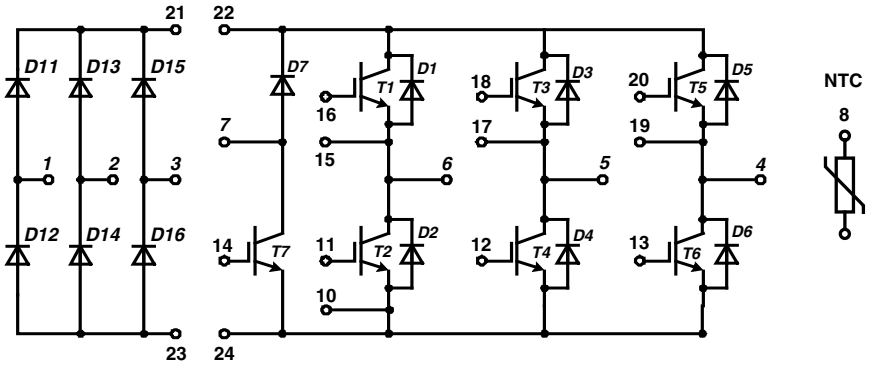
Converter - Brake - Inverter Module

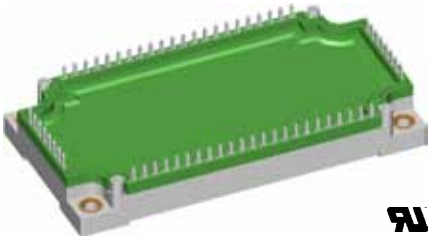
XPT IGBT

Single Phase Rectifier	Brake Chopper	Three Phase Inverter
V_{RRM} = 1600 V	V_{CES} = 1200 V	V_{CES} = 1200 V
I_{DAVM25} = 290 A	I_{C25} = 60 A	I_{C25} = 85 A
I_{FSM} = 700 A	$V_{CE(sat)}$ = 1.8 V	$V_{CE(sat)}$ = 1.8 V

Part name (Marking on product)

MIXA60WB1200TEH





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:

- "E3-Pack" standard outline
- Insulated copper base plate
- Soldering pins for PCB mounting
- Temperature sense included

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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}	*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			85	A
I_{C80}			T_C = 80°C			60	A
P_{tot}	*total power dissipation*		T_C = 25°C			290	W
$V_{CE(sat)}$	*collector emitter saturation voltage*	I_C = 55 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 = 2 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			0.5	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 = 50 A			165		nC
$t_{d(on)}$	*turn-on delay time*	inductive load V_{CE} = 600 V; I_C = 50 A V_{GE} = ±15 V; R_G = 15 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*				4.5		mJ
E_{off}	*turn-off energy per pulse*				5.5		mJ
RBSOA	*reverse bias safe operating area*	V_{GE} = ±15 V; R_G = 15 Ω;	T_{VJ} = 125°C V_{CEK} = 1200 V			150	A
SCSOA	*short circuit safe operating area*						
t_{SC}	*short circuit duration*	V_{CE} = 900 V; V_{GE} = ±15 V;	T_{VJ} = 125°C			10	µs
I_{SC}	*short circuit current*	R_G = 15 Ω; non-repetitive			200		A
R_{thJC}	*thermal resistance junction to case*	(per IGBT)				0.43	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}	*forward current*		T_C = 25°C			88	A
I_{F80}			T_C = 80°C			59	A
V_F	*forward voltage*	I_F = 60 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 = -1200 A/µs I_F = 60 A; V_{GE} = 0 V	T_{VJ} = 125°C		8		µC
I_{RM}	*max. reverse recovery current*				60		A
t_{rr}	*reverse recovery time*				350		ns
E_{rec}	*reverse recovery energy*				2.5		mJ
R_{thJC}	*thermal resistance junction to case*	(per diode)				0.6	K/W

