



**Photocoupler**  
**Product Data Sheet**  
LTV-60L series

Spec No. :DS70-2015-0087  
Effective Date: 01/18/2018  
Revision: B

**LITE-ON DCC**

**RELEASE**

**BNS-OD-FC001/A4**

## Photocoupler LTV-60L series

### High Speed LVTTTL Compatible 3.3 Volt / 5 Volt Optocoupler

#### 1. DESCRIPTION

The LTV-60L series consists of a high efficient AlGaAs Light Emitting Diode and a high speed optical detector. This design provides excellent AC and DC isolation between the input and output sides of the Optocoupler. The output of the optical detector features an open collector Schottky clamped transistor. The internal shield ensures high common mode transient immunity. A guaranteed common mode transient immunity is up to 15KV/ $\mu$ s at 3.3V. The Optocoupler operational parameters are guaranteed over the temperature range from -40°C ~ +105°C.

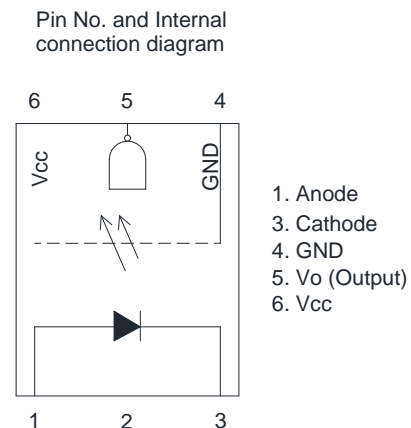
##### 1.1 Features

- Dual Voltage Operating (3.3/5V)
  - Package clearance / creepage at 8 mm
  - High speed – 15MBd typical
  - Guaranteed performance over temperature -40°C ~ +105°C.
  - Internal Shield for High Common Mode Rejection (CMR)
  - LVTTTL/LVCMOS Compatible.
  - Low input current capability : 5mA
  - UL 1577 recognized with 5000  $V_{rms}$  for 1 minute for LTV-60LP and LTV-60LW
- VDE DIN EN 60747-5-5 Approved  
 $V_{IORM} = 891V_{peak}$  for LTV-60LP  
 $V_{IORM} = 1140V_{peak}$  for LTV-60LW

##### 1.2 Applications

- Isolation in line receivers
- Computer-peripheral interfaces
- Ground loop elimination
- Digital isolation for A/D, D/A conversion
- Pulse transformer replacement
- Power transistor isolation in motor drives
- Interface between Microprocessor system, computer and their peripheral

##### Functional Diagram



A 0.1 $\mu$ F bypass Capacitor must be connected between Pin 4 and 6.

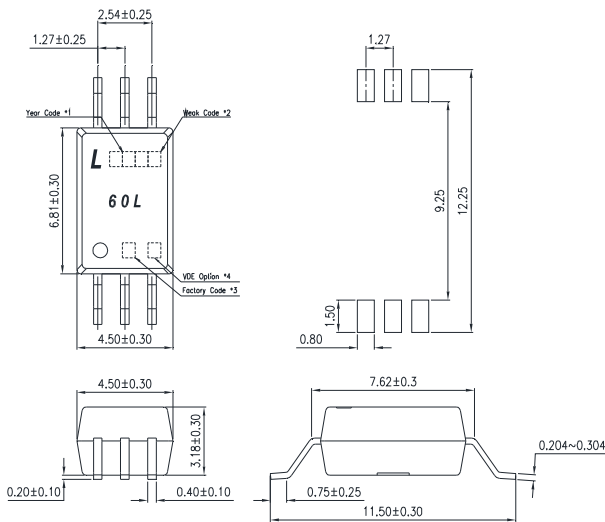
##### Truth Table (Positive Logic)

LED	OUT
ON	LOW
OFF	HIGH

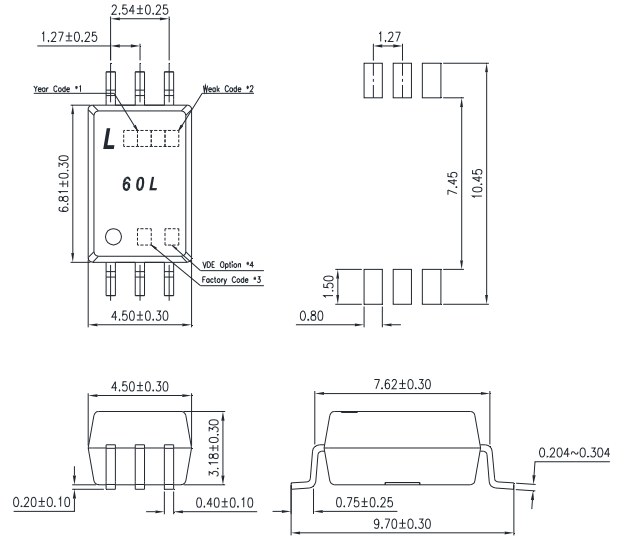
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### 2. PACKAGE DIMENSIONS

