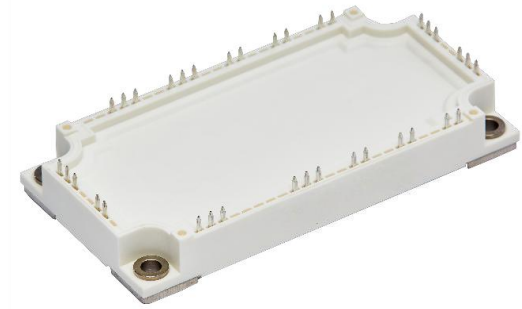


EconoPIM3 PIM IGBT Module

$V_{CES}=1200V, I_C=75A, V_{CE(sat)}=1.9V$

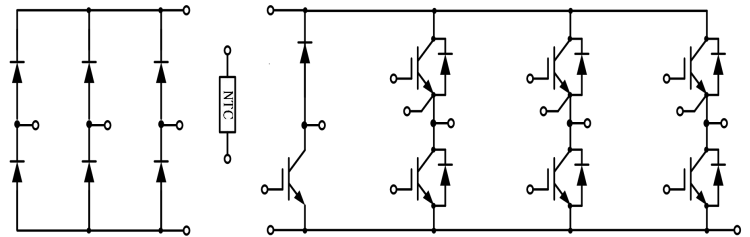
Features

- 1200V Trench Gate/Field Termination Process
- Low Switching Losses
- $V_{CE(sat)}$ With Positive Temperature Coefficient
- Integrated NTC Temperature Sensor



Applications

- Power Conversion System
- Inverter
- Servo Drives



IGBT, Inverter Maximum Ratings

Parameter	Symbol	Condition	Value	Unit
Collector-emitter voltage	V_{CES}	$T_{vj}=25^{\circ}C, V_{GE}=0V$	1200	V
Continuous DC collector current	$I_{C\ nom}$	$T_C=100^{\circ}C$	75	A
Repetitive peak collector current	I_{CRM}	$t_P=1ms$	150	A
Total power dissipation	P_{tot}	$T_C=25^{\circ}C, T_{vj\ max}=175^{\circ}C$	455	W
Gate-emitter peak voltage	V_{GES}	$T_{vj}=25^{\circ}C$	± 20	V
Short Circuit Withstand Time	t_{SC}	$T_J=150^{\circ}C$	>10	μs

Characteristics Values

Parameter	Symbol	Conditions	Value			Unit	
			Min.	Typ.	Max.		
Collector-emitter saturation voltage	$V_{CE(sat)}$	$I_C=75A, V_{GE}=15V$	$T_{vj}=25^{\circ}C$	1.9	2.1	V	
			$T_{vj}=125^{\circ}C$	2.2		V	
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C=1mA, V_{CE}=V_{GE}$	$T_{vj}=25^{\circ}C$	4.5	5.4	6.5	V
Gate charge	Q_G	$V_{CE}=600V, I_C=75A$ $V_{GE}=-15V...+15V$		630			μC
Input capacitance	C_{ies}	$f=1MHz, V_{CE}=25V,$ $V_{GE}=0V$	$T_{vj}=25^{\circ}C$	10.4			nF
Reverse transfer capacitance	C_{res}		$T_{vj}=25^{\circ}C$	0.56			nF
Collector-emitter cut-off current	I_{CES}	$V_{CE}=V_{CES}, V_{GE}=0V$	$T_{vj}=25^{\circ}C$			500	μA

Gate-emitter leakage current	I_{GES}	$V_{GE}=V_{GES}$ $V_{CE}=0V$	$T_{vj}=25^{\circ}C$			300	nA	
Turn-on delay time	$t_{d\ on}$	$I_C=75A$, $V_{CE}=600V$, $V_{GE}=\pm 15V$, $R_G=15\Omega$, Inductive Load	$T_{vj}=25^{\circ}C$		190		ns	
			$T_{vj}=125^{\circ}C$		175			
Rise time	t_r		$T_{vj}=25^{\circ}C$		100			
			$T_{vj}=125^{\circ}C$		110			
Turn-off delay time	$t_{d\ off}$		$T_{vj}=25^{\circ}C$		270			
			$T_{vj}=125^{\circ}C$		280			
Fall time	t_f		$T_{vj}=25^{\circ}C$		160			
			$T_{vj}=125^{\circ}C$		240			
Turn-on energy loss per pulse	E_{on}			$T_{vj}=25^{\circ}C$		5.2		mJ
				$T_{vj}=125^{\circ}C$		6.9		
Turn-off energy loss per pulse	E_{off}	$T_{vj}=25^{\circ}C$			3.6			
		$T_{vj}=125^{\circ}C$			5.5			
Total Switching Loss	E_{ts}	$V_{CC}=600V$, $I_C=75A$, $R_G=15\Omega$, $V_{GE}=\pm 15V$, Inductive Load		$T_{vj}=25^{\circ}C$		8.8		
				$T_{vj}=125^{\circ}C$		12.4		
Reverse Bias Safe Operating Area	RBSOA			$I_C=150A$, $V_{CC}=960V$, $V_p=1200V$, $R_g=15\Omega$, $V_{GE}=+15V$ to $0V$, $T_J=150^{\circ}C$	Trapezoid			
Short Circuit Safe Operating Area	SCSOA			$V_{CC}=600V$, $V_{GE}=15V$, $T_J=150^{\circ}C$		10		μs

