

GP2T040A120X

QSiC™ 1200V SiC MOSFET

V_{DS}	1200 V
$R_{DS,on}$	37 mΩ
I_D (TC=25°C)	63 A
$T_{j,max}$	175°C

Features

- High speed switching
- Reliable body diode
- All parts tested to greater than 1,400V

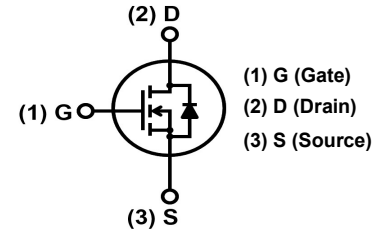
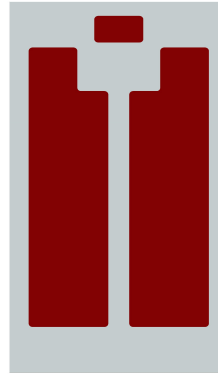
Benefits

- Lower capacitance
- Higher system efficiency
- Easy to parallel

Applications

- Solar Inverters
- Switch mode power supplies, UPS
- Induction heating and welding
- EV charging stations
- High voltage DC/DC converters
- Motor drives

Chip Outline and Inner Circuit



Part #	Top Side	Bottom Side
GP2T040A120X	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^*	$T_C=25^\circ\text{C}, T_j=175^\circ\text{C}$	63	A
		$T_C=100^\circ\text{C}, T_j=175^\circ\text{C}$	47	
Pulsed Drain Current	$I_{D,pulse}^{**}$	$T_C=25^\circ\text{C}$	160	
Gate Source Voltage	V_{GSmax}		-10/25	V
	V_{GSop}	Recommended operational	-5/20	
Operating & Storage Temperature	$T_j, T_{storage}$	Continuous	-55...175	$^\circ\text{C}$

Values have been verified on SemiQ TO-247-3L packaged devices

* Assumes R_{thJC} thermal resistance of 0.47 $^\circ\text{C}/\text{W}$ 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	μA
		$V_{DS}=1200\text{V}, V_{GS}=0\text{V}, T_j=175^\circ\text{C}$	-	1	-	
Gate-Source Leakage Current	I_{GSS+}^{***}	$V_{GS}=20\text{V}, V_{DS}=0\text{V}$	-	<+10	100	nA
	I_{GSS-}^{***}	$V_{GS}=-5\text{V}, V_{DS}=0\text{V}$	-	>-10	-100	
Gate Threshold Voltage	$V_{GS(th)}$	$V_{GS}=V_{DS}, I_{DS}=10\text{mA}^{***}$	1.8	2.4	4	V
		$V_{GS}=V_{DS}, I_{DS}=10\text{mA}, T_j=125^\circ\text{C}$	-	1.8	-	
		$V_{GS}=V_{DS}, I_{DS}=10\text{mA}, T_j=175^\circ\text{C}$	-	1.6	-	
Drain-Source On-Resistance	$R_{DS(on)}$	$V_{GS}=20\text{V}, I_{DS}=40\text{A}^{***}$	-	37	52	m Ω
		$V_{GS}=20\text{V}, I_{DS}=20\text{A}$	-	35	45	
		$V_{GS}=20\text{V}, I_{DS}=40\text{A}, T_j=125^\circ\text{C}$	-	56	-	
		$V_{GS}=20\text{V}, I_{DS}=40\text{A}, T_j=175^\circ\text{C}$	-	73	-	
Transconductance	g_{fs}	$V_{DS}=20\text{V}, I_{DS}=40\text{A}$	-	16	-	S
Gate Input Resistance	R_G	$f=1\text{MHz}, V_{AC}=25\text{mV}, \text{D-S Short}$	-	1.9	-	Ω

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}	$V_{GS}=0\text{V},$ $V_{DS}=1000\text{V},$ $f=200\text{kHz}, V_{AC}=25\text{mV}$	-	3192	-	pF
Output Capacitance	C_{OSS}		-	132	-	
Reverse Transfer Capacitance	C_{RSS}		-	7	-	
Coss Stored Energy	E_{OSS}		-	77	-	
Total Gate Charge	Q_G	$V_{DD}=800\text{V}, I_{DS}=20\text{A},$ $V_{GS}=-5/+20\text{V}$	-	118	-	nC
Gate to Source Charge	Q_{GS}		-	53	-	
Gate to Drain Charge	Q_{GD}		-	23	-	

