

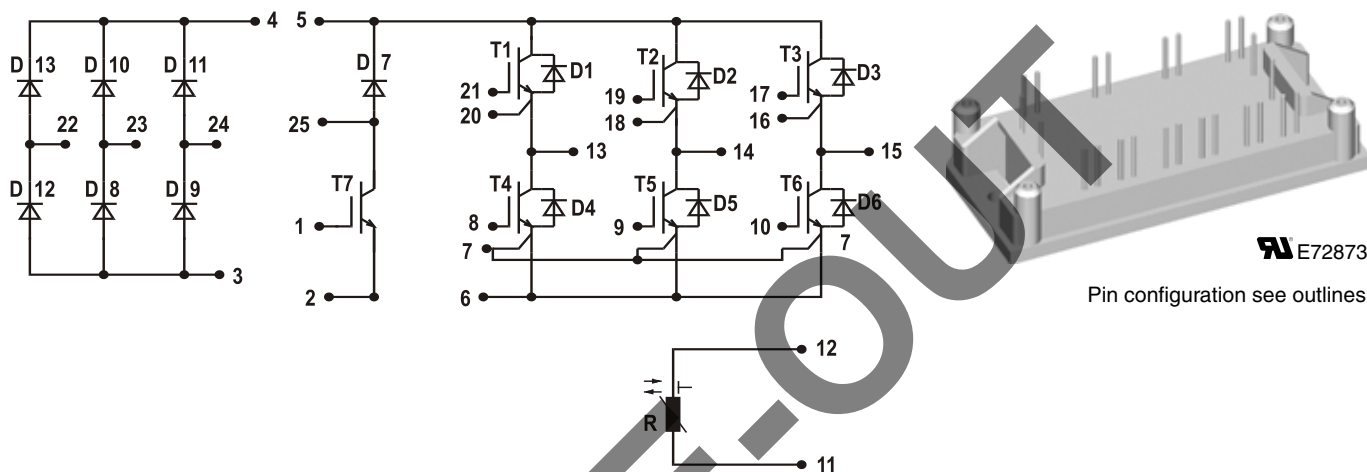
# Converter - Brake - Inverter Module (CBI 1) NPT IGBT

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

Preliminary data

**Part name** (Marking on product)

MUBW20-06A6K



E72873

Pin configuration see outlines.

**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

**Application:**

- AC motor drives with
- Input from single or three phase grid
- Three phase synchronous or asynchronous motor
- Electric braking operation

**Package:**

- UL registered
- Industry standard E1-pack

**Output Inverter T1 - T6**

Symbol	Definitions	Conditions	Ratings			Unit
			min.	typ.	max.	
$V_{CES}$	collector emitter voltage		$T_{VJ} = 25^{\circ}\text{C to } 150^{\circ}\text{C}$			V
$V_{GES}$	max. DC gate voltage	continuous			$\pm 20$	V
$V_{GEM}$	max. transient collector gate voltage	transient			$\pm 30$	V
$I_{C25}$	collector current		$T_C = 25^{\circ}\text{C}$			A
$I_{C80}$			$T_C = 80^{\circ}\text{C}$			A
$P_{tot}$	total power dissipation		$T_C = 25^{\circ}\text{C}$			W
$V_{CE(sat)}$	collector emitter saturation voltage	$I_C = 15\text{ A}; V_{GE} = 15\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$			V
			$T_{VJ} = 125^{\circ}\text{C}$			V
$V_{GE(th)}$	gate emitter threshold voltage	$I_C = 0.4\text{ mA}; V_{GE} = V_{CE}$	4.5		6.5	V
$I_{CES}$	collector emitter leakage current	$V_{CE} = V_{CES}; V_{GE} = 0\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$			mA
			$T_{VJ} = 125^{\circ}\text{C}$			mA
$I_{GES}$	gate emitter leakage current	$V_{CE} = 0\text{ V}; V_{GE} = \pm 20\text{ V}$			100	nA
$C_{ies}$	input capacitance	$V_{CE} = 25\text{ V}; V_{GE} = 0\text{ V}; f = 1\text{ MHz}$		800		pF
$Q_{G(on)}$	total gate charge	$V_{CE} = 300\text{ V}; V_{GE} = 15\text{ V}; I_C = 15\text{ A}$		57		nC
$t_{d(on)}$	turn-on delay time	inductive load $V_{CE} = 300\text{ V}; I_C = 15\text{ A}$ $V_{GE} = \pm 15\text{ V}; R_{G(on)} = 39\ \Omega$ $R_{G(off)} = 22\ \Omega$	$T_{VJ} = 125^{\circ}\text{C}$			ns
$t_r$	current rise time		30			ns
$t_{d(off)}$	turn-off delay time		25			ns
$t_f$	current fall time		160			ns
$E_{on}$	turn-on energy per pulse		50			mJ
$E_{off}$	turn-off energy per pulse		0.42			mJ
		0.44			mJ	
$I_{CM}$	reverse bias safe operating area	RBSOA; $V_{GE} = \pm 15\text{ V}; R_G = 68\ \Omega$ $L = 100\ \mu\text{H};$ clamped induct. load $V_{CEmax} = V_{CES} - L_S \cdot di/dt$	$T_{VJ} = 125^{\circ}\text{C}$			A
$t_{SC}$ (SCSOA)	short circuit safe operating area	$V_{CE} = 600\text{ V}; V_{GE} = \pm 15\text{ V};$ $R_G = 68\ \Omega;$ non-repetitive	$T_{VJ} = 125^{\circ}\text{C}$			$\mu\text{s}$
$R_{thJC}$	thermal resistance junction to case	(per IGBT)			1.5	K/W
$R_{thCH}$	thermal resistance case to heatsink	(per IGBT)		0.55		K/W

