MITSUBISHI ELECTRIC

< GCT(Gate Commutated Turn-off) Thyristor Unit >

GCU15DB-130

HIGH POWER INVERTER USE
PRESS PACK TYPE

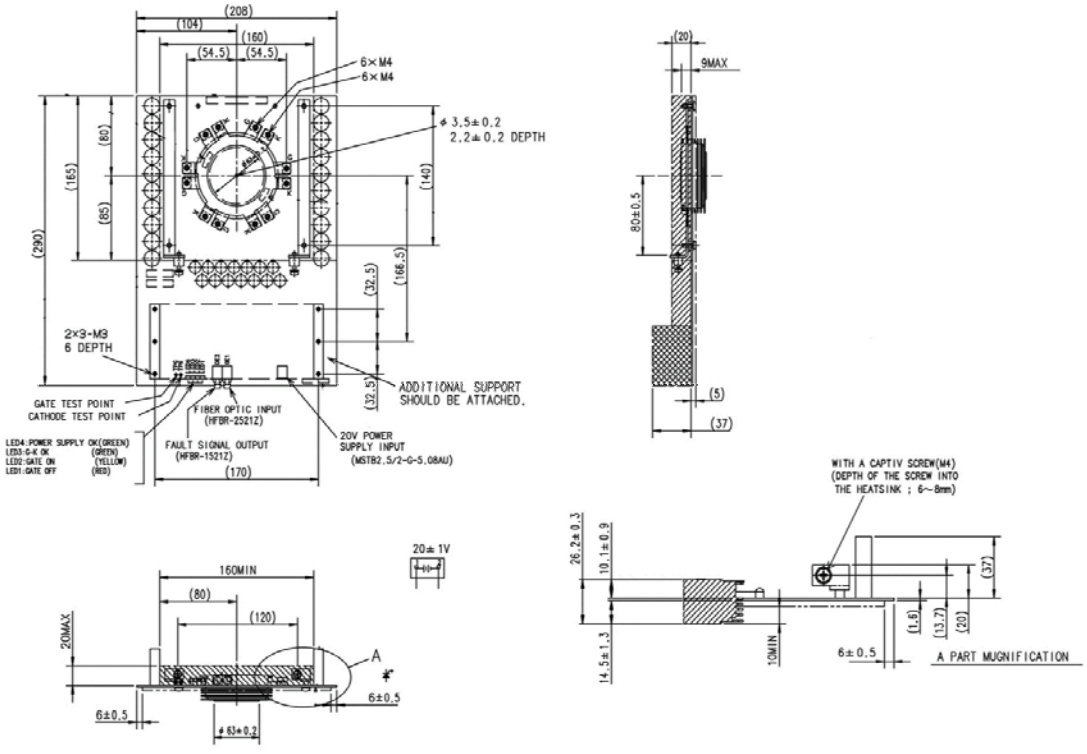
GCU15DB-130

- Symmetrical GCT unit
- GCT and gate driver are connected
- I_{TQRM} · · · · · · · · · · · 1500A
- $I_{T(AV)}$ · · · · · · · · · · · 500A
- V_{DRM} · · · · · · · · · · · 6500V
- V_{RRM} · · · · · · · · · · · 6500V
- Tj · · · · · · · · · · · · · 125 ºC

APPLICATION

Current source inverters, DC choppers, Induction heaters, DC to DC converters

OUTLINE DRAWING **Dimensions in mm**



GCT PART
MAXIMUM RATINGS

Symbol	Parameter	Condition	Voltage	Unit
V_{RRM}	Repetitive peak reverse voltage	-	6500	V
V_{RSM}	Non-repetitive peak reverse voltage	-	6500	V
V_{DRM}	Repetitive peak off-state voltage	Gate driver energized	6500	V
V_{DSM}	Non-repetitive peak off-state voltage	Gate driver energized	6500	V
$V_{(LTDS)}$	Long term DC stability voltage	Gate driver energized λ=100Fit	3600	V

Symbol	Parameter	Condition	Ratings	Unit
$I_{T(RMS)}$	RMS on-state current	Applied for all condition angles f=60Hz,sinewave θ=180°, Tf=69 ºC	780	A
$I_{T(AV)}$	Average on-state current		500	A
I_{TQRM}	Repetitive controllable on state current	V_D=3000V, V_{DM}=3/4V_{DRM}, Tj=25/125 ºC Lc=0.3μH (See Fig.1,3)	1500	A
I_{TSM}	Surge on-state current	One half cycle at 60Hz, Tj=125 ºC start	8	kA
I^2t	Current-squared, time integration		2.7×10^5	A^2s
di_T/dt	Critical rate of rise of on state current	I_T=1500A, V_D=3000V, Tj=25/125 ºC Cs=0.2μF, Rs=5Ω, f=60Hz (See Fig.1,2)	1000	A/μs
di_R/dt	Critical rate of rise of reverse recovery current	I_T=1500A, V_R=3000V, Tj=25/125 ºC Cs=0.2μF, Rs=5Ω (See Fig.3,4)	1000	A/μs
P_{FGM}	Peak forward gate power dissipation		9	kW
P_{RGM}	Peak reverse gate power dissipation		32	kW
$P_{FG(AV)}$	Average forward gate power dissipation		180	W
$P_{RG(AV)}$	Average reverse gate power dissipation		230	W
V_{FGM}	Peak forward gate voltage		10	V
V_{RGM}	peak reverse gate voltage		21	V
I_{FGM}	Peak forward gate current		900	A
I_{RGM}	Peak reverse gate current		1500	A

ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Condition	Limits			Unit
			Min	Typ	Max	
V_{TM}	On-state voltage	I_T=800A, Tj=125 ºC	—	—	6	V
I_{RRM}	Repetitive peak reverse current	V_{RM}=6500V, Tj=125 ºC	—	—	300	mA
I_{DRM}	Repetitive peak off state current	V_{DM}=6500V, Tj=125 ºC Gate driver energized	—	—	150	mA
I_{GRM}	Reverse gate current	V_{RG}=21V, Tj=125 ºC	—	—	100	mA
dv/dt	Critical rate of rise of off state voltage	V_D=3000V, Tj=125 ºC Gate driver energized	3000	—	—	V/μs
tgt	Turn-on time	I_T=1500A, V_D=3000V, di/dt=1000A/μs Cs=0.2μF, Rs=5Ω, Tj=125 ºC (See Fig.1,2)	—	—	5	μs
td	Turn-on delay time		—	—	1	μs
Eon	Turn-on switching energy	I_T=800A, V_D=3000V, di/dt=1000A/μs Cs=0.2μF, Rs=5Ω, Tj=125 ºC (See Fig.1,2)	—	—	1.3	J/P
ts	Storage time	I_T=1500A , V_{DM}=3/4V_{DRM}, V_D=3000V Cs=0.2μF, Rs=5Ω, Tj=125 ºC (See Fig.1,3)	—	—	3	μs
Eoff	Turn-off switching energy	I_T=800A , V_{DM}=4000V, V_D=3000V Cs=0.2μF, Rs=5Ω, Tj=125 ºC (See Fig.1,3)	—	—	5.2	J/P
Q_{RR}	Reverse recovery charge	I_T=800A, V_R=3000V, di/dt=1000A/μs Cs=0.2μF, Rs=5Ω, Tj=125 ºC (See Fig.3,4)	—	—	2000	μC
Erec	Reverse recovery energy		—	—	7.4	J/P
I_{GT}	Gate trigger current	V_D=24V, R_L=0.1Ω, Tj=25 ºC DC method	—	—	0.75	A
V_{GT}	Gate trigger voltage		—	—	1.5	V

GATE DRIVER PART

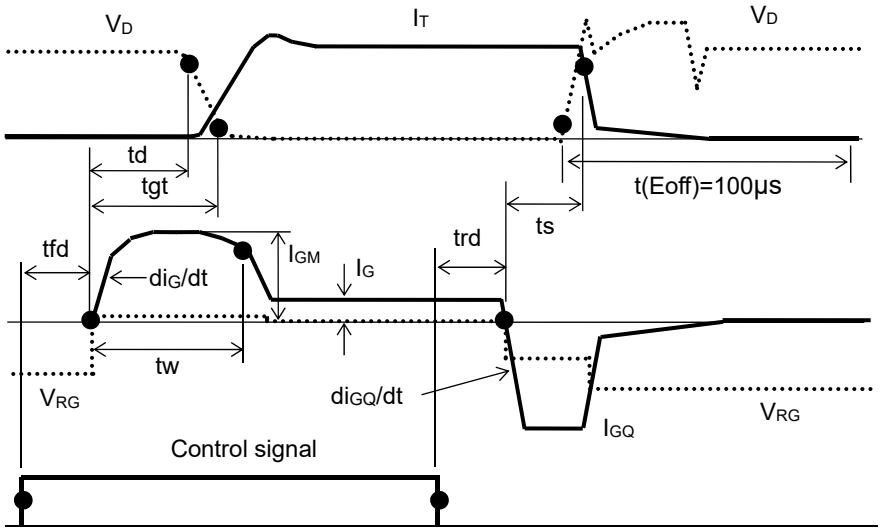
Symbol	Parameter	Condition	Limits			UNIT
			Min	Typ	Max	
V_{GIN}	Power supply voltage	DC power supply	19	20	21	V
P_{GIN}	Gate power consumption	I_T=830Arms, f=780Hz duty=0.33	—	—	35	W
tfd	Delay time of on gate current	Ta=25 ºC	—	—	3	μs
trd	Delay time of off gate current	Ta=25 ºC	—	—	3	μs
—	Control signal	Optical fiber data link Transmitter: HFBR-1521Z (BROADCOM) Receiver:HFBR-2521Z (BROADCOM)	—	—	—	—
—	Power supply connector	Phoenix contact Type name :MSTB25/2-G-508AU	—	—	—	—
—	Status signal	— (Note 1)	—	—	—	—

MECHANICAL DATA

Symbol	Parameter	Condition	Limits			UNIT
			Min	Typ	Max	
F_M	Mounting force	—	18	20	24	kN
—	Weight	—	—	1500	—	g
—	Pole piece diameter(GCT device)	±0.2mm	—	63	—	mm
—	Housing thickness(GCT device)	±0.5mm	—	26	—	mm

THERMAL DATA

Symbol	Parameter	Condition	Limits			UNIT
			Min	Typ	Max	
Tj	Junction operating temperature	—	-20	—	125	ºC
Tstg	Storage temperature	—	-40	—	60	ºC
Ta	Ambient operation temperature	Recommend:≤40 ºC	-10	—	60	ºC
Rt(j-f)	Thermal resistance	Junction to Fin	—	—	0.014	K /W



td; $0V_{RG}$～$0.9V_D$
tgt; $0V_{RG}$～$0.1V_D$
ts; $0V_{RG}$～$0.9I_T$
di_G/dt; $0.1I_{GM}$～$0.9I_{GM}$
tw; $0V_{RG}$～$0.9I_{GM}$
di_{GQ}/dt; $0.1I_{RG}$～$0.9I_{RG}$
tfd; 50%on signal～$0V_{RG}$
trd; 50%off signal～$0V_{RG}$

