Features

- 1 A maximum peak output current
- Rail-to-rail output voltage
- 110 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.
- Regulatory Approvals
  - UL - UL1577
  - VDE - EN60747-5-5(VDE0884-5)
  - CQC - GB4943.1

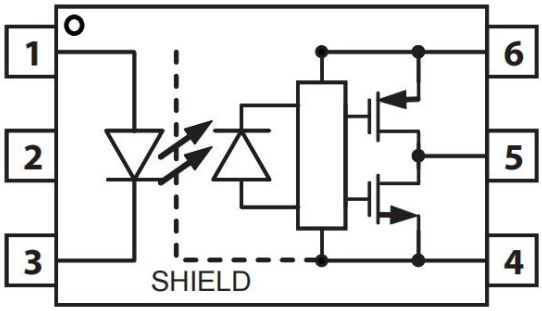
Applications

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

Description

The ICPL-314 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.

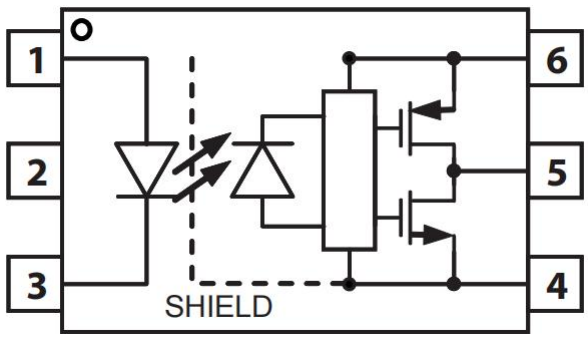


ORDERING INFORMATION

Outline	Part Number	Package	Marking	Packing	Packing Size	Quantity
	ICPL-314P-500E	LSOP6	314P/W /YYWW	Reel	13 "	3000
	ICPL-314W-500E	LSOP6		Reel	13 "	3000

CONTENTS

PIN CONFIGURATION AND FUNCTIONS



Pin	Name
1	Anode
2	NC
3	Cathode
4	V_{SS}
5	V_O
6	V_{CC}

TRUTH TABLE			
LED	V_{CC}-V_{SS} (Turn-ON, +ve going)	V_{CC}-V_{SS} (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 6.

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit	Note
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	$I_{OH(PEAK)}$		1	A	1
“Low” Peak Output Current	$I_{OL(PEAK)}$		1	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	°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	1.9	2.4	V	I_F= 10 mA	-
Input Forward Voltage Temperature Coefficient	$\Delta V_F/ \Delta T_j$	-	-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}	-	0.6	2	mA	V_O > 5V, I_O = 0A	-
Input Threshold Voltage (High to Low)	V_{FHL}	0.8	-	-	V	V_{CC} = 30 V, V_O < 5V	-
Input Capacitance	C_{IN}	-	60	-	pF	V_F = 0, f = 1MHz	-
OUTPUT CHARACTERISTICS							
High Level Supply Current	I_{CCH}	-	1.55	3	mA	I_F=10mA, V_{CC}=30V, V_O=Open, R_g=30Ω, C_g=3nF	
Low Level Supply Current	I_{CCL}	-	1.92	3	mA	I_F=0mA, V_{CC}=30V, V_O=Open, R_g=30Ω, C_g=3nF	
High Level Output Voltage	V_{OH}	29.4	29.69	-	V	I_F=10mA, V_{CC}=30V, I_O= -100mA	2,3
Low Level Output Voltage	V_{OL}	-	0.17	0.4	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}-4	1
Low Level Output Current	I_{OL}	0.8	-	-	A	I_F=0mA, V_{CC}=30V V_O=V_{SS}+4	1
Under Voltage Lockout Threshold	V_{UVLO+}	6.9	7.8	8.7	V	V_O>5V, I_F=10mA	
	V_{UVLO-}	5.9	6.9	7.5	V	V_O<5V, I_F=10mA	

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

Note 1: Maximum pulse width = 10μs.

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 = 1ms.

SWITCHING SPECIFICATION

Parameter	Symbol	Min	Typ	Max	Unit	Test Condition	Note
SWITCHING CHARACTERISTICS							
Propagation Delay Time to Output Low Level	t_{PHL}	-	54	110	ns	R_g = 47Ω, C_g = 3nF, f = 10kHz, Duty Cycle = 50% I_F = 10mA, V_{CC} = 30V	-
Propagation Delay Time to Output High Level	t_{PLH}	-	69	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	t_r	-	35	-	ns		-
Fall Time	t_f	-	25	-	ns		-
Common Mode Transient Immunity at Logic High	CM_H	20	40	-	kV/μs	I_F=7 to 16mA，V_{CC}= 30V, T_a= 25°C, V_{CM}= 1kV	1,2
Common Mode Transient Immunity at Logic Low	CM_L	20	40	-	kV/μs	I_F=0mA，V_{CC}= 30V, T_a= 25°C, V_{CM}= 1kV	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 dV_{CM}/dt of the common mode pulse, V_{CM}, to assure that the output will remain in the high state (meaning V_O > 10.0V).

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 < 1.0V).

