

1-2-4-Bit Bidirectional Voltage-Level Translator with Automatic Direction Sensing and $\pm 15\text{kV}$ ESD Protection

Features

- 1.2V to 3.6V on A port and 1.65V to 5.5V on B port ($V_{CCA} \leq V_{CCB}$)
- V_{CC} Isolation Feature-If Either V_{CC} Input Is at GND, All Outputs Are in the High-Impedance State
- EO Input Circuit Referenced to V_{CCA}
- Low Power Consumption, $5\mu\text{A}$ Max I_{CC}
- No Power-Supply Sequencing Required-Either V_{CCA} or V_{CCB} Can be Ramped First
- I_{off} Supports Partial-Power-Down Mode Operation
- Latch-Up Performance Exceeds 100mA Per JESD 78, Class II
- ESD Protection Exceeds JESD 22
 - A Port
2500V Human-Body Model (A114-B)
1500V Charged-Device Model (C101)
 - B Port
 $\pm 15\text{kV}$ Human-Body Model (A114-B)
1500V Charged-Device Model (C101)
- SC-70-6 (SOT-363), SOT-23-6, SOT-23-8, AQFN1.7X2.0-12 and AQFN1.5X1.5-8 Package

General Description

This 4-bit noninverting translator uses two separate configurable power-supply rails. The A port is designed to track V_{CCA} . V_{CCA} accepts any supply voltage from 1.2V to 3.6V. The B port is designed to track V_{CCB} . V_{CCB} accepts any supply voltage from 1.65V to 5.5V. This allows for universal low-voltage bidirectional translation between any of the 1.2V, 1.5V, 1.8V, 2.5V, 3.3V, and 5V voltage nodes. V_{CCA} should not exceed V_{CCB} .

When the enable-output (EO) input is low, all outputs are placed in the high-impedance state. To ensure the high-impedance state during power up or power down, EO should be tied to GND through a pulldown resistor; the minimum value of the resistor is determined by the current-sourcing capability of the driver.

The G2129 is designed so that the EO input circuit is supplied by V_{CCA} .

This device is fully specified for partial-power-down applications using I_{off} . The I_{off} circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

Ordering Information

ORDER NUMBER	MARKING	TEMP. RANGE	PACKAGE (Green)
G2129TL1U	219x	-40°C to +85°C	SC-70-6 (SOT-363)
G2129TB1U	2129x	-40°C to +85°C	SOT-23-6
G2129TM1U	2129x	-40°C to +85°C	SOT-23-8
G2129AE1U	2129	-40°C to +85°C	AQFN1.7X2.0-12
G2129A71U	29 xx	-40°C to +85°C	AQFN1.5X1.5-8

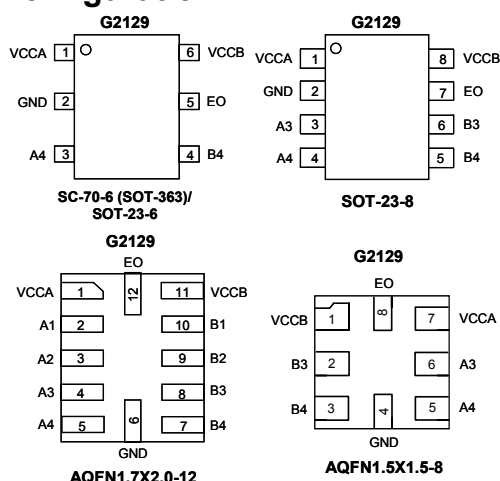
Note: TL: SC-70-6 (SOT-363) TB: SOT-23-6 TM: SOT-23-8 AE: AQFN1.7X2.0-12 A7: AQFN1.5X1.5-8

1: Bonding Code

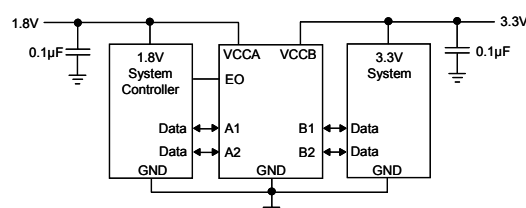
U: Tape & Reel

Green : Lead Free / Halogen Free

Pin Configuration



Typical Application Circuit



Absolute Maximum Ratings¹

Supply voltage range (V_{CCA})	-.5V to 4.6V	Thermal Resistance Junction to Ambient, (θ_{JA})*	
Supply voltage range (V_{CCB})	-.5V to 6.5V	SC-70-6 (SOT-363)	330°C/W
Input voltage range (V_I) ²		SOT-23-6	240°C/W
A port	-.5V to 4.6V	SOT-23-8	240°C/W
B port, EO	-.5V to 6.5V	AQFN1.7X2.0-12	230°C/W
Voltage range applied to any output in the high-impedance or power-off state (V_O) ²		AQFN1.5X1.5-8	310°C/W
A port	-.5V to 4.6V	Continuous Power Dissipation ($T_A = +25^\circ\text{C}$)*	
B port	-.5V to 6.5V	SC-70-6 (SOT-363)	0.375W
Voltage range applied to any output in the high or low state (V_O) ²		SOT-23-6	0.52W
A port	-.5V to $V_{CCA}+0.5V$	SOT-23-8	0.52W
B port	-.5V to $V_{CCB}+0.5V$	AQFN1.7X2.0-12	0.54W
Input clamp current (I_{IK}) ($V_I < 0$)	-50mA	AQFN1.5X1.5-8	0.4W
Output clamp current (I_{OK}) ($V_O < 0$)	-50mA	Thermal Resistance Junction to Case, (θ_{JC})	
Continuous output current (I_O)	$\pm 50\text{mA}$	SC-70-6 (SOT-363)	120°C/W
Continuous current through V_{CCA} or V_{CCB} or GND	$\pm 100\text{mA}$	SOT-23-6	60°C/W
		SOT-23-8	60°C/W
		AQFN1.7X2.0-12	70°C/W
		AQFN1.5X1.5-8	100°C/W
		Storage Temperature Range (T_{stg})	-65°C to +150°C

* Please refer to Minimum Footprint PCB Layout

- 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 in the operational sections of specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.
- The value of V_{CCA} and V_{CCB} are provided in the recommended operating conditions table.

