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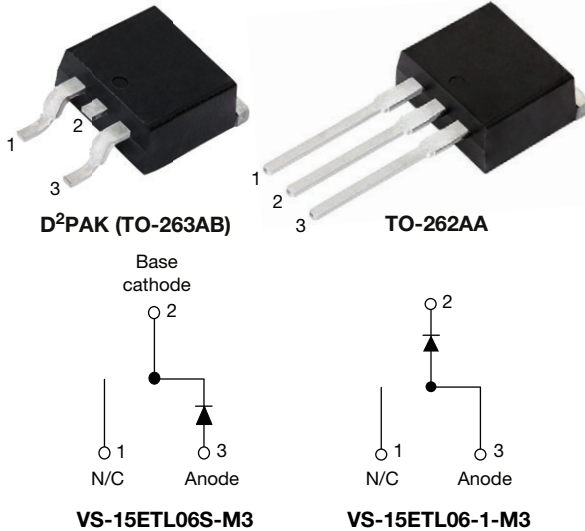
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Ultralow V_F Hyperfast Rectifier for Discontinuous Mode PFC, 15 A FRED Pt[®]



FEATURES

- Benchmark ultralow forward voltage drop
- Hyperfast recovery time
- Low leakage current
- 175 °C operating junction temperature
- Meets MSL level 1, per J-STD-020, LF maximum peak of 245 °C
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE

DESCRIPTION

State of the art, ultralow V_F , soft-switching hyperfast 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 PC, TV and monitor, games units and DVD AC/DC power supplies.

PRIMARY CHARACTERISTICS

$I_{F(AV)}$	15 A
V_R	600 V
V_F at I_F	0.85 V
t_{rr} (typ.)	60 ns
T_J max.	175 °C
Package	D ² PAK (TO-263AB), TO-262AA
Circuit configuration	Single

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Peak repetitive reverse voltage	V_{RRM}		600	V
Average rectified forward current	$I_{F(AV)}$	$T_C = 154$ °C	15	A
Non-repetitive peak surge current	I_{FSM}	$T_J = 25$ °C	250	
Peak repetitive forward current	I_{FM}		30	
Operating junction and storage temperatures	T_J, T_{Stg}		-65 to +175	°C

ELECTRICAL SPECIFICATIONS ($T_J = 25$ °C unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Breakdown voltage, blocking voltage	V_{BR}, V_R	$I_R = 100$ μ A	600	-	-	V
Forward voltage	V_F	$I_F = 15$ A $I_F = 15$ A, $T_J = 150$ °C	-	0.99 0.85	- 1.05 0.92	
Reverse leakage current	I_R	$V_R = V_R$ rated $T_J = 150$ °C, $V_R = V_R$ rated	-	0.1 15	- 10 120	μ A
Junction capacitance	C_T	$V_R = 600$ V	-	20	-	pF
Series inductance	L_S	Measured lead to lead 5 mm from package body	-	8.0	-	nH



DYNAMIC RECOVERY CHARACTERISTICS ($T_C = 25\text{ }^\circ\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Reverse recovery time	t_{rr}	$I_F = 1\text{ A}$, $di_F/dt = 100\text{ A}/\mu\text{s}$, $V_R = 30\text{ V}$	-	60	120	ns
		$I_F = 15\text{ A}$, $di_F/dt = 100\text{ A}/\mu\text{s}$, $V_R = 30\text{ V}$	-	190	270	
		$T_J = 25\text{ }^\circ\text{C}$	-	220	-	
		$T_J = 125\text{ }^\circ\text{C}$	-	320	-	
Peak recovery current	I_{RRM}	$T_J = 25\text{ }^\circ\text{C}$	-	19	-	A
		$T_J = 125\text{ }^\circ\text{C}$	-	26	-	
Reverse recovery charge	Q_{rr}	$T_J = 25\text{ }^\circ\text{C}$	-	2.2	-	μC
		$T_J = 125\text{ }^\circ\text{C}$	-	4.3	-	

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 per leg	R_{thJC}		-	1.0	1.3	$^\circ\text{C}/\text{W}$
Thermal resistance, junction to ambient per leg	R_{thJA}	Typical socket mount	-	-	70	
Thermal resistance, case to heatsink	R_{thCS}	Mounting surface, flat, smooth and greased	-	0.5	-	
Weight			-	2.0	-	g
			-	0.07	-	oz.
Mounting torque			6.0 (5.0)	-	12 (10)	kgf · cm (lbf · in)
Marking device		Case style D ² PAK (TO-263AB)	15ETL06S			
		Case style TO-262AA	15ETL06-1			

