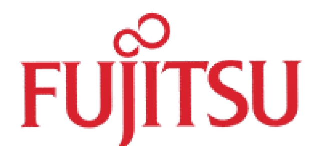
PRODUCT STORAGE RULES

FSEU

TQM DEPARTMENT



Revision History

Date	Issue
06-May-2009	1.0 Initial version
14-Jul-2009	1.1 Include soldering profiles
20-Jul-2010	1.1-1.2 Change of company name from FME to FSEU (Fujitsu Semiconductor Europe GmbH), minor changes
31-Mar-2012	1.3 Update desiccants and humidity indicator

This document contains 26 pages.

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1 Purpose

This document shows the product storage periods and warehouse storage environment for the purpose of quality assurance for semiconductor IC products, and it applies to storage controls. Certain plastic packages are sensitive to moisture. Moisture can be collected by the package when the storage conditions are not ideal. Once a device will be soldered, the moisture inside the package will turn into steam. This can lead to package damage. To avoid this and to be able to store the device properly you will find some information about Product storage within this document. In addition to this, several soldering profiles for our products are included.

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2 Product Storage

2.1 Recommended storage environment for IC´s

This storage environment assume that the IC are packed properly inside a humidity barrier bag

- Temperature 5 degC to 30 degC
- Humidity: between 40 to 70% RH
- Air should be clean
- Avoid harmful gas or dust
- Avoid outdoor exposure or storage in areas subject to rain or water spraying
- Avoid storage in areas subject to corrosive gas or dust. Products shall not stored in areas exposed to direct sunlight
- Avoid rapid changes of temperature
- Avoid condensation
- Mechanical stress such as vibration and impact shall be avoided
- The products shall not be placed directly on the floor
- The products shall to be stored on a plane area. They should not be turned up side down. They should not be placed against the wall

2.2 Shelf-Life of Fujitsu IC Products

The shelf life of products is the period from product manufacture to shipment to customers. The product can be unconditionally shipped within this period. The period is defined as follows:

Shelf-Life: 2 years

If products are stored longer then the shelf-life of 2 years (24 Month), the products should be subjected to a quality check, including the following steps:

- Retest of the IC (Production Final Test)
- Solderability test (some samples)
- Baking of the devices (24h @ 125degC)
- Co-planarity check
- Re-packaging

The possible problems after the shelf life of two years is over are:

- Solderability problems
- Discoloration problem of pins (especially DIP packages)
- Electrical characteristic change

2.3 Floor life and MSL Level

When the moisture sensitive bag is opened the floor life will start. In case the device MSL level is classified according to JEDEC (J-STD-020C), the related floor life can be seen below. In case the device is qualified according to Fujitsu MSL level the conditions are listed in Figure 2.

JEDEC MSL Level		
Level	**Time**	**Condition**
1	**Unlimited**	**≤ 30 °C / 85% RH**
2	**1 year**	**≤ 30 °C / 60% RH**
2a	**4 weeks**	**≤ 30 °C / 60% RH**
3	**168 hours**	**≤ 30 °C / 60% RH**
4	**72 hours**	**≤ 30 °C / 60% RH**
5	**48 hours**	**≤ 30 °C / 60% RH**
5a	**24 hours**	**≤ 30 °C / 60% RH**
6	**Time on label (TOL)**	**≤ 30 °C / 60% RH**

Figure 1 Floor Life according to JEDEC MSL level

Fujitsu MSL Level			
Level	**Time**	**Condition**	**Max Temperature(°C)**
H02	**2 days**	**5 °C to 30 °C, 70% RH**	**260**
H04	**4 days**	**5 °C to 30 °C, 70% RH**	**260**
H06	**6 days**	**5 °C to 30 °C, 70% RH**	**260**
H07	**7 days**	**5 °C to 30 °C, 70% RH**	**260**
H08	**8 days**	**5 °C to 30 °C, 70% RH**	**260**
M02	**2 days**	**5 °C to 30 °C, 70% RH**	**250**
M04	**4 days**	**5 °C to 30 °C, 70% RH**	**250**
M06	**6 days**	**5 °C to 30 °C, 70% RH**	**250**
M08	**8 days**	**5 °C to 30 °C, 70% RH**	**250**

Figure 2 Floor Life according to Fujitsu MSL level

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An important difference between the JEDEC MSL standard and the Fujitsu MSL level standard is that JEDEC refers to 3 times reflow soldering and Fujitsu to 2 times reflow soldering.

Therefore the JEDEC MSL and Fujitsu MSL level can not be directly compared. Some of the Fujitsu components are qualified against both Fujitsu and JEDEC standard.

Comparison of JEDEC and Fujitsu MSL			
Fujitsu MSL Level (2x reflow)	JEDEC MSL (3 x reflow)	Time	Comment
	5a	1 day	
H02, M02	5	2 days	
H04, M04		4 days	
	4	3 days	
H06, M06		6 days	
H07	3	7 days	
H08, M08		8 days	
	2a	28 days	
	2	365 days	
	1	unlimited	

Figure 3 Comparison between JEDEC and Fujitsu MSL level in terms of floor life

Once the hermetic sealed bag is opened, the floor life starts to count. If the floor life time is over, a reset of the floor life has to be performed when the part will be soldered, and also when the bag will be sealed again.

