

DESCRIPTION

The GLF7131x is an ultra-efficiency, 2 A rated, Load Switch with integrated slew rate control. The best in class efficiency makes it an ideal chose for use in IoT, mobile, and wearable electronics.

The GLF7131x features ultra-efficient I_QSmart™ technology that supports the lowest quiescent current (I_Q) and shutdown current (I_{SD}) in the industry. Low I_Q and I_{SD} solutions help designers to reduce parasitic leakage current, improve system efficiency, and increase battery lifetime.

The GLF7131x 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.

GLF7131x Load Switch devices support an industry leading wide input voltage range and helps to improve operating life and system robustness. Furthermore, one device can be used in multiple voltage rail applications which helps to simplify inventory management and reduce operating cost.

GLF7131x Load Switch device is small utilizing a chip scale package with 4 bumps in a 0.97 mm x 0.97 mm x 0.55 mm die size and a 0.5 mm bump pitch.

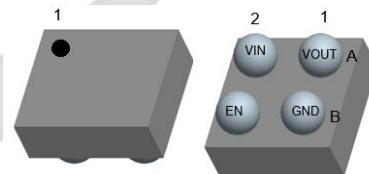
FEATURES

- Ultra-Low I_Q:
7 nA Typ @ 5.5 V_{IN} on GLF71310, GLF71311
520 nA Typ @ 5.5 V_{IN} on GLF71312, GLF71313
- Ultra-Low I_{SD}: 28 nA Typ @ 5.5 V_{IN}
- Low R_{ON} : 31 mΩ Typ @ 5.5 V_{IN}
- I_{OUT} Max: 2 A
- Wide Input Range: 1.1 V to 5.5 V
6 Vabs max
- Controlled Rise Time: 335 us at 3.3 V_{IN}
- Internal EN Pull-Down Resistor on GLF71310 and GLF71311
- Internal EN Pull-Up Resistor on GLF71312 and GLF71313
- Integrated Output Discharge Switch: GLF71311 and GLF71313
- Ultra-Small: 0.97 mm x 0.97 mm

APPLICATIONS

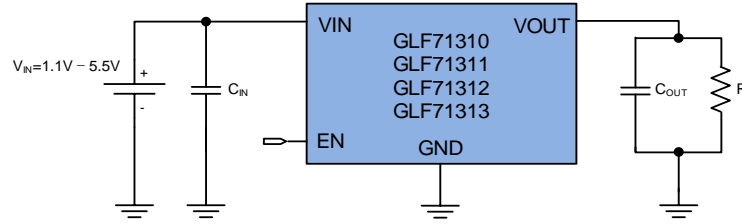
- Wearables
- Data Storage, SSD
- Mobile Devices
- Low Power Subsystems

PACKAGE



0.97 mm x 0.97 mm x 0.55 mm WLCSP

APPLICATION DIAGRAM



ALTERNATE DEVICE OPTIONS

Part Number	Top Mark	R _{ON} (Typ) at 5.5 V	Output Discharge	EN Activity	Availability
GLF71310	BA	31 mΩ	No	High	Released
GLF71311	BC	31 mΩ	85 Ω	High	Released
GLF71312	BD	31 mΩ	No	Low	On Request
GLF71313	BE	31 mΩ	85 Ω	Low	Released

Note: Contact GLF representatives for more information on alternate devices' delivery and availability.

FUNCTIONAL BLOCK DIAGRAM

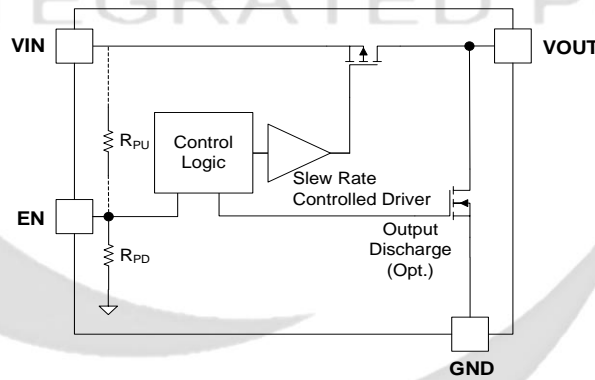
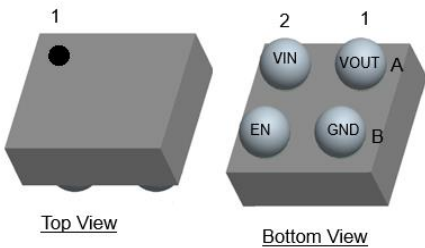


Figure 1. Functional Block Diagram

PIN CONFIGURATION



PIN DEFINITION

Pin #	Name	Description
A1	V _{OUT}	Switch Output
A2	V _{IN}	Switch Input. Supply Voltage for IC
B1	GND	Ground
B2	EN	Enable to control the switch

