Power Semiconductor Specification

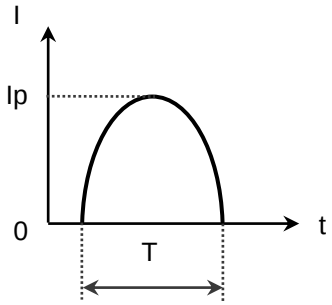
Alternator Diode (Super Low Loss type)
Type code :MSM35H22 / MSM35J22 / MSM35J22R

■1. **Absolute maximum ratings**(Unless otherwise stated, Ta=25℃)

No.	Item	Symbol	Units	Min.	Typ.	Max.	Conditions
1	Operating junction temperature	Tj	℃	-40	-	175	
2	Minimum Operating voltage	Vo	V	8	-	-	
3	Operating frequency	fo	Hz	50	-	3,000	
4	Average rectified forward current	IF(Av)	A	-	-	35	Single-phase half sine wave 50%duty
5	Storage Temperature	Tstg	℃	-40	25	175	Stored at not applied voltage
6	Forward Surge Capability	IFSM	A	530	-	-	T=10±1ms Non-RepetitiveSine Wave*1
7	Reverse Surge Capability	VRSM	V	58	-	-	Refer to followings.*2

■Absolute maximum ratings test conditions

No.6:Forward Surge test*1



T=10±1ms

Non-Repetitive Sine Wave

Fig 1-1. Forward Surge test sequence

No.7:**Reverse Surge *2**

Measuring Circuit

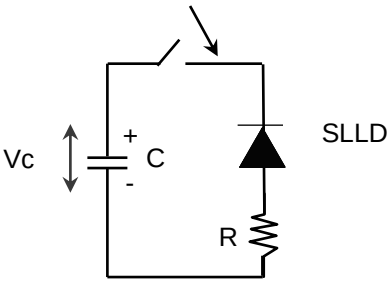
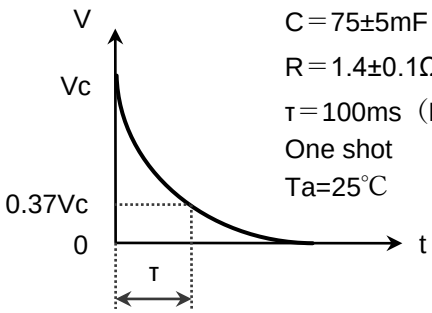


Fig 1-2. Reverse Surge testing circuit

Applied Voltage waveform



C＝75±5mF

R＝1.4±0.1Ω

τ＝100ms（Reference）

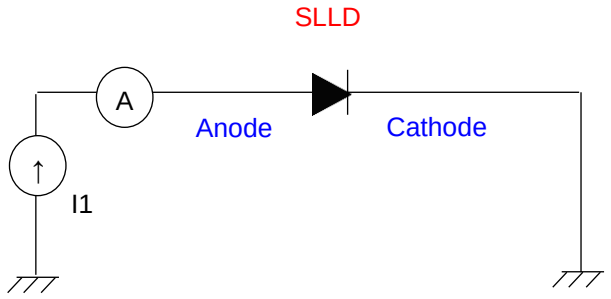
One shot

Ta=25℃

Fig 1-3. Reverse Surge test sequence

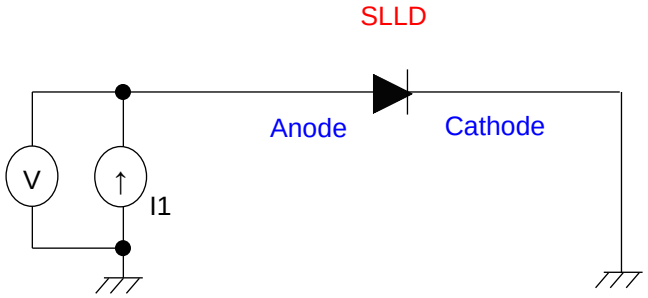
■2. **Electrical characteristics(**Ta=25℃)

No.	Item	Symbol	Units	Min.	Typ.	Max.	**Conditions (Refer to below fig.)**
1	Leakage current .	IR	μA	-	-	0.8	VR=18V
2	Zener voltage	Vz	V	20	-	24	Iz=10mA
3	Active mode forward voltage	$V_{F(35A)}$	V	-	-	0.105	IF=35A,t=5ms
4	Active mode forward voltage	$V_{F(100A)}$	V	-	-	0.3	IF=100A,t=5ms



I1 Power supplier：18V/2mA

Fig 2-1. IR testing circuit



I1 Power supplier：10mA/100V (Vz measurement)

35A or 100A/15V (V_F measurement)

