LITEON®
OPTOELECTRONICS

Photocoupler

Product Data Sheet

LTV-60L series

Spec No.: DS70-2015-0087

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LITE-ON DCC

RELEASE

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Photocoupler
LTV-60L series

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/μs 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 creepage at 8 mm
- High speed – 15MBd typical
- Guaranteed performance over temperature -40°C ~ +105°C.
- Internal Shield for High Common Mode Rejection (CMR)
- LVTTL/LVCMOS Compatible.
- Low input current capability : 3mA
- 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} = 891Vpeak for LTV-60LP

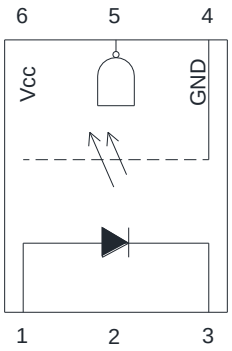
  V_{IORM} = 1140Vpeak for LTV-60LW

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

Pin No. and Internal connection diagram



1. Anode
3. Cathode
4. GND
5. Vo (Output)
6. Vcc

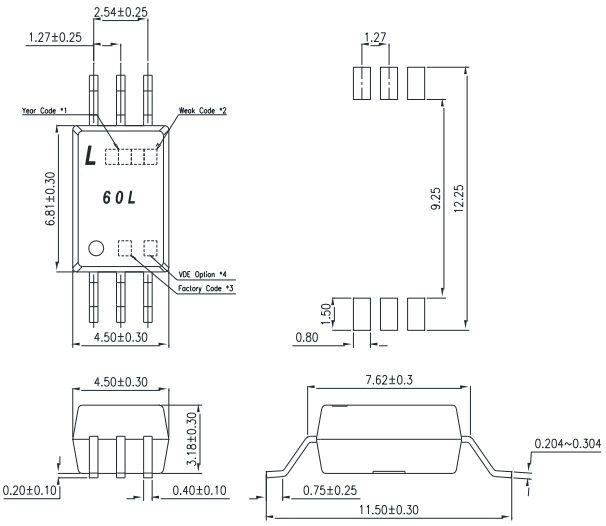
A 0.1μF bypass Capacitor must be connected between Pin 4 and 6. *1

Truth Table (Positive Logic)

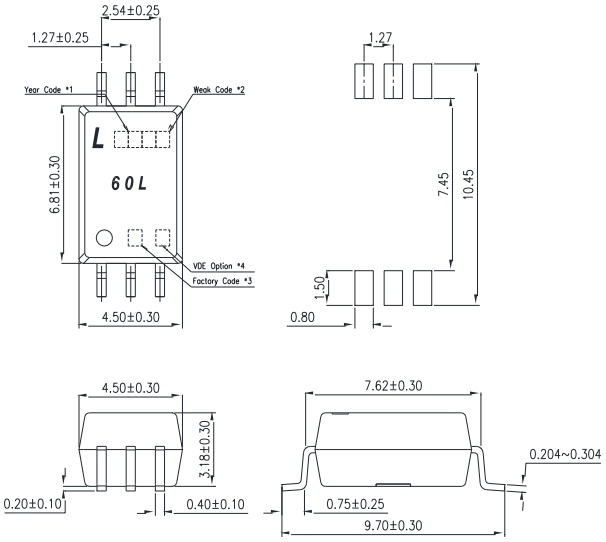
LED	OUT
ON	LOW
OFF	HIGH

2. PACKAGE DIMENSIONS

2.1 LTV-60LW



2.2 LTV-60LP



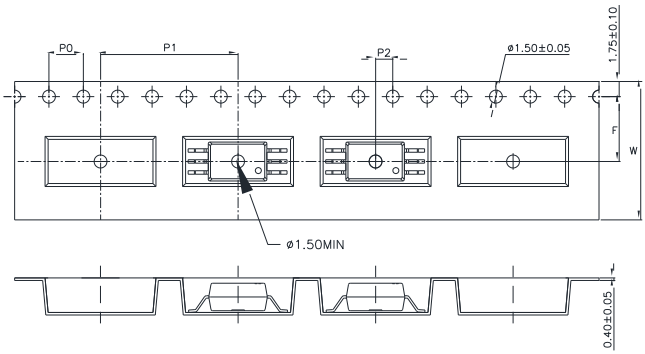
Notes :