T_C = 25°C unless otherwise stated

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Brake T7

Symbol	Definitions	Conditions		min.	typ.	max.	Unit
					Ratings		
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			60	A
I_{C80}			T_C = 80°C			40	A
P_{tot}	*total power dissipation*		T_C = 25°C			200	W
$V_{CE(sat)}$	*collector emitter saturation voltage*	I_C = 35 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 = 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			0.5	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 = 35 A			107		nC
$t_{d(on)}$	*turn-on delay time*	inductive load	T_{VJ} = 125°C		70		ns
t_r	*current rise time*	V_{CE} = 600 V; I_C = 35 A			40		ns
$t_{d(off)}$	*turn-off delay time*	V_{GE} = ±15 V; R_G = 27 Ω			250		ns
t_f	*current fall time*				100		ns
E_{on}	*turn-on energy per pulse*				3.8		mJ
E_{off}	*turn-off energy per pulse*				3.8		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	*short circuit safe operating area*						
t_{SC}	*short circuit duration*	V_{CE} = 900 V; V_{GE} = ±15 V;	T_{VJ} = 125°C			10	µs
I_{SC}	*short circuit current*	R_G = 27 Ω; non-repetitive			140		A
R_{thJC}	*thermal resistance junction to case*	(per IGBT)				0.64	K/W

Brake Chopper D7

Symbol	Definitions	Conditions		min.	typ.	max.	Unit
					Ratings		
V_{RRM}	*max. repetitive reverse voltage*		T_{VJ} = 25°C			1200	V
I_{F25}	*forward current*		T_C = 25°C			44	A
I_{F80}			T_C = 80°C			29	A
V_F	*forward voltage*	I_F = 30 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			2.0	mA
			T_{VJ} = 125°C		0.8		mA
Q_{rr}	*reverse recovery charge*	V_R = 600 V	T_{VJ} = 125°C		3.5		µC
I_{RM}	*max. reverse recovery current*	di_F/dt = 600 A/µs			30		A
t_{rr}	*reverse recovery time*	I_F = 30 A; V_{GE} = 0 V			350		ns
E_{rec}	*reverse recovery energy*				0.9		mJ
R_{thJC}	*thermal resistance junction to case*	(per diode)				1.2	K/W

T_C = 25°C unless otherwise stated

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Input Rectifier Bridge D11 - D16

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			70	A
I_{DAVM}	*max. average DC output current*	rect.; d = $^1/_3$	T_C = 80°C			190	A
I_{FSM}	*max. forward surge current*	t = 10 ms; sine 50 Hz	T_{VJ} = 25°C			700	A
			T_{VJ} = 125°C			620	A
I^2t	*I^2t value for fusing*	t = 10 ms; sine 50 Hz	T_{VJ} = 25°C			1920	A^2s
			T_{VJ} = 125°C			2450	A^2s
P_{tot}	*total power dissipation*		T_C = 25°C			192	W
V_F	*forward voltage*	I_F = 80 A	T_{VJ} = 25°C		1.2	1.5	V
			T_{VJ} = 125°C		1.2		V
I_R	*reverse current*	$V_R = V_{RRM}$	T_{VJ} = 25°C		0.05	0.1	mA
			T_{VJ} = 125°C		1.5		mA
R_{thJC}	*thermal resistance junction to case*	(per diode)				0.65	K/W

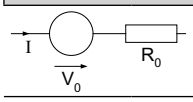
Temperature Sensor NTC

Symbol	Definitions	Conditions		Ratings min.	typ.	max.	Unit
R_{25}	*resistance*		T_C = 25°C	4.75	5.0	5.25	kΩ
$B_{25/50}$					3375		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			3000	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
$R_{pin-chip}$	*resistance pin to chip*			5		mΩ
R_{thCH}	*thermal resistance case to heatsink*	with heatsink compound		0.01		K/W
Weight				300		g

Equivalent Circuits for Simulation



Symbol	Definitions	Conditions		Ratings min.	typ.	max.	Unit
V_0	*rectifier diode*	D8 - D13	T_{VJ} = 150°C			0.85	V
R_0						3.9	mΩ
V_0	*IGBT*	T1 - T6	T_{VJ} = 150°C			1.1	V
R_0						25.1	mΩ
V_0	*free wheeling diode*	D1 - D6	T_{VJ} = 150°C			1.22	V
R_0						13	mΩ
V_0	*IGBT*	T7	T_{VJ} = 150°C			1.1	V
R_0						40	mΩ
V_0	*free wheeling diode*	D7	T_{VJ} = 150°C			1.2	V
R_0						27.0	mΩ

