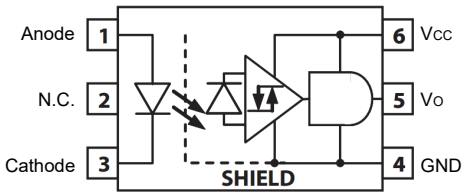
Low Profile, IPM Gate Drive Interface Optocoupler

DESCRIPTION

The SJS-480 series fast speed optocoupler contains a LED and photo detector with built-in Schmitt trigger to provide logic-compatible waveforms, eliminating the need for additional wave shaping. The totem pole output eliminates the need for a pull up resistor and allows for direct drive Intelligent Power Module or gate drive. Minimized propagation delay difference between devices makes these optocouplers excellent solutions for improving inverter efficiency through reduced switching dead time. This optocoupler operational parameters are guaranteed over the temperature range from -40°C to +110°C.

FUNCTIONAL SCHEMATIC



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

FEATURESES

- Positive output type (totem pole output)
- Truth Table Guaranteed: Vcc from 4.5V to 30V
- Performance Specified for Common IPM Applications Over Industrial Temperature Range.
- Short Maximum Propagation Delays
- Minimized Pulse Width Distortion (PWD)
- Very High Common Mode Rejection (CMR)
- Hysteresis

APPLICATIONS

- IPM Interface Isolation
- Isolated IGBT/MOSFET gate drive
- AC and brushless DC motor drives
- Industrial Inverters
- General digital Isolation

SAFETY SPECIFICATION

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

TRUTH TABLE	
LED	OUT
On	H
Off	L

■ 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
Average Forward Input Current	I_F	-	20	mA
Reverse Input Voltage	V_R	-	5	V
Output Collector Current	I_O	-	50	mA
Supply Voltage	V_{CC}	0	35	V
Output Collector Voltage	V_O	-0.5	V_{CC}	V
Total Package Power Dissipation	P_T	-	145	mW
Lead Solder Temperature	T_{sol}	-	260	°C

■ Note: A ceramic capacitor (0.1μF) should be connected between pin 6 and pin 4 to stabilize the operation of a high gain linear amplifier. Otherwise, this optocoupler may not switch properly. The bypass capacitor should be placed within 10mm of each pin.

RECOMMENDED OPERATION CONDITIONS				
PARAMETER	SYMBOL	MIN.	MAX.	UNIT
Operating Temperature	T_A	-40	110	°C
Supply Voltage (1)	V_{CC}	4.5	30	V
Input Current (ON) (2)	$I_{F(ON)}$	1.6	5	mA
Input Voltage (OFF)	$V_{F(OFF)}$		0.8	V

■ Note (1): Detector requires a V_{CC} of 4.5V or higher for stable operation as output might be unstable if V_{CC} is lower than 4.5V. Be sure to check the power ON/OFF operation other than the supply current.
■ Note (2): The initial switching threshold is 1.6mA or less. It is recommended that 2.2mA be used to permit at least a 20% LED degradation guard band.

ELECTRICAL OPTICAL CHARACTERISTICS						
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
INPUT CHARACTERISTICS						
Input Forward Voltage	V_F	1.6	2.0	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}	-	0.2	1.5	mA	V_{CC} = 30V, V_O > 5V
Input Threshold Voltage (High to Low)	V_{FHL}	0.8	-	-	V	V_{CC} = 30V, V_O < 5V
Input Capacitance (2)	C_{IN}	-	60	-	pF	V_F = 0, f = 1MHz
OUTPUT CHARACTERISTICS						
High Level Supply Current	I_{CCH}	-	-	3	mA	V_{CC} = 5.5V, I_F = 5mA, I_O = 0 mA
			1.9	3		V_{CC} = 30V, I_F = 5mA, I_O = 0 mA
Low Level Supply Current	I_{CCL}	-	-	3	mA	V_{CC} = 5.5V, V_F = 0 V, I_O = 0 mA
			2	3		V_{CC} = 30V, V_F = 0 V, I_O = 0 mA
High Level Output Current (1)	I_{OH}	-	-	-160	mA	V_{CC} = 5.5V, I_F = 5mA, V_O = GND
		-	-	-200		V_{CC} = 20V, I_F = 5mA, V_O = GND
Low Level Output Current (1)	I_{OL}	160	-	-	mA	V_O = V_{CC} = 5.5V, V_F = 0 V
		200	-	-		V_O = V_{CC} = 20V, V_F = 0 V
High Level Output Voltage	V_{OH}	V_{CC} - 0.5	V_{CC} - 0.04	-	V	I_{OL} = -6.5mA
Low Level Output Voltage	V_{OL}	-	0.09	0.5	V	I_{OL} = 6.5mA