Fig.1 Turn on and turn off waveform

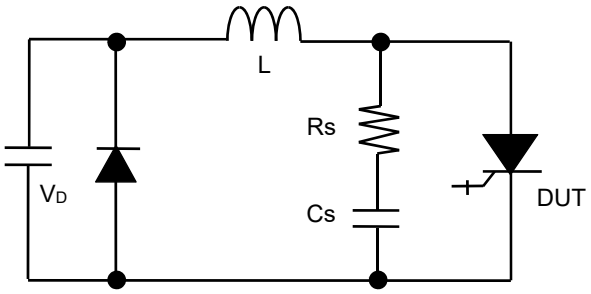


Fig.2 Turn-on test circuit

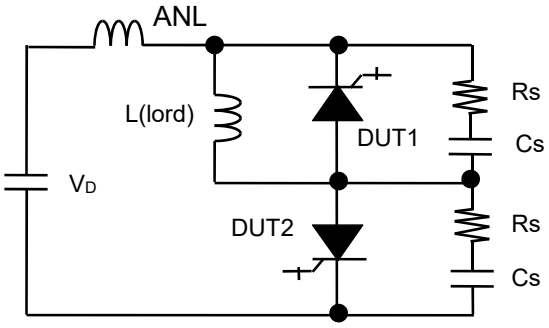


Fig.3 Turn off and Reverse recovery test circuit

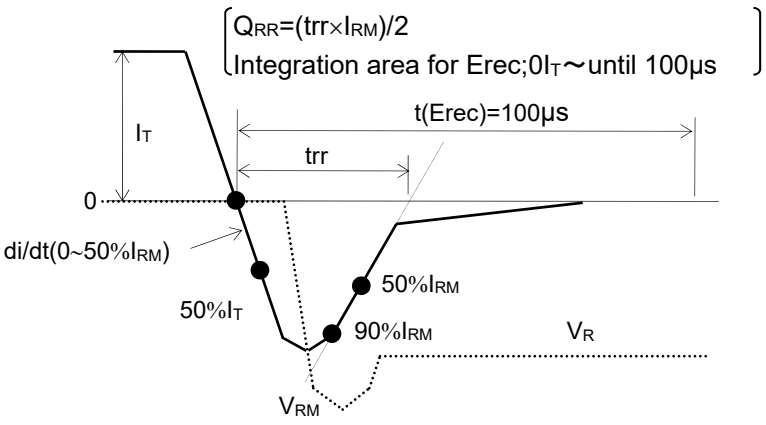


Fig.4 Reverse recovery waveform

(Note 1): Status signal

1.Status signal from LED

(1)Status signal

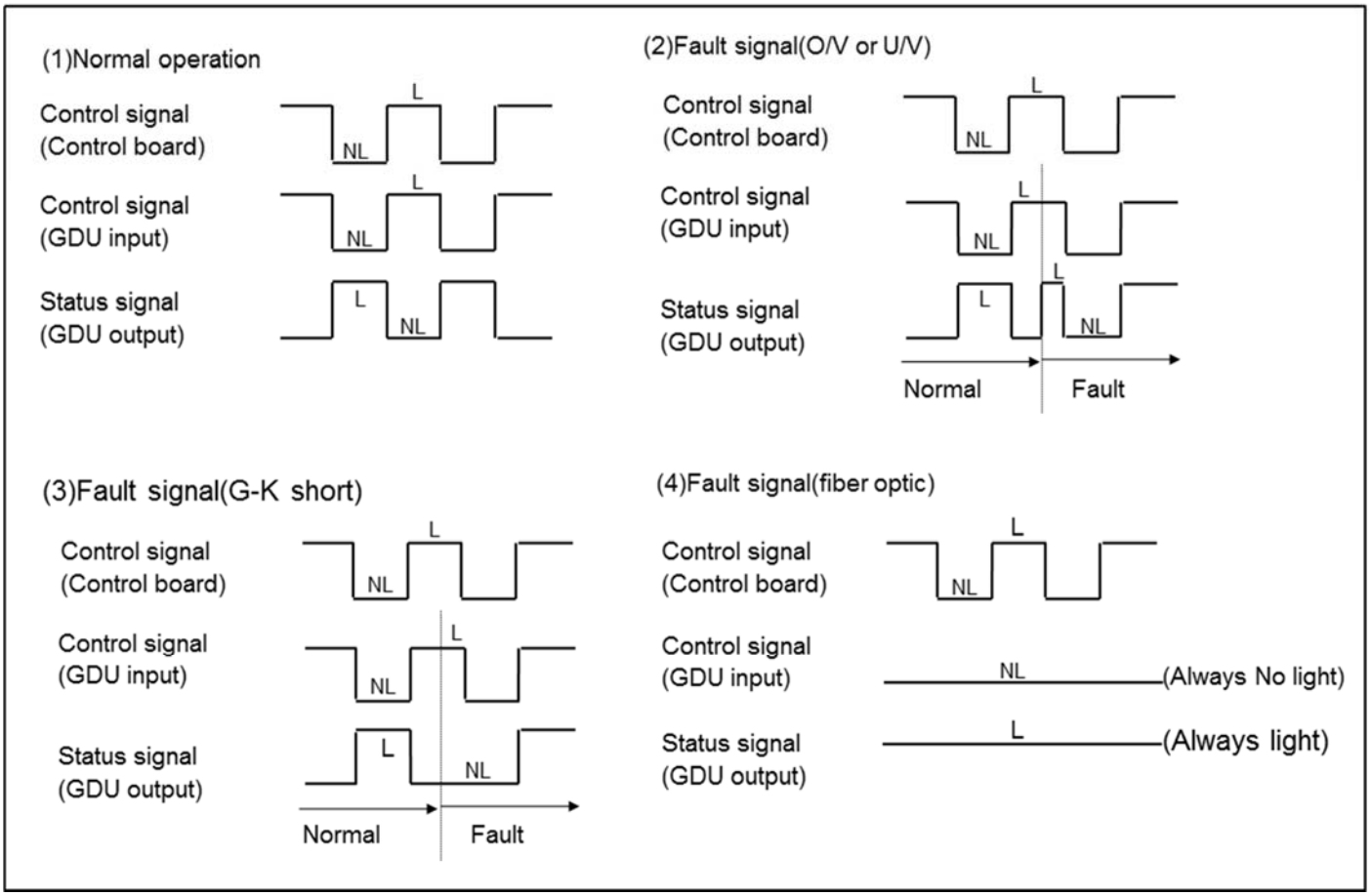
Status of GCT	LED 1 (Red)	LED 2 (Yellow)
On state	OFF	ON
Off state	ON	OFF

