

# TF440..C

## FAST SWITCHING THYRISTOR

### APPLICATIONS

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

### KEY PARAMETERS

$V_{DRM}$	2000V
$I_{T(RMS)}$	400A
$I_{TSM}$	4000A
$dV/dt$	200V/ $\mu$ s
$dI/dt$	500A/ $\mu$ s
$t_q$	50 $\mu$ s

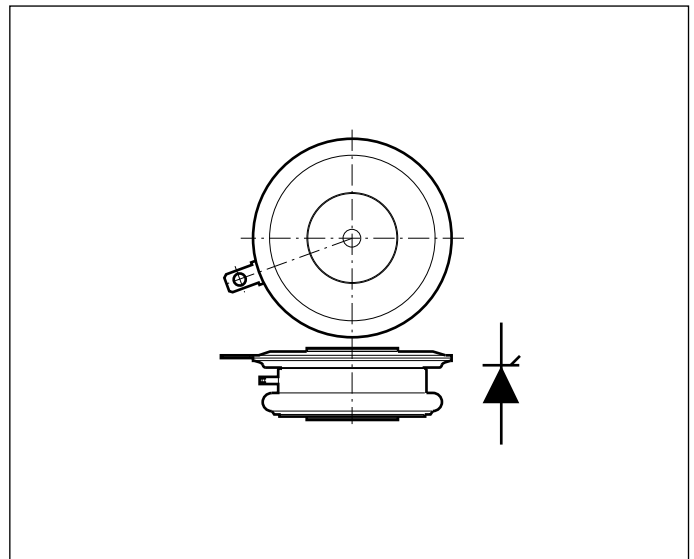
### FEATURES

- Double Side Cooling.
- High Surge Capability.
- High Voltage.

### VOLTAGE RATINGS

Type Number	Repetitive Peak Voltages $V_{DRM}$ $V_{RRM}$	Conditions
TF440 20C	2000	$V_{RSM} = V_{RRM} + 100V$ $I_{DRM} = I_{RRM} = 25mA$ at $V_{RRM}$ or $V_{DRM}$ & $T_{vj}$
TF440 18C	1800	
TF440 16C	1600	
TF440 14C	1400	

Lower voltage grades available.



Outline type code: MU86. Turn to page 12 for further information.

### CURRENT RATINGS

Symbol	Parameter	Conditions	Max.	Units
$I_{T(AV)}$	Mean on-state current	Half sinewave, 50Hz, $T_{case} = 80^{\circ}C$	255	A
$I_{T(RMS)}$	RMS value	Half sinewave, 50Hz, $T_{case} = 80^{\circ}C$	400	A

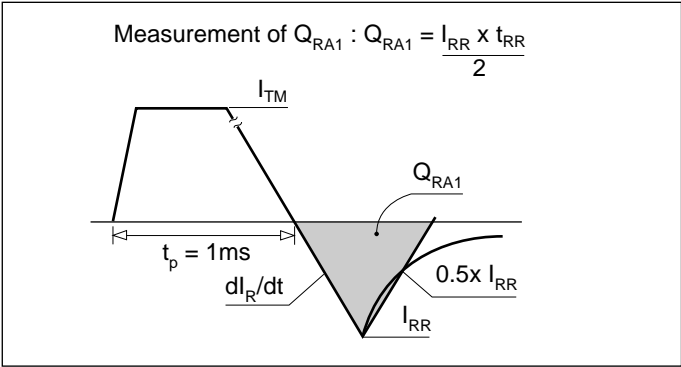
SURGE RATINGS

Symbol	Parameter	Conditions	Max.	Units
$I_{TSM}$	Surge (non-repetitive) on-state current	10ms half sine; $V_R = 0\% V_{RRM}$ ; $T_j = 125^{\circ}C$	4.0	kA
$I^2t$	$I^2t$ for fusing	10ms half sine; $V_R = 0\% V_{RRM}$ ; $T_j = 125^{\circ}C$	$80.0 \times 10^3$	A <sup>2</sup> s

THERMAL AND MECHANICAL DATA

Symbol	Parameter	Conditions		Min.	Max.	Units
$R_{th(j-c)}$	Thermal resistance - junction to case	Double side cooled	dc	-	0.07	°C/W
		Single side cooled	Anode dc	-	0.133	°C/W
			Cathode dc	-	0.154	°C/W
$R_{th(c-h)}$	Thermal resistance - case to heatsink	Clamping force 5.0kN with mounting compound	Double side	-	0.02	°C/W
			Single side	-	0.04	°C/W
$T_{vj}$	Virtual junction temperature	On-state (conducting)		-	125	°C
		Reverse (blocking)		-	125	°C
$T_{stg}$	Storage temperature range			-40	150	°C
-	Clamping force			4.75	5.25	kN

