

Silicon Carbide Enhancement Mode MOSFET

Features

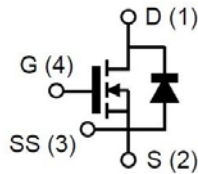
- High blocking voltage with low $R_{DS(on)}$
- High frequency operation with low Capacitance
- Simple to drive with -4V/+18V gate
- Robust body diode with low Q_{rr}
- 100% Avalanche Tested

Benefits

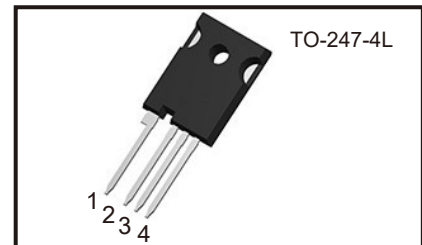
- Superior robustness and system reliability
- Higher system efficiency
- Easier paralleling without thermal runaway
- Capable of high temperature application
- Faster and more efficient switching

Applications

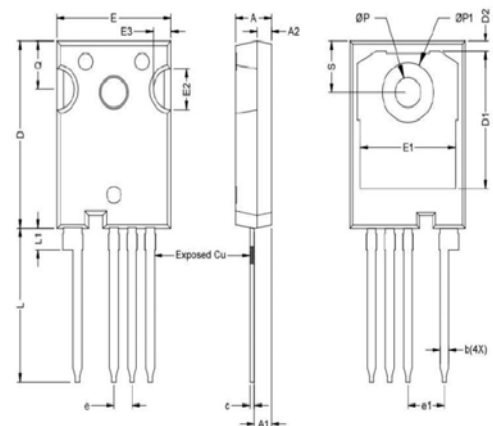
- EV motor drives
- EV/HEV charging station
- Energy storage and Battery charging
- High voltage DC-DC converters
- Solar / Wind Inverters
- UPS and PFC



V_{DSS}	1200V
$I_D(@25^{\circ}C)$	125A
$R_{DS(ON) typ.}$	17mΩ



Package Dimensions



Absolute Maximum Ratings

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

Parameter	Symbol	Ratings	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	125 90	A
Pulse Drain Current	$I_{D,pulse}$	250	A
Power Dissipation	P_D	577	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}	46	A
Avalanche Capability, single pulse** $V_{DD}=100V$ $V_{GS}=10V$ $L=2mH$	E_{AV}	2300	mJ

* 100% tested in 60% rating

** 100% tested in 36% rating

DIM	MILLIMETERS		
	MIN	TYP.	MAX
A	4.82	5.02	5.22
A1	2.21	2.41	2.61
A2	1.8	2	2.2
b	0.95	1.2	1.45
b1	1.95	2.2	2.45
b2	2.95	3.2	3.45
c	0.35	0.6	0.85
D	22.34	22.54	22.74
D1	16.3	16.55	16.8
D2	0.99	1.19	1.39
E	15.74	15.94	16.14
E1	13.01	13.26	13.51
E2	4.71	4.91	5.11
E3	2.26	2.46	2.66
e	2.54 BSC.		
e1	5.08 BSC.		
L	18.23	18.48	18.73
L1	2.35	2.60	2.85
P	3.41	3.61	3.81
P1	6.94	7.19	7.44
Q	5.59	5.79	5.99
S	5.97	6.17	6.37

