FAIRCHILD SEMICONDUCTOR®

June 2001

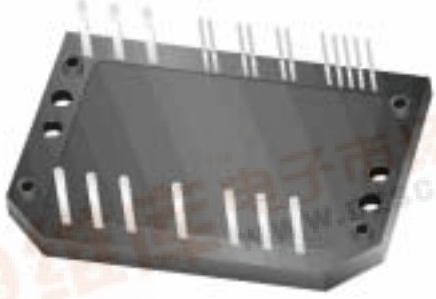
IGBT

FMC6G10US60

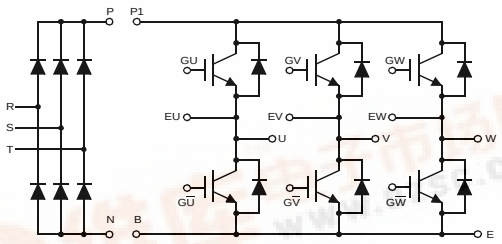
Compact & Complex Module

General Description

Fairchild's Insulated Gate Bipolar Transistor (IGBT) power modules provide low conduction and switching losses as well as short circuit ruggedness. They are designed for applications such as motor control, uninterrupted power supplies (UPS) and general inverters where short circuit ruggedness is a required feature.



Package Code : 21PM-AA



Internal Circuit Diagram

Features

- UL Certified No. E209204
- Short circuit rated 10us @ T_C = 100°C, V_{GE} = 15V
- High speed switching
- Low saturation voltage : V_{CE}(sat) = 2.2 V @ I_C = 10A
- High input impedance
- Built in 3 phase rectifier circuit
- Fast & soft anti-parallel FWD

Applications

- AC & DC motor controls
- General purpose inverters
- Robotics
- Servo controls

Absolute Maximum Ratings

T_C = 25°C unless otherwise noted

	Symbol	Description		FMC7G10US60	Units
Inverter	V_{CES}	Collector-Emitter Voltage		600	V
	V_{GES}	Gate-Emitter Voltage		± 20	V
	I_C	Collector Current	@ T_C = 25°C	10	A
	$I_{CM\ (1)}$	Pulsed Collector Current		20	A
	I_F	Diode Continuous Forward Current	@ T_C = 100°C	10	A
	I_{FM}	Diode Maximum Forward Current		20	A
	P_D	Maximum Power Dissipation	@ T_C = 25°C	36	W
	T_{SC}	Short Circuit Withstand Time	@ T_C = 100°C	10	us
Converter	V_{RRM}	Repetitive Peak Reverse Voltage		1200	V
	I_O	Average Output Rectified Current		10	A
	I_{FSM}	Surge Forward Current @ 1Cycle at 60Hz, Peak value Non-Repetitive		100	A
	I^2t	1 Cycle Surge Current		41	A^2s
Common	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		Mounting part Screw	@ M4	1.25	N.m

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

Electrical Characteristics of the IGBT @ Inverter 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 Coefficient 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}	G-E Leakage Current	V_{GE} = V_{GES}, V_{CE} = 0V	--	--	± 100	nA
On Characteristics						
$V_{GE(th)}$	G-E Threshold Voltage	I_C = 10mA, V_{CE} = V_{GE}	5.0	6.0	8.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C = 10A, V_{GE} = 15V	--	2.2	2.8	V
Dynamic Characteristics						
C_{ies}	Input Capacitance	V_{CE} = 30V, V_{GE} = 0V, f = 1MHz	--	660	--	pF
C_{oes}	Output Capacitance		--	115	--	pF
C_{res}	Reverse Transfer Capacitance		--	25	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 300 V, I_C = 10A, R_G = 20Ω, V_{GE} = 15V, Inductive Load, T_C = 25°C	--	15	--	ns
t_r	Rise Time		--	30	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	36	50	ns
t_f	Fall Time		--	158	200	ns
E_{on}	Turn-On Switching Loss		--	0.14	--	mJ
E_{off}	Turn-Off Switching Loss		--	0.22	--	mJ
E_{ts}	Total Switching Loss		--	0.36	0.5	mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 300 V, I_C = 10A, R_G = 20Ω, V_{GE} = 15V, Inductive Load, T_C = 125°C	--	16	--	ns
t_r	Rise Time		--	33	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	42	60	ns
t_f	Fall Time		--	242	350	ns
E_{on}	Turn-On Switching Loss		--	0.16	--	mJ
E_{off}	Turn-Off Switching Loss		--	0.45	--	mJ
E_{ts}	Total Switching Loss		--	0.61	0.86	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 = 10A, V_{GE} = 15V	--	30	45	nC
Q_{ge}	Gate-Emitter Charge		--	5	10	nC
Q_{gc}	Gate-Collector Charge		--	8	16	nC

