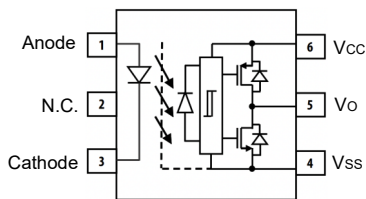


## Low Profile, 1.0 A Output Current Optocoupler Gate Driver

### DESCRIPTION

The SJS-314 series consists of an light emitting diode optically coupled to an integrated circuit with a power output stage. This optocoupler is ideally suited for driving power IGBTs and MOSFETs used in motor control, switching mode power supply and solar inverter applications. The high operating voltage range of the output stage provides the drive voltages required by gate controlled devices. The voltage and current supplied by this optocoupler makes it ideally suited for directly driving high power IGBTs with ratings up to 50A / 1200V. This optocoupler operational parameters are guaranteed over the temperature range from -40°C to +110°C.

### FUNCTIONAL SCHEMATIC



### FEATURES

- 1.0 A maximum peak output current
- Rail-to-rail output voltage
- 110 ns maximum propagation delay
- Under Voltage Lock-Out protection (UVLO)
- Wide operating range from 10 to 30 Volts (Vcc)

### APPLICATIONS

- Isolated IGBT/Power MOSFET gate drive
- Industrial Inverters
- AC brushless and DC motor drives
- Induction Heating
- Switch mode power supplies (SMPS)
- Uninterruptible power supplies (UPS)

### SAFETY SPECIFICATION

- UL 1577
- VDE DIN EN/IEC 60747-5-5
- CQC GB4943.1-2011



Pin #	Name	Description
1	Anode	LED Anode
2	N.C.	N.C.
3	Cathode	LED Cathode
4	Vss	Negative Supply Voltage
5	Vo	Output Voltage
6	Vcc	Positive Supply Voltage

TRUTH TABLE

LED	Vcc-Vss (Turn-ON, +ve going)	Vcc-Vss (Turn-OFF, -ve going)	Vo
Off	0V to 30V	0V to 30V	Low
On	0V to 6.9V	0V to 5.9V	Low
On	6.9V to 8.7V	5.9V to 7.5V	Transition
On	8.7V to 30V	7.5V to 30V	High

■ Note: A 0.1μF bypass capacitor must be connected between Pin 4 and Pin 6

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	MIN.	MAX.	UNIT
Storage Temperature	T <sub>stg</sub>	-55	125	°C
Operating Temperature	T <sub>opr</sub>	-40	110	°C
Output IC Junction Temperature	T <sub>J</sub>	-	125	°C
Total Output Supply Voltage	(V <sub>CC</sub> -V <sub>SS</sub> )	0	35	V
Average Forward Input Current	I <sub>F</sub>	-	20	mA
Reverse Input Voltage	V <sub>R</sub>	-	5	V
"High" Peak Output Current <sup>(1)</sup>	I <sub>OH</sub> (PEAK)	-	1	A
"Low" Peak Output Current <sup>(1)</sup>	I <sub>OL</sub> (PEAK)	-	1	A
Output Voltage	V <sub>O</sub> (PEAK)	-0.5	V <sub>CC</sub>	V
Power Dissipation	P <sub>I</sub>	-	45	mW
Output IC Power Dissipation	P <sub>O</sub>	-	250	mW
Lead Solder Temperature	T <sub>sol</sub>	-	260	°C

■ Ambient temperature at 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 <sub>A</sub>	-40	110	°C
Supply Voltage	V <sub>CC</sub>	10	30	V
Input Current (ON)	I <sub>F</sub> (ON)	7	16	mA
Input Voltage (OFF)	V <sub>F</sub> (OFF)	-3	0.8	V

