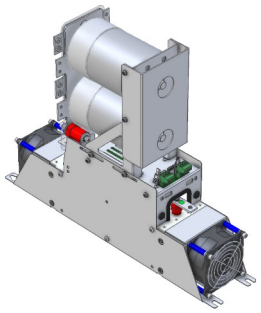
MTM-1/2B2IC0450F12INKB

MODULAR IGBT POWER STACKS SERIES

PRELIMINARY TECHNICAL INFORMATION



Features

- EconoDUAL™3 IGBT4
- 1/2B2IC module topology
- Capacitor bank included
- Driver included
- Current sensor included
- Forced air heatsink
- Modular and compact design

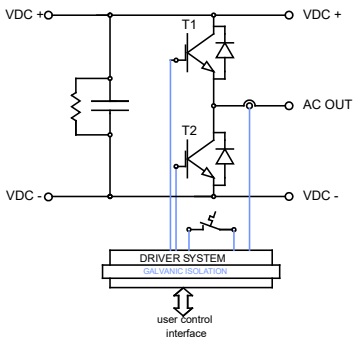
Typical applications

- Renewable energies
- AC inverter drives
- Traction
- Elevators
- Industrial drives
- UPS

POWER STACK GENERAL CHARACTERISTICS

Symbol	Conditions	Min	Typ	Max	Units
System					
V_{DClink}	*Working as DC/AC converter inverter*			800	V_{DC}
I_{OUT}	*f_{SW}=5 kHz, T_A=35ºC, T_{vj}<125ºC, T_{HK}<90ºC* *f_{AC}=50 Hz, PF= 0.85, m=0.94, V_{DCLink}=600V*			240	A_{RMS}
T_{stg}		-40		70	ºC
T_{op}		-20	35	70	ºC
V_{ISOmod}	*50 Hz @1min*		4000		V_{AC}
IGBT					FF450R12ME4 (Infineon)
V_{CES}	*T_J=25ºC*			1200	V
I_C	*T_C=25ºC, $T_{vj\,max}$=175ºC*			675	A
	T_C=100ºC, $T_{vj\,max}$=175ºC			450	A
$T_{vj\,op}$	*under switching conditions*	-40		150	ºC
Diode					
V_{RRM}	*T_{vj}=25ºC*			1200	V
I_F				450	A
$T_{vj\,op}$	*under switching conditions*	-40		150	ºC
Driver					2SP0115T (Power Integrations)
V_S	Driver supply voltage		15	16	V
V_{iH}	Input signal voltage (high)		15		V
V_{isolSS}	Isolation between secondaries			4000	V
V_{isolPS}	Isolation primary to secondary			5000	V
f_{sw}	Switching frequency		5		kHz
Only 15 V logic supported.					
Capacitor bank					
C_N	Nominal capacity		840		µF
C_{N_TOL}	Capacity tolerance		10		%
V_{DC_max}	Maximum nominal capacitor voltage		1100		V_{DC}
Current sensor					HO 200-S/SP33-1106 (LEM)
I_{PN}	Nominal current		200		A
I_{PM}	Primary current measuring range	-500		500	A
G_{th}	Theoretical sensivity (460 mV @ I_{PN})		2.3		mV/A
V_{out}	Output voltage range @ I_{PM}	-1.15		1.15	V
Heatsink					SV-8214JH4-RG42080L12/245AFR
V_S	Fan supply voltage (forced air)		24		V_{DC}
R_{thHA}	Thermal resistance to ambient		0.08		K/W
T_{TH}	Thermal switch temperature		NC 90 ±5		ºC

Topology



Rectificadores Guasch, S.A.U. reserves the right to change limits, test conditions and dimensions given in this data sheet at any time without previous notice.

