

Silicon Carbide Enhancement Mode MOSFET

Features

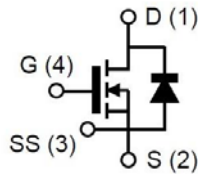
- High blocking voltage with low $R_{ds(on)}$
- High frequency operation with low Capacitance
- Simple to drive with -4V/+18V gate
- Robust body diode with low Q_{rr}
- 100% Avalanche Tested

Benefits

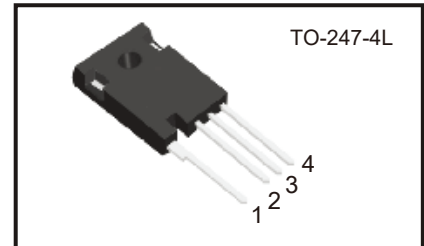
- Superior robustness and system reliability
- Higher system efficiency
- Easier paralleling without thermal runaway
- Capable of high temperature application
- Faster and more efficient switching

Applications

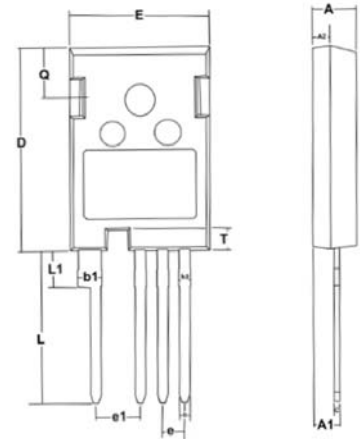
- EV motor drives
- EV/HEV charging station
- Energy storage and Battery charging
- High voltage DC-DC converters
- Solar / Wind Inverters
- UPS and PFC



V_{DSS}	1200V
$I_D(@25^{\circ}C)$	67A
$R_{DS(ON) typ.}$	35m Ω



Package Dimensions



Absolute Maximum Ratings

($T_c = 25^{\circ}C$ unless otherwise specified)

Parameter	Symbol	Rated	Unit
Drain-Source Voltage $V_{GS}=0V$ $I_D=100\mu A$	V_{DS}	1200	V
Gate-Source Voltage (dynamic) AC ($f > 1$ Hz, duty cycle < 1%, pulse width < 200ns)	V_{GS}	-9/+22	V
Gate-Source Voltage (static)	$V_{GS(op)}$	-4/+18	V
Drain Current-Continuous $V_{GS}=18V @ T_c=25^{\circ}C$ $V_{GS}=18V @ T_c=100^{\circ}C$	I_D	67 47	A
Pulse Drain Current	$I_{D,pulse}$	134	A
Power Dissipation	P_D	312	W
Storage Temperature Range	T_{STG}	-55 to +175	$^{\circ}C$
Operating Junction Temperature Range	T_J	-55 to +175	$^{\circ}C$
Soldering Temperature	T_L	260	$^{\circ}C$
Avalanche Capability, single pulse * $V_{DD}=100V$ $V_{GS}=10V$ $L=2mH$	I_{AV}	35	A
Avalanche Capability, single pulse** $V_{DD}=100V$ $V_{GS}=10V$ $L=2mH$	E_{AV}	1225	mJ

