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**DIODE, POWER, SCHOTTKY RECTIFIER**

**BASED ON TYPE STPS80A45C AND STPS40A45C**

**ESCC Detail Specification No. 5106/024**

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<a href="#">1774</a>	Specification upissued to incorporate changes per DCR.

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## 1 GENERAL

### 1.1 SCOPE

This specification details the ratings, physical and electrical characteristics and test and inspection data for the component type variants and/or the range of components specified below. It supplements the requirements of, and shall be read in conjunction with, the ESCC Generic Specification listed under Applicable Documents.

### 1.2 APPLICABLE DOCUMENTS

The following documents form part of this specification and shall be read in conjunction with it:

- (a) ESCC Generic Specification No. [5000](#)
- (b) [MIL-STD-750](#), Test Methods and Procedures for Semiconductor Devices

### 1.3 TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS

For the purpose of this specification, the terms, definitions, abbreviations, symbols and units specified in ESCC Basic Specification No. [21300](#) shall apply.

### 1.4 THE ESCC COMPONENT NUMBER AND COMPONENT TYPE VARIANTS

#### 1.4.1 The ESCC Component Number

The ESCC Component Number shall be constituted as follows:

Example: 510602401

- Detail Specification Reference: 5106024
- Component Type Variant Number: 01 (as required)

#### 1.4.2 Component Type Variants

The component type variants applicable to this specification are as follows:

Variant Number	Based on Type	Case	Average Output Rectified Current per Device ( $I_o$ ) (A)	Description	Lead/Terminal Material and Finish	Weight Max (g)
01	STPS80A45C	SMD.5	80	Dual diode, common cathode	Q14	0.92
02	STPS40A45C	TO-254AA	40	Dual diode, common cathode	S14	9.4
03	STPS40A45C	TO-254AA	40	Dual diode, common cathode	S4	9.4
04	STPS80A45C	SMD.5	80	Dual diode, common cathode	Q4	0.92

The lead/terminal material and finish shall be in accordance with the requirements of ESCC Basic Specification No. [23500](#).

## 1.5 MAXIMUM RATINGS

The maximum ratings shall not be exceeded at any time during use or storage.

Maximum ratings shall only be exceeded during testing to the extent specified in this specification and when stipulated in Test Methods and Procedures of the ESCC Generic Specification.

Characteristics	Symbols	Maximum Ratings	Unit	Remarks
Forward Surge Current (per diode)	$I_{FSM}$	200	A	Notes 1, 2
Working Peak Reverse Voltage	$V_{RWM}$	45	V	
Repetitive Peak Reverse Voltage	$V_{RRM}$	45	V	
Average Output Rectified Current Variants 01, 04 (per diode) Variants 01, 04 (per device) Variants 02, 03 (per diode) Variants 02, 03 (per device)	$I_O$	40 80 40 40	A	Note 3
Operating Temperature Range (Case Temperature)	$T_{op}$	-65 to +175	°C	
Junction Temperature	$T_j$	+175	°C	Note 4
Storage Temperature Range	$T_{stg}$	-65 to +175	°C	
Soldering Temperature	$T_{sol}$	+245	°C	Note 5
Thermal Resistance, Junction to Case Variants 01, 04 (per diode) Variants 01, 04 (per device) Variants 02, 03 (per diode) Variants 02, 03 (per device)	$R_{th(j-c)}$	3.4 2.8 2 1.5	°C/W	
Thermal Resistance, Junction to Ambient Variants 01, 04 Variants 02, 03	$R_{th(j-a)}$	100 50	°C/W	Note 4

### NOTES:

- Sinusoidal pulse of 10ms duration.
- At  $T_{amb} \leq 25^{\circ}\text{C}$ .
- For Variants 01, 04 per diode: At  $T_{case} > +63.5^{\circ}\text{C}$ , derate linearly to 0A at  $+175^{\circ}\text{C}$ .  
For Variants 01, 04 per device: At  $T_{case} > -8.6^{\circ}\text{C}$ , derate linearly to 0A at  $+175^{\circ}\text{C}$ .  
For Variants 02, 03 per diode: At  $T_{case} > +109.4^{\circ}\text{C}$ , derate linearly to 0A at  $+175^{\circ}\text{C}$ .  
For Variants 02, 03 per device: At  $T_{case} > +134.8^{\circ}\text{C}$ , derate linearly to 0A at  $+175^{\circ}\text{C}$ .
- To avoid the risk of thermal runaway of a diode, on its own heatsink, the following condition shall be applied:  $(dP_{tot}/dT_j) < (1/R_{th(j-a)})$
- Duration 5s maximum and the same package shall not be resoldered until 3 minutes have elapsed.