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^*	$V_{GS}=-5\text{V}, T_C=25^\circ\text{C}$	-	-	74	A
Diode Forward Voltage	V_{SD}^{***}	$V_{GS}=-5\text{V}, I_{SD}=20\text{A}$	-	3.8	-	V
Reverse Recovery Time	t_{RR}	$I_{SD}=20\text{A}, V_R=800\text{V}, V_{GS}=-5\text{V},$ $di_f/dt=3.6\text{A/ns}$	-	24	-	ns
Reverse Recovery Charge	Q_{RR}		-	297	-	nC
Peak Reverse Recovery Current	I_{RRM}		-	21	-	A

Values have been verified on SemiQ TO-247-3L packaged devices

For examples of switching characteristics, please refer to packaged datasheets GP2T040A120U and GP2T040A120H

* Assumes R_{thJC} thermal resistance of 0.47°C/W with recommended wire bonds

*** Verified by 100% wafer test

Mechanical Parameters

Parameter	Typ.	Unit
Wafer Size	150	mm

Typical Performance

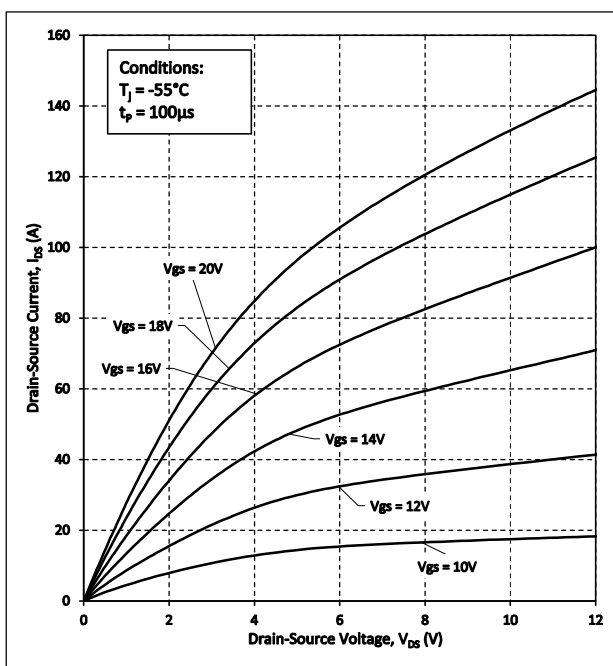


Figure 1. Output Characteristics $T_j = -55^\circ\text{C}$

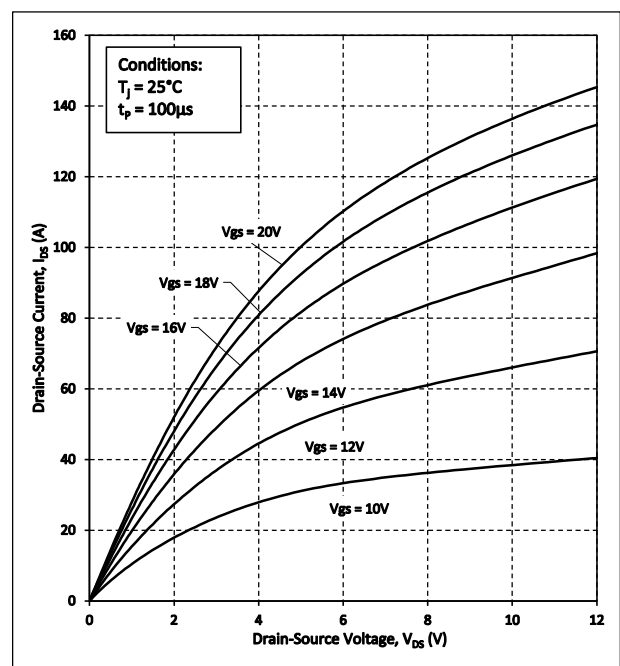


