# SGM2206
# Dual Low Noise, Low Dropout Regulator with Enable

## GENERAL DESCRIPTION

The SGM2206 is a dual low noise, high PSRR, low quiescent current and low dropout voltage linear regulator. It is capable of supplying 150mA per channel output current with typical dropout voltage of only 150mV. The operating input voltage range is from 1.7V to 7.5V and output voltage range is from 1.2V to 5.0V.

Other features include logic-controlled shutdown mode, short-circuit current limit and thermal shutdown protection.

The SGM2206 is suitable for applications which need low noise and fast line and load transient responses, such as smartphone and many other portable equipment.

The SGM2206 is available in a Green UTDFN-1.2×1.2-6AL package and allows for small footprint and dense PCB layout. It operates over an ambient temperature range of -40℃ to +85℃.

## FEATURES

- **Operating Input Voltage Range: 1.7V to 7.5V**
- **Fixed Output Voltage Range: 1.2V to 5.0V**
- **Output Voltage Accuracy: ±0.8% at +25℃**
- **Output Current: 150mA per Channel**
- **High PSRR: 60dB (TYP) at 1kHz**
- **Low Output Noise: 70μ$V_{RMS}$ (TYP)**
- **Low Quiescent Current: 35μA (TYP) per Channel**
- **Current Limiting and Thermal Protection**
- **Fast Line and Load Transient Responses**
- **-40℃ to +85℃ Operating Temperature Range**
- **Available in a Green UTDFN-1.2×1.2-6AL Package**

## APPLICATIONS

Smartphone
PAD
USB Interface
Fingerprint Modular
Radio Frequency Supplies
Portable Electronic Devices
Wireless Network Equipment

## TYPICAL APPLICATION

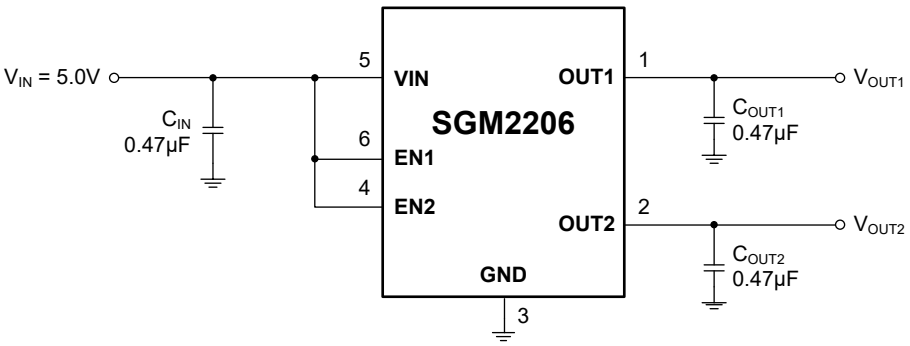



**Figure 1. Typical Application Circuit**

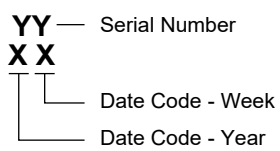
# PACKAGE/ORDERING INFORMATION

| ORDERING NUMBER | $V_{OUT1}$ | $V_{OUT2}$ | PACKAGE DESCRIPTION | SPECIFIED TEMPERATURE RANGE | PACKAGE MARKING | PACKING OPTION |
|---|---|---|---|---|---|---|
| SGM2206-AYUDX6G/TR | 3.3V | 1.8V | UTDFN-1.2×1.2-6AL | -40℃ to +85℃ | 9F<br>XX | Tape and Reel, 5000 |
| SGM2206-BYUDX6G/TR | 1.2V | 1.8V | UTDFN-1.2×1.2-6AL | -40℃ to +85℃ | A0<br>XX | Tape and Reel, 5000 |
| SGM2206-CYUDX6G/TR | 1.5V | 2.8V | UTDFN-1.2×1.2-6AL | -40℃ to +85℃ | A1<br>XX | Tape and Reel, 5000 |
| SGM2206-DYUDX6G/TR | 1.8V | 1.5V | UTDFN-1.2×1.2-6AL | -40℃ to +85℃ | A2<br>XX | Tape and Reel, 5000 |
| SGM2206-EYUDX6G/TR | 1.8V | 1.8V | UTDFN-1.2×1.2-6AL | -40℃ to +85℃ | A3<br>XX | Tape and Reel, 5000 |
| SGM2206-FYUDX6G/TR | 1.8V | 2.8V | UTDFN-1.2×1.2-6AL | -40℃ to +85℃ | A4<br>XX | Tape and Reel, 5000 |
| SGM2206-GYUDX6G/TR | 1.8V | 3.3V | UTDFN-1.2×1.2-6AL | -40℃ to +85℃ | A5<br>XX | Tape and Reel, 5000 |
| SGM2206-HYUDX6G/TR | 2.5V | 1.8V | UTDFN-1.2×1.2-6AL | -40℃ to +85℃ | A6<br>XX | Tape and Reel, 5000 |
| SGM2206-IYUDX6G/TR | 2.8V | 1.2V | UTDFN-1.2×1.2-6AL | -40℃ to +85℃ | A7<br>XX | Tape and Reel, 5000 |
| SGM2206-JYUDX6G/TR | 2.8V | 1.8V | UTDFN-1.2×1.2-6AL | -40℃ to +85℃ | A8<br>XX | Tape and Reel, 5000 |
| SGM2206-KYUDX6G/TR | 2.8V | 2.5V | UTDFN-1.2×1.2-6AL | -40℃ to +85℃ | A9<br>XX | Tape and Reel, 5000 |
| SGM2206-LYUDX6G/TR | 2.8V | 3.3V | UTDFN-1.2×1.2-6AL | -40℃ to +85℃ | AA<br>XX | Tape and Reel, 5000 |
| SGM2206-MYUDX6G/TR | 3.0V | 1.8V | UTDFN-1.2×1.2-6AL | -40℃ to +85℃ | AB<br>XX | Tape and Reel, 5000 |
| SGM2206-NYUDX6G/TR | 3.0V | 2.8V | UTDFN-1.2×1.2-6AL | -40℃ to +85℃ | AC<br>XX | Tape and Reel, 5000 |
| SGM2206-OYUDX6G/TR | 3.0V | 3.0V | UTDFN-1.2×1.2-6AL | -40℃ to +85℃ | AD<br>XX | Tape and Reel, 5000 |
| SGM2206-PYUDX6G/TR | 3.3V | 2.8V | UTDFN-1.2×1.2-6AL | -40℃ to +85℃ | AE<br>XX | Tape and Reel, 5000 |
| SGM2206-QYUDX6G/TR | 3.3V | 3.0V | UTDFN-1.2×1.2-6AL | -40℃ to +85℃ | AF<br>XX | Tape and Reel, 5000 |
| SGM2206-RYUDX6G/TR | 3.3V | 3.3V | UTDFN-1.2×1.2-6AL | -40℃ to +85℃ | B0<br>XX | Tape and Reel, 5000 |
| SGM2206-SYUDX6G/TR | 3.6V | 1.2V | UTDFN-1.2×1.2-6AL | -40℃ to +85℃ | B1<br>XX | Tape and Reel, 5000 |
| SGM2206-TYUDX6G/TR | 5.0V | 4.4V | UTDFN-1.2×1.2-6AL | -40℃ to +85℃ | B2<br>XX | Tape and Reel, 5000 |

Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

## MARKING INFORMATION

NOTE: XX = Date Code.