## 1.6 HANDLING PRECAUTIONS

These devices are susceptible to damage by electrostatic discharge. Therefore, suitable precautions shall be employed for protection during all phases of manufacture, testing, packaging, shipment and any handling.

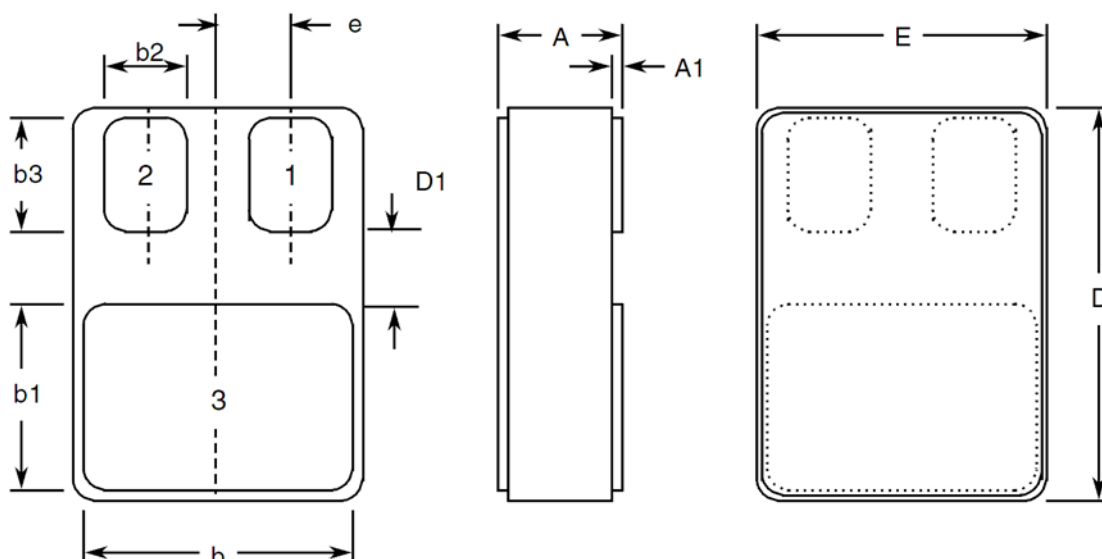
These components are categorised as Class 3 per ESCC Basic Specification No. [23800](#) with a Minimum Critical Path Failure Voltage of 8kV.

The TO-254AA package contains Beryllium Oxide (BeO) and therefore must not be ground, machined, sandblasted or subjected to any mechanical operation which will produce dust. The case must not be subjected to any chemical process (e.g. etching) which will produce fumes.

