0.8A, Gate Driver Photo Coupler

■ Features

- 0.8 A maximum peak output current
- Rail-to-rail output voltage
- 120ns maximum propagation delay
- Under Voltage Lock-Out protection (UVLO) with hysteresis
- Wide operating range: 10 to 30 Volts (VCC)
- Guaranteed performance over temperature -40°C ~ +110°C.
- MSL class 1
- Regulatory Approvals
  - UL - UL1577
  - VDE - EN60747-5-5
  - CQC – GB4943.1-2011

■ Applications

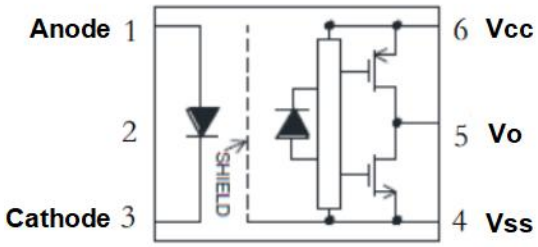
- Isolated IGBT/Power MOSFET gate drive
- Industrial Inverter
- AC/Brushless DC motor drives
- Induction Heating

■ Description

The MPH5701 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.

The Photocoupler operational parameters are guaranteed over the temperature range from 40° C ~ +110°C

■ Schematic



TURTH 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 0.1μF bypass capacitor must be connected between Pin 4 and 6.

ABSOLUTE MAXIMUM RATINGS					
PARAMETER	SYMBOL	Min	Max	UNIT	Note
Storage Temperature	Tstg	-55	125	°C	-
Operating Temperature	Topr	-40	110	°C	-
Output IC Junction Temperature	T_J	-	125	°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	$I_{OH(PEAK)}$		0.8	A	1
“Low” Peak Output Current	$I_{OL(PEAK)}$		0.8	A	1
Output Voltage	$V_{O(PEAK)}$	-0.5	Vcc	V	-
Power Dissipation	P_I	-	45	mW	-
Output IC Power Dissipation	P_O	-	250	mW	-
Lead Solder Temperature	Tsol	-	260	°C	-

Note: 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.
Note 1: Exponential waveform. Pulse width ≤ 10 μs, f ≤ 15 kHz

RECOMMENDED OPERATION CONDITIONS				
PARAMETER	SYMBOL	MIN.	MAX.	UNIT
Operating Temperature	T_A	-40	110	°C
Supply Voltage	V_{CC}	10	30	V
Input Current(ON)	$I_{F(ON)}$	7	16	mA
Input Voltage(OFF)	$V_{F(OFF)}$	-3.0	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=10mA	
Input Forward Voltage Temperature Coefficient	$\Delta V_F/\Delta T$	-	-1.237	-	mV/°C	I_F=10mA	
Input Reverse Voltage	BV_R	5	-	-	V	I_R=10μA	
Input Threshold Current (Low to High)	I_{FLH}	-	1.0	5	mA	V_O>5V,I_O=0A	
Input Threshold Voltage (High to Low)	V_{FHL}	0.8	-	-	V	V_{CC}=30V,V_O<5V	
Input Capacitance	Cin	-	60	-	pF	V_F=0, f=1kHz	
OUTPUT CHARACTERISTICS							
High Level Supply Current	I_{CCH}	-	2	3	mA	I_F=10mA,V_{CC}=30V V_O=Open	
Low Level Supply Current	I_{CCL}	-	2.6	3.5	mA	I_F=0mA,V_{CC}=30V V_O=Open	
High Level Output Voltage	V_{OH}	$V_{CC-1.0v}$	29.69	-	V	I_F=10mA,I_O=-100mA	2,3
Low Level Output Voltage	V_{OL}	-	0.25	1	V	I_F=0mA,I_O=100mA	
High Level Output Current	I_{OH}		-	-0.8	A	I_F=10mA,V_{CC}=30V V_O=V_{CC}-6	1
Low Level Output Current	I_{OL}	0.8	-	-	A	I_F=0mA,V_{CC}=30V V_O=V_{SS}+6	1
Under Voltage Lockout Threshold	VUVLO+	6.9	7.9	8.7	V	V_O>5V,I_F=10mA	
	VUVLO-	5.9	6.8	7.5	V	V_O<5V,I_F=10mA	

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: 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	Rg=47Ω, Cg=3nF, f=10kHz, Duty Cycle=50%, I_F=10mA, V_{CC}=30V	
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 to16mA, V_{CC}=30V,T_A=25°C, V_{CM}=1.5kV	1,2
Common Mode Transient Immunity at Logic Low	CM_L	10		-	kV/μs	I_F=0mA,V_{CC}=30V, T_A=25° C,V_{CM}=1.5kV	1,3

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: Pin 2 needs to be connected to LED common.

Note 2: Common mode transient immunity in the high state is the maximum tolerable dVCM/dt of the common mode pulse, VCM, to assure that the output will remain in the high state (meaning V_O > 10.0V).

Note 3: Common mode transient immunity in a low state is the maximum tolerable dVCM/dt of the common mode pulse, VCM, to assure that the output will remain in a low state (meaning V_O < 1.0V).

