

2MSI400VE-170-53

Hybrid Modules

Power Module (Vseries IGBT&SiC SBD Hybrid type)
1700V / 400A / 2-in-1 package

■ **Features**

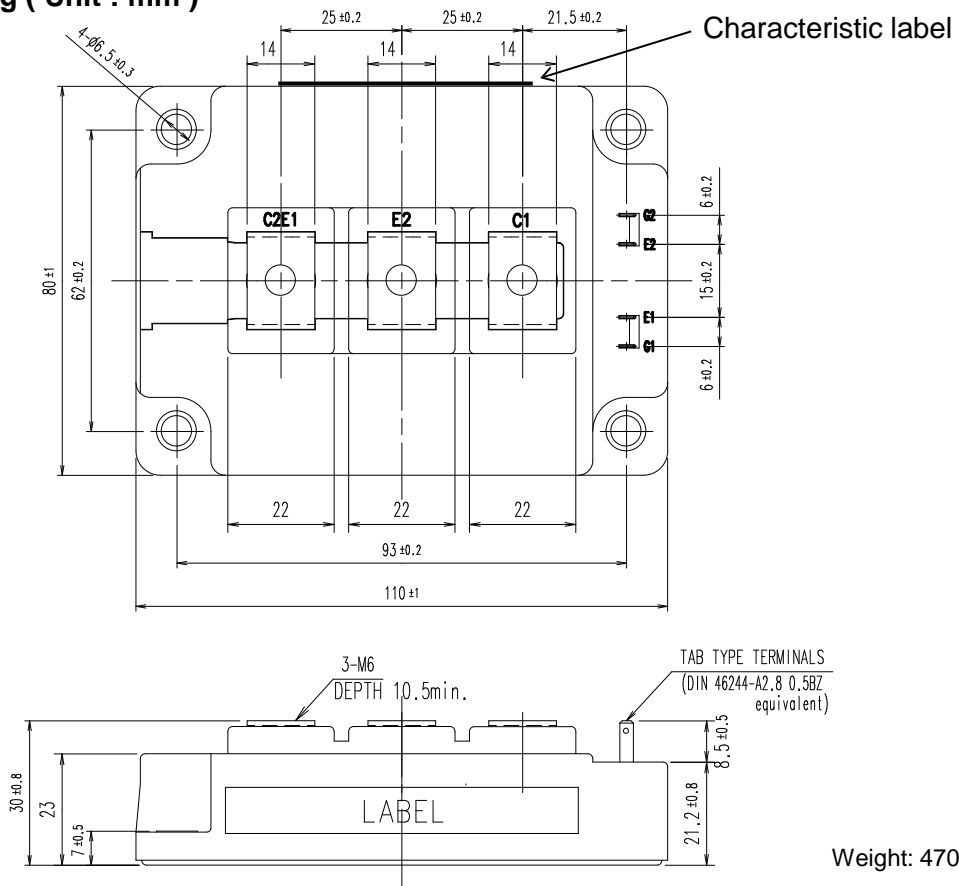
- High speed switching
- Voltage drive
- Low switching loss
- Low Inductance module structure

■ **Applications**

- Inverter for Motor Drive
- AC and DC Servo Drive Amplifier
- Uninterruptible Power Supply
- Active Front End

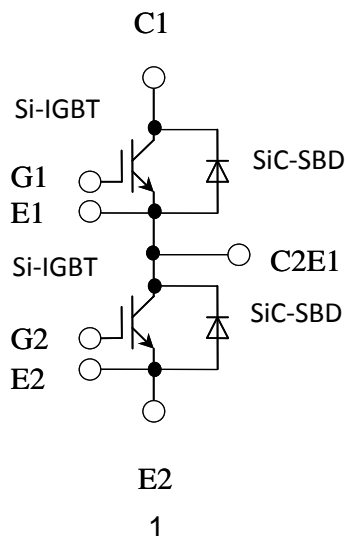


■ **Outline drawing (Unit : mm)**



Weight: 470g (typ.)

