



ORIENT

Photo coupler

Product Data Sheet

Name: OR-M502

Customer: _____

Date: _____

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1. Features

- (1) Performance specified for common IPM applications over industrial temperature range: -40° C to 100° C
- (2) Fast maximum propagation delays $t_{PHL} = 400 \text{ ns}$, $t_{PLH} = 550 \text{ ns}$
- (3) Minimized Pulse Width Distortion ($P_{WD} = 370 \text{ ns}$)
- (4) Very high Common Mode Rejection (CMR): $15 \text{ kV}/\mu\text{s}$ at $V_{CM} = 1500\text{V}$
- (5) $CTR > 44\%$ at $I_F = 10 \text{ mA}$
- (6) Safety approval
 - UL approved(No.E323844)
 - VDE approved(No.40029733)
 - CQC approved (No.CQC19001231256)
- (7) In compliance with RoHS, REACH standards
- (8) MSL Class I



2. Instructions

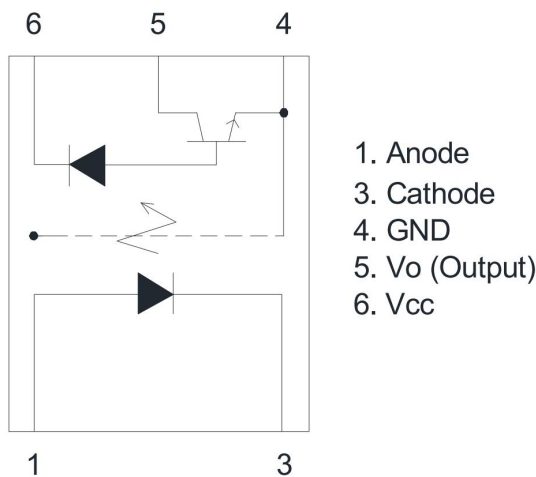
The OR-M502 consists of a GaAsP LED optically coupled to an integrated high gain photo detector. Minimized propagation delay difference between devices make these optocouplers excellent solutions for improving inverter efficiency through reduced switching dead time.

Specifications and performance plots are given for typical IPM applications.

3. Application Range

- (1) IPM isolation
- (2) Isolated IGBT/MOSFET gate drive
- (3) AC and brushless dc motor drives
- (4) Industrial inverters

4. Functional Diagram



Truth table	
Input (LED)	Output
ON	L
OFF	H

5. Absolute Maximum Ratings (Ta=25°C) *1

	Parameter	Symbol	Rated Value	Unit
Input	Average Forward Input Current	I_F	25	mA
	Reverse Input Voltage	V_R	5	V
	Power Dissipation	P_I	45	mW
	Average Input Current	$I_{F(avg)}$	25	mA
	Peak Input Current (50% duty cycle, <1 s pulse width)	$I_{F(peak)}$	50	mA
	Peak Transient Input Current (<1 s pulse width, 300 pps)	$I_{F(tran)}$	1.0	A
Output	Output Collector Current	I_O	8	mA
	Output Collector Voltage	V_O	30	V
	Output Collector Power Dissipation	P_O	145	mW
	Supply Voltage	V_{CC}	30	V
	Insulation Voltage	V_{iso}	3750	V _{rms}
	Working Temperature	T_{opr}	-40 ~ +100	°C
	Storage Temperature	T_{stg}	-55 ~ +125	
	*2 Soldering Temperature	T_{sol}	260	

*1. Room temperature = 25 °C. Exceeding the maximum absolute rating can permanently damage the device.

Working long hours at the maximum absolute rating can affect reliability.

*2. soldering time is 10 seconds.

6. Electrical optical characteristics at TA=25°C

Over recommended operating conditions unless otherwise specified: $V_{CC} = +4.5 \text{ V to } 30 \text{ V}$, $I_{F(\text{on})} = 10 \text{ mA to } 20 \text{ mA}$, $V_{F(\text{off})} = -5 \text{ V to } 0.8 \text{ V}$

