Fast Switching Thyristor

Replaces January 2000 version, DS4411-2.0

DS4411-3.0 July 2001

FEATURES

- Low Switching Losses At High Frequency
- Fully Characterised For Operation Up To 20kHz

APPLICATIONS

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

VOLTAGE RATINGS

Type Number	Repetitive Peak Voltages V_{DRM} V_{RRM} V	Conditions
DK13 12FX K or M DK13 10FX K or M	1200 1000	$V_{RSM} = V_{RRM}$ + 100V $I_{DRM} = I_{RRM}$ = 15mA at V_{RRM} or V_{DRM} & T_{vj}

ORDERING INFORMATION

When ordering, select the required part number shown in the Voltage Ratings selection table, then:-

Add K to type number for 1/2" 20 UNF thread, e.g. **DK13 10FXK**

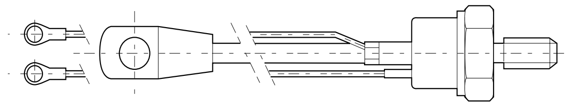
or

Add M to type number for M12 thread, e.g. **DK13 10FXM**.

Note: Please use the complete part number when ordering and quote this number in any future correspondance relating to your order.

KEY PARAMETERS

V_{DRM}	**1200V**
$I_{T(RMS)}$	**130A**
I_{TSM}	**1600A**
dVdt	**200V/µs**
dI/dt	**500A/µs**
t_q	**15µs**



Outline type code: TO94
See Package Details for further information.

Fig. 1 Package outline

CURRENT RATINGS

Symbol	Parameter	Conditions	Max.	Units
$I_{T(AV)}$	Mean on-state current	Half wave resistive load, T_{case} = 80ºC	83	A
$I_{T(RMS)}$	RMS value	T_{case} = 80ºC	130	A

SURGE RATINGS

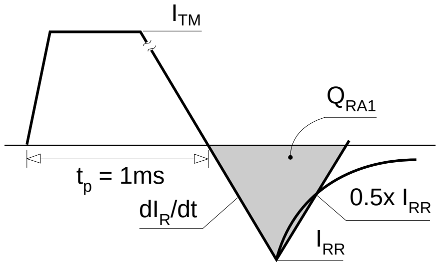
Symbol	Parameter	Conditions	Max.	Units
I_{TSM}	Surge (non-repetitive) on-state current	t_p ≥ 10ms half sine; T_{case} = 125ºC	1.6	kA
I^2t	I^2t for fusing	V_R = 0% V_{RRM} - 1/4 sine	12.8 x 10^3	A^2s

THERMAL AND MECHANICAL DATA

Symbol	Parameter	Conditions	Min.	Max.	Units
$R_{th(j-c)}$	Thermal resistance - junction to case	dc	-	0.24	ºC/W
$R_{th(c-h)}$	Thermal resistance - case to heatsink	Mounting torque 15.0Nm with mounting compound	-	0.08	ºC/W
T_{vj}	Virtual junction temperature	On-state (conducting)	-	125	ºC
		Reverse (blocking)	-	125	ºC
T_{stg}	Storage temperature range		-40	150	ºC
-	Mounting torque		12.0	15.0	Nm

MEASUREMENT OF RECOVERED CHARGE - Q_{RA1}

Measurement of Q_{RA1} : $Q_{RA1} = \frac{I_{RR} \times t_{RR}}{2}$



DYNAMIC CHARACTERISTICS

Symbol	Parameter	Conditions		Min.	Max.	Units
V_{TM}	Maximum on-state voltage	At 300A peak, T_{case} = 25°C		-	2.35	V
I_{RRM}/I_{DRM}	Peak reverse and off-state current	At V_{RRM}/V_{DRM}, T_{case} = 125°C		-	15	mA
dV/dt	Maximum linear rate of rise of off-state voltage	Linear to 60% V_{DRM} T_j = 125°C, Gate open circuit		-	200	V/µs
dI/dt	Rate of rise of on-state current	Gate source 20V, 20Ω	Repetitive 50Hz	-	500	A/µs
		t_r < 0.5µs, T_j = 125°C	Non-repetitive	-	800	A/µs
$V_{T(TO)}$	Threshold voltage	At T_{vj} = 125°C		-	1.5	V
r_T	On-state slope resistance	At T_{vj} = 125°C		-	2.83	mΩ
t_{gd}	Delay time	T_j = 25°C, I_T = 50A, V_D = 300V, I_G = 1A, dI/dt =50A/µs, dI_G/dt = 1A/µs		-	5	µs
$t_{(ON)TOT}$	Total turn-on time			-	3	µs
I_H	Holding current	T_j = 25°C, I_{TM} = 1A, V_D = 12V		60*	-	mA
t_q	Turn-off time	T_j = 125°C, I_T = 100A, V_R = 50V, dV/dt = 200V/µs (Linear to 60% V_{DRM}), dI_R/dt = 30A/µs, Gate open circuit	t_q code: X	-	15	µs

**Typical value.*

GATE TRIGGER CHARACTERISTICS AND RATINGS

Symbol	Parameter	Conditions	Typ.	Max.	Units
V_{GT}	Gate trigger voltage	V_{DRM} = 12V, T_{case} = 25°C, R_L = 6Ω	-	3.0	V
I_{GT}	Gate trigger current	V_{DRM} = 12V, T_{case} = 25°C, R_L = 6Ω	-	200	mA
V_{GD}	Gate non-trigger voltage	At V_{DRM} T_{case} = 125°C, R_L = 1kΩ	-	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		-	3.0	W