## ABSOLUTE MAXIMUM RATINGS

Input Voltage ..... 8V
Input Voltage at EN Pins ..... -0.3V to 6V
Output Voltage, $V_{OUT}$ ..... -0.3V to 6V
Output Current, $I_{OUT}$ ..... 200mA
Package Thermal Resistance
UTDFN-1.2×1.2-6AL, $\theta_{JA}$ ..... 213℃/W
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility
HBM ..... 5000V
MM ..... 300V
CDM ..... 1000V

## RECOMMENDED OPERATING CONDITIONS

Input Voltage Range ..... 1.7V to 7.5V
Output Current Range ..... 0mA to 150mA
Operating Temperature Range ..... -40℃ to +85℃

## OVERSTRESS CAUTION

Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

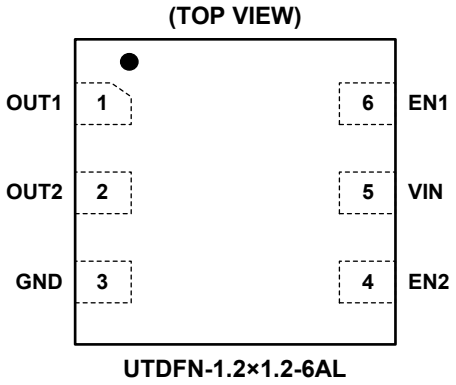
## ESD SENSITIVITY CAUTION

This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because even small parametric changes could cause the device not to meet the published specifications.

## DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

## PIN CONFIGURATION




## PIN DESCRIPTION

| PIN | NAME | FUNCTION |
|---|---|---|
| 1 | OUT1 | Channel 1 Regulator Output Pin. It is recommended to use a minimum 0.47μF ceramic capacitor to get good power supply decoupling. This ceramic capacitor should be placed as close as possible to OUT1 pin. |
| 2 | OUT2 | Channel 2 Regulator Output Pin. It is recommended to use a minimum 0.47μF ceramic capacitor to get good power supply decoupling. This ceramic capacitor should be placed as close as possible to OUT2 pin. |
| 3 | GND | Ground. |
| 4 | EN2 | Channel 2 Enable Control Pin. Drive EN2 high to turn on the channel 2 regulator. Drive EN2 low to turn off the channel 2 regulator. This pin must not be floated. |
| 5 | VIN | Input Supply Voltage Pin. |
| 6 | EN1 | Channel 1 Enable Control Pin. Drive EN1 high to turn on the channel 1 regulator. Drive EN1 low to turn off the channel 1 regulator. This pin must not be floated. |

## ELECTRICAL CHARACTERISTICS

($T_A$ = +25℃, $V_{IN}$ = $V_{OUT(NOM)}$ + 1.0V, $I_{OUT}$ = 1mA, $C_{IN}$ = $C_{OUT1}$ = $C_{OUT2}$ = 0.47μF, Full = -40℃ to +85℃, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | | TEMP | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|---|
| Input Voltage Range | $V_{IN}$ | | | Full | 1.7 | | 7.5 | V |
| Output Voltage Accuracy | $V_{OUT}$ | $V_{IN}$ = ($V_{OUT(NOM)}$ + 1.0V) to 7.5V, $I_{OUT}$ = 1mA to 150mA | | +25℃ | -0.8 | | 0.8 | % |
| | | $V_{IN}$ = ($V_{OUT(NOM)}$ + 1.0V) to 7.5V, $I_{OUT}$ = 1mA to 140mA | | Full | -1.5 | | 1.5 | |
| Maximum Output Current | | | | +25℃ | 150 | | | mA |
| Ground Pin Current | $I_Q$ | EN1 = High, EN2 = Low, or EN2 = High, EN1 = Low, No Load | | +25℃ | | 35 | 45 | μA |
| | | EN1 and EN2 = High, No Load | | +25℃ | | 62 | 75 | |
| Shutdown Supply Current | $I_{SHDN}$ | EN1 and EN2 = Low, No Load | | +25℃ | | 0.55 | 0.75 | μA |
| Fold-Back Short Current | | $V_{OUT}$ Short to Ground | | +25℃ | | 55 | | mA |
| Power Supply Rejection Ratio | PSRR | $V_{IN}$ = $V_{OUT(NOM)}$ + 1.0V, $\Delta V_{RIPPLE}$ = 0.2$V_{P-P}$ $V_{OUT(NOM)}$ ≥ 1.8V, $I_{OUT}$ = 30mA, f = 1kHz | | +25℃ | | 60 | | dB |
| Output Voltage Noise | $e_n$ | $I_{OUT}$ = 30mA, f = 10Hz to 100kHz | | +25℃ | | 70 | | $\mu V_{RMS}$ |
| Dropout Voltage (1) | $V_{DROP}$ | $I_{OUT}$ = 150mA | 1.7V < $V_{OUT(NOM)}$ ≤ 2.1V | +25℃ | | 250 | 300 | mV |
| | | | 2.1V < $V_{OUT(NOM)}$ ≤ 2.5V | +25℃ | | 190 | 220 | |
| | | | 2.5V < $V_{OUT(NOM)}$ ≤ 3.0V | +25℃ | | 160 | 210 | |
| | | | 3.0V < $V_{OUT(NOM)}$ ≤ 3.6V | +25℃ | | 150 | 200 | |
| Line Regulation | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$ | $V_{IN}$ = ($V_{OUT(NOM)}$ + 1.0V) to 7.5V, $I_{OUT}$ = 1mA | | +25℃ | | 0.0015 | 0.06 | %/V |
| Load Regulation | $\frac{\Delta V_{OUT}}{\Delta I_{LOAD} \times V_{OUT}}$ | $V_{IN}$ = $V_{OUT(NOM)}$ + 1.0V, $I_{OUT}$ = 1mA to 150mA | | +25℃ | | 2.5 | 7 | mV |
| Output Voltage Temperature Coefficient | | $I_{OUT}$ = 50mA | | Full | | ±25 | | ppm/℃ |
| Enable Input Low Voltage | | | | Full | | | 0.3 | V |
| Enable Input High Voltage | | | | Full | 1.3 | | 5.5 | V |
| Enable Input Leakage | | | | +25℃ | -1 | | 1 | μA |
| Over-Current Protection | OCP | | | Full | 140 | 200 | 265 | mA |
| On-Resistance of N-Channel for Auto-Discharge | | $V_{IN}$ = 4.0V, $V_{EN}$ = 0V, Disabled, Channel 1 & Channel 2 | | +25℃ | | 80 | | Ω |

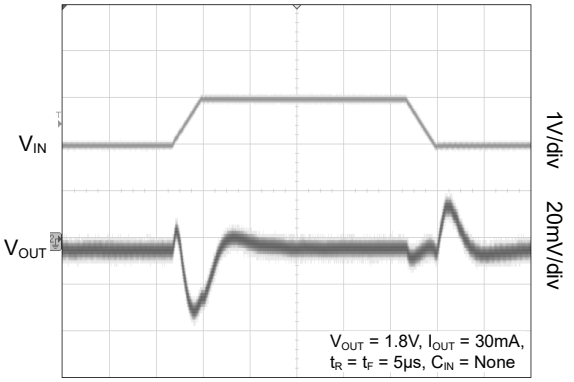
NOTE:

1. The dropout voltage is defined as the difference between $V_{IN}$ and $V_{OUT}$ when $V_{OUT}$ falls to 98% × $V_{OUT(NOM)}$.

