# IFX20002

## Low dropout voltage regulator

RoHS


## Features

- Two output voltage versions: 3.3 V, 5.0 V
- Low drop voltage ≤ 300 mV over the full temperature range
- Output current: 30 mA
- Inhibit function
- Low quiescent current
- Stable with ceramic output capacitor
- Input voltage up to 45 V
- Wide temperature range: $T_j$ = -40°C to +125°C
- Output protected against short circuit
- Overtemperature protection
- Reverse polarity protection
- Very small and thermally enhanced package
- Green Product (RoHS compliant)

## Potential applications

- Manufacturing automation
- Appliances
- Network routers

The IFX20002 is not qualified and manufactured according to the requirements of Infineon Technologies with regards to automotive and/or transportation applications. For automotive applications please refer to the Infineon TLx (TLE, TLS, TLF, ...) voltage regulator products.

## Product validation

Qualified for industrial applications according to the relevant tests of JEDEC.

## Description

The IFX20002 is a monolithic integrated low drop voltage regulator in very small SMD package PG-SCT595-5. It is designed to supply various loads (e.g. microcontrollers, sensors, or as stand-by supply, etc.) under severe conditions. Therefore the device is equipped with additional protection functions against overload, short circuit and reverse polarity. In case of an overtemperature condition the regulator is automatically turned off by the integrated thermal protection circuit.

Input voltages up to 40 V are regulated to $V_{Q,nom}$ = 3.3 V (V33 version) or 5.0 V (V50 version). The output is able to drive a load of 30 mA while it regulates the output voltage within a 4% accuracy. To save energy the device can be switched to stand-by mode via an inhibit input which causes the current consumption to drop below 5 µA.

| Type | Package | Marking |
|---|---|---|
| IFX20002MBV33 | PG-SCT595-5 | E3 |
| IFX20002MBV50 | PG-SCT595-5 | E5 |