ELECTRICAL OPTICAL CHARACTERISTICS						
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
INPUT CHARACTERISTICS						
Forward Voltage	$V_F$	1.6	1.9	2.4	V	$I_F = 10\text{mA}$
Temperature Coefficient of Forward Voltage	$\Delta V_F / \Delta T$	-	-1.24	-	mV/°C	$I_F = 10\text{mA}$
Input Reverse Voltage	$BVR$	5	-	-	V	$I_R = 10\mu\text{A}$
Input Threshold Current (Low to High)	$I_{FLH}$	-	0.6	2	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	$C_{IN}$	-	60	-	pF	$V_F = 0, f = 1\text{MHz}$
OUTPUT CHARACTERISTICS						
High Level Supply Current	$I_{CCH}$	-	1.55	3	mA	$I_F = 10\text{mA}, V_{CC} = 30V, V_O = \text{Open}, R_g = 30\Omega, C_g = 3\text{nF}$
Low Level Supply Current	$I_{CCL}$	-	1.92	3	mA	$I_F = 0\text{mA}, V_{CC} = 30V, V_O = \text{Open}, R_g = 30\Omega, C_g = 3\text{nF}$
High Level Output Voltage <sup>(2) (3)</sup>	$V_{OH}$	29.4	29.7	-	V	$I_F = 10\text{mA}, I_O = -100\text{mA}$
Low Level Output Voltage	$V_{OL}$	-	0.17	0.4	V	$I_F = 0\text{mA}, I_O = 100\text{mA}$
High Level Output Current <sup>(1)</sup>	$I_{OH}$	1	-	-	A	$I_F = 10\text{mA}, V_{CC} = 30V, V_O = V_{CC} - 4$
Low Level Output Current <sup>(1)</sup>	$I_{OL}$	1	-	-	A	$I_F = 0\text{mA}, V_{CC} = 30V, V_O = V_{SS} + 4$
Under Voltage Lockout Threshold	$V_{UVLO+}$	6.9	7.8	8.7	V	$V_O > 5V, I_F = 10\text{mA}$
	$V_{UVLO-}$	5.9	6.9	7.5	V	$V_O < 5V, I_F = 10\text{mA}$

- 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  $\mu\text{s}$ .
- 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.

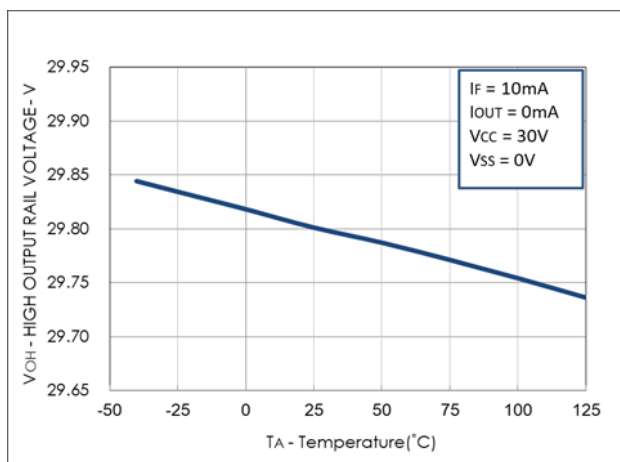
SWITCHING CHARACTERISTICS						
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
Propagation Delay Time to Output Low Level	t <sub>PHL</sub>	-	54	110	ns	R <sub>g</sub> = 30Ω, C <sub>g</sub> = 3nF, f = 10kHz, Duty Cycle = 50%, I <sub>F</sub> = 10mA, V <sub>CC</sub> = 30V
Propagation Delay Time to Output High Level	t <sub>PLH</sub>	-	69	110	ns	
Pulse Width Distortion	PWD	-	22	70	ns	
Propagation Delay Difference Between Any Two Parts	PDD (t <sub>PHL</sub> - t <sub>PLH</sub> )	-100	-	100	ns	
Rise Time	t <sub>r</sub>	-	35	-	ns	
Fall Time	t <sub>f</sub>	-	25	-	ns	
Common Mode Transient Immunity at Logic High <sup>(1)(2)</sup>	CMH	20	40	-	kV/μs	I <sub>F</sub> = 7 to 16mA, V <sub>CC</sub> = 30V, T <sub>A</sub> = 25°C, V <sub>CM</sub> = 1kV
Common Mode Transient Immunity at Logic Low <sup>(1)(3)</sup>	CML	20	40	-	kV/μs	I <sub>F</sub> = 0mA, V <sub>CC</sub> = 30V, T <sub>A</sub> = 25°C, V <sub>CM</sub> = 1kV

- All Typical values at T<sub>A</sub> = 25°C and V<sub>CC</sub> – V<sub>SS</sub> = 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 dV<sub>CM</sub>/dt of the common mode pulse, V<sub>CM</sub> to assure that the output will remain in the high state (meaning V<sub>O</sub> > 10.0V)
- Note (3): Common mode transient immunity in a low state is the maximum tolerable dV<sub>CM</sub>/dt of the common mode pulse, V<sub>CM</sub> to assure that the output will remain in a low state (meaning V<sub>O</sub> < 1.0V)

