

MITSUBISHI REVERSE-CONDUCTING GTO THYRISTORS

# FGR3000FX-90DA

HIGH POWER INVERTER USE  
PRESS PACK TYPE

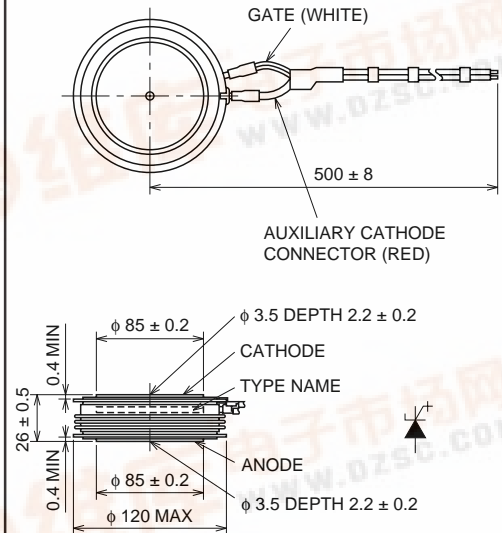
FGR3000FX-90DA



- ITQRM Repetitive controllable on-state current ..... 3000A
- IT(AV) Average on-state current ..... 780A
- VDRM Repetitive peak off state voltage ..... 4500V
- Reverse conducting type

OUTLINE DRAWING

Dimensions in mm



## APPLICATION

Inverters, D.C. choppers, Induction heaters, D.C. to D.C. converters.

## MAXIMUM RATINGS

Symbol	Parameter	Voltage class		Unit
		90DA		
VDRM	Repetitive peak off-state voltage*	4500		V
VDSM	Non-repetitive peak off-state voltage*	4500		V
VD(DC)	DC off-state voltage*	3600		V
VLTD5	Long term DC stability voltage*	3000		V

\* : VGK = -2V

Symbol	Parameter	Conditions	Ratings	Unit
ITQRM	Repetitive controllable on-state current	VDM = 4500V, Tj = 125°C, Cs = 6.0μF, Ls = 0.2μH	3000	A
IT(RMS)	RMS on-state current		1220	A
IT(AV)	Average on-state current	f = 60Hz, sine wave θ = 180°, Tr = 70°C	780	A
ITSM	Surge (non-repetitive) on-state current	One half cycle at 60Hz	16	kA
IT <sup>2</sup> t	I <sup>2</sup> t for fusing	One cycle at 60Hz	1.0 × 10 <sup>6</sup>	A <sup>2</sup> s
IR(RMS)	RMS Reverse current		940	A
IR(AV)	Average reverse current	f = 60Hz, sine wave θ = 180°C, Tr = 75°C	600	A
IRSM	Surge (non-repetitive) reverse current	One half cycle at 60Hz	16	kA
IR <sup>2</sup> t	Current-squared, time integration	One cycle at 60Hz	1.0 × 10 <sup>6</sup>	A <sup>2</sup> s
diT/dt	Critical rate of rise of on-state current	VD = 3000V, IGM = 75A, Tj = 75°C	500	A/μs
VFGM	Peak forward gate voltage		10	V
VRGM	Peak reverse gate voltage		18	V
IFGM	Peak forward gate current		100	A
IRGM	Peak gate reverse current		900	A
PFGM	Peak forward gate power dissipation		400	W
PRGM	Peak reverse gate power dissipation		27	kW
PFG(AV)	Average forward gate power dissipation		100	W
PRG(AV)	Average reverse gate power dissipation		230	W
Tj	Junction temperature		-40 ~ +125	°C
Tstg	Storage temperature		-40 ~ +150	°C
—	Mounting force required	Recommended value 37	31 ~ 43	kN
—	Weight	Standard value	1450	g

