Bulletin PD-20192 rev. M 07/06

International
IOR Rectifier

# 16CTQ...
# 16CTQ...S
# 16CTQ...-1

## SCHOTTKY RECTIFIER

16 Amp

$I_{F(AV)}$ = 15Amp
$V_R$ = 60/ 100V

### Major Ratings and Characteristics

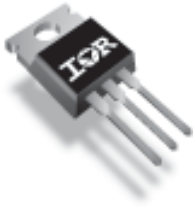
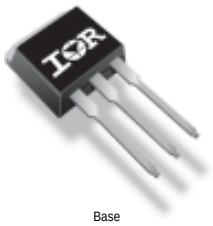
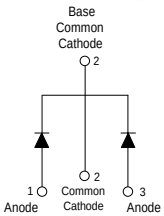
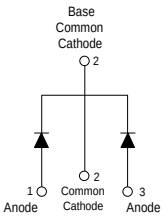
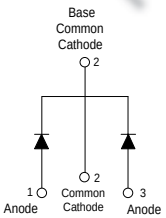
| Characteristics | | Values | Units |
|---|---|---|---|
| $I_{F(AV)}$ | Rectangular waveform | 16 | A |
| $V_{RRM}$ | | 60 / 100 | V |
| $I_{FSM}$ | @ tp = 5 µs sine | 850 | A |
| $V_F$ | @8 Apk, $T_J$ = 125°C (per leg) | 0.58 | V |
| $T_J$ | range | - 55 to 175 | °C |

### Description/ Features

This center tap Schottky rectifier series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175°C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175° C $T_J$ operation
- Center tap configuration
- Low forward voltage drop
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

### Case Styles

| 16CTQ... | 16CTQ... S | 16CTQ... -1 |
|---|---|---|
|  |  |  |
|   |   |   |
| TO-220 | $D^2PAK$ | TO-262 |

## Voltage Ratings

| Parameters | | 16CTQ060 16CTQ060S 16CTQ060-1 | 16CTQ80 16CTQ80S 16CTQ80-1 | 16CTQ100 16CTQ100S 16CTQ100-1 |
|---|---|---|---|---|
| $V_R$ | Max. DC Reverse Voltage (V) | 60 | 80 | 100 |
| $V_{RWM}$ | Max. Working Peak Reverse Voltage (V) | | | |

## Absolute Maximum Ratings

| Parameters | | Values | Units | Conditions | |
|---|---|---|---|---|---|
| $I_{F(AV)}$ | Max. Average Forward (Per Leg) | 8 | A | 50% duty cycle @ $T_C$ = 148°C, rectangular wave form | |
| | Current * See Fig. 5 (Per Device) | 16 | | | |
| $I_{FSM}$ | Max. Peak One Cycle Non-Repetitive | 850 | A | 5µs Sine or 3µs Rect. pulse | Following any rated load condition and with rated $V_{RRM}$ applied |
| | Surge Current (Per Leg) * See Fig. 7 | 275 | | 10ms Sine or 6ms Rect. pulse | |
| $E_{AS}$ | Non-Repetitive Avalanche Energy (Per Leg) | 7.50 | mJ | $T_J$ = 25 °C, $I_{AS}$ = 0.50 Amps, L = 60 mH | |
| $I_{AR}$ | Repetitive Avalanche Current (Per Leg) | 0.50 | A | Current decaying linearly to zero in 1 µsec Frequency limited by $T_J$ max. $V_A$ = 1.5 x $V_R$ typical | |

