JL3I200V65SE2F7SN

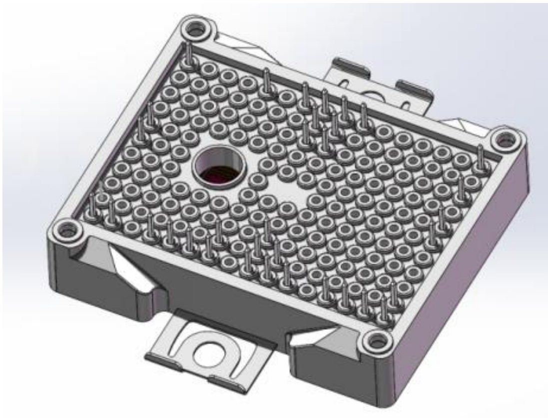
3-Level NPC Inverter Module with 650V Trench Stop IGBTs

RoHS

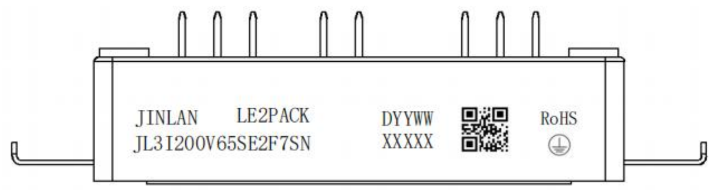
Features

- Electrical features
  - 650V Trench Stop IGBTs
  - Low Inductive Design
  - Low Switching Losses
  - Low Inductive Layout
  - Thermistor

- Mechanical features
  - Compact Design
  - Pressfit contact technology
  - Al_2O_3 Substrate with Low Thermal Resistance



LE2 Pack

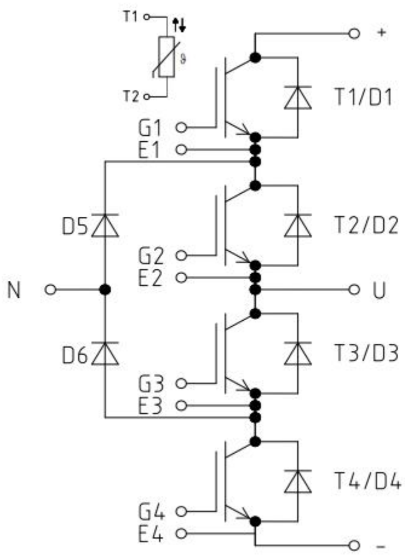


JINLAN	= Company Name
JL3I200V65SE2F7SN	= Specific Device Code
YYWW	= Year and Work Week Code
XXXXX	= Serial Number
QR code	= Custom Assembly Information

Typical Applications

- 3-Level-Applications
- Solar Applications
- UPS Systems
- Motor drivers

Description



Package Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	V_{ISOL}	RMS,f=50Hz,t=60s	2.5	kV
Internal isolation		basic insulation(class 1,IEC 61140)	Al_2O_3	
Creepage distance	d_{creep}	terminal to heatsink	11.5	mm
Clearance	d_{clear}	terminal to heatsink	10	mm
Comparative tracking index (electrical)	CTI		>200	
RTI Elec.	RTI	housing	140	℃

Package Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Stray Inductance	L_{CE}		--	20	--	nH
Storage Temperature Range	T_{STG}		-40		125	℃
Mountig force per clamp	F		40	--	80	N
Weight	G		--	39	--	g

IGBT（T1,T4）

Absolute Maximum Ratings (Tc = 25°C unless otherwise noted)

Symbol	Description	Value	Unit
V_{CES}	Collector-Emitter Voltage	650	V
V_{GES}	Gate-Emitter Voltage	±30	V
I_{CDC}	Continuous Collector Current @ T_C = 80°C (T_{JMAX} = 175°C)	200	A
I_{CM}	Pulsed Collector Current，t_p limited by $T_{vj\,max}$	400	A
P_D	Power Dissipation @ T_C = 25°C	425	W
	Power Dissipation @T_C = 100 °C	170	W

Characteristics （Tc=25℃ unless otherwise noted）

Symbol	Parameter	Test Condition		Min	Typ	Max	Unit
$V_{CE(sat)}$	Collector−Emitter Saturation Voltage	I_C =100A, V_{GE} = 15V	T_{vj} = 25°C	--	1.15	1.90	V
			T_{vj} = 150°C	--	1.25	--	
		I_C =200A, V_{GE} = 15V	T_{vj} = 25°C	--	1.45	2.20	
			T_{vj} = 150°C	--	1.65	--	
$V_{GE(TH)}$	Gate−Emitter Threshold Voltage	I_C=3mA,V_{CE}=V_{GE}		4.0	--	5.5	V
I_{CES}	Collector−Emitter Cutoff Current	V_{GE} = 0 V, V_{CE} = 650 V		--	--	200	μA
I_{GES}	Gate-Emitter Leakage Current	V_{GE} = ±30 V, V_{CE} = 0 V, T_{vj} = 25°C		--	--	±100	nA
R_{Gint}	Internal Gate Resistance	T_{vj} = 25 °C		--	1.45	--	Ω
C_{ies}	Input Capacitance	V_{CE}=25V,V_{GE}=0V, f=1MHz		--	11900	--	pF
C_{oes}	Output capacitance			--	505	--	pF
C_{res}	Reverse Transfer			--	71.4	--	pF
Q_G	Gate Charge	T_J = 25°C V_{CE} = 400 V, I_C = 200 A V_{GE} = −5 V to +15 V		--	0.356	--	μC
$t_{d(on)}$	Turn−On Delay Time	V_{CE}=400V, I_C=200A, V_{GE}= −5 V to +15 V, R_G=25Ω Inductive Load Tvj=25°C		--	370	--	ns
t_r	Rise Time			--	50	--	
$t_{d(off)}$	Turn−off Delay Time			--	1220	--	
t_f	Fall Time			--	160	--	
E_{on}	Turn−On Switching Loss per Pulse			--	13.75	--	mJ
E_{off}	Turn Off Switching Loss per Pulse			--	23.47	--	
$t_{d(on)}$	Turn−On Delay Time	V_{CE}=400V, IC=200A, V_{GE}= −5 V to +15 V, R_G=25Ω T_j=150°C		--	350	--	ns
t_r	Rise Time			--	60	--	
$t_{d(off)}$	Turn−off Delay Time			--	1190	--	
t_f	Fall Time			--	230	--	
E_{on}	Turn−on Switching Loss per Pulse			--	19.36	--	mJ
E_{off}	Turn Off Switching Loss per Pulse			--	19.96	--	
R_{thJC}	Thermal resistance	Junction-to-Case (per IGBT)		--	0.294	--	K/W
$T_{vj\,op}$		Temperature under switching conditions		-40		175[1)]	℃

[1)]$T_{vj\,op}$ > 150℃ is only allowed for operation at overload conditions.

