TDL314 Series

0.8A, Gate Driver Photo Coupler

Description

The TDL314 series Photocoupler is ideally suited for driving power IGBTs and MOSFETs used in motor control inverter applications
and inverters in power supply system. It contains an AlGaAs LED optically coupled to an integrated circuit with a power output stage.
The Photocoupler operational parameters are guaranteed over the temperature range from -40° C ~ +110°C.

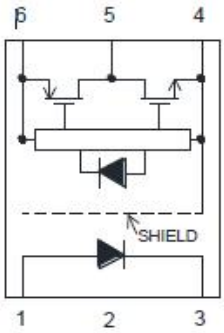
Features

- 1.5 A maximum peak output current
- 0.8 A minimum peak output current
- Rail-to-rail output voltage
- 110 ns maximum propagation delay
- Under Voltage Lock-Out protection (UVLO) with hysteresis
- Wide operating range: 10 to 30 Volts (V_{CC})
- Guaranteed performance over temperature -40°C ~ +110°C.

Applications

- Isolated IGBT/Power MOSFET gate drive
- Industrial Inverter
- AC brushless and DC motor drives
- Induction Heating

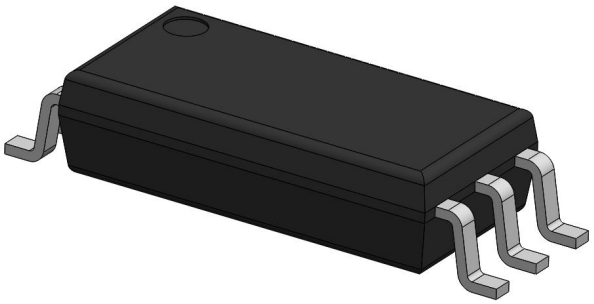
SCHEMATIC



PIN DEFINITION

1.Anode	6.V_{CC}
2.None	5.VO
3.Cathode	4.V_{SS}

PACKAGE



TRUTH TABLE			
LED	V_{CC}-V_{SS} (Turn-ON, +ve going)	V_{CC}-V_{SS} (Turn-OFF, -ve going)	V_O
Off	0V to 30V	0V to 30V	Low
On	0V to 6.9V	0V to 5.9V	Low
On	6.9V to 8.7V	5.9V to 7.5V	Transition
On	8.7V to 30V	7.5V to 30V	High

Note: A 0.1μF bypass capacitor must be connected between Pin 4 and 6.

ABSOLUTE MAXIMUM RATINGS					
PARAMETER	SYMBOL	Min	Max	UNIT	Note
Storage Temperature	T_{stg}	-55	125	°C	-
Operating Temperature	T_{opr}	-40	110	°C	-
Output IC Junction Temperature	T_J	-	125	°C	-
Total Output Supply Voltage	(V_{CC} –V_{SS})	0	35	V	-
Average Forward Input Current	I_F	-	20	mA	-
Reverse Input Voltage	V_R	-	5	V	-
“High” Peak Output Current	$I_{OH(PEAK)}$	0.8	1.5	A	1
“Low” Peak Output Current	$I_{OL(PEAK)}$	0.8	1.5	A	1
Output Voltage	$V_{O(PEAK)}$	-0.5	Vcc	V	-
Power Dissipation	P_I	-	45	mW	-
Output IC Power Dissipation	P_O	-	250	mW	-
Lead Solder Temperature	T_{sol}	-	260	°C	-

Note: Ambient temperature = 25°C, unless otherwise specified. Stresses exceeding the absolute maximum ratings can cause permanent damage to the device. Exposure to absolute maximum ratings for long periods of time can adversely affect reliability.

Note 1: Exponential waveform. Pulse width ≤ 10 μs, f ≤ 15 kHRECOMMENDED OPERATION CONDITIONS				
PARAMETER	SYMBOL	MIN.	MAX.	UNIT
Operating Temperature	T_A	-40	110	°C
Supply Voltage	V_{CC}	10	30	V
Input Current (ON)	$I_{F(ON)}$	7	16	mA
Input Voltage (OFF)	$V_{F(OFF)}$	-3.0	0.8	V

ELECTRICAL OPTICAL CHARACTERISTICS							
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION	NOTE
INPUT CHARACTERISTICS							
Forward Voltage	V_F	-	1.38	1.8	V	I_F= 10 mA	-
Reverse Current	I_R	-	-	10	μA	V_R=5V	-
Input Threshold Current (Low to High)	I_{FLH}	-	0.6	2	mA	V_O > 5V, I_O = 0A	-
Input Threshold Voltage (High to Low)	V_{FHL}	0.8	-	-	V	V_{CC} = 30 V, V_O < 5V	-
Input Capacitance	C_{IN}	-	60	-	pF	V_F = 0, f = 1MHz	-
OUTPUT CHARACTERISTICS							
High Level Supply Current	I_{CCH}	-	1.50	3	mA	I_F = 10 mA, V_{CC} = 30 V, V_O = Open, Rg = 30Ω, Cg = 3 nF	
Low Level Supply Current	I_{CCL}	-	1.50	3	mA	I_F = 0 mA, V_{CC} = 30 V, V_O = Open, Rg = 30Ω, Cg = 3 nF	
High Level Output Voltage	V_{OH}	29.4	29.69	-	V	I_F = 10 mA, I_O = -100 mA	2,3
Low Level Output Voltage	V_{OL}	-	0.17	0.34	V	I_F = 0 mA, I_O = 100 mA	
High Level Output Current	I_{OH}	-0.8	-	-	A	I_F = 10 mA, V_{CC} = 30V V_O = V_{CC} - 4	1
Low Level Output Current	I_{OL}	0.8	-	-	A	I_F = 0 mA, V_{CC} = 30V V_O = V_{SS} + 4	1
Under Voltage Lockout Threshold	VUVLO+	6.9	7.8	8.7	V	V_O > 5V, I_F = 10 mA	
	VUVLO-	5.9	6.9	7.5	V	V_O < 5V, I_F = 10 mA	

