

# Varistor Products

## High Energy Industrial

### HB34, HF34 and HG34 Varistor Series



The HB34, HF34, and HG34 Series of transient surge suppressors are industrial high-energy Metal-Oxide Varistors (MOVs). They are designed to provide surge suppression in the AC mains outdoor and service entrance environment (distribution panels) of buildings. Applications also include industrial heavy motors, controls, and power supplies such as used in the oil-drilling, mining, and transportation fields, including HVAC and motor/generator applications.

The HB34 Series provides rigid terminals for through-hole solder mounting on printed circuit boards, thereby eliminating the need for screw mounting. The HF34 Series has the same rigid through-hole terminals as the HB34 with the addition of mounting holes for bolt-down mounting and longer terminals to allow for additional mounting flexibility. The HG34 has formed feet with mounting holes for vertical bolt-down mounting.

See Ratings and Specifications table for part numbers.

#### Features

- Wide Operating Voltage Range  
 $V_{M(AC)RMS}$  ..... 110V to 750V
- High Energy Absorption  
 Capability .....  $W_{TM} = 220J$  to 1050J
- High Peak Pulse Current  
 Capability .....  $I_{TM} = 40,000A$
- Rigid Terminals for Secure Through-Hole Solder Mounting
- No Derating Up to 85°C Ambient

**AGENCY APPROVALS:** Recognized under the components program of Underwriters Laboratories. Certified by CSA.

**AGENCY FILE NUMBERS:** UL E75961, CSA LR91788.



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**Absolute Maximum Ratings** For ratings of individual members of a series, see Device Ratings and Specifications chart

	Hx34 SERIES	UNITS
Continuous:		
Steady State Applied Voltage:		
AC Voltage Range ( $V_{M(AC)RMS}$ )	110 to 750	V
DC Voltage Range ( $V_{M(DC)}$ )	148 to 970	V
Transient:		
Peak Pulse Current ( $I_{TM}$ )		
For 8/20 $\mu$ s Current Wave (See Figure 2)	40,000	A
Single Pulse Energy Range		
For 2ms Current Square Wave ( $W_{TM}$ )	220 to 1050	J
Operating Ambient Temperature Range ( $T_A$ )	-55 to 85	°C
Storage Temperature Range ( $T_{STG}$ )	-55 to 125	°C
Temperature Coefficient ( $\alpha_V$ ) of Clamping Voltage ( $V_C$ ) at Specified Test Current	<0.01	%/°C

*CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.*

## Device Ratings and Specifications

MODEL NUMBER	SIZE (mm)	MAXIMUM RATINGS (85°C)				SPECIFICATIONS (25°C)				
		CONTINUOUS		TRANSIENT		VARISTOR VOLTAGE AT 1mA DC TEST CURRENT			MAXIMUM CLAMPING VOLTAGE ( $V_C$ ) AT 200A (8/20 $\mu$ s)	TYPICAL CAPACITANCE
		$V_{RMS}$	$V_{DC}$	ENERGY (2ms)	PEAK CURRENT (8/20 $\mu$ s)					
		$V_{M(AC)}$	$V_{M(DC)}$	$W_{TM}$	$I_{TM}$	MIN (V)	$V_{N(DC)}$ (V)	MAX (V)	$V_C$ (V)	f = 1MHz (pF)
V111HB34	34	110	148	220	40,000 <sup>5</sup>	156	173	190	288	11,600
V131HB34	34	130	175	270	40,000 <sup>1</sup>	184	200	228	345	10,000
V141HB34	34	140	188	291	40,000 <sup>2</sup>	198	220	248	375	9,000
V151HB34	34	150	200	300	40,000 <sup>4</sup>	212	240	268	405	8,000
V181HB34	34	180	240	330	40,000	254	282	310	468	6,800
V201HB34	34	200	265	350	40,000	283	314	345	533	6,350
V251HB34	34	250	330	370	40,000	354	390	429	650	5,000
V271HB34	34	275	370	400	40,000	389	430	473	730	4,500
V301HB34	34	300	410	430	40,000	433	478	526	780	4,100
V321HB34	34	320	420	460	40,000	462	510	561	830	3,800
V331HB34	34	330	435	475	40,000	467	519	570	843	3,750
V351HB34	34	350	460	500	40,000	495	550	604	894	3,600

NOTE: Average power dissipation of transients not to exceed 2.0W.

