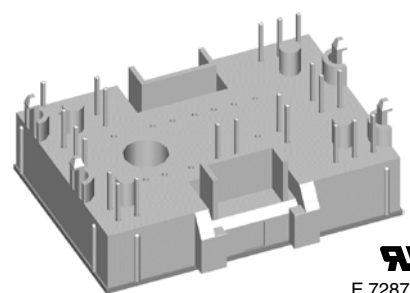
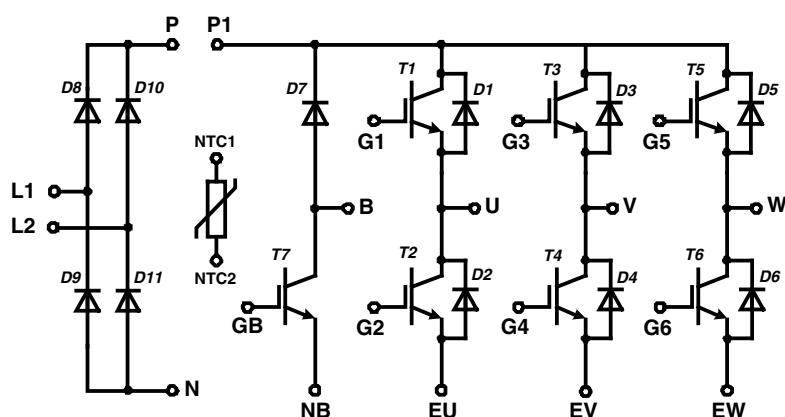


Converter - Brake - Inverter Module NPT IGBT

Single Phase Rectifier	Brake Chopper	Three Phase Inverter
$V_{RRM} = 1600 \text{ V}$	$V_{CES} = 600 \text{ V}$	$V_{CES} = 600 \text{ V}$
$I_{DAVM25} = 65 \text{ A}$	$I_{C25} = 29 \text{ A}$	$I_{C25} = 29 \text{ A}$
$I_{FSM} = 550 \text{ A}$	$V_{CE(sat)} = 2.1 \text{ V}$	$V_{CE(sat)} = 2.1 \text{ V}$

Part name (Marking on product)

MIAA20WE600TMH



UL
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

Output Inverter T1 - T6

Symbol	Definitions	Conditions	min.	Ratings			Unit
				typ.	max.		
V_{CES}	collector emitter voltage	$T_{VJ} = 150^{\circ}\text{C}$			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	$T_C = 25^{\circ}\text{C}$			29		A
I_{C80}		$T_C = 80^{\circ}\text{C}$			20		A
P_{tot}	total power dissipation	$T_C = 25^{\circ}\text{C}$			100		W
$V_{CE(sat)}$	collector emitter saturation voltage	$I_C = 20\text{ A}; V_{GE} = 15\text{ V}$		$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	2.1 2.4	2.7	V V
$V_{GE(th)}$	gate emitter threshold voltage	$I_C = 0.5\text{ A}; V_{GE} = V_{CE}$	$T_{VJ} = 25^{\circ}\text{C}$	4.5	5.5	6.5	V
I_{CES}	collector emitter leakage current	$V_{CE} = V_{CES}; V_{GE} = 0\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		1.3	1.1	mA mA
I_{GES}	gate emitter leakage current	$V_{GE} = \pm 20\text{ V}$			150		nA
C_{ies}	input capacitance	$V_{CE} = 25\text{ V}; V_{GE} = 0\text{ V}; f = 1\text{ MHz}$		900			pF
$Q_{G(on)}$	total gate charge	$V_{CE} = 300\text{ V}; V_{GE} = 15\text{ V}; I_C = 20\text{ A}$		76			nC
$t_{d(on)}$	turn-on delay time	inductive load $V_{CE} = 300\text{ V}; I_C = 20\text{ A}$ $V_{GE} = \pm 15\text{ V}; R_G = 47\ \Omega$	$T_{VJ} = 25^{\circ}\text{C}$	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 $V_{CE} = 300\text{ V}; I_C = 20\text{ A}$ $V_{GE} = \pm 15\text{ V}; R_G = 47\ \Omega$	$T_{VJ} = 125^{\circ}\text{C}$	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	$V_{GE} = \pm 15\text{ V}; R_G = 47\ \Omega; I_C = 40\text{ A}$	$T_{VJ} = 125^{\circ}\text{C}$	$V_{CEK} \leq V_{CES} - L_S \cdot di/dt$			V
I_{SC} (SCSOA)	short circuit safe operating area	$V_{CE} = 360\text{ V}; V_{GE} = \pm 15\text{ V};$ $R_G = 47\ \Omega; t_p = 10\ \mu\text{s};$ non-repetitive	$T_{VJ} = 125^{\circ}\text{C}$	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	min.	Ratings			Unit
				typ.	max.		
V_{RRM}	max. repetitive reverse voltage	$T_{VJ} = 150^{\circ}\text{C}$			600		V
I_{F25}	forward current	$T_C = 25^{\circ}\text{C}$			37		A
I_{F80}		$T_C = 80^{\circ}\text{C}$			24		A
V_F	forward voltage	$I_F = 20\text{ A}; V_{GE} = 0\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	1.95 1.65	2.2		V V
Q_{rr}	reverse recovery charge	$V_R = 300\text{ V}$ $di_F/dt = -370\text{ A}/\mu\text{s}$ $I_F = 20\text{ A}; V_{GE} = 0\text{ V}$	$T_{VJ} = 125^{\circ}\text{C}$	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

