

IGBT Modules

H-Bridge

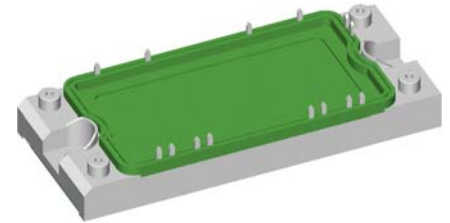
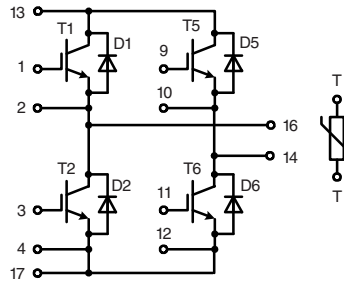
Short Circuit SOA Capability
Square RBSOA

$$I_{C25} = 72 \text{ A}$$

$$V_{CES} = 600 \text{ V}$$

$$V_{CE(sat) \text{ typ.}} = 1.9 \text{ V}$$

Type	NTC - Option
MKI 50-06 A7	without NTC
MKI 50-06 A7T	with NTC



IGBTs				
Symbol	Conditions	Maximum Ratings		
V_{CES}	$T_{VJ} = 25^{\circ}\text{C to } 150^{\circ}\text{C}$	600	V	
V_{GES}		± 20	V	
I_{C25}	$T_C = 25^{\circ}\text{C}$	72	A	
I_{C80}	$T_C = 80^{\circ}\text{C}$	50	A	
RBSOA	$V_{GE} = \pm 15 \text{ V}$; $R_G = 22 \Omega$; $T_{VJ} = 125^{\circ}\text{C}$ Clamped inductive load; $L = 100 \mu\text{H}$	$I_{CM} = 100$ $V_{CEK} \leq V_{CES}$	A	
t_{SC} (SCSOA)	$V_{CE} = V_{CES}$; $V_{GE} = \pm 15 \text{ V}$; $R_G = 22 \Omega$; $T_{VJ} = 125^{\circ}\text{C}$ non-repetitive	10	μs	
P_{tot}	$T_C = 25^{\circ}\text{C}$	225	W	

Features

- NPT IGBT technology
- low saturation voltage
- low switching losses
- square RBSOA, no latch up
- high short circuit capability
- positive temperature coefficient for easy paralleling
- MOS input, voltage controlled
- ultra fast free wheeling diodes
- solderable pins for PCB mounting
- package with copper base plate

Advantages

- space savings
- reduced protection circuits
- package designed for wave soldering

Typical Applications

- motor control
 - DC motor armature winding
 - DC motor excitation winding
 - synchronous motor excitation winding
- supply of transformer primary winding
 - power supplies
 - welding
 - X-ray
 - UPS
 - battery charger

Symbol	Conditions	Characteristic Values ($T_{VJ} = 25^{\circ}\text{C}$, unless otherwise specified)		
		min.	typ.	max.
$V_{CE(sat)}$	$I_C = 50 \text{ A}$; $V_{GE} = 15 \text{ V}$; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	1.9 2.2		2.4 V
$V_{GE(th)}$	$I_C = 1 \text{ mA}$; $V_{GE} = V_{CE}$	4.5		6.5 V
I_{CES}	$V_{CE} = V_{CES}$; $V_{GE} = 0 \text{ V}$; $T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	0.7		0.6 mA
I_{GES}	$V_{CE} = 0 \text{ V}$; $V_{GE} = \pm 20 \text{ V}$			200 nA
$t_{d(on)}$ t_r $t_{d(off)}$ t_f E_{on} E_{off}	Inductive load, $T_{VJ} = 125^{\circ}\text{C}$ $V_{CE} = 300 \text{ V}$; $I_C = 50 \text{ A}$ $V_{GE} = \pm 15 \text{ V}$; $R_G = 22 \Omega$	50 60 300 30 2.3 1.7		ns ns ns ns mJ mJ
C_{ies}		2800		pF
Q_{Gon}		120		nC
R_{thJC}			0.55	K/W

