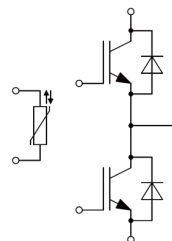


General Description

GD450HFY120C6S IGBT Power Module provides ultra low conduction loss as well as short circuit ruggedness. They are designed for the applications such as hybrid and electric vehicle.

Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- 10 μ s short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 175°C
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper baseplate using DBC technology



Equivalent Circuit Schematic

Typical Applications

- Hybrid and electric vehicle
- Inverter for motor drive
- Uninterruptible power supply

Absolute Maximum Ratings

$T_c=25^\circ\text{C}$ unless otherwise noted

IGBT			
Symbol	Description	Value	Unit
V_{CES}	Collector-Emitter Voltage	1200	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_c=25^\circ\text{C}$	698	A
	Collector Current @ $T_c=100^\circ\text{C}$	450	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	900	A
P_D	Maximum Power Dissipation @ $T_j=175^\circ\text{C}$	2272	W
Diode			
Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	450	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	900	A
Module			
Symbol	Description	Value	Unit
T_{jmax}	Maximum Junction Temperature	175	$^\circ\text{C}$
T_{jop}	Operating Junction Temperature	-40 to +150	$^\circ\text{C}$
T_{STG}	Storage Temperature Range	-40 to +125	$^\circ\text{C}$
V_{ISO}	Isolation Voltage RMS, $f=50\text{Hz}$, $t=1\text{min}$	2500	V

IGBT Characteristics

Tc=25°C, unless otherwise specified

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=450A, V_{GE}=15V, T_J=25^{\circ}C$		1.70	2.15	V
		$I_C=450A, V_{GE}=15V, T_J=125^{\circ}C$		1.95		
		$I_C=450A, V_{GE}=15V, T_J=150^{\circ}C$		2.00		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=18.0mA, V_{CE}=V_{GE}, T_J=25^{\circ}C$	5.6	6.2	6.8	V
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0V, T_J=25^{\circ}C$			1	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{CE}=V_{CES}, V_{GE}=0V, T_J=25^{\circ}C$			400	nA
R_{Gint}	Internal Gate Resistance			0.7		Ω
C_{ies}	Input Capacitance	$V_{CE}=25V, f=1MHz$		46.6		nF
C_{res}	Reverse Transfer Capacitance	$V_{GE}=0V$		1.31		nF
Q_G	Gate Charge	$V_{GE}=-15...+15V$		3.50		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=450A,$ $R_G=1.5\Omega, L_s=45nH,$ $V_{GE}=\pm 15V, T_J=25^{\circ}C$		208		ns
t_r	Rise Time			54		ns
$t_{d(off)}$	Turn-Off Delay Time			356		ns
t_f	Fall Time			256		ns
E_{on}	Turn-On Switching Loss			25.4		mJ
E_{off}	Turn-Off Switching Loss			42.1		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=450A,$ $R_G=1.5\Omega, L_s=45nH,$ $V_{GE}=\pm 15V, T_J=125^{\circ}C$		221		ns
t_r	Rise Time			58		ns
$t_{d(off)}$	Turn-Off Delay Time			420		ns
t_f	Fall Time			370		ns
E_{on}	Turn-On Switching Loss			39.2		mJ
E_{off}	Turn-Off Switching Loss			57.6		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=450A,$ $R_G=1.5\Omega, L_s=45nH,$ $V_{GE}=\pm 15V, T_J=150^{\circ}C$		230		ns
t_r	Rise Time			62		ns
$t_{d(off)}$	Turn-Off Delay Time			431		ns
t_f	Fall Time			403		ns
E_{on}	Turn-On Switching Loss			45.3		mJ
E_{off}	Turn-Off Switching Loss			60.2		mJ
I_{SC}	SC Data	$t_p \leq 10\mu s, V_{GE}=15V,$ $T_J=150^{\circ}C, V_{CC}=800V,$ $V_{CEM} \leq 1200V$		1800		A

