

GENERAL DESCRIPTION

The SGM4542 is a 2-bit, non-inverting, bidirectional voltage-level translator which features two independent configurable power-supply lines. The A and B ports track the V_{CCA} supply and V_{CCB} supply respectively. The supply voltage range is 0.9V to 3.6V for both A and B ports. The device provides a bidirectional translation function among the different voltage nodes (including 1.2V, 1.8V, 2.5V, and 3.6V).

The SGM4542 has an output enable (OE) function, which controls the inputs and outputs states. When OE goes low, all I/Os enter into the high-impedance state. It is beneficial to reduce quiescent current consumption.

The SGM4542 is available in a Green XTDFN-1.35×1-8L package. It operates over an ambient temperature range of -40°C to +125°C.

FEATURES

- **Power Supply Voltage Range ($V_{CCA} \leq V_{CCB}$)**
 - ♦ **A Ports and B Ports: 0.9V to 3.6V**
- **When V_{CCA} or V_{CCB} is Low, Device Enters Power-Down Mode**
- **Direction-Control Signal is Not Required**
- **No Specific Power Sequences Required for V_{CCA} and V_{CCB}**
- **Supports Power-Down Mode**
- **Available in a Green XTDFN-1.35×1-8L Package**

APPLICATIONS

Universal Asynchronous Receiver/Transmitter
I²C/SMBus Interfaces
General Purpose I/O (GPIO)

TYPICAL APPLICATION

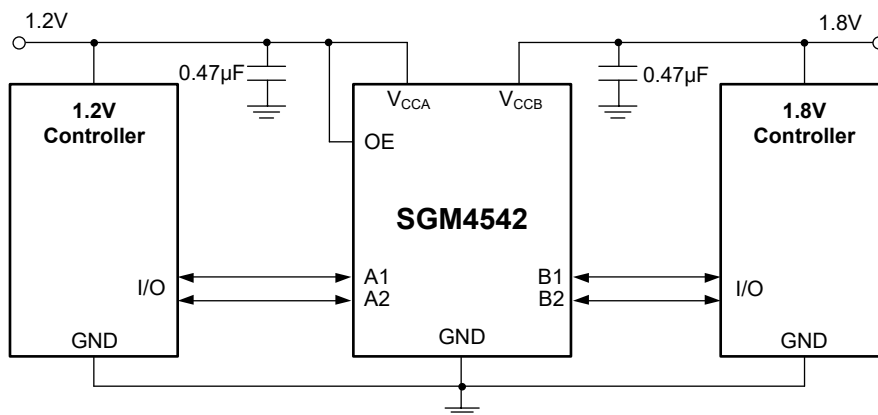


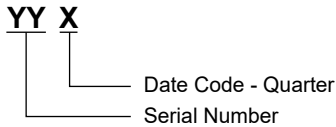
Figure 1. Typical Application Circuit

PACKAGE/ORDERING INFORMATION

| MODEL | PACKAGE DESCRIPTION | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE MARKING | PACKING OPTION |
|---------|---------------------|-----------------------------|------------------|-----------------|---------------------|
| SGM4542 | XTDFN-1.35×1-8L | -40°C to +125°C | SGM4542XXET8G/TR | XSX | Tape and Reel, 5000 |

MARKING INFORMATION

NOTE: X = Date Code.



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 Range

- V_{CCA} -0.5V to 4.6V
- V_{CCB} -0.5V to 4.6V

Input Voltage Range, V_I

- A Ports -0.5V to 4.6V
- B Ports -0.5V to 4.6V
- OE..... -0.5V to 4.6V

Output Voltage Range for the High-Impedance or Power-Off State, V_O

- A Ports -0.5V to 4.6V
- B Ports -0.5V to 4.6V

Output Voltage Range for the High or Low State, V_O

- A Ports -0.5V to V_{CCA} + 0.5V
- B Ports -0.5V to V_{CCB} + 0.5V

Input Clamp Current, I_{IK}, (V_I < 0).....-50mA

Output Clamp Current, I_{OK}, (V_O < 0).....-50mA

Package Thermal Resistance

XTDFN-1.35×1-8L, θ_{JA}..... 240°C/W

Junction Temperature.....+150°C

Storage Temperature Range-65°C to +150°C

Lead Temperature (Soldering, 10s).....+260°C

ESD Susceptibility

HBM..... 3000V

CDM 1000V

RECOMMENDED OPERATING CONDITIONS

Operating Temperature Range-40°C to +125°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.

