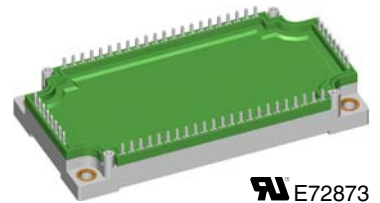
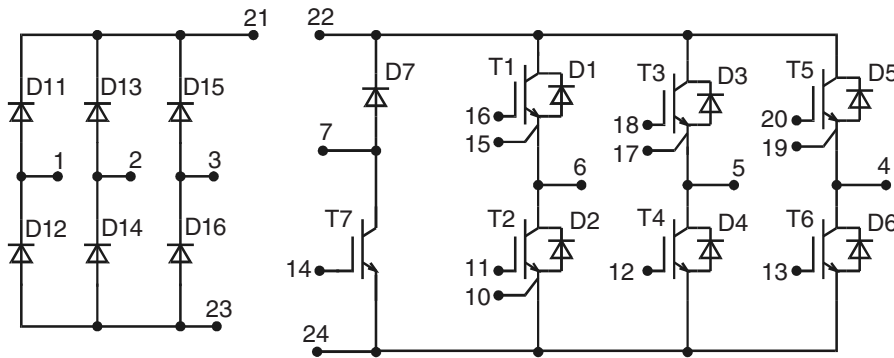


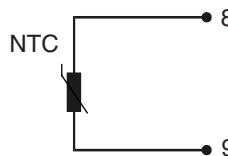
# Converter - Brake - Inverter Module (CBI3)



E72873

See outline drawing for pin arrangement

## Preliminary data



Three Phase Rectifier	Brake Chopper	Three Phase Inverter
$V_{RRM} = 1600 \text{ V}$	$V_{CES} = 1200 \text{ V}$	$V_{CES} = 1200 \text{ V}$
$I_{FAVM} = 70 \text{ A}$	$I_{C25} = 50 \text{ A}$	$I_{C25} = 85 \text{ A}$
$I_{FSM} = 700 \text{ A}$	$V_{CE(sat)} = 2.5 \text{ V}$	$V_{CE(sat)} = 2.2 \text{ V}$

### Input Rectifier D11 - D16

Symbol	Conditions	Maximum Ratings	
$V_{RRM}$		1600	V
$I_{FAV}$	$T_C = 80^\circ\text{C}$ ; sine 180°	50	A
$I_{DAVM}$	$T_C = 80^\circ\text{C}$ ; rectangular; $d = 1/3$ ; bridge	140	A
$I_{FSM}$	$T_{VJ} = 25^\circ\text{C}$ ; $t = 10 \text{ ms}$ ; sine 50 Hz	700	A
$P_{tot}$	$T_C = 25^\circ\text{C}$	135	W

Symbol	Conditions	Characteristic Values ( $T_{VJ} = 25^\circ\text{C}$ , unless otherwise specified)		
		min.	typ.	max.
$V_F$	$I_F = 50 \text{ A}$ ; $T_{VJ} = 25^\circ\text{C}$ $T_{VJ} = 125^\circ\text{C}$		1.1 1.1	1.3 V V
$I_R$	$V_R = V_{RRM}$ ; $T_{VJ} = 25^\circ\text{C}$ $T_{VJ} = 125^\circ\text{C}$		0.8	0.05 mA mA
$R_{thJC}$	(per diode)			0.94 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
- € NPT IGBT technology with low saturation voltage, low switching losses, high RBSOA and short circuit ruggedness
- € 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**

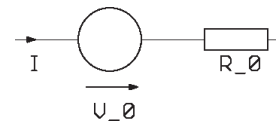
Symbol	Conditions	Maximum Ratings	
$V_{CES}$	$T_{VJ} = 25^{\circ}\text{C}$ to $150^{\circ}\text{C}$	1200	V
$V_{GES}$	Continuous	$\pm 20$	V
$I_{C25}$	$T_C = 25^{\circ}\text{C}$	85	A
$I_{C80}$	$T_C = 80^{\circ}\text{C}$	60	A
<b>RBSOA</b>	$V_{GE} = \pm 15\text{ V}$ ; $R_G = 22\ \Omega$ ; $T_{VJ} = 125^{\circ}\text{C}$ Clamped inductive load; $L = 100\ \mu\text{H}$	$I_{CM} = 100$ $V_{CEK} \leq V_{CES}$	A
$t_{SC}$ <b>(SCSOA)</b>	$V_{CE} = V_{CES}$ ; $V_{GE} = \pm 15\text{ V}$ ; $R_G = 22\ \Omega$ ; $T_{VJ} = 125^{\circ}\text{C}$ non-repetitive	10	$\mu\text{s}$
$P_{tot}$	$T_C = 25^{\circ}\text{C}$	350	W

