PHOTOCOUPLER
LTV-481 series

LTV-481 series
Inverted Logic High CMR Intelligent Power Module and Gate Drive Interface Photocoupler

Description

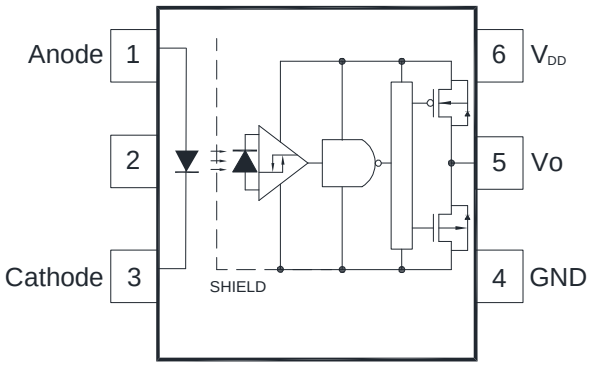
The LTV-481 series fast speed photocoupler contains a AlGaAs LED and photo detector with built-in Schmitt trigger to provide logic-compatible waveforms, eliminating the need for additional wave shaping. The totem pole output eliminates the need for a pull up resistor and allows for direct drive Intelligent Power Module or gate drive. Minimized propagation delay difference between devices makes these optocouplers excellent solutions for improving inverter efficiency through reduced switching dead time.

Features

- Positive output type (totem pole output)
- Truth Table Guaranteed: VCC from 4.5V to 30V
- Performance Specified for Common IPM Applications Over Industrial Temperature Range.
- Short Maximum Propagation Delays
- Minimized Pulse Width Distortion (PWD)
- Very High Common Mode Rejection (CMR)
- Hysteresis
- Safety approval
  - UL 1577 recognized with 5000 V_{RMS} for 1 minute for LTV-481P and LTV-481W
  - VDE DIN EN 60747-5-5 Approved
    V_{IORM} = 891Vpeak for LTV-481P
    V_{IORM} = 1140Vpeak for LTV-481W

Applications

- IPM Interface Isolation
- Isolated IGBT/MOSFET Gate Drive
- AC and Brushless DC Motor Drives
- Industrial Inverters
- General Digital Isolation



Specification

- Wide operating temperature range: -40°C to 105°C
- Maximum propagation delay t_{PHL} / t_{PLH} = 160/160 ns
- Maximum Pulse Width Distortion (PWD) = 70 ns
- Propagation Delay Difference Min/Max = -160/160 ns
- Wide Operating V_{CC} Range: 4.5 to 30Volts
- 20 kV/μs minimum common mode rejection (CMR) at V_{CM} = 1000 V