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

Brake T7

				Ratings			
Symbol	Definitions	Conditions	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 T _{VJ} = 125°C	2.1 2.4	2.7	V 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 T _{VJ} = 125°C	0.8	1.0	mA 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} ≤ V _{CES} - L _S ·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

				Ratings		
Symbol	Definitions	Conditions	min.	typ.	max.	Unit
V_{RRM}	max. repetitive reverse voltage	$T_{VJ} = 150^{\circ}\text{C}$			600	V
I_{F25}	forward current	$T_C = 25^{\circ}\text{C}$			37	A
I_{F80}		$T_C = 80^{\circ}\text{C}$			24	A
V_F	forward voltage	$I_F = 20\text{ A}; V_{GE} = 0\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	1.95 1.65	2.2	V V
I_R	reverse current	$V_R = V_{RRM}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	0.4	0.1	mA mA
Q_{rr}	reverse recovery charge	$V_R = 300\text{ V}$ $di_F/dt = -370\text{ A}/\mu\text{s}$ $I_F = 20\text{ A}; V_{GE} = 0\text{ V}$	$T_{VJ} = 125^{\circ}\text{C}$	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

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

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

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Input Rectifier Bridge D8 - D11

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°	$T_C = 80^{\circ}\text{C}$		39		A
I_{DAVM}	max. average DC output current	rect.; $d = 1/2$	$T_C = 80^{\circ}\text{C}$		42		A
I_{FSM}	max. forward surge current	$t = 10 \text{ ms}$; sine 50 Hz	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		550 tbd		A A
I^2t	I^2t value for fusing	$t = 10 \text{ ms}$; sine 50 Hz	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		1270 tbd		A^2s A^2s
P_{tot}	total power dissipation		$T_C = 25^{\circ}\text{C}$		100		W
V_F	forward voltage	$I_F = 30 \text{ A}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	1.2 1.3	1.5		V V
I_R	reverse current	$V_R = V_{RRM}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	0.3	0.03		mA mA
R_{thJC}	thermal resistance junction to case	(per diode)		0.4	1.2		K/W
R_{thCH}	thermal resistance case to heatsink	(per diode)					K/W

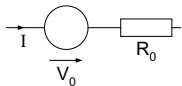
Temperature Sensor NTC

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			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



