



## Fast Recovery Diodes (Stud Version), 6 A, 12 A, 16 A



DO-4 (DO-203AA)

### FEATURES

- Short reverse recovery time
- Low stored charge
- Wide current range
- Excellent surge capabilities
- Standard JEDEC® types
- Stud cathode and stud anode versions
- Fully characterized reverse recovery conditions
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



RoHS  
COMPLIANT

### TYPICAL APPLICATIONS

- DC power supplies
- Inverters
- Converters
- Choppers
- Ultrasonic systems
- Freewheeling diodes

### PRIMARY CHARACTERISTICS

$I_{F(AV)}$	6 A, 12 A, 16 A
Package	DO-4 (DO-203AA)
Circuit configuration	Single

### MAJOR RATINGS AND CHARACTERISTICS

PARAMETER	TEST CONDITIONS	6FL	12FL	16FL	UNITS
$I_{F(AV)}$		6	12	16	A
	$T_C$	100	100	100	°C
$I_{F(RMS)}$		9.5	19	25	A
$I_{FSM}$	50 Hz	110	145	180	A
	60 Hz	115	150	190	
$I^2t$	50 Hz	60	103	160	A <sup>2</sup> s
	60 Hz	55	94	150	
$I^2\sqrt{t}$		1452	1452	2290	$I^2\sqrt{s}$
$V_{RRM}$	Range	50 to 1000	50 to 1000	50 to 1000	V
$t_{rr}$		See Recovery Characteristics table	See Recovery Characteristics table	See Recovery Characteristics table	ns
$T_J$	Range	-65 to +150	-65 to +150	-65 to +150	°C

### ELECTRICAL SPECIFICATIONS

#### VOLTAGE RATINGS

TYPE NUMBER	VOLTAGE CODE	$V_{RRM}$ , MAXIMUM REPETITIVE PEAK AND OFF-STATE VOLTAGE V	$V_{RSM}$ , MAXIMUM NON-REPETITIVE PEAK VOLTAGE V	$I_{RRM}$ MAXIMUM AT $T_J = 25\text{ °C}$ µA	$I_{RRM}$ MAXIMUM AT $T_J = 100\text{ °C}$ mA	$I_{RRM}$ MAXIMUM AT $T_J = 150\text{ °C}$ mA
VS-6FL..., VS-12FL..., VS-16FL..	5	50	75	50	-	6.0
	10	100	150			
	20	200	275			
	40	400	500			
	60	600	725			
	80	800	950			
	100	1000	1250			

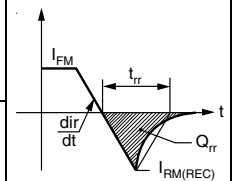


FORWARD CONDUCTION								
PARAMETER	SYMBOL	TEST CONDITIONS		6FL..	12FL..	16FL..	UNITS	
Maximum average forward current at case temperature	$I_{F(AV)}$	180° conduction, half sine wave DC		6	12 <sup>(1)</sup>	16	A	
				100	100	100	°C	
Maximum RMS current	$I_{F(RMS)}$			9.5	19	25		
Maximum peak, one-cycle non-repetitive forward current	$I_{FSM}$	t = 10 ms t = 8.3 ms	No voltage reapplied	Sinusoidal half wave, initial $T_J = 150\text{ °C}$	130	170	215	A
					135	180	225	
					110	145	180	
					115	150 <sup>(1)</sup>	190	
Maximum $I^2t$ for fusing	$I^2t$	t = 10 ms t = 8.3 ms	No voltage reapplied	$T_J = 150\text{ °C}$	86	145	230	A <sup>2</sup> s
					78	130	210	
					60	103	160	
					55	94	150	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 ms to 10 ms, no voltage reapplied		856	1452	2290	A <sup>2</sup> √s	
Maximum forward voltage drop	$V_{FM}$	$T_J = 25\text{ °C}; I_F = \text{Rated } I_{F(AV)} \text{ (DC)}$		1.4	1.4 <sup>(1)</sup>	1.4	V	
		$T_C = 100\text{ °C}; I_{FM} = \pi \times \text{rated } I_{F(AV)}$		1.5	1.5 <sup>(1)</sup>	1.5		

Note

(1) JEDEC® registered values

RECOVERY CHARACTERISTICS												
PARAMETER	SYMBOL	TEST CONDITIONS	6FL...			12FL...			16FL..			UNITS
			S02	S05	S10	S02	S05	S10	S02	S05	S10	
Maximum reverse recovery time	$t_{rr}$	$T_J = 25\text{ °C}, I_F = 1\text{ A to } V_R = 30\text{ V}, dl_F/dt = 100\text{ A}/\mu\text{s}$	110	285	490	100	250	430	90	225	390	ns
		$T_J = 25\text{ °C}, dl_F/dt = 25\text{ A}/\mu\text{s}, I_{FM} = \pi \times \text{rated } I_{F(AV)}$	200	500	1000	200	500	1000	200	500	1000	
Maximum peak recovery current	$I_{RM(REC)}$	$I_{FM} = \pi \times \text{rated } I_{F(AV)}$	-	-	-	-	-	-	-	-	-	-
Maximum reverse recovery charge	$Q_{rr}$	$T_J = 25\text{ °C}, I_F = 1\text{ A to } V_R = 30\text{ V}, dl_F/dt = 100\text{ A}/\mu\text{s}$	230	1700	5000	200	1300	3800	150	1100	3000	nC
		$T_J = 25\text{ °C}, dl_F/dt = 25\text{ A}/\mu\text{s}, I_{FM} = \pi \times \text{rated } I_{F(AV)}$	200	1200	5000	200	1200	5000	200	1200	5000	



