

Silicon Carbide Enhancement Mode MOSFET

Features

- High blocking voltage with low Rds(on)
- High frequency operation with low Capacitance
- Simple to drive with -4V/+18V gate
- Robust body diode with low Qrr
- 100% Avalanche Tested

Benefits

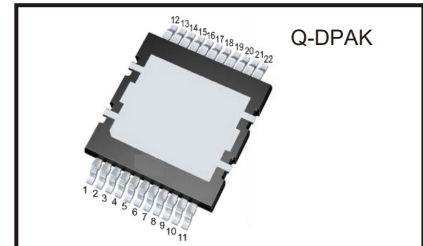
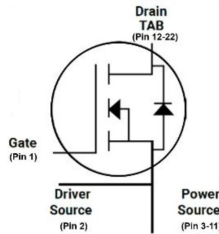
- Superior robustness and system reliability
- Higher system efficiency
- Easier paralleling without thermal runaway
- Capable of high temperature application
- Faster and more efficient switching

Applications

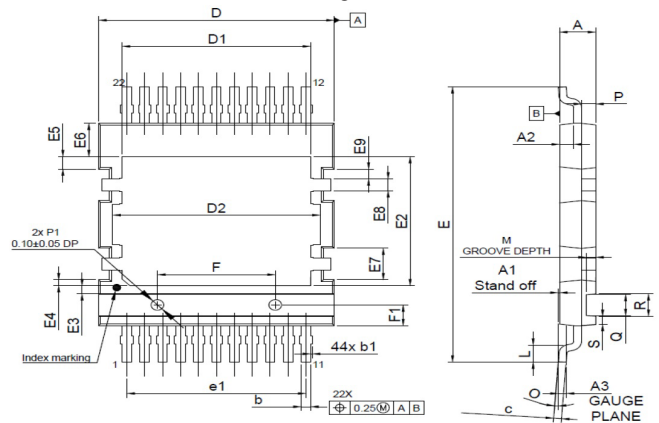
- EV/HEV charging station
- Energy storage and Battery charging
- High voltage DC-DC converters
- Solar / Wind Inverters
- UPS and PFC

Preliminary

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



Package Dimensions



Absolute Maximum Ratings

(T_c = 25°C unless otherwise specified)

Parameter	Symbol	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	°C
Operating Junction Temperature Range	T_J		-55 to +175	°C
Soldering Temperature	T_L		260	°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