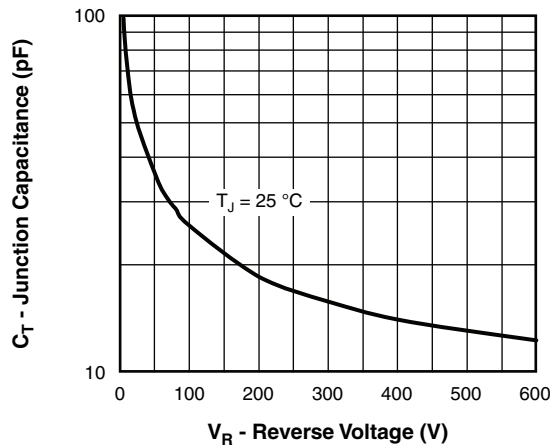
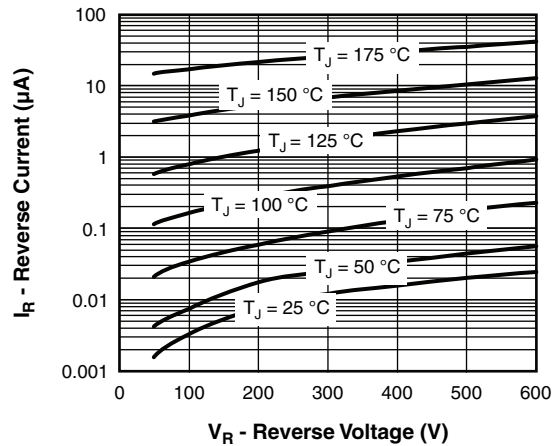
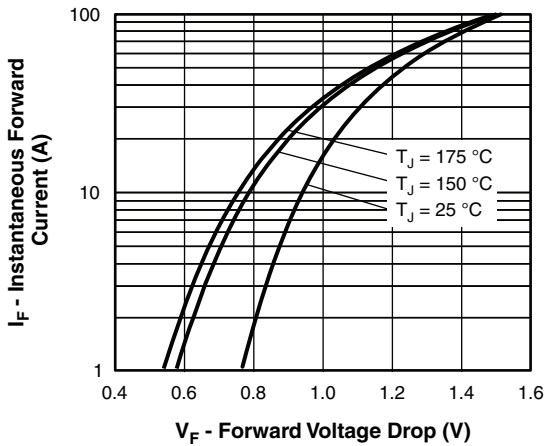
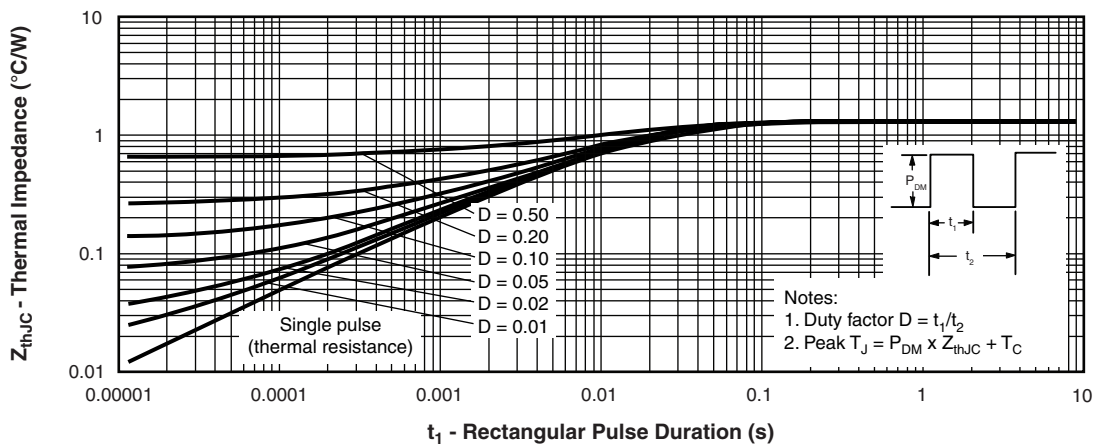


