GLF4000, GLF4001

Ultra-Low Current Consumption Power Multiplexer Switch with Auto & Manual Input Selection in SOT23-6L

Product Specification

DESCRIPTION

The GLF4000 and GLF4001 are integrated power multiplexer switch with dual independent power switches connected to a single output pin to enable seamless transition between two input sources.

The GLF4000 and GLF4001 provide an automatic selection mode as well as a manual selection mode by the combination of the logic input pins of EN and SEL. The EN input pin is used along with the select (SEL) input pin to select the automatic switching function, select VIN1 only, select VIN2 only, or turn both switches off. In the automatic selection mode, the GLF4000 and GLF4001 automatically select the higher input voltage source out of two input DC power supplies.

The GLF4000 and GLF4001 feature an ultra-efficient I_QSmart™ technology that offers quiescent current (I_Q) and shutdown current (I_{SD}) in the industry. Low R_{ON} reduces conduction losses while low I_Q and I_{SD} solutions help designers to reduce parasitic leakage current, improve system efficiency, and increase battery lifetime.

The GLF4000 and GLF4001 block any cross-conduction current between two input power sources. When the switch is disabled, the GLF4000 and GLF4001 prevent the reverse current to the input source from the output at any higher Vout than Vin condition.

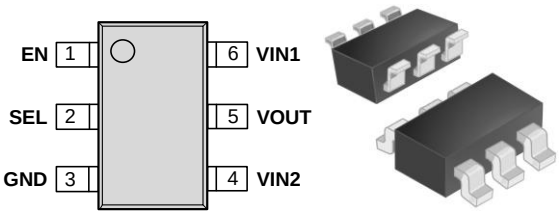
FEATURES

- Two-Input and Single-Output Power Multiplexer Switch
- Automatic and Manual Input Selection Mode
- Supply Voltage Range: 1.5 V to 5.5 V
  6 Vabs Max
- R_{ON}: 68 mΩ Typ. at 5.5 V_{IN1} or V_{IN2}
  77 mΩ Typ. at 3.3 V_{IN1} or V_{IN2}
- 2 A Continuous Output Current Capability Per Channel
- Ultra-Low Supply Current at Operation
  I_Q: 4 μA Typ at 5.5 V_{IN}
- Ultra-Low Stand-by Current
  I_{SD}: 20 nA Typ at 5.5 V_{IN}
- Smart Control Pins
  I_{EN} and I_{SEL}: 3 nA Typ at V_{EN} or V_{SEL} > V_{IH}
  R_{EN} and R_{SEL}: 500 kΩ Typ
- Integrated Output Discharge Switch: GLF4000
- No Cross Conduction Between Two Inputs
- Reverse Current Blocking when Disabled
- Operating Temperature Range: -40 °C to 85 °C
- HBM: ±6 kV, CDM: ±2 kV

APPLICATIONS

- Smart IoT Devices
- Wearables / Portable Devices
- Headset and Audio System
- Backup Power System

PACKAGE

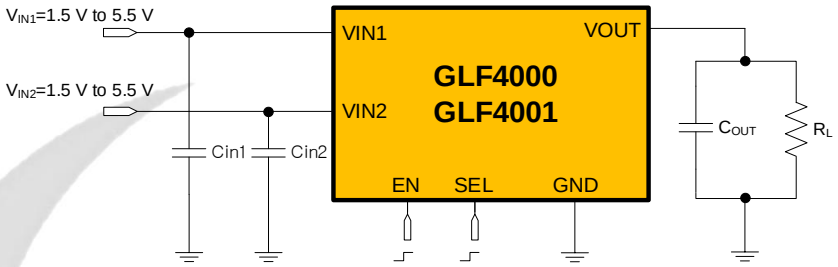


SOT23-6L

DEVICE ORDERING INFORMATION

Part Number	Top Mark	R_{ON} at 5.5 V_{IN}	Output Discharge	Output Current, I_{OUT}	Ultra-low I_Q at 5.5 V_{IN}
GLF4000-T2G7	BX	68 mΩ	70 Ω	2 A	4 µA
GLF4001-T2G7	AR		NA		

APPLICATION DIAGRAM



FUNCTIONAL BLOCK DIAGRAM

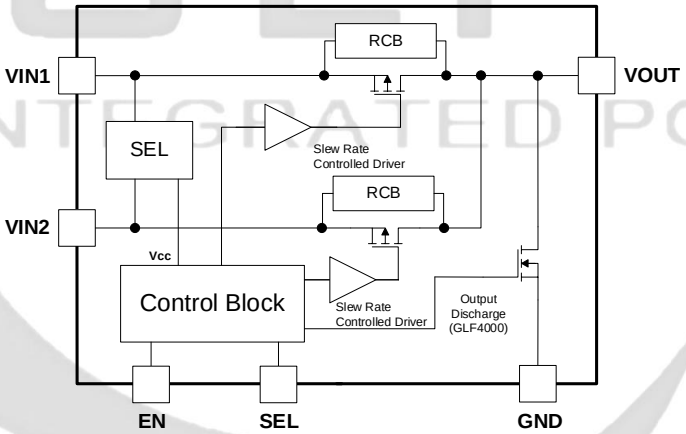


Figure 1. Functional Block Diagram

PIN CONFIGURATION

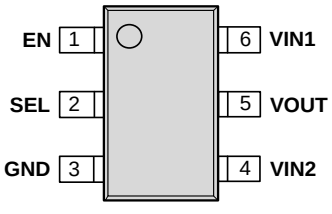


Figure 2. SOT23-6L

PIN DEFINITION

Pin #	Name	Description
1	EN	Enable to control the switch. Do not leave the EN pin floating.
2	SEL	Input Source Selection. Do not leave the SEL pin floating.
3	GND	Ground
4	VIN2	Switch Input 2
5	VOUT	Switch Output
6	VIN1	Switch Input 1

