

Photocoupler LTV-M61L series

Low Power, 10 MBd Digital CMOS Optocoupler

1. DESCRIPTION

LTV-M61L is optically-coupled logic gates. The detector IC has CMOS output stage and optical receiver input stage with built-in Schmitt trigger to provide logic-compatible waveforms, eliminating the need for additional wave-shaping. An internal shield on the LTV-M61L guarantees common mode transient immunity of 20 kV/ μ s at a common mode voltage of 1000 V. The LTV-M61L Optocouplers' series operates from a 2.7 V to 5.5 V supply with guaranteed AC and DC performance from an extended temperature range of -40 °C to 105 °C. Glitches free output upon power-up and power-down of Optocoupler. Functional

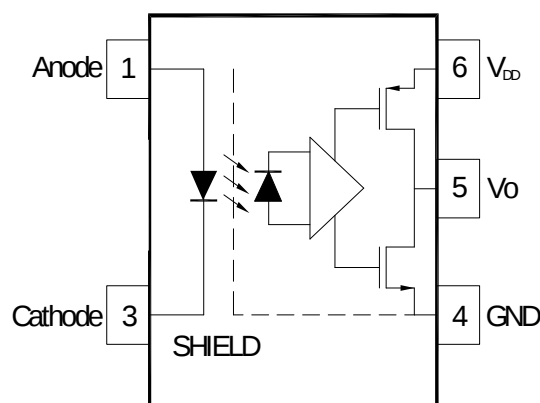
1.1 Features

- CMOS output, negative Logic Buffer output
- Wide supply voltage: 2.7V – 5.5V
- Low power supply current I_{DD} : 1.0 mA max
- Low forward current I_F : 1.6mA min
- Speed: 10MBd typ
- Pulse width distortion (PWD): 30 ns max
- Propagation delay skew: 30 ns max
- Propagation delay (t_p): 80 ns max
- Common mode rejection: 20kV/ μ s min at $V_{CM} = 1000V$
- Temperature: -40°C to 105°C
- Safety approval
- In process (to update)

1.2 Applications

- High Voltage Isolation
- Isolation in line receivers
- Ground loop elimination
- Feedback Element in Switching Mode Power Supplier
- Data transmission
- CANBus, RS485, USB
- Interface between Microprocessor system, computer and their peripheral

Functional Diagram



Truth Table (Negative Logic)