ISOLATION CHARACTERISTIC

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION	NOTE
Withstand Insulation Test Voltage	V_{ISO}	5000	-	-	V	RH≤40~60%, t=1min,T_A=25°C	1,2
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

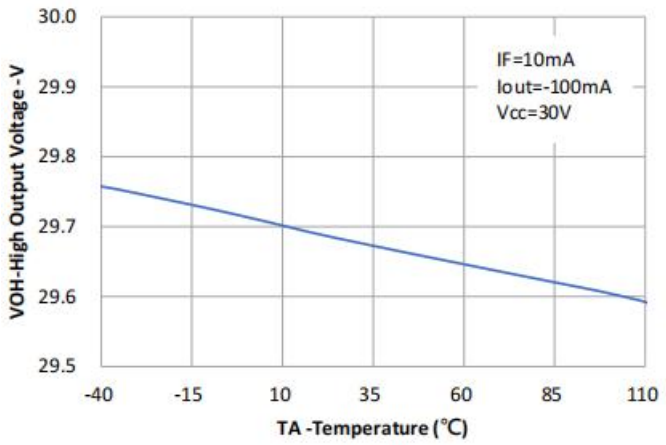


Fig.1 High output rail voltage vs. Temperature

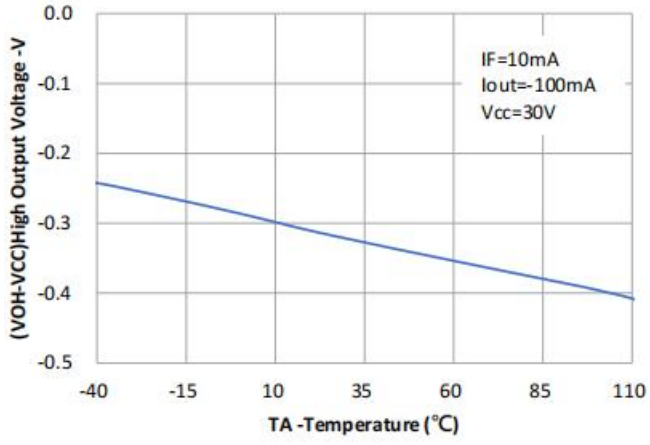


