

ACPL-K308U

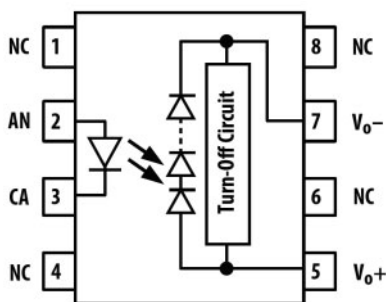
Industrial Photovoltaic MOSFET Driver

Description

The Broadcom® industrial ACPL-K308U photovoltaic driver is designed to drive high voltage MOSFETs. It consists of an AlGaAs infrared light-emitting diode (LED) input stage optically coupled to an output detector circuit. The detector consists of a high-speed photovoltaic diode array and a turn-off circuit. This photovoltaic driver turns on (contact closes) with a minimum input current of 5 mA through the input LED. It turns off (contact opens) with an input voltage of 0.8V or less.

The ACPL-K308U is available in the stretched SO-8 package outline footprint with a minimum of 8 mm (clearance/creepage). It is ideal for fast turn on and turn off in inrush current prevention and insulation resistance measurement and leakage current detection.

Figure 1: Functional Diagram



Features

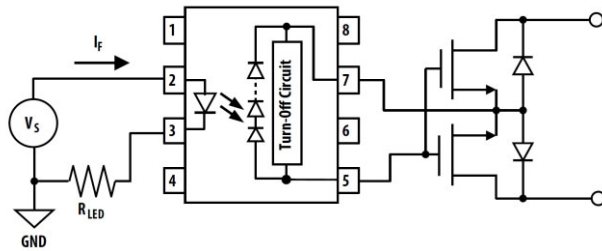
- 8-mm creepage and clearance in a compact SSO-8 package
- Operating temperature range: -40°C to $+125^{\circ}\text{C}$
- Photovoltaic driver for high-voltage MOSFETs in a solid state relay application
- Open circuit voltage: 7.5V typical at $I_F = 5\text{ mA}$
- Short circuit current: 30 μA typical at $I_F = 5\text{ mA}$
- Logic circuit compatibility
- Switching speed (typical): 58 μs (T_{ON}), 16 μs (T_{OFF}) at $I_F = 5\text{ mA}$, $C_L = 1\text{ nF}$
- Configurable to wide portfolio of high-voltage MOSFETs
- Galvanic isolation
- High input-to-output insulation voltage
- Safety and regulatory approvals
 - IEC/EN/DIN EN 60747-5-5, maximum working insulation voltage 1140 V_{PEAK}
 - 5000 V_{rms} for 1 minute per UL1577
 - CSA component acceptance

Applications

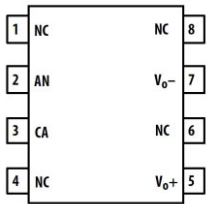
- Solid state relay module
- Inrush current prevention
- Insulation resistance measurement in battery system, solar PV inverters; EV charging system; motor winding insulation

Typical Application Circuit

Figure 2: Application Circuit



Package Pinout



Pin Description

Pin Number	Pin Name	Description
2	AN	Anode
3	CA	Cathode
5	VO+	Positive Output
7	VO-	Negative Output
1, 4, 6, 8	NC	Not Connected

Ordering Information

Specify part number followed by option number (if desired).

Part Number	Option (RoHS Compliant)	Package	Surface Mount	Tape and Reel	UL 5000 V _{rms} / 1 Minute Rating	IEC 60747-5-5 EN/ DIN EN 60747-5-5	Quantity
ACPL-K308U	-000E	Stretched SO-8	X		X		80 per tube
	-060E		X		X	X	80 per tube
	-500E		X	X	X		1000 per reel
	-560E		X	X	X	X	1000 per reel