#### 2.1 LTV-60LW



#### 2.2 LTV-60LP



#### Notes :

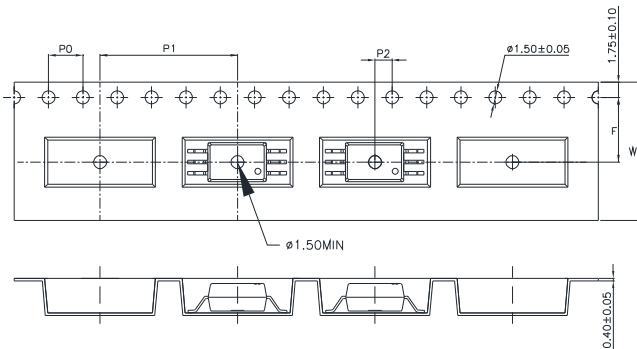
1. Year date code.
2. 2-digit work week.
3. Factory identification mark (Y : Thailand).
4. "4" or "V" for VDE option.

\* Dimensions are in Millimeters and (Inches).

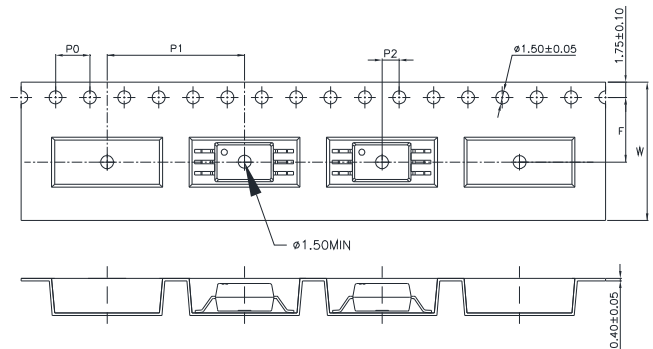
## Photocoupler LTV-60L series

### 3. TAPING DIMENSIONS

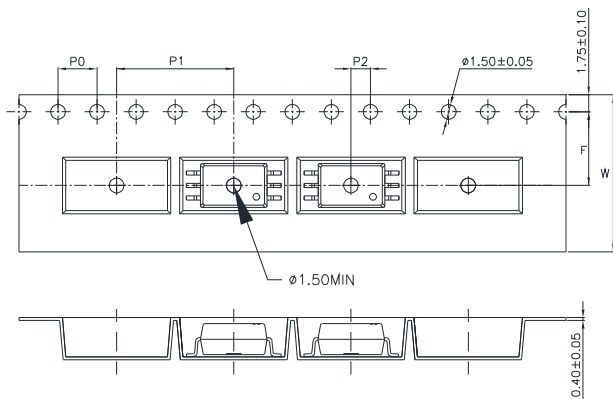
#### 3.1 LTV-60LW-TA



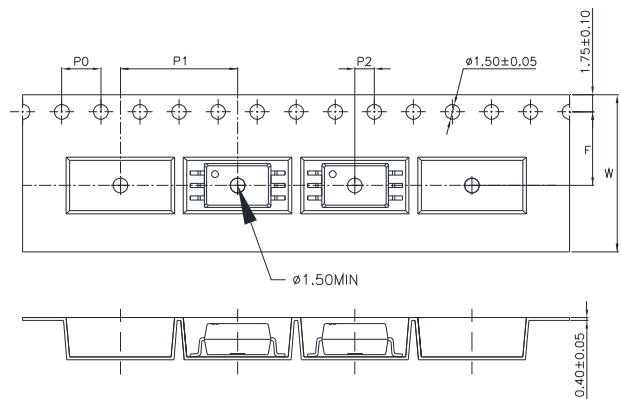
#### 3.2 LTV-60LW-TA1



#### 3.3 LTV-60LP-TA



#### 3.4 LTV-60LP-TA1



Description	Symbol	Dimension in mm (inch)	
		For W type	For P type
Tape wide	W	16±0.3 (0.63)	16±0.3 (0.63)
Pitch of sprocket holes	P <sub>0</sub>	4±0.1 (0.16)	4±0.1 (0.16)
Distance of compartment	F	7.5±0.1 (0.3)	7.5±0.1 (0.3)
	P <sub>2</sub>	2±0.1 (0.079)	2±0.1 (0.079)
Distance of compartment to compartment	P <sub>1</sub>	16±0.1 (0.63)	12±0.1 (0.47)

#### 3.5 Quantities Per Reel

Package Type	LTV-60L series
Quantities (pcs)	1000

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### 4. RATING AND CHARACTERISTICS

#### 4.1 Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Units	Note
Storage Temperature	$T_{ST}$	-55	125	°C	—
Operating Temperature	$T_A$	-40	105	°C	—
Isolation Voltage	$V_{ISO}$	5000	—	$V_{RMS}$	—
Supply Voltage	$V_{CC}$	—	7	V	—
Lead Solder Temperature (for 10 seconds)	—	—	260	°C	—
<b>Input</b>					
Average Forward Input Current	$I_F$	—	20	mA	2
Input Power Dissipation	$P_I$	—	40	mW	—
<b>Output</b>					
Output Collector Current	$I_O$	—	50	mA	—
Output Collector Voltage	$V_O$	—	7	V	—
Output Collector Power Dissipation	$P_O$	—	85	mW	—