■ **Equivalent Circuit**



2MSI400VE-170-53

Hybrid Modules
■ Absolute Maximum Ratings (at Tc= 25°C unless otherwise specified)

| Items | Symbols | Conditions | Maximum Ratings | Units | |
|--|---------------------------------------|-----------------------------|-----------------|--------|------------------|
| Collector-Emitter voltage | VCES | | 1,700 | V | |
| Gate-Emitter voltage | VGES | | ±20 | V | |
| Collector current | Ic | Continuous | Tc=100°C | 400 | A |
| | | | Tc=25°C | 520 | |
| | Ic pulse | 1ms | 800 | | |
| | -Ic | | 400 | | |
| | -Ic pulse | 1ms | 800 | | |
| Collector power dissipation | Pc | 1 device | 4,540 | W | |
| I ² t (*1) | I ² t | 1 device VCE=0V, tw=10ms | Tj=125°C | 14,240 | A ² s |
| | | | Tj=150°C | 11,760 | |
| Junction temperature | Tj | | 175 | °C | |
| Operating junction temperature (under switching conditions) | Tjop | | 150 | | |
| Case temperature | Tc | | 125 | | |
| Storage temperature | Tstg | | -40 ~ 125 | | |
| Isolation | between terminal and copper base (*2) | Viso | AC: 1min. | 4,000 | VAC |
| Screw Mounting (*3) | | - | | 6.0 | N m |
| Torque Terminals (*4) | | - | | 5.0 | |

(* Non-repetitive

(* All terminals should be connected together during the test.

(* Recommendable Value : 3.0-6.0 Nm (M5 or M6)

(* Recommendable Value : 2.5-5.0 Nm (M6)

2MSI400VE-170-53

Hybrid Modules
■ Electrical characteristics (at T_j= 25°C unless otherwise specified)
NOTICE:

The external gate resistance (R_{g_on}, R_{g_off}) shown in below is one of our recommend value for the purpose of minimum switching loss. However the optimum R_g depends on circuit configuration and/or environment. We recommend that the R_g has to be carefully chosen based on consideration if IGBT module matches design criteria, for example, switching loss, EMC/EMI, spike voltage, surge current and no unexpected oscillation and so on. Especially, we recommend to choose R_{g_on} value shown in below or more.

| Items | Symbols | Conditions | Characteristics | | | Units | |
|--------------------------------------|---------------------|---|-----------------------|------|------|-------|---|
| | | | min. | typ. | max. | | |
| Zero gate voltage Collector current | ICES | VGE=0V, VCE=1700V | - | - | 10.0 | mA | |
| Gate-Emitter leakage current | IGES | VCE=0V, VGE=±20V | - | - | 800 | nA | |
| Gate-Emitter threshold voltage | VGE(th) | VCE=20V, Ic=400mA | 6.0 | 6.5 | 7.0 | V | |
| Collector-Emitter saturation voltage | VCE(sat) (terminal) | VGE=15V, Ic=400A | T _j =25°C | - | 2.15 | 2.60 | V |
| | | | T _j =125°C | - | 2.55 | - | |
| | | | T _j =150°C | - | 2.60 | - | |
| | VCE(sat) (chip) | VGE=15V, Ic=400A | T _j =25°C | - | 2.00 | 2.25 | |
| | | | T _j =125°C | - | 2.40 | - | |
| T _j =150°C | - | 2.45 | - | | | | |
| Internal gate resistance | Rg(int) | - | - | 5.6 | - | Ω | |
| Input capacitance | Cies | VCE=10V, VGE=0V, f=1MHz | - | 38 | - | nF | |
| Turn-on time | ton | Vcc=900V, Ic=400A, VGE=±15V, Rg_on=1Ω, Rg_off=0.5Ω, Tj=125°C, Ls=30nH | - | 1050 | - | nsec | |
| | tr | | - | 450 | - | | |
| | tr(i) | | - | - | - | | |
| Turn-off time | toff | Tj=125°C, Ls=30nH | - | 1950 | - | nsec | |
| | tf | | - | 90 | - | | |
| Forward on voltage | VF (terminal) | VGE=0V, IF=400A | T _j =25°C | - | 1.70 | 2.15 | V |
| | | | T _j =125°C | - | 2.25 | - | |
| | | | T _j =150°C | - | 2.45 | - | |
| | VF (chip) | VGE=0V, IF=400A | T _j =25°C | - | 1.60 | 1.90 | |
| | | | T _j =125°C | - | 2.15 | - | |
| T _j =150°C | - | 2.35 | - | | | | |

