



Description

The APPL-P/W304 series Photocoupler is ideally suited for driving power IGBTs and MOSFETs used in motor control inverter applications and inverters in power supply system. It contains an LED optically coupled to an integrated circuit with a power output stage.

0.6 A peak output current is capable of directly driving most IGBTs with ratings up to 1200 V/160 A. For IGBTs with higher ratings, the P/W304 series can be used to drive a discrete power stage which drives the IGBT gate. The Photocoupler operational parameters are guaranteed over the temperature range from -40°C ~ +110°C.

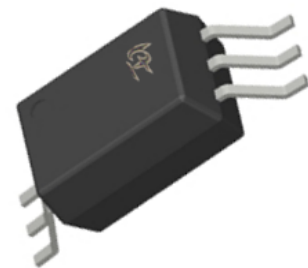
Features

- 0.6 A maximum peak output current
- Rail-to-rail output voltage
- 120 ns maximum propagation delay
- Under Voltage Lock-Out protection (UVLO) with hysteresis
- Wide operating range: 10 to 30 Volts (V_{CC})
- Guaranteed performance over temperature -40°C ~ +110°C.

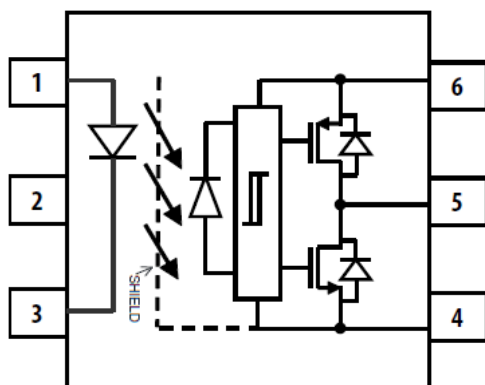
Applications

- IGBT/MOSFET gate drive
- Uninterruptible power supply (UPS)
- Industrial Inverter
- AC/Brushless DC motor drives
- Switching power suppliers

PACKAGE



SCHEMATIC



PIN DEFINITION

1. Anode	4. V_{SS}
3. Cathode	5. VO
	6. V_{CC}

TRUTH TABLE			
LED	$V_{CC}-V_{SS}$ (Turn-ON, +ve going)	$V_{CC}-V_{SS}$ (Turn-OFF, -ve going)	V_o
Off	0V to 30V	30V to 0V	Low
On	0V to 6.9V	5.9V to 0V	Low
On	6.9V to 8.7V	7.5V to 5.9V	Transition
On	8.7V to 30V	30V to 7.5V	High

Note: A 0.1 μ F bypass capacitor must be connected between Pin 4 and 6.

ABSOLUTE MAXIMUM RATINGS					
PARAMETER	SYMBOL	Min	Max	UNIT	Note
Storage Temperature	T_{stg}	-55	125	$^{\circ}\text{C}$	-
Operating Temperature	T_{opr}	-40	110	$^{\circ}\text{C}$	-
Output IC Junction Temperature	T_J	-	125	$^{\circ}\text{C}$	-
Total Output Supply Voltage	$(V_{CC}-V_{SS})$	0	35	V	-
Average Forward Input Current	I_F	-	20	mA	-
Reverse Input Voltage	V_R	-	5	V	-
“High” Peak Output Current	$I_{OH(PEAK)}$		0.6	A	1
“Low” Peak Output Current	$I_{OL(PEAK)}$		0.6	A	1
Output Voltage	$V_{O(PEAK)}$	-0.5	V_{CC}	V	-
Power Dissipation	P_I	-	45	mW	-
Output IC Power Dissipation	P_O	-	250	mW	-
Lead Solder Temperature	T_{sol}	-	260	$^{\circ}\text{C}$	-

Note: Ambient temperature = 25 $^{\circ}\text{C}$, 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.

Note 1: Exponential waveform. Pulse width $\leq 10\ \mu\text{s}$, $f \leq 15\ \text{kHz}$

RECOMMENDED OPERATION CONDITIONS				
PARAMETER	SYMBOL	MIN.	MAX.	UNIT
Operating Temperature	T_A	-40	110	$^{\circ}\text{C}$
Supply Voltage	V_{CC}	10	30	V
Input Current (ON)	$I_{F(ON)}$	7	16	mA
Input Voltage (OFF)	$V_{F(OFF)}$	0	0.8	V

