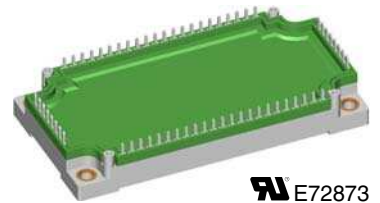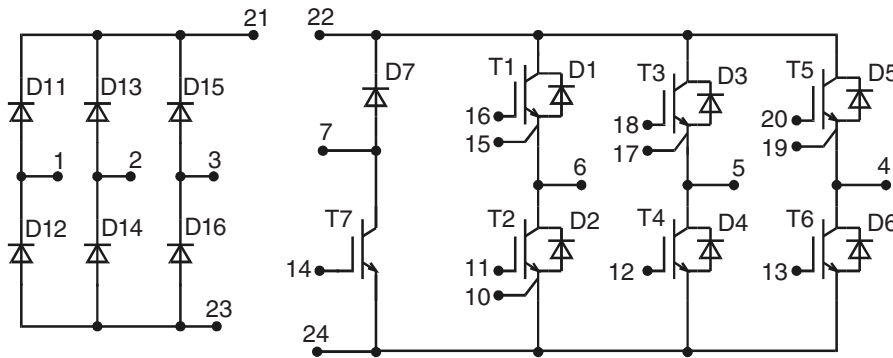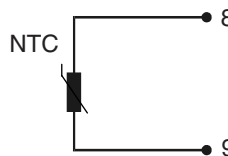# Converter - Brake - Inverter Module (CBI3)

U E72873

See outline drawing for pin arrangement

Preliminary data

Three Phase Rectifier	Brake Chopper	Three Phase Inverter
V_{RRM} = 1600 V	V_{CES} = 600 V	V_{CES} = 600 V
I_{FAVM} = 70 A	I_{C25} = 50 A	I_{C25} = 100 A
I_{FSM} = 700 A	$V_{CE(sat)}$ = 2.0 V	$V_{CE(sat)}$ = 2.0 V

Input Rectifier D11 - D16

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

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified)			
		min.	typ.	max.	
V_F	I_F = 75 A; T_{VJ} = 25°C		1.2	1.4	V
	T_{VJ} = 125°C		1.2		V
I_R	V_R = V_{RRM}; T_{VJ} = 25°C			0.05	mA
	T_{VJ} = 125°C		0.8		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

IXYS reserves the right to change limits, test conditions and dimensions.

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MUBW 75-06 A8

Output Inverter T1 - T6

Symbol	Conditions		Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C		600	V
V_{GES}	Continuous		± 20	V
I_{C25}	T_C = 25°C		100	A
I_{C80}	T_C = 80°C		65	A
RBSOA	V_{GE} = ±15 V; R_G = 15 Ω; T_{VJ} = 125°C	I_{CM} =	150	A
	Clamped inductive load; L = 100 µH	$V_{CEK} \leq V_{CES}$		
t_{SC} (SCSOA)	V_{CE} = V_{CES}; V_{GE} = ±15 V; R_G = 15 Ω; T_{VJ} = 125°C non-repetitive		10	µs
P_{tot}	T_C = 25°C		320	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified)			
		min.	typ.	max.	
$V_{CE(sat)}$	I_C = 75 A; V_{GE} = 15 V; T_{VJ} = 25°C		2.0	2.5	V
	T_{VJ} = 125°C		2.3		V
$V_{GE(th)}$	I_C = 1.5 mA; V_{GE} = V_{CE}	4.5		6.5	V
I_{CES}	V_{CE} = V_{CES}; V_{GE} = 0 V; T_{VJ} = 25°C			1.4	mA
	T_{VJ} = 125°C		1.5		mA
I_{GES}	V_{CE} = 0 V; V_{GE} = ± 20 V			200	nA
$t_{d(on)}$			150		ns
t_r	Inductive load, T_{VJ} = 125°C		60		ns
$t_{d(off)}$	V_{CE} = 300 V; I_C = 75 A		450		ns
t_f	V_{GE} = ±15 V; R_G = 15 Ω		40		ns
E_{on}			4.0		mJ
E_{off}			3.3		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz		4.2		nF
Q_{Gon}	V_{CE}= 300V; V_{GE} = 15 V; I_C = 100 A		260		nC
R_{thJC}	(per IGBT)			0.39	K/W