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage



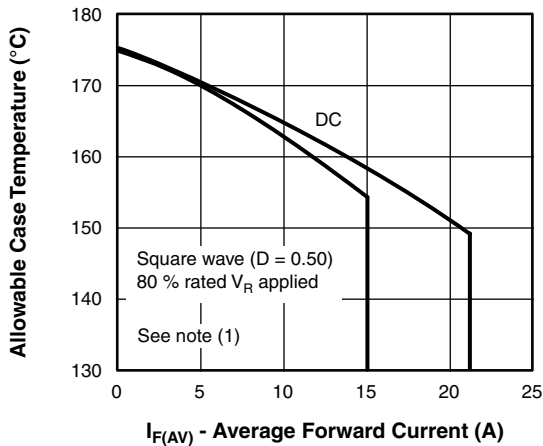


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

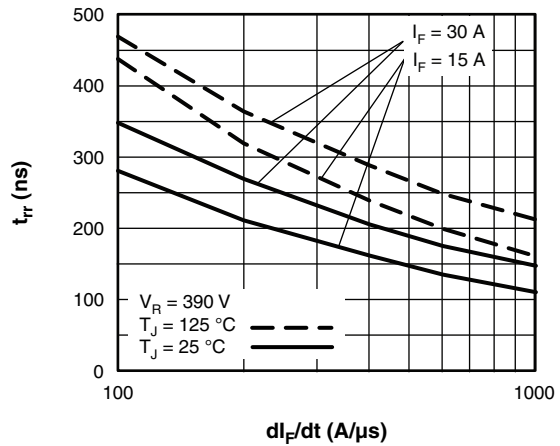


Fig. 7 - Typical Reverse Recovery Time vs. di_F/dt

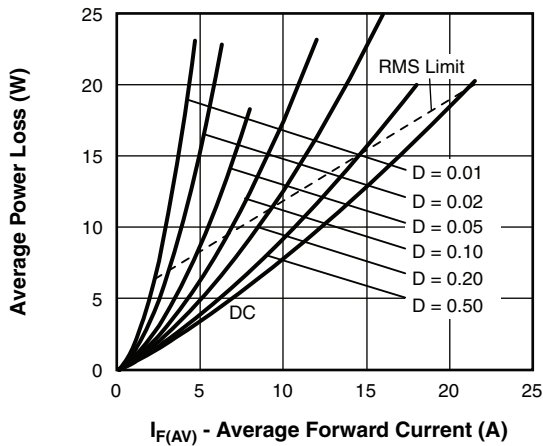


Fig. 6 - Forward Power Loss Characteristics

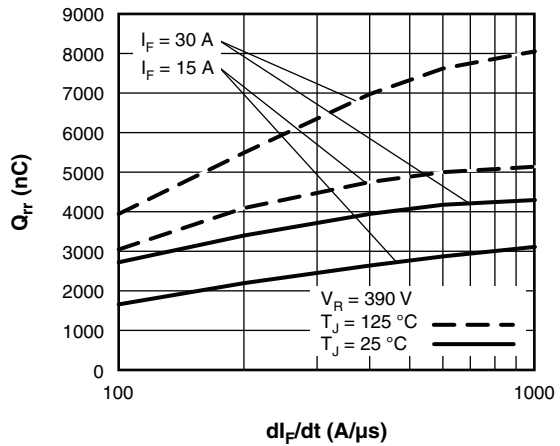
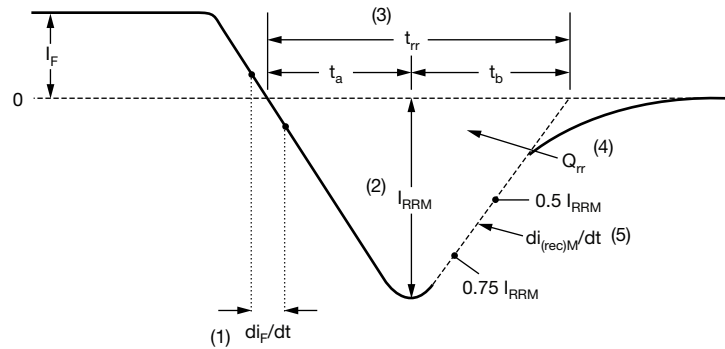


Fig. 8 - Typical Stored Charge vs. di_F/dt

Note

- (1) Formula used: $T_C = T_J - (P_d + P_{d_{REV}}) \times R_{thJC}$;
- P_d = forward power loss = $I_{F(AV)} \times V_{FM}$ at $(I_{F(AV)}/D)$ (see fig. 6);
- $P_{d_{REV}}$ = inverse power loss = $V_{R1} \times I_R (1 - D)$; I_R at V_{R1} = rated V_R



