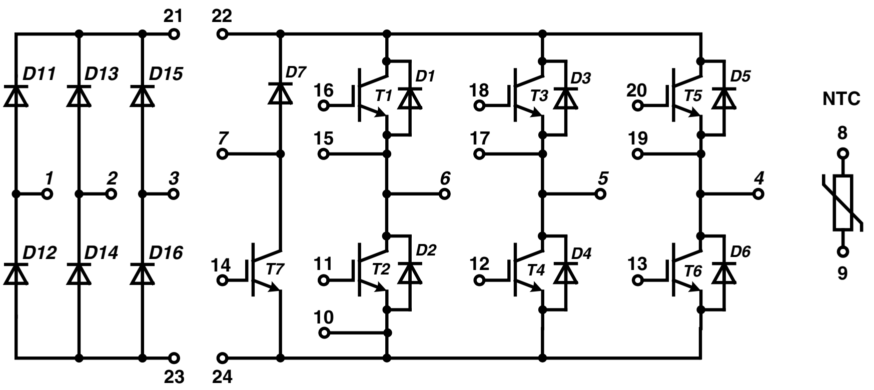
Converter - Brake - Inverter Module

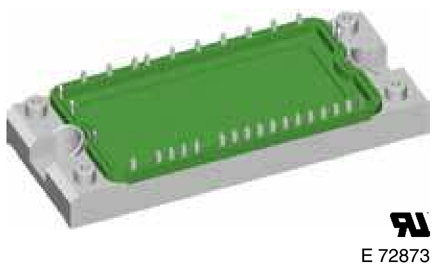
XPT IGBT

Three Phase Rectifier	Brake Chopper	Three Phase Inverter
V_{RRM} = 1600 V	V_{CES} = 1200 V	V_{CES} = 1200 V
I_{DAVM} = 105 A	I_{C25} = 28 A	I_{C25} = 60 A
I_{FSM} = 320 A	$V_{CE(sat)}$ = 1.8 V	$V_{CE(sat)}$ = 1.8 V

Part name (Marking on product)

MIXA40WB1200TED





E 72873

Pin configuration see outlines.

Features:

- Easy paralleling due to the positive temperature coefficient of the on-state voltage
- Rugged XPT design (Xtreme light Punch Through) results in:
  - short circuit rated for 10 µsec.
  - very low gate charge
  - square RBSOA @ 3x I_C
  - low EMI
- Thin wafer technology combined with the XPT design results in a competitive low $V_{CE(sat)}$
- SONIC™ diode
  - fast and soft reverse recovery
  - low operating forward voltage

Application:

- AC motor drives
- Solar inverter
- Medical equipment
- Uninterruptible power supply
- Air-conditioning systems
- Welding equipment
- Switched-mode and resonant-mode power supplies

Package:

- "E2-Pack" standard outline
- Insulated copper base plate
- Soldering pins for PCB mounting
- Temperature sense included

IXYS reserves the right to change limits, test conditions and dimensions.

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Ouput Inverter T1 - T6

Symbol	Definitions	Conditions		min.	typ.	max.	Unit
					Ratings		
V_{CES}	*collector emitter voltage*		T_{VJ} = 25°C			1200	V
V_{GES} V_{GEM}	*max. DC gate voltage* *max. transient collector gate voltage*	continuous transient				±20 ±30	V V
I_{C25} I_{C80}	*collector current*		T_C = 25°C T_C = 80°C			60 40	A A
P_{tot}	*total power dissipation*		T_C = 25°C			195	W
$V_{CE(sat)}$	*collector emitter saturation voltage*	I_C = 35 A; V_{GE} = 15 V	T_{VJ} = 25°C T_{VJ} = 125°C		1.8 2.1	2.1	V V
$V_{GE(th)}$	*gate emitter threshold voltage*	I_C = 1.5 mA; V_{GE} = V_{CE}	T_{VJ} = 25°C	5.4	6.0	6.5	V
I_{CES}	*collector emitter leakage current*	V_{CE} = V_{CES}; V_{GE} = 0 V	T_{VJ} = 25°C T_{VJ} = 125°C		 0.2	2.1	mA mA
I_{GES}	*gate emitter leakage current*	V_{GE} = ±20 V				500	nA
$Q_{G(on)}$	*total gate charge*	V_{CE} = 600 V; V_{GE} = 15 V; I_C = 35 A			106		nC
$t_{d(on)}$ t_r $t_{d(off)}$ t_f E_{on} E_{off}	*turn-on delay time* *current rise time* *turn-off delay time* *current fall time* *turn-on energy per pulse* *turn-off energy per pulse*	inductive load V_{CE} = 600 V; I_C = 35 A V_{GE} = ±15 V; R_G = 27 Ω	T_{VJ} = 125°C		70 40 250 100 3.8 4.1		ns ns ns ns mJ mJ
RBSOA	*reverse bias safe operating area*	V_{GE} = ±15 V; R_G = 27 Ω;	T_{VJ} = 125°C V_{CEK} = 1200 V			105	A
SCSOA t_{SC} I_{SC}	*short circuit safe operating area* *short circuit duration* *short circuit current*	V_{CE} = 900 V; V_{GE} = ±15 V; R_G = 27 Ω; non-repetitive	T_{VJ} = 125°C		 140	 10	 μs A
R_{thJC}	*thermal resistance junction to case*	(per IGBT)				0.64	K/W

