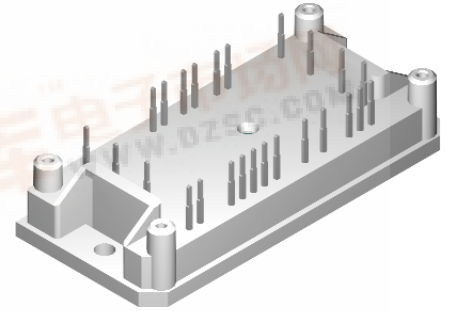
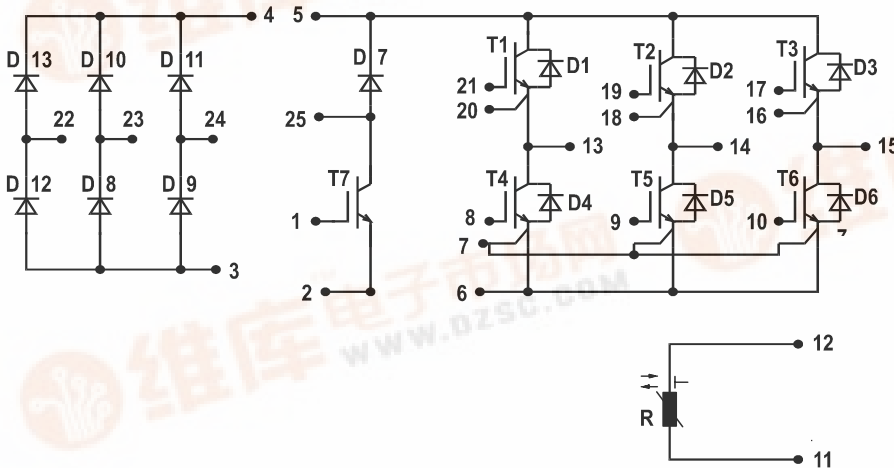


Converter - Brake - Inverter Module (CBI1)

NPT IGBT



Three Phase Rectifier	Brake Chopper	Three Phase Inverter
$V_{RRM} = 1600 \text{ V}$	$V_{CES} = 600 \text{ V}$	$V_{CES} = 600 \text{ V}$
$I_{DAVM25} = 95 \text{ A}$	$I_{C25} = 12 \text{ A}$	$I_{C25} = 25 \text{ A}$
$I_{FSM} = 250 \text{ A}$	$V_{CE(sat)} = 2.25 \text{ V}$	$V_{CE(sat)} = 2.0 \text{ V}$

Input Rectifier Bridge D8 - D13

Symbol	Conditions	Maximum Ratings	
V_{RRM}		1600	V
I_{FAV}	$T_C = 80^\circ\text{C}$; sine 180°	23	A
I_{DAVM}	bridge output current; $T_C = 80^\circ\text{C}$; rectangular; $d = 1/3$	65	A
I_{FSM}	$T_{VJ} = 25^\circ\text{C}$; $t = 10 \text{ ms}$; sine 50 Hz	250	A
P_{tot}	$T_C = 25^\circ\text{C}$	65	W

Symbol	Conditions	Characteristic Values		
		$(T_{VJ} = 25^\circ\text{C}, \text{ unless otherwise specified})$		
		min.	typ.	max.
V_F	$I_F = 30 \text{ A}; T_{VJ} = 25^\circ\text{C}$		1.1	1.45 V
	$T_{VJ} = 125^\circ\text{C}$		1.2	V
I_R	$V_R = V_{RRM}; T_{VJ} = 25^\circ\text{C}$			0.02 mA
	$T_{VJ} = 125^\circ\text{C}$		0.4	mA
R_{thJC}	(per diode)			1.9 K/W
R_{thCH}			0.65	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 NPT IGBTs
 - low saturation voltage
 - positive temperature coefficient
 - fast switching
 - short tail current
- Epitaxial free wheeling diodes with Hyperfast 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	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^{\circ}\text{C}$	25	A
I_{C80}	$T_C = 80^{\circ}\text{C}$	17	A
RBSOA	$V_{GE} = \pm 15\text{ V}$; $R_G = 68\ \Omega$; $T_{VJ} = 125^{\circ}\text{C}$ Clamped inductive load; $L = 100\ \mu\text{H}$	$I_{CM} = 30$ $V_{CEK} \leq V_{CES}$	A
t_{SC} (SCSOA)	$V_{CE} = 600\text{ V}$; $V_{GE} = \pm 15\text{ V}$; $R_G = 68\ \Omega$; $T_{VJ} = 125^{\circ}\text{C}$ non-repetitive	10	μs
P_{tot}	$T_C = 25^{\circ}\text{C}$	85	W

