

# Converter - Brake - Inverter Module

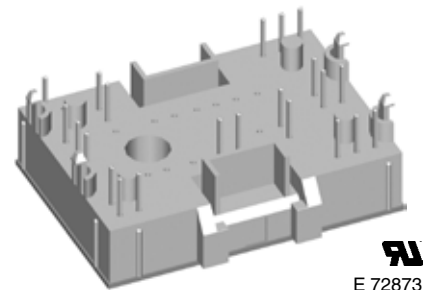
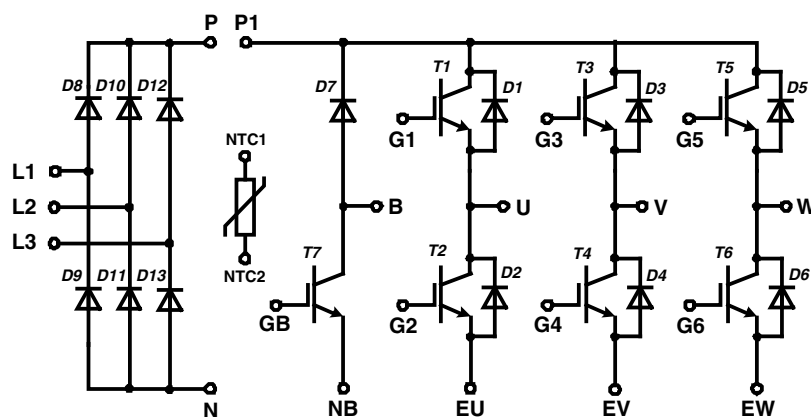
## XPT IGBT

Preliminary data

Three Phase Rectifier	Brake Chopper	Three Phase Inverter
$V_{RRM} = 1600 \text{ V}$	$V_{CES} = 1200 \text{ V}$	$V_{CES} = 1200 \text{ V}$
$I_{DAVM25} = 100 \text{ A}$	$I_{C25} = 17 \text{ A}$	$I_{C25} = 17 \text{ A}$
$I_{FSM} = 270 \text{ A}$	$V_{CE(sat)} = 1.8 \text{ V}$	$V_{CE(sat)} = 1.8 \text{ V}$

**Part name** (Marking on product)

MIXA10WB1200TMH



E 72873

Pin configuration see outlines.

### Features:

- High level of integration - only one power semiconductor module required for the whole drive
- Rugged XPT design (Xtreme light Punch Through) results in:
  - short circuit rated for 10  $\mu\text{sec}$ .
  - very low gate charge
  - square RBSOA @  $3 \times I_c$
  - low EMI
- Thin wafer technology combined with the XPT design results in a competitive low  $V_{CE(sat)}$
- Temperature sense included
- SONIC™ diode
  - fast and soft reverse recovery
  - low operating forward voltage

