GLF73510

Nano-Current Consumed, I_QSmart™ Battery Protection Switch

Product Specification

DESCRIPTION

The GLF73510 is an I_QSmart™ ultra-efficiency, 2 A rated switch with the accurate turn-off threshold to prevent a battery from being discharged deeply.

When the voltage of a battery decreases to the off threshold voltage level, the GLF73510 is turned off, consuming an ultra-low leakage current (I_{SD}) to save the battery. The GLF73510 remains in the off state until a higher voltage is applied to V_{OUT} pin. Note that the GLF73510 is enabled only by V_{OUT} voltage with a charger output.

With the higher V_{OUT} voltage from a charger applied, the GLF73510 is fully turned on and monitors V_{BAT} voltage. When the V_{OUT} voltage of a charger is less than the on threshold voltage, a battery can be charged through the body diode of the main switch.

In case that a charged battery is assembled without a higher V_{OUT} applied, the GLF73510 continues to stay at the sleep mode, consuming an ultra-low leakage current (I_{SD}) to save the battery, during shipping or storage.

The GLF73510 is available in 0.97 mm x 0.97 mm x 0.55 mm wafer level chip scale package (WLCSP).

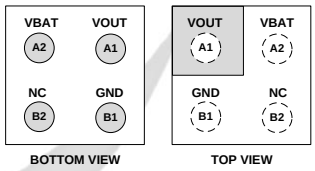
FEATURES

- Off Threshold Voltage to Protect Battery Discharge
  V_{TH_OFF} : V_{BAT}=3.05 V
  Contact GLF for a different V_{TH} level
- Switch is activated only by the V_{OUT} voltage of a charger output
- Ultra-Low I_Q : 500 nA Typ @ V_{BAT}=3.6 V
- Ultra-Low I_{SD} : 2 nA Typ @ V_{BAT} =1.1 V
  6 nA Typ @ V_{BAT} =3.6 V
- Low R_{ON} : 30 mΩ Typ @ V_{BAT}=3.6 V
  28 mΩ Typ @ V_{BAT}=4.2 V
- I_{OUT} Max : 2 A
- Temperature Range: -40 to 85 °C
- HBM: 6kV, CDM: 2 kV
- Ultra-Small : 0.97 mm x 0.97 mm WLCSP

APPLICATIONS

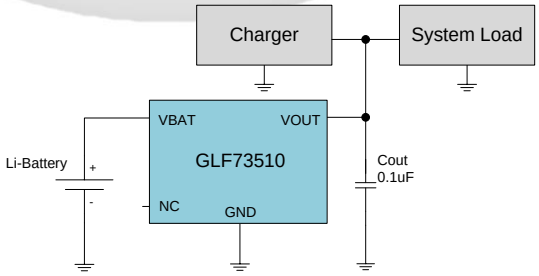
- Battery protection
- Wearables / IoT Devices
- Mobile Devices
- Mobile Medical

PACKAGE



0.97 mm x 0.9 7mm x 0.55 mm WLCSP

APPLICATION DIAGRAM



Note: 1) The GLF73510 can be activated by applying a voltage above V_{ON} to the V_{OUT} pin.
2) When the GLF73510 is at the off state, the battery can be charged through the body diode of the main switch.

DEVICE INFORMATION

Part Number	Top Mark	RON (Typ) VBAT=3.6V	Threshold VTH_OFF
GLF73510	UA	30 mΩ	3.05 V