- Specified over recommended temperature (T_A = -40°C to +110°C, +4.5V ≤ V_{CC} ≤ 30V), I_F(ON) = 1.6mA to 5mA, V_F(OFF) = 0 V to 0.8V, unless otherwise specified. All typical values at T_A = 25°C.
- Note (1): Duration of output short circuit time should not exceed 500μs.
- Note (2): Input capacitance is measured between pin 1 and pin 3.

SWITCHING CHARACTERISTICS						
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
Propagation Delay Time to Output Low Level (1)	t_{PHL}	-	110	220	ns	f = 10kHz, Duty Cycle = 50%, I_F = 2mA, V_{CC} = 30V
Propagation Delay Time to Output High Level (1)	t_{PLH}	-	90	220		
Pulse Width Distortion (2)	PWD	-	20	120		
Propagation Delay Difference Between Any Two Parts (3)	PDD (t_{PHL} - t_{PLH})	-200	-	200		
Rise Time	t_r	-	6	-		
Fall Time	t_f	-	7	-		
Common Mode Transient Immunity at Logic High (4)	$\|CM_H\|$	20	-	-	kV/μs	I_F= 4 mA, V_{CC}= 5V, T_A= 25°C, V_{CM}= 1.5kV
Common Mode Transient Immunity at Logic Low (4)	$\|CM_L\|$	20	-	-	kV/μs	I_F= 0 mA, V_{CC}= 5V, T_A= 25°C, V_{CM}= 1.5kV

- Over recommended operating conditions T_A = -40°C to 110°C, V_{CC} = +4.5V to 30V, I_F(ON) = 1.6mA to 5mA, V_F(OFF) = 0 V to 0.8V, unless otherwise specified. All typical values at T_A = 25°C.
- Note (1): The t_{PLH} propagation delay is measured from the 50% point on the leading edge of the input pulse to the 1.3V point on the leading edge of the output pulse. The t_{PHL} propagation delay is measured from the 50% point on the trailing edge of the input pulse to the 1.3V point on the trailing edge of the output pulse.
- Note (2): Pulse Width Distortion (PWD) is defined as | t_{PHL} - t_{PLH} | for any given device.
- Note (3): The difference of t_{PLH} and t_{PHL} between any two devices under the same test condition.
- Note (4): CM_H is the maximum slew rate of the common mode voltage that can be sustained with the output voltage in the logic high state, V_O > 2.0V. CM_L is the maximum slew rate of the common mode voltage that can be sustained with the output voltage in the logic low state, V_O < 0.8V.
- Note: Equal value split resistors (Rin/2) must be used at both ends of the LED.

ISOLATION CHARACTERISTIC							
PARAMETER	SYMBOL	DEVICE	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
Withstand Insulation Test Voltage (1) (2)	V_{ISO}	SJS-480P SJS-480W	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
- 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.