T_C = 25°C unless otherwise stated

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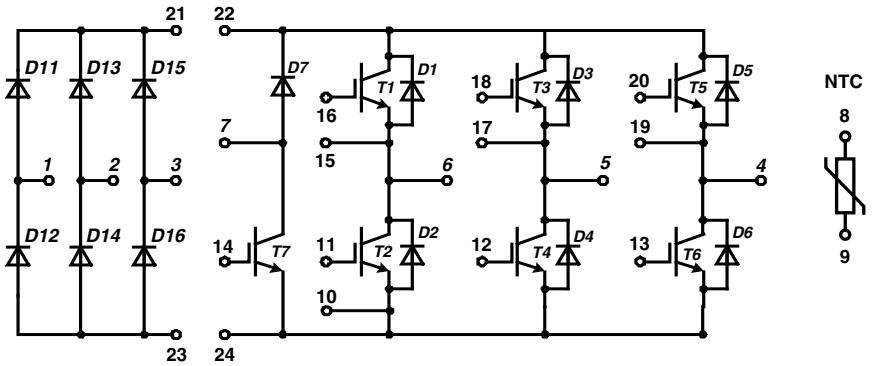
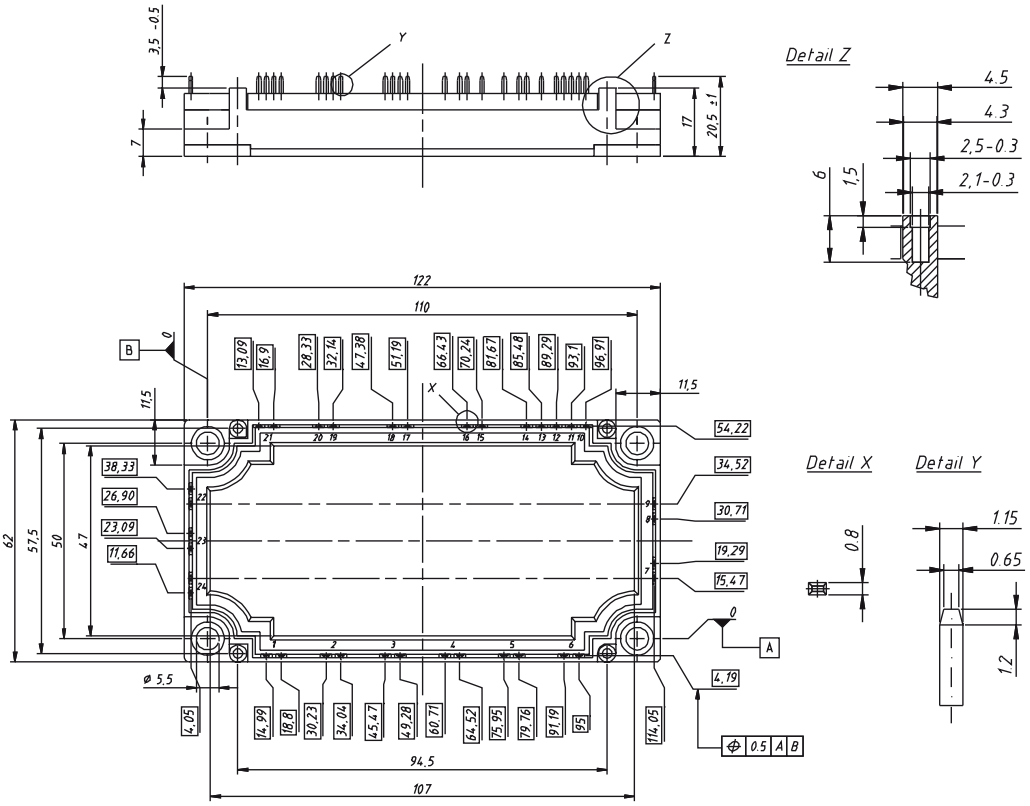
Circuit Diagram



Outline Drawing

Dimensions in mm (1 mm = 0.0394“)



Product Marking

Part number

M = Module
I = IGBT
XA = XPT standard
60 = Current Rating [A]
WB = 6-Pack + 3~ Rectifier Bridge & Brake Unit
1200 = Reverse Voltage [V]
T = NTC
EH = E3-Pack

Ordering	Part Name	Marking on Product	Delivering Mode	Base Qty	Ordering Code
Standard	MIXA60WB1200 TEH	MIXA60WB1200TEH	Box	5	507653

