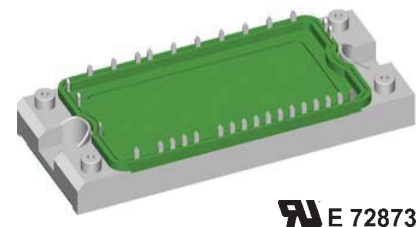
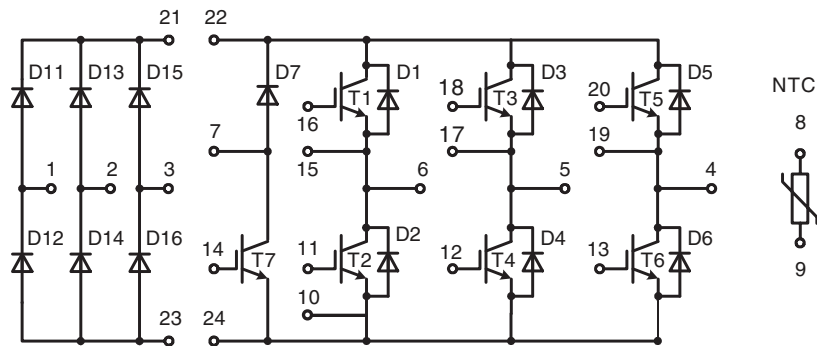


Converter - Brake - Inverter Module (CBI2) with Trench IGBT technology

Preliminary data



Three Phase Rectifier	Brake Chopper	Three Phase Inverter
$V_{RRM} = 1600 \text{ V}$	$V_{CES} = 1200 \text{ V}$	$V_{CES} = 1200 \text{ V}$
$I_{FAVM} = 38 \text{ A}$	$I_{C25} = 30 \text{ A}$	$I_{C25} = 45 \text{ A}$
$I_{FSM} = 300 \text{ A}$	$V_{CE(sat)} = 1.7 \text{ V}$	$V_{CE(sat)} = 1.7 \text{ V}$

Input Rectifier Bridge D11 - D16

Symbol	Conditions	Maximum Ratings	
V_{RRM}		1600	V
I_{FAV}	$T_C = 80^\circ\text{C}$; sine 180°	25	A
I_{DAVM}	$T_C = 80^\circ\text{C}$; rectangular; $d = 1/3$; bridge	72	A
I_{FSM}	$T_{VJ} = 25^\circ\text{C}$; $t = 10 \text{ ms}$; sine 50 Hz	300	A
P_{tot}	$T_C = 25^\circ\text{C}$	100	W

Symbol	Conditions	Characteristic Values ($T_{VJ} = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
V_F	$I_F = 25 \text{ A}$; $T_{VJ} = 25^\circ\text{C}$ $T_{VJ} = 125^\circ\text{C}$		1.1 1.1	1.3 V V
I_R	$V_R = V_{RRM}$; $T_{VJ} = 25^\circ\text{C}$ $T_{VJ} = 125^\circ\text{C}$		0.4	0.02 mA mA
R_{thJC}	(per diode)			1.3 K/W

Application: AC motor drives with

- Input from single or three phase grid
- Three phase synchronous or asynchronous motor
- electric braking operation

Features

- High level of integration - only one power semiconductor module required for the whole drive
- Inverter with Trench IGBTs
 - low saturation voltage
 - positive temperature coefficient
 - fast switching
 - short tail current
- Epitaxial free wheeling diodes with Hyperfast and soft reverse recovery
- Industry standard package with insulated copper base plate and soldering pins for PCB mounting
- Temperature sense included

Output Inverter T1 - T6

Symbol	Conditions	Maximum Ratings	
V_{CES}	$T_{VJ} = 25^{\circ}\text{C}$ to 150°C	1200	V
V_{GES}	Continuous	± 20	V
I_{C25}	$T_C = 25^{\circ}\text{C}$	45	A
I_{C80}	$T_C = 80^{\circ}\text{C}$	25	A
I_{CM}	$T_C = 80^{\circ}\text{C}$; $t_p = 1\text{ ms}$	50	A
P_{tot}	$T_C = 25^{\circ}\text{C}$	170	W

