

# FM600TU-3A

HIGH POWER SWITCHING USE  
INSULATED PACKAGE

## FM600TU-3A



- ID(rms) .....300A
- VDSS..... 150V
- Insulated Type
- 6-elements in a pack
- Thermistor inside
- UL Recognized

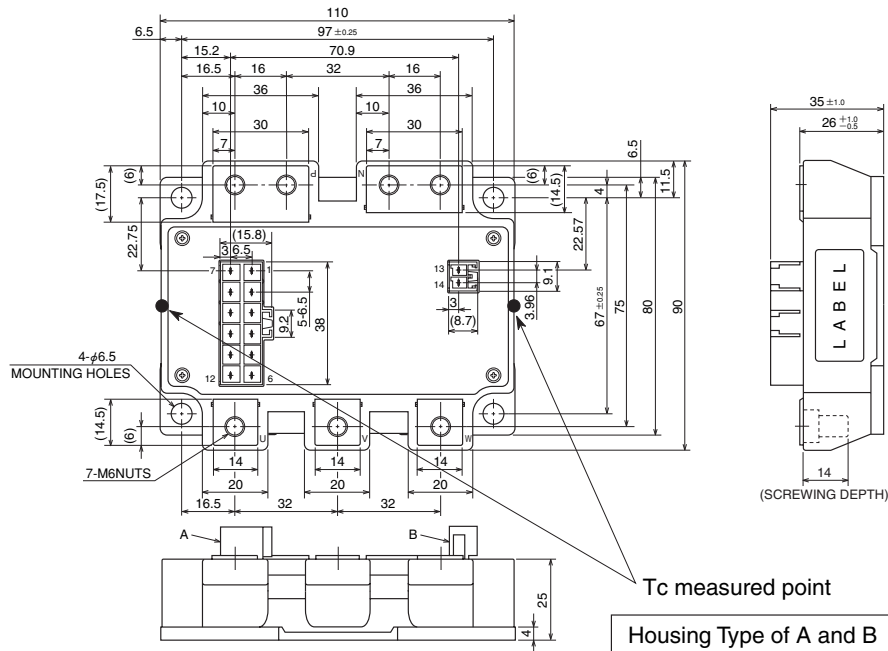
File No.E323585

## APPLICATION

AC motor control of forklift (battery power source), UPS

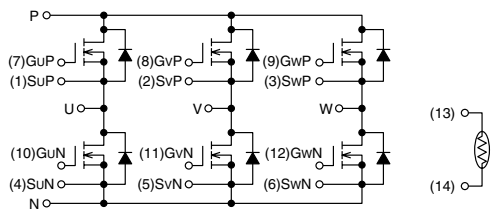
## OUTLINE DRAWING & CIRCUIT DIAGRAM

Dimensions in mm



Tc measured point  
Housing Type of A and B  
(Tyco Electronics P/N:)  
A: 917353-1  
B: 179838-1

### CIRCUIT DIAGRAM



(1)SuP	(2)SvP	(3)SwP	(4)SuN	(5)SvN	(6)SwN	A
(7)GuP	(8)GvP	(9)GwP	(10)GuN	(11)GvN	(12)GwN	A
(13)TH1	(14)TH2					B

## FM600TU-3A

HIGH POWER SWITCHING USE  
INSULATED PACKAGEABSOLUTE MAXIMUM RATINGS (T<sub>j</sub> = 25°C unless otherwise specified.)

