Low Profile, 4.0 A Output Current Optocoupler Gate Driver

DESCRIPTION

The SJS-343 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 most IGBTs with ratings up to 200A / 1200V. This optocoupler operational parameters are guaranteed over the temperature range from -40°C to +110°C.

FEATURESES

- 4.0 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)

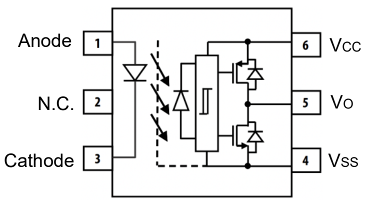
APPLICATIONS

- 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

FUNCTIONAL SCHEMATIC



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	V_{CC}-V_{SS} (Turn-ON, +ve going)	V_{CC}-V_{SS} (Turn-OFF, -ve going)	V_O
Off	0V to 30V	0V to 30V	Low
On	0V to 11V	0V to 9.5V	Low
On	11V to 13.5V	9.5V to 12V	Transition
On	13.5V to 30V	12V 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_{stg}	-55	125	°C
Operating Temperature	T_{opr}	-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 (1)	$I_{OH(PEAK)}$	-	4	A
"Low" Peak Output Current (1)	$I_{OL(PEAK)}$	-	4	A
Output Voltage	$V_{O(PEAK)}$	-0.5	V_{CC}	V
Power Dissipation	P_I	-	45	mW
Output IC Power Dissipation	P_O	-	700	mW
Lead Solder Temperature	T_{sol}	-	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_A	-40	110	°C
Supply Voltage	V_{CC}	15	30	V
Input Current (ON)	$I_{F(ON)}$	7	16	mA
Input Voltage (OFF)	$V_{F(OFF)}$	-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=10mA
Temperature Coefficient of Forward Voltage	$\Delta V_F/\Delta T$	-	-1.24	-	mV/°C	I_F=10mA
Input Reverse Voltage	B_{VR}	5	-	-	V	I_R=10μA
Input Threshold Current (Low to High)	I_{FLH}	-	0.9	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 = 1MHz
OUTPUT CHARACTERISTICS						
High Level Supply Current	I_{CCH}	-	1.70	3	mA	I_F= 10mA, V_{CC}= 30V, V_O= Open, Rg= 10Ω, Cg= 6nF
Low Level Supply Current	I_{CCL}	-	2.11	3	mA	I_F= 0 mA, V_{CC}= 30V, V_O= Open, Rg= 10Ω, Cg= 6nF
High Level Output Voltage (2) (3)	V_{OH}	29.7	29.9	-	V	I_F= 10mA, I_O= -100mA
Low Level Output Voltage	V_{OL}	-	0.1	0.3	V	I_F= 0mA, I_O= 100mA
High Level Output Current (1)	I_{OH}	4	-	-	A	I_F= 10mA, V_{CC}= 30V, V_O= V_{CC} - 15
Low Level Output Current (1)	I_{OL}	4	-	-	A	I_F= 0mA, V_{CC}= 30V, V_O= V_{SS} + 15
Under Voltage Lockout Threshold	V_{UVLO+}	11.0	12.6	13.5	V	V_O > 5V, I_F= 10mA
	V_{UVLO-}	9.5	11.2	12.0	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 CHARACTERISTICS						
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
Propagation Delay Time to Output Low Level	t_{PHL}	-	61.3	110	ns	Rg = 10Ω, Cg = 25nF, f = 10kHz, Duty Cycle = 50%, I_F = 10mA, V_{CC} = 30V
Propagation Delay Time to Output High Level	t_{PLH}	-	74.5	110	ns	
Pulse Width Distortion	PWD	-	22	70	ns	
Propagation Delay Difference Between Any Two Parts	PDD (t_{PHL} - t_{PLH})	-100	-	100	ns	
Rise Time (20 to 80%)	t_r	-	20	-	ns	
Fall Time (20 to 80%)	t_f	-	15	-	ns	
Common Mode Transient Immunity at Logic High (1) (2)	$\|CM_H\|$	20	40	-	kV/μs	I_F = 7 to 16mA, V_{CC} = 30V, T_A = 25°C, V_{CM} = 1kV
Common Mode Transient Immunity at Logic Low (1) (3)	$\|CM_L\|$	20	40	-	kV/μs	I_F = 0mA, V_{CC} = 30V, T_A= 25°C, V_{CM} = 1kV