A reset of the floor life can be done by baking the parts.

2.4 Potential problems with moisture inside the package "Popcorn-effect"

Once a plastic packaged IC will be exposed to the air which contains humidity the package will get saturated with humidity over time.

The expansion of trapped moisture can result in internal separation (delamination) of the plastic from the die or lead-frame, wire bond damage, die damage, and internal cracks. Most of this damage is not visible on the component surface. In extreme cases, cracks will extend to the component surface.

In case a device will be soldered when the floor life is over and the part is saturated with humidity, it is possible that the package can bulge and pop by soldering because of the fast

expansion of the humidity inside the package. This is known as the "popcorn" effect. A visual description of this effect can be seen below.

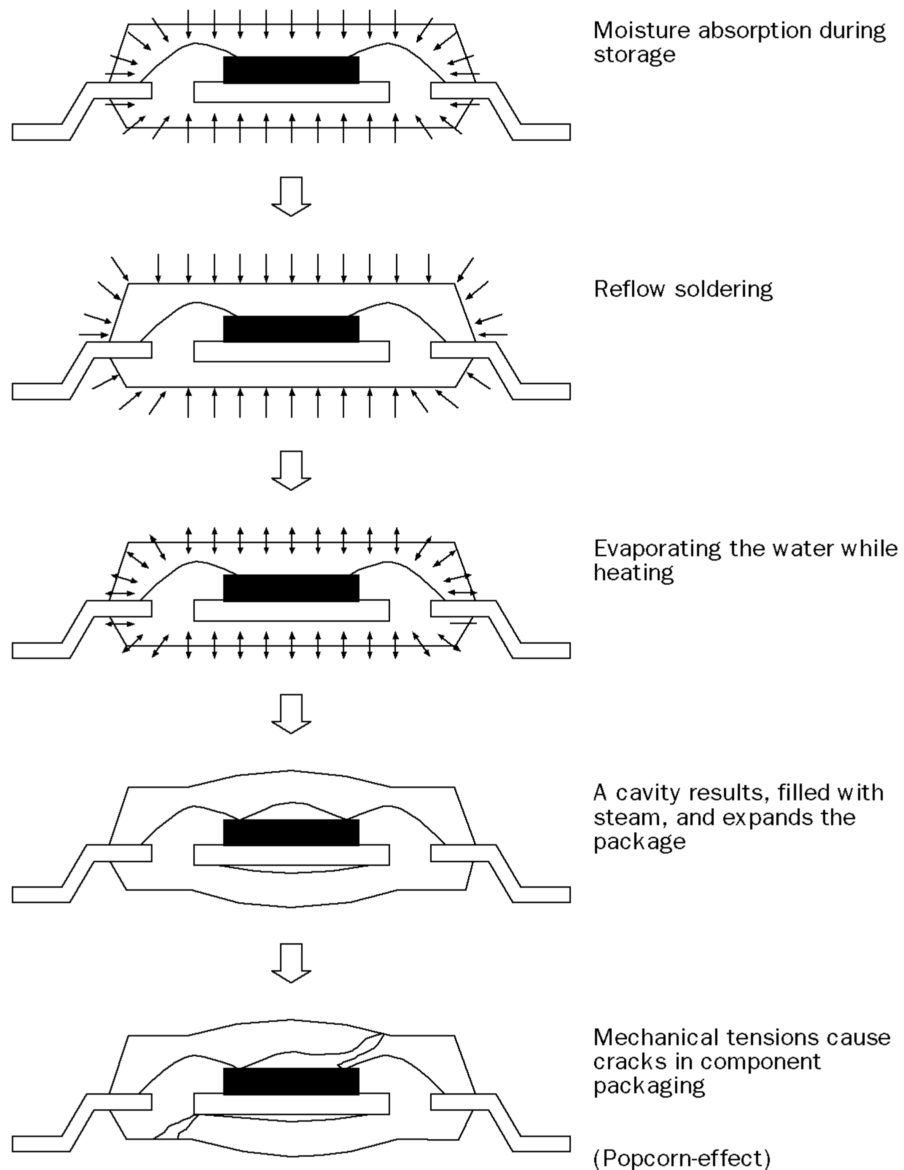

Figure 4 Popcorn-effect

2.5 Baking requirements

If a device will be open for longer times as the floor life in Figure 1 and Figure 2 described, baking is required to reset the floor life time.
The device must be baked for **24 hours at 125°C**. This ensures that the humidity inside the package disappears slowly and the component can be stored again or soldered without any risk to get damaged.

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The following points should be considered when baking is required:

- 125°C for 24 hours is the general baking time when the part is stored in trays which can handle 125 °C
- When the parts are in reels it is recommend to take out of the parts from the reel and do the baking in a tray which can deal with 125°C
- For the re-condition of products in reels as well as in trays, it is recommendable to refer to dedicated laboratories.