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℃	-	0.5	100	μA
			T _J =175℃	-	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 =20mA	T _J =25℃	2.2	3.0	4.2	V
			T _J =175℃	-	2.2	-	
Drain-Source On-State Resistance	R _{DS(on)}	V _{GS} =18V , I _D =50A	T _J =25℃	-	17	23	mΩ
			T _J =175℃	-	32	-	
Transconductance	g _{fs}	V _{DS} =20V , I _D =50A	T _J =25℃	-	40	-	S
			T _J =175℃	-	38	-	
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 f =100kHz V _{AC} =25mV		-	4300	-	pF
Output Capacitance	C _{oss}			-	170	-	
Reverse Transfer Capacitance	C _{rss}			-	15	-	
Coss Stored Energy	E _{oss}			-	100	-	
Turn-On Switching Energy	E _{on}	V _{DS} =800V , V _{GS} =-4/+18V I _D =50A , R _{G(ext)} =2.0Ω L =200μH		-	410	-	μJ
Turn-Off Switching Energy	E _{off}			-	120	-	
Switching Characteristics							
Turn-On Delay Time	t _{d(on)}	V _{DS} =800V , V _{GS} =-4/+18V I _D =50A , R _{G(ext)} =2.0Ω L =200μH		-	19	-	ns
Rise Time	t _r			-	23	-	
Turn-Off Delay Time	t _{d(off)}			-	41	-	
Fall Time	t _f			-	10	-	
Total Gate Charge	Q _g	V _{DS} =800V V _{GS} =-4/+18V I _D =50A		-	210	-	nC
Gate to Source Charge	Q _{gs}			-	55	-	
Gate to Drain Charge	Q _{gd}			-	77	-	
Body Diode Characteristics							
Inverse Diode Forward Voltage	V _{SD}	V _{GS} =-4V , I _{SD} =40A	T _J =25℃	-	4.4	-	V
Inverse Diode Forward Voltage			T _J =175℃	-	3.9	-	V
Continuous Diode Forward Current	I _S	V _{GS} =-4V , T _J =25℃		-	100	-	A
Reverse Recovery Time	T _{rr}	I _{SD} =50A , V _{GS} =-4V V _R =800V , R _{G(ext)} =10Ω dif/dt =2500A/μs L =200μH		-	23	-	ns
Reverse Recovery Charge	Q _{rr}			-	510	-	nC
Peak Reverse Recovery Current	I _{rrm}			-	41	-	A
Thermal Resistance							
Thermal Resistance, Junction-to-Case	Rθ _{Jc}			-	0.26	0.31	℃/W