MEASUREMENT OF RECOVERED CHARGE -  $Q_{RA1}$



## DYNAMIC CHARACTERISTICS

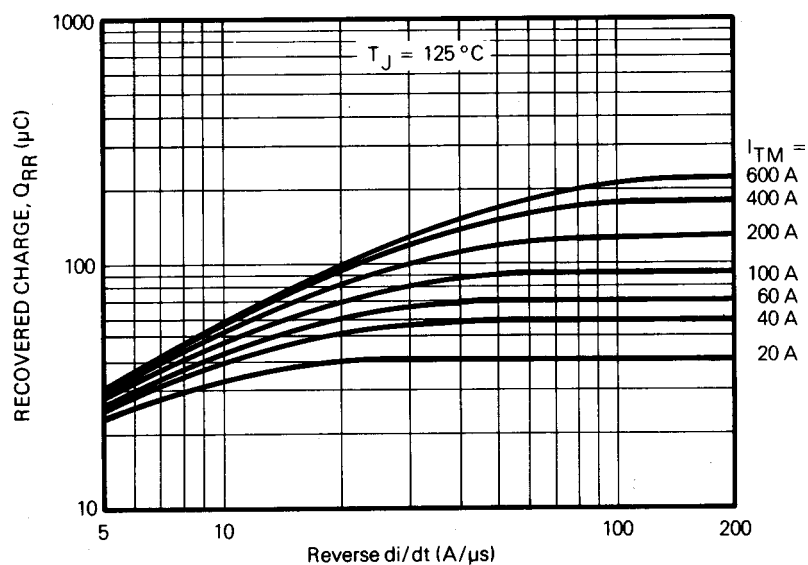
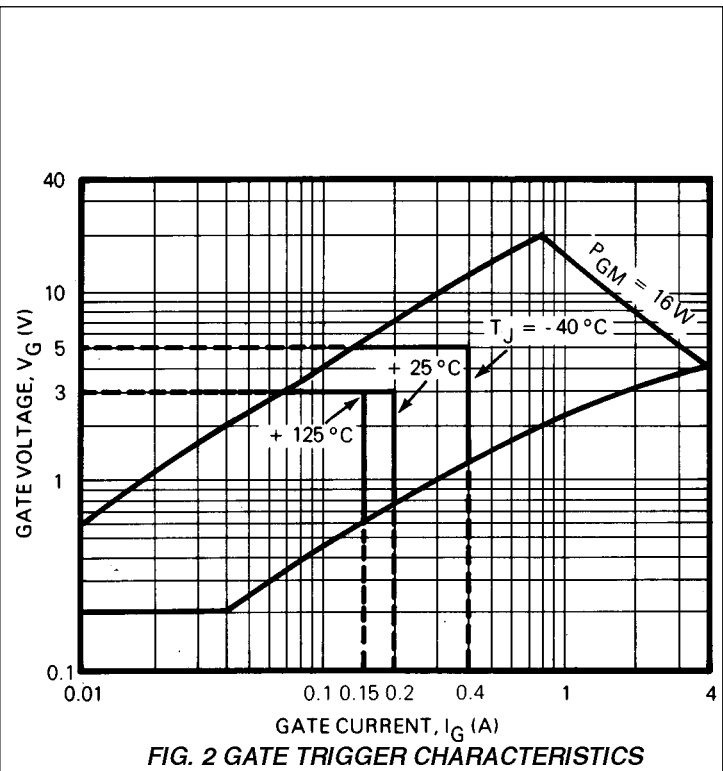
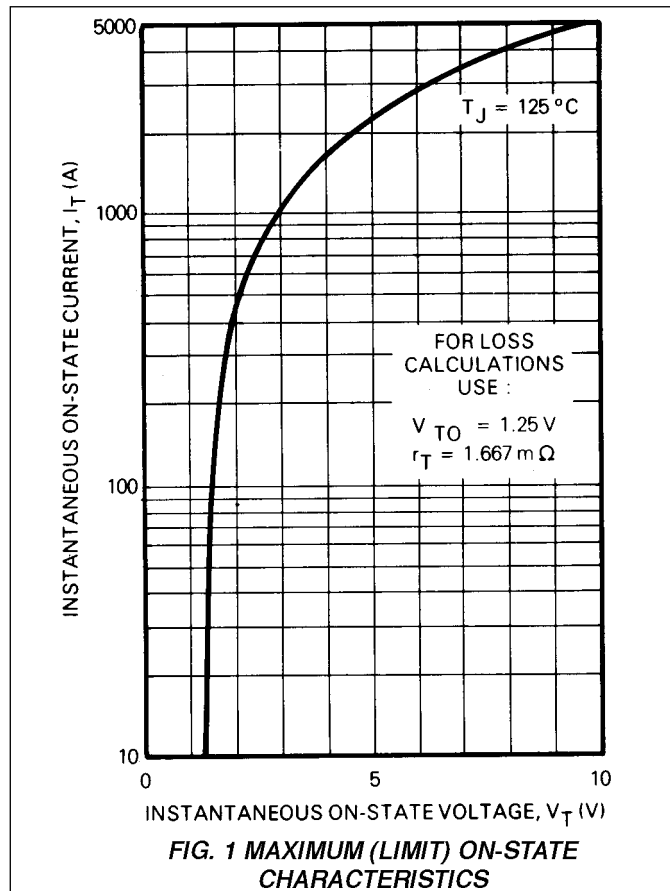
Symbol	Parameter	Conditions		Min.	Max.	Units
$V_{TM}$	Maximum on-state voltage	At 450A peak, $T_{case} = 25^{\circ}C$		-	2.0	V
$I_{RRM}/I_{DRM}$	Peak reverse and off-state current	At $V_{RRM}/V_{DRM}$ , $T_{case} = 125^{\circ}C$		-	25	mA
dV/dt	Maximum linear rate of rise of off-state voltage	Linear to 60% $V_{DRM}$ , $T_j = 125^{\circ}C$ , Gate open circuit		-	200	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 $T_{vj} = 125^{\circ}C$		-	1.66	m $\Omega$
$t_{gd}$	Delay time	$T_j = 25^{\circ}C$ , $I_T = 100A$ , $V_D = 50V$ , $I_G = 1A$ , $dI/dt = 50A/\mu s$ , $dI_G/dt = 1A/\mu s$		-	3*	$\mu s$
$t_{(ON)TOT}$	Total turn-on time			-	1.5*	$\mu s$
$I_H$	Holding current	$T_j = 25^{\circ}C$ , $I_{TM} = 1A$ , $V_D = 12V$		-	70	mA
$t_q$	Turn-off time	$T_j = 125^{\circ}C$ , $I_T = 200A$ , $V_R = 50V$ , $dV/dt = 200V/\mu s$ (Linear to 60% $V_{DRM}$ ), $dI_R/dt = 30A/\mu s$ , 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	-	4	A
$P_{GM}$	Peak gate power		-	16	W
$P_{G(AV)}$	Mean gate power		-	3	W

