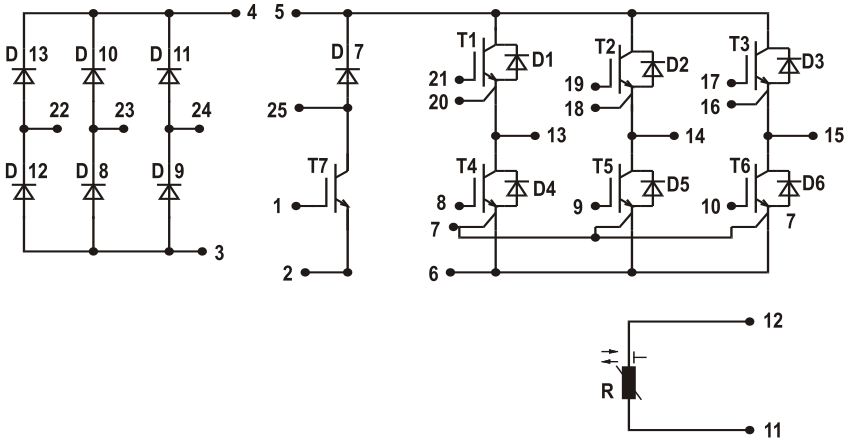
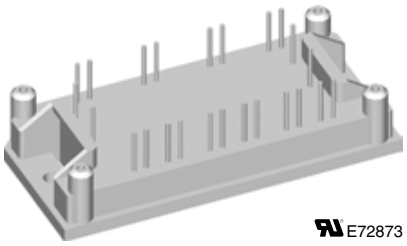
Converter - Brake - Inverter Module
XPT IGBT

Three Phase Rectifier	Brake Chopper	Three Phase Inverter
V_{RRM} = 1600 V	V_{CES} = 1200 V	V_{CES} = 1200 V
I_{DAVM25} = 150 A	I_{C25} = 17 A	I_{C25} = 28 A
I_{FSM} = 320 A	$V_{CE(sat)}$ = 1.8 V	$V_{CE(sat)}$ = 1.8 V

Part name (Marking on product)

MIXA20WB1200TML





Pin configuration see outlines.

Features:

- High level of integration - only one power semiconductor module required for the whole drive
- 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 $V_{CE(sat)}$
- Temperature sense included
- SONIC™ diode
  - fast and soft reverse recovery
  - low operating forward voltage

Application:

- AC motor drives
- Pumps, Fans
- Washing machines
- Air-conditioning system
- Inverter and power supplies

Package:

- DCB based "E1-Pack"
- Assembly height is 17 mm
- Insulated base plate
- UL registered E72873

Ouput Inverter T1 - T6

Symbol	Definitions	Conditions		min.	Ratings typ.	max.	Unit
V_{CES}	*collector emitter voltage*		T_{VJ} = 25°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°C			28	A
I_{C80}			T_C = 80°C			20	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		1.8	2.1	V
			T_{VJ} = 125°C		2.1		V
$V_{GE(th)}$	*gate emitter threshold voltage*	I_C = 0.6 mA; V_{GE} = V_{CE}	T_{VJ} = 25°C	5.5	6.0	6.5	V
I_{CES}	*collector emitter leakage current*	V_{CE} = V_{CES}; V_{GE} = 0 V	T_{VJ} = 25°C		0.02	0.2	mA
			T_{VJ} = 125°C		0.2		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
$t_{d(on)}$	*turn-on delay time*	inductive load V_{CE} = 600 V; I_C = 15 A V_{GE} = ±15 V; R_G = 56 Ω	T_{VJ} = 125°C		70		ns
t_r	*current rise time*				40		ns
$t_{d(off)}$	*turn-off delay time*				250		ns
t_f	*current fall time*				100		ns
E_{on}	*turn-on energy per pulse*				1.55		mJ
E_{off}	*turn-off energy per pulse*				1.7		mJ
RBSOA	*reverse bias safe operating area*	V_{GE} = ±15 V; R_G = 56 Ω; V_{CEK} = 1200 V	T_{VJ} = 125°C			45	A
I_{SC} (SCSOA)	*short circuit safe operating area*	V_{CE} = 900 V; V_{GE} = ±15 V; R_G = 56 Ω; t_p = 10 µs; non-repetitive	T_{VJ} = 125°C		60		A
R_{thJC}	*thermal resistance junction to case*	(per IGBT)				1.26	K/W
R_{thCH}	*thermal resistance case to heatsink*				0.42		K/W