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

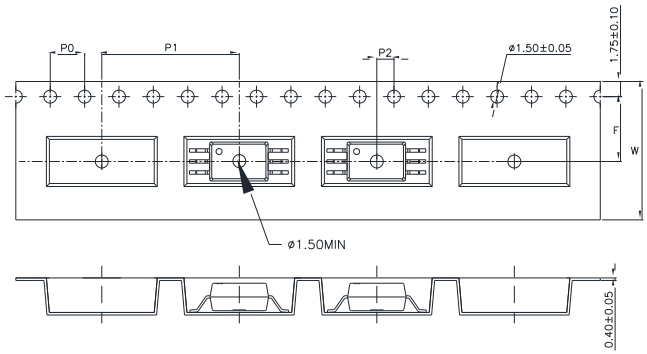
* Dimensions are in Millimeters and (Inches).

3. TAPING DIMENSIONS

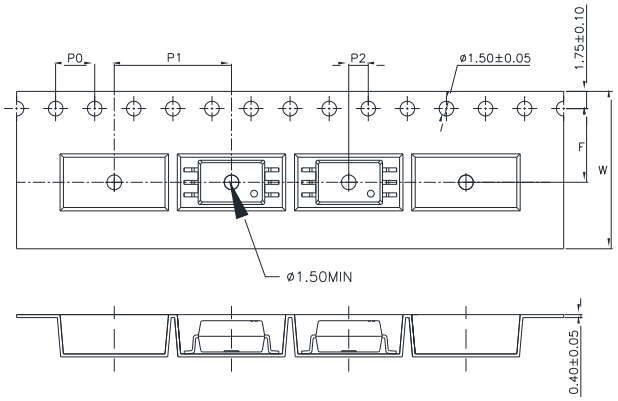
3.1 LTV-60LW-TA



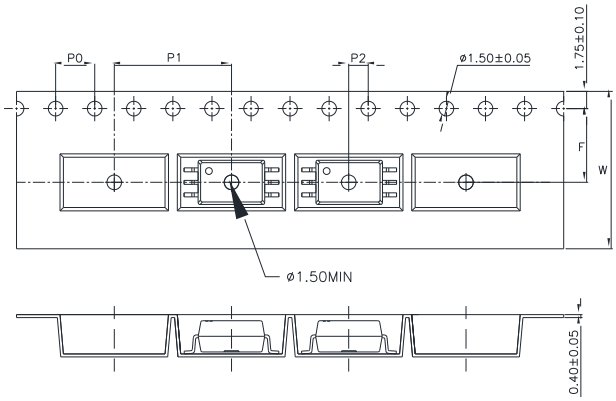
3.2 LTV-60LW-TA1



3.3 LTV-60LP-TA



3.4 LTV-60LP-TA1



Description	Symbol	Dimension in mm (inch) For W type	Dimension in mm (inch) For P type
Tape wide	W	16±0.3 (0.63)	16±0.3 (0.63)
Pitch of sprocket holes	P_0	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_2	2±0.1 (0.079)	2±0.1 (0.079)
Distance of compartment to compartment	P_1	16±0.1 (0.63)	12±0.1 (0.47)

3.5 Quantities Per Reel

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

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	2
Input					
Average Forward Input Current	I_F	—	20	mA	—
Peak Input Current (50% duty cycle, 1 ms pulse width)	I_F	—	50	mA	3
Input Power Dissipation	P_I	—	40	mW	—
Output					
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=1kΩ per channel)	N	—	5	TTL Loads

4.3 Electrical Optical Characteristics

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

Specified over recommended temperature (TA = -40 °C to +105°C, 2.7V ≤ VCC ≤ 3.6V), IF = 7.5mA unless otherwise specified. All typicals at TA = 25 °C, VCC = 3.3V.

4.4 Electrical Optical Characteristic

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

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

5. SWITCHING SPECIFICATION

Parameter	Symbol	Min	Typ	Max	Units	Test Condition	Fig.	Note
Propagation Delay Time to Low Output Level	t_{PHL}	—	39	75	ns	R_L = 350Ω, C_L = 15pF, T_A = 25°C	6, 7, 8	5
Propagation Delay Time to High Output Level	t_{PLH}	—	48	90				4
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 °C to +105 °C , 2.7V ≤ V_{CC} ≤ 3.6V), IF = 7.5mA unless otherwise specified. All typicals at T_A = 25 °C , V_{CC} = 3.3V.

