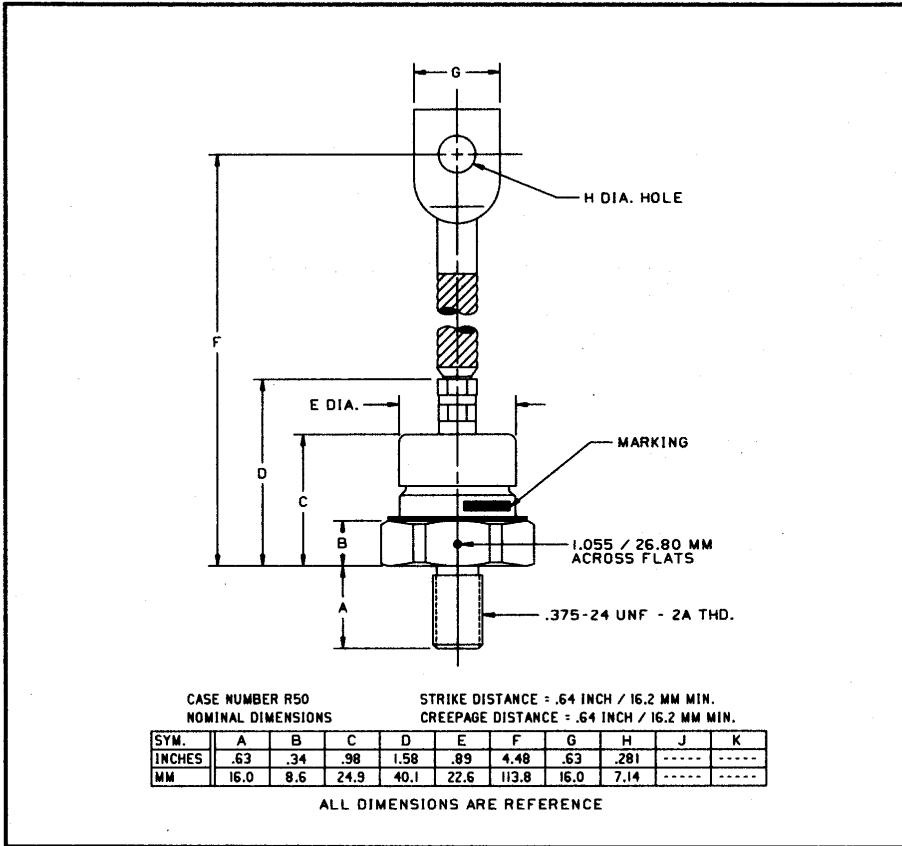


Powerex, Inc., 200 Hillis Street, Youngwood, Pennsylvania 15697-1800 (412) 925-7272  
 Powerex, Europe, S.A. 428 Avenue G. Durand, BP107, 72003 Le Mans, France (43) 41.14.14

**Fast Recovery Rectifier**  
 125 Amperes Average  
 1400 Volts



R502\_\_13/R503\_\_13  
**Fast Recovery Rectifier**  
 125 Amperes Average, 1400 Volts

R502\_\_13/R503\_\_13 (Outline Drawing)

**Features:**

- Fast Recovery Times
- Soft Recovery Characteristics
- Standard and Reverse Polarities
- Flag Lead and Stud Top Terminals Available
- High Surge Current Ratings
- High Rated Blocking Voltages
- Special Electrical Selection for Parallel and Series Operation
- Glazed Ceramic Seal Gives High Voltage Creepage and Strike Paths

**Ordering Information:**

Select the complete part number you desire from the following table:

Type	Voltage		Current		Recovery Time		Leads	
	V <sub>RRM</sub> (Volts)	Code	I <sub>F(av)</sub> (A)	Code	t <sub>rr</sub> (μsec)	Code	Case	Code
R502 (Standard Polarity)	200	02	125	13	0.7	LS	DO-8	WA
	400	04						
	600	06						
	800	08						
R503 (Reverse Polarity)	1000	10						
	1200	12						
	1400	14						

**Example:** Type R502 rated at 125A average with V<sub>RRM</sub> = 1400V, Recovery Time = 0.7 μsec and standard flexible lead, order as:

