RY5KD01
Infrared Transceiver Module

FEATURES

- Fully Compliant to IrDA 1.1 - 4.0 Mbps
- Low Height Transceiver (H = 4.9 mm)
- Compatible with Legacy IrDA 1.0 and SHARP ASK Devices (SHARP ASK: 9.6 kbps - 57.6 kbps, f = 500 kHz)
- Low Voltage Operation (3.0 V) and also Capable for 5.5 V
- Single RX Out for multiple infrared ports and Simple Hardware Implementation
- Soldering Reflow Capability
- Built-in Power Down (Shut Down) Function
- Excellent Noise Immunity Due to Metal Shield Case
- Two Package Types
  - Mount Guide Pin Type (RY5KD01)
  - Flat Bottom Type (RY5KD01K)
- Supported by Various I/O chips
- Optimized Interface to SHARP UIRCC Modem ASIC

DESCRIPTION

The SHARP RY5KD01 is a 3.0 V low operating voltage, low-height infrared transceiver module. It provides the interface between logic and IR signals for through-air, serial, half-duplex IR wireless data links and is designed to satisfy the IrDA physical layer specifications.

The SHARP RY5KD01 infrared transceiver module contains a high speed, high efficiency, low power consumption AlGaAs LED, a silicon PIN photodiode, and the low power driven bipolar integrated circuit. The IC contains a LED driver circuit, and a receiver that provides the single RX output supporting 9.6 kbps to 115.2 kbps IrDA signals, 1.152 Mbps and 4 Mbps IrDA 1.1 signals, and 9.6 kbps to 57.6 kbps SHARP ASK signals. This single RX output design provides manufacturers with the capability to have multiple infrared capabilities in one application at any desired location, and reduces work for the hardware implementation.

Though the RY5KD01 transceiver module is intended for operation at 3.3 V, the module can be operated at 5.0 V without any performance degradation. This capability provides the advantage of an energy saving design in any application field by having alternatives for supply voltage and supporting components.

The RY5KD01 transceiver module has a built-in power down mode for those applications that are very conscious about the current consumption.

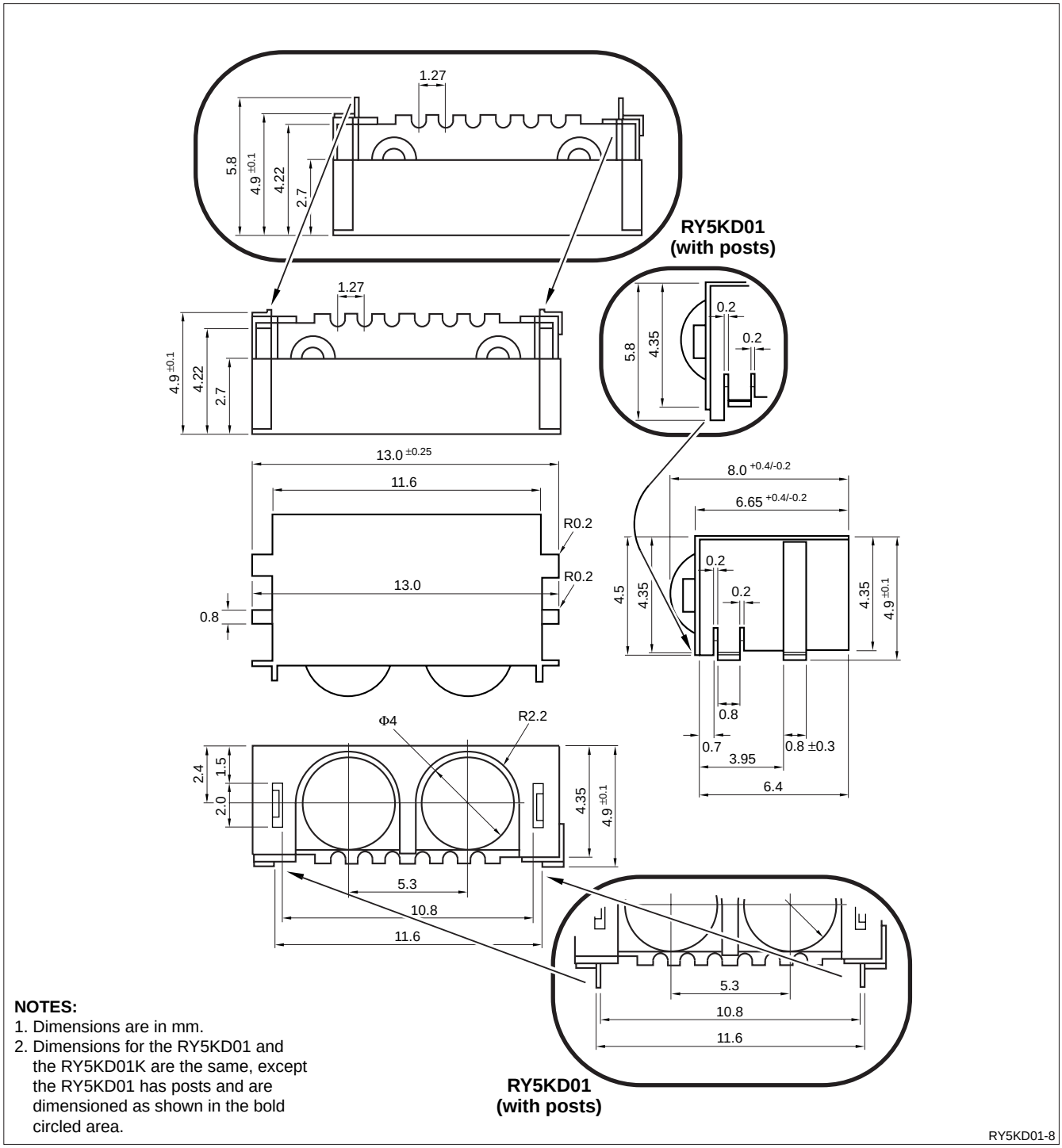
RY5KD01 IrDA 1.1 low height transceivers are available in two types: RY5KD01 with mount position guide pins, and RY5KD01K, a flat bottom complete SMD package.

