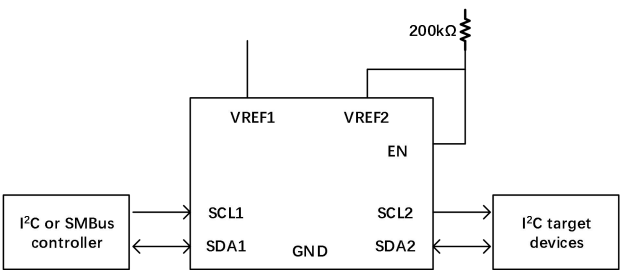


GT9306

Dual Bidirectional I²C Bus and SMBus Voltage-Level Translator

1 Features	2 Application
<ul style="list-style-type: none"> - 2-Bit bidirectional translator for SDA and SCL lines in mixed-mode I²C Applications - I²C and SMBus compatible - Provides bidirectional voltage translation with no direction pin - Low 3.5-Ω ON-state resistance between input and output ports provides less signal distortion - Open-drain I²C I/O ports (SCL1, SDA1, SCL2, and SDA2) - 5-V Tolerant I²C I/O ports to support mixed-mode signal operation - High-impedance SCL1, SDA1, SCL2, and SDA2 pins for EN = low 	<ul style="list-style-type: none"> - I²C SMBus, PMBus, MDIO, UART, low-speed SDIO, GPIO, and other two-signal interfaces - Servers - Routers (telecom switching equipment) - Personal Computers • Industrial Automation

3 Description	Circuit Diagram
<p>The GT9306 device is a dual bidirectional I²C and SMBus voltage-level translator with an enable (EN) input, and is operational from 1.2-V to 3.3-V VREF1 and 1.8-V to 5.5-V VREF2. The GT9306 device allows bidirectional voltage translations between 1.2 V and 5 V, without the use of a direction pin. The low ON-state resistance (RON) of the switch allows connections to be made with minimal propagation delay. When EN is high, the translator switch is ON, and the SCL1 and SDA1 I/O are connected to the SCL2 and SDA2 I/O, respectively, allowing bidirectional data flow between ports. When EN is low, the translator switch is off, and a high-impedance state exists between ports.</p>	

4 Revision History

Revision	Date	Note
Rev. A0. 1	2024. 09. 18	Original Version

The latest datasheet version should be checked on the GTIC official website, as the company does not actively inform customers about updates to the datasheet.

5 Device Summary, Pin and Packages

Table 5-1. Device Summary⁽¹⁾

Serial Name	Part Name	Package	Body Size (Nom)	Marking ⁽²⁾⁽⁴⁾	MSL ⁽³⁾	Package Qty
GT9306	GT9306S8	SOT23-8	2.92mm×2.80mm×1.15mm	GT9306 XXXX	3	Tape and Reel,3000
	GT9306V8	VSSOP8	2.3mm×3.1mm×0.8mm	GT9306 XXXX	3	Tape and Reel,3000
	GT9306D8	DFN1.4×1-8	1.40mm×1.00mm×0.37mm	GT9306 XXXX	3	Tape and Reel,5000

(1) For all available packages, please contact product sales.

(2) There may be additional marking, which relates to the lot trace code information (data code and vendor code), the logo or the environmental category on the device.

(3) MSL, The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications.

(4) "XXXXX" in Marking will be appeared as the batch code.