Fig 2-2. Vz and V_F testing circuit

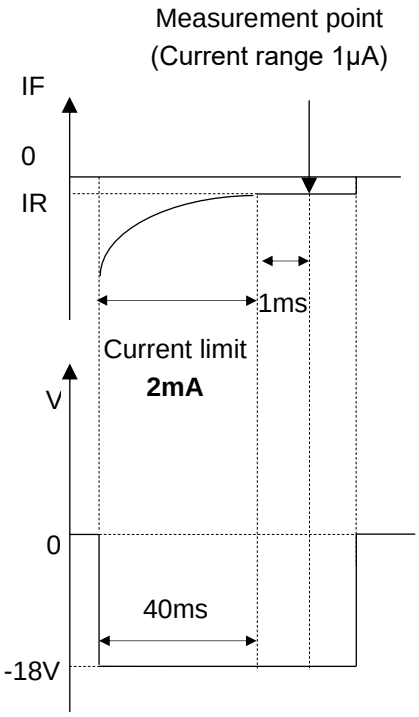


Fig 2-3. IR testing sequence

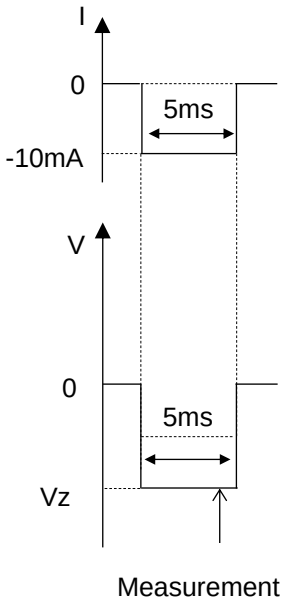


Fig 2-4. Vz testing sequence

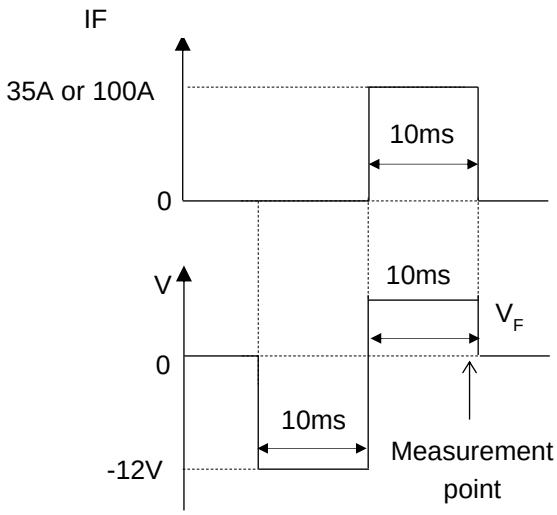


Fig 2-5. V_F testing sequence

We recommend measuring in the order of IR,VZ ,VF.

■3. **Mechanical, reliability characteristics (Ta=25℃)**

No.	Item	Units	Min.	Typ.	Max.	Conditions
1	Press in force	kN	1.5	-	12	Refer to chapter 8.for detail*3
2	Lead bending	mm	-	-	5	Bend 3 times from side to side. Refer toFig.3-1
3	Lead pulling	N	150	-	-	Refer to Fig3-2

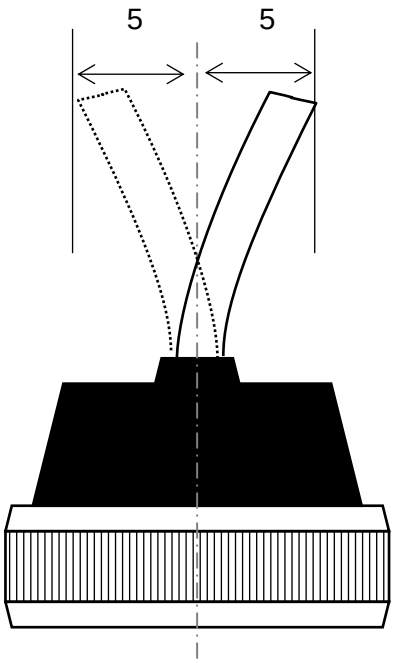


Fig 3-1. Lead bending

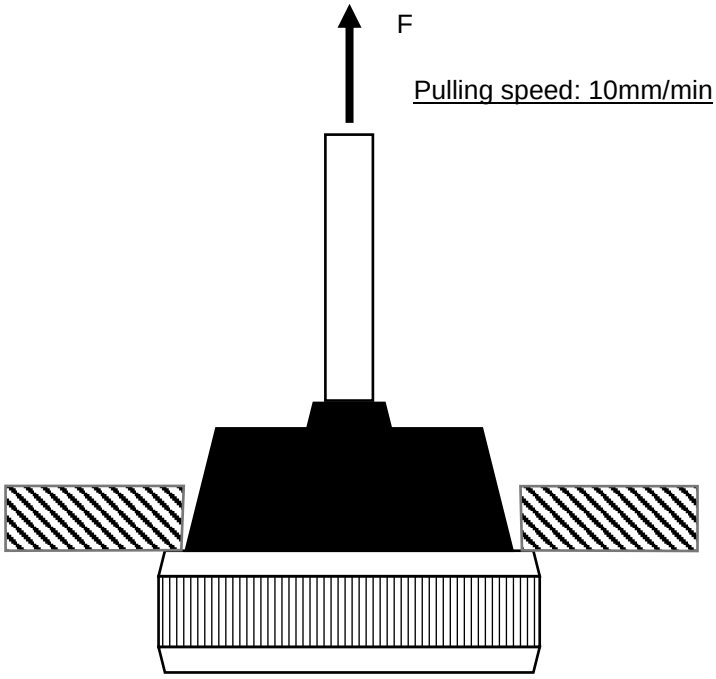


Fig 3-2. Lead pulling

■**4. Reliability test**

No.	Item	Sample	Test conditions	Criteria
1	Thermal fatigue test	11 pair	IF=35A,Tj=50℃⇔175℃, Refer to Appendix B and FigB-1.	B(10) ≧ 3,400 B(50) ≧ 7,200
2	High Temperature Blocking	5 pair	Tc=175℃, V=11±2Vrms, 60Hz or 50Hz	1000hr
3	High Temperature and High Humidity Blocking	5 pair	Tc=80℃±5℃, RH=90%±5%, V=11±2Vrms, 60Hz or 50Hz	1000hr
4	Thermal Shock	11 pair	Tc=-40℃±5℃⇔175℃±5℃ Time to raise, lower and keep temperature 15min.±5min. each	500cycle
5	Water Immersion	5 pair	95℃±5℃ (Water) 10±1min ⇔ within 10sec., 25℃±5℃ (Water) 10±1min.	100 cycles
6	Oil Immersion	5 pair	133±5℃(Oil) 10±1sec. ⇔ R.T.(Air) 60±10min. Oil:ASTM#1, IRM903, or Equivalent	50cycle
7	Gasoline Immersion	5 pair	25±5℃(Gasoline) 10±1sec. ⇔ R.T.(Air) 60±10min. Gasoline: Gasoline for General Vehicle	50cycle
8	Anti-freezing Fluid Immersion	5 pair	95^{+5}_{-0}℃(Anti-freezing Fluid) 10±1sec. ⇔ R.T.(Air) 60±10min. Composition of Anti-freezing Fluid :Ethylene Glycol 50%, Water 50%	50cycle
9	Wash Fluid Immersion	5 pair	50±5℃(Wash Fluid) 10±1sec. ⇔ R.T.(Air) 60±10min. Composition of Wash Fluid: 5±1%Lypon F(Trade name) or Equivalent	50cycle

10	Salt Spray test	5 pair	Test procedure follows JIS Z 2371.	Test procedure follows JIS Z2371.
11	High operating life	11 pair	Ta=175℃, V=18±1Vrms, 3000Hz, R=1±0.1Ω,	1000hr
12	Temperature Humidity-Bias	11 pair	Ta=85±2℃, RH=85±5%, V=18±1Vrms, 3000Hz, R=1±0.1Ω,	1000hr
13	USPCBT	11 pair	Ta=120±2℃, RH=85±5%, Steam Pressure 1.7×10^5Pa V=18±1Vrms, 3000Hz, R=1±0.1Ω,	96Hr
14	PCT	11pair	Ta=121℃, RH=100%, Steam Pressure 2.03×10^5Pa	96hr
15	ESD tolerance	11pair	1)R=2kΩ, C=330pF, Discharge: Contact, Air 2)R=300Ω, C=330pF, Discharge: Contact, Air Test procedure follows ISO10605.	V=±15kV Test procedure follows ISO10605.