ISOLATION CHARACTERISTIC

Parameter	Symbo	Device	Min.	Typ.	Max.	Unit	Test Condition	Note
Withstand Insulation Test Voltage	V_{ISO}	ICPL-314P	5000	-	-	V	40% ≤ RH ≤ 60%, t = 1min, T_a = 25 °C	1,2
		ICPL-314W						
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

Fig.1 High output rail voltage vs. Temperature

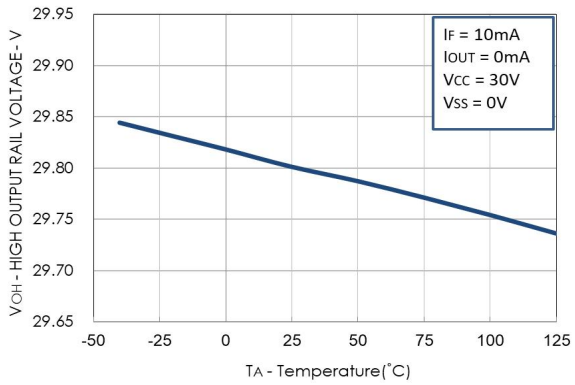


Fig.2 V_{OH} vs. Temperature

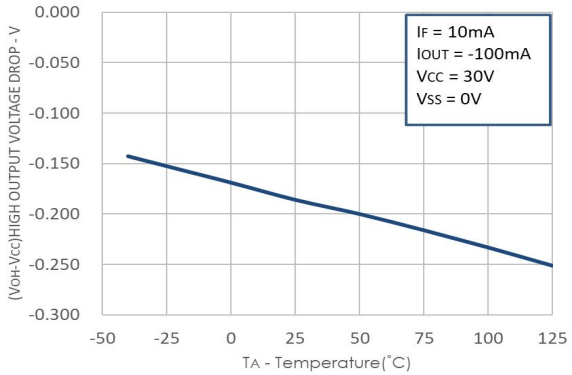


Fig.3 V_{OL} vs. Temperature

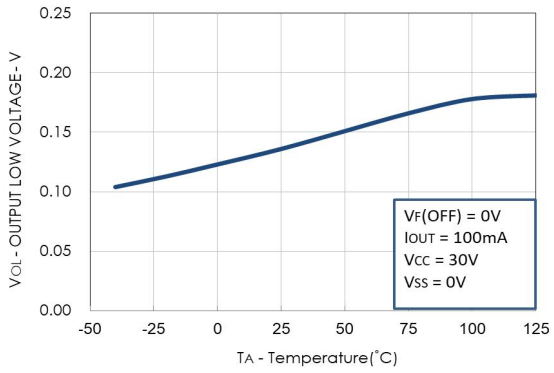


Fig.4 I_{CC} vs. Temperature

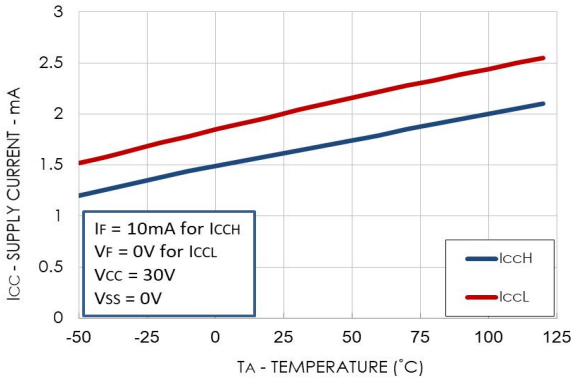


Fig.5 I_{CC} vs. V_{CC}

