

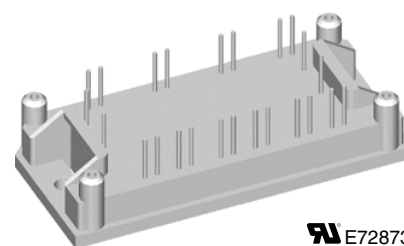
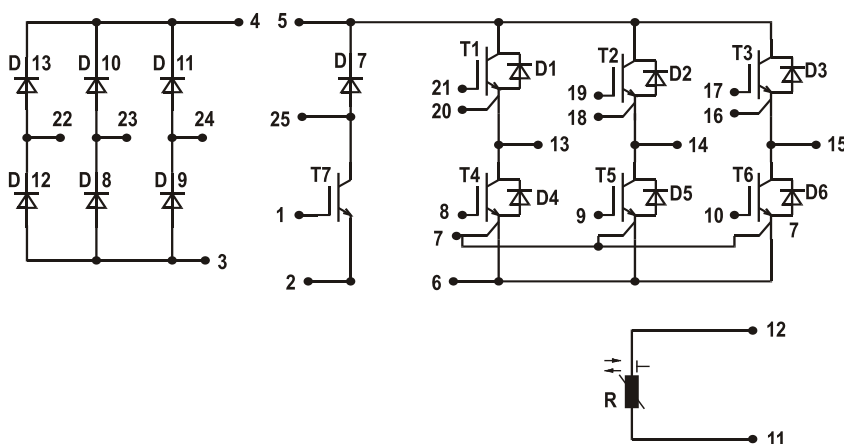
Converter - Brake - Inverter Module (CBI 1) Trench IGBT

Three Phase Rectifier	Brake Chopper	Three Phase Inverter
$V_{RRM} = 1600 \text{ V}$	$V_{CES} = 1200 \text{ V}$	$V_{CES} = 1200 \text{ V}$
$I_{DAVM25} = 151 \text{ A}$	$I_{C25} = 19 \text{ A}$	$I_{C25} = 43 \text{ A}$
$I_{FSM} = 320 \text{ A}$	$V_{CE(sat)} = 2.9 \text{ V}$	$V_{CE(sat)} = 2.5 \text{ V}$

Preliminary data

Part name (Marking on product)

MUBW45-12T6K



E72873

Pin configuration see outlines.

Features:

- High level of integration - only one power semiconductor module required for the whole drive
- Inverter with Trench 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			
			min.	typ.	max.	Unit
V_{CES}	collector emitter voltage	$T_{VJ} = 25^{\circ}\text{C}$ to 150°C			1200	V
V_{GES}	max. DC gate voltage	continuous			± 20	V
V_{GEM}	max. transient collector gate voltage	transient			± 30	V
I_{C25}	collector current	$T_C = 25^{\circ}\text{C}$			43	A
I_{C80}		$T_C = 80^{\circ}\text{C}$			31	A
P_{tot}	total power dissipation	$T_C = 25^{\circ}\text{C}$			160	W
$V_{CE(sat)}$	collector emitter saturation voltage	$I_C = 45\text{ A}; V_{GE} = 15\text{ V}$		2.5 3.2	3.1	V
$V_{GE(th)}$	gate emitter threshold voltage	$I_C = 1\text{ mA}; V_{GE} = V_{CE}$	$T_{VJ} = 25^{\circ}\text{C}$	5	6.5	V
I_{CES}	collector emitter leakage current	$V_{CE} = V_{CES}; V_{GE} = 0\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	1.0 1.5	1.25	mA mA
I_{GES}	gate emitter leakage current	$V_{CE} = 0\text{ V}; V_{GE} = \pm 20\text{ V}$			400	nA
C_{ies}	input capacitance	$V_{CE} = 25\text{ V}; V_{GE} = 0\text{ V}; f = 1\text{ MHz}$		1810		pF
$Q_{G(on)}$	total gate charge	$V_{CE} = 600\text{ V}; V_{GE} = 15\text{ V}; I_C = 25\text{ A}$		240		nC
$t_{d(on)}$	turn-on delay time	inductive load $V_{CE} = 600\text{ V}; I_C = 25\text{ A}$ $V_{GE} = \pm 15\text{ V}; R_G = 36\ \Omega$	$T_{VJ} = 125^{\circ}\text{C}$	90		ns
t_r	current rise time			50		ns
$t_{d(off)}$	turn-off delay time			520		ns
t_f	current fall time			90		ns
E_{on}	turn-on energy per pulse			2.5		mJ
E_{off}	turn-off energy per pulse			3.4		mJ
I_{CM}	reverse bias safe operating area	RBSOA; $V_{GE} = \pm 15\text{ V}; R_G = 36\ \Omega$ $L = 100\ \mu\text{H}$; clamped induct. load $V_{CEmax} = V_{CES} - L_S \cdot di/dt$	$T_{VJ} = 125^{\circ}\text{C}$	50		A
t_{SC} (SCSOA)	short circuit safe operating area	$V_{CE} = 900\text{ V}; V_{GE} = \pm 15\text{ V};$ $R_G = 36\ \Omega$; non-repetitive	$T_{VJ} = 125^{\circ}\text{C}$	10		μs
R_{thJC}	thermal resistance junction to case	(per IGBT)			0.8	K/W
R_{thCH}	thermal resistance case to heatsink	(per IGBT)		0.3		K/W