(2)Fault signal

Status	G-K	Power Supply	G-K LED (LED 3) (Green)	PS LED (LED 4) (Green)
Normal	Normal	20±1V	On	On
Fault	Normal	Voltage down	Off	Off
Fault	G-K short	20±1V	Off	On
Fault	G-K short	Voltage down	Off	Off

2.Status signal from Transmitter

(L: Light NL: No light)



(Note 2); Additional support for vibration test

Additional support is necessary for vibration test of GCU15DB-130. Fig.6 shows detailed figure about connection method between gate driver and heat sink by additional support.

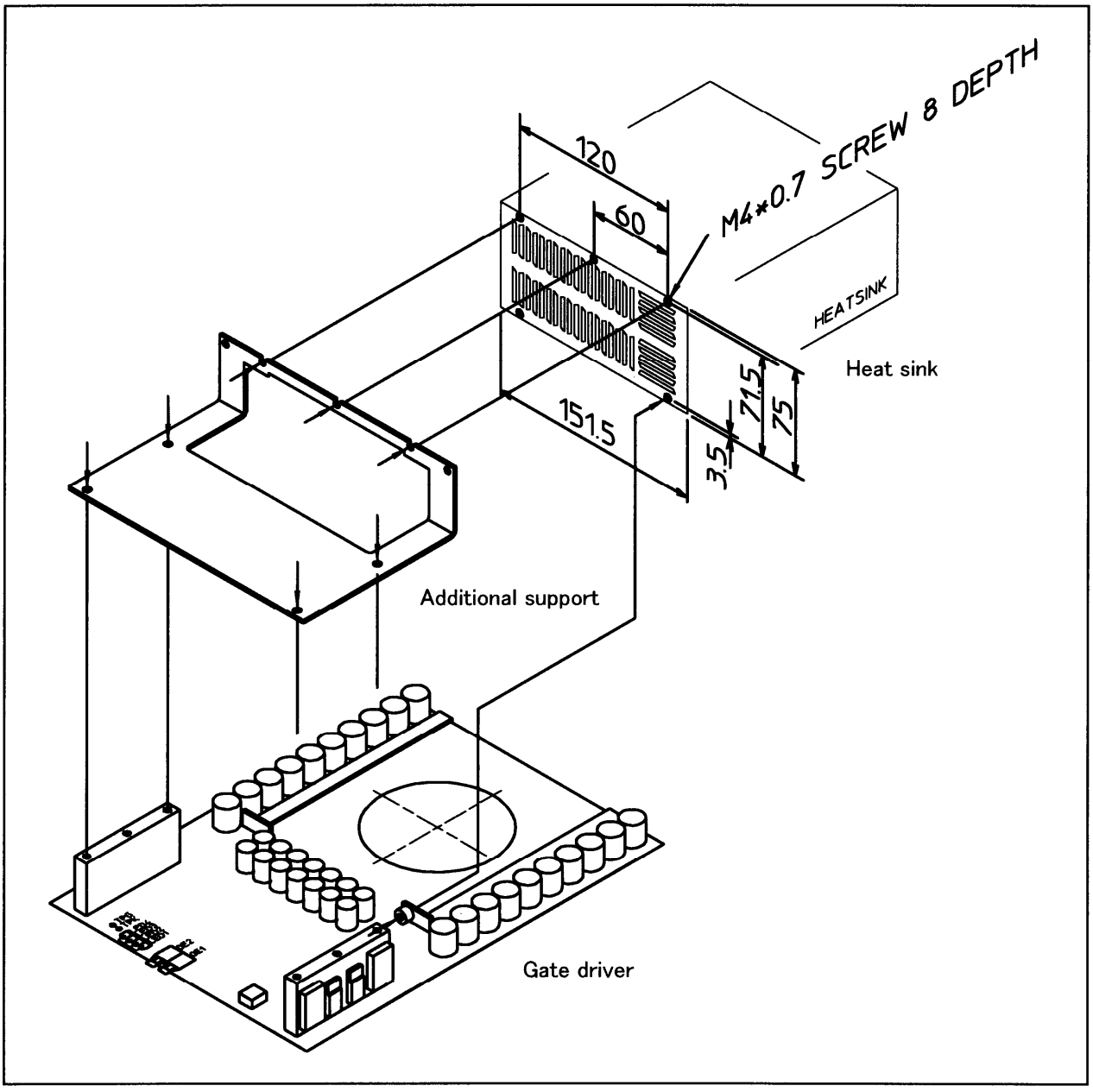
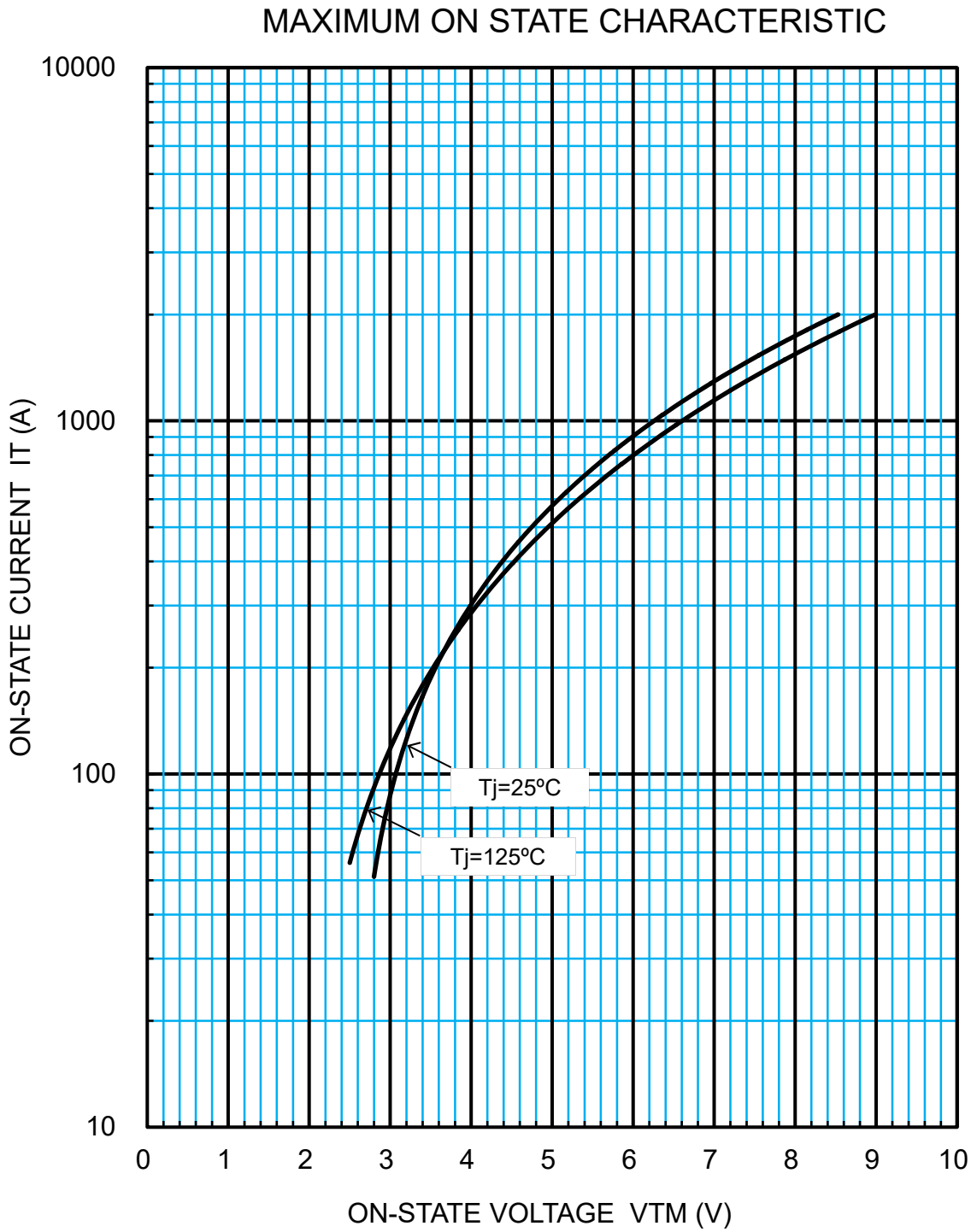
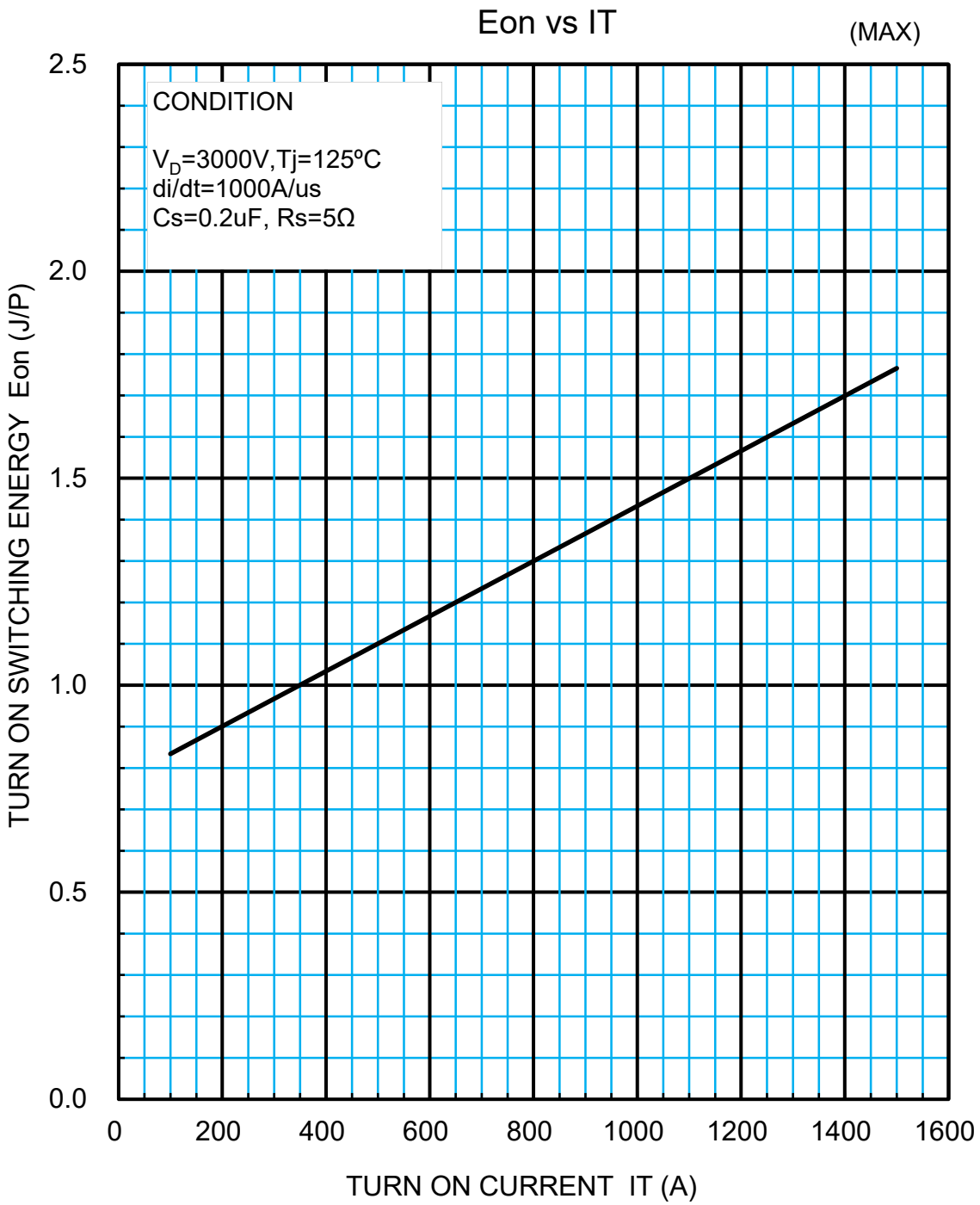
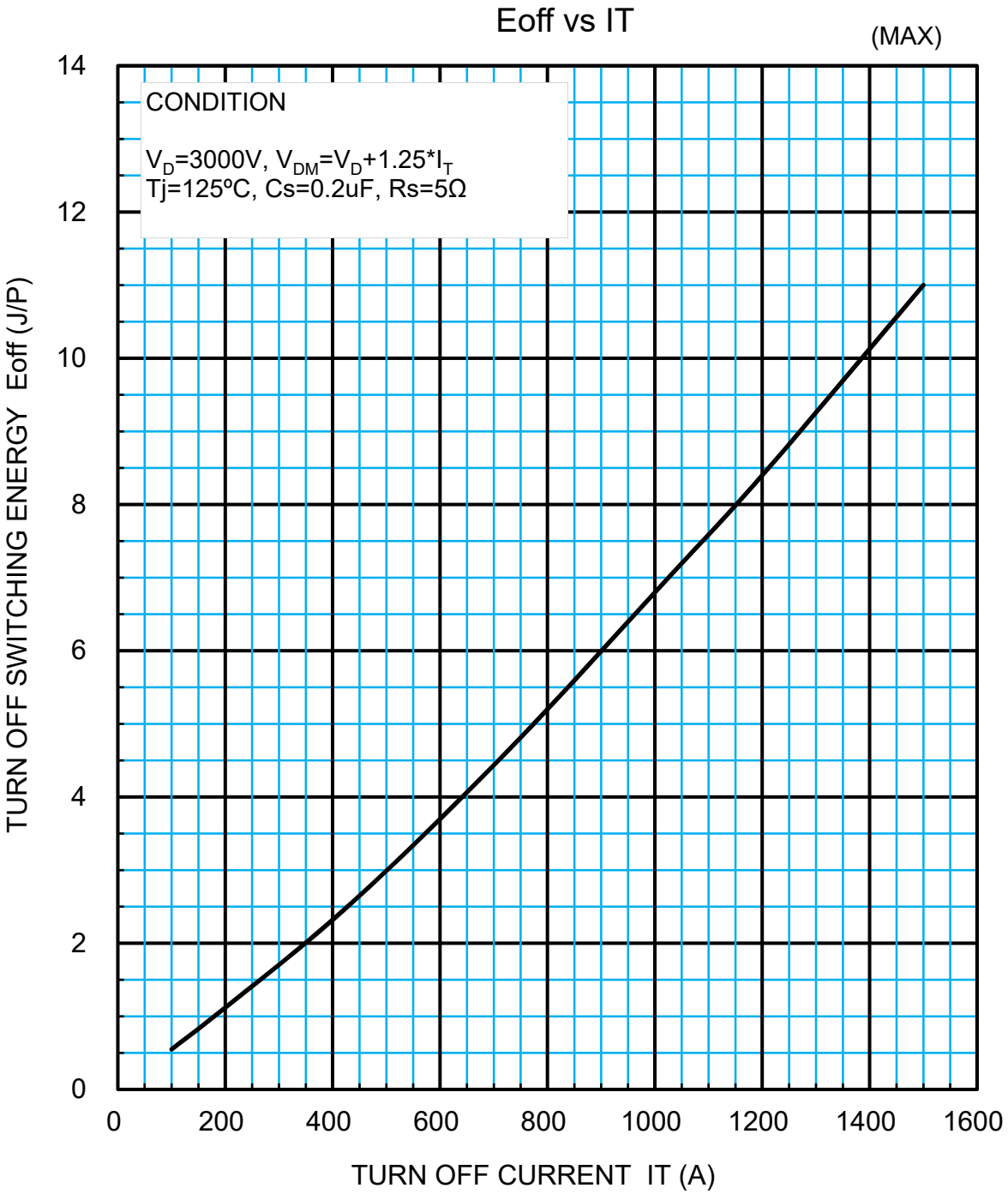
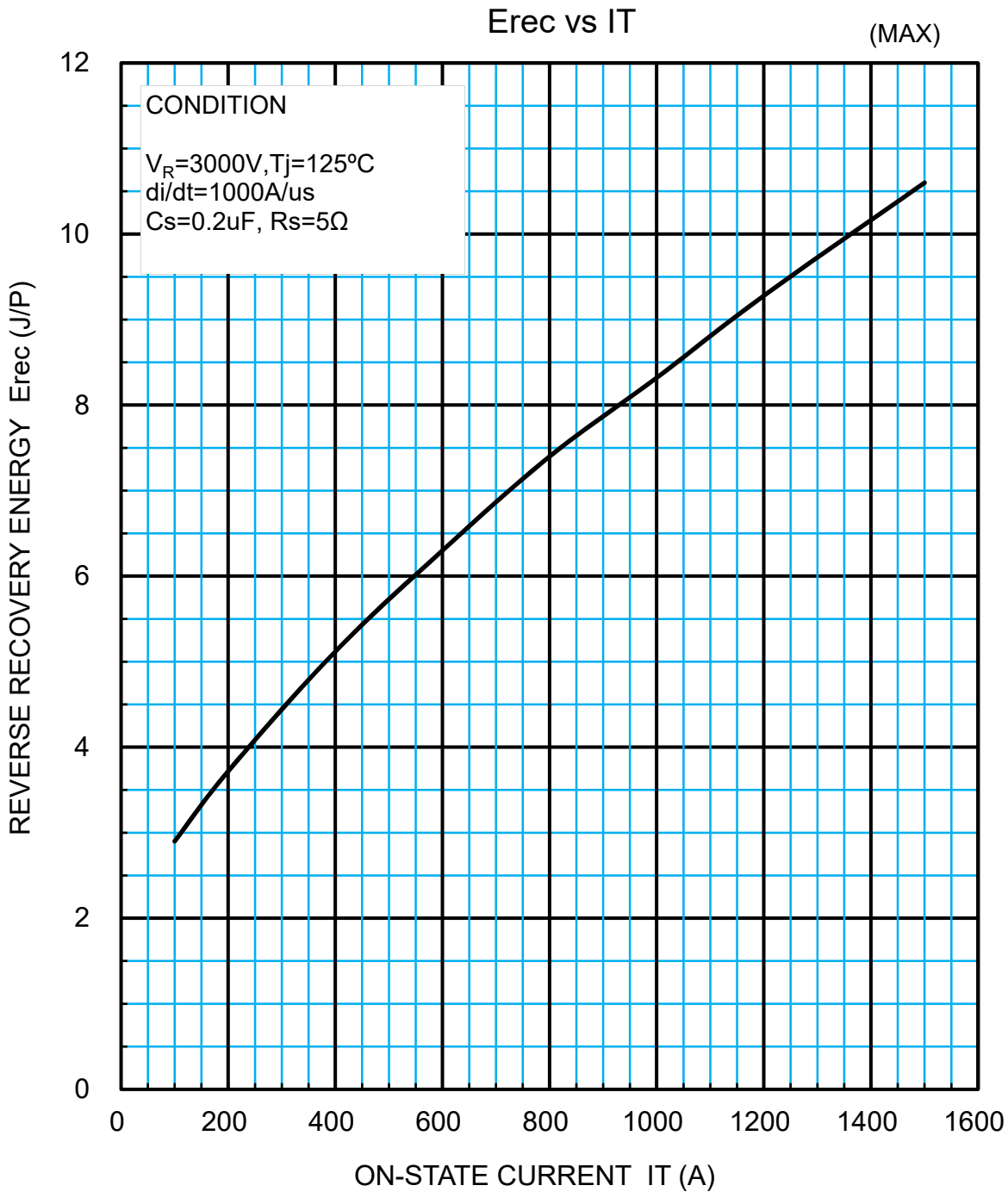