FUNCTIONAL BLOCK DIAGRAM

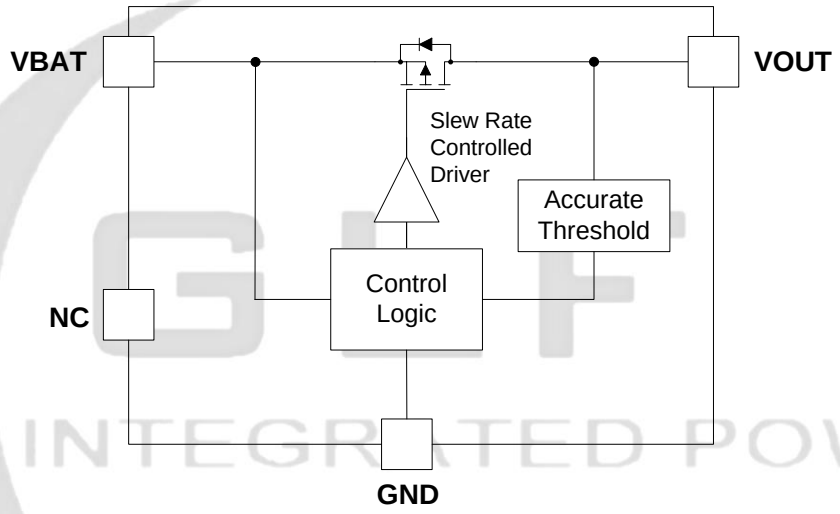


Figure 1. Functional Block Diagram

PIN CONFIGURATION

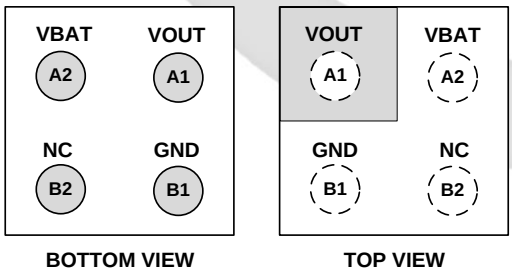


Figure 2. 0.97 mm x 0.97 mm x 0.55 mm WLCSP

PIN DEFINITION

Pin #	Name	Description
A1	VOUT	VOUT pin is connected to the charger output and system load. If the switch is in the off state applying the appropriate voltage (VON) to VOUT will turn the switch back on.
A2	VBAT	VBAT pin is connected to the battery pack's positive input to monitor the battery voltage. When the VBAT voltage reaches the VTH_OFF, the main switch is turned off immediately and latches to save the battery from discharging.
B1	GND	Ground
B2	NC	No Connection

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_{BAT}, V_{OUT}	Each Pin Voltage 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		

ELECTRICAL CHRACTERISTICS

Values are at T_A = 25 °C unless otherwise noted.

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Unit
V_{BAT}, V_{OUT}	Operating Voltage			1.1		5.5	V
V_{TH_OFF}	OFF Threshold Voltage	V_{BAT} decreases until switch turns OFF		2.85	3.05	3.20	V
		V_{BAT} decreases until switch turns OFF, Ta=55 °C (1)			2.9		
V_{ON}	ON Voltage applied to V_{OUT}	V_{OUT} increases until switch turns ON, V_{BAT} =3.6 V(2)			3.5		V
		V_{OUT} increasing, V_{BAT} =3.6 V, Ta=55 °C (1)			3.4		
I_Q	Quiescent Current with Switch On	V_{BAT} = 3.6 V, I_{OUT}=0 mA, Switch = ON			0.51		uA
		V_{BAT} = 4.2 V, I_{OUT}=0 mA, Switch = ON			0.73	1	
		V_{BAT} = 4.2 V, I_{OUT}=0 mA, Switch = ON, Ta=55 °C (1)			0.70		
		V_{BAT} = 4.2 V, I_{OUT}=0 mA, Switch = ON, Ta=85 °C (1)			0.69		
I_{SD}	Shutdown Current	V_{BAT} = 1.1 V, V_{OUT} = 0 V			2		nA
		V_{BAT} = 2.5 V, V_{OUT} = 0 V			3		
		V_{BAT} = 3.3 V, V_{OUT} = 0 V			5		
		V_{BAT} = 3.6 V, V_{OUT} = 0 V			6		
		V_{BAT} = 4.2 V, V_{OUT} = 0 V			9	50	
		V_{BAT} = 4.2 V, V_{OUT} = 0 V, Ta=55 °C (1)			0.06		uA
		V_{BAT} = 4.2 V, V_{OUT} = 0 V, Ta=85 °C (1)			0.55		
R_{ON}	On-Resistance	V_{BAT}=4.2 V, I_{OUT}= 500 mA	Ta=25 °C		28	32	mΩ
			Ta=55 °C (1)		30		
			Ta=85 °C (1)		33		
		V_{BAT} =3.6 V, I_{OUT}= 500 mA	Ta=25 °C		30	34	
			Ta=55 °C (1)		32		
			Ta=85 °C (1)		35		
		V_{BAT} =3.3 V, I_{OUT}= 500 mA	Ta=25 °C		31	35	
V_F	Forward Voltage of Diode (1)	I_F= 5 mA			0.4		V
t_{OFF}	Turn-Off Time (1)	C_{OUT}=0.1 µF, R_{OUT}=150 Ω, V_{OUT} = V_{TH_OFF} to 0 V			36		us