Output Inverter D1 - D6

Symbol	Definitions	Conditions		min.	typ.	max.	Unit
					Ratings		
V_{RRM}	*max. repetitve reverse voltage*		T_{VJ} = 25°C			1200	V
I_{F25} I_{F80}	*forward current*		T_C = 25°C T_C = 80°C			44 29	A A
V_F	*forward voltage*	I_F = 30 A; V_{GE} = 0 V	T_{VJ} = 25°C T_{VJ} = 125°C		1.95 1.95	2.2	V V
Q_{rr} I_{RM} t_{rr} E_{rec}	*reverse recovery charge* *max. reverse recovery current* *reverse recovery time* *reverse recovery energy*	V_R = 600 V di_F/dt = -600 A/μs I_F = 30 A; V_{GE} = 0 V	T_{VJ} = 125°C		3.5 30 350 0.9		μC A ns mJ
R_{thJC}	*thermal resistance junction to case*	(per diode)				1.2	K/W

T_C = 25°C unless otherwise stated

Brake T7

Symbol	Definitions	Conditions		min.	typ.	max.	Unit
V_{CES}	*collector emitter voltage*		T_{VJ} = 25°C			1200	V
V_{GES} V_{GEM}	*max. DC gate voltage* *max. transient collector gate voltage*	continuous transient				±20 ±30	V V
I_{C25} I_{C80}	*collector current*		T_C = 25°C T_C = 80°C			28 20	A A
P_{tot}	*total power dissipation*		T_C = 25°C			100	W
$V_{CE(sat)}$	*collector emitter saturation voltage*	I_C = 16 A; V_{GE} = 15 V	T_{VJ} = 25°C T_{VJ} = 125°C		1.8 2.1	2.1	V V
$V_{GE(th)}$	*gate emitter threshold voltage*	I_C = 0.6 mA; V_{GE} = V_{CE}	T_{VJ} = 25°C	5.4	6.0	6.5	V
I_{CES}	*collector emitter leakage current*	V_{CE} = V_{CES}; V_{GE} = 0 V	T_{VJ} = 25°C T_{VJ} = 125°C		 0.1	0.1	mA mA
I_{GES}	*gate emitter leakage current*	V_{GE} = ±20 V				500	nA
$Q_{G(on)}$	*total gate charge*	V_{CE} = 600 V; V_{GE} = 15 V; I_C = 15 A			48		nC
$t_{d(on)}$ t_r $t_{d(off)}$ t_f E_{on} E_{off}	*turn-on delay time* *current rise time* *turn-off delay time* *current fall time* *turn-on energy per pulse* *turn-off energy per pulse*	inductive load V_{CE} = 600 V; I_C = 15 A V_{GE} = ±15 V; R_G = 56 Ω	T_{VJ} = 125°C		70 40 250 100 1.6 1.7		ns ns ns ns mJ mJ
RBSOA	*reverse bias safe operating area*	V_{GE} = ±15 V; R_G = 56 Ω;	T_{VJ} = 125°C V_{CEK} = 1200 V			45	A
SCSOA t_{SC} I_{SC}	*short circuit safe operating area* *short circuit duration* *short circuit current*	V_{CE} = 900 V; V_{GE} = ±15 V; R_G = 56 Ω; non-repetitive	T_{VJ} = 125°C		 60	 10	 µs A
R_{thJC}	*thermal resistance junction to case*	(per IGBT)				1.26	K/W

