## Features

- Low Power Consumption: 60uA (Typ)
- Maximum Output Current: 500mA
- Small Dropout Voltage
  100mV@100mA (Vout=3.3V)
- PSRR=75dB@1KHz
- Input Voltage Range: 2.0V~8.0V
- Output Voltage Range: 1.2V~3.6V
  (customized on command in 0.1V steps)
- Standby Current : less than 1μA
- High Accurate: ±2%
- Good Transient Response
- Over-Temperature Protection
- Support Fixed Output Voltage
- Output Current Limit
- Stable with Ceramic Capacitor
- Available Package
  SOT23-5 \ DFN1x1-4
- RoHS Compliant and Lead (Pb) Free

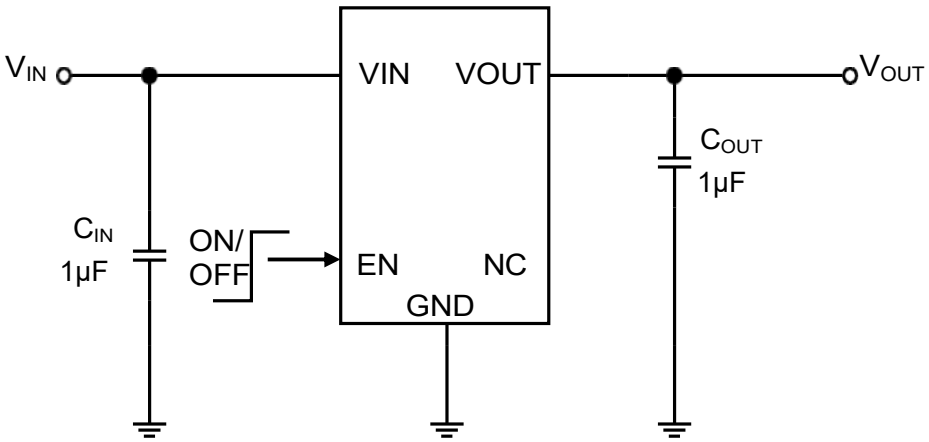
## Application

- Portable, Battery Powered Equipment
- Audio/Video Equipment
- Power Management of MP3. PDA…..
- Weighting Scales. Home Automation

## Description

The HE2211 series are highly precise, low noise, positive voltage LDO regulators manufactured using CMOS processes. The series achieves high ripple rejection and low dropout and consists of a standard voltage source, an error correction, current limiter and a phase compensation circuit plus a driver transistor. Output voltage is selectable in 0.1V increments within a range of 1.2V ~ 3.6V. The series is also compatible with low ESR ceramic capacitors which give added output stability. This stability can be maintained even during load fluctuations due to the excellent transient response of the series. The limiter's feedback circuit also operates as a protect for the output current limiter The EN function enables the output to be turned off, resulting in greatly reduced power consumption.The HE2211 consumes less than 1μA in shutdown mode and has fast turn-on time less than 50s. The other features include ultra low dropout voltage, high output accuracy, current limiting protection, and high ripple rejection ratio.

## Application Circuits



## Selection Table

| Part No. | Output Voltage | Package | Marking |
|---|---|---|---|
| **HE2211A12M5R** | 1.2V | SOT23-5 | Refer to Marking rule |
| **HE2211A15M5R** | 1.5V | | |
| **HE2211A18M5R** | 1.8V | | |
| **HE2211A25M5R** | 2.5V | | |
| **HE2211A28M5R** | 2.8V | | |
| **HE2211A30M5R** | 3.0V | | |
| **HE2211A33M5R** | 3.3V | | |
| **HE2211A36M5R** | 3.6V | | |
| **HE2211A12D4R** | 1.2V | DFN1x1-4 | |
| **HE2211A15D4R** | 1.5V | | |
| **HE2211A18D4R** | 1.8V | | |
| **HE2211A25D4R** | 2.5V | | |
| **HE2211A28D4R** | 2.8V | | |
| **HE2211A30D4R** | 3.0V | | |
| **HE2211A33D4R** | 3.3V | | |
| **HE2211A36D4R** | 3.6V | | |

## Package and Pin assignment

SOT23-5 (Top View)