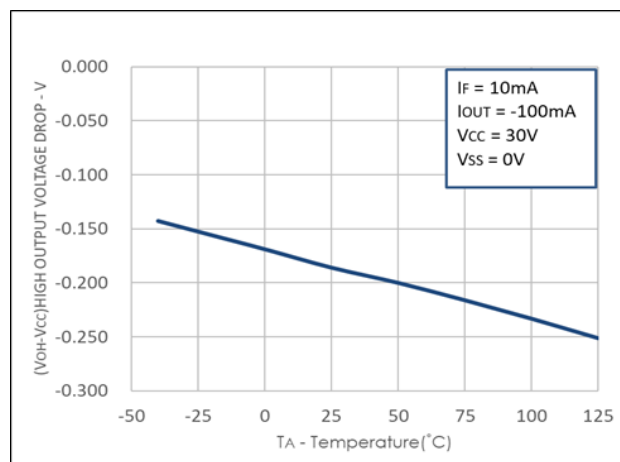
ISOLATION CHARACTERISTIC							
PARAMETER	SYMBOL	DEVICE	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
Withstand Insulation Test Voltage <sup>(1)(2)</sup>	V <sub>ISO</sub>	SJS-314P	5000	-	-	V	RH ≤ 40%-60%, t = 1min, T <sub>A</sub> = 25°C
		SJS-314W					
Input-Output Resistance <sup>(1)</sup>	R <sub>I-O</sub>	-	-	10 <sup>12</sup>	-	Ω	V <sub>I-O</sub> = 500V DC

- All Typical values at T<sub>A</sub> = 25°C and V<sub>CC</sub> – V<sub>SS</sub> = 30 V, unless otherwise specified; all minimum and maximum specifications are at recommended operating condition.
- Note (1): Device is considered at two terminal device: pins 1, 2, 3 are shorted together and pins 4, 5, 6 are shorted together.
- Note (2): According to UL 1577, each photocoupler is tested by applying an insulation test voltage 6000V<sub>RMS</sub> for one second. This test is performed before the 100% production test for partial discharge.

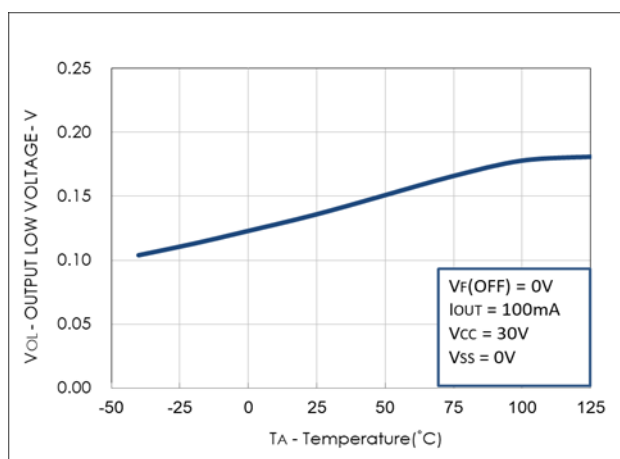
## TYPICAL PERFORMANCE CURVES & TEST CIRCUITS



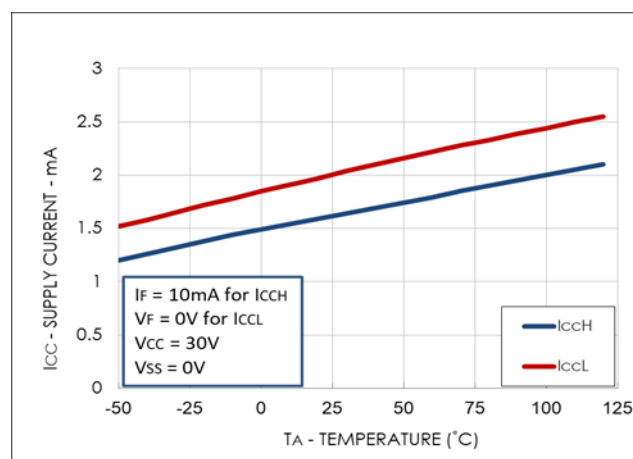
**Fig.1 High output rail voltage vs. Temperature**



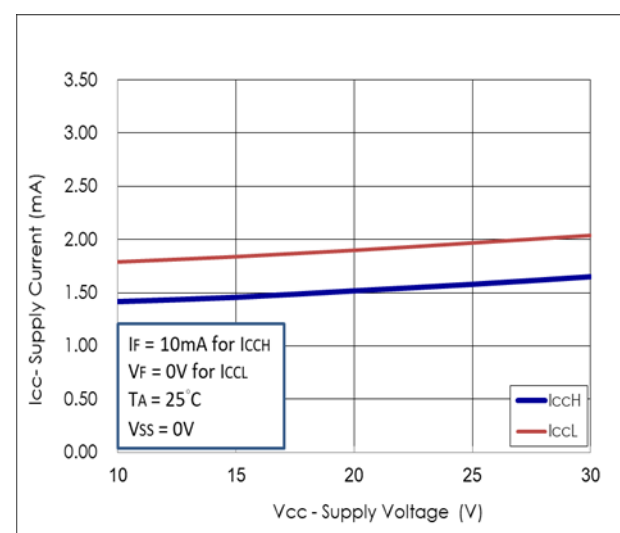
**Fig.2 V<sub>OH</sub> vs. Temperature**