* 100% tested in 60% rating

** 100% tested in 36% rating

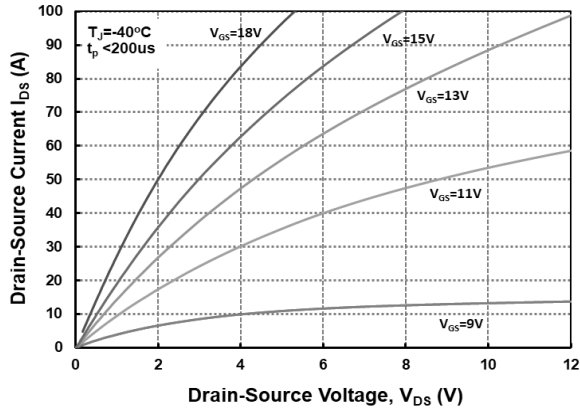
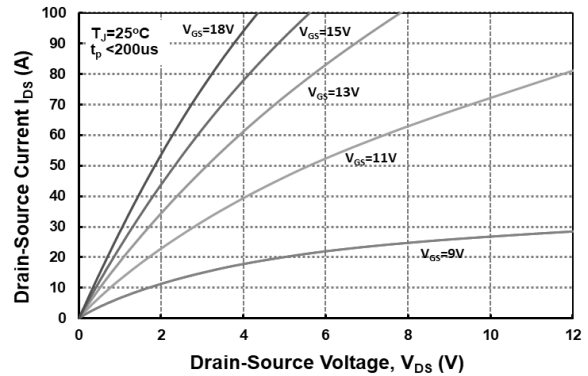
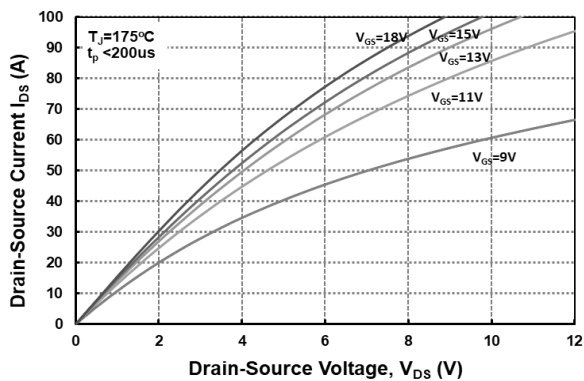
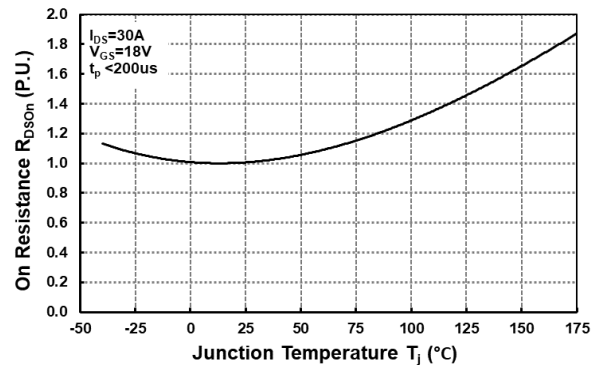
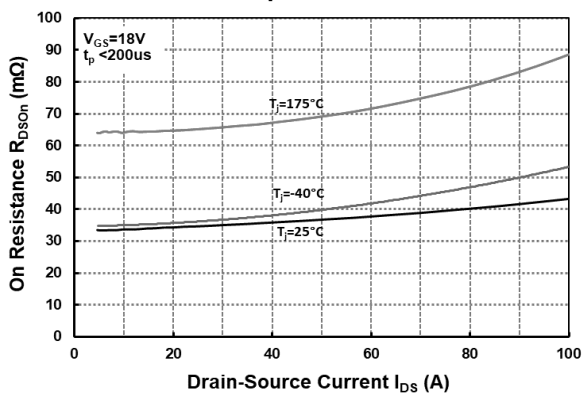
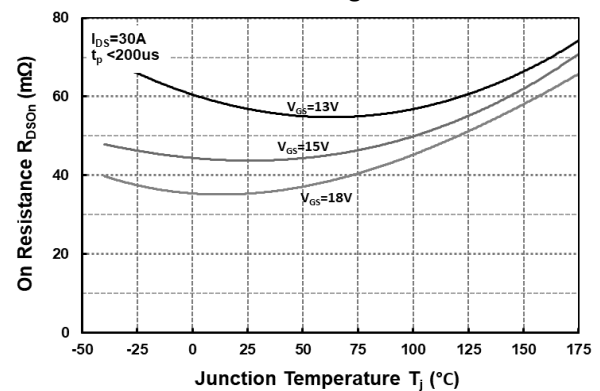
Symbol	Dimensions in millimeters		
	Min.	Avg.	Max.
A	4.80	5.00	5.20
A1	2.21	2.41	2.61
A2	1.80	2.00	2.20
b	1.06	1.21	1.36
b1	2.33	2.63	2.93
b2	1.07	1.30	1.60
C	0.51	0.61	0.75
D	23.30	23.45	23.60
E	15.74	15.94	16.14
e	2.54 BSC		
e1	5.08 BSC		
L	17.27	17.57	17.87
L1	3.99	4.19	4.39
Q	5.49	5.79	6.09
T	2.35	2.50	2.65

