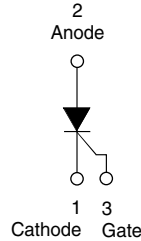


## Surface Mountable Phase Control SCR, 16 A



D<sup>2</sup>PAK



### DESCRIPTION/FEATURES

The 16TTS..SPbF High Voltage Series of silicon controlled rectifiers are specifically designed for medium power switching and phase control applications. The glass passivation technology used has reliable operation up to 125 °C junction temperature.



RoHS\*  
COMPLIANT

Typical applications are in input rectification (soft start) and these products are designed to be used with Vishay HPP input diodes, switches and output rectifiers which are available in identical package outlines.

This product has been designed and qualified for industrial level and lead (Pb)-free ("PbF" suffix).

PRODUCT SUMMARY	
$V_T$ at 10 A	< 1.4 V
$I_{TSM}$	200 A
$V_{RRM}$	800/1200 V

OUTPUT CURRENT IN TYPICAL APPLICATIONS			
APPLICATIONS	SINGLE-PHASE BRIDGE	THREE-PHASE BRIDGE	UNITS
NEMA FR-4 or G-10 glass fabric-based epoxy with 4 oz. (140 μm) copper	2.5	3.5	A
Aluminum IMS, $R_{thCA} = 15 \text{ °C/W}$	6.3	9.5	
Aluminum IMS with heatsink, $R_{thCA} = 5 \text{ °C/W}$	14.0	18.5	

**Note**

- $T_A = 55 \text{ °C}$ ,  $T_J = 125 \text{ °C}$ , footprint 300 mm<sup>2</sup>

MAJOR RATINGS AND CHARACTERISTICS			
SYMBOL	CHARACTERISTICS	VALUES	UNITS
$I_{T(AV)}$	Sinusoidal waveform	10	A
$I_{RMS}$		16	
$V_{RRM}/V_{DRM}$		800/1200	V
$I_{TSM}$		200	A
$V_T$	10 A, $T_J = 25 \text{ °C}$	1.4	V
dV/dt		500	V/μs
dI/dt		150	A/μs
$T_J$		- 40 to 125	°C

VOLTAGE RATINGS			
PART NUMBER	$V_{RRM}$ , MAXIMUM PEAK REVERSE VOLTAGE V	$V_{DRM}$ , MAXIMUM PEAK DIRECT VOLTAGE V	$I_{RRM}/I_{DRM}$ AT 125 °C mA
16TTS08SPbF	800	800	10
16TTS12SPbF	1200	1200	

\* Pb containing terminations are not RoHS compliant, exemptions may apply

# 16TTS..SPbF High Voltage Series



Vishay High Power Products Surface Mountable Phase Control SCR, 16 A

ABSOLUTE MAXIMUM RATINGS						
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES		UNITS	
			TYP.	MAX.		
Maximum average on-state current	$I_{T(AV)}$	$T_C = 93\text{ }^\circ\text{C}$ , 180° conduction, half sine wave	10		A	
Maximum RMS on-state current	$I_{RMS}$		16			
Maximum peak, one-cycle, non-repetitive surge current	$I_{TSM}$	10 ms sine pulse, rated $V_{RRM}$ applied	170			
		10 ms sine pulse, no voltage reapplied	200			
Maximum $I^2t$ for fusing	$I^2t$	10 ms sine pulse, rated $V_{RRM}$ applied	144		A <sup>2</sup> s	
		10 ms sine pulse, no voltage reapplied	200			
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	$t = 0.1$ to 10 ms, no voltage reapplied	2000		A <sup>2</sup> √s	
Maximum on-state voltage drop	$V_{TM}$	16 A, $T_J = 25\text{ }^\circ\text{C}$	1.4		V	
On-state slope resistance	$r_t$	$T_J = 125\text{ }^\circ\text{C}$	24.0		mΩ	
Threshold voltage	$V_{T(TO)}$		1.1		V	
Maximum reverse and direct leakage current	$I_{RM}/I_{DM}$	$V_R = \text{Rated } V_{RRM}/V_{DRM}$	$T_J = 25\text{ }^\circ\text{C}$	0.5		mA
			$T_J = 125\text{ }^\circ\text{C}$	10		
Holding current	$I_H$	Anode supply = 6 V, resistive load, initial $I_T = 1$ A	-	100		
Maximum latching current	$I_L$	Anode supply = 6 V, resistive load	200			
Maximum rate of rise of off-state voltage	$dV/dt$		500		V/μs	
Maximum rate of rise of turned-on current	$dI/dt$		150		A/μs	

