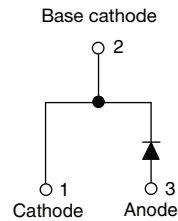
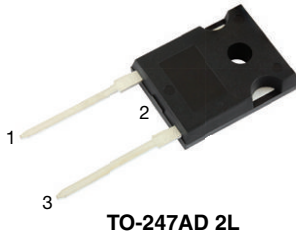




## Hyperfast Rectifier, 60 A FRED Pt® Gen 5



## FEATURES

- Hyperfast and optimized  $Q_{rr}$
- Best in class forward voltage drop and switching losses trade off
- Optimized for high speed operation
- 175 °C maximum operating junction temperature
- Polyimide passivation
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



RoHS  
COMPLIANT  
HALOGEN  
FREE

## PRIMARY CHARACTERISTICS

$I_{F(AV)}$	60 A
$V_R$	1200 V
$V_F$ at $I_F$ at 125 °C	2.1 V
$t_{rr}$	30 ns
$T_J$ max.	175 °C
Package	TO-247AD 2L
Circuit configuration	Single

## DESCRIPTION / APPLICATIONS

Featuring a unique combination of low conduction and switching losses, this rectifier is the right choice for high frequency converters, both soft switched / resonant. Specifically designed to improve efficiency of PFC and output rectification stages of EV / HEV battery charging stations, booster stage of solar inverters and UPS applications, these devices are perfectly matched to operate with MOSFETs or high speed IGBTs.

## ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Repetitive peak reverse voltage	$V_{RRM}$		1200	V
Average rectified forward current	$I_{F(AV)}$	$T_C = 105\text{ °C}$ , $D = 0.50$	60	A
Non-repetitive peak surge current	$I_{FSM}$	$T_C = 45\text{ °C}$ , $t_p = 10\text{ ms}$ , sine wave	420	
Repetitive peak forward current	$I_{FRM}$	$T_C = 105\text{ °C}$ , $D = 0.50$ , $f = 20\text{ kHz}$	120	
Operating junction and storage temperature	$T_J$ , $T_{Stg}$		-55 to +175	°C

ELECTRICAL SPECIFICATIONS ( $T_J = 25\text{ °C}$  unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Breakdown voltage, blocking voltage	$V_{BR}$ , $V_R$	$I_R = 100\text{ }\mu\text{A}$	1200	-	-	V
Forward voltage	$V_F$	$I_F = 60\text{ A}$	-	2.6	3.15	
		$I_F = 60\text{ A}$ , $T_J = 125\text{ °C}$	-	2.1	-	
Reverse leakage current	$I_R$	$V_R = V_R$ rated	-	-	50	$\mu\text{A}$
		$T_J = 125\text{ °C}$ , $V_R = V_R$ rated	-	-	500	
Junction capacitance	$C_T$	$V_R = 200\text{ V}$	-	32	-	pF
Series inductance	$L_S$	Measured to lead 5 mm from package body	-	8	-	nH



<b>DYNAMIC RECOVERY CHARACTERISTICS</b> ( $T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Reverse recovery time	$t_{rr}$	$I_F = 1.0\text{ A}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$	-	30	-	ns
		$T_J = 25\text{ }^\circ\text{C}$	-	120	-	
		$T_J = 125\text{ }^\circ\text{C}$	-	170	-	
Peak recovery current	$I_{RRM}$	$T_J = 25\text{ }^\circ\text{C}$	-	17	-	A
		$T_J = 125\text{ }^\circ\text{C}$	-	32	-	
Reverse recovery charge	$Q_{rr}$	$T_J = 25\text{ }^\circ\text{C}$	-	970	-	nC
		$T_J = 125\text{ }^\circ\text{C}$	-	2950	-	
Reverse recovery time	$t_{rr}$	$T_J = 25\text{ }^\circ\text{C}$	-	90	-	ns
		$T_J = 125\text{ }^\circ\text{C}$	-	130	-	
Peak recovery current	$I_{RRM}$	$T_J = 25\text{ }^\circ\text{C}$	-	32	-	A
		$T_J = 125\text{ }^\circ\text{C}$	-	53	-	
Reverse recovery charge	$Q_{rr}$	$T_J = 25\text{ }^\circ\text{C}$	-	1570	-	nC
		$T_J = 125\text{ }^\circ\text{C}$	-	4300	-	