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	MIN.	MAX.	UNIT
Supply Voltage	V_{CC}	0	6.0	V
Operating Temperature	T_{OP}	0	70	°C
Storage Temperature	T_{ST}	-20	85	°C
Average Forward LED Current	$I_{LED\ (DC)}$	—	100	mA
Peak Forward LED Current	$I_{LED\ (PK)}$	—	500	mA

OUTLINE DIMENSIONS

All dimensions given in Figure 1 are in mm, and are only applicable for design reference, and subject to change without notice. Contact your local SHARP office for the device specifications to ensure the outline dimensions.



NOTES:
1. Dimensions are in mm.
2. Dimensions for the RY5KD01 and the RY5KD01K are the same, except the RY5KD01 has posts and are dimensioned as shown in the bold circled area.

Figure 1. Outline Dimensions

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN.	MAX.	UNIT	CONDITIONS	NOTES
Operating Temperature	T_{OP}	0	+70	°C		
Supply Voltage	V_{CC}	3.0	3.6	V		
Logic High Transmitter Input Voltage (TXIN)	V_{IH}	2.3	3.3	V		
Logic Low Transmitter Input Voltage (TXIN)	V_{IL}	0.0	0.45	V		
Logic High Receiver Input Irradiance	E_{IH}	0.0036	500	mW/cm^2	Bit Rate = 9.6 kbps - 115 kbps (in band signals)	1
	E_{IH}	0.0090	500	mW/cm^2	Bit Rate = 1.152 Mbps/4 Mbps (in band signals) and ASK	1
Receiver Signal Rate		9.6	4,000	kbps		
Ambient Light						2

NOTES:

1. An in-band optical signal is a pulse/sequence where the peak wavelength, λp, is defined as 850 nm $\leq \lambda p \leq$ 900 nm, and the pulse characteristics are compliant with the IrDA Serial Infrared Physical Layer Link Specifications.
2. See IrDA Serial Infrared Physical Layer Link Specification Appendix A for ambient light.

ELECTRICAL AND OPTICAL SPECIFICATIONS

Specifications hold over the Recommended Operating Conditions, unless otherwise noted herein. All typical values are at 25°C and 3.3 V, ambient light on the receiver surface under 100 lz, unless otherwise noted herein.

