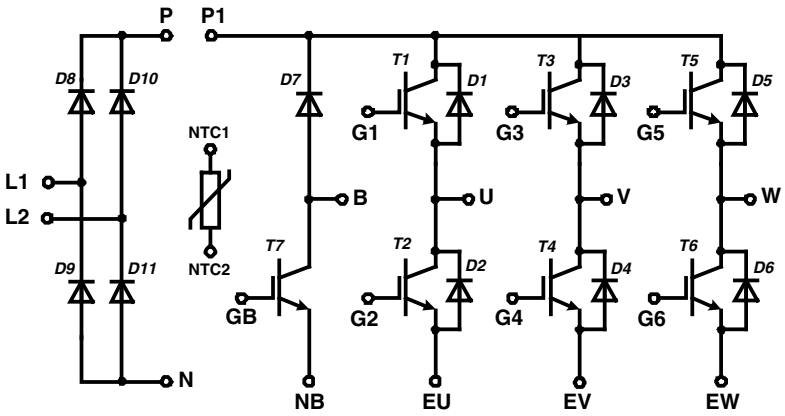
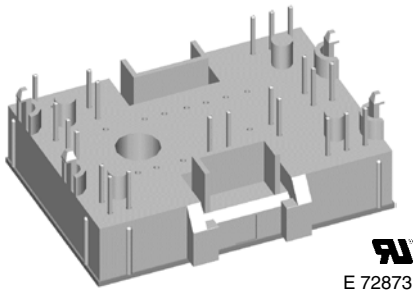
Converter - Brake - Inverter Module
NPT IGBT

Single Phase Rectifier	Brake Chopper	Three Phase Inverter
V_{RRM} = 1600 V	V_{CES} = 600 V	V_{CES} = 600 V
I_{DAVM25} = 65 A	I_{C25} = 23 A	I_{C25} = 23 A
I_{FSM} = 550 A	$V_{CE(sat)}$ = 2.1 V	$V_{CE(sat)}$ = 2.1 V

Part name (Marking on product)

MIAA15WE600TMH





E 72873

Pin configuration see outlines.

Features:

- High level of integration - only one power semiconductor module required for the whole drive
- Inverter with NPT IGBTs
  - low saturation voltage
  - positive temperature coefficient
  - fast switching
  - 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

Ouput Inverter T1 - T6

Symbol	Definitions	Conditions		Ratings min.	typ.	max.	Unit
V_{CES}	*collector emitter voltage*		T_{VJ} = 150°C			600	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			23	A
I_{C80}			T_C = 80°C			16	A
P_{tot}	*total power dissipation*		T_C = 25°C			80	W
$V_{CE(sat)}$	*collector emitter saturation voltage*	I_C = 15 A; V_{GE} = 15 V	T_{VJ} = 25°C		2.1	2.5	V
			T_{VJ} = 125°C		2.3		V
$V_{GE(th)}$	*gate emitter threshold voltage*	I_C = 0.4 A; V_{GE} = V_{CE}	T_{VJ} = 25°C	4.5	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		1.0		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			700		pF
$Q_{G(on)}$	*total gate charge*	V_{CE} = 300 V; V_{GE} = 15 V; I_C = 15 A			57		nC
$t_{d(on)}$	*turn-on delay time*	inductive load V_{CE} = 300 V; I_C = 15 A V_{GE} = ±15 V; R_G = 68 Ω	T_{VJ} = 25°C		40		ns
t_r	*current rise time*				45		ns
$t_{d(off)}$	*turn-off delay time*				155		ns
t_f	*current fall time*				95		ns
E_{on}	*turn-on energy per pulse*				0.35		mJ
E_{off}	*turn-off energy per pulse*				0.27		mJ
$t_{d(on)}$	*turn-on delay time*	inductive load V_{CE} = 300 V; I_C = 15 A V_{GE} = ±15 V; R_G = 68 Ω	T_{VJ} = 125°C		40		ns
t_r	*current rise time*				45		ns
$t_{d(off)}$	*turn-off delay time*				160		ns
t_f	*current fall time*				120		ns
E_{on}	*turn-on energy per pulse*				0.55		mJ
E_{off}	*turn-off energy per pulse*				0.4		mJ
RBSOA	*reverse bias safe operating area*	V_{GE} = ±15 V; R_G = 68 Ω; I_C = 30 A	T_{VJ} = 125°C	$V_{CEK} \le V_{CES}$-L_S·d_i/dt			V
I_{SC} (SCSOA)	*short circuit safe operating area*	V_{CE} = 360 V; V_{GE} = ±15 V; R_G = 68 Ω; t_p = 10 µs; non-repetitive	T_{VJ} = 125°C		65		A
R_{thJC}	*thermal resistance junction to case*	(per IGBT)				1.6	K/W
R_{thCH}	*thermal resistance case to heatsink*				0.55		K/W