<b>THERMAL - MECHANICAL SPECIFICATIONS</b>						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Thermal resistance, junction-to-case	$R_{thJC}$		-	-	0.4	$^\circ\text{C}/\text{W}$
Weight			-	5.5	-	g
			-	0.2	-	oz.
Mounting torque			6.0 (5.0)	-	12 (10)	kgf · cm (lbf · in)
Maximum junction and storage temperature range	$T_J$ , $T_{Stg}$		-55	-	175	$^\circ\text{C}$
Marking device		Case style: TO-247AD 2L	E5PX6012L			

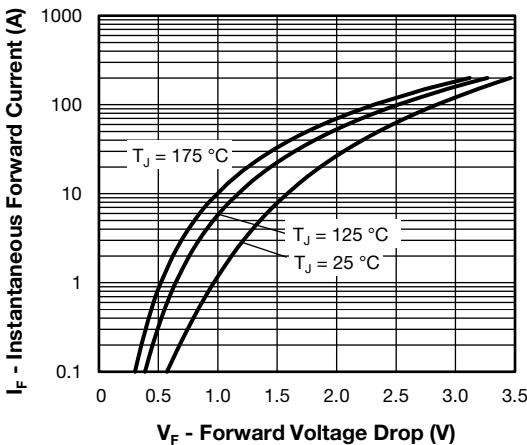


Fig. 1 - Typical Forward Voltage Drop Characteristics

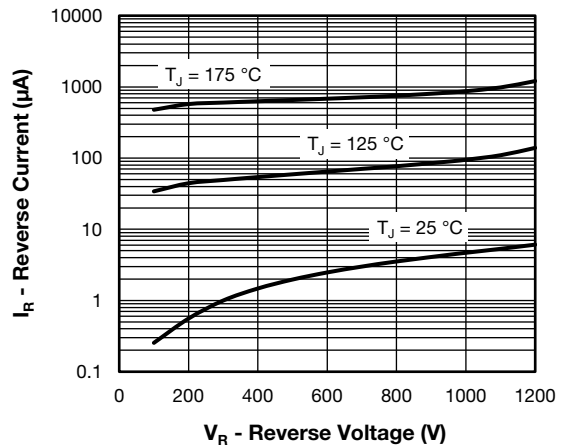


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

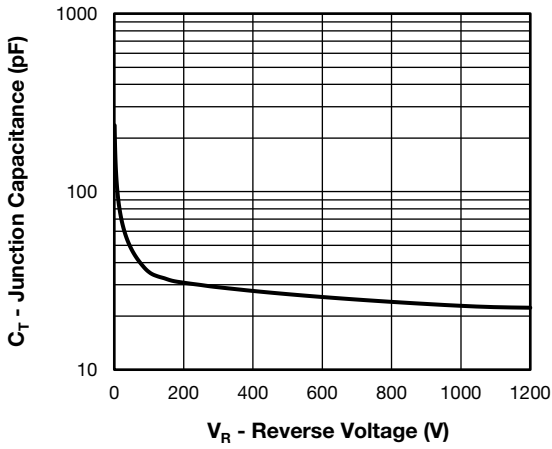


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

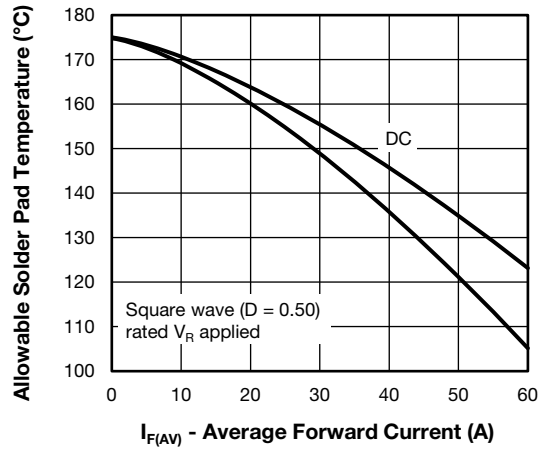


Fig. 4 - Maximum Allowable Case Temperature vs. Average Forward Current