Figure 2. 0.97 mm x 0.97 mm x 0.55 mm WLCSP

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	6	V
I _{OUT}	Maximum Continuous Switch Current		2	A
P _D	Power Dissipation at T _A = 25°C		1.2	W
T _{STG}	Storage Junction Temperature	-65	150	°C
T _A	Operating Temperature Range	-40	85	°C
θ _{JA}	Thermal Resistance, Junction to Ambient		85	°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	1.1	5.5	V
T _A	Ambient Operating Temperature	-40	+85	°C

INTEGRATED POWER

ELECTRICAL CHARACTERISTICS

 Values are at V_{IN} = 3.3 V and T_A = 25 °C unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Basic Operation						
V _{IN}	Supply Voltage		1.1		5.5	V
I _Q	Quiescent Current ⁽¹⁾ GLF71310, GLF71311	V _{IN} = V _{EN} = 5.5 V, I _{OUT} = 0 mA		7	70	nA
		V _{IN} = V _{EN} = 5.5 V, I _{OUT} = 0 mA, T _a = 85 °C ⁽⁵⁾		12		
	Quiescent Current GLF71312, GLF71313	V _{IN} = 5.5 V, V _{EN} = 0 V, I _{OUT} = 0 mA		520		
		V _{IN} = 5.5 V, V _{EN} = 0 V, I _{OUT} = 0 mA, T _a = 85 °C ⁽⁵⁾		640		
I _{SD}	Shut Down Current	EN = Disable, I _{OUT} = 0 mA, V _{IN} = 1.1 V		5		nA
		EN = Disable, I _{OUT} = 0 mA, V _{IN} = 1.8 V		6		
		EN = Disable, I _{OUT} = 0 mA, V _{IN} = 3.3 V		9	35	
		EN = Disable, I _{OUT} = 0 mA, V _{IN} = 4.5 V		13		
		EN = Disable, I _{OUT} = 0 mA, V _{IN} = 5.5 V		28	100	
		EN = Disable, I _{OUT} = 0 mA, V _{IN} = 5.5 V, T _a = 55 °C ⁽⁵⁾		200		
		EN = Disable, I _{OUT} = 0 mA, V _{IN} = 5.5 V, T _a = 85 °C ⁽⁵⁾		1		uA
R _{ON}	On-Resistance	V _{IN} = 5.5 V, I _{OUT} = 500 mA	T _a = 25 °C	31	34	mΩ
			T _a = 85 °C ⁽⁵⁾	36		
		V _{IN} = 3.3 V, I _{OUT} = 500 mA	T _a = 25 °C	36	41	
			T _a = 85 °C ⁽⁵⁾	43		
		V _{IN} = 1.8 V, I _{OUT} = 300 mA	T _a = 25 °C	52		
V _{IN} = 1.1 V, I _{OUT} = 100 mA	T _a = 25 °C	95				
R _{DSC}	Output Discharge Resistance	E _N = Low, I _{FORCE} = 10 mA	70	85	100	Ω
V _{IH}	EN Input Logic High Voltage	V _{IN} = 1.1 V - 1.8 V	0.9			V
		V _{IN} = 1.8 V - 5.5 V	1.2			V
V _{IL}	EN Input Logic Low Voltage	V _{IN} = 1.1 V - 1.8 V			0.3	V
		V _{IN} = 1.8 V - 5.5 V			0.4	V
R _{EN}	EN internal resistance	Internal Pull-down Resistance : GLF71310, GLF71311 Internal Pull-up Resistance : GLF71312, GLF71313		9.5		MΩ
I _{EN}	EN Current	E _N = 5.5 V			1.0	μA

