

1. Description

The TLP350 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.

3. Features

- 35kV/ μ s minimum Common Mode Rejection
- 2.5A maximum peak output current
- Wide operating V_{CC} Range: 15V~30V
- 400ns maximum propagation delay

2. Applications

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

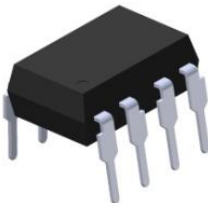
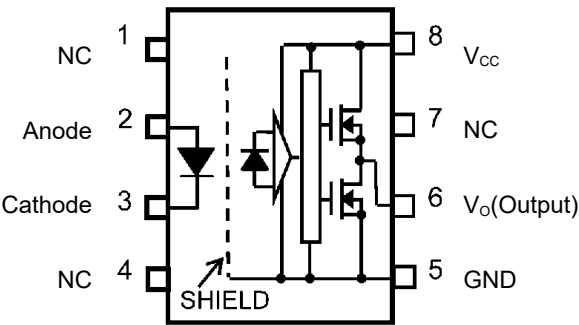
- 100ns of pulse width distortion
- Under Voltage Lock-Out protection (UVLO) with hysteresis
- Operating temperature range: -40°C~ +110°C

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 $T_A = 25^\circ\text{C}$

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}	35	V
	Output Voltage	V_O	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 110	$^\circ\text{C}$
Storage Temperature		T_{stg}	-55 to 125	$^\circ\text{C}$
Soldering Temperature ⁽²⁾		T_{sol}	260	$^\circ\text{C}$

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: A ceramic capacitor (0.1 μF) 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 1 cm of each pin.

(1): Exponential waveform. Pulse width $\leq 0.3\mu\text{s}$, $f \leq 15\text{ kHz}$.

(2) $\geq 2\text{ mm}$ below seating plane.



8.Recommended Operating Conditions

Parameter	Symbol	Min	Max	Units
Power Supply Voltage	$V_{CC} - V_{SS}$	15	30	V
Input Current (ON) ⁽¹⁾	$I_{F(ON)}$	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 data sheet should also be considered.

Note 1: The rise and fall times of the input on-current should be less than 0.5μs.



9. Electro-optical Characteristics ($T_A=25^\circ\text{C}$)

All minimum and maximum specifications are at recommended operating conditions, unless otherwise noted