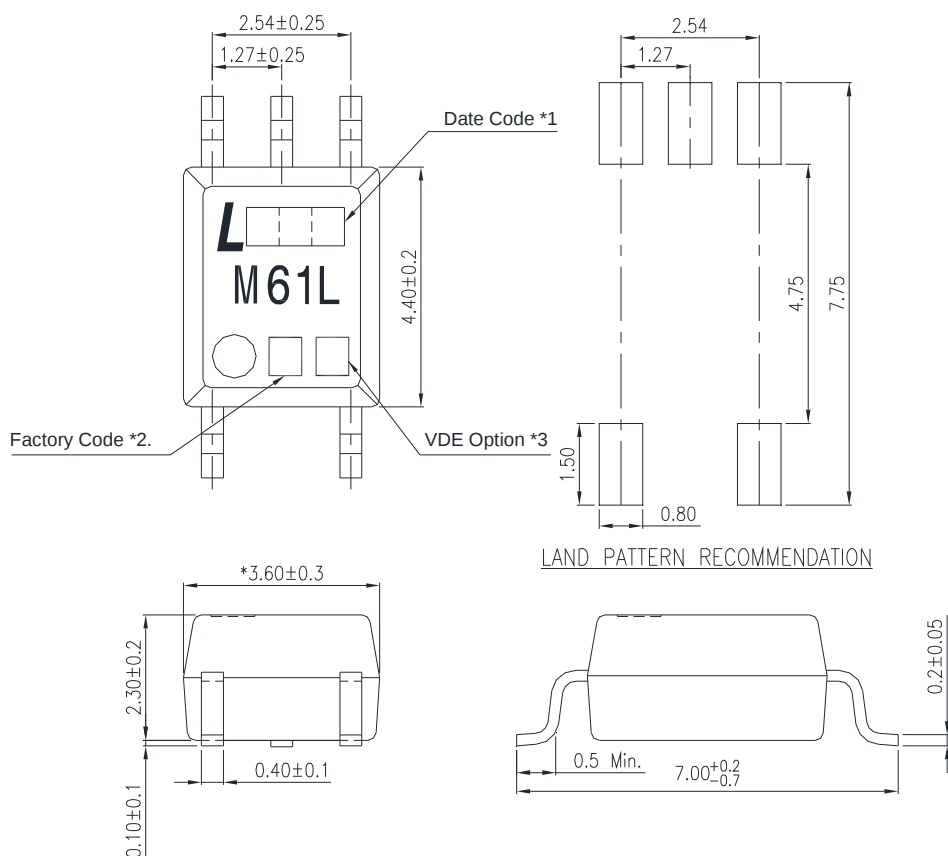
LED	OUT
ON	LOW
OFF	HIGH

A 0.1 μ F bypass Capacitor must be connected between Pin6 and Pin4

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2. PACKAGE DIMENSIONS

2.1 LTV-M61L



Notes :

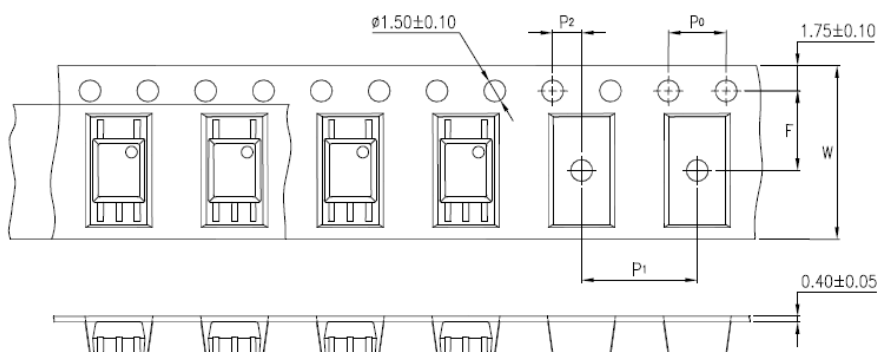
1. The first digit is year date code, second and third digit is work week
2. Factory identification mark (W :China-CZ)
3. "4" or "V" for VDE option.

* Dimensions are in Millimeters and (Inches).

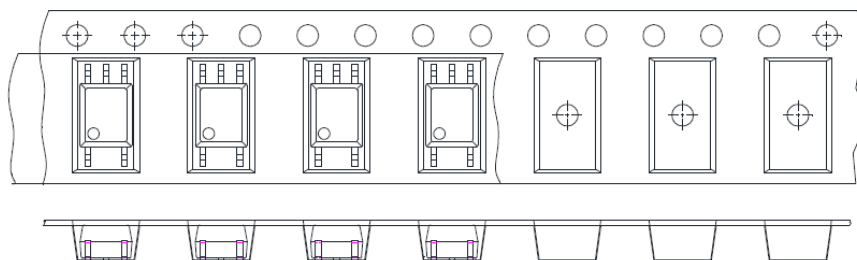
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3. TAPING DIMENSIONS

3.1 LTV-M61L



3.2 LTV-M61L-TP



Description	Symbol	Dimension in mm (inch)
Tape wide	W	12 ± 0.3 (.472)
Pitch of sprocket holes	P_0	4 ± 0.1 (.157)
Distance of compartment	F	5.5 ± 0.1 (.217)
	P_2	2 ± 0.1 (.079)
Distance of compartment to compartment	P_1	8 ± 0.1 (.315)

3.3 Quantities Per Reel

Package Type	LTV-M61L series
Quantities (pcs)	3000

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4. RATING AND CHARACTERISTICS