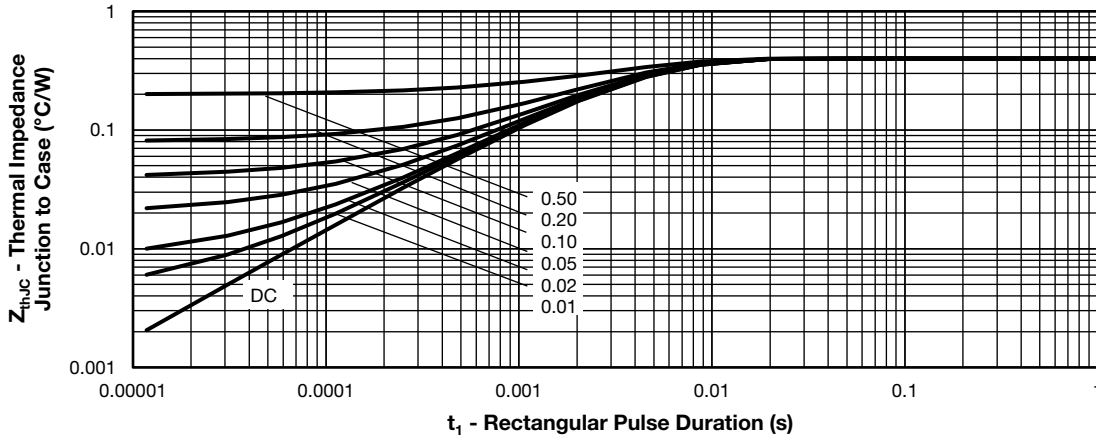


Fig. 5 - Thermal Impedance  $Z_{thJC}$  - Characteristics

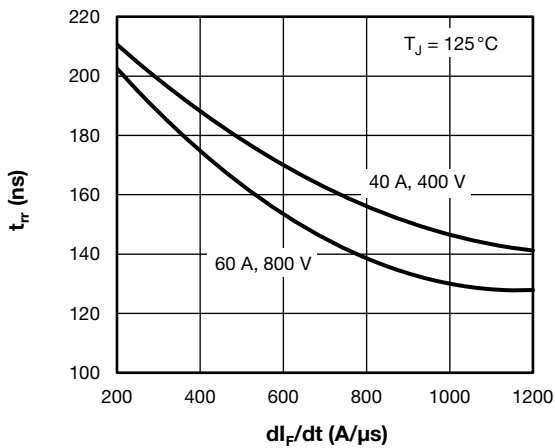


Fig. 6 - Typical Reverse Recovery Time vs.  $di_F/dt$

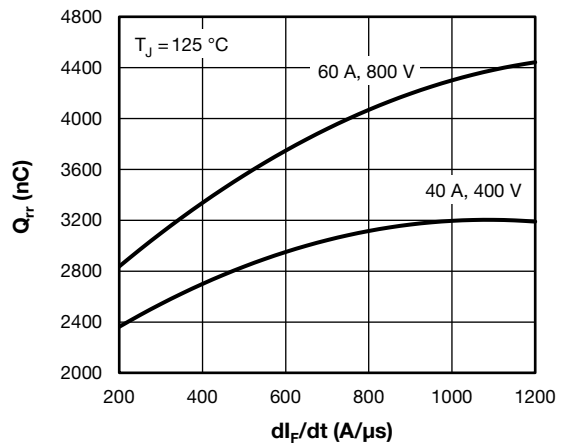


Fig. 7 - Typical Stored Charge vs.  $di_F/dt$

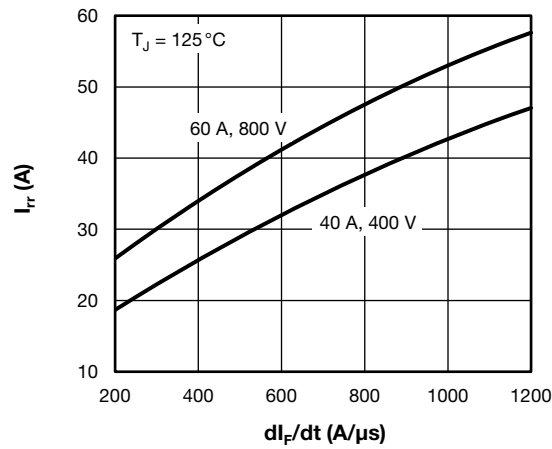


Fig. 8 - Typical Recovery Current vs.  $di_F/dt$

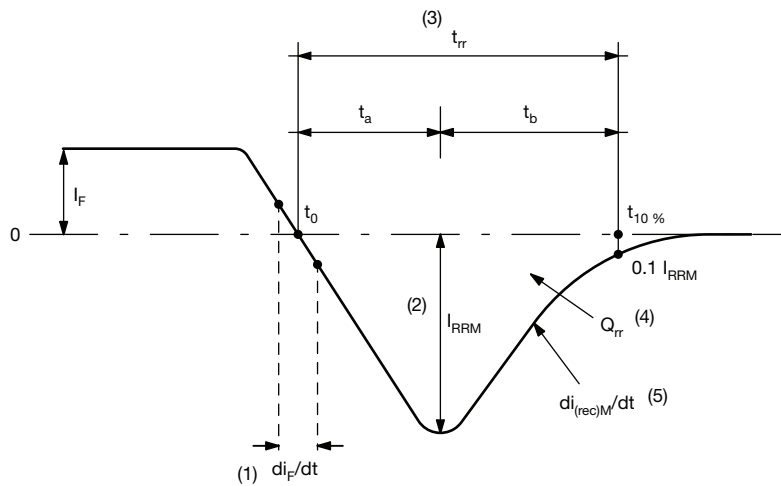


Fig. 9 - Reverse Recovery Waveform and Definitions

**Notes**

- (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  $t_0$ , crossing point of negative going  $I_F$ , to point  $t_{10\%}$ ,  $0.1 I_{RRM}$
- (4)  $Q_{rr}$  - area under curve defined by  $t_0$  and  $t_{10\%}$

$$Q_{rr} = \int_{t_0}^{t_{10\%}} I(t) dt$$