2.6 Humidity Indicator

The humidity indicator is able to display if the humidity inside the vacuum bag is above 30% RH. The indicator is Cobalt Chloride free. Below you will find some pictures and dimensions of the indicator

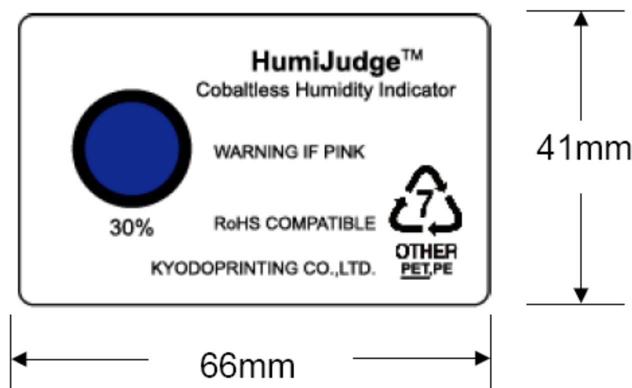


Figure 5 Humidity indicator dimensions

Figure 6 Humidity indicator picture, Humidity < 10% RH

Figure 7 Humidity indicator picture, Humidity > 30% RH

Below you will find some more details about this indicator.

- Product information
  - Name: HUMIJUDGE
  - Type : KP—COF—HIC30
- Colour change
  - Dry RH<30 % : blue,
  - Humid RH>30 %: pink
  - It takes about 20 to 60min to change the colour from blue to pink.
  - Changing time depends on surrounding conditions

2.7 Desiccant

In order to ensure dry conditions inside the sealed aluminium bag a desiccant will be used to ensure the humidity inside the bag will be absorbed. Two different types of desiccant will be used at FSEU.

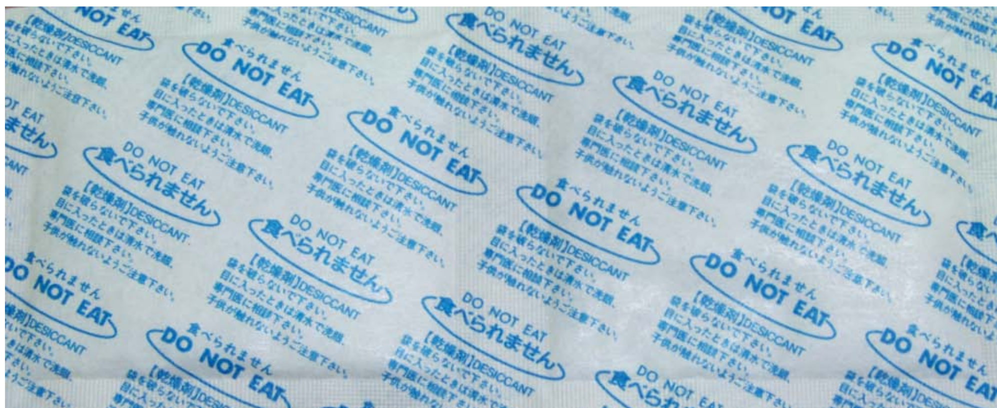


Figure 8 Desiccant

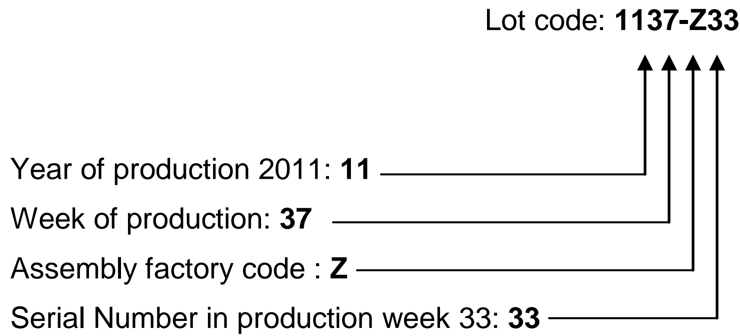
Desiccate (Figure 8) will be used for the shipments from FSL (Fujitsu Semiconductor Limited, Japan) to FSEU (Fujistu Semiconductor Europe) and to the End customer in case no repacking was necessary

Figure 9 Desiccant 2

In case repacking at FSEU is required, Desiccant 2 will be used for our products.

3 Package lot code explanation

Below you will find an example how the lot code is defined and how the 2 years of shelf life will be determined:



When, for example, a device has the lot code of 1137-xxx the shelf-life will last till 1337-xxx. This means week 37 in the year 2013.

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4 Lead insertion type

There are two methods for mounting lead inserted type packages on a printed circuit board:

- Device directly soldered on the printed circuit board
- Device mounted in a socket on the board.

When applying solder directly to the board, the leads are inserted into the mounting holes in the printed circuit board first, and the flow soldering method (wave soldering method) is used with jet solder. This is the most popular and widely used method for mounting packages on a printed circuit board.
However, during the soldering process, heat in excess of the normal maximum rating for the storage temperature is applied to the leads. As a result, quality assurance concerning heat resistance during soldering limits the soldering process to the levels shown below; do not exceed these levels during soldering work.

