

Silicon Carbide Enhancement Mode MOSFET

Features

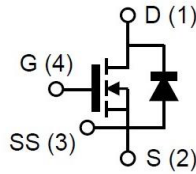
- High blocking voltage with low $R_{DS(on)}$
- High frequency operation with low Capacitance
- Simple to drive with -5/+18V gate
- Robust body diode with low Q_{rr}
- 100% Avalanche Tested

Benefits

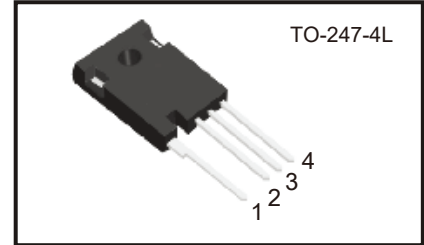
- Superior robustness and system reliability
- Higher system efficiency
- Easier paralleling without thermal runaway
- Capable of high temperature application
- Faster and more efficient switching

Applications

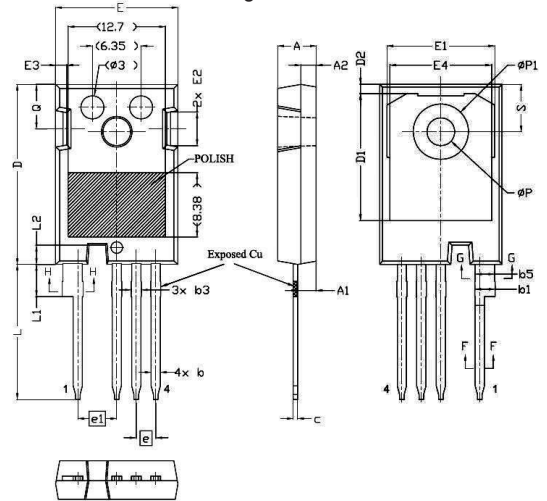
- EV motor drives
- EV/HEV charging station
- Energy storage and Battery charging
- High voltage DC-DC converters
- Solar / Wind Inverters
- UPS and PFC



V_{DS}	2000V
$I_D(@25^{\circ}\text{C})$	88A
$R_{DS(ON)}$ typ.	28m Ω



Package Dimensions



Absolute Maximum Ratings

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

Parameter	Symbol	Ratings	Unit
Drain-Source Voltage $V_{GS}=0\text{V}$ $I_D=100\mu\text{A}$	V_{DS}	2000	V
Gate-Source Voltage (dynamic) AC ($f>1\text{Hz}$, duty cycle<1%, pulse width<200ns)	V_{GS}	-10/+25	V
Gate-Source Voltage (static)	$V_{GS(op)}$	-5/+18	V
Drain Current-Continuous $V_{GS}=18\text{V}@T_c=25^{\circ}\text{C}$ $V_{GS}=18\text{V}@T_c=100^{\circ}\text{C}$	I_D	88 60	A
Pulse Drain Current	$I_{D,pulse}$	260	A
Power Dissipation	P_D	535	W
Storage Temperature Range	T_{STG}	-55 to +175	$^{\circ}\text{C}$
Operating Junction Temperature Range	T_J	-55 to +175	$^{\circ}\text{C}$
Soldering Temperature	T_L	260	$^{\circ}\text{C}$
Avalanche Capability, single pulse * $V_{DD}=100\text{V}$ $V_{GS}=10\text{V}$ $L=2\text{mH}$	I_{AV}	50	A
Avalanche Capability, single pulse** $V_{DD}=100\text{V}$ $V_{GS}=10\text{V}$ $L=2\text{mH}$	E_{AV}	2500	mJ

* 100% tested in 60% rating

** 100% tested in 36% rating

SYMBOL	DIMENSIONS			SYMBOL	DIMENSIONS		
	MIN.	NOM.	MAX.		MIN.	NOM.	MAX.
A	4.83	5.02	5.21	E	15.75	15.94	16.13
A1	2.29	2.41	2.54	E1	13.10	14.02	14.15
A2	1.91	2.00	2.16	E2	3.68	4.40	5.10
b'	1.07	1.20	1.28	E3	1.00	1.45	1.90
b	1.07	1.20	1.33	E4	12.38	13.26	13.43
b1	2.39	2.67	2.94	e	2.54 BSC		
b2	2.39	2.67	2.84	e1	5.08 BSC		
b3	1.07	1.30	1.60	L	17.31	17.57	17.82
b4	1.07	1.30	1.50	L1	3.97	4.19	4.37
b5	2.39	2.53	2.69	L2	2.35	2.50	2.65
b6	2.39	2.53	2.64	ØP	3.51	3.61	3.65
c	0.55	0.60	0.68	ØP1	7.19 REF.		
c1	0.55	0.60	0.65	Q	5.49	5.79	6.00
D	23.30	23.45	23.60	S	6.04	6.17	6.30
D1	16.25	16.55	17.65				
D2	0.95	1.19	1.25				

