

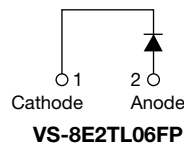
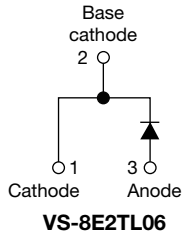
## Ultralow $V_F$ Ultrafast Rectifier, 8 A FRED Pt<sup>®</sup>



2L TO-220AC



2L TO-220 FULL-PAK



### FEATURES

- Ultrafast recovery time, extremely low  $V_F$  and soft recovery
- 175 °C maximum operating junction temperature
- For PFC DCM operation
- True 2 pin package
- Low leakage current
- Fully isolated package ( $V_{INS} = 2500 V_{RMS}$ )
- Compliant to RoHS directive 2002/95/EC
- Halogen-free according to IEC 61249-2-21 definition
- Designed and qualified for industrial level



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
Available

### DESCRIPTION

State of the art, ultralow  $V_F$ , soft-switching ultrafast rectifiers optimized for Discontinuous (Critical) Mode (DCM) Power Factor Correction (PFC).

The minimized conduction loss, optimized stored charge and low recovery current minimize the switching losses and reduce over dissipation in the switching element and snubbers.

The device is also intended for use as a freewheeling diode in power supplies and other power switching applications.

### APPLICATIONS

AC/DC SMPS 70 W to 400 W  
e.g. laptop and printer AC adaptors, desktop PCs, TVs and monitors, games units and DVD ac-to-dc power supplies.

### PRODUCT SUMMARY

Package	2L TO-220AC, 2L TO-220 FP
$I_{F(AV)}$	8 A
$V_R$	600 V
$V_F$ at $I_F$	1.07 V
$t_{rr}$ (typ.)	60 ns
$T_J$ max.	175 °C
Diode variation	Single die

### ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Peak repetitive reverse voltage	$V_{RRM}$		600	V
Average rectified forward current	$I_{F(AV)}$	$T_C = 156\text{ °C}$	8	A
FULL-PAK		$T_C = 131\text{ °C}$		
Non-repetitive peak surge current	$I_{FSM}$	$T_J = 25\text{ °C}$	125	
Peak repetitive forward current	$I_{FM}$		16	
Operating junction and storage temperatures	$T_J, T_{Stg}$		- 65 to 175	°C

### ELECTRICAL SPECIFICATIONS ( $T_J = 25\text{ °C}$ unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Breakdown voltage, blocking voltage	$V_{BR}, V_R$	$I_R = 100\ \mu A$	600	-	-	V
Forward voltage	$V_F$	$I_F = 8\text{ A}$	-	1	1.07	
		$I_F = 8\text{ A}, T_J = 150\text{ °C}$	-	0.85	0.90	
Reverse leakage current	$I_R$	$V_R = V_R$ rated	-	0.04	4	$\mu A$
		$T_J = 150\text{ °C}, V_R = V_R$ rated	-	10	70	
Junction capacitance	$C_T$	$V_R = 600\text{ V}$	-	6	-	pF
Series inductance	$L_S$	Measured lead to lead 5 mm from package body	-	8	-	nH

# VS-8E2TL06-E, VS-8E2TL06-M, VS-8E2TL06FP-E



Vishay Semiconductors Ultralow  $V_F$  Ultrafast Rectifier,  
8 A FRED Pt®

DYNAMIC RECOVERY CHARACTERISTICS ( $T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Reverse recovery time	$t_{rr}$	$I_F = 1.0\text{ A}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$	-	60	100	ns
		$I_F = 8.0\text{ A}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$	-	150	250	
		$T_J = 25\text{ }^\circ\text{C}$	-	200	-	
		$T_J = 125\text{ }^\circ\text{C}$	-	255	-	
Peak recovery current	$I_{RRM}$	$T_J = 25\text{ }^\circ\text{C}$	-	15	-	A
		$T_J = 125\text{ }^\circ\text{C}$	-	20	-	
Reverse recovery charge	$Q_{rr}$	$T_J = 25\text{ }^\circ\text{C}$	-	1.5	-	$\mu\text{C}$
		$T_J = 125\text{ }^\circ\text{C}$	-	2.4	-	