IGBT（T2,T3）

Absolute Maximum Ratings (Tc = 25°C unless otherwise noted)

Symbol	Description	Value	Unit
V_{CES}	Collector-Emitter Voltage	650	V
V_{GES}	Gate-Emitter Voltage	±30	V
I_{CDC}	Continuous Collector Current @ T_C = 80°C (T_{JMAX} = 175°C)	200	A
I_{CM}	Pulsed Collector Current，t_p limited by $T_{vj\,max}$	400	A

Characteristics （Tc=25℃ unless otherwise noted）

Symbol	Parameter	Test Condition		Min	Typ	Max	Unit
$V_{CE(sat)}$	Collector−Emitter Saturation Voltage	I_C =100A, V_{GE} = 15V	T_{vj} = 25 °C	--	1.15	1.90	V
			T_{vj} = 150°C	--	1.25	--	
		I_C =200A, V_{GE} = 15V	T_{vj} = 25 °C	--	1.45	2.20	
			T_{vj} = 150°C	--	1.65	--	
$V_{GE(TH)}$	Gate−Emitter Threshold Voltage	I_C=3mA,V_{CE}=V_{GE}		4.0	--	5.5	V
I_{CES}	Collector−Emitter Cutoff Current	V_{GE} = 0 V, V_{CE} = 650 V		--	--	200	μA
I_{GES}	Gate-Emitter Leakage Current	V_{GE} = ±30 V, V_{CE} = 0 V, T_{vj} = 25°C		--	--	±100	nA
R_{Gint}	Internal Gate Resistance	T_{vj} = 25 °C		--	1.45	--	Ω
C_{ies}	Input Capacitance	V_{CE}=25V,V_{GE}=0V, f=1MHz		--	11900	--	pF
C_{oes}	Output capacitance			--	505	--	pF
C_{res}	Reverse Transfer			--	71.4	--	pF
Q_G	Gate Charge	T_J = 25°C V_{CE} = 400 V, I_C = 200 A V_{GE} = −5 V to +15 V		--	0.356	--	μC
$t_{d(on)}$	Turn−On Delay Time	V_{CE}=400V, I_C=200A, V_{GE}= −5 V to +15 V, R_G=25Ω Inductive Load Tvj=25°C		--	360	--	ns
t_r	Rise Time			--	60	--	
$t_{d(off)}$	Turn−off Delay Time			--	1110	--	
t_f	Fall Time			--	190	--	
E_{on}	Turn−On Switching Loss per Pulse			--	10.9	--	mJ
E_{off}	Turn Off Switching Loss per Pulse			--	20.52	--	
$t_{d(on)}$	Turn−On Delay Time	V_{CE}=400V, IC=200A, V_{GE}= −5 V to +15 V, R_G=25Ω T_j=150°C		--	360	--	ns
t_r	Rise Time			--	70	--	
$t_{d(off)}$	Turn−off Delay Time			--	1140	--	
t_f	Fall Time			--	200	--	
E_{on}	Turn−on Switching Loss per Pulse			--	14.36	--	mJ
E_{off}	Turn Off Switching Loss per Pulse			--	17.67	--	
R_{thJC}	Thermal resistance	Junction-to-Case (per IGBT)		--	0.294	--	K/W
$T_{vj\,op}$		Temperature under switching conditions		-40		175[2)]	℃

2) $T_{vj\,op}$ > 150℃ is only allowed for operation at overload conditions.

Diode (D1,D4)

Absolute Maximum Ratings (Tc = 25°C unless otherwise noted)

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	650	V
I_F	Diode Continuous Forward Current	200	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	400	A

Characteristics （Tc=25℃ unless otherwise noted）

Symbol	Parameter	Test Condition		Min	Typ	Max	Unit
V_F	Diode Forward Voltage	I_F = 100 A	T_J = 25°C	--	1.40	2.40	V
			T_J = 150°C	--	1.30	--	
		I_F = 200 A	T_J = 25°C	--	1.75	2.75	V
			T_J = 150°C	--	1.60	--	
T_{rr}	Reverse Recovery Time	V_{CE}=400V, V_{GE}= −5 V to +15 V, I_F=200A,R_G=25Ω, T_{vj}=25°C		--	220	--	ns
I_{RM}	Peak Reverse Recovery Current			--	76.2	--	A
Q_{rr}	Recovered Charge			--	6.75	--	μC
E_{rec}	Reverse Recovery Energy			--	1.54	--	mJ
T_{rr}	Reverse Recovery Time	V_{CE}=400V, V_{GE}= −5 V to +15 V I_F=200A,R_G=25Ω, T_{vj}=150°C		--	300	--	ns
I_{RM}	Peak Reverse Recovery Current			--	92.95	--	A
Q_{rr}	Recovered Charge			--	16.21	--	μC
E_{rec}	Reverse Recovery Energy			--	3.63	--	mJ
R_{thJC}	Thermal resistance	Junction-to-Case (per diode)		--	0.32	--	K/W
$T_{vj\ op}$		Temperature under switching conditions		-40		175[3)]	℃

[3)] $T_{vj\ op}$ > 150℃ is only allowed for operation at overload conditions.

Diode (D2,D3)

Absolute Maximum Ratings (Tc = 25°C unless otherwise noted)

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	650	V
I_F	Diode Continuous Forward Current	200	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	400	A

Characteristics （Tc=25℃ unless otherwise noted）

Symbol	Parameter	Test Condition		Min	Typ	Max	Unit
V_F	Diode Forward Voltage	I_F = 100 A	T_J = 25°C	--	1.40	2.40	V
			T_J = 150°C	--	1.30	--	
		I_F = 200 A	T_J = 25°C	--	1.75	2.75	V
			T_J = 150°C	--	1.60	--	
T_{rr}	Reverse Recovery Time	V_{CE}=400V, V_{GE}= −5 V to +15 V, I_F=200A,R_G=25Ω, T_{vj}=25°C		--	219	--	ns
I_{RM}	Peak Reverse Recovery Current			--	76.7	--	A
Q_{rr}	Recovered Charge			--	6.79	--	μC
E_{rec}	Reverse Recovery Energy			--	1.53	--	mJ

T_{rr}	Reverse Recovery Time	V_{CE}=400V, V_{GE}= −5 V to +15 V I_F=200A,R_G=25Ω, T_{vj}=150°C	--	299	--	ns
I_{RM}	Peak Reverse Recovery Current		--	93.9	--	A
Q_{rr}	Recovered Charge		--	16.02	--	μC
E_{rec}	Reverse Recovery Energy		--	3.50	--	mJ
R_{thJC}	Thermal resistance	Junction-to-Case (per diode)	--	0.32	--	K/W
$T_{vj\,op}$		Temperature under switching conditions	-40		175[4]	℃

[4]$T_{vj\,op}$ > 150℃ is only allowed for operation at overload conditions.

