

# INTERNATIONAL RECTIFIER

## 1N3879, 1N3889, 6FL, 12FL, 16FL SERIES

### 6A, 12A and 16A Fast Recovery Rectifiers

#### Major Ratings and Characteristics

|                     | 1N3879<br>-1N3883 | 1N3889<br>-1N3893 | 6FL...    | 12FL... | 16FL... | Unit         |                  |
|---------------------|-------------------|-------------------|-----------|---------|---------|--------------|------------------|
| $I_F(AV)^{\dagger}$ | 6*                | 12*               | 6         | 12      | 16      | A            |                  |
| $I_{FSM}$           | 50Hz              | 72                | 145       | 110     | 145     | 180          | A                |
|                     | 60Hz              | 75*               | 150*      | 115     | 150     | 190          | A                |
| $I^2t$              | 50Hz              | 26                | 103       | 60      | 103     | 160          | A <sup>2</sup> s |
|                     | 60Hz              | 23                | 94        | 55      | 94      | 150          | A <sup>2</sup> s |
| $I_{RMS}$           | 363               | 1452              | 895       | 1452    | 2290    | A $\sqrt{s}$ |                  |
| $t_{rr}$ range      | see table         |                   |           |         |         | ns           |                  |
| $V_{RRM}$ range     | 50 - 400*         |                   | 50 - 1000 |         |         | V            |                  |
| $T_J$ range         | -65 to 150        |                   |           |         |         | °C           |                  |

\*JEDEC registered values.

† At max.  $T_C = 100^\circ\text{C}$ .

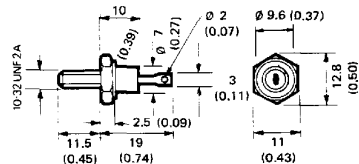
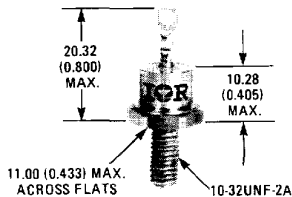
#### Description

This range of fast recovery diodes is designed for applications in DC power supplies, inverters, converters, choppers, ultrasonic systems and for use as free wheel diodes.

#### Features

- Short reverse recovery time
- Low stored charge
- Wide current range
- Excellent surge capabilities
- Standard JEDEC types
- Stud cathode and stud anode versions
- Types up to 1000V  $V_{RRM}$
- Fully characterised reverse recovery conditions

#### CASE STYLE AND DIMENSIONS



Conforms to JEDEC: DO-203AA (DO-4)  
IEC 191-2: A3U  
BS 3934: SO-10A  
DIN 41885: 101 C 2

All dimensions in millimetres (inches)