4.1 Absolute Maximum Ratings

	Parameter	Symbol	Rating	Unit	Note
Input	Average Forward Input Current	I_F	8	mA	
	Peak Forward Input Current ≤1 us Pulse Width < 300 pulses per second	$I_{F(TRAN)}$	1	A	
	Reverse Input Voltage	V_R	5	V	
	Input Power Dissipation	P_I	14	mW	
Output	Output Current	I_O	10	mA	
	Output Voltage	V_O	$V_{DD}+0.5$	V	
	Output Power Dissipation	P_O	20	mW	
	Isolation Voltage	V_{iso}	3750	V_{rms}	
	Supply Voltage	V_{CC}	6.5	V	
	Operating Temperature	T_{opr}	-40 ~ +105	°C	
	Storage Temperature	T_{stg}	-55 ~ +125	°C	
	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.	Units
Ambient Operation Temperature	T_A	-40	+105	°C
Input Current, Low Level	I_{FL}	0	250	μA
Supply Voltage	V_{DD}	2.7	5.5	V
Input Current (ON)	I_{FH}	1.6*	6	mA
Forward Input Voltage	$V_{F(OFF)}$		0.8	V

* The initial switching threshold is 1.6 mA or less. It is recommended that 2 mA to be used to permit at least a 20% LED degradation guardband.

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4.3 Electrical Optical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition	Figure	Note
Input								
Input Forward Voltage	V_F	—	1.3	1.80	V	$I_F = 2\text{mA}$	9	
Input Forward Voltage Temperature	$\Delta V_F / \Delta T$	—	-2.070	—	mV/°C	$I_F = 2\text{mA}$	10	
Input Reverse Voltage	BV_R	5.0	—	—	V	$I_R = 10\mu\text{A}$		
Input Threshold Current	I_{TH}	—	0.6	1.3	mA	$V_O < 0.8\text{V}$	11	
Input Capacitance	C_{IN}	—	31	—	pF	$f = 1\text{MHz}$, $V_F = 0\text{V}$		
Detector								
Logic High Level Supply Current	I_{DDH}	—	0.65	1.0	mA	$I_F = 0\text{mA}$, $V_{DD} = 5\text{V}$ $I_O = \text{Open}$	12	1
Logic Low Level Supply Current	I_{DDL}	—	0.68	1.0	mA	$I_F = 2\text{mA}$, $V_{DD} = 5\text{V}$ $I_O = \text{Open}$	13	1
High Level Output Current	V_{OH}	$V_{DD} - 0.1$	$V_{DD} - 0.002$	—	V	$I_F = 0\text{mA}$, $I_O = -20\mu\text{A}$		
		$V_{DD} - 1.0$	$V_{DD} - 0.13$	—		$I_F = 0\text{mA}$, $I_O = -3.2\text{mA}$		
Low Level Output Voltage	V_{OL}	—	0.006	0.1	V	$I_F = 2\text{mA}$, $I_O = 20\mu\text{A}$		
		—	0.13	0.4		$I_F = 2\text{mA}$, $I_O = 3.2\text{mA}$		

Over recommended temperature ($T_A = -40^\circ\text{C}$ to 105°C) and supply voltage ($2.7\text{V} \leq V_{DD} \leq 5.5\text{V}$). All typical specifications are at $V_{DD} = 5.0\text{V}$, $T_A = 25^\circ\text{C}$, unless otherwise specified.

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5. SWITCHING SPECIFICATION

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition	Figure	Note
Propagation Delay Time to Low Output Level	t_{PHL}	—	43	80	ns	$I_F=2mA$, $C_L = 15pF$,	14,15	2
Propagation Delay Time to High Output Level	t_{PLH}	—	38	80		$I_F=2mA$, $C_L = 15pF$,		3
Pulse Width Distortion	$ t_{PLH} - t_{PHL} $	—	5	30		CMOS Signal Levels		
Propagation Delay Skew	t_{PSK}			30				
Output Rise Time (10 to 90%)	t_r	—	10	—		$I_F=2mA$, $C_L = 15pF$ CMOS Signal Levels		
Output Fall Time (90 to 10%)	t_f	—	10	—				
Common Mode Transient Immunity at High Output Level	$ CM_H $	20	—	—	kV/ μ s	$V_{CM} = 1000 V$, $T_A = 25^\circ C$, $I_F = 0 mA$, $C_L = 15 pF$, $V_I = 5 V$ ($R_T = 1.6 k\Omega$) or $V_I = 3.3 V$ ($R_T = 840 \Omega$)		4
Common Mode Transient Immunity at Low Output Level	$ CM_L $	20	—	—	kV/ μ s	$V_{CM} = 1000 V$, $T_A = 25^\circ C$, $I_F = 2 mA$, $C_L = 15 pF$, $V_I = 0 V$ ($R_T = 1.6 k\Omega$) or ($R_T = 840 \Omega$)		5