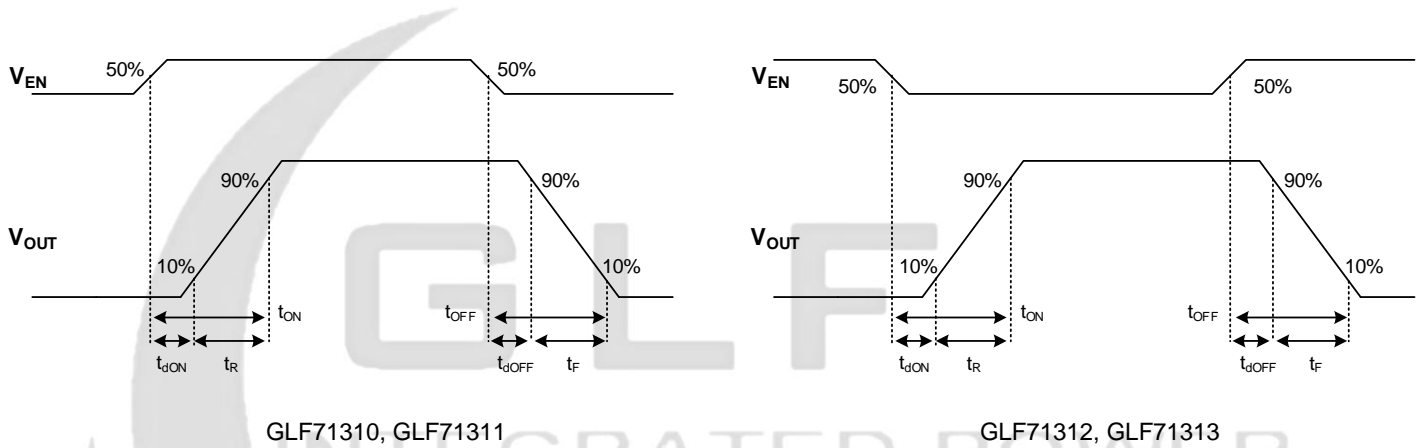
Switching Characteristics

t _{dON}	Turn-On Delay ⁽²⁾	R _L = 150 Ω, C _{OUT} = 0.1 μF		210		μs
t _R	V _{OUT} Rise Time ⁽²⁾			335		
t _{dON}	Turn-On Delay ^(2,5)	R _L = 500 Ω, C _{OUT} = 0.1 μF		220		
t _R	V _{OUT} Rise Time ^(2,5)			330		
t _{dOFF}	Turn-Off Delay ^(3,4,5)	R _L = 10 Ω, C _{OUT} = 0.1 μF, GLF71311, GLF71313		0.38		
t _F	V _{OUT} Fall Time ^(3,4,5)			1.30		
t _{dOFF}	Turn-Off Delay ^(3,5)			0.35		
t _F	V _{OUT} Fall Time ^(3,5)		GLF71310, GLF71312 : No Output Discharge, R _{bsc}		2.45	
t _{dOFF}	Turn-Off Delay ^(3,4,5)	R _L = 500 Ω, C _{OUT} = 0.1 μF, GLF71311, GLF71313		0.9		
t _F	V _{OUT} Fall Time ^(3,4,5)			16		

t_{dOFF}	Turn-Off Delay ^(3, 5)	$R_L=500 \Omega, C_{OUT}=0.1 \mu F$ GLF71310, GLF71312 : No Output Discharge, R_{Dsc}	4.0		μs
t_F	V_{OUT} Fall Time ^(3, 5)		105		

- Notes:
- I_Q does NOT include Enable pull down current through the pull-down resistor R_{Dsc} .
 - $t_{ON} = t_{dON} + t_R$
 - $t_{OFF} = t_{dOFF} + t_F$
 - Output discharge path is enabled during off.
 - By design; characterized, not production tested.

TIMING DIAGRAM



GLF71310, GLF71311

GLF71312, GLF71313

Figure 3. Timing Diagram

TYPICAL PERFORMANCE CHARACTERISTICS

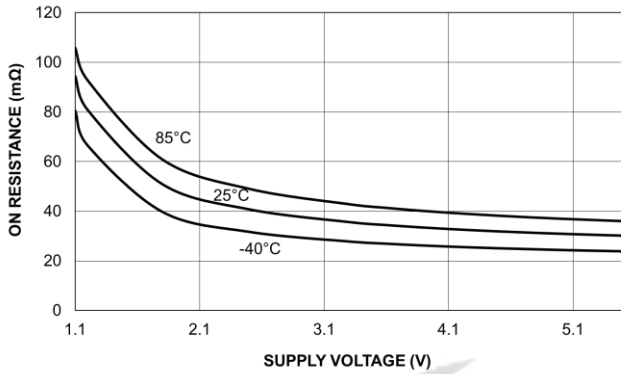


Figure 4. On-Resistance vs. Input Voltage

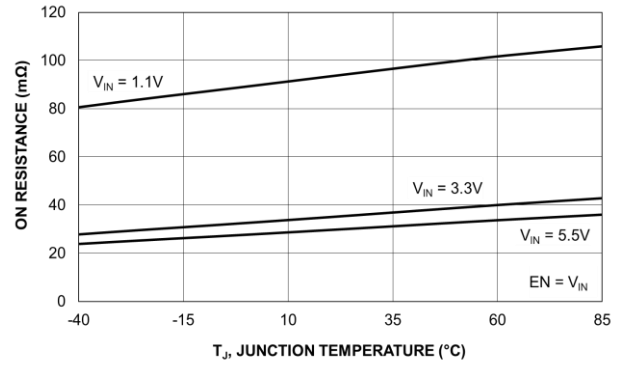
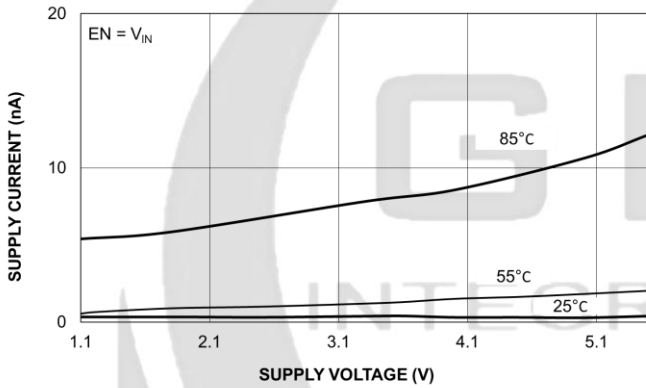
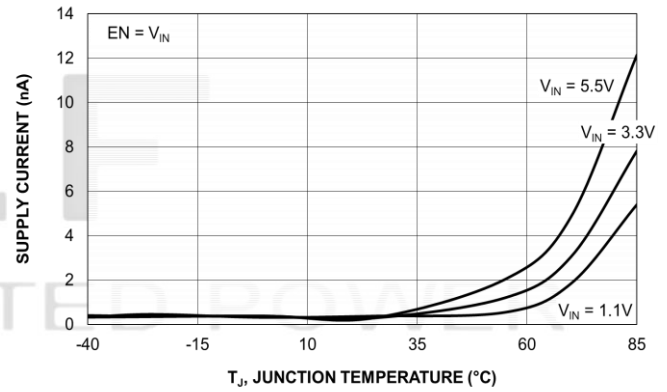


