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# Photocoupler

## Product Data Sheet

### LTV-3150-L Series

Spec No.: DS70-2013-0037

Effective Date: 04/19/2014

Revision: A

**LITE-ON DCC**

**RELEASE**

BNS-OD-FC001/A4

## Photocouplers LTV-3150-L series

### 1. DESCRIPTION

The LTV-3150-L is a 1.0A Output Current Gate Drive Optocoupler, capable of driving most 1200V/50A IGBT/MOSFET. It is ideally suited for fast switching driving of power IGBT and MOSFETs used in motor control inverter applications, and high performance power system. It consists of a gallium aluminum arsenide (AlGaAs) light emitting diode optically coupled to an integrated circuit with a high-speed driver for push-pull MOSFET output stage.

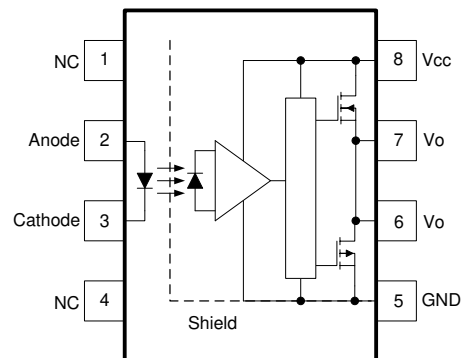
#### 1.1 Features

- 1.0 A maximum peak output current
- 0.8 A minimum peak output current
- Rail-to-rail output voltage
- 400 ns maximum propagation delay
- 150 ns maximum propagation delay difference
- 15 kV/us minimum Common Mode Rejection (CMR) at  $V_{CM} = 1500\text{ V}$
- $I_{CC} = 3.0\text{ mA}$  maximum supply current
- Wide operating range: 10 to 30 Volts ( $V_{CC}$ )
- Guaranteed performance over temperature  $-40^{\circ}\text{C} \sim +105^{\circ}\text{C}$ .
- MSL Level 1
- Safety approval:
  - UL/ cUL Recognized 5000  $V_{RMS}/1\text{ min}$
  - IEC/EN/DIN EN 60747-5-5  $V_{IORM} = 630\text{ V}_{peak}$

#### 1.2 Applications

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

#### Functional Diagram



A 0.1 $\mu\text{F}$  bypass Capacitor must be connected between Pin 5 and 8. See note 11.

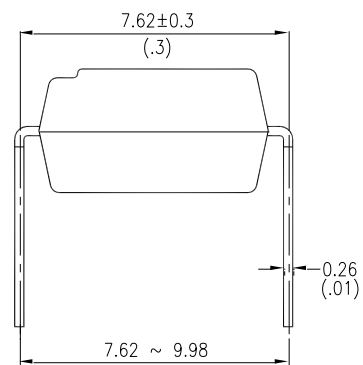
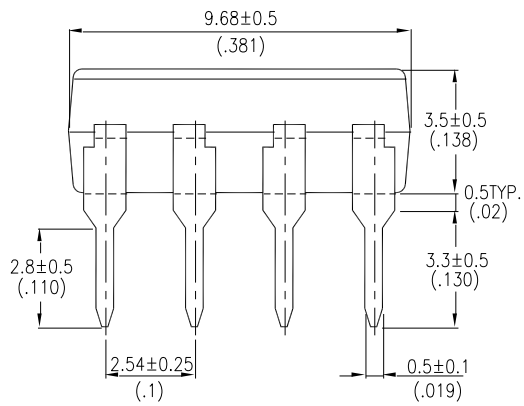
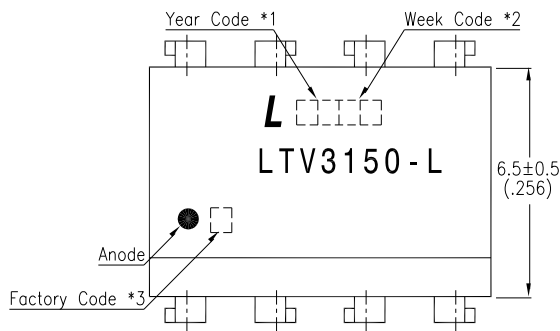
#### Truth Table

LED	High side	Low side	$V_o$
OFF	OFF	ON	Low
ON	ON	OFF	High

# Photocouplers LTV-3150-L series

## 2. PACKAGE DIMENSIONS

### 2.1 LTV-3150-L



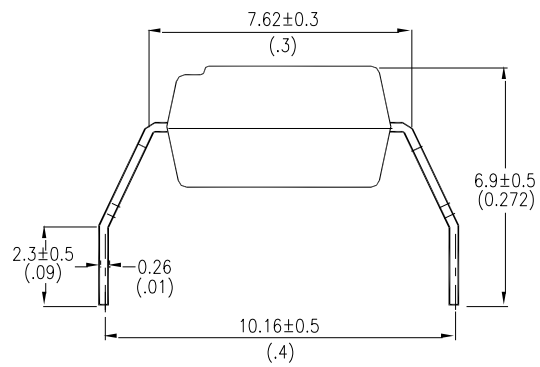
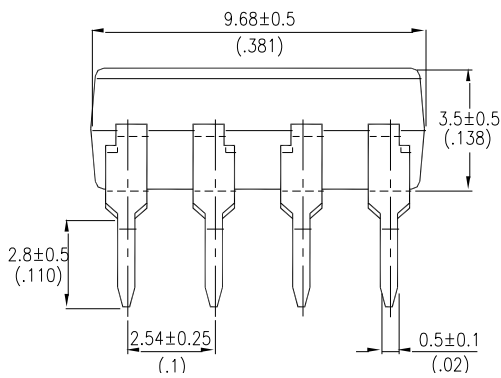
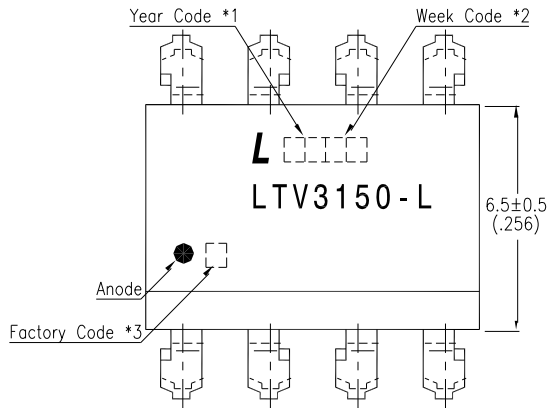
#### Notes :