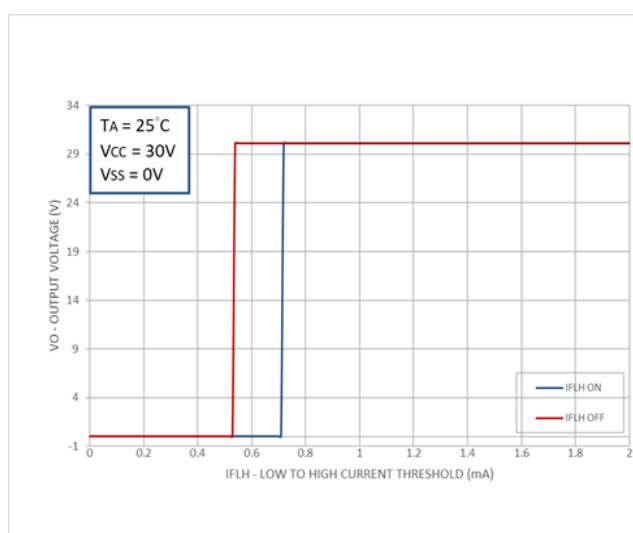
**Fig.3 V<sub>OL</sub> vs. Temperature**



**Fig.4 I<sub>CC</sub> vs. Temperature**



**Fig.5 I<sub>CC</sub> vs. V<sub>CC</sub>**



**Fig.6 I<sub>FLH</sub> vs. Hysteresis**

TYPICAL PERFORMANCE CURVES & TEST CIRCUITS

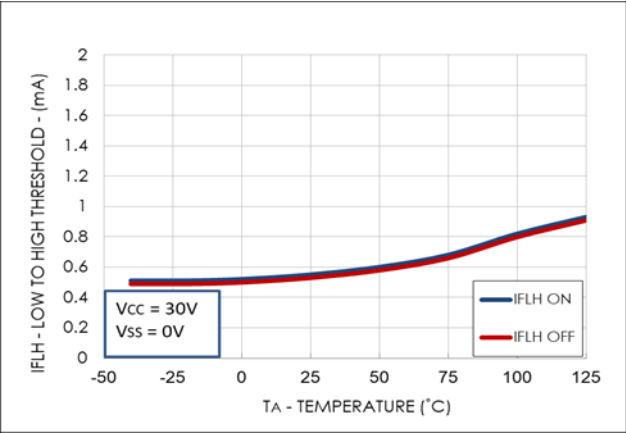


Fig.7 IFLH vs. Temperature

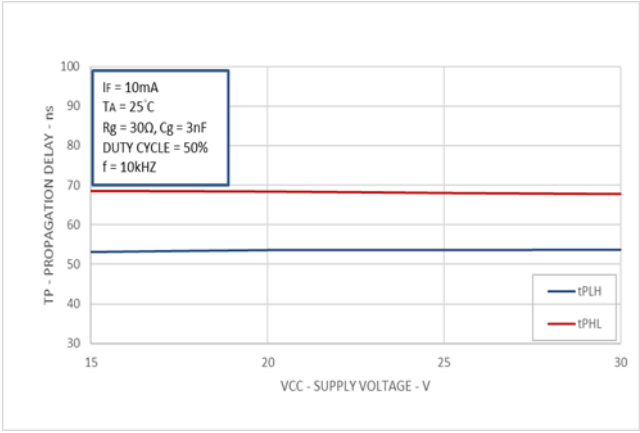


Fig.8 Propagation Delays vs. Vcc

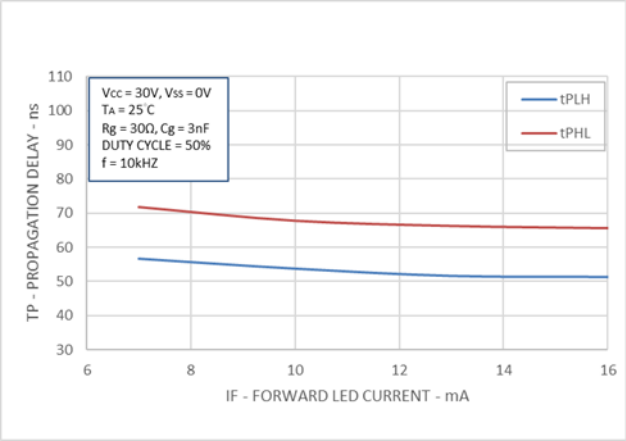


Fig.9 Propagation Delays vs. If