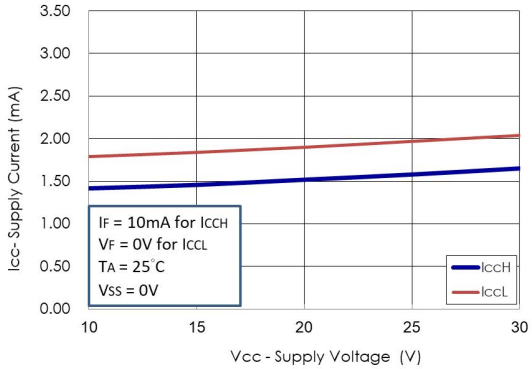


Fig.6 I_{FLH} vs. Hysteresis

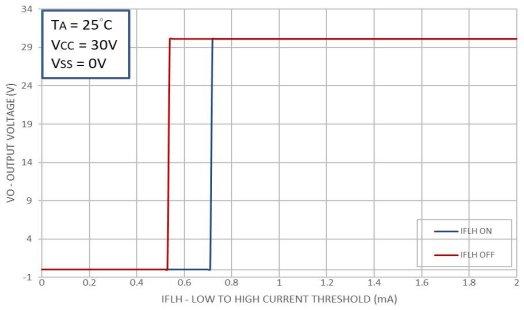


Fig.7 I_{FH} vs. Temperature

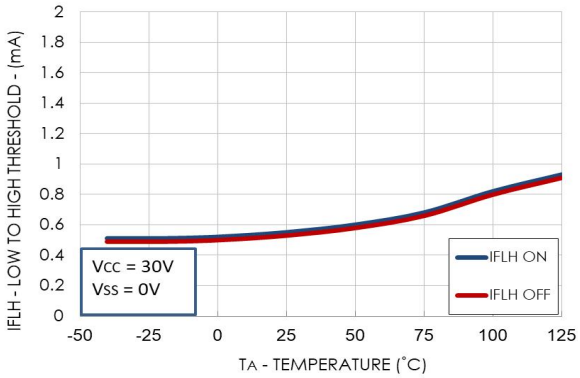


Fig.8 Propagation Delays vs. V_{CC}

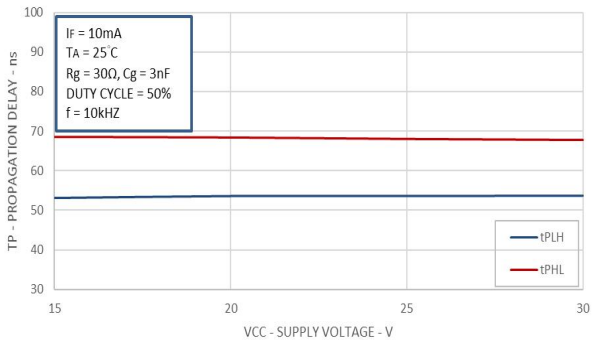


Fig.9 Propagation Delays vs. I_F

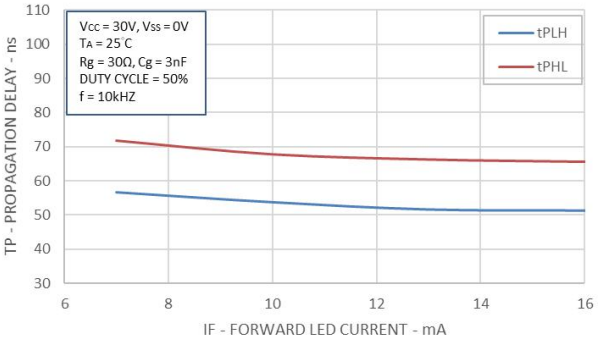


Fig.10 Propagation Delays vs. Temperature

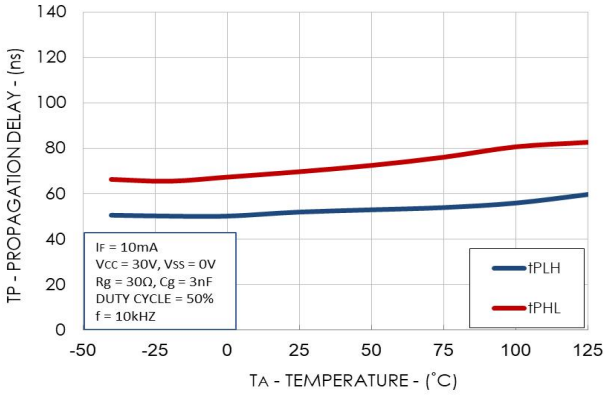


Fig.11 Propagation Delays vs. R_g

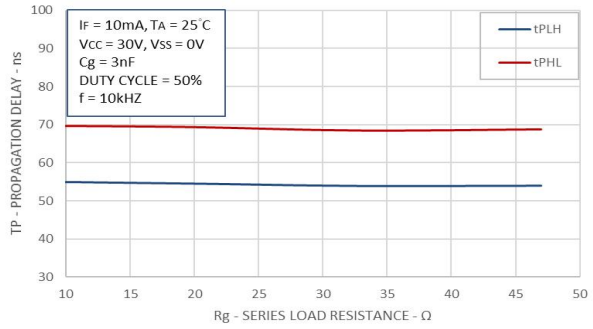


Fig.12 Propagation Delays vs. C_g

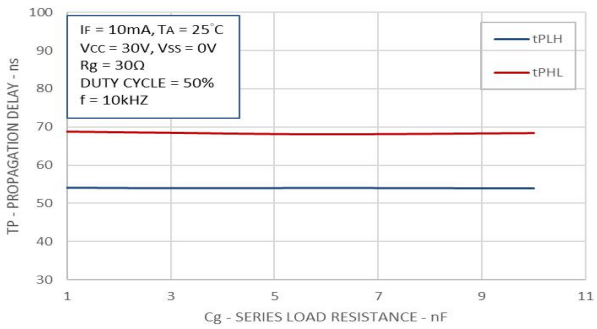
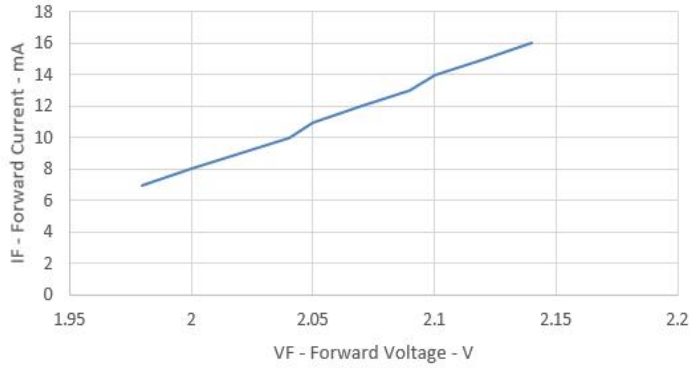