Note

(1) JEDEC® registered values

THERMAL AND MECHANICAL SPECIFICATIONS							
PARAMETER	SYMBOL	TEST CONDITIONS		6FL..	12FL..	16FL..	UNITS
Maximum junction operating temperature range	$T_J$			-65 to +150			°C
Maximum storage temperature range	$T_{Stg}$			-65 to +175			
Maximum thermal resistance, junction to case	$R_{thJC}$	DC operation		2.5	2.0	1.6	°C/W
Maximum thermal resistance, case to heatsink	$R_{thCS}$	Mounting surface, smooth, flat, and greased		0.5			
Allowable mounting torque			Not lubricated threads	1.5 + 0 - 10 % (13)			N · m (lbf · in)
			Lubricated threads	1.2 + 0 - 10 % (10)			
Approximate weight						7	g
						0.25	oz.
Case style			JEDEC®		DO-4 (DO-203AA)		

$\Delta R_{thJC}$ CONDUCTION								
CONDUCTION ANGLE	6FL..	12FL..	16FL..	6FL..	12FL..	16FL..	TEST CONDITIONS	UNITS
	SINUSOIDAL CONDUCTION			RECTANGULAR CONDUCTION				
180°	0.58	0.46	0.37	0.33	0.26	0.21	$T_J = 150^\circ C$	K/W
120°	0.60	0.48	0.39	0.58	0.46	0.37		
60°	1.28	1.02	0.82	1.28	1.02	0.82		
30°	2.20	1.76	1.41	2.20	1.76	1.41		

**Note**

- The table above shows the increment of thermal resistance  $R_{thJC}$  when devices operate at different conduction angles than DC

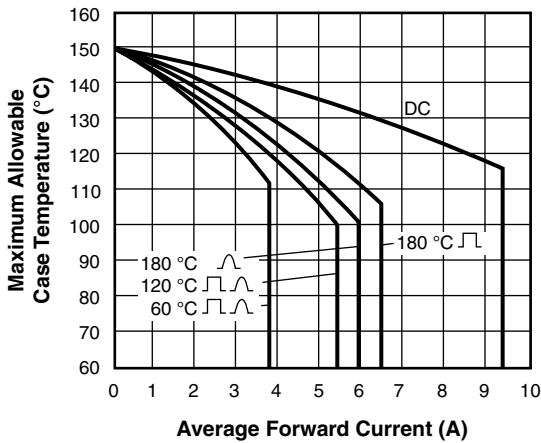


Fig. 1 - Average Forward Current vs. Maximum Allowable Case Temperature, 6FL Series

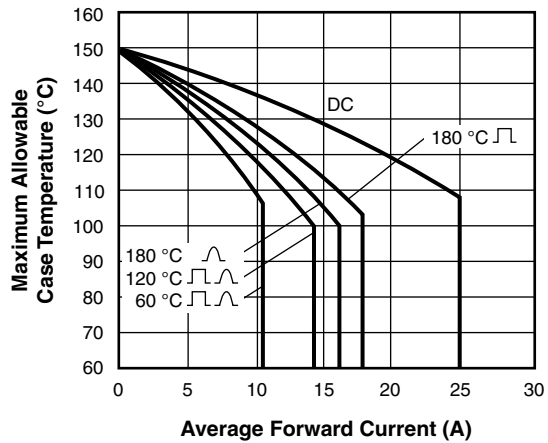


Fig. 3 - Average Forward Current vs. Maximum Allowable Case Temperature, 16FL Series