## 1.7 PHYSICAL DIMENSIONS AND TERMINAL IDENTIFICATION

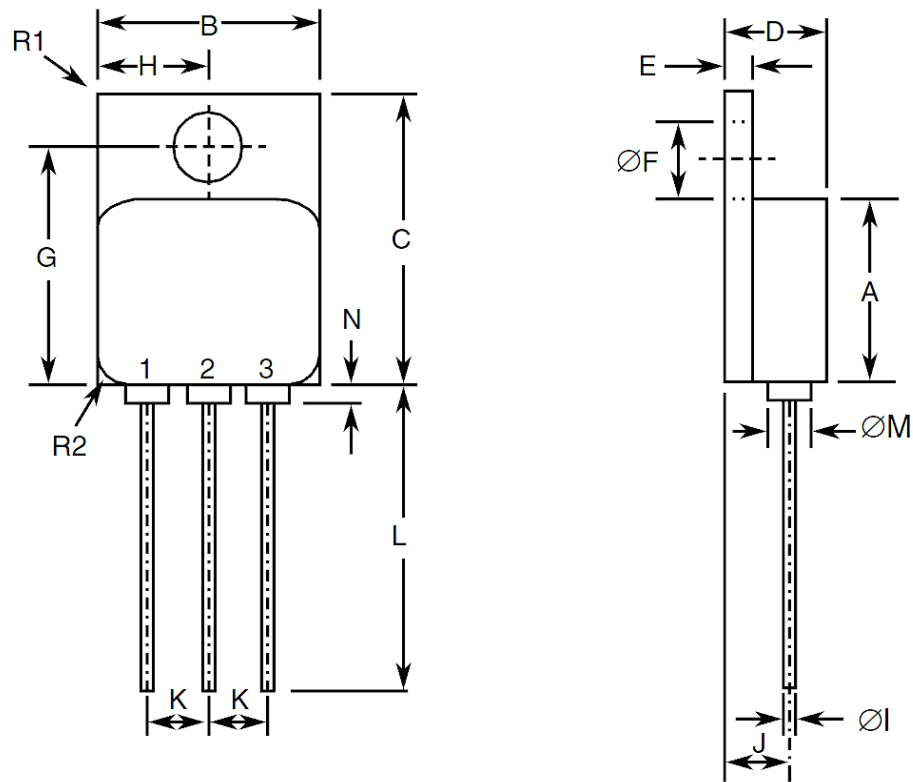
Consolidated Notes are given in Para. 1.7.3.

### 1.7.1 Surface Mount Package (SMD.5) - 3 Terminal (Variants 01, 04)



Symbols	Dimensions mm		Notes
	Min	Max	
A	2.84	3.3	
A1	0.25	0.51	
b	7.13	7.39	
b1	5.58	5.84	
b2	2.28	2.54	2
b3	2.92	3.18	2
D	10.03	10.28	
D1	0.76	-	2
E	7.39	7.64	
e	1.91 BSC		2

## 1.7.2 Metal Flange Mount Package (TO-254AA) - 3 Lead (Variants 02, 03)

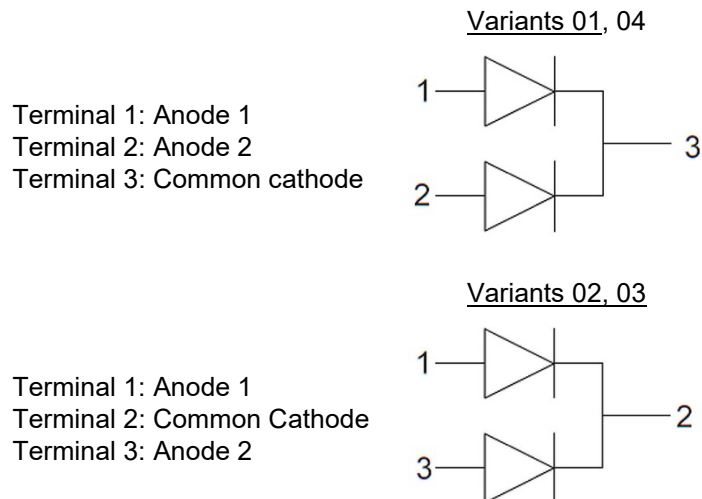


Symbols	Dimensions mm		Notes
	Min	Max	
A	13.59	13.84	
B	13.59	13.84	
C	20.07	20.32	
D	6.3	6.7	
E	1	1.35	
ØF	3.5	3.9	
G	16.89	17.4	
H	6.86 BSC		
ØI	0.89	1.14	3
J	3.81 BSC		
K	3.81 BSC		
L	12.95	14.5	
ØM	3.05 Typical		3
N	-	0.71	3
R1	-	1	4
R2	1.65 Typical		5

### 1.7.3 Notes to Para. 1.7 Physical Dimensions and Terminal Identification

1. Terminal identification is specified by the component's geometry. See Para. 1.8 Functional Diagram for the terminal connections.
2. 2 places.
3. 3 places.
4. Radius of heatsink flange corner, 4 places.
5. Radius of body corner, 4 places.