- 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 > 15.0V)
- 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	DEVICE	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
Withstand Insulation Test Voltage (1) (2)	V_{ISO}	SJS-343P SJS-343W	5000	-	-	V	RH ≦ 40%-60%, t = 1min, T_A = 25°C
Input-Output Resistance (1)	R_{I-O}	-	-	10^{12}	-	Ω	V_{I-O} = 500V DC

- 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 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_{RMS} for one second. This test is performed before the 100% production test for partial discharge.

TYPICAL PERFORMANCE CURVES & TEST CIRCUITS

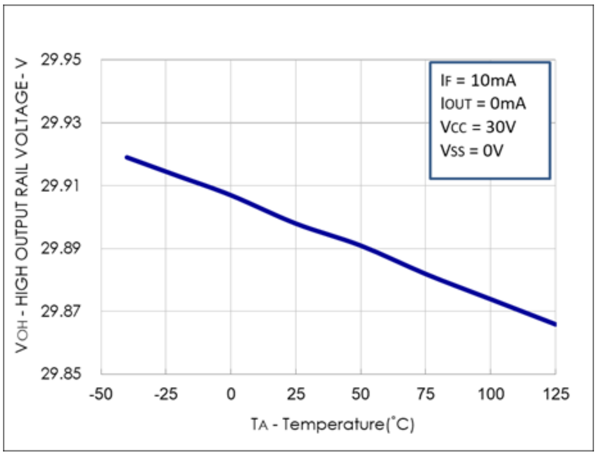


Fig.1 High output rail voltage vs. Temperature

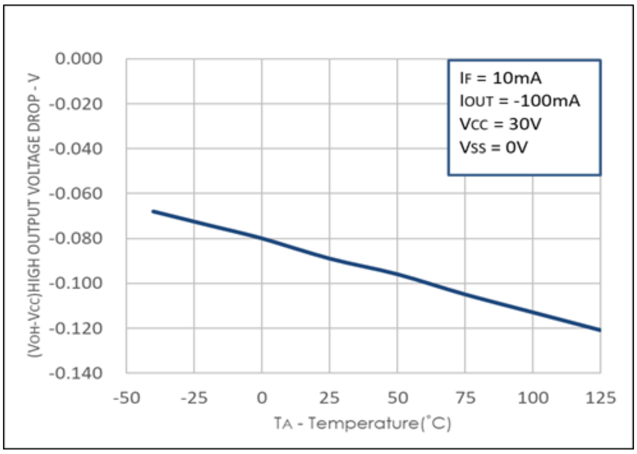


Fig.2 V_{OH} vs. Temperature

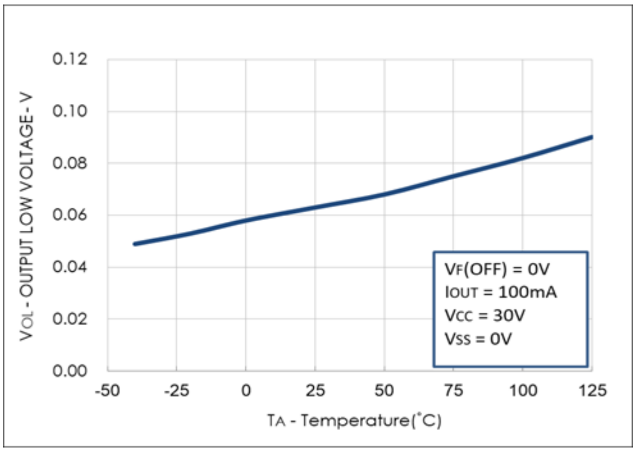


