

Silicon Carbide Enhancement Mode MOSFET

Features

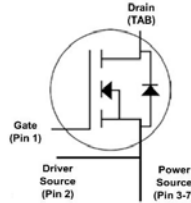
- High blocking voltage with low $R_{DS(on)}$
- High frequency operation with low Capacitance
- Simple to drive with -5V/+20V gate
- Robust body diode with low Q_{rr}
- 100% Avalanche Tested

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

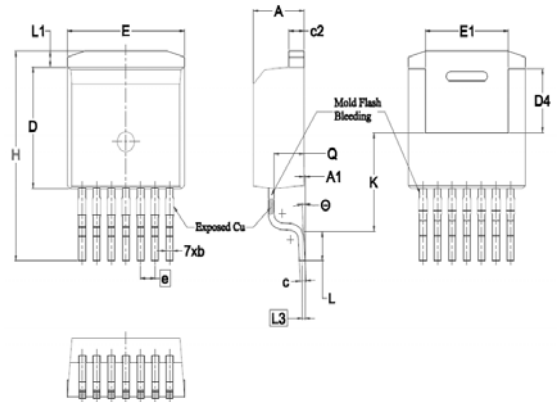
- EV motor drives
- EV/HEV charging station
- Energy storage and Battery charging
- High voltage DC-DC converters
- Solar / Wind Inverters
- UPS and PFC



V_{DSS}	1700V
$I_D(@25^{\circ}C)$	7.3A
$R_{DS(ON)}$ typ.	500m Ω



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}	1700	V
Gate-Source Voltage (dynamic) AC ($f > 1$ Hz, duty cycle $< 1\%$, pulse width $< 200ns$)	V_{GS}	-10/+25	V
Gate-Source Voltage (static)	$V_{GS(op)}$	-5/+20	V
Drain Current-Continuous $V_{GS}=20V @ T_c=25^{\circ}C$ $V_{GS}=20V @ T_c=100^{\circ}C$	I_D	7.3 5	A
Pulse Drain Current	$I_{D,pulse}$	14	A
Power Dissipation	P_D	83	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 * $V_{DD}=100V$ $V_{GS}=20V$ $L=2mH$	I_{AV}	12	A
Avalanche Capability, single pulse** $V_{DD}=100V$ $V_{GS}=20V$ $L=2mH$	E_{AV}	120	mJ

* 100% tested in 63% rating

** 100% tested in 40% rating

SYMBOL	DIMENSIONS		
	MIN.	NOM.	MAX.
A	4.30	4.40	4.50
A1	0.00	0.10	0.20
b	0.50	0.60	0.70
c	0.45	0.50	0.60
c2	1.20	1.30	1.40
D	8.93	9.08	9.23
D4	4.65	4.80	4.95
E	10.08	10.18	10.28
E1	6.82	7.22	7.62
e	1.27 BSC		
H	15.00	15.70	16.00
K	7.30		
L	1.90	2.20	2.50
L1	1.00	1.20	1.40
L3	0.25 BSC		
Q	2.45	2.60	2.75
theta	0°	3°	7°

