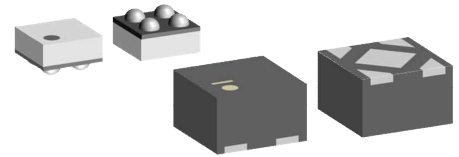




450mA Ultra Low Noise LDO

MM4047 series



Outline

The MM4047 is ultra low noise LDO capable of supplying 450mA output current. Designed to meet the requirements of RF circuits, Image sensor and high resolution audio codec, the MM4047 device provides low noise, High PSRR. It is available in WLCSP (0.65 mm×0.65 mm max.) and PLP-4 (1.0mm×1.0mm), which are suitable for smartphones, wireless earphones and wearable devices.

Features

- | | |
|--|---|
| ■ Ultra low output voltage noise | 10 μ V _{RMS} |
| ■ High PSRR | 82dB at 1kHz |
| ■ Low Iq | 13 μ A at no-load |
| ■ Low dropout | 200mV (typ) at 450mA (V _{OUT} =2.8V) |
| ■ Operating input voltage range | 2.2V to 5.5V |
| ■ Output voltage range | 1.2V to 4.5V |
| ■ Output voltage accuracy | ±2% at I _O =1mA to 450mA |
| ■ Output capacitor for stable operation | Ceramic 1.0 μ F (min) |
| ■ Output capacitor auto discharge function | |
| ■ Very small package | |

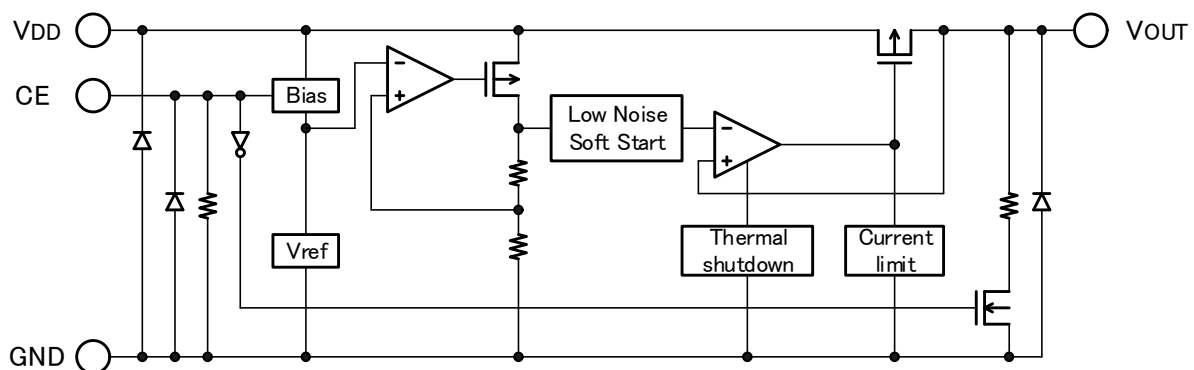
Package type

- WLCSP-4 0.65mm × 0.65mm max, t=0.4mm max
- PLP-4 1.00mm × 1.00mm, t=0.6mm max

Applications

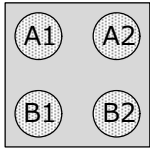
- Smartphones
- Tablets
- Wireless earphones
- Wearable devices
- Digital camera

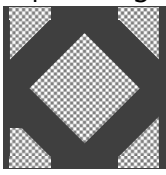
Block Diagram





Package and pin configuration

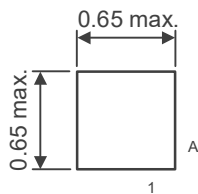
| WLCSP-4 | Pin No. | Symbol | Function |
|---|---------|--------|------------------|
|  <p>Top view</p> | A1 | VDD | Regulator input |
| | A2 | VOUT | Regulator output |
| | B1 | CE | Chip enable |
| | B2 | GND | Ground |

| PLP-4 | Pin No. | Symbol | Function |
|---|---------|--------|------------------|
|  <p>Top view</p> | 1 | VOUT | Regulator output |
| | 2 | GND | Ground |
| | 3 | CE | Chip enable |
| | 4 | VDD | Regulator input |