Fig.13 Input Current vs. Forward Voltage



TEST CIRCUITS

Fig.14 I_{OH} Test Circuit

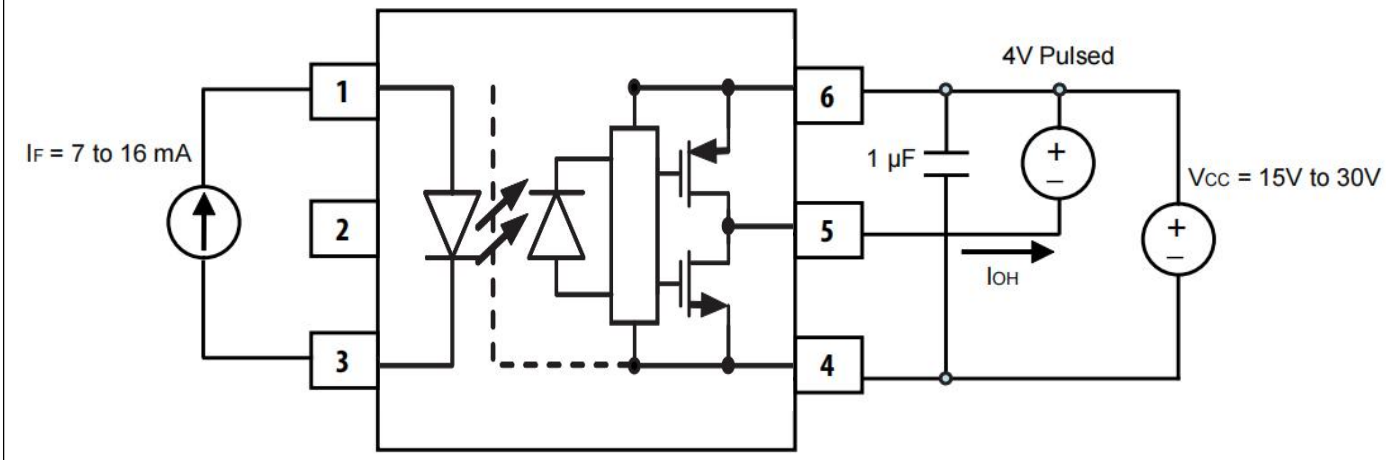


Fig.15 I_{OL} Test Circuit

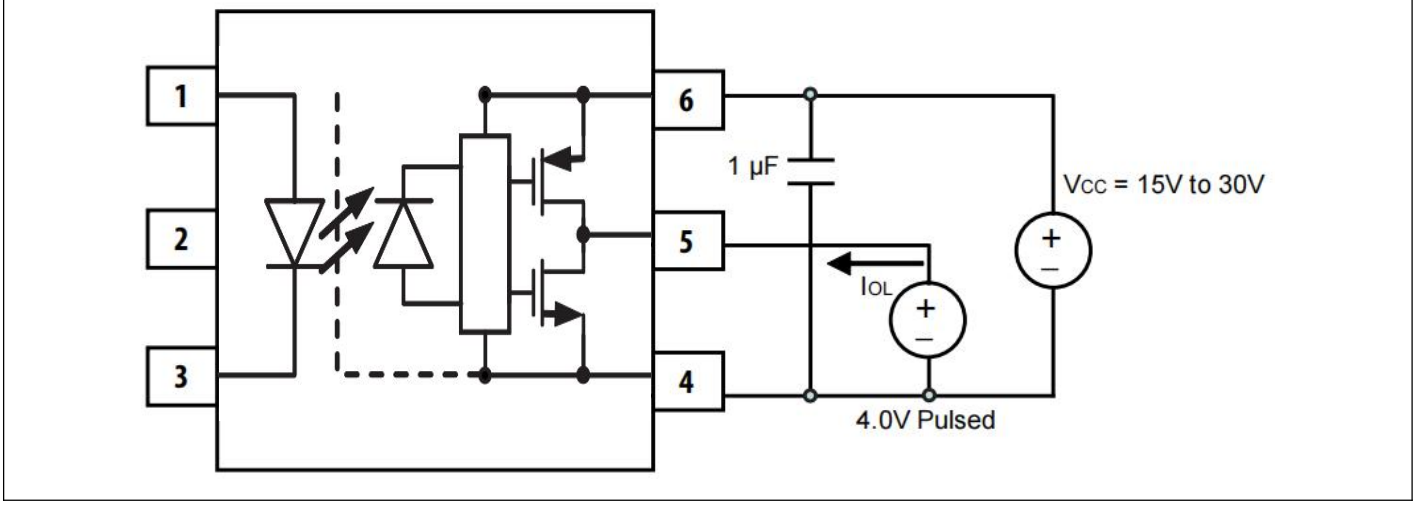


Fig.16 V_{OH} Test Circuit

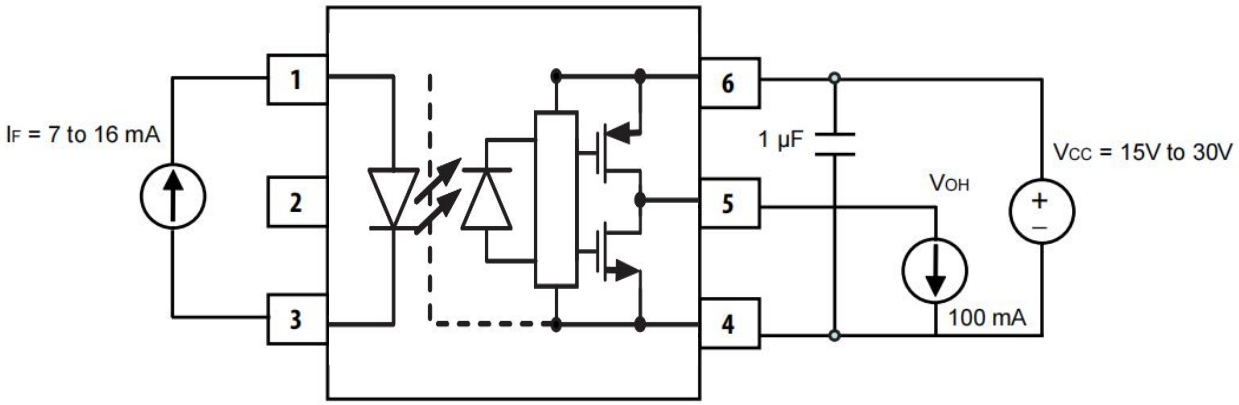


Fig.17 V_{OL} Test Circuit