## CURVES



**FIG. 3 TYPICAL RECOVERED CHARGE**  
 (FOR A DEVICE RATED  $V_{drm} = 1000\text{ V}$ ,  $t_q = 50\mu\text{s}$ )

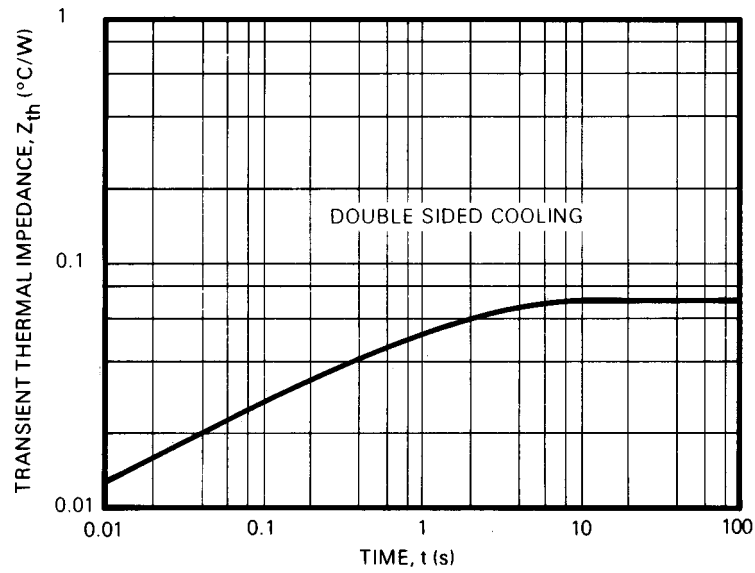


FIG. 4 TRANSIENT THERMAL IMPEDANCE - JUNCTION TO CASE

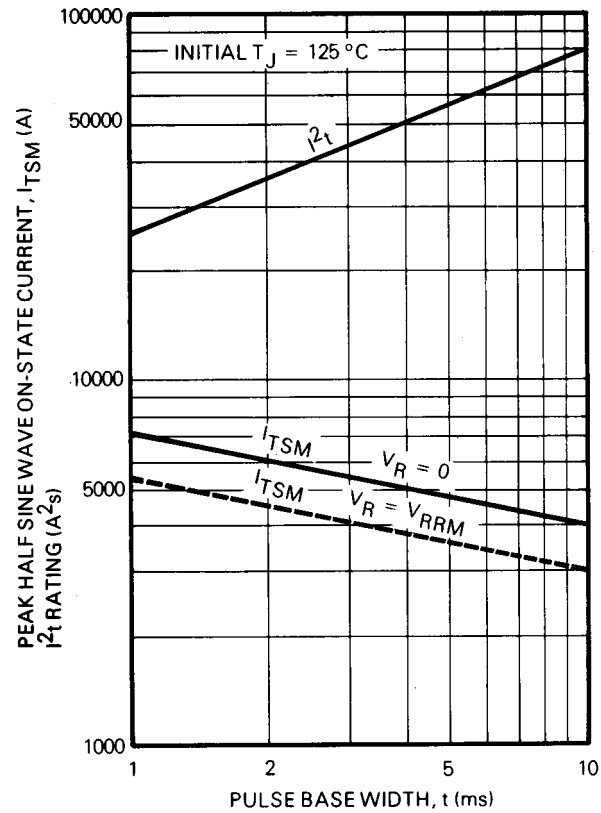


FIG. 5 NON-REPETITIVE SUB-CYCLE SURGE ON-STATE CURRENT AND  $I^2t$  RATING

