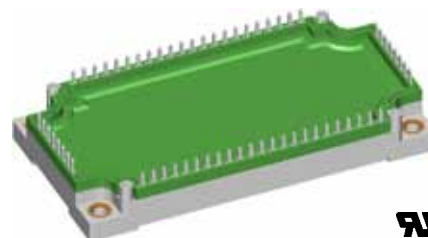
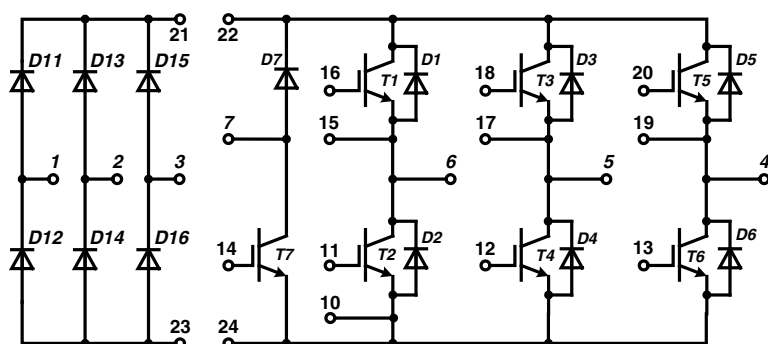


Converter - Brake - Inverter Module XPT IGBT

Three Phase Rectifier	Brake Chopper	Three Phase Inverter
$V_{RRM} = 1600 \text{ V}$	$V_{CES} = 1200 \text{ V}$	$V_{CES} = 1200 \text{ V}$
$I_{DAVM} = 190 \text{ A}$	$I_{C25} = 60 \text{ A}$	$I_{C25} = 85 \text{ A}$
$I_{FSM} = 700 \text{ A}$	$V_{CE(sat)} = 1.8 \text{ V}$	$V_{CE(sat)} = 1.8 \text{ V}$

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 @ $3 \times I_C$
 - 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

Output Inverter T1 - T6

Symbol	Definitions	Conditions	min.	Ratings			Unit
				typ.	max.		
V_{CES}	collector emitter voltage	$T_{VJ} = 25^{\circ}\text{C}$			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	$T_C = 25^{\circ}\text{C}$			85		A
I_{C80}		$T_C = 80^{\circ}\text{C}$			60		A
P_{tot}	total power dissipation	$T_C = 25^{\circ}\text{C}$			290		W
$V_{CE(sat)}$	collector emitter saturation voltage	$I_C = 55\text{ A}; V_{GE} = 15\text{ V}$		$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	1.8 2.1	2.1	V V
$V_{GE(th)}$	gate emitter threshold voltage	$I_C = 2\text{ mA}; V_{GE} = V_{CE}$	$T_{VJ} = 25^{\circ}\text{C}$	5.4	6.0	6.5	V
I_{CES}	collector emitter leakage current	$V_{CE} = V_{CES}; V_{GE} = 0\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		0.2	0.5	mA mA
I_{GES}	gate emitter leakage current	$V_{GE} = \pm 20\text{ V}$			500		nA
$Q_{G(on)}$	total gate charge	$V_{CE} = 600\text{ V}; V_{GE} = 15\text{ V}; I_C = 50\text{ A}$			165		nC
$t_{d(on)}$	turn-on delay time	inductive load $V_{CE} = 600\text{ V}; I_C = 50\text{ A}$ $V_{GE} = \pm 15\text{ V}; R_G = 15\text{ }\Omega$	$T_{VJ} = 125^{\circ}\text{C}$		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	$V_{GE} = \pm 15\text{ V}; R_G = 15\text{ }\Omega;$	$T_{VJ} = 125^{\circ}\text{C}$ $V_{CEK} = 1200\text{ V}$			150	A
SCSOA	short circuit safe operating area						
t_{SC}	short circuit duration	$V_{CE} = 900\text{ V}; V_{GE} = \pm 15\text{ V};$	$T_{VJ} = 125^{\circ}\text{C}$			10	μs
I_{SC}	short circuit current	$R_G = 15\text{ }\Omega;$ 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.	Ratings			Unit
				typ.	max.		
V_{RRM}	max. repetitive reverse voltage	$T_{VJ} = 25^{\circ}\text{C}$			1200		V
I_{F25}	forward current	$T_C = 25^{\circ}\text{C}$			88		A
I_{F80}		$T_C = 80^{\circ}\text{C}$			59		A
V_F	forward voltage	$I_F = 60\text{ A}; V_{GE} = 0\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	1.95 1.95	2.2		V V
Q_{rr}	reverse recovery charge	$V_R = 600\text{ V}$ $di_F/dt = -1200\text{ A}/\mu\text{s}$ $I_F = 60\text{ A}; V_{GE} = 0\text{ V}$	$T_{VJ} = 125^{\circ}\text{C}$		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

