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FAIRCHILD
SEMICONDUCTOR®

August 2005

FMS7G20US60S
Compact & Complex Module

Features

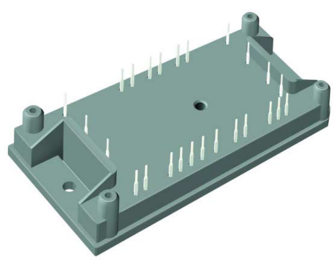
- Short Circuit Rated 10µs @ T_C = 100°C, V_{GE} = 15V
- High Speed Switching
- Low Saturation Voltage : V_{CE}(sat) = 2.1 V @ I_C = 20A
- High Input Impedance
- Built-in Brake & 1 Phase Rectifier Circuit
- Fast & Soft Anti-Parallel FWD
- Built-in NTC Thermistor

Applications

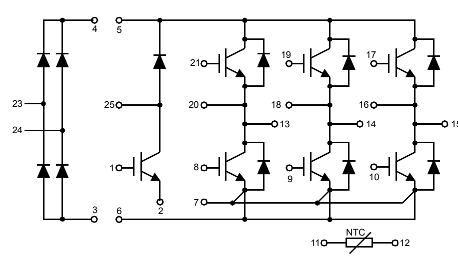
- AC & DC Motor Controls
- General Purpose Inverters
- Robotics
- Servo Controls

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.



Package Code : 25PM-AA



Internal Circuit Diagram

Absolute Maximum Ratings T_C = 25°C unless otherwise noted

	Symbol	Description		FMS7G20US60S	Units
Inverter & Brake	V_{CES}	Collector-Emitter Voltage		600	V
	V_{GES}	Gate-Emitter Voltage		± 20	V
	I_C	Collector Current	@ T_C = 80°C	20	A
	$I_{CM\ (1)}$	Pulsed Collector Current		40	A
	I_F	Diode Continuous Forward Current	@ T_C = 80°C	20	A
	I_{FM}	Diode Maximum Forward Current		40	A
	P_D	Maximum Power Dissipation	@ T_C = 25°C	89	W
	T_{SC}	Short Circuit Withstand Time	@ T_C = 100°C	10	µs
Converter	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	°C
	T_{STG}	Storage Temperature Range		-40 to +125	°C
	V_{ISO}	Isolation Voltage	@ AC 1minute	2500	V
Mounting Torque		Mounting part Screw	@ M4	2.0	N·m

Notes :

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

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FMS7G20US60S	FMS7G20US60S	25PM-AA	--	--	--

(2) TMC2 Relibility test was done under -45°C ~ 125°C

Electrical Characteristics of 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 = 250μA	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	μA
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 = 20mA, V_{CE} = V_{GE}	5.0	6.5	8.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C = 20A, V_{GE} = 15V	--	2.1	2.7	V
Dynamic Characteristics						
C_{ies}	Input Capacitance	V_{CE} = 30V, V_{GE} = 0V, f = 1MHz	--	1277	--	pF
C_{oes}	Output Capacitance		--	98	--	pF
C_{res}	Reverse Transfer Capacitance		--	21	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 300 V, I_C = 20A, R_G = 10Ω, V_{GE} = 15V, Inductive Load, T_C = 25°C	--	65	130	ns
t_r	Rise Time		--	100	200	ns
$t_{d(off)}$	Turn-Off Delay Time		--	80	160	ns
t_f	Fall Time		--	100	200	ns
E_{on}	Turn-On Switching Loss		--	0.45	--	mJ
E_{off}	Turn-Off Switching Loss		--	0.42	--	mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 300 V, I_C = 20A, R_G = 10Ω, V_{GE} = 15V, Inductive Load, T_C = 125°C	--	70	140	ns
t_r	Rise Time		--	100	200	ns
$t_{d(off)}$	Turn-Off Delay Time		--	110	220	ns
t_f	Fall Time		--	210	350	ns
E_{on}	Turn-On Switching Loss		--	0.5	--	mJ
E_{off}	Turn-Off Switching Loss		--	0.72	--	mJ
T_{sc}	Short Circuit Withstand Time	V_{CC} = 300 V, V_{GE} = 15V @ T_C = 100°C	10	--	--	μs
Q_g	Total Gate Charge	V_{CE} = 300 V, I_C = 20A, V_{GE} = 15V	--	55	65	nC
Q_{ge}	Gate-Emitter Charge		--	10	15	nC
Q_{gc}	Gate-Collector Charge		--	20	30	nC