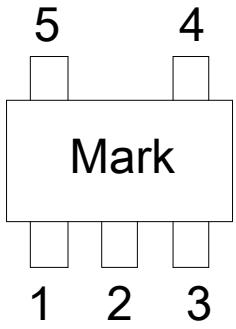



Table1: HE2211AXXM5R series (SOT23-5 PKG)

| PIN NUMBER | SYMBOL | FUNCTION |
|---|---|---|
| 1 | $V_{IN}$ | Power Input Pin |
| 2 | GND | Ground |
| 3 | CE | Chip Enable Pin |
| 4 | NC | No Connection |
| 5 | $V_{OUT}$ | Output Pin |

DFN1x1-4L (Top View)

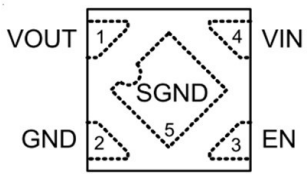



**Table2:** HE2211AXXD4R series (DFN1*1-4LPKG)

| PIN NUMBER | SYMBOL | FUNCTION |
|---|---|---|
| 1 | $V_{OUT}$ | Output Pin |
| 2 | GND | Ground |
| 3 | CE | Chip Enable Pin |
| 4 | $V_{IN}$ | Power Input Pin |
| 5 | SGND | Substrate of Chip. Leave floating or tie to GND |

## Absolute Maximum Ratings (1) (2)

| Parameter | | Symbol | Maximum Rating | Unit |
|---|---|---|---|---|
| Input Voltage | | $V_{IN}$ | $V_{SS}$ -0.3~$V_{SS}$+8.0 | V |
| | | $V_{ON/OFF}$ | $V_{SS}$ -0.3~$V_{IN}$+0.3 | V |
| Output Current | | $I_{OUT}$ | 600 | mA |
| Output Voltage | | $V_{OUT}$ | $V_{SS}$ -0.3~$V_{IN}$+0.3 | V |
| Power Dissipation | SOT23-5 | Pd | 250 | mW |
| | DFN1x1-4 | | 400 | |
| Thermal Resistance | SOT23-5 | $R_{\theta JA}$ (3) (Junction-to-ambient thermal resistance) | 400 | ℃/W |
| | DFN1x1-4 | | 250 | ℃/W |
| Operating Temperature | | Topr | -40~85 | ℃ |
| Storage Temperature | | Tstg | -40~125 | ℃ |
| Soldering Temperature & Time | | Tsolder | 260℃, 10s | |

Note (1): Exceeding these ratings may damage the device.

Note (2): The device is not guaranteed to function outside of its operating conditions

Note (3): The package thermal impedance is calculated in accordance to JESD 51-7.

## ESD Ratings

| Item | Description | Value | Unit |
|---|---|---|---|
| $V_{(ESD-HBM)}$ | Human Body Model (HBM)<br>ANSI/ESDA/JEDEC JS-001-2014<br>Classification, Class: 2 | ±4000 | V |
| $V_{(ESD-CDM)}$ | Charged Device Mode (CDM)<br>ANSI/ESDA/JEDEC JS-002-2014<br>Classification, Class: C0b | ±400 | V |
| $I_{LATCH-UP}$ | JEDEC STANDARD NO.78E APRIL 2016<br>Temperature Classification, Class: I | ±200 | mA |

ESD testing is performed according to the respective JESD22 JEDEC standard.The human body model is a 100 pF capacitor discharged through a 1.5kΩ resistor into each pin. The machine model is a 200pF capacitor discharged directly into each pin.

## Recommended Operating Conditions

| Parameter | MIN. | MAX. | Units |
|---|---|---|---|
| Supply voltage at $V_{IN}$ | 2.0 | 8.0 | V |
| Operating junction temperature range, Tj | -40 | 125 | °C |
| Operating free air temperature range, TA | -40 | 85 | °C |

