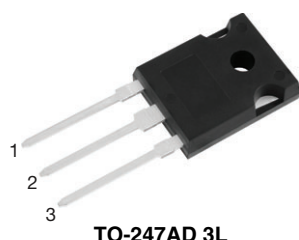
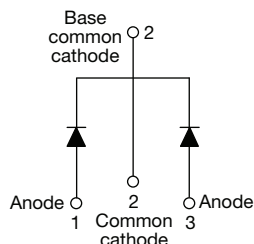


# Hyperfast Rectifier, 2 x 30 A FRED Pt® G5



TO-247AD 3L



## FEATURES

- Hyperfast and optimized  $Q_{rr}$
- Best in class forward voltage drop and switching losses trade off
- Optimized for high speed operation
- 175 °C maximum operating junction temperature
- Polyimide passivation
- AEC-Q101 qualified meets JESD 201 class 1A whisker test
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
FREE

## LINKS TO ADDITIONAL RESOURCES



3D Models



Application Notes

PRIMARY CHARACTERISTICS	
$I_{F(AV)}$ , per leg	30 A
$V_R$	600 V
$V_F$ at $I_F$ at 125 °C, per leg	1.15 V
$t_{rr}$ (typ.)	25
$I_{FSM}$ , per leg	330
$T_J$ max.	175 °C
Package	TO-247AD 3L
Circuit configuration	Common cathode

## DESCRIPTION / APPLICATIONS

Featuring a unique combination of low conduction and switching losses, this rectifier is the right choice for soft switched and resonant converters, as well as medium frequency hard switching converters. This device is specifically designed to improve efficiency of high speed LLC output rectification stages of EV / HEV on-board battery chargers

## MECHANICAL DATA

**Case:** TO-247AD 3L

Molding compound meets UL 94 V-0 flammability rating

**Terminal:** matte tin plated leads, solderable per J-STD-002

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Repetitive peak reverse voltage, per leg	$V_{RRM}$		600	V
Average rectified forward current, per leg	$I_{F(AV)}$	$T_C = 123\text{ °C}$ , $D = 0.50$	30	A
Non-repetitive peak surge current, per leg	$I_{FSM}$	$T_C = 25\text{ °C}$ , $t_p = 10\text{ ms}$ , sine wave	330	
Repetitive peak forward current, per leg	$I_{FRM}$	$T_C = 123\text{ °C}$ , $D = 0.50$ , $f = 20\text{ kHz}$	60	
Operating junction and storage temperature	$T_J, T_{Stg}$		-55 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, per leg	$V_{BR}, V_R$	$I_R = 100\text{ }\mu\text{A}$	600	-	-	V
Forward voltage, per leg	$V_F$	$I_F = 30\text{ A}$	-	1.3	1.6	
		$I_F = 30\text{ A}$ , $T_J = 125\text{ °C}$	-	1.15	-	
Reverse leakage current, per leg	$I_R$	$V_R = V_R$ rated	-	-	20	$\mu\text{A}$
		$T_J = 125\text{ °C}$ , $V_R = V_R$ rated	-	-	500	
Junction capacitance, per leg	$C_T$	$V_R = 200\text{ V}$	-	36	-	pF
Series inductance, per leg	$L_S$	Measured to lead 5 mm from package body	-	8	-	nH

**DYNAMIC RECOVERY CHARACTERISTICS** ( $T_J = 25\text{ }^{\circ}\text{C}$  unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Reverse recovery time, per leg	$t_{rr}$	$I_F = 1.0\text{ A}$ , $dI_F/dt = 100\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$	-	25	-	ns
		$T_J = 25\text{ }^{\circ}\text{C}$	-	41	-	
		$T_J = 125\text{ }^{\circ}\text{C}$	-	58	-	
Peak recovery current, per leg	$I_{RRM}$	$T_J = 25\text{ }^{\circ}\text{C}$	-	19	-	A
		$T_J = 125\text{ }^{\circ}\text{C}$	-	32	-	
		$I_F = 20\text{ A}$ , $dI_F/dt = 1000\text{ A}/\mu\text{s}$ , $V_R = 400\text{ V}$	-	419	-	
Reverse recovery charge, per leg	$Q_{rr}$	$T_J = 25\text{ }^{\circ}\text{C}$	-	1176	-	nC
		$T_J = 125\text{ }^{\circ}\text{C}$	-	1176	-	
Reverse recovery time, per leg	$t_{rr}$	$T_J = 25\text{ }^{\circ}\text{C}$	-	46	-	ns
		$T_J = 125\text{ }^{\circ}\text{C}$	-	65	-	
Peak recovery current, per leg	$I_{RRM}$	$T_J = 25\text{ }^{\circ}\text{C}$	-	21	-	A
		$T_J = 125\text{ }^{\circ}\text{C}$	-	36	-	
Reverse recovery charge, per leg	$Q_{rr}$	$T_J = 25\text{ }^{\circ}\text{C}$	-	550	-	nC
		$T_J = 125\text{ }^{\circ}\text{C}$	-	1560	-	

