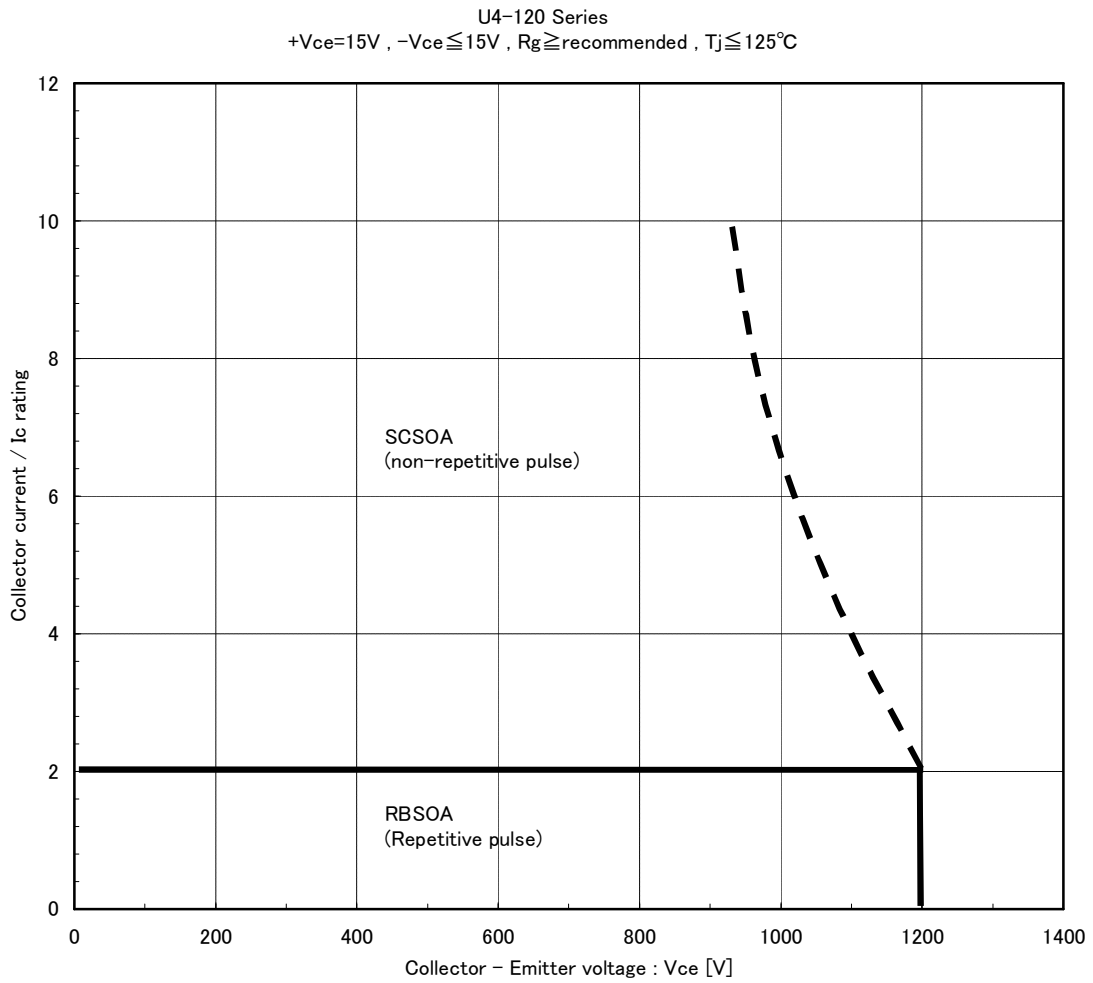

FUJI IGBT Modules U4-120 Series

Technical Documents

1.	RBSOA, SCSOA	MT5F15412
2.	High current output-characteristics	MT5F19808
3.	2 in one-package module parallel connection application	MT5F17044
4.	Switching loss, dv/dt vs. C_{GE} , R_G	MT5F19703
5.	$-V_{GE}$ vs. switching loss characteristics	MT5F17044
6.	$-di/dt$ vs. T_j characteristics	MT5F19887
7.	Dynamic avalanche voltage vs. T_j characteristics	MT5F19890

