FAIRCHILD
SEMICONDUCTOR®

IGBT

FMM7G50US60I

Compact & Complex Module

General Description

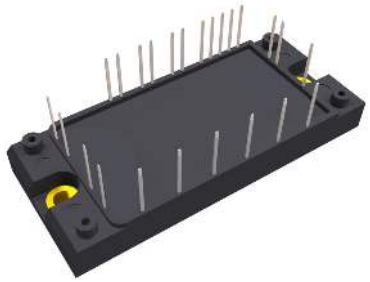
Fairchild IGBT Power Module provides low conduction and switching losses as well as short circuit ruggedness. It's designed for the applications such as motor control and general inverters where short-circuit ruggedness is required.

Features

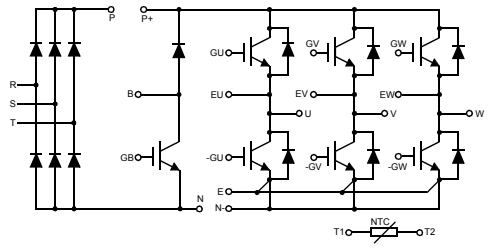
- Short Circuit rated Time 10us @ T_C = 100°C, V_{GE} = 15V
- High Speed Switching
- Low Saturation Voltage : V_{CE}(sat) = 2.1 V @ I_C = 50A
- High Input Impedance
- Built-in Brake & 3 Phase Rectifier Circuit
- Fast & Soft Anti-Parallel FWD
- Built-in NTC Thermistor
- UL Certified No. E209204

Application

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



Package Code : 24PM-AA



Internal Circuit Diagram

Absolute Maximum Ratings

T_C = 25°C unless otherwise noted

	Symbol	Description		FMM7G50US60I	Units
Inverter	V_{CES}	Collector-Emitter Voltage		600	V
	V_{GES}	Gate-Emitter Voltage		± 20	V
	I_C	Collector Current	@ T_C = 80°C	50	A
	$I_{CM\ (1)}$	Pulsed Collector Current		100	A
	I_F	Diode Continuous Forward Current	@ T_C = 80°C	50	A
	I_{FM}	Diode Maximum Forward Current		100	A
	P_D	Maximum Power Dissipation	@ T_C = 25°C	139	W
	T_{SC}	Short Circuit Withstand Time	@ T_C = 100°C	10	us
Converter	V_{RRM}	Repetitive Peak Reverse Voltage		1600	V
	I_O	Average Output Rectified Current		50	A
	I_{FSM}	Surge Forward Current @ 1Cycle at 60Hz, Peak value Non-Repetitive		320	A
	I^2t	Energy pulse @ 1Cycle at 60Hz		419	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	4.0	N.m

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

Electrical Characteristics of IGBT @ Inverter & Brake 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 = 50mA, V_{CE} = V_{GE}	5.0	6.5	8.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C =50A, V_{GE} = 15V	--	2.1	2.7	V
Dynamic Characteristics						
C_{ies}	Input Capacitance	V_{CE} = 30V, V_{GE} = 0V, f = 1MHz	--	3565	--	pF
C_{oes}	Output Capacitance		--	286	--	pF
C_{res}	Reverse Transfer Capacitance		--	60	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 300 V, I_C = 50A, R_G = 10Ω, V_{GE} = 15V, Inductive Load, T_C = 25°C	--	90	200	ns
t_r	Rise Time		--	60	150	ns
$t_{d(off)}$	Turn-Off Delay Time		--	110	200	ns
t_f	Fall Time		--	120	250	ns
E_{on}	Turn-On Switching Loss		--	1.08	--	mJ
E_{off}	Turn-Off Switching Loss		--	0.95	--	mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 300 V, I_C = 50A, R_G = 10Ω, V_{GE} = 15V, Inductive Load, T_C = 125°C	--	80	200	ns
t_r	Rise Time		--	60	150	ns
$t_{d(off)}$	Turn-Off Delay Time		--	110	200	ns
t_f	Fall Time		--	210	400	ns
E_{on}	Turn-On Switching Loss		--	1.28	--	mJ
E_{off}	Turn-Off Switching Loss		--	1.5	--	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 = 50A, V_{GE} = 15V	--	150	300	nC
Q_{ge}	Gate-Emitter Charge		--	35	70	nC
Q_{gc}	Gate-Collector Charge		--	60	120	nC