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Inverter T1 - T6

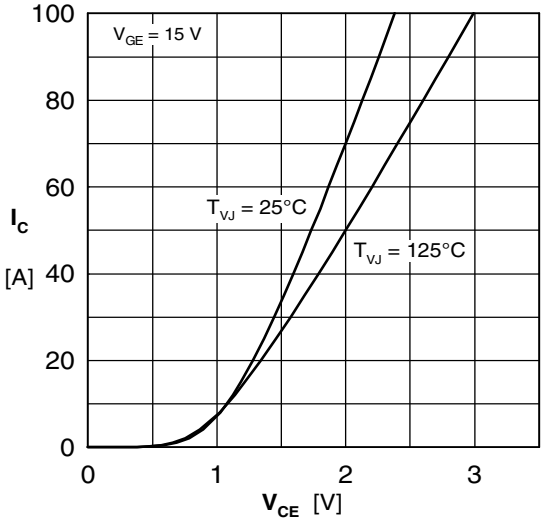

Fig. 1 Typ. output characteristics

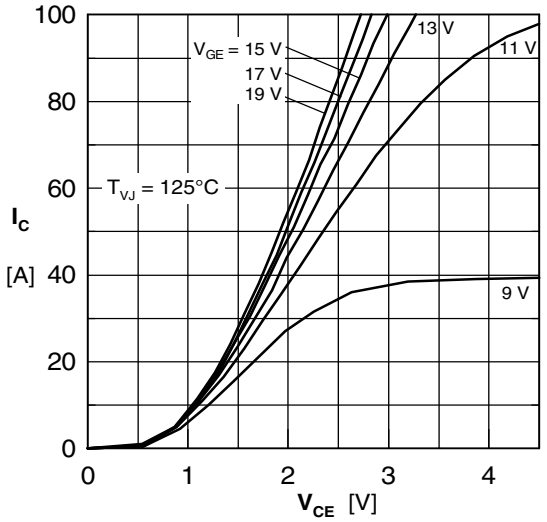

Fig. 2 Typ. output characteristics

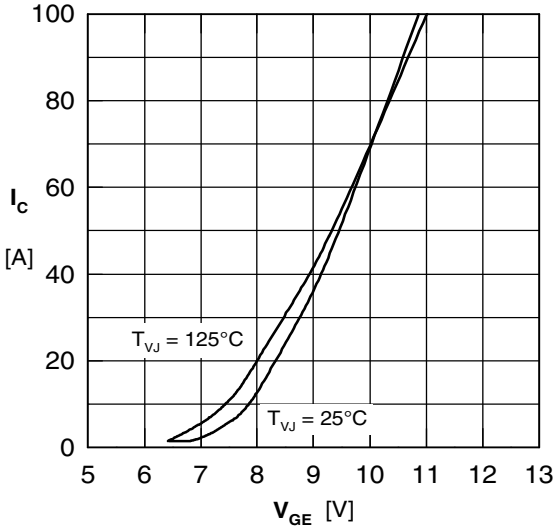

Fig. 3 Typ. tranfer characteristics

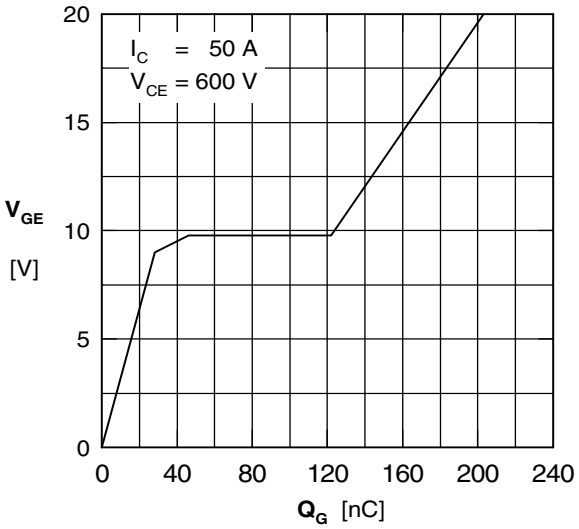

Fig. 4 Typ. turn-on gate charge

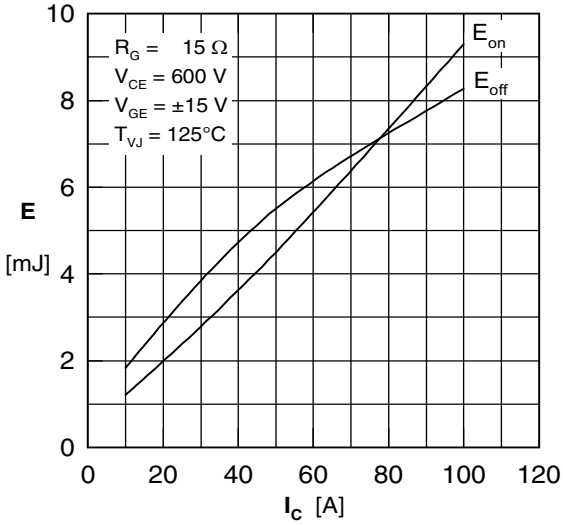