Output Inverter D1 - D6

Symbol	Definitions	Conditions	Ratings			
			min.	typ.	max.	Unit
V_{RRM}	max. repetitive reverse voltage	$T_{VJ} = 150^{\circ}\text{C}$			1200	V
I_{F25}	forward current	$T_C = 25^{\circ}\text{C}$			49	A
I_{F80}		$T_C = 80^{\circ}\text{C}$			32	A
V_F	forward voltage	$I_F = 45\text{ A}; V_{GE} = 0\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		3.1 2.3	V V
I_{RM}	max. reverse recovery current	$V_R = 600\text{ V}$ $di_F/dt = -1700\text{ A}/\mu\text{s}$ $I_F = 30\text{ A}; V_{GE} = 0\text{ V}$	$T_{VJ} = 100^{\circ}\text{C}$	51		A
t_{rr}	reverse recovery time			180		ns
$E_{rec(off)}$	reverse recovery energy			1.8		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			
			min.	typ.	max.	Unit
V_{CES}	collector emitter voltage	$T_{VJ} = 25^{\circ}\text{C}$ to 150°C			1200	V
V_{GES}	max. DC gate voltage	continuous			± 20	V
V_{GEM}	max. transient collector gate voltage	transient			± 30	V
I_{C25}	collector current	$T_C = 25^{\circ}\text{C}$			19	A
I_{C80}		$T_C = 80^{\circ}\text{C}$			13	A
P_{tot}	total power dissipation	$T_C = 25^{\circ}\text{C}$			90	W
$V_{CE(sat)}$	collector emitter saturation voltage	$I_C = 15\text{ A}; V_{GE} = 15\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	2.9 3.5	3.4	V
$V_{GE(th)}$	gate emitter threshold voltage	$I_C = 0.4\text{ mA}; V_{GE} = V_{CE}$	$T_{VJ} = 25^{\circ}\text{C}$	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	$V_{CE} = 25\text{ V}; V_{GE} = 0\text{ V}; f = 1\text{ MHz}$		600		pF
$Q_{G(on)}$	total gate charge	$V_{CE} = 600\text{ V}; V_{GE} = 15\text{ V}; I_C = 10\text{ A}$		45		nC
$t_{d(on)}$	turn-on delay time	inductive load $V_{CE} = 600\text{ V}; I_C = 10\text{ A}$ $V_{GE} = \pm 15\text{ V}; R_G = 82\ \Omega$	$T_{VJ} = 125^{\circ}\text{C}$	45		ns
t_r	current rise time			40		ns
$t_{d(off)}$	turn-off delay time			290		ns
t_f	current fall time			60		ns
E_{on}	turn-on energy per pulse			1.2		mJ
E_{off}	turn-off energy per pulse			1.1		mJ
I_{CM}	reverse bias safe operating area	RBSOA; $V_{GE} = \pm 15\text{ V}; R_G = 82\ \Omega$ $L = 100\ \mu\text{H}$; clamped induct. load $V_{CEmax} = V_{CES} - L_S \cdot di/dt$	$T_{VJ} = 125^{\circ}\text{C}$	20		A
t_{SC} (SCSOA)	short circuit safe operating area	$V_{CE} = 720\text{ V}; V_{GE} = \pm 15\text{ V}; R_G = 82\ \Omega$; non-repetitive	$T_{VJ} = 125^{\circ}\text{C}$	10		μs
R_{thJC}	thermal resistance junction to case	(per IGBT)			1.35	K/W
R_{thCH}	thermal resistance case to heatsink	(per IGBT)		0.405		K/W