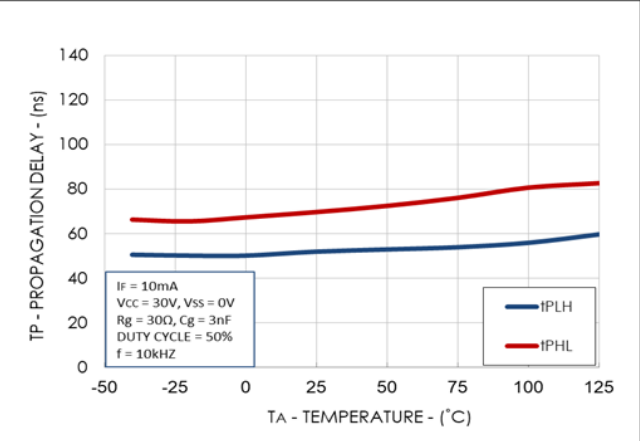


Fig.10 Propagation Delays vs. Temperature

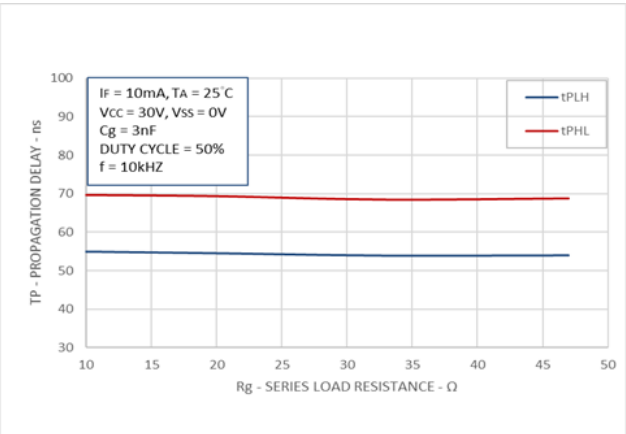


Fig.11 Propagation Delays vs. Rg

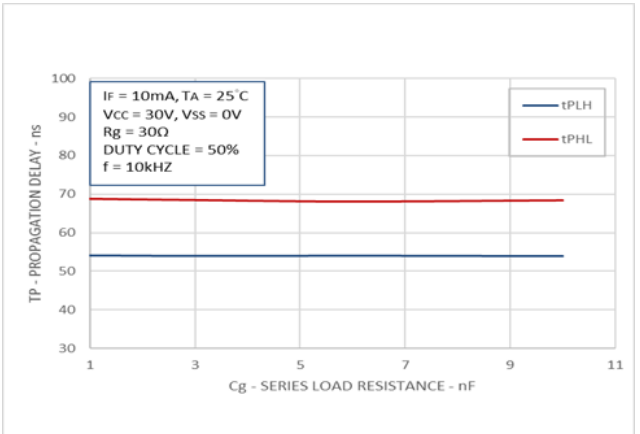


Fig.12 Propagation Delays vs. Cg

TYPICAL PERFORMANCE CURVES & TEST CIRCUITS

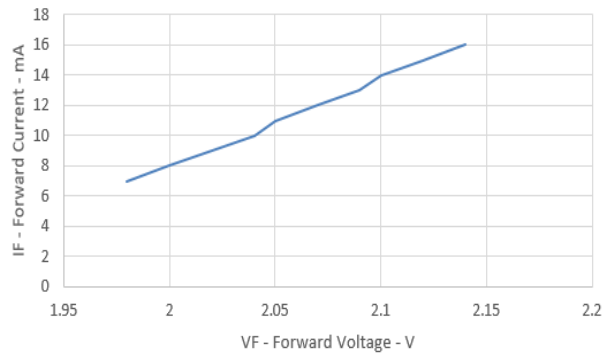


Fig.13 Input Current vs. Forward Voltage

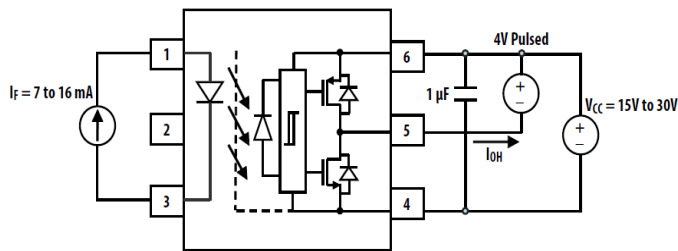


Fig.14  $I_{OH}$  Test Circuit

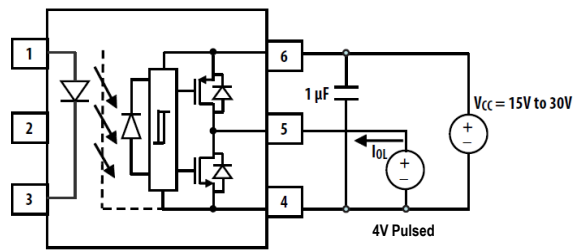


Fig.15  $I_{OL}$  Test Circuit

