Bulletin PD-21068 07/05

International
IOR Rectifier

16CTU04SPbF
16CTU04-1PbF

Ultrafast Rectifier

t_{rr} = 60ns
$I_{F(AV)}$ = 16Amp
V_R = 400V

Features

- Ultrafast Recovery Time
- Low Forward Voltage Drop
- Low Leakage Current
- 175°C Operating Junction Temperature
- Lead-Free ("PbF" suffix)

Description/ Applications

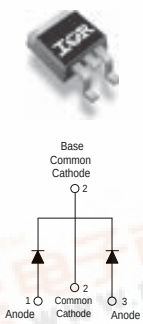
International Rectifier's FRED.. series are the state of the art Ultra fast recovery rectifiers specifically designed with optimized performance of forward voltage drop and ultra fast recovery time.
The planar structure and the platinum doped life time control, guarantee the best overall performance, ruggedness and reliability characteristics.
These devices are intended for use in the output rectification stage of SMPS, UPS, DC-DC converters as well as free-wheeling diode in low voltage inverters and chopper motor drives.
Their extremely optimized stored charge and low recovery current minimize the switching losses and reduce over dissipation in the switching element and snubbers.

Absolute Maximum Ratings

	Parameters		Max	Units
V_{RRM}	Peak Repetitive Peak Reverse Voltage		400	V
$I_{F(AV)}$	Average Rectified Forward Current	Per Leg	8	A
	Total Device, (Rated V_R), T_C = 155°C	Total Device	16	
I_{FSM}	Non Repetitive Peak Surge Current, T_C = 25°C		100	
I_{FRM}	Peak Repetitive Forward Current (Rated V_R, Square wave, 20KHz), T_C = 155°C		16	
T_J, T_{STG}	Operating Junction and Storage Temperatures		- 65 to 175	°C

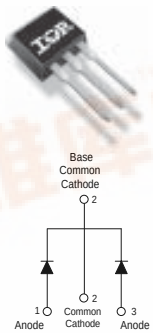
Case Styles

16CTU04SPbF



D²PAK

16CTU04-1PbF



TO-262

Electrical Characteristics @ T_J = 25°C, Per Leg (unless otherwise specified)

Parameters		Min	Typ	Max	Units	Test Conditions
V_{BR}, V_r	Breakdown Voltage, Blocking Voltage	400	-	-	V	I_R = 100µA
V_F	Forward Voltage	-	1.19	1.3	V	I_F = 8A
		-	0.94	1.0	V	I_F = 8A, T_J = 150°C
I_R	Reverse Leakage Current	-	0.2	10	µA	V_R = V_R Rated
		-	20	500	µA	T_J = 150°C, V_R = V_R Rated
C_T	Junction Capacitance	-	14	-	pF	V_R = 400V
L_S	Series Inductance	-	8.0	-	nH	Measured lead to lead 5mm from package body

Dynamic Recovery Characteristics @ T_J = 25°C, Per Leg (unless otherwise specified)

Parameters		Min	Typ	Max	Units	Test Conditions	
t_{rr}	Reverse Recovery Time	-	35	60	ns	I_F = 1.0A, di_F/dt = 50A/µA, V_R = 30V	
		-	43	-		T_J = 25°C	I_F = 8A V_R = 200V di_F/dt = 200A/µs
			67			T_J = 125°C	
I_{RRM}	Peak Recovery Current	-	2.8	-	A	T_J = 25°C	
		-	6.3	-		T_J = 125°C	
Q_{rr}	Reverse Recovery Charge	-	60	-	nC	T_J = 25°C	
		-	210	-		T_J = 125°C	

Thermal - Mechanical Characteristics

Parameters			Min	Typ	Max	Units
T_J	Max. Junction Temperature Range		- 65	-	175	°C
T_{Stg}	Max. Storage Temperature Range		- 65	-	175	
R_{thJC}	Thermal Resistance, Junction to Case	Per Leg	-	1.8	2.0	°C/W
R_{thJA} ①	Thermal Resistance, Junction to Ambient	Per Leg	-	-	50	
R_{thCS} ②	Thermal Resistance, Case to Heatsink		-	0.5	-	
	Weight		-	2.0	-	g
			-	0.07	-	(oz)
	Mounting Torque		6.0	-	12	Kg-cm
			5.0	-	10	lbf.in
	Marking Device		16CTU04S		Case style D^2Pak	
			16CTU04-1		Case style TO-262	