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

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V_{FM}	Diode Forward Voltage	I_F = 10A	T_C = 25°C	--	1.8	2.8	V
			T_C = 100°C	--	1.75	--	
t_{rr}	Diode Reverse Recovery Time	I_F = 10A di / dt = 20 A/us	T_C = 25°C	--	90	130	ns
			T_C = 100°C	--	110	--	
I_{rr}	Diode Peak Reverse Recovery Current		T_C = 25°C	--	0.7	1.2	A
			T_C = 100°C	--	1	--	
Q_{rr}	Diode Reverse Recovery Charge		T_C = 25°C	--	32	70	nC
			T_C = 100°C	--	55	--	

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

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V_{FM}	Diode Forward Voltage	I_F = 10A	T_C = 25°C	--	1.1	1.5	V
			T_C = 100°C	--	1.0	--	
I_{RRM}	Repetitive Reverse Current	$V_R = V_{RRM}$	T_C = 25°C	--	--	8	mA
			T_C = 100°C	--	5	--	

Thermal Characteristics

	Symbol	Parameter	Typ.	Max.	Units
Inverter	$R_{\theta JC}$	Junction-to-Case (IGBT Part, per 1/6 Module)	--	3.47	°C/W
	$R_{\theta JC}$	Junction-to-Case (DIODE Part, per 1/6 Module)	--	4.0	°C/W
Converter	$R_{\theta JC}$	Junction-to-Case (DIODE Part, per 1/6 Module)	--	3.6	°C/W
Weight		Weight of Module	60	--	g