FUJI IGBT Modules U4-120 Series
RBSOA, SCSOA



Technical documents | MT5F15412

2008-03-27

FUJI IGBT Modules U4-120 Series
High current output-characteristics

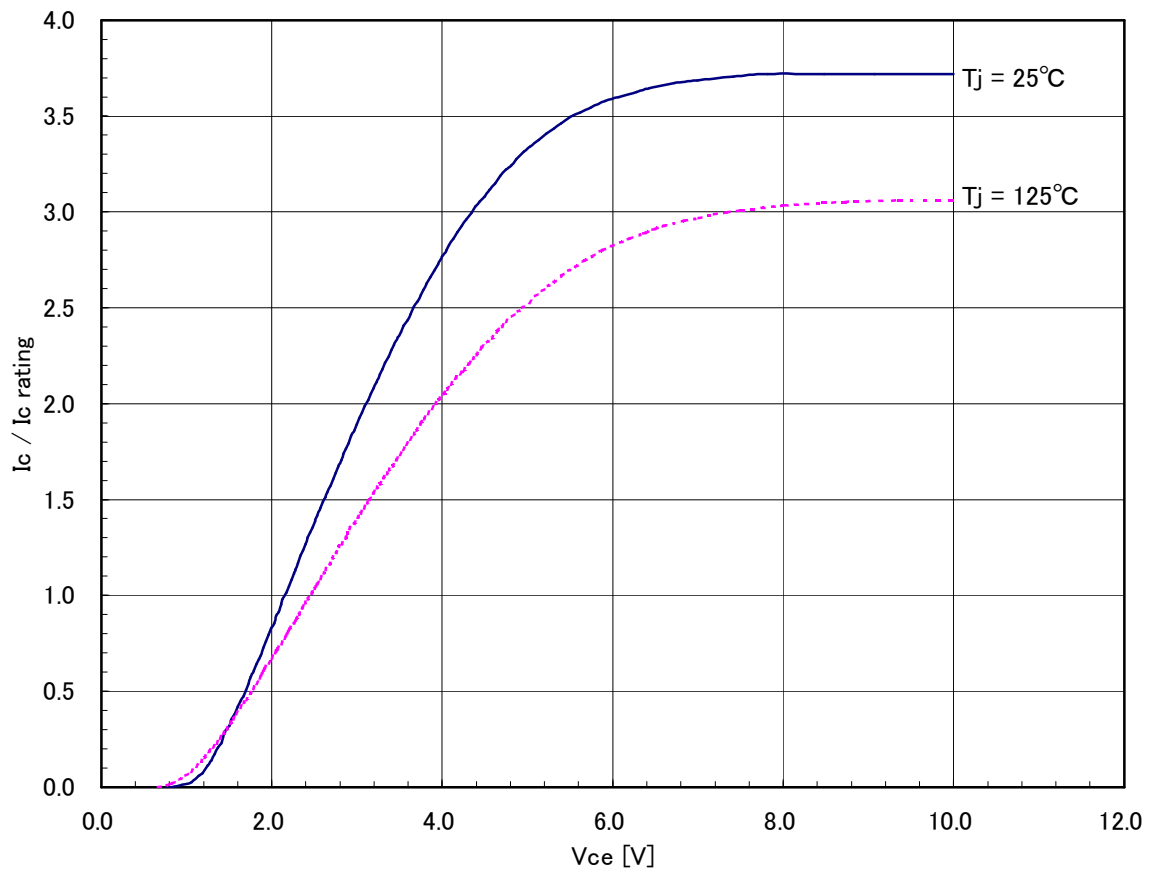
U4-120Series

Conditions: $T_j=25/125^{\circ}\text{C}$

$V_{GE}=15\text{V}$

Include internal-drop voltage due to internal-resistance of module.

U4 - 120 Series



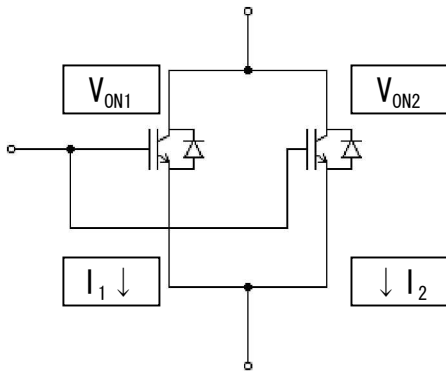
Technical documents | MT5F19808

2008-03-27

FUJI IGBT Modules U4-120 Series

2 in one-package module parallel connection application

Current imbalance in parallel connection



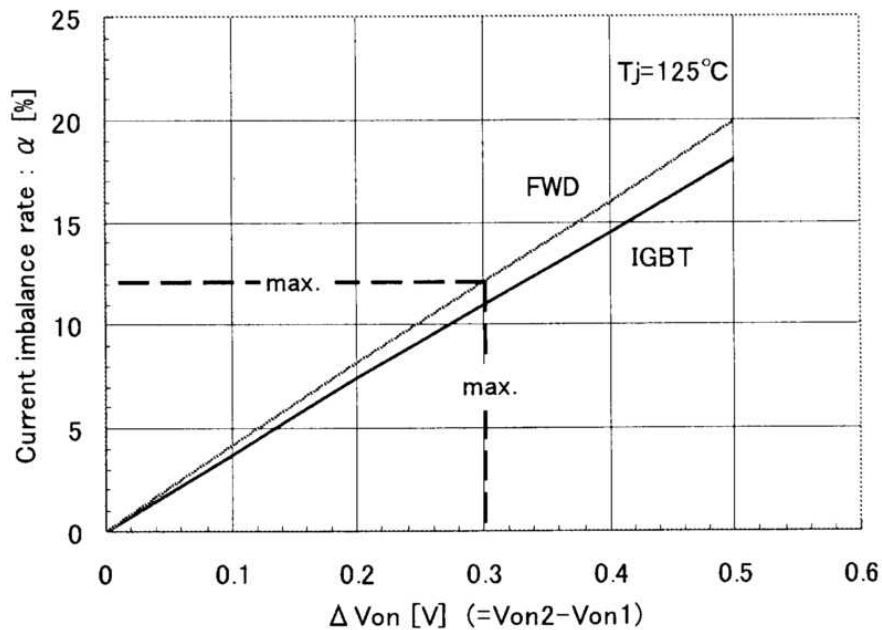
Configuration and equation

$$\Delta V_{on} = V_{on2} - V_{on1} \quad (V_{on1} < V_{on2})$$

$$I_{C(ave)} = (I_1 + I_2) / 2$$

Current imbalance was caused by difference between V_{on1} , V_{on2} , current will be divided to I_1 and I_2 respectively. In this case, the current imbalance rate is defined as following equation.