## TYPICAL PERFORMANCE CHARACTERISTICS

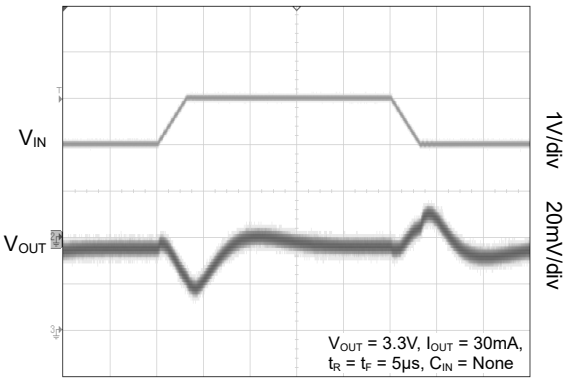
$T_A$ = +25℃, $V_{IN}$ = $V_{OUT(NOM)}$ + 1.0V, $C_{IN}$ = $C_{OUT1}$ = $C_{OUT2}$ = 0.47μF, unless otherwise noted.

Line Transient Response



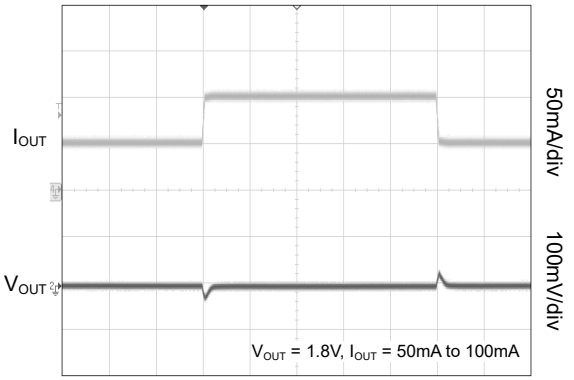

Time (10μs/div)

Line Transient Response



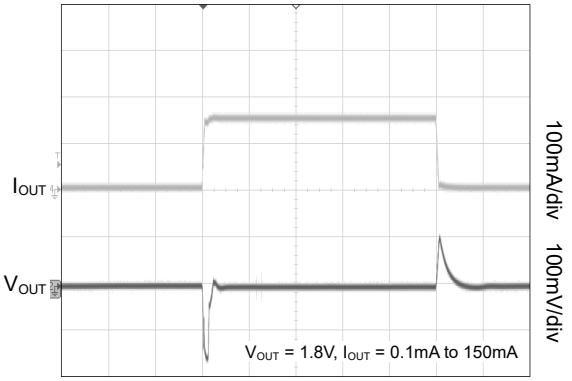

Time (10μs/div)

Load Transient Response



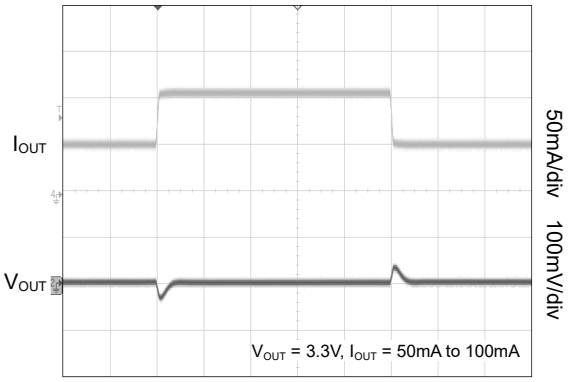

Time (40μs/div)

Load Transient Response



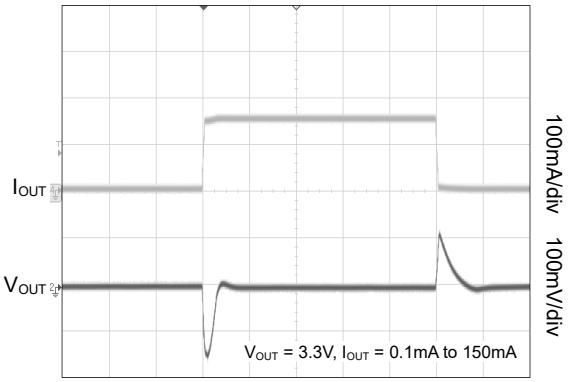

Time (40μs/div)

Load Transient Response




Time (40μs/div)

Load Transient Response

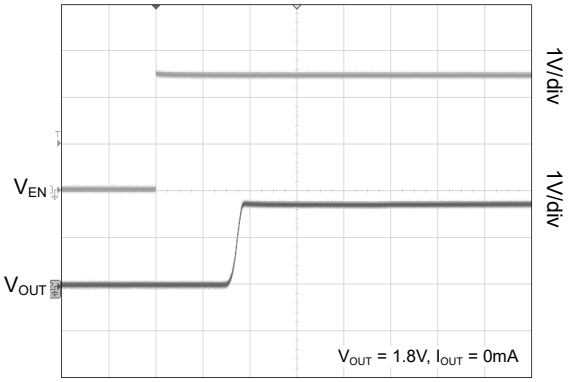



Time (40μs/div)

## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

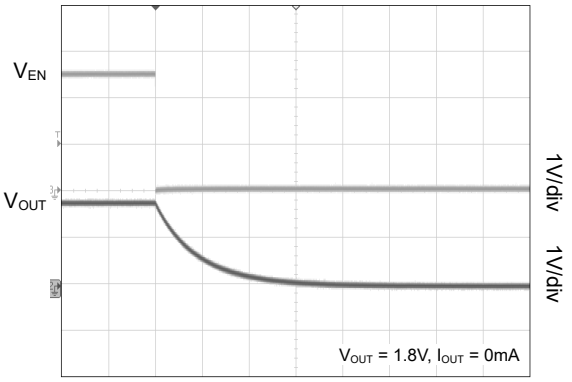
$T_A$ = +25℃, $V_{IN}$ = $V_{OUT(NOM)}$ + 1.0V, $C_{IN}$ = $C_{OUT1}$ = $C_{OUT2}$ = 0.47μF, unless otherwise noted.