1. Solder temperature and immersion time 260 °C (500 °F), 10 seconds or less
2. Lead immersion position Up to a distance of at least 1 to 1.5 mm from the main body of the package
3. When mounting an element using the solder flow method, ensure that the element itself is not immersed in the solder
4. When using flux, avoid chlorine based fluxes; instead, use a resin-based flux

Note, however, that if the module leads are exposed to the solder for a long period of time, solder on the module board may melt and previously mounted ICs may become detached.
Also be careful to prevent any solder from coming into direct contact with the packages mounted on the module.

5 Selected soldering profiles

The information on the next pages will give you an overview about the soldering profiles from Fujitsu and as well a link to the JEDEC classification levels according to JEDEC J-STD-020D. This selection is covering the majority of our IC products.

5.1 Fujitsu MSL Level H02

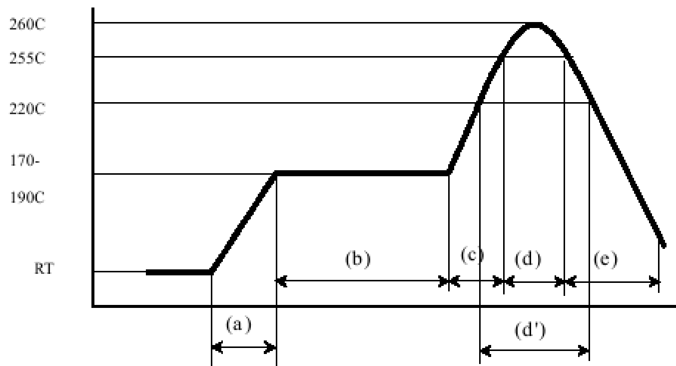
Recommended Conditions of Moisture Sensitivity Level (H02)

Item	Condition	
Mounting Method	IR (infrared reflow), Manual soldering (partial heating method)	
Mounting times	2 times	
Storage period	Before opening	Please use it within two years after Manufacture.
	From opening to the 2nd reflow	Less than 2 days
	When the storage period after opening was exceeded	Please processes within 2 days after baking (125C, 24H)
Storage conditions	5C to 30C, 70%RH or less (the lowest possible humidity)	

[Temperature Profile for FJ Standard IR Reflow]

<1> IR (infrared reflow)

H rank : 260C Max.



(a) Temperature Increase gradient : Average 1C/s to 4C/s

(b) Preliminary heating : Temperature 170C to 190C, 60s to 180s

(c) Temperature Increase gradient : Average 1C/s to 4C/s

(d) Actual heating : Temperature 260C MAX; 255C or more, 10s or less

(d') : Temperature 230C or more, 40s or less
or
Temperature 225C or more, 60s or less
or
Temperature 220C or more, 80s or less

(e) Cooling : Natural cooling or forced cooling

(Temperature: the top of the package body).

<2> Manual soldering (partial heating method)
Conditions : Temperature 400C MAX
Times : 5seconds max/pin

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Figure 10 Fujitsu MSL Level H02 - Soldering profile

5.2 Fujitsu MSL Level H04

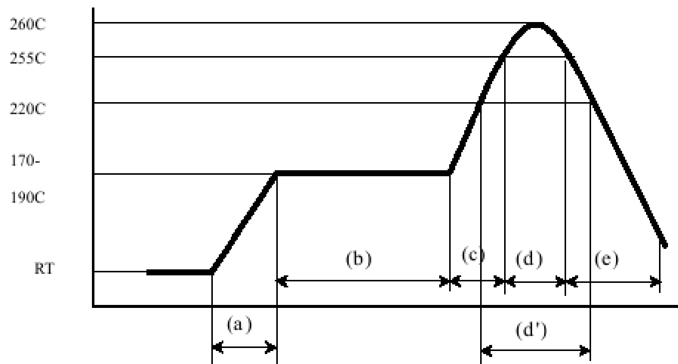
Recommended Conditions of Moisture Sensitivity Level (H04)

Item	Condition	
Mounting Method	IR (infrared reflow), Manual soldering (partial heating method)	
Mounting times	2 times	
Storage period	Before opening	Please use it within two years after Manufacture.
	From opening to the 2nd reflow	Less than 4 days
	When the storage period after opening was exceeded	Please processes within 4 days after baking (125C, 24H)
Storage conditions	5C to 30C, 70%RH or less (the lowest possible humidity)	

[Temperature Profile for FJ Standard IR Reflow]

<1> IR (infrared reflow)

H rank : 260C Max.



(a) Temperature Increase gradient : Average 1C/s to 4C/s

(b) Preliminary heating : Temperature 170C to 190C, 60s to 180s

(c) Temperature Increase gradient : Average 1C/s to 4C/s

(d) Actual heating : Temperature 260C MAX; 255C or more, 10s or less

(d') : Temperature 230C or more, 40s or less
or
Temperature 225C or more, 60s or less
or
Temperature 220C or more, 80s or less

(e) Cooling : Natural cooling or forced cooling

(Temperature: the top of the package body).