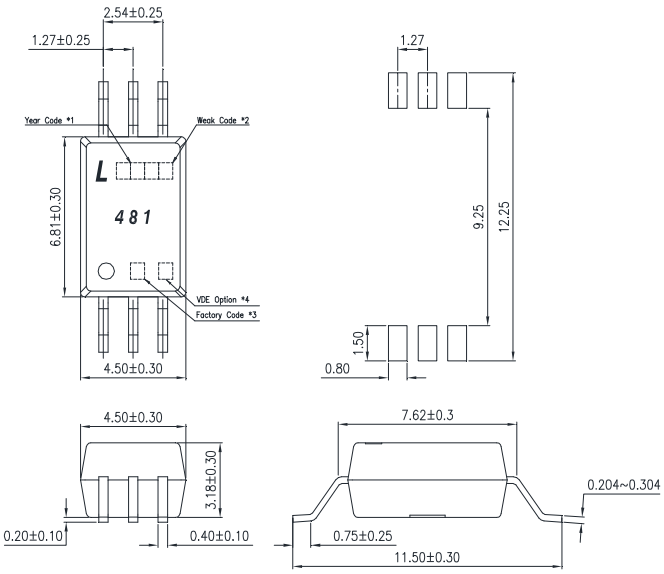
Truth Table

LED	OUT
ON	L
OFF	H

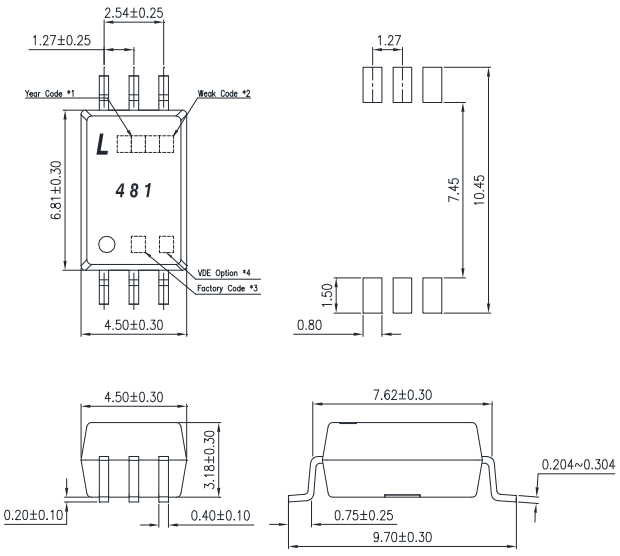
A 0.1μF bypass Capacitor must be connected between Pin4 and Pin6

2. PACKAGE DIMENSIONS

2.1 LTV-481W



2.2 LTV-481P



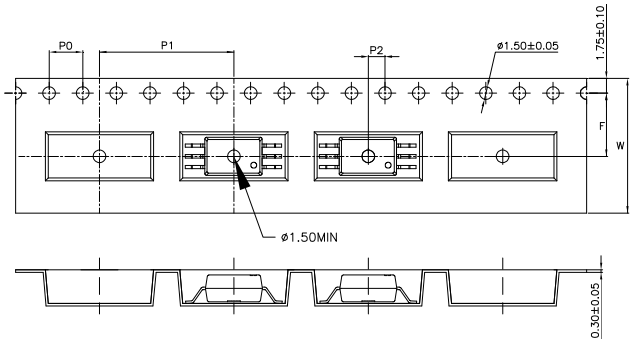
Notes :

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

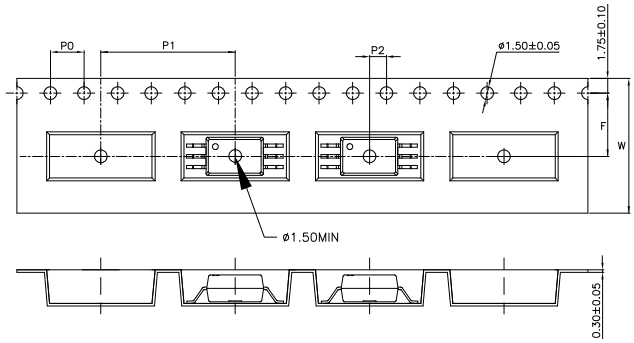
* Dimensions are in Millimeters and (Inches).