TYPICAL PERFORMANCE CURVES & TEST CIRCUITS

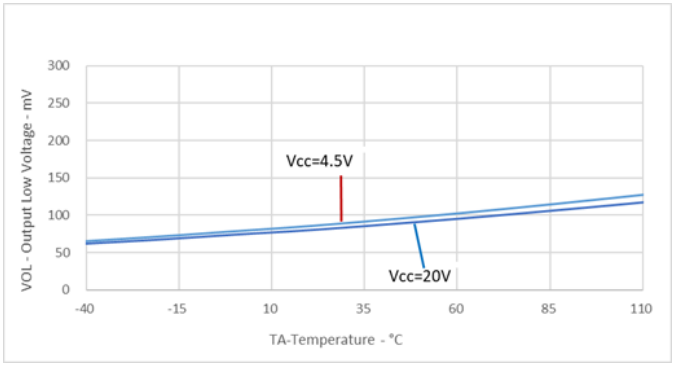


Fig.1 V_{OL} vs. Temperature

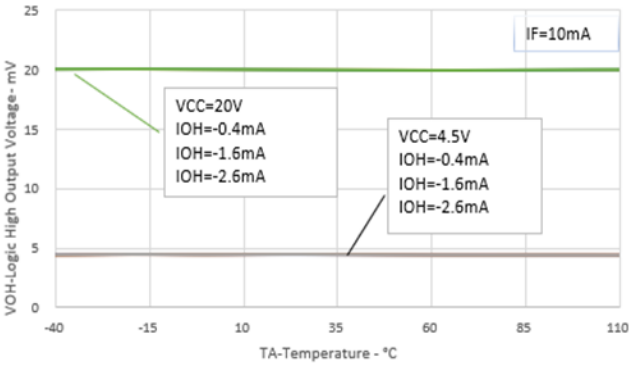


Fig.2 V_{OH} vs. Temperature

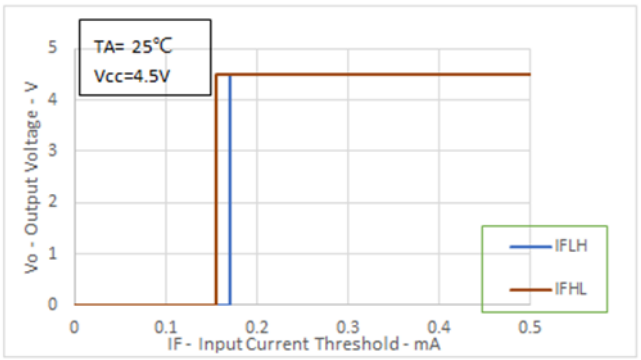


Fig.3 I_{FLH} Hysteresis

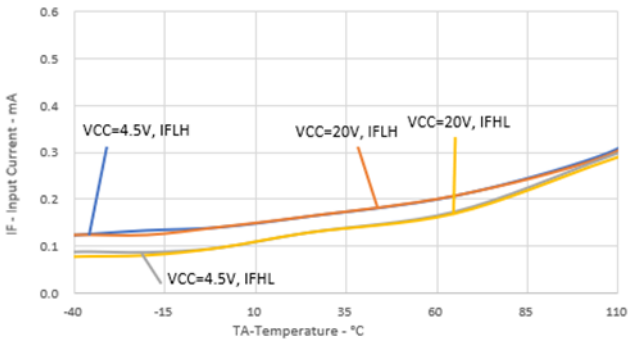


