TDL341 Series

2.5A, Gate Driver Photo Coupler

Description

The TDL341 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 2.5A peak output current is capable of directly driving most IGBTs with ratings up to 1200 V/200 A. For IGBTs with higher ratings, the TDS341 series can be used to drive a discrete power stage which drives the IGBT gate.

The Photocoupler operational parameters are guaranteed over the temperature range from -40°C ~ +110°C.

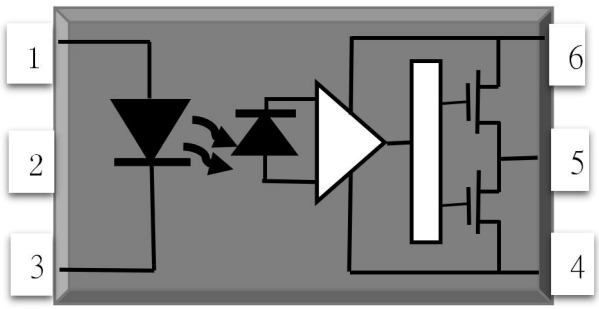
Features

- 2.5 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: 15 to 30 Volts (V_{CC})
- Guaranteed performance over temperature -40°C ~ +110°C.

Applications

- IGBT/MOSFET gate drive
- Uninterruptible power supply (UPS)
- Industrial Inverter
- AC/Brushless DC motor drives
- Switching power suppliers

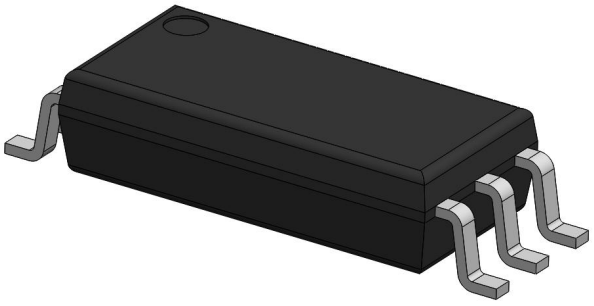
SCHEMATIC



PIN DEFINITION

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

PACKAGE



TRUTH TABLE			
LED	VCC-VSS (Turn-ON, +ve going)	VCC-VSS (Turn-OFF, -ve going)	VO
OFF	0 - 30 V	0 - 30 V	Low
ON	0 - 11.0 V	0 - 9.5 V	Low
ON	11.0 - 13.5 V	9.5 - 12 V	Transition
ON	13.5 - 30 V	12 - 30 V	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	Tstg	-55	125	°C	-
Operating Temperature	Topr	-40	100	°C	-
Output IC Junction Temperature	TJ	-	125	°C	-
Total Output Supply Voltage	(VCC –VSS)	0	35	V	-
Average Forward Input Current	IF	-	20	mA	-
Reverse Input Voltage	VR	-	5	V	-
“High” Peak Output Current	IOH(PEAK)	2.5	-	A	1
“Low” Peak Output Current	IOL(PEAK)	2.5	-	A	1
Output Voltage	VO(PEAK)	-0.5	Vcc	V	-
Power Dissipation	PI	-	45	mW	-
Output IC Power Dissipation	PO	-	700	mW	-
Lead Solder Temperature	Tsol	-	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 kHz

RECOMMENDED 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}	-	0.9	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}	29.7	29.88	-	V	I_F = 10 mA, I_O = -100 mA	2,3
Low Level Output Voltage	V_{OL}	-	0.1	0.3	V	I_F = 0 mA, I_O = 100 mA	
High Level Output Current	I_{OH}	-	-	-2.5	A	I_F = 10 mA, V_{CC} = 30V V_O = V_{CC} - 4	1
Low Level Output Current	I_{OL}	2.5	-	-	A	I_F = 0 mA, V_{CC} = 30V V_O = V_{SS} + 4	1
Under Voltage Lockout Threshold	VUVLO+	11.0	12.6	13.5	V	V_O > 5V, I_F = 10 mA	
	VUVLO-	9.5	11.2	12.0	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}	-	150	500	ns	Rg = 10Ω, Cg = 10 nF, f = 10kHz, Duty Cycle = 50%, I_F = 10mA, V_{CC} = 30V	-
Propagation Delay Time to Output High Level	t_{PLH}	-	170	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	-	50	-	ns		-
Fall Time	t_f	-	50	-	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 Forward Current vs. Forward Voltage