Parameter	Symbol	Min.	Typ.*	Max.	Units	Conditions
Current Transfer Ratio	CTR	44	90	—	%	$I_F = 10 \text{ mA}$, $V_O = 0.6 \text{ V}$
Low Level Output Current	I_{OL}	4.4	9.0	—	mA	$I_F = 10 \text{ mA}$, $V_O = 0.6 \text{ V}$
Low Level Output Voltage	V_{OL}	—	0.3	0.6	V	$I_O = 2.4 \text{ mA}$
Input Threshold Current	I_{TH}	—	1.5	5.0	mA	$V_O = 0.8 \text{ V}$, $I_O = 0.75 \text{ mA}$
High Level Output Current	I_{OH}	—	5	50	A	$V_F = 0.8 \text{ V}$
High Level Supply Current	I_{CCH}	—	0.6	1.3	mA	$V_F = 0.8 \text{ V}$, $V_O = \text{Open}$
Low Level Supply Current	I_{CCL}	—	0.6	1.3	mA	$I_F = 10 \text{ mA}$, $V_O = \text{Open}$
Input Forward Voltage	V_F	—	1.5	1.8	V	$I_F = 10 \text{ mA}$
Temperature Coefficient of Forward Voltage	$\Delta V_F / \Delta T_A$	—	-1.6	—	mV/°C	$I_F = 10 \text{ mA}$
Input Reverse Breakdown Voltage	BV_R	5	—	—	V	$I_R = 10 \text{ A}$
Input Capacitance	C_{IN}	—	60	—	pF	$f = 1 \text{ MHz}$, $V_F = 0 \text{ V}$
Input-Output Insulation Voltage	V_{ISO}	3750	—	—	V_{RMS}	$R_H < 50\%$, $t = 1 \text{ min}$, $T_A = 25^\circ \text{ C}$
Resistance (Input - Output)	R_{I-O}	—	10^{12}	—		$V_{I-O} = 500 \text{ Vdc}$
Capacitance (Input - Output)	C_{I-O}	—	0.6	—	pF	$f = 1 \text{ MHz}$

*All typical values at 25° C, $V_{CC} = 15 \text{ V}$.

7. Switching Characteristics at TA=25°C

Over recommended operating conditions unless otherwise specified: $V_{CC} = +4.5\text{ V to }30\text{ V}$, $I_{F(on)} = 10\text{ mA to }20\text{ mA}$, $V_{F(off)} = -5\text{ V to }0.8\text{ V}$

Parameter	Symbol	Min	Typ	Max	Unit	Condition	
Propagation delay time to output Low level	t_{PHL}	30	200	400	ns	$C_L=100\text{pF}$	$I_{F(on)} = 10\text{ mA}$ $V_{F(off)} = 0.8\text{ V}$ $V_{CC} = 15.0\text{ V}$ $V_{THLH} = 2.0\text{ V}$ $V_{THHL} = 1.5\text{ V}$
Propagation delay time to output High level	t_{PLH}	—	100	—	ns	$C_L=10\text{pF}$	
Propagation Delay Difference Between Any 2 Parts	$t_{PLH}-t_{PHL}$	-150	200	450	ns	$C_L=100\text{pF}$	
Logic High Common Mode Transient Immunity	$ CM_H $	15	30	—	kV/ μs	$I_F = 0\text{ mA}$, $V_O > 3.0\text{ V}$	$V_{CC} = 15.0\text{ V}$ $C_L = 100\text{ pF}$ $V_{CM} = 1500\text{ VP-P}$ $T_A = 25^\circ\text{ C}$ $C_L = 100\text{ pF}$
Logic Low Common Mode Transient Immunity	$ CM_L $	15	30	—	kV/ μs	$I_F = 10\text{ mA}$, $V_O < 1.0\text{ V}$	

8. Isolation characteristics at TA=25°C

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Input-Output Insulation Leakage Current	I_{I-O}	45% RH, $t=5\text{s}$, $V_{I-O} = 3\text{kV DC}$, $T_A = 25^\circ\text{C}$	—	—	1	μA
Withstand Insulation Test Voltage	V_{ISO}	$RH \leq 50\%$, $t = 1\text{min}$, $T_A = 25^\circ\text{C}$	3750	—	—	V_{RMS}
Input-Output Resistance	R_{I-O}	$V_{I-O} = 3750\text{V DC}$	—	10^{12}	—	Ω

Typical values of $T_A = 25^\circ\text{C}$

9. Order Information

Part Number

OR-M502-X-Y-Z

Note

X = Tape and reel option (TP or TP1).

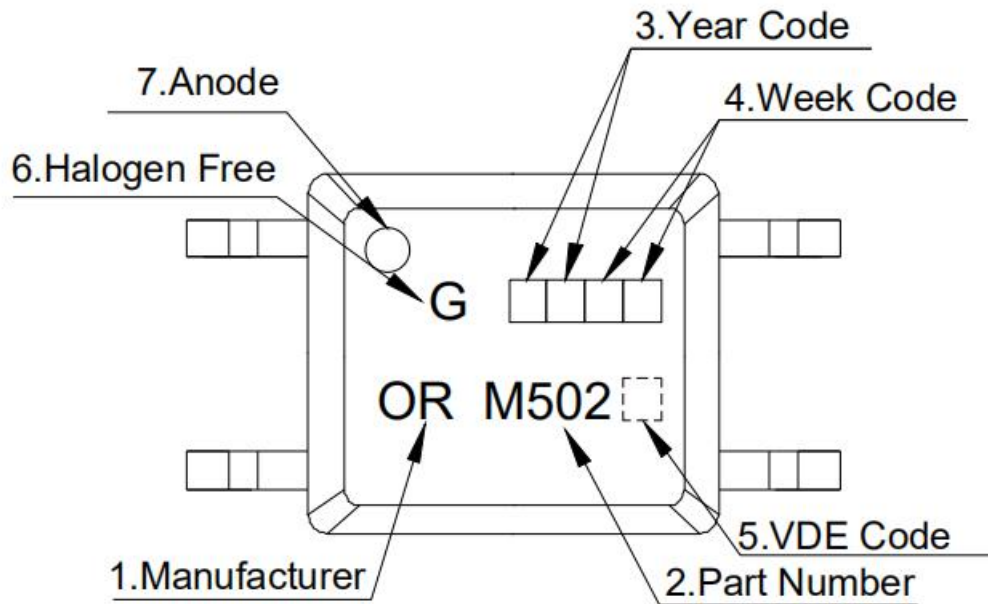
Y = 'V' code for VDE safety (This options is not necessary).