Fig. 5 Typ. switching energy vs. collector current

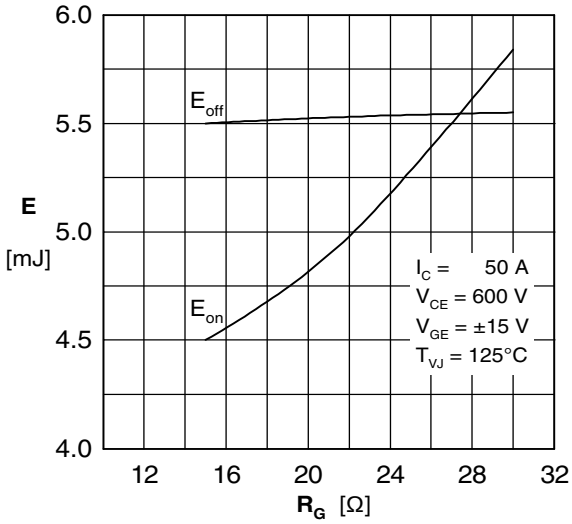

Fig. 6 Typ. switching energy vs. gate resistance

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Inverter D1 - D6

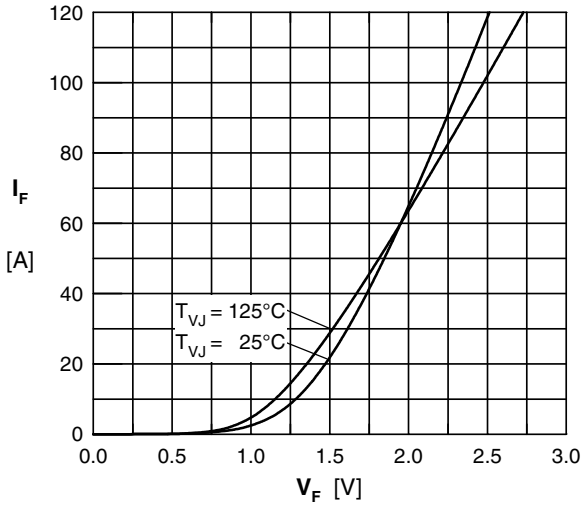


Fig. 7 Typ. Forward current versus V_F

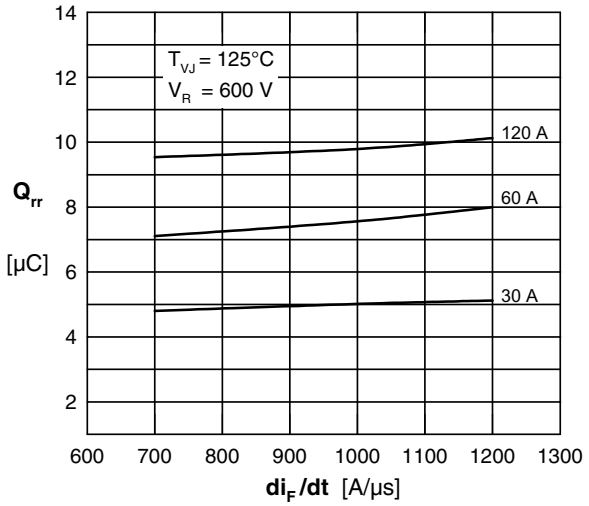


Fig. 8 Typ. reverse recov.charge Q_{rr} vs. di/dt

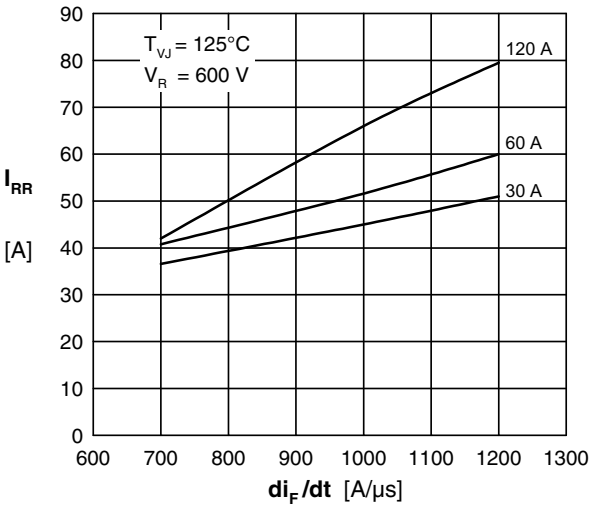