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	Units
Operating Temperature	$T_A$	-40	105	°C
Supply Voltage	$V_{CC}$	2.7	3.6	V
		4.5	5.5	
Low Level Input Current	$I_{FL}$	0	250	μA
High Level Input Current	$I_{FH}$	6	15	mA
Output Pull-up Resistor	$R_L$	330	4k	Ω
Fan Out (at $R_L=1k\Omega$ per channel)	N	—	5	TTL Loads

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### 4.3 ELECTRICAL OPTICAL CHARACTERISTICS

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition	Fig.
<b>Input</b>							
Input Forward Voltage	$V_F$	—	1.38	1.80	V	$I_F = 10\text{mA}$	5
Input Forward Voltage Temperature Coefficient	$\Delta V_F / \Delta T$	—	-1.6	—	mV/°C	$I_F = 10\text{mA}$	
Input Reverse Voltage	$BV_R$	5.0	—	—	V	$I_R = 10\mu\text{A}$	
*1 Input Threshold Current	$I_{TH}$	—	1.5	5	mA	$V_{CC} = 3.3\text{V}$ , $V_O = 0.6\text{V}$ $I_{OL}(\text{sinking}) = 13\text{mA}$	2
Input Capacitance	$C_{IN}$	—	34	—	pF	$f = 1\text{MHz}$ , $V_F = 0\text{V}$	
<b>Detector</b>							
High Level Supply Current	$I_{CCH}$	—	3.8	7	mA	$V_{CC} = 3.3\text{V}$ , $I_F = 0\text{mA}$	
Low Level Supply Current	$I_{CCL}$	—	5.8	10	mA	$V_{CC} = 3.3\text{V}$ , $I_F = 10\text{mA}$	
High Level Output Current	$I_{OH}$	—	5	100	$\mu\text{A}$	$V_{CC} = 3.3\text{V}$ , $V_O = 3.3\text{V}$ , $I_F = 250\mu\text{A}$	1
Low Level Output Voltage	$V_{OL}$	—	0.30	0.60	V	$V_{CC} = 3.3\text{V}$ , $I_F = 5\text{mA}$ , $I_{OL}(\text{sinking}) = 13\text{mA}$	3

Specified over recommended temperature ( $T_A = -40^\circ\text{C}$  to  $+105^\circ\text{C}$ ,  $2.7\text{V} \leq V_{CC} \leq 3.6\text{V}$ ),  $I_F = 7.5\text{mA}$  unless otherwise specified. All typicals at  $T_A = 25^\circ\text{C}$ ,  $V_{CC} = 3.3\text{V}$ .

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### 4.3 ELECTRICAL OPTICAL CHARACTERISTIC

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition	Fig.
<b>Input</b>							
Input Forward Voltage	$V_F$	—	1.38	1.80	V	$I_F = 10\text{mA}$	5
Input Forward Voltage Temperature Coefficient	$\Delta V_F / \Delta T$	—	-1.6	—	mV/°C	$I_F = 10\text{mA}$	
Input Reverse Voltage	$BV_R$	5.0	—	—	V	$I_R = 10\mu\text{A}$	
*1 Input Threshold Current	$I_{TH}$	—	1.57	5	mA	$V_{CC} = 5.5\text{V}, V_O = 0.6\text{V}, I_{OL} \geq 13\text{mA}$	2
Input Capacitance	$C_{IN}$	—	34	—	pF	$f = 1\text{MHz}, V_F = 0\text{V}$	
<b>Detector</b>							
High Level Supply Current	$I_{CCH}$	—	6	10	mA	$V_{CC} = 5.5\text{V}, I_F = 0\text{mA}$	
Low Level Supply Current	$I_{CCL}$	—	8	13	mA	$V_{CC} = 5.5\text{V}, I_F = 10\text{mA}$	
High Level Output Current	$I_{OH}$	—	3	100	$\mu\text{A}$	$V_{CC} = 5.5\text{V}, V_O = 5.5\text{V}, I_F = 250\mu\text{A}$	1
Low Level Output Voltage	$V_{OL}$	—	0.40	0.60	V	$V_{CC} = 5.5\text{V}, I_F = 5\text{mA}, I_{OL} (\text{sinking}) = 13\text{mA}$	3

Specified over recommended temperature ( $T_A = -40^\circ\text{C}$  to  $+105^\circ\text{C}$ ,  $4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$ ),  $I_F = 7.5\text{mA}$  unless otherwise specified. All typicals at  $T_A = 25^\circ\text{C}$ ,  $V_{CC} = 5.0\text{V}$ .

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### 5. SWITCHING SPECIFICATION

Parameter	Symbol	Min	Typ	Max	Units	Test Condition	Fig.
Propagation Delay Time to Low Output Level	$t_{PHL}$	—	39	75	ns	$R_L = 350\Omega$ , $C_L = 15pF$ , $T_A = 25^\circ C$	6, 7, 8
Propagation Delay Time to High Output Level	$t_{PLH}$	—	48	90			
Pulse Width Distortion	$ t_{PLH} - t_{PHL} $	—	10	30			7
Propagation Delay Skew	$t_{PSK}$	—	—	40			—
Output Rise Time (10 to 90%)	$t_r$	—	16	—			—
Output Fall Time (90 to 10%)	$t_f$	—	7	—			—

Specified over recommended temperature ( $T_A = -40^\circ C$  to  $+105^\circ C$ ,  $2.7V \leq V_{CC} \leq 3.6V$ ),  $I_F = 7.5mA$  unless otherwise specified. All typicals at  $T_A = 25^\circ C$ ,  $V_{CC} = 3.3V$ .