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_{IN1}, V_{IN2} V_{OUT}, V_{EN}	Each Pin Voltage Range to GND		-0.3	6	V
I_{OUT}	Maximum Continuous Switch Current			2.0	A
P_D	Power Dissipation at T_A = 25°C			1.0	W
T_{STG}	Storage Junction Temperature		-65	150	°C
θ_{JC}	Thermal Resistance, Junction to Case (1)			90	°C/W
θ_{JA}	Thermal Resistance, Junction to Ambient (1)			180	°C/W
ESD	Electrostatic Discharge Capability	Human Body Model, JESD22-A114	±6		kV
		Charged Device Model, JESD22-C101	±2		

Note: 1. The thermal resistance depends on the PCB layout and heat dissipation.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min.	Max.	Unit
V_{IN1}, V_{IN2}	Supply Voltage	1.5	5.5	V
T_A	Ambient Operating Temperature	-40	+85	°C

ELECTRICAL CHARACTERISTICS

V_{IN1} = V_{IN2} = 1.5 V to 5.5 V and T_A = 25 °C. Unless otherwise noted

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Units
Basic Operation							
I_{Q1}, I_{Q2}	Quiescent Current	V_{IN1} = 5.5 V, V_{IN2} < V_{in1}, I_{OUT} = 0 mA, EN = 0 V, SEL = V_{IN1}, V_{OUT} = V_{IN1} or V_{IN2} = 5.5 V, V_{IN1} < V_{IN2}, I_{OUT} = 0 mA, EN = SEL = V_{IN2}, V_{OUT} = V_{IN2}			4	6	µA
		As above, Ta = 85°C (1)			4.7		
I_{SD1}, I_{SD2}	Shutdown Current	$V_{IN1,2}$ = 5.5 V, V_{OUT} = GND, V_{EN} = V_{SEL} = 0 V			20	40	nA
		$V_{IN1,2}$ = 5.5 V, V_{OUT} = GND, V_{EN} = V_{SEL} = 0 V, Ta=85 °C (1)			680		
R_{ON}	On-Resistance	V_{IN1} or V_{IN2} = 5.5 V I_{OUT}= 500 mA	Ta = 25 °C		68		mΩ
			Ta = 85 °C (1)		80		
		V_{IN1} or V_{IN2} = 4.5 V, I_{OUT}= 500 mA	Ta = 25 °C		70		
			Ta = 85 °C (1)		83		
		V_{IN1} or V_{IN2} = 3.3 V, I_{OUT}= 500 mA	Ta = 25 °C		77		
			Ta = 85 °C (1)		90		
		V_{IN1} or V_{IN2} = 2.5 V, I_{OUT}= 300 mA	Ta = 25 °C		85		
		V_{IN1} or V_{IN2} = 1.5 V, I_{OUT}= 100 mA	Ta = 25 °C		114		
V_{IH}	EN, SEL Input Logic High Voltage			1.2			V
V_{IL}	EN, SEL Input Logic Low Voltage					0.4	V
I_{EN}, I_{SEL}	EN, SEL Current	V_{EN} or V_{SEL} > V_{IH}, Enabled			3	20	nA
R_{EN}, R_{SEL}	EN, SEL Pulldown Resistance	V_{EN} or V_{SEL} < V_{IL}, Disabled			500		kΩ
I_{RVS}	Reverse Current (1)	V_{IN1} = V_{IN2} =0 V, V_{OUT}=5.5 V, V_{EN} = V_{SEL} = 0 V			2.6		µA
R_{DSC}	Output Discharge Resistance,	V_{EN} = V_{SEL}=Low , I_{FORCE}= 10 mA, GLF4000 Only			70		Ω
Switching Characteristics (2)							
t_{dON}	Turn-On Delay	V_{IN1} = 5.0 V, V_{IN2} = 3.3 V R_L=150 Ω, C_{OUT}=1.0 µF			200		µs
t_R	V_{OUT} Rise Time				350		
TdHL	High-low Delay (1)				3		
TfHL	High-low Fall Time (1)				6		
Vdroop	Voltage Droop (1)				80		mV
TdLH	Low-high Delay (1)				7		µs
TrLH	Low-high Rise Time (1)				4		
td_{OFF}	Turn-Off Delay (1), GLF4000				5		
	Turn-Off Delay (1), GLF4001				15		
t_F	V_{OUT} Fall Time (1), GLF4000				110		
	V_{OUT} Fall Time (1), GLF4001				350		

Notes:
1. By design; characterized, not production tested.
2. t_{ON} = t_{dON} + t_R, t_{OFF} = t_{dOFF} + t_F