- \*1. Year date code.
- \*2. 2-digit work week.
- \*3. Factory identification mark  
(Y : Thailand).

Dimensions are in Millimeters and (Inches).

## Photocouplers LTV-3150-L series

### 2.2 LTV-3150M-L



### Notes

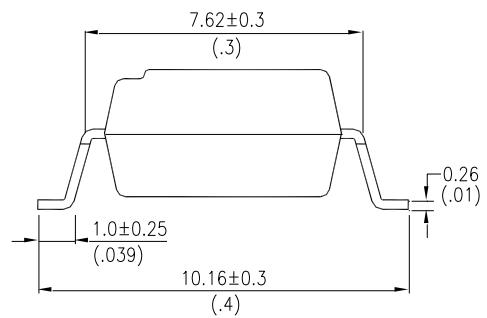
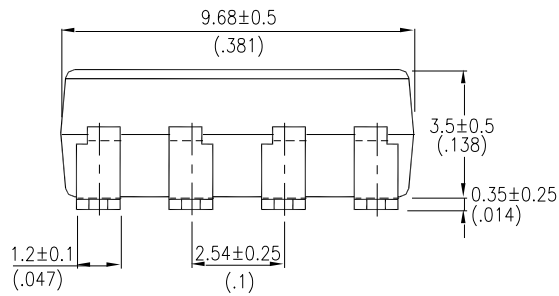
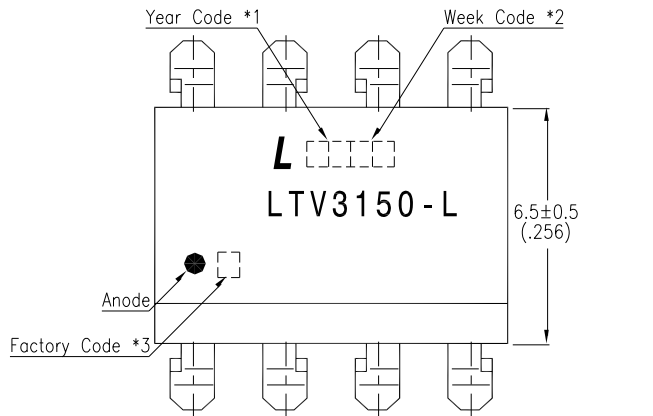
- \*1. Year date code.
- \*2. 2-digit work week.
- \*3. Factory identification mark

(Y : Thailand).

Dimensions are in Millimeters and (Inches).

## Photocouplers LTV-3150-L series

### 2.3 LTV-3150S-L



#### Notes :

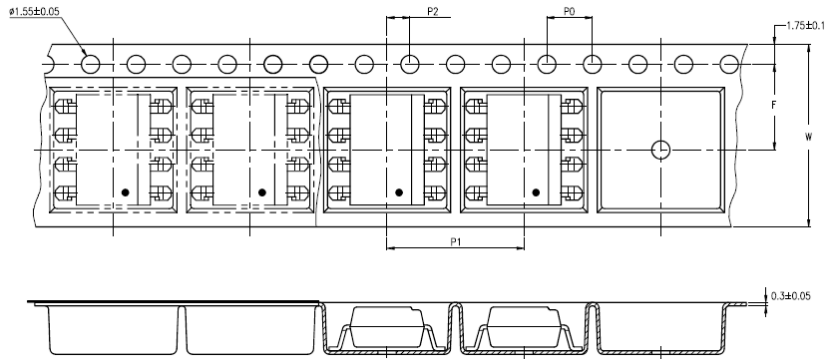
- \*1. Year date code.
- \*2. 2-digit work week.
- \*3. Factory identification mark  
(Y : Thailand).

Dimensions are in Millimeters and (Inches).

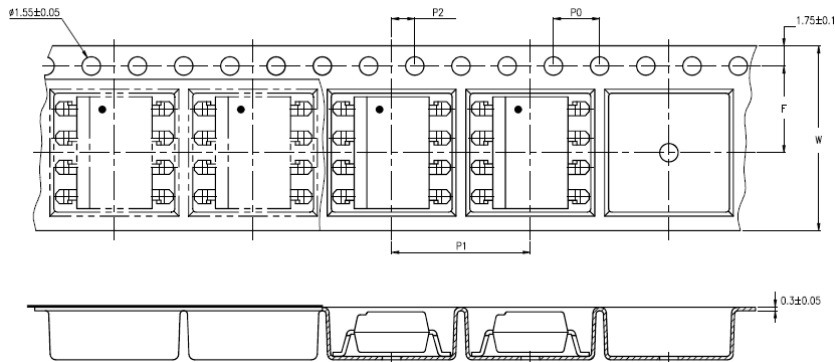
## Photocouplers LTV-3150-L series

### 3. TAPING DIMENSIONS

#### 3.1 LTV-3150S-TA-L



#### 3.2 LTV-3150S-TA1-L



Description	Symbol	Dimension in mm (inch)
Tape wide	W	16±0.3 (0.63)
Pitch of sprocket holes	P <sub>0</sub>	4±0.1 (0.15)
Distance of compartment	F	7.5±0.1 (0.295)
	P <sub>2</sub>	2±0.1 (0.079)
Distance of compartment to compartment	P <sub>1</sub>	12±0.1 (0.47)