① Typical Socket Mount
② Mounting Surface, Flat, Smooth and Greased

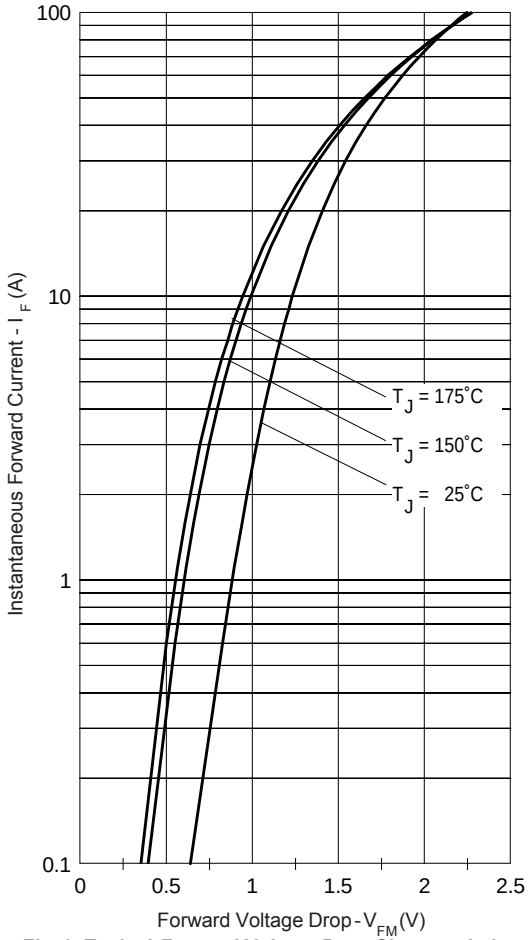


Fig. 1 - Typical Forward Voltage Drop Characteristics

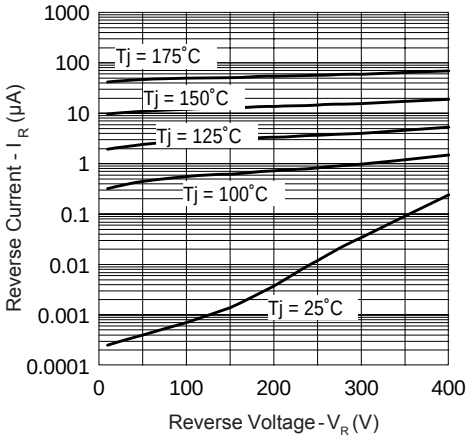


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage

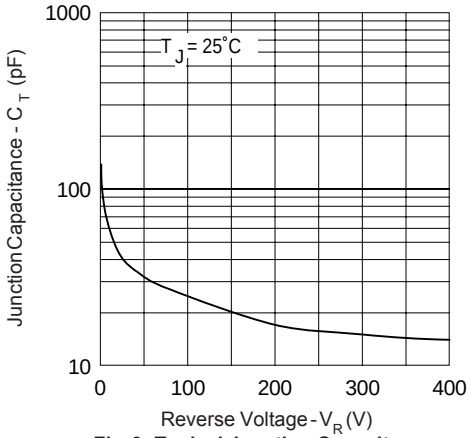


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

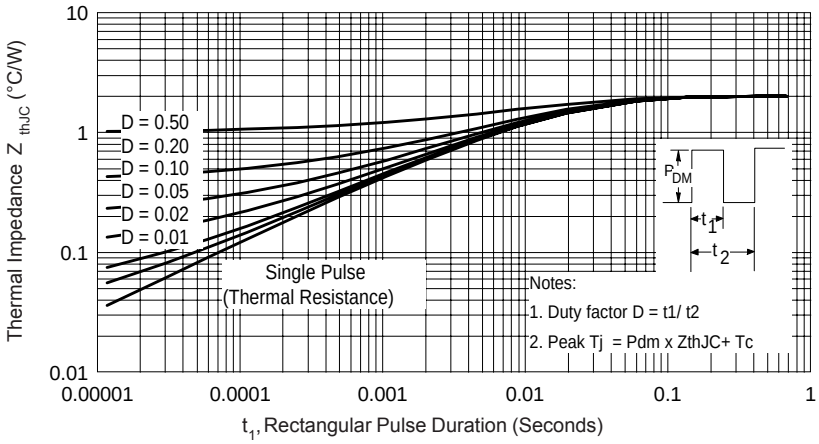


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics

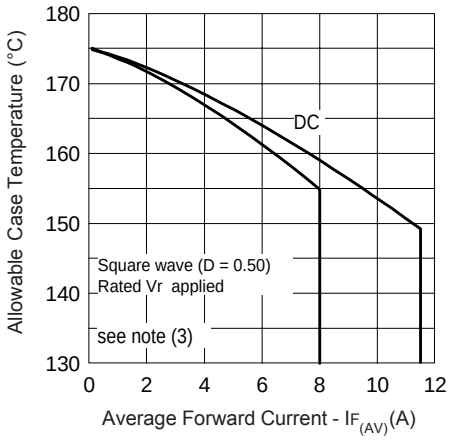