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		1700	-	-	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =1700V V _{GS} =0V	T _J =25°C	-	0.5	60	μA
			T _J =175°C	-	5	-	
Gate-Source Leakage Current	I _{GSS}	V _{GS} =20V , 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 =1mA	T _J =25°C	2.0	2.9	4.0	V
			T _J =175°C	-	2.0	-	
Drain-Source On-State Resistance	R _{DS(on)}	V _{GS} =20V , I _D =2A	T _J =25°C	-	500	700	mΩ
			T _J =175°C	-	1120	-	
Transconductance	g _{fs}	V _{DS} =20V , I _D =3A	T _J =25°C	-	1.3	-	S
			T _J =175°C	-	1.3	-	
Internal Gate Resistance	R _{G(int.)}	f =1MHz , I _D =0A		-	5.8	-	Ω
Dynamic Characteristics							
Input Capacitance	C _{iss}	V _{DS} =1000V V _{GS} =0V f =1MHz V _{AC} =25mV		-	215	-	pF
Output Capacitance	C _{oss}			-	12	-	
Reverse Transfer Capacitance	C _{rss}			-	1.7	-	
Coss Stored Energy	E _{oss}			-	9.6	-	μJ
Turn-On Switching Energy	E _{on}	V _{DS} =1200V , V _{GS} =-5/+20V I _D =3A , R _{G(ext)} =2.0Ω L=500μH		-	96	-	μJ
Turn-Off Switching Energy	E _{off}			-	40	-	
Switching Characteristics							
Turn-On Delay Time	t _{d(on)}	V _{DS} =1200V , V _{GS} =-5/+20V I _D =3A , R _{G(ext)} =2.0Ω L=500μH		-	5	-	ns
Rise Time	t _r			-	15	-	
Turn-Off Delay Time	t _{d(off)}			-	23	-	
Fall Time	t _f			-	63	-	
Total Gate Charge	Q _g	V _{DS} =1200V V _{GS} =-5/+20V I _D =3A		-	20	-	nC
Gate to Source Charge	Q _{gs}			-	3	-	
Gate to Drain Charge	Q _{gd}			-	11	-	
Body Diode Characteristics							
Inverse Diode Forward Voltage	V _{SD}	V _{GS} =-5V , I _{SD} =1A	T _J =25°C	-	3.9	-	V
Inverse Diode Forward Voltage			T _J =175°C	-	3.5	-	V
Continuous Diode Forward Current	I _S	V _{GS} =-5V , T _J =25°C		-	-	8	A
Reverse Recovery Time	T _{rr}	I _{SD} =3A , V _{GS} =-5V V _R =1200V dif/dt=1200A/μs		-	5	-	ns
Reverse Recovery Charge	Q _{rr}			-	28	-	nC
Peak Reverse Recovery Current	I _{rrm}			-	10	-	A
Thermal Resistance							
Thermal Resistance, Junction-to-Case	Rθ _{Jc}			-	1.4	1.8	°C/W