Electrical Characteristics @ T_c =25°C (unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
OFF Characteristics							
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V, I _D =0.1mA	1200	-	-	V	
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =1200V V _{GS} =0V	T _J =25°C	-	0.5	60	μA
			T _J =150°C	-	5	200	
Gate-Source Leakage Current	I _{GSS}	V _{GS} =18V, V _{DS} =0V	-	5	100	nA	
		V _{GS} =-4V, V _{DS} =0V	-100	-5	-		
ON Characteristics							
Gate Threshold Voltage **	V _{GS(th)}	V _{DS} = V _{GS} , I _D =10mA	T _J =25°C	2.2	3.1	4.3	V
			T _J =175°C	-	2.4	-	
Drain-Source On-State Resistance	R _{DS(on)}	V _{GS} =18V, I _D =30A	T _J =25°C	-	35	48	mΩ
			T _J =175°C	-	66	-	
Transconductance	g _{fs}	V _{DS} =20V, I _D =30A	T _J =25°C	-	24	-	S
			T _J =175°C	-	22	-	
Internal Gate Resistance	R _{G(int.)}	f=1MHz, I _D =0A	-	1.2	-	Ω	
Dynamic Characteristics							
Input Capacitance	C _{iss}	V _{DS} =1000V V _{GS} =0V Freq.=1MHz V _{AC} =25mV	-	2440	-	pF	
Output Capacitance	C _{oss}		-	85	-		
Reverse Transfer Capacitance	C _{riss}		-	6.5	-		
C _{oss} Stored Energy	E _{oss}		-	51	-		μJ
Turn-On Switching Energy	E _{on}	V _{DS} =800V, V _{GS} =-4/+18V I _D =30A, R _{G(ext)} =2.0Ω L=200μA	-	122	-	μJ	
Turn-Off Switching Energy	E _{off}		-	45	-		
Switching Characteristics							
Turn-On Delay Time	t _{d(on)}	V _{DS} =800V, V _{GS} =-4/+18V I _D =30A, R _{G(ext)} =2.0Ω L=200μA	-	12	-	ns	
Rise Time	t _r		-	10	-		
Turn-Off Delay Time	t _{d(off)}		-	25	-		
Fall Time	t _f		-	7	-		
Total Gate Charge	Q _g	V _{DS} =800V V _{GS} =-4/+18V I _D =30A	-	108	-	nC	
Gate to Source Charge	Q _{gs}		-	31	-		
Gate to Drain Charge	Q _{gd}		-	41	-		
Body Diode Characteristics							
Inverse Diode Forward Voltage	V _{SD}	V _{GS} =-4V, I _{SD} =20A	T _J =25°C	-	4.5	-	V
Inverse Diode Forward Voltage			T _J =175°C	-	4	-	V
Continuous Diode Forward Current	I _S	V _{GS} =-4V, T _J =25°C	-	-	46	A	
Reverse Recovery Time	T _{rr}	I _{SD} =30A, V _{GS} =-4V V _R =800V, T _J =25°C dif/dt=1800A/μs	-	18	-	ns	
Reverse Recovery Charge	Q _{rr}		-	300	-	nC	
Reverse Recovery Charge	I _{rrm}		-	27	-	A	
Thermal Resistance							
Thermal Resistance, Junction-to-Case	R _{θJC}		-	0.48	0.6	°C/W	