Electrical Characteristics @ $T_c = 25^\circ\text{C}$ (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		2000	-	-	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =2000V V _{GS} =0V	T _J =25℃	-	0.5	100	μA
			T _J =175℃	-	5	-	
Gate-Source Leakage Current	I _{GSS}	V _{GS} =18V , V _{DS} =0V		-	5	100	nA
		V _{GS} =-5V , V _{DS} =0V		-100	-5	-	
ON Characteristics							
Gate Threshold Voltage ***	V _{GS(th)}	V _{DS} = V _{GS} , I _D =15mA	T _J =25℃	2.4	3.1	4.2	V
			T _J =175℃	-	2.3	-	
Drain-Source On-State Resistance	R _{DS(on)}	V _{GS} =18V , I _D =40A	T _J =25℃	-	28	38	mΩ
			T _J =175℃	-	70	-	
Transconductance	g _{fs}	V _{DS} =20V , I _D =40A	T _J =25℃	-	36	-	S
			T _J =175℃	-	33	-	
Internal Gate Resistance	R _{G(int.)}	f=1MHz , I _D =0A		-	1.1	-	Ω
Dynamic Characteristics							
Input Capacitance	C _{iss}	V _{DS} =1200V V _{GS} =0V f=100kHz V _{AC} =25mV		-	4400	-	pF
Output Capacitance	C _{oss}			-	100	-	
Reverse Transfer Capacitance	C _{rss}			-	10	-	
Coss Stored Energy	E _{oss}			-	100	-	
Turn-On Switching Energy	E _{on}	V _{DS} =1200V , V _{GS} =-5/+18V I _D =40A , R _{G(ext)} =2.0Ω L=200μH		-	900	-	μJ
Turn-Off Switching Energy	E _{off}			-	160	-	
Switching Characteristics							
Turn-On Delay Time	t _{d(on)}	V _{DS} =1200V , V _{GS} =-4/+18V I _D =40A , R _{G(ext)} =2.0Ω L=200μH		-	20	-	ns
Rise Time	t _r			-	22	-	
Turn-Off Delay Time	t _{d(off)}			-	45	-	
Fall Time	t _f			-	15	-	
Total Gate Charge	Q _g	V _{DS} =1200V V _{GS} =-5/+18V I _D =40A		-	230	-	nC
Gate to Source Charge	Q _{gs}			-	70	-	
Gate to Drain Charge	Q _{gd}			-	86	-	
Body Diode Characteristics							
Inverse Diode Forward Voltage	V _{SD}	V _{GS} =-5V , 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} =-5V , T _J =25℃		-	90	-	A
Reverse Recovery Time	T _{rr}	I _{SD} =40A , V _{GS} =-5V V _R =1200V , T _J =25℃ dif/dt=2647/μs		-	26	-	ns
Reverse Recovery Charge	Q _{rr}			-	520	-	nC
Peak Reverse Recovery Current	I _{rrm}			-	40	-	A
Thermal Resistance							
Thermal Resistance, Junction-to-Case	Rθ _{Jc}			-	0.25	0.22	℃/W

