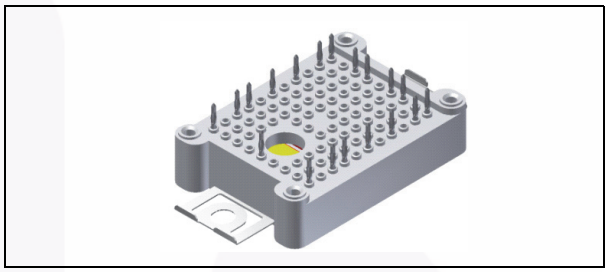
July. 2014

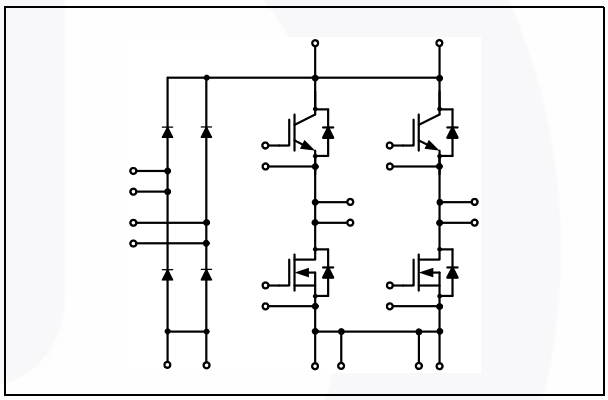
FPF1C2P5MF07AM
F1 Module solution for PV-Application

General Description

Fairchild's brand-new DC-AC module is designed for a power stage that needs more compact design. And the Press-fit technology provides simple and reliable mounting. This module is optimized for the application such as solar inverter where a high efficiency and robust design are needed.



Package Code: F1



Internal Circuit Diagram

Electrical Features

- High Efficiency
- Low Conduction and Switching losses
- Low $V_{CE(sat)}$: 1.1 V typ. @ Ic = 30 A
- Low $R_{DS(ON)}$: 90 mΩ max.
- Fast Recovery Body Diode

Mechanical Features

- Compact size : F1 Package
- Press-fit contact technology

Applications

- Solar Inverter

Certification

- UL approved (E209204)

Absolute Maximum Ratings $T_C = 25^oC$ unless otherwise noted.

Symbol	Description		Rating	Units
Rectifier Diode				
V_{RRM}	Peak Repetitive Reverse Voltage		620	V
I_{Fav}	Diode Continuous Forward Current	@ T_C = 80°C	27	A
I_{FSM}	Diode Maximum Forward Surge Current		245	A
I^2t	I^2t value		300	A^2s
P_D	Maximum Power Dissipation	@ T_C = 25°C	77	W
T_J	Operating Junction Temperature		-40 to +150	°C

Absolute Maximum Ratings T_C = 25°C unless otherwise noted. (Continued)

Symbol	Description		Rating	Units
High-side IGBT				
V_{CES}	Collector-Emitter Voltage		620	V
V_{GES}	Gate-Emitter Voltage		± 20	V
I_C	Collector Current	@ T_C = 80°C	39	A
I_{CM}	Pulsed Collector Current		90	A
I_F	Diode Continuous Forward Current	@ T_C = 80°C	22	A
I_{FM}	Diode Maximum Forward Current		90	A
P_D	Maximum Power Dissipation	@ T_C = 25°C	231	W
T_J	Operating Junction Temperature		-40 to +150	°C
Low-side MOSFET				
V_{DSS}	Drain-Source Voltage		620	V
V_{GSS}	Gate-Source Voltage		± 20	V
I_D	Continuous Drain Current	@ T_C = 25°C	36	A
		@ T_C = 80°C	27	A
I_{DM}	Pulsed Drain Current	Limited by T_J max.	156	A
I_S	Continuous Source-Drain Forward Current		36	A
I_{SM}	Maximum Pulsed Source-Drain Forward Current		156	A
P_D	Maximum Power Dissipation	@ T_C = 25°C	250	W
T_J	Operating Junction Temperature		-40 to +150	°C
Module				
T_{STG}	Storage Temperature		-40 to +125	°C
V_{ISO}	Isolation Voltage	@ AC 1_{MIN}	2500	V
Iso._Material	Internal Isolation Material		Al_2O_3	
F_{MOUNT}	Mounting Force per Clamp		20 to 50	N
Weight		Typ.	22	g
Creepage	Terminal to Heatsink		11.5	mm
	Terminal to Terminal		6.3	mm
Clearance	Terminal to Heatsink		10.0	mm
	Terminal to Terminal		5.0	mm

