

Silicon Carbide Enhancement Mode MOSFET

Features

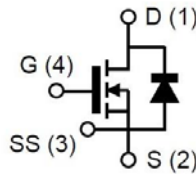
- High blocking voltage with low $R_{ds(on)}$
- High frequency operation with low Capacitance
- Simple to drive with -4V/+18V gate
- Robust body diode with low Q_{rr}
- 100% Avalanche Tested

Benefits

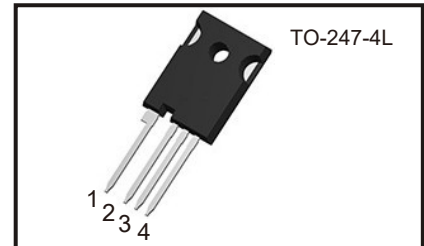
- Superior robustness and system reliability
- Higher system efficiency
- Easier paralleling without thermal runaway
- Capable of high temperature application
- Faster and more efficient switching

Applications

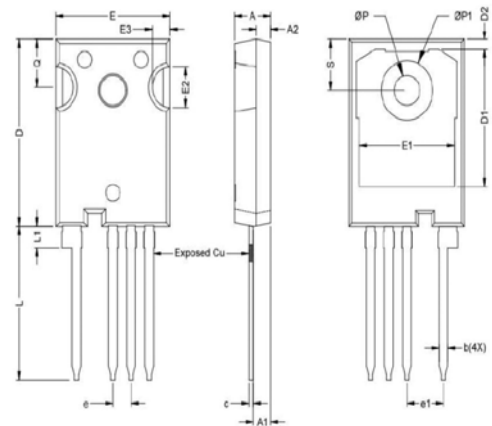
- EV motor drives
- EV/HEV charging station
- Energy storage and Battery charging
- High voltage DC-DC converters
- Solar / Wind Inverters
- UPS and PFC



