

# AS3T040A120X

$V_{DS}$	1200 V
$R_{DS,on}$	38 mΩ
$I_D (T_C=25°C)$	62 A
$T_{j,max}$	175°C

## QSiC™ 1200V SiC MOSFET

### Features

- High speed switching
- Reliable body diode
- All parts tested to greater than 1,400V
- Qualified for Automotive Applications  
Product Validation according to AEC-Q101

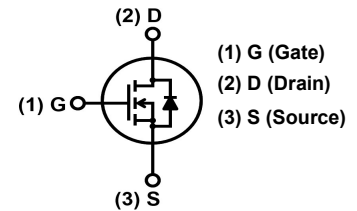
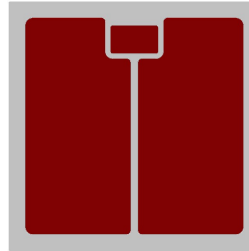
### Benefits

- Lower capacitance
- Higher system efficiency
- Easy to parallel

### Applications

- On board chargers
- High voltage DC/DC converters
- Motor drives
- Switch mode power supplies
- EV charging stations

### Chip Outline and Inner Circuit



Part #	Top Side	Bottom Side
AS3T040A120X	Al	Ni/Ag



**Maximum Ratings**, at  $T_j=25^\circ\text{C}$ , unless otherwise specified

Characteristics	Symbol	Conditions	Values	Unit
Drain-Source Voltage	$V_{rated}$	$V_{GS}=0V, I_{DS}=1\mu A$	1200	V
Continuous Drain Current	$I_D^*$	$T_C=25^\circ\text{C}, T_j=175^\circ\text{C}$	62	A
		$T_C=100^\circ\text{C}, T_j=175^\circ\text{C}$	44	
Pulsed Drain Current	$I_{D,pulse}^{**}$	$T_C=25^\circ\text{C}$	140	
Gate Source Voltage	$V_{GSmax}$		-8/22	V
	$V_{GSop}$	Recommended operational	-4.5/18	
Operating & Storage Temperature	$T_j, T_{storage}$	Continuous	-55...175	$^\circ\text{C}$

Values have been verified on SemiQ TO-247-4L packaged devices

\* Assumes  $R_{thJC}$  thermal resistance of  $0.61^\circ\text{C/W}$  with recommended wire bonds

\*\* Pulse width is limited by  $T_{jmax}$

**Refer to the Warnings and Notes at the end of this document**

**Static Electrical Characteristics, at  $T_j=25^\circ\text{C}$ , unless otherwise specified**

Characteristics	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Drain-Source Breakdown Voltage	$BV_{DSS}^{***}$	$I_{DS}=1\text{mA}$	1200	-	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=1200\text{V}, V_{GS}=0\text{V}$	-	0.1	1.0	$\mu\text{A}$
		$V_{DS}=1200\text{V}, V_{GS}=0\text{V}, T_j=175^\circ\text{C}$	-	0.6	-	
Gate-Source Leakage Current	$I_{GSS+}^{***}$	$V_{GS}=18\text{V}, V_{DS}=0\text{V}$	-	10	100	nA
	$I_{GSS-}^{***}$	$V_{GS}=-4.5\text{V}, V_{DS}=0\text{V}$	-	-10	-100	
Gate Threshold Voltage	$V_{GS(th)}$	$V_{GS}=V_{DS}, I_{DS}=10\text{mA}$	1.8	3.5	4	V
		$V_{GS}=V_{DS}, I_{DS}=10\text{mA}, T_j=125^\circ\text{C}$	-	2.7	-	
		$V_{GS}=V_{DS}, I_{DS}=10\text{mA}, T_j=175^\circ\text{C}$	-	2.5	-	
Drain-Source On-Resistance	$R_{DS(on)}$	$V_{GS}=18\text{V}, I_{DS}=20\text{A}$	-	38	52	m $\Omega$
		$V_{GS}=18\text{V}, I_{DS}=20\text{A}, T_j=125^\circ\text{C}$	-	50	-	
		$V_{GS}=18\text{V}, I_{DS}=20\text{A}, T_j=175^\circ\text{C}$	-	63	-	
Transconductance	$g_{fs}$	$V_{DS}=20\text{V}, I_{DS}=20\text{A}$	-	12	-	S
Gate Input Resistance	$R_G$	$f=1\text{MHz}, V_{AC}=25\text{mV}, \text{D-S Short}$	-	2.9	-	$\Omega$