THERMAL - MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Maximum junction and storage temperature range	$T_J, T_{Stg}$		- 65	-	175	$^\circ\text{C}$
Thermal resistance, junction to case	$R_{thJC}$		-	2	2.4	$^\circ\text{C}/\text{W}$
FULL-PAK			-	5	5.5	
Thermal resistance, junction to ambient per leg	$R_{thJA}$	Typical socket mount	-	-	70	
Typical thermal resistance, case to heatsink	$R_{thCS}$	Mounting surface, flat, smooth and greased	-	0.5	-	
Weight			-	2	-	g
			-	0.07	-	oz.
Mounting torque			6 (5)	-	12 (10)	kgf · cm (lbf · in)
Marking device		Case style TO-220	8E2TL06			
		Case style TO-220 FULL-PAK	8E2TL06FP			



# VS-8E2TL06-E, VS-8E2TL06-M, VS-8E2TL06FP-E

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Vishay Semiconductors

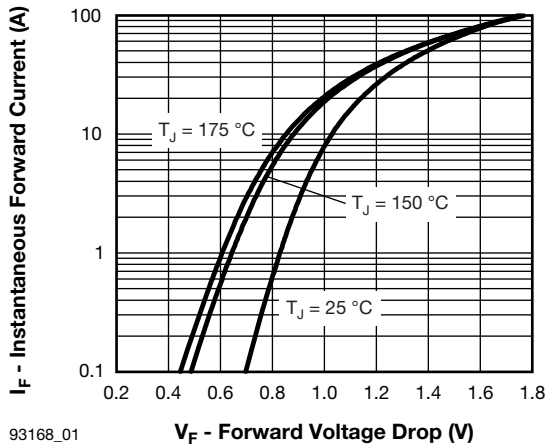


Fig. 1 - Typical Forward Voltage Drop Characteristics

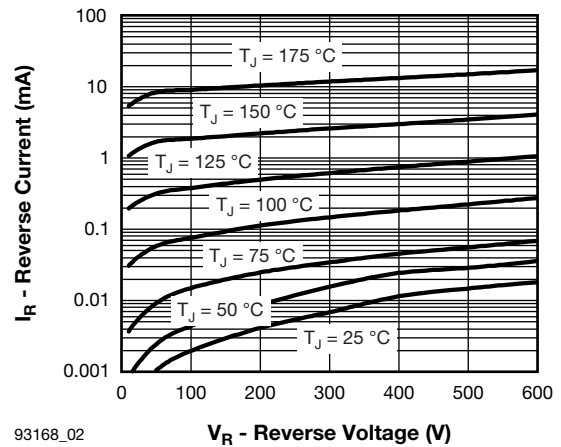


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

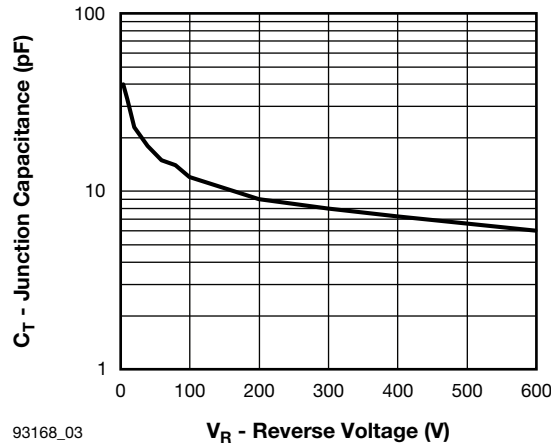


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

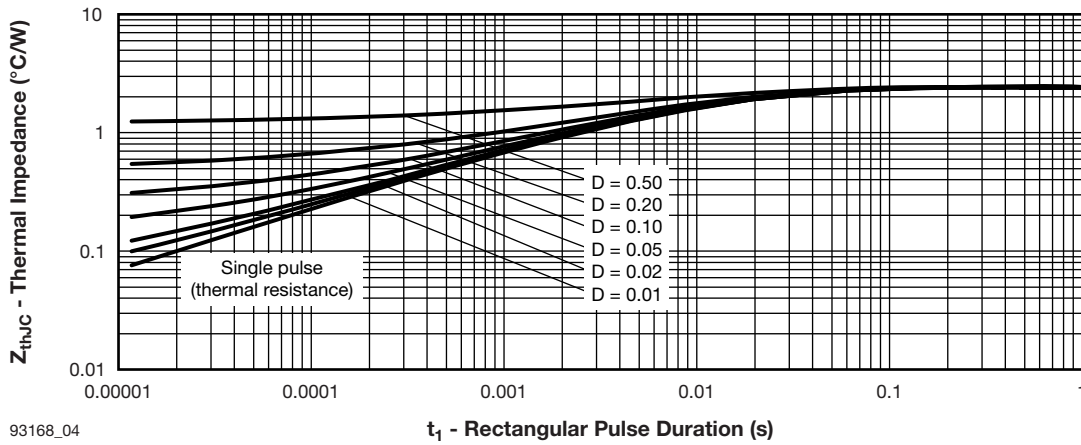
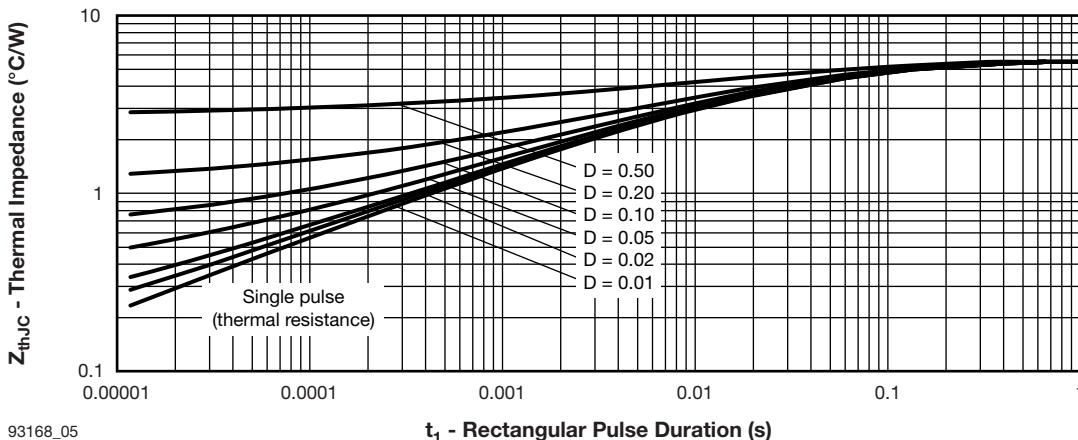


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics (TO-220)

# VS-8E2TL06-E, VS-8E2TL06-M, VS-8E2TL06FP-E

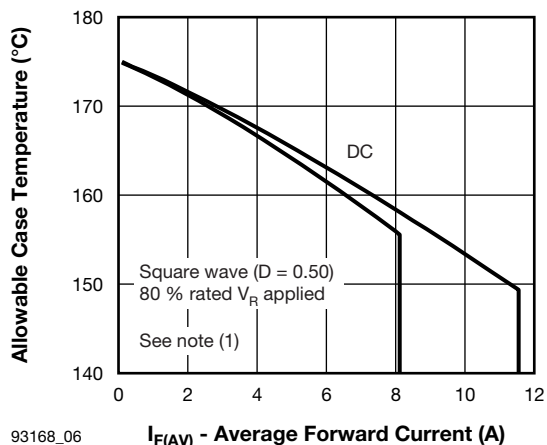


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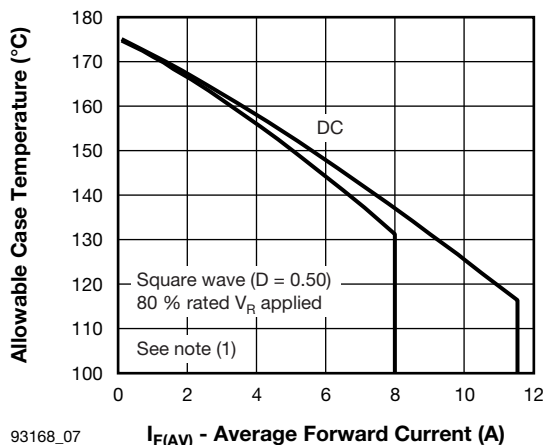
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Fig. 5 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics (FULL-PAK)



