SG(600, 800)EX21

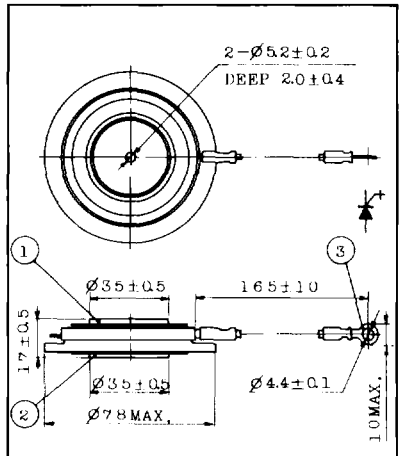
GATE TURN-OFF THYRISTOR
SILICON DIFFUSED TYPE

CHOPPER, INVERTER APPLICATION

FEATURES:

- Repetitive Peak Off-State Voltage : V_{DRM}=2500V
- Repetitive Peak Reverse Voltage : V_{RRM}=1250V
- R.M.S On-State Current : $I_{T(RMS)}$=400A
- Peak Turn-Off Current : I_{TGQM}=600, 800A
- Critical Rate of Rise of On-State Current
  : di/dt=100A/μs
- Critical Rate of Rise of Off-State Voltage
  : dv/dt=350V/μs
- Flat Package

Unit in mm



1. CATHODE
2. ANODE
3. GATE

JEDEC	—
EIAJ	—
TOSHIBA	13-78B1A

Weight : 260g

MAXIMUM RATINGS

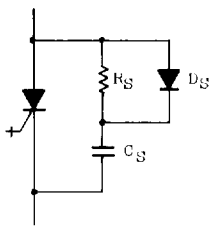
CHARACTERISTIC		SYMBOL	RATING	UNIT
Repetitive Peak Off-State Voltage		V_{DRM}	2500	V
Repetitive Peak Reverse Voltage		V_{RRM}	1250	V
Peak Turn-Off Current (Note.2)	SG600EX21	I_{TGQM}	600	A
	SG800EX21		800	A
R.M.S On-State Current		$I_{T(RMS)}$	400	A
Peak One Cycle Surge On-State Current (Non-Repetitive)		I_{TSM}	5000(50Hz)	A
			5500(60Hz)	
Critical Rate of Rise of On-State Current (Note.1)		di/dt	100	A/μs
Peak Forward Gate Power Dissipation		P_{FGM}	20	W
Peak Reverse Gate Power Dissipation		P_{RGM}	8	kW
Average Forward Gate Power Dissipation		$P_{G(AV)}$	4	W
Peak Forward Gate Current		I_{FGM}	10	A
Peak Reverse Gate Voltage		V_{RGM}	10	V
Storage Temperature Range		T_{stg}	-40~115	^{o}C
Operating Junction Temperature Range		T_j	-40~115	^{o}C
Mounting Force		-	1200±120	kg

Note.1 : V_D=1/2 Rated, Gate Supply (I_G=5A, $t_r \leqslant 1\mu s$), f=50Hz

ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Repetitive Peak Off-State Current	I_{DRM}	V_{DRM}, V_{RRM}=Rated R_{GK}=20Ω, T_j=115°C		-	-	50	mA
Repetitive Peak Reverse Current	I_{RRM}			-	-	50	mA
Peak On-State Voltage	V_{TM}	I_{TM}=600A, Tc=25°C		-	-	2.5	V
Gate Trigger Voltage	V_{GT}	V_D=12V, R_L=2Ω	Tc=-40°C	-	1.0	-	V
			Tc=25°C	-	0.65	2.0	
Gate Trigger Current	I_{GT}		Tc=-40°C	-	400	-	mA
			Tc=25°C	-	120	350	
Gate Non-Trigger Voltage	V_{GD}	V_D=1/2 Rated, Tc=115°C		0.3	-	-	V
Gate Non Trigger Current	I_{GD}			10	-	-	mA
Delay Time	t_d	V_D=1/2 Rated, Tc=25°C Gate Supply (I_G=5A, $t_r \leq 1\mu s$)		-	-	4	μs
Gate Turn-On Time	tgt			-	-	10	
Critical Rate of Rise of Off-State Voltage	dv/dt	V_{DRM}=2/3 Rated T_j=115°C, V_G=-4V Exponential Rise R_{GK}=20Ω		350	-	-	V/μs
Holding Current	IH	Tc=25°C, R_{GK}=20Ω, R_L=2Ω		-	2	-	A
Gate Turn-Off Voltage	V_{GQ}	I_T=600A, V_{DRM}=2/3 Rated dv/dt=350V/μs Tc=110°C		-	25	-	V
Gate Turn-Off Current	I_{GQ}			-	180	-	A
Storage Time (Note. 2)	t_s	diRG/dt=30A/μs I_T=600A, I_{RG}=200A dv/dt=350V/μs V_{DRM}=2/3 Rated, Tc=110°C		-	-	15	μs
Gate Turn-Off Time (Note. 2)	tgq			-	-	18	
Thermal Resistance	$R_{th(j-f)}$	Junction to Fin		-	-	0.04	°C/W