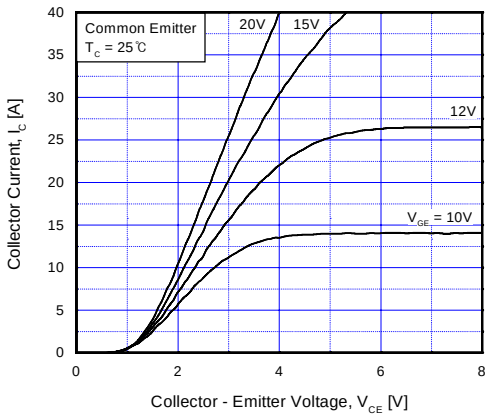


Fig 1. Typical Output Characteristics

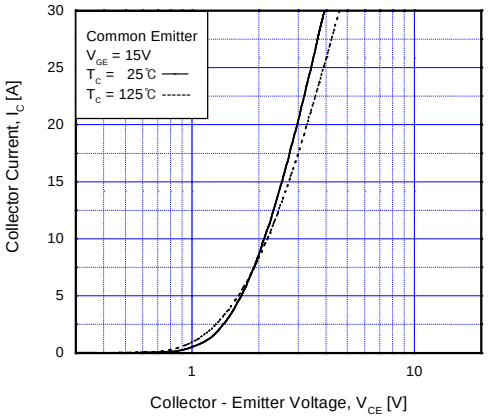


Fig 2. Typical Saturation Voltage Characteristics

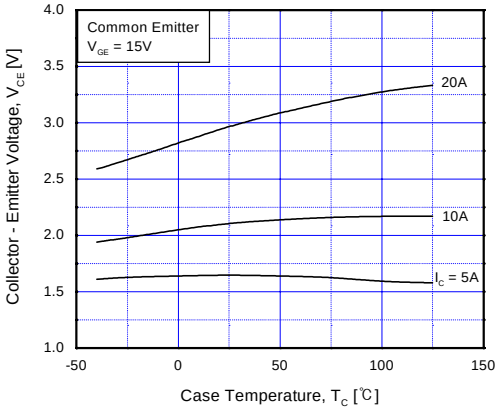


Fig 3. Saturation Voltage vs. Case Temperature at Variant Current Level

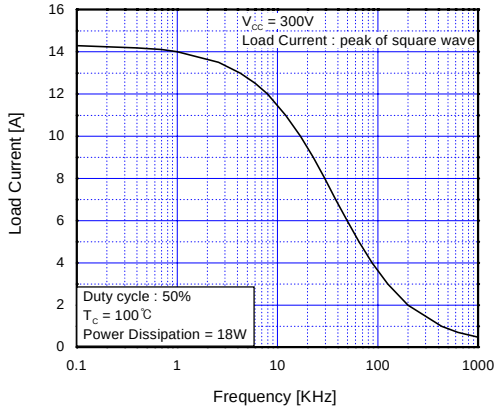


Fig 4. Load Current vs. Frequency

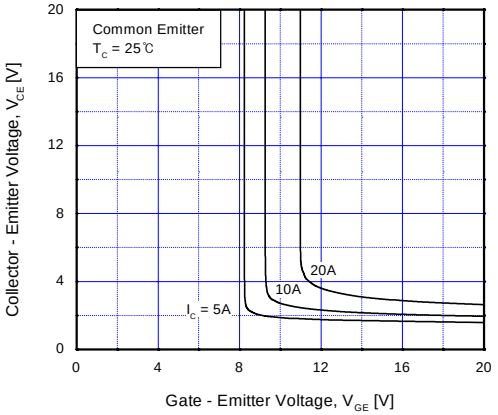


Fig 5. Saturation Voltage vs. V_{GE}

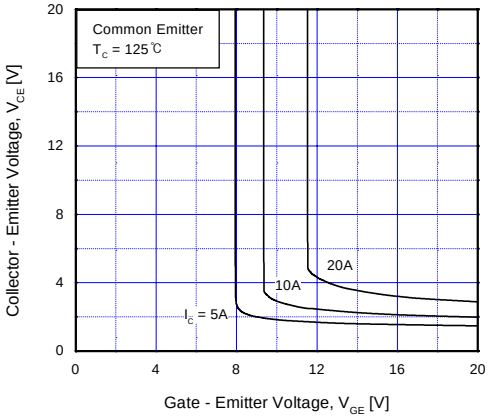