# Table of contents

# 1 Block diagram

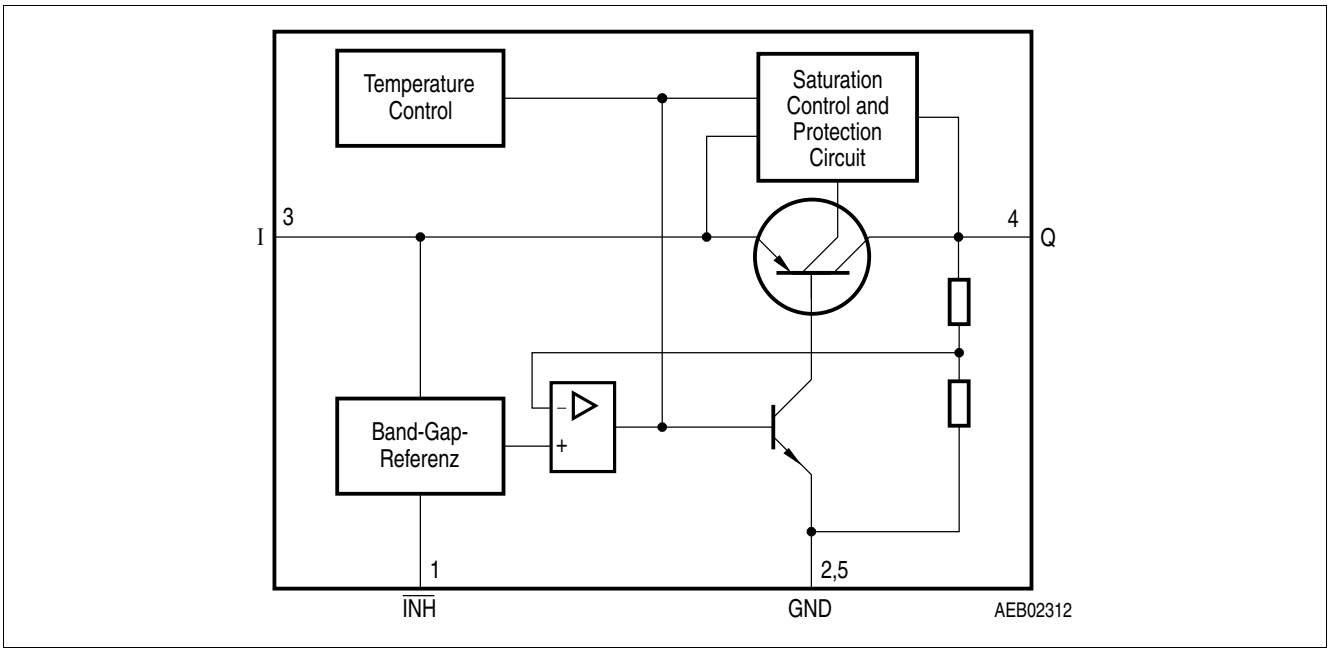



**Figure 1 Block diagram**

# 2 Pin configuration

## 2.1 Pin assignment

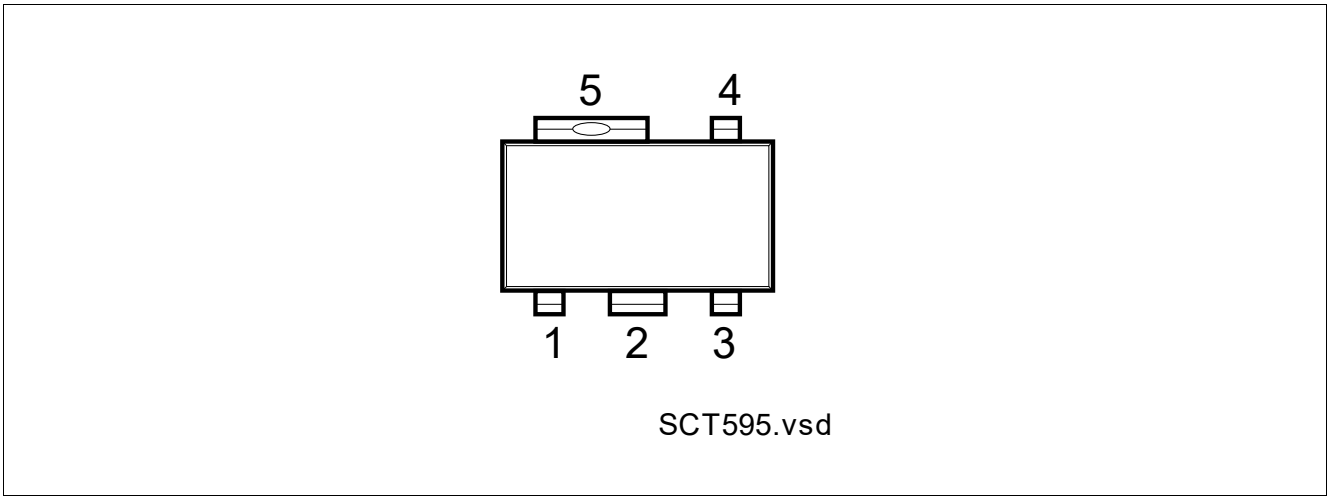



**Figure 2 Pin configuration (top view)**

## 2.2 Pin definitions and functions

**Table 1 Pin definitions and functions**

| Pin | Symbol | Function |
|---|---|---|
| 1 | $\overline{\text{INH}}$ | **Inhibit input**<br>High level to turn on the IC. |
| 2 | GND | **Ground**<br>Connected to pin 5. |
| 3 | I | **Input voltage** |
| 4 | Q | **Output voltage**<br>Must be blocked with a ceramic capacitor $C_Q \geq 3.3\ \mu F$, $ESR \leq 2\ \Omega$. |
| 5 | GND | **Ground**<br>Connected to pin 2. |

