

FM2G400US60

Molding Type Module

General Description

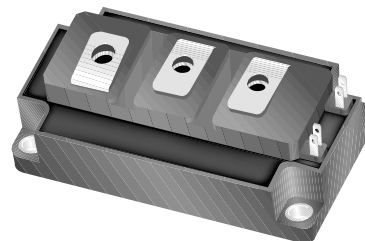
Fairchild Insulated Gate Bipolar Transistor (IGBT) Power Module provides low conduction and switching losses as well as short circuit ruggedness. It's designed for the applications such as motor control, Uninterrupted Power Supply (UPS) and general inverters where short-circuit ruggedness is a required feature.

Features

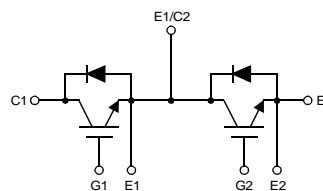
- UL Certified No.E209204
- Short Circuit rated 10us @ $T_C = 100^\circ\text{C}$, $V_{GE} = 15\text{V}$
- High Speed Switching
- Low Saturation Voltage : $V_{CE(sat)} = 2.2\text{V}$ @ $I_C = 400\text{A}$
- High Input Impedance
- Fast & Soft Anti-Parallel FWD

Application

- AC & DC Motor Controls
- General Purpose Inverters
- Robotics
- Servo Controls
- UPS



Package Code : 7PM-EA



Internal Circuit Diagram

Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Description	FM2G400US60	Units
V_{CES}	Collector-Emitter Voltage	600	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C = 25^\circ\text{C}$	400	A
$I_{CM(1)}$	Pulsed Collector Current	800	A
I_F	Diode Continuous Forward Current @ $T_C = 25^\circ\text{C}$	400	A
I_{FM}	Diode Maximum Forward Current	800	A
T_{SC}	Short Circuit Withstand Time @ $T_C = 100^\circ\text{C}$	10	us
P_D	Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$	1560	W
T_J	Operating Junction Temperature	-40 to +150	$^\circ\text{C}$
T_{stg}	Storage Temperature Range	-40 to +125	$^\circ\text{C}$
V_{iso}	Isolation Voltage @ AC 1minute	2500	V
Mounting Torque	Power Terminals Screw : M6	2.5	N.m
	Mounting Screw : M6	2.5	N.m

Notes :

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

Electrical Characteristics of IGBT $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
Off Characteristics						
BV_{CES}	Collector-Emitter Breakdown Voltage	$V_{GE} = 0V, I_C = 250\mu A$	600	--	--	V
$\Delta BV_{CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	$V_{GE} = 0V, I_C = 1mA$	--	0.6	--	$V/^\circ C$
I_{CES}	Collector Cut-Off Current	$V_{CE} = V_{CES}, V_{GE} = 0V$	--	--	250	μA
I_{GES}	G-E Leakage Current	$V_{GE} = V_{GES}, V_{CE} = 0V$	--	--	± 100	nA
On Characteristics						
$V_{GE(th)}$	G-E Threshold Voltage	$V_{GE} = V_{CE}, I_C = 400mA$	5.0	6.0	8.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C = 400A, V_{GE} = 15V$	--	2.2	2.8	V
Dynamic Characteristics						
C_{ies}	Input Capacitance	$V_{CE} = 30V, V_{GE} = 0V,$ $f = 1MHz$	--	66000	--	pF
C_{oes}	Output Capacitance		--	3600	--	pF
C_{res}	Reverse Transfer Capacitance		--	1980	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 300V, I_C = 400A,$ $R_G = 1.6\Omega, V_{GE} = 15V$ Inductive Load, $T_C = 25^\circ C$	--	870	--	ns
t_r	Rise Time		--	550	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	720	--	ns
t_f	Fall Time		--	178	250	ns
E_{on}	Turn-On Switching Loss		--	36	--	mJ
E_{off}	Turn-Off Switching Loss	--	22	--	mJ	
E_{ts}	Total Switching Loss	--	58	116	mJ	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 300V, I_C = 400A,$ $R_G = 1.6\Omega, V_{GE} = 15V$ Inductive Load, $T_C = 125^\circ C$	--	1230	--	ns
t_r	Rise Time		--	580	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	890	--	ns
t_f	Fall Time		--	190	--	ns
E_{on}	Turn-On Switching Loss		--	52	--	mJ
E_{off}	Turn-Off Switching Loss	--	24	--	mJ	
E_{ts}	Total Switching Loss	--	75	--	mJ	
T_{sc}	Short Circuit Withstand Time	$V_{CC} = 300V, V_{GE} = 15V$ @ $T_C = 100^\circ C$	10	--	--	us
Q_g	Total Gate Charge	$V_{CE} = 300V, I_C = 400A,$ $V_{GE} = 15V$	--	1800	2700	nC
Q_{ge}	Gate-Emitter Charge		--	350	--	nC
Q_{gc}	Gate-Collector Charge		--	750	--	nC