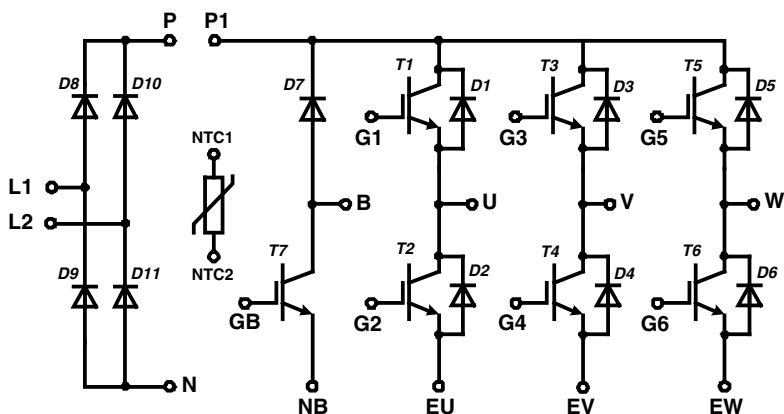
Symbol	Definitions	Conditions	min.	Ratings			Unit
				typ.	max.		
V_0 R_0	rectifier diode	D8 - D11	$T_{VJ} = 125^{\circ}\text{C}$	0.9 6			V m Ω
V_0 R_0	IGBT	T1 - T6	$T_{VJ} = 125^{\circ}\text{C}$	1.1 40			V m Ω
V_0 R_0	free wheeling diode	D1 - D6	$T_{VJ} = 125^{\circ}\text{C}$	1.25 12			V m Ω
V_0 R_0	IGBT	T7	$T_{VJ} = 125^{\circ}\text{C}$	1.1 60			V m Ω
V_0 R_0	free wheeling diode	D7	$T_{VJ} = 125^{\circ}\text{C}$	1.25 25			V m Ω

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

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

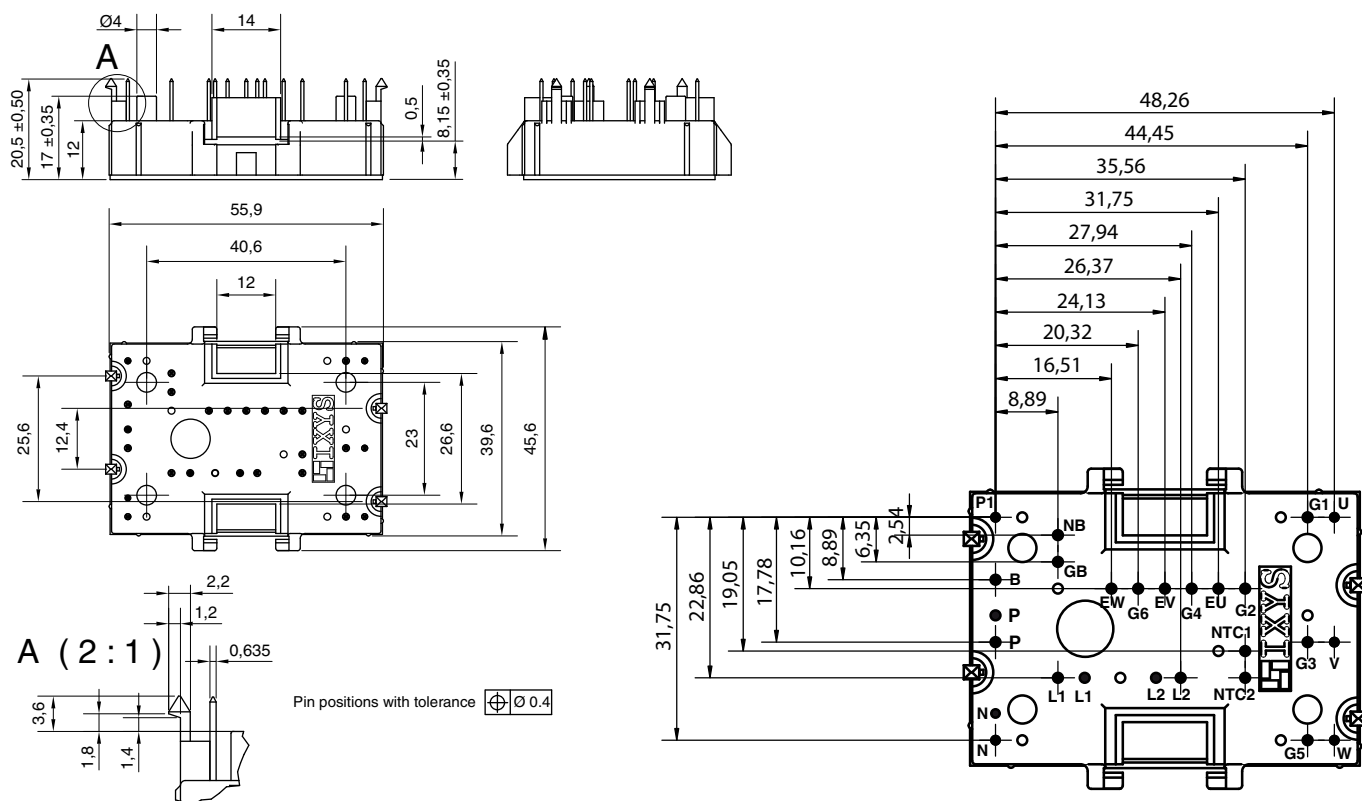
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Circuit Diagram

