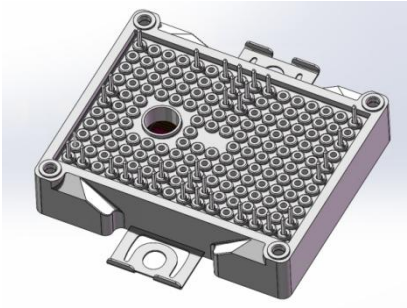
JL3I150V65SE2F7SN

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

RoHS

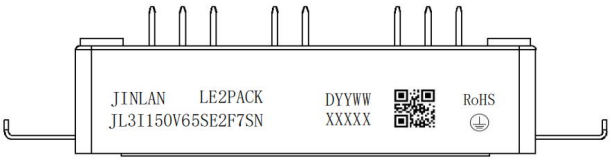
Features

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



LE2 Pack

• Mechanical features
- Compact Design
- Solderable Pins
- Al_2O_3 Substrate with Low Thermal Resistance

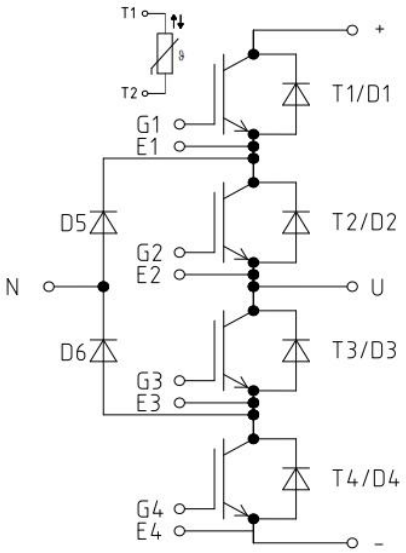


JINLAN	= Company Name
JL3I150V65SE2F7SN	= Specific Device Code
YYWW	= Year and Work Week Code
XXXXX	= Serial Number
QR code	= Custom Assembly Information

Typical Applications

• 3-Level-Applications
• Solar Applications
• UPS Systems

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}		--	15	--	nH
Module Lead Resistance, Terminal to Chip	$R_{CC'+EE'}$		--	2	--	mΩ
Storage Temperature Range	T_{STG}		-40	--	125	℃
Mounting torque for module mounting	M	-Mounting according to valid application note	40	--	80	N
Weight	G		--	39	--	g

IGBT

Absolute Maximum Ratings (Tc = 25°C unless otherwise noted)（T1、T2、T3、T4）

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)	150	A
I_{CM}	Pulsed Collector Current，t_p limited by $T_{vj\ max}$	300	A
P_D	Power Dissipation @ T_C = 25°C	379	W
	Power Dissipation @T_C = 100 °C	151	W

Characteristics （Tc=25℃ unless otherwise noted） （T1、T4）

Symbol	Parameter	Test Condition		Min	Typ	Max	Unit
$V_{CE(sat)}$	Collector−Emitter Saturation Voltage	I_C =150A, V_{GE} = 15V	T_{vj} = 25 °C	--	1.35	1.90	V
			T_{vj} = 150°C	--	1.50	--	
$V_{GE(TH)}$	Gate−Emitter Threshold Voltage	I_C=3mA,V_{CE}=VGE		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
RGint	Internal Gate Resistance	T_{vj} = 25 °C		--	1.45	--	Ω
Cies	Input Capacitance	V_{CE}=25V,V_{GE}=0V, f=1MHz		--	11900	--	pF
Coes	Output capacitance			--	505	--	pF
Cres	Reverse Transfer			--	71.4	--	pF
Q_G	Gate Charge	V_{CE} = 400 V, I_C = 150 A V_{GE} = −5 V to +15 V T_{vj} = 25 °C		--	0.356	--	μC
td(on)	Turn−On Delay Time	V_{CE}=400V, I_C=150A, V_{GE}= −5 V to +15 V, R_G=25Ω Inductive Load T_{vj} = 25 °C		--	260	--	ns
tr	Rise Time			--	50	--	
td(off)	Turn−off Delay Time			--	1280	--	
tf	Fall Time			--	130	--	
Eon	Turn−On Switching Loss per Pulse			--	8.3	--	mJ
Eoff	Turn Off Switching Loss per Pulse			--	15.3	--	
td(on)	Turn−On Delay Time	V_{CE}=400V, IC=150A, V_{GE}= −5 V to +15 V, R_G=25Ω T_{vj} = 150 °C		--	350	--	ns
tr	Rise Time			--	50	--	
td(off)	Turn−off Delay Time			--	1270	--	
tf	Fall Time			--	190	--	
Eon	Turn−on Switching Loss per Pulse			--	12.4	--	mJ
Eoff	Turn Off Switching Loss per Pulse			--	14.7	--	
RthJC	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.

Characteristics （Tc=25℃ unless otherwise noted） （T2、T3）

Symbol	Parameter	Test Condition		Min	Typ	Max	Unit
$V_{CE(sat)}$	Collector−Emitter Saturation Voltage	I_C =150A, V_{GE} = 15V	T_{vj} = 25 °C	--	1.35	1.90	V
			T_{vj} = 150°C	--	1.50	--	
$V_{GE(TH)}$	Gate−Emitter Threshold Voltage	I_C=3mA,V_{CE}=VGE		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
RGint	Internal Gate Resistance	T_{vj} = 25 °C		--	1.45	--	Ω
Cies	Input Capacitance	V_{CE}=25V,V_{GE}=0V, f=1MHz		--	11900	--	pF
Coes	Output capacitance			--	505	--	pF
Cres	Reverse Transfer			--	71.4	--	pF
Q_G	Gate Charge	V_{CE} = 400 V, I_C = 150 A V_{GE} = −5 V to +15 V T_{vj} = 25 °C		--	0.356	--	μC
td(on)	Turn−On Delay Time	V_{CE}=400V, I_C=150A, V_{GE}= −5 V to +15 V, R_G=25Ω Inductive Load T_{vj} = 25 °C		--	370	--	ns
tr	Rise Time			--	40	--	
td(off)	Turn−off Delay Time			--	1190	--	
tf	Fall Time			--	120	--	
Eon	Turn−On Switching Loss per Pulse			--	4.3	--	mJ
Eoff	Turn Off Switching Loss per Pulse			--	12.6	--	
td(on)	Turn−On Delay Time	V_{CE}=400V, IC=150A, V_{GE}= −5 V to +15 V, R_G=25Ω T_{vj} = 150 °C		--	350	--	ns
tr	Rise Time			--	50	--	
td(off)	Turn−off Delay Time			--	1220	--	
tf	Fall Time			--	150	--	
Eon	Turn−on Switching Loss per Pulse			--	8.5	--	mJ
Eoff	Turn Off Switching Loss per Pulse			--	11.3	--	
RthJC	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