Table 1. Electrical and Optical Specifications

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
RECEIVER SIDE						
High Level Output Voltage	V_{OH}	2.1	2.5		V	
Low Level Output Voltage	V_{OL}	—	0.1	0.6	V	
Viewing Angle	2Φ	30	—	—	degrees	
Low Level Pulse Width	tw_1	1.0	—	22	µs	BR = 9.6 kbps (pulse width 19.53 µs)
	tw_2	1.0	—	7.0	µs	BR = 115.2 kbps (pulse width 1.63 µs)
	tw_3	100	—	700	ns	BR = 1.152 Mbps (pulse width 217 ns)
	tw_4	85	—	170	ns	BR = 4.0 Mbps (pulse width 125 ns)
	tw_5	0.5	—	1.6	µs	ASK [f = 500 kHz] (pulse width 217 ns)
Current Consumption	I_{CC1}	3.0	4.0	6.0	mA	All mode, with no input signal
		—	20	—	mA	Maximum of TYP. value
Rise Time	tr			30	ns	
Fall Time	tf			30	ns	
Maximum Reception Distance	L2	≥ 1.0	—	—	m	2Φ.5 ≤ 15°, BR = 115.2 kbps
	L3	≥ 1.0	—	—	m	2Φ.5 ≤ 15°, BR = 1.152 Mbps
	L4					2Φ.5 ≤ 15°, BR = 4.0 Mbps
	L1	≥ 1.0	—	—	m	2Φ.5 ≤ 15°, BR = 19.2 kbps
TRANSMITTER SIDE						
Radiant Intensity	I_E	100	—	—	mW/sr	V_{IH} = 2.3 V
Peak Emission Wavelength	λp	—	865	—	nm	
Peak LED Current	I_{LEDA}	—	300	—	mA	All mode
Rise Time	$tr_{(IE)}$	—	—	40	ns	
Fall Time	$tf_{(IE)}$	—	—	40	ns	
Transmitter Data Input Current (Logic High)	I_{IH}	3.0	—	5.1	mA	V_{IH} = 3.3 V, Duty Ratio 50%, Freq ≥ 1 kHz
Transmitter Data Input Current (Logic Low)	I_{IL}	-1	—	1	µA	V_{IH} = 0.0 V
High Level Input Voltage	V_{IH}	2.1	—	V_{CC}	V	
Low Level Input Voltage	V_{IL}	0.0	—	0.5	V	

TRUTH TABLE

INPUTS		OUTPUTS	
TXIN	**EI**	**IE (LED)**	**RXOUT**
V_{IH}	NV	ON	X
V_{IL}	ON	OFF	Low
V_{IL}	OFF	OFF	High

NOTES:
1. X = Don't care,
2. NV = Not Valid

PINOUTS

PIN NO.	DESCRIPTION	SYMBOL
1	Power Saving Circuit Input	Power Save
2	Receiver Ground	RX GND
3	Receiver Supply Voltage	RX V_{CC}
4	Transmitter Supply Voltage	TX V_{CC}
5	Data Input	IN
6	Receiver Output	RX OUT
7	LED Anode	LEDA

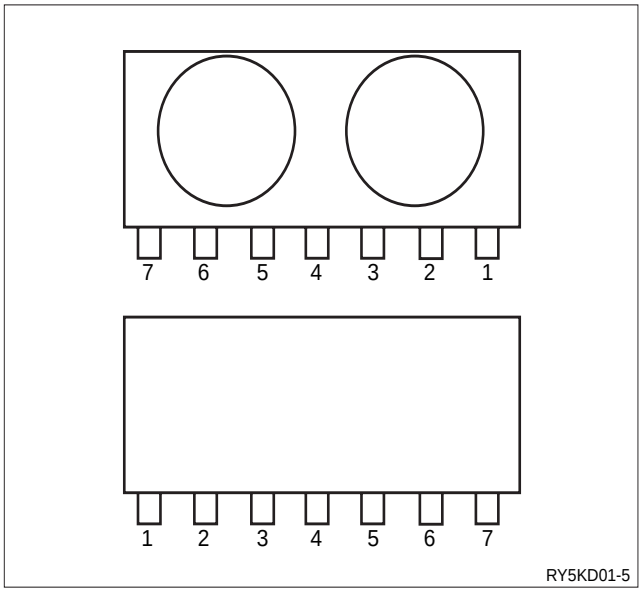


Figure 2. Pin Locations

APPLICATION ELECTRICAL DESIGN HINTS

Figure 3 and Table 2 show the recommended application circuit and passive values for RY5KD01. Table 2 only provides an idea for external passive values and is only applicable to customers' design reference.

Table 2. Passive Values for RY5KD01

COMPONENTS	RECOMMENDED VALUES
C1	2.2 µF
C2	0.1 µF
C3	82 pF
C4	6.8 µF - 47 µF*
R1	10 Ω, 1/8 W
R2	10 Ω, 1/8 W
R3	300 Ω, 1/8 W
RL	2.7 Ω, 1/2W (V_{CC} = 3.3 V) 8.2 Ω, 1/2W (V_{CC} = 5.0 V)

NOTE: *Supply Voltage Ripple: ≤ 50 mVp-p.