■5. Part dimensions

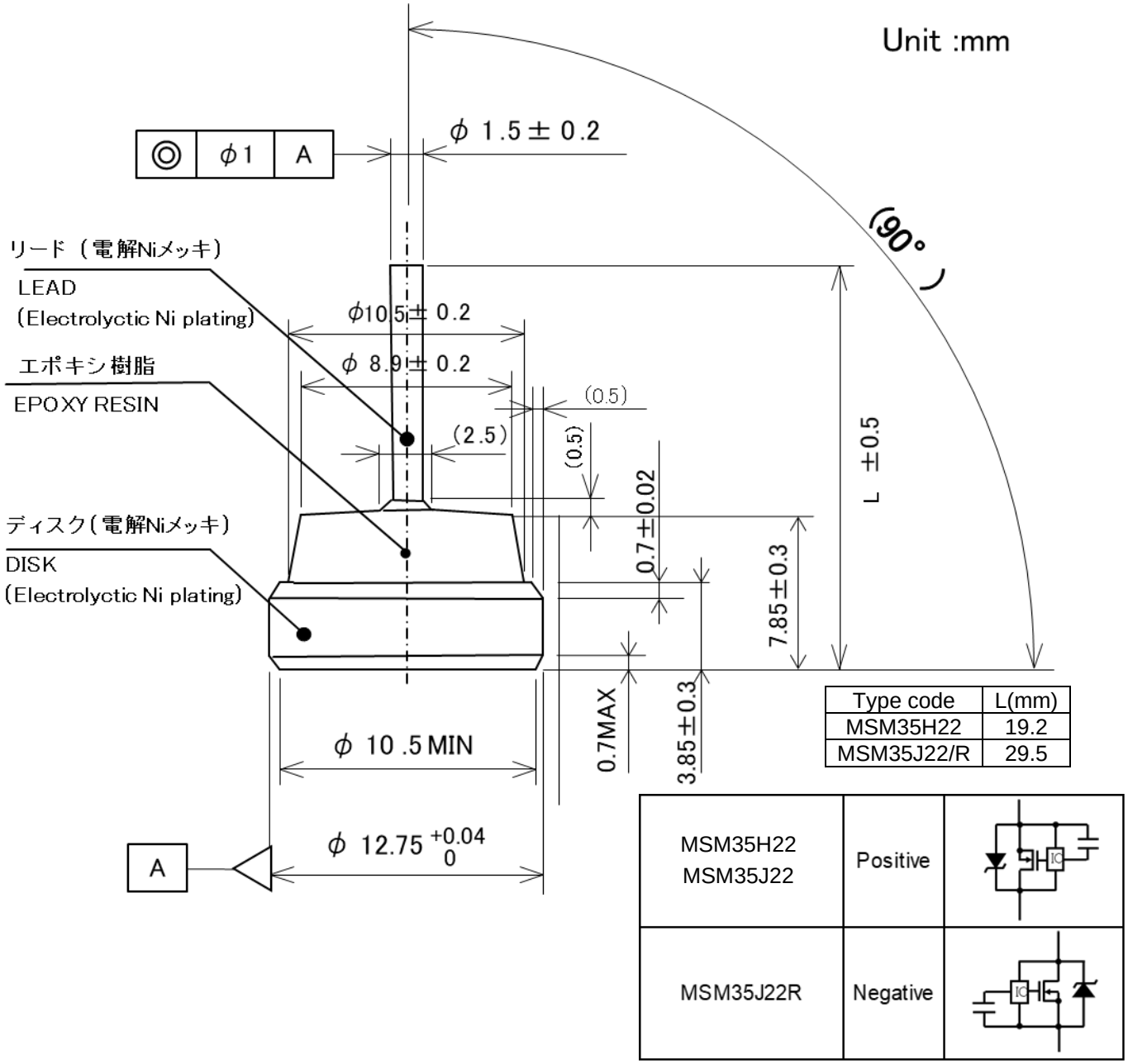


Fig 5. Physical Dimensions

■6.Marking

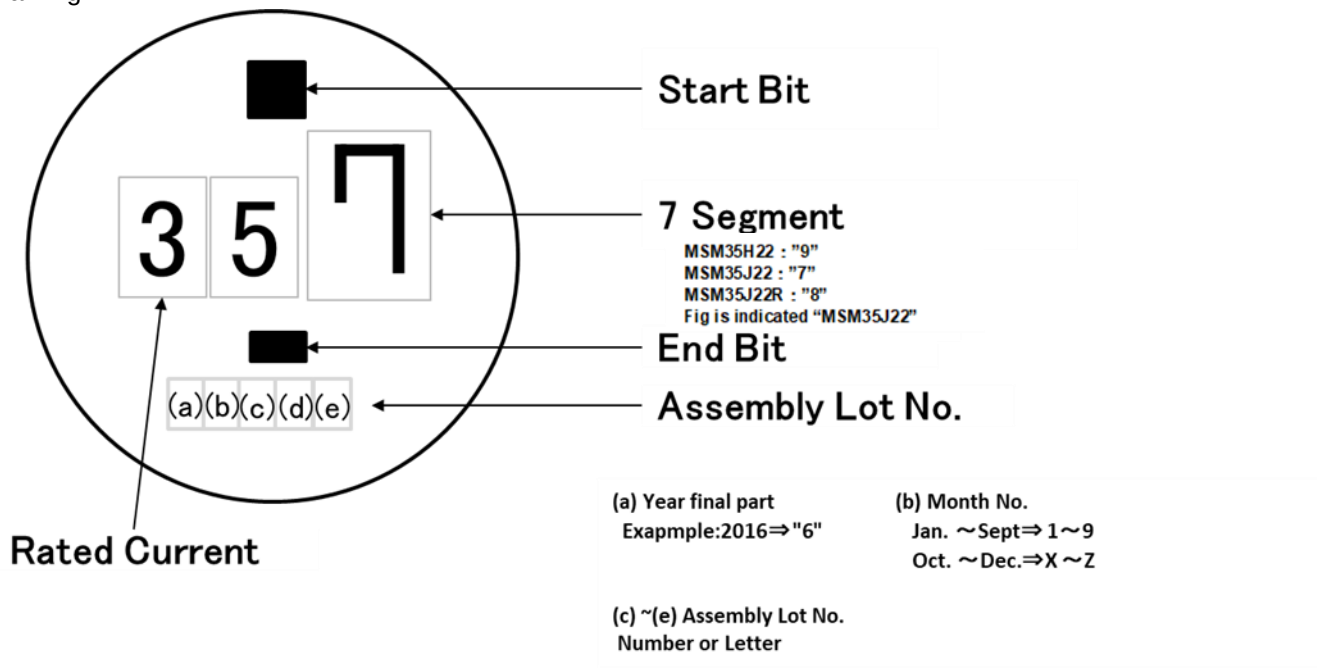


Fig6. Marking diagram

■7.Packing

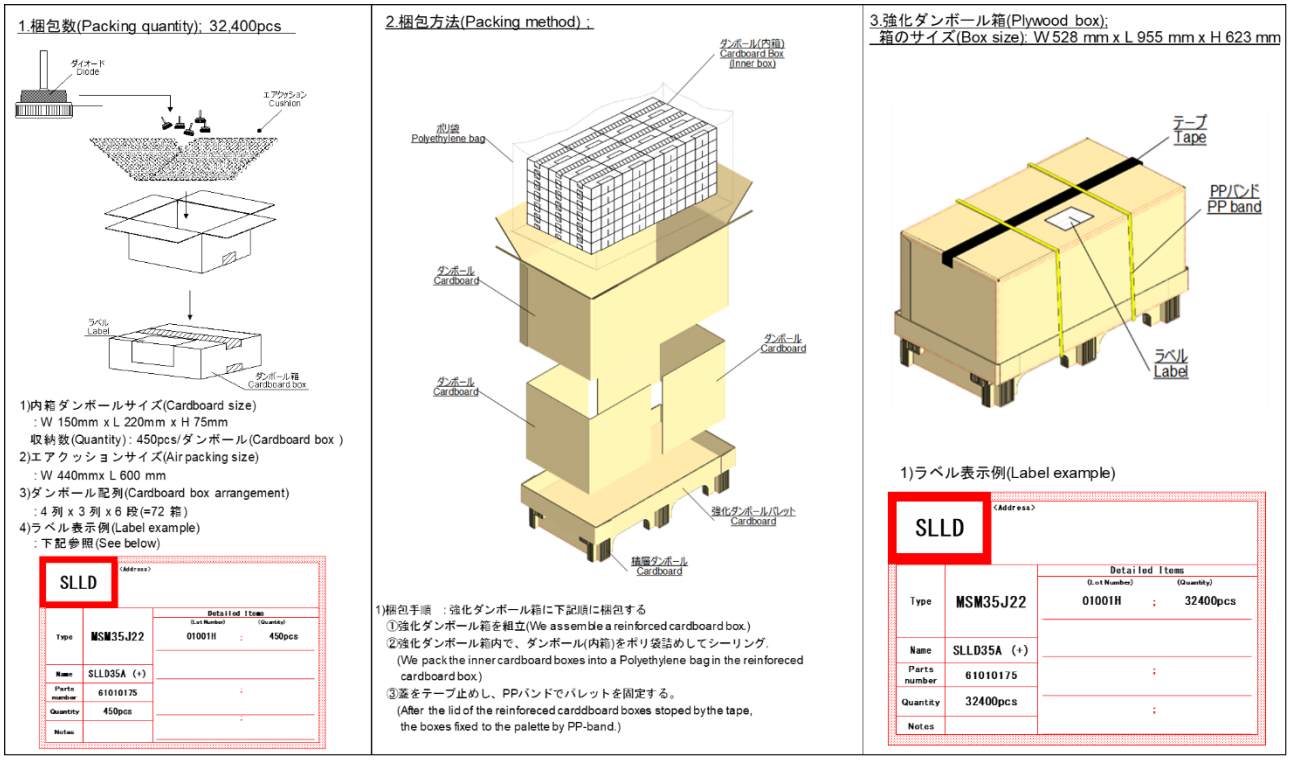


Fig7-1. Packing specification

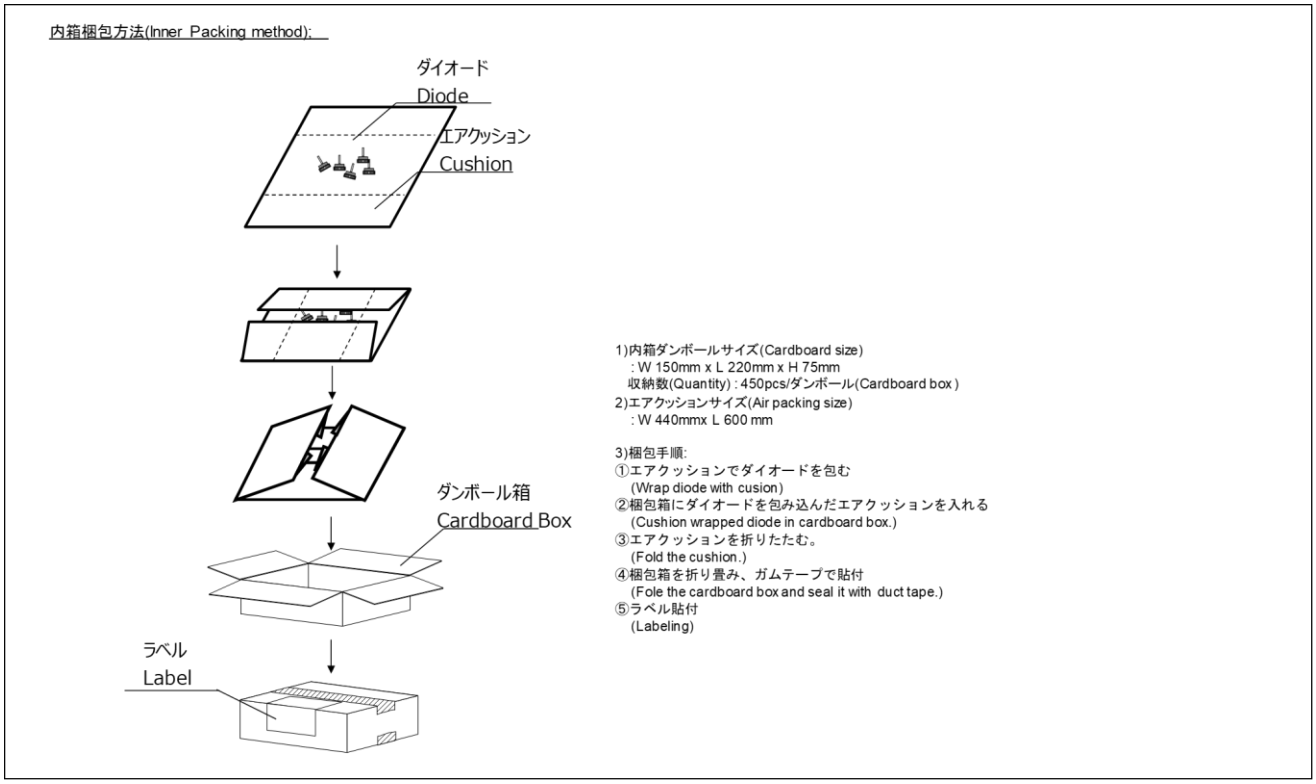


Fig7-2. Packing specification

■8.Notcies on the use of products ***3**

1) Precautions for handling during press-fitting

Based on the following standards, we guarantee the press-fit condition according to the results of the evaluation. Regarding detail validation, please refer to Appendix.C .

The fin (heatsinks) design and press-fit conditions of the fins (heatsinks) should be determined based on this standard. If you deviate from this regulation, there is a possibility that the press-fit conditions may not be able to guarantee, so please contact us in advance.