Symbol	Conditions	Characteristic Values			
		(T <sub>VJ</sub> = 25°C, unless otherwise specified)			
		min.	typ.	max.	
$V_{CE(sat)}$	$I_C = 50\text{ A}$ ; $V_{GE} = 15\text{ V}$ ; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	2.2 2.5		2.6 V	
$V_{GE(th)}$	$I_C = 2\text{ mA}$ ; $V_{GE} = V_{CE}$	4.5		6.5 V	
$I_{CES}$	$V_{CE} = V_{CES}$ ; $V_{GE} = 0\text{ V}$ ; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	3.1		3.7 mA	
$I_{GES}$	$V_{CE} = 0\text{ V}$ ; $V_{GE} = \pm 20\text{ V}$			200 nA	
$t_{d(on)}$ $t_r$ $t_{d(off)}$ $t_f$ $E_{on}$ $E_{off}$	Inductive load, $T_{VJ} = 125^{\circ}\text{C}$ $V_{CE} = 600\text{ V}$ ; $I_C = 50\text{ A}$ $V_{GE} = \pm 15\text{ V}$ ; $R_G = 22\ \Omega$		100	ns	
				70	ns
				500	ns
				70	ns
				7.6	mJ
				5.6	mJ
$C_{ies}$	$V_{CE} = 25\text{ V}$ ; $V_{GE} = 0\text{ V}$ ; $f = 1\text{ MHz}$	3.3		nF	
$Q_{Gon}$	$V_{CE} = 600\text{ V}$ ; $V_{GE} = 15\text{ V}$ ; $I_C = 50\text{ A}$	230		nC	
$R_{thJC}$	(per IGBT)			0.35 K/W	

**Output Inverter D1 - D6**

Symbol	Conditions	Maximum Ratings	
$I_{F25}$	$T_C = 25^{\circ}\text{C}$	110	A
$I_{F80}$	$T_C = 80^{\circ}\text{C}$	70	A

Symbol	Conditions	Characteristic Values		
		min.	typ.	max.
$V_F$	$I_F = 50\text{ A}$ ; $V_{GE} = 0\text{ V}$ ; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	2.1 1.5		2.5 V
$I_{RM}$ $t_{rr}$	$I_F = 60\text{ A}$ ; $di_F/dt = -500\text{ A}/\mu\text{s}$ ; $T_{VJ} = 125^{\circ}\text{C}$ $V_R = 600\text{ V}$ ; $V_{GE} = 0\text{ V}$		41	A
				200
$R_{thJC}$	(per diode)			0.61 K/W

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

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

$$V_0 = 1.5\text{ V}; R_0 = 20\text{ m}\Omega$$

T7

$$V_0 = 1.5\text{ V}; R_0 = 40\text{ m}\Omega$$

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

D1-D6

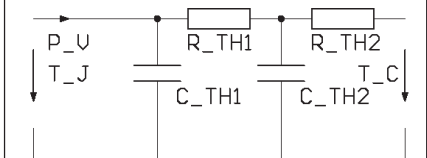
$$V_0 = 1.25\text{ V}; R_0 = 5.5\text{ m}\Omega$$

D7

$$V_0 = 1.3\text{ V}; R_0 = 30\text{ m}\Omega$$

D11-D16

$$V_0 = 0.85\text{ V}; R_0 = 5\text{ m}\Omega$$

**Thermal Response**


IGBT (typ.)

T1-T6

$$C_{th1} = 0.216\text{ J/K}; R_{th1} = 0.264\text{ K/W}$$

$$C_{th2} = 1.338\text{ J/K}; R_{th2} = 0.086\text{ K/W}$$

T7

$$C_{th1} = 0.134\text{ J/K}; R_{th1} = 0.424\text{ K/W}$$

$$C_{th2} = 0.986\text{ J/K}; R_{th2} = 0.126\text{ K/W}$$

Diode (typ.)

