

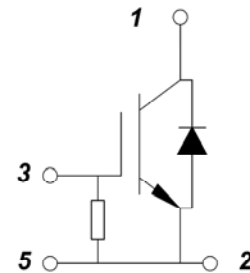
PRODUCT FEATURES

- IGBT³ CHIP(1700V Trench+Field Stop technology)
- Low turn-off losses, short tail current
- $V_{CE(sat)}$ with positive temperature coefficient
- DIODE CHIP(1700V EMCON 3 technology)
- Free wheeling diodes with fast and soft reverse recovery
- 10K Ω Gate Protected Resistance Inside



APPLICATIONS

- High frequency switching application
- Medical applications
- Motion/servo control
- UPS systems



IGBT-inverter

ABSOLUTE MAXIMUM RATINGS($T_C=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter/Test Conditions	Values	Unit
V_{CES}	Collector Emitter Voltage $T_J=25^\circ\text{C}$	1700	V
V_{GES}	Gate Emitter Voltage	± 20	
I_C	DC Collector Current	$T_C=25^\circ\text{C}, T_{Jmax}=175^\circ\text{C}$	600
		$T_C=90^\circ\text{C}, T_{Jmax}=175^\circ\text{C}$	400
I_{CM}	Repetitive Peak Collector Current $t_p=1\text{ms}$	800	A
P_{tot}	Power Dissipation Per IGBT $T_C=25^\circ\text{C}, T_{Jmax}=175^\circ\text{C}$	2700	W

Reverse-Diode

ABSOLUTE MAXIMUM RATINGS ($T_C=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter/Test Conditions	Values	Unit
V_{RRM}	Repetitive Reverse Voltage $T_J=25^\circ\text{C}$	1700	V
$I_{F(AV)}$	Average Forward Current	400	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1\text{ms}$	800	
i^2t	$T_J=125^\circ\text{C}, t=10\text{ms}, V_R=0\text{V}$	24000	A ² S

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MMG400K170U6EN

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ELECTRICAL CHARACTERISTICS ($T_C=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
$V_{GE(th)}$	Gate Emitter Threshold Voltage	$V_{CE}=V_{GE}, I_C=16\text{mA}$	5.2	5.8	6.4	V
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	$I_C=400\text{A}, V_{GE}=15\text{V}, T_J=25^\circ\text{C}$		2	2.45	
		$I_C=400\text{A}, V_{GE}=15\text{V}, T_J=125^\circ\text{C}$		2.4		
I_{CES}	Collector Leakage Current	$V_{CE}=1700\text{V}, V_{GE}=0\text{V}, T_J=25^\circ\text{C}$			3	mA
		$V_{CE}=1700\text{V}, V_{GE}=0\text{V}, T_J=125^\circ\text{C}$			20	mA
I_{GES}	Gate Leakage Current	$V_{CE}=0\text{V}, V_{GE}=\pm 15\text{V}, T_J=25^\circ\text{C}$	-400		400	nA
R_{gint}	Integrated Gate Resistor			1.9		Ω
Q_g	Gate Charge	$V_{CE}=900\text{V}, I_C=400\text{A}, V_{GE}=\pm 15\text{V}$		4.8		μC
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$		36		nF
C_{res}	Reverse Transfer Capacitance			1200		pF
$t_{d(on)}$	Turn on Delay Time	$V_{CC}=900\text{V}, I_C=400\text{A}$ $R_G=3.3\Omega,$ $V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		380	ns
			$T_J=125^\circ\text{C}$		420	ns
t_r	Rise Time	$V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		80	ns
			$T_J=125^\circ\text{C}$		100	ns
$t_{d(off)}$	Turn off Delay Time	$V_{CC}=900\text{V}, I_C=400\text{A}$ $R_G=3.3\Omega,$ $V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		800	ns
			$T_J=125^\circ\text{C}$		1000	ns
t_f	Fall Time	$V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		180	ns
			$T_J=125^\circ\text{C}$		300	ns
E_{on}	Turn on Energy	$V_{CC}=900\text{V}, I_C=400\text{A}$ $R_G=3.3\Omega,$ $V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		116	mJ
			$T_J=125^\circ\text{C}$		156	mJ
E_{off}	Turn off Energy	$V_{GE}=\pm 15\text{V},$ Inductive Load	$T_J=25^\circ\text{C}$		83	mJ
			$T_J=125^\circ\text{C}$		126	mJ
I_{SC}	Short Circuit Current	$t_{psc} \leq 10\mu\text{S}, V_{GE}=15\text{V}$ $T_J=125^\circ\text{C}, V_{CC}=1000\text{V}$		1600		A
R_{thJC}	Junction to Case Thermal Resistance (Per IGBT)				0.055	K/W