Diode, Inverter Maximum Ratings

Parameter	Symbol	Conditions	Value	Unit
Repetitive peak reverse voltage	V_{RRM}	$T_{vj}=25^{\circ}C$	1200	V
Continuous forward current	I_F		50	A
Repetitive peak forward current	I_{FRM}	$t_p=1ms$	100	A
I^2t -value	I^2t	$V_R=0V$, $t_p=10ms$	$T_{vj}=125^{\circ}C$	1200 A^2s

Characteristics Values

Parameter	Symbol	Conditions	Value			Unit	
			Min.	Typ.	Max.		
Forward voltage	V_F	$I_F=75A$, $V_{GE}=0V$	$T_{vj}=25^{\circ}C$		2.0	2.2	V
			$T_{vj}=150^{\circ}C$		2.2		V
Reverse Recovery Time	t_{rr}	$I_F=75A$, $V_R=600V$, $V_{GE}=-15V$, $-diF/dt=750A/\mu s$	$T_J=25^{\circ}C$		190		ns
			$T_J=125^{\circ}C$		200		ns
Peak reverse recovery current	I_{RM}		$T_{vj}=25^{\circ}C$		46		A
			$T_{vj}=125^{\circ}C$		75		A
Recovered charge	Q_{rr}		$T_{vj}=25^{\circ}C$		4.5		μC
			$T_{vj}=125^{\circ}C$		9.1		μC

Reverse recovery energy	E_{rec}	$I_F=75A,$ $V_R=600V,$ $V_{GE}=-15V,$ $-diF/dt=750A/\mu s$	$T_{vj}=25^\circ C$	1.2	mJ
			$T_{vj}=125^\circ C$	3.2	mJ
Temperature under switching conditions	$T_{vj\ op}$		-40	150	$^\circ C$

Diode, Rectifier Maximum Ratings

Description	Symbol	Conditions	Value	Unit
Repetitive Peak Reverse Voltage	V_{RRM}	$T_J=25^\circ C$	1600	V
Forward Current RMS Maximum Per Diode	I_R	$T_C=80^\circ C$	80	A
Maximum RMS Current At Rectifier Output	I_{RMSM}	$T_C=80^\circ C$	120	A
Surge current @ $t_p=10\ ms$	I_{FSM}	$T_J=25^\circ C$	500	A
		$T_J=150^\circ C$	400	
I^2t -value	I^2t	$t_p=10ms\ T_J=25^\circ C$	1250	A ² s
		$t_p=10ms\ T_J=150^\circ C$	800	

Characteristics Values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Forward voltage	V_F	$I_F=75A$ $V_{GE}=0V$	$T_{vj}=25^\circ C$	1.15	1.35	V
			$T_{vj}=150^\circ C$	1.1		V

IGBT, Brake-Chopper Maximum Ratings

Parameter	Symbol	Conditions	Value	Unit
Collector-emitter voltage	V_{CES}	$T_{vj}=25^\circ C$	1200	V
Continuous DC collector current	$I_{C\ nom}$	$T_C=80^\circ C$	40	A
		$T_{vj}=25^\circ C$	60	A
Repetitive peak collector current	I_{CRM}	$t_p=1ms\ T_J=175^\circ C$	80	A
Total power dissipation	P_{tot}	$T_C=25^\circ C, T_{vj\ max}=175^\circ C$	375	W
Gate-emitter peak voltage	V_{GE}	$T_C=25^\circ C, T_{vj\ max}=175^\circ C$	± 20	V