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current

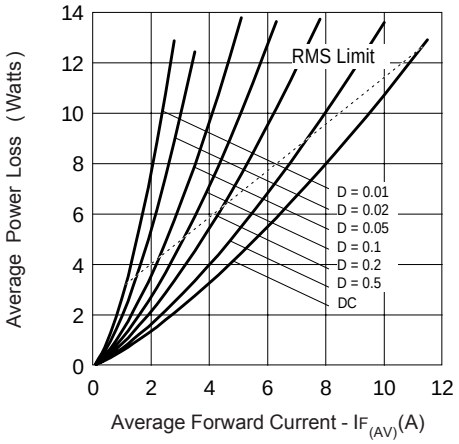


Fig. 6 - Forward Power Loss Characteristics

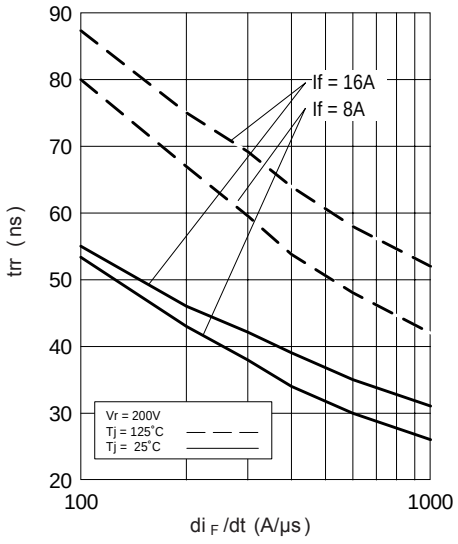


Fig. 7 - Typical Reverse Recovery vs. di_F/dt

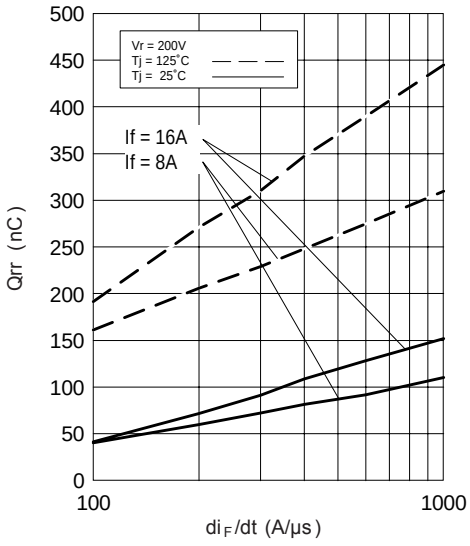


Fig. 8 - Typical Stored Charge vs. di_F/dt

(3) Formula used: $T_C = T_J - (Pd + Pd_{REV}) \times R_{thJC}$;
Pd = Forward Power Loss = $I_{F(AV)} \times V_{FM} @ (I_{F(AV)} / D)$ (see Fig. 6);
Pd_{REV} = Inverse Power Loss = $V_{R1} \times I_R (1 - D)$; $I_R @ V_{R1}$ = rated V_R