TIMING DIAGRAM and TRUTH TABLE

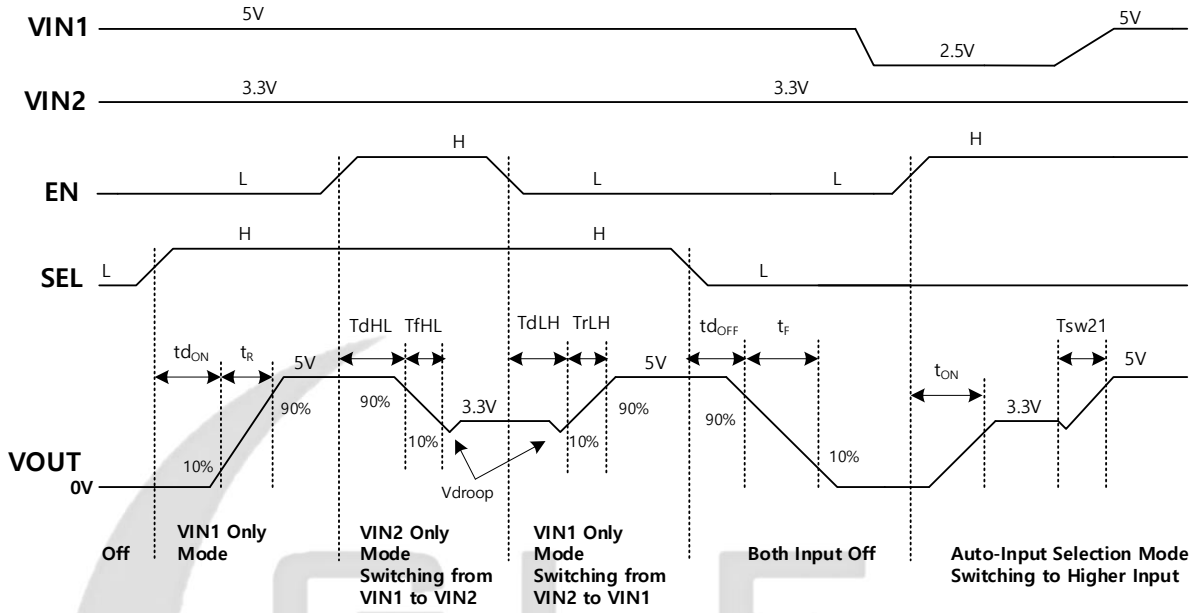


Figure 3. Timing Diagram

SEL	EN	Function	VOUT
0	0	Both switches are off	GLF4000: GND GLF4001: High-Z
0	1	Auto-Input selection. Vout is connected to a higher input source automatically	Higher Input between VIN1 and VIN2
1	0	Only VIN1 is selected	VIN1
1	1	Only VIN2 is selected	VIN2

