

DESCRIPTION

The GLF82321 is an advanced technology fully integrated I_QSmart™ load switch device with reverse current blocking (RCB) protection and slew rate control of the output voltage.

The GLF82321 offers industry leading reverse current blocking (RCB) protection performance, featuring an ultra-low threshold voltage. The GLF82321 minimizes reverse current flow in the event that the V_{OUT} voltage exceeds the V_{IN} voltage.

The GLF82321 integrated slew rate control can also enhance system reliability by mitigating bus voltage swings during switching events. Where uncontrolled switches can generate high inrush currents that result in voltage droop and/or bus reset events, the GLF slew rate control specifically limits inrush currents during turn-on to minimize voltage droop.

The GLF82321 load switch device supports an industry leading wide input voltage range that helps to improve system operating life and overall performance. One GLF120x device can be used in multiple voltage rail applications which helps mitigate inventory management and reduces BOM cost.

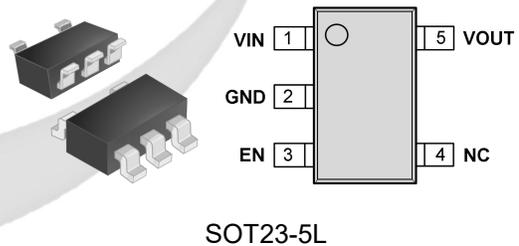
APPLICATIONS

- Smart IoT Devices
- Portable Industrial Devices
- Low Power Subsystems
- Wearable Devices

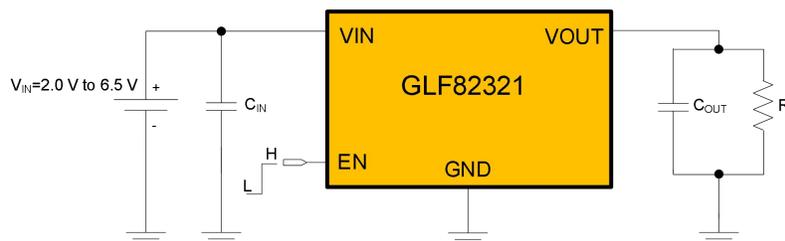
FEATURES

- Supply Voltage Range: 2.0 V to 6.5 V
7.0 V_{Abs} max
- I_{OUT} Max: 2 A
- Low R_{ON}: 40 mΩ Typ at 6.5 V_{IN}
- Ultra-Low I_Q: 1.6 μA Typ at 6.5 V_{IN}
- Ultra-Low I_{SD}: 20 nA Typ at 6.5 V_{IN}
- Controlled Rise Time: 2.6 ms at 6.0 V_{IN}
- Reverse Current Blocking Protection
- Smart Enable Pin
 - I_{EN}: 3 nA Typ at V_{EN} > V_{IH}
 - R_{EN}: 500 kΩ Typ at V_{EN} < V_{IL}
- Integrated Output Discharge Switch
- Wide Operating Temperature Range:
-40 °C ~ 85 °C
- HBM: 6 kV, CDM: 2 kV

PACKAGE



APPLICATION DIAGRAM



ALTERNATE DEVICE OPTIONS

Part Number	Top Mark	R_{ON} (Typ.) at 6.5 V	EN Activity	Tape and Reel Packaging
GLF82321	DG	40 m Ω	High	3000 Pieces on 7 inch reel