- (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 $0.50 I_{RRM}$ extrapolated to zero current.
- (4) Q_{rr} - area under curve defined by t_{rr} and I_{RRM}
- (5) $di_{(rec)M}/dt$ - peak rate of change of current during t_b portion of t_{rr}

$$Q_{rr} = \frac{t_{rr} \times I_{RRM}}{2}$$

Fig. 9 - Reverse Recovery Waveform and Definitions

ORDERING INFORMATION TABLE

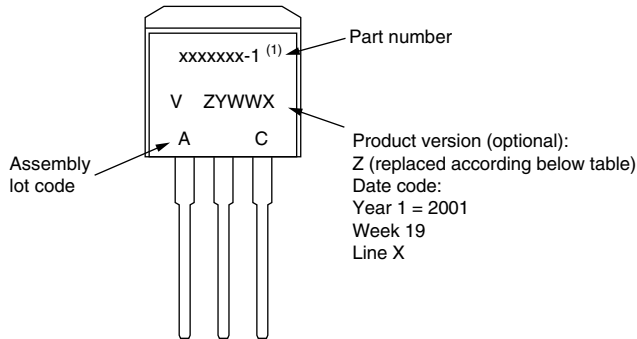
Device code	VS-	15	E	T	L	06	S	TRL	-M3
	1	2	3	4	5	6	7	8	9
	1	2	3	4	5	6	7	8	9
	1	2	3	4	5	6	7	8	9
	1	2	3	4	5	6	7	8	9
	1	2	3	4	5	6	7	8	9
	1	2	3	4	5	6	7	8	9
	1	2	3	4	5	6	7	8	9
	1	2	3	4	5	6	7	8	9
	1	2	3	4	5	6	7	8	9
	1	2	3	4	5	6	7	8	9

- 1 - Vishay Semiconductors product
- 2 - Current rating (15 A)
- 3 - E = single diode
- 4 - T = TO-220, D²PAK
- 5 - L = ultralow V_F hyperfast recovery
- 6 - Voltage rating (06 = 600 V)
- 7 -
 - S = D²PAK
 - -1 = TO-262
- 8 -
 - None = tube (50 pieces)
 - TRL = tape and reel (left oriented, for D²PAK package)
 - TRR = tape and reel (right oriented, for D²PAK package)
- 9 - Environmental digit:
 - M3 = halogen-free, RoHS-compliant, and terminations lead(Pb)-free

LINKS TO RELATED DOCUMENTS		
Dimensions	D ² PAK (TO-263AB)	www.vishay.com/doc?96164
	TO-262AA	www.vishay.com/doc?96165
Part marking information	D ² PAK (TO-263AB)	www.vishay.com/doc?95444
	TO-262AA	www.vishay.com/doc?95443
Packaging information		www.vishay.com/doc?96424
SPICE model		www.vishay.com/doc?96051



TO-262



Example: This is a xxxxxx-1 ⁽¹⁾ with assembly lot code AC, assembled on WW 19, 2001 in the assembly line "X"

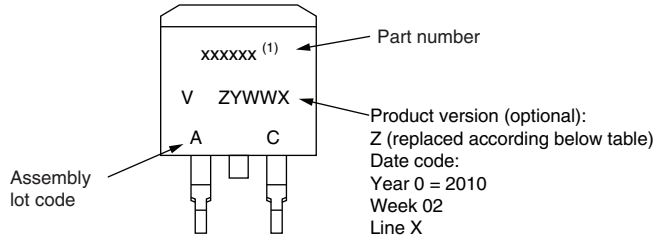
Note

⁽¹⁾ If part number contain "H" as last digit, product is AEC-Q101 qualified

ENVIRONMENTAL NAMING CODE (Z)	PRODUCT DEFINITION
A	Termination lead (Pb)-free
B	Totally lead (Pb)-free
E	RoHS-compliant and termination lead (Pb)-free
F	RoHS-compliant and totally lead (Pb)-free
M	Halogen-free, RoHS-compliant and termination lead (Pb)-free
N	Halogen-free, RoHS-compliant and totally lead (Pb)-free
G	Green



D²PAK



Example: This is a xxxxxx ⁽¹⁾ with assembly lot code AC, assembled on WW 02, 2010