5. Thermal resistance characteristics

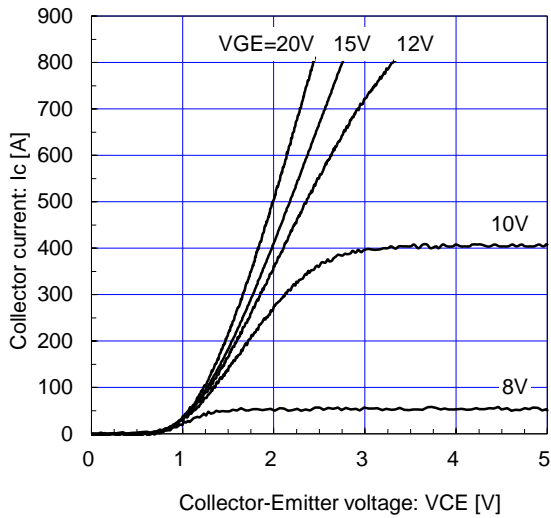
| Items | Symbols | Conditions | Characteristics | | | Units |
|--|----------|-----------------------|-----------------|--------|-------|-------|
| | | | min. | typ. | max. | |
| Thermal resistance(1 device) | Rth(j-c) | IGBT | - | - | 0.033 | °C/W |
| | | FWD(SiC-SBD) | - | - | 0.070 | |
| Contact thermal resistance (1 device) (*1) | Rth(c-f) | with Thermal Compound | - | 0.0125 | - | |

(*1) This is the value which is defined mounting on the additional cooling fin with thermal compound.

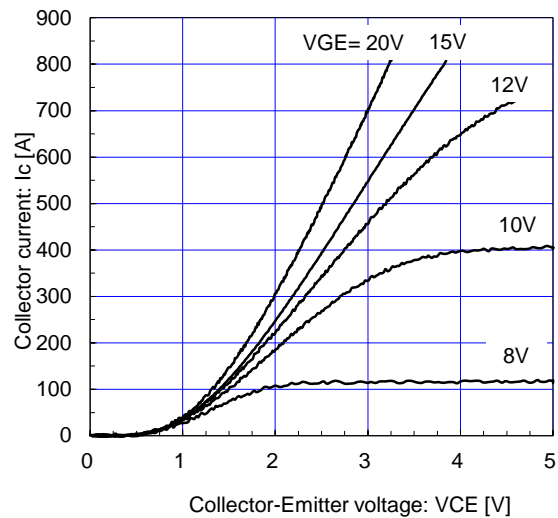
2MSI400VE-170-53

Hybrid Modules

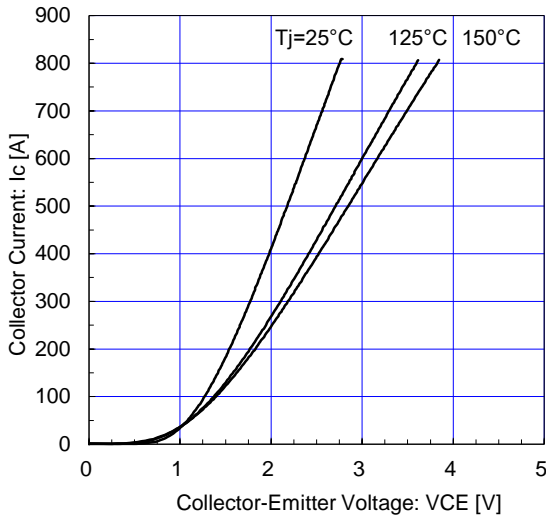
Collector current vs. Collector-Emitter voltage
T_j = 25°C / chip