**THERMAL - MECHANICAL SPECIFICATIONS**

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Thermal resistance, junction-to-case, per leg	$R_{thJC}$		-	-	1.1	$^{\circ}\text{C}/\text{W}$
Weight			-	5.5	-	g
Mounting torque			6.0 (5.0)	-	12 (10)	kgf · cm (lbf · in)
Maximum junction and storage temperature range	$T_J$ , $T_{Stg}$		-55	-	175	$^{\circ}\text{C}$
Marking device		Case style: TO-247AD 3L	C5PH6006LH			

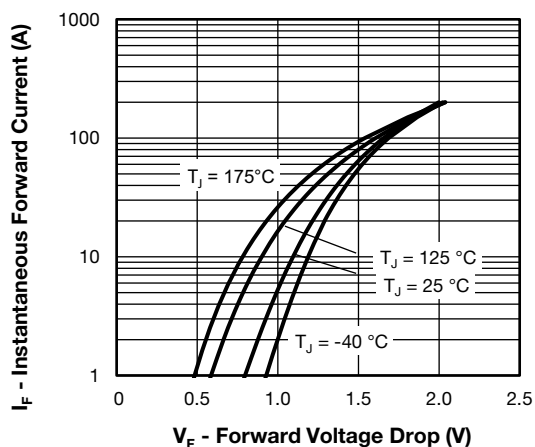


Fig. 1 - Forward Voltage Drop Characteristics, per Leg

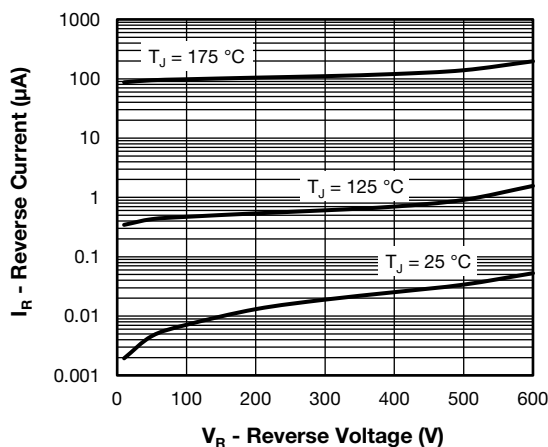


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage, per Leg

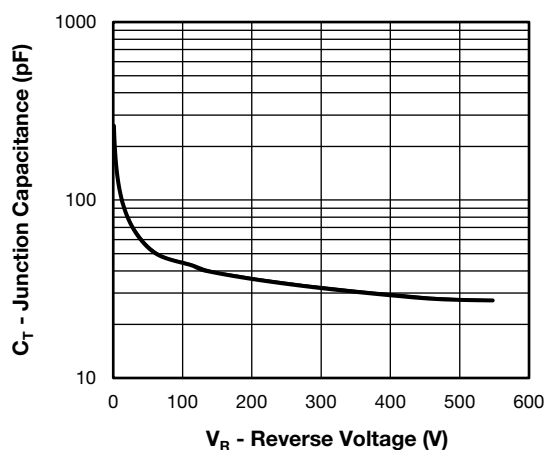


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage, per Leg

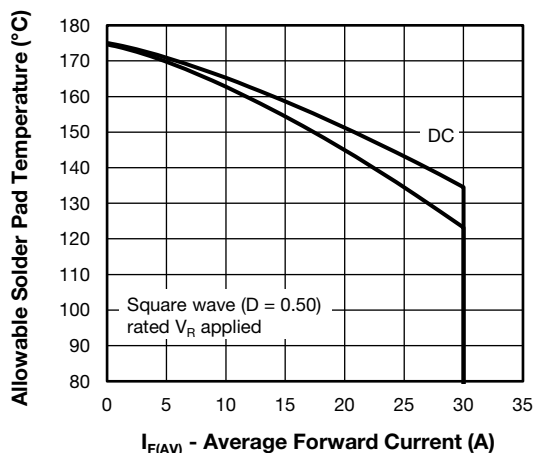


Fig. 4 - Maximum Allowable Case Temperature vs. Average Forward Current, per Leg