5 Device Summary, Pin and Packages(Continued)

Top View

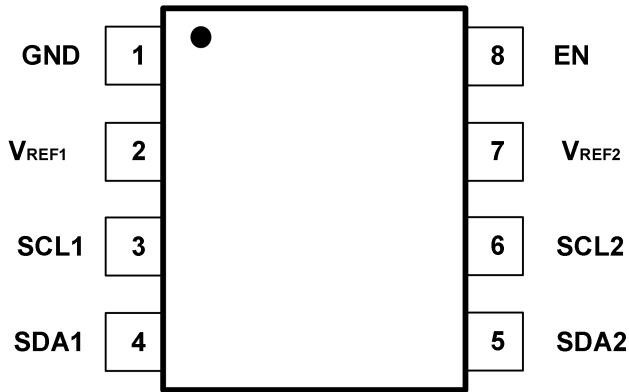


Fig.5-1. GT9306: V8 (VSSOP8) Package
GT9306: S8 (SOT23-8) Package

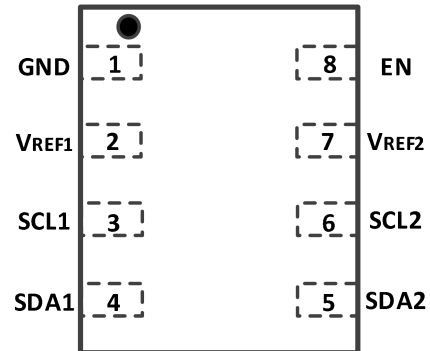


Fig.5-2. GT9306: D8 (DFN1.4x1-8) Package

Table 5-2 Pin definition

Name	Pin		I/O	Description
	S8/V8/D8			
GND	1		-	Ground, 0V
V _{REF1}	2		I	Low-voltage-side reference supply voltage for SCL1 and SDA1
SCL1	4		I/O	Serial clock, low-voltage side
SDA1	5		I/O	Serial data, low-voltage side
SDA2	6		I/O	Serial data, high-voltage side
SCL2	7		I/O	Serial clock, high-voltage side
V _{REF2}	8		I	High-voltage-side reference supply voltage for SCL2 and SDA2
EN	9		I	Switch enable input

6 Voltage, Temperature, ESD and Thermal Ratings

6.1 Absolute Maximum Ratings⁽¹⁾

Parameters		Min.	Max.	Unit
V _{REF1}	DC reference voltage range	-0.5	6.5	V
V _{REF2}	DC reference bias voltage range	-0.5	6.5	V
V _I	Input voltage range ⁽²⁾	-0.5	6.5	V
V _{I/O}	Input/output voltage range ⁽²⁾⁽³⁾	-0.5	V _{CC} +0.5	V
	Continuous channel current		128	mA
I _{IK}	Input clamp current	V _I < 0	-50	mA
T _J	Junction temperature		125	°C
T _{stg}	Storage temperature	-55	150	°C

(1) Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2) The input and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.

(3) The output positive-voltage rating may be exceeded up to 6.5 V maximum if the output current rating is observed.

6.2 ESD Ratings

ESD		Value	Unit
V(ESD)	Electrostatic discharge	Human-Body Model (HBM) ⁽¹⁾	4 K
		Charged-Device Model (CDM) ⁽²⁾	2 K

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

6 Voltage, Temperature, ESD and Thermal Ratings(Continued)

6.3 Recommended Operating Conditions⁽¹⁾

Over operating free-air temperature range (unless otherwise noted)

Symbol	Parameter	Min	Max	Units
V _{I/O}	Input/output voltage			
	SCL1, SDA1, SCL2, SDA2	0	5.5	V
V _{REF1} ⁽¹⁾	Reference voltage	0	5.5	V
V _{REF2} ⁽¹⁾	Reference voltage	0	5.5	V
EN	Enable input voltage	0	5.5	V
I _{PASS}	Pass switch current		64	mA
T _A	Operating ambient temperature	-40	85	°C

(1) To support translation, VREF1 supports 1.0 V to VREF2 - 0.6 V. VREF2 must be between VREF1 + 0.6 V to 5.5 V. See Typical Application for more information.

