

Photocoupler LTV-063L series

1. DESCRIPTION

The LTV-063L series consists of a high efficient AlGaAs Light Emitting Diode and a high speed photo 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 enable function allows the optical detector to be strobed. The internal shield ensures high common mode transient immunity. A guaranteed common mode transient immunity is up to 10KV/ μ s at 3.3V. The Optocoupler operational parameters are guaranteed over the temperature range from -40°C ~ +85°C. This unique design provides maximum AC and DC circuit isolation while achieving LVTTL/LVCMOS compatibility.

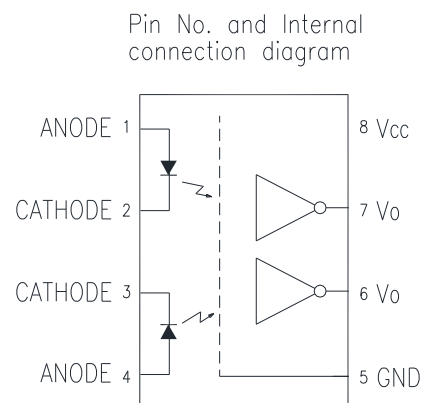
1.1 Features

- Small outline SO8 package
- 3.3V/5V Dual Supply Voltage.
- Dual channel output
- Lower power consumption
- High speed: 10 Mbd typical
- Low input current capability: 5mA
- LVTTL/LVCMOS compatible
- Guaranteed performance from temperature -40 °C to +85 °C
- 10KV/ μ s minimum Common Mode Rejection (CMR) at $V_{CM} = 1000V$
- Safety approval
UL 1577
VDE DIN/EN 60747-5-5

1.2 Applications

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

1.3 Functional Diagram



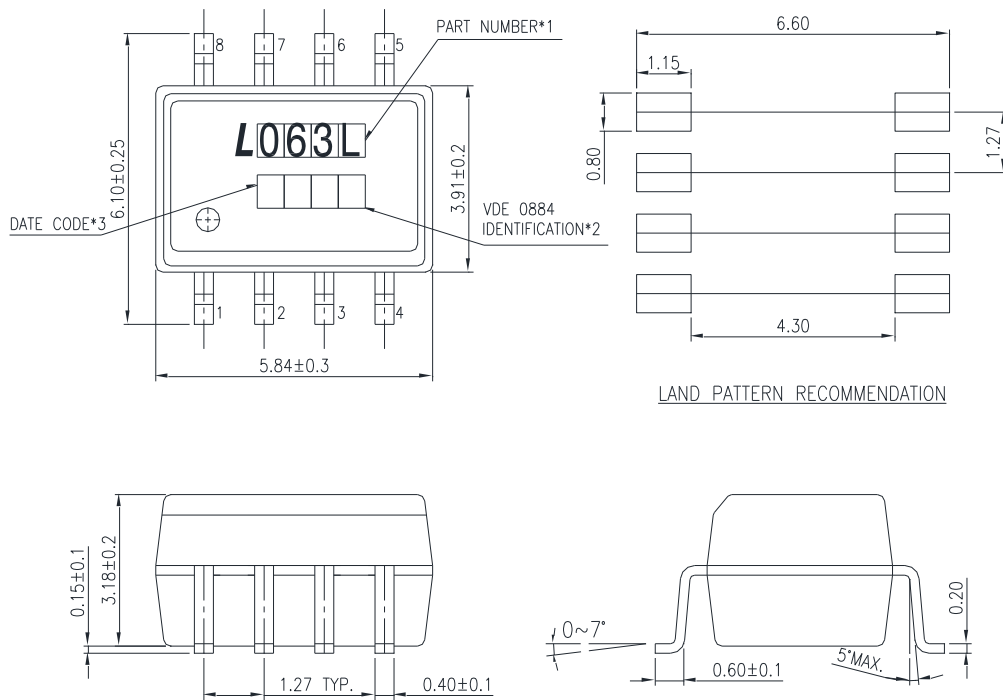
Truth Table (Positive Logic)