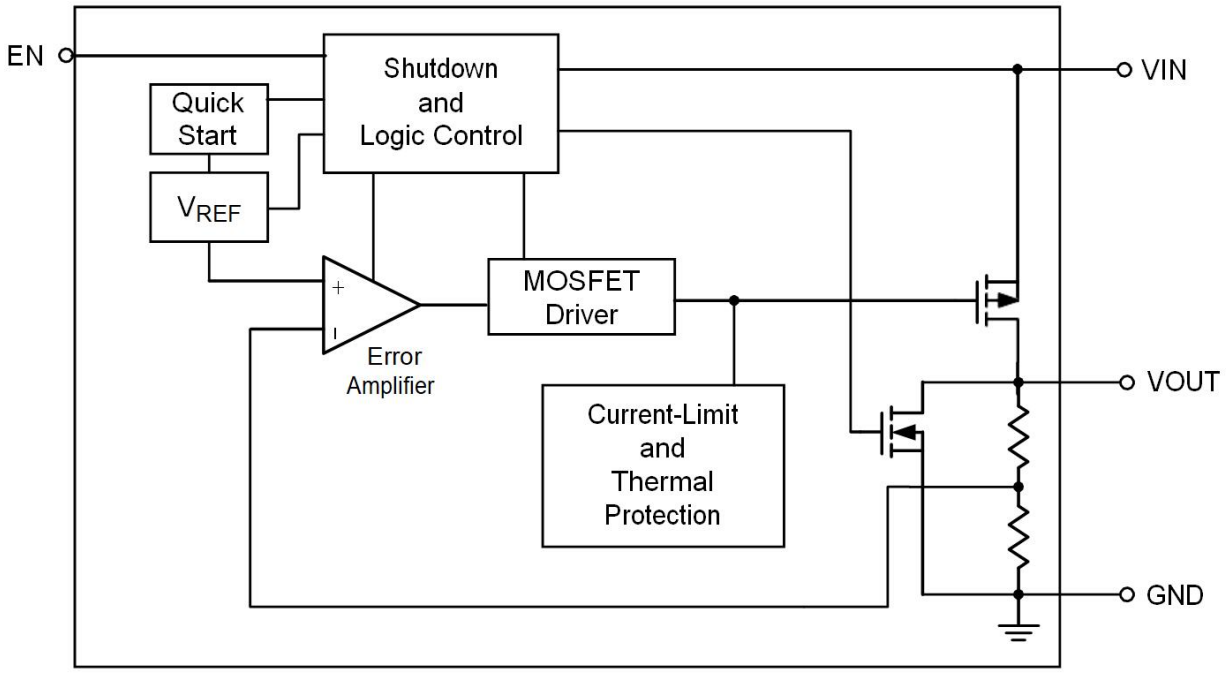
Note : All limits specified at room temperature (TA = 25°C) unless otherwise specified. All room temperature limits are 100% production tested. All limits at temperature extremes are ensured through correlation using standard Statistical Quality Control (SQC) methods. All limits are used to calculate Average Outgoing Quality Level (AOQL).

## Electrical Characteristics

(Test Conditions:$V_{IN}$=4.3V, $V_{OUT}$=3.3V,$C_{IN}$=1uF, $C_{OUT}$=1uF,TA=25℃, unless otherwise specified.)

| Parameter | Symbol | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Input Voltage | $V_{IN}$ | | -0.3 | | 8.0 | V |
| Supply Current | $I_Q$ | $V_{IN}$ > $V_{OUT}$ ,EN=$V_{IN}$ $I_{LOAD}$=0mA | — | 60 | — | uA |
| Standby Current | $I_{STBY}$ | $V_{EN}$ = GND, Shutdown | — | 1 | — | uA |
| Output Voltage | $V_{OUT}$ | $V_{IN}$=$V_{set}$+1.0V $I_{OUT}$=40mA | Vset*0.98 | Vset | Vset*1.02 | V |
| Maximum Output Current | $I_{OUT}$(Max) | $V_{IN}$=$V_{OUT}$+1.0V | — | 500 | — | mA |
| Dropout Voltage | $V_{DROP}$ | $I_{OUT}$=100mA | — | 100 | — | mV |
| | | $I_{OUT}$=200mA | — | 220 | | |
| Line Regulation | $\Delta V_{OUT}/\Delta V_{IN} \cdot V_{OUT}$ | $I_{OUT}$=40mA (Vset+1.0v)≦$V_{IN}$≦8.0V | — | 0.05 | — | %/V |
| Load Regulation | $\Delta V_{OUT}$ | $V_{IN}$=$V_{set}$+1.0V 1mA≦$I_{OUT}$≦100mA | — | 50 | — | mV |
| Current Limit | $I_{LIMIT}$ | | — | 600 | — | mA |
| Power Supply Rejection Rate | PSRR | $V_{IN}$=$V_{set}$+1.0V f=1KHz,$I_{OUT}$= 40mA | — | 75 | — | dB |
| EN Threshold Voltage | $V_{IL}$ | $V_{IN}$=3V~ 5.5V, Shutdown | — | — | 0.4 | V |
| | $V_{IH}$ | $V_{IN}$=3V~ 5.5V, Start-Up | 1.1 | — | — | V |
| Output Noise Voltage | $e_{NO}$ | $I_{OUT}$=40Ma BW = 300Hz~50kHz | — | 50 | — | $uV_{RMS}$ |
| Output Voltage Temperature Coefficient | $\Delta V_{OUT}/\Delta T \cdot V_{OUT}$ | $I_{OUT}$=10mA | — | 100 | — | ppm/℃ |