Type	Voltage	Current	Time	Leads
R 5 0 2	1 4	1 3	LS	W A

**Applications:**

- Inverters
- Choppers
- Transmitters
- Free Wheeling Diode

R502\_13/R503\_13  
**Fast Recovery Rectifier**  
 125 Amperes Average, 1400 Volts

## Absolute Maximum Ratings

Characteristics	Symbol	R502_13/R503_13	Units
RMS Forward Current	$I_{F(rms)}$	195	Amperes
Average Forward Current	$I_{F(av)}$	125	Amperes
One-half Cycle Surge Current	$I_{FSM}$	2500	Amperes
$I^2t$ (for Fusing), Times $\geq 8.3$ milliseconds	$I^2t$	26000	A <sup>2</sup> sec
Storage Temperature	$T_{stg}$	-40 to +190	°C
Operating Temperature	$T_j$	-40 to +150	°C
Mounting Torque		120	in-lb

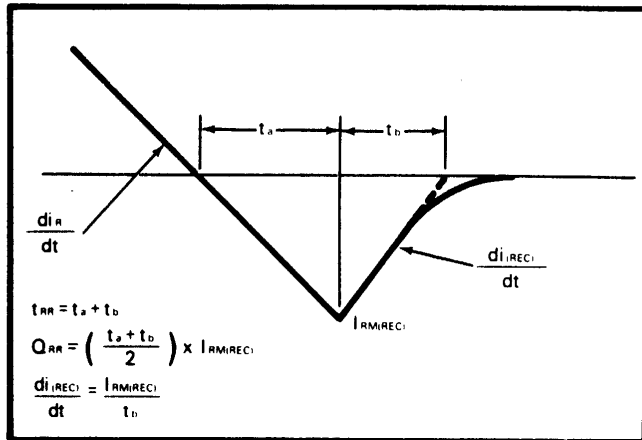
## Electrical and Thermal Characteristics

Characteristics	Symbol	Test Conditions	R502_13/R503_13	Units
<b>Current - Conducting State Maximums</b>				
Forward Voltage Drop	$V_{FM}$	$T_j = 25^\circ\text{C}, I_{FM} = 470\text{A}$	2.5	Volts
<b>Voltage - Blocking State Maximums</b>				
Repetitive Peak Reverse Voltage (Rated Limit)	$V_{RRM}$		1400	Volts
Non-rep. Trans. Peak Rev. Voltage (Rated Limit)	$V_{RSM}$	$V \leq 5.0\text{msec}$	1600	Volts
Reverse Leakage Current, mA peak	$I_{RRM}$	$T_j$ at max., $V_{RRM} = \text{Rated}$	45	mA
<b>Switching</b>				
Maximum Reverse Recovery Time	$t_{rr}$	$I_{FM} = 314\text{A}, t_p = 40\mu\text{sec},$ $di_F/dt = 25\text{A}/\mu\text{sec}, T_C = 25^\circ\text{C}$	0.7	$\mu\text{sec}$
<b>Thermal</b>				
Maximum Resistance, Junction to Case	$R_{\theta(j-c)}$		0.28	°C/Watt
Maximum Resistance, Case to Sink (Lubricated)	$R_{\theta(c-s)}$		0.12	°C/Watt

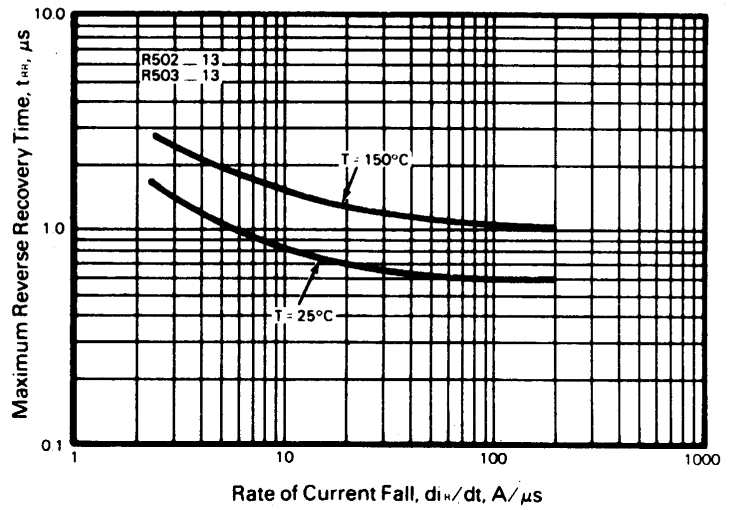
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R502\_13/R503\_13  
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 125 Amperes Average, 1400 Volts