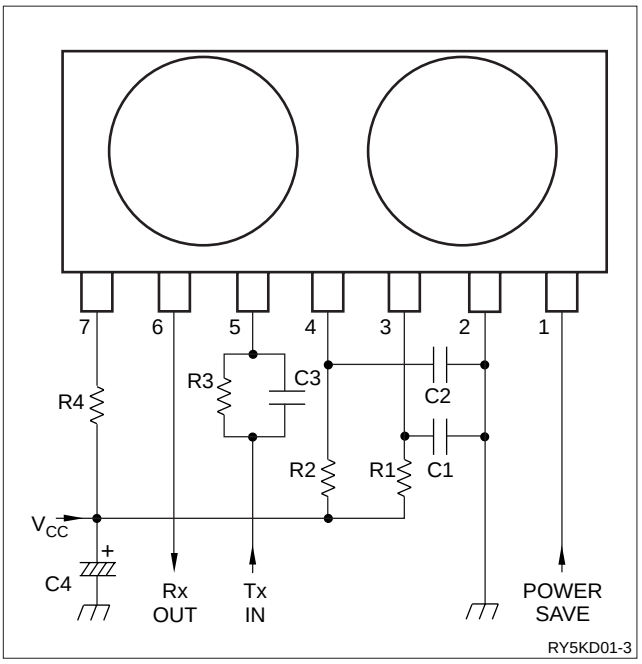


Figure 3. Application Circuit

The 'Power Save' pin is an active HIGH terminal, and performs the power save function in accordance with Table 3.

The switching time from 'Power Save' to 'Normal' requires a time period of ≥ 50 µs as a Power-up time.

Table 3. Power Save Function

INPUT	PERFORMANCE
HIGH	Power Save Mode
LOW	Normal Operation Mode

APPLICATION MECHANICAL DESIGN HINTS

Recommended Foot Print

Figure 4 shows the recommended foot print for PCB design in using SHARP RY5KD01 infrared transceiver module. All values in Figure 4 are only applicable to design reference and are in mm (UNIT).

Design Hints for Cabinet and IR Cosmetic Window

Figure 5 and the following calculation explain the example and designing hints for cabinet and IR cosmetic window with ±18° viewing angles, in vertical and horizontal axis. All values for the transceiver dimensions are applicable only for design reference, and in mm (UNIT).

The optical window size should be the minimum of W × H rectangular or elliptical in order to not reduce IrDA data transfer performance. In the example, having a viewing angle of + 18°, which conforms to or exceeds the IrDA Serial Infrared Physical Layer Link Specifications the dimensions for W can be calculated by the formula W = 2 × L × tan 18 + w and the dimensions for H can be calculated by the formula H = 2 × L × tan 18 + h. Any values to be calculated with the above formula must be given in mm.