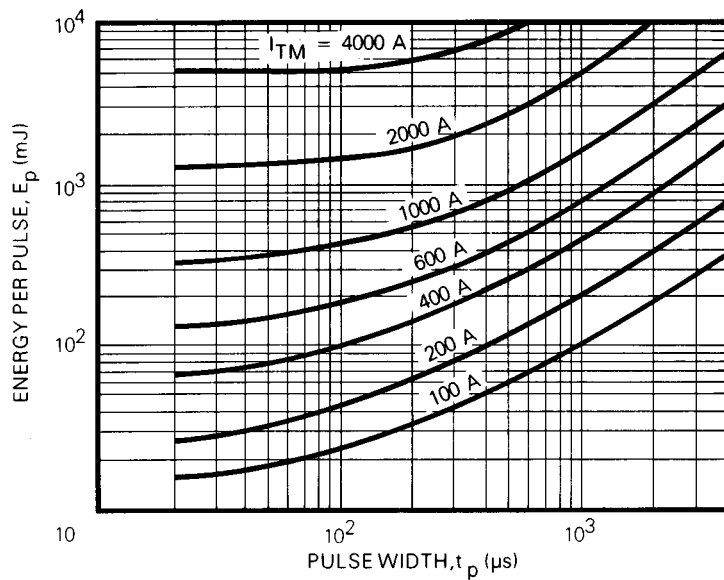


FIG. 6 ENERGY PER PULSE FOR SINUSOIDAL PULSES

**NOTES:**

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

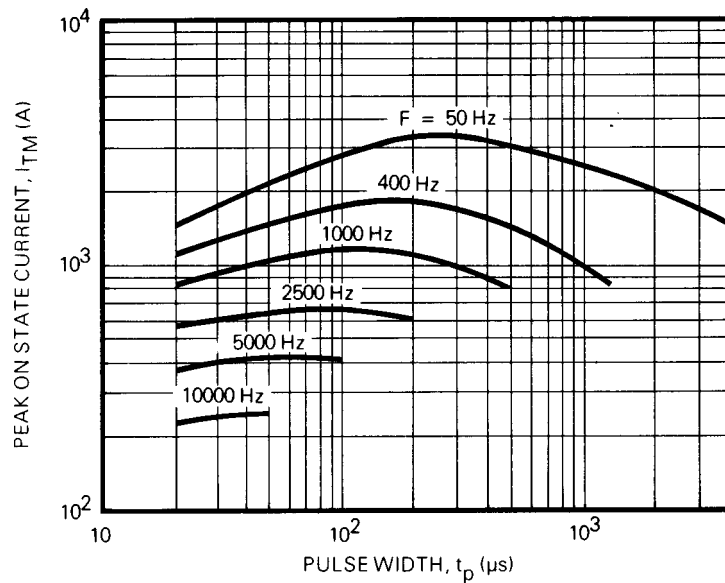
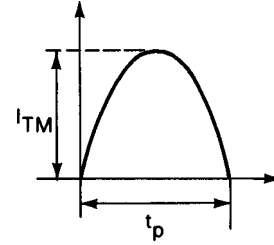
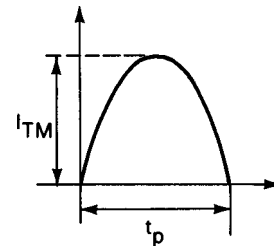
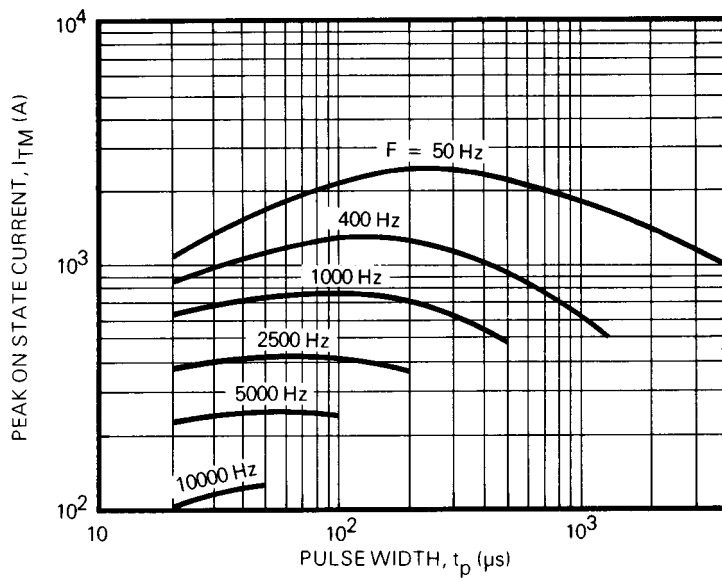


