

#### DESCRIPTION

The GLF71301T is an ultra-efficiency, 2.0 A rated, Load Switch with integrated slew rate control. The best in class efficiency makes it an ideal choice for use in IoT, mobile, and wearable electronics.

The GLF71301T features an ultra-efficient I<sub>Q</sub>Smart™ technology that supports the lowest quiescent current (I<sub>Q</sub>) and shutdown current (I<sub>SD</sub>) in the industry. Low I<sub>Q</sub> and I<sub>SD</sub> solutions help designers to reduce parasitic leakage current, improve system efficiency, and increase battery lifetime.

The GLF71301T 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 current during turn-on to minimize voltage droop.

GLF71301T Load Switch device supports 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 reduces operating cost.

GLF71301T Load Switch device is small utilizing a wafer level chip scale package with 4 bumps in a 0.77 mm x 0.77 mm die size and a 0.4 mm bump pitch.

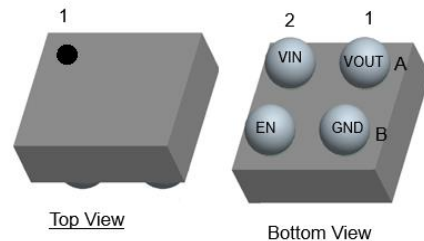
#### FEATURES

- Ultra-Low I<sub>Q</sub>: 1 nA Typ @ 5.5 V<sub>IN</sub>
- Ultra-Low I<sub>SD</sub>: 19 nA Typ @ 5.5 V<sub>IN</sub>
- Low R<sub>ON</sub> = 34 mΩ Typ. @ 5.5 V<sub>IN</sub>
- I<sub>OUT</sub> Max = 2.0 A
- Supply Voltage Range: 1.1 V to 5.5 V  
6 V abs max
- Controlled Rise Time: 430 us at 3.3 V<sub>IN</sub>
- Internal EN Pull-Down Resistor
- Integrated Output Discharge Switch
- Ultra-Small: 0.77 mm x 0.77 mm

#### APPLICATIONS

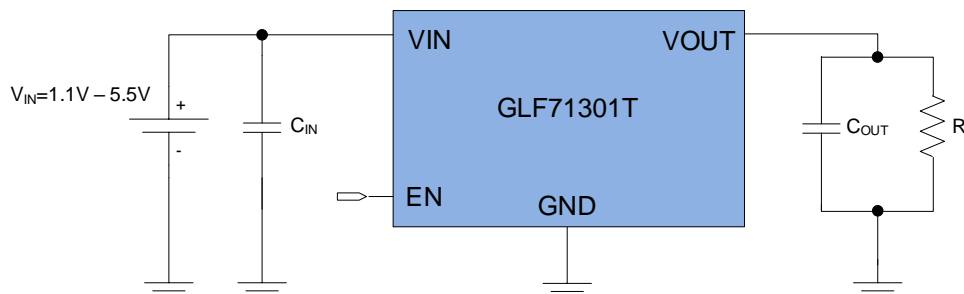
- Wearables
- Data Storage, SSD
- Mobile Devices
- Low Power Subsystems

#### PACKAGE



0.77 mm x 0.77 mm x 0.35 mm  
0.4 mm pitch WLCSP

#### APPLICATION DIAGRAM



**ALTERNATE DEVICE OPTIONS**

Part Number	Top Mark	R <sub>ON</sub> (Typ) at 5.5 V	Output Discharge	EN Activity	Availability
GLF71301T	B	34 mΩ	85 Ω	High	Released

**FUNCTIONAL BLOCK DIAGRAM**

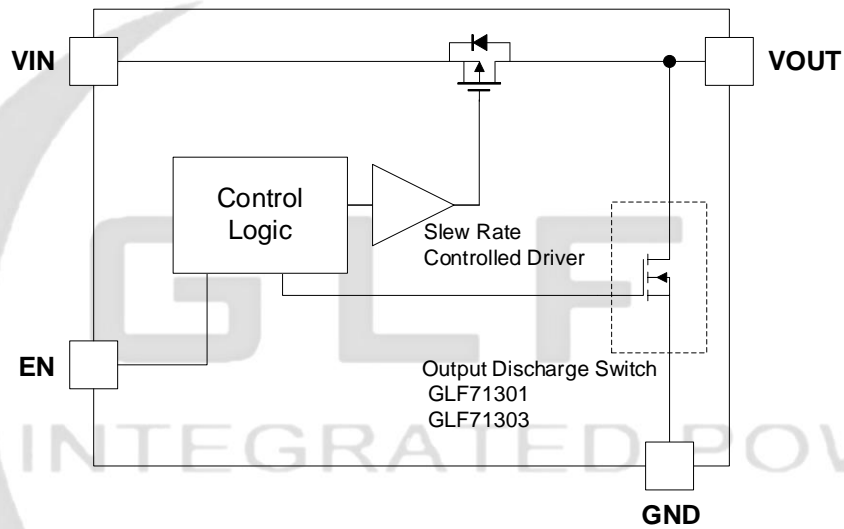
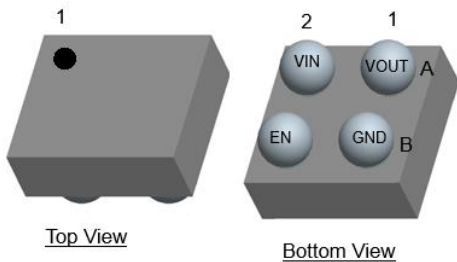