Output Inverter D1 - D6

Symbol	Definitions	Conditions		min.	Ratings typ.	max.	Unit
V_{RRM}	*max. repetitve reverse voltage*		T_{VJ} = 25°C			1200	V
I_{F25}	*forward current*		T_C = 25°C			33	A
I_{F80}			T_C = 80°C			22	A
V_F	*forward voltage*	I_F = 20 A; V_{GE} = 0 V	T_{VJ} = 25°C		1.95	2.2	V
			T_{VJ} = 125°C		1.95		V
Q_{rr}	*reverse recovery charge*	V_R = 600 V di_F/dt = -400 A/µs I_F = 20 A; V_{GE} = 0 V	T_{VJ} = 125°C		3		µC
I_{RM}	*max. reverse recovery current*				20		A
t_{rr}	*reverse recovery time*				350		ns
E_{rec}	*reverse recovery energy*				0.7		mJ
R_{thJC}	*thermal resistance junction to case*	(per diode)				1.5	K/W
R_{thCH}	*thermal resistance case to heatsink*				0.5		K/W

Brake T7

Symbol	Definitions	Conditions		min.	Ratings typ.	max.	Unit
V_{CES}	*collector emitter voltage*		T_{VJ} = 25°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°C			17	A
I_{C80}			T_C = 80°C			12	A
P_{tot}	*total power dissipation*		T_C = 25°C			63	W
$V_{CE(sat)}$	*collector emitter saturation voltage*	I_C = 9 A; V_{GE} = 15 V	T_{VJ} = 25°C		1.8	2.1	V
			T_{VJ} = 125°C		2.1		V
$V_{GE(th)}$	*gate emitter threshold voltage*	I_C = 0.3 mA; V_{GE} = V_{CE}	T_{VJ} = 25°C	5.5	6.0	6.5	V
I_{CES}	*collector emitter leakage current*	V_{CE} = V_{CES}; V_{GE} = 0 V	T_{VJ} = 25°C		0.01	0.1	mA
			T_{VJ} = 125°C		0.1		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 = 10 A			27		nC
$t_{d(on)}$	*turn-on delay time*	inductive load V_{CE} = 600 V; I_C = 10 A V_{GE} = ±15 V; R_G = 100 Ω	T_{VJ} = 125°C		70		ns
t_r	*current rise time*				40		ns
$t_{d(off)}$	*turn-off delay time*				250		ns
t_f	*current fall time*				100		ns
E_{on}	*turn-on energy per pulse*				1.1		mJ
E_{off}	*turn-off energy per pulse*				1.1		mJ
RBSOA	*reverse bias safe operating area*	V_{GE} = ±15 V; R_G = 100 Ω; V_{CEK} = 1200 V	T_{VJ} = 125°C			30	A
I_{SC} **(SCSOA)**	*short circuit safe operating area*	V_{CE} = 900 V; V_{GE} = ±15 V; R_G = 100 Ω; t_p = 10 µs; non-repetitive	T_{VJ} = 125°C		40		A
R_{thJC}	*thermal resistance junction to case*	(per IGBT)				2.0	K/W
R_{thCH}	*thermal resistance case to heatsink*				0.7		K/W

Brake Chopper D7

Symbol	Definitions	Conditions		min.	Ratings typ.	max.	Unit
V_{RRM}	*max. repetitive reverse voltage*		T_{VJ} = 150°C			1200	V
I_{F25}	*forward current*		T_C = 25°C			33	A
I_{F80}			T_C = 80°C			22	A
V_F	*forward voltage*	I_F = 20 A; V_{GE} = 0 V	T_{VJ} = 25°C		1.95	2.2	V
			T_{VJ} = 125°C		1.95		V
I_R	*reverse current*	V_R = V_{RRM}	T_{VJ} = 25°C		0.01	0.1	mA
			T_{VJ} = 125°C		0.1		mA
Q_{rr}	*reverse recovery charge*	V_R = 600 V di_F/dt = 400 A/µs I_F = 20 A; V_{GE} = 0 V	T_{VJ} = 125°C		3		µC
I_{RM}	*max. reverse recovery current*				20		A
t_{rr}	*reverse recovery time*				350		ns
E_{rec}	*reverse recovery energy*				0.7		mJ
R_{thJC}	*thermal resistance junction to case*	(per diode)				1.5	K/W
R_{thCH}	*thermal resistance case to heatsink*				0.5		K/W