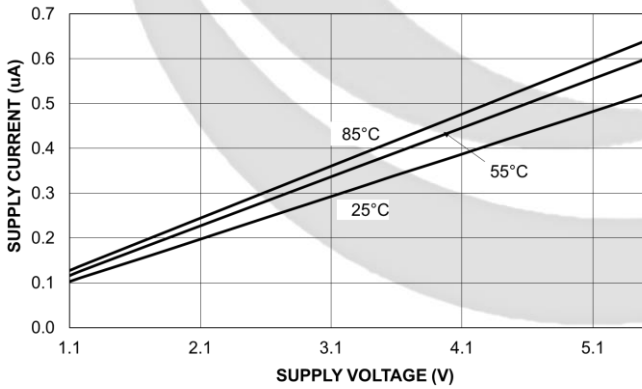
Figure 5. On-Resistance vs. Temperature



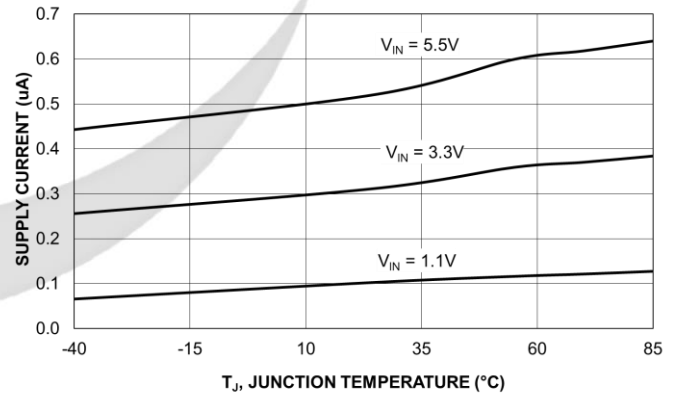
**Figure 6. Quiescent Current vs. Input Voltage
GLF71310, GLF71311**