TRIGGERING					
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS	
Maximum peak gate power	$P_{GM}$		8.0	W	
Maximum average gate power	$P_{G(AV)}$		2.0		
Maximum peak positive gate current	+ $I_{GM}$		1.5	A	
Maximum peak negative gate voltage	- $V_{GM}$		10	V	
Maximum required DC gate current to trigger	$I_{GT}$	Anode supply = 6 V, resistive load, $T_J = -10\text{ }^\circ\text{C}$	90		mA
		Anode supply = 6 V, resistive load, $T_J = 25\text{ }^\circ\text{C}$	60		
		Anode supply = 6 V, resistive load, $T_J = 125\text{ }^\circ\text{C}$	35		
Maximum required DC gate voltage to trigger	$V_{GT}$	Anode supply = 6 V, resistive load, $T_J = -10\text{ }^\circ\text{C}$	3.0		V
		Anode supply = 6 V, resistive load, $T_J = 25\text{ }^\circ\text{C}$	2.0		
		Anode supply = 6 V, resistive load, $T_J = 125\text{ }^\circ\text{C}$	1.0		
Maximum DC gate voltage not to trigger	$V_{GD}$	$T_J = 125\text{ }^\circ\text{C}$ , $V_{DRM} = \text{Rated value}$	0.25		
Maximum DC gate current not to trigger	$I_{GD}$		2.0		mA

SWITCHING				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Typical turn-on time	$t_{gt}$	$T_J = 25\text{ }^\circ\text{C}$	0.9	μs
Typical reverse recovery time	$t_{rr}$	$T_J = 125\text{ }^\circ\text{C}$	4	
Typical turn-off time	$t_q$		110	



# 16TTS..SPbF High Voltage Series

Surface Mountable Phase Control SCR, 16 A Vishay High Power Products

THERMAL - MECHANICAL SPECIFICATIONS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum junction and storage temperature range	$T_J, T_{Stg}$		- 40 to 125	°C
Soldering temperature	$T_S$	For 10 s (1.6 mm from case)	240	
Maximum thermal resistance, junction to case	$R_{thJC}$	DC operation	1.3	°C/W
Typical thermal resistance, junction to ambient	$R_{thJA}$	PCB mount <sup>(1)</sup>	40	
Approximate weight			2	g
			0.07	oz.
Marking device		Case style D <sup>2</sup> PAK (SMD-220)	16TTS08S	
			16TTS12S	

**Note**

<sup>(1)</sup> When mounted on 1" square (650 mm<sup>2</sup>) PCB of FR-4 or G-10 material 4 oz. (140 μm) copper 40 °C/W.  
For recommended footprint and soldering techniques refer to application note #AN-994.