LED	OUT
ON	L
OFF	H

A 0.1 μ F bypass Capacitor must be connected between Pin8 and Pin5

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2. PACKAGE DIMENSIONS



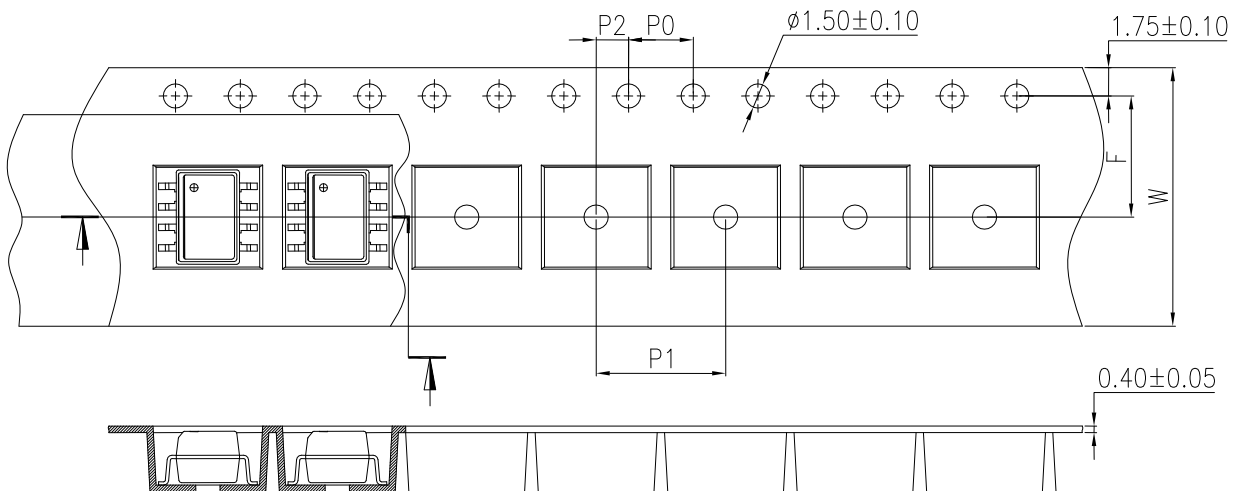
NOTE :

- *1. Part Numbers
- *2. "V" for VDE option.
- *3. 1st digit year code, 2nd and 3rd digit work week code
- *. Dimensions are all in Millimeters.
- *. Lead Coplanarity = 0.1mm max.

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3. TAPING DIMENSIONS

3.1 LTV-063L



Description	Symbol	Dimension in mm (inch)
Tape wide	W	16±0.3 (0.63)
Pitch of sprocket holes	P ₀	4±0.1 (0.157)
Distance of compartment	F	7.5±0.1 (0.295)
	P ₂	2±0.1 (0.079)
Distance of compartment to compartment	P ₁	12±0.1 (0.472)

3.2 Quantities Per Reel

Package Type	LTV-063L
Quantities (pcs)	2000

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4. RATING AND CHARACTERISTICS

4.1 Absolute Maximum Ratings at Ta=25°C *

	Parameter	Symbol	Rating	Unit	Note
Input	Average Forward Input Current	$I_{F(AVG)}$	15	mA	2
	Peak Transient Input Current ($<1\mu s$ Pulse Width, 300pps)	$I_{F(TRAN)}$	1.0	A	2
	Reverse Input Voltage	V_R	5	V	2
	Power Dissipation	P_I	40	mW	
Output	Output Collector Current	I_O	50	mA	2
	Output Collector Voltage	V_O	7	V	2
	Output Collector Power Dissipation	P_O	60	mW	2
	Isolation Voltage	V_{ISO}	3750	V_{rms}	
	Supply Voltage	V_{CC}	7	V	
	Operating Temperature	T_{opr}	-40 ~ +85	°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.

**260°C for 10 seconds. Refer to Lead Free Reflow Profile

4.2 Recommended Operating Conditions

Parameter	Symbol	Min	Max	Units
Operating Temperature	T_A	-40	85	°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}	5	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 at $T_A=25^\circ\text{C}$

