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Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

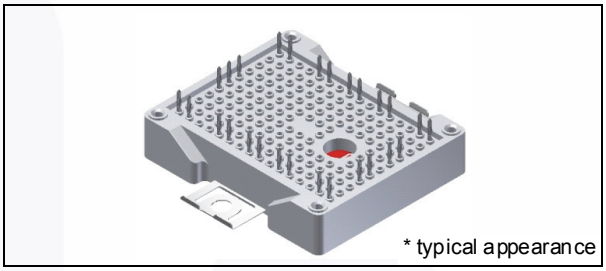
Nov. 2016

FPF2C110BI07AS2

F2, Boost and Inverter module with Press-fit

General Description

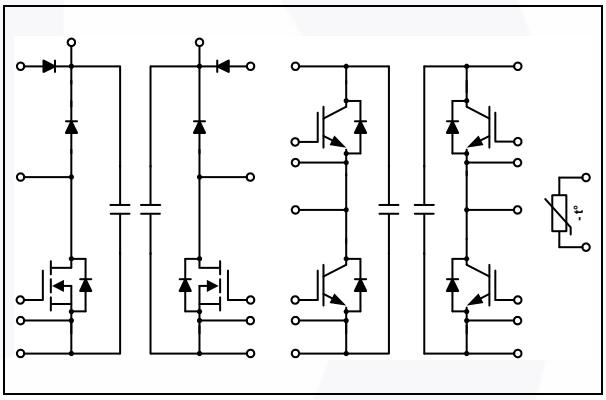
Fairchild's Boost and H-Bridge module is designed for a power stage that needs more compact design. And the Press-fit technology provides simple and reliable mounting. This module is optimized for the application such as solar inverter where a high efficiency and robust design are needed.