Z = 'G' code for Halogen free.

* VDE Code can be selected.

Option	Description	Packing quantity
TP	Surface mount lead form (low profile) + TP tape & reel option	3000 units per reel
TP1	Surface mount lead form (low profile) + TP1 tape & reel option	3000 units per reel

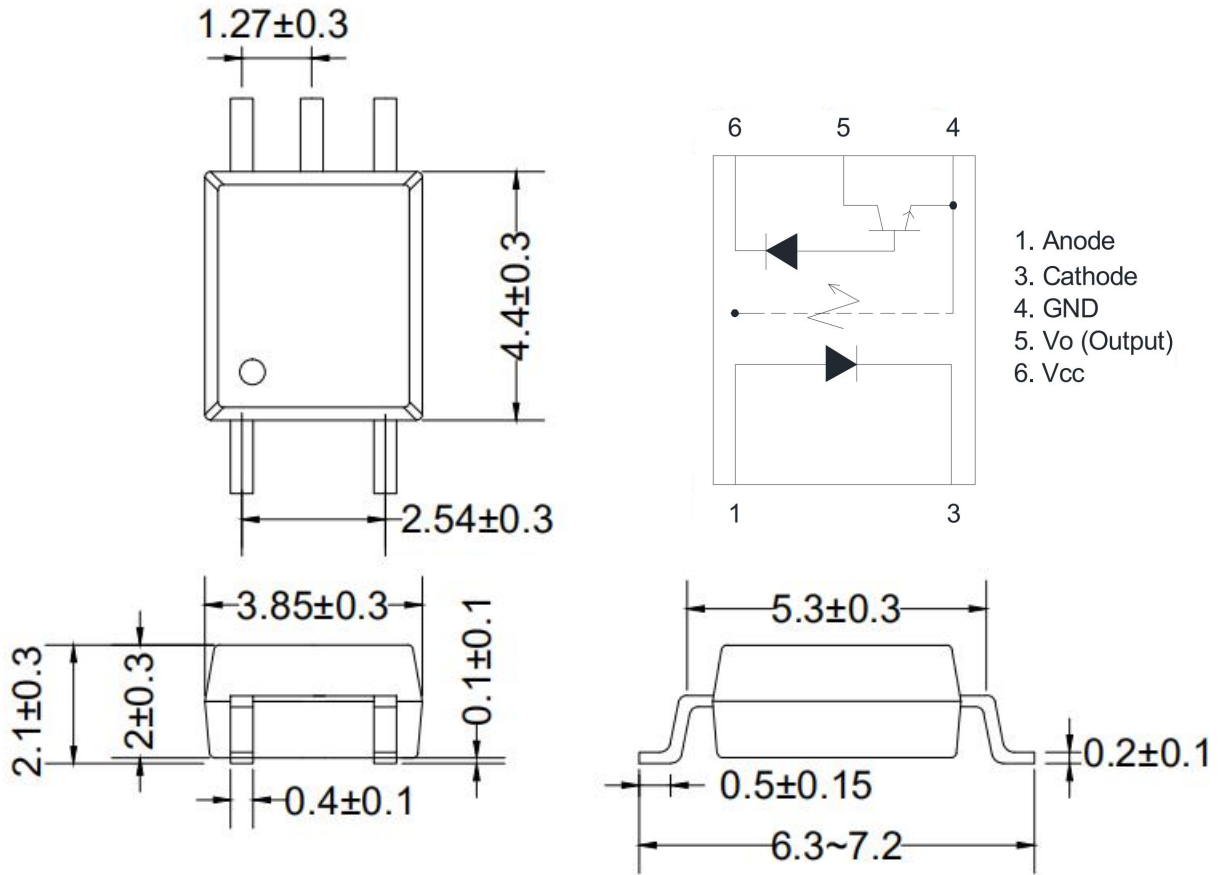
10. Naming Rule



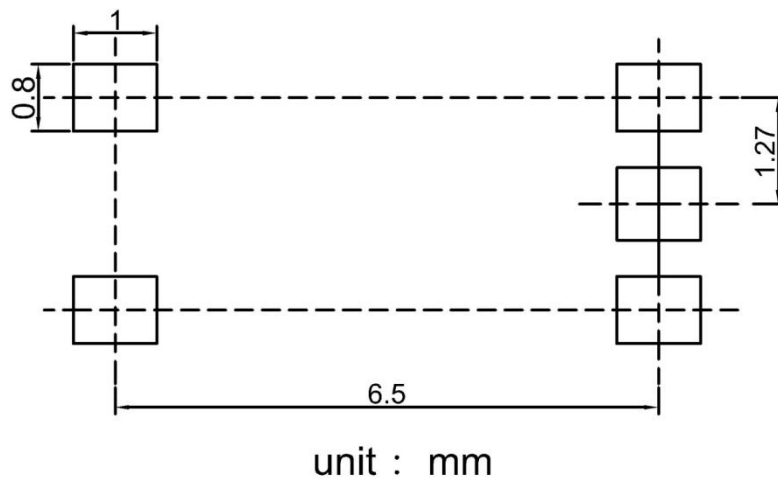
1. Manufacturer : ORIENT.
2. Part Number : M502.
3. Year Code : '21' means '2021' and so on.
4. Week Code : 01 means the first week, 02 means the second week and so on.