Fig.4 I_{FLH} vs. Temperature

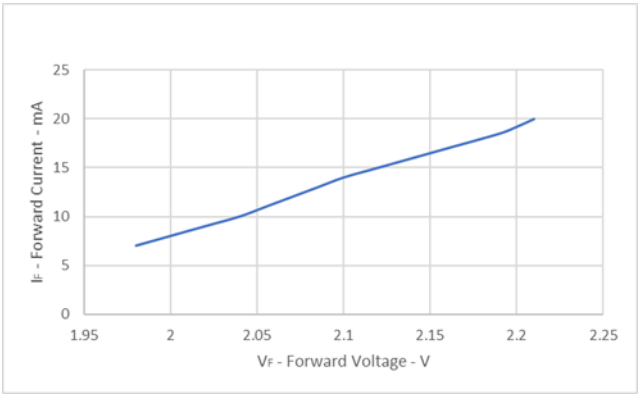


Fig.5 Input Current vs. Voltage

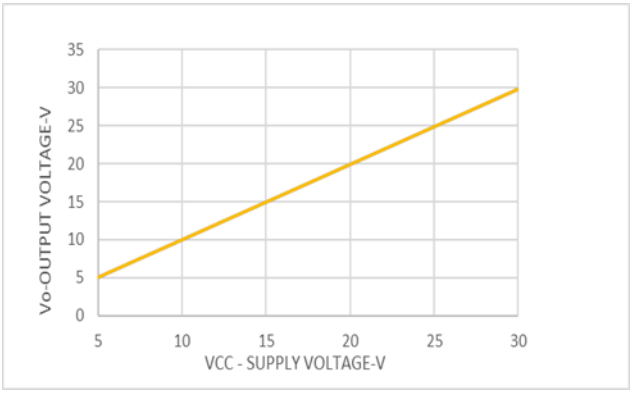


Fig. 6 Supply Voltage vs. Output Voltage

TYPICAL PERFORMANCE CURVES & TEST CIRCUITS

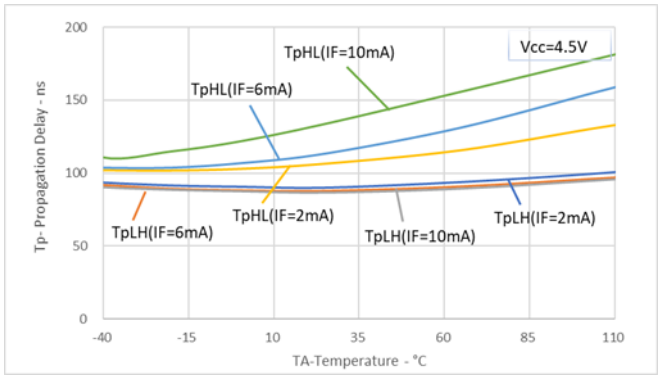