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

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V_{FM}	Diode Forward Voltage	I_F = 20A	T_C = 25°C	--	1.9	2.8	V
			T_C = 100°C	--	2.0	--	
t_{rr}	Diode Reverse Recovery Time	I_F = 20A di / dt = 40 A/µs	T_C = 25°C	--	75	150	ns
			T_C = 100°C	--	110	--	
I_{rr}	Diode Peak Reverse Recovery Current		T_C = 25°C	--	1.3	2.6	A
			T_C = 100°C	--	1.8	--	
Q_{rr}	Diode Reverse Recovery Charge		T_C = 25°C	--	50	195	nC
			T_C = 100°C	--	100	--	

Electrical Characteristics of DIODE @ Converter T_C = 25°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)	--	1.4	°C/W
	$R_{\theta JC}$	Junction-to-Case (DIODE Part, per 1/6 Module)	--	2.3	°C/W
Brake	$R_{\theta JC}$	Junction-to-Case (IGBT Part)	--	1.4	°C/W
	$R_{\theta JC}$	Junction-to-Case (DIODE Part)	--	2.3	°C/W
Converter	$R_{\theta JC}$	Junction-to-Case (DIODE Part, per 1/6 Module)	--	1.3	°C/W
Weight		Weight of Module	60	--	g

NTC Thermistor Characteristics

	Symbol	Parameter	Tol.	Typ.	Units
Thermistor	R25	Rated Resistance @ Tc = 25°C	+/- 5 %	4.7	KΩ
	B(25/100)	B - Value	+/- 3 %	3530	

