QS120C040YL: 1200V N-Channel SiC MOSFET

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Description

- FAST SWITCHING WITH LOW EMI/RFI
- LOW GATE CHARGE MINIMIZE SWITCHING LOSS
- SHORT CIRCUIT WITHSTAND RATED
- LOW RDS(ON) TEMPERATURE COEFFICIENT FOR IMPROVE EFFICIENCY

Applications

- ASYMMETRICAL BRIDGE
- CONVERTER
- INVERTER
- SINGLE SWITCH FORWARD
- FLYBACK
- PV INVERTER (STRING SOLAR INVERTER)
- EV CHARGING PILE

Part Number

QS120C040YL

Package

TO-3P

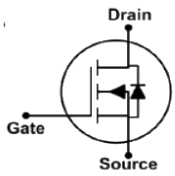
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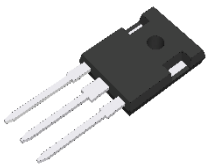
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Features

PARAMETER	VALUE	UNIT
BV_{DSS}	1200	V
$R_{DS(ON),typ}$ $(20V)$	40	mΩ
$V_{GS(TH),typ}$	2.0~4.0	V
E_{ON}	1.2	mJ
E_{OFF}	0.54	mJ
I_D $(at\ 25°C)$	66	A

Package





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ABSOLUTE MAXIMUM RATINGS (Ta = 25°C Unless otherwise specified)

Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	V_{DSS}	1200	V
Maximum Gate-to-Source Voltage	V_{GSmax}	$-10 \sim +25$	
Recommended operations values of gate to source voltage	$V_{GSop(DC)}$	$-5.0 \sim +20$	
Recommended operations values of gate to source voltage (f>1Hz)	$V_{GSop(AC)}$	$-5.0 \sim +20$	
Continuous Drain Current	I_D	66.0	A
Continuous Drain Current at $\boldsymbol{T_c = 100}$°C		47.0	
Pulsed Drain Current at $\boldsymbol{VGS = 10V^2}$	I_{DM}	164	
Single Pulse Avalanche Energy $(\boldsymbol{V_{DD} = 50V, V_{GS} = 15V, R_G = 25\Omega, L = 1mH})$	E_{AS}	288	mJ
Power Dissipation	P_D	333	W
Derating Factor above 25°C		2.20	°C/W
Soldering Temperature, Distance of 1.6mm from case for 10 seconds	T_L	300	°C
Operating and Storage Temperature Range	T_J, T_{STG}	$-55\ to\ 175$	
Caution: Stresses greater than those listed in the Absolute Maximum Ratings may cause permanent damage to devices.			
Thermal Characteristics			
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	0.45	°C/W
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	40	

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ELECTRICAL CHARACTERISTICS (Ta = 25°C Unless otherwise specified)

Parameter	Symbol	Test Conditions	Value			Unit
			Min	Typ	Max	
OFF Characteristics (T_J = 25°C unless otherwise specified)						
Drain-to-Source Breakdown Voltage	BV_{DSS}	$V_{GS} = 0V, I_D = 100\mu A$	1200	–	–	V
Drain-to-Source Leakage Current	I_{DSS}	$V_{DS} = 1200V, V_{GS} = 0V$	–	–	100	μA
Gate-to-Source Leakage Current	I_{Gss+}	$V_{DS} = 0V, V_{GS} = 20V$	–	–	100	nA
Gate-to-Source Leakage Current	I_{Gss-}	$V_{DS} = 0V, V_{GS} = -10V$	–	–	−100	nA
ON Characteristics (T_J = 25°C unless otherwise specified)						
Static Drain-to-Source On Resistance [3]	$R_{DS(ON)}$	$V_{GS} = 20V, I_D = 40A$	–	40	50	$m\Omega$
		$V_{GS} = 20V, I_D = 40A, T_J = 150°C$	–	55	–	
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 10mA$	2.0	–	4.0	V
Dynamic Characteristics (Essentially independent of operating temperature)						
Input Capacitance	C_{iss}	$V_{GS} = 0V$ $V_{DS} = 800V$ $f = 1MHz$	–	2027	–	pF
Reverse Transfer Capacitance	C_{rss}		–	11	–	
Output Capacitance	C_{oss}		–	115	–	
Gate Series Resistance	R_g	$f = 1MHz$	–	3.2	–	Ω
Total Gate Charge	Q_g	$V_{DD} = 800V$ $I_D = 40A$ $V_{GS} = -\frac{5}{20V}$	–	132	–	nC
Gate-to-Source Charge	Q_{gs}		–	25	–	
Gate-to-Drain (Miller) Charge	Q_{gd}		–	61	–	
Resistive Switching Characteristics (Essentially independent of operating temperature)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD} = 800V$ $I_D = 40A$ $V_{GS} = -\frac{3.5}{18V}$ $R_G = 2.0\Omega$ $L = 1mH$	–	11	–	nS
Rise Time	t_{rise}		–	31	–	
Turn-off Delay Time	$t_{d(off)}$		–	33	–	
Fall Time	t_{fall}		–	27	–	
Turn-On Switching Energy	E_{ON}		–	1.2	–	mJ
Turn-Off Switching Energy	E_{OFF}		–	0.54	–	
Source-Drain Body Diode Characteristics (T_J = 25°C unless otherwise specified)						
Continuous Source Current	I_{SD}	$Maximum\ Ratings$	–	–	66	A
Diode Forward Voltage	V_{SD}	$I_S = 20A, V_{GS} = 0V$	–	4.2	–	V
Reverse Recovery Time	t_{rr}	$V_{GS} = 0V$ $I_F = 40A$ $\frac{di}{dt} = 1000A/\mu s$	–	46	–	nS
Reverse Recovery Charge	Q_{rr}		–	278	–	nC
Peak Reverse Recovery Charge	I_{mm}		–	9.3	–	A