Fig.2 V_{OH} vs. Temperature

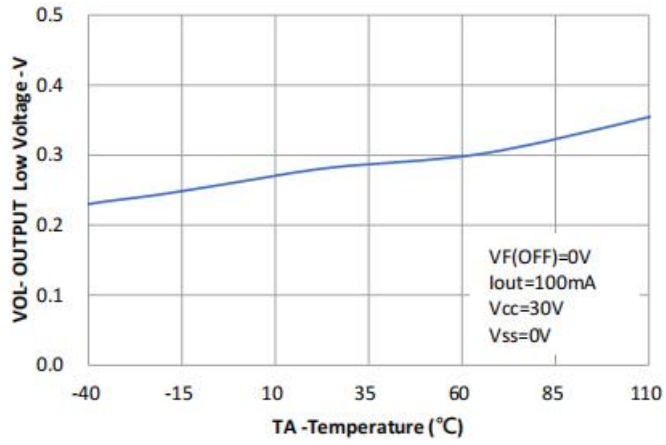


Fig.3 VOL vs. Temperature

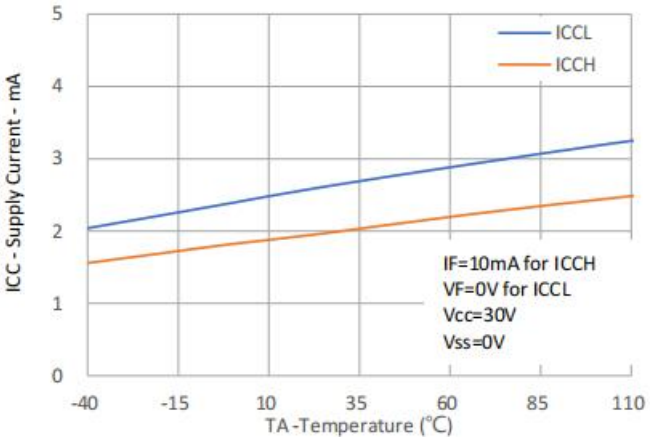


Fig.4 ICC vs. Temperature

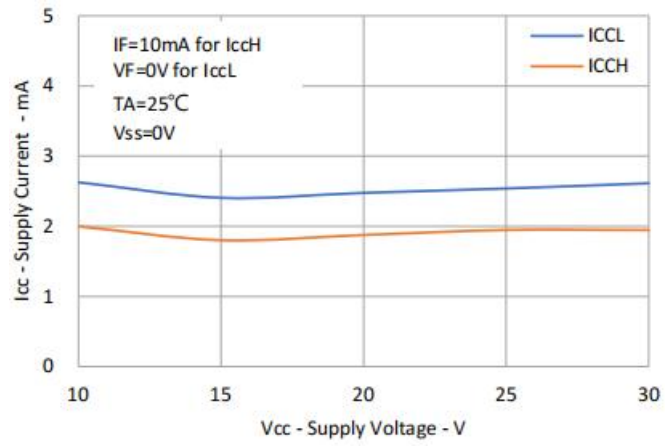


Fig.5 ICC vs. VCC

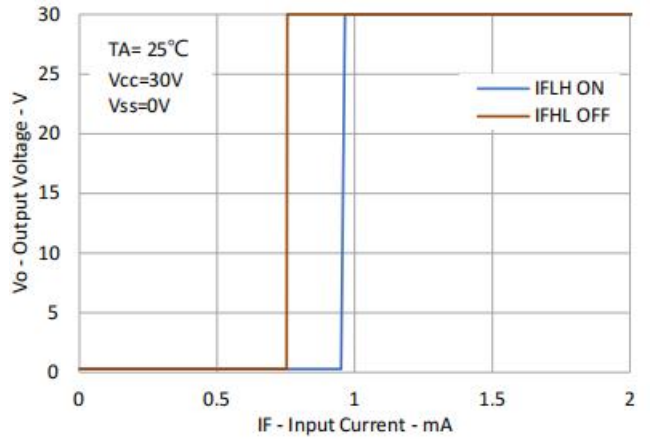


Fig.6 FLH vs. Hysteresis

CHARACTERISTIC CURVES

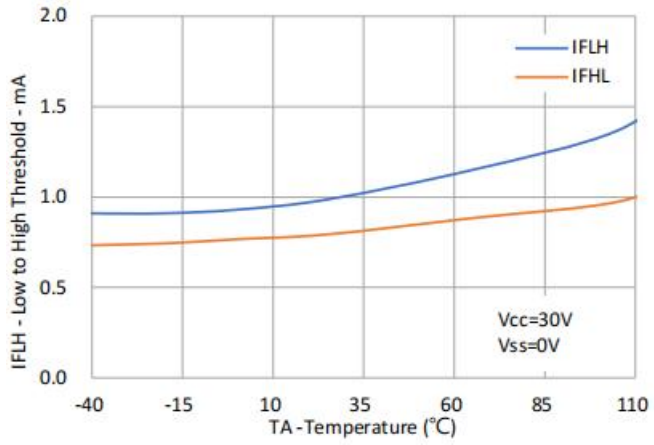