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

Typical Performance

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

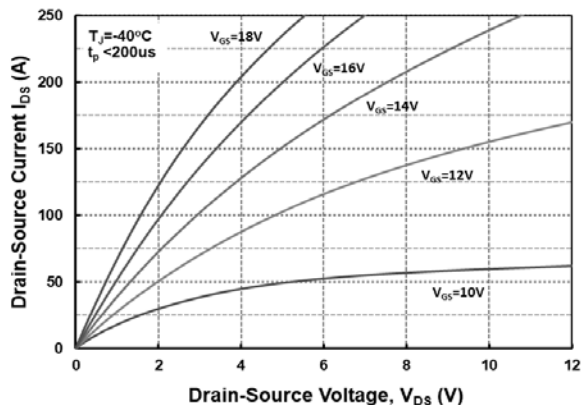


Fig 2. Output Characteristics, $T_J = 25^\circ\text{C}$

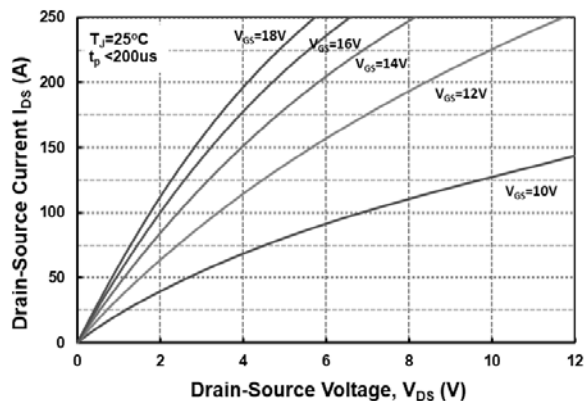


Fig 3. Output Characteristics, $T_J = 175^\circ\text{C}$

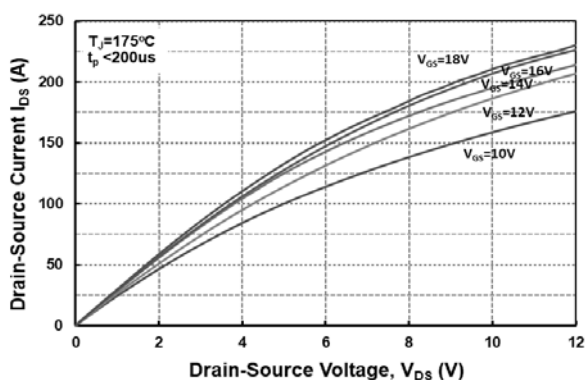


Fig 4. Normalized On-Resistance vs. Temperature

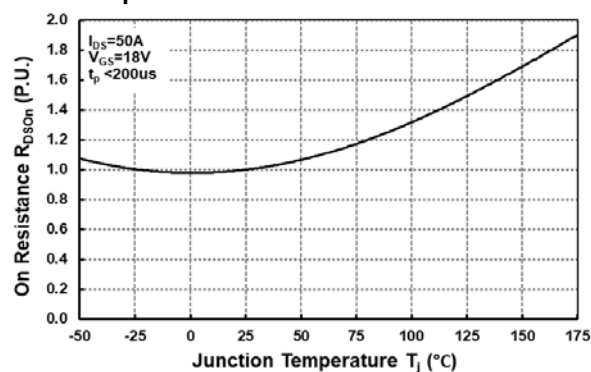


Fig 5. On-Resistance vs. Drain Current for Various Temperatures

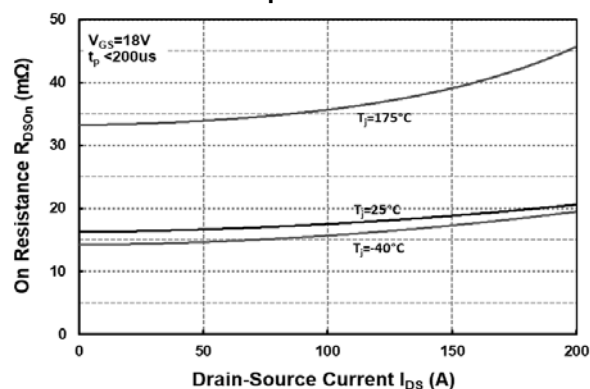
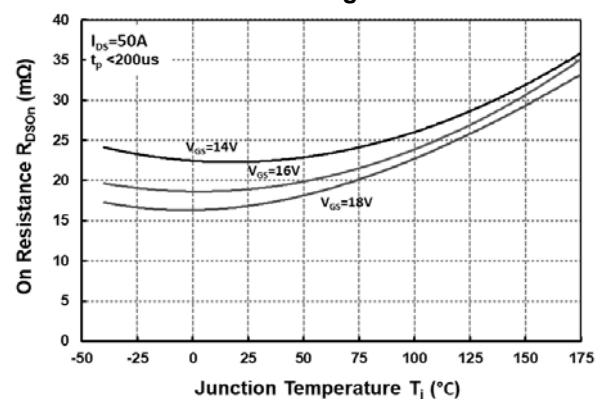