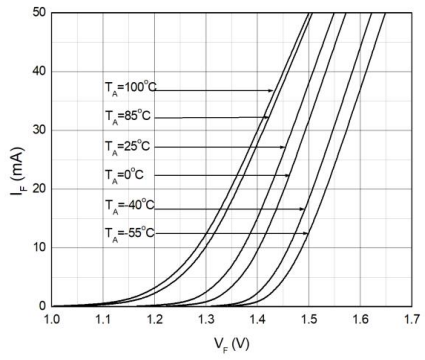


Fig.2 Forward Voltage vs. Ambient Temperature

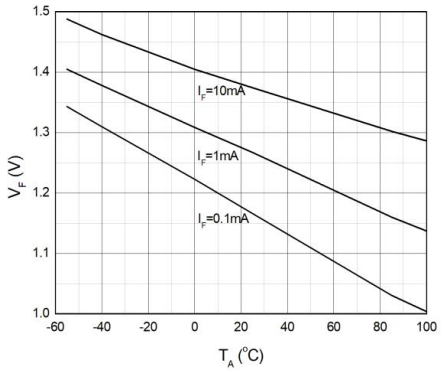


Fig.3 Supply Current vs. Ambient Temperature

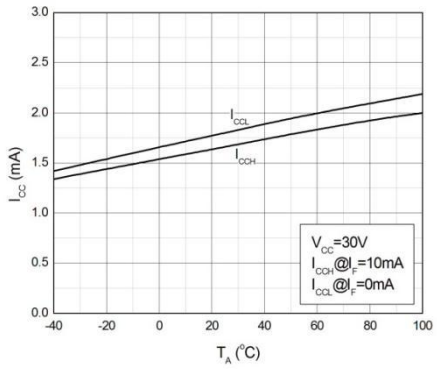


Fig.4 Supply Current vs. Supply Voltage

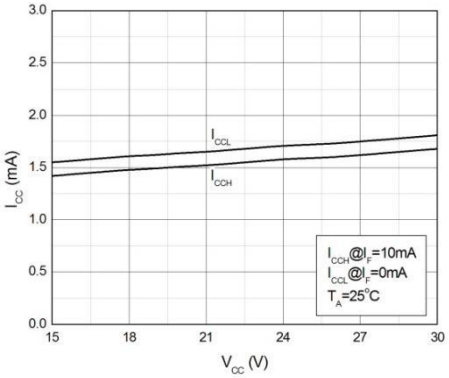


Fig.5 High Level Output Voltage vs. High Level Output Current

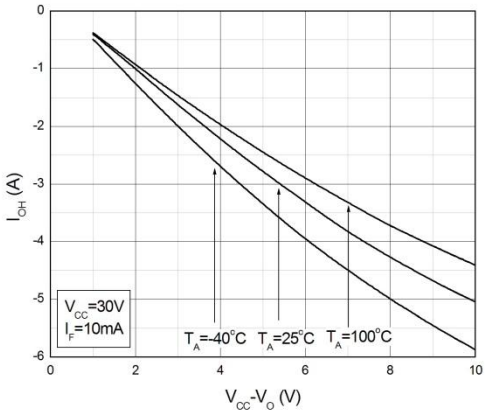
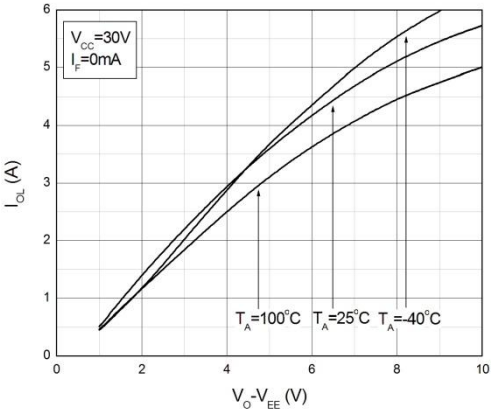


Fig.6 Low Level Output Voltage vs. Low Level Output Current



CHARACTERISTIC CURVES

Fig.7 High Level Output Voltage vs. Ambient Temperature

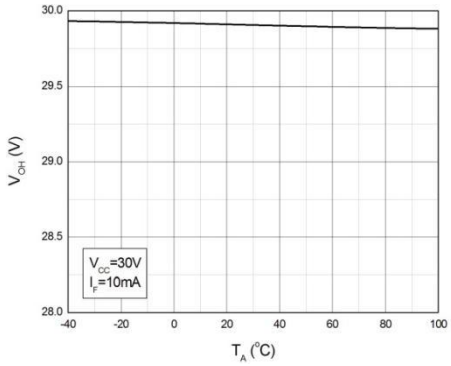


Fig.8 Low Level Output Voltage vs. Ambient Temperature

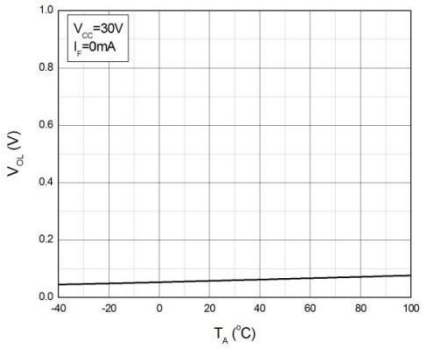


Fig.9 Output Voltage vs. Forward Current

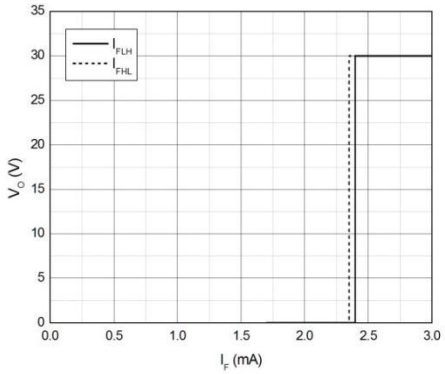


Fig.10 Output Voltage vs. Supply Voltage

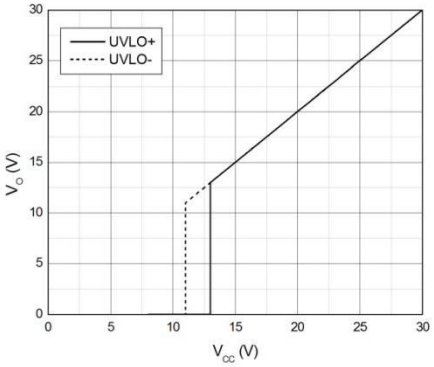


Fig.11 Forward Current vs. Ambient Temperature

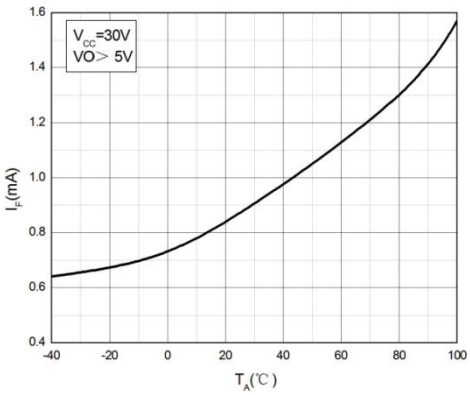
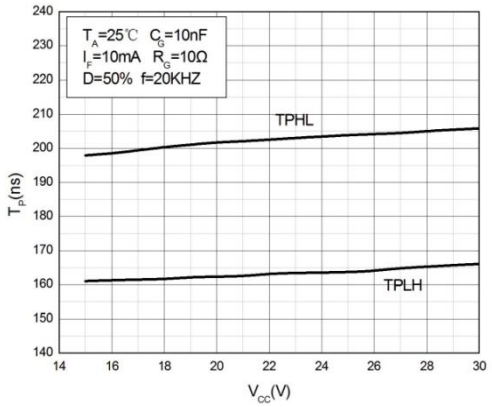