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

Typical Performance

Fig 1. Output Characteristics, $T_J = -55^\circ\text{C}$

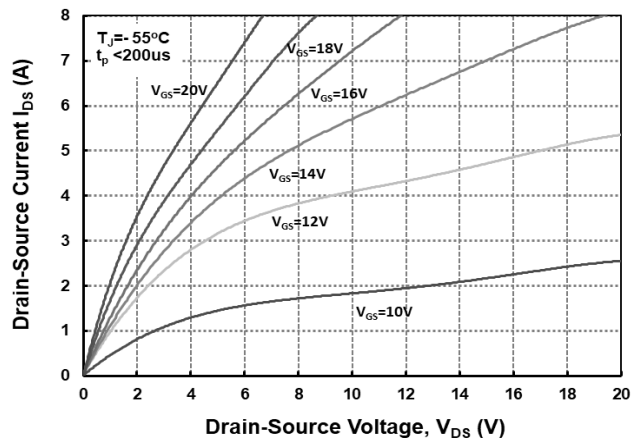


Fig 2. Output Characteristics, $T_J = 25^\circ\text{C}$

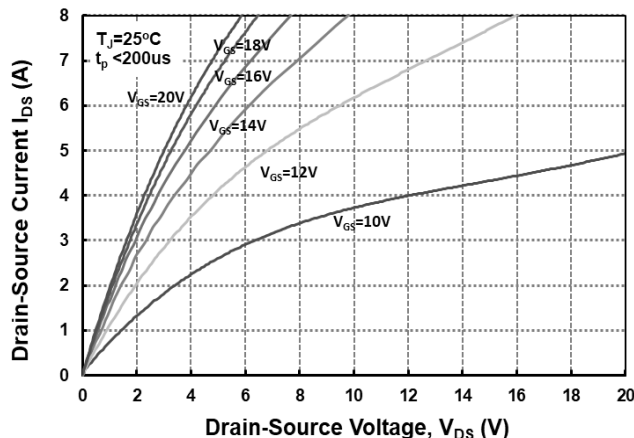


Fig 3. Output Characteristics, $T_J = 175^\circ\text{C}$

