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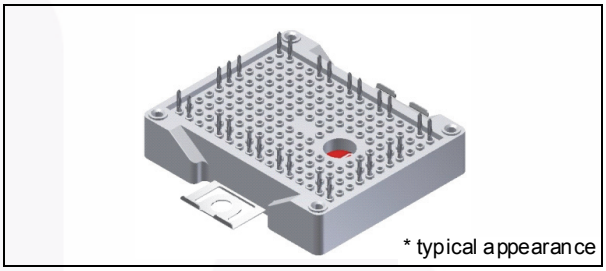
Nov. 2016

FPF2C110BI07AS2

F2, Boost and Inverter module with Press-fit

General Description

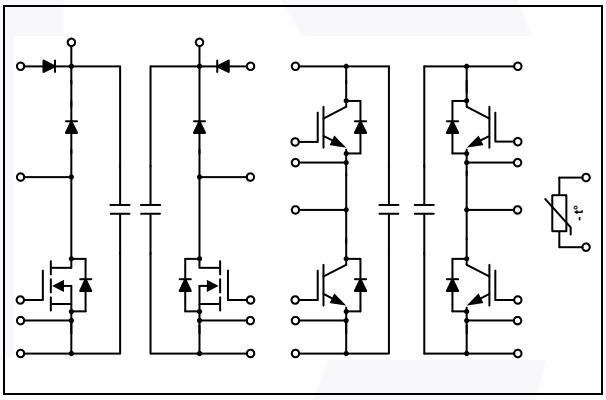
Fairchild's Boost and H-Bridge module is designed for a power stage that needs more compact design. And the Press-fit technology provides simple and reliable mounting. This module is optimized for the application such as solar inverter where a high efficiency and robust design are needed.



Package Code: F2

Electrical Features

- Boost Stage
  - Dual Boost Topology
  - SiC Boost Diode
  - Low $R_{DS(ON)}$ Boost Switch
  - Low V_F and High Voltage Bypass Diode
- Inverter Stage
  - H-bridge Topology
  - High Speed IGBT and Fast Recovery FWD
- Integrated DC-capacitor for Boost and Inverter
- Temperature Sensor



Internal Circuit Diagram

Mechanical Features

- Compact size : F2 Package
- Press-fit Contact Technology
- Al_2O_3 Substrate with Low Thermal Resistance

Applications

- Solar Inverter

Package Marking and Ordering Information

Device	Device Marking	Package	Packing Type	Quantity / Tray
FPF2C110BI07AS2	FPF2C110BI07AS2	F2	Tray	14

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

Symbol	Description	Condition	Rating	Units
Bypass Diode (DA1, DA2)				
V_{RRM}	Peak Repetitive Reverse Voltage		1000	V
I_F	Continuous Forward Current	T_C = 80 °C, T_{Jmax} = 175 °C	50	A
I_{FSM}	Non-repetitive Peak Surge Current	60 Hz Single Half-Sine Wave	350	A
I^2t	Surge Current Integral Value		510	A^2s
P_D	Maximum Power Dissipation	T_{Jmax} = 175 °C	300	W
T_J	Operating Junction Temperature		- 40 to + 150	°C
Boost Diode (DB1, DB2)				
V_{RRM}	Peak Repetitive Reverse Voltage		650	V
I_F	Continuous Forward Current	T_C = 80 °C, T_{Jmax} = 175 °C	10	A
I_{FSM}	Non-repetitive Peak Surge Current	60 Hz Single Half-Sine Wave	40	A
I^2t	Surge Current Integral Value		6.6	A^2s
P_D	Maximum Power Dissipation	T_{Jmax} = 175 °C	90	W
T_J	Operating Junction Temperature		- 40 to + 150	°C
Boost MOSFET (M1, M2)				
V_{DSS}	Drain-Source Voltage		650	V
V_{GSS}	Gate-Source Voltage		± 20	V
I_D	Drain Current	T_C = 25 °C, T_{Jmax} = 150 °C	25	A
		T_C = 80 °C, T_{Jmax} = 150 °C	19	A
I_{DM}	Pulsed Drain Current	limited by T_{Jmax}	50	A
P_D	Maximum Power Dissipation	T_{Jmax} = 150 °C	199	W
T_J	Operating Junction Temperature		- 40 to + 150	°C
H-bridge IGBT (QA, QB, QC, QD)				
V_{CES}	Collector-Emitter Voltage		650	V
V_{GES}	Gate-Emitter Voltage		± 20	V
I_C	Collector Current	T_C = 80 °C, T_{Jmax} = 175 °C	40	A
I_{CM}	Pulsed Collector Current	limited by T_{Jmax}	80	A
P_D	Maximum Power Dissipation	T_{Jmax} = 175 °C	158	W
T_J	Operating Junction Temperature		- 40 to + 150	°C
H-bridge FWD (QAD, QBD, QCD, QDD)				
V_{RRM}	Peak Repetitive Reverse Voltage		650	V
I_F	Diode Forward Current	T_C = 80 °C, T_{Jmax} = 175 °C	30	A
I_{FM}	Pulsed Maximum Forward Currents	limited by T_{Jmax}	60	A
P_D	Maximum Power Dissipation	T_{Jmax} = 175 °C	109	W
T_J	Operating Junction Temperature		- 40 to + 150	°C
DC Link Capacitor				
V_{MAX}	Maximum DC Voltage		1000	V
T_{OP}	Operating Temperature		- 55 to + 125	°C