Note

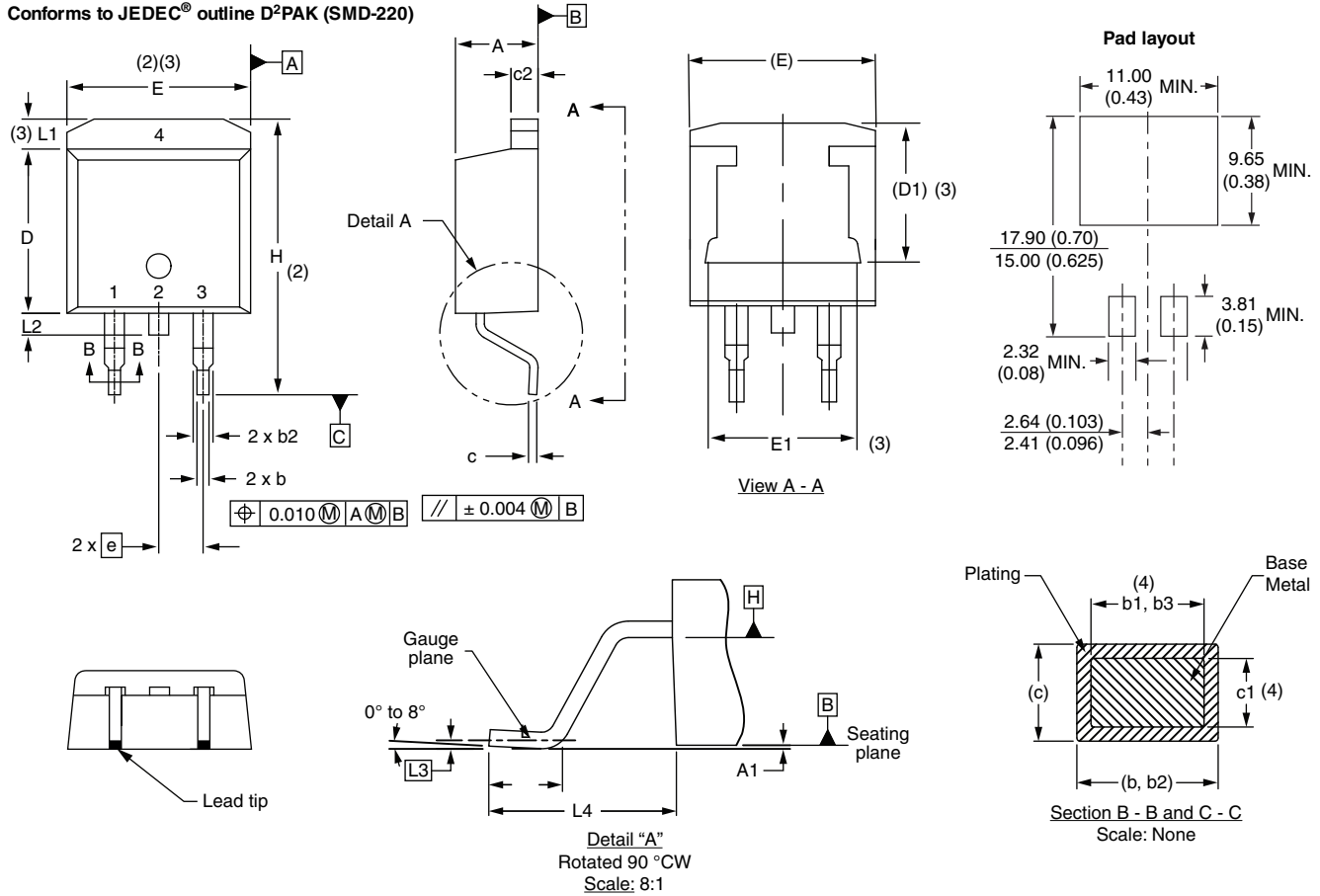
⁽¹⁾ If part number contain "H" as last digit, product is AEC-Q101 qualified

ENVIRONMENTAL NAMING CODE (Z)	PRODUCT DEFINITION
A	Termination lead (Pb)-free
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F	RoHS-compliant and totally lead (Pb)-free
M	Halogen-free, RoHS-compliant, and termination lead (Pb)-free
N	Halogen-free, RoHS-compliant, and totally lead (Pb)-free
G	Green

D²PAK

DIMENSIONS in millimeters and inches

Conforms to JEDEC[®] outline D²PAK (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	8.00	0.270	0.315	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	7.90	8.80	0.311	0.346	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	