All Typical values at T_A = 25°C and V_{CC} – V_{SS} = 30 V, unless otherwise specified; all minimum and maximum specifications are at recommended operating condition.

Note 1: Maximum pulse width = 10 μs.

Note 2: In this test VOH is measured with a dc load current. When driving capacitive loads, VOH will approach VCC as IOH approaches zero amps.

Note 3: Maximum pulse width = 1 ms.

SWITCHING SPECIFICATION							
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION	NOTE
SWITCHING CHARACTERISTICS							
Propagation Delay Time to Output Low Level	t_{PHL}	-	54	500	ns	Rg = 30Ω, Cg = 3 nF, f = 10kHz, Duty Cycle = 50%, I_F = 10mA, V_{CC} = 30V	-
Propagation Delay Time to Output High Level	t_{PLH}	-	69	500	ns		-
Pulse Width Distortion	PWD	-	22	200	ns		-
Propagation Delay Difference Between Any Two Parts	PDD (t_{PHL} - t_{PLH})	-200	-	+200	ns		-
Rise Time	t_r	-	13	-	ns		-
Fall Time	t_f	-	13	-	ns		-
Common Mode Transient Immunity at Logic High	CM_H	-20	-	-	kV/μs	I_F=7 to 16mA V_{CC}= 30V, T_A= 25 °C, V_{CM}= 1kV	1,2
Common Mode Transient Immunity at Logic Low	CM_L	20	-	-	kV/μs	I_F=0mA V_{CC}= 30V, T_A= 25 °C, V_{CM}= 1kV	1,3

All Typical values at T_A = 25°C and V_{CC} – V_{SS} = 30 V, unless otherwise specified; all minimum and maximum specifications are at recommended operating condition.

Note 1:Pin 2 needs to be connected to LED common.

Note 2: Common mode transient immunity in the high state is the maximum tolerable dVCM/dt of the common mode pulse, VCM, to assure that the output will remain in the high state (meaning VO > 10.0V).

Note 3: Common mode transient immunity in a low state is the maximum tolerable dVCM/dt of the common mode pulse, VCM, to assure that the output will remain in a low state (meaning VO < 1.0V).

ISOLATION CHARACTERISTIC								
Parameter	Symbo	Device	Min.	Typ.	Max.	Unit	Test Condition	Note
Withstand Insulation Test Voltage	VISO	-	5000	-	-	V	RH ≤ 40%-60%, t = 1min, T_A = 25 °C	1,2
Input-Output Resistance	R_{I-O}	-	-	10^{12}	-	Ω	V_{I-O} = 500V DC	1

All Typical values at T_A = 25°C and V_{CC} – V_{SS} = 30 V, unless otherwise specified; all minimum and maximum specifications are at recommended operating condition.

Note 1: Device is considered a two terminal device: pins 1, 2, 3 are shorted together and pins 4, 5, 6 are shorted together.

Note 2: According to UL1577, each photocoupler is tested by applying an insulation test voltage 6000VRMS for one second (leakage current less than 10uA). This test is performed before the 100% production test for partial discharge.