Figure 1. Functional Block Diagram

**PIN CONFIGURATION**



**PIN DEFINITION**

Pin #	Name	Description
A1	V <sub>OUT</sub>	Switch Output
A2	V <sub>IN</sub>	Switch Input. Supply Voltage for IC
B1	GND	Ground
B2	EN	Enable to control the switch

Figure 2. 0.77 mm x 0.77 mm x 0.35 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 <sub>IN</sub> , V <sub>OUT</sub> , V <sub>EN</sub>	Each Pin Voltage Range to GND	-0.3	6	V
I <sub>OUT</sub>	Maximum Continuous Switch Current		2	A
P <sub>D</sub>	Power Dissipation at T <sub>A</sub> = 25 °C		1	W
T <sub>STG</sub>	Storage Junction Temperature	-65	150	°C
T <sub>A</sub>	Operating Temperature Range	-40	85	°C
θ <sub>JA</sub>	Thermal Resistance, Junction to Ambient (board dependent)		110	°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 <sub>IN</sub>	Supply Voltage	1.1	5.5	V
T <sub>A</sub>	Ambient Operating Temperature	-40	+85	°C

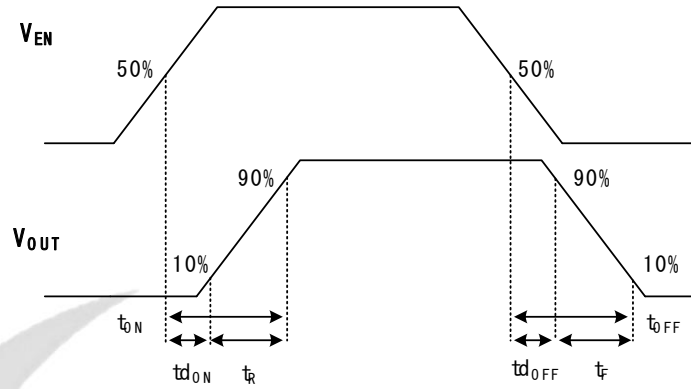
### ELECTRICAL CHARACTERISTICS

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit	
<b>Basic Operation</b>							
$V_{IN}$	Supply Voltage		1.1		5.5	V	
$I_Q$	Quiescent Current	EN = Enable, $I_{OUT}=0\text{ mA}$ , $V_{IN} = V_{EN}=5.5\text{ V}$		1		nA	
		EN = Enable, $I_{OUT}=0\text{ mA}$ , $V_{IN}=V_{EN}=5.5\text{ V}$ , $T_a=85\text{ °C}$ <sup>(4)</sup>		7			
$I_{SD}$	Shutdown Current	EN = Disable, $I_{OUT}=0\text{ mA}$ , $V_{IN}=1.1\text{ V}$		3		nA	
		EN = Disable, $I_{OUT}=0\text{ mA}$ , $V_{IN}=1.8\text{ V}$		4			
		EN = Disable, $I_{OUT}=0\text{ mA}$ , $V_{IN}=3.3\text{ V}$		6			
		EN = Disable, $I_{OUT}=0\text{ mA}$ , $V_{IN}=4.5\text{ V}$		9			
		EN = Disable, $I_{OUT}=0\text{ mA}$ , $V_{IN}=5.5\text{ V}$		19	50		
		EN = Disable, $I_{OUT}=0\text{ mA}$ , $V_{IN}=5.5\text{ V}$ , $T_a=55\text{ °C}$ <sup>(4)</sup>		110			
		EN = Disable, $I_{OUT}=0\text{ mA}$ , $V_{IN}=5.5\text{ V}$ , $T_a=85\text{ °C}$ <sup>(4)</sup>		600			
$R_{ON}$	On-Resistance	$V_{IN}=5.5\text{ V}$ , $I_{OUT}= 500\text{ mA}$	$T_a=25\text{ °C}$		34	47	mΩ
			$T_a=85\text{ °C}$ <sup>(4)</sup>		40		
		$V_{IN}=3.3\text{ V}$ , $I_{OUT}= 500\text{ mA}$	$T_a=25\text{ °C}$		42	56	
			$T_a=85\text{ °C}$ <sup>(4)</sup>		50		
		$V_{IN}=1.8\text{ V}$ , $I_{OUT}= 300\text{ mA}$	$T_a=25\text{ °C}$		68		
		$V_{IN}=1.1\text{ V}$ , $I_{OUT}= 100\text{ mA}$	$T_a=25\text{ °C}$		155		
$R_{DSC}$	Output Discharge Resistance	EN=LOW , $I_{FORCE}= 10\text{ mA}$	70	85	100	Ω	
$V_{IH}$	EN Input Logic High Voltage	$V_{IN}=1.1\text{ V} - 1.8\text{ V}$	0.9			V	
		$V_{IN}=1.8\text{ V} - 5.5\text{ V}$	1.2			V	
$V_{IL}$	EN Input Logic Low Voltage	$V_{IN}=1.1\text{ V} - 1.8\text{ V}$			0.3	V	
		$V_{IN}=1.8\text{ V} - 5.5\text{ V}$			0.4	V	
$R_{EN}$	EN pull down resistance	Internal Resistance	7	10.1	13	MΩ	
$I_{EN}$	EN Current	EN=5.5 V			0.8	μA	
<b>Switching Characteristics</b>							
$t_{dON}$	Turn-On Delay <sup>(1)</sup>	$R_L=150\text{ Ω}$ , $C_{OUT}=0.1\text{ μF}$		275		μs	
$t_R$	$V_{OUT}$ Rise Time <sup>(1)</sup>			430			
$t_{dON}$	Turn-On Delay <sup>(1,4)</sup>	$R_L=500\text{ Ω}$ , $C_{OUT}=0.1\text{ μF}$		245			
$t_R$	$V_{OUT}$ Rise Time <sup>(1,4)</sup>			410			
$t_{dOFF}$	Turn-Off Delay <sup>(2,3,4)</sup>	$R_L=10\text{ Ω}$ , $C_{OUT}=0.1\text{ μF}$		0.38			
$t_F$	$V_{OUT}$ Fall Time <sup>(2,3,4)</sup>			1.32			
$t_{dOFF}$	Turn-Off Delay <sup>(2,3,4)</sup>	$R_L=500\text{ Ω}$ , $C_{OUT}=0.1\text{ μF}$		1.1			
$t_F$	$V_{OUT}$ Fall Time <sup>(2,3,4)</sup>			18			