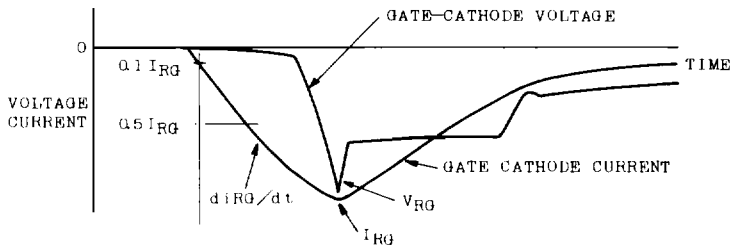
Note 2 : Sunbber Circuit



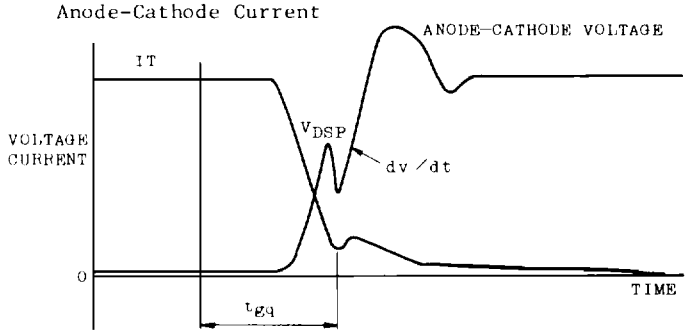
R_S : 20Ω

C_S : 2μF

Waveforms of Voltage and Current During Turn-Off



Anode-Cathode Current



di/dt PROTECTION

For di/dt protection, inductance is needed especially on high treguncy operation to decrease the power dissipation during turn on.

But inductance in the main circuit causes instantaneous over-voltage on GTO during turn off, so the suppressor of the voltage, for example the fly-wheeling diode of inductance, is needed to decrease the power dissipation during turn-off.

dv/dt PROTECTION

Because the GTO dose not adopt the shorted-emitter structure, dv/dt capability is not so high.

Gate-cathode reverse dias should be applied to prevent dv/dt triggering during turn-off.

And optimum snubber circuit is needed for the same purpose.

RECOMMENDED SNUBBER CIRCUIT

·The following conditions should be maintained during turn-off

: $V_{DSP} \leqq 600V$ for SG600EX21, SG800EX21 (See Fig.2)

To satisfy the above condition the snubber circuit is necessary. The recommended valuses of capacitance and resistance of snubber circuit are as follows

: C_S 2μF
R_S 20Ω

and Fast Recovery Diode is desirable for Ds.

And the wire length of the snubber circuit loop should be minimized. (See Fig.1)

RECOMMENDED GATE-CATHODE WAVE FORMS

The following conditions are desirable : to minimize turn-on and turn-off power dissipation.

to keep continuous on-state.

to prevent dv/dt triggering during turn-off.

to supply high peak gate turn-off current.

