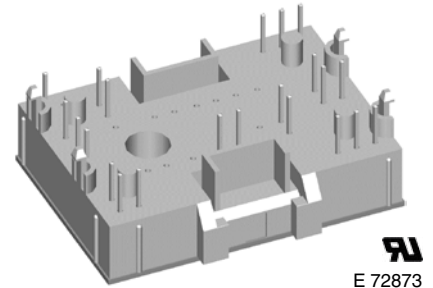
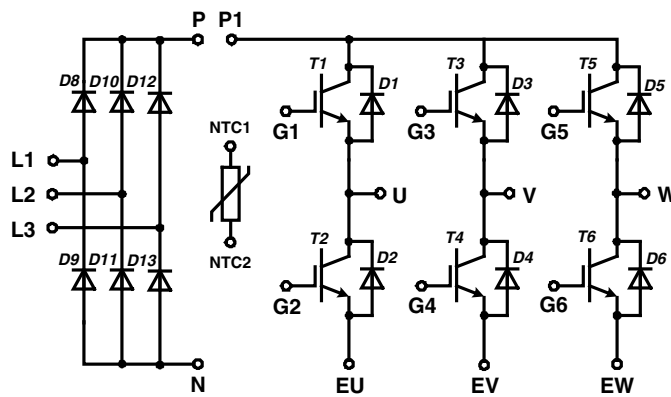


Converter - Brake - Inverter Module NPT IGBT

Single Phase Rectifier	Three Phase Inverter
$V_{RRM} = 1600 \text{ V}$	$V_{CES} = 600 \text{ V}$
$I_{DAVM25} = 90 \text{ A}$	$I_{C25} = 18 \text{ A}$
$I_{FSM} = 270 \text{ A}$	$V_{CE(sat)} = 2.1 \text{ V}$

Part name (Marking on product)

MIAA10WF600TMH



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
Ratings

Symbol	Definitions	Conditions	min.	typ.	max.	Unit
V_{CES}	collector emitter voltage				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				18	A
I_{C80}					13	A
P_{tot}	total power dissipation				70	W
$V_{CE(sat)}$	collector emitter saturation voltage	$I_C = 10\text{ A}; V_{GE} = 15\text{ V}$		2.1 2.3	2.6	V V
$V_{GE(th)}$	gate emitter threshold voltage	$I_C = 0.35\text{ A}; V_{GE} = V_{CE}$	4.5	5.5	6.5	V
I_{CES}	collector emitter leakage current	$V_{CE} = V_{CES}; V_{GE} = 0\text{ V}$		0.8	0.6	mA mA
I_{GES}	gate emitter leakage current	$V_{GE} = \pm 20\text{ V}$			150	nA
C_{ies}	input capacitance	$V_{CE} = 25\text{ V}; V_{GE} = 0\text{ V}; f = 1\text{ MHz}$		450		pF
$Q_{G(on)}$	total gate charge	$V_{CE} = 300\text{ V}; V_{GE} = 15\text{ V}; I_C = 10\text{ A}$		50		nC
$t_{d(on)}$ t_r $t_{d(off)}$ t_f E_{on} E_{off}	turn-on delay time current rise time turn-off delay time current fall time turn-on energy per pulse turn-off energy per pulse	inductive load $V_{CE} = 300\text{ V}; I_C = 10\text{ A}$ $V_{GE} = \pm 15\text{ V}; R_G = 82\ \Omega$	$T_{VJ} = 25^\circ\text{C}$	32		ns
				35		ns
				180		ns
				110		ns
				0.17		mJ
				0.2		mJ
$t_{d(on)}$ t_r $t_{d(off)}$ t_f E_{on} E_{off}	turn-on delay time current rise time turn-off delay time current fall time turn-on energy per pulse turn-off energy per pulse	inductive load $V_{CE} = 300\text{ V}; I_C = 10\text{ A}$ $V_{GE} = \pm 15\text{ V}; R_G = 82\ \Omega$	$T_{VJ} = 125^\circ\text{C}$	32		ns
				35		ns
				190		ns
				170		ns
				0.27		mJ
				0.42		mJ
RBSOA	reverse bias safe operating area	$V_{GE} = \pm 15\text{ V}; R_G = 82\ \Omega; I_C = 20\text{ A}$	$T_{VJ} = 125^\circ\text{C}$	$V_{CEK} \leq V_{CES} - L_S \cdot di/dt$		V
I_{SC} (SCSOA)	short circuit safe operating area	$V_{CE} = 360\text{ V}; V_{GE} = \pm 15\text{ V}; R_G = 82\ \Omega; t_p = 10\ \mu\text{s};$	$T_{VJ} = 125^\circ\text{C}$	40		A
R_{thJC} R_{thCH}	thermal resistance junction to case thermal resistance case to heatsink	(per IGBT)		0.6	1.8	K/W K/W