Recommended Operating Conditions (Level Translator)^{1,2}

PARAMETER	SYMBOL	CONDITIONS	V_{CCA}	V_{CCB}	MIN	MAX	UNIT
Supply voltage	V_{CCA}		---	---	1.2	3.6	V
	V_{CCB}		---	---	1.65	5.5	
High-level input voltage	V_{IH}	Data inputs	1.2V to 3.6V	1.65V to 5.5 V	$V_{CCI} \times 0.65^3$	V_{CCI}	V
		EO	1.2V to 3.6V	1.65V to 5.5 V	$V_{CCA} \times 0.65$	5.5	
Low-level input voltage	V_{IL}	Data inputs	1.2V to 5.5V	1.65V to 5.5 V	0	$V_{CCI} \times 0.35^3$	V
		EO	1.2V to 3.6V	1.65V to 5.5 V	0	$V_{CCA} \times 0.35$	
Voltage range applied to any output in the high-impedance or power-off state	V_O	A-Port I/Os	1.2V to 3.6V	1.65V to 5.5 V	0	3.6	V
		B-Port I/Os			0	5.5	
Input transition rise or fall rate	$\Delta t / \Delta v$	A-Port inputs	1.2V to 3.6V	1.65V to 5.5 V	0	10	ns/V
		B-Port inputs	1.2V to 3.6V	1.65V to 3.6 V	0	10	
				4.5V to 5.5 V	0	10	
Operating free-air temperature	T_A		---	---	-40	85	°C

- The A and B sides of an unused data I/O pair must be held in the same state, i.e., both at V_{CCI} or both at GND
- V_{CCA} must be less than or equal to V_{CCB} and must not exceed 3.6V.
- V_{CCI} is the supply voltage associated with the input port.

Electrical Characteristics

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

 $T_A = 25^\circ\text{C}$

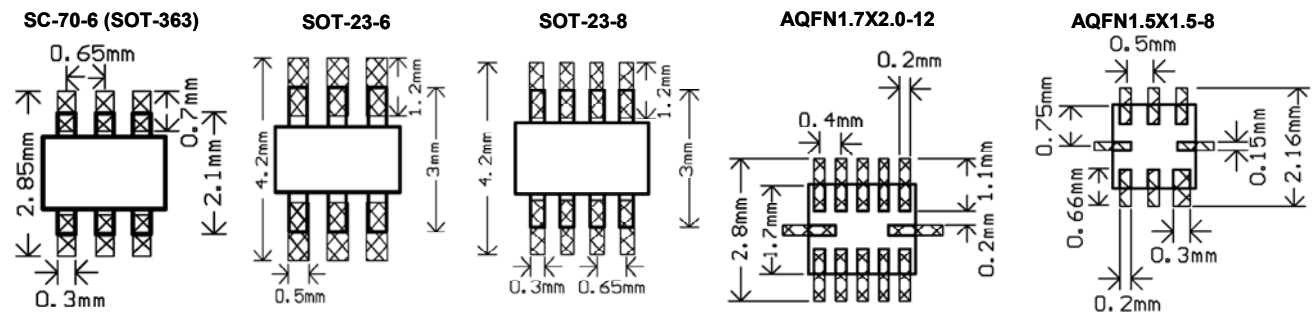
PARAMETER		CONDITIONS	V_{CCA}	V_{CCB}	MIN	TYP	MAX	UNIT
V_{OHA}		$I_{OH} = -20\mu\text{A}$	1.2V		---	1.1	---	V
			1.4V to 3.6V		---	---	---	
V_{OLA}		$I_{OL} = 20\mu\text{A}$	1.2V		---	0.9	---	V
			1.4V to 3.6V		---	---	---	
V_{OHB}		$I_{OH} = -20\mu\text{A}$		1.65V to 5.5V	---	---	---	V
V_{OLB}		$I_{OL} = 20\mu\text{A}$		1.65V to 5.5V	---	---	---	V
I_I	EO	$V_I = V_{CCI}$ or GND	1.2V to 3.6V	1.65V to 5.5V	---	---	± 1	μA
I_{off}	A port	V_I or $V_O = 0$ to 3.6V	0V	0V to 5.5V	---	---	± 1	μA
	B port	V_I or $V_O = 0$ to 5.5V	0V to 3.6V	0V	---	---	± 1	
I_{OZ}	A or B port	EO = GND	1.2V to 3.6V	1.65V to 5.5V	---	---	± 1	μA
I_{CCA}		$V_I = V_{CCI}$ or GND, $I_O = 0$	1.2V	1.65V to 5.5V	---	0.06	---	μA
			1.4V to 3.6V	1.65V to 5.5V	---	---	---	
			3.6V	0V	---	---	---	
			0V	5.5V	---	---	---	
I_{CCB}		$V_I = V_{CCI}$ or GND, $I_O = 0$	1.2V	1.65V to 5.5V	---	3.4	---	μA
			1.4V to 3.6V	1.65V to 5.5V	---	---	---	
			3.6V	0V	---	---	---	
			0V	5.5V	---	---	---	
$I_{CCA} + I_{CCB}$		$V_I = V_{CCI}$ or GND, $I_O = 0$	1.2V	1.65V to 5.5V	---	3.5	---	μA
			1.4V to 3.6V	1.65V to 5.5V	---	---	---	
I_{CCZA}		$V_I = V_{CCI}$ or GND, $I_O = 0$, EO = GND	1.2V	1.65V to 5.5V	---	0.05	---	μA
			1.4V to 3.6V	1.65V to 5.5V	---	---	---	
I_{CCZB}		$V_I = V_{CCI}$ or GND, $I_O = 0$, EO = GND	1.2V	1.65V to 5.5V	---	3.3	---	μA
			1.4V to 3.6V	1.65V to 5.5V	---	---	---	
C_i	EO		1.2V to 3.6V	1.65V to 5.5V	---	3	---	pF
C_{io}	A port		1.2V to 3.6V	1.65V to 5.5V	---	5	---	pF
	B port				---	11	---	

Electrical Characteristics (continued)

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

 $T_A = -40$ to 85°C .