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

Symbol	Description	Condition	Rating	Units
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	-
T_{MOUNT}	Mounting Torque$_{(1)}$		2.4	N•m
Creepage	Terminal to Heat Sink		11.5	mm
	Terminal to Terminal		6.3	mm
Clearance	Terminal to Heat Sink		10.0	mm
	Terminal to Terminal		5.0	mm

Notes:

1. Recommendable value : 2.0 ~ 2.4 Nm (M4)

Electrical Characteristics T_C = 25 °C unless otherwise noted. **Parantheses value is based on the discrete.**

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
Bypass Diode (DA1, DA2)						
V_F	Diode Forward Voltage	I_F = 50 A	-	1.37	1.7	V
		I_F = 50 A, T_C = 125 °C	-	1.3	-	V
I_R	Reverse Leakage Current	V_R = 1000 V	-	-	250	μA
$R_{\theta JC}$	Thermal Resistance of Junction to Case	per Diode	-	-	0.49	°C/W
$R_{\theta CH}$	Thermal Resistance of Case to Heat sink	per Chip, λ_{PCM} = 3.4 W/mK	-	0.56	-	°C/W
Boost Diode (DB1, DB2)						
V_F	Diode Forward Voltage	I_F = 10 A	-	1.42	1.58	V
		I_F = 10 A, T_C = 125 °C	-	1.61	-	V
I_R	Reverse Leakage Current	V_R = 650 V	-	-	250	μA
I_{rr}	Reverse Recovery Current	V_R = 300 V, I_F = 10 A, di / dt = 1560 A/us, T_C = 25 °C	-	6	-	A
Q_C	Total Capacitive Charge		-	60	-	nC
E_{rec}	Reverse Recovery Energy		-	7.5	-	μJ
I_{rr}	Reverse Recovery Current	V_R = 300 V, I_F = 10 A, di / dt = 1560 A/us, T_C = 125 °C	-	6	-	A
Q_C	Total Capacitive Charge		-	61	-	nC
E_{rec}	Reverse Recovery Energy		-	7.5	-	μJ
$R_{\theta JC}$	Thermal Resistance of Junction to Case	per Chip	-	-	1.63	°C/W
$R_{\theta CH}$	Thermal Resistance of Case to Heat sink	per Chip, λ_{PCM} = 3.4 W/mK	-	0.42	-	°C/W
Boost MOSFET (M1, M2)						
Off Characteristics						
V_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 1 mA	650	-	-	V
I_{DSS}	Drain Cut-off Current	V_{DS} = V_{DSS}, V_{GS} = 0 V	-	-	250	μA
I_{GSS}	Gate-Source Leakage Current	V_{GS} = V_{GSS}, V_{DS} = 0 V	-	-	± 1	μA
On Characteristics						
$V_{GS(th)}$	Gate-Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 250uA	3.0	3.9	5.0	V
$R_{DS(ON)}$	Static Drain-Source On Resistance	I_D = 17.5 A, V_{GS} = 10 V	-	110	137	mΩ
V_{SD}	Drain-Source Diode Forward Voltage	I_{SD} = 17.5 A, V_{GS} = 0 V	-	1.07	1.37	V
		I_{SD} = 17.5 A, V_{GS} = 0 V, T_C = 125 °C	-	0.93	-	V
R_{LEAD}	Lead Resistance of Pin to Chip	per Chip	-	3.2	-	mΩ
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 300 V, I_D = 17.5 A, V_{GS} = 10 V, R_G = 4.7 Ω, Inductive Load, T_C = 25 °C	-	27	-	ns
t_r	Rise Time		-	5.0	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	3.0	-	ns
t_f	Fall Time		-	5.5	-	ns
E_{ON}	Turn-On Switching Loss per Pulse		-	33	-	μJ
E_{OFF}	Turn-Off Switching Loss per Pulse		-	20	-	μJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 300 V, I_D = 17.5 A, V_{GS} = 10 V, R_G = 4.7 Ω, Inductive Load, T_C = 125 °C	-	26	-	ns
t_r	Rise Time		-	5.3	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	87	-	ns
t_f	Fall Time		-	6.0	-	ns
E_{ON}	Turn-On Switching Loss per Pulse		-	39	-	μJ
E_{OFF}	Turn-Off Switching Loss per Pulse		-	21	-	μJ
Q_g	Total Gate Charge	V_{CC} = 300 V, I_{SD} = 17.5 A, V_{GS} = 10 V	-	84	-	nC
$R_{\theta JC}$	Thermal Resistance of Junction to Case	per Chip	-	-	0.63	°C/W
$R_{\theta CH}$	Thermal Resistance of Case to Heat sink	per Chip, λ_{PCM} = 3.4 W/mK	-	0.49	-	°C/W