Absolute Maximum Ratings (Tc = 25°C unless otherwise noted)（D1、D2、D3、D4）

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	650	V
I_F	Diode Continuous Forward Current	150	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	300	A

Characteristics （Tc=25℃ unless otherwise noted）(D1、D4)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
V_F	Diode Forward Voltage	I_F = 150 A, T_{vj} = 25 °C	--	1.60	2.3	V
		I_F = 150 A, T_{vj} = 150°C	--	1.40	--	
Trr	Reverse Recovery Time	V_{CE}=400V, V_{GE}= −5 V to +15 V, I_F=150A,R_G=25Ω , T_{vj} = 25 °C	--	164	--	ns
I_{RM}	Peak Reverse Recovery Current		--	79.04	--	A
Qrr	Recovered Charge		--	5.73	--	μC

E_{rec}	Reverse Recovery Energy		--	1.6	--	mJ
T_{rr}	Reverse Recovery Time	V_{CE}=400V, V_{GE}= −5 V to +15 V I_F=150A,R_G=25Ω, T_{vj} = 150°C	--	259	--	ns
I_{RM}	Peak Reverse Recovery Current		--	91	--	A
Qrr	Recovered Charge		--	13.9	--	μC
E_{rec}	Reverse Recovery Energy		--	3.25	--	mJ
R_{thJC}	Thermal resistance	Junction-to-Case (per diode)	--	0.319	--	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.

Characteristics （Tc=25℃ unless otherwise noted）(D2、D3)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
V_F	Diode Forward Voltage	I_F = 150 A, T_{vj} = 25 °C	--	1.60	2.3	V
		I_F = 150 A, T_{vj} = 150°C	--	1.40	--	
T_{rr}	Reverse Recovery Time	V_{CE}=400V, V_{GE}= −5 V to +15 V, I_F=150A,R_G=25Ω , T_{vj} = 25 °C	--	185	--	ns
I_{RM}	Peak Reverse Recovery Current		--	76.4	--	A
Qrr	Recovered Charge		--	5.94	--	μC
E_{rec}	Reverse Recovery Energy		--	1.45	--	mJ
T_{rr}	Reverse Recovery Time	V_{CE}=400V, V_{GE}= −5 V to +15 V I_F=150A,R_G=25Ω, T_{vj} = 150°C	--	273	--	ns
I_{RM}	Peak Reverse Recovery Current		--	96.9	--	A
Qrr	Recovered Charge		--	14.1	--	μC
E_{rec}	Reverse Recovery Energy		--	3.13	--	mJ
R_{thJC}	Thermal resistance	Junction-to-Case (per diode)	--	0.319	--	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	150	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	300	A

Characteristics （Tc=25℃ unless otherwise noted）

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
V_F	Diode Forward Voltage	I_F = 150 A, T_{vj} = 25 °C	--	1.45	2.20	V
		I_F = 150 A, T_{vj} =175 °C	--	1.25	--	
T_{rr}	Reverse Recovery Time	V_{CE}=400V, V_{GE}= −5 V to +15 V I_F=150A,R_G=25Ω T_{vj} = 25 °C	--	158	--	ns
I_{RM}	Peak Reverse Recovery Current		--	85	--	A
Q_{rr}	Recovered Charge		--	5.58	--	μC
E_{rec}	Reverse Recovery Energy		--	1.25	--	mJ
T_{rr}	Reverse Recovery Time	V_{CE}=400V, V_{GE}= −5 V to +15 V I_F=150A,R_G=25Ω, T_{vj} = 150 °C	--	279	--	ns
IRM	Peak Reverse Recovery Current		--	92.7	--	A
Q_{rr}	Recovered Charge		--	14.88	--	μC
E_{rec}	Reverse Recovery Energy		--	2.65	--	mJ
R_{thJC}	Thermal resistance	Junction-to-Case (per diode)	--	0.2	--	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 °C,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

