

FEATURES

- Dual Channel Ultra Low Dropout Voltage
- Compatible with low ESR MLCC as Input/Output Capacitor
- Good Line and Load Regulation
- Guaranteed Output Current of 300/500mA
- Available in SOP8, SOP8-PP
- Fixed Output Voltage: 1 ~ 5V
- Over-Temperature Protection
- -40 °C to 125 °C Junction Temperature Range

APPLICATION

- LCD TVs and SETTOP Boxes
- Battery Powered Equipments
- Motherboards and Graphic Cards
- Microprocessor Power Supplies
- Peripheral Cards
- High Efficiency Linear Regulators
- Battery Chargers

DESCRIPTION

The TJ5631 of two channels high performance ultra-low dropout linear regulators operates from 2.5V to 5.5V input supply and provides ultra-low dropout voltage with low ground current. These ultra-low dropout linear regulators respond fast to step changes in load which makes them suitable for low voltage micro-processor applications. The TJ5631 is developed on a CMOS process technology which allows low quiescent current operation independent of output load current. This CMOS process also allows the TJ5631 to operate under extremely low dropout conditions.

SOP8 / SOP8-PP

**ORDERING INFORMATION**

| Device | Package |
|------------|---------|
| TJ5631AGD | SOP8 |
| TJ5631BGD | |
| TJ5631CGD | |
| TJ5631DGD | |
| TJ5631EGD | |
| TJ5631FGD | |
| TJ5631HGD | |
| TJ5631AGDP | SOP8-PP |
| TJ5631BGDP | |
| TJ5631CGDP | |
| TJ5631DGDP | |
| TJ5631EGDP | |
| TJ5631FGDP | |
| TJ5631HGDP | |

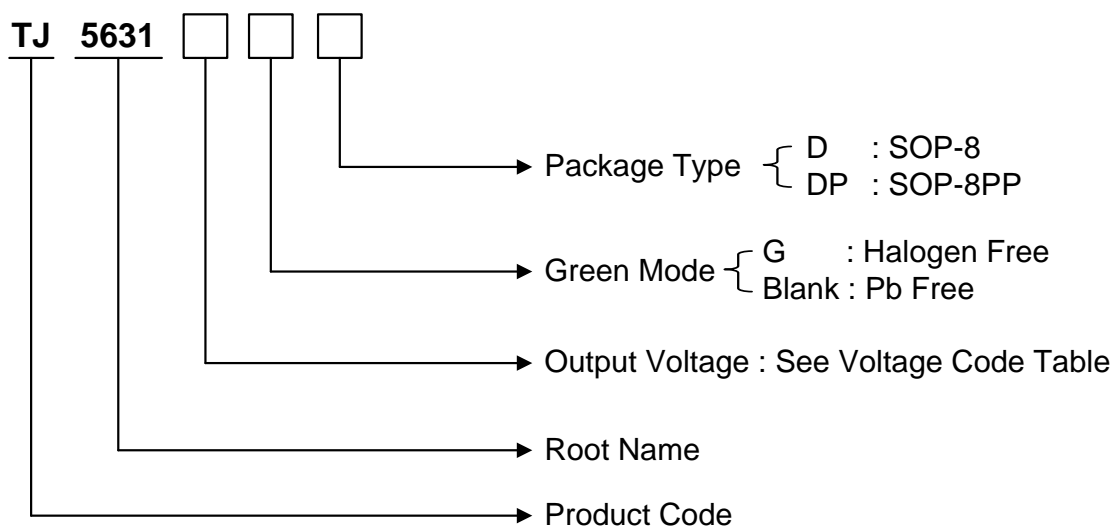
Absolute Maximum Ratings

| CHARACTERISTIC | SYMBOL | MIN. | MAX. | UNIT |
|--------------------------------------|---------------------------------------|------|---------|------|
| Input Supply Voltage (Survival) | V _{IN1} , V _{IN2} | - | 6.5 | V |
| Enable Input Voltage (Survival) | V _{EN1} , V _{EN2} , | - | 6.5 | V |
| Maximum Continuous Output Current | I _{MAX} | - | 300/500 | mA |
| Lead Temperature (Soldering, 5 sec) | T _{SOL} | | 260 | °C |
| Storage Temperature Range | T _{STG} | -65 | 150 | °C |
| Operating Junction Temperature Range | T _{JOPR} | -40 | 125 | °C |
| Package Thermal Resistance * | Θ _{JA-SOP8-PP} | 68 | | °C/W |
| | Θ _{JC-SOP8-PP} | 15 | | |

* Calculated from package in still air, mounted to 2.6mm X 3.5mm(minimum foot print) 2 layer PCB without thermal vias per JESD51 standards.