Package Marking and Ordering Information

Device	Device Marking	Package	Packing Type	Quantity / Tray
FPF1C2P5MF07AM	FPF1C2P5MF07AM	F1	Tray	22

Electrical Characteristics T_C = 25°C unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
Rectifier Diode						
V_F	Diode Forward Voltage	I_F = 30 A	-	-	1.9	V
		I_F = 30 A @T_C = 125°C	-	1.45	-	V
I_R	Reverse Leakage Current	V_R = 620 V	-	-	25	µA
$R_{\theta JC}$	Thermal Resistance of Junction to Case	per Diode	-	-	1.62	°C/W
High-side IGBT						
Off Characteristics						
BV_{CES}	Collector-Emitter Breakdown Voltage	V_{GE} = 0 V, I_C = 1 mA	620	-	-	V
I_{CES}	Collector Cut-off Current	V_{CE} = V_{CES}, V_{GE} = 0 V	-	-	25	µA
I_{GES}	Gate-Emitter Leakage Current	V_{GE} = V_{GES}, V_{CS} = 0 V	-	-	2.5	µA
On Characteristics						
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	V_{GE} = V_{CE}, I_C = 30 mA	4	5.7	7	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 30 A, V_{GE} = 15 V	-	1.1	1.6	V
		I_C = 30 A, V_{GE} = 15 V @T_C = 125°C	-	1.0	-	V
		I_C = 60 A, V_{GE} = 15 V	-	1.4	-	V
Switching Characteristics						
Q_g	Total Gate Charge	V_{DS} = 380 V, V_{GS} = 0V...+15 V, I_D = 30 A	-	214	-	nC
$R_{\theta JC}$	Thermal Resistance of Junction to Case	per IGBT	-	-	0.54	°C/W

* Note : High-side IGBT is optimized for line frequency switching such as 50/60 Hz.

High-Side FWD						
V_{FM}	Diode Forward Voltage	I_F = 15 A, V_{GS} = 0 V	-	1.75	2.25	V
t_{rr}	Reverse Recovery Time	I_F = 15 A dI_F/dt = 1650 A/µs	-	30	-	ns
I_{rr}	Reverse Recovery Current		-	27	-	A
Q_{rr}	Reverse Recovery Charge		-	405	-	nC
t_{rr}	Reverse Recovery Time	I_F = 15 A dI_F/dt = 1500 A/µs @T_C = 125°C	-	43		ns
I_{rr}	Reverse Recovery Current		-	38	-	A
Q_{rr}	Reverse Recovery Charge		-	814	-	nC
$R_{\theta JC}$	Thermal Resistance of Junction to Case	per Diode	-	-	1.61	°C/W

