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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.

Electrical Features

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

Mechanical Features

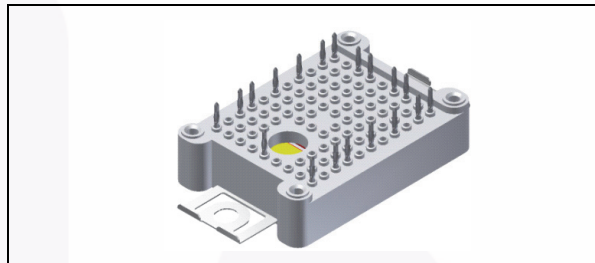
- Compact size : F1 Package
- Press-fit contact technology

Applications

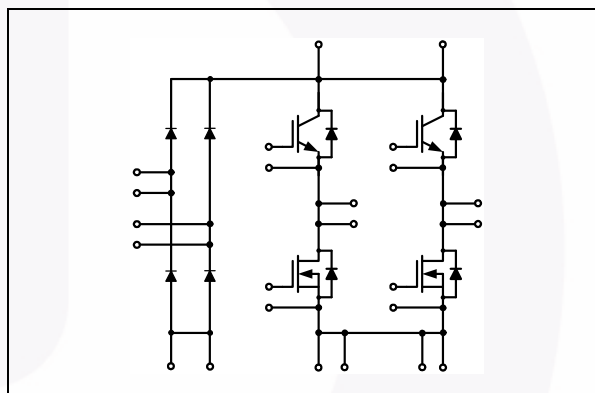
- Solar Inverter

Certification

- UL approved (E209204)



Package Code: F1



Internal Circuit Diagram

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

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

Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ 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 @ $T_C = 80^\circ\text{C}$	39	A
I_{CM}	Pulsed Collector Current	90	A
I_F	Diode Continuous Forward Current @ $T_C = 80^\circ\text{C}$	22	A
I_{FM}	Diode Maximum Forward Current	90	A
P_D	Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$	231	W
T_J	Operating Junction Temperature	-40 to +150	$^\circ\text{C}$
Low-side MOSFET			
V_{DSS}	Drain-Source Voltage	620	V
V_{GSS}	Gate-Source Voltage	± 20	V
I_D	Continuous Drain Current @ $T_C = 25^\circ\text{C}$	36	A
		@ $T_C = 80^\circ\text{C}$	27
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 @ $T_C = 25^\circ\text{C}$	250	W
T_J	Operating Junction Temperature	-40 to +150	$^\circ\text{C}$
Module			
T_{STG}	Storage Temperature	-40 to +125	$^\circ\text{C}$
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 $T_C = 25^\circ\text{C}$ unless otherwise noted.

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

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

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

Electrical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted. (Continued)