- Notes:
- $t_{ON} = t_{dON} + t_R$
  - $t_{OFF} = t_{dOFF} + t_F$
  - Output discharge path is enabled during off.
  - By design; characterized; not production tested.

**TIMING DIAGRAM**



**Figure 3. Timing Diagram**



## TYPICAL PERFORMANCE CHARACTERISTICS

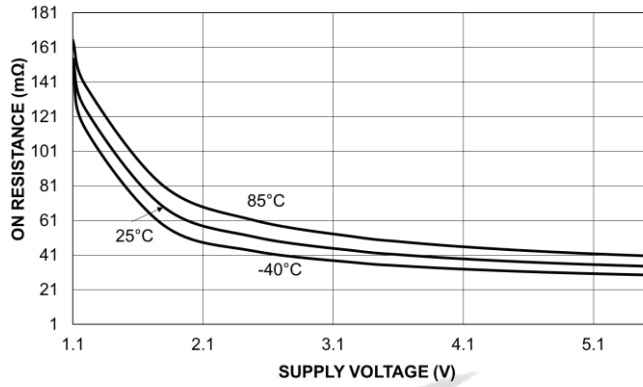


Figure 4. On-Resistance vs. Supply Voltage

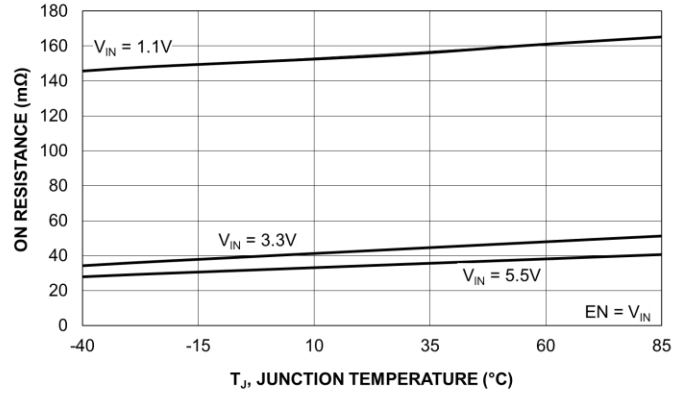


Figure 5. On-Resistance vs. Temperature

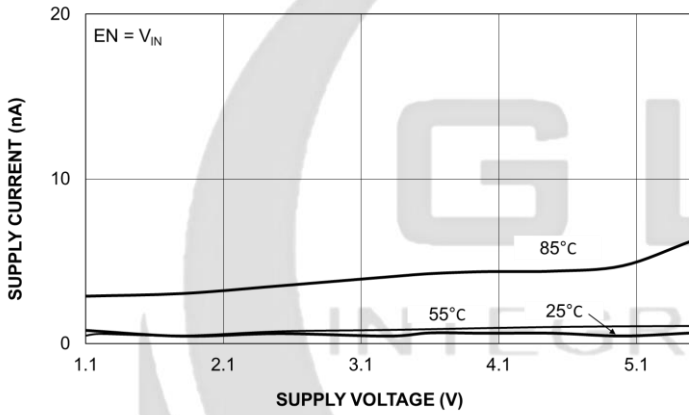


Figure 6. Quiescent Current vs. Supply Voltage

