SGM4578
8-Bit Bidirectional Voltage-Level Translator for Open-Drain and Push-Pull Applications

GENERAL DESCRIPTION

This 8-bit non-inverting translator is a bidirectional voltage-level translator and can be used to establish digital switching compatibility between mixed-voltage systems. It uses two separate configurable power-supply rails, with the A ports supporting operating voltages from 1.65V to 5.5V while it tracks the V_{CCA} supply, and the B ports supporting operating voltages from 2.3V to 5.5V while it tracks the V_{CCB} supply. This allows the support of both lower and higher logic signal levels while providing bidirectional translation capabilities between any of the 1.8V, 2.5V, 3.3V and 5V voltage nodes.

When the output-enable (OE) input is low, all I/Os are placed in the high-impedance state, which significantly reduces the power-supply quiescent current consumption. OE has an internal pull-down current source, as long as V_{CCA} is powered.

To ensure the high-impedance state during power up or power down, OE should be tied to GND through a pull-down resistor; the minimum value of the resistor is determined by the current-sourcing capability of the driver.

The SGM4578 is available in the Green TSSOP-20 and TQFN-3×3-20L packages. It operates over an ambient temperature range of -40℃ to +85℃.

FEATURES

- **No Direction-Control Signal Needed**
- **Data Rates**
  24Mbps (Push-Pull)
  2Mbps (Open-Drain)
- **1.65V to 5.5V on A Ports and 2.3V to 5.5V on B Ports ($V_{CCA} \leq V_{CCB}$)**
- **V_{CC} Isolation: If Either V_{CC} is at GND, Both Ports are in the High-Impedance State**
- **No Power-Supply Sequencing Required: Either V_{CCA} or V_{CCB} can be Ramped First**
- **I_{OFF}: Supports Partial-Power-Down Mode Operation**
- **-40℃ to +85℃ Operating Temperature Range**
- **Available in Green TSSOP-20 and TQFN-3×3-20L Packages**

APPLICATIONS

I^2C/SMBus
UART
GPIO

TYPICAL APPLICATION

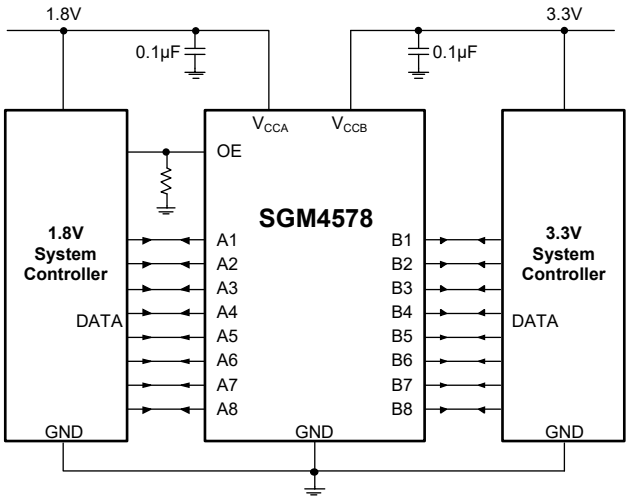


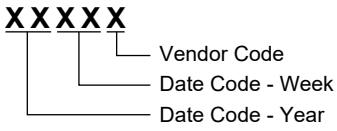
Figure 1. Typical Application Circuit

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM4578	TSSOP-20	-40℃ to +85℃	SGM4578YTS20G/TR	SGM4578YTS20 XXXXX	Tape and Reel, 4000
	TQFN-3×3-20L	-40℃ to +85℃	SGM4578YTQG20G/TR	SGM 4578QG XXXXX	Tape and Reel, 4000

MARKING INFORMATION

NOTE: XXXXX = Date Code and Vendor 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.

OVERSTRESS CAUTION

Stresses beyond those listed may cause permanent damage to the device. Functional operation of the device at these or any other conditions beyond those indicated in the operational section of the specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time.

ESD SENSITIVITY CAUTION

This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. 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 very small parametric changes could cause the device not to meet its published specifications.

ABSOLUTE MAXIMUM RATINGS

Supply Voltage Range
V_{CCA} ..... -0.3V to 6V
V_{CCB} ..... -0.3V to 6V
A Ports, B Ports, OE Input Voltage Range, V_I (1)
..... -0.3V to 6V
Voltage Range Applied to Any Output in the High-Impedance or Power-Off State, V_O (1)
A Ports ..... -0.3V to 6V
B Ports ..... -0.3V to 6V
Voltage Range Applied to Any Output in the High or Low State, V_O (1) (2)
A Ports ..... -0.3V to V_{CCA} + 0.3V
B Ports ..... -0.3V to V_{CCB} + 0.3V
Input Clamp Current, I_{IK} (V_I < 0) ..... -50mA
Output Clamp Current, I_{OK} (V_O < 0) ..... -25mA
Continuous Output Current, I_O ..... ±50mA
Continuous Current through V_{CCA}, V_{CCB}, or GND ..... ±100mA
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility
HBM 4000V
MM 300V
CDM 1000V

NOTES:
1. The input and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.
2. The value of V_{CCA} and V_{CCB} are provided in the recommended operating conditions table.