# 3 General product characteristics

## 3.1 Absolute maximum ratings

**Table 2 Absolute maximum ratings[1)]**

$T_j$ = -40°C to 150°C; all voltages with respect to ground, positive current flowing into pin (unless otherwise specified)

| Parameter | Symbol | Values | | | Unit | Note or Test Condition | Number |
|---|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | | |
| **Input** | | | | | | | |
| Voltage | $V_I$ | -42 | – | 45 | V | – | P_3.1.1 |
| Current | $I_I$ | – | – | – | | 2) | |
| **Output** | | | | | | | |
| Voltage | $V_Q$ | -0.3 | – | 30 | V | – | P_3.1.2 |
| Current | $I_I$ | – | – | – | | 2) | |
| **Inhibit** | | | | | | | |
| Voltage | $V_{\overline{INH}}$ | -42 | – | 45 | V | – | P_3.1.3 |
| Current | $I_{\overline{INH}}$ | -500 | – | 2) | µA | – | P_3.1.4 |
| | | -5 | – | 5 | mA | -0.3 V ≤ $V_I$ ≤ 45 V; $t_p$ < 1 ms | P_3.1.5 |
| **Temperatures** | | | | | | | |
| Junction temperature | $T_j$ | -40 | – | 150 | °C | – | P_3.1.6 |
| Storage temperature | $T_{stg}$ | -50 | – | 150 | °C | – | P_3.1.7 |
| **ESD susceptibility** | | | | | | | |
| ESD resistivity to GND | $V_{ESD}$ | -2 | – | 2 | kV | HBM[3)] | P_3.1.8 |

1) Not subject to production test, specified by design.
2) Internally limited.
3) ESD susceptibility, HBM according to ANSI/ESDA/JEDEC JS-001 (1.5 kΩ, 100pF).

**Notes**

1. *Stresses above the ones listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.*
2. *Integrated protection functions are designed to prevent IC destruction under fault conditions described in the data sheet. Fault conditions are considered as "outside" normal operating range. Protection functions are not designed for continuous repetitive operation.*

## 3.2 Functional range

**Table 3 Functional range**

| Parameter | Symbol | Values | | | Unit | Note or Test Condition | Number |
|---|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | | |
| Input voltage | $V_I$ | 4.0 | – | 45 | V | IFX20002MBV33 | P_3.2.1 |
| | | 5.5 | – | 45 | V | IFX20002MBV50 | P_3.2.2 |
| Inhibit voltage | $V_{\overline{INH}}$ | -0.3 | – | 40 | V | – | P_3.2.3 |
| Junction temperature | $T_j$ | -40 | – | 125 | °C | – | P_3.2.4 |

*Note: Within the functional or operating range, the IC operates as described in the circuit description. The electrical characteristics are specified within the conditions given in the electrical characteristics table.*

## 3.3 Thermal resistance

*Note: This thermal data was generated in accordance with JEDEC JESD51 standards. For more information, go to **www.jedec.org**.*

**Table 4 Thermal resistance**

| Parameter | Symbol | Values | | | Unit | Note or Test Condition | Number |
|---|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | | |
| Junction to ambient | $R_{thJA}$ | – | 81 | – | K/W | 2s2p board[1)] | P_3.3.1 |
| | | – | 217 | – | K/W | Footprint only[2)] | P_3.3.2 |
| | | – | 117 | – | K/W | 300 mm² PCB heatsink area[2)] | P_3.3.3 |
| | | – | 103 | – | K/W | 600 mm² PCB heatsink area[2)] | P_3.3.4 |
| Junction to soldering point | $R_{thJSP}$ | – | 30 | – | K/W | Pins 2, 5 fixed to $T_A$ | P_3.3.5 |

1) Specified $R_{thJA}$ value is according to Jedec JESD51-2,-5,-7 at natural convection on FR4 2s2p board; The product (chip+package) was simulated on a 76.2 × 114.3 × 1.5 mm³ board with 2 inner copper layers (2 × 70 µm Cu, 2 × 35 µm Cu). Where applicable a thermal via array under the exposed pad contacted the first inner copper layer.

2) Package mounted on PCB FR4; 80 × 80 × 1.5 mm³, 35 µm Cu, 5 µm Sn; horizontal position; zero airflow. Not subject to production test; specified by design.