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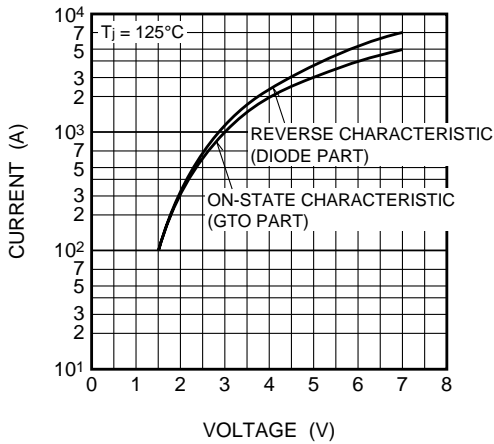
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## ELECTRICAL CHARACTERISTICS

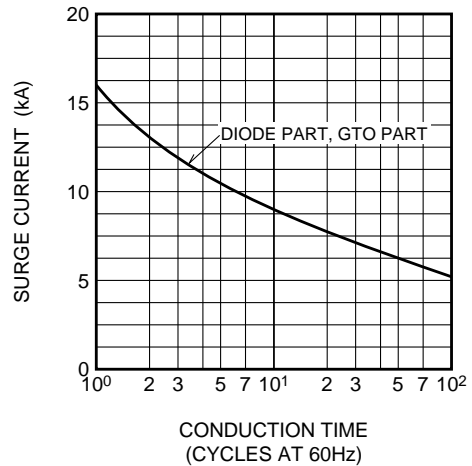
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
V <sub>TM</sub>	On-state voltage	T <sub>j</sub> = 125°C, I <sub>TM</sub> = 3000A, Instantaneous measurement	—	—	5.0	V
V <sub>RM</sub>	Peak reverse voltage drop	T <sub>j</sub> = 125°C, I <sub>RM</sub> = 3000A, Instantaneous measurement	—	—	4.5	V
I <sub>DRM</sub>	Repetitive peak off-state current	T <sub>j</sub> = 125°C, V <sub>DRM</sub> Applied, V <sub>GK</sub> = -2V	—	—	250	mA
I <sub>RG</sub>	Reverse gate current	T <sub>j</sub> = 125°C, V <sub>RG</sub> = 17V	—	—	500	mA
dv/dt	Critical rate of rise of off-state voltage	T <sub>j</sub> = 125°C, V <sub>D</sub> = 3000V, V <sub>GK</sub> = -2V	1000	—	—	V/μs
t <sub>gt</sub>	Turn-on time	T <sub>j</sub> = 125°C, I <sub>TM</sub> = 3000A, I <sub>GM</sub> = 75A, V <sub>D</sub> = 3000V	—	—	10	μs
t <sub>gq</sub>	Turn-off time	T <sub>j</sub> = 125°C, I <sub>TM</sub> = 3000A, V <sub>DM</sub> = 4500V, diGQ/dt = -30A/μs V <sub>RG</sub> = 17V, C <sub>S</sub> = 6.0μF, L <sub>S</sub> = 0.2μH	—	—	30	μs
I <sub>GQM</sub>	Peak gate turn-off current		—	720	—	A
V <sub>GT</sub>	Gate trigger voltage	DC METHOD : V <sub>D</sub> = 24V, R <sub>L</sub> = 0.1Ω, T <sub>j</sub> = 25°C	—	—	1.5	V
I <sub>GT</sub>	Gate trigger current		—	—	3000	mA
R <sub>th(j-f)</sub>	Thermal resistance	GTO Side (Junction to fin)	—	—	0.016	°C/W
		Diode Side (Junction to fin)	—	—	0.025	

## PERFORMANCE CURVES

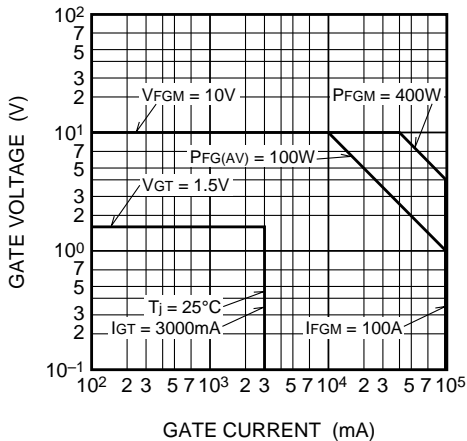
MAXIMUM ON-STATE AND MAXIMUM REVERSE CHARACTERISTICS