Brake Chopper D7

Symbol	Definitions	Conditions	Ratings			
			min.	typ.	max.	Unit
V_{RRM}	max. repetitive reverse voltage	$T_{VJ} = 150^{\circ}\text{C}$			1200	V
I_{F25}	forward current	$T_C = 25^{\circ}\text{C}$			15	A
I_{F80}		$T_C = 80^{\circ}\text{C}$			10	A
V_F	forward voltage	$I_F = 15\text{ A}; V_{GE} = 0\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	2.0	3.5	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	$V_R = 600\text{ V}; I_F = 10\text{ A}$ $di_F/dt = -400\text{ A}/\mu\text{s}$	$T_{VJ} = 100^{\circ}\text{C}$	13		A
t_{rr}	reverse recovery time			110		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°C	37	A
I _{DAVM}	max. average DC output current	rectangular; d = 1/3; bridge	T _C = 80°C	104	A
I _{FSM}	max. surge forward current	t = 10 ms; sine 50 Hz	T _C = 25°C	320	A
P _{tot}	total power dissipation	T _C = 25°C	110	W	

Symbol	Conditions	Characteristic Values			
		min.	typ.	max.	
V_F	<i>forward voltage</i>	I _F = 45 A	T _{VJ} = 25°C T _{VJ} = 125°C	1.41 1.38	V V
I_R	<i>reverse current</i>	V _R = V _{RRM}	T _{VJ} = 25°C T _{VJ} = 125°C	0.4	0.02 mA mA
R_{thJC}	<i>thermal resistance junction to case</i>	(per diode)	T _{VJ} = 25°C	1.1	K/W
R_{thCH}	<i>thermal resistance case to heatsink</i>	(per diode)		0.35	K/W

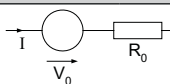
Temperature Sensor NTC

					Ratings		
Symbol	Definitions	Conditions	min.	typ.	max.	Unit	
R ₂₅	resistance	T _C = 25°C	4.45	4.7	5.0	kΩ	
B _{25/85}				3510		K	

Module

				Ratings		
Symbol	Definitions	Conditions	min.	typ.	max.	Unit
T _{VJ}	operating temperature		-40		125	°C
T _{VJM}	max. virtual junction temperature				150	°C
T _{stg}	storage temperature		-40		125	°C
V _{ISOL}	isolation voltage	I _{ISOL} ≤ 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