1. Peak current applies to applications rated up to 115  $V_{RMS}$ . Peak current is 30kA for applications greater than 115  $V_{RMS}$ .
2. Peak current applies to applications rated up to 123  $V_{RMS}$ . Peak Current is 30kA for applications greater than 123  $V_{RMS}$ .
3. Peak current applies to applications rated up to 132  $V_{RMS}$ . Peak Current is 30kA for applications greater than 132  $V_{RMS}$ .
4. Peak current applies to applications rated up to 97  $V_{RMS}$ . Peak Current is 30kA for applications greater than 97  $V_{RMS}$ .
5. 40kA capability depends on applications rated up to 97Vrms. 30kA applies if >97 Vrms.

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MODEL NUMBER	SIZE (mm)	MAXIMUM RATINGS (85°C)				SPECIFICATIONS (25°C)				
		CONTINUOUS		TRANSIENT		VARISTOR VOLTAGE AT 1mA DC TEST CURRENT			MAXIMUM CLAMPING VOLTAGE (V <sub>C</sub> ) AT 200A (8/20μs)	TYPICAL CAPACITANCE
		V <sub>RMS</sub>	V <sub>DC</sub>	ENERGY (2ms)	PEAK CURRENT (8/20μs)					
		V <sub>M(AC)</sub>	V <sub>M(DC)</sub>	W <sub>TM</sub>	I <sub>TM</sub>	MIN	V <sub>N(DC)</sub>	MAX	V <sub>C</sub>	f = 1MHz
(V)	(V)	(V)	(A)	(V)	(V)	(V)	(V)	(pF)		
V391HB34	34	385	510	550	40,000	545	604	663	1000	3,500
V421HB34	34	420	560	600	40,000	610	680	748	1,130	3,000
V441HB34	34	440	587	620	40,000	622	691	759	1,150	2,900
V481HB34	34	480	640	650	40,000	670	750	825	1,240	2,700
V511HB34	34	510	675	700	40,000	735	820	910	1,350	2,500
V551HB34	34	550	710	755	40,000	778	864	949	1,404	2,390
V571HB34	34	570	730	770	40,000	805	910	1000	1,480	2,200
V661HB34	34	660	850	900	40,000	940	1050	1160	1,720	2,000
V681HB34	34	680	875	925	40,000	962	1068	1173	1,777	1,900
V751HB34	34	750	970	1050	40,000	1080	1200	1320	2,000	1,800

NOTE: Average power dissipation of transients not to exceed 2.0W.

1. Peak current applies to applications rated up to 115 V<sub>RMS</sub>. Peak current is 30kA for applications greater than 115V<sub>RMS</sub>.
2. Peak current applies to applications rated up to 123V<sub>RMS</sub>. Peak Current is 30kA for applications greater than 123V<sub>RMS</sub>.
3. Peak current applies to applications rated up to 132V<sub>RMS</sub>. Peak Current is 30kA for applications greater than 132V<sub>RMS</sub>.
4. Peak current applies to applications rated up to 97V<sub>RMS</sub>. Peak Current is 30kA for applications greater than 97V<sub>RMS</sub>.
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MODEL NUMBER	SIZE	MAXIMUM RATINGS (85°C)				SPECIFICATIONS (25°C)				
		CONTINUOUS		TRANSIENT		VARISTOR VOLTAGE AT 1mA DC TEST CURRENT			MAXIMUM CLAMPING VOLTAGE (V <sub>C</sub> ) AT 200A (8/20μs)	TYPICAL CAPACITANCE
		V <sub>RMS</sub>	V <sub>DC</sub>	ENERGY (2ms)	PEAK CURRENT (8/20μs)					
		V <sub>M(AC)</sub>	V <sub>M(DC)</sub>	W <sub>TM</sub>	I <sub>TM</sub>	MIN	V <sub>N(DC)</sub>	MAX	V <sub>C</sub>	f = 1MHz
(mm)	(V)	(V)	(J)	(A)	(V)	(V)	(V)	(V)	(pF)	
V111HF34	34	110	148	220	40,000 <sup>5</sup>	156	173	190	288	11,600
V131HF34	34	130	175	270	40,000 <sup>2</sup>	184	200	228	345	10,000
V141HF34	34	140	188	291	40,000 <sup>3</sup>	198	220	248	375	9,000
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V181HF34	34	180	240	330	40,000	254	282	310	468	6,800
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V321HF34	34	320	420	460	40,000	462	510	561	830	3,800
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V441HF34	34	440	587	620	40,000	622	691	759	1,150	2,900
V481HF34	34	480	640	650	40,000	670	750	825	1,240	2,700
V511HF34	34	510	675	700	40,000	735	820	910	1,350	2,500
V551HF34	34	550	710	755	40,000	778	864	949	1,404	2,390
V571HF34	34	570	730	770	40,000	805	910	1000	1,480	2,200
V661HF34	34	660	850	900	40,000	940	1050	1160	1,720	2,000
V681HF34	34	680	875	925	40,000	962	1068	1173	1777	1,900
V751HF34	34	750	970	1050	40,000	1080	1200	1320	2,000	1,800

