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# 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.

### Electrical Features

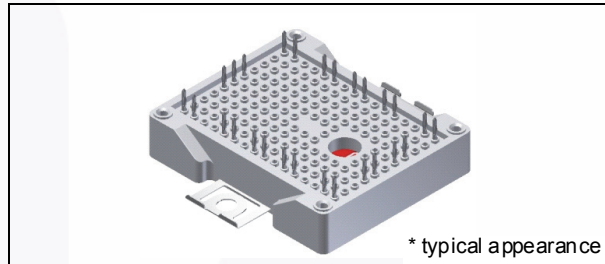
- Boost Stage
  - Dual Boost Topology
  - SiC Boost Diode
  - Low  $R_{DS(ON)}$  Boost Switch
  - Low  $V_F$  and High Voltage Bypass Diode
- Inverter Stage
  - H-bridge Topology
  - High Speed IGBT and Fast Recovery FWD
- Integrated DC-capacitor for Boost and Inverter
- Temperature Sensor

### Mechanical Features

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

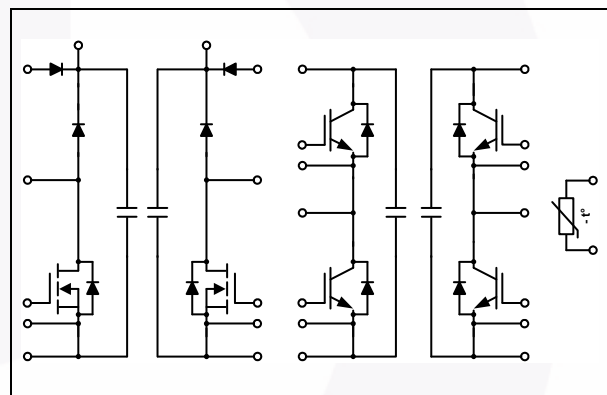
### Applications

- Solar Inverter



\* typical appearance

Package Code: F2



Internal Circuit Diagram

### Package Marking and Ordering Information

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

FPF2C110BI07AS2 F2, Boost and Inverter module with Press-fit

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

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

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

Symbol	Description	Condition	Rating	Units
<b>Module</b>				
$T_{STG}$	Storage Temperature		- 40 to + 125	$^\circ\text{C}$
$V_{ISO}$	Isolation Voltage	AC 1 min.	2500	V
Iso_Material	Internal Isolation Material		$\text{Al}_2\text{O}_3$	-
$T_{MOUNT}$	Mounting Torque <sub>(1)</sub>		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**  $T_C = 25^\circ\text{C}$  unless otherwise noted. **Parantheses value is based on the discrete.**

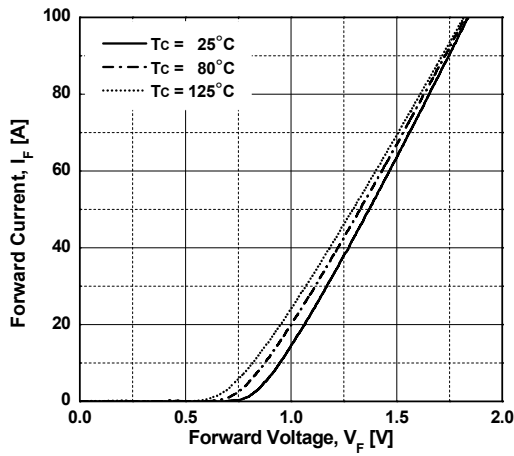
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units	
<b>Bypass Diode (DA1, DA2)</b>							
$V_F$	Diode Forward Voltage	$I_F = 50\text{ A}$	-	1.37	1.7	V	
		$I_F = 50\text{ A}, T_C = 125^\circ\text{C}$	-	1.3	-	V	
$I_R$	Reverse Leakage Current	$V_R = 1000\text{ V}$	-	-	250	$\mu\text{A}$	
$R_{\theta\text{JC}}$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

**Electrical Characteristics**  $T_C = 25\text{ }^\circ\text{C}$  unless otherwise noted. **Parantheses value is based on the discrete.**