5. VDE Code . (Optional)
6. HF Code 'G': Halogen Free.
7. Anode.

* VDE Code can be selected.

11. Outer Dimension

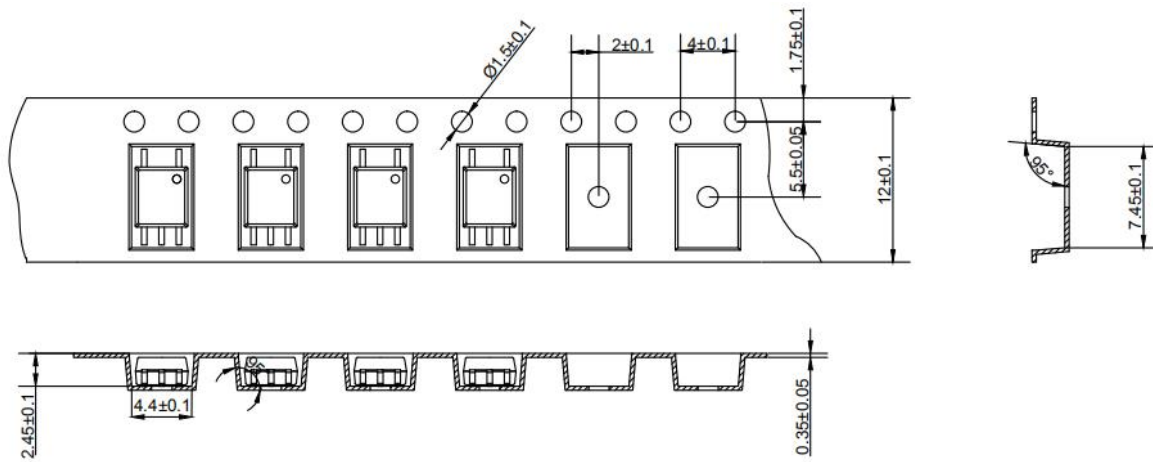


12. Recommended Foot Print Patterns (Mount Pad)

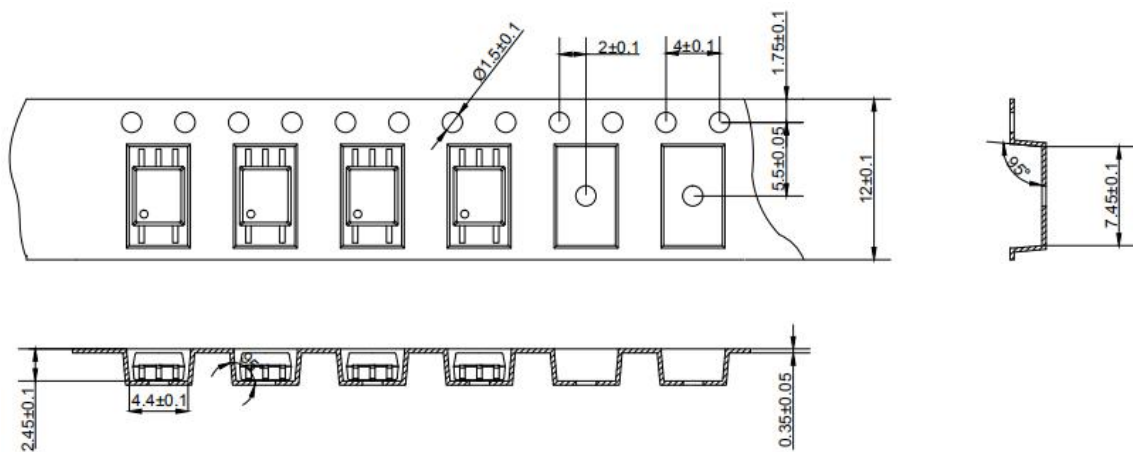


13. Taping Dimensions

(1) OR-M502-TP



(2) OR-M502-TP1



Description	Symbol	Dimension in mm(inch)
Tape wide	W	12 ± 0.3 (0.472)
Pitch of sprocket holes	P0	4 ± 0.1 (0.157)
Distance of compartment	F	5.5 ± 0.1 (0.217)
	P2	2 ± 0.1 (0.079)
Distance of compartment to compartment	P1	8 ± 0.1 (0.315)