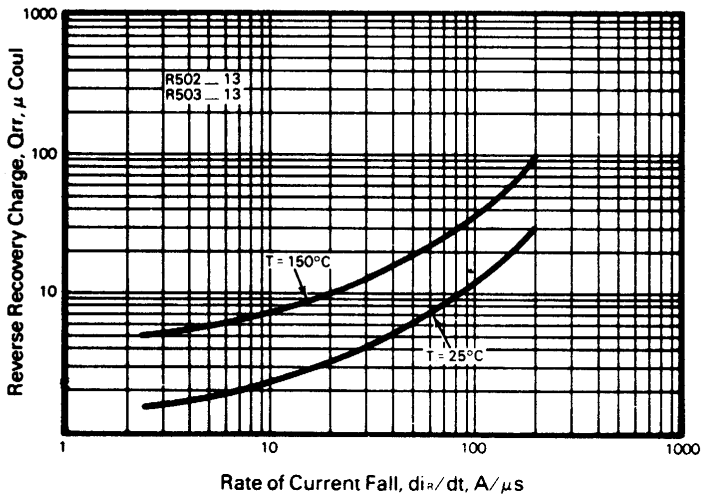
Reverse Recovery Wave Form



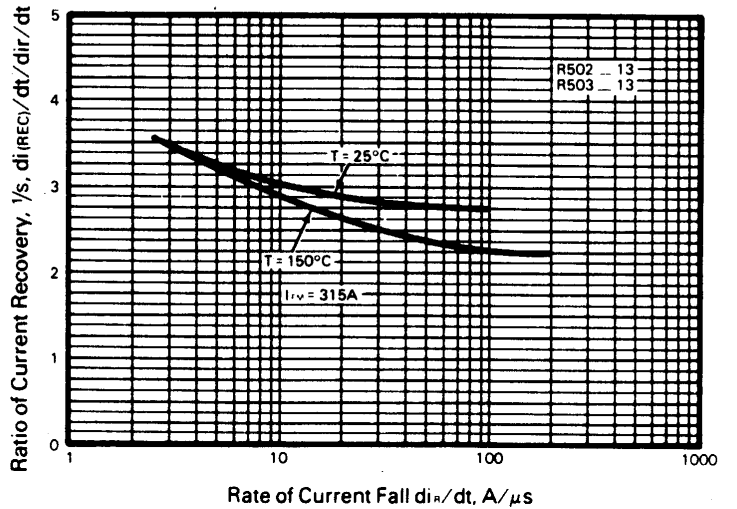
Typical Reverse Recovery Charge Vs. Rate of Current Fall