Typical Performance Characteristics

Figure 1. Typical Output Characteristics

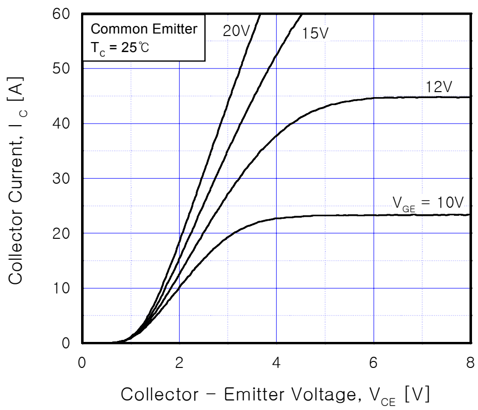


Figure 2. Typical Saturation Voltage Characteristics

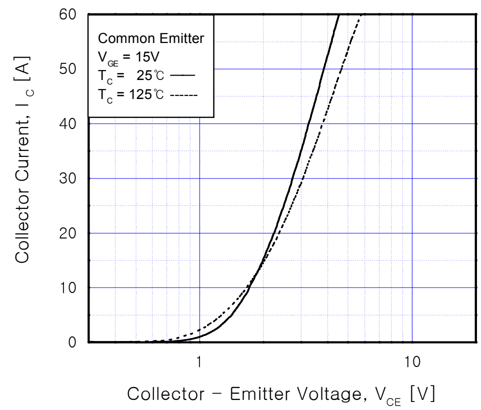


Figure 3. Saturation Voltage vs. Case Temperature at Variant Current Level

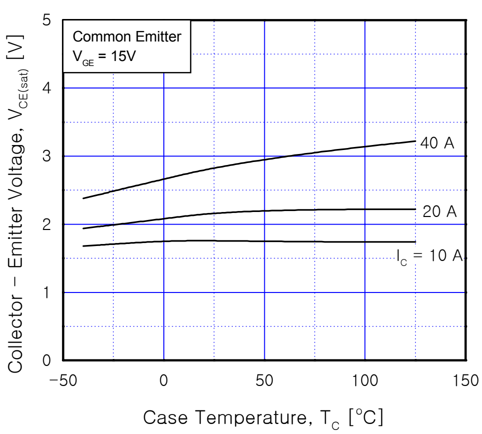


Figure 4. Transient Thermal Impedance

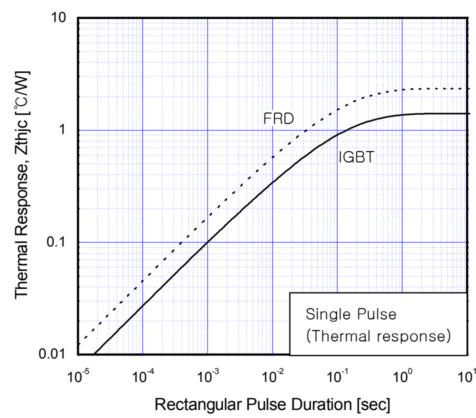


Figure 5. Saturation Voltage vs. V_{GE}

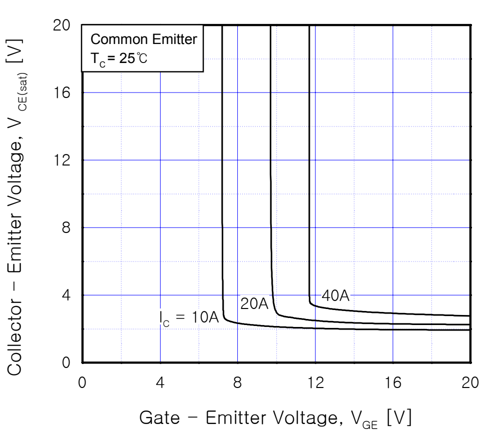
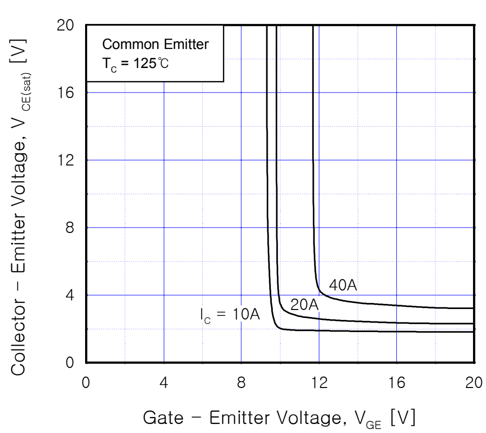


Figure 6. Saturation Voltage vs. V_{GE}



Typical Performance Characteristics (Continued)