Output Inverter D1 - D6
Ratings

Symbol	Definitions	Conditions	min.	typ.	max.	Unit
V_{RRM}	max. repetitive reverse voltage				600	V
I_{F25}	forward current				22	A
I_{F80}					14	A
V_F	forward voltage	$I_F = 10\text{ A}; V_{GE} = 0\text{ V}$		1.7 1.4	2.2	V V
Q_{rr} I_{RM} t_{rr} E_{rec}	reverse recovery charge max. reverse recovery current reverse recovery time reverse recovery energy	$V_R = 300\text{ V}$ $di_F/dt = -300\text{ A}/\mu\text{s}$ $I_F = 10\text{ A}; V_{GE} = 0\text{ V}$	$T_{VJ} = 125^\circ\text{C}$	0.3		μC
				8.8		A
				95		ns
				22		μJ
R_{thJC} R_{thCH}	thermal resistance junction to case thermal resistance case to heatsink	(per diode)		0.85	2.5	K/W K/W

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

Input Rectifier Bridge D8 - D11

Symbol	Definitions	Conditions	Ratings			Unit
			min.	typ.	max.	
V_{RRM}	max. repetitive reverse voltage		$T_{VJ} = 25^{\circ}\text{C}$		1600	V
I_{FAV}	average forward current	sine 180°	$T_C = 80^{\circ}\text{C}$		22	A
I_{DAVM}	max. average DC output current	rect.; $d = 1/3$	$T_C = 80^{\circ}\text{C}$		62	A
I_{FSM}	max. forward surge current	$t = 10$ ms; sine 50 Hz	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		270 tbd	A A
I^2t	I^2t value for fusing	$t = 10$ ms; sine 50 Hz	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		365 tbd	A^2s A^2s
P_{tot}	total power dissipation		$T_C = 25^{\circ}\text{C}$		50	W
V_F	forward voltage	$I_F = 30$ A	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	1.35 1.35	1.6	V V
I_R	reverse current	$V_R = V_{RRM}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	0.3	0.01	mA 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

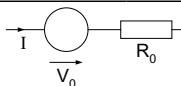
Temperature Sensor NTC

Symbol	Definitions	Conditions	Ratings			Unit	
			min.	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	Ratings			Unit
			min.	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	$I_{ISOL} \leq 1$ 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

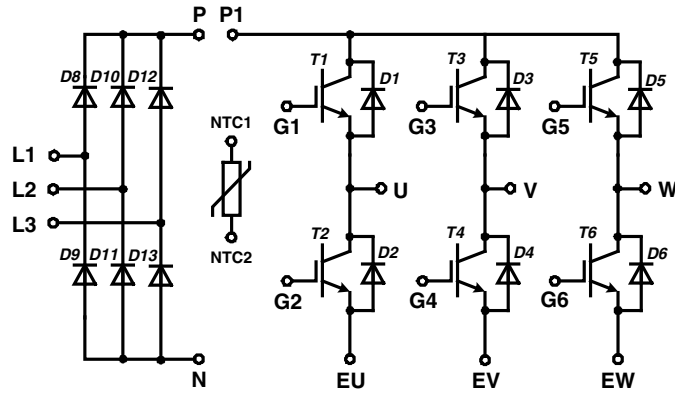
Equivalent Circuits for Simulation



Symbol	Definitions	Conditions	Ratings			Unit
			min.	typ.	max.	
V_0	rectifier diode	D8 - D11	$T_{VJ} = 125^{\circ}\text{C}$	0.9		V
R_0				16		$\text{m}\Omega$
V_0	IGBT	T1 - T6	$T_{VJ} = 125^{\circ}\text{C}$	1.0		V
R_0				125		$\text{m}\Omega$
V_0	free wheeling diode	D1 - D6	$T_{VJ} = 125^{\circ}\text{C}$	1.05		V
R_0				35		$\text{m}\Omega$

