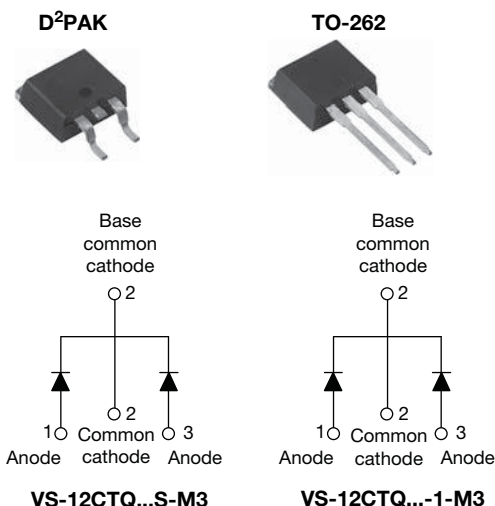


High Performance Schottky Rectifier, 2 x 6 A



FEATURES

- 175 °C T_J operation
- Center tap configuration
- Low forward voltage drop
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C
- Designed and qualified according to JEDEC®-JESD 47
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE

DESCRIPTION

The VS-12CTQ... center tap Schottky rectifier series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175 °C junction temperature. Typical applications are in switching power supplies, converters, freewheeling diodes, and reverse battery protection.

PRODUCT SUMMARY

$I_{F(AV)}$	2 x 6 A
V_R	35 V/40 V/45 V
V_F at I_F	0.53 V
I_{RM} max.	7.0 mA at 125 °C
T_J max.	175 °C
E_{AS}	8 mJ
Package	TO-263AB (D²PAK), TO-262AA
Diode variation	Common cathode

MAJOR RATINGS AND CHARACTERISTICS

SYMBOL	CHARACTERISTICS	VALUES	UNITS
$I_{F(AV)}$	Rectangular waveform	12	A
V_{RRM}	Range	35 to 45	V
I_{FSM}	$t_p = 5 \mu s$ sine	690	A
V_F	6 A _{pk} , $T_J = 125$ °C (per leg)	0.53	V
T_J	Range	-55 to 175	°C

VOLTAGE RATINGS

PARAMETER	SYMBOL	VS-12CTQ035S-M3 VS-12CTQ035-1-M3	VS-12CTQ040S-M3 VS-12CTQ040-1-M3	VS-12CTQ045S-M3 VS-12CTQ045-1-M3	UNITS
Maximum DC reverse voltage	V_R	35	40	45	V
Maximum working peak reverse voltage	V_{RWM}				

**ABSOLUTE MAXIMUM RATINGS**

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum average forward current See fig. 5	$I_{F(AV)}$	50 % duty cycle at $T_C = 160\text{ }^{\circ}\text{C}$, rectangular waveform	6 12	A
Maximum peak one cycle non-repetitive surge current per leg See fig. 7	I_{FSM}	5 μs sine or 3 μs rect. pulse 10 ms sine or 6 ms rect. pulse	690 140	A
Non-repetitive avalanche energy per leg	E_{AS}	$T_J = 25\text{ }^{\circ}\text{C}$, $I_{AS} = 1.20\text{ A}$, $L = 11.10\text{ mH}$	8	mJ
Repetitive avalanche current per leg	I_{AR}	Current decaying linearly to zero in 1 μs Frequency limited by T_J maximum $V_A = 1.5 \times V_R$ typical	1.20	A

ELECTRICAL SPECIFICATIONS

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum forward voltage drop per leg See fig. 1	$V_{FM}^{(1)}$	6 A 12 A 6 A 12 A	0.60 0.73 0.53 0.64	V
Maximum reverse leakage current per leg See fig. 2	$I_{RM}^{(1)}$	$T_J = 25\text{ }^{\circ}\text{C}$ $T_J = 125\text{ }^{\circ}\text{C}$	0.8 7.0	mA
Threshold voltage	$V_{F(TO)}$	$T_J = T_J$ maximum	0.35	V
Forward slope resistance	r_t		18.23	m Ω
Maximum junction capacitance per leg	C_T	$V_R = 5\text{ V}_{DC}$ (test signal range 100 kHz to 1 MHz), $25\text{ }^{\circ}\text{C}$	400	pF
Typical series inductance per leg	L_S	Measured lead to lead 5 mm from package body	8.0	nH
Maximum voltage rate of change	dV/dt	Rated V_R	10 000	V/ μs