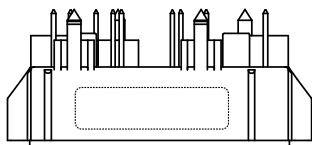


Outline Drawing

Dimensions in mm (1 mm = 0.0394")



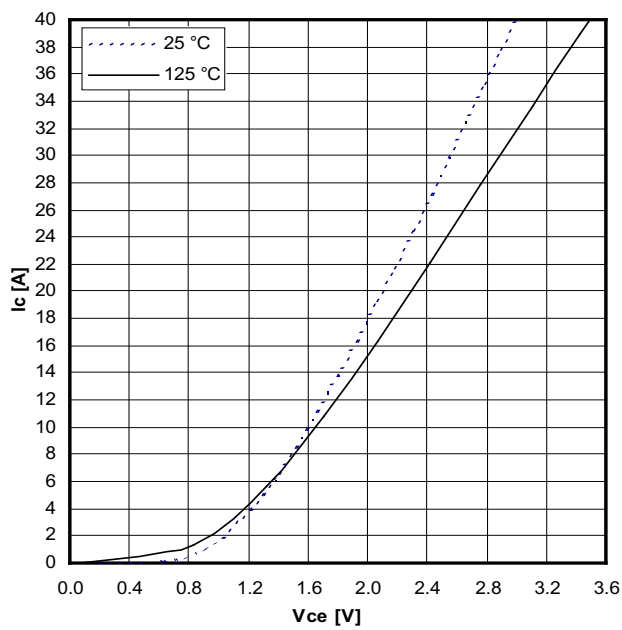
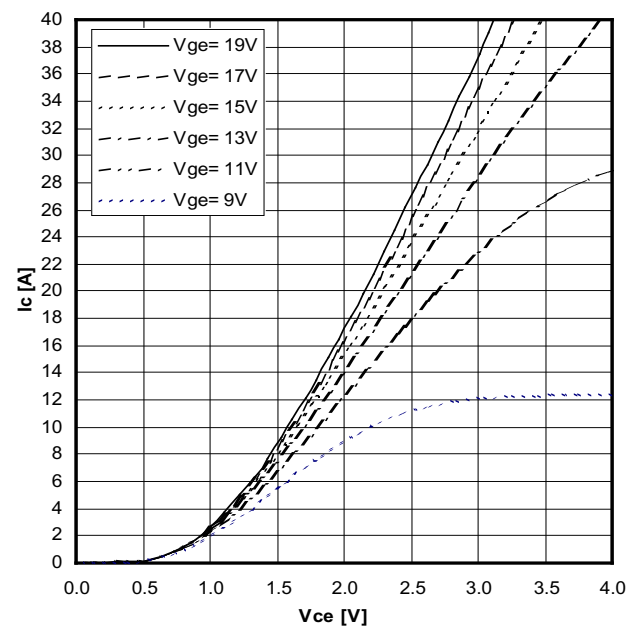
Product Marking