PARAMETER		CONDITIONS	V_{CCA}	V_{CCB}	MIN	TYP	MAX	UNIT
V_{OHA}		$I_{OH} = -20\mu\text{A}$	1.2V		---	---	---	V
			1.4V to 3.6V		$V_{CCA}-0.4$	---	---	
V_{OLA}		$I_{OL} = 20\mu\text{A}$	1.2V		---	---	---	V
			1.4V to 3.6V		---	---	0.4	
V_{OHB}		$I_{OH} = -20\mu\text{A}$		1.65V to 5.5V	$V_{CCB}-0.4$	---	---	V
V_{OLB}		$I_{OL} = 20\mu\text{A}$		1.65V to 5.5V	---	---	0.4	V
I_I	EO	$V_I = V_{CCI}$ or GND	1.2V to 3.6V	1.65V to 5.5V	---	---	± 2	μA
I_{off}	A port	V_I or $V_O = 0$ to 3.6V	0V	0V to 5.5V	---	---	± 2	μA
	B port	V_I or $V_O = 0$ to 5.5V	0V to 3.6V	0V	---	---	± 2	
I_{OZ}	A or B port	EO = GND	1.2V to 3.6V	1.65V to 5.5V	---	---	± 2	μA
I_{CCA}		$V_I = V_{CCI}$ or GND, $I_O = 0$	1.2V	1.65V to 5.5V	---	---	---	μA
			1.4V to 3.6V	1.65V to 5.5V	---	---	5	
			3.6V	0V	---	---	2	
			0V	5.5V	---	---	-2	
I_{CCB}		$V_I = V_{CCI}$ or GND, $I_O = 0$	1.2V	1.65V to 5.5V	---	---	---	μA
			1.4V to 3.6V	1.65V to 5.5V	---	---	5	
			3.6V	0V	---	---	-2	
			0V	5.5V	---	---	2	
$I_{CCA} + I_{CCB}$		$V_I = V_{CCI}$ or GND, $I_O = 0$	1.2V	1.65V to 5.5V	---	---	---	μA
			1.4V to 3.6V	1.65V to 5.5V	---	---	10	
I_{CCZA}		$V_I = V_{CCI}$ or GND, $I_O = 0$, EO = GND	1.2V	1.65V to 5.5V	---	---	---	μA
			1.4V to 3.6V	1.65V to 5.5V	---	---	5	
I_{CCZB}		$V_I = V_{CCI}$ or GND, $I_O = 0$, EO = GND	1.2V	1.65V to 5.5V	---	---	---	μA
			1.4V to 3.6V	1.65V to 5.5V	---	---	5	
C_i	EO		1.2V to 3.6V	1.65V to 5.5V	---	---	4	pF
C_{io}	A port		1.2V to 3.6V	1.65V to 5.5V	---	---	6	pF
	B port				---	---	14	

Minimum Footprint PCB Layout Section


Pin Description

PIN				NAME	FUNCTION
SC-70-6 (SOT-363) /SOT-23-6	SOT-23-8	AQFN1.7X2.0-12	AQFN1.5X1.5-8		
1	1	1	7	VCCA	A-port supply voltage. $1.2V \leq V_{CCA} \leq 3.6V$ and $V_{CCA} \leq V_{CCB}$
2	2	6	4	GND	Ground
---	---	2	---	A1	Input/output A1. Referenced to V_{CCA} .
---	---	3	---	A2	Input/output A2. Referenced to V_{CCA} .
---	3	4	6	A3	Input/output A3. Referenced to V_{CCA} .
3	4	5	5	A4	Input/output A4. Referenced to V_{CCA} .
---	---	10	---	B1	Input/output B1. Referenced to V_{CCB} .
---	---	9	---	B2	Input/output B2. Referenced to V_{CCB} .
---	6	8	2	B3	Input/output B3. Referenced to V_{CCB} .
4	5	7	3	B4	Input/output B4. Referenced to V_{CCB} .
5	7	12	8	EO	Output enable. Pull EO low to place all outputs in 3-state mode. Referenced to V_{CCA} .
6	8	11	1	VCCB	B-port supply voltage. $1.65V \leq V_{CCB} \leq 5.5V$

Timing Requirements
 $T_A=25^{\circ}\text{C}$, $V_{CCA}=1.2\text{V}$

			$V_{CCB}=1.8\text{ V}$	$V_{CCB}=2.5\text{ V}$	$V_{CCB}=3.3\text{ V}$	$V_{CCB}=5\text{ V}$	UNIT
			TYP	TYP	TYP	TYP	
Data rate			20	20	20	20	Mbps
Pulse duration	t_w	Data inputs	50	50	50	50	ns

 over recommended operating free-air temperature range, $V_{CCA}=1.5\text{V}\pm 0.1\%$ (unless otherwise noted)

			$V_{CCB}=1.8\text{V}$ $\pm 0.15\text{V}$		$V_{CCB}=2.5\text{V}$ $\pm 0.2\text{V}$		$V_{CCB}=3.3\text{V}$ $\pm 0.3\text{V}$		$V_{CCB}=5.0\text{V}$ $\pm 0.5\text{V}$		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
Data rate			---	40	---	40	---	40	---	40	Mbps
Pulse duration	t_w	Data inputs	25	---	25	---	25	---	25	---	ns

 over recommended operating free-air temperature range, $V_{CCA}=1.8\text{V}\pm 0.15\%$ (unless otherwise noted)

			$V_{CCB}=1.8\text{V}$		$V_{CCB}=2.5\text{V}$		$V_{CCB}=3.3\text{V}$		$V_{CCB}=5.0\text{V}$		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
Data rate			---	60	---	60	---	60	---	60	Mbps
Pulse duration	t_w	Data inputs	17	---	17	---	17	---	17	---	ns

 over recommended operating free-air temperature range, $V_{CCA}=2.5\text{V}\pm 0.2\%$ (unless otherwise noted)

			$V_{CCB}=2.5\text{V}$		$V_{CCB}=3.3\text{V}$		$V_{CCB}=5.0\text{V}$		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
Data rate			---	100	---	100	---	100	Mbps
Pulse duration	t_w	Data inputs	10	---	10	---	10	---	ns

 over recommended operating free-air temperature range, $V_{CCA}=3.3\text{V}\pm 0.3\%$ (unless otherwise noted)

			$V_{CCB}=3.3\text{V}$		$V_{CCB}=5.0\text{V}$		UNIT
			MIN	MAX	MIN	MAX	
Data rate			---	100	---	100	Mbps
Pulse duration	t_w	Data inputs	10	---	10	---	ns

