



**PRELIMINARY**

**MG50HF12C1** **RoHS**  
**COMPLIANT**

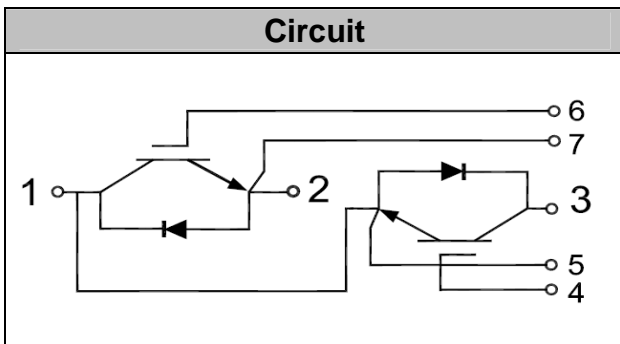
## IGBT Modules

**V<sub>CEs</sub>**            1200V  
**I<sub>c</sub>**                 50A



### Applications

- Industrial Inverters
- Servo Applications
- SMPS UPS
- Induction Heating
- Welder



### Features

- High Short Circuit Capability
- Low Stray Inductance
- Low Saturation Voltage
- Ultra Low loss
- HI-REL Power Terminals
- Lead Free, Compliant With RoHS Requirement

### Absolute Maximum Ratings (T<sub>c</sub> = 25°C unless otherwise specified)

Symbol	Description	Values	Units
V <sub>CEs</sub>	Collector - Emitter Voltage	1200	V
V <sub>GES</sub>	Gate-Emitter Voltage	±20	V
I <sub>c</sub>	DC Collector Current	T <sub>c</sub> =25°C	80 A
		T <sub>c</sub> =80°C	50 A
I <sub>CM(1)</sub>	Peak Collector Current Repetitive	T <sub>J</sub> = 125°C	100 A
I <sub>F</sub>	Diode Continuous Forward Current	T <sub>J</sub> = 125°C	50 A
I <sub>FM</sub>	Peak FWD Current Repetitive		100 A
t <sub>SC</sub>	Short Circuit Withstand Time	>10	µs
P <sub>D</sub>	Maximum Power Dissipation (IGBT)	T <sub>c</sub> = 25°C, T <sub>Jmax</sub> =150°C	500 W
T <sub>J</sub>	Maximum Junction Temperature		150 °C
T <sub>JOP</sub>	Operating Temperature		-40 ~ +150 °C
T <sub>stg</sub>	Storage Temperature		-40 ~ +125 °C
Viso	Isolation Voltage (All Terminals Shorted)	f=50Hz, 1min	3000 V
Mounting Torque	Power Terminals Screw:M5		5 N*m
	Mounting Screw:M6		6 N*m

Notes :

(1) Repetitive Rating: Pulse width limited by max. junction temperature



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**Electrical Characteristics of IGBT** ( $T_J = 25^\circ\text{C}$  unless otherwise specified)

Symbol	Item	Conditions	Values			Units
			Min.	Typ.	Max.	
<b>OFF Characteristics</b>						
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	$V_{GE} = 0V, I_C = 1mA$	1200			V
$I_{CES}$	Collector Leakage Current	$V_{CE}=V_{CES}, V_{GE}=0V,$			200	$\mu\text{A}$
		$V_{CE}=V_{CES}, V_{GE}=0V,$ $T_J=125^\circ\text{C}$			1	mA
$I_{GES}$	Gate Leakage Current	$V_{CE}=0V, V_{GE}=\pm 20V$	-400		400	nA
<b>ON Characteristics</b>						
$V_{GE(th)}$	Gate - Emitter Threshold Voltage	$V_{CE}=V_{GE}, I_C=2mA$	5	6.2	7	V
$V_{CE(sat)}$	Collector – Emitter Saturation Voltage	$I_C=50A, V_{GE}=15V$		1.8		V
		$I_C=50A, V_{GE}=15V,$ $T_J=125^\circ\text{C}$		2		V
<b>Dynamic Characteristics</b>						
$C_{ies}$	Input Capacitance	$V_{CE} = 25V, V_{GE} = 0V,$ $f = 1MHz$		4.3		nF
$C_{oes}$	Output Capacitance			0.3		nF
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-on Delay Time	$V_{CC} = 600V, I_C = 50A,$ $R_G = 18\Omega, V_{GE} = \pm 15V,$ Inductive Load, $T_J = 25^\circ\text{C}$		270		ns
$t_r$	Rise Time			70		ns
$t_{d(off)}$	Turn-off Delay Time			480		ns
$T_f$	Fall Time			60		ns
$E_{on}$	Turn-on Switching Loss			6		mJ
$E_{off}$	Turn-off Switching Loss			3.6		mJ
$t_{d(on)}$	Turn-on Delay Time	$V_{CC} = 600V, I_C = 50A,$ $R_G = 18\Omega, V_{GE} = \pm 15V,$ Inductive Load, $T_J = 125^\circ\text{C}$		280		ns
$t_r$	Rise Time			65		ns
$t_{d(off)}$	Turn-off Delay Time			500		ns
$T_f$	Fall Time			70		ns
$E_{on}$	Turn-on Switching Loss			8.3		mJ
$E_{off}$	Turn-off Switching Loss			5.7		mJ
$Q_{ge}$	Gate Charge	$V_{CC}=600V, I_C=50A,$ $V_{GE}=\pm 15V$		640		nC
RBSOA	Reverse Bias Safe Operating Area	$I_C = 100A, V_{CC} = 600V,$ $V_p = 1200V, R_g = 4.7\Omega,$ $V_{GE} = +15V \text{ to } 0V,$ $T_J = 150^\circ\text{C}$	Trapezoid			
SCSOA	Short Circuit Safe Operating Area	$V_{CC} = 600V, V_{GE} = 15V,$ $T_J = 150^\circ\text{C}$	10			$\mu\text{s}$