Figure 2. Output Characteristics $T_j = 25^\circ\text{C}$

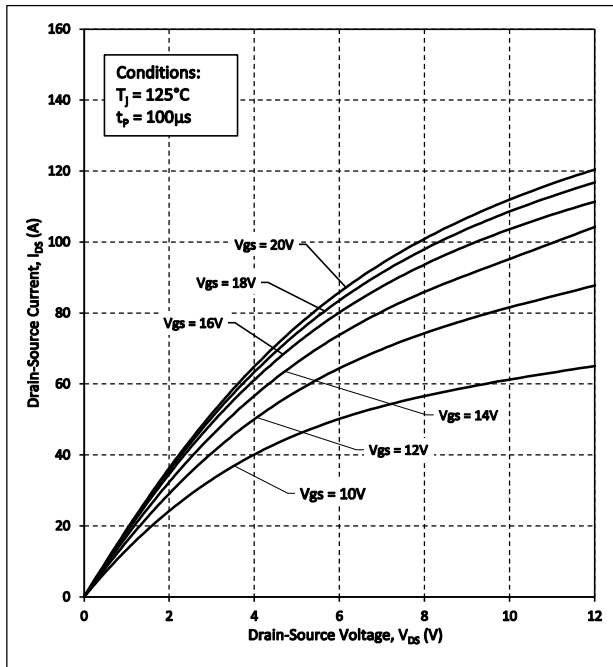


Figure 3. Output Characteristics $T_j = 125^\circ\text{C}$

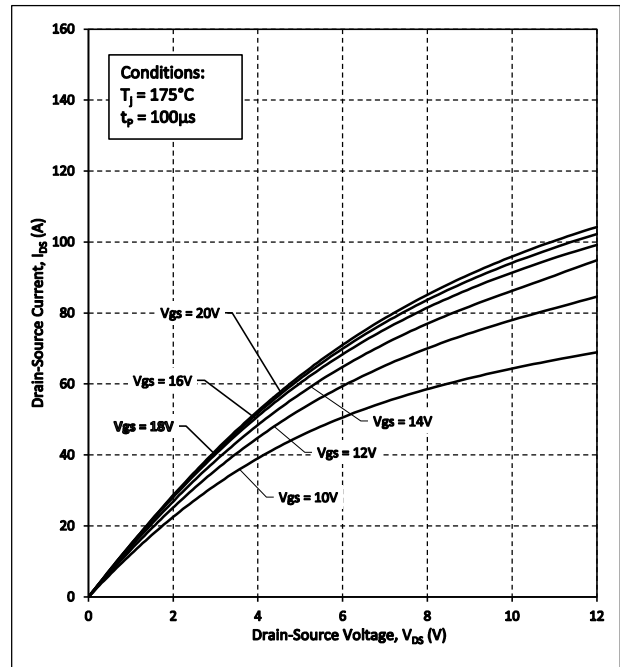


Figure 4. Output Characteristics $T_j = 175^\circ\text{C}$

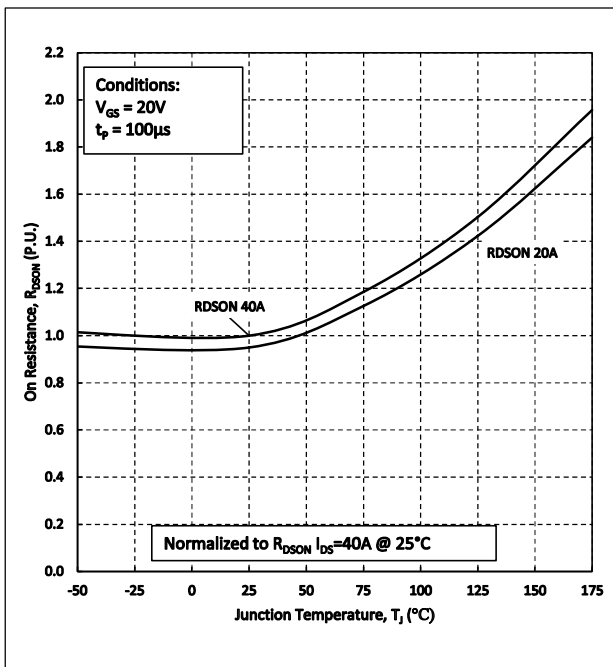


Figure 5. Normalized On-Resistance vs. Temperature

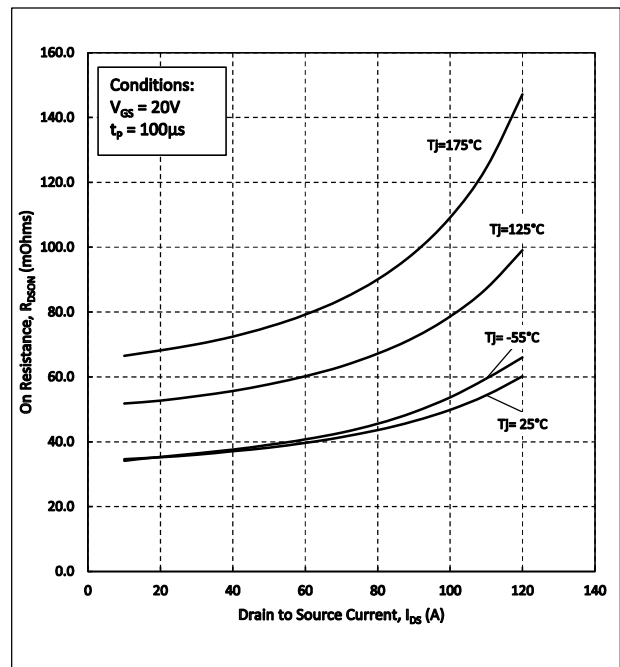


Figure 6. On-Resistance vs. Drain Current For Various Temperature