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Electrical Characteristics T_C = 25 °C unless otherwise noted. **Parantheses value is based on the discrete.**

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
H-Bridge IGBT (QA, QB, QC, QD)						
Off Characteristics						
BV_{CES}	Collector-Emitter Breakdown Voltage	V_{GE} = 0 V, I_C = 1 mA	650	-	-	V
I_{CES}	Collector Cut-off Current	V_{CE} = V_{CES}, V_{GE} = 0 V	-	-	250	μA
I_{GES}	Gate-Emitter Leakage Current	V_{GE} = V_{GES}, V_{CE} = 0 V	-	-	± 2	μA
On Characteristics						
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	V_{GE} = V_{CE}, I_C = 40 mA	3.0	5.2	6.1	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 40 A, V_{GE} = 15 V	-	1.6	2.3	V
		I_C = 40 A, V_{GE} = 15 V, T_C = 125 °C	-	1.8	-	V
R_{LEAD}	Lead Resistance of Pin to Chip	per Chip	-	3.5	-	mΩ
Switching Characteristics (QB-QAD / QD-QCD)						
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 300 V I_C = 40 A V_{GE} = 15 V R_G = 15 Ω Inductive Load T_C = 25 °C	-	26	-	ns
t_r	Rise Time		-	22	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	125	-	ns
t_f	Fall Time		-	14	-	ns
E_{ON}	Turn-On Switching Loss per Pulse		-	0.45	-	mJ
E_{OFF}	Turn-Off Switching Loss per Pulse		-	0.27	-	mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 300 V I_C = 40 A V_{GE} = 15 V R_G = 15 Ω Inductive Load T_C = 125 °C	-	24	-	ns
t_r	Rise Time		-	25	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	139	-	ns
t_f	Fall Time		-	13	-	ns
E_{ON}	Turn-On Switching Loss per Pulse		-	0.74	-	mJ
E_{OFF}	Turn-Off Switching Loss per Pulse		-	0.35	-	mJ
Q_g	Total Gate Charge	V_{CC} = 300 V, I_C = 40 A, V_{GE} = 15 V	-	60	-	nC
$R_{\theta JC}$	Thermal Resistance of Junction to Case	per Chip	-	-	0.95	°C/W
$R_{\theta CH}$	Thermal Resistance of Case to Heat sink	per Chip, λ_{PCM} = 3.4 W/mK	-	0.64	-	°C/W
H-bridge FWD (QAD, QBD, QCD, QDD)						
V_F	Diode Forward Voltage	I_F = 30 A	-	2.45	3.2	V
		I_F = 30 A, T_C = 125 °C	-	2.15	-	V
I_R	Reverse Leakage Current	V_R = 650 V	-	-	250	μA
I_{rr}	Reverse Recovery Current	V_R = 300 V, I_F = 30 A, di / dt = 1570 A/us, T_C = 25 °C	-	20.1	-	A
t_{rr}	Reverse Recovery Time		-	30	-	ns
E_{rec}	Reverse Recovery Energy		-	27	-	μJ
I_{rr}	Reverse Recovery Current	V_R = 300 V, I_F = 30 A, di / dt = 1135 A/us, T_C = 125 °C	-	23.1	-	A
t_{rr}	Reverse Recovery Time		-	52	-	ns
E_{rec}	Reverse Recovery Energy		-	73	-	μJ
$R_{\theta JC}$	Thermal Resistance of Junction to Case	per Chip	-	-	1.38	°C/W
$R_{\theta CH}$	Thermal Resistance of Case to Heat sink	per Chip, λ_{PCM} = 3.4 W/mK	-	0.45	-	°C/W
DC link Capacitor						
C value	Capacitance Value		-	47	-	nF
NTC (Thermistor)						
R_{NTC}	Rated Resistance	T_C = 25 °C	-	22	-	kΩ
		T_C = 100 °C	-	1.486	-	kΩ
	Tolerance	T_C = 25 °C	-5	-	+5	%
P_D	Power Dissipation	T_C = 25 °C	-	-	20	mW
B_{Value}	B-Constance	$B_{25/50}$, tol.	-	3950	-	K
		$B_{25/100}$	-	3998	-	K