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

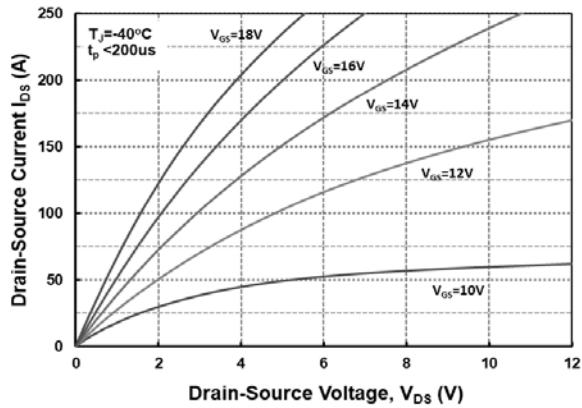
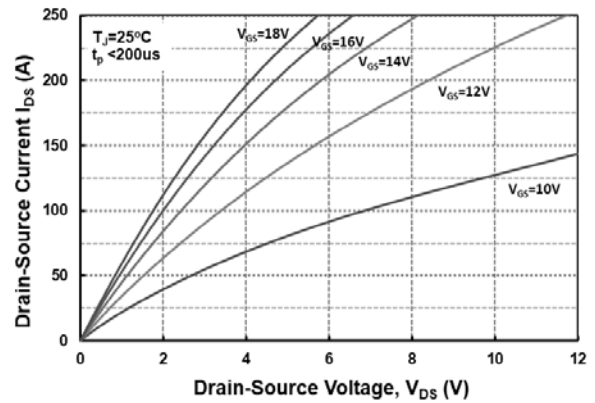
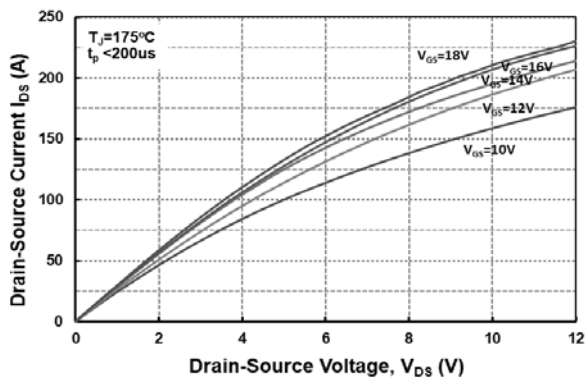
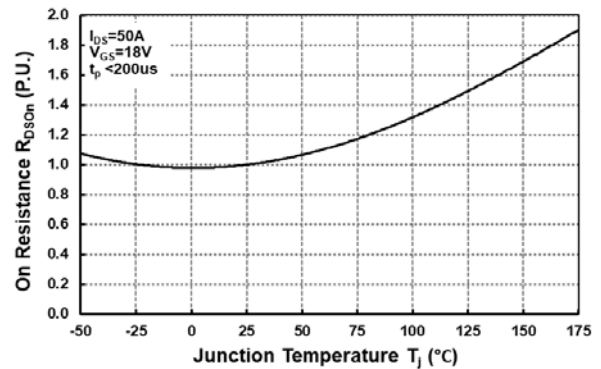
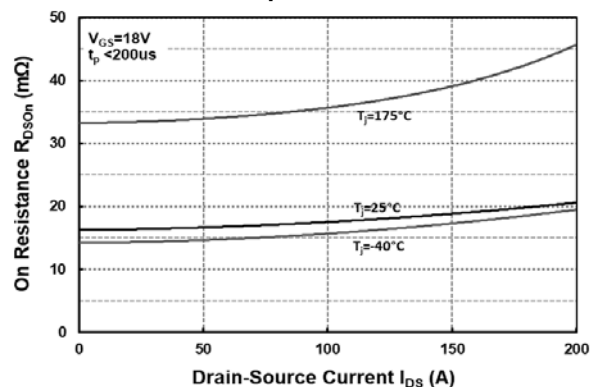
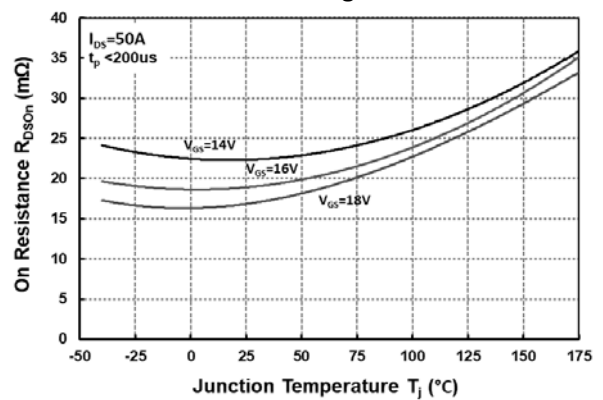
DIM	MILLIMETERS		
	MIN	TYP.	MAX
A	4.82	5.02	5.22
A1	2.21	2.41	2.61
A2	1.8	2	2.2
b	0.95	1.2	1.45
b1	1.95	2.2	2.45
b2	2.95	3.2	3.45
c	0.35	0.6	0.85
D	22.34	22.54	22.74
D1	16.3	16.55	16.8
D2	0.99	1.19	1.39
E	15.74	15.94	16.14
E1	13.01	13.26	13.51
E2	4.71	4.91	5.11
E3	2.26	2.46	2.66
e	2.54 BSC.		
e1	5.08 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 @ $T_c = 25^\circ\text{C}$ (unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
OFF Characteristics							
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=0.1mA$	1200	-	-	V	
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=1200V$ $V_{GS}=0V$	$T_J=25^\circ\text{C}$	-	0.5	100	μA
			$T_J=175^\circ\text{C}$	-	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 ***	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=20mA$	$T_J=25^\circ\text{C}$	2.2	3.0	4.2	V
			$T_J=175^\circ\text{C}$	-	2.2	-	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=18V, I_D=50A$	$T_J=25^\circ\text{C}$	-	17	23	$\text{m}\Omega$
			$T_J=175^\circ\text{C}$	-	32	-	
