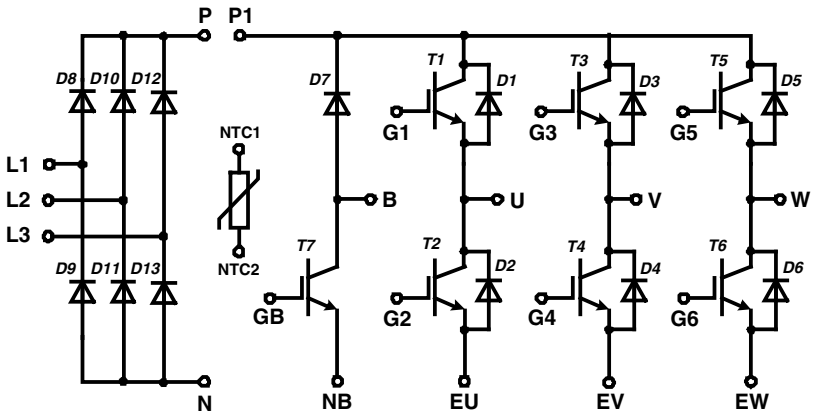
Converter - Brake - Inverter Module

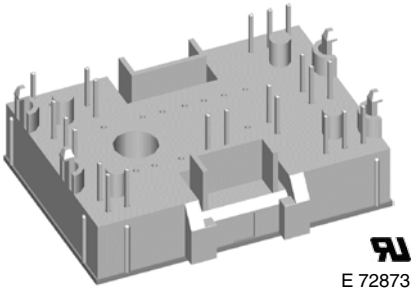
Fast Trench IGBT

Single Phase Rectifier	Brake Chopper	Three Phase Inverter
V_{RRM} = 1600 V	V_{CES} = 1200 V	V_{CES} = 1200 V
I_{DAVM25} = 90 A	I_{C25} = 17 A	I_{C25} = 17 A
I_{FSM} = 300 A	$V_{CE(sat)}$ = 1.9 V	$V_{CE(sat)}$ = 1.9 V

Part name (Marking on product)

MITB10WB1200TMH





Pin configuration see outlines.

Features:

- High level of integration - only one power semiconductor module required for the whole drive
- Inverter with standard trench IGBTs
  - very low saturation voltage
  - positive temperature coefficient
  - short tail current
- Epitaxial free wheeling diodes with hiperfast soft reverse recovery
- Temperature sense included

Application:

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

Package:

- "Mini" package
- Assembly height is 17 mm
- Insulated base plate
- Pins suitable for wave soldering and PCB mounting
- Assembly clips available
  - IXKU 5-505 screw clamp
  - IXRB 5-506 click clamp
- UL registered E72873

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Ouput Inverter T1 - T6

Symbol	Definitions	Conditions		min.	typ.	max.	Unit
					Ratings		
V_{CES}	*collector emitter voltage*		T_{VJ} = 150°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			70	W
$V_{CE(sat)}$	*collector emitter saturation voltage*	I_C = 10 A; V_{GE} = 15 V	T_{VJ} = 25°C		1.9	2.2	V
			T_{VJ} = 125°C		2.3		V
$V_{GE(th)}$	*gate emitter threshold voltage*	I_C = 0.3 A; V_{GE} = V_{CE}	T_{VJ} = 25°C	5	5.5	6.5	V
I_{CES}	*collector emitter leakage current*	V_{CE} = V_{CES}; V_{GE} = 0 V	T_{VJ} = 25°C			0.6	mA
			T_{VJ} = 125°C		0.8		mA
I_{GES}	*gate emitter leakage current*	V_{GE} = ±20 V				150	nA
C_{ies}	*input capacitance*	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz			600		pF
$Q_{G(on)}$	*total gate charge*	V_{CE} = 600 V; V_{GE} = 15 V; I_C = 10 A			54		nC
$t_{d(on)}$	*turn-on delay time*	inductive load	T_{VJ} = 25°C		55		ns
t_r	*current rise time*	V_{CE} = 600 V; I_C = 10 A			30		ns
$t_{d(off)}$	*turn-off delay time*	V_{GE} = ±15 V; R_G = 100 Ω			320		ns
t_f	*current fall time*				200		ns
E_{on}	*turn-on energy per pulse*				0.9		mJ
E_{off}	*turn-off energy per pulse*				0.75		mJ
$t_{d(on)}$	*turn-on delay time*	inductive load	T_{VJ} = 125°C		60		ns
t_r	*current rise time*	V_{CE} = 600 V; I_C = 10 A			35		ns
$t_{d(off)}$	*turn-off delay time*	V_{GE} = ±15 V; R_G = 100 Ω			360		ns
t_f	*current fall time*				340		ns
E_{on}	*turn-on energy per pulse*				1.55		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; I_C = 20 A; T_{VJ} = 125°C		$V_{CEK} \leq V_{CES}$-L_S·d_I/dt			V
I_{SC} **(SCSOA)**	*short circuit safe operating area*	V_{CE} = 720 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)				1.9	K/W
R_{thCH}	*thermal resistance case to heatsink*				0.65		K/W