**AC Electrical Characteristics, at  $T_j=25^\circ\text{C}$ , unless otherwise specified**

Characteristics	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Input Capacitance	$C_{ISS}$	$V_{GS}=0\text{V},$ $V_{DS}=1000\text{V},$ $f=200\text{kHz}, V_{AC}=25\text{mV}$	-	2803	-	pF
Output Capacitance	$C_{OSS}$		-	97	-	
Reverse Transfer Capacitance	$C_{RSS}$		-	9	-	
Coss Stored Energy	$E_{OSS}$		-	56	-	$\mu\text{J}$
Total Gate Charge	$Q_G$	$V_{DD}=800\text{V}, I_{DS}=40\text{A},$ $V_{GS}=-4.5/+18\text{V}$	-	108	-	nC
Gate to Source Charge	$Q_{GS}$		-	43	-	
Gate to Drain Charge	$Q_{GD}$		-	28	-	

**Body Diode Characteristics, at  $T_j=25^\circ\text{C}$ , unless otherwise specified**

Characteristics	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Max Continuous Diode Fwd Current	$I_S^*$	$V_{GS}=-5\text{V}, T_C=25^\circ\text{C}$	-	-	55	A
Diode Forward Voltage	$V_{SD}^{***}$	$V_{GS}=-5\text{V}, I_{SD}=10\text{A}$	-	3.7	-	V
Reverse Recovery Time	$t_{RR}$	$I_{SD}=40\text{A}, V_R=800\text{V},$ $V_{GS}=-4.5/+18\text{V}, di_F/dt=7.8\text{A/ns}$	-	11	-	ns
Reverse Recovery Charge	$Q_{RR}$		-	323	-	nC
Peak Reverse Recovery Current	$I_{RRM}$		-	50	-	A

Values have been verified on SemiQ TO-247-4L packaged devices

For examples of switching characteristics, please refer to packaged datasheets AS3T040A120X