# 4 Electrical characteristics

## 4.1 Electrical characteristics voltage regulator

**Table 5 Electrical characteristics voltage regulator**

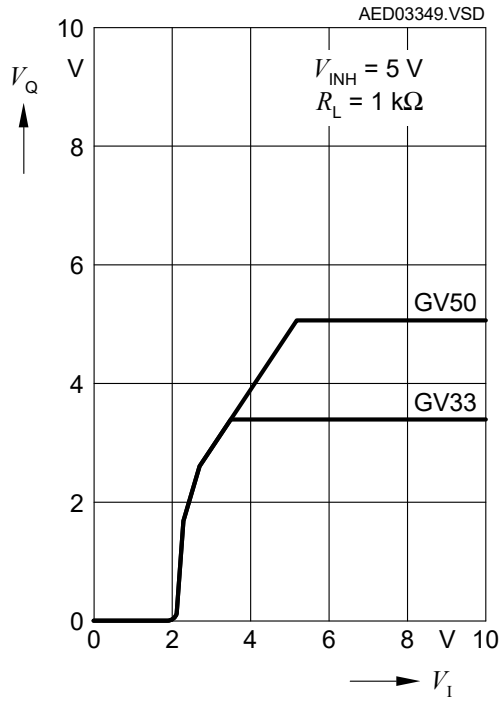
$V_I$ = 13.5 V; $V_{\overline{INH}}$ > 2.5 V; $T_j$ = -40°C to +125°C; all voltages with respect to ground (unless otherwise specified)

| Parameter | Symbol | Values | | | Unit | Note or Test Condition | Number |
|---|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | | |
| Output voltage IFX20002MBV33 | $V_Q$ | 3.17 | 3.30 | 3.43 | V | 1 mA ≤ $I_Q$ ≤ 30 mA | P_5.1.1 |
| | | 3.17 | 3.30 | 3.43 | V | $I_Q$ = 10 mA; 4.3 V ≤ $V_I$ ≤ 40 V | P_5.1.2 |
| Output voltage IFX20002MBV50 | $V_Q$ | 4.80 | 5.00 | 5.20 | V | 1 mA ≤ $I_Q$ ≤ 30 mA | P_5.1.18 |
| | | 4.80 | 5.00 | 5.20 | V | $I_Q$ = 10 mA; 6 V ≤ $V_I$ ≤ 40 V | P_5.1.19 |
| Output current limitation | $I_Q$ | 30 | – | – | mA | 1) | P_5.1.3 |
| Dropout voltage 1) | $V_{dr}$ | – | 250 | 300 | mV | $I_Q$ = 20 mA | P_5.1.4 |
| Output capacitor | $C_Q$ | 3.3 | – | – | µF | ESR ≤ 2 Ω at 10 kHz | P_4.1.2 |
| Current consumption $I_q = I_I - I_Q$ | $I_q$ | – | 2 | 5.2 | mA | $I_Q$ < 30 mA | P_5.1.6 |
| | | – | 130 | 170 | µA | $I_Q$ < 0.1 mA; $T_j$ < 85°C | P_5.1.7 |
| Quiescent current (stand-by) $I_q = I_I - I_Q$ | $I_q$ | – | – | 1 | µA | $V_{\overline{INH}}$ = 0.4 V; $T_j$ < 85°C | P_5.1.8 |
| | | – | – | 5 | µA | $V_{\overline{INH}}$ = 0.4 V | P_5.1.9 |
| Load regulation | $\Delta V_Q$ | – | 17 | 50 | mV | 1 mA < $I_Q$ < 25 mA; $T_j$ = 25°C; IFX20002MBV50 | P_5.1.21 |
| | | – | 14 | 40 | mV | 1 mA < $I_Q$ < 25 mA; $T_j$ = 25°C; IFX20002MBV33 | P_5.1.11 |
| Line regulation | $\Delta V_Q$ | – | 10 | 25 | mV | $V_I$ = ($V_{Q,nom}$ + 0.5 V) to 36 V; $I_Q$ = 1 mA; $T_j$ = 25°C | P_5.1.12 |
| Power supply ripple rejection | PSRR | – | 60 | – | dB | $f_r$ = 100 Hz; $V_r$ = 0.5 $V_{pp}$ | P_5.1.13 |
| **Logic Inhibit input** | | | | | | | |
| Inhibit, turn-on voltage | $V_{\overline{INH},high}$ | – | – | 2.2 | V | $V_Q$ > 0.95 × $V_{Q,nom}$ | P_5.1.14 |
| Inhibit, turn-off voltage | $V_{\overline{INH},low}$ | 0.4 | – | – | V | $V_Q$ < 0.1 V | P_5.1.15 |
| H-input current | $V_{\overline{INH},high}$ | – | 8 | 12 | µA | $V_{\overline{INH}}$ = 5 V | P_5.1.16 |
| L-input current | $V_{\overline{INH},low}$ | -2 | – | 2 | µA | $V_{\overline{INH}}$ = 0 V | P_5.1.17 |