Output Inverter D1 - D6

Symbol	Definitions	Conditions		min.	typ.	max.	Unit
					Ratings		
V_{RRM}	*max. repetitve reverse voltage*		T_{VJ} = 150°C			1200	V
I_{F25}	*forward current*		T_C = 25°C			24	A
I_{F80}			T_C = 80°C			16	A
V_F	*forward voltage*	I_F = 10 A; V_{GE} = 0 V	T_{VJ} = 25°C		2.0	2.4	V
			T_{VJ} = 125°C		1.6		V
Q_{rr}	*reverse recovery charge*	V_R = 600 V			1.9		µC
I_{RM}	*max. reverse recovery current*	di_F/dt = -300 A/µs	T_{VJ} = 125°C		12.8		A
t_{rr}	*reverse recovery time*	I_F = 10 A; V_{GE} = 0 V			335		ns
E_{rec}	*reverse recovery energy*				0.54		mJ
R_{thJC}	*thermal resistance junction to case*	(per diode)				1.6	K/W
R_{thCH}	*thermal resistance case to heatsink*				0.55		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} = 150°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			70	W
$V_{CE(sat)}$	*collector emitter saturation voltage*	I_C = 10 A; V_{GE} = 15 V	T_{VJ} = 25°C		1.9	2.2	V
			T_{VJ} = 125°C		2.3		V
$V_{GE(th)}$	*gate emitter threshold voltage*	I_C = 0.3 A; V_{GE} = V_{CE}	T_{VJ} = 25°C	5	5.5	6.5	V
I_{CES}	*collector emitter leakage current*	V_{CE} = V_{CES}; V_{GE} = 0 V	T_{VJ} = 25°C			0.6	mA
			T_{VJ} = 125°C		0.8		mA
I_{GES}	*gate emitter leakage current*	V_{GE} = ±20 V				150	nA
C_{ies}	*input capacitance*	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz			600		pF
$Q_{G(on)}$	*total gate charge*	V_{CE} = 600 V; V_{GE} = 15 V; I_C = 10 A			54		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} = 25°C		55		ns
t_r	*current rise time*				30		ns
$t_{d(off)}$	*turn-off delay time*				320		ns
t_f	*current fall time*				200		ns
E_{on}	*turn-on energy per pulse*				0.9		mJ
E_{off}	*turn-off energy per pulse*				0.75		mJ
$t_{d(on)}$	*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		60		ns
t_r	*current rise time*				35		ns
$t_{d(off)}$	*turn-off delay time*				360		ns
t_f	*current fall time*				340		ns
E_{on}	*turn-on energy per pulse*				1.55		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; I_C = 20 A; T_{VJ} = 125°C		$V_{CEK} \leq V_{CES}$-L_S·d_I/dt			V
I_{SC} **(SCSOA)**	*short circuit safe operating area*	V_{CE} = 720 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)				1.9	K/W
R_{thCH}	*thermal resistance case to heatsink*				0.65		K/W