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition	Fig.	Note
Input								
Input Forward Voltage	V_F	—	1.38	1.70	V	$I_F=10\text{mA}$, $T_A=25^\circ\text{C}$	7	2
Input Forward Voltage Temperature Coefficient	$\Delta V_F/\Delta T$	—	-1.5	—	mV/ $^\circ\text{C}$	$I_F=10\text{mA}$		2
Input Reverse Voltage	BV_R	5.0	—	—	V	$I_R = 10\mu\text{A}$		2
Input Threshold Current	I_{TH}	—	2	5	mA	$V_{CC} = 3.3\text{V}$, $V_O = 0.6\text{V}$ $I_{OL} \text{ (sinking)} = 13\text{mA}$	4	
Input Capacitance	C_{IN}	—	34	—	pF	$V_F=0$; $f=1\text{MHz}$		2
Detector								
Logic low output voltage	V_{OL}	—	0.3	0.6	V	$V_{CC} = 3.3\text{V}$, $I_F = 5\text{mA}$, $I_{OL} \text{ (sinking)} = 13\text{mA}$	5	
Logic high output current	I_{OH}	—	5	100	μA	$V_{CC} = 3.3\text{V}$, $V_O = 5.5\text{V}$, $I_F = 250\mu\text{A}$	3	2
Logic low supply current	I_{CCL}	—	9.6	15	mA	$V_{CC} = 3.3\text{V}$, $I_F = 10\text{mA}$		
Logic high supply current	I_{CCH}	—	7.7	10	mA	$V_{CC} = 3.3\text{V}$, $I_F = 0\text{mA}$		

* Over recommended operating conditions ($T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$, $2.7\text{V} \leq V_{CC} \leq 3.6\text{V}$) unless otherwise specified.

* All Typical at $V_{CC} = 3.3\text{V}$, $T_A=25^\circ\text{C}$.

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Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition	Fig.	Note
Input								
Input Forward Voltage	V_F	—	1.38	1.70	V	$I_F=10\text{mA}$, $T_A=25^\circ\text{C}$	7	2
Input Forward Voltage Temperature Coefficient	$\Delta V_F/\Delta T$	—	-1.5	—	mV/ $^\circ\text{C}$	$I_F=10\text{mA}$		2
Input Reverse Voltage	BV_R	5.0	—	—	V	$I_R = 10\mu\text{A}$		2
Input Threshold Current	I_{TH}	—	2	5	mA	$V_{CC} = 5.5\text{V}$, $V_O = 0.6\text{V}$ $I_{OL} \text{ (sinking)} = 13\text{mA}$	4	
Input Capacitance	C_{IN}	—	34	—	pF	$V_F=0$; $f=1\text{MHz}$		2
Detector								
Logic low output voltage	V_{OL}	—	0.29	0.6	V	$V_{CC} = 5.5\text{V}$, $I_F = 5\text{mA}$ $I_{OL} \text{ (sinking)} = 13\text{mA}$	5	
Logic high output current	I_{OH}	—	0.9	100	μA	$V_{CC} = 5.5\text{V}$, $V_O = 5.5\text{V}$, $I_F = 250\mu\text{A}$	3	2
Logic low supply current	I_{CCL}	—	14.8	21	mA	$V_{CC} = 5.5\text{V}$, $I_F = 10\text{mA}$		
Logic high supply current	I_{CCH}	—	12.7	15	mA	$V_{CC} = 5.5\text{V}$, $I_F = 0\text{mA}$		

* Over recommended operating conditions ($T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$, $4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$) unless otherwise specified.

* All Typical at $V_{CC} = 5\text{V}$, $T_A=25^\circ\text{C}$.

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5. SWITCHING SPECIFICATION

Parameter	Test Condition	Sym.	Min.	Typ.	Max.	Units	Fig.	Note
Propagation Delay Time to High Output Level	$R_L = 350\Omega, C_L = 15pF$	t_{PLH}	25	48	90	ns	1,8	2, 4
Propagation Delay Time to Low Output Level		t_{PHL}	25	35	75		1,8	2, 5
Pulse Width Distortion		$ t_{PLH} - t_{PHL} $		13			9	
Propagation Delay Skew		t_{PSK}			40			10
Output Rise Time (10 to 90%)		t_r		21				2
Output Fall Time (90 to 10%)		t_f		6.6				2

*Over Recommended Operating Conditions ($T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$, $2.7V \leq V_{CC} \leq 3.6V$), $I_F = 7.5 \text{ mA}$ unless otherwise specified.

*All Typical at $T_A=25^\circ\text{C}$, $V_{CC} = 3.3V$.

Parameter	Test Condition	Sym.	Min.	Typ.	Max.	Units	Fig.	Note
Propagation Delay Time to High Output Level	$R_L = 350\Omega, C_L = 15pF$	t_{PLH}	25	40	100	ns	1,8	2, 4
Propagation Delay Time to Low Output Level		t_{PHL}	25	32	100		1,8	2, 5
Pulse Width Distortion		$ t_{PLH} - t_{PHL} $		8			9	
Propagation Delay Skew		t_{PSK}			40			10
Output Rise Time (10 to 90%)		t_r		22				2
Output Fall Time (90 to 10%)		t_f		6.9				2

*Over Recommended Operating Conditions ($T_A = -40^\circ\text{C}$ to 85°C , $4.5 \leq V_{CC} \leq 5.5V$), $I_F = 7.5 \text{ mA}$ unless otherwise specified.