Parameter	Symbol	Min	Typ	Max	Units	Test Condition	Fig.	Note
Propagation Delay Time to Low Output Level	t_{PHL}	—	35	75	ns	R_L = 350Ω, C_L = 15pF, T_A = 25°C	6, 7, 8	5
Propagation Delay Time to High Output Level	t_{PLH}	—	40	75				4
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 °C to +105 °C , 4.5V ≤ V_{CC} ≤ 5.5V), IF = 7.5mA unless otherwise specified. All typicals at T_A = 25 °C, V_{CC} = 5.0V.

Photocoupler
LTV-60L series

Parameter	Symbol	Min	Typ	Max	Units	Test Condition	Note
Common Mode Transient Immunity at High Output Level	$\|CM_H\|$	10	—	—	KV/μs	V_{CC} = 3.3V, I_F = 0mA, V_{CM} = 1000V, R_L = 350Ω, T_A = 25°C	6
Common Mode Transient Immunity at Low Output Level	$\|CM_L\|$	10	—	—		V_{CC} = 3.3V, I_F = 7.5mA, V_{CM} = 1000V, R_L = 350Ω, T_A = 25°C	7
Common Mode Transient Immunity at High Output Level	$\|CM_H\|$	10	—	—	KV/μs	V_{CC} = 5V, I_F = 0mA, V_{CM} = 1000V, R_L = 350Ω, T_A = 25°C	6
Common Mode Transient Immunity at Low Output Level	$\|CM_L\|$	10	—	—		V_{CC} = 5V, I_F = 7.5mA, V_{CM} = 1000V, R_L = 350Ω, T_A = 25°C	7

6. ISOLATION CHARACTERISTIC

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition	Note
Input-Output Insulation Leakage Current	I_{I-O}	—	—	1.0	μA	45% RH, t = 5s, V_{I-O} = 3kV DC, T_A = 25°C	8
Withstand Insulation Test Voltage	V_{ISO}	5000	—	—	V	RH ≤ 50%, t = 1min, T_A = 25 °C	8,9
Input-Output Resistance	R_{I-O}	—	10^{12}	—	Ω	V_{I-O} = 500V DC	8
Input-Output Capacitance	C_{I-O}	—	1	—	pF	f = 1MHz, T_A = 25 °C	8

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

NOTES:

1) A 0.1μF or bigger bypass capacitor for V_{CC} is needed.
2) 260°C for 10 seconds
3) 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.
4) 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.
5) 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.
6) 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).
7) 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).
8) Device is considered a two-terminal device: pins 1, 2, 3 shorted together, and pins 4, 5, 6 shorted together.
9) 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 uA). This test is performed before the 100% production test for partial discharge

7. TYPICAL PERFORMANCE CURVES & TEST CIRCUITS

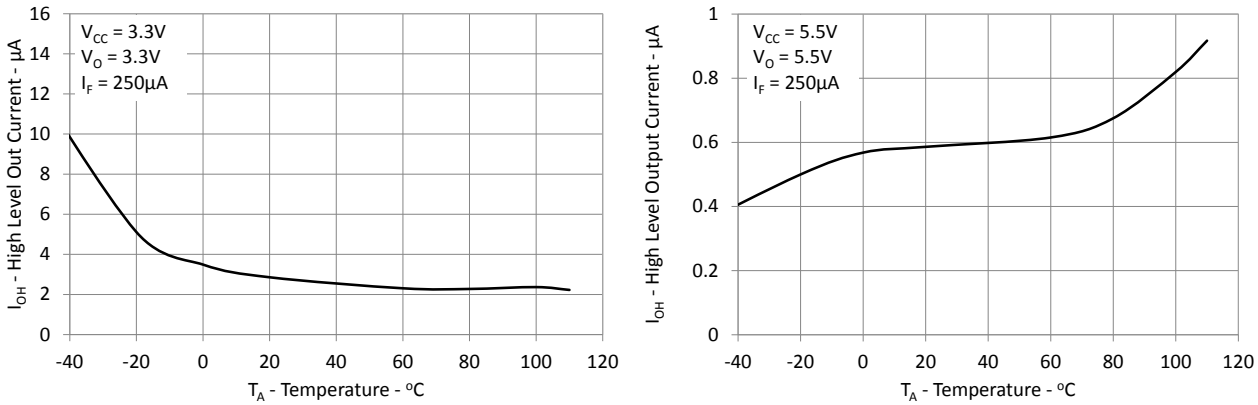


Figure 1. Typical high level output current vs. temperature.