Electrical Characteristics of DIODE $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units	
V_{FM}	Diode Forward Voltage	$I_F = 400\text{A}$	$T_C = 25^\circ\text{C}$	--	1.9	2.8	V
			$T_C = 100^\circ\text{C}$	--	1.8	--	
t_{rr}	Diode Reverse Recovery Time		$T_C = 25^\circ\text{C}$	--	90	130	ns
			$T_C = 100^\circ\text{C}$	--	130	--	
I_{rr}	Diode Peak Reverse Recovery Current	$I_F = 400\text{A}$ $di / dt = 600 \text{ A/us}$	$T_C = 25^\circ\text{C}$	--	35	46	A
			$T_C = 100^\circ\text{C}$	--	76	--	
Q_{rr}	Diode Reverse Recovery Charge		$T_C = 25^\circ\text{C}$	--	1575	2960	nC
			$T_C = 100^\circ\text{C}$	--	4940	--	

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case (IGBT Part, per 1/2 Module)	--	0.08	$^\circ\text{C/W}$
$R_{\theta JC}$	Junction-to-Case (DIODE Part, per 1/2 Module)	--	0.18	$^\circ\text{C/W}$
$R_{\theta CS}$	Case-to-Sink (Conductive grease applied)	0.04	--	$^\circ\text{C/W}$
Weight	Weight of Module	--	400	g