Ordering Information

| V _{OUT} | Package | Order No. | Description | Package Marking | Status |
|------------------|---------|------------|---------------|-----------------|------------|
| A | SOP8 | TJ5631AGD | Fixed, Enable | TJ5631AG | Contact Us |
| | SOP8-PP | TJ5631AGDP | Fixed, Enable | TJ5631AG | Contact Us |
| B | SOP8 | TJ5631BGD | Fixed, Enable | TJ5631BG | Contact Us |
| | SOP8-PP | TJ5631BGDP | Fixed, Enable | TJ5631BG | Contact Us |
| C | SOP8 | TJ5631CGD | Fixed, Enable | TJ5631CG | Contact Us |
| | SOP8-PP | TJ5631CGDP | Fixed, Enable | TJ5631CG | Contact Us |
| D | SOP8 | TJ5631DGD | Fixed, Enable | TJ5631DG | Contact Us |
| | SOP8-PP | TJ5631DGDP | Fixed, Enable | TJ5631DG | Contact Us |
| E | SOP8 | TJ5631EGD | Fixed, Enable | TJ5631EG | Contact Us |
| | SOP8-PP | TJ5631EGDP | Fixed, Enable | TJ5631EG | Contact Us |
| F | SOP8 | TJ5631FGD | Fixed, Enable | TJ5631FG | Contact Us |
| | SOP8-PP | TJ5631FGDP | Fixed, Enable | TJ5631FG | Contact Us |
| H | SOP8 | TJ5631HGD | Fixed, Enable | TJ5631HG | Contact Us |
| | SOP8-PP | TJ5631HGDP | Fixed, Enable | TJ5631HG | Contact Us |

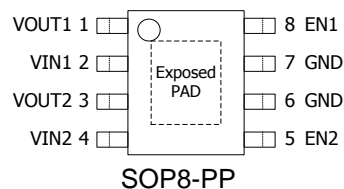
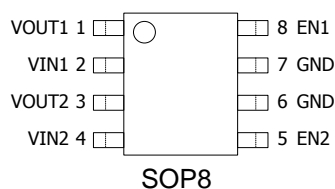


Voltage Code Table

| Code | Output | Output Voltage | Maximum Continuous Output Current [*] | Code | Output | Output Voltage | Maximum Continuous Output Current [*] |
|------|--------|----------------|--|------|--------|----------------|--|
| A | VOUT1 | 3.3V | 500mA | D | VOUT1 | 1.8V | 300mA |
| | VOUT2 | 1.8V | 300mA | | VOUT2 | 3.3V | 500mA |
| B | VOUT1 | 3.3V | 500mA | E | VOUT1 | 1.5V | 300mA |
| | VOUT2 | 1.5V | 300mA | | VOUT2 | 3.3V | 500mA |
| C | VOUT1 | 3.3V | 500mA | F | VOUT1 | 1.2V | 300mA |
| | VOUT2 | 1.2V | 300mA | | VOUT2 | 3.3V | 500mA |
| H | VOUT1 | 3.3V | 500mA | - | - | - | - |
| | VOUT2 | 1.0V | 300mA | | - | - | - |

* The output current is limited by the restriction of power dissipation which differs from packages.