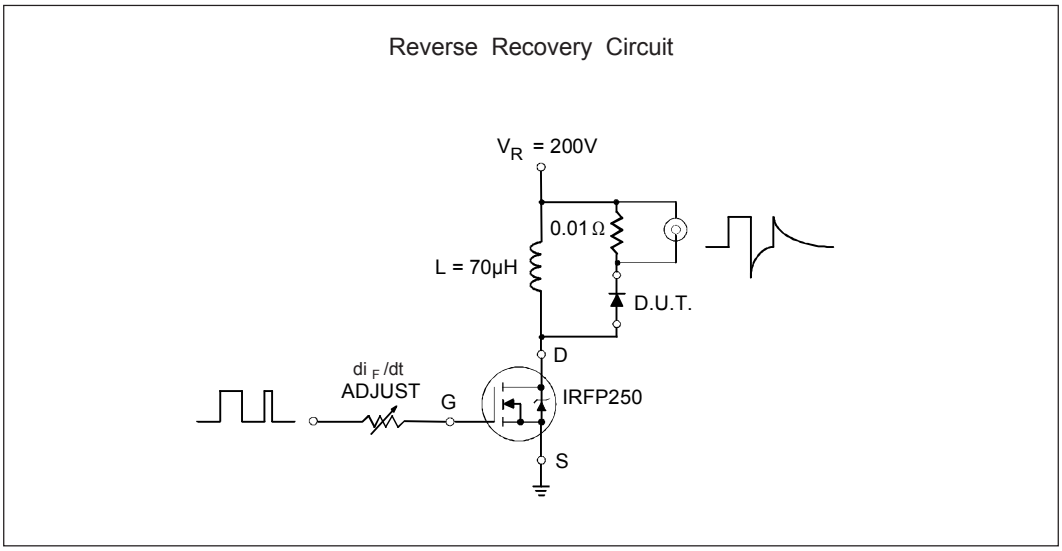
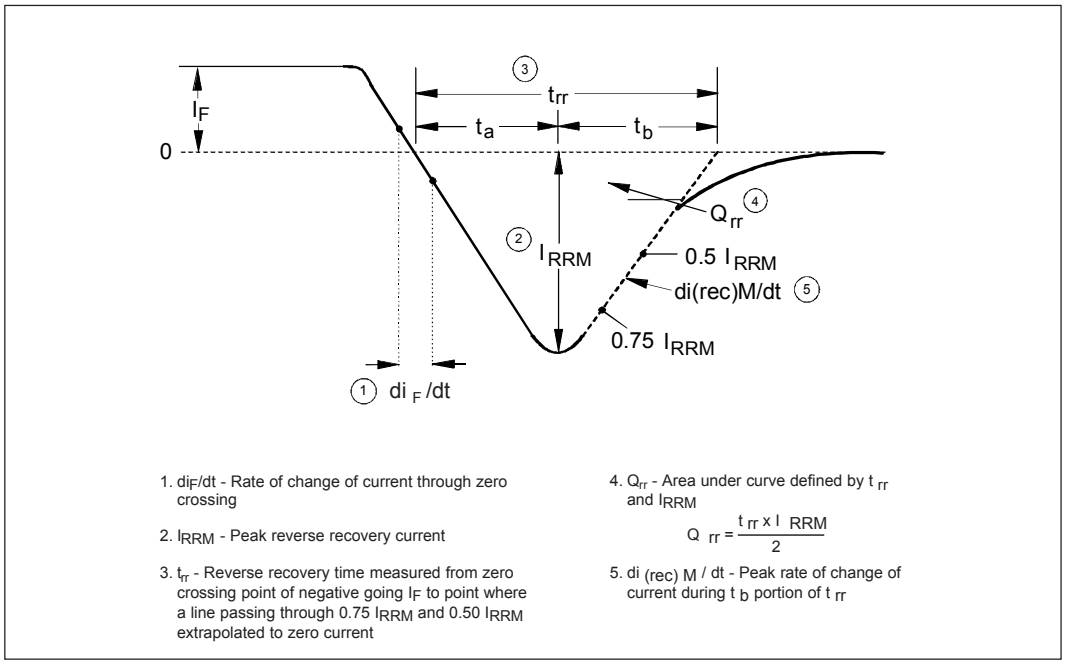