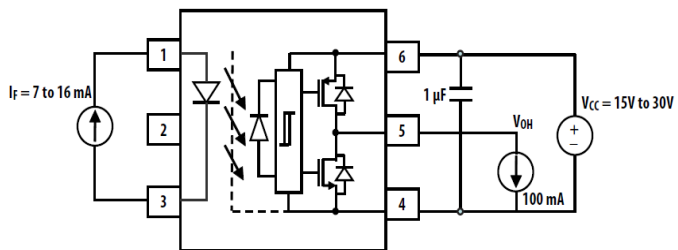


Fig.16  $V_{OH}$  Test Circuit

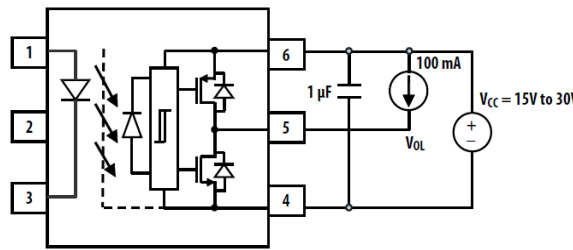


Fig.17  $V_{OL}$  Test Circuit

TYPICAL PERFORMANCE CURVES & TEST CIRCUITS

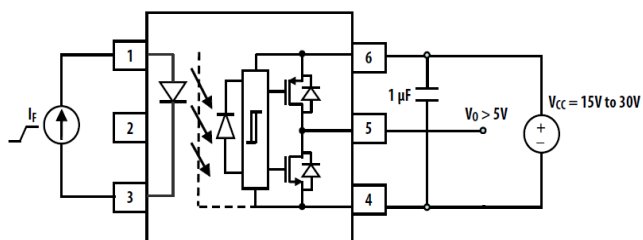


Fig.18 IFLH Test Circuit

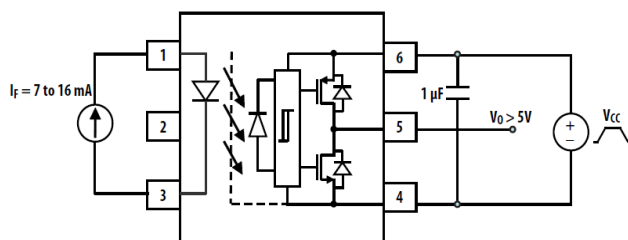


Fig.19 UVLO Test Circuit

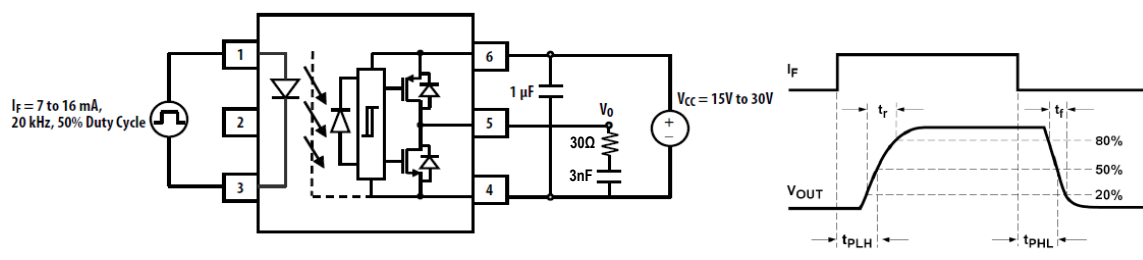


Fig.20 tPHL, tPLH, tr and tf Test Circuit and Waveforms

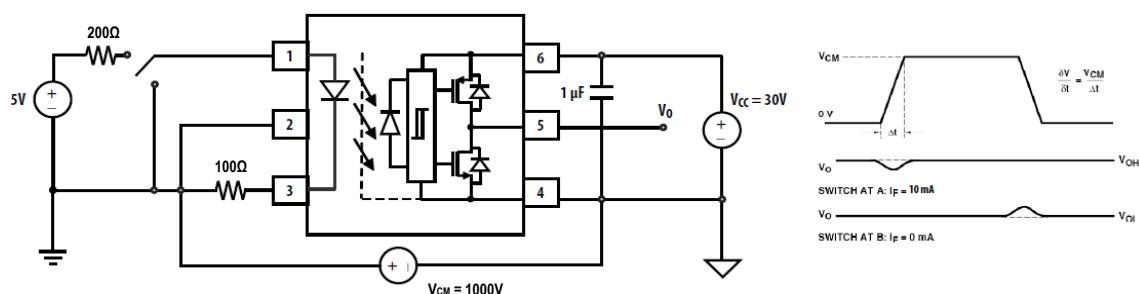
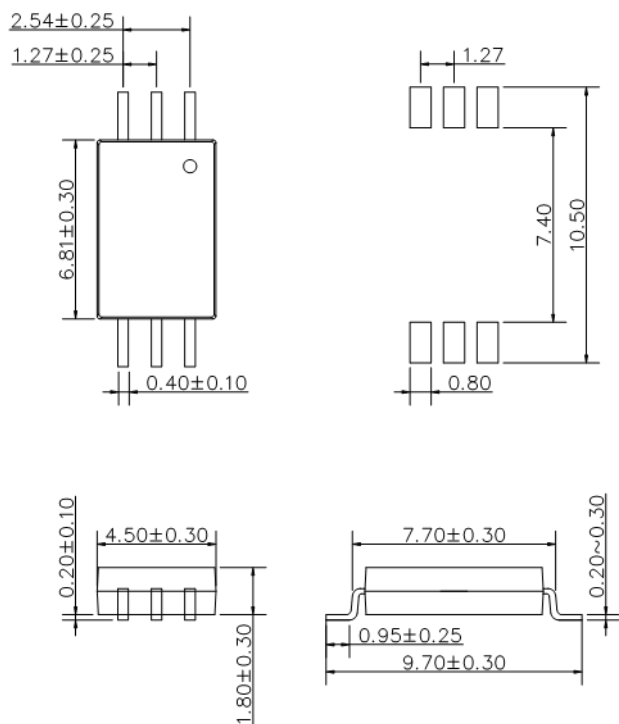


