

## SCT055W65G3-4AG-VB Datasheet

### N-Channel 650V (D-S) SiC Power MOSFET

PRODUCT SUMMARY		
V <sub>DS</sub> (V)	650	
R <sub>DS(on)</sub> at 25 °C (Ω)	V <sub>GS</sub> = 18 V	0.07
Q <sub>g</sub> (nC)	90	

#### FEATURES

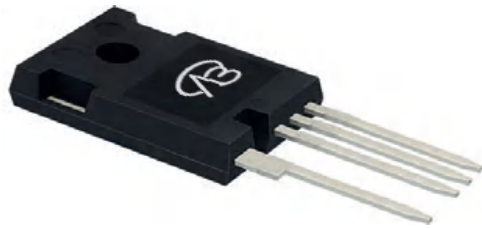
- Low figure-of-merit (FOM) R<sub>on</sub> x Q<sub>g</sub>
- Low input capacitance (C<sub>iss</sub>)
- Reduced switching and conduction losses
- Ultra low gate charge (Q<sub>g</sub>)
- Avalanche energy rated (UIS)



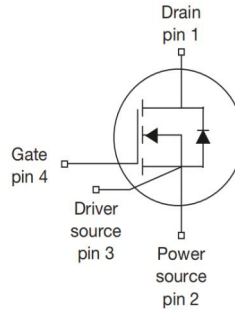
#### APPLICATIONS

- Server and telecom power supplies
- Switch mode power supplies (SMPS)
- Power factor correction power supplies (PFC)
- DC/DC converter

TO-247



- Pin1 D - Drain
- Pin2 S - Source(Power)
- Pin3 S - Source(Driver)
- Pin4 G - Gate



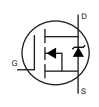
N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS (T <sub>C</sub> = 25 °C, unless otherwise noted)					
PARAMETER		SYMBOL	LIMIT	UNIT	
Drain-Source Voltage		V <sub>DS</sub>	650	V	
Gate-Source Voltage		V <sub>GS</sub>	-10 / +22		
Continuous Drain Current (T <sub>J</sub> = 150 °C)	V <sub>GS</sub> at 18 V	I <sub>D</sub>	T <sub>C</sub> = 25 °C	30	A
			T <sub>C</sub> = 100 °C	24	
Pulsed Drain Current <sup>a</sup>		I <sub>DM</sub>	90		
Linear Derating Factor			2.1	W/°C	
Single Pulse Avalanche Energy <sup>b</sup>		E <sub>AS</sub>	225	mJ	
Maximum Power Dissipation		P <sub>D</sub>	187	W	
Operating Junction and Storage Temperature Range		T <sub>J</sub> , T <sub>stg</sub>	-55 to +175	°C	
Drain-Source Voltage Slope	T <sub>J</sub> = 125 °C	dV/dt	50	V/ns	
Reverse Diode dV/dt <sup>d</sup>			15		
Soldering Recommendations (Peak Temperature) <sup>c</sup>	for 10 s		260	°C	

**Notes**

- Repetitive rating; pulse width limited by maximum junction temperature.
- V<sub>DD</sub> = 100 V, starting T<sub>J</sub> = 25 °C, L = 0.5mH, R<sub>g</sub> = 25 Ω, I<sub>AS</sub> = 30A.
- 1.6 mm from case.
- I<sub>SD</sub> ≤ I<sub>D</sub>, dI/dt = 100 A/μs, starting T<sub>J</sub> = 25 °C.

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	$R_{thJA}$	-	40	°C/W
Maximum Junction-to-Case (Drain)	$R_{thJC}$	-	0.8	

