FAIRCHILD

SEMICONDUCTOR®

IGBT

FMM6G50US60

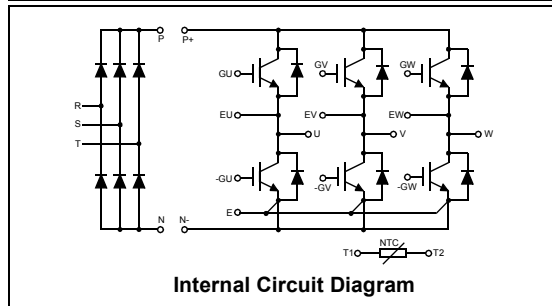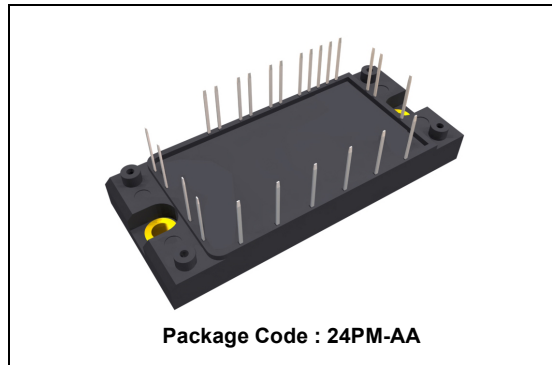## Compact & Complex Module

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
- 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°C unless otherwise noted

	Symbol	Description		FMM6G50US60	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 $T_C = 25°C$ 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, $I_C = 50A$, $R_G = 10\Omega$, $V_{GE} = 15V$, 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, $I_C = 50A$, $R_G = 10\Omega$, $V_{GE} = 15V$, 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
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

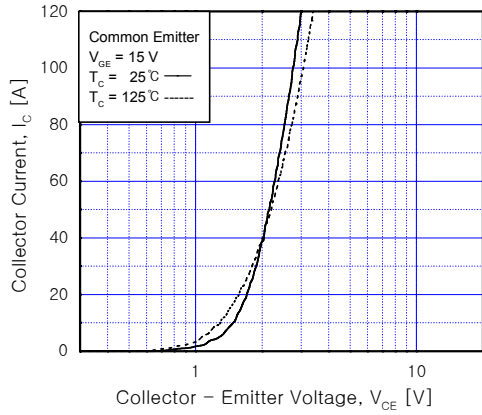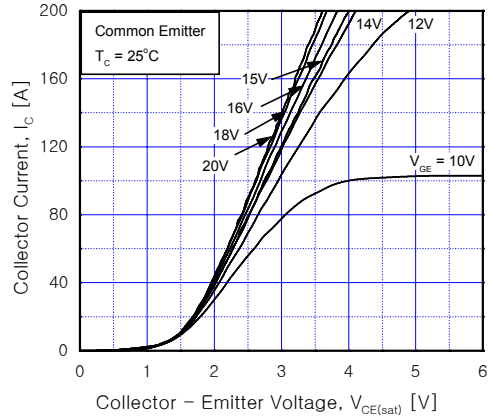|	Symbol	Parameter	Tol.	Typ.	Units
Thermistor	R_{25}	Rated Resistance @ Tc = 25°C	+/- 5 %	5	KΩ
	R_{100}	Rated Resistance @ Tc = 100 °C	+/- 5 %	0.415	KΩ
	$B_{(25/100)}$	B - Value	+/- 3 %	3692	

Fig 1. Typical Output Characteristics

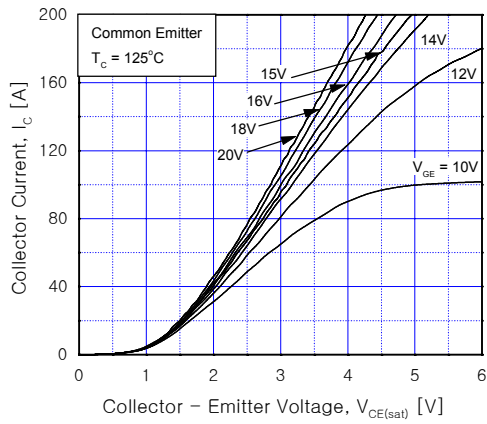Fig 2. Typical Saturation Voltage
Characteristics