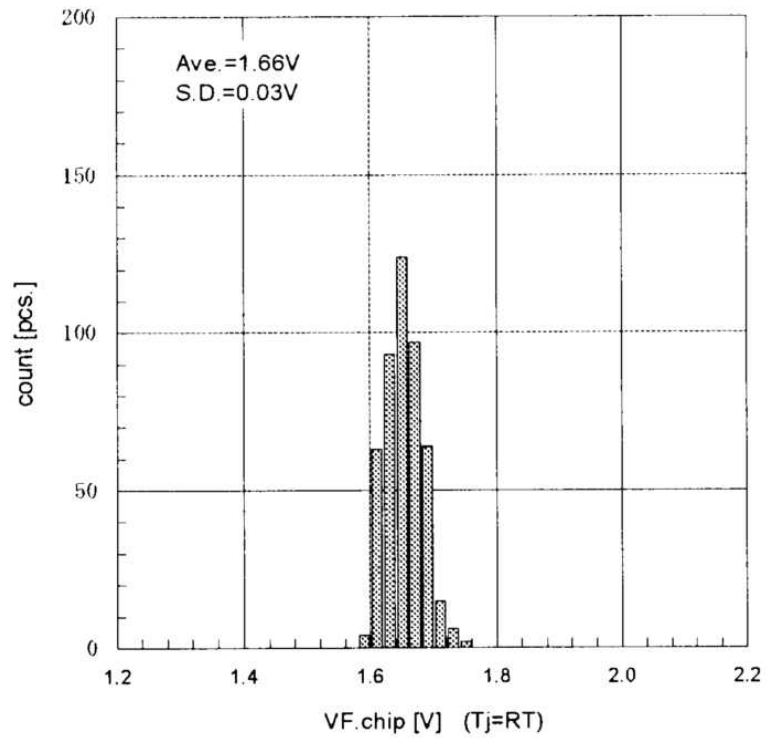
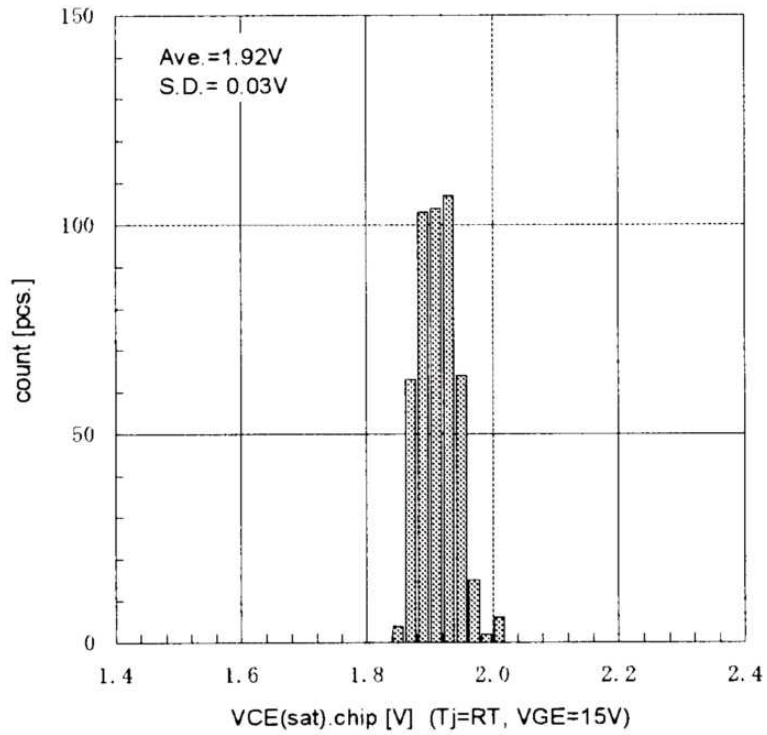
$$\alpha = [I_1 / I_{C(ave)} - 1] \times 100(\%)$$



The rank division of V_{on} is unnecessary for U4 Series by the set value of $\alpha = 12\%$ (IGBT: $\alpha = 11\%$, FWD: $\alpha = 12\%$). When connecting parallel the chips of N piece, overall permissible current is shown by the follow (I_{max} is made maximum permissible current).

$$\text{Overall permissible current } \Sigma I = I_{max} \times [1 + (n-1) \times (1 - \alpha/100) / (1 + \alpha/100)]$$

Distribution chart of $V_{CE(sat)}$ and V_F (example)

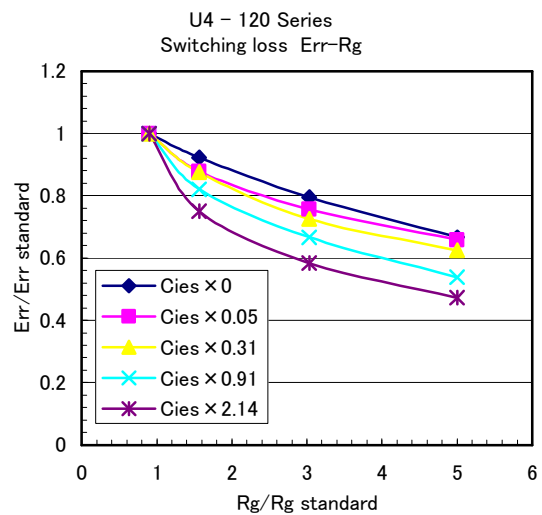
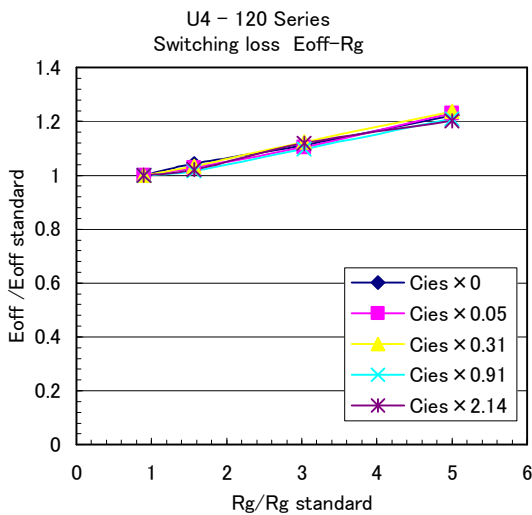
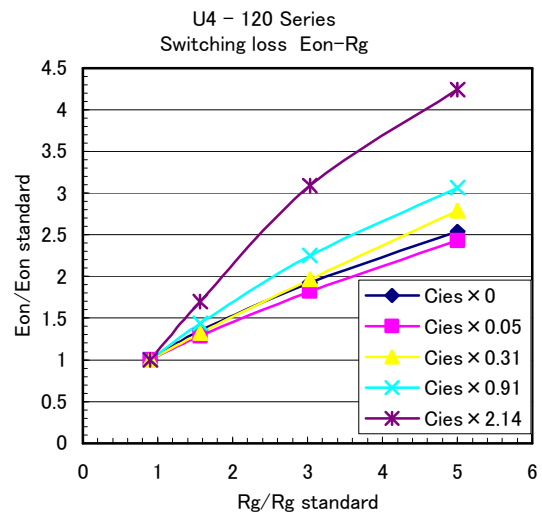
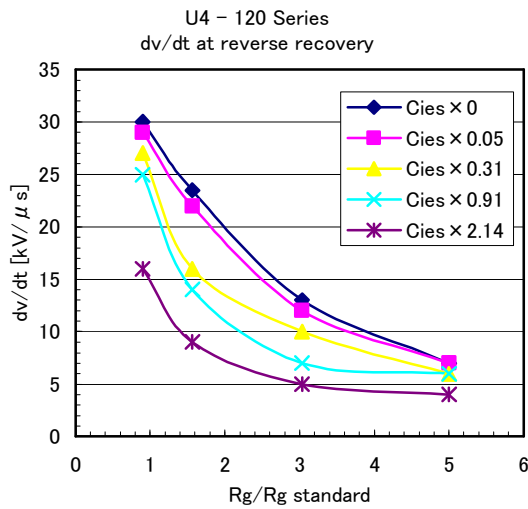


