | OFF |

2. Operation of back up mode

In case of back up mode, this IC is operated by blocking oscillation. This operation is described as follows.

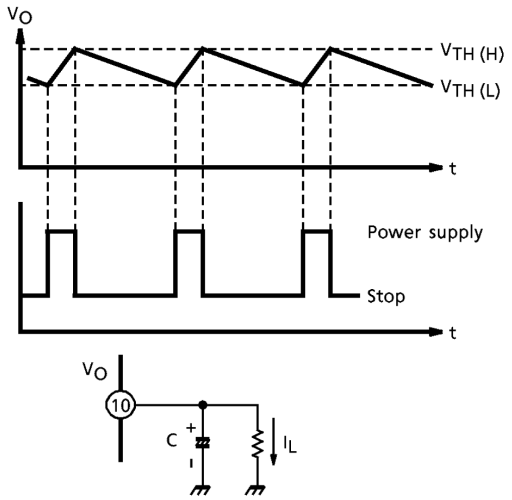
(1) When potential of output $V_O$ reaches $V_{TH\ (L)}$, the $V_O$ control circuit in the IC starts the converter circuit.

(2) When the converter is started, the capacitor C connected with $V_O$ terminal is charged and when $V_O$ reaches $V_{TH\ (H)}$, the converter is stopped.

(3) The charge of the capacitor C is consumed gradually by load current and comes close to $V_{TH\ (L)}$.

This IC is performs the blocking oscillation by repeating (1) ~ (3) above.

The frequency of this blocking oscillation depends on load current and a capacitor connected with $V_O$ terminal.




3. Mode SW

It is necessary to connect an external pull–down resistor with the terminal of MODE SW (pin(1)), in case that this IC operates in power supply mode due to external noise etc, even though this IC is back up mode.

4. Current driver terminal

In case that current driver terminal (pin(2)) isn't used, this terminal should be connected with $SW_{B2}$ terminal (pin(5)), as a result low voltage operation is improved. When this terminal is kept open, there is a probability that the MODE SW circuit doesn't operate normally.

5. Radiation

It is necessary to connect a L / C or R / C filter, in case that output noise is large due to radiation etc. Because this IC has adopted a converter circuit of flyback system.

6. $V_O$ and $V_{CC}$

Supply voltage shoule not be high than output voltage, because this IC is boost type DC / DC converter.

## Maximum Ratings (Ta = 25°C)

| Characteristic | Symbol | Rating | Unit |
|---|---|---|---|
| Supply voltage | $V_{CC}$ | 5 | V |
| Output voltage | $V_O$ | 8 | V |
| Output current | $I_O$ | 40 | mA |
| Power dissipation | $P_D$ (Note) | 400 | mW |
| Operating temperature | $T_{opr}$ | −25~75 | °C |
| Storage temperature | $T_{stg}$ | −55~150 | °C |

(Note) Derated above Ta = 25°C in the proportion of 3.2mW / °C

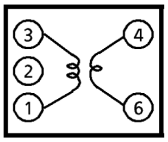
## Electrical Characteristics

(unless otherwise specified, $V_{CC}$ = 1.2V, Ta = 25°C, $SW_2$: a, $SW_3$: a)