** Turn-off with -4V gate bias is highly recommended

Typical Performance

Fig 1. Output Characteristics, $T_J = -40^\circ\text{C}$

Fig 2. Output Characteristics, $T_J = 25^\circ\text{C}$

Fig 3. Output Characteristics, $T_J = 175^\circ\text{C}$

Fig 4. Normalized On-Resistance vs. Temperature

Fig 5. On-Resistance vs. Drain Current for Various Temperatures

Fig 6. On-Resistance vs. Temperature for Various Gate Voltage


Typical Performance

Fig 7. Transfer Characteristic for Various Junction Temperatures

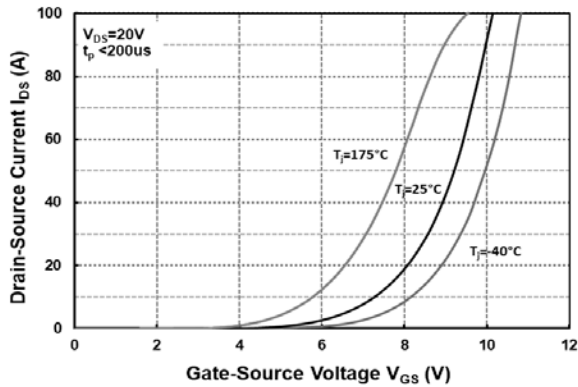


Fig 8. Body Diode Characteristics @ -40°C

