SILERGY

SQ93409RL22-J00

Photo-Relay

General Description

The SQ93409RL22-J00 photo-relay consists of two MOSFETs optically coupled to an internal infrared light-emitting diode, making it a suitable substitute for a mechanical relay. When the internal circuit detects infrared light, it turns on the MOSFETs, changing the MOSFET side from a high-impedance state to a low on-resistance state.

Housed in a compact package, it features low on-resistance and supports ON/OFF switching of currents up to 0.65A, making it suitable for switching applications in high-speed testers or similar systems.

Features

- Isolation Voltage: 500Vrms
- On-State Current: Maximum 0.65A
- R_{ON}: 0.44Ω (Typical)
- 1-Form-A, Normally Open Configuration
- Operating Temperature Range: -40°C ~110°C
- Leakage Current: Less Than 1μA Under 100V Load Voltage
- LED Trigger Current: 3mA (max)
- Compact Package: 2.0×1.45×1.20mm^3 (max 1.30mm height)

Applications

- ATE (Automatic Test Equipment)
- Measurement Equipment

Typical Application Schematic

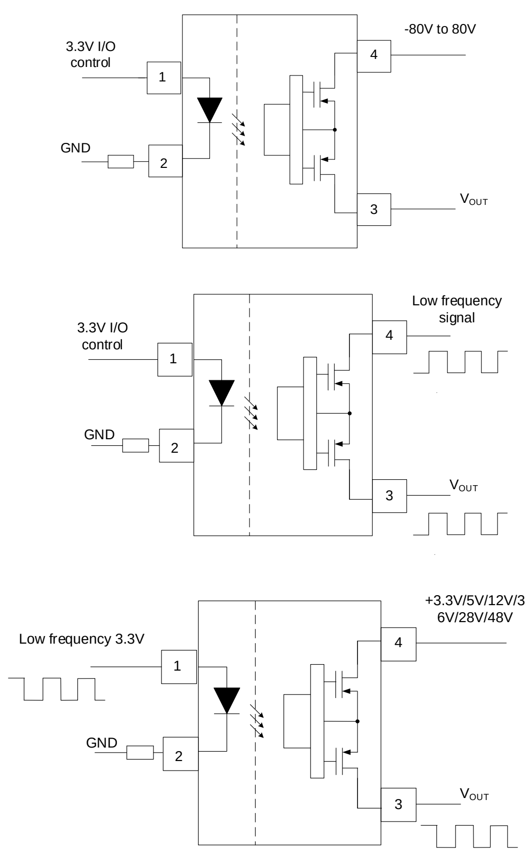


Figure 1. Typical Application Schematic

Ordering Information

Part Number	Package Type	Top Mark	MSL	Delivery Quantity
SQ93409RL22-J00	SMD2015-4 RoHS-Compliant and Halogen-Free	2A1*xyz*	3	2500 pcs/reel

Device code: 2A1,
x=year code, y=week code, z=package lot number code

Block Diagram

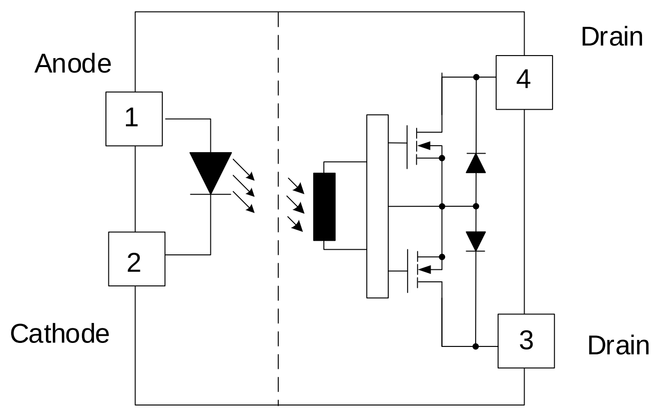
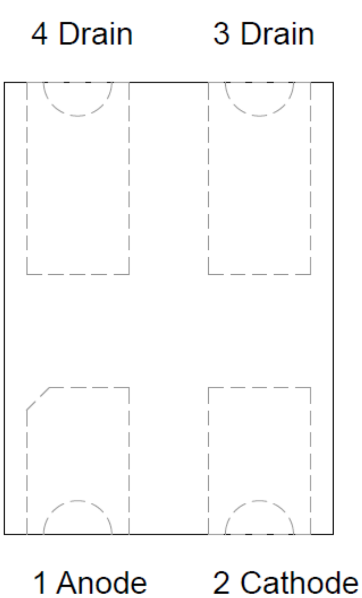


Figure 2. Block Diagram

Device Pinout (Top View)



Pin No.	Pin Name	Pin Description
1	Anode	Anode pin of internal IR LED
2	Cathode	Cathode pin of internal IR LED
3	Drain	Drain terminal of the 1st power MOSFET
4	Drain	Drain terminal of the 2nd power MOSFET

Absolute Maximum Ratings [1] (T_A=25°C unless otherwise specified)