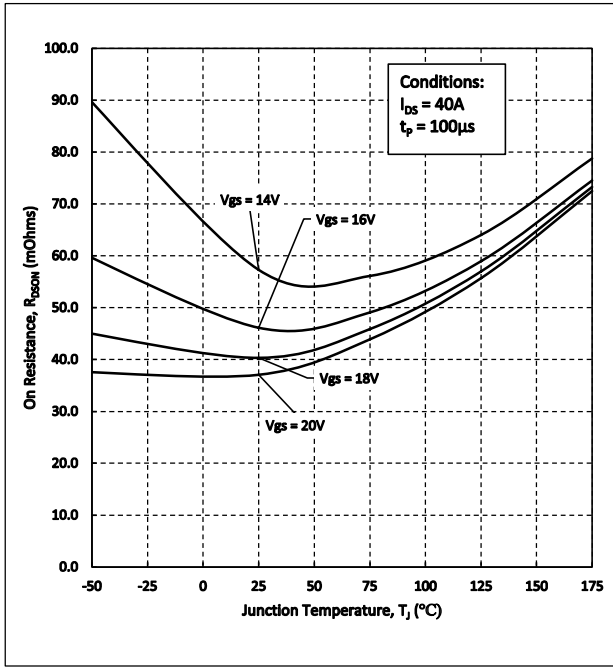


Figure 7. On-Resistance vs. Temperature For Various Gate Voltages

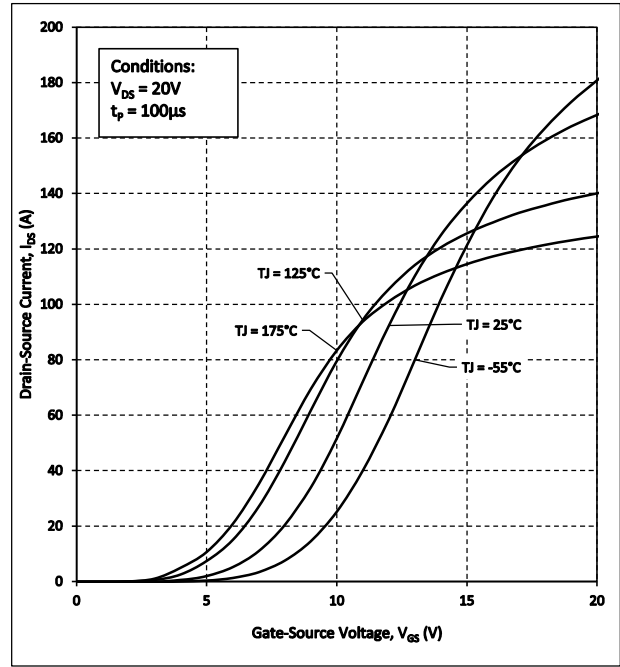


Figure 8. Transfer Characteristic for Various Junction Temperatures

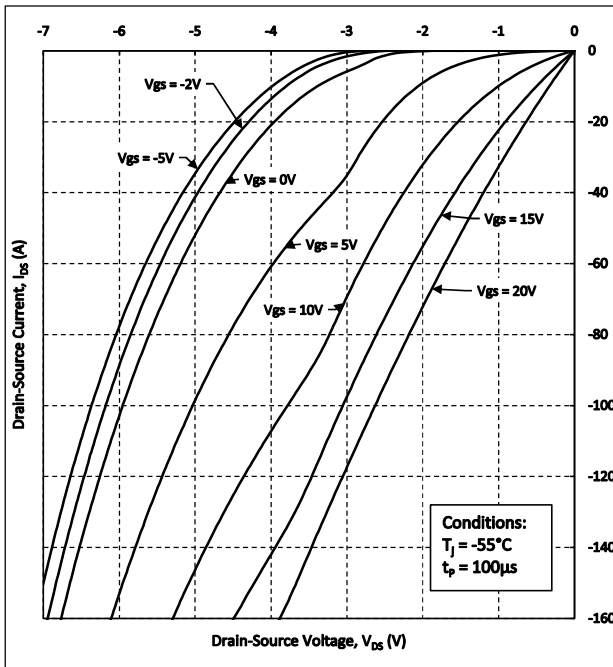


Figure 9. Body Diode Characteristics at $T_J = -55^\circ\text{C}$

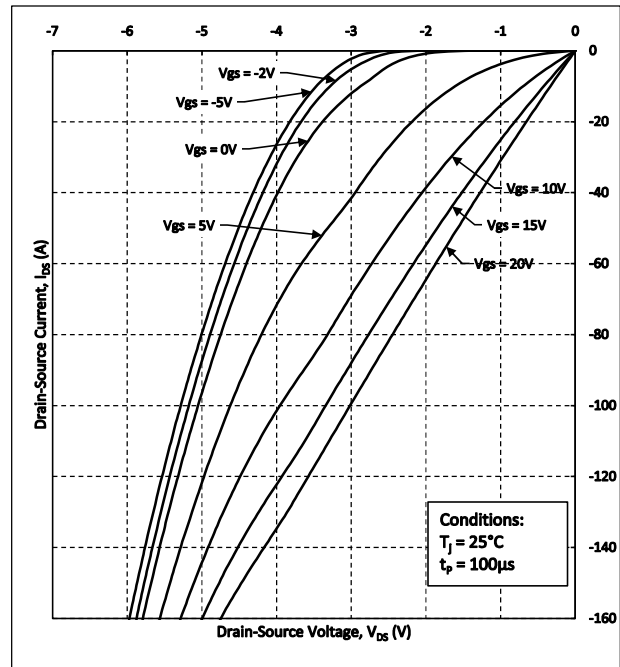


Figure 10. Body Diode Characteristics at $T_J = 25^\circ\text{C}$

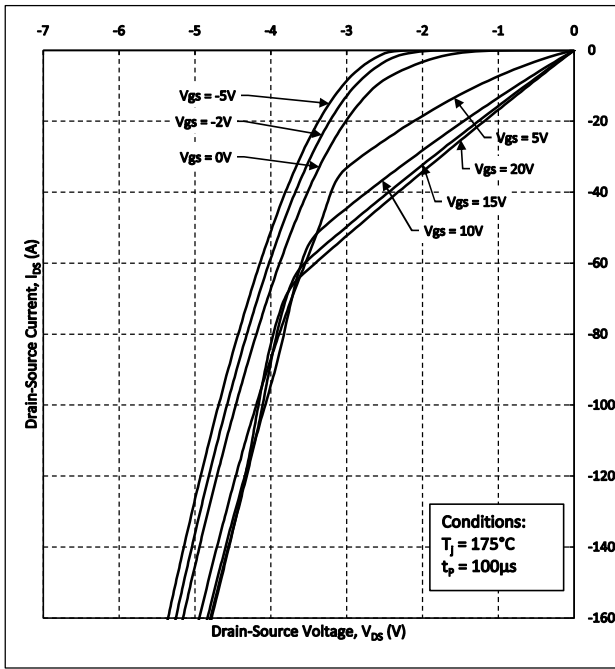