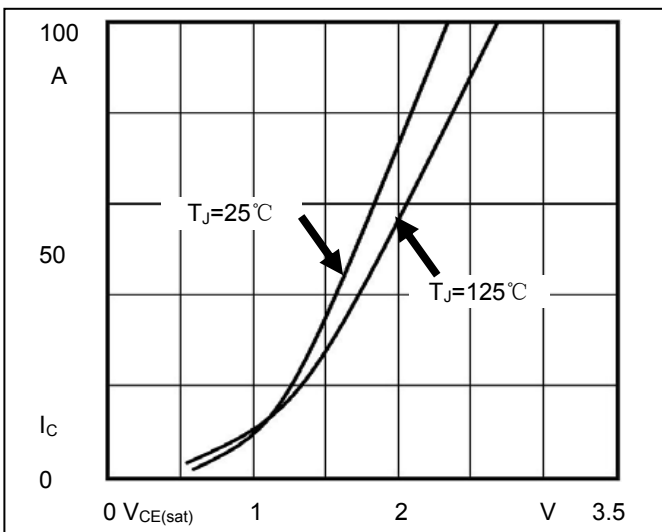
**Electrical Characteristics of FWD** ( $T_C = 25^\circ\text{C}$  unless otherwise specified)

Symbol	Item	Conditions	Values			Units
			Min.	Typ.	Max.	
$V_{FM}$	Forward Voltage	$I_F = 50\text{A}, V_{GE} = 0\text{V}$	$T_J = 25^\circ\text{C}$	1.9		V
			$T_J = 125^\circ\text{C}$	1.7		
$t_{rr}$	Reverse Recovery Time	$I_F = 50\text{A},$ $di/dt = 1000\text{A}/\mu\text{s},$ $V_{rr} = 600\text{V},$ $V_{GE} = -15\text{V}$	$T_J = 25^\circ\text{C}$	150		ns
			$T_J = 125^\circ\text{C}$	180		
$I_{rr}$	Peak Reverse Recovery Current		$T_J = 25^\circ\text{C}$	50		A
			$T_J = 125^\circ\text{C}$	60		
$Q_{rr}$	Reverse Recovery Charge		$T_J = 25^\circ\text{C}$	5.1		$\mu\text{C}$
			$T_J = 125^\circ\text{C}$	7.1		