\* Assumes RthJC thermal resistance of 0.61°C/W with recommended wire bonds

\*\*\* Verified by 100% wafer test

Mechanical Parameters

Parameter	Typ.	Unit
Wafer Size	150	mm

Typical Performance

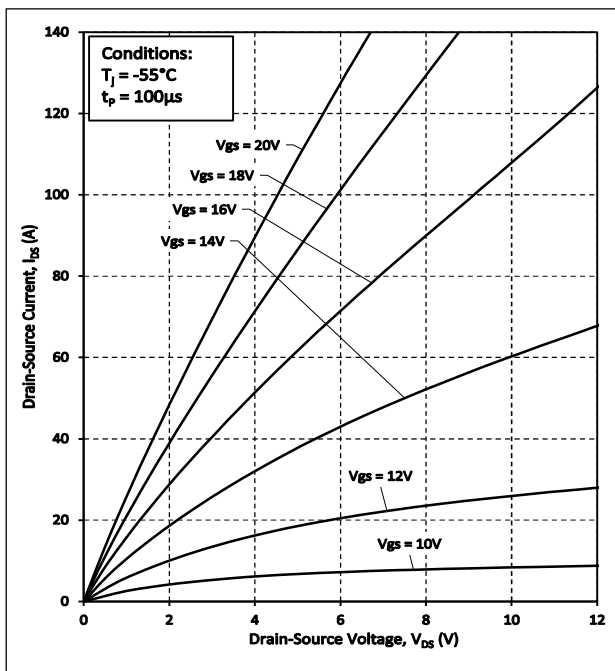


Figure 1. Output Characteristics  $T_j = -55^\circ\text{C}$

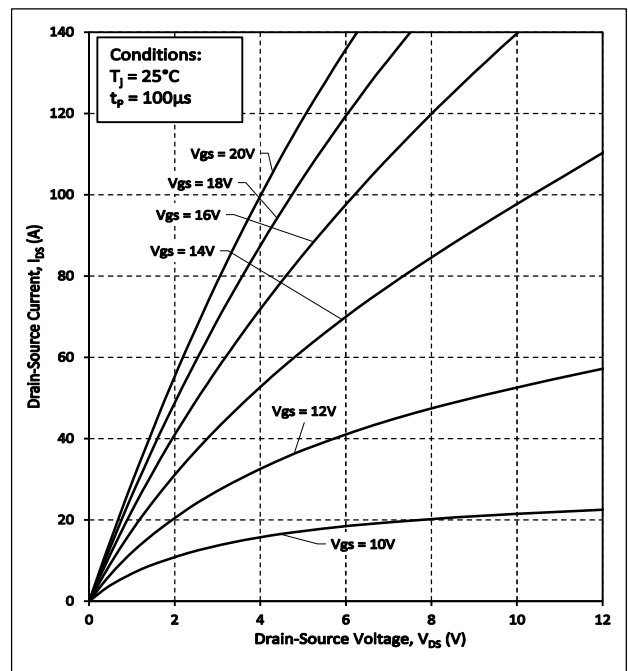


Figure 2. Output Characteristics  $T_j = 25^\circ\text{C}$

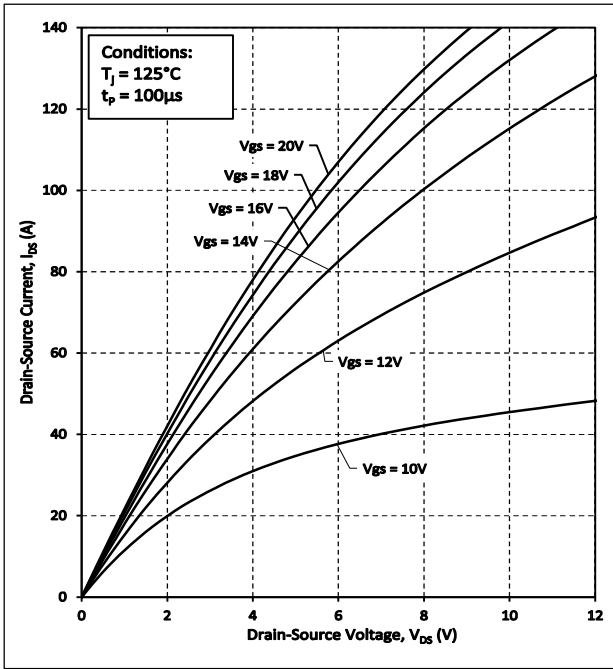


Figure 3. Output Characteristics  $T_j = 125^\circ\text{C}$

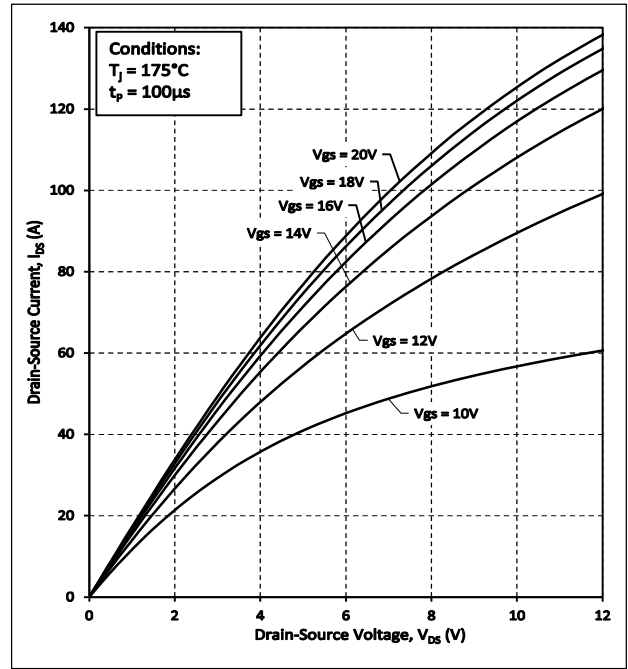


Figure 4. Output Characteristics  $T_j = 175^\circ\text{C}$

