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Converter - Brake - Inverter Module
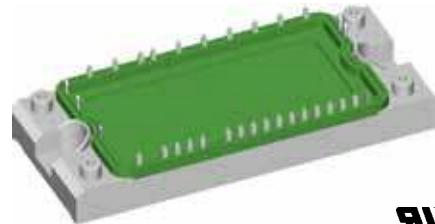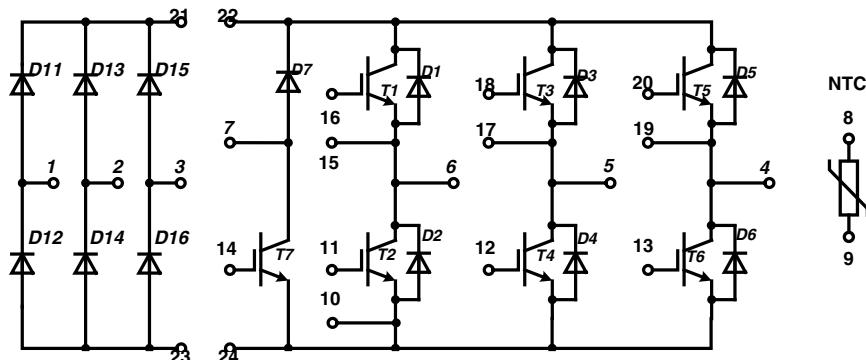## XPT IGBT

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}	= 17 A	I_{C25}	= 17 A
I_{FSM}	= 320 A	$V_{CE(sat)}$	= 1.8 V	$V_{CE(sat)}$	= 1.8 V

Preliminary data

Part name (Marking on product)

MIXA10WB1200TED

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
  - 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}	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	$T_C = 25°C$				60	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	0.7	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				70		ns
t_r	current rise time	inductive load			40		ns
$t_{d(off)}$	turn-off delay time	$V_{CE} = 600 V; I_C = 10 A$	$T_{VJ} = 125°C$		250		ns
t_f	current fall time	$V_{GE} = ±15 V; R_G = 100 Ω$			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	$V_{GE} = ±15 V; R_G = 100 Ω;$	$T_{VJ} = 125°C$				
			$V_{CEK} = 1200 V$			30	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	$R_G = 100 Ω;$ non-repetitive			40		A
R_{thJC}	thermal resistance junction to case	(per IGBT)				2.0	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	$T_C = 25°C$				19	A
I_{F80}		$T_C = 80°C$				13	A
V_F	forward voltage	$I_F = 10 A; V_{GE} = 0 V$	$T_{VJ} = 25°C$		1.95	2.2	V
			$T_{VJ} = 125°C$		1.85		V
Q_{rr}	reverse recovery charge	$V_R = 600 V$			tbd		µC
I_{RM}	max. reverse recovery current	$di_F/dt = - A/µs$	$T_{VJ} = 125°C$		tbd		A
t_{rr}	reverse recovery time	$I_F = 10 A; V_{GE} = 0 V$			tbd		ns
E_{rec}	reverse recovery energy				tbd		mJ
R_{thJC}	thermal resistance junction to case	(per diode)				2.4	K/W

$T_C = 25°C$ unless otherwise stated

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Brake T7

Symbol	Definitions	Conditions		min.	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			60	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			0.1	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				70		ns
t_r	current rise time	inductive load	T_{VJ} = 125°C		40		ns
$t_{d(off)}$	turn-off delay time	V_{CE} = 600 V; I_C = 10 A			250		ns
t_f	current fall time	V_{GE} = ±15 V; R_G = 100 Ω			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;	T_{VJ} = 125°C			30	A
			V_{CEK} = 1200 V				
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 = 100 Ω; non-repetitive			40		A
R_{thJC}	thermal resistance junction to case	(per IGBT)				2.0	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}	forward current		T_C = 25°C			12	A
I_{F80}			T_C = 80°C			8	A
V_F	forward voltage	I_F = 5 A; V_{GE} = 0 V	T_{VJ} = 25°C		1.95	2.2	V
			T_{VJ} = 125°C		1.85		V
I_R	reverse current	V_R = V_{RRM}	T_{VJ} = 25°C			0.5	mA
			T_{VJ} = 125°C		0.5		mA
Q_{rr}	reverse recovery charge	V_R = 600 V			tbd		µC
I_{RM}	max. reverse recovery current	di_F/dt = tbd A/µs	T_{VJ} = 125°C		tbd		A
t_{rr}	reverse recovery time	I_F = 10 A; V_{GE} = 0 V			tbd		ns
E_{rec}	reverse recovery energy				tbd		µJ
R_{thJC}	thermal resistance junction to case	(per diode)				3.4	K/W