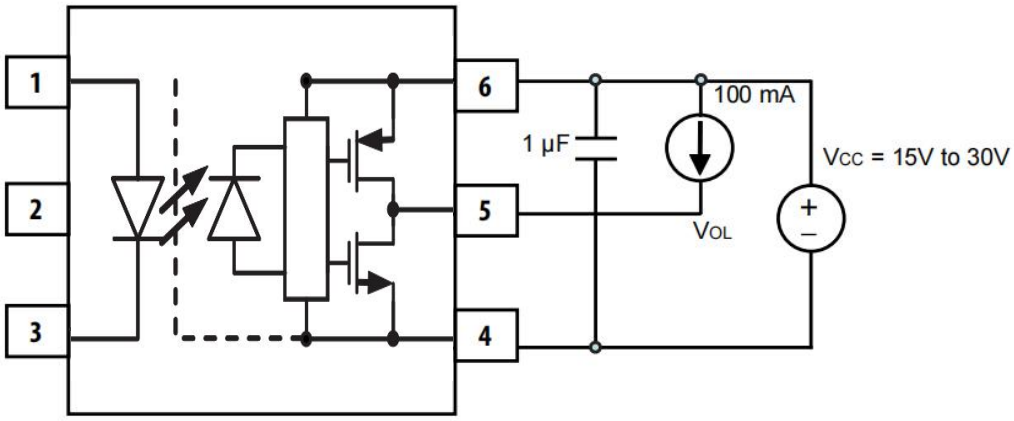


Fig.18 I_{FLH} Test Circuit

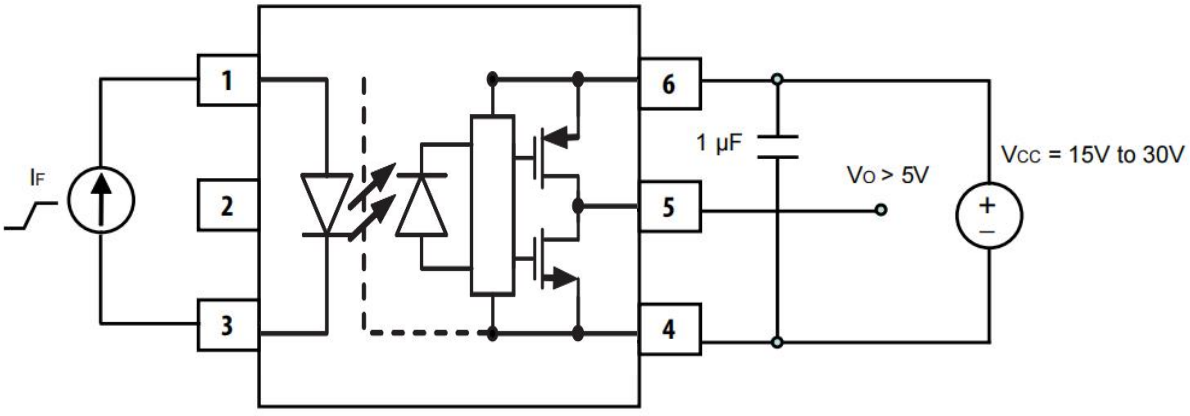


Fig.19 U_{VLO} Test Circuit

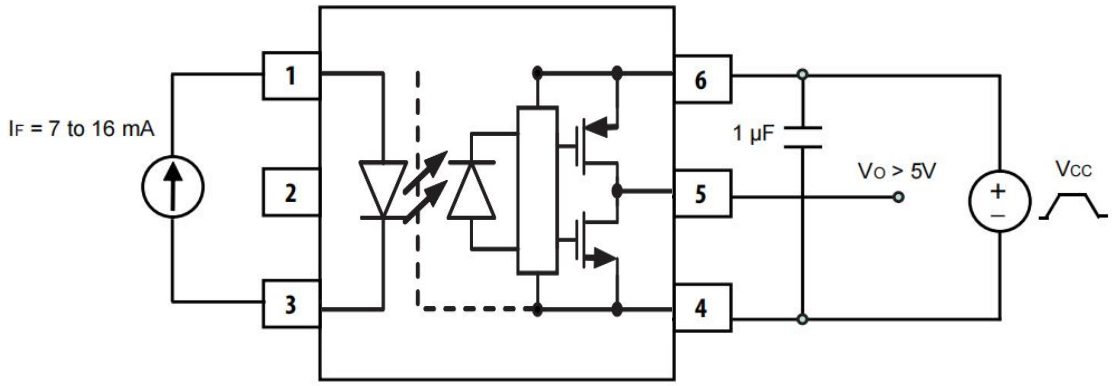


Fig.20 t_{PHL}, t_{PLH}, t_r and t_f Test Circuit and Waveforms

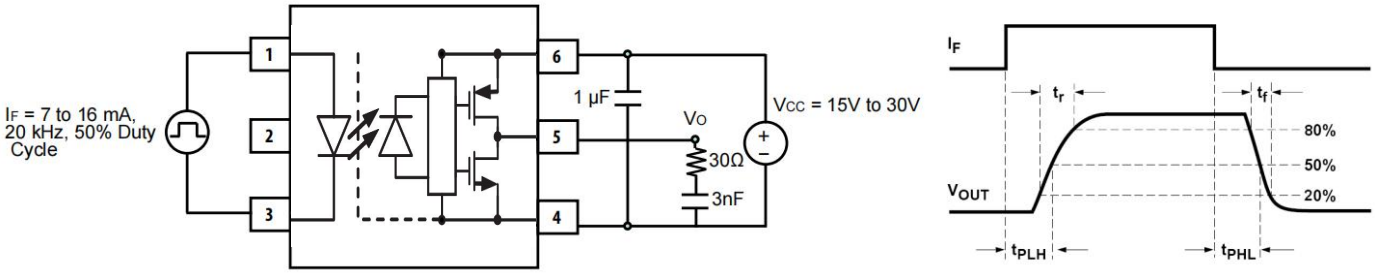
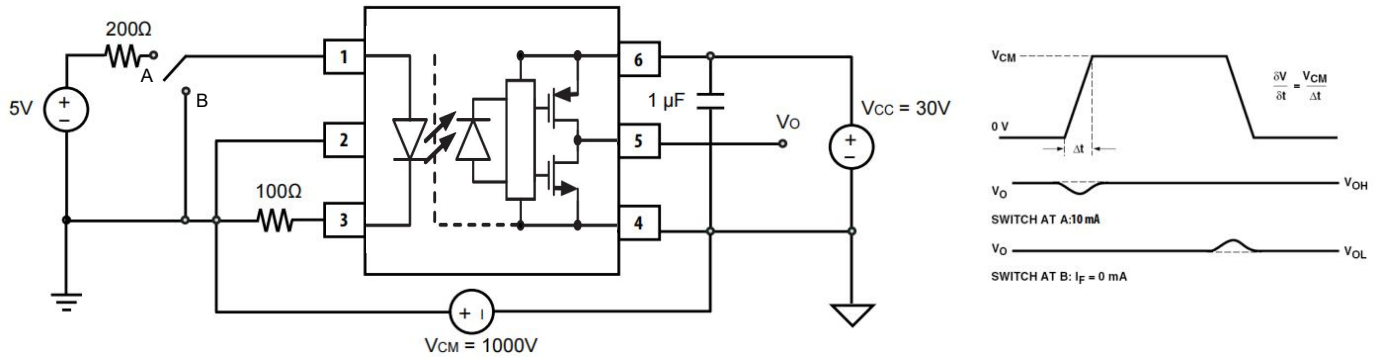