Characteristics Values

Parameter	Symbol	Conditions	Value			Unit	
			Min.	Typ.	Max.		
Collector-emitter saturation voltage	$V_{CE(sat)}$	$I_C=40A, V_{GE}=15V$	$T_{vj}=25^\circ C$	2.0	2.2	V	
			$T_{vj}=125^\circ C$	2.26	2.46	V	
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C=1mA, V_{CE}=V_{GE}$	$T_{vj}=25^\circ C$	3.5	4.4	5.5	V
Gate charge	Q_G	$V_{CE}=600V, I_C=40A$ $V_{GE}=-15V...+15V$		235		μC	
Input capacitance	C_{ies}	$f=1MHz, V_{CE}=25V, V_{GE}=0V$	$T_{vj}=25^\circ C$	4.9		nF	
Reverse transfer capacitance	C_{res}		$T_{vj}=25^\circ C$	0.3		nF	

Collector-emitter cut-off current	I_{CES}	$V_{GE}=0V, V_{CE}=V_{CES}$	$T_{vj}=25^{\circ}C$		300	μA
			$T_{vj}=125^{\circ}C$		900	
Gate-emitter leakage current	I_{GES}	$V_{GE}=V_{GES}, V_{CE}=0V$	$T_{vj}=25^{\circ}C$		300	μA
			$T_{vj}=125^{\circ}C$		600	
Turn-on delay time	$t_{d\ on}$	$V_{CC}=600V, I_C=40A, R_G=15\Omega, V_{GE}=\pm 15V, \text{Inductive Load,}$	$T_{vj}=25^{\circ}C$	90		ns
Rise time	t_r		$T_{vj}=125^{\circ}C$	80		
			$T_{vj}=25^{\circ}C$	50		
Turn-off delay time	$t_{d\ off}$		$T_{vj}=125^{\circ}C$	50		
			$T_{vj}=25^{\circ}C$	140		
Fall time	t_f		$T_{vj}=125^{\circ}C$	145		
			$T_{vj}=25^{\circ}C$	180		
Turn-on energy loss per pulse	E_{on}		$T_{vj}=25^{\circ}C$	1.9		mJ
Turn-off energy loss per pulse	E_{off}		$T_{vj}=125^{\circ}C$	2.0		
			$T_{vj}=25^{\circ}C$	1.1		
Total Switching Loss	E_{ts}	$T_{vj}=125^{\circ}C$	2.1			
		$T_{vj}=25^{\circ}C$	3.0			
Temperature under switching conditions	$T_{vj\ op}$			-40	150	$^{\circ}C$
Reverse Bias Safe Operating Area	RBSOA	$I_C=80A, V_{CC}=960V, V_p=1200V, R_g=15\Omega, V_{GE}=+15V \text{ to } 0V, T_J=150^{\circ}C$	Trapezoid			

Diode, Brake-Chopper Maximum Ratings

Parameter	Symbol	Conditions	Value	Unit	
Repetitive peak reverse voltage	V_{RRM}	$T_{vj}=25^{\circ}C$	1200	V	
Continuous forward current	I_F		25	A	
Repetitive peak forward current	I_{FRM}	$t_p=1ms$	50	A	
I^2t -value	I^2t	$V_R=0V, t_p=10ms$	$T_{vj}=125^{\circ}C$	170	A^2s

Characteristics Values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Forward voltage	V_F	$I_F=25A, V_{GE}=0V$	$T_{vj}=25^{\circ}C$	2.0	2.2	V
			$T_{vj}=150^{\circ}C$	2.1		
Reverse Recovery Time	t_{rr}	$I_F=25A, di/dt=850A/\mu s, V_{rr}=600V, V_{GE}=-15V$	$T_{vj}=25^{\circ}C$	100		ns
			$T_{vj}=125^{\circ}C$	135		
Peak reverse recovery current	I_{RM}	$V_{rr}=600V, V_{GE}=-15V$	$T_{vj}=25^{\circ}C$	30		A
			$T_{vj}=125^{\circ}C$	50		

Recovered charge	Q_{rr}	$I_F=25A,$ $di/dt=850A/\mu s,$ $V_{rr}=600V,$ $V_{GE}=-15V$	$T_{vj}=25^\circ C$		2.0		μC
			$T_{vj}=125^\circ C$		3.5		
Reverse recovery energy	E_{rec}	$I_F=25A,$ $di/dt=850A/\mu s,$ $V_{rr}=600V,$ $V_{GE}=-15V$	$T_{vj}=25^\circ C$		1.0		mJ
			$T_{vj}=125^\circ C$		1.6		
Temperature under switching conditions	$T_{vj\ op}$			-40		150	$^\circ C$