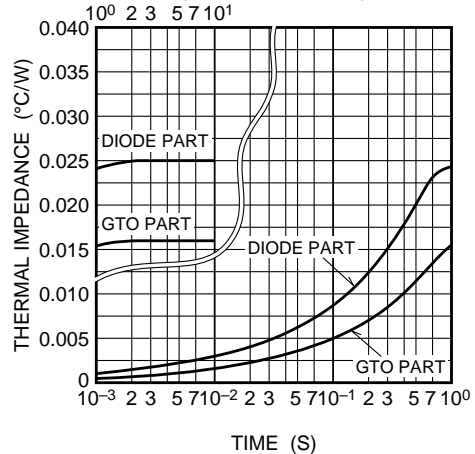
RATED ON-STATE AND REVERSE SURGE CURRENT



GATE CHARACTERISTICS



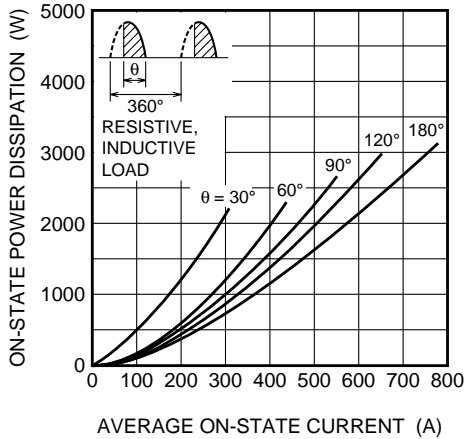
MAXIMUM THERMAL IMPEDANCE CHARACTERISTICS (JUNCTION TO FIN)



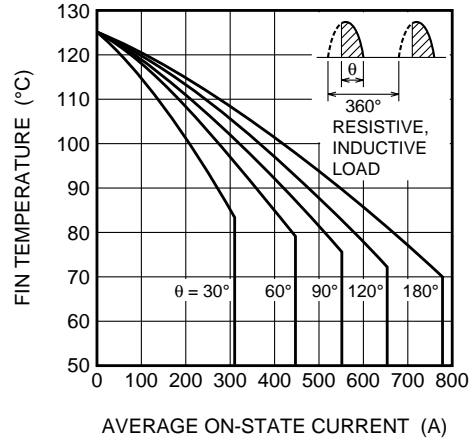
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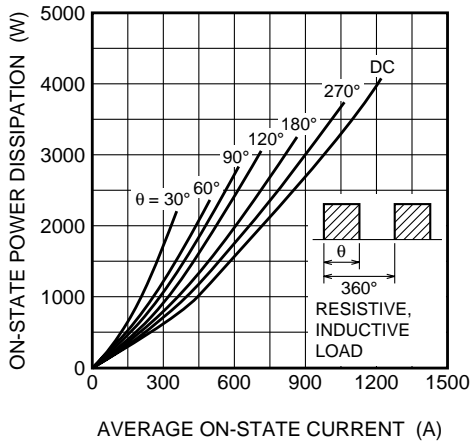
**MAXIMUM ON-STATE POWER DISSIPATION CHARACTERISTICS (GTO PART, SINGLE-PHASE HALF WAVE)**



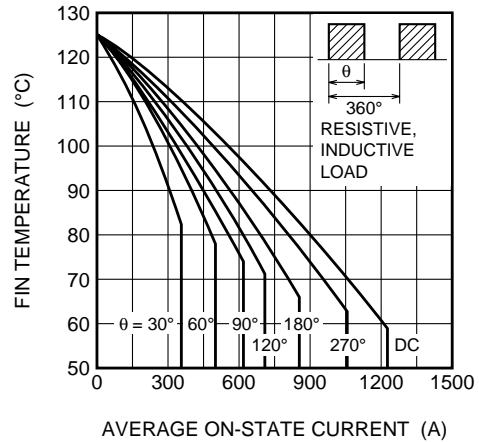
**ALLOWABLE FIN TEMPERATURE VS. AVERAGE ON-STATE CURRENT (GTO PART, SINGLE-PHASE HALF WAVE)**