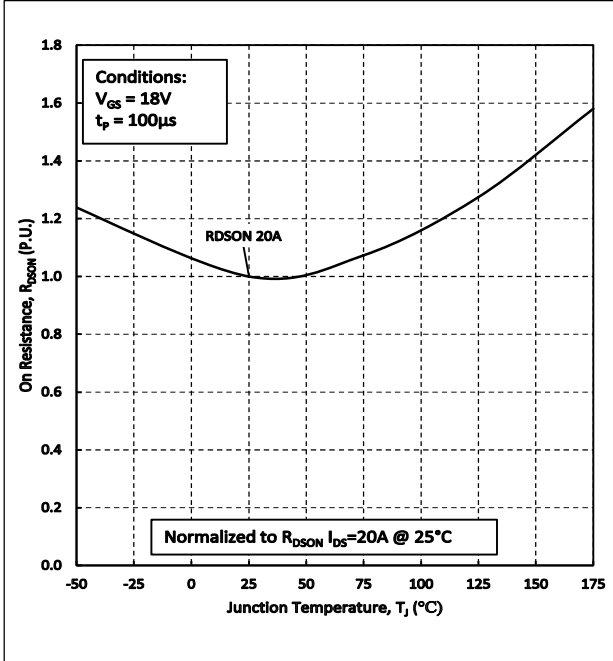


Figure 5. Normalized On-Resistance vs. Temperature

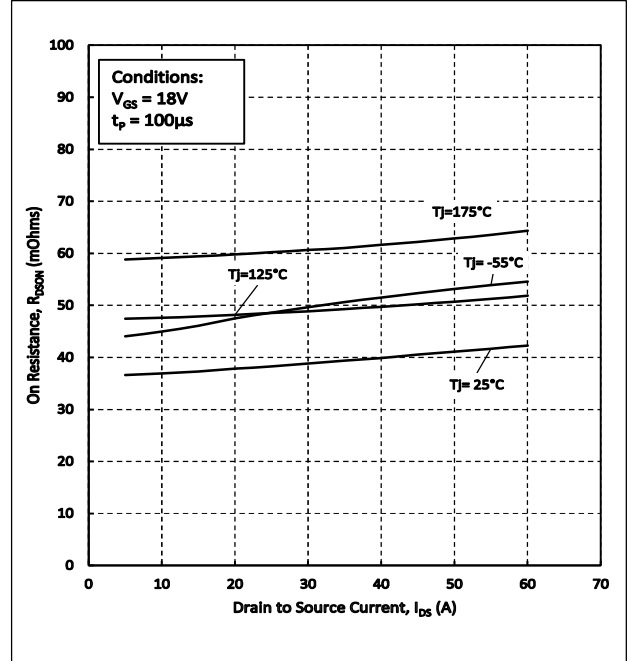


Figure 6. On-Resistance vs. Drain Current For Various Temperature

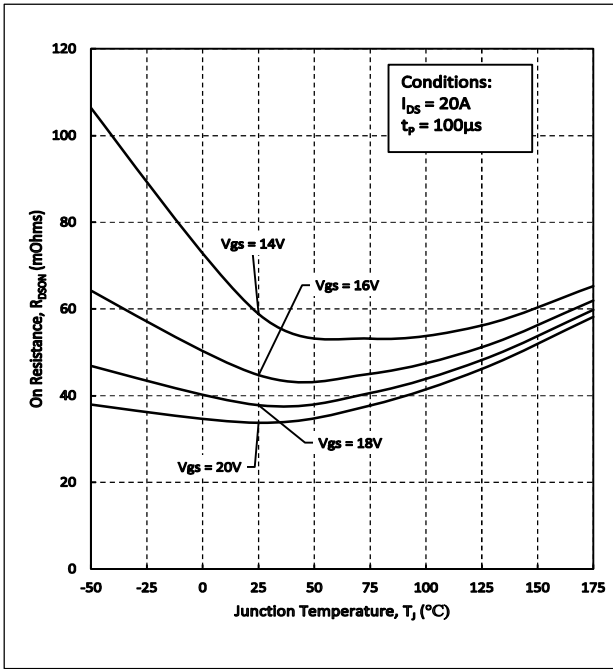


Figure 7. On-Resistance vs. Temperature For Various Gate Voltages

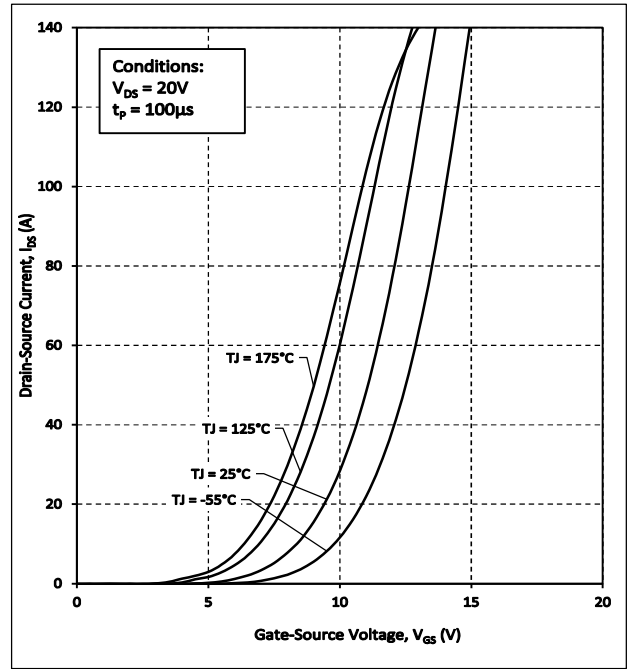


Figure 8. Transfer Characteristic for Various Junction Temperatures

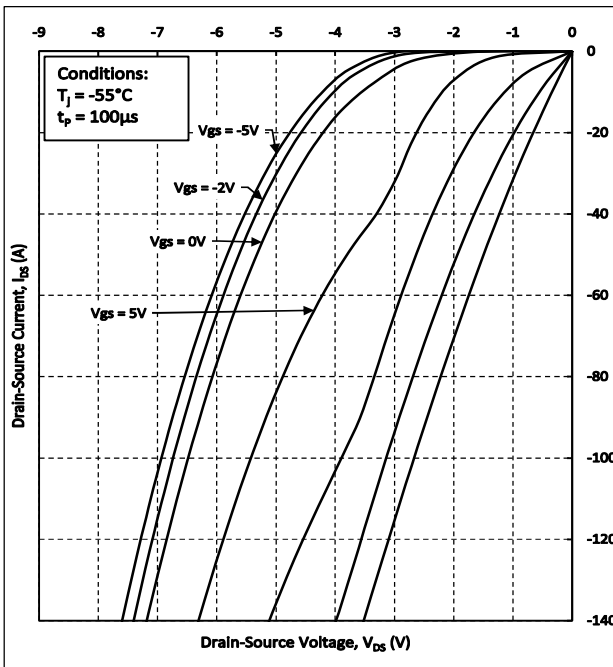


Figure 9. Body Diode Characteristics at  $T_J = -55^\circ\text{C}$

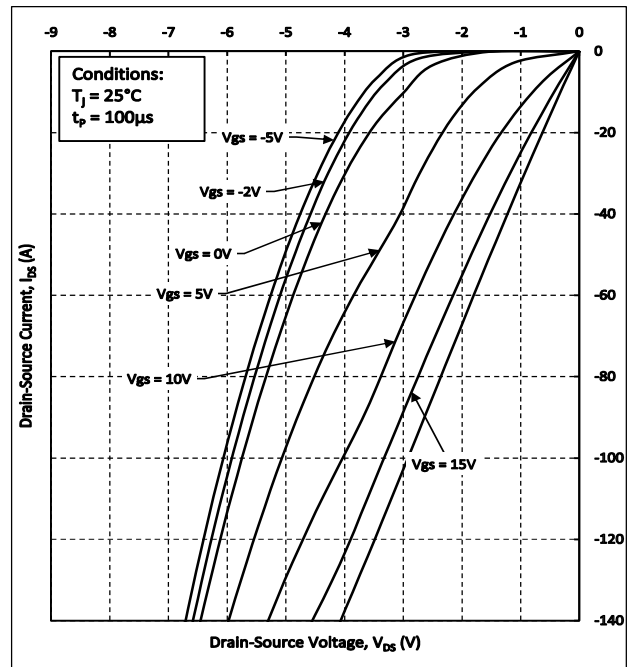


Figure 10. Body Diode Characteristics at  $T_J = 25^\circ\text{C}$

