

**APPLICATIONS**

- High Power Inverters And Choppers
- UPS
- Railway Traction
- Induction Heating
- AC Motor Drives
- Cycloconverters

**KEY PARAMETERS**

$V_{DRM}$	<b>2000V</b>
$I_{T(RMS)}$	<b>1300A</b>
$I_{TSM}$	<b>17000A</b>
$dV/dt$	<b>300V/<math>\mu</math>s</b>
$di/dt$	<b>500A/<math>\mu</math>s</b>
$t_q$	<b>50<math>\mu</math>s</b>

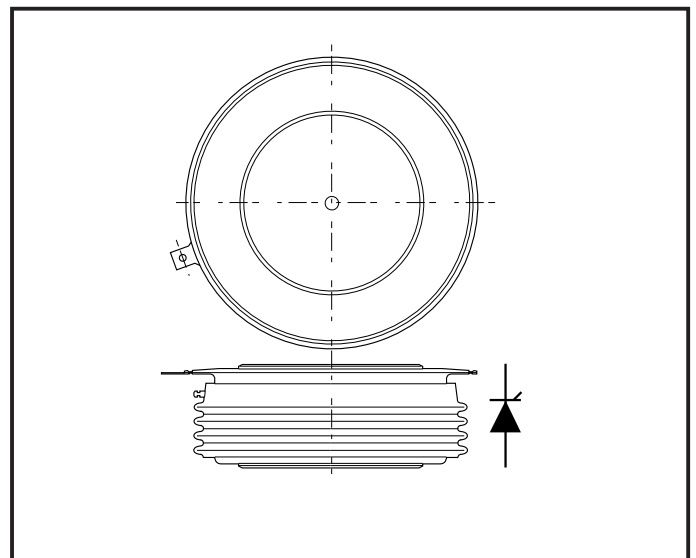
**FEATURES**

- Double Side Cooling
- High Surge Capability
- High Voltage

**VOLTAGE RATINGS**

Type Number	Repetitive Peak Voltages $V_{DRM}$ $V_{RRM}$	Conditions
TF913 20C	2000	$V_{RSM} = V_{RRM} + 100V$  $I_{DRM} = I_{RRM} = 60mA$  at $V_{RRM}$ or $V_{DRM}$ & $T_{vj}$
TF913 18C	1800	
TF913 16C	1600	

Lower voltage grades available.



Outline type code: MU169.  
See Package Details for further information.

**CURRENT RATINGS**

Symbol	Parameter	Conditions	Max.	Units
$I_{T(AV)}$	Mean on-state current	Half sinewave, 50Hz, $T_{case} = 80^{\circ}C$	828	A
$I_{T(RMS)}$	RMS value	Half sinewave, 50Hz, $T_{case} = 80^{\circ}C$	1300	A

# TF913..C

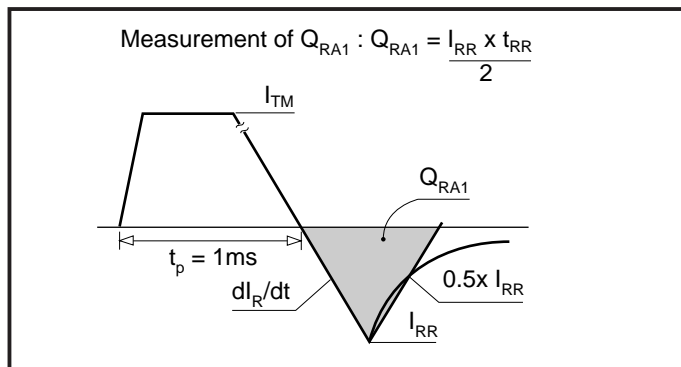
## SURGE RATINGS

Symbol	Parameter	Conditions	Max.	Units
$I_{TSM}$	Surge (non-repetitive) on-state current	10ms half sine; $V_R = 0\% V_{RRM}$ , $T_j = 125^\circ\text{C}$	17.0	kA
$I^2t$	$I^2t$ for fusing	10ms half sine; $V_R = 0\% V_{RRM}$ , $T_j = 125^\circ\text{C}$	$1445 \times 10^3$	$\text{A}^2\text{s}$

## THERMAL AND MECHANICAL DATA

Symbol	Parameter	Conditions		Min.	Max.	Units
$R_{th(j-c)}$	Thermal resistance - junction to case	Double side cooled	dc	-	0.020	$^\circ\text{C/W}$
		Single side cooled	Anode dc	-	-	$^\circ\text{C/W}$
			Cathode dc	-	-	$^\circ\text{C/W}$
$R_{th(c-h)}$	Thermal resistance - case to heatsink	Clamping force 23.5kN with mounting compound	Double side	-	0.006	$^\circ\text{C/W}$
			Single side	-	0.012	$^\circ\text{C/W}$
$T_{vj}$	Virtual junction temperature	On-state (conducting)		-	125	$^\circ\text{C}$
		Reverse (blocking)		-	125	$^\circ\text{C}$
$T_{stg}$	Storage temperature range			-40	150	$^\circ\text{C}$
-	Clamping force			22.3	24.6	kN