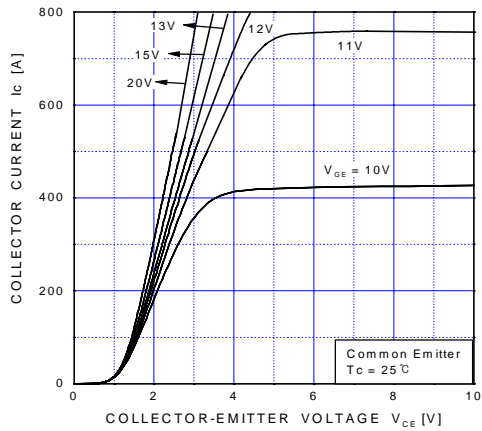


Fig 1. Typical Output Characteristics

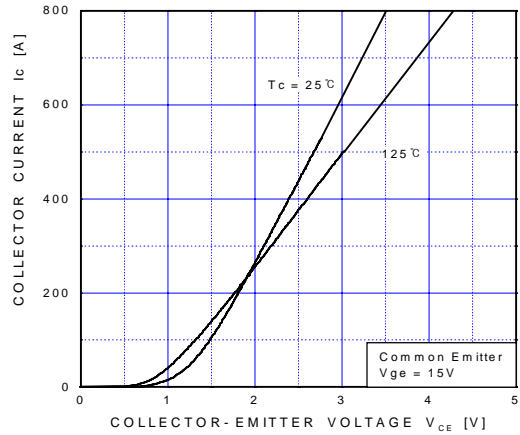


Fig 2. Typical Saturation Voltage Characteristics

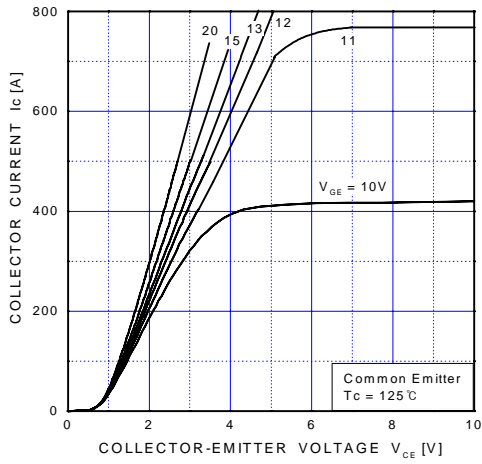


Fig 3. Typical Output Characteristics

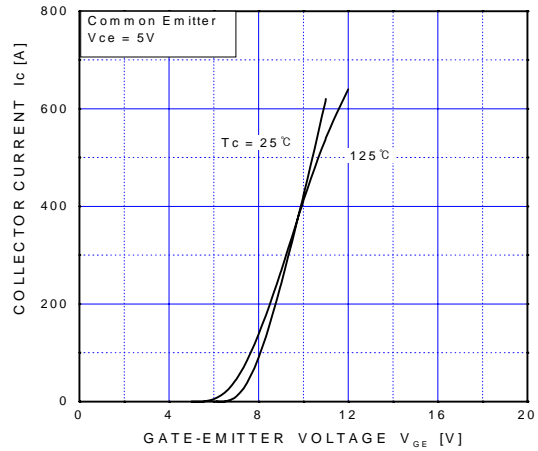


Fig 4. Collector Current vs. Gate-Emitter Voltage

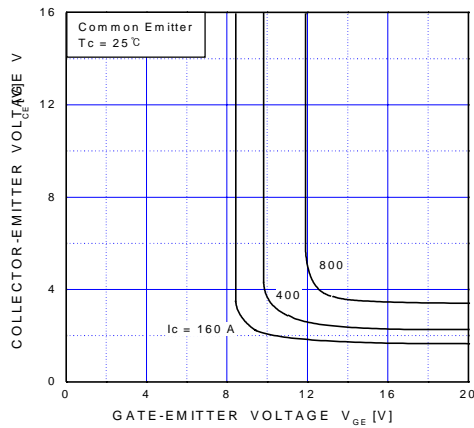


Fig 5. Saturation Voltage vs. V_{ge}

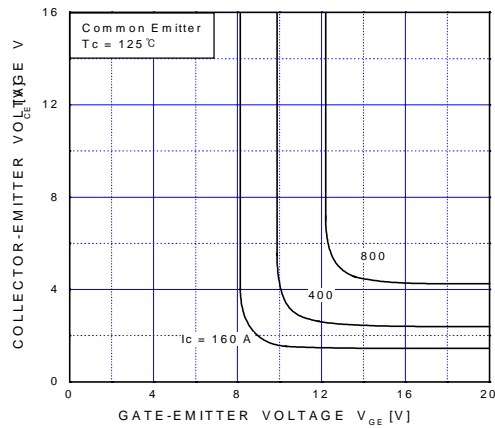