 $T_C = 25^{\circ}\text{C}$ unless otherwise stated

Brake T7

Symbol	Definitions	Conditions	min.	Ratings			Unit
				typ.	max.		
V_{CES}	collector emitter voltage	$T_{VJ} = 25^{\circ}\text{C}$			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	$T_C = 25^{\circ}\text{C}$			60		A
I_{C80}		$T_C = 80^{\circ}\text{C}$			40		A
P_{tot}	total power dissipation	$T_C = 25^{\circ}\text{C}$			200		W
$V_{CE(sat)}$	collector emitter saturation voltage	$I_C = 35\text{ A}; V_{GE} = 15\text{ V}$		1.8 2.1	2.1		V V
$V_{GE(th)}$	gate emitter threshold voltage	$I_C = 1.5\text{ mA}; V_{GE} = V_{CE}$	$T_{VJ} = 25^{\circ}\text{C}$	5.4	6.0	6.5	V
I_{CES}	collector emitter leakage current	$V_{CE} = V_{CES}; V_{GE} = 0\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		0.1	0.5	mA mA
I_{GES}	gate emitter leakage current	$V_{GE} = \pm 20\text{ V}$			500		nA
$Q_{G(on)}$	total gate charge	$V_{CE} = 600\text{ V}; V_{GE} = 15\text{ V}; I_C = 35\text{ A}$		107			nC
$t_{d(on)}$	turn-on delay time	inductive load $V_{CE} = 600\text{ V}; I_C = 35\text{ A}$ $V_{GE} = \pm 15\text{ V}; R_G = 27\ \Omega$	$T_{VJ} = 125^{\circ}\text{C}$	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			3.8			mJ
E_{off}	turn-off energy per pulse			4.1			mJ
RBSOA	reverse bias safe operating area	$V_{GE} = \pm 15\text{ V}; R_G = 27\ \Omega;$	$T_{VJ} = 125^{\circ}\text{C}$ $V_{CEK} = 1200\text{ V}$		105		A
SCSOA	short circuit safe operating area						
t_{SC}	short circuit duration	$V_{CE} = 900\text{ V}; V_{GE} = \pm 15\text{ V};$	$T_{VJ} = 125^{\circ}\text{C}$		10		μs
I_{SC}	short circuit current	$R_G = 27\ \Omega;$ non-repetitive		140			A
R_{thJC}	thermal resistance junction to case	(per IGBT)			0.64		K/W

Brake Chopper D7

Symbol	Definitions	Conditions	min.	Ratings			Unit
				typ.	max.		
V_{RRM}	max. repetitive reverse voltage	$T_{VJ} = 25^{\circ}\text{C}$			1200		V
I_{F25}	forward current	$T_C = 25^{\circ}\text{C}$			44		A
I_{F80}		$T_C = 80^{\circ}\text{C}$			29		A
V_F	forward voltage	$I_F = 30\text{ A}; V_{GE} = 0\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	1.95 1.95	2.2		V V
I_R	reverse current	$V_R = V_{RRM}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	0.8	2.0		mA mA
Q_{rr}	reverse recovery charge	$V_R = 600\text{ V}$ $di_F/dt = 600\text{ A}/\mu\text{s}$ $I_F = 30\text{ A}; V_{GE} = 0\text{ V}$	$T_{VJ} = 125^{\circ}\text{C}$	3.5			μC
I_{RM}	max. reverse recovery current			30			A
t_{rr}	reverse recovery time			350			ns
E_{rec}	reverse recovery energy			0.9			mJ
R_{thJC}	thermal resistance junction to case	(per diode)			1.2		K/W