Diode Characteristics

Tc=25°C, unless otherwise specified

Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Diode Forward Voltage	I _F =450A, V _{GE} =0V, T _j =25°C		1.60	2.05	V
	I _F =450A, V _{GE} =0V, T _j =125°C		1.70		
	I _F =450A, V _{GE} =0V, T _j =150°C		1.70		
Recovered Charge	V _{CC} =600V, I _F =450A,		28.6		μC
Peak Reverse Recovery Current	-di/dt=7860A/μs, L _s =45nH,		393		A
Reverse Recovery Energy	V _{GE} =-15V, T _j =25°C		22.8		mJ
Recovered Charge	V _{CC} =600V, I _F =450A,		56.6		μC
Peak Reverse Recovery Current	-di/dt=7160A/μs, L _s =45nH,		453		A
Reverse Recovery Energy	V _{GE} =-15V, T _j =125°C		38.2		mJ
Recovered Charge	V _{CC} =600V, I _F =450A,		63.7		μC
Peak Reverse Recovery Current	-di/dt=6760A/μs, L _s =45nH,		462		A
Reverse Recovery Energy	V _{GE} =-15V, T _j =150°C		41		mJ

NTC Characteristics

Tc=25°C, unless otherwise specified

Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Rated Resistance			5.0		kΩ
Deviation of R ₁₀₀	T _C =100°C, R ₁₀₀ =493.3Ω	-5		5	%
Power Dissipation				20.0	mW
B-value	R ₂ =R ₂₅ exp[B _{25/50} (1/T ₂ -1/298.15K)]		3375		K
B-value	R ₂ =R ₂₅ exp[B _{25/80} (1/T ₂ -1/298.15K)]		3411		K
B-value	R ₂ =R ₂₅ exp[B _{25/100} (1/T ₂ -1/298.15K)]		3433		K

Module Characteristics

Tc=25°C, unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit
L _{CE}	Stray Inductance		20		nH
R _{CC'+EE'}	Module Lead Resistance, Terminal to Chip		1.10		mΩ
R _{thJC}	Junction-to-Case (per IGBT)			0.066	K/W
	Junction-to-Case (per Diode)			0.109	
R _{thCH}	Case-to-Heatsink (per IGBT)		0.029		K/W
	Case-to-Heatsink (per Diode)		0.048		
	Case-to-Heatsink (per Module)		0.009		
M	Terminal Connection Torque, Screw M6	3.0		6.0	N · m
	Mounting Torque, Screw M5	3.0		6.0	
G	Weight of Module		350		g

