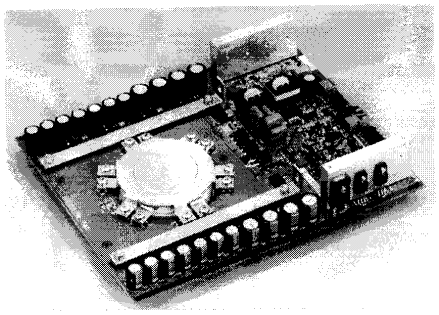
MITSUBISHI GCT(Gate Commutated Turn-off) THYRISTOR UNIT

GCU08BA-130

HIGH POWER INVERTER USE
PRESS PACK TYPE

GCU08BA-130



- Symmetrical GCT unit
- GCT and gate driver are connected
- I_{TQRM} :Repetitive controllable on state current.....800A
- $I_{T(AV)}$:Average on-state current.....330A
- V_{DRM} :Repetitive peak off state voltage 6500V
- V_{RRM} :Repetitive peak reverse voltage 6500V
- Tj :Operation junction temperature.....125deg

APPLICATION

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

GCT PART(Type name: FGC800B-130DS)

Symbol	Parameter	Condition	Voltage class	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	V_{GK}=-2V	6500	V
V_{DSM}	Non-repetitive peak off state voltage	V_{GK}=-2V	6500	V
V_{LTDS}	Long term DC stability voltage	V_{GK}=-2V, λ=100Fit	3600	V

Symbol	Parameter	Condition	Ratings	Unit
I_{TQRM}	Repetitive controllable on state current	V_{DM}=3/4V_{DRM}, V_D=3000V, Tj=25/125deg Lc=0.3μH, With GU-D08 (See Fig.1,3)	800	A
$I_{T(RMS)}$	RMS on-state current	Applied for all condition angles	520	A
$I_{T(AV)}$	Average on-state current	f=60Hz,sinewave θ=180°, Tf=62deg	330	A
I_{TSM}	Surge on-state current	One half cycle at 60Hz, Tj=125deg start	4.8	kA
I^2t	Current-squared, time integration		9.6×10^4	A^2s
di_T/dt	Critical rate of rise of on state current	I_T=800A, V_D=3000V, Tj=25/125deg Cs=0.1μF, Rs=10ohm, f=60Hz With GU-D08 (See Fig.1,2)	1000	A/μs
di_R/dt	Critical rate of rise of reverse recovery current	I_T=800A, V_R=3000V, Tj=25/125deg Cs=0.1μF, Rs=10ohm (See Fig.4,5)	1000	A/μs
V_{FGM}	Peak forward gate voltage		10	V
V_{RGM}	peak reverse gate voltage		21	V
I_{FGM}	Peak forward gate current		500	A
I_{RGM}	Peak reverse gate current		800	A
P_{FGM}	Peak forward gate power dissipation		5	kW
P_{RGM}	Peak reverse gate power dissipation		17	kW
$P_{FG(AV)}$	Average forward gate power dissipation		100	W
$P_{RG(AV)}$	Average reverse gate power dissipation		120	W
Tj	Operation junction temperature		-20~125	°C
Tstg	Storage temperature		-20~150	°C
—	Mounting force required	(Recommended value 13 kN)	11.1 ~ 15.8	kN
—	Weight	Typical value 530g	—	g