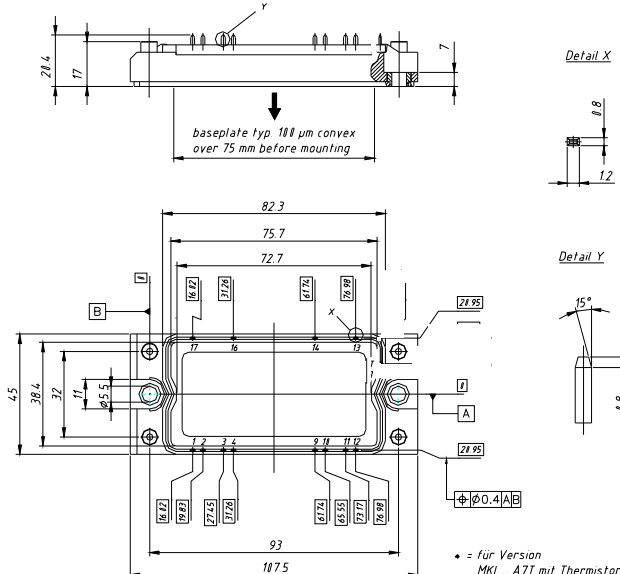
Diodes			
Symbol	Conditions	Maximum Ratings	
I_{F25}	$T_C = 25^\circ\text{C}$	72	A
I_{F80}	$T_C = 80^\circ\text{C}$	45	A

		Characteristic Values		
		min.	typ.	max.
V_F	$I_F = 50\text{ A}; V_{GE} = 0\text{ V}; T_{VJ} = 25^\circ\text{C}$		1.6	1.8
			1.3	V
I_{RM}	$I_F = 30\text{ A}; di_F/dt = -500\text{ A}/\mu\text{s}; T_{VJ} = 125^\circ\text{C}$		25	A
t_{rr}			90	ns
R_{thJC}	(per diode)			1.19 K/W

Module			
Symbol	Conditions	Maximum Ratings	
T_{VJ}		-40...+150	$^\circ\text{C}$
T_{stg}		-40...+125	$^\circ\text{C}$
V_{ISOL}	$I_{ISOL} \leq 1\text{ mA}; 50/60\text{ Hz}$	2500	V~
M_d	Mounting torque (M5)	2.7 - 3.3	Nm

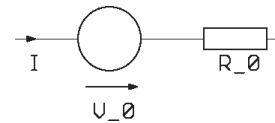
		Characteristic Values		
		min.	typ.	max.
$R_{pin-chip}$			5	m Ω
d_s	Creepage distance on surface	6		mm
d_A	Strike distance in air	6		mm
R_{thCH}	with heatsink compound		0.02	K/W
Weight			180	g

Temperature Sensor NTC (MKI ... A7T version only)				
Symbol	Conditions	Characteristic Values		
		min.	typ.	max.
R ₂₅	T = 25°C	4.75	5.0	5.25 kΩ
B _{25/50}			3375	K



Equivalent Circuits for Simulation

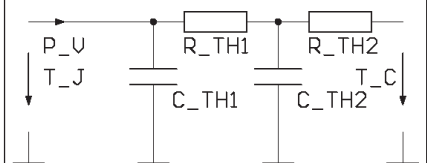
Conduction



IGBT (typ. at $V_{GE} = 15\text{ V}; T_J = 125^\circ\text{C}$)
 $V_o = 0.82\text{ V}; R_o = 28\text{ m}\Omega$

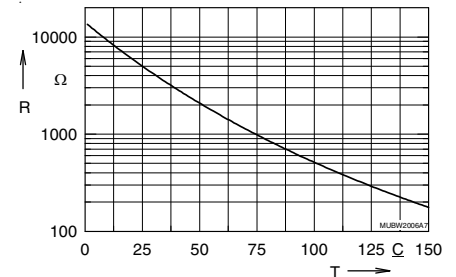
Free Wheeling Diode (typ. at $T_J = 125^\circ\text{C}$)
 $V_o = 0.89\text{ V}; R_o = 8\text{ m}\Omega$