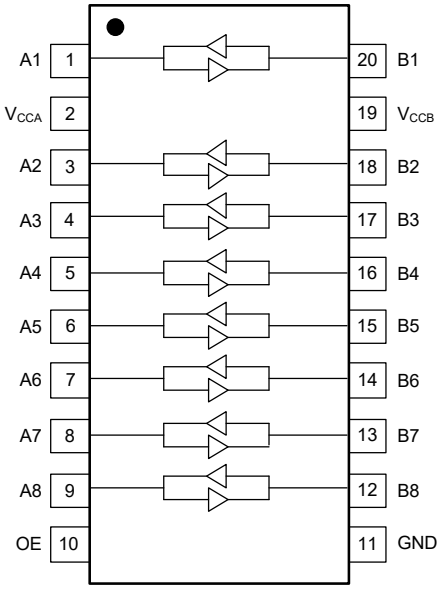
RECOMMENDED OPERATING CONDITIONS (3, 4)

Supply Voltage Range (5)
V_{CCA} ..... 1.65V to 5.5V
V_{CCB} ..... 2.3V to 5.5V
High-Level Input Voltage, V_{IH}
A Port I/Os (V_{CCA} = 1.65V, V_{CCB} = 2.3V to 5.5V)
..... V_{CCI} - 0.1V to V_{CCI}
A Port I/Os (V_{CCA} = 1.95V to 5.5V, V_{CCB} = 2.3V to 5.5V)
..... V_{CCI} - 0.4V to V_{CCI}
B Port I/Os ..... V_{CCI} - 0.4V to V_{CCI}
OE Input ..... V_{CCA} × 0.8V to 5.5V
Low-Level Input Voltage, V_{IL}
A Port I/Os ..... 0V to 0.15V
B Port I/Os ..... 0V to 0.15V
OE Input ..... 0V to V_{CCA} × 0.25V
Operating Temperature Range ..... -40℃ to +85℃

NOTES:
3. V_{CCI} is the V_{CC} associated with the input ports.
4. V_{CCO} is the V_{CC} associated with the output ports.
5. V_{CCA} must be less than or equal to V_{CCB}, and V_{CCA} must not exceed 5.5V.

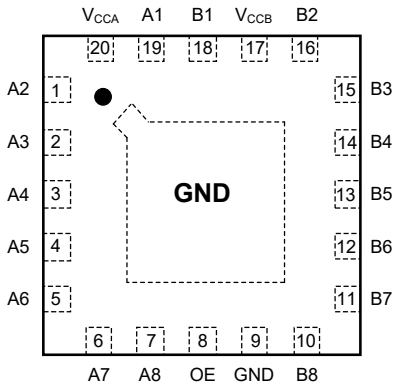
PIN CONFIGURATIONS

(TOP VIEW)



TSSOP-20

(TOP VIEW)



TQFN-3×3-20L

PIN DESCRIPTION

PIN		NAME	TYPE	FUNCTION
TSSOP-20	TQFN-3×3-20L			
1	19	A1	I/O	Input/Output 1. Referenced to V_{CCA}.
2	20	V_{CCA}	S	A Ports Supply Voltage. 1.65V ≤ V_{CCA} ≤ 5.5V and V_{CCA} ≤ V_{CCB}.
3	1	A2	I/O	Input/Output 2. Referenced to V_{CCA}.
4	2	A3	I/O	Input/Output 3. Referenced to V_{CCA}.
5	3	A4	I/O	Input/Output 4. Referenced to V_{CCA}.
6	4	A5	I/O	Input/Output 5. Referenced to V_{CCA}.
7	5	A6	I/O	Input/Output 6. Referenced to V_{CCA}.
8	6	A7	I/O	Input/Output 7. Referenced to V_{CCA}.
9	7	A8	I/O	Input/Output 8. Referenced to V_{CCA}.
10	8	OE	I	Output Enable (Active High). Pull OE low to place all outputs in 3-state mode. Referenced to V_{CCA}.
11	9	GND	S	Ground.
12	10	B8	I/O	Input/Output 8. Referenced to V_{CCB}.
13	11	B7	I/O	Input/Output 7. Referenced to V_{CCB}.
14	12	B6	I/O	Input/Output 6. Referenced to V_{CCB}.
15	13	B5	I/O	Input/Output 5. Referenced to V_{CCB}.
16	14	B4	I/O	Input/Output 4. Referenced to V_{CCB}.
17	15	B3	I/O	Input/Output 3. Referenced to V_{CCB}.
18	16	B2	I/O	Input/Output 2. Referenced to V_{CCB}.
19	17	V_{CCB}	S	B Ports Supply Voltage. 2.3V ≤ V_{CCB} ≤ 5.5V.
20	18	B1	I/O	Input/Output 1. Referenced to V_{CCB}.
—	Exposed Pad	GND	—	Exposed pad should be soldered to PCB board and connected to GND or left floating.

