

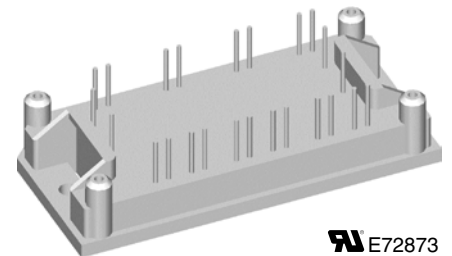
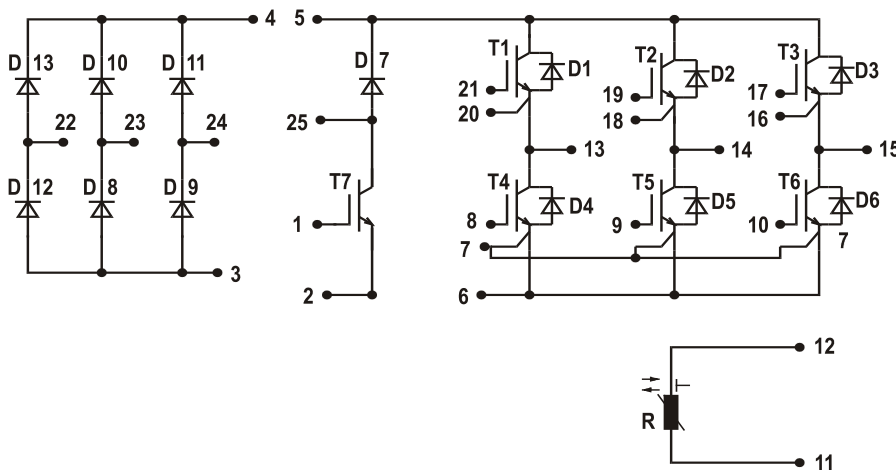
Converter - Brake - Inverter Module (CBI 1) NPT IGBT

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

Preliminary data

Part name (Marking on product)

MUBW35-06A6K



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	$T_{VJ} = 25^{\circ}\text{C to } 150^{\circ}\text{C}$			600	V	
V_{GES}	max. DC gate voltage	continuous			± 20	V	
V_{GEM}	max. transient collector gate voltage	transient			± 30	V	
I_{C25}	collector current	$T_C = 25^{\circ}\text{C}$			42	A	
I_{C80}		$T_C = 80^{\circ}\text{C}$			29	A	
P_{tot}	total power dissipation	$T_C = 25^{\circ}\text{C}$			130	W	
$V_{CE(sat)}$	collector emitter saturation voltage	$I_C = 35\text{ A}; V_{GE} = 15\text{ V}$			2.3 2.6	V V	
$V_{GE(th)}$	gate emitter threshold voltage	$I_C = 0.7\text{ mA}; V_{GE} = V_{CE}$	4.5		6.5	V	
I_{CES}	collector emitter leakage current	$V_{CE} = V_{CES}; V_{GE} = 0\text{ V}$			1.5	0.75 mA mA	
I_{GES}	gate emitter leakage current	$V_{CE} = 0\text{ V}; V_{GE} = \pm 20\text{ V}$			200	nA	
C_{ies}	input capacitance	$V_{CE} = 25\text{ V}; V_{GE} = 0\text{ V}; f = 1\text{ MHz}$			1600	pF	
$Q_{G(on)}$	total gate charge	$V_{CE} = 300\text{ V}; V_{GE} = 15\text{ V}; I_C = 30\text{ A}$			95	nC	
$t_{d(on)}$	turn-on delay time	inductive load $V_{CE} = 300\text{ V}; I_C = 30\text{ A}$ $V_{GE} = \pm 15\text{ V}; R_G = 33\ \Omega$			50	ns	
t_r	current rise time		$T_{VJ} = 125^{\circ}\text{C}$			50	ns
$t_{d(off)}$	turn-off delay time					270	ns
t_f	current fall time					40	ns
E_{on}	turn-on energy per pulse					1.4	mJ
E_{off}	turn-off energy per pulse					1.0	mJ
I_{CM}	reverse bias safe operating area	RBSOA; $V_{GE} = \pm 15\text{ V}; R_G = 33\ \Omega$ $L = 100\ \mu\text{H};$ clamped induct. load $V_{CEmax} = V_{CES} - L_S \cdot di/dt$			60	A	
t_{SC} (SCSOA)	short circuit safe operating area	$V_{CE} = 600\text{ V}; V_{GE} = \pm 15\text{ V};$ $R_G = 82\ \Omega;$ non-repetitive			10	μs	
R_{thJC}	thermal resistance junction to case	(per IGBT)			0.95	K/W	
R_{thCH}	thermal resistance case to heatsink	(per IGBT)			0.35	K/W	