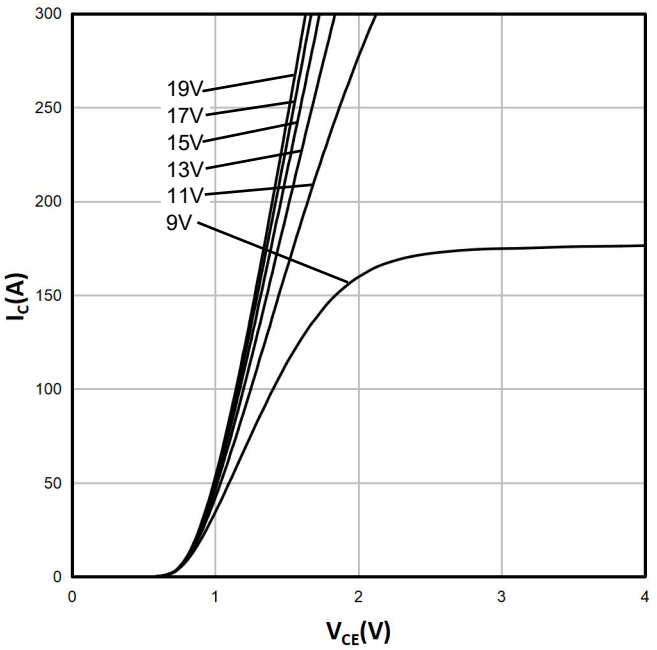


Figure2.output characteristic IGBT,Inverter(typical)
T_{vj}=150°C

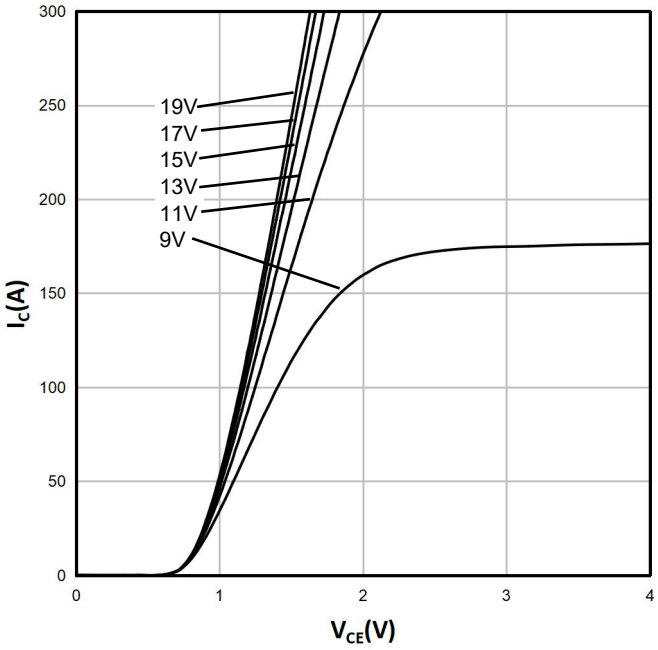


Figure3. $V_{CE(sat)}$ vs. Temperature

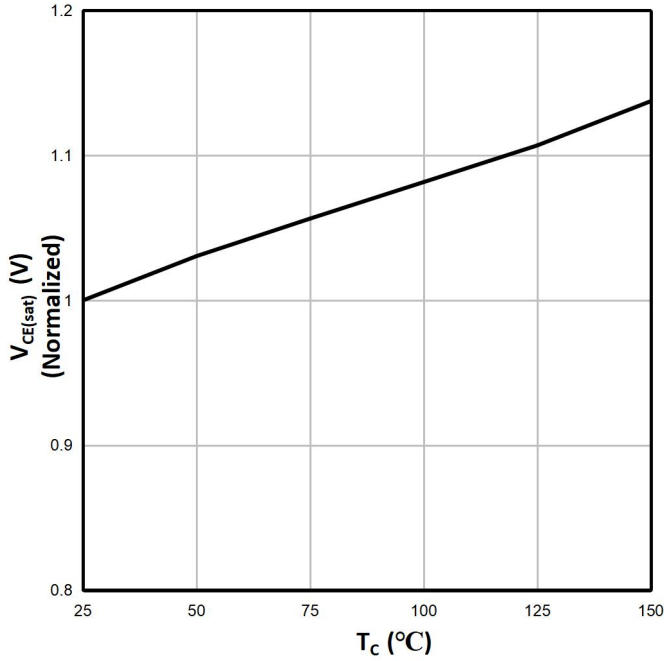


Figure4.transfer characteristic IGBT,Inverter(typical)
V_{CE}=20V

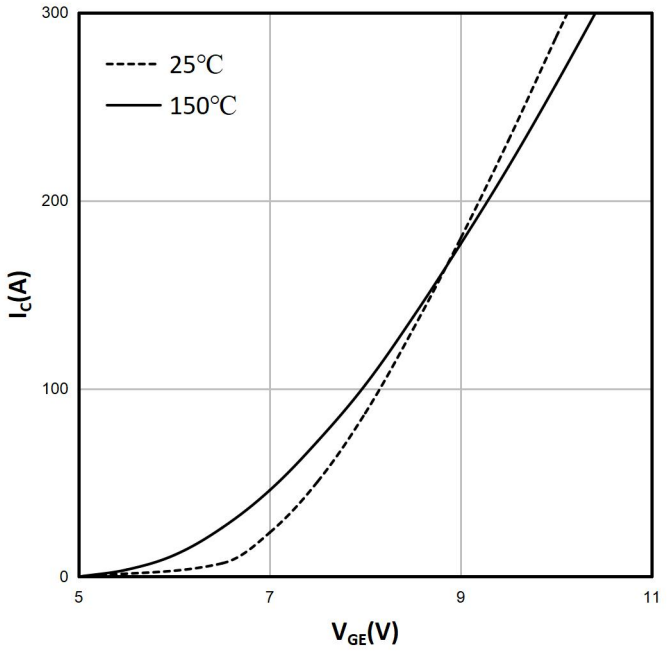


Figure5. V_{TH} vs. Temperature