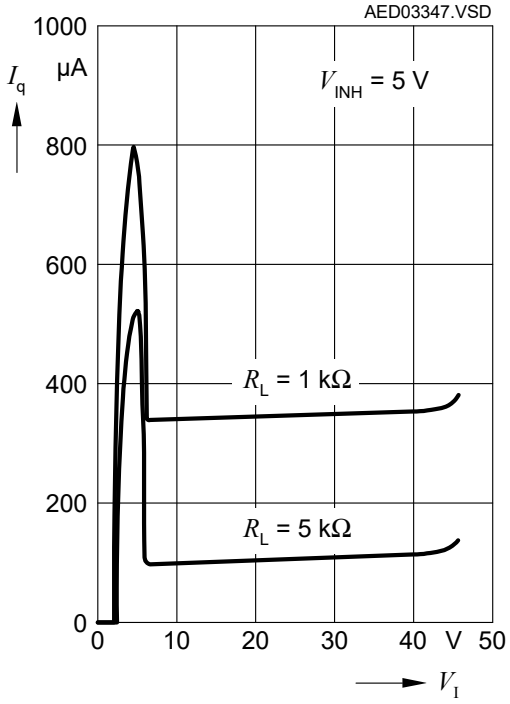
1) Measured when the output voltage $V_Q$ has dropped 100 mV from the nominal value.

## 4.2 Typical performance characteristics voltage regulator

**Output voltage $V_Q$ vs. input voltage $V_I$**




**Current consumption $I_q$ vs. input voltage $V_I$**



# 5 Application information

*Note: The following information is given as a hint for the implementation of the device only and shall not be regarded as a description or warranty of a certain functionality, condition or quality of the device.*