### 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	Ratings			Unit	
			min.	typ.	max.		
$V_{CES}$	collector emitter voltage		$T_{VJ} = 25^{\circ}\text{C}$		1200	V	
$V_{GES}$	max. DC gate voltage	continuous			$\pm 20$	V	
$V_{GEM}$	max. transient collector gate voltage	transient			$\pm 30$	V	
$I_{C25}$	collector current		$T_C = 25^{\circ}\text{C}$		17	A	
$I_{C80}$			$T_C = 80^{\circ}\text{C}$		12	A	
$P_{tot}$	total power dissipation		$T_C = 25^{\circ}\text{C}$		63	W	
$V_{CE(sat)}$	collector emitter saturation voltage	$I_C = 9\text{ A}; V_{GE} = 15\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	1.8 2.1	2.1	V V	
$V_{GE(th)}$	gate emitter threshold voltage	$I_C = 0.3\text{ mA}; V_{GE} = V_{CE}$	$T_{VJ} = 25^{\circ}\text{C}$	5	5.5	6.5	V
$I_{CES}$	collector emitter leakage current	$V_{CE} = V_{CES}; V_{GE} = 0\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	0.02 0.2	0.1	mA mA	
$I_{GES}$	gate emitter leakage current	$V_{GE} = \pm 20\text{ V}$			500	nA	
$Q_{G(on)}$	total gate charge	$V_{CE} = 600\text{ V}; V_{GE} = 15\text{ V}; I_C = 10\text{ A}$			27	nC	
$t_{d(on)}$	turn-on delay time	inductive load $V_{CE} = 600\text{ V}; I_C = 10\text{ A}$ $V_{GE} = \pm 15\text{ V}; R_G = 100\ \Omega$	$T_{VJ} = 125^{\circ}\text{C}$		70	ns	
$t_r$	current rise time				40	ns	
$t_{d(off)}$	turn-off delay time				250	ns	
$t_f$	current fall time				100	ns	
$E_{on}$	turn-on energy per pulse				1.1	mJ	
$E_{off}$	turn-off energy per pulse				1.1	mJ	
<b>RBSOA</b>	reverse bias safe operating area	$V_{GE} = \pm 15\text{ V}; R_G = 100\ \Omega; V_{CEK} = 1200\text{ V}$	$T_{VJ} = 125^{\circ}\text{C}$		30	A	
<b><math>I_{SC}</math> (SCSOA)</b>	short circuit safe operating area	$V_{CE} = 900\text{ V}; V_{GE} = \pm 15\text{ V};$ $R_G = 100\ \Omega; t_p = 10\ \mu\text{s};$ non-repetitive	$T_{VJ} = 125^{\circ}\text{C}$		40	A	
$R_{thJC}$	thermal resistance junction to case	(per IGBT)			2	K/W	
$R_{thCH}$	thermal resistance case to heatsink			0.7		K/W	

**Output Inverter D1 - D6**

Symbol	Definitions	Conditions	Ratings			Unit
			min.	typ.	max.	
$V_{RRM}$	max. repetitive reverse voltage		$T_{VJ} = 25^{\circ}\text{C}$		1200	V
$I_{F25}$	forward current		$T_C = 25^{\circ}\text{C}$		19	A
$I_{F80}$			$T_C = 80^{\circ}\text{C}$		13	A
$V_F$	forward voltage	$I_F = 10\text{ A}; V_{GE} = 0\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	1.95 1.85	2.2	V V
$Q_{rr}$	reverse recovery charge	$V_R = 600\text{ V}$ $di_F/dt = -250\text{ A}/\mu\text{s}$ $I_F = 10\text{ A}; V_{GE} = 0\text{ V}$	$T_{VJ} = 125^{\circ}\text{C}$		1.2	$\mu\text{C}$
$I_{RM}$	max. reverse recovery current				9	A
$t_{rr}$	reverse recovery time				320	ns
$E_{rec}$	reverse recovery energy				0.4	mJ
$R_{thJC}$	thermal resistance junction to case	(per diode)			2.4	K/W
$R_{thCH}$	thermal resistance case to heatsink			0.8		K/W