Brake Chopper D7

Symbol	Definitions	Conditions		min.	typ.	max.	Unit
					Ratings		
V_{RRM}	*max. repetitive reverse voltage*		T_{VJ} = 150°C			1200	V
I_{F25}	*forward current*		T_C = 25°C			15	A
I_{F80}			T_C = 80°C			10	A
V_F	*forward voltage*	I_F = 10 A; V_{GE} = 0 V	T_{VJ} = 25°C		2.5	3.1	V
			T_{VJ} = 125°C		2.0		V
I_R	*reverse current*	V_R = V_{RRM}	T_{VJ} = 25°C			0.1	mA
			T_{VJ} = 125°C		0.2		mA
Q_{rr}	*reverse recovery charge*	V_R = 600 V; di_F/dt = tbd A/µs; I_F = 10 A; V_{GE} = 0 V	T_{VJ} = 125°C		tbd		µC
I_{RM}	*max. reverse recovery current*				tbd		A
t_{rr}	*reverse recovery time*				tbd		ns
E_{rec}	*reverse recovery energy*				tbd		µJ
R_{thJC}	*thermal resistance junction to case*	(per diode)				2.5	K/W
R_{thCH}	*thermal resistance case to heatsink*				0.85		K/W

T_C = 25°C unless otherwise stated

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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			22	A
I_{DAVM}	*max. average DC output current*	rect.; d = $^1/_3$	T_C = 80°C			61	A
I_{FSM}	*max. forward surge current*	t = 10 ms; sine 50 Hz	T_{VJ} = 25°C			300	A
			T_{VJ} = 125°C			tbd	A
I^2t	*I^2t value for fusing*	t = 10 ms; sine 50 Hz	T_{VJ} = 25°C			450	A^2s
			T_{VJ} = 125°C			tbd	A^2s
P_{tot}	*total power dissipation*		T_C = 25°C			50	W
V_F	*forward voltage*	I_F = 30 A	T_{VJ} = 25°C		1.35	1.6	V
			T_{VJ} = 125°C		1.35		V
I_R	*reverse current*	$V_R = V_{RRM}$	T_{VJ} = 25°C			0.01	mA
			T_{VJ} = 125°C		0.3		mA
R_{thJC}	*thermal resistance junction to case*	(per diode)				2.1	K/W
R_{thCH}	*thermal resistance case to heatsink*	(per diode)			0.7		K/W

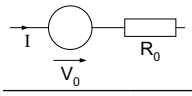
Temperature Sensor NTC

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			2500	V~
CTI	*comparative tracking index*				-	
F_C	*mounting force*		40		80	N
d_S	*creep distance on surface*		12.7			mm
d_A	*strike distance through air*		12			mm
Weight				35		g

Equivalent Circuits for Simulation



Symbol	Definitions	Conditions		Ratings min.	typ.	max.	Unit
V_0	*rectifier diode*	D8 - D13	T_{VJ} = 125°C		0.9		V
R_0					16		mΩ
V_0	*IGBT*	T1 - T6	T_{VJ} = 125°C		1.0		V
R_0					125		mΩ
V_0	*free wheeling diode*	D1 - D6	T_{VJ} = 125°C		1.15		V
R_0					45		mΩ
V_0	*IGBT*	T7	T_{VJ} = 125°C		1.0		V
R_0					125		mΩ
V_0	*free wheeling diode*	D7	T_{VJ} = 125°C		1.4		V
R_0					60		mΩ