Parameter	Symbol	Min	Max	Unit
LED Input Forward Current	I_F		50	mA
LED Input Forward Current Derating (T_A≥ 25°C)	$\Delta I_F/\Delta T_A$		-0.3	mA/°C
LED Input Reverse Voltage	V_R	-0.3	5	V
LED Junction Temperature	T_j		125	°C
MOSFET Off-State Output Terminal Voltage	V_{OFF}		100	V
MOSFET On-State Current	I_{ON}		0.65	A
MOSFET On-State Current Derating (T_A ≥ 25°C)	$\Delta I_{ON}/\Delta T_A$		-7.0	mA/°C
MOSFET On-State Current (pulsed) (t=100ms, Duty=1/10)	I_{ONP}		2	A
MOSFET Junction Temperature	T_j		125	°C
Storage Temperature	T_{stg}	-55	125	°C
Operation Temperature	T_{ope}	-40	110	°C
Lead Soldering Temperature (10s)	T_{sol}		260	°C
Junction to Air Thermal Resistance[2]	$R_{\theta JA}$		177.9	°C/W
Junction to Case (top) Thermal Resistance	$R_{\theta JC(top)}$		36.5	°C/W
Junction to Board Thermal Resistance	$R_{\theta JB}$		13.0	°C/W
Isolation Voltage (AC, 60s, R.H.≤ 60 % [3])	BV_S		500	Vrms

Recommended Operating Conditions (T_A=25°C unless otherwise specified. [4])

Parameter	Symbol	Min	Max	Unit
Input Forward Current	I_F	5	30	mA
OFF-State Voltage	V_{DD}		80	V
ON-State Current	I_{ON}		0.65	A
Operating Temperature	T_{ope}	-40	110	°C

Photo-Relay Electrical and Optical Characteristics

(T_A = 25°C unless otherwise specified. [5])

Parameter		Symbol	Test Conditions	Min	Typ	Max	Unit
Electrical Characteristics	LED Input Forward Voltage	V_F	I_F=10mA	1.43	1.59	1.75	V
	LED Input Reverse Current	I_R	V_R=5V			10	μA
	LED Input Capacitance	C_t	V=0V, f=1MHz		28		pF
	OFF State Current	I_{OFF}	V_{OFF}=100V			1	μA
			V_{OFF}=80V			1	nA
	Output Capacitance	C_{OFF}	V=0V, f=1MHz		43		pF
Coupled Electrical Characteristics	Trigger LED Current	I_{FT}	I_{ON}=100mA		1.4	3.0	mA
	Return LED Current	I_{FC}	I_{OFF}=10μA	0.1			
	ON-State Resistance	R_{ON}	I_{ON}=0.65A, I_F=5mA, t<1s	0.3	0.44	0.6	Ω
Switching Characteristics	Turn-On Time	t_{ON}	R_L=200Ω,V_{DD}=20V, I_F=10mA		0.45	1.0	ms
	Turn-Off Time	t_{OFF}			0.05	0.2	ms
Isolation Characteristics[3]	Total Capacitance (Input to Output)	C_S	V_S=0V, f=1MHz		1		pF
	Isolation Resistance	R_S	V_S=500V, R.H.≤60%		10^{14}		Ω
	Isolation Voltage	BV_S	AC, 60s	500			Vrms

Note 1: Stresses beyond the “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. This device is sensitive to electrostatic discharge (ESD). Extreme ESD conditions should be guarded against by using proper antistatic precautions for the worktable, operator, solder iron, soldering equipment and so on.

Note 2: Thermal resistance values are obtained by thermal simulation.

Note 3: This device is considered a two-terminal device: Pins 1 and 2 are shorted together, and pins 3 and 4 are shorted together.

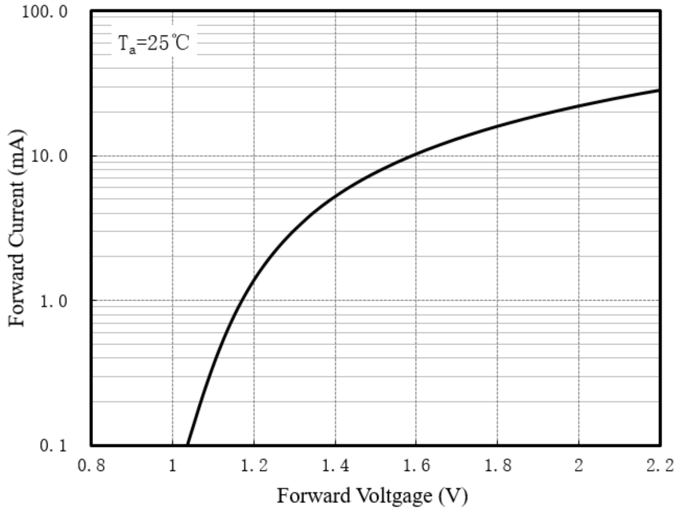
Note 4: The device is not guaranteed to function outside its recommended operating conditions.

