1.Description

The TLP350H is a gate driven optocoupler with an output current of 2.5A, with an AlGaAs LED, which is coupled to a photosensitive integrated circuit through infrared light. This optocoupler can drive most low-power IGBTs and MOSFETs. In the motor control inverter and high-performance power system applications, it is very suitable for fast switching drive power IGBTs and MOSFETs.

2.Applications

- Uninterrupted Power Supply
- IGBT isolation / power MOSFET gate drive
- Induction heating
- Industrial inverters

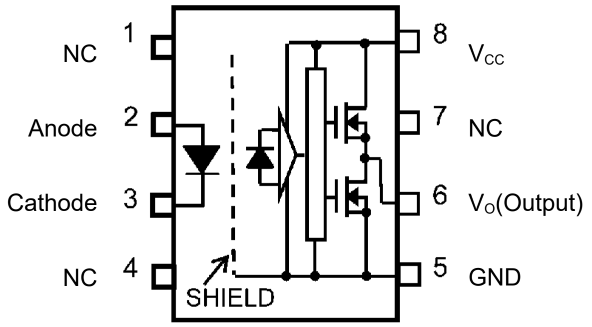
3.Features

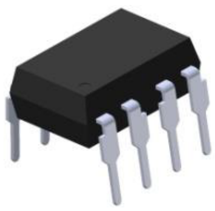
- 35kV/μs minimum Common Mode Rejection
- 2.5A maximum peak output current
- Wide operating V_{CC} Range: 15V~30V
- 400ns maximum propagation delay
- 100ns of pulse width distortion
- Under Voltage Lock-Out protection (UVLO) with hysteresis
- Operating temperature range: -40°C~ +125°C

4.Truth Table

Input	LED	M1	M2	Output
H	ON	ON	OFF	H
L	OFF	OFF	ON	L

5.Pinning Information





DIP-8

SOP- 8

Note: 0.1uF bypass capacitor must be connected between pins 5 and 8.

6.Insulation And Safety Related Specifications

Parameter	Symbol	Note	Value	Unit
Creepage Distance	L	Measured from input terminals to output terminals, shortest distance path along body	≥7	mm
Clearance Distance	L	Measured from input terminals to output terminals, shortest distance through air	≥7	mm
Insulation Thickness	DTI	Insulation thickness between emitter and detector	≥0.4	mm
Peak Isolation Voltage	V_{IORM}	DIN/EN/IEC EN60747-5-5.	1500	V_{peak}
Transient Isolation Voltage	V_{IOTM}	DIN/EN/IEC EN60747-5-5.	7000	V_{peak}
Isolation Voltage	V_{ISO}	For 1 min	5000	V_{rms}

7.Absolute Maximum Ratings T_A= 25°C

Parameter		Symbol	Value	Units
Input	Forward Input Current	I_{FM}	25	mA
	Reverse Voltage	V_R	5	V
	Input Power Dissipation	P_D	40	mW
Output	Peak Output Current (1)	$I_{O(PEAK)}$	2.5	A
	Supply Voltage	V_{CC}	0 to 35	V
	Output Voltage	V_O	0 to 35	V
	Output Power Dissipation	P_O	260	mW
Isolation Voltage		V_{ISO}	5000	V_{rms}
Total Power Consumption		P_{tot}	300	mW
Operating Temperature		T_{opr}	-40 to 125	°C
Storage Temperature		T_{stg}	-55 to 130	°C
Soldering Temperature (2)		T_{sol}	260	°C

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings. Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1: Exponential waveform. Pulse width ≤ 0.3μs, f ≤ 15 kHz

Note 2: ≥ 2 mm below seating plane.

8.Recommended Operating Conditions

Parameter	Symbol	Min	Max	Units
Power Supply Voltage (1)	V_{CC} - V_{SS}	15	30	V
Input Current (ON) (2)	$I_{F(ON)}$	7	16	mA
Input Voltage (OFF)	$V_{F(OFF)}$	0	0.8	V
Operating Temperature	T_A	-40	110	°C

Note: The recommended operating conditions are given as a design guide necessary to obtain the intended performance of the device. Each parameter is an independent value. When creating a system design using this device, the electrical characteristics specified in this datasheet should also be considered.