ELECTRICAL CHARACTERISTICS

(V_{CCA} = 1.65V to 5.5V, V_{CCB} = 2.3V to 5.5V, Full = -40℃ to +85℃, typical values are at T_A = +25℃, unless otherwise noted.)

PARAMETER		CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
ELECTRICAL CHARACTERISTICS								
A Ports High Level Output Voltage (V_{OHA})		I_{OH} = -20μA, V_{IB} ≥ V_{CCB} - 0.4V		Full	V_{CCA} × 0.67			V
A Ports Low Level Output Voltage (V_{OLA})		I_{OL} = 1mA, V_{IB} ≤ 0.15V		Full			0.4	
B Ports High Level Output Voltage (V_{OHB})		I_{OH} = -20μA, V_{IA} ≥ V_{CCA} - 0.4V		Full	V_{CCB} × 0.67			
B Ports Low Level Output Voltage (V_{OLB})		I_{OL} = 1mA, V_{IA} ≤ 0.15V		Full			0.4	
Input Leakage Current (I_I)	OE			+25℃			±1	μA
				Full			±1.5	
Power Off Leakage Current (I_{OFF})	A Ports	V_{CCA} = 0V, V_{CCB} = 0V to 5.5V		+25℃			±0.5	μA
				Full			±1	
	B Ports	V_{CCA} = 0V to 5.5V, V_{CCB} = 0V		+25℃			±0.5	
				Full			±1	
3-State Output Leakage (I_{OZ})	A or B Ports	OE = 0V		+25℃			±0.5	μA
				Full			±1	
Quiescent Supply Current (I_{CCA})		V_I = V_O = OPEN, I_O = 0	V_{CCA} = 1.65V to V_{CCB}, V_{CCB} = 2.3V to 5.5V	Full			13	μA
			V_{CCA} = 5.5V, V_{CCB} = 0V	Full			13	
			V_{CCA} = 0V, V_{CCB} = 5.5V	Full			-1	
Quiescent Supply Current (I_{CCB})		V_I = V_O = OPEN, I_O = 0	V_{CCA} = 1.65V to V_{CCB}, V_{CCB} = 2.3V to 5.5V	Full			17	μA
			V_{CCA} = 5.5V, V_{CCB} = 0V	Full			-1	
			V_{CCA} = 0V, V_{CCB} = 5.5V	Full			8	
Quiescent Supply Current (I_{CCA} + I_{CCB})		V_I = V_O = OPEN, I_O = 0	V_{CCA} = 1.65V to V_{CCB}, V_{CCB} = 2.3V to 5.5V	Full			21	μA
Quiescent Supply Current (I_{CCZA})		V_I = V_{CCI} or 0V, I_O = 0, OE = 0V	V_{CCA} = 1.65V to V_{CCB}, V_{CCB} = 2.3V to 5.5V	Full			13	μA
Quiescent Supply Current (I_{CCZB})		V_I = V_{CCI} or 0V, I_O = 0, OE = 0V	V_{CCA} = 1.65V to V_{CCB}, V_{CCB} = 2.3V to 5.5V	Full			8	μA
OE Input Capacitance (C_I)		V_{CCA} = 3.3V, V_{CCB} = 3.3V		+25℃		6		pF
Input/Output Capacitance A Ports (C_{IO})		V_{CCA} = 3.3V, V_{CCB} = 3.3V		+25℃		6		pF
Input/Output Capacitance B Ports (C_{IO})				+25℃		6		

TIMING REQUIREMENTS

PARAMETER			V_{CCB} = 2.5V	V_{CCB} = 3.3V	V_{CCB} = 5V	UNITS
			TYP	TYP	TYP	
(T_A = +25℃, V_{CCA} = 1.8V, unless otherwise noted.)						
Data Rate	Push-Pull Driving		24	24	24	Mbps
	Open-Drain Driving		2	2	2	
Pulse Duration (t_W)	Push-Pull Driving	Data Inputs	41	41	41	ns
	Open-Drain Driving		500	500	500	
(T_A = +25℃, V_{CCA} = 2.5V, unless otherwise noted.)						
Data Rate	Push-Pull Driving		24	24	24	Mbps
	Open-Drain Driving		2	2	2	
Pulse Duration (t_W)	Push-Pull Driving	Data Inputs	41	41	41	ns
	Open-Drain Driving		500	500	500	
(T_A = +25℃, V_{CCA} = 3.3V, unless otherwise noted.)						
Data Rate	Push-Pull Driving			24	24	Mbps
	Open-Drain Driving			2	2	
Pulse Duration (t_W)	Push-Pull Driving	Data Inputs		41	41	ns
	Open-Drain Driving			500	500	
(T_A = +25℃, V_{CCA} = 5V, unless otherwise noted.)						
Data Rate	Push-Pull Driving				24	Mbps
	Open-Drain Driving				2	
Pulse Duration (t_W)	Push-Pull Driving	Data Inputs			41	ns
	Open-Drain Driving				500	