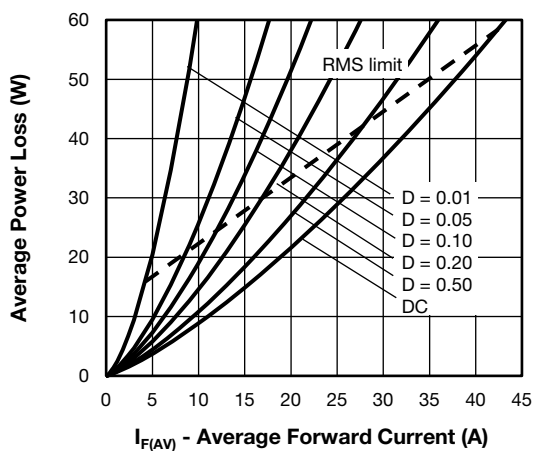


Fig. 5 - Forward Power Loss Characteristics, per Leg

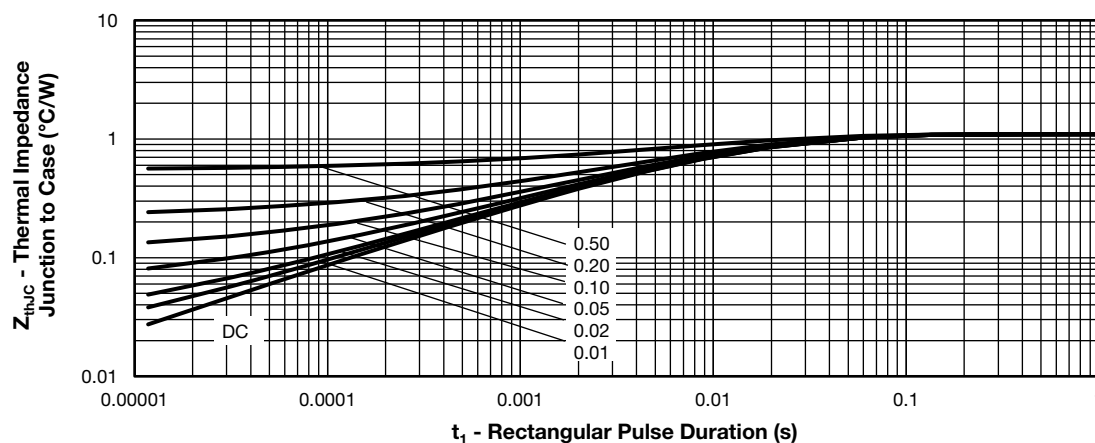
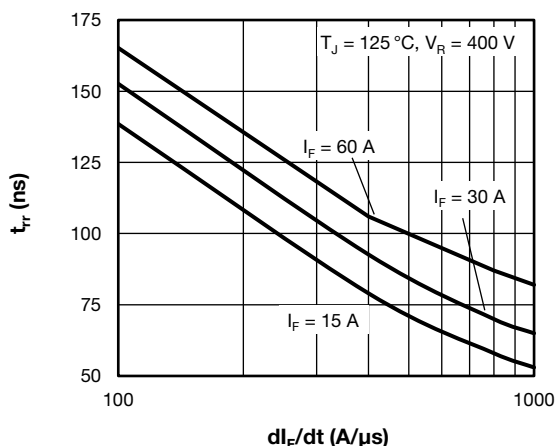
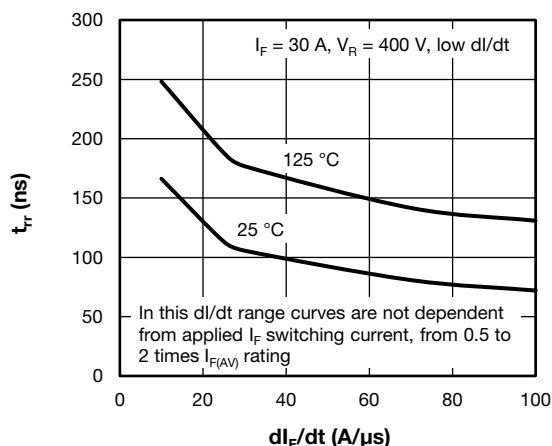
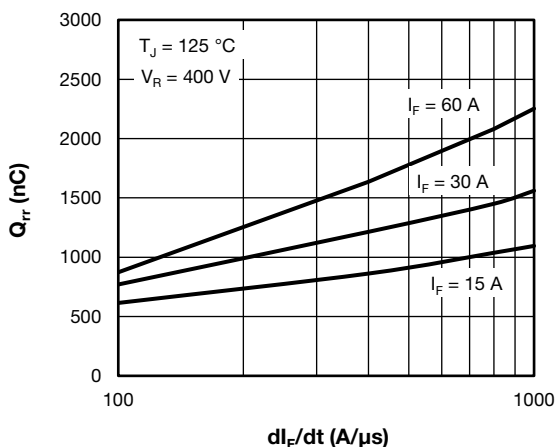
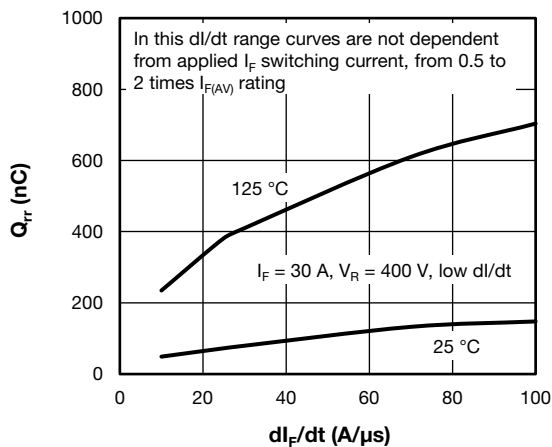
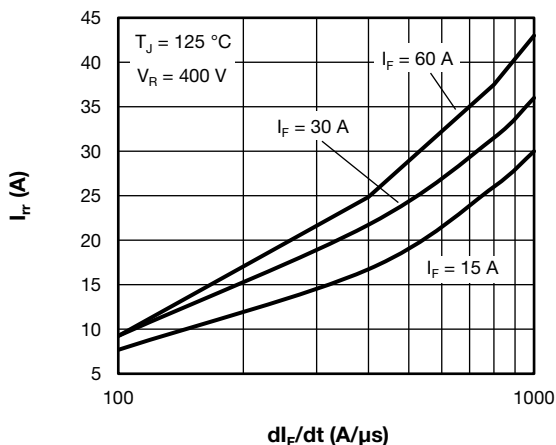
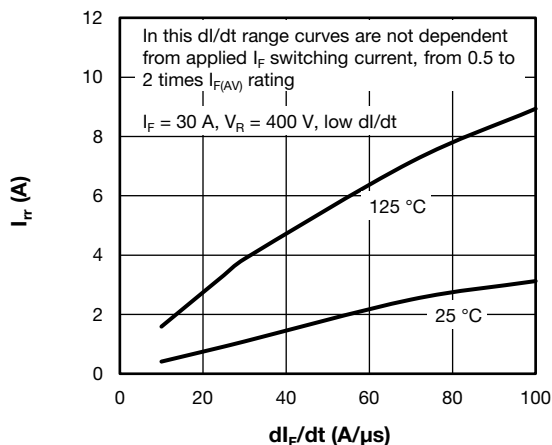