REVERSE VOLTAGE RATINGS

| Part Number <sup>①</sup> <sup>②</sup> | VRRM – Max. Repetitive Peak Reverse Voltage |            | VRRM – Max. Non-Repetitive Peak Reverse Voltage <sub>tp ≤ 5 ms</sub> |      | I <sub>R</sub> – Max. Reverse Current At Rated V <sub>R</sub> |                        |                        |
|---------------------------------------|---|------------|--|------|---|------------------------|------------------------|
|                                       | V   |            | V  |      | T <sub>J</sub> = 25°C   | T <sub>J</sub> = 100°C | T <sub>J</sub> = 150°C |
|                                       | mA  |            | mA   |      | mA  |                        |                        |
| 1N3879                                | 50  | 75         | 0.015*   | 1.0* | 3.0*  |                        |                        |
| 1N3880                                | 100   | 150        | 0.015*   | 1.0* | 3.0*  |                        |                        |
| 1N3881                                | 200   | 250        | 0.015*   | 1.0* | 3.0*  |                        |                        |
| 1N3882                                | 300   | 350        | 0.015*   | 1.0* | 3.0*  |                        |                        |
| 1N3883                                | 400   | 450        | 0.015*   | 1.0* | 3.0*  |                        |                        |
| 1N3889                                | 50  | 75         | 0.025*   | 3.0* | 5.0*  |                        |                        |
| 1N3890                                | 100   | 150        | 0.025*   | 3.0* | 5.0*  |                        |                        |
| 1N3891                                | 200   | 250        | 0.025*   | 3.0* | 5.0*  |                        |                        |
| 1N3892                                | 300   | 350        | 0.025*   | 3.0* | 5.0*  |                        |                        |
| 1N3893                                | 400   | 450        | 0.025*   | 3.0* | 5.0*  |                        |                        |
| **6FL6S02                             | 6FL6S05                                     | 6FL6S10    | 50   | 75   | 0.050   | —                      | 6.0                    |
| 6FL10S02                              | 6FL10S05                                    | 6FL10S10   | 100  | 150  | 0.050   | —                      | 6.0                    |
| 6FL20S02                              | 6FL20S05                                    | 6FL20S10   | 200  | 275  | 0.050   | —                      | 6.0                    |
| 6FL40S02                              | 6FL40S05                                    | 6FL40S10   | 400  | 500  | 0.050   | —                      | 6.0                    |
| 6FL60S02                              | 6FL60S05                                    | 6FL60S10   | 600  | 725  | 0.050   | —                      | 6.0                    |
| —                                     | 6FL80S05                                    | 6FL80S10   | 800  | 950  | 0.050   | —                      | 6.0                    |
| —                                     | 6FL100S05                                   | 6FL100S10  | 1000   | 1250 | 0.050   | —                      | 6.0                    |
| **12FL6S02                            | 12FL6S05                                    | 12FL6S10   | 50   | 75   | 0.050   | —                      | 6.0                    |
| 12FL10S02                             | 12FL10S05                                   | 12FL10S10  | 100  | 150  | 0.050   | —                      | 6.0                    |
| 12FL20S02                             | 12FL20S05                                   | 12FL20S10  | 200  | 275  | 0.050   | —                      | 6.0                    |
| 12FL40S02                             | 12FL40S05                                   | 12FL40S10  | 400  | 500  | 0.050   | —                      | 6.0                    |
| 12FL60S02                             | 12FL60S05                                   | 12FL60S10  | 600  | 725  | 0.050   | —                      | 6.0                    |
| —                                     | 12FL80S05                                   | 12FL80S10  | 800  | 950  | 0.050   | —                      | 6.0                    |
| —                                     | 12FL100S05                                  | 12FL100S10 | 1000   | 1250 | 0.050   | —                      | 6.0                    |
| **16FL6S02                            | 16FL6S05                                    | 16FL6S10   | 50   | 75   | 0.050   | —                      | 6.0                    |
| 16FL10S02                             | 16FL10S05                                   | 16FL10S10  | 100  | 150  | 0.050   | —                      | 6.0                    |
| 16FL20S02                             | 16FL20S05                                   | 16FL20S10  | 200  | 275  | 0.050   | —                      | 6.0                    |
| 16FL40S02                             | 16FL40S05                                   | 16FL40S10  | 400  | 500  | 0.050   | —                      | 6.0                    |
| 16FL60S02                             | 16FL60S05                                   | 16FL60S10  | 600  | 725  | 0.050   | —                      | 6.0                    |
| —                                     | 16FL80S05                                   | 16FL80S10  | 800  | 950  | 0.050   | —                      | 6.0                    |
| —                                     | 16FL100S05                                  | 16FL100S10 | 1000   | 1250 | 0.050   | —                      | 6.0                    |

REVERSE RECOVERY CHARACTERISTICS

|                       |                                    | 1N3879–1N3883 |      | 6FL... |      |      | 12FL... |      |      | 16FL... |      |      | Unit | Conditions  |
|-----------------------|------------------------------------|---------------|------|--------|------|------|---------|------|------|---------|------|------|------|---|
|                       |                                    | S02           | S05  | S10    | S02  | S05  | S10     | S02  | S05  | S10     |      |      |      |   |
| t <sub>rr</sub>       | Max. reverse recovery time         | 150           | 150  | 110    | 285  | 490  | 100     | 250  | 430  | 90      | 225  | 390  | ns   | T <sub>J</sub> = 25°C, I <sub>F</sub> = 1A to V <sub>R</sub> = 30V<br>dI <sub>F</sub> /dt = 100 A/μs    |
|                       |                                    | 300*          | 300* | 200    | 500  | 1000 | 200     | 500  | 1000 | 200     | 500  | 1000 | ns   | T <sub>J</sub> = 25°C, dI <sub>F</sub> /dt = 25 A/μs.   |
| I <sub>RM</sub> (REC) | Max. peak reverse recovery current | 4*            | 5*   | —      | —    | —    | —       | —    | —    | —       | —    | —    | nA   | I <sub>FM</sub> = π × rated I <sub>F</sub> (AV)   |
| Q <sub>RR</sub>       | Max. reverse recovered charge      | 400           | 350  | 230    | 1700 | 5000 | 200     | 1300 | 3800 | 150     | 1100 | 3000 | nC   | T <sub>J</sub> = 25°C, I <sub>F</sub> = 1A to V <sub>R</sub> = 30V<br>dI <sub>F</sub> /dt = 100 A/μs    |
|                       |                                    | 400           | 400  | 200    | 1200 | 5000 | 200     | 1200 | 5000 | 200     | 1200 | 5000 | nC   | T <sub>J</sub> = 25°C, dI <sub>F</sub> /dt = 25 A/μs<br>I <sub>FM</sub> = π × rated I <sub>F</sub> (AV) |