POWER MODULE CHARACTERISTICS

IGBT STATIC CHARACTERISTICS

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
V_{CES}	C-E Breakdown Voltage	T_{vj} = 25 °C			1200	V
I_{CES}	C-E Cut-Off Current	$V_{CE} = V_{CES}$, V_{GE} = 0 V, T_{vj} = 25 °C			3	mA
I_{GES}	G-E Leakage Current	$V_{GE} = V_{GES}$, V_{CE} = 0 V			400	nA
$V_{GE(th)}$	G-E Threshold Voltage	$V_{GE} = V_{CE}$, I_C = 9 mA	5.2	5.8	6.4	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C = 450 A, V_{GE} = 15 V, T_{vj} = 25 °C		1.75	2.1	V
		I_C = 450 A, V_{GE} = 15 V, T_{vj} = 125 °C		2.0		V

Table 1: IGBT part static characteristics FF450R12ME4.

IGBT DYNAMIC CHARACTERISTICS

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
C_{ies}	Input Capacitance	V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz		28.0		nF
C_{oes}	Output Capacitance					nF
C_{res}	Reverse Transfer Capacitance			1.55		nF
$t_{d(on)}$	Turn-On Delay Time	Inductive load, T_{vj} = 125°C, R_G = 1.3 Ω, V_{CE} = 600 V, I_C = 450 A, V_{GE} = ±15 V		220		ns
t_r	Rise Time			70		ns
$t_{d(off)}$	Turn-Off Delay Time			580		ns
t_f	Fall Time			110		ns
E_{on}	Turn-On Switching Loss			26		mJ
E_{off}	Turn-Off Switching Loss			55.5		mJ
E_{ts}	Total Switching Loss			81.5		mJ
Q_g	Total Gate Charge	V_{GE} = -15 V...+15 V		3.30		µC
Q_{ge}	Gate-Emitter Charge					µC
Q_{gc}	Gate-Collector Charge					µC

Table 2: IGBT part dynamic characteristics FF450R12ME4.

DIODE ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
V_F	Diode Forward Voltage	I_F = 450 A, V_{GE} = 0 V	T_{vj} = 25 °C		1.65	2.10	V
			T_{vj} = 125 °C		1.65		
I_{RRM}	Peak Reverse Recovery Current	V_{DC} = 600 V, I_C = 450 A, V_{GE} = ±15 V, di/dt$_{off}$ = 7000 A/µs	T_{vj} = 125 °C		550		A
Q_{rr}	Diode Reverse Recovery Charge		T_{vj} = 125 °C		92		µC
E_{rr}	Diode Reverse Recovery Energy		T_{vj} = 125 °C		48.5		mJ

Table 3: Diode part electrical specifications FF450R12ME4.

IGBT MODULE THERMAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$Rth_{(J-C)Q}$	Thermal Resistance (per IGBT)	Junction-to-Case			0.066	°C/W
$Rth_{(C-H)Q}$	Thermal Resistance (per IGBT)	Case-to-Heatsink		0.03		°C/W
$Rth_{(J-C)D}$	Thermal Resistance (per Diode)	Junction-to-Case			0.10	°C/W
$Rth_{(C-H)D}$	Thermal Resistance(per Diode)	Case-to-Heatsink		0.045		°C/W

Table 4: IGBT module thermal characteristics FF450R12ME4.

Note: *All above data extracted from Infineon IGBT module data sheet, please refer to manufacturer's website for its last updated revision.*

CAPACITOR BANK CHARACTERISTICS

CAPACITOR BANK TECHNICAL SPECIFICATIONS

Symbol	Description	Notes / Test conditions	Min	Typ	Max	Units
C_{TOT}	Total bank nominal capacitance	2x capacitors, parallel connection		840		µF
V_{DC_MAX}	Maximum rated voltage	capacitor bank			1100	V_{DC}
V_S	Non-recurrent surge voltage	capacitor bank			1650	V
ESR	Equivalent series resistance	per capacitor; @1.0 kHz			2.2	mΩ
tan(δ)	Dissipation factor	per capacitor; @100 Hz, T_C=20±5ºC			$2 \cdot 10^{-4}$	
I_{RMS}	Max RMS current	per capacitor; @10 kHz, T_C=45ºC			40	A
	Mounting position	upright or horizontal				
	C_N tolerance				10	%
T_{op}	Operating Temperature	T_C	-40		85	ºC

Table 5: Capacitor bank technical specifications.