## MEASUREMENT OF RECOVERED CHARGE - $Q_{RA1}$



## DYNAMIC CHARACTERISTICS

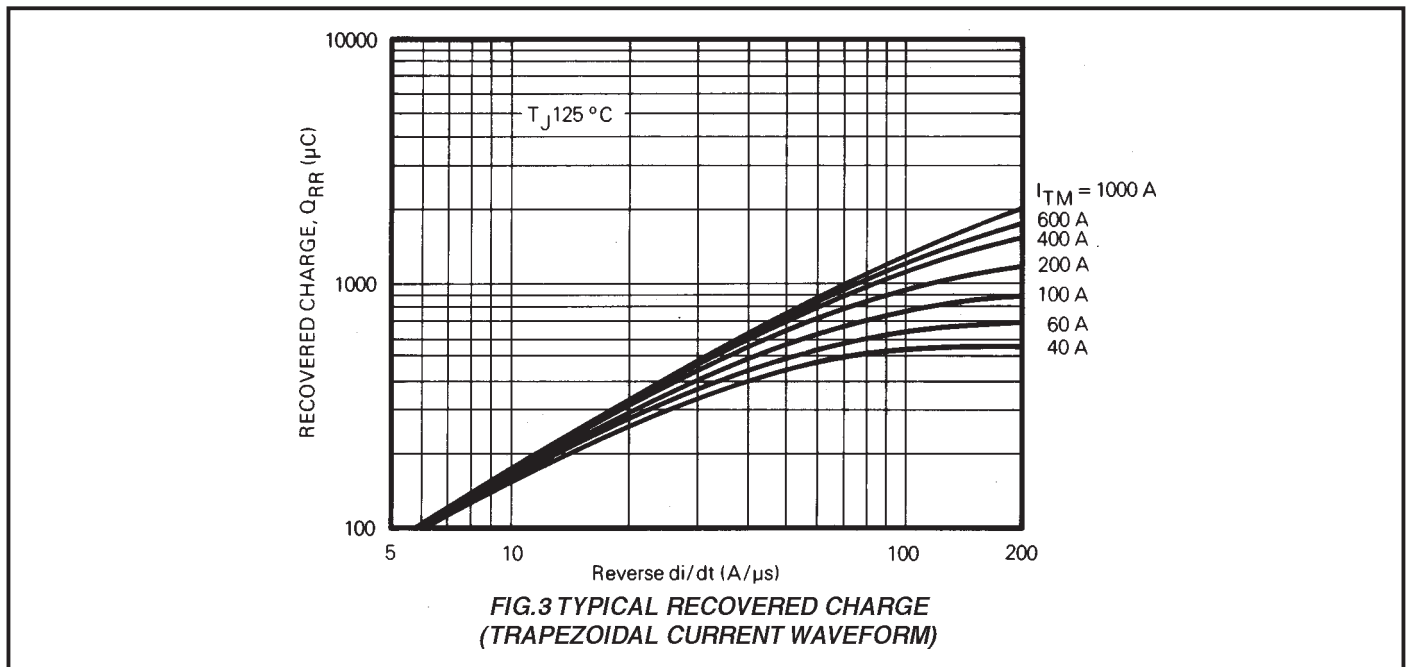
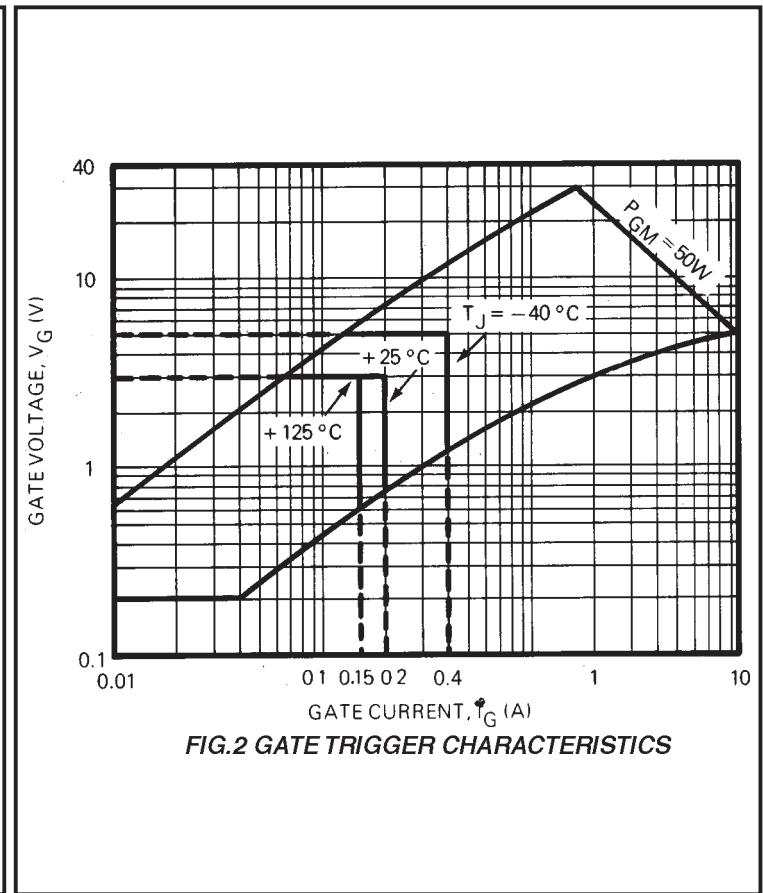
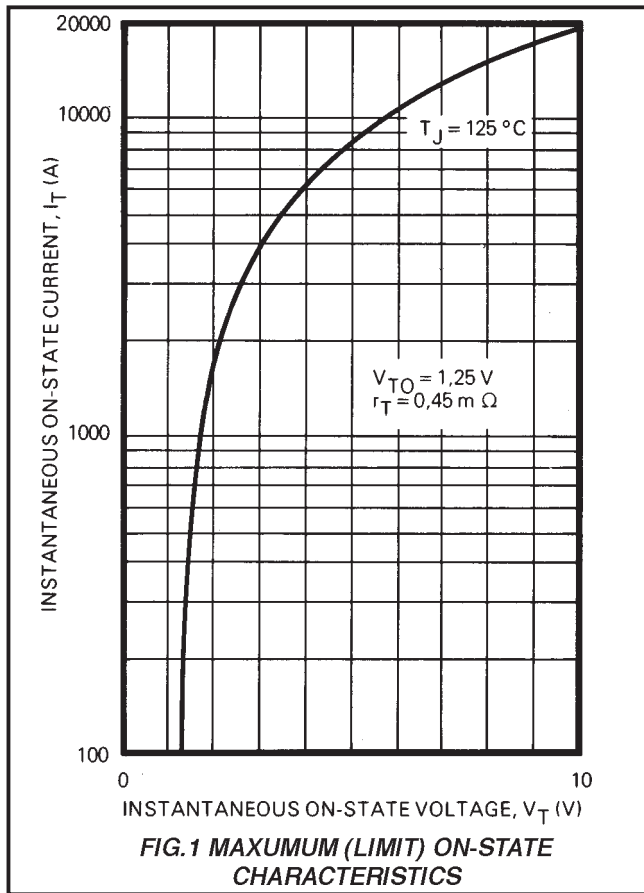
Symbol	Parameter	Conditions	Min.	Max.	Units	
$V_{TM}$	Maximum on-state voltage	At 2000A peak, $T_{case} = 25^{\circ}C$	-	2.15	V	
$I_{RRM}/I_{DRM}$	Peak reverse and off-state current	At $V_{RRM}/V_{DRM}$ , $T_{case} = 125^{\circ}C$	-	60	mA	
dV/dt	Maximum linear rate of rise of off-state voltage	Linear to 60% $V_{DRM}$ , $T_j = 125^{\circ}C$ , Gate open circuit	-	300	V/ $\mu$ s	
dI/dt	Rate of rise of on-state current	Gate source 20V, 20 $\Omega$	Repetitive 50Hz	-	500	A/ $\mu$ s
		$t_r \leq 0.5\mu$ s, $T_j = 125^{\circ}C$	Non-repetitive	-	800	A/ $\mu$ s
$V_{T(TO)}$	Threshold voltage	At $T_{vj} = 125^{\circ}C$	-	1.25	V	
$r_T$	On-state slope resistance	At $T_{vj} = 125^{\circ}C$	-	0.45	m $\Omega$	
$t_{gd}$	Delay time	$T_j = 25^{\circ}C$ , $I_T = 50A$ , $V_D = 300V$ , $I_G = 1A$ , $dI/dt = 50A/\mu$ s, $dI_G/dt = 1A/\mu$ s	4*	-	$\mu$ s	
$t_{(ON)TOT}$	Total turn-on time		2*	-	$\mu$ s	
$I_H$	Holding current	$T_j = 25^{\circ}C$ , $I_{TM} = 1A$ , $V_D = 12V$	100*	-	mA	
$I_L$	Latching current	$T_j = 25^{\circ}C$ , $I_G = 0.5A$ , $V_D = 12V$	300*	-	mA	
$t_q$	Turn-off time	$T_j = 125^{\circ}C$ , $I_T = 250A$ , $V_R = 50V$ , $dV/dt = 20V/\mu$ s (Linear to 60% $V_{DRM}$ ), $dI_R/dt = 50A/\mu$ s, Gate open circuit	$t_q$ code: C	-	50	$\mu$ s

\*Typical value.