SWITCHING CHARACTERISTICS

(T_A = +25℃, V_{CCA} = 1.8V, unless otherwise noted.)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	V_{CCB} = 2.5V	V_{CCB} = 3.3V	V_{CCB} = 5V	UNITS
				TYP	TYP	TYP	
t_{PHL}	A	B	Push-Pull Driving	3.5	3.5	5.1	ns
			Open-Drain Driving	56.2	27.0	27.9	
t_{PLH}			Push-Pull Driving	5.1	4.5	4.4	
			Open-Drain Driving	142.7	119.8	92.1	
t_{PHL}	B	A	Push-Pull Driving	3.0	2.8	3.4	ns
			Open-Drain Driving	25.6	25.3	25.4	
t_{PLH}			Push-Pull Driving	3.7	3.2	2.6	
			Open-Drain Driving	55.1	49.4	48.0	
t_{EN} (t_{PZH} & t_{PZL})	OE	A or B		28.4	24.6	22.5	ns
t_{DIS} (t_{PHZ} & t_{PLZ})	OE	A or B		674	677	671	
t_{rA}	A Ports Rise Time		Push-Pull Driving	7.2	8.1	9.1	ns
			Open-Drain Driving	12.3	11.3	10.1	
t_{rB}	B Ports Rise Time		Push-Pull Driving	7.2	6.1	5.4	ns
			Open-Drain Driving	99.3	72.9	36.7	
t_{fA}	A Ports Fall Time		Push-Pull Driving	5.7	5.9	6.9	ns
			Open-Drain Driving	3.8	3.6	3.6	
t_{fB}	B Ports Fall Time		Push-Pull Driving	7.9	7.8	8.4	ns
			Open-Drain Driving	3.5	8.4	5.0	
Data Rate			Push-Pull Driving	24	24	24	Mbps
			Open-Drain Driving	2	2	2	

SWITCHING CHARACTERISTICS (continued)

(T_A = +25℃, V_{CCA} = 2.5V, unless otherwise noted.)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	V_{CCB} = 2.5V	V_{CCB} = 3.3V	V_{CCB} = 5V	UNITS
				TYP	TYP	TYP	
t_{PHL}	A	B	Push-Pull Driving	4.5	4.5	5.0	ns
			Open-Drain Driving	26.2	27.1	26.2	
t_{PLH}			Push-Pull Driving	3.8	3.3	3.1	
			Open-Drain Driving	111.0	95.6	76.0	
t_{PHL}	B	A	Push-Pull Driving	4.2	4.0	4.1	ns
			Open-Drain Driving	25.8	25.5	25.6	
t_{PLH}			Push-Pull Driving	3.7	3.5	3.6	
			Open-Drain Driving	52.7	50.6	49.8	
t_{EN} (t_{PZH} & t_{PZL})	OE	A or B		21.6	17.4	15.5	ns
t_{DIS} (t_{PHZ} & t_{PLZ})	OE	A or B		689	688	678	
t_{rA}	A Ports Rise Time		Push-Pull Driving	6.4	6.7	6.9	ns
			Open-Drain Driving	10.5	7.7	7.8	
t_{rB}	B Ports Rise Time		Push-Pull Driving	6.2	5.4	4.9	ns
			Open-Drain Driving	67.0	50.9	30.5	
t_{fA}	A Ports Fall Time		Push-Pull Driving	8.6	8.2	7.3	ns
			Open-Drain Driving	3.6	3.3	3.1	
t_{fB}	B Ports Fall Time		Push-Pull Driving	8.5	7.7	8.1	ns
			Open-Drain Driving	3.4	3.9	5.4	
Data Rate			Push-Pull Driving	24	24	24	Mbps
			Open-Drain Driving	2	2	2	

SWITCHING CHARACTERISTICS (continued)

(T_A = +25℃, V_{CCA} = 3.3V, unless otherwise noted.)