Fig 6. Saturation Voltage vs. V_{ge}

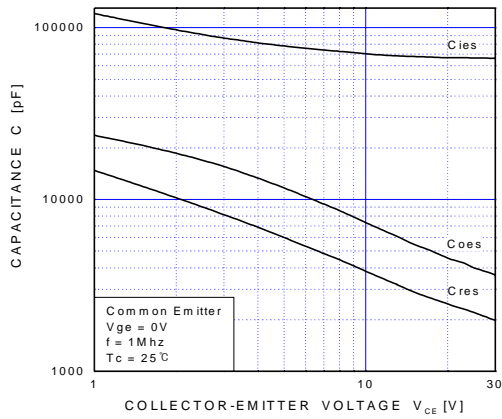


Fig 7. Capacitance Characteristics

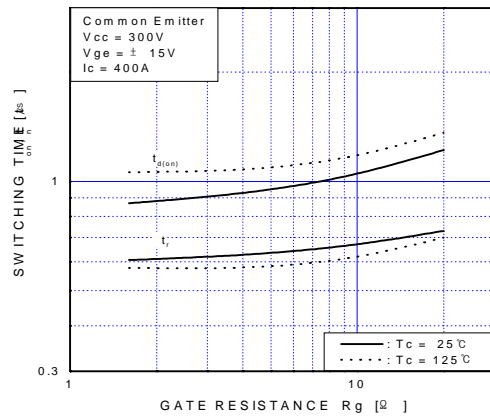


Fig 8. Turn-On Characteristics vs. Gate Resistance

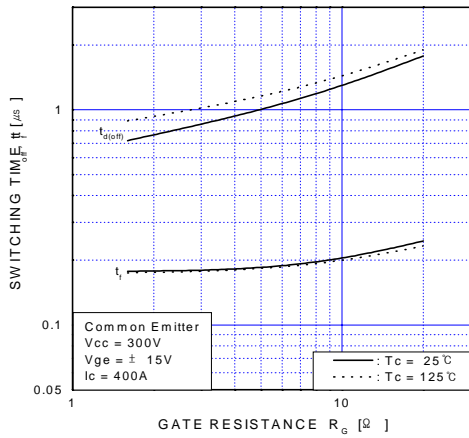


Fig 9. Turn-Off Characteristics vs. Gate Resistance

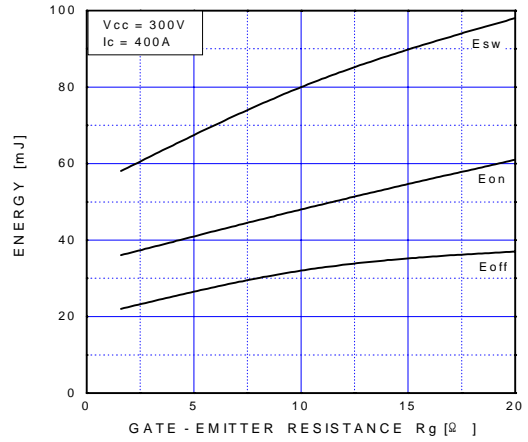


Fig 10. Switching Loss vs. Gate Resistance

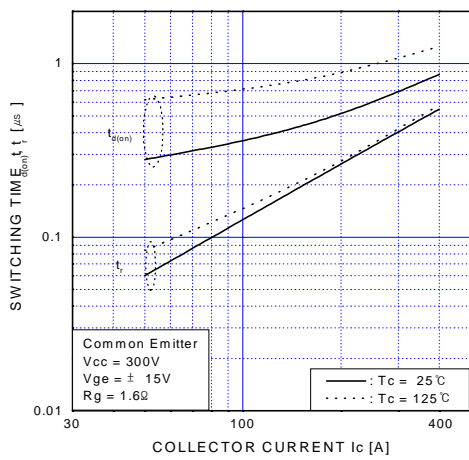