## GATE TRIGGER CHARACTERISTICS AND RATINGS

Symbol	Parameter	Conditions	Typ.	Max.	Units
$V_{GT}$	Gate trigger voltage	$V_{DRM} = 12V$ , $T_{case} = 25^{\circ}C$ , $R_L = 6\Omega$	-	3.0	V
$I_{GT}$	Gate trigger current	$V_{DRM} = 12V$ , $T_{case} = 25^{\circ}C$ , $R_L = 6\Omega$	-	200	mA
$V_{GD}$	Gate non-trigger voltage	At $V_{DRM}$ , $T_{case} = 125^{\circ}C$ , $R_L = 1k\Omega$	-	0.2	V
$V_{RGM}$	Peak reverse gate voltage		-	5.0	V
$I_{FGM}$	Peak forward gate current	Anode positive with respect to cathode	-	10	A
$P_{GM}$	Peak gate power		-	50	W
$P_{G(AV)}$	Mean gate power		-	3	W

CURVES



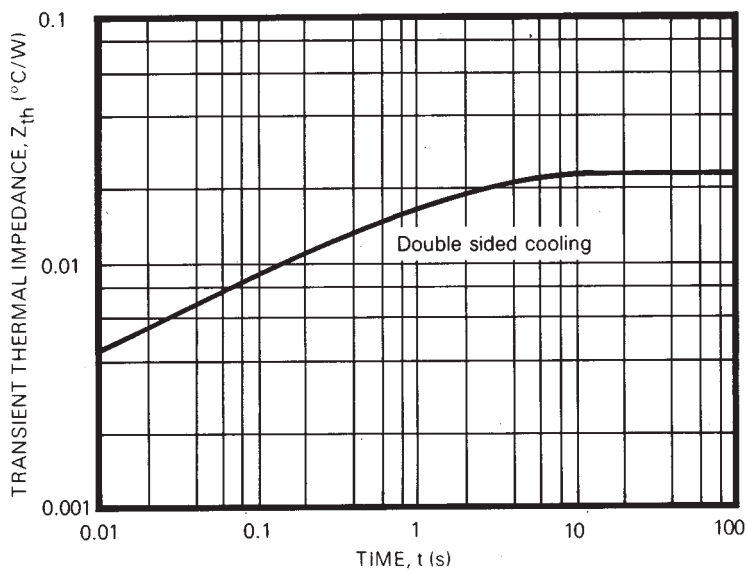


FIG.4 TRANSIENT THERMAL IMPEDANCE - JUNCTION TO CASE

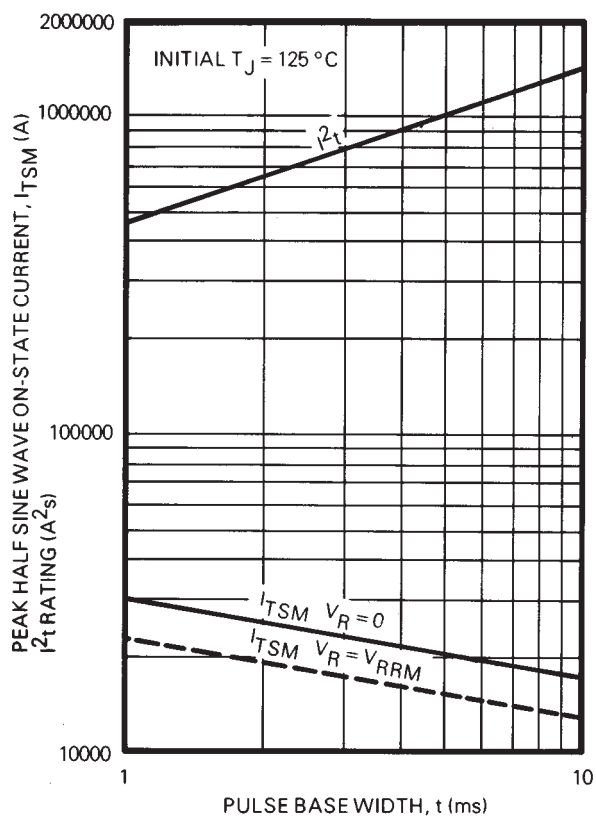


FIG.5 NON-REPETITIVE SUB-CYCLE SURGE ON-STATE CURRENT AND  $I^2t$  RATING

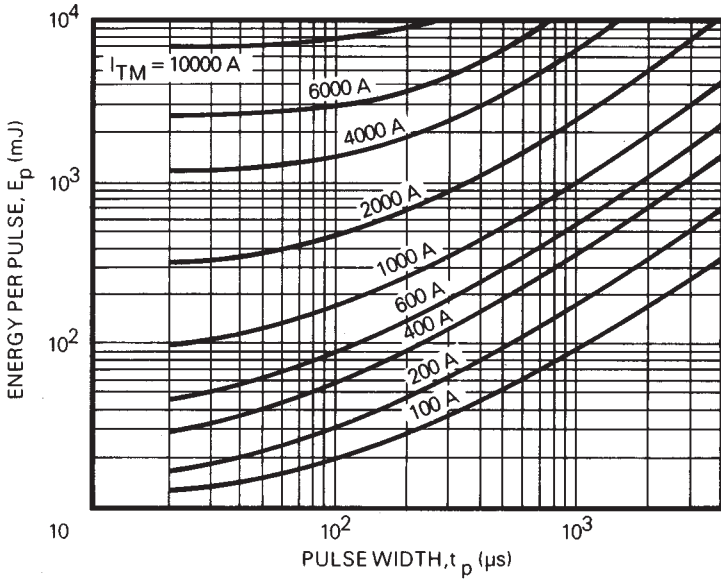


FIG.6 ENERGY PER PULSE FOR SINUSOIDAL PULSES

**NOTES:**

1.  $V_D \leq 600V$ .
2.  $V_R \leq 10V$ .
3. R.C Snubber,  $C = 0.22\mu F$ ,  $R = 4.7\Omega$