*All Typical at $T_A=25^\circ\text{C}$, $V_{CC} = 5V$

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Parameter	Test Condition	Sym.	Min.	Typ.	Max.	Units	Fig.	Note
Common Mode Transient Immunity at High Output Level	$V_{CC} = 3.3V$ $V_{CM} = 1000V$ $R_L = 350\Omega$ $I_F = 0mA$ $T_A = 25^\circ C$	CM _H	10	15		KV/ μs	2	6
	$V_{CC} = 5V$ $V_{CM} = 1000V$ $R_L = 350\Omega$ $I_F = 0mA$ $T_A = 25^\circ C$		10	15				
Common Mode Transient Immunity at Low Output Level	$V_{CC} = 3.3V$ $V_{CM} = 1000V$ $R_L = 350\Omega$ $I_F = 10.0mA$ $T_A = 25^\circ C$	CM _L	10	15		KV/ μs	2	7
	$V_{CC} = 5V$ $V_{CM} = 1000V$ $R_L = 350\Omega$ $I_F = 10.0mA$ $T_A = 25^\circ C$		10	15				

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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, $T_A = 25^\circ C$	8
Withstand Insulation Test Voltage	V_{ISO}	3750	—	—	V_{RMS}	RH $\leq 50\%$, $t = 1min$, $T_A = 25^\circ C$	8, 9
Input-Output Resistance	R_{I-O}	—	10^{11}	—	Ω	$V_{I-O} = 500V$ DC	2,8
Input- Output Capacitance	C_{I-O}		0.25		pG	$f = 1MHz$	2,8

*All Typical at $T_A = 25^\circ C$

Note

1. A 0.1 μF or bigger bypass capacitor for V_{CC} is needed as shown in Fig.1
2. Each channel
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 15mA.
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 and 4 shorted together, and pins 5, 6, 7 and 8 shorted together.
9. In accordance with UL1577, each optocoupler is proof tested by applying an insulation test voltage 4500Vrms for one second (leakage current less than 10 μA). This test is performed before the 100% production test for partial discharge
10. t_{PSK} is equal to the worst case difference in t_{PHL} and/or t_{PLH} that will be seen between units at any given temperature and specified test conditions.

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7. SWITCHING TIME TEST CIRCUIT