Fig.3 V_{OL} vs. Temperature

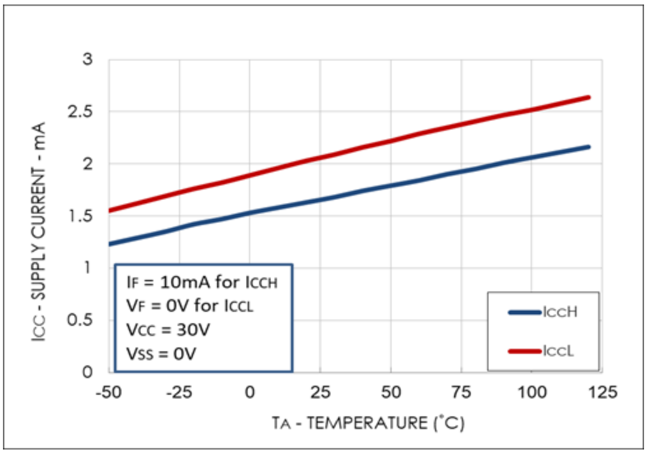


Fig.4 I_{CC} vs. Temperature

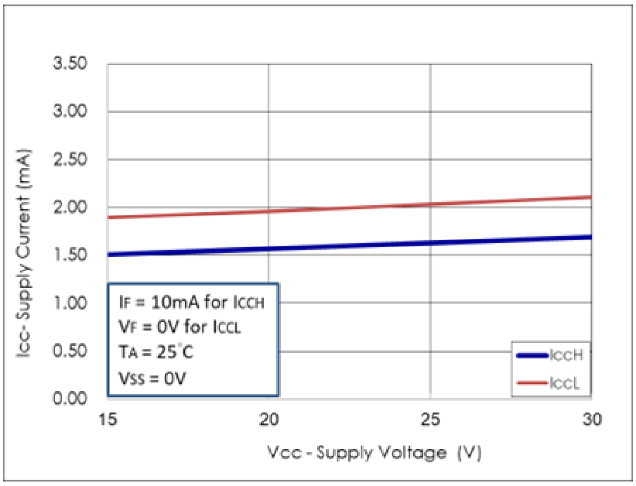


Fig.5 I_{CC} vs. V_{CC}

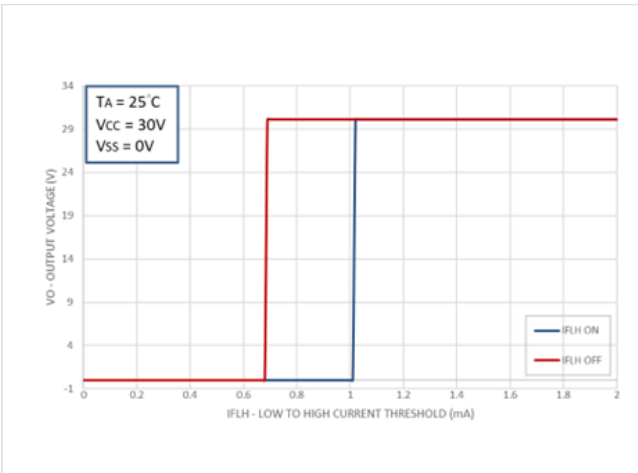


Fig.6 I_{FLH} vs. Hysteresis

TYPICAL PERFORMANCE CURVES & TEST CIRCUITS

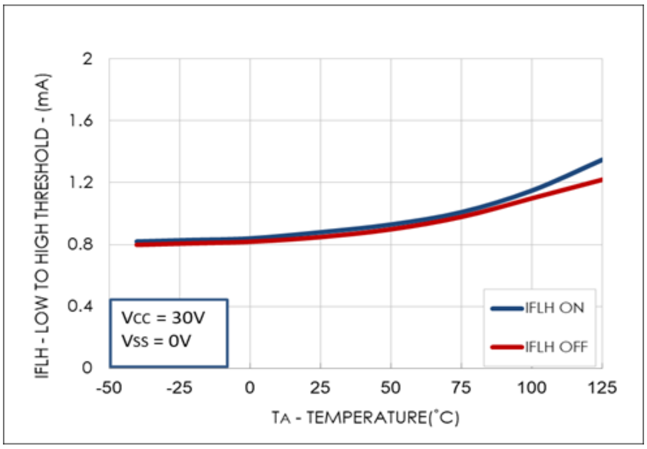


Fig.7 IFH vs. Temperature

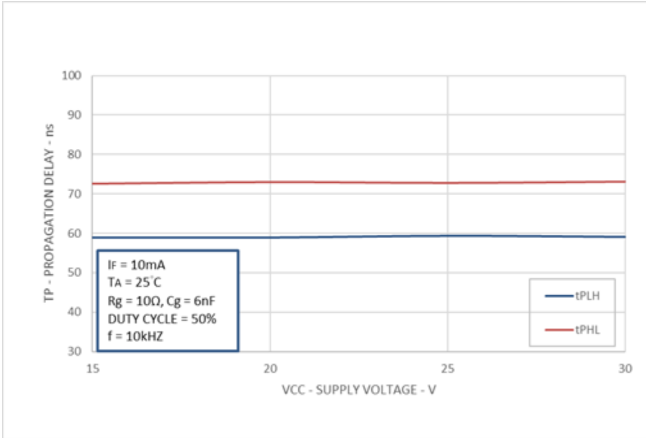


Fig.8 Propagation Delays vs. Vcc