#### 3.3 Quantities Per Reel

Package Type	LTV-3150-L
Quantities (pcs)	1000

## Photocouplers LTV-3150-L series

### 4. RATING AND CHARACTERISTICS

#### 4.1 Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit	Note
Storage Temperature	$T_{stg}$	-55	+125	°C	
Operating Temperature	$T_{opr}$	-40	+105	°C	
Output IC Junction Temperature	$T_J$		125	°C	
Isolation Voltage	$V_{iso}$	5000		$V_{RMS}$	
Total Output Supply Voltage	$(V_{CC} - V_{EE})$	0	35	V	
Average Forward Input Current	$I_F$		25	mA	
Reverse Input Voltage	$V_R$		5	V	
Peak Transient Input Current ( $<1 \mu s$ pulse width, 300 pps)	$I_{F(TRAN)}$		1	A	
“High” Peak Output Current	$I_{OH(PEAK)}$		1.0	A	1
“Low” Peak Output Current	$I_{OL(PEAK)}$		1.0	A	1
Input Current (Rise/Fall Time)	$t_{r(IN)} / t_{f(IN)}$		500	ns	
Output Voltage	$V_{O(PEAK)}$	-0.5	$V_{CC}$	V	
Power Dissipation	$P_I$		40	mW	
Output Power Dissipation	$P_O$		250	mW	
Total Power Dissipation	$P_T$		295	mW	
Lead Solder Temperature	$T_{sol}$		260	°C	

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.

#### 4.2 Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
Operating Temperature	$T_A$	-40	105	°C
Supply Voltage	$V_{CC}$	10	30	V
Input Current (ON)	$I_{FL(ON)}$	7	16	mA
Input Voltage (OFF)	$V_{F(OFF)}$	-3.0	0.8	V



## Photocouplers LTV-3150-L series

### 4.3 ELECTRICAL OPTICAL CHARACTERISTICS

	Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition	Figure	Note
Input	Input Forward Voltage	$V_F$	1.2	1.37	1.8	V	$I_F = 10\text{mA}$	13	
	Input Forward Voltage Temperature Coefficient	$\Delta V_F / \Delta T$	—	-1.237	—	mV/°C	$I_F = 10\text{mA}$		
	Input Reverse Voltage	$BV_R$	5	—	—	V	$I_R = 10\mu\text{A}$		
	Input Threshold Current (Low to High)	$I_{FLH}$	—	1.4	5	mA	$R_g = 10\Omega$ , $C_g = 25\text{nF}$ , $V_O > 5\text{V}$	6, 7,18	
	Input Threshold Voltage (High to Low)	$V_{FHL}$	0.8	—	—	V			
	Input Capacitance	$C_{IN}$	—	33	—	pF	$f = 1\text{MHz}$ , $V_F = 0\text{V}$		
Output	High Level Supply Current	$I_{CCH}$	—	1.9	3.0	mA	$R_g = 10\Omega$ , $C_g = 25\text{nF}$ , $I_F = 10\text{mA}$	4, 5	
	Low Level Supply Current	$I_{CCL}$	—	2.1	3.0	mA	$R_g = 10\Omega$ , $C_g = 25\text{nF}$ , $V_F = 0\text{V}$		
	High level output current	$I_{OH}$	—	—	-0.6.	A	$V_O = (V_{CC} - 2.5\text{V})$	16	1
			—	—	-1.0		$V_{CC} - V_O \leq 15\text{V}$		2
	Low level output current	$I_{OL}$	0.6	—	—	A	$V_O = (V_{CC} + 2.0\text{V})$	17	1
			1.0	—	—		$V_{CC} - V_{EE} \leq 15\text{V}$		3
	High level output voltage	$V_{OH}$	$V_{CC} - 0.25$	$V_{CC} - 0.1$		V	$I_F = 10\text{mA}$ , $I_O = -100\text{mA}$	1, 2, 14	4
Low level output voltage	$V_{OL}$		$V_{EE} + 0.1$	$V_{EE} + 0.25$	V	$I_F = 0\text{mA}$ , $I_O = 100\text{mA}$	3, 15		

All Typical values at  $T_A = 25^\circ\text{C}$  and  $V_{CC} - V_{EE} = 30\text{V}$ , unless otherwise specified; all minimum and maximum specifications are at recommended operating condition. (As page 6)

## Photocouplers LTV-3150-L series

### 5. SWITCHING SPECIFICATION

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition	Figure	Note
Propagation Delay Time to High Output Level	$t_{PHL}$	100	242	400	ns	$R_g = 10\Omega$ , $C_g = 25nF$ , $f = 20\text{ kHz}$ , Duty Cycle = 50% $I_F = 7\text{ to }16\text{ mA}$ , $V_{CC} = 15\text{ to }30V$ $V_{EE} = \text{ground}$	8, 9, 10, 11, 12, 19	
Propagation Delay Time to Low Output Level	$t_{PLH}$	100	183	400				
Pulse Width Distortion	PWD		-60	-120				10
Propagation delay difference between any two parts or channels	PDD	-150		150			7	
Output Rise Time (20 to 80%)	$T_r$		42				19	
Output Fall Time (80 to 20%)	$T_f$		50					
Common mode transient immunity at high level output	CMH	15			kV/ $\mu$ s	$T_A = 25^\circ\text{C}$ , $I_F = 10\text{ to }16\text{ mA}$ , $V_{CM} = 1500\text{ V}$ , $V_{CC} = 30\text{ V}$	20	8
Common mode transient immunity at low level output	CML	15			kV/ $\mu$ s	$T_A = 25^\circ\text{C}$ , $V_F = 0\text{ V}$ , $V_{CM} = 1500\text{ V}$ , $V_{CC} = 30\text{ V}$		9