Fig.12 Propagation Delay vs. Supply Voltage



CHARACTERISTIC CURVES

Fig.13 Propagation Delay vs. Forward Current

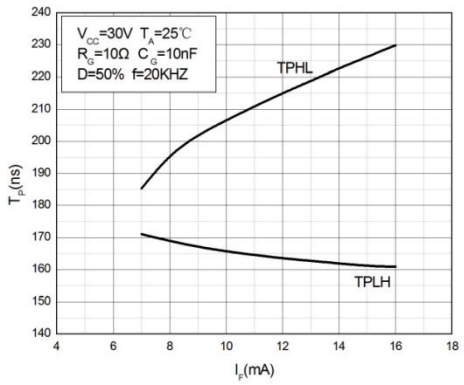


Fig.14 Propagation Delay vs. Ambient Temperature

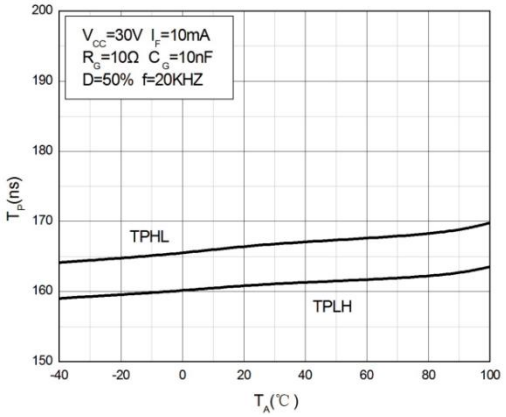


Fig.15 Propagation Delay vs. Load Resistance

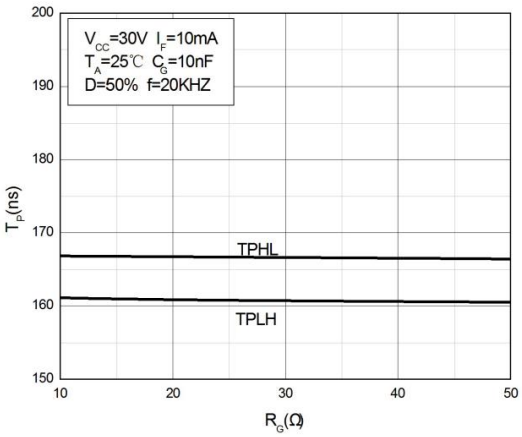
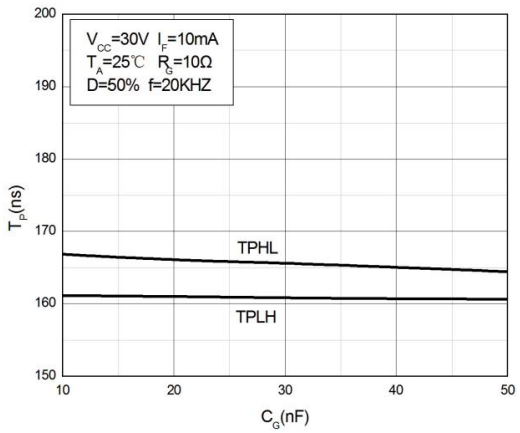


Fig.16 Propagation Delay vs. Load Capacitance



TEST CIRCUITS

Fig.17 Test Circuits for IOH

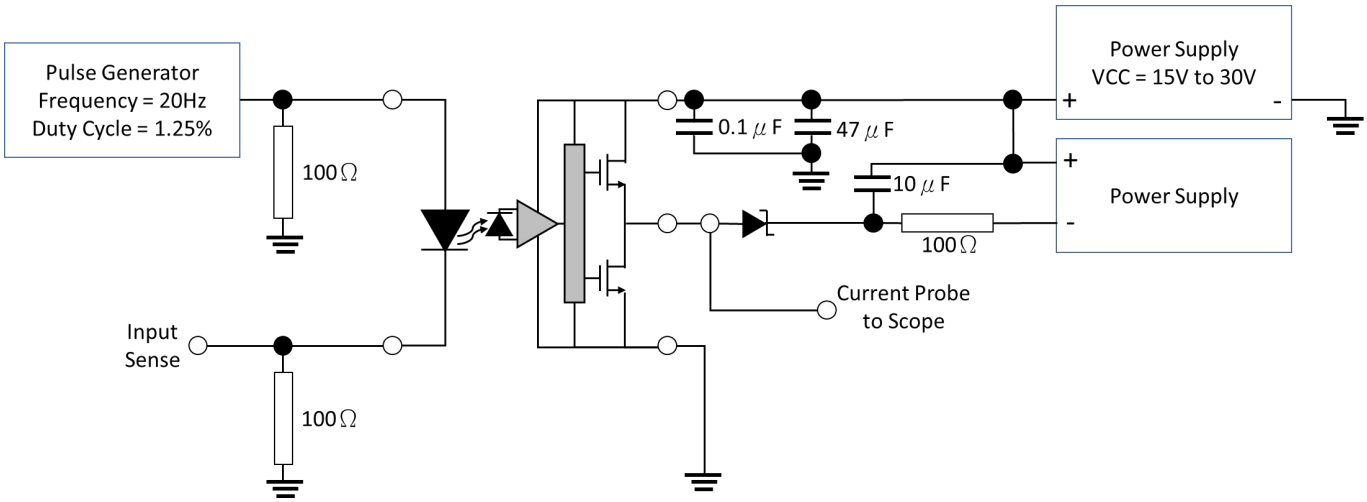
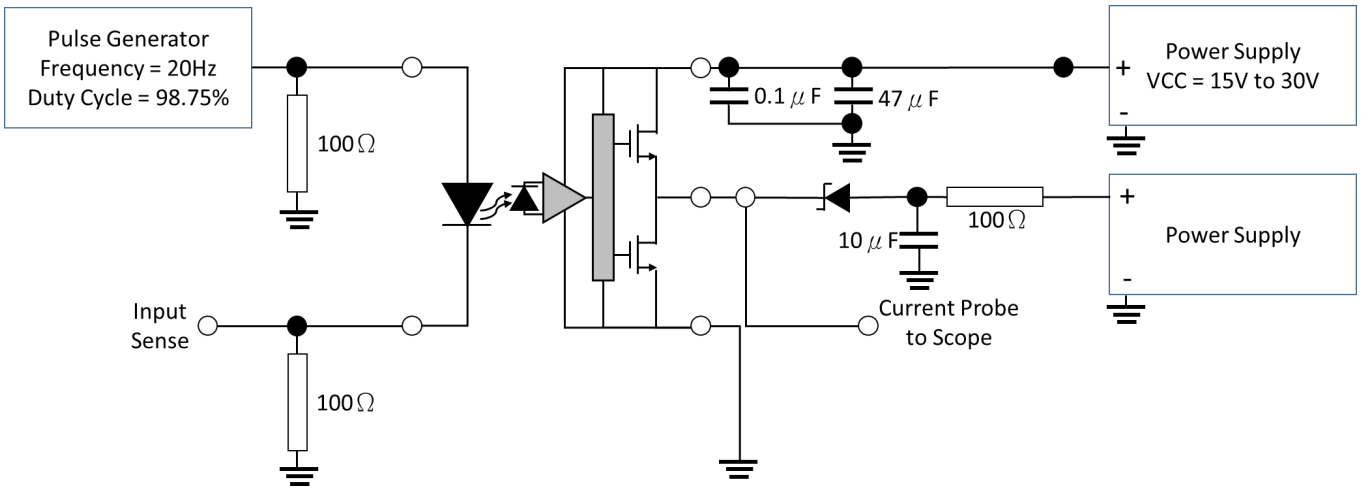