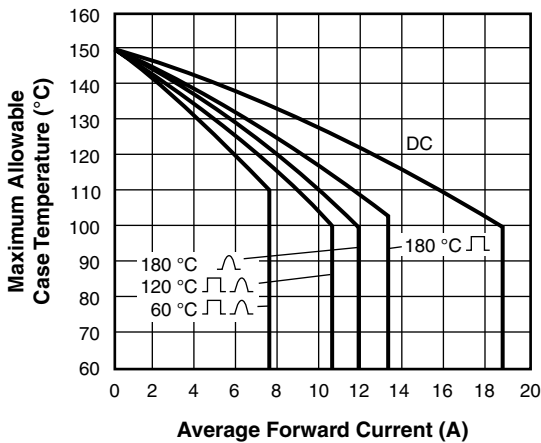
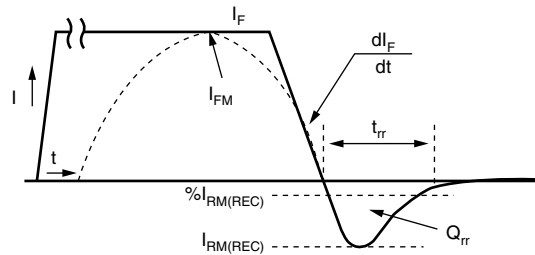
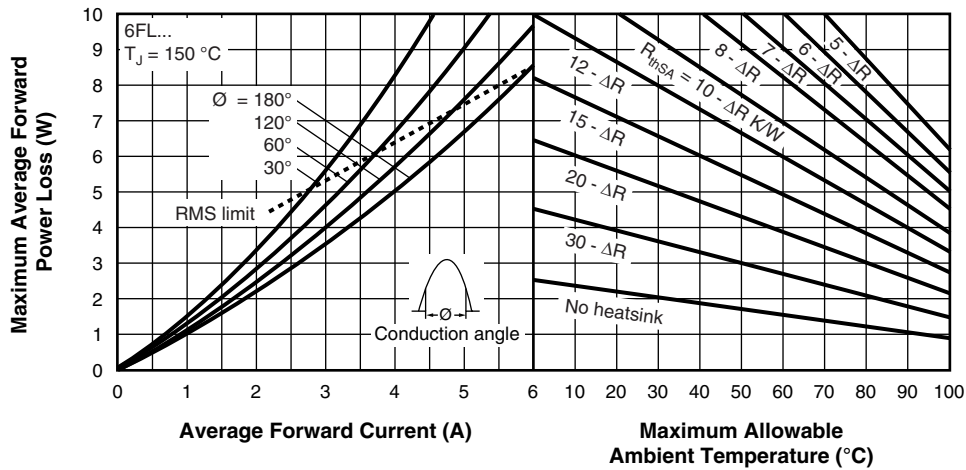


Fig. 2 - Average Forward Current vs. Maximum Allowable Case Temperature, 12FL Series



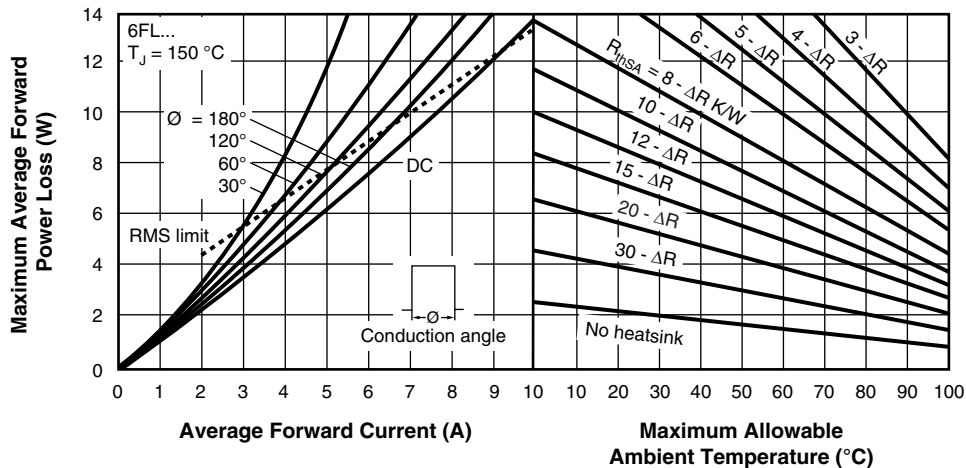
$I_F, I_{FM}$  - Peak forward current prior to commutation  
 $-dI_F/dt$  - Rate of fall of forward current  
 $I_{RM(REC)}$  - Peak reverse recovery current  
 $t_{rr}$  - Reverse recovery time  
 $Q_{rr}$  - Reverse recovered charge

Fig. 4 - Reverse Recovery Time Test Waveform



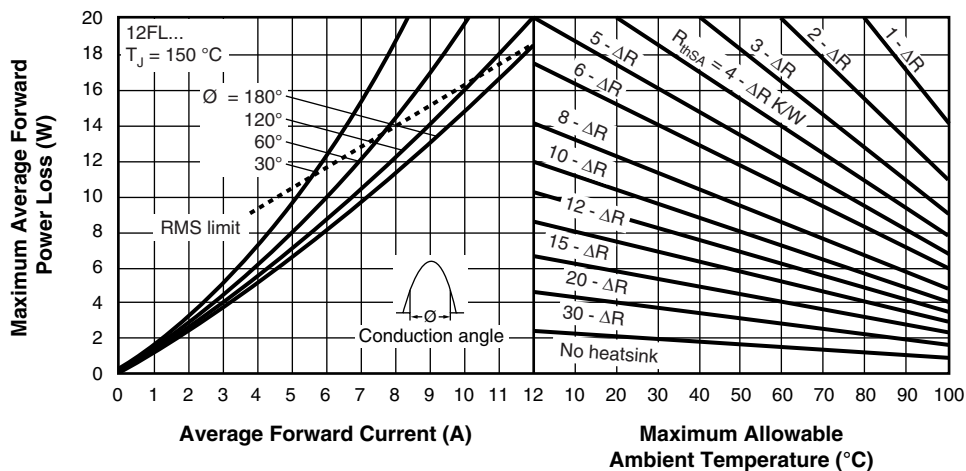
Conduction angle - Ø	ΔR - KW
180°	0.58
120°	0.60
60°	1.28
30°	2.20