# 16TTS..SPbF High Voltage Series



Vishay High Power Products Surface Mountable Phase Control SCR, 16 A

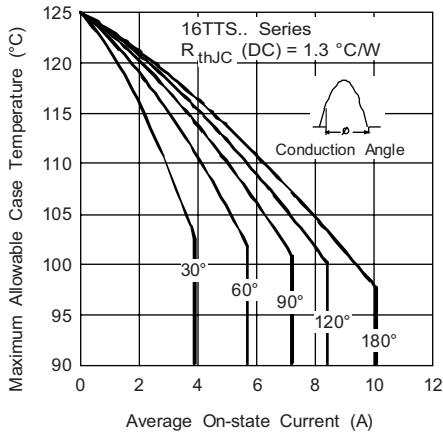


Fig. 1 - Current Rating Characteristics

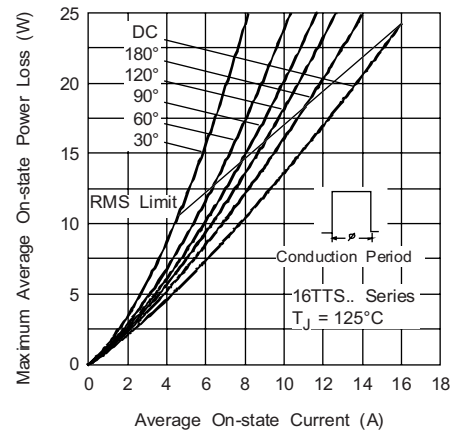


Fig. 4 - On-State Power Loss Characteristics

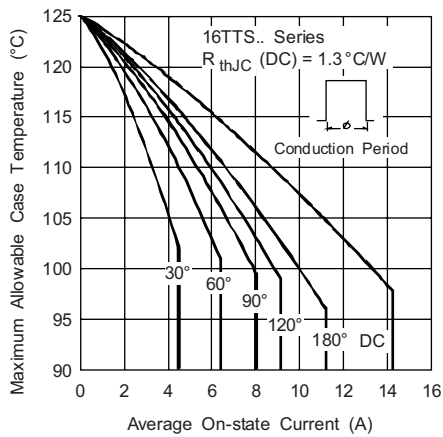


Fig. 2 - Current Rating Characteristics

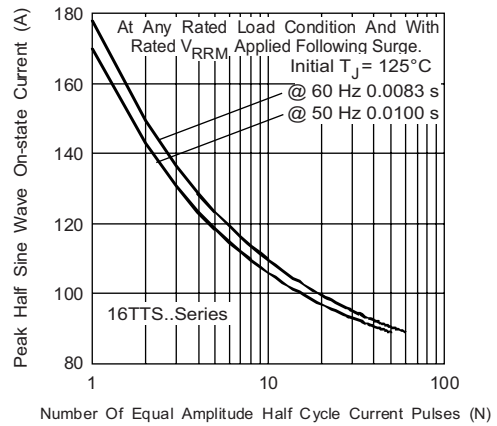


Fig. 5 - Maximum Non-Repetitive Surge Current

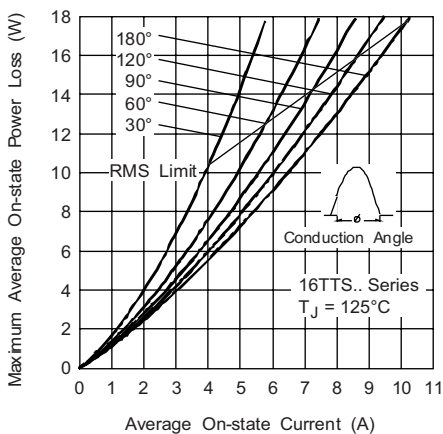


Fig. 3 - On-State Power Loss Characteristics

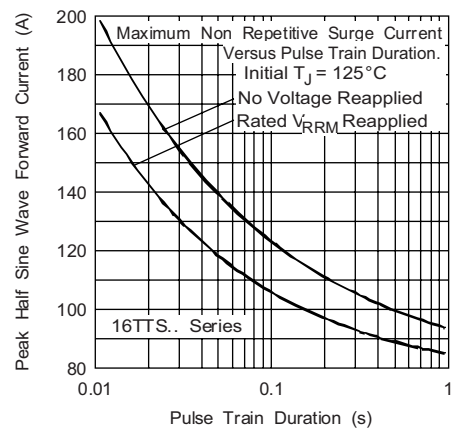


Fig. 6 - Maximum Non-Repetitive Surge Current



# 16TTS..SPbF High Voltage Series

Surface Mountable Phase Control SCR, 16 A Vishay High Power Products