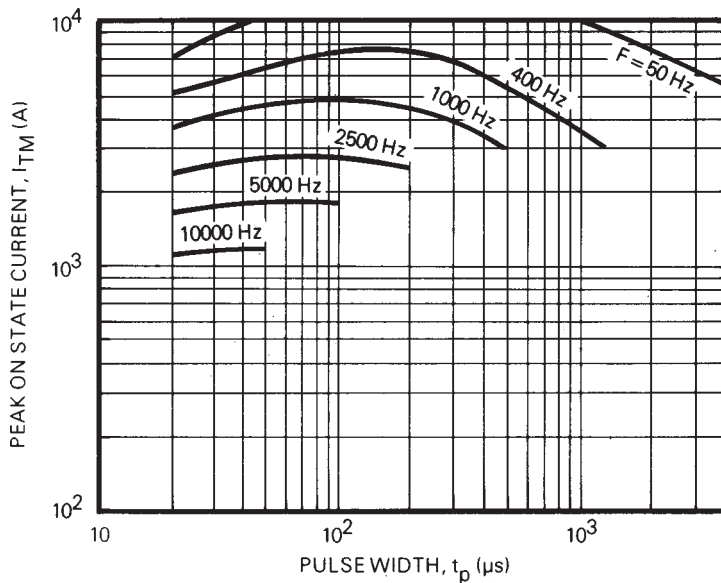
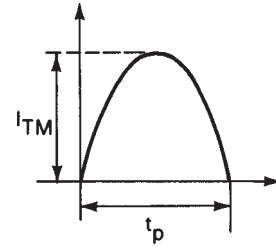
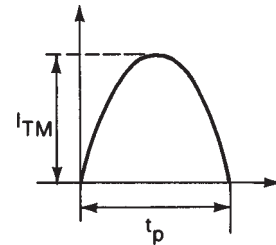


FIG.7 MAXIMUM ALLOWABLE PEAK ON-STATE CURRENT vs PULSE WIDTH FOR  $T_c = 65^\circ C$

**NOTES:**

1.  $V_D \leq 600V$ .
2.  $V_R \leq 10V$ .
3. R.C Snubber,  $C = 0.22\mu F$ ,  $R = 4.7\Omega$



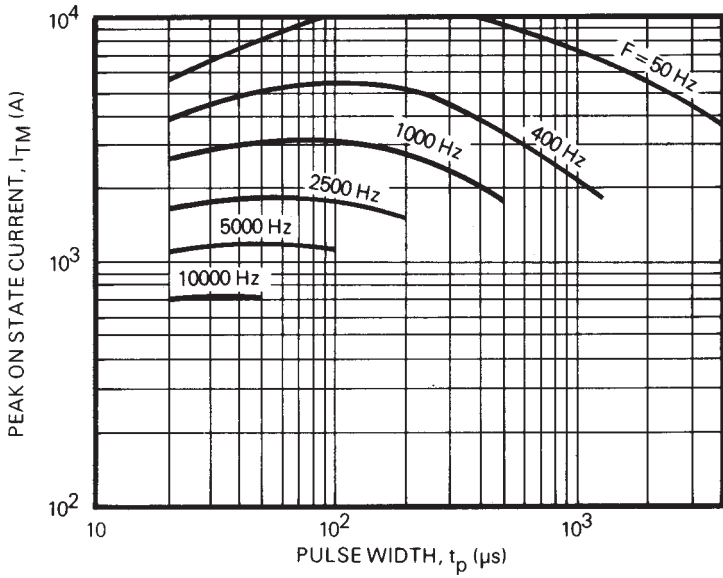


FIG.8 MAXIMUM ALLOWABLE PEAK ON-STATE CURRENT vs PULSE WIDTH FOR  $T_c = 90^\circ C$

**NOTES:**

1.  $V_D \leq 600V$ .
2.  $V_R \leq 10V$ .
3. R.C Snubber,  $C = 0.22\mu F$ ,  $R = 4.7\Omega$