Electrical Characteristics T_C = 25°C unless otherwise noted. (Continued)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
Low-Side MOSFET						
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 1 mA	620	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 620 V, V_{GS} = 0 V	-	-	25	μA
I_{GSS}	Gate-Body Leakage Current, Forward	V_{GS} = 20 V, V_{DS} = 0 V			2.5	μA
On Characteristics						
$V_{GS(th)}$	Gate-Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 250 mA	2.7	3.8	5.3	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	I_D = 27 A, V_{GS} = 10 V	-	-	90	mΩ
		I_D = 27 A, V_{GS} = 10 V @T_C = 125°C	-	135	-	mΩ
		I_D = 47 A, V_{GS} = 10 V	-	76	-	mΩ
V_{SD}	Source-Drain Diode Forward Voltage	I_{SD} = 27 A, V_{GS} = 0 V	-	-	1.5	V
		I_{SD} = 47 A, V_{GS} = 0 V	-	1.3	-	V
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 380 V I_D = 27 A V_{GS} = 10 V R_G = 10 Ω Inductive Load T_C = 25°C	-	57	-	ns
t_r	Rise Time		-	14	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	240	-	ns
t_f	Fall Time		-	20	-	ns
E_{ON}	Turn-On Switching Loss per Pulse		-	440	-	μJ
E_{OFF}	Turn-Off Switching Loss per Pulse		-	113	-	μJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 380 V I_D = 27 A V_{GS} = 10 V R_G = 10 Ω Inductive Load T_C = 125°C	-	53	-	ns
t_r	Rise Time		-	16	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	257	-	ns
t_f	Fall Time		-	20	-	ns
E_{ON}	Turn-On Switching Loss per Pulse		-	719	-	μJ
E_{OFF}	Turn-Off Switching Loss per Pulse		-	124	-	μJ
Q_g	Total Gate Charge	V_{DS} = 380 V, V_{GS} = 0V...+10 V, I_D = 27 A	-	155	-	nC
$R_{\theta JC}$	Thermal Resistance of Junction to Case	per Chip	-	-	0.5	°C/W