**Figure 7. Quiescent Current vs. Temperature
GLF71310, GLF71311**



**Figure 8. Quiescent Current vs. Input Voltage
GLF71312, GLF71313**



**Figure 9. Quiescent Current vs. Temperature
GLF71312, GLF71313**

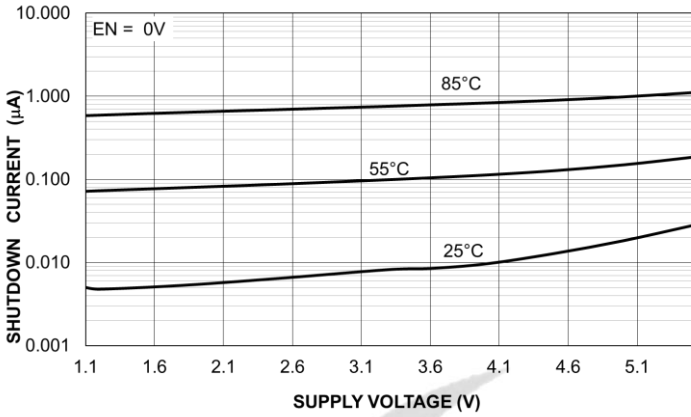


Figure 10. Shut Down Current vs. Input Voltage

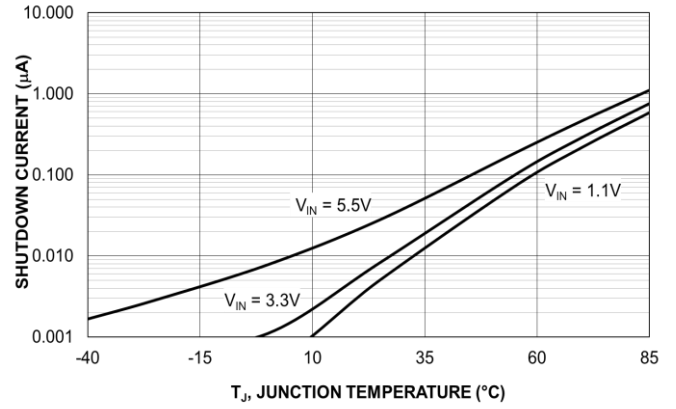


Figure 11. Shut Down Current vs. Temperature

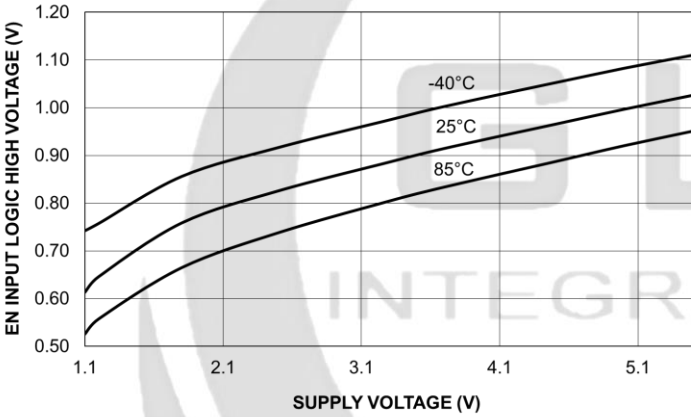


Figure 12. EN Input Logic High Threshold

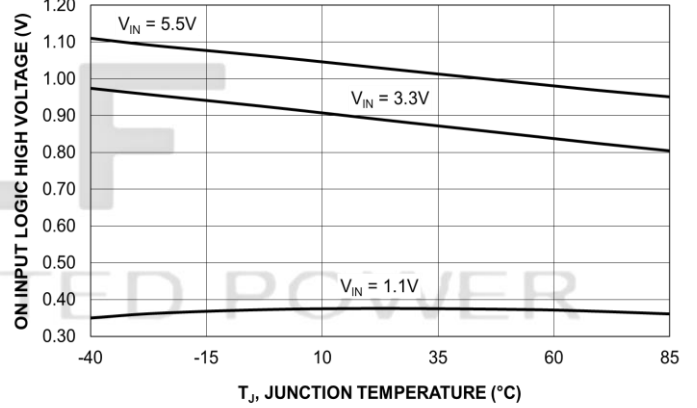


Figure 13. EN Input Logic High Threshold Vs. Temperature

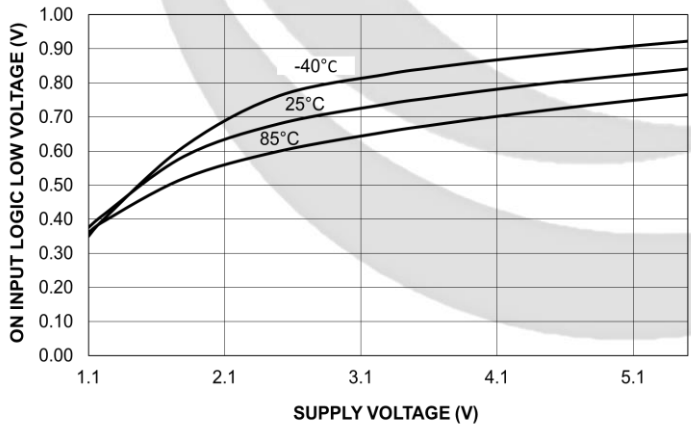


Figure 14. EN Input Logic Low Threshold

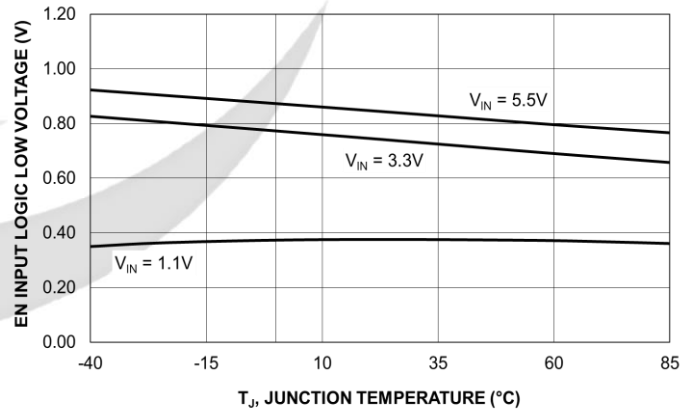


Figure 15. EN Input Logic Low Threshold Vs. Temperature

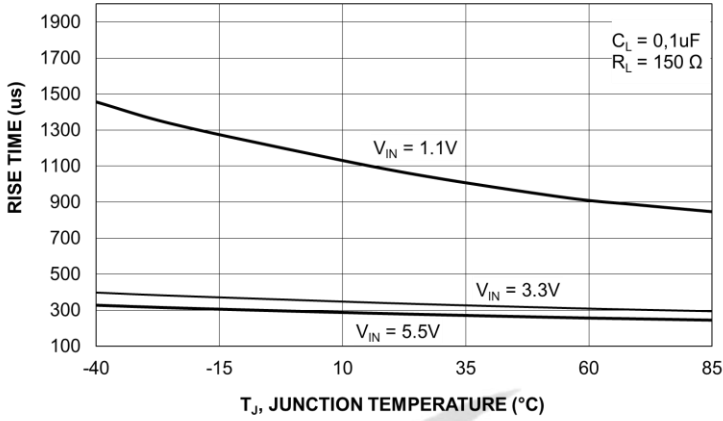


Figure 16. VOUT Rise Time vs. Temperature