Fig 6. On-Resistance vs. Temperature for Various Gate Voltage



Typical Performance

Fig 7. Transfer Characteristic for Various Junction Temperatures

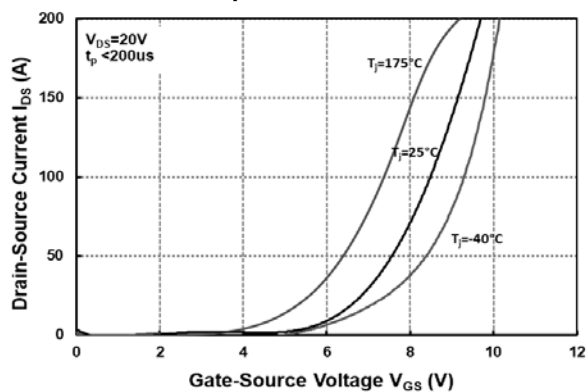


Fig 8. Body Diode Characteristics @ -40°C

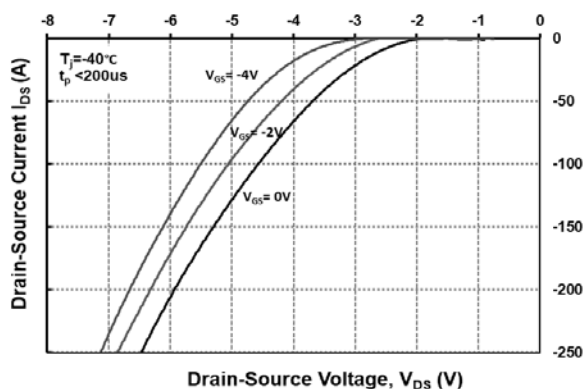


Fig 9. Body Diode Characteristics @ 25°C

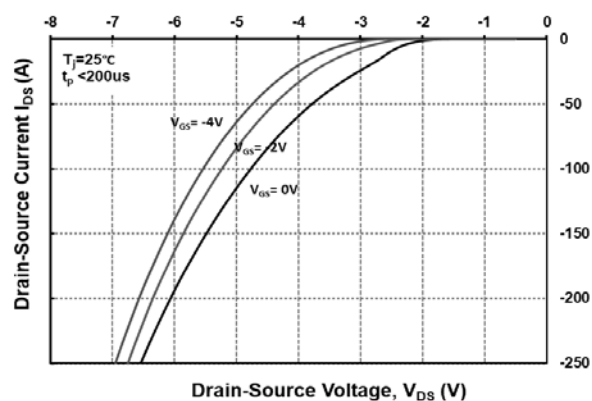


Fig 10. Body Diode Characteristics @ 175°C

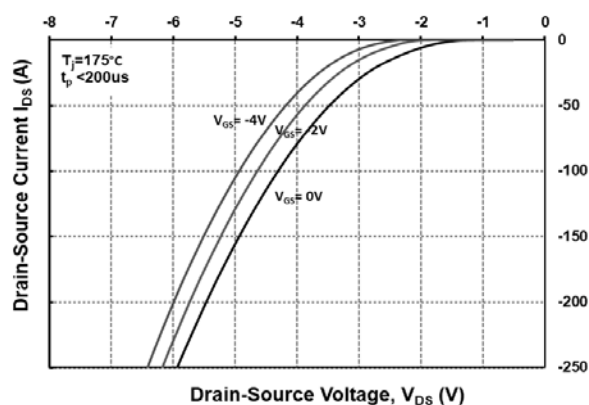


Fig 11. Threshold Voltage vs. Temperature

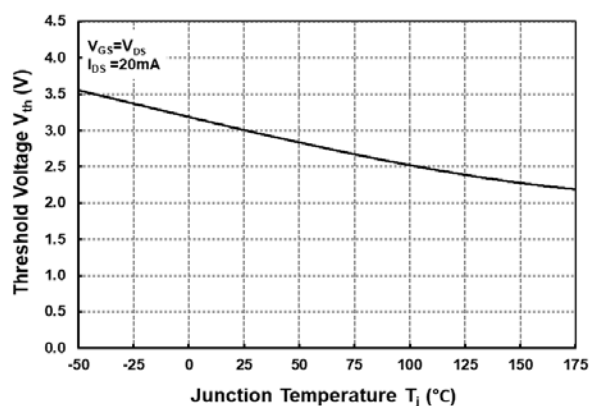
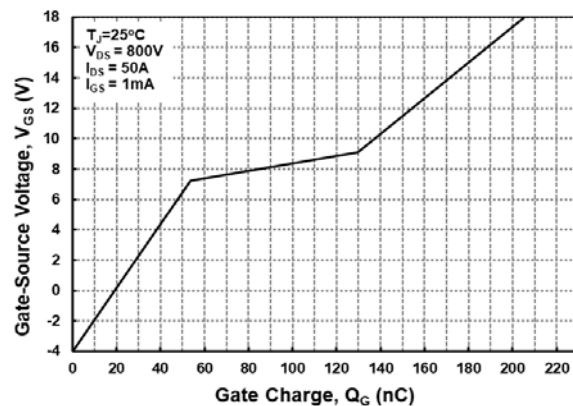