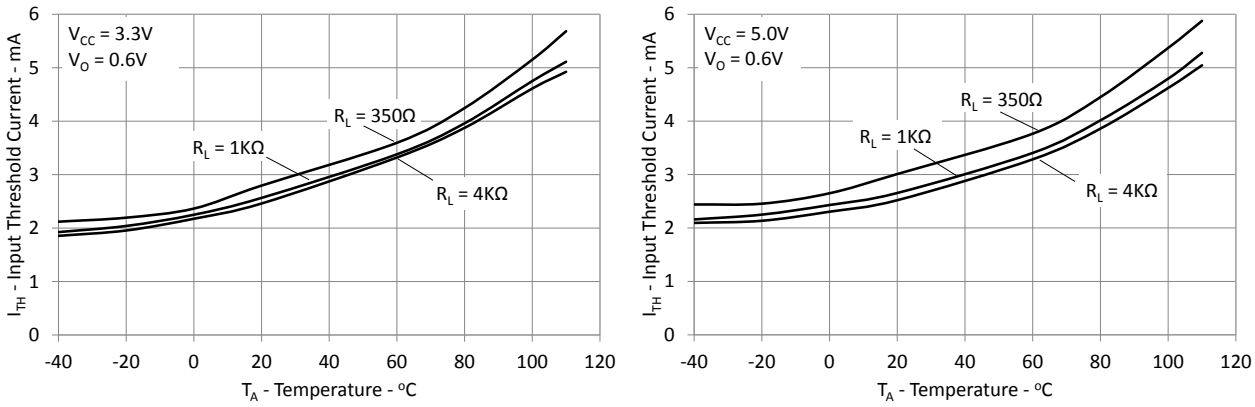


Figure 2. Typical input threshold current vs. temperature.

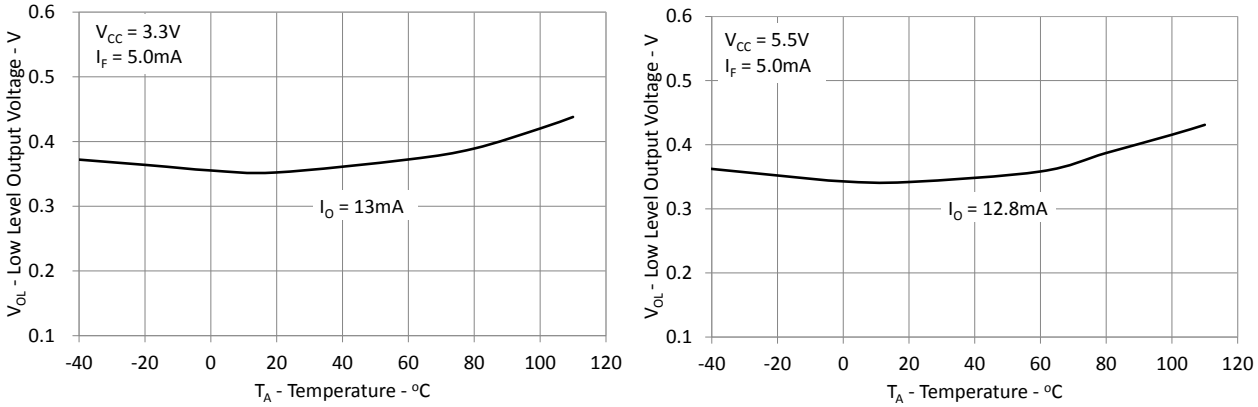


Figure 3. Typical low level output voltage vs. temperature.