Input Rectifier Bridge D8 - D11

Symbol	Definitions	Conditions		Ratings min.	typ.	max.	Unit
V_{RRM}	*max. repetitive reverse voltage*		T_{VJ} = 25°C			1600	V
I_{FAV}	*average forward current*	sine 180°	T_C = 80°C			37	A
I_{DAVM}	*max. average DC output current*	rect.; d = $^1/_3$	T_C = 80°C			105	A
I_{FSM}	*max. forward surge current*	t = 10 ms; sine 50 Hz	T_{VJ} = 25°C			320	A
			T_{VJ} = 125°C			280	A
I^2t	*I^2t value for fusing*	t = 10 ms; sine 50 Hz	T_{VJ} = 25°C			510	A^2s
			T_{VJ} = 125°C			390	A^2s
P_{tot}	*total power dissipation*		T_C = 25°C			110	W
V_F	*forward voltage*	I_F = 50 A	T_{VJ} = 25°C		1.36	1.7	V
			T_{VJ} = 125°C		1.36		V
I_R	*reverse current*	$V_R = V_{RRM}$	T_{VJ} = 25°C			0.02	mA
			T_{VJ} = 125°C		0.2		mA
R_{thJC}	*thermal resistance junction to case*	(per diode)				1.1	K/W
R_{thCH}	*thermal resistance case to heatsink*	(per diode)			0.36		K/W

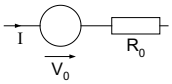
Temperature Sensor NTC

Symbol	Definitions	Conditions		Ratings min.	typ.	max.	Unit
R_{25}	*resistance*		T_C = 25°C	4.45	4.7	5.0	kΩ
$B_{25/50}$					3510		K

Module

Symbol	Definitions	Conditions	Ratings 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*	$I_{ISOL} \leq$ 1 mA; 50/60 Hz			2500	V~
CTI	*comparative tracking index*				-	
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*		7.6			mm
Weight				40		g

Equivalent Circuits for Simulation



Symbol	Definitions	Conditions		Ratings min.	typ.	max.	Unit
V_0	*rectifier diode*	D8 - D13	T_{VJ} = 150°C			0.88	V
R_0						9.0	mΩ
V_0	*IGBT*	T1 - T6	T_{VJ} = 150°C			1.1	V
R_0						86.3	mΩ
V_0	*free wheeling diode*	D1 - D6	T_{VJ} = 150°C			1.19	V
R_0						40.0	mΩ
V_0	*IGBT*	T7	T_{VJ} = 150°C			1.1	V
R_0						153	mΩ
V_0	*free wheeling diode*	D7	T_{VJ} = 150°C			1.19	V
R_0						40	mΩ