ELECTRICAL OPTICAL CHARACTERISTICS							
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION	NOTE
INPUT CHARACTERISTICS							
Forward Voltage	V_F	1.6	2.0	2.4	V	$I_F = 10 \text{ mA}$	
Input Forward Voltage Temperature Coefficient	$\Delta V_F / \Delta T$	-	-1.237	-	mV/°C	$I_F = 10 \text{ mA}$	
Input Reverse Voltage	BV_R	5	-	-	V	$I_R = 10 \mu\text{A}$	
Input Threshold Current (Low to High)	I_{FLH}	-	1.0	5	mA	$V_O > 5\text{V}, I_O = 0\text{A}$	
Input Threshold Voltage (High to Low)	V_{FHL}	0.8	-	-	V	$V_{CC} = 30 \text{ V}, V_O < 5\text{V}$	
Input Capacitance	C_{IN}	-	60	-	pF	$V_F = 0, f = 1\text{MHz}$	
OUTPUT CHARACTERISTICS							
High Level Supply Current	I_{CCH}	-	2	3	mA	$I_F = 10 \text{ mA}, V_{CC} = 30 \text{ V}, V_O = \text{Open}$	
Low Level Supply Current	I_{CCL}	-	2.6	3.5	mA	$I_F = 0 \text{ mA}, V_{CC} = 30 \text{ V}, V_O = \text{Open}$	
High Level Output Voltage	V_{OH}	$V_{CC} - 1.0\text{V}$	$V_{CC} - 0.4\text{V}$	-	V	$I_F = 10 \text{ mA}, I_O = -100 \text{ mA}$	2,3
Low Level Output Voltage	V_{OL}	-	0.25	1	V	$I_F = 0 \text{ mA}, I_O = 100 \text{ mA}$	
High Level Output Current	I_{OH}		-	-0.8	A	$I_F = 10 \text{ mA}, V_{CC} = 30\text{V}$ $V_O = V_{CC} - 6$	1
Low Level Output Current	I_{OL}	0.8	-	-	A	$I_F = 0 \text{ mA}, V_{CC} = 30\text{V}$ $V_O = V_{SS} + 6$	1
Under Voltage Lockout Threshold	VUVLO+	6.9	7.9	8.7	V	$V_O > 5\text{V}, I_F = 10 \text{ mA}$	
	VUVLO-	5.9	6.8	7.5	V	$V_O < 5\text{V}, I_F = 10 \text{ mA}$	

All Typical values at $T_A = 25^\circ\text{C}$ and $V_{CC} - V_{SS} = 30 \text{ V}$, unless otherwise specified; all minimum and maximum specifications are at recommended operating condition.

Note 1: Maximum pulse width = 10 μs .

Note 2: In this test V_{OH} is measured with a dc load current. When driving capacitive loads, V_{OH} will approach V_{CC} as I_{OH} approaches zero amps.

Note 3: Maximum pulse width = 1 ms.

SWITCHING SPECIFICATION							
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION	NOTE
SWITCHING CHARACTERISTICS							
Propagation Delay Time to Output Low Level	t_{PHL}	-	60	120	ns	$R_g = 47 \Omega$, $C_g = 3 \text{ nF}$, $f = 10 \text{ kHz}$, Duty Cycle = 50% $I_F = 10 \text{ mA}$, $V_{CC} = 30 \text{ V}$	-
Propagation Delay Time to Output High Level	t_{PLH}	-	55	120	ns		-
Pulse Width Distortion	PWD	-	5	80	ns		-
Propagation Delay Difference Between Any Two Parts	PDD ($t_{PHL} - t_{PLH}$)	-100	-	+100	ns		-
Rise Time	t_r	-	6	-	ns		-
Fall Time	t_f	-	5	-	ns		-
Common Mode Transient Immunity at Logic High	CM_H	10		-	kV/ μs	$I_F = 7 \text{ to } 16 \text{ mA}$ $V_{CC} = 30 \text{ V}$, $T_A = 25^\circ \text{C}$, $V_{CM} = 1.5 \text{ kV}$	1,2
Common Mode Transient Immunity at Logic Low	CM_L	10		-	kV/ μs	$I_F = 0 \text{ mA}$ $V_{CC} = 30 \text{ V}$, $T_A = 25^\circ \text{C}$, $V_{CM} = 1.5 \text{ kV}$	1,3

All Typical values at $T_A = 25^\circ \text{C}$ and $V_{CC} - V_{SS} = 30 \text{ V}$, unless otherwise specified; all minimum and maximum specifications are at recommended operating condition.

Note 1: Pin 2 needs to be connected to LED common.

Note 2: Common mode transient immunity in the high state is the maximum tolerable dV_{CM}/dt of the common mode pulse, V_{CM} , to assure that the output will remain in the high state (meaning $V_O > 10.0 \text{ V}$).

Note 3: Common mode transient immunity in a low state is the maximum tolerable dV_{CM}/dt of the common mode pulse, V_{CM} , to assure that the output will remain in a low state (meaning $V_O < 1.0 \text{ V}$).

ISOLATION CHARACTERISTIC

Parameter	Symbo	Device	Min.	Typ.	Max.	Unit	Test Condition	Note
Withstand Insulation Test Voltage	V _{ISO}	APPL-P304S	5000	-	-	V	RH ≤ 40%-60%, t = 1min, T _A = 25 °C	1,2
		APPL-W304S						
Input-Output Resistance	R _{I-O}	-	-	10 ¹²	-	Ω	V _{I-O} = 500V DC	1

All Typical values at T_A = 25°C and V_{CC} – V_{SS} = 30 V, unless otherwise specified; all minimum and maximum specifications are at recommended operating condition.

Note 1: Device is considered a two terminal device: pins 1, 2, 3 are shorted together and pins 4, 5, 6 are shorted together.

Note 2: According to UL1577, each photocoupler is tested by applying an insulation test voltage 6000VRMS for one second. This test is performed before the 100% production test for partial discharge.