All Typical values at  $T_A = 25^\circ\text{C}$  and  $V_{CC} - V_{EE} = 30\text{ V}$ , unless otherwise specified; all minimum and maximum specifications are at recommended operating condition. (As page 6)

## Photocouplers LTV-3150-L series

### 6. ISOLATION CHARACTERISTIC

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition	Note
Withstand Insulation Test Voltage	$V_{ISO}$	5000	—	—	V	RH $\leq$ 50%, t = 1min, $T_A = 25^\circ\text{C}$	5, 6
Input-Output Resistance	$R_{I-O}$	—	$6.5 \times 10^{11}$	—	$\Omega$	$V_{I-O} = 500\text{V DC}$	5
Input-Output Capacitance	$C_{I-O}$	—	1.0	—	pF	f = 1MHz	

All Typical values at  $T_A = 25^\circ\text{C}$  unless otherwise specified. All minimum and maximum specifications are at recommended operating condition. (As page 6)

#### Notes:

- 1) Maximum pulse width = 10 $\mu\text{s}$ , maximum duty cycle = 0.2%.
- 2) Output is sourced at -1.0A with a maximum pulse width = 10 $\mu\text{s}$ .  $V_{CC}-V_O$  is measured to ensure 15 V or below.
- 3) Output is sourced at 1.0 A with a maximum pulse width = 10 $\mu\text{s}$ .  $V_O-V_{EE}$  is measured to ensure 15 V or below.
- 4) In this test  $V_{OH}$  is measured with a dc load current. When driving capacitive loads,  $V_{OH}$  will approach  $V_{CC}$  as  $I_{OH}$  approaches zero amps.
- 5) Device is considered a two terminal device: pins 1, 2, 3 and 4 are shorted together and pins 5, 6, 7 and 8 are shorted together.
- 6) According to UL1577, each optocoupler is tested by applying an insulation test voltage 5250  $V_{RMS}$  for one second (leakage current less than 10uA). This test is performed before the 100% production test for partial discharge
- 7) The difference between  $T_{PHL}$  and  $T_{PLH}$  between any two LTV-3150-L parts under same test conditions.
- 8) Common mode transient immunity in high stage is the maximum tolerable negative  $dV_{CM}/dt$  on the trailing edge of the common mode impulse signal,  $V_{CM}$ , to assure that the output will remain high.
- 9) Common mode transient immunity in low stage is the maximum tolerable positive  $dV_{CM}/dt$  on the leading edge of the common mode impulse signal,  $V_{CM}$ , to assure that the output will remain low.
- 10) Pulse Width Distortion is defined as  $T_{PHL} - T_{PLH}$  for any given device.
- 11) At least a 0.1 $\mu\text{F}$  or bigger bypass capacitor must be connected/ closed across pin 8 and pin 5. Failure to provide the bypass may impair the switching property. Normally, it is recommended to place a 1 $\mu\text{F}$  multi-layer ceramic capacitor. To parallel one larger capacitor (>1 $\mu\text{F}$ ) to optimize performance is better.