FUNCTIONAL BLOCK DIAGRAM

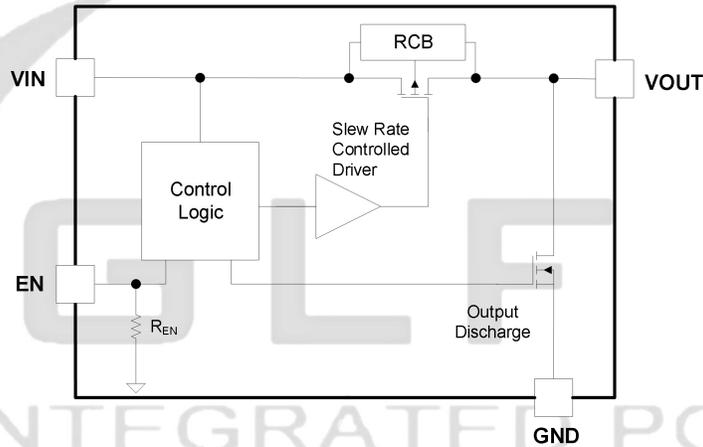


Figure 1. Functional Block Diagram

PIN CONFIGURATION

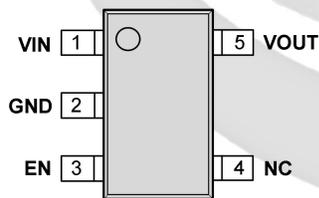


Figure 2. SOT23-5L

PIN DEFINITION

Pin #	Name	Description
1	VIN	Switch Input. Supply Voltage for IC
2	GND	Ground
3	EN	Enable to control the switch.
4	NC	No connection
5	VOUT	V_{OUT} pin is connected to the downstream system.

ABSOLUTE MAXIMUM RATINGS

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions; extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter	Min.	Max.	Unit
V _{IN} , V _{OUT} , V _{EN}	Each Pin Voltage Range to GND	-0.3	7.0	V
I _{OUT}	Maximum Continuous Switch Current		2	A
P _D	Power Dissipation at T _A = 25 °C		1.0	W
T _{STG}	Storage Junction Temperature	-65	150	°C
T _J	Maximum Junction Temperature		150	°C
T _A	Operating Temperature Range	-40	85	°C
θ _{JC}	Thermal Resistance, Junction to Case		90	°C/W
θ _{JA}	Thermal Resistance, Junction to Ambient (Measured using 2S2P JEDEC std. PCB.)		180	°C/W
ESD	Electrostatic Discharge Capability	Human Body Model, JESD22-A114	±6	kV
		Charged Device Model, JESD22-C101	±2	

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min.	Max.	Unit
V _{IN}	Supply Voltage	2.0	6.5	V
T _A	Ambient Operating Temperature	-40	+85	°C

ELECTRICAL CHARACTERISTICS

V_{IN} = 2.0 V to 6.5 V and T_A = 25 °C. Unless otherwise noted

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
Basic Operation						
I _Q	Supply Current	EN = Enable, I _{OUT} = 0 mA, V _{IN} = V _{EN} = 2.0 V		0.3		μA
		EN = Enable, I _{OUT} = 0 mA, V _{IN} = V _{EN} = 3.7 V		0.6		
		EN = Enable, I _{OUT} = 0 mA, V _{IN} = V _{EN} = 4.2 V		0.7		
		EN = Enable, I _{OUT} = 0 mA, V _{IN} = V _{EN} = 5.0 V		1.0		
		EN = Enable, I _{OUT} = 0 mA, V _{IN} = V _{EN} = 6.0 V		1.3		
		EN = Enable, I _{OUT} = 0 mA, V _{IN} = V _{EN} = 6.5 V		1.6	2.5	
		EN = Enable, I _{OUT} = 0 mA, V _{IN} = V _{EN} = 6.5 V, T _A = 85 °C ⁽²⁾		1.7		
I _{SD}	Shutdown Current	EN = Disable, I _{OUT} = 0 mA, V _{IN} = 2.0 V		2		nA
		EN = Disable, I _{OUT} = 0 mA, V _{IN} = 3.7 V		8		
		EN = Disable, I _{OUT} = 0 mA, V _{IN} = 4.2 V		12		
		EN = Disable, I _{OUT} = 0 mA, V _{IN} = 5.0 V		14		
		EN = Disable, I _{OUT} = 0 mA, V _{IN} = 6.0 V		17		
		EN = Disable, I _{OUT} = 0 mA, V _{IN} = 6.5 V		20	50	
		EN = Disable, I _{OUT} = 0 mA, V _{IN} = 6.5 V, T _A = 85 °C ⁽²⁾		440		
R _{ON}	On-Resistance	V _{IN} = 6.5 V, I _{OUT} = 500 mA	T _A = 25 °C	40	48	mΩ
			T _A = 85 °C	50		
		V _{IN} = 6.0 V, I _{OUT} = 500 mA	T _A = 25 °C	41	49	
			T _A = 85 °C	51		
		V _{IN} = 5.0 V, I _{OUT} = 500 mA	T _A = 25 °C	42		
		V _{IN} = 4.2 V, I _{OUT} = 500 mA	T _A = 25 °C	44		
		V _{IN} = 3.7 V, I _{OUT} = 300 mA	T _A = 25 °C	46		
		V _{IN} = 3.3 V, I _{OUT} = 300 mA	T _A = 25 °C	48	56	
V _{IN} = 2.5 V, I _{OUT} = 300 mA	T _A = 25 °C	54				
V _{IN} = 2.0 V, I _{OUT} = 300 mA	T _A = 25 °C	62				
R _{DSC}	Output Discharge Resistance	EN = Low, I _{FORCE} = 10 mA		550		Ω
V _{IH}	EN Input Logic High Voltage	V _{IN} = 2.0 to 6.5 V	1.5			V
V _{IL}	EN Input Logic Low Voltage				0.5	V
I _{EN}	EN Current	EN Voltage > V _{IH}		3	30	nA
R _{EN}	EN Pulldown Resistance	V _{EN} < V _{IL} , Disabled		500		kΩ
V _{RCB_TH}	RCB Protection Threshold Voltage ⁽²⁾	V _{OUT} - V _{IN} , V _{IN} = 5 V		90		mV
V _{RCB_RL}	RCB Protection Release Voltage ⁽²⁾	V _{IN} - V _{OUT} , V _{IN} = 5 V		50		
Switching Characteristics ^{(1), (2)}						
t _{dON}	Turn-On Delay	V _{IN} = 6.0 V, R _{OUT} = 150 Ω, C _{OUT} = 1.0 μF		1.3		ms
t _R	V _{OUT} Rise Time			2.6		
t _{dOFF}	Turn-Off Delay			21		μs
t _F	V _{OUT} Fall Time			360		