 $T_C = 25^{\circ}\text{C}$ unless otherwise stated

Input Rectifier Bridge D11 - D16

Symbol	Definitions	Conditions	min.	Ratings			Unit
				typ.	max.		
V_{RRM}	max. repetitive reverse voltage	$T_{VJ} = 25^{\circ}\text{C}$			1600		V
I_{FAV}	average forward current	sine 180° $T_C = 80^{\circ}\text{C}$			70		A
I_{DAVM}	max. average DC output current	rect.; $d = 1/3$ $T_C = 80^{\circ}\text{C}$			190		A
I_{FSM}	max. forward surge current	$t = 10\text{ ms}$; sine 50 Hz $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$			700 620		A A
I^2t	I^2t value for fusing	$t = 10\text{ ms}$; sine 50 Hz $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$			1920 2450		A^2s A^2s
P_{tot}	total power dissipation	$T_C = 25^{\circ}\text{C}$			192		W
V_F	forward voltage	$I_F = 80\text{ A}$ $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		1.2 1.2	1.5		V V
I_R	reverse current	$V_R = V_{RRM}$ $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		0.05 1.5	0.1		mA mA
R_{thJC}	thermal resistance junction to case	(per diode)			0.65		K/W

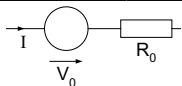
Temperature Sensor NTC

Symbol	Definitions	Conditions	min.	Ratings			Unit
				typ.	max.		
R_{25}	resistance	$T_C = 25^{\circ}\text{C}$	4.75	5.0	5.25		k Ω
$B_{25/50}$				3375			K

Module

Symbol	Definitions	Conditions	min.	Ratings			Unit
				typ.	max.		
T_{VJ}	operating temperature		-40		125		$^{\circ}\text{C}$
T_{VJM}	max. virtual junction temperature				150		$^{\circ}\text{C}$
T_{stg}	storage temperature		-40		125		$^{\circ}\text{C}$
V_{ISOL}	isolation voltage	$I_{ISOL} \leq 1\text{ mA}$; 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			m Ω
R_{thCH}	thermal resistance case to heatsink	with heatsink compound		0.01			K/W
Weight				300			g