Symbol	Item	Conditions	Rating	Unit
V <sub>DSS</sub>	Drain-source voltage	G-S Short	150	V
V <sub>GSS</sub>	Gate-source voltage	D-S Short	±20	V
I <sub>D</sub>	Drain current	T <sub>C</sub> ' = 114°C* <sup>3</sup>	300	A
I <sub>DM</sub>		Pulse* <sup>2</sup>	600	A
I <sub>DA</sub>	Avalanche current	L = 10μH Pulse* <sup>2</sup>	300	A
I <sub>S</sub> * <sup>1</sup>	Source current		300	A
I <sub>SM</sub> * <sup>1</sup>		Pulse* <sup>2</sup>	600	A
P <sub>D</sub> * <sup>4</sup>	Maximum power dissipation	T <sub>C</sub> = 25°C	960	W
P <sub>D</sub> * <sup>4</sup>		T <sub>C</sub> ' = 25°C* <sup>3</sup>	1300	W
T <sub>ch</sub>	Channel temperature		-40 ~ +150	°C
T <sub>stg</sub>	Storage temperature		-40 ~ +125	°C
V <sub>isol</sub>	Isolation voltage	Main terminal to base plate, AC 1 min, f=60Hz, RMS	2500	V
—	Mounting torque	Main Terminal M6	3.5 ~ 4.5	N • m
		Mounting to heat sink M6	3.5 ~ 4.5	N • m
—	Weight	Typical value	600	g

ELECTRICAL CHARACTERISTICS (T<sub>j</sub> = 25°C unless otherwise specified.)

Symbol	Item	Conditions	Limits			Unit	
			Min.	Typ.	Max.		
I <sub>DSS</sub>	Drain cutoff current	V <sub>DS</sub> = V <sub>DSS</sub> , V <sub>GS</sub> = 0V	—	—	1	mA	
V <sub>GS(th)</sub>	Gate-source threshold voltage	I <sub>D</sub> = 30mA, V <sub>DS</sub> = 10V	4.7	6	7.3	V	
I <sub>GSS</sub>	Gate leakage current	V <sub>GS</sub> = V <sub>GSS</sub> , V <sub>DS</sub> = 0V	—	—	1.5	μA	
r <sub>DS(on)</sub>	Static drain-source (chip) On-state resistance	I <sub>D</sub> = 300A V <sub>GS</sub> = 15V	T <sub>j</sub> = 25°C	—	1.6	2.2	mΩ
			T <sub>j</sub> = 125°C	—	3.0	—	
V <sub>DS(on)</sub>	Static drain-source (chip) On-state voltage	I <sub>D</sub> = 300A V <sub>GS</sub> = 15V	T <sub>j</sub> = 25°C	—	0.48	0.66	V
			T <sub>j</sub> = 125°C	—	0.91	—	
R <sub>DD-SS'</sub>	Internal lead resistance	I <sub>D</sub> = 300A terminal-chip	T <sub>j</sub> = 25°C	—	0.7	—	mΩ
			T <sub>j</sub> = 125°C	—	1.0	—	
C <sub>iss</sub>	Input capacitance	V <sub>DS</sub> = 10V V <sub>GS</sub> = 0V	—	—	110	nF	
C <sub>oss</sub>	Output capacitance		—	—	15		
C <sub>rss</sub>	Reverse transfer capacitance		—	—	10		
Q <sub>G</sub>	Total gate charge	V <sub>DD</sub> = 80V, I <sub>D</sub> = 300A, V <sub>GS</sub> = 15V	—	1950	—	nC	
t <sub>d(on)</sub>	Turn-on delay time	V <sub>DD</sub> = 80V, I <sub>D</sub> = 300A, V <sub>GS1</sub> = V <sub>GS2</sub> = 15V R <sub>G</sub> = 4.2Ω, Inductive load switching operation I <sub>S</sub> = 300A	—	—	400	ns	
t <sub>r</sub>	Rise time		—	—	400		
t <sub>d(off)</sub>	Turn-off delay time		—	—	500		
t <sub>f</sub>	Fall time		—	—	400		
t <sub>rr</sub> * <sup>1</sup>	Reverse recovery time		—	—	200		
Q <sub>rr</sub> * <sup>1</sup>	Reverse recovery charge		—	8.0	—		μC
V <sub>SD</sub> * <sup>1</sup>	Source-drain voltage		I <sub>S</sub> = 300A, V <sub>GS</sub> = 0V	—	—		1.3
R <sub>th(j-c)</sub>	Thermal resistance	MOSFET part (1/6 module)* <sup>7</sup>	—	—	0.13	K/W	
R <sub>th(j-c')</sub>		MOSFET part (1/6 module)* <sup>3</sup>	—	—	0.096		
R <sub>th(c-s)</sub>	Contact thermal resistance	Case to fin, Thermal grease Applied* <sup>8</sup> (1/6 module)	—	0.1	—		
R <sub>th(c-s')</sub>		Case to fin, Thermal grease Applied* <sup>3, 8</sup> (1/6 module)	—	0.09	—		