Output Inverter D1 - D6

Symbol	Conditions	Maximum Ratings	
I_{F25}	T_C = 25°C	140	A
I_{F80}	T_C = 80°C	85	A

Symbol	Conditions	Characteristic Values			
		min.	typ.	max.	
V_F	I_F = 75 A; V_{GE} = 0 V; T_{VJ} = 25°C		1.7	2.0	V
	T_{VJ} = 125°C		1.2		V
I_{RM}	I_F = 60 A; di_F/dt = -500 A/µs; T_{VJ} = 125°C		28		A
t_{rr}	V_R = 300 V; V_{GE} = 0 V		100		ns
R_{thJC}	(per diode)			0.61	K/W

Equivalent Circuits for Simulation

Conduction
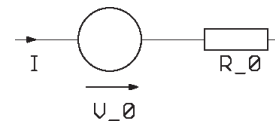
IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
T1-T6
V_0 = 1.21 V; R_0 = 15 mΩ
T7
V_0 = 1.06 V; R_0 = 36 mΩ

Diode (typ. at T_J = 125°C)
D1-D6
V_0 = 1.1 V; R_0 = 2 mΩ
D7
V_0 = 1.1 V; R_0 = 12 mΩ
D11-D16
V_0 = 0.85 V; R_0 = 5 mΩ

Thermal Response
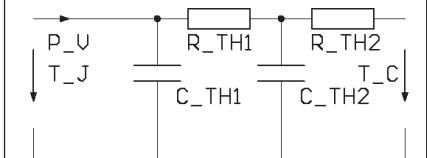
IGBT (typ.)
T1-T6
C_{th1} = 0.177 J/K; R_{th1} = 0.293 K/W
C_{th2} = 1.228 J/K; R_{th2} = 0.097 K/W
T7
C_{th1} = 0.088 J/K; R_{th1} = 0.583 K/W
C_{th2} = 0.799 J/K; R_{th2} = 0.167 K/W

Diode (typ.)
D1-D6
C_{th1} = 0.138 J/K; R_{th1} = 0.48 K/W
C_{th2} = 0.957 J/K; R_{th2} = 0.13 K/W
D7
C_{th1} = 0.038 J/K; R_{th1} = 1.725 K/W
C_{th2} = 0.439 J/K; R_{th2} = 0.375 K/W
D11-D16
C_{th1} = 0.086 J/K; R_{th1} = 0.738 K/W
C_{th2} = 0.621 J/K; R_{th2} = 0.202 K/W

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Brake Chopper T7

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	600	V
V_{GES}	Continuous	± 20	V
I_{C25}	T_C = 25°C	50	A
I_{C80}	T_C = 80°C	35	A
RBSOA	V_{GE} = ±15 V; R_G = 33 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 60 $V_{CEK} \leq V_{CES}$	A
t_{SC} (SCSOA)	V_{CE} = V_{CES}; V_{GE} = ±15 V; R_G = 33 Ω; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	165	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified)			
		min.	typ.	max.	
$V_{CE(sat)}$	I_C = 35 A; V_{GE} = 15 V; T_{VJ} = 25°C		2.0	2.5	V
	T_{VJ} = 125°C		2.3		V
$V_{GE(th)}$	I_C = 0.7 mA; V_{GE} = V_{CE}	4.5		6.5	V
I_{CES}	V_{CE} = V_{CES}; V_{GE} = 0 V; T_{VJ} = 25°C			0.5	mA
	T_{VJ} = 125°C		0.3		mA
I_{GES}	V_{CE} = 0 V; V_{GE} = ± 20 V			200	nA
$t_{d(on)}$			50		ns
t_r	Inductive load, T_{VJ} = 125°C		50		ns
$t_{d(off)}$	V_{CE} = 300 V; I_C = 35 A		270		ns
t_f	V_{GE} = ±15 V; R_G = 33 Ω		40		ns
E_{on}			1.63		mJ
E_{off}			1.17		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MH z		1.6		nF
Q_{Gon}	V_{CE} = 300 V; V_{GE} = 15 V; I_C = 25 A		94		nC
R_{thJC}				0.75	K/W