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![IXYS logo]

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}	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	$I_F = 50 A$	$T_{VJ} = 25°C$		1.34	1.7	V
			$T_{VJ} = 125°C$		1.34		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

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

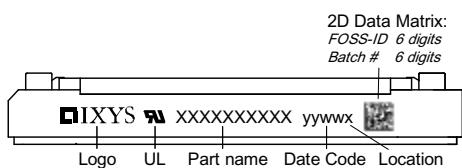| Symbol	Definitions	Conditions	min.	typ.	max.	Unit
					Ratings	
T_{VJ}	operating temperature		-40		125	°C
T_{VJM}	max. virtual junction temperature				150	°C
T_{stg}	storage temperature		-40		125	°C
V_{ISOL}	isolation voltage	$I_{ISOL} \le 1$ mA; 50/60 Hz			2500	V~
CTI	comparative tracking index			-		
M_d	mounting torque (M5)		3		6	Nm
d_S	creep distance on surface		6			mm
d_A	strike distance through air		6			mm
$R_{pin-chip}$	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

![Equivalent circuit diagram with current source I, voltage source V₀ and resistor R₀]
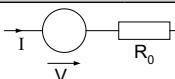
Symbol	Definitions	Conditions		min.	typ.	max.	Unit
						Ratings	
V_0	rectifier diode	D8 - D13	$T_{VJ} = 150°C$			0.88	V
R_0						9	mΩ
V_0	IGBT	T1 - T6	$T_{VJ} = 150°C$			1.1	V
R_0						153	mΩ
V_0	free wheeling diode	D1 - D6	$T_{VJ} = 150°C$			1.1	V
R_0						90	mΩ
V_0	IGBT	T7	$T_{VJ} = 150°C$			1.1	V
R_0						153	mΩ
V_0	free wheeling diode	D7	$T_{VJ} = 150°C$			1.15	V
R_0						170	mΩ

$T_C = 25°C$ unless otherwise stated

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MIXA10WB1200TED

Circuit Diagram
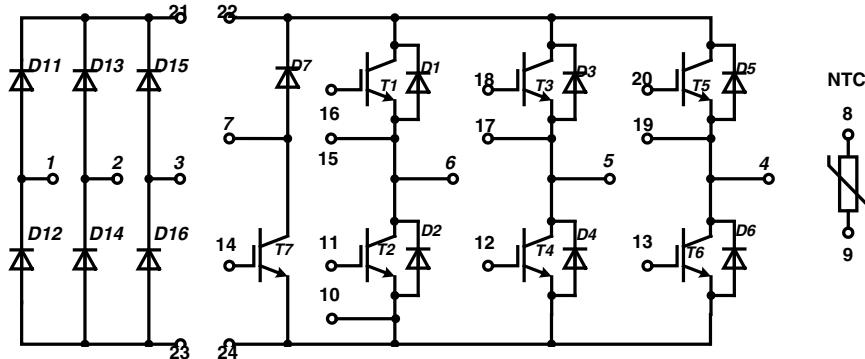
Outline Drawing

Dimensions in mm (1 mm = 0.0394")