All typical values are at $T_A=25^\circ\text{C}$, $V_{CC}=30\text{V}$, and $V_{EE}=\text{GND}$.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Forward Voltage	V_F	$I_F=10\text{mA}$	1.2	1.5	1.8	V
Reverse Current	I_R	$V_R=5\text{V}$			10	μA
High Level Output Current ⁽¹⁾	I_{OH}	$V_{CC}=30\text{V}$, $I_F=5\text{mA}$, $V_{8-6}=3.5\text{V}$	-1	-2	-2.5	A
		$V_{CC}=15\text{V}$, $I_F=5\text{mA}$, $V_{8-6}=7\text{V}$	-2		-2.5	A
Low Level Output Current ⁽¹⁾	I_{OL}	$V_{CC}=30\text{V}$, $I_F=0\text{mA}$, $V_{6-5}=2.5\text{V}$	1	2	2.5	A
		$V_{CC}=15\text{V}$, $I_F=0\text{mA}$, $V_{6-5}=7\text{V}$	2		2.5	A
High Level Output Voltage	V_{OH}	$I_F=10\text{mA}$, $I_O=-2.5\text{A}$	$V_{CC}-6.25\text{V}$	$V_{CC}-2.5\text{V}$		V
		$I_O=-100\text{mA}$	$V_{CC}-0.3\text{V}$	$V_{CC}-0.1\text{V}$		V
Low Level Output Voltage	V_{OL}	$I_F=0\text{mA}$, $I_O=2.5\text{A}$		$V_{EE}+2.5\text{V}$	$V_{EE}+6.25\text{V}$	V
		$I_O=100\text{mA}$		$V_{EE}+0.1\text{V}$	$V_{EE}+0.3\text{V}$	V
High Level Power Supply Current	I_{cCH}	$V_O=\text{Open}$, $I_F=7$ to 16mA		1.8	3.8	mA
Low Level Power Supply Current	I_{cCL}	$V_O=\text{Open}$, $V_F=0$ to 0.8V		2.1	3.8	mA
Input The Turn On Current	I_{FLH}	$I_O=0\text{mA}$, $V_O>5\text{V}$		2.8	5	mA
Input The Turn Off Voltage	V_{FHL}	$I_O=0\text{mA}$, $V_O<5\text{V}$	0.8			V
UVLO Threshold	V_{UVLO+}	$I_F=10\text{mA}$, $V_O>5\text{V}$	11.5	12.7	13.5	V