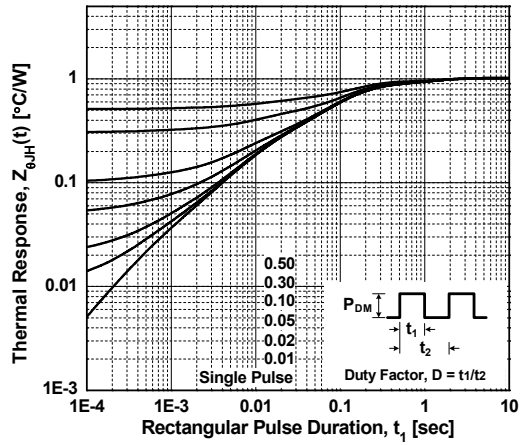
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units	
<b>H-Bridge IGBT (QA, QB, QC, QD)</b>							
<b>Off Characteristics</b>							
$BV_{CES}$	Collector-Emitter Breakdown Voltage	$V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$	650	-	-	V	
$I_{CES}$	Collector Cut-off Current	$V_{CE} = V_{CES}, V_{GE} = 0\text{ V}$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

## Typical Performance Characteristics

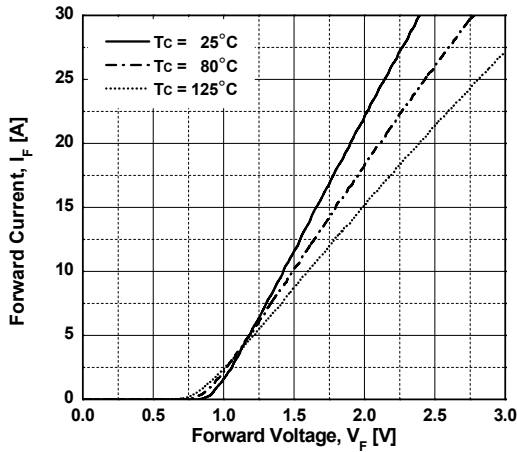
**Fig 1. Forward Voltage Drop**  
- Bypass Diode



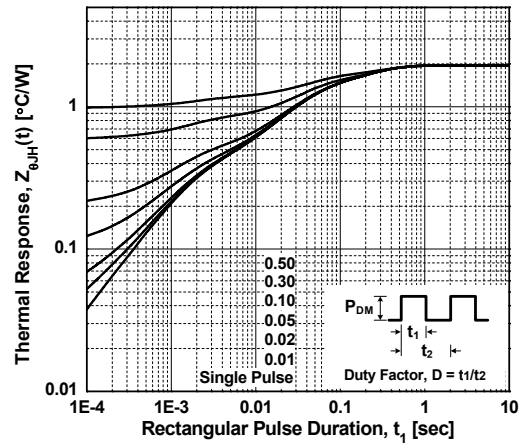
**Fig 2. Transient Thermal Impedance**  
- Bypass Diode



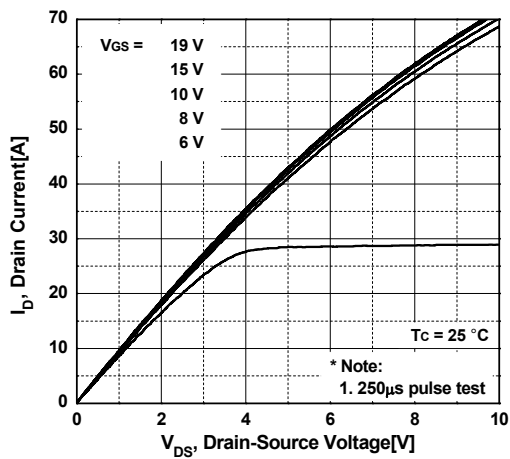
**Fig 3. Forward Voltage Drop**  
- Boost Diode



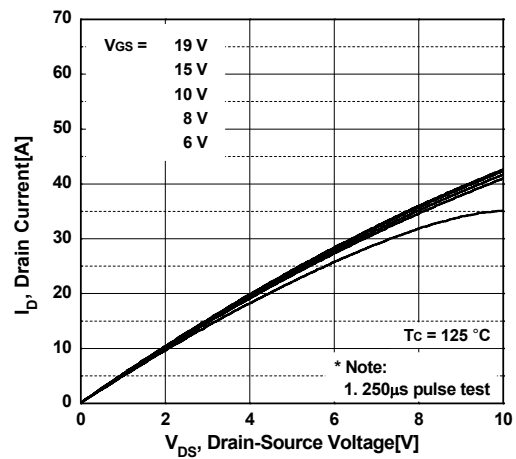
**Fig 4. Transient Thermal Impedance**  
- Boost Diode