Circuit diagram

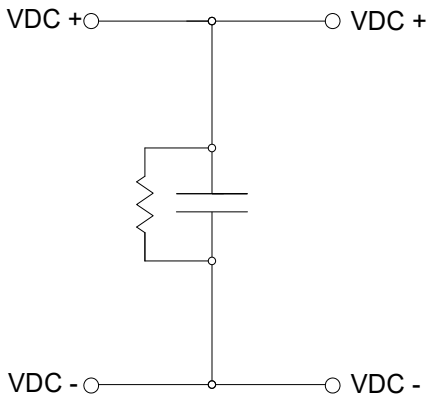
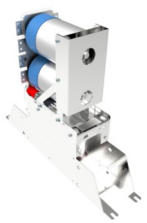


Figure 1: Simplified capacitor bank circuit diagram.

Warning note:
When charged at nominal voltage and then disconnected from DC power source the capacitor bank will be naturally discharged after approximately 4 min ($V_{C@10min}$ < 2% x V_{RATED}). If a shorter discharge time is needed an external discharge resistor must be added.

ADDITIONAL CAPACITOR BANK MODULES

There are available additional capacitor bank modules compatible and ready to add to this power stack module to increase its overall capacitance:



MTM-DCL00840MKP1100xxBA (840 µF / 1100 V)

Download here its data sheet

COOLING SYSTEM CHARACTERISTICS

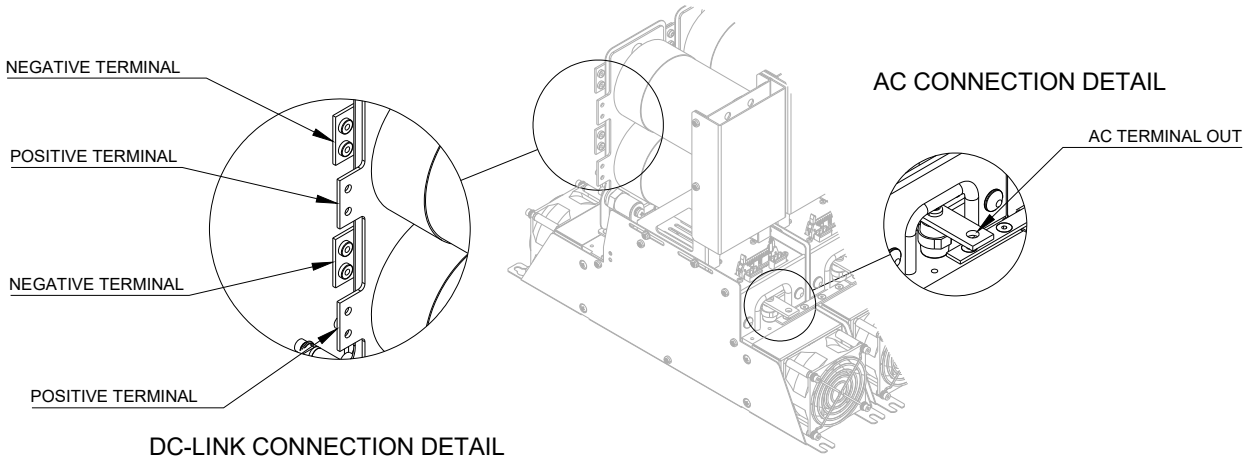
HEATSINK TECHNICAL SPECIFICATION

Symbol	Parameter	Notes / Test conditions	Min	Typ	Max	Units
$R_{th(HA)}$	Nominal thermal resistance	for large area heat distribution		0.08		K/W
	Cooling type			Forced air convection		
	Fan configuration			2x series radial fan		
$V_{IN\ DC}$	Input supply voltage		12	24	27.6	V_{DC}
$I_{IN\ DC}$	Input supply current	per module		3167		mA
P_N	Power consumption			76		W
	Fan rated speed	±10%		14000		rpm
Q	Air Flow	Free air		222		m^3/h
P	Static Air Pressure				1300	Pa
	Noise Level	per fan		71		dBA
	Service life	@40ºC		50000		h

Data at T_a = 25 °C, V_{IN} = 24 V_{DC} and rated values, unless otherwise indicated

Table 6: Cooling system technical specifications.