## Electrical Specifications

| Parameters | | Values | Units | Conditions | |
|---|---|---|---|---|---|
| $V_{FM}$ | Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1) | 0.72 | V | @ 8A | $T_J$ = 25 °C |
| | | 0.88 | V | @ 16A | |
| | | 0.58 | V | @ 8A | $T_J$ = 125 °C |
| | | 0.69 | V | @ 16A | |
| $I_{RM}$ | Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1) | 0.55 | mA | $T_J$ = 25 °C | $V_R$ = rated $V_R$ |
| | | 7.0 | mA | $T_J$ = 125 °C | |
| $V_{F(TO)}$ | Threshold Voltage | 0.415 | V | $T_J$ = $T_J$ max | |
| $r_t$ | Forward Slope Resistance | 11.07 | mΩ | | |
| $C_T$ | Max. Junction Capacitance (Per Leg) | 500 | pF | $V_R$ = 5$V_{DC}$ (test signal range 100Khz to 1Mhz) 25°C | |
| $L_S$ | Typical Series Inductance (Per Leg) | 8.0 | nH | Measured lead to lead 5mm from package body | |
| dv/dt | Max. Voltage Rate of Change (Rated $V_R$) | 10000 | V/ µs | | |

(1) Pulse Width < 300µs, Duty Cycle <2%

## Thermal-Mechanical Specifications

| Parameters | | | Values | Units | Conditions |
|---|---|---|---|---|---|
| $T_J$ | Max. Junction Temperature Range | | -55 to 175 | °C | |
| $T_{stg}$ | Max. Storage Temperature Range | | -55 to 175 | °C | |
| $R_{thJC}$ | Max. Thermal Resistance Junction to Case (Per Leg) | | 3.25 | °C/W | DC operation |
| $R_{thJC}$ | Max. Thermal Resistance Junction to Case (Per Package) | | 1.63 | °C/W | DC operation |
| $R_{thCS}$ | Typical Thermal Resistance, Case to Heatsink | | 0.50 | °C/W | Mounting surface, smooth and greased (only for TO-220) |
| wt | Approximate Weight | | 2 (0.07) | g (oz.) | |
| T | Mounting Torque | Min. | 6 (5) | Kg-cm (lbf-in) | |
| | | Max. | 12 (10) | | |

