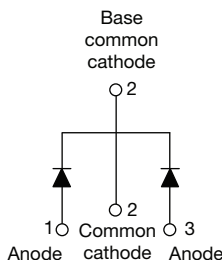
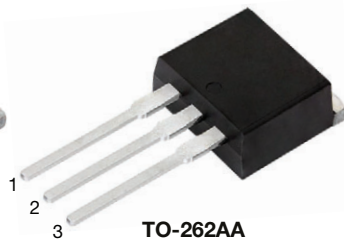
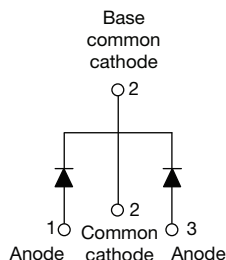


## High Performance Schottky Rectifier, 2 x 10 A



**VS-20CTQ...S-M3**



**VS-20CTQ...-1-M3**

### FEATURES

- 175 °C T<sub>J</sub> operation
- Center tap configuration
- Low forward voltage drop
- High frequency operation
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Guard ring for enhanced ruggedness and long term reliability
- Meets MSL level 1, per J-STD-020, LF maximum peak of 245 °C
- Designed and qualified according to JEDEC®-JESD 47
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
FREE

### DESCRIPTION

The VS-20CTQ... 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.

### PRIMARY CHARACTERISTICS

I <sub>F(AV)</sub>	2 x 10 A
V <sub>R</sub>	35 V, 40 V, 45 V
V <sub>F</sub> at I <sub>F</sub>	0.57 V
I <sub>RM</sub>	15 mA at 125 °C
T <sub>J</sub> max.	175 °C
E <sub>AS</sub>	13 mJ
Package	D <sup>2</sup> PAK (TO-263AB), TO-262AA
Circuit configuration	Common cathode

### MAJOR RATINGS AND CHARACTERISTICS

SYMBOL	CHARACTERISTICS	VALUES	UNITS
I <sub>F(AV)</sub>	Rectangular waveform	20	A
V <sub>RRM</sub>	Range	35 to 45	V
I <sub>FSM</sub>	t <sub>p</sub> = 5 μs sine	1060	A
V <sub>F</sub>	10 A <sub>pk</sub> , T <sub>J</sub> = 125 °C (per leg)	0.57	V
T <sub>J</sub>	Range	-55 to +175	°C

### VOLTAGE RATINGS

PARAMETER	SYMBOL	VS-20CTQ035S-M3 VS-20CTQ035-1-M3	VS-20CTQ040S-M3 VS-20CTQ040-1-M3	VS-20CTQ045S-M3 VS-20CTQ045-1-M3	UNITS
Maximum DC reverse voltage	V <sub>R</sub>	35	40	45	V
Maximum working peak reverse voltage	V <sub>RWM</sub>				

**ABSOLUTE MAXIMUM RATINGS**

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum average forward current See fig. 5	$I_{F(AV)}$	50 % duty cycle at $T_C = 145\text{ }^{\circ}\text{C}$ , rectangular waveform	20	A
Maximum peak one cycle non-repetitive surge current per leg See fig. 7	$I_{FSM}$	5 $\mu\text{s}$ sine or 3 $\mu\text{s}$ rect. pulse	1060	
		10 ms sine or 6 ms rect. pulse	265	
Non-repetitive avalanche energy per leg	$E_{AS}$	$T_J = 25\text{ }^{\circ}\text{C}$ , $I_{AS} = 2.0\text{ A}$ , $L = 6.5\text{ mH}$	13	mJ
Repetitive avalanche current per leg	$I_{AR}$	Current decaying linearly to zero in 1 $\mu\text{s}$ Frequency limited by $T_J$ maximum $V_A = 1.5 \times V_R$ typical	2.0	A

**ELECTRICAL SPECIFICATIONS**

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum forward voltage drop per leg See fig. 1	$V_{FM}^{(1)}$	10 A	0.64	V
		20 A	0.76	
		10 A	0.57	
		20 A	0.68	
Maximum reverse leakage current per leg See fig. 2	$I_{RM}^{(1)}$	$T_J = 25\text{ }^{\circ}\text{C}$	2	mA
		$T_J = 125\text{ }^{\circ}\text{C}$	15	
Maximum junction capacitance per leg	$C_T$	$V_R = 5\text{ V}_{DC}$ (test signal range 100 kHz to 1 MHz), $25\text{ }^{\circ}\text{C}$	900	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/ $\mu\text{s}$