Thermal Response



IGBT (typ.)
 $C_{th1} = 0.201\text{ J/K}; R_{th1} = 0.42\text{ K/W}$
 $C_{th2} = 1.252\text{ J/K}; R_{th2} = 0.131\text{ K/W}$

Free Wheeling Diode (typ.)
 $C_{th1} = 0.116\text{ J/K}; R_{th1} = 0.973\text{ K/W}$
 $C_{th2} = 0.88\text{ J/K}; R_{th2} = 0.277\text{ K/W}$



Typ. thermistor resistance versus temperature

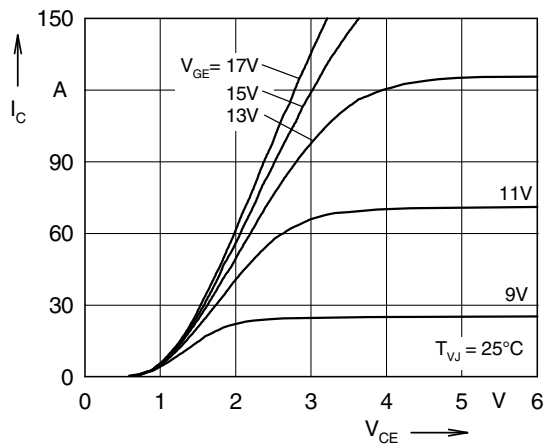


Fig. 1 Typ. output characteristics

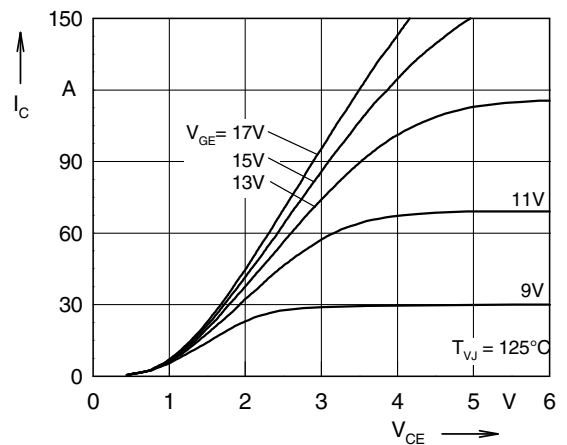


Fig. 2 Typ. output characteristics