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

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

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

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

Typical Performance Characteristics

Fig 1. Forward Voltage Drop - Bypass Diode

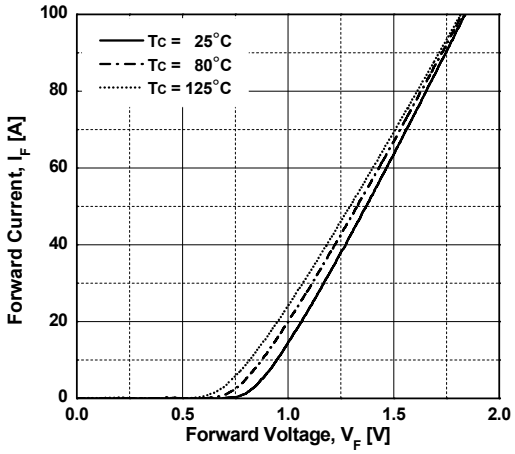


Fig 2. Transient Thermal Impedance - Bypass Diode

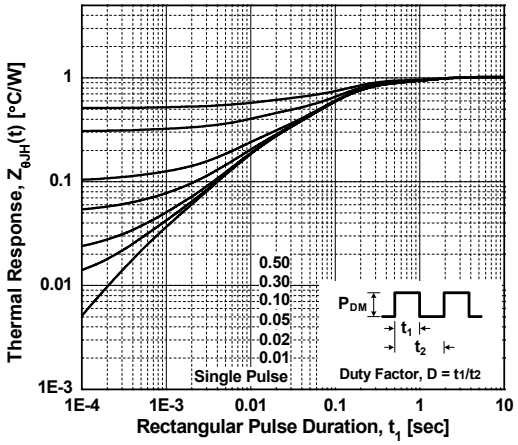


Fig 3. Forward Voltage Drop - Boost Diode

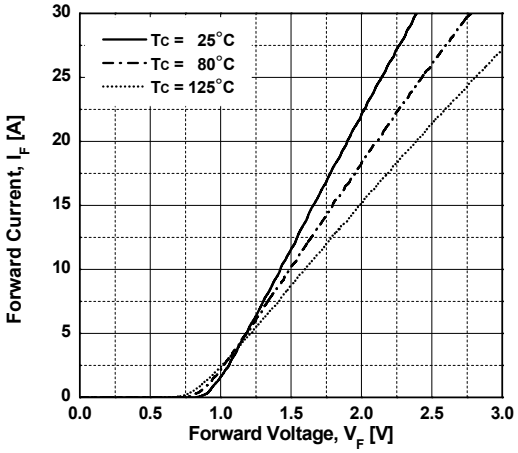


Fig 4. Transient Thermal Impedance - Boost Diode

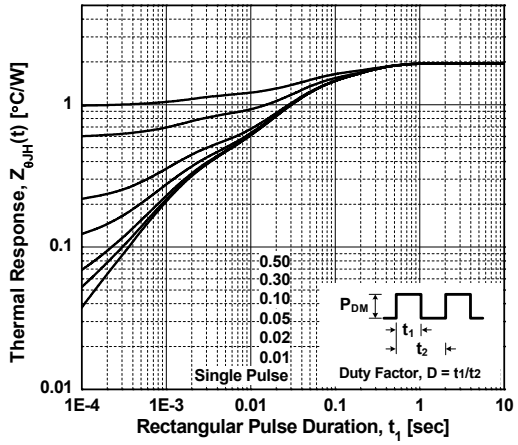


Fig 5. On-Region Characteristics - Boost MOSFET

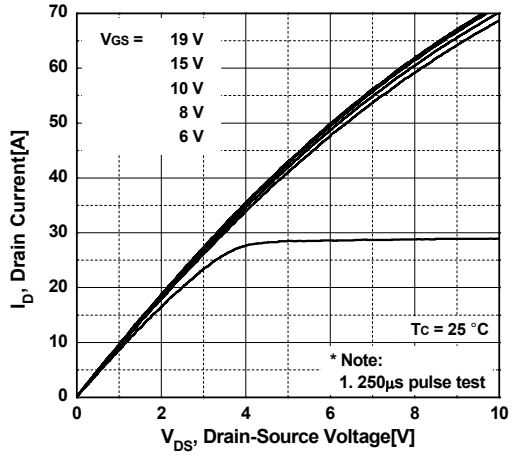
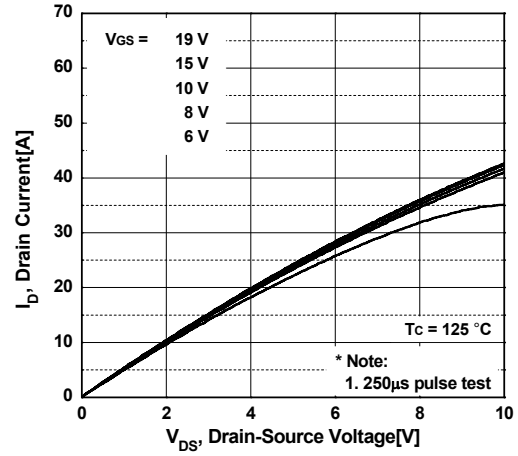