Note 5: Unless otherwise stated, limits are 100% production tested under pulsed load conditions such that $T_A = T_J = 25°C$. Limits over the operating temperature range (see recommended operating conditions) and relevant voltage range(s) are guaranteed by design, test, or statistical correlation.

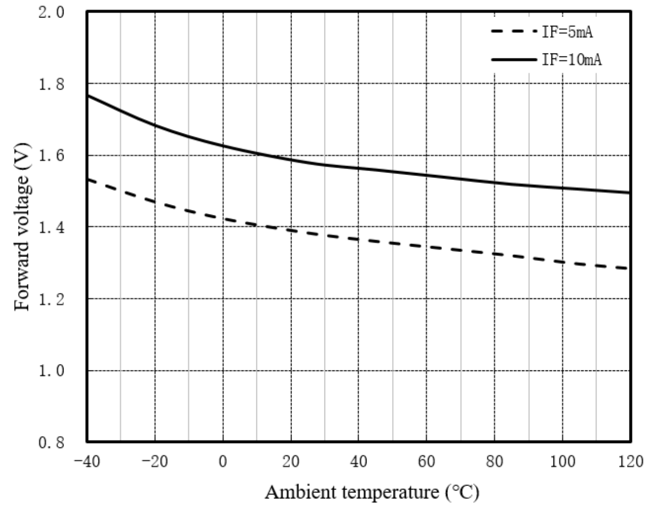
Note 6: Guaranteed by design or statistical correlation and not production tested.

Typical Performance

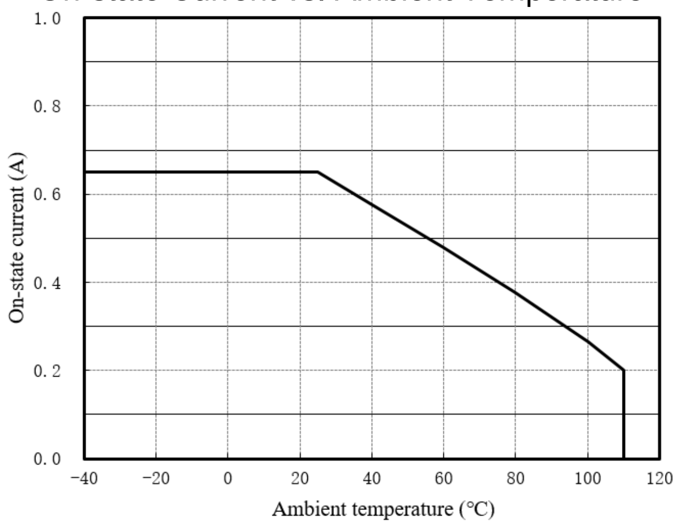
Forward Current vs. Forward Voltage



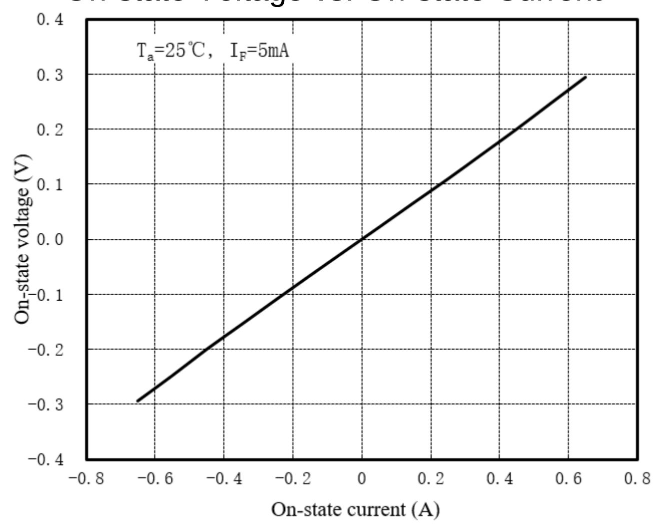
Forward Voltage vs. Ambient Temperature



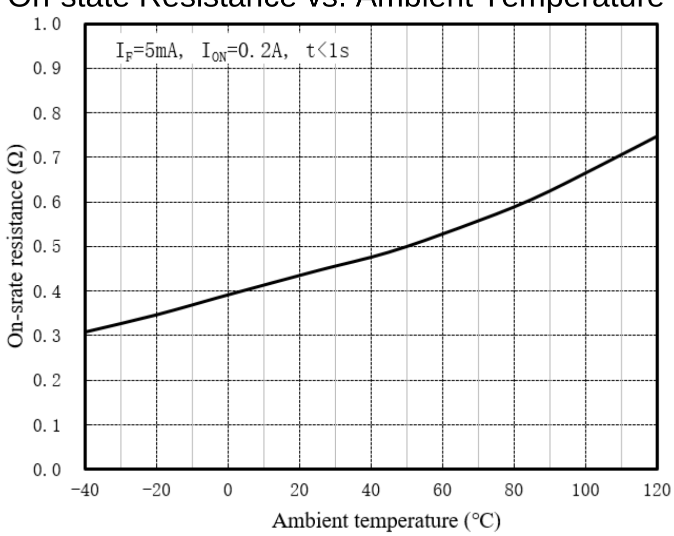
On-state Current vs. Ambient Temperature