Note: A ceramic capacitor (0.1µF) should be connected between pin 8 and pin 5 to stabilize the operation of a highgain linear amplifier. Otherwise, this photocoupler may not switch properly. The bypass capacitor should be placed within 1cm of each pin.

Note 1: Denotes the operating range, not the recommended operating condition

Note 2: The rise and fall times of the input on-current should be less than 0.5µs.

9.Electro-optical Characteristics (T_A=25°C)

All minimum and maximum specifications are at recommended operating conditions, unless otherwise noted
All typical values are at T_A=25°C, V_{CC}=30V, and V_{EE}=GND.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Forward Voltage	V_F	I_F=10mA	1.2	1.5	1.8	V
Reverse Current	I_R	V_R=5V			10	μA
High Level Output Current (1)	I_{OH}	I_F=5mA, V_{CC}=30V, $V_{8\text{-}6}$=-3.5V	-1	-2	-2.5	A
		I_F=5mA, V_{CC}=15V, $V_{8\text{-}6}$=-7V	-2		-2.5	A
Low Level Output Current (1)	I_{OL}	I_F=0mA, V_{CC}=30V, $V_{6\text{-}5}$=2.5V	1	2	2.5	A
		I_F=0mA, V_{CC}=15V, $V_{6\text{-}5}$=7V	2		2.5	A
High Level Output Voltage	V_{OH}	I_F=10mA, I_O=-2.5A	V_{CC}-6.25V	V_{CC}-2.5V		V
		I_F=10mA, I_O=-100mA	V_{CC}-0.3V	V_{CC}-0.1V		V
Low Level Output Voltage	V_{OL}	I_F=0mA, I_O=2.5A		V_{EE}+2.5V	V_{EE}+6.25V	V
		I_F=0mA, I_O=100mA		V_{EE}+0.1V	V_{EE}+0.3V	V
High Level Power Supply Current	I_{ccH}	V_O=Open, I_F=7 to 16mA		1.8	3.8	mA
Low Level Power Supply Current	I_{ccL}	V_O=Open, V_F=0 to 0.8V		2.1	3.8	mA
Input The Tum On Current	I_{FLH}	I_O=0mA, V_O>5V		2.8	5	mA
Input The Turn Off Voltage	V_{FHL}	I_O=0mA, V_O<5V	0.8			V
UVLO Threshold	V_{UVLO+}	I_F=10mA, V_O>5V	11.5	12.7	13.5	V
	V_{UVLO-}	I_F=10mA, V_O<5V	10	11.2	12	V
UVLO Hysteresis	$UVLO_{HYS}$			1.5		V
Isolation Resistance	R_{ISO}	$V_{I\text{-}O}$=500V, 40~60%R.H.		10^{11}		Ω
Isolation Capacitance	C_{ISO}	$V_{I\text{-}O}$=0V, Freq=1MHZ		1		pF
Propagation Delay Time to Low Output Level (1)	T_{PHL}	I_F=7mA to 16mA Rg=10Ω Cg=10nF F=10KHZ Duty Cycle=50%		100	300	ns
Propagation Delay Time to High Output Level (1)	T_{PLH}			100	300	ns
Pulse Width Distortion	PWD			3	100	ns
Propagation Delay Difference Between Any Two Parts	P_{DD}		-250		250	ns

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Output Rise Time (10% To 90%)	T_R	I_F=7mA to 16mA,Rg=10Ω,Cg=10NF F=10KHZ, Duty Cycle=50%		80		ns
Output Drop Time(90%~10%)	T_F			80		ns
UVLO Turn On Delay	$T_{UVLO\ ON}$	I_F=10mA, V_O>5V		1.6		μs
UVLO Turn Off Delay	$T_{UVLO\ OFF}$	I_F=10mA, V_O<5V		0.4		μs
Output High Level Common Mode Transient Immunity (2)	$\|CM_H\|$	T_A=25°C, V_{DD}=30V V_{CM}=2000V, I_F=7~16mA, V_F=0V	35	50		KV/μs
Output Low Level Common Mode Transient Immunity (3)	$\|CM_L\|$	T_A=25°C, V_{DD}=30V V_{CM}=2000V, I_F=7~16mA, V_F=0V	35	50		KV/μs

Note: All typical values are at T_a = 25°C.