3. TAPING DIMENSIONS

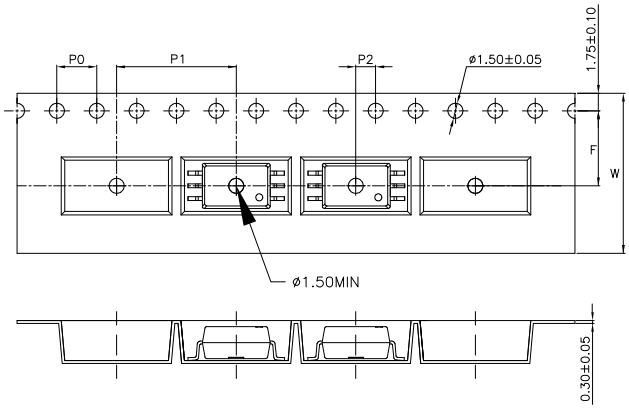
3.1 LTV-481W-TA



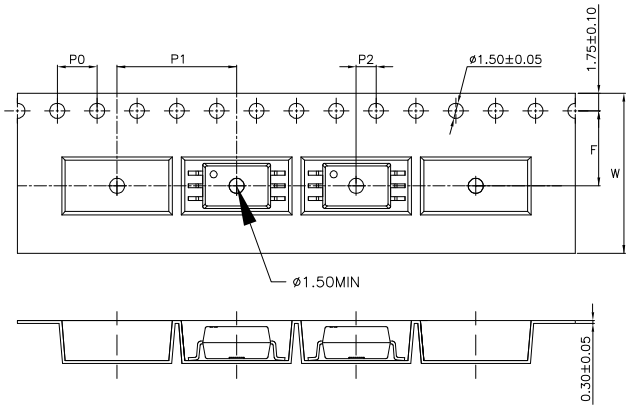
3.2 LTV-481W-TA1



3.3 LTV-481P-TA



3.4 LTV-481P-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-481 series
Quantities (pcs)	1000

4. RATING AND CHARACTERISTICS

4.1 Absolute Maximum Ratings at Ta=25℃

	Parameter	Symbol	Rating	Unit	Note
Input	Average Forward Input Current	I_F	10	mA	
	Peak Transient Input Current (<1us pulse width, 300pps)	$I_{F(tran)}$	1.0	A	
	Reverse Input Voltage	V_R	5	V	
Output	Output Collector Current	I_O	50	mA	
	Output Collector Voltage	V_O	-0.5 ~ +35	V	
	Total Package Power Dissipation	P_T	145	mW	
	Supply Voltage	V_{CC}	35	V	
	Operating Temperature	T_{opr}	-40 ~ +105	°C	
	Storage Temperature	T_{stg}	-55 ~ +125	°C	
	Lead Solder Temperature *2	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}	4.5	30	V
Forward Input Current (ON)	$I_{F(ON)}$	4	7	mA
Forward Input Voltage (OFF)	$V_{F(OFF)}$	-	0.8	V

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 = 10mA	6	
	Input Forward Voltage Temperature Coefficient	$\Delta V_F / \Delta T$		-1.237		mV/°C	I_F = 10mA		
	Input Reverse Voltage	BV_R	5			V	I_R = 10μA		
	Input Threshold Current (Low to High)	I_{FLH}		1.6	4	mA		5	
	Input Threshold Voltage (High to Low)	V_{FHL}	0.8			V			
	Input Capacitance	C_{IN}		33		pF	f = 1 MHz, V_F = 0 V		3
Output	High Level Supply Current	I_{CCH}			3.0	mA	V_{CC} = 5.5 V, I_F = 7 mA, I_O = 0 mA		
				1.9	3.0	mA	V_{CC} = 30 V, I_F = 7 mA, I_O = 0 mA		
	Low Level Supply Current	I_{CCL}			3.0	mA	V_{CC} = 5.5 V, V_F = 0V, I_O = 0 mA		
				2.0	3.0	mA	V_{CC} = 30 V, V_F = 0 V, I_O = 0 mA		
	High level output current	I_{OSH}			-160	mA	V_{CC} = 5.5V, I_F = 7mA, V_O = GND		2
					-200		V_{CC} = 20V, I_F = 7mA, V_O = GND		
	Low level output current	I_{OSL}	160			mA	V_O = V_{CC} = 5.5V, V_F = 0V		2
			200				V_O = V_{CC} = 20V, V_F = 0V		
	High level output voltage	V_{OH}	V_{CC} - 0.5	V_{CC} – 0.025		V	I_{OL} = -6.5mA	4,8	
	Low level output voltage	V_{OL}		V_{EE} + 0.015	V_{EE} + 0.5	V	I_{OL} = 6.5mA	3	

Specified over recommended temperature (T_A = -40°C to +105°C, +4.5V ≤ V_{CC} ≤ 30V), $I_{F(ON)}$ = 4mA to 7mA, $V_{F(OFF)}$ = 0V to 0.8V, unless otherwise specified. All typicals at T_A = 25°C.

5. SWITCHING SPECIFICATION

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition	Figure	Note
Propagation Delay Time to High Output Level	t_{PHL}		110	200	ns	C_L = 100pF, V_F = 0V→ $I_{F(ON)}$ = 4mA	1,7,9	5
Propagation Delay Time to Low Output Level	t_{PLH}		110	200		C_L = 100pF, $I_{F(ON)}$ = 4mA→V_F = 0V		5
Pulse Width Distortion	PWD		10	70		C_L = 100pF,		8
Propagation delay difference between any two parts or channels	PDD	-160		160		C_L = 100pF,		9
Output Rise Time (10 to 90%)	Tr		35				1	
Output Fall Time (90 to 10%)	Tf		35					
Common mode transient immunity at high level output	$\|CM_H\|$	20			kV/μs	T_A = 25℃, I_F = 4.0 mA, V_{CM} = 1500 V, V_{CC} = 5 V	2	6
Common mode transient immunity at low level output	$\|CM_L\|$	20			kV/μs	T_A = 25℃, V_F = 0 V, V_{CM} = 1500 V, V_{CC} = 5 V	2	6

Over recommended operating conditions T_A = -40°C to 105°C, V_{CC} = +4.5 V to 30 V, $I_{F(ON)}$ = 4 mA to 7 mA, $V_{F(OFF)}$ = 0 V to 0.8 V, unless otherwise specified. All typicals at T_A = 25°C.