**Brake T7**

Symbol	Definitions	Conditions	Ratings			Unit	
			min.	typ.	max.		
$V_{CES}$	collector emitter voltage	$T_{VJ} = 25^{\circ}\text{C}$			1200	V	
$V_{GES}$	max. DC gate voltage	continuous			$\pm 20$	V	
$V_{GEM}$	max. transient collector gate voltage	transient			$\pm 30$	V	
$I_{C25}$	collector current	$T_C = 25^{\circ}\text{C}$			17	A	
$I_{C80}$		$T_C = 80^{\circ}\text{C}$			12	A	
$P_{tot}$	total power dissipation	$T_C = 25^{\circ}\text{C}$			63	W	
$V_{CE(sat)}$	collector emitter saturation voltage	$I_C = 9\text{ A}; V_{GE} = 15\text{ V}$			1.8 2.1	V V	
$V_{GE(th)}$	gate emitter threshold voltage	$I_C = 0.3\text{ mA}; V_{GE} = V_{CE}$	5	5.5	6.5	V	
$I_{CES}$	collector emitter leakage current	$V_{CE} = V_{CES}; V_{GE} = 0\text{ V}$			0.01 0.1	mA mA	
$I_{GES}$	gate emitter leakage current	$V_{GE} = \pm 20\text{ V}$			500	nA	
$Q_{G(on)}$	total gate charge	$V_{CE} = 600\text{ V}; V_{GE} = 15\text{ V}; I_C = 10\text{ A}$			27	nC	
$t_{d(on)}$	turn-on delay time	inductive load $V_{CE} = 600\text{ V}; I_C = 10\text{ A}$ $V_{GE} = \pm 15\text{ V}; R_G = 100\ \Omega$			70	ns	
$t_r$	current rise time		$T_{VJ} = 125^{\circ}\text{C}$			40	ns
$t_{d(off)}$	turn-off delay time					250	ns
$t_f$	current fall time					100	ns
$E_{on}$	turn-on energy per pulse					1.1	mJ
$E_{off}$	turn-off energy per pulse					1.1	mJ
<b>RBSOA</b>	reverse bias safe operating area	$V_{GE} = \pm 15\text{ V}; R_G = 100\ \Omega; V_{CEK} = 1200\text{ V}$ $T_{VJ} = 125^{\circ}\text{C}$			30	A	
<b><math>I_{SC}</math> (SCSOA)</b>	short circuit safe operating area	$V_{CE} = 900\text{ V}; V_{GE} = \pm 15\text{ V};$ $R_G = 100\ \Omega; t_p = 10\ \mu\text{s};$ non-repetitive $T_{VJ} = 125^{\circ}\text{C}$			40	A	
$R_{thJC}$	thermal resistance junction to case	(per IGBT)			2	K/W	
$R_{thCH}$	thermal resistance case to heatsink				0.7	K/W	

**Brake Chopper D7**

Symbol	Definitions	Conditions	Ratings			Unit	
			min.	typ.	max.		
$V_{RRM}$	max. repetitive reverse voltage	$T_{VJ} = 150^{\circ}\text{C}$			1200	V	
$I_{F25}$	forward current	$T_C = 25^{\circ}\text{C}$			12	A	
$I_{F80}$		$T_C = 80^{\circ}\text{C}$			8	A	
$V_F$	forward voltage	$I_F = 5\text{ A}; V_{GE} = 0\text{ V}$			1.95 1.85	V V	
$I_R$	reverse current	$V_R = V_{RRM}$			0.01 0.1	mA mA	
$Q_{rr}$	reverse recovery charge	$V_R = 600\text{ V}$ $di_F/dt = 200\text{ A}/\mu\text{s}$ $I_F = 5\text{ A}; V_{GE} = 0\text{ V}$			0.7	$\mu\text{C}$	
$I_{RM}$	max. reverse recovery current		$T_{VJ} = 125^{\circ}\text{C}$			6	A
$t_{rr}$	reverse recovery time					320	ns
$E_{rec}$	reverse recovery energy					0.2	mJ
$R_{thJC}$	thermal resistance junction to case	(per diode)			3.4	K/W	
$R_{thCH}$	thermal resistance case to heatsink				1.1	K/W	

**Input Rectifier Bridge D8 - D11**

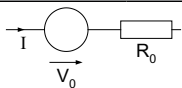
Symbol	Definitions	Conditions	Ratings			Unit
			min.	typ.	max.	
$V_{RRM}$	max. repetitive reverse voltage		$T_{VJ} = 25^{\circ}\text{C}$		1600	V
$I_{FAV}$	average forward current	sine $180^{\circ}$	$T_C = 80^{\circ}\text{C}$		24	A
$I_{DAVM}$	max. average DC output current	rect.; $d = 1/3$	$T_C = 80^{\circ}\text{C}$		69	A
$I_{FSM}$	max. forward surge current	$t = 10$ ms; sine 50 Hz	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		270 240	A A
$I^2t$	$I^2t$ value for fusing	$t = 10$ ms; sine 50 Hz	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		360 290	$\text{A}^2\text{s}$ $\text{A}^2\text{s}$
$P_{tot}$	total power dissipation		$T_C = 25^{\circ}\text{C}$		69	W
$V_F$	forward voltage	$I_F = 30$ A	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	1.27 1.24	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)			1.8	K/W
$R_{thCH}$	thermal resistance case to heatsink	(per diode)		0.6		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	$5.25$	$\text{k}\Omega$
$B_{25/50}$					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**