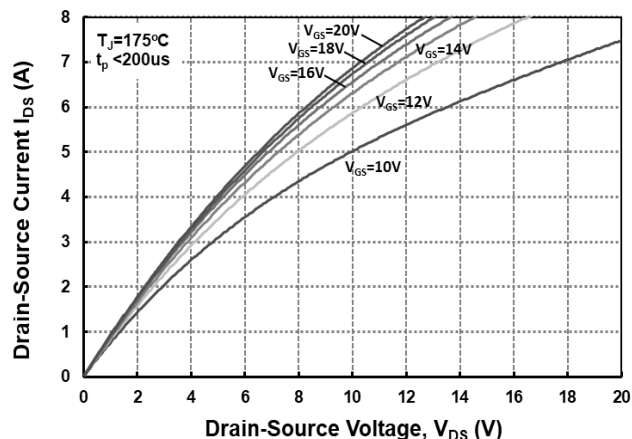


Fig 4. Normalized On-Resistance vs. Temperature

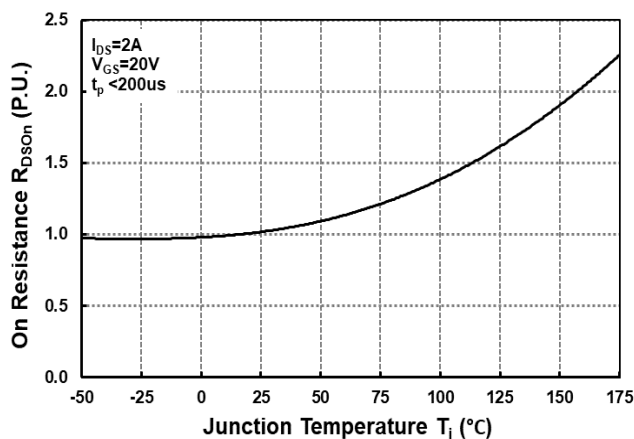


Fig 5. On-Resistance vs. Drain Current for Various Temperatures

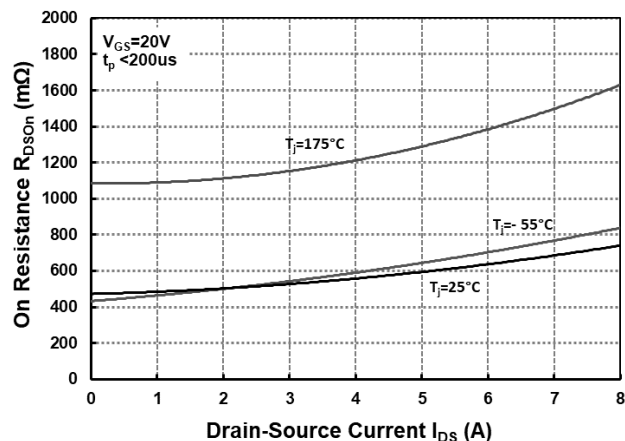
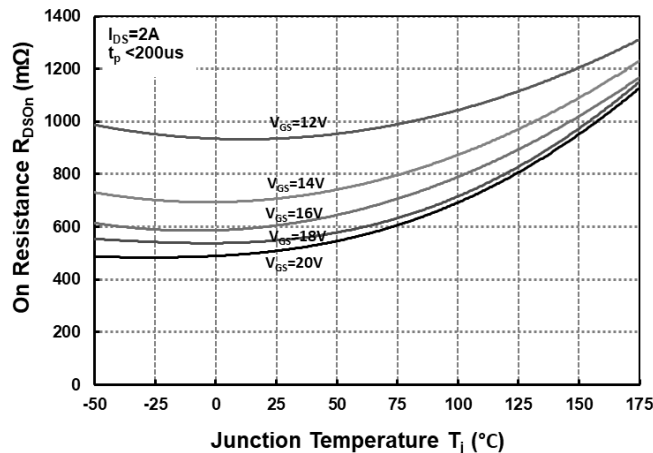