Notes: 1. By design; characterized, not production tested. 2. See Figure 10 for details.

TYPICAL PERFORMANCE CHARACTERISTICS

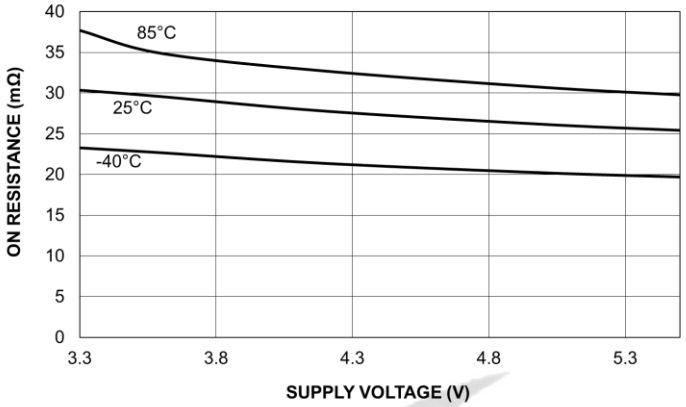


Figure 3. On-Resistance vs. Supply Voltage, V_{BAT}

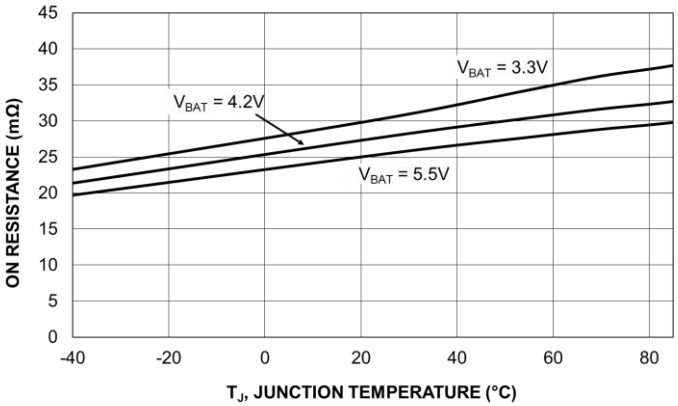


Figure 4. On-Resistance vs. Temperature

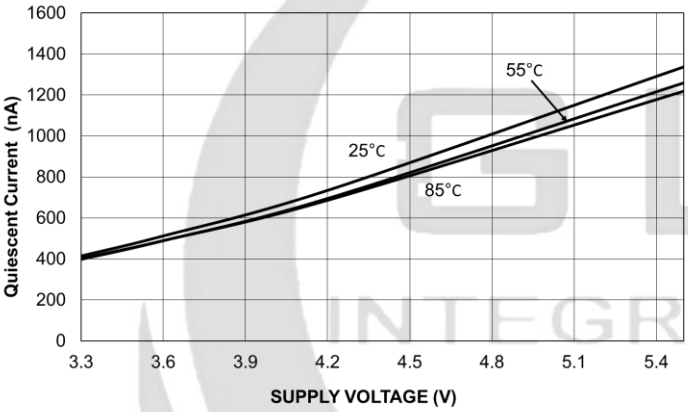


Figure 5. Quiescent Current vs. Supply Voltage, V_{BAT}

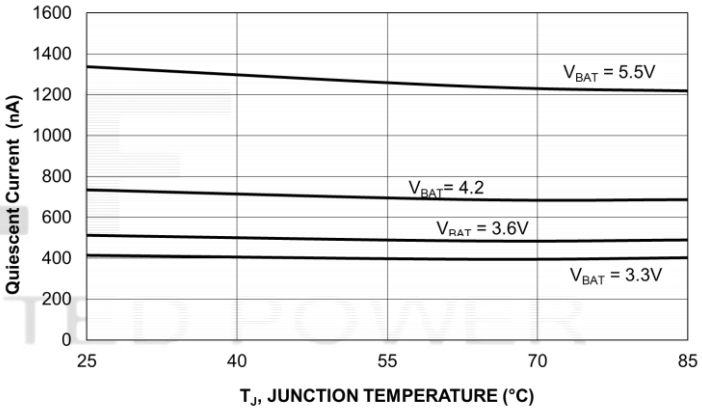


Figure 6. Quiescent Current vs. Temperature

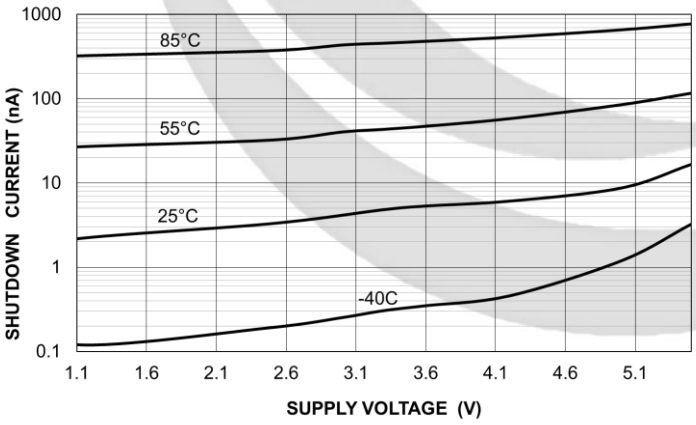


Figure 7. Shutdown Current vs. V_{BAT}

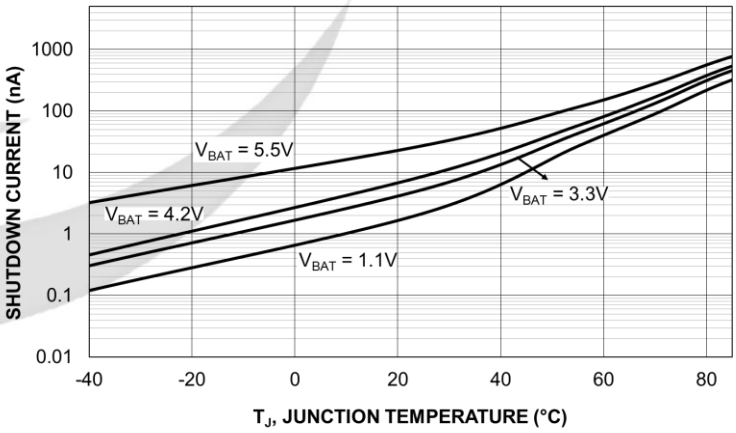


Figure 8. Shutdown Current vs. Temperature