FIG. 7 MAXIMUM ALLOWABLE PEAK ON-STATE CURRENT vs PULSE WIDTH FOR  $T_c = 65^\circ C$

**NOTES:**

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

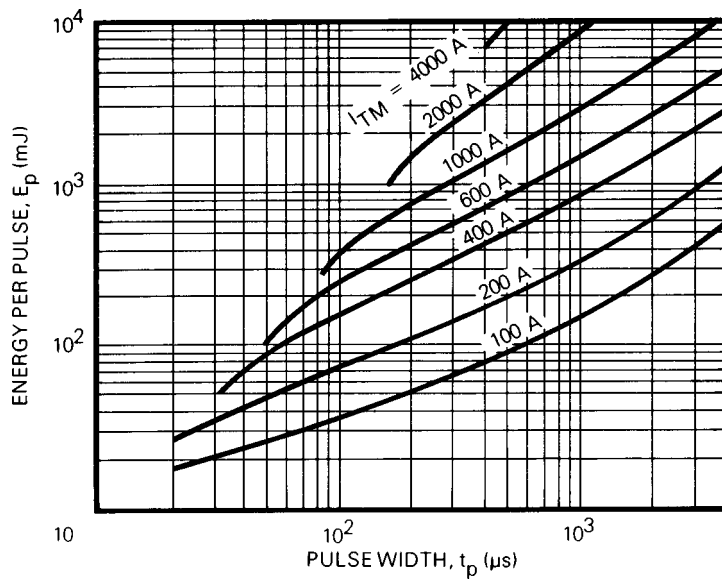
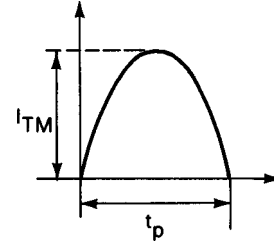




**FIG. 8 MAXIMUM ALLOWABLE PEAK ON-STATE CURRENT vs PULSE WIDTH FOR  $T_c = 90^\circ C$**

**NOTES:**

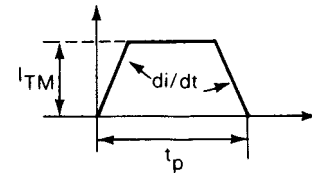
1.  $V_D \leq 600V$ .
2.  $V_R \leq 10V$ .
3. R.C Snubber,  $C = 0.22\mu F$ ,  $R = 4.7\Omega$