Over recommended temperature ($T_A = -40^\circ C$ to $+105^\circ C$), supply voltage ($2.7 V \leq V_{DD} \leq 5.5 V$). All typical specifications are at $V_{DD} = 5.0 V$, $T_A = 25^\circ C$.

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6. ISOLATION CHARACTERISTIC

Parameter	Symbo	Min.	Typ.	Max.	Unit	Test Condition	Note
Withstand Insulation Test Voltage	V_{ISO}	3750	—	—	V	$RH \leq 40\%-60\%$, $t = 1\text{min}$, $T_A = 25^\circ\text{C}$	6
Input-Output Resistance	R_{I-O}	—	10^{12}	—	Ω	$V_{I-O} = 500\text{V DC}$	6
Input-Output Capacitance	C_{I-O}	—	0.92	—	pF	$f = 1\text{MHz}$, $T_A = 25^\circ\text{C}$	6

Specified over recommended temperature ($T_A = -40^\circ\text{C}$ to $+105^\circ\text{C}$) unless otherwise specified. Typical values applies to $T_A = 25^\circ\text{C}$

Notes:

1. A $0.1\mu\text{F}$ or bigger bypass capacitor for V_{DD} is needed as shown in Fig.1
2. t_{PHL} propagation delay is measured from the 50% (V_{in} or I_F) on the rising edge of the input pulse to the 50% V_{DD} of the falling edge of the V_O signal.
3. t_{PLH} propagation delay is measured from the 50% (V_{in} or I_F) on the falling edge of the input pulse to the 50% level of the rising edge of the V_O signal.
4. $|CM_H|$ 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., $V_O > 2.0\text{V}$).
5. $|CM_L|$ 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., $V_O < 0.8\text{V}$).
6. Device is considered a two-terminal device: pins 1 and 3 shorted together, and pins 4, 5 and 6 shorted together.