Typical Performance Characteristic

Fig 1. Typical Output Characteristics - IGBT

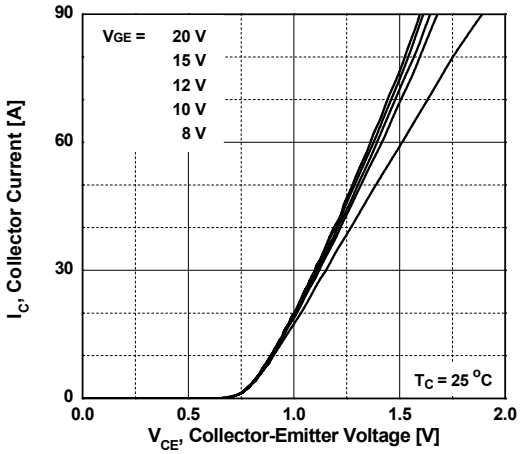


Fig 2. Typical Output Characteristics - IGBT

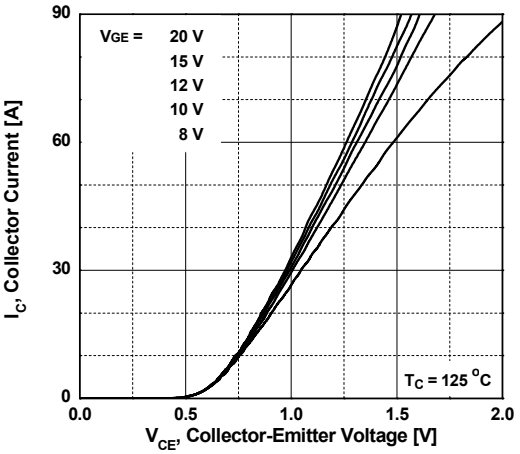


Fig 3. Typical Saturation Voltage Characteristics - IGBT

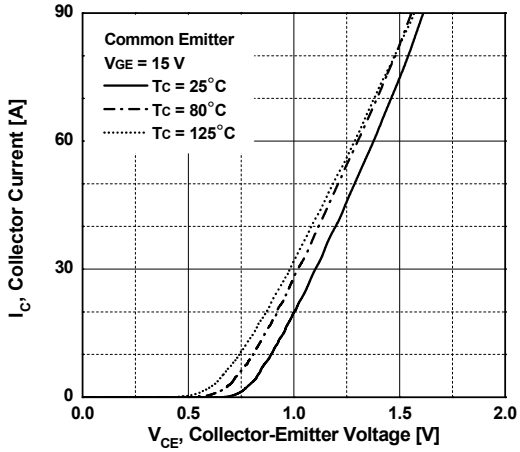


Fig 4. Transient Thermal Response Curve - IGBT

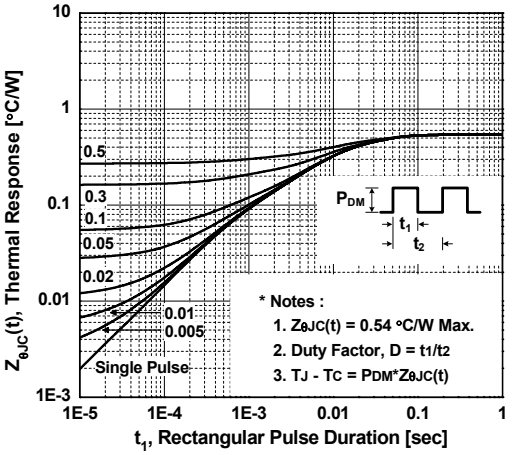


Fig 5. Typical Forward Voltage Drop vs. Forward Current - High-Side FWD

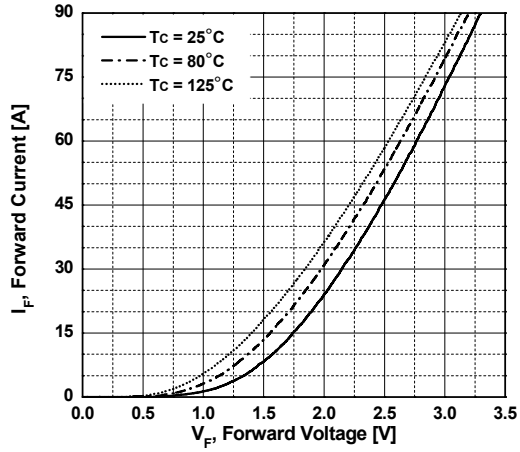
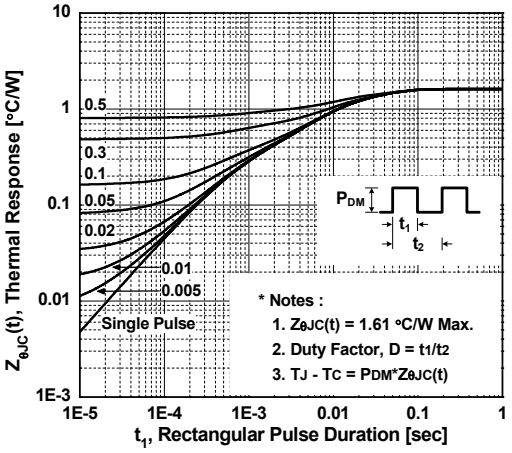


Fig 6. Transient Thermal Response Curve - High-Side FWD



Typical Performance Characteristic (Continued)