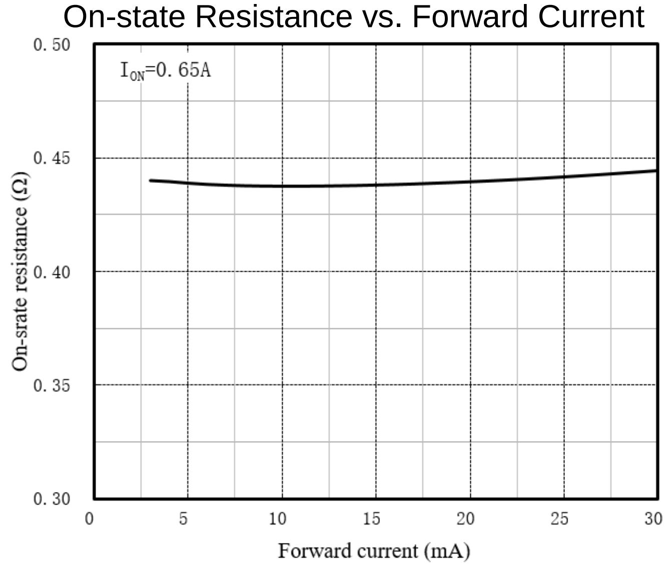
On-state Voltage vs. On-state Current



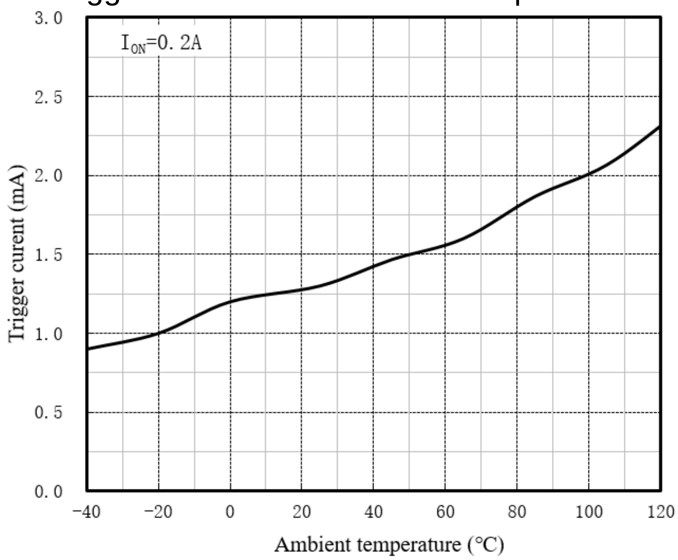
On-state Resistance vs. Ambient Temperature