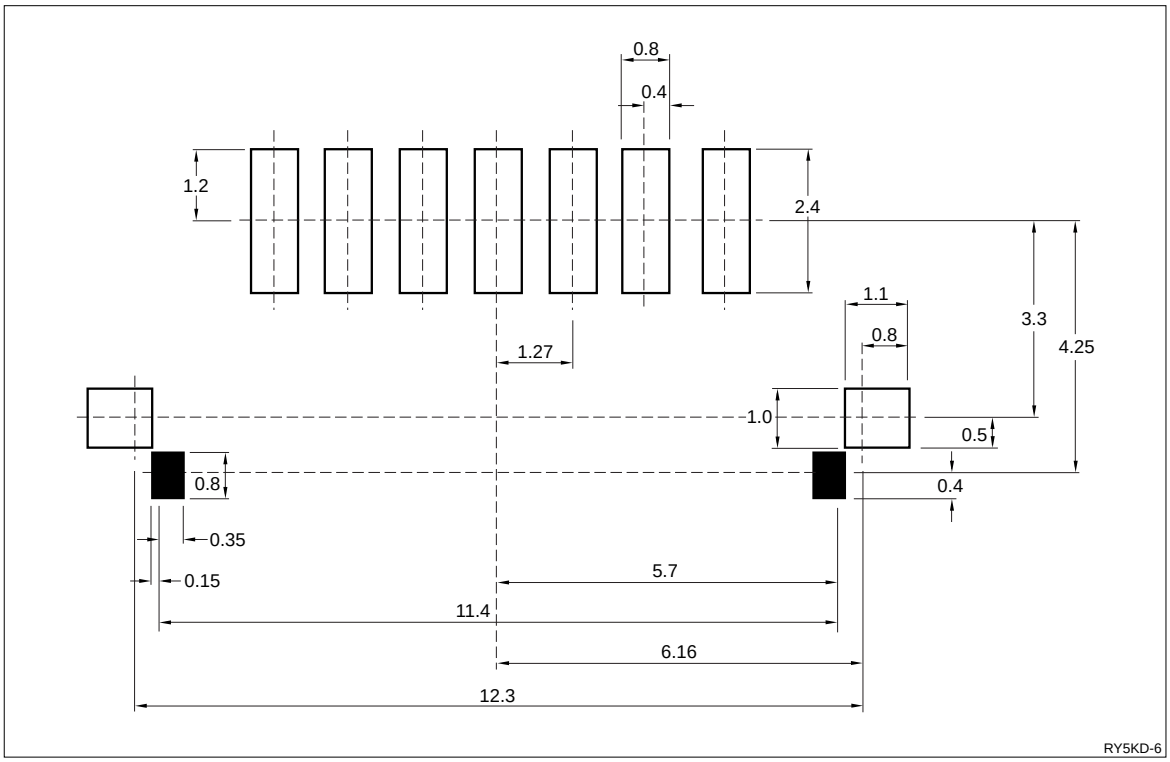


Figure 4. Foot Print for PCB Design

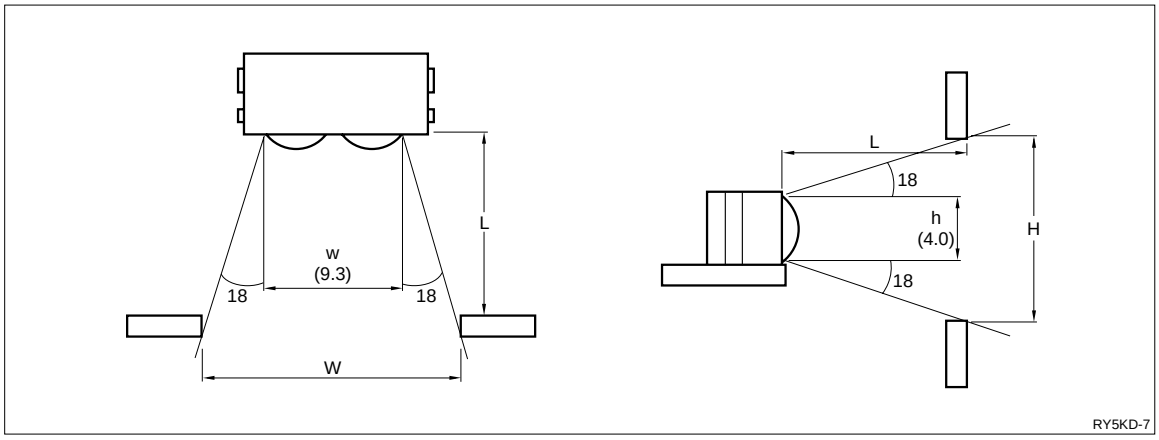


Figure 5. IR Cosmetic Window and Cabinet Example

RECOMMENDED SOLDER REFLOW

Recommended Solder Reflow Profile

Figure 6 is a straight line representation of a recommended temperature profile for IR solder reflow process. The temperature profile is divided into four process sections with three temperature/time change rates. The temperature/time details are described in Table 4.

In Process Section 1, the PCB and SMD RY5KD01 (or RY5KD01K) castellation pinouts joints are heated to a temperature of 150°C to activate the flux in the solder paste. The temperature ramp up rate R1, should be within the range of 1°C to 4°C per second.

Process Section 2 should allow sufficient time for the solder paste to dry. Ninety seconds ±30 seconds is recommended for optimum results. It is also recommended that the temperature remain stable with little termperature increase, preferably remaining at the level of 150°C.

Process Section 3 is the section for solder reflow. In this section, the temperature should be heated up to the point of 220°C, at the increasing ratio of 1°C to 4°C per second (R2) for desired result. The dwell time above 220°C must not exceed 30 seconds. Beyond 30 seconds, it would result in weak and unreliable connections. The temperature should be reduced with the reducing ratio of -1°C to -4°C per second (R3).