Brake Chopper D7

Symbol	Definitions	Conditions		min.	typ.	max.	Unit
V_{RRM}	*max. repetitive reverse voltage*		T_{VJ} = 25°C			1200	V
I_{F25} I_{F80}	*forward current*		T_C = 25°C T_C = 80°C			12 8	A A
V_F	*forward voltage*	I_F = 10 A; V_{GE} = 0 V	T_{VJ} = 25°C T_{VJ} = 125°C		2.5 2.6	2.9	V V
I_R	*reverse current*	V_R = V_{RRM}	T_{VJ} = 25°C T_{VJ} = 125°C		 0.5	0.5	mA mA
Q_{rr} I_{RM} t_{rr} E_{rec}	*reverse recovery charge* *max. reverse recovery current* *reverse recovery time* *reverse recovery energy*	V_R = 600 V di_F/dt = 200 A/µs I_F = 5 A; V_{GE} = 0 V	T_{VJ} = 125°C		0.6 6 350 0.2		µC A ns mJ
R_{thJC}	*thermal resistance junction to case*	(per diode)				3.4	K/W

T_C = 25°C unless otherwise stated

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Input Rectifier Bridge D11 - D16

Symbol	Definitions	Conditions		min.	typ.	max.	Unit
					Ratings		
V_{RRM}	*max. repetitive reverse voltage*		T_{VJ} = 25°C			1600	V
I_{FAV} I_{DAVM}	*average forward current* *max. average DC output current*	sine 180° rect.; d = $^1/_3$	T_C = 80°C T_C = 80°C			37 105	A A
I_{FSM}	*max. forward surge current*	t = 10 ms; sine 50 Hz	T_{VJ} = 25°C T_{VJ} = 125°C			320 280	A A
I^2t	*I^2t value for fusing*	t = 10 ms; sine 50 Hz	T_{VJ} = 25°C T_{VJ} = 125°C			510 390	A^2s A^2s
P_{tot}	*total power dissipation*		T_C = 25°C			114	W
V_F	*forward voltage*	I_F = 50 A	T_{VJ} = 25°C T_{VJ} = 125°C		1.34 1.34	1.7	V V
I_R	*reverse current*	$V_R = V_{RRM}$	T_{VJ} = 25°C T_{VJ} = 125°C		 0.2	0.02	mA mA
R_{thJC}	*thermal resistance junction to case*	(per diode)				1.1	K/W

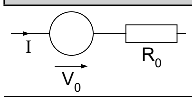
Temperature Sensor NTC

Symbol	Definitions	Conditions		min.	typ.	max.	Unit
					Ratings		
R_{25}	*resistance*		T_C = 25°C	4.75	5.0	5.25	kΩ
$B_{25/50}$					3375		K

Module

Symbol	Definitions	Conditions	min.	typ.	max.	Unit
				Ratings		
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*	$I_{ISOL} \leq$ 1 mA; 50/60 Hz			2500	V~
CTI	*comparative tracking index*				-	
M_d	*mounting torque (M5)*		3		6	Nm
d_S	*creep distance on surface*		6			mm
d_A	*strike distance through air*		6			mm
$R_{pin\text{-}chip}$	*resistance pin to chip*			5		mΩ
R_{thCH}	*thermal resistance case to heatsink*	with heatsink compound		0.02		K/W
Weight				180		g

Equivalent Circuits for Simulation



Symbol	Definitions	Conditions		min.	typ.	max.	Unit
					Ratings		
V_0 R_0	*rectifier diode*	D8 - D13	T_{VJ} = 150°C			0.88 9	V mΩ
V_0 R_0	*IGBT*	T1 - T6	T_{VJ} = 150°C			1.1 40	V mΩ
V_0 R_0	*free wheeling diode*	D1 - D6	T_{VJ} = 150°C			1.2 27	V mΩ
V_0 R_0	*IGBT*	T7	T_{VJ} = 150°C			1.1 86	V mΩ
V_0 R_0	*free wheeling diode*	D7	T_{VJ} = 150°C			1.15 170	V mΩ