| | Characteristic | Symbol | Test Cir-cuit | $SW_1$ | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|---|---|
| Power supply mode | Quiescent supply current | $I_{CCQ1}$ | — | a | $I_O$ = 0 | — | 0.5 | 1.0 | mA |
| | | $I_{CCQ2}$ | | b | | — | 0.3 | 0.8 | |
| | Boosted output voltage 1 | $V_{O11}$ | | a | $I_O$ = 5mA | 4.6 | 5.0 | 5.3 | V |
| | | $V_{O12}$ | | | $I_O$ = 5mA, $V_{CC}$ = 1V | 4.6 | 5.0 | 5.3 | |
| | $V_{O1}$ temperature coefficient | $\Delta V_{O1\ /\ T}$ | | | $I_O$ = 5mA | — | −4.4 | — | mV /°C |
| | $V_{O1}$ maximum output current | $I_{O1\ max1}$ | | | $V_{CC}$ = 1.2V, $\Delta V_{O1}$ =0.5V,with respect to standard $I_{O1}$ = 5mA | 8 | 11 | — | mA |
| | | $I_{O1\ max2}$ | | | $V_{CC}$ = 1.5V | 10 | 17 | — | |
| | Boosted output voltage 2 | $V_{O21}$ | | b | $I_O$ = 10mA | 2.2 | 2.5 | 2.8 | V |
| | | $V_{O22}$ | | | $V_{CC}$ = 1V, $I_O$ = 10mA | 2.2 | 2.5 | 2.8 | |
| | $V_{O2}$ temperature coefficient | $\Delta V_{O2\ /\ T}$ | | | $I_O$ = 10mA | — | −4.6 | — | mV /°C |
| | $V_{O2}$ maximum output current | $I_{O2\ max}$ | | | $\Delta V_{O2}$ = 0.3V, with respect to standard $I_{O2}$ = 10mA | 16 | 22 | — | mA |
| Back up mode | Quiescent supply current | $I_{BU1}$ | — | a | $SW_2$: b, $I_O$ = 0 | — | 50 | — | μA |
| | | $I_{BU2}$ | | b | | — | 30 | — | |
| | OSC start output voltage1 | $V_{TH11}$ | | a | $SW_2$: b, $I_O$ = 0 | 4.0 | 4.3 | 4.6 | V |
| | OSC stop output voltage1 | $V_{TH12}$ | | | | 4.6 | 5.0 | 5.3 | |
| | OSC start output voltage2 | $V_{TH21}$ | | b | $SW_2$: b, $I_O$ = 0 | 1.8 | 2.2 | 2.4 | V |
| | OSC stop output voltage2 | $V_{TH22}$ | | | | 2.2 | 2.5 | 2.7 | |
| OSC transistor saturation voltage | | $V_{DRV}$ | — | b | $V_{CC}$ = 0.9V, $SW_3$: b<br>$I_{DRV}$ = 0.5mA | — | 50 | 150 | mV |
| Mode SW | Power supply mode on current | $I_{mode}$ | — | b | $V_{CC}$ = 0.9V, $SW_2$: c<br>$SW_3$: b<br>$V_{O1} \geq$ 2V, $V_{DRV} \leq$ 50mV | 10 | — | — | μA |
| | Back up mode on voltage | $V_{mode}$ | — | b | $V_{CC}$ = 0.9V, $SW_2$: d<br>$SW_3$: b<br>$V_{DRV} \geq$ 0.8V | 0 | — | 0.3 | V |