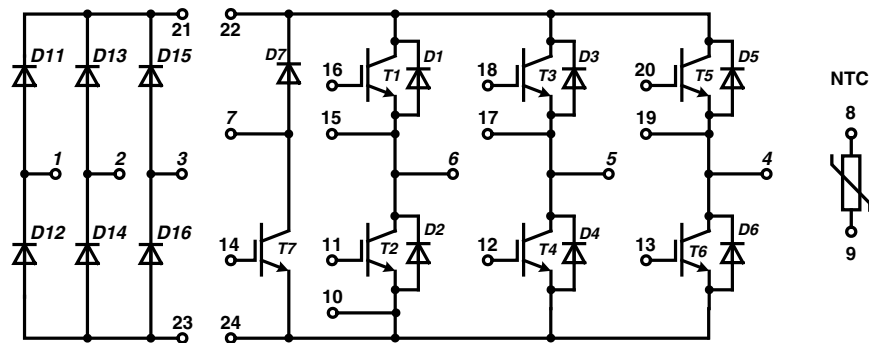
Equivalent Circuits for Simulation



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

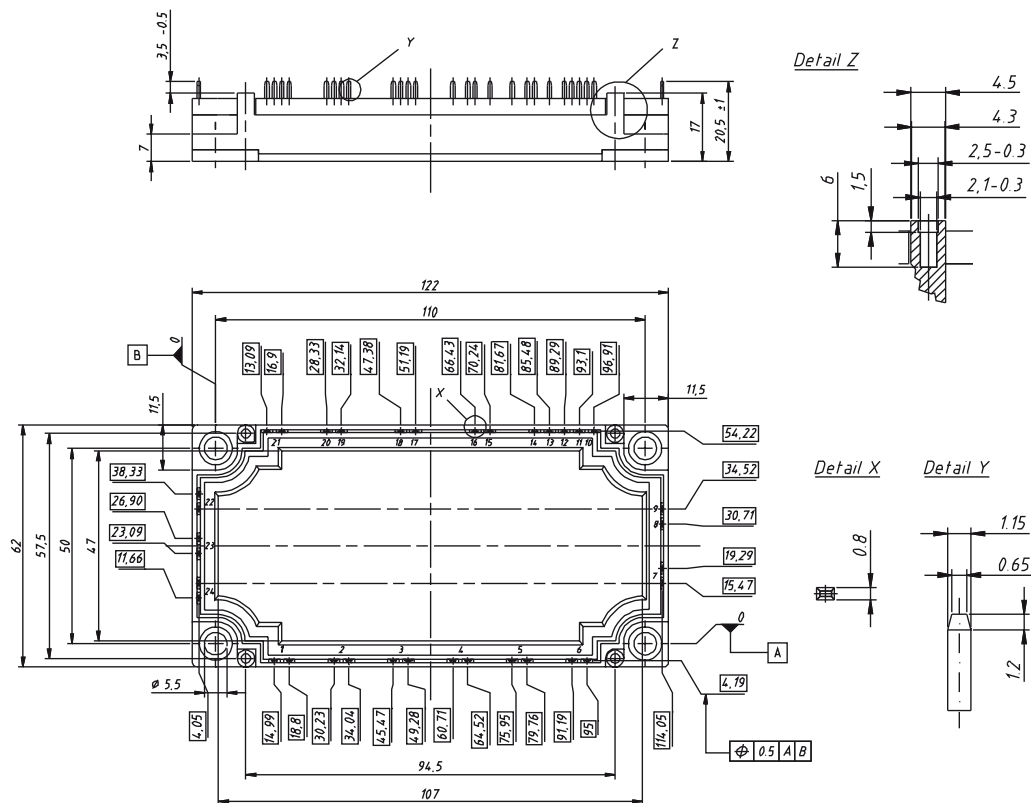
 $T_C = 25^{\circ}\text{C}$ unless otherwise stated

Circuit Diagram

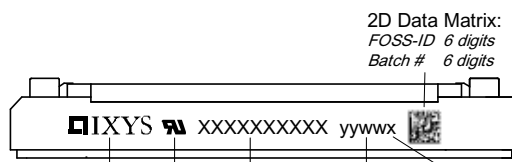


Outline Drawing

Dimensions in mm (1 mm = 0.0394")