Fig.7 Propagation Delays vs. Temperature

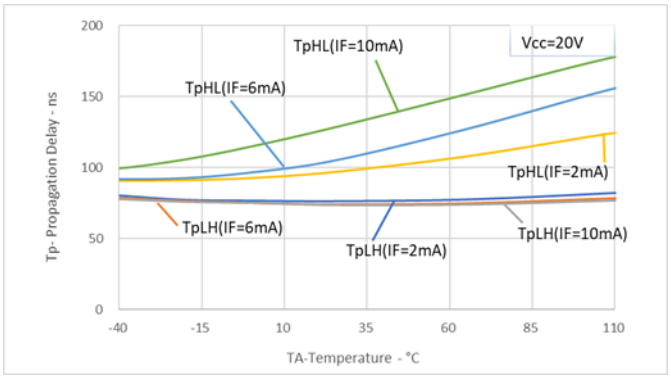


Fig.8 Propagation Delays vs. Temperature

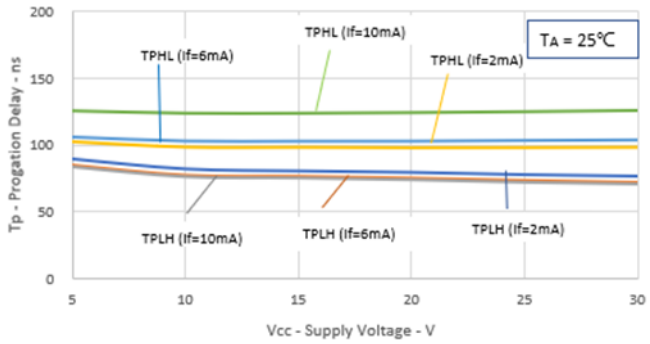


Fig.9 Propagation Delays vs. Vcc

TYPICAL PERFORMANCE CURVES & TEST CIRCUITS

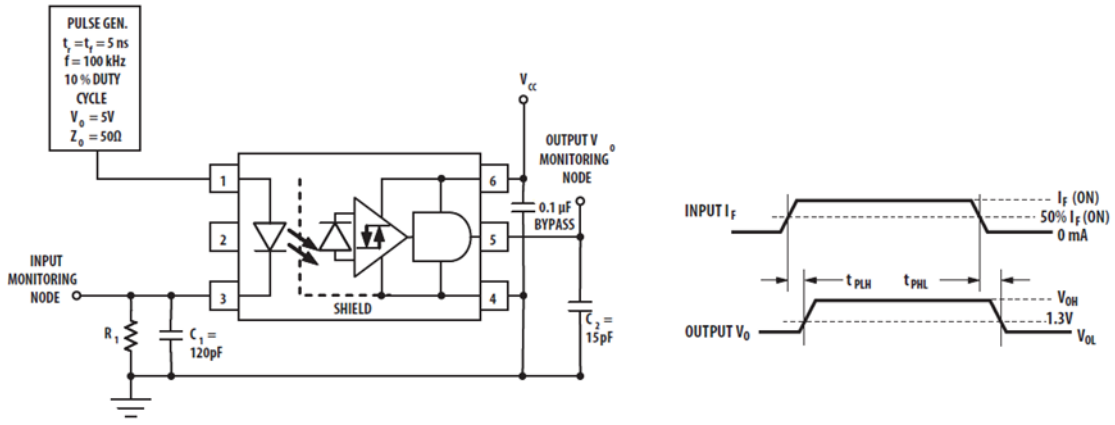