Note(1) Pulse width < 300 μs , duty cycle < 2 %**THERMAL - MECHANICAL SPECIFICATIONS**

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum junction and storage temperature range	T_J, T_{Stg}		-55 to 175	$^{\circ}\text{C}$
Maximum thermal resistance, junction to case per leg	R_{thJC}	DC operation See fig. 4	3.50	$^{\circ}\text{C/W}$
Maximum thermal resistance, junction to case per package		DC operation	1.75	
Typical thermal resistance, case to heatsink	R_{thCS}	Mounting surface, smooth and greased	0.50	
Approximate weight			2 0.07	g oz.
Mounting torque	minimum maximum		6 (5) 12 (10)	kgf · cm (lbf · in)
Marking device		Case style D ² PAK	12CTQ035S 12CTQ040S 12CTQ045S	
		Case style TO-262	12CTQ035-1 12CTQ040-1 12CTQ045-1	

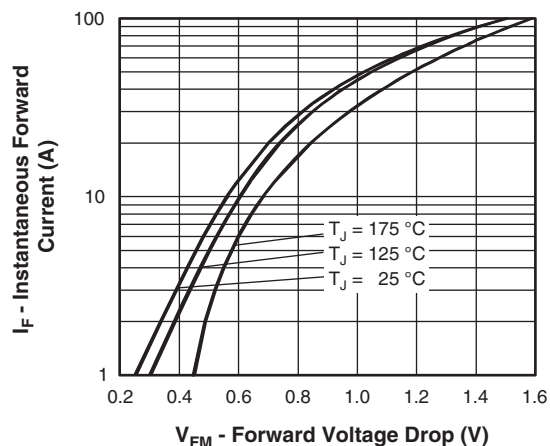


Fig. 1 - Maximum Forward Voltage Drop Characteristics (Per Leg)

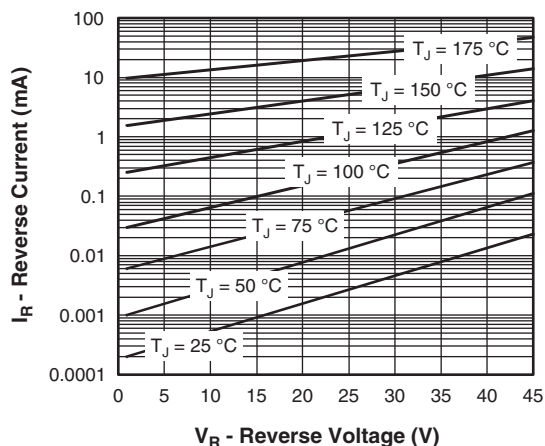


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage (Per Leg)

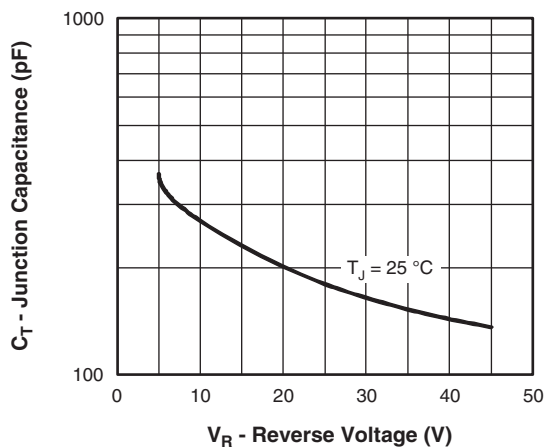


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Leg)

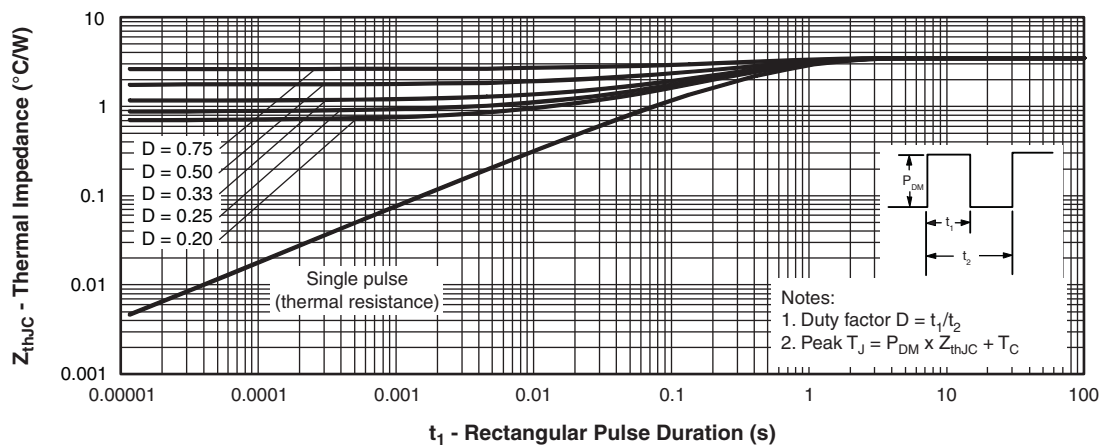


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics (Per Leg)