T_C = 25°C unless otherwise stated

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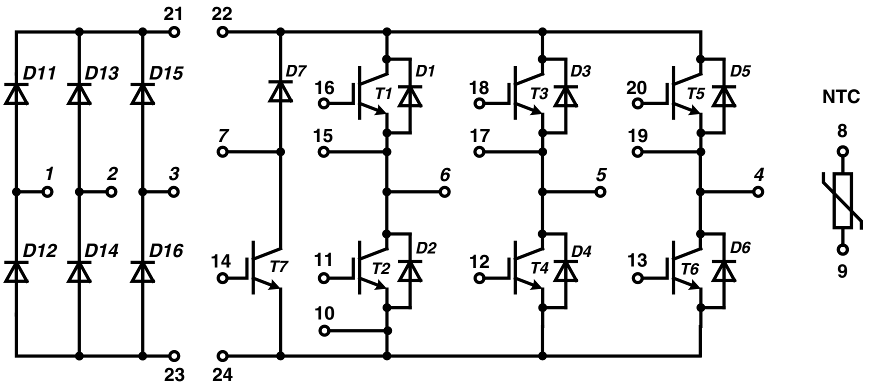
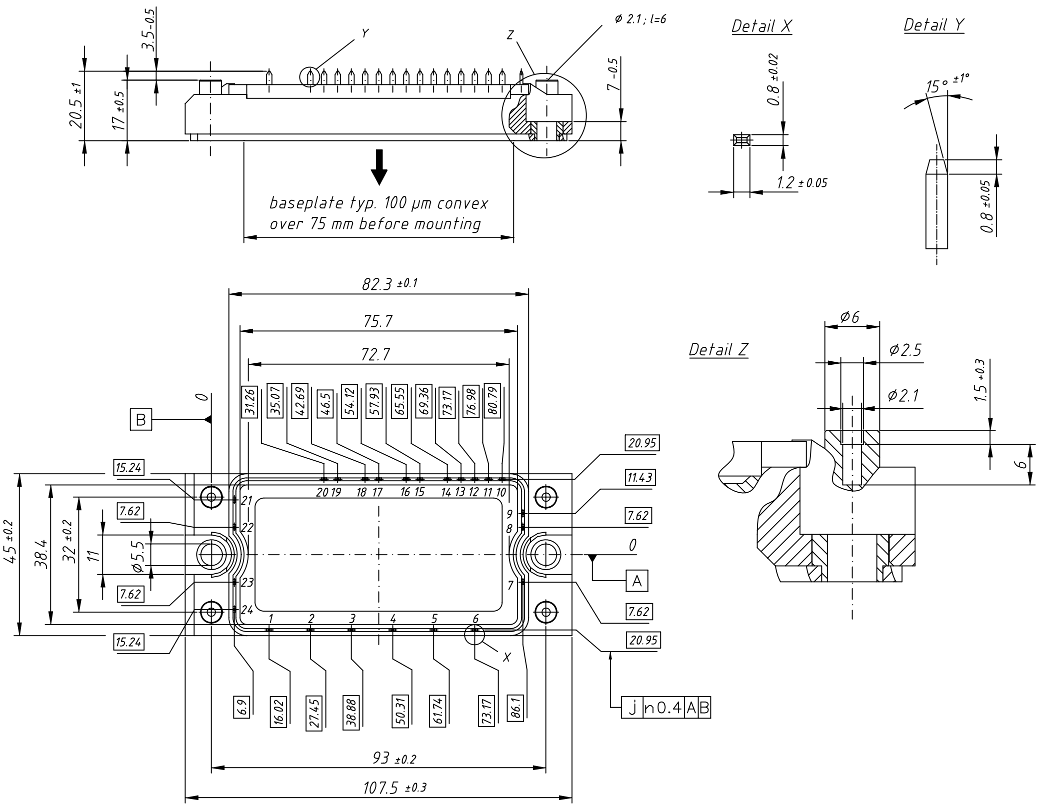
Circuit Diagram

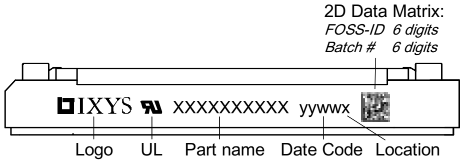


Outline Drawing

Dimensions in mm (1 mm = 0.0394“)



Product Marking



Part number

M = Module
I = IGBT
X = XPT
A = Standard
40 = Current Rating [A]
WB = 6-Pack + 3~ Rectifier Bridge & Brake Unit
1200 = Reverse Voltage [V]
T = NTC
ED = E2-Pack

Ordering	Part Name	Marking on Product	Delivering Mode	Base Qty	Ordering Code
Standard	MIXA40WB1200 TED	MIXA40WB1200TED	Box	6	507497