Fig.18 Test Circuits for IOL



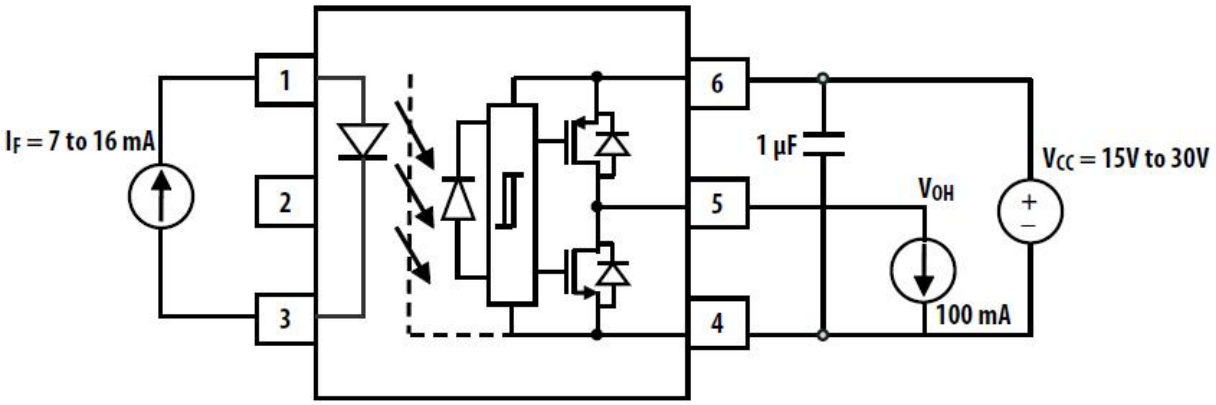


Fig.19 V_{OL} Test Circuit

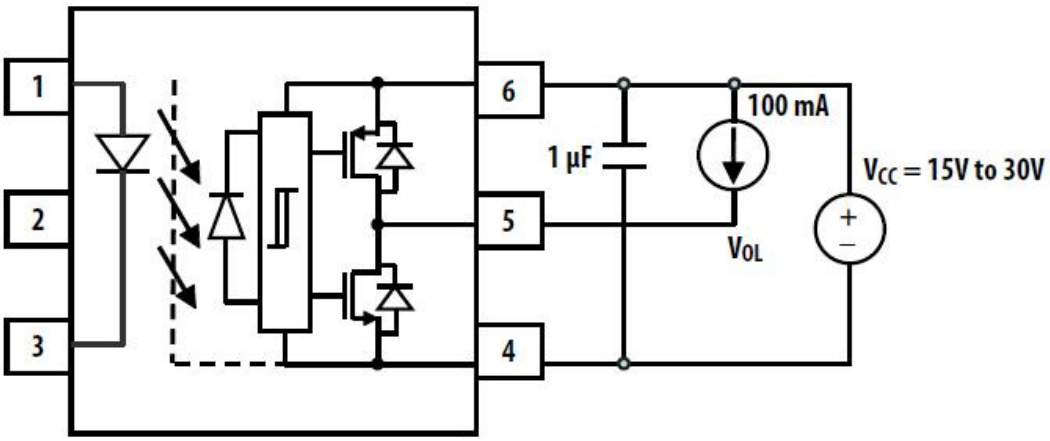


Fig.20 I_{FLH} Test Circuit

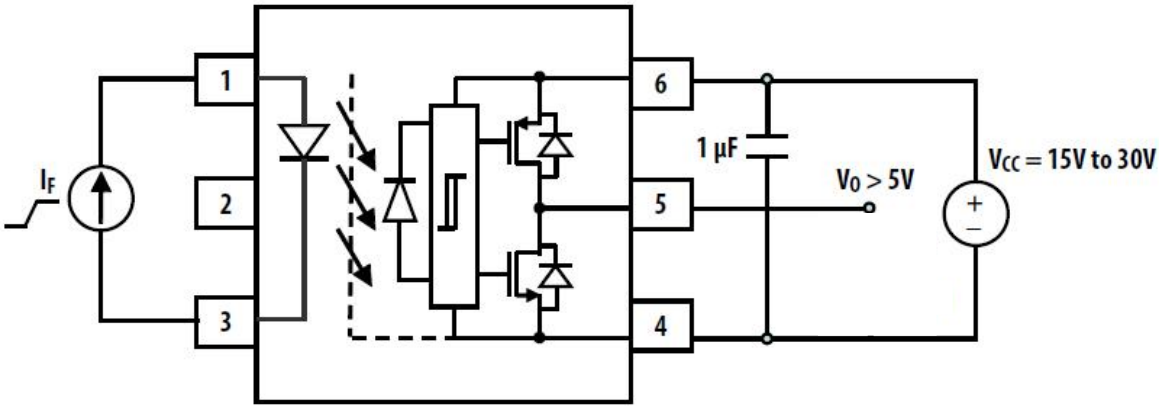


Fig.21 UVLO Test Circuit