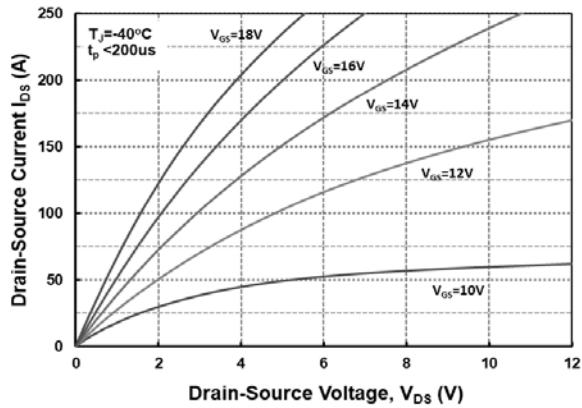
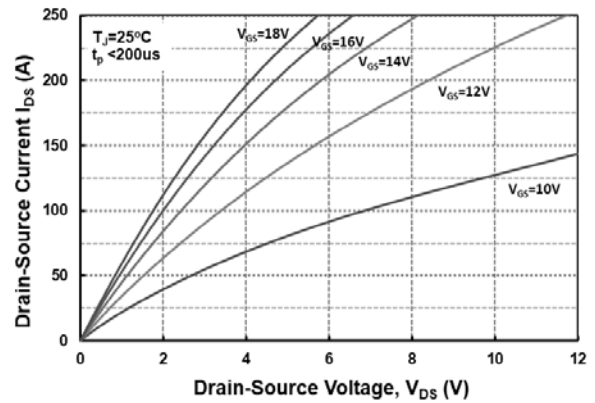
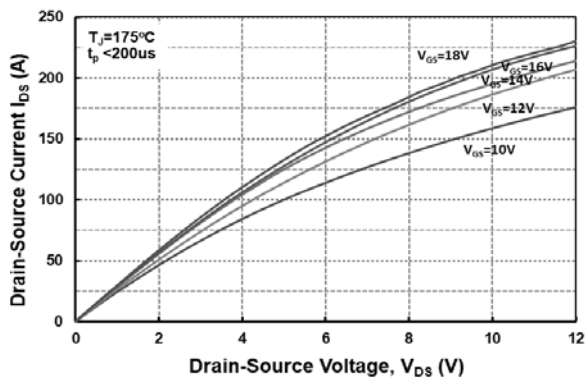
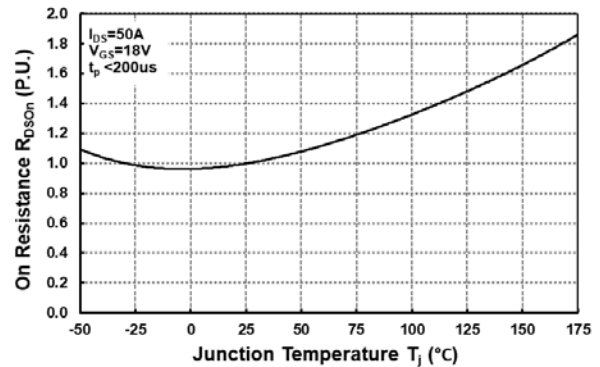
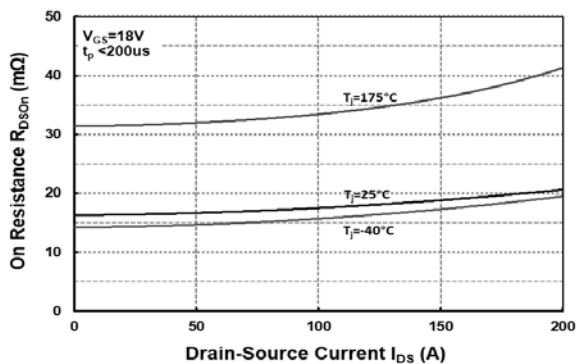
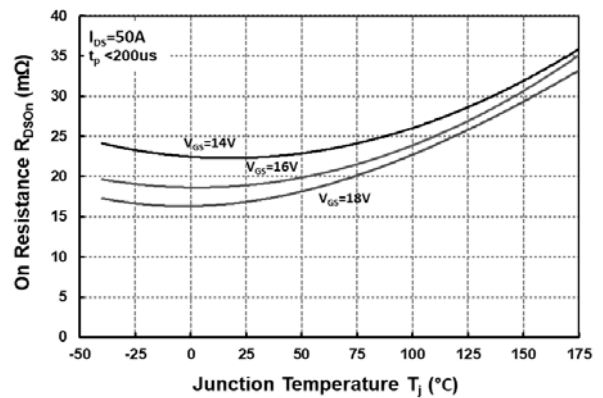
SYMBOL	MIN	MAX	SYMBOL	MIN	MAX
A	2.25	2.35	E9		0.75
A1	0.00	0.15	e		1.14
A2	0.90		e1		11.4
A3	0.50		F	7.40	7.60
b	0.50	0.70	F1	1.47	1.67
b1	-	0.15	F2	7.40	7.60
c	0.46	0.58	F3	3.65	3.85
D	14.90	15.10	F4	5.07	5.27
D1	12.00		F5	10.24	10.44
D2	13.20		L		1.30
D3	14.50	14.70	M		0.60
E	20.81	21.11	N		22
E1	15.30	15.50	O	0°	8°
E2	9.83		P		0.90
E3	0.625		P1	0.70	0.90
E4	0.45		P2	0.90	1.10
E5	0.95		Q		1.60
E6	2.53		R		1.70
E7	2.40		S		0.631
E8	0.90				

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	100	μA
			T _J =175°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 =20mA	T _J =25°C	2.2	3.0	4.2	V
			T _J =175°C	-	2.2	-	
Drain-Source On-State Resistance	R _{DS(on)}	V _{GS} =18V, I _D =50A	T _J =25°C	-	17	23	mΩ
			T _J =175°C	-	32	-	
Transconductance	g _{fs}	V _{DS} =20V, I _D =50A	T _J =25°C	-	40	-	S
			T _J =175°C	-	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 _{riss}		-	15	-		
Coss Stored Energy	E _{oss}		-	100	-		μJ
Turn-On Switching Energy	E _{on}	V _{DS} =800V, V _{GS} =-4/+18V I _D =50A, R _{G(ext)} =2.0Ω	-	410	-	μJ	
Turn-Off Switching Energy	E _{off}	L=200μH	-	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°C	-	3.5	-	V
Inverse Diode Forward Voltage			T _J =175°C	-	3.2	-	V
Continuous Diode Forward Current	I _S	V _{GS} =-4V, T _J =25°C	-	100	-	A	
Reverse Recovery Time	T _{rr}	I _{SD} =50A, V _{GS} =-4V	-	23	-	ns	
Reverse Recovery Charge	Q _{rr}	V _R =800V, R _{G(ext)} =10Ω dif/dt=2500A/μs	-	510	-	nC	
Peak Reverse Recovery Current	I _{rrm}	L=200μH	-	41	-	A	
Thermal Resistance							
Thermal Resistance, Junction-to-Case	Rθ _{JC}		-	0.26	0.31	°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