CHARACTERISTIC CURVES

Fig.1 High output rail voltage vs. Temperature

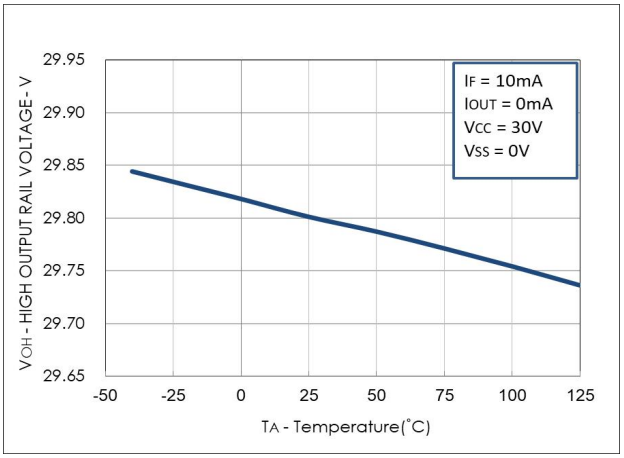


Fig.2 V_{OH} vs. Temperature

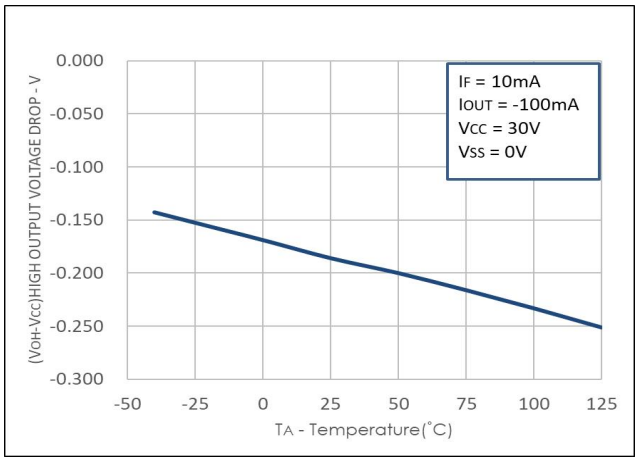


Fig.3 V_{OL} vs. Temperature

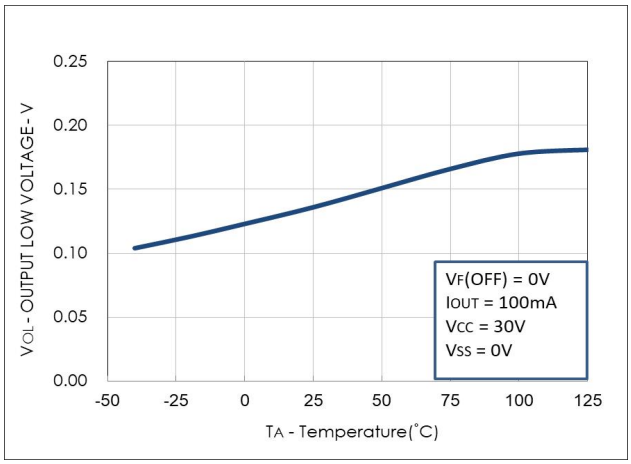


Fig.4 I_{CC} vs. Temperature

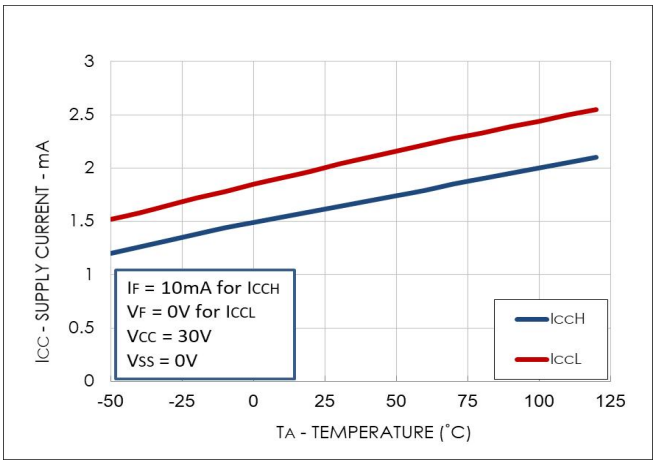