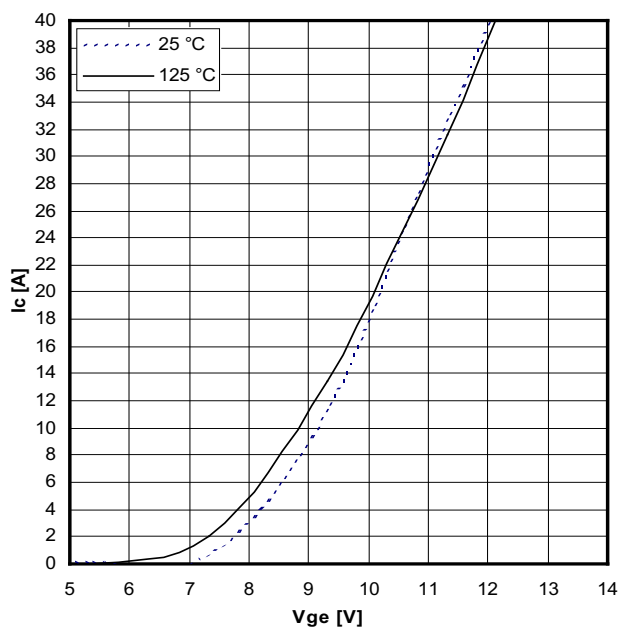
Part number

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

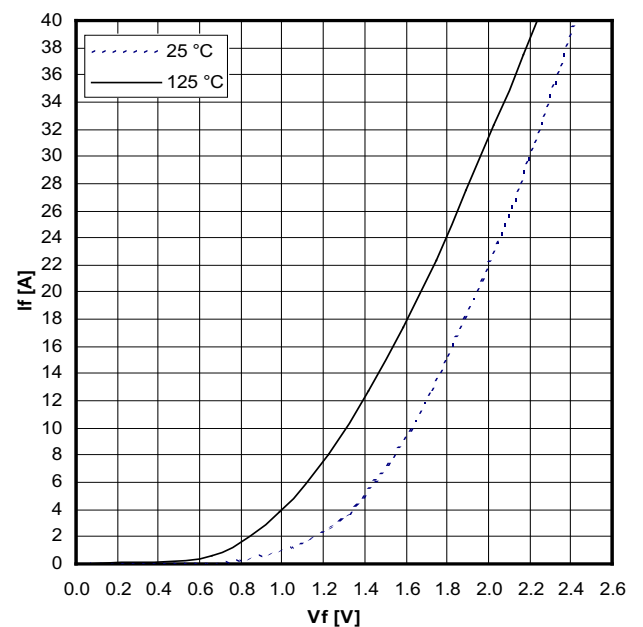
Ordering	Part Name	Marking on Product	Delivering Mode	Base Qty	Ordering Code
Standard	MIAA 20 WE 600 TMH	MIAA20WE600TMH	Box	20	504708


Typical output characteristics, $V_{GE} = 15 \text{ V}$


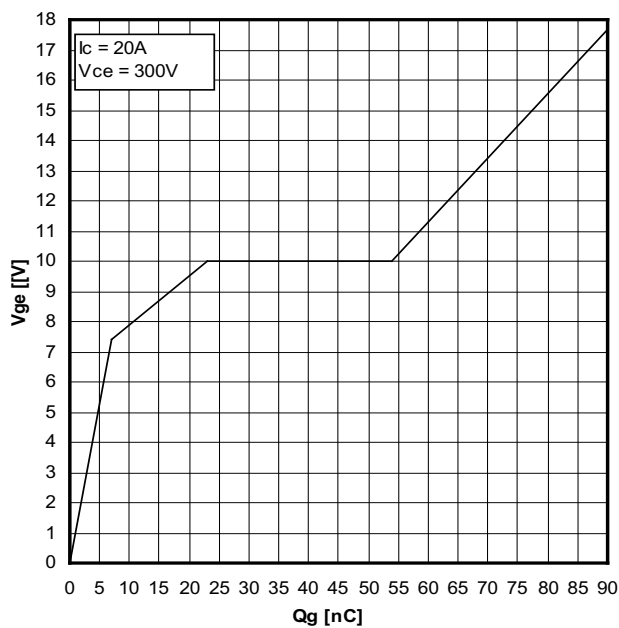
Typical output characteristics (125 °C)