POWER CONNECTIONS



TERMINAL CONNECTIONS

DC-Link terminals: 4x M4 threaded and 4x Ø4.5 mm, for M4 terminal thightening (on each converter side). Torque 1.1 Nm.

AC Output terminal: 1x Ø6.5 mm, for M6 terminal thightening. Torque 4 Nm.

MAIN POWER SUPPLY AND SIGNAL INTERFACE CONNECTIONS

J1 PINOUT

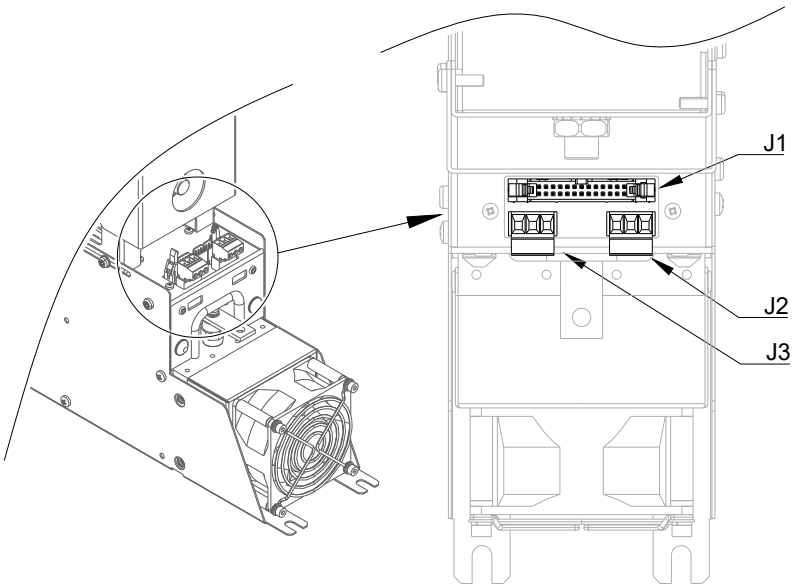
Pin		Function	Pin		Function
1	VREF	Current sense external voltage reference(1)	2	OCD	Over current detection output signal(1)
3	VOUT	Current sense output signal(1)	4	NC	Not connected
5	GND2	Current sensor GND	6	UC	Current sensor +UC power supply(1)
7	TH1	Thermal switch A	8	TH2	Thermal switch B
9	VDD	+15 V_{DC} supply voltage(2)	10	GND	Ground terminal for supply and logic signals
11	VDD	+15 V_{DC} supply voltage(2)	12	GND	Ground terminal for supply and logic signals
13	VDD	+15 V_{DC} supply voltage(2)	14	GND	Ground terminal for supply and logic signals
15	SO2	Status output channel 2, TOP IGBT(2)	16	GND	Ground terminal for supply and logic signals
17	INB	Input logic signal for switching TOP IGBT(2)	18	GND	Ground terminal for supply and logic signals
19	SO1	Status output channel 1, BOT IGBT(2)	20	GND	Ground terminal for supply and logic signals
21	INA	Input logic signal for switching BOT IGBT(2)	22	GND	Ground terminal for supply and logic signals
23	MOD	Mode selection (direct/half-bridge)(2)	24	NTC1	IGBT NTC(3)
25	NC	Not connected	26	NTC2	IGBT NTC(3)

***(1)**: Direct connections to electrical interface of LEM HO series current sensor. By default the mounted current sensor type is HO xxx-S/SP33-1106 (LEM). See its nominal current and mounted reference on this data sheet's first page. Please read current transducer's technical documentation for more information.*
***(2):** Direct connections to electrical interface of Power Integrations driver 2SP0115T2Cx-17. Please read driver's technical documentation for more information.*
By default dead time is internally configured to 3 µs ±20%. If other dead time or higher timing precisions are required direct mode should be used and dead time generated externally.
***(3)**: Direct connection to IGBT module internal NTC. Please see IGBT module's datasheet for NTC parametrization and characteristics.*