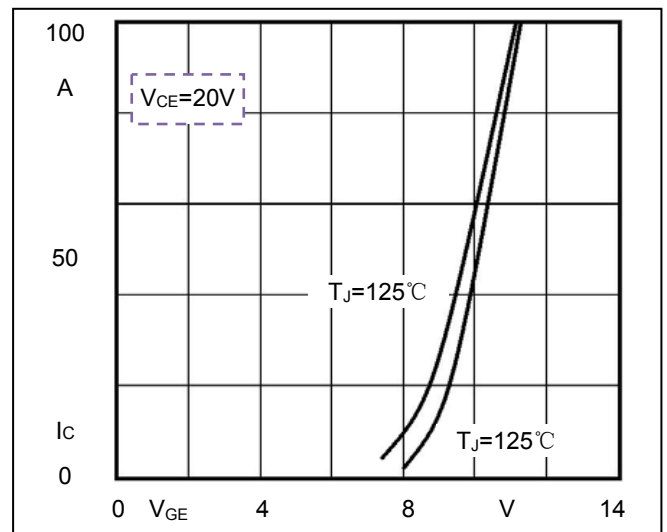
**Thermal Resistance Characteristics**

Symbol	Description	Values			Units
		Min.	Typ.	Max.	
$R_{\theta JC}$	Junction-To-Case (IGBT Part, Per Leg)			0.3	$^\circ\text{C}/\text{W}$
$R_{\theta JC}$	Junction-To-Case (Diode Part, Per Leg)			0.6	$^\circ\text{C}/\text{W}$
$R_{\theta CS}$	Case-To-Sink (Conductive Grease Applied)			0.1	$^\circ\text{C}/\text{W}$
M	Power Terminals Screw:M5			5	N·m
M	Mounting Screw:M6			6	N·m
Weight	Weight Of Module		150	160	g