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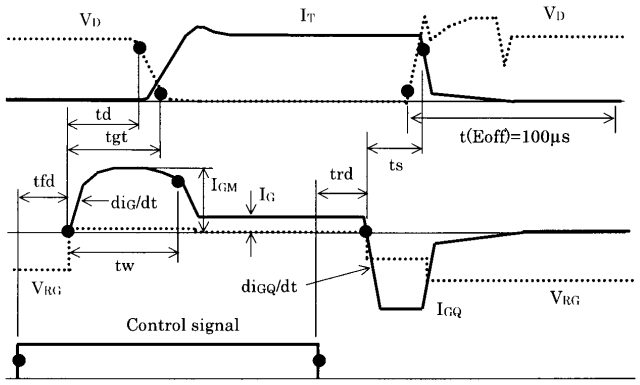
Symbol	Parameter	Condition	Limits			Unit
			Min	Typ	Max	
V_{TM}	On-state voltage	I_T=400A, Tj=125deg	–	–	5.5	V
I_{RRM}	Repetitive peak reverse current	V_{RM}=6500V, Tj=125deg	–	–	250	mA
I_{DRM}	Repetitive peak off state current	V_{DM}=6500V, V_{GK}=-2V, Tj=125deg	–	–	100	mA
I_{GRM}	Reverse gate current	V_{RG}=21V, Tj=125deg	–	–	40	mA
dv/dt	Critical rate of rise of off state voltage	V_D=3000V, V_{GK}=-2V, Tj=125deg (Expo. wave)	3000	–	–	V/μs
tgt	Turn-on time	I_T=800A, V_D=3000V, di/dt=1000A/μs	–	–	5	μs
td	Turn-on delay time	Cs=0.1μF, Rs=10ohm, Tj=125deg With GU-D08 (See Fig.1,2)	–	–	1	μs
Eon	Turn-on switching energy	I_T=400A, V_D=3000V, di/dt=1000A/μs Cs=0.1μF, Rs=10ohm, Tj=125deg With GU-D08 (See Fig.1,2)	–	–	0.6	J/P
ts	Storage time	I_T=800A , V_{DM}=3/4V_{DRM}, V_D=3000V Cs=0.1μF, Rs=10ohm, Tj=125deg With GU-D08 (See Fig.1,5)	–	–	3	μs
Eoff	Turn-off switching energy	I_T=400A , V_{DM}=4000V, V_D=3000V Cs=0.1μF, Rs=10ohm, Tj=125deg With GU-D08 (See Fig.1,5)	–	–	2.3	J/P
Q_{RR}	Reverse recovery charge	I_T=400A, V_R=3000V, di/dt=1000A/μs	–	–	1800	μC
Erec	Reverse recovery energy	Cs=0.1μF, Rs=10ohm, Tj=125deg (See Fig.4,5)	–	–	4.4	J/P
I_{GT}	Gate trigger current	V_D=24V, R_L=0.1ohm, Tj=25deg	–	–	0.5	A
V_{GT}	Gate trigger voltage	DC method	–	–	1.5	V
Rth(j-f)	Thermal resistance	Junction to Fin	–	–	0.025	K/W

GATE DRIVER PART(Type name: GU-D08)

Parameter	Symbol	Unit	Ratings			Conditions
			Min	Typ	Max	
Power supply (NOTE 1)	Vc	V	19	20	21	DC power supply
Power consumption	P	W	2.5	-	-	-
(NOTE 2)			-	-	35	I_T=420Arms, f=780Hz duty=0.33
Control signal (NOTE 3)	-	-	-	-	-	Optical fiber data link Transmitter: HFBR-1521(HP) Receiver:HFBR-2521(HP)
Frequency	f	Hz	-	-	780	I_T=420A, duty=0.33
Delay time of on gate current	tfd	μs	-	-	3.0	
Delay time of off gate current	trd	μs	-	-	3.0	
Critical rate of rise of on gate current	di_G/dt	A/μs	50	-	-	
Peak on gate current	I_{GM}	A	-	90	-	
Width of on high gate current	tw	μs	3	-	-	
On gate current	I_G	A	1.25	-	-	Tj≥-10deg
Critical rate of rise of off gate current	di_{GQ}/dt	A/μs	-	1200	-	V_{RG}=20V
Maximum duty	Dmax	%	-	-	100	
Temperature	Ta	deg.	-10	-	+60	Operation temperature (Recommend:≤40deg)
Weight	—	g	—	1100	—	With FGC800B-130DS
Status signal (NOTE 4)	—	—	—	—	—	



td; $0V_{RG}\sim0.9V_D$
tgt; $0V_{RG}\sim0.1V_D$
ts; $0V_{RG}\sim0.9I_T$
di_G/dt; $0.1I_{GM}\sim0.9I_{GM}$
tw; $0V_{RG}\sim0.9I_{GM}$
di_{GQ}/dt; $0.1I_{RG}\sim0.9I_{RG}$
tfd; 50%on signal$\sim0V_{RG}$
trd; 50%off signal$\sim0V_{RG}$
Integration area for Eoff;
$5\%V_D\sim$until 100μs