Fig 6. Saturation Voltage vs. V_{GE}

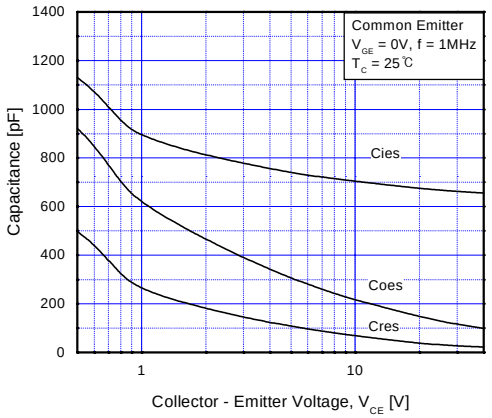


Fig 7. Capacitance Characteristics

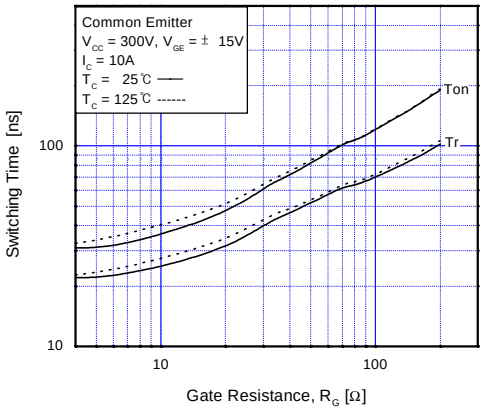


Fig 8. Turn-On Characteristics vs. Gate Resistance

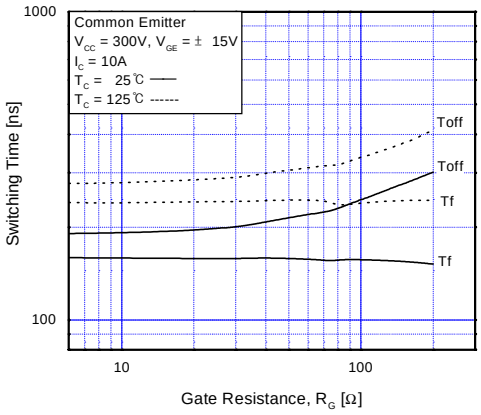


Fig 9. Turn-Off Characteristics vs. Gate Resistance

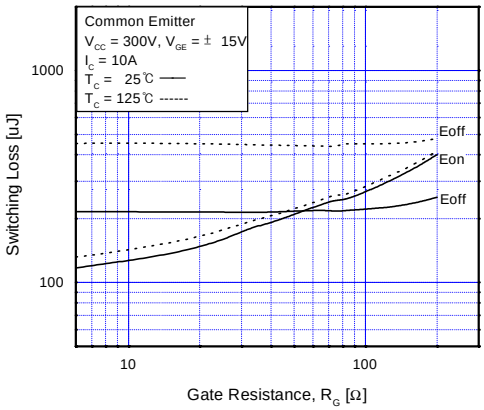


Fig 10. Switching Loss vs. Gate Resistance

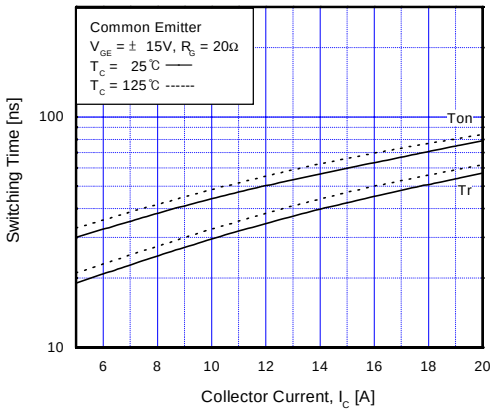