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

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V_{FM}	Diode Forward Voltage	I_F = 50A	T_C = 25°C	--	1.9	2.8	V
			T_C = 100°C	--	2.0	--	
t_{rr}	Diode Reverse Recovery Time	I_F = 50A di / dt = 100 A/us	T_C = 25°C	--	75	150	ns
			T_C = 100°C	--	130	--	
I_{rr}	Diode Peak Reverse Recovery Current		T_C = 25°C	--	5	6.5	A
			T_C = 100°C	--	7	--	
Q_{rr}	Diode Reverse Recovery Charge		T_C = 25°C	--	225	422	nC
			T_C = 100°C	--	455	--	

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 = 50A	T_C = 25°C	--	1.2	1.6	V
			T_C = 100°C	--	1.2	--	
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)	--	0.9	°C/W
	$R_{\theta JC}$	Junction-to-Case (DIODE Part, per 1/6 Module)	--	1.3	°C/W
Brake	$R_{\theta JC}$	Junction-to-Case (IGBT Part, per 1/6 Module)	--	0.9	°C/W
	$R_{\theta JC}$	Junction-to-Case (DIODE Part, per 1/6 Module)	--	1.3	°C/W
Converter	$R_{\theta JC}$	Junction-to-Case (DIODE Part, per 1/6 Module)	--	1.3	°C/W
Weight		Weight of Module	210	--	g

NTC Thermistor Characteristics

	Symbol	Parameter	Tol.	Typ.	Units
Thermistor	R_{25}	Rated Resistance @ Tc = 25°C	+/- 5 %	5	KΩ
	R_{100}	Rated Resistance @ Tc = 100 °C	+/- 5 %	0.415	KΩ
	$B_{(25/100)}$	B - Value	+/- 3 %	3692	

