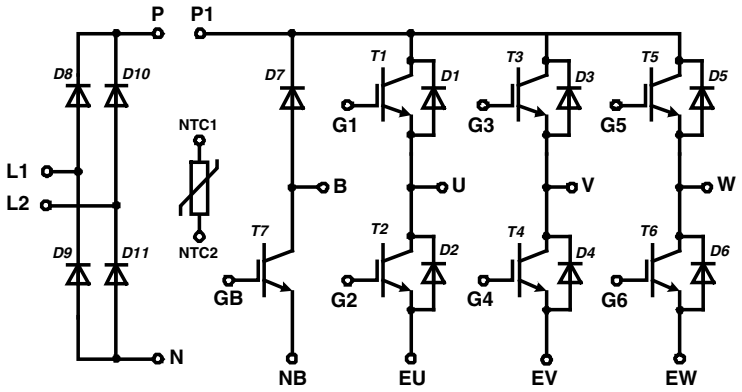
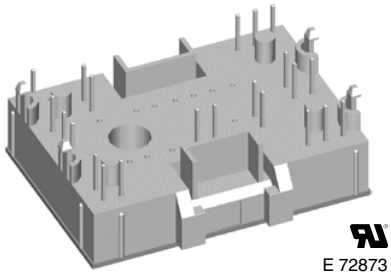
Converter - Brake - Inverter Module
NPT IGBT

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} = 29 A	I_{C25} = 29 A
I_{FSM} = 550 A	$V_{CE(sat)}$ = 2.1 V	$V_{CE(sat)}$ = 2.1 V

Part name (Marking on product)

MIAA20WE600TMH





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			29	A
I_{C80}			T_C = 80°C			20	A
P_{tot}	*total power dissipation*		T_C = 25°C			100	W
$V_{CE(sat)}$	*collector emitter saturation voltage*	I_C = 20 A; V_{GE} = 15 V	T_{VJ} = 25°C		2.1	2.7	V
			T_{VJ} = 125°C		2.4		V
$V_{GE(th)}$	*gate emitter threshold voltage*	I_C = 0.5 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			1.1	mA
			T_{VJ} = 125°C		1.3		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			900		pF
$Q_{G(on)}$	*total gate charge*	V_{CE} = 300 V; V_{GE} = 15 V; I_C = 20 A			76		nC
$t_{d(on)}$	*turn-on delay time*	inductive load V_{CE} = 300 V; I_C = 20 A V_{GE} = ±15 V; R_G = 47 Ω	T_{VJ} = 25°C		35		ns
t_r	*current rise time*				45		ns
$t_{d(off)}$	*turn-off delay time*				155		ns
t_f	*current fall time*				75		ns
E_{on}	*turn-on energy per pulse*				0.39		mJ
E_{off}	*turn-off energy per pulse*				0.4		mJ
$t_{d(on)}$	*turn-on delay time*	inductive load V_{CE} = 300 V; I_C = 20 A V_{GE} = ±15 V; R_G = 47 Ω	T_{VJ} = 125°C		35		ns
t_r	*current rise time*				45		ns
$t_{d(off)}$	*turn-off delay time*				165		ns
t_f	*current fall time*				150		ns
E_{on}	*turn-on energy per pulse*				0.6		mJ
E_{off}	*turn-off energy per pulse*				0.54		mJ
RBSOA	*reverse bias safe operating area*	V_{GE} = ±15 V; R_G = 47 Ω; I_C = 40 A	T_{VJ} = 125°C	$V_{CEK} \le V_{CES}$-$L_S \cdot di/dt$			V
I_{SC} (SCSOA)	*short circuit safe operating area*	V_{CE} = 360 V; V_{GE} = ±15 V; R_G = 47 Ω; t_p = 10 µs; non-repetitive	T_{VJ} = 125°C		90		A
R_{thJC}	*thermal resistance junction to case*	(per IGBT)				1.3	K/W
R_{thCH}	*thermal resistance case to heatsink*				0.45		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 = 20 A; V_{GE} = 0 V	T_{VJ} = 25°C		1.95	2.2	V
			T_{VJ} = 125°C		1.65		V
Q_{rr}	*reverse recovery charge*	V_R = 300 V di_F/dt = -370 A/µs I_F = 20 A; V_{GE} = 0 V	T_{VJ} = 125°C		0.58		µC
I_{RM}	*max. reverse recovery current*				10.7		A
t_{rr}	*reverse recovery time*				110		ns
E_{rec}	*reverse recovery energy*				60		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