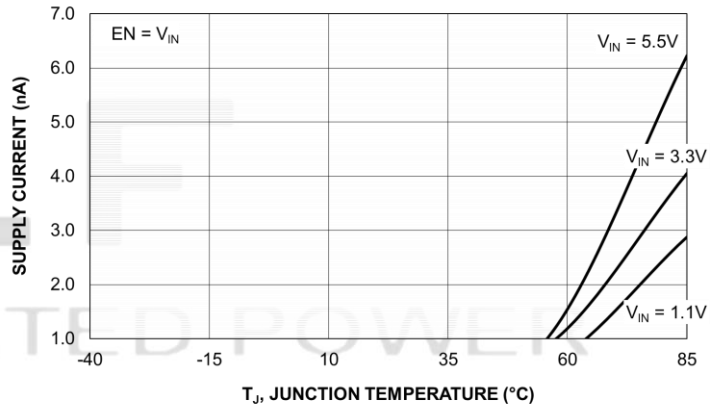


Figure 7. Quiescent Current vs. Temperature

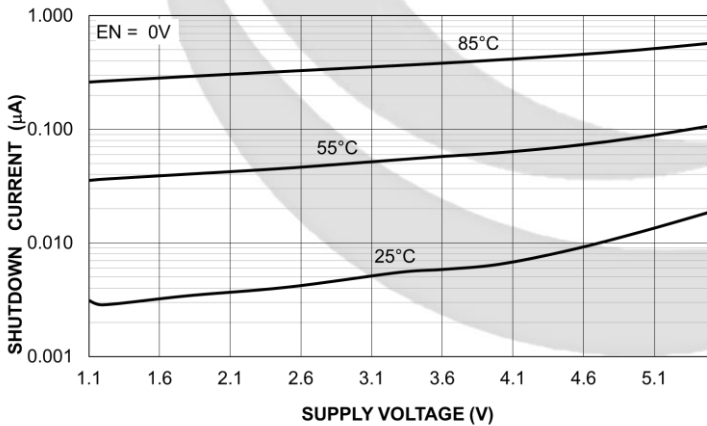


Figure 8. Shutdown Current vs. Supply Voltage

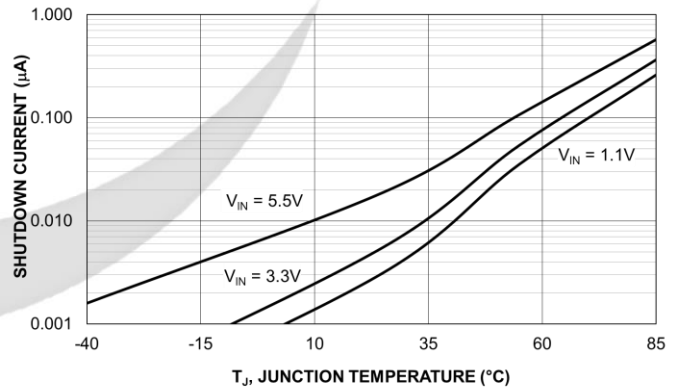


Figure 9. Shutdown Current vs. Temperature

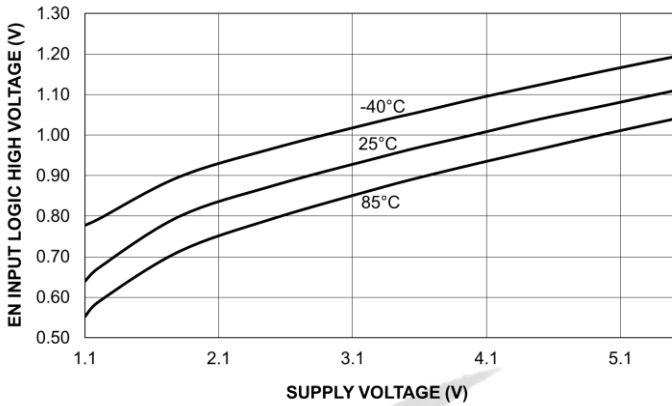


Figure 10. EN Input Logic High Threshold

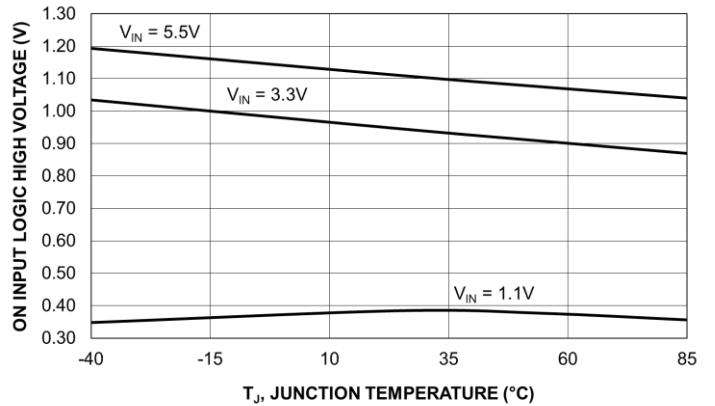


Figure 11. EN Input Logic High Threshold Vs. Temperature

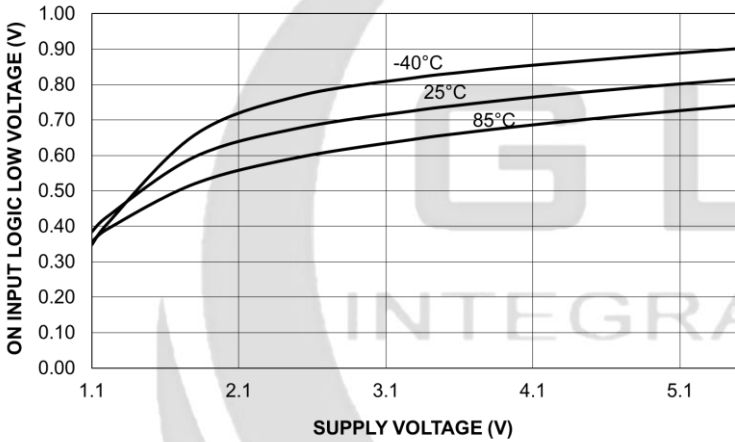


Figure 12. EN Input Logic Low Threshold