Fig 7. On-Region Characteristics - MOSFET

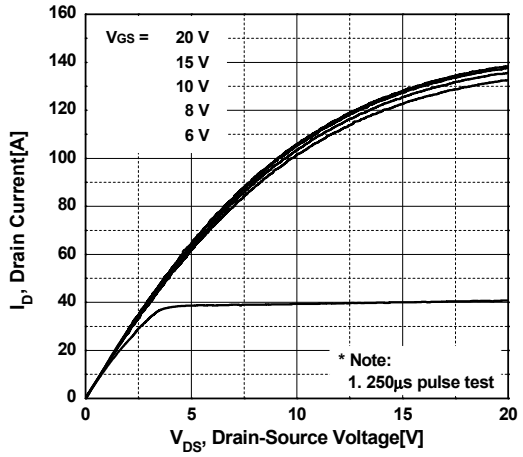


Fig 8. On-Resistance Variation vs. Drain Current and Gate Voltage - MOSFET

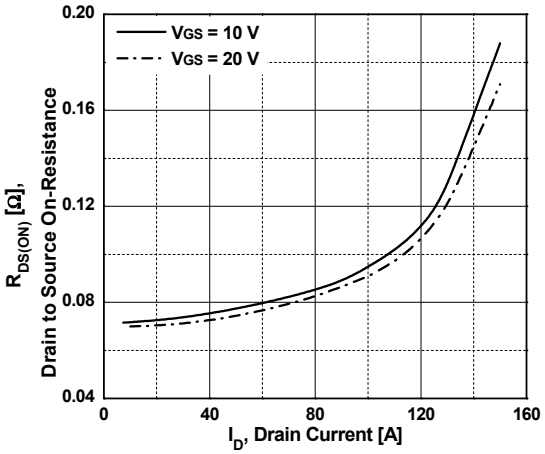


Fig 9. On-Resistance Variation vs. Temperature - MOSFET

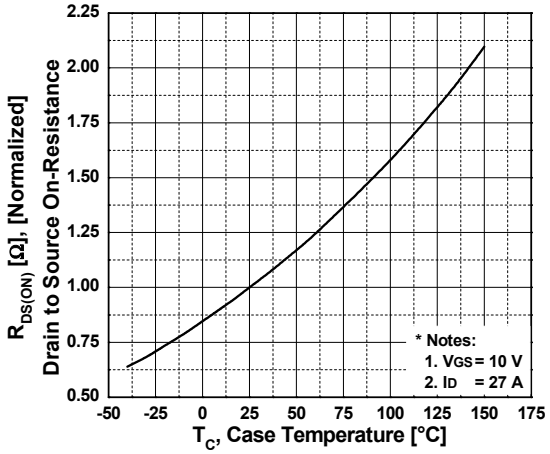


Fig 10. Body Diode Forward Voltage Variation vs. Source Current and Temperature - MOSFET

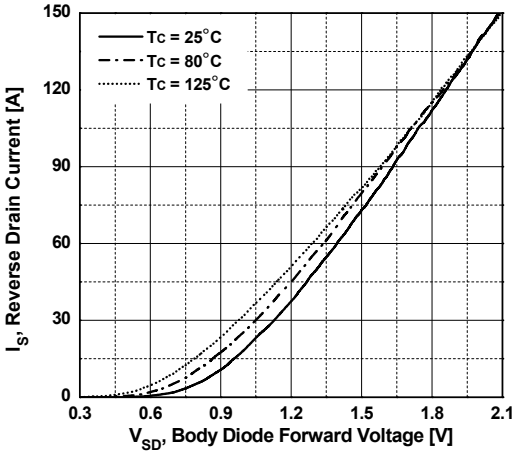


Fig 11. Turn-Off Loss vs. Gate Resistor Values - MOSFET

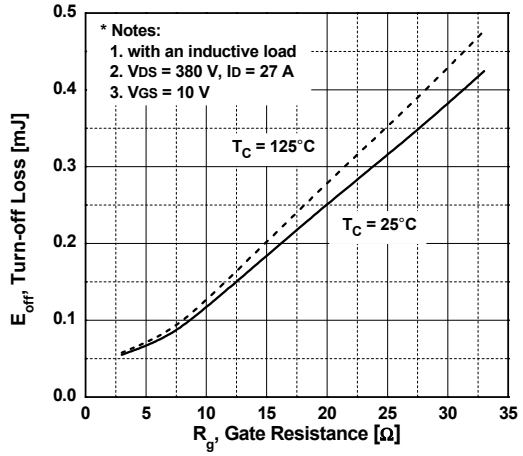
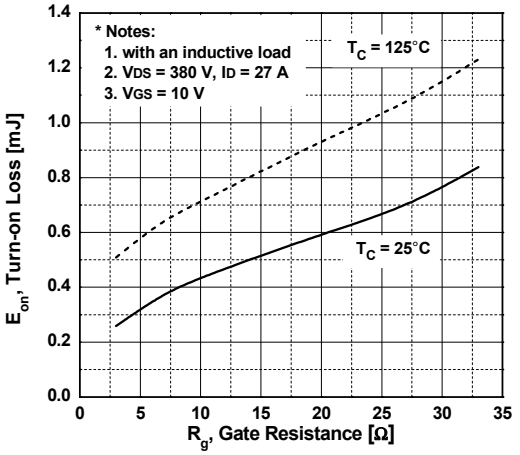


Fig 12. Turn-On Loss vs. Gate Resistor Values - MOSFET



Typical Performance Characteristic (Continued)