Note 1: Input signal (f = 25 kHz, duty = 50 %, t_r = t_f = 5 ns or less). C_L is approximately 15 pF which includes probe and stray wiring capacitance.

Note 2: CM_H is the maximum rate of rise of the common mode voltage that can be sustained with the output voltage in the logic high state (V_O > 26 V).

Note 3: CM_L is the maximum rate of fall of the common mode voltage that can be sustained with the output voltage in the logic low state (V_O < 1 V).

10.1 Typical Characteristic

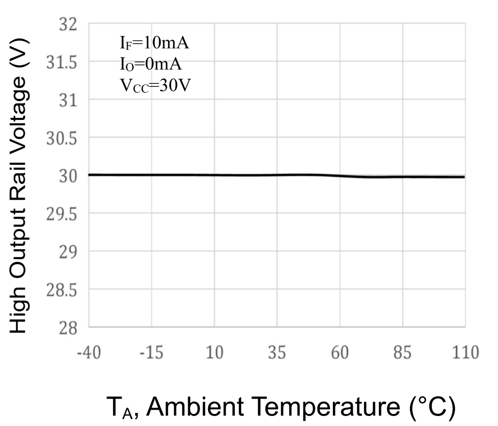


Figure 1: High Output Rail Voltage vs Ambient Temperature

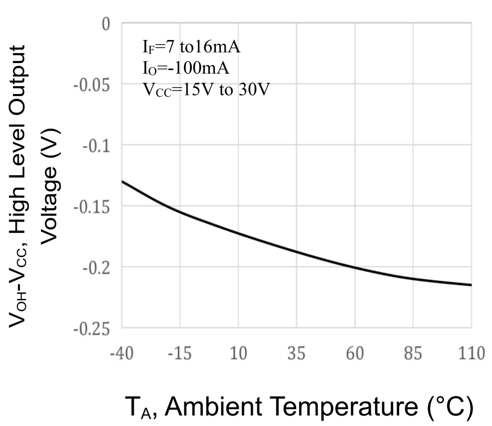


Figure 2: High Level Output Voltage vs Ambient Temperature

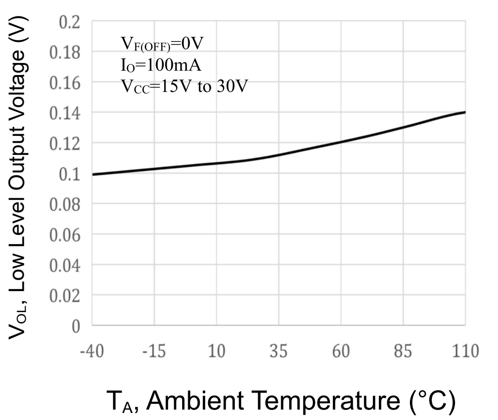


Figure 3: Low Level Output Voltage vs Ambient Temperature

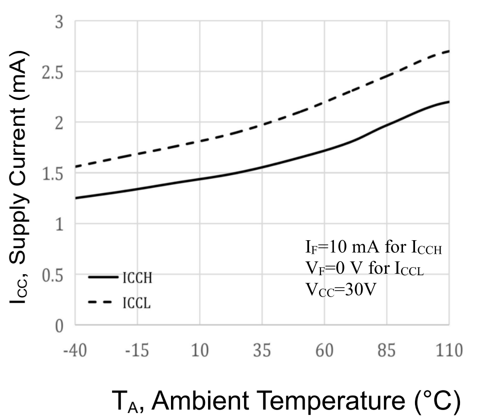


Figure 4: Supply Current vs Ambient Temperature

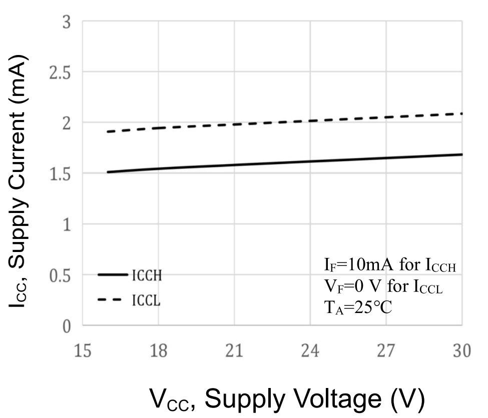


Figure 5: Supply Current vs supply Voltage

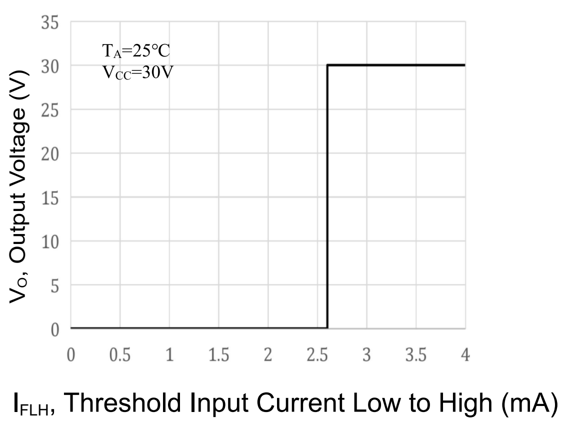


Figure 6: Output Voltage vs Threshold input Current Low to High