**Performance Curves**



**Fig1. Typical Output Characteristics**



**Fig2. Typical Transfer Characteristics**

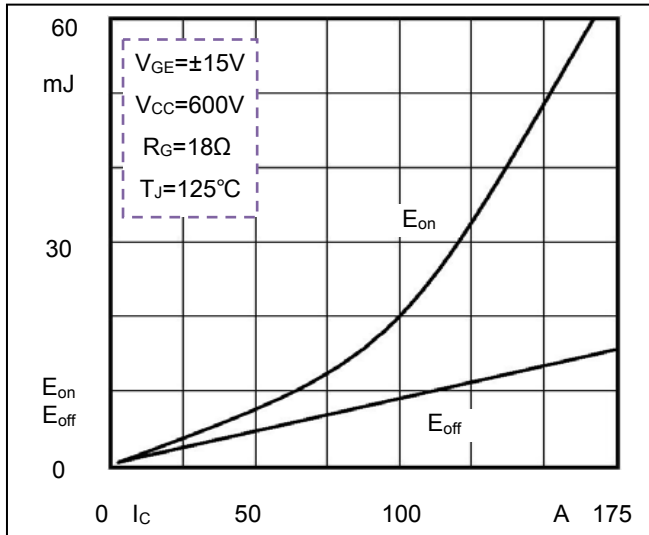


Fig3. Switching Energy vs. Collector Current

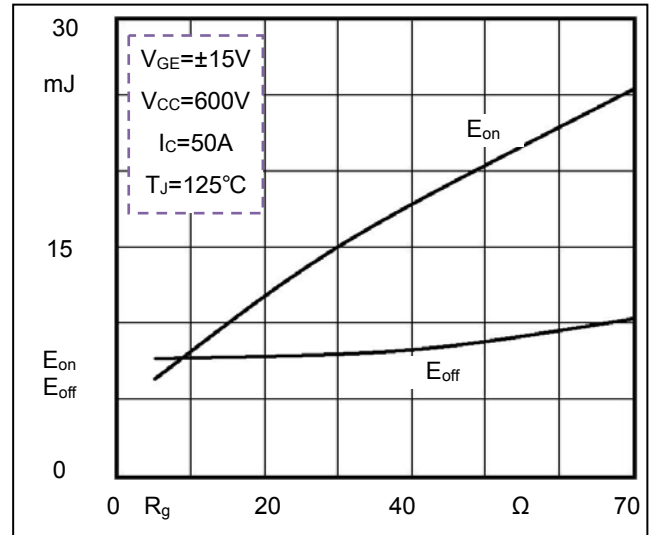


Fig4. Switching Energy vs. Gate Resistor

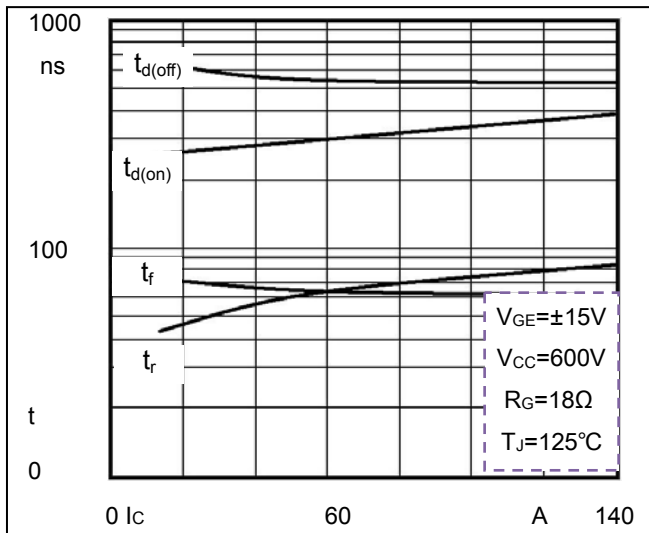