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

T_C = 25°C unless otherwise stated

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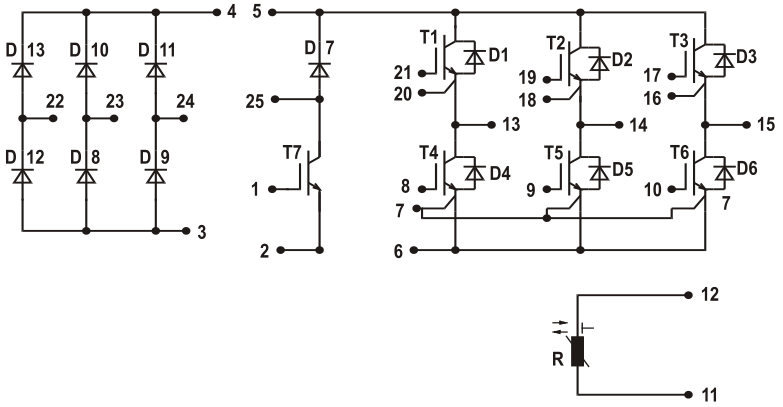
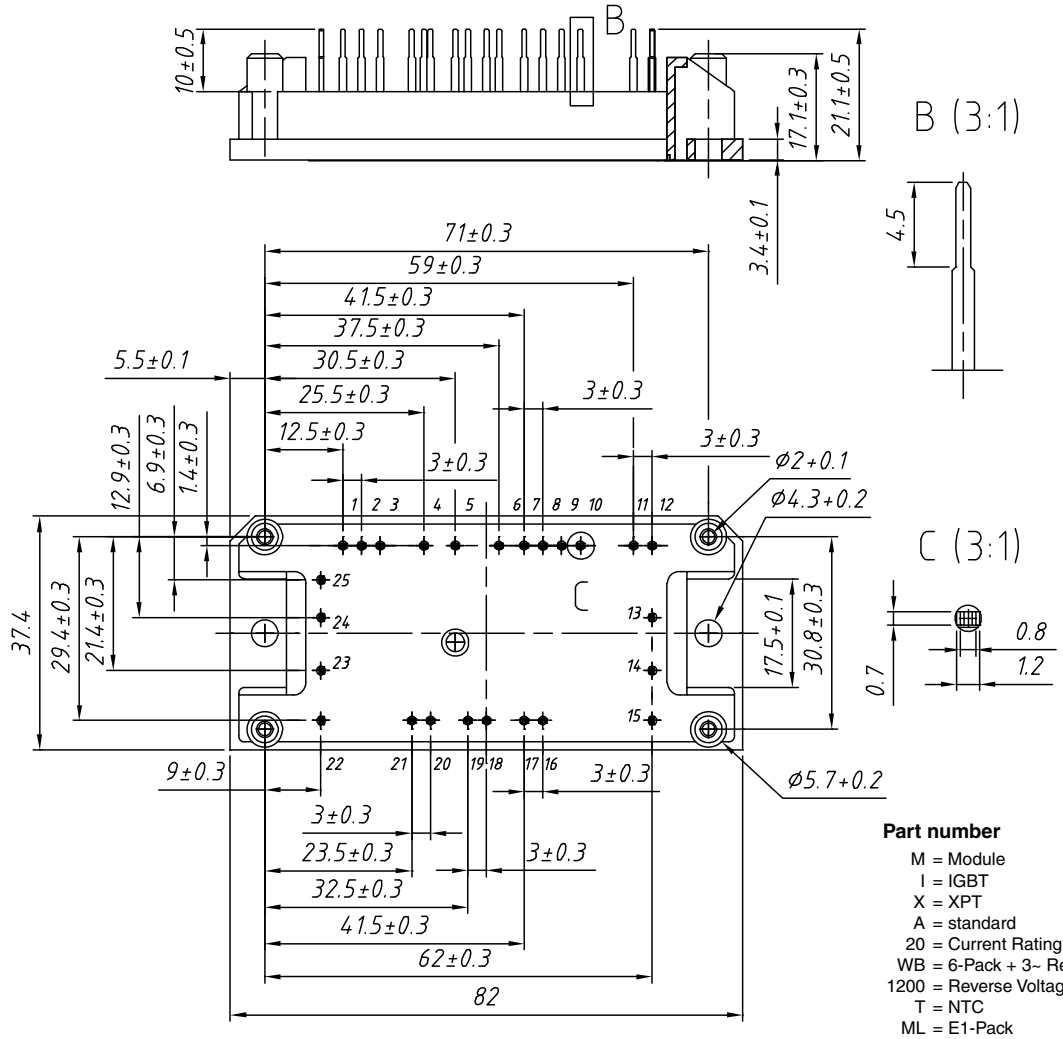
Circuit Diagram



Outline Drawing

Dimensions in mm (1 mm = 0.0394“)



Part number

M = Module
I = IGBT
X = XPT
A = standard
20 = Current Rating [A]
WB = 6-Pack + 3~ Rectifier Bridge & Brake Unit
1200 = Reverse Voltage [V]
T = NTC
ML = E1-Pack

Ordering	Part Name	Marking on Product	Delivering Mode	Base Qty	Ordering Code
Standard	MIXA 20 WB 1200 TML	MIXA20WB1200TML	Box	10	508630

