



IGBT

FMM6G30US60

Compact & Complex Module

General Description

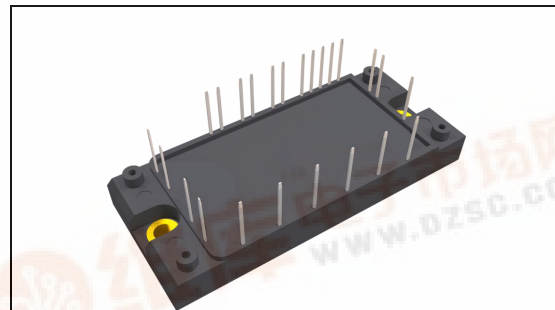
Fairchild IGBT Power Module provides low conduction and switching losses as well as short circuit ruggedness. It's designed for the applications such as motor control and general inverters where short-circuit ruggedness is required.

Features

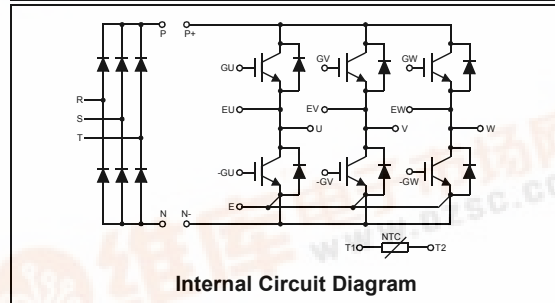
- Short Circuit rated Time ; 10us @ $T_C = 100^\circ\text{C}$, $V_{GE} = 15\text{V}$
- High Speed Switching
- Low Saturation Voltage : $V_{CE}(\text{sat}) = 2.1\text{V}$ @ $I_C = 30\text{A}$
- High Input Impedance
- 3 Phase Rectifier Circuit
- Fast & Soft Anti-Parallel FWD
- Built-in NTC Thermistor
- UL Certified No. E209204

Application

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



Package Code : 24PM-AA



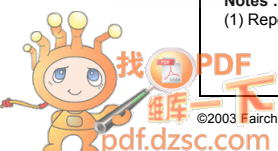
Internal Circuit Diagram

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

	Symbol	Description	FMM6G30US60	Units
Inverter	V_{CES}	Collector-Emitter Voltage	600	V
	V_{GES}	Gate-Emitter Voltage	± 20	V
	I_C	Collector Current @ $T_C = 80^\circ\text{C}$	30	A
	$I_{CM}(1)$	Pulsed Collector Current	60	A
	I_F	Diode Continuous Forward Current @ $T_C = 80^\circ\text{C}$	30	A
	I_{FM}	Diode Maximum Forward Current	60	A
	P_D	Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$	104	W
Converter	T_{SC}	Short Circuit Withstand Time @ $T_C = 100^\circ\text{C}$	10	us
	V_{RRM}	Repetitive Peak Reverse Voltage	1600	V
	I_O	Average Output Rectified Current	30	A
	I_{FSM}	Surge Forward Current @ 1Cycle at 60Hz, Peak value Non-Repetitive	300	A
	I^2t	Energy pulse @ 1Cycle at 60Hz	369	A^2s
Common	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		Mounting part Screw @ M4	4.0	N.m

Notes :