**Note**(1) Pulse width < 300  $\mu\text{s}$ , 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	3.25	$^{\circ}\text{C/W}$
Maximum thermal resistance, junction to case per package		DC operation	1.63	
Typical thermal resistance, case to heatsink	$R_{thCS}$	Mounting surface, smooth and greased	0.50	
Approximate weight			2	g
			0.07	oz.
Mounting torque	minimum		6 (5)	kgf · cm
	maximum		12 (10)	(lbf · in)
		Case style D <sup>2</sup> PAK (TO-263AB)	20CTQ035S 20CTQ040S 20CTQ045S	
		Case style TO-262AA	20CTQ035-1 20CTQ040-1 20CTQ045-1	

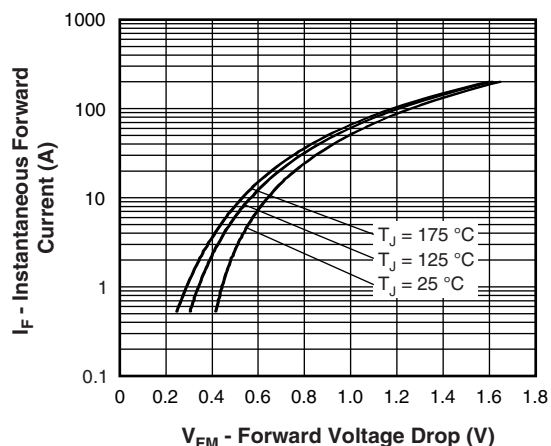


Fig. 1 - Maximum Forward Voltage Drop Characteristics (Per Leg)

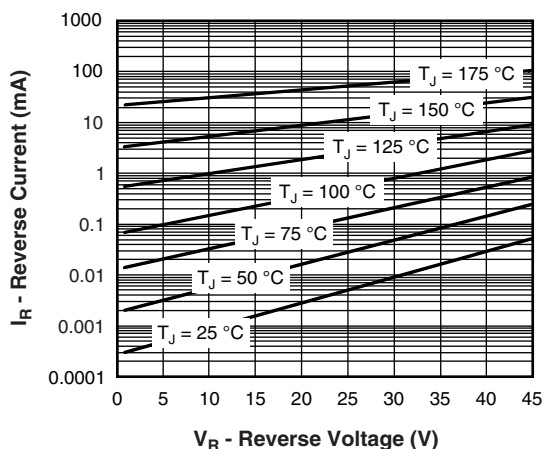


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage (Per Leg)

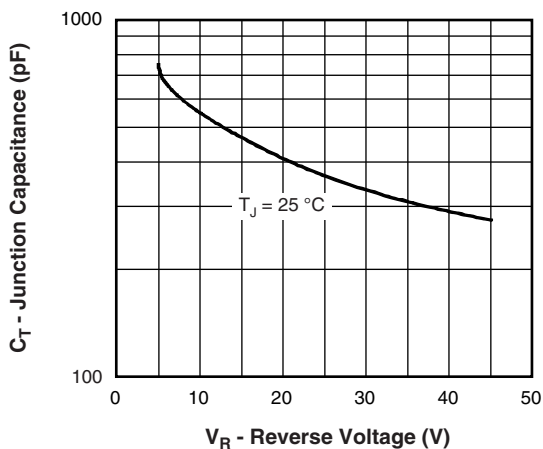


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Leg)

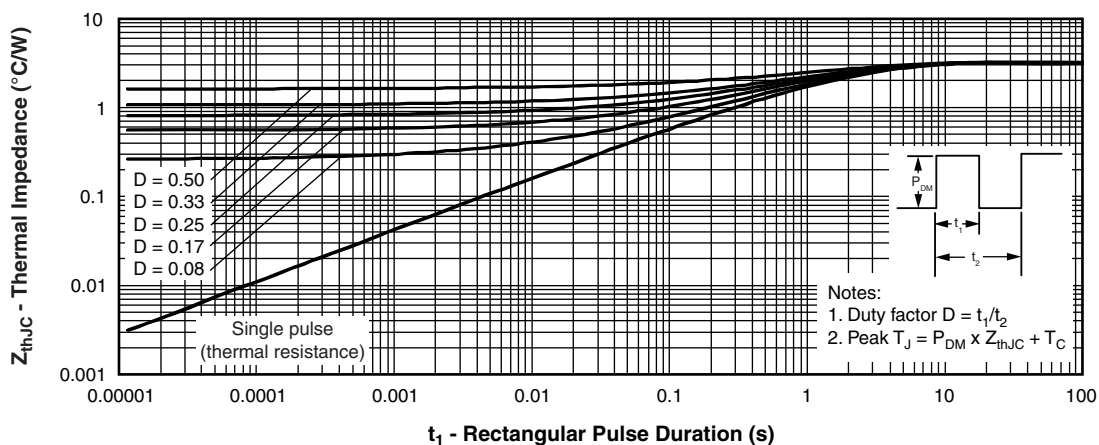


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics (Per Leg)