Encapsulation type	TP/TP1
amount (pcs)	3000

14. Package Dimension

(1) package dimension

Packing Information	
Packing type	Reel type
Tape Width	12mm
Qty per Reel	3,000pcs
Small box (inner) Dimension	345*345*45mm
Large box (Outer) Dimension	480x360x360mm
Max qty per small box	6,000pcs
Max qty per large box	60,000pcs

(2) Packing Label Sample



Note:

1. Material Code :Product ID.
2. P/N :Contents with "Order Information" in the specification.
3. Lot No. :Product data.
4. D/C :Product weeks.
5. Quantity :Packaging quantity.

15. Reliability Test

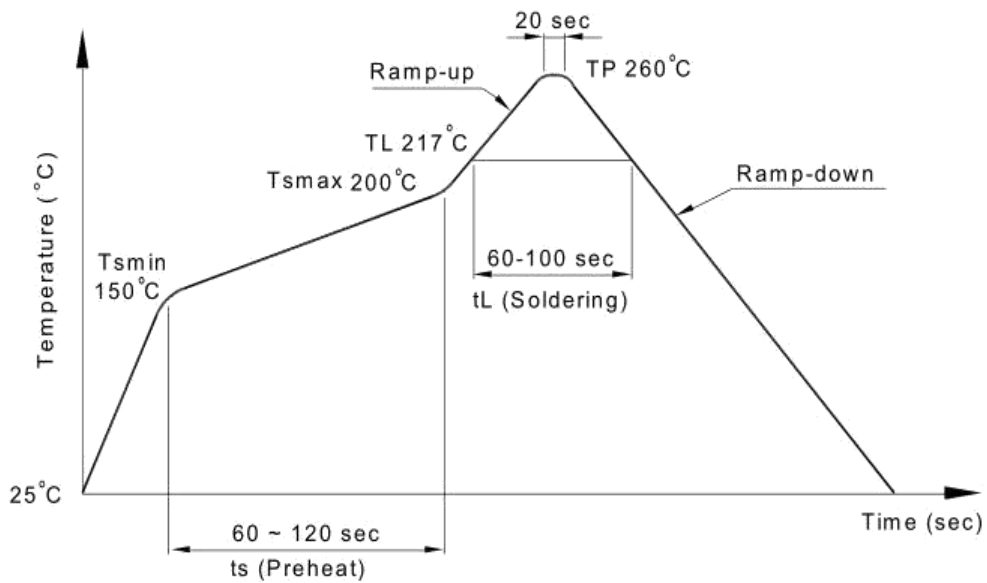
NO.	ITEMS	Reliability Testing				
		QTY. (Pcs)	Condition	Process	Device	Standard
1	RSH 耐焊接热	22	260±5°C	5s/3 次	锡炉	JESD22-A106
2	HTSL 高温存储	77	125°C	168 hrs	高温烤箱 测试仪	JESD22-A103
				500 hrs		
				1000 hrs		
3	LTSL 低温存储	77	-40°C	168 hrs	低温箱 测试仪	JESD22-A119
				500 hrs		
				1000 hrs		
4	TC 温度循环	77	H:125°C 15min ↓5min L:-55°C 15min	300 cycle	冷热冲击 机	JESD22-A104
5	TS 温度冲击	77	H:100°C 5min ↓15s L:-40°C 5min	300 cycle	冷热冲击 机	JESD22-A106
6	HTOL 高温操作	77	100°C IF=10mA Vcc=5V	168 hrs	高温烤箱 测试仪、 老化电 路板	JESD22-A108
				500 hrs		
				1000 hrs		
7	ESD-HB M 人体模式	22	≥8KV 1Cycle	1 次	ESD 静 电测试 仪	JESD22-A114
8	SD 可焊性	22	Pb-free 245±5°C	5s/1 次	锡炉	JESD22-B102
9	HTHB 温湿寿命 试验	77	85°C,85%RH IF=10mA,Vcc=5V	168 hrs	恒温恒湿 机, 测试 仪	JESD22-A101
				500 hrs		
				1000 hrs		
10	Autoclave 压力锅	77	Ta=121 °C,100%RH,2atm	96hrs	压力锅	JESD22-A102

16. Temperature Profile Of Soldering

(1) IR Reflow soldering (JEDEC-STD-020C compliant)

Note: one solder backflow is recommended under the conditions described below in the temperature and time profile. Do not weld more than three times.