Output Inverter D1 - D6

Symbol	Definitions	Conditions		Ratings min.	typ.	max.	Unit
V_{RRM}	*max. repetitve reverse voltage*		T_{VJ} = 150°C			600	V
I_{F25}	*forward current*		T_C = 25°C			37	A
I_{F80}			T_C = 80°C			24	A
V_F	*forward voltage*	I_F = 15 A; V_{GE} = 0 V	T_{VJ} = 25°C		1.8	2.1	V
			T_{VJ} = 125°C		1.3		V
Q_{rr}	*reverse recovery charge*	V_R = 300 V di_F/dt = -380 A/µs I_F = 15 A; V_{GE} = 0 V	T_{VJ} = 125°C		0.58		µC
I_{RM}	*max. reverse recovery current*				11.5		A
t_{rr}	*reverse recovery time*				115		ns
E_{rec}	*reverse recovery energy*				50		µJ
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

Brake T7

Symbol	Definitions	Conditions		Ratings min.	typ.	max.	Unit
V_{CES}	*collector emitter voltage*		T_{VJ} = 150°C			600	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			23	A
I_{C80}			T_C = 80°C			16	A
P_{tot}	*total power dissipation*		T_C = 25°C			80	W
$V_{CE(sat)}$	*collector emitter saturation voltage*	I_C = 15 A; V_{GE} = 15 V	T_{VJ} = 25°C		2.1	2.5	V
			T_{VJ} = 125°C		2.3		V
$V_{GE(th)}$	*gate emitter threshold voltage*	I_C = 0.4 A; V_{GE} = V_{CE}	T_{VJ} = 25°C	4.5	5.5	6.5	V
I_{CES}	*collector emitter leakage current*	V_{CE} = V_{CES}; V_{GE} = 0 V	T_{VJ} = 25°C			0.5	mA
			T_{VJ} = 125°C		0.6		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			700		pF
$Q_{G(on)}$	*total gate charge*	V_{CE} = 300 V; V_{GE} = 15 V; I_C = 15 A			57		nC
$t_{d(on)}$	*turn-on delay time*	inductive load V_{CE} = 300 V; I_C = 15 A V_{GE} = ±15 V; R_G = 68 Ω	T_{VJ} = 25°C		40		ns
t_r	*current rise time*				45		ns
$t_{d(off)}$	*turn-off delay time*				155		ns
t_f	*current fall time*				95		ns
E_{on}	*turn-on energy per pulse*				0.35		mJ
E_{off}	*turn-off energy per pulse*				0.27		mJ
$t_{d(on)}$	*turn-on delay time*	inductive load V_{CE} = 300 V; I_C = 15 A V_{GE} = ±15 V; R_G = 68 Ω	T_{VJ} = 125°C		40		ns
t_r	*current rise time*				45		ns
$t_{d(off)}$	*turn-off delay time*				160		ns
t_f	*current fall time*				120		ns
E_{on}	*turn-on energy per pulse*				0.55		mJ
E_{off}	*turn-off energy per pulse*				0.4		mJ
RBSOA	*reverse bias safe operating area*	V_{GE} = ±15 V; R_G = 68 Ω; I_C = 30 A	T_{VJ} = 125°C	$V_{CEK} \le V_{CES}$-L_S·d_I/dt			V
I_{SC} (SCSOA)	*short circuit safe operating area*	V_{CE} = 360 V; V_{GE} = ±15 V; R_G = 68 Ω; t_p = 10 µs; non-repetitive	T_{VJ} = 125°C		65		A
R_{thJC}	*thermal resistance junction to case*	(per IGBT)				1.6	K/W
R_{thCH}	*thermal resistance case to heatsink*				0.55		K/W