FUJI IGBT Modules U4-120 Series
Switching loss, dv/dt vs. C_{GE} , R_g

Sample: 2MBI200U4H-120

Conditions: Reverse recovery dv/dt: $V_{CC}=600V$, $I_C=20A$, $V_{GE}=+15V/-8V$, $T_j=RT$

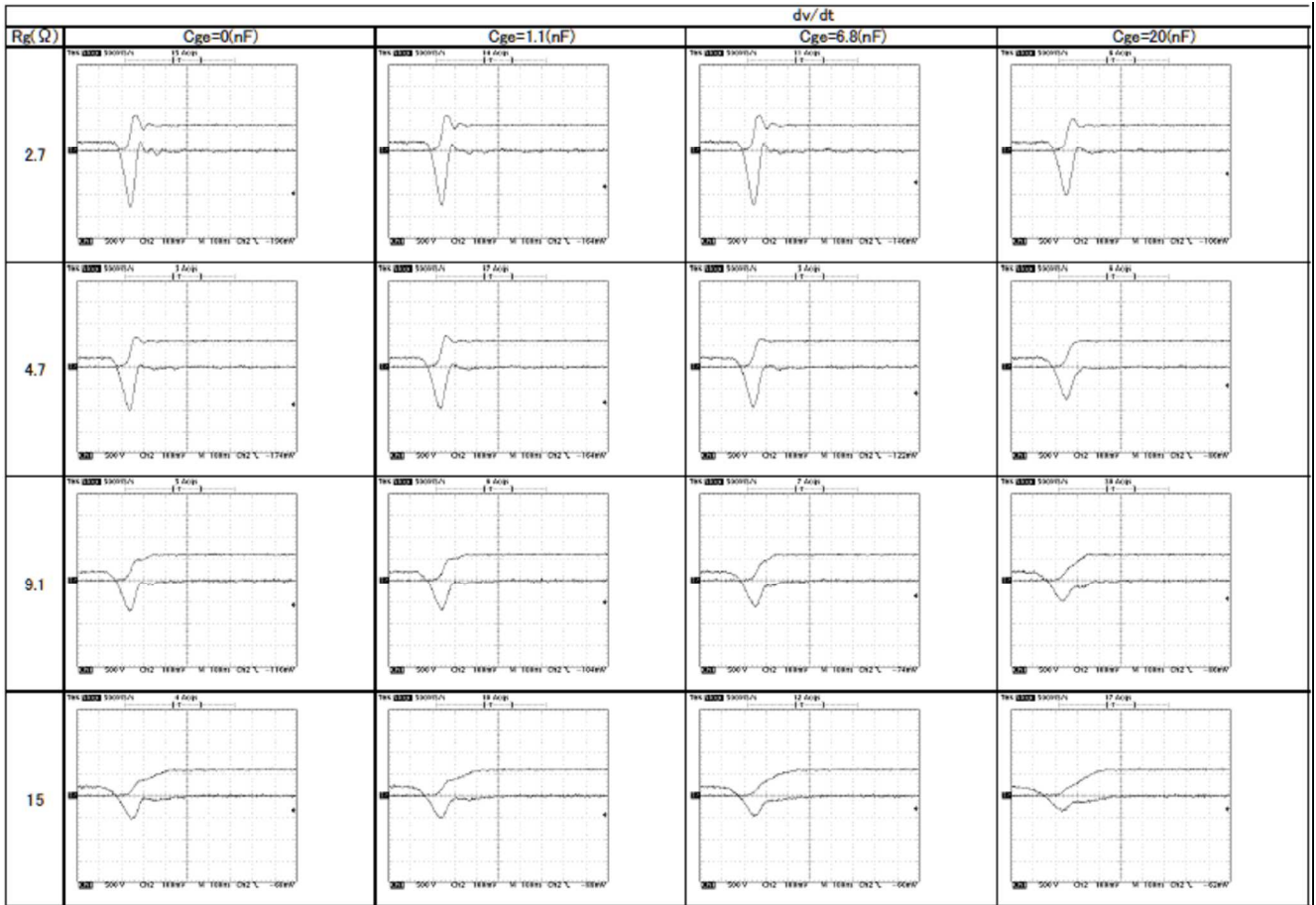
Switching loss: $V_{CC}=600V$, $I_C=20A$, $V_{GE}=+15V/-8V$, $T_j=RT$



※ E_{on} standard : $R_g=R_g$ standard , $C_{ies}=0 \mu F$ (they are similar for E_{off} and E_{rr})

※ Connecting C_{ge} is unnecessary for U4-Series because it able to control the switching loss, dv/dt by the gate resistance.