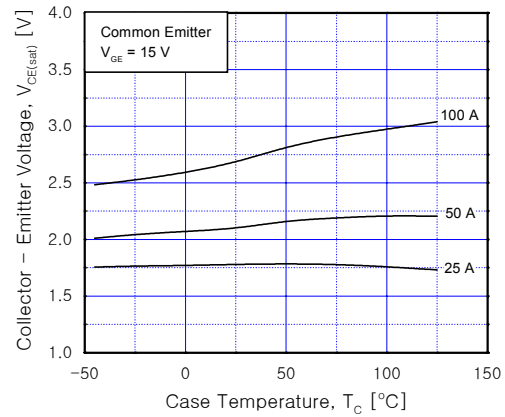Fig 3. Typical Saturation Voltage
Characteristics

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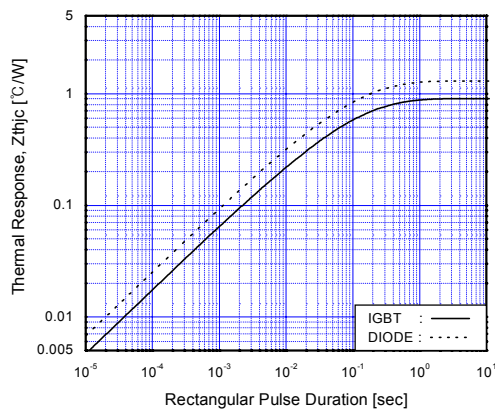Temperature at Variant Current Level

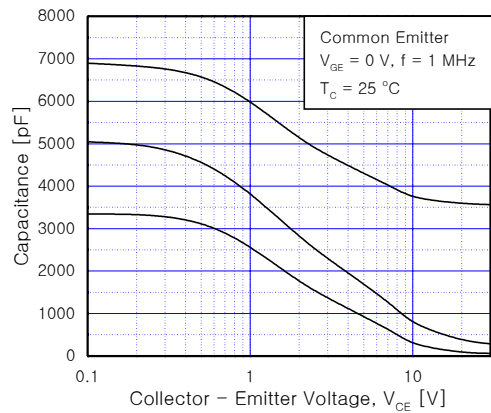Fig 5. Transient Thermal Impedance
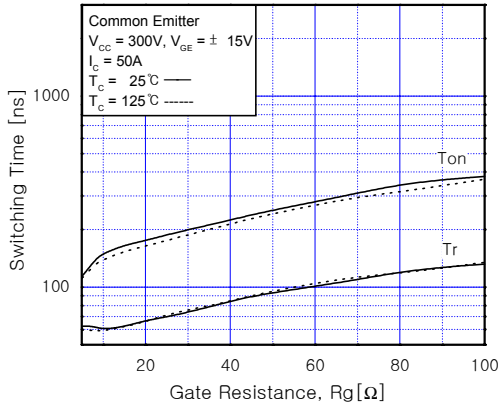

Fig 6. Capacitance Characteristics
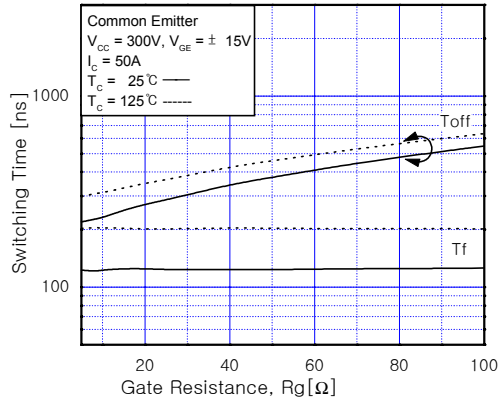
Fig 7. Turn-On Characteristics vs.
Gate Resistance
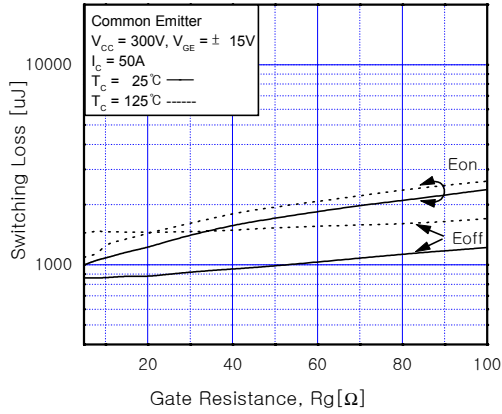