Brake Chopper D7

Symbol	Definitions	Conditions		Ratings min.	typ.	max.	Unit
V_{RRM}	*max. repetitive reverse voltage*		T_{VJ} = 150°C			600	V
I_{F25}	*forward current*		T_C = 25°C			37	A
I_{F80}			T_C = 80°C			24	A
V_F	*forward voltage*	I_F = 15 A; V_{GE} = 0 V	T_{VJ} = 25°C		1.8	2.1	V
			T_{VJ} = 125°C		1.3		V
I_R	*reverse current*	V_R = V_{RRM}	T_{VJ} = 25°C			0.1	mA
			T_{VJ} = 125°C		0.4		mA
Q_{rr}	*reverse recovery charge*	V_R = 300 V di_F/dt = -380 A/µs I_F = 15 A; V_{GE} = 0 V	T_{VJ} = 125°C		0.58		µC
I_{RM}	*max. reverse recovery current*				11.5		A
t_{rr}	*reverse recovery time*				115		ns
E_{rec}	*reverse recovery energy*				50		µJ
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

20080327b

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			39	A
I_{DAVM}	*max. average DC output current*	rect.; d = ½	T_C = 80°C			42	A
I_{FSM}	*max. forward surge current*	t = 10 ms; sine 50 Hz	T_{VJ} = 25°C			550	A
			T_{VJ} = 125°C			tbd	A
I^2t	*I^2t value for fusing*	t = 10 ms; sine 50 Hz	T_{VJ} = 25°C			1270	A^2s
			T_{VJ} = 125°C			tbd	A^2s
P_{tot}	*total power dissipation*		T_C = 25°C			100	W
V_F	*forward voltage*	I_F = 30 A	T_{VJ} = 25°C		1.2	1.5	V
			T_{VJ} = 125°C		1.3		V
I_R	*reverse current*	$V_R = V_{RRM}$	T_{VJ} = 25°C			0.03	mA
			T_{VJ} = 125°C		0.3		mA
R_{thJC}	*thermal resistance junction to case*	(per diode)				1.2	K/W
R_{thCH}	*thermal resistance case to heatsink*	(per diode)			0.4		K/W

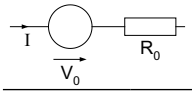
Temperature Sensor NTC

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



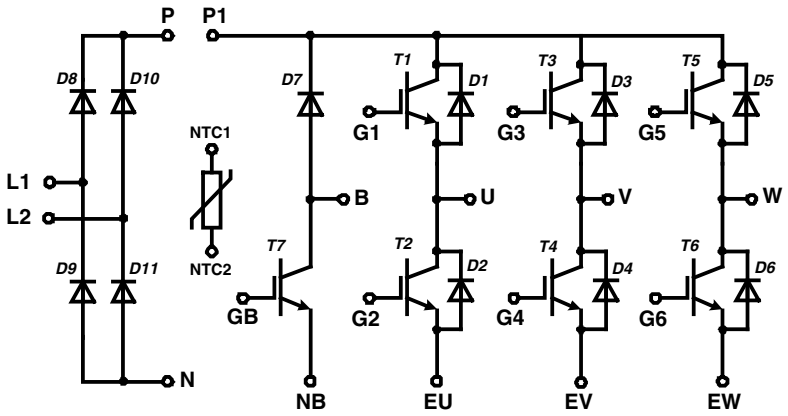
Symbol	Definitions	Conditions		Ratings min.	typ.	max.	Unit
V_0	*rectifier diode*	D8 - D11	T_{VJ} = 125°C		0.9		V
R_0					6		mΩ
V_0	*IGBT*	T1 - T6	T_{VJ} = 125°C		1.15		V
R_0					77		mΩ
V_0	*free wheeling diode*	D1 - D6	T_{VJ} = 125°C		1.05		V
R_0					30		mΩ
V_0	*IGBT*	T7	T_{VJ} = 125°C		1.15		V
R_0					77		mΩ
V_0	*free wheeling diode*	D7	T_{VJ} = 125°C		1.05		V
R_0					35		mΩ