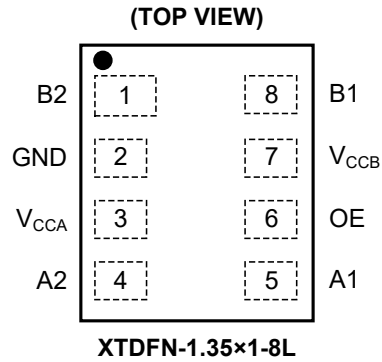
ESD SENSITIVITY CAUTION

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



PIN DESCRIPTION

| PIN | NAME | FUNCTION |
|-----|-----------|--|
| 1 | B2 | Channel 2 Input/Output B. It tracks the V_{CCB} supply. |
| 2 | GND | Ground. |
| 3 | V_{CCA} | Supply Voltage on A Port. It can be operated from 0.9V to 3.6V, and V_{CCA} is always $\leq V_{CCB}$. |
| 4 | A2 | Channel 2 Input/Output A. It tracks the V_{CCA} supply. |
| 5 | A1 | Channel 1 Input/Output A. It tracks the V_{CCA} supply. |
| 6 | OE | Output Enable Control Pin. Active high. When OE goes low, all outputs enter into the high-impedance state. It tracks the V_{CCA} supply. |
| 7 | V_{CCB} | Supply Voltage on B Port. It can be operated from 0.9V to 3.6V. |
| 8 | B1 | Channel 1 Input/Output B. It tracks the V_{CCB} supply. |

FUNCTIONAL DESCRIPTION





Table 1. Functional Table

| $V_{CCA}^{(1)}$ | $V_{CCB}^{(1)}$ | $OE^{(3)}$ | An | Bn |
|-----------------|-----------------|------------------|------------------|--------------|
| 1.08V to 1.98V | 1.08V to 1.98V | L | Z ⁽²⁾ | Z |
| 1.08V to 1.98V | 1.08V to 1.98V | H ⁽²⁾ | Input/Output | Output/Input |

NOTES:

1. No specific power sequence is required for V_{CCA} and V_{CCB} . V_{CCA} is always $\leq V_{CCB}$.
2. H = high voltage level, L = low voltage level, X = don't care, Z = high impedance state.
3. OE can withstand voltage up to V_{CCB} , but its V_{IL} and V_{IH} are referenced to V_{CCA} .

Table 2. Truth Table when OE = H

| Input | Output |
|---|---|
|  Transition Rising Edge |  Follow Input Signal |
| H | H (Once it reaches the steady-state high, it can respond to signal driven in the opposite direction) |
|  Transition Falling Edge |  Follow Input Signal |
| L | L (Once it reaches the steady-state low, it can respond to signal driven in the opposite direction) |

ELECTRICAL CHARACTERISTICS

($V_{CCA} = 1.08V$ to $3.6V$, $V_{CCB} = 1.08V$ to $3.6V$, Full = $-40^{\circ}C$ to $+125^{\circ}C$, typical values are at $T_A = +25^{\circ}C$, unless otherwise noted.)