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

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IGBT T1 - T6

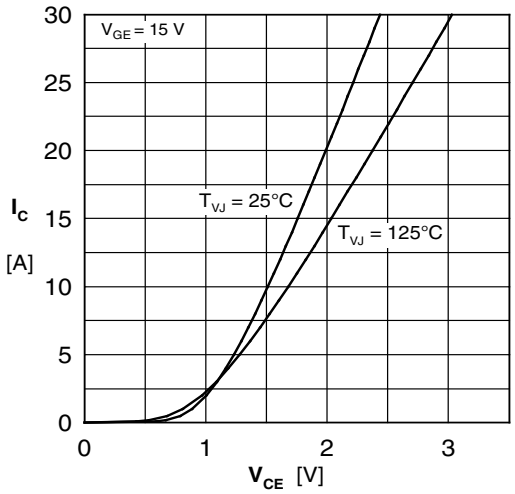


Fig. 1 Typ. output characteristics

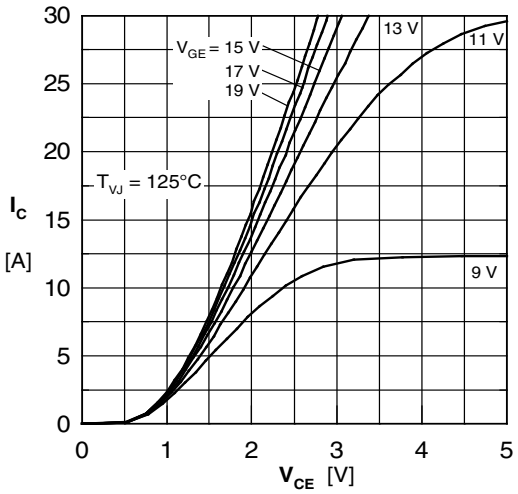


Fig. 2 Typ. output characteristics

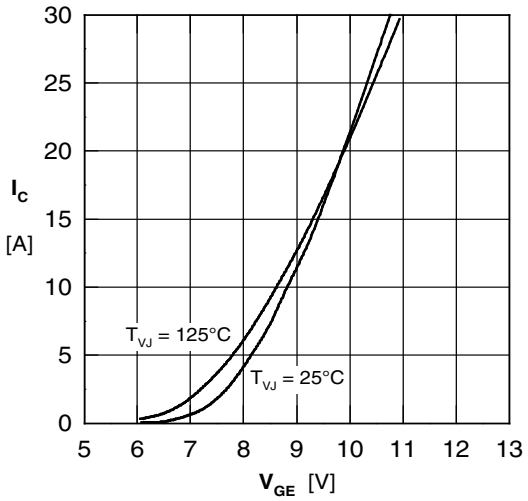


Fig. 3 Typ. tranfer characteristics

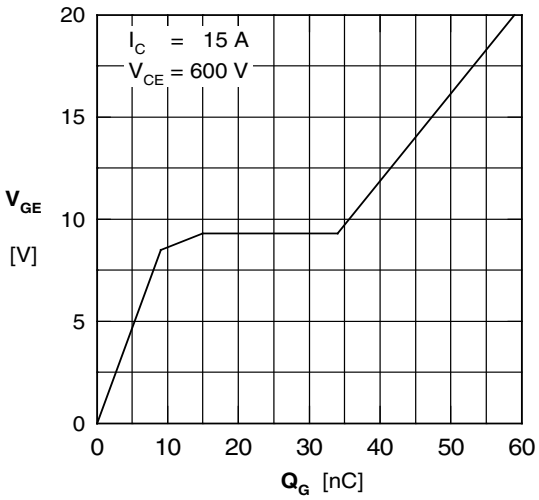


Fig. 4 Typ. turn-on gate charge

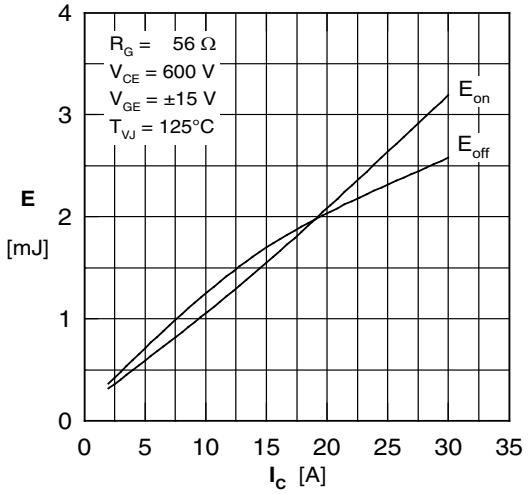