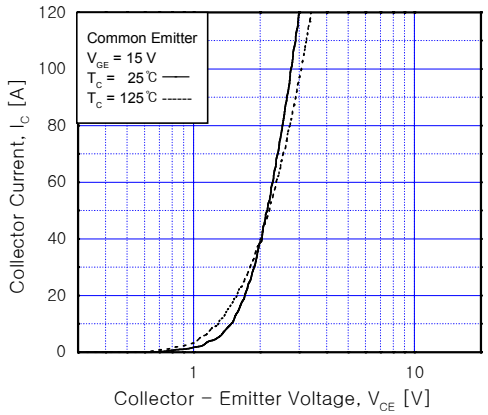


Fig 1. Typical Output Characteristics

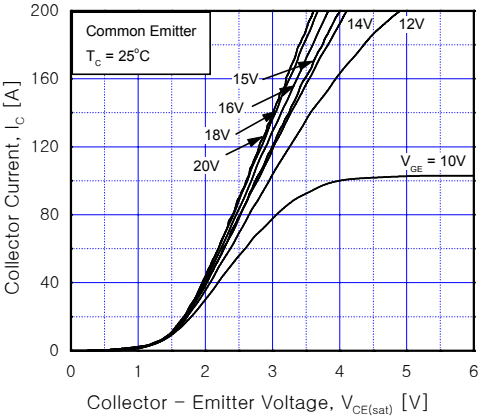


Fig 2. Typical Saturation Voltage Characteristics

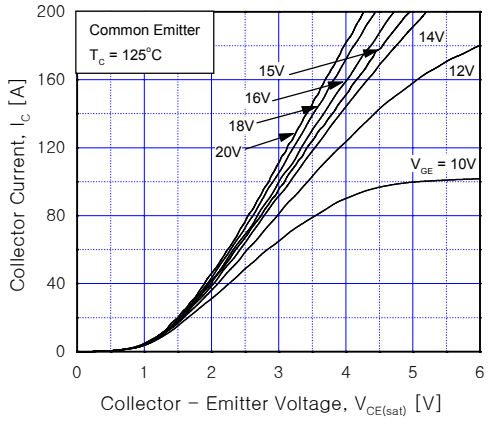


Fig 3. Typical Saturation Voltage Characteristics

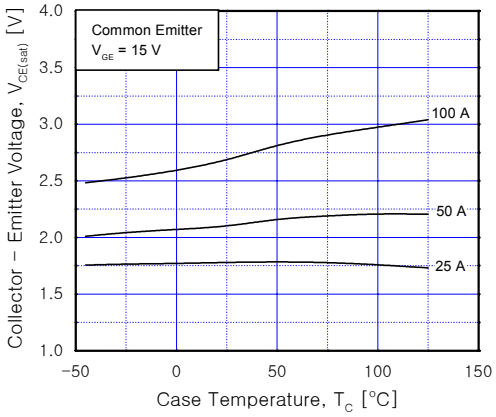


Fig 4. Saturation Voltage vs. Case Temperature at Variant Current Level

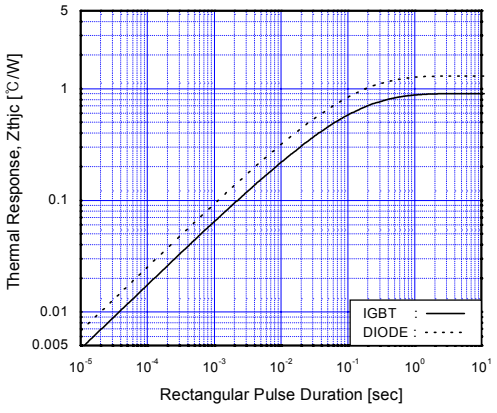


Fig 5. Transient Thermal Impedance

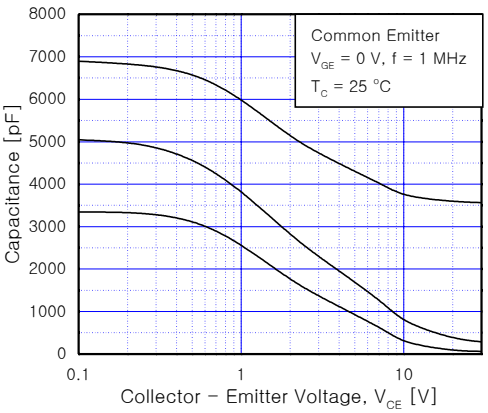


Fig 6. Capacitance Characteristics

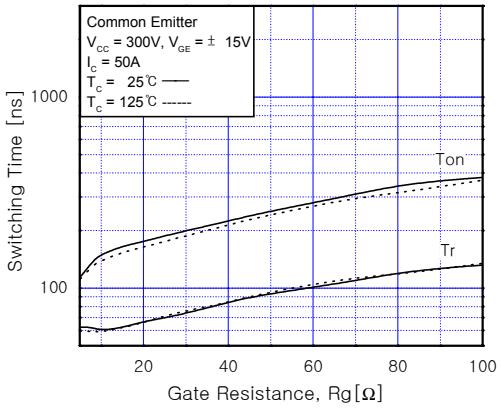


Fig 7. Turn-On Characteristics vs. Gate Resistance

