

# Technical Specification

## TS-DG-00001



|       |              |        |               |
|-------|--------------|--------|---------------|
|       |              |        |               |
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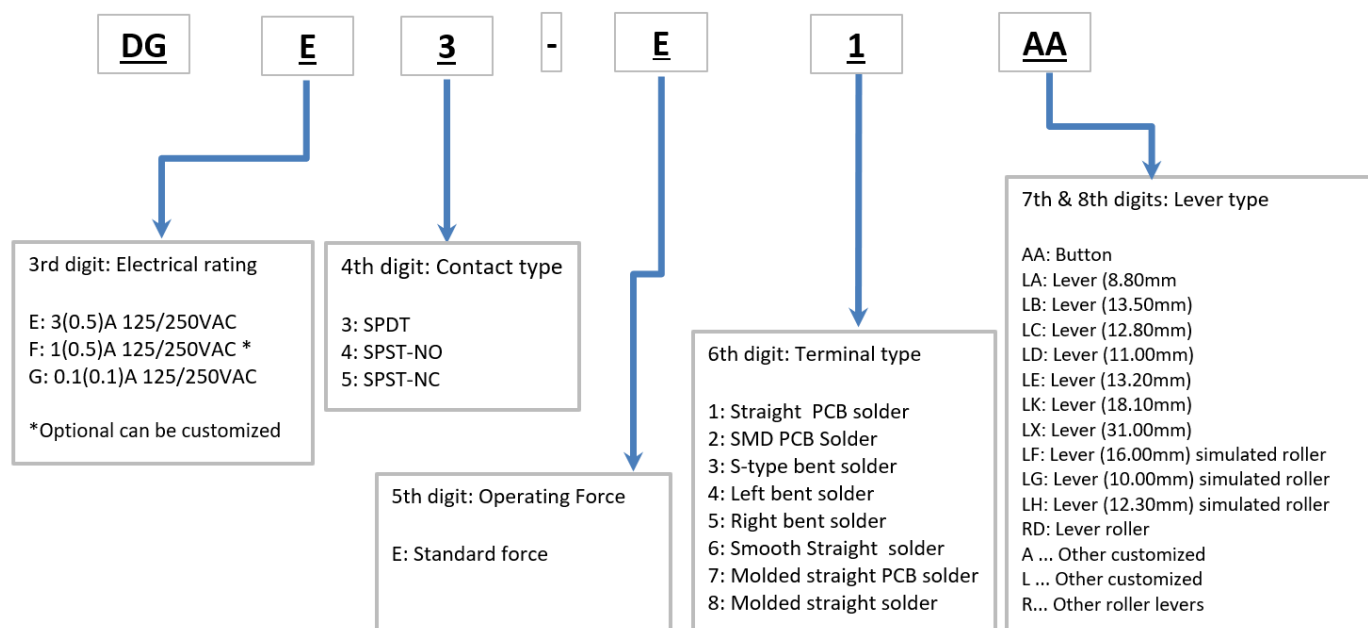
## 1. General Characteristics

- 1.1 Application: This specification is applied to the micro switch for general applications.
- 1.2 Operating Temperature Range: -25℃ to +125℃
- 1.3 Operating Relative Humidity: ≤85% at +5℃ to +40℃
- 1.4 Storage Temperature Range: -25℃ to +40℃
- 1.5 Test Conditions - Unless otherwise specified, the atmospheric conditions for making measurements and tests are as following:  
 Ambient Temperature: 5-35℃  
 Air Pressure: 86-106Kpa (860-1060mbar)  
 Relative Humidity: 25-85%RH

## 2. Appearance, Structure & Dimensions:

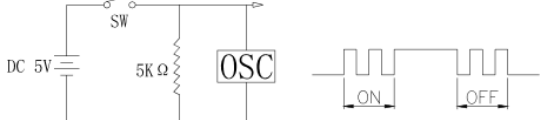
- 2.1 Appearance: The switch shall have good appearance, no rust, crack or plating defects.
- 2.2 Structure & Dimensions: Refer to the product drawing.
- 2.3 Markings: Refer to the product drawing.