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

T_C = 25°C unless otherwise stated

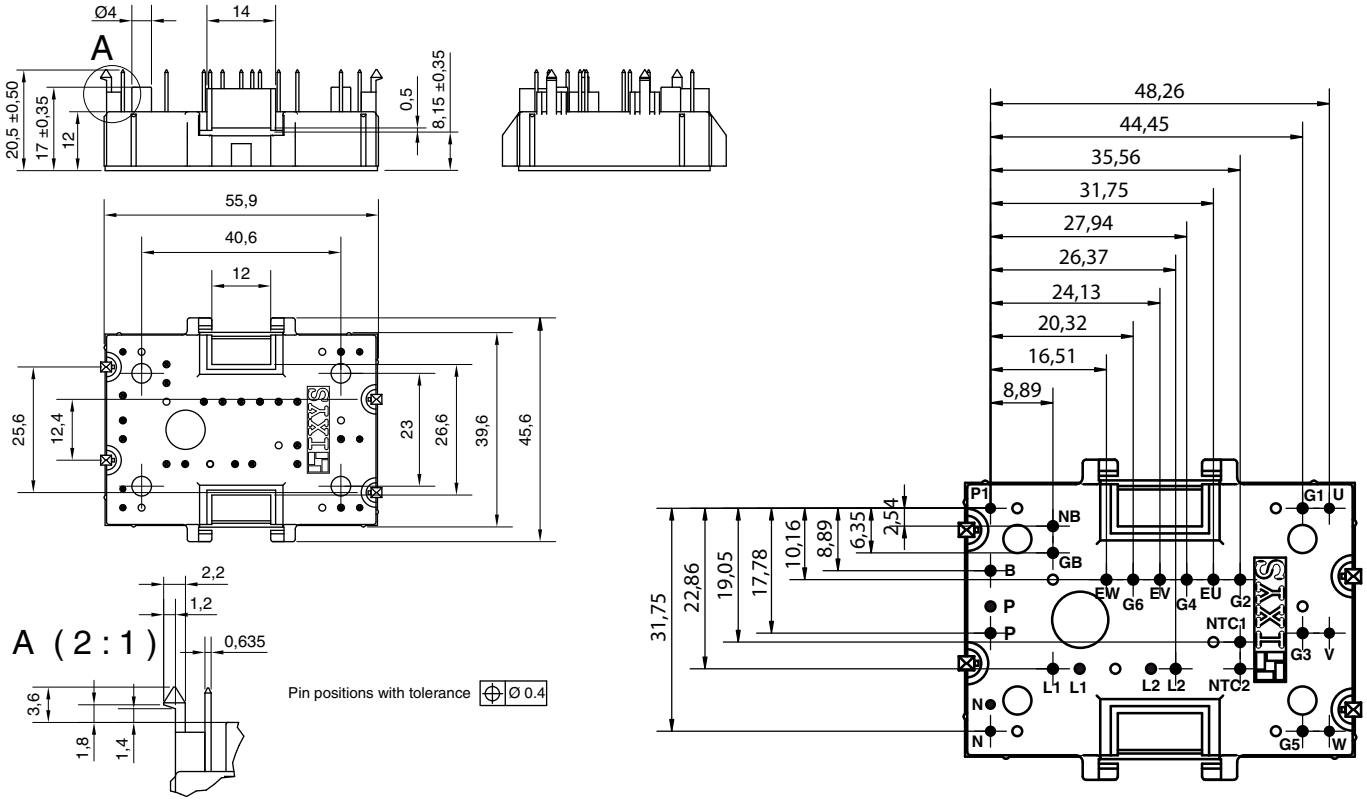
20080327b

Circuit Diagram

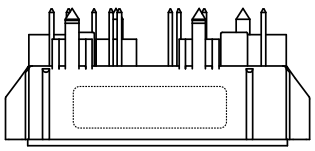


Outline Drawing

Dimensions in mm (1 mm = 0.0394“)