Typical Reverse Recovery Time Vs. Rate of Current Fall

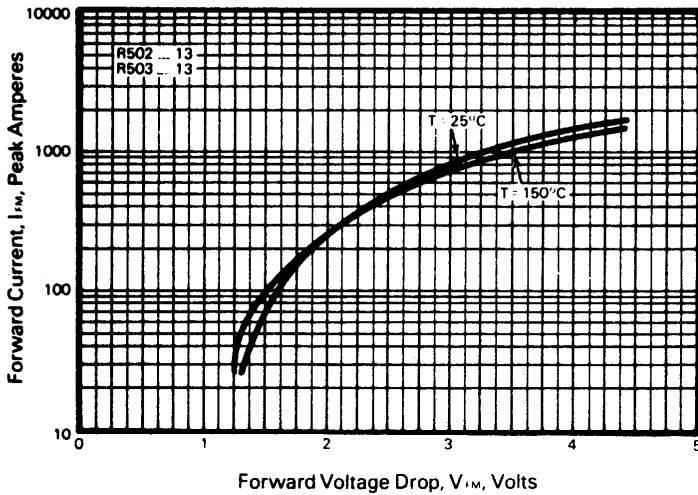


Typical Ratio of Current Recovery to Rate of Current Fall

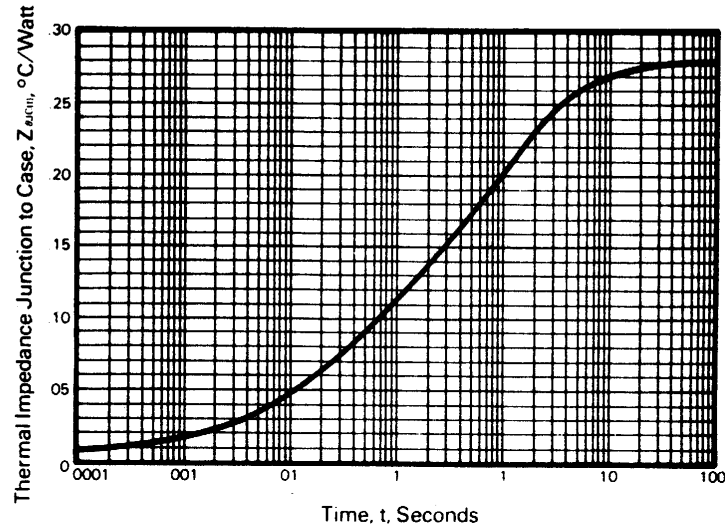


**R502\_13/R503\_13**  
**Fast Recovery Rectifier**  
 125 Amperes Average, 1400 Volts

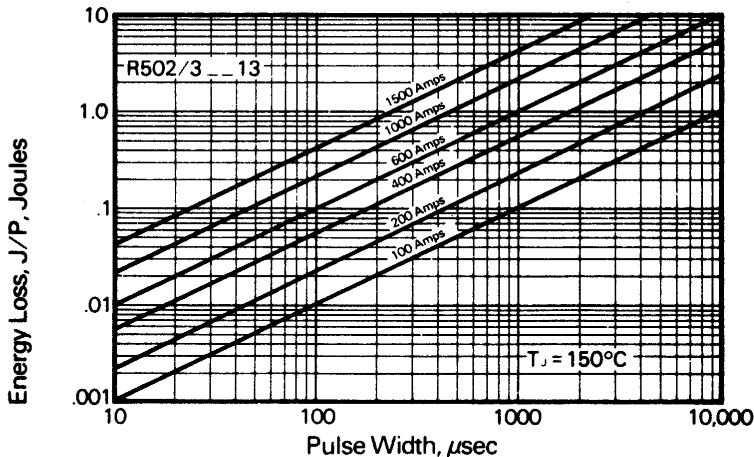
Forward Current Vs. Forward Voltage Drop



Transient Thermal Impedance Vs. Time



Energy Loss Per Pulse for Sinusoidal Pulses



### Calculation of Fast Recovery Diodes and Allowable Case Temperature

1. Conduction Losses

$$P_{av(cond)} = J/P \times F$$

2. Reverse Recovery Losses (Approximate)

$$P_{av(sw)} = 1/4 \times V_R \times \frac{di_R}{dt} \times T_{rr}^2 \times \left( \frac{1/s}{1 + 1/s} \right)^2 \times F \times 1 \times 10^{-6}$$

3. Maximum Allowable Case Temperature

$$T_{C(max)} = T_j - (P_{av(cond)} + P_{av(sw)} \times R_{\theta(j-c)})$$

Where:

$P_{av(cond)}$  = Forward Conduction Power Loss in Watts

$P_{av(sw)}$  = Reverse Recovery Power Loss in Watts

$J/P$  = Energy Loss per Pulse in Joules

$F$  = Frequency in Hertz

$V_R$  = Steady State Reverse Operating Voltage in Volts

$di_R/dt$  = Rate of Decay of Forward Current in Amperes/ $\mu\text{sec}$

$T_{rr}$  = Reverse Recovery Time in Microseconds

$\frac{1}{"S"}$  = Ratio of Recovery  $di/dt$  ( $\frac{di_F/dt}{di_R/dt}$ )

$F$  = Operating Frequency in Hertz

$T_{C(max)}$  = Maximum Allowable Case Temperature in  $^\circ\text{C}$ .

$T_j$  = Maximum Operating Junction Temperature in  $^\circ\text{C}$ .

$R_{\theta(j-c)}$  = DC Junction to Case Thermal Impedance in  $^\circ\text{C}/\text{Watt}$ .