## 3. Type Reference Matrix:



## 4. Initial Electrical Characteristics:

| Item                      | Criteria   | Test Method                                                                                                                                    |
|---------------------------|------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| 4.1 Contact Resistance    | 50mΩ Max.  | Shall be measured at 10VDC 0.1A for silver contact and 3VDC 0.01A for gold contact by voltage drop method.                                     |
| 4.2 Insulation Resistance | 100MΩ Min. | 500V DC voltage is applied between each pair of terminals, and between the terminal and exposed non-current carrying metal parts for 60±5 sec. |

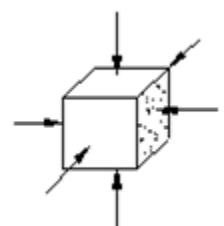
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|-----|--------------------|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| 4.3 | Dielectric Voltage | No dielectric breakdown shall occur. | Between terminals: 1000V AC shall be applied for 1 minute,<br>Between terminals and grounded parts: 1500V AC shall be applied for 1 minute. |
| 4.4 | Bounce time        | ON: 4 ms Max<br>OFF: 4 ms Max        |  <p>Remark: Min testing voltage 3V.</p>                   |

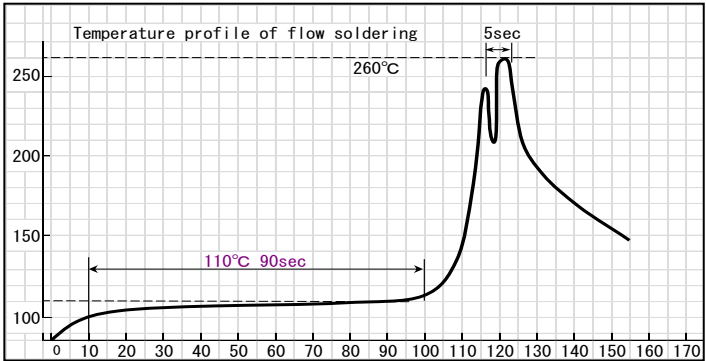
## 5. Initial Mechanical Characteristics

| Item                   | Criteria                       | Test Method                                                                                                                                   |
|------------------------|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| 5.1 Operating Force    | Refer to the product drawings. | A static load shall be applied to the tip of actuator in operating direction to change the component to operating position                    |
| 5.2 Releasing Force    |                                | A static load shall be reduced to the tip of actuator in operating direction to change component from operating position to release position. |
| 5.3 Free/Rest Position |                                | When the switch is free, the distance between the operation element end and the surface of PCB.                                               |
| 5.4 Operation position |                                | When the switch switched on, the distance between the operation element end and the surface of PCB                                            |

## 6. Mechanical Characteristics

| Item                               | Criteria                                                                        | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------------|---------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6.1 Actuator and Terminal Strength | After test:<br>- Electrically and mechanically performances shall be satisfied. | A static load shall be gradually applied to objects to be tested for 5 sec. Each object can be tested once.<br>Actuator: 4.9N min.<br>Axial direction of terminals: 9.8N min.<br>Other directions of terminals: 4.9N min.                                                                                                                                                                                                                                                          |
| 6.2 Vibration Test                 | After test:<br>- Electrically and mechanically performances shall be satisfied. | Switch shall be fixed to the testing machine under required mounting method, and be tested under following conditions:<br>(1) Vibration frequency range = 10-55 Hz<br>(2) Amplitude = 1.5mm<br>(3) Sweep ratio: 10-55-10Hz<br>Approx. 1 min.<br>(4) Method of changing the sweep vibration frequency: Logarithmic or linear<br>(5) Direction of vibration: Three perpendicular directions including actuating direction.<br>(6) Duration: 2 hours per direction (6 hours in total) |
| 6.3 Shock Test                     | After test:<br>- Electrically and mechanically performances shall be satisfied. | Switch shall be tested under following conditions:<br>(1) Mounting Method: Normal<br>(2) Acceleration: <u>490m/s<sup>2</sup></u> (50G)<br>(3) Duration: <u>11ms</u><br>(4) Test Direction: 6 directions<br>(5) Number of shocks: 3 times per direction<br>(18 times in total)                                                                                                                                                                                                      |