Transconductance	g_{fs}	$V_{DS}=20V, I_D=50A$	$T_J=25^\circ\text{C}$	-	40	-	S
			$T_J=175^\circ\text{C}$	-	38	-	
Internal Gate Resistance	$R_{G(int.)}$	$f=1\text{MHz}, I_D=0A$	-	1.2	-	Ω	
Dynamic Characteristics							
Input Capacitance	C_{iss}	$V_{DS}=1000V$ $V_{GS}=0V$ $f=100\text{kHz}$ $V_{AC}=25\text{mV}$	-	4300	-	pF	
Output Capacitance	C_{oss}		-	170	-		
Reverse Transfer Capacitance	C_{rss}		-	15	-		
Coss Stored Energy	E_{oss}		-	100	-		μJ
Turn-On Switching Energy	E_{on}	$V_{DS}=800V, V_{GS}=-4/+18V$ $I_D=50A, R_{G(ext)}=2.0\Omega$ $L=200\mu\text{H}$	-	410	-	μJ	
Turn-Off Switching Energy	E_{off}		-	120	-		
Switching Characteristics							
Turn-On Delay Time	$t_{d(on)}$	$V_{DS}=800V, V_{GS}=-4/+18V$ $I_D=50A, R_{G(ext)}=2.0\Omega$ $L=200\mu\text{H}$	-	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}	$V_{GS}=-4V, I_{SD}=40A$	$T_J=25^\circ\text{C}$	-	4.4	-	V
Inverse Diode Forward Voltage			$T_J=175^\circ\text{C}$	-	3.9	-	V
Continuous Diode Forward Current	I_S	$V_{GS}=-4V, T_J=25^\circ\text{C}$	-	100	-	A	
Reverse Recovery Time	T_{rr}	$I_{SD}=50A, V_{GS}=-4V$ $V_R=800V, R_{G(ext)}=10\Omega$ $di/dt=2500A/\mu\text{s}$ $L=200\mu\text{H}$	-	23	-	ns	
Reverse Recovery Charge	Q_{rr}		-	510	-	nC	
Peak Reverse Recovery Current	I_{rrm}		-	41	-	A	
Thermal Resistance							
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$		-	0.26	0.31	$^\circ\text{C/W}$	