Diode (D5,D6)

Absolute Maximum Ratings (Tc = 25°C unless otherwise noted)

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	650	V
I_F	Diode Continuous Forward Current	200	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	400	A

Characteristics （Tc=25℃ unless otherwise noted）

Symbol	Parameter	Test Condition		Min	Typ	Max	Unit
V_F	Diode Forward Voltage	I_F = 100 A	T_J = 25°C	--	1.35	2.20	V
			T_J = 150°C	--	1.10	--	
		I_F = 200 A	T_J = 25°C	--	1.55	2.35	V
			T_J = 150°C	--	1.35	--	
T_{rr}	Reverse Recovery Time	V_{CE}=400V, V_{GE}= −5 V to +15 V, I_F=200A,R_G=25Ω, T_{vj}=25°C		--	213	--	ns
I_{RM}	Peak Reverse Recovery Current			--	66.7	--	A
Q_{rr}	Recovered Charge			--	6.26	--	μC
E_{rec}	Reverse Recovery Energy			--	0.86	--	mJ
T_{rr}	Reverse Recovery Time	V_{CE}=400V, V_{GE}= −5 V to +15 V I_F=200A,R_G=25Ω, T_{vj}=150°C		--	318	--	ns
IRM	Peak Reverse Recovery Current			--	79.57	--	A
Q_{rr}	Recovered Charge			--	16.19	--	μC
E_{rec}	Reverse Recovery Energy			--	2.65	--	mJ
R_{thJC}	Thermal resistance	Junction-to-Case (per diode)		--	0.20	--	K/W
$T_{vj\,op}$		Temperature under switching conditions		-40		175[5]	℃

[5]$T_{vj\,op}$ > 150℃ is only allowed for operation at overload conditions.

NTC Characteristics (Tc = 25°C unless otherwise noted)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
R_{25}	Rated Resistance		--	5.0	--	kΩ
ΔR/R	Deviation of R100	Tc=100 ℃,R_{100}=493.3Ω	-5	--	5	%
P_{25}	Power Dissipation		--	--	20.0	mW
$B_{25/50}$	B-value	$R_2=R_{25}\exp[B_{25/50}(1/T_2- 1/(298.15K))]$	--	3375	--	K
$B_{25/80}$	B-value	$R_2=R_{25}\exp[B_{25/80}(1/T_2- 1/(298.15K))]$	--	3411	--	K
$B_{25/100}$	B-value	$R_2=R_{25}\exp[B_{25/100}(1/T_2- 1/(298.15K))]$	--	3433	--	K