A) Standard Fin and caution for design

The fins should be designed with the material, dimension described in table 8-1.

In addition, be sure to chamfer the press-fit hole. The recommended value for the Chamfer is C0.5.

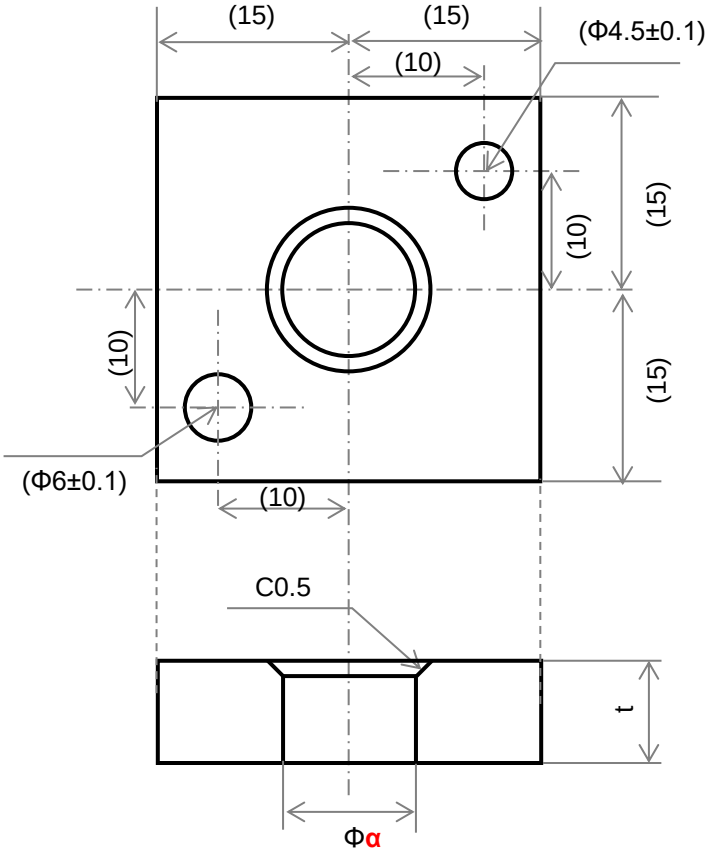


Fig 8-1. FIN outline (unit in mm)

Table.8-1, Standard Fin specification

Material	Thickness t(mm)	Hole size φα(mm)
A5052R-H34	4±0.1	12.625±0.025
ADC12	4±0.1	12.645±0.005

B) Standard press-fit pin(jig)

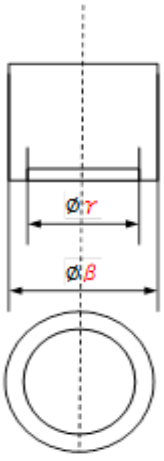


Fig.8-2 Press-fit pin outline

Table.8-2,Standard Press-fit pin

Material	SK105
Press-fit pin outer diameter φβ(mm)	12.2±0.2
Press-fit pin inner diameter φγ(mm)	7±0.05

C) **Press-fit methods and cautions**

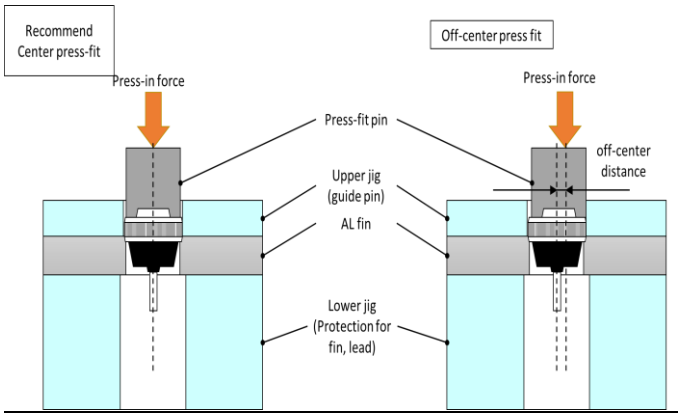


Fig.8-3 Press-fit method

Table.8-3.Press-fit condition

Item	Min	Typ	Max
Press-fit speed (mm/sec)	1	-	5
Off-center distance(mm)	0	0	1.5
Press-fit Depth(mm)	-	-	4
Press-in force (A5052R-H34)	1.5	-	12
Press-in force (ADC12)	1.5	-	12

① Consider the position accuracy of fins, pins, and products so as not to misalignment when press-in. (Refer to Fig8-3)
② We recommend providing a guide with the upper jig to press fit the product vertically rather than diagonally.
③ We recommend providing a lower receiving jig to prevent deformation of the fins during press fitting.
④ Monitor the press-in force and perform process control such as rejecting possible products that are greatly out of the normal distribution.
⑤ Pushing the bottom of disk locally will cause characteristic degradation or destruction of the product.
⑥ When press-fitting, be careful not to get foreign objects between the press-fitting jig and the bottom of the disk.