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

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Brake T7

Symbol	Definitions	Conditions		min.	Ratings 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			29	A
I_{C80}			T_C = 80°C			20	A
P_{tot}	*total power dissipation*		T_C = 25°C			100	W
$V_{CE(sat)}$	*collector emitter saturation voltage*	I_C = 20 A; V_{GE} = 15 V	T_{VJ} = 25°C		2.1	2.7	V
			T_{VJ} = 125°C		2.4		V
$V_{GE(th)}$	*gate emitter threshold voltage*	I_C = 0.5 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			1.0	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			900		pF
$Q_{G(on)}$	*total gate charge*	V_{CE} = 300 V; V_{GE} = 15 V; I_C = 20 A			76		nC
$t_{d(on)}$	*turn-on delay time*	inductive load V_{CE} = 300 V; I_C = 20 A V_{GE} = ±15 V; R_G = 47 Ω	T_{VJ} = 25°C		35		ns
t_r	*current rise time*				45		ns
$t_{d(off)}$	*turn-off delay time*				155		ns
t_f	*current fall time*				75		ns
E_{on}	*turn-on energy per pulse*				0.39		mJ
E_{off}	*turn-off energy per pulse*				0.4		mJ
$t_{d(on)}$	*turn-on delay time*	inductive load V_{CE} = 300 V; I_C = 20 A V_{GE} = ±15 V; R_G = 47 Ω	T_{VJ} = 125°C		35		ns
t_r	*current rise time*				45		ns
$t_{d(off)}$	*turn-off delay time*				165		ns
t_f	*current fall time*				150		ns
E_{on}	*turn-on energy per pulse*				0.6		mJ
E_{off}	*turn-off energy per pulse*				0.54		mJ
RBSOA	*reverse bias safe operating area*	V_{GE} = ±15 V; R_G = 47 Ω; I_C = 40 A	T_{VJ} = 125°C		$V_{CEK} \le V_{CES}$-$L_S \cdot di/dt$		V
I_{SC} (SCSOA)	*short circuit safe operating area*	V_{CE} = 360 V; V_{GE} = ±15 V; R_G = 47 Ω; t_p = 10 µs; non-repetitive	T_{VJ} = 125°C		90		A
R_{thJC}	*thermal resistance junction to case*	(per IGBT)				1.3	K/W
R_{thCH}	*thermal resistance case to heatsink*				0.45		K/W

Brake Chopper D7

Symbol	Definitions	Conditions		min.	Ratings 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 = 20 A; V_{GE} = 0 V	T_{VJ} = 25°C		1.95	2.2	V
			T_{VJ} = 125°C		1.65		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 = -370 A/µs I_F = 20 A; V_{GE} = 0 V	T_{VJ} = 125°C		0.58		µC
I_{RM}	*max. reverse recovery current*				10.7		A
t_{rr}	*reverse recovery time*				110		ns
E_{rec}	*reverse recovery energy*				60		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

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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			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	*I²t 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

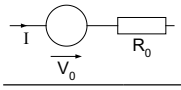
Temperature Sensor NTC

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		1.1		V
R_0					40		mΩ
V_0	*free wheeling diode*	D1 - D6	T_{VJ} = 125°C		1.25		V
R_0					12		mΩ
V_0	*IGBT*	T7	T_{VJ} = 125°C		1.1		V
R_0					60		mΩ
V_0	*free wheeling diode*	D7	T_{VJ} = 125°C		1.25		V
R_0					25		mΩ

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T_C = 25°C unless otherwise stated