# Photocouplers LTV-3150-L series

## 7. TYPICAL PERFORMANCE CURVES & TEST CIRCUITS

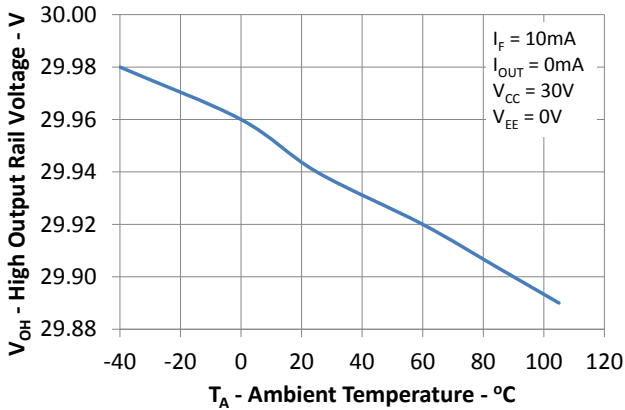


Figure 1: High output rail voltage vs. Temperature

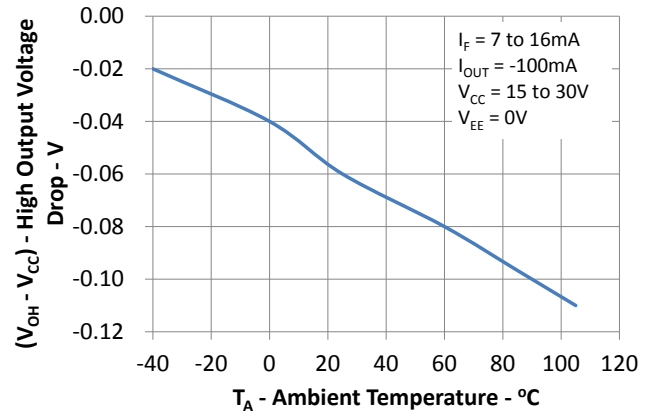


Figure 2:  $V_{OH}$  vs. Temperature

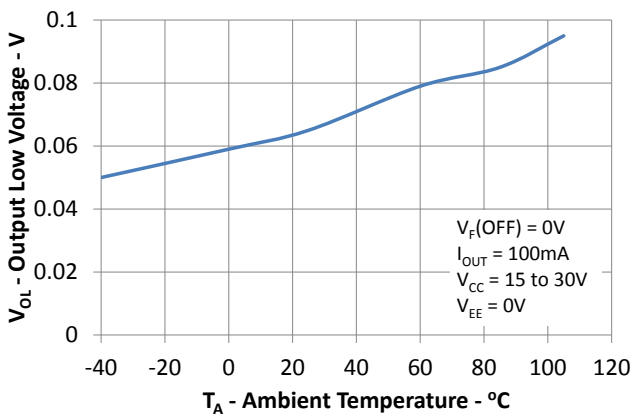


Figure 3:  $V_{OL}$  vs. Temperature

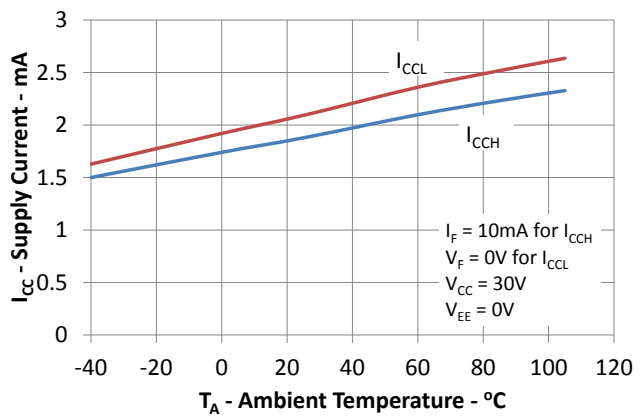


Figure 4:  $I_{CC}$  vs. Temperature

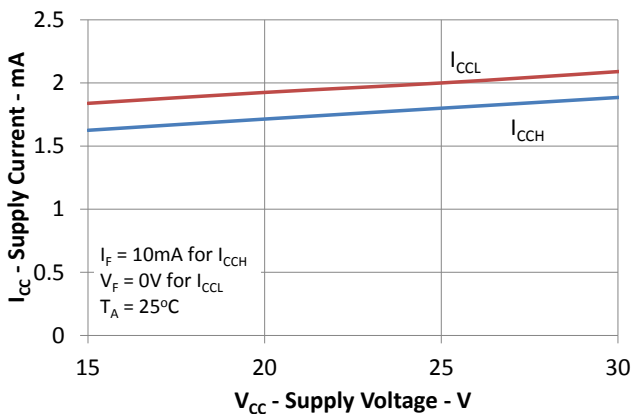


Figure 5:  $I_{CC}$  vs.  $V_{CC}$

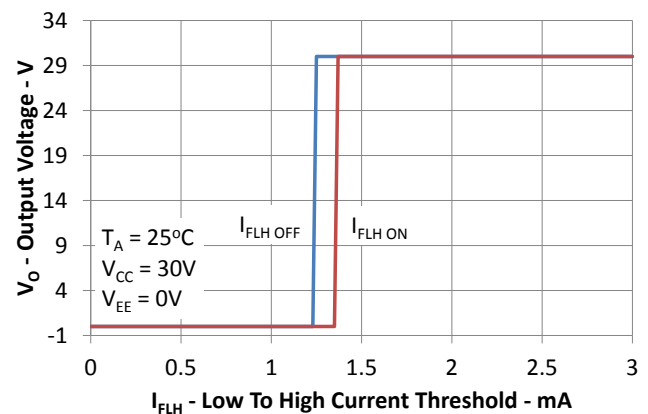


Figure 6: IFLH hysteresis