SPECIFICATIONS ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
<b>Static</b>							
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$		650	-	-	V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$ , $I_D = 1\text{ mA}$		-	0.70	-	V/°C
Gate-Source Threshold Voltage (N)	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 10\text{ mA}$		2	-	5	V
Gate-Source Leakage	$I_{GSS}$	$V_{GS} = +22\text{ V}$		-	-	100	nA
		$V_{GS} = -10\text{ V}$		-	-	100	$\mu\text{A}$
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$		-	10	-	$\mu\text{A}$
		$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$		-	-	100	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 18\text{ V}$	$I_D = 20\text{ A}$	-	0.07	-	$\Omega$
Forward Transconductance	$g_{fs}$	$V_{DS} = 0\text{ V}, I_D = 30\text{ A}$		-	12	-	S
<b>Dynamic</b>							
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}, V_{DS} = 600\text{ V}, f = 1\text{ MHz}$		-	1600	-	pF
Output Capacitance	$C_{oss}$			-	175	-	
Reverse Transfer Capacitance	$C_{rss}$			-	9	-	
Effective Output Capacitance, Energy Related <sup>a</sup>	$C_{o(er)}$	$V_{DS} = 0\text{ V to } 400\text{ V}, V_{GS} = 0\text{ V}$		-	156	-	
Effective Output Capacitance, Time Related <sup>b</sup>	$C_{o(tr)}$			-	268	-	
Total Gate Charge	$Q_g$	$V_{GS} = -5/18\text{ V}$	$I_D = 20\text{ A}, V_{DS} = 400\text{ V}$	-	70	-	nC
Gate-Source Charge	$Q_{gs}$			-	20	-	
Gate-Drain Charge	$Q_{gd}$			-	23	-	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 400\text{ V}, I_D = 20\text{ A}, V_{GS} = -5/18\text{ V}, R_g = 2\text{ }\Omega$		-	12	15	ns
Rise Time	$t_r$			-	10	13	
Turn-Off Delay Time	$t_{d(off)}$			-	20	-	
Fall Time	$t_f$			-	10	-	
Gate Input Resistance	$R_g$	$f = 1\text{ MHz}, \text{open drain}$		-	2.2	-	$\Omega$
<b>Drain-Source Body Diode Characteristics</b>							
Continuous Source-Drain Diode Current	$I_S$	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	30	A
Pulsed Diode Forward Current	$I_{SM}$			-	-	90	
Diode Forward Voltage	$V_{SD}$	$T_J = 25\text{ }^\circ\text{C}, I_S = 20\text{ A}, V_{GS} = 0$		-	-	4.1	V
Reverse Recovery Time	$t_{rr}$	$T_J = 25\text{ }^\circ\text{C}, I_F = I_S = 20\text{ A}, di/dt = 1000\text{ A}/\mu\text{s}, V_R = 400\text{ V}$		-	20	-	ns
Reverse Recovery Charge	$Q_{rr}$			-	60	-	$\mu\text{C}$
Reverse Recovery Current	$I_{RRM}$			-	10	-	A

**Notes**

- a.  $C_{oss(er)}$  is a fixed capacitance that gives the same energy as  $C_{oss}$  while  $V_{DS}$  is rising from 0 % to 60 %  $V_{DSS}$ .  
 b.  $C_{oss(tr)}$  is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 % to 60 %  $V_{DSS}$ .