Switching Characteristics
 $T_A = 25^\circ\text{C}$, $V_{CCA} = 1.2\text{V}$

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 1.8\text{V}$	$V_{CCB} = 2.5\text{V}$	$V_{CCB} = 3.3\text{V}$	$V_{CCB} = 5\text{V}$	UNIT
			TYP	TYP	TYP	TYP	
t_{pd}	A	B	6.9	5.7	5.3	5.5	ns
	B	A	7.4	6.4	6	5.8	
t_{en}	EO	A	1	1	1	1	μs
		B	1	1	1	1	
t_{dis}	EO	A	18	15	14	14	ns
		B	20	17	16	16	
t_{rA}, t_{fA}	A-port rise and fall times		4.2	4.2	4.2	4.2	ns
t_{rB}, t_{fB}	B-port rise and fall times		2.1	1.5	1.2	1.1	ns
$t_{SK(O)}$	Channel-to-channel skew		0.4	0.5	0.5	1.4	ns
Max data rate			20	20	20	20	Mbps

 over recommended operating free-air temperature range, $V_{CCA} = 1.5\text{V} \pm 0.1\text{V}$ (unless otherwise noted)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 1.8\text{V} \pm 0.15\text{V}$		$V_{CCB} = 2.5\text{V} \pm 0.2\text{V}$		$V_{CCB} = 3.3\text{V} \pm 0.3\text{V}$		$V_{CCB} = 5.0\text{V} \pm 0.5\text{V}$		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{pd}	A	B	1.4	12.9	1.2	10.1	1.1	10	0.8	9.9	ns
	B	A	0.9	14.2	0.7	12	0.4	11.7	0.3	13.7	
t_{en}	EO	A	---	1	---	1	---	1	---	1	μs
		B	---	1	---	1	---	1	---	1	
t_{dis}	EO	A	5.9	31	5.7	25.9	5.6	23	5.7	22.4	ns
		B	5.4	30.3	4.9	22.8	4.8	20	4.9	19.5	
t_{rA}, t_{fA}	A-port rise and fall		1.4	5.1	1.4	5.1	1.4	5.1	1.4	5.1	ns
t_{rB}, t_{fB}	B-port rise and fall		0.9	4.5	0.6	3.2	0.5	2.8	0.4	2.7	ns
$t_{SK(O)}$	Channel-to-channel		---	0.5	---	0.5	---	0.5	---	0.5	ns
Max data rate			40	---	40	---	40	---	40	---	Mbps

 over recommended operating free-air temperature range, $V_{CCA} = 1.8\text{V} \pm 0.15\text{V}$ (unless otherwise noted)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 1.8\text{V} \pm 0.15\text{V}$		$V_{CCB} = 2.5\text{V} \pm 0.2\text{V}$		$V_{CCB} = 3.3\text{V} \pm 0.3\text{V}$		$V_{CCB} = 5.0\text{V} \pm 0.5\text{V}$		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{pd}	A	B	1.6	11	1.4	7.7	1.3	6.8	1.2	6.5	ns
	B	A	1.5	12	1.3	8.4	1	7.6	0.9	7.1	
t_{en}	EO	A	---	1	---	1	---	1	---	1	μs
		B	---	1	---	1	---	1	---	1	
t_{dis}	EO	A	5.9	31	5.1	21.3	5	19.3	5	17.4	ns
		B	5.4	30.3	4.4	20.8	4.2	17.9	4.3	16.3	
t_{rA}, t_{fA}	A-port rise and fall		1	4.2	1.1	4.1	1.1	4.1	1.1	4.1	ns
t_{rB}, t_{fB}	B-port rise and fall		0.9	3.8	0.6	3.2	0.5	2.8	0.4	2.7	ns
$t_{SK(O)}$	Channel-to-channel		---	0.5	---	0.5	---	0.5	---	0.5	ns
Max data rate			60	---	60	---	60	---	60	---	Mbps

Switching Characteristics (continued)

 over recommended operating free-air temperature range, $V_{CCA}=2.5V \pm 0.2V$ (unless otherwise noted)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB}=2.5V$ $\pm 0.2V$		$V_{CCB}=3.3V$ $\pm 0.3V$		$V_{CCB}=5.0V$ $\pm 0.5V$		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t_{pd}	A	B	1.1	6.3	1	5.2	0.9	4.7	ns
	B	A	1.2	6.6	1.1	5.1	0.9	4.4	
t_{en}	EO	A	---	1	---	1	---	1	μs
		B	---	1	---	1	---	1	
t_{dis}	EO	A	5.1	21.3	4.6	15.2	4.6	13.2	ns
		B	4.4	20.8	3.8	16	3.9	13.9	
t_{rA}, t_{fA}	A-port rise and fall times		0.8	3	0.8	3	0.8	3	ns
t_{rB}, t_{fB}	B-port rise and fall times		0.7	2.6	0.5	2.8	0.4	2.7	ns
$t_{SK(O)}$	Channel-to-channel skew		---	0.5	---	0.5	---	0.5	ns
Max data rate			100	---	100	---	100	---	Mbps

 over recommended operating free-air temperature range, $V_{CCA}=3.3V \pm 0.3V$ (unless otherwise noted)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB}=3.3V$ $\pm 0.3V$		$V_{CCB}=5.0V$ $\pm 0.5V$		UNIT
			MIN	MAX	MIN	MAX	
t_{pd}	A	B	0.9	4.7	0.8	4	ns
	B	A	1	4.9	0.9	3.8	
t_{en}	EO	A	---	1	---	1	μs
		B	---	1	---	1	
t_{dis}	EO	A	4.6	15.2	4.3	12.1	ns
		B	3.8	16	3.4	13.2	
t_{rA}, t_{fA}	A-port rise and fall times		0.7	2.5	0.7	2.5	ns
t_{rB}, t_{fB}	B-port rise and fall times		0.5	2.1	0.4	2.7	ns
$t_{SK(O)}$	Channel-to-channel skew		---	0.5	---	0.5	ns
Max data rate			100	---	100	---	Mbps