CURVES

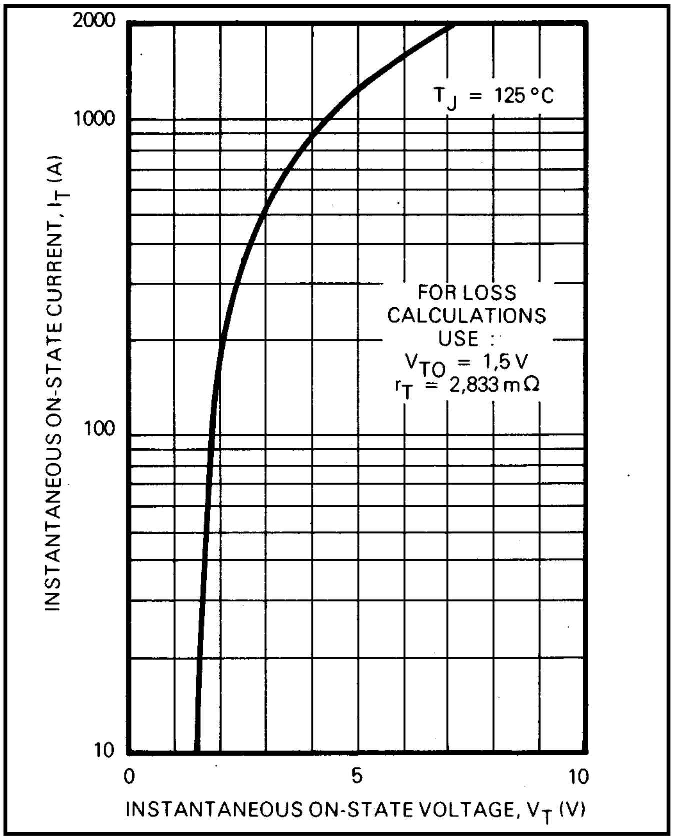


Fig.2 Maximum (limit) on-state characteristics

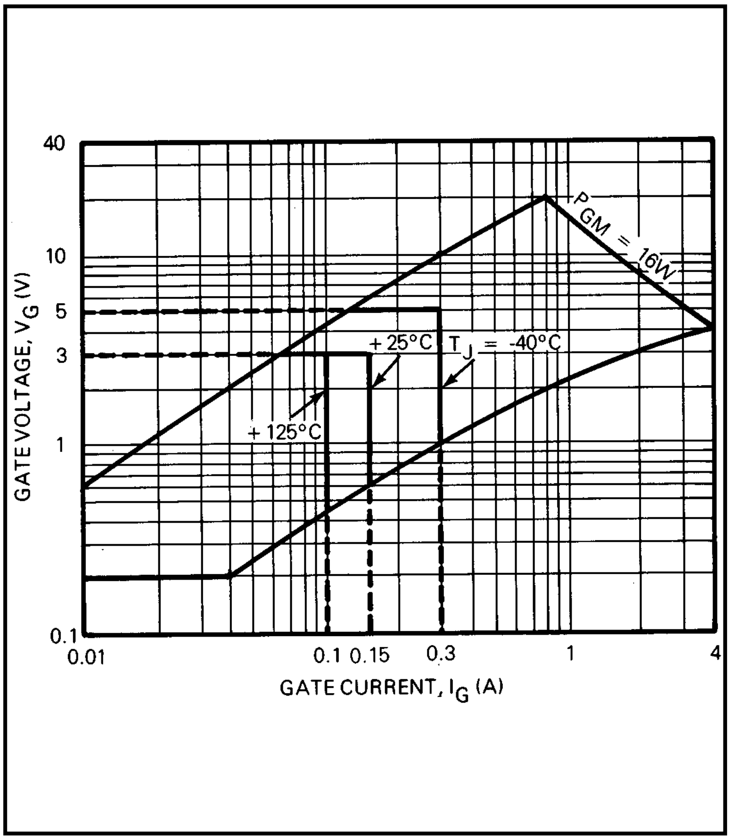


Fig.3 Gate characteristics

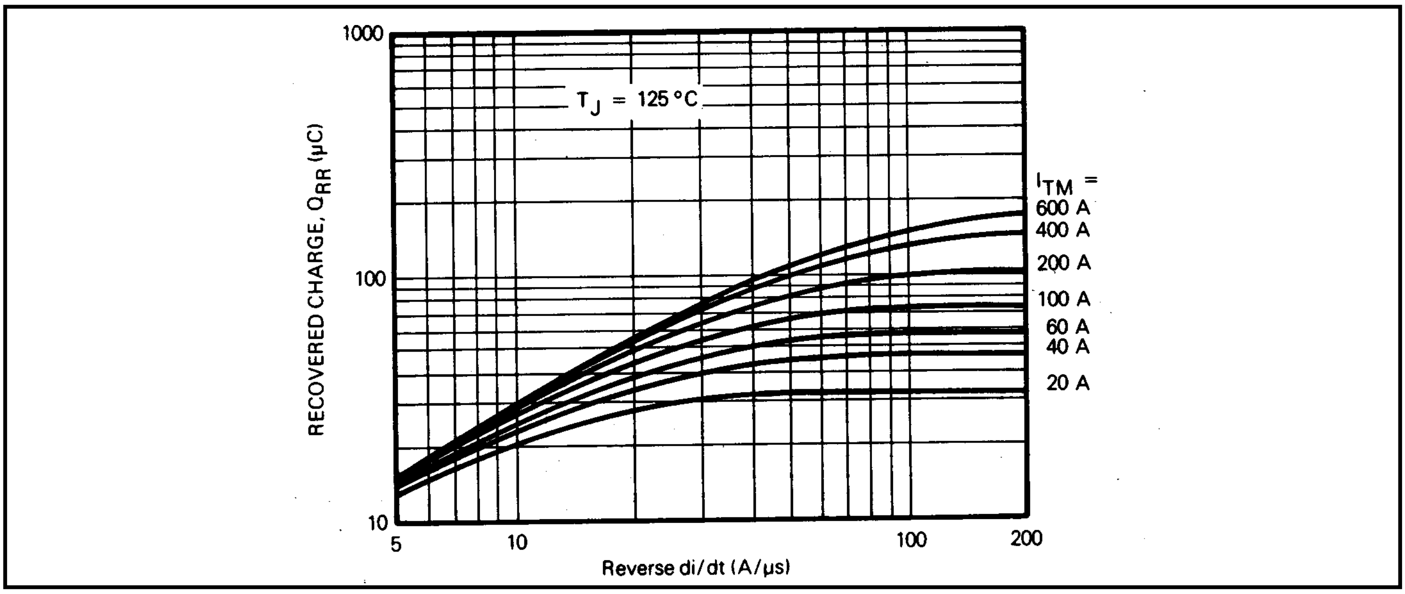