Fig 11. Turn-On Characteristics vs. Collector Current

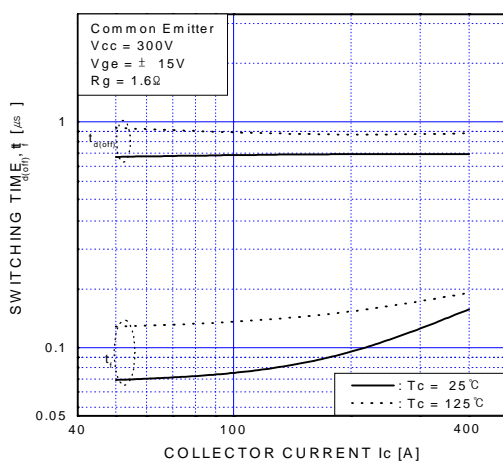


Fig 12. Turn-Off Characteristics vs. Collector Current

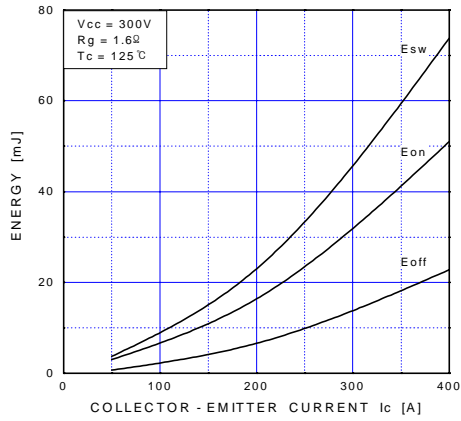


Fig 13. Switching Loss vs. Collector Current

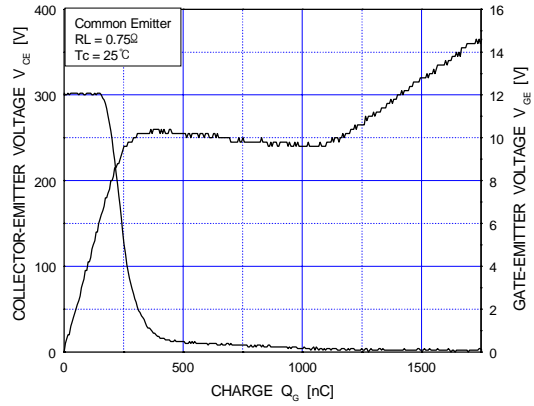


Fig 14. Gate Charge Characteristics

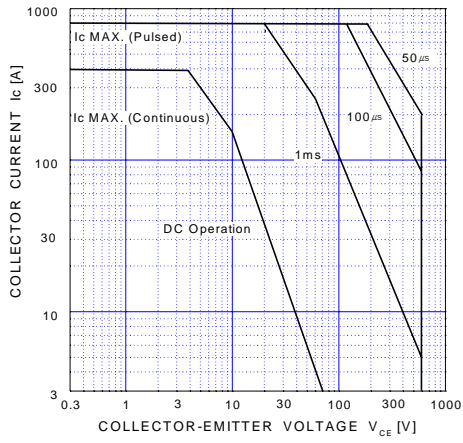


Fig 15. SOA Characteristics

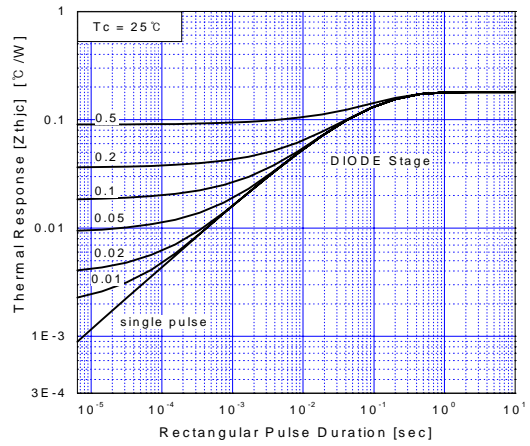


Fig 16. Transient Thermal Impedance