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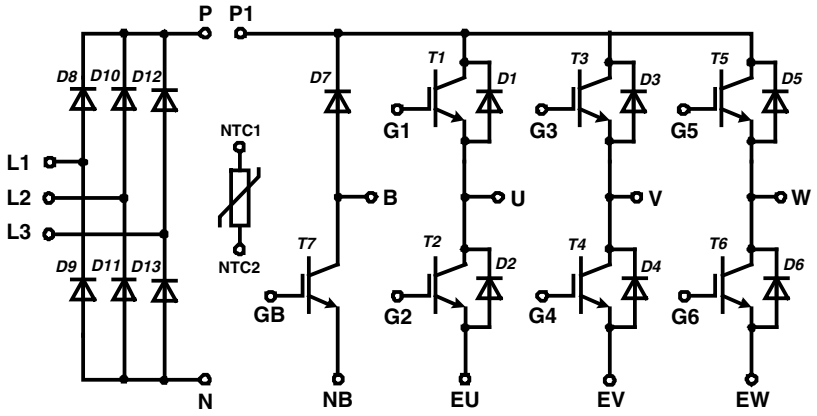
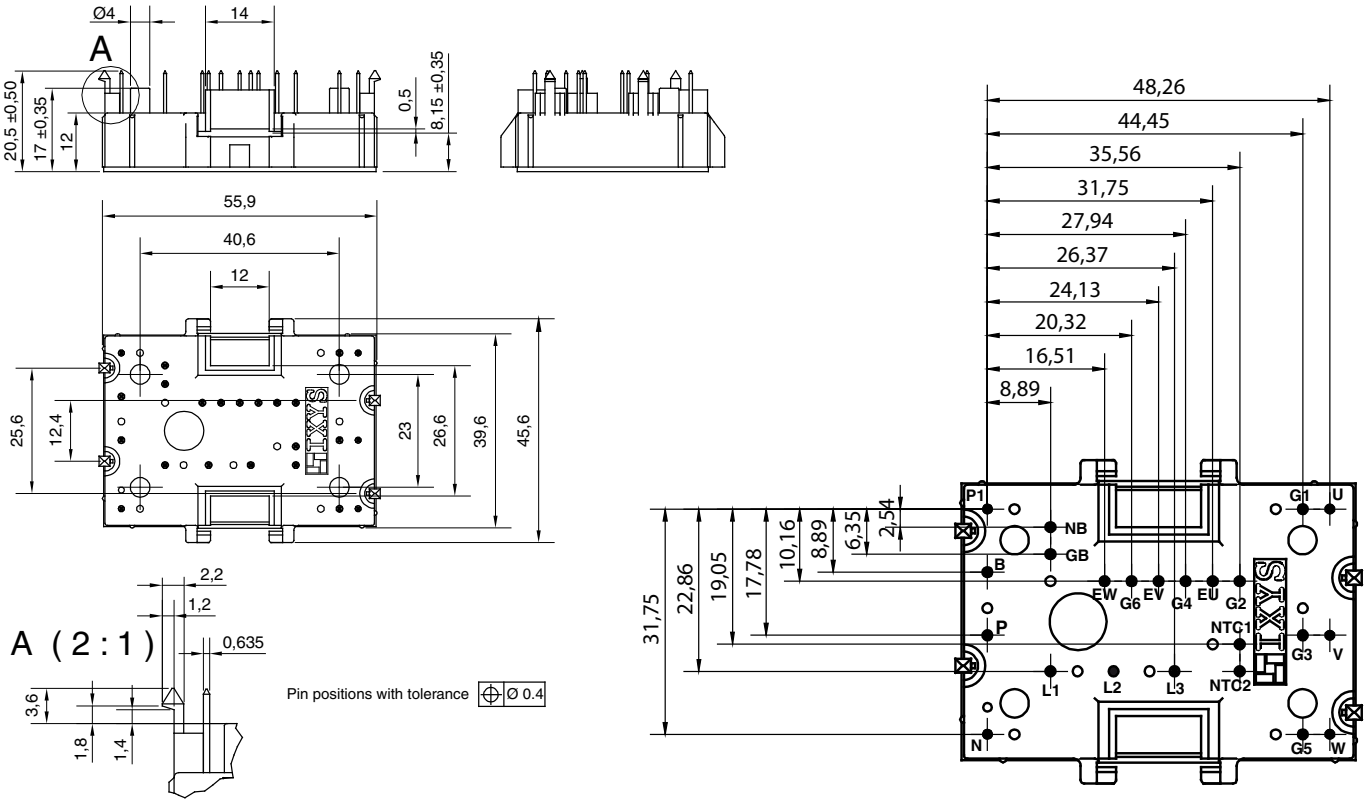
Circuit Diagram

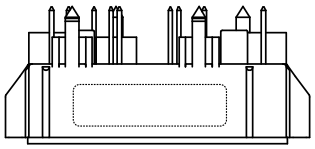


Outline Drawing

Dimensions in mm (1 mm = 0.0394“)



Product Marking



Part number

M = Module
I = IGBT
T = Standard trench
B = Gen 1 / std
10 = Current Rating [A]
WB = 6-Pack + 3~ Rectifier Bridge & Brake Unit
1200 = Reverse Voltage [V]
T = NTC
MH = MiniPack2