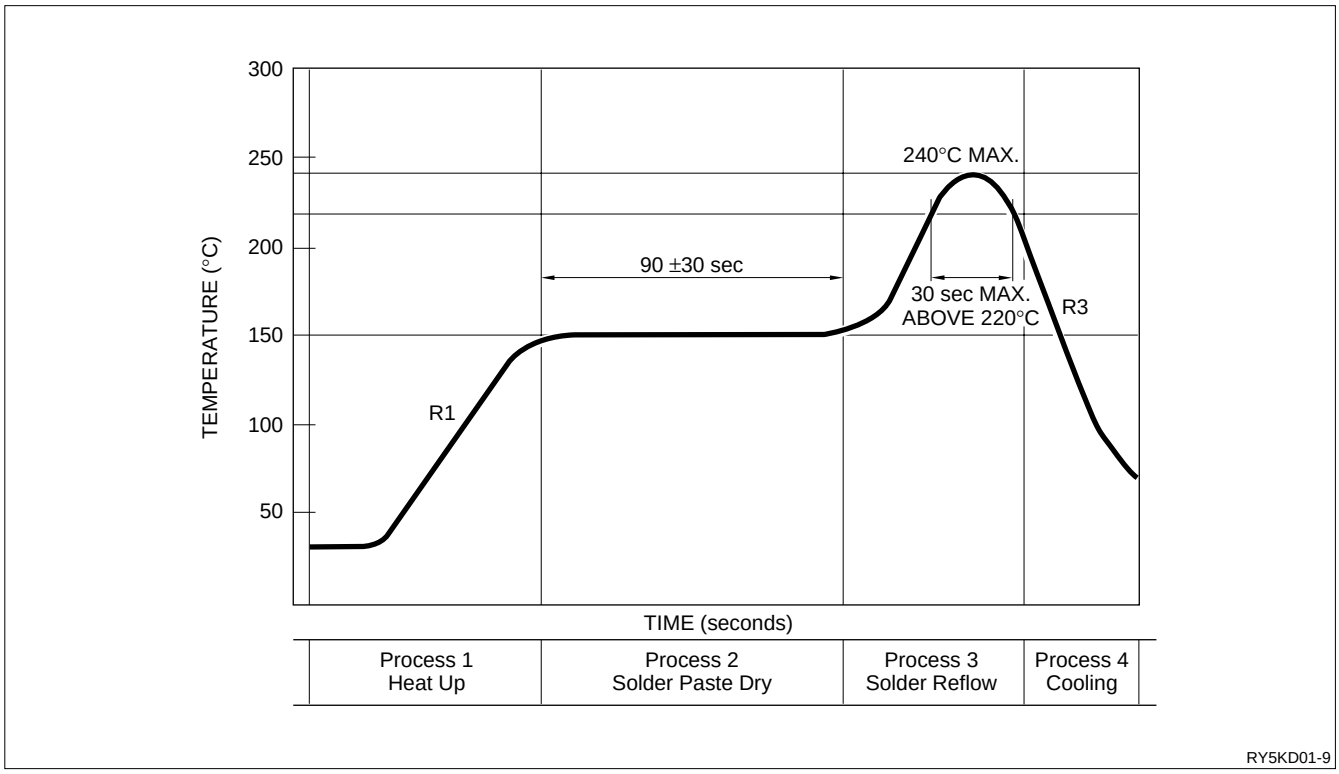


Figure 6. Recommended Temperature Profile for IR Solder Reflow Process

Table 4. Temperature/Time Details

SECTION	TEMPERATURE	SYMBOL	TEMPERATURE/ TIME MAX.
Heat Up	~150°c	R1	1°C ~ 4°C/sec. MAX.
Solder Paste Dry	150°C	—	
Solder Reflow	150°C ~ 240°C	R2	1°C - 4°C/sec. MAX.
Cooling	200°C~	R3	1°C - 4°C/sec. MAX.

Recommended Solder Cream Pasting

For solder reflow of RY5KD01/RY5KD01K, a solder mask should be created to match the recommended PCB foot print.

Figure 7 shows the recommended solder mask dimensions. The thickness of the solder paste should be between 200 mm and 250 mm.