Operating Characteristics
 $T_A=25^\circ C$

PARAMETER		TEST CONDITIONS	V _{CCA}							UNIT
			1.2V	1.2V	1.5V	1.8V	2.5V	2.5V	3.3V	
			V _{CCB}							
			5V	1.8V	1.8V	1.8V	2.5V	5V	3.3V to 5V	
			TYP	TYP	TYP	TYP	TYP	TYP	TYP	
C _{PD} A	A-port input, B-port output	C _L =0, f =10MHz, t _r =t _f =1ns, EO=V _{CCA} (outputs enabled)	7.8	10	9	8	8	8	9	pF
	B-port input, A-port output		12	11	11	11	11	11	11	
C _{PD} B	A-port input, B-port output		38.1	28	28	28	29	29	29	
	B-port input, A-port output		25.4	19	18	18	19	21	22	
C _{PD} A	A-port input, B-port output	C _L =0, f =10MHz, t _r =t _f =1ns, EO=GND (outputs disabled)	0.01	0.01	0.01	0.01	0.01	0.01	0.01	pF
	B-port input, A-port output		0.01	0.01	0.01	0.01	0.01	0.01	0.01	
C _{PD} B	A-port input, B-port output		0.01	0.01	0.01	0.01	0.01	0.01	0.03	
	B-port input, A-port output		0.01	0.01	0.01	0.01	0.01	0.01	0.04	

Principles of Operation

Applications

The G2129 can be used in level-translation applications for interfacing devices or systems operating at different interface voltages with one another.

Architecture

The G2129 architecture (see Figure 1) does not require a direction-control signal to control the direction of data flow from A to B or from B to A. In a dc state, the output drivers of the G2129 can maintain a high or low, but are designed to be weak, so that they can be overdriven by an external driver when data on the bus starts flowing in the opposite direction.

The output one shots detect rising or falling edges on the A or B ports. During a rising edge, the one shot turns on the PMOS transistors (T1,T3) for a short duration, which speeds up the low-to-high transition. Similarly, during a falling edge, the one shot turns on the NMOS transistors (T2,T4) for a short duration, which speeds up the high-to-low transition. The typical output impedance during output transition is 70Ω at $V_{CCO}=1.2V$ to $1.8V$, 50Ω at $V_{CCO}=1.8V$ to $3.3V$, and 40Ω at $V_{CCO}=3.3V$ to $5V$.

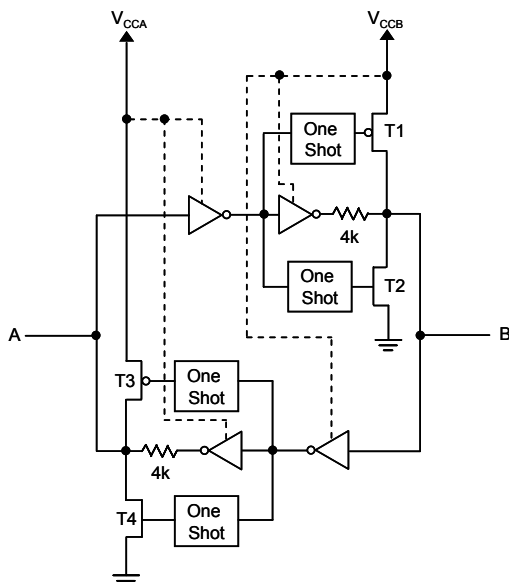
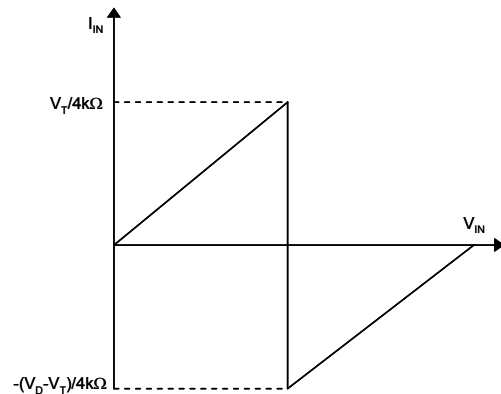


Figure 1 Architecture of G2129 I/O Cell

Input Driver Requirements

Typical I_{IN} vs V_{IN} characteristics of the G2129 are shown in Figure 2. For proper operation, the device driving the data I/Os of the G2129 must have drive strength of at least $\pm 2mA$.



A. V_T is the input threshold voltage of the G2129 (typically $V_{CC}/2$).
B. V_D is the supply voltage of the external driver.

Figure 2 Typical I_{IN} vs V_{IN} Curve

Power Up

During operation, ensure that $V_{CCA} \leq V_{CCB}$ at all times. During power-up sequencing, $V_{CCA} \geq V_{CCB}$ does not damage the device, so any power supply can be ramped up first. The G2129 has circuitry that disables all output ports when either V_{CC} is switched off ($V_{CCA/B}=0V$).