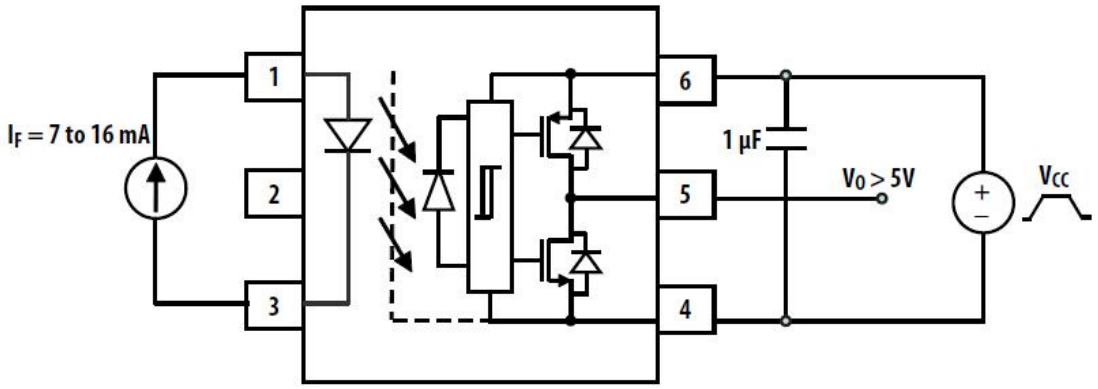


Fig.22 tPHL, tPLH, tr and tf Test Circuit and Waveforms

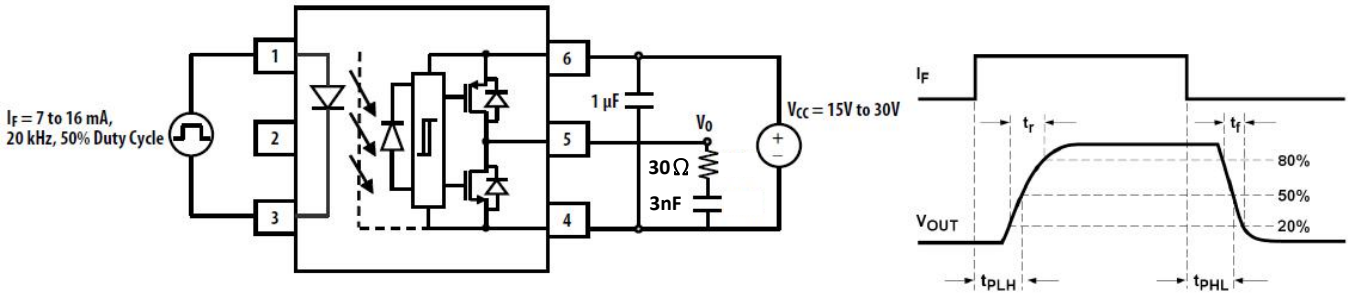
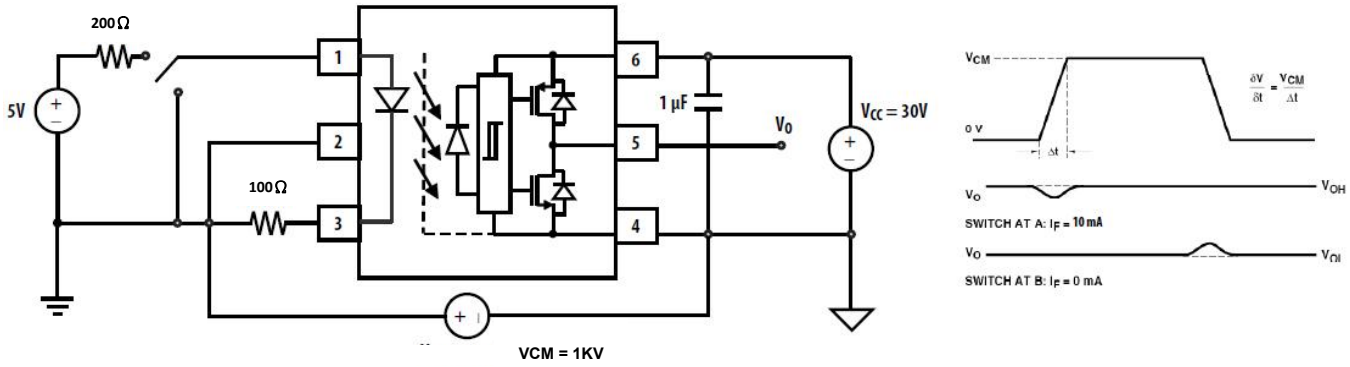
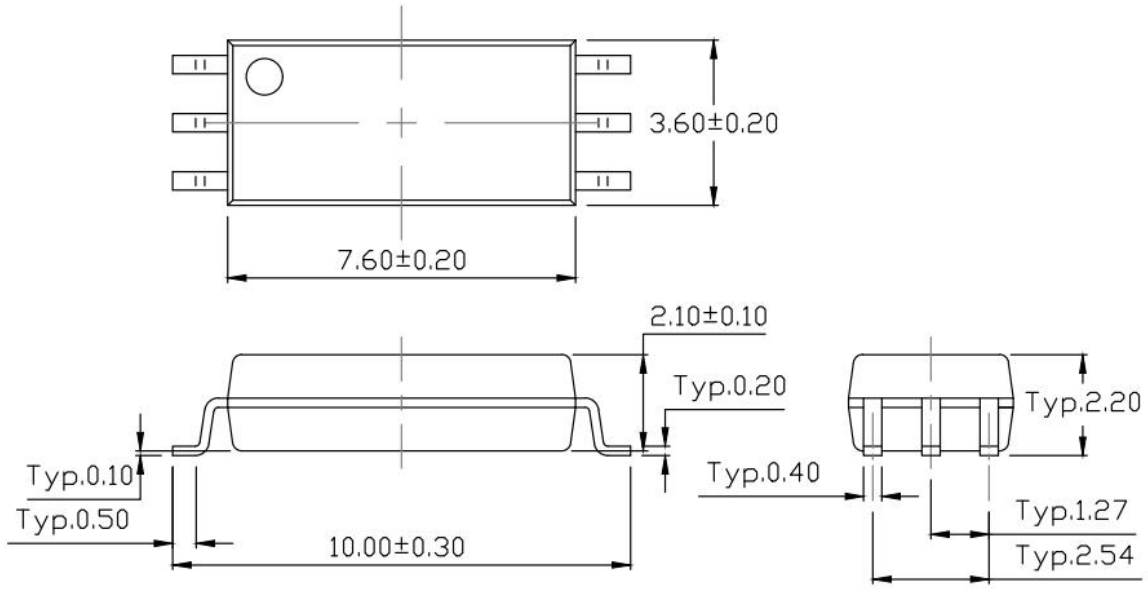