PIN CONFIGURATION

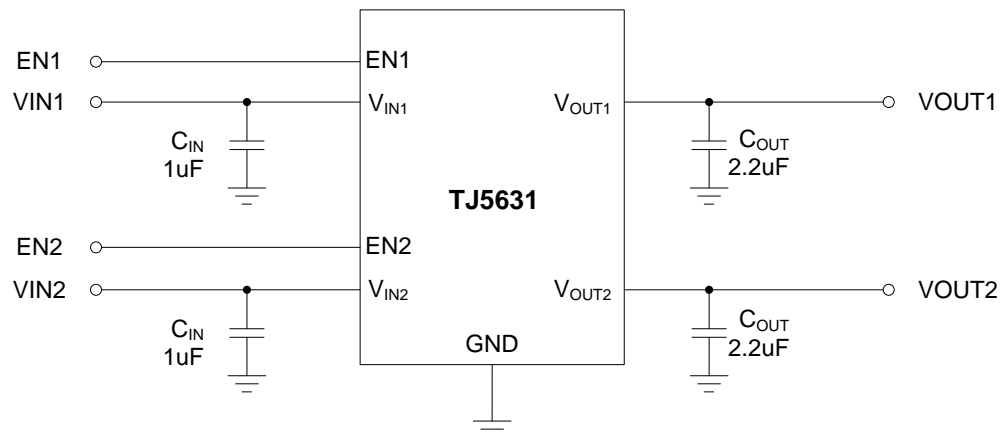


PIN DESCRIPTION

| Pin No. | SOP8/SOP8-PP | |
|---------|-------------------|-------------------------|
| | Name | Function |
| 1 | V _{OUT1} | Output Voltage 1 |
| 2 | V _{IN1} | Input Voltage 1 |
| 3 | V _{OUT2} | Output Voltage 2 |
| 4 | V _{IN2} | Input Voltage 2 |
| 5 | EN2 | Output Voltage 2 Enable |
| 6 | GND | Ground |
| 7 | GND | Ground |
| 8 | EN1 | Output Voltage 1 Enable |

- Exposed Pad of SOP8-PP package should be externally connected to GND.

BASIC APPLICATION



* The output current is limited by the restriction of power dissipation which differs from packages. A heat sink may be required depending on the maximum power dissipation and maximum ambient temperature of application. With respect to the applied package, the maximum continuous output current of each channel may be still undeliverable.

* See Application Information.

ELECTRICAL CHARACTERISTICS^(Note 1)

Limits in standard typeface are for $T_J=25^{\circ}\text{C}$, and limits in **boldface type** apply over the **full operating temperature range**.
 Unless otherwise specified: $V_{IN}^{(Note\ 2)} = V_{O(NOM)} + 1\text{V}$, $I_L = 10\text{ mA}$, $C_{IN} = 1\text{ }\mu\text{F}$, $C_{OUT} = 2.2\text{ }\mu\text{F}$, $V_{EN} = V_{IN} - 0.3\text{ V}$

| PARAMETER | | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|--|------------|----------------------|---|----------|------|----------|------|
| Output Voltage Tolerance | | V _{OUT1, 2} | | -2 -3 | - | +2 +3 | % |
| VIN Shutdown Current | | I _{GND.OFF} | V _{EN1} = V _{EN2} = 0V | - | - | 2 | uA |
| VIN Supply Current ^(Note 6) | | I _{GND.ON} | V _{EN1} = V _{EN2} = 5V, I _{OUT} = 0A | - | - | 220 | |
| Line Regulation ^(Note 3) | | ΔV _{LINE} | V _{IN} = V _{OUT} +1V to 6V | - | 0.03 | 0.19 | %/V |
| Load Regulation ^(Note 3, 4) | | ΔV _{LOAD} | I _{OUT} = 1mA to 300mA | - | 0.6 | - | %/A |
| Dropout Voltage ^(Note 5) | | V _{DROP} | V _{OUT} = 3.3V, I _{OUT} = 500mA | - | 300 | 450 | mV |
| Ripple Rejection | | PSRR | V _{IN} = V _{OUT} +2V, f = 1kHz | - | 55 | - | dB |
| Output Current Limit | | I _{LIM} | | 700 | - | - | mA |
| Short-Circuit Current-Limit | | I _{SC} | | - | 250 | - | mA |
| Thermal Shutdown Temperature | | T _{SD} | | - | 150 | - | ℃ |
| Enable threshold | Logic High | V _{IH} | Output = High | 1.6 | - | - | V |
| | Logic Low | V _{IL} | Output = Low | - | - | 0.4 | V |

Note 1. Stresses listed as the absolute maximum ratings may cause permanent damage to the device. These are for stress ratings. Functional operating of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may remain possibly to affect device reliability.