D1-D6

$$C_{th1} = 0.138\text{ J/K}; R_{th1} = 0.48\text{ K/W}$$

$$C_{th2} = 0.957\text{ J/K}; R_{th2} = 0.13\text{ K/W}$$

D7

$$C_{th1} = 0.038\text{ J/K}; R_{th1} = 1.725\text{ K/W}$$

$$C_{th2} = 0.439\text{ J/K}; R_{th2} = 0.375\text{ K/W}$$

D11-D16

$$C_{th1} = 0.086\text{ J/K}; R_{th1} = 0.738\text{ K/W}$$

$$C_{th2} = 0.621\text{ J/K}; R_{th2} = 0.202\text{ K/W}$$

**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
$I_{C25}$	$T_C = 25^{\circ}\text{C}$	50	A
$I_{C80}$	$T_C = 80^{\circ}\text{C}$	35	A
<b>RBSOA</b>	$V_{GE} = \pm 15\text{ V}$ ; $R_G = 47\ \Omega$ ; $T_{VJ} = 125^{\circ}\text{C}$ Clamped inductive load; $L = 100\ \mu\text{H}$	$I_{CM} = 50$ $V_{CEK} \leq V_{CES}$	A
$t_{SC}$ <b>(SCSOA)</b>	$V_{CE} = V_{CES}$ ; $V_{GE} = \pm 15\text{ V}$ ; $R_G = 47\ \Omega$ ; $T_{VJ} = 125^{\circ}\text{C}$ non-repetitive	10	$\mu\text{s}$
$P_{tot}$	$T_C = 25^{\circ}\text{C}$	225	W

Symbol	Conditions	Characteristic Values		
		(T <sub>VJ</sub> = 25°C, unless otherwise specified)		
		min.	typ.	max.
$V_{CE(sat)}$	$I_C = 35\text{ A}$ ; $V_{GE} = 15\text{ V}$ ; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		2.5	3.1 V
			2.9	V
$V_{GE(th)}$	$I_C = 1\text{ mA}$ ; $V_{GE} = V_{CE}$	4.5		6.5 V
$I_{CES}$	$V_{CE} = V_{CES}$ ; $V_{GE} = 0\text{ V}$ ; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		0.8	0.8 mA mA
$I_{GES}$	$V_{CE} = 0\text{ V}$ ; $V_{GE} = \pm 20\text{ V}$			200 nA
$t_{d(on)}$	} Inductive load, $T_{VJ} = 125^{\circ}\text{C}$ $V_{CE} = 600\text{ V}$ ; $I_C = 35\text{ A}$ $V_{GE} = \pm 15\text{ V}$ ; $R_G = 47\ \Omega$		100	ns
$t_r$			70	ns
$t_{d(off)}$			500	ns
$t_t$			70	ns
$E_{on}$			5.3	mJ
$E_{off}$			3.9	mJ
$C_{ies}$	$V_{CE} = 25\text{ V}$ ; $V_{GE} = 0\text{ V}$ ; $f = 1\text{ MHz}$		1.6	nF
$Q_{Gon}$	$V_{CE} = 600\text{ V}$ ; $V_{GE} = 15\text{ V}$ ; $I_C = 25\text{ A}$		120	nC
$R_{thJC}$				0.55 K/W

**Brake Chopper D7**

Symbol	Conditions	Maximum Ratings	
$V_{RRM}$	$T_{VJ} = 25^{\circ}\text{C}$ to $150^{\circ}\text{C}$	1200	V
$I_{F25}$	$T_C = 25^{\circ}\text{C}$	25	A
$I_{F80}$	$T_C = 80^{\circ}\text{C}$	16	A

Symbol	Conditions	Characteristic Values		
		min.	typ.	max.
$V_F$	$I_F = 35\text{ A}$ ; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		3.0	3.4 V
			2.3	V
$I_R$	$V_R = V_{RRM}$ ; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		0.1	0.1 mA mA
$I_{RM}$	} $I_F = 15\text{ A}$ ; $di_F/dt = -400\text{ A}/\mu\text{s}$ ; $T_{VJ} = 125^{\circ}\text{C}$ $V_R = 600\text{ V}$		16	A
$t_{rr}$			130	ns
$R_{thJC}$				2.1 K/W

