



SGM8417A-1

24V, 1.5A Peak Output Current Rail-to-Rail I/O Operational Amplifier

GENERAL DESCRIPTION

The SGM8417A-1 is a single, high slew rate, low power operational amplifier optimized for high voltage systems. The device can operate on single or dual power supply. It supports rail-to-rail input and output operation.

The SGM8417A-1 features 10mV maximum offset voltage, 1.5A peak output current, and 74V/ μ s high slew rate. The combination of characteristics makes the device suitable for TFT-LCDs.

The SGM8417A-1 is available in a Green TDFN-3 \times 3-8L package. It is specified over the -40°C to +85°C temperature range.

FEATURES

- **Peak Output Current: 1.5A**
- **High Slew Rate: 74V/ μ s**
- **Unity-Gain Stable**
- **Rail-to-Rail Input and Output**
- **Supply Voltage Range: 4.5V to 24V**
- **-40°C to +85°C Operating Temperature Range**
- **Available in a Green TDFN-3 \times 3-8L Package**

APPLICATIONS

TFT-LCD Panels
LCD TVs
Monitors
Laptops

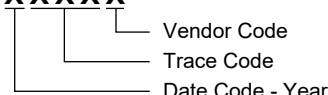
PACKAGE/ORDERING INFORMATION

| MODEL | PACKAGE DESCRIPTION | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE MARKING | PACKING OPTION |
|------------|---------------------|-----------------------------|---------------------|-----------------------|---------------------|
| SGM8417A-1 | TDFN-3×3-8L | -40°C to +85°C | SGM8417A-1YTDB8G/TR | SGM G5XDB XXXXX | Tape and Reel, 4000 |

MARKING INFORMATION

NOTE: XXXXX = Date Code, Trace Code and Vendor Code.

XXXXX



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.

ABSOLUTE MAXIMUM RATINGS

| | |
|--|------------------------------------|
| Supply Voltage, +V _S to -V _S | -0.3V to 28V |
| Input/Output Voltage to -V _S | -0.3V to (+V _S) + 0.3V |
| +IN to -IN | ±5V |
| Duration of Output Short to +V _S or -V _S | 30min |
| Package Thermal Resistance | |
| TDFN-3×3-8L, θ _{JA} | 84°C/W |
| Junction Temperature..... | +150°C |
| Storage Temperature Range | -65°C to +150°C |
| Lead Temperature (Soldering, 10s)..... | +260°C |
| ESD Susceptibility | |
| HBM..... | 8000V |
| CDM | 1000V |

RECOMMENDED OPERATING CONDITIONS

| | |
|-----------------------------------|----------------|
| Supply Voltage Range | 4.5V to 24V |
| Operating Temperature Range | -40°C to +85°C |

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.

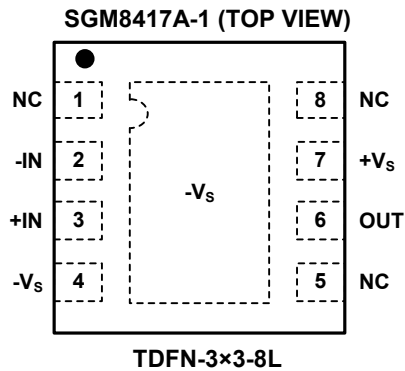
ESD SENSITIVITY CAUTION

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.

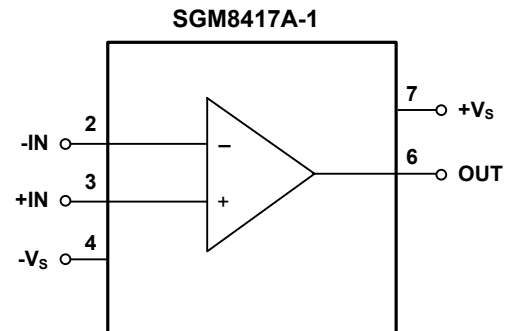
DISCLAIMER

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

PIN CONFIGURATION



FUNCTIONAL BLOCK DIAGRAM



NOTE: Connect thermal die pad to -Vs. Connect it to -Vs plane to maximize thermal performance.