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

Typical Performance Characteristic

Fig 1. Typical Output Characteristics - IGBT

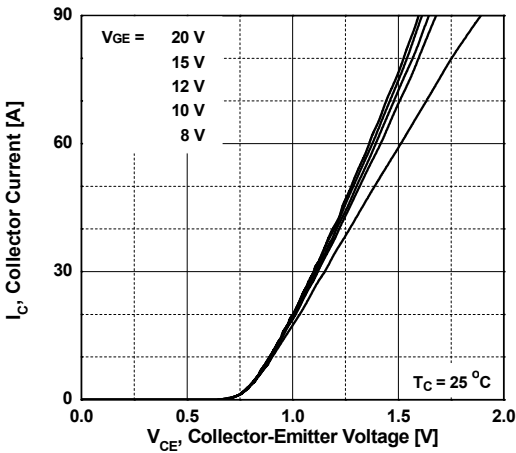


Fig 2. Typical Output Characteristics - IGBT

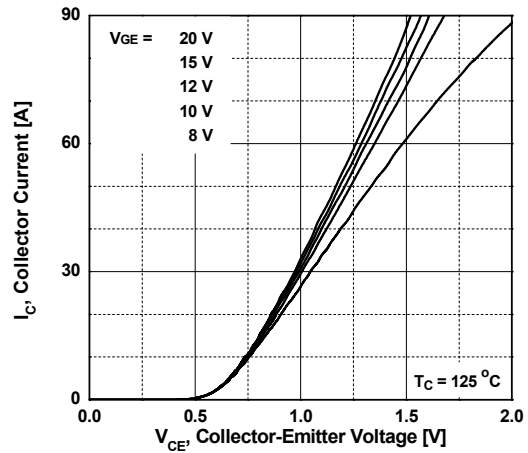


Fig 3. Typical Saturation Voltage Characteristics - IGBT

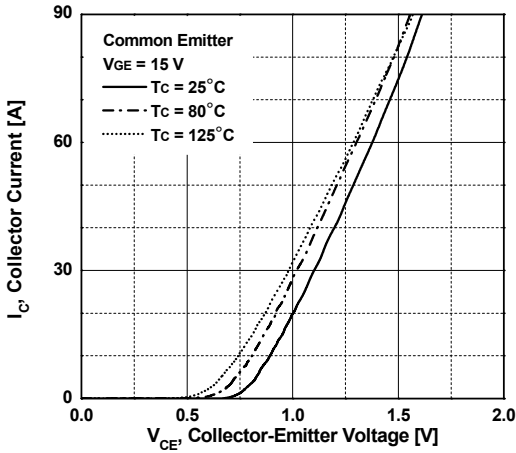


Fig 4. Transient Thermal Response Curve - IGBT

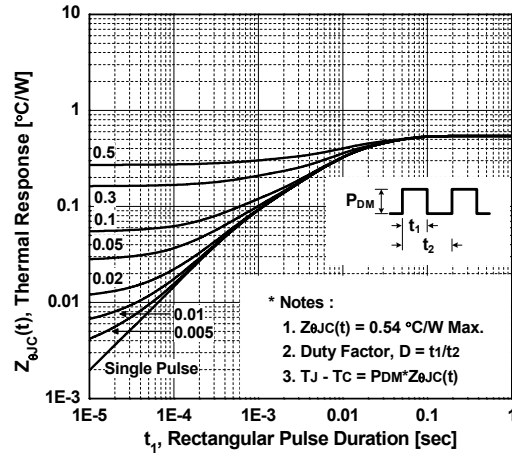


Fig 5. Typical Forward Voltage Drop vs. Forward Current - High-Side FWD

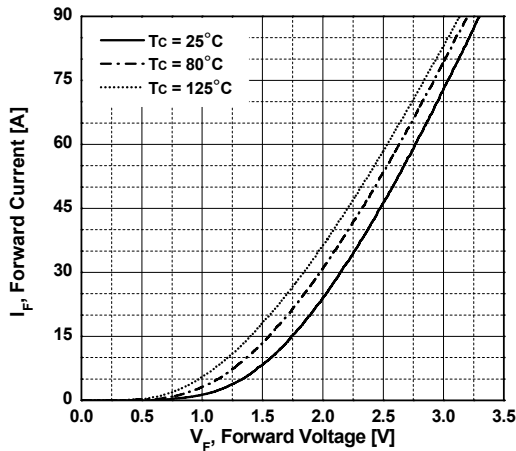
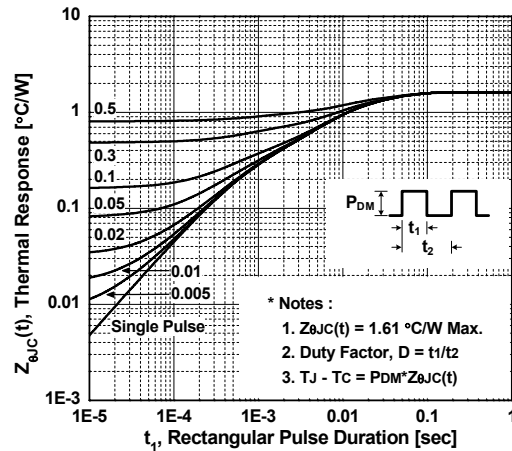


Fig 6. Transient Thermal Response Curve - High-Side FWD



Typical Performance Characteristic (Continued)