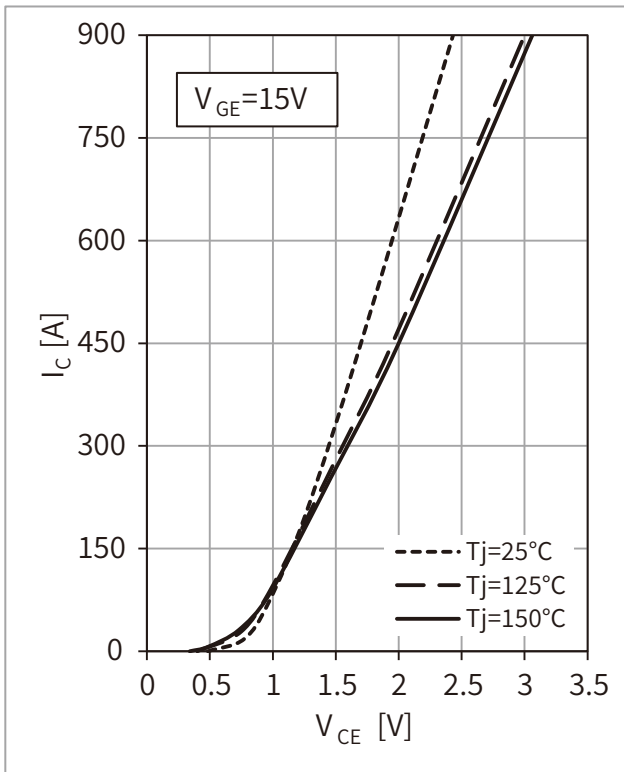


Fig 1. IGBT Output Characteristics

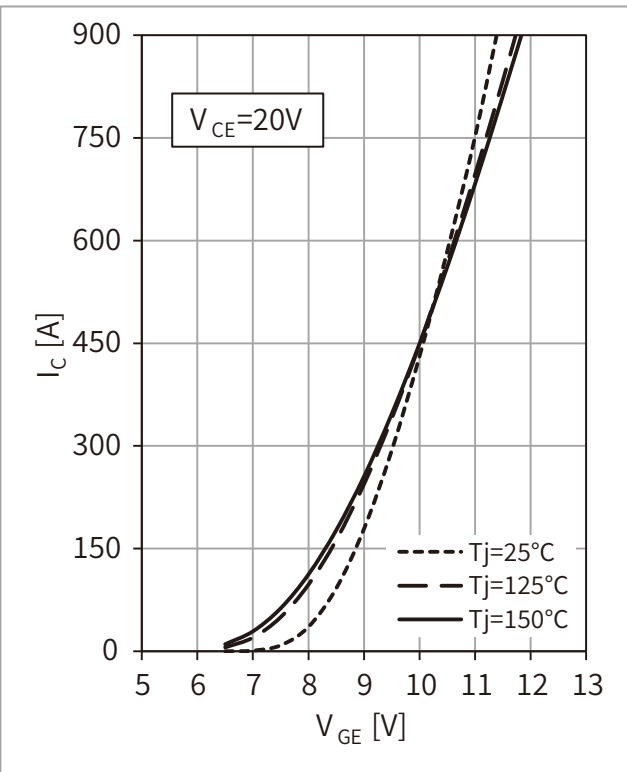


Fig 2. IGBT Transfer Characteristics

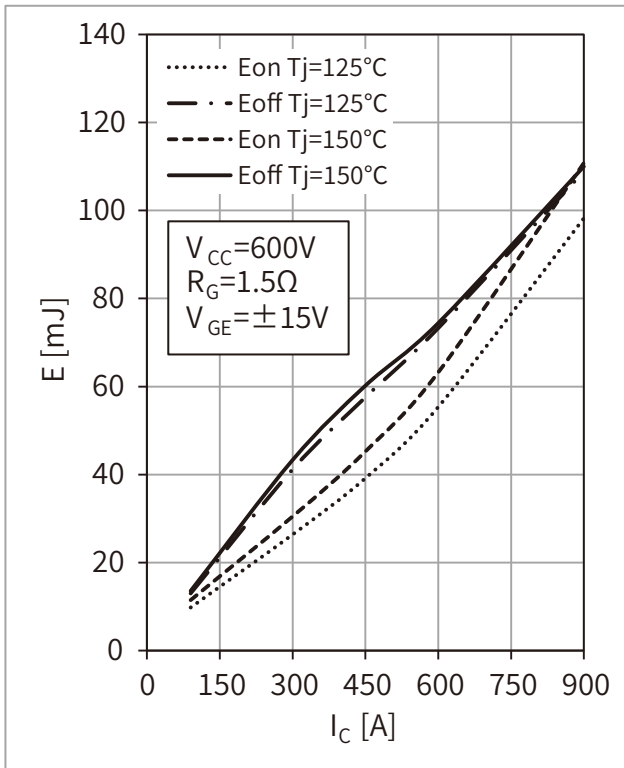