Fig.4 Typical recovered charge (for a device rated V_{DRM} = 600V, t_q = 10μs)

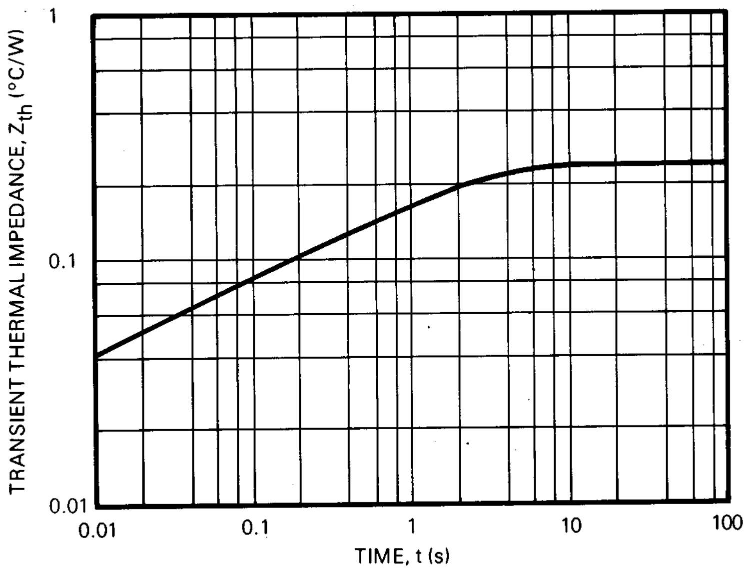


Fig.5 Transient thermal impedance - junction to case

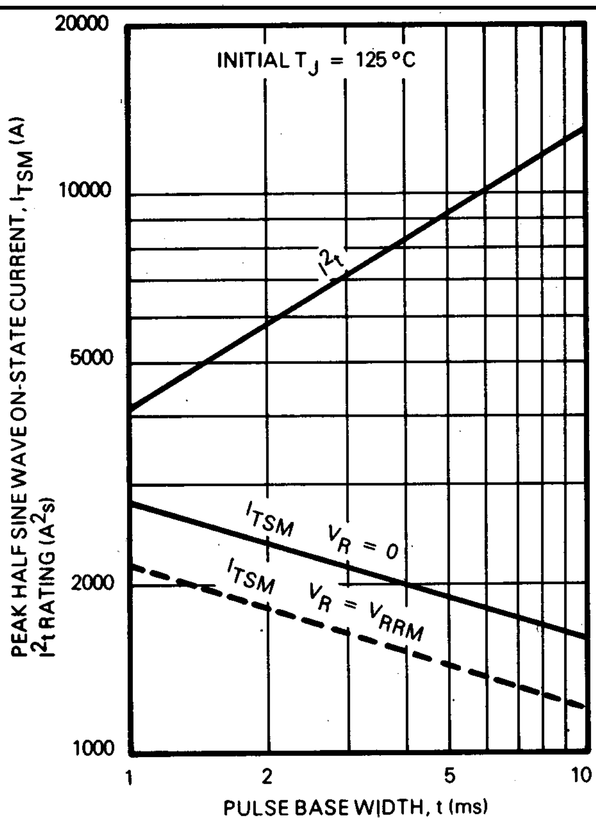
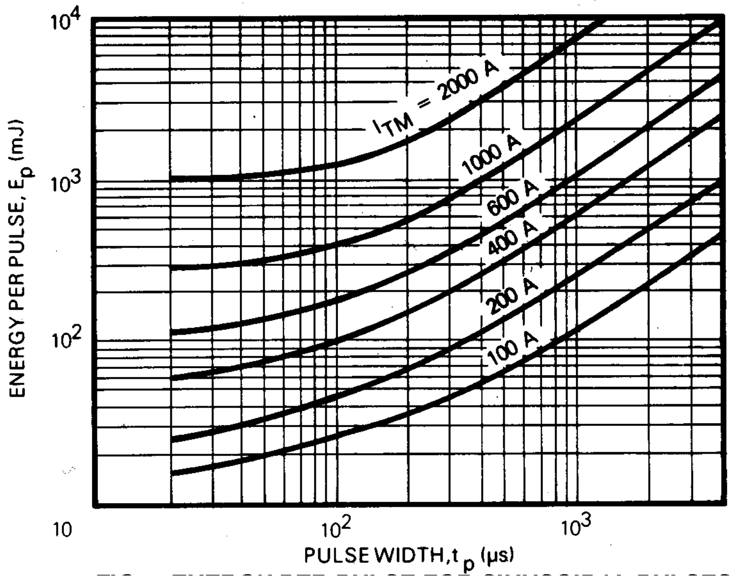