- (5)  $di_{(rec)M}/dt$  - peak rate of change of current during  $t_b$  portion of  $t_{rr}$



**ORDERING INFORMATION TABLE**

Device code	<b>VS-</b>	<b>E</b>	<b>5</b>	<b>P</b>	<b>X</b>	<b>60</b>	<b>12</b>	<b>L</b>	<b>-N3</b>
	①	②	③	④	⑤	⑥	⑦	⑧	⑨

- 1** - Vishay Semiconductors product
- 2** - E = single diode
- 3** - 5 = Fred generation 5
- 4** - Package:  
P = TO-247 package
- 5** - X = hyperfast recovery
- 6** - Current rating (60 = 60 A)
- 7** - Voltage rating (12 = 1200 V)
- 8** - Package: L = long lead (TO-247AD)
- 9** - Environmental digit:  
-N3 = halogen-free, RoHS-compliant, and totally lead (Pb)-free

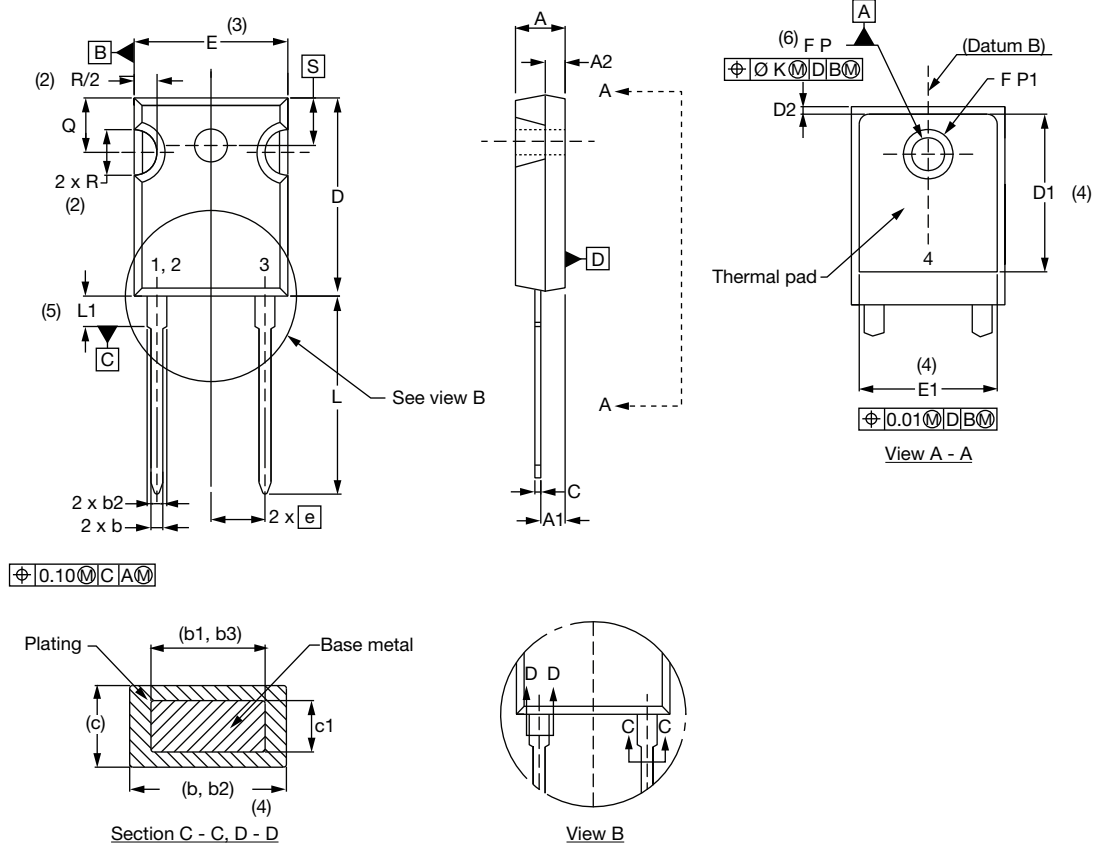
<b>ORDERING INFORMATION</b> (Example)			
<b>PREFERRED P/N</b>	<b>QUANTITY PER TUBE</b>	<b>MINIMUM ORDER QUANTITY</b>	<b>PACKAGING DESCRIPTION</b>
VS-E5PX6012L-N3	25	500	Antistatic plastic tube