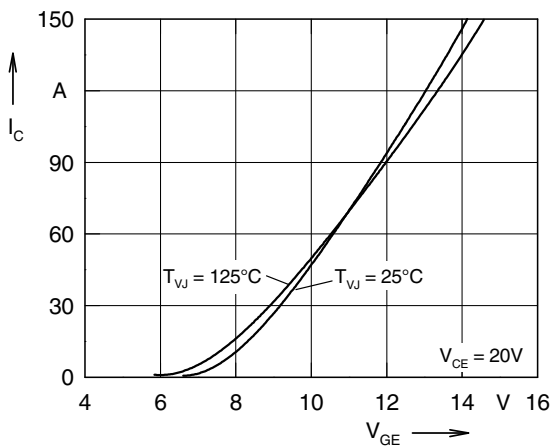


Fig. 3 Typ. transfer characteristics

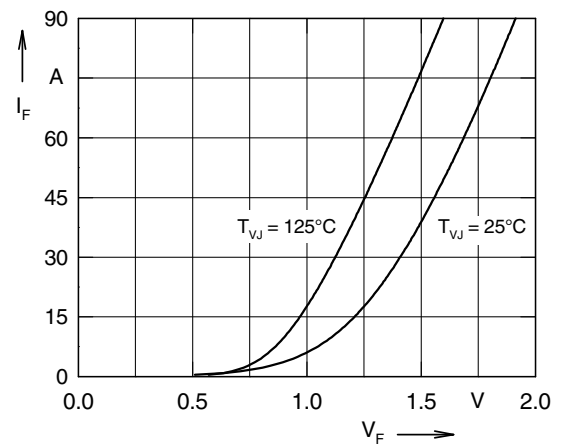


Fig. 4 Typ. forward characteristics of free wheeling diode

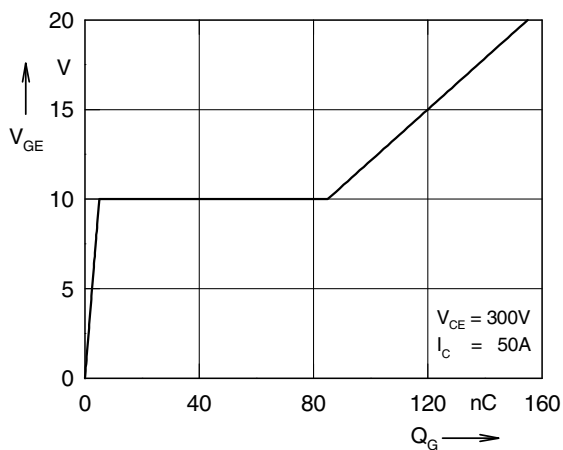


Fig. 5 Typ. turn on gate charge

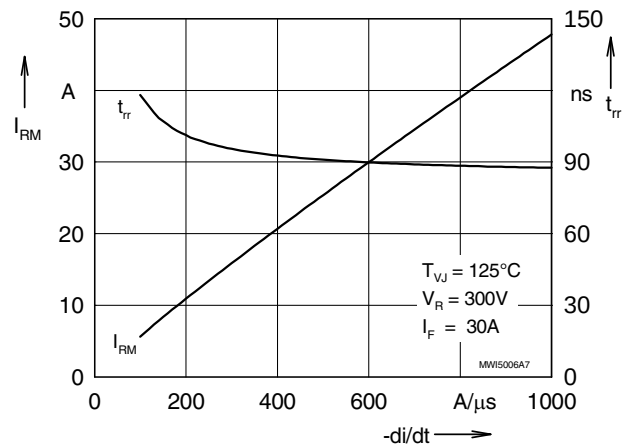


Fig. 6 Typ. turn off characteristics of free wheeling diode

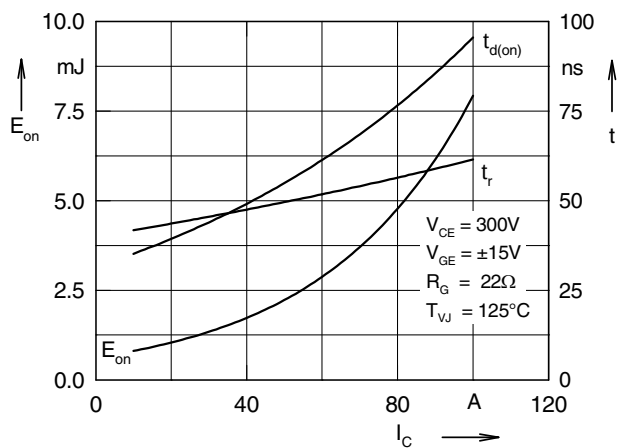


Fig. 7 Typ. turn on energy and switching times versus collector current

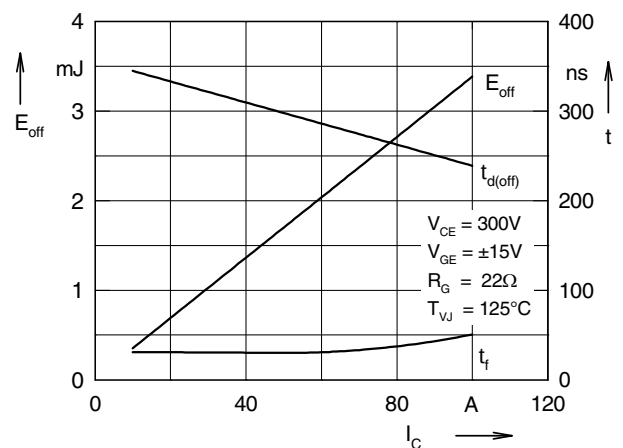