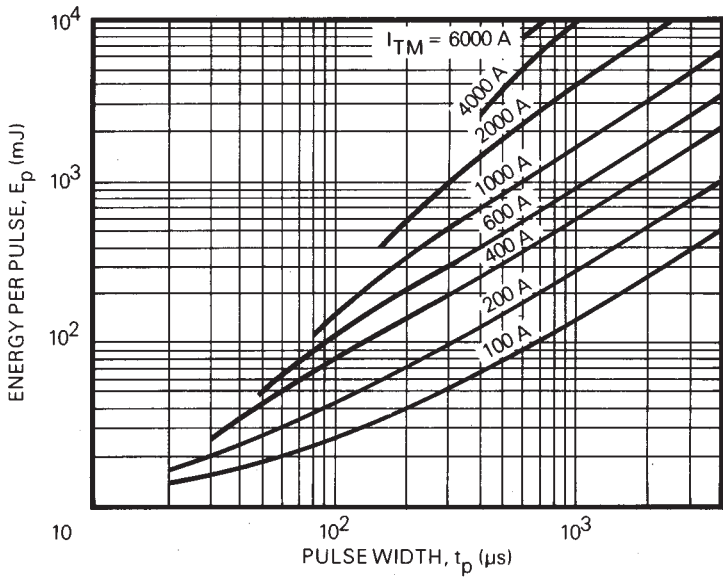
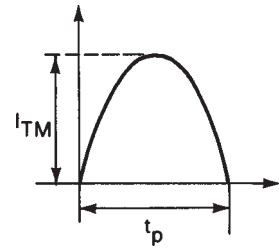
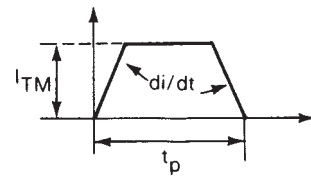
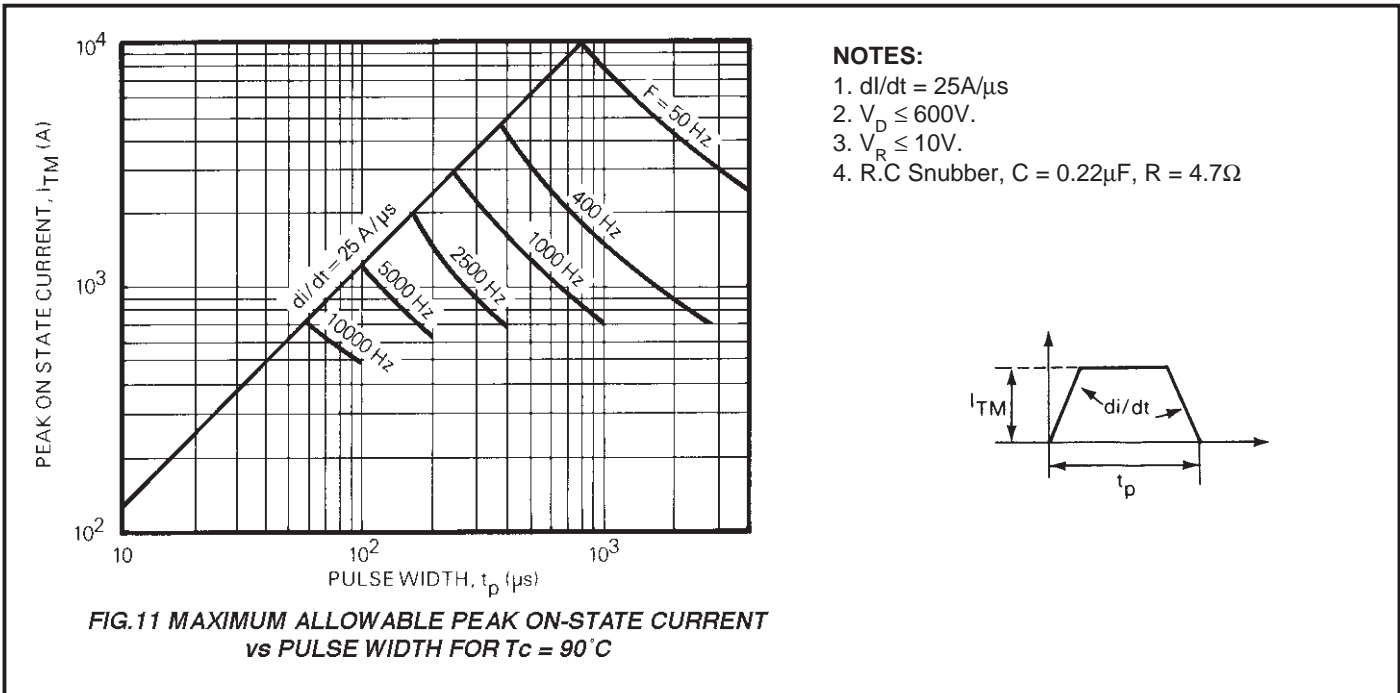
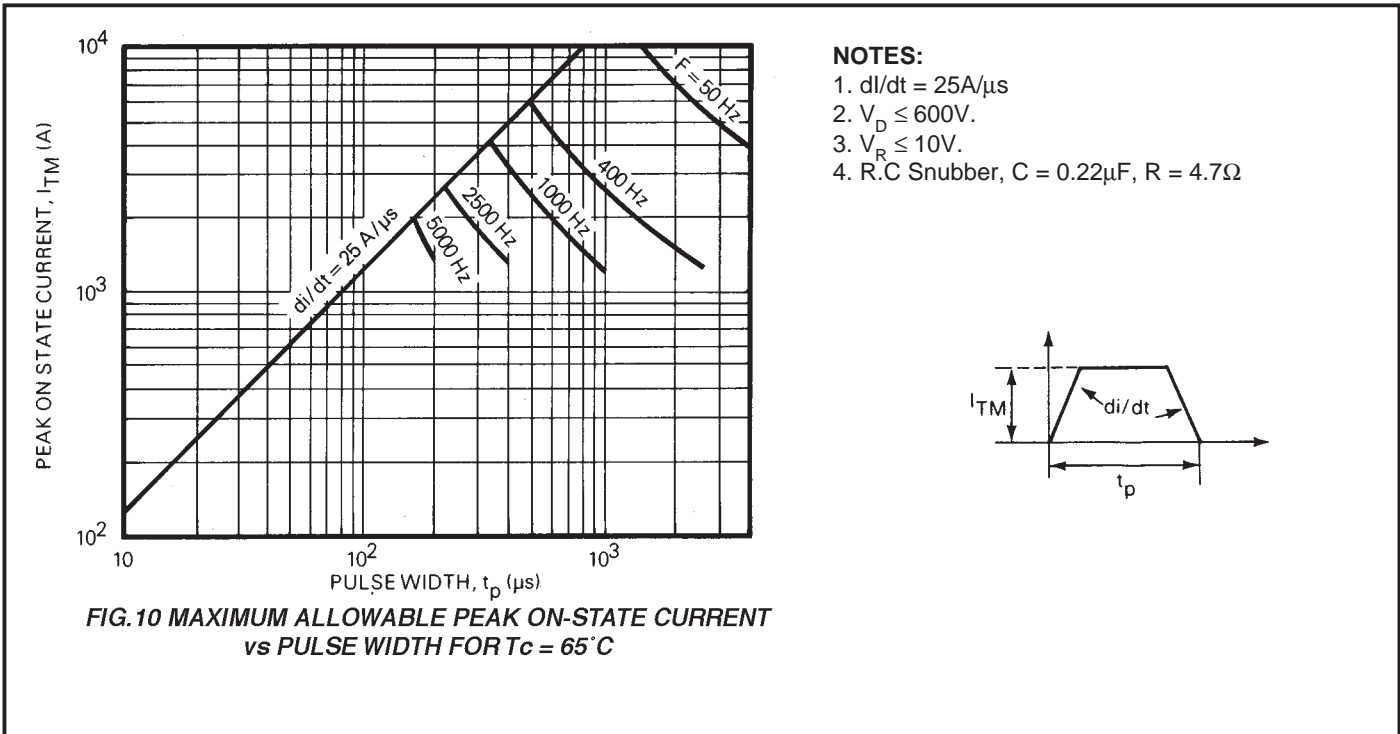


FIG.9 ENERGY PER PULSE FOR TRAPEZOIDAL PULSES

**NOTES:**

1.  $di/dt = 25A/\mu s$
2.  $V_D \leq 600V$ .
3.  $V_R \leq 10V$ .
4. R.C Snubber,  $C = 0.22\mu F$ ,  $R = 4.7\Omega$