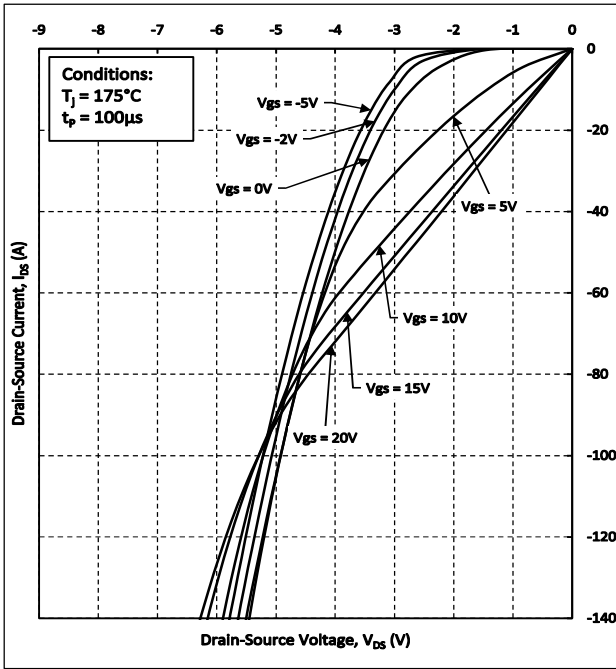


Figure 11. Body Diode Characteristics at  $T_j = 175^\circ\text{C}$

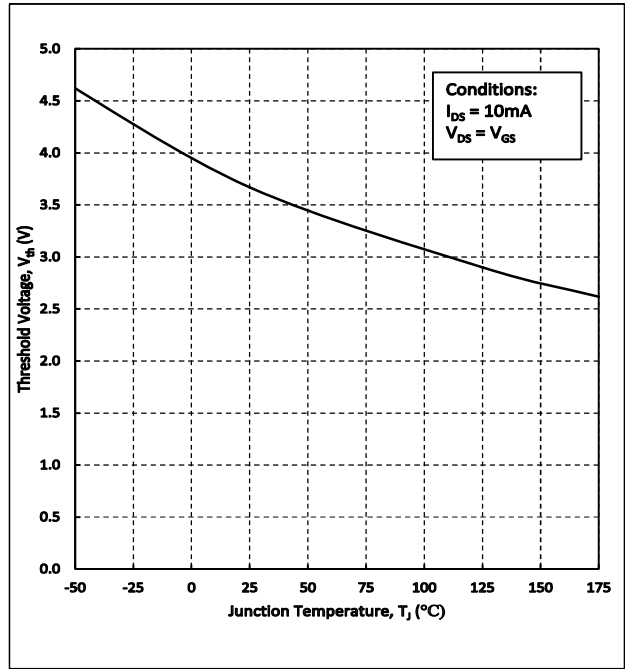


Figure 12. Threshold Voltage vs. Temperature

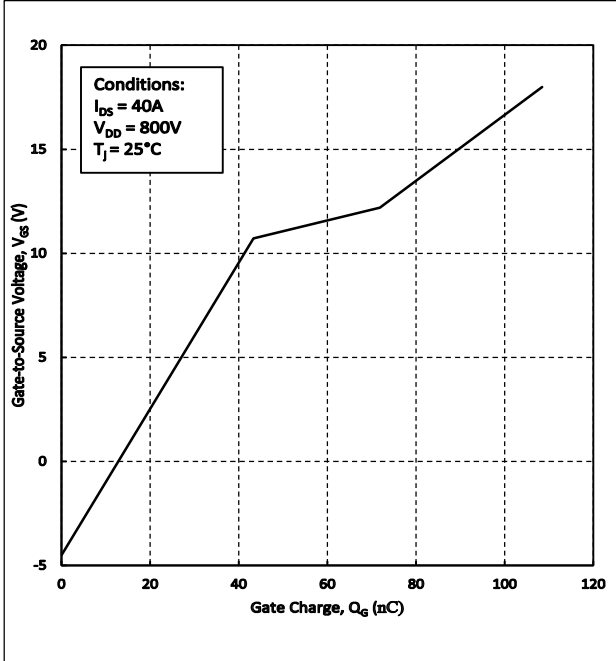


Figure 13. Gate Charge Characteristics

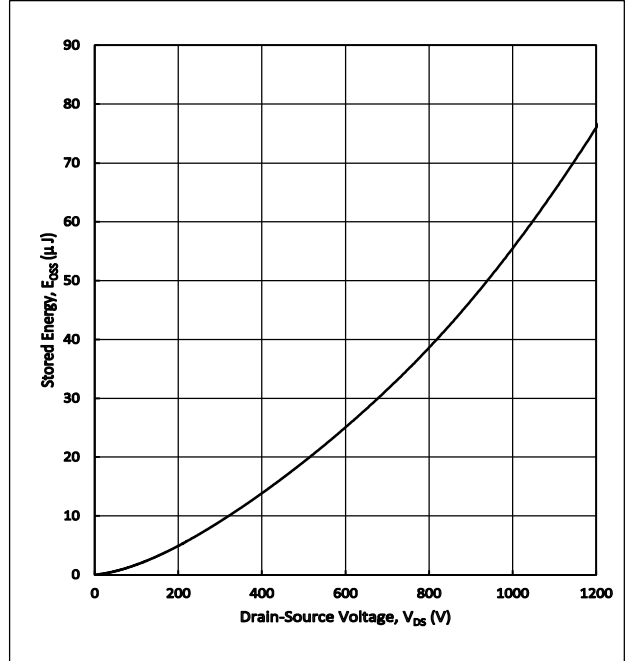


Figure 14. Output Capacitor Stored Energy

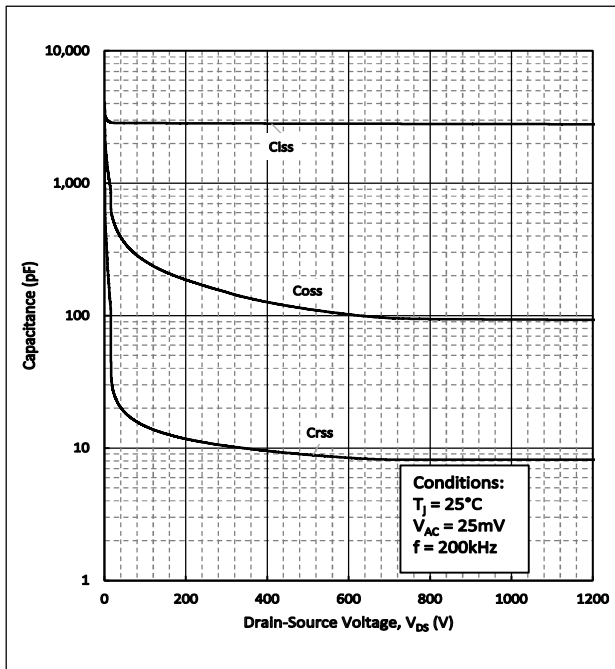


Figure 15. Capacitance vs Drain-Source Voltage

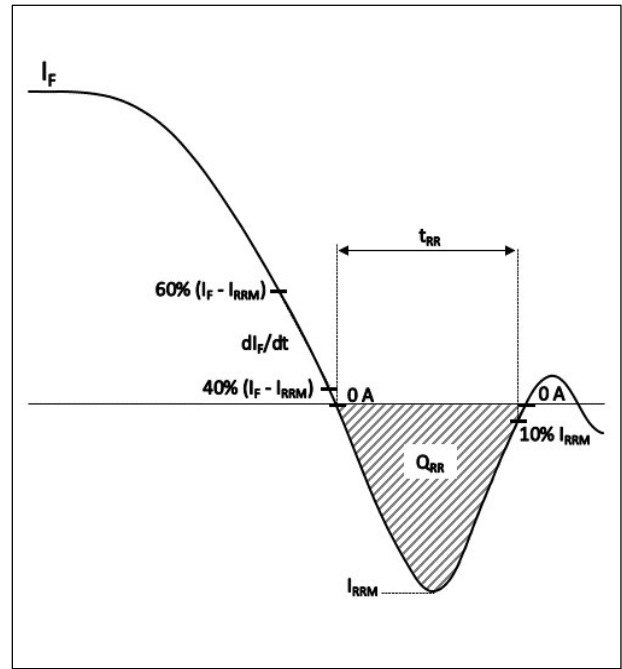


Figure 16. Reverse Recovery Definitions

**Revision History**

Date	Revision	Notes
1/21/2025	1.0	Initial Release