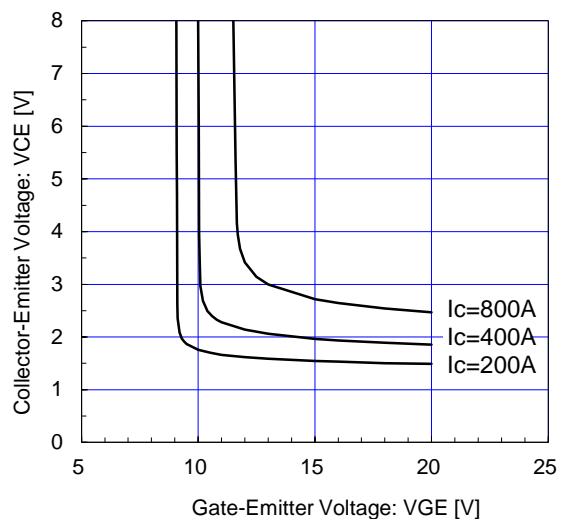
Collector current vs. Collector-Emitter voltage (typ.)
T_j = 150°C / chip



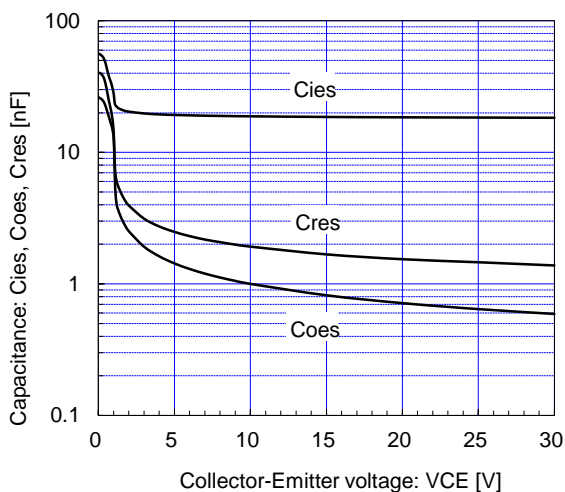
Collector current vs. Collector-Emitter voltage
VGE = 15V / chip



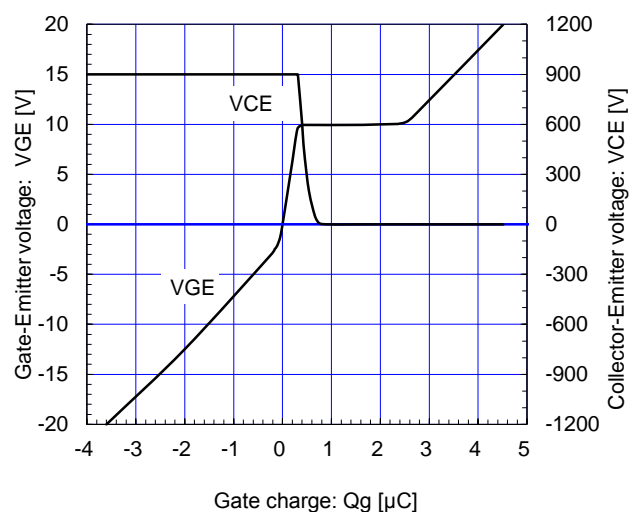
Collector-Emitter voltage vs. Gate-Emitter voltage
T_j = 25°C / chip



Capacitance vs. Collector-Emitter Voltage (typ.)
VGE = 0V, f = 1MHz, T_j = 25°C



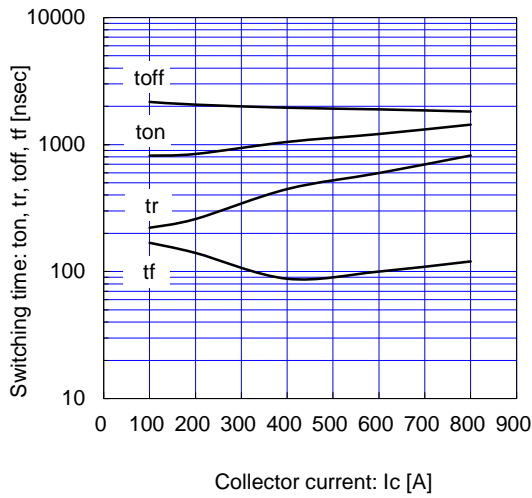
Dynamic Gate Charge (typ.)
V_{cc} = 900V, I_c = 400A, T_j = 25°C