Switching waveform



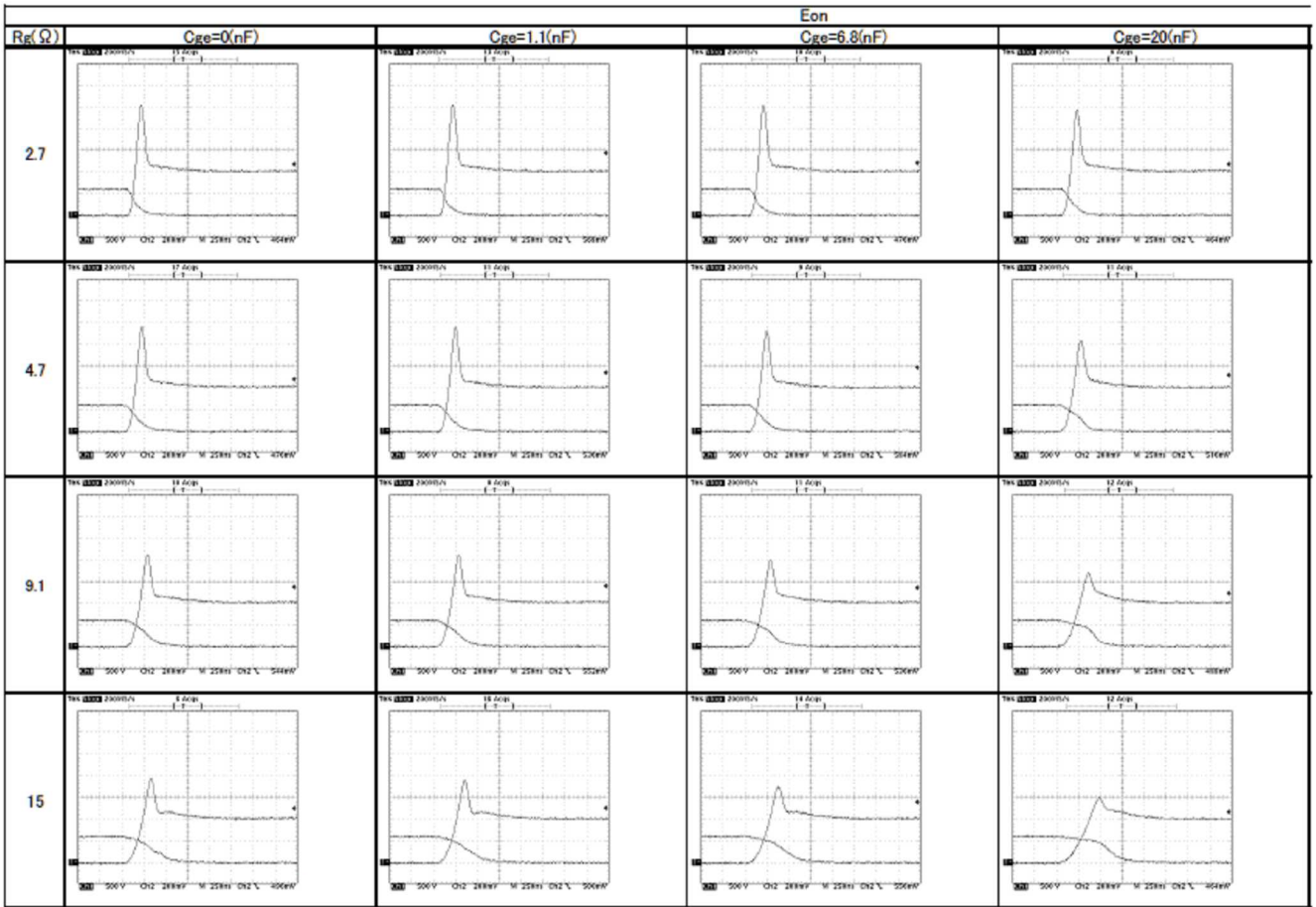
$E_d=600V, I_c=20A, 2MBI200U4H-120, V_{ge}=+15V/-8V, T_j=RT$

$I_c: 100A/div, V_{ce}: 500V/div, t: 100ns/div$

Figure 1. Reverse-recovery waveform

Technical documents | MT5F19703

2008-03-27



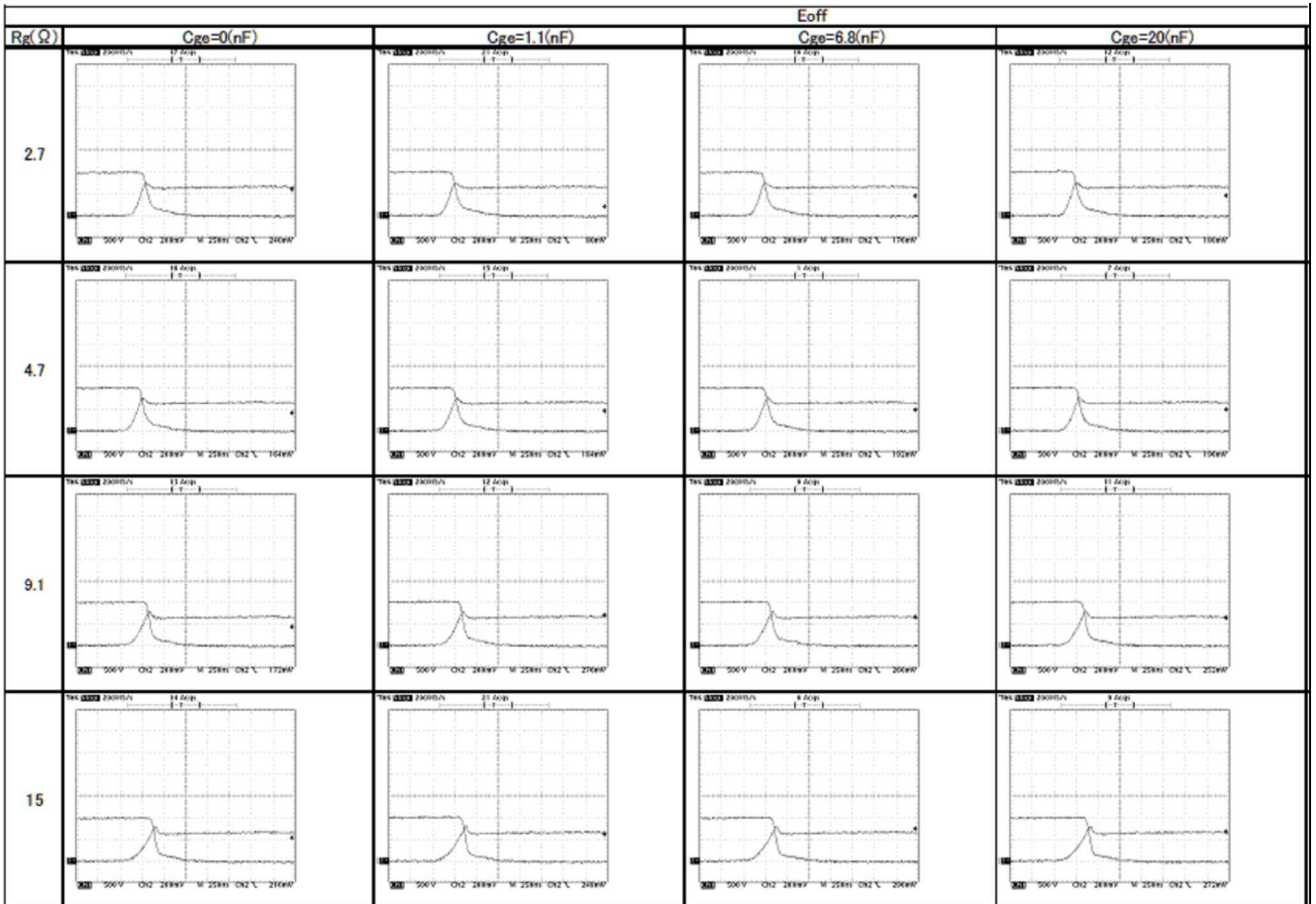
$E_d=600V, I_c=200A, 2MBI200U4H-120, V_{ge}=+15V/-8V, T_j=125^\circ C$

