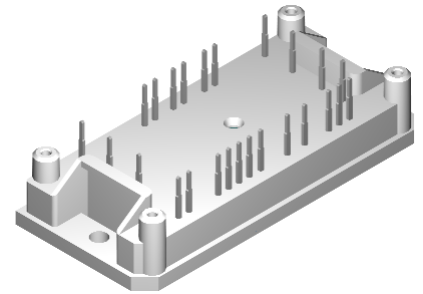
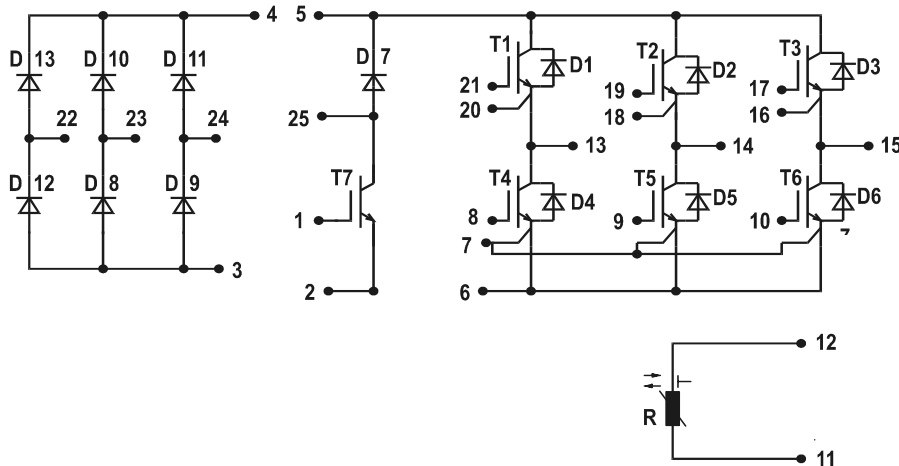


# Converter - Brake - Inverter Module (CBI1)

NPT IGBT



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

## Input Rectifier Bridge D8 - D13

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

Symbol	Conditions	Characteristic Values ( $T_{VJ} = 25^\circ C$ , unless otherwise specified)		
		min.	typ.	max.
$V_F$	$I_F = 30A$ ; $T_{VJ} = 25^\circ C$ $T_{VJ} = 125^\circ C$		1.0 1.1	1.35 V V
$I_R$	$V_R = V_{RRM}$ ; $T_{VJ} = 25^\circ C$ $T_{VJ} = 125^\circ C$		0.4	0.02 mA mA
$R_{thJC}$ $R_{thCH}$	(per diode)		0.45	1.4 K/W 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**

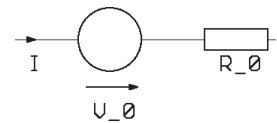
Symbol	Conditions	Maximum Ratings	
$V_{CES}$	$T_{VJ} = 25^{\circ}\text{C}$ to $150^{\circ}\text{C}$	600	V
$V_{GES}$	Continuous	$\pm 20$	V
$V_{GEM}$	Transient	$\pm 30$	V
$I_{C25}$	$T_C = 25^{\circ}\text{C}$	42	A
$I_{C80}$	$T_C = 80^{\circ}\text{C}$	29	A
<b>RBSOA</b>	$V_{GE} = \pm 15\text{ V}$ ; $R_G = 33\ \Omega$ ; $T_{VJ} = 125^{\circ}\text{C}$ Clamped inductive load; $L = 100\ \mu\text{H}$	$I_{CM} = 60$ $V_{CEK} \leq V_{CES}$	A
$t_{SC}$ <b>(SCSOA)</b>	$V_{CE} = 600\text{ V}$ ; $V_{GE} = \pm 15\text{ V}$ ; $R_G = 33\ \Omega$ ; $T_{VJ} = 125^{\circ}\text{C}$ non-repetitive	10	$\mu\text{s}$
$P_{tot}$	$T_C = 25^{\circ}\text{C}$	130	W

Symbol	Conditions	Characteristic Values ( $T_{VJ} = 25^{\circ}\text{C}$ , unless otherwise specified)		
		min.	typ.	max.
$V_{CE(sat)}$	$I_C = 35\text{ A}$ ; $V_{GE} = 15\text{ V}$ ; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		2.3 2.6	V V
$V_{GE(th)}$	$I_C = 0.7\text{ mA}$ ; $V_{GE} = V_{CE}$	4.5		6.5 V
$I_{CES}$	$V_{CE} = V_{CES}$ ; $V_{GE} = 0\text{ V}$ ; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		1.5	0.75 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, $T_{VJ} = 125^{\circ}\text{C}$ $V_{CE} = 300\text{ V}$ ; $I_C = 30\text{ A}$ $V_{GE} = \pm 15\text{ V}$ ; $R_G = 33\ \Omega$		50 50 270 40	ns ns ns ns
			1.4	mJ
			1.0	mJ
$C_{ies}$		$V_{CE} = 25\text{ V}$ ; $V_{GE} = 0\text{ V}$ ; $f = 1\text{ MHz}$	1600	pF
$Q_{Gon}$		$V_{CE} = 300\text{ V}$ ; $V_{GE} = 15\text{ V}$ ; $I_C = 30\text{ A}$	95	nC
$R_{thJC}$ $R_{thCH}$		(per IGBT)	0.35	0.95