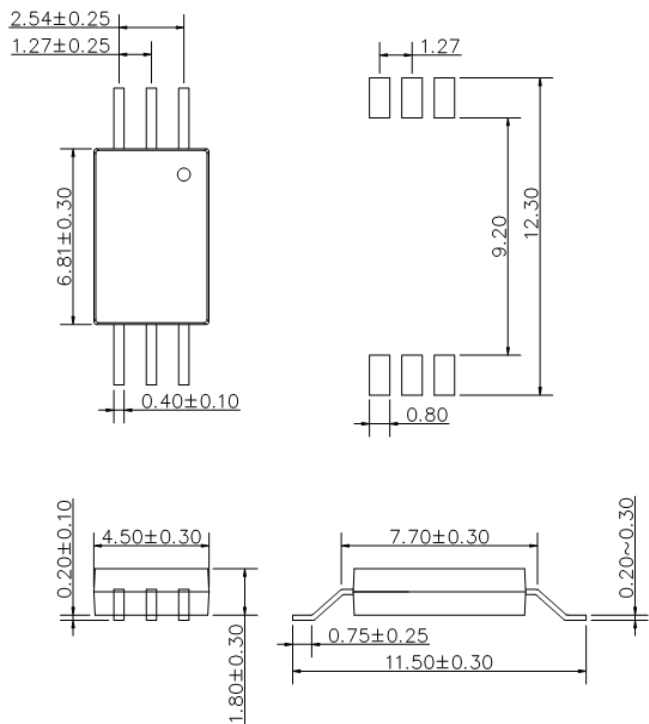
Fig.21 CMR Test Circuit with Split Resistors Network and Waveforms



PACKAGE DIMENSIONS (Dimensions in mm unless otherwise stated)

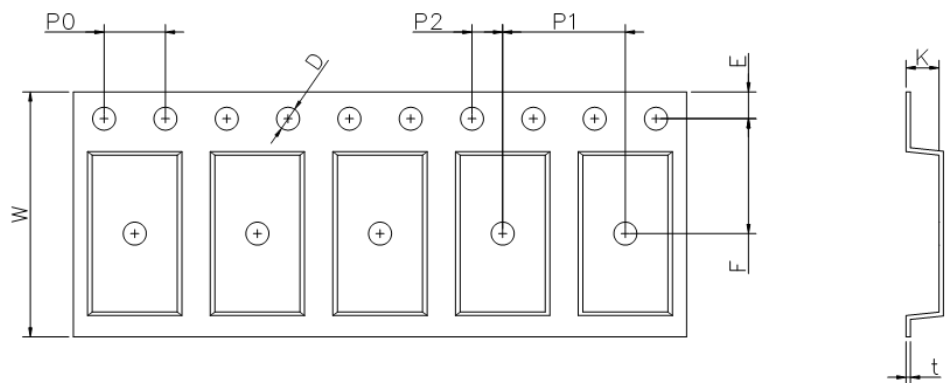


P type Dimension



W type Dimension

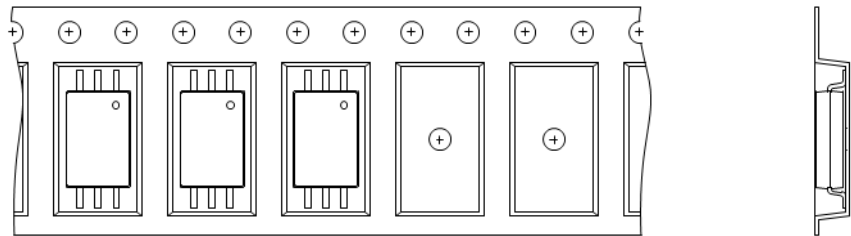
TAPING DIMENSIONS (Dimensions in mm unless otherwise stated)