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Typical Performance Characteristics

Fig 1. Forward Voltage Drop - Bypass Diode

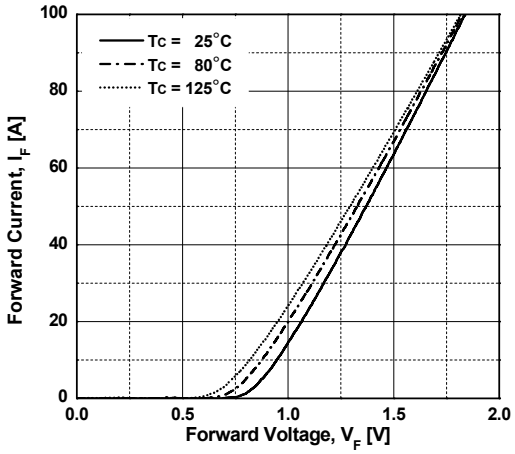


Fig 2. Transient Thermal Impedance - Bypass Diode

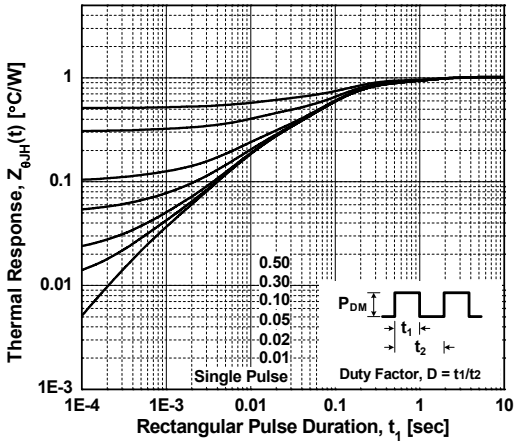


Fig 3. Forward Voltage Drop - Boost Diode

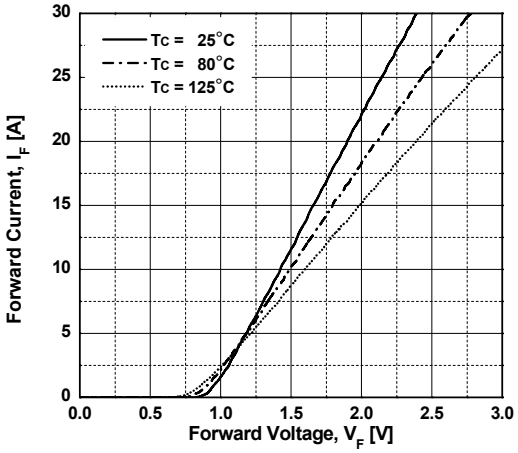


Fig 4. Transient Thermal Impedance - Boost Diode

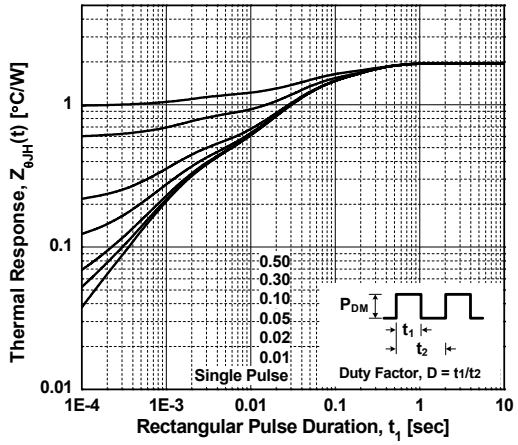


Fig 5. On-Region Characteristics - Boost MOSFET

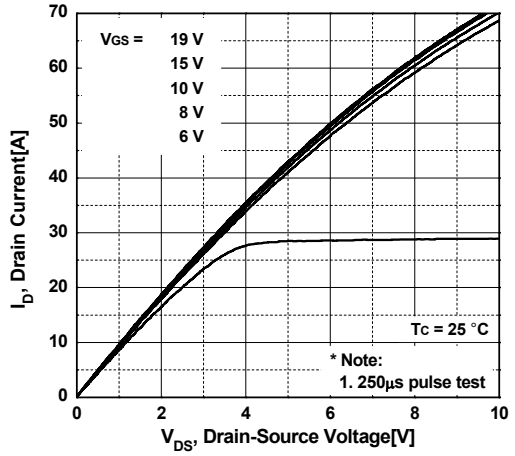
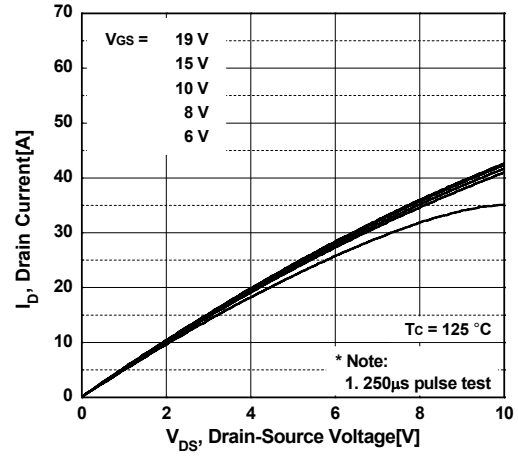