Product Marking



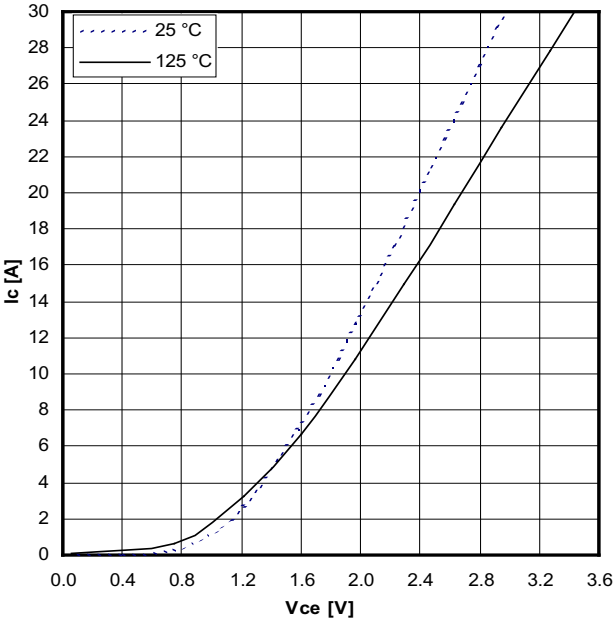
Part number

M = Module
I = IGBT
A = IGBT (NPT)
A = Gen 1 / std
15 = Current Rating [A]
WE = 6-Pack + 1~ Rectifier Bridge & Brake Unit
600 = Reverse Voltage [V]
T = NTC
MH = MiniPack2

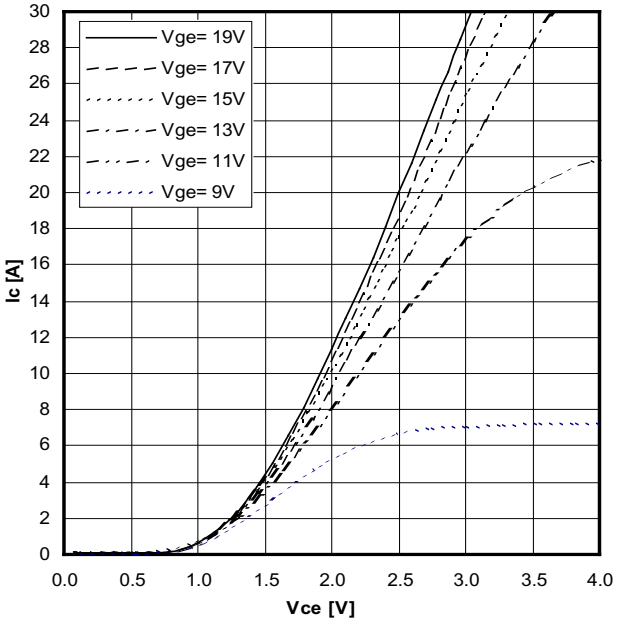
Ordering	Part Name	Marking on Product	Delivering Mode	Base Qty	Ordering Code
Standard	MIAA 15 WE 600 TMH	MIAA15WE600TMH	Box	20	504701