6. ISOLATION CHARACTERISTIC

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition	Note
Withstand Insulation Test Voltage	V_{ISO}	5000	—	—	V_{RMS}	RH ≤ 50%, t = 1min, T_A = 25°C	4, 7
Input-Output Resistance	R_{I-O}	—	10^{12}	—	Ω	V_{I-O} = 500V DC	4
Input-Output Capacitance	C_{I-O}	—	1.0	—	p	f = 1MHz, T_A = 25°C	4

Specified over recommended temperature (T_A = -40°C to +105°C) unless otherwise specified. Typical values applies to T_A = 25°C

Notes

1. Detector requires a V_{CC} of 4.5 V or higher for stable operation as output might be unstable if V_{CC} is lower than 4.5 V. Be sure to check the power ON/OFF operation other than the supply current.
2. Duration of output short circuit time should not exceed 500 µs.
3. Input capacitance is measured between pin 1 and pin 3.
4. Device considered a two-terminal device: pins 1, 2 and 3 shorted together and pins 4, 5 and 6 shorted together.
5. The t_{PLH} propagation delay is measured from the 50% point on the trailing edge of the input pulse to the 1.3 V point on the leading edge of the output pulse. The t_{PHL} propagation delay is measured from the 50% point on the leading edge of the input pulse to the 1.3 V point on the trailing edge of the output pulse. Peaking capacitor, C1 = 120 pF must be connected as shown in Figure 1.
6. CM_H is the maximum slew rate of the common mode voltage that can be sustained with the output voltage in the logic high state, V_O > 2.0 V. CM_L is the maximum slew rate of the common mode voltage that can be sustained with the output voltage in the logic low state, V_O < 0.8 V. Note: Equal value split resistors (Rin/2) must be used at both ends of the LED.
7. In accordance with UL 1577, each optocoupler is proof tested by applying an insulation test voltage ≥ 6000 VRMS for one second (leakage detection current limit, II-O < = 5 µA). This test is performed before the 100% production test.
8. Pulse Width Distortion (PWD) is defined as $|t_{PHL} - t_{PLH}|$ for any given device.
9. The difference of t_{PLH} and t_{PHL} between any two devices under the same test condition.
10. Use of a 0.1 µF bypass capacitor connected between pins Vcc and Ground is recommended.