Turn-On Waveform



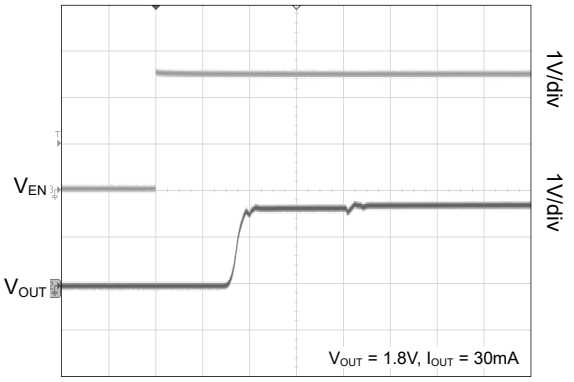

Time (50μs/div)

Turn-Off Waveform



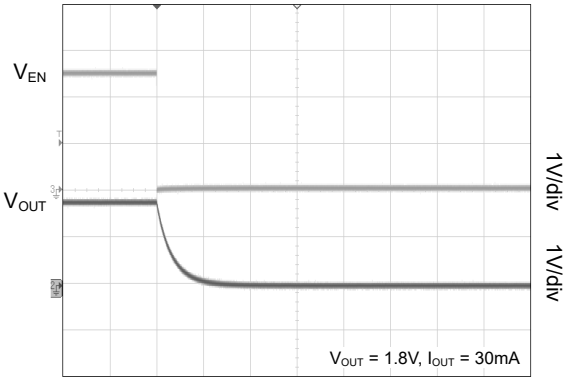

Time (50μs/div)

Turn-On Waveform



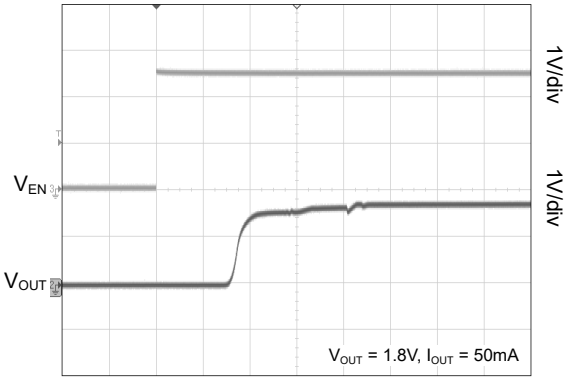

Time (50μs/div)

Turn-Off Waveform



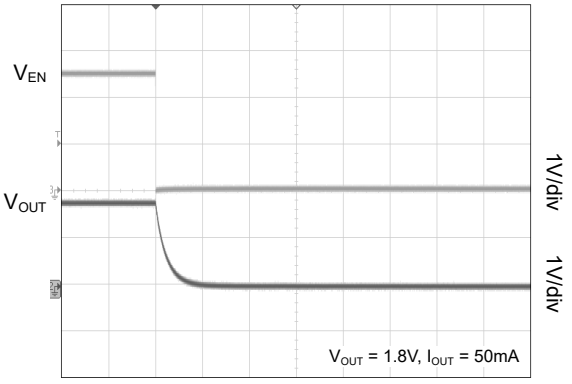

Time (50μs/div)

Turn-On Waveform




Time (50μs/div)

Turn-Off Waveform

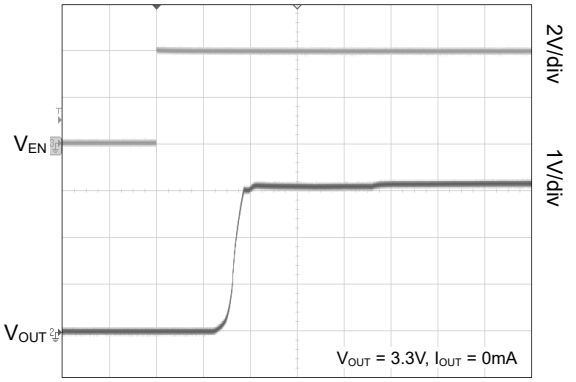



Time (50μs/div)

## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

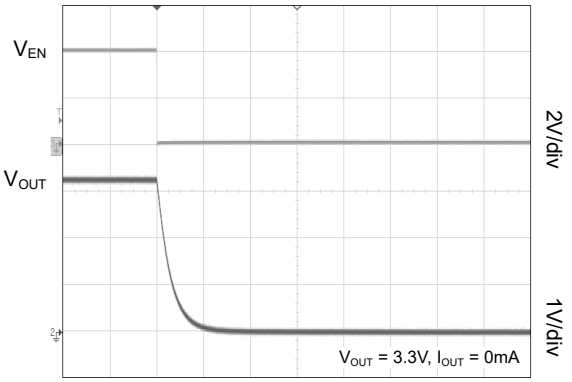
$T_A$ = +25℃, $V_{IN}$ = $V_{OUT(NOM)}$ + 1.0V, $C_{IN}$ = $C_{OUT1}$ = $C_{OUT2}$ = 0.47μF, unless otherwise noted.

Turn-On Waveform



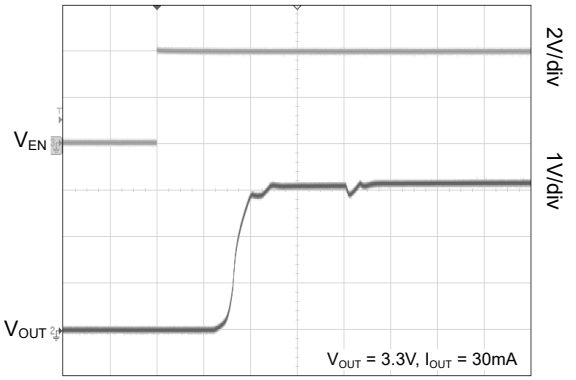

Time (50μs/div)

Turn-Off Waveform



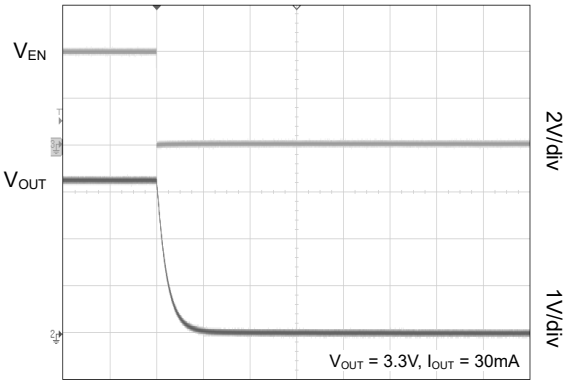

Time (50μs/div)