Fig 7. On-Region Characteristics - MOSFET

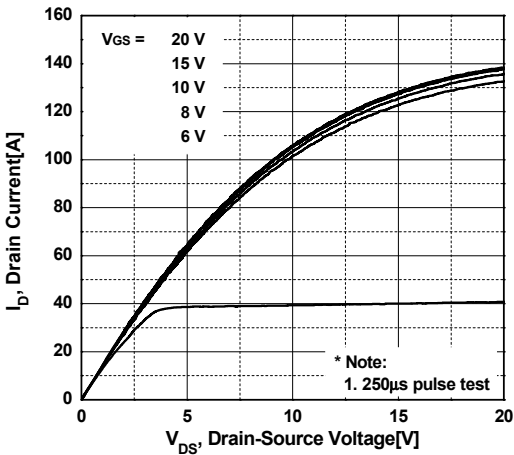


Fig 8. On-Resistance Variation vs. Drain Current and Gate Voltage - MOSFET

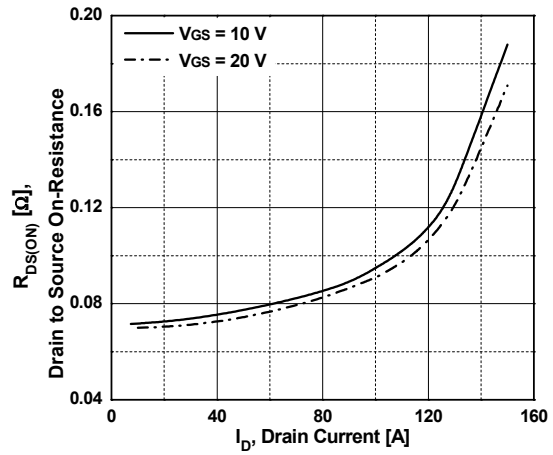


Fig 9. On-Resistance Variation vs. Temperature - MOSFET

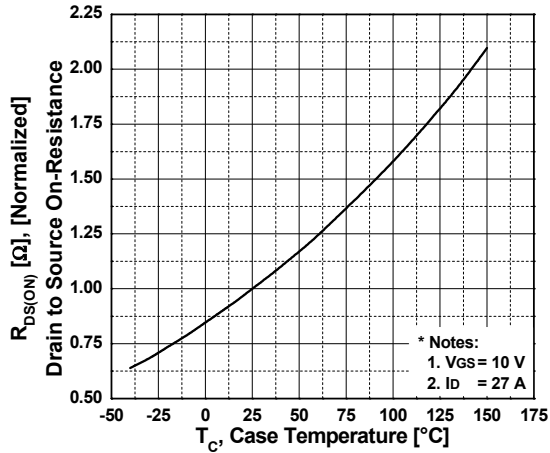


Fig 10. Body Diode Forward Voltage Variation vs. Source Current and Temperature - MOSFET

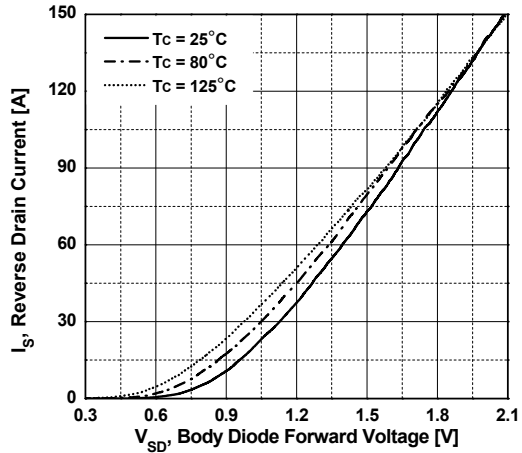


Fig 11. Turn-Off Loss vs. Gate Resistor Values - MOSFET

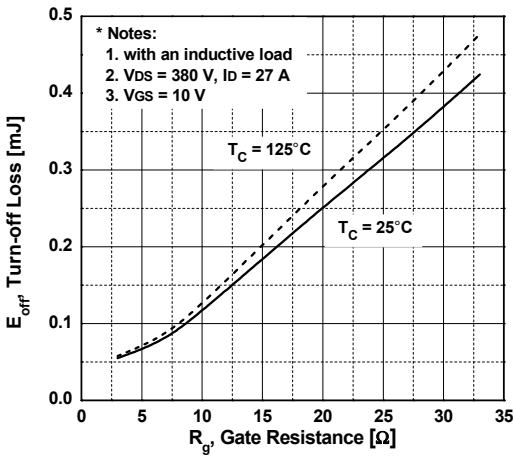
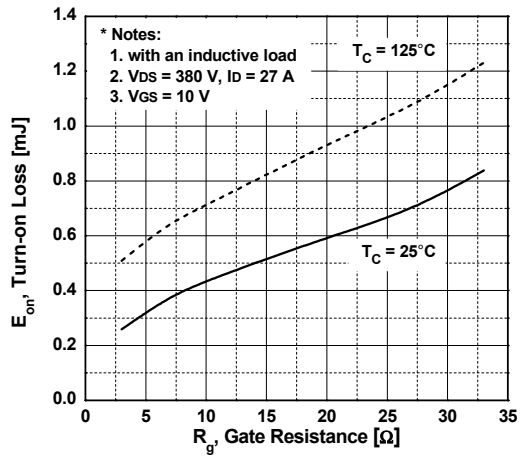