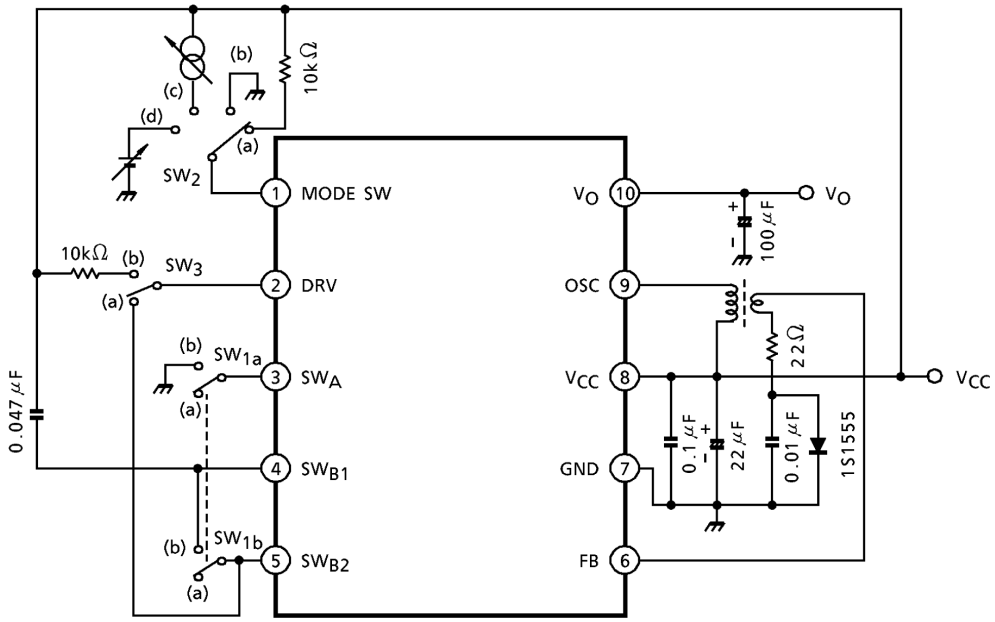
## Coil Data

| Test Frequency | L (μH) | $Q_o$ | Turn | | Wire (mmϕ) | Reference |
|---|---|---|---|---|---|---|
| | 1–3 | | 1–3 | 4–6 | | |
| 796kHz | 200 | 35 | 72 | 42 | 0.10 UEW | Sumida electric co., ltd, 6300–131A |



(Bottom of view)