ELECTRICAL SPECIFICATIONS

|                             | 1N3879–1N3883  | 6FL... | 1N3889–1N3893 | 12FL... | 16FL...            | Unit              | Conditions   |
|-----------------------------|--|--------|---------------|---------|--------------------|-------------------|--|
| FORWARD CONDUCTION          |  |        |               |         |                    |                   |  |
| I <sub>F</sub> (AV)         | Max. average forward current                                     | 6*     | 6             | 12*     | 16                 | A                 | 180° conduction, half sine wave, T <sub>C</sub> = 100°C                  |
| I <sub>F</sub> (RMS)        | Max. r.m.s. forward current                                      | 9.5    | 9.5           | 19      | 25                 | A                 |  |
| I <sub>FSM</sub>            | Max. peak one-cycle non-repetitive forward current               | 72     | 110           | 145     | 180                | A                 | t = 10 ms With rated VRRM  |
|                             |  | 75*    | 115           | 150*    | 190                |                   | t = 8.3 ms   |
|                             |  | 85     | 130           | 170     | 215                |                   | t = 10 ms VRRM = 0   |
| i <sup>2</sup> <sub>t</sub> | Max. i <sup>2</sup> for fusing                                   | 90     | 135           | 160     | 245                | A <sup>2</sup> s  | t = 10 ms With rated VRRM  |
|                             |  | 26     | 80            | 103     | 160                |                   | t = 8.3 ms   |
|                             | 36   | 86     | 145           | 230     | t = 10 ms VRRM = 0 |                   |  |
|                             | 33   | 76     | 130           | 210     | t = 8.3 ms         |                   |  |
| i <sup>2</sup> √t           | Max. i <sup>2</sup> √t for individual device fusing <sup>①</sup> | 363    | 856           | 1452    | 2290               | i <sup>2</sup> √s | t = 0.1 to 10 ms   |
| V <sub>FM</sub>             | Max. peak forward voltage  | 1.4*   | 1.4           | 1.4*    | 1.4                | V                 | T <sub>J</sub> = 25°C, I <sub>F</sub> = rated I <sub>F</sub> (AV) (D.C.) |
|                             |  | 1.5*   | 1.5           | 1.5*    | 1.5                |                   | T <sub>C</sub> = 100°C, I <sub>FM</sub> = π × rated I <sub>F</sub> (AV)  |

\* JEDEC registered value  
 \*\* Suffix "S02" may be omitted, i.e., 12FL10 to imply 12FL10S02, 12FLR60 implies 12FLR60S02.

① I<sub>R</sub>(AV) @ rated I<sub>F</sub>(AV) and VRRM, and T<sub>C</sub> = 100°C.

② I<sub>RM</sub> @ rated VRRM and T<sub>J</sub> = 150°C.

③ i<sup>2</sup>t for time t<sub>x</sub> = 12√t \* √x

④ When these devices are ordered without a suffix, e.g., 40HFL, the order will be filled with devices that meet the S02 specification.

① Types listed are cathode to case; for anode-to-case include "R" in code, i.e., 1N3879R, 6FLR20S10, 16FLR40S02.