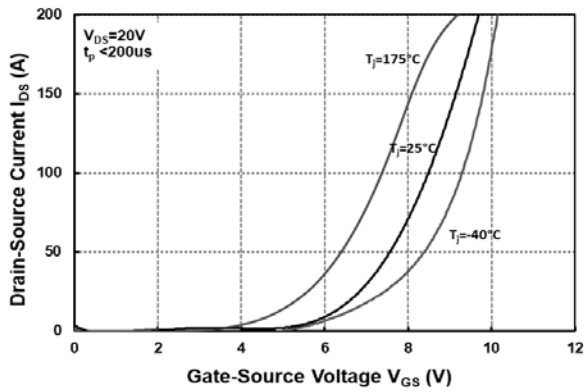


Fig 8. Body Diode Characteristics @ -40°C

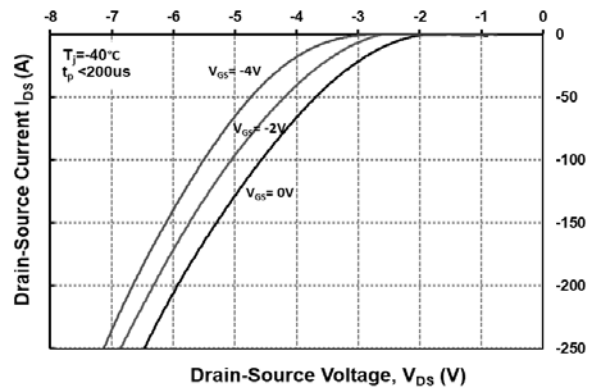


Fig 9. Body Diode Characteristics @ 25°C

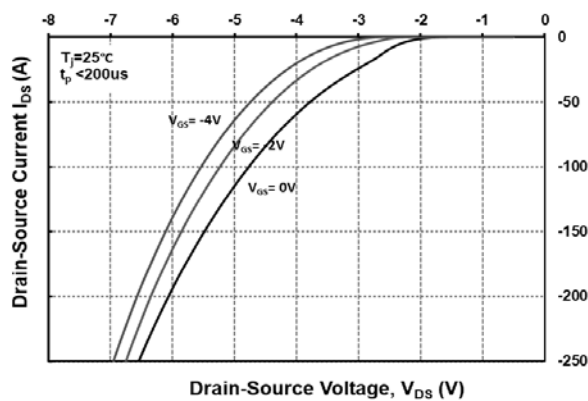


Fig 10. Body Diode Characteristics @ 175°C

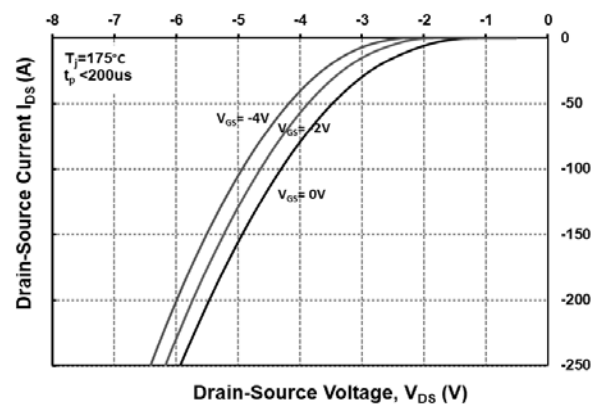


Fig 11. Threshold Voltage vs. Temperature