Fig. 9 Typ. peak reverse current I_{RM} vs. di/dt

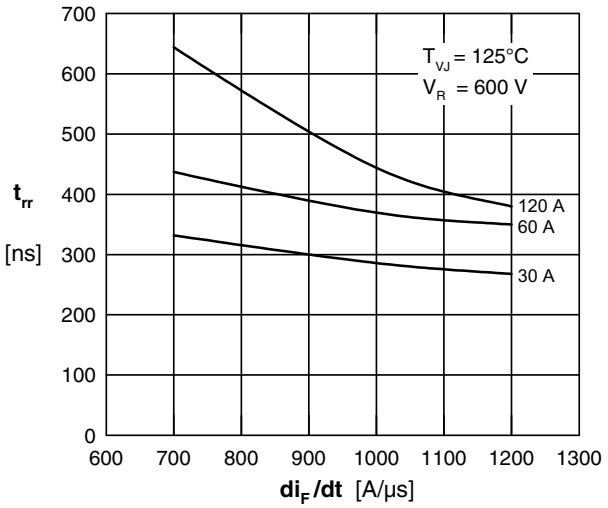


Fig. 10 Typ. recovery time t_{rr} versus di/dt

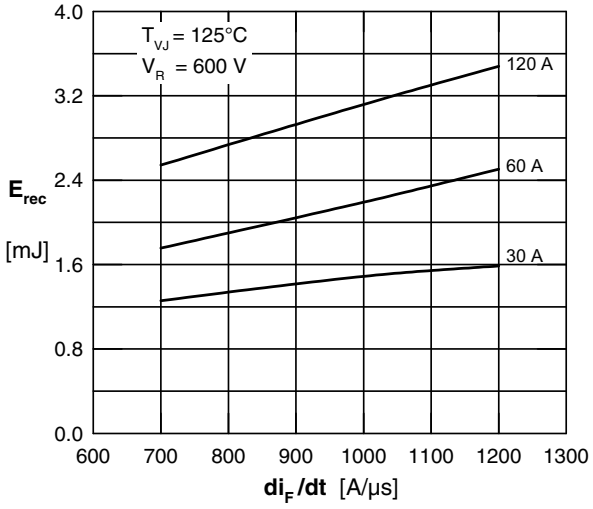
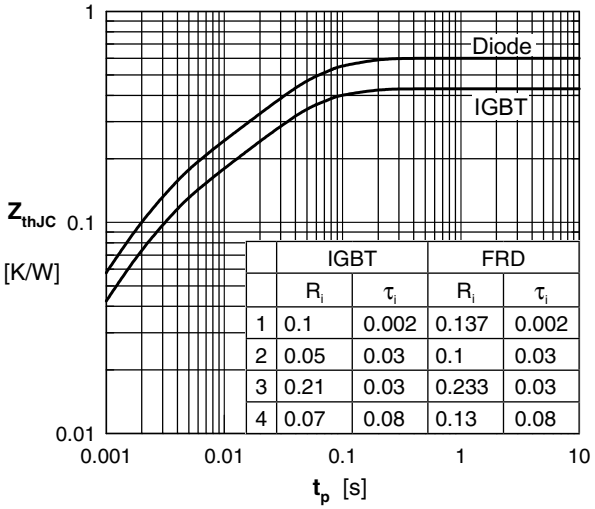


Fig. 8 Typ. recovery energy E_{rec} versus di/dt



	IGBT		FRD	
	R_i	τ_i	R_i	τ_i
1	0.1	0.002	0.137	0.002
2	0.05	0.03	0.1	0.03
3	0.21	0.03	0.233	0.03
4	0.07	0.08	0.13	0.08