Fig.5 I_{CC} vs. V_{CC}

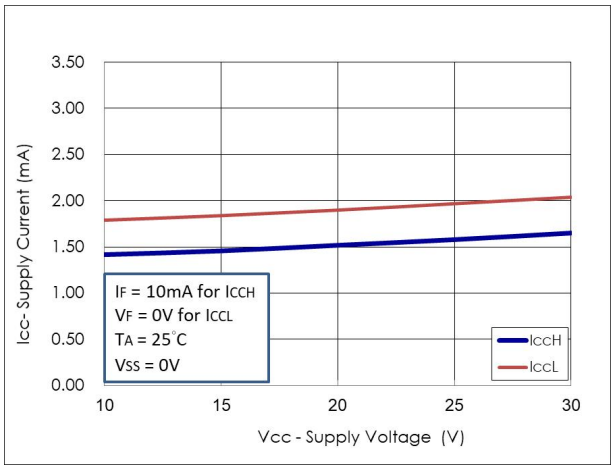


Fig.6 I_{FLH} vs. Hysteresis

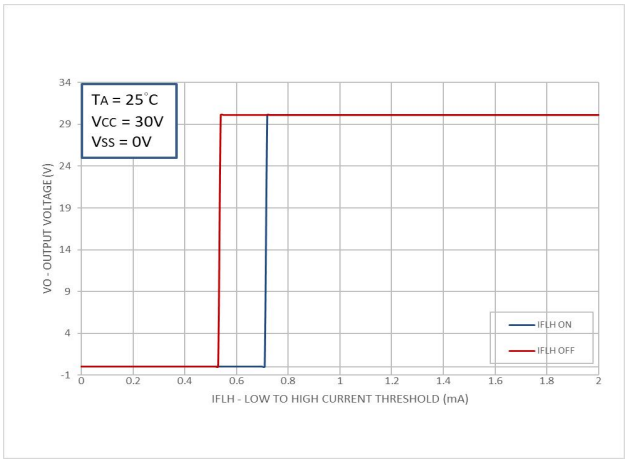


Fig.7 I_{FH} vs. Temperature

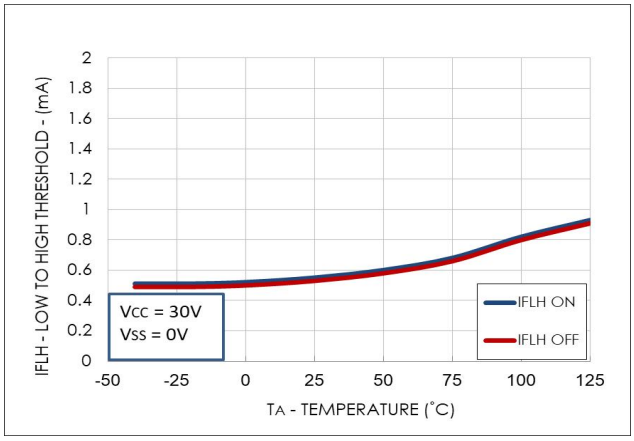


Fig.8 Propagation Delays vs. V_{CC}

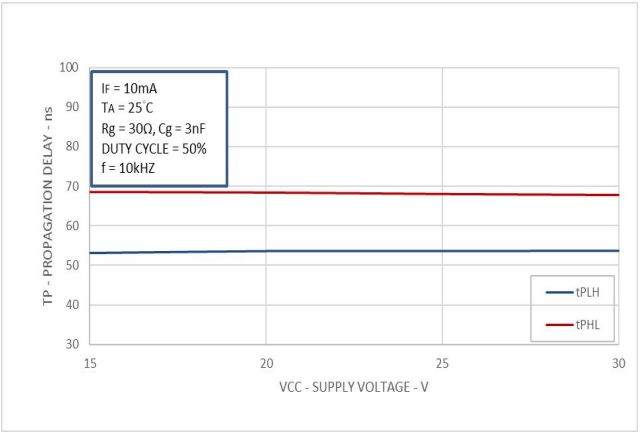


Fig.9 Propagation Delays vs. I_F