Fig.6 Non-repetitive sub-cycle surge on-state current and I^2t rating



NOTES:
1. $V_D \leq 600V$.
2. $V_R \leq 10V$.
3. R.C Snubber, C = 0.22µF, R = 4.7Ω

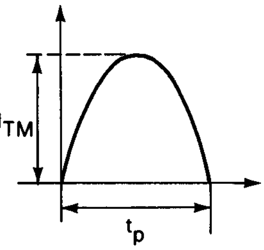
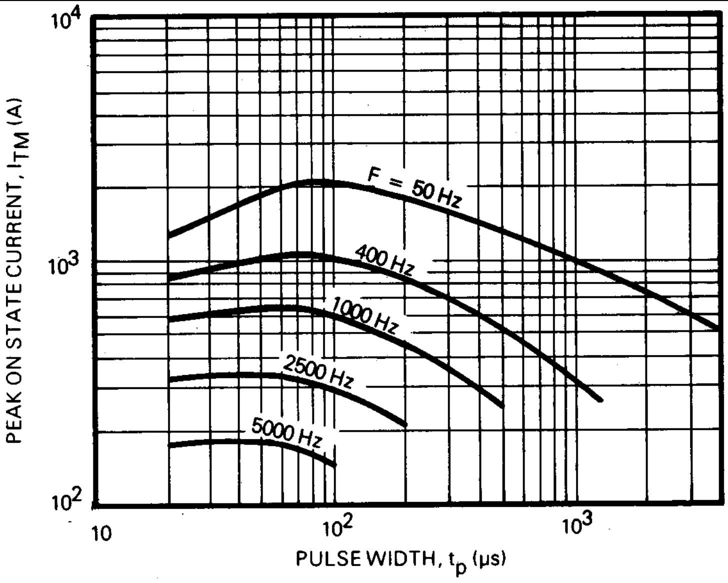


Fig.7 Energy per pulse for sinusoidal pulses



NOTES:
1. $V_D \leq 600V$.
2. $V_R \leq 10V$.
3. R.C Snubber, C = 0.22µF, R = 4.7Ω

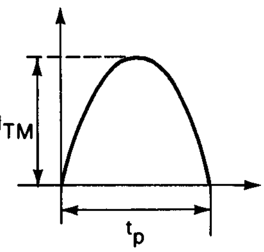
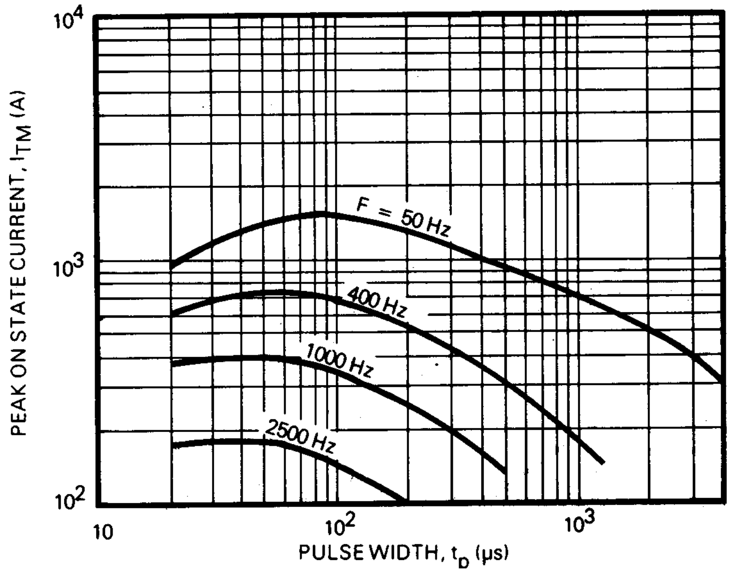


Fig.8 Maximum allowable peak on-state current vs pulse width for T_{case} = 65°C



NOTES:
1. $V_D \leq 600V$.
2. $V_R \leq 10V$.
3. R.C Snubber, C = 0.22µF, R = 4.7Ω

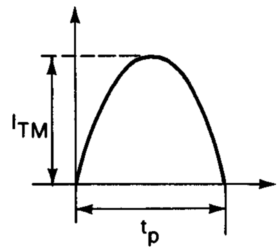
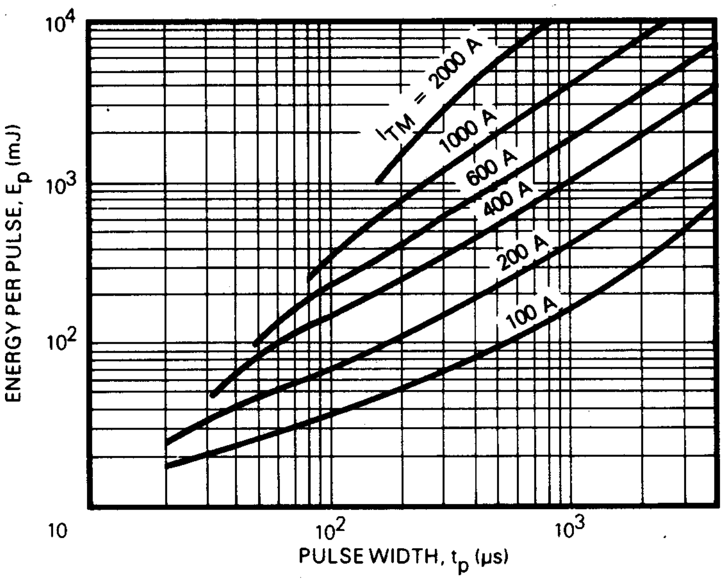