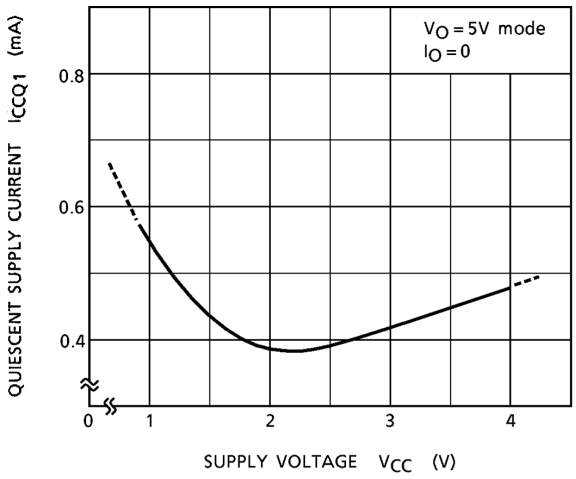
## Test Circuit



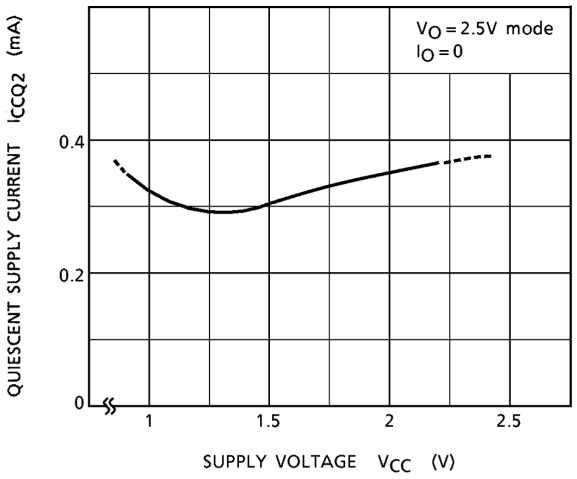
## Characteristic Curves

Unless Otherwise Specified $V_{CC}$ = 1.2V, Ta = 25°C, $I_O$ = 0

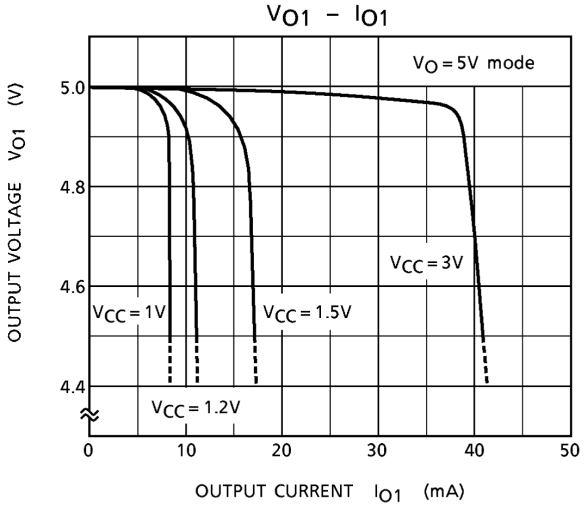
$I_{CCQ1}$ – $V_{CC}$



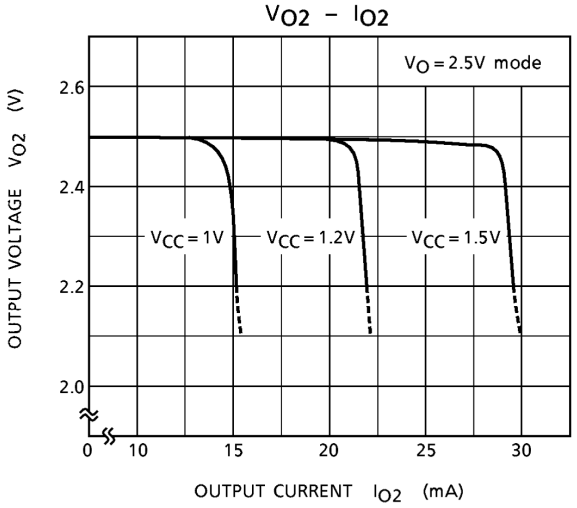

$I_{CCQ2}$ – $V_{CC}$



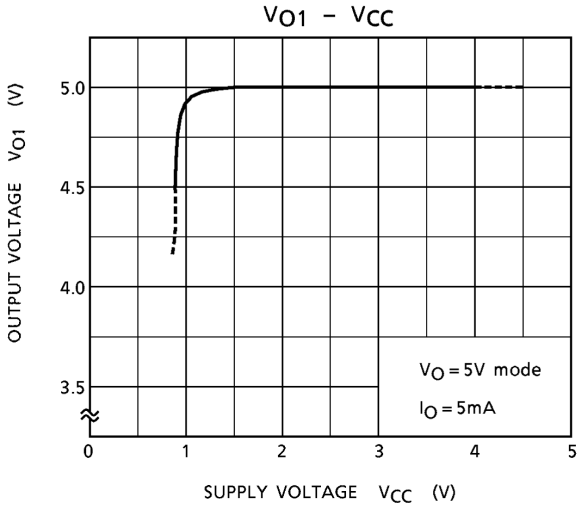