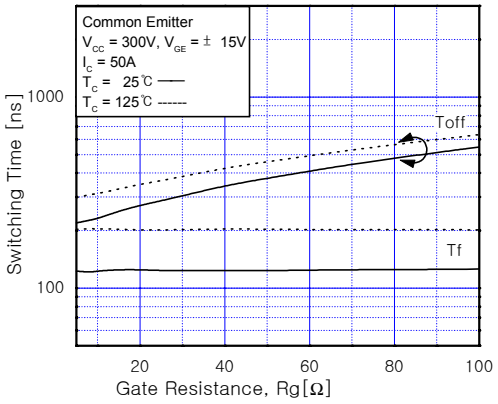


Fig 8. Turn-Off Characteristics vs. Gate Resistance

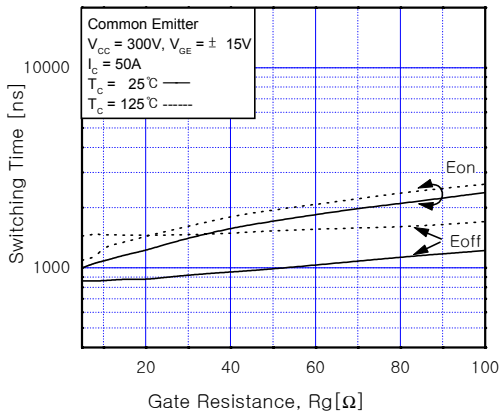


Fig 9. Switching Loss vs. Gate Resistance

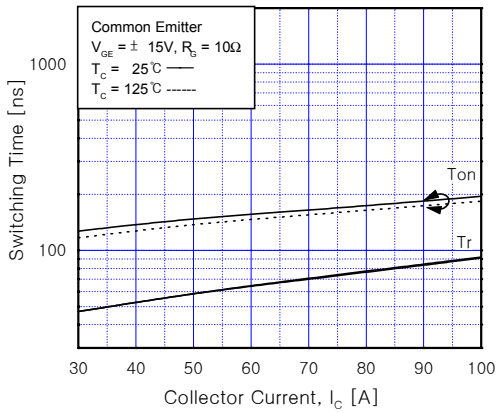


Fig 10. Turn-On Characteristics vs. Collector Current

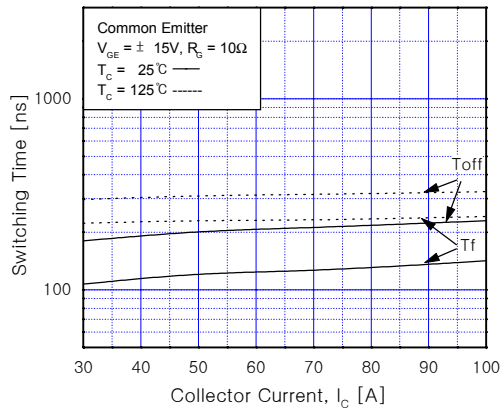


Fig 11. Turn-Off Characteristics vs. Collector Current

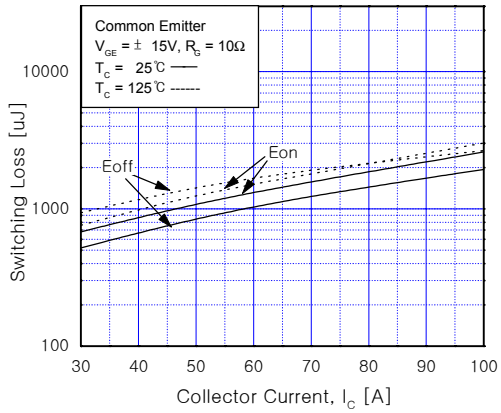


Fig 12. Switching Loss vs. Collector Current

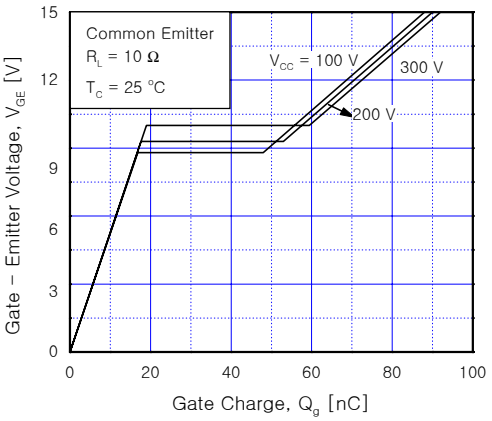


Fig 13. Gate Charge Characteristics

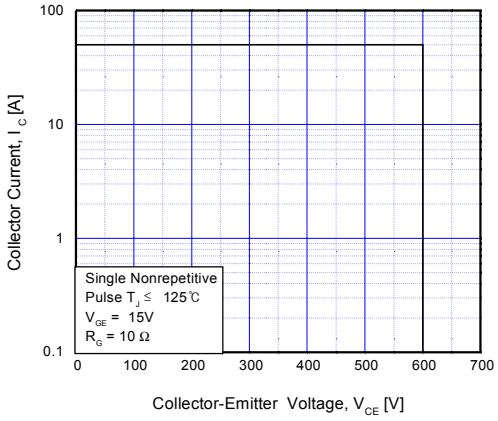


Fig 14. RBSOA Characteristics