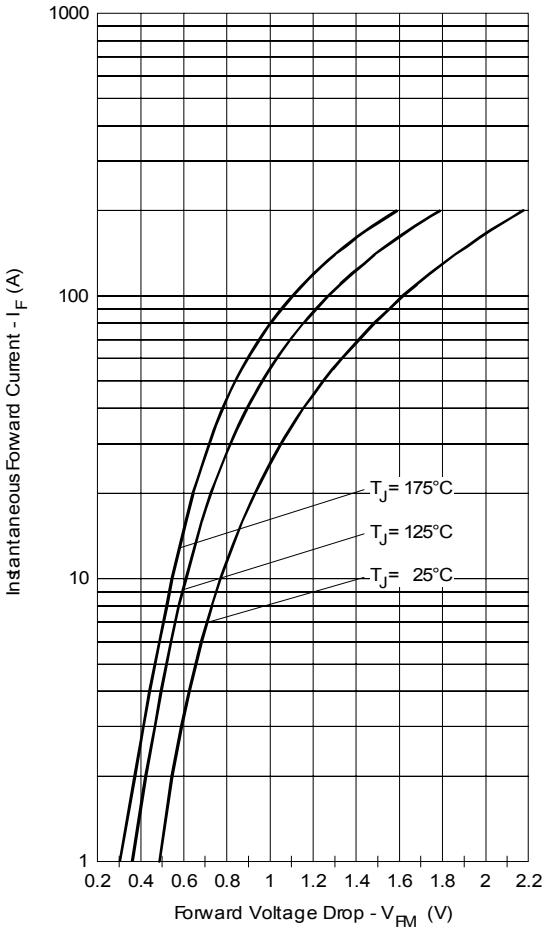



Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

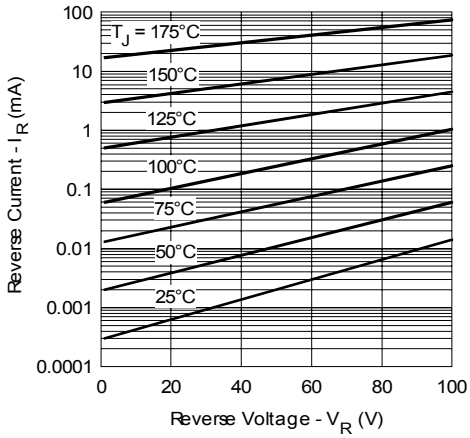



Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

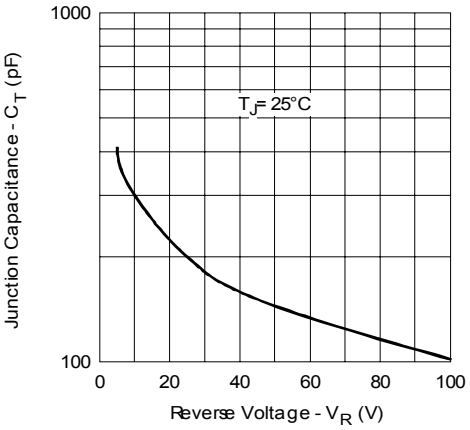



Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

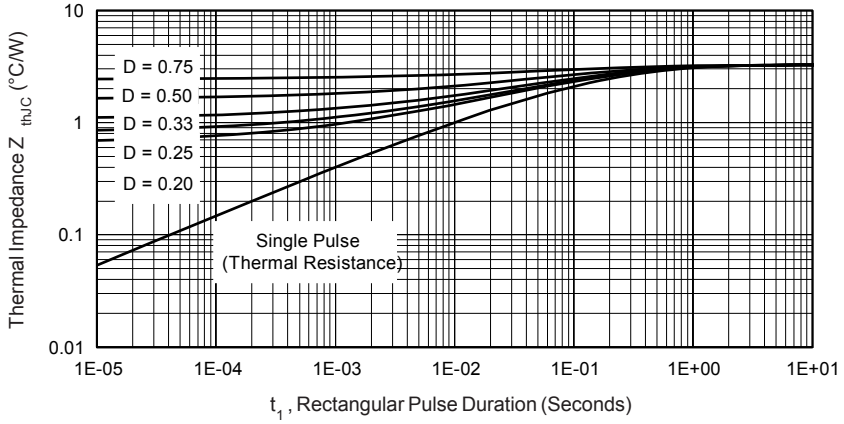



Fig. 4 - Max. Thermal Impedance $Z_{thJC}$ Characteristics (Per Leg)

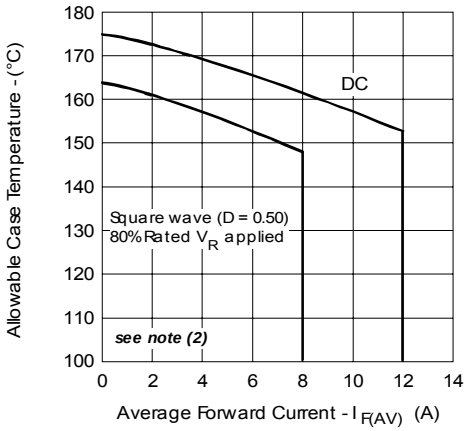



Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

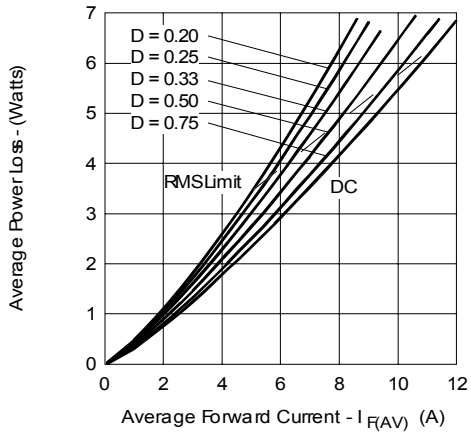



Fig. 6 - Forward Power Loss Characteristics (Per Leg)