baseplate typ. 100 µm convex
over 75 mm before mounting

Detail X

Detail Y

Detail Z
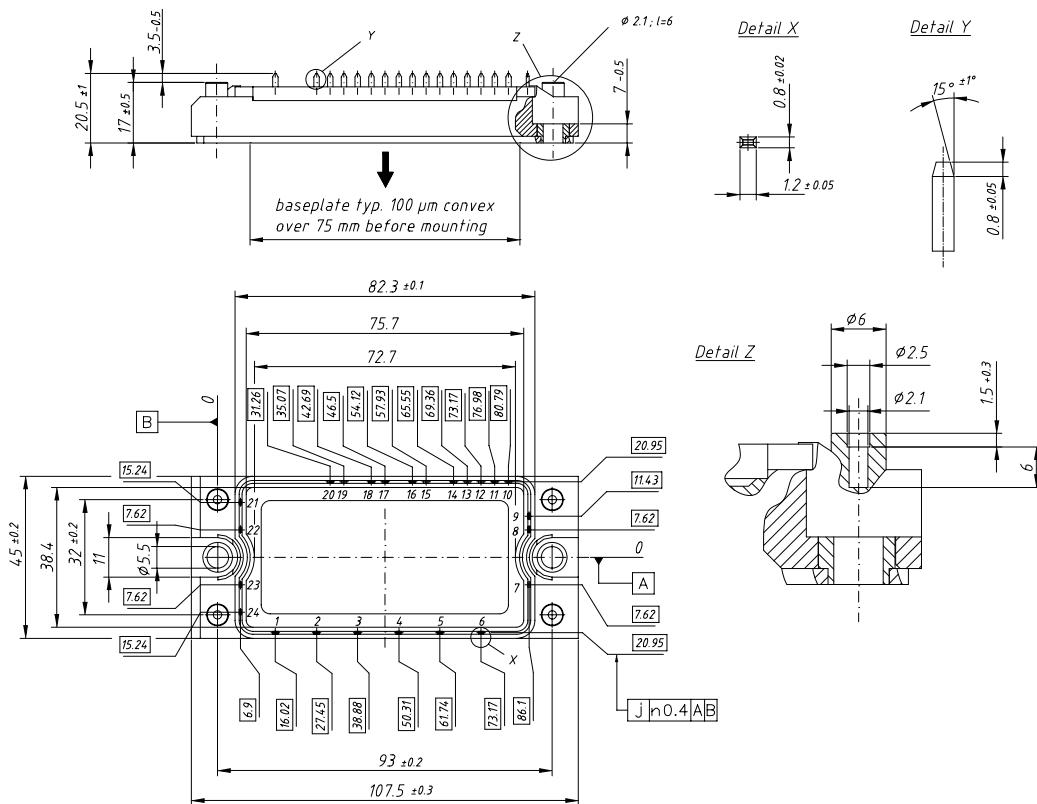
Product Marking

2D Data Matrix:
FOSS-ID 6 digits
Batch #   6 digits

IXYS ⓊⓁ XXXXXXXXXX yywwx

Logo   UL   Part name   Date Code   Location

Part number

M = Module
I = IGBT
A = MPT
X = Parallel Legs
10 = 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	MIXA10WB1200 TED	MIXA10WB1200TED	Box	6	508061