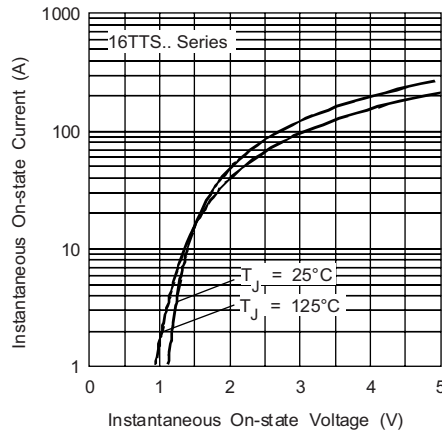


Fig. 7 - On-State Voltage Drop Characteristics

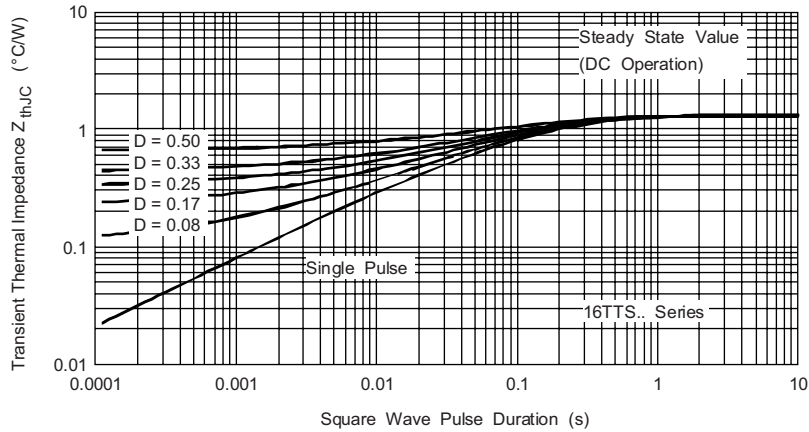


Fig. 8 - Thermal Impedance  $Z_{thJC}$  Characteristics

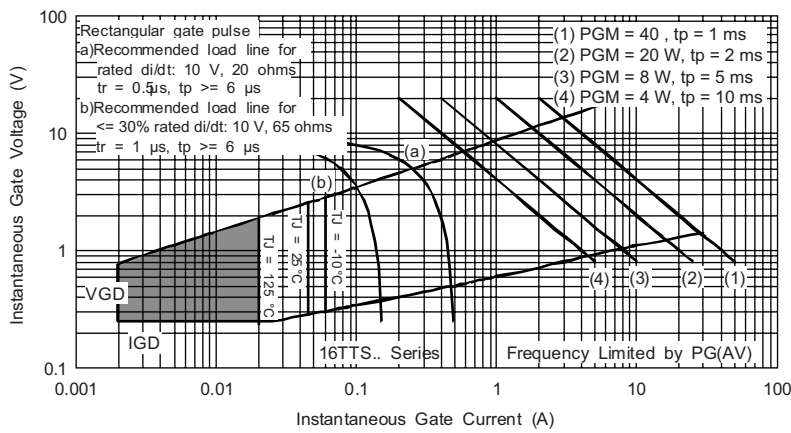


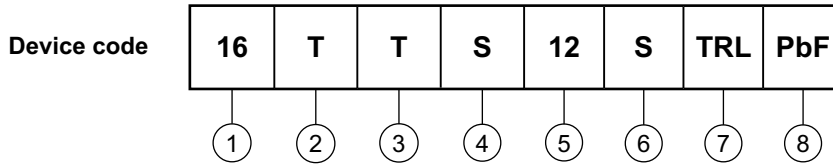
Fig. 9 - Gate Characteristics

# 16TTS..SPbF High Voltage Series



Vishay High Power Products Surface Mountable Phase Control SCR, 16 A

## ORDERING INFORMATION TABLE



- 1** - Current rating
- 2** - Circuit configuration:  
T = Single thyristor
- 3** - Package:  
T = TO-220AC
- 4** - Type of silicon:  
S = Standard recovery rectifier
- 5** - Voltage rating: Voltage code x 100 =  $V_{RRM}$  — 