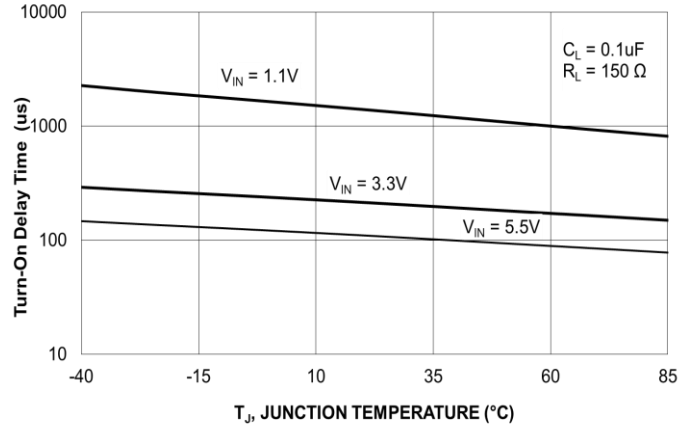


Figure 17. Turn-On Delay Time vs. Temperature

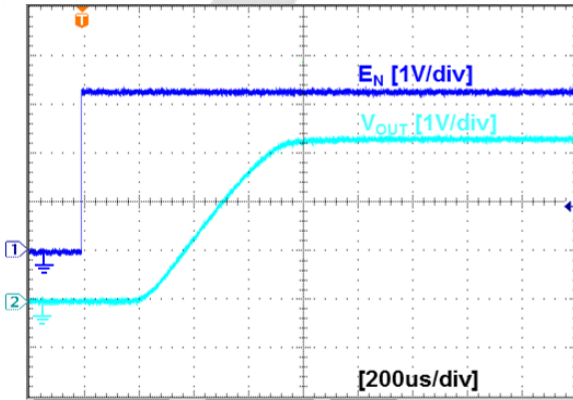


Figure 18. Turn-On Response, GLF71311
 $V_{IN}=3.3\text{ V}$, $C_{IN}=1.0\text{ uF}$, $C_{OUT}=0.1\text{ uF}$, $R_L=10\text{ }\Omega$

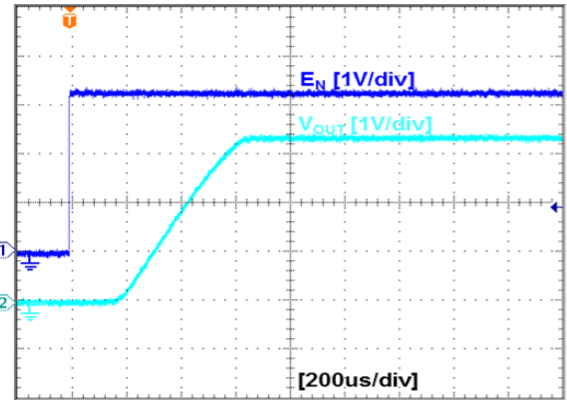


Figure 19. Turn-On Response, GLF71311
 $V_{IN}=3.3\text{ V}$, $C_{IN}=1.0\text{ uF}$, $C_{OUT}=0.1\text{ uF}$, $R_L=500\text{ }\Omega$

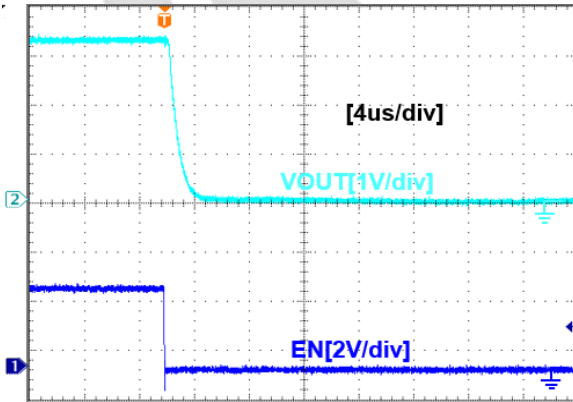


Figure 20. Turn-Off Response, Output Discharge, GLF71311
 $V_{IN}=3.3\text{ V}$, $C_{IN}=1.0\text{ uF}$, $C_{OUT}=0.1\text{ uF}$, $R_L=10\text{ }\Omega$

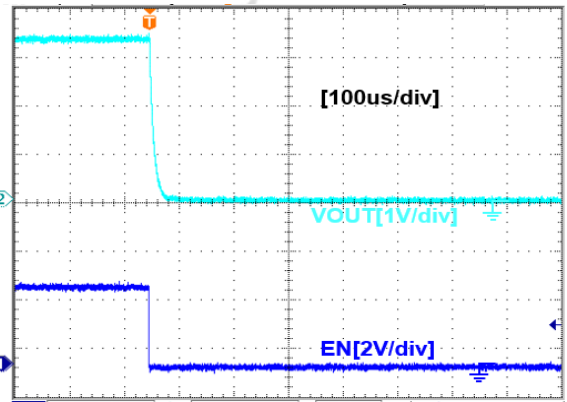


Figure 21. Turn-Off Response, Output Discharge, GLF71311
 $V_{IN}=3.3\text{ V}$, $C_{IN}=1.0\text{ uF}$, $C_{OUT}=0.1\text{ uF}$, $R_L=500\text{ }\Omega$