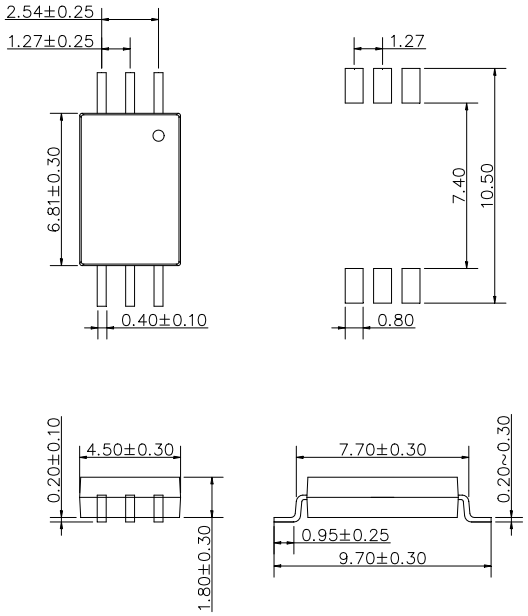


Fig.21 CMR Test Circuit with Split Resistors Network and Waveforms

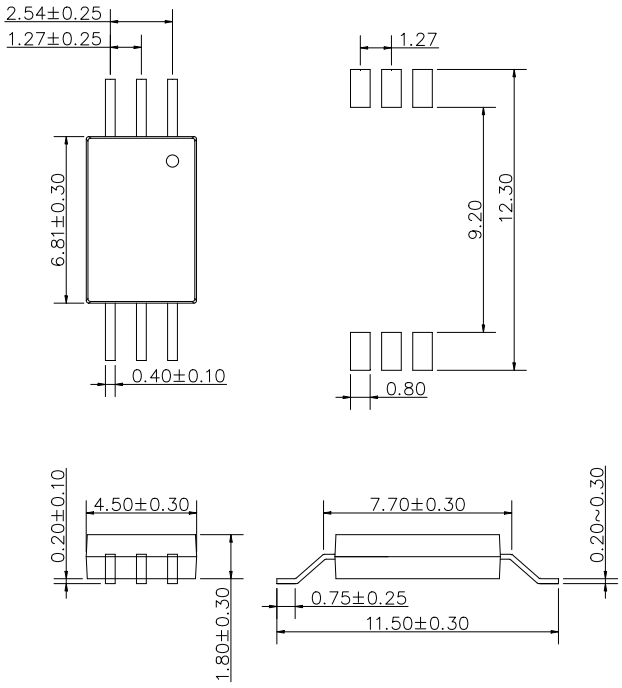


PACKAGE DIMENSIONS

Surface Mount Lead Forming (P type)



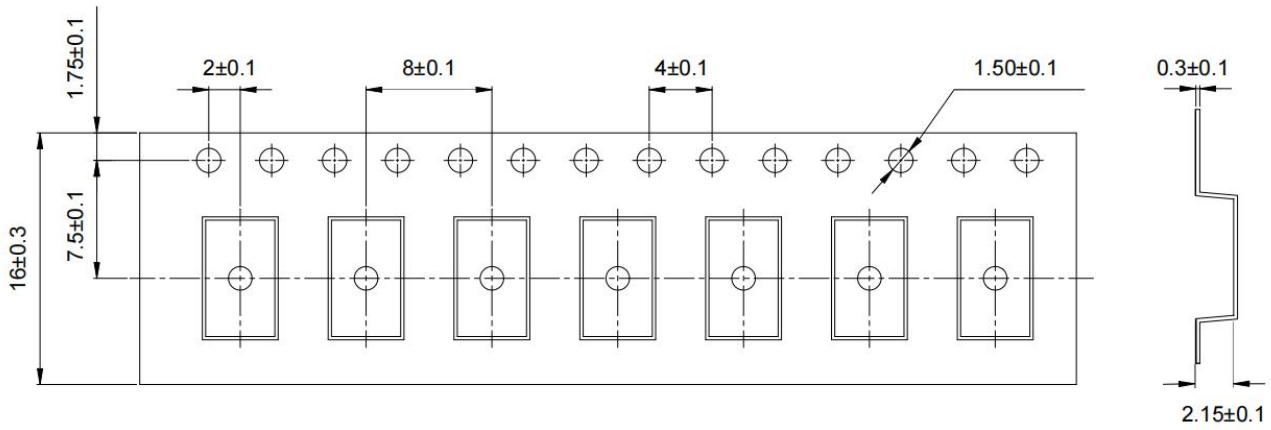
Surface Mount Lead Forming (W type)