	V_{UVLO-}	$I_F=10\text{mA}$, $V_O<5\text{V}$	10	11.2	12	V
UVLO Hysteresis	$UVLO_{HYS}$			1.5		V
Isolation Resistance	R_{ISO}	$V_{I-O}=500\text{V}$, 40~60% R.H.		10^{11}		Ω
Isolation Capacitance	C_{ISO}	$V_{I-O}=0\text{V}$, Freq=1MHZ		1		pF
Propagation Delay Time to Low Output Level ⁽¹⁾	T_{PHL}	$I_F=7\text{mA}$ to 16mA $R_g=10\Omega$ $C_g=10\text{nF}$ $F=10\text{KHZ}$ 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%) ⁽¹⁾	T_R	$I_F=7\text{mA to }16\text{mA}, R_g=10\Omega, C_g=10\text{NF}$ $F=10\text{KHZ, Duty Cycle}=50\%$		80		ns
Output Drop Time(90%~10%) ⁽¹⁾	T_F			80		ns
UVLO Turn On Delay	$T_{UVLO\ ON}$	$I_F=10\text{mA}, V_O>5\text{V}$		1.6		μs
UVLO Turn Off Delay	$T_{UVLO\ OFF}$	$I_F=10\text{mA}, V_O<5\text{V}$		0.4		μs
Output High Level Common Mode Transient Immunity ⁽²⁾	$ CM_H $	$T_A=25^\circ\text{C}, V_{DD}=30\text{V}$ $V_{CM}=2000\text{V}, I_F=7\sim16\text{mA}, V_F=0\text{V}$	35	50		KV/ μs
Output Low Level Common Mode Transient Immunity ⁽³⁾	$ CM_L $	$T_A=25^\circ\text{C}, V_{DD}=30\text{V}$ $V_{CM}=2000\text{V}, I_F=7\sim16\text{mA}, V_F=0\text{V}$	35	50		KV/ μs

Note: All typical values are at $T_a = 25^\circ\text{C}$.

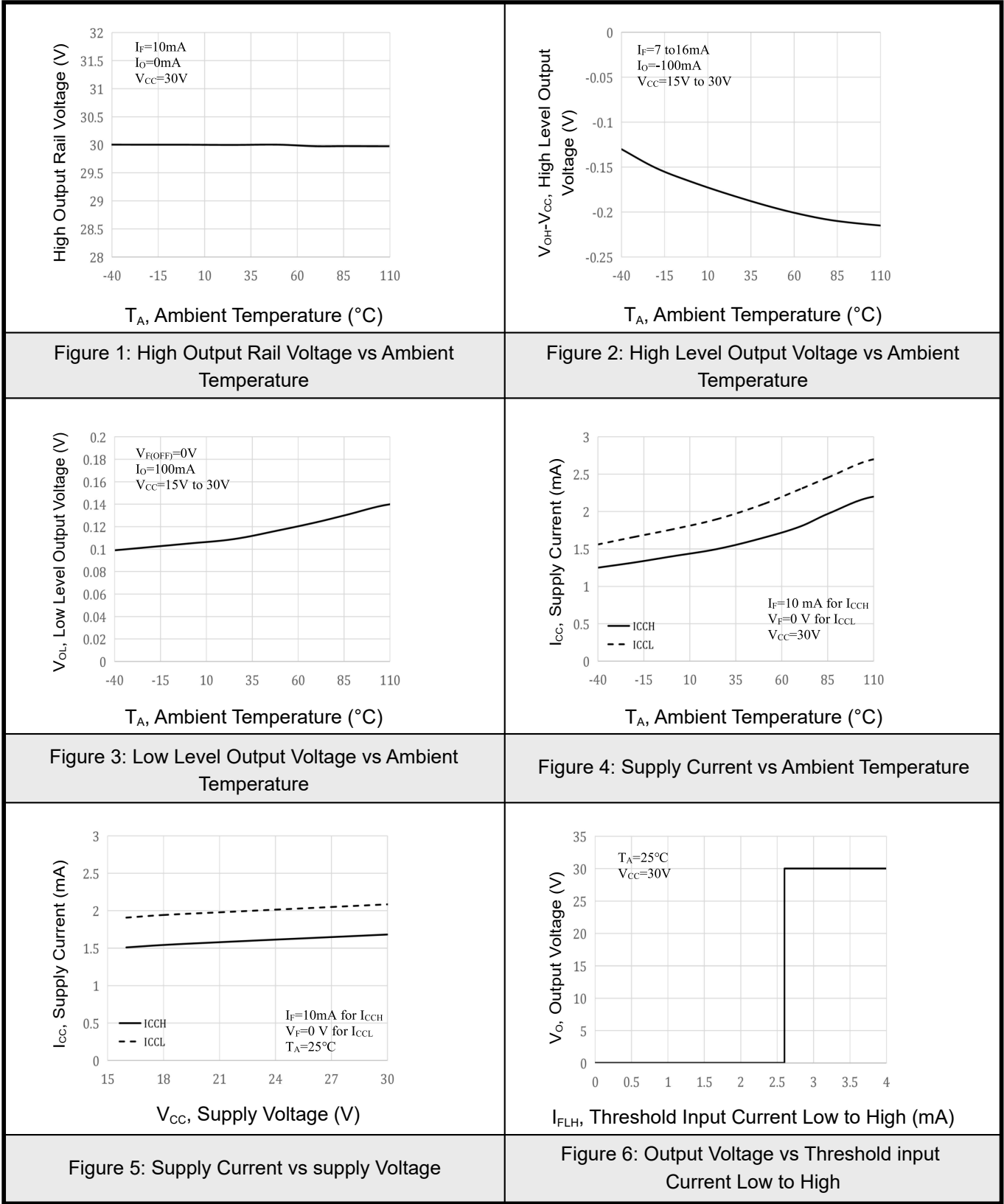
Note 1: $f = 25\text{ kHz}$, duty = 50 %, input current $t_r = t_f = 5\text{ ns}$, C_L is approximately 15 pF which includes probe and stray wiring capacitance.