Table 1. Truth Table of Input Source Selection

TYPICAL PERFORMANCE CHARACTERISTICS

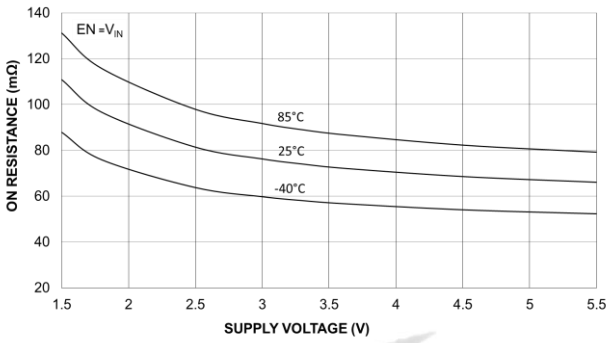


Figure 4. On-Resistance vs. Supply Voltage

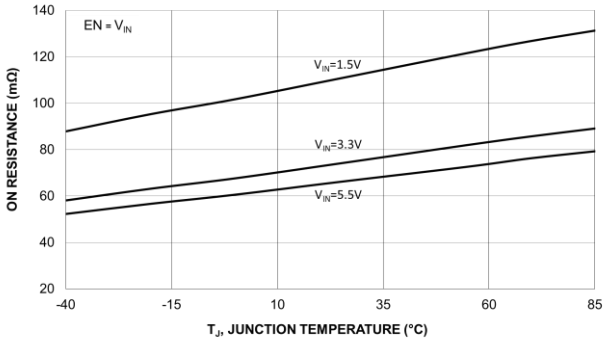


Figure 5. On-Resistance vs. Temperature

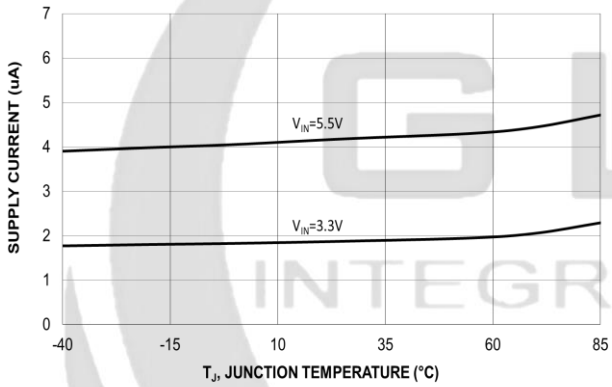


Figure 6. Quiescent Current vs. Temperature

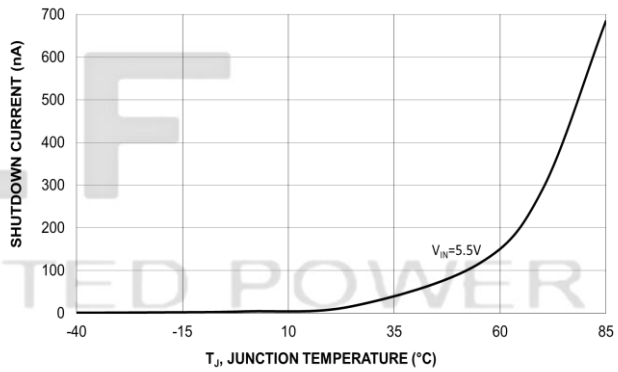


Figure 7. Shutdown Current vs. Temperature

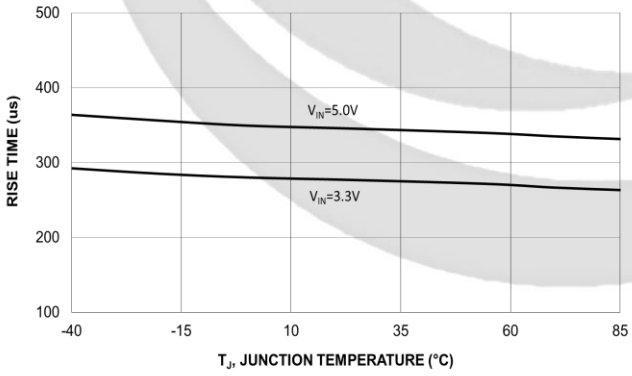


Figure 8. V_{OUT} Rise Time vs. Temperature

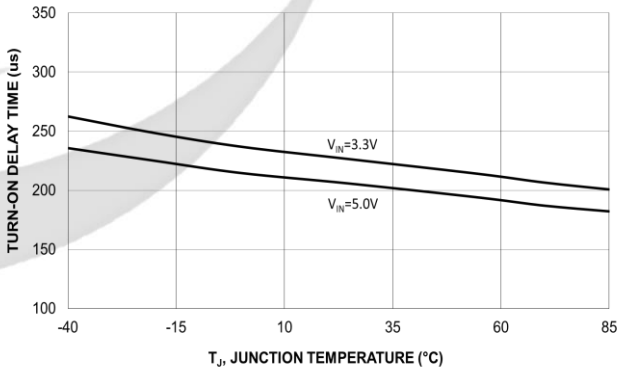


Figure 9. Turn-On Delay Time vs. Temperature

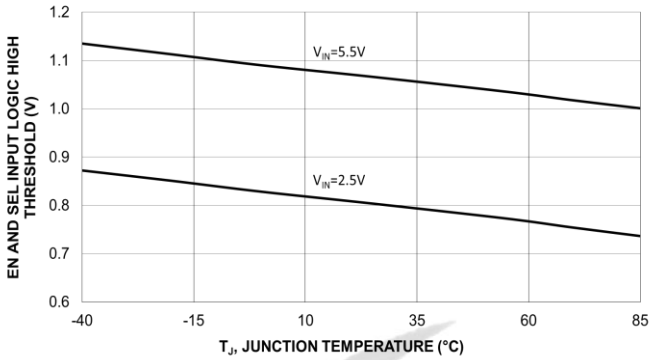


Figure 10. EN and SEL Input Logic High Threshold Vs. Temperature

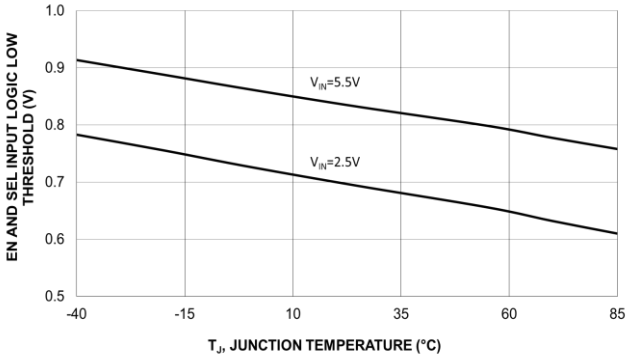


Figure 11. EN and SEL Input Logic Low Threshold Vs. Temperature

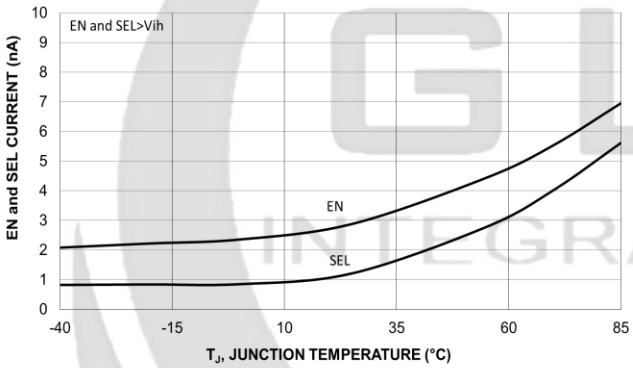


Figure 12. EN and SEL Current vs. Temperature

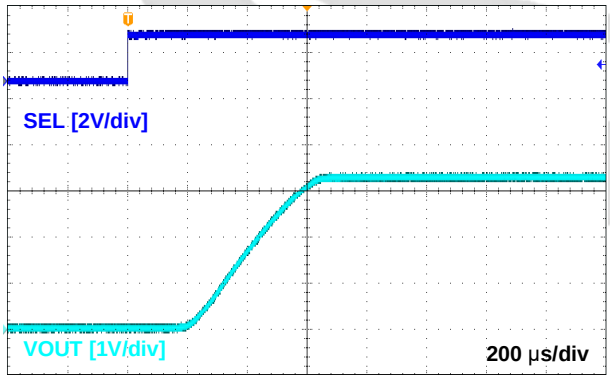


Figure 13. Turn-On Response, GLF4000
V_{IN1}=3.3 V, C_{IN}=0.1 µF, C_{OUT}=1.0 µF, R_L=150 Ω