Fig. 9- Reverse Recovery Parameter Test Circuit



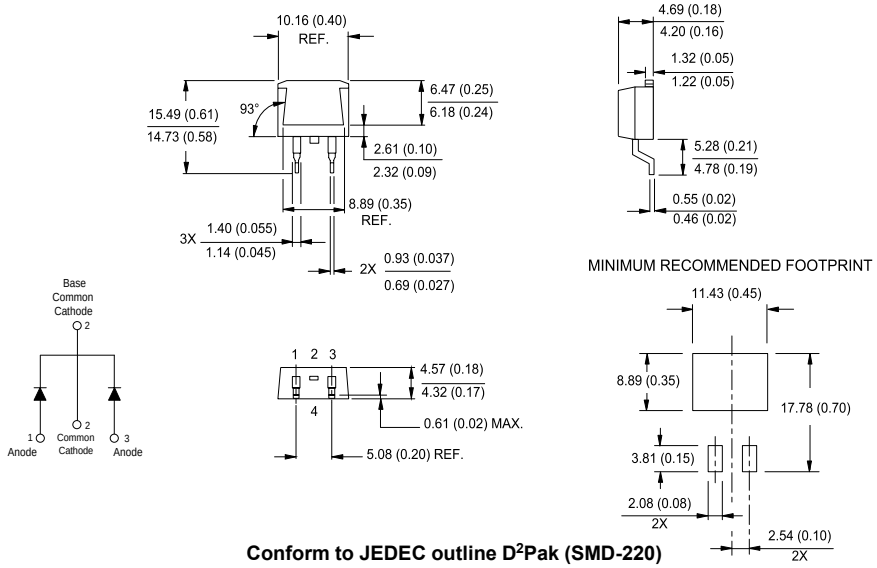
1. di_F/dt - Rate of change of current through zero crossing
2. I_{RRM} - Peak reverse recovery current
3. t_{rr} - Reverse recovery time measured from zero crossing point of negative going I_F to point where a line passing through 0.75 I_{RRM} and 0.50 I_{RRM} extrapolated to zero current
4. Q_{rr} - Area under curve defined by t_{rr} and I_{RRM}

$$Q_{rr} = \frac{t_{rr} \times I_{RRM}}{2}$$

5. $di_{(rec)M}/dt$ - Peak rate of change of current during t_b portion of t_{rr}

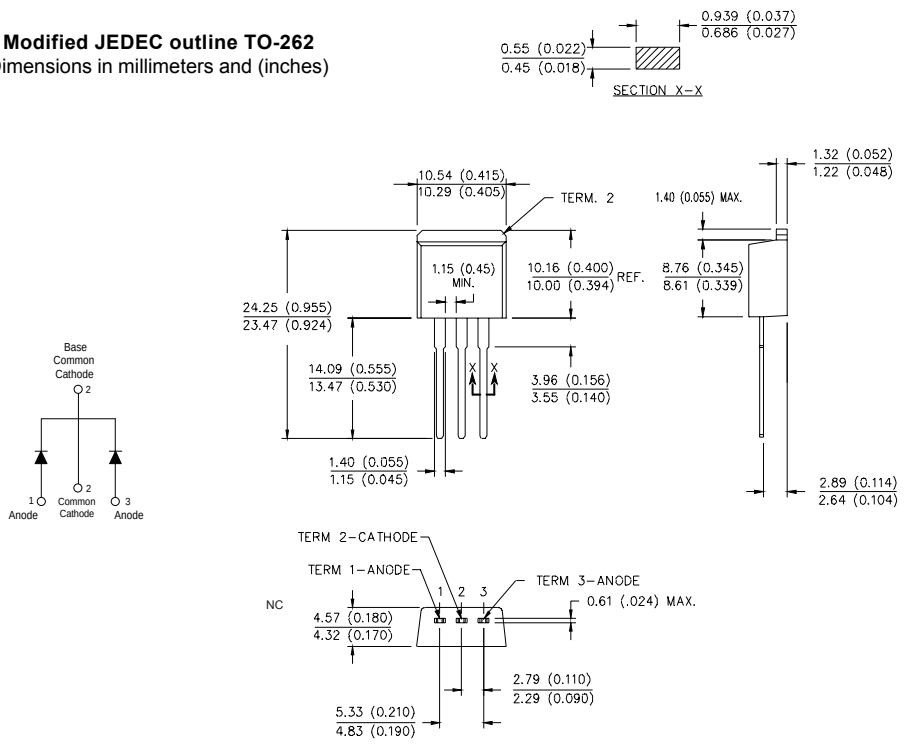
Fig. 10 - Reverse Recovery Waveform and Definitions

Outlines Table



Conform to JEDEC outline D²Pak (SMD-220)
Dimensions in millimeters and (inches)

Modified JEDEC outline TO-262
Dimensions in millimeters and (inches)