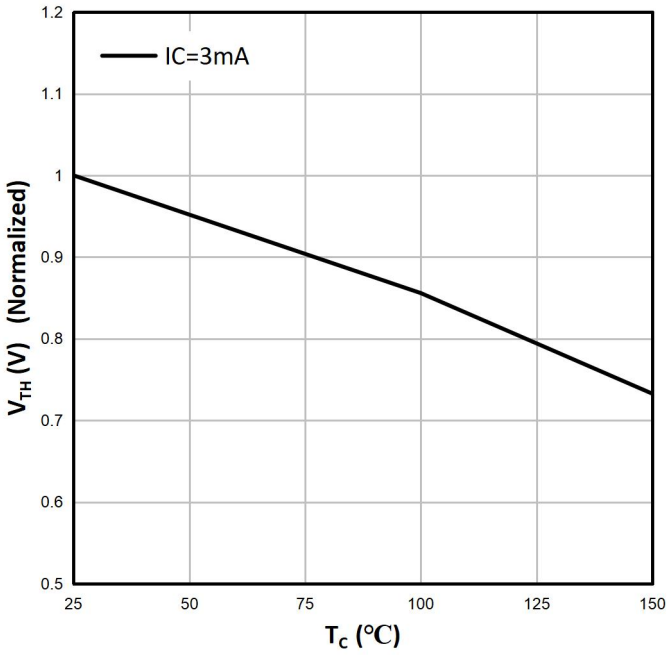


Figure6. Gate Charge Waveform
Vcc=480V

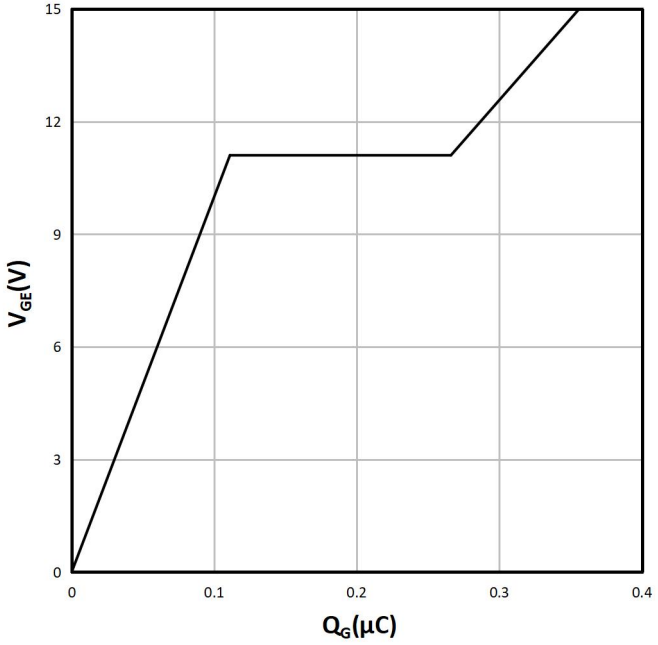


Figure7.switching losses IGBT,Inverter(typical)（T1，T4）
Vcc=400V,Rgon=25Ω,Rgoff=50Ω,Vge=15V/-5V

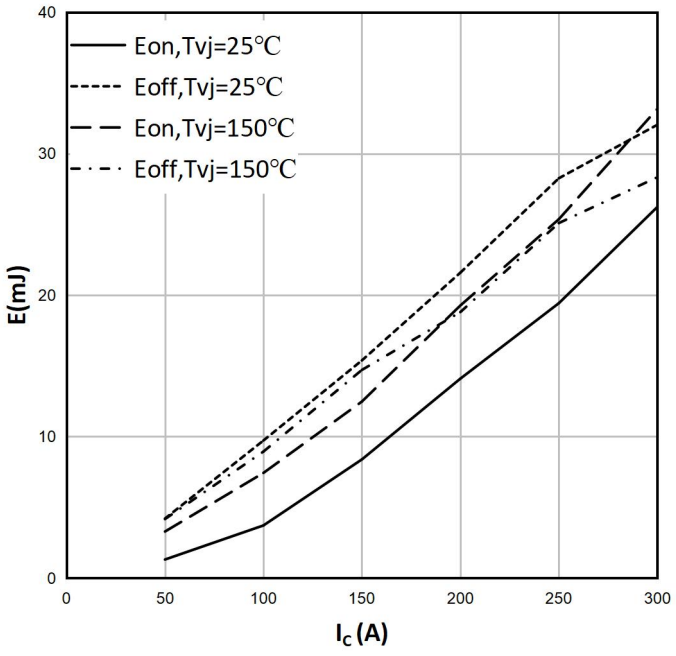


Figure8.switching losses IGBT,Inverter(typical)（T1，T4）
Vcc=400V,IC=150A,Vge=15V/-5V