TYPICAL PERFORMANCE CURVES & TEST CIRCUITS

Fig.1 High output rail voltage vs. Temperature

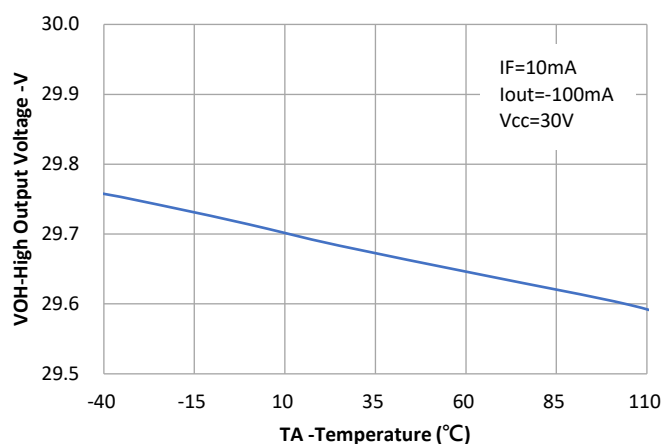


Fig.2 V_{OH} vs. Temperature

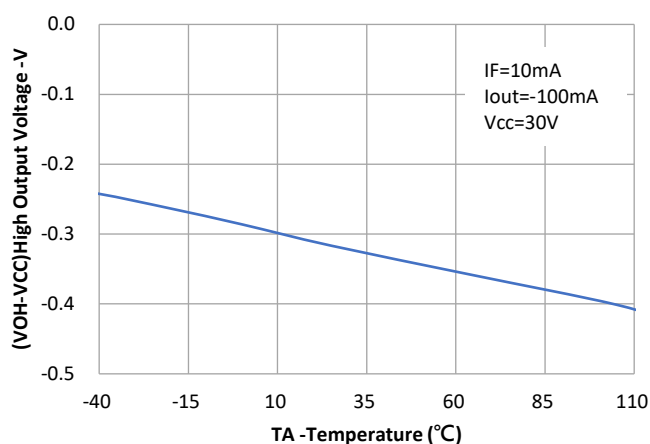


Fig.3 V_{OL} vs. Temperature

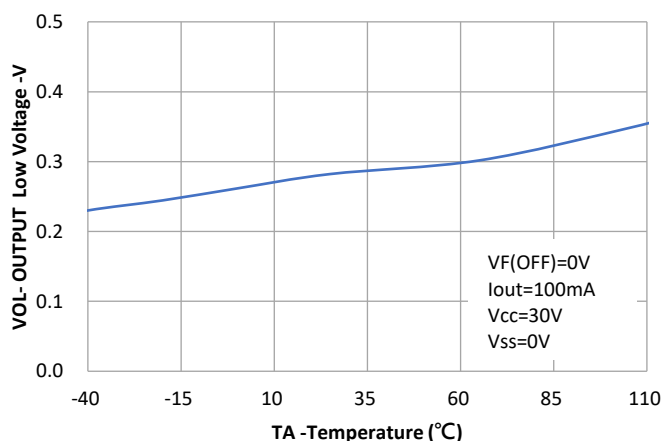


Fig.4 I_{CC} vs. Temperature

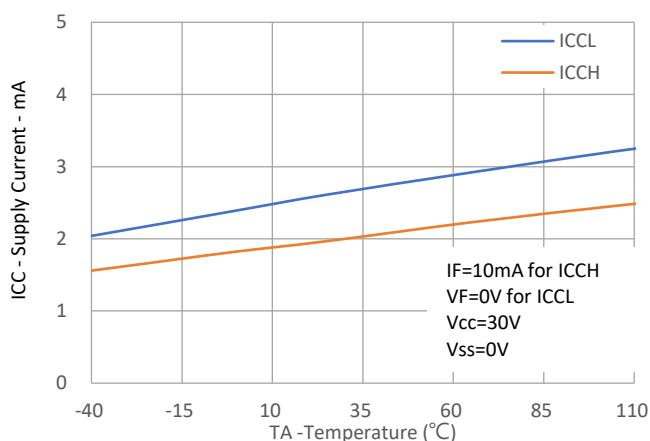