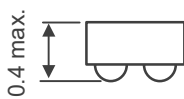
Package dimensions

WLCSP-4

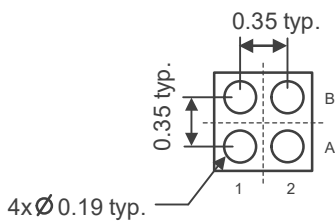
Top View



Side View



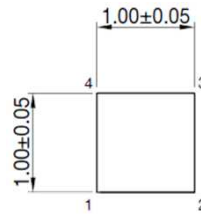
bottom View



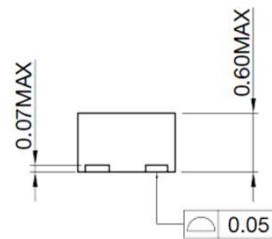
Unit:mm

PLP-4

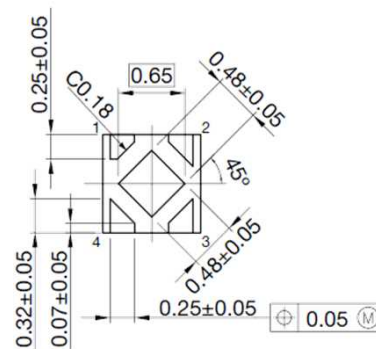
Top View



Side View



bottom View



Unit:mm



Absolute Maximum Ratings

| Parameter | Symbol | Min. | Max. | Unit |
|----------------------|-------------------|------|----------------------|------|
| Input voltage | V _{DD} | -0.3 | 6.0 | V |
| Output voltage | V _{OUT} | - | V _{DD} +0.3 | V |
| CE Input voltage | V _{CE} | - | 6.0 | V |
| Output current | I _{OUT} | 450 | - | mA |
| Junction temperature | T _{JMAX} | - | 150 | °C |
| Storage temperature | T _{stg} | -55 | 150 | °C |
| Power dissipation | P _d | - | TBD | mW |

Recommended Operating Conditions

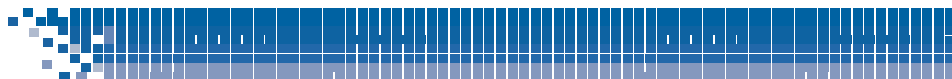
| Parameter | Symbol | Min. | Max. | Unit |
|--------------------------------|-------------------|------|------|------|
| Operating ambient temperature | T _{aopr} | -40 | 85 | °C |
| Operating junction temperature | T _{jopr} | -40 | 125 | °C |
| Operating input voltage | V _{DDop} | 2.2 | 5.5 | V |
| CE Operating voltage | V _{CEop} | 0 | 5.5 | V |

Electrical characteristics

(Unless otherwise specified, T_a=25°C, V_{DD}=V_{OUT}+1V, V_{CE}=1.2V, I_{OUT}=1mA)

| Parameter | Symbol | Condition | Min. | Typ. | Max. | Unit |
|--------------------------|-------------------|---|------|-------|------|------|
| Input voltage | V _{DD} | | 2.2 | - | 5.5 | V |
| Standby current | I _{STBY} | V _{CE} =0.3V(Disabled) | - | 0.2 | 1.0 | µA |
| Quiescent current | I _{DD1} | V _{CE} =1.2V, I _{OUT} =0mA | - | 13 | 25 | µA |
| | I _{DD2} | V _{CE} =1.2V, I _{OUT} =250mA | - | 250 | 425 | µA |
| Output voltage tolerance | V _{OUT} | V _{DD} =V _{OUT} +1V to 5.5V I _{OUT} =1mA to 450mA | -2 | - | 2 | % |
| | | V _{DD} =V _{OUT} +1V to 5.5V I _{OUT} =1mA to 450mA (V _{OUT} <1.8V) | -3 | - | 3 | % |
| Line regulation | V _{LINE} | V _{DD} =V _{OUT} +1V to 5.5V I _{OUT} =1mA to 450mA | - | 0.02 | - | %/V |
| Load regulation | V _{LOAD} | I _{OUT} =1mA to 450mA | - | 0.001 | - | %/mA |
| Dropout voltage | V _{DO1} | V _{OUT} =1.8V, I _{OUT} =450mA (WLCSP) | - | TBD | TBD | mV |
| | V _{DO2} | V _{OUT} =2.8V, I _{OUT} =450mA (WLCSP) | - | 200 | TBD | mV |
| | V _{DO3} | V _{OUT} =4.5V, I _{OUT} =450mA (WLCSP) | - | 160 | TBD | mV |





Electrical characteristics

($T_a=25^{\circ}\text{C}$, $V_{DD}=V_{OUT}+1\text{V}$, $V_{CE}=1.2\text{V}$, $I_{OUT}=1\text{mA}$, $C_o=1\mu\text{F}$, unless otherwise specified)