Fig. 9 Typ. transient thermal impedance

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Brake T7 & D7

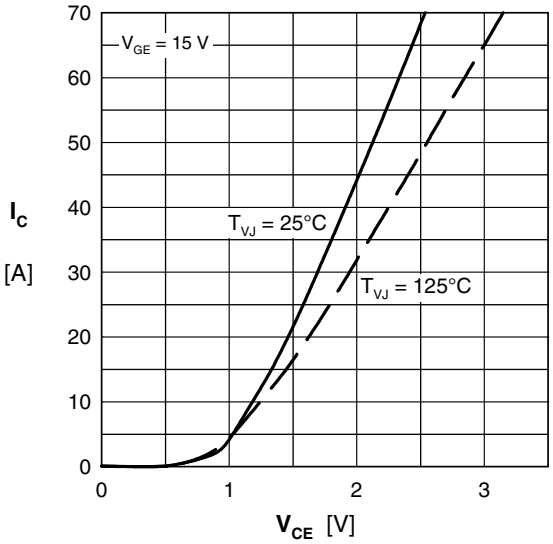

Fig. 13 Typ. output characteristics

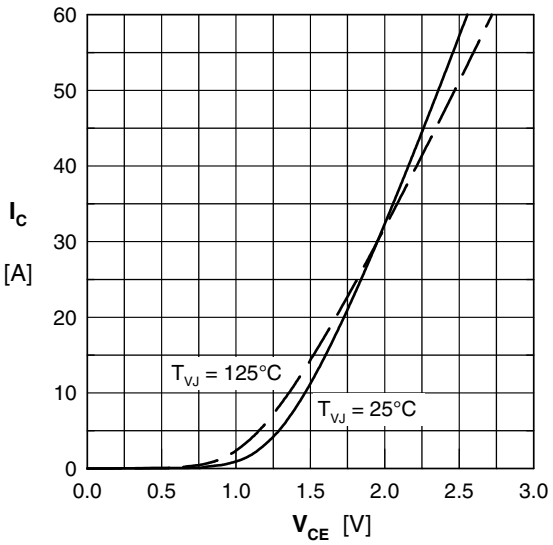

Fig. 14 Typ. forward characteristics

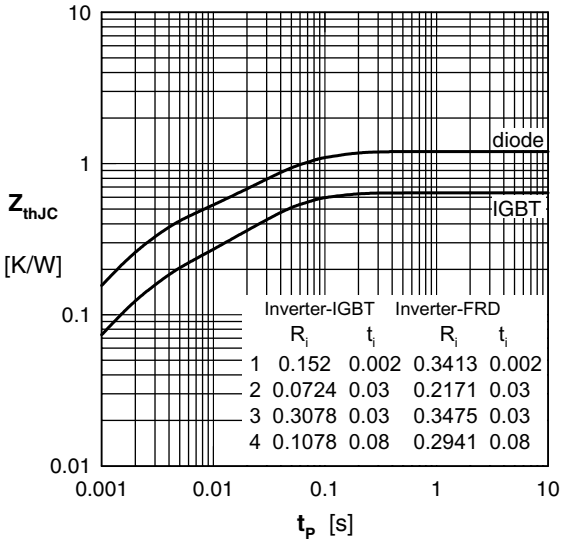

Fig. 15 Typ. transient thermal impedance

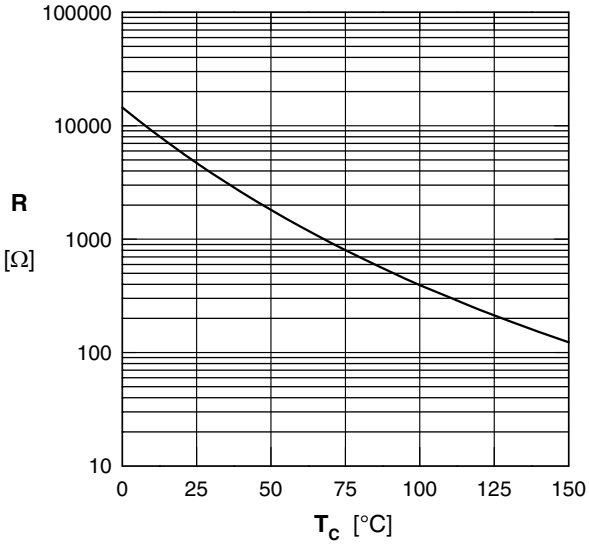

Fig.16 Typ. NTC resistance vs. temperature

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