Fig.23 CMR Test Circuit with Split Resistors Network and Waveforms

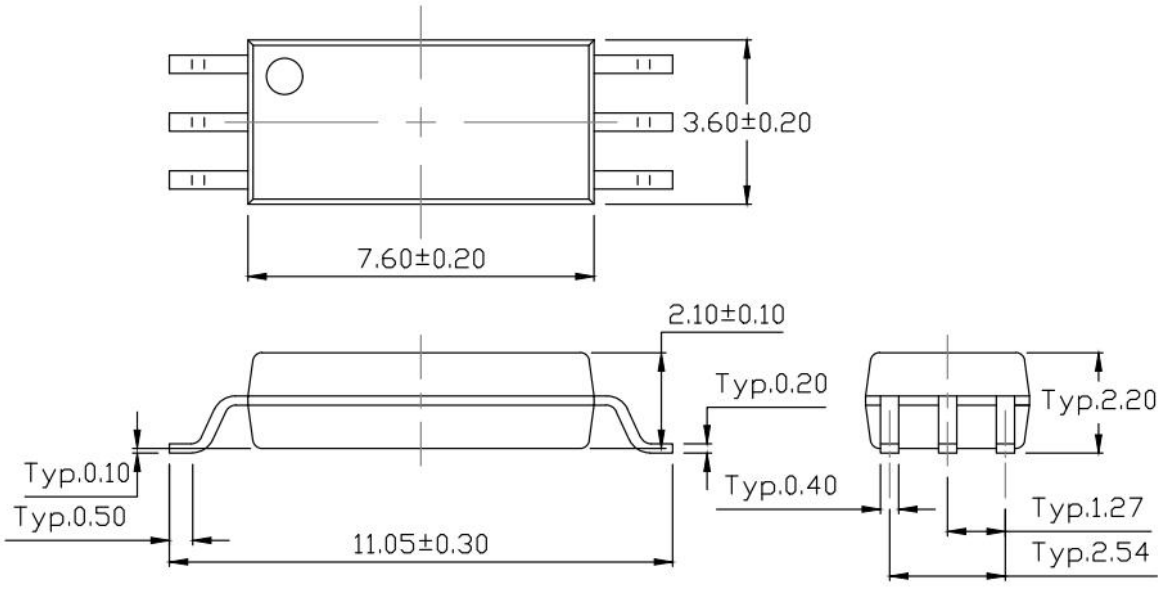


PACKAGE DIMENSIONS (Dimensions in mm unless otherwise stated)