*** Turn-off with -3V to -5V gate bias is highly recommended

Typical Performance

Fig 1. Output Characteristics, $T_J = 25^\circ\text{C}$

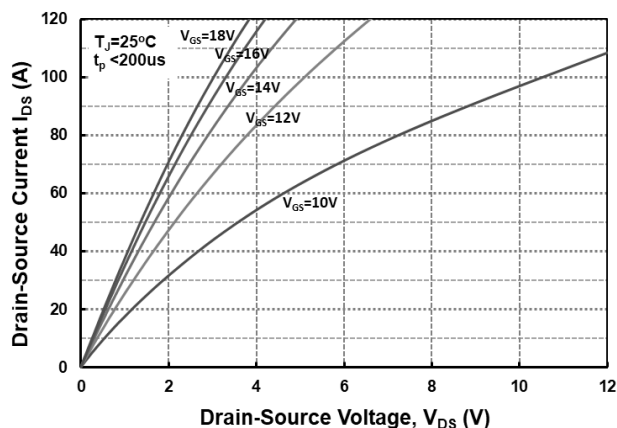


Fig 2. Output Characteristics, $T_J = 175^\circ\text{C}$

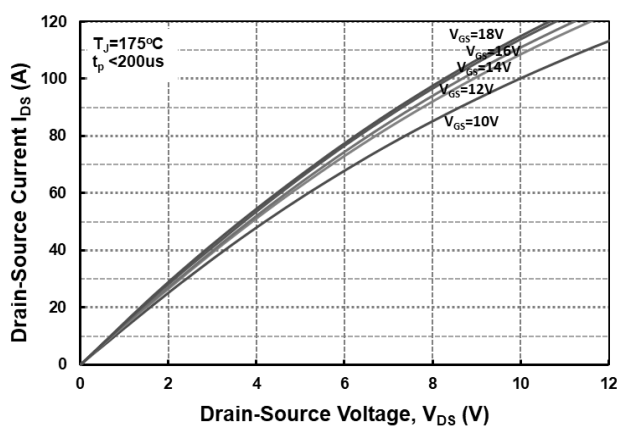


Fig 3. Output Characteristics vs temp, $V_{GS}=18\text{V}$

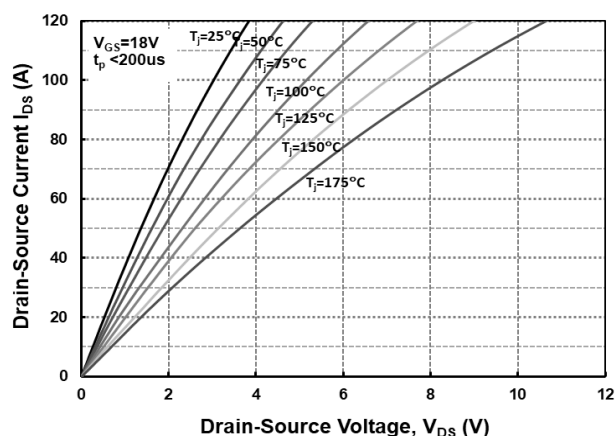


Fig 4. Normalized On-Resistance vs. Temperature

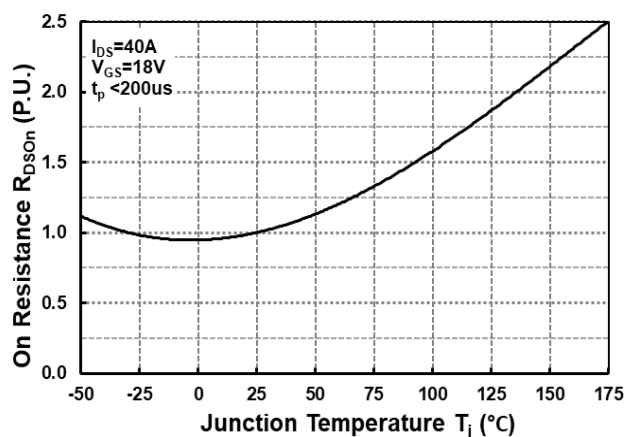


Fig 5. On-Resistance vs. Drain Current for Various Temperatures

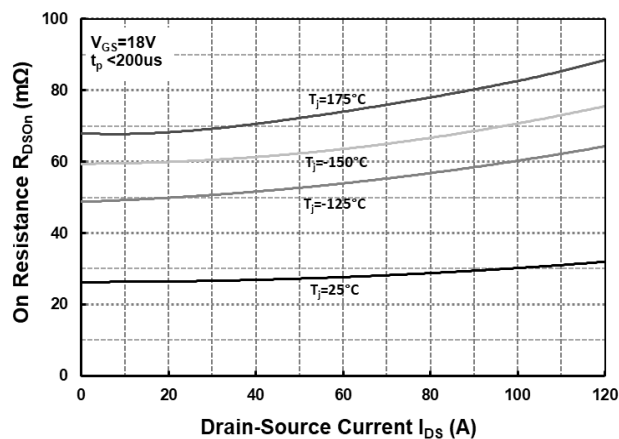
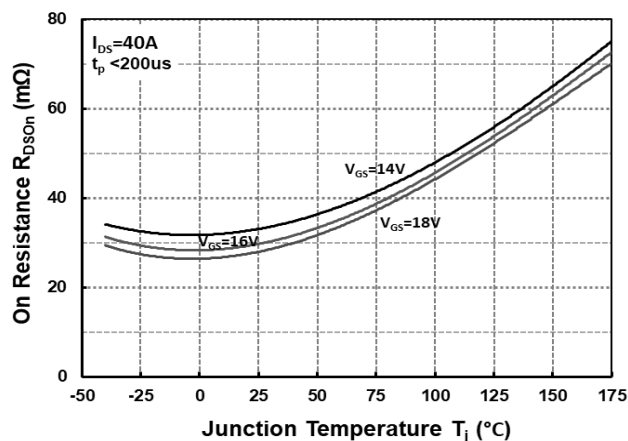