Fig 6. On-Resistance vs. Temperature for Various Gate Voltage



Typical Performance

Fig 7. Transfer Characteristic for Various Junction Temperatures

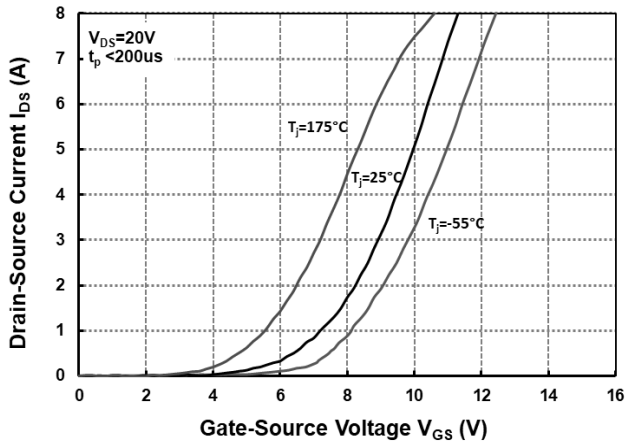


Fig 8. Body Diode Characteristics @ -55°C

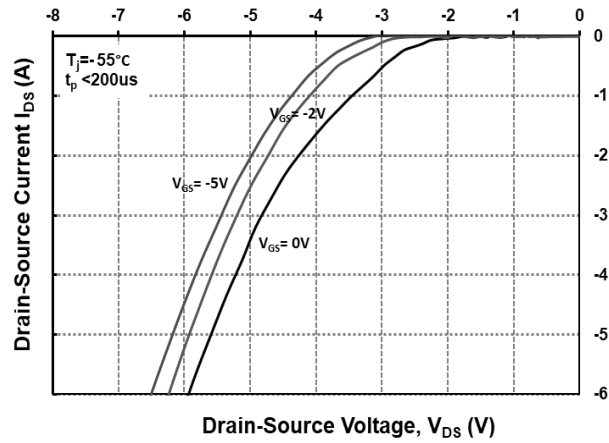


Fig 9. Body Diode Characteristics @ 25°C

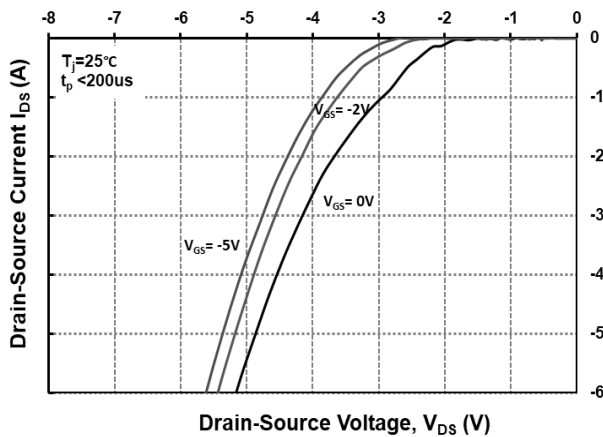


Fig 10. Body Diode Characteristics @ 175°C

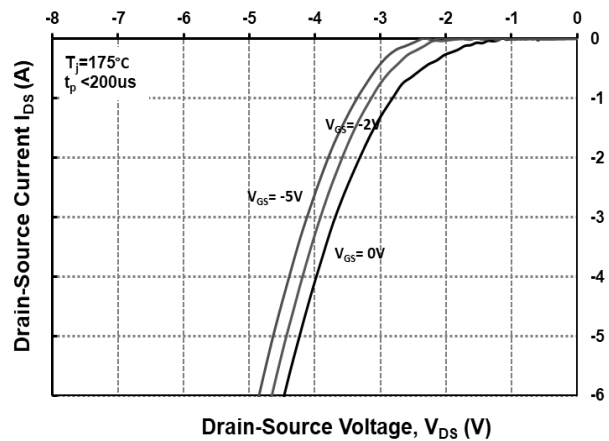


Fig 11. Threshold Voltage vs. Temperature

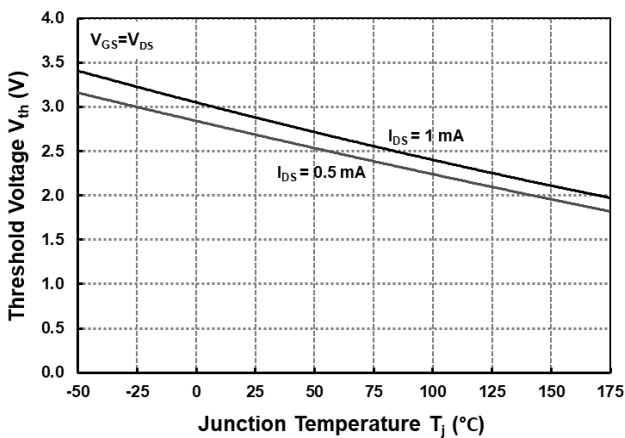
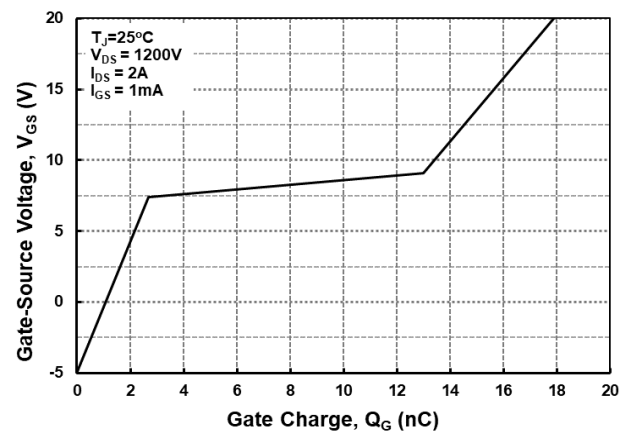