Fig 3. IGBT Switching Loss vs. I_c

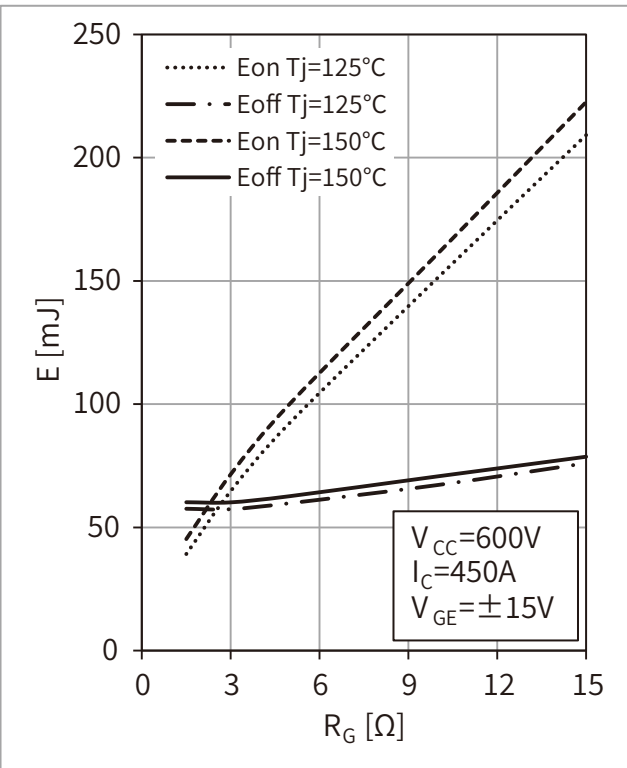


Fig 4. IGBT Switching Loss vs. R_G

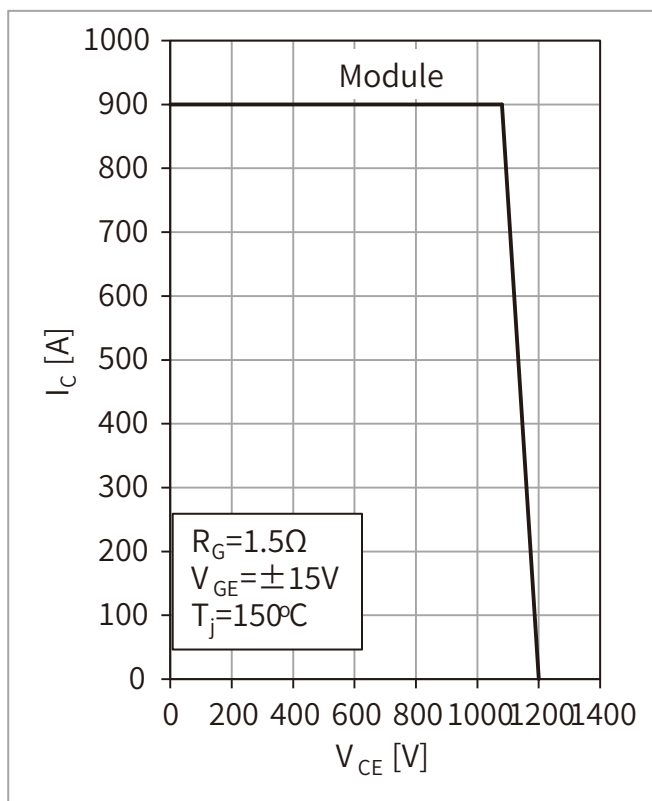


Fig 5. RBSOA