ELECTRICAL CHARACTERISTICS

($+V_S = 4.5V$ to $24V$, $-V_S = 0V$, $+V_{IN} = V_{OUT} = +V_S/2$, Full = $-40^\circ C$ to $+85^\circ C$, typical values are at $T_A = +25^\circ C$, unless otherwise noted.)

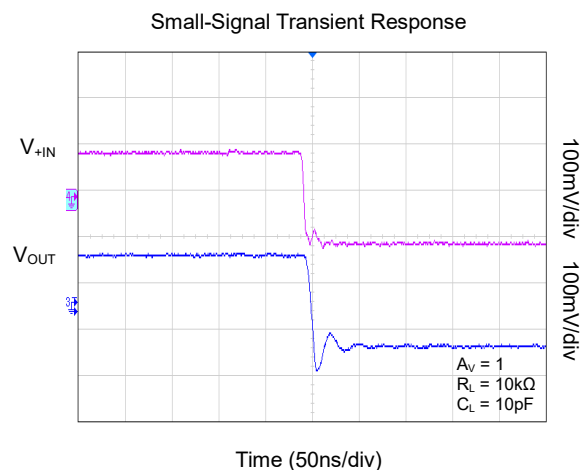
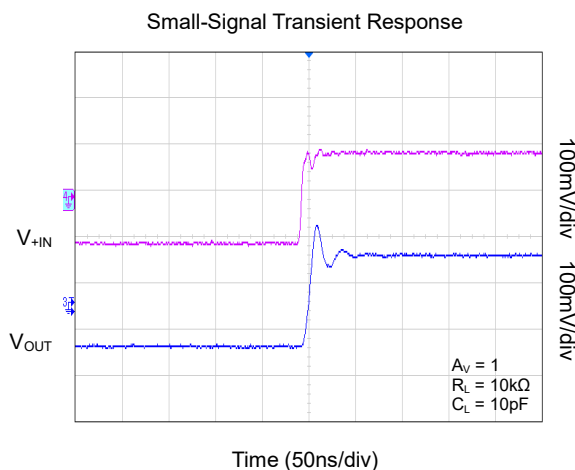
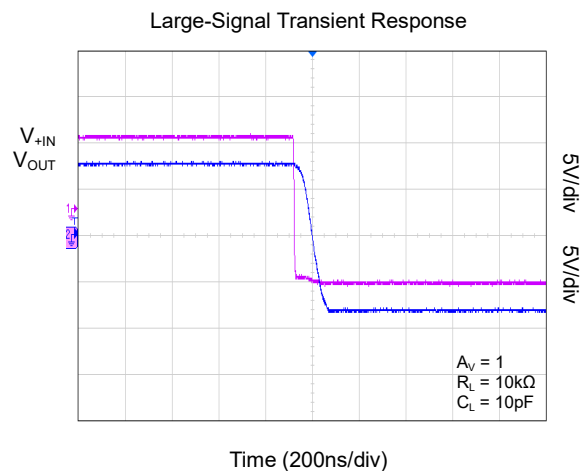
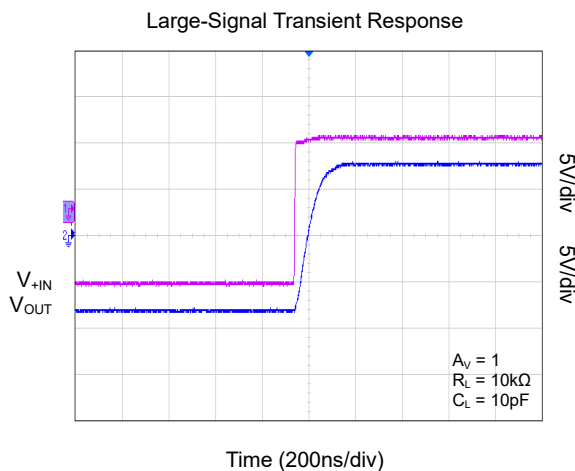
| PARAMETER | SYMBOL | CONDITIONS | TEMP | MIN | TYP | MAX | UNITS |
|--|----------------------|---|-------|---------------------------|---------------------------|--------------------------|--------|
| Input Characteristics | | | | | | | |
| Input Offset Voltage | V _{OS} | V _{CM} = +V _S /2 | +25°C | | 2.4 | 10 | mV |
| | | | Full | | | 12 | |
| Input Offset Voltage Drift | ΔV _{OS} /ΔT | V _{CM} = +V _S /2 | | | 3.6 | | μV/°C |
| Input Bias Current | I _B | V _{CM} = +V _S /2 | +25°C | | 0.3 | 1.5 | nA |
| | | | Full | | | 60 | |
| Load Regulation | ΔV _{LOAD} | I _{OUT} = 0mA to -80mA | Full | | 0.01 | 0.08 | mV/mA |
| | | I _{OUT} = 0mA to 80mA | Full | -0.08 | -0.01 | | |
| Input Common Mode Voltage Range | V _{CM} | | Full | -0.1 | | (+V _S) + 0.1 | V |
| Common Mode Rejection Ratio | CMRR | +V _S = 16V, -0.1V ≤ V _{CM} ≤ (+V _S) + 0.1V | +25°C | 60 | 72 | | dB |
| | | | Full | 57 | | | |
| Open-Loop Voltage Gain | A _{OL} | +V _S = 16V, 0.5V ≤ V _{CM} ≤ (+V _S) - 0.5V | +25°C | 92 | 120 | | dB |
| | | | Full | 88 | | | |
| Output Characteristics | | | | | | | |
| Low Output Voltage Swing from Rail | V _{OL} | I _L = -50mA | Full | | 0.13 | 0.22 | V |
