

**Features**

- SiC MOSFET Technology
- High Switching Speed With Low Gate Charge
- Fast Intrinsic Diode With Low Reverse Recovery
- Higher Frequency Applicability
- Halogen Free. "Green" Device (Note 1)
- Epoxy Meets UL 94 V-0 Flammability Rating
- Lead Free Finish/RoHS Compliant("P" Suffix Designates RoHS Compliant. See Ordering Information) (Note2)

**Maximum Ratings**

- Operating Junction Temperature Range : -55°C to +175°C
- Storage Temperature Range: -55°C to +175°C
- Thermal Resistance Junction to Ambient,Max(Note 3): 62°C/W
- Thermal Resistance Junction to Case,Typ : 0.32°C/W

**Applications**

- Solar Inverter
- EV Charging Station
- UPS
- Industrial Power Supply

Parameter	Symbol	Rating	Unit	
Drain-Source Voltage	$V_{DS}$	1200	V	
Gate-Source Voltage(Note 4)	$V_{GSmax}$	-10/+22	V	
Recommended Gate-Source Voltage	$V_{GSop}$	-5/+18	V	
Continuous Drain Current $V_{GS}=18V$	$I_D$	$T_C=25^{\circ}C$	100	A
		$T_C=100^{\circ}C$	71	
Pulsed Drain Current (Note 5)	$I_{DM}$	250	A	
Total Power Dissipation	$P_D$	$T_C=25^{\circ}C$	469	W
		$T_C=110^{\circ}C$	203	

Note1:Halogen free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

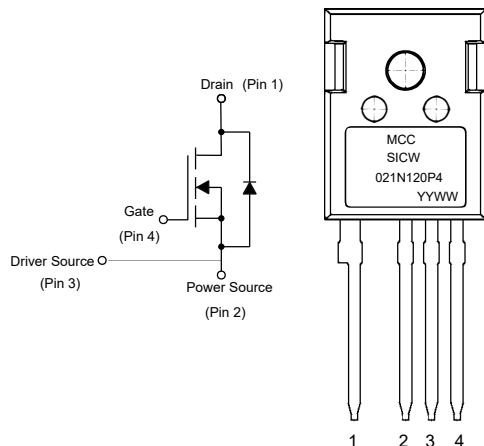
Note2:High Temperature Solder Exemptions Applied, see EU Directive Annex 7a.

Note3:Device in a still air environment with  $T_A=25^{\circ}C$ .

Note4:AC f > 1Hz, duty cycle < 1%

Note5:Pulse Test: Pulse Width Limited by  $T_{jmax}$ .

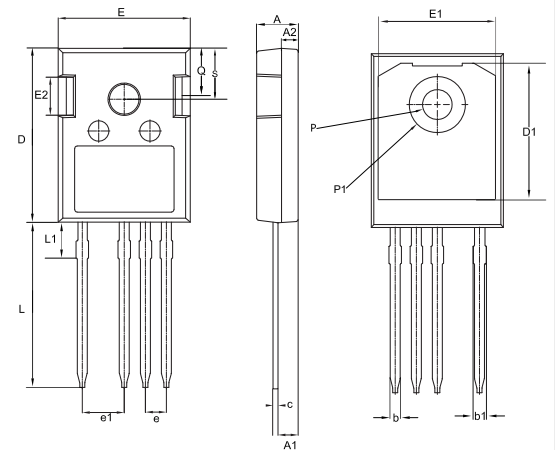
**Internal Structure and Marking Code**



Device Code: SICW021N120P4  
Date Code: YYWW (Year & Week)

**SiC  
N-CHANNEL  
MOSFET**

**TO-247-4L**



DIM	INCHES		mm		NOTE
	MIN	MAX	MIN	MAX	
A	0.189	0.205	4.80	5.20	
A1	0.090	0.100	2.29	2.54	
A2	0.075	0.083	1.90	2.10	
b	0.043	0.051	1.10	1.30	
b1	0.051	0.059	1.30	1.50	
c	0.020	0.028	0.50	0.70	
D	0.819	0.831	20.80	21.10	
D1	0.686	0.702	17.43	17.83	
E	0.620	0.635	15.75	16.13	
E1	0.514	0.530	13.06	13.46	
E2	0.170	0.190	4.32	4.83	
e	0.100		2.54		TYP
e1	0.200		5.08		TYP
L	0.781	0.797	19.85	20.25	
L1	0.177		4.49		
P	0.140	0.144	3.55	3.65	Φ
P1	0.276	0.291	7.00	7.40	Φ
Q	0.220	0.244	5.59	6.19	
S	0.242		6.15		TYP