Reverse-Diode

ELECTRICAL CHARACTERISTICS ($T_C=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
V_F	Forward Voltage	$I_F=400\text{A}, V_{GE}=0\text{V}, T_J=25^\circ\text{C}$		1.8	2.2	V
		$I_F=400\text{A}, V_{GE}=0\text{V}, T_J=125^\circ\text{C}$		1.9		
I_{RRM}	Max. Reverse Recovery Current	$I_F=400\text{A}, V_R=900\text{V}$		480		A
Q_{RR}	Reverse Recovery Charge	$di_F/dt=-2700\text{A}/\mu\text{s}$		160		μC
E_{rec}	Reverse Recovery Energy	$T_J=125^\circ\text{C}$		96		mJ
R_{thJCD}	Junction to Case Thermal Resistance (Per Diode)				0.1	K/W

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MODULE CHARACTERISTICS ($T_C=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter/Test Conditions		Values	Unit
T_{Jmax}	Max. Junction Temperature		175	°C
T_{Jop}	Operating Temperature		-40~150	
T_{stg}	Storage Temperature		-40~125	
V_{isol}	Isolation Breakdown Voltage	AC, 50Hz(R.M.S), t=1minute	4000	V
Torque	to heatsink	Recommended (M6)	3~5	Nm
	to terminal	Recommended (M6)	2.5~5	Nm
	to terminal	Recommended (M4)	0.7~1.1	Nm
Weight			330	g