6.4 Thermal Information

Package Type	θ_{JA}	θ_{JC}	Unit
VSSOP8	227	84	°C/W
SOT23-8			
DFN1.4×1-8			

7 Electrical Specifications

7.1 Electrical Characteristics

Over recommended operating ambient temperature range (unless otherwise noted)⁽¹⁾

Parameter		Test Conditions		Min	Typ	Max	Units	
V_{IK}	Input clamp voltage	$I_I = -18\text{mA}$	$EN = 0\text{V}$	-1.2		0	V	
I_I	Input leakage current	$V_I = 5\text{V}$	$EN = 0\text{V}$			5	μA	
$C_i(EN)$	Input capacitance	$V_I = 3\text{V}$ or 0V			11		pF	
$C_i(off)$	Off capacitance	SCLn, SDA _n	$V_o = 3\text{V}$ or 0V		4	6	pF	
$C_i(on)$	On capacitance	SCLn, SDA _n	$V_o = 3\text{V}$ or 0V		10.5	12.5	pF	
$R_{ON(2)}$	ON-state resistance	SCLn, SDA _n	$V_I = 0\text{V}, I_o = 64\text{mA}$	$EN = 4.5\text{V}$		3.5	5.5	Ω
				$EN = 3\text{V}$		4.7	7	
				$EN = 2.3\text{V}$		6.3	9.5	
			$V_I = 0\text{V}, I_o = 15\text{mA}$	$EN = 1.5\text{V}$		25.5	32	
				$EN = 4.5\text{V}$	1	6	15	
					$EN = 3\text{V}$	20	60	
$V_I = 1.7\text{V}, I_o = 15\text{mA}$	$EN = 2.3\text{V}$	20	60	140				

(1) All typical values are at $T_A = 25^\circ\text{C}$.

(2) Measured by the voltage drop between the SCL1 and SCL2, or SDA1 and SDA2 terminals, at the indicated current through the switch. Minimum ON-state resistance is determined by the lowest voltage of the two terminals.

7.2 Switching Characteristics AC Performance (Translating Down) (EN = 3.3 V)

Over recommended operating ambient temperature range, $EN = 3.3\text{V}$, $V_{IH} = 3.3\text{V}$, $V_{IL} = 0$, $V_M = 1.15\text{V}$ (unless otherwise noted)

Parameter	From (Input)	To (Output)	$C_L = 50\text{pF}$		$C_L = 30\text{pF}$		$C_L = 15\text{pF}$		Unit
			Min	Max	Min	Max	Min	Max	
t_{PLH}	SCL2 or SDA2	SCL1 or SDA1	0	0.8	0	0.6	0	0.3	ns
t_{PHL}			0	1.2	0	1	0	0.75	

7.3 Switching Characteristics AC Performance (Translating Down) (EN = 2.5 V)

Over recommended operating ambient temperature range, $EN = 3.3\text{V}$, $V_{IH} = 3.3\text{V}$, $V_{IL} = 0$, $V_M = 1.15\text{V}$ (unless otherwise noted)

Parameter	From (Input)	To (Output)	$C_L = 50\text{pF}$		$C_L = 30\text{pF}$		$C_L = 15\text{pF}$		Unit
			Min	Max	Min	Max	Min	Max	
t_{PLH}	SCL2 or SDA2	SCL1 or SDA1	0	1	0	0.7	0	0.4	ns
t_{PHL}			0	1.3	0	1	0	0.75	

7 Electrical Specifications (Continued)

7.4 Switching Characteristics AC Performance (Translating Up) (EN = 3.3 V)

Over recommended operating ambient temperature range, EN = 3.3 V, $V_{IH} = 3.3$ V, $V_{IL} = 0$, $V_M = 1.15$ V (unless otherwise noted)

Parameter	From (Input)	To (Output)	$C_L=50\text{pF}$		$C_L=30\text{pF}$		$C_L=15\text{pF}$		Unit
			Min	Max	Min	Max	Min	Max	
t_{PLH}	SCL2 or SDA2	SCL1 or SDA1	0	0.9	0	0.6	0	0.4	ns
t_{PHL}			0	1.7	0	1.1	0	0.75	

7.5 Switching Characteristics AC Performance (Translating Up) (EN = 2.5 V)

Over recommended operating ambient temperature range, EN = 3.3 V, $V_{IH} = 3.3$ V, $V_{IL} = 0$, $V_M = 1.15$ V (unless otherwise noted)

Parameter	From (Input)	To (Output)	$C_L=50\text{pF}$		$C_L=30\text{pF}$		$C_L=15\text{pF}$		Unit
			Min	Max	Min	Max	Min	Max	
t_{PLH}	SCL2 or SDA2	SCL1 or SDA1	0	1	0	0.6	0	0.4	ns
t_{PHL}			0	1.7	0	1.1	0	0.75	