$t_r \leqq 1\mu s$

$I_{FGM} \geqq 5A$

$t_{w1} \geqq 20\mu s$

$I_{FG} \geqq 2A$

$diRG/dt = 20 \sim 30A/\mu s$

$I_{RG} = 180 \sim 220A$

$V_{RG} = 20 \sim 35V$

$t_{w2} = 30\mu s$

$t_{w3} = 120\mu s$

$VR = 5V$

Fig. 1 TEST CIRCUIT

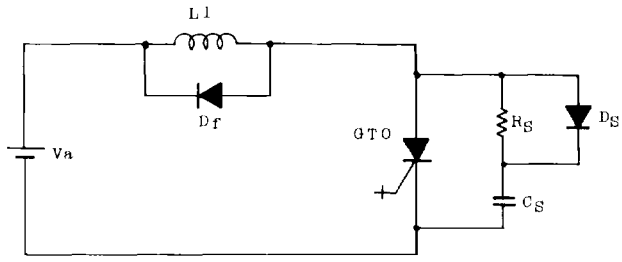


Fig. 2 TYPICAL WAVEFORMS OF ANODE-CATHODE VOLTAGE AND CURRENT

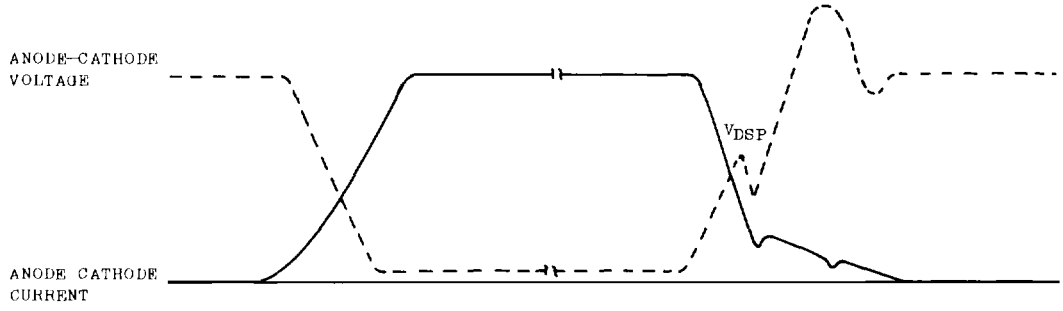
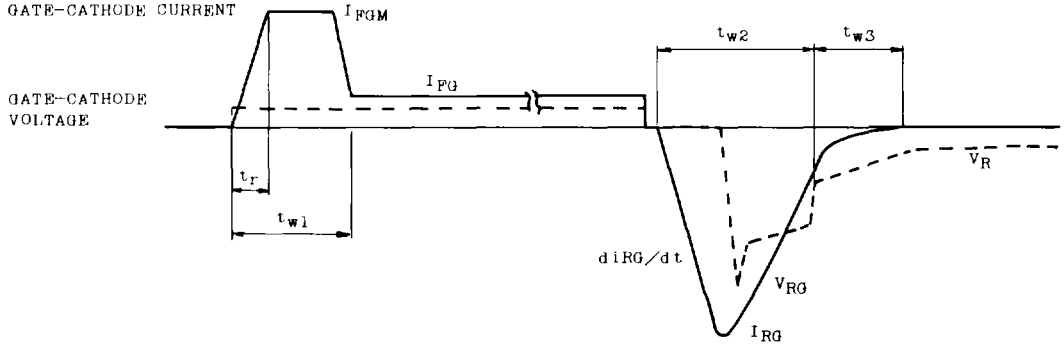
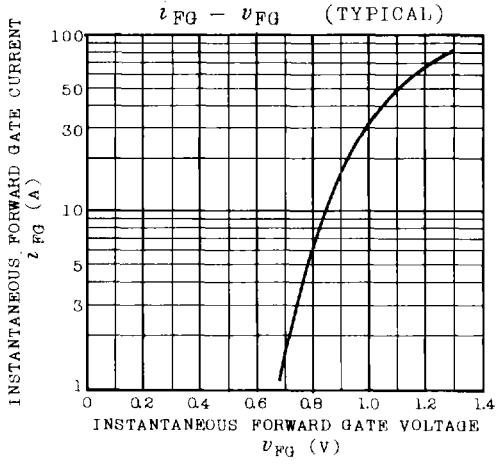


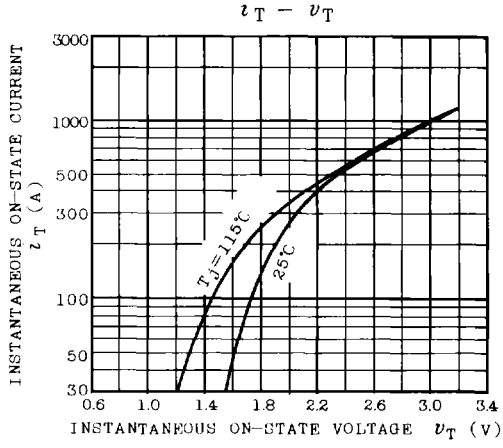
Fig. 3 TYPICAL WAVEFORMS OF GATE-CATHODE VOLTAGE AND CURRENT



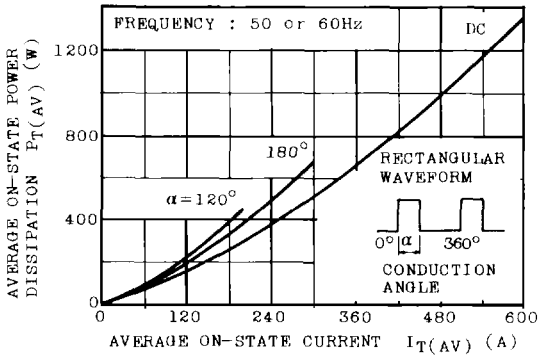
$i_{FG} - v_{FG}$ (TYPICAL)