**Electrical Characteristics @  $T_j=25^\circ\text{C}$  (Unless Otherwise Specified)**

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit	
<b>Static Characteristics</b>							
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS}=0V, I_D=1mA$	1200			V	
Gate-Source Leakage Current	$I_{GSS}$	$V_{DS}=0V, V_{GS}=+22V$			+100	nA	
		$V_{DS}=0V, V_{GS}=-10V$			-100		
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=1200V, V_{GS}=0V$		1	100	$\mu\text{A}$	
		$V_{DS}=1200V, V_{GS}=0V, T_J=175^\circ\text{C}$		10			
Gate-Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=17mA$	2.0	3.0	4.5	V	
Drain-Source On-Resistance	$R_{DS(on)}$	$V_{GS}=18V, I_D=50A$		21	29.4	$\text{m}\Omega$	
		$V_{GS}=18V, I_D=50A, T_J=175^\circ\text{C}$		33.6		$\text{m}\Omega$	
Transconductance	$g_{FS}$	$V_{DS}=20V, I_D=50A$		24.4		S	
<b>Dynamic Characteristics</b>							
Input Capacitance	$C_{iss}$	$V_{DS}=800V, V_{GS}=0V, f=250kHz$		3741		$\text{pF}$	
Output Capacitance	$C_{oss}$			224			
Reverse Transfer Capacitance	$C_{rss}$			17			
Coss Stored Energy	$E_{oss}$	$V_{DS}=0 \text{ to } 800V, V_{GS}=0V$		93		$\mu\text{J}$	
Effective Transfer Capacitance	Energy Related $C_{o(er)}$			291		$\text{pF}$	
	Time Related $C_{o(tr)}$			456			
Total Gate Charge	$Q_g$	$V_{DS}=800V, V_{GS}=-5/+18V, I_D=50A$ Inductive load		200		nC	
Gate-Source Charge	$Q_{gs}$			48			
Gate-Drain Charge	$Q_{gd}$			68			
Internal Gate Resistance	$R_g$	$f=1MHz$		3		$\Omega$	
Turn-On Delay Time	$t_{d(on)}$	$V_{DS}=800V, V_{GS}=-5/+18V,$ $R_G=2\Omega, I_D=50A, \text{Inductive load}$		29		ns	
Turn-On Rise Time	$t_r$			29			
Turn-Off Delay Time	$t_{d(off)}$			62			
Turn-Off Fall Time	$t_f$			12			
Turn-On switching energy	$E_{on}$				599		$\mu\text{J}$
Turn-Off switching energy	$E_{off}$				228		
<b>Diode Characteristics</b>							
Maximum Continuous Diode Forward Current	$I_S$				100	A	
Maximum Pulsed Diode Forward Current	$I_{SM}$				250	A	
Diode Forward Voltage	$V_{SD}$	$V_{GS}=-5V, I_{SD}=50A$		4.2		V	
Reverse Recovery Time	$t_{rr}$	$I_{SD}=50A, V_{DD}=800V,$ $dI_F/dt=3000A/\mu\text{s}$		22		ns	
Reverse Recovery Charge	$Q_{rr}$			482		nC	