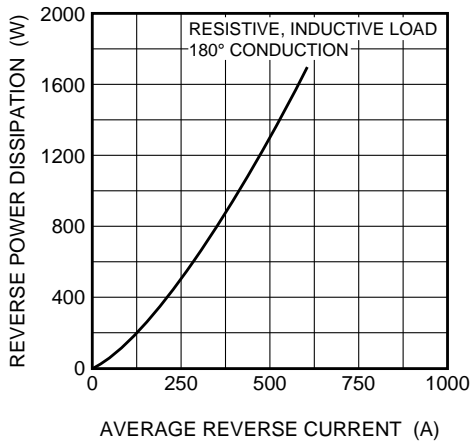
**MAXIMUM ON-STATE POWER DISSIPATION CHARACTERISTICS (GTO PART, RECTANGULAR WAVE)**



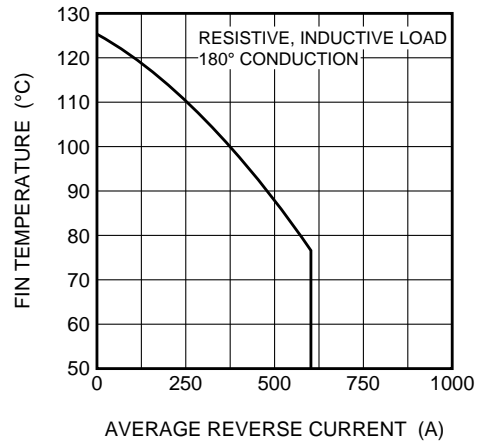
**ALLOWABLE FIN TEMPERATURE VS. AVERAGE ON-STATE CURRENT (GTO PART, RECTANGULAR WAVE)**



**MAXIMUM REVERSE POWER DISSIPATION CHARACTERISTICS (DIODE PART, SINGLE PHASE WAVE)**



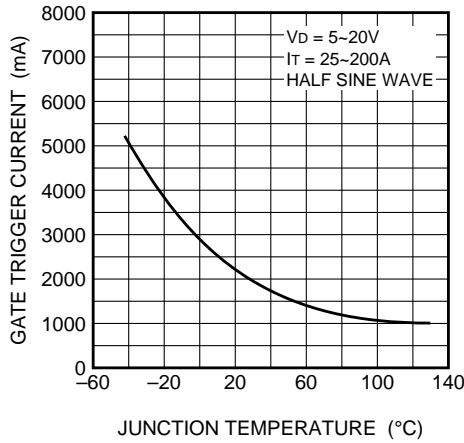
**ALLOWABLE FIN TEMPERATURE VS. AVERAGE REVERSE CURRENT (DIODE PART, SINGLE PHASE HALF WAVE)**



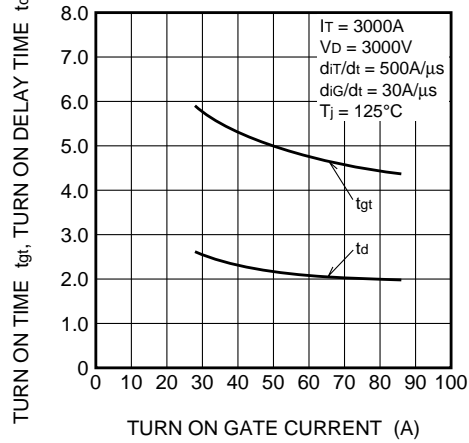
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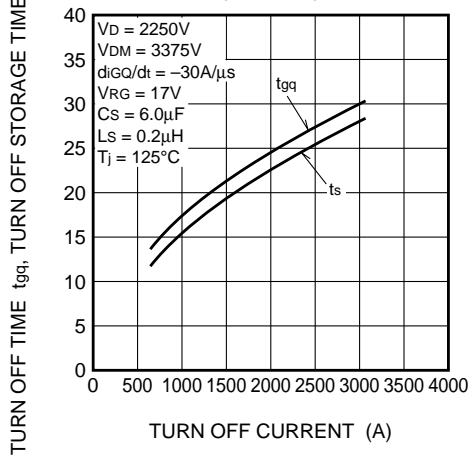
**GATE TRIGGER CURRENT VS. JUNCTION TEMPERATURE (TYPICAL)**