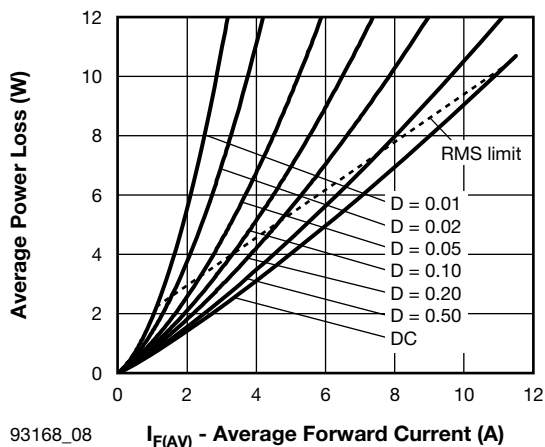
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Fig. 6 - Maximum Allowable Case Temperature vs. Average Forward Current (TO-220)



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Fig. 7 - Maximum Allowable Case Temperature vs. Average Forward Current (FULL-PAK)

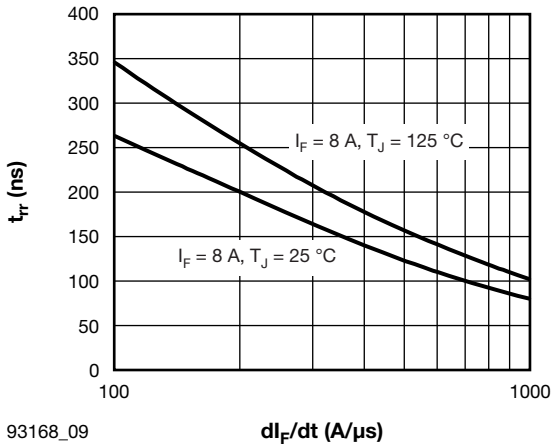


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Fig. 8 - Forward Power Loss Characteristics

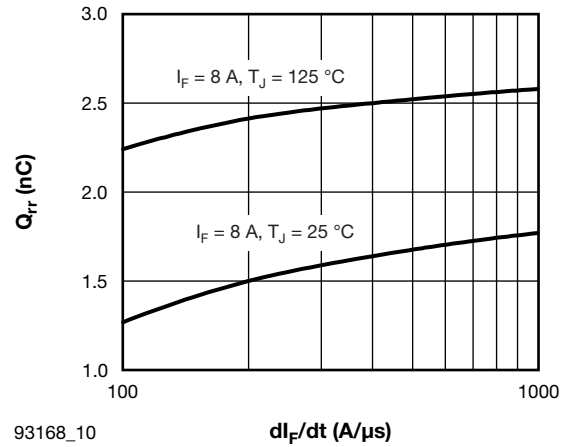
## Note

(1) Formula used:  $T_C = T_J - (Pd + Pd_{REV}) \times R_{thJC}$ ;  $Pd = \text{Forward power loss} = I_{F(AV)} \times V_{FM}$  at  $(I_{F(AV)}/D)$  (see fig. 6);  
 $Pd_{REV} = \text{Inverse power loss} = V_{R1} \times I_R (1 - D)$ ;  $I_R$  at  $V_{R1} = \text{Rated } V_R$



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Fig. 9 - Typical Reverse Recovery Time vs.  $di_F/dt$



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Fig. 10 - Typical Stored Charge vs.  $di_F/dt$

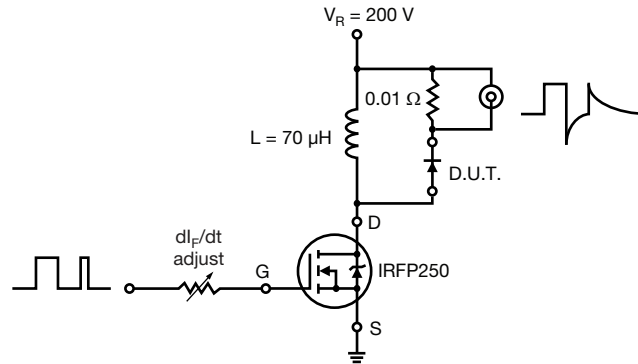
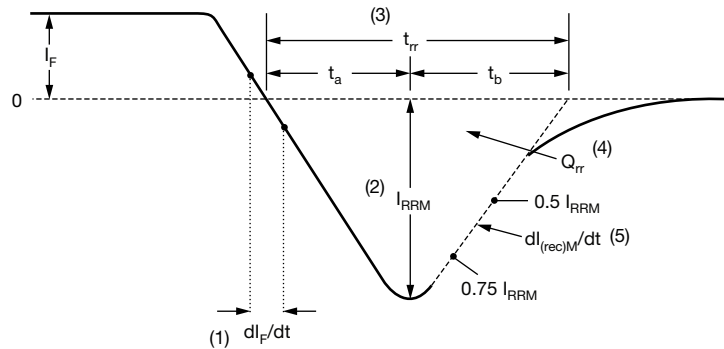