Turn-On Waveform



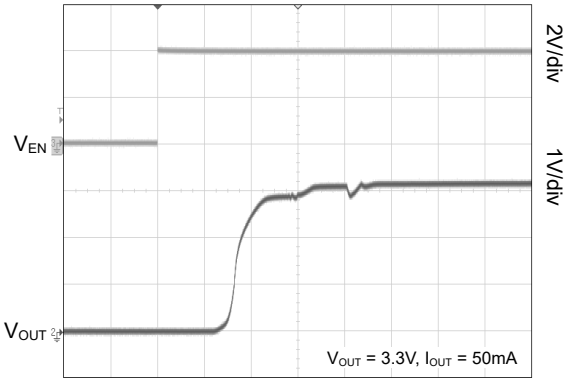

Time (50μs/div)

Turn-Off Waveform



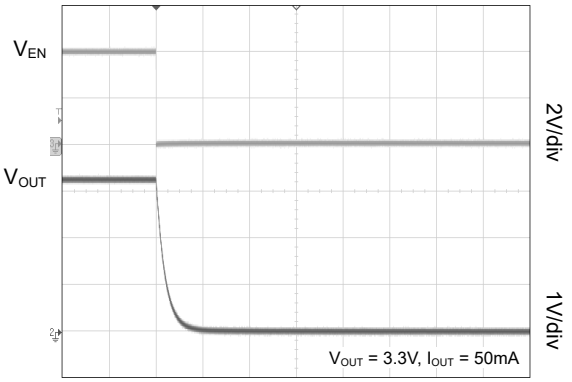

Time (50μs/div)

Turn-On Waveform




Time (50μs/div)

Turn-Off Waveform

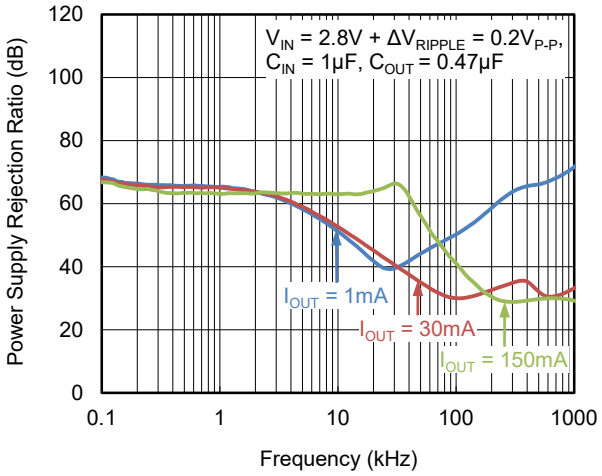



Time (50μs/div)

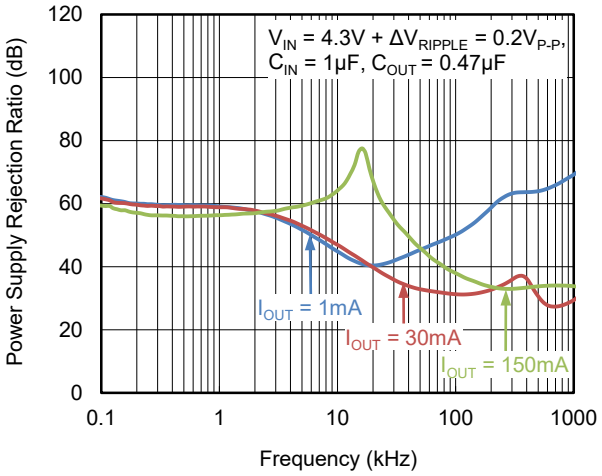
## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

$T_A$ = +25℃, $C_{IN}$ = $C_{OUT1}$ = $C_{OUT2}$ = 0.47μF, unless otherwise noted.

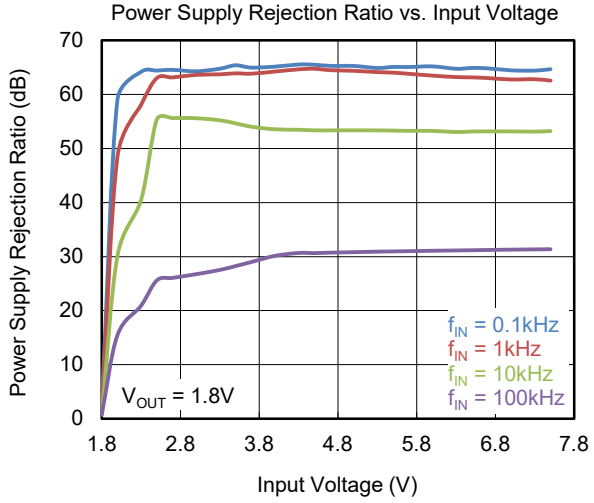
Power Supply Rejection Ratio vs. Frequency