$I_c: 100A/div, V_{ce}: 500V/div, t: 250ns/div$

Figure 2. Turn-on waveform

Technical documents | MT5F19703

2008-03-27



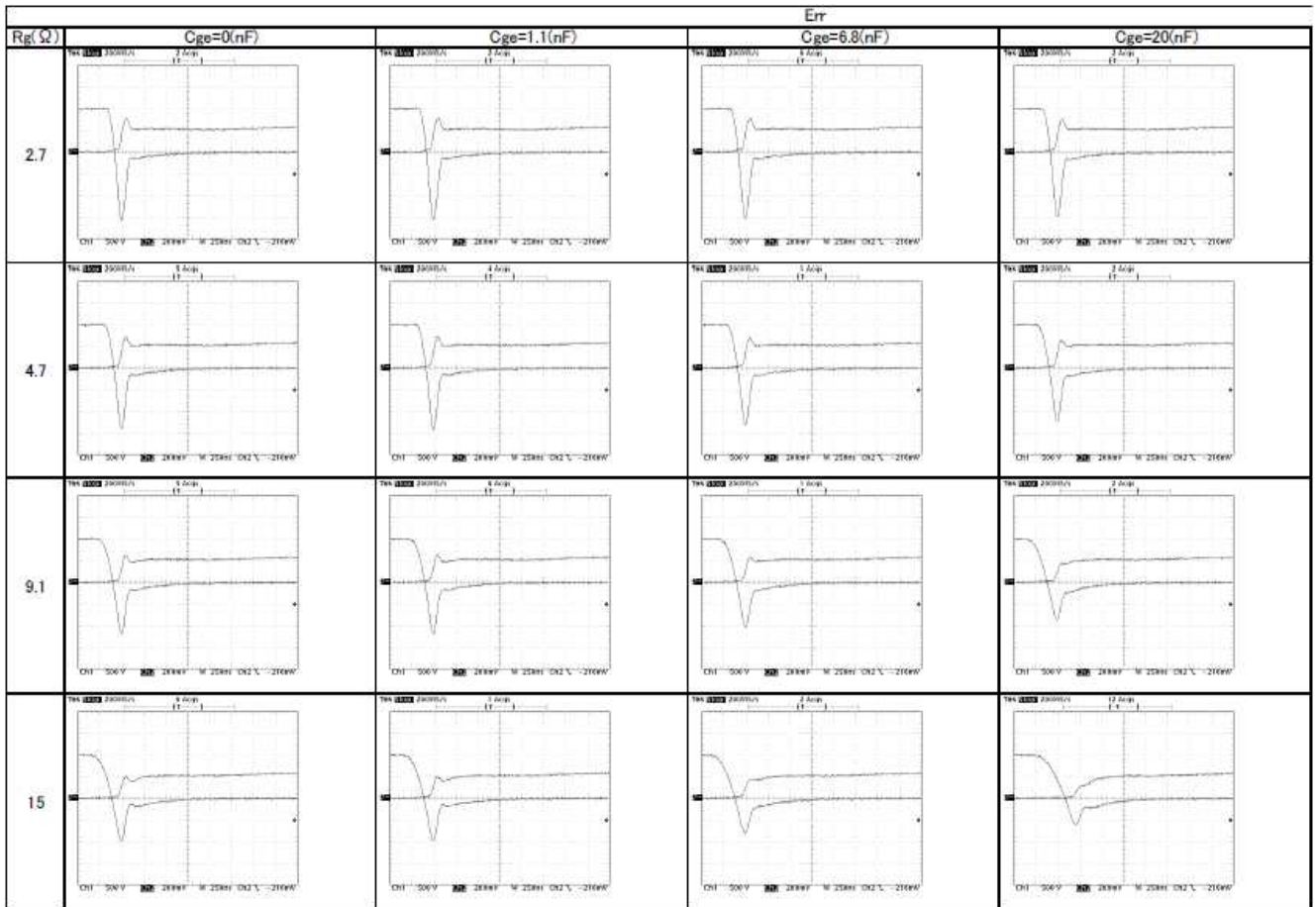
$E_d=600V, I_c=200A, 2MBI200U4H-120, V_{ge}=+15V/-8V, T_j=125^\circ C$