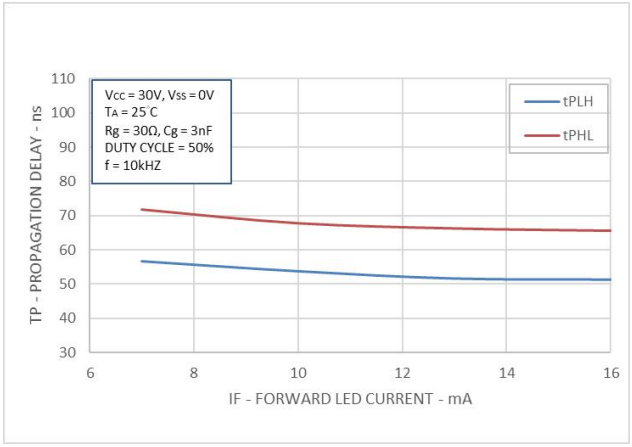


Fig.10 Propagation Delays vs. Temperature

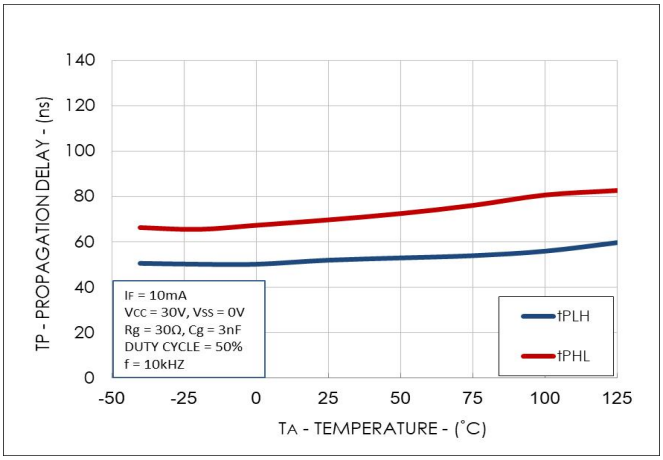


Fig.11 Propagation Delays vs. Rg

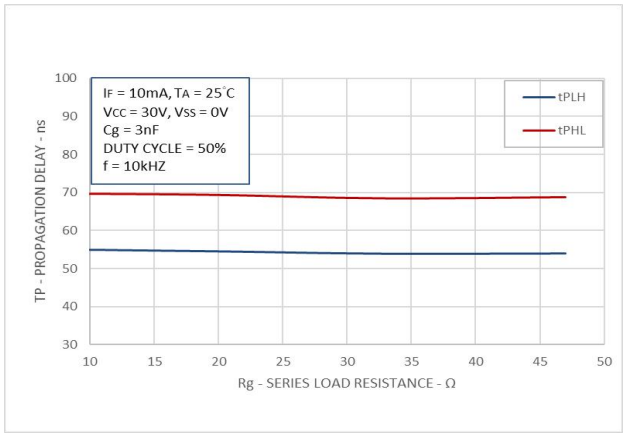


Fig.12 Propagation Delays vs. Cg

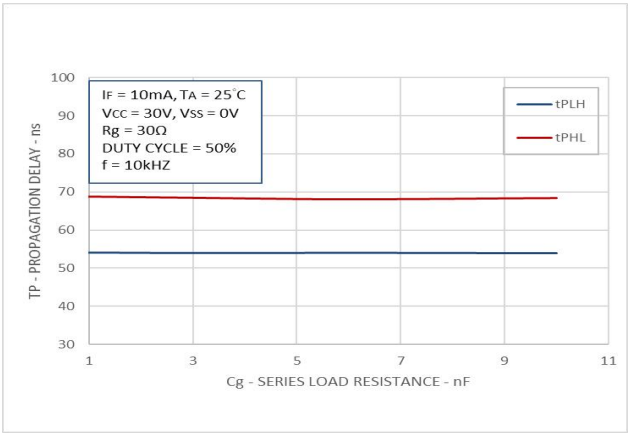


Fig.13 Input Current vs. Forward Voltage