Fig 6. On-Region Characteristics - Boost MOSFET



Typical Performance Characteristics

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

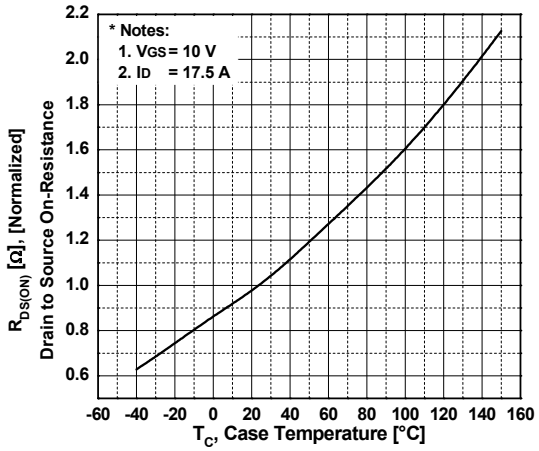


Fig 8. Switching Loss vs. Gate Resistor Values - Boost MOSFET

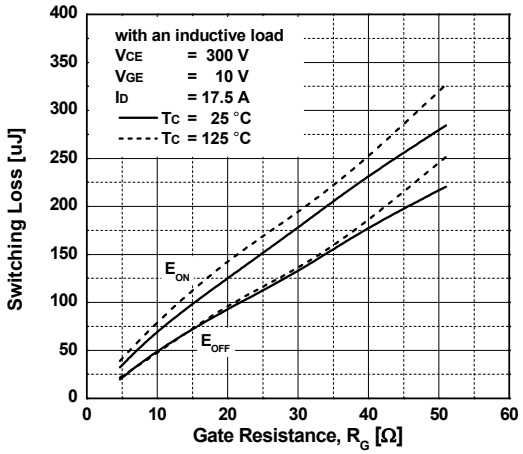


Fig 9. Switching Loss vs. Drain Current - Boost MOSFET

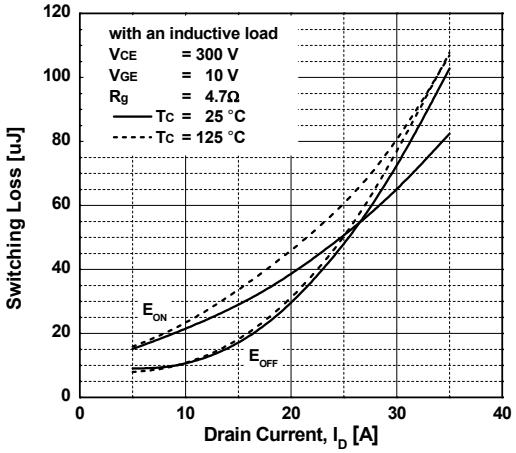


Fig 10. Body Diode Forward Voltage Variation vs. Source Current and Temperature - Boost MOSFET

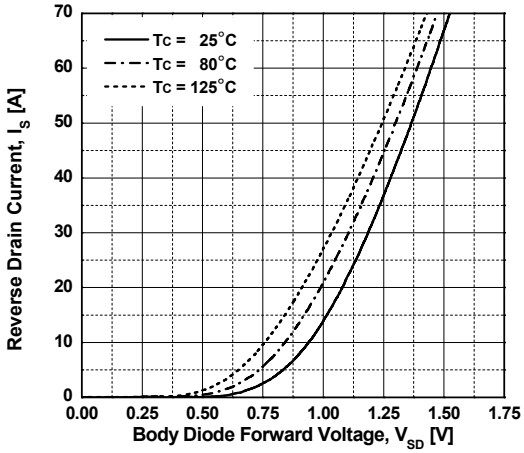


Fig 11. Transient Thermal Impedance - Boost MOSFET

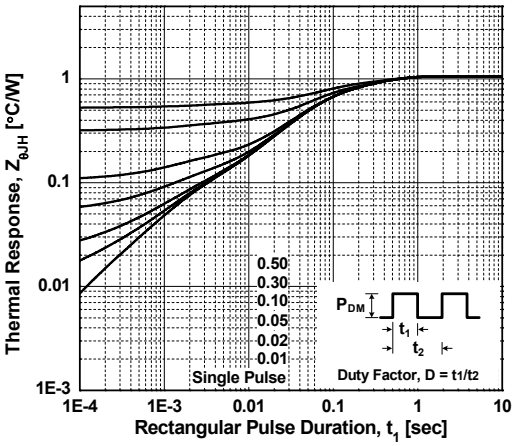
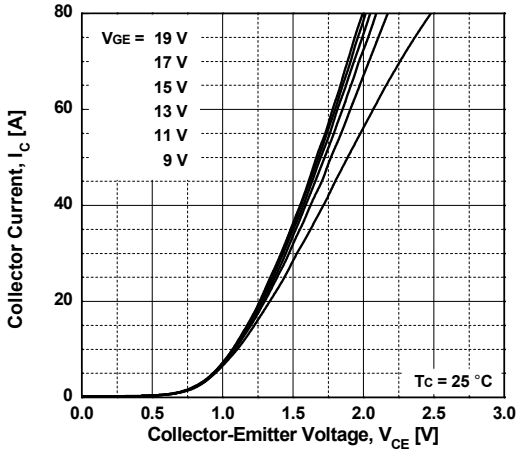