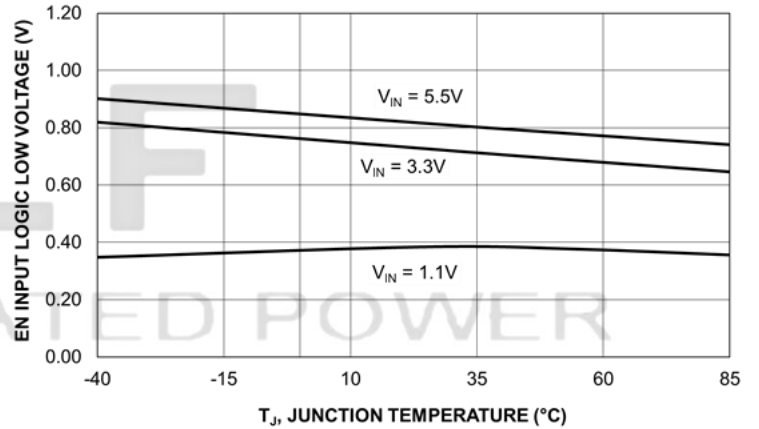


Figure 13. EN Input Logic Low Threshold Vs. Temperature

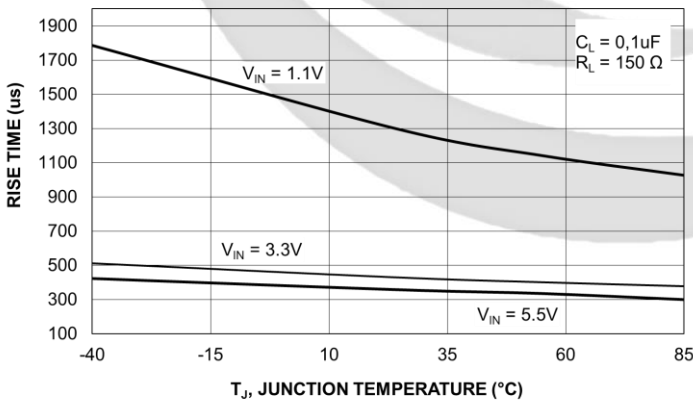


Figure 14. *V*<sub>OUT</sub> Rise Time vs. Temperature

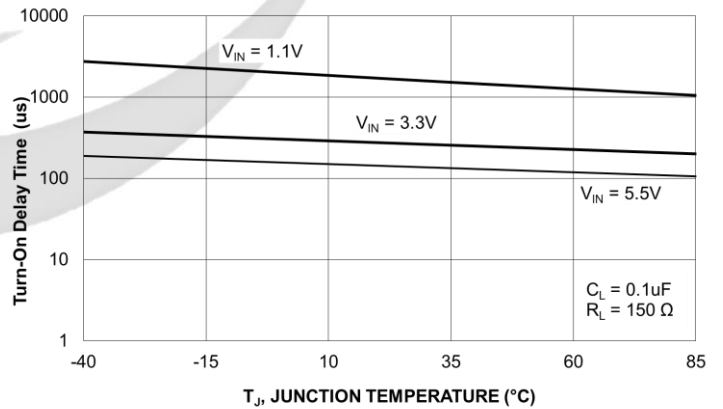


Figure 15. Turn-On Delay Time vs. Temperature

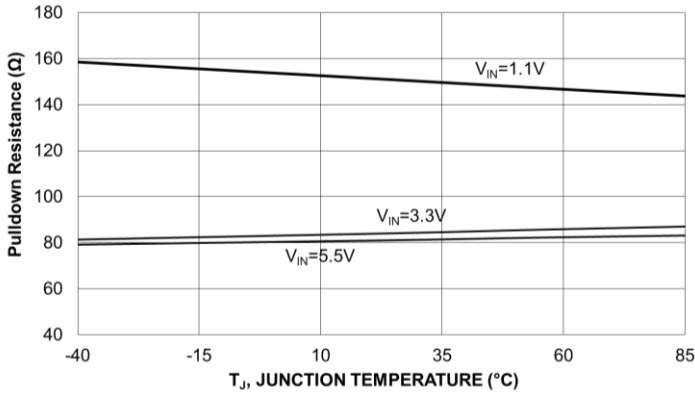


Figure 16. Pulldown Resistance vs. Temperature

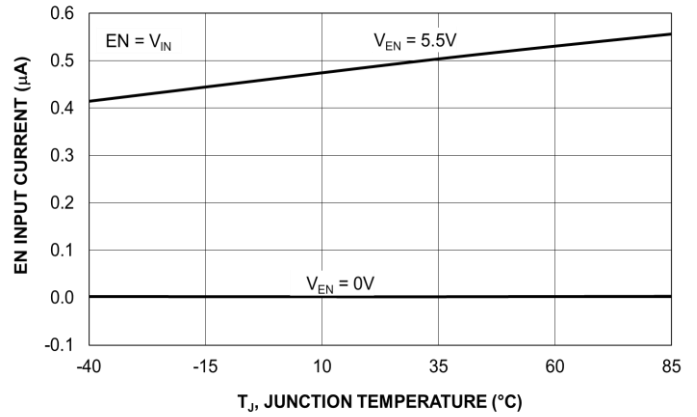


Figure 17. Enable Input Current vs. Temperature

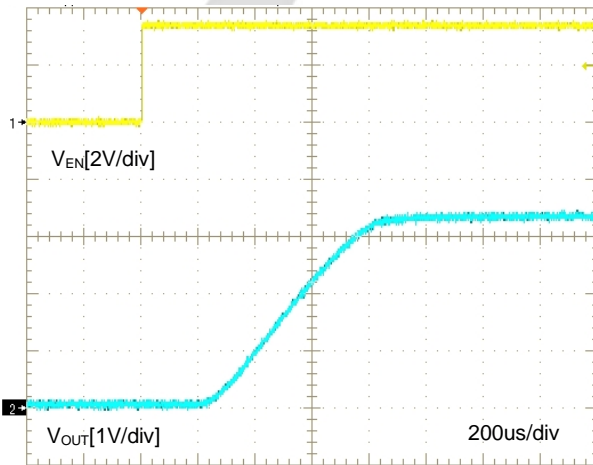


Figure 18. Turn-On Response  