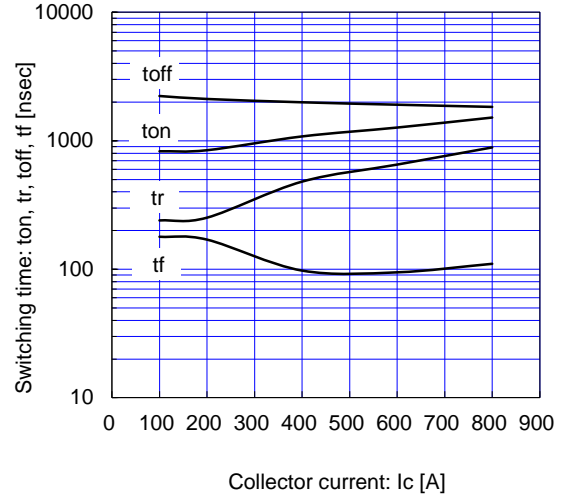
2MSI400VE-170-53

Hybrid Modules

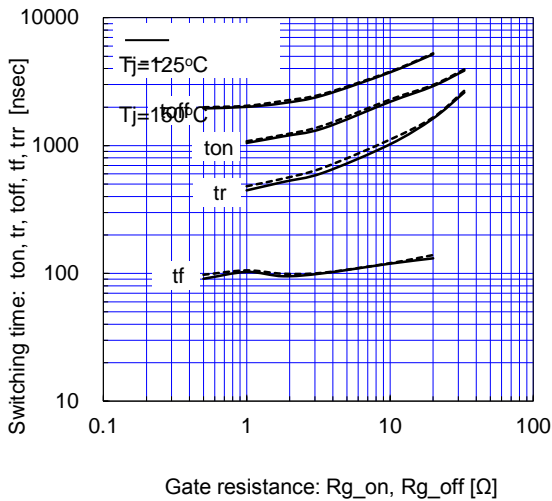
Switching time vs. Collector current (typ.)
 $V_{cc}=900V$, $V_{GE}=\pm 15V$, $R_{g_on}=1\Omega$, $R_{g_off}=0.5\Omega$, $T_j=125^\circ C$



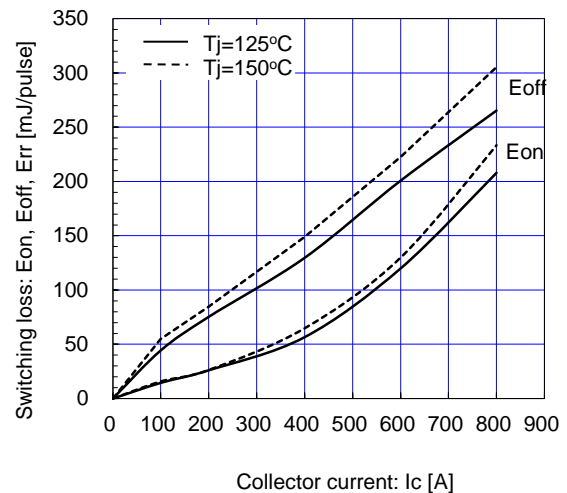
Switching time vs. Collector current (typ.)
 $V_{cc}=900V$, $V_{GE}=\pm 15V$, $R_{g_on}=1\Omega$, $R_{g_off}=0.5\Omega$, $T_j=150^\circ C$



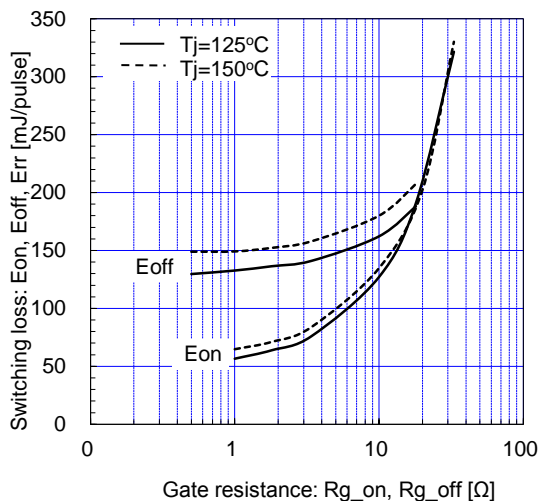
Switching time vs. Gate resistance (typ.)
 $V_{cc}=900V$, $I_c=I_F=400A$, $V_{GE}=\pm 15V$