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Inverter T1 - T6

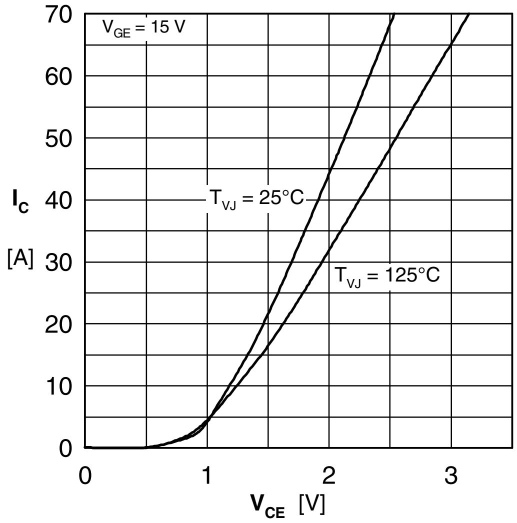


Fig. 1 Typ. output characteristics

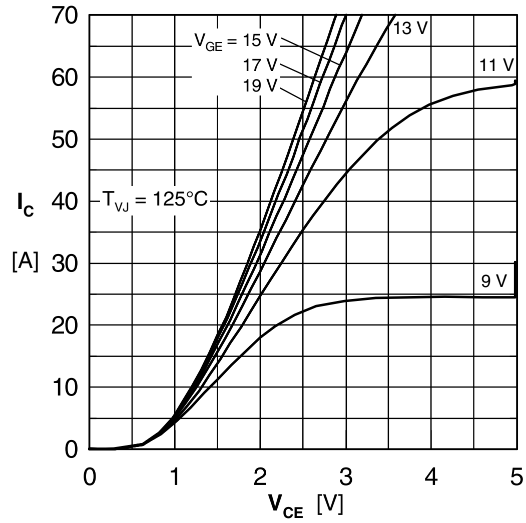


Fig. 2 Typ. output characteristics

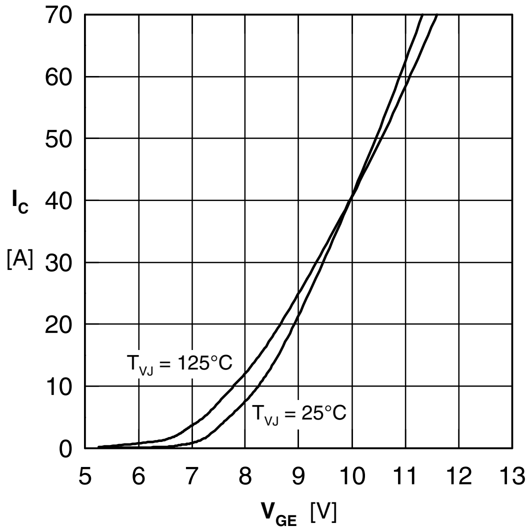


Fig. 3 Typ. tranfer characteristics

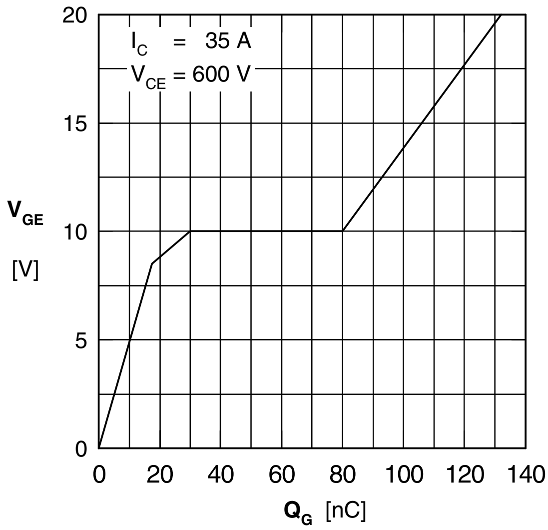


Fig. 4 Typ. turn-on gate charge