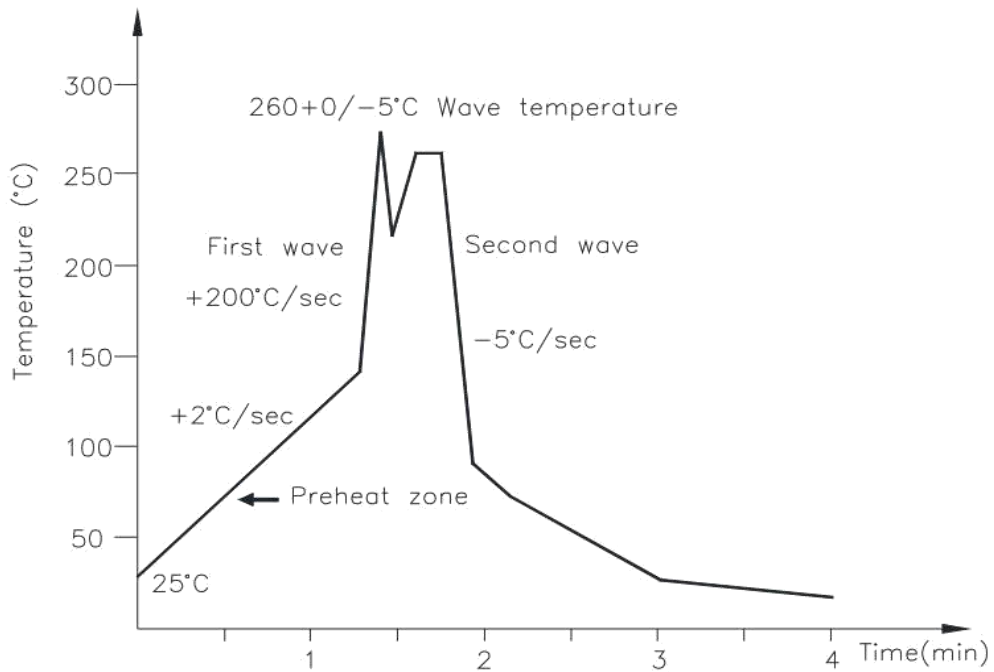
Profile item	Conditions
Preheat - Temperature Min (T Smin) - Temperature Max (T Smax) - Time (min to max) (ts)	150°C 200°C 90±30 sec
Soldering zone - Temperature (TL) - Time (t L)	217°C 60 sec
Peak Temperature	260°C
Peak Temperature time	20 sec
Ramp-up rate	3°C / sec max.
Ramp-down rate from peak temperature	3~6°C / sec
Reflow times	≤3



(2) Wave soldering (JEDEC22A111 compliant)

One-time welding is recommended under the temperature condition.

Temperature	260+0/-5°C
Time	10 sec
Preheat temperature	5 to 140°C
Preheat time	30 to 80 sec



(3) Hand soldering by soldering iron

Single lead welding is allowed in each process and one-time welding is recommended.

Temperature	380+0/-5°C
Time	3 sec max

17. Characteristics Curve

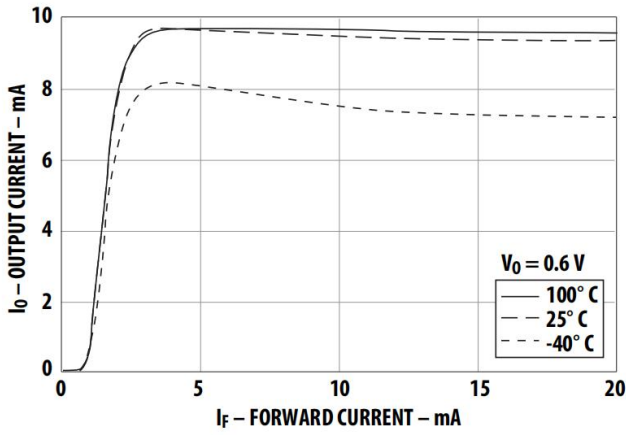


Figure 2. Typical Transfer Characteristics.

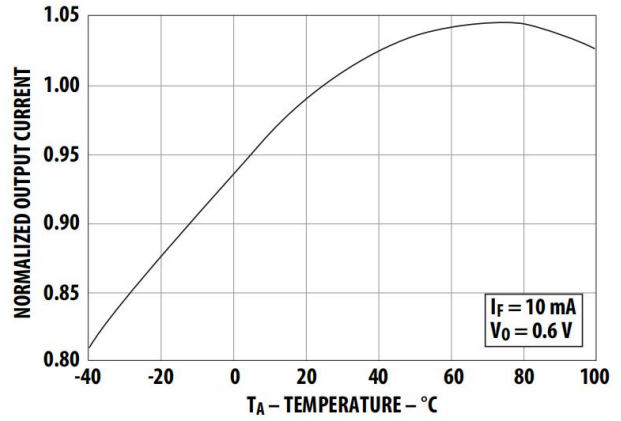


Figure 3. Normalized Output Current vs. Temperature.