Fig. 6 - Transient Thermal Impedance, Junction to Case, per Leg


Fig. 7 - Typical Reverse Recovery Time vs.  $dI_F/dt$ , per Leg

Fig. 10 - Typical Reverse Recovery Time vs.  $dI_F/dt$ , per Leg

Fig. 8 - Typical Reverse Recovery Charge vs.  $dI_F/dt$ , per Leg

Fig. 11 - Typical Reverse Recovery Charge vs.  $dI_F/dt$ , per Leg

Fig. 9 - Typical Reverse Recovery Current vs.  $dI_F/dt$ , per Leg

Fig. 12 - Typical Reverse Recovery Current vs.  $dI_F/dt$ , per Leg

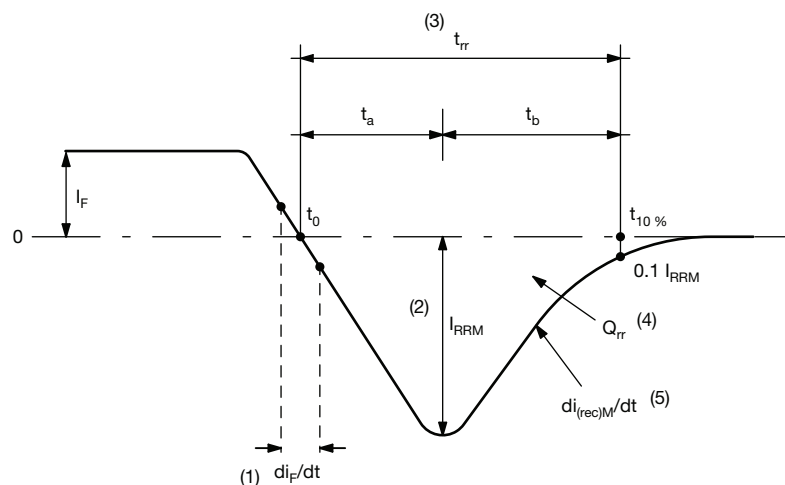


Fig. 13 - Reverse Recovery Waveform and Definitions

**Notes**

- (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  $t_0$ , crossing point of negative going  $I_F$ , to point  $t_{10\%}$ ,  $0.1 I_{RRM}$
- (4)  $Q_{rr}$  - area under curve defined by  $t_0$  and  $t_{10\%}$

$$Q_{rr} = \int_{t_0}^{t_{10\%}} I(t) dt$$

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

**ORDERING INFORMATION TABLE**

Device code	VS-	C	5	P	H	60	06	L	H	N3
	1	2	3	4	5	6	7	8	9	10
1	Vishay Semiconductors product									
2	Circuit configuration C = common cathode									
3	FRED Pt® Gen 5									
4	P = TO-247 package									
5	Process type: H = hyperfast recovery									
6	Current rating (60 = 60 A)									
7	Voltage rating (06 = 600 V)									
8	Package: L = long lead (TO-247AD)									
9	H = AEC-Q101 qualified									
10	Environmental digit: N3 = halogen-free, RoHS-compliant, and totally lead (Pb)-free									