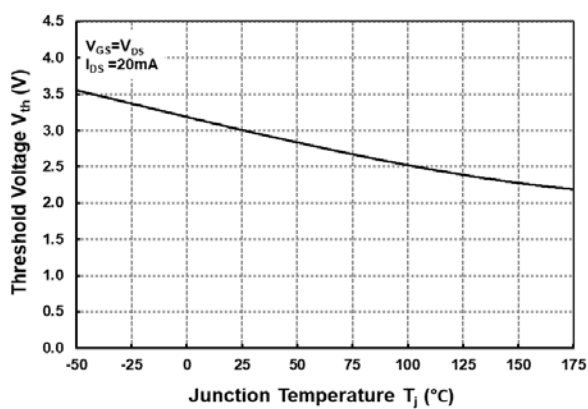
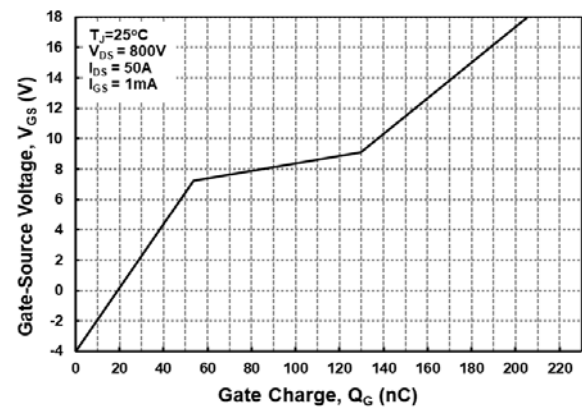
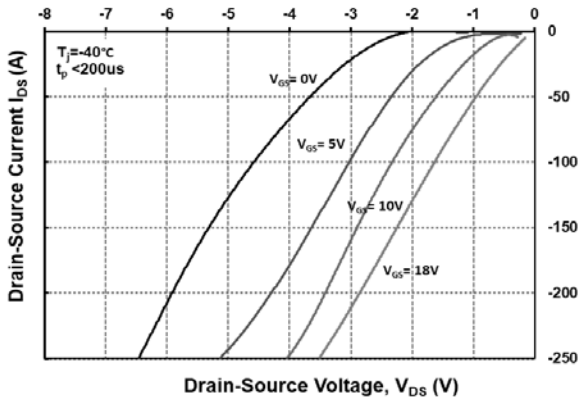
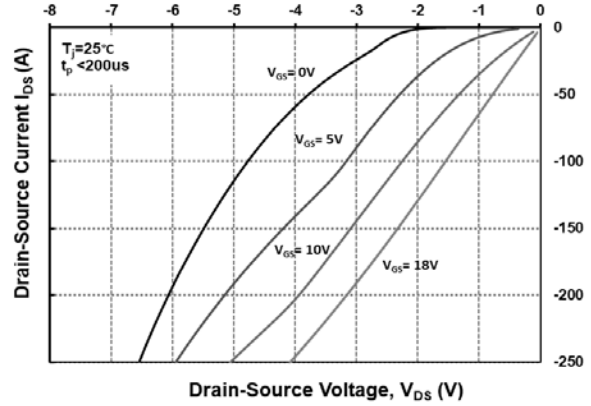
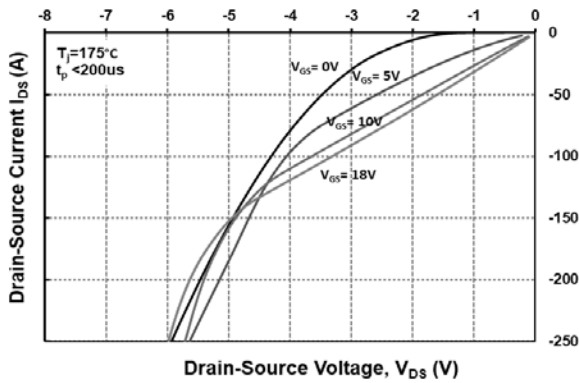
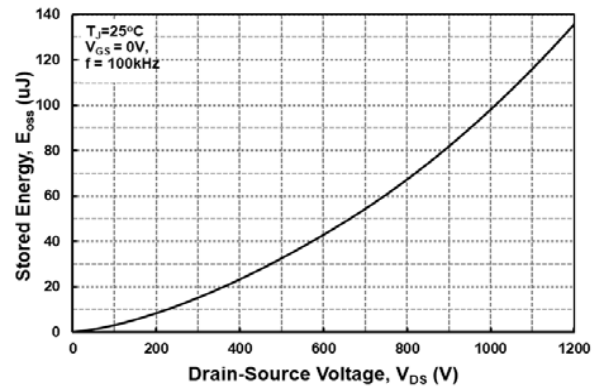
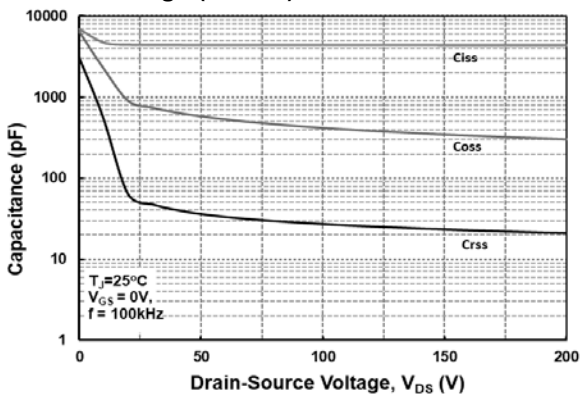
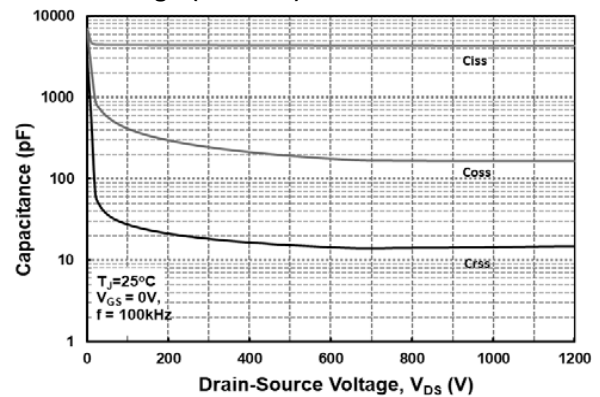