Fig 6. On-Resistance vs. Temperature for Various Gate Voltage



Typical Performance

Fig 7. Transfer Characteristic for Various Junction Temperatures

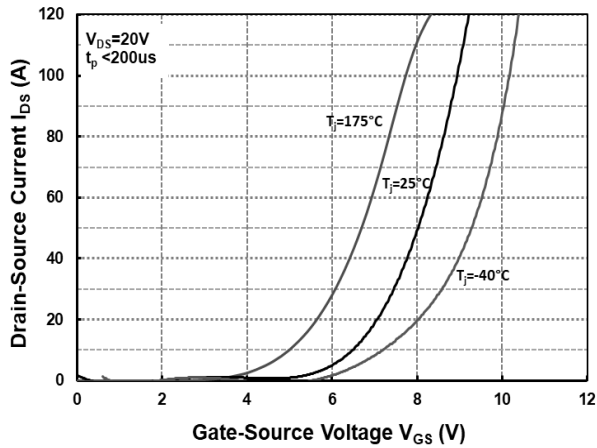


Fig 8. Body Diode Characteristics @ 25°C

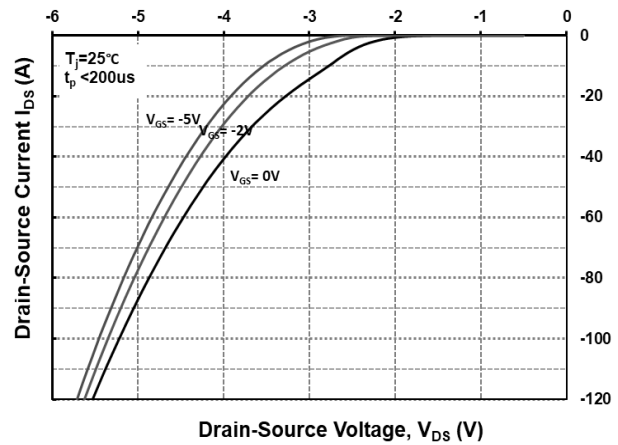


Fig 9. Body Diode Characteristics @ 150°C

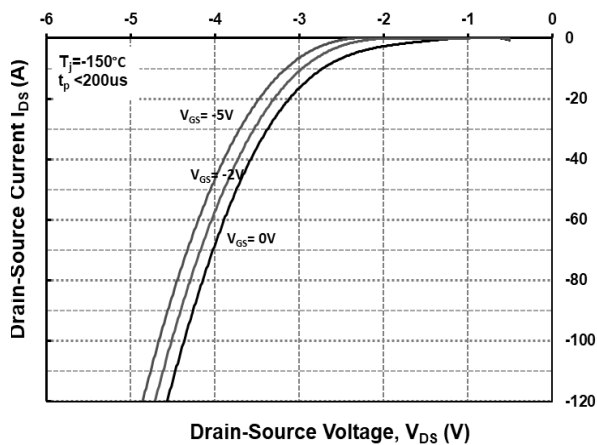


Fig 10. Body Diode Characteristics @ 175°C

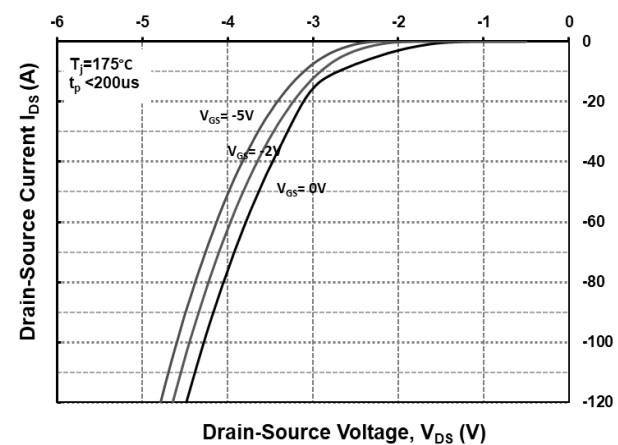


Fig 11. Threshold Voltage vs. Temperature

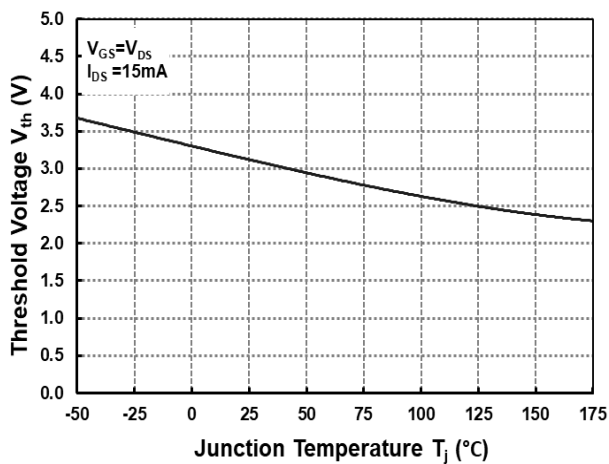
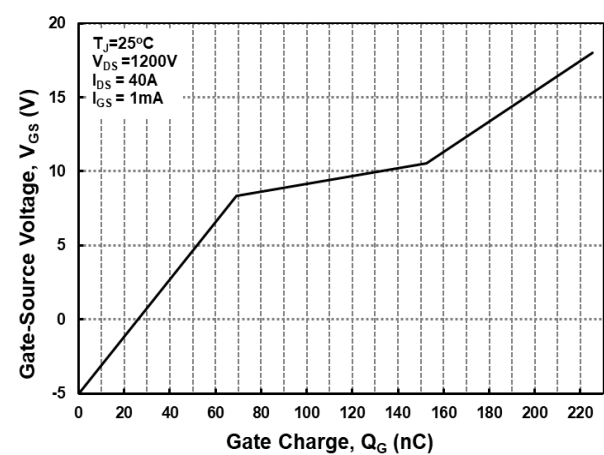