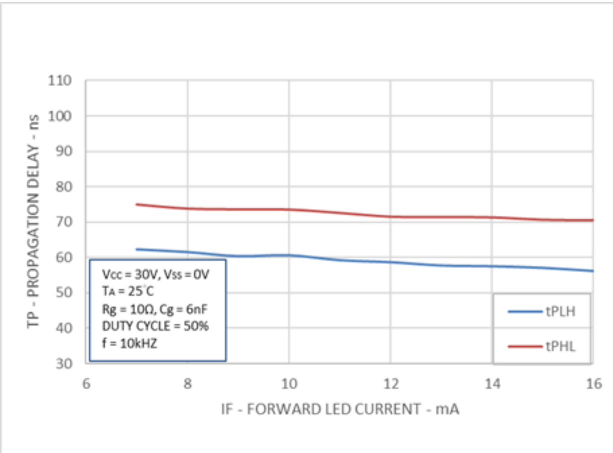


Fig.9 Propagation Delays vs. IF

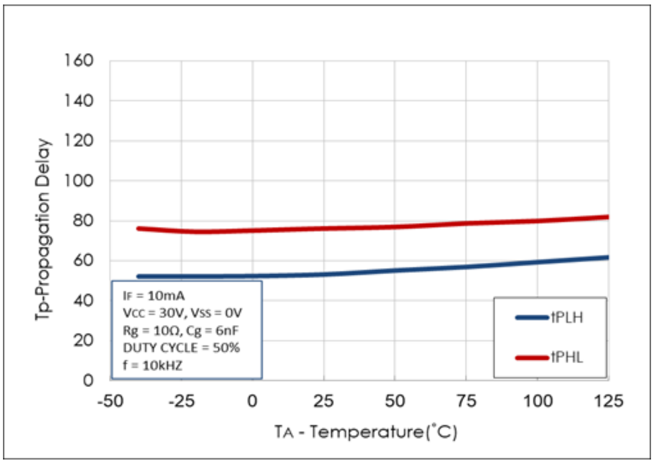


Fig.10 Propagation Delays vs. Temperature

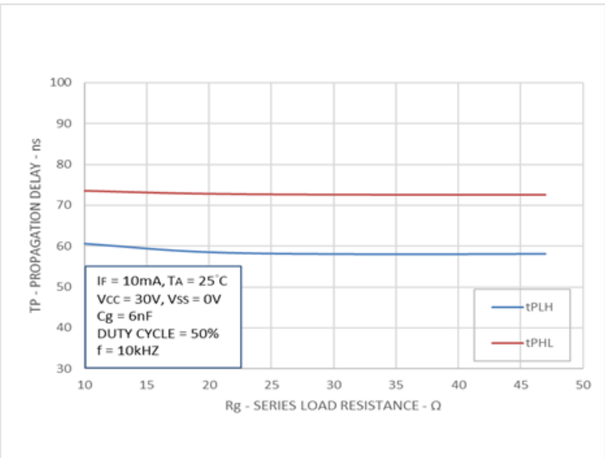


Fig.11 Propagation Delays vs. Rg

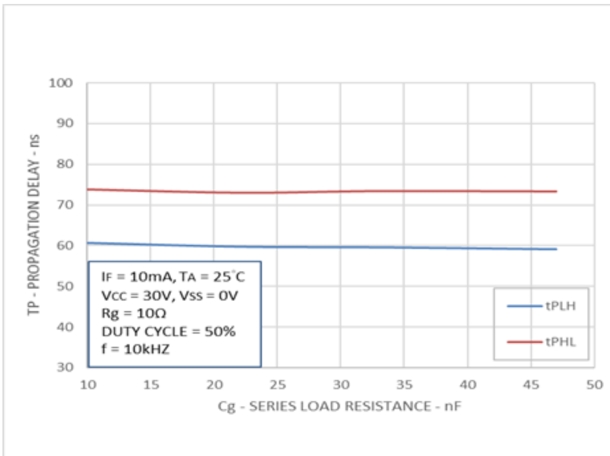


Fig.12 Propagation Delays vs. Cg

TYPICAL PERFORMANCE CURVES & TEST CIRCUITS

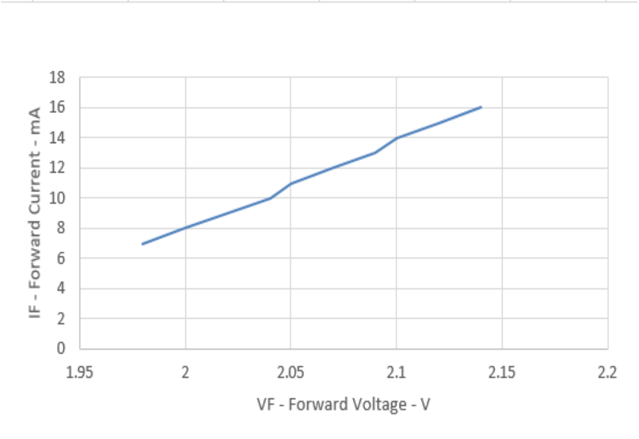