7. TEST CIRCUIT

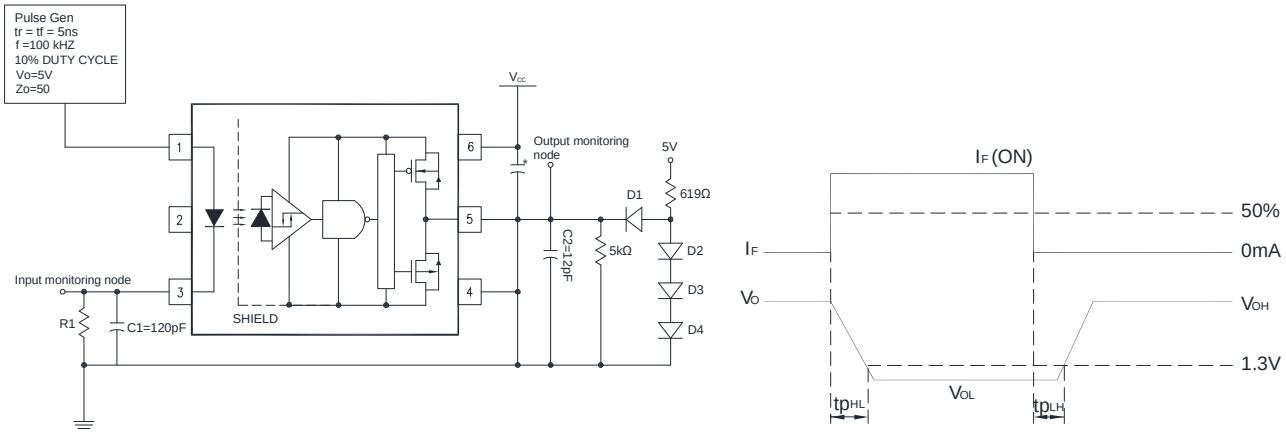


Figure 1 : tr, tf, tPLH and tPHL Test Circuit and Waveforms

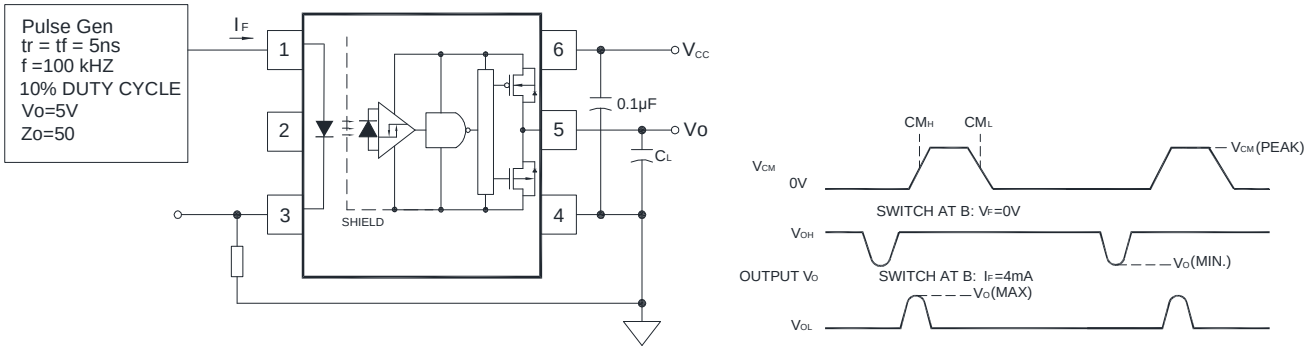


Figure 2 : CMR Test Circuit and Waveforms

8. TYPICAL PERFORMANCE CURVES

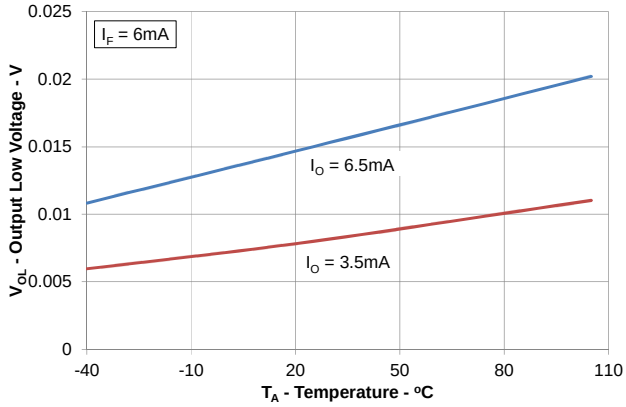


Figure 3: V_{OL} vs. Temperature

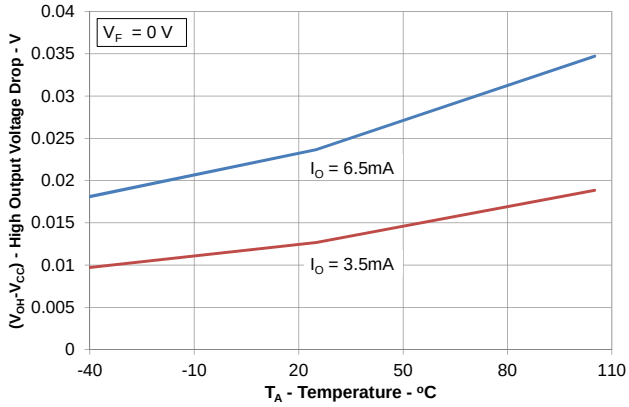


Figure 4: V_{OH} - V_{CC} vs. Temperature

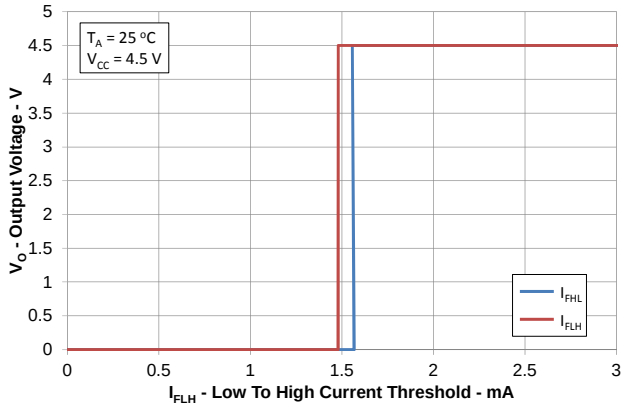


Figure 5: I_{FLH} Hysteresis

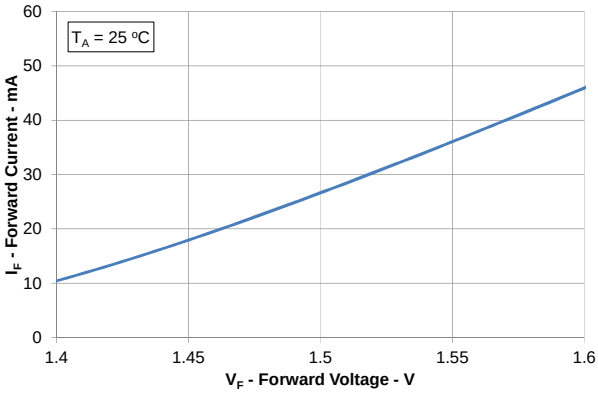


Figure 6: Input Current vs. Forward Voltage

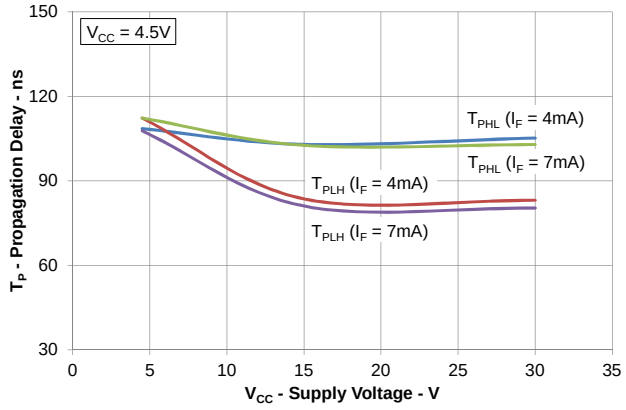