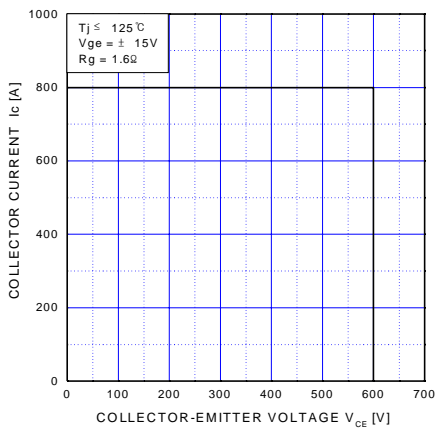


Fig 17. RBSOA Characteristics

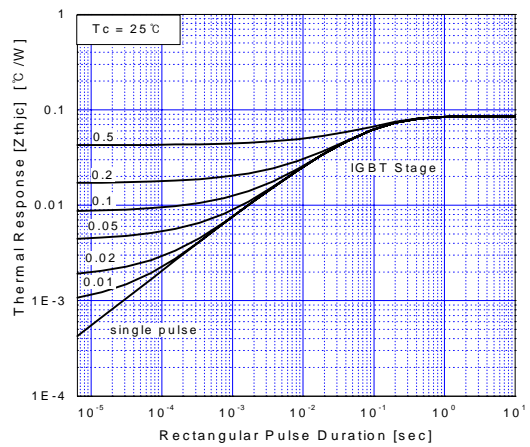


Fig 18. Transient Thermal Impedance

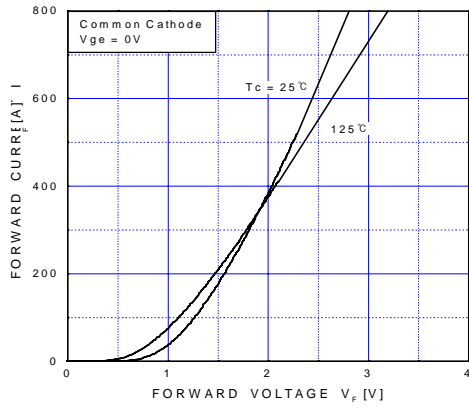


Fig 19. Forward Characteristics

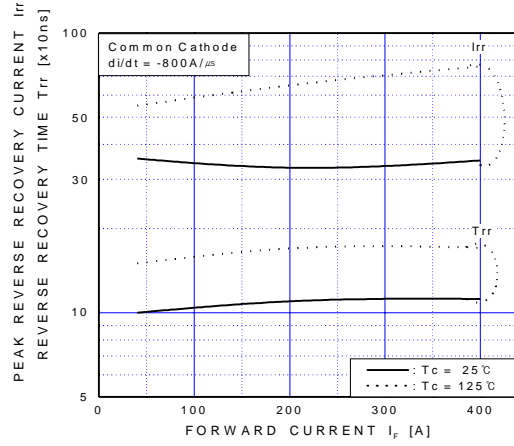
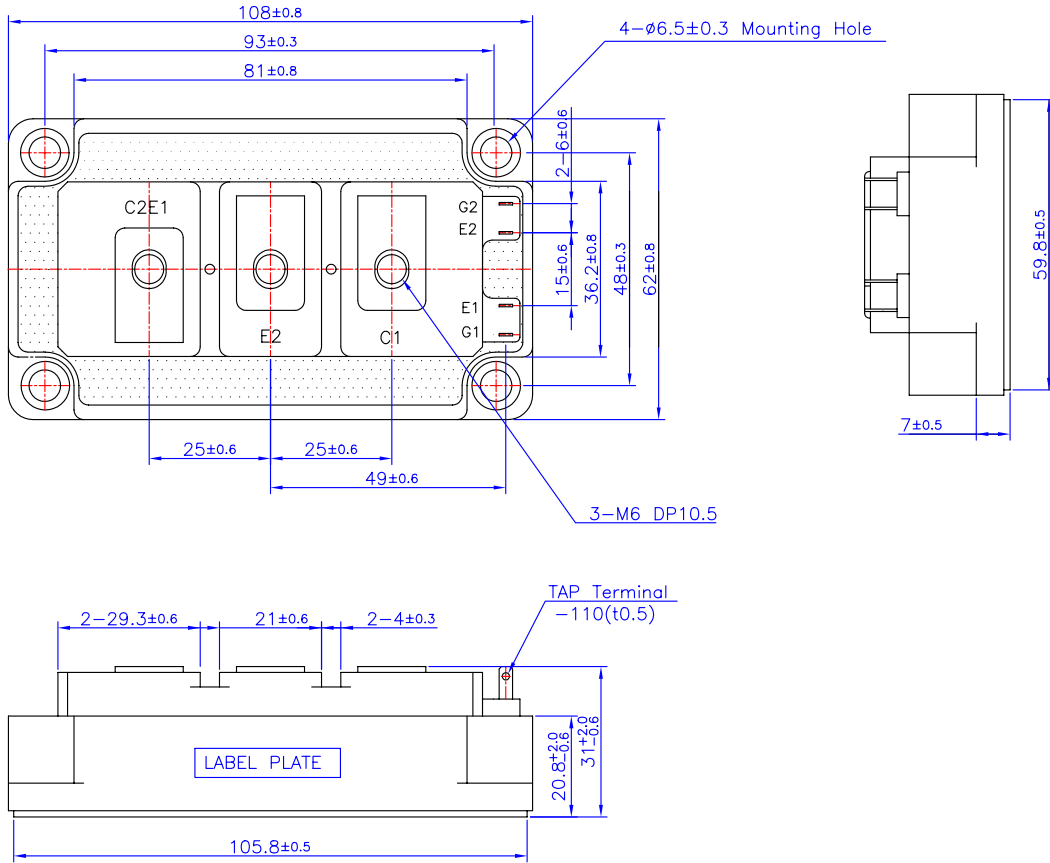


Fig 20. Reverse Recovery Characteristics

Package Dimension

7PM-EA



Dimensions in Millimeters

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