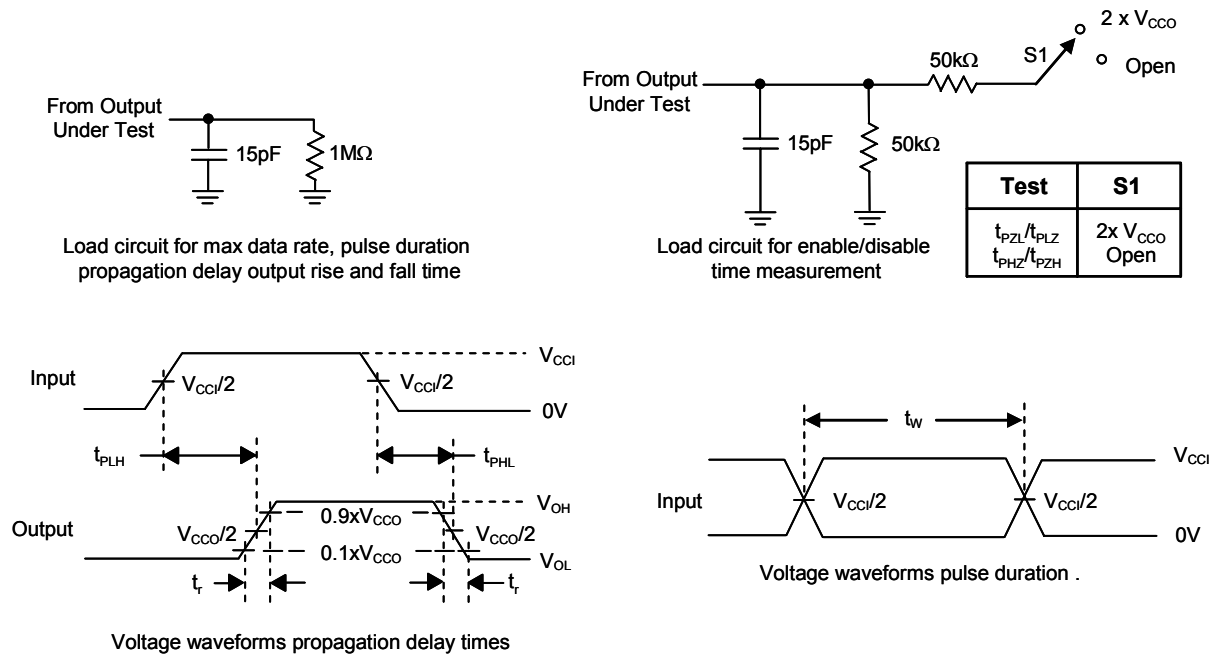
Enable and Disable

The G2129 has an EO input that is used to disable the device by setting EO=low, which places all I/Os in the high-impedance (Hi-Z) state. The disable time (t_{dis}) indicates the delay between when EO goes low and when the outputs actually get 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 EO is taken high.

Pullup or Pulldown Resistors on I/O Lines

The G2129 is designed to drive capacitive loads of up to $70pF$. The output drivers of the G2129 have low dc drive strength. If pullup or pulldown resistors are connected externally to the data I/Os, their values must be kept higher than $50k\Omega$ to ensure that they do not contend with the output drivers of the G2129.

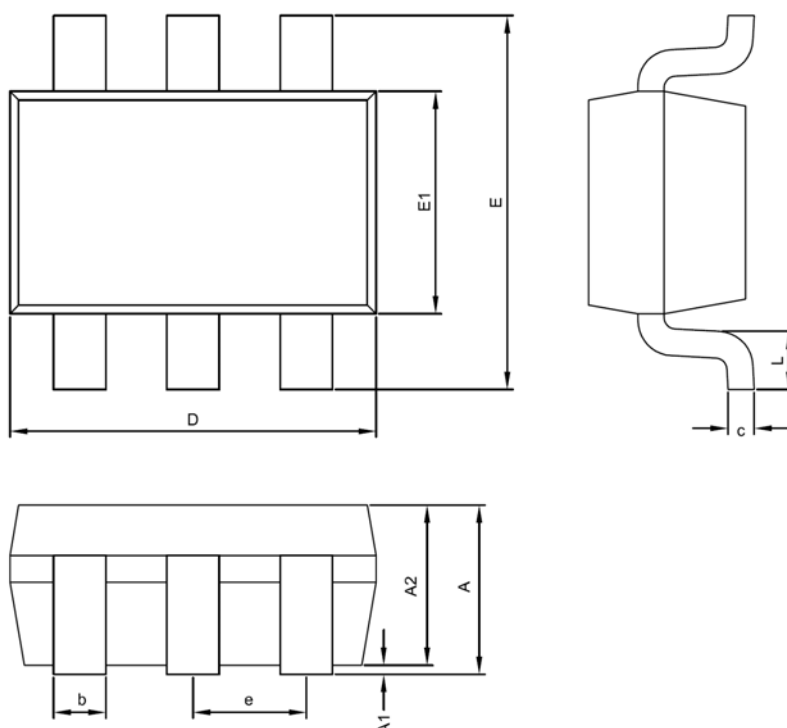
For the same reason, the G2129 should not be used in applications such as I^2C or 1-Wire where an open-drain driver is connected on the bidirectional data I/O. For these applications, use a device from the GMT G2129B of level translators.

Parameter Measurement Information


- A. C_L includes probe and jig capacitance.
- B. 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.
- C. All input pulses are supplied by generators having the following characteristics: $PRR \leq 10\text{MHz}$, $Z_O = 50\Omega$, $dv/dt \geq 1\text{V/ns}$.
- D. The outputs are measured one at a time, with one transition per measurement.
- E. t_{PLZ} and t_{PHZ} are the same as t_{dis} .
- F. t_{PZL} and t_{PZH} are the same as t_{en} .
- G. t_{PLH} and t_{PHL} are the same as t_{pd} .
- H. V_{CCI} is the V_{CC} associated with the input port.
- I. V_{CCO} is the V_{CC} associated with the output port.
- J. All parameters and waveforms are not applicable to all devices.