Fig.10 Test Circuit for t_{PHL}, t_{PLH}, t_r and t_f

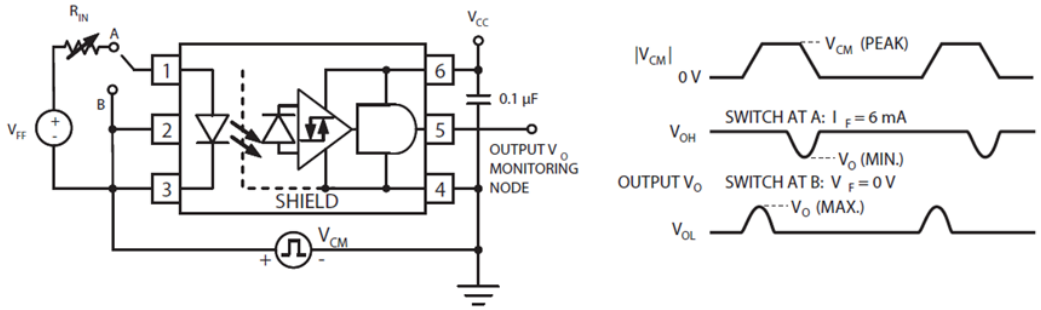
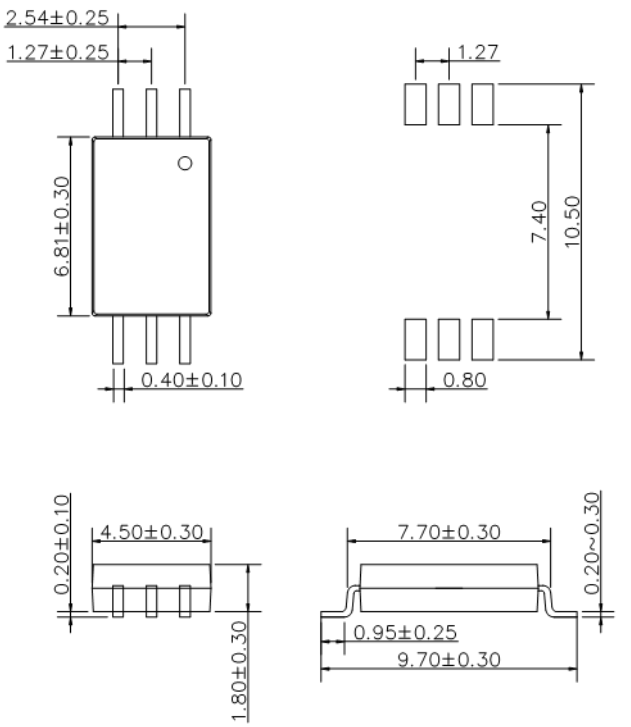
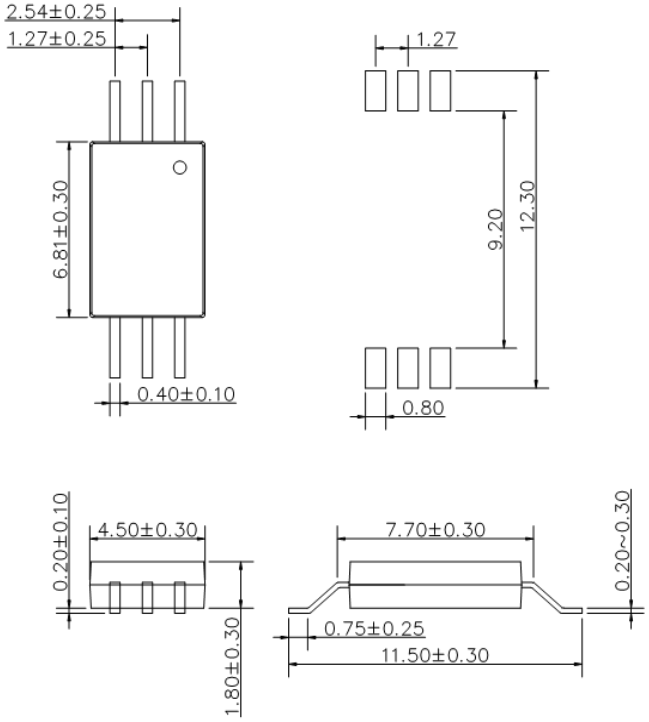


Fig.11 Common Mode Transient Immunity Test Circuit and Typical Waveforms

PACKAGE DIMENSIONS (Dimensions in mm unless otherwise stated)