Fig. 5 - Current Rating Nomogram (Sinusoidal Waveforms), 6FL Series



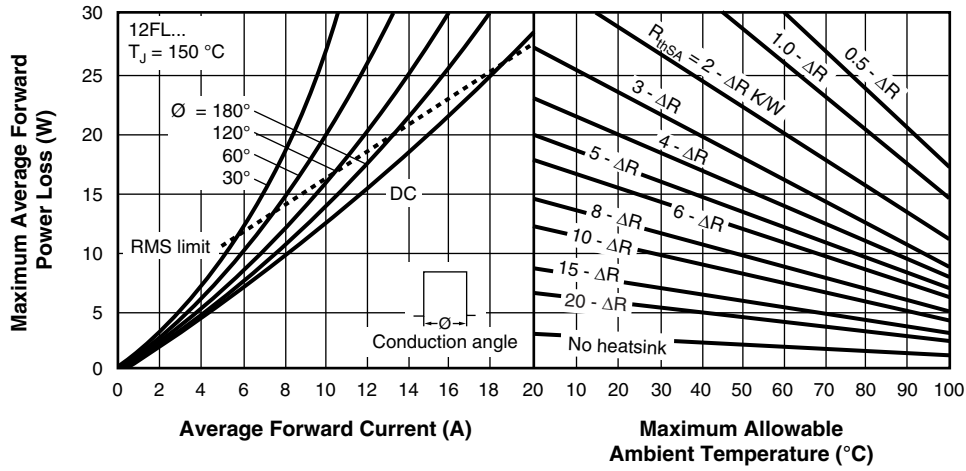
Conduction angle - Ø	ΔR - KW
DC	0
180°	0.33
120°	0.58
60°	1.28
30°	2.20

Fig. 6 - Current Rating Nomogram (Rectangular Waveforms), 6FL Series



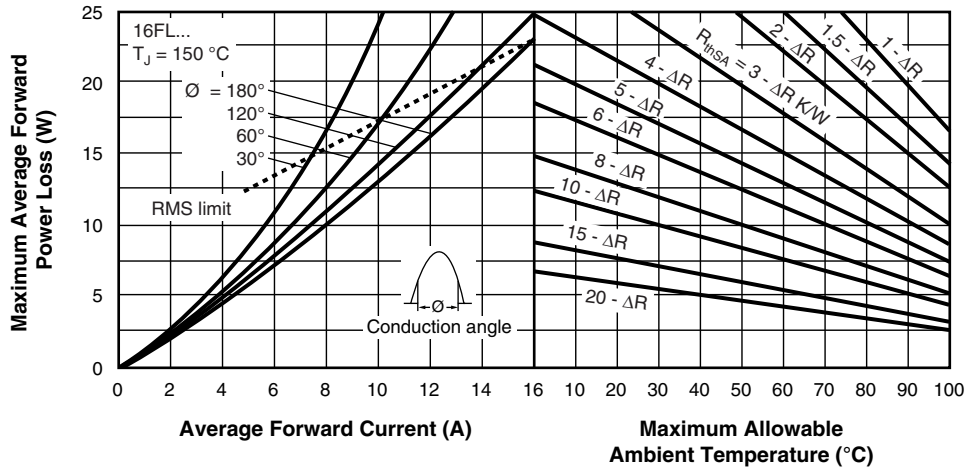
Conduction angle - Ø	ΔR - KW
180°	0.46
120°	0.48
60°	1.02
30°	1.76

Fig. 7 - Current Rating Nomogram (Sinusoidal Waveforms), 12FL Series



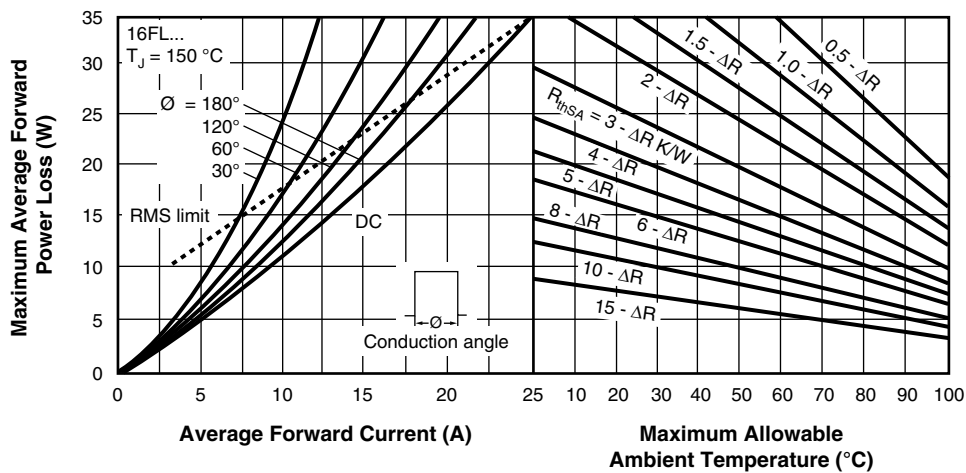
Conduction angle - $\Phi$	$\Delta R$ - KW
DC	0
180°	0.26
120°	0.46
60°	1.02
30°	1.76