Fig.5 I_{CC} vs. V_{CC}

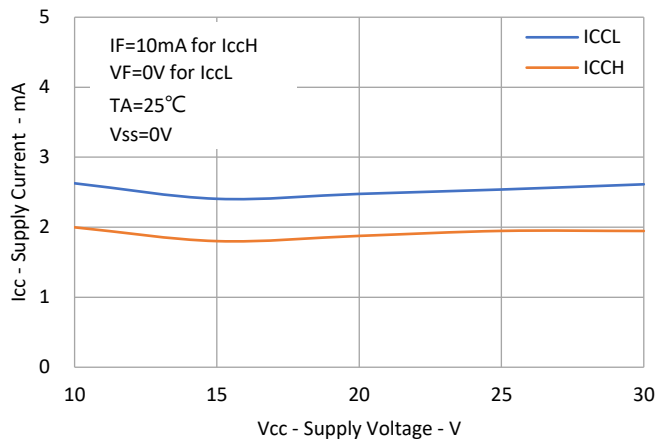


Fig.6 I_{FLH} vs. Hysteresis

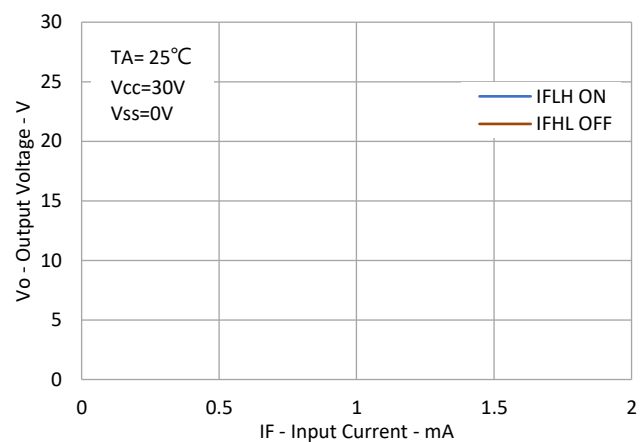


Fig.7 I_{FLH} vs. Temperature

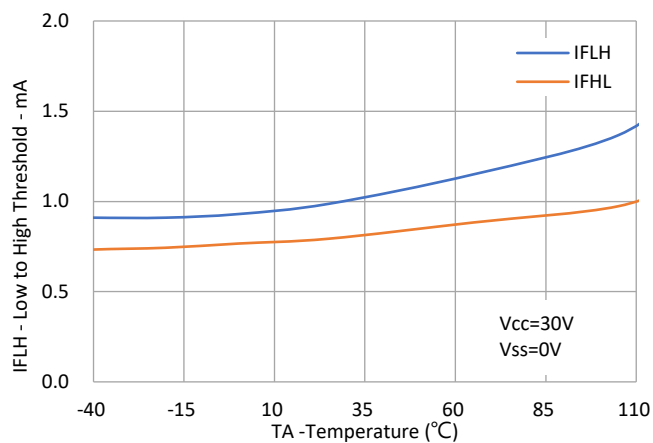


Fig.8 Propagation Delays vs. V_{CC}

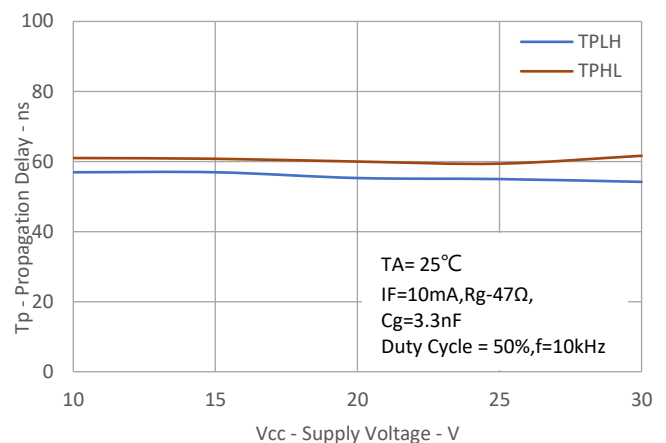


Fig.9 Propagation Delays vs. I_F