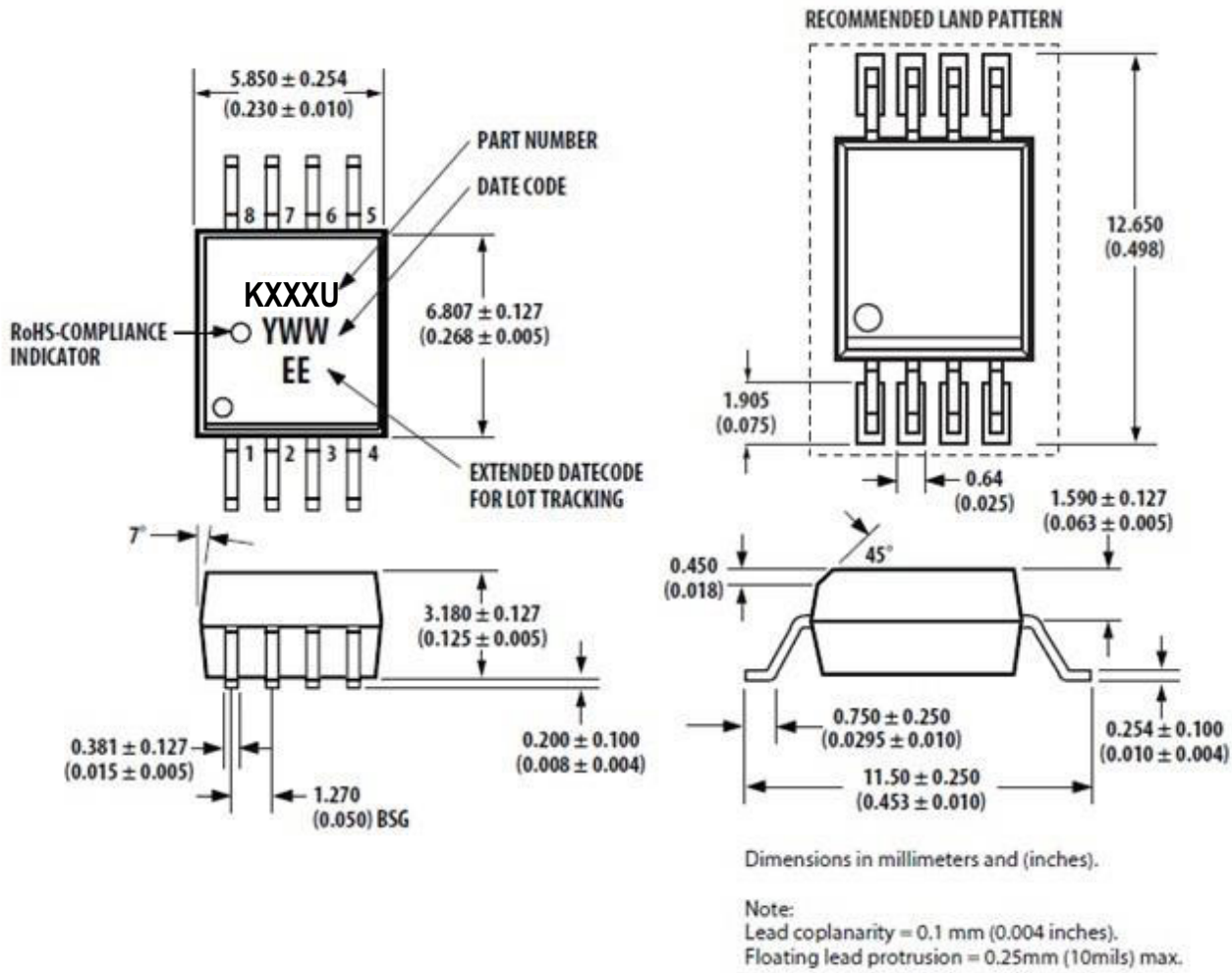
To order, choose a part number from the part number column and combine with the desired option from the option column to form an order entry.

Example 1:

ACPL-K308U-560E to order product of SSO-8 surface mount package in tape and reel packaging with IEC/EN/DIN EN 60747-5-5 safety approval in RoHS compliant.

Option data sheets are available. Contact your Broadcom sales representative or authorized distributor for information.

Package Outline Drawings (Stretched SO8)



Recommended Pb-Free IR Profile

Recommended reflow condition as per JEDEC Standard J-STD-020 (latest revision).

NOTE: Non-halide flux should be used.

Regulatory Information

The ACPL-K308U is approved by the following organizations.