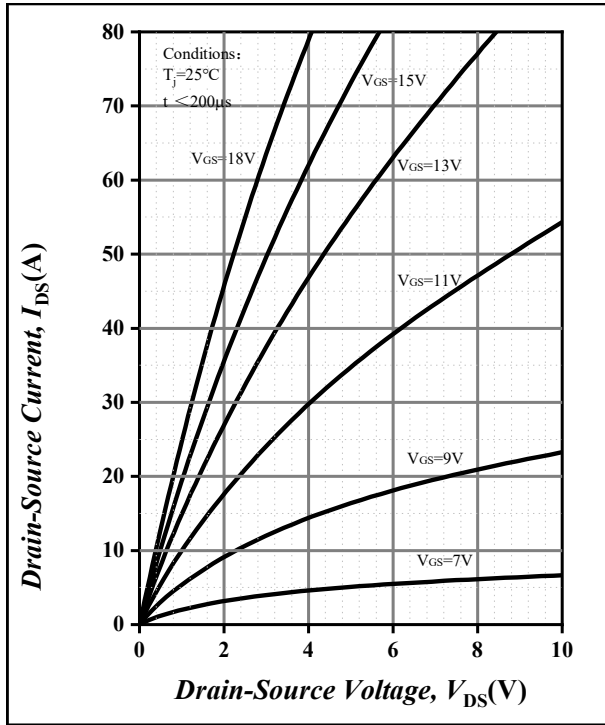


Fig.1 Output characteristics  $T_j=25^\circ\text{C}$

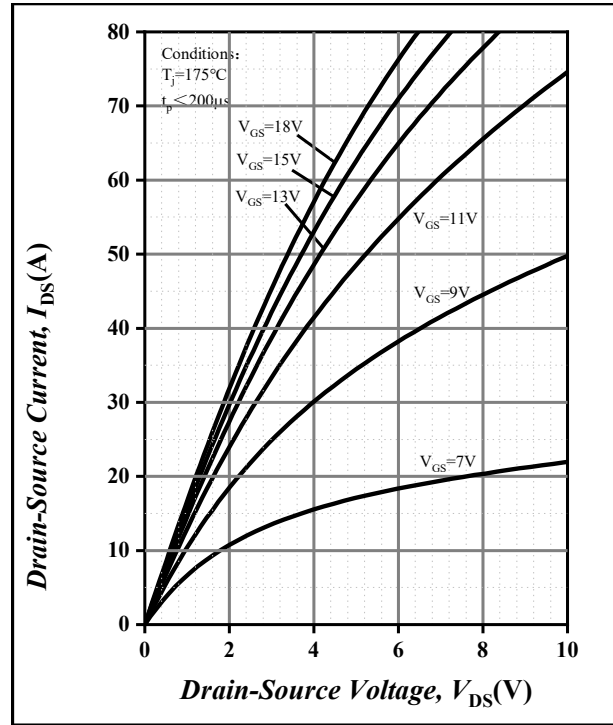


Fig.2 Output characteristics  $T_j=175^\circ\text{C}$

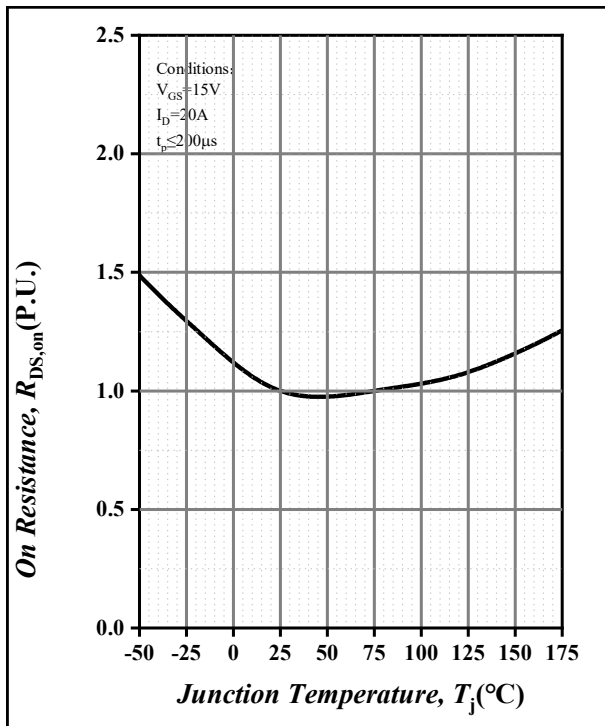


Fig.3 Normalized On-Resistance vs. Temperature

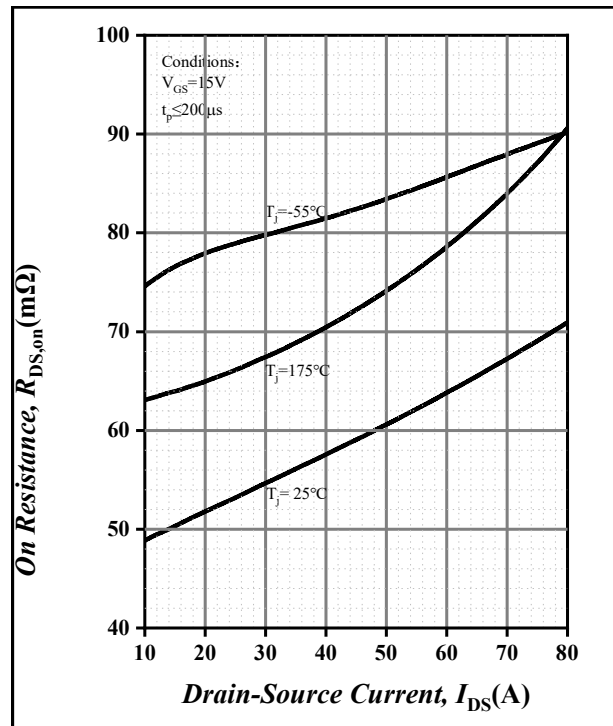


Fig.4 On-Resistance vs. Drain Current For Various Temperatures