**Curve Characteristics** ( $T_j=25^\circ\text{C}$  unless otherwise specified)

Fig. 1 - Typical Output Characteristic

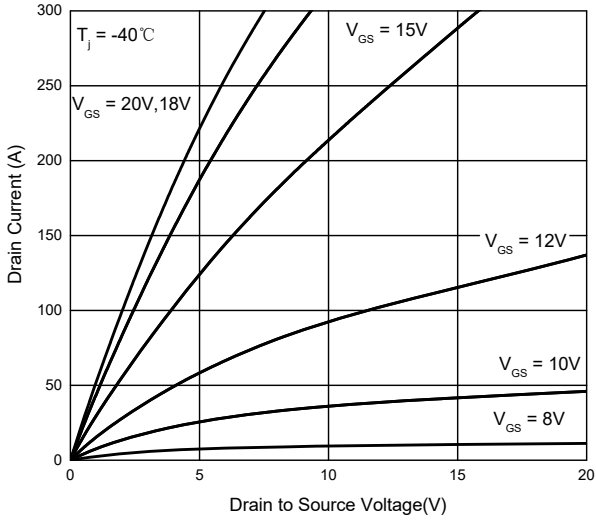


Fig. 2 - Typical Output Characteristic

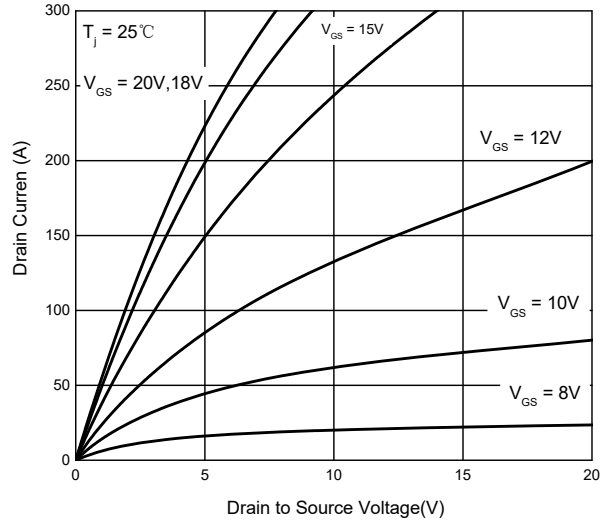


Fig. 3 - Typical Output Characteristic

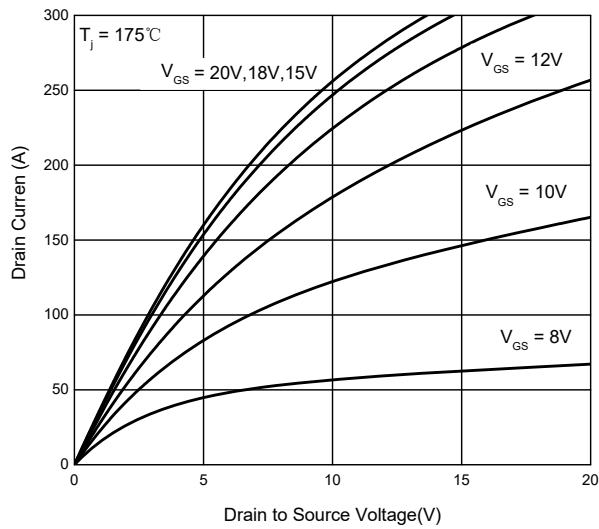


Fig. 4 - Typical Transfer Characteristic

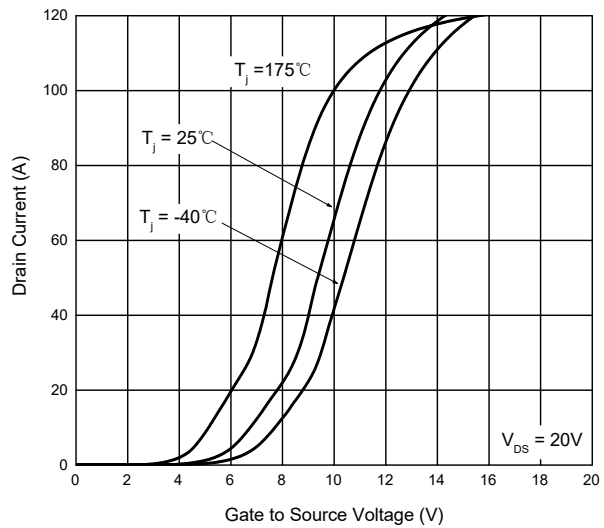


Fig. 5 - Normalized On-Resistance vs. Temperature

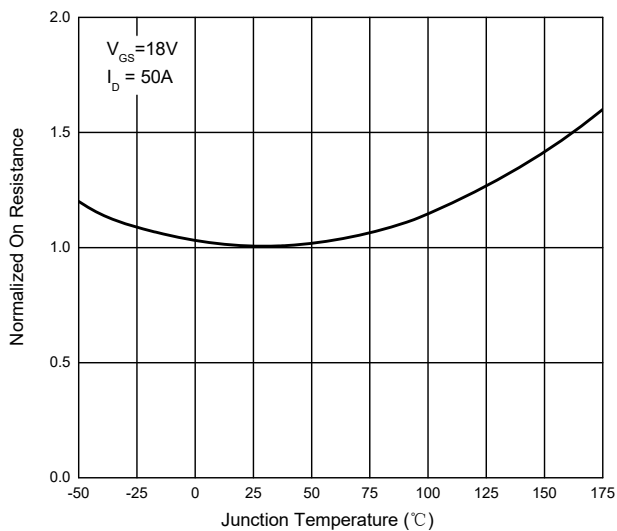
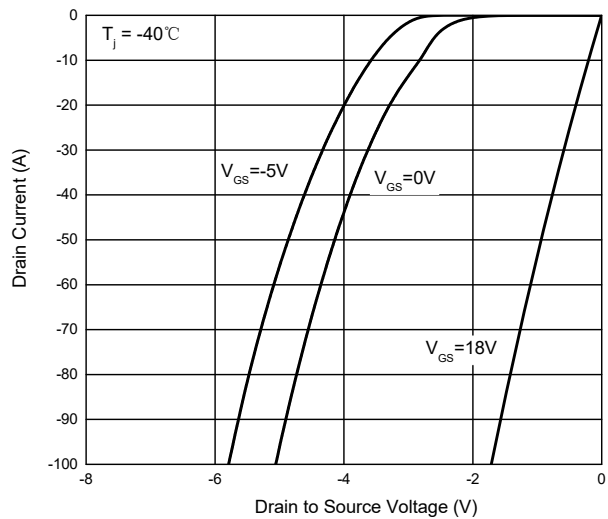