8 Typical Characteristics

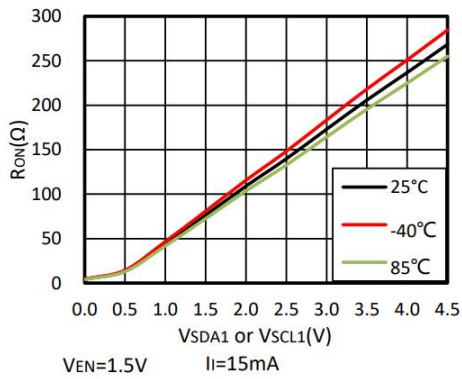


Fig.8-1. On-Resistance (RON) vs Input Voltage (VSDA1 or VSCL1)

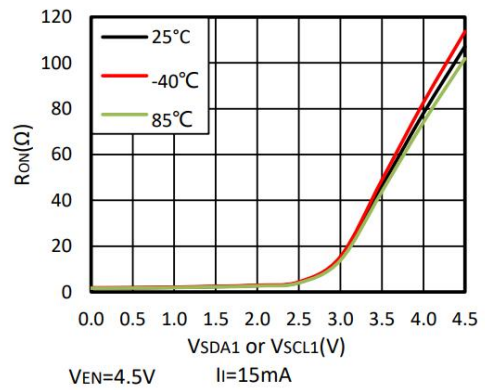


Fig.8-2. On-Resistance (RON) vs Input Voltage (VSDA1 or VSCL1)

9 Measurement Information

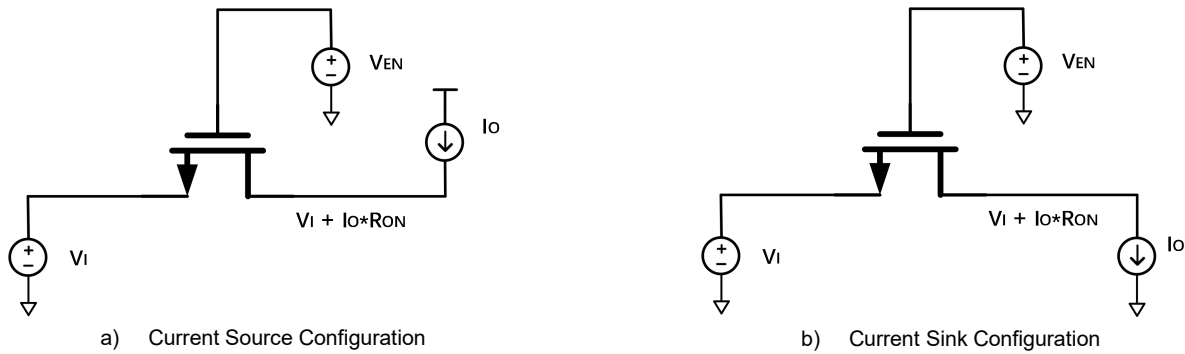
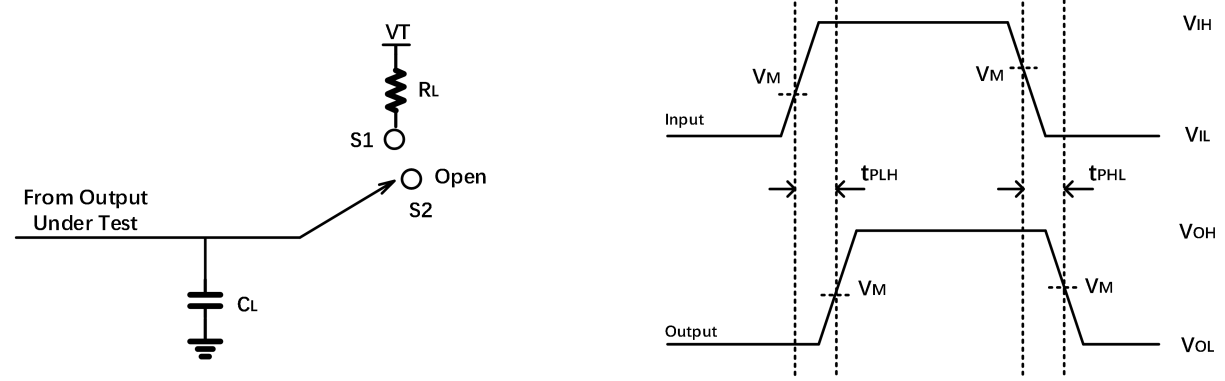


