FAIRCHILD
SEMICONDUCTOR®

IGBT

FMG2G400LS60

Molding Type Module

General Description

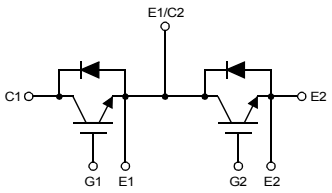
Fairchild IGBT Power Module provides low conduction as well as short circuit ruggedness. It's designed for the applications such as welder.

Features
- Short Circuit Rated Time; 10us @ T_C =100°C, V_{GE} = 15V
- Low Saturation Voltage : $V_{CE(sat)}$ = 1.4 V @ I_C = 400A
- High Input Impedance
- Fast & Soft Anti-Parallel FWD
- UL Certified No.E209204

Application

- AC/ DC Welder

Package Code : 7PM-IA



Internal Circuit Diagram

Absolute Maximum Ratings

T_C = 25°C unless otherwise noted

Symbol	Description		FMG2G400LS60	Units
V_{CES}	Collector-Emitter Voltage		600	V
V_{GES}	Gate-Emitter Voltage		± 20	V
I_C	Collector Current		400	A
$I_{CM\ (1)}$	Pulsed Collector Current		800	A
I_F	Diode Continuous Forward Current		400	A
I_{FM}	Diode Maximum Forward Current		800	A
P_D	Maximum Power Dissipation	@ T_C = 25°C	1136	W
T_{SC}	Short Circuit Withstand Time	@ T_C = 100°C	10	us
T_J	Operating Junction Temperature		-40 to +150	°C
T_{STG}	Storage Temperature Range		-40 to +125	°C
V_{ISO}	Isolation Voltage	@ AC 1minute	2500	V
Mounting Torque	Power Terminal Screw : M6		4.0	N.m
	Mounting Screw : M6		4.0	N.m

Notes :
(1) Repetitive rating : Pulse width limited by max. junction temperature

Electrical Characteristics of IGBT T_C = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
Off Characteristics						
BV_{CES}	Collector-Emitter Breakdown Voltage	V_{GE} = 0V, I_C = 250uA	600	--	--	V
$\Delta B_{VCES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	V_{GE} = 0V, I_C = 1mA	--	0.6	--	V/°C
I_{CES}	Collector Cut-Off Current	V_{CE} = V_{CES}, V_{GE} = 0V	--	--	250	uA
I_{GES}	Gate - Emitter Leakage Current	V_{GE} = V_{GES}, V_{CE} = 0V	--	--	± 100	nA
On Characteristics						
$V_{GE(th)}$	Gate - Emitter Threshold Voltage	I_C = 400mA, V_{CE} = V_{GE}	5.0	6.5	8.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C = 400A, V_{GE} = 15V	--	1.4	1.8	V
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 300 V, I_C = 400A, R_G = 10Ω, V_{GE} = 15V, Inductive Load, T_C = 25°C	--	0.33	--	us
t_r	Rise Time		--	0.3	--	us
$t_{d(off)}$	Turn-Off Delay Time		--	0.52	--	us
t_f	Fall Time		--	2.3	--	us
E_{on}	Turn-On Switching Loss		--	19.5	--	mJ
E_{off}	Turn-Off Switching Loss		--	230	--	mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 300 V, I_C = 400A, R_G = 10Ω, V_{GE} = 15V, Inductive Load, T_C = 125°C	--	0.41	--	us
t_r	Rise Time		--	0.33	--	us
$t_{d(off)}$	Turn-Off Delay Time		--	0.62	--	us
t_f	Fall Time		--	23	--	us
E_{on}	Turn-On Switching Loss		--	320	--	mJ
E_{off}	Turn-Off Switching Loss		--		--	mJ
T_{sc}	Short Circuit Withstand Time	V_{CC} = 300 V, V_{GE} = 15V @ T_C = 100°C	10		--	us
Q_g	Total Gate Charge	V_{CE} = 300 V, I_C =400A, V_{GE} = 15V	--	1200	--	nC
Q_{ge}	Gate-Emitter Charge		--	310	--	nC
Q_{gc}	Gate-Collector Charge		--	490	--	nC

Electrical Characteristics of DIODE T_C = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V_{FM}	Diode Forward Voltage	I_F = 400A	T_C = 25°C	--	1.9	2.8	V
			T_C = 100°C	--	1.8	--	
t_{rr}	Diode Reverse Recovery Time	I_F = 400A di / dt = 800 A/us	T_C = 25°C	--	90	130	ns
			T_C = 100°C	--	130	--	
I_{rr}	Diode Peak Reverse Recovery Current		T_C = 25°C	--	35	46	A
			T_C = 100°C	--	76	--	
Q_{rr}	Diode Reverse Recovery Charge		T_C = 25°C	--	1580	3000	nC
			T_C = 100°C	--	4940	--	