Fig.1:Turn on and turn off waveform

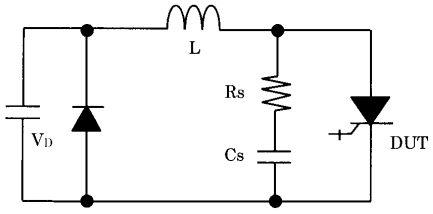


Fig.2:Turn-on test circuit

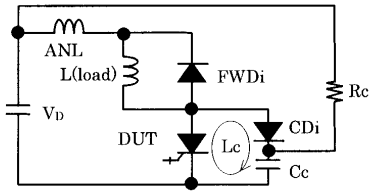


Fig.3:Turn-off test circuit (With clamp circuit)

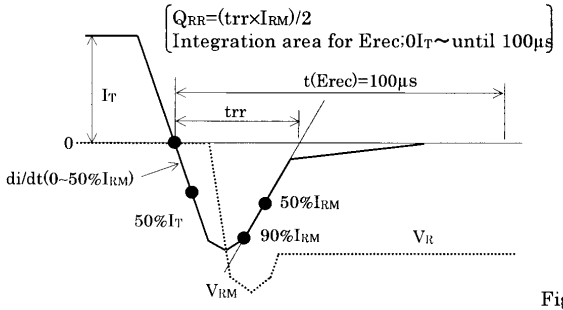


Fig.4:Reverse recovery waveform

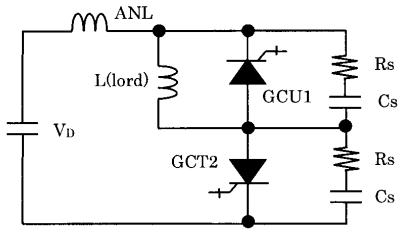


Fig.5:Turn off and Reverse recovery test circuit

Without the GDU and I_G=0.5A(DC) is supplied to GCT 1 at reverse recovery test.

(NOTE 1); (1)Guaranteed power supply voltage for operation is 19V minimum and 21V maximum.
(2)When over voltage occurs, GDU voltage bus (G-K voltage for GCT) is clamped to be 21V if maximum voltage for input gate voltage from power supply is 25V and maximum duration of over voltage higher than 21V from power supply is 0.4 sec when control signal is on(Please see Fig.8).
(3)When over voltage occurs, GDU voltage bus is clamped to be 21V with no time limitation if maximum voltage from power supply is 25V and control signal is off(Please see Fig.8).
(NOTE 2); GCT is off state and no gate signal is supplied for gate driver. No leakage current flows between gate and cathode of GCT.
(NOTE 3); Optic fiber data link HFBR-1521 and HFBR-2521 are interlocked each other.