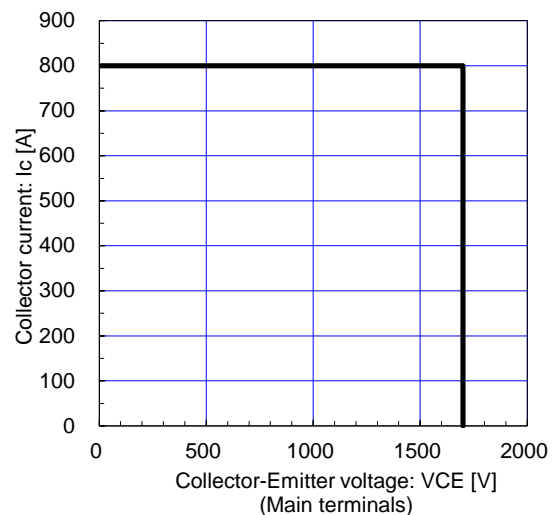
Switching loss vs. Collector current (typ.)
 $V_{cc}=900V$, $V_{GE}=\pm 15V$, $R_{g_on}=1\Omega$, $R_{g_off}=0.5\Omega$



Switching loss vs. Gate resistance (typ.)
 $V_{cc}=900V$, $I_c=I_F=400A$, $V_{GE}=\pm 15V$



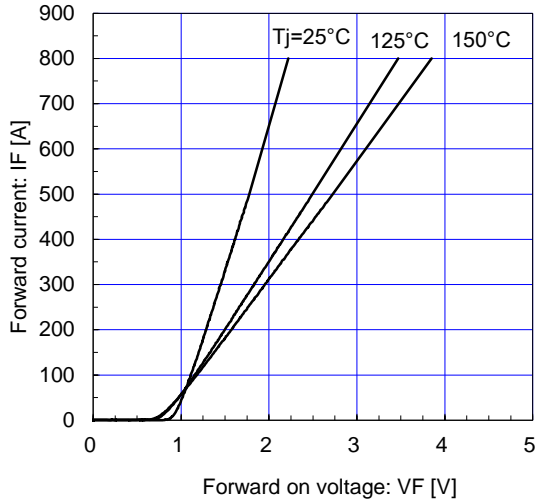
Reverse bias safe operating area (max.)
 $+V_{GE}=15V$, $-V_{GE}=15V$, $R_{g_off}=0.5\Omega$, $T_j=150^\circ C$



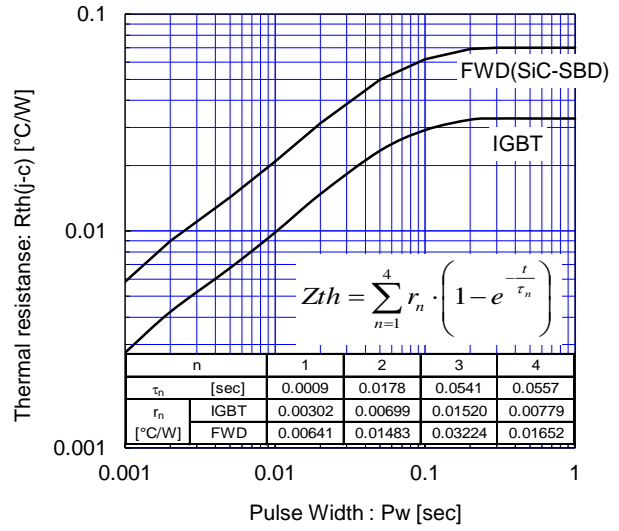
2MSI400VE-170-53

Hybrid Modules

Forward Current vs. Forward Voltage (typ.)
chip



Transient Thermal Resistance (max.)



Warnings

1. This Catalog contains the product specifications, characteristics, data, materials, and structures as of 6/2015. 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 fail-safe, 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 (c)1996-2015 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.