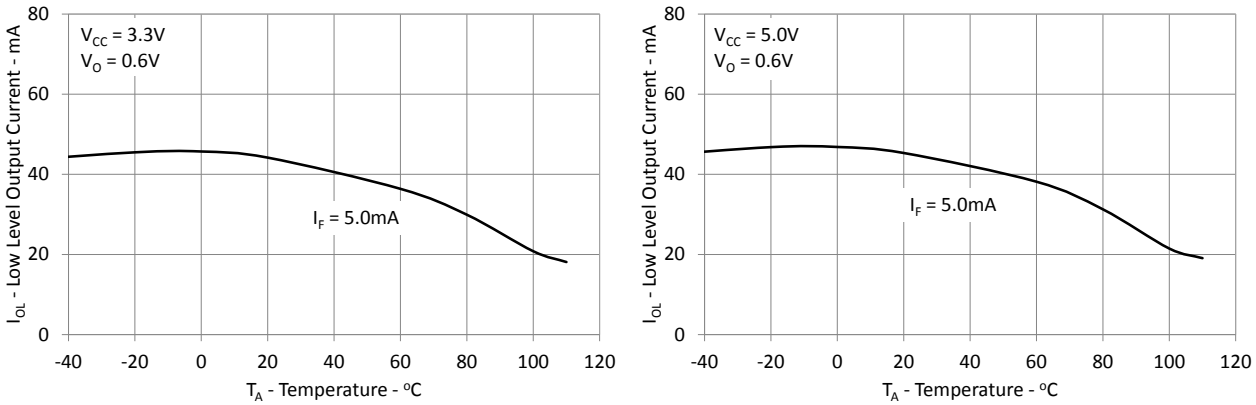


Figure 4. Typical low level output current vs. temperature.

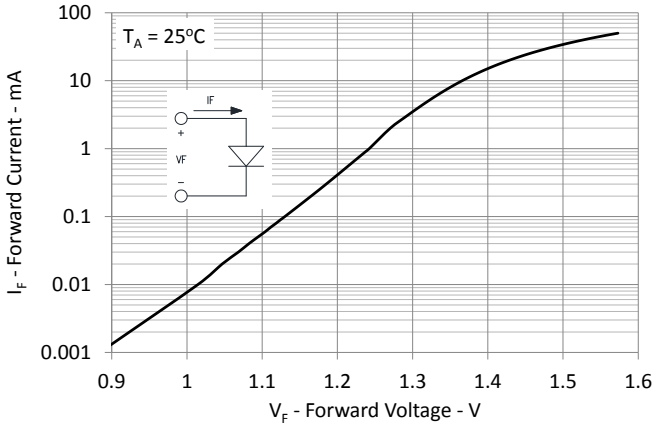


Figure 5. Typical input diode forward characteristic.

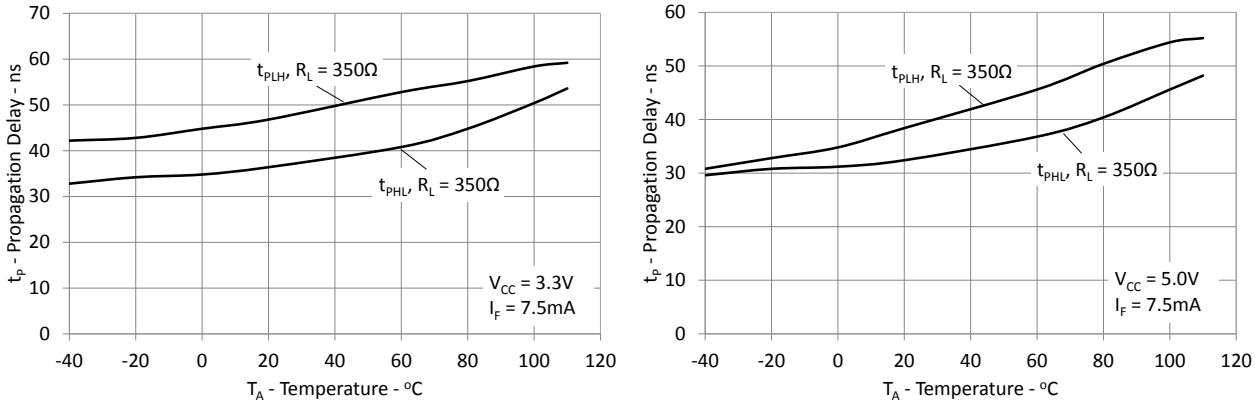


Figure 6. Typical propagation delay vs. temperature.