Fig.9-1. Current Source and Current Sink Configurations for RON Measurements



USAGE	SWITCH
Translating up	S1
Translating down	S2

- NOTES: A. C_L includes probe and jig capacitance
 B. All input pulses are supplied by generators having the following characteristics: $P_{RR} \leq 10$ MHz, $Z_O = 50 \Omega$, $t_r \leq 2$ ns, $t_f \leq 2$ ns.
 C. The outputs are measured one at a time, with one transition per measurement.

Fig.9-2. Load Circuit for Outputs

10 Typical Application

As with the standard I²C system, pullup resistors are required to provide the logic-high levels on the translator bus. The size of these pullup resistors depends on the system, but each side of the repeater must have a pullup resistor. The device is designed to work with standard-mode and fast-mode I²C devices in addition to SMBus devices. Standard-mode I²C devices only specify 3 mA in a generic I²C system where standard-mode devices and multiple controllers are possible. Under certain conditions, high termination currents can be used. When the SDA1 or SDA2 port is low, the clamp is in the ON state, and a low-resistance connection exists between the SDA1 and SDA2 ports. Assuming the higher voltage is on the SDA2 port when the SDA2 port is high, the voltage on the SDA1 port is limited to the voltage set by V_{REF1}. When the SDA1 port is high, the SDA2 port is pulled to the pullup supply voltage of the drain (V_{DPU}) by the pullup resistors. This functionality allows a seamless translation between higher and lower voltages selected by the user, without the need for directional control. The SCL1-SCL2 channel also functions in the same way as the SDA1-SDA2 channel.