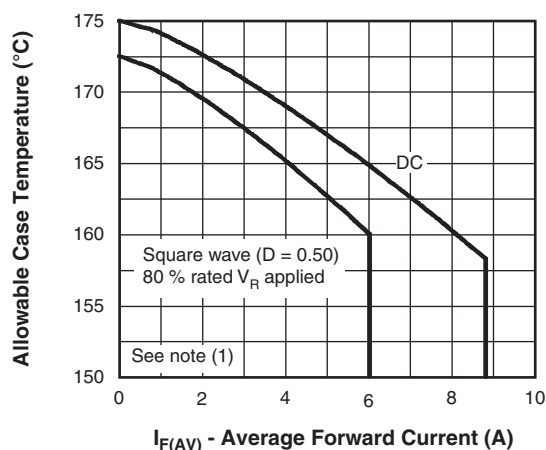


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current (Per Leg)

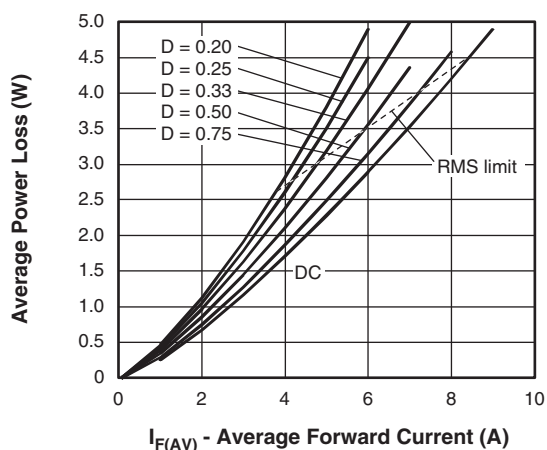


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

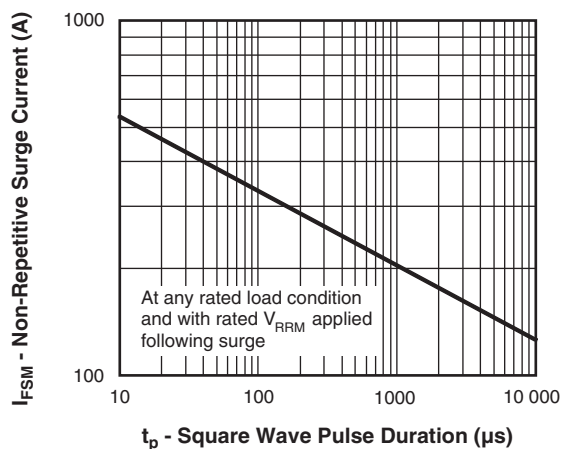


Fig. 7 - Maximum Non-Repetitive Surge Current (Per Leg)

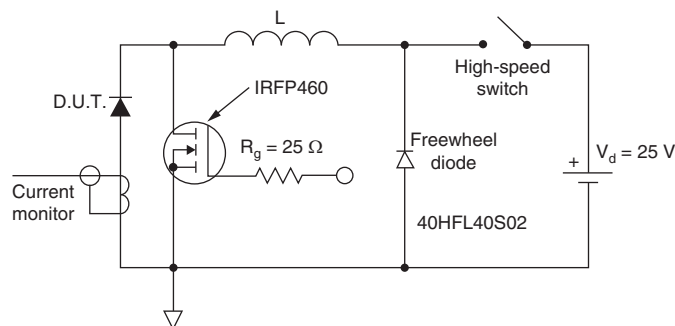


Fig. 8 - Unclamped Inductive Test Circuit

Note

- (1) Formula used: $T_C = T_J - (P_d + P_{dREV}) \times R_{thJC}$;
 P_d = Forward power loss = $I_{F(AV)} \times V_{FM}$ at $(I_{F(AV)}/D)$ (see fig. 6);
 P_{dREV} = Inverse power loss = $V_{R1} \times I_R (1 - D)$; I_R at $V_{R1} = 80\%$ rated V_R