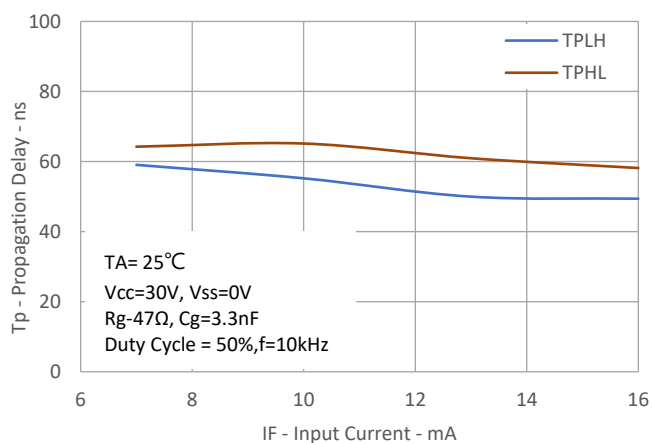


Fig.10 Propagation Delays vs. Temperature

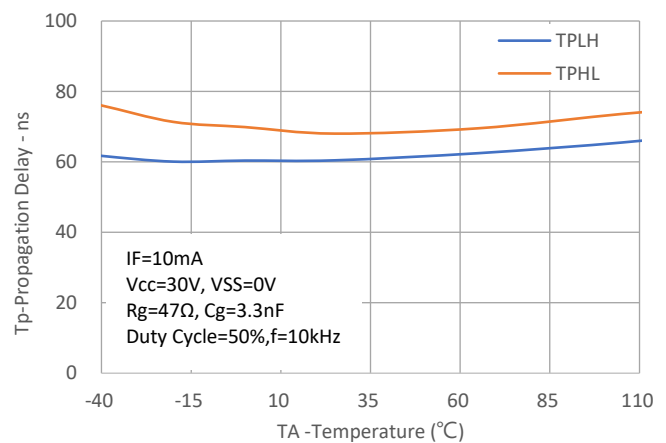


Fig.11 Propagation Delays vs. Rg

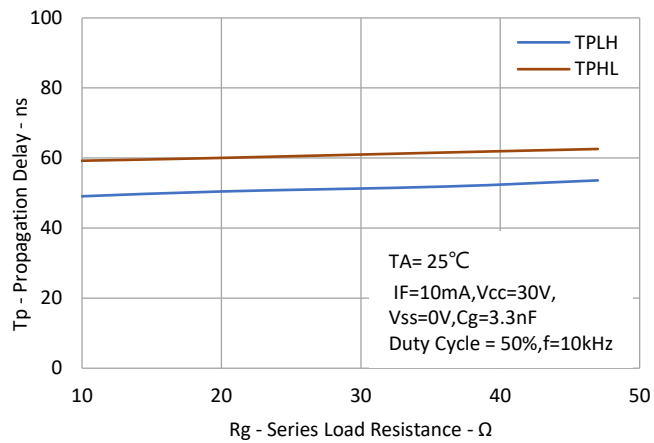


Fig.12 Propagation Delays vs. Cg

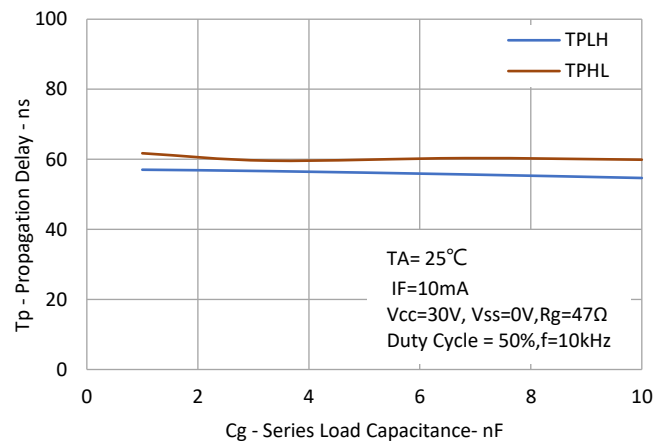


Fig.13 Input Current vs. Forward Voltage

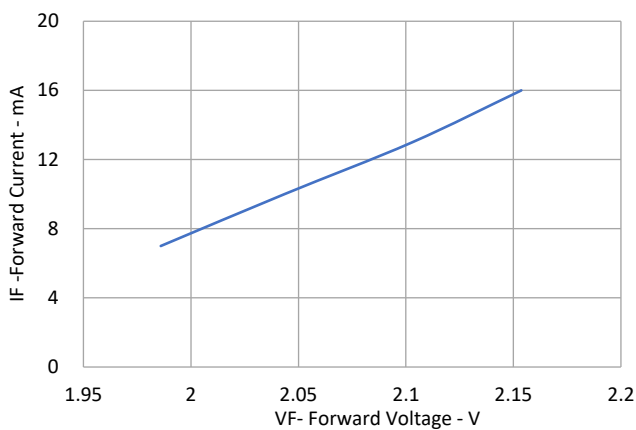