Notes: 1. t_{ON} = t_{dON} + t_R, t_{OFF} = t_{dOFF} + t_F

2. By design; characterized, not production tested

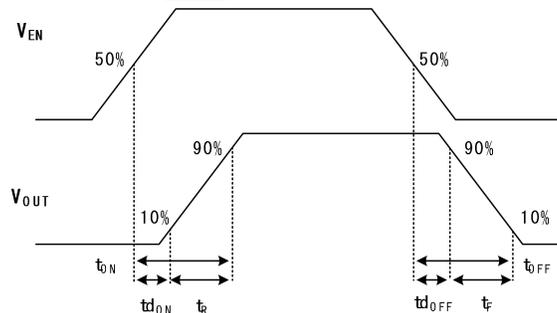


Figure 3. Timing Diagram

TYPICAL PERFORMANCE CHARACTERISTICS

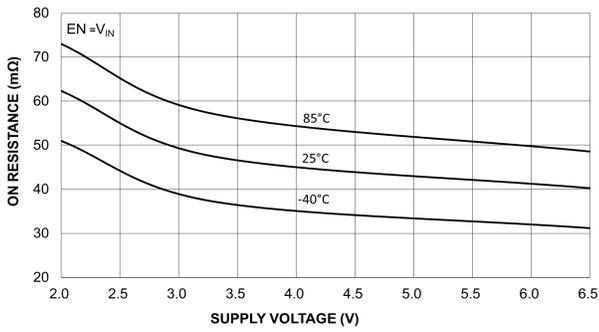


Figure 4. On-Resistance vs. Supply Voltage

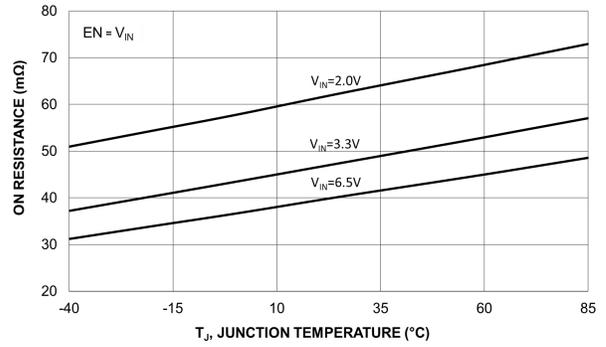


Figure 5. On-Resistance vs. Temperature

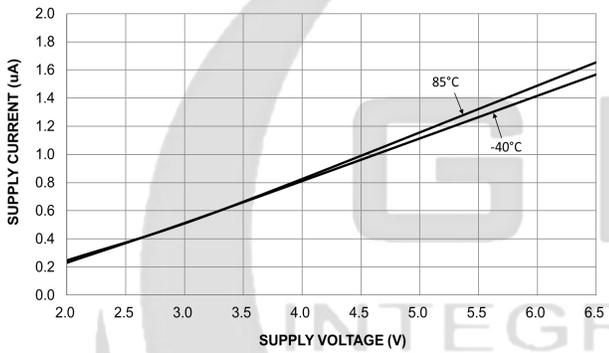


Figure 6. Quiescent Current vs. Supply Voltage

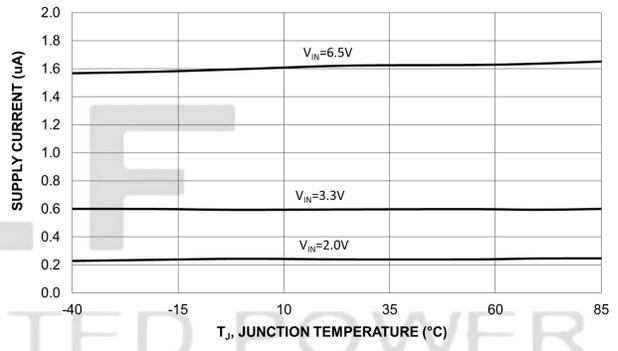


Figure 7. Quiescent Current vs. Temperature

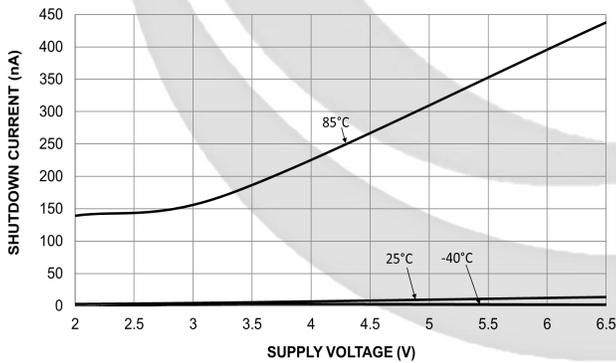


Figure 8. Shutdown Current vs. Supply Voltage

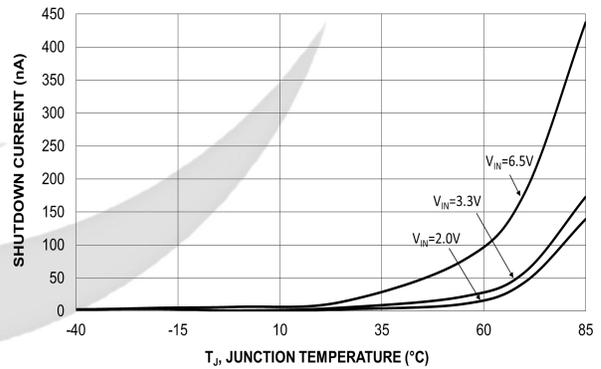


Figure 9. Shutdown Current vs. Temperature

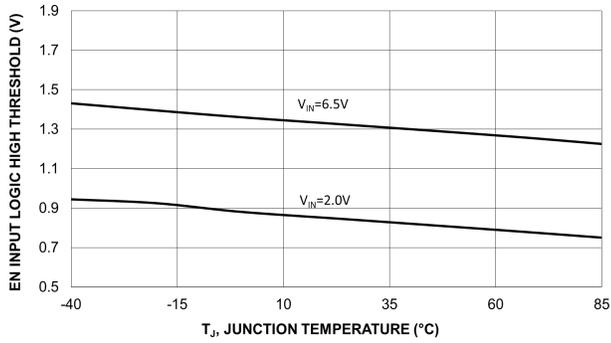


Figure 10. EN Input Logic High Threshold vs. Temperature

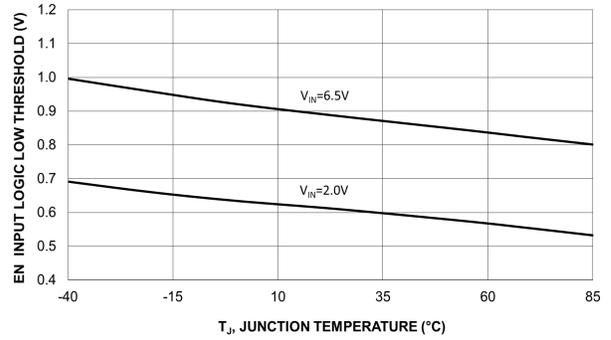


Figure 11. EN Input Logic Low Threshold vs. Temperature

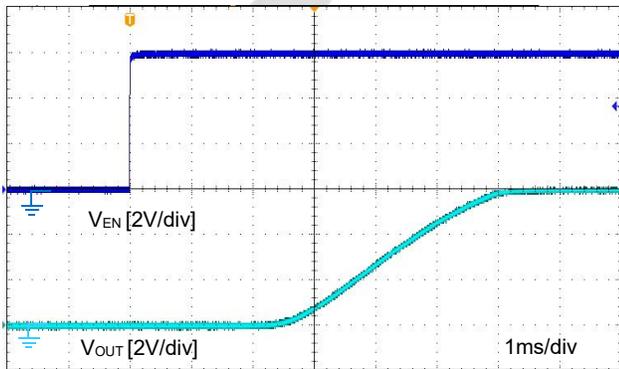


Figure 11. Turn-On Response
V_{IN}=6.0 V, C_{IN}=1.0 μF, C_{OUT}=1.0 μF, R_L=150 Ω

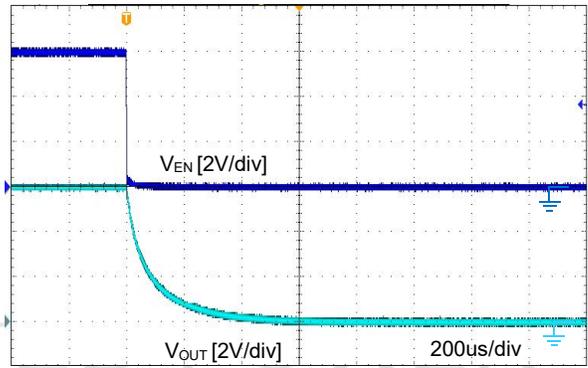