## NTC THERMISTOR PART

Symbol	Parameter	Conditions	Limits			Unit
			Min.	Typ.	Max.	
R <sub>25</sub> * <sup>6</sup>	Resistance	T <sub>TH</sub> = 25°C* <sup>5</sup>	—	100	—	kΩ
B* <sup>6</sup>	B Constant	Resistance at T <sub>TH</sub> = 25°C, 50°C* <sup>5</sup>	—	4000	—	K

\*1: It is characteristics of the anti-parallel, source to drain free-wheel diode (FWDi).

\*2: Pulse width and repetition rate should be such that the device junction temperature (T<sub>j</sub>) does not exceed T<sub>j</sub> max rating.\*3: T<sub>C</sub>' measured point is just under the chips. If use this value, R<sub>th(s-a)</sub> should be measured just under the chips.

\*4: Pulse width and repetition rate should be such as to cause negligible temperature rise.

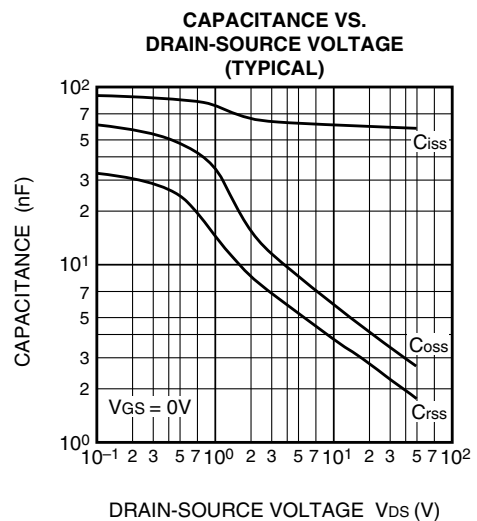
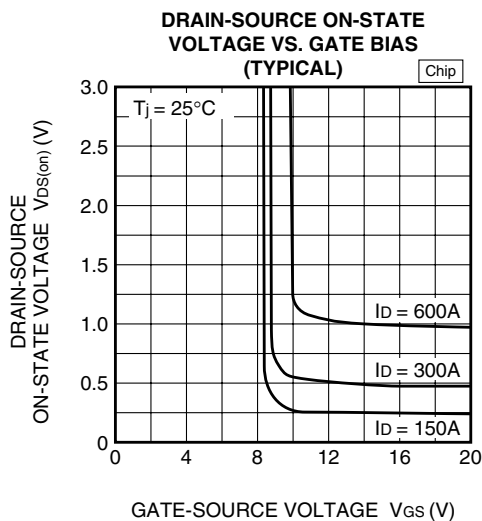
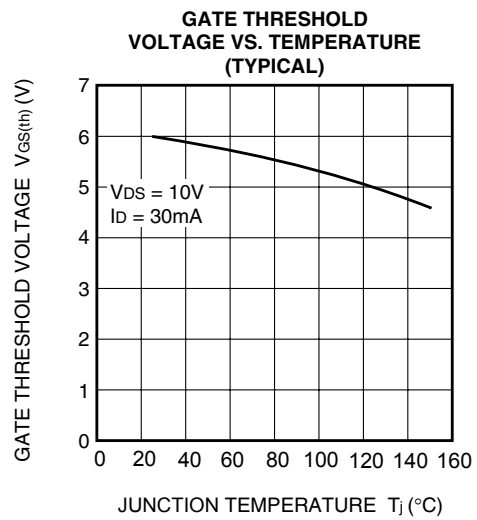
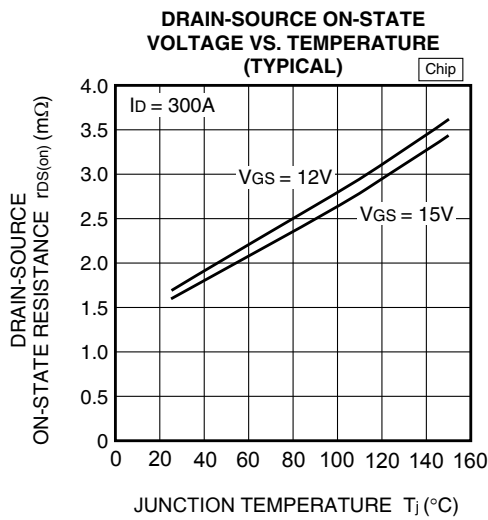
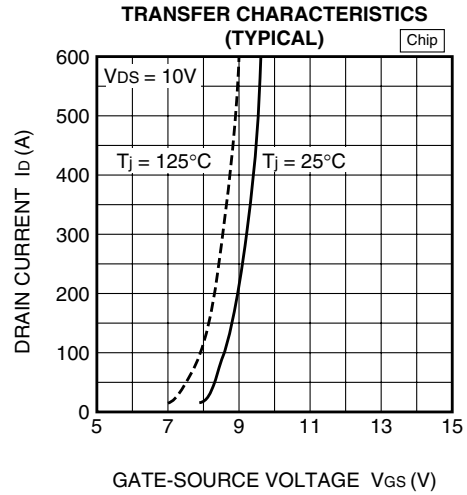
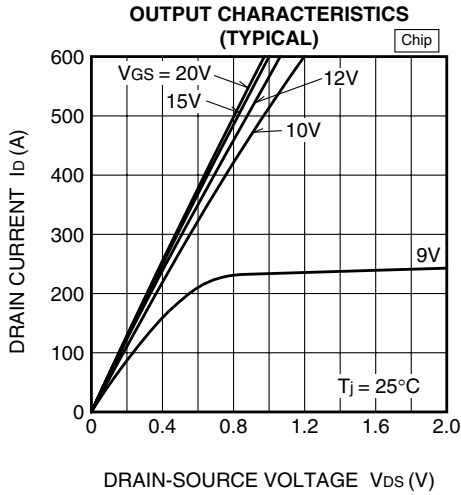
\*5: T<sub>TH</sub> is thermistor temperature.\*6: B = (lnR<sub>1</sub> - lnR<sub>2</sub>) / (1/T<sub>1</sub> - 1/T<sub>2</sub>) R<sub>1</sub>: Resistance at T<sub>1</sub>(K), R<sub>2</sub>: Resistance at T<sub>2</sub>(K)\*7: T<sub>C</sub> measured point is shown in page OUTLINE DRAWING.

\*8: Typical value is measured by using thermally conductive grease of λ=0.9 W/(m·K).