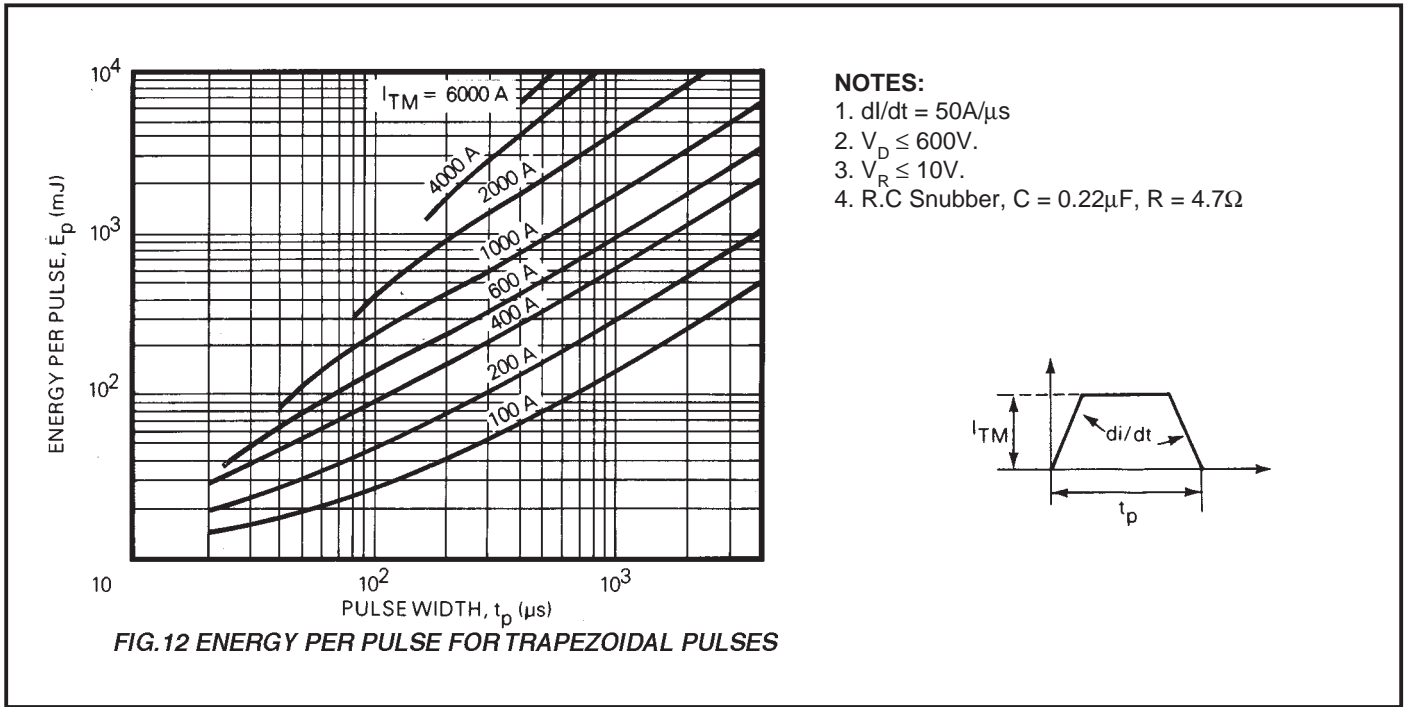


FIG.12 ENERGY PER PULSE FOR TRAPEZOIDAL PULSES

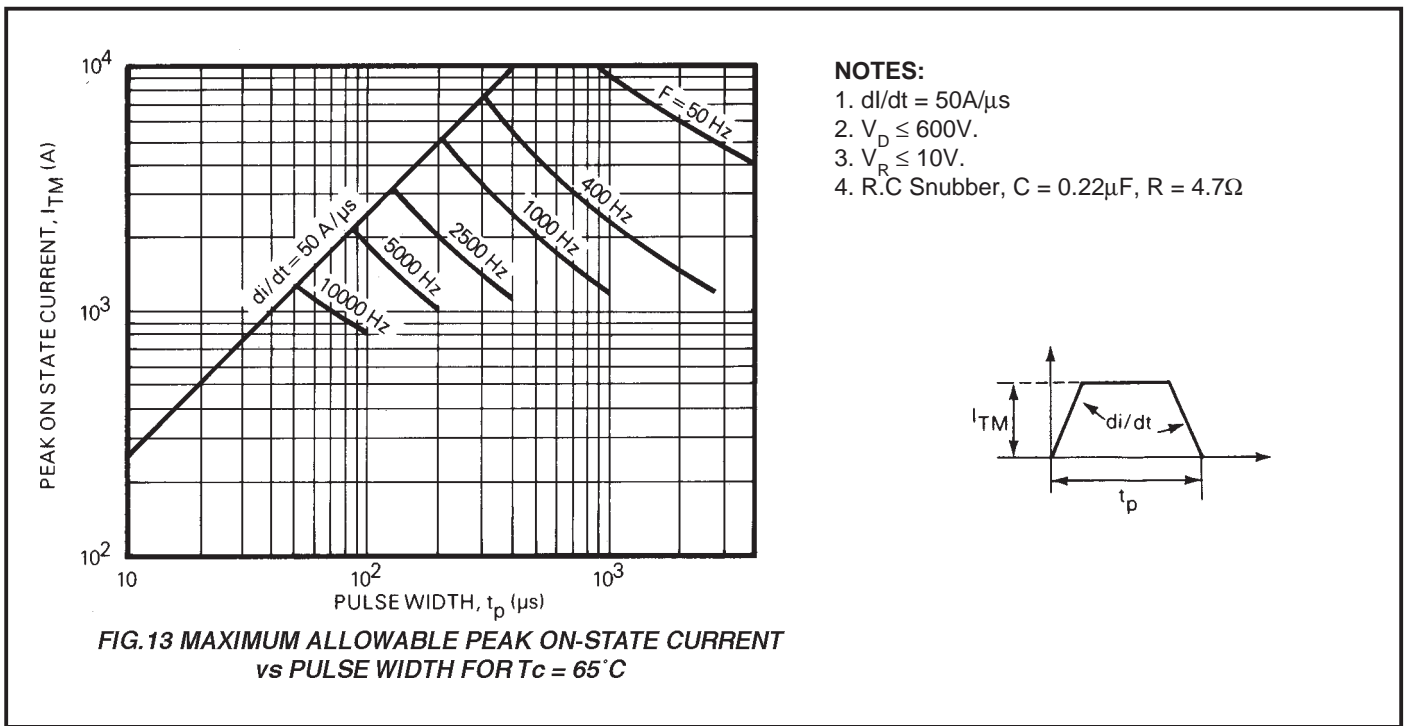
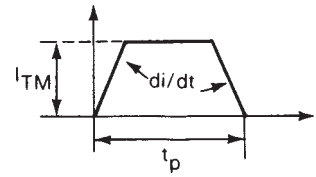
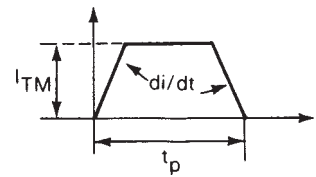


FIG.13 MAXIMUM ALLOWABLE PEAK ON-STATE CURRENT vs PULSE WIDTH FOR  $T_c = 65^\circ C$



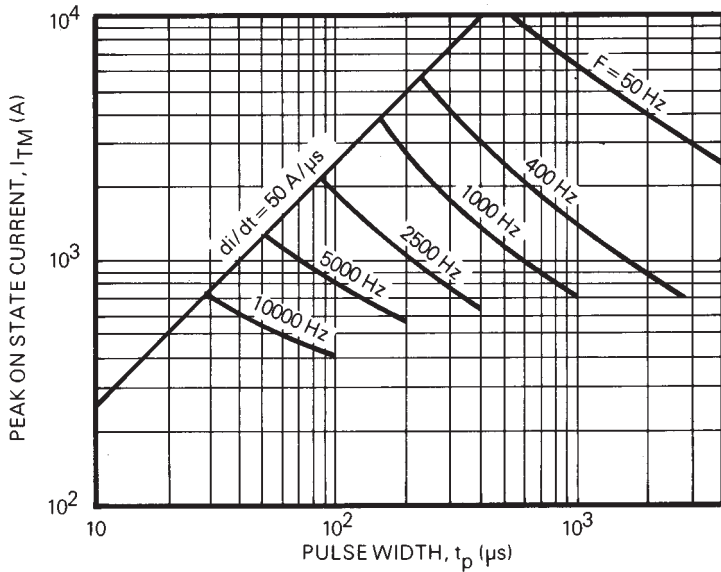


FIG. 14 MAXIMUM ALLOWABLE PEAK ON-STATE CURRENT vs PULSE WIDTH FOR  $T_c = 90^\circ\text{C}$

**NOTES:**

1.  $di/dt = 50\text{A}/\mu\text{s}$
2.  $V_D \leq 600\text{V}$ .
3.  $V_R \leq 10\text{V}$ .
4. R.C Snubber,  $C = 0.22\mu\text{F}$ ,  $R = 4.7\Omega$