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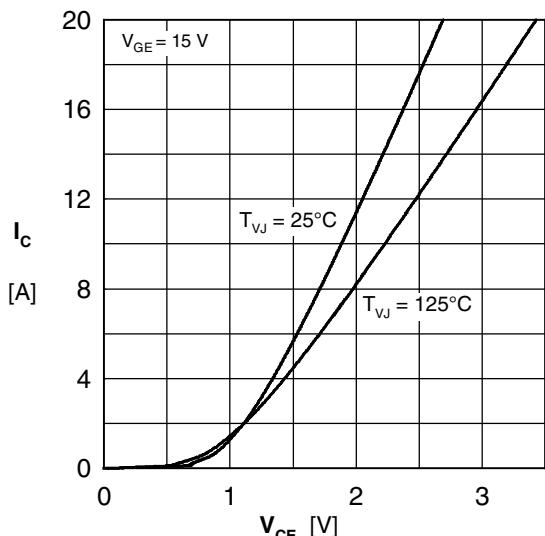
Fig. 1 Typ. output characteristics
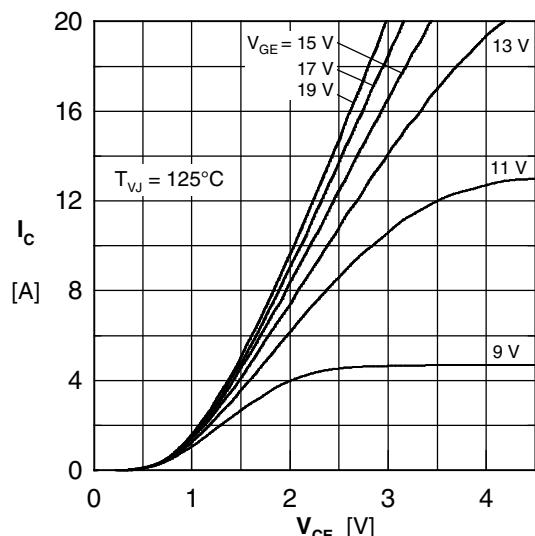
Fig. 2 Typ. output characteristics
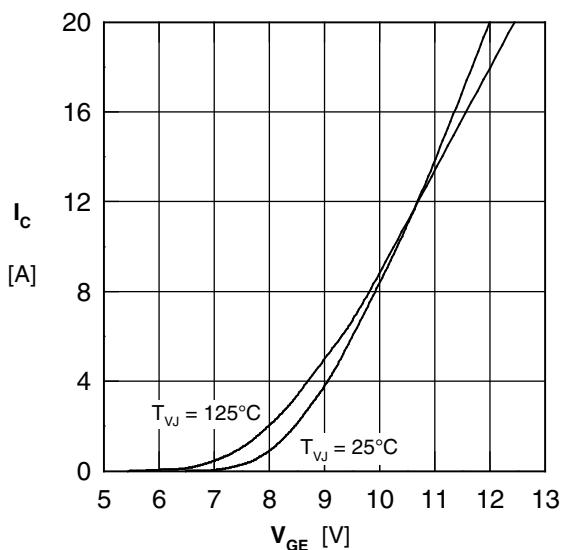
Fig. 3 Typ. tranfer characteristics
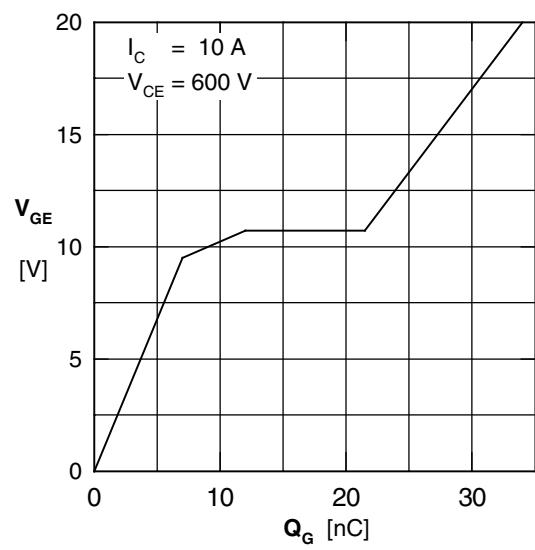
Fig. 4 Typ. turn-on gate charge
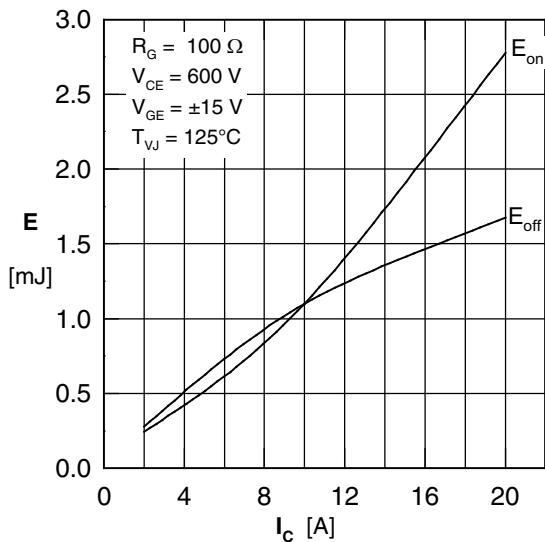
Fig. 5 Typ. switching energy vs. collector current