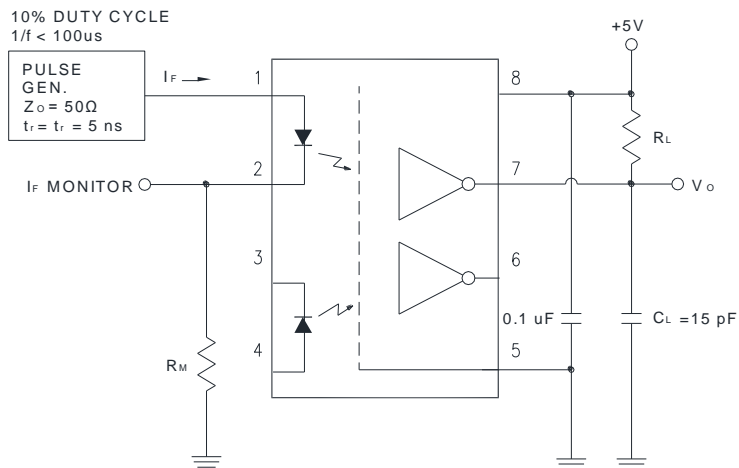


Figure 1: Test Circuit for t_{PHL} and t_{PLH}

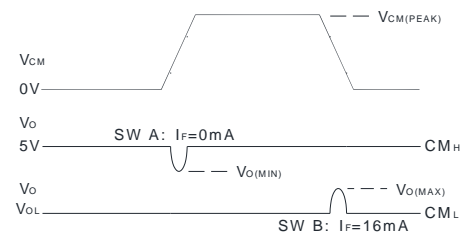
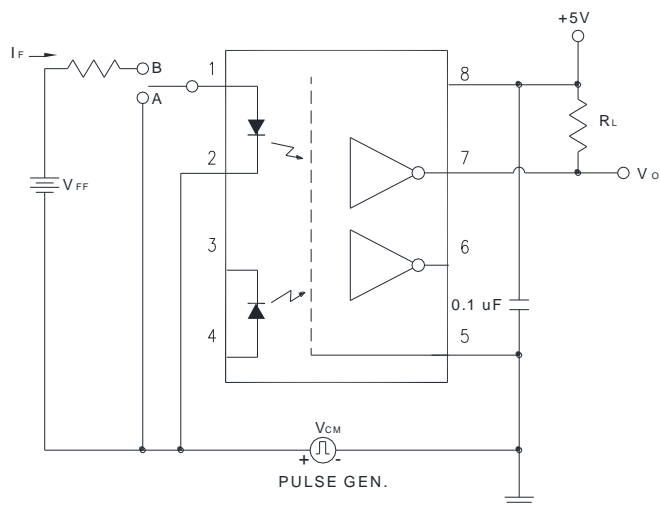