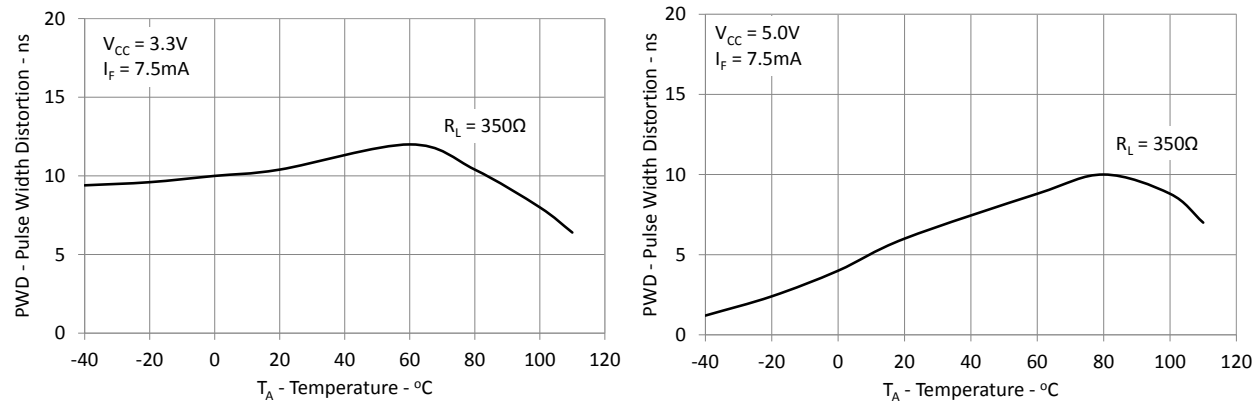


Figure 7. Typical pulse width distortion vs. temperature.