NTC-Thermistor Characteristics Values

Symbol	Condition	Typ.	Max.	Unit
R_{25}	$TC=25^\circ C$	5		k Ω
$\Delta R/R$	$TC=100^\circ C, R_{100}=481\Omega$		± 5	%
P_{25}	$TC=25^\circ C$	50		mW
$B_{25/50}$	$R_2=R_{25} \exp[B_{25/50}(1/T_2-1/(298.15K))]$	3380		K
$B_{25/80}$	$R_2=R_{25} \exp[B_{25/80}(1/T_2-1/(298.15K))]$	3440		K

Module Characteristics Values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Isolation test voltage	V_{ISOL}	RMS, $f=50Hz, t=1\ min$		2.5		kV
Operating Junction Temperature of IGBT	T_J		-40		175	$^\circ C$
Operating Junction Temperature of diode	T_J		-40		150	$^\circ C$
Storage temperature	T_{stg}		-40		125	$^\circ C$
Mounting torque for module mounting	M		3	-	6	N·m
Weight	G			300		g

Typical Characteristics

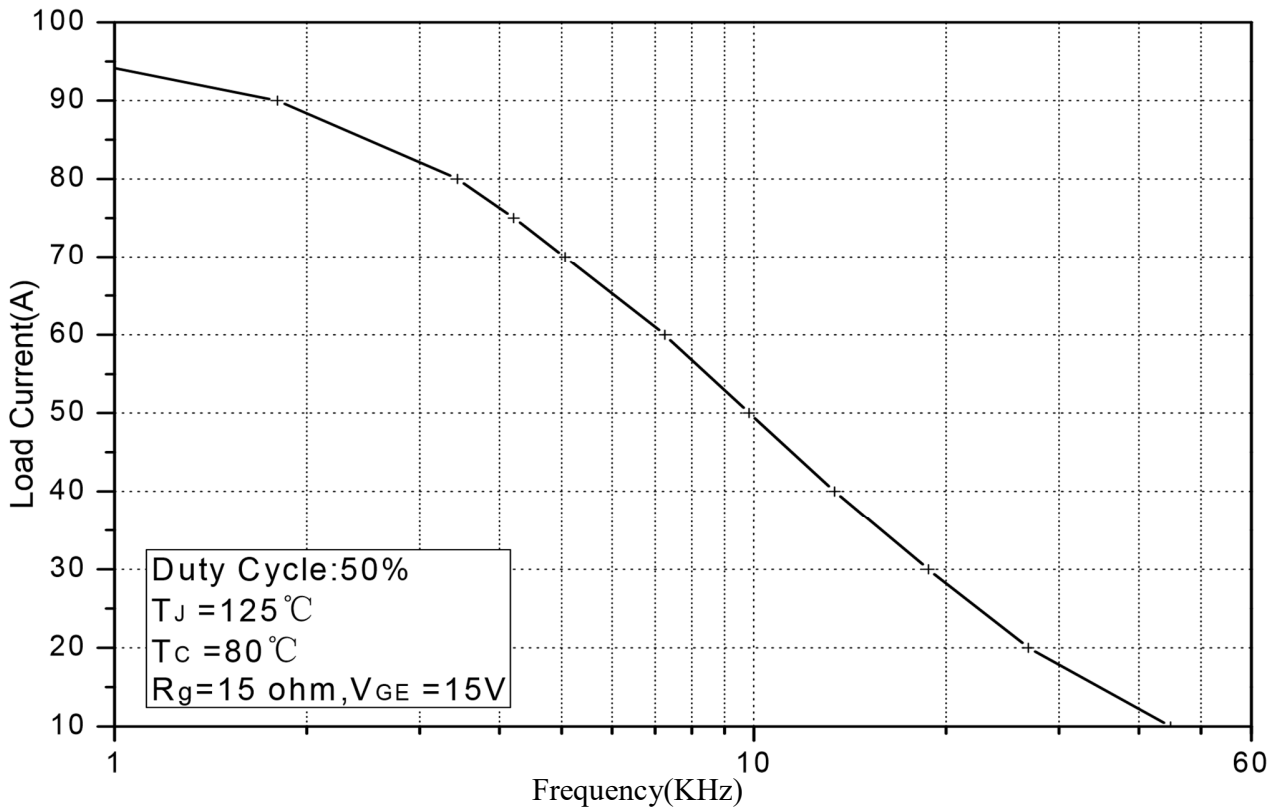


Fig.1 Typical Load Current vs. Frequency(IGBT Inverter)