Fig.7 IFH vs. Temperature

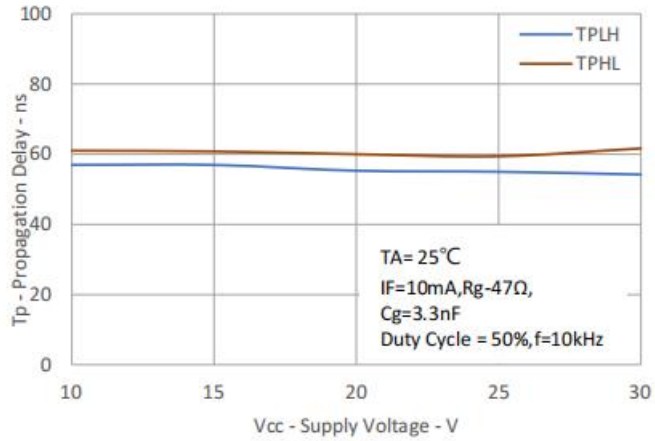


Fig.8 Propagation Delays vs. VCC

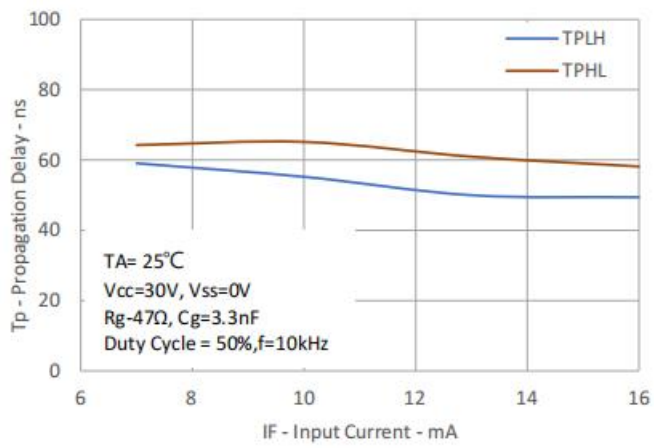


Fig.9 Propagation Delays vs. I_F

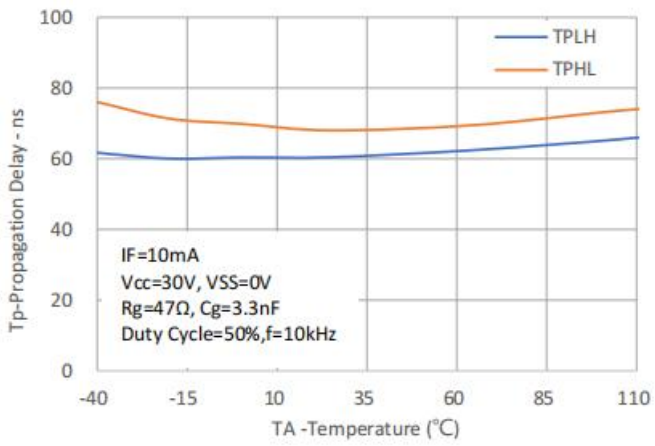


Fig.10 Propagation Delays vs. Temperature

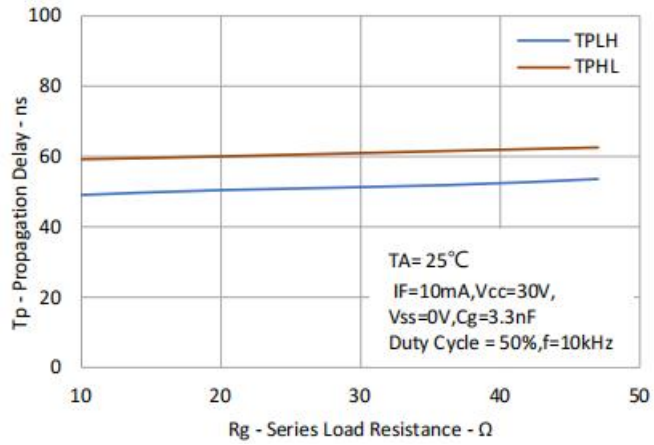


Fig.11 Propagation Delays vs. Rg

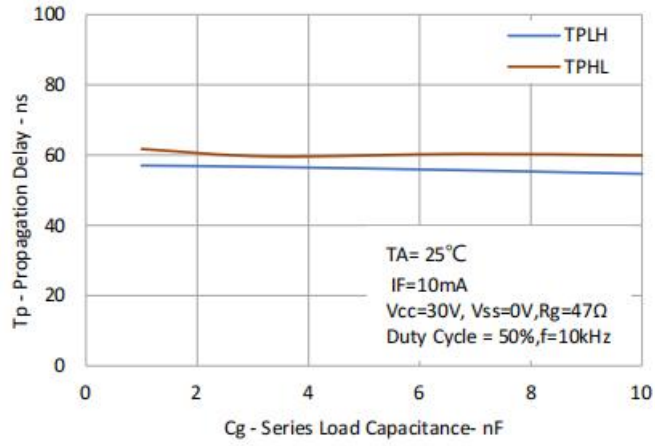