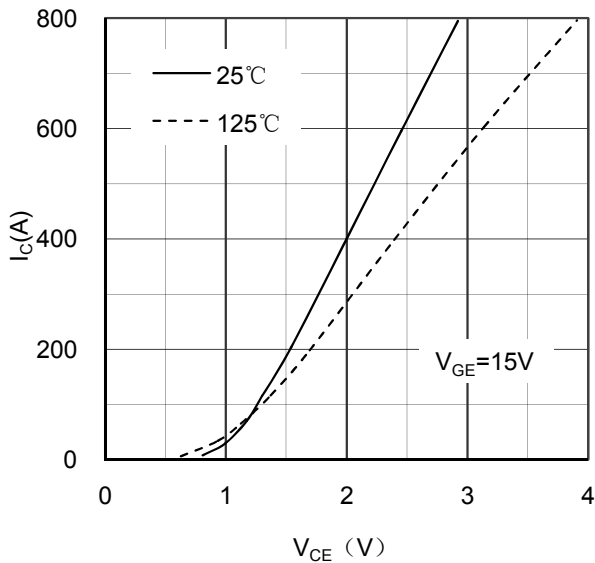


Figure 1. Typical Output Characteristics IGBT-inverter

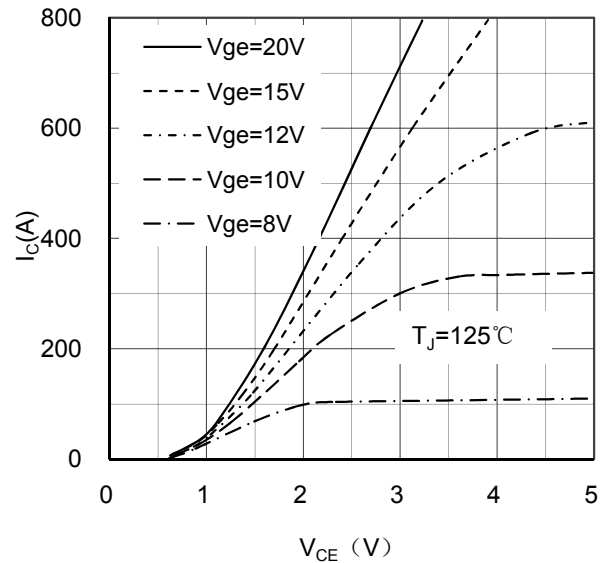


Figure 2. Typical Output Characteristics IGBT-inverter

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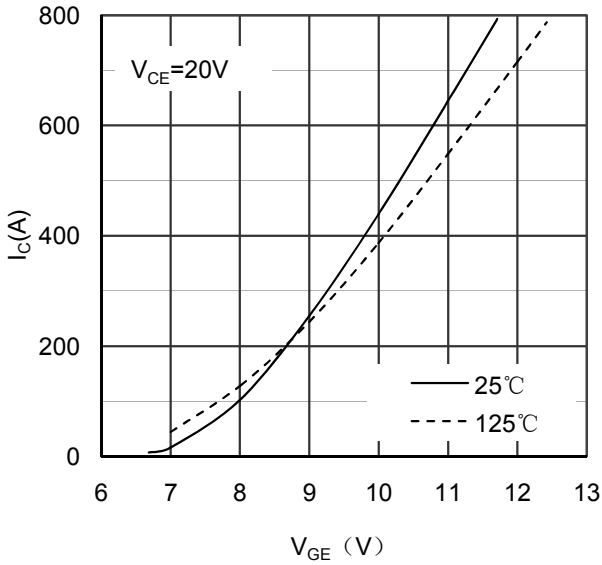