Fig 6. On-Region Characteristics - Boost MOSFET



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Typical Performance Characteristics

Fig 7. On-Resistance Variation vs. Temperature - Boost MOSFET

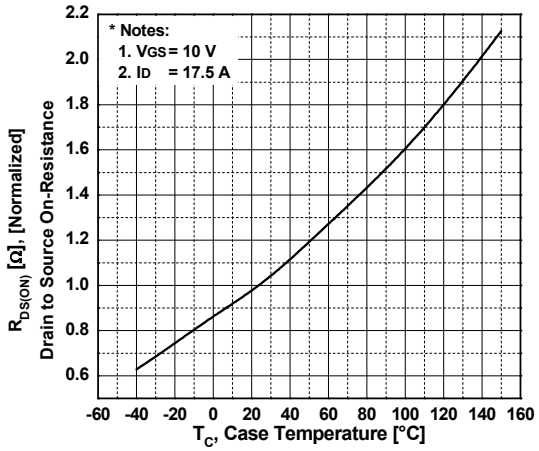


Fig 8. Switching Loss vs. Gate Resistor Values - Boost MOSFET

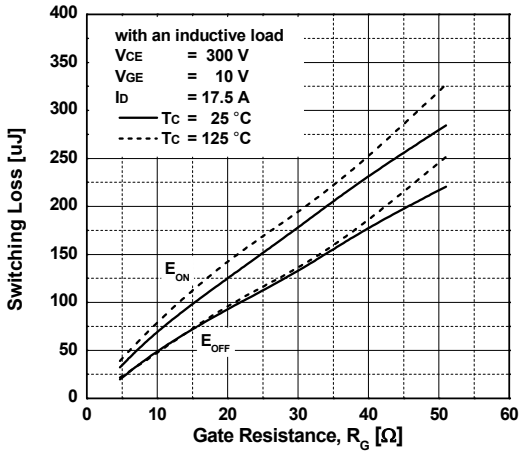


Fig 9. Switching Loss vs. Drain Current - Boost MOSFET

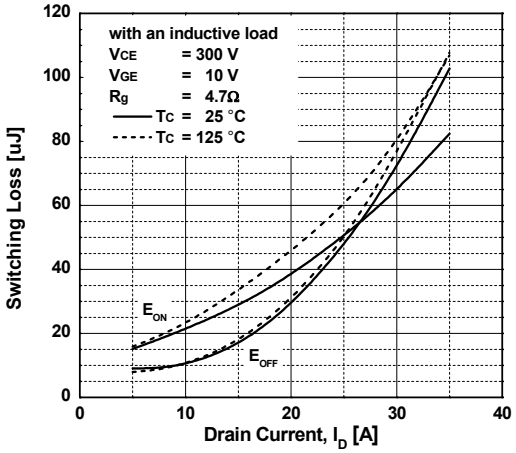


Fig 10. Body Diode Forward Voltage Variation vs. Source Current and Temperature - Boost MOSFET