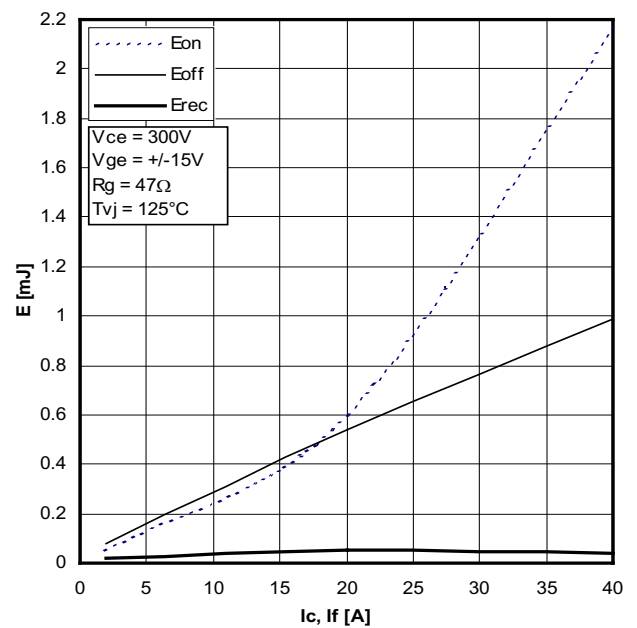
Typical transfer characteristics



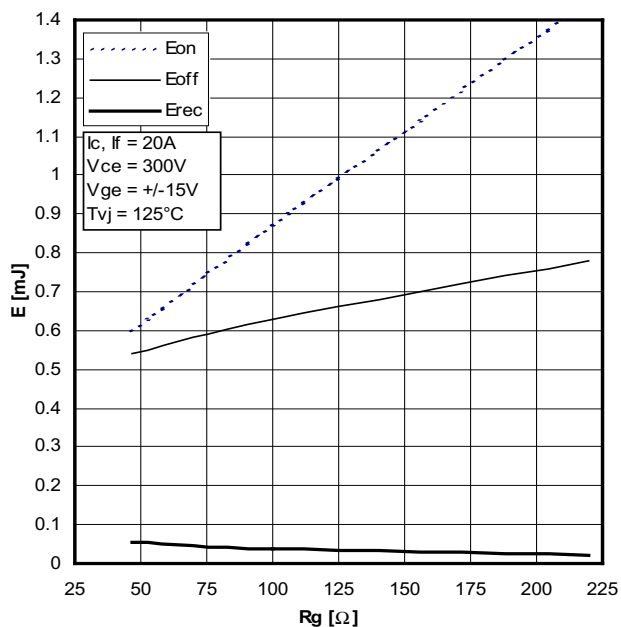
Typical forward characteristics of freewheeling diode