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



Electrical Characteristics of IGBT @ Inverter $T_C = 25^\circ\text{C}$ 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
$\Delta B_{V_{CES}} / \Delta T_J$	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	$I_C = 30mA, V_{CE} = V_{GE}$	5.0	6.5	8.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C = 30A, V_{GE} = 15V$	--	2.1	2.7	V
Dynamic Characteristics						
C_{ies}	Input Capacitance	$V_{CE} = 30V, V_{GE} = 0V, f = 1MHz$	--	2100	--	pF
C_{oes}	Output Capacitance		--	270	--	pF
C_{res}	Reverse Transfer Capacitance		--	36	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 300V, I_C = 30A, R_G = 15\Omega, V_{GE} = 15V, \text{Inductive Load}, T_C = 25^\circ C$	--	110	150	ns
t_r	Rise Time		--	90	200	ns
$t_{d(off)}$	Turn-Off Delay Time		--	150	200	ns
t_f	Fall Time		--	130	250	ns
E_{on}	Turn-On Switching Loss		--	0.9	--	mJ
E_{off}	Turn-Off Switching Loss	$V_{CC} = 300V, I_C = 30A, R_G = 15\Omega, V_{GE} = 15V, \text{Inductive Load}, T_C = 125^\circ C$	--	0.58	--	mJ
$t_{d(on)}$	Turn-On Delay Time		--	100	150	ns
t_r	Rise Time		--	90	200	ns
$t_{d(off)}$	Turn-Off Delay Time		--	150	200	ns
t_f	Fall Time		--	200	400	ns
E_{on}	Turn-On Switching Loss	$V_{CC} = 300V, V_{GE} = 15V @ T_C = 100^\circ C$	--	0.98	--	mJ
E_{off}	Turn-Off Switching Loss		--	0.9	--	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	$V_{CE} = 300V, I_C = 30A, V_{GE} = 15V$	--	90	150	nC
Q_{ge}	Gate-Emitter Charge		--	20	40	nC
Q_{gc}	Gate-Collector Charge		--	35	70	nC

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

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V _{FM}	Diode Forward Voltage	I _F = 30A	T _C = 25°C	--	2.0	2.8	V
			T _C = 100°C	--	2.0	--	
t _{rr}	Diode Reverse Recovery Time	I _F = 30A di / dt = 60 A/us	T _C = 25°C	--	90	180	ns
			T _C = 100°C	--	130	--	
I _{rr}	Diode Peak Reverse Recovery Current	I _F = 30A di / dt = 60 A/us	T _C = 25°C	--	2.2	3.4	A
			T _C = 100°C	--	3.4	--	
Q _{rr}	Diode Reverse Recovery Charge	I _F = 30A di / dt = 60 A/us	T _C = 25°C	--	400	600	nC
			T _C = 100°C	--	880	--	

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

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V _{FM}	Diode Forward Voltage	I _F = 30A	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)	--	1.2	$^\circ\text{C/W}$
	$R_{\theta JC}$	Junction-to-Case (DIODE Part, per 1/6 Module)	--	1.5	$^\circ\text{C/W}$
Converter	$R_{\theta JC}$	Junction-to-Case (DIODE Part, per 1/6 Module)	--	1.3	$^\circ\text{C/W}$
Weight		Weight of Module	210	--	g

NTC Thermistor Characteristics

	Symbol	Parameter	Tol.	Typ.	Units
Thermistor	R_{25}	Rated Resistance @ $T_c = 25^\circ\text{C}$	+/- 5 %	5.0	$\text{K}\Omega$
	R_{100}	Rated Resistance @ $T_c = 100^\circ\text{C}$	+/- 5 %	0.415	$\text{K}\Omega$
	$B_{(25/100)}$	B - Value	+/- 3 %	3692	