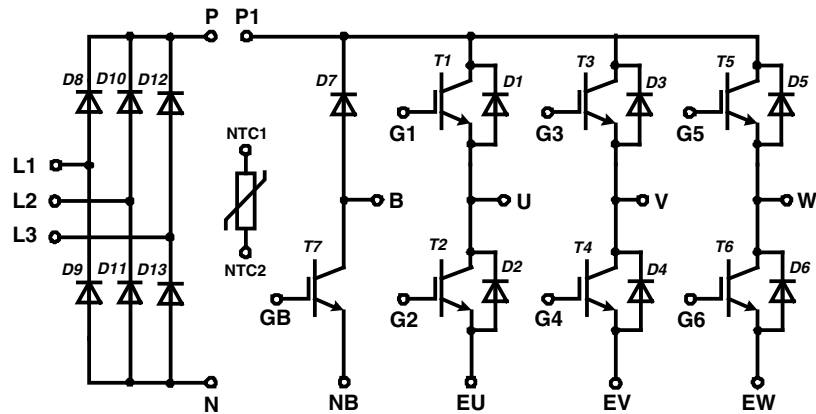
Symbol	Definitions	Conditions	Ratings			Unit
			min.	typ.	max.	
$V_0$	rectifier diode	D8 - D13	$T_{VJ} = 150^{\circ}\text{C}$		0.86	V
$R_0$					12.3	$\text{m}\Omega$
$V_0$	IGBT	T1 - T6	$T_{VJ} = 150^{\circ}\text{C}$		1.1	V
$R_0$					153	$\text{m}\Omega$
$V_0$	free wheeling diode	D1 - D6	$T_{VJ} = 150^{\circ}\text{C}$		1.09	V
$R_0$					91	$\text{m}\Omega$
$V_0$	IGBT	T7	$T_{VJ} = 150^{\circ}\text{C}$		1.1	V
$R_0$					153	$\text{m}\Omega$
$V_0$	free wheeling diode	D7	$T_{VJ} = 150^{\circ}\text{C}$		1.15	V
$R_0$					171	$\text{m}\Omega$