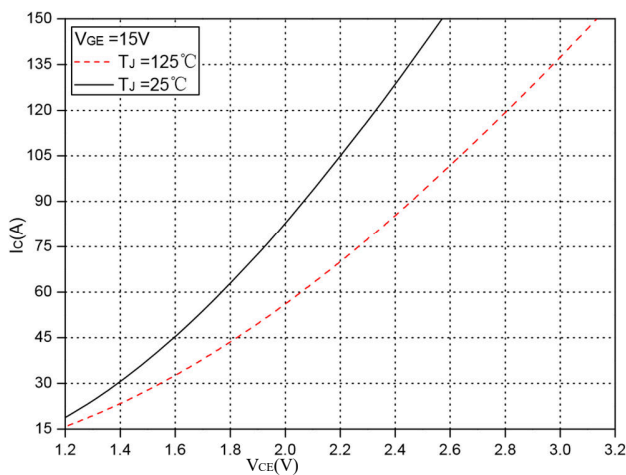


Fig.2 Typical Saturation Voltage Characteristics (IGBT Inverter)

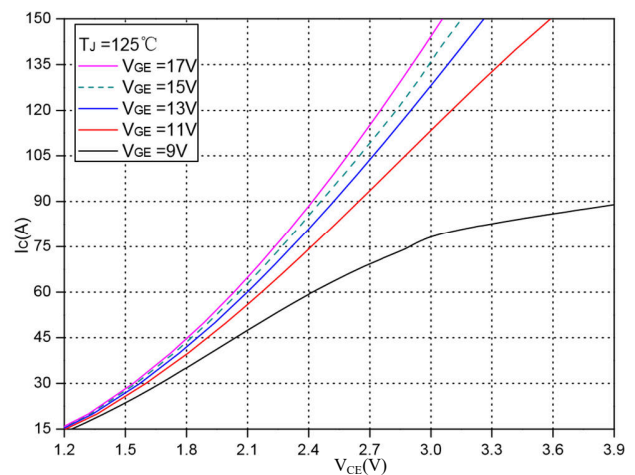
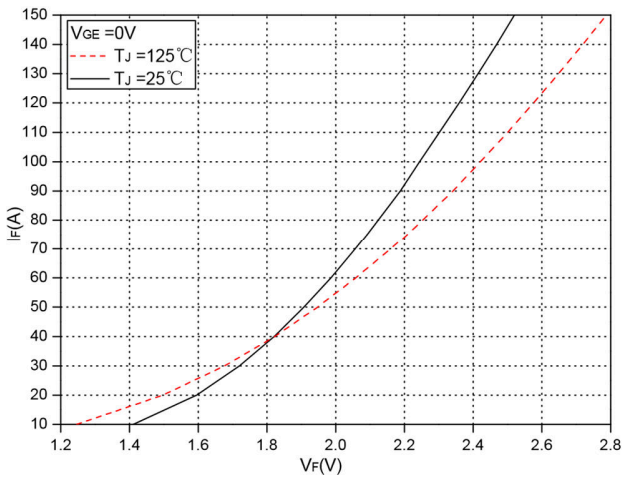
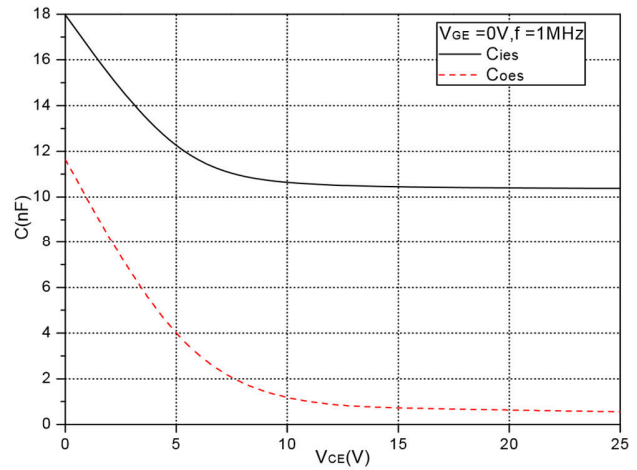