**Warnings**

Except as otherwise explicitly approved by SemiQ in a written document signed by authorized representatives of SemiQ, SemiQ’s products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.

SemiQ’s packaged MOSFET products undergo 100% UIL screening and gate burn in at the package level Wafer level versions of these tests are currently under development at SemiQ and will be added to the wafers products as they become viable.

**AEC Qualification**

Except as otherwise explicitly approved by SemiQ, Inc. in a written document signed by authorized representatives of SemiQ, SemiQ products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.

**Notes**

**RoHS Compliance**

The levels of RoHS restricted materials in this product are below the maximum concentration values (also referred to as the threshold limits) permitted for such substances, or are used in an exempted application, in accordance with EU Directive 2011/65/EC (RoHS2), as implemented March, 2013. RoHS Declarations for this product can be obtained from the Product Documentation sections of [www.SemiQ.com](http://www.SemiQ.com).

**REACH Compliance**

REACH substances of high concern (SVHC) information is available for this product. Since the European Chemicals Agency (ECHA) has published notice of their intent to frequently revise the SVHC listing for the foreseeable future, please contact our office at SemiQ Headquarters in Lake Forest, California to insure you get the most up-to-date REACH SVHC Declaration. REACH banned substance information (REACH Article 67) is also available upon request. SemiQ Inc., reserves the right to make changes to the product specifications and data in this document without notice. SemiQ products are sold pursuant to SemiQ’s terms and conditions of sale in place at the time of order acknowledgement.

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