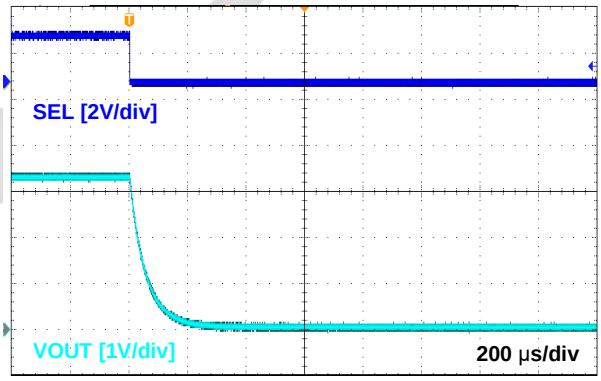


Figure 14. Turn-Off Response, GLF4000
V_{IN1}=3.3 V, C_{IN}=0.1 µF, C_{OUT}=1.0 µF, R_L=150 Ω

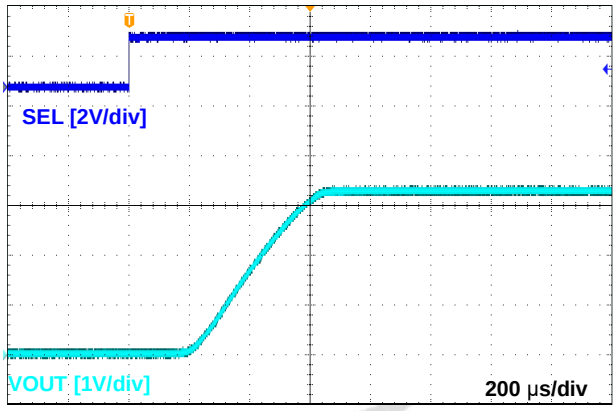


Figure 15 Turn-On Response, GLF4001
V_{IN1}=3.3 V, C_{IN}=0.1 µF, C_{OUT}=1.0 µF, R_L=150 Ω

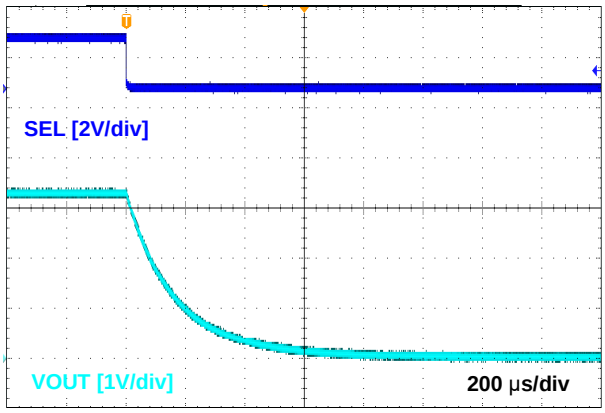


Figure 16 Turn-Off Response, GLF4001
V_{IN1}=3.3 V, C_{IN}=0.1 µF, C_{OUT}=1.0 µF, R_L=150 Ω

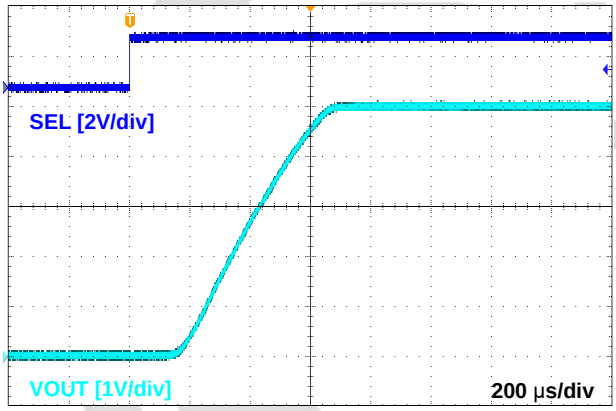


Figure 17. Turn-On Response, GFL4000
V_{IN1}=5.0 V, C_{IN}=0.1 µF, C_{OUT}=1.0 µF, R_L=150 Ω

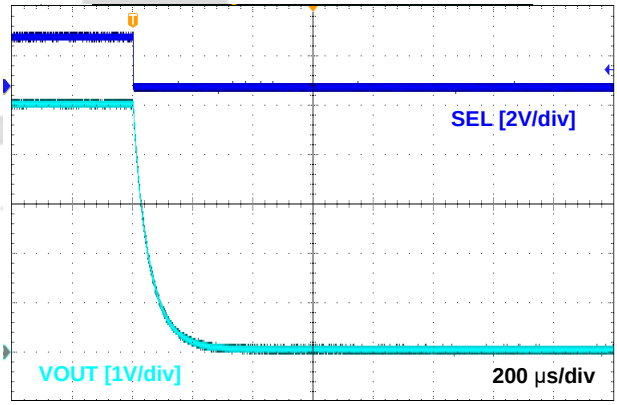


Figure 18. Turn-Off Response, GFL4000
V_{IN1}=5.0 V, C_{IN}=0.1 µF, C_{OUT}=1.0 µF, R_L=150 Ω