Figure 7. Capacitance Characteristics

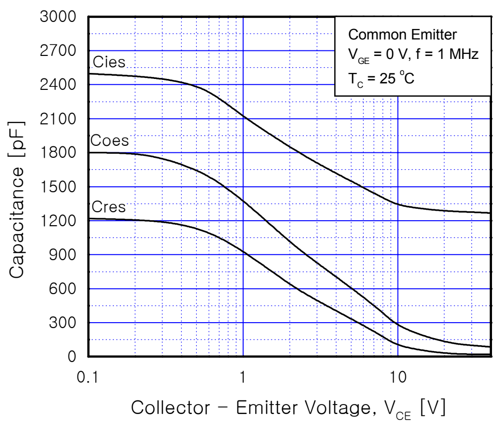


Figure 8. Turn-On Characteristics vs. Gate Resistance

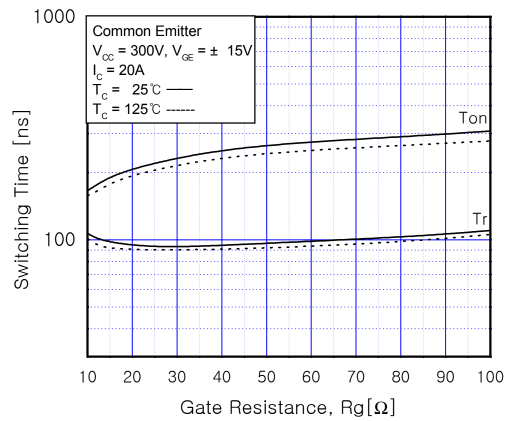


Figure 9. Turn-Off Characteristics vs. Gate Resistance

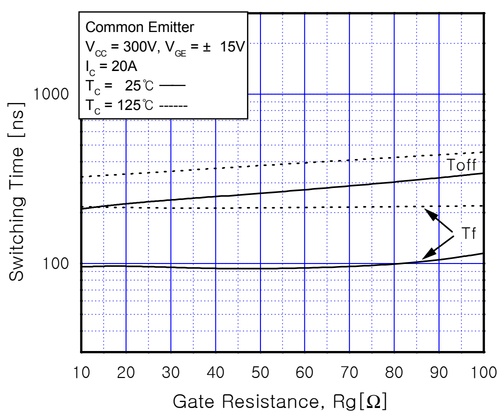


Figure 10. Switching Loss vs. Gate Resistance

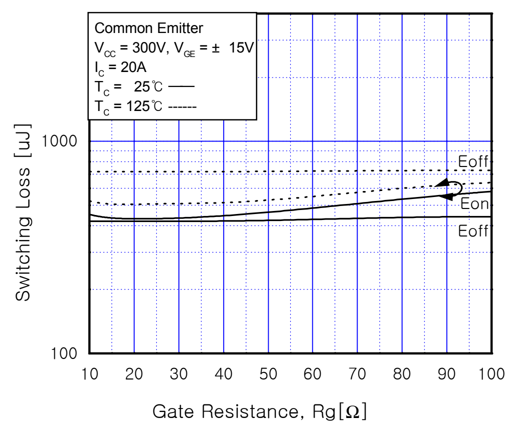


Figure 11. Turn-On Characteristics vs. Collector Current

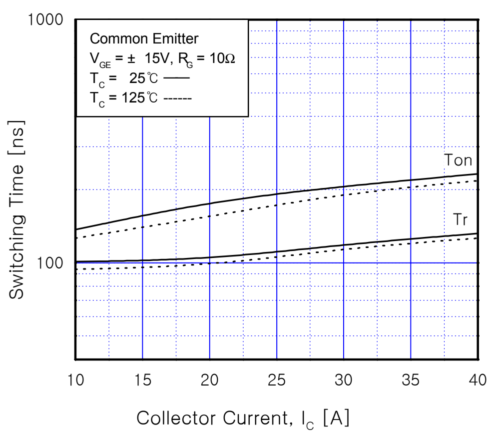
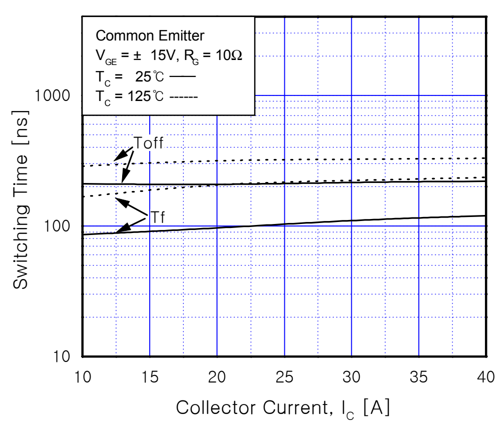


Figure 12. Turn-Off Characteristics vs. Collector Current



Typical Performance Characteristics (Continued)