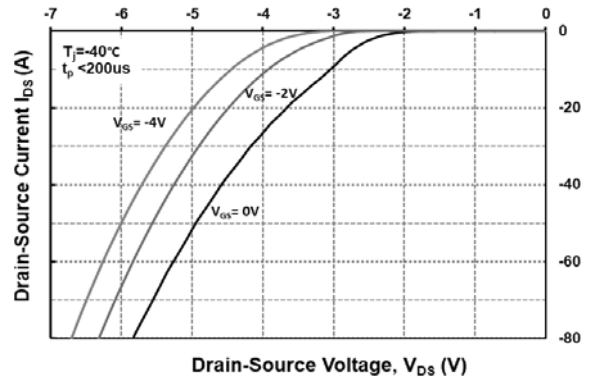


Fig 9. Body Diode Characteristics @ 25°C

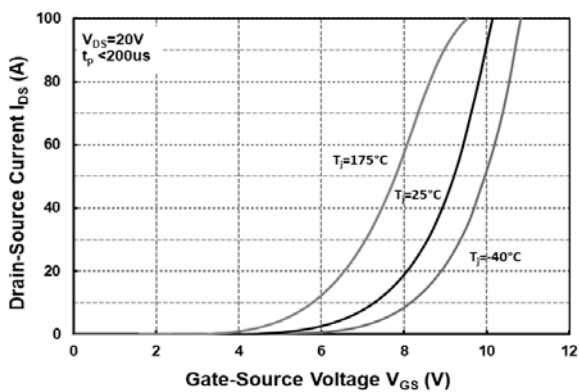


Fig 10. Body Diode Characteristics @ 175°C

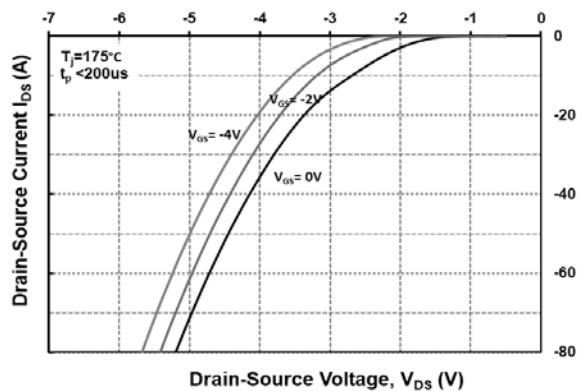


Fig 11. Threshold Voltage vs. Temperature

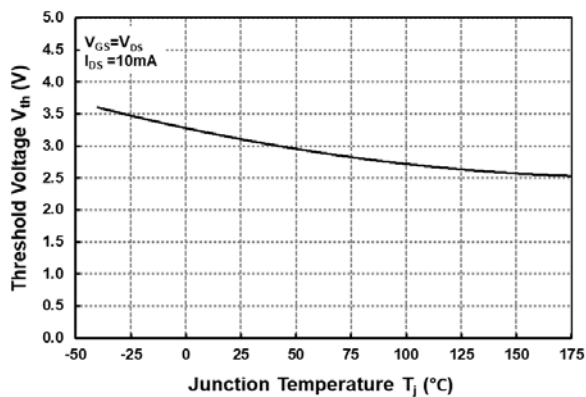
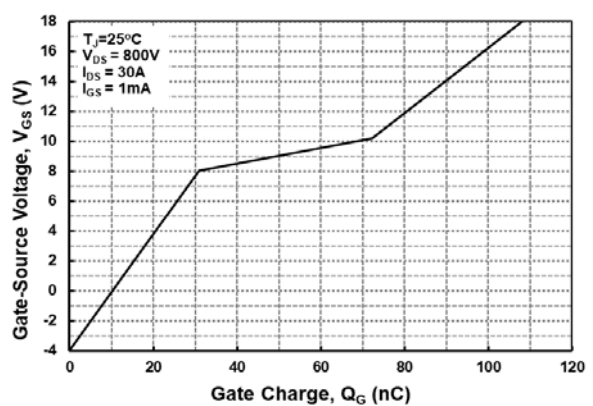
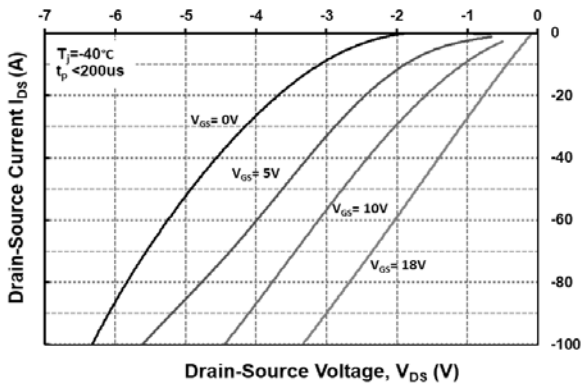
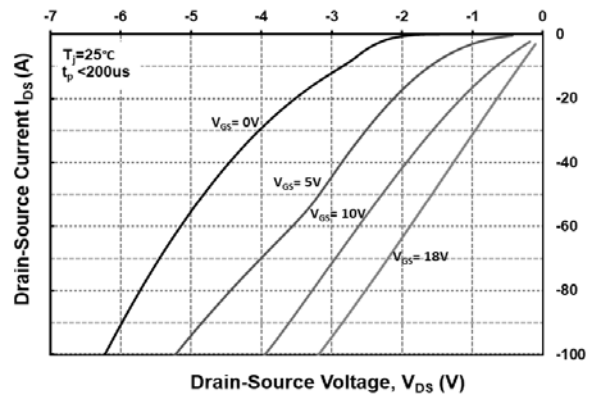
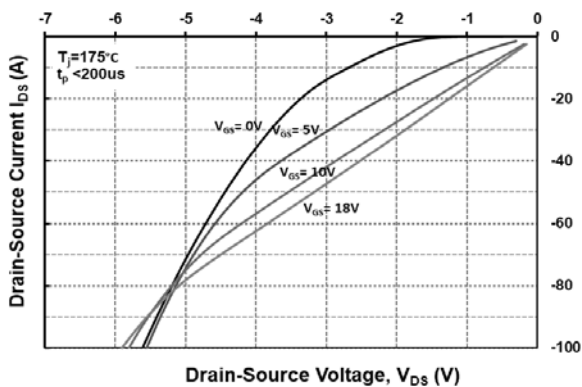
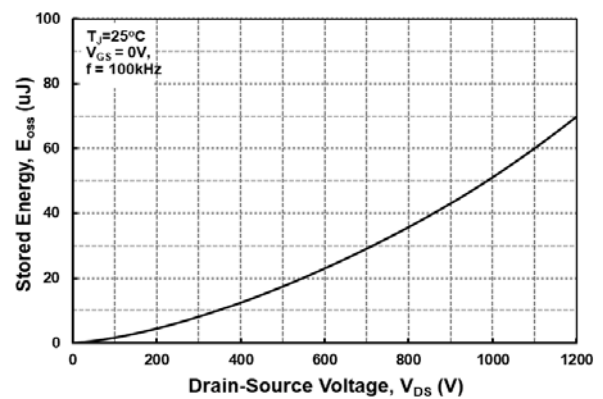
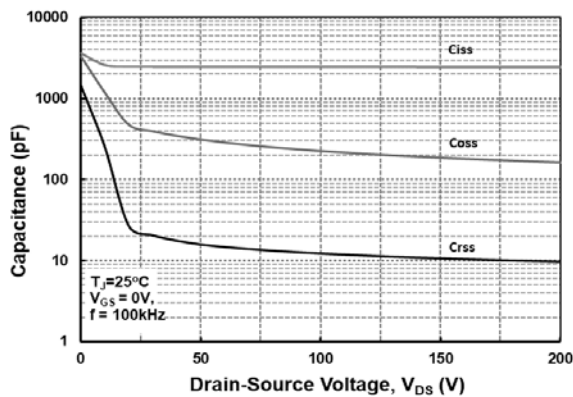
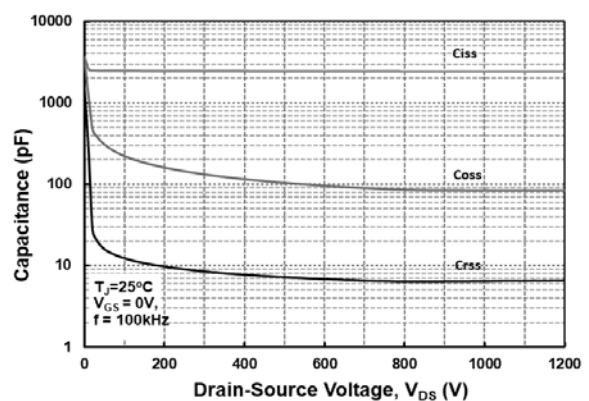