*** 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

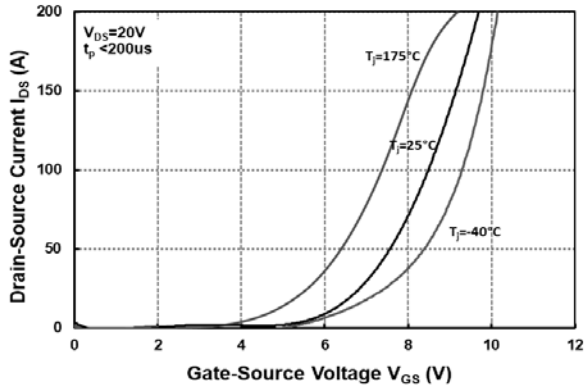


Fig 8. Body Diode Characteristics @ -40°C

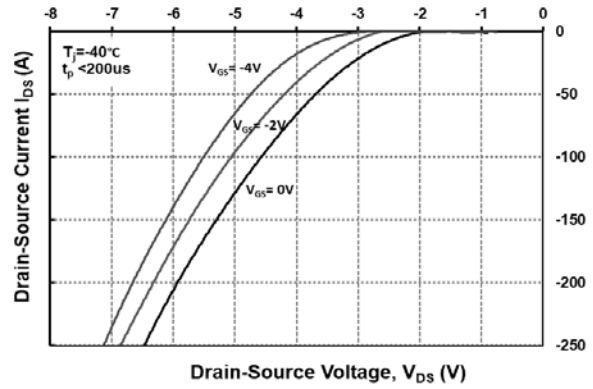


Fig 9. Body Diode Characteristics @ 25°C

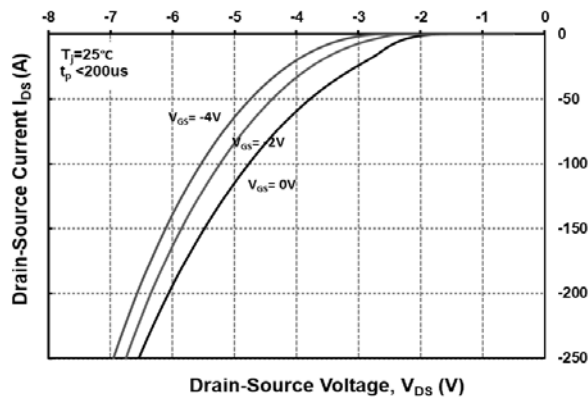


Fig 10. Body Diode Characteristics @ 175°C

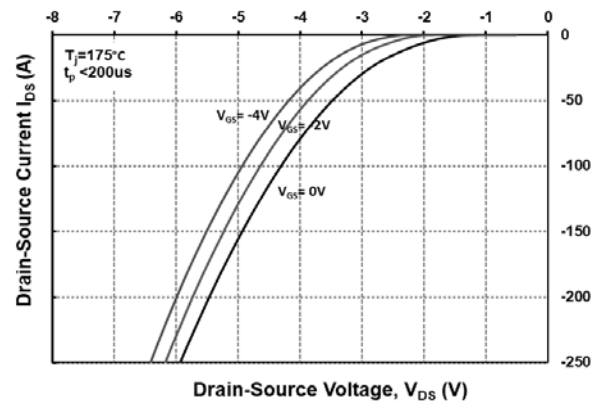


Fig 11. Threshold Voltage vs. Temperature

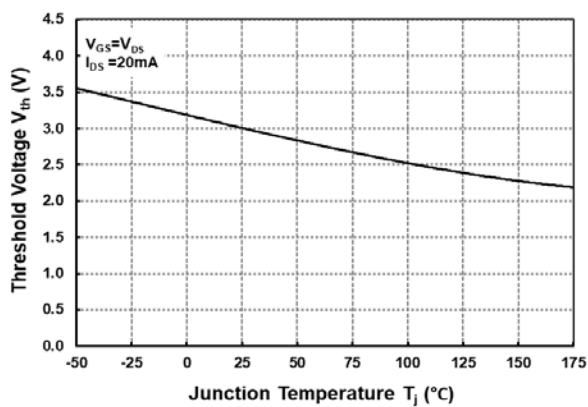
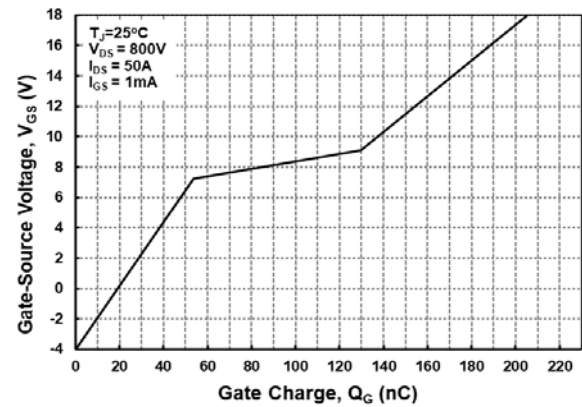