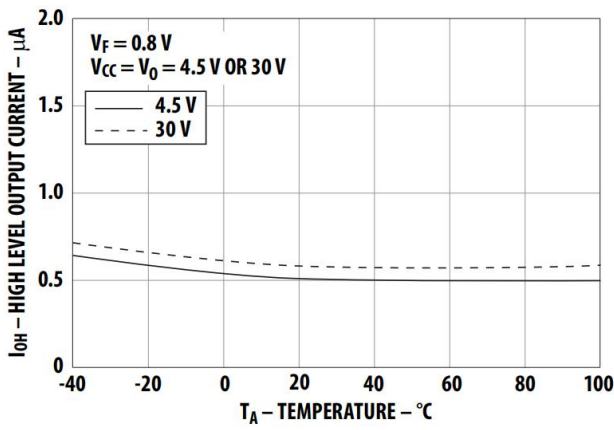


Figure 4. High Level Output Current vs. Temperature.

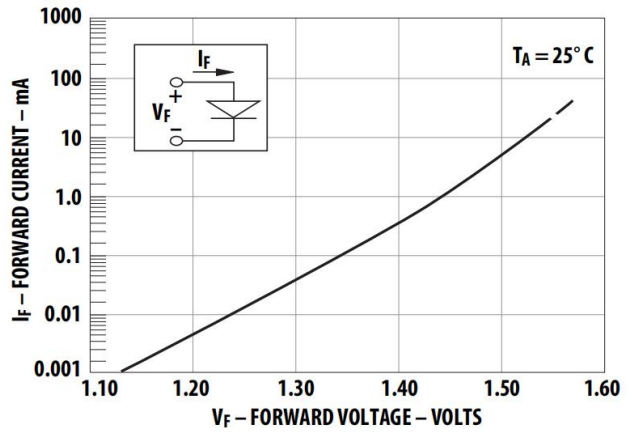


Figure 5. Input Current vs. Forward Voltage.

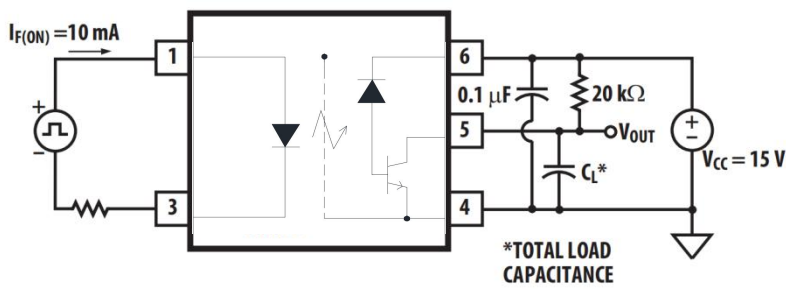
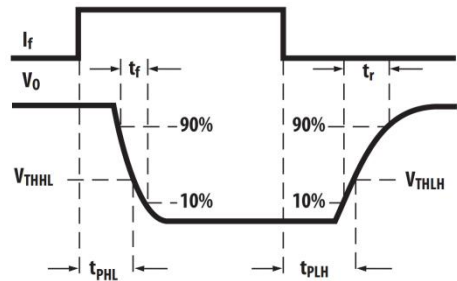


Figure 6. Propagation Delay Test Circuit.



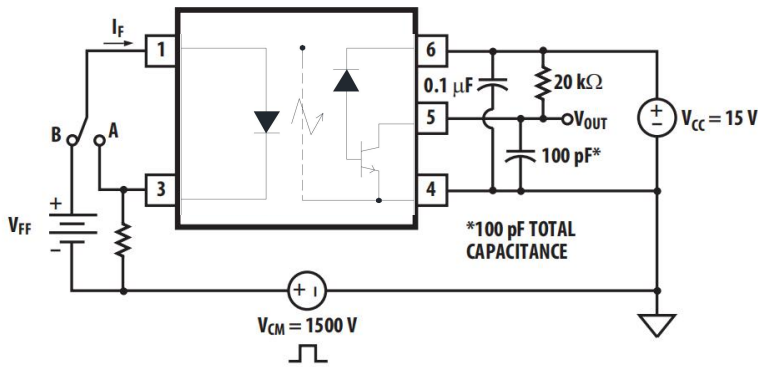
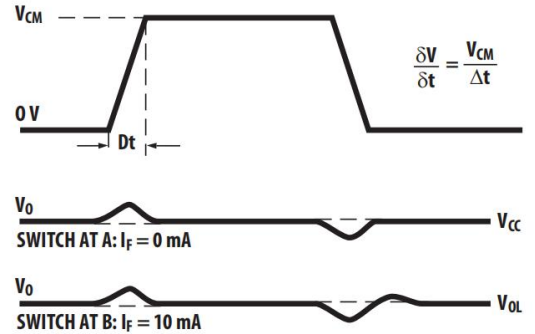


Figure 7. CMR Test Circuit.



Typical CMR Waveform.

