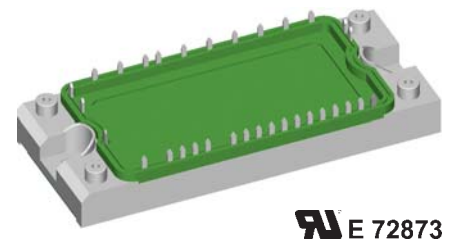
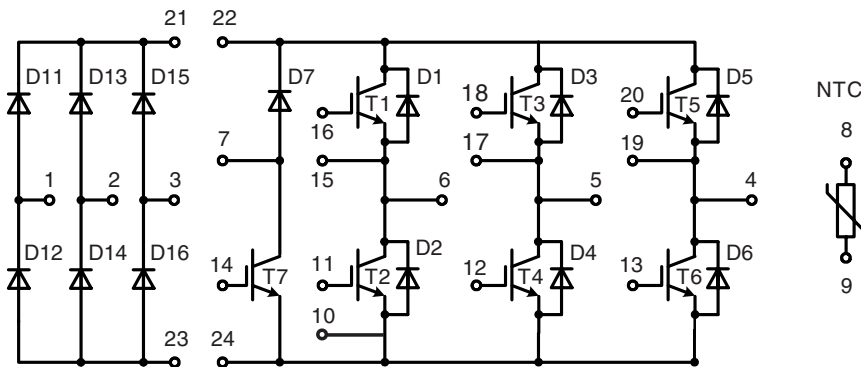


# Converter - Brake - Inverter Module (CBI2) with Trench IGBT technology

Preliminary data



**IXYS** E 72873

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

### 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.
$V_F$	$I_F = 15 \text{ A}$ ; $T_{VJ} = 25^\circ\text{C}$ $T_{VJ} = 125^\circ\text{C}$		1	1.2
			1	V
$I_R$	$V_R = V_{RRM}$ ; $T_{VJ} = 25^\circ\text{C}$ $T_{VJ} = 125^\circ\text{C}$		0.4	0.02
				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 Hiperfast 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 $150^{\circ}\text{C}$	1200	V
$V_{GES}$	Continuous	$\pm 20$	V
$I_{C25}$	$T_C = 25^{\circ}\text{C}$	30	A
$I_{C80}$	$T_C = 80^{\circ}\text{C}$	15	A
$I_{CM}$	$T_C = 80^{\circ}\text{C}$ ; $t_p = 1$ ms	30	A
$P_{tot}$	$T_C = 25^{\circ}\text{C}$	140	W

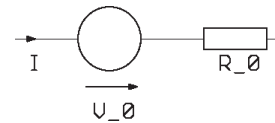
Symbol	Conditions	Characteristic Values			
		$(T_{VJ} = 25^{\circ}\text{C}$ , unless otherwise specified)			
		min.	typ.	max.	
$V_{CE(sat)}$	$I_C = 15$ A; $V_{GE} = 15$ V; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		1.7 2.0	V V	
$V_{GE(th)}$	$I_C = 0.5$ mA; $V_{GE} = V_{CE}$	5	5.8	6.5 V	
$I_{CES}$	$V_{CE} = V_{CES}$ ; $V_{GE} = 0$ V; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		0.7	2.7 mA mA	
$I_{GES}$	$V_{CE} = 0$ V; $V_{GE} = \pm 20$ V			400 nA	
$C_{ies}$	$V_{CE} = 25$ V; $V_{GE} = 0$ V; $f = 1$ MHz		1.1	nF	
$Q_{Gon}$	$V_{CE} = 600$ V; $V_{GE} = 15$ V; $I_C = 15$ A		150	nC	
$t_{d(on)}$ $t_r$ $t_{d(off)}$ $t_t$ $E_{on}$ $E_{off}$	Inductive load, $T_{VJ} = 125^{\circ}\text{C}$ $V_{CE} = 600$ V; $I_C = 15$ A $V_{GE} = \pm 15$ V; $R_G = 75$ $\Omega$		90	ns	
				50	ns
				520	ns
				90	ns
				2.1	mJ
				1.5	mJ
<b>RBSOA</b>	$I_C = I_{CM}$ ; $V_{GE} = \pm 15$ V $R_G = 75$ $\Omega$ ; $T_{VJ} = 125^{\circ}\text{C}$			$V_{CEK} \leq V_{CES} - L_S di/dt$ V	
<b><math>I_{SC}</math> (SCSOA)</b>	$V_{CE} = 720$ V; $V_{GE} = \pm 15$ V; $R_G = 75$ $\Omega$ ; $t_p \leq 10$ $\mu\text{s}$ ; non-repetitive; $T_{VJ} = 125^{\circ}\text{C}$		60	A	
$R_{thJC}$	(per IGBT)			0.88 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.	
$V_F$	$I_F = 15$ A; $V_{GE} = 0$ V; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		2.0 1.5	V V	
$I_{RM}$ $Q_{rr}$ $t_{rr}$ $E_{rec}$	$I_F = tbd$ A; $di_F/dt = -tbd$ A/ $\mu\text{s}$ ; $T_{VJ} = 125^{\circ}\text{C}$ $V_R = 600$ V; $V_{GE} = 0$ V		tbd	A	
			tbd	$\mu\text{C}$	
				tbd	ns
				tbd	mJ
$R_{thJC}$	(per diode)			2.1 K/W	

**Equivalent Circuits for Simulation**
**Conduction**

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

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

T7

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

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

D1-D6

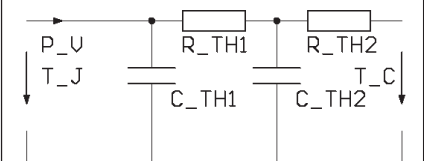
$$V_0 = tbd \text{ V}; R_0 = tbd \text{ m}\Omega$$

D7

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

D11-D16

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

**Thermal Response**


IGBT (typ.)

T1-T6

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

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

T7

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

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

Diode (typ.)

D1-D6

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

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

D7

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

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

D11-D16

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

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

**Brake Chopper T7**

Symbol	Conditions	Maximum Ratings	
$V_{CES}$	$T_{VJ} = 25^{\circ}\text{C}$ to $150^{\circ}\text{C}$	1200	V
$V_{GES}$	Continuous	$\pm 20$	V
$I_{C25}$	$T_C = 25^{\circ}\text{C}$	30	A
$I_{C80}$	$T_C = 80^{\circ}\text{C}$	20	A
$I_{CM}$	$T_C = 80^{\circ}\text{C}; t_p = 1 \text{ ms}$	40	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	2.1	V
		2.0		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	ns
			50	ns
			520	ns
			90	ns
			1.5	mJ
<b>RBSOA</b>	$I_C = I_{CM}; V_{GE} = \pm 15 \text{ V}$ $R_G = 75 \Omega; T_{VJ} = 125^{\circ}\text{C}$			$V_{CEK} \leq V_{CES} - L_S di/dt$ V
<b><math>I_{SC}</math> (SCSOA)</b>	$V_{CE} = 720 \text{ V}; V_{GE} = \pm 15 \text{ V}; R_G = 75 \Omega$ $t_p \leq 10 \mu\text{s}; \text{non-repetitive}; T_{VJ} = 125^{\circ}\text{C}$	60		A
$R_{thJC}$				1.05 KW

**Brake Chopper D7**

Symbol	Conditions	Maximum Ratings	
$V_{RRM}$	$T_{VJ} = 25^{\circ}\text{C}$ to $150^{\circ}\text{C}$	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.
$V_F$	$I_F = 15 \text{ A}; T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	3.0	3.3	V
		2.6		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 KW