<2> Manual soldering (partial heating method)
Conditions : Temperature 400C MAX
Times : 5seconds max/pin

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Figure 11 Fujitsu MSL Level H04 - Soldering profile

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5.3 Fujitsu MSL Level H06

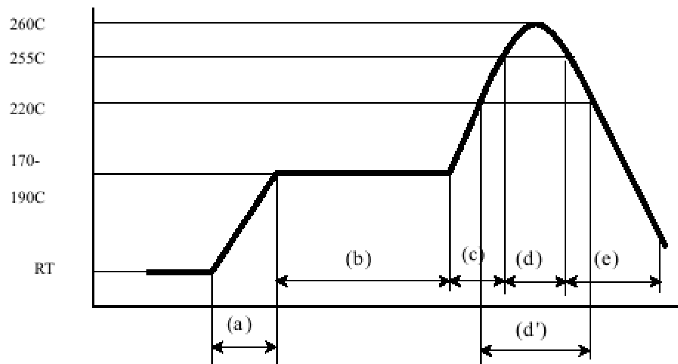
Recommended Conditions of Moisture Sensitivity Level (H06)

Item	Condition	
Mounting Method	IR (infrared reflow), Manual soldering (partial heating method)	
Mounting times	2 times	
Storage period	Before opening	Please use it within two years after Manufacture.
	From opening to the 2nd reflow	Less than 6days
	When the storage period after opening was exceeded	Please processes within6 days after baking (125C, 24H)
Storage conditions	5C to 30C, 70%RH or less (the lowest possible humidity)	

[Temperature Profile for FJ Standard IR Reflow]

<1> IR (infrared reflow)

H rank : 260C Max.



(a) Temperature Increase gradient : Average 1C/s to 4C/s

(b) Preliminary heating : Temperature 170C to 190C, 60s to 180s

(c) Temperature Increase gradient : Average 1C/s to 4C/s

(d) Actual heating : Temperature 260C MAX; 255C or more, 10s or less

(d') : Temperature 230C or more, 40s or less
or
Temperature 225C or more, 60s or less
or
Temperature 220C or more, 80s or less

(e) Cooling : Natural cooling or forced cooling

(Temperature: the top of the package body).

<2> Manual soldering (partial heating method)
Conditions : Temperature 400C MAX
Times : 5seconds max/pin

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Figure 12 Fujitsu MSL Level H06 - Soldering profile

5.4 Fujitsu MSL Level H07

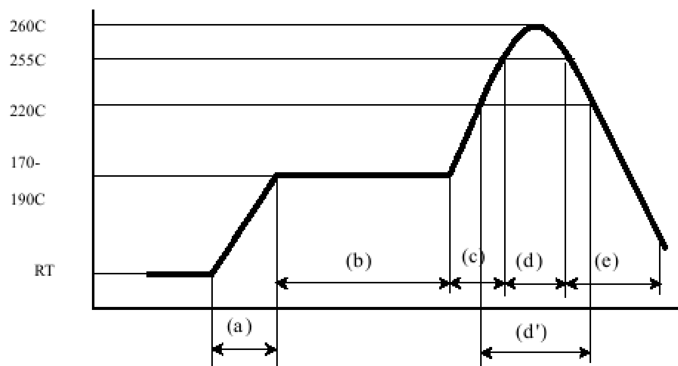
Recommended Conditions of Moisture Sensitivity Level (H07)

Item	Condition	
Mounting Method	IR (infrared reflow), Manual soldering (partial heating method)	
Mounting times	2 times	
Storage period	Before opening	Please use it within two years after Manufacture.
	From opening to the 2nd reflow	Less than 7 days
	When the storage period after opening was exceeded	Please processes within 7 days after baking (125C, 24H)
Storage conditions	5C to 30C, 70%RH or less (the lowest possible humidity)	

[Temperature Profile for FJ Standard IR Reflow]

<1> IR (infrared reflow)

H rank : 260C Max.



(a) Temperature Increase gradient : Average 1C/s to 4C/s

(b) Preliminary heating : Temperature 170C to 190C, 60s to 180s

(c) Temperature Increase gradient : Average 1C/s to 4C/s

(d) Actual heating : Temperature 260C MAX; 255C or more, 10s or less

(d') : Temperature 230C or more, 40s or less
or
Temperature 225C or more, 60s or less
or
Temperature 220C or more, 80s or less

(e) Cooling : Natural cooling or forced cooling

(Temperature: the top of the package body).

<2> Manual soldering (partial heating method)
Conditions : Temperature 400C MAX
Times : 5seconds max/pin

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Figure 13 Fujitsu MSL Level H07 - Soldering profile

5.5 Fujitsu MSL Level H08

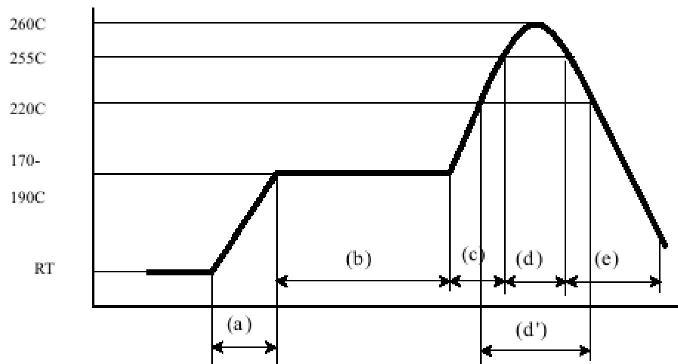
Recommended Conditions of Moisture Sensitivity Level (H08)

Item	Condition	
Mounting Method	IR (infrared reflow), Manual soldering (partial heating method)	
Mounting times	2 times	
Storage period	Before opening	Please use it within two years after Manufacture.
	From opening to the 2nd reflow	Less than 8 days
	When the storage period after opening was exceeded	Please processes within 8 days after baking (125C, 24H)
Storage conditions	5C to 30C, 70%RH or less (the lowest possible humidity)	

[Temperature Profile for FJ Standard IR Reflow]

<1> IR (infrared reflow)

H rank : 260C Max.