### 1.8 FUNCTIONAL DIAGRAM



#### **NOTES:**

1. For Variants 01, 04, the lid is not connected to any terminal.
2. For Variants 02, 03, the case is not connected to any lead.

### 1.9 MATERIALS AND FINISHES

Materials and finishes shall be as follows:

- (a) **Case**  
For the surface mount package the case shall be hermetically sealed and have a ceramic body with a Kovar lid.  
For the metal flange mount package the case shall be hermetically sealed and have a metal body. The leads pass through ceramic eyelets brazed into the frame and the lid shall be welded.
- (b) **Lead/Terminal Finish**  
As specified in Para. 1.4.2 Component Type Variants.

## 2 REQUIREMENTS

### 2.1 GENERAL

The complete requirements for procurement of the components specified herein are as stated in this specification and the ESCC Generic Specification. Permitted deviations from the Generic Specification, applicable to this specification only, are listed below.

Permitted deviations from the Generic Specification and this Detail Specification, formally agreed with specific Manufacturers on the basis that the alternative requirements are equivalent to the ESCC requirement and do not affect the component's reliability, are listed in the appendices attached to this specification.

#### 2.1.1 Deviations from the Generic Specification

None.

### 2.2 MARKING

The marking shall be in accordance with the requirements of ESCC Basic Specification No. 21700 and as follows.

The information to be marked on the component shall be:

- (a) The ESCC qualified components symbol (for ESCC qualified components only).
- (b) The ESCC Component Number (see Para. 1.4.1).
- (c) Traceability information.
- (d) Warning sign for beryllium oxide (only applicable to Variants 02 and 03).

### 2.3 CASE ISOLATION

For Variants 02 and 03, Case Isolation shall be performed as specified in the ESCC Generic Specification and as follows:

- Test Conditions:
  - Test voltage: 500Vdc
  - Duration of application of test voltage: 1s
  - Points of application of test voltage: between case metal tab and all terminals connected together.
  - Maximum leakage current: 10nA

### 2.4 TERMINAL STRENGTH

For Variants 02 and 03, the test conditions for Terminal Strength, tested as specified in the ESCC Generic Specification, shall be as follows:

- Test Condition: A, tension, with an applied force of 10N for a duration of 10s.

### 2.5 ELECTRICAL MEASUREMENTS AT ROOM, HIGH AND LOW TEMPERATURES

Electrical measurements shall be performed at room, high and low temperatures. Consolidated notes are given in Para. 2.5.3.

### 2.5.1 Room Temperature Electrical Measurements

The measurements shall be performed at  $T_{amb} = +25 \pm 3^{\circ}\text{C}$ .

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions Note 1	Limits		Units
				Min	Max	
Reverse Current	$I_R$	4016	DC Method $V_R = 45\text{V}$	-	25	$\mu\text{A}$
Forward Voltage	$V_{F1}$	4011	$I_F = 5\text{A}$ , Note 2	-	0.51	V
	$V_{F2}$	4011	$I_F = 10\text{A}$ , Note 2	-	0.57	V
	$V_{F3}$	4011	$I_F = 20\text{A}$ , Note 2	-	0.67	V
	$V_{F4}$	4011	$I_F = 30\text{A}$ , Note 2	-	0.75	V
	$V_{F5}$	4011	$I_F = 40\text{A}$ , Note 2	-	0.82	V
Capacitance	C	4001	$V_R = 10\text{V}$ $V_{sig} = 30\text{mV (p-p) max}$ $f = 1\text{MHz}$	-	610	pF
Critical Rate of Rise of Reverse Voltage	$dV/dt$	-	Note 3	-	10000	V/ $\mu\text{s}$
Thermal Impedance, Junction to Case	$Z_{th(j-c)}$	3101	Note 4	$\Delta V_F$ , Note 5		$^{\circ}\text{C/W}$