Figure 13. Turn -Off Response
V_{IN}=6.0 V, C_{IN}=1.0 μF, C_{OUT}=1.0 μF, R_L=150 Ω

APPLICATION INFORMATION

The GLF82321 is an ultra-low leakage integrated 2 A I_QSmart™ load switch with reverse current blocking (RCB) technology and the slew rate control of the output voltage. It is capable of operating over a wide input range from 2.0 V to 6.5 V with very low on-resistance to reduce conduction loss. In the off state, these devices consume very low leakage current to avoid unwanted standby current and save limited input power supply.

Input Capacitor

The GLF82321 requires an input capacitor to function. To reduce the voltage drop on the input power rail caused by transient inrush current at start-up, a 1 μF capacitor is recommended to be placed close to V_{IN} pin. A higher input capacitor value can be used to attenuate the input voltage drop.

Output Capacitor

A 0.1μF capacitor or higher values can be able to prevent undershoot caused by parasitic inductance on board traces at switching off and improve reliability of a controlled voltage rail. The C_{OUT} should be placed close to V_{OUT} and GND pins.

Input Voltage Spike Reduction

In steady state condition, the voltages at input pins almost equal to the input power sources. However, at the transient time when the power source is plugged in, a spike voltage will be induced at input pin. The level of the voltage spike is determined by the parasitic inductance between power source and input pin as well as the change rate of input current. The longer length between power source and input pin, the faster change rate of input current, the larger voltage spike. If the spike voltage level exceeds the absolute maximum rated input voltage, it may damage the chip permanently. Below is the waveform when a 6.0 V power source is “hot” plugged in, and the voltage spike can be up to 9.1 V. A “hot” plug-in is not recommended all the time.

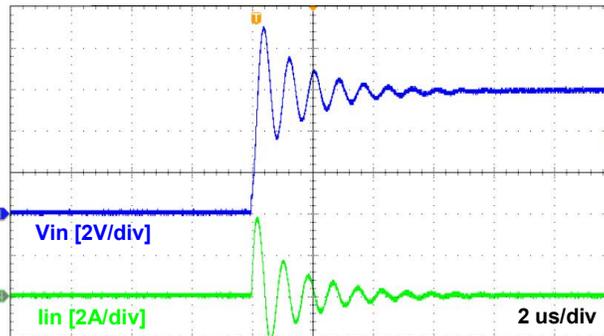


Figure 14. the voltage spike when the power source is “hot” plugged in (IC is disabled)

The voltage spikes are tested with different wire length between the power source and input pin. The results are shown in the table below.