10.2 Typical Characteristic

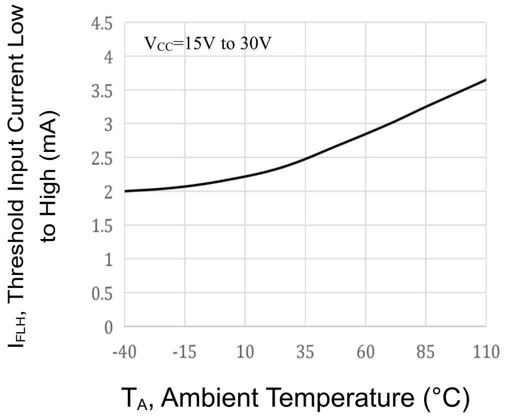


Figure 7: Threshold Input Current Low to High vs Ambient Temperature

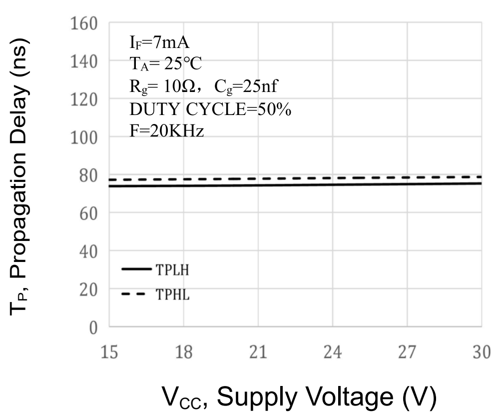


Figure 8: Propagation Delay vs Supply Voltage

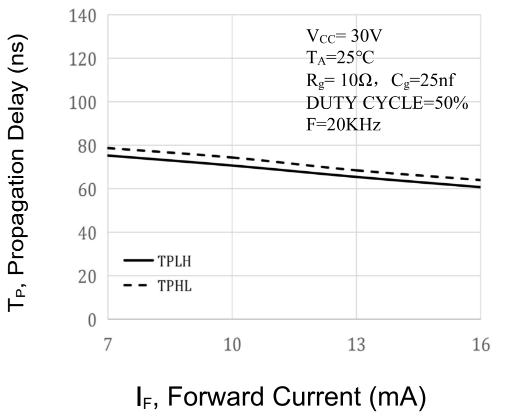


Figure 9: Propagation Delay vs Forward Current

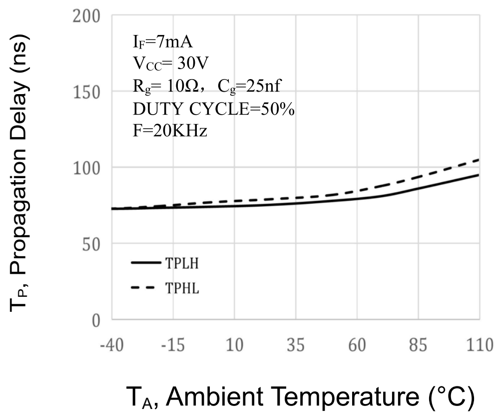


Figure 10: Propagation Delay vs Ambient Temperature

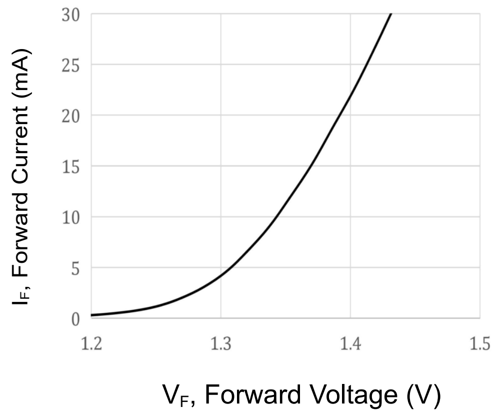


Figure 11: Forward Current vs Forward Voltage

11.Test Circuits Diagrams