**Fig 5. On-Region Characteristics**  
- Boost MOSFET

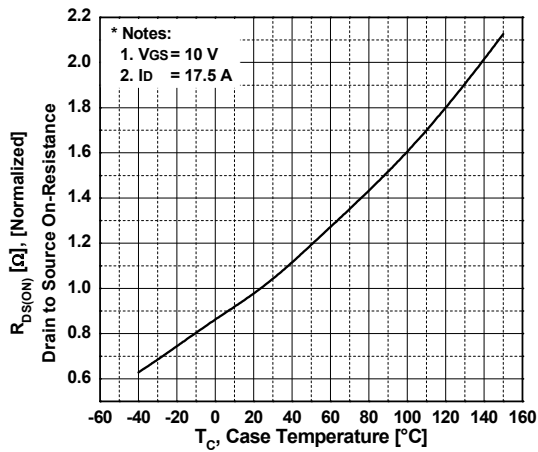


**Fig 6. On-Region Characteristics**  
- Boost MOSFET

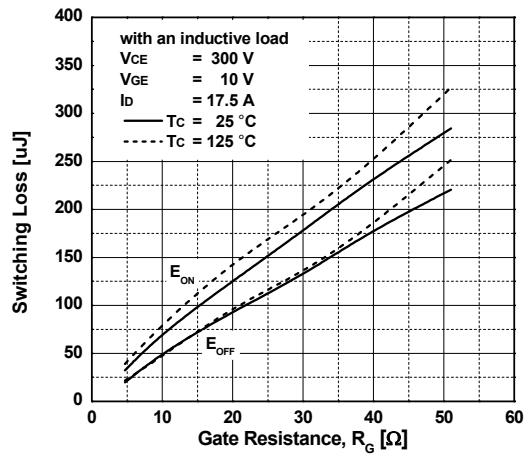


## Typical Performance Characteristics

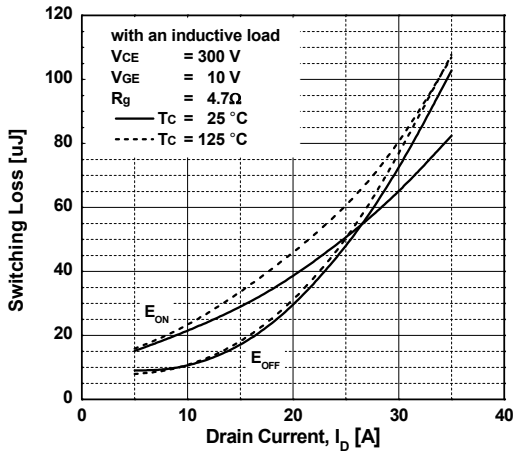
**Fig 7. On-Resistance Variation vs. Temperature - Boost MOSFET**



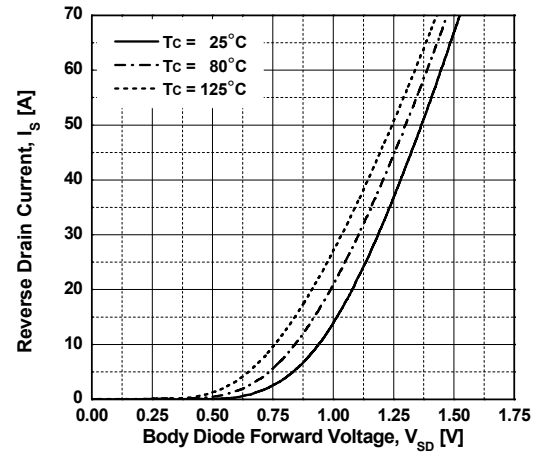
**Fig 8. Switching Loss vs. Gate Resistor Values - Boost MOSFET**



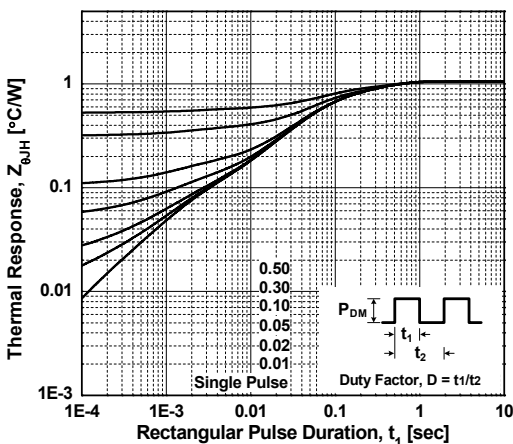
**Fig 9. Switching Loss vs. Drain Current - Boost MOSFET**