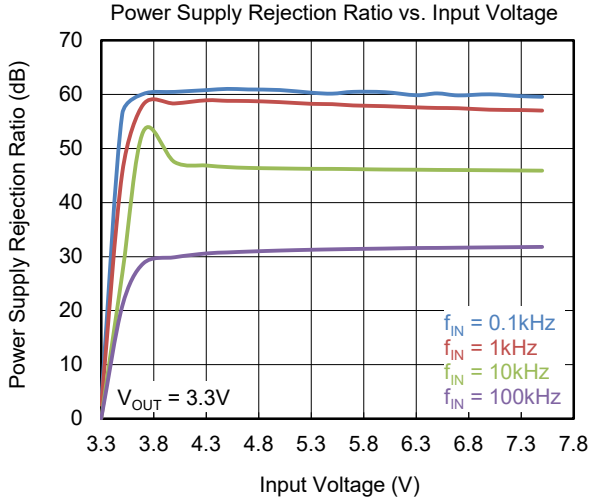

Power Supply Rejection Ratio vs. Frequency



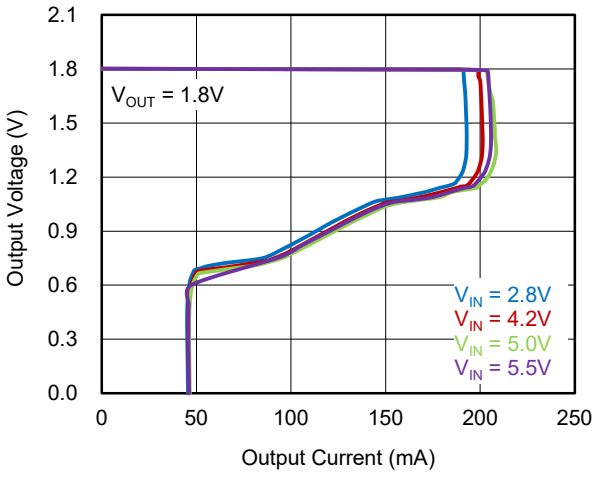

Power Supply Rejection Ratio vs. Input Voltage



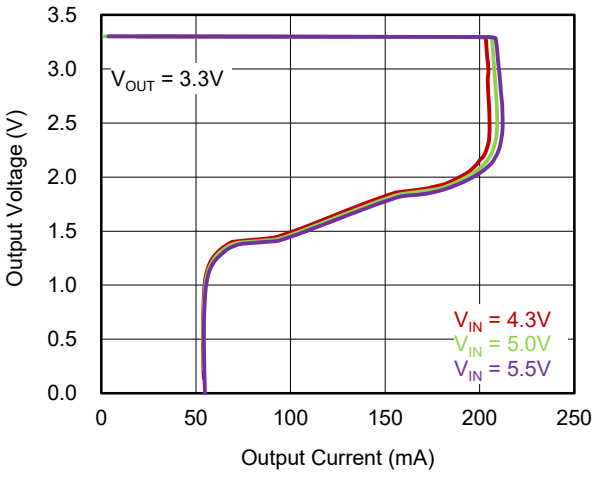

Power Supply Rejection Ratio vs. Input Voltage




Output Voltage vs. Output Current



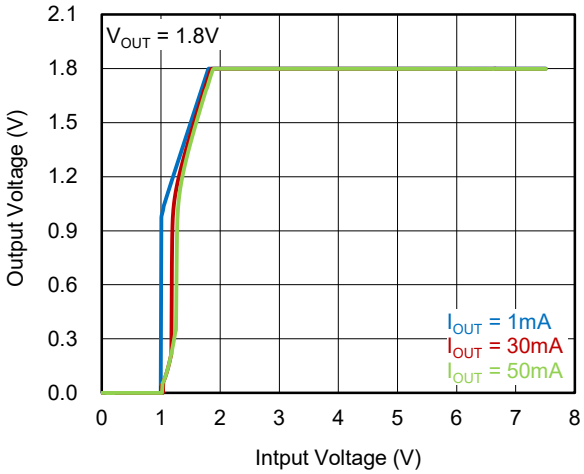

Output Voltage vs. Output Current



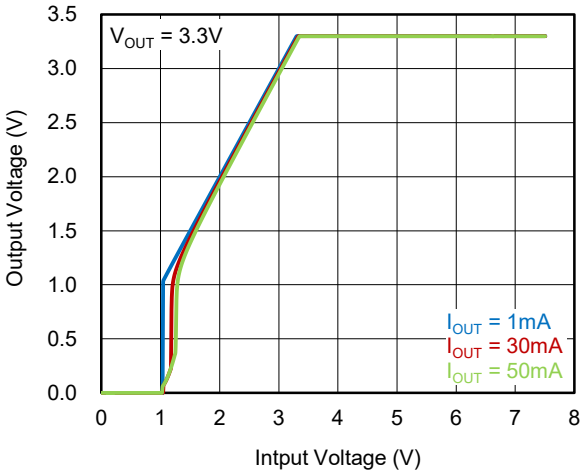
## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

$T_A$ = +25℃, $C_{IN}$ = $C_{OUT1}$ = $C_{OUT2}$ = 0.47μF, unless otherwise noted.