Parameter	Symbol	Min	Typ	Max	Units	Test Condition	Fig.
Propagation Delay Time to Low Output Level	$t_{PHL}$	—	35	75	ns	$R_L = 350\Omega$ , $C_L = 15pF$ , $T_A = 25^\circ C$	6, 7, 8
Propagation Delay Time to High Output Level	$t_{PLH}$	—	40	75			
Pulse Width Distortion	$ t_{PLH} - t_{PHL} $	—	5	35			7
Propagation Delay Skew	$t_{PSK}$	—	—	40			—
Output Rise Time (10 to 90%)	$t_r$	—	21	—			—
Output Fall Time (90 to 10%)	$t_f$	—	7	—			—

Specified over recommended temperature ( $T_A = -40^\circ C$  to  $+105^\circ C$ ,  $4.5V \leq V_{CC} \leq 5.5V$ ),  $I_F = 7.5mA$  unless otherwise specified. All typicals at  $T_A = 25^\circ C$ ,  $V_{CC} = 5.0V$ .



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Parameter	Symbol	Min	Typ	Max	Units	Test Condition
Common Mode Transient Immunity at High Output Level	CM <sub>H</sub>	10	15	—	KV/μs	V <sub>CC</sub> = 3.3V, I <sub>F</sub> = 0mA, V <sub>CM</sub> = 1000V, R <sub>L</sub> = 350Ω, T <sub>A</sub> = 25°C
Common Mode Transient Immunity at Low Output Level	CM <sub>L</sub>	10	15	—		V <sub>CC</sub> = 3.3V, I <sub>F</sub> = 7.5mA, V <sub>CM</sub> = 1000V, R <sub>L</sub> = 350Ω, T <sub>A</sub> = 25°C
Common Mode Transient Immunity at High Output Level	CM <sub>H</sub>	10	15	—	KV/μs	V <sub>CC</sub> = 5V, I <sub>F</sub> = 0mA, V <sub>CM</sub> = 1000V, R <sub>L</sub> = 350Ω, T <sub>A</sub> = 25°C
Common Mode Transient Immunity at Low Output Level	CM <sub>L</sub>	10	15	—		V <sub>CC</sub> = 5V, I <sub>F</sub> = 7.5mA, V <sub>CM</sub> = 1000V, R <sub>L</sub> = 350Ω, T <sub>A</sub> = 25°C

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### 6. ISOLATION CHARACTERISTIC

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition
Input-Output Insulation Leakage Current	$I_{I-O}$	—	—	1.0	$\mu A$	45% RH, $t = 5s$ , $V_{I-O} = 3kV$ DC, $T_A = 25^\circ C$
Withstand Insulation Test Voltage	$V_{ISO}$	5000	—	—	V	RH $\leq 50\%$ , $t = 1min$ , $T_A = 25^\circ C$
Input-Output Resistance	$R_{I-O}$	—	$10^{12}$	—	$\Omega$	$V_{I-O} = 500V$ DC
Input-Output Capacitance	$C_{I-O}$	—	1	—	pF	$f = 1MHz$ , $T_A = 25^\circ C$

\*All Typical values at  $T_A = 25^\circ C$  unless otherwise specified. All minimum and maximum specifications are at recommended operating condition.

#### Notes:

- 1) A 0.1 $\mu F$  or bigger bypass capacitor for  $V_{CC}$  is needed.
- 2) Peaking driving circuit may be used to speed up the LED. The peak drive current of LED may go up to 50mA and maximum pulse width 50ns, as long as average current doesn't exceed 20mA.
- 3)  $t_{PLH}$  (propagation delay) is measured from the 3.75 mA point on the falling edge of the input pulse to the 1.5 V point on the rising edge of the output pulse.
- 4)  $t_{PHL}$  (propagation delay) is measured from the 3.75 mA point on the rising edge of the input pulse to the 1.5 V point on the falling edge of the output pulse.
- 5)  $CM_H$  is the maximum tolerable rate of rise of the common mode voltage to assure that the output will remain in a high logic state (i.e.,  $V_O > 2.0$  V).
- 6)  $CM_L$  is the maximum tolerable rate of fall of the common mode voltage to assure that the output will remain in a low logic state (i.e.,  $V_O < 0.8$  V).
- 7) Device is considered a two-terminal device: pins 1, 2, 3 shorted together, and pins 4, 5, 6 shorted together.
- 8) In accordance with UL1577, each optocoupler is proof tested by applying an insulation test voltage 6000 Vrms for one second (leakage current less than 10  $\mu A$ ). This test is performed before the 100% production test for partial discharge