Figure 3. Load Circuit and Voltage Waveforms

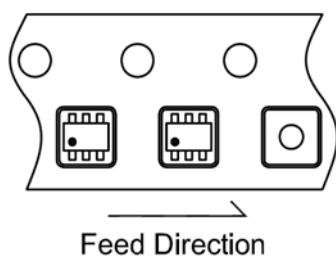
Package Information



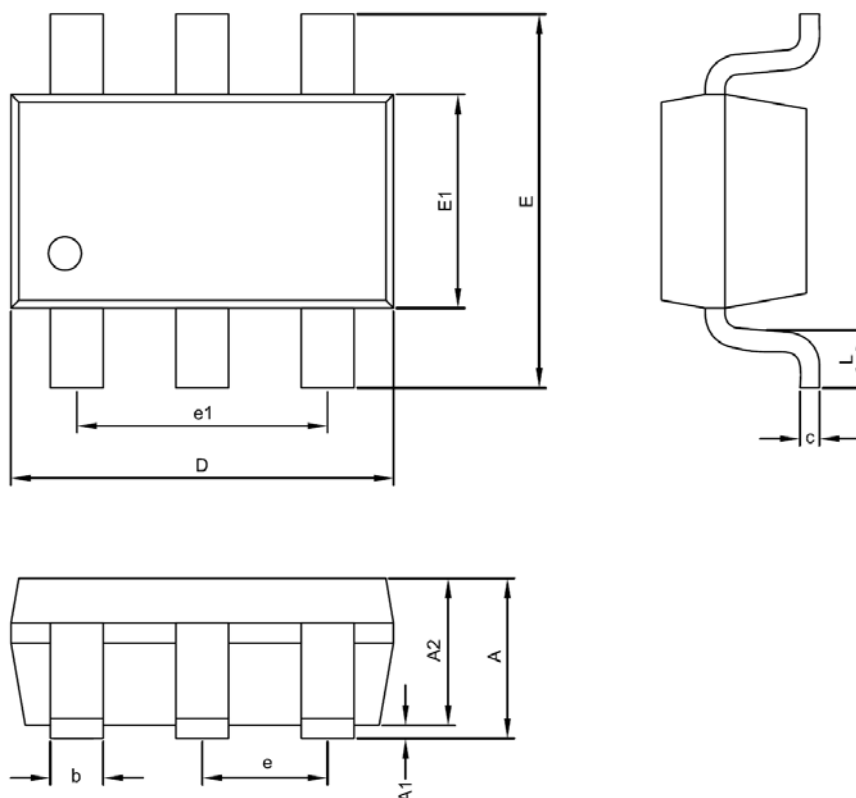
SC-70-6 (SOT-363) Package

Symbol	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.80	0.95	1.10	0.031	0.037	0.043
A1	0.00	---	0.10	0.000	---	0.004
A2	0.80	0.90	1.00	0.031	0.035	0.039
D	1.90	2.10	2.15	0.075	0.083	0.085
E	2.00	2.10	2.20	0.079	0.083	0.087
E1	1.15	1.25	1.35	0.045	0.049	0.053
c	0.08	0.15	0.25	0.003	0.006	0.010
b	0.15	0.25	0.30	0.006	0.010	0.012
e	0.65 BSC			0.026 BSC		
L	0.26	0.36	0.46	0.010	0.014	0.018

Taping Specification



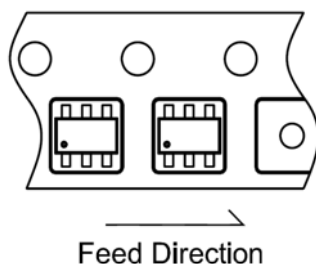
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SC-70-6 (SOT-363)	3,000 ea



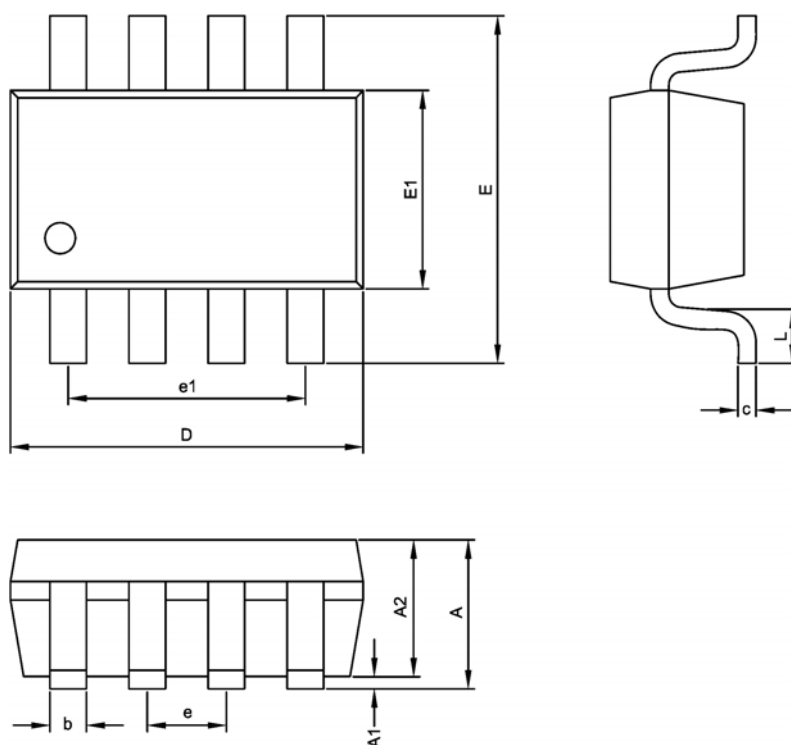
SOT-23-6 Package

Symble	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	1.00	1.10	1.45	0.039	0.043	0.057
A1	0.00	---	0.15	0.000	---	0.006
A2	1.00	1.10	1.30	0.039	0.043	0.051
D	2.70	2.90	3.10	0.106	0.114	0.122
E	2.60	2.80	3.00	0.102	0.110	0.118
E1	1.50	1.60	1.70	0.059	0.063	0.067
c	0.08	0.15	0.25	0.003	0.006	0.010
b	0.30	0.40	0.50	0.012	0.016	0.020
e	0.95 BSC			0.037 BSC		
e1	1.90 BSC			0.075 BSC		
L	0.30	0.45	0.60	0.012	0.018	0.024

Taping Specification



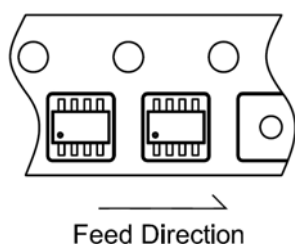
PACKAGE	Q'TY/REEL
SOT-23-6	3,000 ea



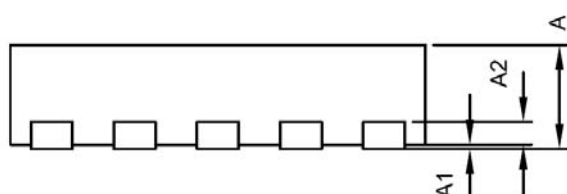
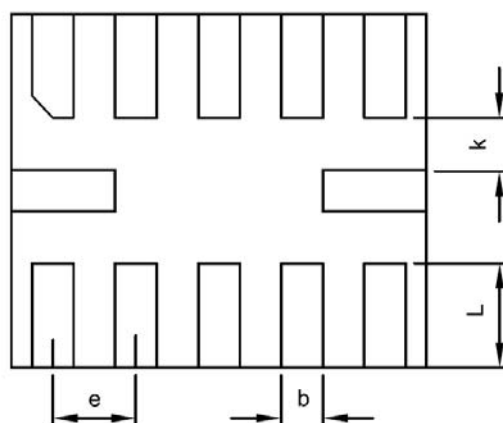
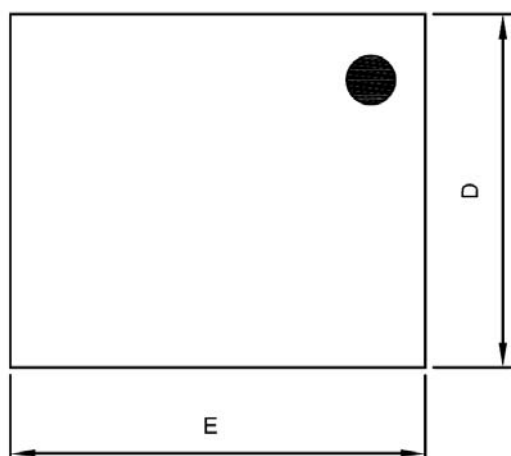
SOT-23-8 Package