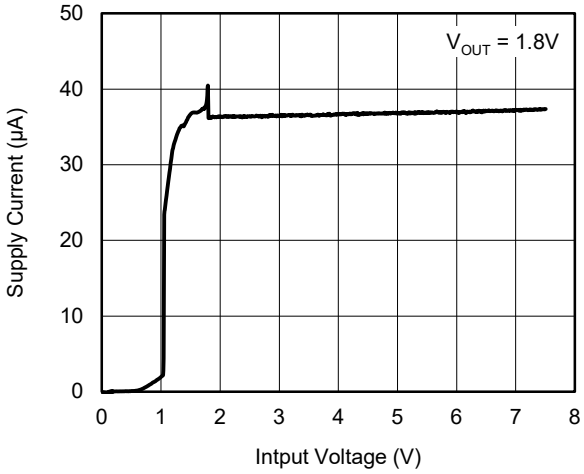
Output Voltage vs. Input Voltage



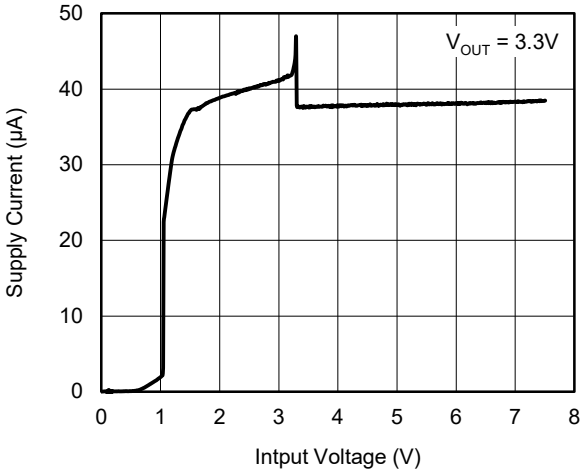

Output Voltage vs. Input Voltage



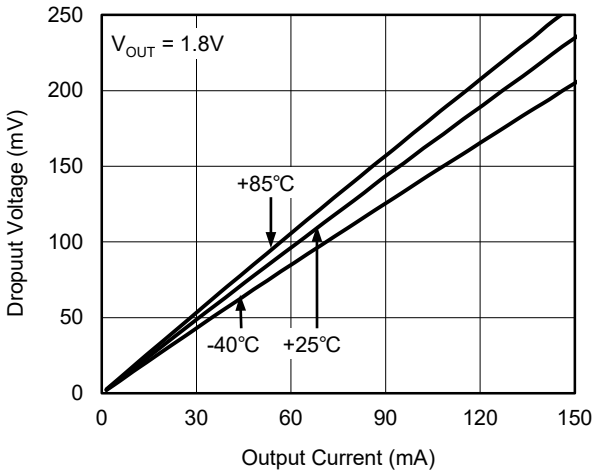

Supply Current vs. Input Voltage



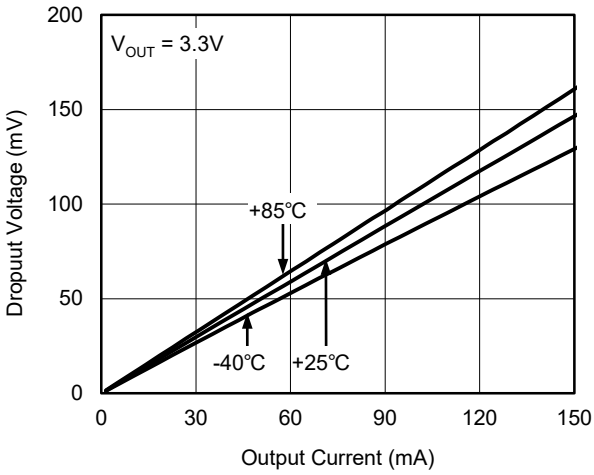

Supply Current vs. Input Voltage




Dropout Voltage vs. Output Current



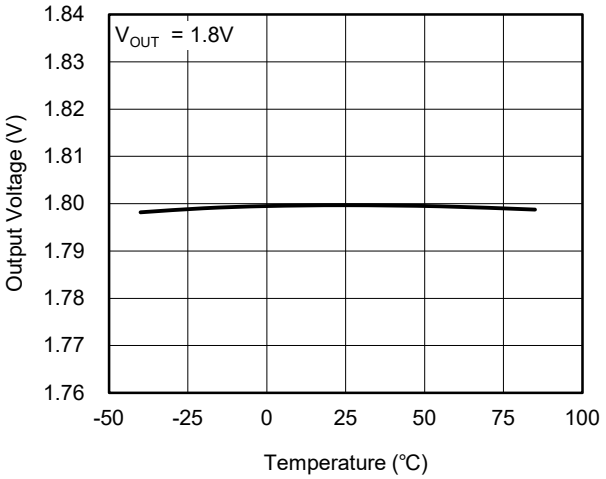

Dropout Voltage vs. Output Current



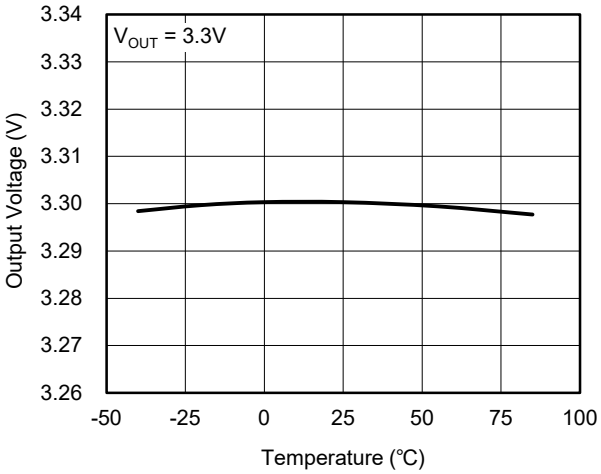
## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

$T_A$ = +25℃, $C_{IN}$ = $C_{OUT1}$ = $C_{OUT2}$ = 0.47μF, unless otherwise noted.

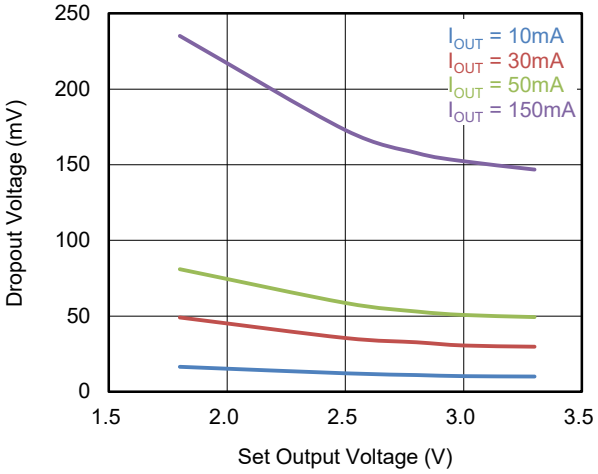
Output Voltage vs. Temperature




Output Voltage vs. Temperature




Dropout Voltage vs. Set Output Voltage



## FUNCTIONAL BLOCK DIAGRAM

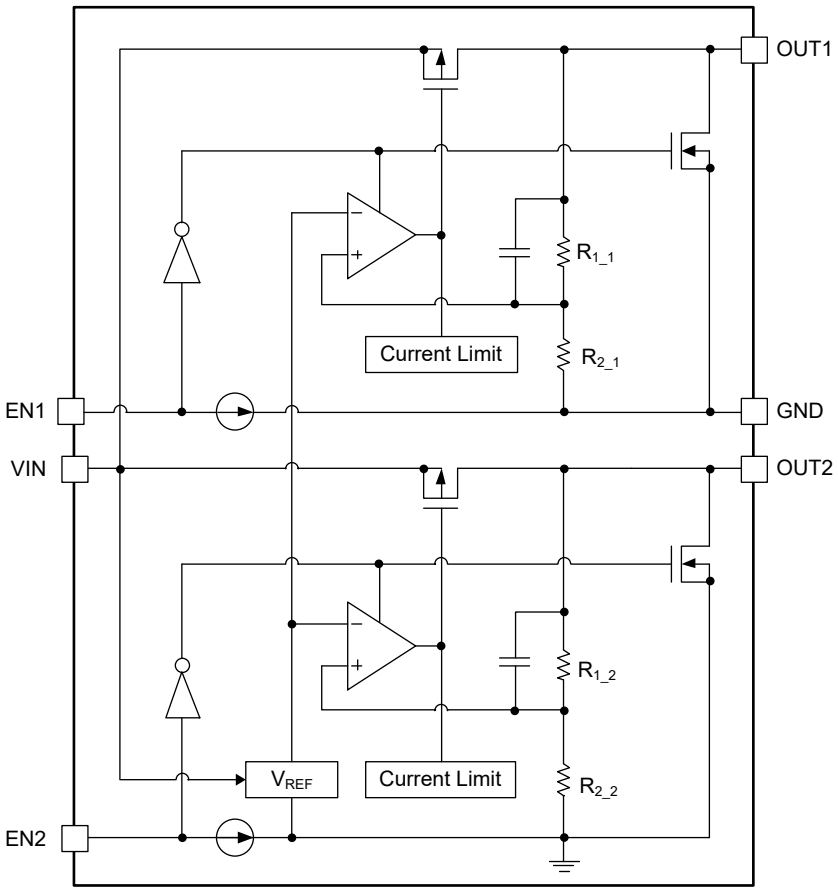



**Figure 2. Block Diagram**

# APPLICATION INFORMATION

## Input Capacitor Selection ($C_{IN}$)

The input decoupling capacitor should be placed as close as possible to the IN pin for ensuring the device stability. 0.47μF or larger X7R or X5R ceramic capacitor is selected to get good dynamic performance.

When $V_{IN}$ is required to provide large current instantaneously, a large effective input capacitor is required. Multiple input capacitors can limit the input tracking inductance. Adding more input capacitors is available to restrict the ringing and to keep it below the device absolute maximum ratings.

## Output Capacitor Selection ($C_{OUT1}$, $C_{OUT2}$)

The output decoupling capacitors should be placed as close as possible to the OUTx pins. 0.47μF or larger X7R or X5R ceramic capacitors are selected to get good dynamic performance. For ceramic capacitors, temperature, DC bias and package size will change the effective capacitance, so enough margins of $C_{OUT1}$ and $C_{OUT2}$ must be considered in design. Additionally, $C_{OUT1}$ and $C_{OUT2}$ with larger capacitance and lower ESR will help increase the high frequency PSRR and improve the load transient response.

## Enable Operation

The ENx pins of the SGM2206 are used to enable/disable the device.

When the ENx pins voltages are low, the device is in shutdown state. There is no current flowing from IN to OUTx pins. When the ENx pins voltages are high, the device is in active state. The output voltage is regulated to expected value.

## Output Current Limit and Short-Circuit Protection

When overload events happen, the output current is internally limited to 200mA (TYP). When the OUT pin is shorted to ground, the short-circuit protection will limit the output current to 55mA (TYP).