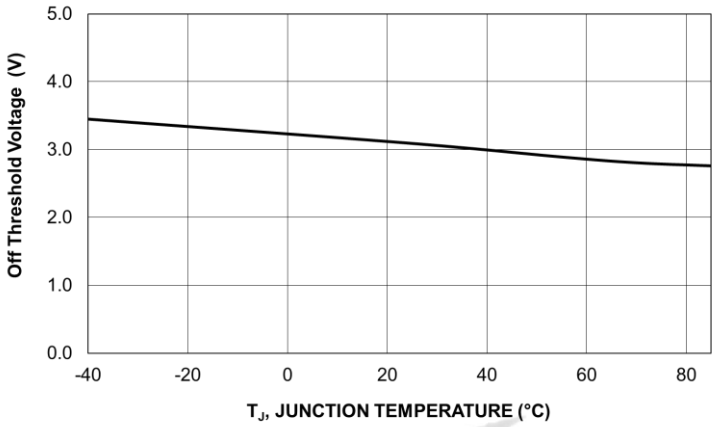


Figure 9. Off Threshold Voltage vs. Temperature

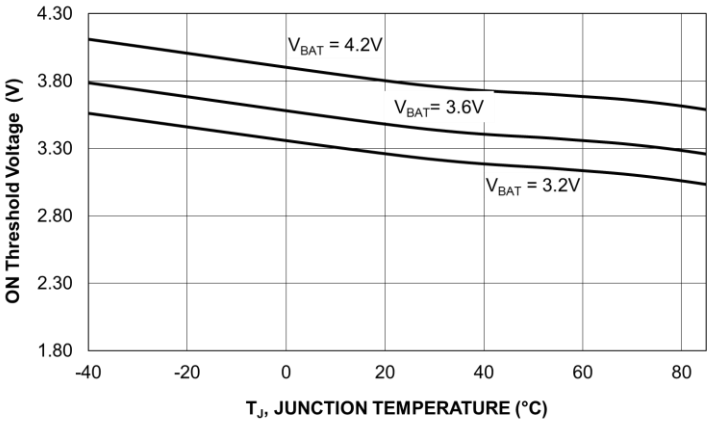


Figure 10. On Voltage vs. Temperature

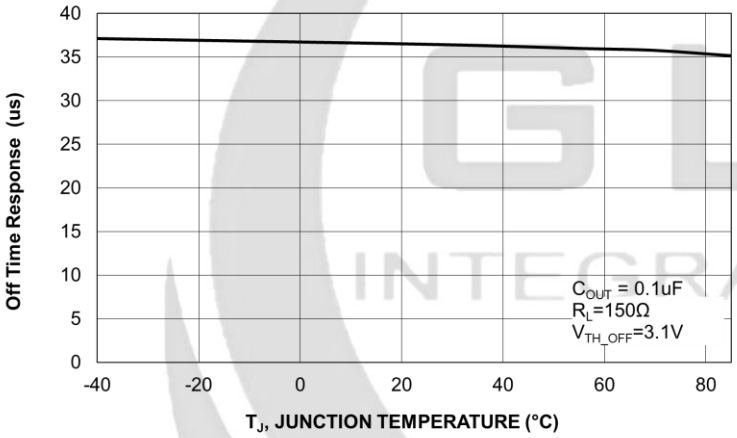


Figure 11. Off Time Response

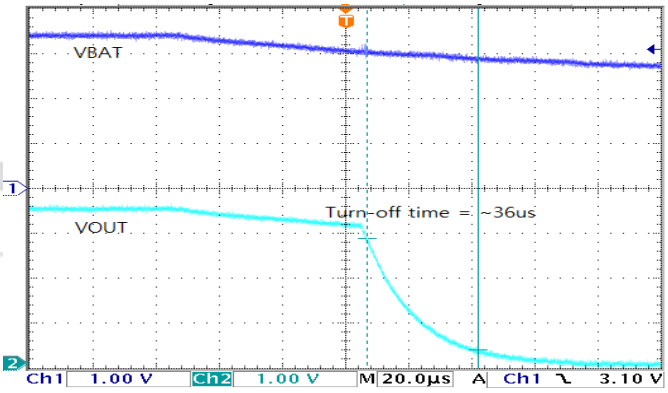


Figure 12. Turn Off Time, **C_{OUT}=0.1 uF, R_L=150 Ω**

APPLICATION INFORMATION

The GLF73510 is an ultra-efficiency, 2 A rated, load switch with accurate ON/OFF threshold voltage and integrated slew rate control. The best in class efficiency makes it an ideal chose for use in wearables, IoT devices, and mobile electronics.

ON / OFF Threshold

When the voltage of a battery decreases to the off threshold voltage level, the GLF73510 is turned off, consuming an ultra-low leakage current to save the battery. The GLF73510 remains in the off state until a higher voltage is applied to the V_{OUT} pin. Note that the GLF73510 is enabled only by the V_{OUT} pin with a higher voltage than the on threshold voltage. With the higher V_{OUT} voltage from a charger applied, the GLF73510 is fully turned on and monitors the V_{BAT} voltage. When the V_{OUT} voltage of a charger is less than the on threshold voltage, a battery can be charged through the body diode of the main switch.