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

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

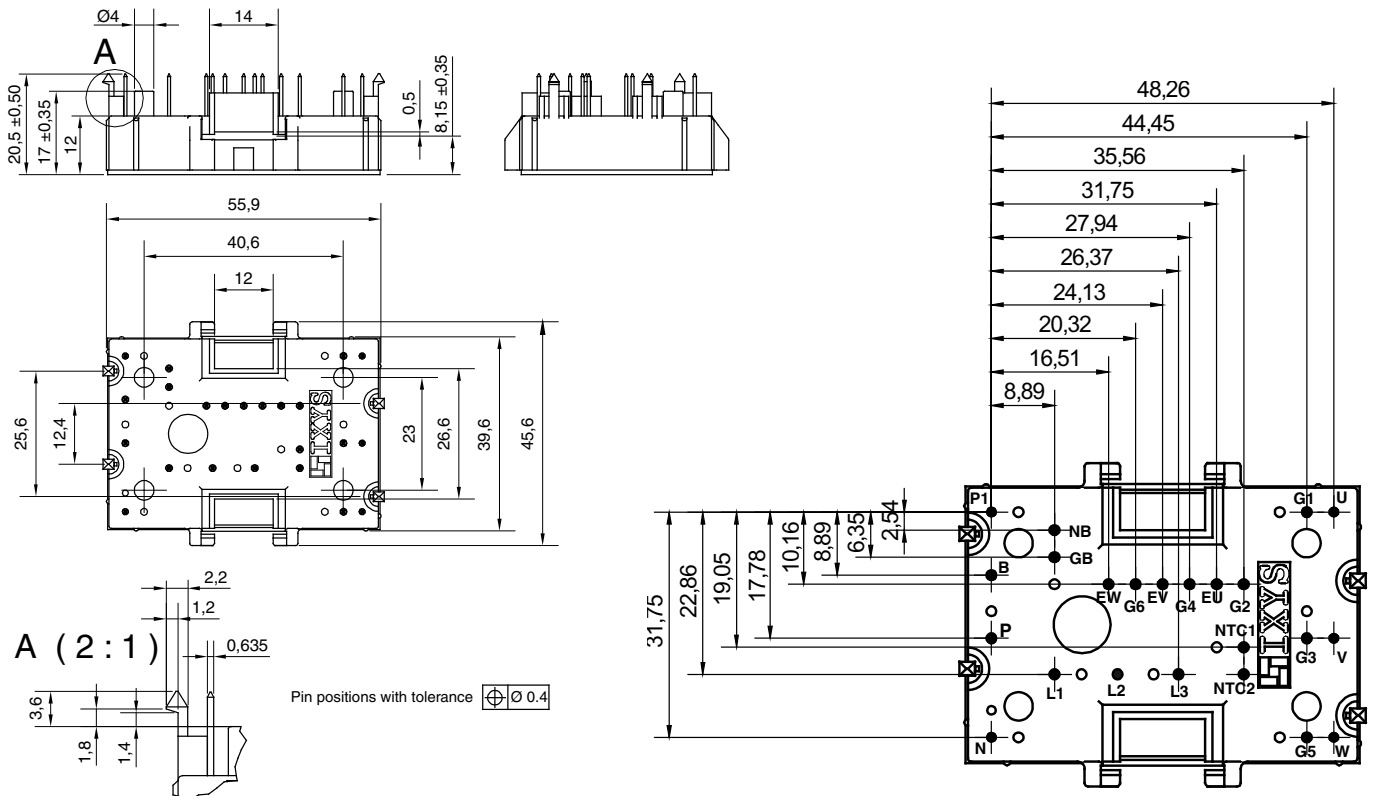
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### Circuit Diagram

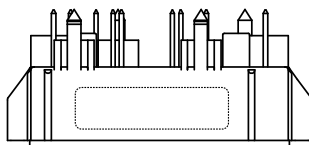


### Outline Drawing

Dimensions in mm (1 mm = 0.0394")



### Product Marking



#### Part number

- M = Module
- I = IGBT
- X = XPT
- A = standard
- 20 = 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	MIXA 10 WB 1200 TMH	MIXA10WB1200TMH	Box	20	508609