# FM600TU-3A

HIGH POWER SWITCHING USE  
INSULATED PACKAGE

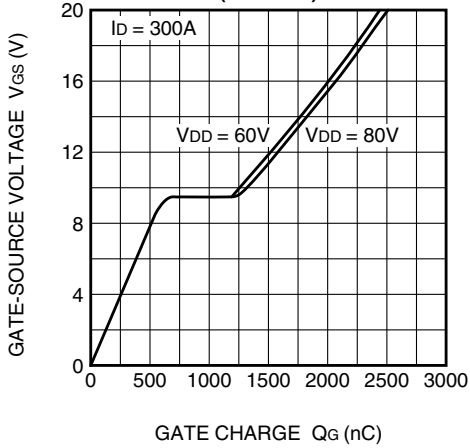
## PERFORMANCE CURVES



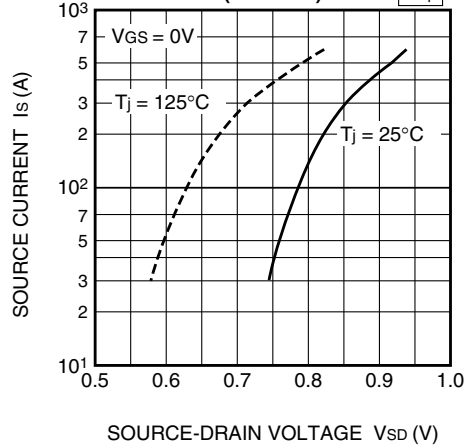
# FM600TU-3A

HIGH POWER SWITCHING USE  
INSULATED PACKAGE

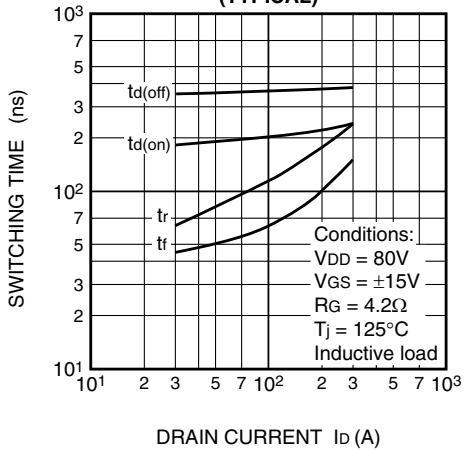
**GATE CHARGE CHARACTERISTICS (TYPICAL)**



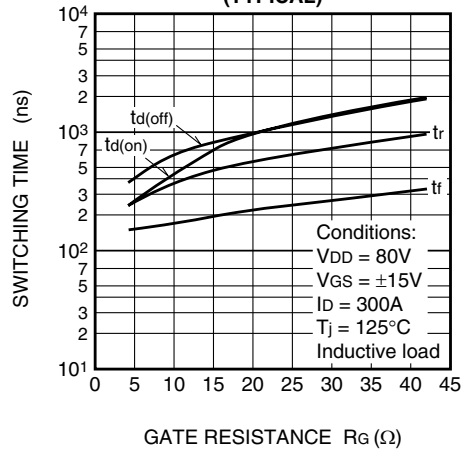
**FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)**



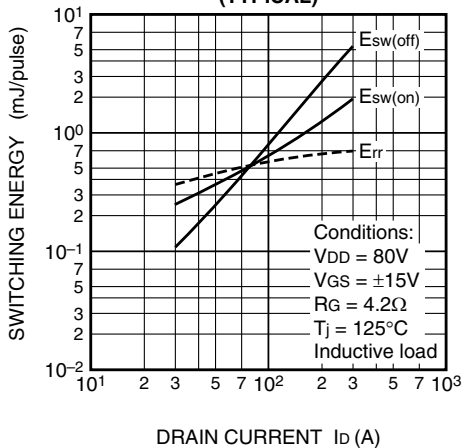
**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**



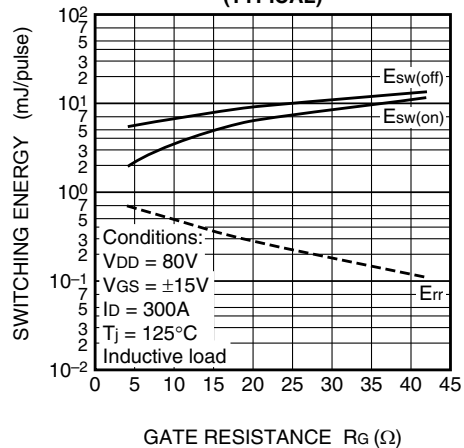
**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**