Ordering	Part Name	Marking on Product	Delivering Mode	Base Qty	Ordering Code
Standard	MITB 10 WB 1200 TMH	MITB10WB1200TMH	Box	20	502722

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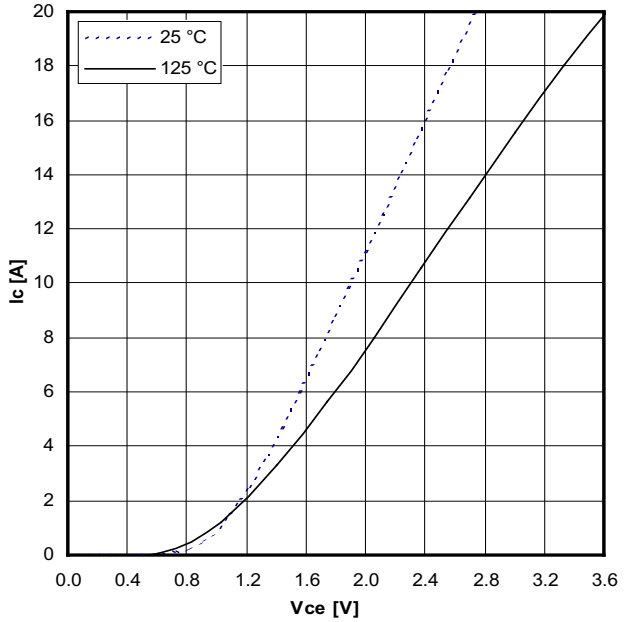
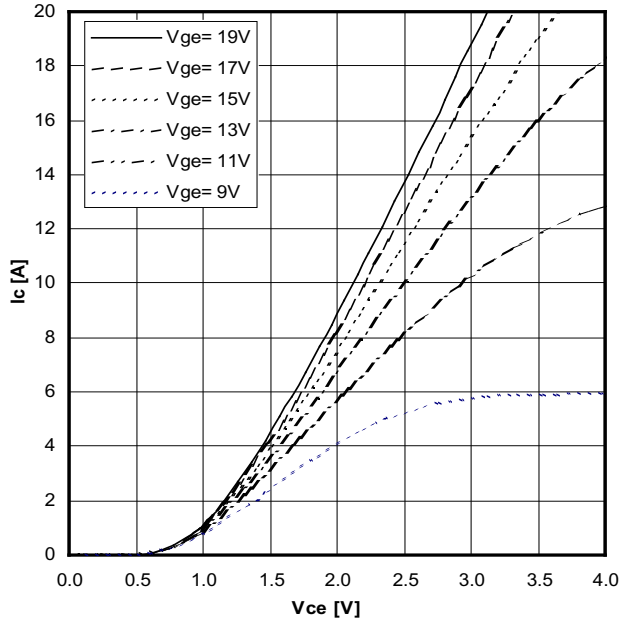
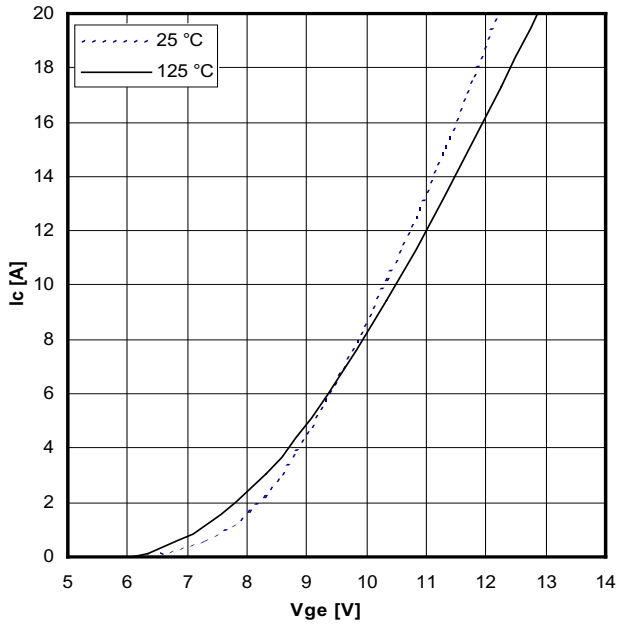