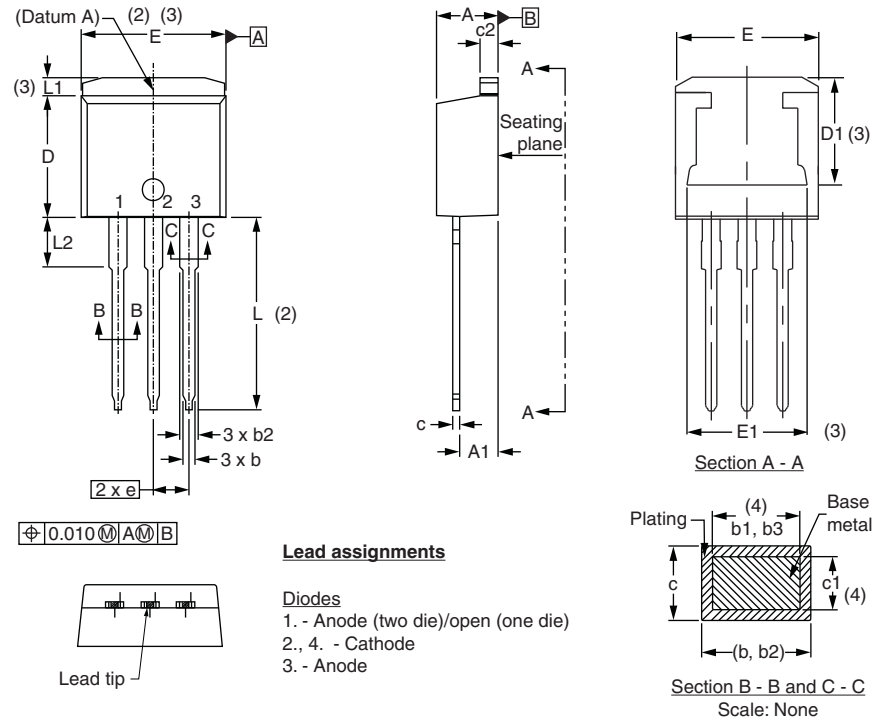
Notes

- (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: inches
- (7) Outline conforms to JEDEC[®] outline TO-263AB

TO-262AA

DIMENSIONS in millimeters and inches

Modified JEDEC® outline TO-262



SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	0.160	0.190	
A1	2.03	3.02	0.080	0.119	
b	0.51	0.99	0.020	0.039	
b1	0.51	0.89	0.020	0.035	4
b2	1.14	1.78	0.045	0.070	
b3	1.14	1.73	0.045	0.068	4
c	0.38	0.74	0.015	0.029	
c1	0.38	0.58	0.015	0.023	4
c2	1.14	1.65	0.045	0.065	
D	8.51	9.65	0.335	0.380	2
D1	6.86	8.00	0.270	0.315	3
E	9.65	10.67	0.380	0.420	2, 3
E1	7.90	8.80	0.311	0.346	3
e	2.54 BSC		0.100 BSC		
L	13.46	14.10	0.530	0.555	
L1	-	1.65	-	0.065	3
L2	3.56	3.71	0.140	0.146	