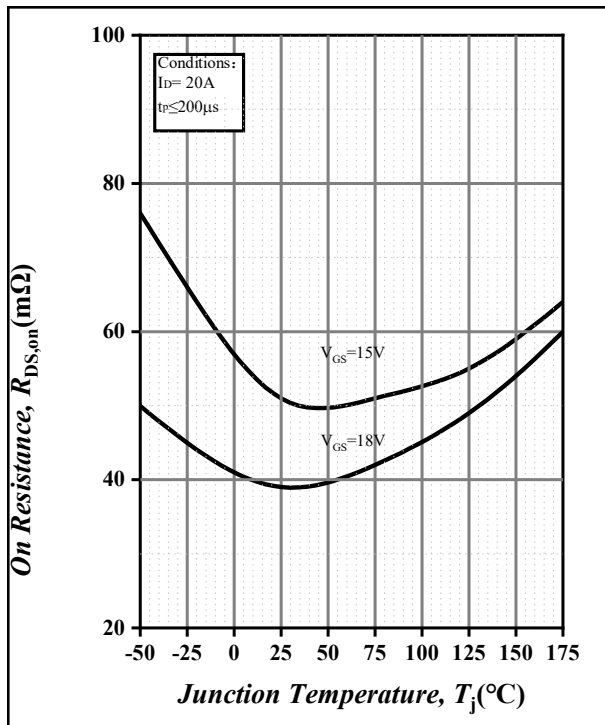


Fig.5 On-Resistance vs. Temperature For Various Gate Voltage

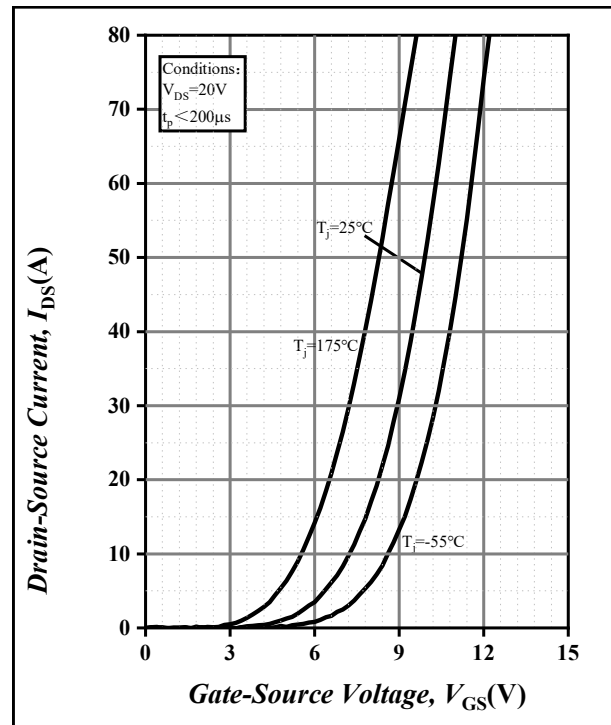


Fig.6 Transfer Characteristic For Various Junction Temperatures

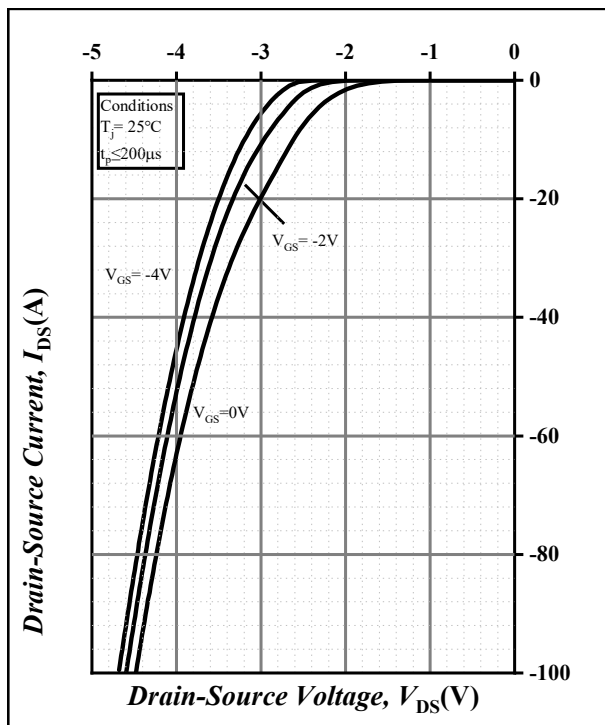


Fig.7 Body Diode Characteristic at 25°C

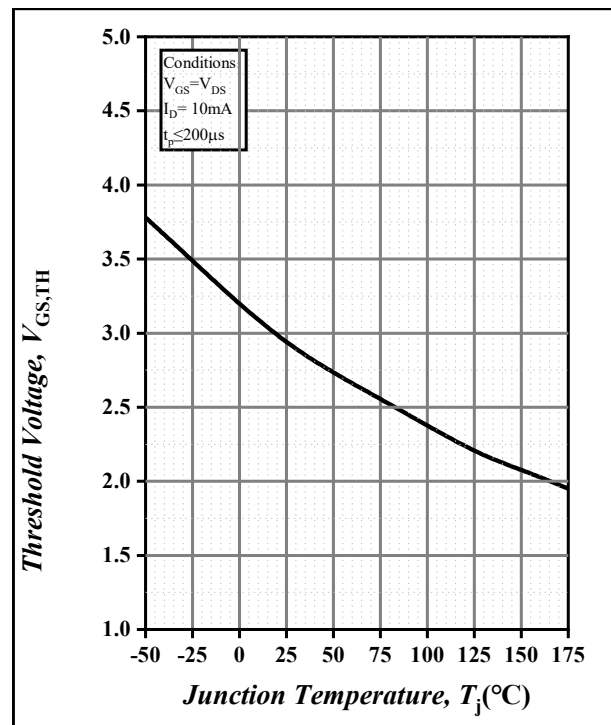


Fig.8 Threshold Voltage vs. Temperature