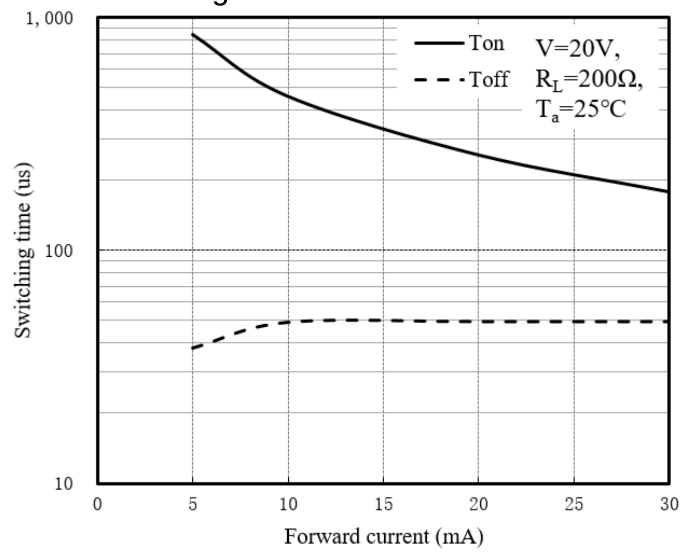
On-state Resistance vs. Forward Current



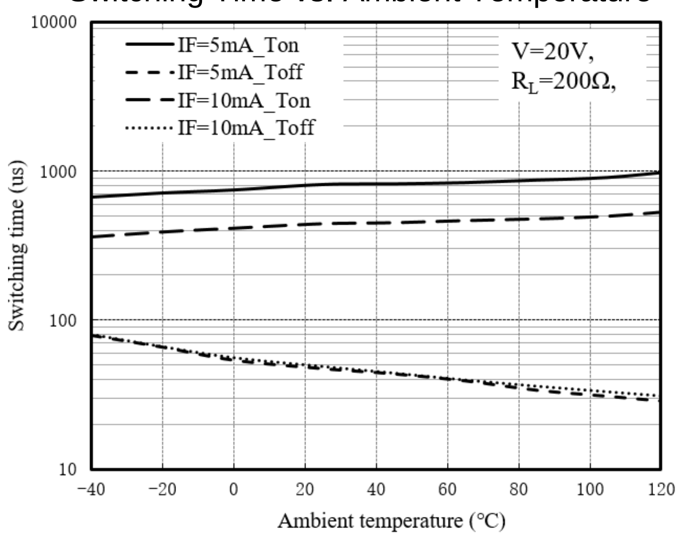
Trigger Current vs. Ambient Temperature



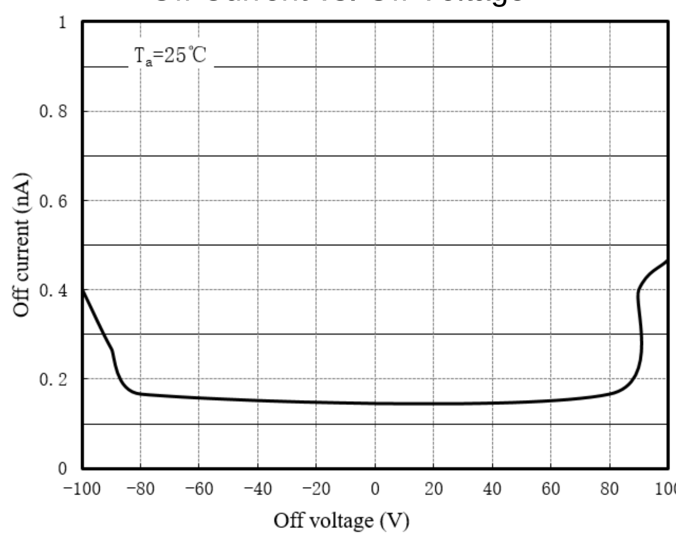
Switching Time vs. Forward Current



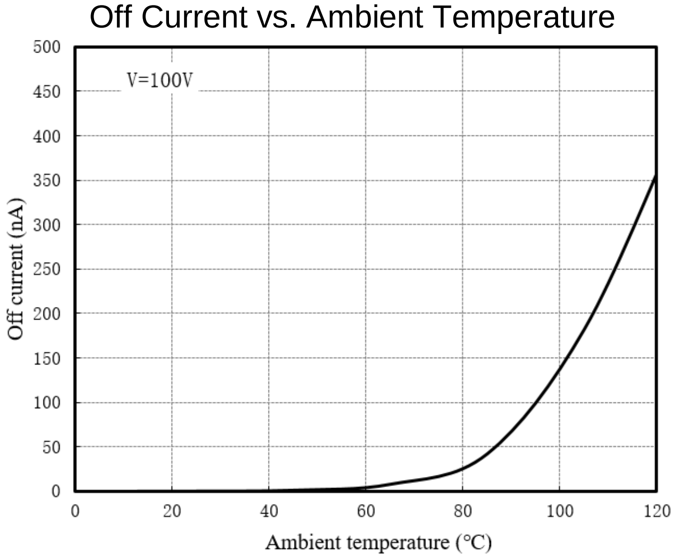
Switching Time vs. Ambient Temperature



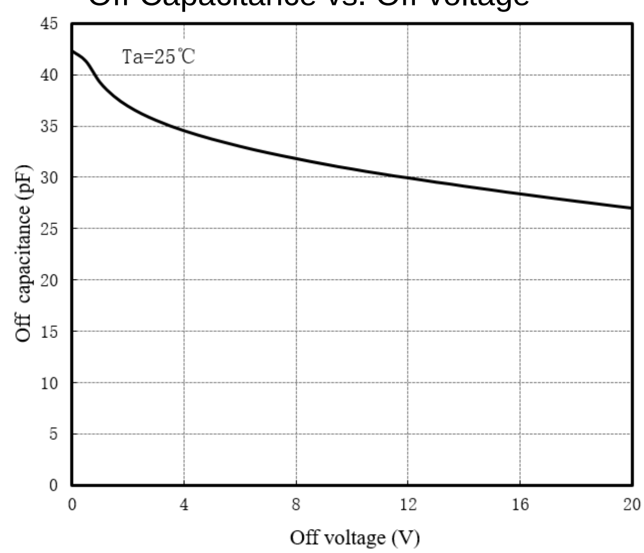
Off Current vs. Off Voltage



Off Current vs. Ambient Temperature



Off Capacitance vs. Off voltage



Application Guide

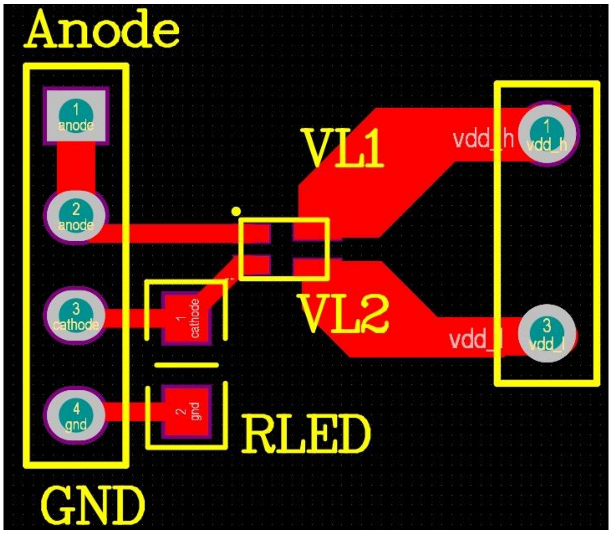
The SQ93409RL22-J00 is easy to use. Typically, only a single resistor is required to protect the internal LED from overcurrent. The resistor value must be calculated to meet the device's lifetime requirements. Since constant-current driven LED emitting energy will decrease as ambient temperature increases, the resistor value should be reduced to generate a higher current for the compensation of the LED emitting efficiency decrease.