Fig.9 Maximum allowable peak on-state current vs pulse width for T_{case} = 90˚C



NOTES:
1. dI/dt = 25A/µs
2. $V_D \leq 600V$.
3. $V_R \leq 10V$.
4. R.C Snubber, C = 0.22µF, R = 4.7Ω

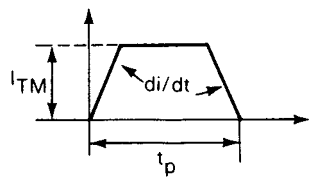
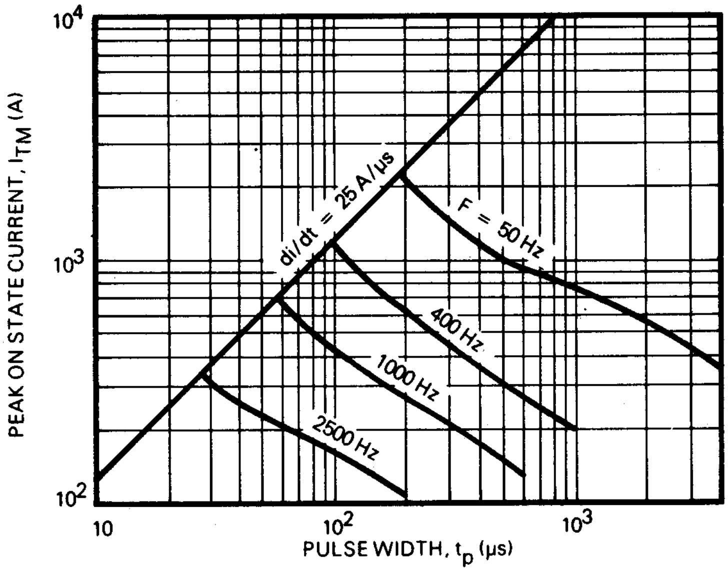


Fig.10 Energy per pulse for trapezoidal pulses



NOTES:
1. dI/dt = 25A/µs
2. $V_D \leq 600V$.
3. $V_R \leq 10V$.
4. R.C Snubber, C = 0.22µF, R = 4.7Ω

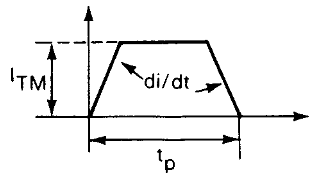
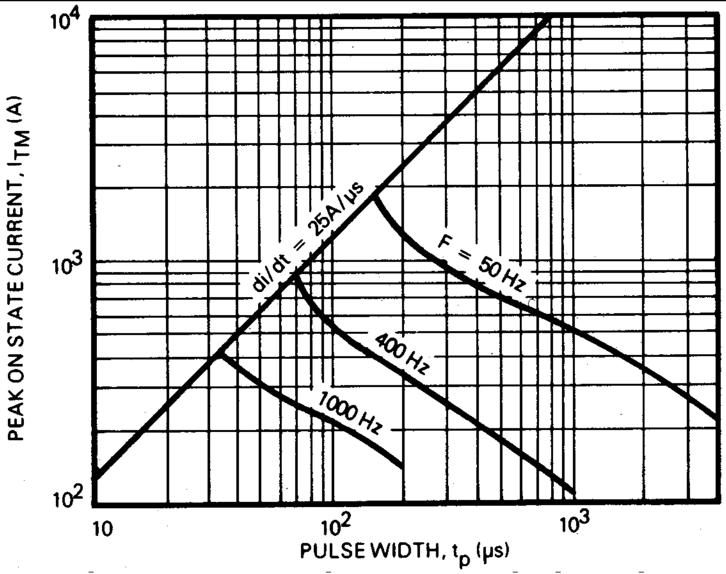


Fig.11 Maximum allowable peak on-state current vs pulse width for T_{case} = 65˚C



NOTES:
1. dI/dt = 25A/µs
2. $V_D \leq 600V$.
3. $V_R \leq 10V$.
4. R.C Snubber, C = 0.22µF, R = 4.7Ω

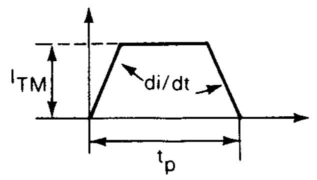
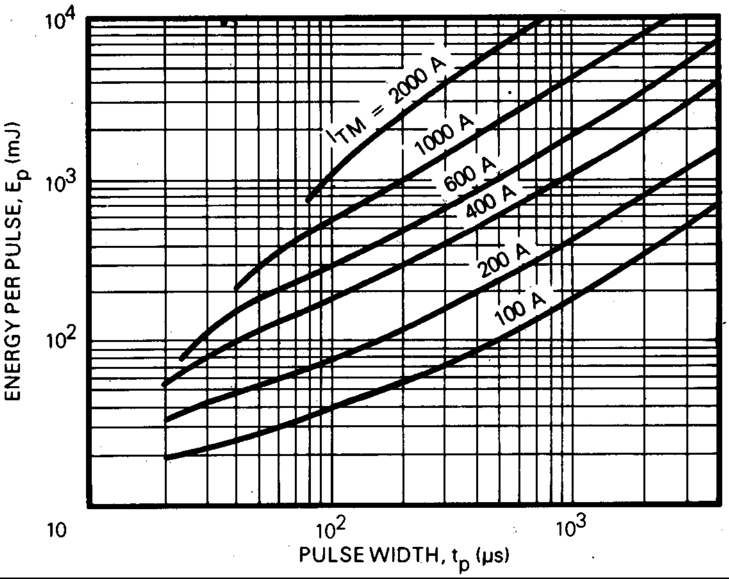