Fig 12. Gate Charge Characteristics



Typical Performance

Fig 13. 3rd Quadrant Characteristics @ 25°C

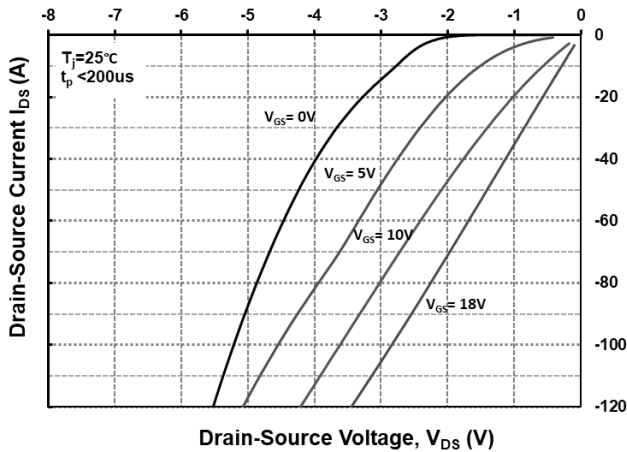


Fig 14. 3rd Quadrant Characteristics @ 150°C

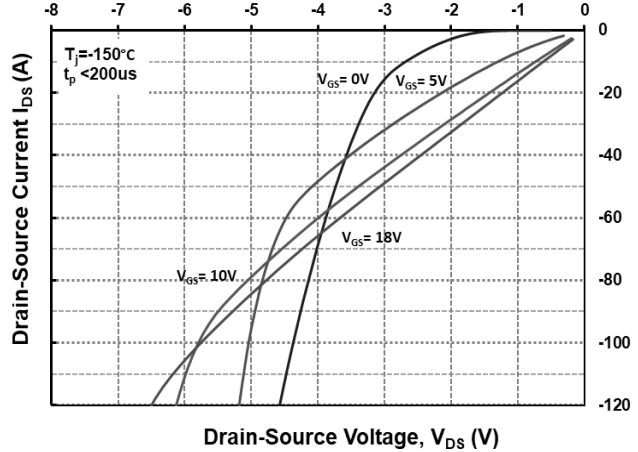


Fig 15. 3rd Quadrant Characteristics @ 175°C