Fig 12. Turn-On Loss vs. Gate Resistor Values - MOSFET



Typical Performance Characteristic (Continued)

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

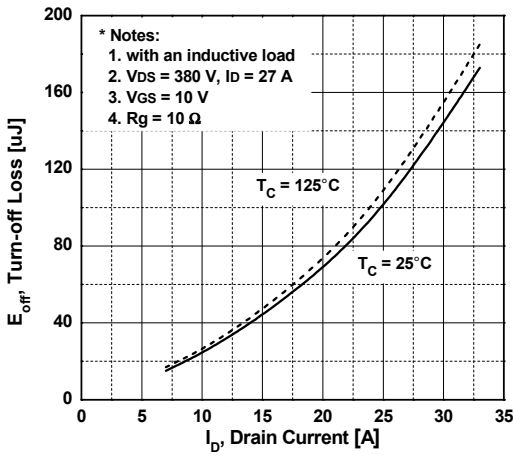


Fig 14. Turn-On Loss vs. Drain Current - MOSFET

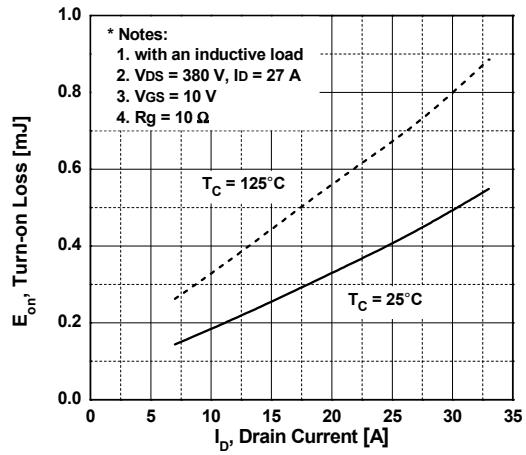


Fig 15. Transient Thermal Response Curve - MOSFET

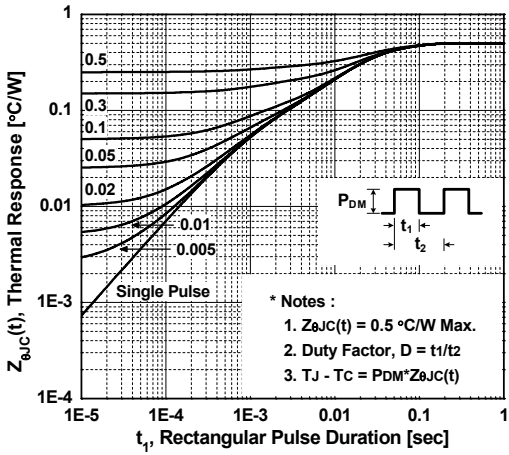


Fig 16. Typical Forward Voltage Drop vs. Forward Current - Rectifier Diode

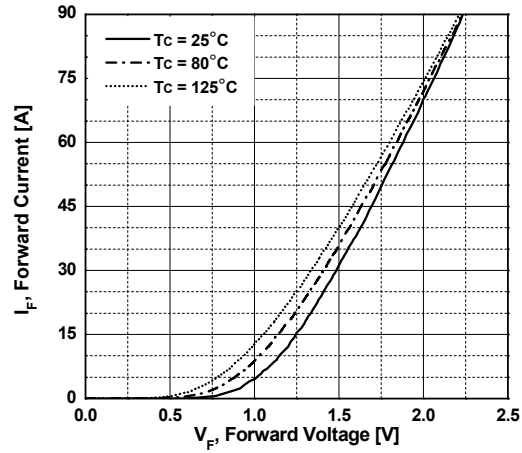
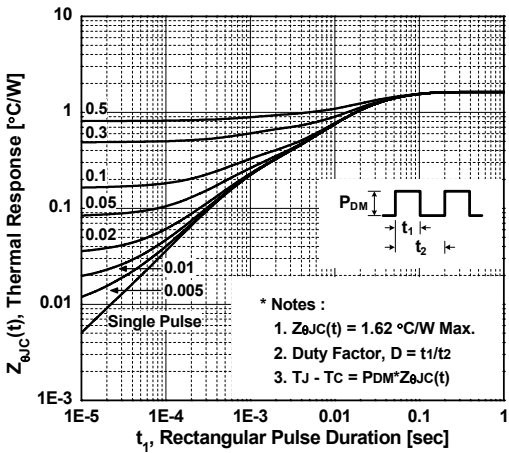