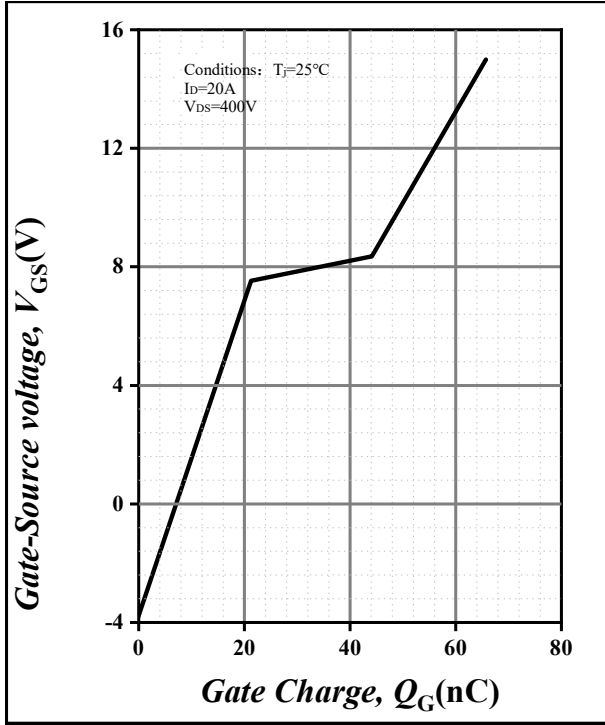


Fig.9 Gate Charge Characteristics

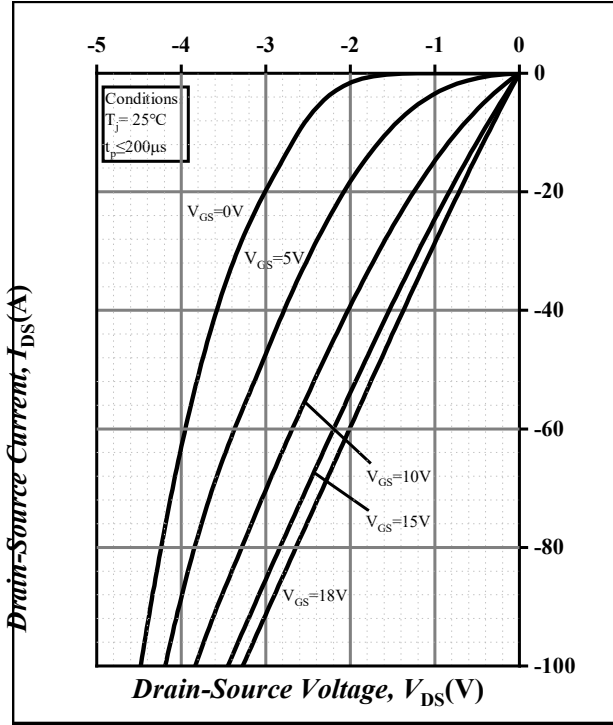


Fig.10 3<sup>rd</sup> Quadrant Characteristic at 25°C

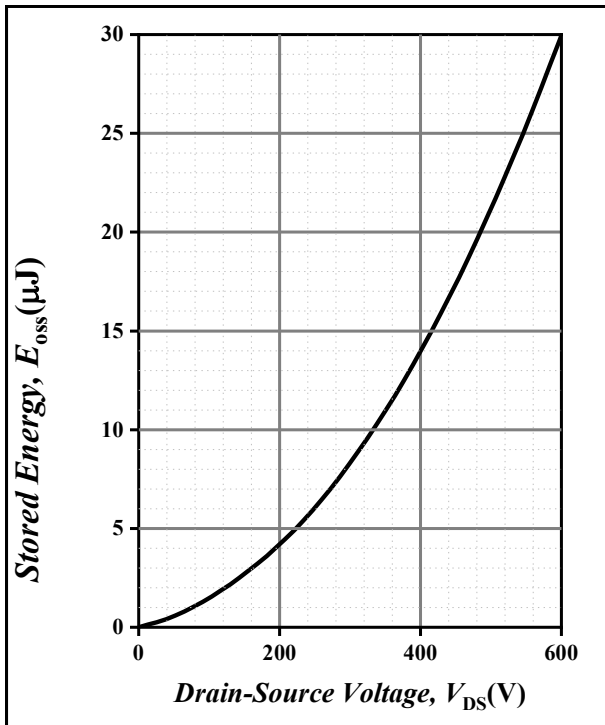


Figure 11. Output Capacitor Stored Energy

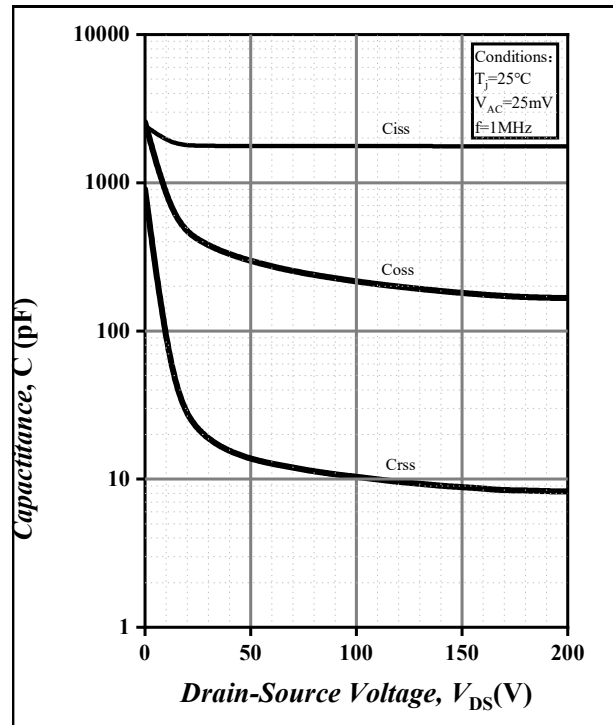


Fig.12 Capacitances vs. Drain-Source Voltage(0-200V)