Fig 12. Gate Charge Characteristics



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 (0-1200V)


Typical Performance

Fig 19. Continuous Drain Current Derating vs. Case Temperature

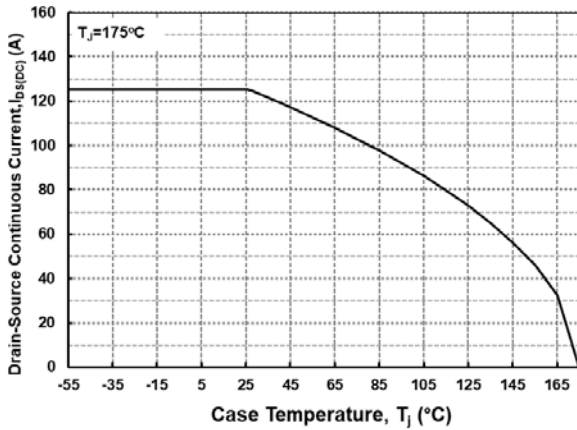


Fig 20. Maximum Power Dissipation Derating vs. Case Temperature

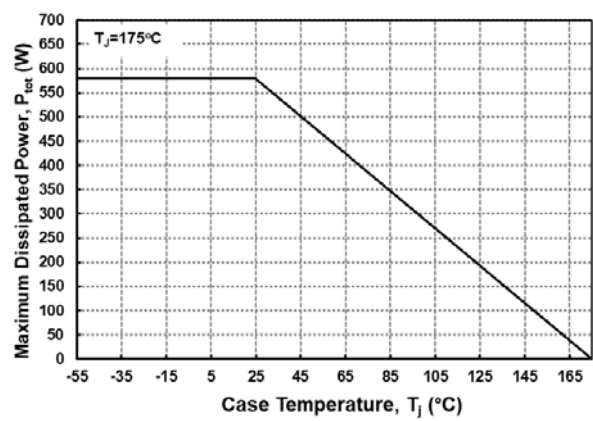


Fig 21. Transient Thermal Impedance (Junction – Case)