| High Output Voltage Swing from Rail | V _{OH} | I _L = 50mA | Full | (+V _S) - 0.33 | (+V _S) - 0.22 | | V |
| Transient Peak Output Current | I _{PK} | +V _S = 24V | +25°C | | ±1.5 | | A |
| Continuous Output Current ⁽¹⁾ | I _{OUT} | +V _S = 24V, V _{OUT} reaches within -3.5V from +V _S and +3.5V from -V _S | +25°C | | ±400 | | mA |
| Power Supply | | | | | | | |
| Supply Voltage Range | V _S | | Full | 4.5 | | 24 | V |
| Power Supply Rejection Ratio | PSRR | +V _S = 4.5V to 24V, V _{CM} = 2.25V | +25°C | 87 | 94 | | dB |
| | | | Full | 84 | | | |
| Quiescent Current | I _Q | No load | Full | | 3.3 | 5.5 | mA |
| Dynamic Performance | | | | | | | |
| Slew Rate | SR | +V _S = 16V, 4V step, R _L = 10kΩ, C _L = 50pF, 20% to 80%, A _V = 1 | +25°C | | 74 | | V/μs |
| Settling Time to ±0.1% | t _s | A _V = 1, V _{OUT} = 2V step, R _L = 10kΩ, C _L = 10pF | +25°C | | 134 | | ns |
| -3dB Bandwidth | BW | R _L = 10kΩ, C _L = 10pF | +25°C | | 75 | | MHz |
| Gain-Bandwidth Product | GBP | R _L = 10kΩ, C _L = 10pF | +25°C | | 26 | | MHz |
| Phase Margin | PM | R _L = 10kΩ, C _L = 10pF | +25°C | | 36 | | ° |
| Noise Performance | | | | | | | |
| Input Voltage Noise Density | e _n | f = 1kHz | +25°C | | 118 | | nV/√Hz |
| Thermal Protection | | | | | | | |
| Thermal Shutdown Temperature | T _{SHDN} | | | | 140 | | °C |
| Thermal Shutdown Hysteresis | ΔT _{SHDN} | | | | 20 | | °C |

NOTE:

1. The result is determined by the power consumption and the heat dissipation of the package, while the power consumption is mainly determined by the $|(\pm V_S) - V_{OUT}| \times I_{OUT}$. See the Thermal Consideration section for more information.