Fig 12. Output Characteristics - H-bridge IGBT



Typical Performance Characteristics

Fig 13. Output Characteristics - H-bridge IGBT

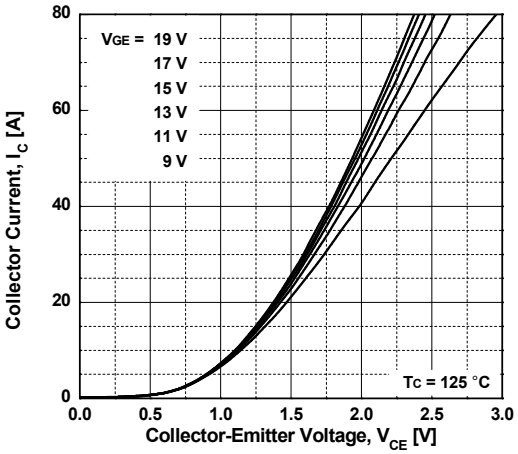


Fig 14. Saturation Voltage Characteristics - H-bridge IGBT

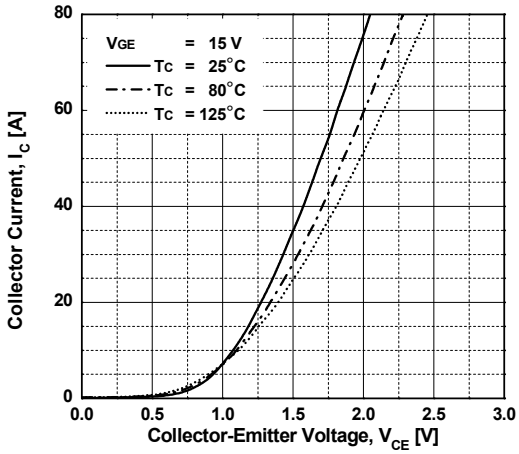


Fig 15. Switching Loss vs. Gate Resistor Values - H-bridge IGBT

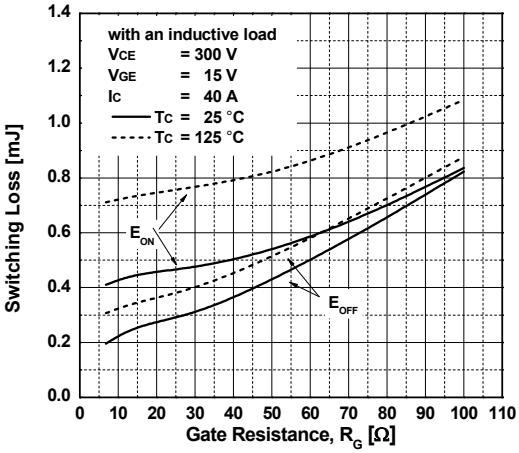


Fig 16. Switching Loss vs. Collector Current - H-bridge IGBT

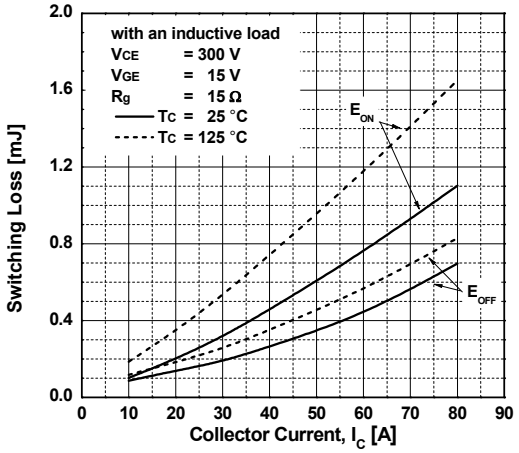