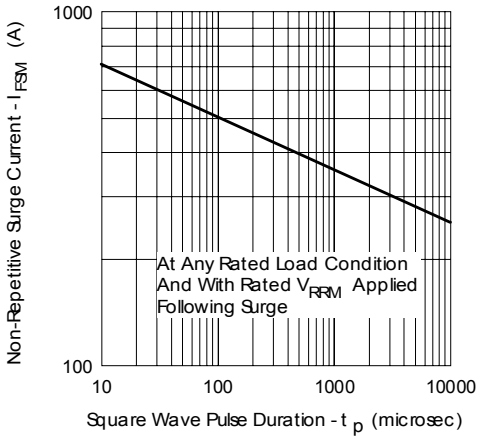



Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

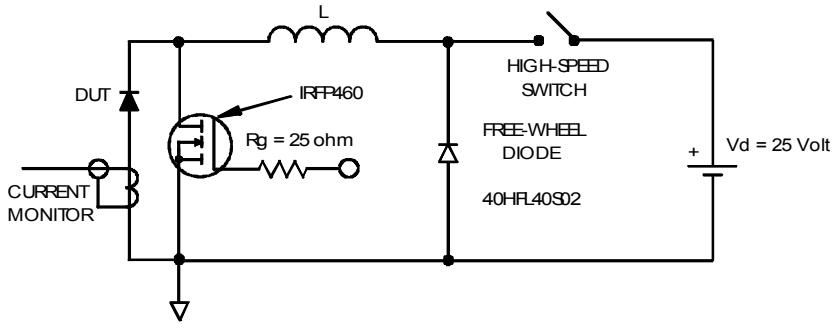
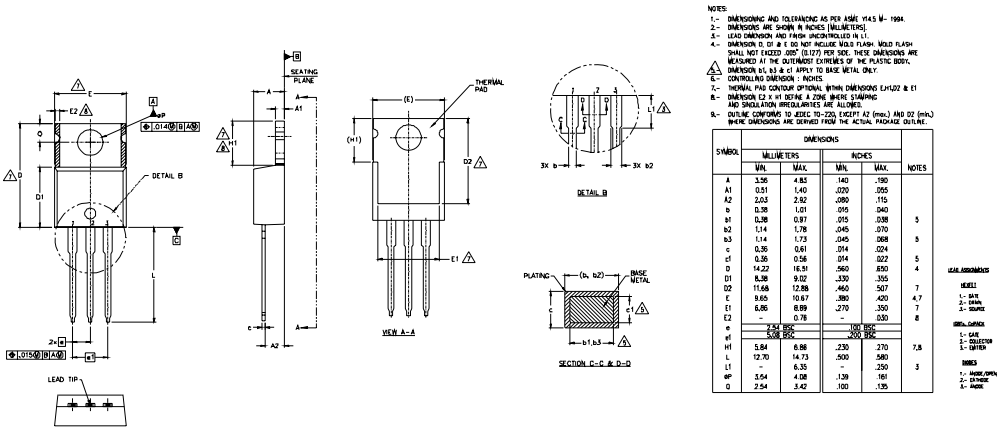