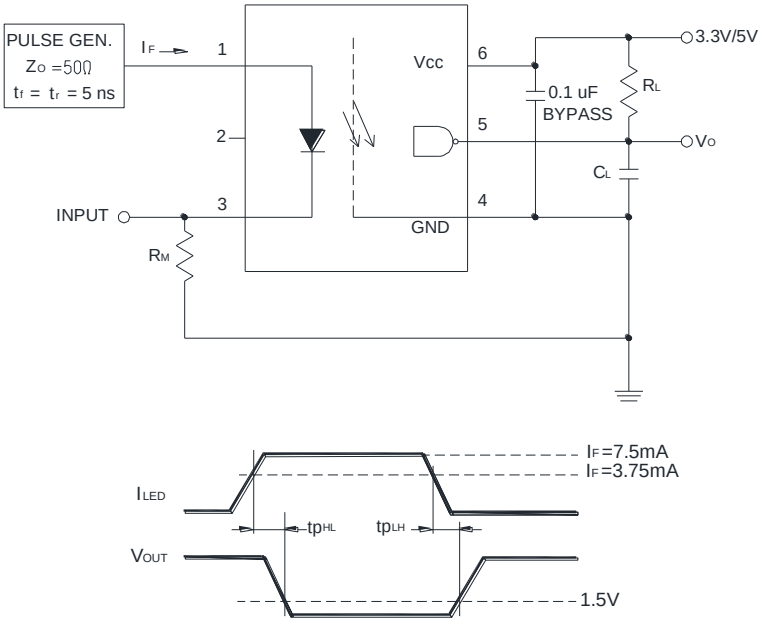


Figure 8. Test Circuit for t_{PHL} and t_{PLH}

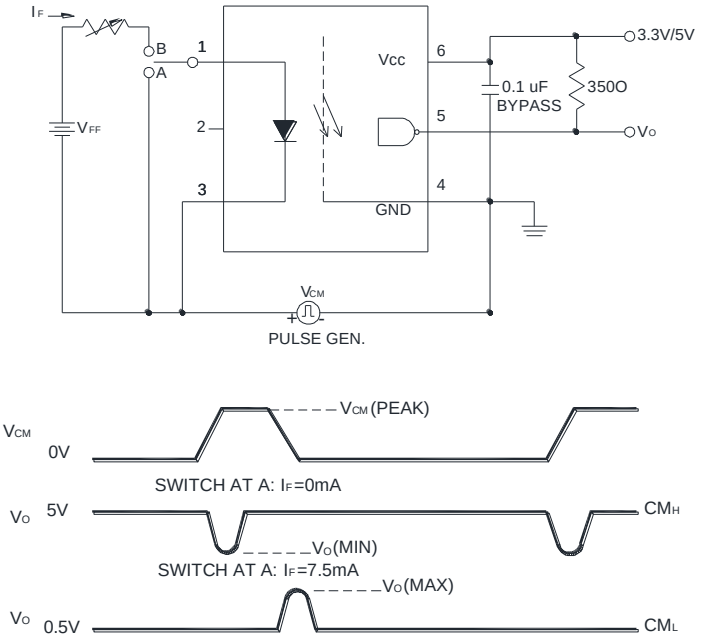


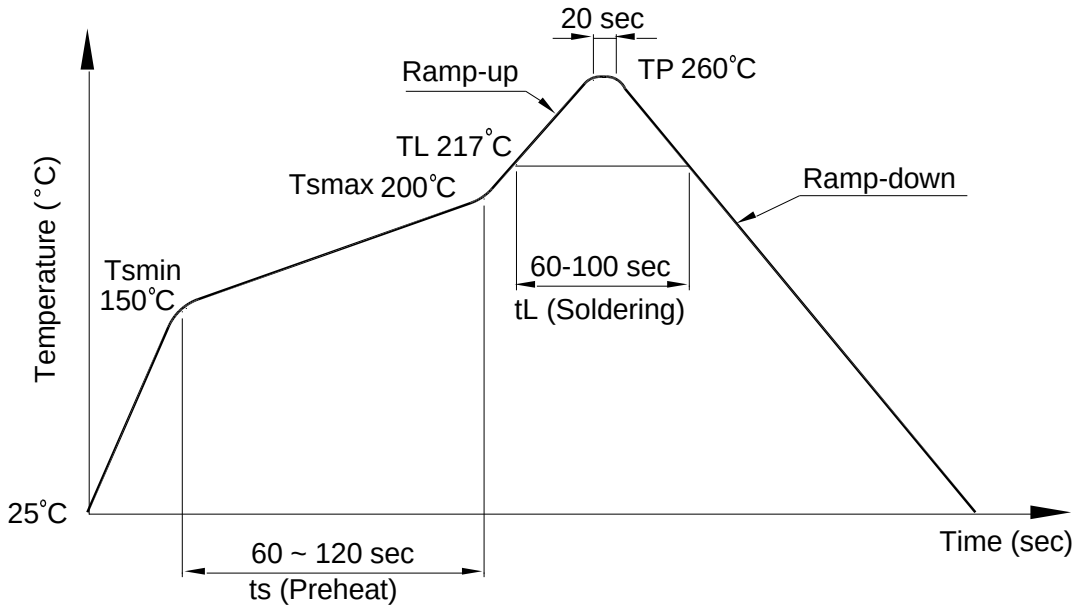
Figure 9. Test Circuit for Common Mode Transient Immunity and typical waveforms

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



8.2 Wave soldering (JEDEC22A111 compliant)

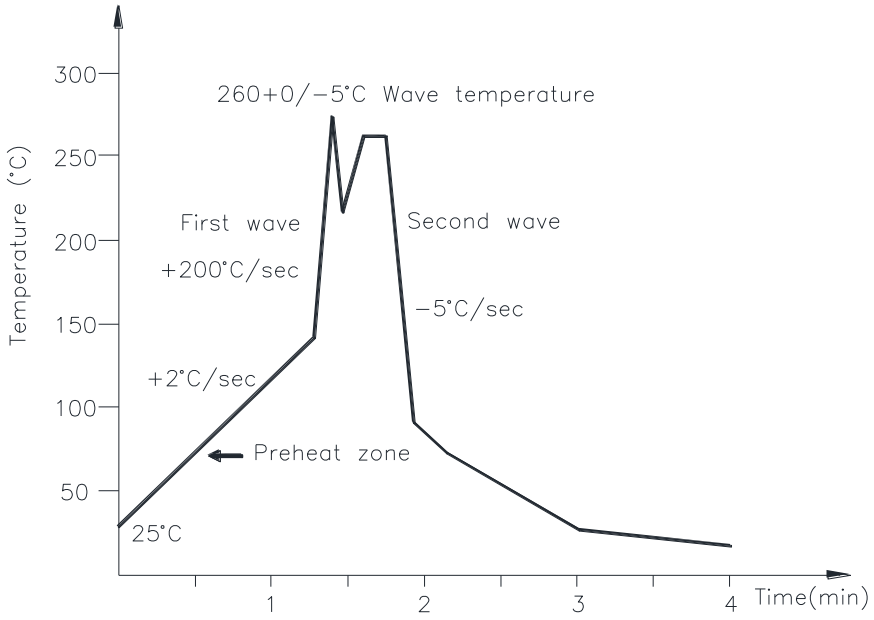
One time soldering is recommended within the condition of temperature.

Temperature: 260+0/-5˚C

Time: 10 sec.

Preheat temperature:25 to 140˚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˚C

Time: 3 sec max.

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 7mm minimum
"W"	clearance distance 8mm minimum
"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.
- Immerge unit’s body in solder paste is not recommended.