Fig.13 Input Current vs. Forward Voltage

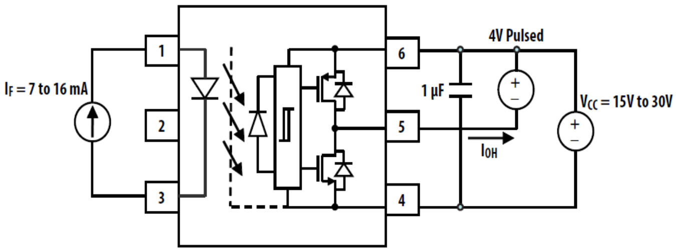


Fig.14 IOH Test Circuit

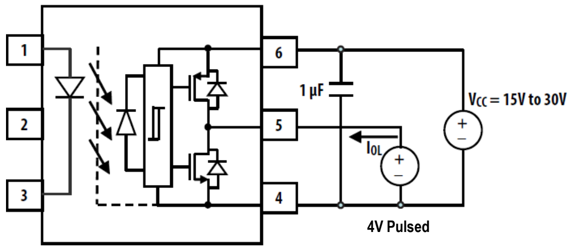


Fig.15 IOL Test Circuit

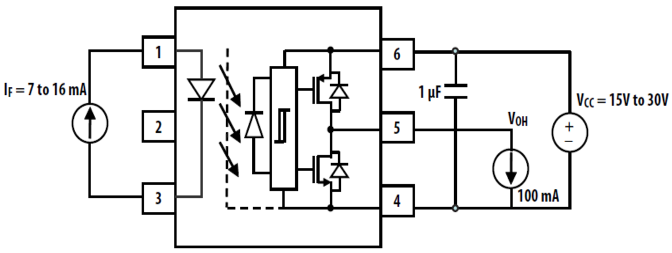


Fig.16 VOH Test Circuit

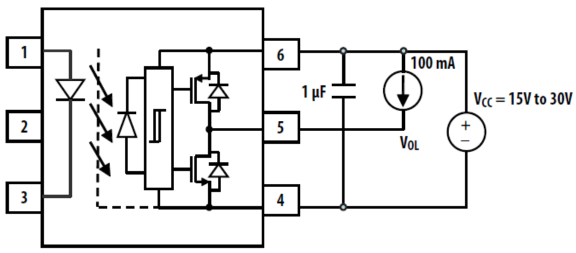


Fig.17 VOL Test Circuit

TYPICAL PERFORMANCE CURVES & TEST CIRCUITS

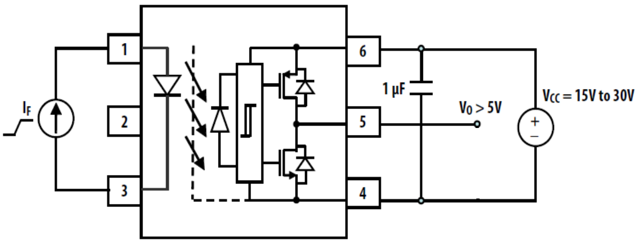


Fig.18 I_{FLH} Test Circuit