A forward current of at least 10mA is recommended for driving the LED. Users should use their supply voltage and the I_F vs. V_F curve to determine the appropriate resistor value.

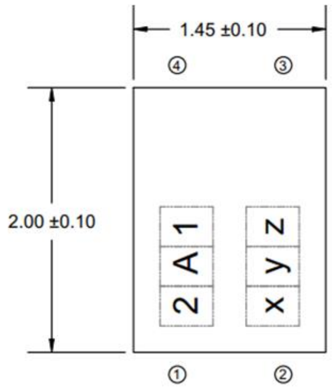
Since the output stage is based on MOSFETs, the same considerations applicable to MOSFET usage should be observed. These include breakdown voltage de-rating and current de-rating based on the temperature increase generated by heat dissipation. A voltage de-rating of approximately 20% is generally recommended.

For layout, users should pay special attention to appropriate heat dissipation measures, such as allocating larger copper areas during layout or leaving sufficient open space for heat dissipation.

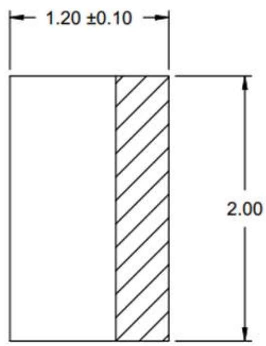
The figure below shows a basic test layout with all traces routed on the top layer. No special layout considerations are required for the input stage due to its lower heat generation. However, for the output stage, wider traces are recommended to improve heat dissipation and extend device lifespan.



