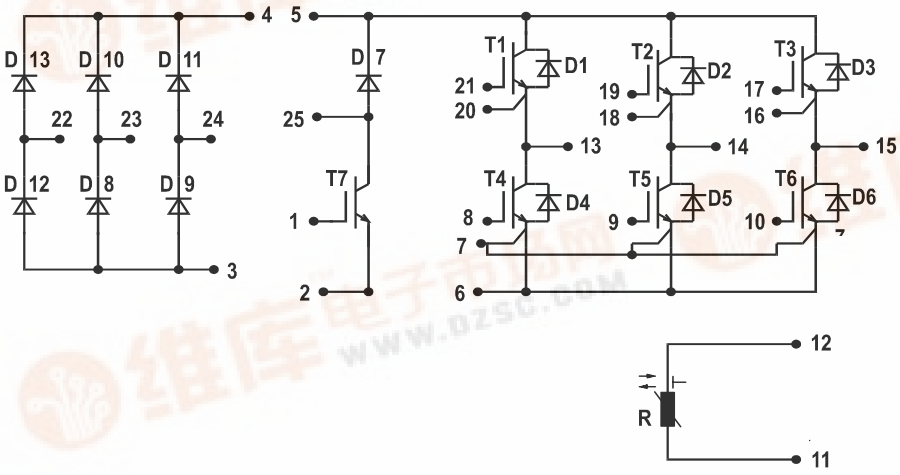
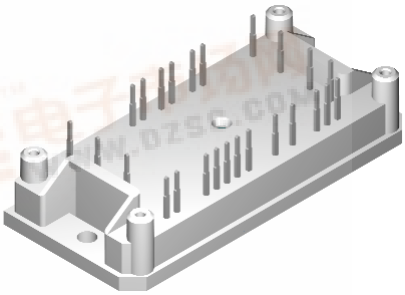
Converter - Brake - Inverter Module (CBI1)

NPT IGBT





Three Phase Rectifier	Brake Chopper	Three Phase Inverter
V_{RRM} = 1600V	V_{CES} = 600 V	V_{CES} = 600 V
I_{DAVM25} = 130 A	I_{C25} = 25 A	I_{C25} = 42 A
I_{FSM} = 320 A	$V_{CE(sat)}$ = 2.0 V	$V_{CE(sat)}$ = 2.3 V

Input Rectifier Bridge D8 - D13

Symbol	Conditions	Maximum Ratings	
V_{RRM}		1600	V
I_{FAV}	T_C = 80°C; sine 180°	31	A
I_{DAVM}	bridge output current; T_C = 80°C; rect.; d = 1/3	89	A
I_{FSM}	T_{VJ} = 25°C; t = 10 ms; sine 50 Hz	320	A
P_{tot}	T_C = 25°C	80	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
V_F	I_F = 30 A; T_{VJ} = 25°C		1.0	1.35	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)			1.4	K/W
R_{thCH}			0.45		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 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	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	T_C = 25°C	42	A
I_{C80}	T_C = 80°C	29	A
RBSOA	V_{GE} = ±15 V; R_G = 33 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 60 $V_{CEK} \le V_{CES}$	A
t_{SC} (SCSOA)	V_{CE} = 600 V; V_{GE} = ±15 V; R_G = 33 Ω; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	130	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		2.3	2.7	V
	T_{VJ} = 125°C		2.6		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			0.75	mA
	T_{VJ} = 125°C		1.5		mA
I_{GES}	V_{CE} = 0 V; V_{GE} = ± 20 V			200	nA
$t_{d(on)}$	Inductive load, T_{VJ} = 125°C		50		ns
t_r	V_{CE} = 300 V; I_C = 30 A		50		ns
$t_{d(off)}$	V_{GE} = ±15 V; R_G = 33 Ω		270		ns
t_f			40		ns
E_{on}			1.4		mJ
E_{off}			1.0		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz		1600		pF
Q_{Gon}	V_{CE} = 300V; V_{GE} = 15 V; I_C = 30 A		95		nC
R_{thJC}	(per IGBT)			0.95	K/W
R_{thCH}			0.35		K/W