| PARAMETER | | SYMBOL | CONDITIONS | TEMP | MIN | TYP | MAX | UNITS |
|---|--------------|---------------------|---|----------------|----------------------|----------------------|----------------------|---------|
| Recommended Operating Conditions | | | | | | | | |
| Supply Voltage ⁽¹⁾ | | V_{CCA} | | Full | 1.08 | | 3.6 | V |
| | | V_{CCB} | | Full | 1.08 | | 3.6 | |
| High-Level Input Voltage | A Port I/Os | V_{IH} | | Full | $0.7 \times V_{CCA}$ | | | V |
| | B Port I/Os | | | Full | $0.7 \times V_{CCB}$ | | | |
| | OE Input | | | Full | $0.7 \times V_{CCA}$ | | | |
| Low-Level Input Voltage | A Port I/Os | V_{IL} | | Full | | | 0.25 | V |
| | B Port I/Os | | | Full | | | 0.25 | |
| | OE Input | | | Full | | | $0.3 \times V_{CCA}$ | |
| Hysteresis Voltage | OE Input | V_{HYS} | | Full | 0.03 | | 0.3 | V |
| Electrical Characteristics | | | | | | | | |
| A Ports High-Level Output Voltage | | V_{OHA} | $I_{OH} = -20\mu A$ | | Full | $0.7 \times V_{CCA}$ | | V |
| A Ports Low-Level Output Voltage | | V_{OLA} | $I_{OL} = 1mA, V_{IB} \leq 0.25V$ | | Full | | 0.4 | V |
| B Ports High-Level Output Voltage | | V_{OHB} | $I_{OH} = -20\mu A$ | | Full | $0.7 \times V_{CCB}$ | | V |
| B Ports Low-Level Output Voltage | | V_{OLB} | $I_{OL} = 1mA, V_{IA} \leq 0.25V$ | | Full | | 0.4 | V |
| Input Leakage Current | OE Input | I_I | | | Full | | ± 4 | μA |
| Power-Off Leakage Current | A Ports | I_{OFF} | $V_{CCA} = 0V, V_{CCB} = 0V$ to $3.6V$ | | Full | | ± 10 | μA |
| | B Ports | | $V_{CCA} = 0V$ to $3.6V, V_{CCB} = 0V$ | | Full | | ± 10 | |
| Off-State Output Leakage | A or B Ports | I_{OZ} | $OE = 0V$ | | Full | | ± 8 | μA |
| Quiescent Supply Current | | $I_{CCA} + I_{CCB}$ | $V_{CCA} = 1.08V$ to V_{CCB} , $V_{CCB} = 1.08V$ to $3.6V$, $V_I = 0V$ or $V_{CCI}^{(2)}$, $I_O = 0A$ | | Full | | 50 | μA |
| OE Input Capacitance | | C_I | | $+25^{\circ}C$ | | 10 | | pF |
| Input/Output Capacitance | A Ports | C_{IO} | Enabled | $+25^{\circ}C$ | | 18 | | pF |
| | | | Disabled | $+25^{\circ}C$ | | 15 | | |
| | B Ports | | Enabled | $+25^{\circ}C$ | | 18 | | |
| | | | Disabled | $+25^{\circ}C$ | | 15 | | |

NOTES:

1. Ensure that $V_{CCA} \leq V_{CCB}$.
2. V_{CCI} is the supply voltage associated with the input ports.

SWITCHING CHARACTERISTICS

($V_{CCA} = 1.08V$ to $3.6V$, $V_{CCB} = 1.08V$ to $3.6V$, Full = $-40^{\circ}C$ to $+125^{\circ}C$, typical values are at $T_A = +25^{\circ}C$, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | TEMP | MIN | TYP | MAX | UNITS |
|-------------------------|-----------|--|------|-----|-----|------|-------|
| Propagation Delay | t_{PD} | An to Bn, or Bn to An, push-pull driving | Full | | | 22 | ns |
| Rise Time | t_R | An or Bn, push-pull driving | Full | 1 | | 26.5 | ns |
| Fall Time | t_F | An or Bn, push-pull driving | Full | 1 | | 26.5 | ns |
| Enable Time | t_{EN} | OE to An or Bn | Full | | | 285 | ns |
| Disable Time | t_{DIS} | OE to An or Bn | Full | | | 100 | ns |
| Channel-to-Channel Skew | t_{SKO} | Push-pull driving | Full | 0 | | 5 | ns |

WAVEFORMS

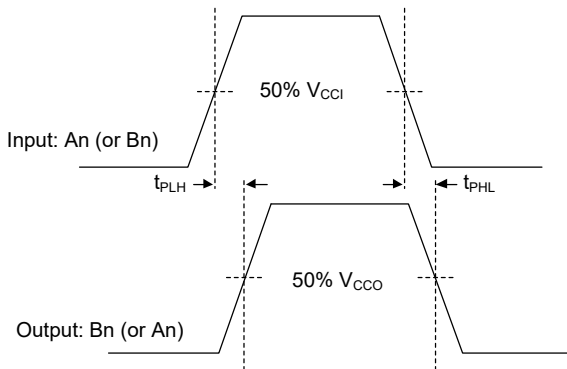


Figure 2. Propagation Delay (Data Input to Data Output)