Fig.14 I_{OH} Test Circuit

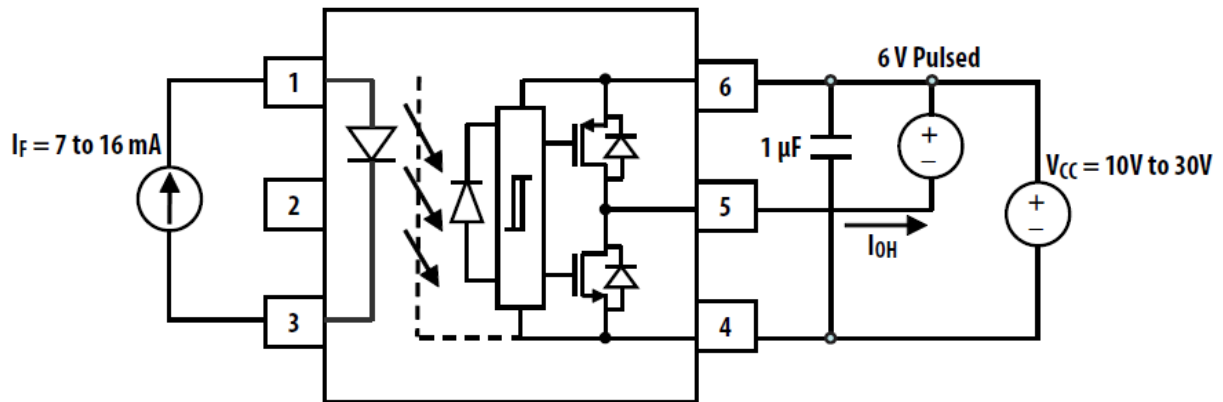


Fig.15 I_{OL} Test Circuit

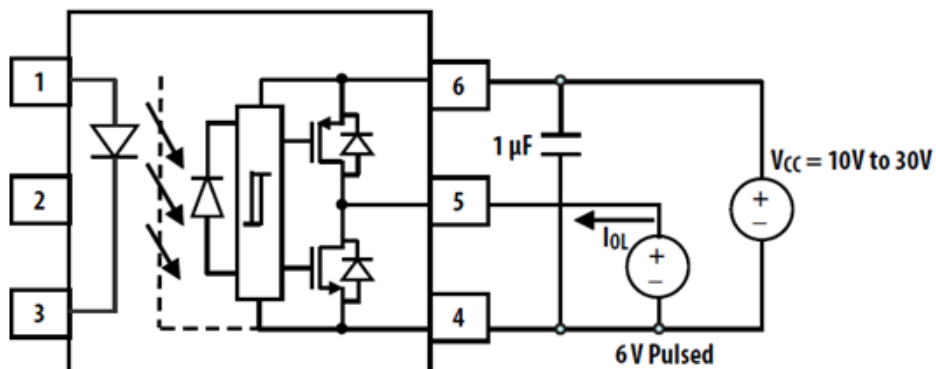


Fig.16 V_{OH} Test Circuit

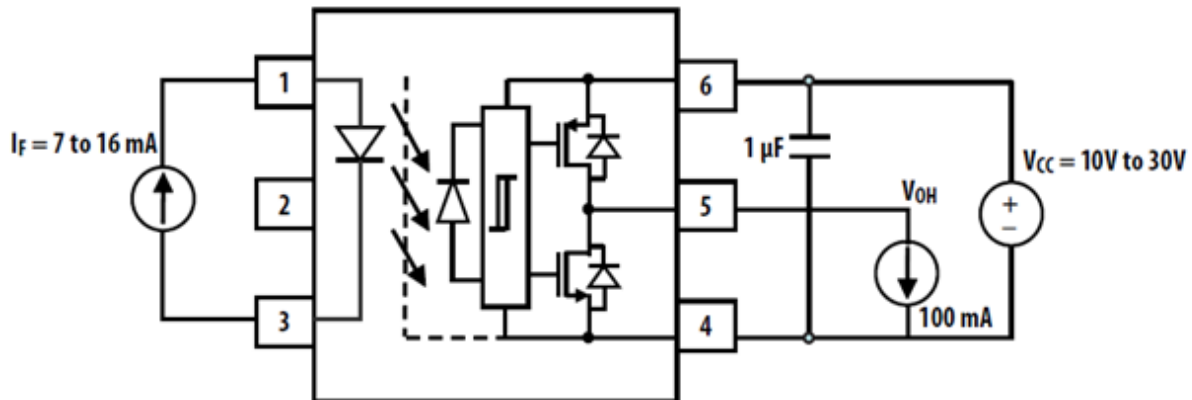


Fig.17 V_{OL} Test Circuit

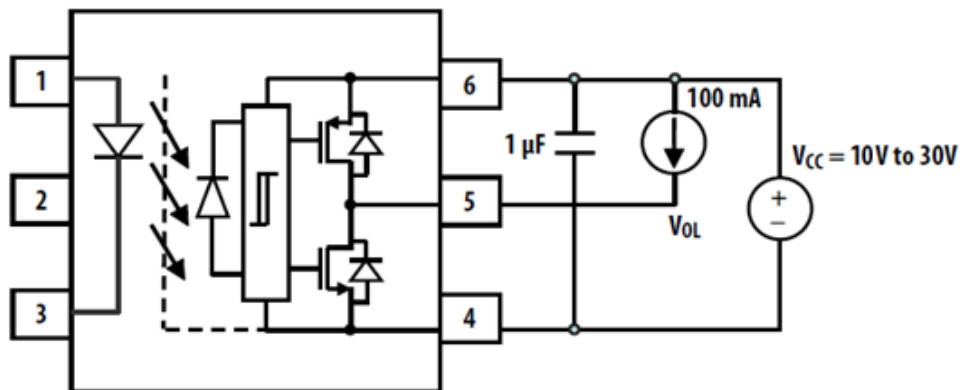


Fig.18 I_{FLH} Test Circuit

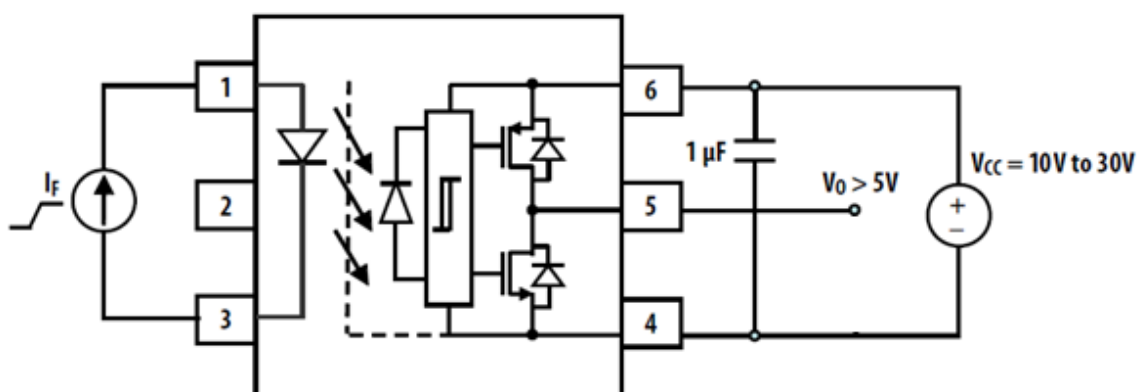