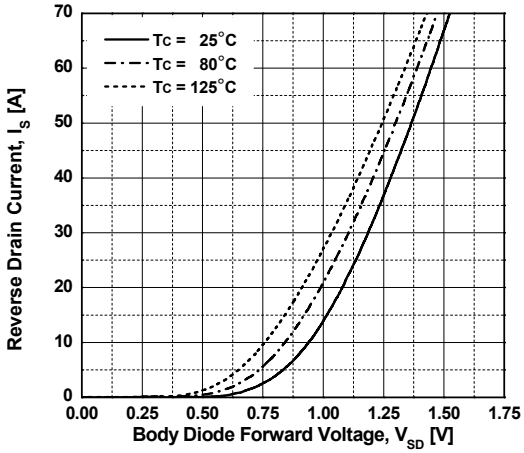


Fig 11. Transient Thermal Impedance - Boost MOSFET

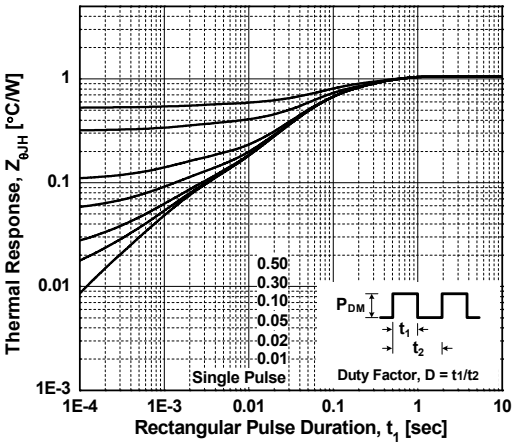
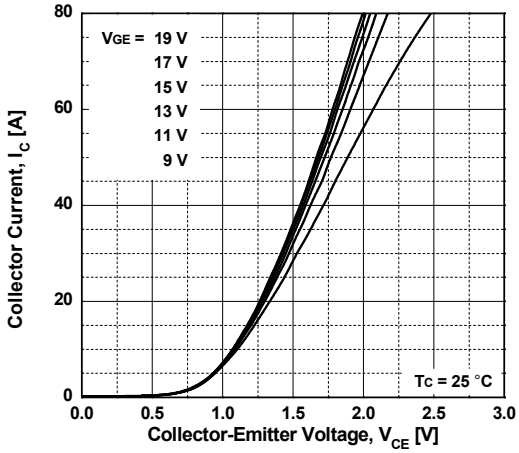