NOTE:

1. Average power dissipation of transients not to exceed 2.0W per varistor
2. 40kA capability depends on applications rated up to 115V<sub>RMS</sub>. 30kA applies if > 115V<sub>RMS</sub>.
3. 40kA capability depends on applications rated up to 123V<sub>RMS</sub>. 30kA applies if > 123V<sub>RMS</sub>.
4. 40kA capability depends on applications rated up to 132V<sub>RMS</sub>. 30kA applies if > 132V<sub>RMS</sub>.
5. 40kA capability depends on applications rated up to 97V<sub>RMS</sub>. 30kA applies if > 97V<sub>RMS</sub>.

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		V <sub>RMS</sub>	V <sub>DC</sub>	ENERGY (2ms)	PEAK CURRENT (8/20μs)					
		V <sup>M(A<sub>C</sub>)</sup> (V)	V <sub>M(DC)</sub> (V)	W <sub>TM</sub> (J)	I <sub>TM</sub> (A)	MIN (V)	V <sub>N(DC)</sub> (V)	MAX (V)	V <sub>C</sub> (V)	f = 1MHz (pF)
V111HG34	34	110	148	220	40,000 <sup>5</sup>	156	173	190	288	11,600
V131HG34	34	140	175	270	40,000 <sup>2</sup>	184	200	228	345	10,000
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V441HG34	34	440	587	620	40,000	622	691	759	1,150	2,900
V481HG34	34	480	640	650	40,000	670	750	825	1,240	2,700
V511HG34	34	510	675	700	40,000	735	820	910	1,350	2,500
V551HG34	34	550	710	755	40,000	778	864	949	1,404	2,390
V571HG34	34	570	730	770	40,000	805	910	1000	1,480	2,200
V661HG34	34	660	850	900	40,000	940	1050	1160	1,720	2,000
V681HG34	34	680	875	925	40,000	962	1068	1173	1,777	1,900
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NOTE:

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3. 40kA capability depends on applications rated up to 123V<sub>RMS</sub> 30kA applies if > 123 V<sub>RMS</sub>.
4. 40kA capability depends on applications rated up to 132V<sub>RMS</sub> 30kA applies if > 132 V<sub>RMS</sub>.
5. 40kA capability depends on applications rated up to 97V<sub>RMS</sub> 30kA applies if > 97 V<sub>RMS</sub>.

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### Power Dissipation Ratings

Should transients occur in rapid succession, the average power dissipation result is simply the energy (watt-seconds) per pulse times the number of pulses per second. The power so developed must be within the specifications shown on the Device Ratings and Specifications table for the specific device. The operating values must be derated as shown in Figure 1.

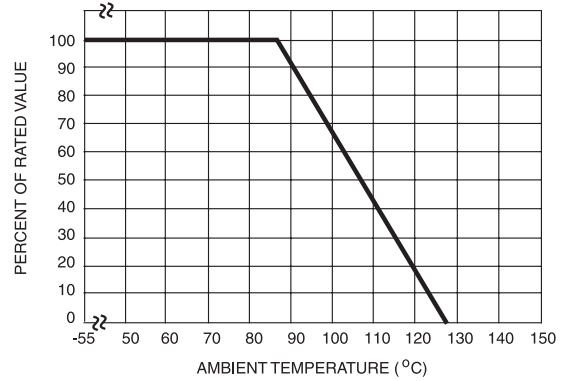
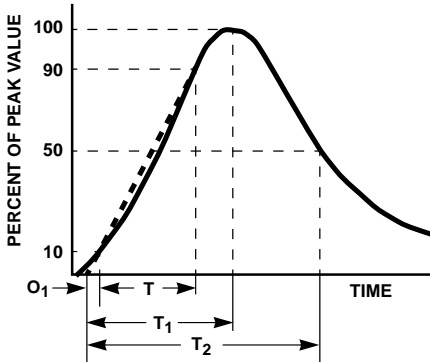