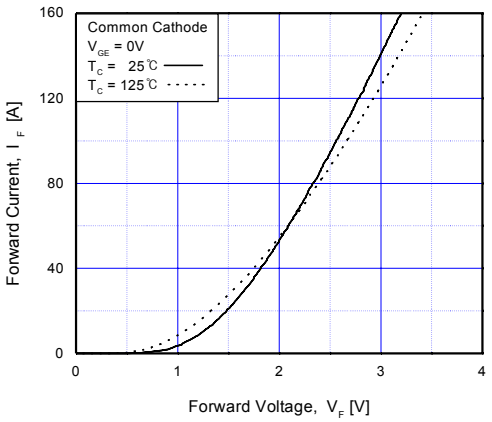


Fig 15. Forward Characteristics

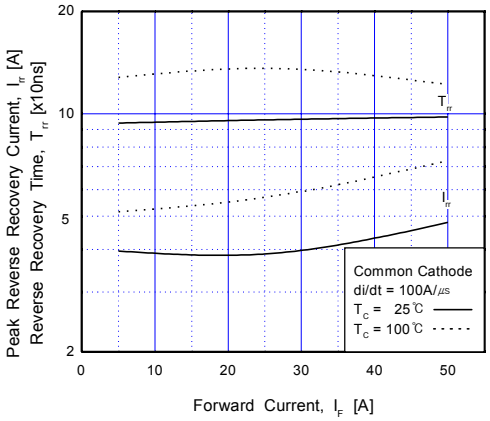


Fig 16. Reverse Recovery Characteristics

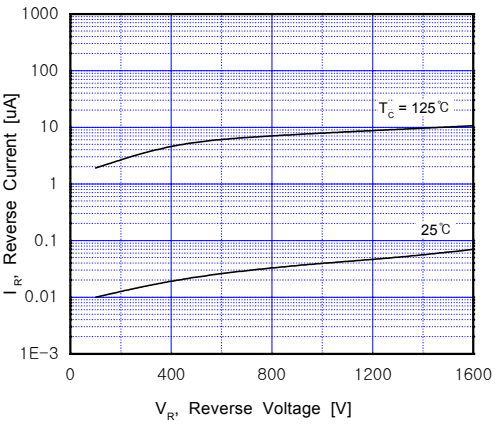


Fig 17. Rectifier(Converter) Characteristics

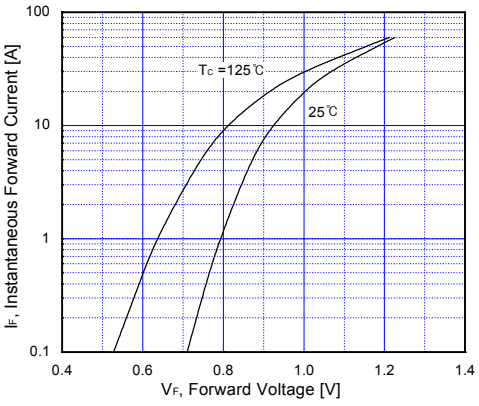


Fig 18. Rectifier(Converter) Characteristics

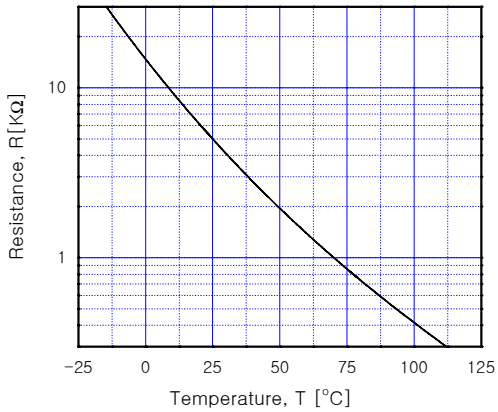


Fig 19. NTC Characteristics

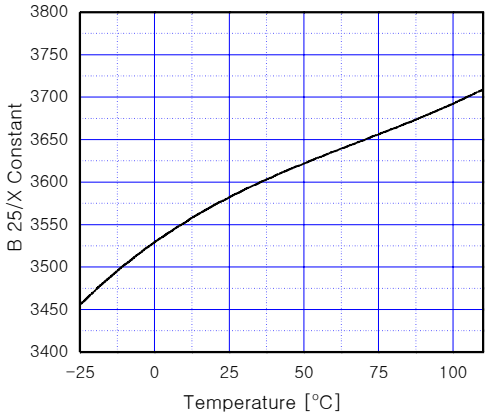
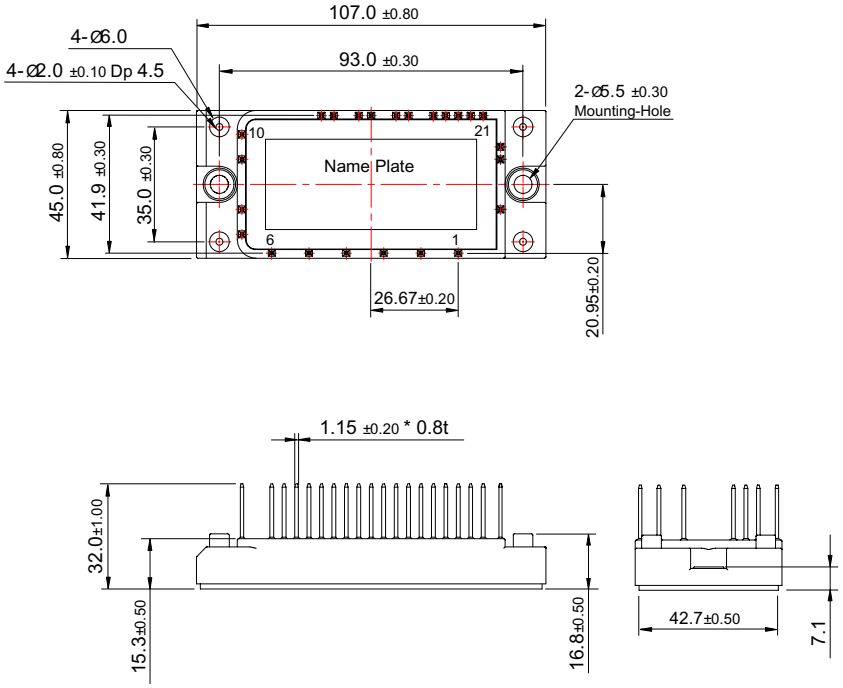


Fig 20. NTC Characteristics

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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CROSSVOLT™	FRFET™	MicroPak™	QFET™	SuperSOT™-8
DOME™	GlobalOptoisolator™	MICROWIRE™	QS™	SyncFET™
EcoSPARK™	GTO™	MSX™	QT Optoelectronics™	TinyLogic®
E^2CMOS™	HiSeC™	MSXPro™	Quiet Series™	TruTranslation™
EnSigna™	I^2C™	OCX™	RapidConfigure™	UHC™
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Programmable Active Droop™		OPTOPLANAR™	SMART START™	

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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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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.
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