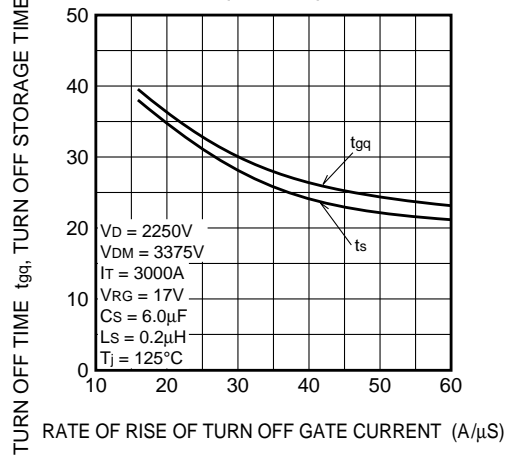
**TURN ON TIME, TURN ON DELAY TIME VS. TURN ON GATE CURRENT (TYPICAL)**



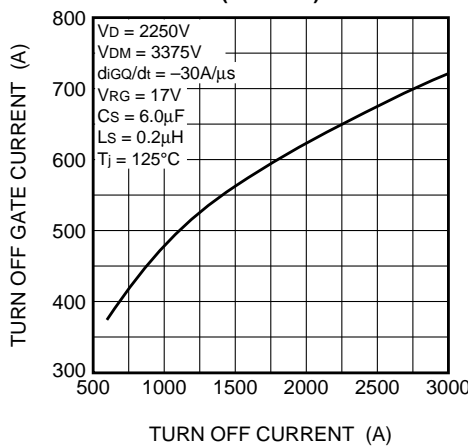
**TURN OFF TIME, TURN OFF STORAGE TIME VS. TURN OFF GATE CURRENT (TYPICAL)**



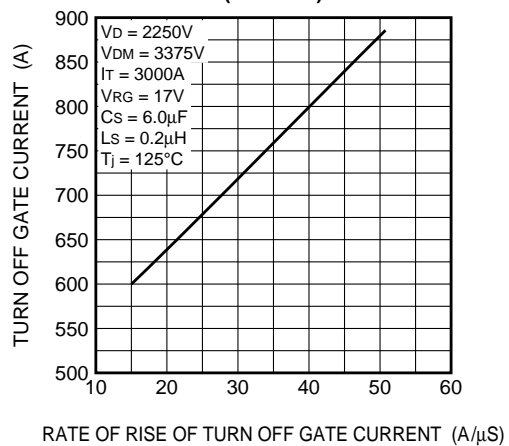
**TURN OFF TIME, TURN OFF STORAGE TIME VS. RATE OF RISE OF TURN OFF GATE CURRENT (TYPICAL)**