Fig. 6 - Reverse Output Voltage



**Curve Characteristics**( $T_j=25^\circ\text{C}$  unless otherwise specified)

Fig. 7 - Reverse Output Voltage

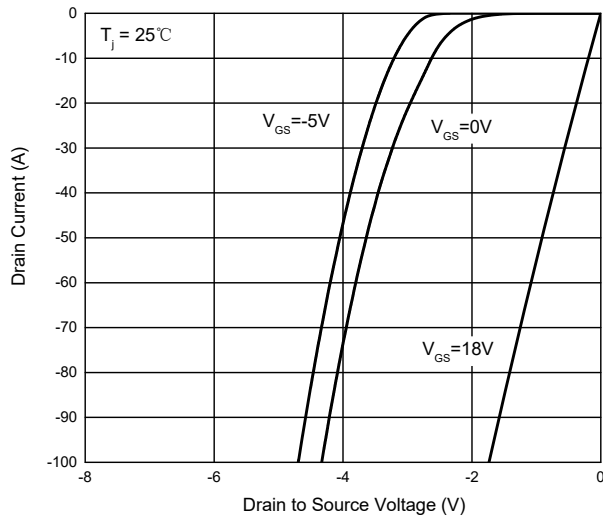


Fig. 8 - Reverse Output Voltage

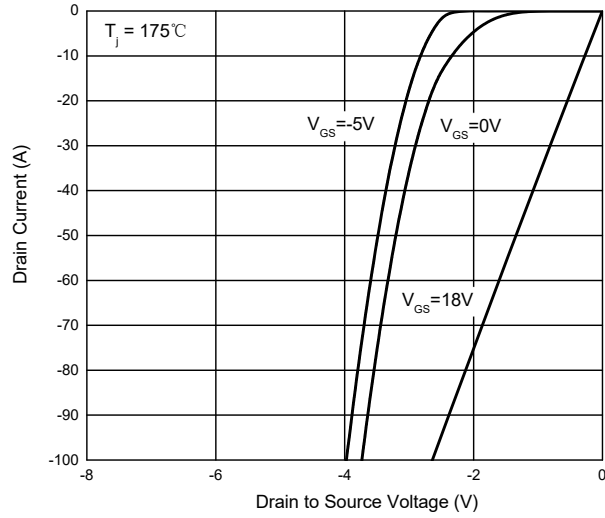