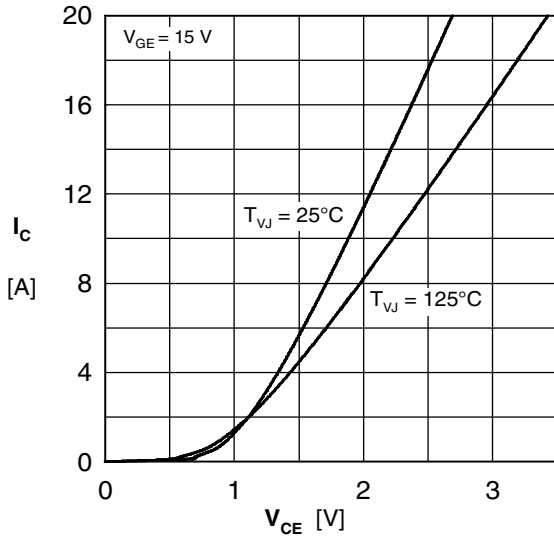


Fig. 1 Typ. output characteristics

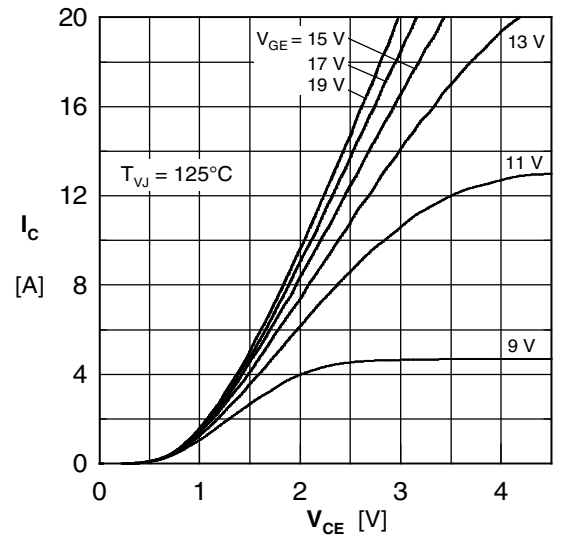


Fig. 2 Typ. output characteristics

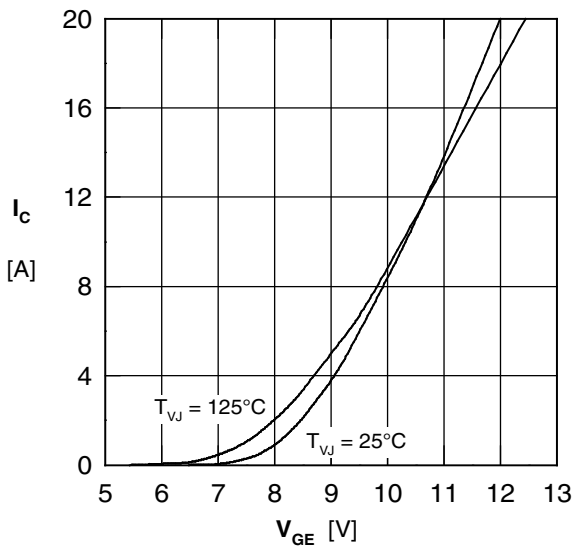


Fig. 3 Typ. transfer characteristics

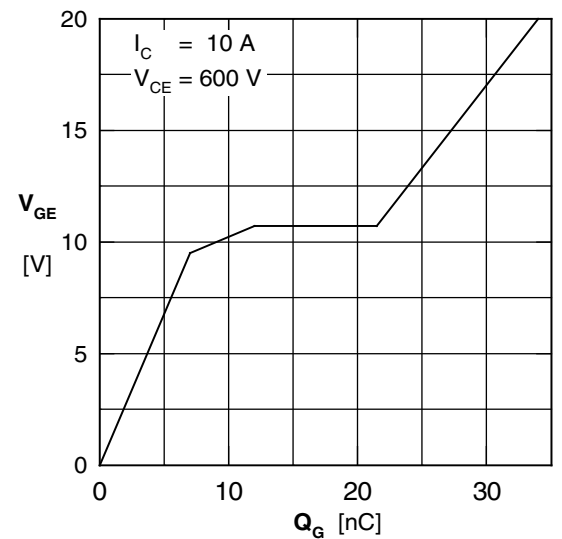


Fig. 4 Typ. turn-on gate charge

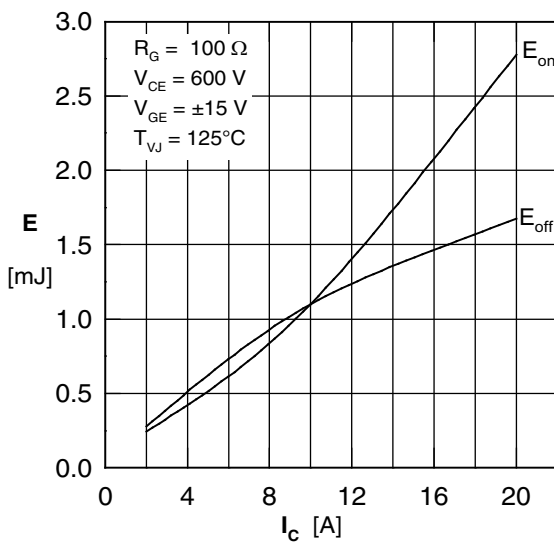