V _{IN} (V)	Wire Length (Cm)	V _{IN_spike} (V)
6.0	1	7.0
	3	7.6
	5	9.1

To avoid unexpected voltage spike, a resistor is recommended in series with input capacitor. The circuit is shown in Figure 15.

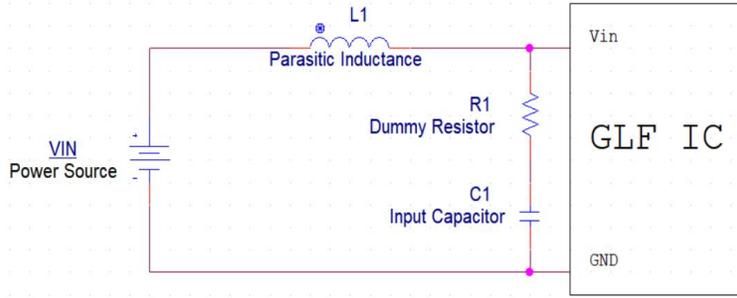


Figure 15. Reduction of voltage spike with a dummy resistor in series with input capacitor

The voltage spike is reduced from 9.1 V (Figure 17) to 6.8 V (Figure 19) by a 1 Ohm dummy resistor which is in series with the input capacitor at same external conditions, which shows a safe voltage spike less than 7.0 V_{Abs.}

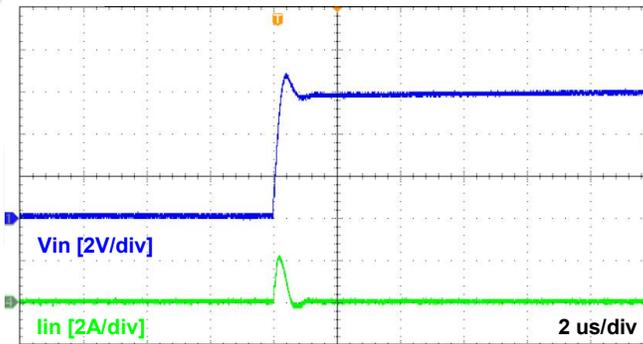


Figure 16. the voltage spike is reduced by the dummy resistor

Several combinations of wire length and dummy resistors are selected for different designs. Test results are shown in the following table. The test results show that the dump resistor can help reduce the voltage spike, and the designers can select proper value resistor in the designs based on the application conditions.

V _{IN} (V)	Dummy Resistor (Ω)	Wire Length (Cm)	V _{IN_spike} (V)
6.0	1.0	1	6.4
		3	6.5
		5	6.8
	2.2	1	6.1
		3	6.3
		5	6.4
	3.6	1	6.0
		3	6.0
		5	6.1

EN Pin

The GLF82321 can be activated by EN pin high. Note that the EN pin has an internal pull-down resistor to maintain a reliable status without EN signal applied from an external controller.

Reverse Current Blocking

The GLF82321 has a built-in reverse current blocking protection which always monitors the output voltage level regardless of the status of EN pin to check if it is greater than the input voltage. When the output voltage goes beyond the input voltage by the reverse current blocking protection threshold voltage