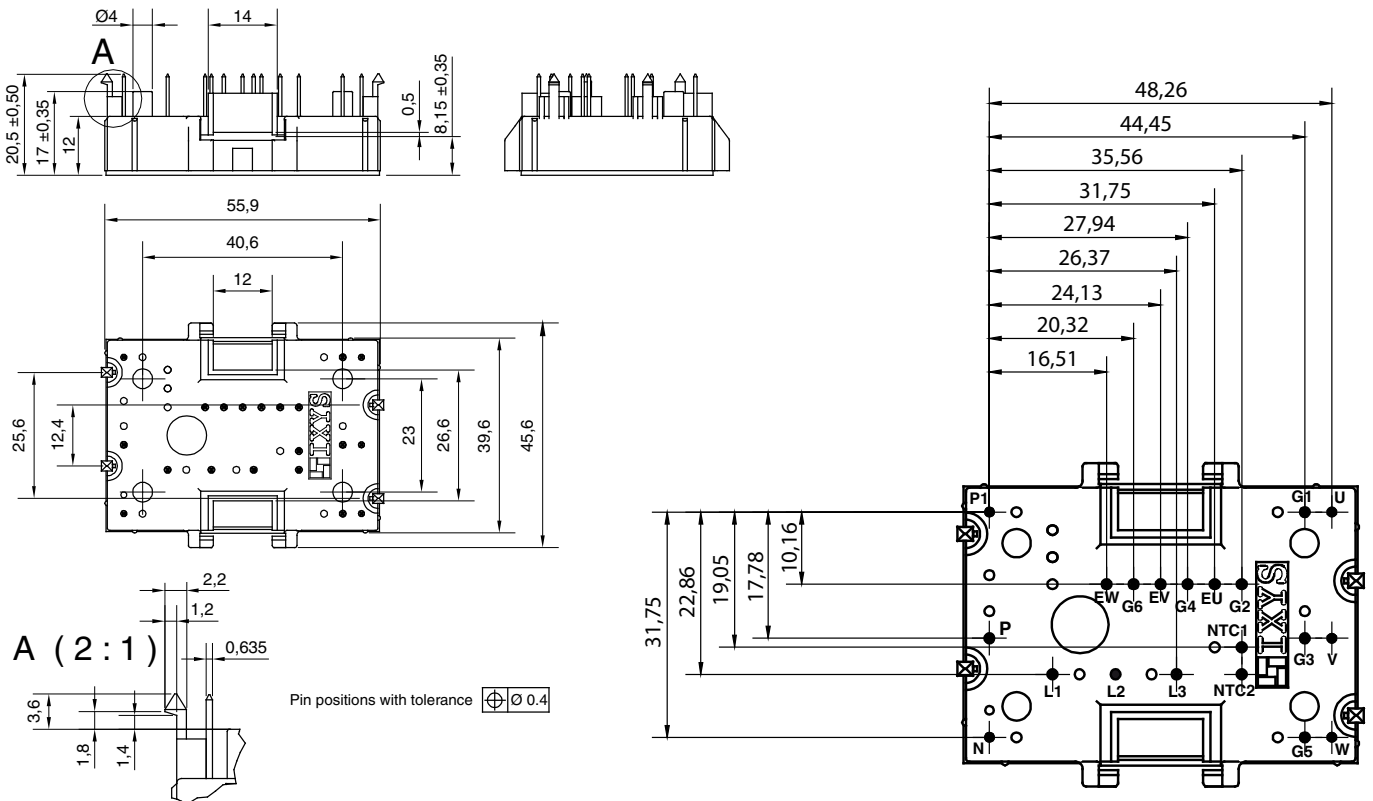
$T_C = 25^{\circ}\text{C}$ unless otherwise stated