08 = 800 V
12 = 1200 V
- 6** - S = TO-220 D<sup>2</sup>PAK (SMD-220) version
- 7** -
  - None = Tube
  - TRL = Tape and reel (left oriented)
  - TRR = Tape and reel (right oriented)
- 8** -
  - None = Standard production
  - PbF = Lead (Pb)-free

LINKS TO RELATED DOCUMENTS	
Dimensions	<a href="http://www.vishay.com/doc?95046">http://www.vishay.com/doc?95046</a>
Part marking information	<a href="http://www.vishay.com/doc?95054">http://www.vishay.com/doc?95054</a>
Packaging information	<a href="http://www.vishay.com/doc?95032">http://www.vishay.com/doc?95032</a>



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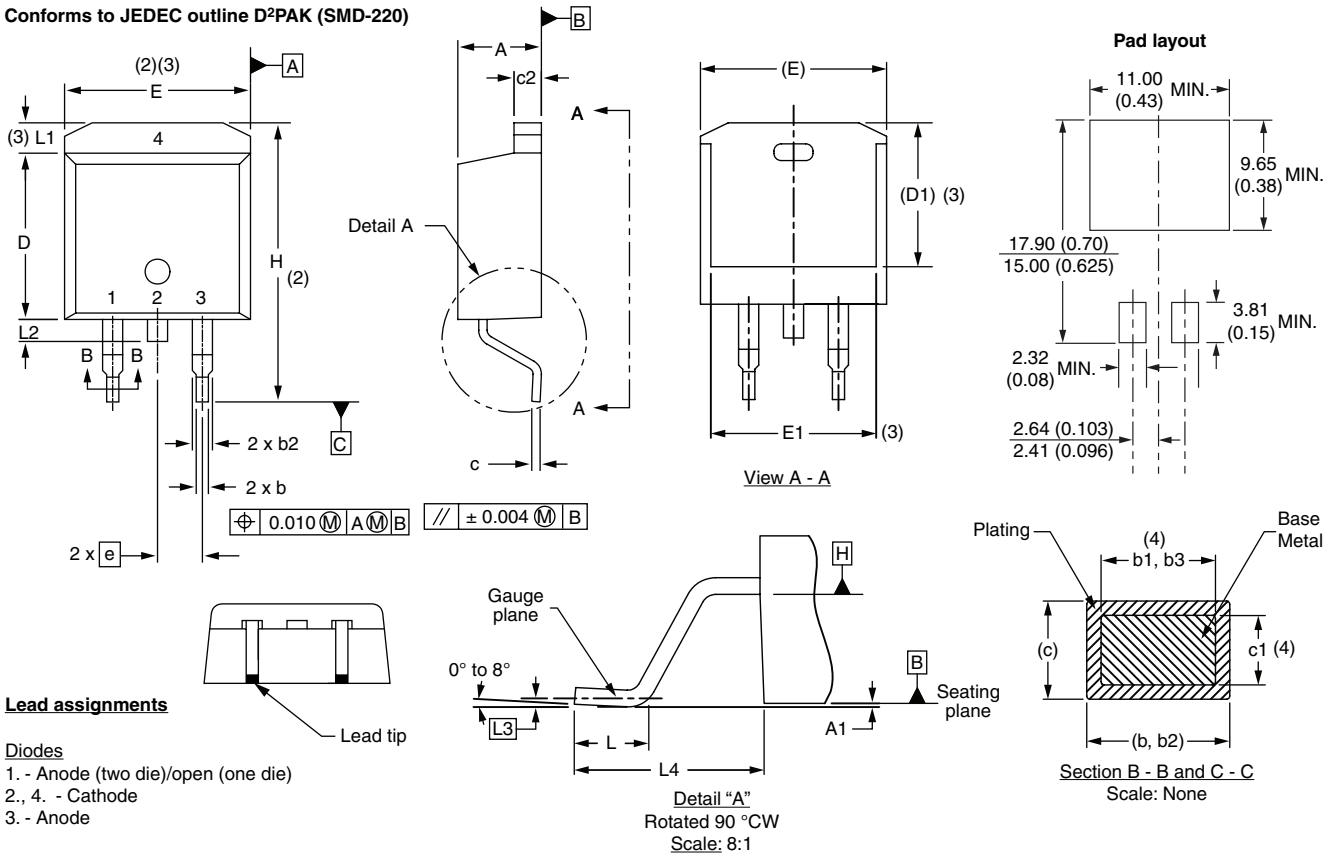
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## D<sup>2</sup>PAK