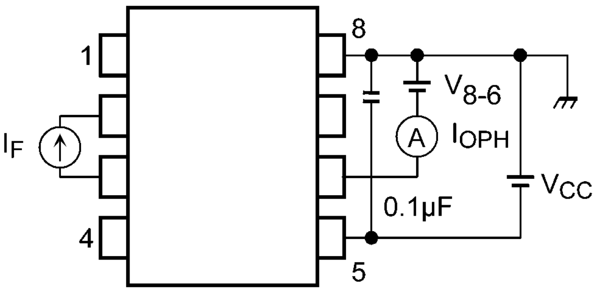


Figure 12: I_{OH} Test Circuit

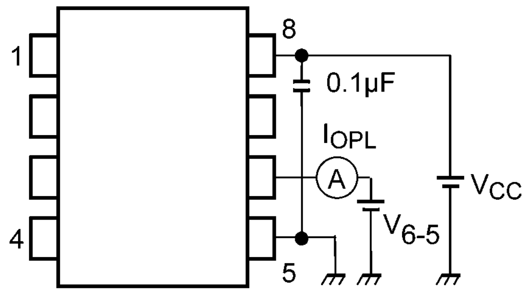


Figure 14: I_{OL} Test Circuit

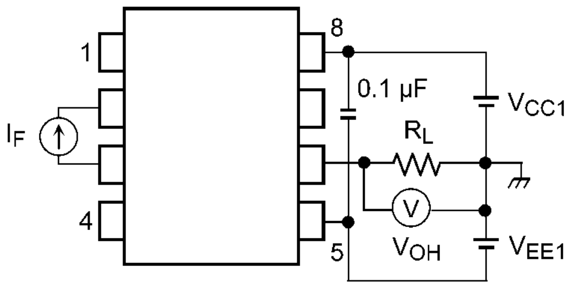


Figure 15: V_{OH} Test Circuit

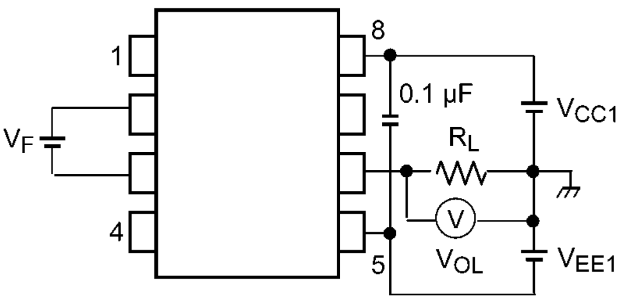


Figure 16: V_{OL} Test Circuit

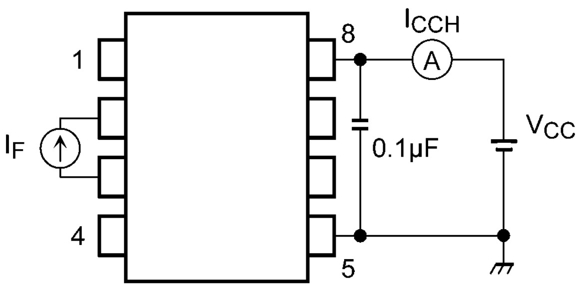


Figure 17: I_{CCH} Test Circuit

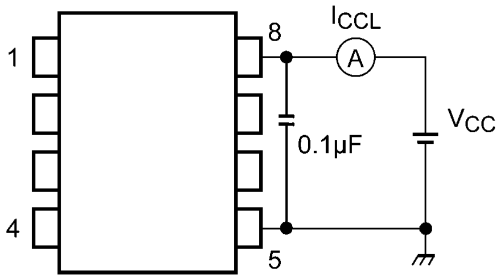


Figure 18: I_{CCL} Test Circuit

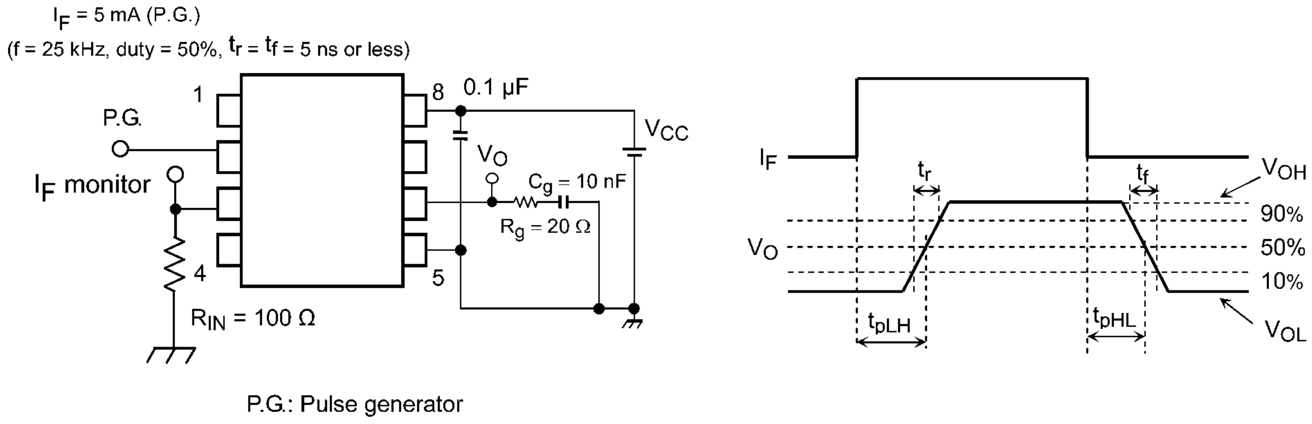
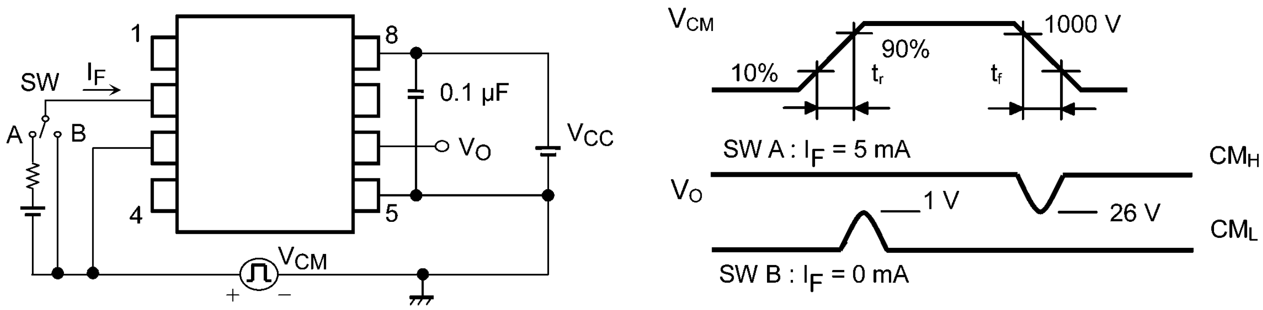