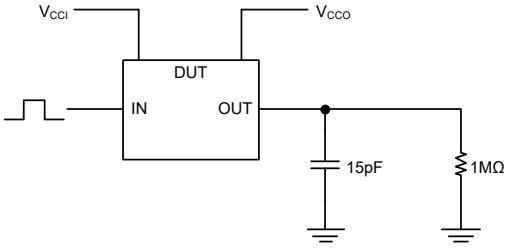
PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	V_{CCB} = 3.3V	V_{CCB} = 5V	UNITS
				TYP	TYP	
t_{PHL}	A	B	Push-Pull Driving	4.4	5.0	ns
			Open-Drain Driving	25.5	27.5	
t_{PLH}			Push-Pull Driving	3.5	2.7	
			Open-Drain Driving	52.4	51.4	
t_{PHL}	B	A	Push-Pull Driving	4.1	4.4	ns
			Open-Drain Driving	25.8	54.3	
t_{PLH}			Push-Pull Driving	3.1	2.8	
			Open-Drain Driving	50.3	49.4	
t_{EN} (t_{PZH} & t_{PZL})	OE	A or B		15.9	13.8	ns
t_{DIS} (t_{PHZ} & t_{PLZ})	OE	A or B		699	678	
t_{rA}	A Ports Rise Time		Push-Pull Driving	5.2	6.2	ns
			Open-Drain Driving	6.3	6.2	
t_{rB}	B Ports Rise Time		Push-Pull Driving	5.3	4.7	ns
			Open-Drain Driving	8.3	6.8	
t_{fA}	A Ports Fall Time		Push-Pull Driving	7.3	7.6	ns
			Open-Drain Driving	3.1	3.0	
t_{fB}	B Ports Fall Time		Push-Pull Driving	7.7	7.3	ns
			Open-Drain Driving	3.8	4.6	
Data Rate			Push-Pull Driving	24	24	Mbps
			Open-Drain Driving	2	2	

SWITCHING CHARACTERISTICS (continued)

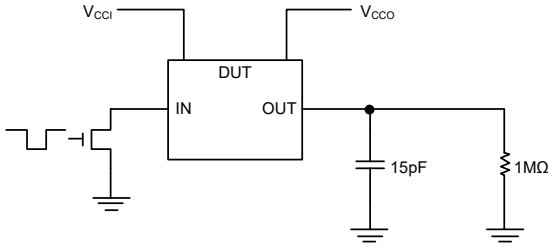
(T_A = +25℃, V_{CCA} = 5V, unless otherwise noted.)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	V_{CCB} = 5V	UNITS
				TYP	
t_{PHL}	A	B	Push-Pull Driving	5.3	ns
			Open-Drain Driving	27.4	
t_{PLH}			Push-Pull Driving	2.4	
			Open-Drain Driving	50.6	
t_{PHL}	B	A	Push-Pull Driving	5.0	ns
			Open-Drain Driving	26.3	
t_{PLH}			Push-Pull Driving	2.2	
			Open-Drain Driving	49.3	
t_{EN} (t_{PZH} & t_{PZL})	OE	A or B		22.6	ns
t_{DIS} (t_{PHZ} & t_{PLZ})	OE	A or B		665	
t_{rA}	A Ports Rise Time		Push-Pull Driving	5.3	ns
			Open-Drain Driving	5.0	
t_{rB}	B Ports Rise Time		Push-Pull Driving	4.9	ns
			Open-Drain Driving	6.5	
t_{fA}	A Ports Fall Time		Push-Pull Driving	8.5	ns
			Open-Drain Driving	2.8	
t_{fB}	B Ports Fall Time		Push-Pull Driving	7.7	ns
			Open-Drain Driving	4.2	
Data Rate			Push-Pull Driving	24	Mbps
			Open-Drain Driving	2	

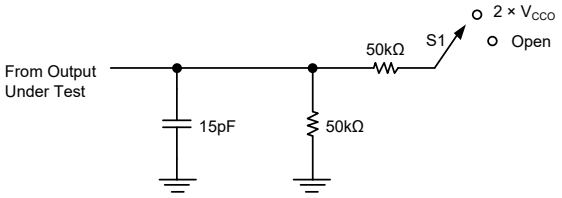
PARAMETER MEASUREMENT INFORMATION



Data Rate, Pulse Duration, Propagation Delay, Output Rise-Time and Fall-Time Measurement Using A Push-Pull Driver

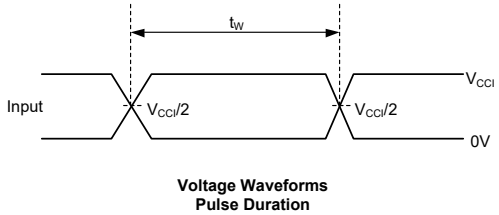


Data Rate (10pF), Pulse Duration (10pF), Propagation Delay, Output Rise-Time and Fall-Time Measurement Using An Open-Drain Driver

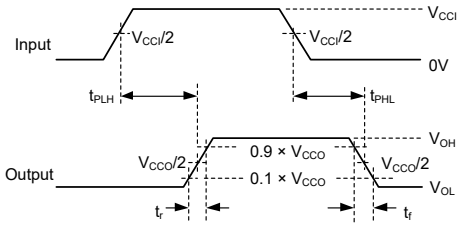


Load Circuit for Enable/Disable Time Measurement

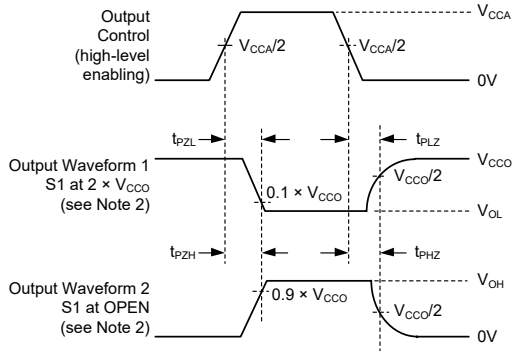
TEST	S1
t_{PZL}/t_{PLZ} (t_{DIS})	2 × V_{CCO}
t_{PHZ}/t_{PZH} (t_{EN})	Open