**Output Inverter D1 - D6**

Symbol	Conditions	Maximum Ratings	
$I_{F25}$	$T_C = 25^{\circ}\text{C}$	69	A
$I_{F80}$	$T_C = 80^{\circ}\text{C}$	46	A

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

**Equivalent Circuits for Simulation**
**Conduction**

**D8 - D13**

Rectifier Diode (typ. at  $T_J = 125^{\circ}\text{C}$ )  
 $V_0 = 0.90\text{ V}$ ;  $R_0 = 9\text{ m}\Omega$

**T1 - T6 / D1 - D6**

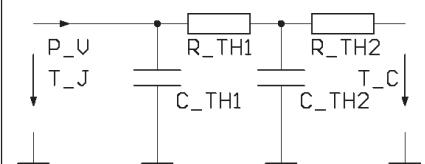
IGBT (typ. at  $V_{GE} = 15\text{ V}$ ;  $T_J = 125^{\circ}\text{C}$ )  
 $V_0 = 1.0\text{ V}$ ;  $R_0 = 4.0\text{ m}\Omega$

Free Wheeling Diode (typ. at  $T_J = 125^{\circ}\text{C}$ )  
 $V_0 = 1.05\text{ V}$ ;  $R_0 = 7\text{ m}\Omega$

**T7 / D7**

IGBT (typ. at  $V_{GE} = 15\text{ V}$ ;  $T_J = 125^{\circ}\text{C}$ )  
 $V_0 = 1.0\text{ V}$ ;  $R_0 = 70\text{ m}\Omega$

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

**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	$\pm 20$	V
$V_{GEM}$	Transient	$\pm 30$	V
$I_{C25}$	$T_C = 25^{\circ}\text{C}$	25	A
$I_{C80}$	$T_C = 80^{\circ}\text{C}$	17	A
<b>RBSOA</b>	$V_{GE} = \pm 15\text{ V}$ ; $R_G = 68\ \Omega$ ; $T_{VJ} = 125^{\circ}\text{C}$ Clamped inductive load; $L = 100\ \mu\text{H}$	$I_{CM} = 30$ $V_{CEK} \leq V_{CES}$	A
$t_{SC}$ <b>(SCSOA)</b>	$V_{CE} = 600\text{ V}$ ; $V_{GE} = \pm 15\text{ V}$ ; $R_G = 68\ \Omega$ ; $T_{VJ} = 125^{\circ}\text{C}$ non-repetitive	10	$\mu\text{s}$
$P_{tot}$	$T_C = 25^{\circ}\text{C}$	80	W

Symbol	Conditions ( $T_{VJ} = 25^{\circ}\text{C}$ , unless otherwise specified)	Characteristic Values		
		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	V V
$V_{GE(th)}$	$I_C = 0.4\text{ mA}$ ; $V_{GE} = V_{CE}$	4.5		6.5 V
$I_{CES}$	$V_{CE} = V_{CES}$ ; $V_{GE} = 0\text{ V}$ ; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		0.8	0.5 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, $T_{VJ} = 125^{\circ}\text{C}$ $V_{CE} = 300\text{ V}$ ; $I_C = 15\text{ A}$ $V_{GE} = \pm 15\text{ V}$ ; $R_G = 68\ \Omega$		30 50 270 40 0.7 0.5	ns ns ns ns mJ mJ
$C_{ies}$		$V_{CE} = 25\text{ V}$ ; $V_{GE} = 0\text{ V}$ ; $f = 1\text{ MHz}$	800	pF
$Q_{Gon}$		$V_{CE} = 300\text{ V}$ ; $V_{GE} = 15\text{ V}$ ; $I_C = 15\text{ A}$	57	nC
$R_{thJC}$ $R_{thCH}$			0.5	1.55 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.
$V_F$	$I_F = 15\text{ A}$ ; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		1.5	2.3 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
$I_{RM}$ $t_{rr}$	} $I_F = 12\text{ A}$ ; $di_F/dt = -100\text{ A}/\mu\text{s}$ ; $T_{VJ} = 125^{\circ}\text{C}$ $V_R = 100\text{ V}$		3.5 80	A ns
$R_{thJC}$ $R_{thCH}$			0.85	2.5 K/W K/W

**Temperature Sensor NTC**

Symbol	Conditions	Characteristic Values		
		min.	typ.	max.
$R_{25}$	$T = 25^{\circ}\text{C}$	4.45	4.7	5.0 k $\Omega$
$B_{25/85}$			3510	K

**Module**

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

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
<b>Weight</b>		40		g