**Thermal and mechanical specifications**

|            | 1N3879<br>-1N3863<br>6FL...                  | 1N3889<br>-1N3893<br>12FL... | 16FL...      | Units      | Conditions   |
|------------|--|------------------------------|--------------|------------|--|
| $T_J$      | Junction operating temperature range         |                              |              | -65 to 150 | °C   |
| $T_{stg}$  | Storage temperature range                    |                              |              | -65 to 175 | °C   |
| $R_{thJC}$ | 2.5  | 2.0                          | 1.6          | deg C/W    | DC operation   |
| $R_{thCS}$ | Maximum thermal resistance, case to heatsink |                              |              | 0.5        | deg C/W  |
| T          | Mounting torque<br>± 10%                     | to nut                       | 10.5         | lb.in      | Mounting surface flat, smooth and greased.<br><br>Lubricated threads<br>(Non-lubricated threads) |
|            |  |                              | 0.12         | kgf.m      |  |
|            |  | 1.2                          | Nm           |            |  |
|            |  | to device                    | 11.5 (13.5)  | lb.in      |  |
|            |  |                              | 0.13 (0.156) | kgf.m      |  |
| wt         | Approximate weight                           | 7                            |              | g          |  |
|            |  | 0.25                         |              | oz         |  |
| Case style |  | DO-203AA (DO-4)              |              | JEDEC      |  |

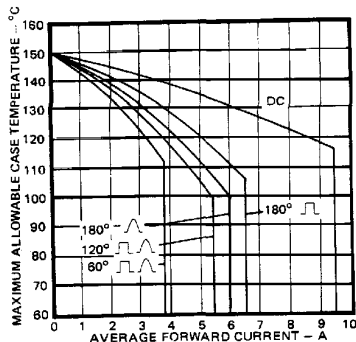


Fig. 1 - Average Forward Current Vs. Maximum Allowable Case Temperature, 1N3879 and 6FL Series

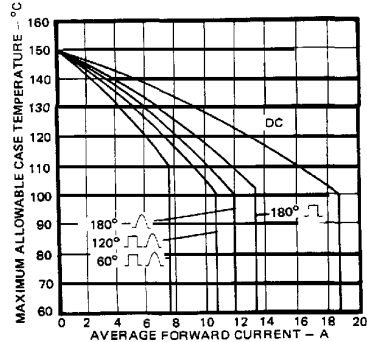


Fig. 2 - Average Forward Current Vs. Maximum Allowable Case Temperature, 1N3889 and 12FL Series

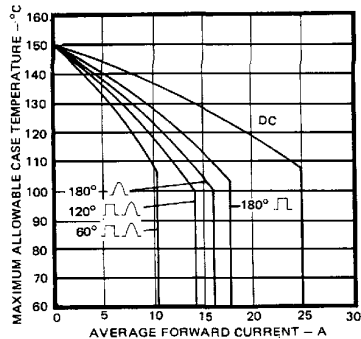
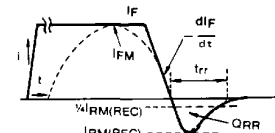
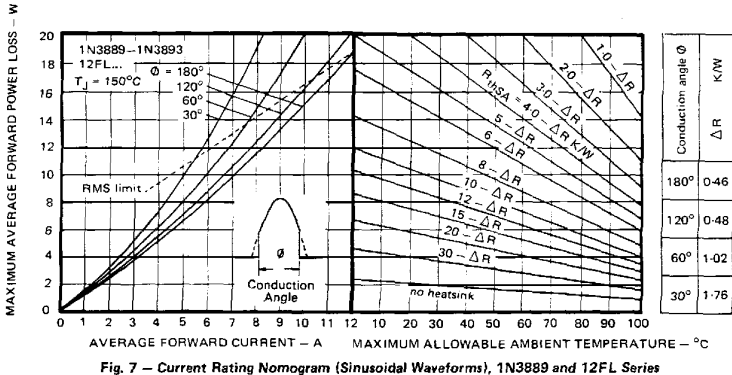
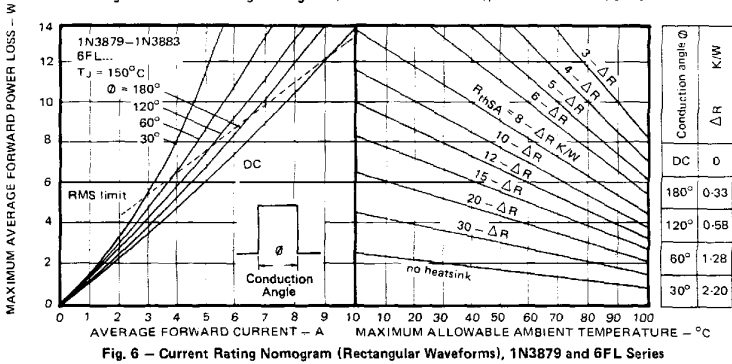
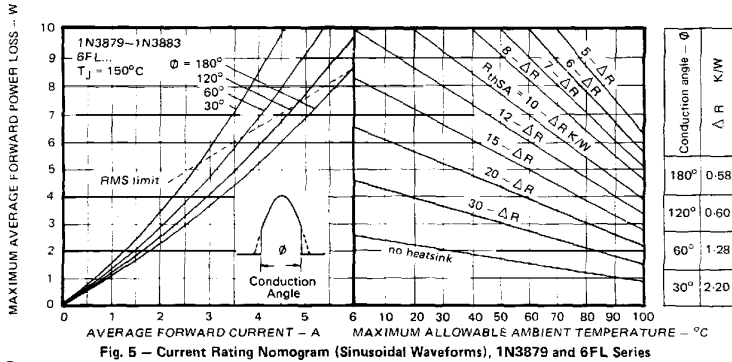