Fig 17. Transient Thermal Impedance - H-bridge IGBT

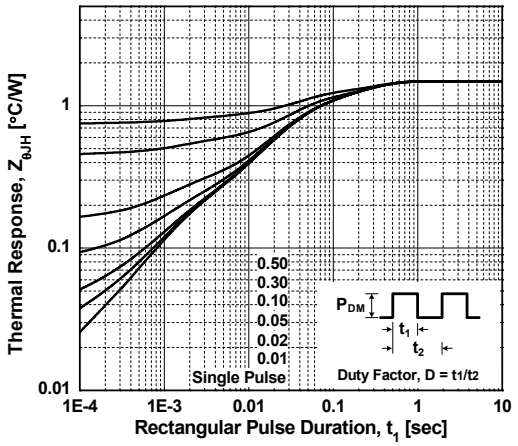
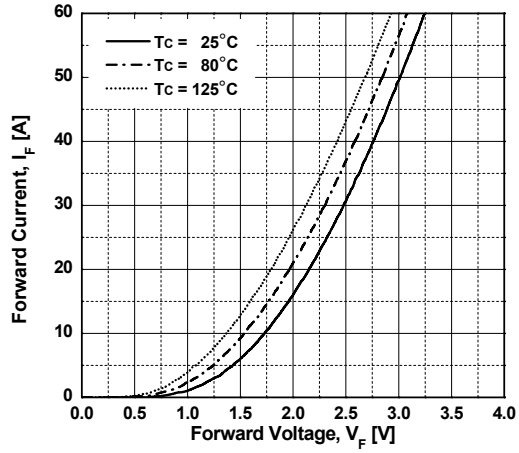


Fig 18. Forward Voltage Drop vs. Forward Current - H-bridge FWD



Typical Performance Characteristics

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

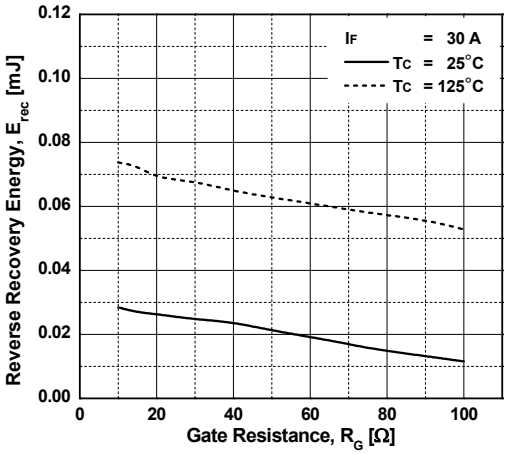


Fig 20. Reverse Recovery Energy vs. Forward Current - H-bridge FWD

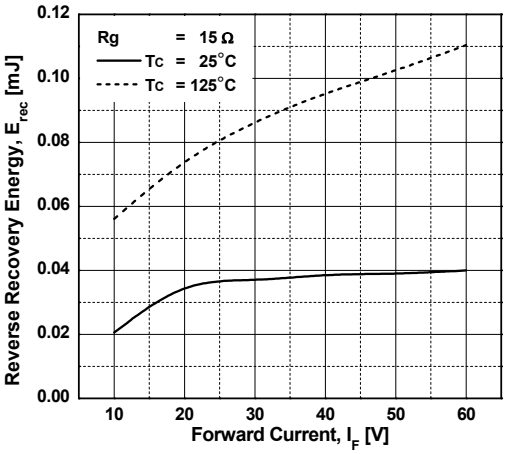
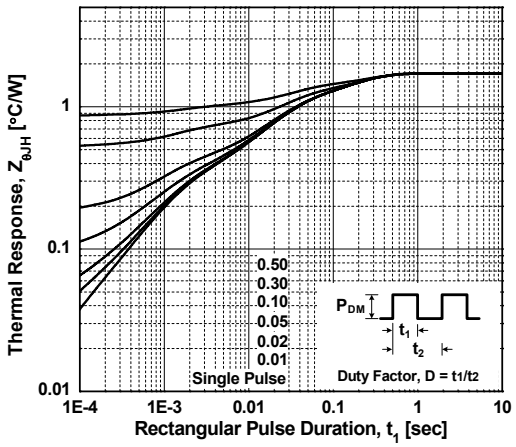
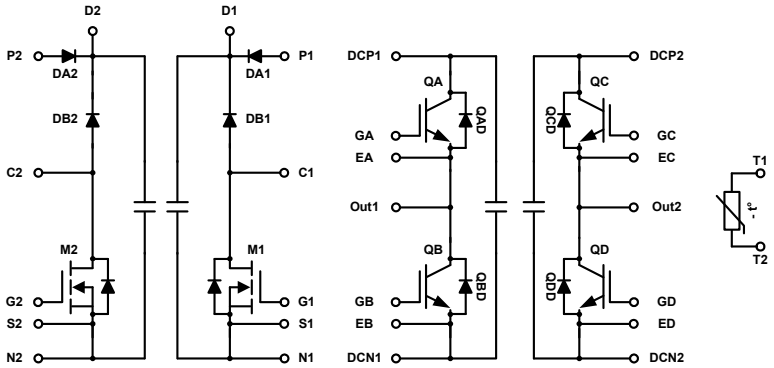