**ORDERING INFORMATION TABLE**

Device code	VS-	12	C	T	Q	045	S	TRL	-M3
	①	②	③	④	⑤	⑥	⑦	⑧	⑨

- | | | |
|---|---|--|
| 1 | - | Vishay Semiconductors product |
| 2 | - | Current rating (12 A) |
| 3 | - | Circuit configuration: C = Common cathode |
| 4 | - | T = TO-220 |
| 5 | - | Schottky "Q" series |
| 6 | - | Voltage ratings |
| 7 | - | <ul style="list-style-type: none"> • S = D²PAK • -1 = TO-262 |
| 8 | - | <ul style="list-style-type: none"> • None = Tube • TRL = Tape and reel (left oriented - for D²PAK only) • TRR = Tape and reel (right oriented - for D²PAK only) |
| 9 | - | -M3 = Halogen-free, RoHS-compliant and termination lead (Pb)-free |

035 = 35 V
040 = 40 V
045 = 45 V

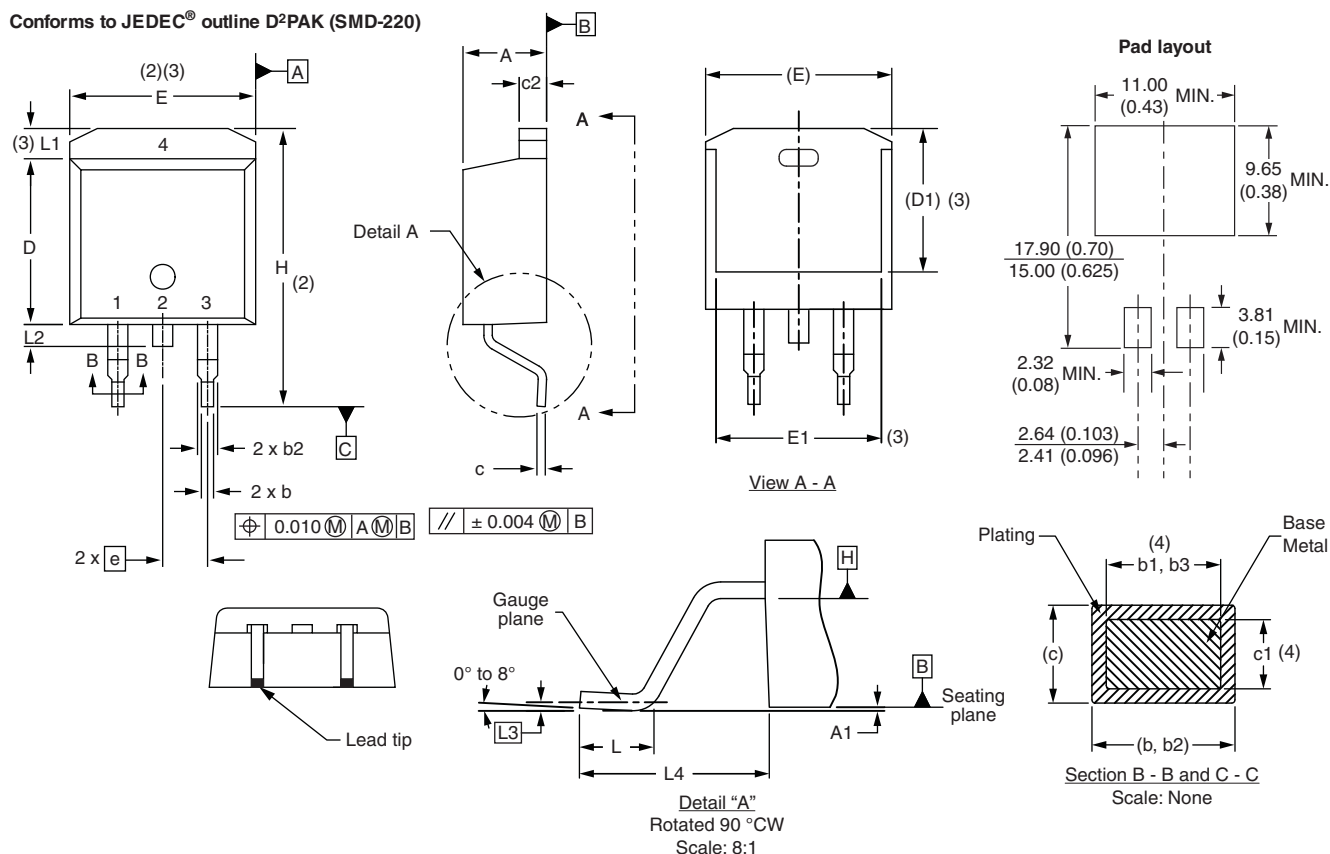
ORDERING INFORMATION			
PREFERRED P/N	QUANTITY PER T/R	MINIMUM ORDER QUANTITY	PACKAGING DESCRIPTION
VS-12CTQ035S-M3	50	1000	Antistatic plastic tubes
VS-12CTQ035STRR-M3	800	800	13" diameter reel
VS-12CTQ035STRL-M3	800	800	13" diameter reel
VS-12CTQ035-1-M3	50	1000	Antistatic plastic tubes
VS-12CTQ040S-M3	50	1000	Antistatic plastic tubes
VS-12CTQ040STRR-M3	800	800	13" diameter reel
VS-12CTQ040STRL-M3	800	800	13" diameter reel
VS-12CTQ040-1-M3	50	1000	Antistatic plastic tubes
VS-12CTQ045S-M3	50	1000	Antistatic plastic tubes
VS-12CTQ045STRR-M3	800	800	13" diameter reel
VS-12CTQ045STRL-M3	800	800	13" diameter reel
VS-12CTQ045-1-M3	50	1000	Antistatic plastic tubes