**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,  $C = 0.22\mu F$ ,  $R = 4.7\Omega$



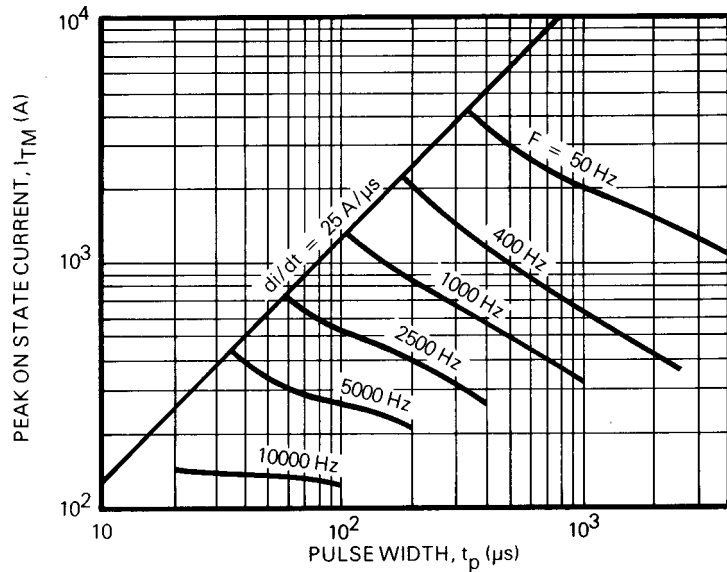


FIG. 10 MAXIMUM ALLOWABLE PEAK ON-STATE CURRENT  
vs PULSE WIDTH FOR  $T_c = 65^\circ\text{C}$

**NOTES:**

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

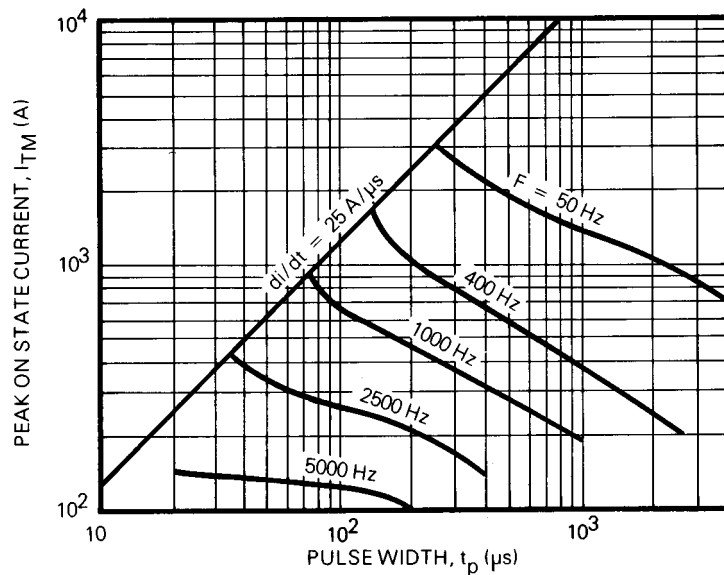
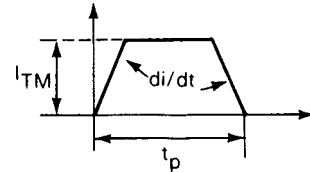
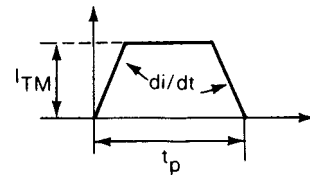


FIG. 11 MAXIMUM ALLOWABLE PEAK ON-STATE CURRENT  
vs PULSE WIDTH FOR  $T_c = 90^\circ\text{C}$

**NOTES:**

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





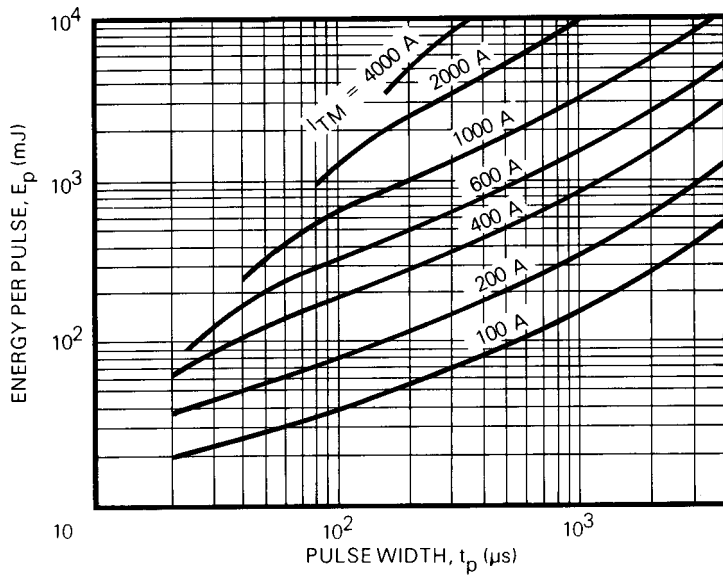


FIG. 12 ENERGY PER PULSE FOR TRAPEZOIDAL PULSES

**NOTES:**

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

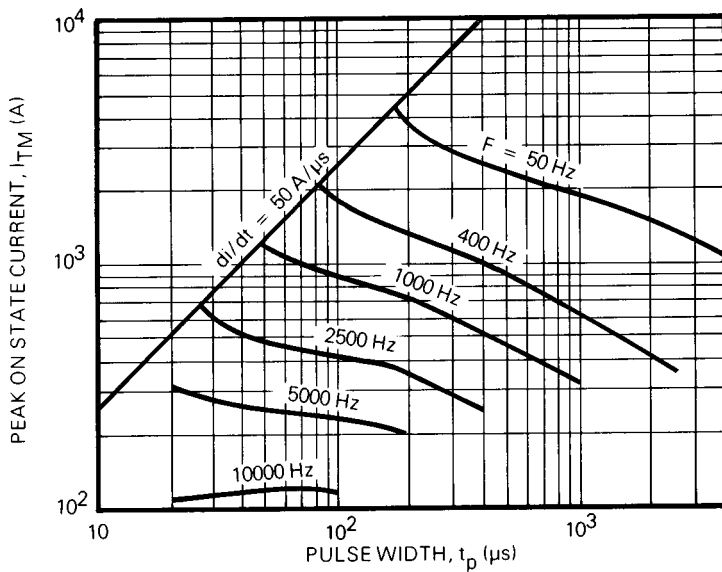
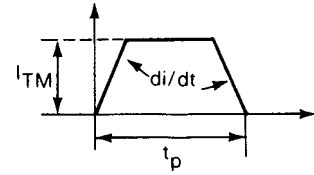
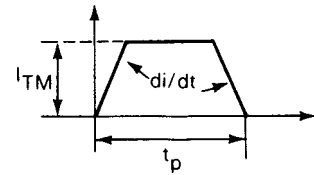