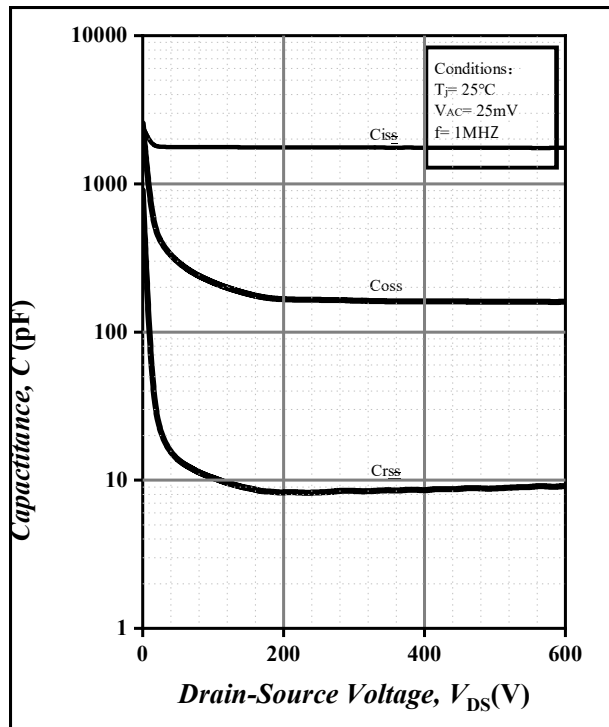


Fig.13 Capacitances vs. Drain-Source Voltage(0-600V)

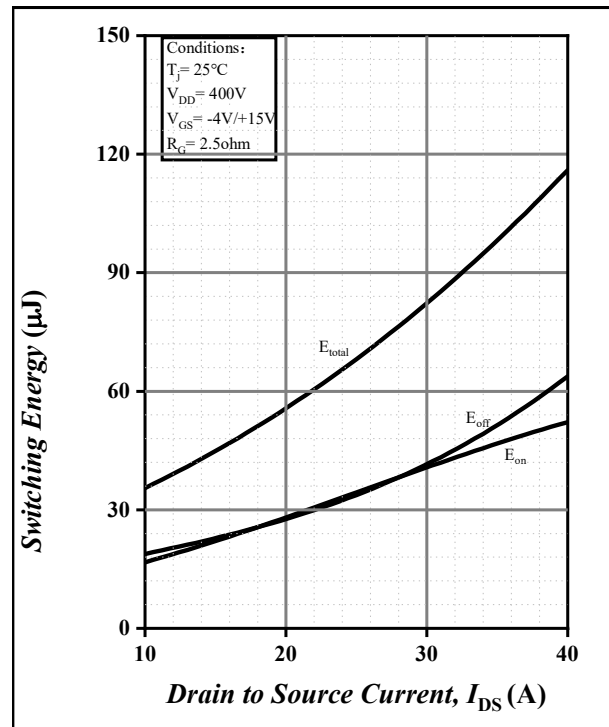


Figure 14. Clamped Inductive Switching Energy vs. Drain Current( $V_{DD}=400\text{V}$ )

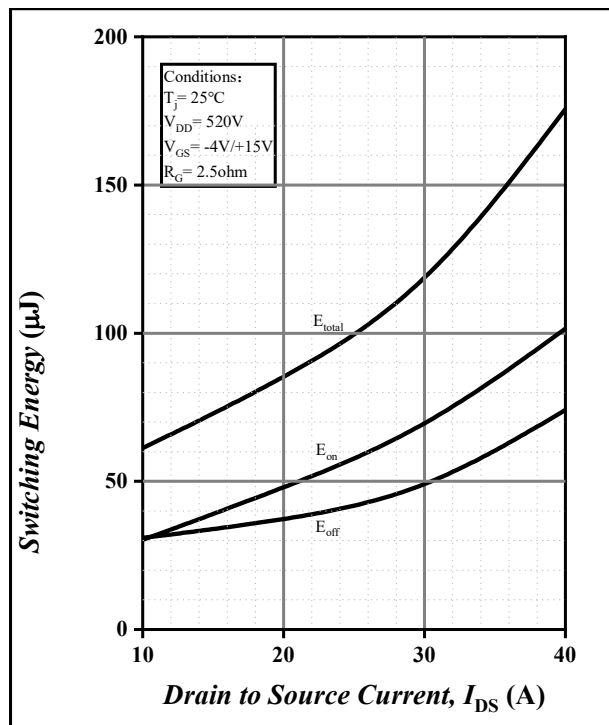


Figure 15. Clamped Inductive Switching Energy vs. Drain Current( $V_{DD}=520\text{V}$ )