Figure1.output characteristic IGBT,Inverter(typical)
T_{vj}=25°C

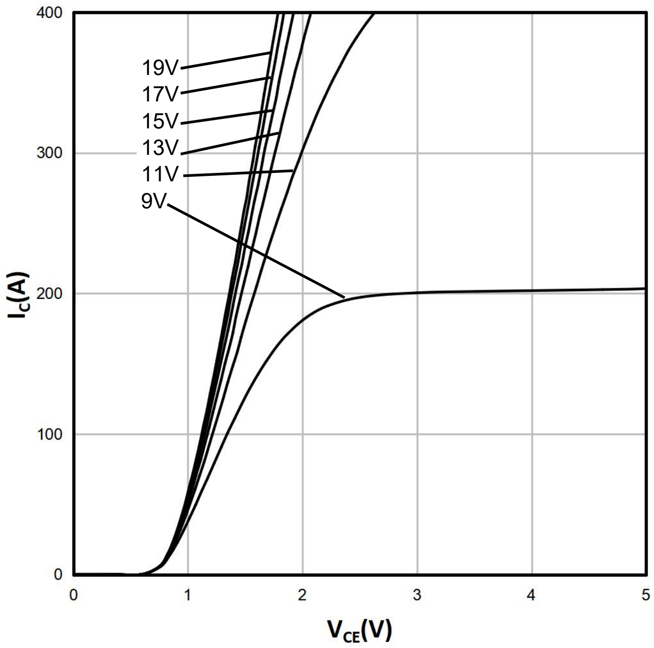


Figure2.output characteristic IGBT,Inverter(typical)
T_{vj}=150°C

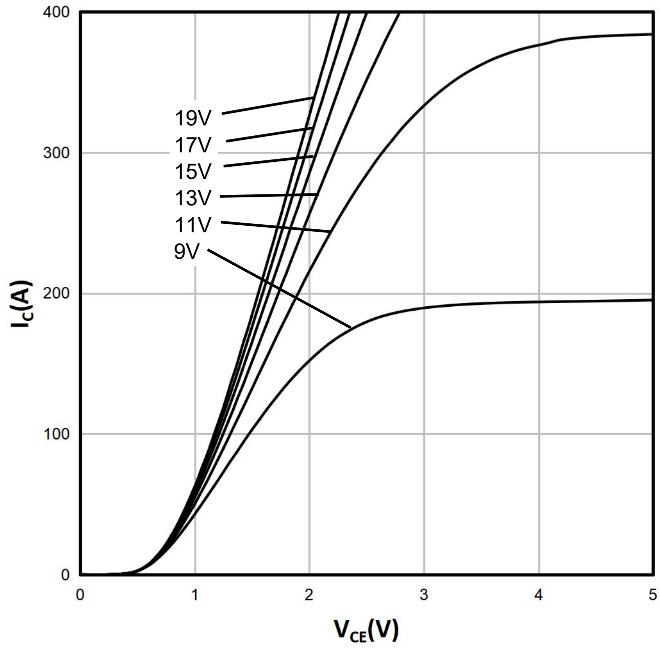


Figure3. $V_{CE(sat)}$ vs. Temperature

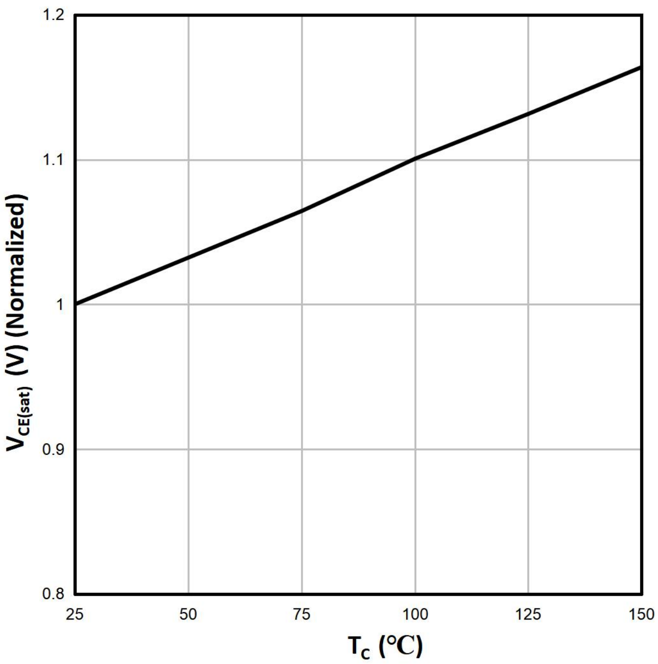


Figure4.transfer characteristic IGBT,Inverter(typical)
V_{CE}=20V

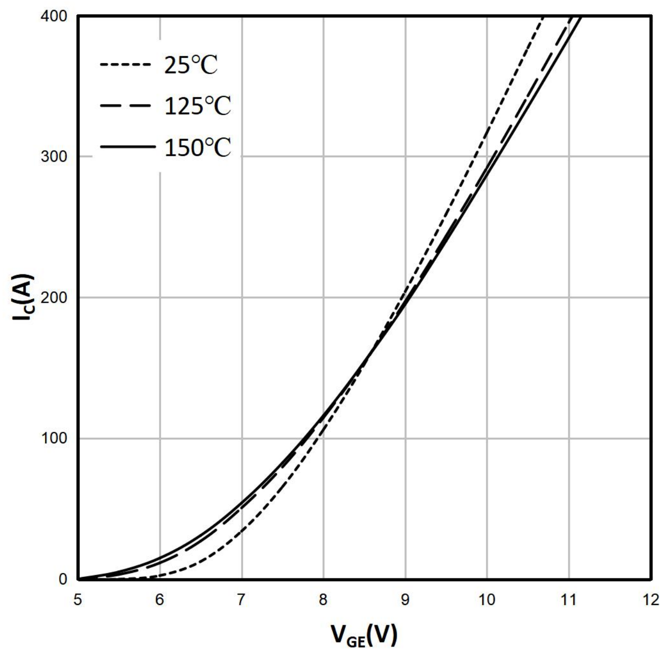


Figure5. V_{TH} vs. Temperature

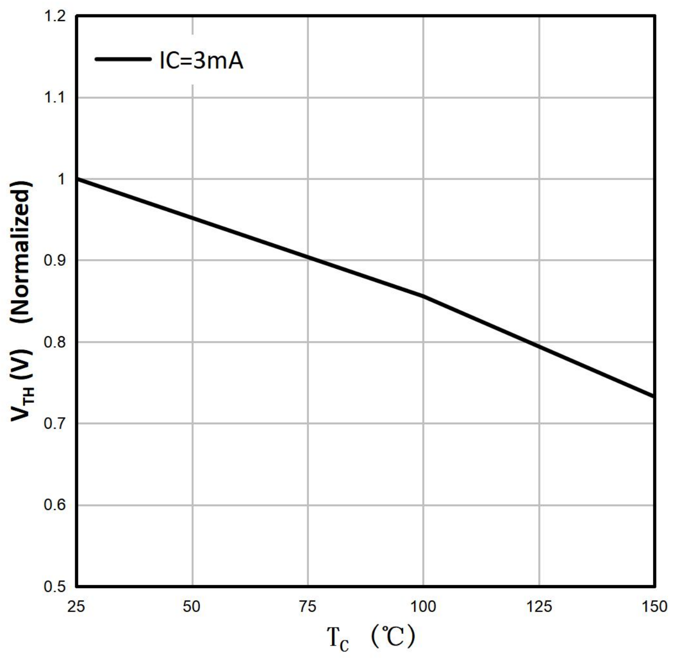


Figure6. Gate Charge Waveform

VCC=400V,IC=150A,VGE=15V

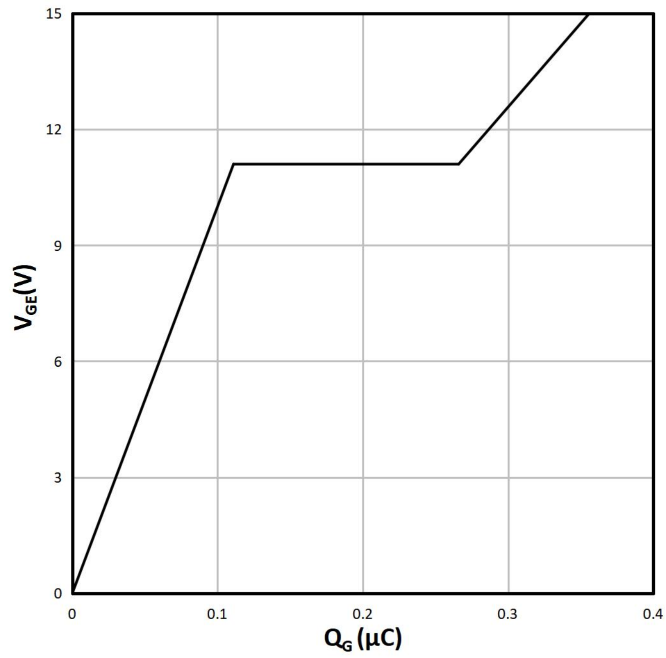