### 2.5.2 High and Low Temperatures Electrical Measurements

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions Notes 1, 6	Limits		Units
				Min	Max	
Reverse Current	$I_R$	4016	$T_{amb} = +125 (+0 -5)^{\circ}\text{C}$ DC Method $V_R = 45\text{V}$	-	18	mA
Forward Voltage	$V_{F1}$	4011	$T_{amb} = +125 (+0 -5)^{\circ}\text{C}$ $I_F = 5\text{A}$ , Note 2	-	0.4	V
			$T_{amb} = -55 (+5 -0)^{\circ}\text{C}$ $I_F = 5\text{A}$ , Note 2	-	0.59	V
	$V_{F2}$	4011	$T_{amb} = +125 (+0 -5)^{\circ}\text{C}$ $I_F = 10\text{A}$ , Note 2	-	0.49	V
			$T_{amb} = -55 (+5 -0)^{\circ}\text{C}$ $I_F = 10\text{A}$ , Note 2	-	0.63	V
	$V_{F3}$	4011	$T_{amb} = +125 (+0 -5)^{\circ}\text{C}$ $I_F = 20\text{A}$ , Note 2	-	0.61	V
			$T_{amb} = -55 (+5 -0)^{\circ}\text{C}$ $I_F = 20\text{A}$ , Note 2	-	0.7	V
	$V_{F4}$	4011	$T_{amb} = +125 (+0 -5)^{\circ}\text{C}$ $I_F = 30\text{A}$ , Note 2	-	0.68	V
			$T_{amb} = -55 (+5 -0)^{\circ}\text{C}$ $I_F = 30\text{A}$ , Note 2	-	0.76	V
	$V_{F5}$	4011	$T_{amb} = +125 (+0 -5)^{\circ}\text{C}$ $I_F = 40\text{A}$ , Note 2	-	0.74	V
			$T_{amb} = -55 (+5 -0)^{\circ}\text{C}$ $I_F = 40\text{A}$ , Note 2	-	0.82	V

### 2.5.3 Notes to Electrical Measurements Tables

1. Measurement per each diode.
2. Pulsed measurement: Pulse Width  $\leq 680\mu\text{s}$ , Duty Cycle  $\leq 2\%$ .
3. Turn-off rate from a stationary state with no conduction. Reverse voltage  $< V_{\text{RWM}}$
4. Performed only during Screening Tests Parameter Drift Values (Initial Measurements), go-no-go.
5. The limits for  $\Delta V_{\text{F}}$  shall be defined by the Manufacturer on every lot in accordance with [MIL-STD-750 Method 3101](#) and shall guarantee the  $R_{\text{th(j-c)}}$  limits specified in Para. 1.5 Maximum Ratings.
6. Read and record measurements shall be performed on a sample of 5 components with 0 failures allowed. Alternatively a 100% inspection may be performed.

### 2.6 PARAMETER DRIFT VALUES

Unless otherwise specified, the measurements shall be performed at  $T_{\text{amb}} = +25 \pm 3^{\circ}\text{C}$ .

The test methods and test conditions shall be as per the corresponding test defined in Para. 2.5.1, Room Temperature Electrical Measurements.

The drift values ( $\Delta$ ) shall not be exceeded for each characteristic specified. The corresponding absolute limit values for each characteristic shall not be exceeded.

Characteristics	Symbols	Limits			Units
		Drift Value Δ	Absolute		
			Min	Max	
Reverse Current	I <sub>R</sub>	±5 or (1) ±100%	-	25	μA
Forward Voltage	V <sub>F1</sub>	±0.05	-	0.51	V
	V <sub>F2</sub>	±0.05	-	0.57	V
	V <sub>F3</sub>	±0.05	-	0.67	V
	V <sub>F4</sub>	±0.05	-	0.75	V
	V <sub>F5</sub>	±0.05	-	0.82	V

#### **NOTES:**

1. Whichever is the greater referred to the initial value.

## 2.7 INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS

Unless otherwise specified, the measurements shall be performed at  $T_{amb} = +25 \pm 3^{\circ}\text{C}$ .

The test methods and test conditions shall be as per the corresponding test defined in Para. 2.5.1, Room Temperature Electrical Measurements.