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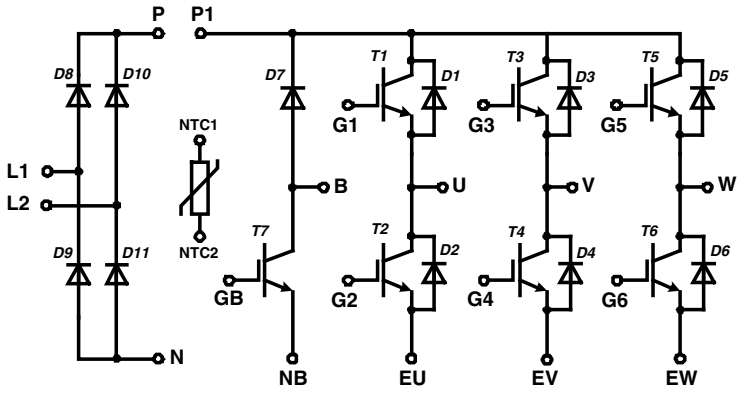
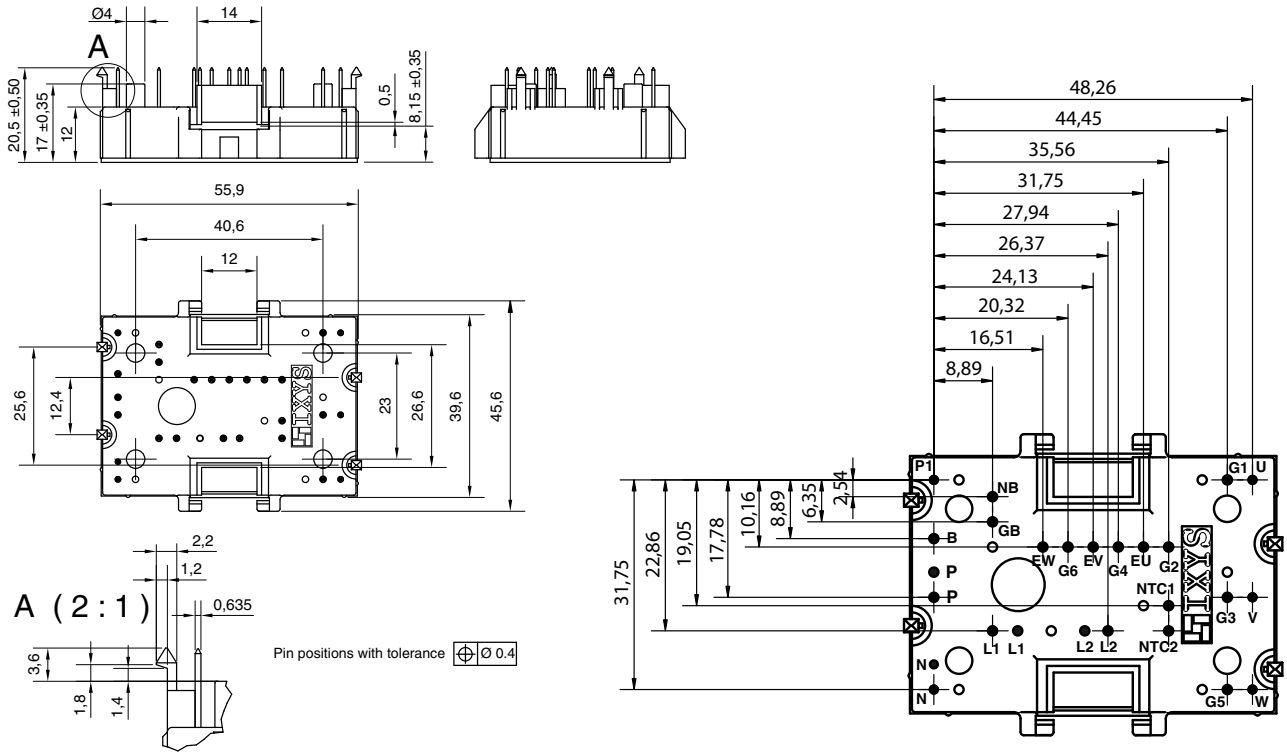
Circuit Diagram

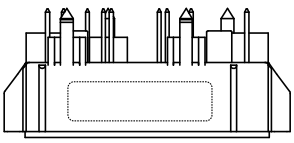


Outline Drawing

Dimensions in mm (1 mm = 0.0394“)



Product Marking



Part number

M = Module
I = IGBT
A = IGBT (NPT)
A = Gen 1 / std
20 = 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 20 WE 600 TMH	MIAA20WE600TMH	Box	20	504708