Circuit Diagram

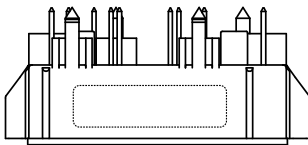


Outline Drawing

Dimensions in mm (1 mm = 0.0394")



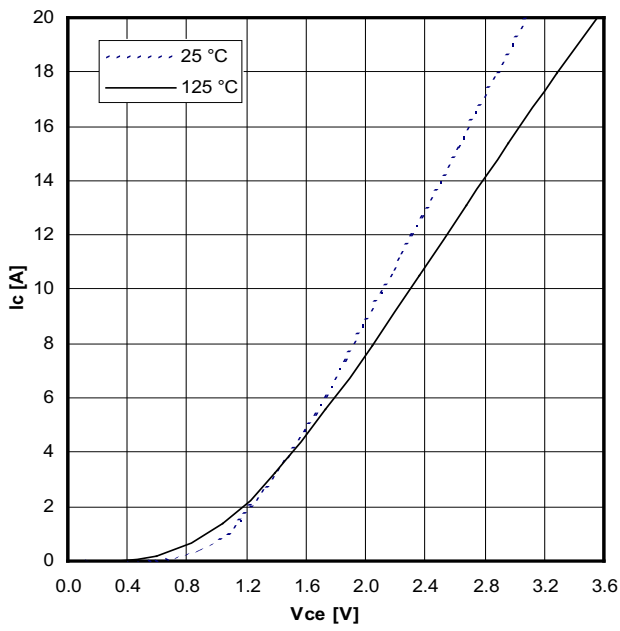
Product Marking



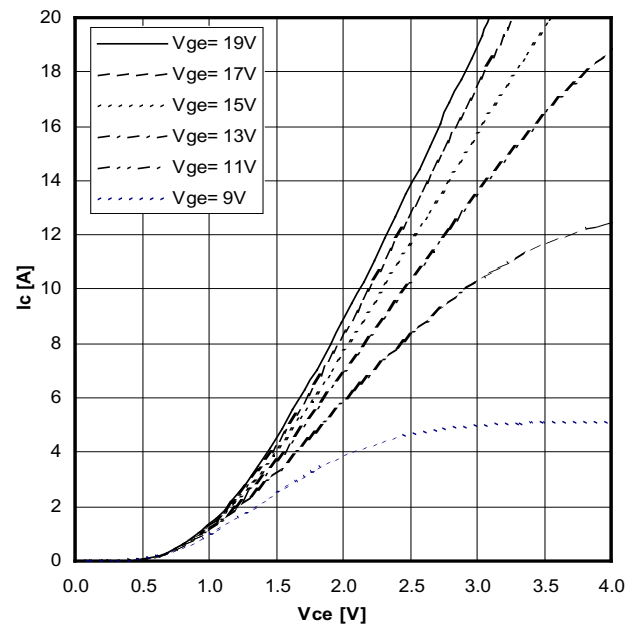
Part number

M = Module
 I = IGBT
 A = IGBT (NPT)
 A = Gen 1 / std
 10 = Current Rating [A]
 WF = 6-Pack + 3~ Rectifier Bridge
 600 = Reverse Voltage [V]
 T = NTC
 MH = MiniPack2