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

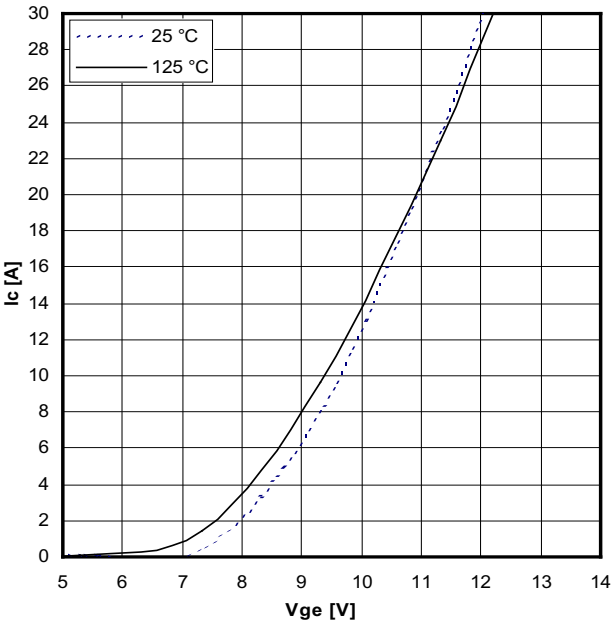
20080327b



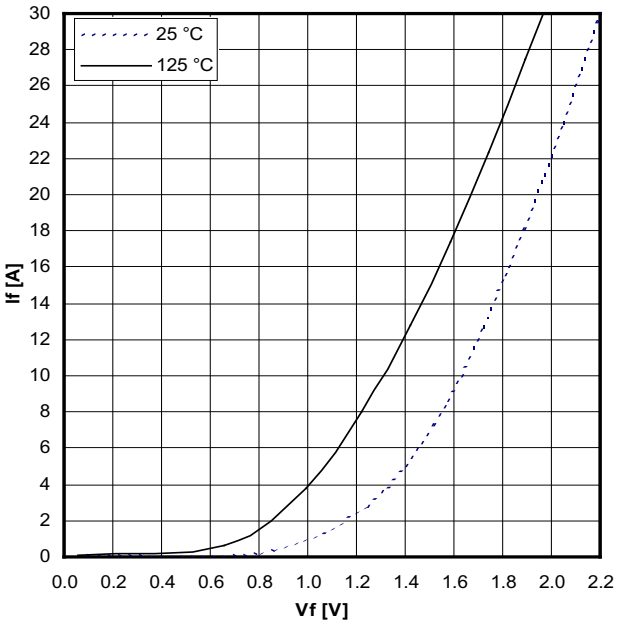
Typical output characteristics, V_{GE} = 15 V



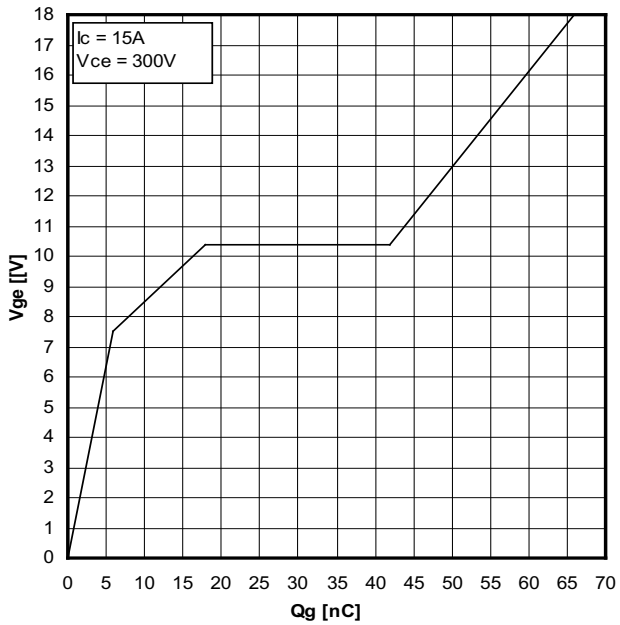
Typical output characteristics (125°C)