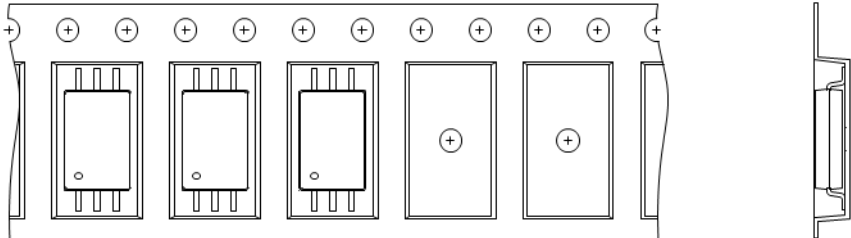
Symbol	D	E	F	P0	P1	P2	t	W	K
Dimension (mm)	1.5 ±0.1	1.75 ±0.1	7.5 ±0.1	4.0 ±0.1	8.0 ±0.1	2.0 ±0.1	0.3 ±0.1	16.0 ±0.3	2.15 ±0.1

TAPE & REEL PACKING SPECIFICATIONS

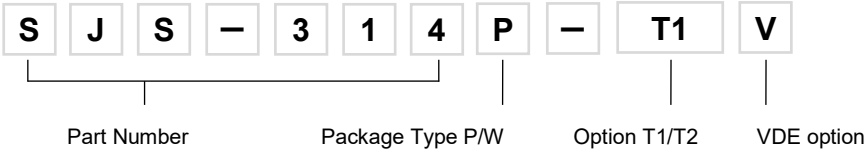
Option T1



Option T2

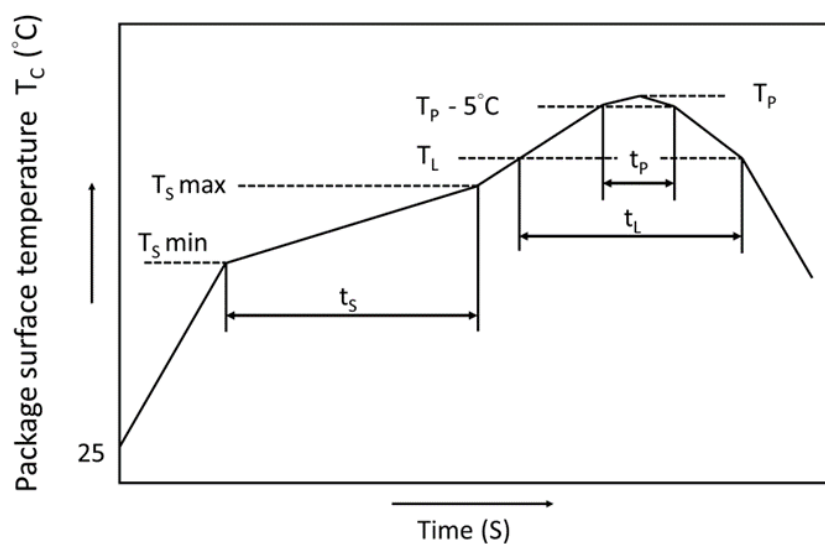


ORDERING AND MARKING INFORMATION



Marking Symbol	Description
SJS	Part Number
314	
P	Package Type Option ( P or W )
YY	Year Date Code
WW	Two Digit Work Week
V	VDE Option ( V or None )

## PRECAUTIONS FOR 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.

DESCRIPTION	SYMBOL	MIN.	MAX.	UNIT
Preheat temperature	$T_s$	150	200	$^\circ\text{C}$
Preheat time	$t_s$	60	120	s
Ramp-up rate ( $T_L$ to $T_P$ )			3	$^\circ\text{C/s}$
Liquidus temperature	$T_L$	217		$^\circ\text{C}$
Time above $T_L$	$t_L$	60	100	s
Peak Temperature	$T_P$		260	$^\circ\text{C}$
Time during which $T_c$ is between ( $T_P - 5$ ) and $T_P$	$t_P$		20	s
Ramp-down rate			6	$^\circ\text{C/s}$

**DISCLAIMER**

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- This product is not intended to be used for military, aircraft, medical, life sustaining or lifesaving applications or any other application which can result in human injury or death.
- Please contact our company or sales agent for special application request.
- Immerge unit's body in solder paste is not recommended.
- Parameters provided in datasheets may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated in each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify our company's terms and conditions of purchase, including but not limited to the warranty expressed therein.
- Discoloration might be occurred on the package surface after soldering, reflow or long-time use. It neither impacts the performance nor reliability.