Fig. 5 Typ. switching energy vs. collector current

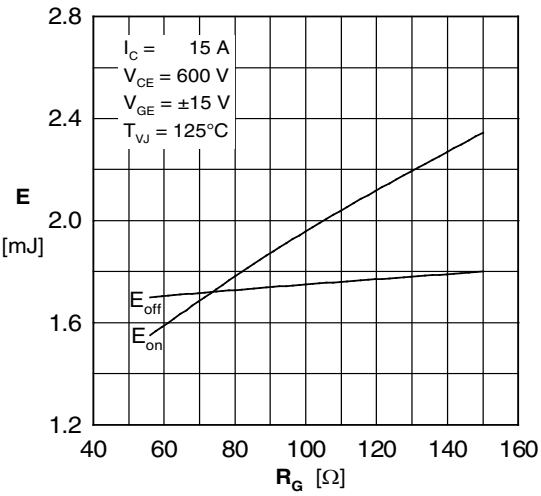


Fig. 6 Typ. switching energy vs. gate resistance

Diode D1 - D6

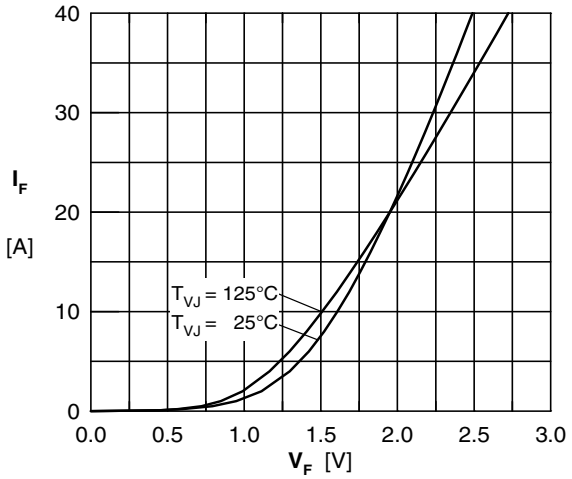


Fig. 7 Typ. Forward current versus V_F

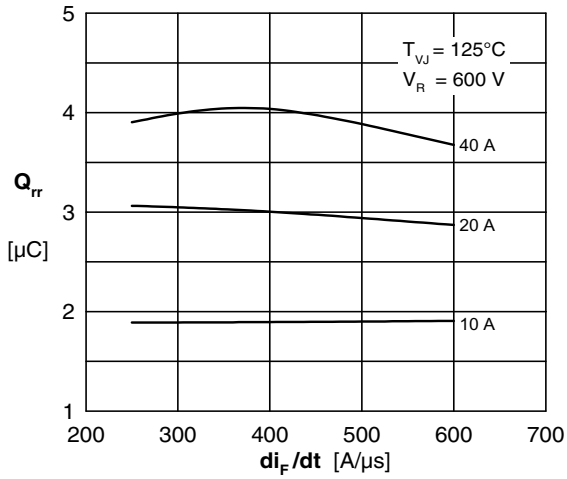


Fig. 8 Typ. reverse recov.charge Q_{rr} vs. di/dt

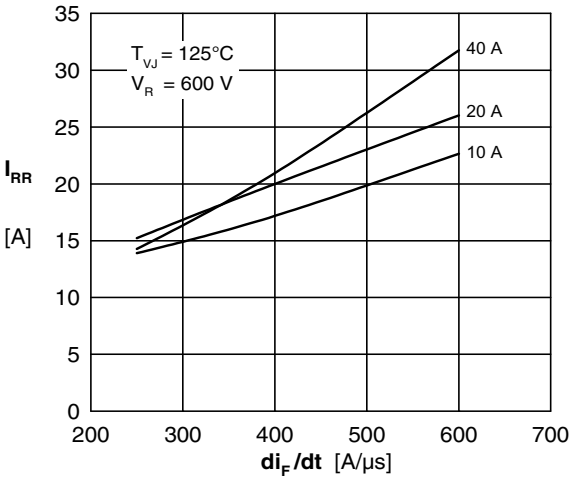


Fig. 9 Typ. peak reverse current I_{RM} vs. di/dt

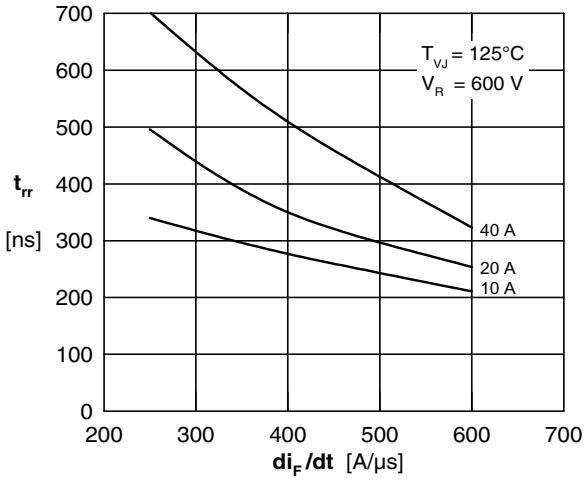