UL	CSA	IEC/EN/DIN EN 60747-5-5
UL 1577, component recognition program up to VISO = 5 kV _{RMS}	Approved under CSA Component Acceptance Notice #5	EC 60747-5-5 EN 60747-5-5 DIN EN 60747-5-5

Insulation and Safety Related Specifications

Parameter	Symbol		Units	Conditions
Minimum External Air Gap (Clearance)	L(101)	8	mm	Measured from the input terminals to the output terminals, shortest distance through the air.
Minimum External Tracking (Creepage)	L(102)	8	mm	Measured from the input terminals to the output terminals, shortest distance path along the body.
Minimum Internal Plastic Gap (Internal Clearance)		0.08	mm	Through insulation distance conductor to conductor, usually the straight line distance thickness between the emitter and the detector.
Tracking Resistance (Comparative Tracking Index)	CTI	175	V	DIN IEC 112/VDE 0303 Part 1.
Isolation Group (DIN VDE0109)		IIIa		Material Group (DIN VDE 0109).

IEC/EN/DIN EN 60747-5-5 Insulation-Related Characteristic (Options 060 and 560 Only)

Description	Symbol	Options 060 and 560	Units
Installation classification per DIN VDE 0110/1.89, Table 1 for rated mains voltage < 600 Vrms for rated mains voltage < 1000 Vrms		I - IV I - III	
Climatic Classification		40/125/21	
Pollution Degree (DIN VDE 0110/1.89)		2	
Maximum Working Insulation Voltage	V_{IORM}	1140	V_{PEAK}
Input to Output Test Voltage, Method b $V_{IORM} \times 1.875 = V_{PR}$, 100% Production Test with $t_m = 1$ second, Partial Discharge < 5 pC	V_{PR}	2137	V_{PEAK}
Input to Output Test Voltage, Method a $V_{IORM} \times 1.6 = V_{PR}$, Type and sample test, $t_m = 10$ seconds, Partial Discharge < 5 pC	V_{PR}	1824	V_{PEAK}
Highest Allowable Overvoltage (Transient Overvoltage, $t_{ini} = 60s$)	V_{IOTM}	8000	V_{PEAK}
Safety Limiting Values (Maximum values allowed in the event of a failure)			
Case Temperature	T_S	175	°C
Input Current	$I_{S,INPUT}$	230	mA
Output Power	$P_{S,OUTPUT}$	600	mW
Insulation Resistance at T_S , $V_{IO} = 500V$	R_S	$>10^9$	Ω

Absolute Maximum Ratings

Parameter		Symbol	Min.	Max.	Units	Note
Storage Temperature		T_S	-55	150	°C	
Operating Ambient Temperature		T_A	-40	125	°C	
Input Current	Average	$I_{F(avg)}$	—	20	mA	
	Surge (50% duty cycle)	$I_{F(surge)}$	—	40	mA	
	Transient ($\leq 1\text{-}\mu\text{s}$ pulse width, 300 pps)	$I_{F(trans)}$	—	1	A	
Reversed Input Voltage		V_R	—	6	V	
Input Power Dissipation		P_{IN}	—	30	mW	
Lead Soldering Cycle	Temperature		—	260	°C	
	Time		—	10	s	
Solder Reflow Temperature Profile		Recommended reflow condition as per JEDEC Standard J-STD-020 (latest revision).				

Recommended Operating Conditions

Parameter	Symbol	Min.	Max.	Units	Note
Input Current (ON)	$I_{F(ON)}$	5	10	mA	Pulse width < 1s, duty cycle < 50%.
			15		
Input Voltage (OFF)	$V_{F(OFF)}$	0	0.8	V	
Operating Temperature	T_A	-40	125	°C	

Electrical Specifications (DC)

Unless otherwise stated, all minimum/maximum specifications are over recommended operating conditions. All typical values are at $T_A = 25^\circ\text{C}$.

Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions	Figure	Note
Open Circuit Voltage	V_{OC}	4.0	7.5	—	V	$I_F = 5\text{ mA}, I_O = 0\text{ mA}$		
		4.5	—	—		$I_F = 10\text{ mA}, I_O = 0\text{ mA}, T_A = 105^\circ\text{C}$		
		6.8	8.2	—		$I_F = 10\text{ mA}, I_O = 0\text{ mA}$		
Temperature Coefficient of Open Circuit Voltage	$\Delta V_{OC}/\Delta T_A$	—	-21	—	mV/°C	$I_F = 10\text{ mA}, I_O = 0\text{ mA}$		
Short Circuit Current	I_{SC}	13	30	—	μA	$I_F = 5\text{ mA}, V_O = 0\text{ V}$		
		25	60	—		$I_F = 10\text{ mA}, V_O = 0\text{ V}$		
Input Forward Voltage	V_F	1.25	1.45	1.85	V	$I_F = 5\text{ mA}$		
Temperature Coefficient of Forward Voltage	$\Delta V_F/\Delta T_A$	—	-1.5	—	mV/°C	$I_F = 10\text{ mA}$		
Input Reverse Breakdown Voltage	BV_R	6	—	—	V	$I_R = 10\text{ }\mu\text{A}$		