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 ($V_O > 26\text{ V}$).

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 ($V_O < 1\text{ V}$).

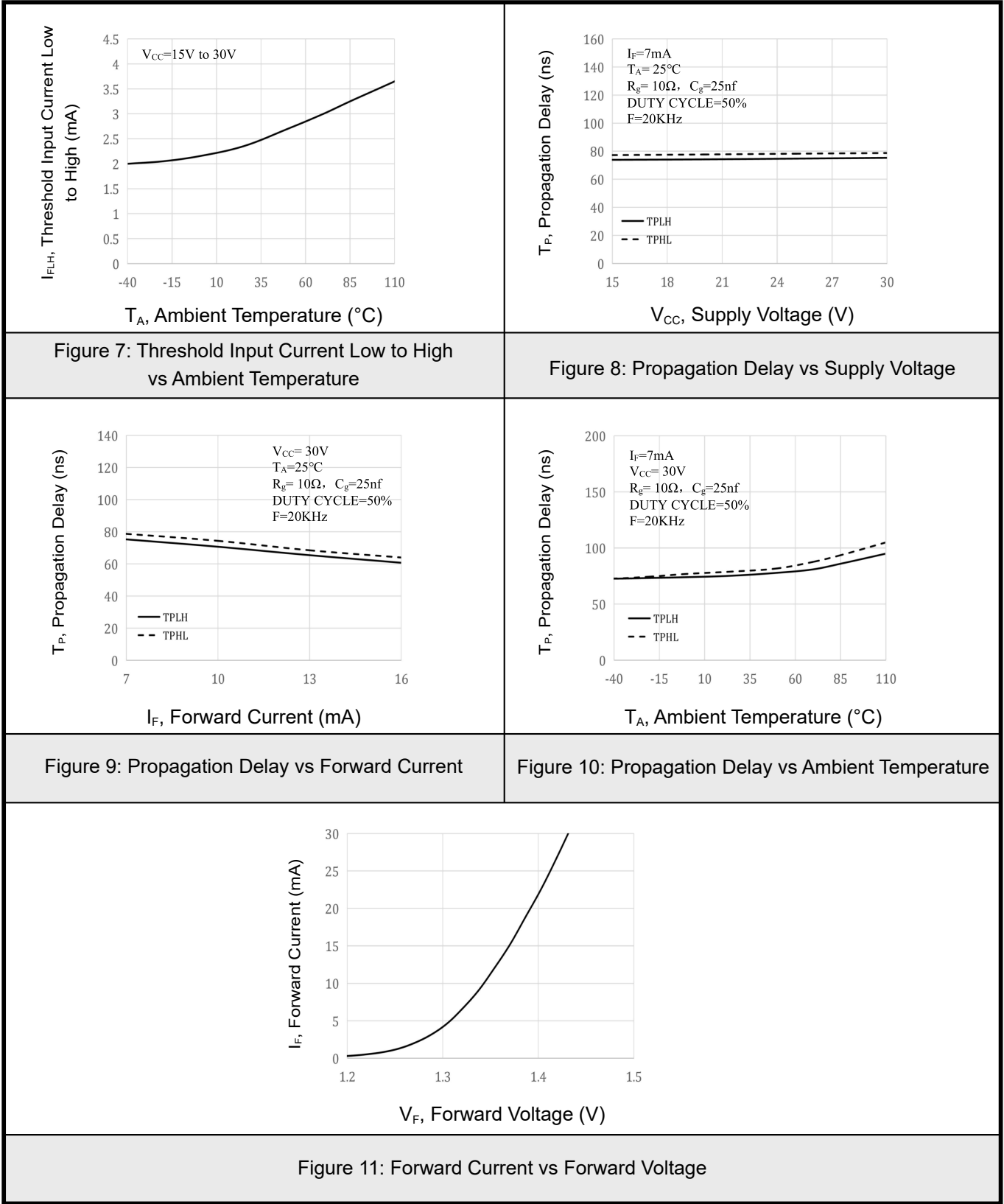


10.1 Typical Characteristic



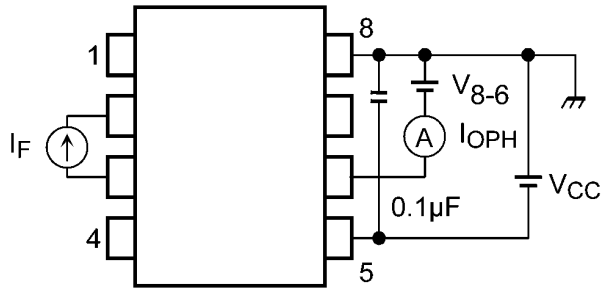
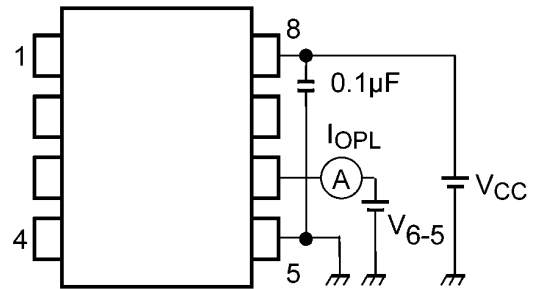
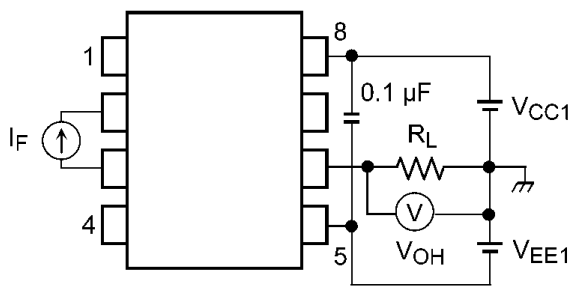
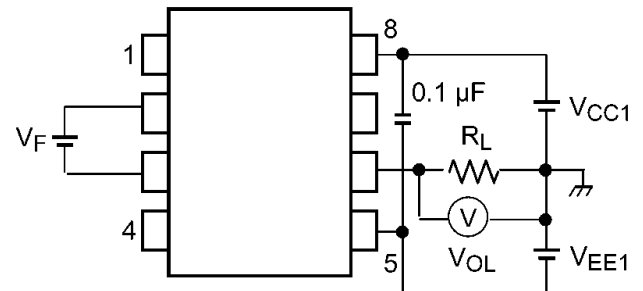
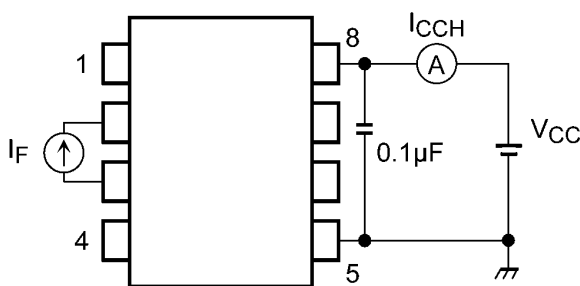
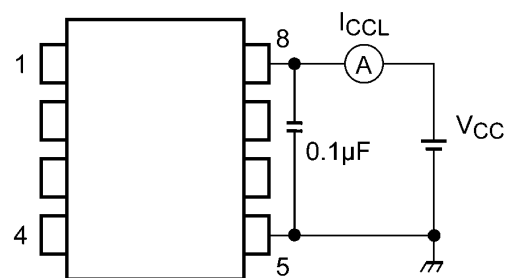