Fig 12. Gate Charge Characteristics



Typical Performance

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

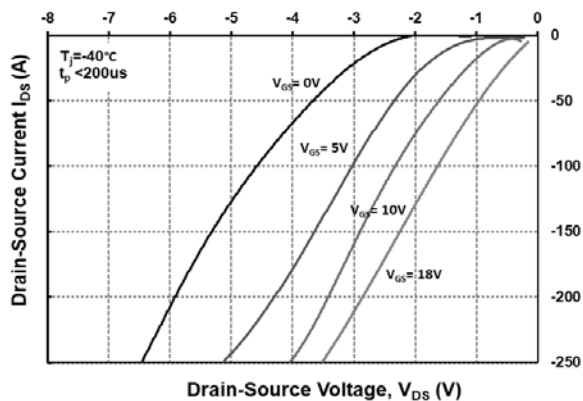


Fig 14. 3rd Quadrant Characteristics @ 25°C

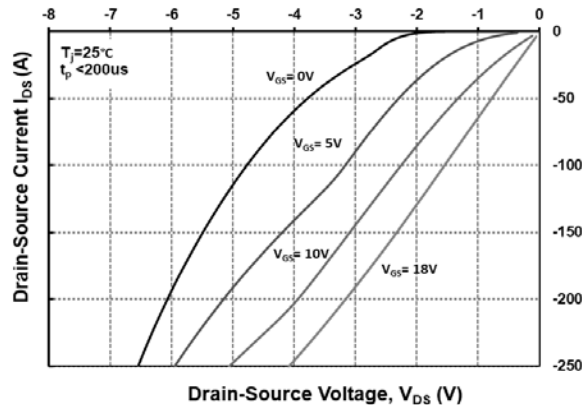


Fig 15. 3rd Quadrant Characteristics @ 175°C

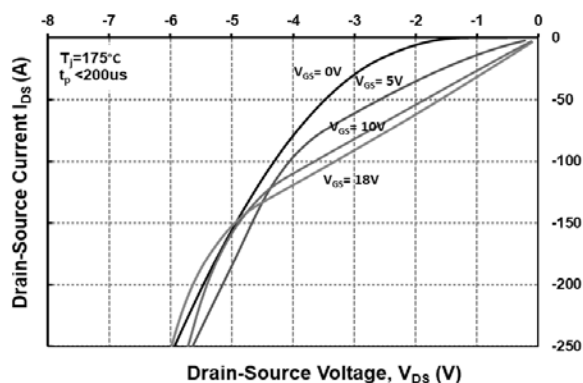


Fig 16. Output Capacitor Stored Energy

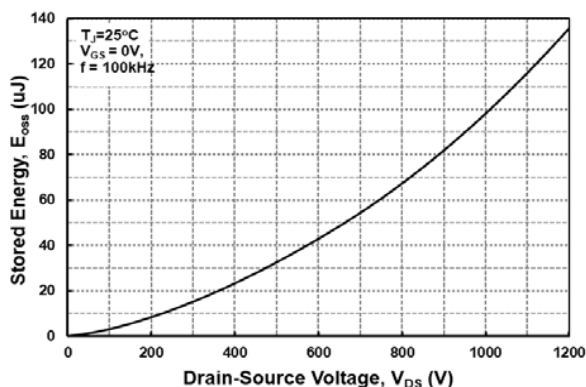


Fig 17. Capacitances vs. Drain-Source Voltage (0-200V)

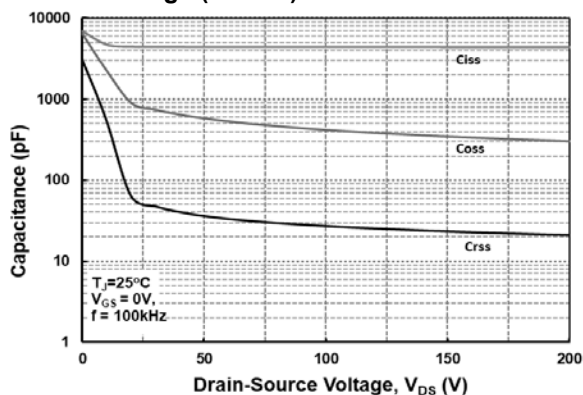
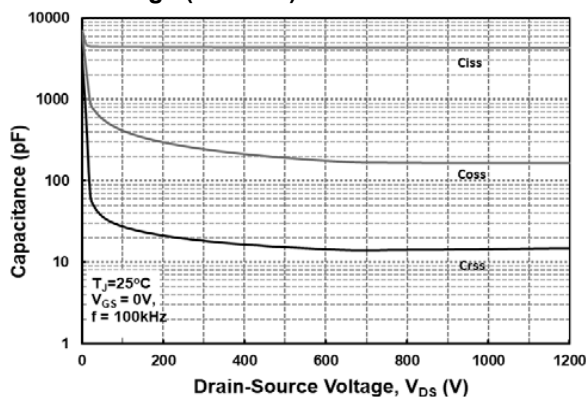