(a) Temperature Increase gradient : Average 1C/s to 4C/s

(b) Preliminary heating : Temperature 170C to 190C, 60s to 180s

(c) Temperature Increase gradient : Average 1C/s to 4C/s

(d) Actual heating : Temperature 260C MAX; 255C or more, 10s or less

(d') : Temperature 230C or more, 40s or less
or
Temperature 225C or more, 60s or less
or
Temperature 220C or more, 80s or less

(e) Cooling : Natural cooling or forced cooling

(Temperature: the top of the package body).

<2> Manual soldering (partial heating method)
Conditions : Temperature 400C MAX
Times : 5seconds max/pin

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Figure 14 Fujitsu MSL Level H08 - Soldering profile

5.6 Fujitsu MSL Level M02 - BGA

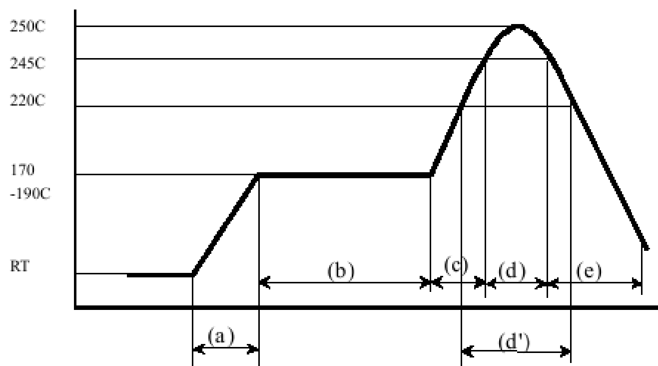
Recommended Conditions of Moisture Sensitivity Level (M02)

Item	Condition	
Mounting Method	IR (infrared reflow)	
Mounting times	2 times	
Storage period	Before opening	Please use it within two years after Manufacture.
	From opening to the 2nd reflow	Less than 2 days
	When the storage period after opening was exceeded	Please processes within 2 days after baking (125C, 24H)
Storage conditions	5C to 30C, 70%RH or less (the lowest possible humidity)	

[Temperature Profile for FJ Standard IR Reflow]

<1> IR (infrared reflow)

M rank : 250C Max.



(a) Temperature Increase gradient : Average 1C/s to 4C/s

(b) Preliminary heating : Temperature 170C to 190C, 60s to 180s

(c) Temperature Increase gradient : Average 1C/s to 4C/s

(d) Actual heating : Temperature 250C MAX; 245C or more, 10s or less

(d') : Temperature 230C or more, 40s or less
or
Temperature 225C or more, 60s or less
or
Temperature 220C or more, 80s or less

(e) Cooling : Natural cooling or forced cooling

(Temperature: the top of the package body).

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Figure 15 Fujitsu MSL Level M02 - BGA - Soldering profile

5.7 Fujitsu MSL Level M02 - Lead Frame

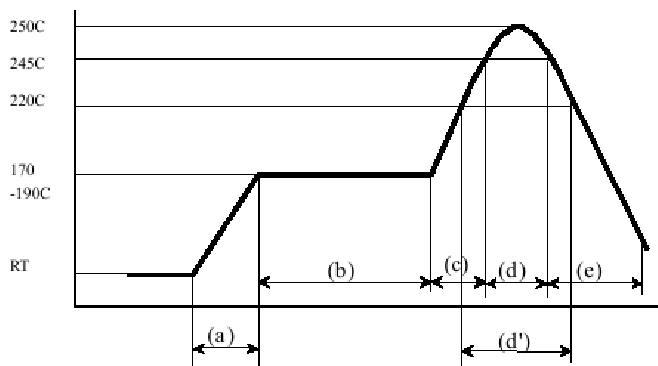
Recommended Conditions of Moisture Sensitivity Level (M02)

Item	Condition	
Mounting Method	IR (infrared reflow), Manual soldering (partial heating method)	
Mounting times	2 times	
Storage period	Before opening	Please use it within two years after Manufacture.
	From opening to the 2nd reflow	Less than 2 days
	When the storage period after opening was exceeded	Please processes within 2 days after baking (125C, 24H)
Storage conditions	5C to 30C, 70%RH or less (the lowest possible humidity)	

[Temperature Profile for FJ Standard IR Reflow]

<1> IR (infrared reflow)

M rank : 250C Max.