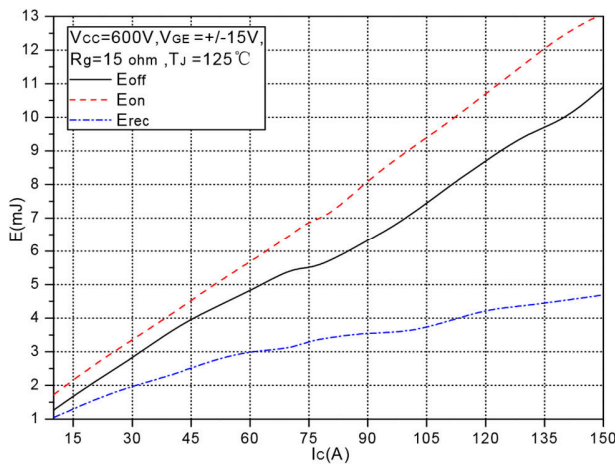
Fig.3 Typical Output Characteristics (IGBT Inverter)



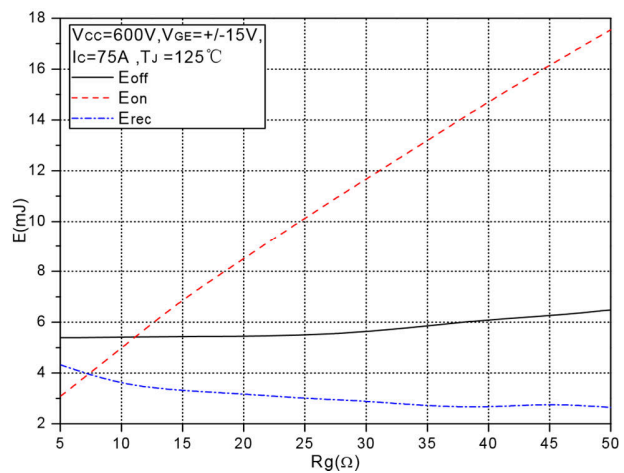
**Fig.4 Forward Characteristics of FWD
(Diode Inverter)**



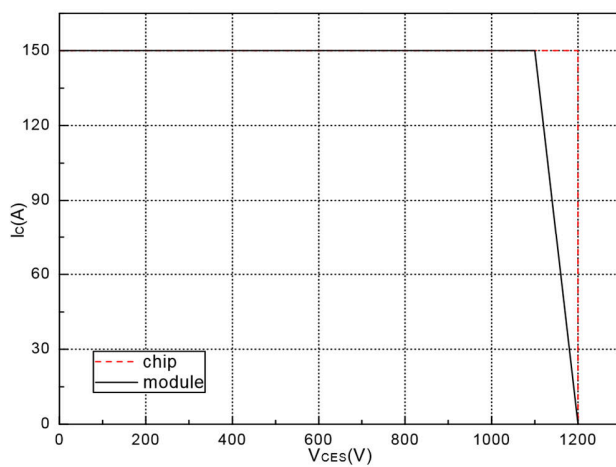
**Fig.5 Capacitance Characteristics
(IGBT Inverter)**



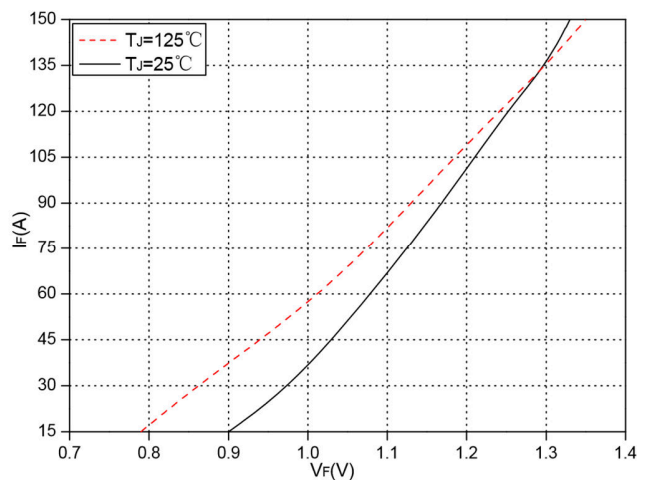
**Fig.6 Typical Switching Loss vs. Collector Current
(IGBT & Diode Inverter)**



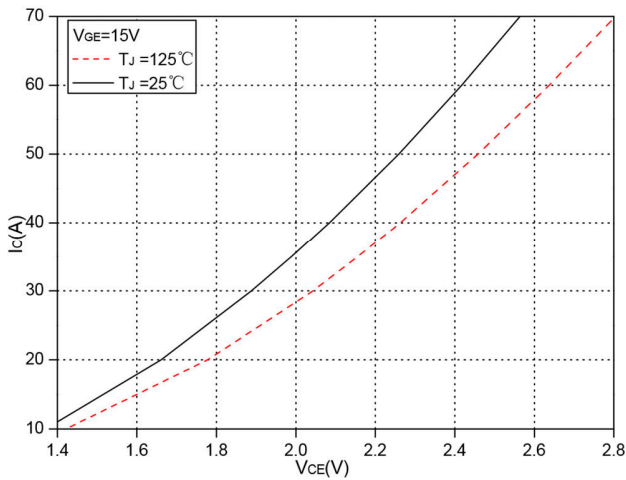
**Fig.7 Typical Switching Loss vs. Gate Resistance
(IGBT & Diode Inverter)**