Fig. 8 - Unclamped Inductive Test Circuit

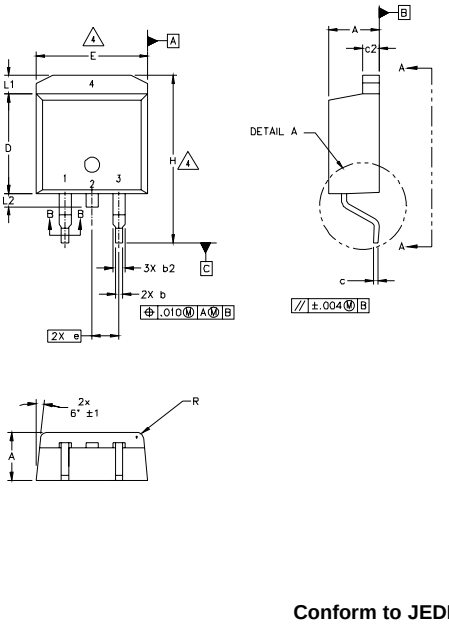
**(2)** Formula used: $T_C = T_J - (Pd + Pd_{REV}) \times R_{thJC}$;
$Pd$ = Forward Power Loss = $I_{F(AV)} \times V_{FM}$ @ ($I_{F(AV)}$ / D) (see Fig. 6);
$Pd_{REV}$ = Inverse Power Loss = $V_{R1} \times I_R (1 - D)$; $I_R$ @ $V_{R1}$ = 80% rated $V_R$ applied

## Outline Table




| SYMBOL | DIMENSIONS | | | | NOTES |
|---|---|---|---|---|---|
| | MILLIMETERS | | INCHES | | |
| | MIN. | MAX. | MIN. | MAX. | |
| A | 3.56 | 4.83 | .140 | .190 | |
| A1 | 0.51 | 1.40 | .020 | .055 | |
| A2 | 2.03 | 2.92 | .080 | .115 | |
| b | 0.38 | 1.01 | .015 | .040 | |
| b1 | 0.38 | 0.97 | .015 | .038 | 5 |
| b2 | 1.14 | 1.78 | .045 | .070 | |
| b3 | 1.14 | 1.73 | .045 | .068 | 5 |
| c | 0.36 | 0.61 | .014 | .024 | |
| c1 | 0.36 | 0.56 | .014 | .022 | 5 |
| D | 14.22 | 16.51 | .560 | .650 | 4 |
| D1 | 8.38 | 9.02 | .330 | .355 | |
| D2 | 11.68 | 12.88 | .460 | .507 | 7 |
| E | 9.65 | 10.67 | .380 | .420 | 4,7 |
| E1 | 6.86 | 8.89 | .270 | .350 | 7 |
| E2 | - | 0.76 | - | .030 | 8 |
| e | 2.54 BSC | | .100 BSC | | |
| e1 | 5.08 BSC | | .200 BSC | | |
| H1 | 5.84 | 6.86 | .230 | .270 | 7,8 |
| L | 12.70 | 14.73 | .500 | .580 | |
| L1 | - | 6.35 | - | .250 | 3 |
| øP | 3.54 | 4.08 | .139 | .161 | |
| Q | 2.54 | 3.42 | .100 | .135 | |

**Conform to JEDEC outline TO-220AB**




NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M–1994
2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
4. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
5. CONTROLLING DIMENSION: INCH.

| SYMBOL | DIMENSIONS | | | | NOTES |
|---|---|---|---|---|---|
| | MILLIMETERS | | INCHES | | |
| | MIN. | MAX. | MIN. | MAX. | |
| A | 4.06 | 4.83 | .160 | .190 | |
| A1 | 0.00 | 0.254 | .000 | .010 | |
| b | 0.51 | 0.99 | .020 | .039 | |
| b1 | 0.51 | 0.89 | .020 | .035 | 4 |
| b2 | 1.14 | 1.78 | .045 | .070 | |
| c | 0.38 | 0.74 | .015 | .029 | |
| c1 | 0.38 | 0.58 | .015 | .023 | 4 |
| c2 | 1.14 | 1.65 | .045 | .065 | |
| D | 8.51 | 9.65 | .335 | .380 | 3 |
| D1 | 6.86 | | .270 | | |
| E | 9.65 | 10.67 | .380 | .420 | 3 |
| E1 | 6.22 | | .245 | | |
| e | 2.54 BSC | | .100 BSC | | |
| H | 14.61 | 15.88 | .575 | .625 | |
| L | 1.78 | 2.79 | .070 | .110 | |
| L1 | | 1.65 | | .065 | |
| L2 | 1.27 | 1.78 | .050 | .070 | |
| L3 | 0.25 BSC | | .010 BSC | | |
| L4 | 4.78 | 5.28 | .188 | .208 | |
| m | 17.78 | | .700 | | |
| m1 | 8.89 | | .350 | | |
| n | 11.43 | | .450 | | |
| o | 2.08 | | .082 | | |
| p | 3.81 | | .150 | | |
| R | 0.51 | 0.71 | .020 | .028 | |
| θ | 90° | 93° | 90° | 93° | |