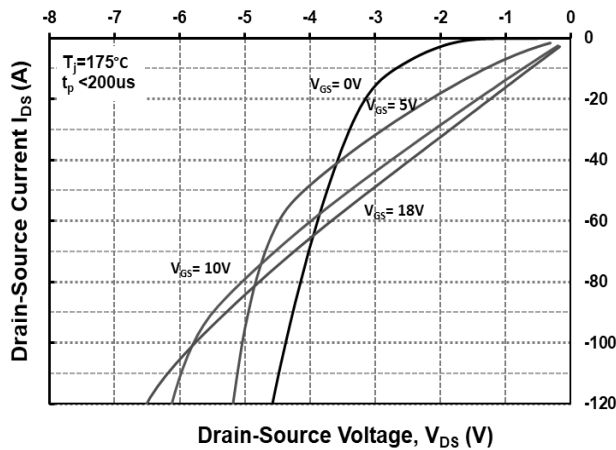


Fig 16. Output Capacitor Stored Energy

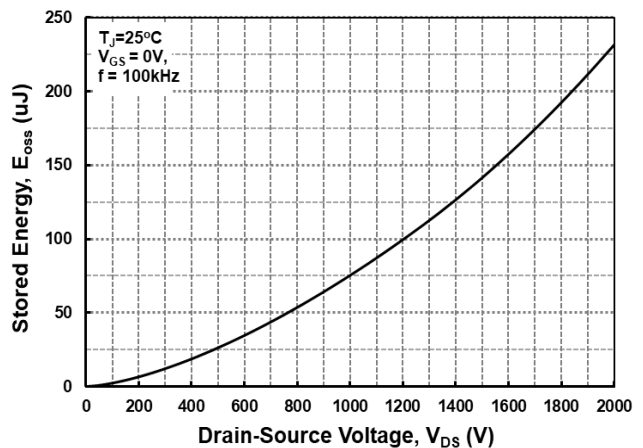


Fig 17. Capacitances vs. Drain-Source Voltage (0-200V)

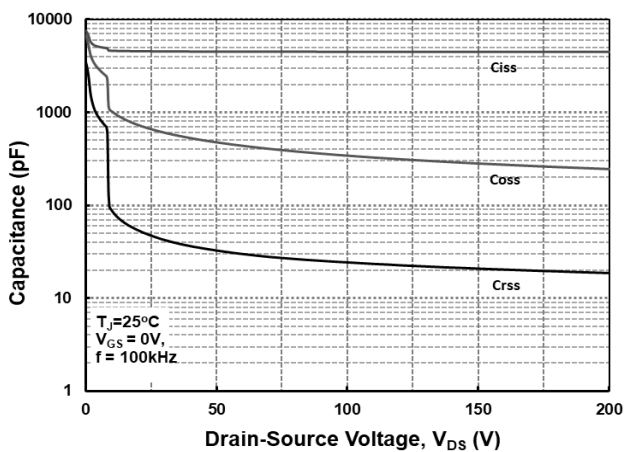
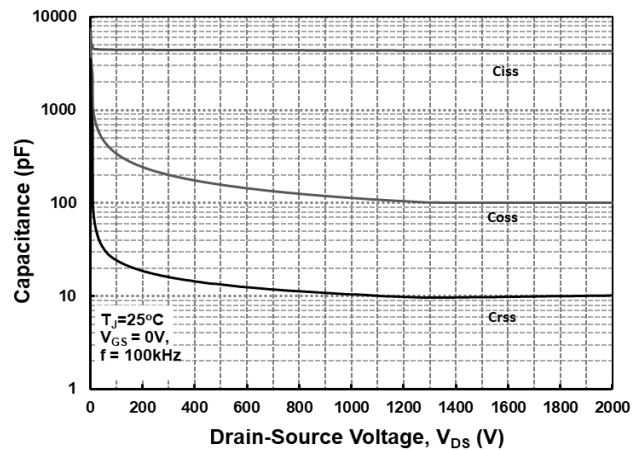