Fig. 8 - Current Rating Nomogram (Rectangular Waveforms), 12FL Series



Conduction angle - $\Phi$	$\Delta R$ - KW
180°	0.37
120°	0.39
60°	0.82
30°	1.41

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



Conduction angle - $\Phi$	$\Delta R$ - KW
DC	0
180°	0.21
120°	0.37
60°	0.82
30°	1.41

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

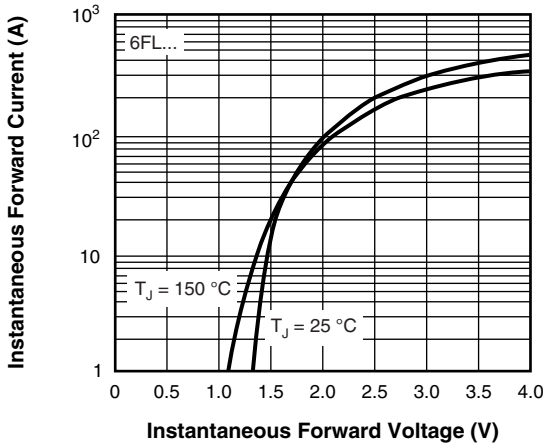


Fig. 11 - Maximum Forward Voltage vs. Forward Current, 6FL Series

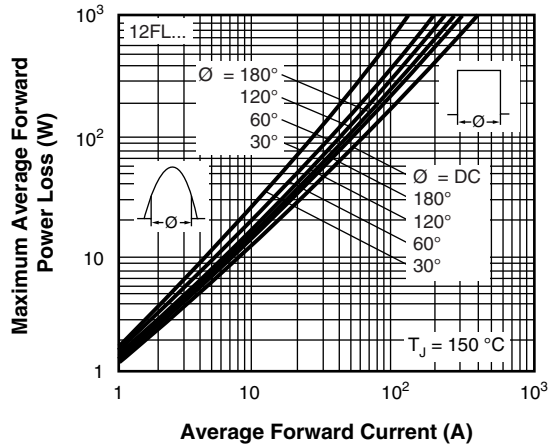


Fig. 14 - Maximum High Level Forward Power Loss vs. Average Forward Current, 12FL Series

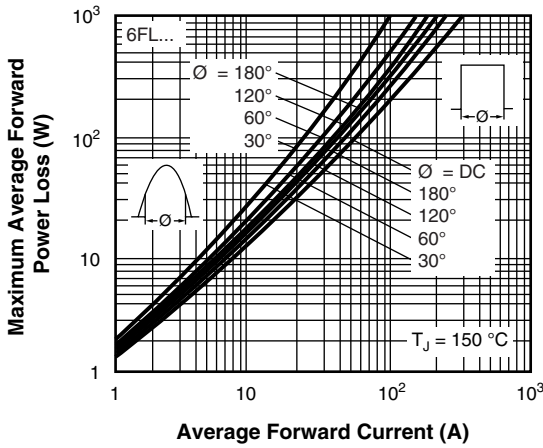


Fig. 12 - Maximum High Level Forward Power Loss vs. Average Forward Current, 6FL Series