Fig 13. Turn-Off Loss vs. Drain Current - MOSFET

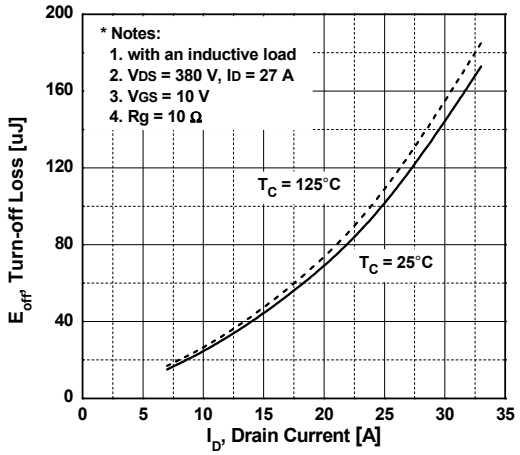


Fig 14. Turn-On Loss vs. Drain Current - MOSFET

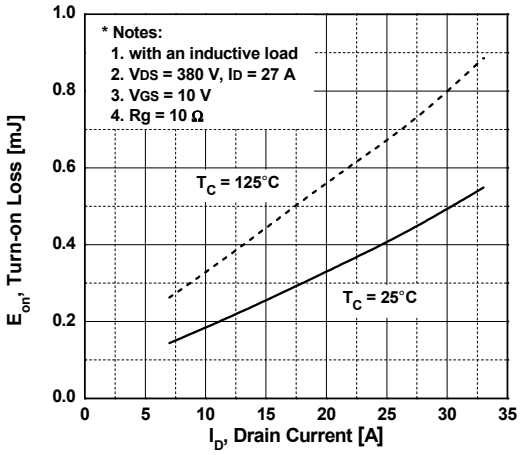


Fig 15. Transient Thermal Response Curve - MOSFET

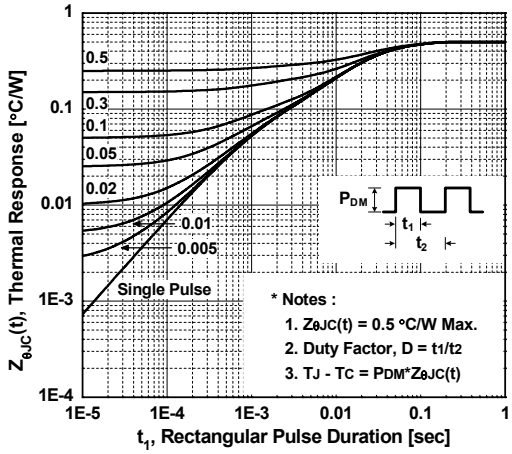


Fig 16. Typical Forward Voltage Drop vs. Forward Current - Rectifier Diode

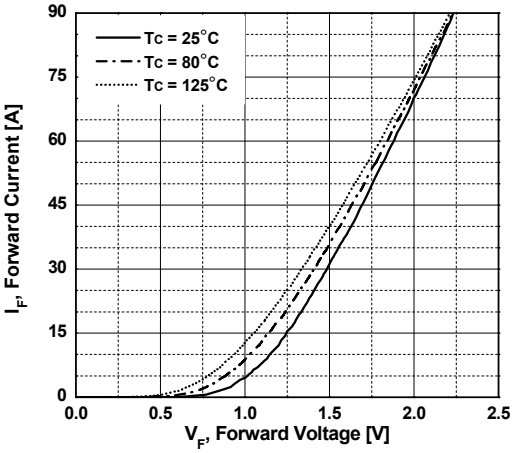
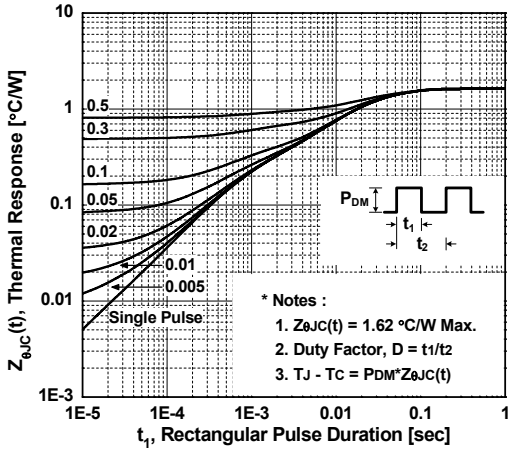
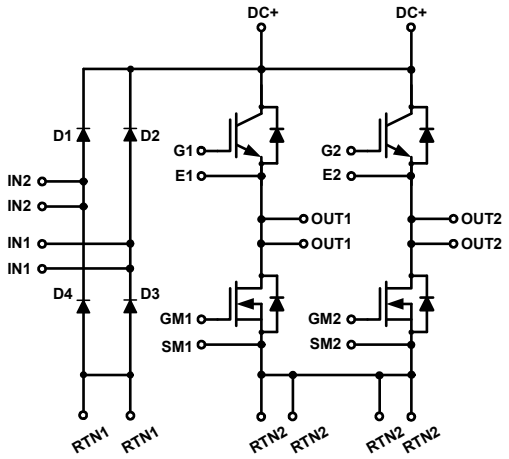