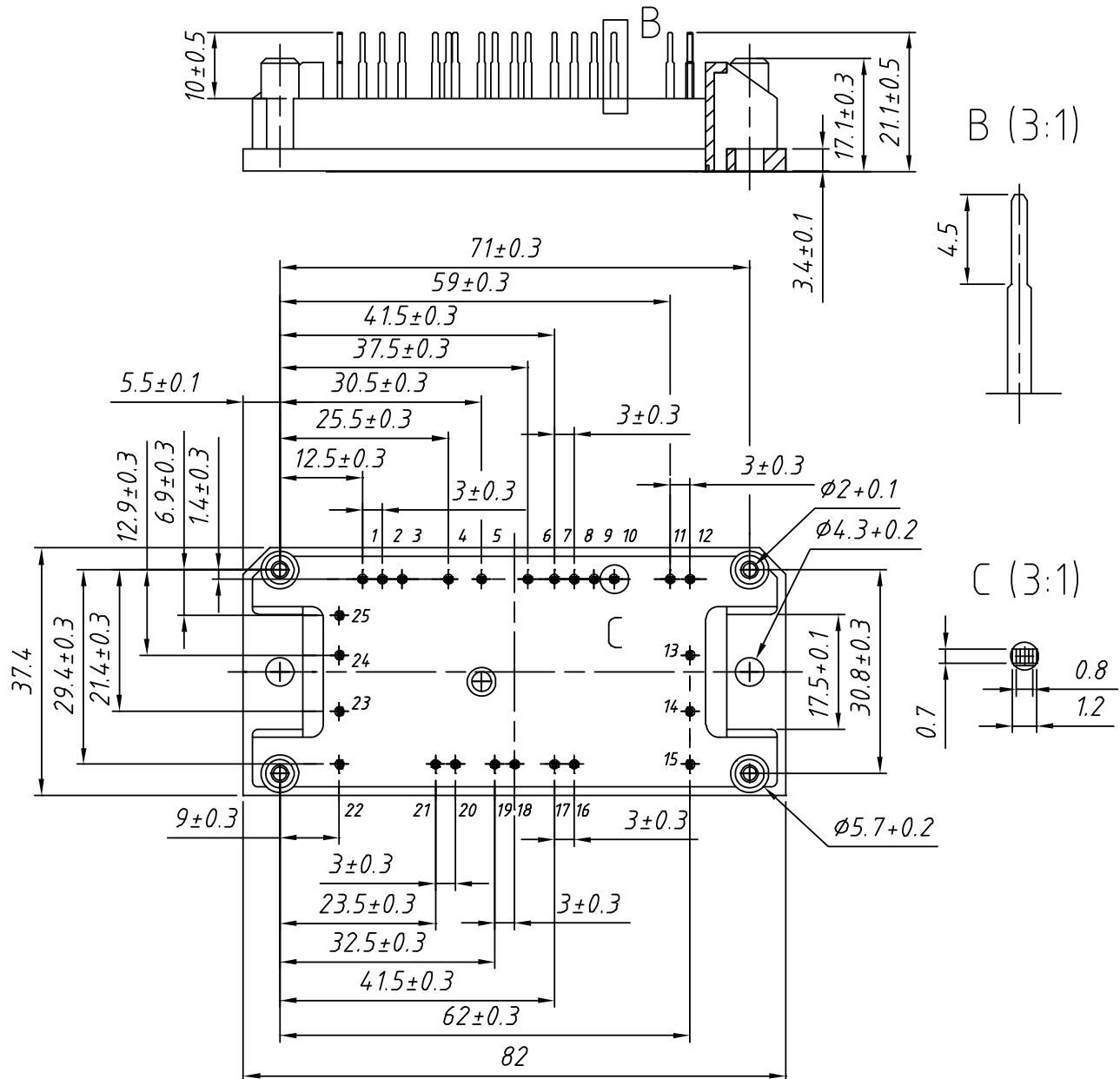


V_0				Ratings		
Symbol	Definitions	Conditions	min.	typ.	max.	Unit
V_0 R_0	<i>rectifier diode</i>	D8 - D13	$T_{VJ} = 125^{\circ}\text{C}$	0.90 9		V m Ω
V_0 R_0	<i>IGBT</i>	T1 - T6	$T_{VJ} = 125^{\circ}\text{C}$	0.95 43		V m Ω
V_0 R_0	<i>free wheeling diode</i>	D1 - D6	$T_{VJ} = 125^{\circ}\text{C}$	1.5 14		V m Ω
V_0 R_0	<i>IGBT</i>	T7	$T_{VJ} = 125^{\circ}\text{C}$	1.5 120		V m Ω
V_0 R_0	<i>free wheeling diode</i>	D7	$T_{VJ} = 125^{\circ}\text{C}$	1.46 63		V m Ω

$T_C = 25^\circ\text{C}$ 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 45-12T6K	MUBW45-12T6K	Box	10	500 131