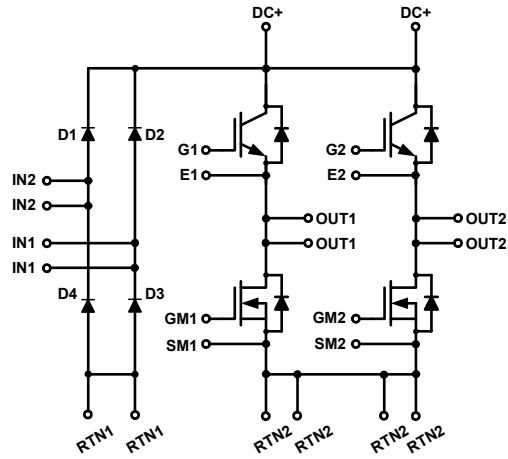


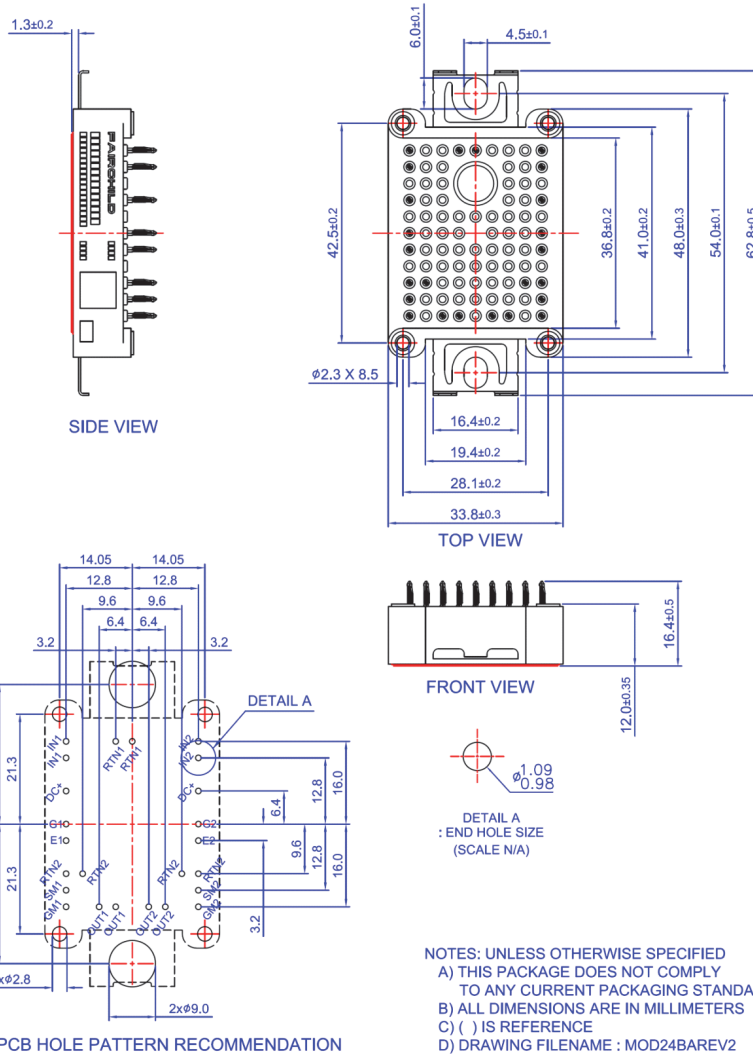
Fig 17. Transient Thermal Response Curve - Rectifier Diode



Internal Circuit Diagram



Package Outlines [mm]



NOTES: UNLESS OTHERWISE SPECIFIED
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- PIN-GRID 3.2mm
 - TOLERANCE OF PCB HOLE PATTERN ± 0.1





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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.
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