**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**



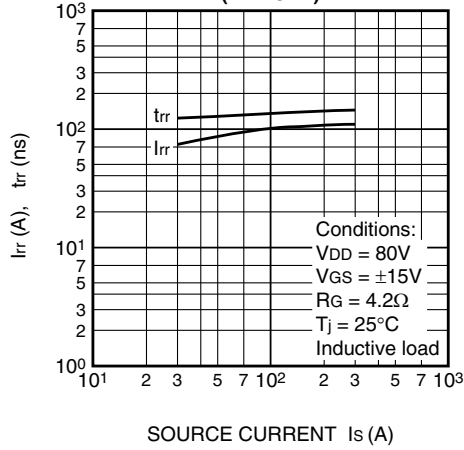
**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**



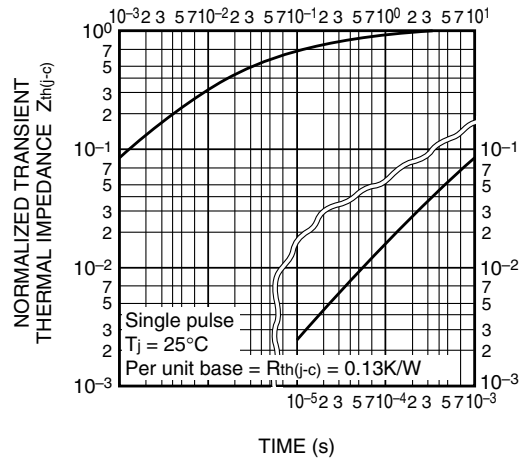
# FM600TU-3A

HIGH POWER SWITCHING USE  
INSULATED PACKAGE

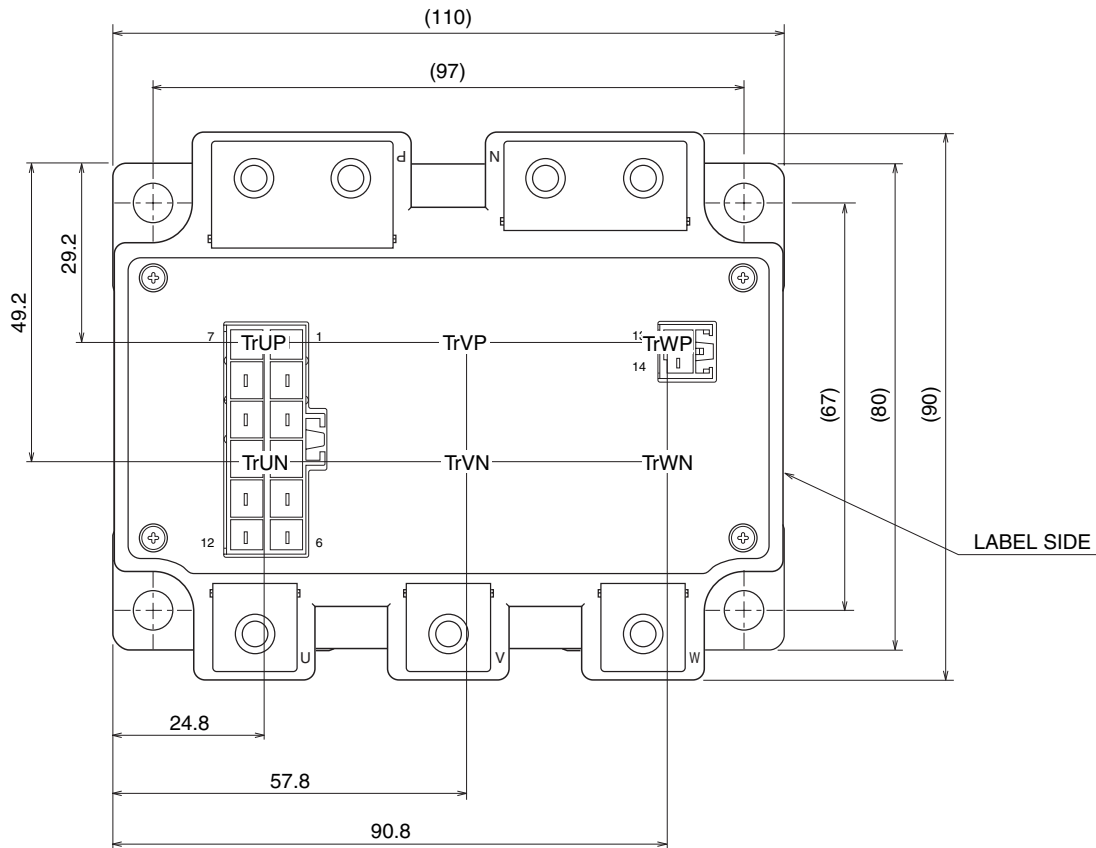
**REVERSE RECOVERY CHARACTERISTICS  
OF FREE-WHEEL DIODE  
(TYPICAL)**



**TRANSIENT THERMAL  
IMPEDANCE CHARACTERISTICS**



**CHIP LAYOUT**



The company name and product names herein are the trademarks and registered trademarks of the respective companies.

**Keep safety first in your circuit designs!**

Mitsubishi Electric Corporation puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury, fire or property damage. Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of non-flammable material or (iii) prevention against any malfunction or mishap.

**Notes regarding these materials**

- These materials are intended as a reference to assist our customers in the selection of the Mitsubishi semiconductor product best suited to the customer's application; they do not convey any license under any intellectual property rights, or any other rights, belonging to Mitsubishi Electric Corporation or a third party.
- Mitsubishi Electric Corporation assumes no responsibility for any damage, or infringement of any third-party's rights, originating in the use of any product data, diagrams, charts, programs, algorithms, or circuit application examples contained in these materials.
- All information contained in these materials, including product data, diagrams, charts, programs and algorithms represents information on products at the time of publication of these materials, and are subject to change by Mitsubishi Electric Corporation without notice due to product improvements or other reasons. It is therefore recommended that customers contact Mitsubishi Electric Corporation or an authorized Mitsubishi Semiconductor product distributor for the latest product information before purchasing a product listed herein.  