Figure 13. Switching Loss vs. Collector Current

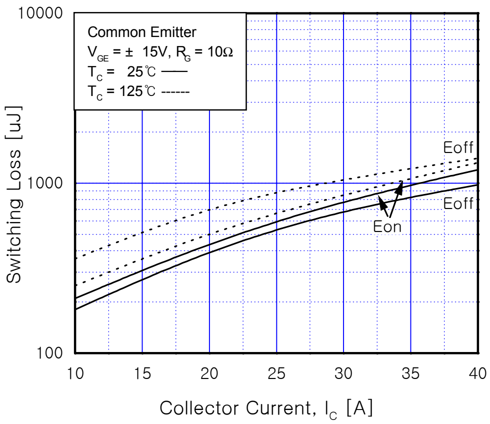


Figure 14. Gate Charge Characteristics

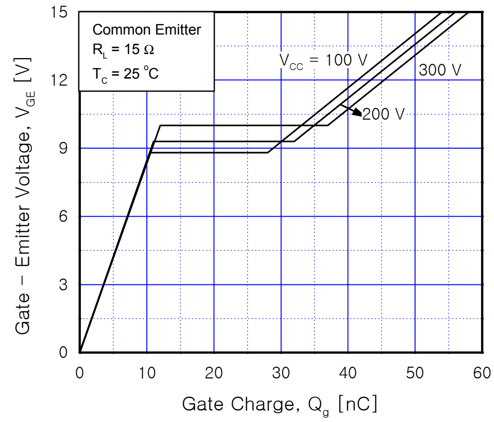


Figure 15. SOA Characteristics

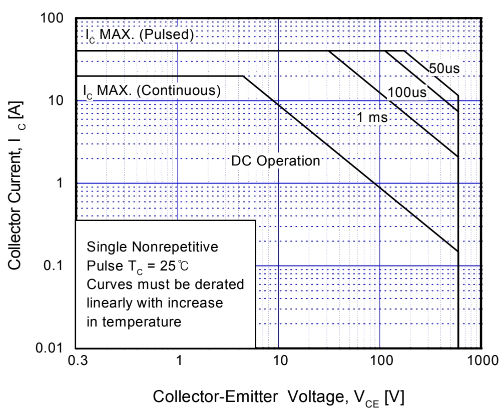


Figure 16. RBSOA Characteristics

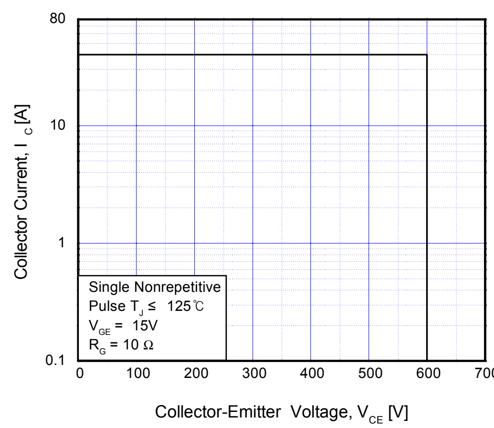


Figure 17. Forward Characteristics

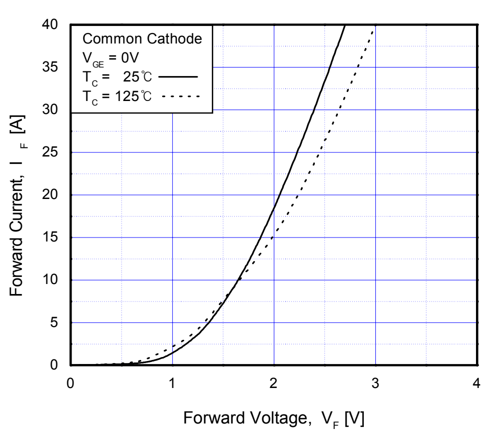
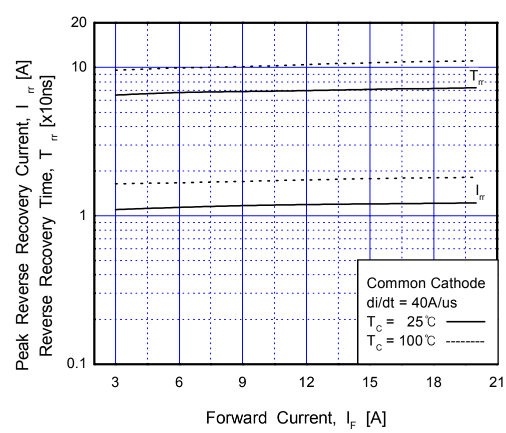


Figure 18. Reverse Recovery Characteristics



Typical Performance Characteristics (Continued)