Figure 2: Test Circuit for Common Mode Transient Immunity

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8. CHARACTERISTICS CURVES

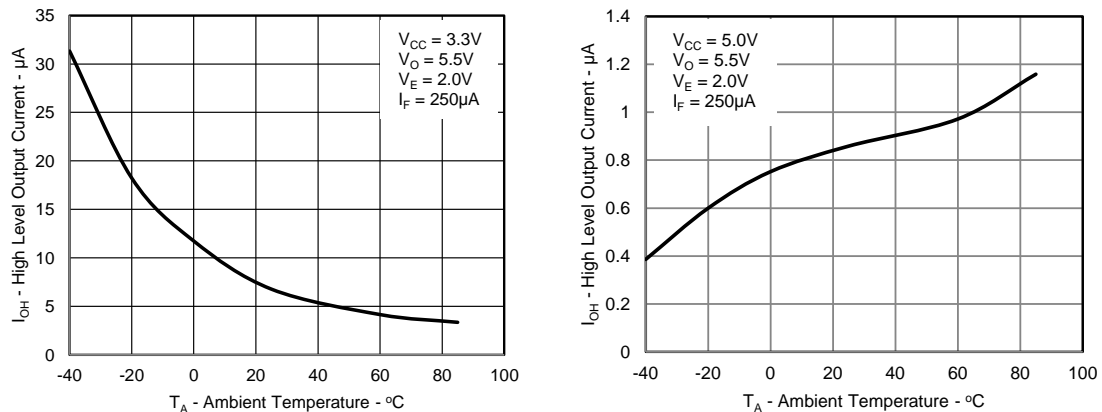


Figure 3: Typical High Level Output Current vs. Ambient Temperature

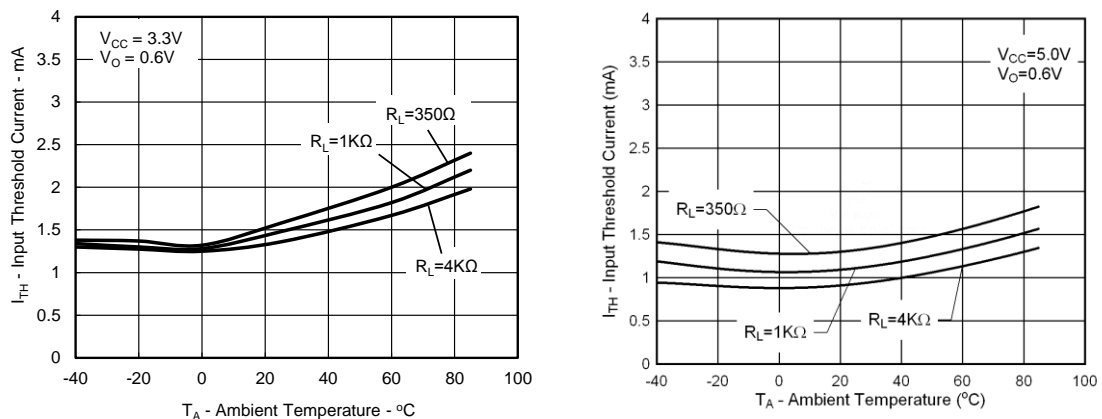


Figure 4: Typical Input Diode Threshold Current vs. Ambient Temperature

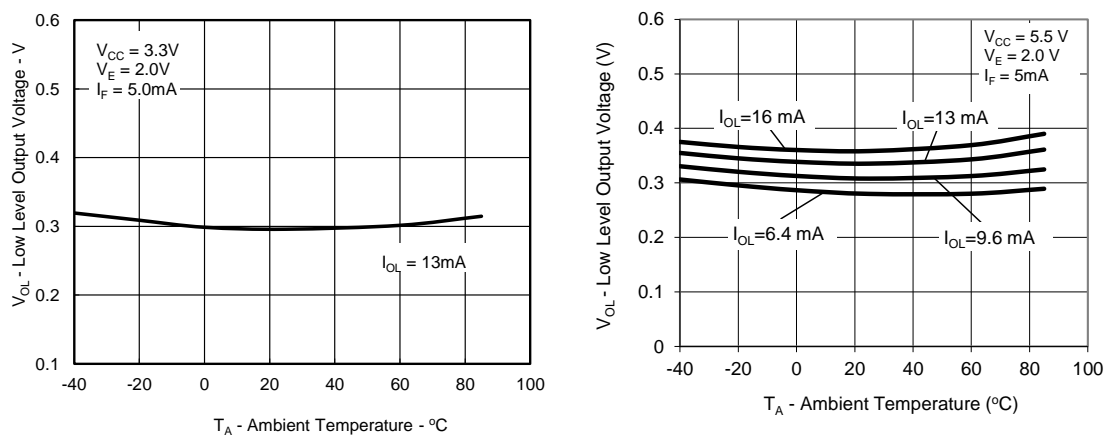


Figure 5: Typical Low Level Output Voltage vs. Ambient



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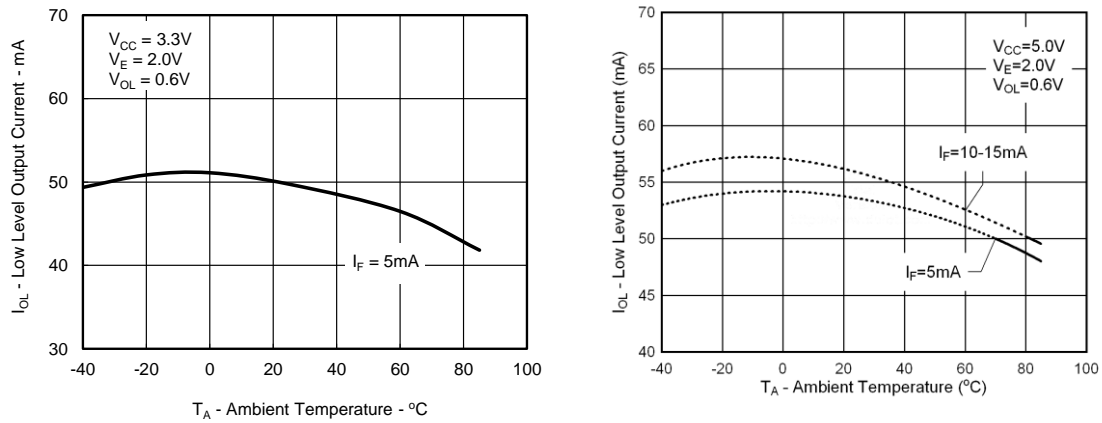