Figure 3. Typical Transfer characteristics IGBT-inverter

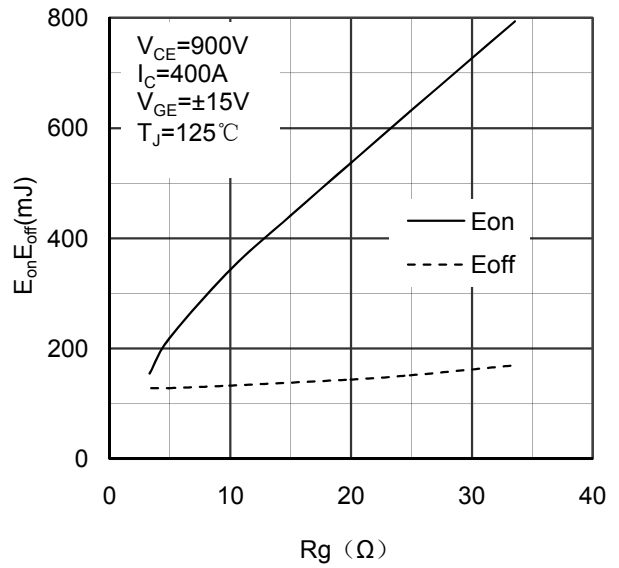


Figure 4. Switching Energy vs Gate Resistor IGBT-inverter

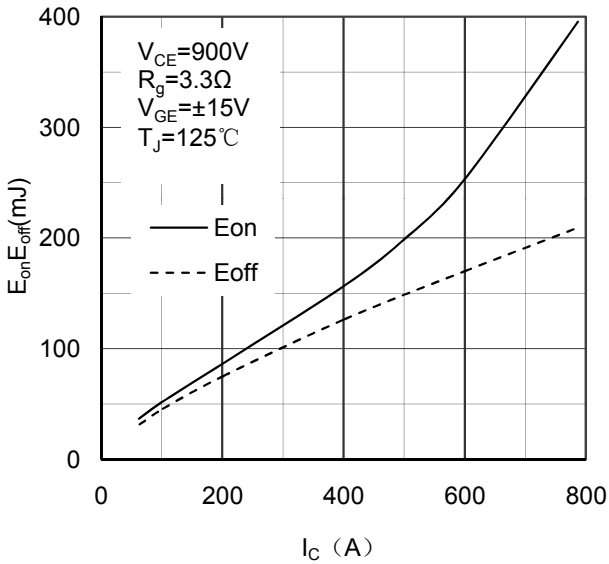


Figure 5. Switching Energy vs Collector Current IGBT-inverter

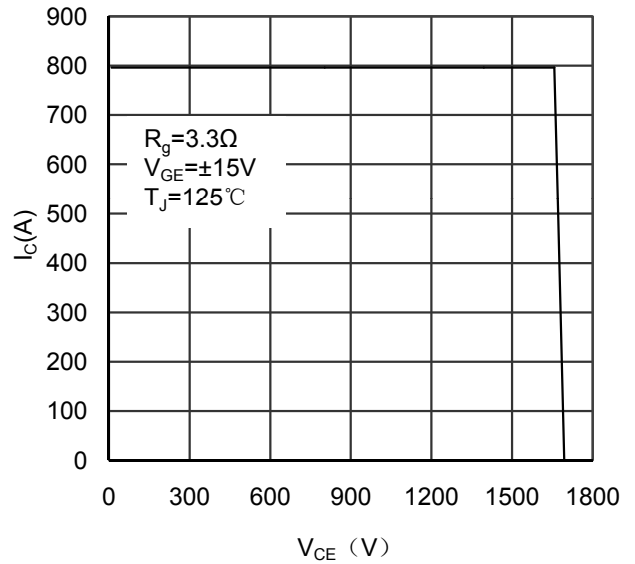