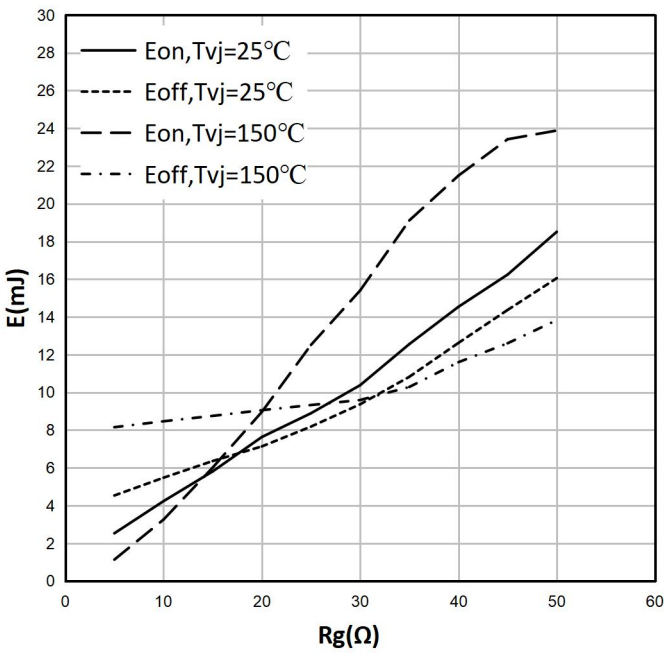


Figure9.switching losses IGBT,Inverter(typical)（T2，T3）

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

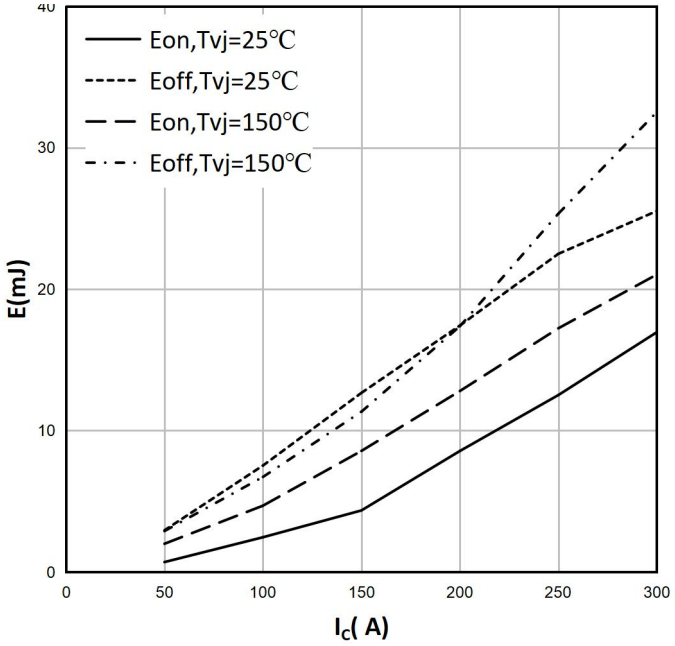


Figure10.switching losses IGBT,Inverter(typical)（T2，T3）

Vcc=400V,IC=150A,Vge=15V/-5V

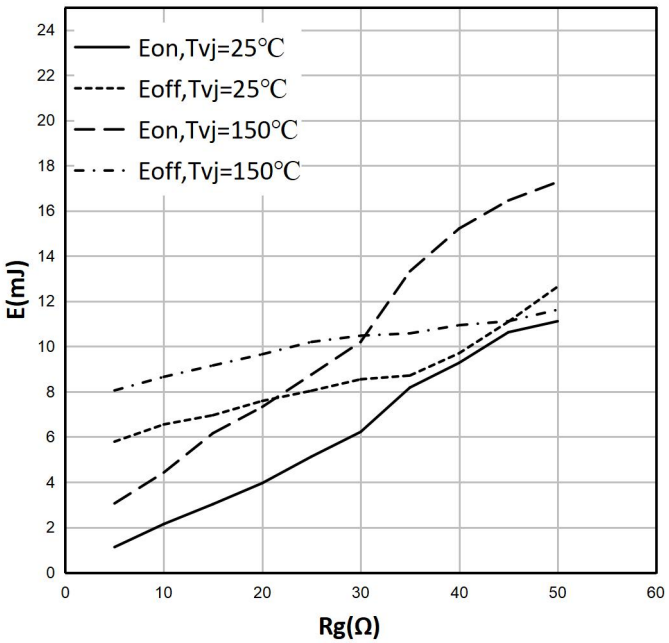


Figure11. FBSOA
IGBT,Inverter(typical)（T1，T2，T3，T4）

D=0, Tc=25℃,Tj<=175℃,Vge=15V

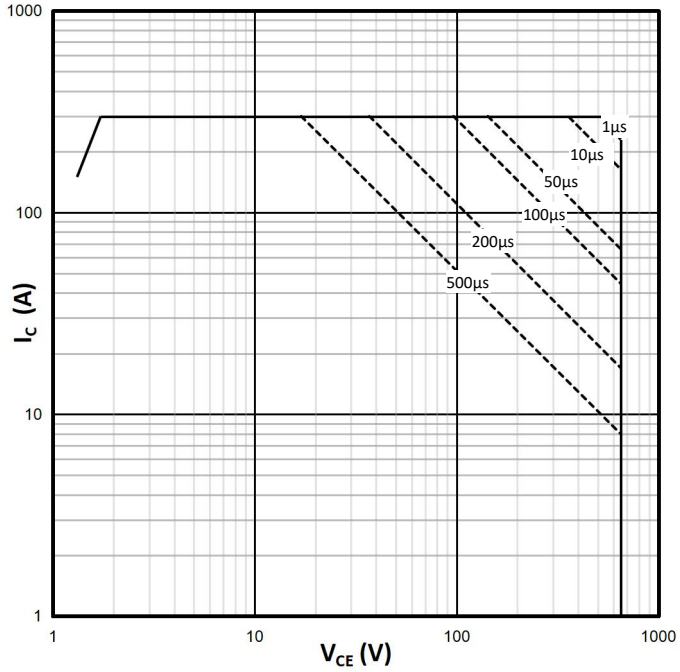


Figure12. transient thermal impedance
IGBT,Inverter(typical)（T1，T2，T3，T4）

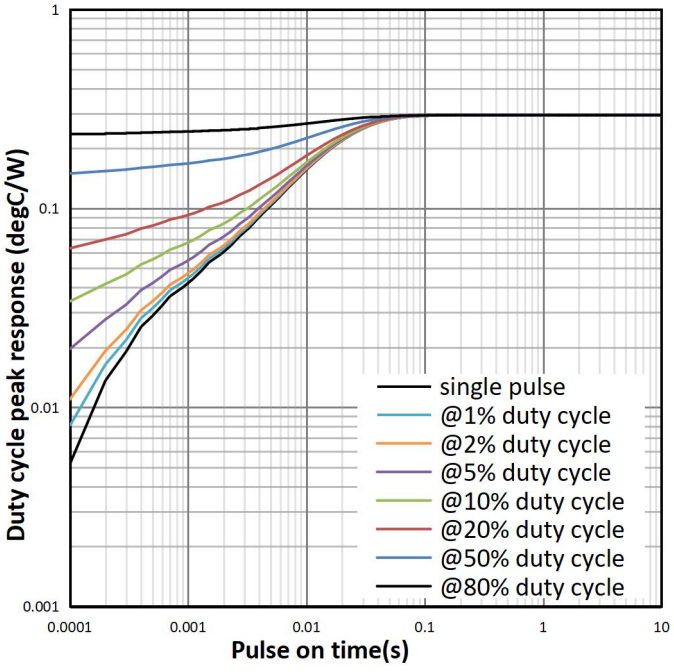