Figure7.switching losses IGBT,Inverter(typical)（T1，T4）

Vcc=400V,Rgon=25Ω,Rgoff=50Ω,Vge=15V/-5V

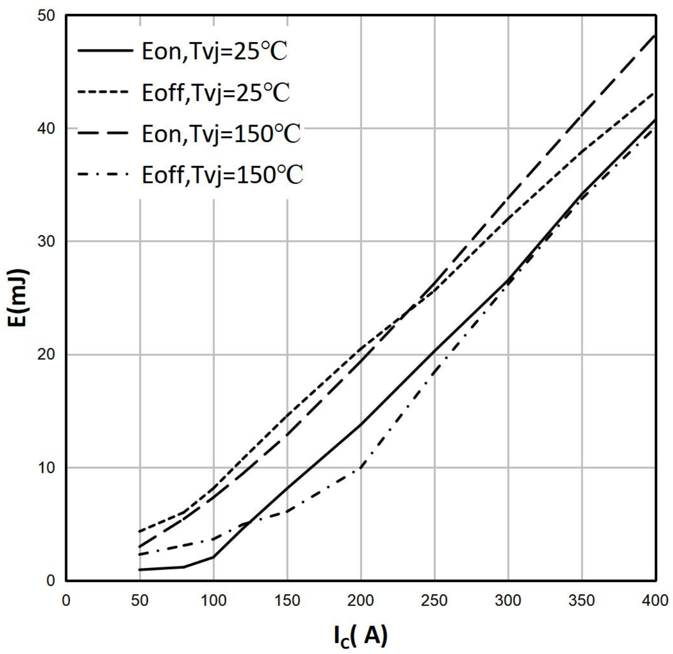


Figure8.switching losses IGBT,Inverter(typical)（T1，T4）

Vcc=400V, IC=200A, Vge=15V/-5V

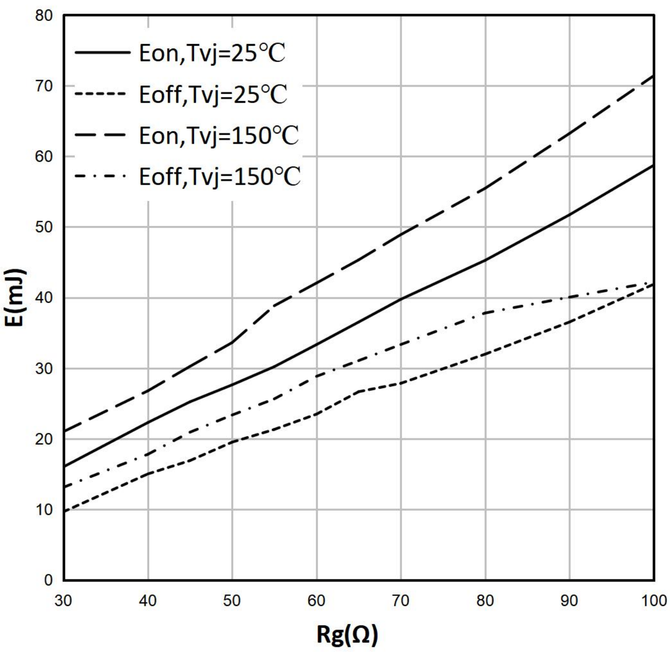


Figure9.switching losses IGBT,Inverter(typical)（T2，T3）

Vcc=400V,Rgon=25Ω,Rgoff=50Ω,Vge=15V/-5V

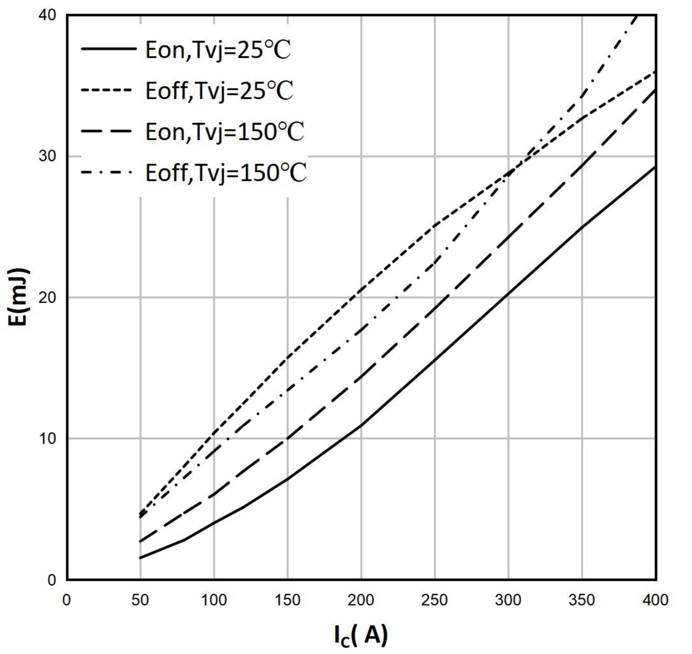


Figure10.switching losses IGBT,Inverter(typical)（T2，T3）

Vcc=400V, IC=200A, Vge=15V/-5V

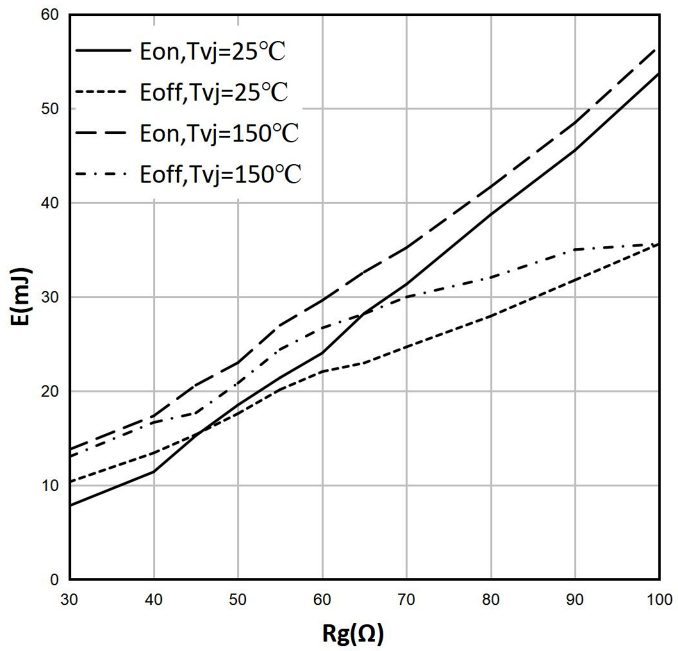


Figure11. FBSOA

IGBT,Inverter(typical)（T1，T2，T3，T4）

D=0, Tc=25℃,Tj<=175℃,Vge=15V