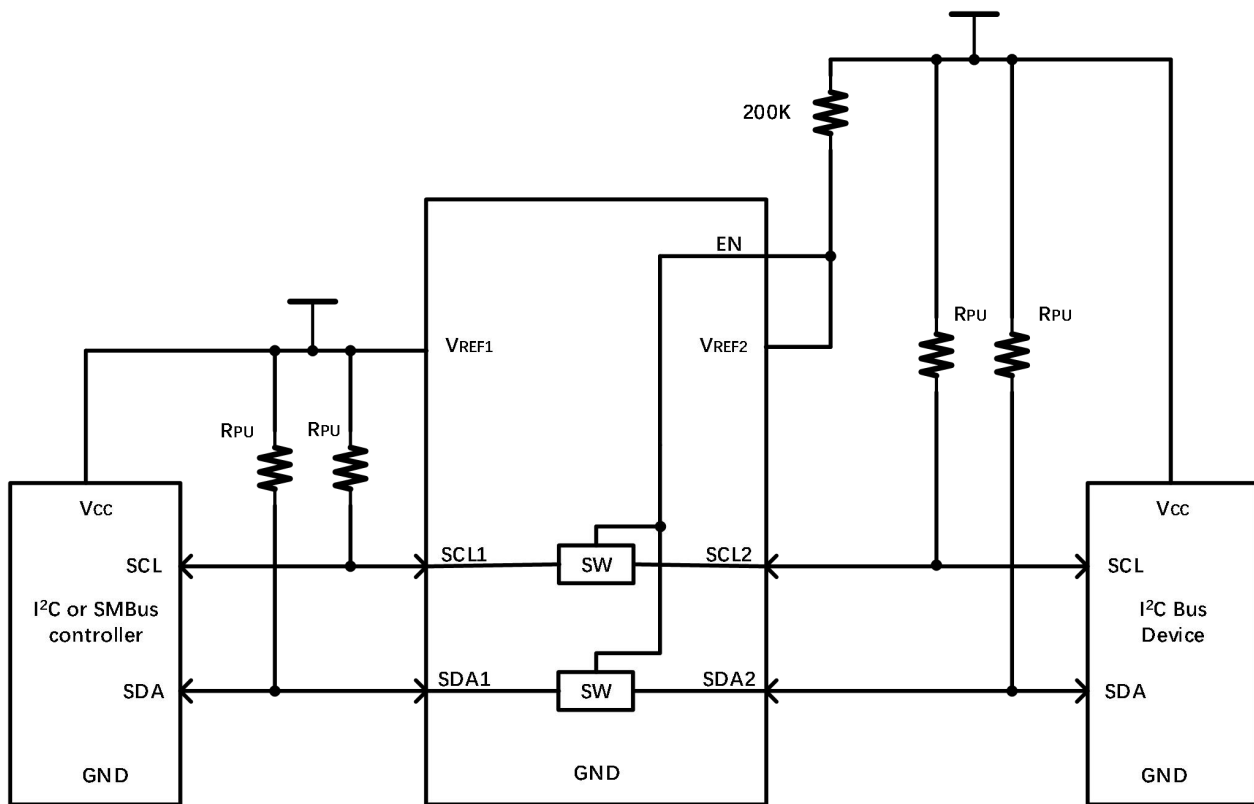
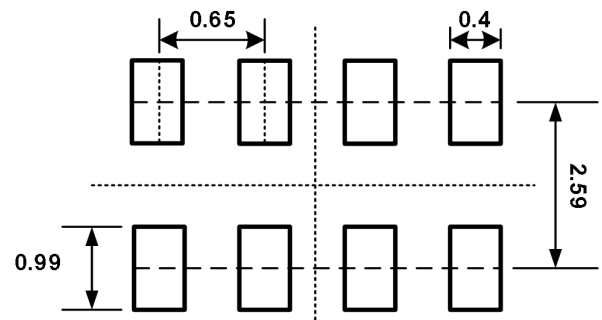
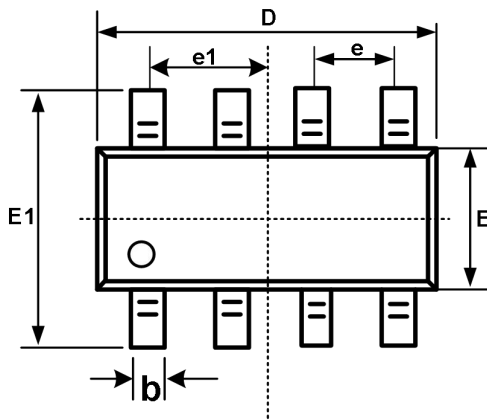
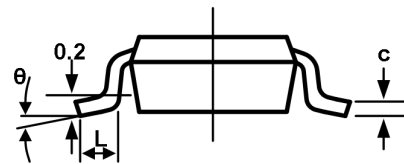
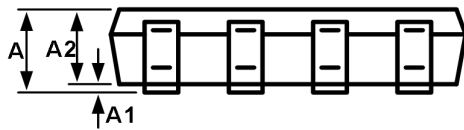
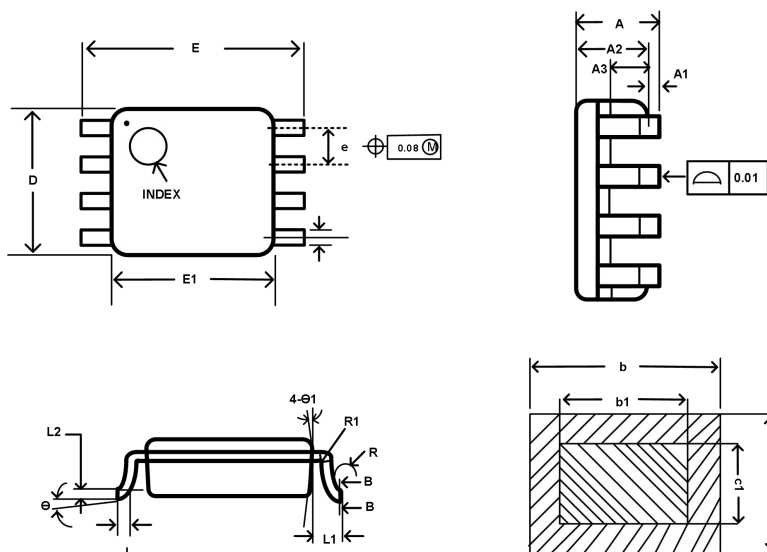