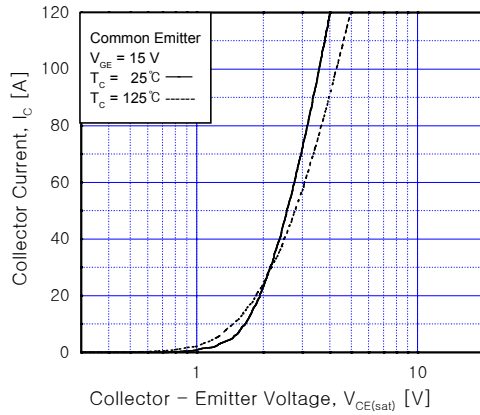


Fig 1. Typical Output Characteristics

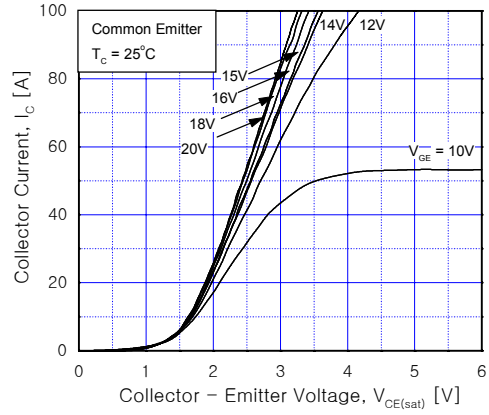


Fig 2. Typical Saturation Voltage Characteristics

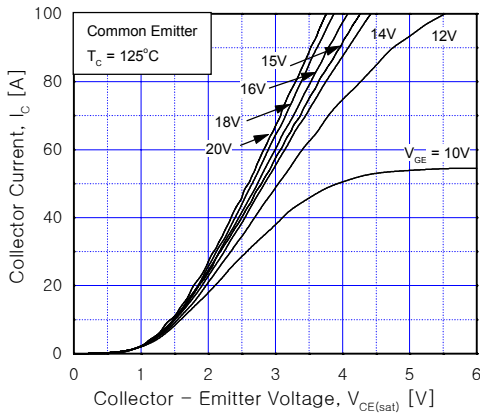


Fig 3. Typical Saturation Voltage Characteristics

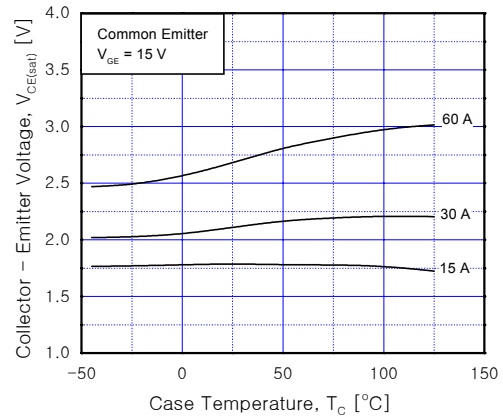


Fig 4. Saturation Voltage vs. Case Temperature at Variant Current Level

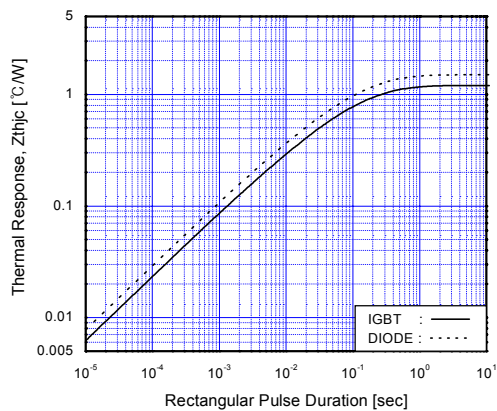


Fig 5. Transient Thermal Impedance

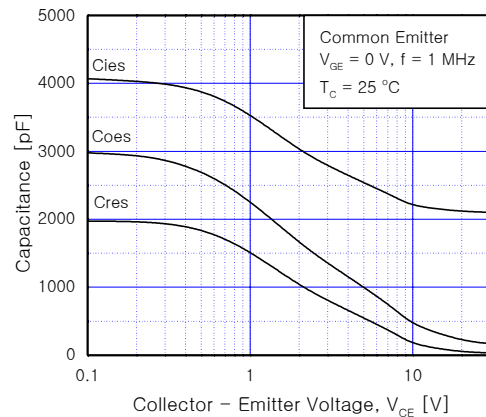


Fig 6. Capacitance Characteristics

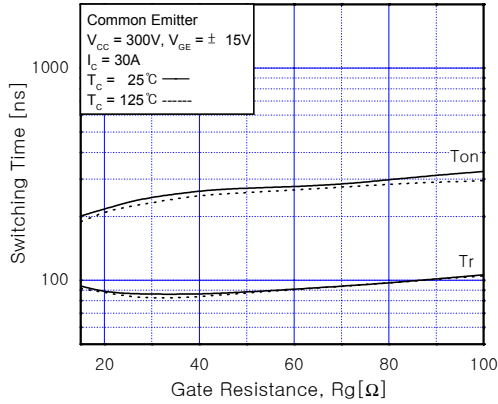