Fig.12 Maximum allowable peak on-state current vs pulse width for T_{case} = 90˚C



NOTES:
1. dI/dt = 50A/µs
2. $V_D \leq$ 600V.
3. $V_R \leq$ 10V.
4. R.C Snubber, C = 0.22µF, R = 4.7Ω

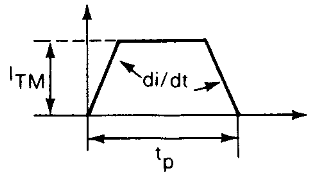
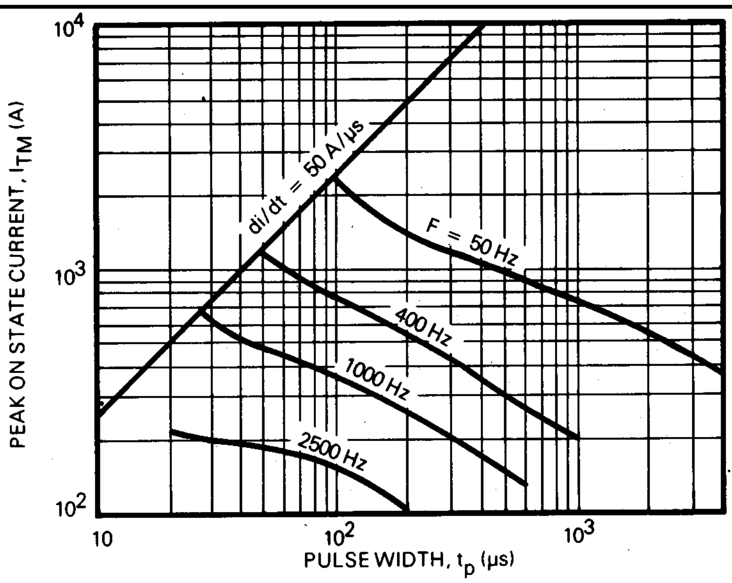


Fig.13 Energy per pulse for trapezoidal pulses



NOTES:
1. dI/dt = 50A/µs
2. $V_D \leq$ 600V.
3. $V_R \leq$ 10V.
4. R.C Snubber, C = 0.22µF, R = 4.7Ω

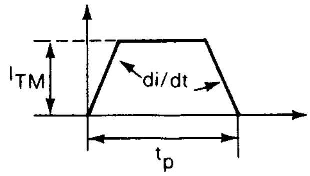
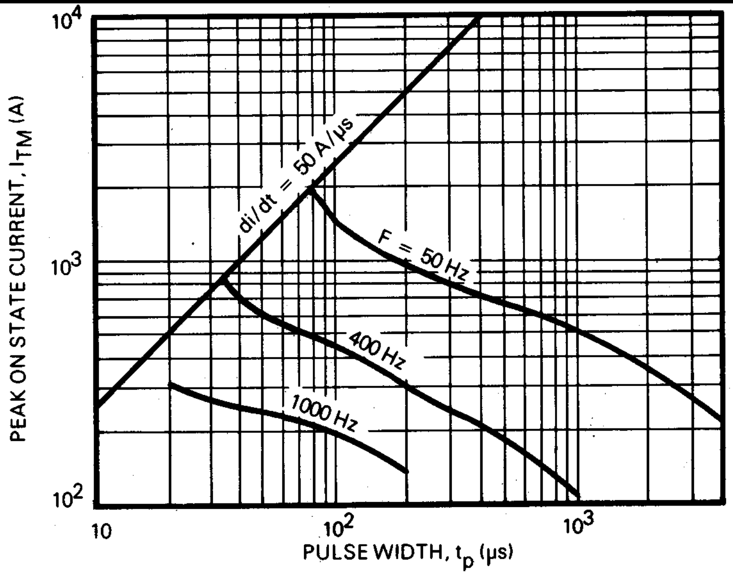


Fig.14 Maximum allowable peak on-state current vs pulse width for T_{case} = 65˚C



NOTES:
1. dI/dt = 50A/µs
2. $V_D \leq 600V$.
3. $V_R \leq 10V$.
4. R.C Snubber, C = 0.22µF, R = 4.7Ω

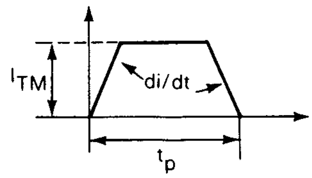
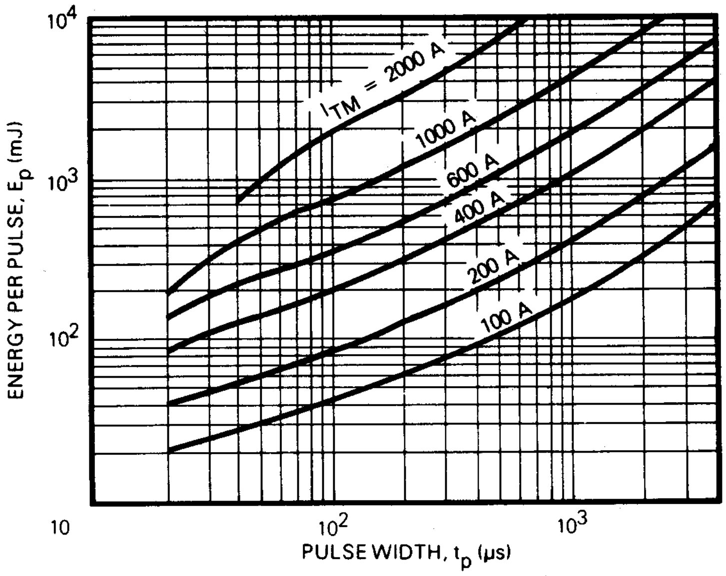