- TJ=25°C to 175°C

- Repetitive rating, pulse width limited by maximum junction temperature

-Pulse width≤380μs; duty cycle≤2%

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Figure 1: Typical Output Characteristics at Tj = 25°C

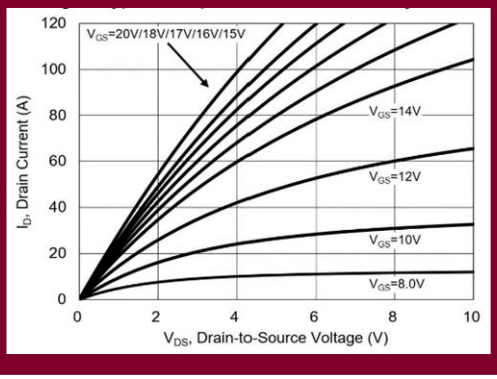


Figure 2: Typical Output Characteristics at Tj = 150°C

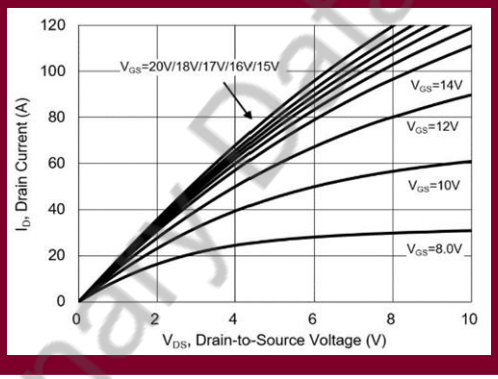


Figure 3: Typical Drain-to-Source ON Resistance vs. Gate Voltage

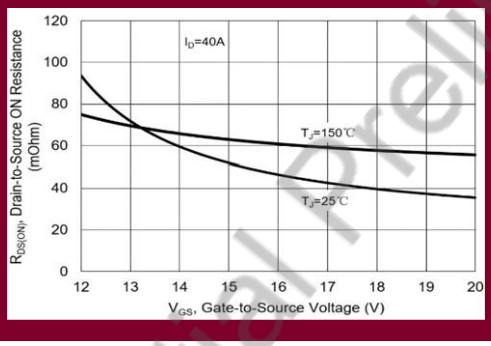


Figure 4: Typical Transfer Characteristics

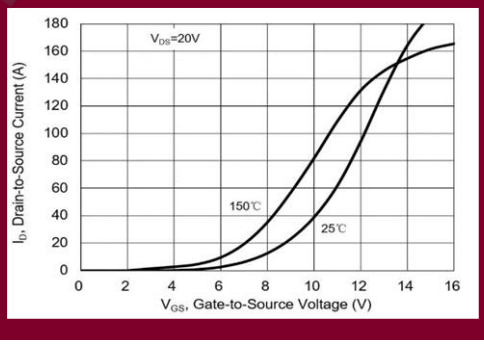


Figure 5: Typical Drain-to-Source ON Resistance at Tj = 25°C

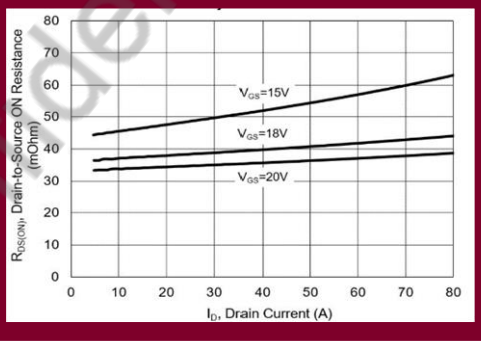