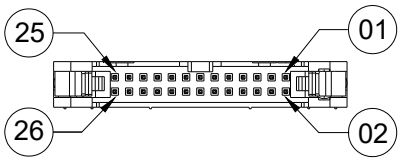
J2 & J3 PINOUT

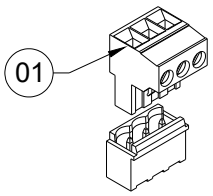
Pin		Function
1	GND	Fan GND supply
2	NC	Not connected
3	24V	Fan power supply +24 V_{DC}

Note: *In case of multiple stacks, when only one is supplied (fans) and the rest jumpered through J2 and J3 please take into account that the maximum current per pole for J2 and J3 connectors is 15 A .*



- PIN POSITION INDICATION:

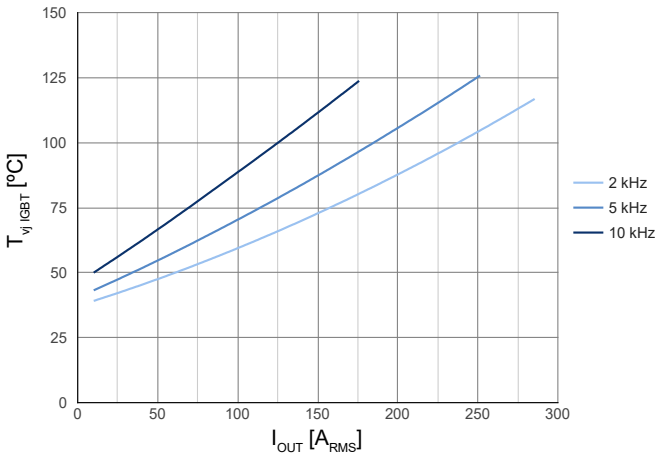




Connector types:
J1 : Quickie™ series, 71918-126LF, AMPHENOL FCI. 26 pos. Dual Vertical.
J2 & J3: COM series, COM030P5,SAURO. 3 pos, 5.08 mm pitch. With plugs. Cable wire section: 30...12 AWG (0.05...2.5 mm^2).

PERFORMANCE CURVES

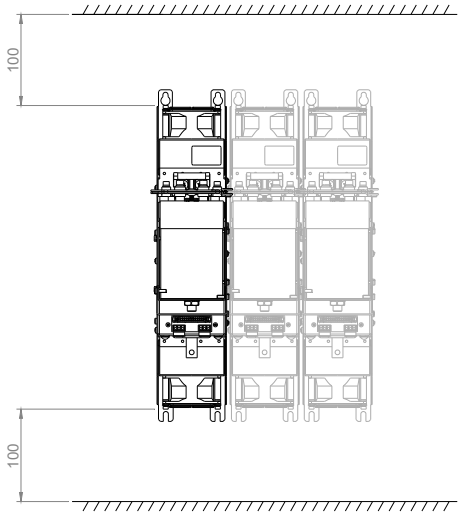
Module working as a single branch on a three-phase inverter power stack.



Condition	Symbol	Value	Units
Ambient temperature	T_A	35	ºC
DC-Link voltage	V_{DCLINK}	600	V
Modulation index	m	1	
Load power factor	PF	0.85	
Output frequency	f_{OUT}	50	Hz