Fig.19 UVLO Test Circuit

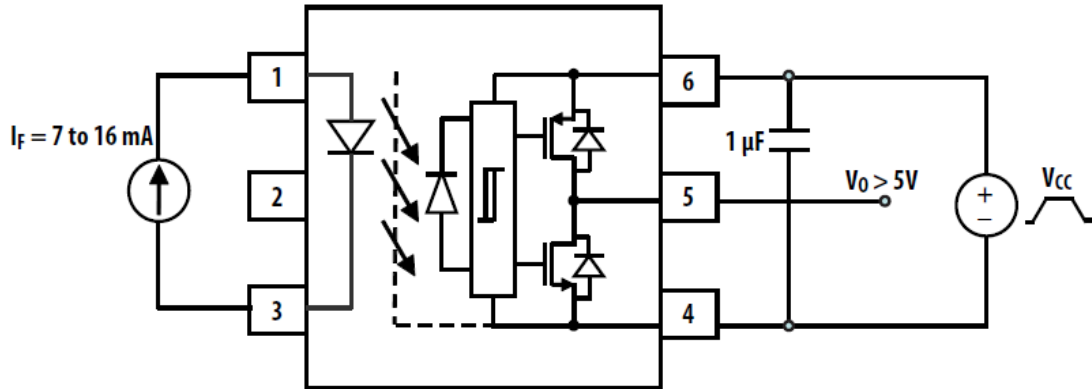


Fig.20 t_{PHL}, t_{PLH}, t_r and t_f Test Circuit and Waveforms

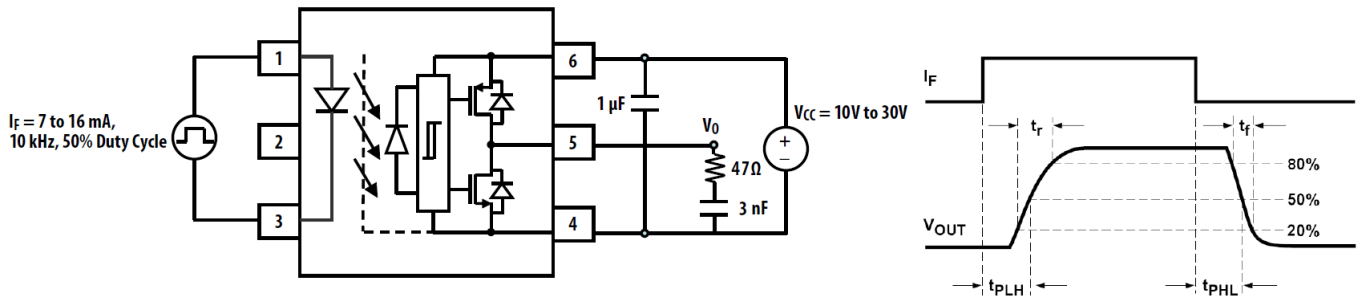
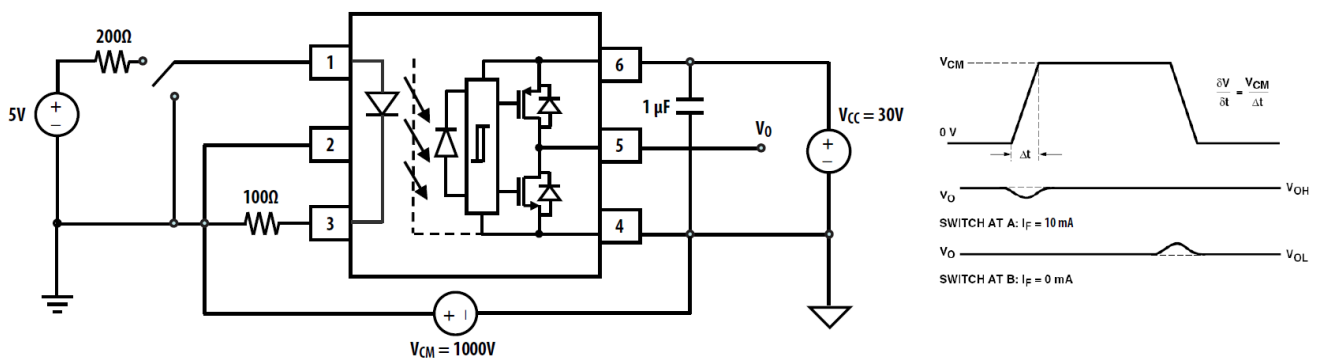


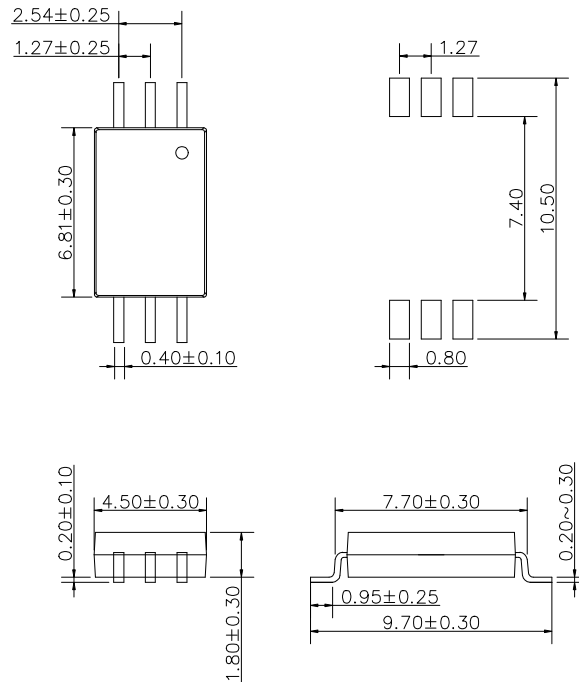
Fig.21 CMR Test Circuit with Split Resistors Network and Waveforms