Product Marking



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

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

Inverter T1 - T6

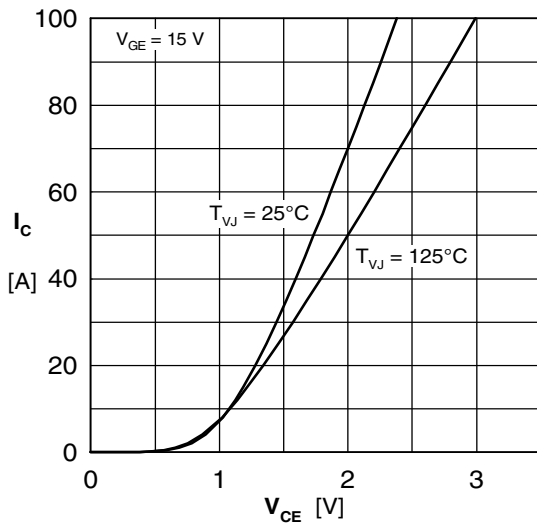


Fig. 1 Typ. output characteristics

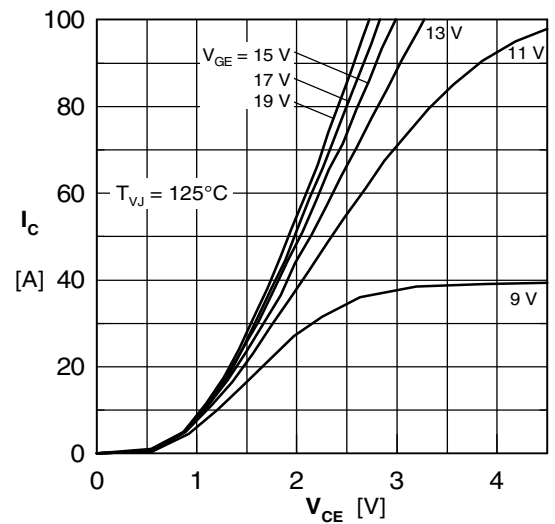


Fig. 2 Typ. output characteristics

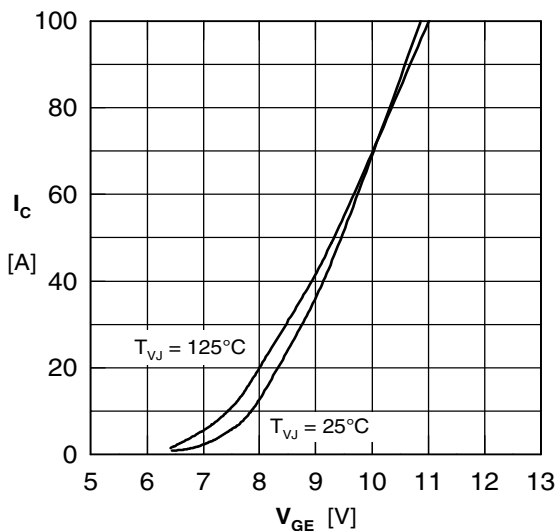


Fig. 3 Typ. transfer characteristics