FIGURE 1. CURRENT, ENERGY AND POWER DERATING CURVE



$O_1$  = Virtual Origin of Wave  
 $T$  = Time From 10% to 90% of Peak  
 $T_1$  = Virtual Front time =  $1.25 \cdot t$   
 $T_2$  = Virtual Time to Half Value (Impulse Duration)  
 Example: For an  $8/20\mu s$  Current Waveform:  
 $8\mu s = T_1 =$  Virtual Front Time  
 $20\mu s = T_2 =$  Virtual Time to Half Value

FIGURE 2. PEAK PULSE CURRENT TEST WAVEFORM

### Transient V-I Characteristics Curves

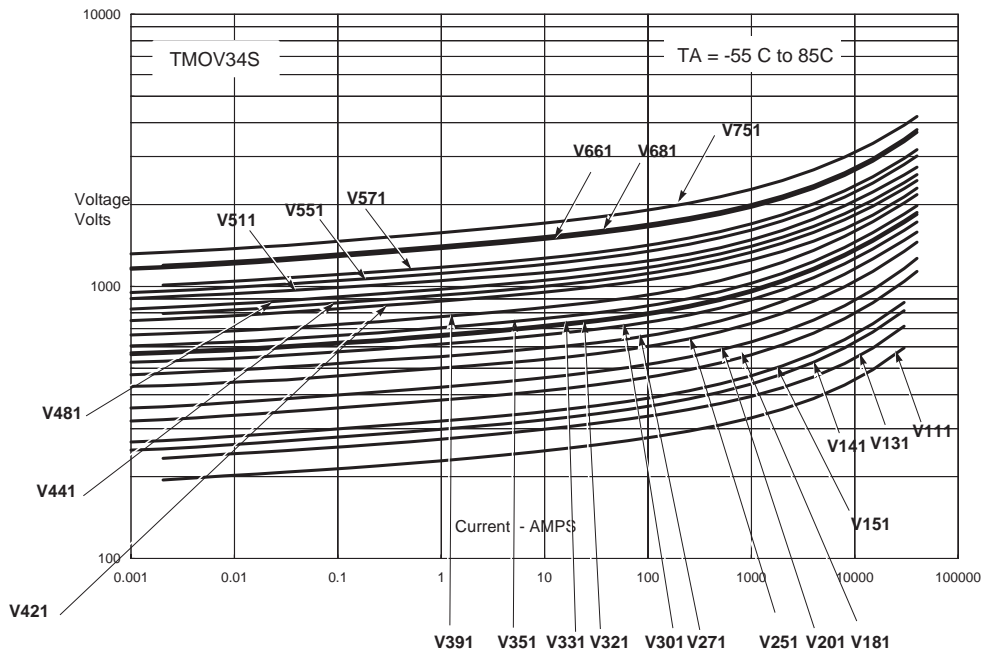


FIGURE 3. CLAMPING VOLTAGE FOR HB34, HF34 and HG34 SERIES

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### Pulse Rating Curves

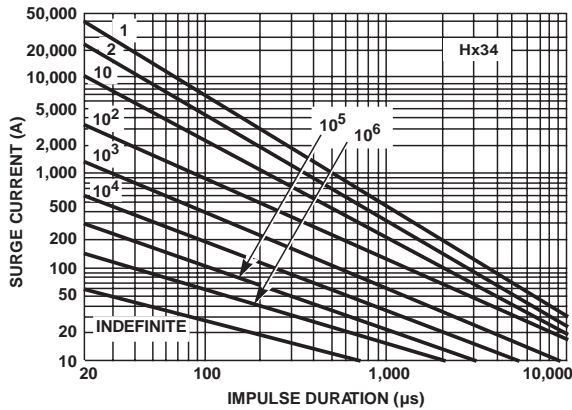
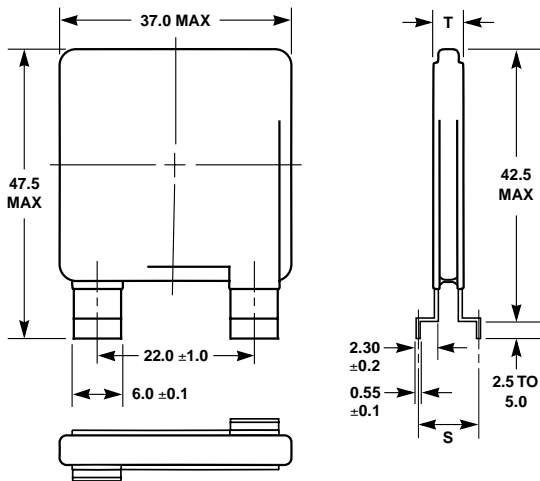