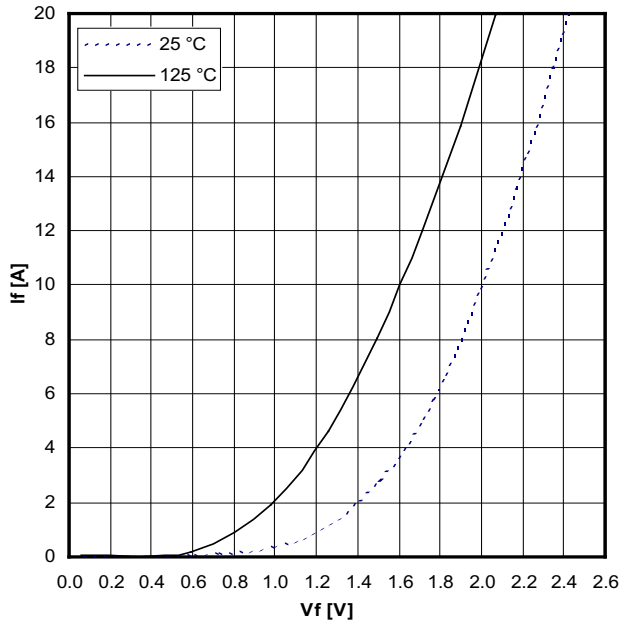
Typical output characteristics, V_{GE} = 15 V



Typical output characteristics (125°C)



Typical transfer characteristics



Typical forward characteristics of freewheeling diode

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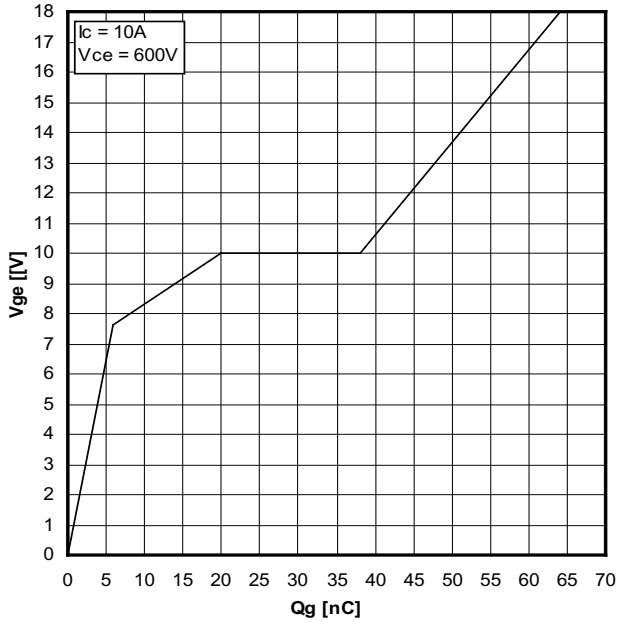
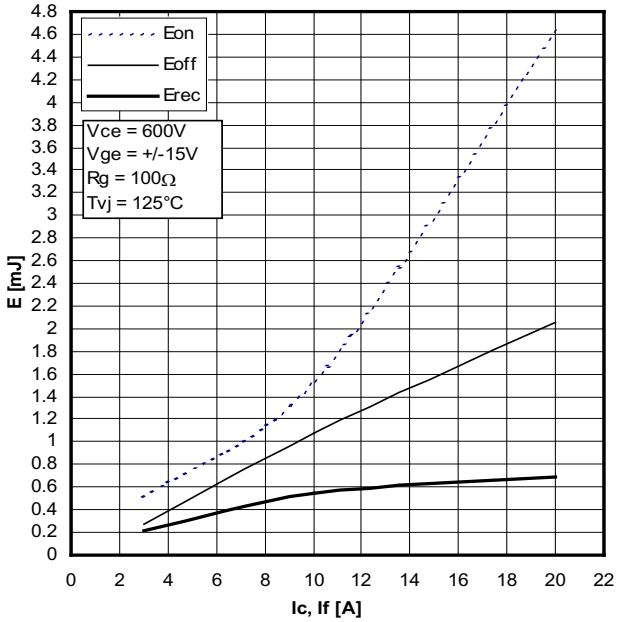
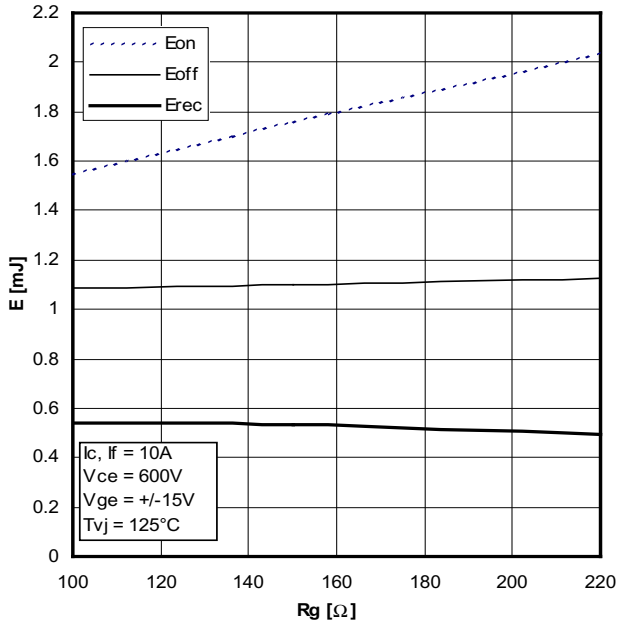