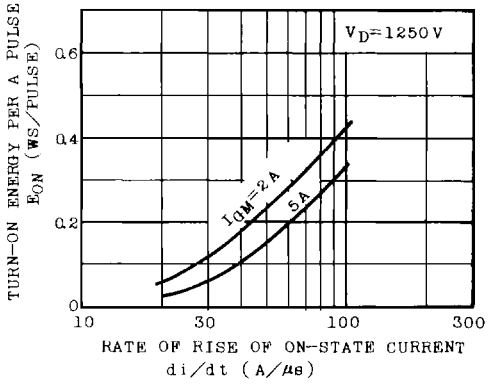
$i_T - v_T$



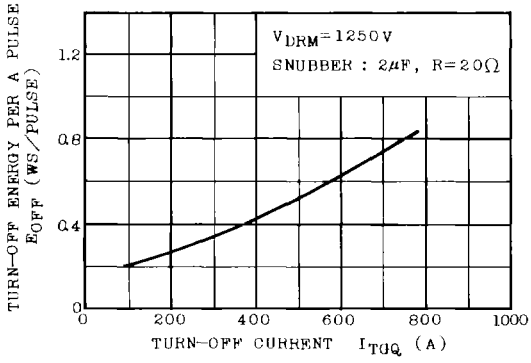
$P_{T(AV)} - I_{T(AV)}$

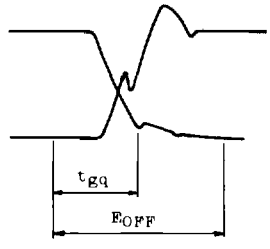


TURN-ON ENERGY

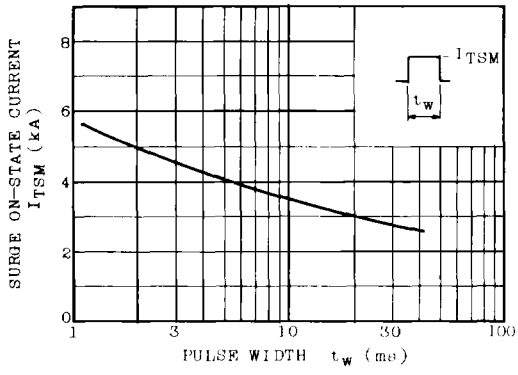


TURN-OFF ENERGY (RESISTIVE LOAD)

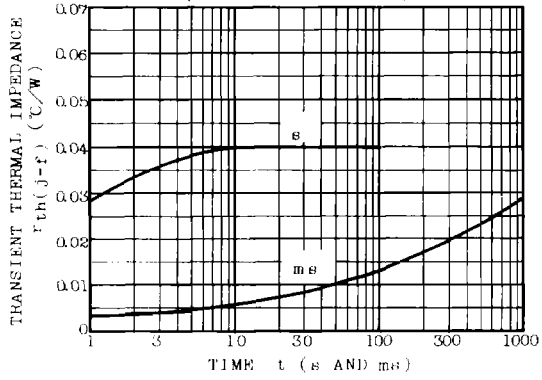




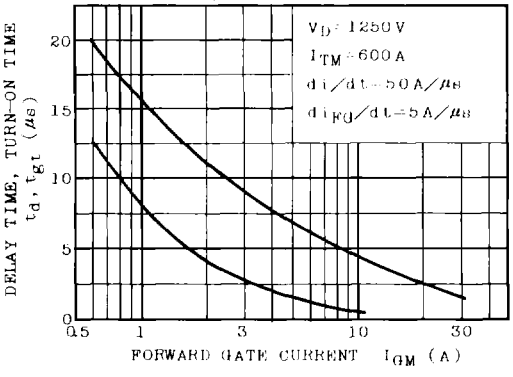
$I_{TSM} - t_w$



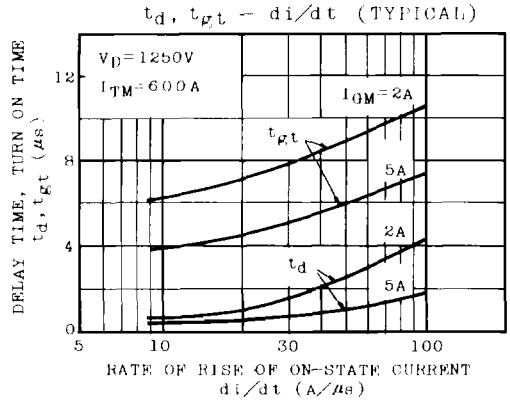
TRANSIENT THERMAL IMPEDANCE (JUNCTION TO FIN)



$t_d, t_{gt} - I_{GM}$ (TYPICAL)



$t_d, t_{gt} - di/dt$ (TYPICAL)



$t_s, t_f - di_{RG}/dt$ (TYPICAL)