**ORDERING INFORMATION (Example)**

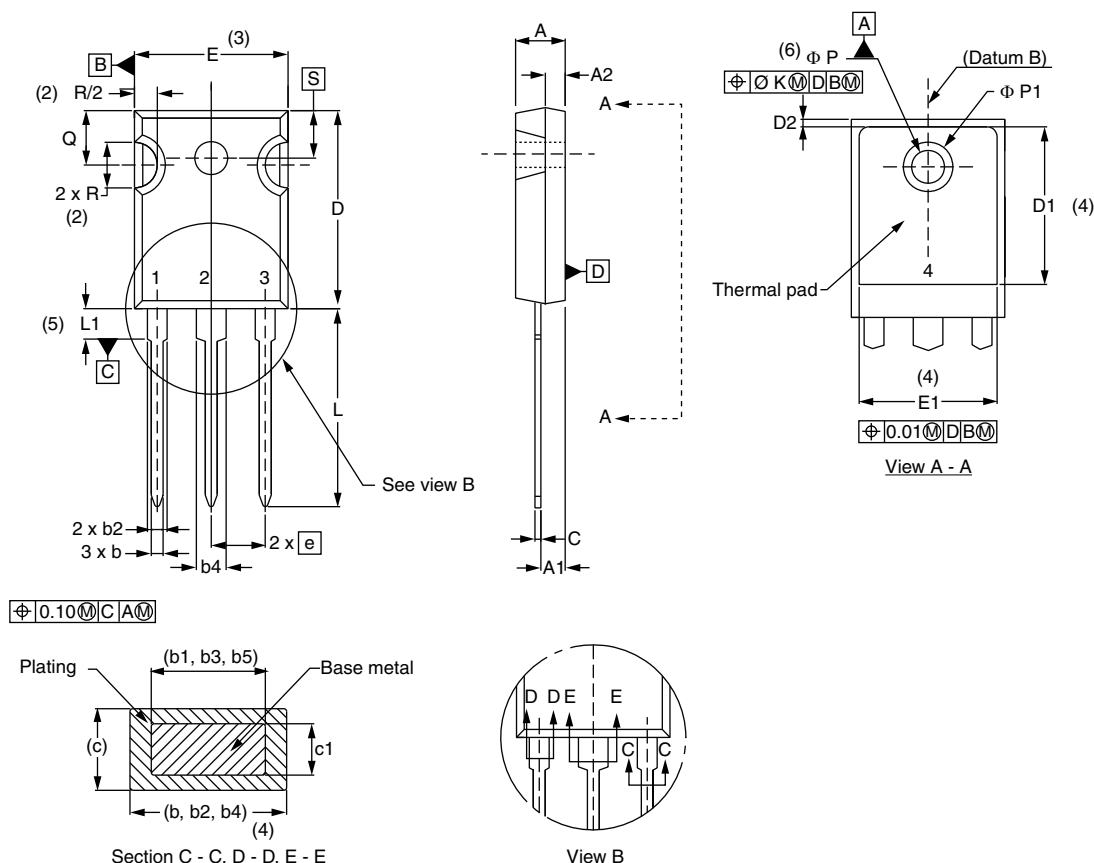
PREFERRED P/N	QUANTITY PER TUBE	MINIMUM ORDER QUANTITY	PACKAGING DESCRIPTION
VS-C5PH6006LHN3	25	500	Antistatic plastic tube

**LINKS TO RELATED DOCUMENTS**

Dimensions	<a href="http://www.vishay.com/doc?95626">www.vishay.com/doc?95626</a>
Part marking information	<a href="http://www.vishay.com/doc?95007">www.vishay.com/doc?95007</a>

### TO-247AD 3L

**DIMENSIONS** in millimeters and inches



SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	4.65	5.31	0.183	0.209	
A1	2.21	2.59	0.087	0.102	
A2	1.50	2.49	0.059	0.098	
b	0.99	1.40	0.039	0.055	
b1	0.99	1.35	0.039	0.053	
b2	1.65	2.39	0.065	0.094	
b3	1.65	2.34	0.065	0.092	
b4	2.59	3.43	0.102	0.135	
b5	2.59	3.38	0.102	0.133	
c	0.38	0.89	0.015	0.035	
c1	0.38	0.84	0.015	0.033	
D	19.71	20.70	0.776	0.815	3
D1	13.08	-	0.515	-	4

SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
D2	0.51	1.30	0.020	0.051	
E	15.29	15.87	0.602	0.625	3
E1	13.46	-	0.53	-	
e	5.46 BSC		0.215 BSC		
Ø K	0.254		0.010		
L	19.81	20.32	0.780	0.800	
L1	3.71	4.29	0.146	0.169	
Ø P	3.56	3.66	0.14	0.144	
Ø P1	-	6.98	-	0.275	
Q	5.31	5.69	0.209	0.224	
R	4.52	5.49	0.178	0.216	
S	5.51 BSC		0.217 BSC		

#### Notes

- Dimensioning and tolerancing per ASME Y14.5M-1994
- Contour of slot optional
- Dimension D and E do not include mold flash. These dimensions are measured at the outermost extremes of the plastic body
- Thermal pad contour optional with dimensions D1 and E1
- Lead finish uncontrolled in L1
- Ø P to have a maximum draft angle of 1.5 to the top of the part with a maximum hole diameter of 3.91 mm (0.154")
- Outline conforms to JEDEC® outline TO-247 with exception of dimension A min., D, E min., Q min., S, and note 4



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