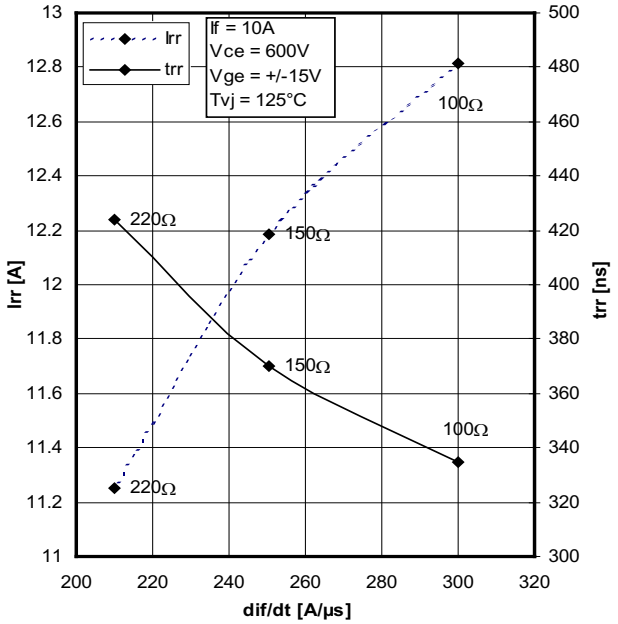
Typical turn on gate charge



Typical switching energy versus collector current



Typical switching energy versus gate resistance



Typical turn-off characteristics of free wheeling diode

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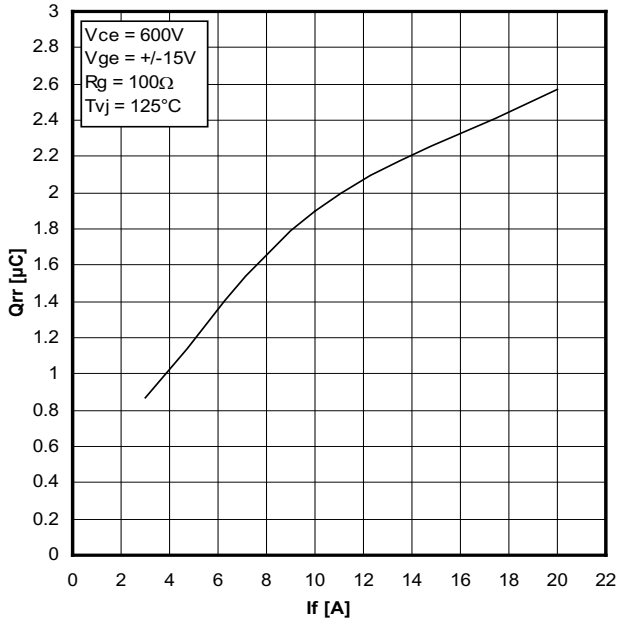
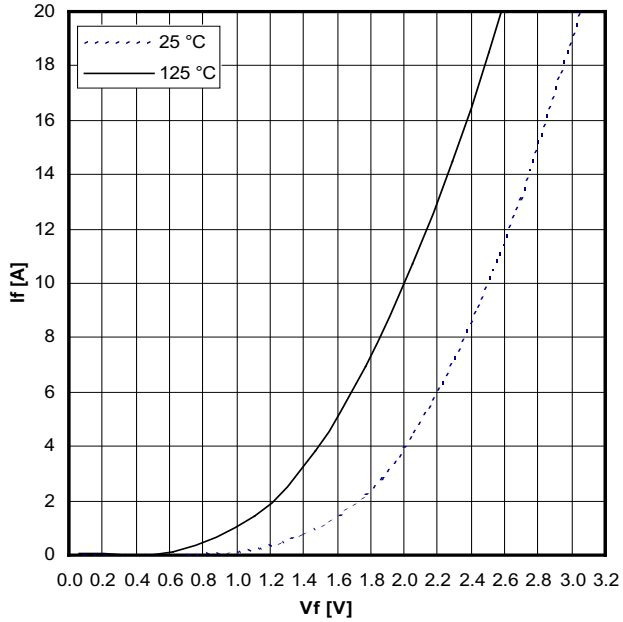