10.2 Typical Characteristic



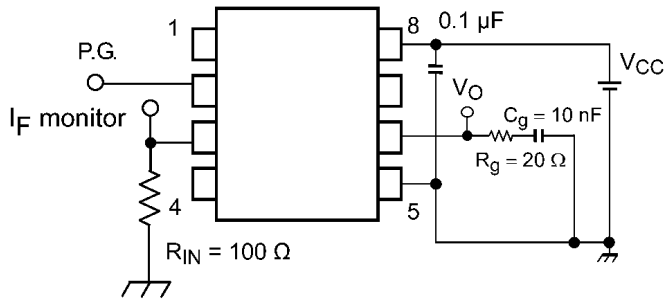


11. Test Circuits Diagrams

Figure 12: I_{OH} Test CircuitFigure 14: I_{OL} Test CircuitFigure 15: V_{OH} Test CircuitFigure 16: V_{OL} Test CircuitFigure 17: I_{CCH} Test CircuitFigure 18: I_{CCL} Test Circuit

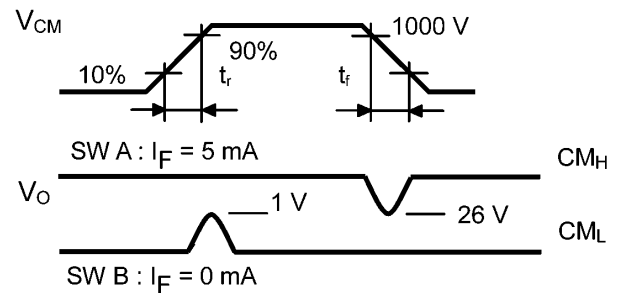
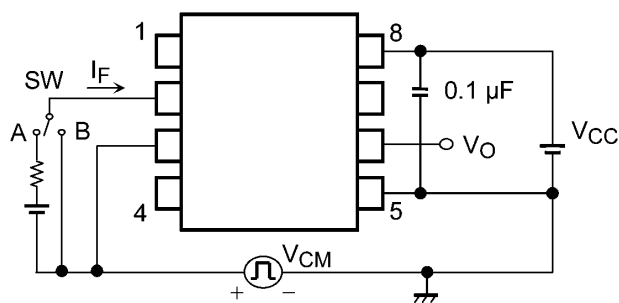


$I_F = 5 \text{ mA (P.G.)}$
($f = 25 \text{ kHz}$, duty = 50%, $t_r = t_f = 5 \text{ ns}$ or less)



P.G.: Pulse generator

Figure 19: Switching Time Test Circuit and Waveform



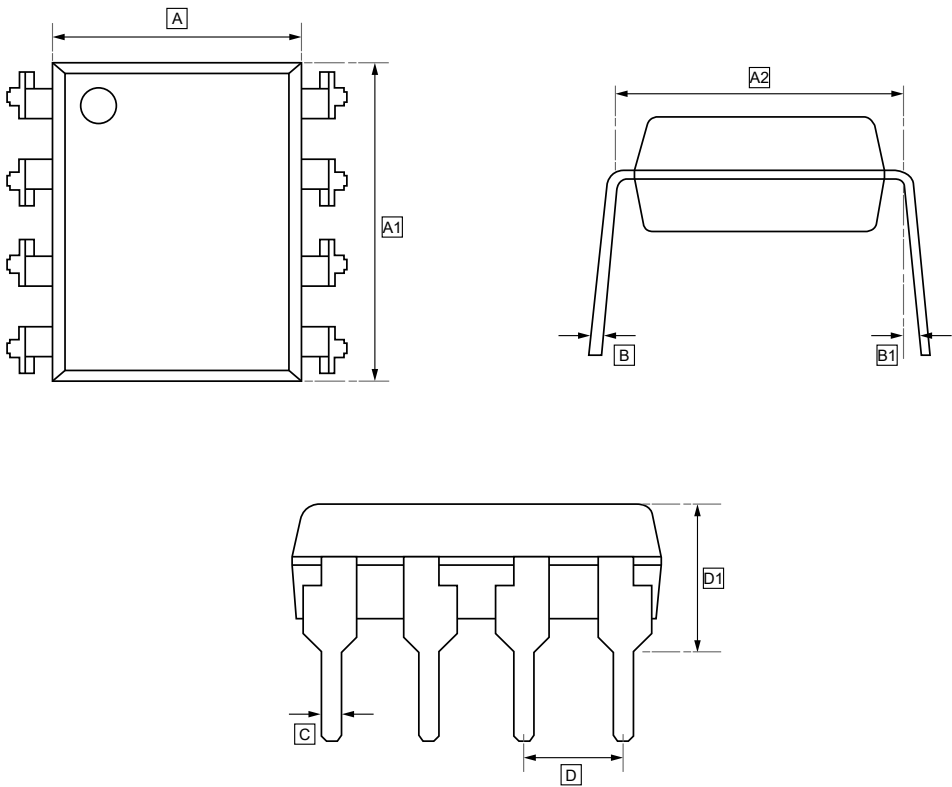
$$CM_L = \frac{800(V)}{t_r(\mu s)} \quad CM_H = -\frac{800(V)}{t_f(\mu s)}$$