Fig. 3 - Average Forward Current Vs. Maximum Allowable Case Temperature, 16FL Series



- $I_F, I_{FM}$  = Peak forward current prior to commutation
- $-dI_F/dt$  = Rate of fall of forward current
- $I_{RM(REC)}$  = Peak reverse recovery current
- $t_{rr}$  = Reverse recovery time
- $Q_{RR}$  = Reverse recovered charge

Fig. 4 - Reverse Recovery Time Test Waveform



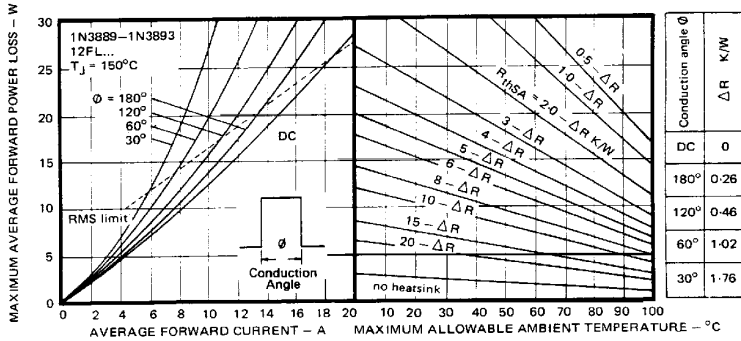


Fig. 8 – Current Rating Nomogram (Rectangular Waveforms), 1N3889 and 12FL Series

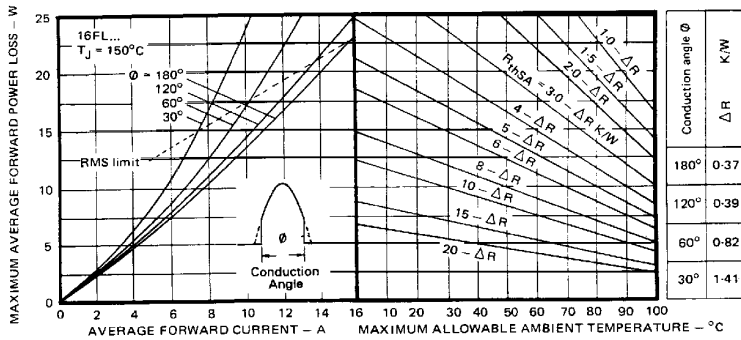


Fig. 9 – Current Rating Nomogram (Sinusoidal Waveforms), 16FL Series

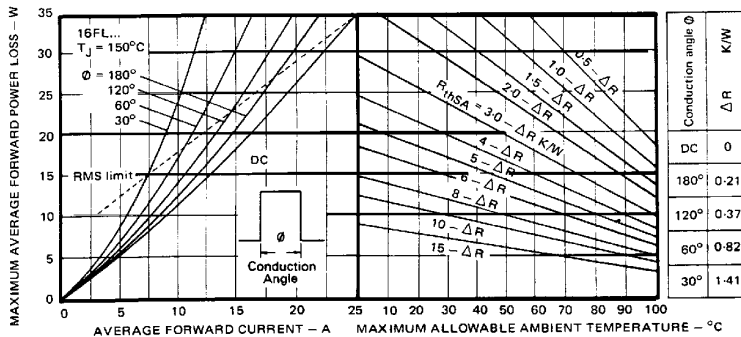


Fig. 10 – Current Rating Nomogram (Rectangular Waveforms), 16FL Series

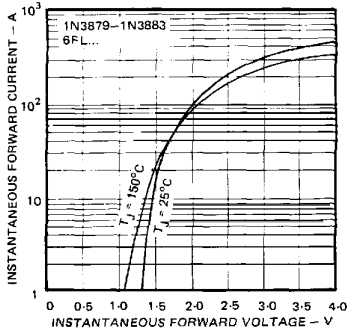


Fig. 11 – Maximum Forward Voltage Vs. Forward Current, 1N3879 and 6FL Series

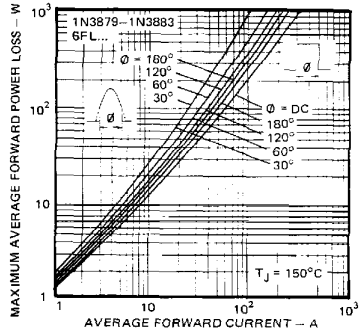