Fig 8. Turn-Off Characteristics vs.
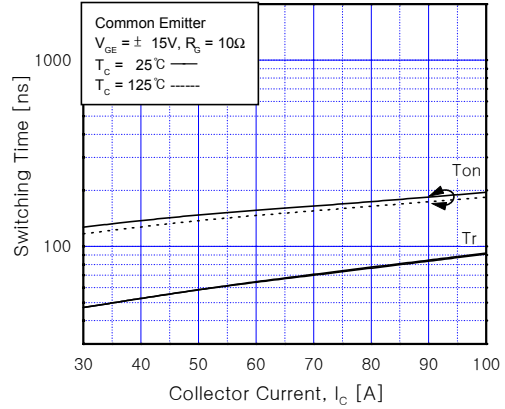Gate Resistance

Fig 9. Switching Loss vs. Gate Resistance

Fig 10. Turn-On Characteristics vs.
Collector Current
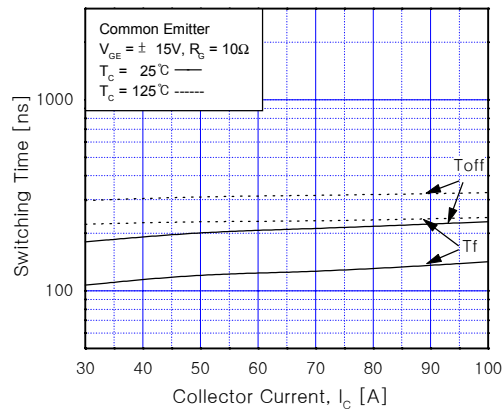

Fig 11. Turn-Off Characteristics vs.
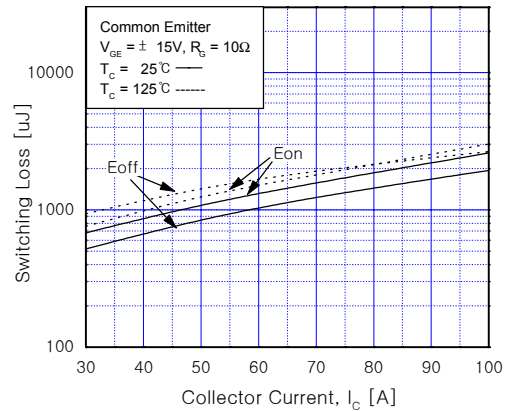Collector Current
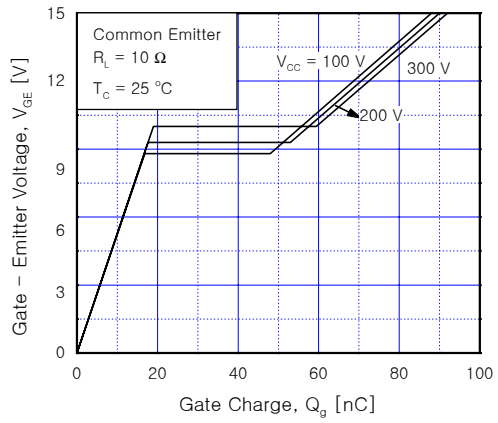

Fig 12. Switching Loss vs. Collector Current

Fig 13. Gate Charge Characteristics

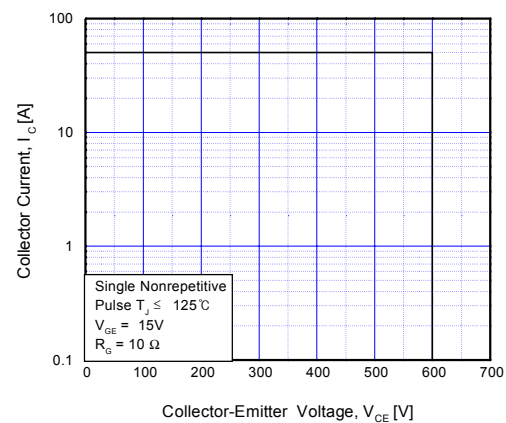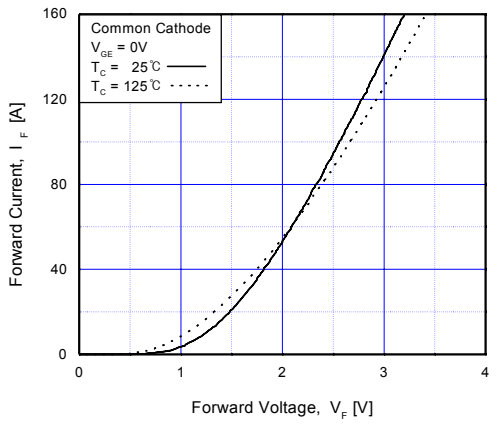**Fig 14. RBSOA Characteristics**
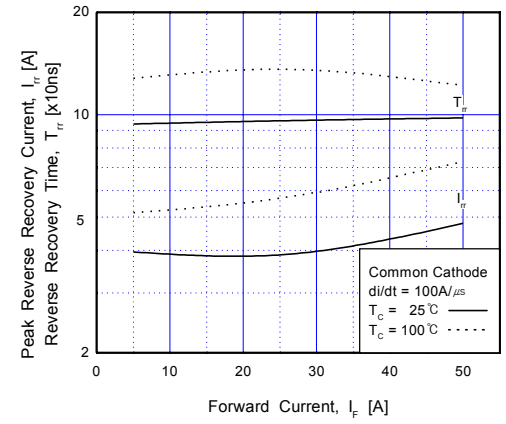
Fig 15. Forward Characteristics