Symbol	Conditions	Characteristic Values		
		$(T_{VJ} = 25^{\circ}\text{C}$, unless otherwise specified)		
		min.	typ.	max.
$V_{CE(sat)}$	$I_C = 15\text{ A}$; $V_{GE} = 15\text{ V}$; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		2.0 2.3	2.4 V
$V_{GE(th)}$	$I_C = 0.4\text{ mA}$; $V_{GE} = V_{CE}$	4.5		6.5 V
I_{CES}	$V_{CE} = V_{CES}$; $V_{GE} = 0\text{ V}$; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		1.3	0.6 mA mA
I_{GES}	$V_{CE} = 0\text{ V}$; $V_{GE} = \pm 20\text{ V}$			100 nA
$t_{d(on)}$ t_r $t_{d(off)}$ t_f E_{on} E_{off}	Inductive load, $T_{VJ} = 125^{\circ}\text{C}$ $V_{CE} = 300\text{ V}$; $I_C = 15\text{ A}$ $V_{GE} = \pm 15\text{ V}$; $R_{Gon} = 39\ \Omega$; $R_{Goff} = 22\ \Omega$		30 25 160 50 0.42 0.44	ns ns ns ns mJ mJ
C_{ies}			800	pF
Q_{Gon}			57	nC
R_{thJC} R_{thCH}	(per IGBT)		0.55	1.5 K/W K/W

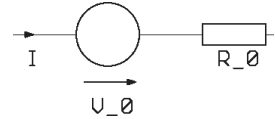
Output Inverter D1 - D6

Symbol	Conditions	Maximum Ratings	
I_{F25}	$T_C = 25^{\circ}\text{C}$	36	A
I_{F80}	$T_C = 80^{\circ}\text{C}$	24	A

Symbol	Conditions	Characteristic Values		
		min.	typ.	max.
V_F	$I_F = 15\text{ A}$; $V_{GE} = 0\text{ V}$; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		1.5	2.1 V V
I_{RM} t_{rr}	$I_F = 15\text{ A}$; $di_F/dt = -400\text{ A}/\mu\text{s}$; $T_{VJ} = 100^{\circ}\text{C}$ $V_R = 300\text{ V}$; $V_{GE} = 0\text{ V}$		14 80	A ns
R_{thJC} R_{thCH}	(per diode)		0.55	1.6 K/W K/W

Equivalent Circuits for Simulation

Conduction



D8 - D13

Rectifier Diode (typ. at $T_J = 125^{\circ}\text{C}$)
 $V_0 = 0.90\text{ V}$; $R_0 = 12\text{ m}\Omega$

T1 - T6 / D1 - D6

IGBT (typ. at $V_{GE} = 15\text{ V}$; $T_J = 125^{\circ}\text{C}$)
 $V_0 = 1.00\text{ V}$; $R_0 = 70\text{ m}\Omega$

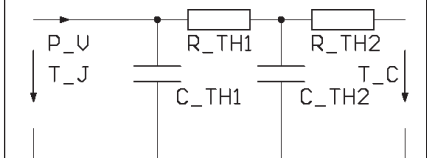
Free Wheeling Diode (typ. at $T_J = 125^{\circ}\text{C}$)
 $V_0 = 1.25\text{ V}$; $R_0 = 13\text{ m}\Omega$

T7 / D7

IGBT (typ. at $V_{GE} = 15\text{ V}$; $T_J = 125^{\circ}\text{C}$)
 $V_0 = 1.40\text{ V}$; $R_0 = 150\text{ m}\Omega$