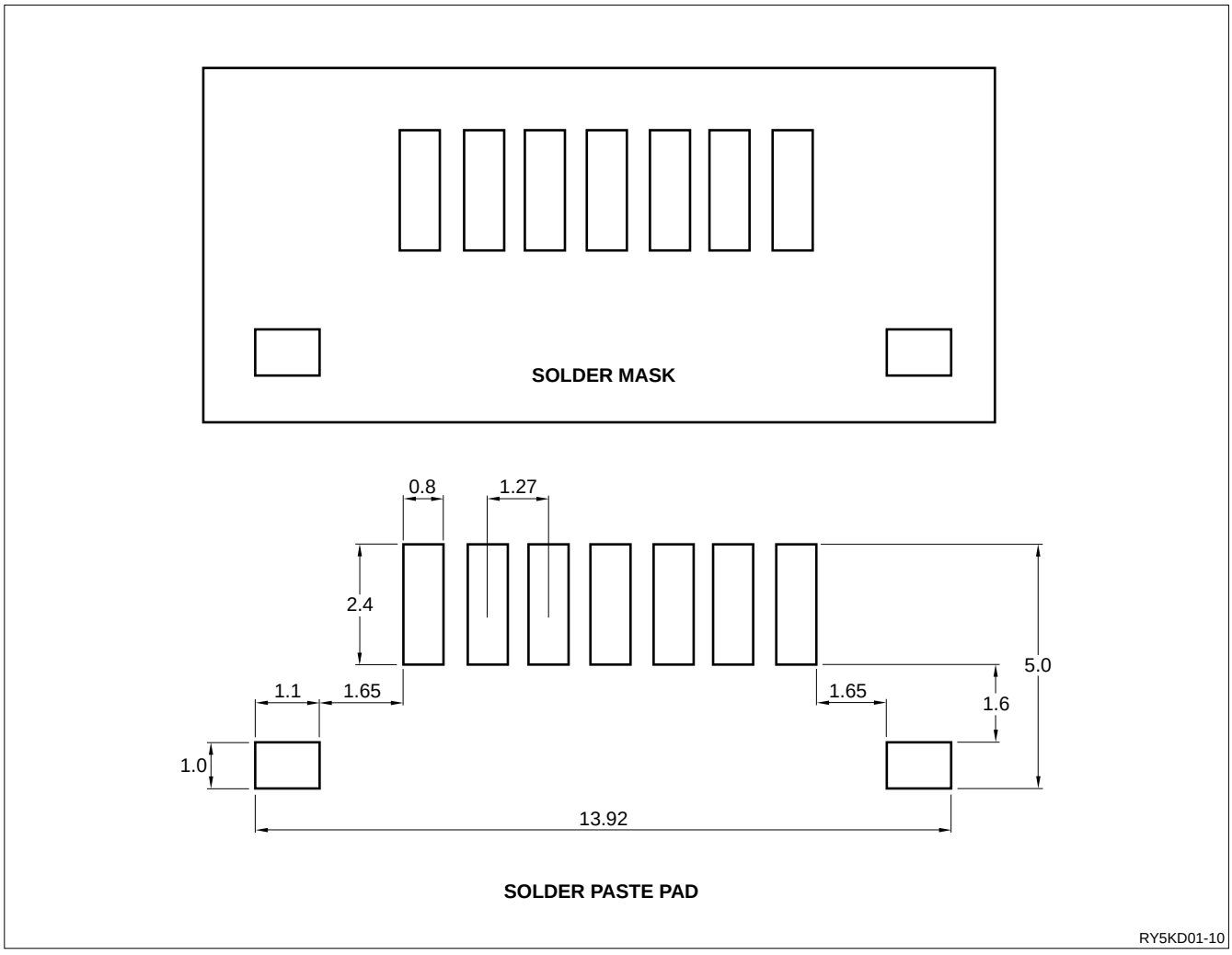


Figure 7. Recommended Solder Mask Dimensions

Evaluation Board

Figure 8 shows the recommended evaluation circuit for the RY5KD01 and RY5KD01K devices. This circuit is provided on an evaluation board for test and evaluation purposes. Please request samples through your Sharp support office or Sales Representative.

The resistor value for RL is adjusted based on the supply voltage. The parallel combination of the three values should be adjusted for approximately 2.7 Ω when V_{CC} = 3.3 V, and 8.2 Ω when V_{CC} = 5 V.

Positions for three components are provided on the board to allow the use of standard resistor values.

To create the 2.7 Ω value, three 8.2 Ω resistors are a standard value and would be connected in parallel. For the 8.2 Ω value, three pieces of 24 Ω will work, or 24.9 Ω is also available.

The resistor positions provided are in the SR1206 footprint, which will support 1/4 Watt resistors. When the 2.7 Ω value is used with V_{CC} = 3.3 V at a forward current of 300 mA, a total of 243 mW is dissipated during LED on-time.

When the 8.2 Ω value is used with V_{CC} = 5 V and a forward current of 300 mA, a total of 738 mW is dissipated during LED on-time. This dissipation is within the rating of the SR1206 package. Since the transmission duty cycle is 25% maximum at 1 Mbps and 4 Mbps, the devices should not be stressed to their limit. When used at a data rate of 115 kbps, the maximum on time is 18.75% of a bit time when the LED is 'on'. Since only the logical '0' values of a data string are sent, the overall duty cycle is below this value.

This test and evaluation board is not intended for production applications, and should not be subjected to long periods at elevated temperature. Operation of the board should be limited to free-air test conditions.