Fig.12 Propagation Delays vs. Cg

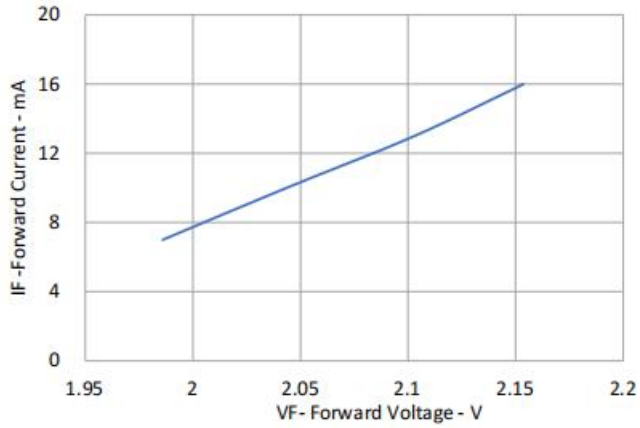


Fig.13 Input Current vs. Forward Voltage

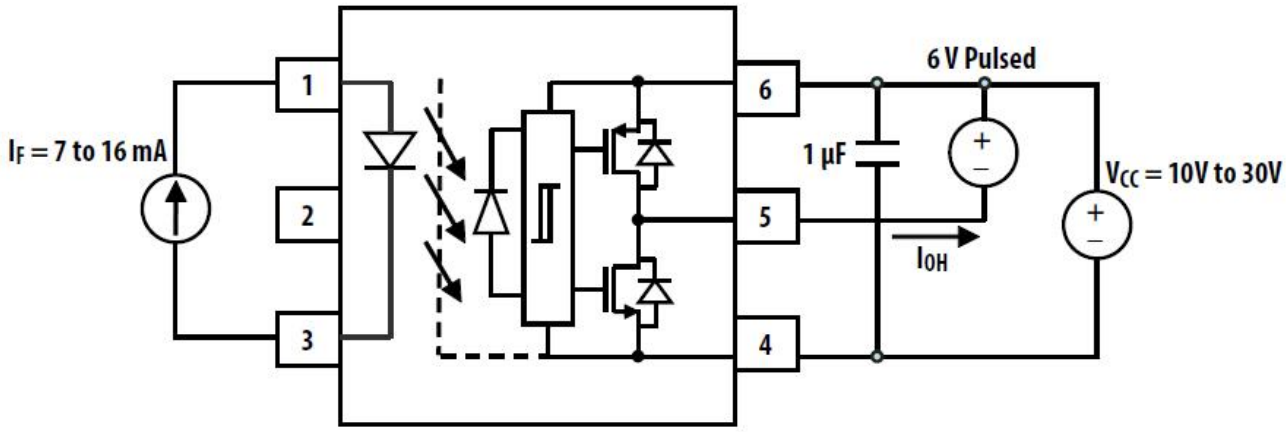


Fig.14 I_{OH} Test Circuit

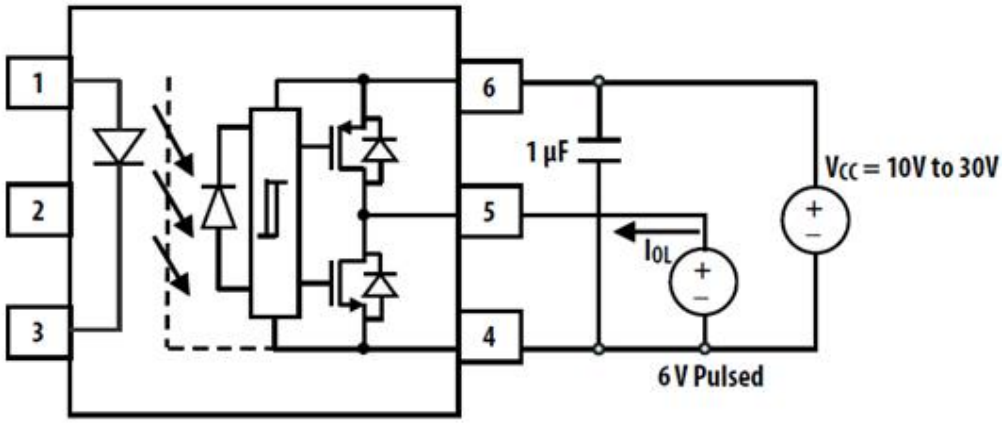


Fig.15 I_{OL} Test Circuit

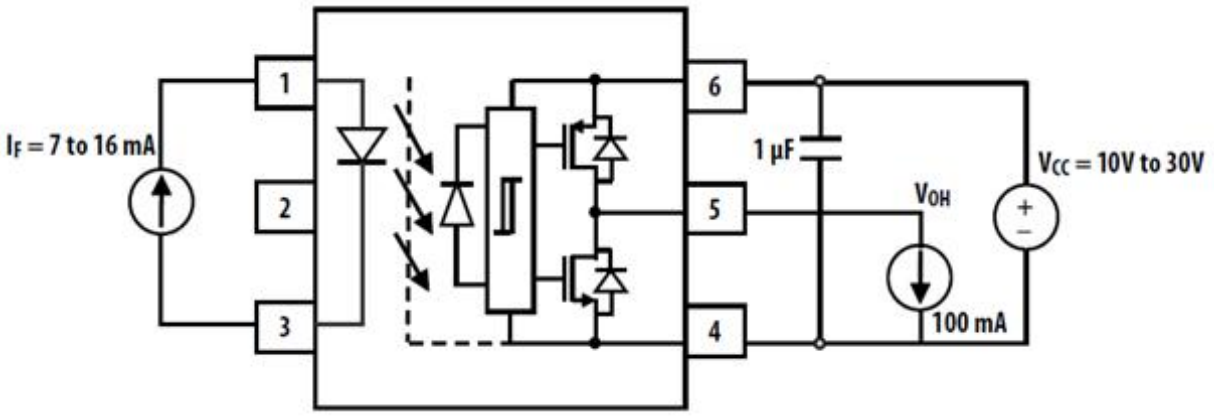


Fig.16 V_{OH} Test Circuit

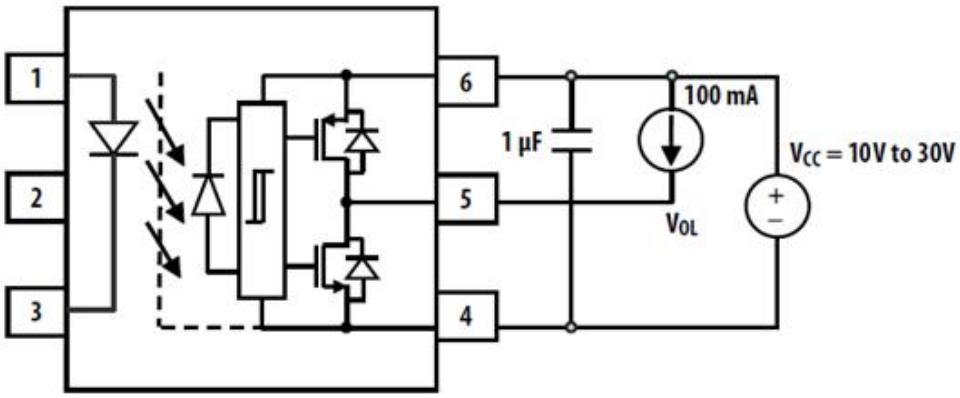