Fig 12. Output Characteristics - H-bridge IGBT



Typical Performance Characteristics

Fig 13. Output Characteristics - H-bridge IGBT

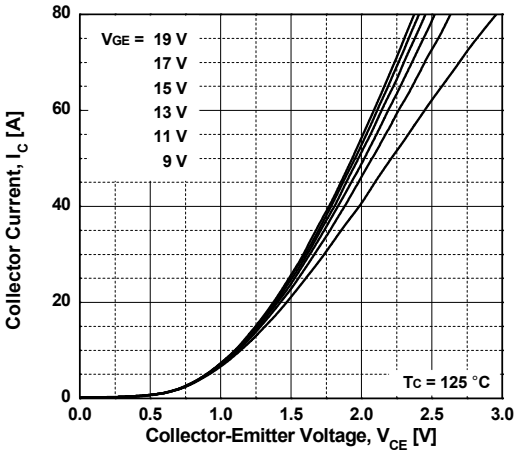


Fig 14. Saturation Voltage Characteristics - H-bridge IGBT

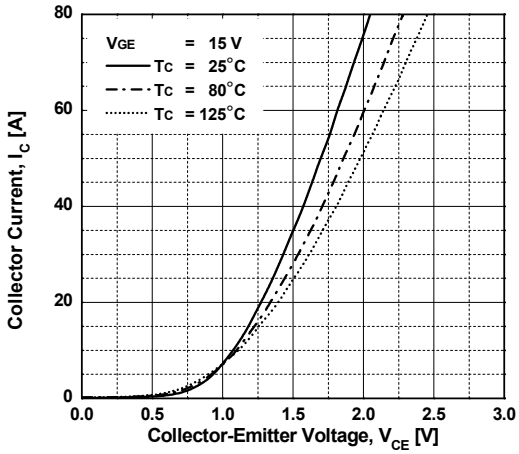


Fig 15. Switching Loss vs. Gate Resistor Values - H-bridge IGBT

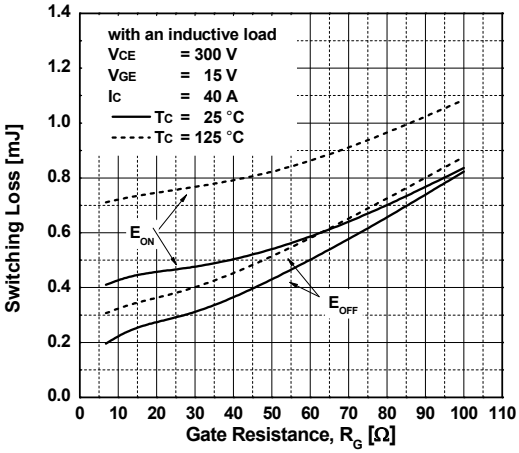


Fig 16. Switching Loss vs. Collector Current - H-bridge IGBT

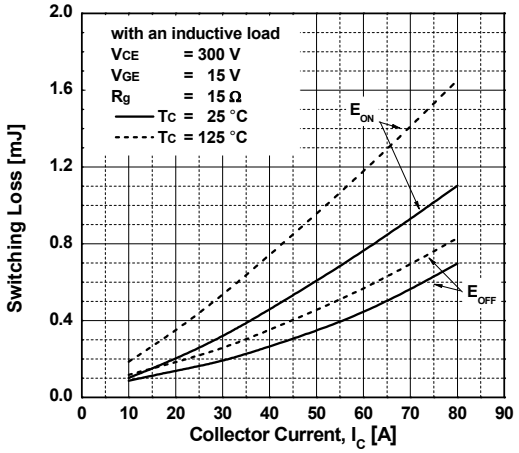


Fig 17. Transient Thermal Impedance - H-bridge IGBT

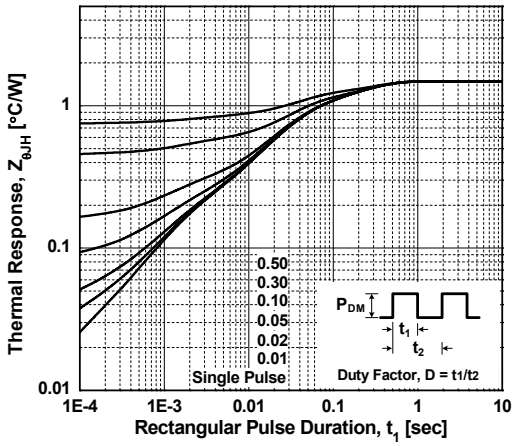
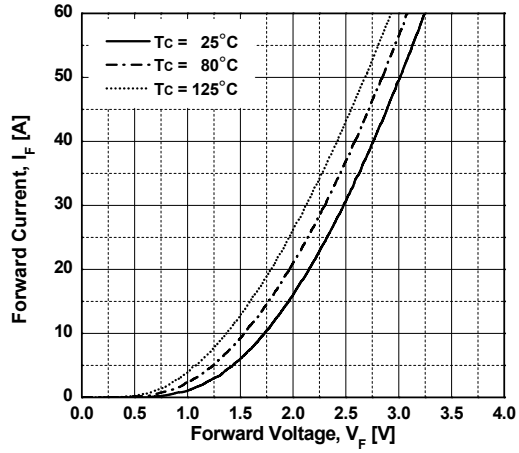


Fig 18. Forward Voltage Drop vs. Forward Current - H-bridge FWD



Typical Performance Characteristics

Fig 19. Reverse Recovery Energy vs. Gate Resistor Values - H-bridge FWD

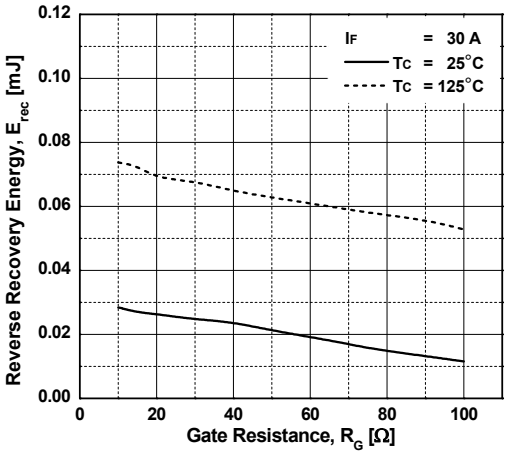


Fig 20. Reverse Recovery Energy vs. Forward Current - H-bridge FWD

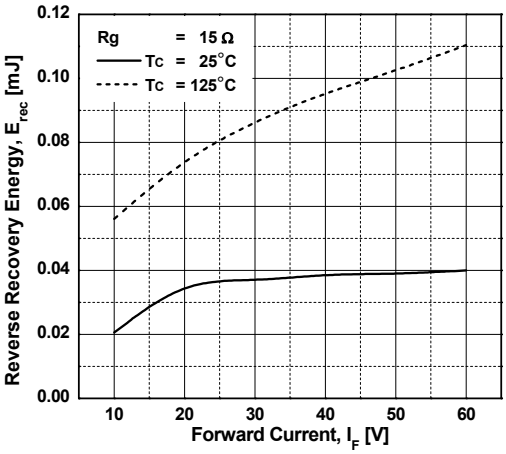
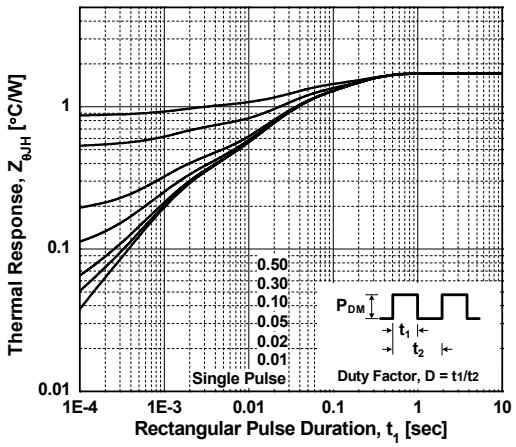
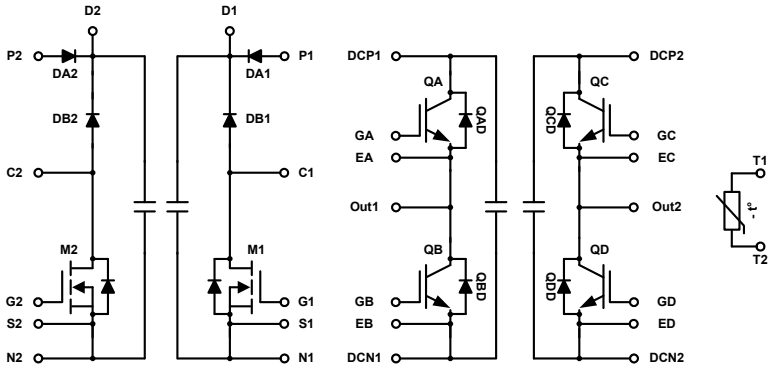