**Output Inverter D1 - D6**

Symbol	Definitions	Conditions	Ratings			Unit
			min.	typ.	max.	
$V_{RRM}$	max. repetitive reverse voltage		$T_{VJ} = 150^{\circ}\text{C}$			V
$I_{F25}$	forward current		$T_C = 25^{\circ}\text{C}$			A
$I_{F80}$			$T_C = 80^{\circ}\text{C}$			A
$V_F$	forward voltage	$I_F = 15\text{ A}; V_{GE} = 0\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$			V
			$T_{VJ} = 125^{\circ}\text{C}$			V
$I_{RM}$	max. reverse recovery current	$V_R = 300\text{ V}$ $di_f/dt = -400\text{ A}/\mu\text{s}$ $I_F = 15\text{ A}; V_{GE} = 0\text{ V}$	$T_{VJ} = 100^{\circ}\text{C}$			A
$t_{rr}$	reverse recovery time		14			ns
$E_{rec(off)}$	reverse recovery energy		80			$\mu\text{J}$
					tdb	$\mu\text{J}$
$R_{thJC}$	thermal resistance junction to case	(per diode)			1.6	K/W
$R_{thCH}$	thermal resistance case to heatsink	(per diode)		0.55		K/W

 $T_C = 25^{\circ}\text{C}$  unless otherwise stated

**Brake Chopper T7**

Symbol	Definitions	Conditions	Ratings			Unit
			min.	typ.	max.	
$V_{CES}$	collector emitter voltage		$T_{VJ} = 25^{\circ}\text{C to } 150^{\circ}\text{C}$			V
$V_{GES}$	max. DC gate voltage	continuous			$\pm 20$	V
$V_{GEM}$	max. transient collector gate voltage	transient			$\pm 30$	V
$I_{C25}$	collector current		$T_C = 25^{\circ}\text{C}$			A
$I_{C80}$			$T_C = 80^{\circ}\text{C}$			A
$P_{tot}$	total power dissipation		$T_C = 25^{\circ}\text{C}$			W
$V_{CE(sat)}$	collector emitter saturation voltage	$I_C = 10\text{ A}; V_{GE} = 15\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$			V V
$V_{GE(th)}$	gate emitter threshold voltage	$I_C = 0.2\text{ mA}; V_{GE} = V_{CE}$	4.5		6.5	V
$I_{CES}$	collector emitter leakage current	$V_{CE} = V_{CES}; V_{GE} = 0\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$			mA mA
$I_{GES}$	gate emitter leakage current	$V_{CE} = 0\text{ V}; V_{GE} = \pm 20\text{ V}$			120	nA
$C_{ies}$	input capacitance	$V_{CE} = 25\text{ V}; V_{GE} = 0\text{ V}; f = 1\text{ MHz}$		220		pF
$Q_{G(on)}$	total gate charge	$V_{CE} = 300\text{ V}; V_{GE} = 15\text{ V}; I_C = 6\text{ A}$		32		nC
$t_{d(on)}$	turn-on delay time	} inductive load $V_{CE} = 300\text{ V}; I_C = 8\text{ A}$ $V_{GE} = \pm 15\text{ V}; R_{G(on)} = 54\ \Omega$ $R_{G(off)} = 22\ \Omega$	$T_{VJ} = 125^{\circ}\text{C}$			ns
$t_r$	current rise time		20		10	ns
$t_{d(off)}$	turn-off delay time		110		30	ns
$t_f$	current fall time		30		0.21	ns
$E_{on}$	turn-on energy per pulse		0.21		0.26	mJ
$E_{off}$	turn-off energy per pulse		0.26			mJ
$I_{CM}$	reverse bias safe operating area	RBSOA; $V_{GE} = \pm 15\text{ V}; R_G = 54\ \Omega$ $L = 100\ \mu\text{H};$ clamped induct. load $V_{CEmax} = V_{CES} - L_S \cdot di/dt$	$T_{VJ} = 125^{\circ}\text{C}$			A
$t_{SC}$ (SCSOA)	short circuit safe operating area	$V_{CE} = 600\text{ V}; V_{GE} = \pm 15\text{ V};$ $R_G = 54\ \Omega;$ non-repetitive	$T_{VJ} = 125^{\circ}\text{C}$			$\mu\text{s}$
$R_{thJC}$	thermal resistance junction to case	(per IGBT)			2.75	K/W
$R_{thCH}$	thermal resistance case to heatsink	(per IGBT)		0.9		K/W