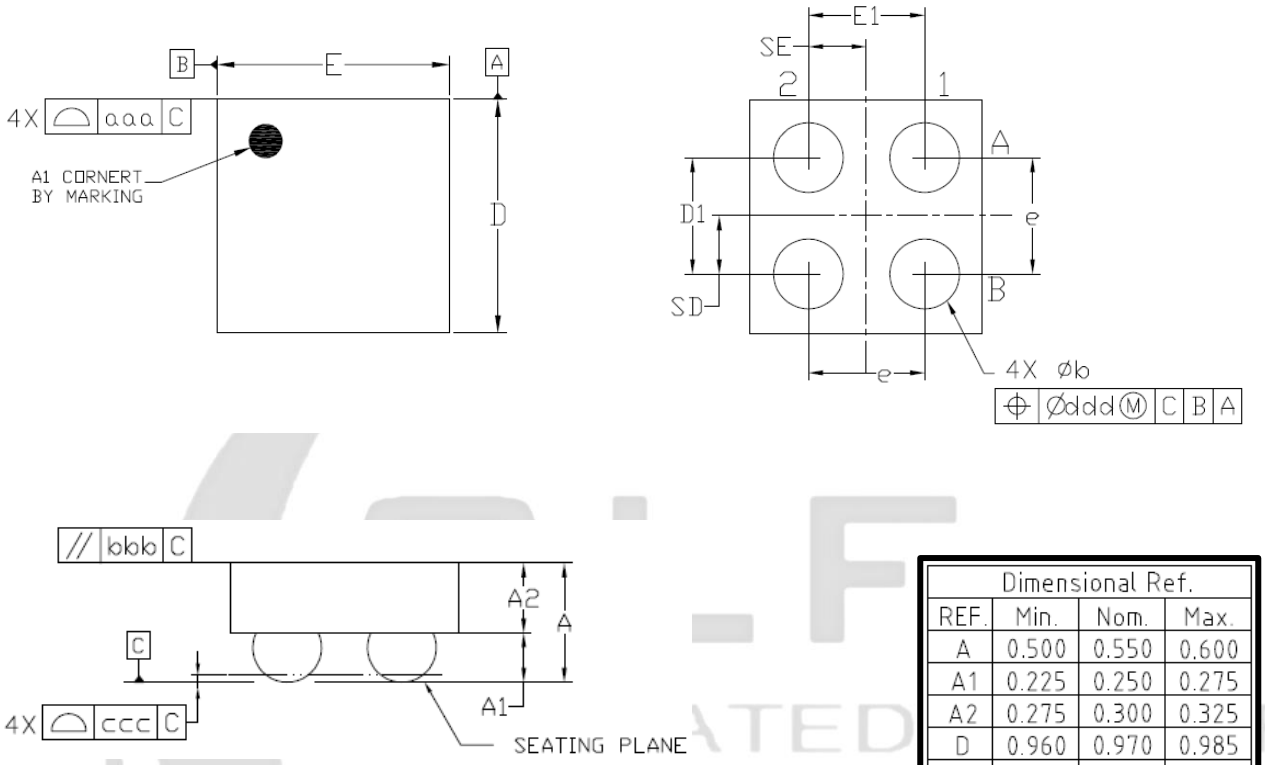
Output Capacitor

An output capacitor is not required for GLF73510 operation. However, a 0.1 uF capacitor is recommended to be placed close to the V_{OUT} pin to mitigate an undershoot voltage or the transient voltage peak caused by a hot-plugging voltage source.