Fig 18. Capacitances vs. Drain-Source Voltage (0-1200V)



Typical Performance

Fig 19. Continuous Drain Current Derating vs. Case Temperature

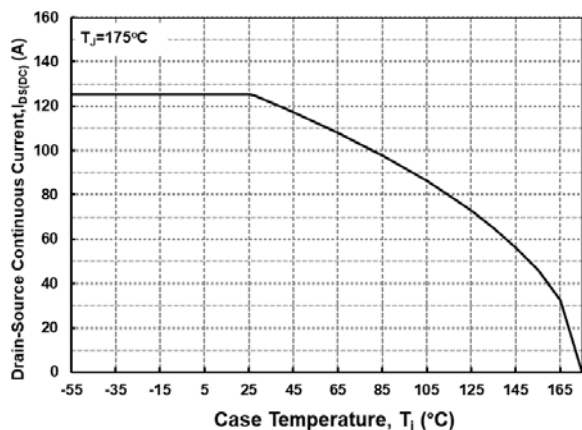


Fig 20. Maximum Power Dissipation Derating vs. Case Temperature

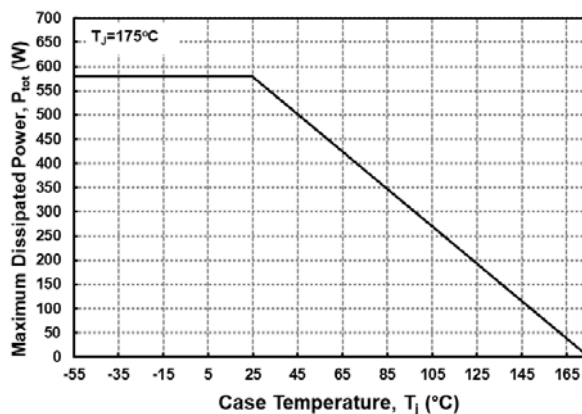


Fig 21. Transient Thermal Impedance (Junction – Case)

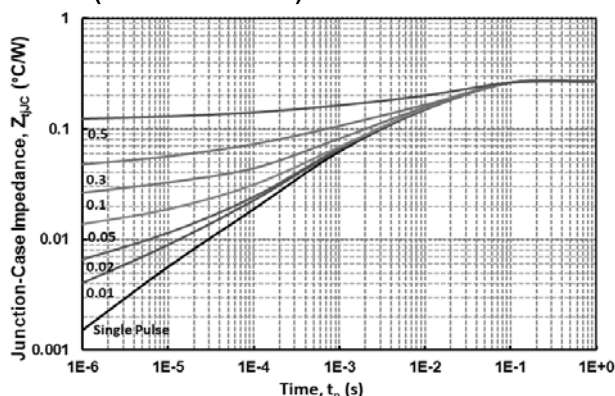


Fig 22. Safe Operating Area

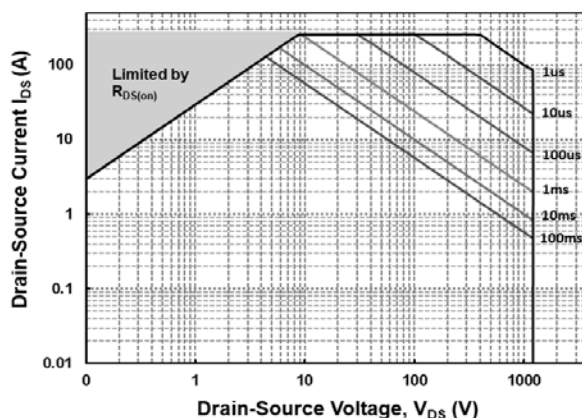


Fig 23. Clamped Inductive Switching Energy vs Drain Current ($V_{DD} = 800V$)