## Photocouplers LTV-3150-L series

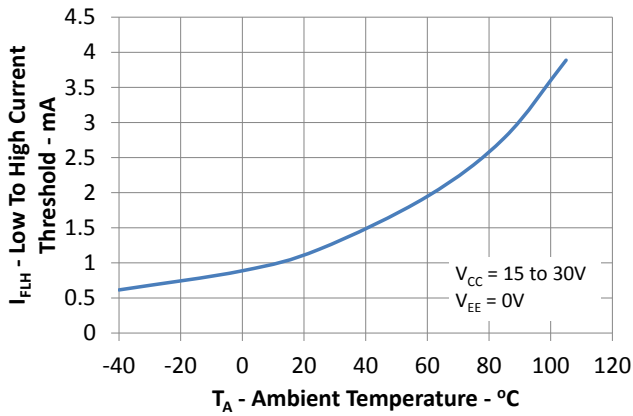


Figure 7:  $I_{FLH}$  vs. Temperature

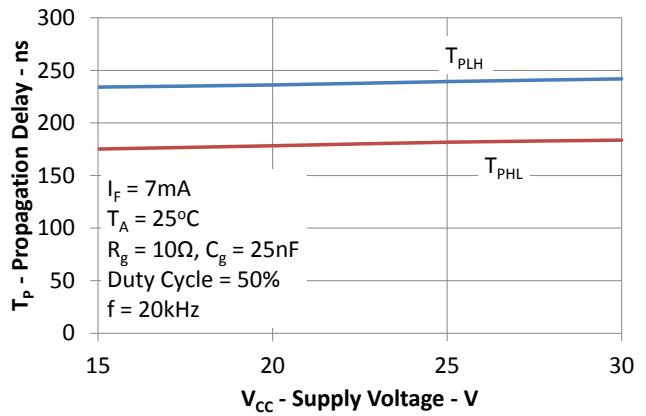


Figure 8: Propagation delays vs.  $V_{CC}$

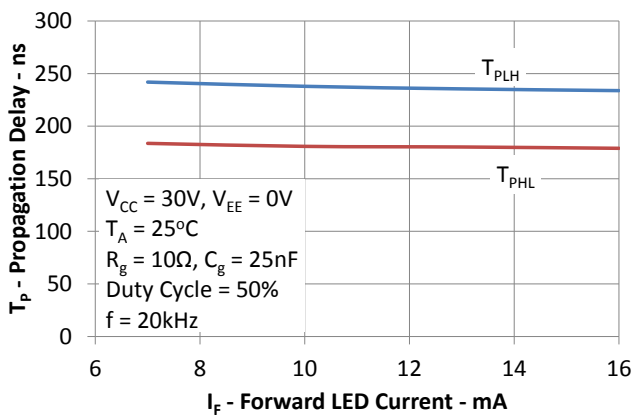


Figure 9: Propagation delays vs.  $I_F$

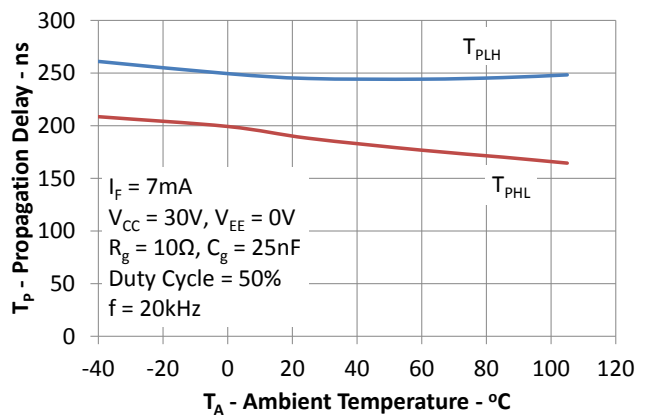


Figure 10: Propagation delays vs. Temperature

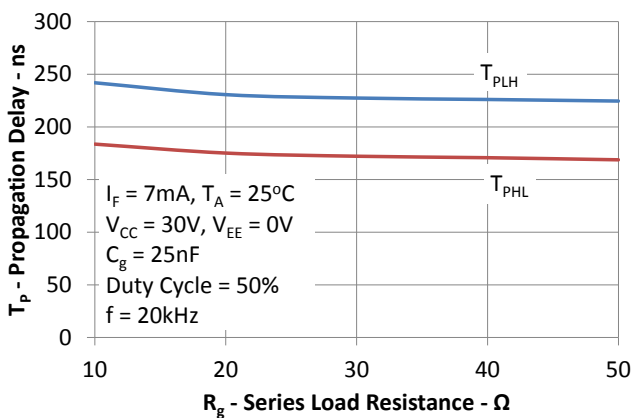


Figure 11: Propagation delays vs.  $R_g$

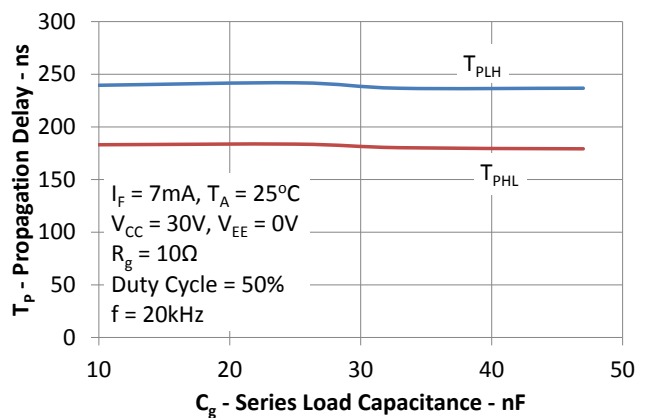


Figure 12: Propagation delays vs.  $C_g$

# Photocouplers LTV-3150-L series

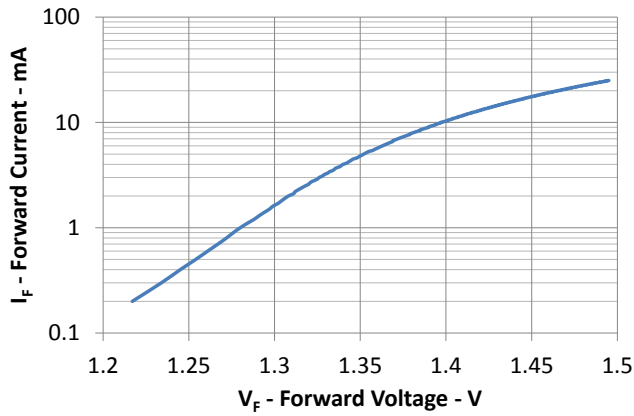