Note 2. The minimum operating value for input voltage is equal to either $(V_{OUT,NOM} + V_{DROP})$ or 2.5V , whichever is greater.

Note 3. Output voltage line regulation is defined as the change in output voltage from the nominal value due to change in the input line voltage.
 Output voltage load regulation is defined as the change in output voltage from the nominal value due to change in load current.

Note 4. Regulation is measured at constant junction temperature by using a 10ms current pulse. Devices are tested for load regulation in the load range from 10mA to 300mA.

Note 5. Dropout voltage is defined as the minimum input to output differential voltage at which the output drops 2% below the nominal value. Dropout voltage specification applies only to output voltages of 2.5V and above. For output voltages below 2.5V, the dropout voltage is nothing but the input to output differential, since the minimum input voltage is 2.5V.

Note 6. Ground current, or quiescent current, is the difference between input and output currents. It's defined by $I_{GND1} = I_{IN1} - I_{OUT1}$ under the given loading condition. The total current drawn from the supply is the sum of the load current plus the ground pin current.

TYPICAL OPERATING CHARACTERISTICS

T.B.C

APPLICATION INFORMATION

Introduction

TJ5631 is intended for applications where very low dropout voltage and current capability are required. It provides a simple, low cost solution that occupies very little PCB estate. Additional features include an enable pin to allow for a very low power consumption standby mode.

Component Selection

Input Capacitor

A large bulk capacitance over than 1uF should be closely placed to the input supply pin of the TJ5631 to ensure that the input supply voltage does not sag. Also a minimum of 1uF ceramic capacitor is recommended to be placed directly next to the V_{IN1} and V_{IN2} Pin. It allows for the device being some distance from any bulk capacitor on the rail. Additionally, input droop due to load transients is reduced, improving load transient response. Additional capacitance may be added if required by the application.

Output Capacitor

A minimum ceramic capacitor over than 2.2uF should be very closely placed to the output voltage pin of the TJ5631. Increasing capacitance will improve the overall transient response and stability.

Decoupling (Bypass) Capacitor

In very electrically noisy environments, it is recommended that additional ceramic capacitors be placed from VIN to GND. The use of multiple lower value ceramic capacitors in parallel with output capacitor also allows to achieve better transient performance and stability if required by the application.

Maximum Continuous Output Current Capability

The TJ5631 can deliver a continuous current of 300A/500mA over the full operating junction temperature range. However, the output current is limited by the restriction of power dissipation which differs from packages. A heat sink may be required depending on the maximum power dissipation and maximum ambient temperature of application. With respect to the applied package, the maximum continuous output current of 500mA may be still undeliverable due to the restriction of the power dissipation of TJ5631. Under all possible conditions, the junction temperature must be within the range specified under operating conditions.

The temperatures over the device are given by:

$$T_C = T_A + P_D \times \theta_{CA}$$

$$T_J = T_C + P_D \times \theta_{JC}$$

$$T_J = T_A + P_D \times \theta_{JA}$$

where T_J is the junction temperature, T_C is the case temperature, T_A is the ambient temperature, P_D is the total power dissipation of the device, θ_{CA} is the thermal resistance of case-to-ambient, θ_{JC} is the thermal

resistance of junction-to-case, and θ_{JA} is the thermal resistance of junction to ambient.

The total power dissipation of the device is given by:

$$\begin{aligned} P_D &= P_{IN} - P_{OUT} = (V_{IN} \times I_{IN}) - (V_{OUT} \times I_{OUT}) \\ &= (V_{IN} \times (I_{OUT} + I_{GND})) - (V_{OUT} \times I_{OUT}) = (V_{IN} - V_{OUT}) \times I_{OUT} + V_{IN} \times I_{GND} \end{aligned}$$

where I_{GND} is the operating ground current of the device which is specified at the Electrical Characteristics.