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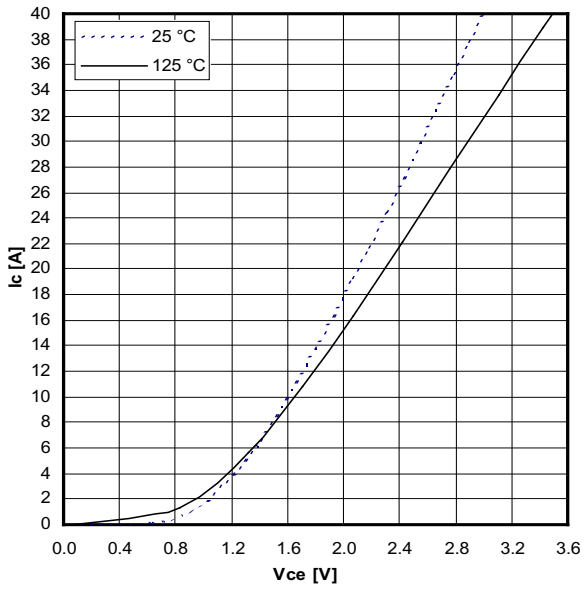
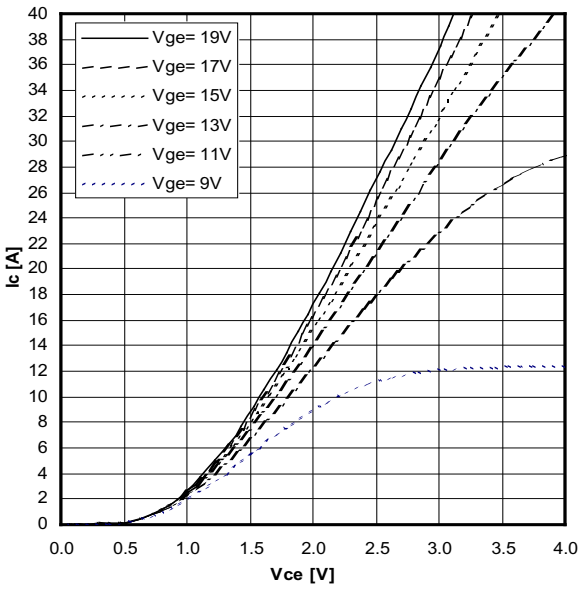
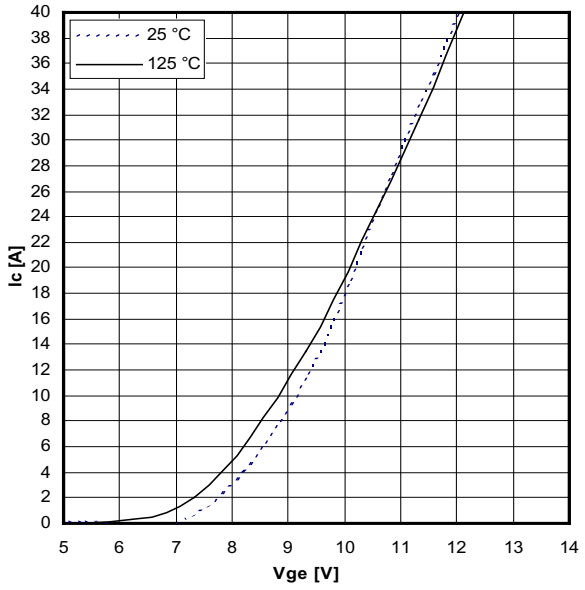


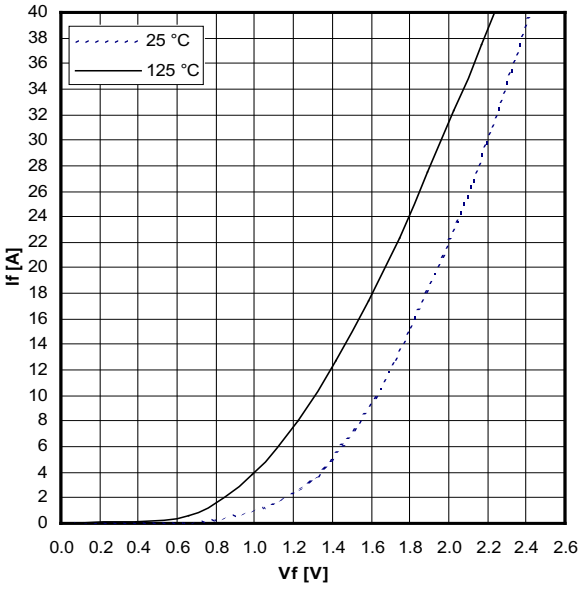
Typical output characteristics, V_{GE} = 15 V