Symbol	Conditions	Characteristic Values ($T_{VJ} = 25^{\circ}\text{C}$, unless otherwise specified)		
		min.	typ.	max.
$V_{CE(sat)}$	$I_C = 25\text{ A}$; $V_{GE} = 15\text{ V}$; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	1.7 2.0		2.15 V
$V_{GE(th)}$	$I_C = 1\text{ mA}$; $V_{GE} = V_{CE}$	5	5.8	6.5 V
I_{CES}	$V_{CE} = V_{CES}$; $V_{GE} = 0\text{ V}$; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	0.7		2.7 mA mA
I_{GES}	$V_{CE} = 0\text{ V}$; $V_{GE} = \pm 20\text{ V}$			400 nA
C_{ies}	$V_{CE} = 25\text{ V}$; $V_{GE} = 0\text{ V}$; $f = 1\text{ MHz}$	1.8		nF
Q_{Gon}	$V_{CE} = 600\text{ V}$; $V_{GE} = 15\text{ V}$; $I_C = 25\text{ A}$	240		nC
$t_{d(on)}$ t_r $t_{d(off)}$ t_f E_{on} E_{off}	Inductive load, $T_{VJ} = 125^{\circ}\text{C}$ $V_{CE} = 600\text{ V}$; $I_C = 25\text{ A}$ $V_{GE} = \pm 15\text{ V}$; $R_G = 36\ \Omega$	90 50 520 90 2.5 3.4		ns ns ns ns mJ mJ
RBSOA		$I_C = I_{CM}$; $V_{GE} = \pm 15\text{ V}$ $R_G = 36\ \Omega$; $T_{VJ} = 125^{\circ}\text{C}$	$V_{CEK} \leq V_{CES} - I_S\text{ di/dt}$	V
I_{SC} (SCSOA)		$V_{CE} = 720\text{ V}$; $V_{GE} = \pm 15\text{ V}$; $R_G = 36\ \Omega$; $t_p \leq 10\ \mu\text{s}$; non-repetitive; $T_{VJ} = 125^{\circ}\text{C}$	100	A
R_{thJC}		(per IGBT)		0.73 K/W

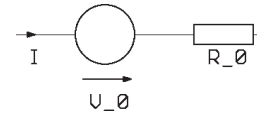
Output Inverter D1 - D6

Symbol	Conditions	Maximum Ratings	
I_{F25}	$T_C = 25^{\circ}\text{C}$	25	A
I_{F80}	$T_C = 80^{\circ}\text{C}$	17	A

Symbol	Conditions	Characteristic Values		
		min.	typ.	max.
V _F	I _F = 25 A; V _{GE} = 0 V; T _{VJ} = 25°C T _{VJ} = 125°C	2.1 1.6	2.6	V V
I _{RM} Q _{rr} t _{rr} E _{rec}	I _F = tbd A; di _F /dt = -tbd A/μs; T _{VJ} = 125°C V _R = 600 V; V _{GE} = 0 V	tbd		A
		tbd		μC
		tbd		ns
		tbd		mJ
R _{thJC}	(per diode)		2.1	K/W

Equivalent Circuits for Simulation

Conduction



IGBT (typ. at $V_{GE} = 15\text{ V}$; $T_J = 125^{\circ}\text{C}$)
T1-T6

$$V_0 = 0.92\text{ V}; R_0 = 42.8\text{ m}\Omega$$

T7

$$V_0 = 0.92\text{ V}; R_0 = 72\text{ m}\Omega$$

Diode (typ. at $T_J = 125^{\circ}\text{C}$)

D1-D6

$$V_0 = \text{tbd V}; R_0 = \text{tbd m}\Omega$$

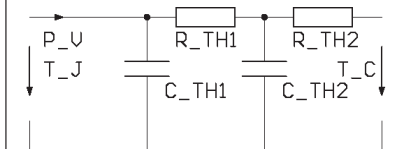
D7

$$V_0 = \text{tbd V}; R_0 = \text{tbd m}\Omega$$

D11-D16

$$V_0 = \text{tbd V}; R_0 = \text{tbd m}\Omega$$

Thermal Response



IGBT (typ.)

T1-T6

$$C_{th1} = \text{tbd J/K}; R_{th1} = \text{tbd K/W}$$

$$C_{th2} = \text{tbd J/K}; R_{th2} = \text{tbd K/W}$$

T7

$$C_{th1} = \text{tbd J/K}; R_{th1} = \text{tbd K/W}$$

$$C_{th2} = \text{tbd J/K}; R_{th2} = \text{tbd K/W}$$

Diode (typ.)