### DIMENSIONS in millimeters and inches

Conforms to JEDEC outline D<sup>2</sup>PAK (SMD-220)



SYMBOL	MILLIMETERS		INCHES		NOTES	SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.			MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	0.160	0.190		D1	6.86	-	0.270	-	3
A1	0.00	0.254	0.000	0.010		E	9.65	10.67	0.380	0.420	2, 3
b	0.51	0.99	0.020	0.039		E1	6.22	-	0.245	-	3
b1	0.51	0.89	0.020	0.035	4	e	2.54 BSC		0.100 BSC		
b2	1.14	1.78	0.045	0.070		H	14.61	15.88	0.575	0.625	
b3	1.14	1.73	0.045	0.068	4	L	1.78	2.79	0.070	0.110	
c	0.38	0.74	0.015	0.029		L1	-	1.65	-	0.066	3
c1	0.38	0.58	0.015	0.023	4	L2	1.27	1.78	0.050	0.070	
c2	1.14	1.65	0.045	0.065		L3	0.25 BSC		0.010 BSC		
D	8.51	9.65	0.335	0.380	2	L4	4.78	5.28	0.188	0.208	

### Notes

- (1) Dimensioning and tolerancing per ASME Y14.5 M-1994
- (2) Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outmost extremes of the plastic body
- (3) Thermal pad contour optional within dimension E, L1, D1 and E1
- (4) Dimension b1 and c1 apply to base metal only
- (5) Datum A and B to be determined at datum plane H
- (6) Controlling dimension: inch
- (7) Outline conforms to JEDEC outline TO-263AB