Fig.10-1. Typical Application

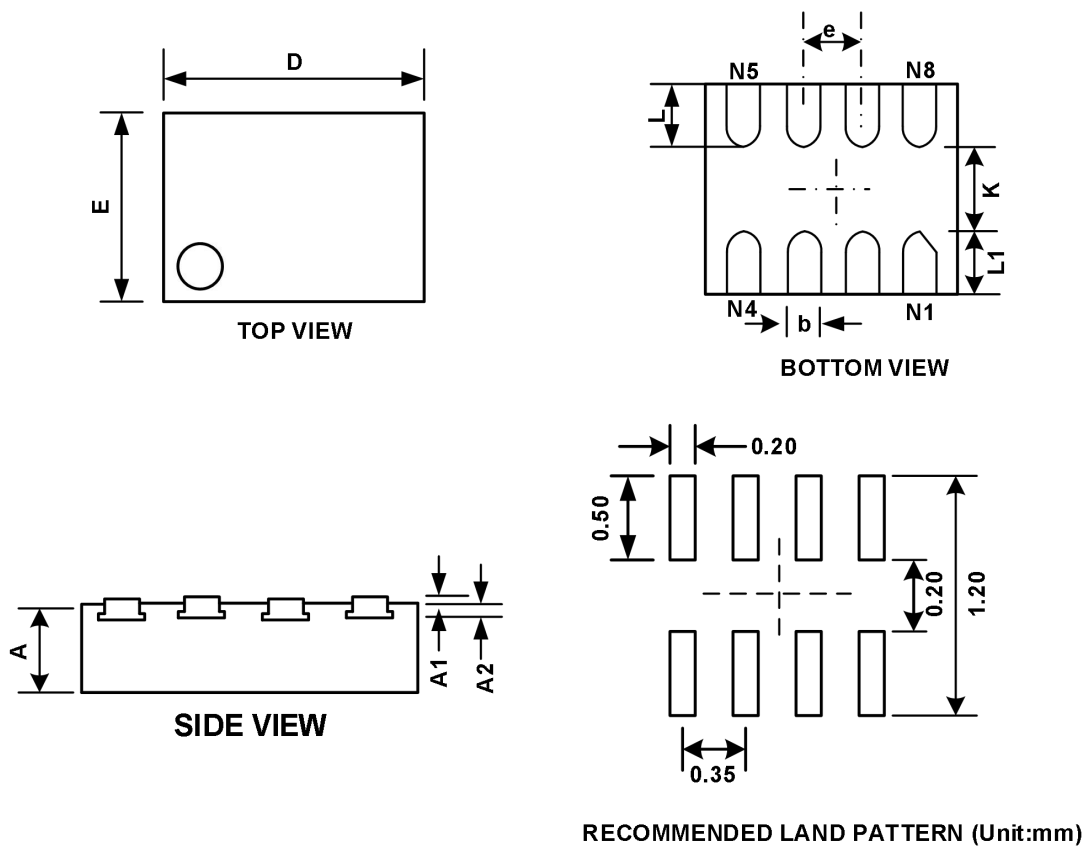
11 Package Outline Dimension

SOT23-8

Recommended Land Pattern (Unit: mm)


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.650BSC		0.026BSC	
e1	0.975BSC		0.038BSC	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