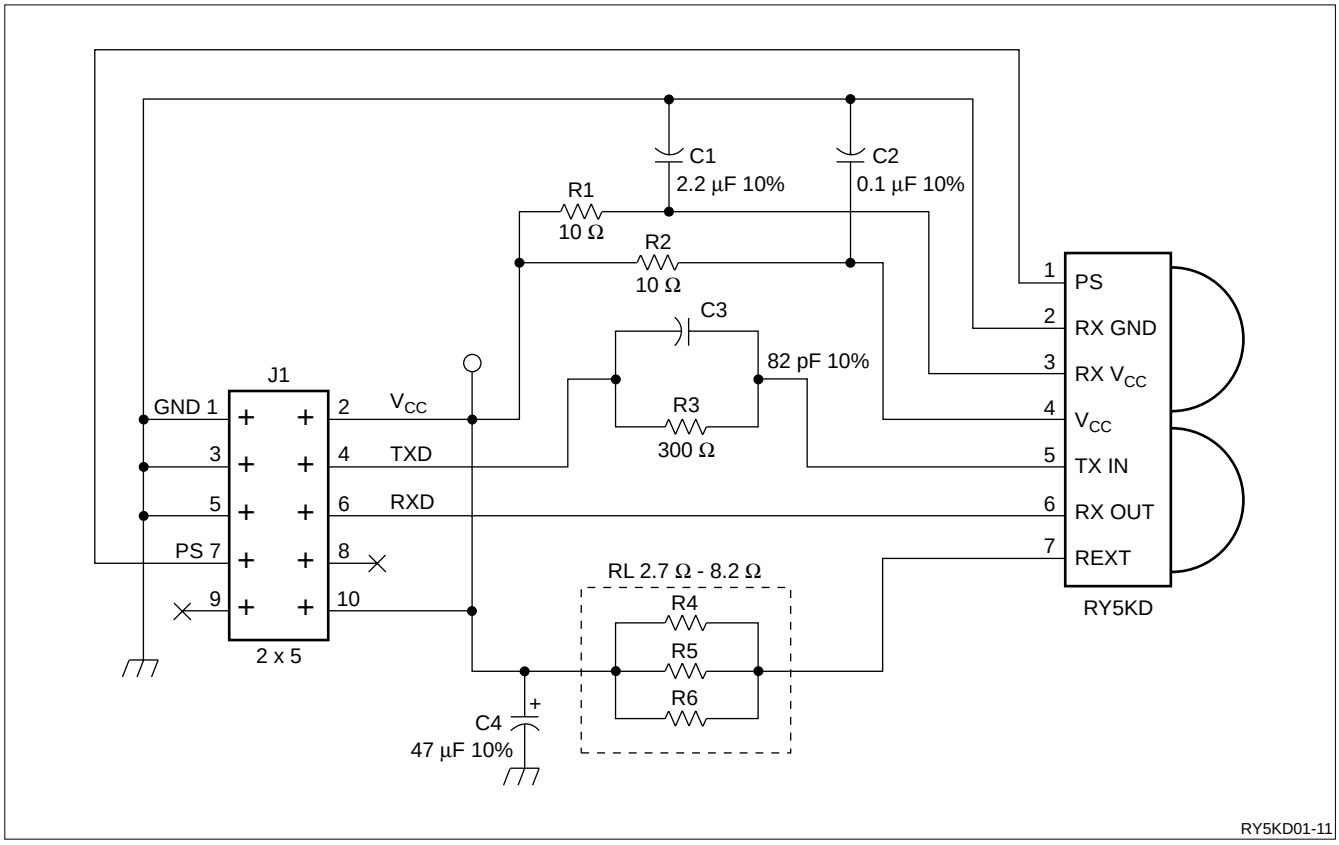


Figure 8. Recommended Evaluation Circuit

LIFE SUPPORT POLICY

SHARP components should not be used in medical devices with life support functions or in safety equipment (or similiar applications where component failure would result in loss of life or physical harm) without the written approval of an officer of the SHARP Corporation.

LIMITED WARRANTY

SHARP warrants to its Customer that the Products will be free from defects in material and workmanship under normal use and service for a period of one year from the date of invoice. Customer's exclusive remedy for breach of this warranty is that SHARP will either (i) repair or replace, at its option, any Product which fails during the warranty period because of such defect (if Customer promptly reported the failure to SHARP in writing) or, (ii) if SHARP is unable to repair or replace, refund the purchase price of the Product upon its return to SHARP. This warranty does not apply to any Product which has been subjected to misuse, abnormal service or handling, or which has been altered or modified in design or construction, or which has been serviced or repaired by anyone other than Sharp. The warranties set forth herein are in lieu of, and exclusive of, all other warranties, express or implied. ALL EXPRESS AND IMPLIED WARRANTIES, INCLUDING THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR USE AND FITNESS FOR A PARTICULAR PURPOSE, ARE SPECIFICALLY EXCLUDED. In no event will Sharp be liable, or in any way responsible, for any incidental or consequential economic or property damage.

The above warranty is also extended to Customers of Sharp authorized distributors with the following exception: reports of failures of Products during the warranty period and return of Products that were purchased from an authorized distributor must be made through the distributor. In case Sharp is unable to repair or replace such Products, refunds will be issued to the distributor in the amount of distributor cost.

SHARP reserves the right to make changes in specifications at any time and without notice. SHARP does not assume any responsibility for the use of any circuitry described; no circuit patent licenses are implied.

SHARP®

NORTH AMERICA

SHARP Microelectronics
of the Americas
5700 NW Pacific Rim Blvd., M/S 20
Camas, WA 98607, U.S.A.
Phone: (360) 834-2500
Telex: 49608472 (SHARPCAM)
Facsimile: (360) 834-8903
http://www.sharpsma.com

EUROPE

SHARP Electronics (Europe) GmbH
Microelectronics Division
Sonninstraße 3
20097 Hamburg, Germany
Phone: (49) 40 2376-2286
Facsimile: (49) 40 2376-2232
http://www.sharpmed.com

ASIA

SHARP Corporation
Integrated Circuits Group
2613-1 Ichinomoto-Cho
Tenri-City, Nara, 632, Japan
Phone: (07436) 5-1321
Telex: LABOMETA-B J63428
Facsimile: (07436) 5-1532