2) Cautions on lead handling

When corrected the lead bending etc., correct the vertical width of 5mm from the lead tip only once, as shown in Fig.5-4. In addition, the lead should be fixed vertically with terminal block, etc., without stresses such as tension and compression are not applied.

3) Cautions on lead welding

① If it is necessary to bend lead at welding, please follow section 2) above in this chapter.
② If it is necessary to change lead length, you can use by cutting the leads.
③ Regarding lead terminal connections, we recommend the TIG welding.
Due to terminal material, welding method or assembling conditions, it may cause the degradation or destruction of device.
④ Therefore, the processing and welding conditions of the lead should be used after a sufficient pre-evaluation by the customer and the Reliability test after the implementation.

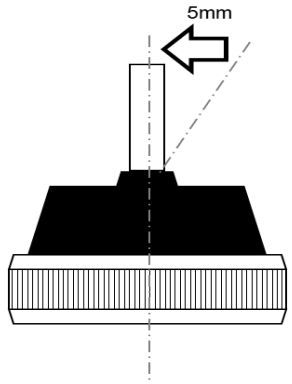


Fig.5-4 Lead bend correction

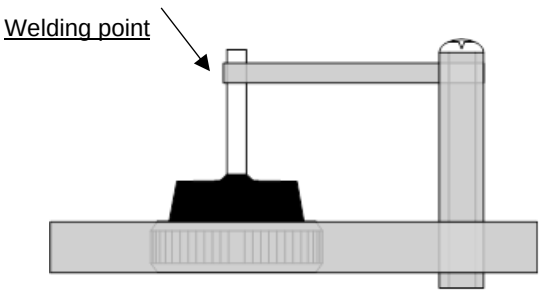


Fig.5-5 Lead Terminal welding

■9. Caution for Storage

1) The products should be stored at a temperature of less 35℃ and relative humidity of less than 60% away from direct sunlight and moisture. Upon storage, keep them polyethylene bags until for use, and they should be used within 12 months.
2) The Storage room should not contain cany corrosive gas (e.g., sulfurous acid gas and chlorine gas)
3) When stored for a long time after unpacked, it must be stored at a temperature of less 35℃ and relative humidity of less than 60% and free from corrosive gas Such products should be used within 30 days of unpacking.
4) If the storage is not appropriate, the weldability of the lead material may be regraded.

■10. Safety precautions

The handling precautions of this product are shown below. Failure to comply with this precaution may result in human or property damage caused by personal accidents, fire accidents, etc.

1) Regardless of changes in external conditions during use “absolute maximum ratings” should never be exceed in designing electronic circuits that employ semiconductors.
   In no event shall MPSD be liable for any failure in a semiconductor device or any secondary damage resulting from use at a value exceeding the absolute maximum rating.
   When using, please use it with sufficient derating in consideration.
2) Semiconductor devices may experience failures due to accidental or unexpected surge voltage, current, etc. Accordingly, adopt safe design features, such as redundancy or prevention of malfunctions, to avoid extensive damage in the event of a failure.
3) If this product fails, there may be cases in which the semiconductor device, wiring or wiring pattern will emit smoke or cause a fire.
4) We strongly recommend measuring electrical characteristics in incoming inspection and post-assembly inspection.

【Usage】

(1) MPSD warrants that the MPSD products have the specified performance according to the respective specifications at the time of its sale. Testing and other quality control techniques of the MPSD products by MPSD are utilized to the extent MPSD needs to meet the specifications described in this document. Not every device of the MPSD products is specifically tested on all parameters, except those mandated by relevant laws and/or regulations.

(2) Following any claim regarding the failure of a product to meet the performance described in this document made within one month of product delivery, all the products in relevant lot(s) shall be re-tested and re-delivered. The MPSD products delivered more than one month before such a claim shall not be counted for such response.

(3) MPSD assumes no obligation nor makes any promise of compensation for any fault which should be found in a customer's goods incorporating the products in the market. If a product failure occurs for reasons obviously attributable to MPSD and a claim is made within six months of product delivery, MPSD shall offer free replacement or payment of compensation. The maximum compensation shall be the amount paid for the products, and MPSD shall not assume responsibility for any other compensation.

(4) MPSD reserves the right to make changes in this document and to discontinue mass production of the relevant products without notice. Customers are advised to confirm specification of the product of inquiry before purchasing of the products that the customer desired. Customers are further advised to confirm before purchasing of such above products that the product of inquiry is the latest version and that the relevant product is in mass production status if the purchasing of the products by the customer is suspended for one year or more.

(5) When you dispose of MPSD products and/or packing materials, comply with the laws and regulations of each country and/or local government. Conduct careful preliminary studies about environmental laws applying to your products such as RoHS, REACH. MPSD shall not assume responsibility for compensation due to contravention of laws and/or regulations.

(6) MPSD shall not be held liable in any way for damages and infringement of patent rights, copyright or other intellectual property rights arising from or related to the use of the information, products, and circuits in this document.

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(9) You shall not use the MPSD products (technologies) described in this document and any other products (technologies) manufactured or developed by using them (hereinafter called "END Products") or supply the MPSD products (technologies) and END Products for the purpose of disturbing international peace and safety, including (ⅰ) the design, development, production, stockpiling or any use of weapons of mass destruction such as nuclear, chemical or biological weapons or missiles, (ⅱ) the other military activities, or (ⅲ) any use supporting these activities. You shall not sell, export, dispose of, license, rent, transfer, disclose or otherwise provide the MPSD products (technologies) and END Products to any third party whether directly or indirectly with knowledge or reason to know that the third party or any other party will engage in the activities described above.