Fig. 8 Typ. turn off energy and switching times versus collector current

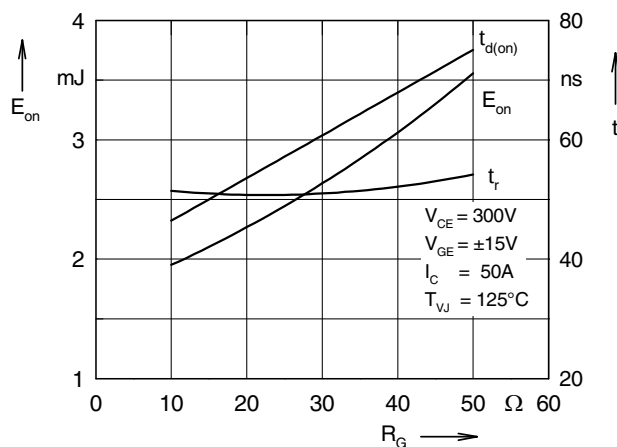


Fig. 9 Typ. turn on energy and switching times versus gate resistor

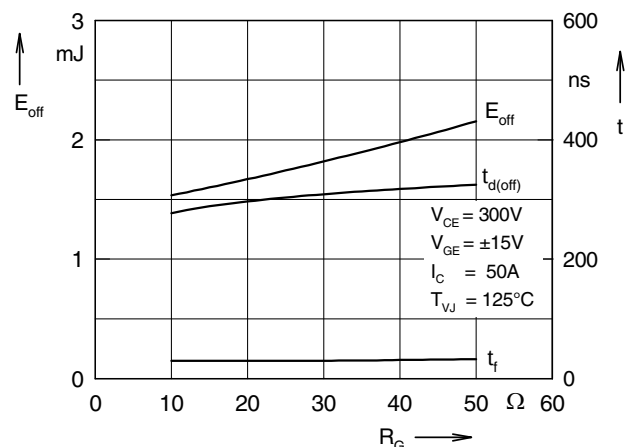


Fig. 10 Typ. turn off energy and switching times versus gate resistor

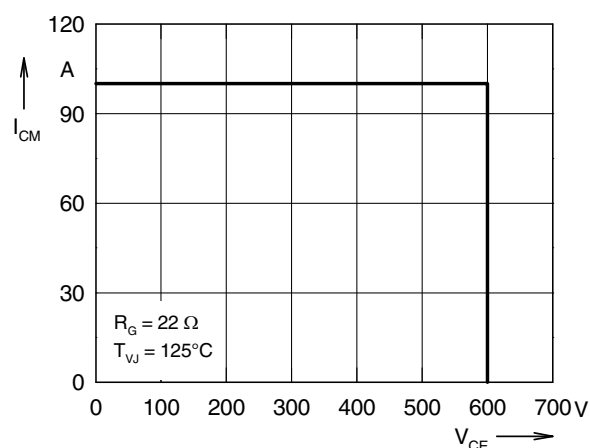


Fig. 11 Reverse biased safe operating area RBSOA

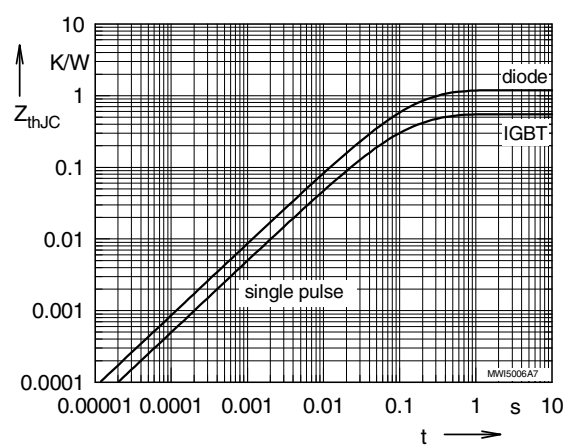


Fig. 12 Typ. transient thermal impedance

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