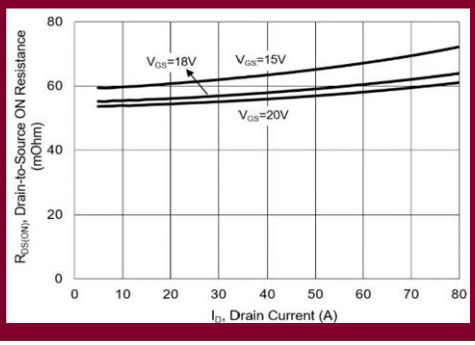


Figure 6: Typical Drain-to-Source ON Resistance at Tj = 150°C



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Figure 7: Typical Body Diode Characteristics at Tj = 25°C

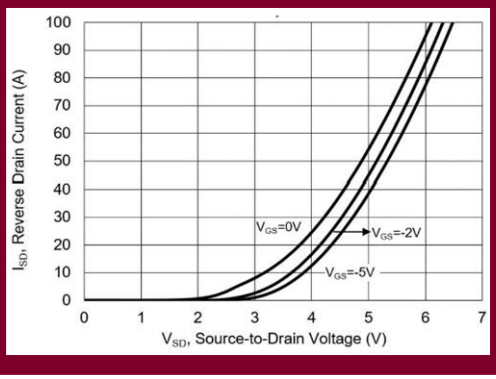


Figure 8: Typical Body Diode Characteristics at Tj=150°C

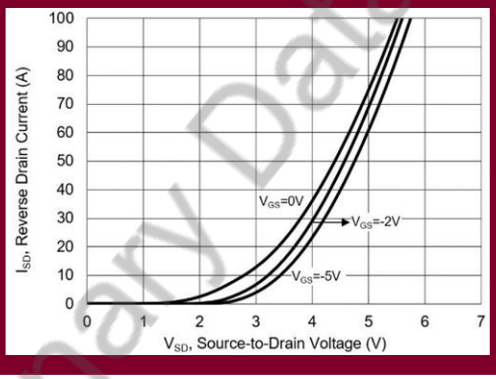


Figure 9: 3rd Quadrant Characteristics at Tj = 25°C

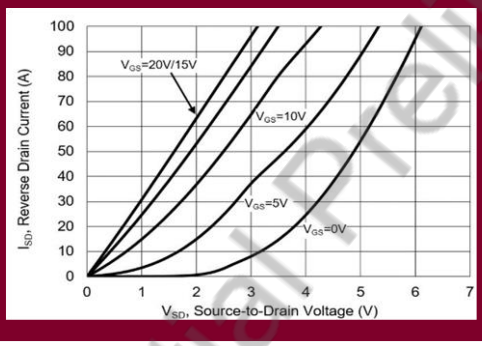


Figure 10: 3rd Quadrant Characteristics at Tj=150°C

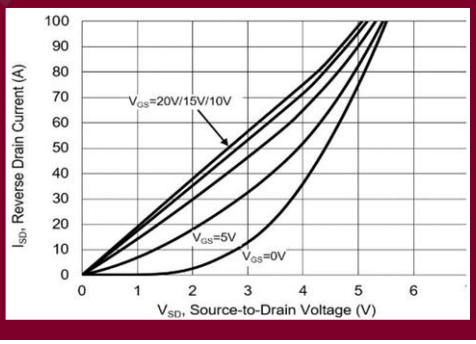


Figure 11: Typical Drain-to-Source ON Resistance vs Junction Temperature

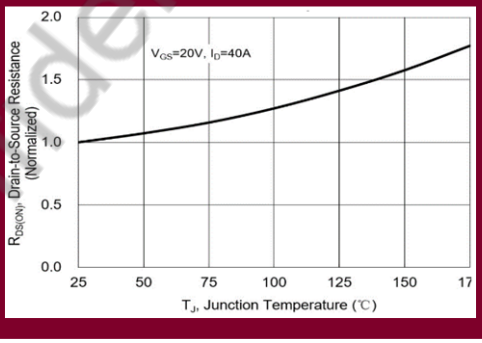
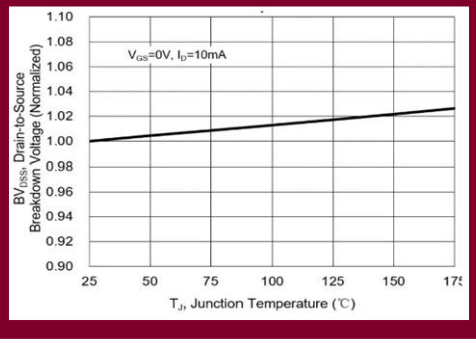