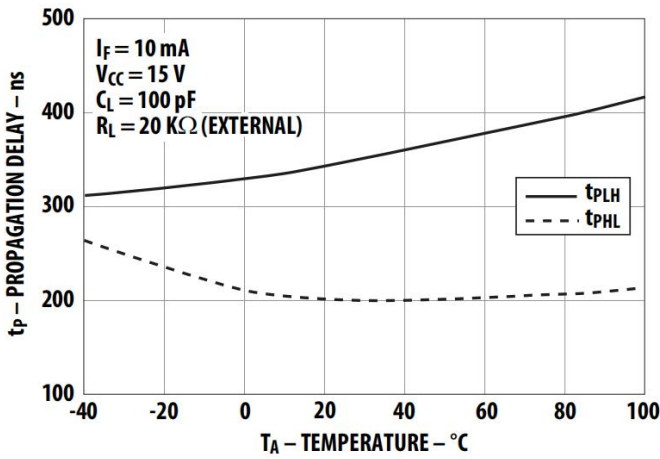


Figure 8. Propagation Delay with External 20 kΩ RL vs. Temperature.

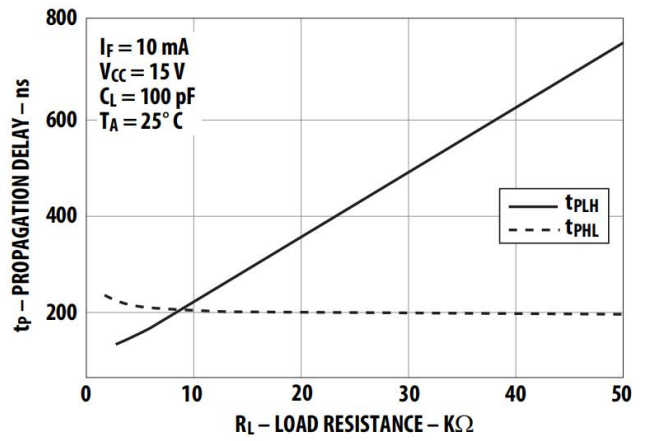


Figure 9. Propagation Delay vs. Load Resistance.

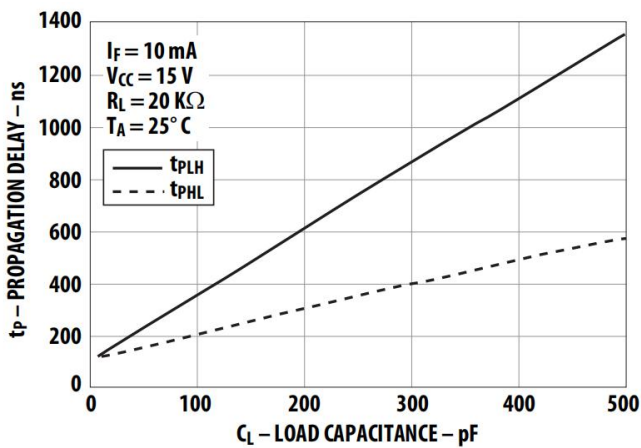


Figure 10. Propagation Delay vs. Load Capacitance.

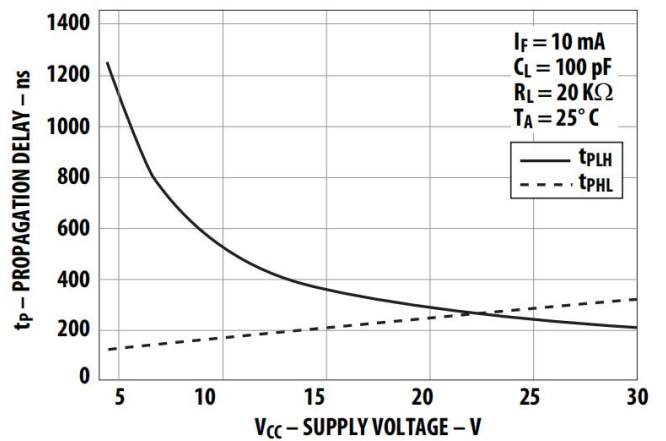


Figure 11. Propagation Delay vs. Supply Voltage.

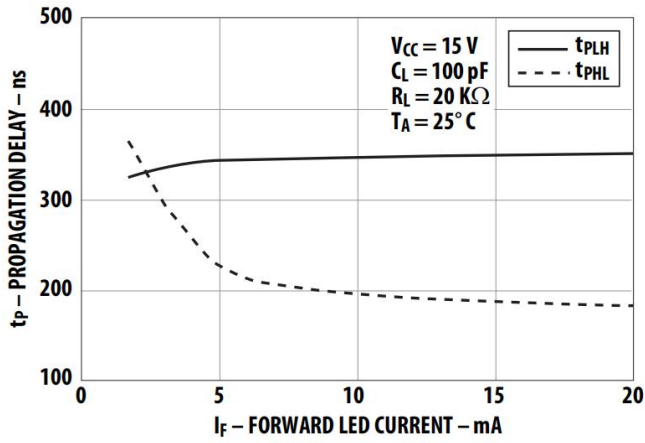


Figure 12. Propagation Delay vs. Input Current.