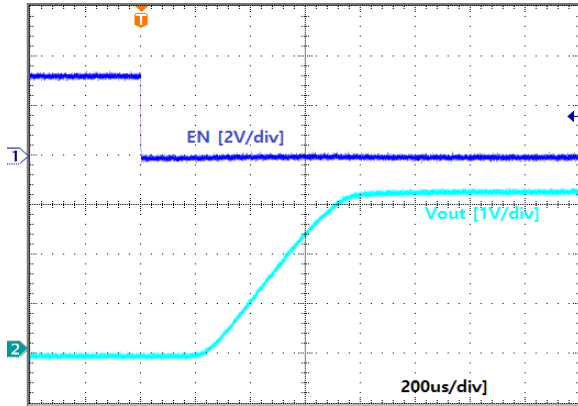


Figure 22. Turn-On Response, GLF71313
 $V_{IN}=3.3\text{ V}$, $C_{IN}=1.0\text{ }\mu\text{F}$, $C_{OUT}=0.1\text{ }\mu\text{F}$, $R_L=10\text{ }\Omega$

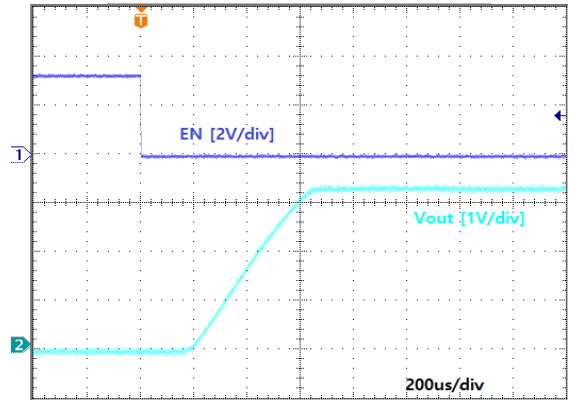


Figure 23. Turn-On Response, GLF71313
 $V_{IN}=3.3\text{ V}$, $C_{IN}=1.0\text{ }\mu\text{F}$, $C_{OUT}=0.1\text{ }\mu\text{F}$, $R_L=500\text{ }\Omega$

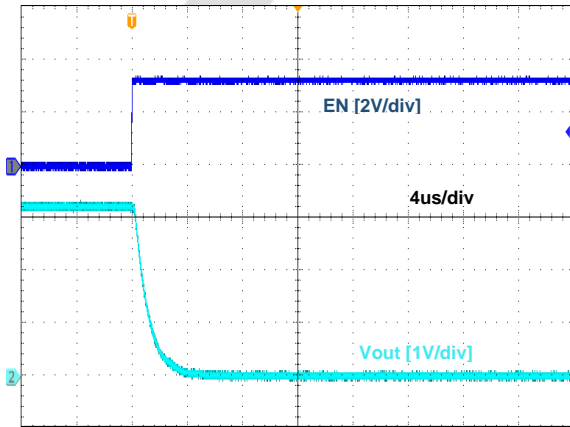


Figure 24. Turn-Off Response, Output Discharge, GLF71313
 $V_{IN}=3.3\text{ V}$, $C_{IN}=1.0\text{ }\mu\text{F}$, $C_{OUT}=0.1\text{ }\mu\text{F}$, $R_L=10\text{ }\Omega$

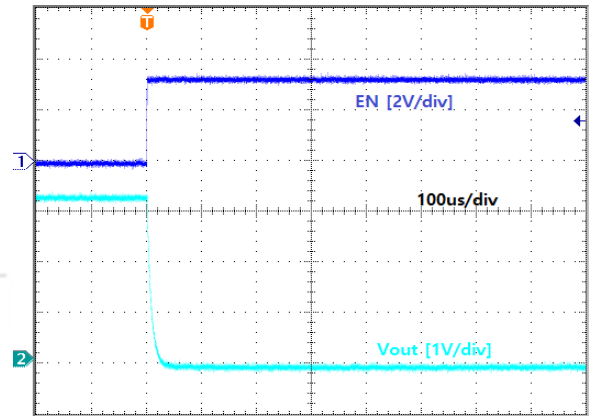


Figure 25. Turn-Off Response, Output Discharge, GLF71313
 $V_{IN}=3.3\text{ V}$, $C_{IN}=1.0\text{ }\mu\text{F}$, $C_{OUT}=0.1\text{ }\mu\text{F}$, $R_L=500\text{ }\Omega$

APPLICATION INFORMATION

The GLF7131x family of devices are integrated 2 A, Ultra-Efficient I_QSmart™ Load Switch devices with a fixed slew rate control to limit the inrush current during turn on. Each device is capable of operating over a wide input range from 1.1 V to 5.5 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. The package is a 0.97 mm x 0.97 mm x 0.5 mm wafer level chip scale package, saving space in compact applications. It is constructed using 4 bumps, with a 0.5 mm pitch for manufacturability.