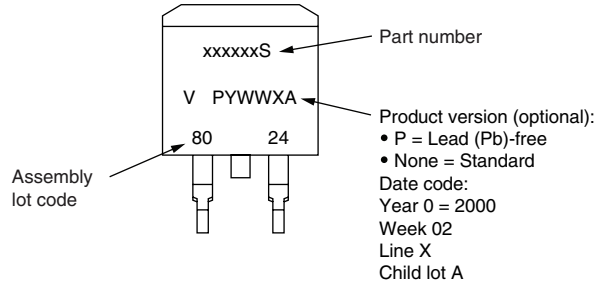




# Part Marking Information

Vishay High Power Products

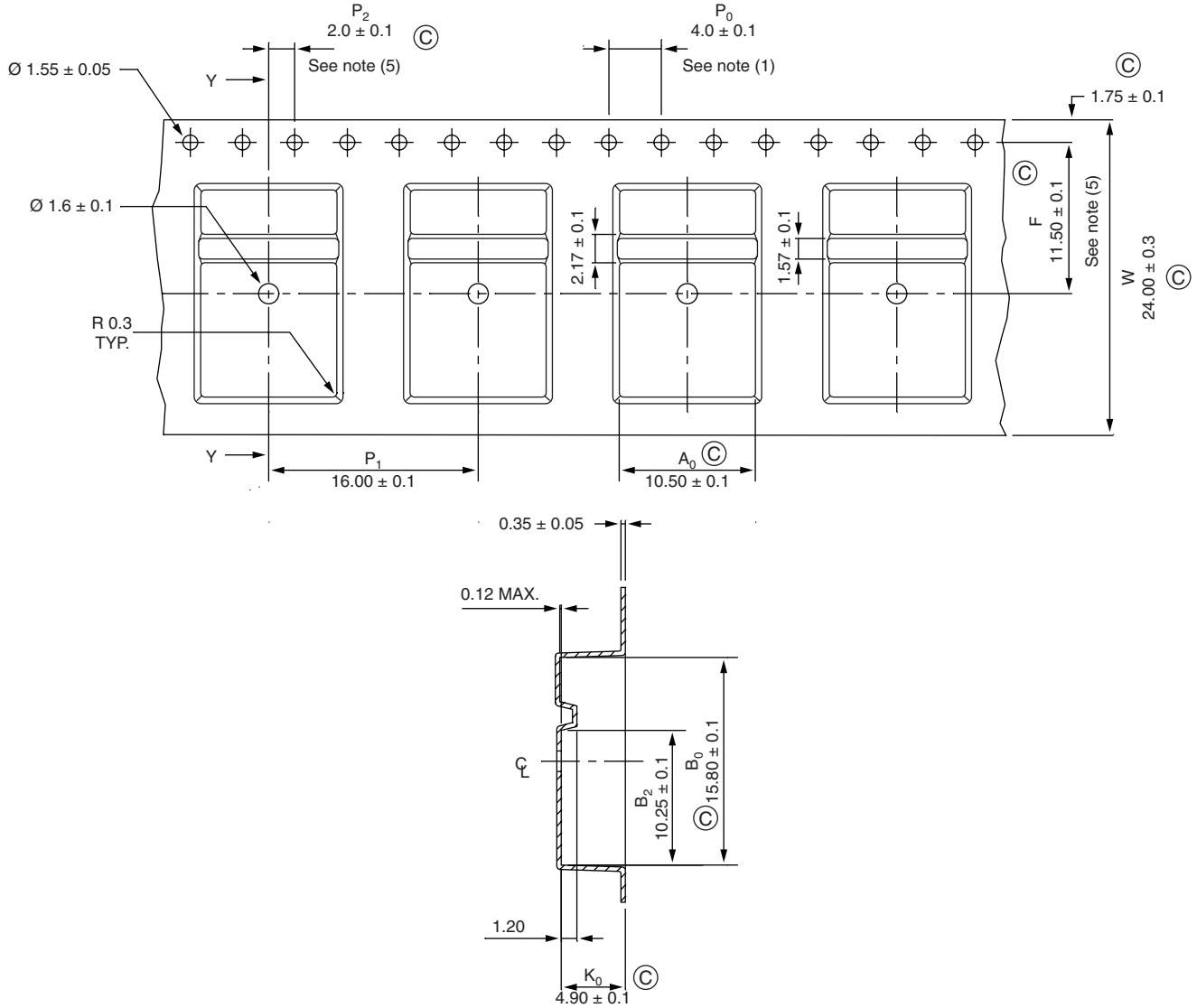
## D<sup>2</sup>PAK



Example: This is a xxxxxxS with assembly lot code 8024, assembled on WW 02, 2000

### D<sup>2</sup>PAK

#### TAPE AND REEL INFORMATION in millimeters (inches)



Section Y - Y

#### Notes

- (1) 10 sprocket hole pitch cumulative tolerance  $\pm 0.02$
- (2) Camber not to exceed 1 mm in 100 mm
- (3) Material: conductive black styrenic alloy
- (4)  $K_0$  measured from a plane on the inside bottom of the pocket to the top surface of the carrier
- (5) Measured from centerline of sprocket hole to centerline of pocket
- (6) Vendor: (optional)
- (7) Must also meet requirements of EIA standard # EIA-481A taping of surface mount components for automatic placement
- (8) Surface resistivity of molded material must measure less or equal to  $10^6 \Omega$  per square. Measured in accordance to procedure given in ASTM D-257 and ASTM D-991
- (9) Total length per reel must be 45 m
- (10) Ⓢ critical