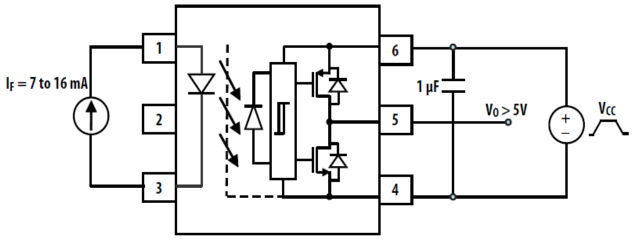


Fig.19 UVLO Test Circuit

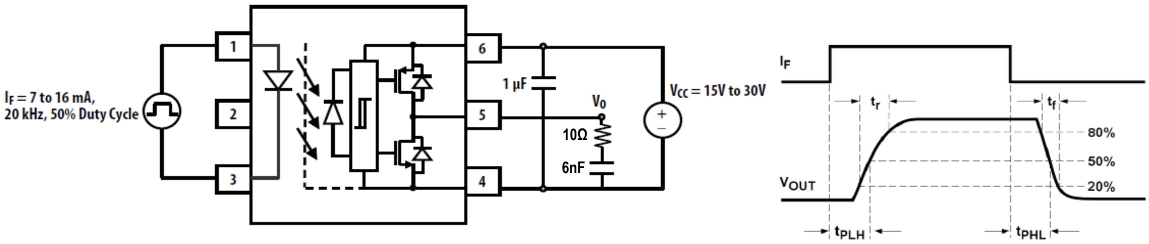


Fig.20 t_{PHL}, t_{PLH}, t_r and t_f Test Circuit and Waveforms

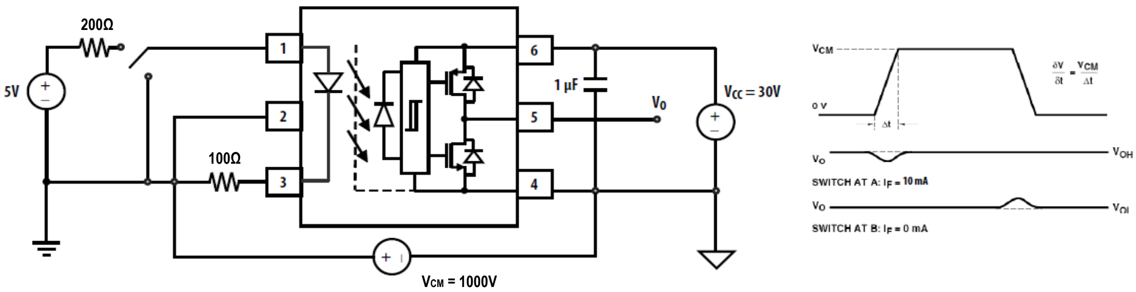
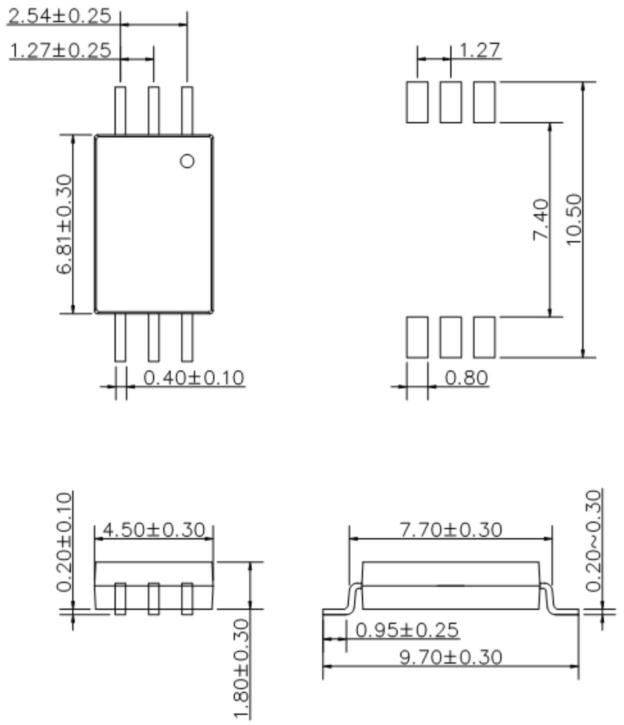
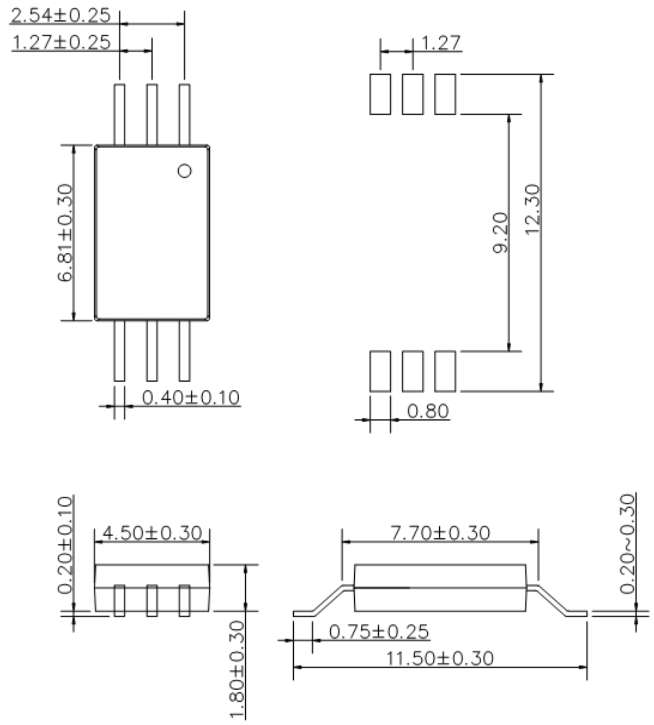


Fig.21 CMR Test Circuit with Split Resistors Network and Waveforms

PACKAGE DIMENSIONS (Dimensions in mm unless otherwise stated)