**Brake Chopper D7**

Symbol	Definitions	Conditions	Ratings			Unit
			min.	typ.	max.	
$V_{RRM}$	max. repetitive reverse voltage		$T_{VJ} = 150^{\circ}\text{C}$			V
$I_{F25}$	forward current		$T_C = 25^{\circ}\text{C}$			A
$I_{F80}$			$T_C = 80^{\circ}\text{C}$			A
$V_F$	forward voltage	$I_F = 10\text{ A}; V_{GE} = 0\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$			V V
$I_R$	reverse current	$V_R = V_{RRM}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$			mA mA
$I_{RM}$	max. reverse recovery current	} $V_R = 100\text{ V}; I_F = 12\text{ A}$ $di_F/dt = -100\text{ A}/\mu\text{s}$	$T_{VJ} = 100^{\circ}\text{C}$			A
$t_{rr}$	reverse recovery time		3.5		80	ns
$R_{thJC}$	thermal resistance junction to case	(per diode)			2.5	K/W
$R_{thCH}$	thermal resistance case to heatsink	(per diode)		0.85		K/W

 $T_C = 25^{\circ}\text{C}$  unless otherwise stated

Input Rectifier Bridge D8 - D13					
Symbol	Definitions	Conditions	Maximum Ratings		
$V_{RRM}$	max. repetitive reverse voltage			1600	V
$I_{FAV}$	average forward current	sine 180°	$T_C = 80^\circ\text{C}$	23	A
$I_{DAVM}$	max. average DC output current	rectangular; $d = 1/3$ ; bridge	$T_C = 80^\circ\text{C}$	65	A
$I_{FSM}$	max. surge forward current	$t = 10\text{ ms}$ ; sine 50 Hz	$T_C = 25^\circ\text{C}$	250	A
$P_{tot}$	total power dissipation		$T_C = 25^\circ\text{C}$	65	W

Symbol	Conditions	Characteristic Values				
		min.	typ.	max.		
$V_F$	forward voltage	$I_F = 30\text{ A}$	$T_{VJ} = 25^\circ\text{C}$	1.1	1.45	V
			$T_{VJ} = 125^\circ\text{C}$	1.2		V
$I_R$	reverse current	$V_R = V_{RRM}$	$T_{VJ} = 25^\circ\text{C}$	0.4	0.02	mA
			$T_{VJ} = 125^\circ\text{C}$			
$R_{thJC}$	thermal resistance junction to case	(per diode)	$T_{VJ} = 25^\circ\text{C}$		1.9	K/W
$R_{thCH}$	thermal resistance case to heatsink	(per diode)		0.65		K/W

Temperature Sensor NTC							
Symbol	Definitions	Conditions	Ratings			Unit	
			min.	typ.	max.		
$R_{25}$	resistance		$T_C = 25^\circ\text{C}$	4.45	4.7	5.0	k $\Omega$
$B_{25/85}$					3510		K