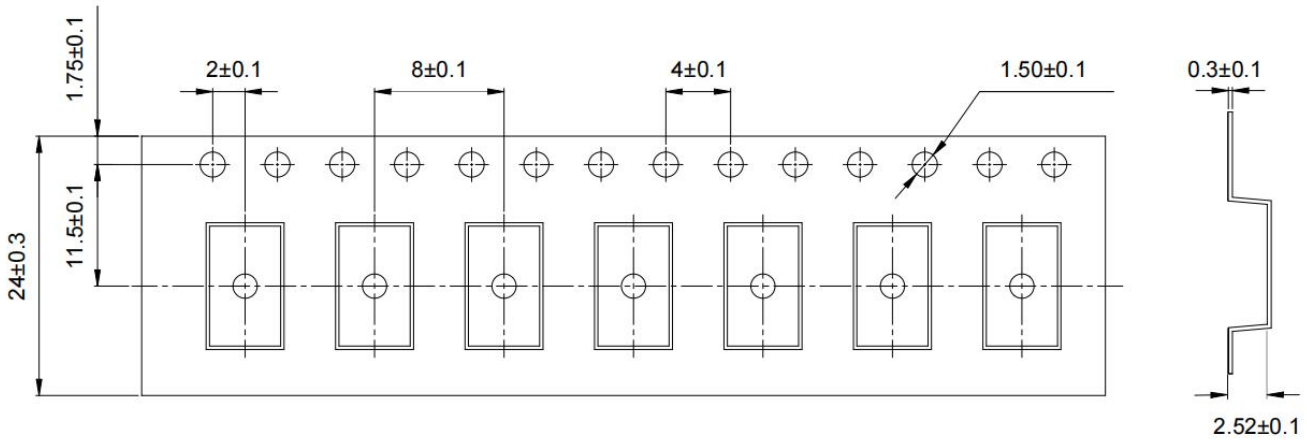
- **Dimensions in mm unless otherwise stated**

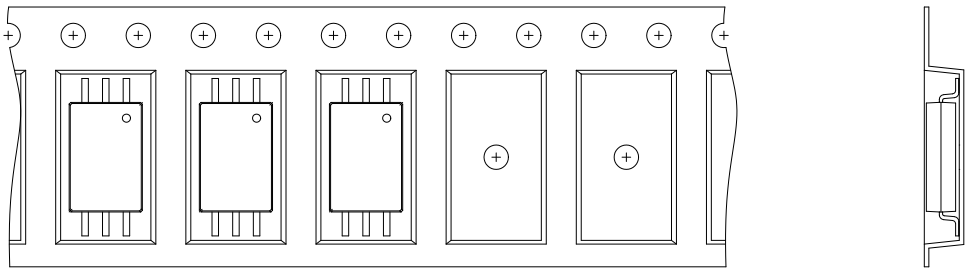
TAPING DIMENSIONS

Option LSOP6-P



Option LSOP6-W





- **Dimensions in mm unless otherwise stated**

ORDERING AND MARKING INFORMATION

Marking Information

314	:	Part Number
X	:	Lead Form Option（P/W）
/	:	ISOMICRON
YY	:	Fiscal Year
WW	:	Work Week

Order Code

ICPL – 314 X - 5 0 0 E

Company Abbr.

Part Number

Lead Form Option
P - 9mm Clearance
W- 11mm Clearance

Lead Forming
5: SM-SL

Halogen Free
E: Halogen-free,Lead-free
Z: Halogen, Lead-free

None

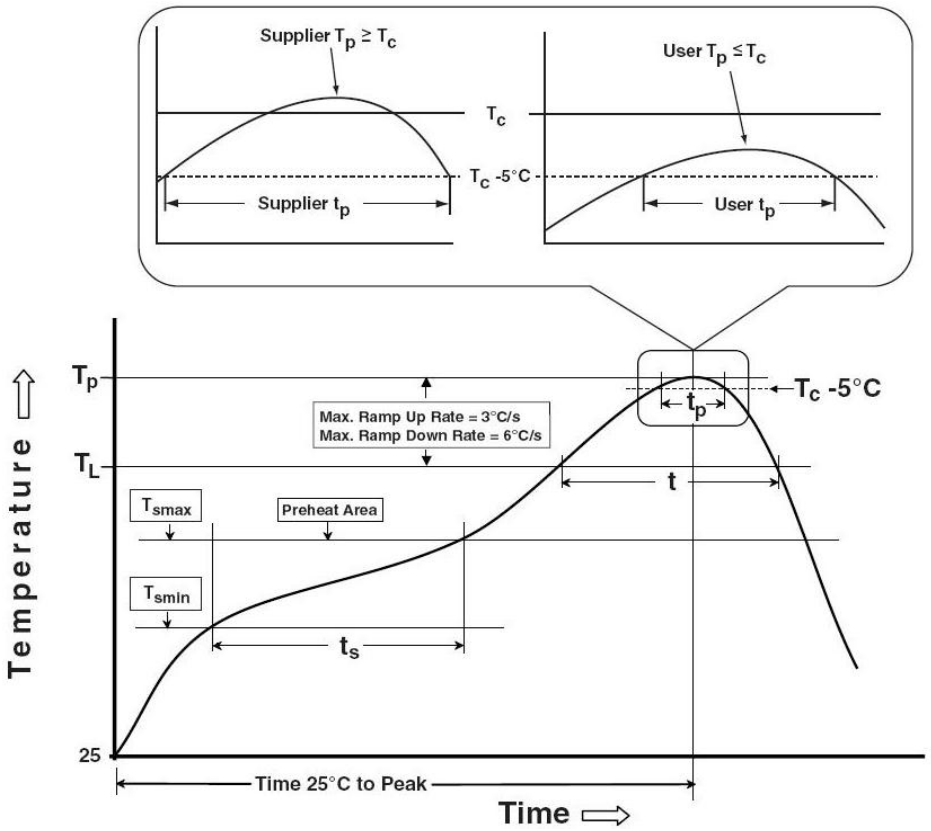
Performance
0: Normal
1: Enhanced
2: Industrial level
3: Auto level
4: Military level