Figure 19. Rectifier (Converter) Characteristics

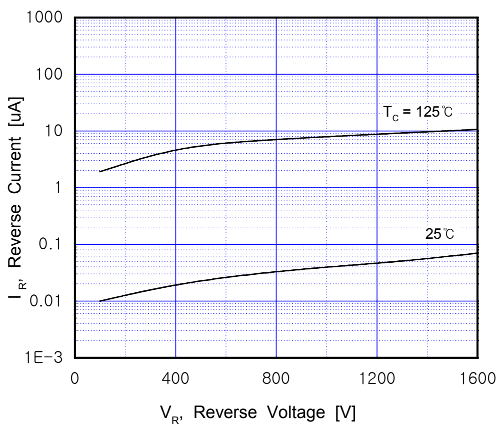


Figure 20. Rectifier (Converter) Characteristics

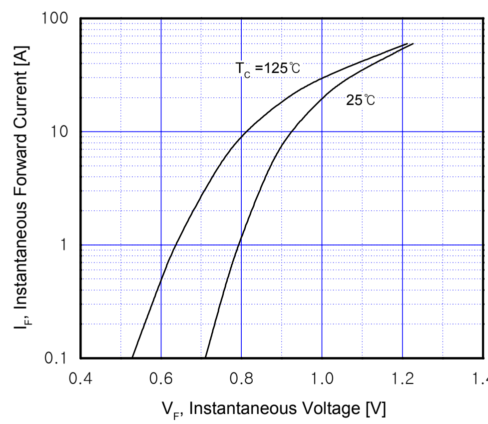
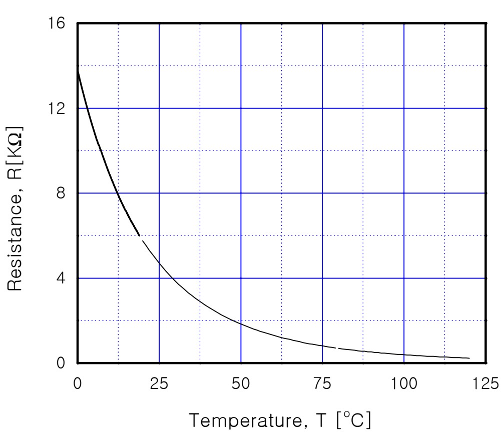


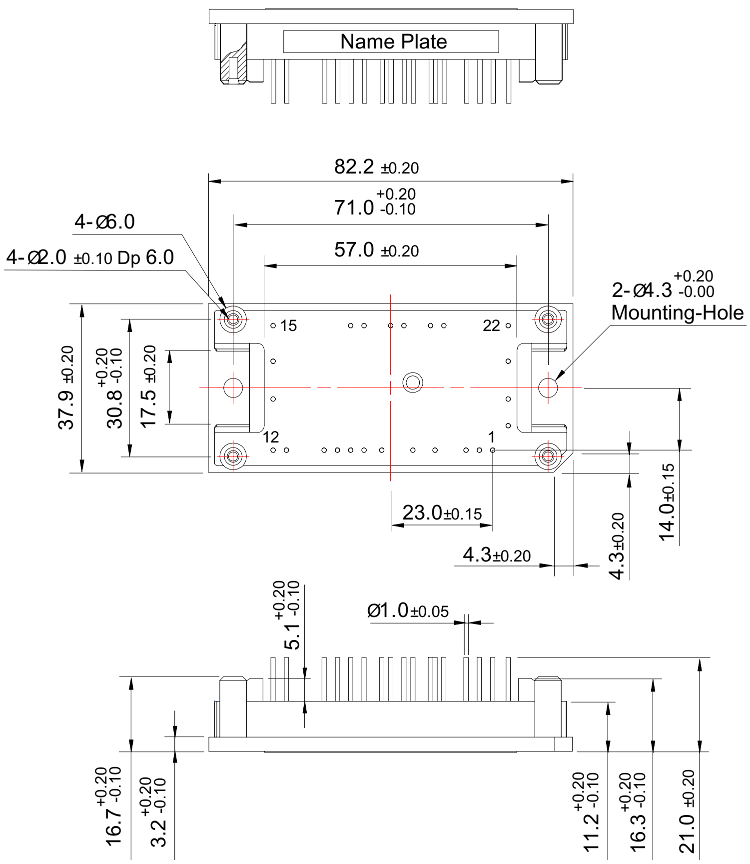
Figure 21. NTC Characteristics



Dimensions in Millimeters

Mechanical Dimensions

25PM-AA



-. Pin Coordinate

Pin #No	Coordinate	
	x	y
1	0.0	0.0
2	-3.0	0.0
3	-6.0	0.0
4	-13.0	0.0
5	-18.0	0.0
6	-25.0	0.0
7	-29.0	0.0
8	-32.0	0.0
9	-35.0	0.0
10	-38.0	0.0
11	-46.5	0.0
12	-49.5	0.0
13	-49.5	11.5
14	-49.5	20.0
15	-49.5	28.0
16	-32.0	28.0
17	-29.0	28.0
18	-23.0	28.0
19	-20.0	28.0
20	-14.0	28.0
21	-11.0	28.0
22	3.5	28.0
23	3.5	20.0
24	3.5	11.5
25	3.5	5.5

* datum pin : #1
* Pin Tilt : ±0.15

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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.

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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.
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