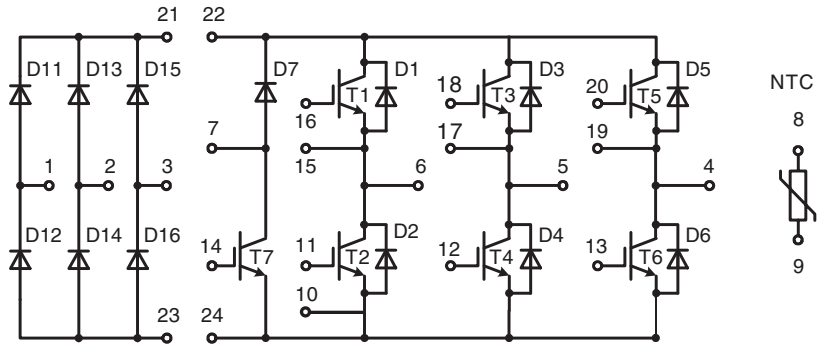
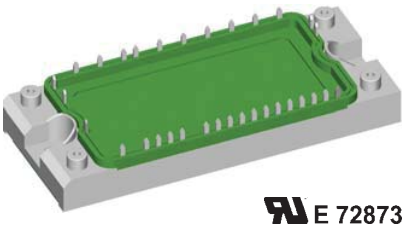
Converter - Brake - Inverter Module (CBI2) with Trench IGBT technology

Preliminary data





E 72873

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

Input Rectifier Bridge D11 - D16

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

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
V_F	I_F = 25 A; T_{VJ} = 25°C		1.1	1.3	V
	T_{VJ} = 125°C		1.1		V
I_R	$V_R = V_{RRM}$; T_{VJ} = 25°C			0.02	mA
	T_{VJ} = 125°C		0.4		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°C to 150°C	1200	V
V_{GES}	Continuous	± 20	V
I_{C25}	T_C = 25°C	45	A
I_{C80}	T_C = 80°C	25	A
I_{CM}	T_C = 80°C; t_p = 1 ms	50	A
P_{tot}	T_C = 25°C	170	W

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

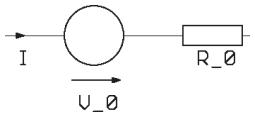
Output Inverter D1 - D6

Symbol	Conditions	Maximum Ratings	
I_{F25}	T_C = 25°C	25	A
I_{F80}	T_C = 80°C	17	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 25 A; V_{GE} = 0 V; T_{VJ} = 25°C		2.1	2.6	V
	T_{VJ} = 125°C		1.6		V
I_{RM}	I_F = tbd A; di_F/dt = -tbd A/µs; T_{VJ} = 125°C		tbd		A
Q_{rr}	V_R = 600 V; V_{GE} = 0 V		tbd		µC
t_{rr}			tbd		ns
E_{rec}			tbd		mJ
R_{thJC}	(per diode)			2.1	K/W

Equivalent Circuits for Simulation

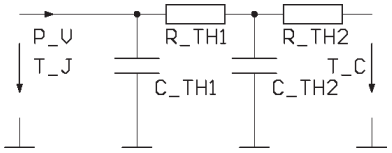
Conduction



IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
T1-T6
V_0 = 0.92 V; R_0 = 42.8 mΩ
T7
V_0 = 0.92 V; R_0 = 72 mΩ

Diode (typ. at T_J = 125°C)
D1-D6
V_0 = tbd V; R_0 = tbd mΩ
D7
V_0 = tbd V; R_0 = tbd mΩ
D11-D16
V_0 = tbd V; R_0 = tbd mΩ

Thermal Response



IGBT (typ.)
T1-T6
C_{th1} = tbd J/K; R_{th1} = tbd K/W
C_{th2} = tbd J/K; R_{th2} = tbd K/W
T7
C_{th1} = tbd J/K; R_{th1} = tbd K/W
C_{th2} = tbd J/K; R_{th2} = tbd K/W