Figure 6: Typical Low Level Output Current vs. temperature

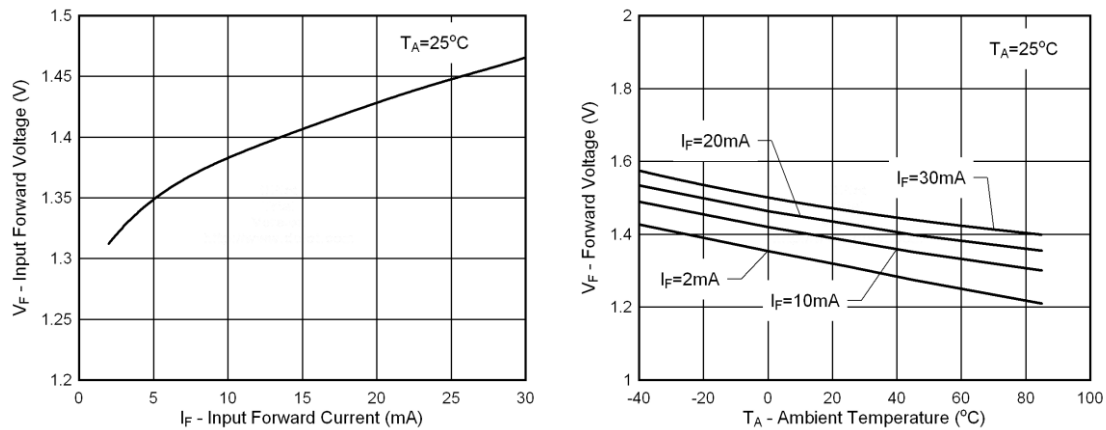


Figure 7: Typical Input Diode Forward Characteristic

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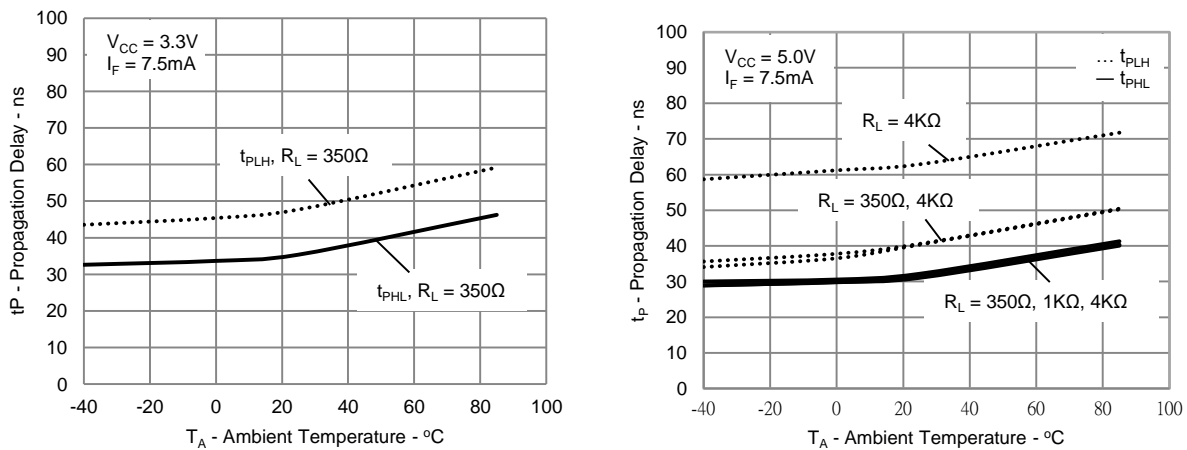