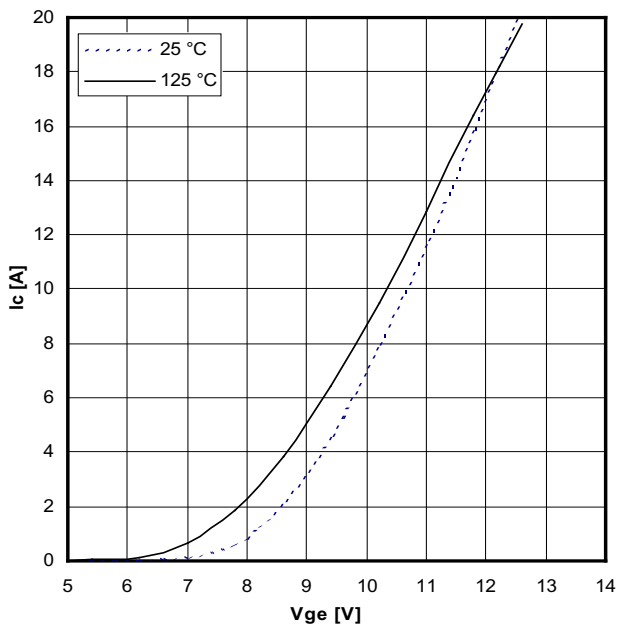
Ordering	Part Name	Marking on Product	Delivering Mode	Base Qty	Ordering Code
Standard	MIAA 10 WF 600 TMH	MIAA10WF600TMH	Box	20	504694



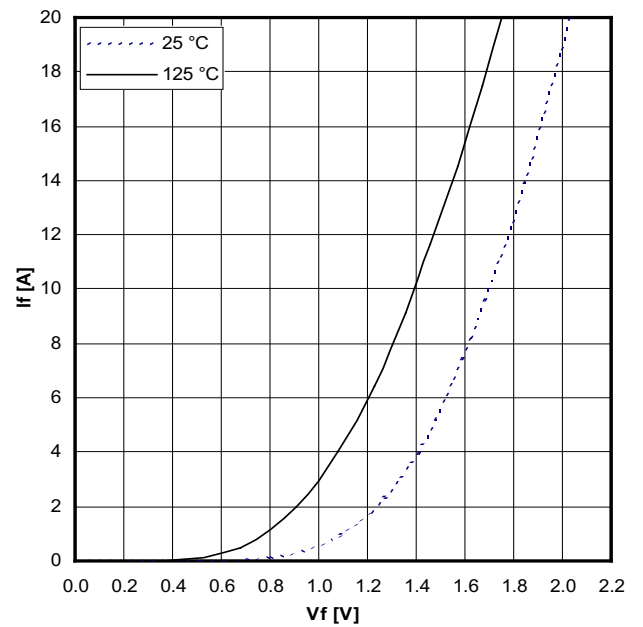
Typical output characteristics, $V_{GE} = 15\text{ V}$



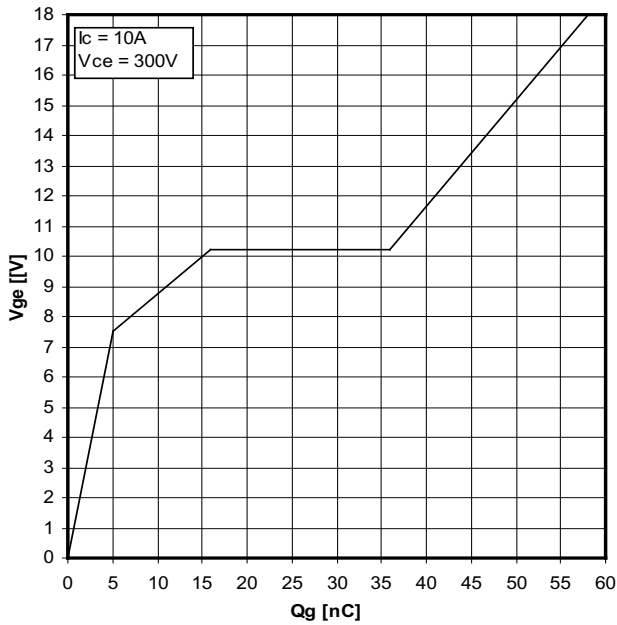
Typical output characteristics (125 °C)