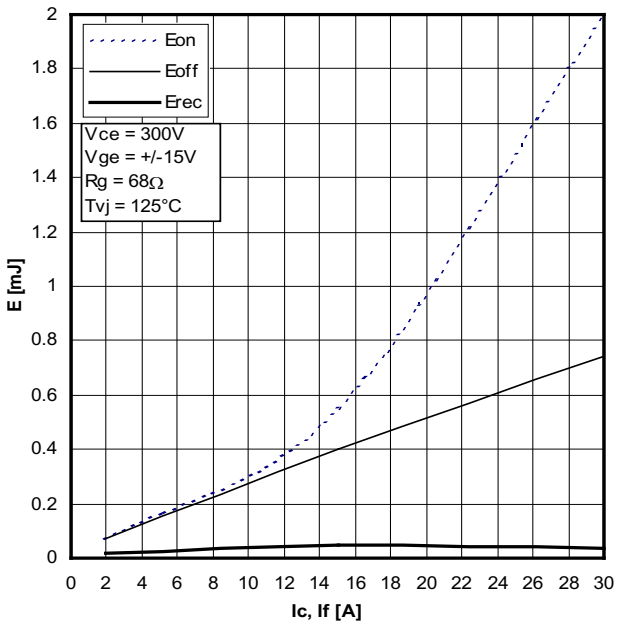
Typical transfer characteristics



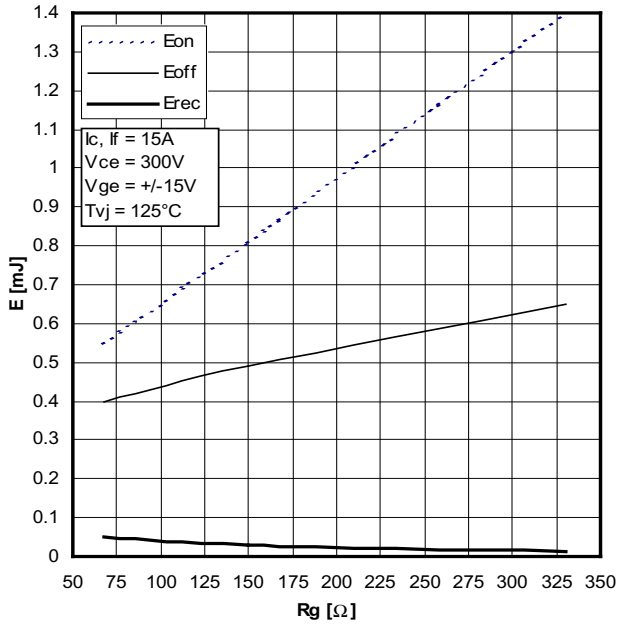
Typical forward characteristics of freewheeling diode