(NOTE 4); 1. Status signal from LED
(1)Status signal

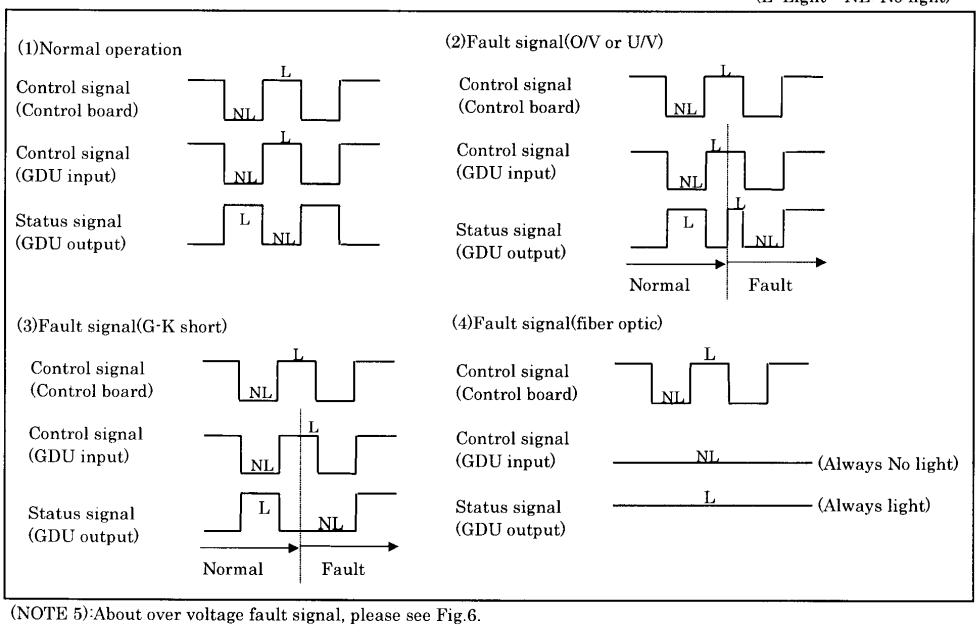
Status of GCT	LED 1 (Red)	LED 2 (Yellow)
On state	OFF	ON
Off state	ON	OFF

(2)Fault signal

Status	G-K	PS	PS LED (LED 4)	G-K LED (LED 3)
Normal	Normal	20±1V	On	On
Fault	Normal	Voltage down	Off, V<17.5V(Typ.)	Off(If V>12.5V(Typ.) then LED 3 is on)
Fault	G-K short	20±1V	On	Off
Fault	G-K short	Voltage down	Off, V<17.5V(Typ.)	Off

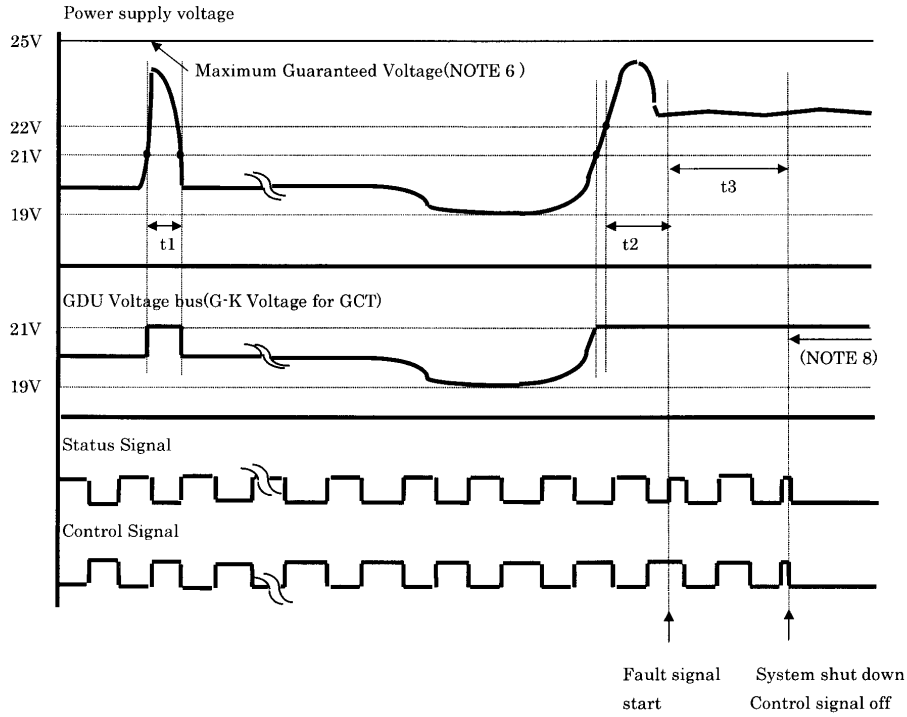
2. Status signal from Transmitter(NOTE 5)

(L: Light NL: No light)



(NOTE 5):About over voltage fault signal, please see Fig.6.