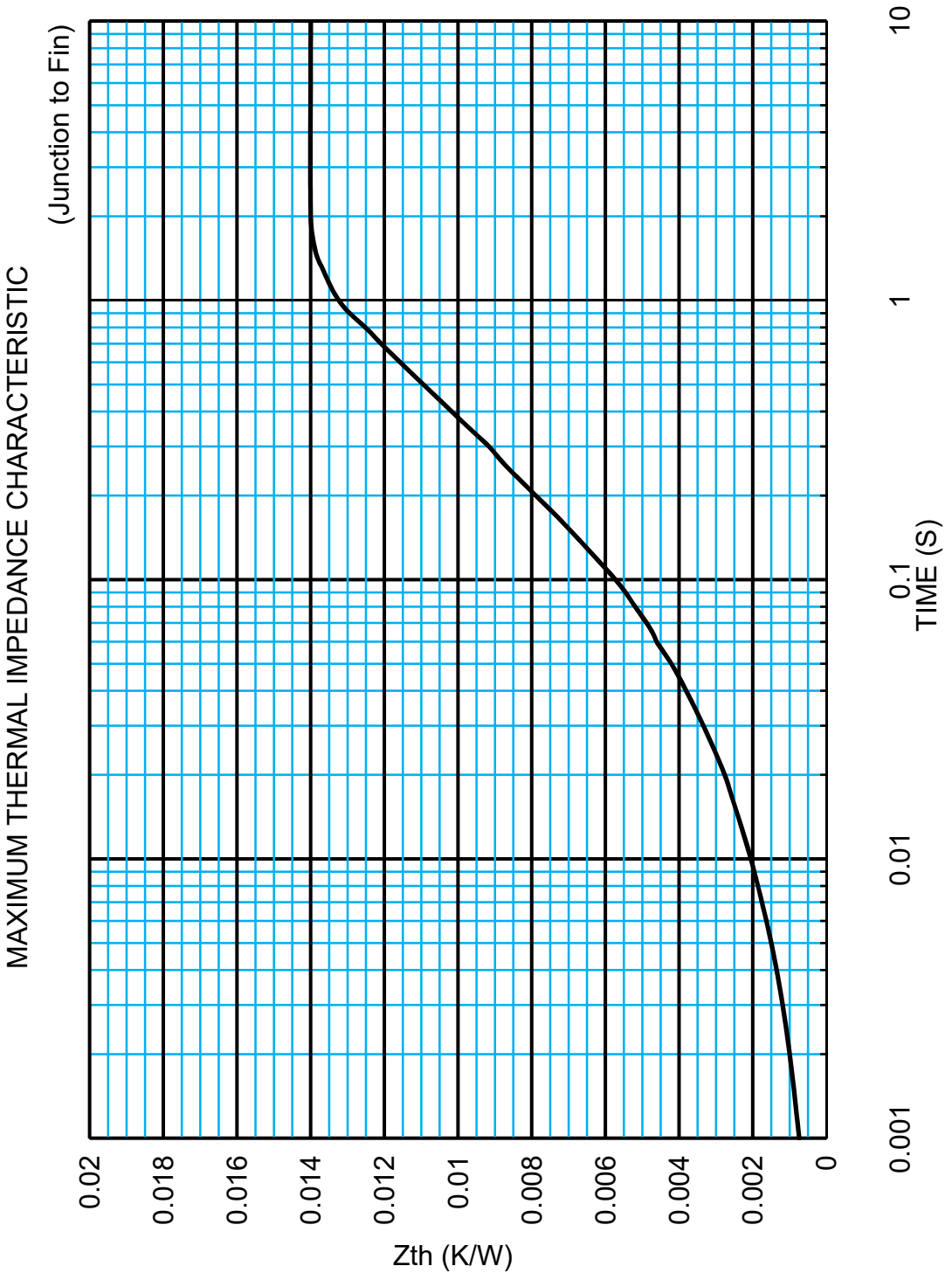
Fig.5 Connection method between gate driver and heat sink by additional support