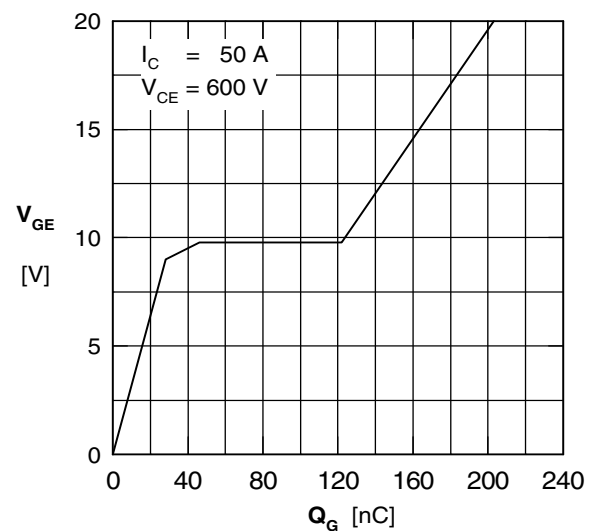


Fig. 4 Typ. turn-on gate charge

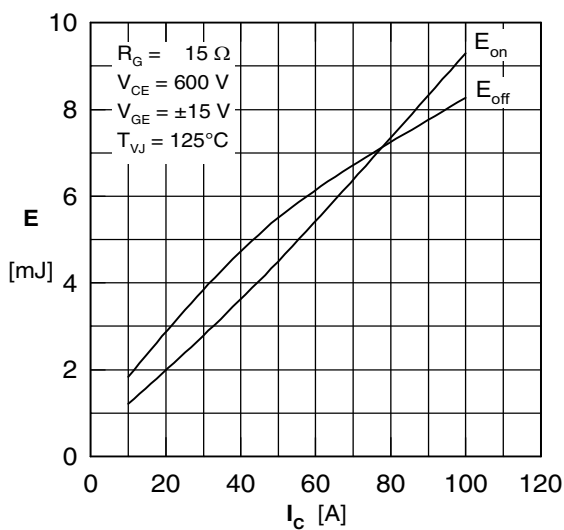


Fig. 5 Typ. switching energy vs. collector current

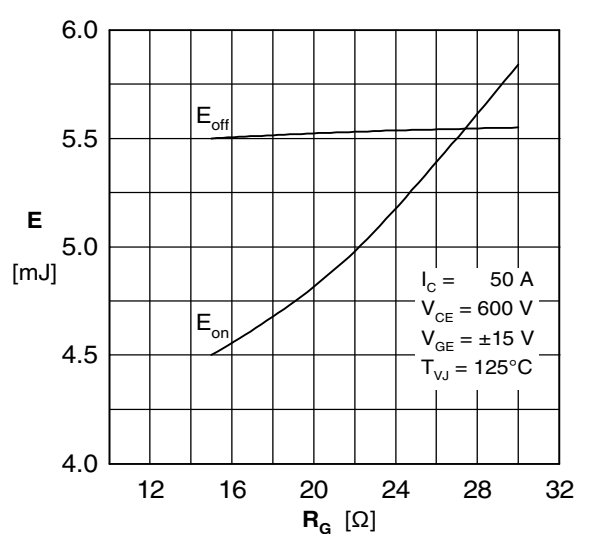


Fig. 6 Typ. switching energy vs. gate resistance

Inverter D1 - D6

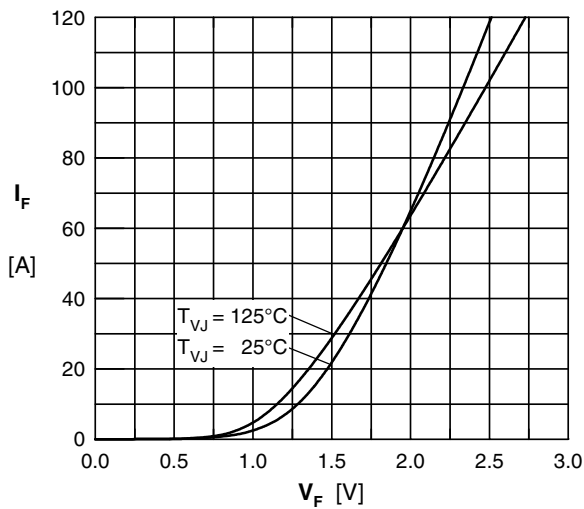


Fig. 7 Typ. Forward current versus V_F

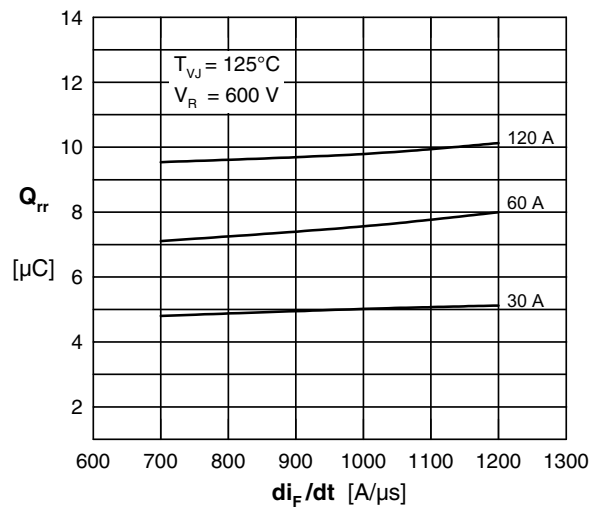