Figure13. forward characteristic of Diode,Inverter(typical)
（D1，D2，D3，D4）

V_{GE}=0V

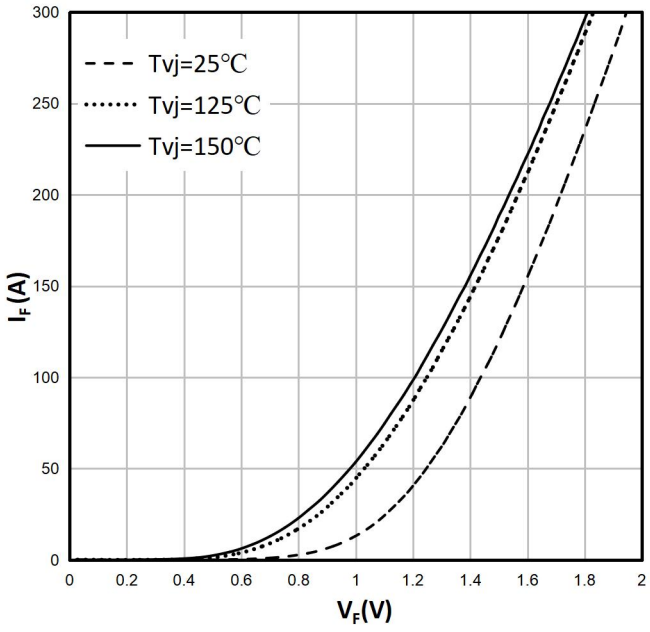


Figure14. forward characteristic of Diode,Inverter(typical)
（D5，D6）

V_{GE}=0V

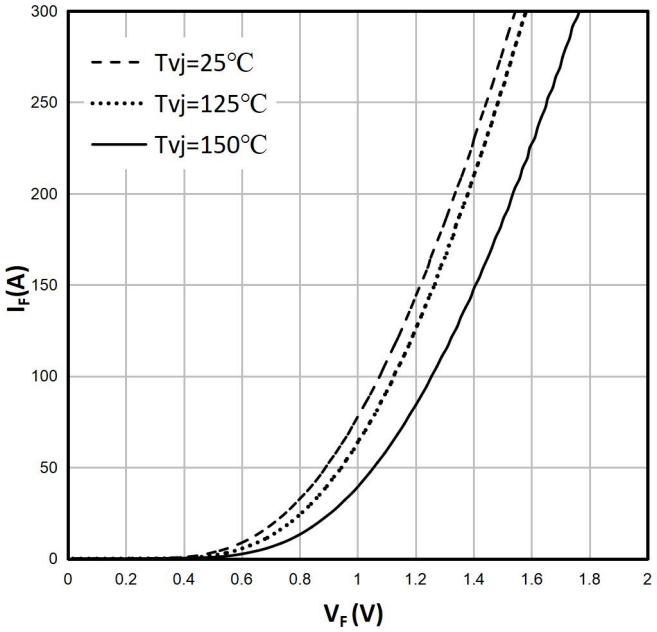


Figure15.Reverse Recovery Energy Loss vs.vs. RG
（D1，D4）

Vcc=400V,IC=150A,Vge=15V/-5V

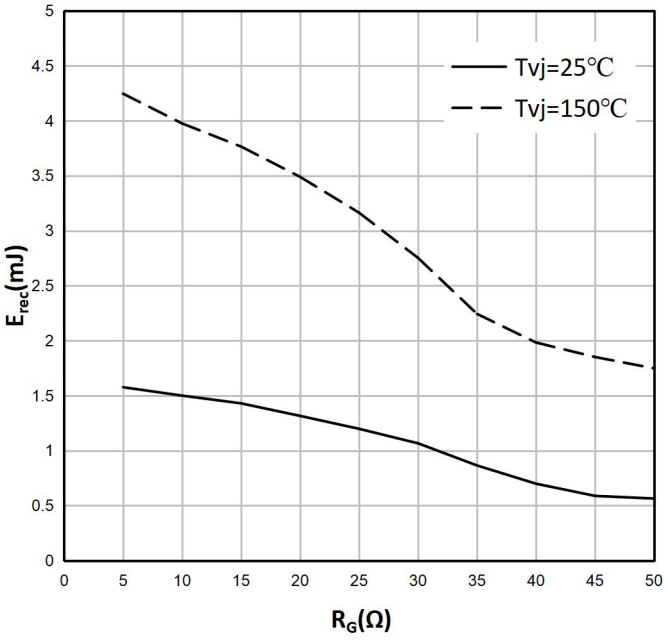


Figure16.Reverse Recovery Energy Loss vs. IC
（D1，D4）

Vcc=400V,Rg=25Ω,Vge=15V/-5V

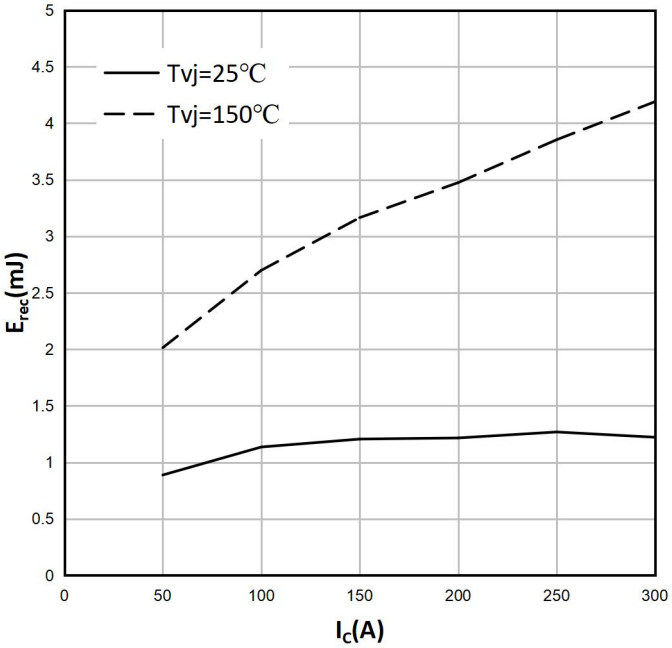


Figure17.Reverse Recovery Energy Loss vs.vs. RG（D2，D3）