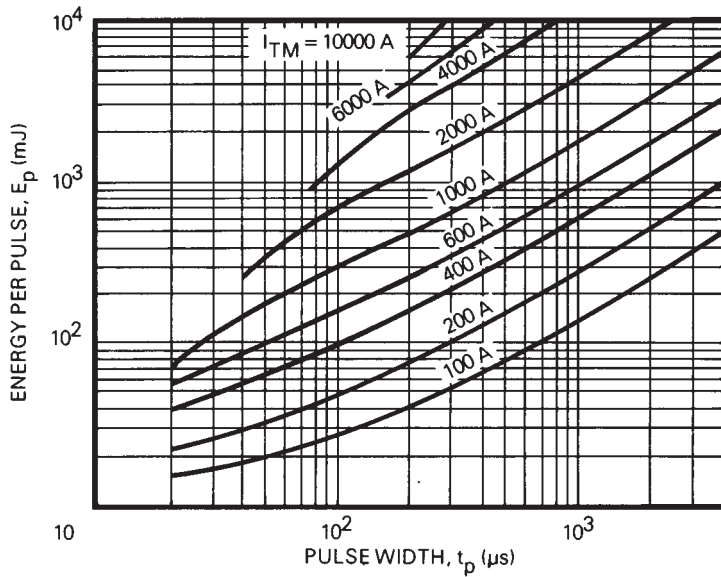
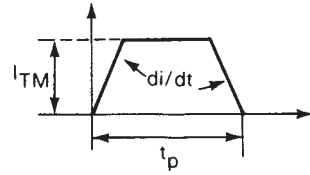
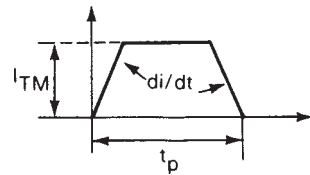


FIG. 15 ENERGY PER PULSE FOR TRAPEZOIDAL PULSES

**NOTES:**

1.  $di/dt = 100\text{A}/\mu\text{s}$
2.  $V_D \leq 600\text{V}$ .
3.  $V_R \leq 10\text{V}$ .
4. R.C Snubber,  $C = 0.22\mu\text{F}$ ,  $R = 4.7\Omega$



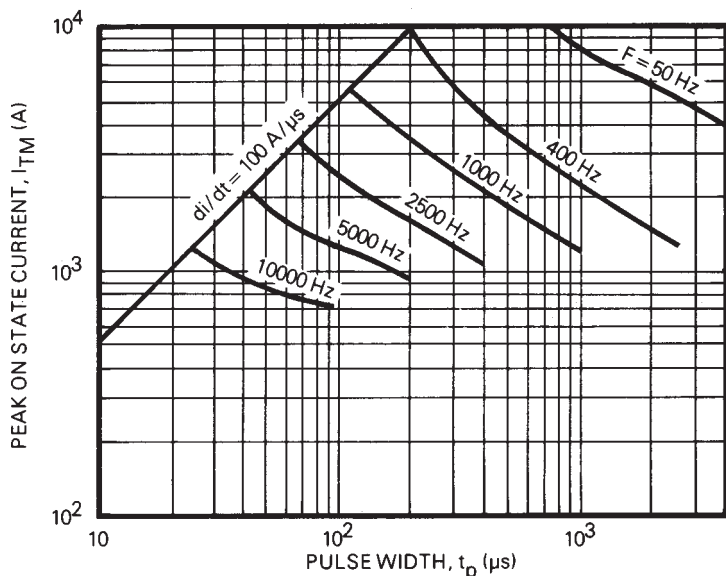


FIG. 16 MAXIMUM ALLOWABLE PEAK ON-STATE CURRENT vs PULSE WIDTH FOR  $T_c = 65^\circ\text{C}$

**NOTES:**

1.  $di/dt = 100\text{A}/\mu\text{s}$
2.  $V_D \leq 600\text{V}$ .
3.  $V_R \leq 10\text{V}$ .
4. R.C Snubber,  $C = 0.22\mu\text{F}$ ,  $R = 4.7\Omega$

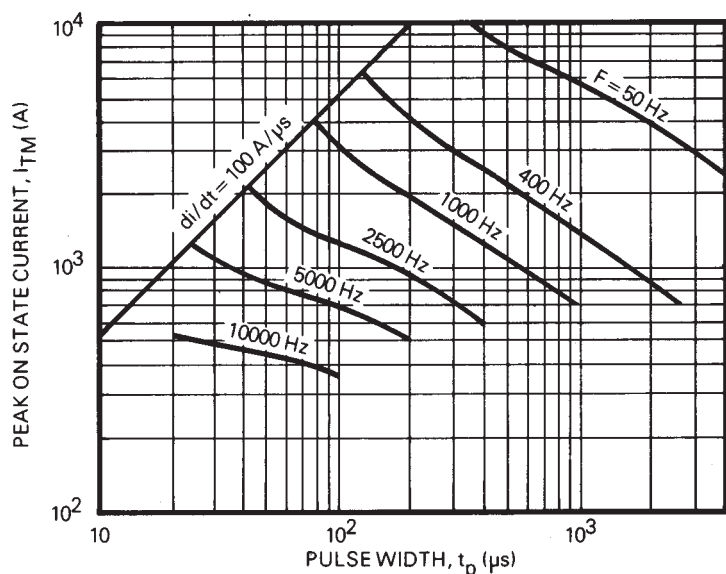
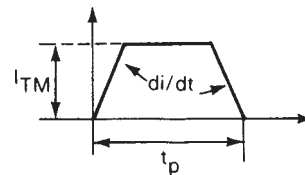
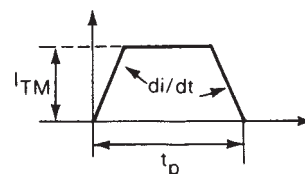