Fig 11. Turn-On Characteristics vs. Collector Current

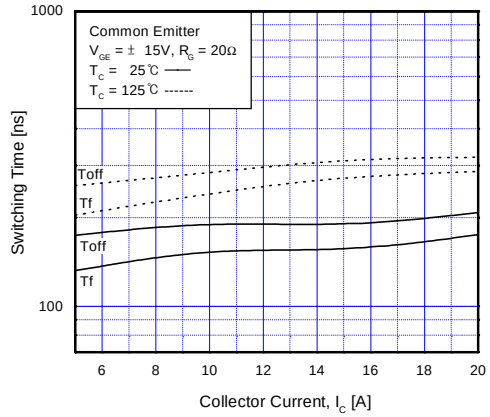


Fig 12. Turn-Off Characteristics vs. Collector Current

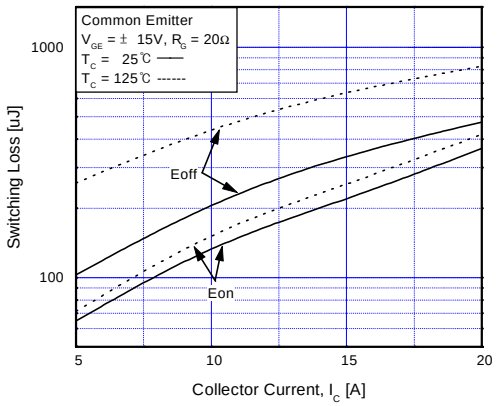


Fig 13. Switching Loss vs. Collector Current

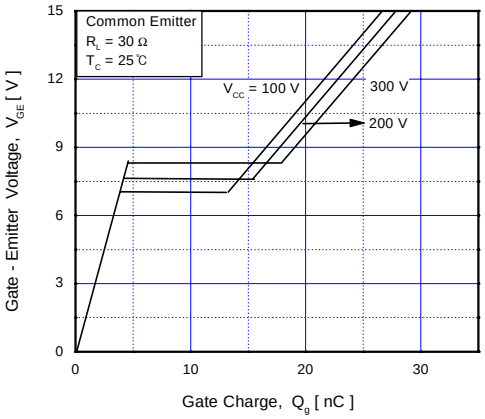


Fig 14. Gate Charge Characteristics

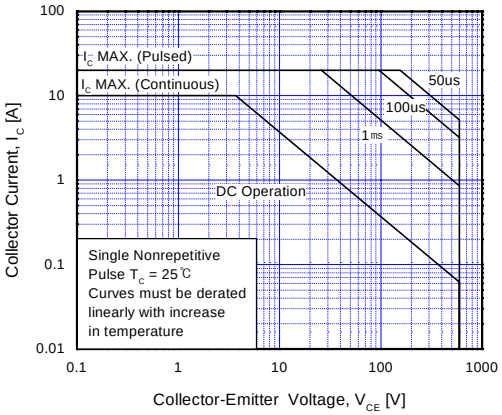


Fig 15. SOA Characteristics

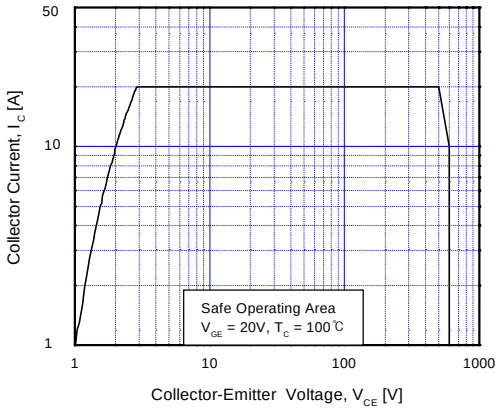


Fig 16. Turn-Off SOA Characteristics