Fig 12. Gate Charge Characteristics



Typical Performance

Fig 13. 3rd Quadrant Characteristics @ -55°C

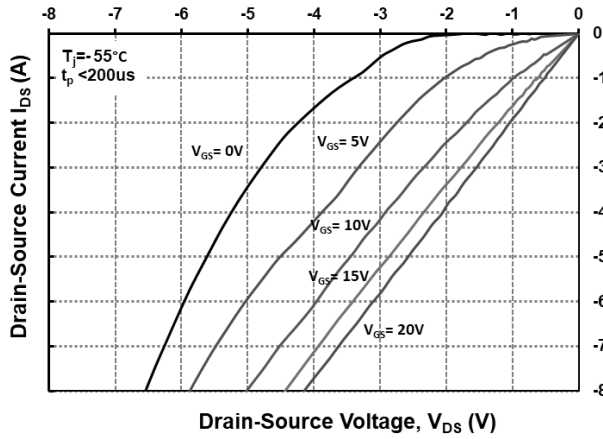


Fig 14. 3rd Quadrant Characteristics @ 25°C

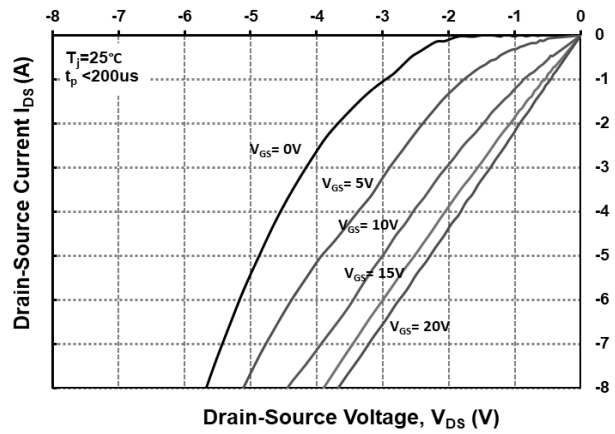


Fig 15. 3rd Quadrant Characteristics @ 175°C

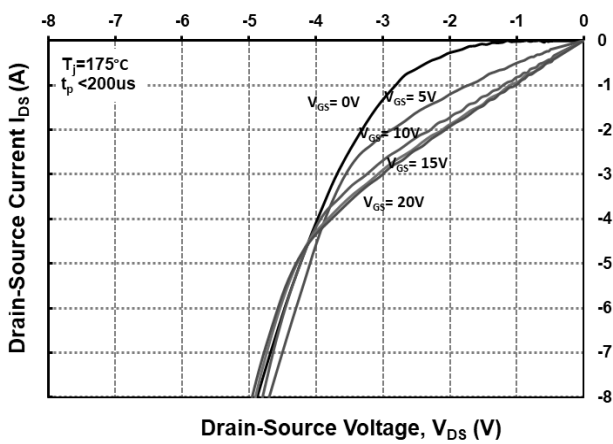


Fig 16. Output Capacitor Stored Energy

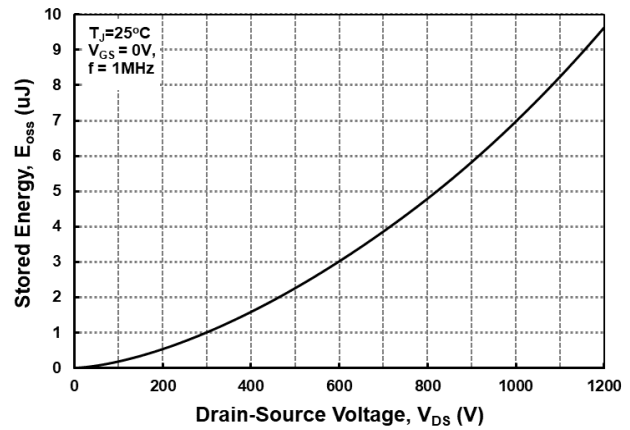


Fig 17. Capacitances vs. Drain-Source Voltage (0-200V)

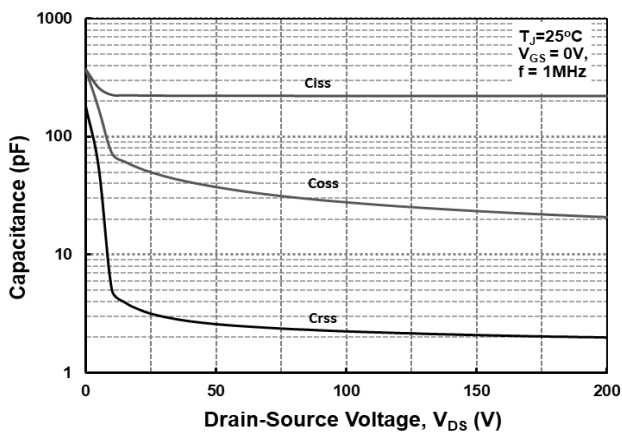
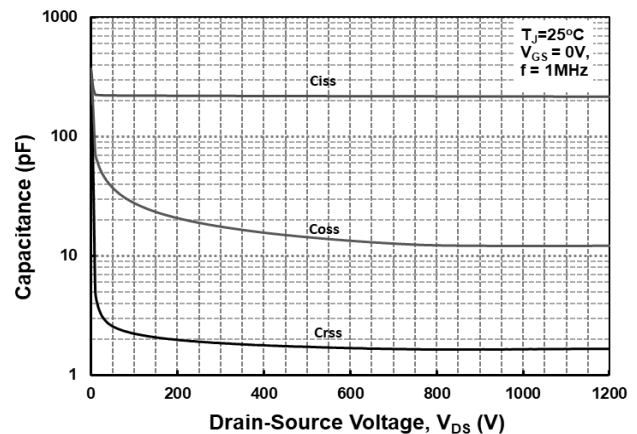