Vcc=400V,IC=150A,Vge=15V/-5V

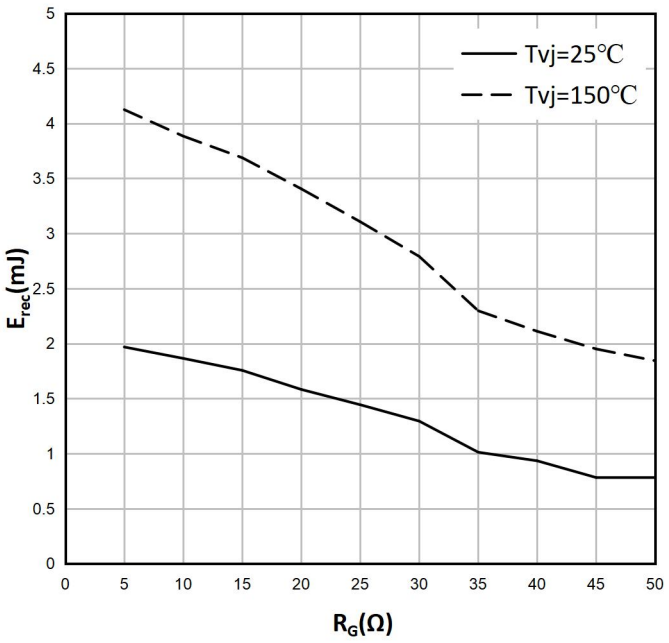


Figure18.Reverse Recovery Energy Loss vs. IC（D2，D3）

Vcc=400V,Rg=25Ω,Vge=15V/-5V

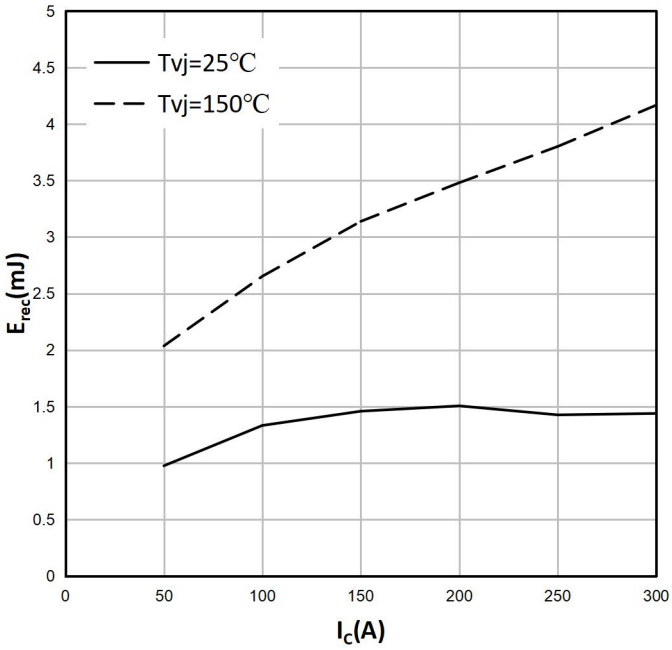


Figure19.Reverse Recovery Energy Loss vs.vs. RG（D5，D6）

Vcc=400V,IC=150A,Vge=15V/-5V

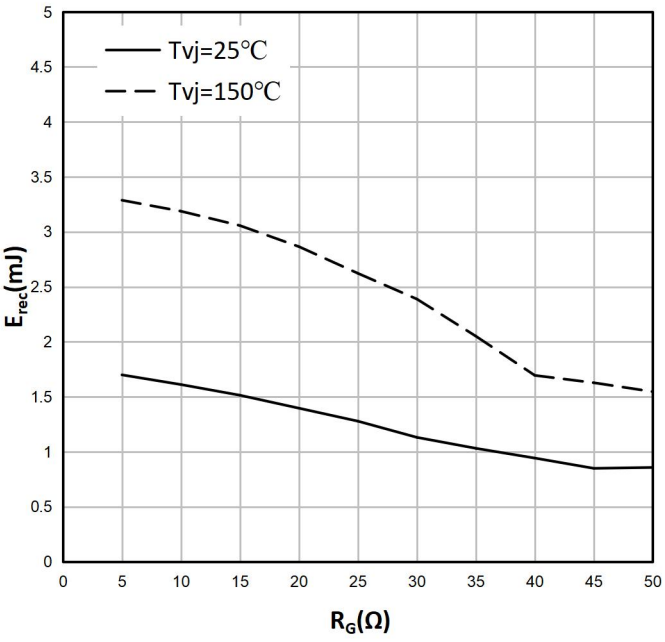


Figure20.Reverse Recovery Energy Loss vs. IC（D5，D6）

Vcc=400V,Rg=25Ω,Vge=15V/-5V

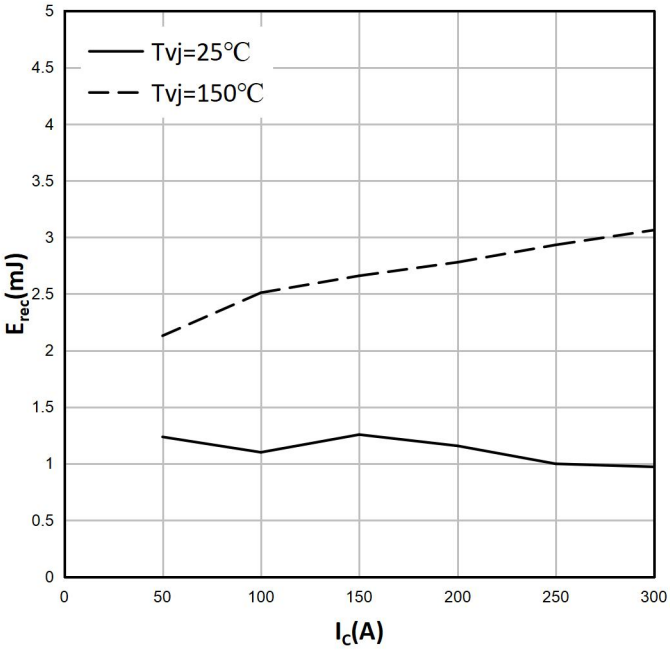


Figure21. transient thermal impedance-FRD（D1，D2，D3，D4）

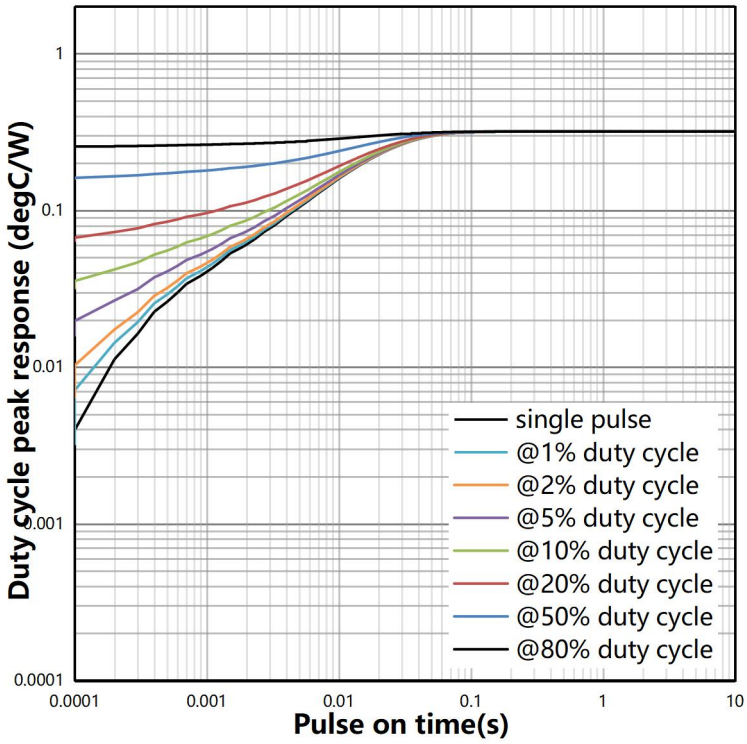