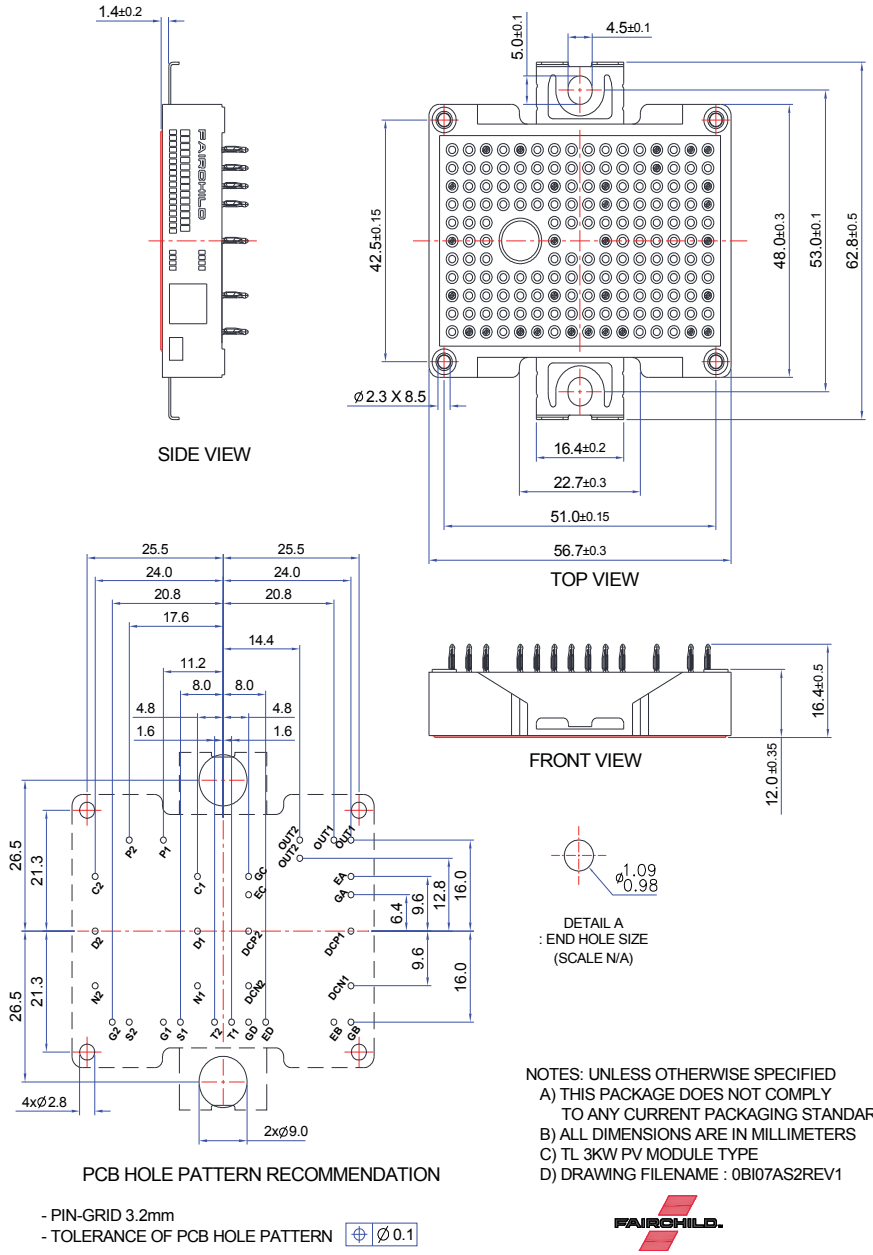
Fig 21. Transient Thermal Impedance - H-bridge FWD



Internal Circuit Diagram



Package Outlines [mm]



- PIN-GRID 3.2mm
- TOLERANCE OF PCB HOLE PATTERN ⌖ | Ø 0.1

NOTES: UNLESS OTHERWISE SPECIFIED
A) THIS PACKAGE DOES NOT COMPLY TO ANY CURRENT PACKAGING STANDARD
B) ALL DIMENSIONS ARE IN MILLIMETERS
C) TL 3KW PV MODULE TYPE
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