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case (IGBT Part, per 1/2 Module)	--	0.11	°C/W
$R_{\theta JC}$	Junction-to-Case (DIODE Part, per 1/2 Module)	--	0.18	°C/W
$R_{\theta JC}$	Case-to-Sink (Conductive grease applied)	0.03	--	°C/W
Weight	Weight of Module	360	--	g

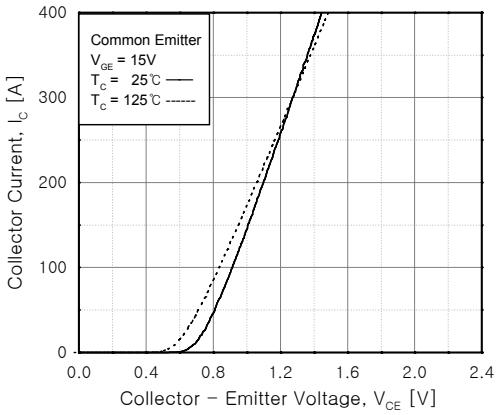


Fig 1. Typical Output Characteristics

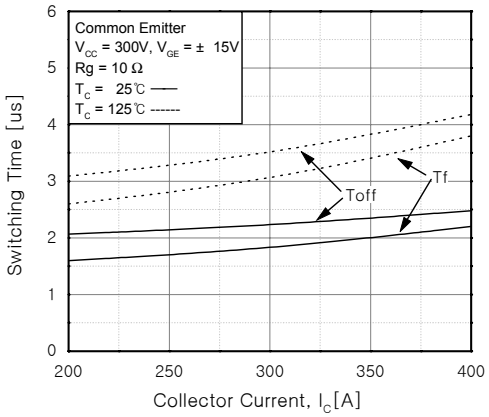


Fig 2. Turn-Off Characteristics vs. Collector Current

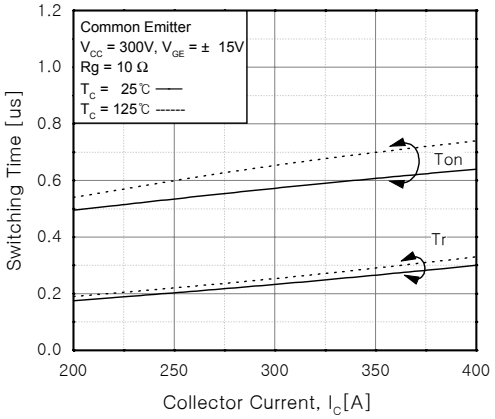


Fig 3. Turn-On Characteristics vs. Collector Current