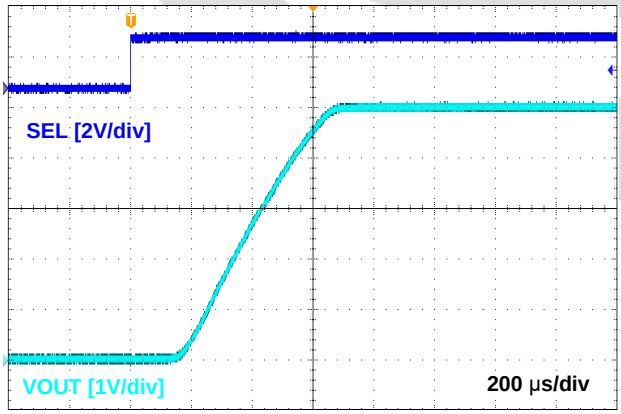


Figure 19. Turn-On Response, GLF4001
V_{IN1}=5.0 V, C_{IN}=0.1 µF, C_{OUT}=1.0 µF, R_L=150 Ω

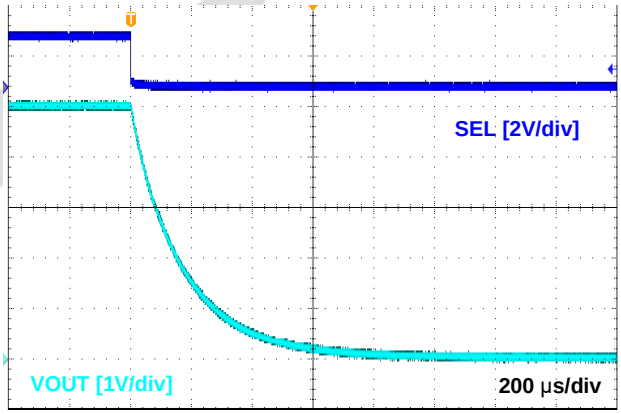


Figure 20. Turn-Off Response, GLF4001
V_{IN1}=5.0 V, C_{IN}=0.1 µF, C_{OUT}=1.0 µF, R_L=150 Ω

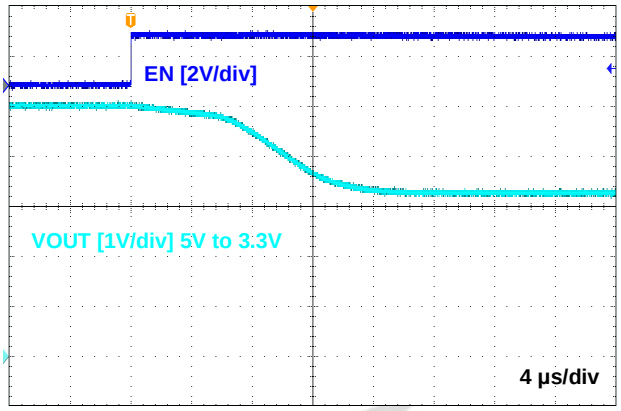


Figure 21. V_{OUT} Switchover from 5 V to 3.3 V
V_{IN1}=5.0 V, V_{IN2}=3.3 V C_{IN}=1.0 µF, C_{OUT}=1.0 µF, R_L=150 Ω

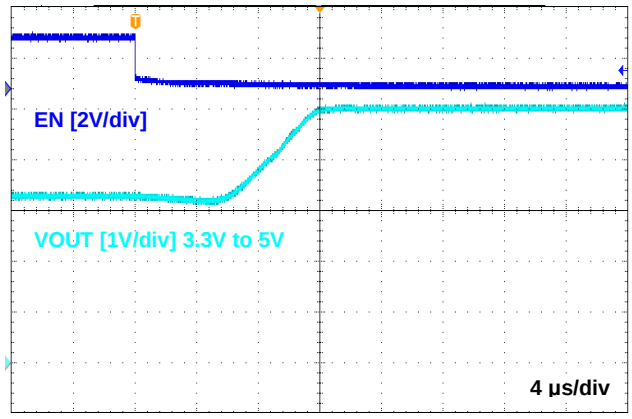


Figure 22. V_{OUT} Switchover from 3.3 V to 5 V
V_{IN1}=5.0 V, V_{IN2}=3.3 V C_{IN}=1.0 µF, C_{OUT}=1.0 µF, R_L=150 Ω

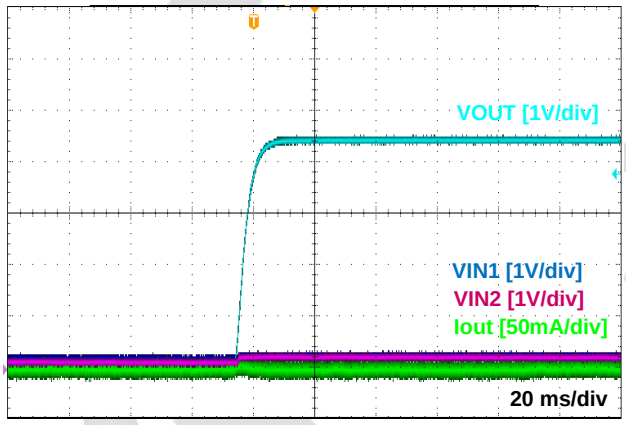


Figure 23. Reverse Current Blocking When Disabled
V_{IN1} = V_{IN2} =0 V, V_{OUT}=0 V to 4.5 V, C_{IN}=1.0 µF, C_{OUT}=1.0 µF, EN=SEL=0 V