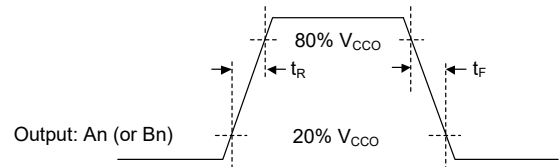
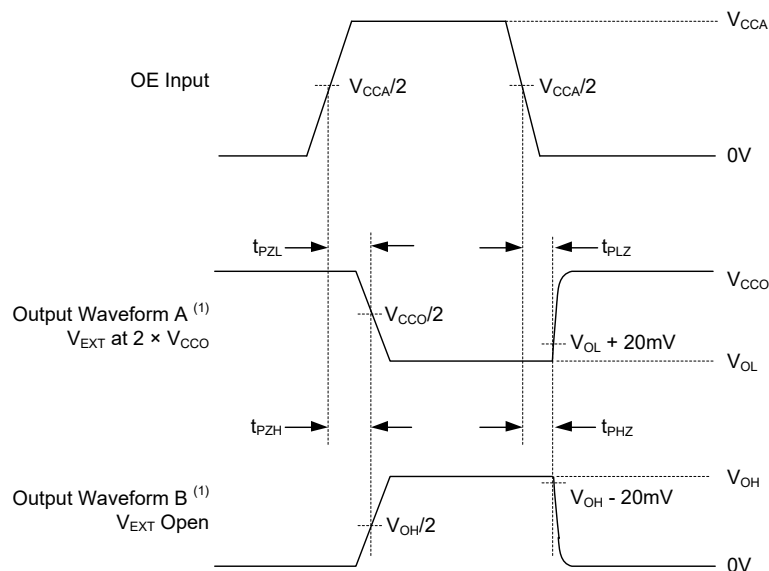


Figure 3. Rise Time and Fall Time of Data Output

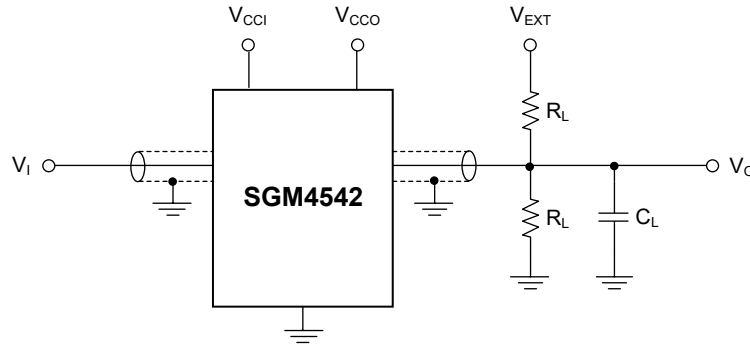


NOTE:

1. Waveform A indicates an output that is high except for OE is high. Waveform B indicates an output that is low except for OE is high.

Figure 4. Enable and Disable Times

TEST CIRCUIT



Test conditions are given in Table 3.

Definitions for test circuit:

R_L = Load resistance.

C_L = Load capacitance including jig and probe capacitance.

V_{EXT} = External voltage for measuring switching times.

Figure 5. Test Circuit for Measuring Switching Times

Table 3. Test Conditions

| Supply Voltage | | Input | | Load | | V_{EXT} | | |
|----------------|---------------|-----------------|---------------------|-------|----------------------------|--------------------------|-----------------------------|-----------------------------|
| V_{CCA} | V_{CCB} | V_I | $\Delta t/\Delta V$ | C_L | $R_L^{(2)}$ | $t_{PLH}, t_{PHL}^{(3)}$ | $t_{PLZ}, t_{PZL}^{(4)(5)}$ | $t_{PHZ}, t_{PZH}^{(4)(5)}$ |
| 1.08V to 3.6V | 1.08V to 3.6V | $V_{CCI}^{(1)}$ | $\leq 2\text{ns/V}$ | 15pF | 50k Ω , 1M Ω | Open | $2 \times V_{CCO}^{(1)}$ | Open |