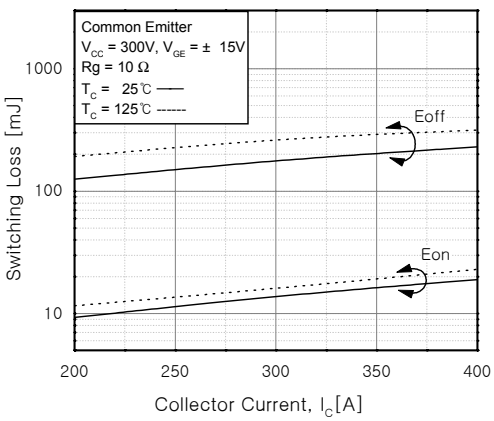


Fig 4. Switching Loss vs. Collector Current

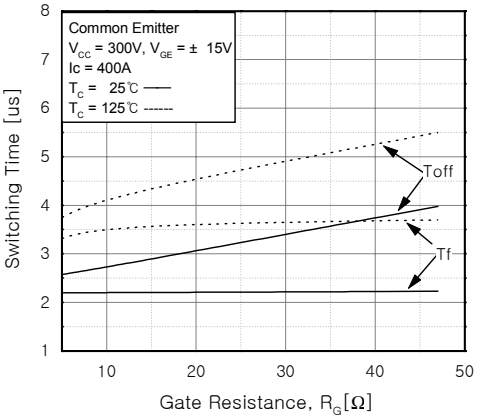


Fig 5. Turn-Off Characteristics vs. Gate Resistance

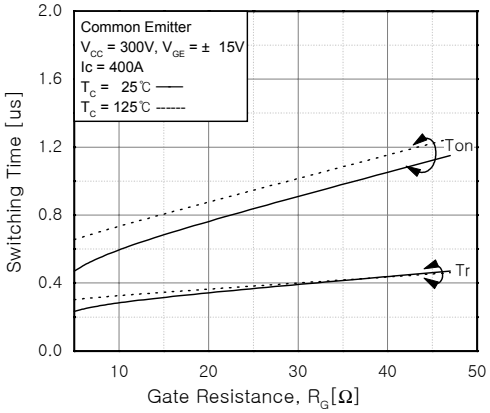


Fig 6. Turn-On Characteristics vs. Gate Resistance

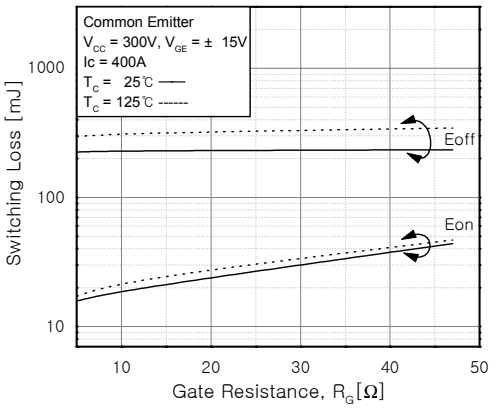


Fig 7. Switching Loss vs. Gate Resistance

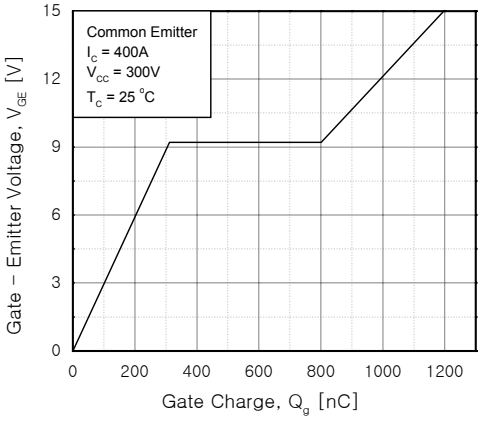


Fig 8. Gate Charge Characteristics

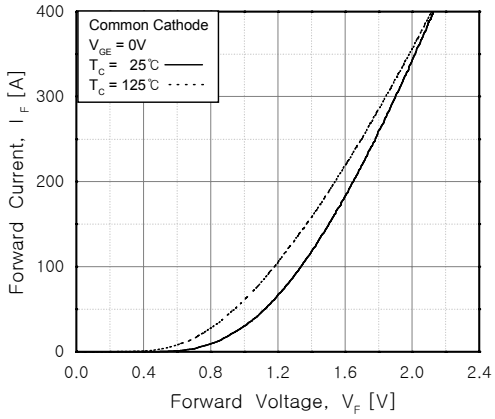


Fig 9. Forward Characteristics (diode)