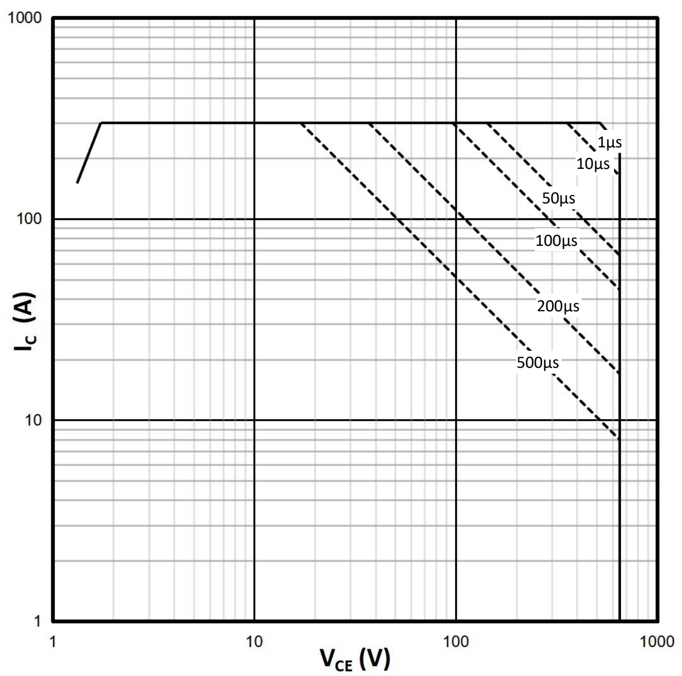


Figure12. transient thermal impedance

IGBT,Inverter(typical)（T1，T2，T3，T4）

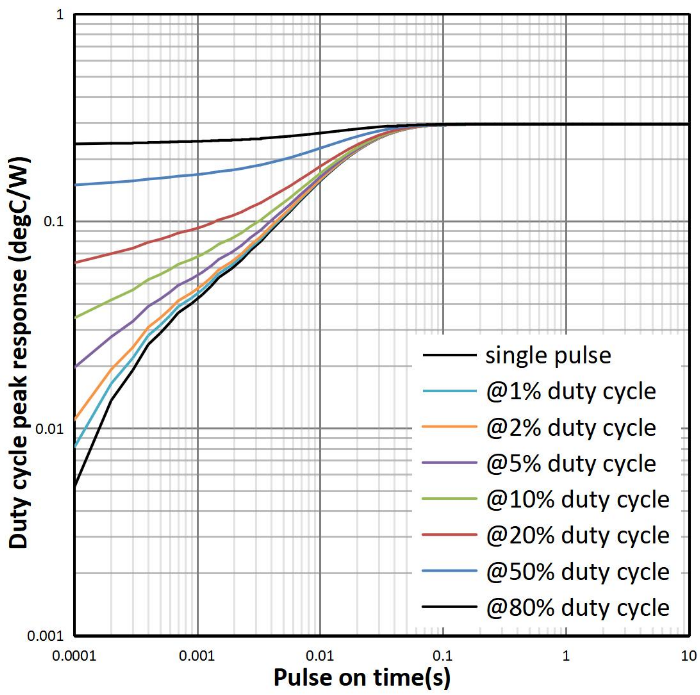


Figure13. forward characteristic of Diode,Inverter(typical)（D1，D2，D3，D4）

V_{GE}=0V

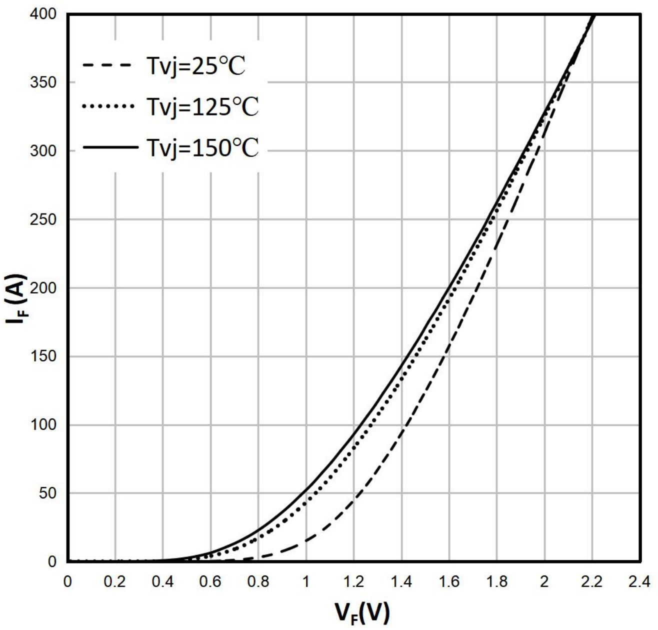


Figure14. forward characteristic of Diode,Inverter(typical)（D5，D6）

V_{GE}=0V

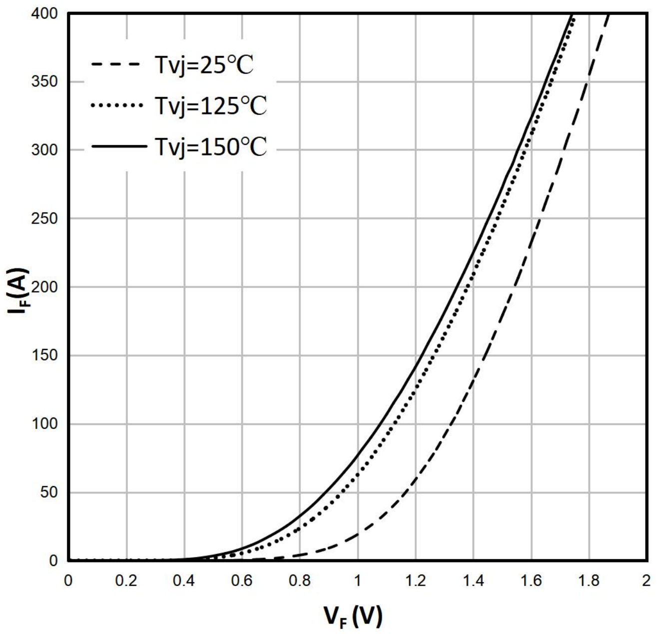


Figure15.Reverse Recovery Energy Loss vs.vs. RG（D1，D4）

Vcc=400V, IC=200A,Vge=15V/-5V

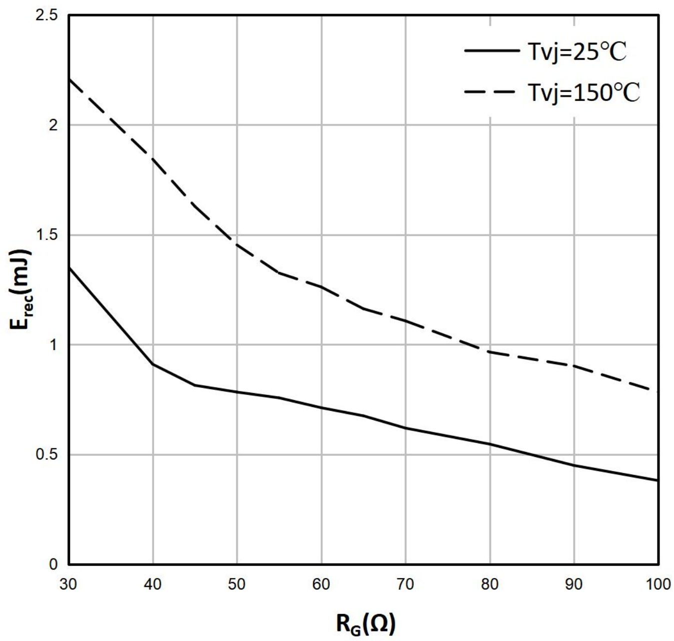


Figure16.Reverse Recovery Energy Loss vs. IC（D1，D4）