Input Capacitor

The GLF7131x family of devices do not require an input capacitor. However, to reduce the voltage drop on the input power rail caused by transient inrush current at start-up, a 0.1µF capacitor is recommended to be placed close to the V_{IN} pin. A higher input capacitor value can be used to further attenuate the input voltage drop.

Output Capacitor

The GLF7131x family of devices do not require an output capacitor. However, use of an output capacitor is recommended to mitigate voltage undershoot on the output pin when the switch is turning 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 spaced close to the V_{OUT} and GND pins.

EN pin

The GLF71310 and GLF71311 can be activated by forcing EN pin high level and the GLF71312 and GLF71313 by EN pin low level. Note that the EN pin has an internal pull-down or pull-up resistor to help pull the main switch to a known “off state” when no EN signal is applied from an external controller.

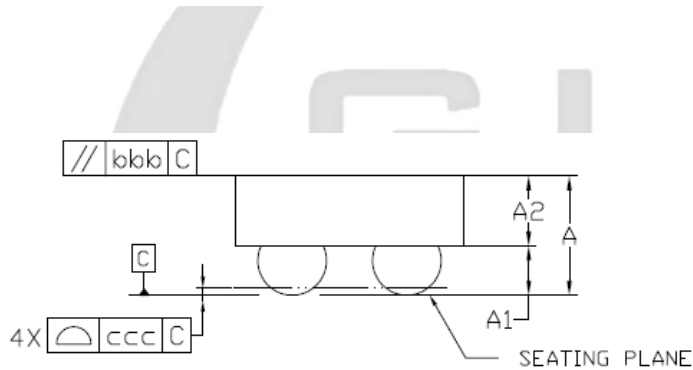
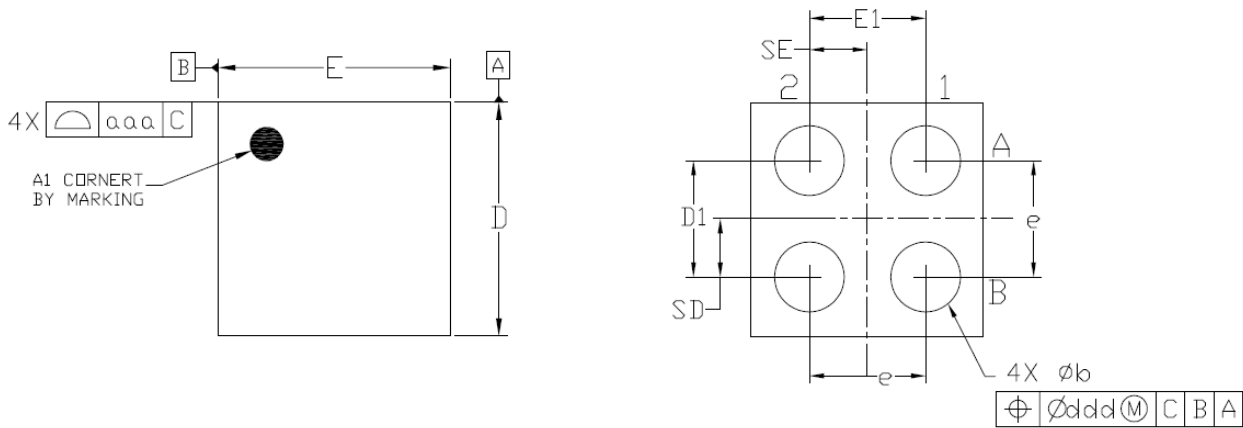
Output Discharge Function

The GLF71311 and GLF71313 have an internal discharge N-channel FET switch on the V_{OUT} pin. When EN signal turns the main power FET to an off state, the N-channel switch turns on to discharge an output capacitor quickly.

Board Layout

All traces should be as short as possible to minimize parasitic inductance effects. Wide traces for V_{IN}, V_{OUT}, and GND will help reduce signal degradation and parasitic effects during dynamic operation as well as improve the thermal performance at high load current.

PACKAGE OUTLINE



Dimensional Ref.			
REF.	Min.	Nom.	Max.
A	0.500	0.550	0.600
A1	0.225	0.250	0.275
A2	0.275	0.300	0.325
D	0.955	0.970	0.985
E	0.955	0.970	0.985
D1	0.450	0.500	0.550
E1	0.450	0.500	0.550
b	0.260	0.310	0.360
e	0.500 BSC		
SD	0.250 BSC		
SE	0.250 BSC		
Tol. of Form&Position			
aaa	0.10		
bbb	0.10		
ccc	0.05		
ddd	0.05		

Notes

1. ALL DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
2. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1994.

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 preliminary 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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