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

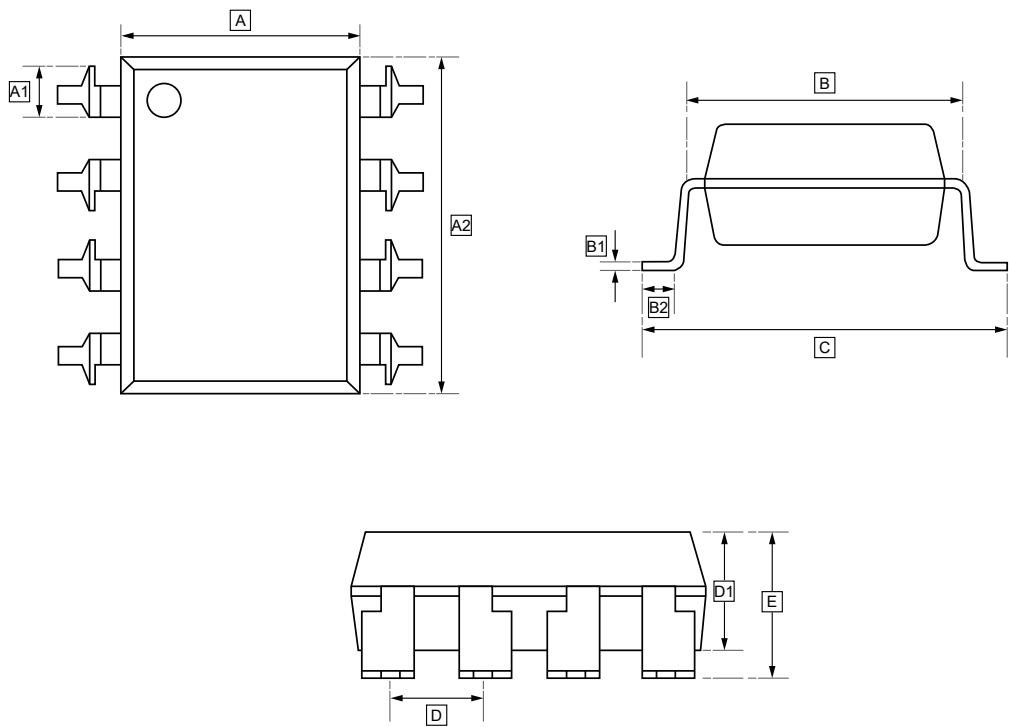


DIMENSIONS (mm are the original dimensions)

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

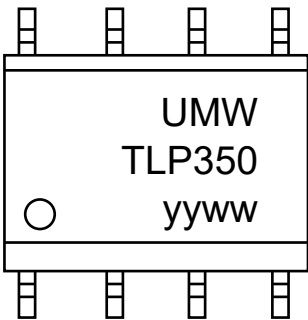


DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	B	B1	B2	C	D	D1	E
Min	6.30	1.45	9.46	7.62	0.25	0.6	-	2.54	3.20	4.00
Max	6.90		10.06	TYP		-	10.3	TYP	3.80	4.60



13.Ordering Information



yy: Year Code
ww: Week Code

Order Code	Marking	Package	Base QTY	Delivery Mode
UMW TLP350	TLP350	SOP-8	1000	Tape and reel
UMW TLP350F	TLP350F	DIP-8	2250	Tube and box



14.Disclaimer

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