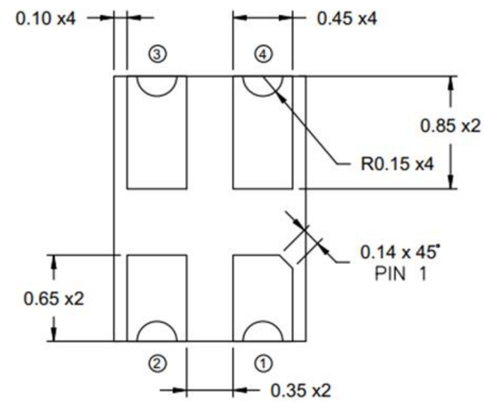
Package Outline and PCB Layout



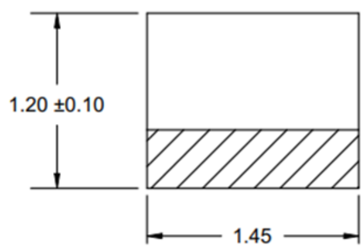
Top View



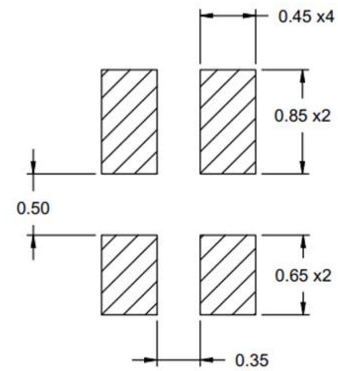
Edge View



Bottom View



Side View



Recommended Land Pattern

Pin Number	Pin Assignment
1	Anode
2	Cathode
3	Drain
4	Drain

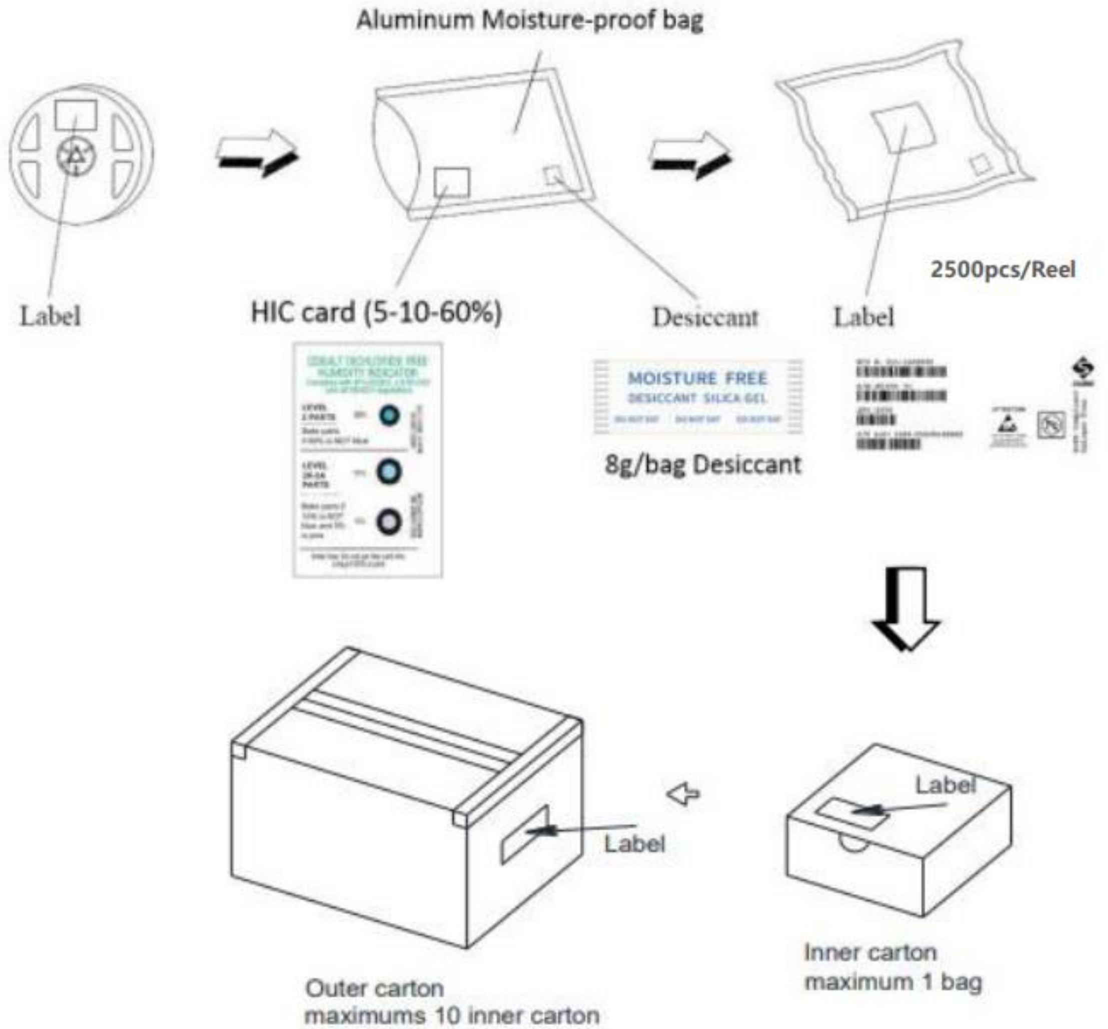
Notes:

1. All dimensions are in millimeters and exclude mold flash and metal burr.

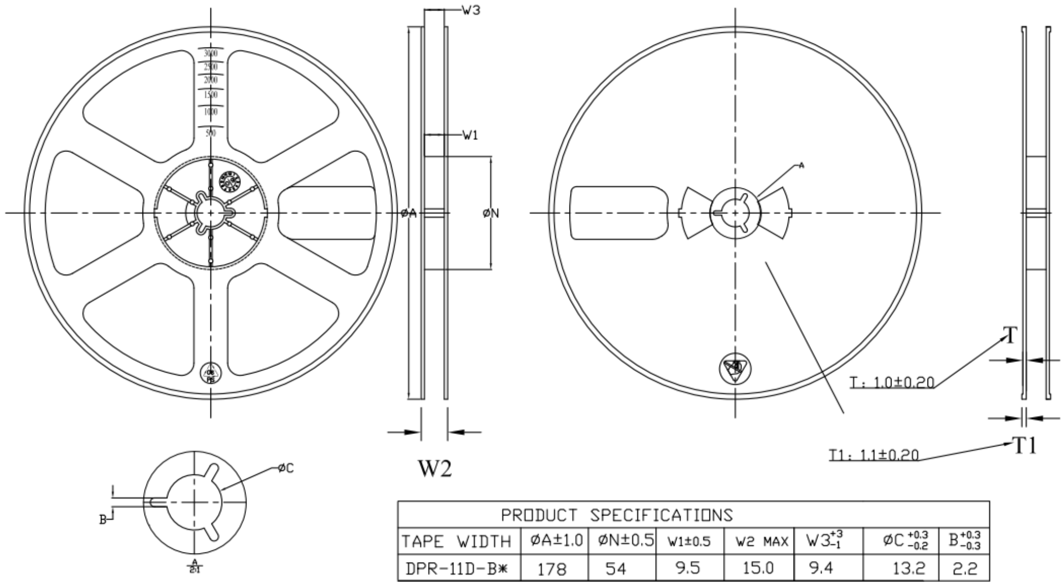
2. All tolerances are ±0.1mm unless otherwise noted.