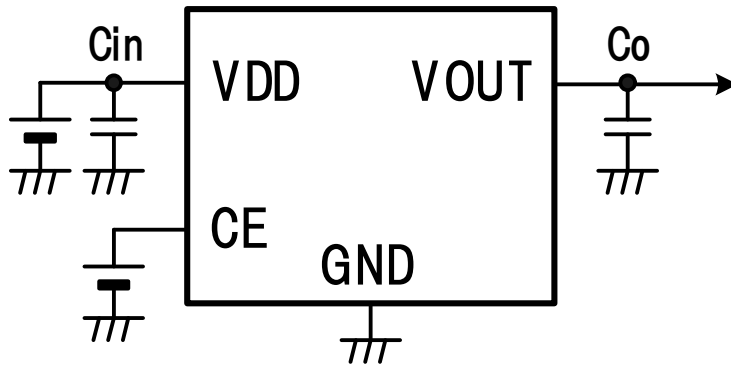
| Parameter | Symbol | Condition | Min. | Typ. | Max. | Unit |
|--|--------------------|--|------|------|------|--------------------|
| Power supply rejection ratio *Note1 | PSRR1 | $f=1\text{kHz}$, $I_{OUT}=20\text{mA}$ | - | 82 | - | dB |
| | PSRR2 | $f=10\text{kHz}$, $I_{OUT}=20\text{mA}$ | - | 65 | - | dB |
| | PSRR3 | $f=100\text{kHz}$, $I_{OUT}=20\text{mA}$ | - | 60 | - | dB |
| Output noise voltage *Note1 | V_{n1} | $f_{BW}=10\text{Hz to }100\text{kHz}$ $I_{OUT}=1\text{mA}$ | - | 10 | - | μVrms |
| | V_{n2} | $f_{BW}=10\text{Hz to }100\text{kHz}$ $I_{OUT}=250\text{mA}$ | - | 6.5 | - | μVrms |
| Load current | I_{LOAD} | | 0 | - | 450 | mA |
| Maximum output current | I_{OUT_MAX} | | 450 | - | - | mA |
| Short circuit current | I_{SC} | | 450 | - | - | mA |
| CE High input threshold | V_{TH_H} | $V_{DD}=2.2\text{V to }5.5\text{V}$ | 1.2 | - | - | V |
| CE Low input threshold | V_{TH_L} | $V_{DD}=2.2\text{V to }5.5\text{V}$ | - | - | 0.4 | V |
| CE Input current | I_{CE_H} | $V_{CE}=5.5\text{V}$, $V_{DD}=5.5\text{V}$ | - | 5.5 | - | μA |
| Turn-on time | t_{ON} | From $V_{CE} > V_{TH_H}$ to $V_{OUT}*95\%$ | - | 80 | 150 | μs |
| Overshoot on start-up *Note1 | V_{OS} | | - | - | 5 | % |
| Line transient 1 *Note1 | $V_{LINE-T1}$ | $V_{DD}=V_{OUT}+1\text{V to }V_{OUT}+1.6\text{V}$ $t_f=30\mu\text{s}$ | -1 | - | - | mV |
| Line transient 2 *Note1 | $V_{LINE-T2}$ | $V_{DD}=V_{OUT}+1.6\text{V to }V_{OUT}+1\text{V}$ $t_f=30\mu\text{s}$ | - | - | 1 | mV |
| Load transient 1 *Note1 | $V_{LOAD-T1}$ | $I_{OUT}=1\text{mA to }450\text{mA}$ $t_f=10\mu\text{s}$ | -40 | - | - | mV |
| Load transient 2 *Note1 | $V_{LOAD-T2}$ | $I_{OUT}=450\text{mA to }1\text{mA}$ $t_f=10\mu\text{s}$ | - | - | 40 | mV |
| Thermal shutdown *Note1 | TSD | T_j rising | - | 160 | - | $^{\circ}\text{C}$ |
| Thermal shutdown hysteresis *Note1 | TSD _{HYS} | T_j falling from shutdown | - | 15 | - | $^{\circ}\text{C}$ |
| Output discharge resistance | R_{DC} | $V_{CE}<V_{TH_L}$ (Output disabled) | - | 230 | - | Ω |

*Note1: The parameter is guaranteed by design





Typical application circuit



Recommended external parts

- Input capacitor : 1uF
- Output capacitor : 1uF