Fig. 8 Typ. reverse recov.charge Q_{rr} vs. di/dt

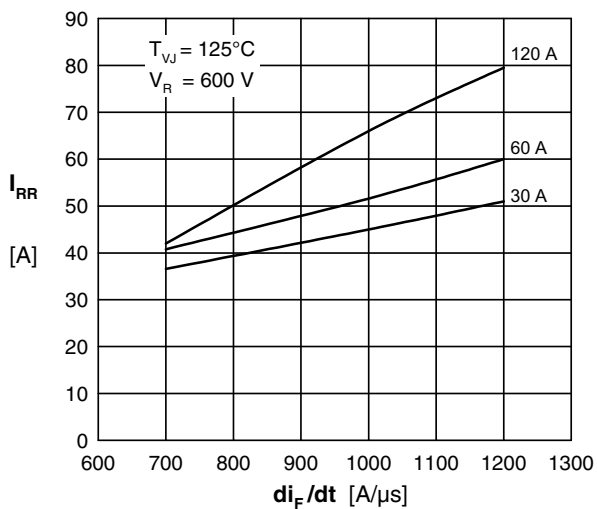


Fig. 9 Typ. peak reverse current I_{RM} vs. di/dt

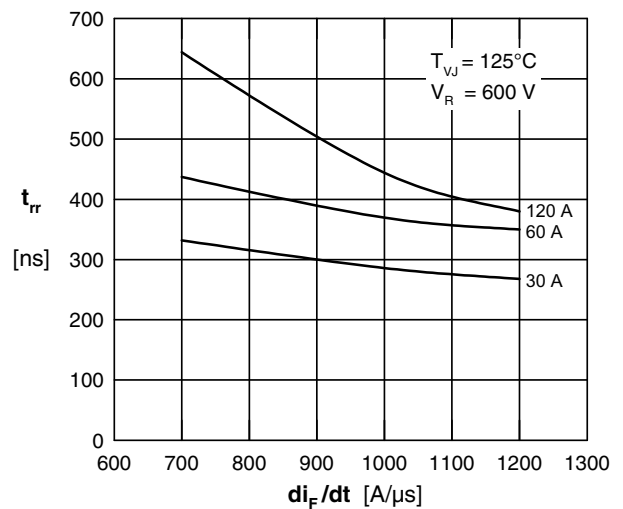


Fig. 10 Typ. recovery time t_{rr} versus di/dt

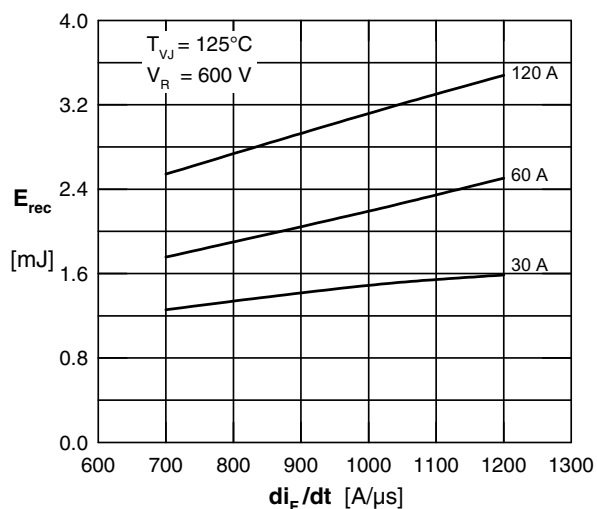


Fig. 8 Typ. recovery energy E_{rec} versus di/dt

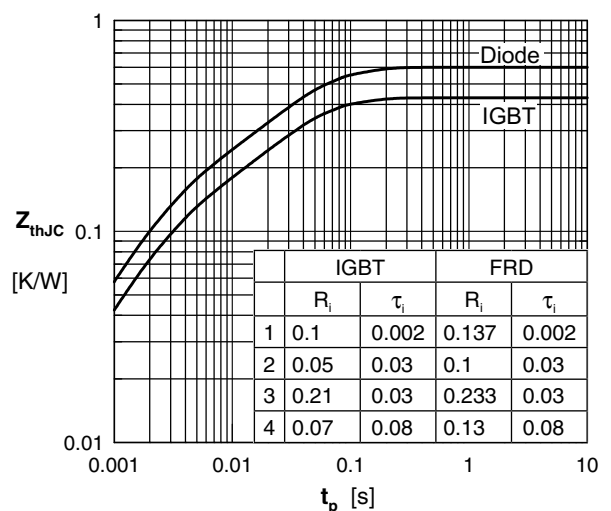


Fig. 9 Typ. transient thermal impedance