 $V_{IN}=3.3\text{ V}$ ,  $C_{IN}=1.0\text{ }\mu\text{F}$ ,  $C_{OUT}=0.1\text{ }\mu\text{F}$ ,  $R_L=10\text{ }\Omega$

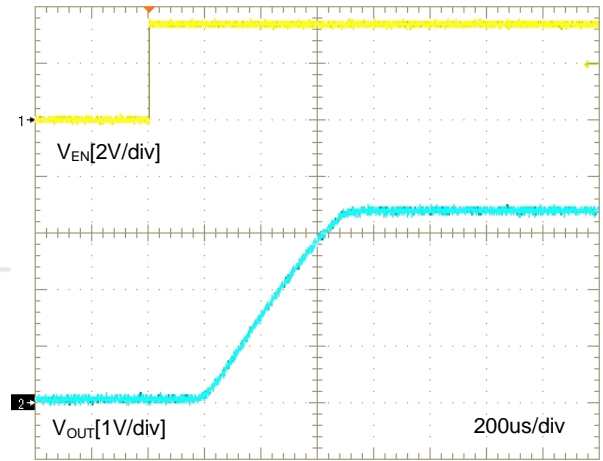


Figure 19. Turn-On Response  
 $V_{IN}=3.3\text{ V}$ ,  $C_{IN}=1.0\text{ }\mu\text{F}$ ,  $C_{OUT}=0.1\text{ }\mu\text{F}$ ,  $R_L=500\text{ }\Omega$

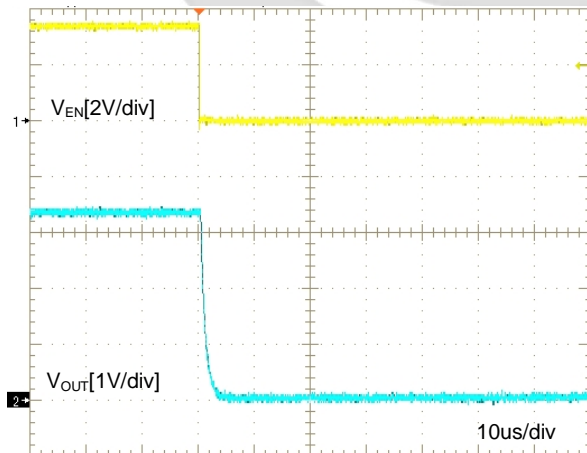


Figure 20. Turn-Off Response, Output Discharge  
 $V_{IN}=3.3\text{ V}$ ,  $C_{IN}=1.0\text{ }\mu\text{F}$ ,  $C_{OUT}=0.1\text{ }\mu\text{F}$ ,  $R_L=10\text{ }\Omega$