Standard P Type

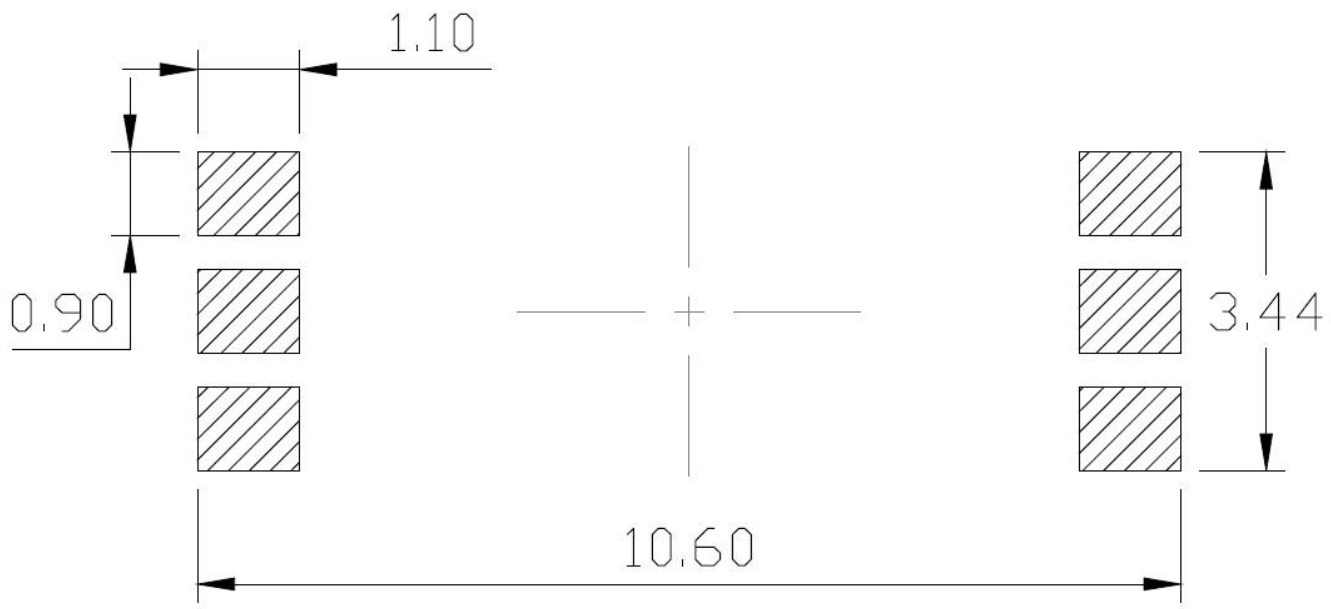


Standard W Type

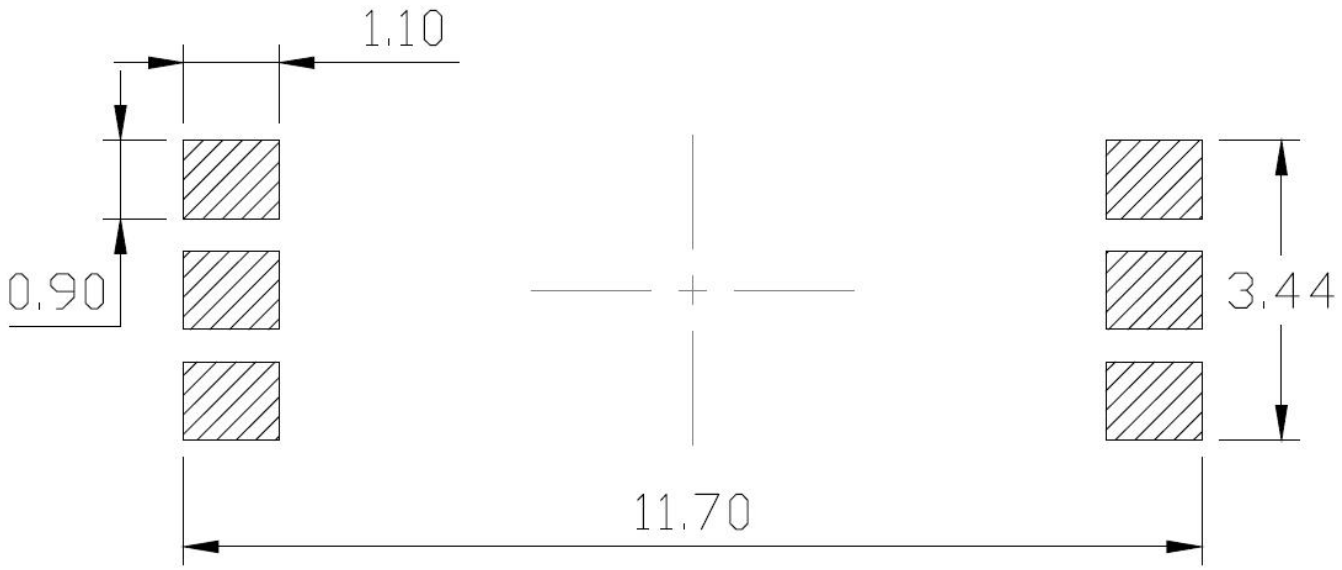


RECOMMENDED SOLDER MASK (Dimensions in mm unless otherwise stated)

Standard P Type

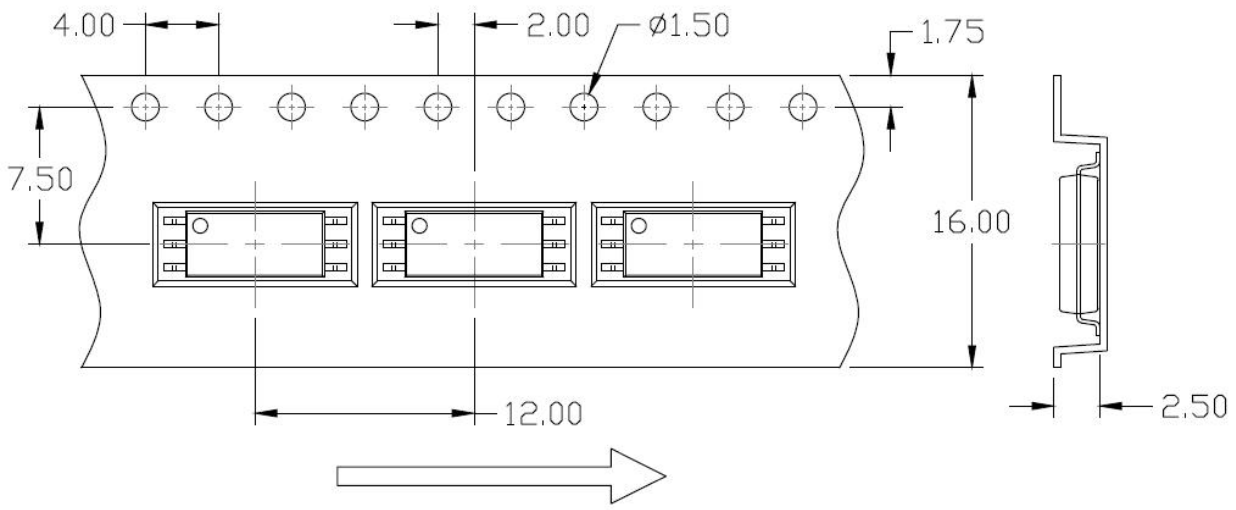


Standard W Type

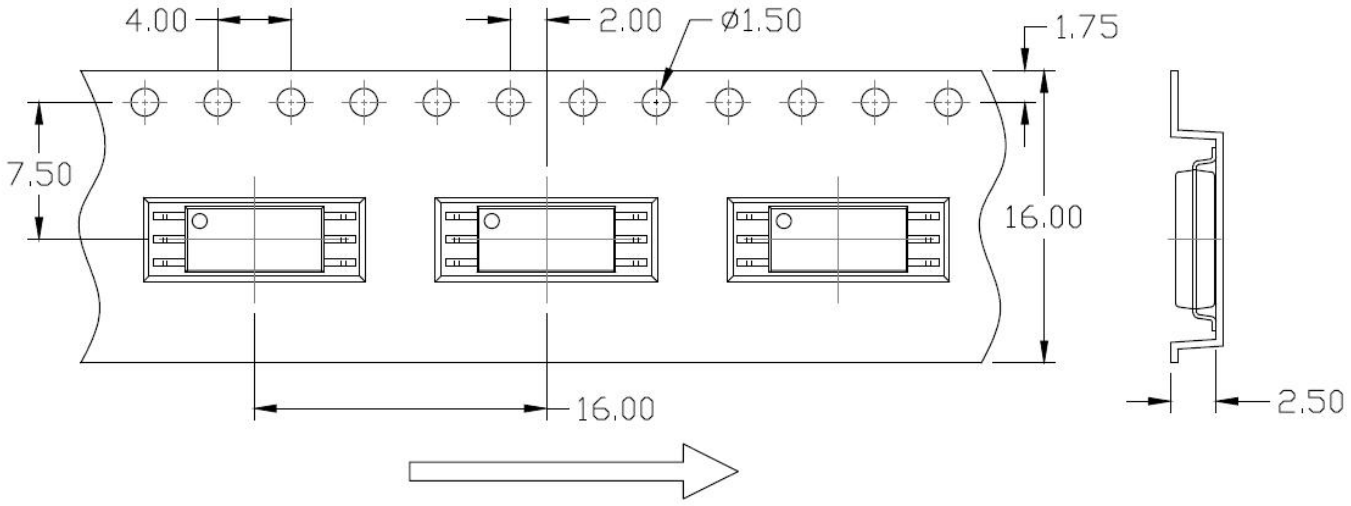


CARRIER TAPE SPECIFICATIONS (Dimensions in mm unless otherwise stated)