Technical Information

Hybrid Modules

- Please refer to URLs below for further information about products, application manuals and technical documents.
- 关于本规格书中没有记载的产品信息，应用手册，技术资料等，请参考以下链接。
- 本データシートに記載されていない製品情報，アプリケーションマニュアル，技術資料は以下のURLをご参照下さい。

FUJI ELECTRIC Power Semiconductor WEB site:

| | | |
|----------|---------------|--|
| WEB site | Global | www.fujielectric.com/products/semiconductor/ |
| | 中国 | www.fujielectric.com.cn/products/semiconductor/ |
| | Europe | www.fujielectric-europe.com/components/semiconductors/ |
| | North America | www.americas.fujielectric.com/components/semiconductors/ |
| | 日本 | www.fujielectric.co.jp/products/semiconductor/ |

Information

1. Semiconductors General Catalog / 半导体综合目录 / 半導体総合カタログ
 - Global www.fujielectric.com/products/semiconductor/catalog/
 - 中国 www.fujielectric.com.cn/products/semiconductor/catalog/
 - 日本 www.fujielectric.co.jp/products/semiconductor/catalog/
2. Product Information / 产品信息 / 製品情報
 - Global www.fujielectric.com/products/semiconductor/model/
 - 中国 www.fujielectric.com.cn/products/semiconductor/model/
 - 日本 www.fujielectric.co.jp/products/semiconductor/model/
3. Application Manuals / 应用手册 / アプリケーションマニュアル
 - Global www.fujielectric.com/products/semiconductor/model/igbt/application/
 - 中国 www.fujielectric.com.cn/products/semiconductor/model/igbt/application/
 - 日本 www.fujielectric.co.jp/products/semiconductor/model/igbt/application/
4. Technical Documents / 技术资料 / 技術資料
 - Global www.fujielectric.com/products/semiconductor/model/igbt/technical/
 - 中国 www.fujielectric.com.cn/products/semiconductor/model/igbt/technical/
 - 日本 www.fujielectric.co.jp/products/semiconductor/model/igbt/technical/
5. Mounting Instructions / 安装说明书 / マウンティングインストラクション
 - Global www.fujielectric.com/products/semiconductor/model/igbt/mounting/
 - 中国 www.fujielectric.com.cn/products/semiconductor/model/igbt/mounting/
 - 日本 www.fujielectric.co.jp/products/semiconductor/model/igbt/mounting/
6. IGBT Loss Simulation Software / IGBT损耗模拟软件 / IGBT損失シミュレーションソフト
 - Global www.fujielectric.com/products/semiconductor/model/igbt/simulation/
 - 中国 www.fujielectric.com.cn/products/semiconductor/model/igbt/simulation/
 - 日本 www.fujielectric.co.jp/products/semiconductor/model/igbt/simulation/
7. AT-NPC 3-Level Loss Simulation Software / AT-NPC 3-Level损耗模拟软件 / AT-NPC 3-Level 損失シミュレーションソフト
 - Global www.fujielectric.com/products/semiconductor/model/igbt/simulation_3level/
 - 中国 www.fujielectric.com.cn/products/semiconductor/model/igbt/simulation_3level/
 - 日本 www.fujielectric.co.jp/products/semiconductor/model/igbt/simulation_3level/
8. Fuji Electric Journal / 富士电机技报 / 富士電機技報
 - Global www.fujielectric.com/products/semiconductor/journal/
 - 中国 www.fujielectric.com.cn/products/semiconductor/journal/
 - 日本 www.fujielectric.co.jp/products/semiconductor/journal/
9. Contact / 产品咨询 / 製品のお問い合わせ
 - Global www.fujielectric.com/products/semiconductor/contact/
 - 中国 www.fujielectric.com.cn/products/semiconductor/contact/
 - 日本 www.fujielectric.co.jp/products/semiconductor/contact/
10. Revised and discontinued product information / 产品更改和停产信息 / 改廃のお知らせ
 - Global www.fujielectric.com/products/semiconductor/discontinued/
 - 中国 www.fujielectric.com.cn/products/semiconductor/discontinued/
 - 日本 www.fujielectric.co.jp/products/semiconductor/discontinued/