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7. TYPICAL PERFORMANCE CURVES & TEST CIRCUITS

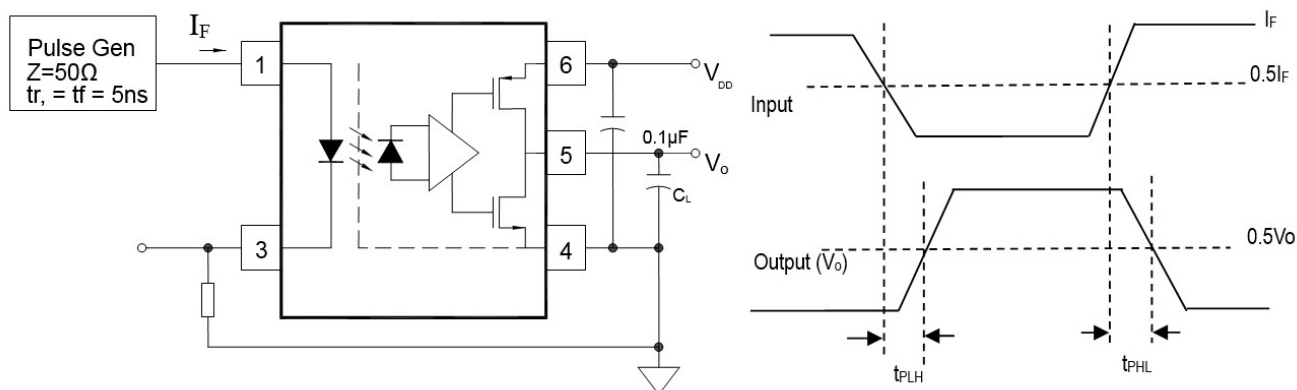


Figure 7. Test Circuit for t_{PHL} and t_{PLH}

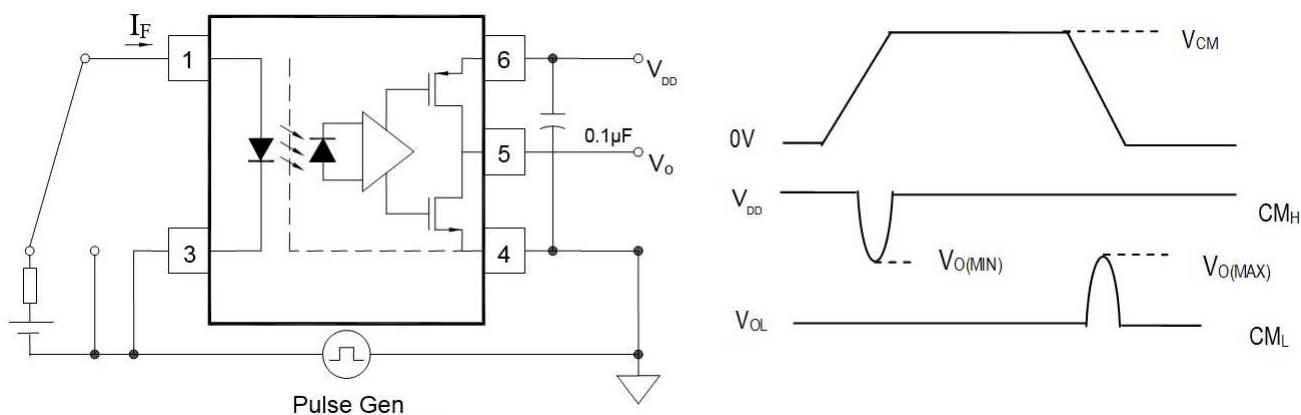


Figure 8. Test Circuit for Common Mode Transient Immunity and typical waveforms

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8. TYPICAL PERFORMANCE CURVES