Fig. 12 – Maximum High Level Forward Power Loss Vs. Average Forward Current, 1N3879 and 6FL Series

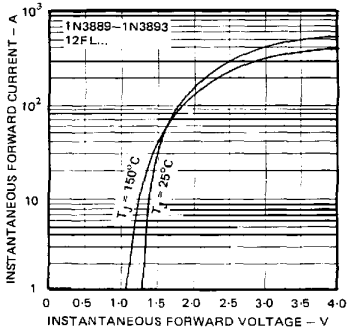


Fig. 13 – Maximum Forward Voltage Vs. Forward Current, 1N3889 and 12FL Series

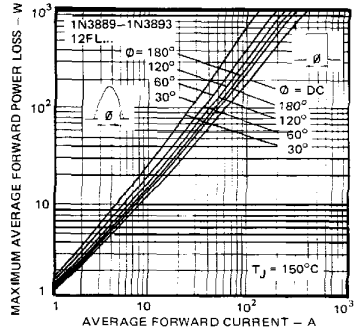


Fig. 14 – Maximum High Level Forward Power Loss Vs. Average Forward Current, 1N3889 and 12FL Series

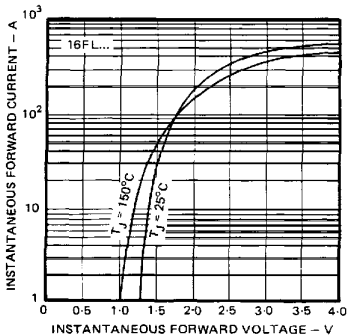


Fig. 15 – Maximum Forward Voltage Vs. Forward Current, 16FL Series

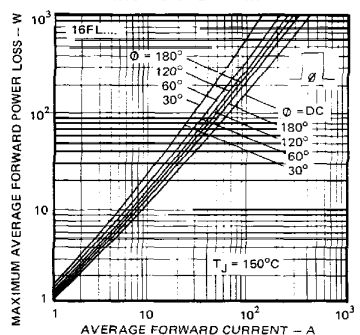


Fig. 16 – Maximum High Level Forward Power Loss Vs. Average Forward Current, 16FL Series

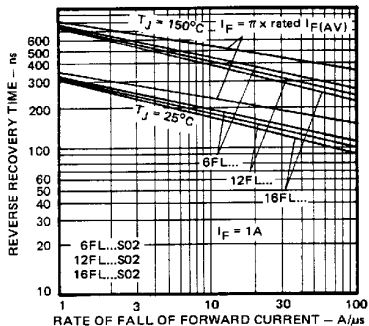


Fig. 17A — Maximum Reverse Recovery Time Vs. Rate of Fall of Forward Current, All Series \_\_S02

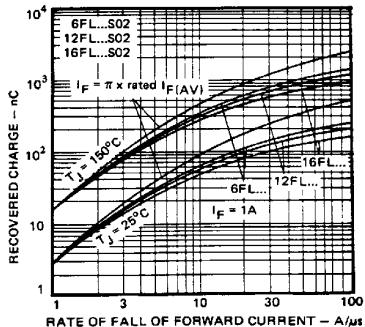


Fig. 17B — Maximum Recovered Charge Vs. Rate of Fall of Forward Current, All Series \_\_S02