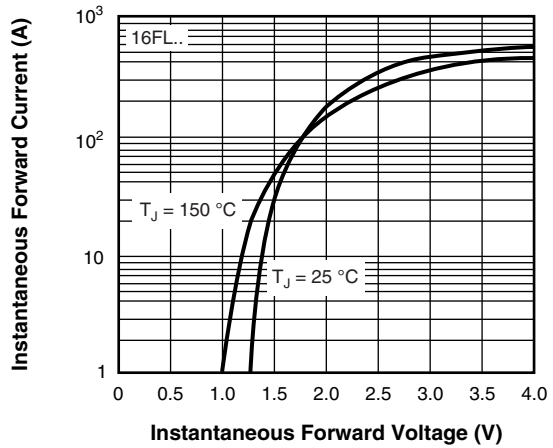


Fig. 15 - Maximum Forward Voltage vs. Forward Current, 16FL Series

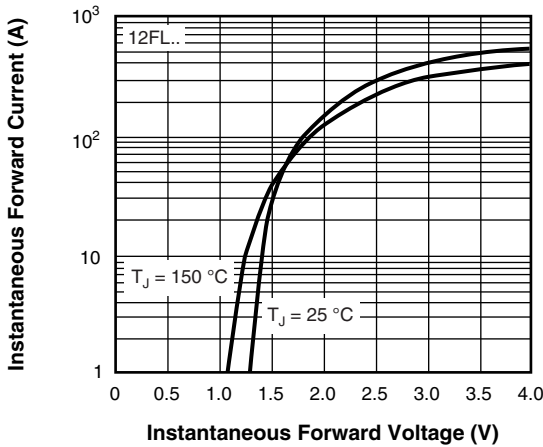


Fig. 13 - Maximum Forward Voltage vs. Forward Current, 12FL Series

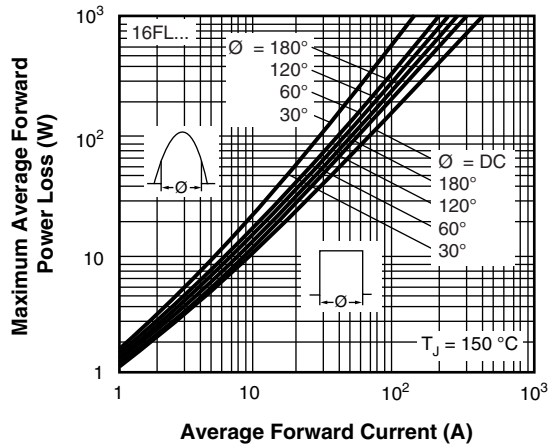


Fig. 16 - Maximum High Level Forward Power Loss vs. Average Forward Current, 16FL Series

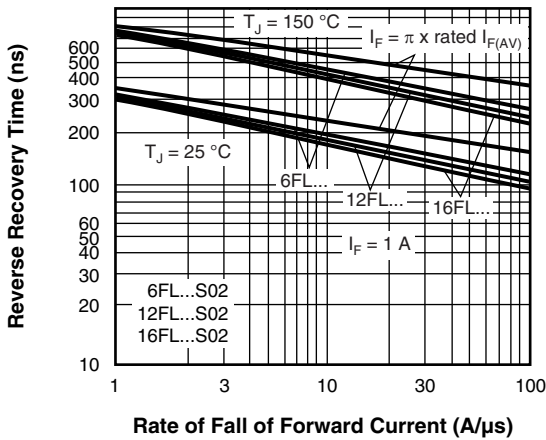


Fig. 17a - Typical Reverse Recovery Time vs. Rate of Fall of Forward Current, All Series...S02

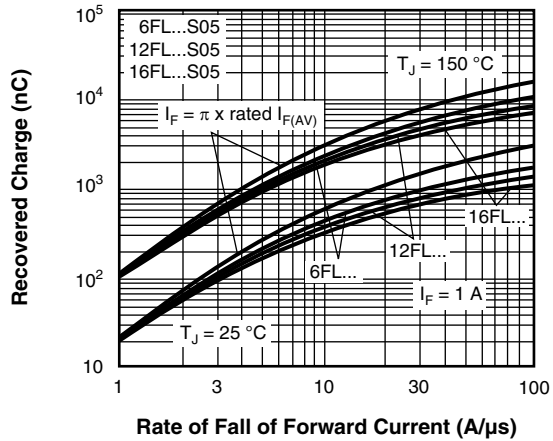


Fig. 18b - Typical Recovered Charge vs. Rate of Fall of Forward Current, All Series...S05

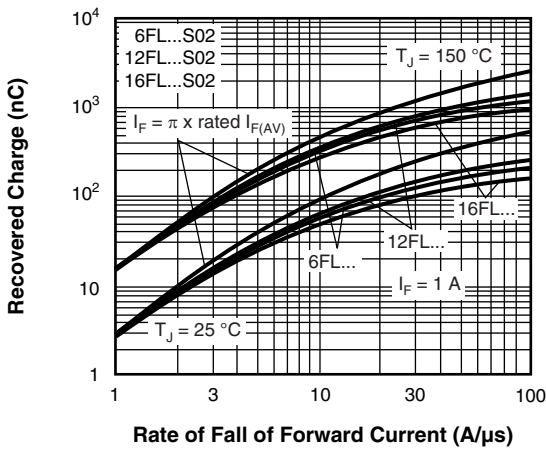


Fig. 17b - Typical Recovered Charge vs. Rate of Fall of Forward Current, All Series...S02

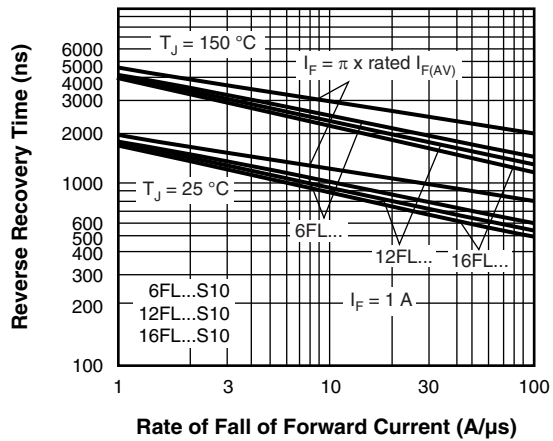


Fig. 19a - Typical Reverse Recovery Time vs. Rate of Fall of Forward Current, All Series...S10

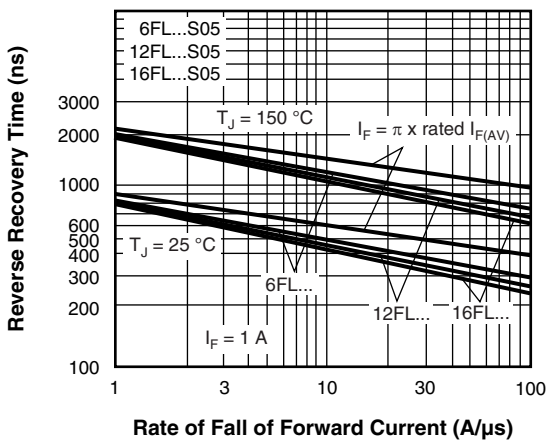


Fig. 18a - Typical Reverse Recovery Time vs. Rate of Fall of Forward Current, All Series...S05