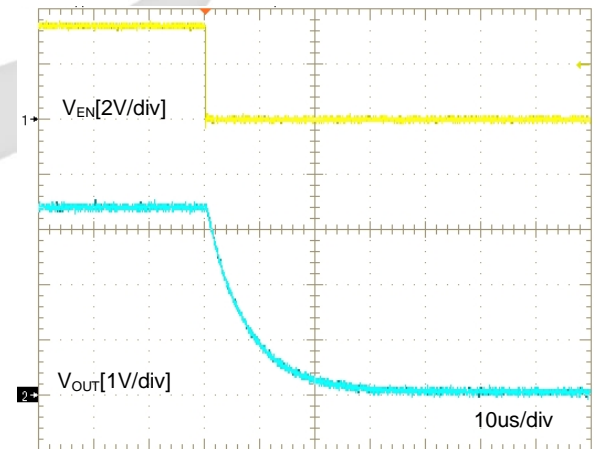


Figure 21. Turn-Off Response, Output Discharge  
 $V_{IN}=3.3\text{ V}$ ,  $C_{IN}=1.0\text{ }\mu\text{F}$ ,  $C_{OUT}=0.1\text{ }\mu\text{F}$ ,  $R_L=500\text{ }\Omega$



## APPLICATION INFORMATION

The GLF71301T is an integrated 2.0 A, Ultra-Efficient I<sub>Q</sub>Smart™ LoadSwitch device with a fixed slew rate control to limit the inrush current during turn on. The GLF71301T operates 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 0.77 mm x 0.77 mm x 0.35 mm wafer level chip scale package, saving space in compact applications. It is constructed using 4 bumps, with a 0.4 mm pitch for manufacturability.

### Input Capacitor

A capacitor is recommended to be placed close to the V<sub>IN</sub> 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.

### Output Capacitor

The 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<sub>OUT</sub> capacitor should be spaced close to the V<sub>OUT</sub> and GND pins.

### EN pin

The GLF71301T can be activated by EN pin high level. Note that the EN pin has an internal pull-down resistor to help pull the main switch to a known “off state” when no EN signal is applied from an external controller.

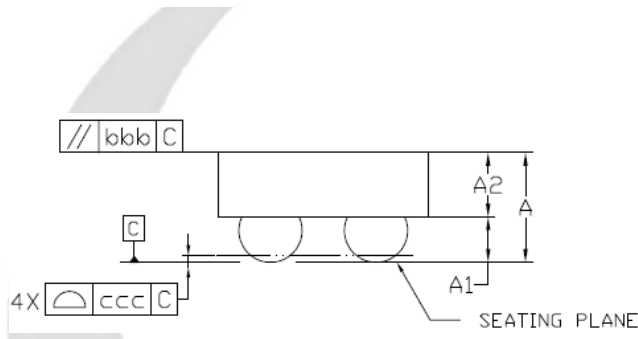
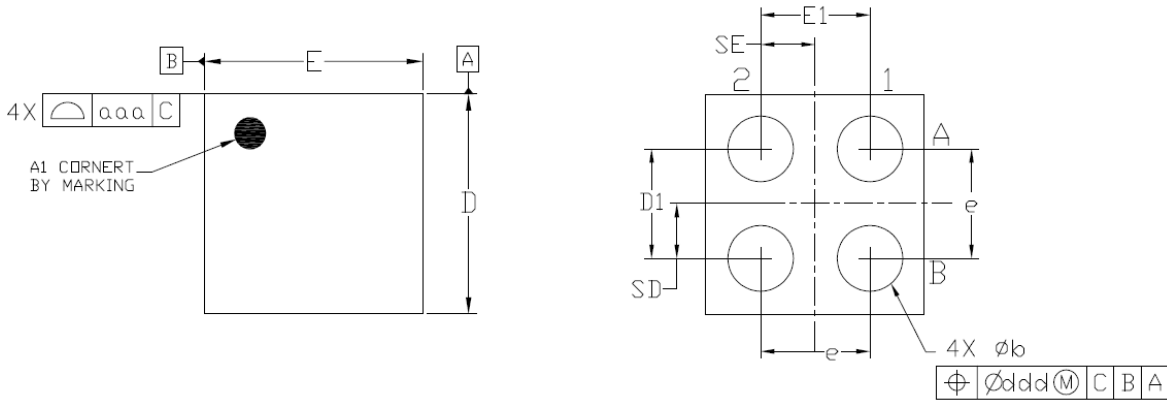
### Output Discharge Function

The GLF71301T has an internal discharge N-channel FET switch on the V<sub>OUT</sub> 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<sub>IN</sub>, V<sub>OUT</sub>, and GND will help reduce voltage drops and parasitic effects during dynamic operation as well as improve the thermal performance at high load current.