Brake Chopper D7

Symbol	Conditions	Maximum Ratings	
V_{RRM}	T_{VJ} = 25°C to 150°C	600	V
I_{F25}	T_C = 25°C	35	A
I_{F80}	T_C = 80°C	24	A

Symbol	Conditions	Characteristic Values			
		min.	typ.	max.	
V_F	I_F = 35 A; T_{VJ} = 25°C		2.0	2.3	V
	T_{VJ} = 125°C		1.5		V
I_R	V_R = V_{RRM}; T_{VJ} = 25°C			0.1	mA
	T_{VJ} = 125°C		0.1		mA
I_{RM}	I_F = 15 A; di_F/dt = -400 A/µs; T_{VJ} = 125°C		13		A
t_{rr}	V_R = 300 V		90		ns
R_{thJC}				2.1	K/W

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Temperature Sensor NTC
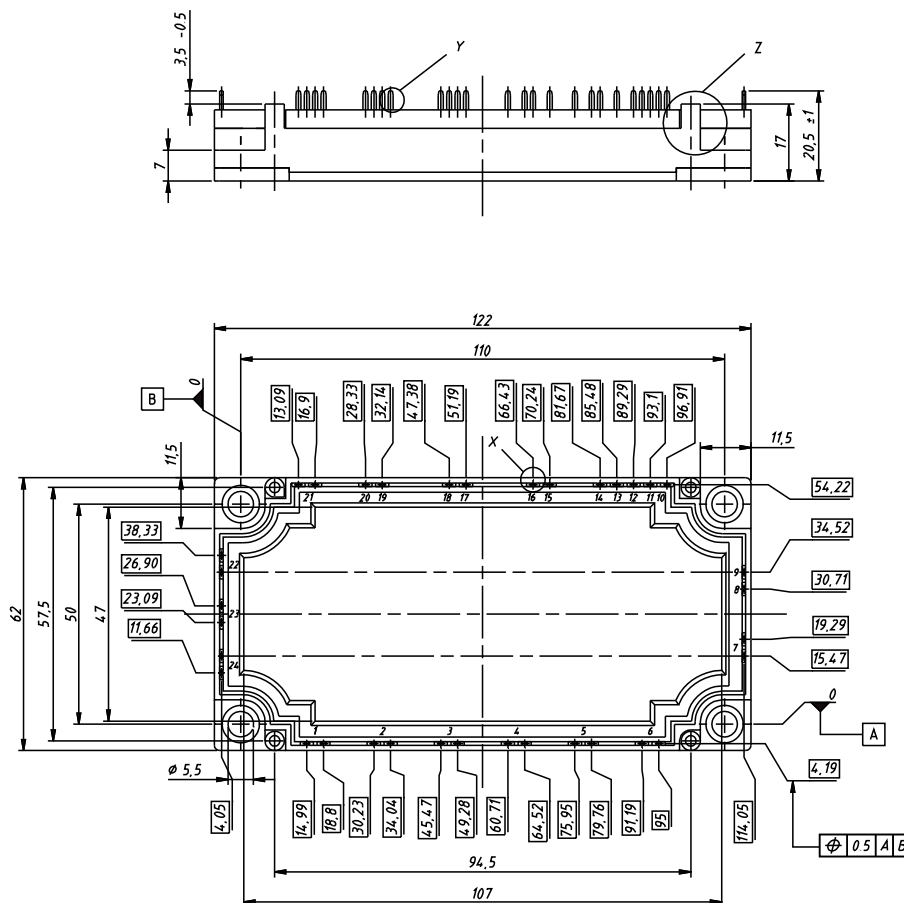
Symbol	Conditions	Characteristic Values			
		min.	typ.	max.	
R_{25}	T = 25°C	4.75	5.0	5.25	kΩ
$B_{25/50}$			3375		K

Module

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

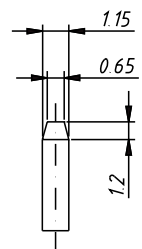| Symbol	Conditions	Characteristic Values			
		min.	typ.	max.	
$R_{pin-chip}$			5		mΩ
d_S	Creepage distance on surface	6			mm
d_A	Strike distance in air	6			mm
R_{thCH}	with heatsink compound		0.01		K/W
Weight			300		g

Dimensions in mm (1 mm = 0.0394")

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