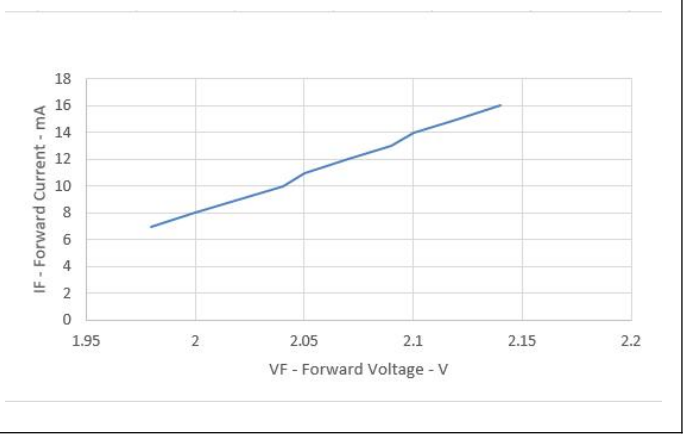


Fig.14 I_{OH} Test Circuit

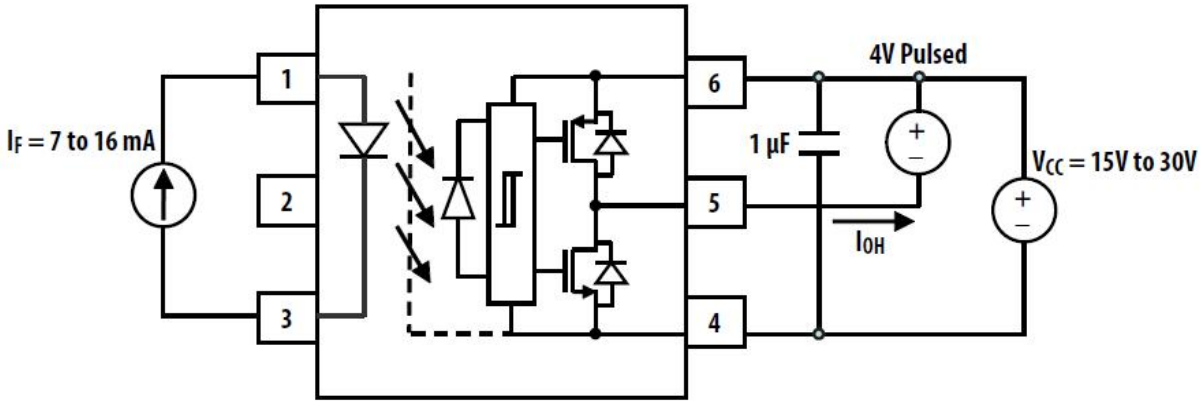


Fig.15 I_{OL} Test Circuit

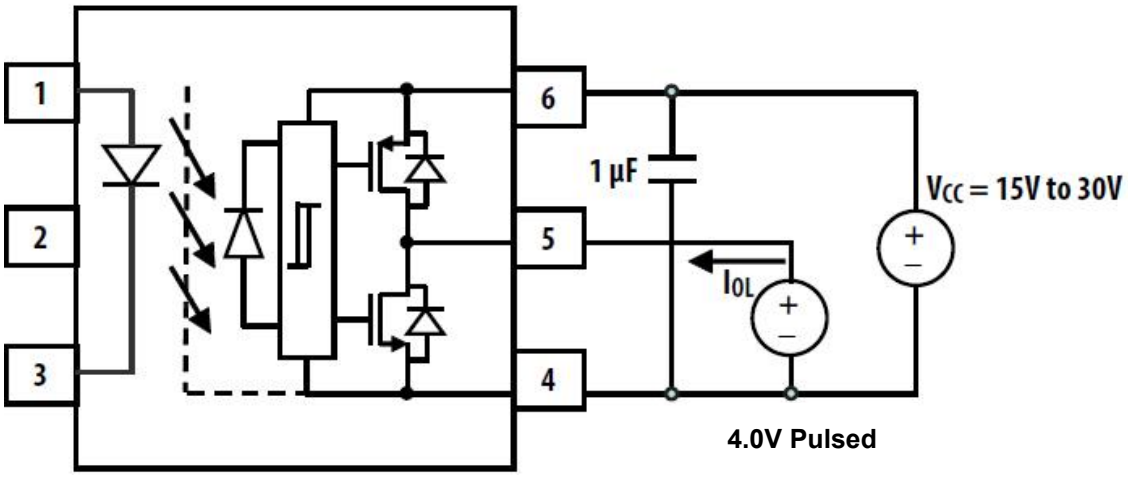


Fig.16 V_{OH} Test Circuit

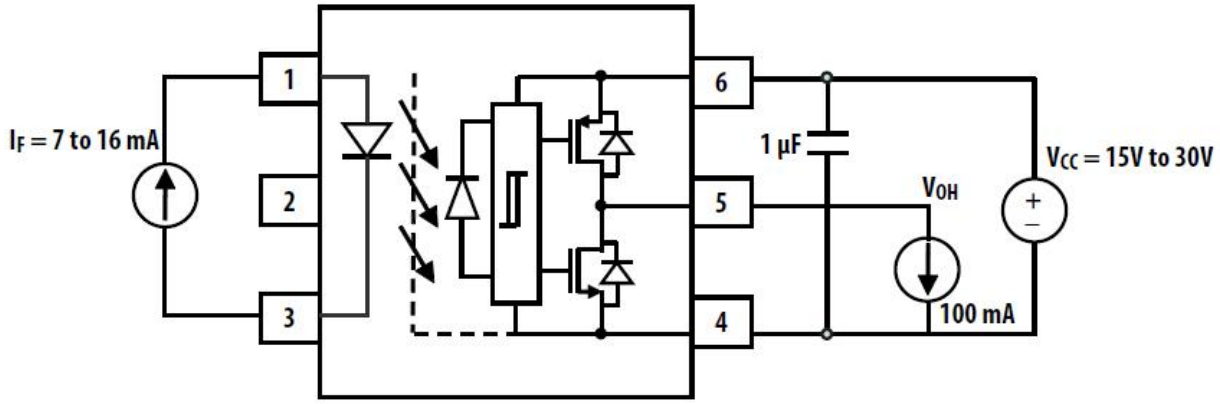


Fig.17 V_{OL} Test Circuit

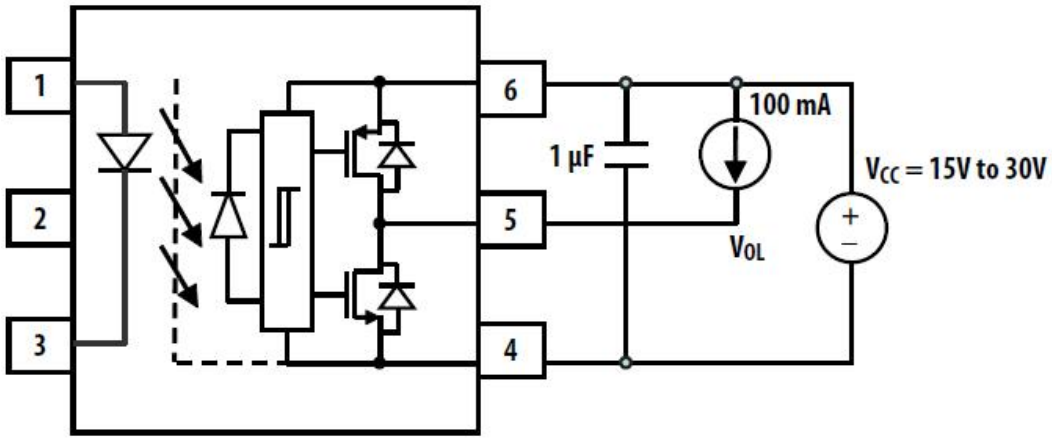