Fig.15 Maximum allowable peak on-state current vs pulse width for T_{case} = 65°C



NOTES:
1. dI/dt = 100A/µs
2. $V_D \leq 600V$.
3. $V_R \leq 10V$.
4. R.C Snubber, C = 0.22µF, R = 4.7Ω

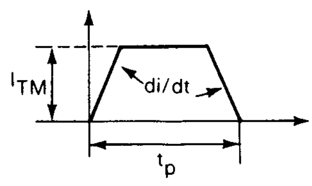
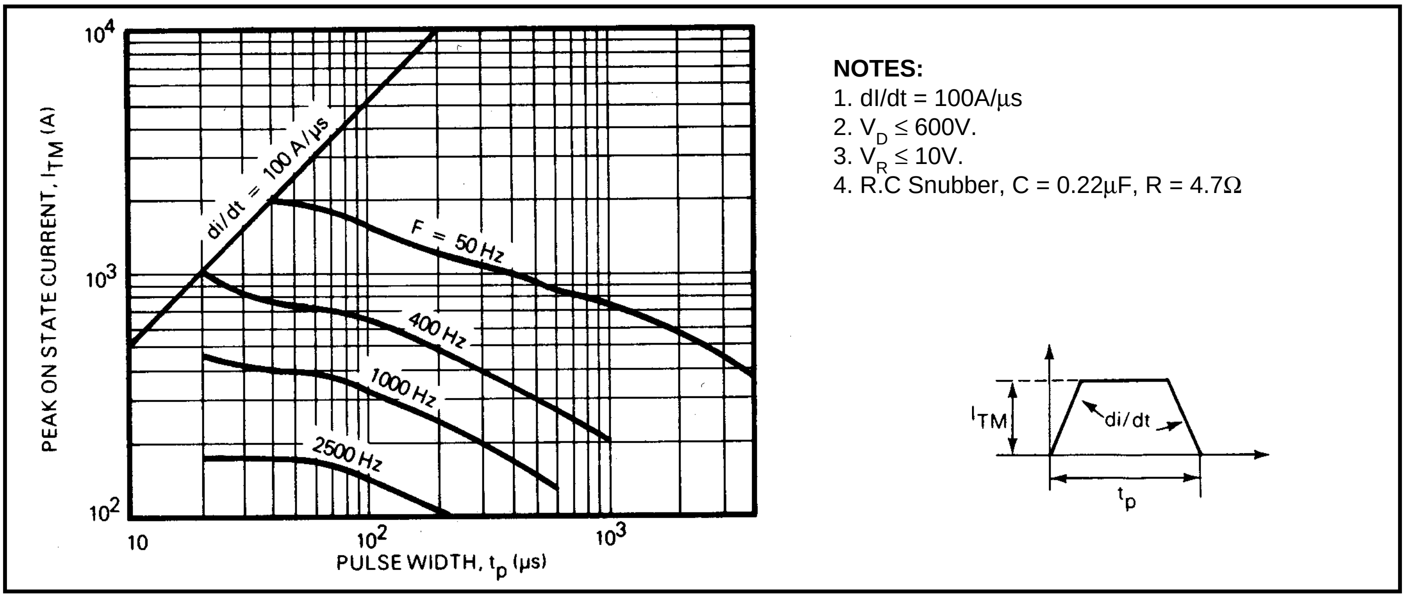
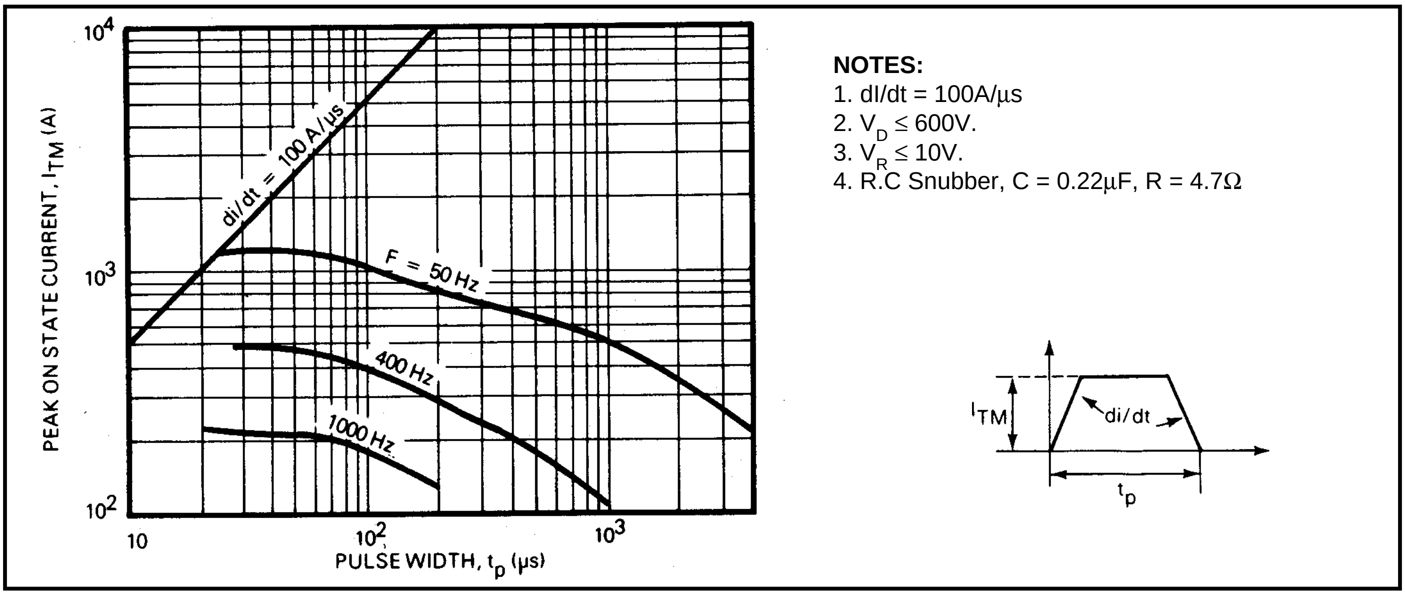