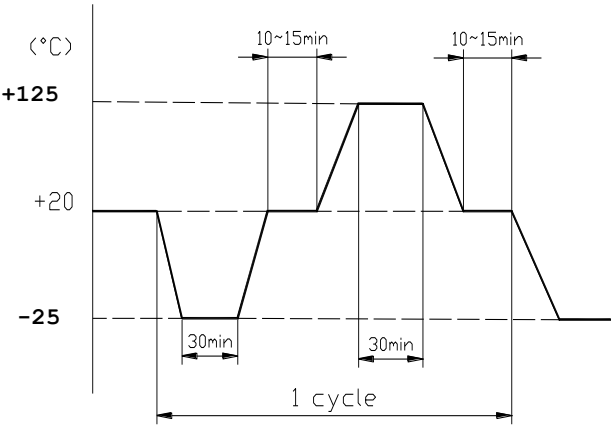


|     |                        |                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-----|------------------------|----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6.4 | Solderability          | More than 75% of immersed part shall be covered with solder.<br>(Except for cutting Profile) | Switch shall be tested under following conditions:<br>(1) Solder: Sn-3Ag-0.5Cu<br>(2) Flux: Rosin Flux JIS K 5902<br>(3) Soldering Temperature: $260 \pm 5^{\circ}\text{C}$<br>(4) Immersing Time: $3 \pm 0.5$ sec.                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 6.5 | Solder Heat Resistance | After test:<br>- Electrically and mechanically performances shall be satisfied.              | Switch shall be tested under the following conditions:<br>(1) Soldering Temperature & Immersing Time(tin/lead-free):<br>Wave soldering: $260 \pm 5^{\circ}\text{C}$ Max 5 sec.<br>Manual soldering: $350 \pm 10^{\circ}\text{C}$ Max 5 sec.<br>(2) Solder: Sn-3.0 Ag-0.5 Cu tin/lead-free.<br>(3) Flux: 25% Rosin, 75% methyl alcohol colorless transparent solution.<br>(4) Immersing speed: $25(\pm 6)$ mm/sec.<br>(5) Immersion Depth: be 1~1.5mm apart from the assembly reference surface.<br>(6) The product should go through wave soldering for 1 time under following condition.<br><br> |

## 7. Durability Characteristics

| Item                                 | Criteria                                                                                                                                                        | Test Method                                                                                                                                                                                                                                                                                                            |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7.1 Mechanical Lifetime without Load | After test:<br>- Contact resistance : $1\Omega$ Max<br>- Insulation resistance: $10\text{M}\Omega$ Min.<br>- Operating force range: $\pm 30\%$ of initial value | Operation shall be performed continuously at a rate of 200 cycles per minute without load for 1,000,000 cycles.                                                                                                                                                                                                        |
| 7.2 Electronics Life Time            | - Other electrical and mechanical performances shall be satisfied.                                                                                              | UL/ENEC/CQC: Under the condition of nominal load, operations shall be performed continuously at a rate of 6 to 10 cycles per minute for 25,000 cycles.<br><br>No UL/ENEC/CQC (for DGG) certified: Continuously operating at 50mA/30VDC for 200,000 cycles, 100% over-travel, 20 cycles/minute, under room temperature. |

## 8. Weather Resistance Characteristics

| Item                             | Criteria                                                                    | Test Method                                                                                                                                                                                                                                                                                                                |
|----------------------------------|-----------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8.1 Low temperature              | After test:<br>- Electrical and mechanical performances shall be satisfied. | After storing at $-25\pm 2^{\circ}\text{C}$ for 96 hours in chamber, the switch shall be allowed to stand under normal temperature and humidity conditions for 1 hour, and the measurement shall be made within 1 hour after that. Water drops shall be eliminated.                                                        |
| 8.2 High temperature             | After test:<br>- Electrical and mechanical performances shall be satisfied. | After storing at $125\pm 2^{\circ}\text{C}$ for 96 hours in chamber, the switch shall be allowed to stand under normal temperature and humidity conditions for 1 hour, and the measurement shall be made within 1 hour after that.                                                                                         |
| 8.3 Heat and Humidity Resistance | After test:<br>- Electrical and mechanical performances shall be satisfied. | After storing at $40\pm 2^{\circ}\text{C}$ , 90-95% RH for 96 hours in chamber, the switch shall be allowed to stand under normal temperature and humidity conditions for 1 hour, and the measurement shall be made within 1 hour after that. Water drops shall be eliminated.                                             |
| 8.4 Temperature Cycling          | After test:<br>- Electrical and mechanical performances shall be satisfied. | After 5 cycles of following conditions, the switch shall be allowed to stand under normal temperature and humidity conditions for 1 hour, and measurement shall be made within 1 hour after that. Water drops shall be eliminated.<br> |

## 9. Remarks

|                                                                                                                                                     |                                                                                               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Unless otherwise specified, the meaning of Electrically and mechanically performances shall be satisfied the following conditions in test standard: |                                                                                               |
| Contact Resistance                                                                                                                                  | 1 $\Omega$ Max.                                                                               |
| Insultation Resistance                                                                                                                              | 10M $\Omega$ Min.                                                                             |
| Dielectric Voltage                                                                                                                                  | 1000 V AC for between terminals and 1500V for between terminals and grounded parts, 1 minute. |
| Operating Force                                                                                                                                     | The elastic force attenuation should be less than 30%                                         |
| Other                                                                                                                                               | The switch shall be no obvious abnormalities in appearance.                                   |



## 10. Precautions for use

### 10.1 General:

The product is used mainly in electronic devices such as automatic devices, visual devices, home electrical appliances, information devices and communication settings. If the products is intended to be used for other endurance equipment requiring higher safety and reliability such as life support system, space and aviation devices, disaster and safety system, it's necessary to make verification of conformity or contact ZF for the details before using. This technical specification (TS) has validity only in connection with the current drawing. Different details on the drawing have priority over the TS. Unless other information is given, all details described here have been defined under room conditions, which means normal conditions (normal pressure, ambient temperature, acc. to ISO 554) and the switches being tested in their rest position (not actuated). Details to the test conditions are described in the test specification.