Board Layout

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

PACKAGE OUTLINE



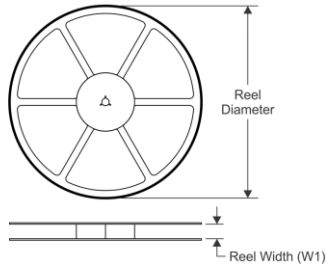
Dimensional Ref.			
REF.	Min.	Nom.	Max.
A	0.500	0.550	0.600
A1	0.225	0.250	0.275
A2	0.275	0.300	0.325
D	0.960	0.970	0.985
E	0.960	0.970	0.985
D1	0.450	0.500	0.550
E1	0.450	0.500	0.550
b	0.260	0.310	0.360
e	0.500 BSC		
SD	0.250 BSC		
SE	0.250 BSC		
Tol. of Form&Position			
aaa	0.10		
bbb	0.10		
ccc	0.05		
ddd	0.05		

Notes

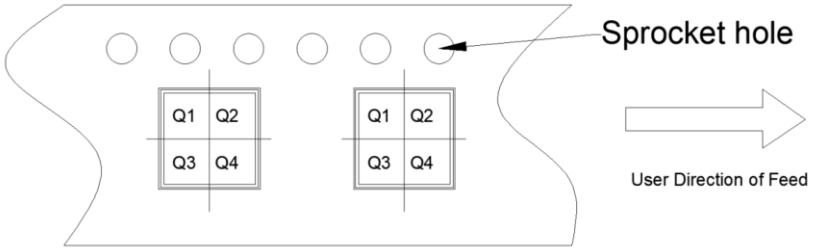
1. All DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
2. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1994.

TAPE AND REEL INFORMATION

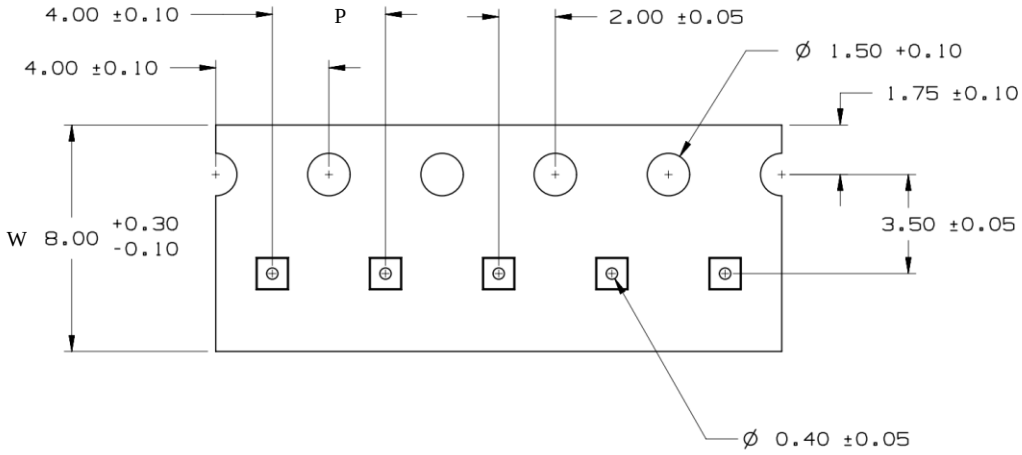
REEL DIMENSIONS

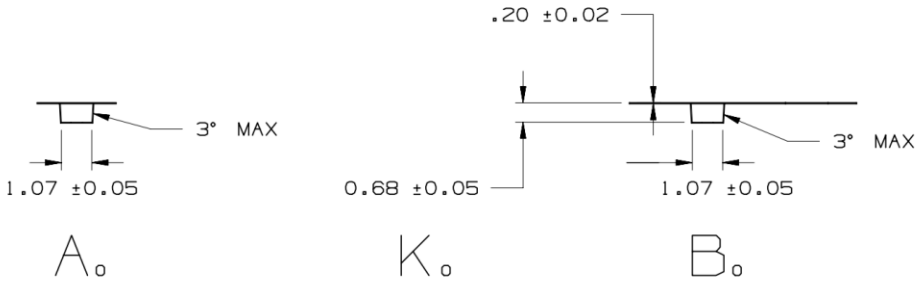


QUADRANT ASSIGNMENTS PIN 1 ORIENTATION TAPE



TAPE DIMENSIONS





Device	Package	Pins	SPQ	Reel Diameter(mm)	Reel Width W1	A0	B0	K0	P	W	Pin1
GLF73510	WLCSP	4	3000	180	9	1.07	1.07	0.68	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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