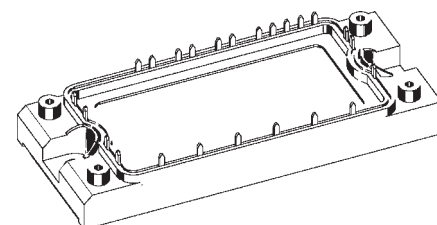
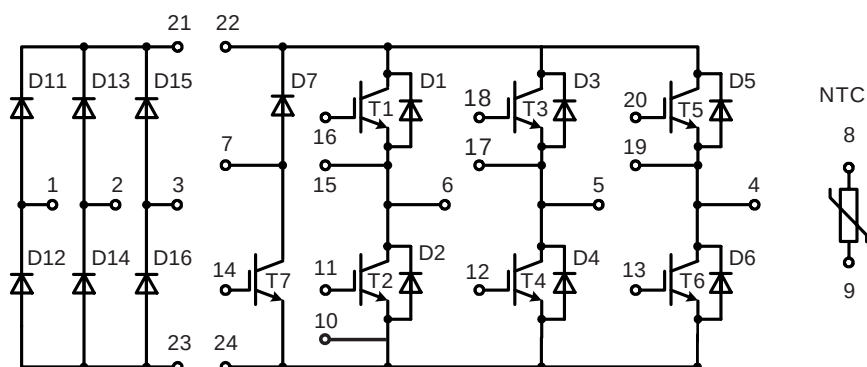


Converter - Brake - Inverter Module (CBI2)

NPT³-IGBT



Three Phase Rectifier	Brake Chopper	Three Phase Inverter
$V_{RRM} = 1600 \text{ V}$	$V_{CES} = 1200 \text{ V}$	$V_{CES} = 1200 \text{ V}$
$I_{FAVM} = 42 \text{ A}$	$I_{C25} = 35 \text{ A}$	$I_{C25} = 52 \text{ A}$
$I_{FSM} = 300 \text{ A}$	$V_{CE(sat)} = 2.3 \text{ V}$	$V_{CE(sat)} = 2.2 \text{ V}$

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 NPT³ 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}	$T_C = 25^{\circ}\text{C}$	52	A
I_{C80}	$T_C = 80^{\circ}\text{C}$	36	A
I_{CM} V_{CEK}	RBSOA; $V_{GE} = \pm 15\text{ V}$; $R_G = 39\ \Omega$; $T_{VJ} = 125^{\circ}\text{C}$ Clamped inductive load; $L = 100\ \mu\text{H}$	50 V_{CES}	A
t_{SC} (SCSOA)	$V_{CE} = 900\text{ V}$; $V_{GE} = \pm 15\text{ V}$; $R_G = 39\ \Omega$; $T_{VJ} = 125^{\circ}\text{C}$ non-repetitive	10	μs
P_{tot}	$T_C = 25^{\circ}\text{C}$	225	W

Symbol	Conditions	Characteristic Values ($T_{VJ} = 25^{\circ}\text{C}$, unless otherwise specified)		
		min.	typ.	max.
$V_{CE(sat)}$	$I_C = 35\text{ A}$; $V_{GE} = 15\text{ V}$; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		2.2 2.5	2.8 V
$V_{GE(th)}$	$I_C = 1\text{ mA}$; $V_{GE} = V_{CE}$	4.5		6.5 V
I_{CES}	$V_{CE} = V_{CES}$; $V_{GE} = 0\text{ V}$; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		0.4	0.4 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_{on} E_{off}	Inductive load, $T_{VJ} = 125^{\circ}\text{C}$ $V_{CE} = 600\text{ V}$; $I_C = 35\text{ A}$ $V_{GE} = \pm 15\text{ V}$; $R_G = 39\ \Omega$		150 60 700 50 4.2 3.5	ns ns ns ns mJ mJ
C_{ies}			2	nF
Q_{Gon}			250	nC
R_{thJC}	(per IGBT)			0.55 K/W

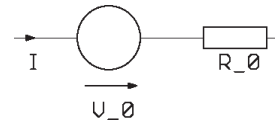
Output Inverter D1 - D6

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	$I_F = 35\text{ A}$; $V_{GE} = 0\text{ V}$; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		1.8	2.8 V
I_{RM} t_{rr}	$I_F = 30\text{ A}$; $di_F/dt = -500\text{ A}/\mu\text{s}$; $T_{VJ} = 125^{\circ}\text{C}$ $V_R = 600\text{ V}$; $V_{GE} = 0\text{ V}$		27 150	A ns
R_{thJC}	(per diode)			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 $V_{GE} = 15\text{ V}$; $T_J = 125^{\circ}\text{C}$)
 $V_0 = 0.95\text{ V}$; $R_0 = 45\text{ m}\Omega$

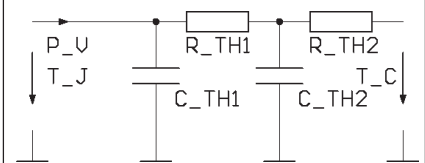
Free Wheeling Diode (typ. at $T_J = 125^{\circ}\text{C}$)
 $V_0 = 1.26\text{ V}$; $R_0 = 15\text{ m}\Omega$

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.)
 $C_{th1} = 0.201\text{ J/K}$; $R_{th1} = 0.419\text{ K/W}$
 $C_{th2} = 1.25\text{ J/K}$; $R_{th2} = 0.131\text{ K/W}$

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°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} V_{CEK}	RBSOA; $V_{GE} = \pm 15\text{ V}$; $R_G = 82\ \Omega$; $T_{VJ} = 125^{\circ}\text{C}$ Clamped inductive load; $L = 100\ \mu\text{H}$	35 V_{CES}	A
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_{on} 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 3.1 2.4	ns ns ns ns mJ mJ
C_{ies}			1000	pF
Q_{Gon}			70	nC
R_{thJC}				0.7 K/W

Brake Chopper D7

Symbol	Conditions	Maximum Ratings	
V_{RRM}	$T_{VJ} = 25^{\circ}\text{C}$ to 150°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	$I_F = 20\text{ A}$; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		2.6	3.6 V 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
I_{RM} t_{rr}	$I_F = 20\text{ A}$; $di_F/dt = -400\text{ A}/\mu\text{s}$; $T_{VJ} = 125^{\circ}\text{C}$ $V_R = 600\text{ V}$		13 110	A ns
R_{thJC}				3.2 K/W