Symble	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	1.00	1.10	1.45	0.039	0.043	0.057
A1	0.00	---	0.15	0.000	---	0.006
A2	1.00	1.10	1.30	0.039	0.043	0.051
D	2.80	2.90	3.00	0.110	0.114	0.118
E	2.60	2.80	3.00	0.102	0.110	0.118
E1	1.50	1.60	1.70	0.059	0.063	0.067
c	0.08	0.15	0.25	0.003	0.006	0.010
b	0.22	0.30	0.40	0.008	0.012	0.016
e	0.65 BSC			0.026 BSC		
e1	1.95 BSC			0.077 BSC		
L	0.30	0.45	0.60	0.012	0.018	0.024

Taping Specification



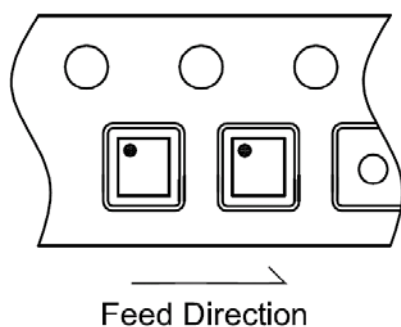
PACKAGE	Q'TY/REEL
SOT-23-8	3,000 ea



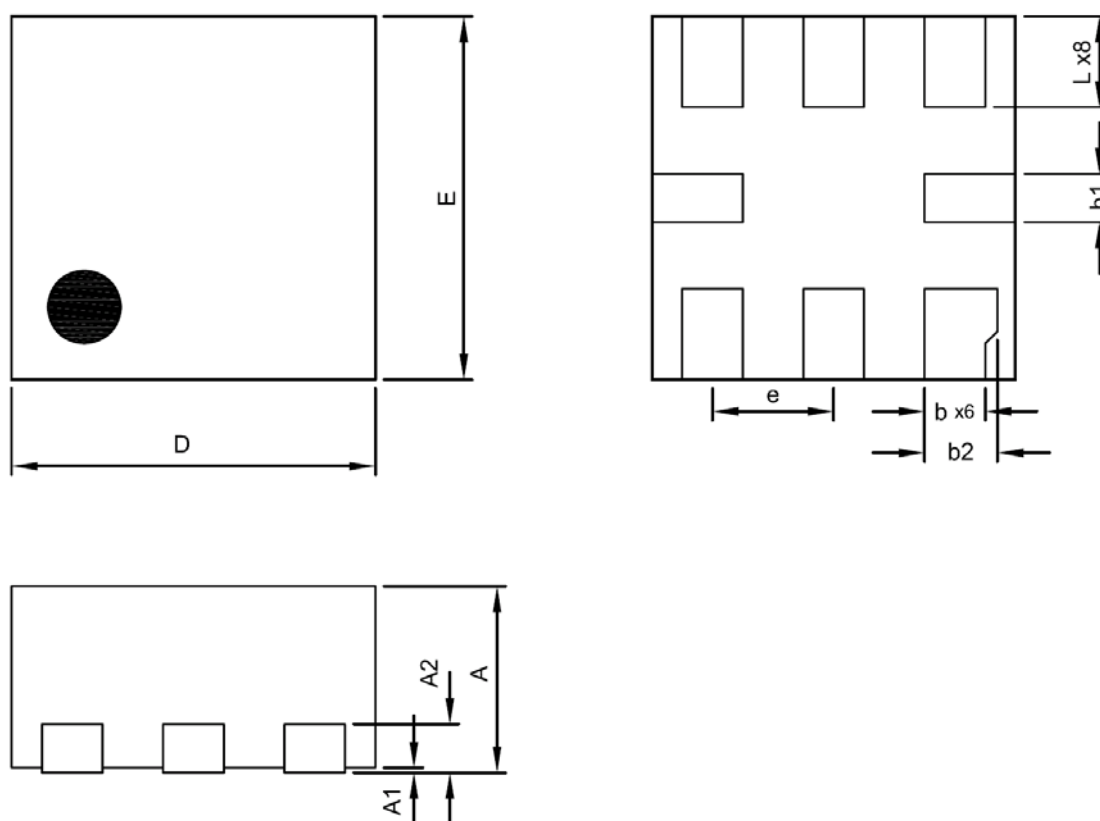
AQFN1.7X2.0-12 Package

Symble	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.50	0.55	0.60	0.0197	0.0217	0.0236
A1	0.00	---	0.05	0.0000	---	0.0020
A2	0.10	0.11	0.12	0.0039	0.0043	0.0047
D	1.60	1.70	1.80	0.0629	0.0669	0.0708
E	1.90	2.00	2.10	0.0748	0.0787	0.0826
b	0.15	0.20	0.25	0.0059	0.0079	0.0098
e	0.40 BSC			0.0157 BSC		
L	0.45	0.50	0.55	0.0177	0.0196	0.0216
k	0.200			0.0078		

Taping Specification



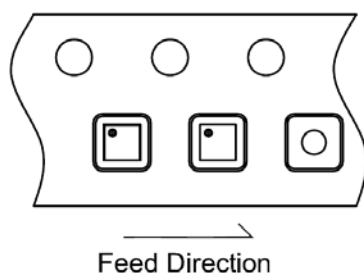
PACKAGE	Q'TY/REEL
AQFN1.7X2.0-12	3,000 ea



AQFN1.5X1.5-8 Package

Symble	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.70	0.75	0.80	0.0276	0.0295	0.0315
A1	0.00	---	0.05	0.0000	---	0.0020
A2	0.10	0.11	0.12	0.0039	0.0043	0.0047
D	1.45	1.50	1.55	0.0570	0.0590	0.0610
E	1.45	1.50	1.55	0.0570	0.0590	0.0610
b	0.20	0.25	0.30	0.0079	0.0098	0.0118
b1	0.15	0.20	0.25	0.0059	0.0079	0.0098
b2	0.30 BSC			0.0118 BSC		
e	0.50 BSC			0.0197 BSC		
L	0.33	0.38	0.43	0.0130	0.0150	0.0169

Taping Specification



PACKAGE	Q'TY/REEL
AQFN1.5X1.5-8	3,000 ea