The maximum allowable temperature rise (T_{Rmax}) depends on the maximum ambient temperature (T_{Amax}) of the application, and the maximum allowable junction temperature (T_{Jmax}):

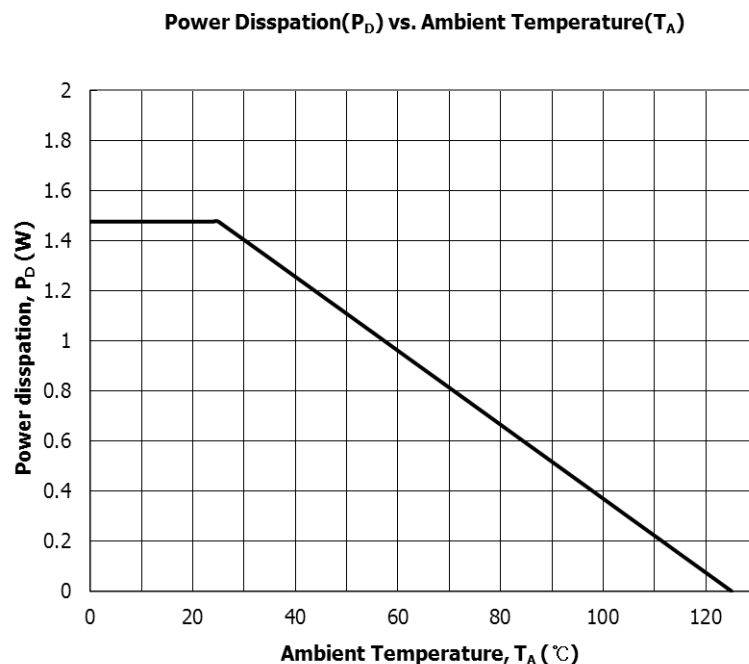
$$T_{Rmax} = T_{Jmax} - T_{Amax}$$

The maximum allowable value for junction-to-ambient thermal resistance, θ_{JA} , can be calculated using the formula:

$$\theta_{JA} = T_{Rmax} / P_D$$

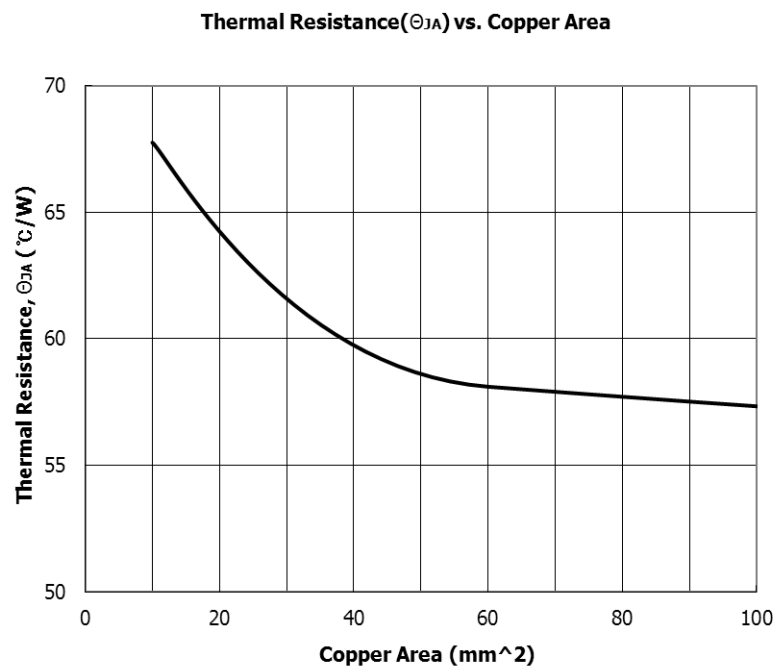
TJ5631 is available in SOP8 and SOP8-PP packages. The thermal resistance depends on amount of copper area or heat sink, and on air flow.

If proper cooling solution such as heat sink, copper plane area, or air flow is applied, the maximum allowable power dissipation could be increased. However, if the ambient temperature is increased, the allowable power dissipation would be decreased.



The graph above is valid for the thermal impedance specified in the Absolute Maximum Ratings section on page 1.

The θ_{JA} could be decreased with respect to the copper plane area. So, the specification of maximum power dissipation for an application is fixed, the proper plane area could be estimated by following graphs. Wider copper plane area leads lower θ_{JA} .



The maximum allowable power dissipation is also influenced by the ambient temperature. With the θ_{JA} -Copper plane area relationship, the maximum allowable power dissipation could be evaluated with respect to the ambient temperature. As shown in graph, the higher copper plane area leads θ_{JA} . And the higher ambient temperature leads lower maximum allowable power dissipation.