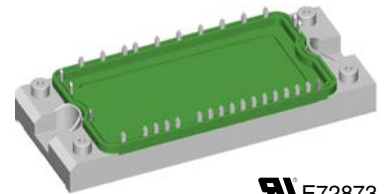
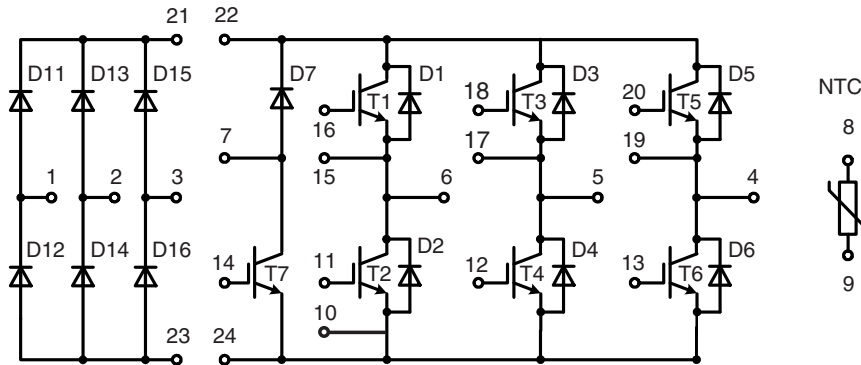


Converter - Brake - Inverter Module (CBI2)

Trench-IGBT



E72873

See outline drawing for pin arrangement

Preliminary data

Three Phase Rectifier	Brake Chopper	Three Phase Inverter
$V_{RRM} = 1600 \text{ V}$	$V_{CES} = 1200 \text{ V}$	$V_{CES} = 1200 \text{ V}$
$I_{FAVM25} = 42 \text{ A}$	$I_{C25} = 35 \text{ A}$	$I_{C25} = 62 \text{ A}$
$I_{FSM} = 300 \text{ A}$	$V_{CE(sat)} = 2.3 \text{ V}$	$V_{CE(sat)} = 2 \text{ V}$

Input Rectifier Bridge D11 - D16

Symbol	Conditions	Maximum Ratings	
V_{RRM}		1600	V
I_{FAV}	$T_C = 80^\circ\text{C}$; sine 180°	30	A
I_{DAVM}	$T_C = 80^\circ\text{C}$; rectangular; $d = 1/3$; bridge	80	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	$I_F = 35 \text{ A}$; $T_{VJ} = 25^\circ\text{C}$ $T_{VJ} = 125^\circ\text{C}$		1.2 1.2	1.4 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 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°C	1200	V
V_{GES}	Continuous	± 20	V
I_{C25}	$T_C = 25^{\circ}\text{C}$	62	A
I_{C80}	$T_C = 80^{\circ}\text{C}$	44	A
I_{CM} V_{CEK}	RBSOA; $V_{GE} = \pm 15\text{ V}$; $R_G = 27\ \Omega$; $T_{VJ} = 125^{\circ}\text{C}$ Clamped inductive load; $L = 100\ \mu\text{H}$	100 V_{CES}	A
t_{SC} (SCSOA)	$V_{CE} = 900\text{ V}$; $V_{GE} = \pm 15\text{ V}$; $R_G = 27\ \Omega$; $T_{VJ} = 125^{\circ}\text{C}$ non-repetitive	10	μs
P_{tot}	$T_C = 25^{\circ}\text{C}$	220	W

Symbol	Conditions	Characteristic Values ($T_{VJ} = 25^{\circ}\text{C}$, unless otherwise specified)		
		min.	typ.	max.
$V_{CE(sat)}$	$I_C = 40\text{ A}$; $V_{GE} = 15\text{ V}$; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	2.0 2.4		2.6 V
$V_{GE(th)}$	$I_C = 1.5\text{ mA}$; $V_{GE} = V_{CE}$	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		1.75 mA mA
I_{GES}	$V_{CE} = 0\text{ V}$; $V_{GE} = \pm 20\text{ V}$			400 nA
$t_{d(on)}$ t_r $t_{d(off)}$ t_f E_{on} E_{off}	Inductive load, $T_{VJ} = 125^{\circ}\text{C}$ $V_{CE} = 600\text{ V}$; $I_C = 40\text{ A}$ $V_{GE} = \pm 15\text{ V}$; $R_G = 27\ \Omega$	90 50 520 90 4 4.7		ns ns ns ns mJ mJ
C_{les}		2.5		nF
Q_{Gon}		330		nC
R_{thJC}	(per IGBT)			0.6 K/W

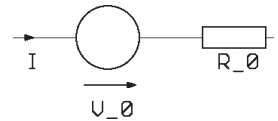
Output Inverter D1 - D6

Symbol	Conditions	Maximum Ratings	
I_{F25}	$T_C = 25^{\circ}\text{C}$	50	A
I_{F80}	$T_C = 80^{\circ}\text{C}$	33	A

Symbol	Conditions	Characteristic Values		
		min.	typ.	max.
V_F	$I_F = 40\text{ A}$; $V_{GE} = 0\text{ V}$; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		1.9 3.0 2.2	V V V
I_{RM} t_{rr} $E_{rec(off)}$	$I_F = 30\text{ A}$; $di_F/dt = -1100\text{ A}/\mu\text{s}$; $T_{VJ} = 125^{\circ}\text{C}$ $V_R = 600\text{ V}$; $V_{GE} = 0\text{ V}$	51 180 1.8		A ns mJ
R_{thJC}				1.19 K/W