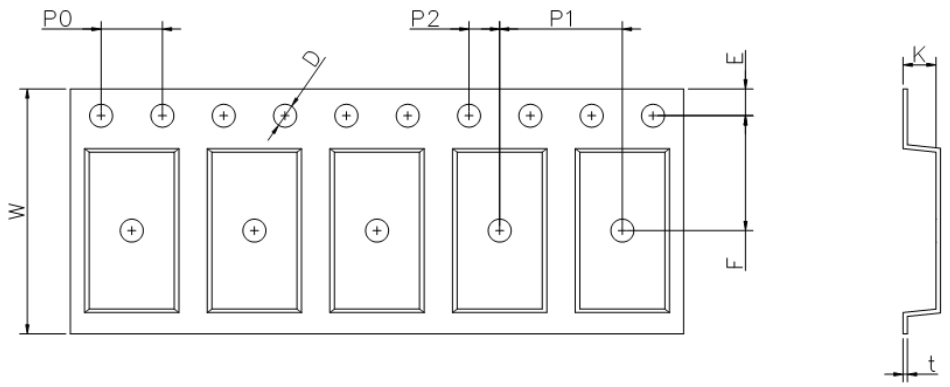


P type Dimension



W type Dimension

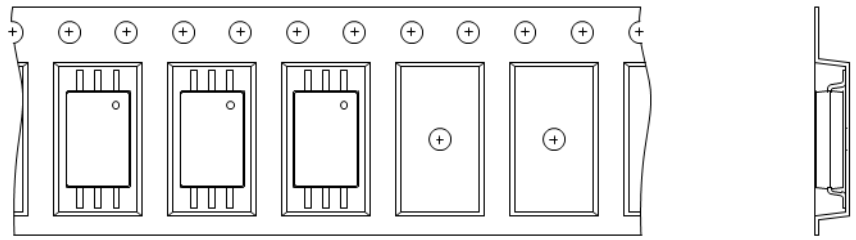
TAPING DIMENSIONS (Dimensions in mm unless otherwise stated)



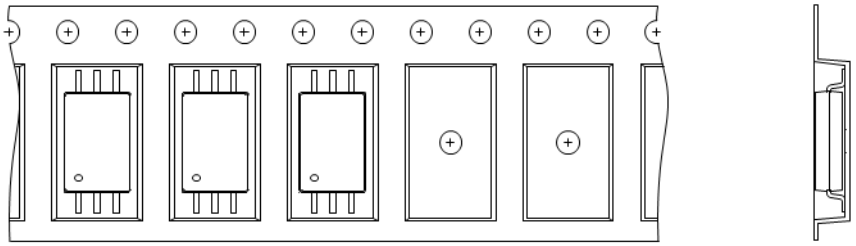
Symbol	D	E	F	P0	P1	P2	t	W	K
Dimension (mm)	1.5 ±0.1	1.75 ±0.1	7.5 ±0.1	4.0 ±0.1	8.0 ±0.1	2.0 ±0.1	0.3 ±0.1	16.0 ±0.3	2.15 ±0.1

TAPE & REEL PACKING SPECIFICATIONS

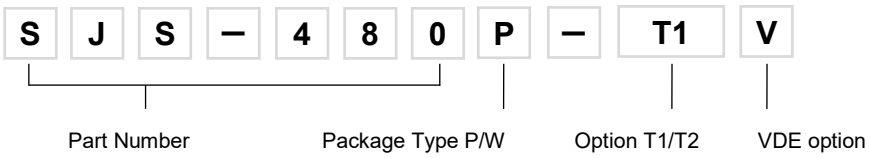
Option T1



Option T2

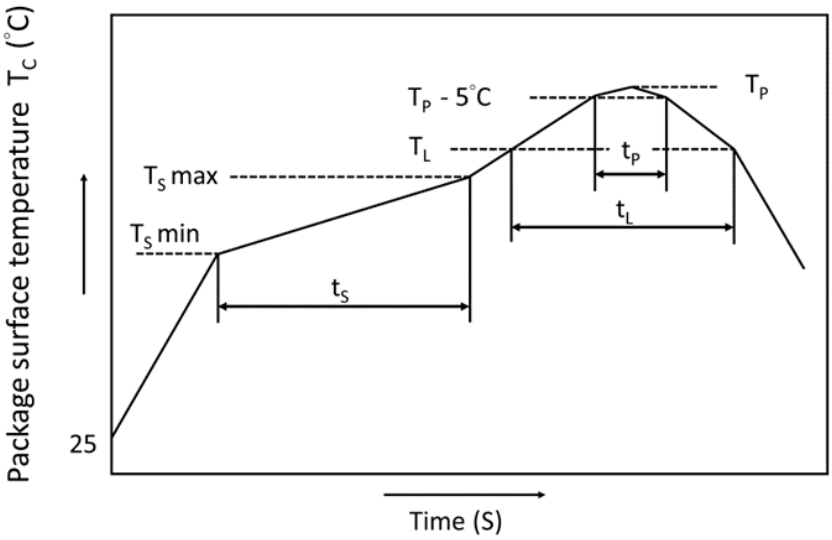


ORDERING AND MARKING INFORMATION



Marking Symbol	Description
SJS	Part Number
480	
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	ts	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

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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.