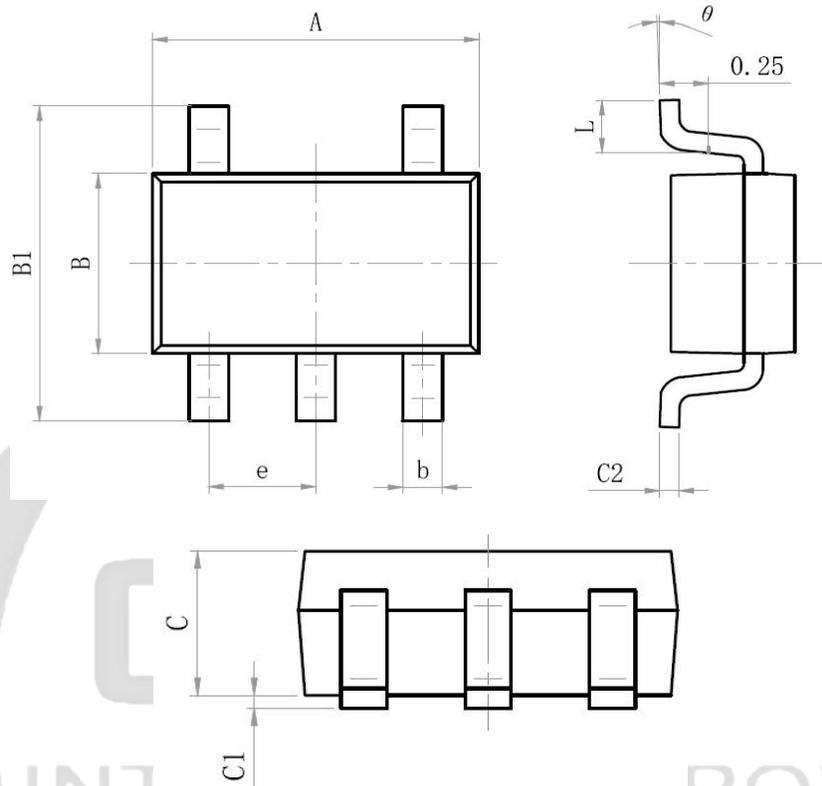
(V_{RCB_TH}), the reverse current blocking function block turns off the switch. Note that some reverse current can occur until the V_{RCB_TH} is triggered. The main switch will resume normal operation when the output voltage drops below the input source by the reverse current blocking protection release voltage (V_{RCB_RL}).

Board Layout

All traces should be as short as possible to minimize parasitic inductance effect. Wide traces for VIN, VOUT, and GND will be better to reduce parasitic effects at dynamic operations and improve thermal performance at high load current.

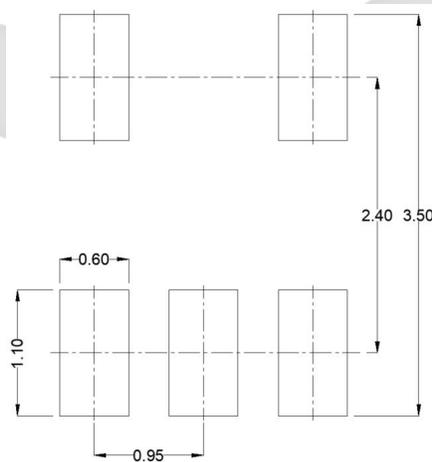


PACKAGE OUTLINE



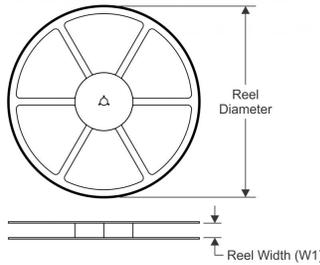
Size Mark	Min(mm)	Max(mm)	Size Mark	Min(mm)	Max(mm)
A	2.82	3.02	C	1.05	1.15
e	0.95 (BSC)		C1	0.03	0.15
b	0.28	0.45	C2	0.12	0.23
B	1.50	1.70	L	0.35	0.55
B1	2.60	3.00	theta	0°	8°