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## Temperature Sensor NTC

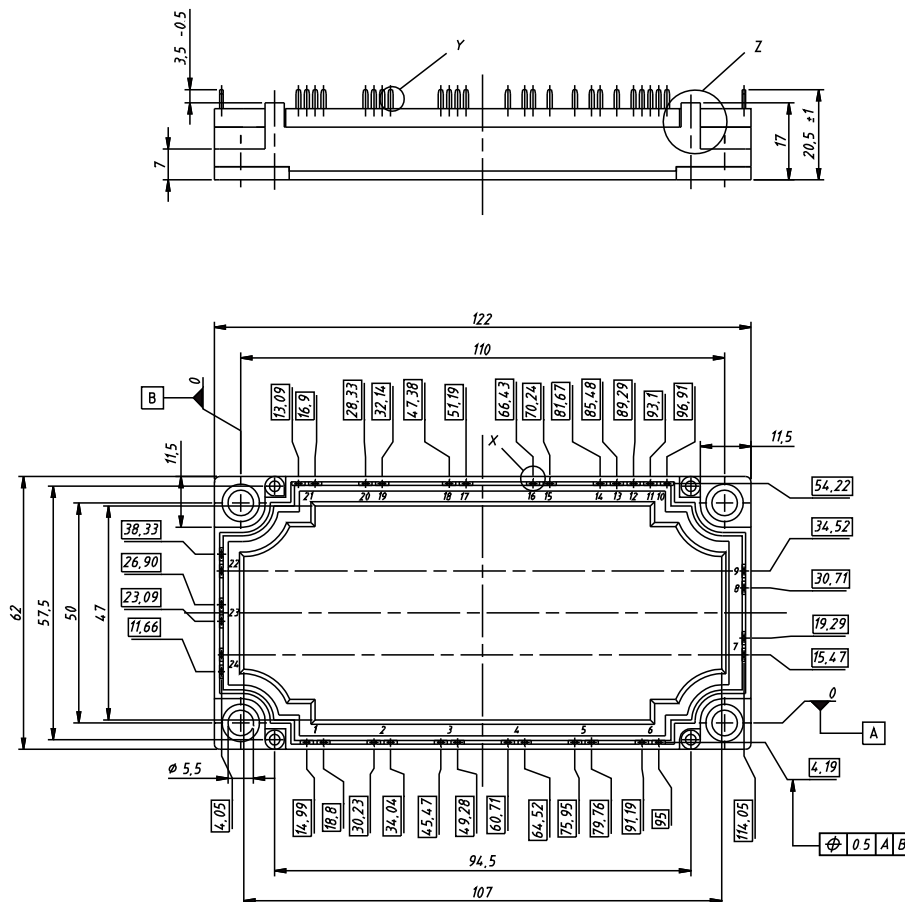
Symbol	Conditions	Characteristic Values		
		min.	typ.	max.
$R_{25}$	$T = 25^{\circ}\text{C}$	4.75	5.0	5.25 k $\Omega$
$B_{25/50}$			3375	K

## Module

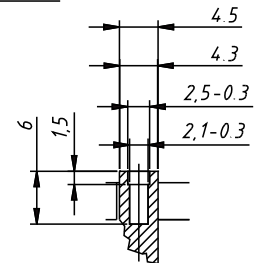
Symbol	Conditions	Maximum Ratings	
$T_{VJ}$	operating	-40...+125	$^{\circ}\text{C}$
$T_{JM}$		+150	$^{\circ}\text{C}$
$T_{stg}$		-40...+125	$^{\circ}\text{C}$
$V_{ISOL}$	$I_{ISOL} \leq 1 \text{ mA}; 50/60 \text{ Hz}$	2500	V~
$M_d$	Mounting torque (M5)	3 - 6	Nm

Symbol	Conditions	Characteristic Values		
		min.	typ.	max.
$R_{pin-chip}$			5	m $\Omega$
$d_s$	Creepage distance on surface	6		mm
$d_A$	Strike distance in air	6		mm
$R_{thCH}$	with heatsink compound		0.01	K/W
Weight			300	g

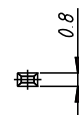
Dimensions in mm (1 mm = 0.0394")



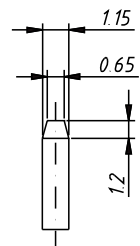
Detail Z



Detail X



Detail Y



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