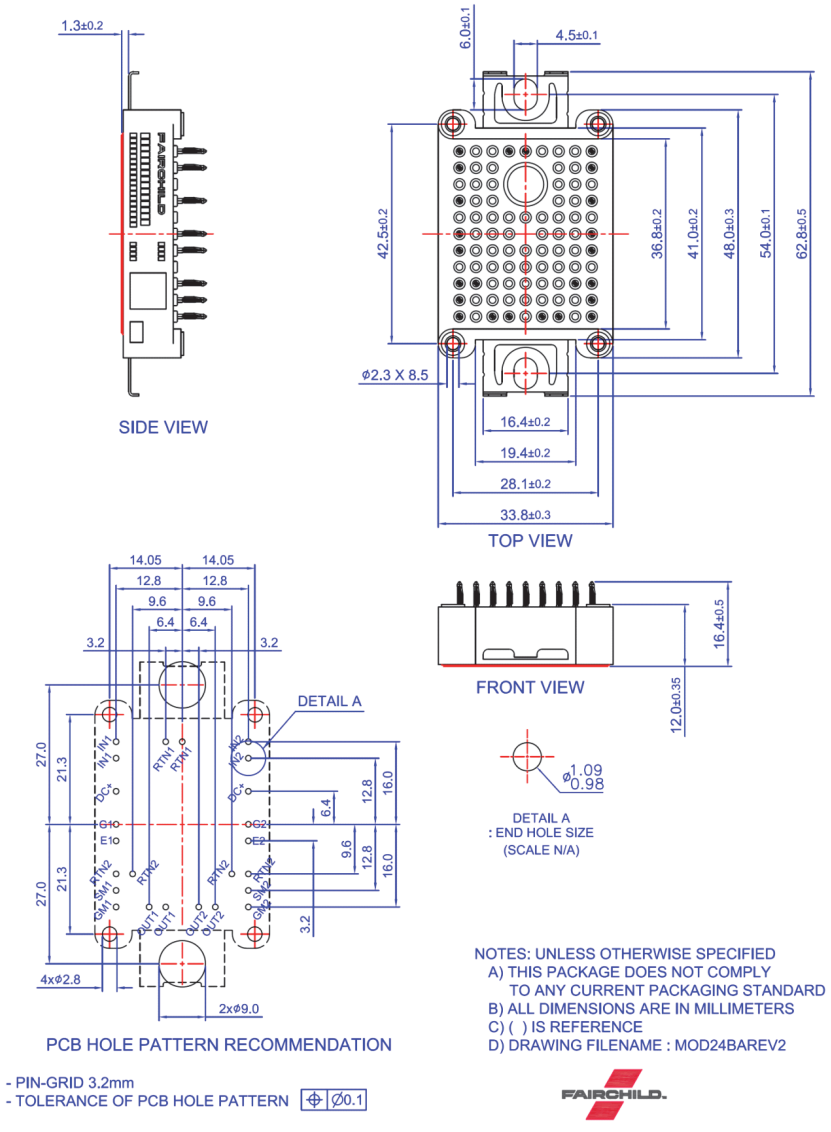
Fig 17. Transient Thermal Response Curve - Rectifier Diode



Internal Circuit Diagram



Package Outlines [mm]



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Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

Rev. I66

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