Figure 13: Input current vs. Forward voltage

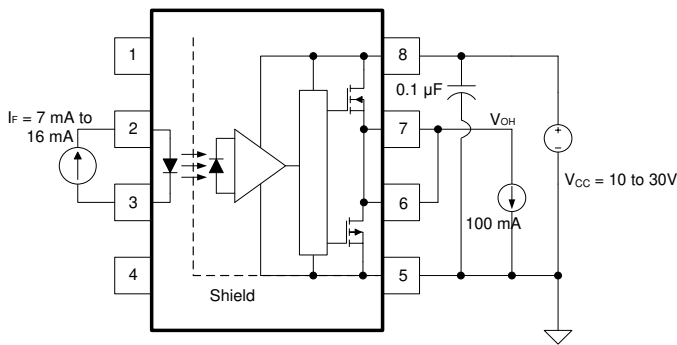


Figure 14 :  $V_{OH}$  Test Circuit

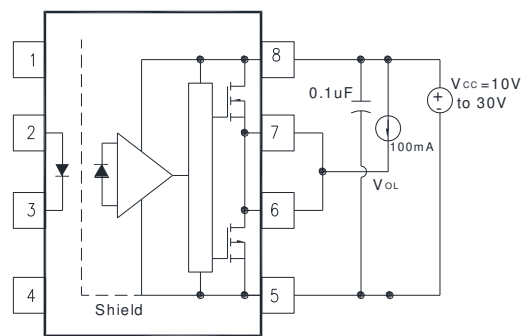


Figure 15 :  $V_{OL}$  Test Circuit

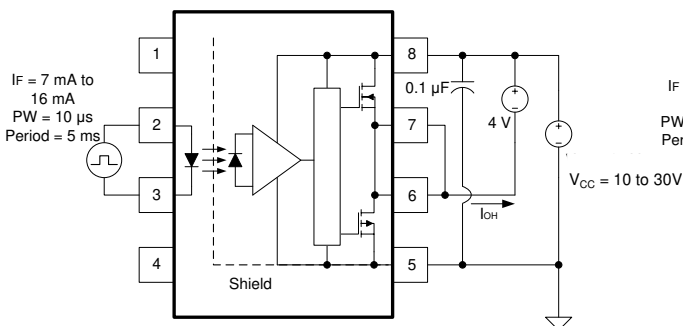


Figure 16 :  $I_{OH}$  Test Circuit

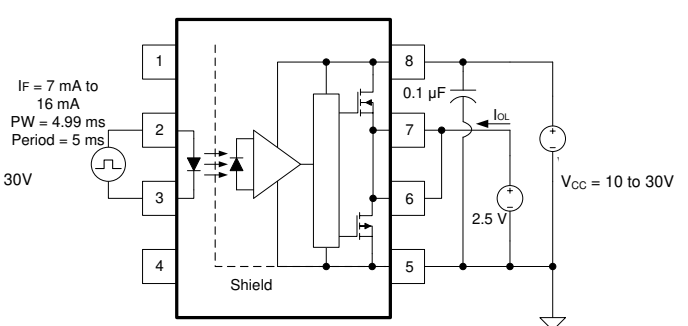


Figure 17 :  $I_{OL}$  Test Circuit

# Photocouplers LTV-3150-L series

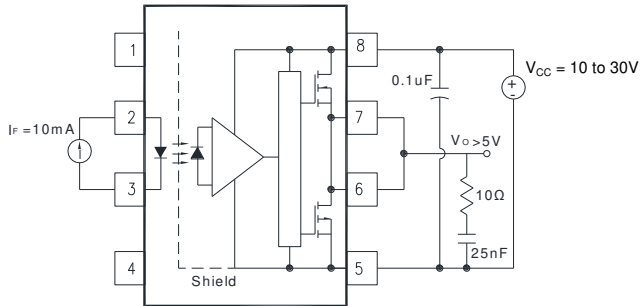


Figure 18 : IFLH Test Circuit

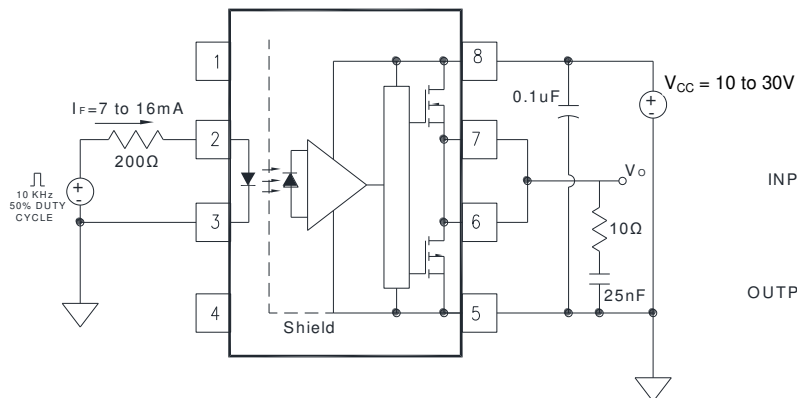


Figure 19 :  $t_r$ ,  $t_f$ ,  $t_{PLH}$  and  $t_{PHL}$  Test Circuit and Waveforms