Fig 7. Turn-On Characteristics vs. Gate Resistance

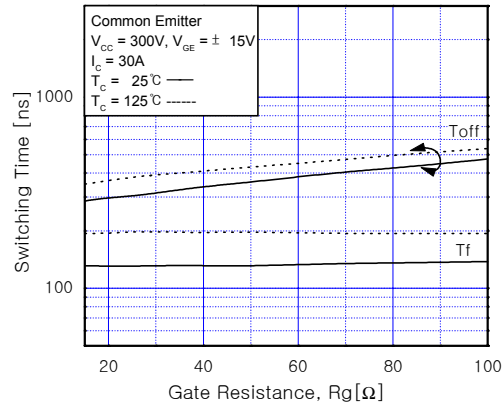


Fig 8. Turn-Off Characteristics vs. Gate Resistance

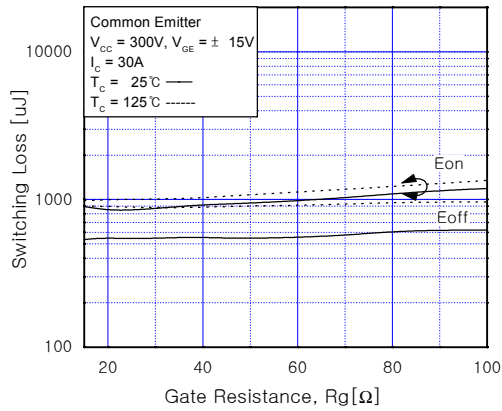


Fig 9. Switching Loss vs. Gate Resistance

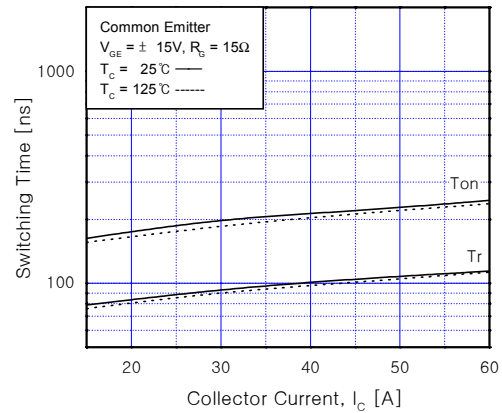


Fig 10. Turn-On Characteristics vs. Collector Current

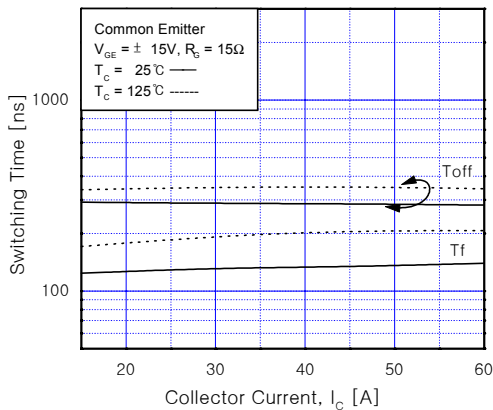


Fig 11. Turn-Off Characteristics vs. Collector Current

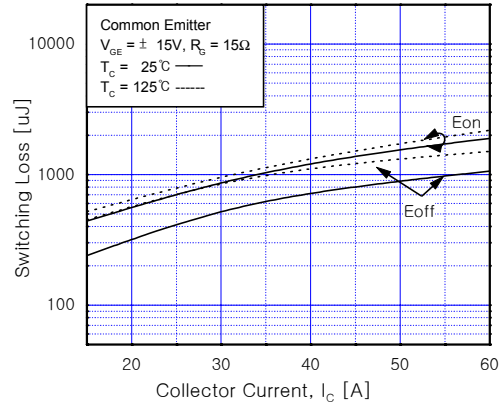


Fig 12. Switching Loss vs. Collector Current

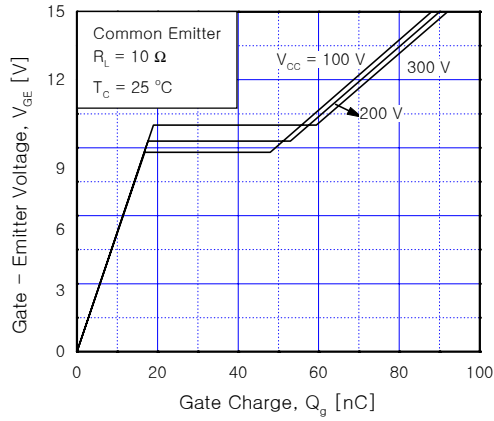