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## 7. TYPICAL PERFORMANCE CURVES & TEST CIRCUITS

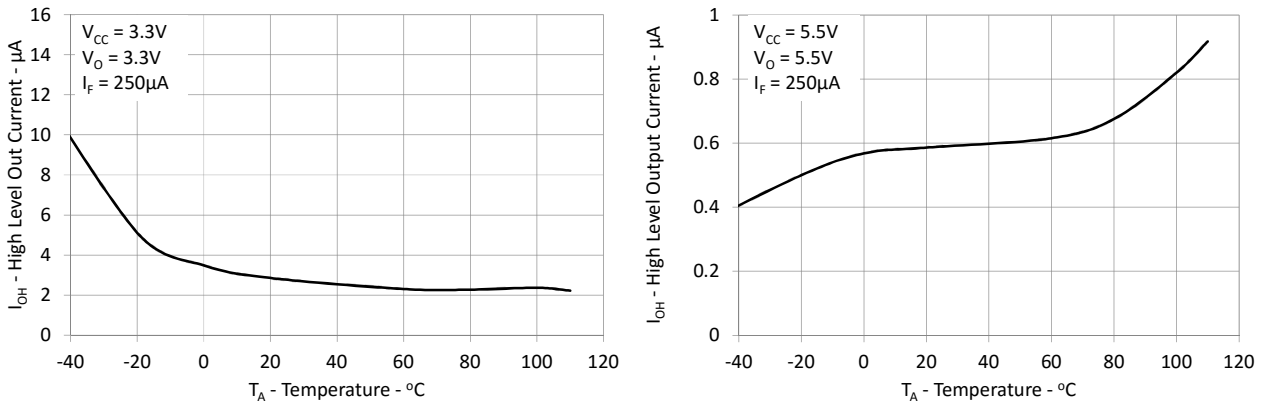


Figure 1. Typical high level output current vs. temperature.

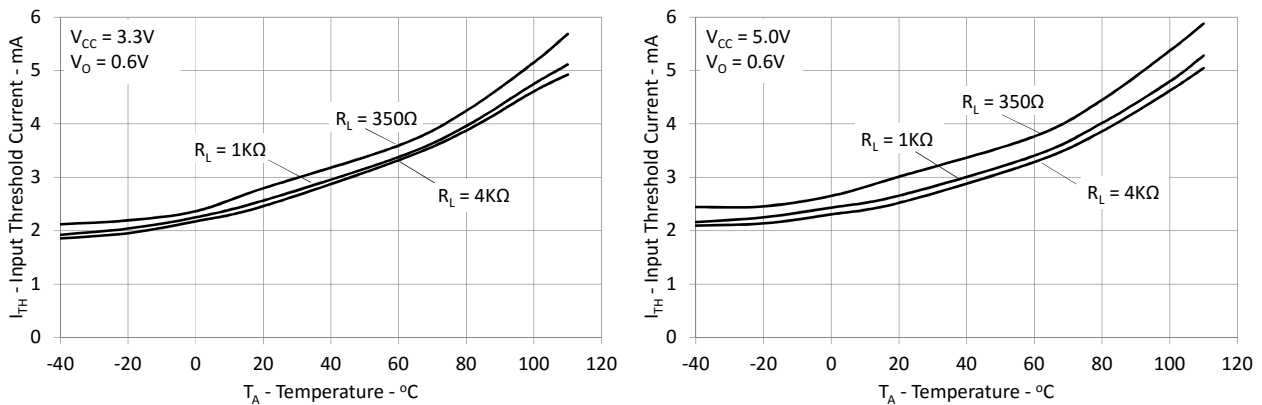


Figure 2. Typical input threshold current vs. temperature.

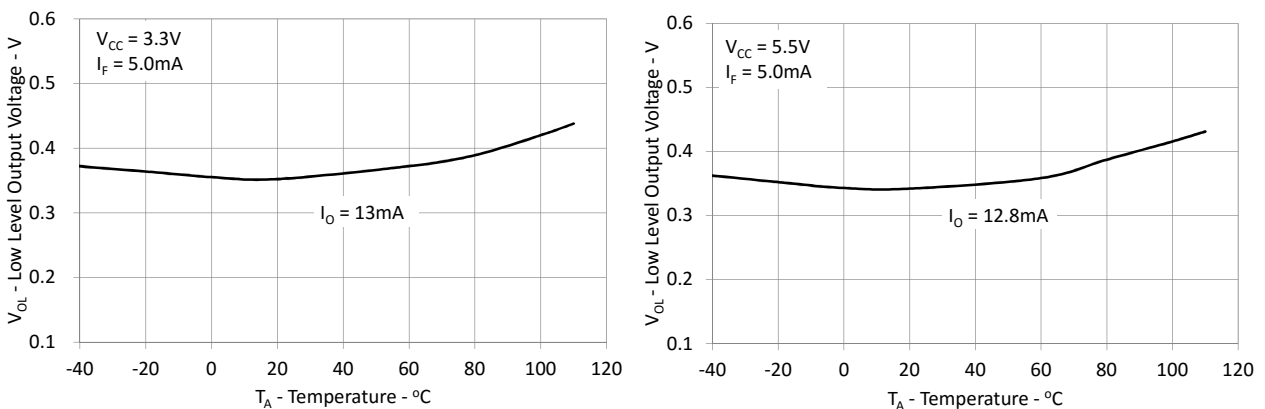


Figure 3. Typical low level output voltage vs. temperature.