Recommended Footprint

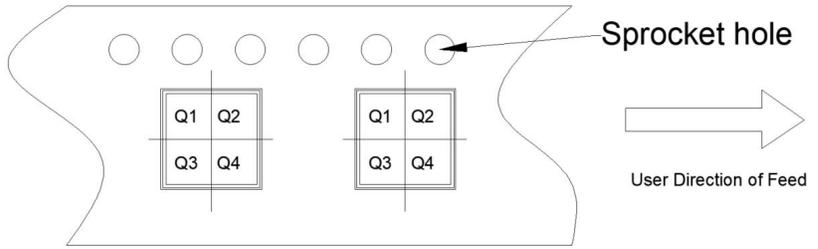


TAPE AND REEL INFORMATION

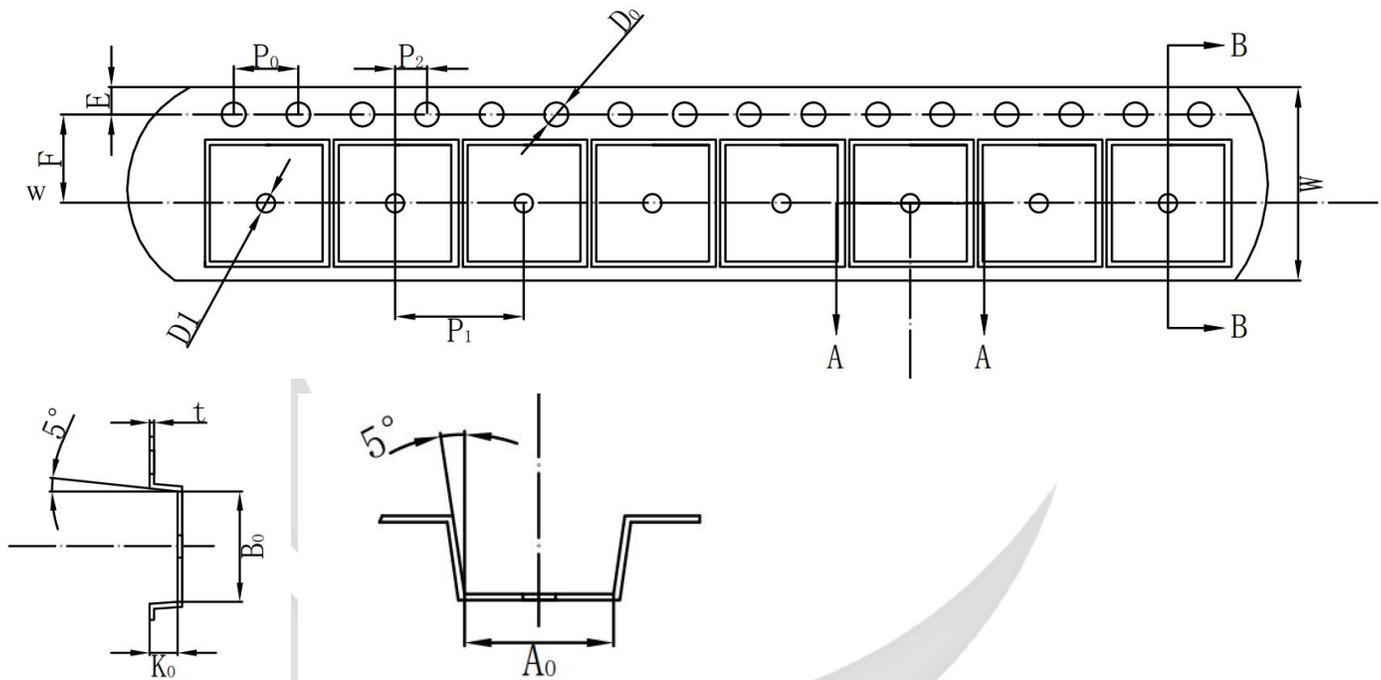
REEL DIMENSIONS



QUADRANT ASSIGNMENTS PIN 1 ORIENTATION TAPE



TAPE DIMENSIONS



Device	Package	Pins	SPQ	Reel Diameter (mm)	Reel Width W1	A0	B0	K0	P1	W	Pin1
GLF82321	SOT23-5	5	3000	178	9	3.25	3.30	1.38	4	8	Q3

Remark:

A0: Dimension designed to accommodate the component width

B0: Dimension designed to accommodate the component length

C0: Dimension designed to accommodate the component thickness

W: Overall width of the carrier tape

P1: Pitch between successive cavity centers

SPECIFICATION DEFINITIONS

Document Type	Meaning	Product Status
Target Specification	This is a target specification intended to support exploration and discussion of critical needs for a proposed or target device. Parameters including the typical, minimum, and maximum values are desired, or target. GLF reserves the right to change contents at any time without warning or notification. A target specification will not guarantee the future production of the device.	Design / Development
Preliminary Specification	This is a draft version of a product specification which is under internal review and subject to change. GLF reserves the right to change the specification at any time without warning or notification. A preliminary specification will not guarantee the future production of the device.	Qualification
Product Specification	This document represents the characteristics of the device.	Production

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