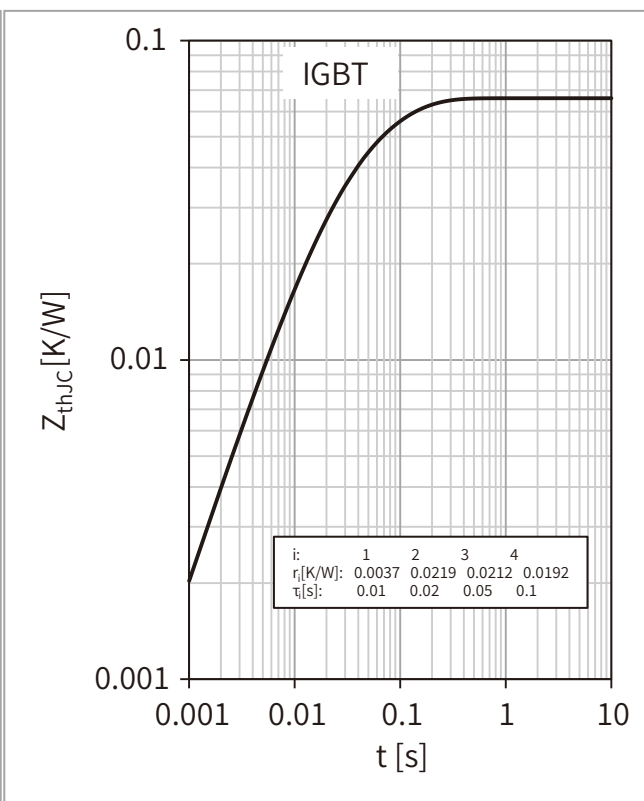


Fig 6. IGBT Transient Thermal Impedance

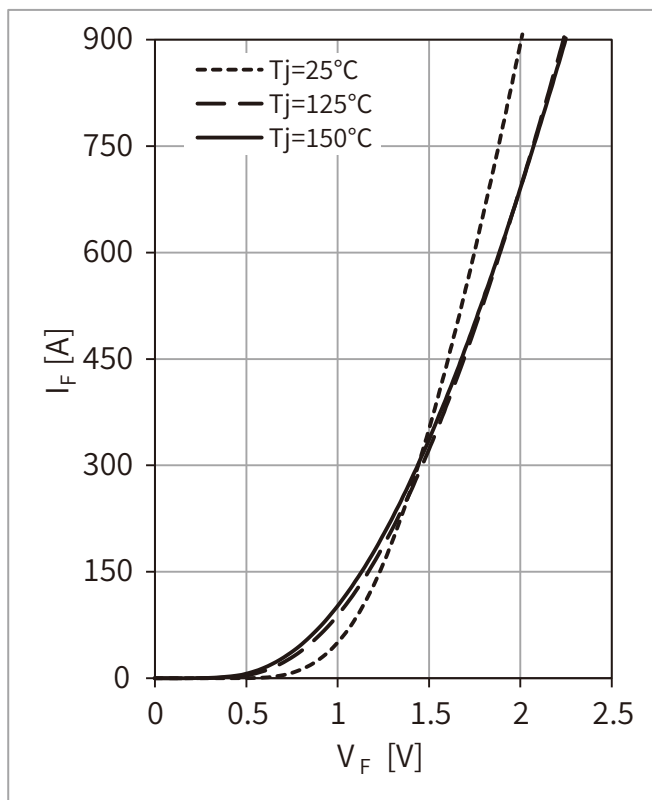


Fig 7. Diode Forward Characteristics