Voltage Waveforms Pulse Duration



Voltage Waveforms Propagation Delay Times



Voltage Waveforms Enable and Disable Times

Figure 2. Load Circuits and Voltage Waveforms

NOTES:

1. C_L includes probe and jig capacitance.
2. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
3. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10MHz, Z_O = 50Ω, dv/dt ≥ 1V/ns.
4. The outputs are measured one at a time, with one transition per measurement.
5. t_{PLZ} and t_{PHZ} are the same as t_{DIS}.
6. t_{PZL} and t_{PZH} are the same as t_{EN}.
7. t_{PLH} and t_{PHL} are the same as t_{PD}.
8. V_{CCI} is the V_{CC} associated with the input ports.
9. V_{CCO} is the V_{CC} associated with the output ports.
10. All parameters and waveforms are not applicable to all devices.

DETAILED DESCRIPTION

Overview

The SGM4578 can be used to bridge the digital-switching compatibility gap between two voltage nodes to successfully interface logic threshold levels found in electronic systems. It should be used in a point-to-point topology for interfacing devices or systems operating at different interface voltages with one another. Its primary target application is for interfacing with open-drain drivers on the data I/Os such as I^2C or 1-wire, where the data is bidirectional and no control signal is available. The SGM4578 can also be used in applications where a push-pull driver is connected to the data I/Os.

Architecture

The SGM4578 architecture (see Figure 3) is an auto-direction-sensing based translator that does not require a direction-control signal to control the direction of data flow from A to B or from B to A.

These two bidirectional channels independently determine the direction of data flow without a direction-control signal. Each I/O pin can be automatically reconfigured as either an input or an output, which is how this auto-direction feature is realized.

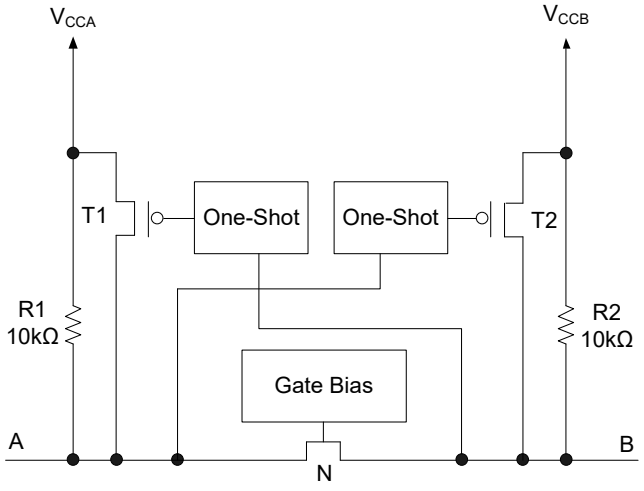


Figure 3. Architecture of a SGM4578 Cell

The SGM4578 employs two key circuits to enable this voltage translation:

- An N-channel pass-gate transistor topology that ties the A port to the B port.
- Output one-shot (O.S.) edge-rate accelerator circuitry to detect and accelerate rising edges on the A or B ports.

Input Driver Requirements

The fall time (t_{fA}, t_{fB}) of a signal depends on the output impedance of the external device driving the data I/Os of the SGM4578. Similarly, the t_{PHL} and data rates also depend on the output impedance of the external driver. The values for t_{fA}, t_{fB}, t_{PHL}, and data rates in the datasheet assume that the output impedance of the external driver is less than 50Ω.

Power Up

During operation, ensure that $V_{CCA} \leq V_{CCB}$ at all times. The sequencing of each power supply will not damage the device during the power up operation, so either power supply can be ramped up first.

Output Load Considerations

We recommend careful PCB layout practices with short PCB trace lengths to avoid excessive capacitive loading and to ensure that proper O.S. triggering takes place. PCB signal trace-lengths should be kept short enough such that the round trip delay of any reflection is less than the one-shot duration. This improves signal integrity by ensuring that any reflection sees a low impedance at the driver. The O.S. circuits have been designed to stay on for approximately 30ns. The maximum capacitance of the lumped load that can be driven also depends directly on the one-shot duration. With very heavy capacitive loads, the one-shot can be time-out before the signal is driven fully to the positive rail. The O.S. duration has been set to optimize trade-offs between dynamic I_{CC}, load driving capability, and maximum bit-rate considerations. Both PCB trace length and connectors add to the capacitance that the SGM4578 output sees, so it is recommended that this lumped-load capacitance be considered to avoid O.S. retriggering, bus contention, output signal oscillations, or other adverse system-level effects.