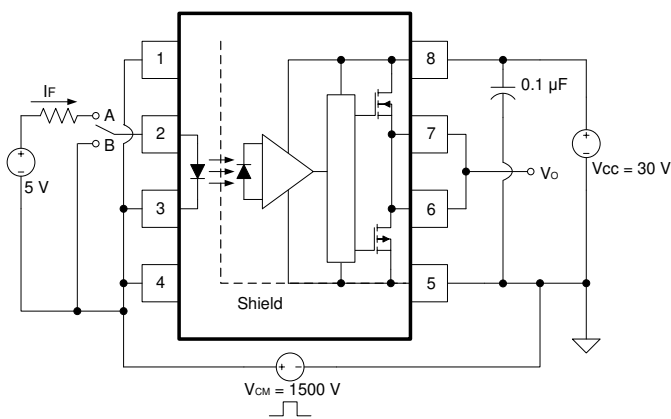


Figure 20 : CMR Test Circuit and Waveforms

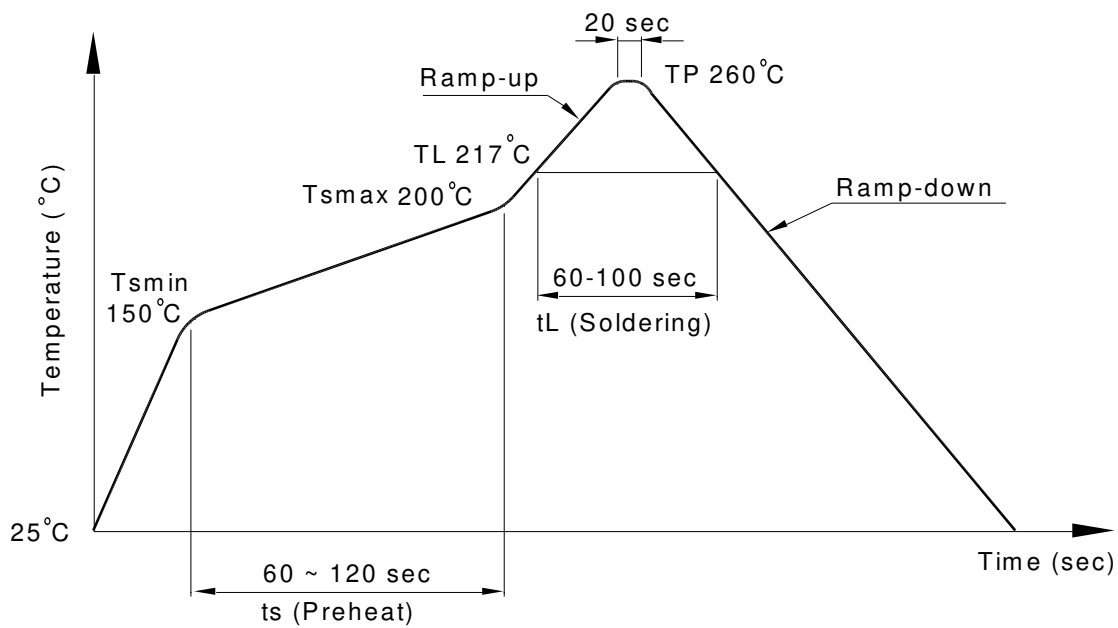
# Photocouplers LTV-3150-L series

## 8. TEMPERATURE PROFILE OF SOLDERING

### 8.1 IR Reflow soldering (JEDEC-STD-020C compliant)

One time soldering reflow is recommended within the condition of temperature and time profile shown below. Do not solder more than three times.

Profile item	Conditions
Preheat	
- Temperature Min ( $T_{Smin}$ )	150°C
- Temperature Max ( $T_{Smax}$ )	200°C
- Time (min to max) (ts)	90±30 sec
Soldering zone	
- Temperature ( $T_L$ )	217°C
- Time ( $t_L$ )	60~100 sec
Peak Temperature ( $T_P$ )	260°C
Ramp-up rate	3°C / sec max.
Ramp-down rate	3~6°C / sec





## Photocouplers LTV-3150-L series

### 8.2 Wave soldering (JEDEC22A111 compliant)

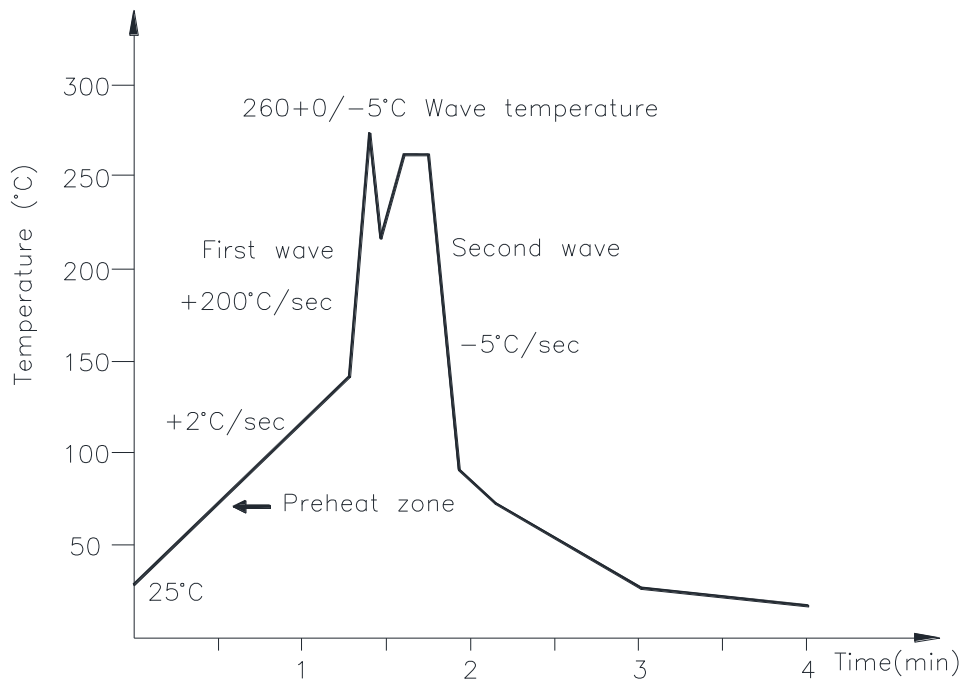
One time soldering is recommended within the condition of temperature.

Temperature:  $260+0/-5^{\circ}\text{C}$

Time: 10 sec.

Preheat temperature: 25 to  $140^{\circ}\text{C}$

Preheat time: 30 to 80 sec.



### 8.3 Hand soldering by soldering iron

Allow single lead soldering in every single process. One time soldering is recommended.

Temperature:  $380+0/-5^{\circ}\text{C}$

Time: 3 sec max.

**Photocouplers  
LTV-3150-L series**

**9. ORDERING INFORMATION**

Parameter	Option	Minimum CMR		Input-On Current (mA)	Remark
		dV/dt (V/μs)	V <sub>CM</sub> (V)		
LTV-3150-L		15,000	1500	10	Single Channel, DIP-8
	M				Single Channel, Wide Lead Spacing
	S				Single Channel, SMD-8