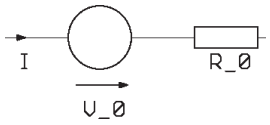
Output Inverter D1 - D6

Symbol	Conditions	Maximum Ratings	
I_{F25}	T_C = 25°C	69	A
I_{F80}	T_C = 80°C	46	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 35 A; V_{GE} = 0 V; T_{VJ} = 25°C			1.7	V
	T_{VJ} = 125°C		1.2		V
I_{RM}	I_F = 50 A; di_F/dt = -100A/µs; T_{VJ} = 125°C		5		A
t_{rr}	V_R = 100 V; V_{GE} = 0 V		100		ns
R_{thJC}	(per diode)			0.9	K/W
R_{thCH}			0.3		K/W

Equivalent Circuits for Simulation

Conduction



D8 - D13

Rectifier Diode (typ. at T_J = 125°C)
V_0 = 0.90V; R_0 = 9 mΩ

T1 - T6 / D1 - D6

IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 1.0 V; R_0 = 4.0 mΩ

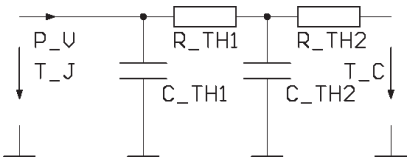
Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.05 V; R_0 = 7 mΩ

T7 / D7

IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 1.0 V; R_0 = 70 mΩ

Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.25 V; R_0 = 26 mΩ

Thermal Response



D8 - D13

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

T1 - T6 / D1 - D6

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

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

T7 / D7

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

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

Brake Chopper T7

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	T_C = 25°C	25	A
I_{C80}	T_C = 80°C	17	A
RBSOA	V_{GE} = ±15 V; R_G = 68 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 30 $V_{CEK} \le V_{CES}$	A
t_{SC} **(SCSOA)**	V_{CE} = 600 V; V_{GE} = ±15 V; R_G = 68 Ω; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	80	W

Symbol	Conditions (T_{VJ} = 25°C, unless otherwise specified)	Characteristic Values min.	typ.	max.	
$V_{CE(sat)}$	I_C = 15 A; V_{GE} = 15 V; T_{VJ} = 25°C		2.0	2.4	V
	T_{VJ} = 125°C		2.3		V
$V_{GE(th)}$	I_C = 0.4 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		0.8		mA
I_{GES}	V_{CE} = 0 V; V_{GE} = ± 20 V			100	nA
$t_{d(on)}$	Inductive load, T_{VJ} = 125°C V_{CE} = 300 V; I_C = 15 A V_{GE} = ±15 V; R_G = 68 Ω		30		ns
t_r			50		ns
$t_{d(off)}$			270		ns
t_f			40		ns
E_{on}			0.7		mJ
E_{off}			0.5		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MH z		800		pF
Q_{Gon}	V_{CE} = 300 V; V_{GE} = 15 V; I_C = 15 A		57		nC
R_{thJC}				1.55	K/W
R_{thCH}			0.5		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	21	A
I_{F80}	T_C = 80°C	14	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 15 A; T_{VJ} = 25°C			2.3	V
	T_{VJ} = 125°C		1.5		V
I_R	V_R = V_{RRM}; T_{VJ} = 25°C			0.06	mA
	T_{VJ} = 125°C		0.2		mA
I_{RM}	I_F = 12 A; di_F/dt = -100 A/µs; T_{VJ} = 125°C		3.5		A
t_{rr}	V_R = 100 V		80		ns
R_{thJC}				2.5	K/W
R_{thCH}			0.85		K/W

Temperature Sensor NTC

Symbol	Conditions	Characteristic Values min.	typ.	max.	
R_{25}	T = 25°C	4.45	4.7	5.0	kΩ
$B_{25/85}$			3510		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 (M4)	2.0 - 2.2	Nm

Symbol	Conditions	Characteristic Values min.	typ.	max.	
d_S	Creepage distance (towards heatsink)	12.7			mm
d_A	Strike distance in air (towards heatsink)	12.7			mm
Weight			40		g