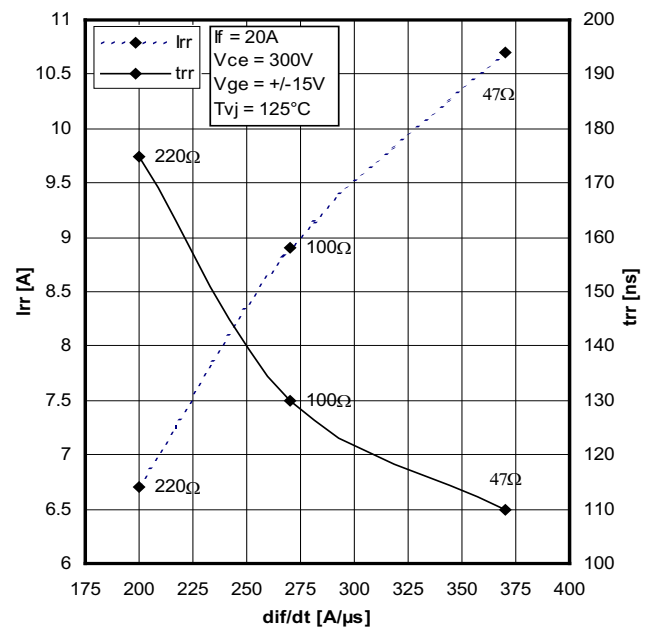
Typical turn on gate charge



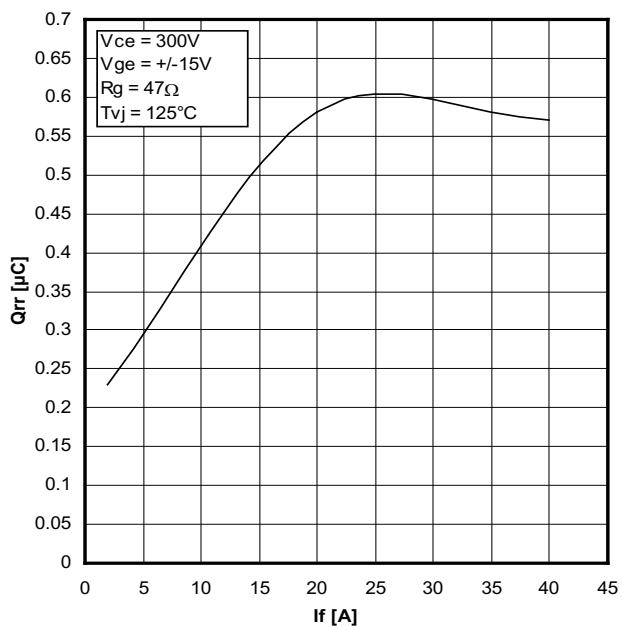
Typical switching energy versus collector current



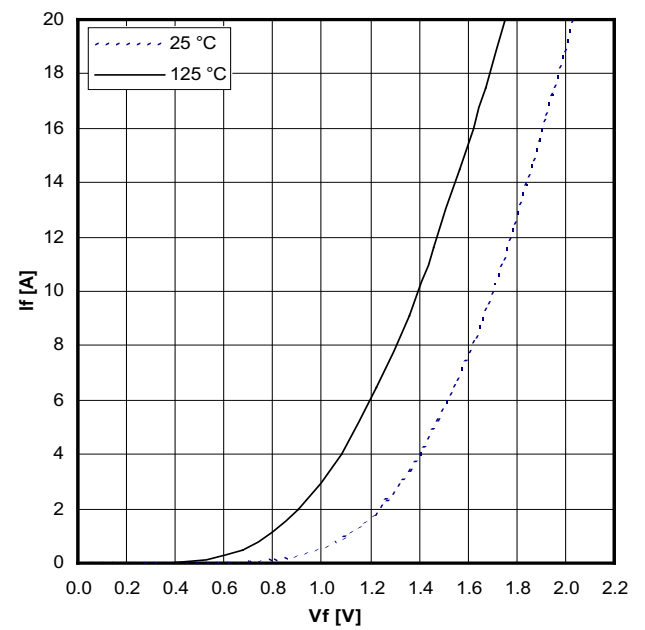
Typical switching energy versus gate resistance



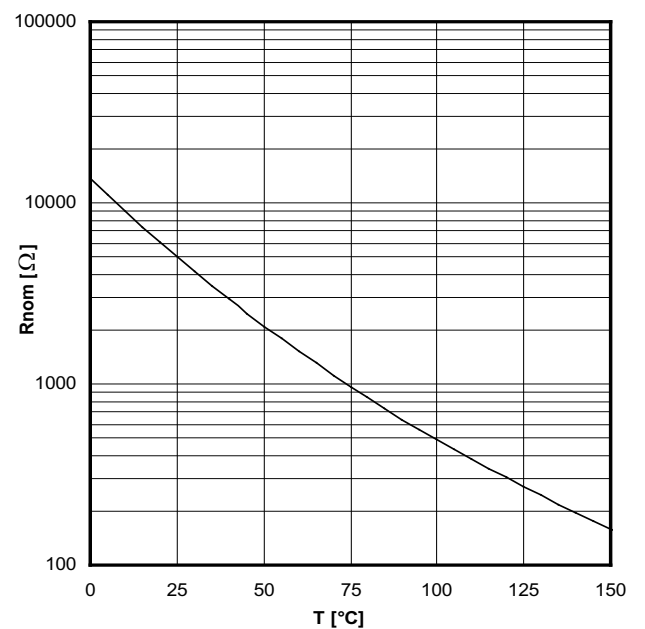
Typical turn-off characteristics of free wheeling diode



Typical turn-off characteristics of free wheeling diode



Typical forward characteristics of brake diode



Typical thermistor resistance versus temperature

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