Figure 12: Typical Breakdown Voltage vs. Junction Temperature



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Figure 13: Typical Threshold Voltage vs. Junction Temperature

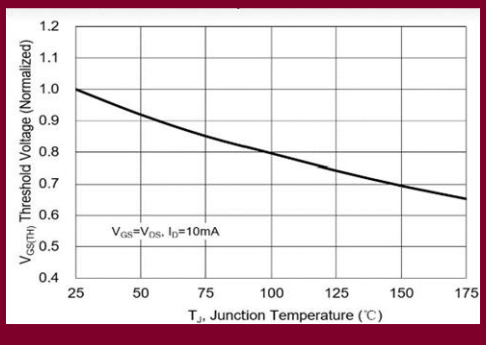


Figure 14: Thermal Impedance Junction to Case

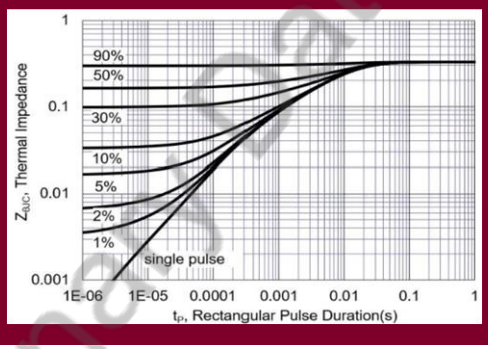


Figure 15: Typical Capacitance vs. Drain-to-Source Voltage

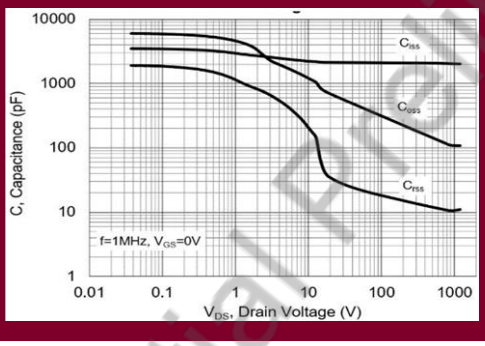


Figure 16: Maximum Peak Current Capability

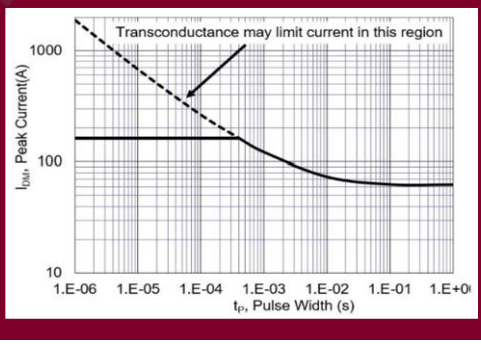


Figure 17: Typical Gate charge vs. Gate to Source voltage

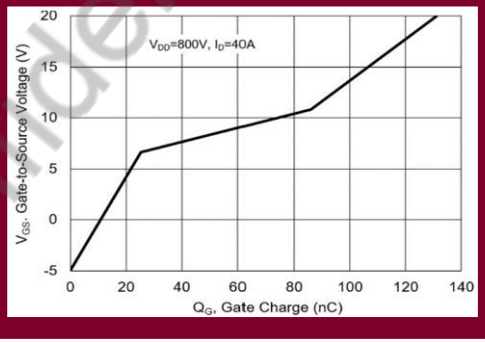
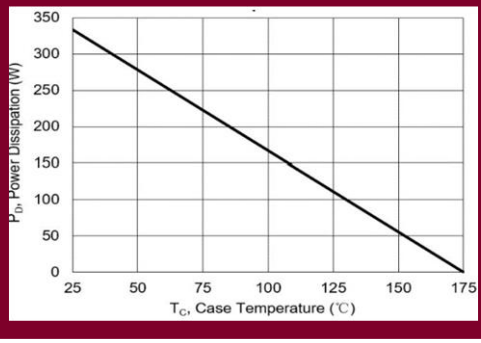


Figure 18: Maximum Power Dissipation vs Case Temperature



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Figure 19: Switching Time vs Rg