FIGURE 6. SURGE CURRENT RATING CURVES FOR HB34, HF34 and HG34

NOTE: If pulse ratings are exceeded, a shift of  $V_{N(DC)}$  (at specified current) of more than  $\pm 10\%$  could result. This type of shift, which normally results in a decrease of  $V_{N(DC)}$ , may result in the device not meeting the original published specifications, but it does not prevent the device from continuing to function, and to provide ample protection.

### Mechanical Dimensions HB34



NOTE: Dimension in mm is typical, unless otherwise specified.

### Ordering Information

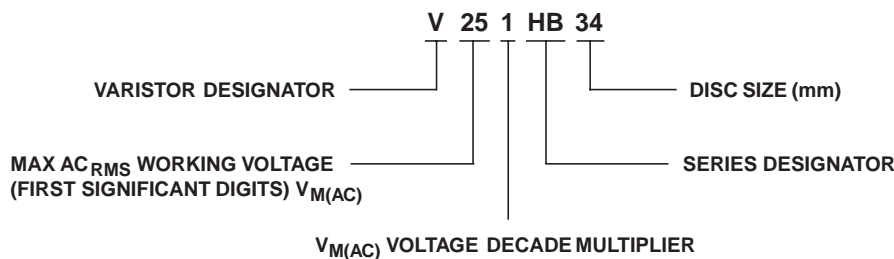


TABLE OF DIMENSIONS - THICKNESS AND TERMINAL OFFSETS

PART TYPE	T BODY THICKNESS (MAXIMUM)	S MOUNTING TERMINAL OFFSET
V111HB34	5.5	5.30 ±0.65
V131HB34	5.7	5.50 ±0.65
V141HB34	5.8	5.70 ±0.65
V151HB34	5.9	5.90 ±0.65
V181HB34	6.0	6.10 ±0.65
V201HB34	6.0	6.10 ±0.65
V251HB34	6.1	6.25 ±0.65
V271HB34	6.4	6.50 ±0.65
V301HB34	6.7	6.70 ±0.65
V321HB34	6.9	6.90 ±0.65
V331HB34	7.0	6.95 ±0.85
V351HB34	7.3	7.20 ±0.85
V391HB34	7.6	7.50 ±0.85
V421HB34	7.8	7.85 ±0.85
V441HB34	8.0	7.95 ±1.00
V481HB34	8.3	8.25 ±1.00
V511HB34	8.8	8.60 ±1.00
V551HB34	9.1	8.55 ±1.5
V571HB34	9.4	8.85 ±1.5
V661HB34	10.2	9.65 ±1.5
V681HB34	10.4	10.35 ±1.5
V751HB34	10.7	10.65 ±1.5

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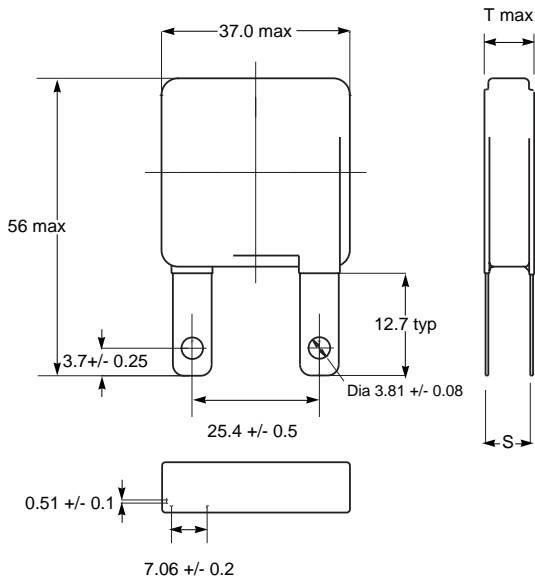
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### Mechanical Dimensions HF34