Figure 8: Typical Propagation Delay vs. Ambient Temperature

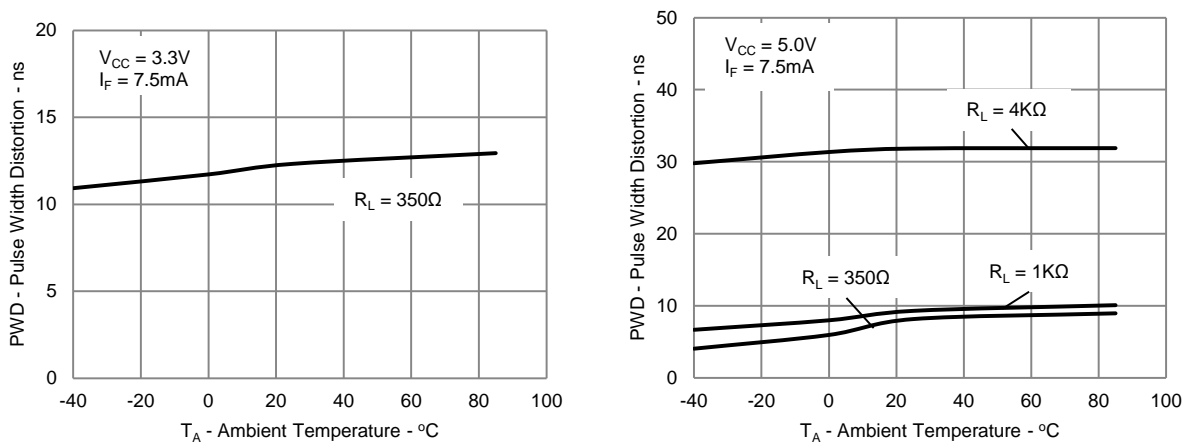


Figure 9: Typical Pulse Width Distortion vs. Ambient Temperature

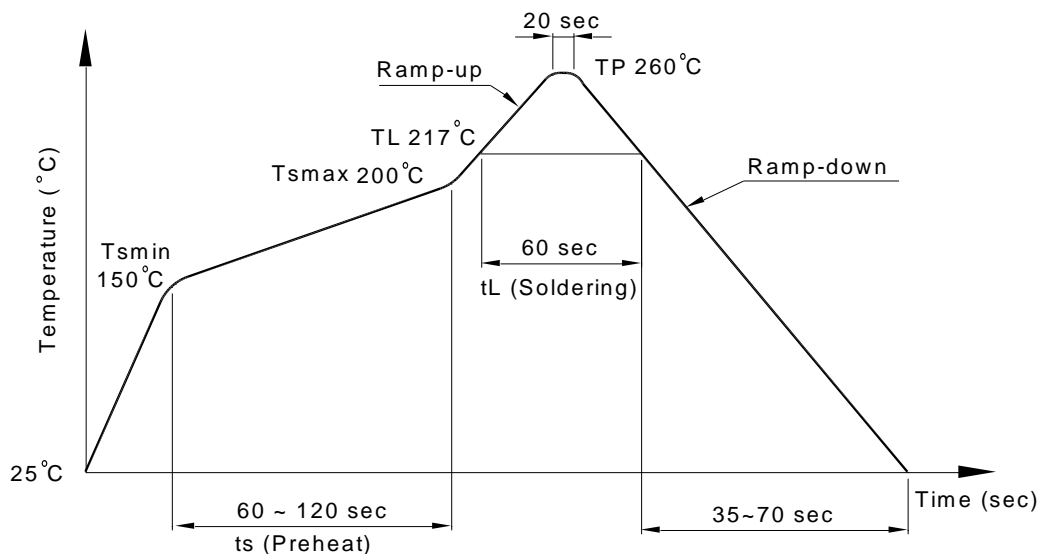
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9. TEMPERATURE PROFILE OF SOLDERING

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) (t_s)	90±30 sec
Soldering zone	
- Temperature (T_L)	217°C
- Time (t_L)	60 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)

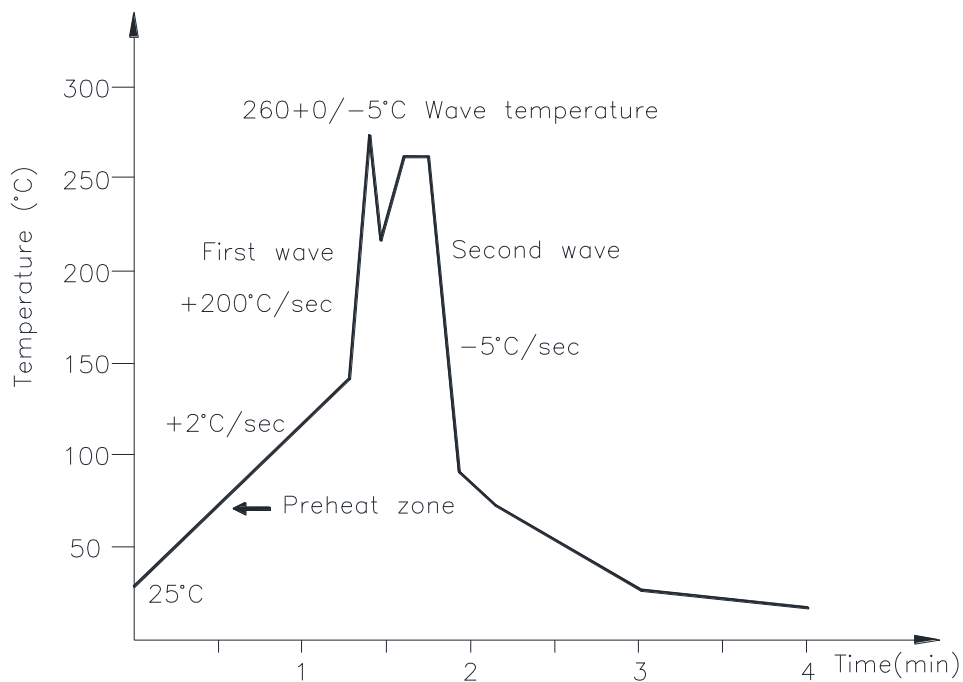
One time soldering is recommended within the condition of temperature.

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

Time: 10 sec.

Preheat temperature: 25 to 140°C

Preheat time: 30 to 80 sec.



9.3 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-063L
LTV063L-V

Definition of Suffix	Remark
"063L"	LiteOn model name
"No Suffix"	Pin 1 location at upper 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.