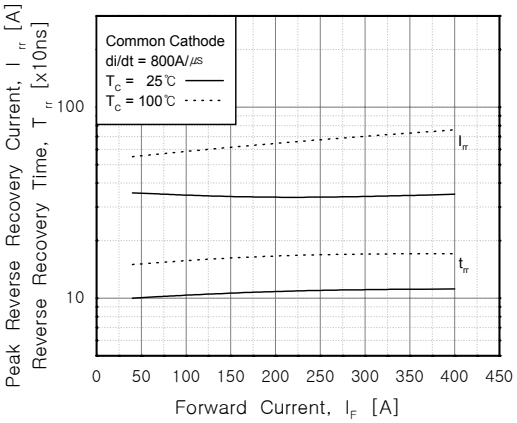
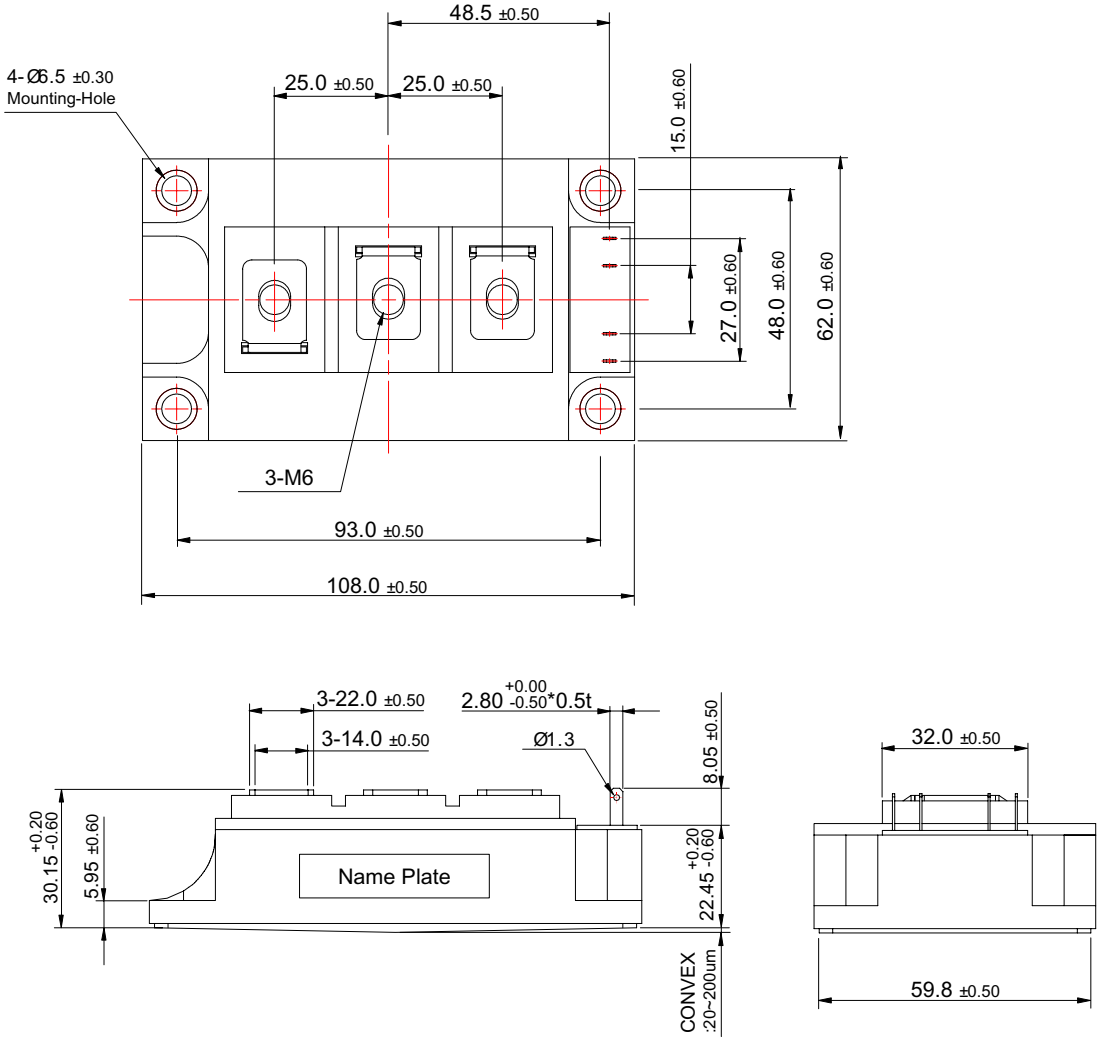


Fig 10. Reverse Recovery Characteristics(diode)

Package Dimension

7PM-IA



Dimensions in Millimeters

TRADEMARKS

The following are registered and unregistered trademarks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

ACEx™	FAST®	ISOPLANAR™	Power247™	SuperFET™
ActiveArray™	FASTr™	LittleFET™	PowerSaver™	SuperSOT™-3
Bottomless™	FPS™	MICROCOUPLER™	PowerTrench®	SuperSOT™-6
CoolFET™	FRFET™	MicroFET™	QFET®	SuperSOT™-8
CROSSVOLT™	GlobalOptoisolator™	MicroPak™	QS™	SyncFET™
DOME™	GTO™	MICROWIRE™	QT Optoelectronics™	TinyLogic®
EcoSPARK™	HiSeC™	MSX™	Quiet Series™	TINYOPTO™
E^2CMOS™	I^2C™	MSXPro™	RapidConfigure™	TruTranslation™
EnSigna™	*i-Lo*™	OCX™	RapidConnect™	UHC™
FACT™	ImpliedDisconnect™	OCXPro™	µSerDes™	UltraFET®
FACT Quiet Series™		OPTOLOGIC®	SILENT SWITCHER®	VCX™
Across the board. Around the world.™		OPTOPLANAR™	SMART START™	
The Power Franchise®		PACMAN™	SPM™	
Programmable Active Droop™		POP™	Stealth™	

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.

2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.