Packing Quantity

Option	Quantity	Quantity – Inner box	Quantity – Outer box
314W	3000Units/Reel	2 Reels/Inner box	5 Inner box/Outer box = 30k Units
314P	3000Units/Reel	3 Reels/Inner box	5 Inner box/Outer box = 45k Units

REFLOW INFORMATION

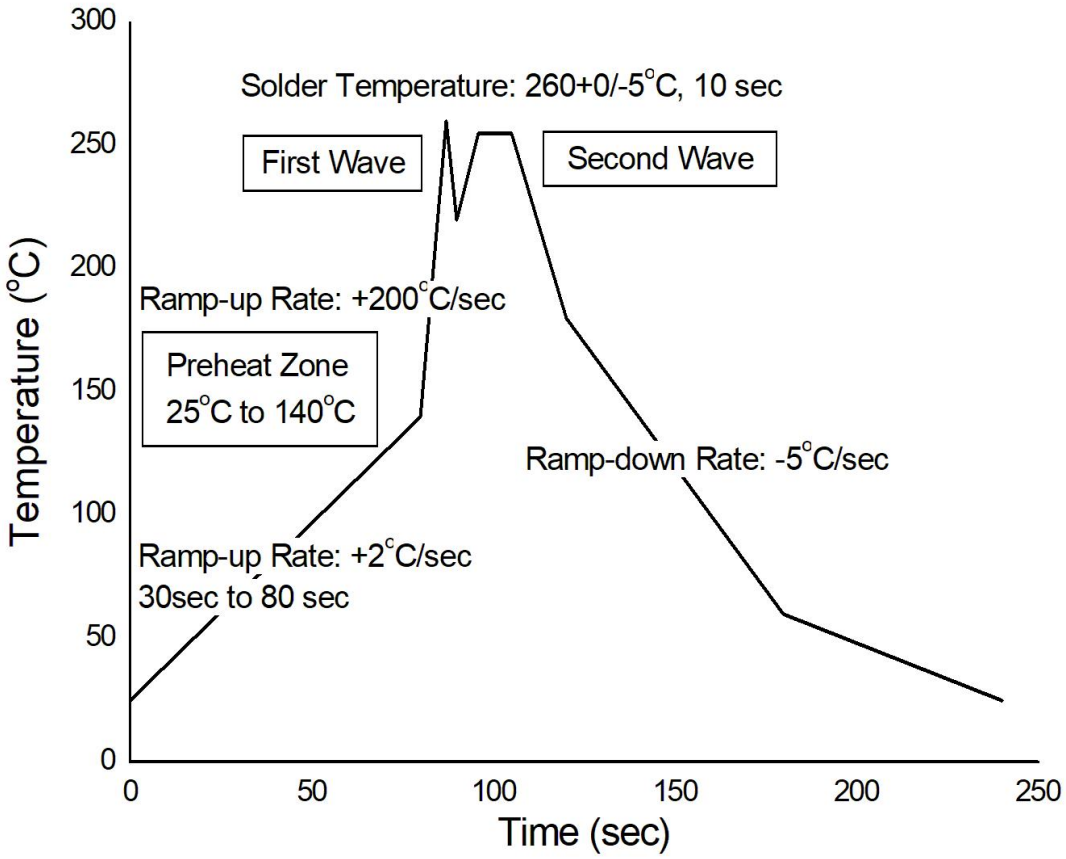
Reflow Profile



Profile Feature	Sn-Pb Assembly Profile	Pb-Free Assembly Profile
Temperature Min. (Tsmin)	100	150°C
Temperature Max. (Tsmax)	150	200°C
Time (ts) from (Tsmin to Tsmax)	60-120 seconds	60-120 seconds
Ramp-up Rate (tL to tP)	3°C/second max.	3°C/second max.
Liquidous Temperature (TL)	183°C	217°C
Time (tL) Maintained Above (TL)	60 – 150 seconds	60 – 150 seconds
Peak Body Package Temperature	235°C +0°C / -5°C	260°C +0°C / -5°C
Time (tP) within 5°C of 260°C	20 seconds	30 seconds
Ramp-down Rate (TP to TL)	6°C/second max	6°C/second max
Time 25°C to Peak Temperature	6 minutes max.	8 minutes max.

TEMPERATURE PROFILE OF SOLDERING

Wave Soldering (JESD22-A111 Compliant)



Hand Soldering By Soldering Iron	
Soldering Temperature	380+0/-5°C
Soldering Time	3 sec max.

- **One time soldering is recommended for all soldering method.**
- **Do not solder more than three times for IR reflow soldering.**

DISCLAIMER

- ISOMICRON is continually improving the quality, reliability, function and design. ISOMICRON reserves the right to make changes without further notices.
- The characteristic curves shown in this datasheet are representing typical performance which are not guaranteed.
- ISOMICRON makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, ISOMICRON disclaims (a) any and all liability arising out of the application or use of any product, (b) any and all liability, including without limitation special, consequential or incidental damages, and (c) any and all implied warranties, including warranties of fitness for particular
- The products shown in this publication are designed for the general use in electronic applications such as office automation, equipment, communications devices, audio/visual equipment, electrical application and instrumentation purpose, non-infringement and merchantability.
- 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 ISOMICRON 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 ISOMICRON'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.