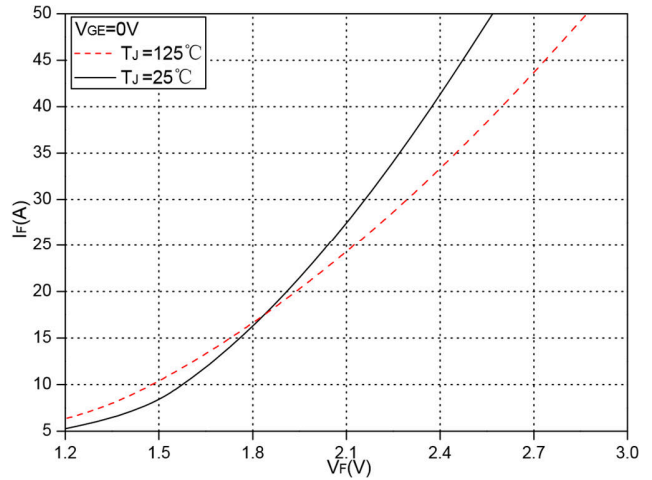
**Fig.8 Reverse Bias Safe Operation Area (RBSOA)
(IGBT Inverter)**



**Fig.9 Forward Characteristics of Diode
(Diode Rectifier)**



**Fig.10 Typical Saturation Voltage Characteristics
(IGBT-Brake-Chopper)**



**Fig.11 Forward Characteristics of Diode
(Diode-Brake-Chopper)**

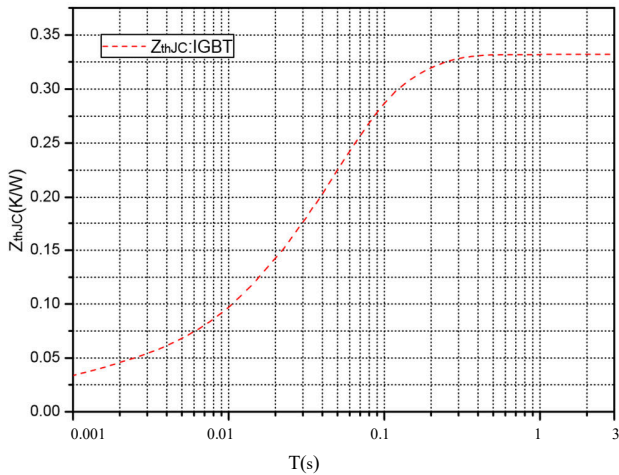


Fig.12 Transient thermal impedance (IGBT Inverter)

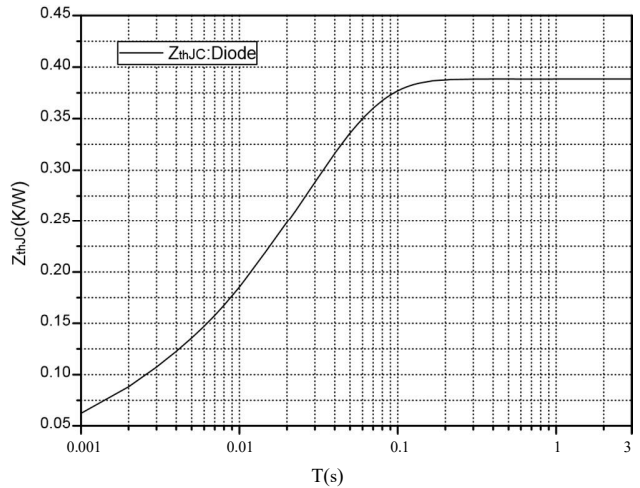


Fig.13 Transient thermal impedance (Diode Inverter)