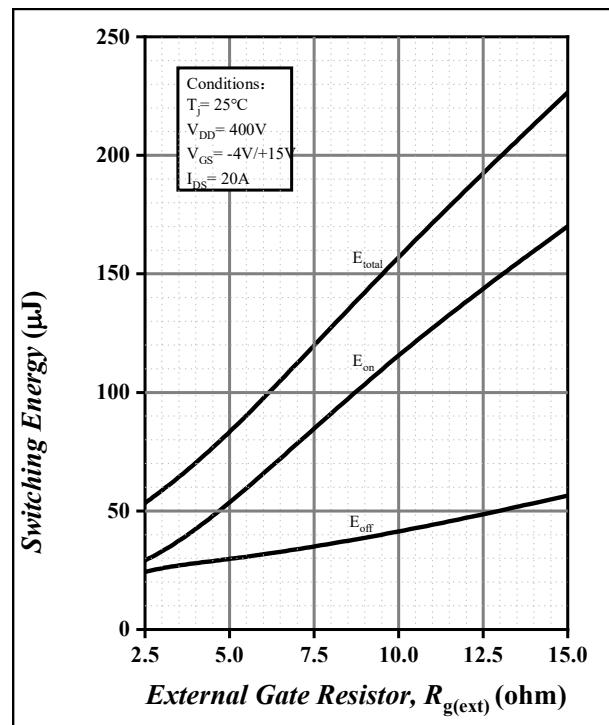


Figure 16. Clamped Inductive Switching Energy vs.  $R_{g(\text{ext})}$

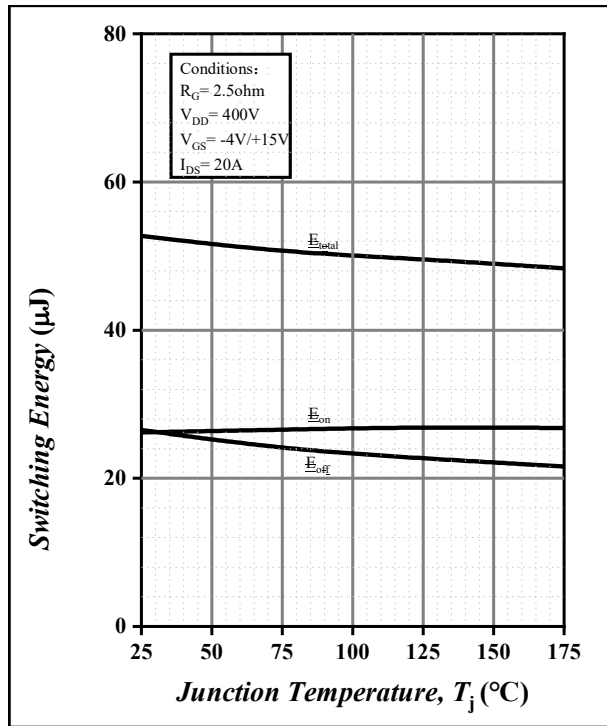


Figure 17. Clamped Inductive Switching Energy vs. Temperature

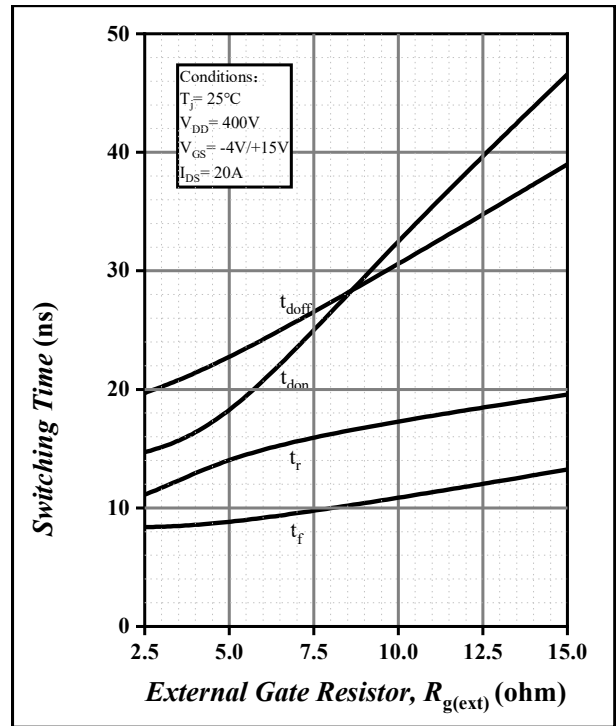
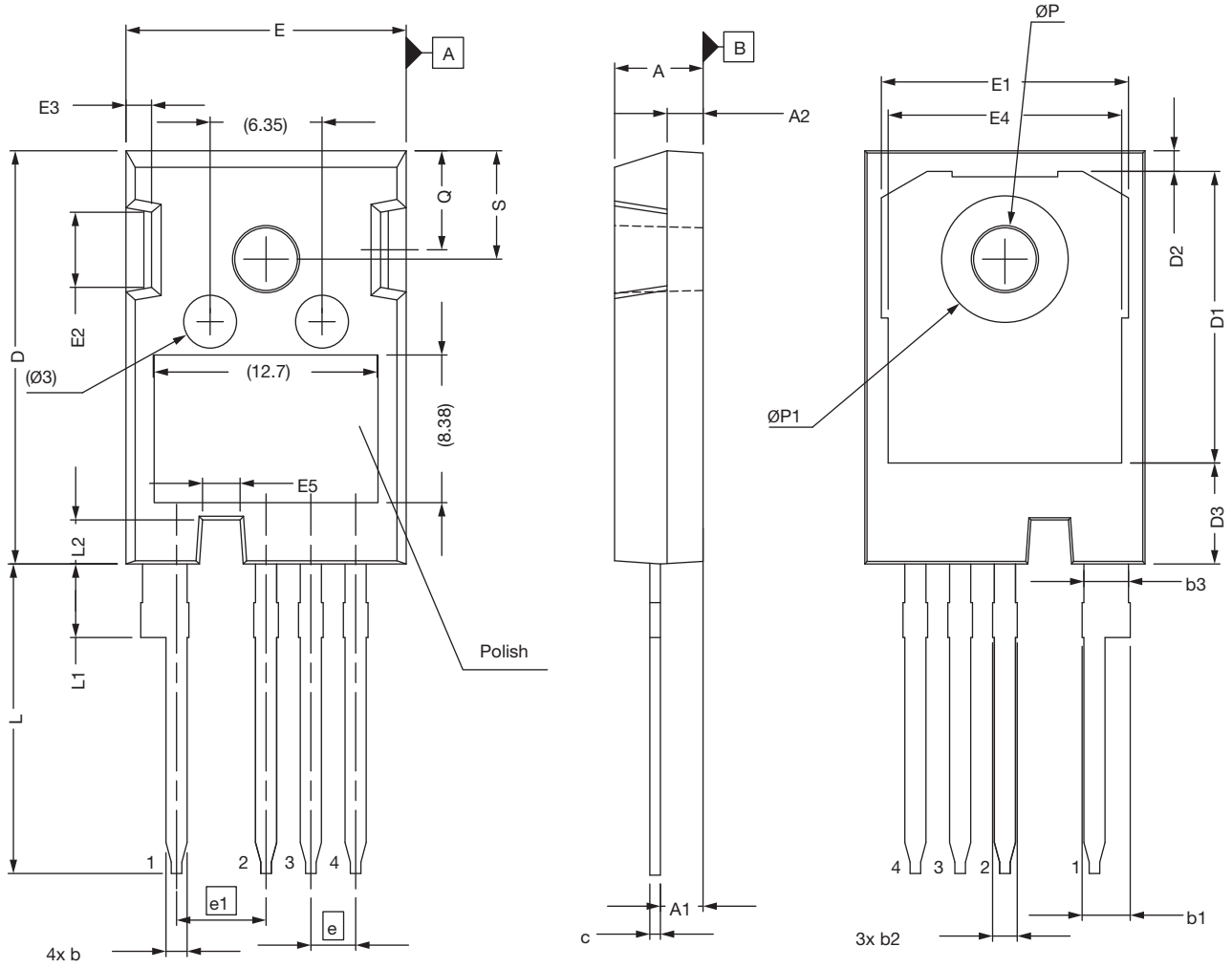


Figure 18. Switching Times vs.  $R_{g(ext)}$

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DIM.	MILLIMETERS		
	MIN.	NOM.	MAX.
A	4.83	5.02	5.21
A1	2.29	2.41	2.54
A2	1.91	2.00	2.16
b	1.07	1.20	1.33
b1	2.39	2.67	2.94
b2	1.07	1.30	1.60
b3	2.39	2.53	2.69
c	0.55	0.60	0.68
D	23.30	23.45	23.60
D1	16.25	16.55	17.65
D2	0.95	1.19	1.25
D3	5.55	5.71	6.01
E	15.75	15.94	16.13
E1	13.10	14.02	14.15
E2	3.68	4.40	5.10
E3	1.00	1.45	1.90
E4	12.38	13.26	13.43
E5	1.95	2.15	2.35
e	2.54 BSC.		
e1	5.08 BSC.		
L	17.31	17.57	17.82
L1	3.97	4.19	4.37
L2	2.35	2.50	2.65
ØP	3.51	3.61	3.65
ØP1	7.19 ref.		
Q	5.49	5.79	6.00
S	6.04	6.17	6.30

**Notes**

- All dimensions are in mm
- Dimension D and E do not include mold flash.
- Creepage 1 is 8.40 mm (ref.) which is the distance alongside the surface between drain (pin 1) and trough the notch towards source (pin 2).  
Creepage 2 is 7.70 mm (ref.) which is the distance from end of the copper slug on the backside of the package to either pin 2, pin 3 or pin 4

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