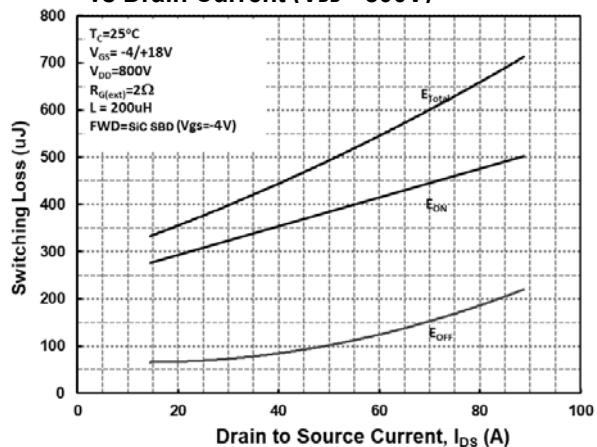
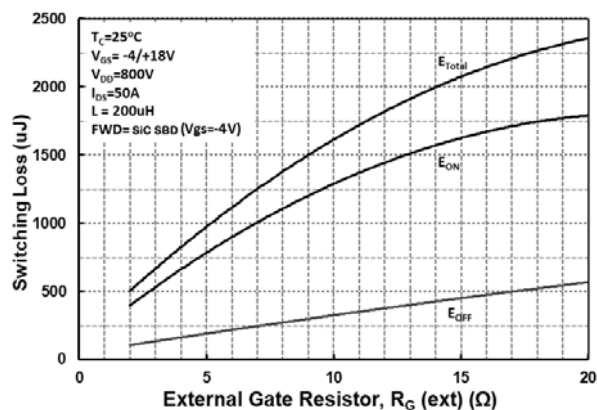


Fig 24. Clamped Inductive Switching Energy vs External Gate Resistor $R_{G(ext)}$



Typical Performance

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

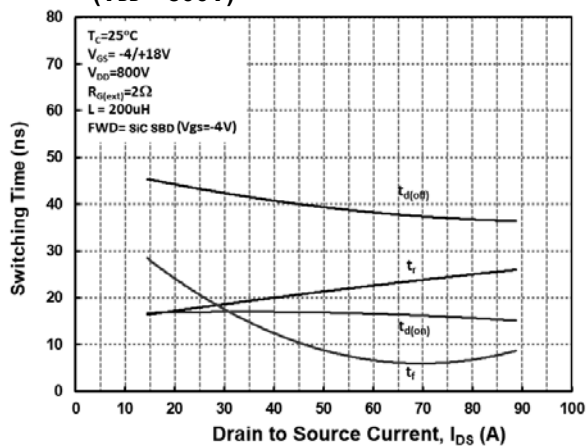
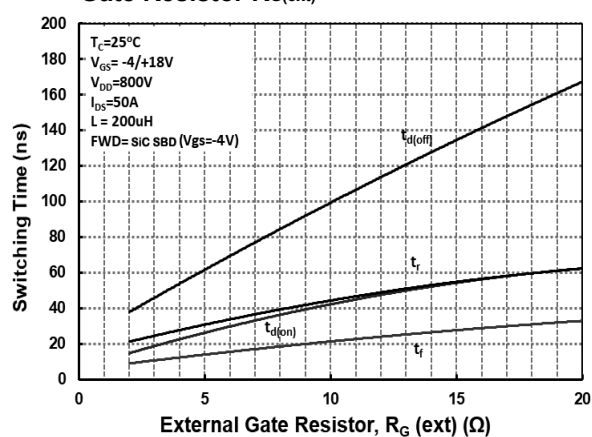


Fig 26. Switching Times vs External Gate Resistor $R_{G(ext)}$



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