FIG. 13 MAXIMUM ALLOWABLE PEAK ON-STATE CURRENT vs PULSE WIDTH FOR  $T_c = 65^\circ C$

**NOTES:**

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



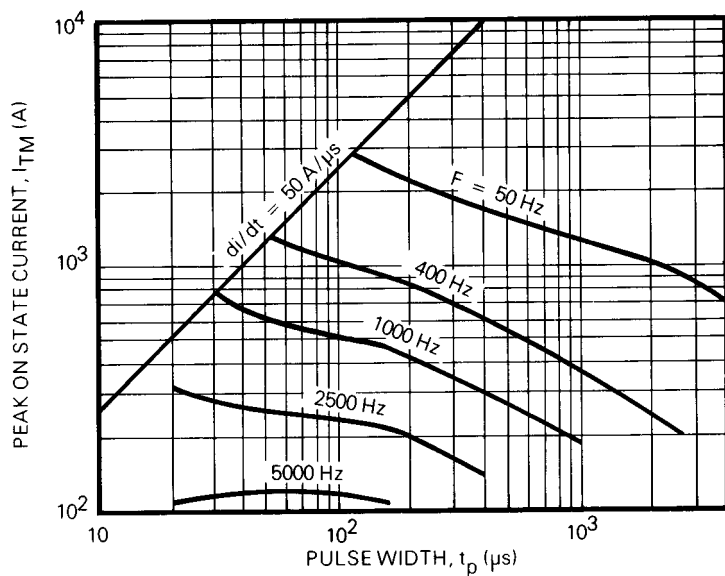


FIG. 14 MAXIMUM ALLOWABLE PEAK ON-STATE CURRENT vs PULSE WIDTH FOR  $T_c = 90^\circ\text{C}$

**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,  $C = 0.22\mu\text{F}$ ,  $R = 4.7\Omega$

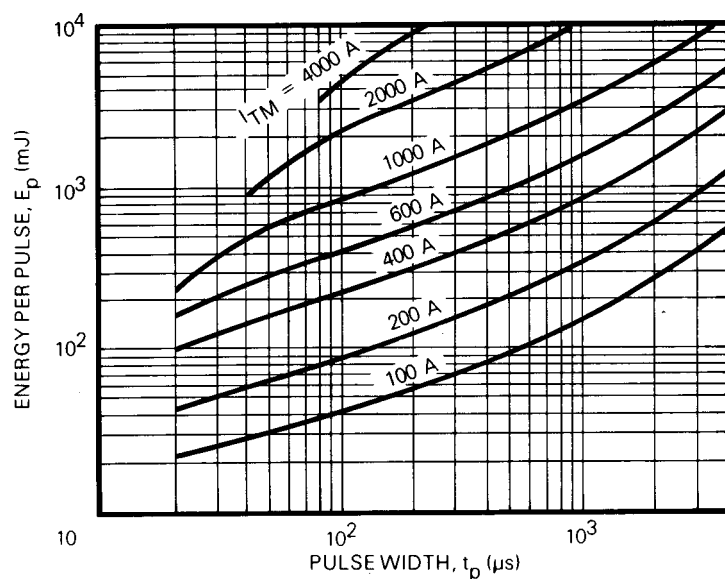
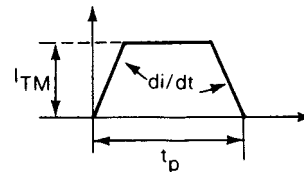
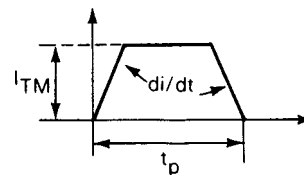
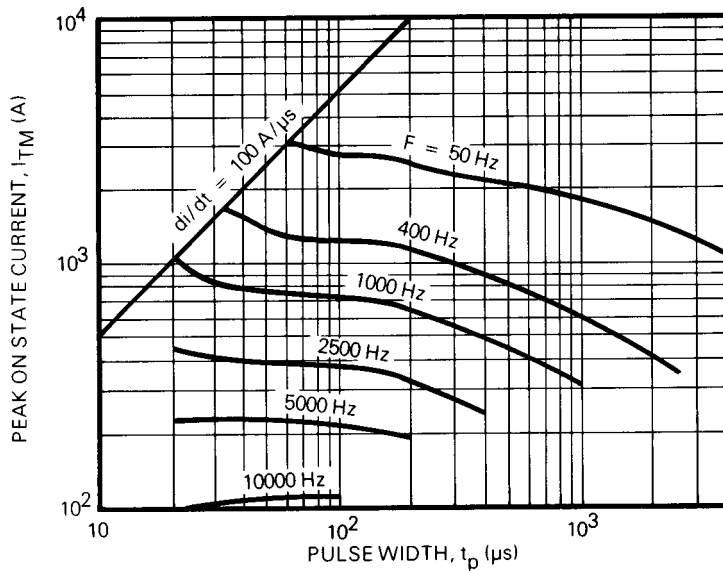