Brake T7 & D7

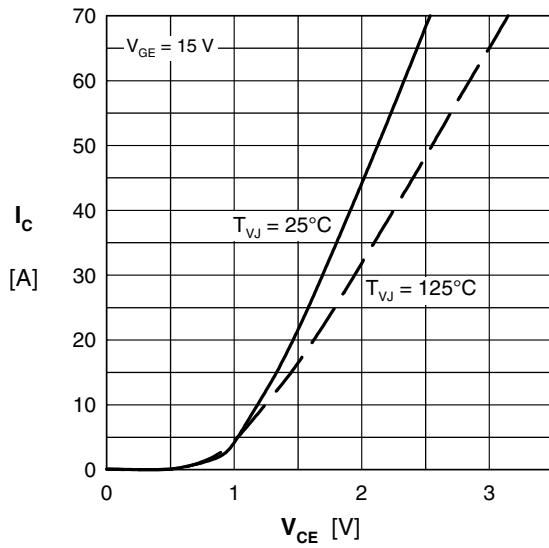


Fig. 13 Typ. output characteristics

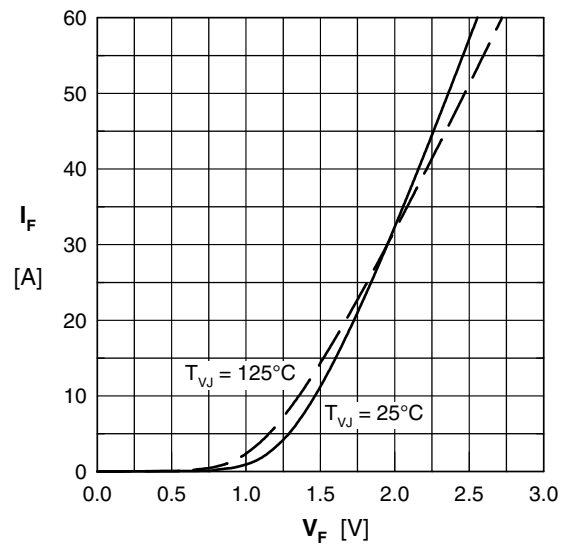


Fig. 14 Typ. forward characteristics

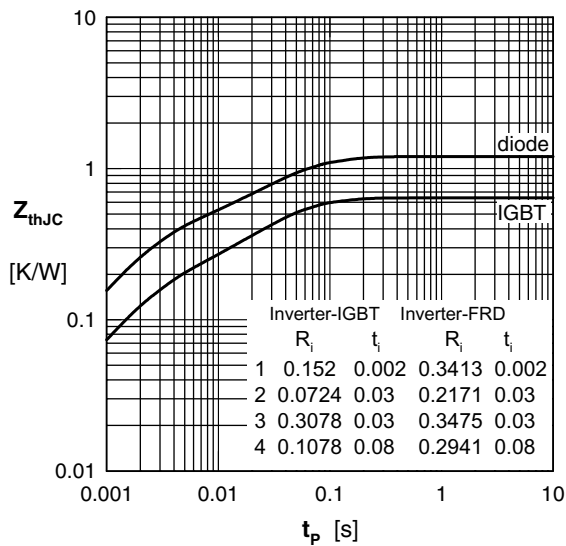


Fig. 15 Typ. transient thermal impedance

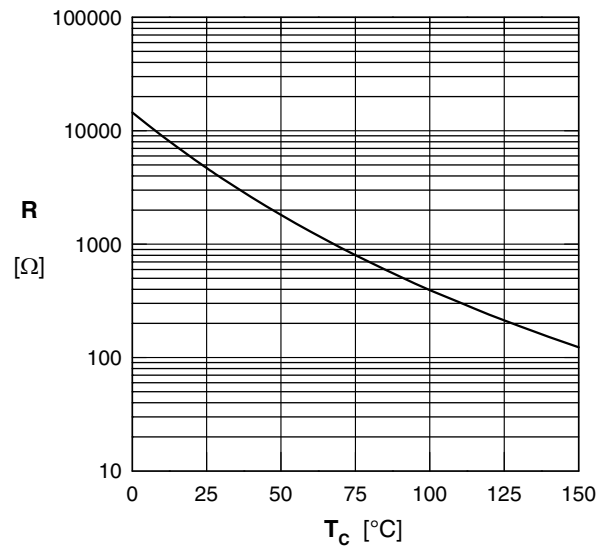


Fig. 16 Typ. NTC resistance vs. temperature

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