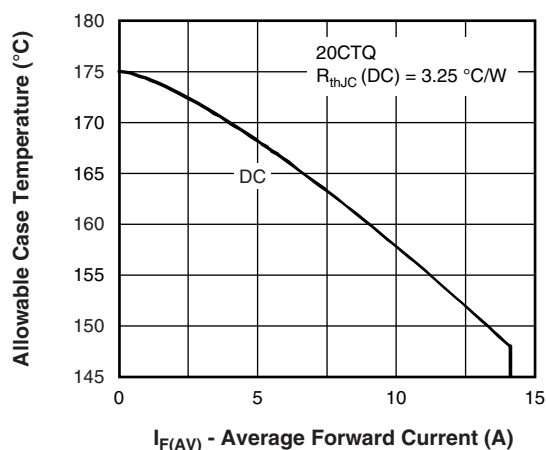


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current (Per Leg)

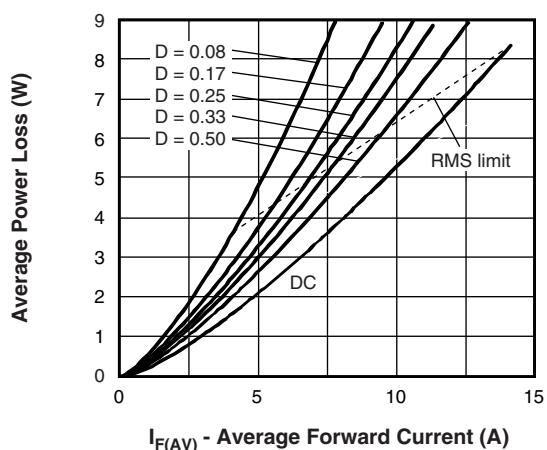


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

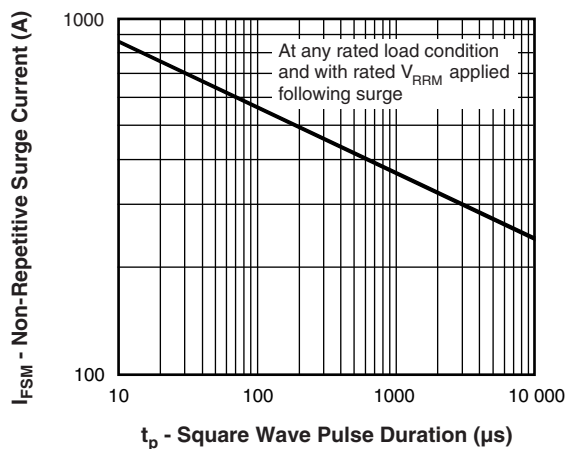


Fig. 7 - Maximum Non-Repetitive Surge Current (Per Leg)

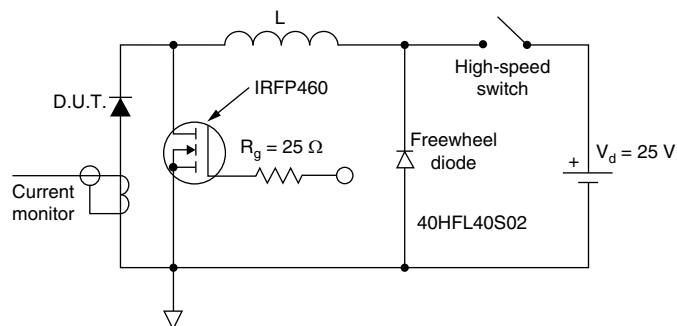


Fig. 8 - Unclamped Inductive Test Circuit

## 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  $V_R$  applied

**ORDERING INFORMATION TABLE**

Device code	<b>VS-</b>	<b>20</b>	<b>C</b>	<b>T</b>	<b>Q</b>	<b>045</b>	<b>S</b>	<b>TRL</b>	<b>-M3</b>
	①	②	③	④	⑤	⑥	⑦	⑧	⑨

- |   |   |                                                                                                                                                                                                                                        |
|---|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | - | Vishay Semiconductors product                                                                                                                                                                                                          |
| 2 | - | Current rating (20 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"> <li>S = D<sup>2</sup>PAK (TO-263AB)</li> <li>-1 = TO-262AA</li> </ul>                                                                                                                               |
| 8 | - | <ul style="list-style-type: none"> <li>None = tube</li> <li>TRL = tape and reel (left oriented - for D<sup>2</sup>PAK (TO-263AB) only)</li> <li>TRR = tape and reel (right oriented - for D<sup>2</sup>PAK (TO-263AB) only)</li> </ul> |
| 9 | - | -M3 = halogen-free, RoHS-compliant, and termination lead (Pb)-free                                                                                                                                                                     |