Standard P Type

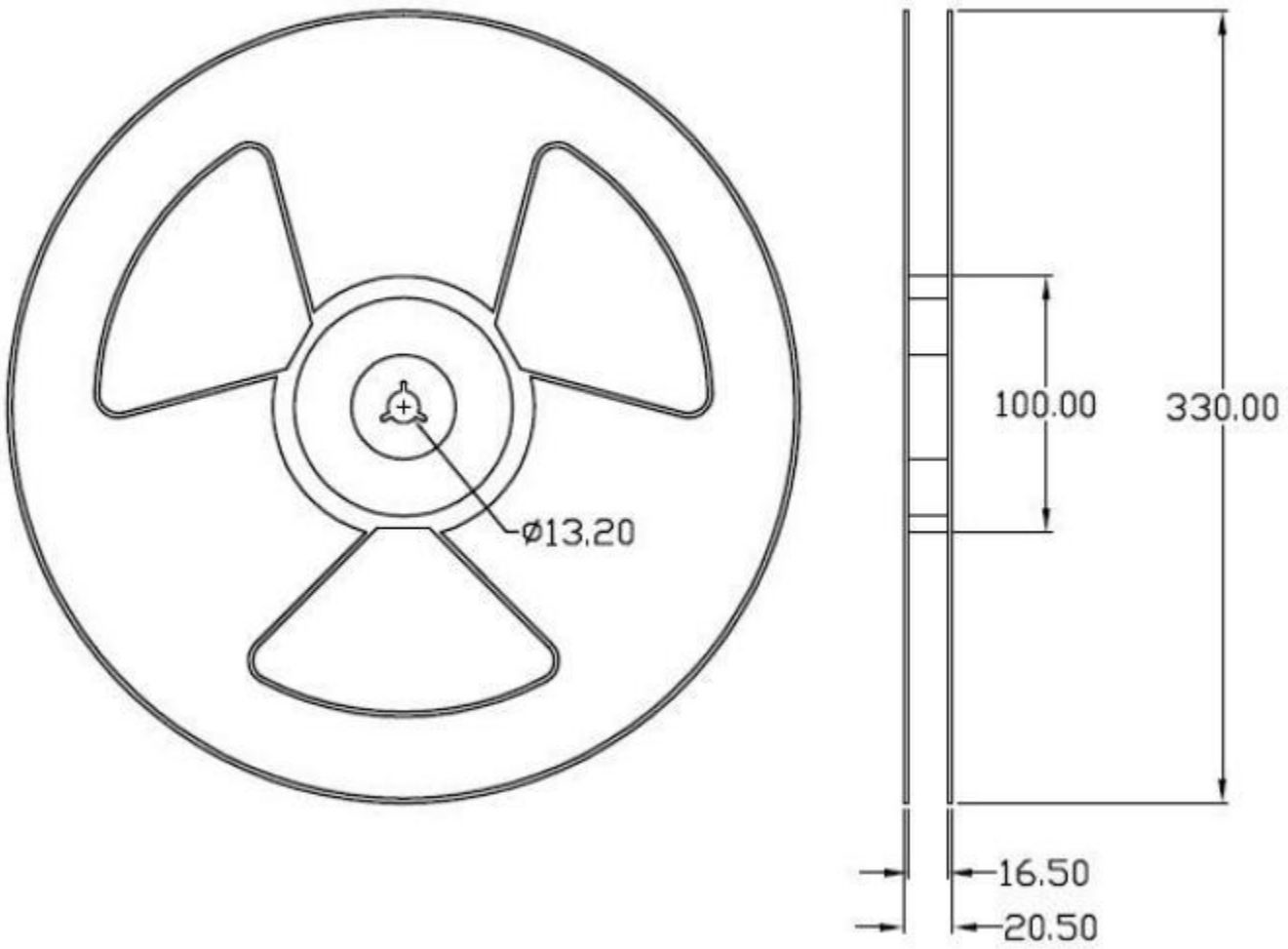


Standard W Type



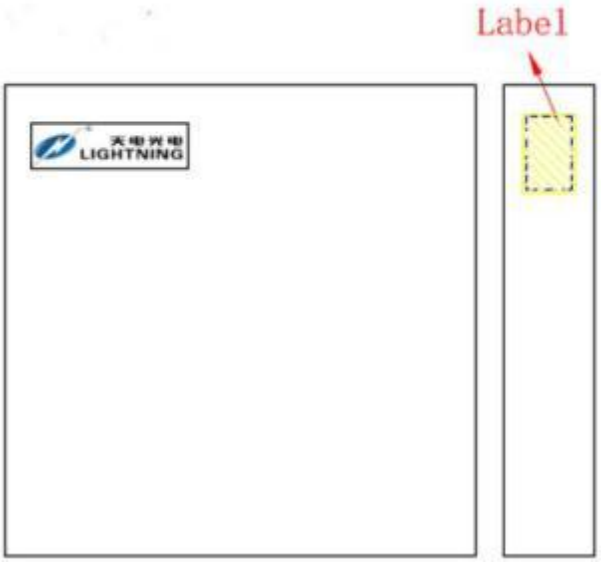
REEL SPECIFICATIONS (Dimensions in mm unless otherwise stated)

Option



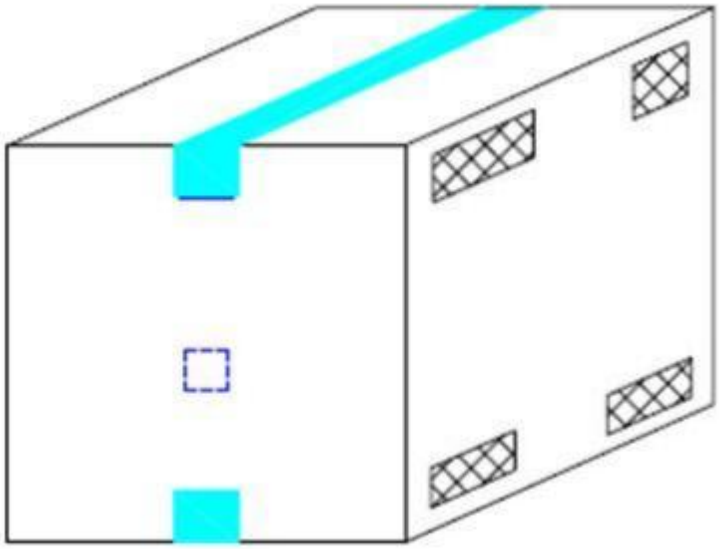
BOX SPECIFICATIONS (Reel Type)

Inner Box



- L x W x H = 36cm x 36cm x 6.9cm

Outer Box



- L x W x H = 45cm x 3

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.