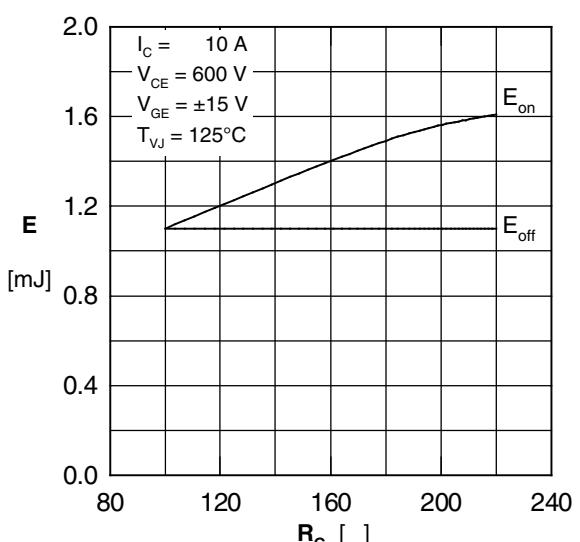Fig. 6 Typ. switching energy vs. gate resistance
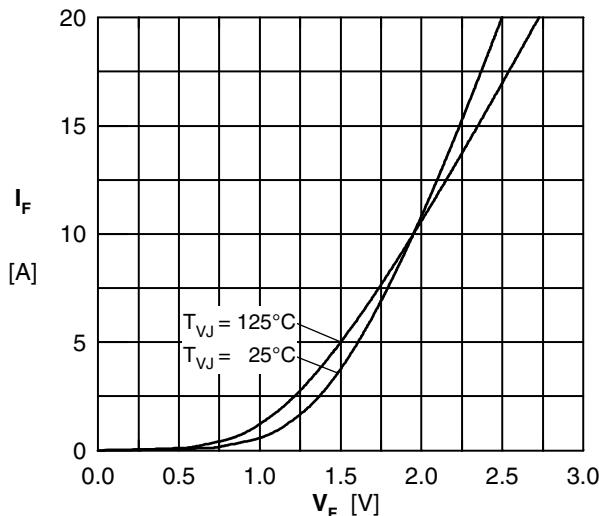
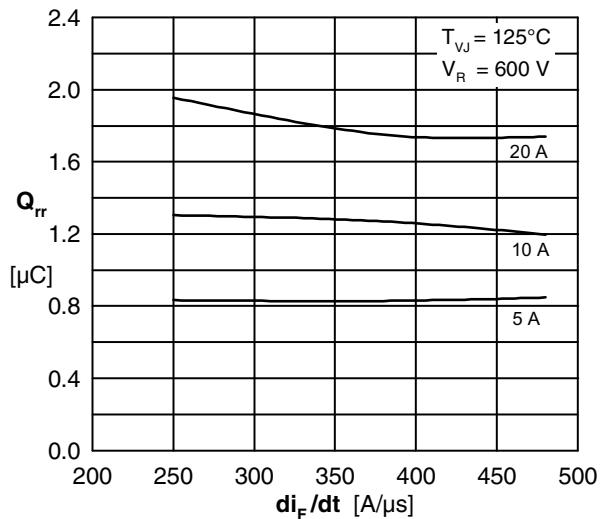20090804b