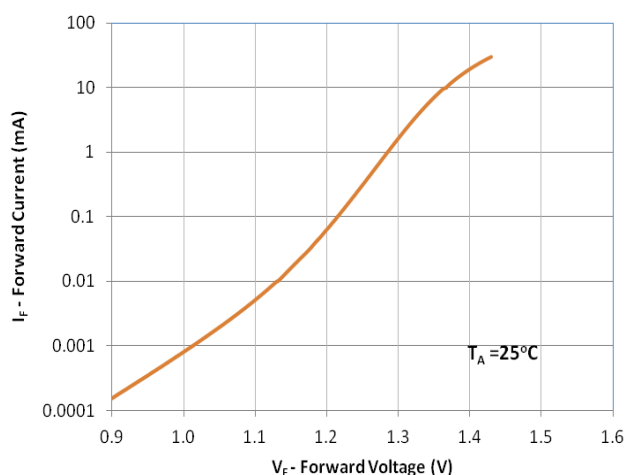


Figure 9: Typical Input Diode Forward Characteristic

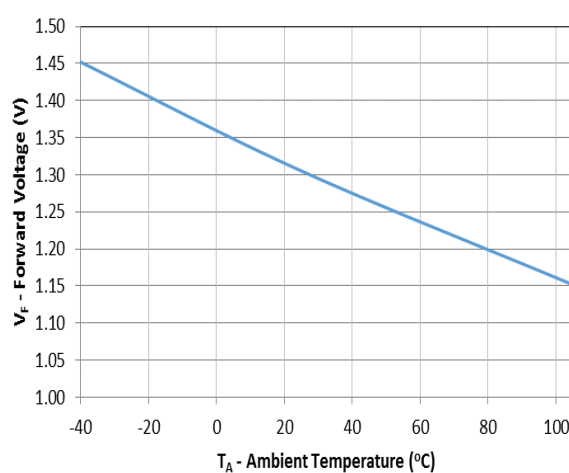


Figure 10: Typical V_F vs Temperature

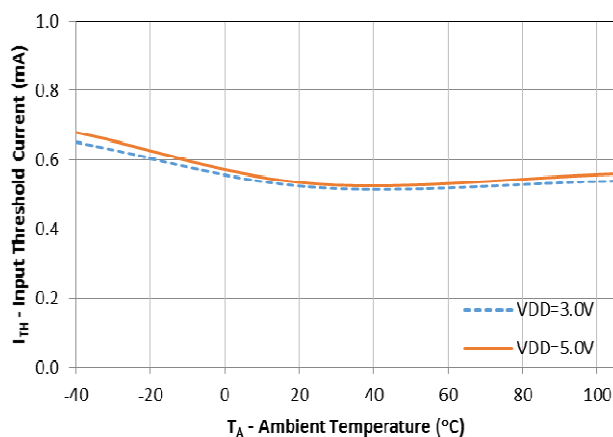


Figure 11: Typical Input Threshold Current vs Temperature

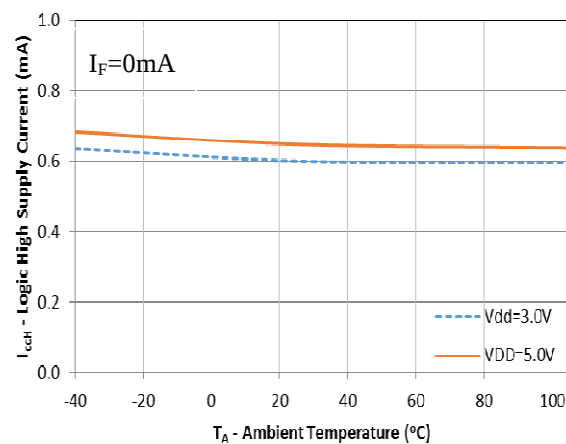


Figure 12: Typical Logic High Output Supply Current vs Temperature

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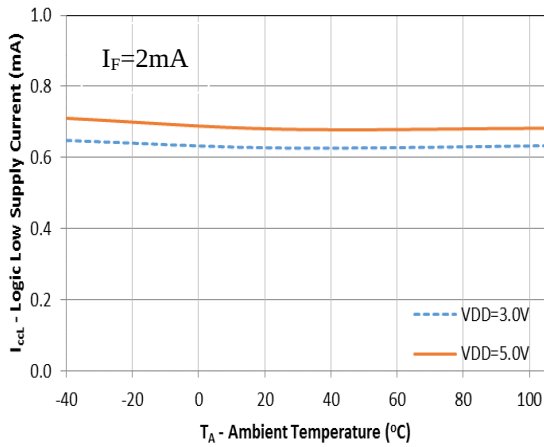