Diode (typ.)
D1-D6
C_{th1} = tbd J/K; R_{th1} = tbd K/W
C_{th2} = tbd J/K; R_{th2} = tbd K/W
D7
C_{th1} = tbd J/K; R_{th1} = tbd K/W
C_{th2} = tbd J/K; R_{th2} = tbd K/W
D11-D16
C_{th1} = tbd J/K; R_{th1} = tbd K/W
C_{th2} = tbd J/K; R_{th2} = tbd K/W

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Brake Chopper T7

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

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

Brake Chopper D7

Symbol	Conditions	Maximum Ratings	
V_{RRM}	T_{VJ} = 25°C to 150°C	1200	V
I_{F25}	T_C = 25°C	16	A
I_{F80}	T_C = 80°C	11	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 65 A; T_{VJ} = 25°C		3.0	3.3	V
	T_{VJ} = 125°C		2.6		V
I_R	V_R = V_{RRM}; T_{VJ} = 25°C			0.06	mA
	T_{VJ} = 125°C		0.07		mA
R_{thJC}				3.2	K/W

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Temperature Sensor NTC

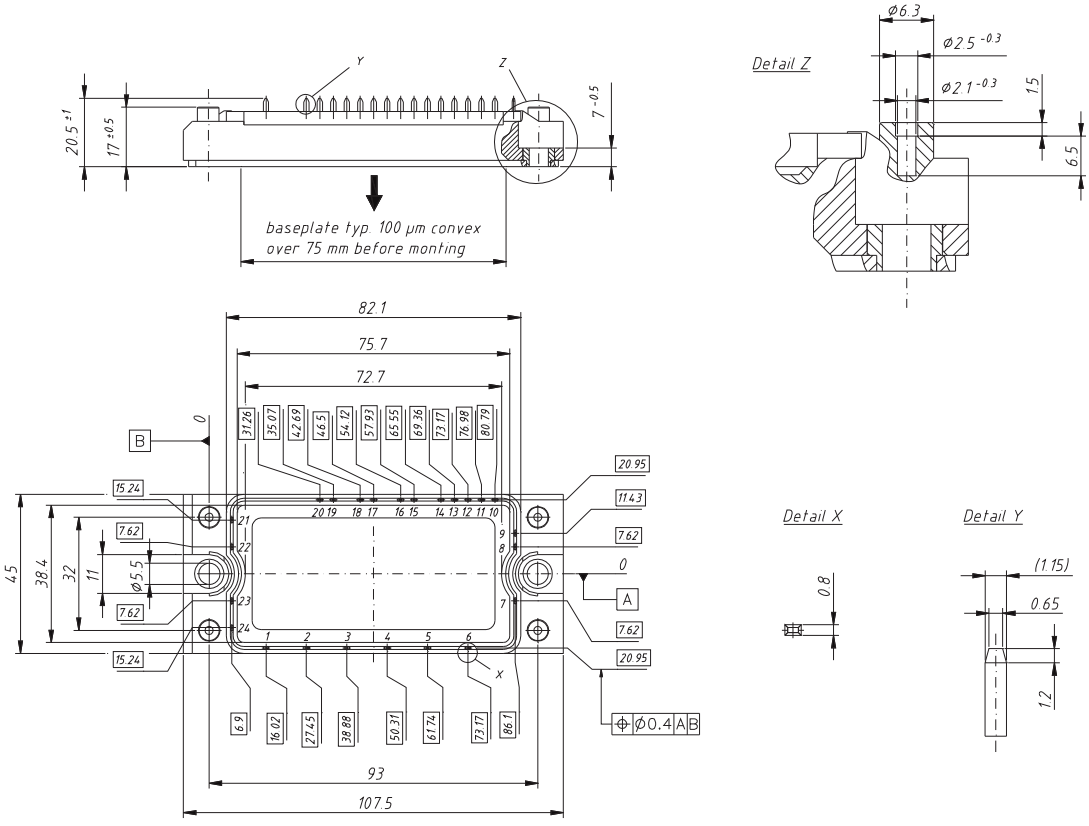
Symbol	Conditions	Characteristic Values min.	typ.	max.	
R_{25}	T = 25°C	4.75	5.0	5.25	kΩ
$B_{25/50}$			3375		K

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)	2.7 - 3.3	Nm

Symbol	Conditions	Characteristic Values min.	typ.	max.	
$R_{pin\text{-}chip}$			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")



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