Fig.17 V_{OL} Test Circuit

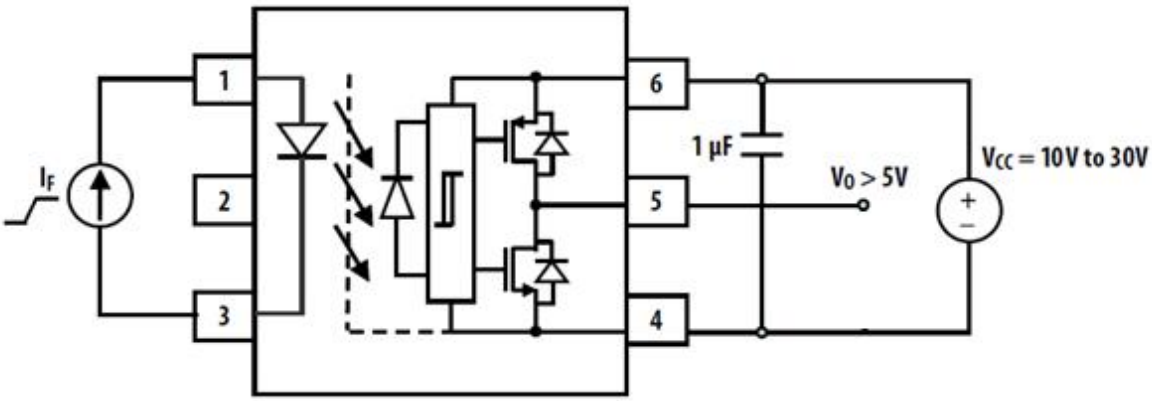


Fig.18 I_{FLH} Test Circuit

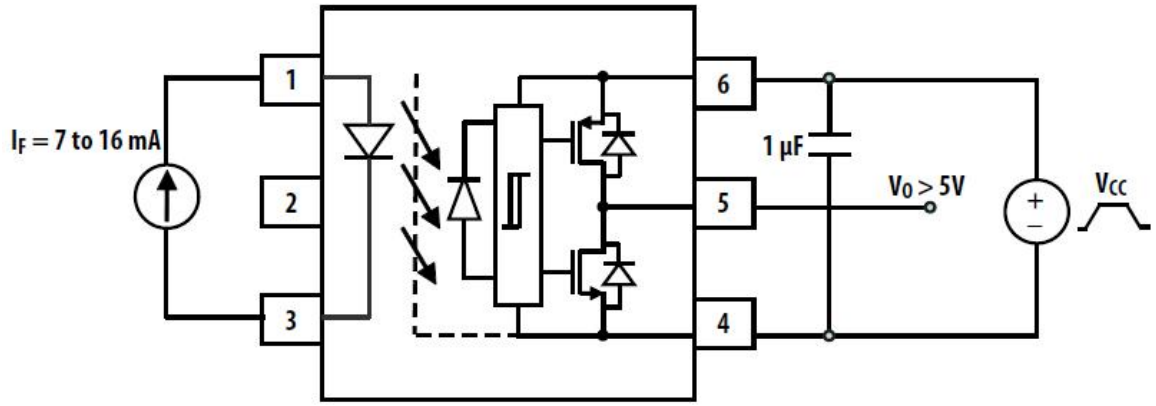


Fig.19 UVLO Test Circuit

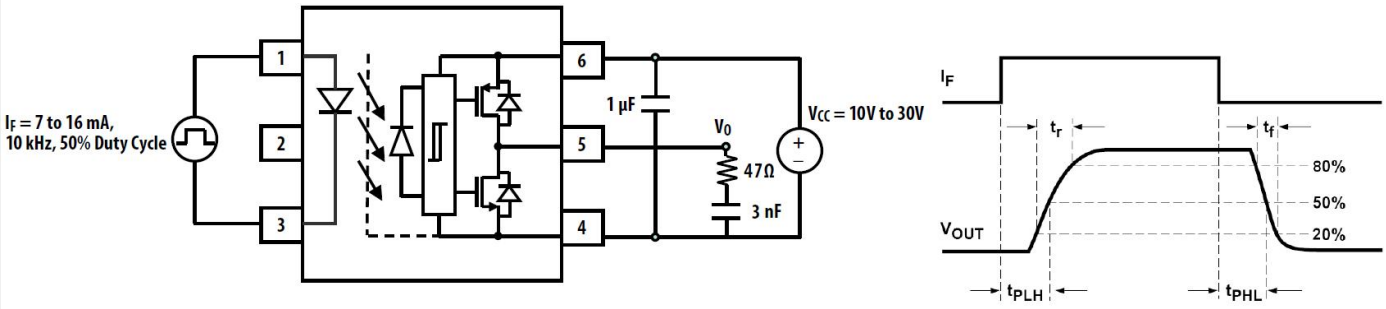


Fig.20 tPHL, tPLH, tr and tf Test Circuit and Waveforms

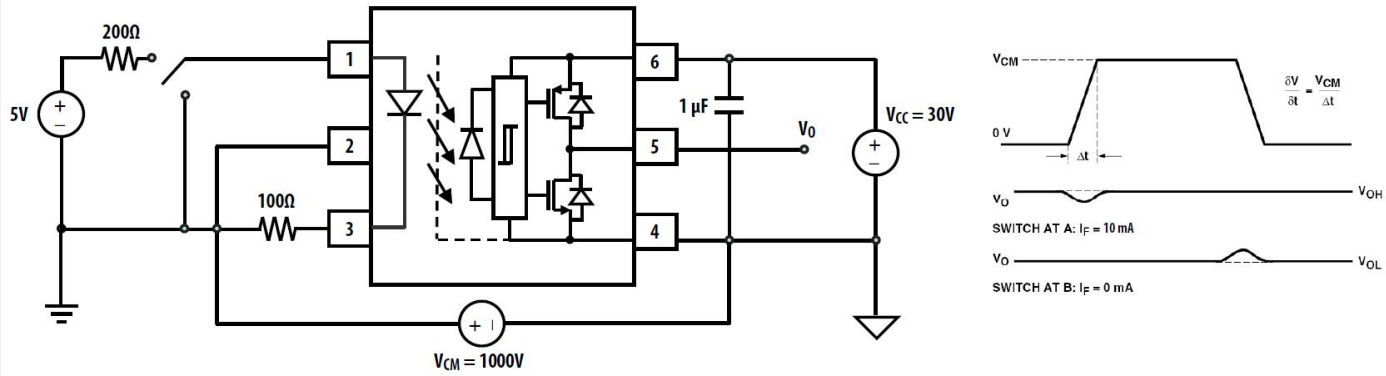
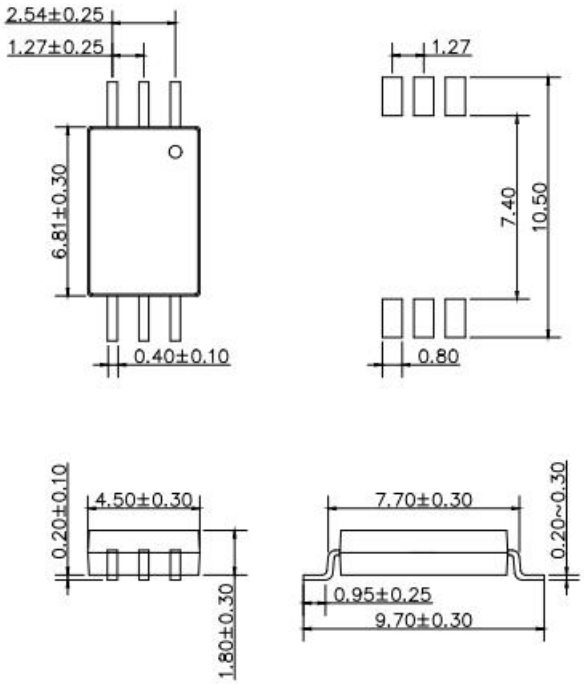