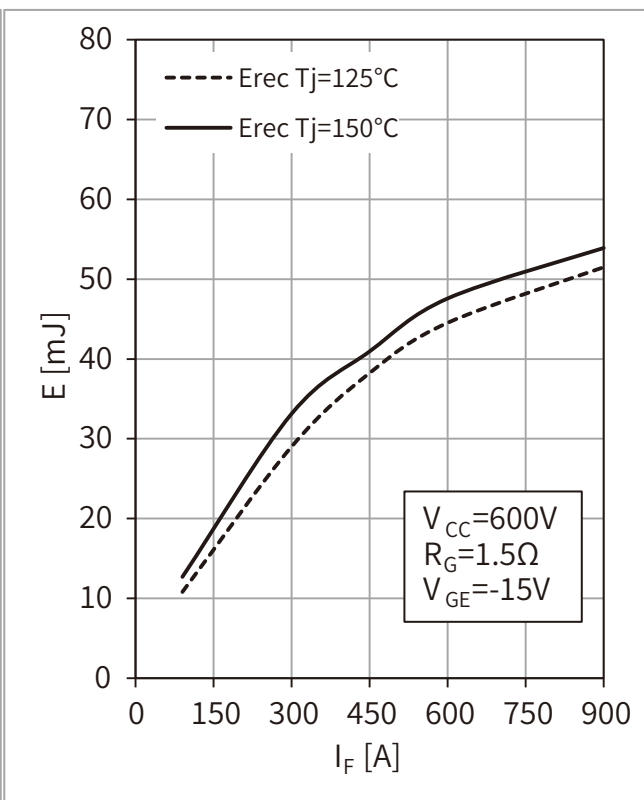
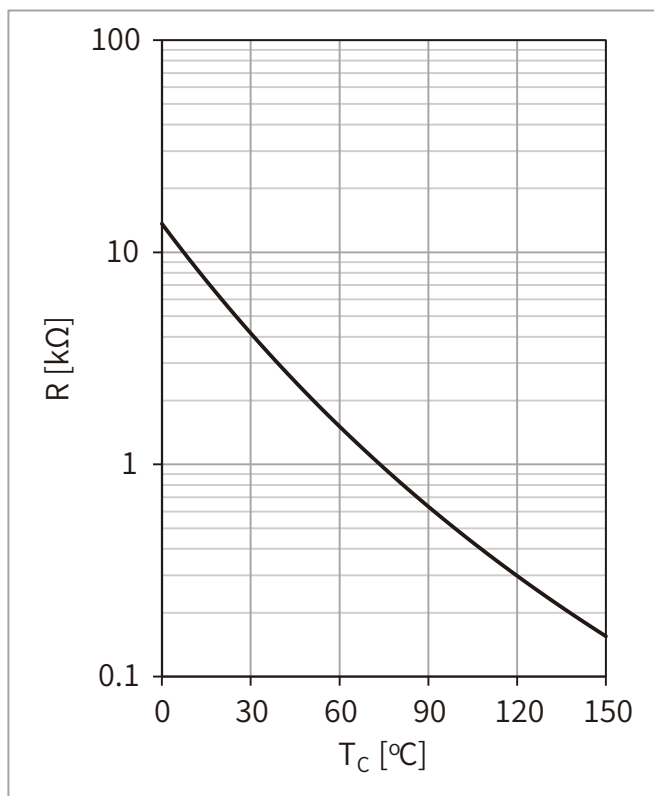
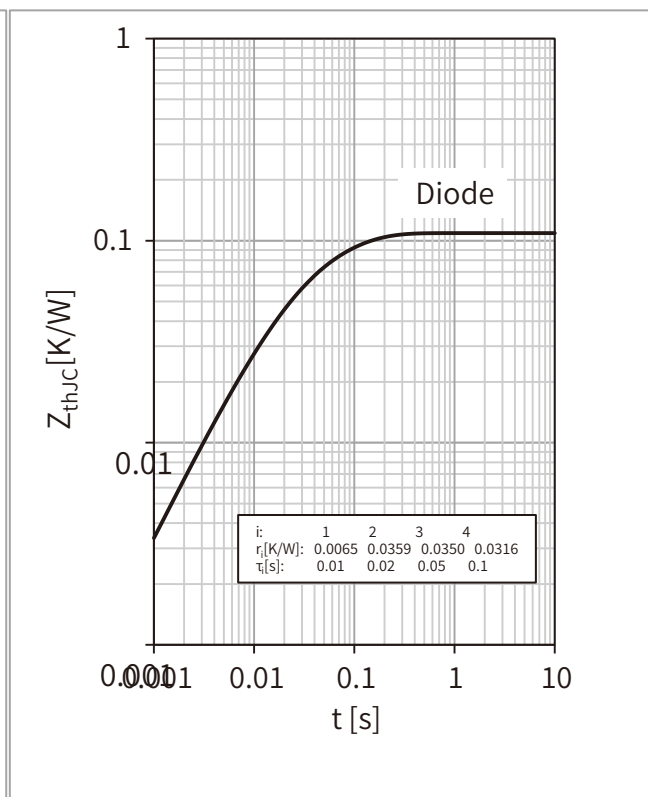
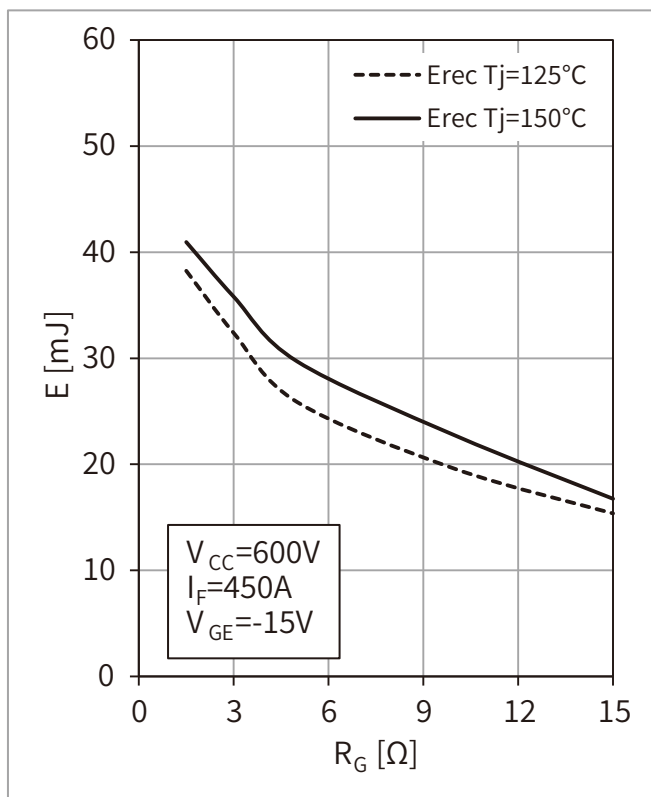
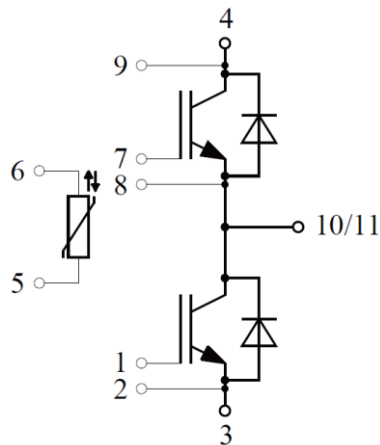