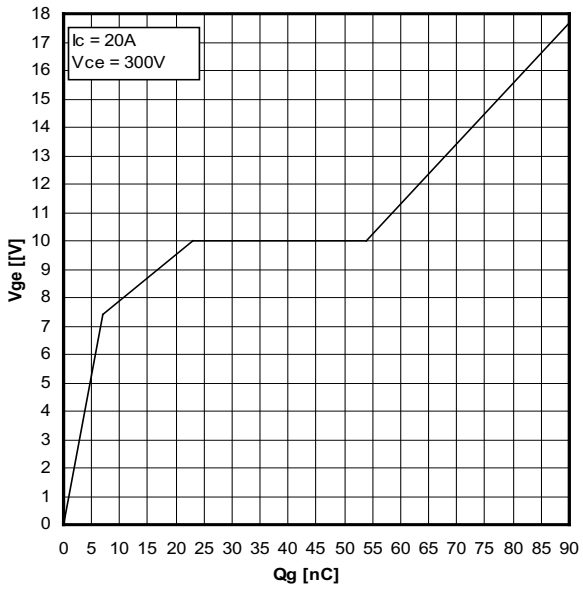
Typical output characteristics (125°C)



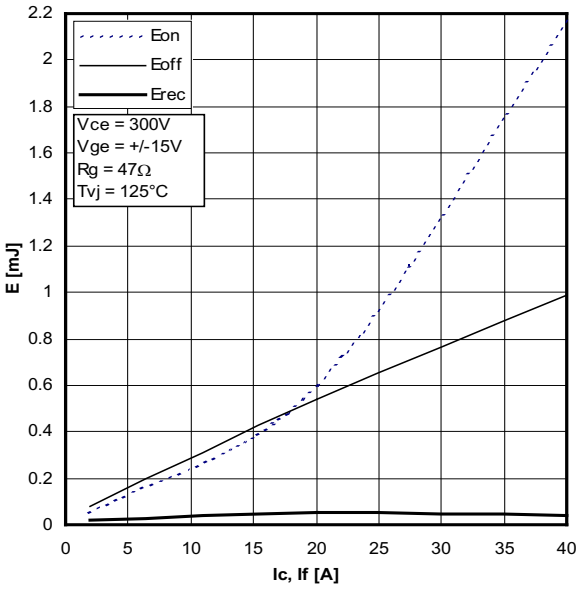
Typical transfer characteristics



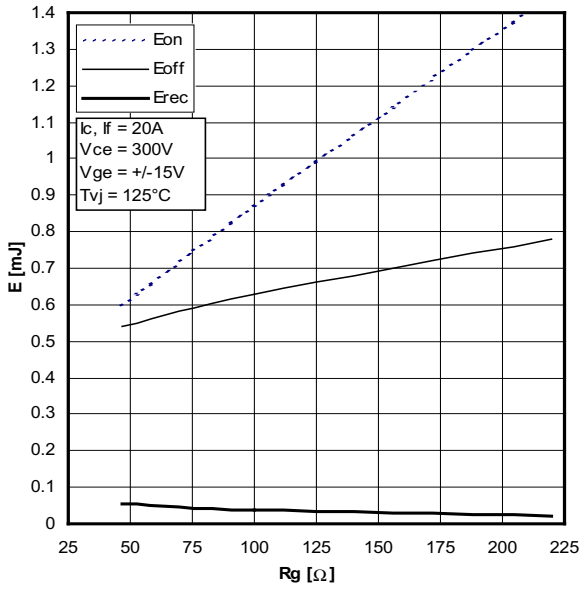
Typical forward characteristics of freewheeling diode