LEAD ASSIGNMENTS

HEXFET

1.– GATE
2, 4.– DRAIN
3.– SOURCE

IGBTs, CoPACK

1.– GATE
2, 4.– COLLECTOR
3.– EMITTER

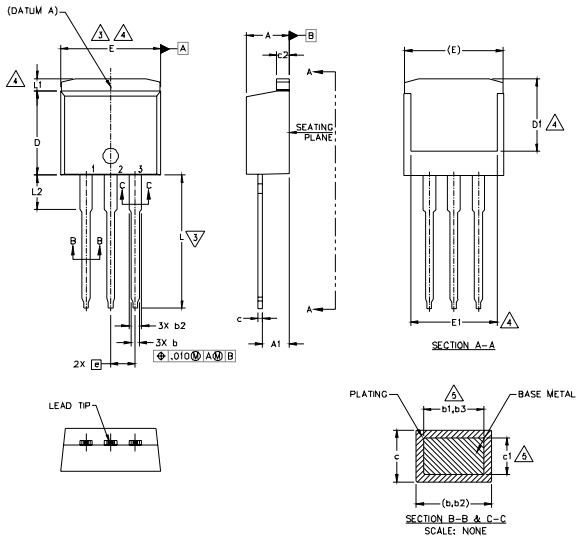
DIODES

1.– ANODE *
2, 4.– CATHODE
3.– ANODE

* PART DEPENDENT.

**Conform to JEDEC outline $D^2Pak$ (SMD-220)**
Dimensions in millimeters and (inches)

## Outline Table




NOTES:
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2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
4. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSION E, L1, D1 & E1.
5. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
6. CONTROLLING DIMENSION: INCH.
7. - OUTLINE CONFORM TO JEDEC TO-262 EXCEPT A1(max.), b(min.) AND D1(min.) WHERE DIMENSIONS DERIVED THE ACTUAL PACKAGE OUTLINE.

| SYMBOL | DIMENSIONS | | | | NOTES |
|---|---|---|---|---|---|
| | MILLIMETERS | | INCHES | | |
| | MIN. | MAX. | MIN. | MAX. | |
| A | 4.06 | 4.83 | .160 | .190 | |
| A1 | 2.03 | 3.02 | .080 | .119 | |
| b | 0.51 | 0.99 | .020 | .039 | |
| b1 | 0.51 | 0.89 | .020 | .035 | 5 |
| b2 | 1.14 | 1.78 | .045 | .070 | |
| b3 | 1.14 | 1.73 | .045 | .068 | 5 |
| c | 0.38 | 0.74 | .015 | .029 | |
| c1 | 0.38 | 0.58 | .015 | .023 | 5 |
| c2 | 1.14 | 1.65 | .045 | .065 | |
| D | 8.38 | 9.65 | .330 | .380 | 3 |
| D1 | 6.86 | – | .270 | – | 4 |
| E | 9.65 | 10.67 | .380 | .420 | 3,4 |
| E1 | 6.22 | – | .245 | | 4 |
| e | 2.54 BSC | | .100 BSC | | |
| L | 13.46 | 14.10 | .530 | .555 | |
| L1 | – | 1.65 | – | .065 | 4 |
| L2 | 3.56 | 3.71 | .140 | .146 | |