## Layout Guidelines

To get good PSRR, low output noise and high transient response performance, the input and output bypass capacitors must be placed as close as possible to the IN pin and OUTx pins separately. $V_{IN}$ and $V_{OUT}$ had better use separate ground planes and these ground planes are single point connected to the GND pin.

# REVISION HISTORY

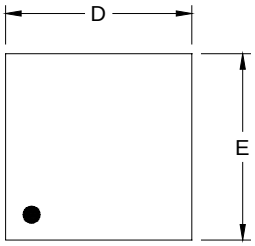
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

| JULY 2019 – REV.A to REV.A.1 | Page |
|---|---|
| Updated ABSOLUTE MAXIMUM RATINGS | 3 |

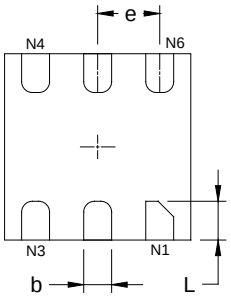
| Changes from Original (SEPTEMBER 2018) to REV.A | Page |
|---|---|
| Changed from product preview to production data | All |

# PACKAGE OUTLINE DIMENSIONS

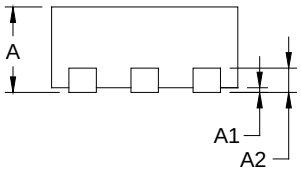
## UTDFN-1.2×1.2-6AL



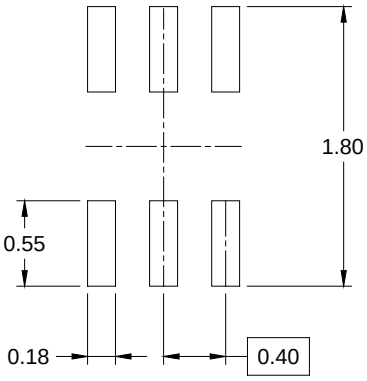

TOP VIEW




BOTTOM VIEW




SIDE VIEW

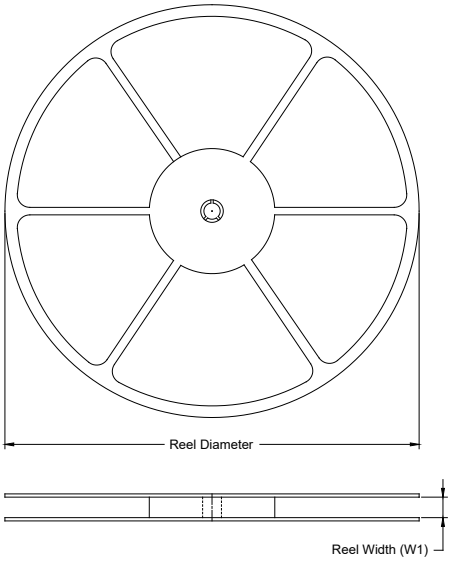



RECOMMENDED LAND PATTERN (Unit: mm)

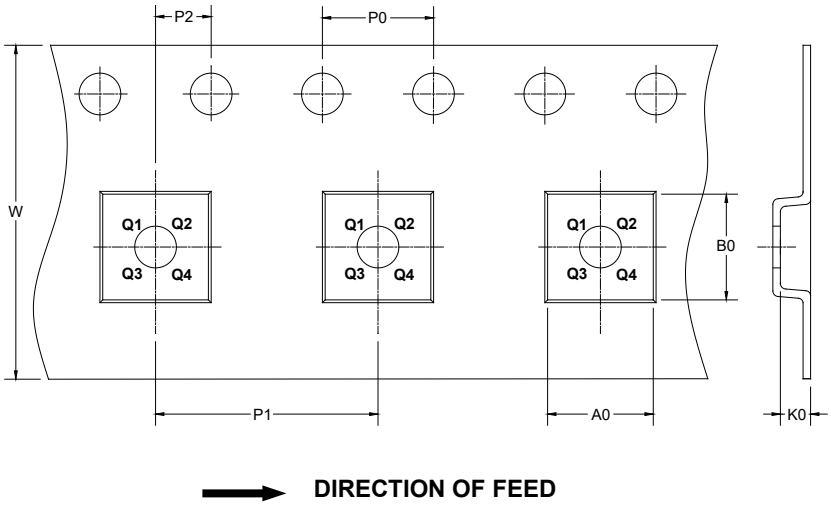
| Symbol | Dimensions In Millimeters | | |
|---|---|---|---|
| | MIN | MOD | MAX |
| A | 0.500 | 0.550 | 0.600 |
| A1 | | | 0.050 |
| A2 | 0.152 REF | | |
| e | 0.400 BSC | | |
| D | 1.150 | 1.200 | 1.250 |
| E | 1.150 | 1.200 | 1.250 |
| b | 0.130 | 0.180 | 0.230 |
| L | 0.200 | 0.250 | 0.300 |

# TAPE AND REEL INFORMATION

### REEL DIMENSIONS




### TAPE DIMENSIONS




DIRECTION OF FEED

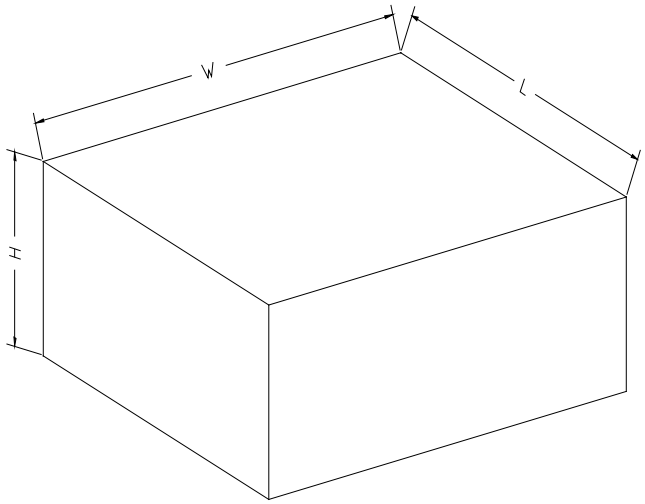
NOTE: The picture is only for reference. Please make the object as the standard.

## KEY PARAMETER LIST OF TAPE AND REEL

| Package Type | Reel Diameter | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P0 (mm) | P1 (mm) | P2 (mm) | W (mm) | Pin1 Quadrant |
|---|---|---|---|---|---|---|---|---|---|---|
| UTDFN-1.2×1.2-6AL | 7″ | 9.0 | 1.35 | 1.35 | 0.73 | 4.0 | 4.0 | 2.0 | 8.0 | Q1 |

DD0001

## CARTON BOX DIMENSIONS




NOTE: The picture is only for reference. Please make the object as the standard.

## KEY PARAMETER LIST OF CARTON BOX

| Reel Type | Length (mm) | Width (mm) | Height (mm) | Pizza/Carton |
|---|---|---|---|---|
| 7″ (Option) | 368 | 227 | 224 | 8 |
| 7″ | 442 | 410 | 224 | 18 |

DD0002