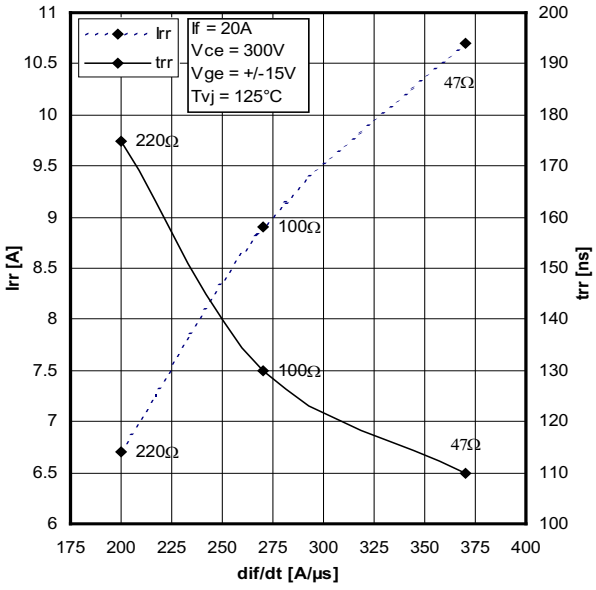
Typical turn on gate charge



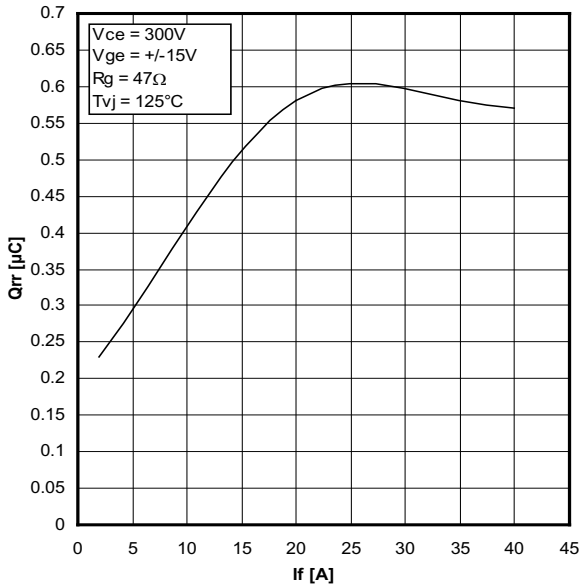
Typical switching energy versus collector current



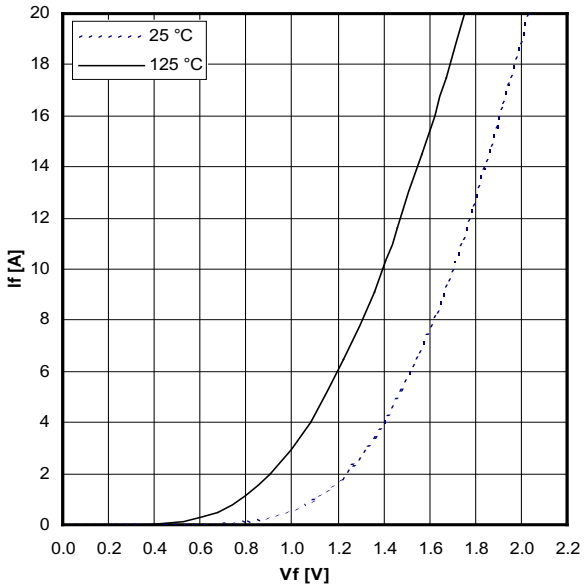
Typical switching energy versus gate resistance



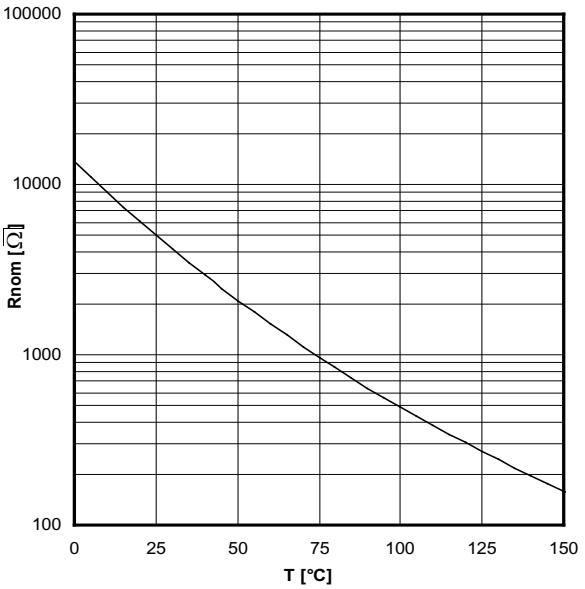
Typical turn-off characteristics of free wheeling diode



Typical turn-off characteristics of free wheeling diode



Typical forward characteristics of brake diode



Typical thermistor resistance versus temperature