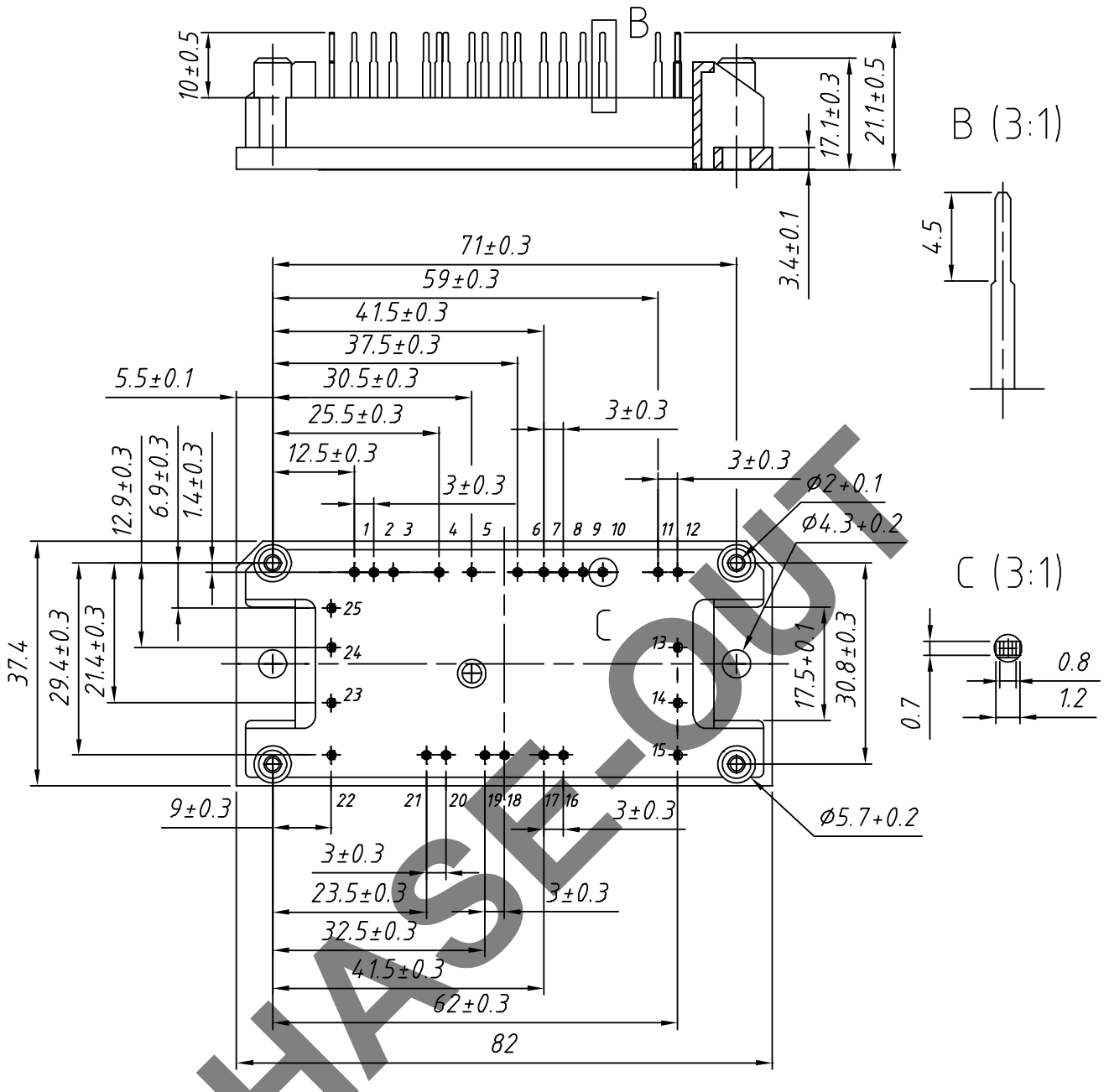
Module						
Symbol	Definitions	Conditions	Ratings			Unit
			min.	typ.	max.	
$T_{VJ}$	operating temperature		-40		125	$^\circ\text{C}$
$T_{VJM}$	max. virtual junction temperature				150	$^\circ\text{C}$
$T_{stg}$	storage temperature		-40		125	$^\circ\text{C}$
$V_{ISOL}$	isolation voltage	$I_{ISOL} \leq 1\text{ mA}$ ; 50/60 Hz			2500	V~
$M_d$	mounting torque	(M4)	2.0		2.2	Nm
$d_S$	creep distance on surface		12.7			mm
$d_A$	strike distance through air		12.7			mm
<b>Weight</b>				40		g

Equivalent Circuits for Simulation						
Symbol	Definitions	Conditions	Ratings			Unit
			min.	typ.	max.	
$V_0$	rectifier diode	D8 - D13	$T_{VJ} = 125^\circ\text{C}$	0.90		V
$R_0$				12		m $\Omega$
$V_0$	IGBT	T1 - T6	$T_{VJ} = 125^\circ\text{C}$	1.0		V
$R_0$				70		m $\Omega$
$V_0$	free wheeling diode	D1 - D6	$T_{VJ} = 125^\circ\text{C}$	1.25		V
$R_0$				13		m $\Omega$
$V_0$	IGBT	T7	$T_{VJ} = 125^\circ\text{C}$	1.4		V
$R_0$				150		m $\Omega$
$V_0$	free wheeling diode	D7	$T_{VJ} = 125^\circ\text{C}$	1.25		V
$R_0$				26		m $\Omega$

$T_C = 25^\circ\text{C}$  unless otherwise stated

**Outline Drawing**

Dimensions in mm (1 mm = 0.0394")



**Product Marking**

Ordering	Part Name	Marking on Product	Delivering Mode	Base Qty	Ordering Code
Standard	MUBW 20-06A6K	MUBW20-06A6K	Box	10	500 103

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