TYPICAL PERFORMANCE CHARACTERISTICS

At $T_A = +25^\circ\text{C}$, $+V_S = 16\text{V}$, $-V_S = 0\text{V}$, unless otherwise specified.



APPLICATION INFORMATION

The SGM8417A-1 is specifically designed to drive high current load. The device supports rail-to-rail input and output operation, and consumes low quiescent current. It can also provide a high slew rate. The combination of characteristics makes SGM8417A-1 suitable for LCD applications.

Operating Voltage

The SGM8417A-1 is guaranteed to operate from 4.5V to 24V, and the operation is extremely stable over the whole specified range of the temperature. The output voltage swing can be closer to the supply rail by reducing the load current.

LCD Panel Application

The SGM8417A-1 can provide optimal performance in LCD V_{COM} buffer. It features $\pm 1.5A$ transient peak source/sink current.

Output Current Limit

The SGM8417A-1 can drive $\pm 1.5A$ transient peak output current. The device has a $\pm 1.5A$ (TYP) current limit, which is accomplished with the characteristics of the internal metal interconnects. Maximum reliability is maintained if the output continuous current never exceeds $\pm 400mA$.

Short-Circuit Protection

The output can be shorted to $\pm V_S$ for 60 seconds and the supply-to-output differential voltage must be less than $|12V|$, else the SGM8417A-1 may be damaged.

Thermal Consideration

When operating the device, the users need to make sure that the junction temperature is below the absolute maximum one. The junction temperature is increasing because the power dissipation is higher than before. And a lot of possibilities can cause the thermal considerations, such as the width of trace in PCB, the package of the device, the gap between ambient and junction temperature and rate of environmental airflow.

When the die temperature exceeds the threshold value of thermal shutdown, the output will be in high impedance state and it will remain in this state until the die temperature decreases to $+120^\circ C$.

The following equation indicates the calculation of power dissipation:

$$P_{D(MAX)} = (T_{J(MAX)} - T_A) / \theta_{JA} \quad (1)$$

where:

$T_{J(MAX)}$ = Maximum junction temperature.

T_A = Ambient temperature.

θ_{JA} = Junction to ambient thermal resistance.

It is recommended that the junction temperature should not exceed $+125^\circ C$ for normal operation. The parameter of ambient thermal resistance is determined by the width of trace in PCB layout.

In addition, the ambient temperature and thermal resistance will affect the power dissipation of SGM8417A-1.

Layout

For the circuits with high power path, a good PCB design is essential. It is recommended to use the following layout method to improve the performance of SGM8417A-1 at most.

- ◆ The power component should be close enough to SGM8417A-1 for better performance. Also, if the high current is necessary, the corresponding trace in PCB should be short and wide.
- ◆ For some applications such as filtering, a series resistor is necessary to be added at the output of the device.
- ◆ Choosing a suitable bypass capacitor can enhance the stability when driving the loads with high transient. For single-supply operation, the bypass capacitor should be placed as close to $+V_S$ pin as possible. For dual-supply operation, both $+V_S$ and $-V_S$ supplies should be bypassed to ground with separate $0.1\mu F$ ceramic capacitors. Using a $10\mu F$ tantalum capacitor is a good choice to improve the operating stability of the device when driving high transient load.
- ◆ A $0.1\mu F$ capacitor should be connected with $+IN$ pin to GND for better operation of SGM8417A-1 and the distance between this capacitor and $+IN$ pin should be minimized.
- ◆ It is recommended to connect exposed pad to $-V_S$ directly in the PCB.