<b>LINKS TO RELATED DOCUMENTS</b>	
Dimensions	<a href="http://www.vishay.com/doc?95536">www.vishay.com/doc?95536</a>
Part marking information	<a href="http://www.vishay.com/doc?95648">www.vishay.com/doc?95648</a>
SPICE model	<a href="http://www.vishay.com/doc?96556">www.vishay.com/doc?96556</a>



TO-247AD 2L

**DIMENSIONS** in millimeters and inches



SYMBOL	MILLIMETERS		INCHES		NOTES	SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.			MIN.	MAX.	MIN.	MAX.	
A	4.65	5.31	0.183	0.209		E	15.29	15.87	0.602	0.625	3
A1	2.21	2.59	0.087	0.102		E1	13.46	-	0.53	-	
A2	1.50	2.49	0.059	0.098		e	5.46 BSC		0.215 BSC		
b	0.99	1.40	0.039	0.055		$\varnothing K$	0.254		0.010		
b1	0.99	1.35	0.039	0.053		L	19.81	20.32	0.780	0.800	
b2	1.65	2.39	0.065	0.094		L1	3.71	4.29	0.146	0.169	
b3	1.65	2.34	0.065	0.092		$\varnothing P$	3.56	3.66	0.14	0.144	
c	0.38	0.89	0.015	0.035		$\varnothing P1$	-	6.98	-	0.275	
c1	0.38	0.84	0.015	0.033		Q	5.31	5.69	0.209	0.224	
D	19.71	20.70	0.776	0.815	3	R	4.52	5.49	0.178	0.216	
D1	13.08	-	0.515	-	4	S	5.51 BSC		0.217 BSC		
D2	0.51	1.35	0.020	0.053							

**Notes**

- (1) Dimensioning and tolerancing per ASME Y14.5M-1994
- (2) Contour of slot optional
- (3) Dimension D and E do not include mold flash. These dimensions are measured at the outermost extremes of the plastic body
- (4) Thermal pad contour optional with dimensions D1 and E1
- (5) Lead finish uncontrolled in L1
- (6)  $\varnothing P$  to have a maximum draft angle of 1.5 to the top of the part with a maximum hole diameter of 3.91 mm (0.154")
- (7) Outline conforms to JEDEC® outline TO-247 with exception of dimension A min., D, E min., Q min., S, and note 4



## **Disclaimer**

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.

## X-ON Electronics

Largest Supplier of Electrical and Electronic Components

*Click to view similar products for [Rectifiers](#) category:*

*Click to view products by [Vishay](#) manufacturer:*

Other Similar products are found below :

[70HFR40](#) [RL252-TP](#) [150KR30A](#) [1N5397](#) [NTE5841](#) [NTE6038](#) [SCF5000](#) [1N4002G](#) [1N4005-TR](#) [JANS1N6640US](#) [481235F](#)  
[RRE02VS6SGTR](#) [067907F](#) [MS306](#) [70HF40](#) [T110HF60](#) [T85HFL60S02](#) [US2JFL-TP](#) [A1N5404G-G](#) [CRS04\(T5L,TEMQ\)](#) [ACGRA4007-HF](#)  
[ACGRB207-HF](#) [CLH03\(TE16L,Q\)](#) [ACGRC307-HF](#) [ACEFC304-HF](#) [NTE6356](#) [NTE6359](#) [NTE6002](#) [NTE6023](#) [NTE6039](#) [NTE6077](#)  
[85HFR60](#) [40HFR60](#) [1N1186RA](#) [70HF120](#) [85HFR80](#) [D126A45C](#) [SCF7500](#) [D251N08B](#) [SCHJ22.5K](#) [SM100](#) [SCPA2](#) [SCH10000](#) [SDHD5K](#)  
[VS-12FL100S10](#) [ACGRA4001-HF](#) [D1821SH45T PR](#) [D1251S45T](#) [NTE5990](#) [NTE6358](#)