**ULTRA-THIN PACKAGE OUTLINE**



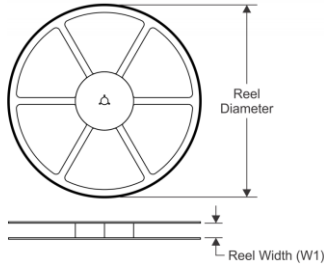
Dimensional Ref.			
REF.	Min.	Nom.	Max.
A	0.300	0.350	0.400
A1	0.075	0.100	0.125
A2	0.225	0.250	0.275
D	0.755	0.770	0.785
E	0.755	0.770	0.785
D1	0.350	0.400	0.450
E1	0.350	0.400	0.450
b	0.145	0.180	0.215
e	0.400 BSC		
SD	0.200 BSC		
SE	0.200 BSC		
Tol. of Form&Position			
aaa	0.10		
bbb	0.10		
ccc	0.05		
ddd	0.05		

Notes

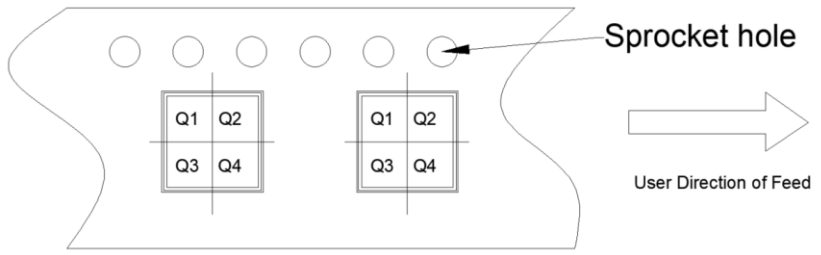
1. ALL DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
2. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1994.

**TAPE AND REEL INFORMATION**

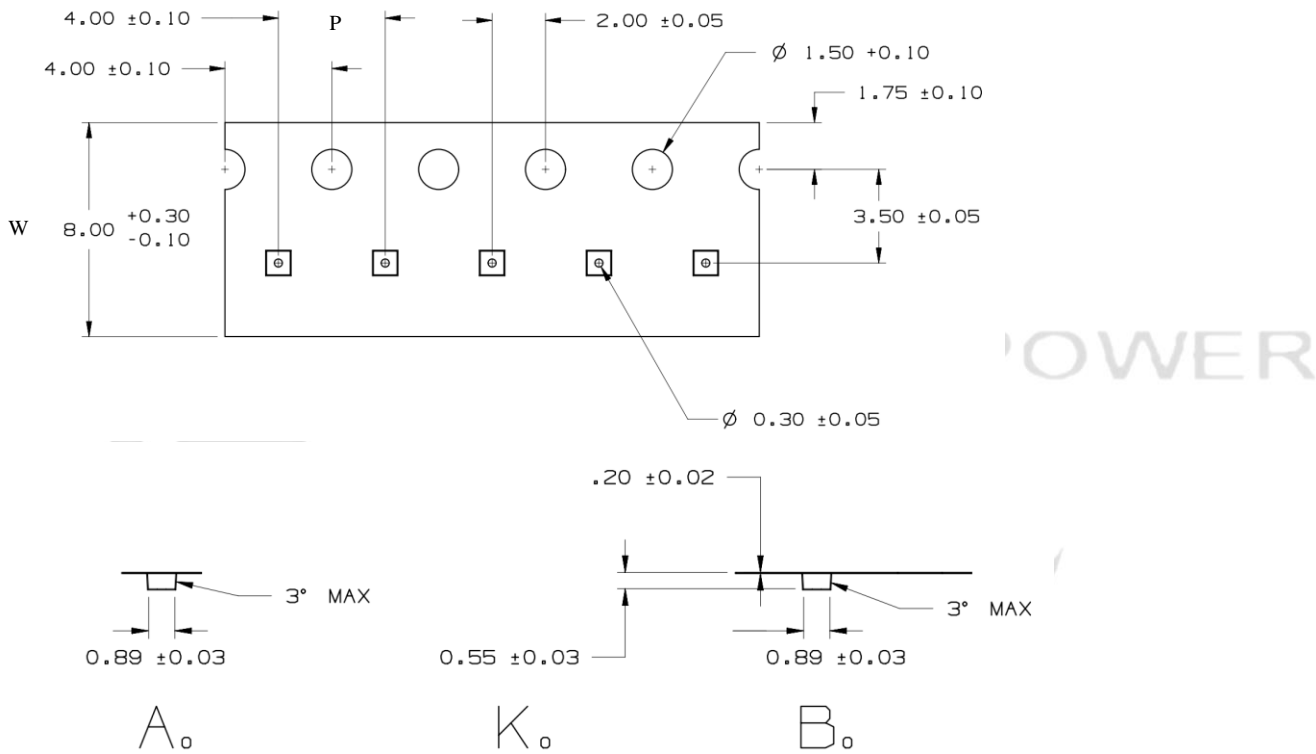
**REEL DIMENSIONS**



**QUADRANT ASSIGNMENTS PIN 1 ORIENTATION TAPE**



**TAPE DIMENSIONS**



Device	Package	Pins	SPQ	Reel Diameter(mm)	Reel Width W1	A0	B0	K0	P	W	Pin1
GLF71301T	WLCSP	4	4000	180	9	0.89	0.89	0.55	4	8	Q1

**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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