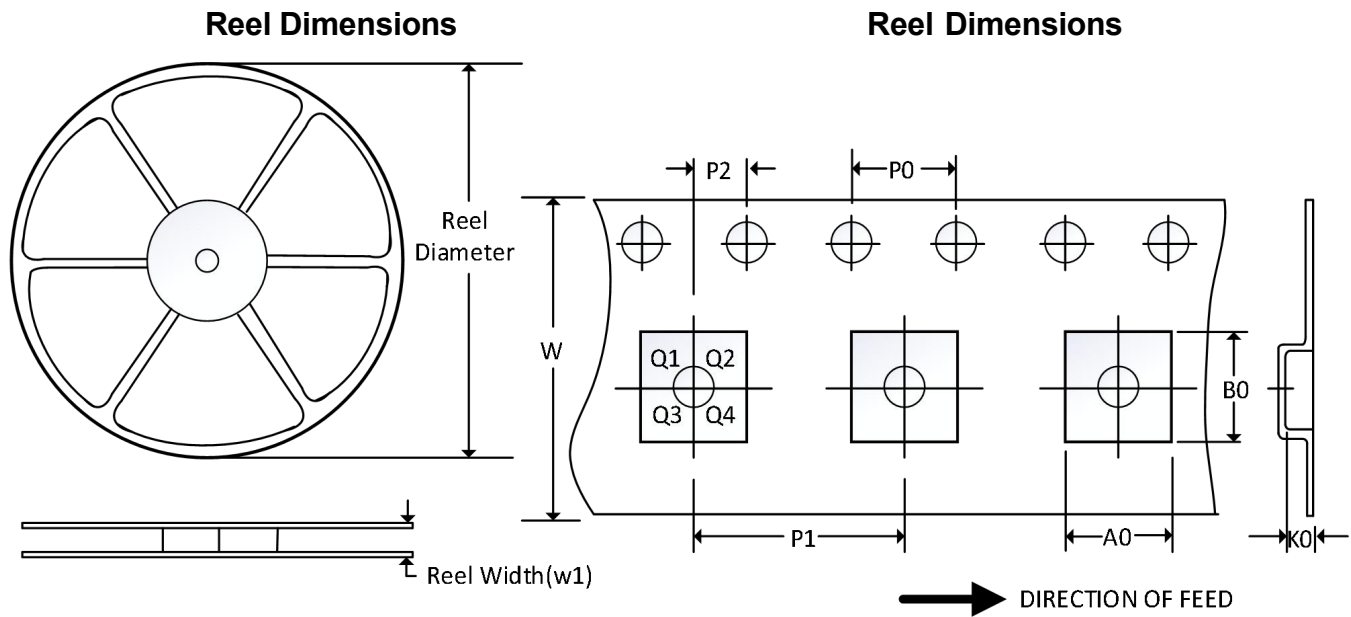
11 Package Outline Dimension(Continued)
VSSOP-8


Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min	Nom	Max	Min	Nom	Max
A	-	-	0.90	-	-	0.035
A1	0	0.05	0.10	0.000	0.002	0.004
A2	0.65	0.75	0.80	0.026	0.030	0.031
A3	0.32	0.37	0.42	0.013	0.015	0.017
b	0.17	-	0.27	0.007	-	0.011
b1	0.17	0.20	0.23	0.007	0.008	0.009
c	0.10	-	0.18	0.004	-	0.007
c1	0.10	0.13	0.14	0.004	0.005	0.006
D	1.90	2.00	2.10	0.075	0.079	0.083
E	3.00	3.10	3.20	0.118	0.122	0.126
E1	2.20	2.30	2.40	0.087	0.091	0.094
e	0.40	0.50	0.60	0.016	0.020	0.024
L	0.20	0.26	0.35	0.008	0.010	0.014
L1	0.40REF			0.016REF		
L2	0.12BSC			0.005BSC		
R	0.07	-	-	0.003	-	-
R1	0.07	-	-	0.003	-	-
θ	0°	-	6°	0°	-	6°
θ1	9°	12°	15°	9°	12°	15°

11 Package Outline Dimension(Continued)
DFN1.4x1-8L


Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	0.340	0.400	0.013	0.016
A1	0.000	0.050	0.000	0.002
A2	0.110REF		0.004REF	
D	1.350	1.450	0.053	0.057
E	0.950	1.050	0.037	0.041
k	0.200MIN		0.008MIN	
b	0.150	0.200	0.006	0.008
e	0.350TYP		0.014TYP	
L	0.250	0.350	0.010	0.014
L1	0.350	0.450	0.014	0.018

12 Tape and Reel Information



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(mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SOT23-8	7"	9.5	3.17	3.23	1.37	4.0	4.0	2.0	8.0	Q3
VSSOP8	13"	12.4	6.95	5.60	1.20	4.0	8.0	2.0	12.0	Q1
DFN1.4*1.0-8	7"	9.5	1.2	1.6	0.5	4.0	4.0	2.0	8.0	Q1

NOTE:

1. All dimensions are nominal.
2. Plastic or metal protrusions of 0.15mm maximum per side are not included.