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

<b>ORDERING INFORMATION</b>			
PREFERRED P/N	QUANTITY PER T/R	MINIMUM ORDER QUANTITY	PACKAGING DESCRIPTION
VS-20CTQ035S-M3	50	1000	Antistatic plastic tubes
VS-20CTQ035STRR-M3	800	800	13" diameter reel
VS-20CTQ035STRL-M3	800	800	13" diameter reel
VS-20CTQ035-1-M3	50	1000	Antistatic plastic tubes
VS-20CTQ040S-M3	50	1000	Antistatic plastic tubes
VS-20CTQ040STRR-M3	800	800	13" diameter reel
VS-20CTQ040STRL-M3	800	800	13" diameter reel
VS-20CTQ040-1-M3	50	1000	Antistatic plastic tubes
VS-20CTQ045S-M3	50	1000	Antistatic plastic tubes
VS-20CTQ045STRR-M3	800	800	13" diameter reel
VS-20CTQ045STRL-M3	800	800	13" diameter reel
VS-20CTQ045-1-M3	50	1000	Antistatic plastic tubes

<b>LINKS TO RELATED DOCUMENTS</b>		
Dimensions	D <sup>2</sup> PAK (TO-263AB)	<a href="http://www.vishay.com/doc?96164">www.vishay.com/doc?96164</a>
	TO-262AA	<a href="http://www.vishay.com/doc?96165">www.vishay.com/doc?96165</a>
Part marking information	D <sup>2</sup> PAK (TO-263AB)	<a href="http://www.vishay.com/doc?95444">www.vishay.com/doc?95444</a>
	TO-262AA	<a href="http://www.vishay.com/doc?95443">www.vishay.com/doc?95443</a>
Packaging information		<a href="http://www.vishay.com/doc?96424">www.vishay.com/doc?96424</a>

### 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
	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	

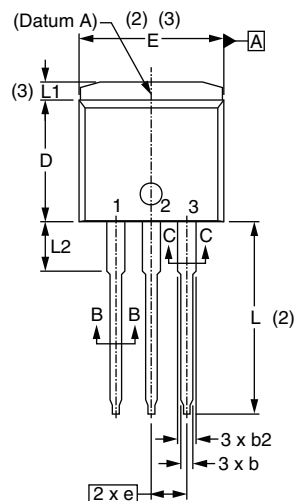
#### Notes

- 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

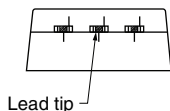
## TO-262

### DIMENSIONS in millimeters and inches

#### Modified JEDEC outline TO-262



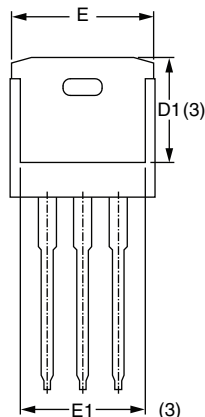
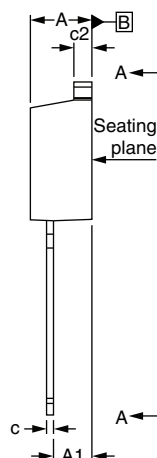
$\pm 0.010$  A A B



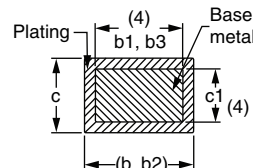
#### Lead assignments

##### Diodes

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



Section A - A



Section B - B and C - C

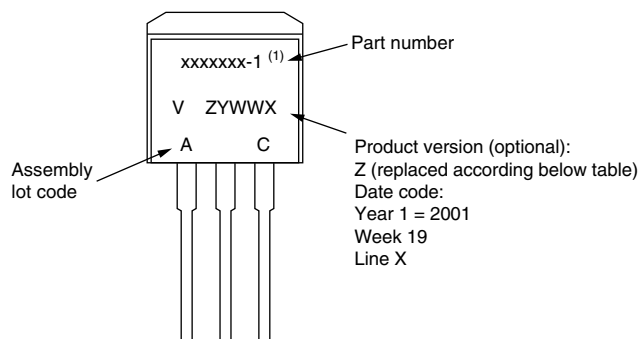
Scale: None

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

## TO-262



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

### Note

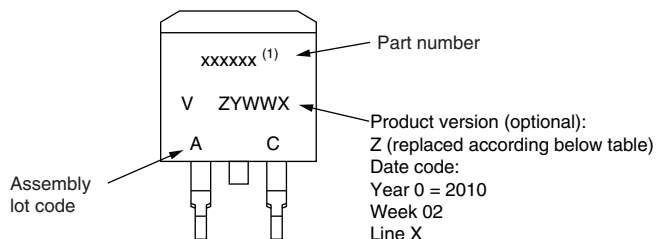
<sup>(1)</sup> If part number contain "H" as last digit, product is AEC-Q101 qualified

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





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



Example: This is a xxxxxx <sup>(1)</sup> 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
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



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