Fig5. Switching Times vs. Collector Current

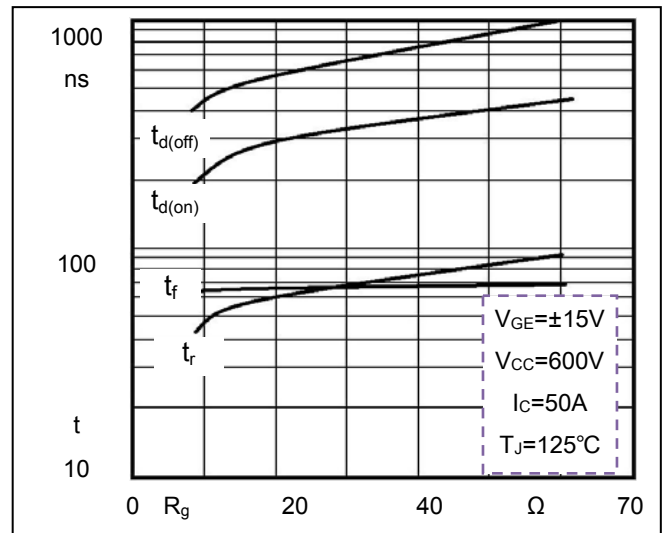


Fig6. Switching Times vs. Gate Resistor

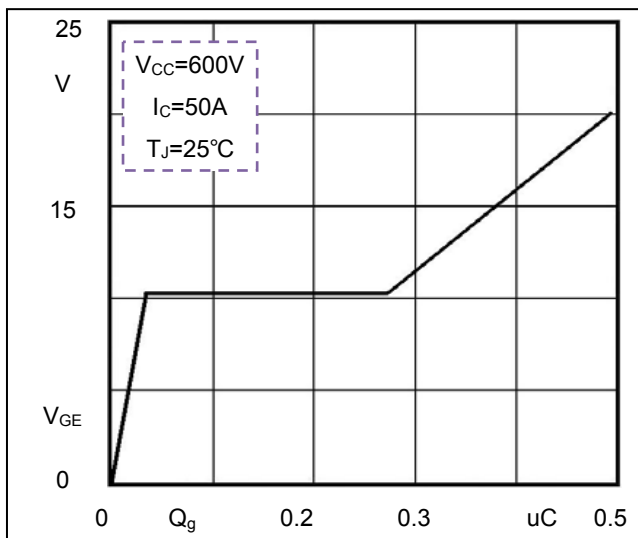


Fig7. Gate Charge characteristics

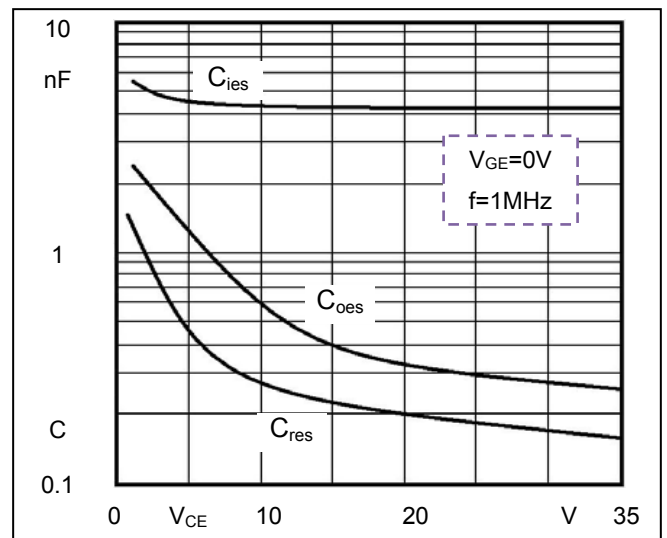


Fig8. Typical Capacitances vs.  $V_{CE}$

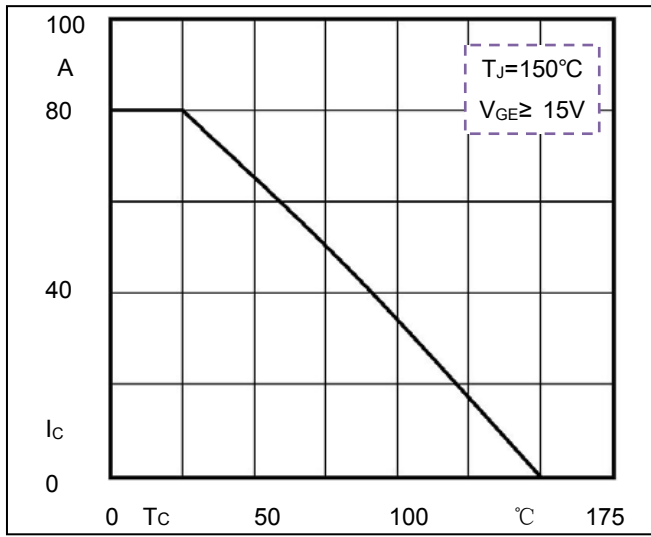


Fig9. Rated Current vs.  $T_c$