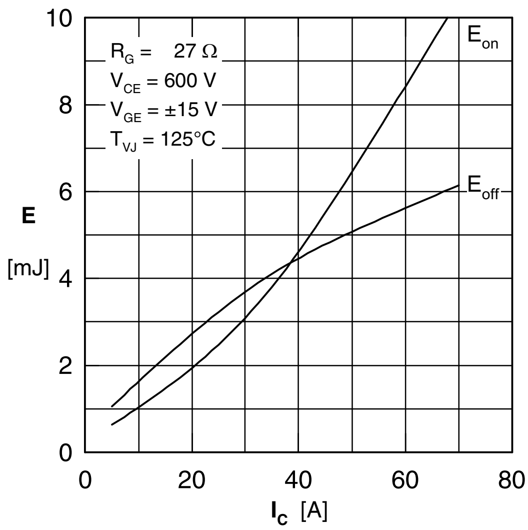


Fig. 5 Typ. switching energy vs. collector current

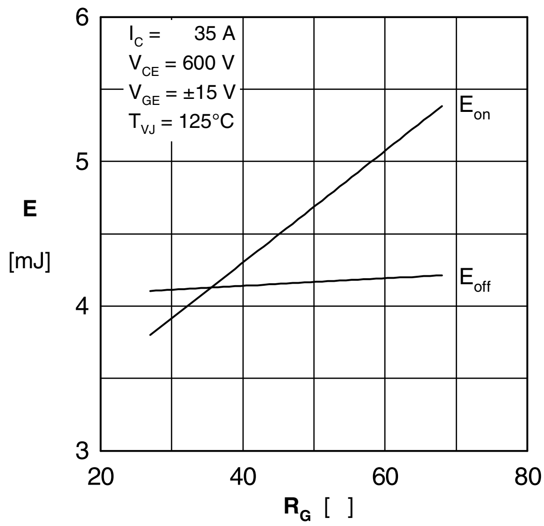


Fig. 6 Typ. switching energy vs. gate resistance

Inverter D1 - D6

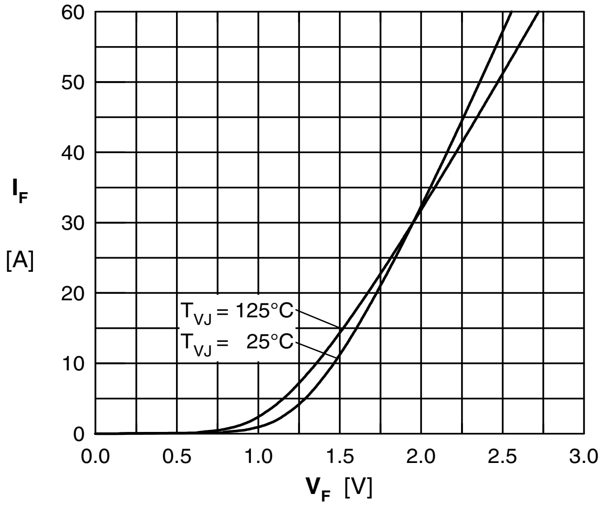


Fig. 7 Typ. Forward current versus V_F

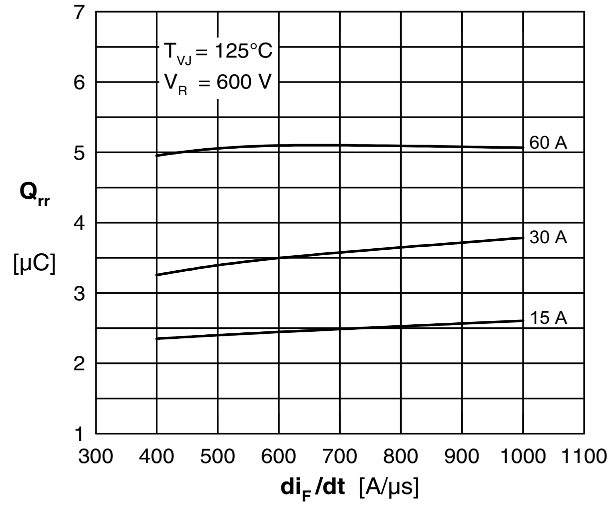


Fig. 8 Typ. reverse recov.charge Q_{rr} vs. di/dt

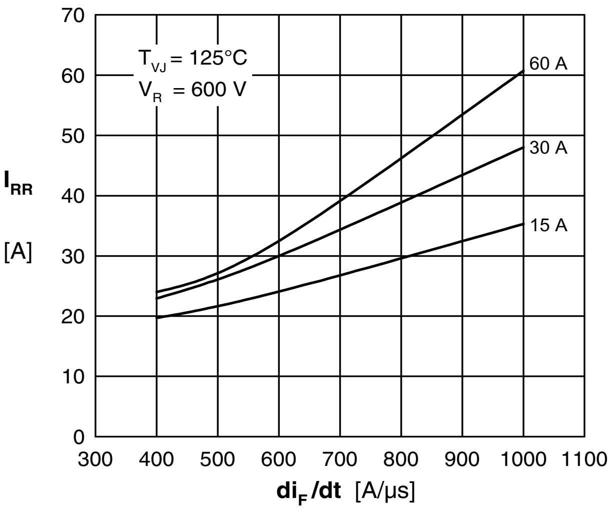