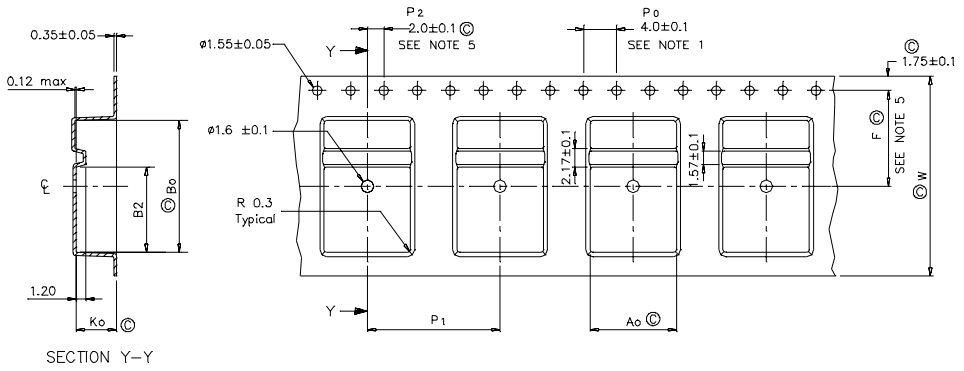
LEAD ASSIGNMENTS

HEXFET
1.- GATE
2.- DRAIN
3.- SOURCE
4.- DRAIN

IGBTs, CoPACK
1.- GATE
2.- COLLECTOR
3.- EMITTER
4.- COLLECTOR

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

## Tape & Reel Information




| | |
|---|---|
| Ao | 10.50 +/- 0.1 |
| Bo | 15.80 +/- 0.1 |
| B2 | 10.25 +/- 0.1 |
| Ko | 4.90 +/- 0.1 |
| F | 11.50 +/- 0.1 |
| P1 | 16.00 +/- 0.1 |
| W | 24.00 +/- 0.3 |

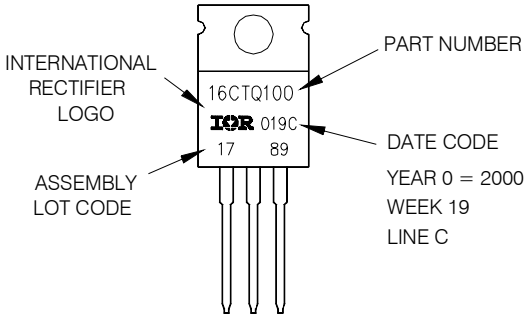
NOTES:
1.0 10 SPROCKET HOLE PITH CUMULATIVE TOLERANCE ±.02
2.0 CAMBER NOT TO EXCEED 1mm In 100mm
3.0 MATERIAL: CONDUCTIVE BLACK STYRENIC ALLOY
4.0 Ko MEASURED FROM A PLANE ON THE INSIDE BOTTOM OF THE POCKET TO THE TOP SURFACE OF THE CARRIER
5.0 MEASURED FROM CENTRELINE OF SPROCKET HOLE TO CENTRELINE OF POCKET
6.0 VENDOR: (OPTIONAL)
7.0 MUST ALSO MEET REQUIREMENTS OF EIA STANDAR #EIA-481A TAPING OF SURFACE MOUNT COMPONENTS FOR AUTOMATIC PLACEMENT
8.0 SURFACE RESISTIVITY OF MOLDED MATL. MUST MEASURE LESS OR EQUAL TO $10^6$ OHMS PER SQUARE. MEASURED IN ACCORDANCE TO PROCEDURE GIVEN IN ASTM D-257 & ASTM D-991
9.0 TOTAL LENGTH PER REEL MUST BE 45 METERS
10.0 © CRITICAL

Dimensions in millimeters and (inches)