Fig 18. Capacitances vs. Drain-Source Voltage (0-2000V)



Typical Performance

Fig 19. Continuous Drain Current Derating vs. Case Temperature

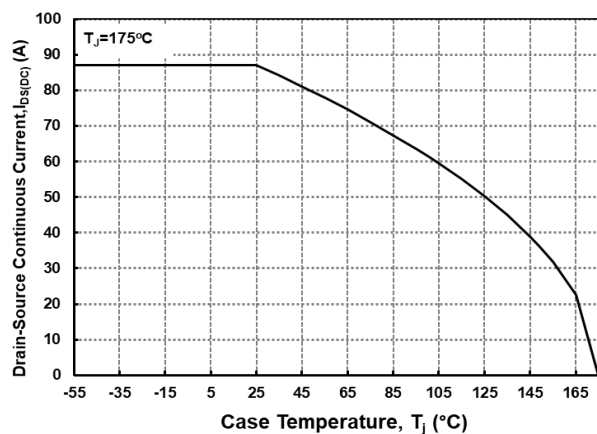


Fig 20. Maximum Power Dissipation Derating vs. Case Temperature

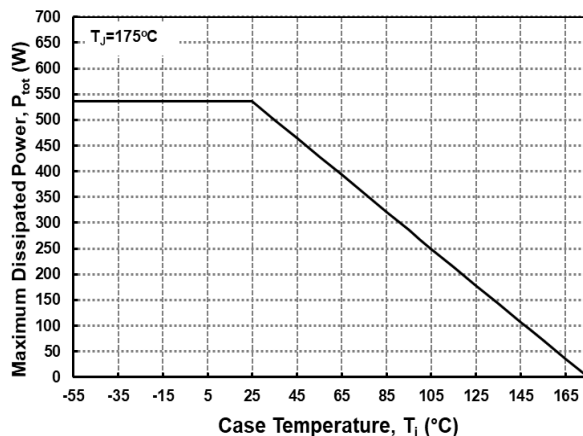


Fig 21. Transient Thermal Impedance (Junction-Case)

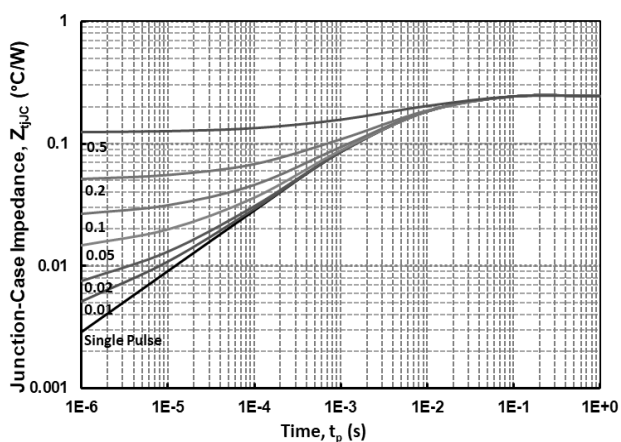


Fig 22. Safe Operating Area

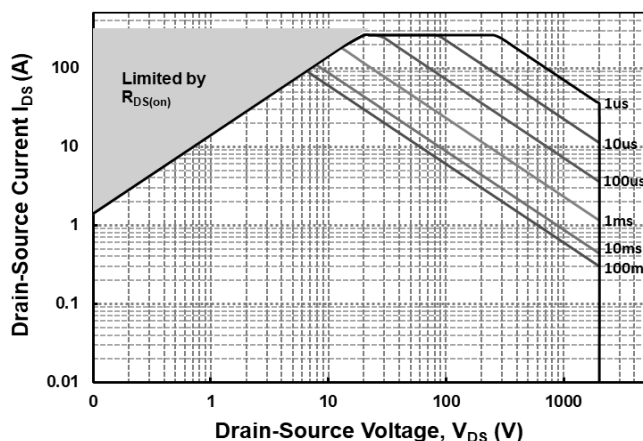


Fig 23. Clamped Inductive Switching Energy vs Drain Current ($V_{DD} = 1200V$)