(a) Temperature Increase gradient : Average 1C/s to 4C/s

(b) Preliminary heating : Temperature 170C to 190C, 60s to 180s

(c) Temperature Increase gradient : Average 1C/s to 4C/s

(d) Actual heating : Temperature 250C MAX; 245C or more, 10s or less

(d') : Temperature 230C or more, 40s or less

or

Temperature 225C or more, 60s or less

or

Temperature 220C or more, 80s or less

(e) Cooling : Natural cooling or forced cooling

(Temperature: the top of the package body).

<2> Manual soldering (partial heating method)
Conditions : Temperature 400C MAX
Times : 5seconds max/pin

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Figure 16 Fujitsu MSL Level M02 - Lead Frame - Soldering profile

5.8 Fujitsu MSL Level M04

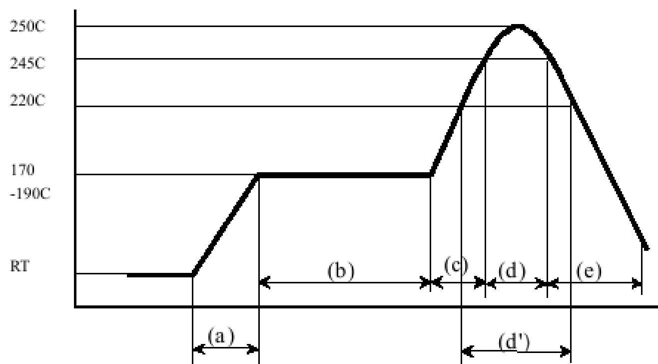
Recommended Conditions of Moisture Sensitivity Level (M04)

Item	Condition	
Mounting Method	IR (infrared reflow), Manual soldering (partial heating method)	
Mounting times	2 times	
Storage period	Before opening	Please use it within two years after Manufacture.
	From opening to the 2nd reflow	Less than 4 days
	When the storage period after opening was exceeded	Please processes within 4 days after baking (125C, 24H)
Storage conditions	5C to 30C, 70%RH or less (the lowest possible humidity)	

[Temperature Profile for FJ Standard IR Reflow]

<1> IR (infrared reflow)

M rank : 250C Max.



(a) Temperature Increase gradient : Average 1C/s to 4C/s

(b) Preliminary heating : Temperature 170C to 190C, 60s to 180s

(c) Temperature Increase gradient : Average 1C/s to 4C/s

(d) Actual heating : Temperature 250C MAX; 245C or more, 10s or less

(d') : Temperature 230C or more, 40s or less
or
Temperature 225C or more, 60s or less
or
Temperature 220C or more, 80s or less

(e) Cooling : Natural cooling or forced cooling

(Temperature: the top of the package body).

<2> Manual soldering (partial heating method)
Conditions : Temperature 400C MAX
Times : 5seconds max/pin

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Figure 17 Fujitsu MSL Level M04 - Soldering profile

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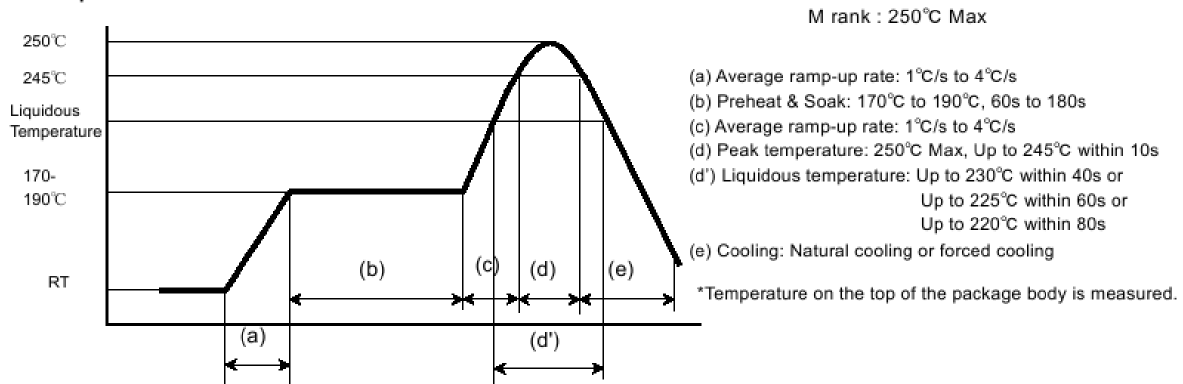
5.9 Fujitsu MSL Level M06

Recommended mounting conditions [M06S00J00]

[Conditions of FML Standard Reflow]

Items	Contents	
Method	IR(Infrared Reflow) / Convection	
Times	2	
Floor life	Before unpacking	Please use within 2 years after production.
	From unpacking to second reflow	Within 6 days
	In case over period of floor life	Baking with 125℃+/-3℃ for 24hrs+2hrs/-0hrs is required. Then please use within 6 days. (Please remember baking is up to 2 times)
Floor life condition	Between 5℃ and 30℃ and also below 70%RH required. (It is preferred lower humidity in the required temp range.)	