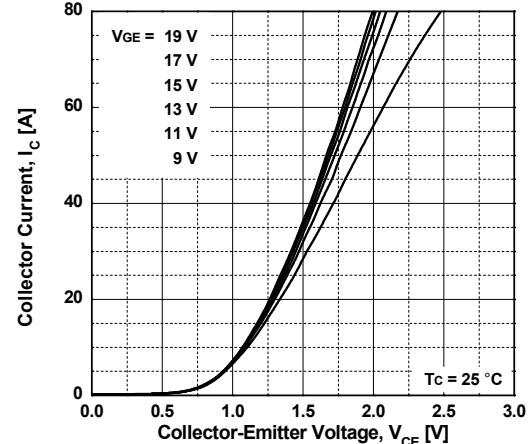
**Fig 10. Body Diode Forward Voltage Variation vs. Source Current and Temperature - Boost MOSFET**



**Fig 11. Transient Thermal Impedance - Boost MOSFET**



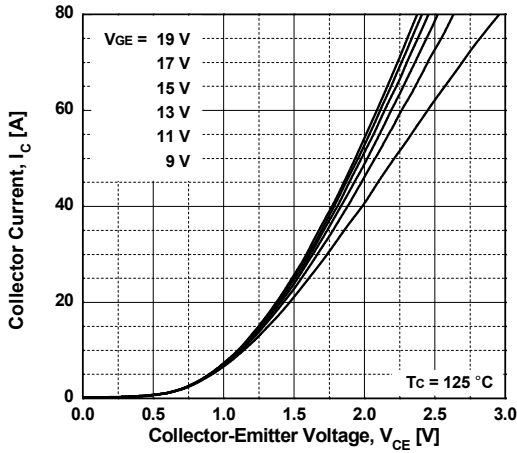
**Fig 12. Output Characteristics - H-bridge IGBT**



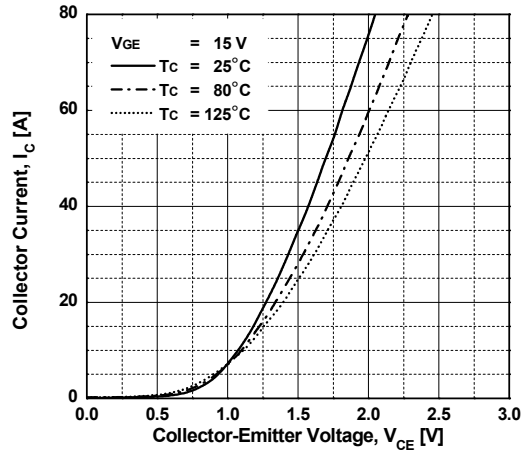


## Typical Performance Characteristics

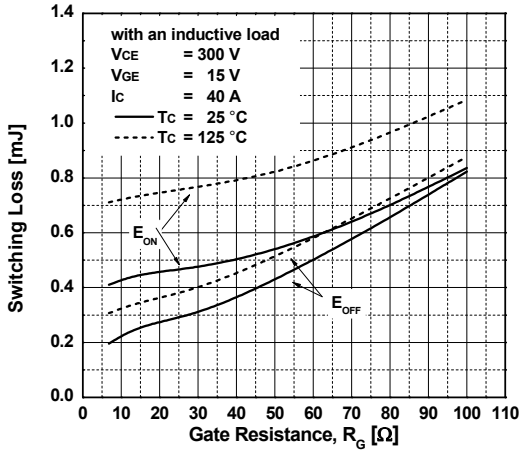
**Fig 13. Output Characteristics**  
- H-bridge IGBT



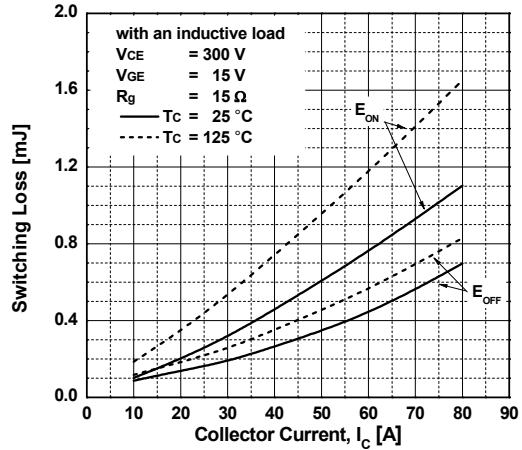
**Fig 14. Saturation Voltage Characteristics**  
- H-bridge IGBT