Fig.18 I_{FLH} Test Circuit

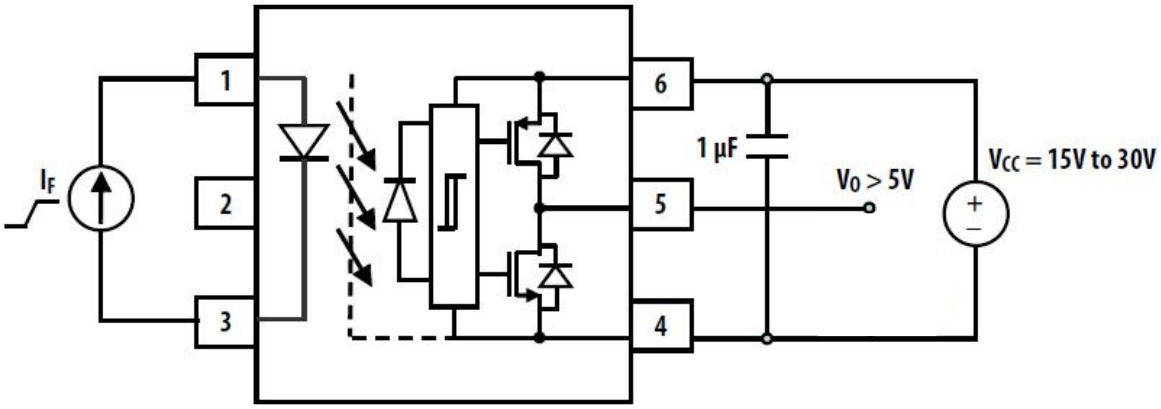


Fig.19 UVLO Test Circuit

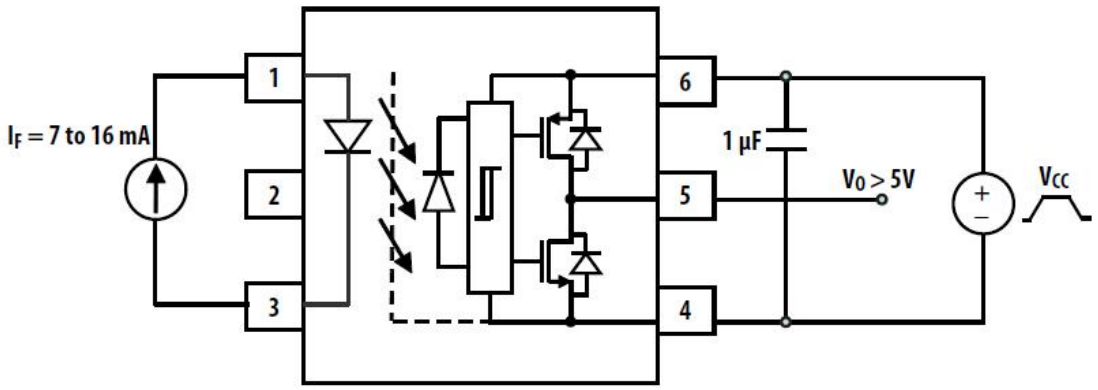


Fig.20 tPHL, tPLH, tr and tf Test Circuit and Waveforms

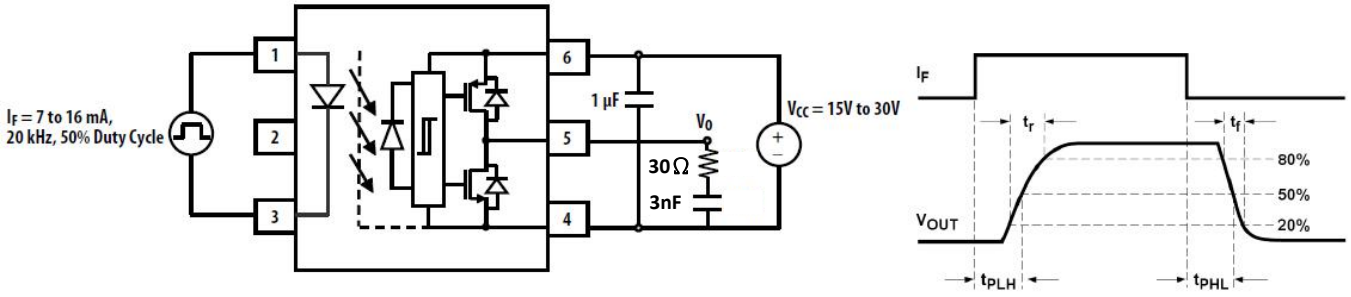
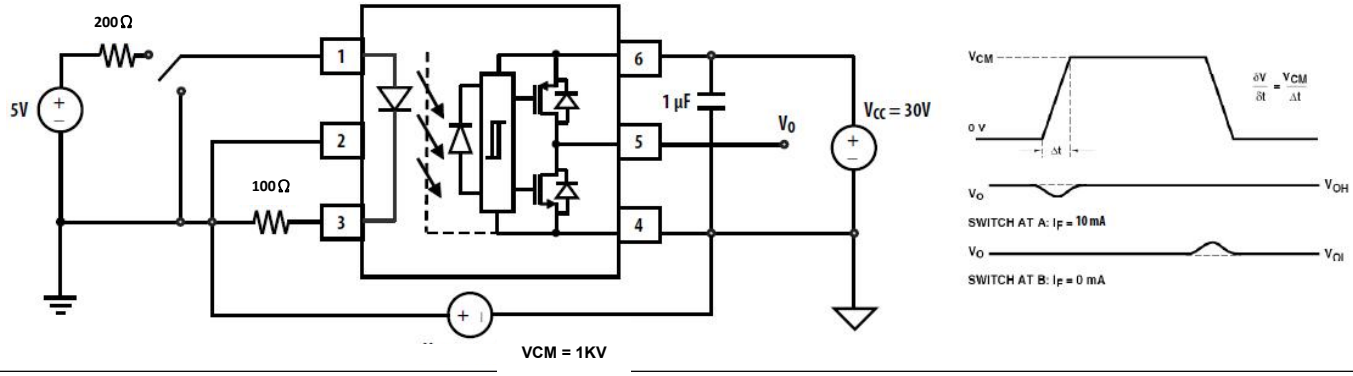
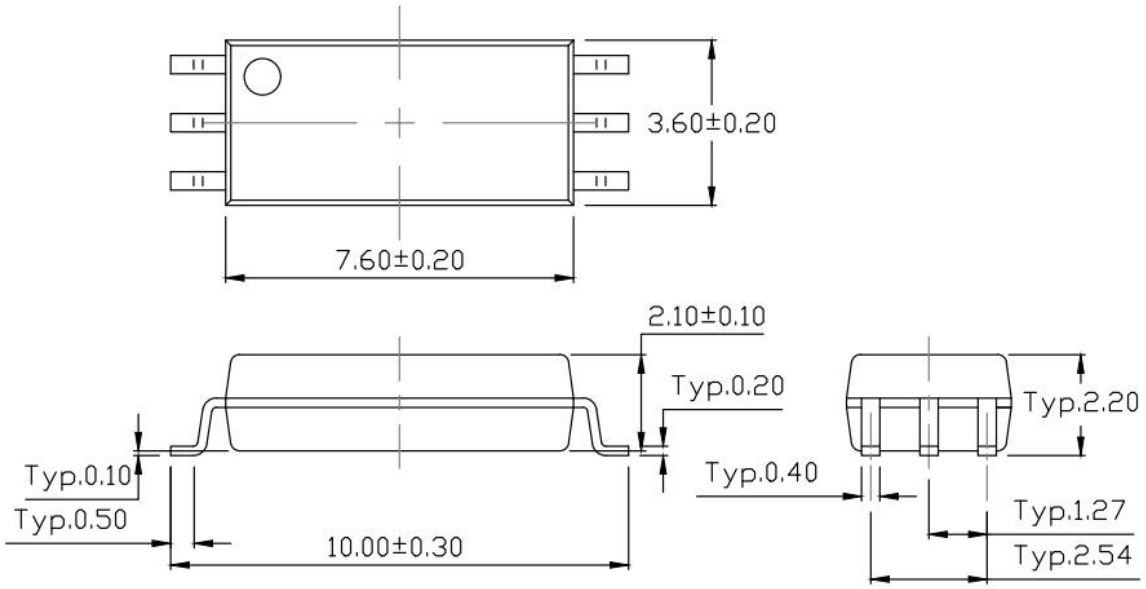