Fig. 7 Typ. forward characteristics

Fig. 8 Typical reverse recovery charge Q_{rr} versus. di_F/dt (125°C)
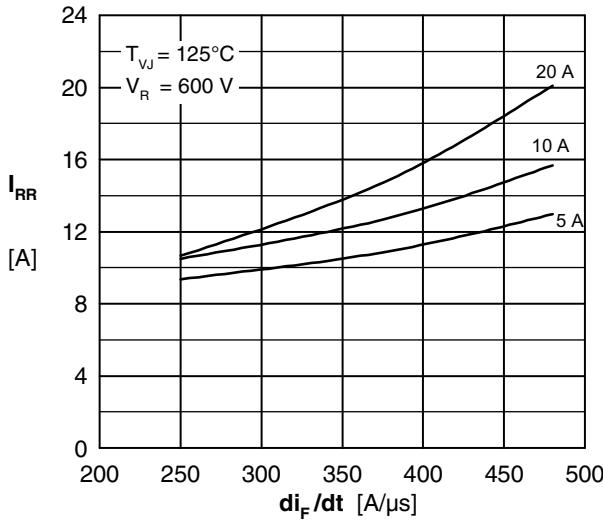
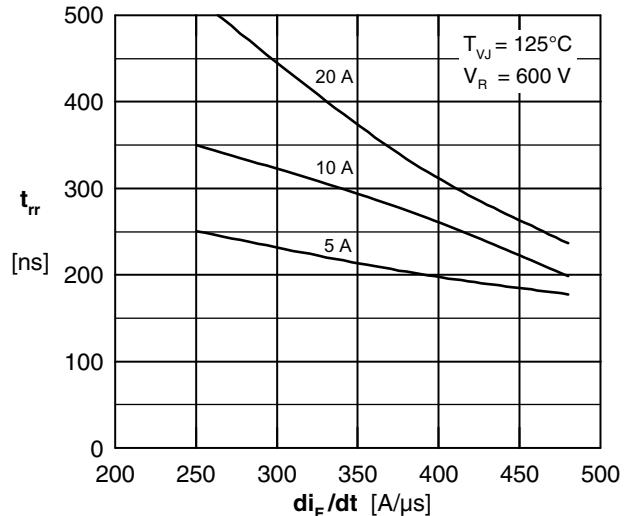Fig. 9 Typical peak reverse current I_{RR} versus di_F/dt (125°C)

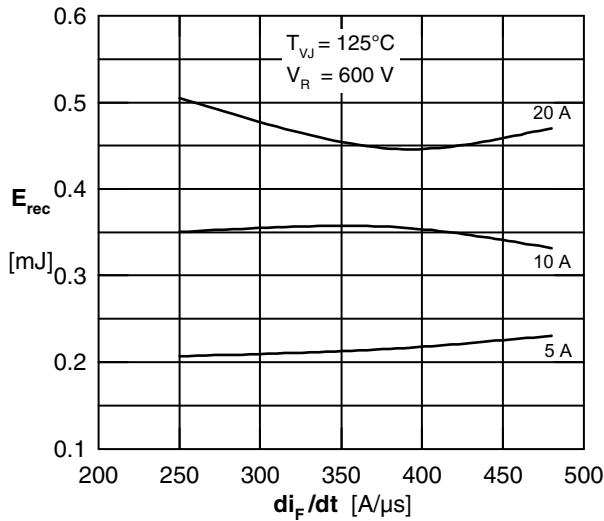Fig. 10 Typ. recovery time t_{rr} vs. di/dt (125°C)

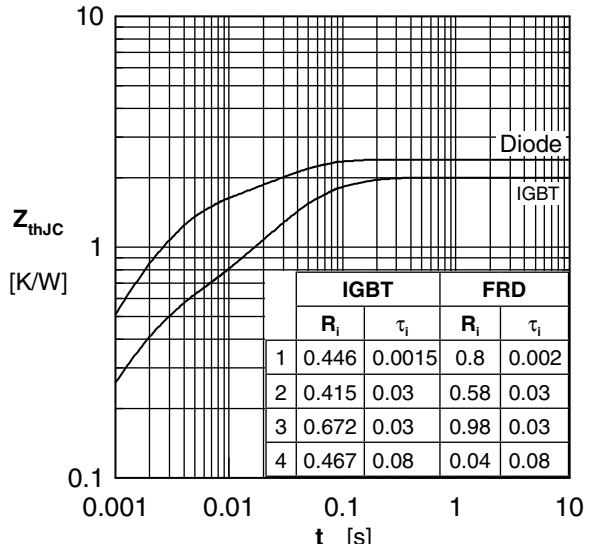Fig. 11 Typ. recovery energy E_{rec} vs. di_F/dt (125°C)

Fig. 8 Transient thermal impedance

	IGBT		FRD	
	R_i	τ_i	R_i	τ_i
1	0.446	0.0015	0.8	0.002
2	0.415	0.03	0.58	0.03
3	0.672	0.03	0.98	0.03
4	0.467	0.08	0.04	0.08

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