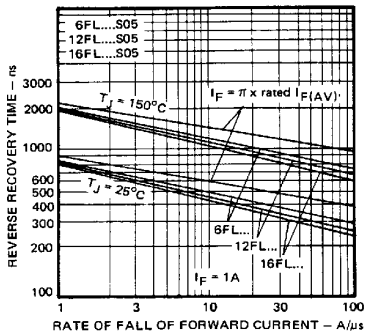


Fig. 18A — Maximum Reverse Recovery Time Vs. Rate of Fall of Forward Current, All Series \_\_S05

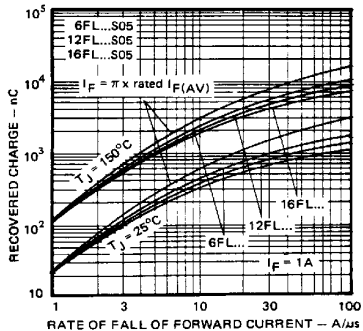


Fig. 18B — Maximum Recovered Charge Vs. Rate of Fall of Forward Current, All Series \_\_S05

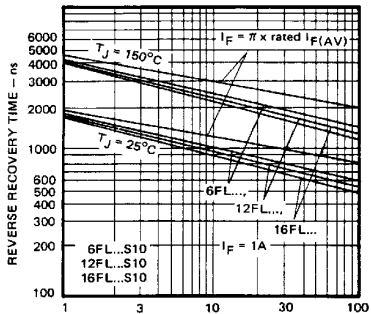


Fig. 19A — Maximum Reverse Recovery Time Vs. Rate of Fall of Forward Current, All Series \_\_S10

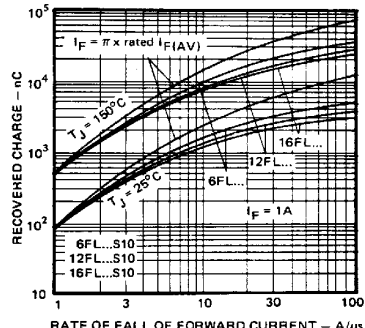


Fig. 19B — Maximum Recovered Charge Vs. Rate of Fall of Forward Current, All Series \_\_S10

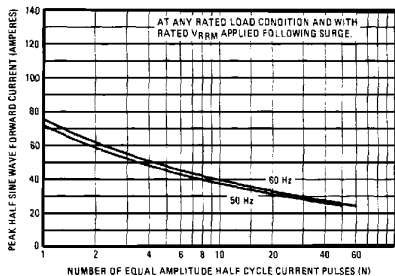


Fig. 20 – Maximum Non-Repetitive Surge Current Vs. Number of Current Pulses, 1N3879 Series

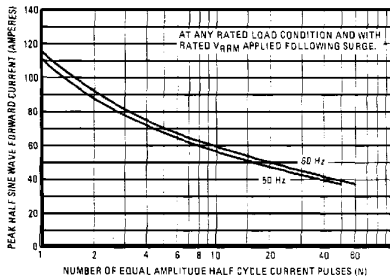


Fig. 21 – Maximum Non-Repetitive Surge Current Vs. Number of Current Pulses, 6FL Series

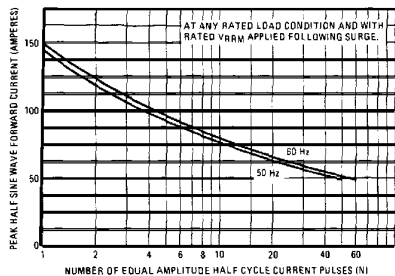


Fig. 22 – Maximum Non-Repetitive Surge Current Vs. Number of Current Pulses, 1N3889 and 12FL Series

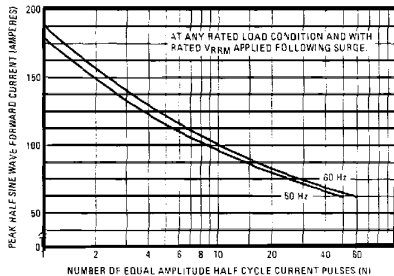


Fig. 23 – Maximum Non-Repetitive Surge Current Vs. Number of Current Pulses, 16FL Series

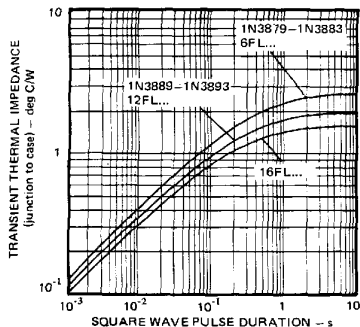


Fig. 24 – Maximum Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration, All Series.