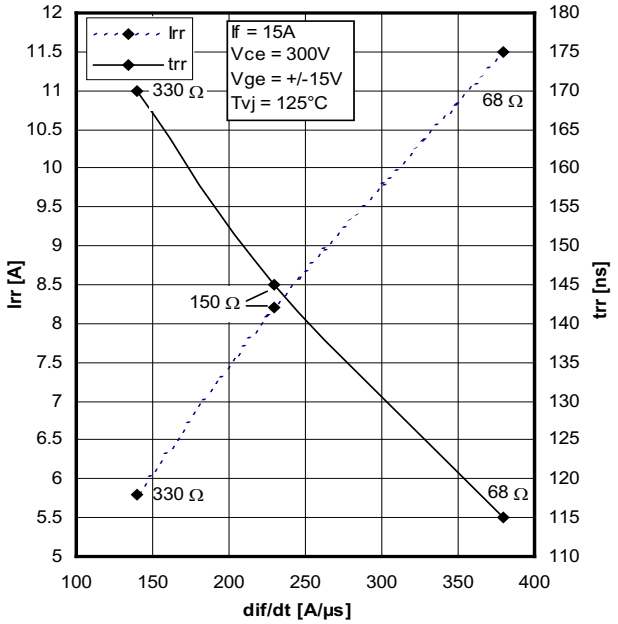
Typical turn on gate charge



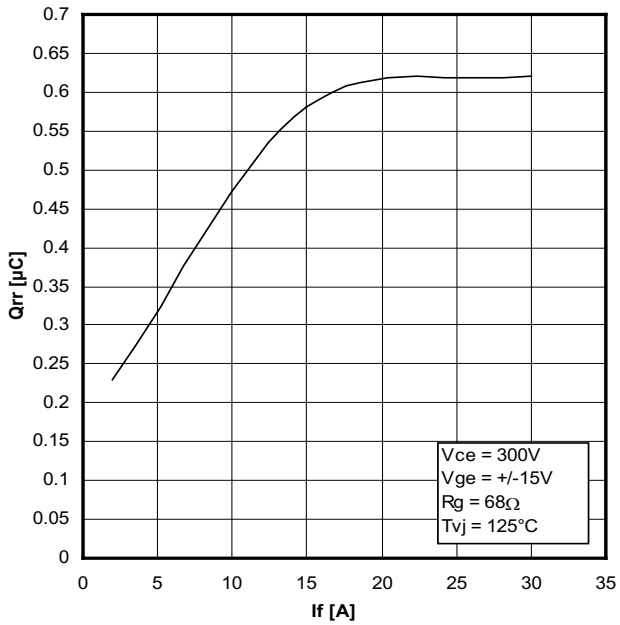
Typical switching energy versus collector current



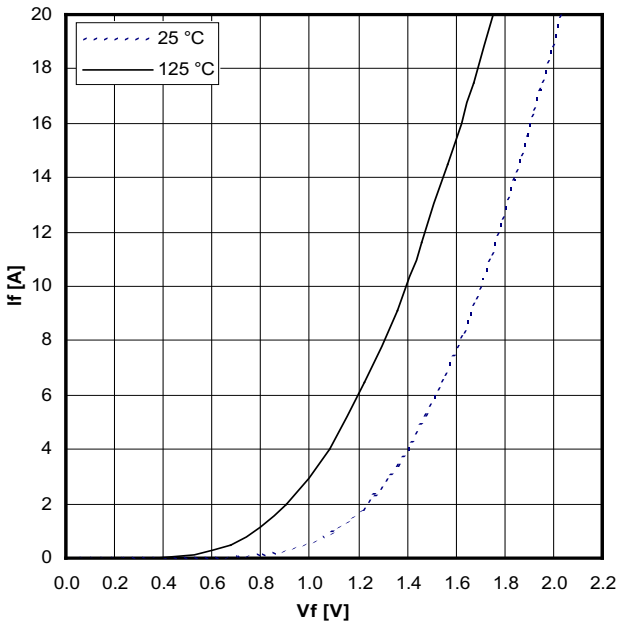
Typical switching energy versus gate resistance



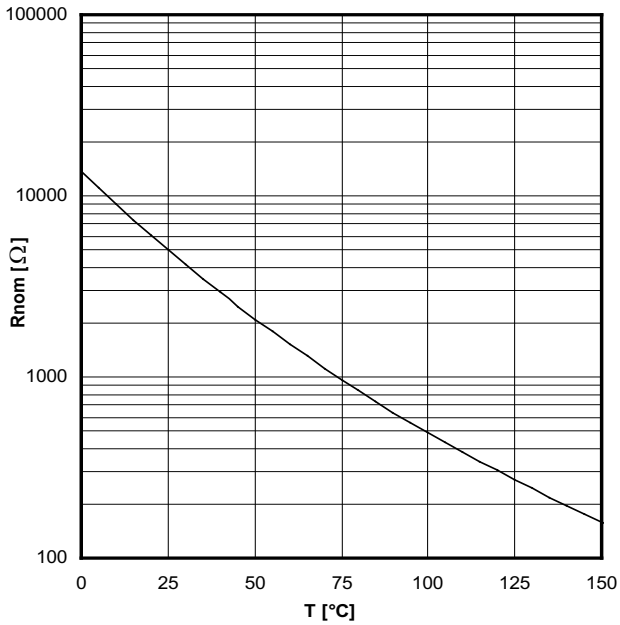
Typical turn-off characteristics of free wheeling diode



Typical turn-off characteristics of free wheeling diode



Typical forward characteristics of brake diode



Typical thermistor resistance versus temperature