Fig. 11 - Reverse Recovery Parameter Test Circuit



(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  $0.5 I_{RRM}$  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  $t_{rr}$

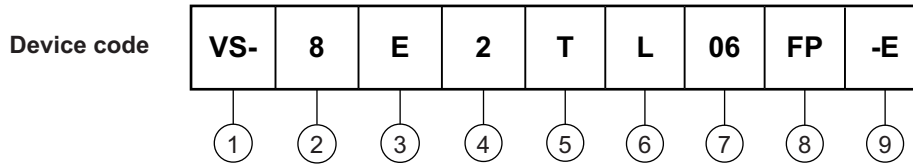
Fig. 12 - Reverse Recovery Waveform and Definitions

# VS-8E2TL06-E, VS-8E2TL06-M, VS-8E2TL06FP-E



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## ORDERING INFORMATION TABLE



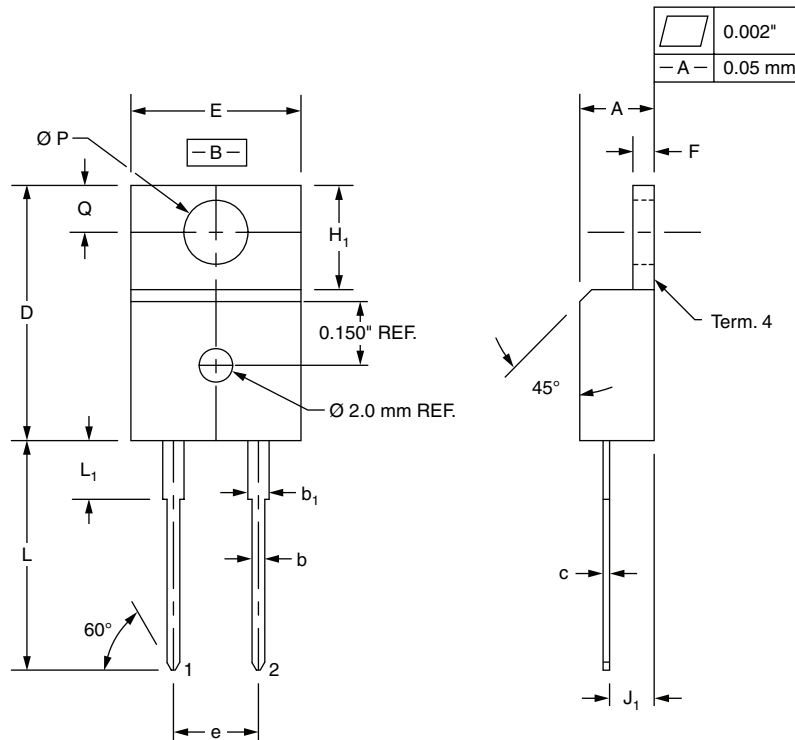
- 1** - Vishay Semiconductors product suffix
- 2** - Current rating (8 = 8 A)
- 3** - Circuit configuration:  
E = Single diode
- 4** - 2 = True 2 pin package
- 5** - T = TO-220
- 6** - L = Ultrafast recovery time
- 7** - Voltage code (06 = 600 V)
- 8** -
  - None = TO-220
  - FP = FULL-PAK
- 9** - Environmental digit:
  - -E = RoHS compliant and terminations lead (Pb)-free
  - -M = Halogen-free, RoHS compliant and terminations lead (Pb)-free

ORDERING INFORMATION (Example)			
PREFERRED P/N	QUANTITY PER TUBE	MINIMUM ORDER QUANTITY	PACKAGING DESCRIPTION
VS-8E2TL06-E	50	1000	Antistatic plastic tubes
VS-8E2TL06-M	50	1000	Antistatic plastic tubes
VS-8E2TL06FP-E	50	1000	Antistatic plastic tubes