Figure 6. Reverse Biased Safe Operating Area IGBT-inverter

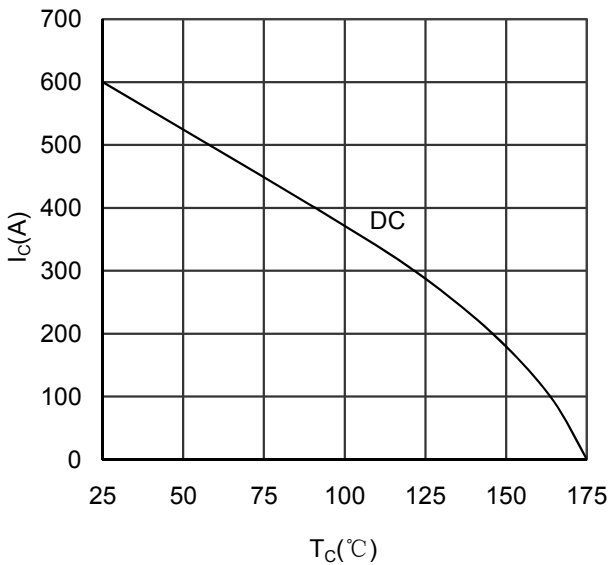


Figure 7. Collector Current vs Case temperature IGBT-inverter

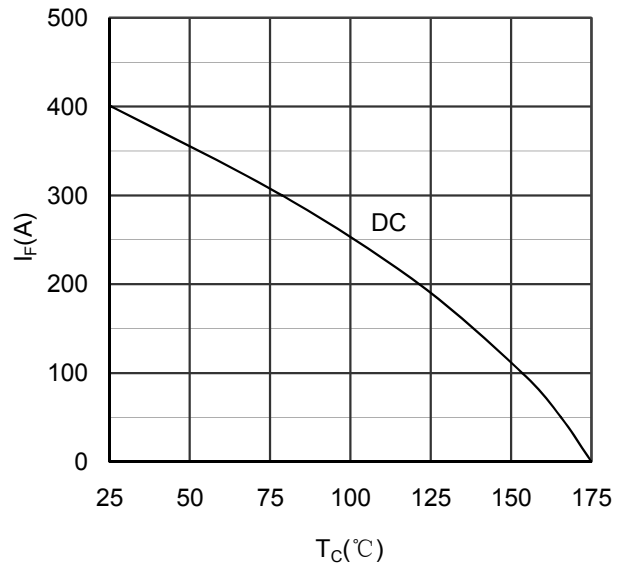


Figure 8. Forward current vs Case temperature Reverse-Diode

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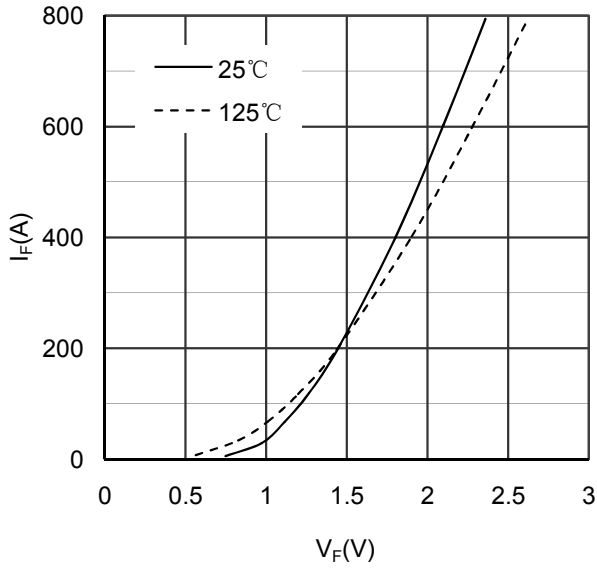