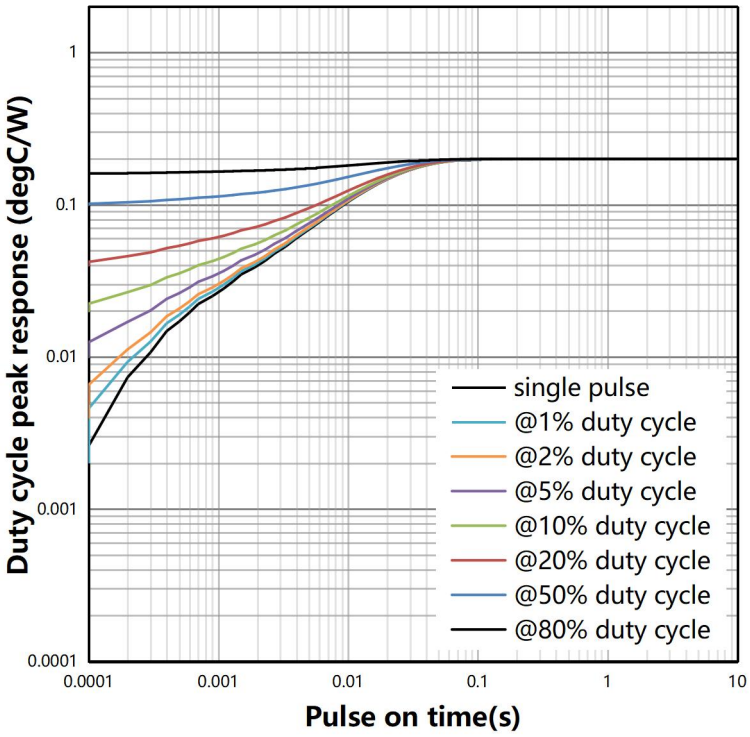
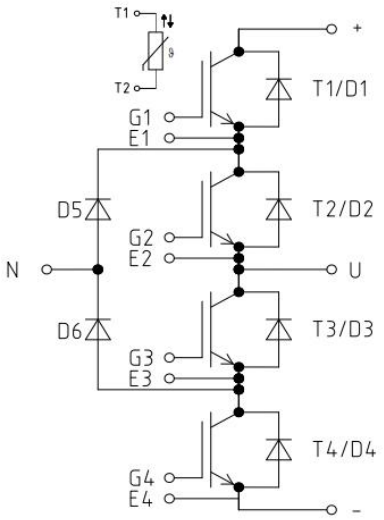


Figure22. transient thermal impedance-FRD（D5，D6）

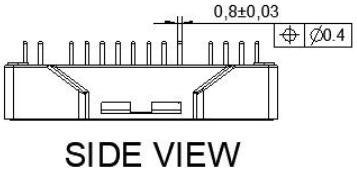


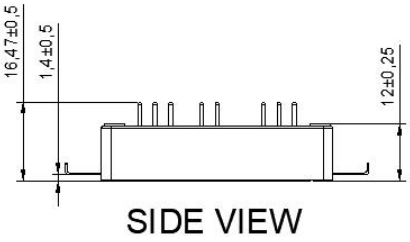
CIRCUIT DIAGRAM

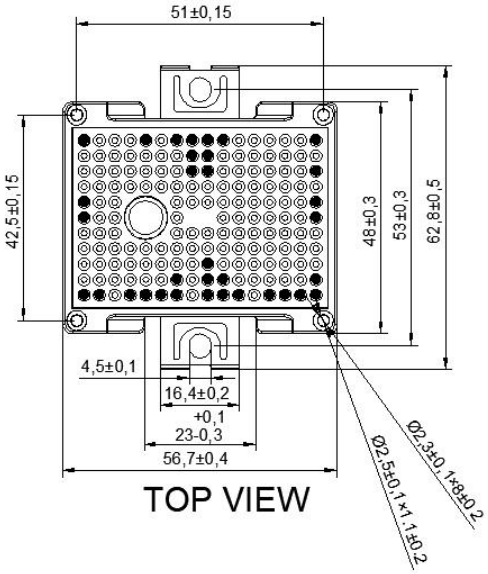


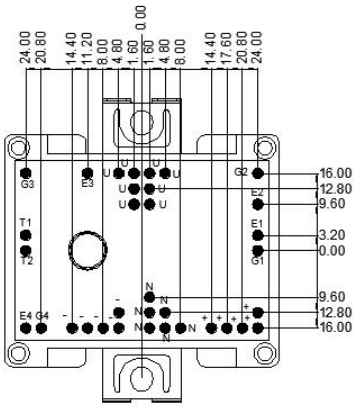
PACKAGE DIMENSION

Dimensions in Millimeters









REVISION HISTORY

Document version	Date of release	Description of changes
Rev.00	2024-09-07	Preview
Rev.01	2025-02-17	Add Chart

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