Figure 19: Switching Time Test Circuit and Waveform

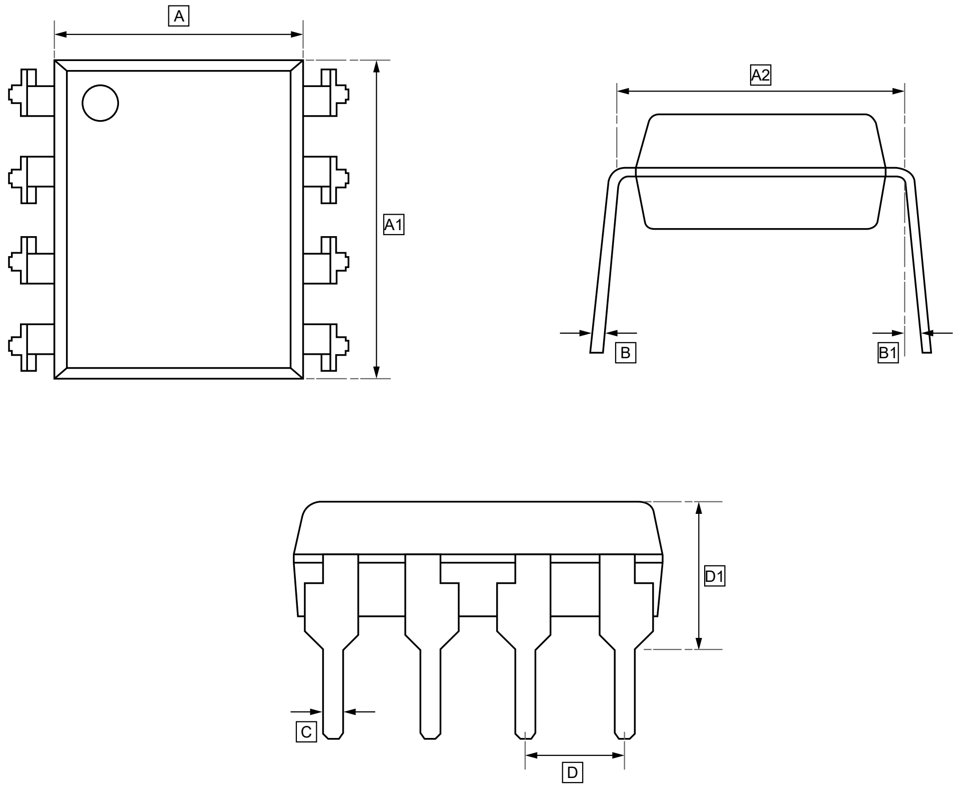


$$CM_L = \frac{800(V)}{t_r(\mu s)} \qquad CM_H = -\frac{800(V)}{t_f(\mu s)}$$

CM_L (CM_H) is the maximum rate of rise (fall) of the common mode voltage that can be sustained with the output voltage in the low (high) state.