DETAILED DESCRIPTION (continued)

Enable and Disable

The SGM4578 has an OE input that is used to disable the device by setting OE low, which places all I/Os in the Hi-Z state. OE has an internal pull-down current source, as long as V_{CCA} is powered. The disable time (t_{DIS}) indicates the delay between the time when OE goes low and when the outputs are disabled (Hi-Z). The enable time (t_{EN}) indicates the amount of time the user must allow for the one-shot circuitry to become operational after OE is taken high.

Pull-Up or Pull-Down Resistors on I/O Lines

Each A port I/O has an internal 10kΩ pull-up resistor to V_{CCA}, and each B port I/O has an internal 10kΩ pull-up resistor to V_{CCB}. If a smaller value of pull-up resistor is required, an external resistor must be added from the I/O to V_{CCA} or V_{CCB} (in parallel with the internal 10kΩ resistors). Adding lower value pull-up resistors will affect V_{OL} levels, however. The internal pull-ups of the SGM4578 are disabled when the OE pin is low.

REVISION HISTORY

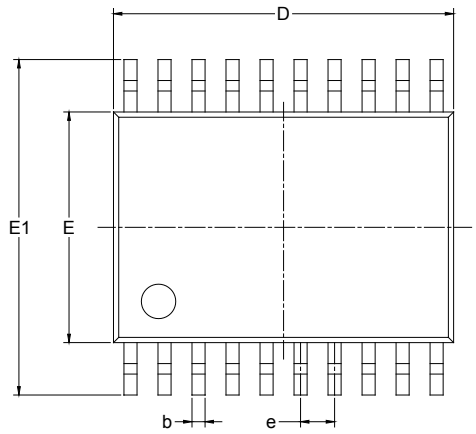
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

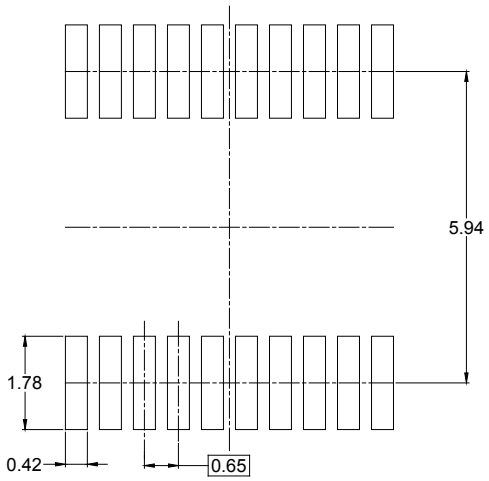
Changes from Original (JUNE 2018) to REV.A

Changed from product preview to production data	All

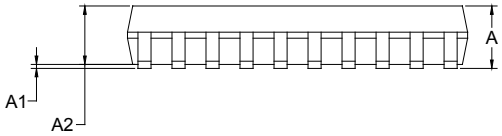
PACKAGE OUTLINE DIMENSIONS

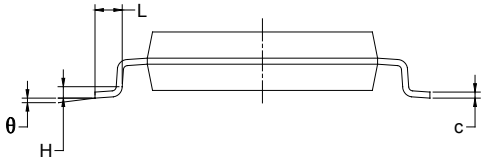
TSSOP-20





RECOMMENDED LAND PATTERN (Unit: mm)

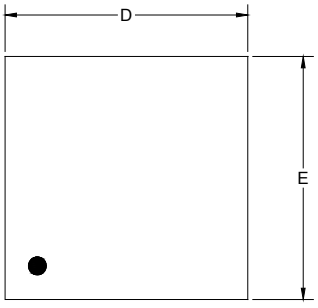




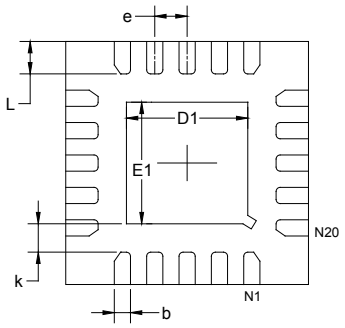
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A		1.100		0.043
A1	0.050	0.150	0.002	0.006
A2	0.800	1.000	0.031	0.039
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	6.400	6.600	0.252	0.259
E	4.300	4.500	0.169	0.177
E1	6.250	6.550	0.246	0.258
e	0.650 BSC		0.026 BSC	
L	0.500	0.700	0.02	0.028
H	0.25 TYP		0.01 TYP	
θ	1°	7°	1°	7°