Equivalent Circuits for Simulation

Conduction



D11 - D16

Rectifier Diode (typ. at $T_J = 125^{\circ}\text{C}$)
 $V_0 = 0.83\text{ V}$; $R_0 = 11\text{ m}\Omega$

T1 - T6 / D1 - D6

IGBT (typ. at $V_{GE} = 15\text{ V}$; $T_J = 125^{\circ}\text{C}$)
 $V_0 = tbd$; $R_0 = tbd$

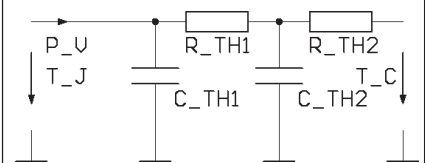
Free Wheeling Diode (typ. at $T_J = 125^{\circ}\text{C}$)
 $V_0 = 1.26\text{ V}$; $R_0 = 15\text{ m}\Omega$

T7 / D7

IGBT (typ. at $V_{GE} = 15\text{ V}$; $T_J = 125^{\circ}\text{C}$)
 $V_0 = 1.37\text{ V}$; $R_0 = 62\text{ m}\Omega$

Free Wheeling Diode (typ. at $T_J = 125^{\circ}\text{C}$)
 $V_0 = 1.39\text{ V}$; $R_0 = 56\text{ m}\Omega$

Thermal Response



D11 - D16

Rectifier Diode (typ.)
 $C_{th1} = 0.106\text{ J/K}$; $R_{th1} = 1.06\text{ K/W}$
 $C_{th2} = 0.79\text{ J/K}$; $R_{th2} = 0.239\text{ K/W}$

T1 - T6 / D1 - D6

IGBT (typ.)
 $C_{th1} = tbd$; $R_{th1} = tbd$
 $C_{th2} = tbd$; $R_{th2} = tbd$

Free Wheeling Diode (typ.)
 $C_{th1} = 0.116\text{ J/K}$; $R_{th1} = 0.973\text{ K/W}$
 $C_{th2} = 0.879\text{ J/K}$; $R_{th2} = 0.217\text{ K/W}$

T7 / D7

IGBT (typ.)
 $C_{th1} = 0.156\text{ J/K}$; $R_{th1} = 0.545\text{ K/W}$
 $C_{th2} = 1.162\text{ J/K}$; $R_{th2} = 0.155\text{ K/W}$

Free Wheeling Diode (typ.)
 $C_{th1} = 0.043\text{ J/K}$; $R_{th1} = 2.738\text{ K/W}$
 $C_{th2} = 0.54\text{ J/K}$; $R_{th2} = 0.462\text{ K/W}$

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	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^{\circ}\text{C}$	35	A
I_{C80}	$T_C = 80^{\circ}\text{C}$	25	A
I_{CM}	RB SOA; $V_{GE} = \pm 15\text{ V}$; $R_G = 82\ \Omega$; $T_{VJ} = 125^{\circ}\text{C}$	35	A
V_{CEK}	Clamped inductive load; $L = 100\ \mu\text{H}$	V_{CES}	
t_{SC} (SCSOA)	$V_{CE} = V_{CES}$; $V_{GE} = \pm 15\text{ V}$; $R_G = 82\ \Omega$; $T_{VJ} = 125^{\circ}\text{C}$ non-repetitive	10	μs
P_{tot}	$T_C = 25^{\circ}\text{C}$	180	W

Symbol	Conditions	Characteristic Values		
		(T _{VJ} = 25°C, unless otherwise specified)		
		min.	typ.	max.
$V_{CE(sat)}$	$I_C = 20\text{ A}$; $V_{GE} = 15\text{ V}$; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		2.3 2.6	3 V V
$V_{GE(th)}$	$I_C = 0.6\text{ mA}$; $V_{GE} = V_{CE}$	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
$t_{d(on)}$ t_r $t_{d(off)}$ t_f E_{off}	Inductive load, $T_{VJ} = 125^{\circ}\text{C}$ $V_{CE} = 600\text{ V}$; $I_C = 20\text{ A}$ $V_{GE} = \pm 15\text{ V}$; $R_G = 82\ \Omega$		100 75 500 70 2.4	ns ns ns ns mJ
C_{ies}			1000	pF
Q_{Gon}			70	nC
R_{thJC}				0.7 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 = 20 A; T _{VJ} = 25°C T _{VJ} = 125°C		2.6	3.6 V V
I _R	V _R = V _{RRM} ; T _{VJ} = 25°C T _{VJ} = 125°C		0.07	0.06 mA mA
I _{RM} t _{rr}	} I _F = 20 A; di _F /dt = -400 A/μs; T _{VJ} = 125°C V _R = 600 V		13 110	A ns
R _{thJC}				

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}		-40...+150	°C
T_{JM}		150	°C
T_{stg}		-40...+125	°C
V_{ISOL}	$I_{ISOL} \leq 1 \text{ mA}; 50/60 \text{ Hz}$	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")