The drift values ( $\Delta$ ) shall not be exceeded for each characteristic specified. The corresponding absolute limit values for each characteristic shall not be exceeded.

Characteristics	Symbols	Limits		Units
		Min	Max	
Reverse Current	$I_R$	-	25	$\mu\text{A}$
Forward Voltage	$V_{F1}$	-	0.51	V
	$V_{F2}$	-	0.57	V
	$V_{F3}$	-	0.67	V
	$V_{F4}$	-	0.75	V
	$V_{F5}$	-	0.82	V

## 2.8 HIGH TEMPERATURE REVERSE BIAS BURN-IN CONDITIONS

Characteristics	Symbols	Test Conditions	Units
Ambient Temperature	$T_{amb}$	+80 (+0 -5)	$^{\circ}\text{C}$
Reverse Voltage	$V_R$	36	V
Duration	t	$\geq 48$	Hours

## 2.9 POWER BURN-IN CONDITIONS

Characteristics	Symbols	Test Conditions	Units
Ambient Temperature	$T_{amb}$	+25 (+0 -5)	$^{\circ}\text{C}$
Junction Temperature	$T_J$	+175 (+0 -5)	$^{\circ}\text{C}$
Average Output Rectified Current	$I_o$	Note 1	A
Duration	t	$\geq 168$	Hours

### NOTES:

1. The output current may be adjusted, within the given limit range, to attain the specified junction temperature.

## 2.10 OPERATING LIFE CONDITIONS

The conditions shall be as specified in Para. 2.9, Power Burn-in Conditions.

### APPENDIX A

#### AGREED DEVIATIONS FOR STMICROELECTRONICS (F)

ITEMS AFFECTED	DESCRIPTION OF DEVIATIONS
Para. 2.1.1, Deviations from the Generic Specification: Para. 8, Test Methods and Procedures	For qualification and qualification maintenance, or procurement of qualified or unqualified components, the following replacement test method specifications shall be used instead of the following ESCC Basic Specifications: <ul style="list-style-type: none"> <li>No. 20400, Internal Visual Inspection: replaced by <a href="#">MIL-STD-750 Test Method 2078</a>.</li> <li>No. 20500, External Visual Inspection: replaced by <a href="#">MIL-STD-750 Test Method 2071</a>.</li> </ul> No. 20900, Radiographic Inspection of Electronic Components: replaced by <a href="#">MIL-STD-750 Test Method 2076</a> .
Para. 2.1.1, Deviations from the Generic Specification: Deviations from Production Control – Chart F2	Special In-Process Controls - Internal Visual Inspection: Wedge bonds equal to 1.1 wire diameter are acceptable for bonding with a V-Groove tool.
Para. 2.1.1, Deviations from the Generic Specification: Deviations from Screening Tests for Packaged Components – Chart F3A	<p>Solderability: Solderability is not applicable unless specifically stipulated in the Purchase Order.</p> <p>Room Temperature Electrical Measurements: Capacitance and Critical Rate of Rise of Reverse Voltage may be considered guaranteed but not tested if successful pilot lot testing has been performed in accordance with STMicroelectronics “Acceptation wafers” internal procedure as specified in the PID, which includes AC characteristic measurements per the Detail Specification.</p> <p>A summary of the pilot lot testing shall be provided if required by the Purchase Order.</p>

#### ADDITIONAL DATA – STMICROELECTRONICS (F)

(a) Derating for Space Application

The derating for space applications was originally obtained on STPS40A45 devices under the following test conditions. A **Post-Irradiation Gate Stress (PIGS)** test has been done after irradiation. The testing was performed in a vacuum at UCL (Louvain-la-Neuve, Belgium):

Ions used: Xe  
LET = 62.5MeV/(mg/cm<sup>2</sup>)  
Energy = 995MeV  
Range = 73.1µm(Si)

These components are susceptible to **Single Event Burn-out (SEB)** if operated in a space environment unless the following derating is applied:

$V_R$ (V)	45	33.75
LET (MeV.cm <sup>2</sup> /mg)		
62.5	SEB	OK