Fig 18. Capacitances vs. Drain-Source Voltage (0-1200V)



Typical Performance

Fig 19. Continuous Drain Current Derating vs. Case Temperature

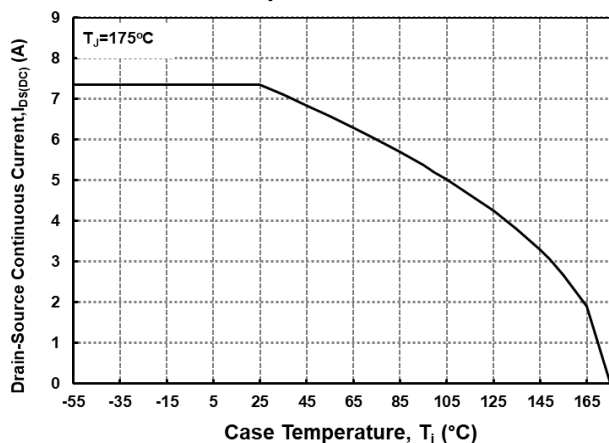


Fig 20. Maximum Power Dissipation Derating vs. Case Temperature

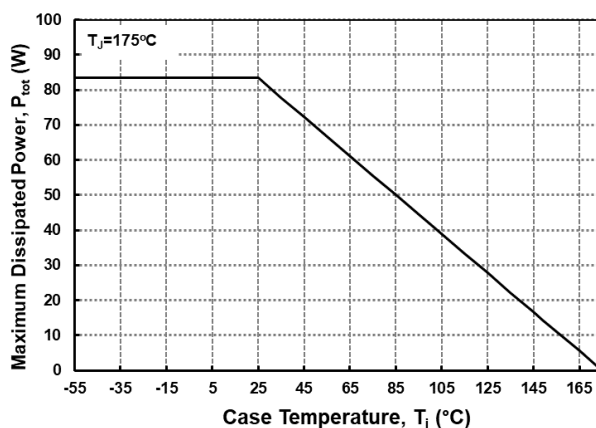


Fig 21. Transient Thermal Impedance (Junction-Case)

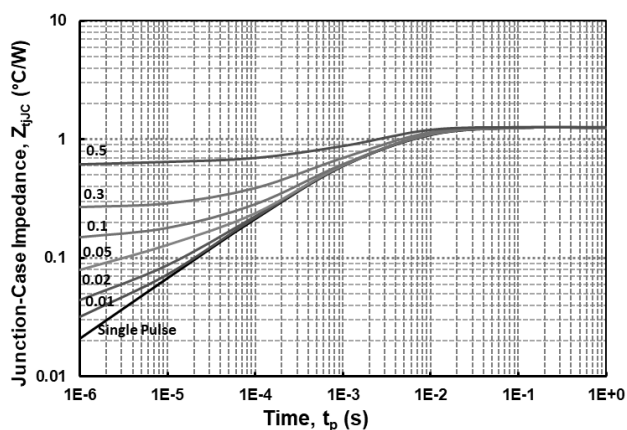


Fig 22. Safe Operating Area

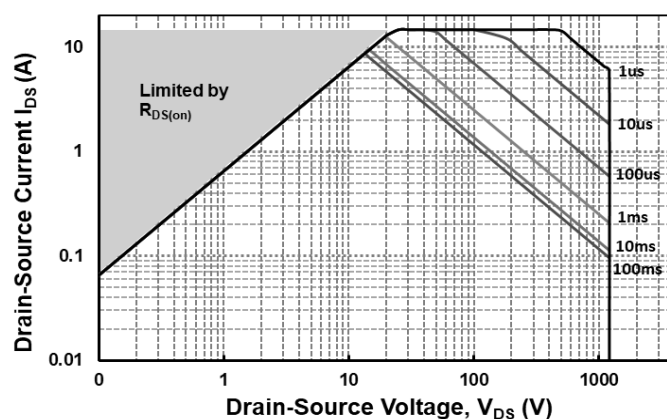


Fig 23. Clamped Inductive Switching Energy vs Drain Current ($V_{DD} = 1200\text{V}$)