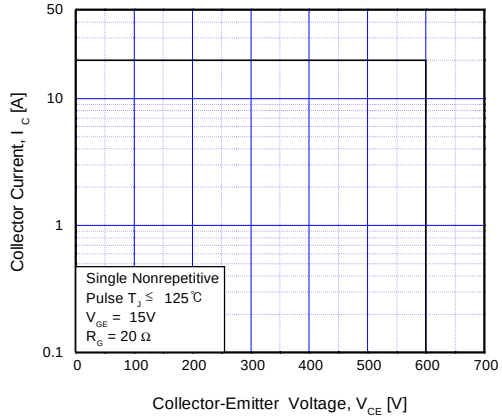


Fig 17. RBSOA Characteristics

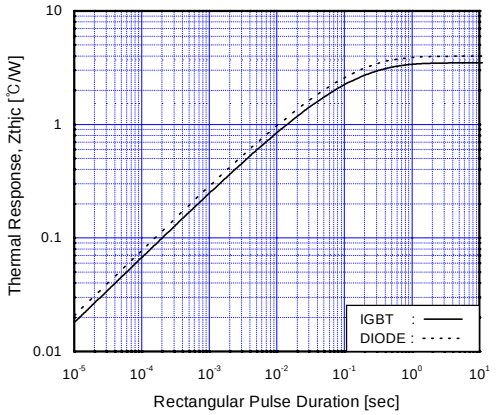


Fig 18. Transient Thermal Impedance

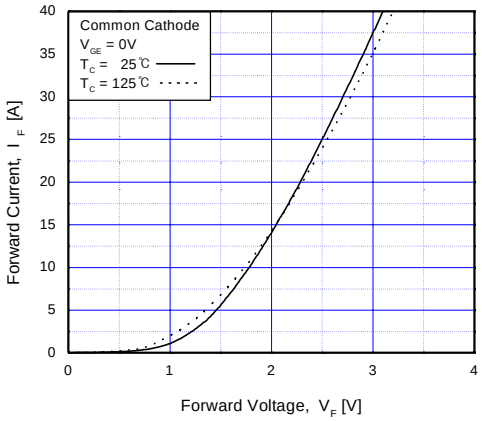


Fig 19. Forward Characteristics

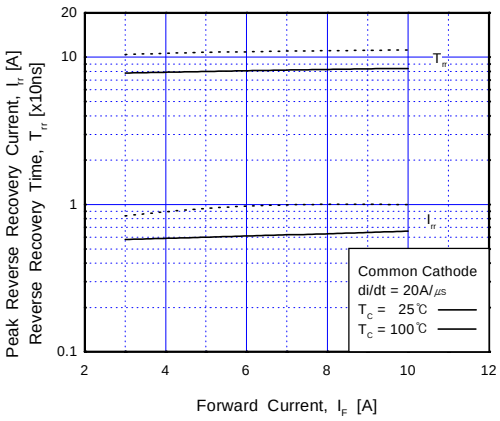
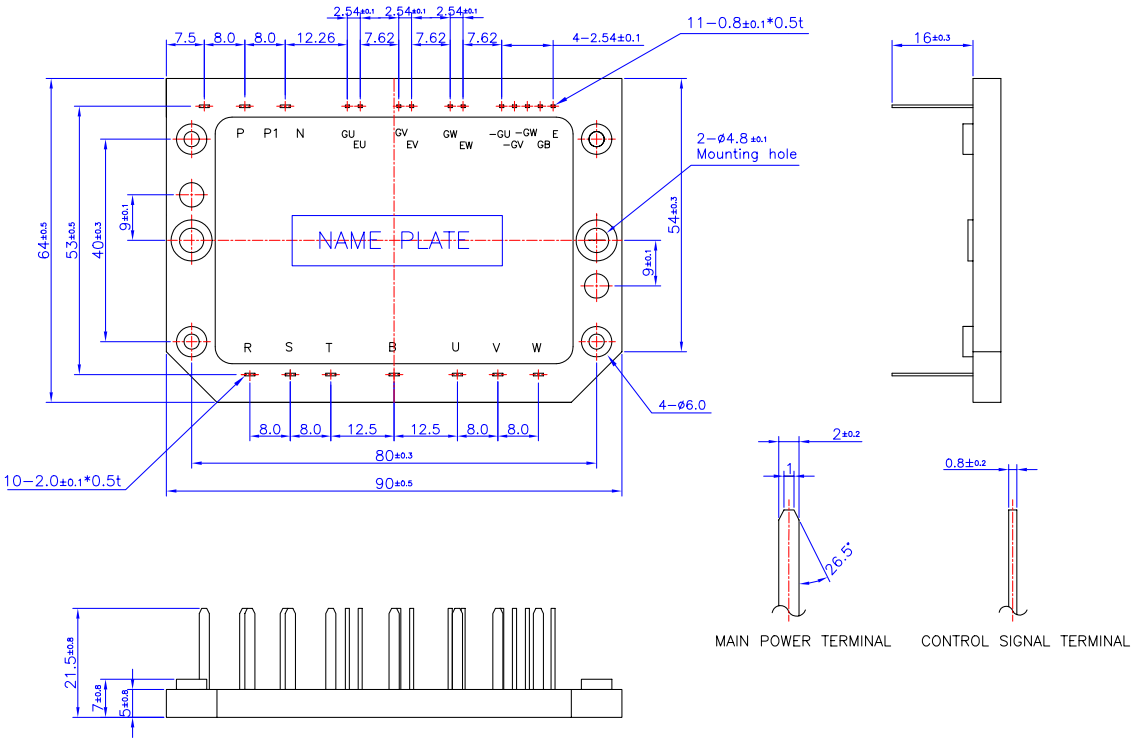


Fig 20. Reverse Recovery Characteristics

Package Dimension

21PM-AA (FS PKG CODE BJ)



Dimensions in Millimeters

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