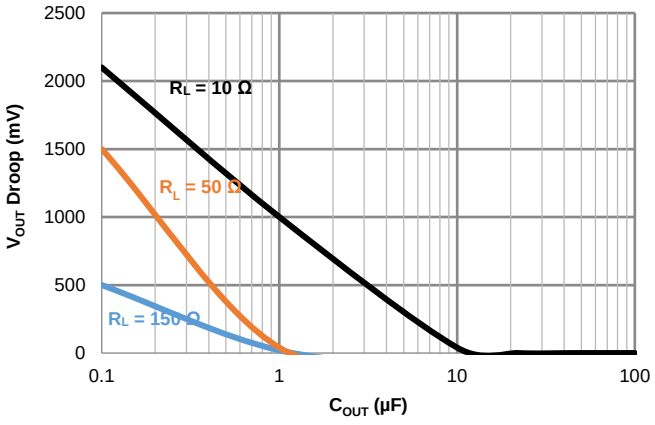


Figure 24. Output Voltage Droop at Switching Over from V_{IN1} (5 V) to V_{IN2} (3.3 V)

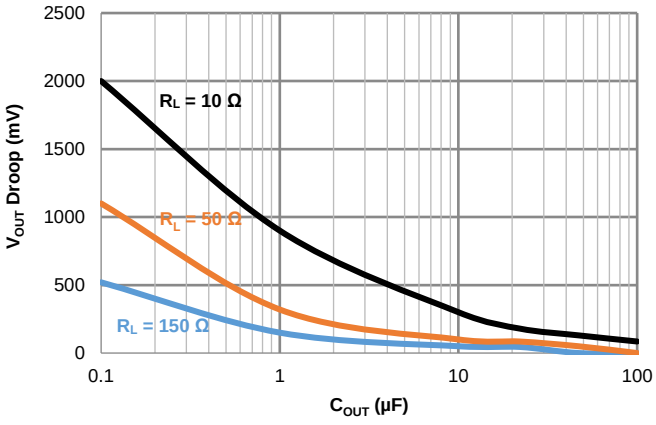


Figure 25. Output Voltage Droop at Switching Over from V_{IN2} (3.3 V) to V_{IN1} (5 V)

APPLICATION INFORMATION

The GLF4000 and GLF4001 are fully integrated 2 A Power Mux with a fixed slew rate control to limit the inrush current during device turn on. The device also has a wide voltage operating range from 1.5 V to 5.5 V. In the off state, the device consumes very low leakage current to avoid unwanted power drain from limited input power supplies.

Input Source Selection

By changing the state of the SEL and EN pins, the GLF4000 and GLF4001 offer the automatic, as well as the manual input selection mode. In each mode, the VOUT connects to one input source.

Input Capacitor and Output Capacitor

A capacitor is recommended to be placed close to the V_{IN} pin to reduce the voltage drop on the input power rail caused by transient inrush current at start-up. A higher input capacitor value can be used to further attenuate the input voltage drop. An output capacitor is recommended to minimize voltage undershoot on the output pin during the transition when the switch is turned off. Undershoot can be caused by parasitic inductance from board traces or intentional load inductances. If load inductances do exist, use of an output capacitor can improve output voltage stability and system reliability. The C_{OUT} capacitor should be placed close to the VOUT and GND pins.

Reverse Current Blocking

The GLF4000 and GLF4001 prevent the reverse current from the output voltage when both switches are turned off at V_{EN} = V_{SEL} = 0 V.

Output Discharge Function

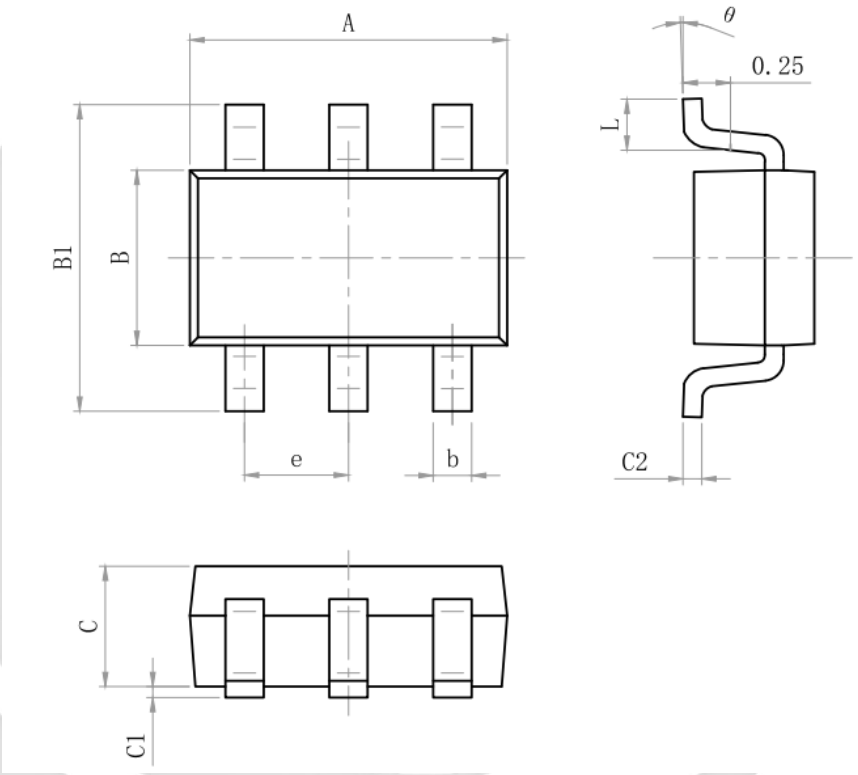
When both channels (VIN1 and VIN2) of the GLF4000 are disabled at the condition of EN = SEL =0 V or < V_{IL}, an internal NMOS turns on to discharge an output capacitor quickly.