Figure 13 Typical Logic Low Output Supply Current vs. Temperature

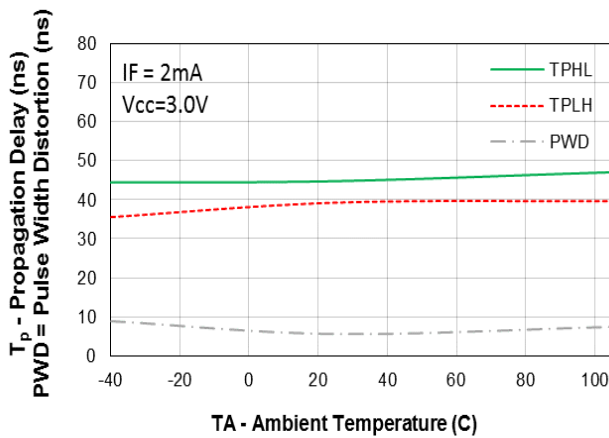


Figure 14a: Typical Propagation Delays (3V) vs Temperature

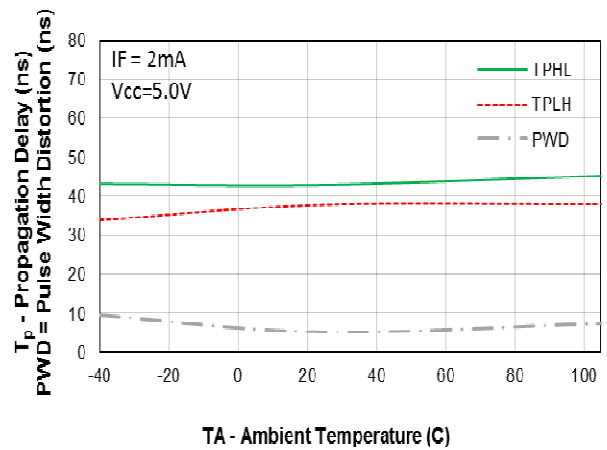


Figure 14b: Typical Propagation Delays (5V) vs Temperature

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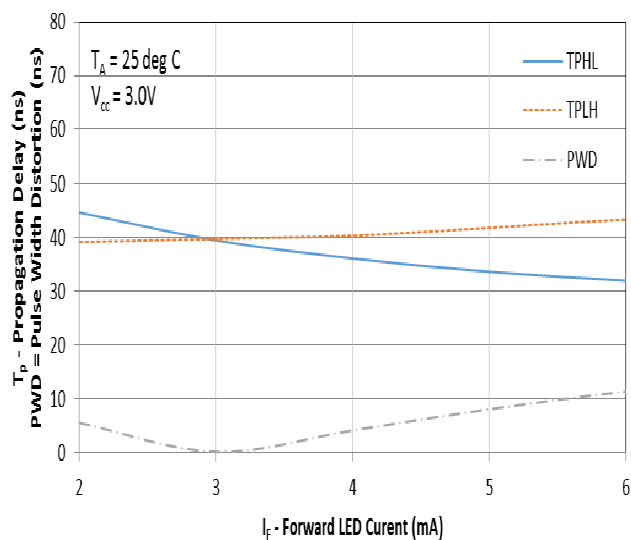