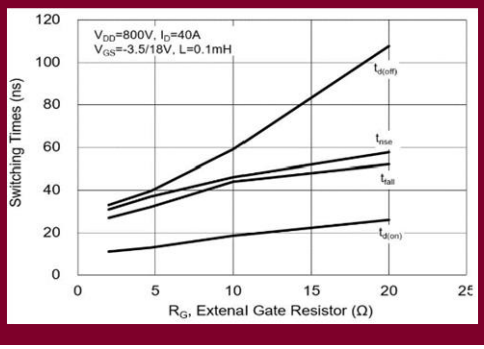


Figure 20: Switching Loss vs Rg

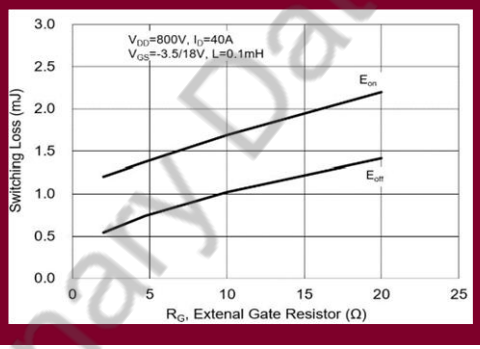


Figure 21: Switching Loss vs Drain Current

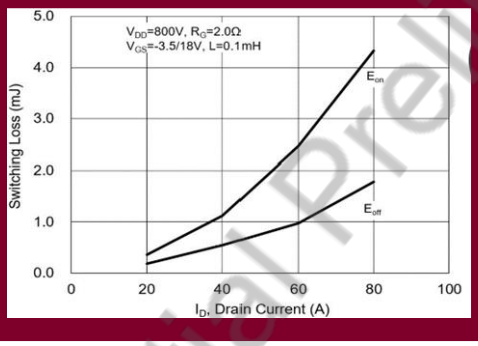


Figure 22: Switching Loss vs Drain Current

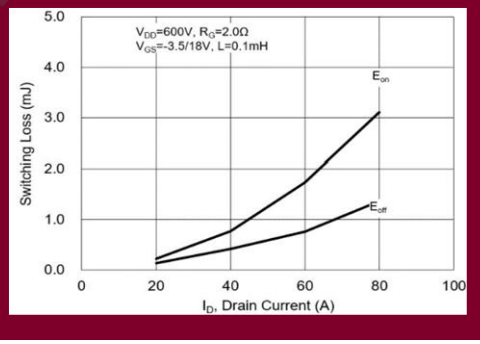


Figure 23: Typical Gate charge vs. Gate to Source voltage

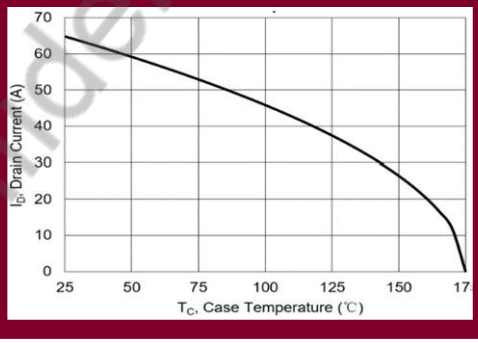
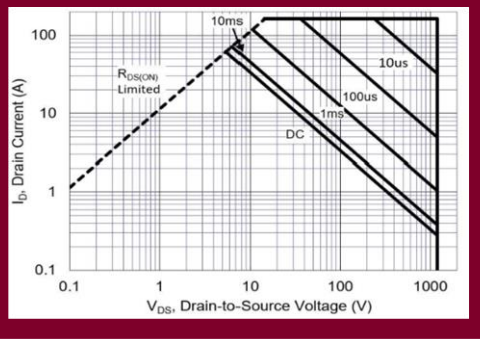


Figure 24: Maximum Power Dissipation vs Case Temperature

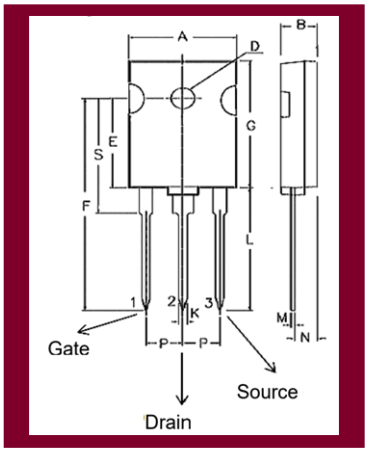


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DIM	MIN	MAX
A	15.20	15.80
B	4.90	5.10
D	3.90	4.10
E	14.20	14.80
F	28.20	30.50
G	19.50	19.80
K	1.00	1.30
L	14.10	17.50
M	0.40	0.60
N	2.50	2.75
P	5.21	5.72
S	18.25	19.25

Pin configuration:

1. Gate
2. Drain
3. Source

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