3. 2A1 is the product code, x,y and z are the tracing lot code.

Packaging Quantity Specifications

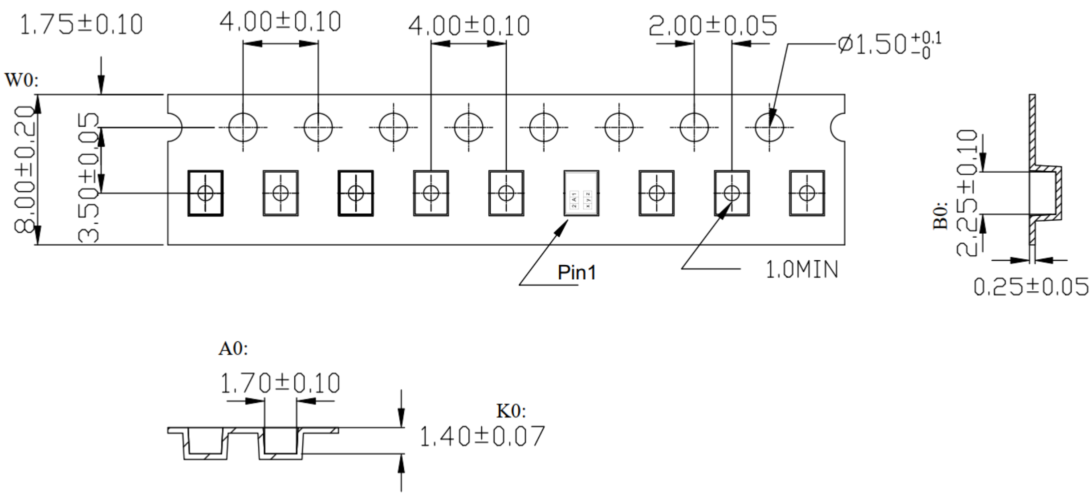


- Dimensions of Reel (Unit: mm)



PRODUCT SPECIFICATIONS							
TAPE WIDTH	ØA±1.0	ØN±0.5	W1±0.5	W2 MAX	W3$^{+3}_{-1}$	ØC$^{+0.3}_{-0.2}$	B$^{+0.3}_{-0.3}$
DPR-11D-B*	178	54	9.5	15.0	9.4	13.2	2.2

- Dimensions of Tape (Unit: mm)



Recommended Method of Storage

Storage is recommended as soon as the bag has been opened to prevent moisture absorption. If moisture-proof bags are not available, the following conditions should be observed:

- Storage temperature: 10°C to 30°C
- Storage humidity: ≦60%RH max.
- Storage Time: ≦168hr max.

Moisture-Proof Package

To avoid moisture absorption by the resin, the product should be stored under the following conditions:

- Temperature: 23 ± 5°C
- Relative humidity: 60% (max)
- Baking is required if the devices have been stored unopened for more than 24 months and the HIC card is not discolored.

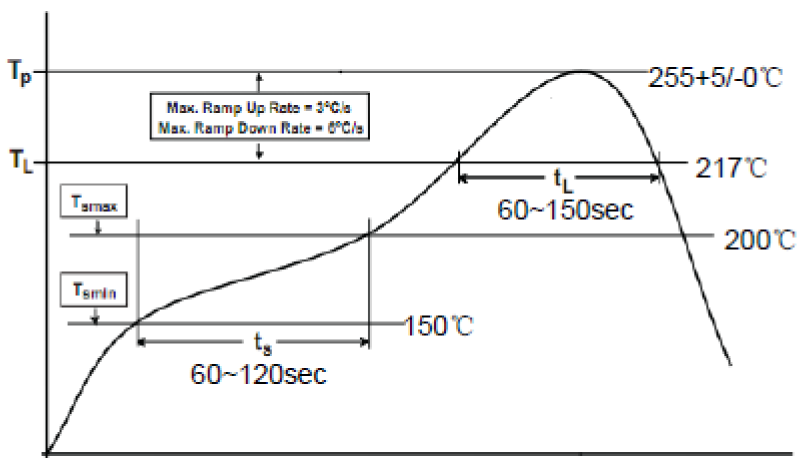
ESD Precaution

Proper storage and handling procedures should be followed to prevent ESD damage to the devices, especially when they are removed from the anti-static bag. Electro-Static Sensitive Devices warning labels are on the packaging.

Hand Soldering Precautions

The temperature must not exceed 350°C (using a 25W soldering iron) for a duration of no more than 3 seconds. Do not apply soldering to the same pin more than once.

Recommended Solder Profile



Note 1: Do not put stress on the devices during heating stage while soldering.

Note 2: Do not warp the circuit board after soldering.

Revision History

The revision history provided is for informational purposes only and is believed to be accurate; however, not warrantied. Please make sure that you have the latest revision.

Revision Number	Revision Date	Description	Pages changed
1.0	Jul. 22, 2025	Initial Release	
1.0a	Sept.17, 2025	Correct the compact package information in ‘Features’	1

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