The information described here may contain technical inaccuracies or typographical errors. Mitsubishi Electric Corporation assumes no responsibility for any damage, liability, or other loss rising from these inaccuracies or errors.  
Please also pay attention to information published by Mitsubishi Electric Corporation by various means, including the Mitsubishi Semiconductor home page ([www.MitsubishiElectric.com/semiconductors/](http://www.MitsubishiElectric.com/semiconductors/)).
- When using any or all of the information contained in these materials, including product data, diagrams, charts, programs, and algorithms, please be sure to evaluate all information as a total system before making a final decision on the applicability of the information and products. Mitsubishi Electric Corporation assumes no responsibility for any damage, liability or other loss resulting from the information contained herein.
- Mitsubishi Electric Corporation semiconductors are not designed or manufactured for use in a device or system that is used under circumstances in which human life is potentially at stake. Please contact Mitsubishi Electric Corporation or an authorized Mitsubishi Semiconductor product distributor when considering the use of a product contained herein for any specific purposes, such as apparatus or systems for transportation, vehicular, medical, aerospace, nuclear, or undersea repeater use.
- The prior written approval of Mitsubishi Electric Corporation is necessary to reprint or reproduce in whole or in part these materials.
- If these products or technologies are subject to the Japanese export control restrictions, they must be exported under a license from the Japanese government and cannot be imported into a country other than the approved destination.  
Any diversion or reexport contrary to the export control laws and regulations of Japan and/or the country of destination is prohibited.
- Please contact Mitsubishi Electric Corporation or an authorized Mitsubishi Semiconductor product distributor for further details on these materials or the products contained therein.