D1-D6

$$C_{th1} = \text{tbd J/K}; R_{th1} = \text{tbd K/W}$$

$$C_{th2} = \text{tbd J/K}; R_{th2} = \text{tbd K/W}$$

D7

$$C_{th1} = \text{tbd J/K}; R_{th1} = \text{tbd K/W}$$

$$C_{th2} = \text{tbd J/K}; R_{th2} = \text{tbd K/W}$$

D11-D16

$$C_{th1} = \text{tbd J/K}; R_{th1} = \text{tbd K/W}$$

$$C_{th2} = \text{tbd J/K}; R_{th2} = \text{tbd K/W}$$

Brake Chopper T7

Symbol	Conditions	Maximum Ratings	
V_{CES}	$T_{VJ} = 25^{\circ}\text{C}$ to 150°C	1200	V
V_{GES}	Continuous	± 20	V
I_{C25}	$T_C = 25^{\circ}\text{C}$	30	A
I_{C80}	$T_C = 80^{\circ}\text{C}$	15	A
I_{CM}	$T_C = 80^{\circ}\text{C}$; $t_p = 1 \text{ ms}$	30	A
P_{tot}	$T_C = 25^{\circ}\text{C}$	120	W

Symbol	Conditions	Characteristic Values ($T_{VJ} = 25^{\circ}\text{C}$, unless otherwise specified)		
		min.	typ.	max.
$V_{CE(sat)}$	$I_C = 15 \text{ A}$; $V_{GE} = 15 \text{ V}$; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		1.7 2.0	2.1 V
$V_{GE(th)}$	$I_C = 0.5 \text{ mA}$; $V_{GE} = V_{CE}$	5	5.8	6.5 V
I_{CES}	$V_{CE} = V_{CES}$; $V_{GE} = 0 \text{ V}$; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		0.25	0.1 mA mA
I_{GES}	$V_{CE} = 0 \text{ V}$; $V_{GE} = \pm 20 \text{ V}$			400 nA
C_{ies}	$V_{CE} = 25 \text{ V}$; $V_{GE} = 0 \text{ V}$; $f = 1 \text{ MHz}$		1.1	nF
Q_{Gon}	$V_{CE} = 600 \text{ V}$; $V_{GE} = 15 \text{ V}$; $I_C = 15 \text{ A}$		150	nC
$t_{d(on)}$ t_r $t_{d(off)}$ t_f E_{off}	Inductive load, $T_{VJ} = 125^{\circ}\text{C}$ $V_{CE} = 600 \text{ V}$; $I_C = 15 \text{ A}$ $V_{GE} = \pm 15 \text{ V}$; $R_G = 75 \Omega$		90 50 520 90 1.5	ns ns ns ns mJ
RBSOA				
	$I_C = I_{CM}$; $V_{GE} = \pm 15 \text{ V}$ $R_G = 75 \Omega$; $T_{VJ} = 125^{\circ}\text{C}$		$V_{CEK} \leq V_{CES} - L_S di/dt$	V
I_{SC} (SCSOA)	$V_{CE} = 720 \text{ V}$; $V_{GE} = \pm 15 \text{ V}$; $R_G = 75 \Omega$ $t_p \leq 10 \mu\text{s}$; non-repetitive; $T_{VJ} = 125^{\circ}\text{C}$		60	A
R_{thJC}				1.05 K/W

Brake Chopper D7

Symbol	Conditions	Maximum Ratings		
V_{RRM}	$T_{VJ} = 25^{\circ}\text{C}$ to 150°C	1200	V	
I_{F25}	$T_C = 25^{\circ}\text{C}$	16	A	
I_{F80}	$T_C = 80^{\circ}\text{C}$	11	A	
Symbol	Conditions	Characteristic Values		
		min.	typ.	max.
V_F	$I_F = 65\text{ A}$; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		3.0 2.6	3.3 V
I_R	$V_R = V_{RRM}$; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		0.07	0.06 mA mA
R_{thJC}				3.2 K/W

Temperature Sensor NTC

Symbol	Conditions	Characteristic Values		
		min.	typ.	max.
R ₂₅	T = 25°C	4.75	5.0	5.25 kΩ
B _{25/50}			3375	K

Module

Symbol	Conditions	Maximum Ratings	
T_{VJ}	operating	-40...+125	°C
T_{JM}		150	°C
T_{stg}		-40...+125	°C
V_{ISOL}	$I_{ISOL} \leq 1 \text{ mA}$; 50/60 Hz	2500	V~
M_d	Mounting torque (M5)	2.7 - 3.3	Nm

Symbol	Conditions	Characteristic Values		
		min.	typ.	max.
$R_{\text{pin-chip}}$			5	mΩ
d_s	Creepage distance on surface	6		mm
d_A	Strike distance in air	6		mm
R_{thCH}	with heatsink compound		0.02	K/W
Weight			180	g

Dimensions in mm (1 mm = 0.0394")