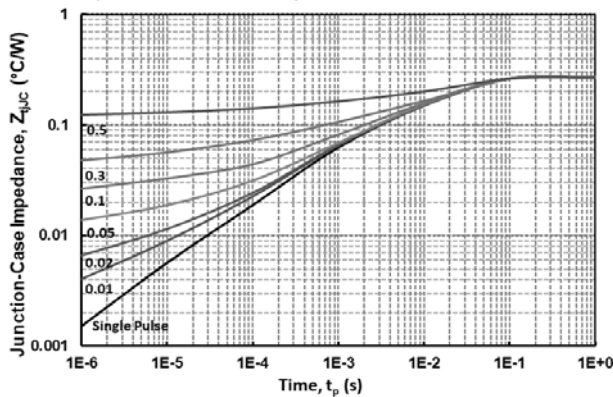


Fig 22. Safe Operating Area

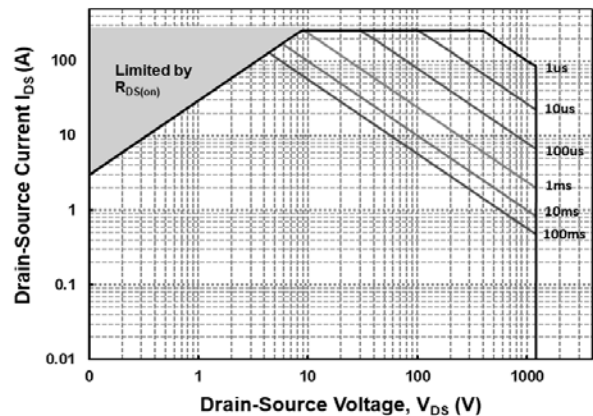


Fig 23. Clamped Inductive Switching Energy vs Drain Current ($V_{DD} = 800\text{V}$)

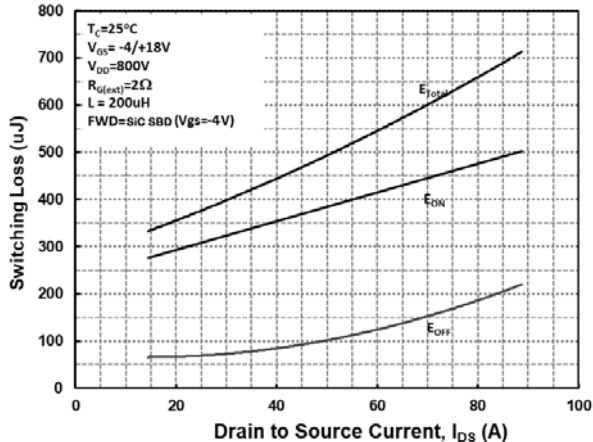
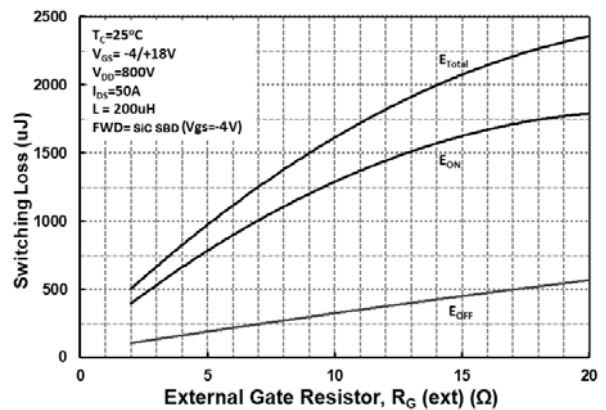
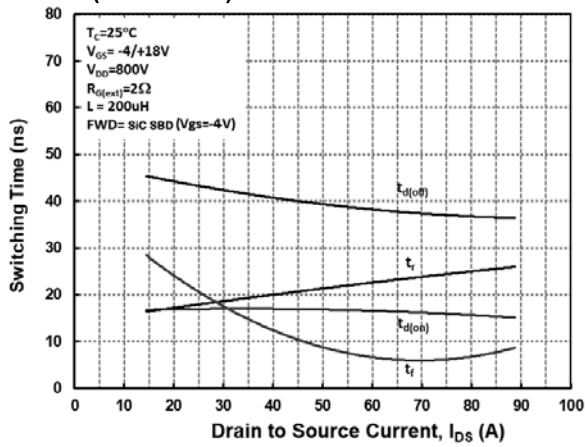
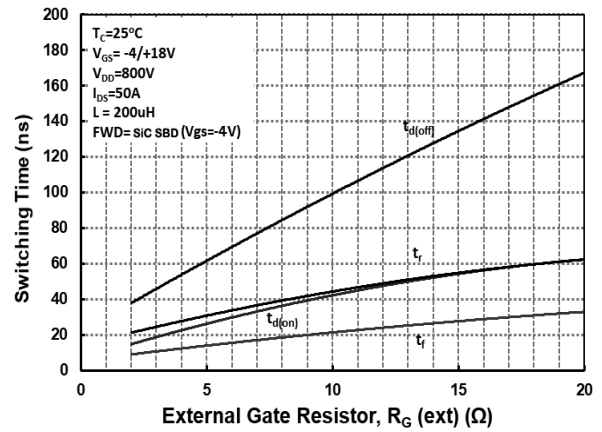


Fig 24. Clamped Inductive Switching Energy vs External Gate Resistor $R_{G(ext)}$



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

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


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