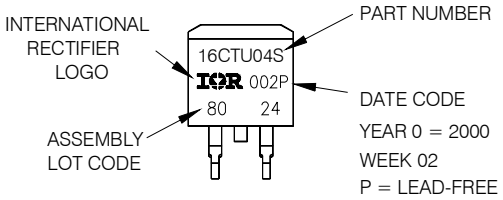


Part Marking Information

D²PAK

EXAMPLE: THIS IS A 16CTU04S
LOT CODE 8024
ASSEMBLED ON WW 02, 2000

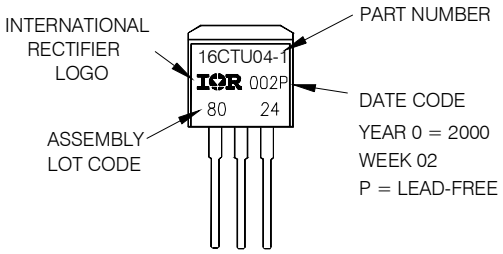
Note: "P" in assembly line position indicates "Lead-Free"



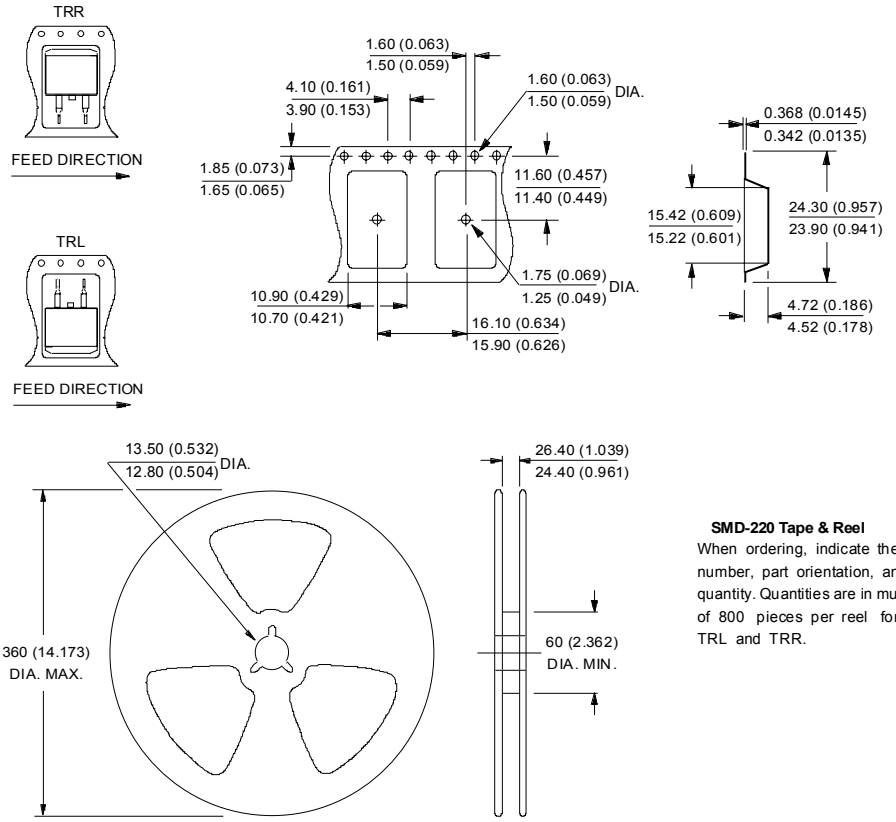
TO-262

EXAMPLE: THIS IS A 16CTU04-1
LOT CODE 8024
ASSEMBLED ON WW 02, 2000

Note: "P" in assembly line position indicates "Lead-Free"



Tape & Reel Information

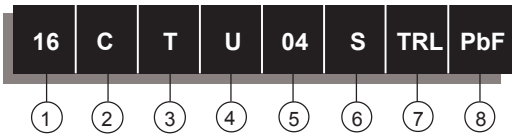


SMD-220 Tape & Reel
When ordering, indicate the part number, part orientation, and the quantity. Quantities are in multiples of 800 pieces per reel for both TRL and TRR.

Dimensions in millimeters and (inches)

Ordering Information Table

Device Code



1	-	Current Rating (16A)
2	-	C = Common Cathode
3	-	T = TO-220, D^2Pak
4	-	U = Ultrafast Rectifier
5	-	Voltage Rating (04 = 400V)
6	-	• S = D^2Pak
		• -1 = TO-262
7	-	• none = Tube (50 pieces)
		• TRL = Tape & Reel (Left Oriented, for D^2PAk package)
		• TRR = Tape & Reel (Right Oriented, for D^2PAk package)
8	-	• none = Standard Production
		• PbF = Lead-Free

Data and specifications subject to change without notice.
This product has been designed and qualified for Industrial Level and Lead-Free.
Qualification Standards can be found on IR's Web site.

International
IOR Rectifier

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