FIG. 15 ENERGY PER PULSE FOR TRAPEZOIDAL PULSES

**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,  $C = 0.22\mu\text{F}$ ,  $R = 4.7\Omega$

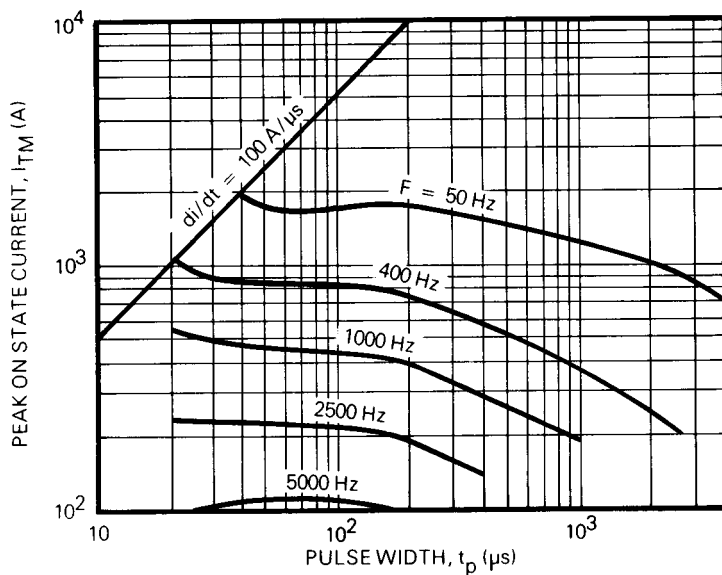
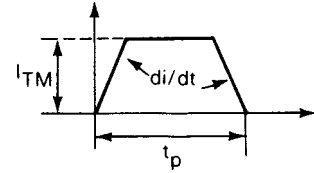




**FIG. 16 MAXIMUM ALLOWABLE PEAK ON-STATE CURRENT vs PULSE WIDTH FOR  $T_c = 65^\circ\text{C}$**

**NOTES:**

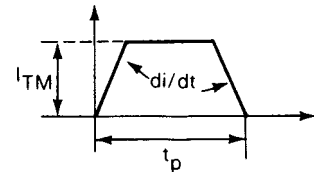
1.  $di/dt = 100\text{ A}/\mu\text{s}$
2.  $V_D \leq 600\text{ V}$ .
3.  $V_R \leq 10\text{ V}$ .
4. R.C Snubber,  $C = 0.22\mu\text{F}$ ,  $R = 4.7\Omega$



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

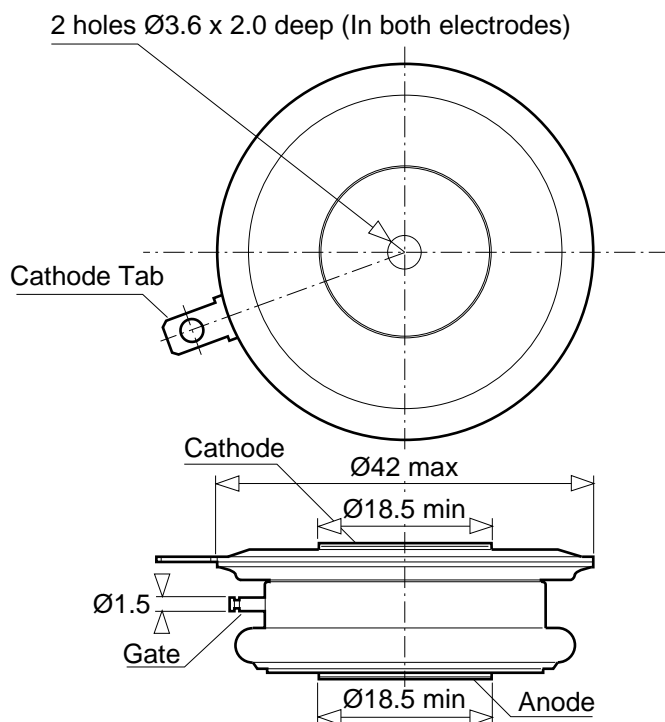
**NOTES:**

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,  $C = 0.22\mu\text{F}$ ,  $R = 4.7\Omega$



## PACKAGE DETAILS - MU86

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



Weight: 50g



### HEADQUARTERS OPERATIONS

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