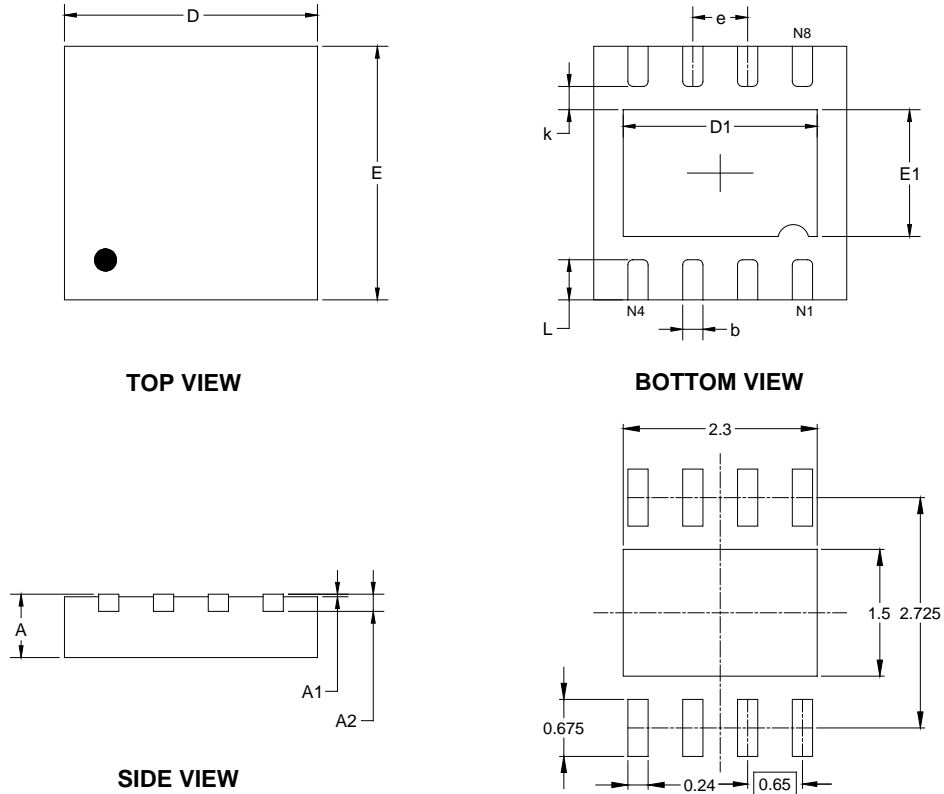
REVISION HISTORY

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

| JULY 2024 – REV.A.1 to REV.A.2 | | Page |
|---|--|------|
| Updated Electrical Characteristics section | | 4 |
| JUNE 2023 – REV.A to REV.A.1 | | Page |
| Updated Electrical Characteristics section | | 4 |
| Updated Application Information section | | 6 |
| Changes from Original (AUGUST 2022) to REV.A | | Page |
| Changed from product preview to production data | | All |

PACKAGE OUTLINE DIMENSIONS

TDFN-3x3-8L



RECOMMENDED LAND PATTERN (Unit: mm)

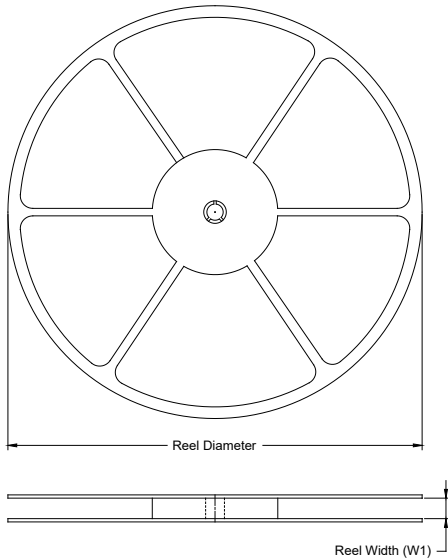
| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|------------------------------|-------|-------------------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.700 | 0.800 | 0.028 | 0.031 |
| A1 | 0.000 | 0.050 | 0.000 | 0.002 |
| A2 | 0.203 REF | | 0.008 REF | |
| D | 2.900 | 3.100 | 0.114 | 0.122 |
| D1 | 2.200 | 2.400 | 0.087 | 0.094 |
| E | 2.900 | 3.100 | 0.114 | 0.122 |
| E1 | 1.400 | 1.600 | 0.055 | 0.063 |
| k | 0.200 MIN | | 0.008 MIN | |
| b | 0.180 | 0.300 | 0.007 | 0.012 |
| e | 0.650 TYP | | 0.026 TYP | |
| L | 0.375 | 0.575 | 0.015 | 0.023 |