Figure 11. Body Diode Characteristics at $T_j = 175^\circ\text{C}$

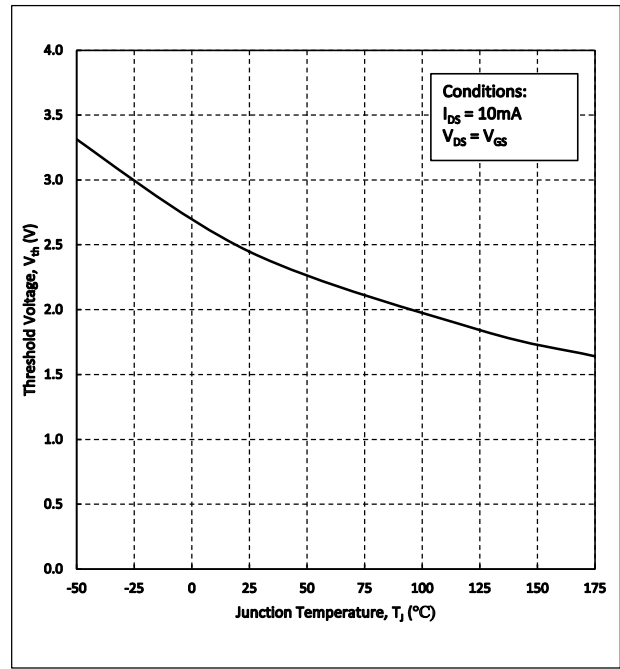


Figure 12. Threshold Voltage vs. Temperature

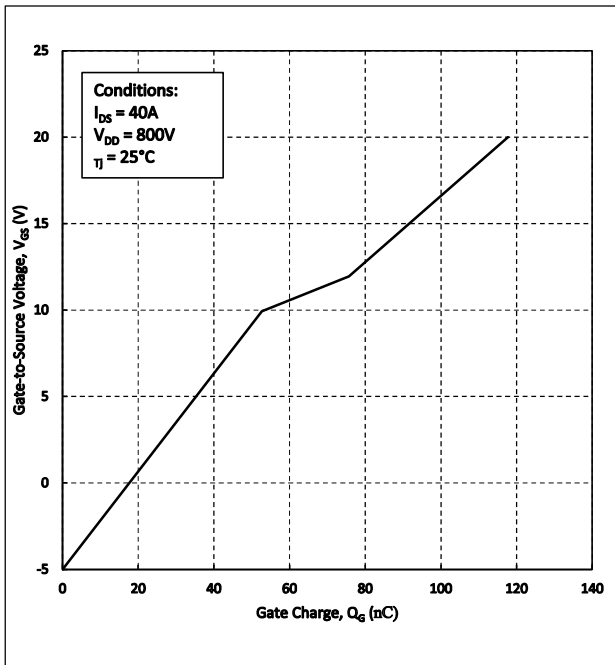


Figure 13. Gate Charge Characteristics

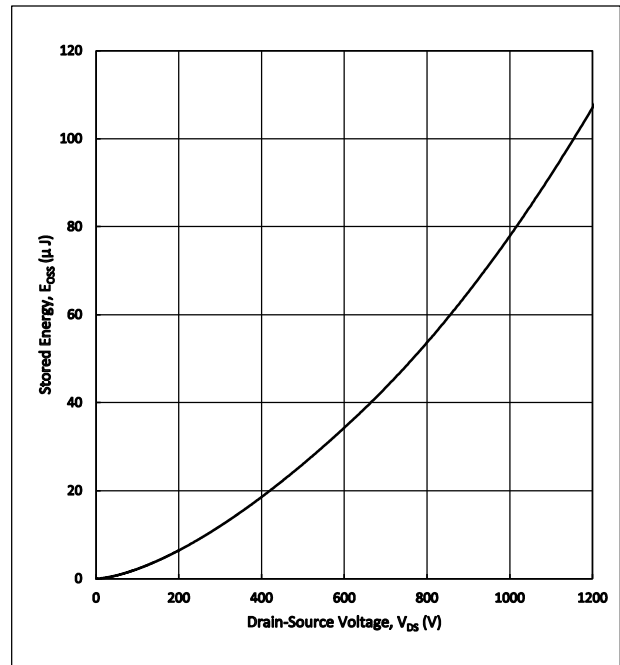


Figure 14. Output Capacitor Stored Energy

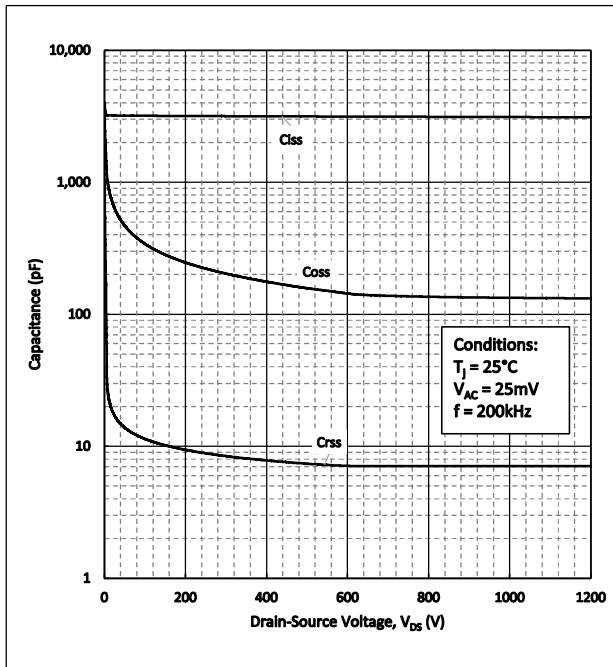


Figure 15. Capacitance vs Drain-Source Voltage

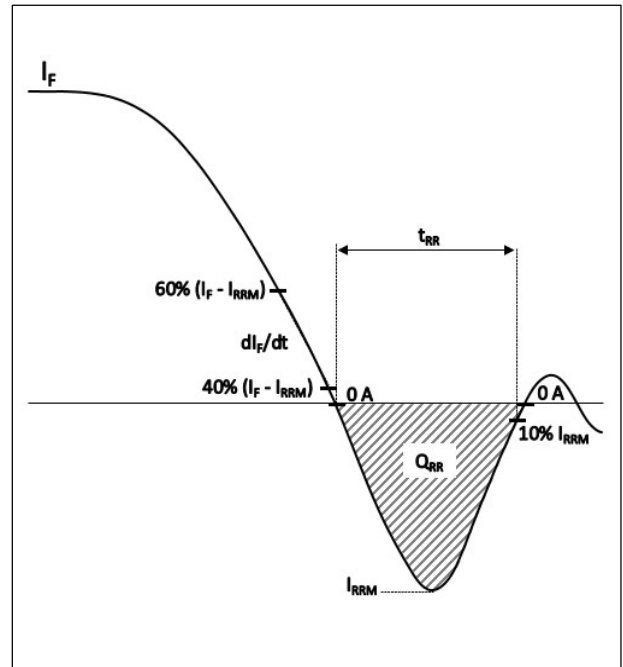


Figure 16. Reverse Recovery Definitions

Revision History

Date	Revision	Notes
8/12/2022	1.0	Initial release of datasheet
10/24/2022	1.1	Updated Qgd, schematic
3/3/2023	1.2	Updated Vth_min and warnings
2/16/2024	1.3	Reduced mechanical information

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.

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.

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.

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