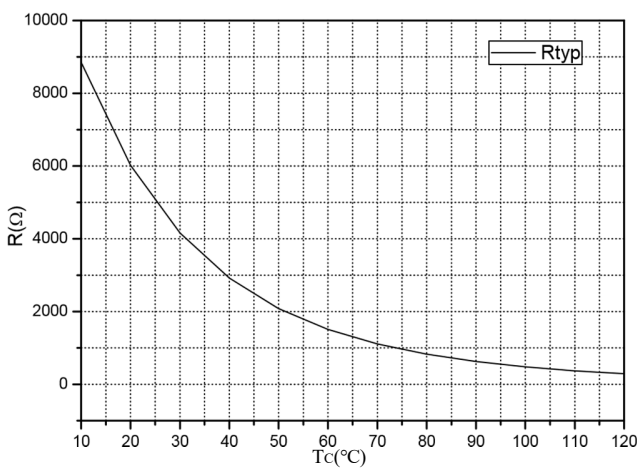
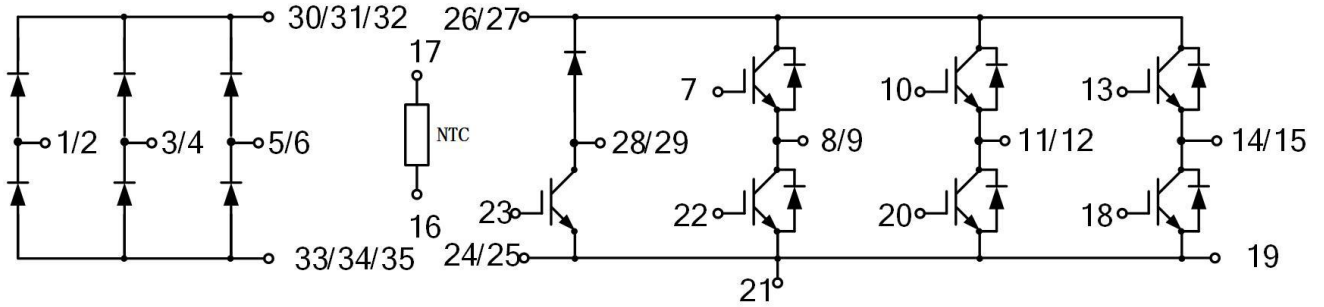
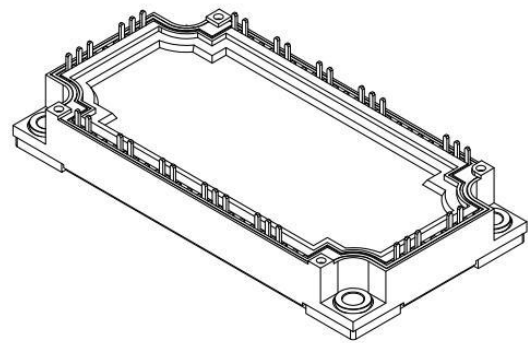
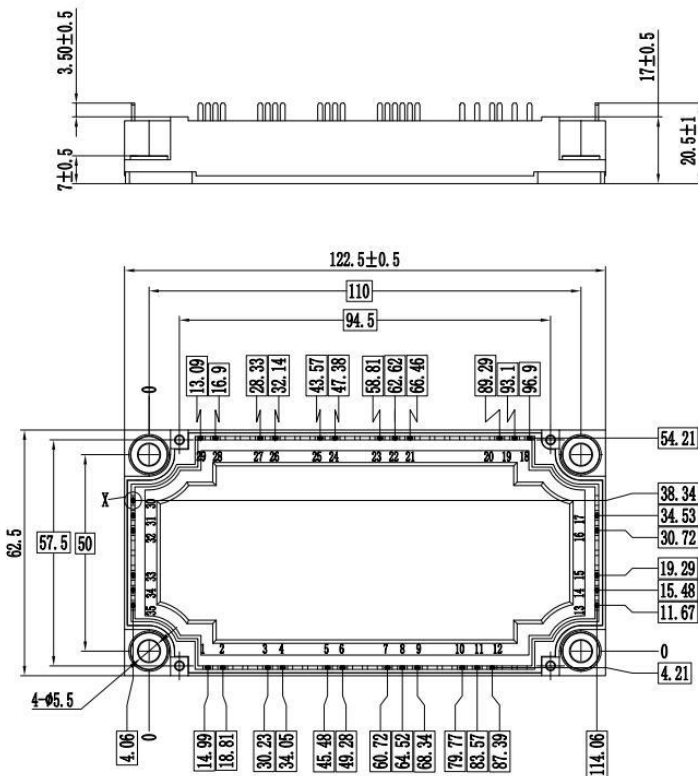


Fig.14 NTC Temperature characteristics

Circuit Diagram



Package Outlines (Unit:mm)



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