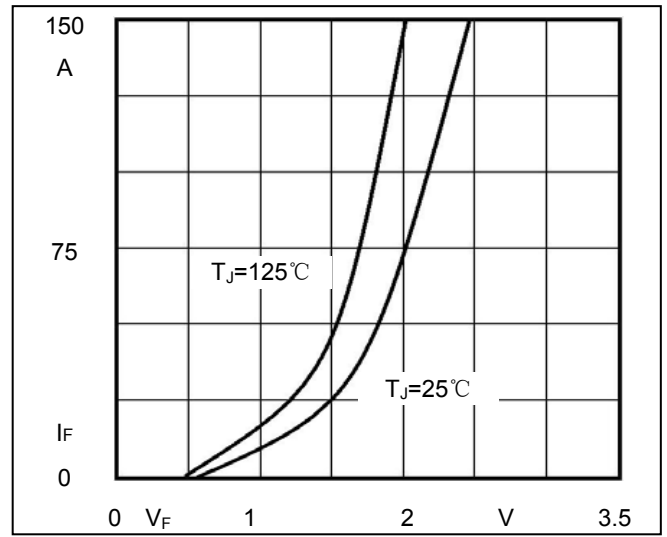


Fig10. Diode Forward Characteristics

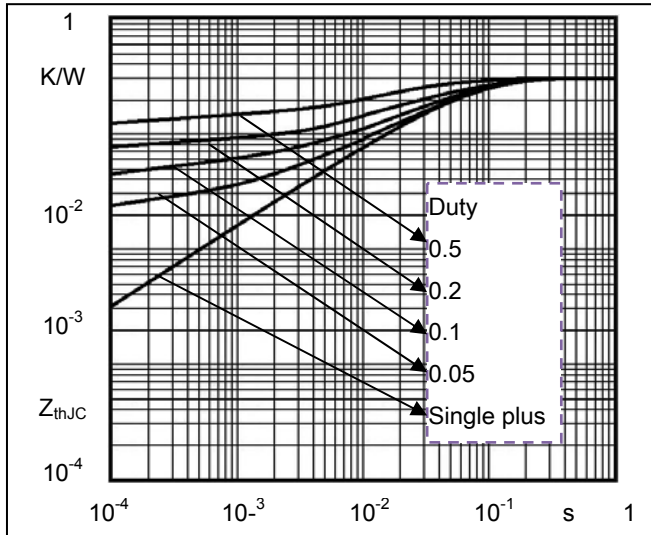


Fig11. Transient Thermal Impedance of IGBT

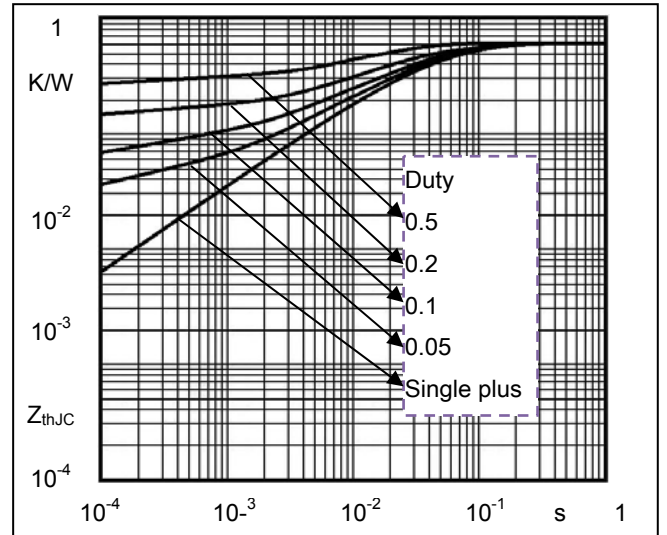
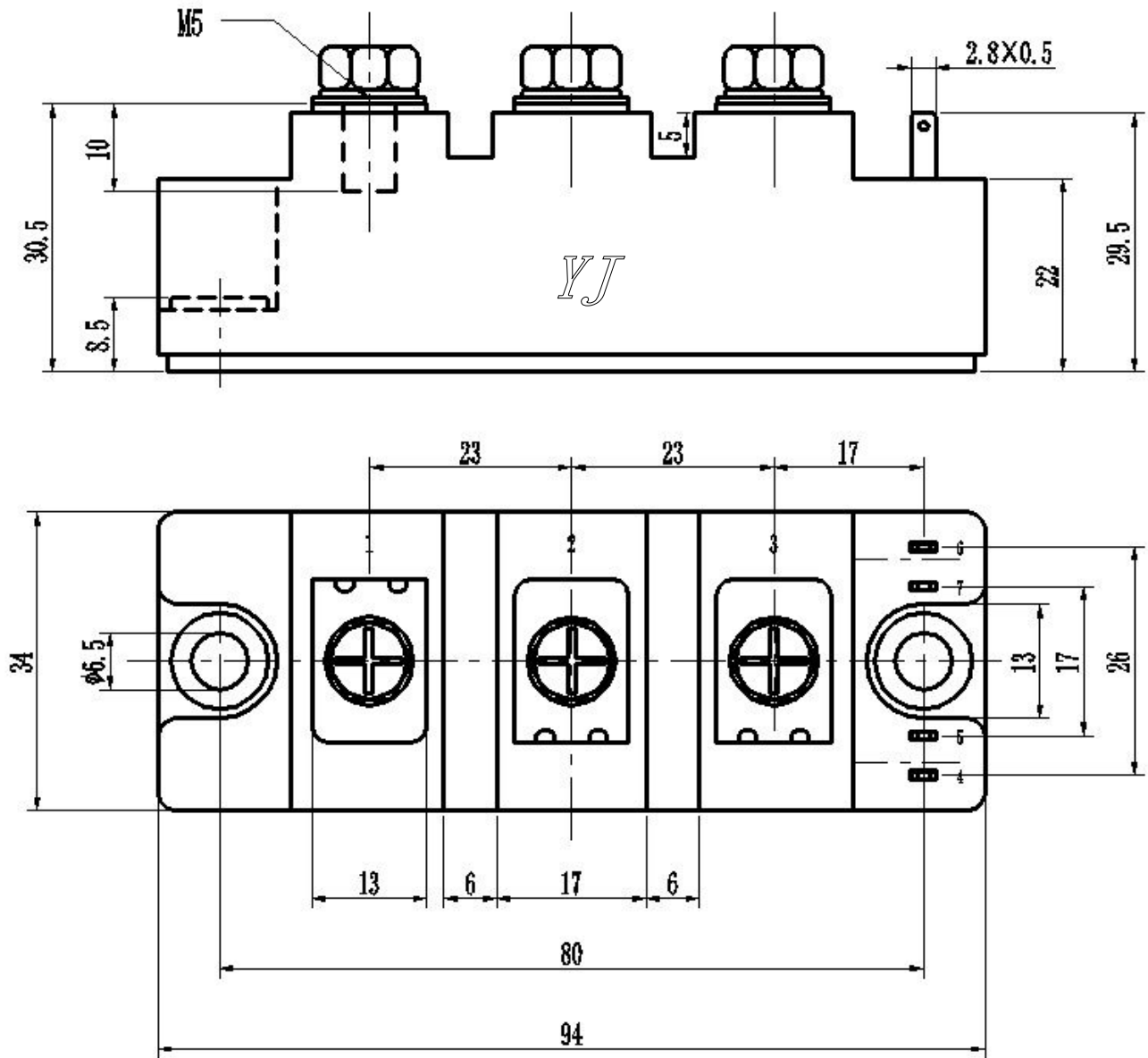


Fig12. Transient Thermal Impedance of Diode



Package Outline Information

CASE: C1



Dimensions in mm