Fig.9 - Capacitances vs.  $V_{DS}$

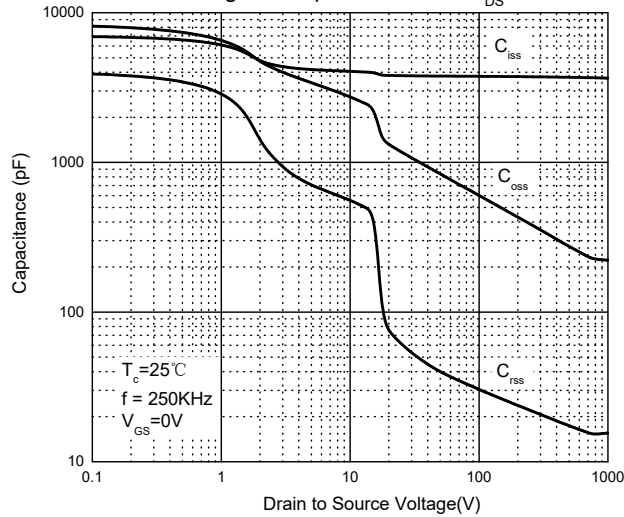


Fig. 10- Threshold Voltage vs. Temperature

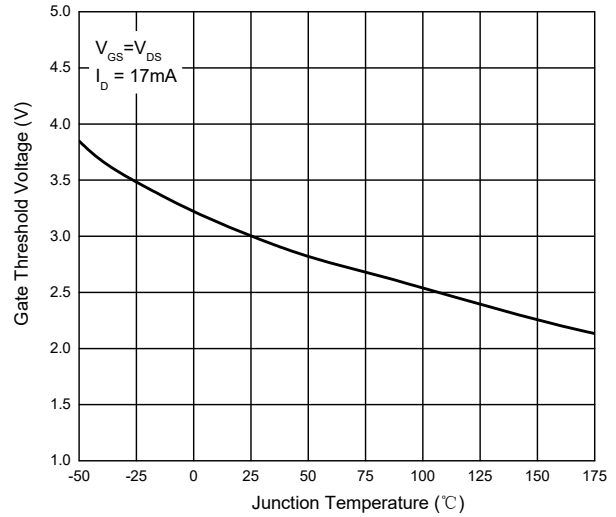


Fig.11 - Output Capacitor Stored Energy

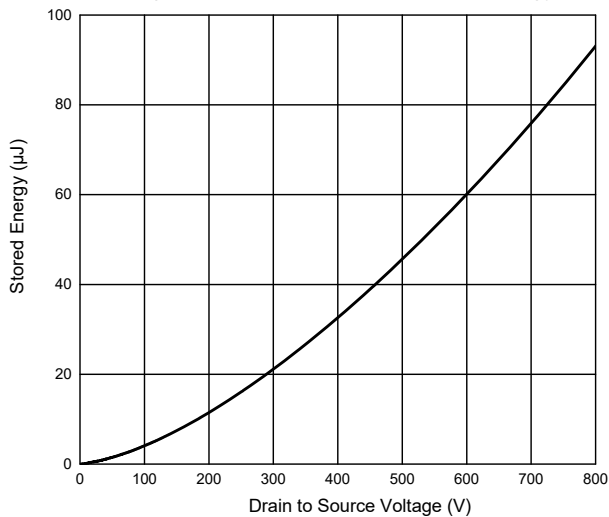
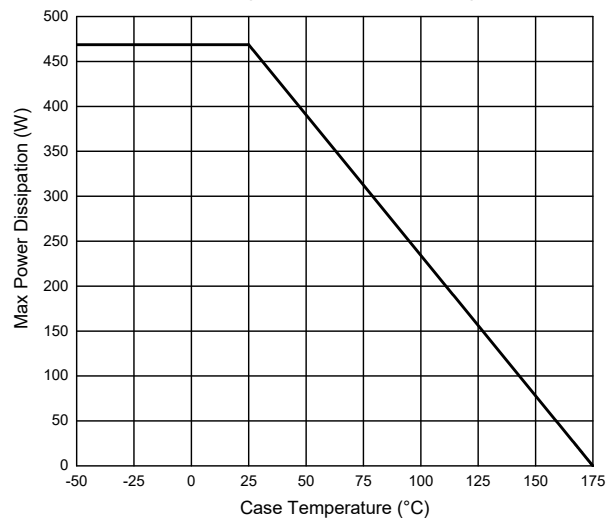