Figure 9. Diode Forward Characteristics Reverse-Diode

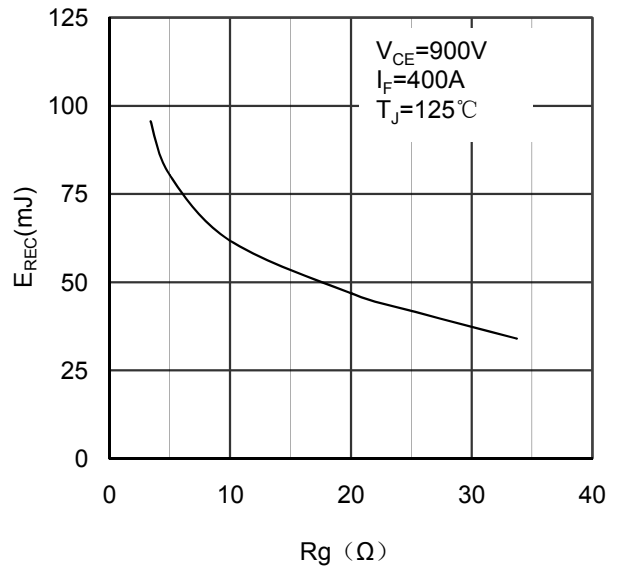


Figure 10. Switching Energy vs Gate Resistor Reverse-Diode

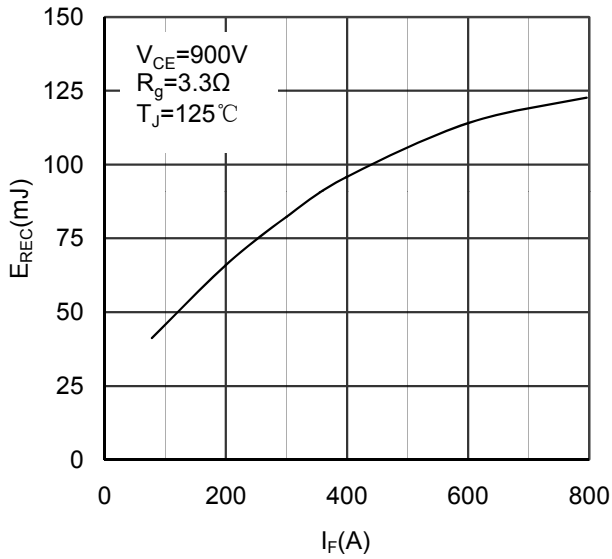


Figure 11. Switching Energy vs Forward Current Reverse-Diode

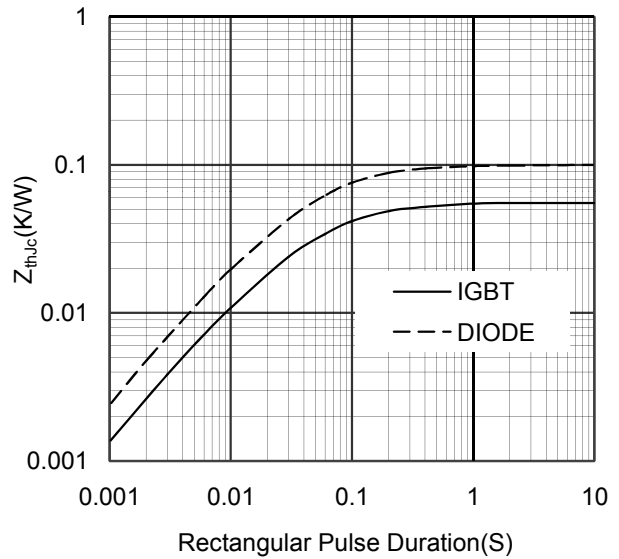
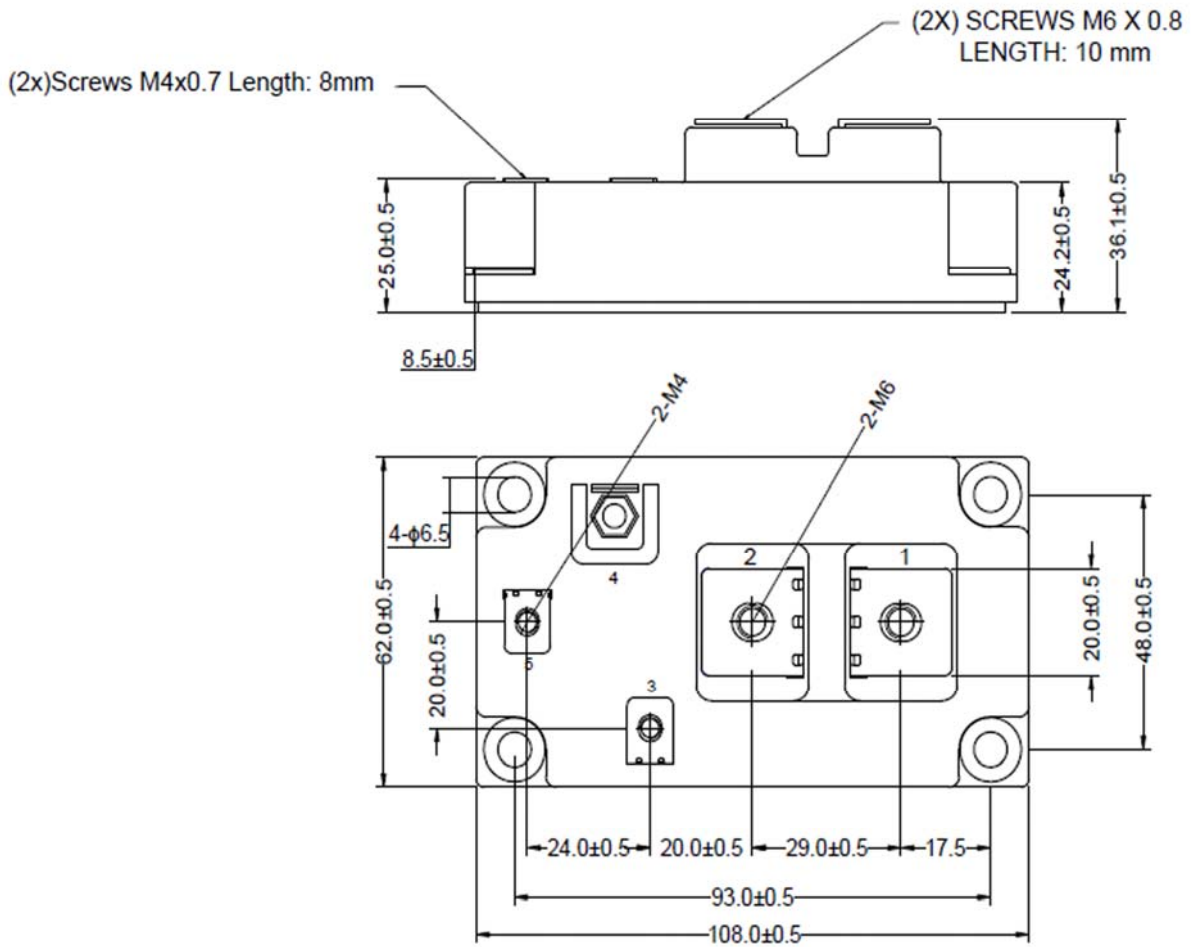


Figure 12. Transient Thermal Impedance of Reverse-Diode and IGBT-inverter

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Dimensions in (mm)
Figure 13. Package Outline