Fig.21 CMR Test Circuit with Split Resistors Network and Waveforms

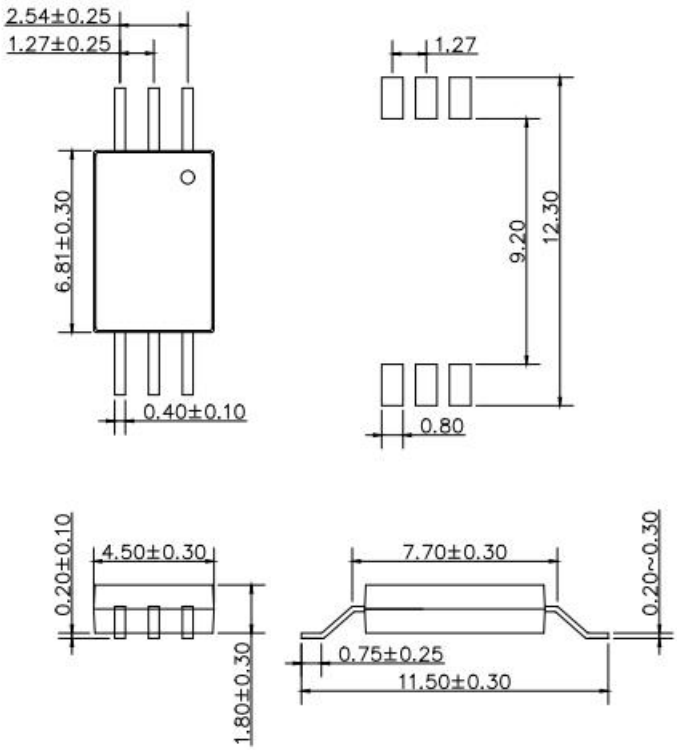
PACKAGE DIMENSIONS (Dimensions in mm unless otherwise stated)

Surface Mount Lead Forming

P type Dimension

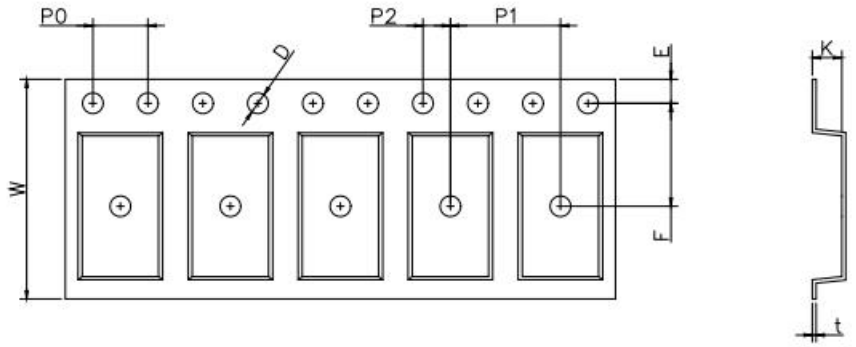


W type Dimension



TAPING DIMENSIONS (Dimensions in mm unless otherwise stated)

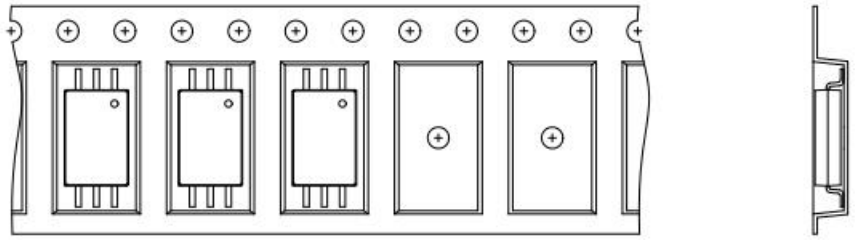
Taping Dimensions



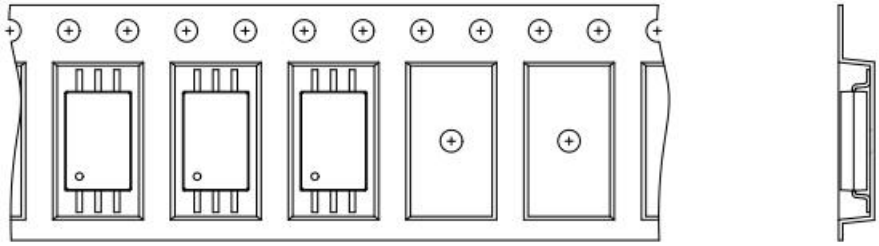
Dimension Symbol	D	E	F	P0	P1	P2	t	W	K
P type Dimension (mm)	1.5±0.1	1.75±0.1	7.5±0.1	4.0±0.1	8.0±0.1	2.0±0.1	0.3±0.1	16.0±0.3	2.15±0.1
W type Dimension (mm)	1.5±0.1	1.75±0.1	11.5±0.1	4.0±0.1	8.0±0.1	2.0±0.1	0.3±0.1	24.0±0.3	2.52±0.1

Tape & Reel Packing Specifications

Option T1



Option T2



ORDERING AND MARKING INFORMATION

MARKING INFORMATION

MP	: Company Abbr.
H	: High performance Photocoupler
5701	: Part Number
P/W	: Lead Form Option
V	: VDE Identification(Option)
Y	: Year date code
H	: Factory identification mark
WW	: 2-digit work week

ORDERING INFORMATION

MPH5701(P/W)-VZ

MP– Company Abbr.