Figure 20: Common-Mode Transient Immunity Test Circuit and Waveform

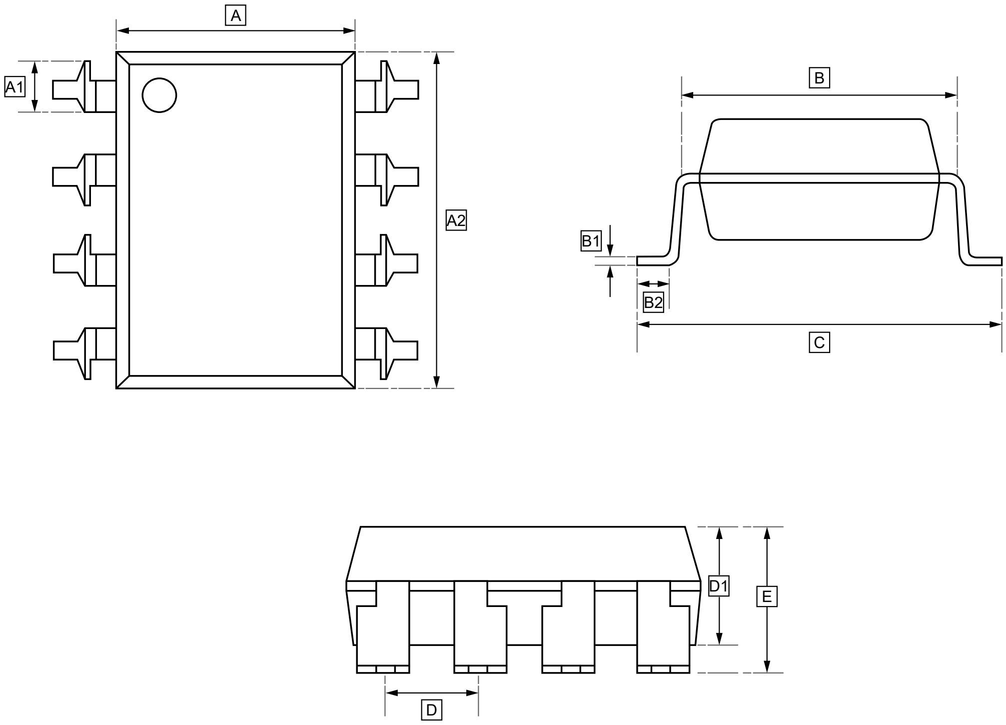
12.1 DIP-8 Package Outline Dimensions



DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	B	B1	C	D	D1
Min	6.30	9.46	7.62	0.25	5°	0.40	2.54	4.20
Max	6.90	10.06	TYP.		15°	0.60	TYP.	4.80

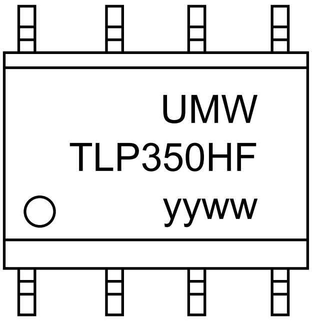
12.2 SOP-8 Package Outline Dimensions



DIMENSIONS (mm are the original dimensions)

<table>
<tr><th>Symbol</th><th>A</th><th>A1</th><th>A2</th><th>B</th><th>B1</th><th>B2</th><th>C</th><th>D</th><th>D1</th><th>E</th></tr>
<tr><td>Min</td><td>6.30</td><td rowspan="2">1.45</td><td>9.46</td><td>7.62</td><td rowspan="2">0.25</td><td>0.6</td><td>-</td><td>2.54</td><td>3.20</td><td>4.00</td></tr>
<tr><td>Max</td><td>6.90</td><td>10.06</td><td>TYP</td><td>-</td><td>10.3</td><td>TYP</td><td>3.80</td><td>4.60</td></tr>
</table>

13.Ordering Information



yy: Year Code
ww: Week Code

Order Code	Marking	Package	Base QTY	Delivery Mode
UMW TLP350HF	TLP350HF	DIP-8	2250	Tube and box
UMW TLP350H	TLP350H	SOP-8	1000	Tape and reel

14.Disclaimer

UMW reserves the right to make changes to all products, specifications. Customers should obtain the latest version of product documentation and verify the completeness and currency of the information before placing an order.

When applying our products, please do not exceed the maximum rated values, as this may affect the reliability of the entire system. Under certain conditions, any semiconductor product may experience faults or failures. Buyers are responsible for adhering to safety standards and implementing safety measures during system design, prototyping, and manufacturing when using our products to prevent potential failure risks that could lead to personal injury or property damage.

Unless explicitly stated in writing, UMW products are not intended for use in medical, life-saving, or life-sustaining applications, nor for any other applications where product failure could result in personal injury or death. If customers use or sell the product for such applications without explicit authorization, they assume all associated risks.

When reselling, applying, or exporting, please comply with export control laws and regulations of China, the United States, the United Kingdom, the European Union, and other relevant countries, regions, and international organizations.

This document and any actions by UMW do not grant any intellectual property rights, whether express or implied, by estoppel or otherwise. The product names and marks mentioned herein may be trademarks of their respective owners.