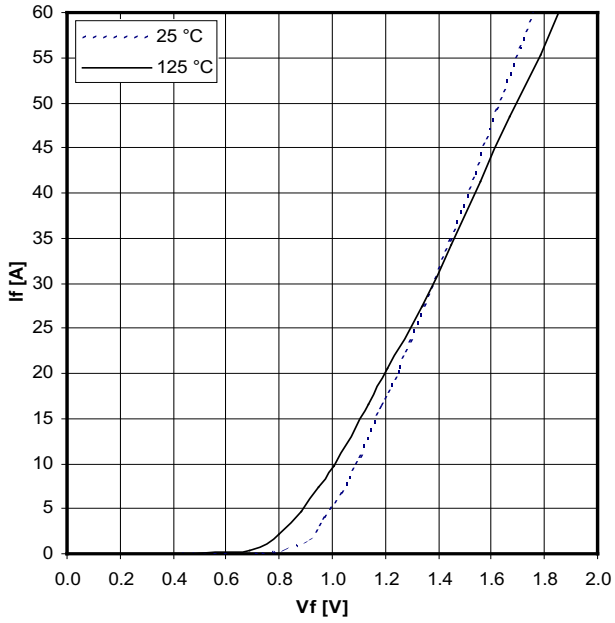


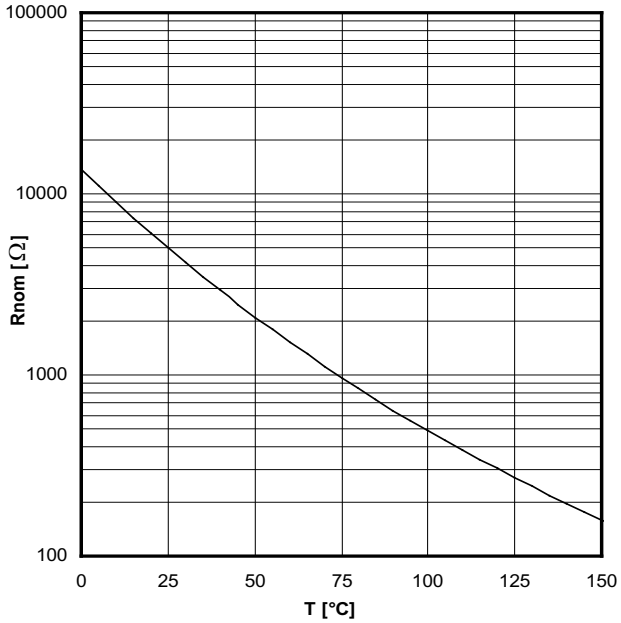
Typical turn-off characteristics of free wheeling diode



Typical forward characteristics of brake diode



Typical forward characteristics per rectifier



Typical thermistor resistance versus temperature

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