H – High performance Photocoupler

5701 – Part Number

P/W – Lead Form Option(P-9mm Clearance or W-11mm Clearance)

V – VDE Option (V or None)

Z – Tape and Reel Option (T1/T2)

Packing Quantity

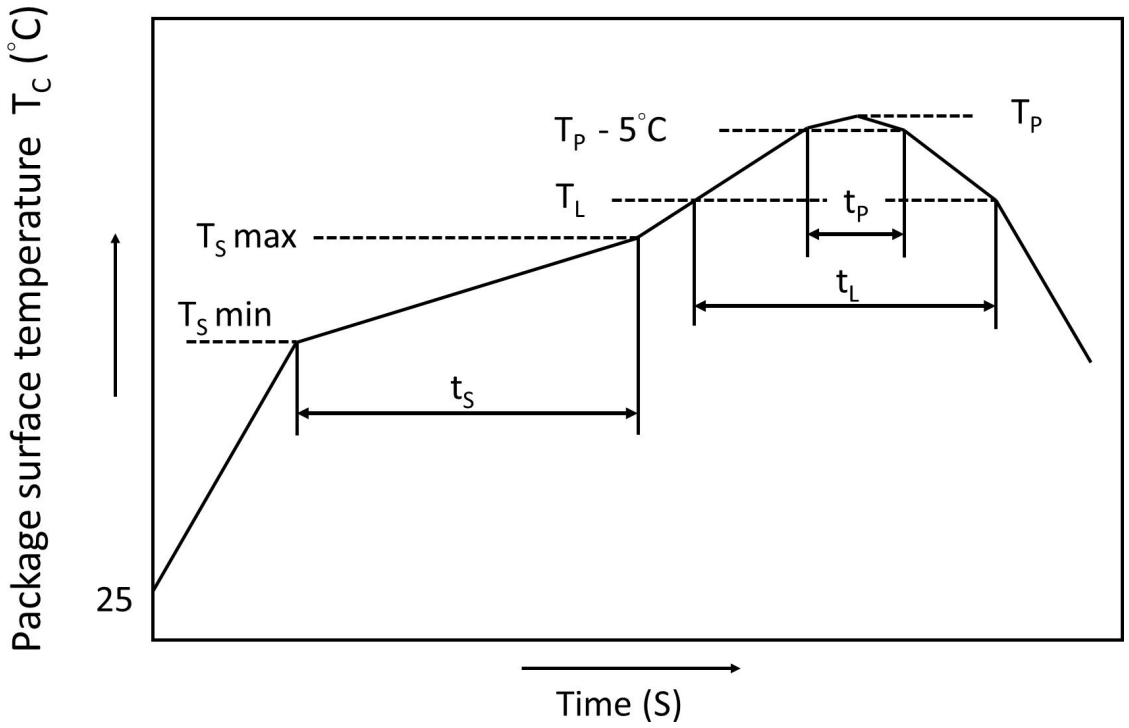
Option	Description	Quantity
P(T1)	Surface Mount Lead Forming – With Option 1 Taping	3000 Units/Reel
P(T2)	Surface Mount Lead Forming – With Option 2 Taping	3000 Units/Reel
W(T1)	Surface Mount Lead Forming – With Option 1 Taping	3000 Units/Reel
W(T2)	Surface Mount Lead Forming – With Option 2 Taping	3000 Units/Reel

REFLOW INFORMATION

REFLOW PROFILE

IR Reflow soldering

One time soldering reflow is recommended within the condition of temperature and time profile shown below. Do not solder more than three times.



	Symbol	Min.	Max.	Unit
Preheat temperature	T_S	150	200	°C
Preheat time	t_S	60	120	s
Ramp-up rate (T_L to T_P)			3	°C/s
Liquidus temperature	T_L	217		°C
Time above T_L	t_L	60	100	s
Peak Temperature	T_P		260	°C
Time during which T_C is between (T_P - 5) and T_P	t_P		20	s
Ramp-down rate			6	°C/s

DISCLAIMER

- Our company is continually improving the quality, reliability, function and design. Our company reserves the right to make changes without further notices.
- The characteristic curves shown in this datasheet are representing typical performance which are not guaranteed.
- This product is not intended to be used for military, aircraft, automotive, medical, life sustaining or lifesaving applications or any other application which can result in human injury or death.
- Immerge unit's body in solder paste is not recommended.
- Discoloration might be occurred on the package surface after soldering, reflow or long-time use. It neither impacts the performance nor reliability.

Revision History

Version	Date	Subjects (major changes since last revision)
1.0	2022-07-22	Datasheet Complete