Fig.16 Energy per pulse for trapezoidal pulses



NOTES:
1. dI/dt = 100A/µs
2. $V_D \leq 600V$.
3. $V_R \leq 10V$.
4. R.C Snubber, C = 0.22µF, R = 4.7Ω

Fig.17 Maximum allowable peak on-state current vs pulse width for T_{case} = 65˚C

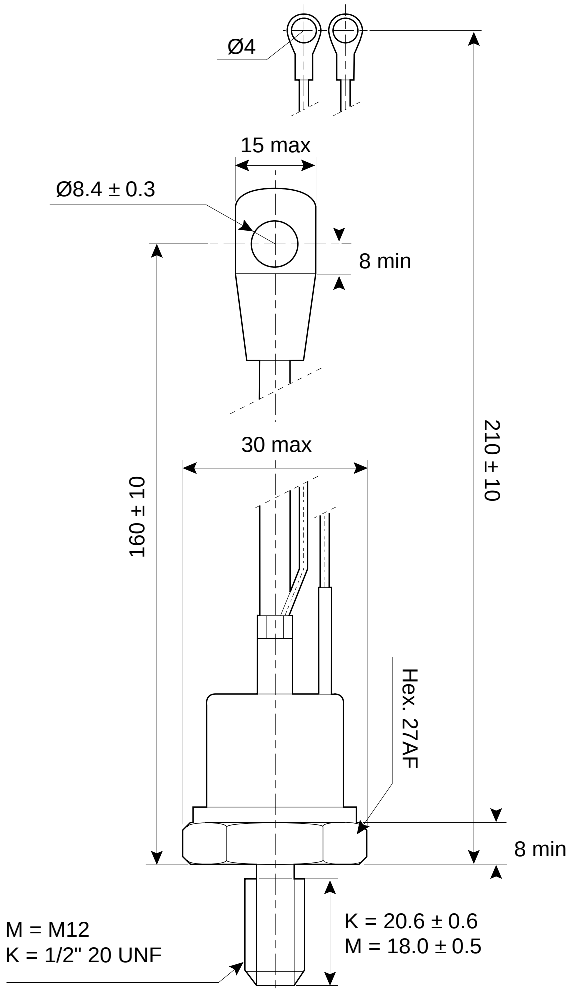


NOTES:
1. dI/dt = 100A/µs
2. $V_D \leq 600V$.
3. $V_R \leq 10V$.
4. R.C Snubber, C = 0.22µF, R = 4.7Ω

Fig.18 Maximum allowable peak on-state current vs pulse width for T_{case} = 90˚C

PACKAGE DETAILS

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



Nominal weight: 120g
Mounting torque: 15Nm ±10%
Gate lead colour: White
Cathode lead colour: Red

Package outine type code: TO94

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 and clamping systems in line with advances in device voltages 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 latest 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 includes a varied selection of pre-loaded clamps to suit all of our manufactured devices. Types available include cube clamps for single side cooling of 'T' 23mm and 'E' 30mm discs, and bar clamps right up to 83kN for our 'Z' 100mm thyristors and diodes.

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

The Power Assembly group has its own proprietary range of extruded aluminium heatsinks. They have been designed to optimise the performance of Dynex 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 customer service office.

DYNEX SEMICONDUCTOR

http://www.dynexsemi.com

e-mail: 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.
99 Bank Street, Suite 410,
Ottawa, Ontario, Canada, K1P 6B9
Tel: 613.723.7035
Fax: 613.723.1518
Toll Free: 1.888.33.DYNEX (39639)

CUSTOMER SERVICE CENTRES
Mainland Europe Tel: +33 (0)1 58 04 91 00. Fax: +33 (0)1 46 38 51 33
North America Tel: (613) 723-7035. Fax: (613) 723-1518.
UK, Scandinavia & Rest Of World Tel: +44 (0)1522 500500. Fax: +44 (0)1522 500020

SALES OFFICES
Mainland Europe Tel: +33 (0)1 58 04 91 00. Fax: +33 (0)1 46 38 51 33
North America Tel: (613) 723-7035. Fax: (613) 723-1518. Toll Free: 1.888.33.DYNEX (39639) /
Tel: (949) 733-3005. Fax: (949) 733-2986.
UK, Scandinavia & Rest Of World Tel: +44 (0)1522 500500. Fax: +44 (0)1522 500020

These offices are supported by Representatives and Distributors in many countries world-wide.

Datasheet Annotations:

Dynex Semiconductor annotate datasheets in the top right hard corner of the front page, to indicate product status. The annotations are as follows:-

Target Information: This is the most tentative form of information and represents a very preliminary specification. No actual design work on the product has been started.

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.