NOTES:

- V_{CCI} is the supply voltage associated with the input, and V_{CCO} is the supply voltage associated with the output.
- For measuring propagation delay and output rise and fall measurements, $R_L = 1\text{M}\Omega$. For measuring enable and disable times, $R_L = 50\text{k}\Omega$.
- t_{PLH} and t_{PHL} are the same as t_{PD} .
- t_{PLZ} and t_{PHZ} are the same as t_{DIS} .
- t_{PZL} and t_{PZH} are the same as t_{EN} .

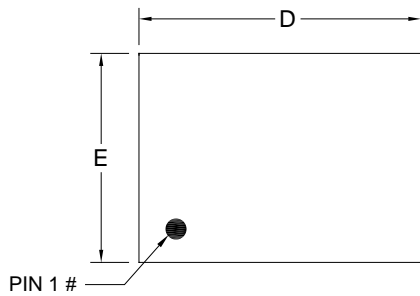
REVISION HISTORY

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

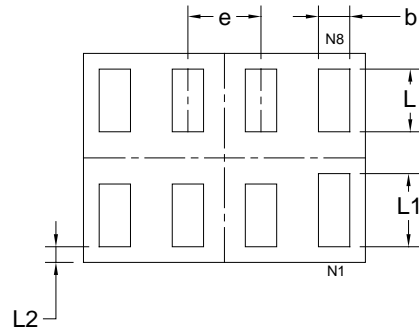
| MAY 2023 – REV.A to REV.A.1 | Page |
|--|------|
| Updated Features section..... | 1 |
| Updated Functional Description section..... | 4 |
| Changes from Original (DECEMBER 2021) to REV.A | Page |
| Changed from product preview to production data..... | All |

PACKAGE OUTLINE DIMENSIONS

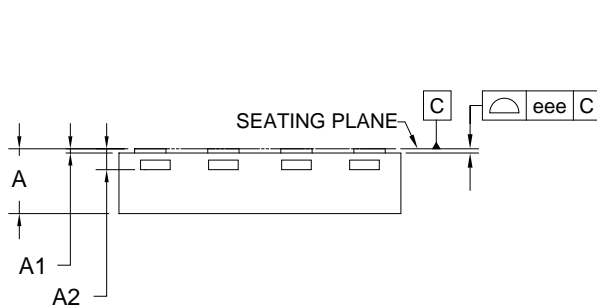
XTDFN-1.35x1-8L



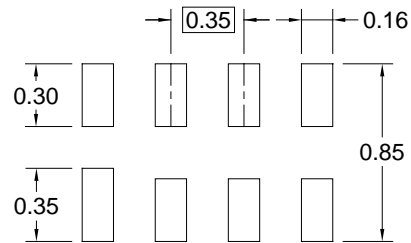
TOP VIEW



BOTTOM VIEW



SIDE VIEW



RECOMMENDED LAND PATTERN (Unit: mm)

| Symbol | Dimensions In Millimeters | | |
|--------|---------------------------|-------|-------|
| | MIN | MOD | MAX |
| A | - | 0.310 | 0.330 |
| A1 | 0.000 | - | 0.050 |
| A2 | 0.100 REF | | |
| D | 1.250 | 1.350 | 1.450 |
| E | 0.900 | 1.000 | 1.100 |
| b | 0.110 | 0.160 | 0.210 |
| e | 0.350 BSC | | |
| L | 0.250 | 0.300 | 0.350 |
| L1 | 0.300 | 0.350 | 0.400 |
| L2 | 0.075 REF | | |
| eee | - | 0.050 | - |

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 |
|-----------------|---------------|--------------------|---------|---------|---------|---------|---------|---------|--------|---------------|
| XTDFN-1.35×1-8L | 7" | 9.5 | 1.21 | 1.51 | 0.39 | 4.0 | 4.0 | 2.0 | 8.0 | Q1 |

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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 |
|-------------|-------------|------------|-------------|--------------|
| 7" (Option) | 368 | 227 | 224 | 8 |
| 7" | 442 | 410 | 224 | 18 |

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