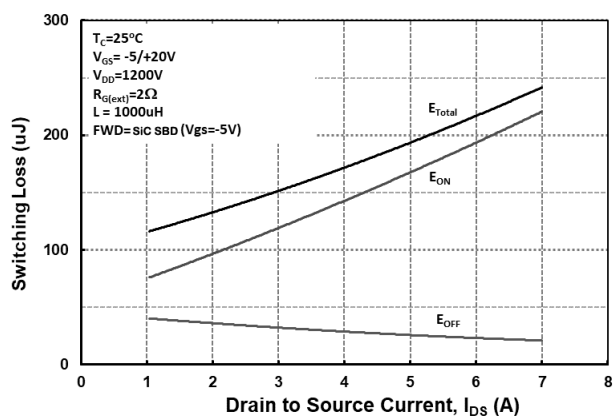
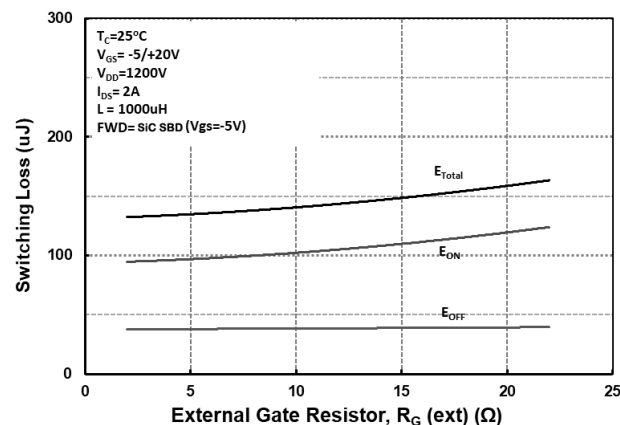


Fig 24. Clamped Inductive Switching Energy vs External Gate Resistor $R_{G(ext)}$



Typical Performance

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

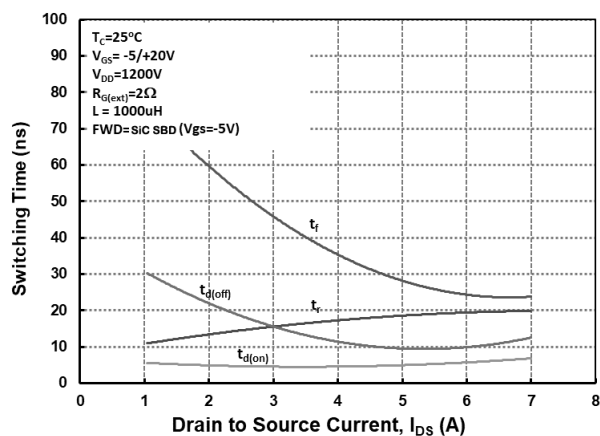
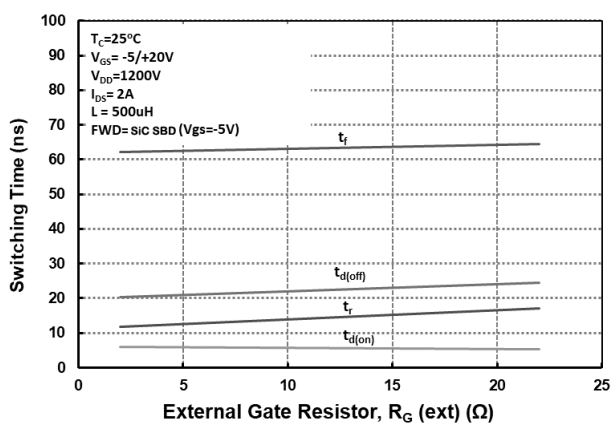


Fig 26. Switching Times vs External Gate Resistor $R_{G(ext)}$



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