When exporting, re-export transshipping or otherwise transferring the MPSD products (technologies) and END Products, all necessary procedures are to be taken in accordance with Foreign Exchange and Foreign Trade Act (Foreign Exchange Act) of Japan, Export Administration Regulations (EAR) of US, and any other applicable export control laws and regulations promulgated and administered by the governments of the countries asserting jurisdictions over the parties or transaction.

■Appendix

A)Rating and Characteristic Curves

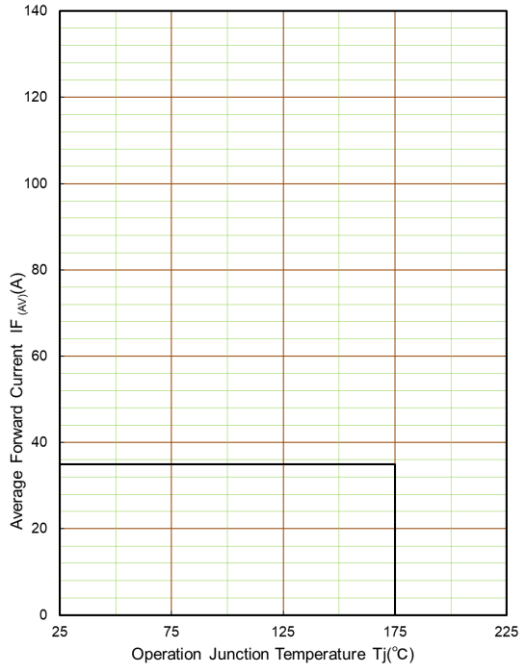


Fig.A-1 Power Dissipation Curves

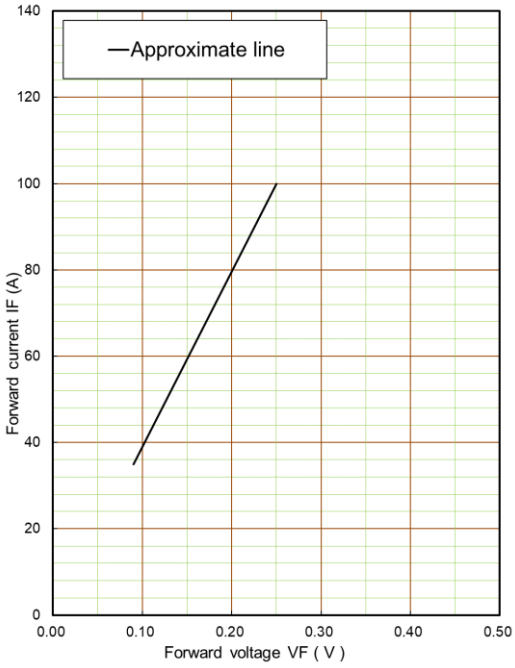


Fig.A-2 Forward current – Forward voltage*

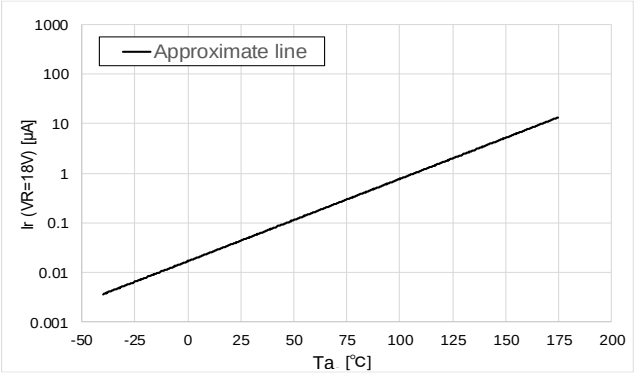


Fig.A-3.Leakage current – Temperature *a

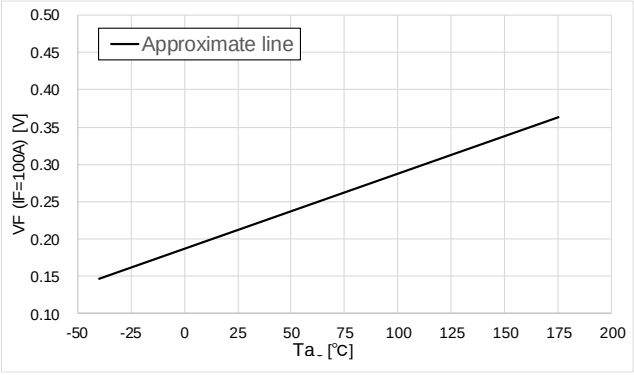


Fig.A-4. Forward voltage – Temperature *

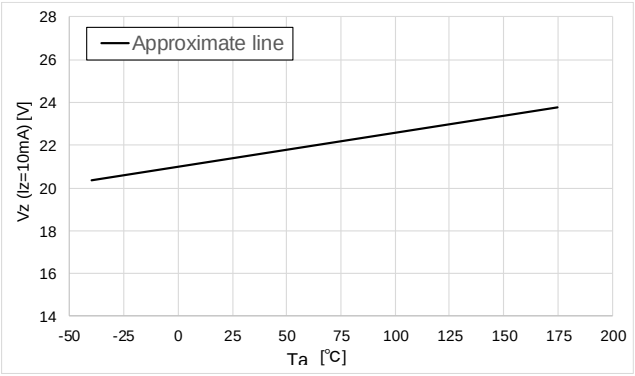


Fig.A-5. Zener voltage – Temperature *

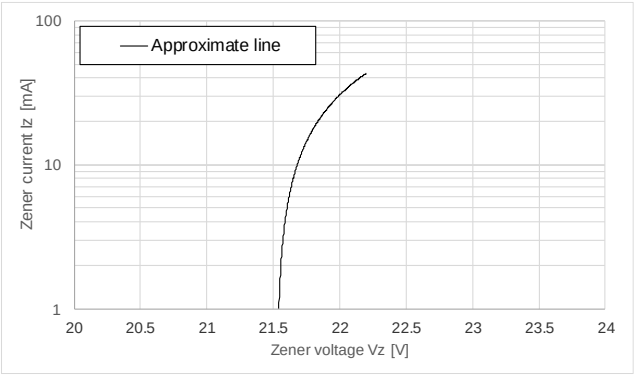
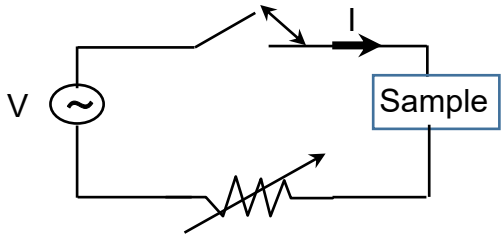


Fig.A-6. Zener current – Zener voltage *

*Fig.A-2 to A-6 are shown for reference only and are approximated from the measured data.