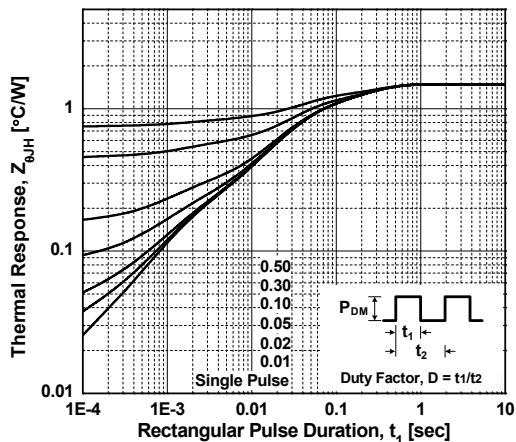
**Fig 15. Switching Loss vs. Gate Resistor Values**  
- H-bridge IGBT



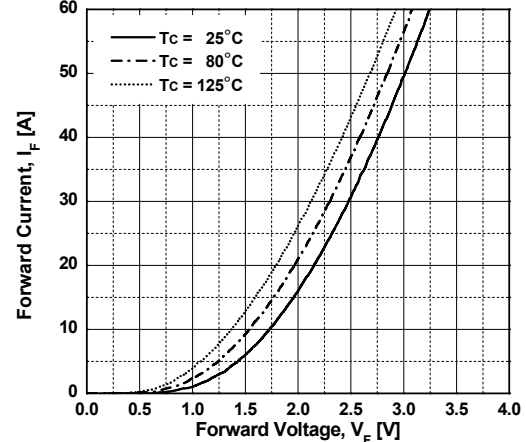
**Fig 16. Switching Loss vs. Collector Current**  
- H-bridge IGBT



**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

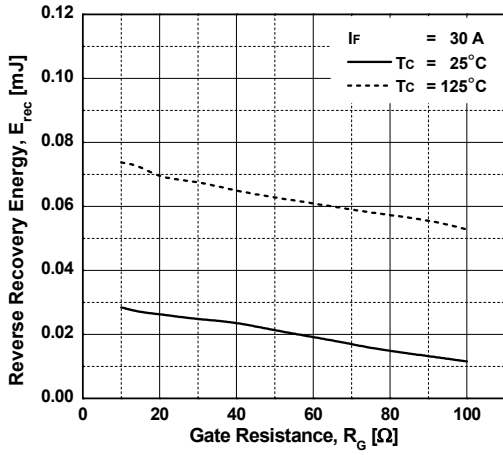


Fig 20. Reverse Recovery Energy vs. Forward Current - H-bridge FWD

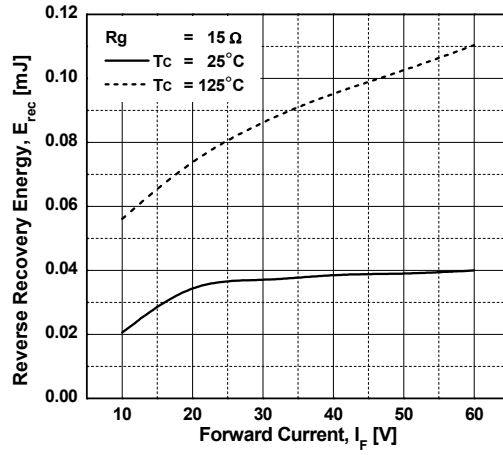
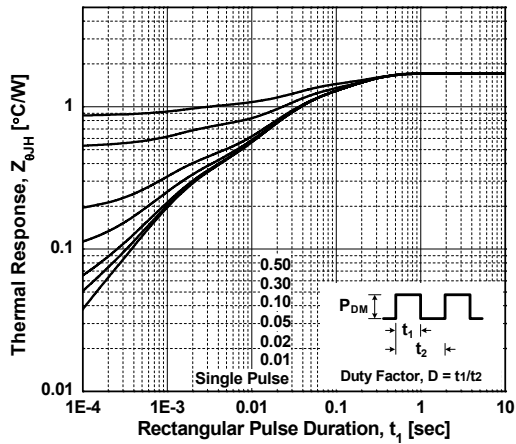
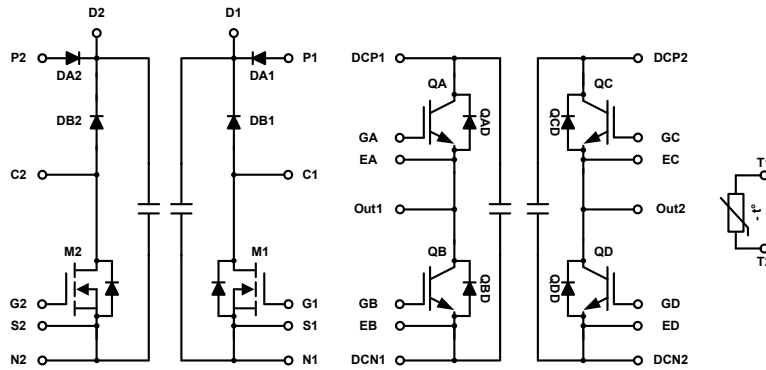