Output Inverter D1 - D6

Symbol	Definitions	Conditions	Ratings			Unit	
			min.	typ.	max.		
V_{RRM}	max. repetitive reverse voltage	$T_{VJ} = 150^{\circ}\text{C}$			600	V	
I_{F25}	forward current	$T_C = 25^{\circ}\text{C}$			69	A	
I_{F80}		$T_C = 80^{\circ}\text{C}$			46	A	
V_F	forward voltage	$I_F = 35\text{ A}; V_{GE} = 0\text{ V}$			1.2	1.7 V V	
I_{RM}	max. reverse recovery current	$V_R = 100\text{ V}$ $di_f/dt = -100\text{ A}/\mu\text{s}$ $I_F = 50\text{ A}; V_{GE} = 0\text{ V}$			5	A	
t_{rr}	reverse recovery time		$T_{VJ} = 100^{\circ}\text{C}$			100	ns
$E_{rec(off)}$	reverse recovery energy					tdb	μJ
R_{thJC}	thermal resistance junction to case	(per diode)			0.9	K/W	
R_{thCH}	thermal resistance case to heatsink	(per diode)			0.3	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			± 20	V	
V_{GEM}	max. transient collector gate voltage	transient			± 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	$I_C = 15\text{ A}; V_{GE} = 15\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$			V 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	$V_{CE} = V_{CES}; V_{GE} = 0\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$			0.8 0.5 mA 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 $V_{CE} = 300\text{ V}; I_C = 15\text{ A}$ $V_{GE} = \pm 15\text{ V}; R_G = 68\ \Omega$	$T_{VJ} = 125^{\circ}\text{C}$			30	ns
t_r	current rise time		50	ns			
$t_{d(off)}$	turn-off delay time		270	ns			
t_f	current fall time		40	ns			
E_{on}	turn-on energy per pulse		0.7	mJ			
E_{off}	turn-off energy per pulse		0.5	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 $V_{CEmax} = V_{CES} - L_S \cdot di/dt$	$T_{VJ} = 125^{\circ}\text{C}$			30	A
t_{SC} (SCSOA)	short circuit safe operating area	$V_{CE} = 600\text{ V}; V_{GE} = \pm 15\text{ V};$ $R_G = 82\ \Omega;$ non-repetitive	$T_{VJ} = 125^{\circ}\text{C}$			10	μs
R_{thJC}	thermal resistance junction to case	(per IGBT)			1.55	K/W	
R_{thCH}	thermal resistance case to heatsink	(per IGBT)		0.5		K/W	

Brake Chopper D7

Symbol	Definitions	Conditions	Ratings			Unit	
			min.	typ.	max.		
V_{RRM}	max. repetitive reverse voltage		$T_{VJ} = 150^{\circ}\text{C}$			600	V
I_{F25}	forward current		$T_C = 25^{\circ}\text{C}$			21	A
I_{F80}			$T_C = 80^{\circ}\text{C}$			14	A
V_F	forward voltage	$I_F = 15\text{ A}; V_{GE} = 0\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$			1.5	2.3 V V
I_R	reverse current	$V_R = V_{RRM}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$			0.2	0.06 mA mA
I_{RM}	max. reverse recovery current	} $V_R = 100\text{ V}; I_F = 12\text{ A}$ $di_F/dt = -100\text{ A}/\mu\text{s}$	$T_{VJ} = 100^{\circ}\text{C}$			3.5	A
t_{rr}	reverse recovery time		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

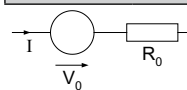
Input Rectifier Bridge D8 - D13					
Symbol	Definitions	Conditions	Maximum Ratings		
V_{RRM}	max. repetitive reverse voltage			1600	V
I_{FAV}	average forward current	sine 180°	$T_C = 80^\circ\text{C}$	31	A
I_{DAVM}	max. average DC output current	rectangular; $d = 1/3$; bridge	$T_C = 80^\circ\text{C}$	89	A
I_{FSM}	max. surge forward current	$t = 10$ ms; sine 50 Hz	$T_C = 25^\circ\text{C}$	320	A
P_{tot}	total power dissipation		$T_C = 25^\circ\text{C}$	80	W

Symbol	Conditions	Characteristic Values			
		min.	typ.	max.	
V_F	forward voltage	$I_F = 30$ A	$T_{VJ} = 25^\circ\text{C}$ $T_{VJ} = 125^\circ\text{C}$	1.0 1.1	1.35 V
I_R	reverse current	$V_R = V_{RRM}$	$T_{VJ} = 25^\circ\text{C}$ $T_{VJ} = 125^\circ\text{C}$	0.4	0.02 mA mA
R_{thJC}	thermal resistance junction to case	(per diode)	$T_{VJ} = 25^\circ\text{C}$		1.4 K/W
R_{thCH}	thermal resistance case to heatsink	(per diode)		0.45	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 Ω
$B_{25/85}$					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	$I_{ISOL} \leq 1$ 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
Weight				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				9		m Ω
V_0	IGBT	T1 - T6	$T_{VJ} = 125^\circ\text{C}$	1.0		V
R_0				4		m Ω
V_0	free wheeling diode	D1 - D6	$T_{VJ} = 125^\circ\text{C}$	1.05		V
R_0				7		m Ω
V_0	IGBT	T7	$T_{VJ} = 125^\circ\text{C}$	1.0		V
R_0				70		m Ω
V_0	free wheeling diode	D7	$T_{VJ} = 125^\circ\text{C}$	1.25		V
R_0				26		m Ω

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