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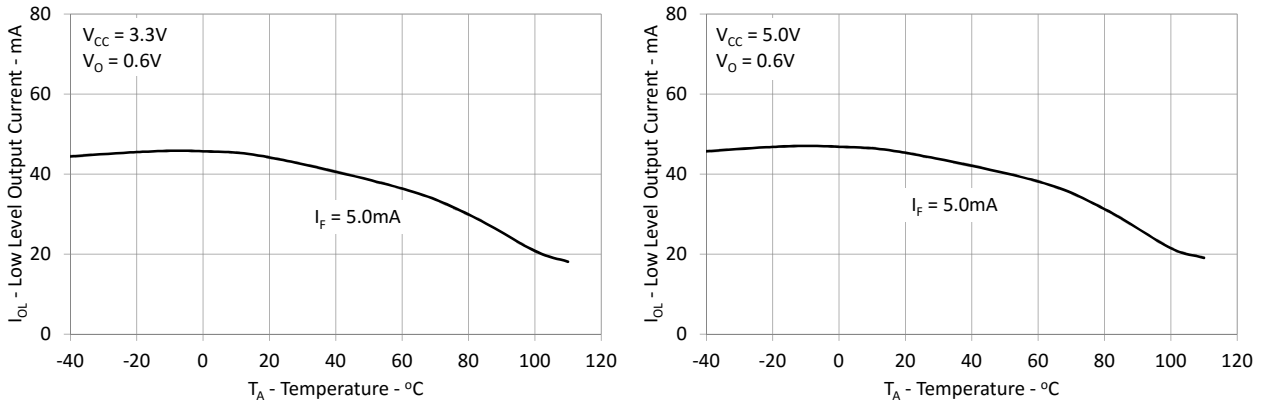


Figure 4. Typical low level output current vs. temperature.

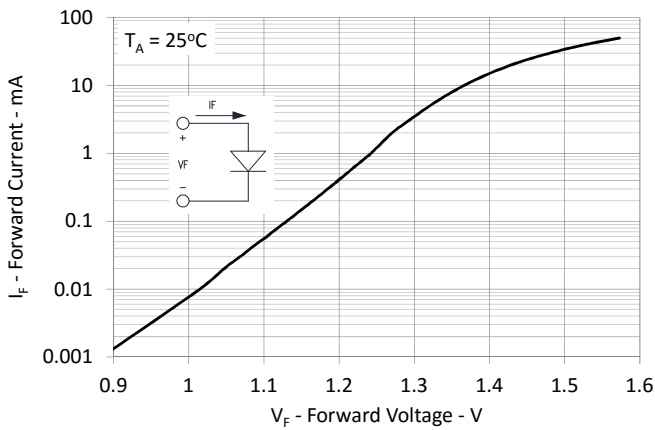


Figure 5. Typical input diode forward characteristic.

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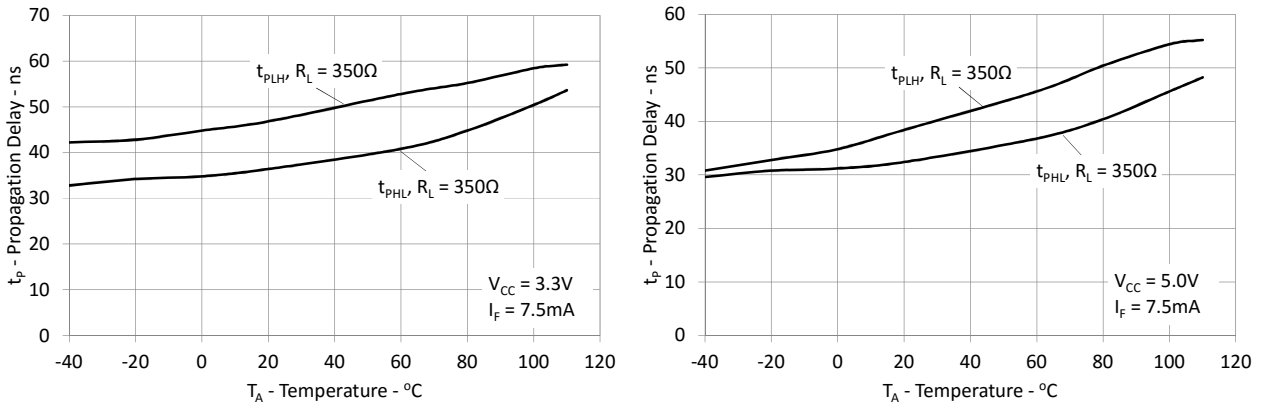


Figure 6. Typical propagation delay vs. temperature.