$I_c: 100A/div, V_{ce}: 500V/div, t: 250ns/div$

Figure 3. Turn-off waveform

Technical documents | MT5F19703

2008-03-27



$E_d=600V, I_c=200A, 2MBI200U4H-120, V_{ge}=+15V/-8V, T_j=125^\circ C$

$I_c: 100A/div, V_{ce}: 500V/div, t: 250ns/div$

Figure 4. Reverse-recovery waveform

Technical documents | MT5F19703

2008-03-27

FUJI IGBT Modules U4-120 Series
-V_{GE} vs. switching loss characteristics

Sample: 1MBI400U4-120

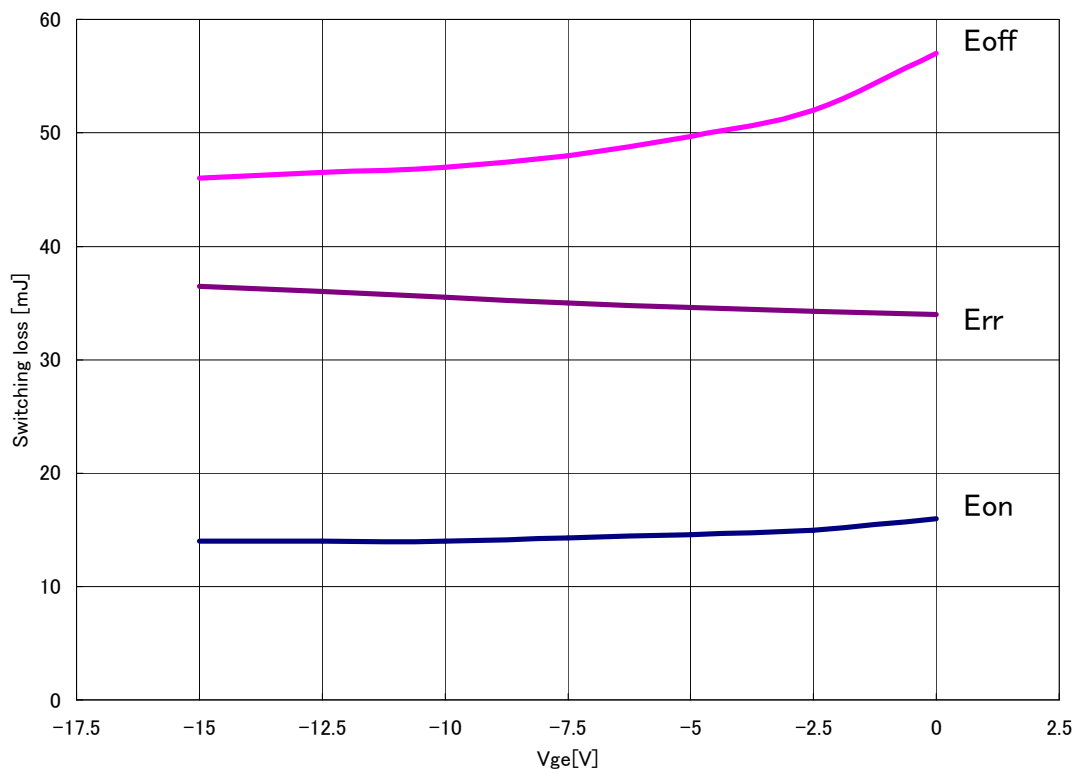
Conditions: T_j=125°C

V_{DC}=600V

V_{GEon}=+15V

I_C=300A

R_G=2.2Ω



Technical documents | MT5F17044

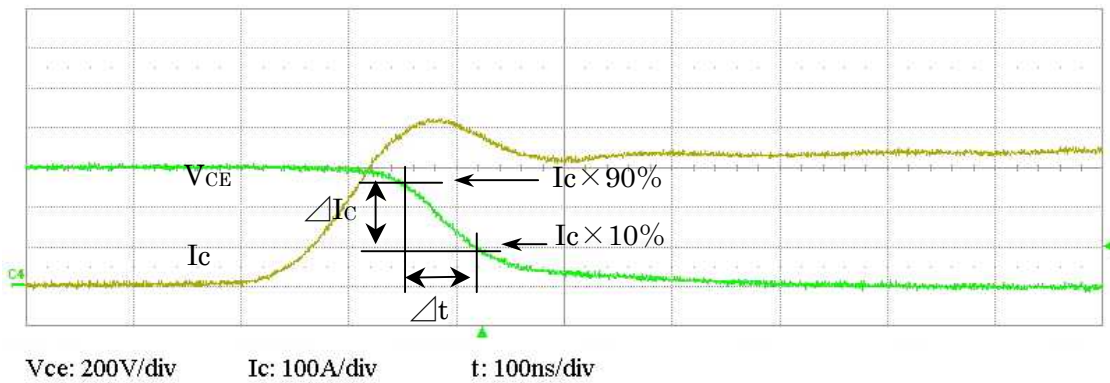
2008-03-27

FUJI IGBT Modules U4-120 Series
-dIc/dt vs. T_j characteristics

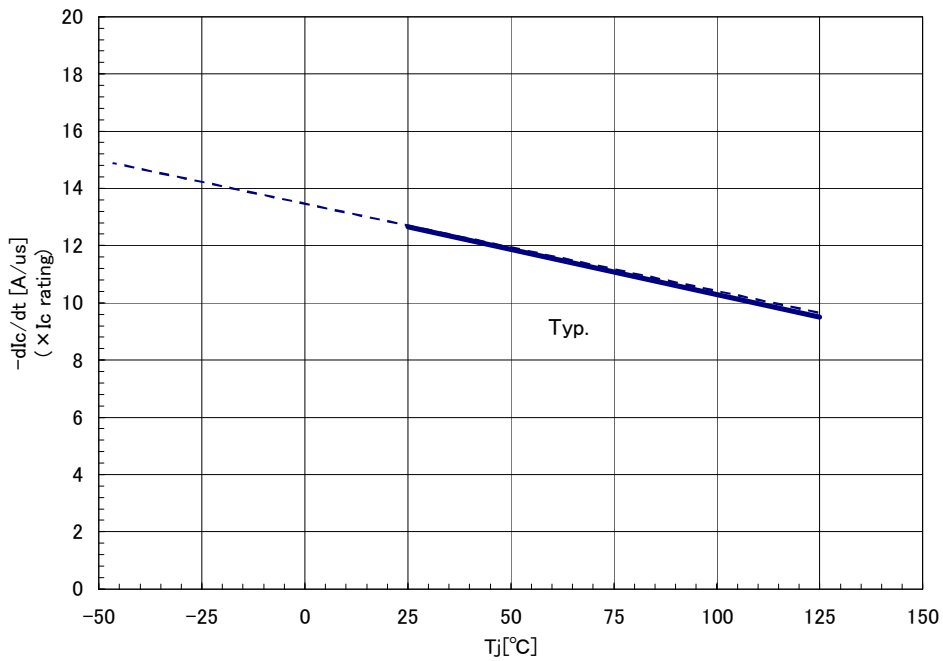
Sample: 2MBI300U4H-120

Conditions: V_{DC}=600V, I_C=300A

V_{GE}=±15V, R_G=2.2Ω



U4-120 Series



Technical documents **MT5F19887**

2008-03-27

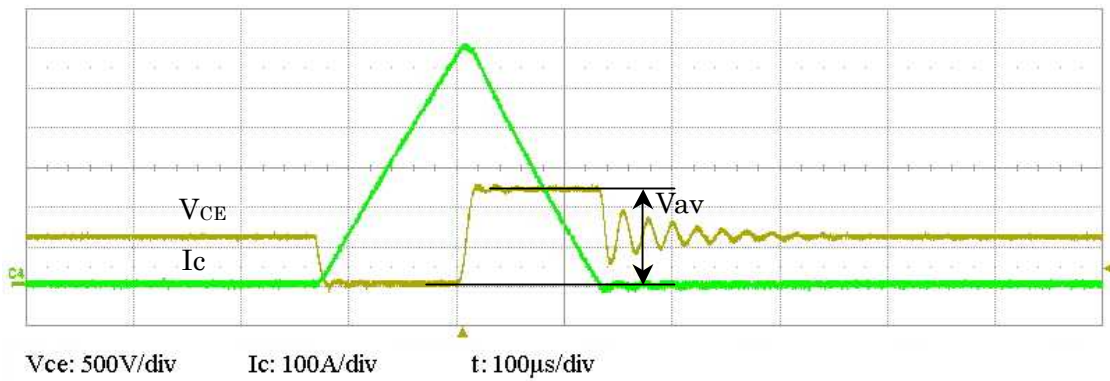
FUJI IGBT Modules U4-120 Series

Dynamic avalanche voltage vs. T_j characteristics

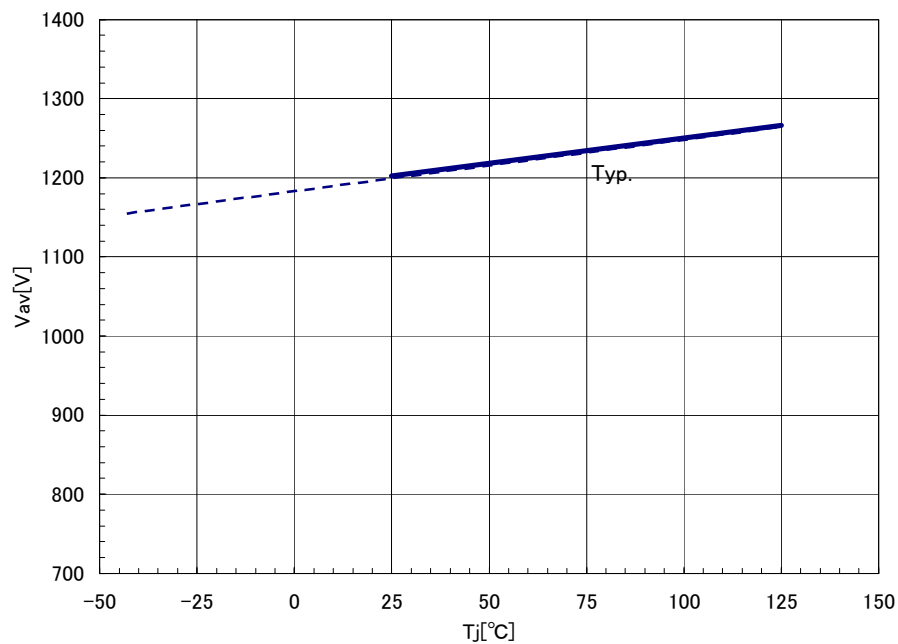
Sample: 2MBI300U4H-120

Conditions: $V_{DC}=600V$, $I_C=2 \times \text{Rated}$

$V_{GE}=\pm 15V$, $R_G=\text{Recommended}$



2MBI300U4H-120



Technical documents **MT5F19890**

2008-03-27

WARNING

1. This Catalog contains the product specifications, characteristics, data, materials, and structures as of May 2011.
The contents are subject to change without notice for specification changes or other reasons. When using a product listed in this Catalog, be sure to obtain the latest specifications.
2. All applications described in this Catalog exemplify the use of Fuji's products for your reference only. No right or license, either express or implied, under any patent, copyright, trade secret or other intellectual property right owned by Fuji Electric Co., Ltd. is (or shall be deemed) granted. Fuji Electric Co., Ltd. makes no representation or warranty, whether express or implied, relating to the infringement or alleged infringement of other's intellectual property rights which may arise from the use of the applications described herein.