Switching Specifications (AC)

Unless otherwise stated, all minimum/maximum specifications are over recommended operating conditions. All typical values are at $T_A = 25^\circ\text{C}$.

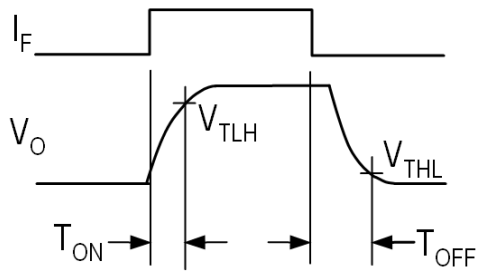
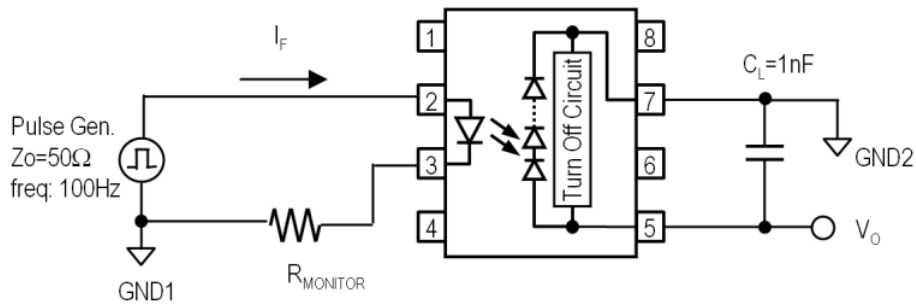
Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions	Figure	Note
Turn On Time	T_{ON}	—	58	150	μs	$I_F = 5\text{ mA}, C_L = 1\text{ nF}$		
		—	30	100		$I_F = 10\text{ mA}, C_L = 1\text{ nF}$		
Turn Off Time	T_{OFF}	—	28	50	μs	$I_F = 10\text{ mA}/20\text{ mA}, C_L = 1\text{ nF}$		
		—	16	40		$I_F = 5\text{ mA}, C_L = 1\text{ nF}$		

Package Characteristics

Unless otherwise stated, all minimum/maximum specifications are over recommended operating conditions. All typical values are at $T_A = 25^\circ\text{C}$.

Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions	Figure	Note
Input-Output Momentary Withstand Voltage ^a	V_{ISO}	5000	—	—	V_{RMS}	$RH \leq 50\%, t = 1\text{ minute}; T_A = 25^\circ\text{C}$		b, c
Input-Output Resistance	R_{I-O}	10^9	10^{14}	—	Ω	$V_{I-O} = 500\text{ Vdc}$		b
Input-Output Capacitance	C_{I-O}	—	0.6	—	pF	$f = 1\text{ MHz}; V_{I-O} = 0\text{ Vdc}$		b

- The Input-Output Momentary Withstand Voltage is a dielectric voltage rating that should not be interpreted as an input-output continuous voltage rating.
- The device is considered to be a two-terminal device: pins 1, 2, 3, and 4 shorted together, and pins 5, 6, 7, and 8 shorted together.
- In accordance with UL 1577, each optocoupler is proof tested by applying an insulation test voltage $\geq 6000 V_{RMS}$ for 1 second.

Figure 3: Switching Time Test Circuit and Waveform

NOTE: The following are the test conditions:

- $T_A = -40^\circ\text{C}$, $V_{TLH} = 3.6\text{V}$, $V_{THL} = 1.2\text{V}$
- $T_A = 25^\circ\text{C}$, $V_{TLH} = 3.6\text{V}$, $V_{THL} = 1.0\text{V}$
- $T_A = 125^\circ\text{C}$, $V_{TLH} = 3.6\text{V}$, $V_{THL} = 0.8\text{V}$

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