## Part Marking Information

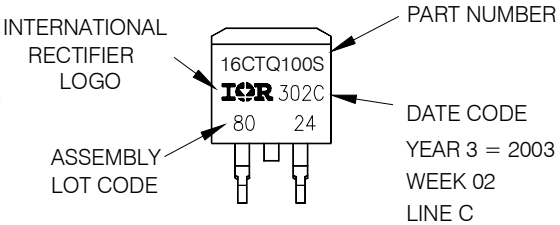
TO-220

EXAMPLE: THIS IS A 16CTQ100
LOT CODE 1789
ASSEMBLED ON WW 19, 2000
IN THE ASSEMBLY LINE "C"



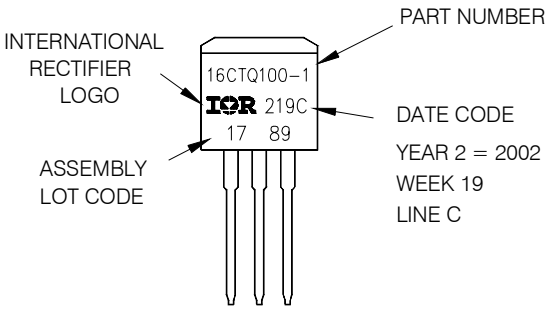

$D^2PAK$

EXAMPLE: THIS IS A 16CTQ100S
LOT CODE 8024
ASSEMBLED ON WW 02, 2003
IN ASSEMBLY LINE "C"



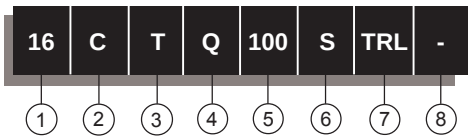

TO-262

EXAMPLE: THIS IS A 16CTQ100-1
LOT CODE 1789
ASSEMBLED ON WW 19, 2002
IN ASSEMBLY LINE "C"



## Ordering Information Table

**Device Code**




1 - Current Rating (16A)

2 - Circuit Configuration
C = Common Cathode

3 - T = TO-220

4 - Schottky "Q" Series

5 - Voltage Ratings
- 060 = 60V
- 080 = 80V
- 100 = 100V

6 - • S = $D^2Pak$
• -1= TO-262

7 - • none = Tube (50 pieces)
• TRL = Tape & Reel (Left Oriented - for $D^2Pak$ only)
• TRR = Tape & Reel (Right Oriented - for $D^2Pak$ only)

8 - • none = Standard Production
• PbF = Lead-Free

```
16CTQ100
******************************************
* SPICE Model Diode                      *
******************************************
.SUBCKT 16CTQ100 ANO CAT
D1 ANO 1 DMOD (0.07089)
*Define diode model
.MODEL DMOD D(IS=21.21E-06,N=1.578,Rs=7.804E-03,Ikf=0.9497, Xti=2,
Eg=1.11
+ Cjo=1.278E-09, M=0.4736, Vj=0.4972, Fc=0.5, Isr =1.114e-21, Nr=4.755,
+ Bv=119.9, Ibv=215.5E-06, Tt=18.2E-09)
******************************************

.ENDS 16CTQ100

Thermal Model Subcircuit
.SUBCKT 16CTQ100  5 1

CTHERM1     5    4     1.45E+00
CTHERM2     4    3     4.54E+00
CTHERM3     3    2     1.09E+01
CTHERM4     2    1     1.01E+02

RTHERM1     5    4     2.49E+00
RTHERM2     4    3     5.20E-04
RTHERM1     3    2     5.43E-01
RTHERM1     2    1     3.05E-02

.ENDS 16CTQ100
```

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

International
IOR Rectifier

**IR WORLD HEADQUARTERS:** 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
TAC Fax: (310) 252-7309
07/06

# Notice

The products described herein were acquired by Vishay Intertechnology, Inc., as part of its acquisition of International Rectifier's Power Control Systems (PCS) business, which closed in April 2007. Specifications of the products displayed herein are pending review by Vishay and are subject to the terms and conditions shown below.

Specifications of the products displayed herein are subject to change without notice. Vishay Intertechnology, Inc., or anyone on its behalf, assumes no responsibility or liability for any errors or inaccuracies.

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