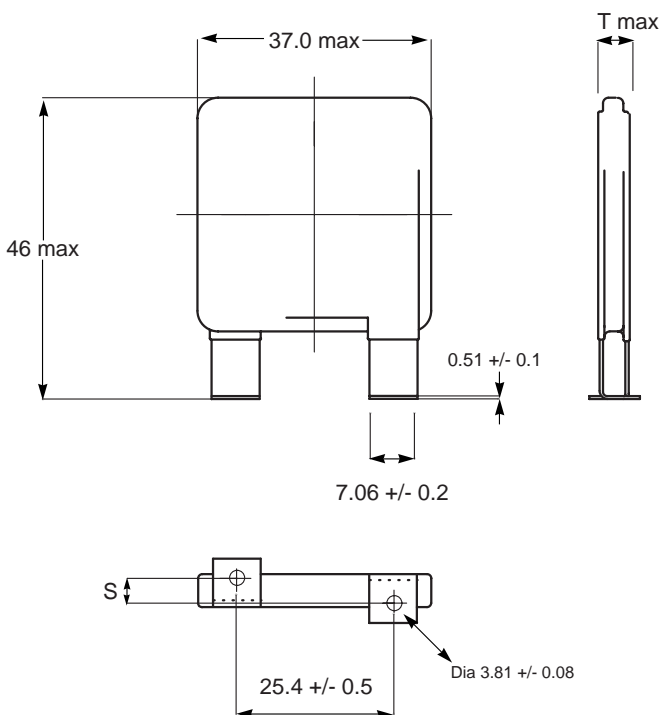


Note: Terminal Material Tin Plated Copper

TABLE OF DIMENSIONS - THICKNESS AND TERMINAL OFFSETS

PART TYPE	T BODY THICKNESS (MAXIMUM)	S MOUNTING TERMINAL OFFSET
V111HF34	5.5	2.0 ± 0.65
V131HF34	5.7	2.1 ± 0.65
V141HF34	5.8	2.2 ± 0.65
V151HF34	5.9	2.4 ± 0.65
V181HF34	6.0	2.5 ± 0.65
V201HF34	6.0	2.6 ± 0.65
V251HF34	6.1	2.7 ± 0.85
V271HF34	6.4	2.9 ± 0.85
V301HF34	6.7	3.2 ± 0.85
V321HF34	6.9	3.4 ± 0.85
V331HF34	7.0	3.5 ± 0.85
V351HF34	7.3	3.9 ± 0.85
V391HF34	7.6	4.2 ± 0.85
V421HF34	7.8	4.4 ± 0.85
V441HF34	8.0	4.5 ± 0.85
V481HF34	8.3	4.8 ± 1.0
V511HF34	8.8	5.2 ± 1.0
V551HF34	9.1	5.5 ± 1.0
V571HF34	9.4	5.7 ± 1.5
V661HF34	10.2	6.5 ± 1.5
V681HF34	10.4	6.7 ± 1.5
V751HF34	10.7	7.3 ± 1.5

### Mechanical Dimensions HG34



Note: Terminal Material Tin Plated Copper

TABLE OF DIMENSIONS - THICKNESS AND TERMINAL OFFSETS

PART TYPE	T BODY THICKNESS (MAXIMUM)	S MOUNTING TERMINAL OFFSET
V111HG34	5.5	6.0 ± 0.65
V131HG34	5.7	5.8 ± 0.65
V141HG34	5.8	5.6 ± 0.65
V151HG34	5.9	5.5 ± 0.65
V181HG34	6.0	5.4 ± 0.65
V201HG34	6.0	5.4 ± 0.65
V251HG34	6.1	5.2 ± 0.65
V271HG34	6.4	4.9 ± 0.65
V301HG34	6.7	4.7 ± 0.85
V321HG34	6.9	4.5 ± 0.85
V331HG34	7.0	4.4 ± 0.85
V351HG34	7.3	4.1 ± 0.85
V391HG34	7.6	3.8 ± 0.85
V421HG34	7.8	3.5 ± 0.85
V441HG34	8.0	3.3 ± 0.85
V481HG34	8.3	3.1 ± 1.0
V511HG34	8.8	2.7 ± 1.0
V551HG34	9.1	2.4 ± 1.0
V571HG34	9.4	2.2 ± 1.5
V661HG34	10.2	1.4 ± 1.5
V681HG34	10.4	1.2 ± 1.5
V751HG34	10.7	0.6 ± 1.5