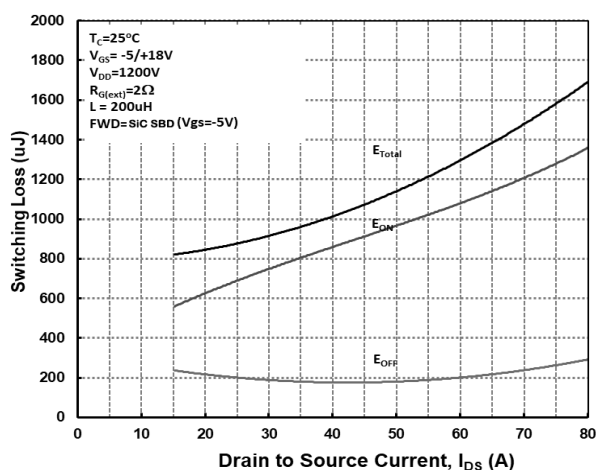
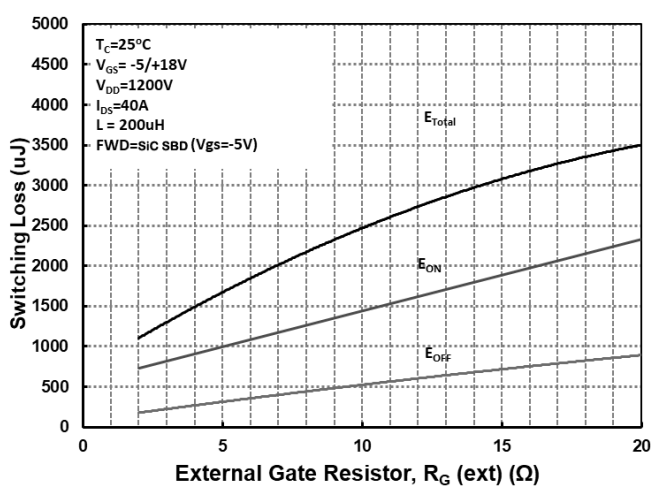


Fig 24. Clamped Inductive Switching Energy vs External Gate Resistor $R_{G(ext)}$



Typical Performance

Fig 25. Switching Times vs Drain Current
($V_{DD} = 1200V$)

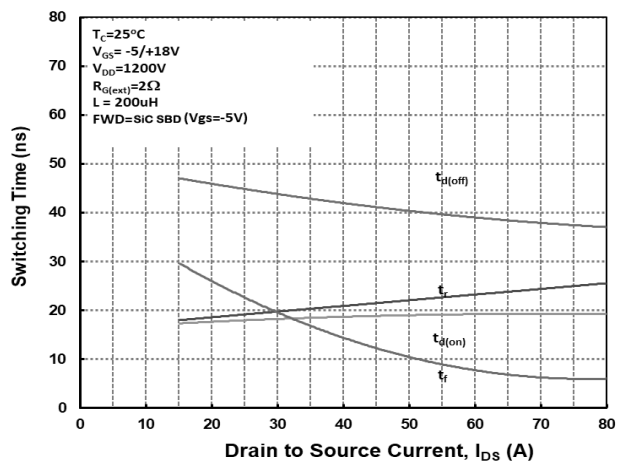
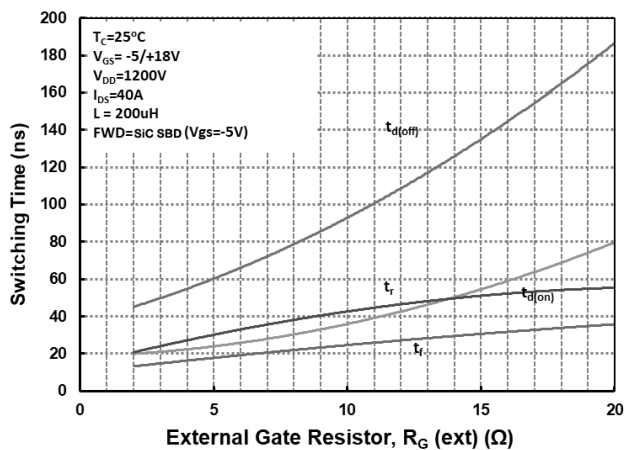


Fig 26. Switching Times vs External Gate Resistor $R_{G(ext)}$



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