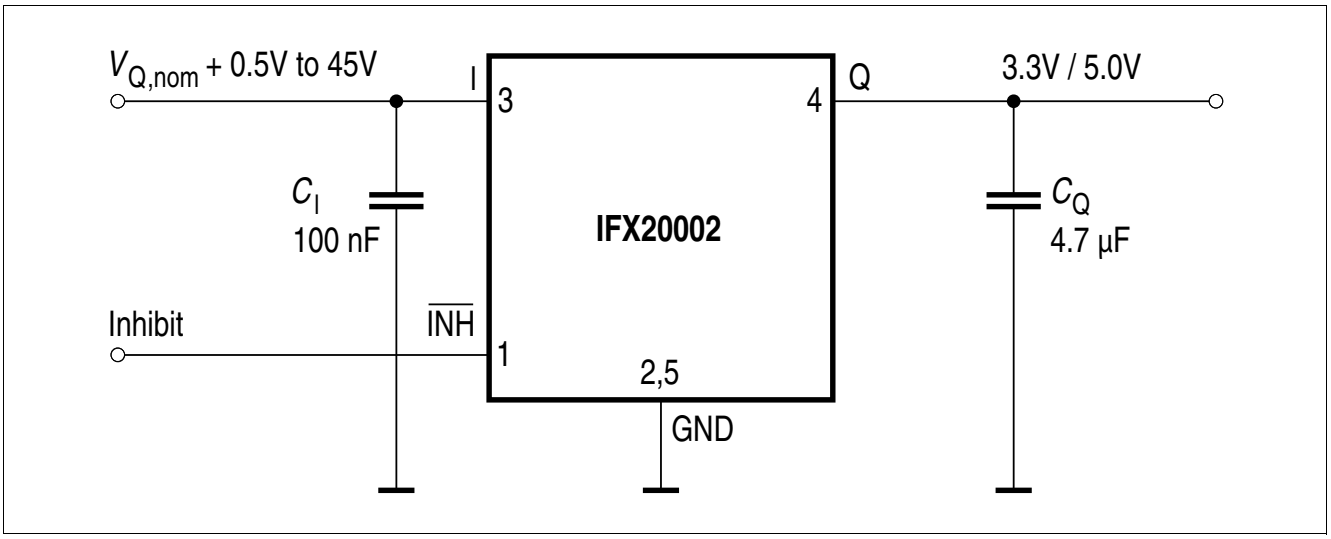



**Figure 3 Application diagram**

The output voltage of the IFX20002 is divided and compared to an internal reference of 2.5 V typical. A regulation loop controls the output to achieve a stabilized output voltage.

**Figure 3** shows a typical application circuit. In order to maintain the stability of the control loop the IFX20002 output requires an output capacitor $C_Q$ of at least 3.3 µF with a maximum permissible ESR of 2 Ω. It is recommended to use a multi layer ceramic capacitor for $C_Q$, e.g. the TDK C3216X7R1C475M with a nominal capacitance of 4.7 µF. Aluminum electrolytic as well as tantalum capacitors do not cover the required ESR range over the full operating temperature range of $T_j$ = -40°C to +125°C.

At the input of the regulator a capacitor is required for compensating line influences (100 nF ceramic capacitor recommended). A resistor of approximately 1 Ω in series with the input capacitor $C_I$ can dampen oscillations that could occur due to the input line inductance and the input capacitor. If the regulator is sourced via long input lines of several meters it is recommended to place an additional electrolytic capacitor ≥ 47 µF at the input.

# 6 Package information

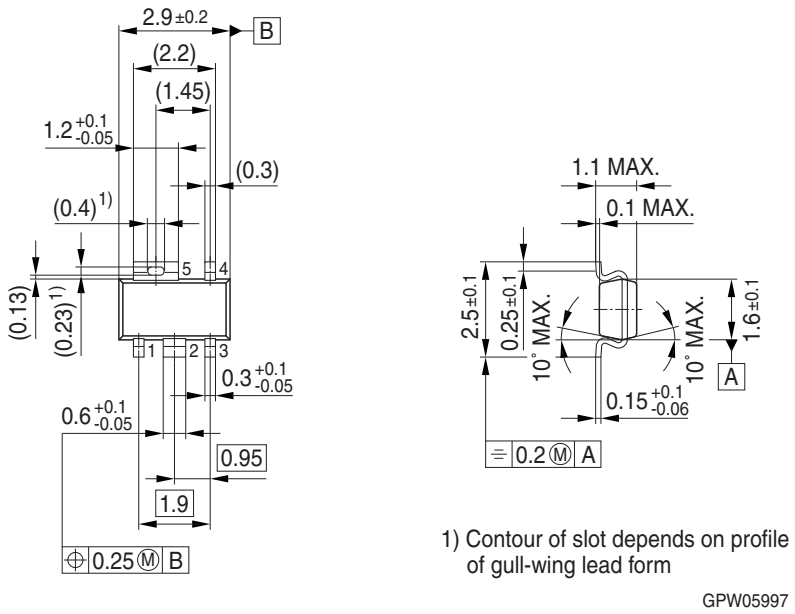



**Figure 4 PG-SCT595-5[1)]**

### Green Product (RoHS compliant)

To meet the world-wide customer requirements for environmentally friendly products and to be compliant with government regulations the device is available as a green product. Green products are RoHS-compliant (i.e. Pb-free finish on leads and suitable for Pb-free soldering according to IPC/JEDEC J-STD-020).

### Further information on packages

**https://www.infineon.com/packages**

1) Dimensions in mm

# 7 Revision history

| Revision | Date | Changes |
|---|---|---|
| 1.10 | 2021-05-11 | Updated layout and structure<br>Editorial changes<br>Corrected typo at PSSR parameter<br>Added TOC |
| 1.0 | 2013-01-12 | Initial Datasheet |

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