ZF has the sole and final right of explanation for all the contents included in this technical specification as well as the other issues related to but not included in this technical specification.

### 10.2 Soldering and assembly:

- (1) If there is force applied on the terminal during soldering, the terminal may deform and the electrical characteristics may not be satisfied.
- (2) The soldering conditions should be confirmed according to the actual production environment.
- (3) Don't try to clean the switch with solvent or similar substance after the soldering process.
- (4) Don't operate the switch if it is still hot after soldering.
- (5) The switch might be damaged if using the water soluble flux, so make sure not to use such kind of flux.

### 10.3 Assembly structure and Mechanical design:

- (1) The dimensions for the holes and the pattern on PCB should refer to the recommended dimensions on the engineering drawing.
- (2) Operating Conditions:  
The allowable inclination of keying section is  $90\pm3^\circ$ .
- (3) The switch might be broken if there is stress stronger than the specified is given on it. Take special care not to stress the switch beyond its specification.
- (4) If the switch is being used together other products, please confirm the compatibility of the specification, laws and regulations. Please also confirm the compatibility of switch to be installed in the systems, machines and devices used by customer. If you want to change the operating conditions of the switch, please consult with ZF in advance.

### 10.4 Minimum using load:

Switch is not recommended using in DC load under 12 V 1 mA, otherwise it may cause poor contact.

### 10.5 Operating Environment

- (1) If the product is always used near sulfurate atmosphere or where exhaust gas from automobiles exists, it's necessary to pay more attention because the switch performance may be affected.
- (2) If the below parts or materials are used in the module where the switch is installed, directions below should be followed:
  - A. For parts, rubber materials, adhesive agents, packing material and grease used for the mechanical part of the device, don't use any material that may generate gas of sulfurization or oxidization.
  - B. If silicon rubber, grease, adhesive agents and oil are used, choose the material that will not generate low molecular siloxane gas, because the low molecular siloxane gas may form silicon dioxide coat on the switch contact part, resulting of failing contact. Please contact ZF if you have to use above mentioned substance.
- (3) Don't use the switch in the environment with high humidity or other bedewing possibility, as it may cause current leakage among the terminals.
- (4) The effect caused by external dust intrusion: Because the switch was designed without dust-proof structure, it may have failed contact due to the dust intrusion from the outer environment. When using the switch, it's necessary to take dust-proof actions. Examples of dust intrusion, which should be prevented during the operation:
  - A. The chips and dust come from the notch or hole of PCB in process, or other wastes come from the protective material for PCB, such as newspaper, foam, polystyrene materials, may intrude into the switch.
  - B. The flux or solder powder being generated when stacking the PCB may intrude into the switch.

## 10.6 Storage Conditions:

- (1) In order to maintain the switch performance and the solderability, the switches must be stored under the following conditions:
  - ① Temperature of  $-10^{\circ}\text{C}$  to  $+40^{\circ}\text{C}$ , with humidity lower than 75%RH.
  - ② Avoid to store in the environment containing corrosive air.
  - ③ Avoid to keep in the location with direct sunlight.
- (2) Store using the standard packing without exerting force, self-lock switch should be kept in released position.
- (3) The standard storage period is 3 months, maximum up to 6 months, preferably to be used as soon as possible. After opening the package, you should put the remaining switches in a sealed plastic bag to isolate from damp and corrosive air, moisture proof measures are recommended.

## 10.7 Others

Please comply with the following guidelines:

- (1) The prohibited items which may cause fire and fume:
  - ① It might cause fire if the rating exceeds the specifications. Never use the switch beyond the rating. If the rating may exceed due to some abuse or abnormal usage, please take protective measures such as protective circuit to shut down the circuit when overload.
- (2) Precautions for the safety using of products:
  - ① Although we are confident in switch quality, we cannot deny that there's still little possibility of performance deterioration, short or open circuit, etc. Therefore, please make careful plan when application designing, to evaluate the effect when failure of individual part occurs, to ensure the product safety.
  - ② Prepare the system with protective circuit and protective devices for safety purposes.
  - ③ Prepare safety standby circuit to prevent the whole system shutdown caused by individual failure to ensure safety.

## 11 Appendix: Sketch of operating parameters