Figure 15a: Typical Propagation Delays (3V) vs Forward Current

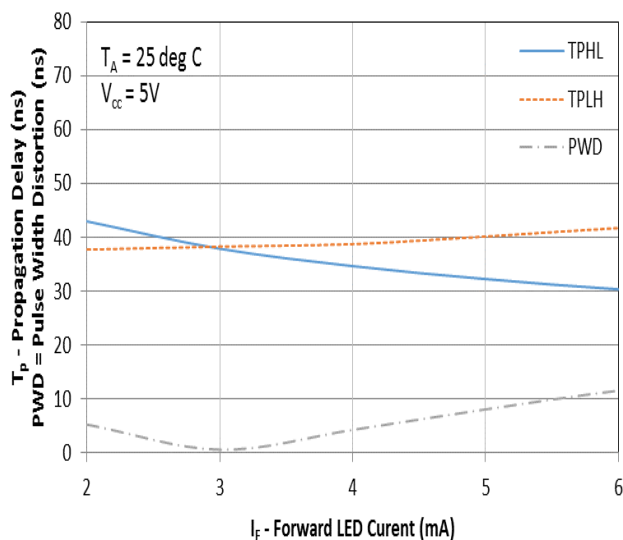


Figure 15b: Typical Propagation Delays (5V) vs. Forward Current

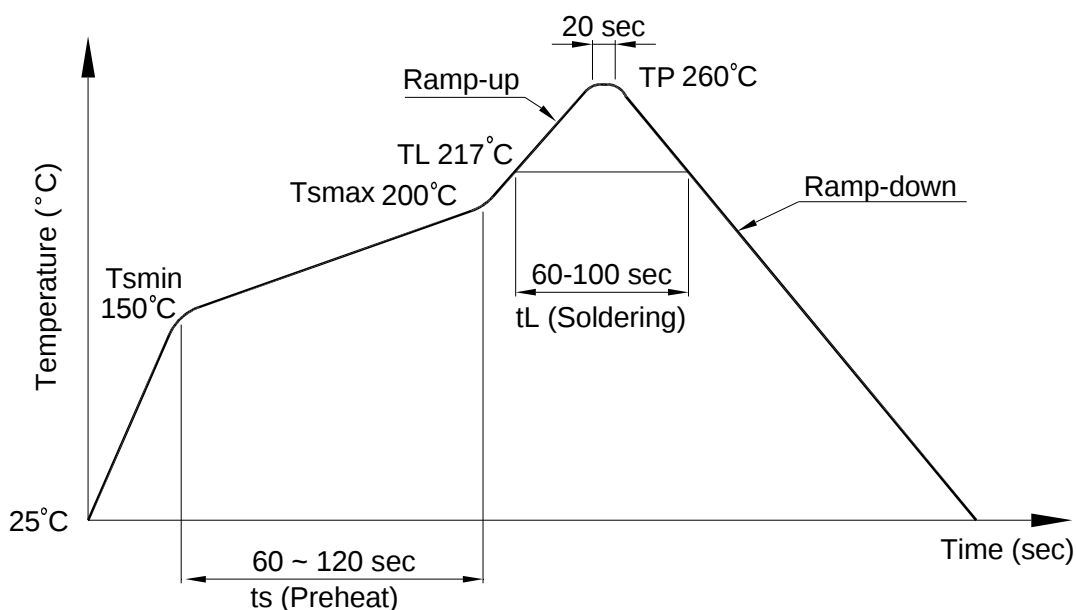
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9. TEMPERATURE PROFILE OF SOLDERING

9.1 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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9.2 Wave soldering (JEDEC22A111 compliant)

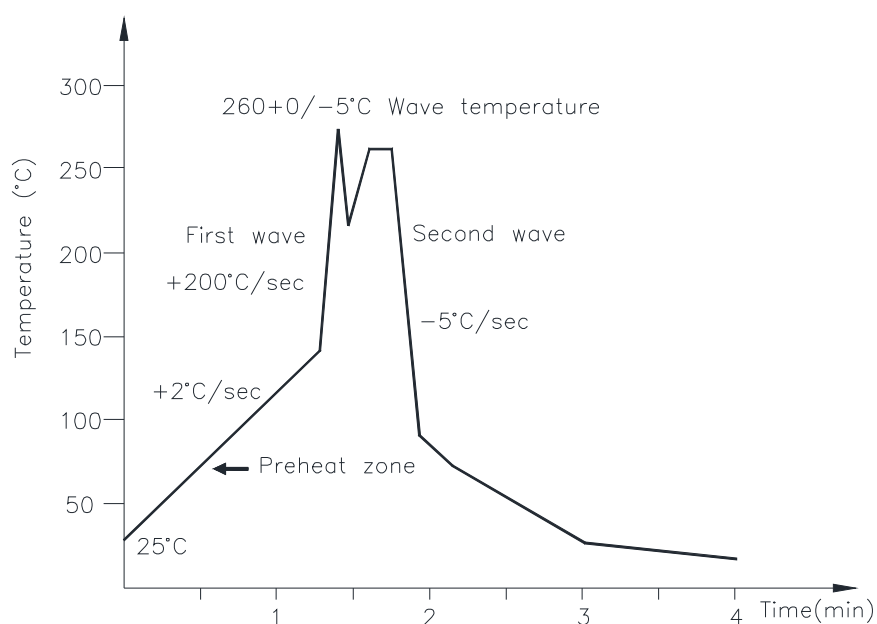
One time soldering is recommended within the condition of temperature.

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

Time: 10 sec.

Preheat temperature: 25 to 140°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.

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10. NAMING RULE

Part Number Options
LTV-M61L-TP
LTV-M61L
LTVM61LTP-V
LTVM61L-V

Definition of Suffix	Remark
"M61L"	LiteOn model name
" no suffix "	Pin 1 location at upper right of the tape
"TP"	Pin 1 location at lower left of the tape
"V"	VDE approved option

11. 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.