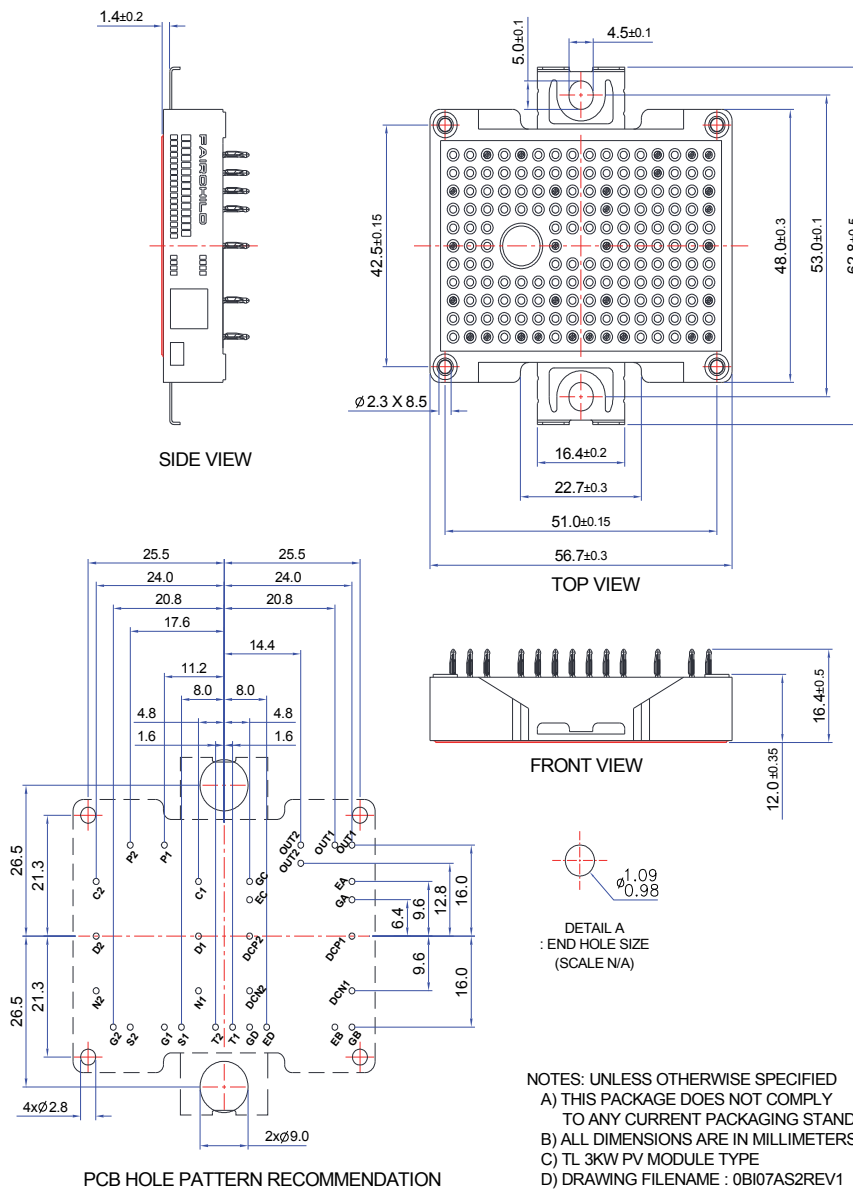
Fig 21. Transient Thermal Impedance - H-bridge FWD



### Internal Circuit Diagram



### Package Outlines [mm]








- PIN-GRID 3.2mm  
 - TOLERANCE OF PCB HOLE PATTERN  $\pm \varnothing 0.1$





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