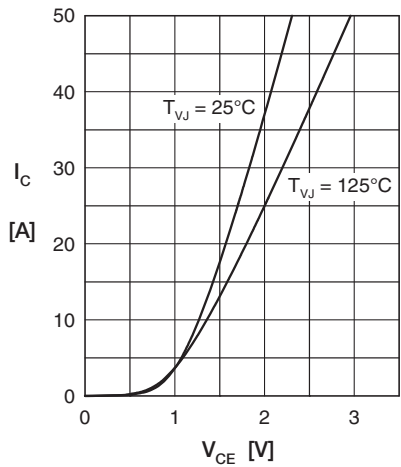


Fig. 1 Typ. output characteristics

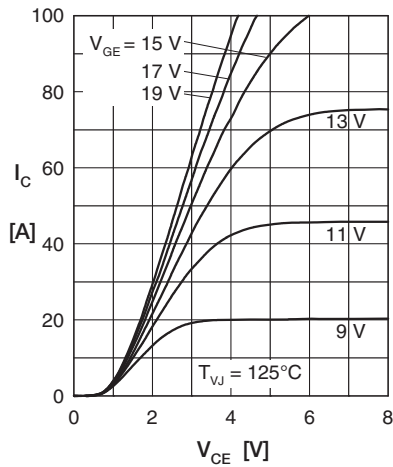


Fig. 2 Typ. output characteristics

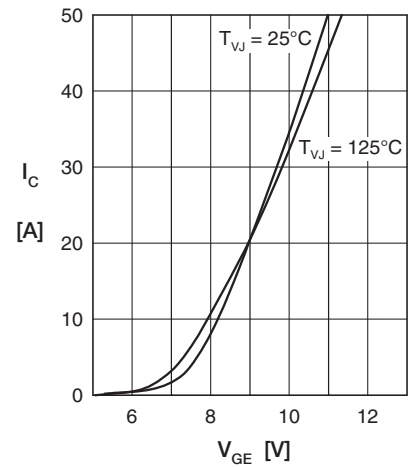


Fig. 3 Typ. transfer characteristics

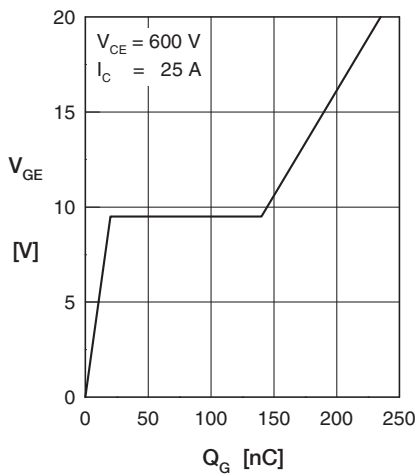


Fig. 4 Typ. turn-on gate charge

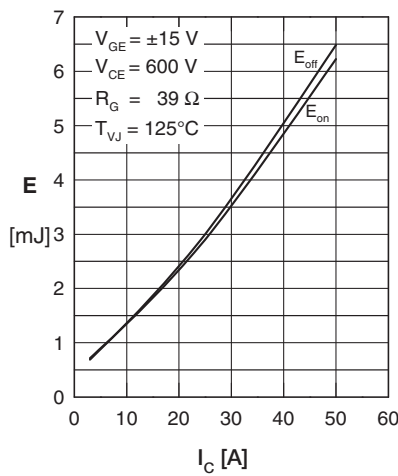


Fig. 5 Typ. switching energy vs. collector current

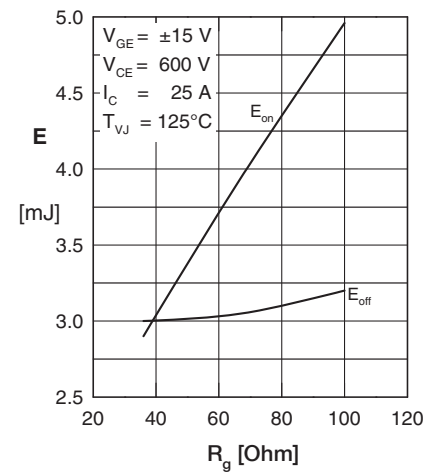


Fig. 6 Typ. switching energy vs. gate resistance

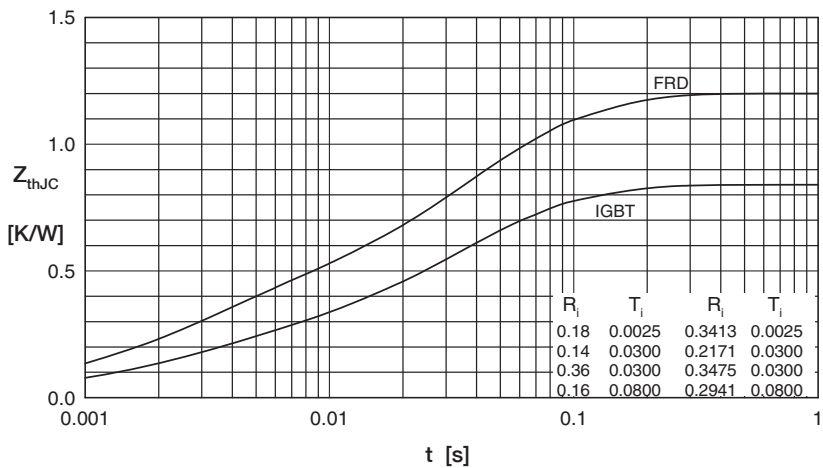


Fig. 7 Typ. transient thermal impedance

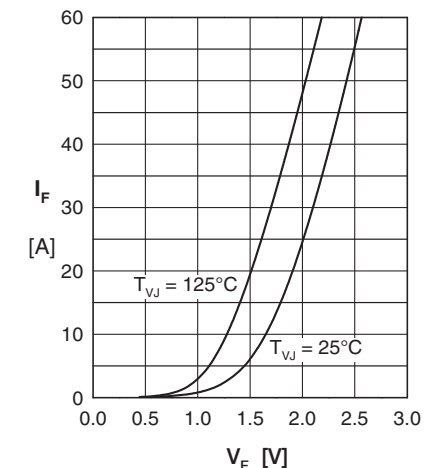


Fig. 8 Typ. forward characteristics