Fig.12 - Power Derating



**Curve Characteristics** ( $T_j=25^\circ\text{C}$  unless otherwise specified)

Fig.13 - Drain Current Derating

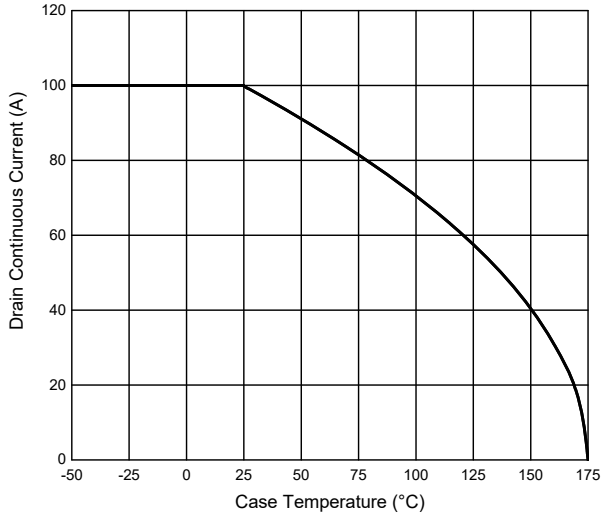


Fig.14 - Safe Operation Area

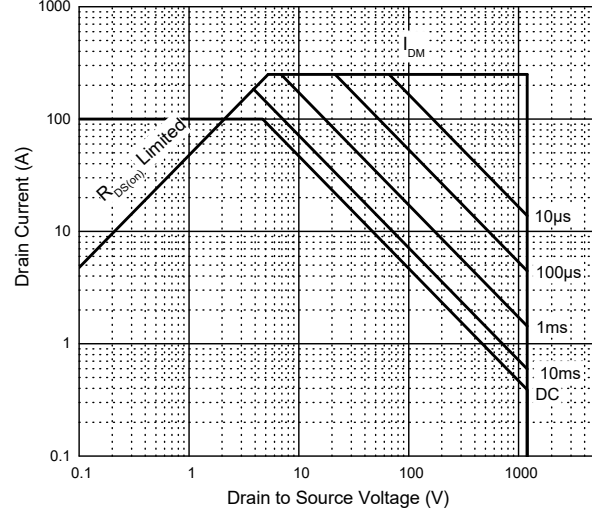


Fig. 15 - Typical Gate Charge

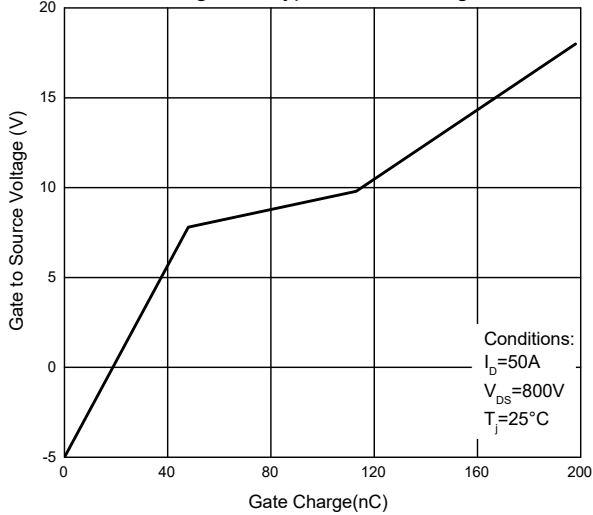


Fig. 16 - Switching Losses vs. Drain Current

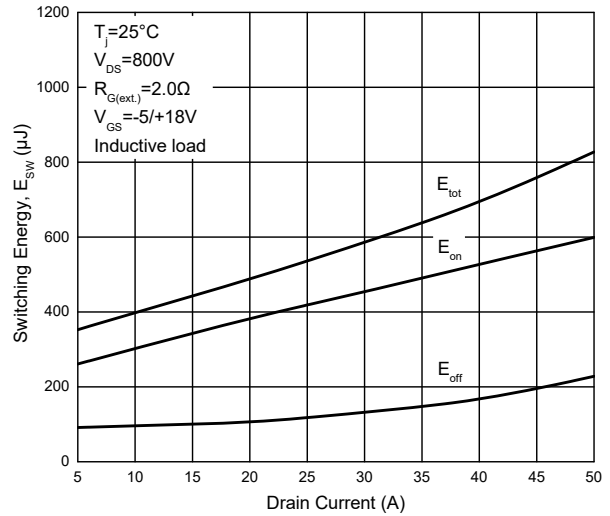