3. Although Fuji Electric Co., Ltd. is enhancing product quality and reliability, a small percentage of semiconductor products may become faulty. When using Fuji Electric semiconductor products in your equipment, you are requested to take adequate safety measures to prevent the equipment from causing a physical injury, fire, or other problem if any of the products become faulty. It is recommended to make your design failsafe, flame retardant, and free of malfunction.
4. The products introduced in this Catalog are intended for use in the following electronic and electrical equipment which has normal reliability requirements.
 - Computers
 - OA equipment
 - Communications equipment (terminal devices)
 - Measurement equipment
 - Machine tools
 - Audiovisual equipment
 - Electrical home appliances
 - Personal equipment
 - Industrial robots etc.
5. If you need to use a product in this Catalog for equipment requiring higher reliability than normal, such as for the equipment listed below, it is imperative to contact Fuji Electric Co., Ltd. to obtain prior approval. When using these products for such equipment, take adequate measures such as a backup system to prevent the equipment from malfunctioning even if a Fuji's product incorporated in the equipment becomes faulty.
 - Transportation equipment (mounted on cars and ships)
 - Trunk communications equipment
 - Traffic-signal control equipment
 - Gas leakage detectors with an auto-shut-off feature
 - Emergency equipment for responding to disasters and anti-burglary devices
 - Safety devices
 - Medical equipment
6. Do not use products in this Catalog for the equipment requiring strict reliability such as the following and equivalents to strategic equipment (without limitation).
 - Space equipment
 - Aeronautic equipment
 - Nuclear control equipment
 - Submarine repeater equipment
7. Copyright ©1996-2011 by Fuji Electric Co., Ltd. All rights reserved.
No part of this Catalog may be reproduced in any form or by any means without the express permission of Fuji Electric Co., Ltd.
8. If you have any question about any portion in this Catalog, ask Fuji Electric Co., Ltd. or its sales agents before using the product. Neither Fuji Electric Co., Ltd. nor its agents shall be liable for any injury caused by any use of the products not in accordance with instructions set forth herein.