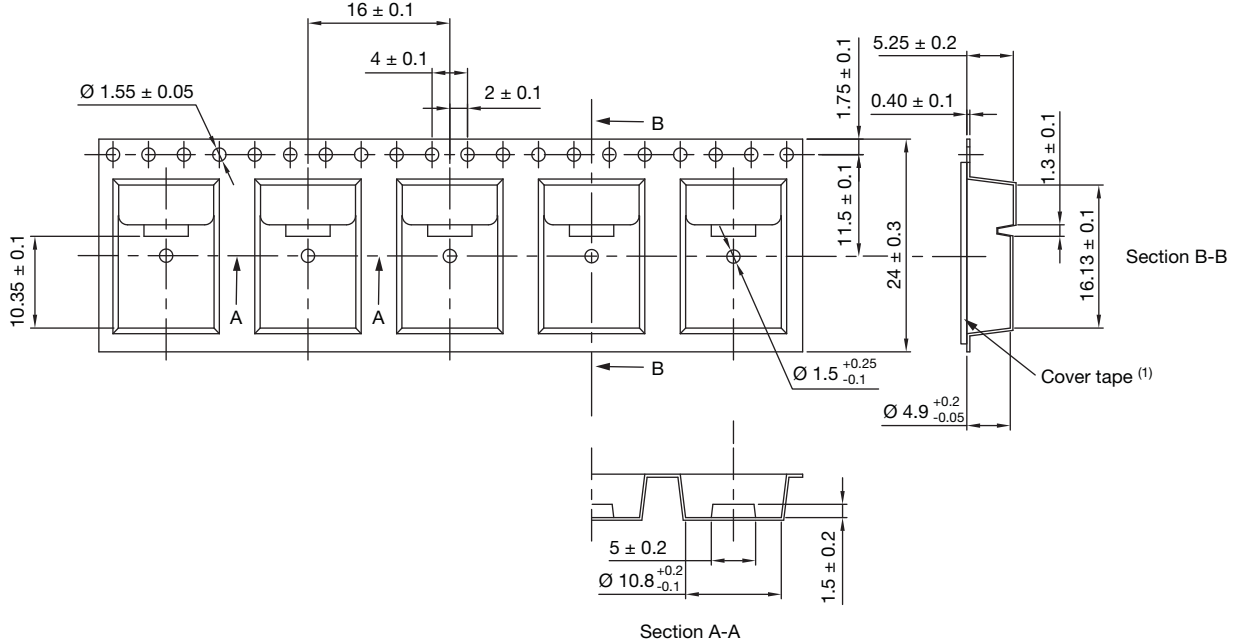
Notes

- (1) Dimensioning and tolerancing as per ASME Y14.5M-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) Controlling dimension: inches
- (6) Outline conform to JEDEC® TO-262 except A1 (max.), b (min., max.), b1 (min.), b2 (max.), c (min.), c1(min.), c2 (max.), D (min.), E (max.), L1 (max.), L2 (min., max.)



D²PAK (TO-263AB)

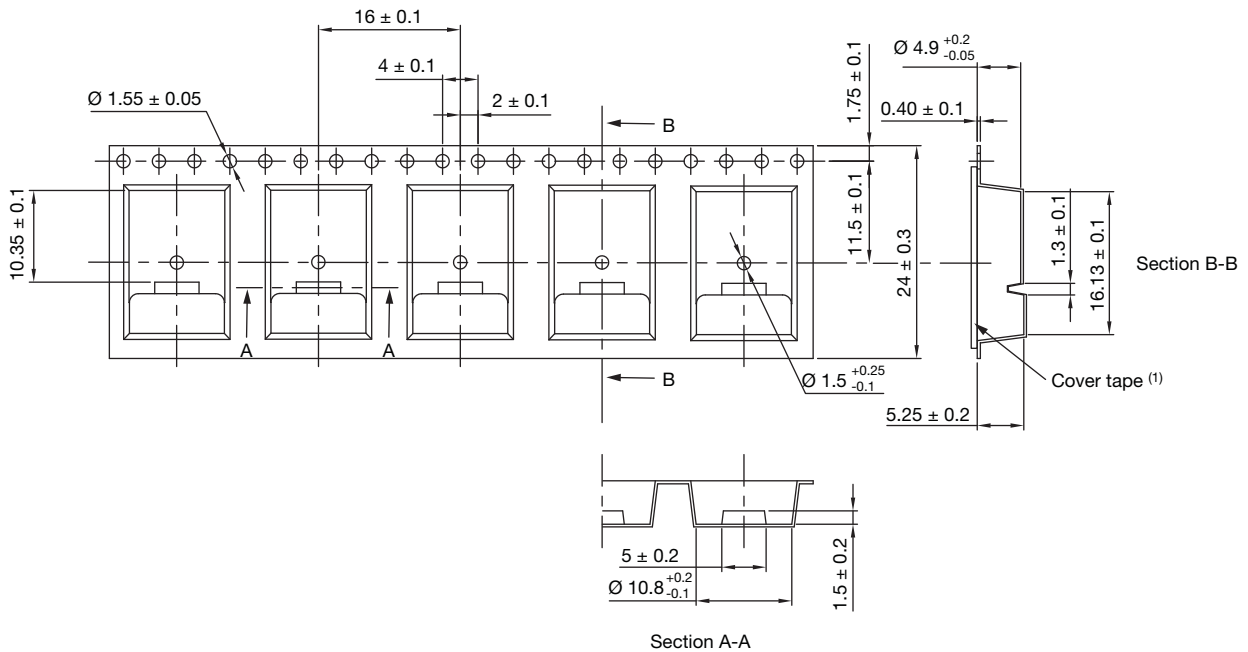
CARRIER TAPE FOR TAPE AND REEL LEFT in millimeters