Fig.21 CMR Test Circuit with Split Resistors Network and Waveforms

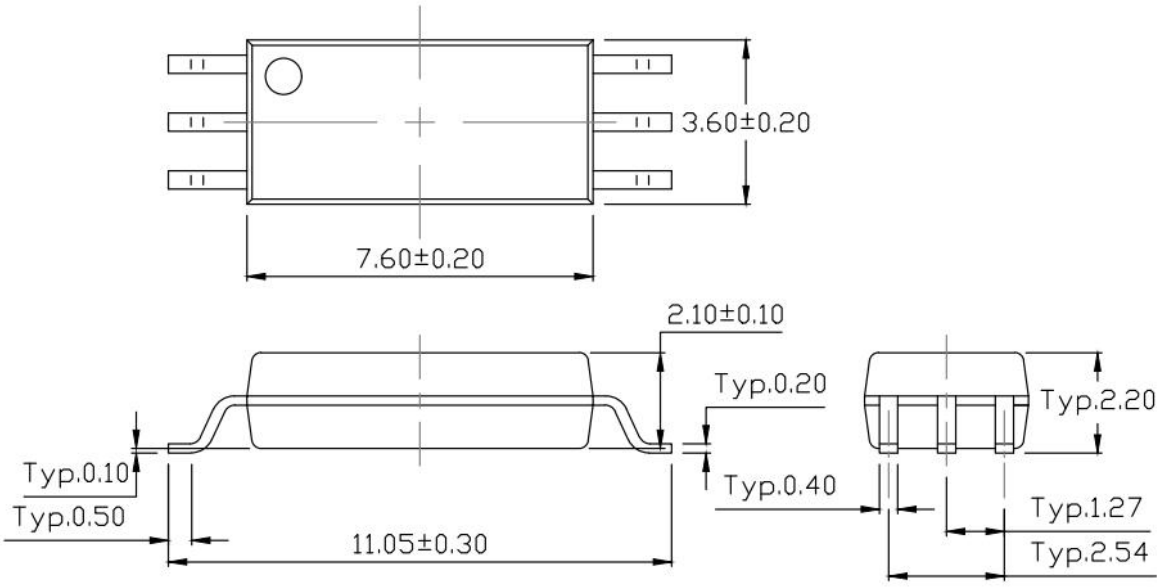


PACKAGE DIMENSIONS (Dimensions in mm unless otherwise stated)

Standard P Type



Standard W Type



ORDERING AND MARKING INFORMATION

MARKING INFORMATION

TD : Company Abbr.
314 : Part Number
V : VDE Option
Y : Fiscal Year
A : Manufacturing Code
WW : Work Week

ORDERING INFORMATION

TDL314(Y)(Z)-GV

TD – Company Abbr.
L – LSOP6
314 – Part Number
Y –Lead Form Option (P/W)
Z – Tape and Reel Option (T1/T2)
G – Green

PACKING QUANTITY

Option	Quantity	Quantity – Inner box	Quantity – Outer box
T1	3000 Units/Reel	3 Reels/Inner box	5 Inner box/Outer box = 45k Units
T2	3000 Units/Reel	3 Reels/Inner box	5 Inner box/Outer box = 45k Units

DISCLAIMER

- LIGHTNING is continually improving the quality, reliability, function and design. LIGHTNING reserves the right to make changes without further notices.
- The characteristic curves shown in this datasheet are representing typical performance which are not guaranteed.
- LIGHTNING makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, LIGHTNING disclaims (a) any and all liability arising out of the application or use of any product, (b) any and all liability, including without limitation special, consequential or incidental damages, and (c) any and all iMPCied warranties, including warranties of fitness for particular
- The products shown in this publication are designed for the general use in electronic applications such as office automation, equipment, communications devices, audio/visual equipment, electrical application and instrumentation purpose, non-infringement and merchantability.
- This product is not intended to be used for military, aircraft, medical, life sustaining or lifesaving applications or any other application which can result in human injury or death.
- Please contact LIGHTNING sales agent for special application request.
- Immerge unit's body in solder paste is not recommended.
- Parameters provided in datasheets may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated in each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify LIGHTNING's terms and conditions of purchase, including but not limited to the warranty expressed therein.
- Discoloration might be occurred on the package surface after soldering, reflow or long-time use. It neither impacts the performance nor reliability.