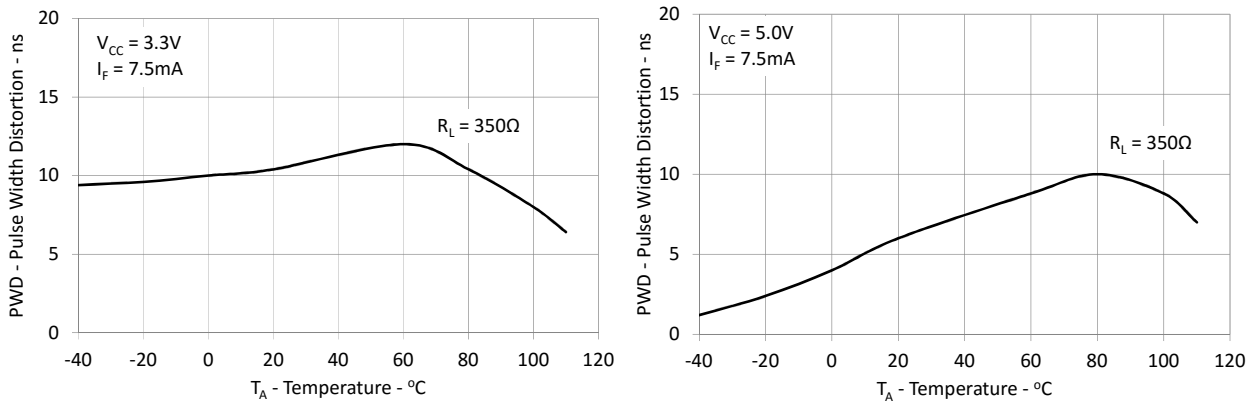


Figure 7. Typical pulse width distortion vs. temperature.

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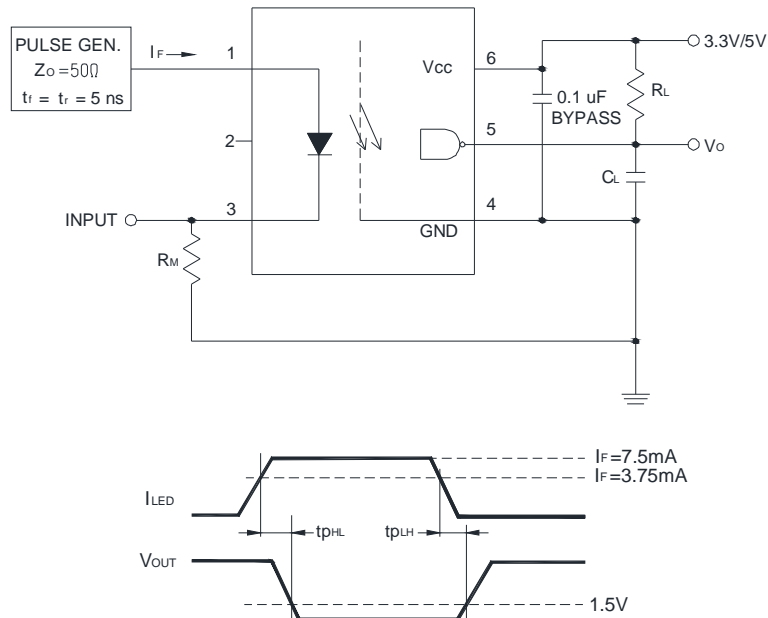