Fig. 10 Typ. recovery time t_{rr} versus di/dt

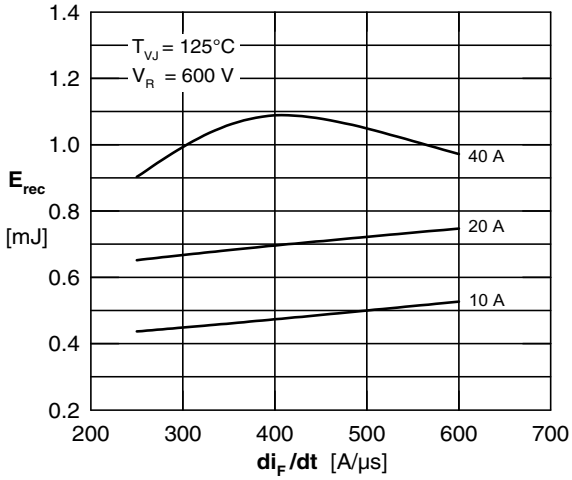
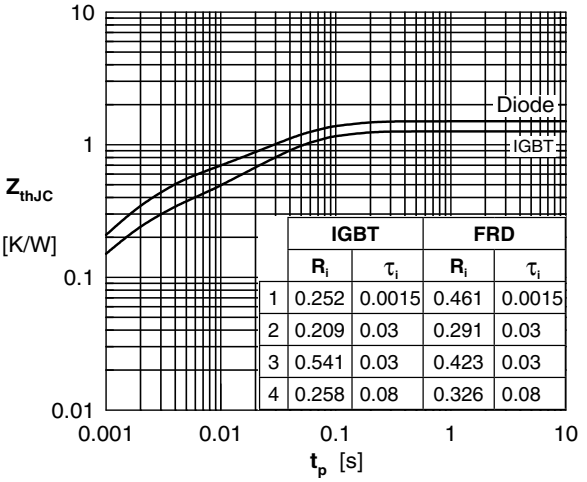


Fig. 11 Typ. recovery energy E_{rec} versus di/dt



	IGBT		FRD	
	R_i	τ_i	R_i	τ_i
1	0.252	0.0015	0.461	0.0015
2	0.209	0.03	0.291	0.03
3	0.541	0.03	0.423	0.03
4	0.258	0.08	0.326	0.08

Fig. 12 Typ. transient thermal impedance

NTC

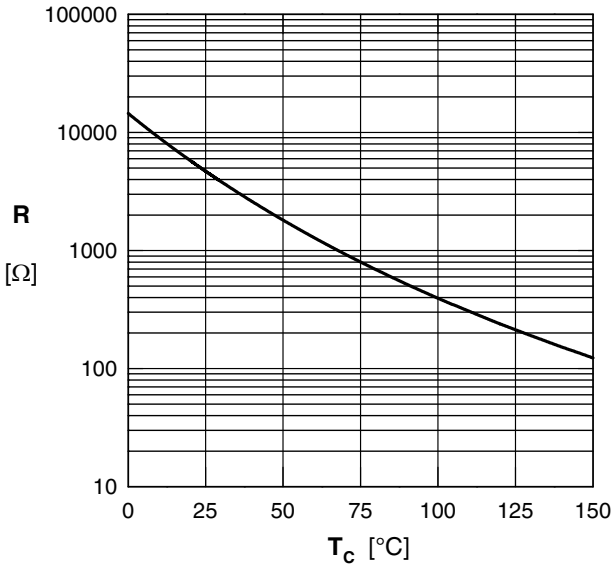


Fig. 13 Typ. thermistor resistance vs. temperature