Temperature Profile



[Manual Soldering (Method of partial hearting)] *Lead type only

Items	Contents	
Floor life	Before unpacking	Please use within 2 years after production.
	From unpacking to Manual Soldering	Within 2 years after production (No control required for moisture adsorption because it is partial hearting)
Floor life condition	Between 5℃ and 30℃ and also below 70%RH required. (It is preferred lower humidity in the required temp range.)	
Solder Condition	Temperature of soldering iron : Max.400℃, Time : Within 5 seconds/pin * Be careful for touching package body with iron.	

M06S00J00_er1

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Figure 18 Fujitsu MSL Level M06 - Soldering profile

5.10 Fujitsu MSL Level M08 - BGA

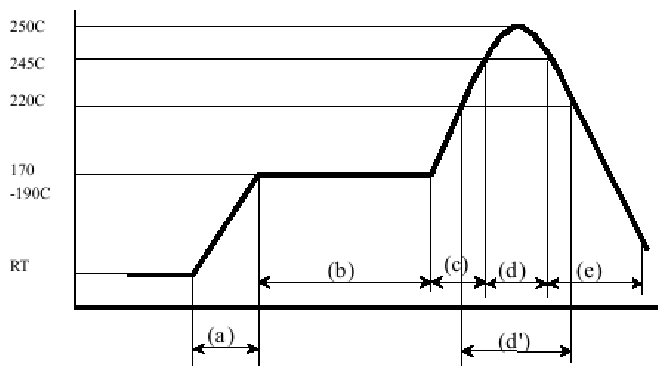
Recommended Conditions of Moisture Sensitivity Level (M08)

Item	Condition	
Mounting Method	IR (infrared reflow)	
Mounting times	2 times	
Storage period	Before opening	Please use it within two years after Manufacture.
	From opening to the 2nd reflow	Less than 8 days
	When the storage period after opening was exceeded	Please processes within 8 days after baking (125C, 24H)
Storage conditions	5C to 30C, 70%RH or less (the lowest possible humidity)	

[Temperature Profile for FJ Standard IR Reflow]

<1> IR (infrared reflow)

M rank : 250C Max.



(a) Temperature Increase gradient : Average 1C/s to 4C/s

(b) Preliminary heating : Temperature 170C to 190C, 60s to 180s

(c) Temperature Increase gradient : Average 1C/s to 4C/s

(d) Actual heating : Temperature 250C MAX; 245C or more, 10s or less

(d') : Temperature 230C or more, 40s or less
or
Temperature 225C or more, 60s or less
or
Temperature 220C or more, 80s or less

(e) Cooling : Natural cooling or forced cooling

(Temperature: the top of the package body).

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Figure 19 Fujitsu MSL Level M08 - BGA - Soldering profile

5.11 Fujitsu MSL Level M08 - Lead Frame

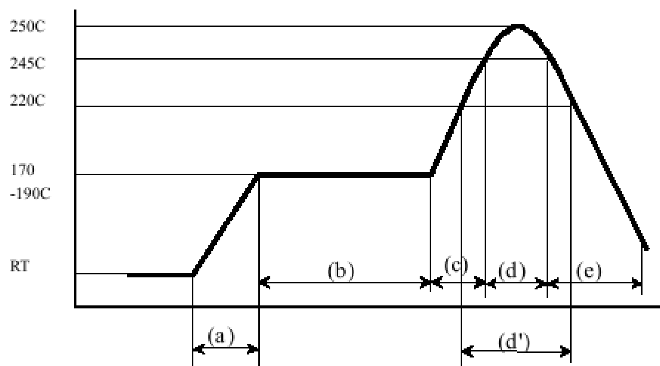
Recommended Conditions of Moisture Sensitivity Level (M08)

Item	Condition	
Mounting Method	IR (infrared reflow), Manual soldering (partial heating method)	
Mounting times	2 times	
Storage period	Before opening	Please use it within two years after Manufacture.
	From opening to the 2nd reflow	Less than 8 days
	When the storage period after opening was exceeded	Please processes within 8 days after baking (125C, 24H)
Storage conditions	5C to 30C, 70%RH or less (the lowest possible humidity)	

[Temperature Profile for FJ Standard IR Reflow]

<1> IR (infrared reflow)

M rank : 250C Max.



(a) Temperature Increase gradient : Average 1C/s to 4C/s

(b) Preliminary heating : Temperature 170C to 190C, 60s to 180s

(c) Temperature Increase gradient : Average 1C/s to 4C/s

(d) Actual heating : Temperature 250C MAX; 245C or more, 10s or less

(d') : Temperature 230C or more, 40s or less
or
Temperature 225C or more, 60s or less
or
Temperature 220C or more, 80s or less

(e) Cooling : Natural cooling or forced cooling

(Temperature: the top of the package body).

<2> Manual soldering (partial heating method)
Conditions : Temperature 400C MAX
Times : 5seconds max/pin

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Figure 20 Fujitsu MSL Level M08 - Lead Frame - Soldering profile

5.12 JEDEC Moisture/Reflow Sensitivity Classification

The purpose of this standard is to identify the classification level of no hermetic solid state surface mount devices (SMD devices) that are sensitive to moisture-induced stress so that they can be properly packaged, stored, and handled to avoid damage during assembly, solder-reflow attachment and/or repair operations.

The link below will direct you to JEDEC web page. Please search for JSTD020D.

http://www.jedec.org/

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