Fig.6: Over voltage fault signal timing chart



1) t1< 1.0 ms
   Max. repetition rate; 1 pulse/100 ms
2) t2≧ 1.0 ms
3) t3<0.4sec

(NOTE 6); Maximum peak voltage of GDU input voltage from power supply should be lower than 25V.

(NOTE 7); If the period for over voltage < 1.0 ms(period t1),no fault signal is sent.
If the period for over voltage ≧1.0 ms, fault signal starts after period t2 from22V of power supply voltage.
System should be shut down(Control signal should be off) within period t3 from fault signal start.

(NOTE 8);GDU Voltage bus(G-K Voltage for GCT) is clamped to be 21V if power supply voltage is higher than 21V after system shut down(control signal off).

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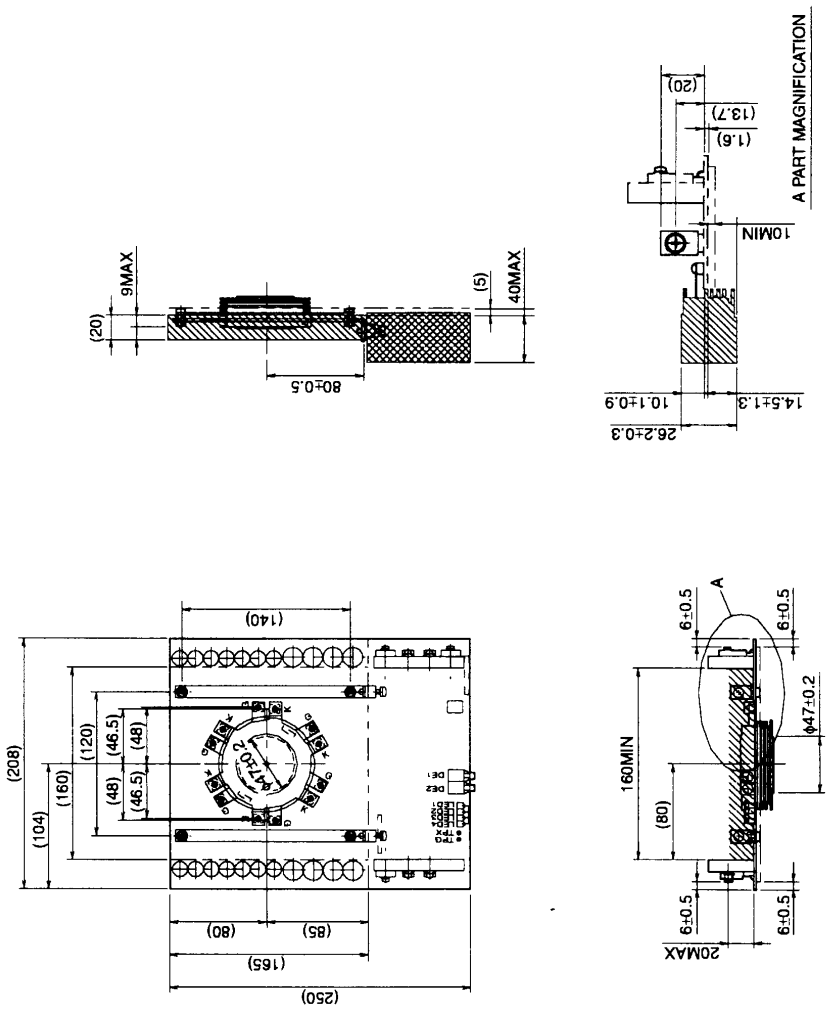
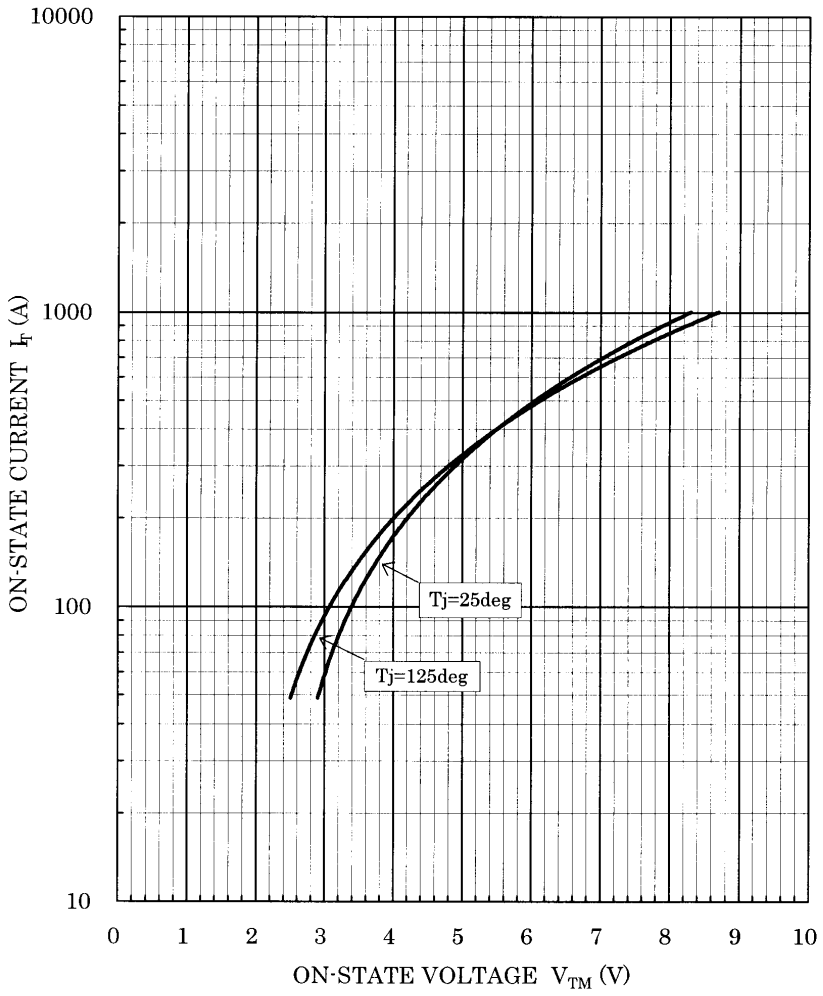
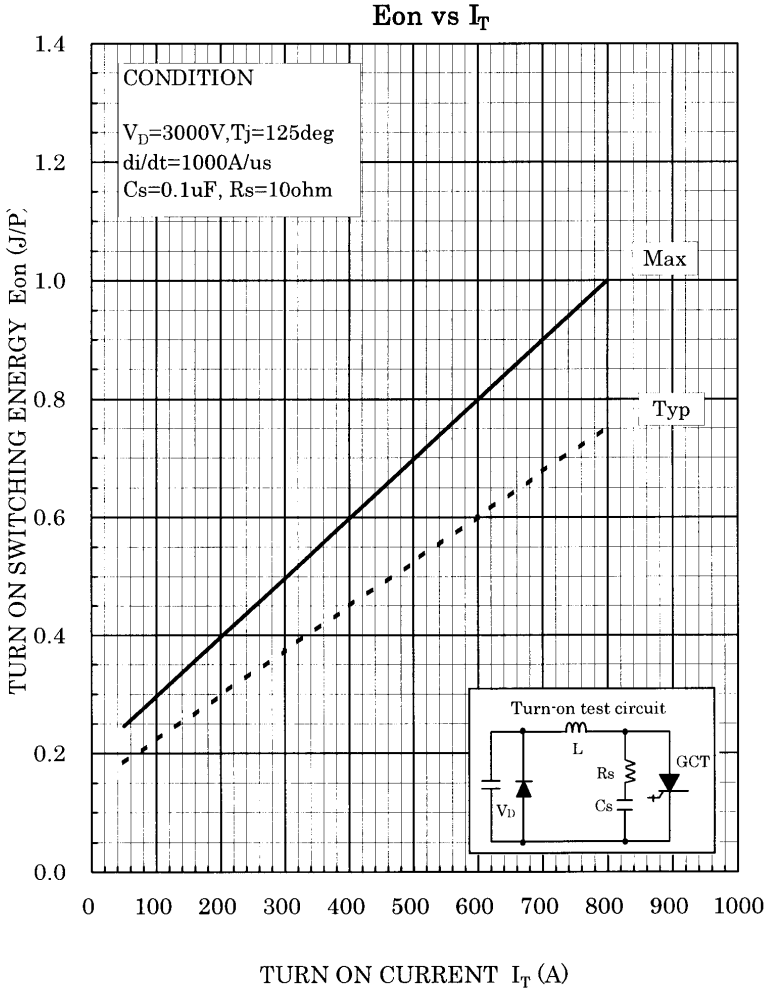
Dimensions in mm