Fig 12. Gate Charge Characteristics



Typical Performance
Fig 13. 3rd Quadrant Characteristics @ -40°C

Fig 14. 3rd Quadrant Characteristics @ 25°C

Fig 15. 3rd Quadrant Characteristics @ 175°C

Fig 16. Output Capacitor Stored Energy

Fig 17. Capacitances vs. Drain-Source Voltage (0-200V)

Fig 18. Capacitances vs. Drain-Source Voltage (0-1000V)


Typical Performance

Fig 19. Continuous Drain Current Derating vs. Case Temperature

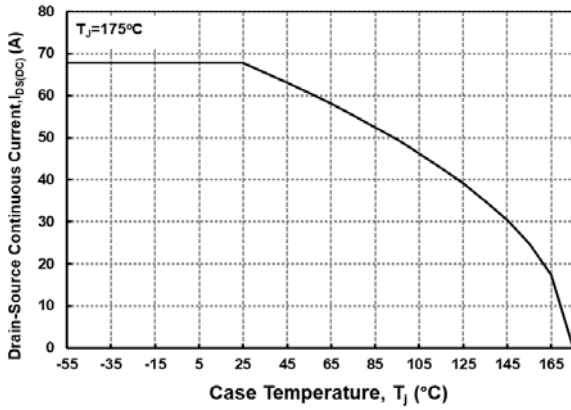


Fig 20. Maximum Power Dissipation Derating vs. Case Temperature

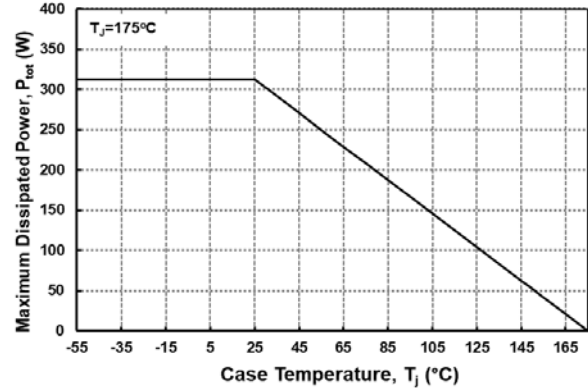


Fig 21. Transient Thermal Impedance (Junction – Case)

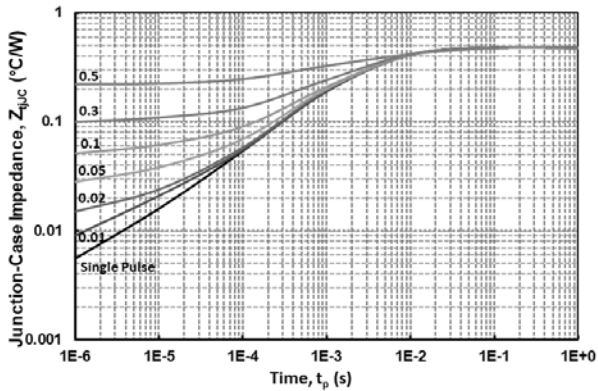


Fig 22. Safe Operating Area

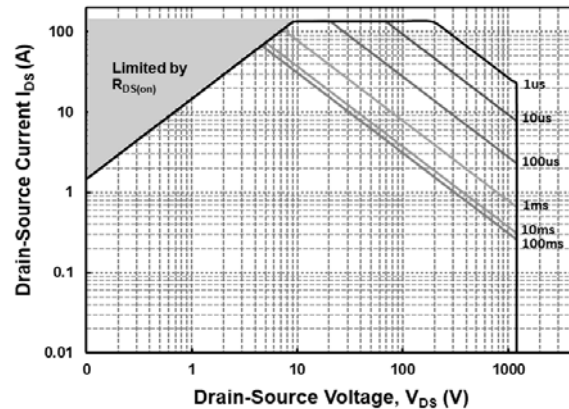


Fig 23. Clamped Inductive Switching Energy vs Drain Current ($V_{DD} = 800V$)