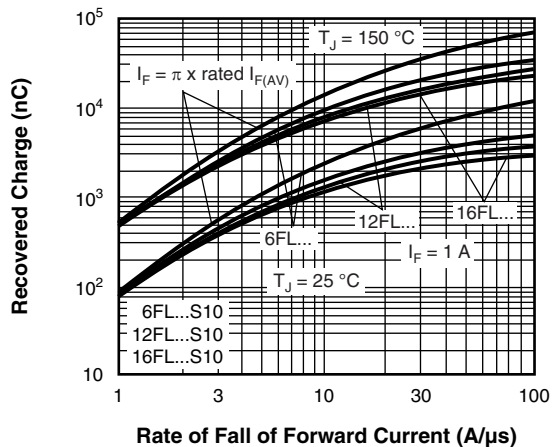


Fig. 19b - Typical Recovered Charge vs. Rate of Fall of Forward Current, All Series...S10



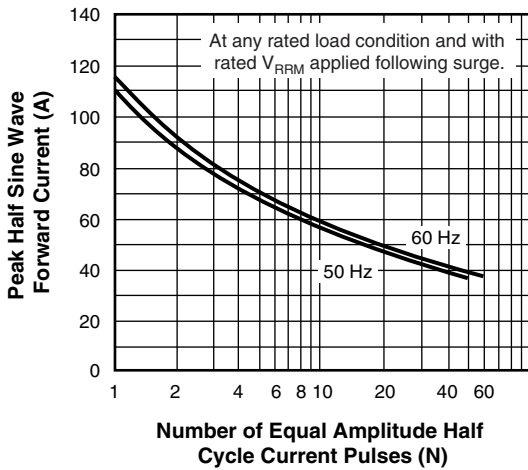


Fig. 20 - Maximum Non-Repetitive Surge Current vs. Number of Current Pulses, 6FL Series

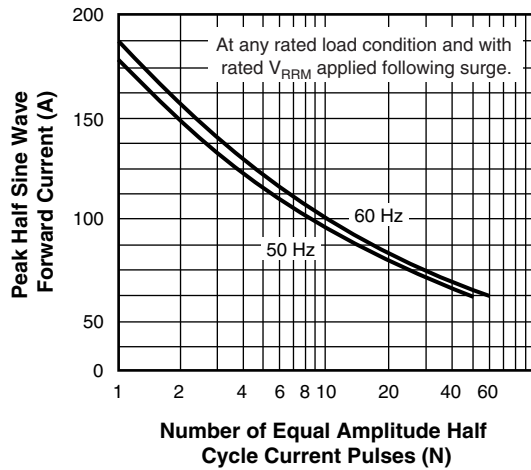


Fig. 22 - Maximum Non-Repetitive Surge Current vs. Number of Current Pulses, 16FL Series

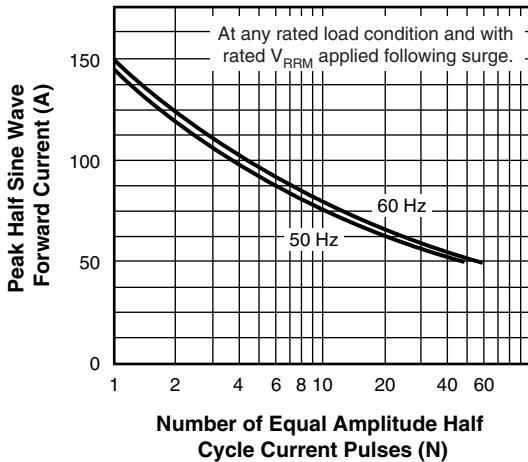


Fig. 21 - Maximum Non-Repetitive Surge Current vs. Number of Current Pulses, 12FL Series

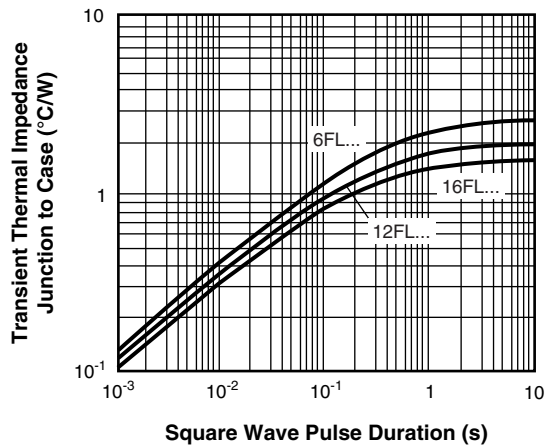
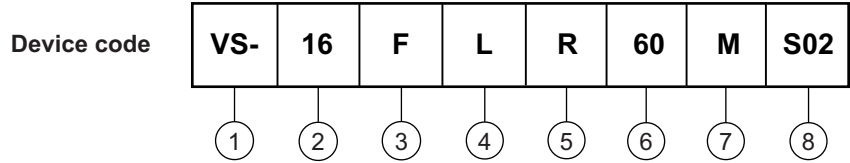