STACK MOUNTING CONSIDERATIONS

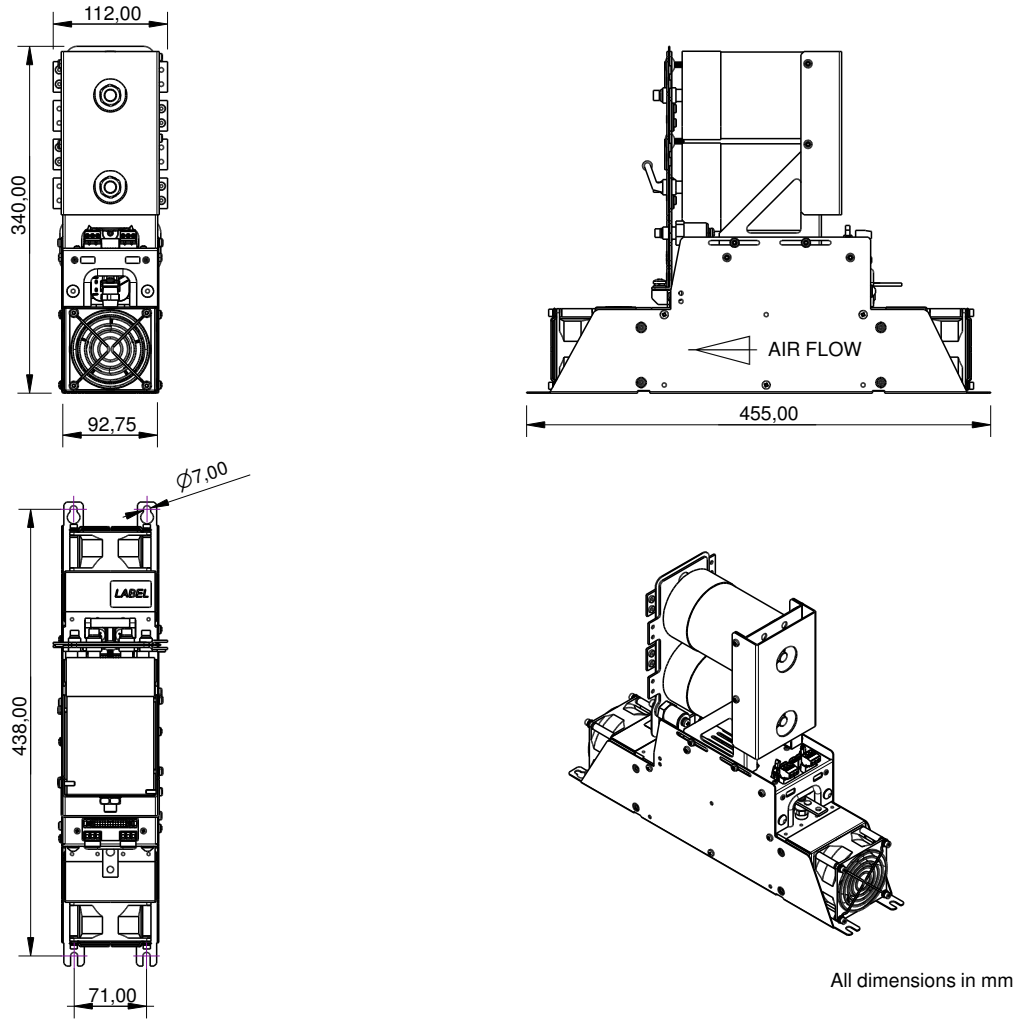
This series of IGBT power converters are designed to be easily stackable in order to implement various converter topologies, parallelled, interleaved operation or redundant working. Please read MTM-1/2B2IC brochure for more information regarding the available options of this IGBT power stacks series.
It is necessary a minimum distance of 100 mm with regard to the envelope. The free air circulation should be guaranteed avoiding external nearby heat sources from the assembly.



The power stack must be mounted in upright or horizontal position and tightened to a plane surface providing a correct heatsink fin air canalization and an optimal heatsink thermal performance, other mounting positions must be avoided.
When operating on final industrial application it is advisable to consider a safety margin with regards the maximum working current, we recommend a margin of the 20%.
For critical cases (24 hours work, repetitive overloads, high ambient temperature...), safety margins of 30% to 50% are used.

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MECHANICAL DIMENSIONS



All dimensions in mm

Dimension	Typ	Units
Length	455	mm
Height	340	mm
Width	112	mm
Weight	9.4	kg

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