$V_{O1}$ – $I_{O1}$



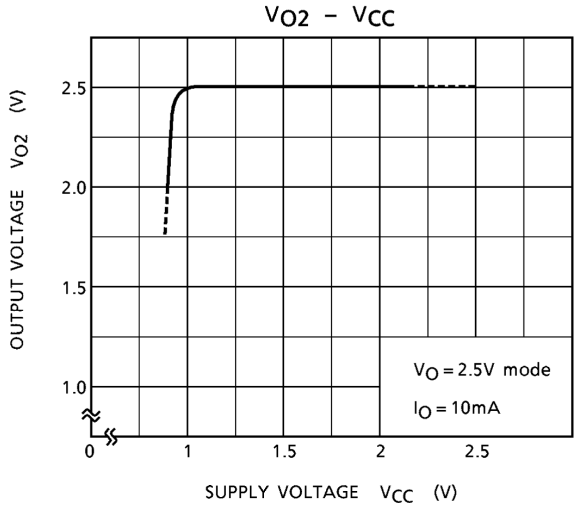

$V_{O2}$ – $I_{O2}$



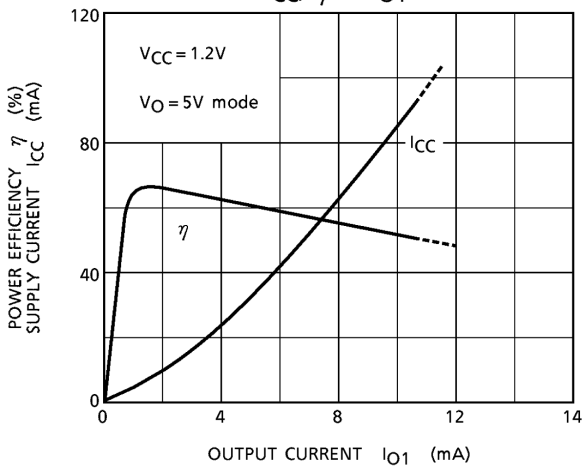

$V_{O1}$ – $V_{CC}$



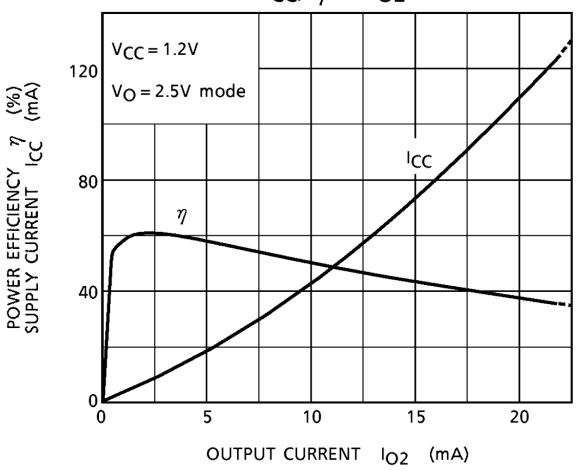

$V_{O2}$ – $V_{CC}$



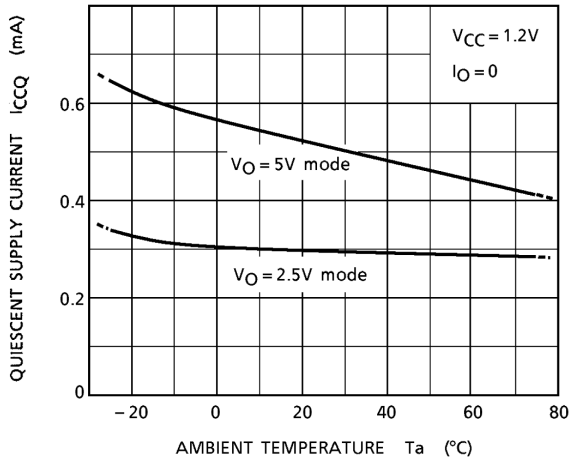
$I_{CC}, \eta - I_{O1}$



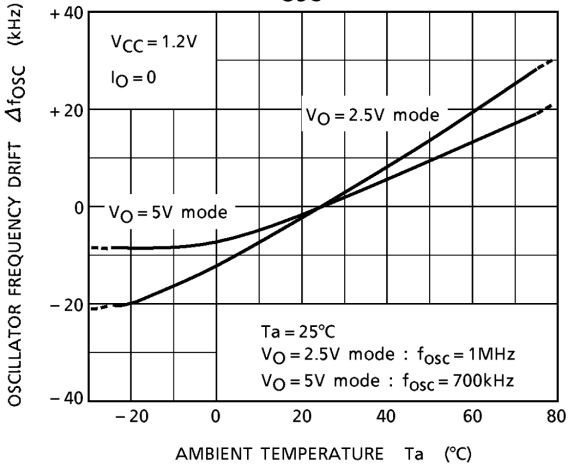