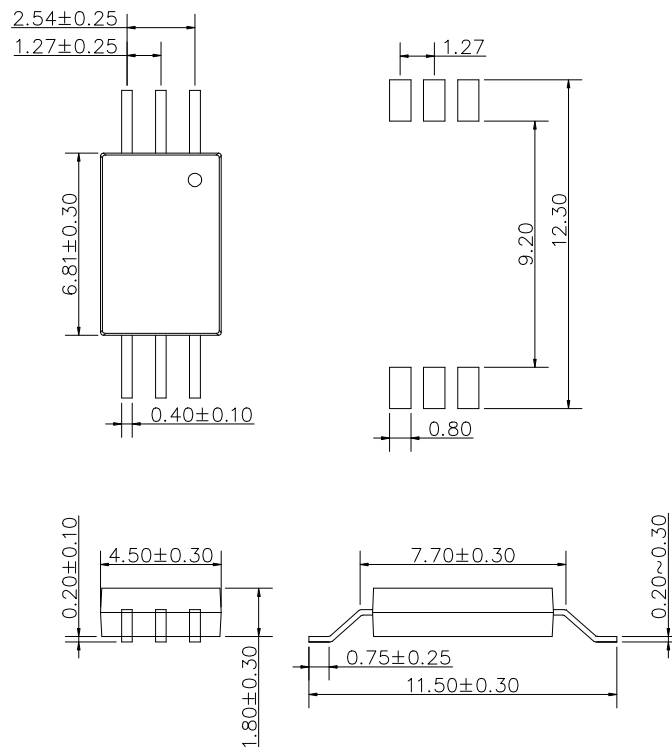
PACKAGE DIMENSIONS (Dimensions in mm unless otherwise stated)

Surface Mount Lead Forming

P type Dimension



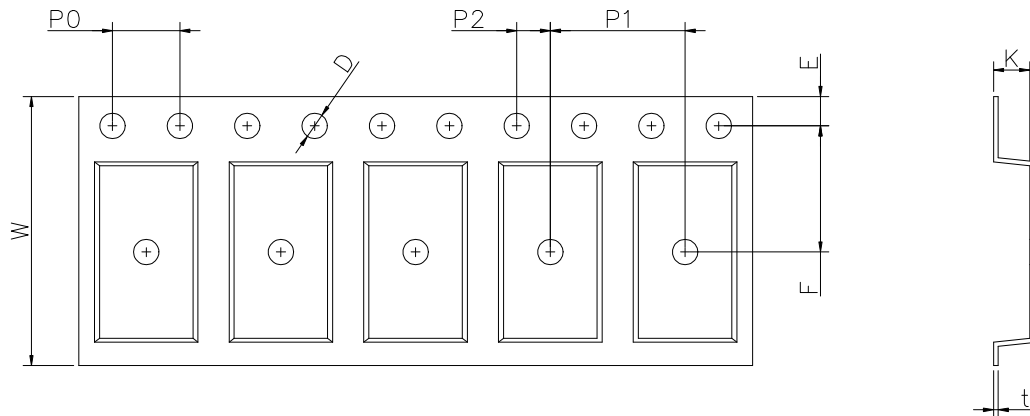
W type Dimension



PACKAGE DIMENSIONS (Dimensions in mm unless otherwise stated)

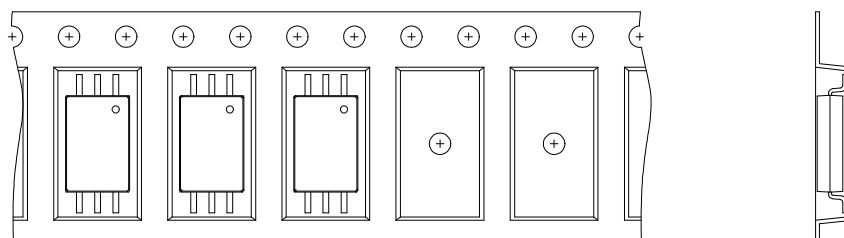
TAPING DIMENSIONS (Dimensions in mm unless otherwise stated)

P type Taping Dimensions



Dimension Symbol	D	E	F	P0	P1	P2	t	W	K
Dimension (mm)	1.5±0.1	1.75±0.1	7.5±0.1	4.0±0.1	8.0±0.1	2.0±0.1	0.3±0.1	16.0±0.3	2.15±0.1

Tape & Reel Packing Specifications



MARKING INFORMATION



APPL : **APSEMI APPL Series**
 □ : P/W – Lead Form Option
314 : **Part Number**
YY : **Year date code**
WW : **2-digit work week**
A : **Identification mark**