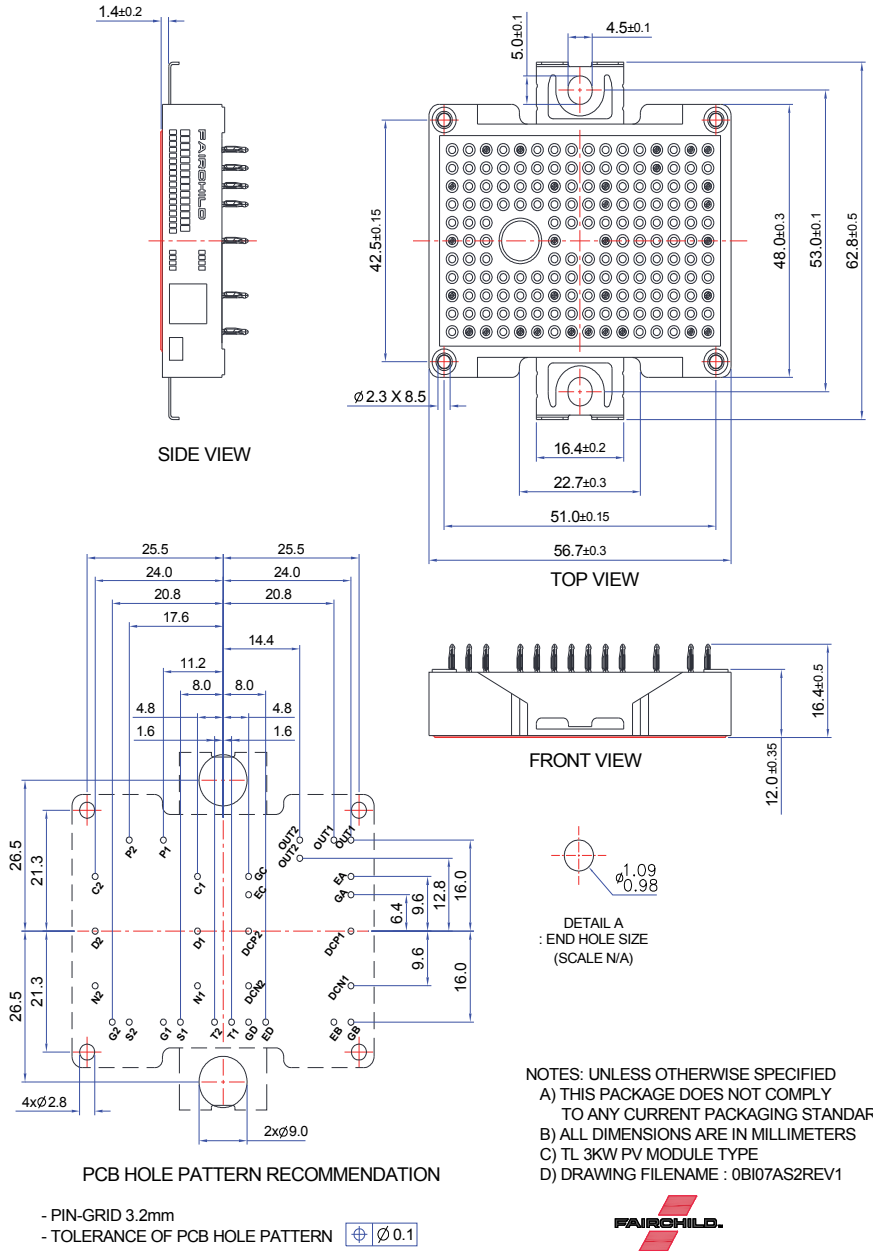
Fig 21. Transient Thermal Impedance - H-bridge FWD



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
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