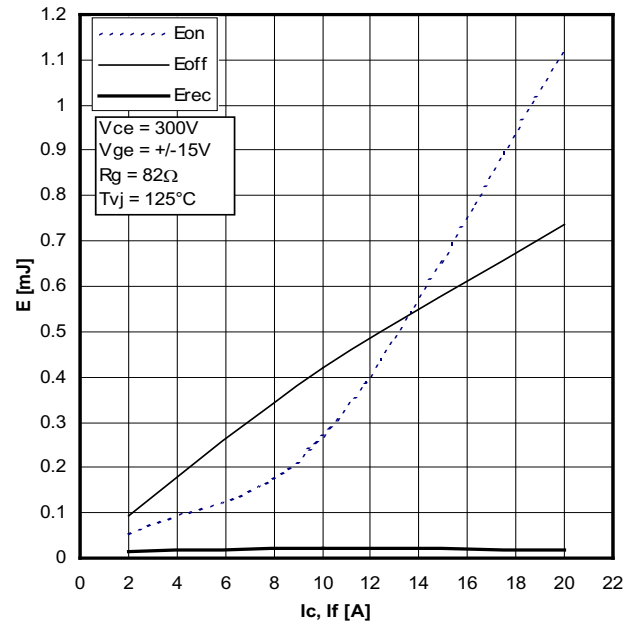
Typical transfer characteristics



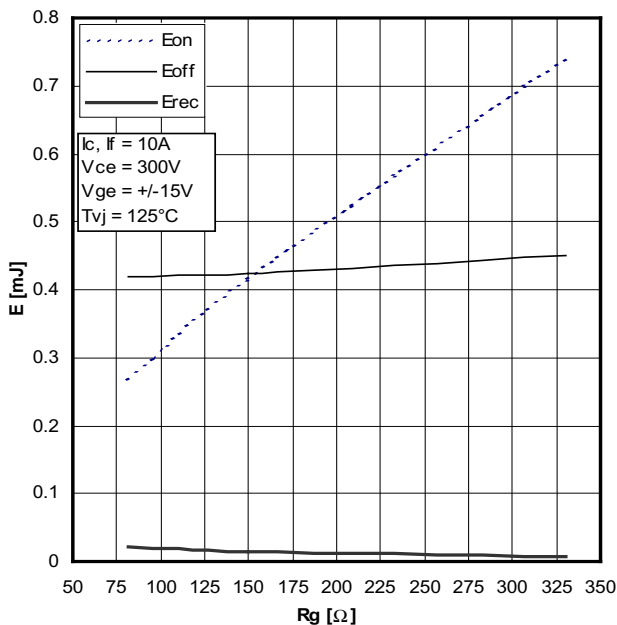
Typical forward characteristics of freewheeling diode