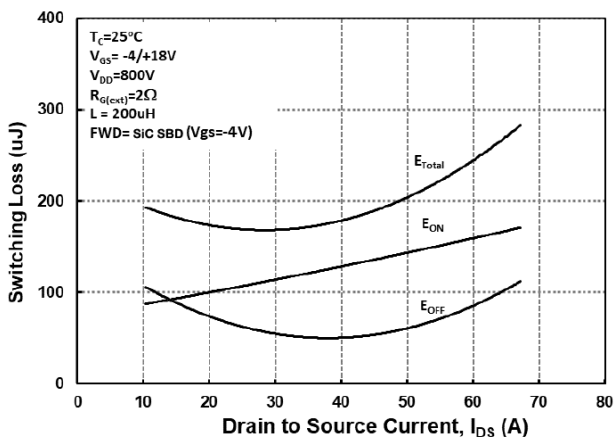
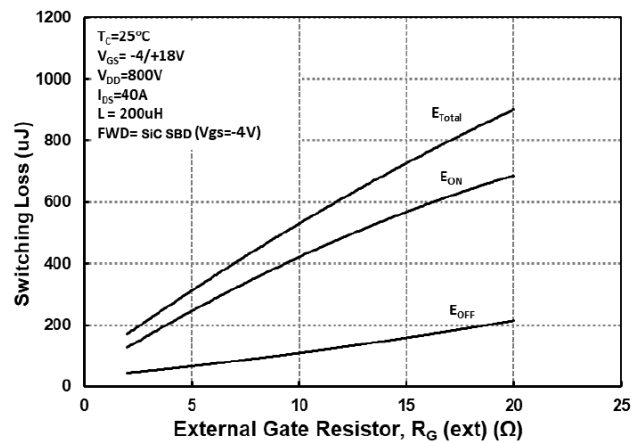
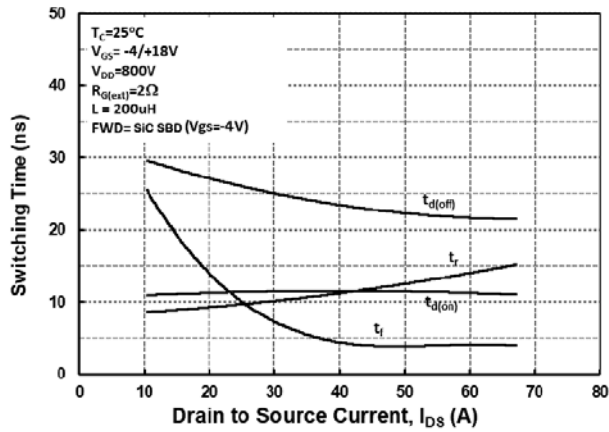
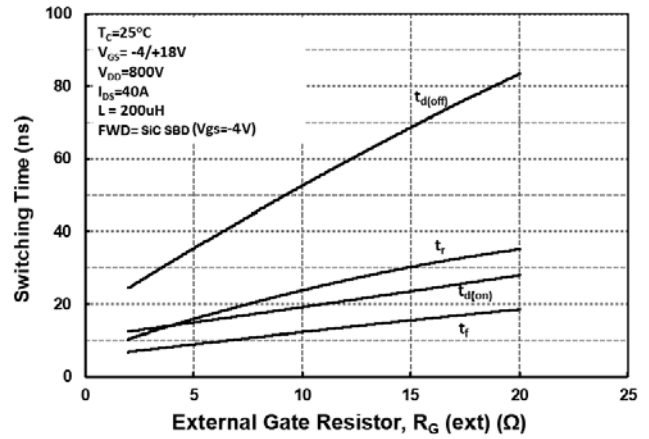


Fig 24. Clamped Inductive Switching Energy vs External Gate Resistor $R_{G(ext)}$



Typical Performance
Fig 25. Switching Times vs Drain Current
($V_{DD} = 800V$)

Fig 26. Switching Times vs External
Gate Resistor $R_{G(ext)}$


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