Fig. 9 Typ. peak reverse current I_{RM} vs. di/dt

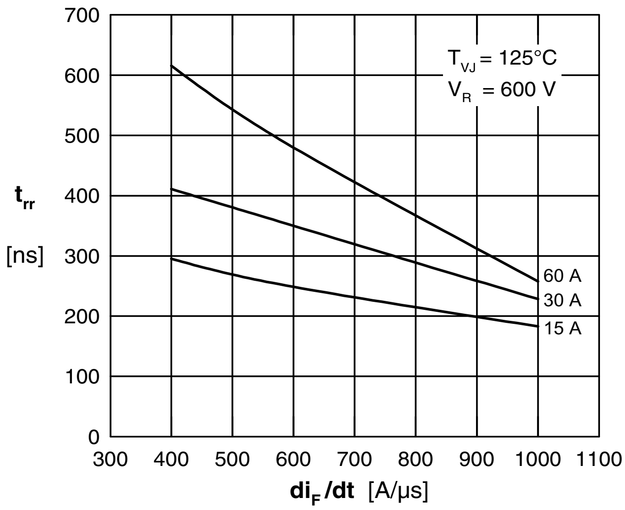


Fig. 10 Typ. recovery time t_{rr} versus di/dt

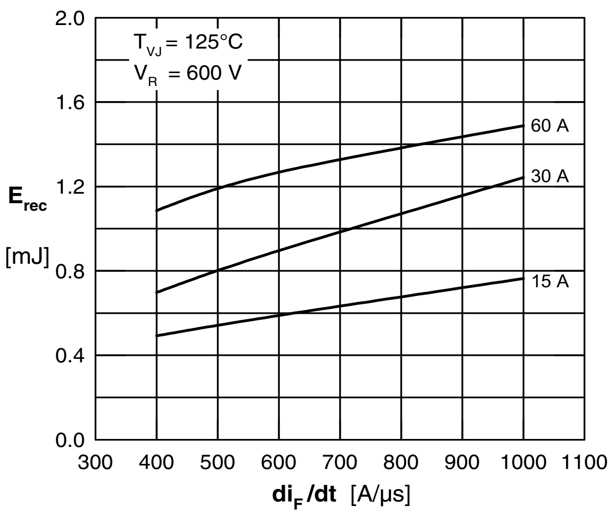
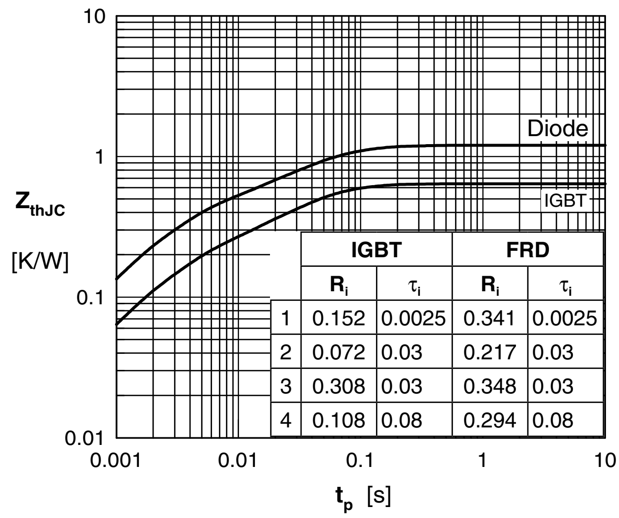


Fig. 5 Typ. recovery energy E_{rec} versus di/dt



	IGBT		FRD	
	R_i	τ_i	R_i	τ_i
1	0.152	0.0025	0.341	0.0025
2	0.072	0.03	0.217	0.03
3	0.308	0.03	0.348	0.03
4	0.108	0.08	0.294	0.08