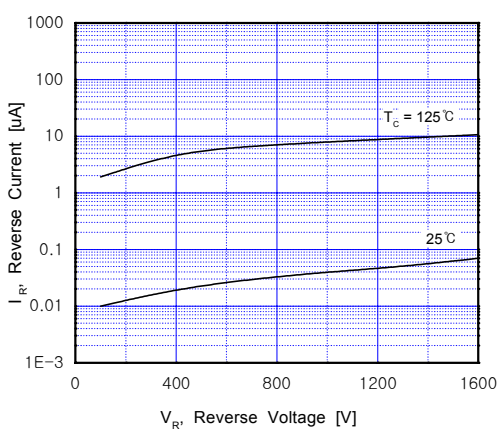**Fig 16. Reverse Recovery Characteristics**
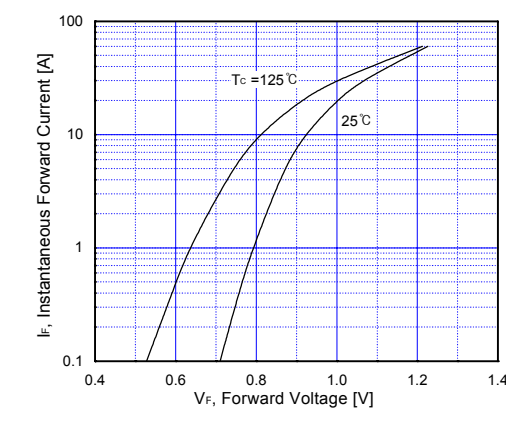
Fig 17. Rectifier(Converter) Characteristics
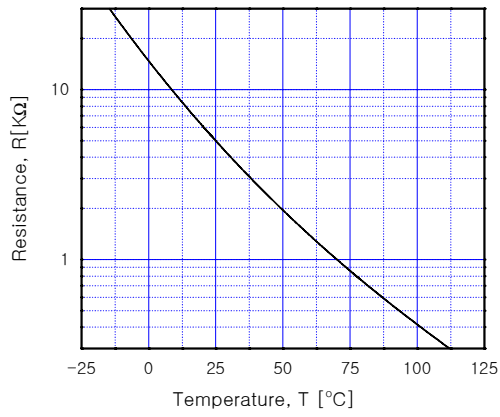
Fig 18. Rectifier(Converter) Characteristics

Fig 19. NTC Characteristics

Fig 20. NTC Characteristics
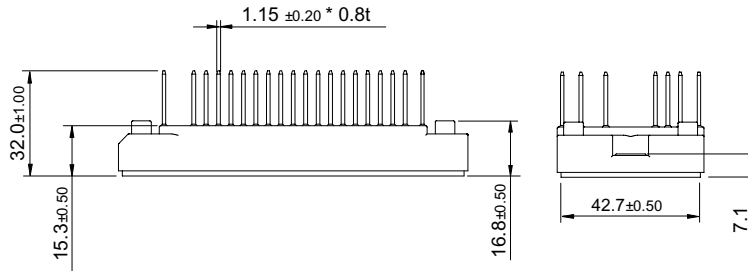
Package Dimension

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

4-Ø6.0
4-Ø2.0 ±0.10 Dp 4.5
107.0 ±0.80
93.0 ±0.30
2-Ø5.5 ±0.30 Mounting-Hole
45.0 ±0.80
41.9 ±0.30
35.0 ±0.30
10
21
Name Plate
6
1
26.67±0.20
20.95±0.20

1.15 ±0.20 * 0.8t
32.0±1.00
15.3±0.50
16.8±0.50
42.7±0.50
7.1

Dimensions in Millimeters

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