Fig. 23 - Maximum Transient Thermal Impedance, Junction to Case vs. Pulse Duration, All Series





## ORDERING INFORMATION TABLE

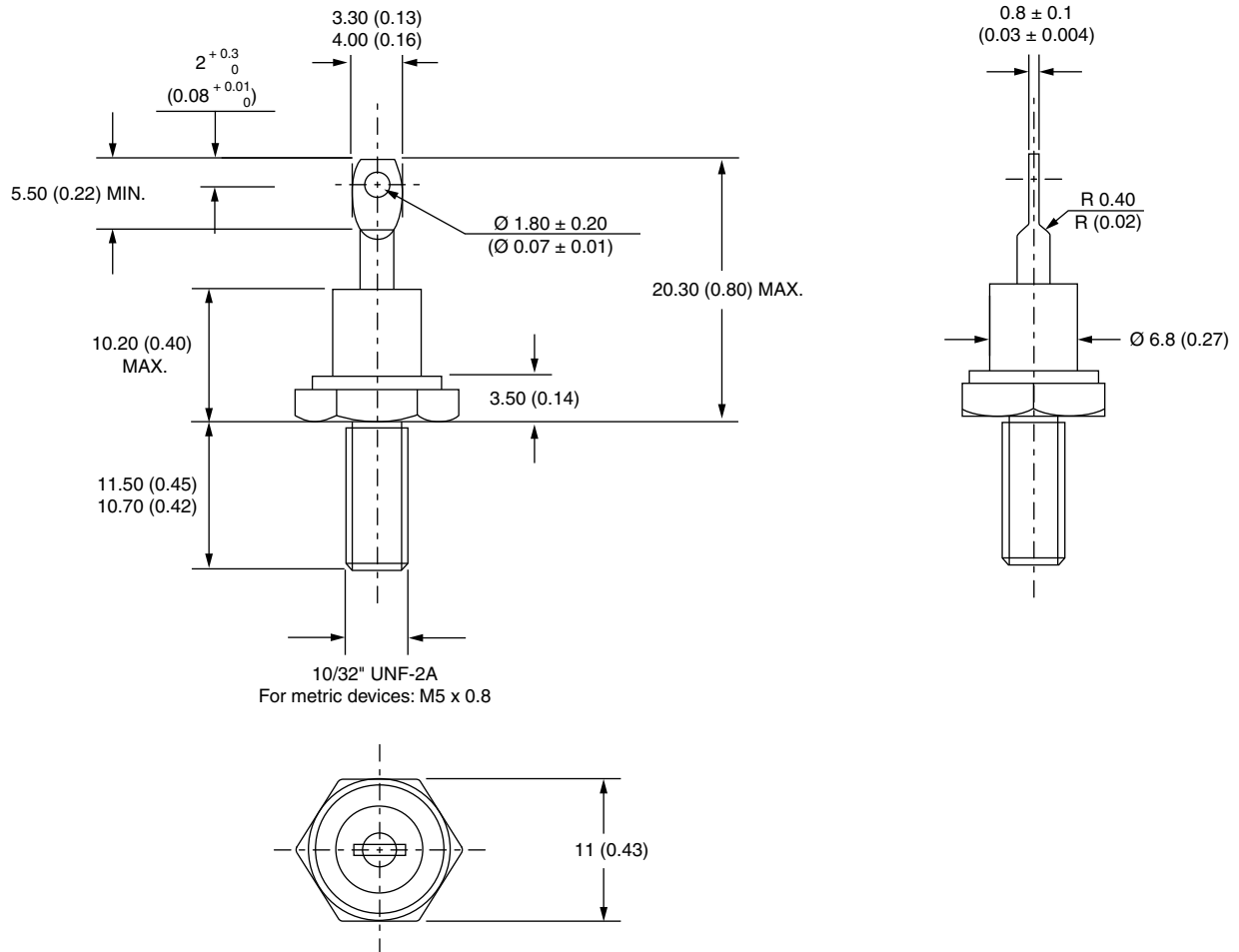


- 1** - Vishay Semiconductors product
- 2** - Current code  $I_{(AVG)}$  = exact current rating
- 3** - F = diode
- 4** - Omit = standard recovery diode  
L = only for fast diode
- 5** - Omit = stud forward polarity  
R = stud reverse polarity
- 6** - Voltage code x 10 =  $V_{RRM}$  (see Voltage Ratings table)
- 7** - Outlines:  
Omit = stud base UNF thread  
M = stud base metric thread
- 8** -  $t_{rr}$  code only for fast diode (see Recovery Characteristics table)

LINKS TO RELATED DOCUMENTS	
Dimensions	<a href="http://www.vishay.com/doc?95311">www.vishay.com/doc?95311</a>

## DO-203AA (DO-4)

**DIMENSIONS** in millimeters (inches)





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