Board Layout

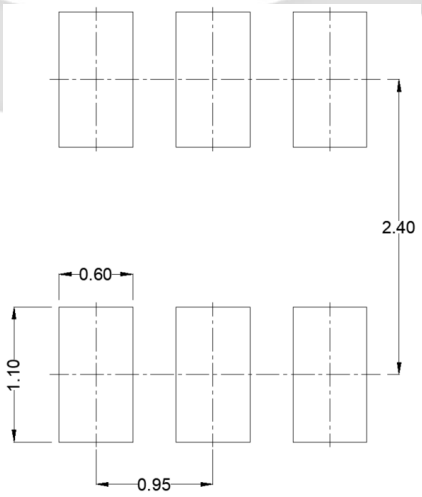
All traces should be as short as possible to minimize parasitic inductance effect. Wide traces for VIN, VOUT, and GND will help reduce signal degradation and parasitic effects during dynamic operations as well as improve the thermal performance at high load current.

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	θ	0°	8°

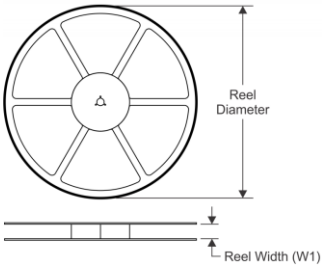


Recommended Footprint

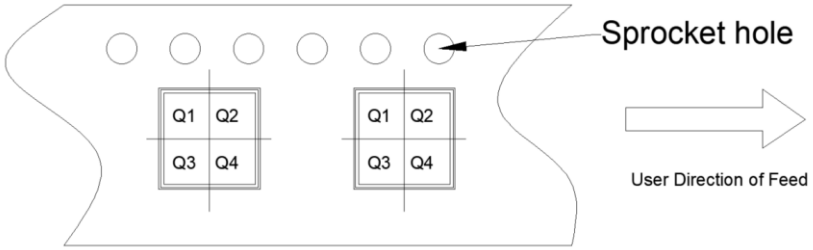


TAPE AND REEL INFORMATION

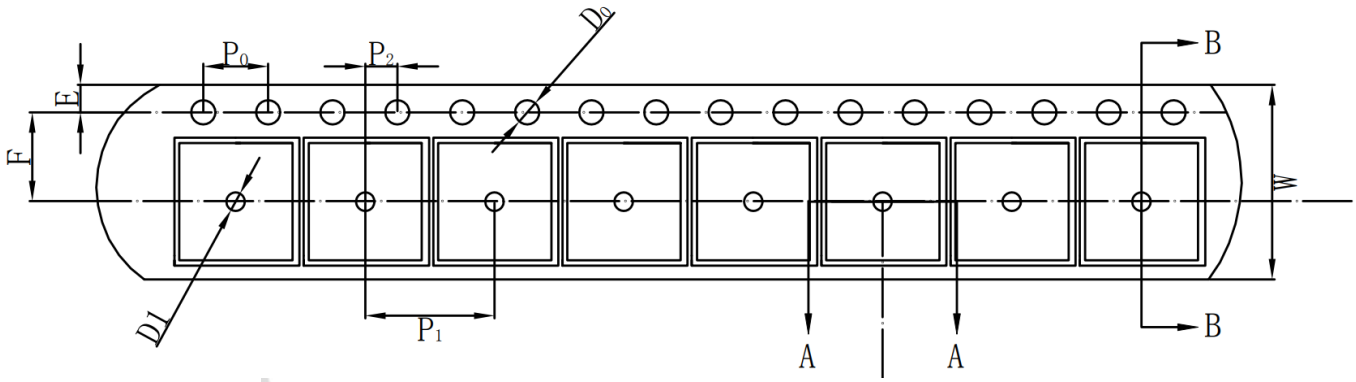
REEL DIMENSIONS

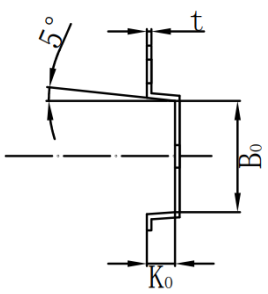


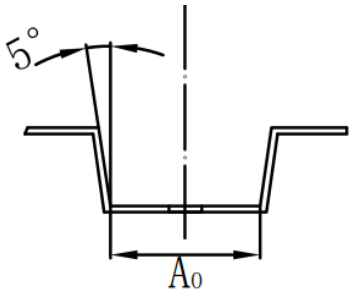
QUADRANT ASSIGNMENTS PIN 1 ORIENTATION TAPE



TAPE DIMENSIONS







Device	Package	Pins	SPQ	Reel Diameter(mm)	Reel Width W1	A0	B0	K0	P1	W	Pin1
GLF4000-T2G7	SOT23-6	6	3000	178	9	3.25	3.30	1.38	4	8	Q3
GLF4001-T2G7	SOT23-6	6	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

P: 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. Spec limits including typical, minimum, and maximum values are desired, or target, limits. GLF reserves the right to change limits at any time without warning or notification. A target specification in no way guarantees future production of the device in question.	Design / Development
Preliminary Specification	This is a draft version of a product specification. The specification is still 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 in no way guarantees future production of the device in question.	Qualification
Product Specification	This document represents the anticipated production performance characteristics of the device.	Production

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