Fig. 12 Typ. transient thermal impedance

Brake T7 & D7

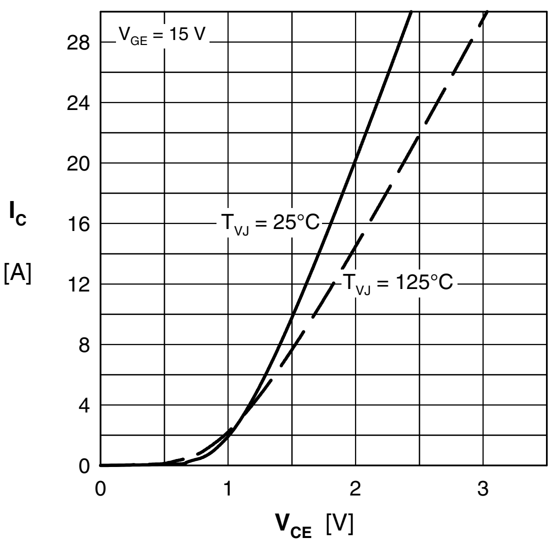


Fig. 13 Typ. output characteristics

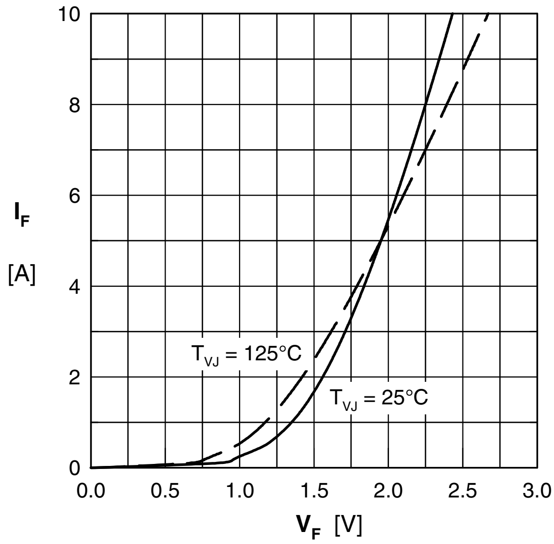
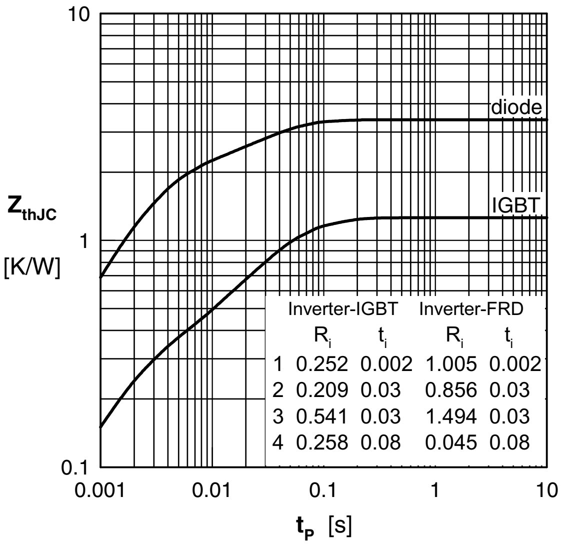


Fig. 14 Typ. forward characteristics



	Inverter-IGBT		Inverter-FRD	
	R_i	t_i	R_i	t_i
1	0.252	0.002	1.005	0.002
2	0.209	0.03	0.856	0.03
3	0.541	0.03	1.494	0.03
4	0.258	0.08	0.045	0.08

Fig. 15 Typ. transient thermal impedance

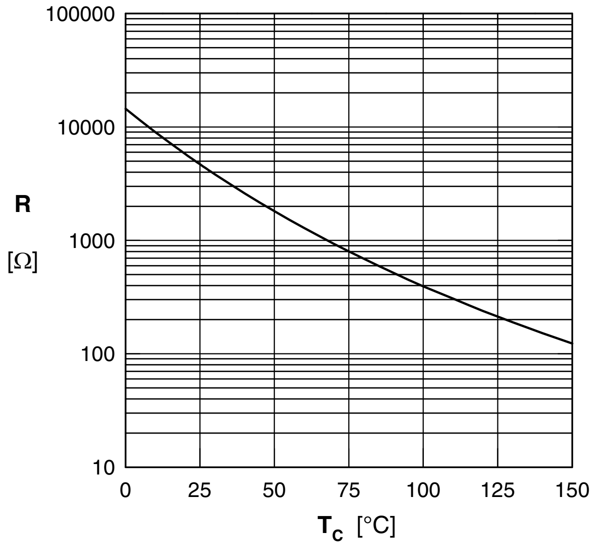


Fig.16 Typ. NTC resistance vs. temperature