Vcc=400V,Rgon=25Ω,Rgoff=50Ω,Vge=15V/-5V

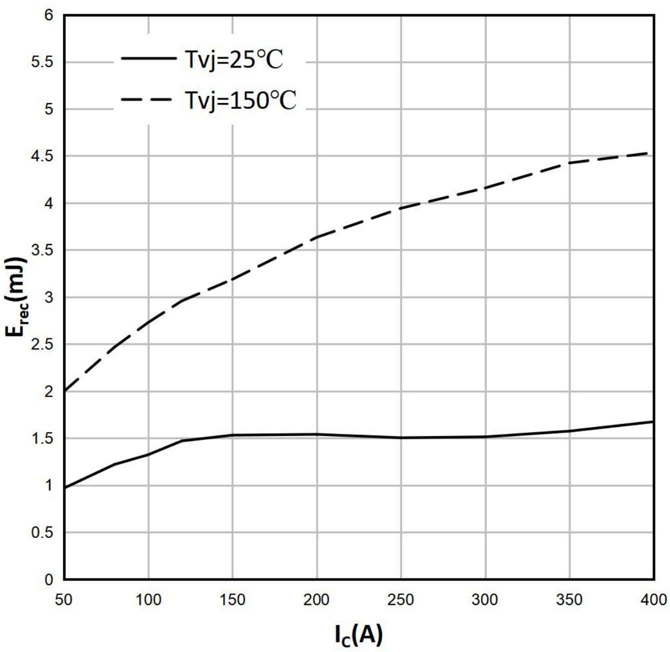


Figure17.Reverse Recovery Energy Loss vs.vs. RG （D2，D3）

Vcc=400V, IC=200A,Vge=15V/-5V

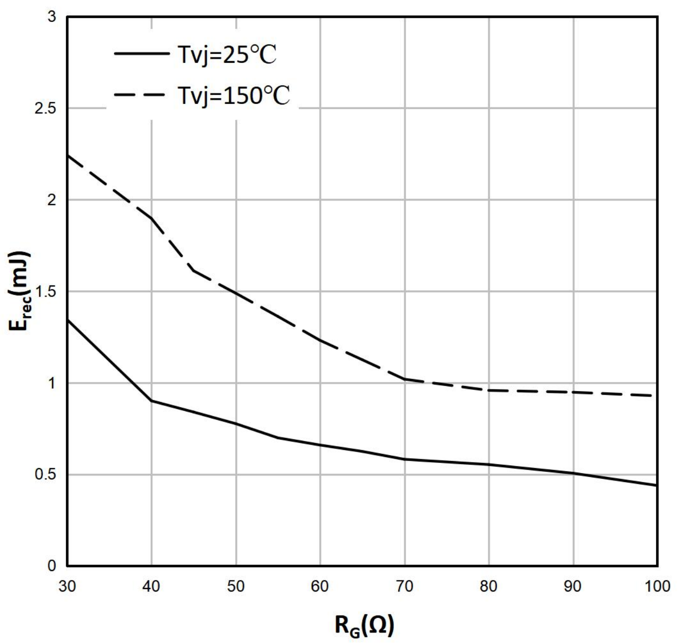


Figure18.Reverse Recovery Energy Loss vs. IC （D2，D3）

Vcc=400V,Rgon=25Ω,Rgoff=50Ω,Vge=15V/-5V

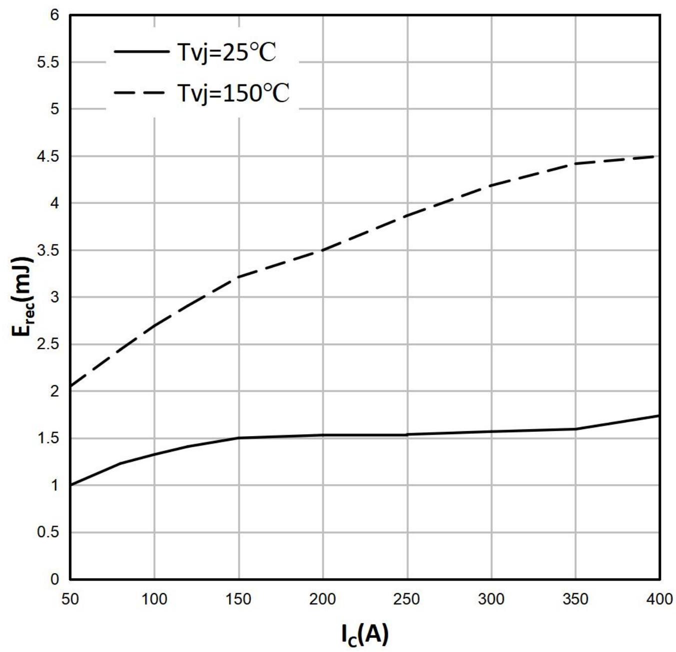


Figure19.Reverse Recovery Energy Loss vs.vs. RG （D5，D6）

Vcc=400V, IC=200A,Vge=15V/-5V

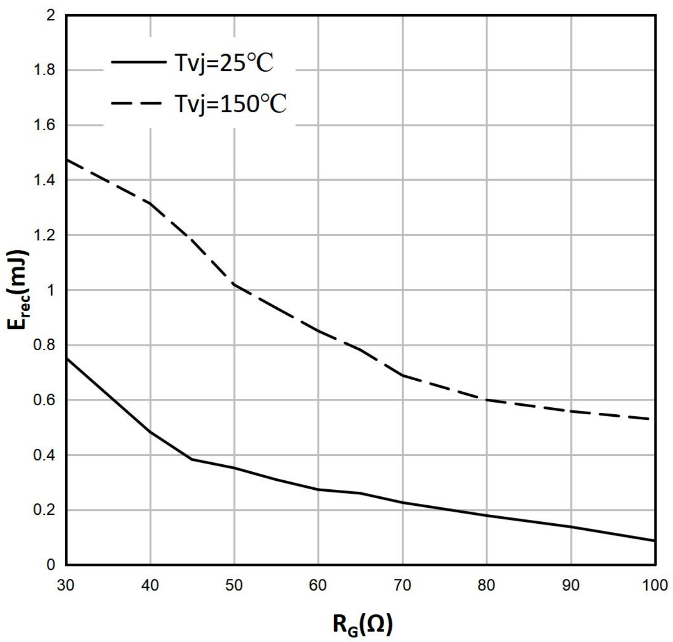


Figure20.Reverse Recovery Energy Loss vs. IC （D5，D6）

Vcc=400V,Rgon=25Ω,Rgoff=50Ω,Vge=15V/-5V