Note

(1) For dimensions, see next pages

CARRIER TAPE FOR TAPE AND REEL RIGHT in millimeters

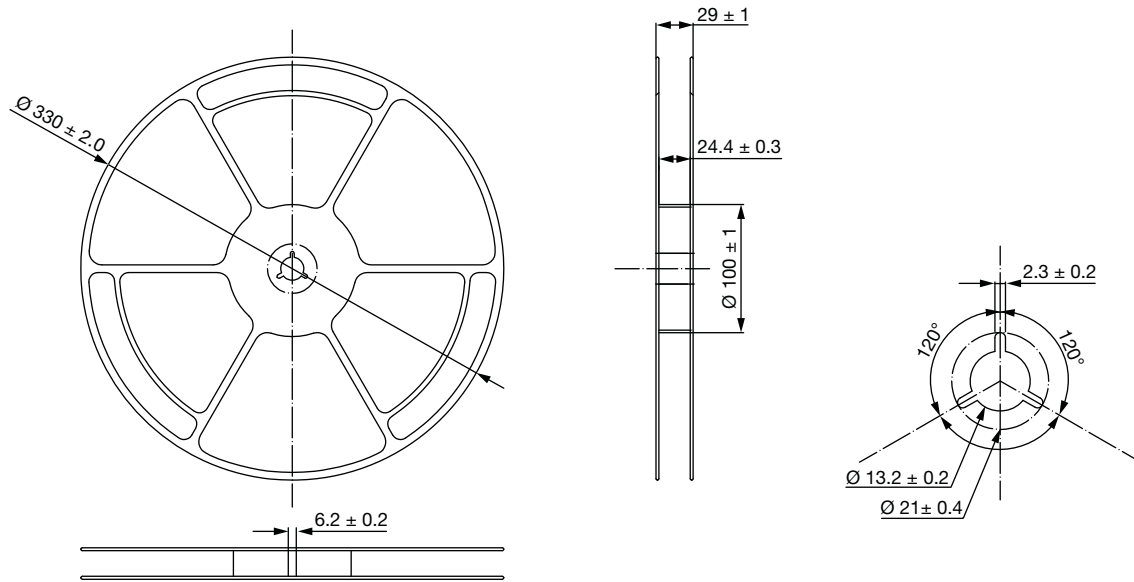


Note

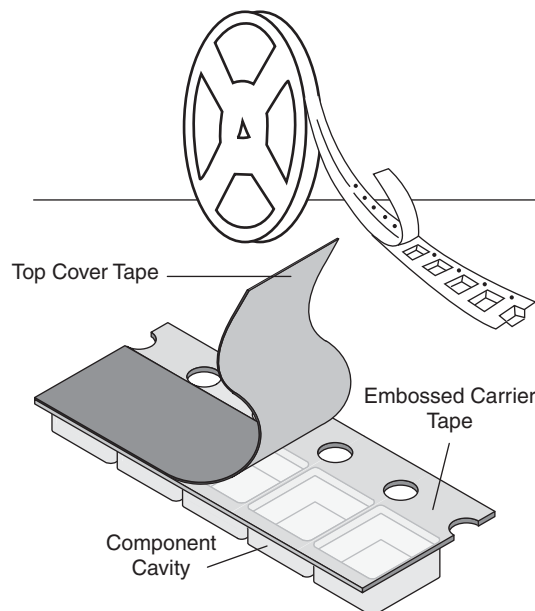
(1) For dimensions, see next pages



REEL FOR CARRIER TAPE in millimeters

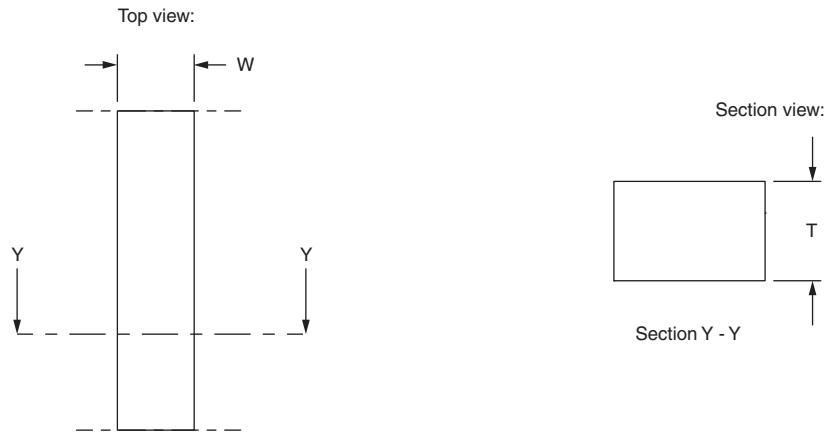


CARRIER TAPE AND REEL PACKAGING D²PAK (TO-263AB)





COVER TAPE FOR CARRIER TAPE in millimeters



APPLICATION	COVER TAPE WIDTH W	COVER TAPE THICKNESS T	CARRIER TAPE WIDTH	MATERIAL
D ² PAK (TO-263AB)	21.3 ± 0.1	0.060 ± 0.01	24	Antistatic/treated/transparent/polyester



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