MAXIMUM ON STATE CHARACTERISTIC
10000
1000
100
10
ON-STATE CURRENT IT (A)
0
1
2
3
4
5
6
7
8
9
10
ON-STATE VOLTAGE VTM (V)
Tj=25ºC
Tj=125ºC


Eon vs IT
(MAX)
CONDITION
V_D=3000V,Tj=125ºC
di/dt=1000A/us
Cs=0.2uF, Rs=5Ω
TURN ON SWITCHING ENERGY Eon (J/P)
2.5
2.0
1.5
1.0
0.5
0.0
0
200
400
600
800
1000
1200
1400
1600
TURN ON CURRENT IT (A)


Eoff vs IT
(MAX)
CONDITION
V_D=3000V, V_{DM}=V_D+1.25*I_T
Tj=125ºC, Cs=0.2uF, Rs=5Ω
TURN OFF SWITCHING ENERGY Eoff (J/P)
0
2
4
6
8
10
12
14
0
200
400
600
800
1000
1200
1400
1600
TURN OFF CURRENT IT (A)


Erec vs IT
(MAX)
CONDITION
V_R=3000V,Tj=125ºC
di/dt=1000A/us
Cs=0.2uF, Rs=5Ω
REVERSE RECOVERY ENERGY Erec (J/P)
ON-STATE CURRENT IT (A)
0
2
4
6
8
10
12
0
200
400
600
800
1000
1200
1400
1600


MAXIMUM THERMAL IMPEDANCE CHARACTERISTIC
(Junction to Fin)
Zth (K/W)
0.02
0.018
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
0.001
0.01
0.1
1
10
TIME (S)

Keep safety first in your circuit designs!

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