Fig. 5 Typ. switching energy vs. collector current

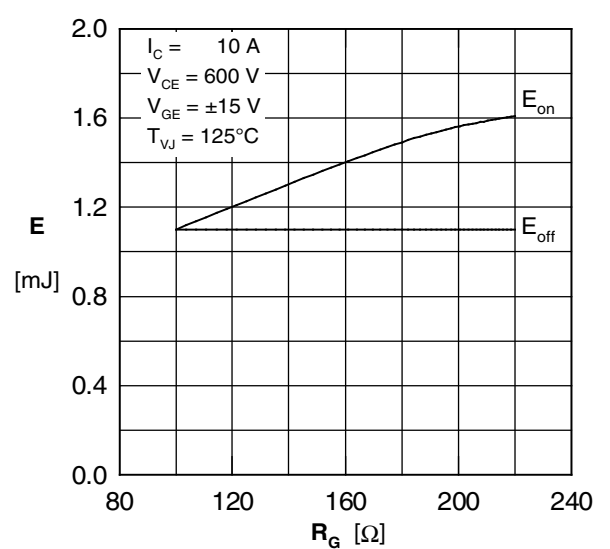


Fig. 6 Typ. switching energy vs. gate resistance

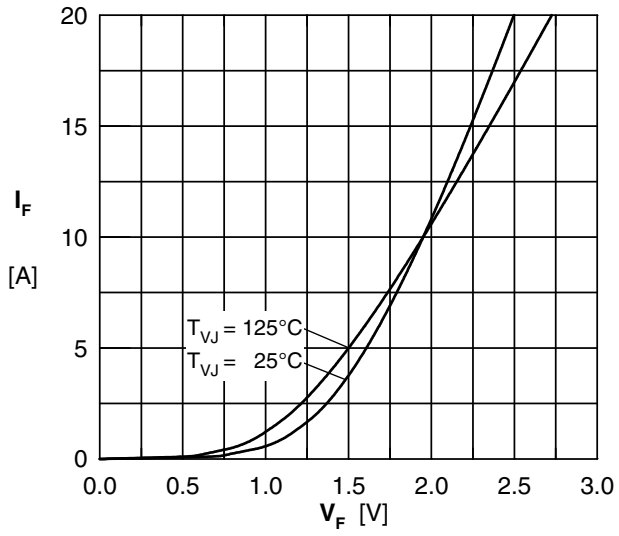


Fig. 7 Typ. forward characteristics

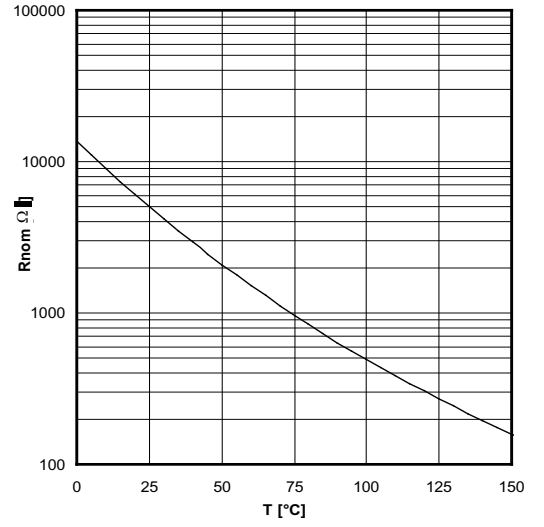


Fig. 8 Typ. thermistor resistance vs. temperature