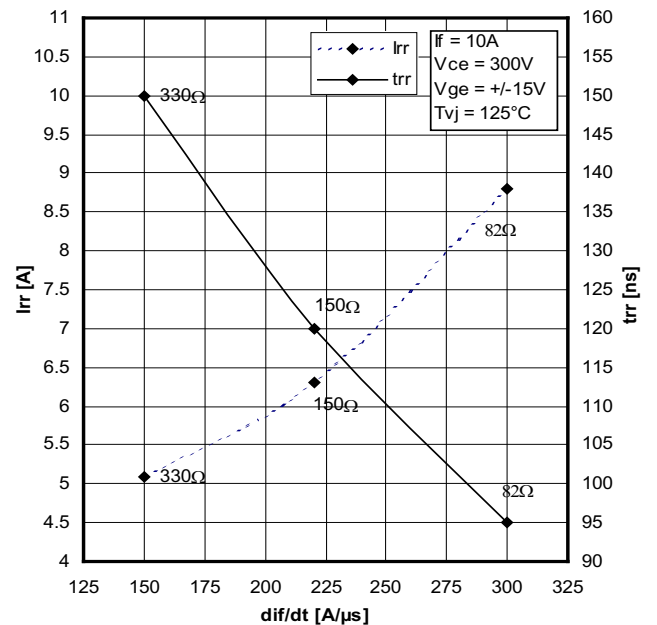
Typical turn on gate charge



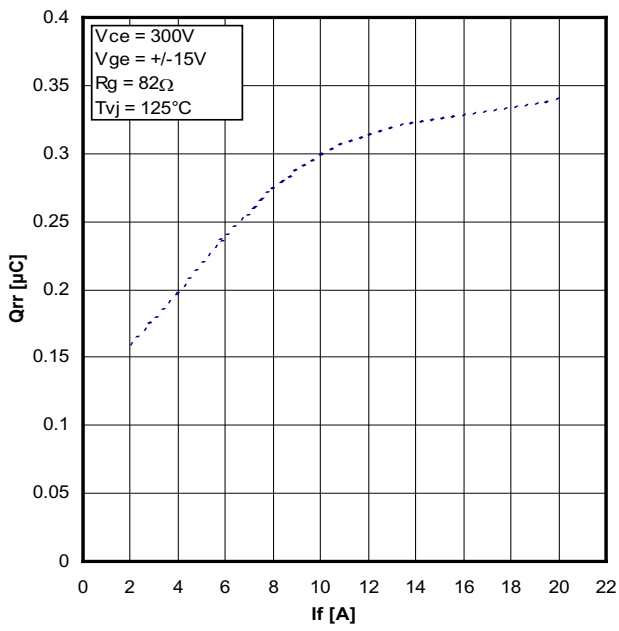
Typical switching energy versus collector current



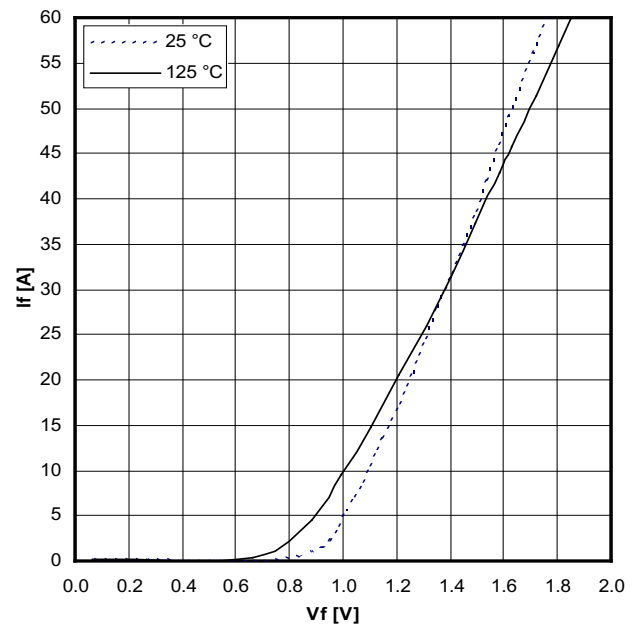
Typical switching energy versus gate resistance



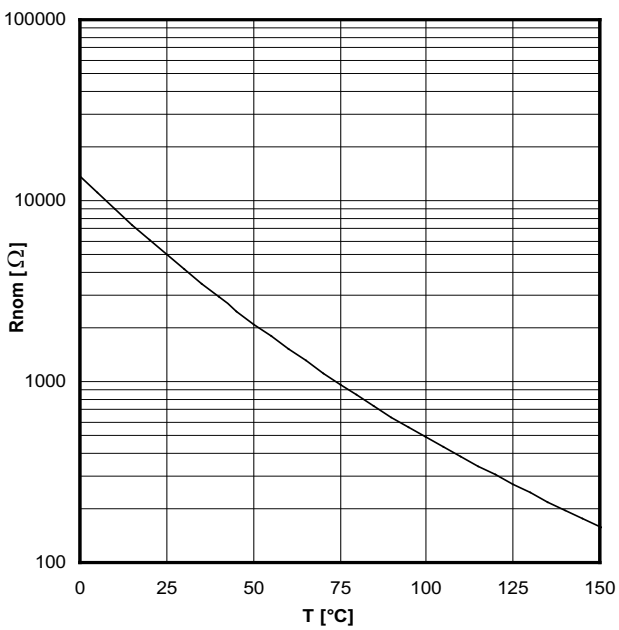
Typical turn-off characteristics of free wheeling diode



Typical turn-off characteristics of free wheeling diode



Typical forward characteristics per rectifier



Typical thermistor resistance versus temperature