Figure 7: Propagation Delays vs. Temperature

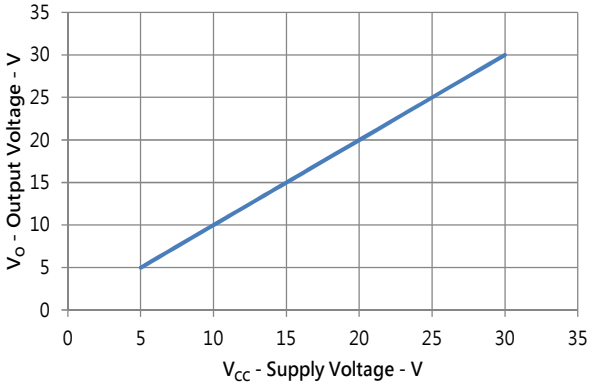


Figure 8: Input Current vs. Forward Voltage

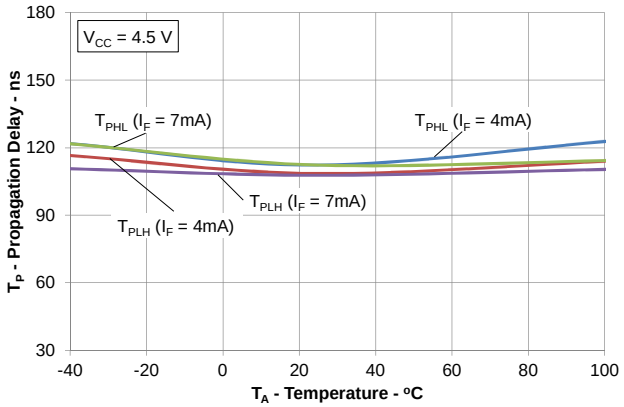


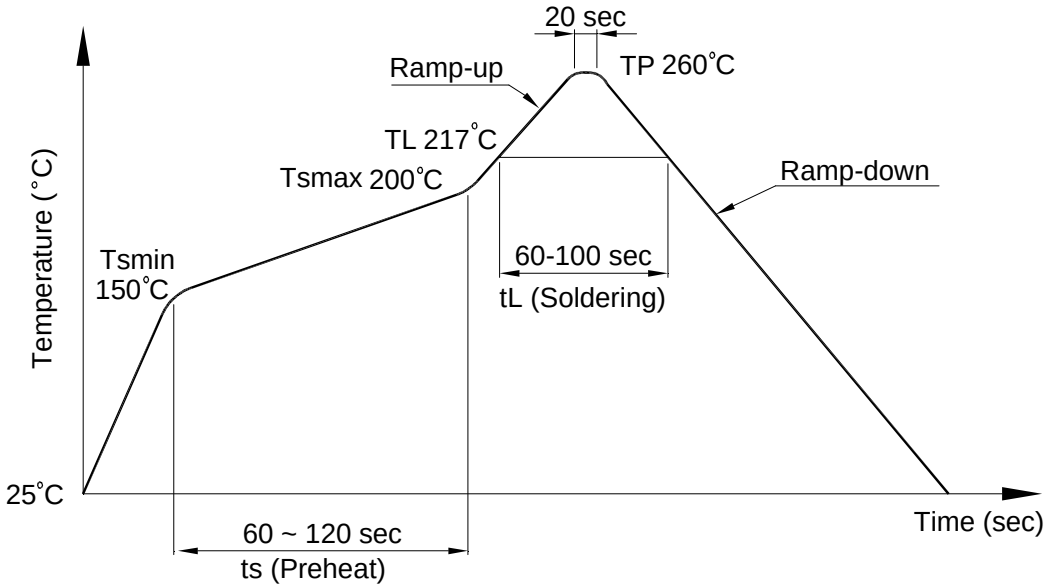
Figure 9: Propagation Delays vs. V_{CC}

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 ~ 100sec
Peak Temperature (T_P)	260˚C
Ramp-up rate	3˚C / sec max.
Ramp-down rate	3~6˚C / sec



9.2 Wave soldering (JEDEC22A111 compliant)

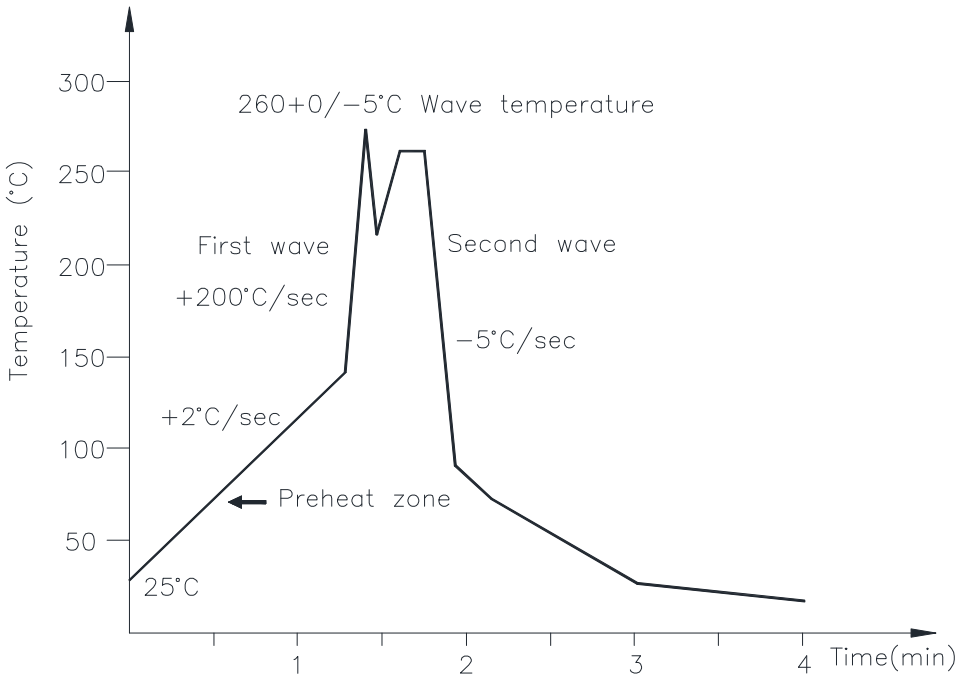
One time soldering is recommended within the condition of temperature.

Temperature: 260+0/-5˚C

Time: 10 sec.

Preheat temperature:25 to 140˚C

Preheat time: 30 to 80 sec.



9.3 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.

10. NAMING RULE

Part Number Options
LTV-481P-TA
LTV-481P-TA1
LTV-481W-TA
LTV-481W-TA1
LTV481PTA-V
LTV481PTA1-V
LTV481WTA-V
LTV481WTA1-V

Definition of Suffix	Remark
"481"	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

11. Notes:

Specifications of the products displayed herein are subject to change without notice.

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 instrumentation and application. 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.