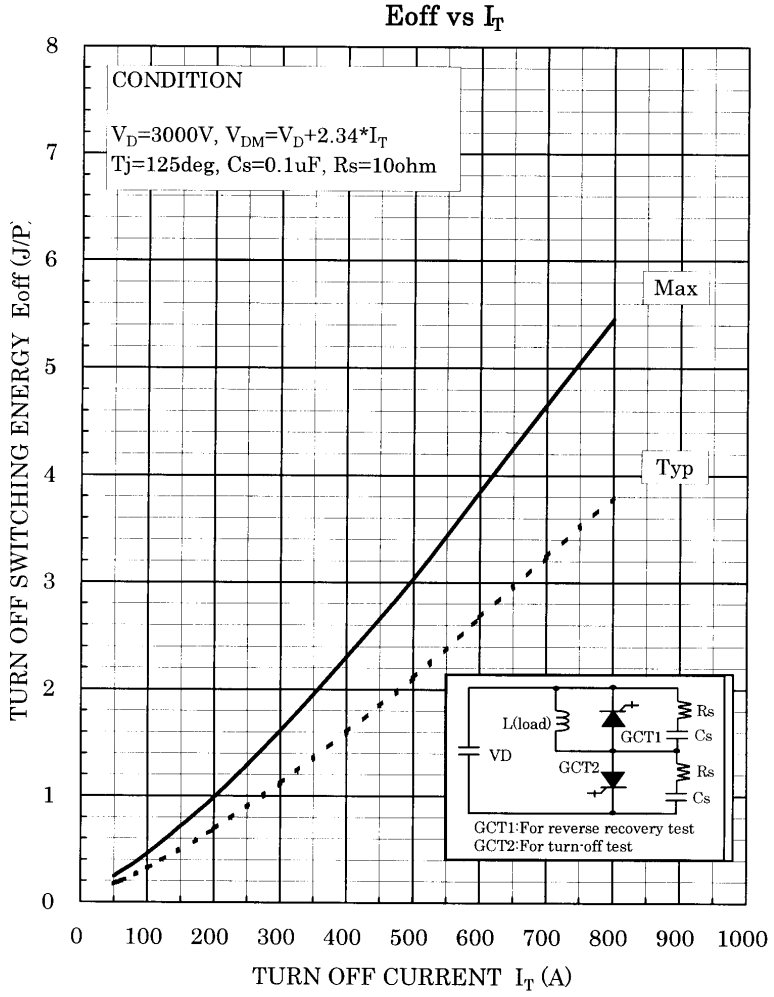
OUTLINE DRAWING

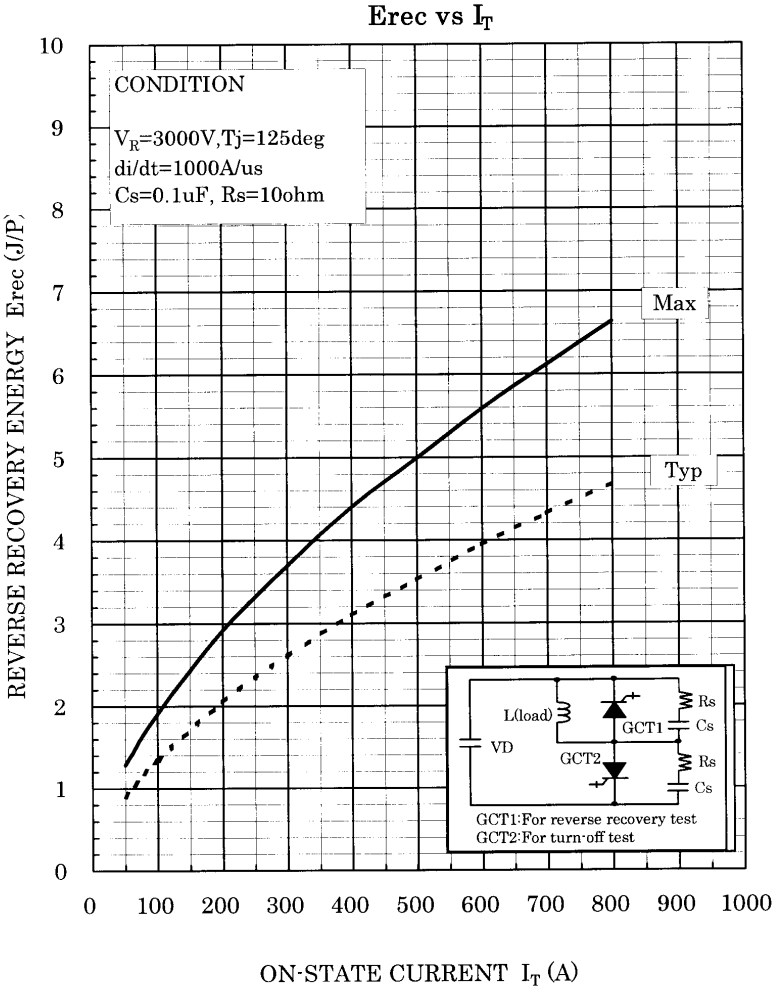


MAXIMUM ON STATE CHARACTERISTIC




Eon vs I_T
CONDITION
V_D=3000V,Tj=125deg
di/dt=1000A/us
Cs=0.1uF, Rs=10ohm
Max
Typ
Turn-on test circuit
L
Rs
Cs
GCT
V_D
TURN ON SWITCHING ENERGY Eon (J/P)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
100
200
300
400
500
600
700
800
900
1000
TURN ON CURRENT I_T (A)


Eoff vs I_T
CONDITION
V_D=3000V, V_{DM}=V_D+2.34*I_T
Tj=125deg, Cs=0.1uF, Rs=10ohm
Max
Typ
TURN OFF SWITCHING ENERGY Eoff (J/P)
TURN OFF CURRENT I_T (A)
0
1
2
3
4
5
6
7
8
0
100
200
300
400
500
600
700
800
900
1000
L(load)
VD
GCT1
GCT2
Rs
Cs
Rs
Cs
GCT1:For reverse recovery test
GCT2:For turn-off test


Erec vs I_T
CONDITION
V_R=3000V,Tj=125deg
di/dt=1000A/us
Cs=0.1uF, Rs=10ohm
Max
Typ
L(load)
VD
GCT1
GCT2
Rs
Cs
Rs
Cs
GCT1:For reverse recovery test
GCT2:For turn-off test
REVERSE RECOVERY ENERGY Erec (J/P)
0
1
2
3
4
5
6
7
8
9
10
0
100
200
300
400
500
600
700
800
900
1000
ON-STATE CURRENT I_T (A)

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