B)TFT conditions

Test Circuit



Average Current
35A

V＝11±2Vrms

60Hz or 50Hz

Must continue Test until breakage.

This condition is typical.

MOSFET maximum
Temperature Tj

Tj=50±1℃

ON 3.5±1min
（No Air Blow）

OFF 1.5±1min
（Air Blow）

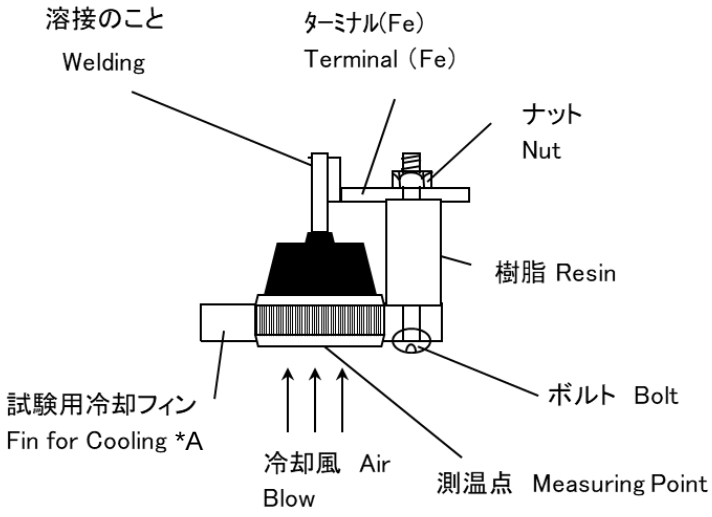
MOSFET maximum
Temperature Tj

Tj=175±1℃

Case Temperature Tc*
(Tc=155℃)

*Reference value

Reference for Condition



Note. Nut must be tightened before lead welding (or soldering).
And Nut must not be tightened again after lead welding (or soldering) .

*A The fin conditions are basically same as Fig.8-1, but when ON-OFF Timing does not meet TFT Test Specification, Fin Shape can be changed only used TFT Test.

Fig.B-1 Thermal Fatigue Test（TFT）

C)Pres-in force and Strain

In order to prevent the destruction, and decrease of electrical characteristics of the product under the load at the time of press-fit, we recommend to validate the strain on the bottom of the disk during press-fit.
An example of our validation is shown in below.
Please contact us for detailed validation methods.

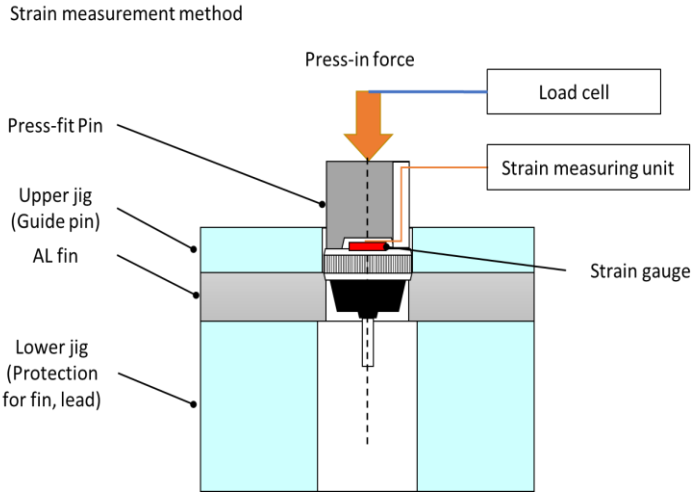


Fig.C-1 ,Jig and strain-measurement point

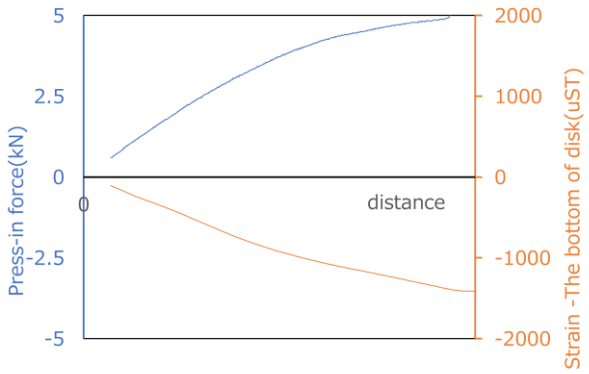


Fig.C-2 Example of strain and press-in force measurement

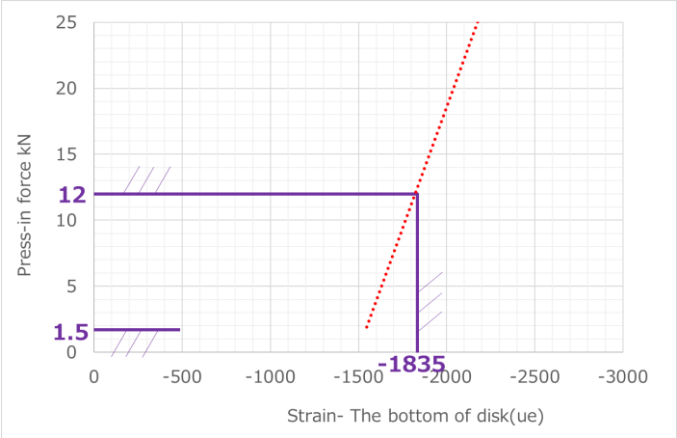


Fig.C-3 Example of strain and press-in force validation
Measure by changing the interference,
Strain threshold is calculated from analysis results