## Function Block Diagram




## Application Guideline

### Input Capacitor

A 1μF ceramic capacitor is recommended to connect between $V_{DD}$ and GND pins to decouple input power supply glitch and noise. The amount of the capacitance may be increased without limit. This input capacitor must be located as close as possible to the device to assure input stability and less noise. For PCB layout, a wide copper trace is required for both VIN and GND.

### Output Capacitor

An output capacitor is required for the stability of the LDO. The recommended output capacitance is 1μF, ceramic capacitor is recommended, and temperature characteristics are X7R or X5R. Higher capacitance values help to improve load/line transient response. The output capacitance may be increased to keep low undershoot/overshoot. Place output capacitor as close as possible to VOUT and GND pins.

### Dropout Voltage

The dropout voltage refers to the voltage difference between the VIN and VOUT pins while operating at specific output current. The dropout voltage VDROP also can be expressed as the voltage drop on

the pass-FET at specific output current (IRATED) while the pass-FET is fully operating at ohmic region and the pass-FET can be characterized asan resistance RDS(ON). Thus the dropout voltage can bedefined as (VDROP = VIN − VOUT = RDS(ON) x IRATED). Fornormal operation, the suggested LDO operating range is (VIN > VOUT + VDROP) for good transient response and PSRR ability. Vice versa, while operating at the ohmic region will degrade the performance severely.

### Thermal Application

For continuous operation, do not exceed the absolute maximum junction temperature. The maximum power dissipation depends on the thermal resistance of the IC package, PCB layout, rate of surrounding airflow, and difference between junction and ambient temperature. The maximum power dissipation can be calculated as below: TA=25°C, PCB,

The max PD= (125°C − 25°C) / (Thermal Resistance °C/W)

Power dissipation (PD) is equal to the product of the output current and the voltage drop across the output pass element, as shown in the equation below:

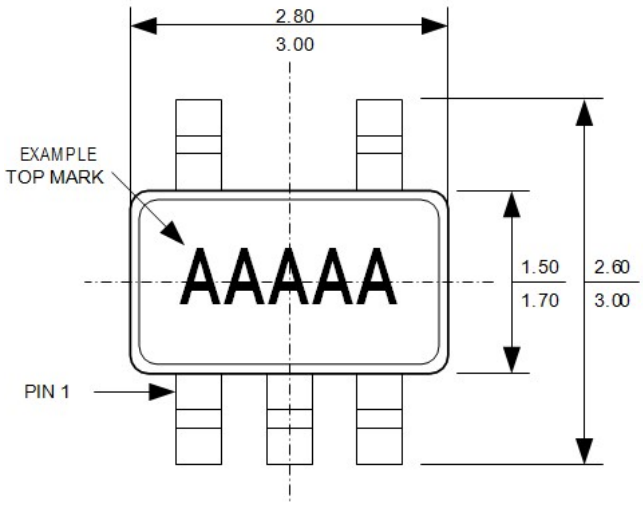
PD = (VIN – VOUT) × IOUT

### Layout Consideration

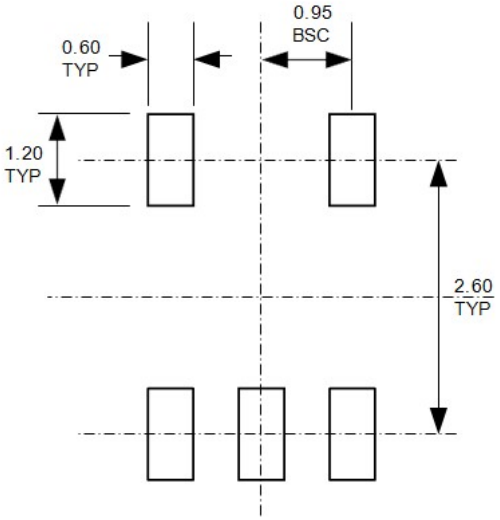
By placing input and output capacitors on the same side of the PCB as the LDO, and placing them as close as is practical to the package can achieve the best performance. The ground connections for input and output capacitors must be back to the HE2211 ground pin using as wide and as short of a copper trace as is practical.Connections using long trace lengths, narrow trace widths, and/or connections through via must be avoided. These add parasitic inductances and resistance that results in worse performance especially during transient conditions.

## Packaging Information

### SOT23-5



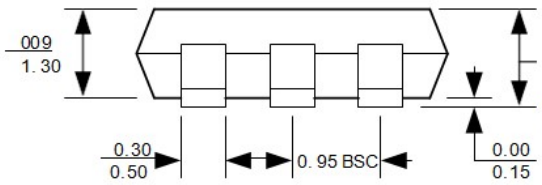

TOP VIEW



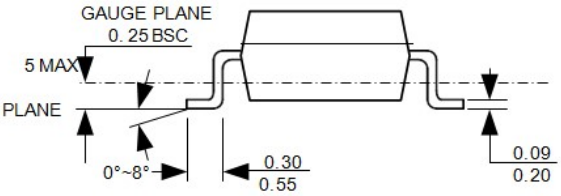

RECOMMENDED PAD LAYOUT

TOP VIEW

RECOMMENDED PAD LAYOUT



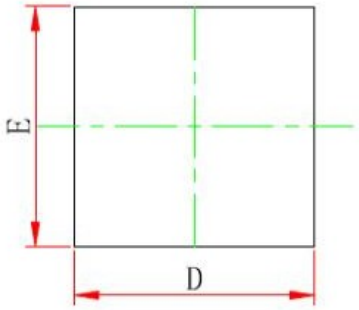

FRONT VIEW



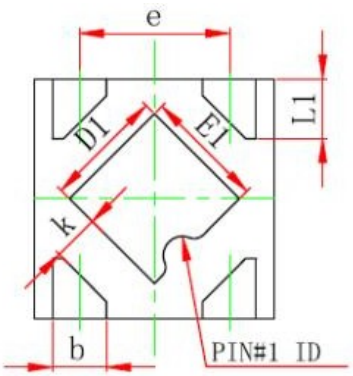

SIDE VIEW

## Packaging Information

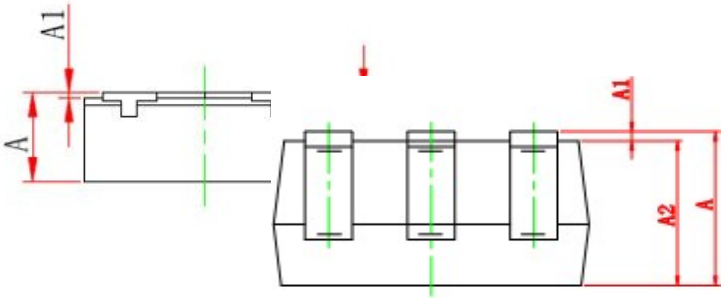
### DFN1x1-4




TOP VIEW
[顶视图]




BOTTOM VIEW
[背视图]




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 0.335 | 0.405 | 0.013 | 0.016 |
| A1 | 0.000 | 0.050 | 0.000 | 0.002 |
| A2 | 0.100REF. | | 0.004REF. | |
| D | 0.950 | 1.050 | 0.037 | 0.041 |
| E | 0.950 | 1.050 | 0.037 | 0.041 |
| D1 | 0.450 | 0.550 | 0.018 | 0.022 |
| E1 | 0.450 | 0.550 | 0.018 | 0.022 |
| k | 0.195REF. | | 0.0077REF. | |
| b | 0.175 | 0.275 | 0.007 | 0.011 |
| e | 0.575 | 0.675 | 0.023 | 0.027 |
| L1 | 0.200 | 0.300 | 0.008 | 0.012 |