Fig 8. Diode Switching Loss vs. I_F

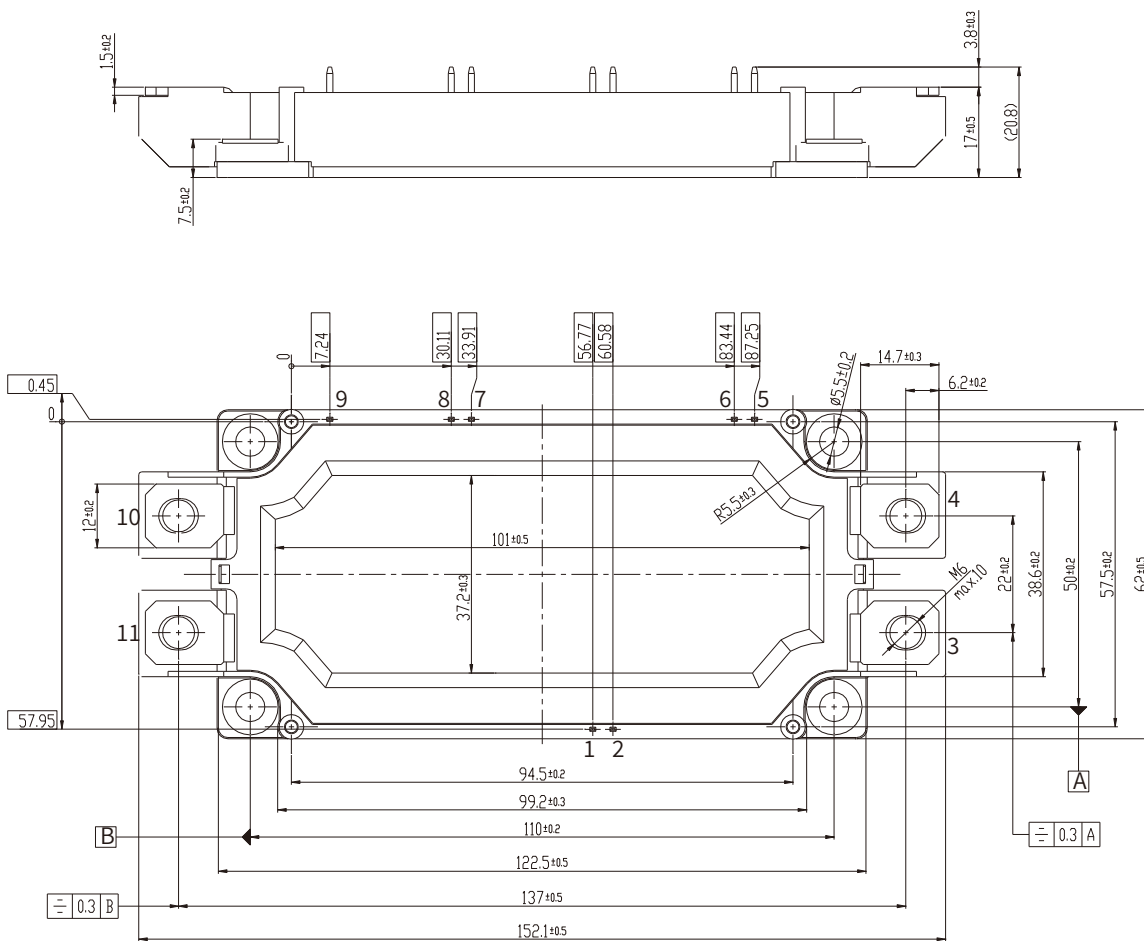


Circuit Schematic



Package Dimension

Dimensions in Millimeters



 = all dimension with tolerance of ± 0.5