NOTE: This drawing is subject to change without notice.

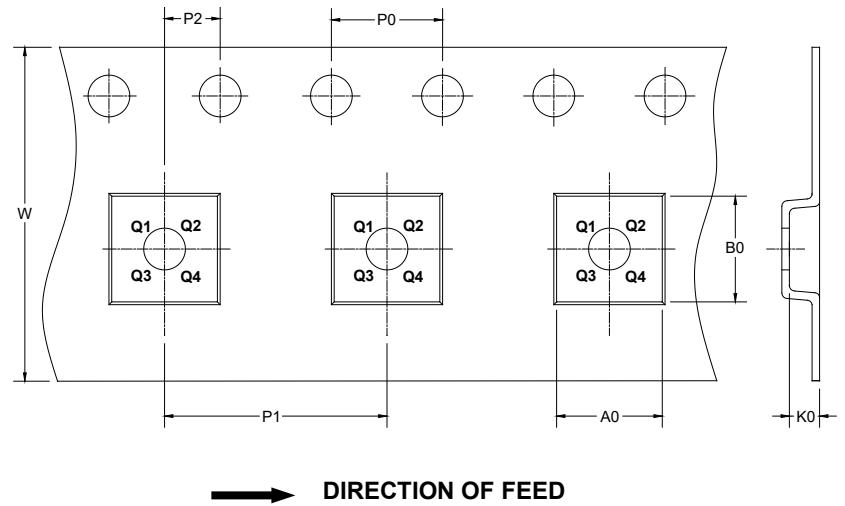
PACKAGE INFORMATION

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



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

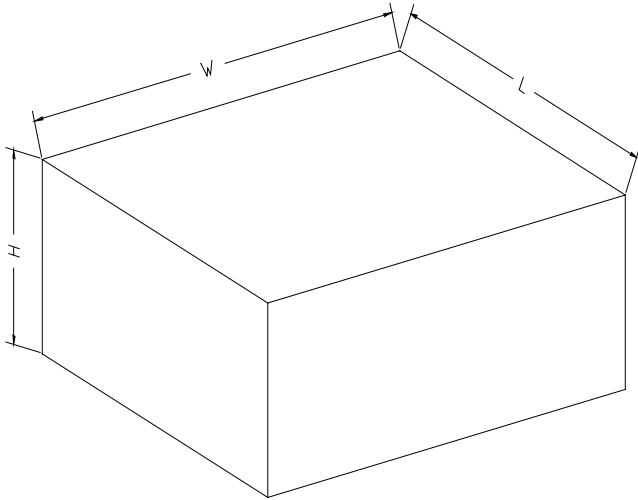
KEY PARAMETER LIST OF TAPE AND REEL

| Package Type | Reel Diameter | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P0 (mm) | P1 (mm) | P2 (mm) | W (mm) | Pin1 Quadrant |
|--------------|---------------|--------------------|---------|---------|---------|---------|---------|---------|--------|---------------|
| TDFN-3×3-8L | 13" | 12.4 | 3.35 | 3.35 | 1.13 | 4.0 | 8.0 | 2.0 | 12.0 | Q1 |

DD00001

PACKAGE INFORMATION

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 |
|-----------|-------------|------------|-------------|--------------|
| 13" | 386 | 280 | 370 | 5 |

DD0002