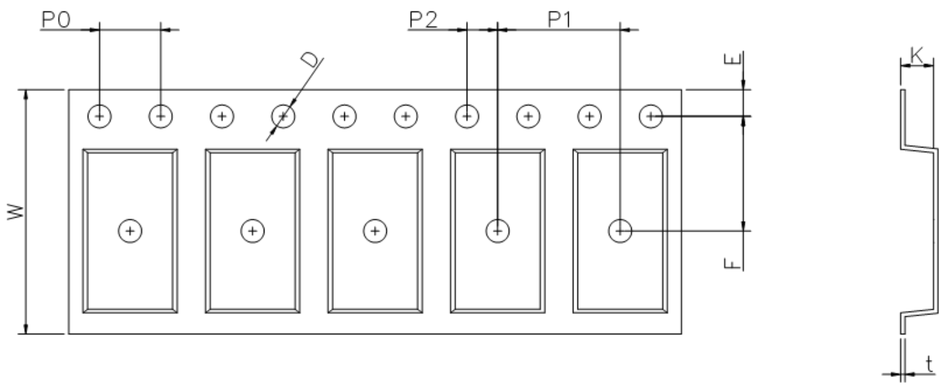


P type Dimension



W type Dimension

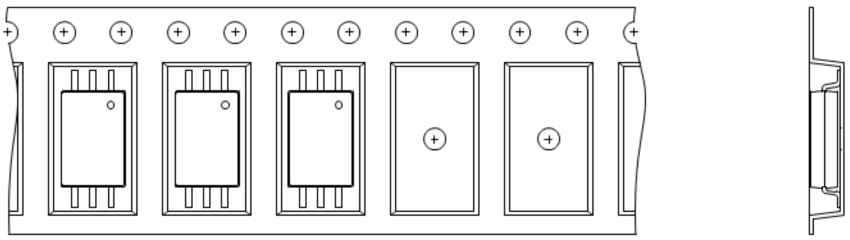
TAPING DIMENSIONS (Dimensions in mm unless otherwise stated)



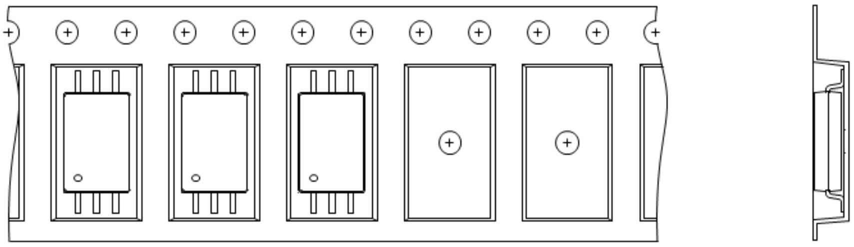
Symbol	D	E	F	P0	P1	P2	t	W	K
Dimension (mm)	1.5 ±0.1	1.75 ±0.1	7.5 ±0.1	4.0 ±0.1	8.0 ±0.1	2.0 ±0.1	0.3 ±0.1	16.0 ±0.3	2.15 ±0.1

TAPE & REEL PACKING SPECIFICATIONS

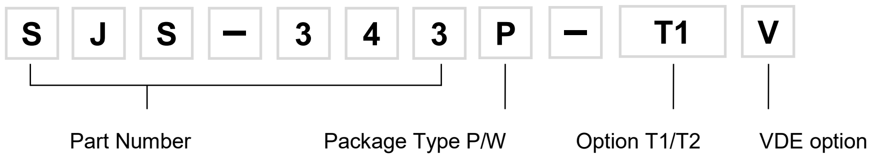
Option T1



Option T2

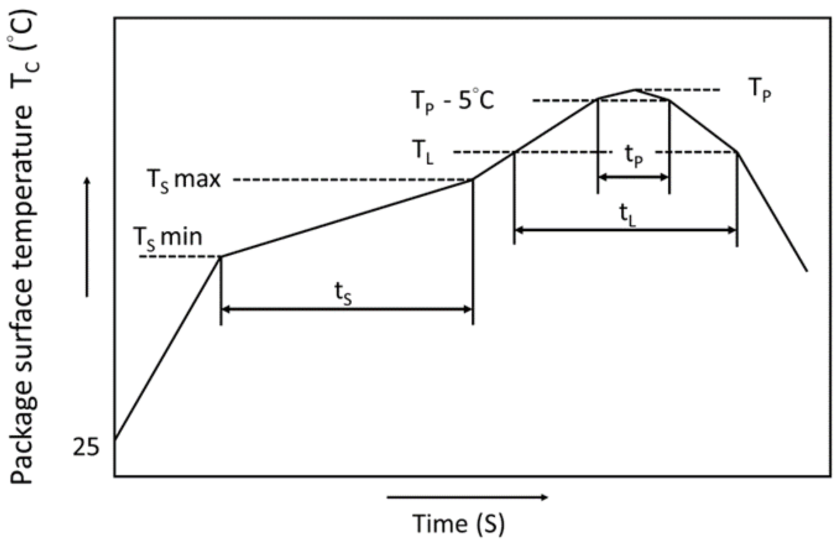


ORDERING AND MARKING INFORMATION



Marking Symbol	Description
SJS	Part Number
343	
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	°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.
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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.