Fig 13. Gate Charge Characteristics

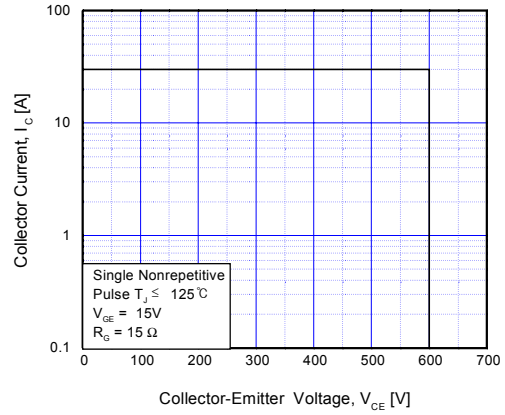


Fig 14. RBSOA Characteristics

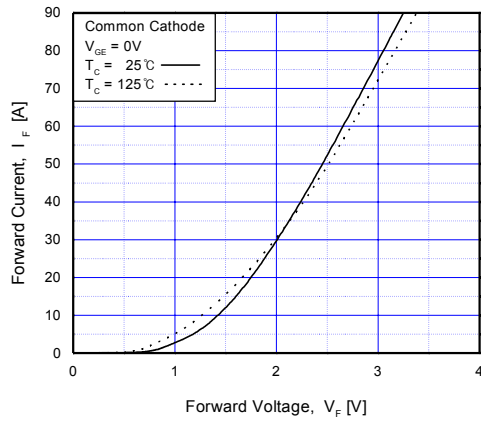


Fig 15. Forward Characteristics

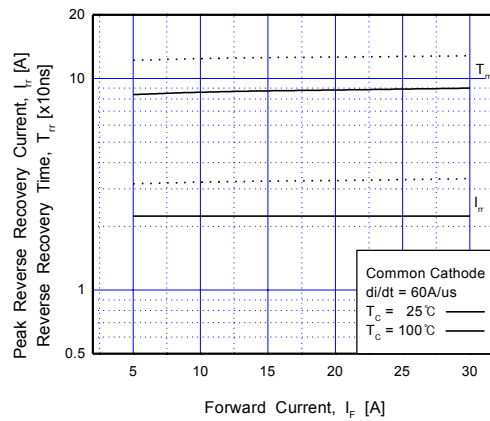


Fig 16. Reverse Recovery Characteristics

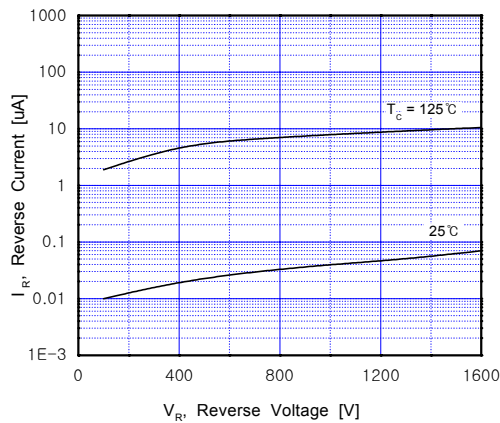


Fig 17. Rectifier(Converter) Characteristics

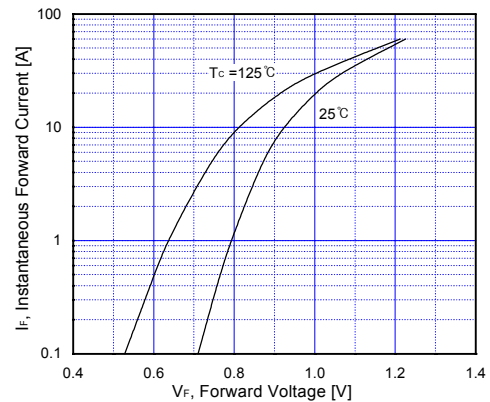


Fig 18. Rectifier(Converter) Characteristics

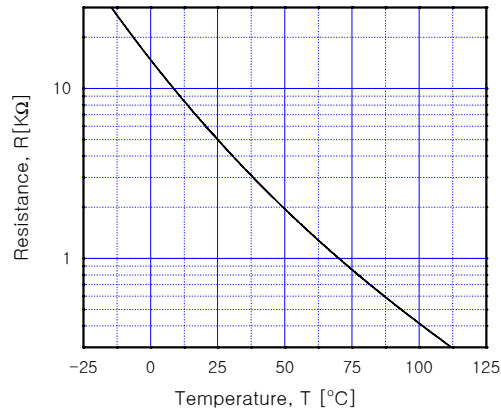


Fig 19. NTC Characteristics

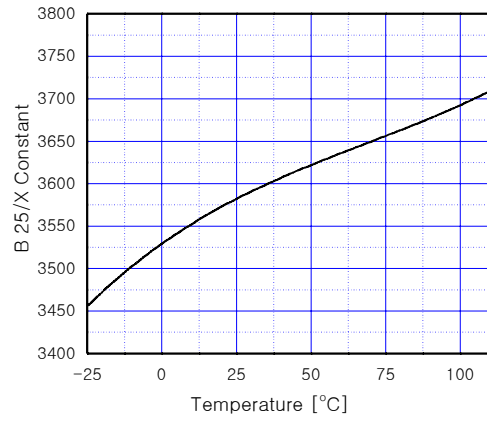
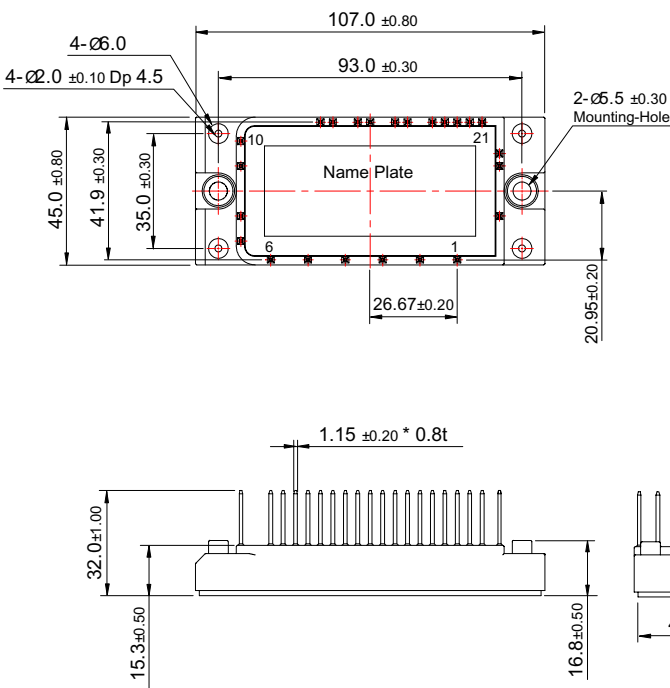


Fig 20. NTC Characteristics

Package Dimension

24PM-AA



-. Pin Coordinate

Pin #No	Coordinate	
	x	y
1	0.0	0.0
2	-11.43	0.0
3	-22.86	0.0
4	-34.29	0.0
5	-45.72	0.0
6	-57.15	0.0
7	-66.27	5.71
8	-66.27	13.33
9	-66.27	28.57
10	-66.27	36.19
11	-41.91	41.90
12	-38.10	41.90
13	-30.48	41.90
14	-26.67	41.90
15	-19.05	41.90
16	-15.24	41.90
17	-7.62	41.90
18	-3.81	41.90
19	0.0	41.90
20	3.81	41.90
21	7.62	41.90
22	12.93	32.38
23	12.93	28.57
24	12.93	13.33

• datum pin : #1

• Pin Tilt : ± 0.20

Dimensions in Millimeters

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