PACKAGE OUTLINE DIMENSIONS

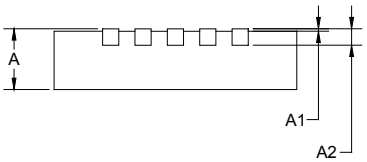
TQFN-3×3-20L



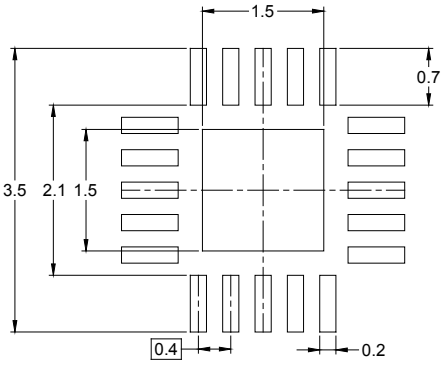
TOP VIEW



BOTTOM VIEW



SIDE VIEW

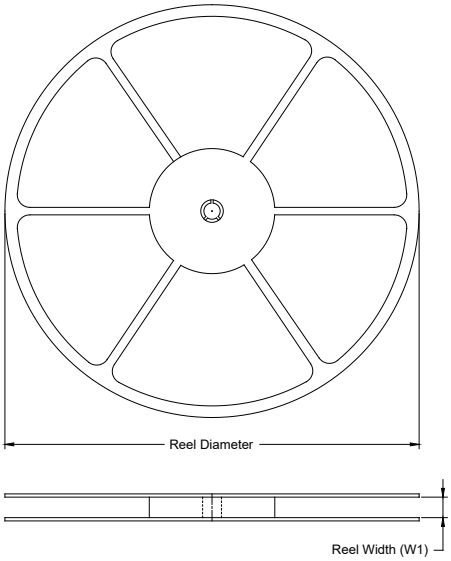


RECOMMENDED LAND PATTERN (Unit: mm)

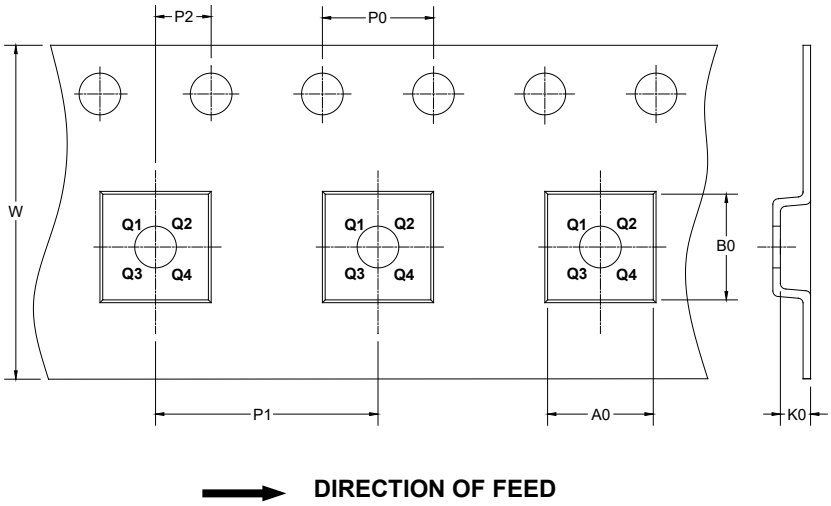
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A2	0.203 REF		0.008 REF	
D	2.924	3.076	0.115	0.121
D1	1.400	1.600	0.055	0.063
E	2.924	3.076	0.115	0.121
E1	1.400	1.600	0.055	0.063
k	0.200 MIN		0.008 MIN	
b	0.150	0.250	0.006	0.010
e	0.400 TYP		0.016 TYP	
L	0.324	0.476	0.013	0.019

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



DIRECTION OF FEED

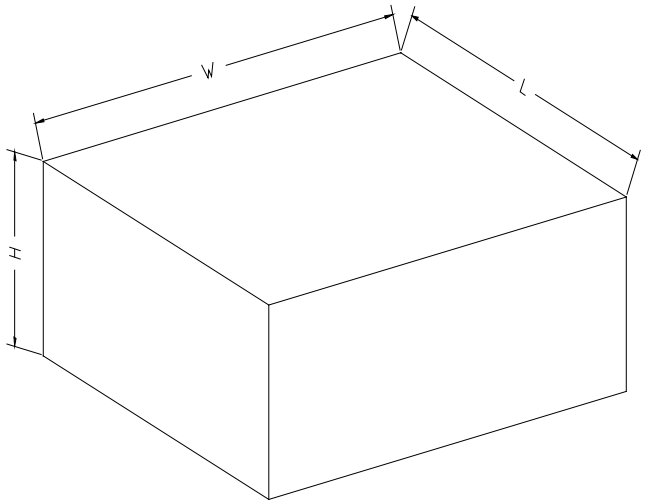
NOTE: The picture is only for reference. Please make the object as the standard.

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
TSSOP-20	13″	12.4	6.80	6.85	1.70	4.0	8.0	2.0	12.0	Q1
TQFN-3×3-20L	13″	12.4	3.30	3.30	1.10	4.0	8.0	2.0	12.0	Q2

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
13″	386	280	370	5

DD0002

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NLSV4T3144MUTAG NLVSX4373MUTAG NB3U23CMNTAG NLSX3013BFCT1G NLSX3012DMR2G NLA9306MU3TCG
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