Figure 8. Test Circuit for  $t_{PHL}$  and  $t_{PLH}$

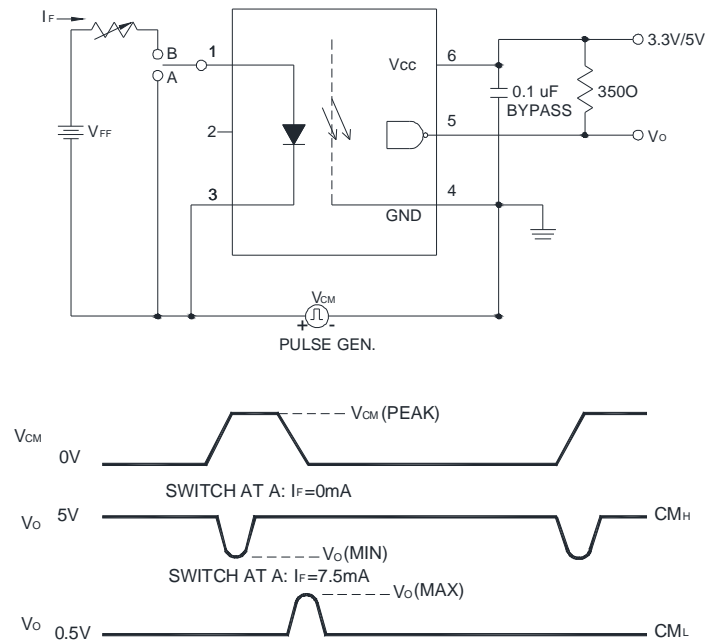


Figure 9. Test Circuit for Common Mode Transient Immunity and typical waveforms

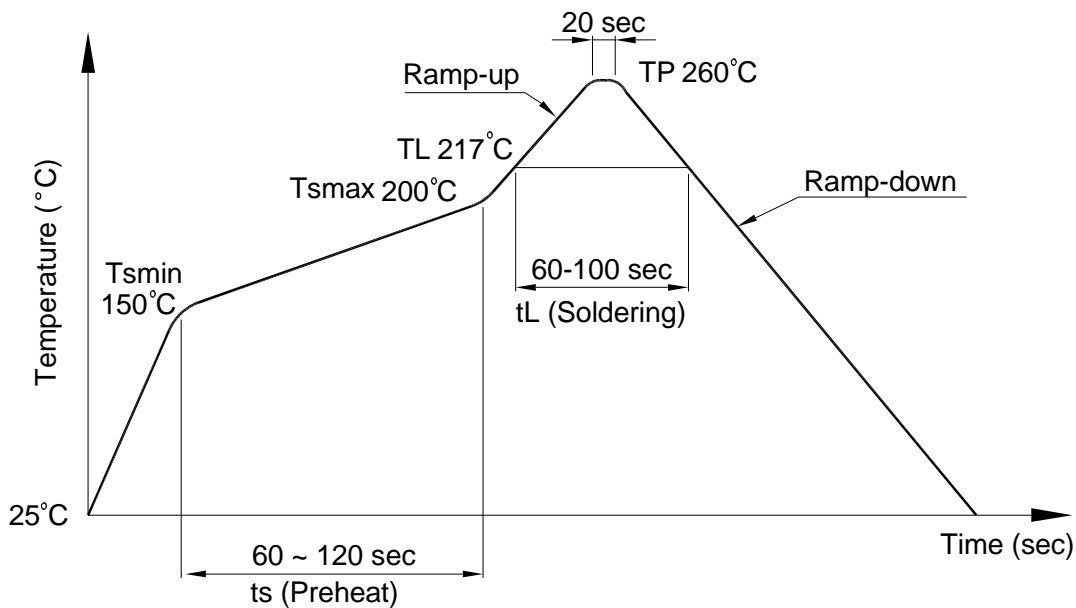
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### 8. TEMPERATURE PROFILE OF SOLDERING

#### 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



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**8.2 Wave soldering (JEDEC22A111 compliant)**

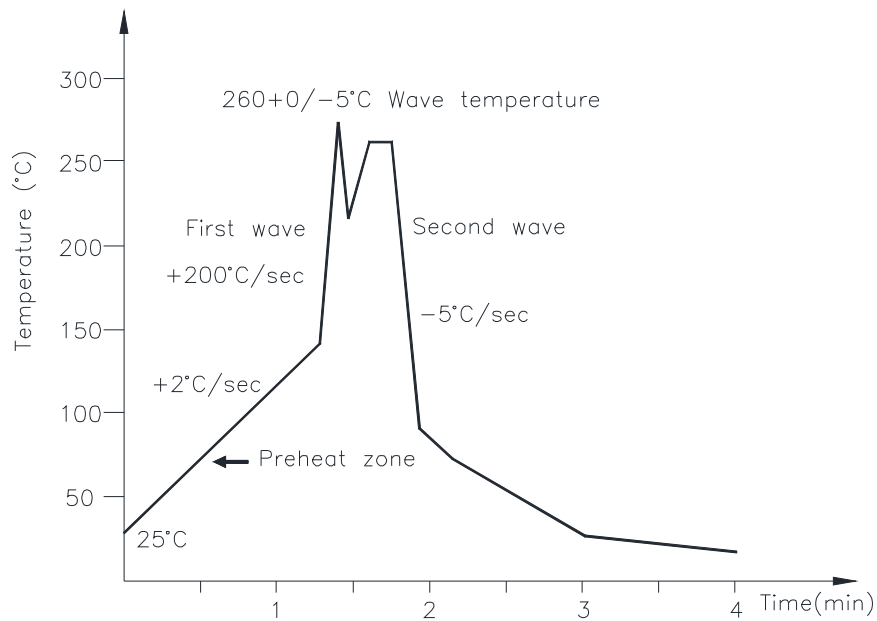
One time soldering is recommended within the condition of temperature.

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

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

Time: 3 sec max.



## Photocoupler LTV-60L series

### 9. NAMING RULE

Part number Options
LTV-60LP-TA
LTV-60LP-TA1
LTV-60LW-TA
LTV-60LW-TA1
LTV60LPTA-V
LTV60LPTA1-V
LTV60LWTA-V
LTV60LWTA1-V

Definition of Suffix	Remark
"60L"	LiteOn model name
"P"	clearance distance 9.7mm typical
"W"	clearance distance 11.5mm typical
"TA"	Pin 1 location at lower right of the tape
"TA1"	Pin 1 location at upper left of the tape
"V"	VDE approved option

### 10. Notes

- LiteOn is continually improving the quality, reliability, function or design and LiteOn reserves the right to make changes without further notices.
- 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.
- For equipment/devices where high reliability or safety is required, such as space applications, nuclear power control equipment, medical equipment, etc, please contact our sales representatives.
- When requiring a device for any "specific" application, please contact our sales in advice.
- If there are any questions about the contents of this publication, please contact us at your convenience.
- The contents described herein are subject to change without prior notice.
- Immerse unit's body in solder paste is not recommended.

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