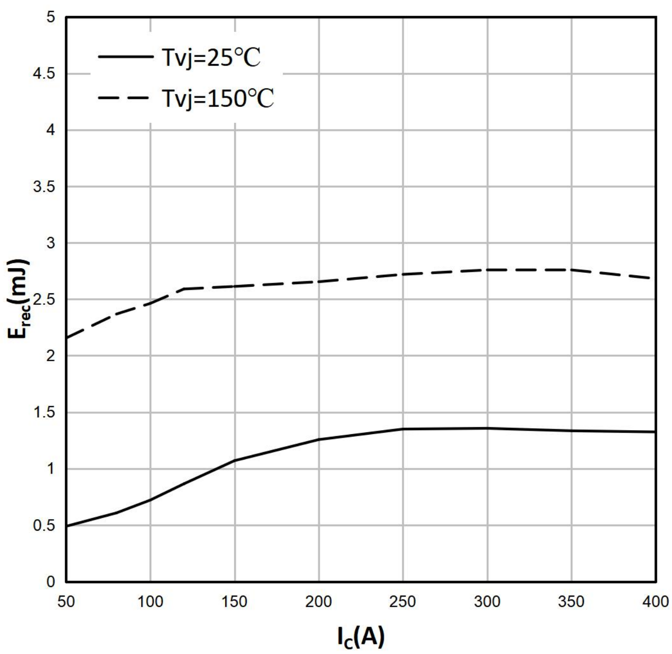


Figure21. transient thermal impedance FRD, Inverter(typical)（D1，D2，D3，D4）

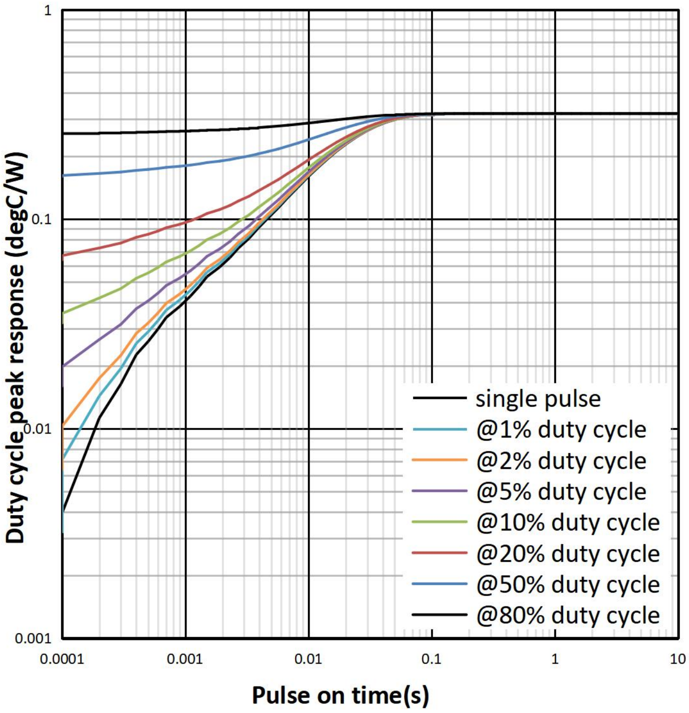
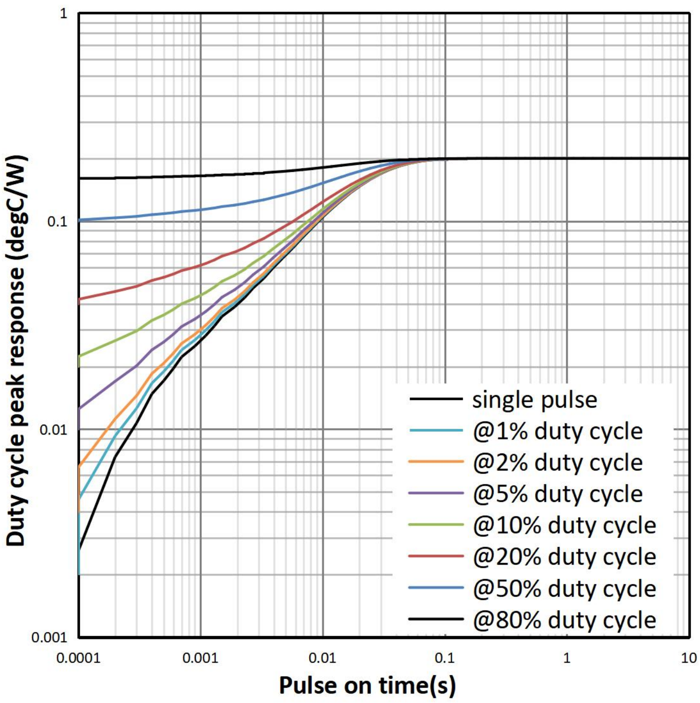
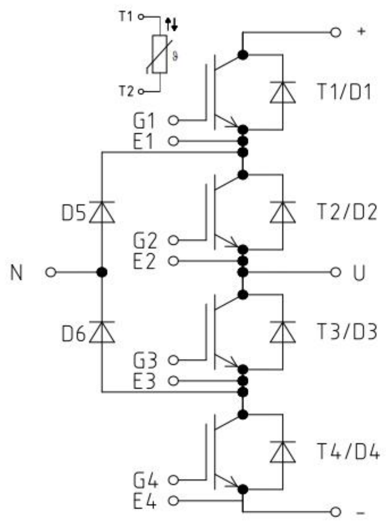


Figure22. transient thermal impedance FRD, Inverter(typical)（D5，D6）

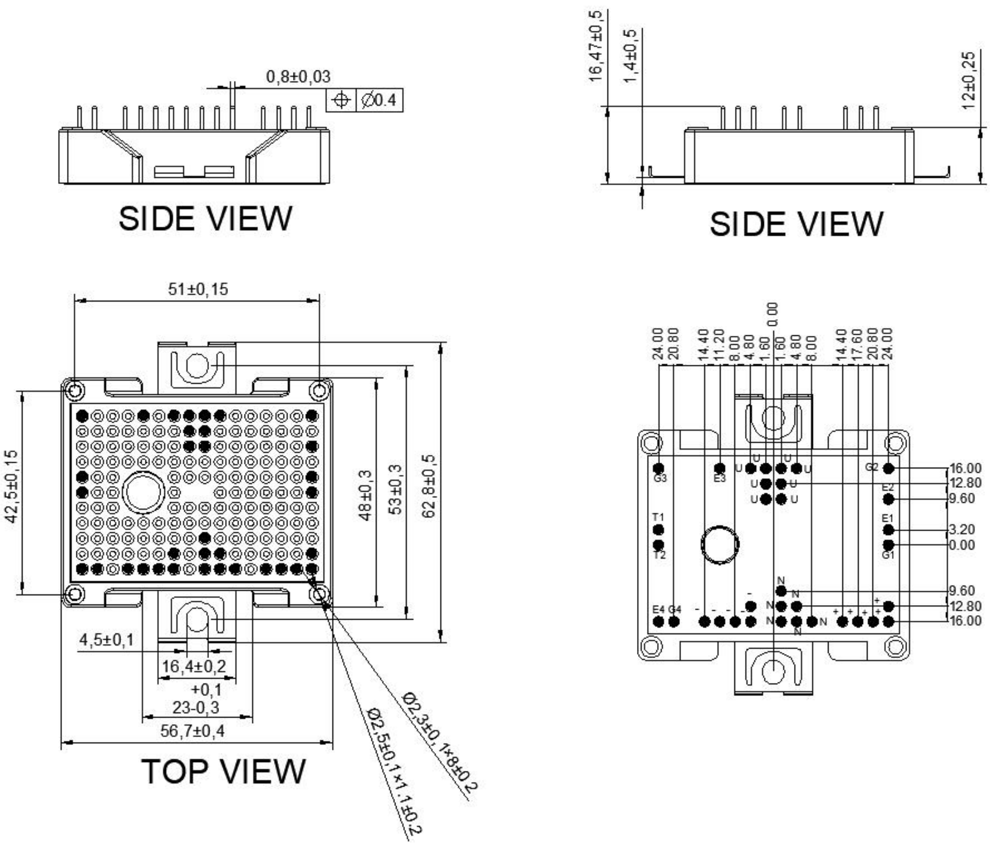


CIRCUIT DIAGRAM



PACKAGE DIMENSION

Dimensions in Millimeters



REVISION HISTORY

Document version	Date of release	Description of changes
Rev.00	2024-11-08	Preview
Rev.01	2025-03-14	Add Chart

ATTENTION

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