LINKS TO RELATED DOCUMENTS		
Dimensions	TO-263AB (D ² PAK)	www.vishay.com/doc?95046
Dimensions	TO-262AA	www.vishay.com/doc?95419
Part marking information	TO-263AB (D ² PAK)	www.vishay.com/doc?95444
Part marking information	TO-262AA	www.vishay.com/doc?95443
Packaging information		www.vishay.com/doc?95032

D²PAK

DIMENSIONS in millimeters and inches

Conforms to JEDEC® outline D²PAK (SMD-220)



SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	0.160	0.190	
A1	0.00	0.254	0.000	0.010	
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

SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
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		
H	14.61	15.88	0.575	0.625	
L	1.78	2.79	0.070	0.110	
L1	-	1.65	-	0.066	3
L2	1.27	1.78	0.050	0.070	
L3	0.25 BSC		0.010 BSC		
L4	4.78	5.28	0.188	0.208	

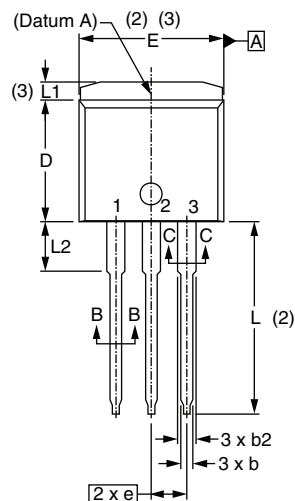
Notes

- Dimensioning and tolerancing per ASME Y14.5 M-1994
- 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
- Thermal pad contour optional within dimension E, L1, D1 and E1
- Dimension b1 and c1 apply to base metal only
- Datum A and B to be determined at datum plane H
- Controlling dimension: inch
- Outline conforms to JEDEC® outline TO-263AB

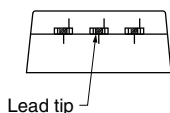
TO-262

DIMENSIONS in millimeters and inches

Modified JEDEC outline TO-262



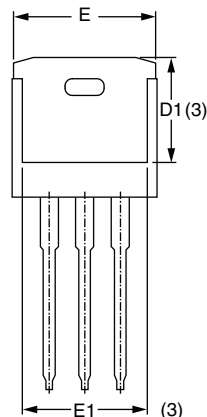
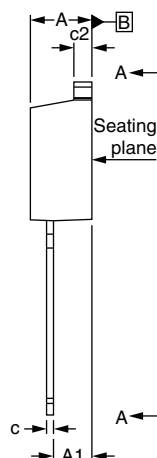
± 0.010 A A B



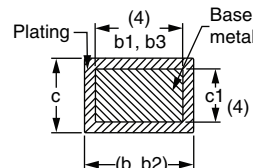
Lead assignments

Diodes

1. - Anode (two die)/open (one die)
2. - Cathode
3. - Anode



Section A - A



Section B - B and C - C

Scale: None

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 (maximum), b (minimum) and D1 (minimum) where dimensions derived the actual package outline



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