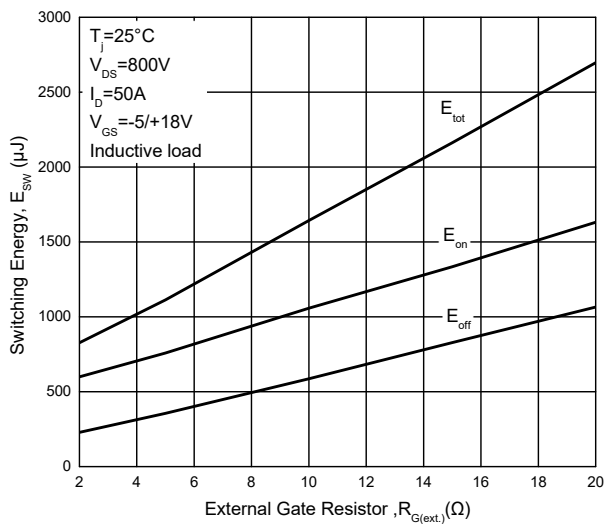
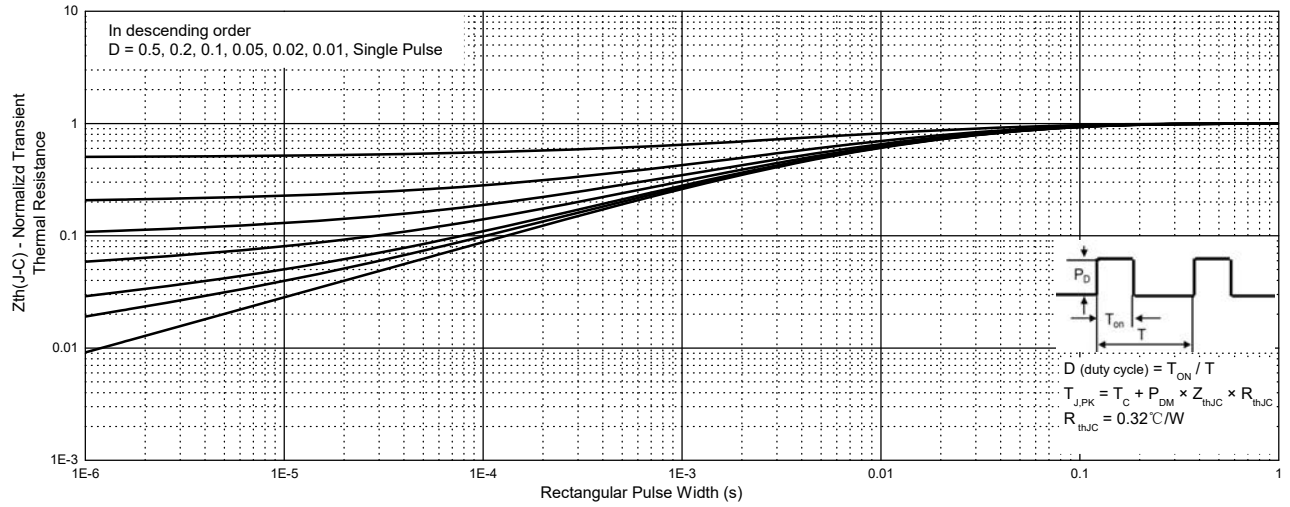


Fig. 17 - Switching Losses vs. External Gate Resistor ( $R_{G(\text{ext.})}$ )



Curve Characteristics ( $T_j=25^\circ\text{C}$  unless otherwise specified)

Fig.18 - Normalized Transient Thermal Impedance



## Ordering Information

Device	Packing
SICW021N120P4-BP	Tube:30pcs/Tube, 1.8K/Ctn;

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