Free Wheeling Diode (typ. at $T_J = 125^{\circ}\text{C}$)
 $V_0 = 1.25\text{ V}$; $R_0 = 26\text{ m}\Omega$

Thermal Response



D8 - D13

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

T1 - T6 / D1 - D6

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

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

T7 / D7

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

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

Brake Chopper T7

Symbol	Conditions	Maximum Ratings	
V_{CES}	$T_{VJ} = 25^{\circ}\text{C to } 150^{\circ}\text{C}$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^{\circ}\text{C}$	12	A
I_{C80}	$T_C = 80^{\circ}\text{C}$	8	A
RBSOA	$V_{GE} = \pm 15\text{ V}$; $R_G = 47\ \Omega$; $T_{VJ} = 125^{\circ}\text{C}$ Clamped inductive load; $L = 100\ \mu\text{H}$	$I_{CM} = 18$ $V_{CEK} \leq V_{CES}$	A
t_{SC} (SCSOA)	$V_{CE} = 600\text{ V}$; $V_{GE} = \pm 15\text{ V}$; $R_G = 47\ \Omega$; $T_{VJ} = 125^{\circ}\text{C}$ non-repetitive	10	μs
P_{tot}	$T_C = 25^{\circ}\text{C}$	45	W

Symbol	Conditions ($T_{VJ} = 25^{\circ}\text{C}$, unless otherwise specified)	Characteristic Values		
		min.	typ.	max.
$V_{CE(sat)}$	$I_C = 8\text{ A}$; $V_{GE} = 15\text{ V}$; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		2.25 2.6	V V
$V_{GE(th)}$	$I_C = 0.2\text{ mA}$; $V_{GE} = V_{CE}$	3		5 V
I_{CES}	$V_{CE} = V_{CES}$; $V_{GE} = 0\text{ V}$; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		0.5	0.1 mA mA
I_{GES}	$V_{CE} = 0\text{ V}$; $V_{GE} = \pm 20\text{ V}$			100 nA
$t_{d(on)}$ t_r $t_{d(off)}$ t_f E_{off}	Inductive load, $T_{VJ} = 125^{\circ}\text{C}$ $V_{CE} = 400\text{ V}$; $I_C = 8\text{ A}$ $V_{GE} = \pm 15\text{ V}$; $R_{Gon} = 47\ \Omega$; $R_{Goff} = 22\ \Omega$		15 15 130 35 0.16	ns ns ns ns mJ
C_{ies}			350	pF
Q_{Gon}			32	nC
R_{thJC} R_{thCH}			0.9	2.75 K/W K/W

Brake Chopper D7

Symbol	Conditions	Maximum Ratings	
V_{RRM}	$T_{VJ} = 25^{\circ}\text{C to } 150^{\circ}\text{C}$	600	V
I_{F25}	$T_C = 25^{\circ}\text{C}$	21	A
I_{F80}	$T_C = 80^{\circ}\text{C}$	14	A

Symbol	Conditions	Characteristic Values		
		min.	typ.	max.
V_F	$I_F = 8\text{ A}$; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		1.35	2.05 V V
I_R	$V_R = V_{RRM}$; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		0.2	0.06 mA mA
I_{RM} t_{rr}	$I_F = 8\text{ A}$; $di_F/dt = -400\text{ A}/\mu\text{s}$; $T_{VJ} = 100^{\circ}\text{C}$ $V_R = 300\text{ V}$		10 80	A ns
R_{thJC} R_{thCH}			0.85	2.5 K/W K/W

Symbol	Conditions	Characteristic Values		
		min.	typ.	max.
R ₂₅	T = 25°C	4.45	4.7	5.0 kΩ
B _{25/85}			3510	K

Symbol	Conditions	Maximum Ratings	
T_{VJ}	Operating	-40...+125	°C
T_{JM}		150	°C
T_{stg}		-40...+125	°C
V_{ISOL}	$I_{ISOL} \leq 1 \text{ mA}; 50/60 \text{ Hz}$	2500	V~
M_d	Mounting torque (M4)	2.0 - 2.2	Nm

[illegible]