LINKS TO RELATED DOCUMENTS	
Dimensions	TO-220AC <a href="http://www.vishay.com/doc?95259">www.vishay.com/doc?95259</a>
	TO-220 FULL-PAK <a href="http://www.vishay.com/doc?95260">www.vishay.com/doc?95260</a>
Part marking information	TO-220AC <a href="http://www.vishay.com/doc?95391">www.vishay.com/doc?95391</a>
	TO-220 FULL-PAK <a href="http://www.vishay.com/doc?95392">www.vishay.com/doc?95392</a>
Packaging information	<a href="http://www.vishay.com/doc?95388">www.vishay.com/doc?95388</a>

## True 2 Pin TO-220

**DIMENSIONS** in millimeters and inches



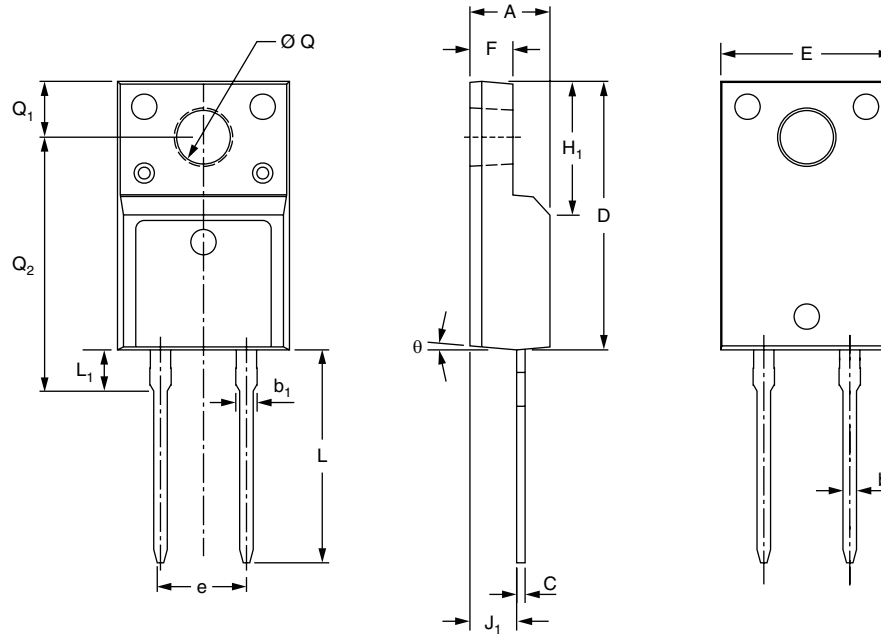
SYMBOL	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.32	4.57	0.170	0.180
b	0.71	0.91	0.028	0.036
b <sub>1</sub>	1.15	1.39	0.045	0.055
c	0.36	0.53	0.014	0.021
D	14.99	15.49	0.590	0.610
E	10.04	10.41	0.395	0.410
e	5.08 BSC		0.200 BSC	
F	1.22	1.37	0.048	0.054
H <sub>1</sub>	5.97	6.47	0.235	0.255
J <sub>1</sub>	2.54	2.79	0.100	0.110
L	13.47	13.97	0.530	0.550
L <sub>1</sub> <sup>(1)</sup>	3.31	3.81	0.130	0.150
Ø P	3.79	3.88	0.149	0.153
Q	2.60	2.84	0.102	0.112

**Notes**

- <sup>(1)</sup> Lead dimension and finish uncontrolled in L<sub>1</sub>
- These dimensions are within allowable dimensions of JEDEC TO-220AB rev. J outline dated 3-24-87
- Controlling dimension: Inch

## True 2 Pin TO-220 FULL-PAK

**DIMENSIONS** in millimeters and inches



SYMBOL	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.53	4.93	0.178	0.194
b	0.71	0.91	0.028	0.036
b <sub>1</sub>	1.15	1.39	0.045	0.055
C	0.36	0.53	0.014	0.021
D	15.67	16.07	0.617	0.633
E	9.96	10.36	0.392	0.408
e	5.08 typical		0.200 typical	
F	2.34	2.74	0.092	0.107
H <sub>1</sub>	6.50	6.90	0.256	0.272
J <sub>1</sub>	2.56	2.96	0.101	0.117
L	12.78	13.18	0.503	0.519
L <sub>1</sub>	2.23	2.63	0.088	0.104
Ø Q	2.98	3.38	0.117	0.133
Q <sub>1</sub>	3.10	3.50	0.122	0.138
Q <sub>2</sub>	14.80	15.20	0.583	0.598
θ	0°	5°	0°	5°





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