FIG. 17 MAXIMUM ALLOWABLE PEAK ON-STATE CURRENT vs PULSE WIDTH FOR  $T_c = 90^\circ\text{C}$

**NOTES:**

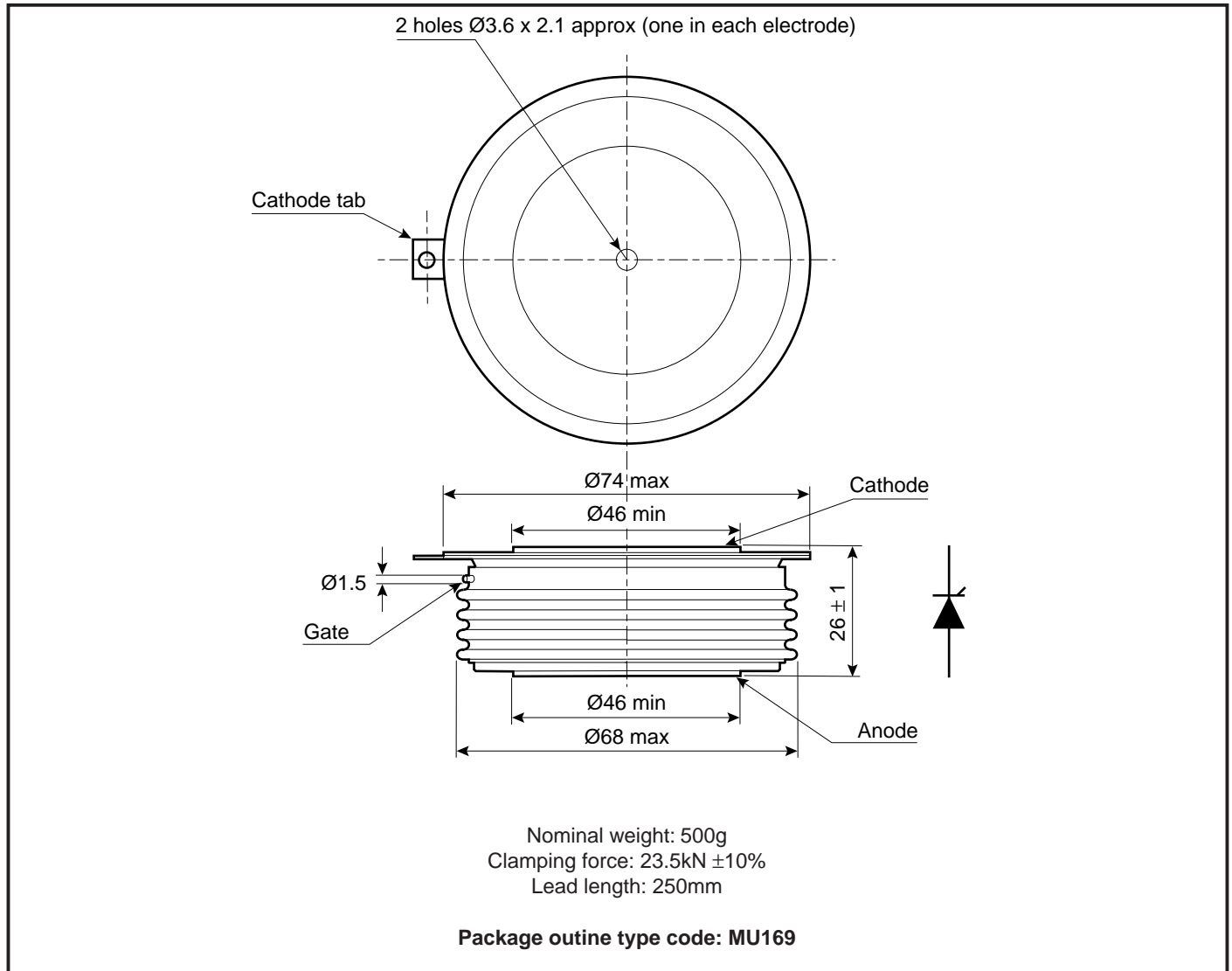
1.  $di/dt = 100\text{A}/\mu\text{s}$
2.  $V_D \leq 600\text{V}$ .
3.  $V_R \leq 10\text{V}$ .
4. R.C Snubber,  $C = 0.22\mu\text{F}$ ,  $R = 4.7\Omega$



## TF913..C

### PACKAGE DETAILS - MU169

For further package information, please contact your local Customer Service Centre. All dimensions in mm, unless stated otherwise. DO NOT SCALE.



### ASSOCIATED PUBLICATIONS

Title	Application Note Number
Calculating the junction temperature of power semiconductors	AN4506
Gate triggering and the use of gate characteristics	AN4840
Recommendations for clamping power semiconductors	AN4839
The effect of temperature on thyristor performance	AN4870
Thyristor and diode measurement with a multi-meter	AN4853
Turn-on performance of thyristors in parallel	AN4999
Use of $V_{TO}$ , $r_T$ on-state characteristic	AN5001

## POWER ASSEMBLY CAPABILITY

The Power Assembly group was set up to provide a support service for those customers requiring more than the basic semiconductor, and has developed a flexible range of heatsink / clamping systems in line with advances in device types and the voltage and current capability of our semiconductors.

We offer an extensive range of air and liquid cooled assemblies covering the full range of circuit designs in general use today. The Assembly group continues to offer high quality engineering support dedicated to designing new units to satisfy the growing needs of our customers.

Using the up to date CAD methods our team of design and applications engineers aim to provide the Power Assembly Complete solution (PACs).

## DEVICE CLAMPS

Disc devices require the correct clamping force to ensure their safe operation. The PACs range offers a varied selection of pre-loaded clamps to suit all of our manufactured devices. This include cube clamps for single side cooling of 'T' 22mm

Clamps are available for single or double side cooling, with high insulation versions for high voltage assemblies.

Please refer to our application note on device clamping, AN4839

## HEATSINKS

Power Assembly has it's own proprietary range of extruded aluminium heatsinks. They have been designed to optimise the performance of our semiconductors. Data with respect to air natural, forced air and liquid cooling (with flow rates) is available on request.

For further information on device clamps, heatsinks and assemblies, please contact your nearest Sales Representative or the factory.



<http://www.dynexsemi.com>

e-mail: [power\\_solutions@dynexsemi.com](mailto:power_solutions@dynexsemi.com)

HEADQUARTERS OPERATIONS  
**DYNEX SEMICONDUCTOR LTD**  
 Doddington Road, Lincoln.  
 Lincolnshire. LN6 3LF. United Kingdom.  
 Tel: 00-44-(0)1522-500500  
 Fax: 00-44-(0)1522-500550

**DYNEX POWER INC.**  
 Unit 7 - 58 Antares Drive,  
 Nepean, Ontario, Canada K2E 7W6.  
 Tel: 613.723.7035  
 Fax: 613.723.1518  
 Toll Free: 1.888.33.DYNEX (39639)

CUSTOMER SERVICE CENTRES  
**France, Benelux, Italy and Spain** Tel: +33 (0)1 69 18 90 00. Fax: +33 (0)1 64 46 54 50  
**North America** Tel: 011-800-5554-5554. Fax: 011-800-5444-5444  
**UK, Germany, Scandinavia & Rest Of World** Tel: +44 (0)1522 500500. Fax: +44 (0)1522 500020

SALES OFFICES  
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**UK, Germany, Scandinavia & Rest Of World** Tel: +44 (0)1522 500500. Fax: +44 (0)1522 500020  
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**Preliminary Information:** The product is in design and development. The datasheet represents the product as it is understood but details may change.

**Advance Information:** The product design is complete and final characterisation for volume production is well in hand.

**No Annotation:** The product parameters are fixed and the product is available to datasheet specification.

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