$I_{CC}, \eta - I_{O2}$



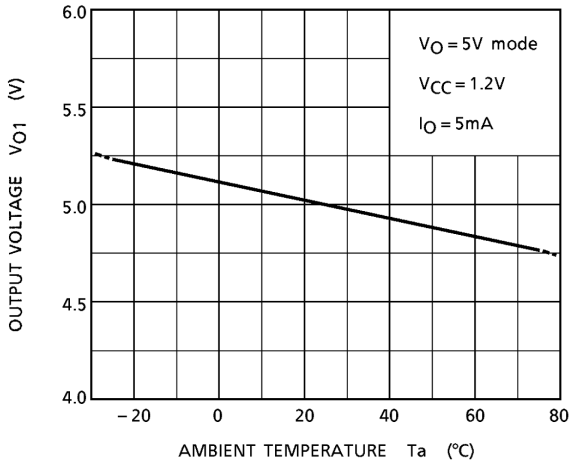

$I_{CCQ}$ – Ta



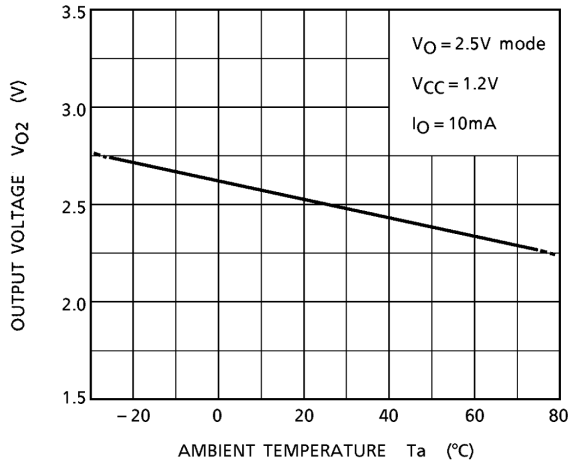

$\Delta f_{OSC}$ – Ta




$V_{O1}$ – Ta

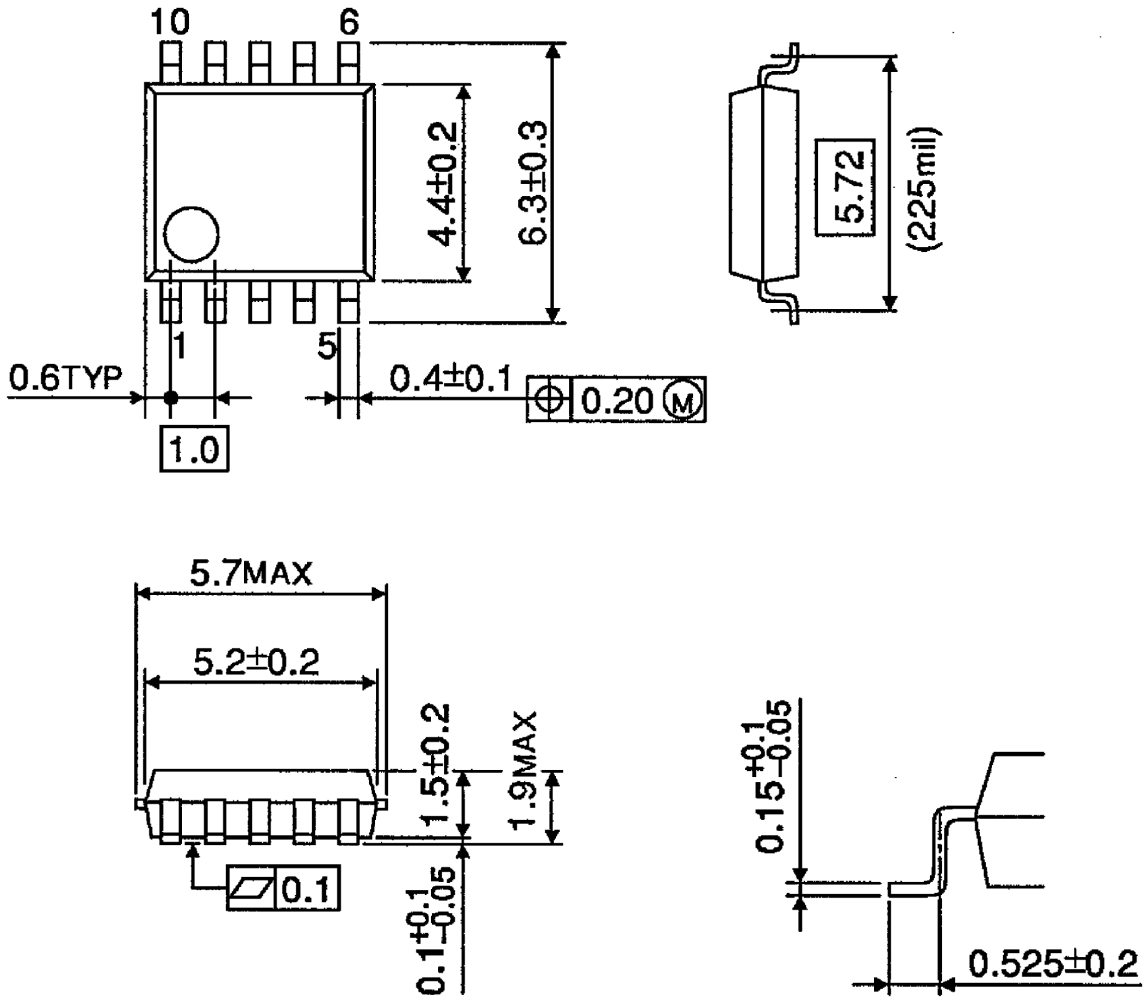



$V_{O2}$ – Ta



**Package Dimensions**

SSOP10-P-225-1.00 Unit : mm




Weight: 0.09g (typ.)

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