**TURN OFF GATE CURRENT VS. TURN OFF CURRENT (TYPICAL)**



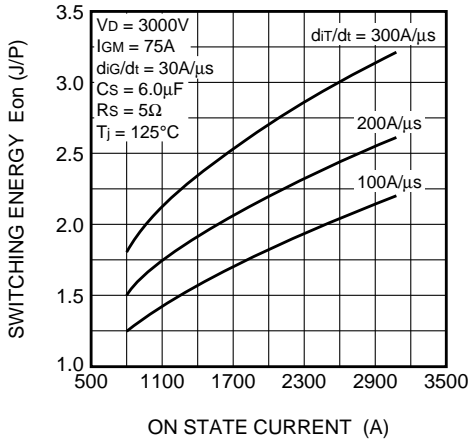
**TURN OFF GATE CURRENT VS. RATE OF RISE OF GATE CURRENT (TYPICAL)**



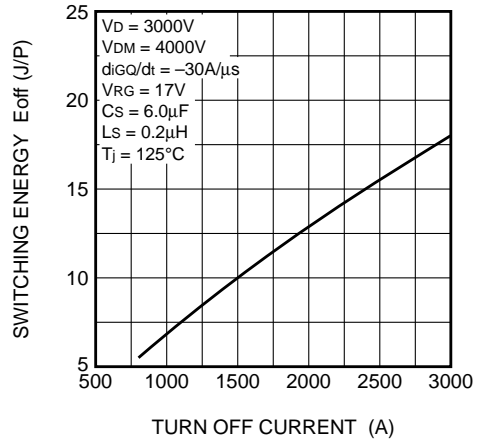
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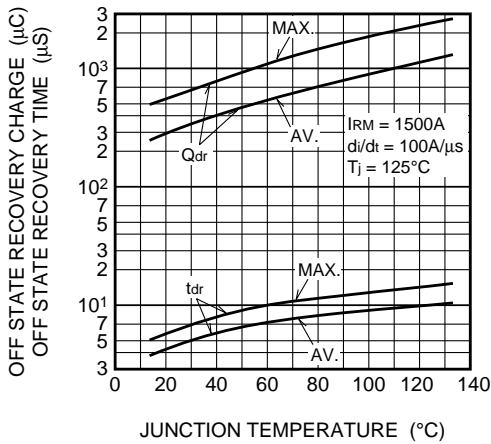
**TURN ON SWITCHING ENERGY (MAXIMUM)**



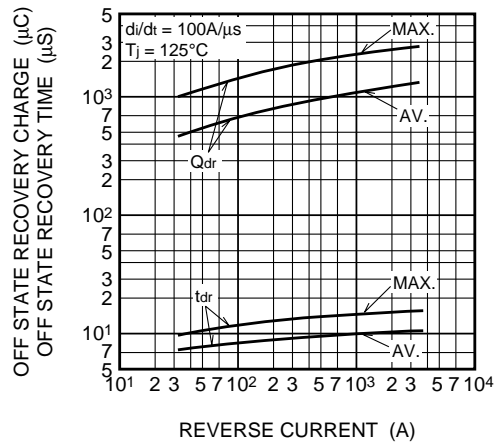
**TURN OFF SWITCHING ENERGY (MAXIMUM)**



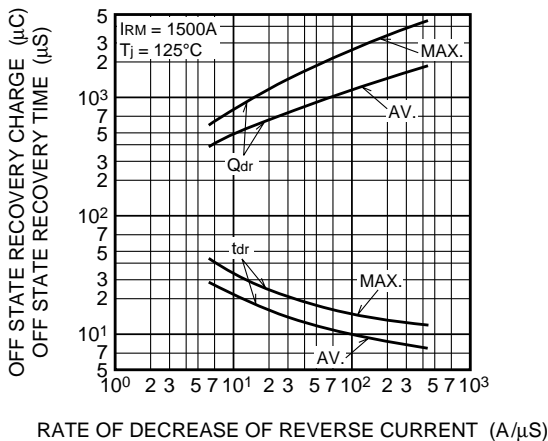
**OFF STATE RECOVERY CHARGE, OFF STATE RECOVERY TIME VS. JUNCTION TEMPERATURE**



**OFF STATE RECOVERY CHARGE, OFF STATE RECOVERY TIME VS. REVERSE CURRENT**



**OFF STATE RECOVERY CHARGE, OFF STATE RECOVERY TIME VS. RATE OF DECREASE OF REVERSE CURRENT**



**OFF STATE RECOVERY LOSS(DIODE PART) VS. REVERSE CURRENT (TYPICAL)**