Technical Information

IGBT Modules

- Please refer to URLs below for further information about products, application manuals and technical documents.
- 关于本规格书中没有记载的产品信息·应用手册·技术资料等·请参考以下链接。
- 本データシートに記載されていない製品情報，アプリケーションマニュアル，技術資料は以下の URL をご参照下さい。

FUJI ELECTRIC Power Semiconductor WEB site

| | |
|---------------|--|
| 日本 | www.fujielectric.co.jp/products/semiconductor/ |
| Global | www.fujielectric.com/products/semiconductor/ |
| 中国 | www.fujielectric.com.cn/products/semiconductor/ |
| Europe | www.fujielectric-europe.com/components/semiconductors/ |
| North America | www.americas.fujielectric.com/components/semiconductors/ |

Information

日本

| | |
|--------------------------------|--|
| 1 半導体総合カタログ | www.fujielectric.co.jp/products/semiconductor/catalog/ |
| 2 製品情報 | www.fujielectric.co.jp/products/semiconductor/model/ |
| 3 アプリケーションマニュアル | www.fujielectric.co.jp/products/semiconductor/model/igbt/application/ |
| 4 技術資料 | www.fujielectric.co.jp/products/semiconductor/model/igbt/technical/ |
| 5 マウンティングインストラクション | www.fujielectric.co.jp/products/semiconductor/model/igbt/mounting/ |
| 6 IGBT 損失シミュレーションソフト | www.fujielectric.co.jp/products/semiconductor/model/igbt/simulation/ |
| 7 AT-NPC 3-Level 損失シミュレーションソフト | www.fujielectric.co.jp/products/semiconductor/model/igbt/simulation_3level/ |
| 8 富士電機技報 | www.fujielectric.co.jp/products/semiconductor/journal/ |
| 9 製品のお問い合わせ | www.fujielectric.co.jp/products/semiconductor/contact/ |
| 10 改廃のお知らせ | www.fujielectric.co.jp/products/semiconductor/discontinued/ |

Global

| | |
|---|--|
| 1 Semiconductors General Catalog | www.fujielectric.com/products/semiconductor/catalog/ |
| 2 Product Information | www.fujielectric.com/products/semiconductor/model/ |
| 3 Application Manuals | www.fujielectric.com/products/semiconductor/model/igbt/application/ |
| 4 Technical Documents | www.fujielectric.com/products/semiconductor/model/igbt/technical/ |
| 5 Mounting Instructions | www.fujielectric.com/products/semiconductor/model/igbt/mounting/ |
| 6 IGBT Loss Simulation Software | www.fujielectric.com/products/semiconductor/model/igbt/simulation/ |
| 7 AT-NPC 3-Level Loss Simulation Software | www.fujielectric.com/products/semiconductor/model/igbt/simulation_3level/ |
| 8 Fuji Electric Journal | www.fujielectric.com/products/semiconductor/journal/ |
| 9 Contact | www.fujielectric.com/products/semiconductor/contact/ |
| 10 Revised and discontinued product information | www.fujielectric.com/products/semiconductor/discontinued/ |

中国

| | |
|-------------------------|--|
| 1 半导体综合目录 | www.fujielectric.com.cn/products/semiconductor/catalog/ |
| 2 产品信息 | www.fujielectric.com.cn/products/semiconductor/model/ |
| 3 应用手册 | www.fujielectric.com.cn/products/semiconductor/model/igbt/application/ |
| 4 技术资料 | www.fujielectric.com.cn/products/semiconductor/model/igbt/technical/ |
| 5 安装说明书 | www.fujielectric.com.cn/products/semiconductor/model/igbt/mounting/ |
| 6 IGBT 损耗模拟软件 | www.fujielectric.com.cn/products/semiconductor/model/igbt/simulation/ |
| 7 AT-NPC 3-Level 损耗模拟软件 | www.fujielectric.com.cn/products/semiconductor/model/igbt/simulation_3level/ |
| 8 富士电机技报 | www.fujielectric.com.cn/products/semiconductor/journal/ |
| 9 产品咨询 | www.fujielectric.com.cn/products/semiconductor/contact/ |
| 10 产品更改和停产信息 | www.fujielectric.com.cn/products/semiconductor/discontinued/ |