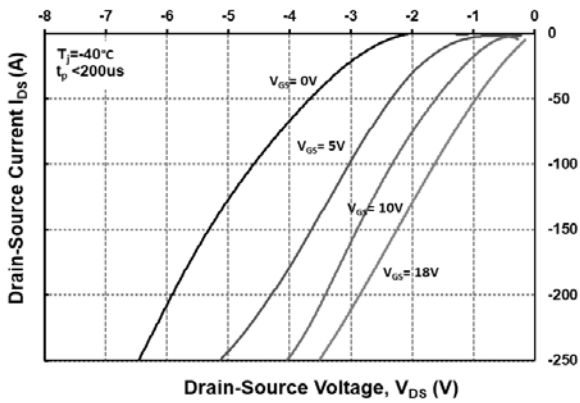
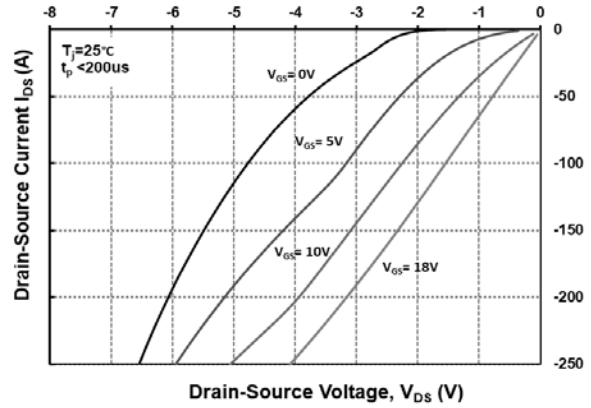
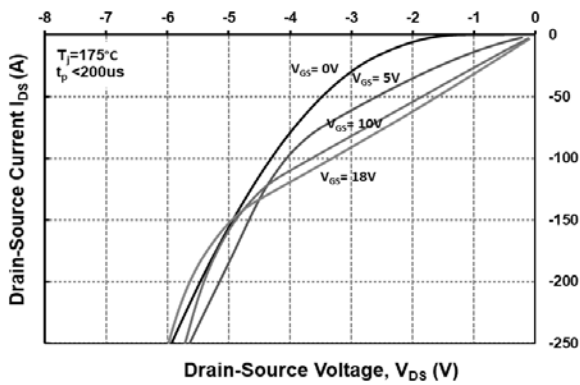
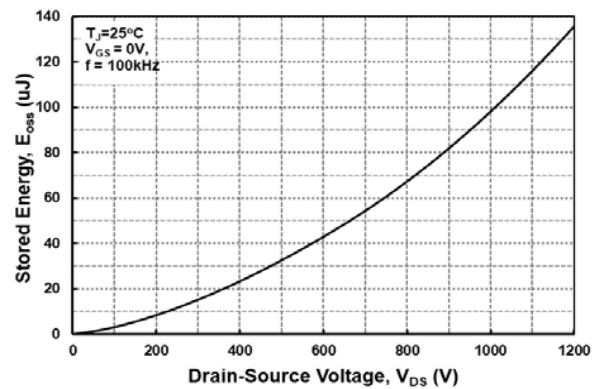
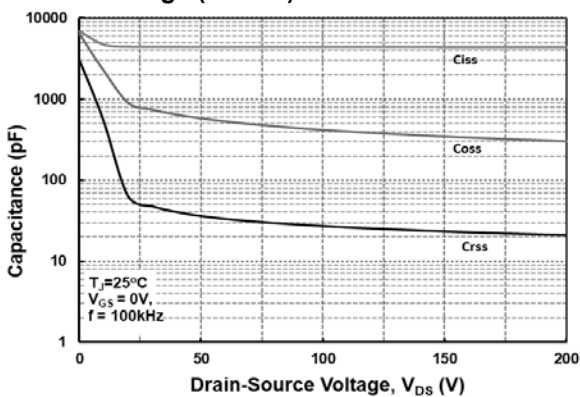
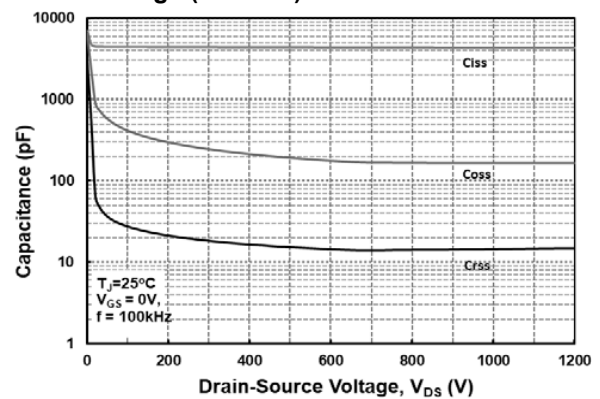


Fig 12. Gate Charge Characteristics



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

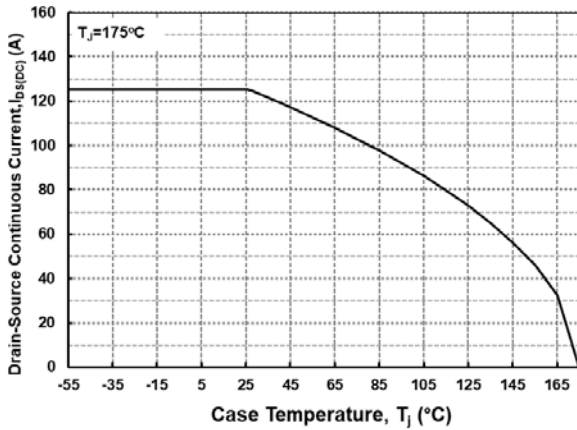


Fig 20. Maximum Power Dissipation Derating vs. Case Temperature

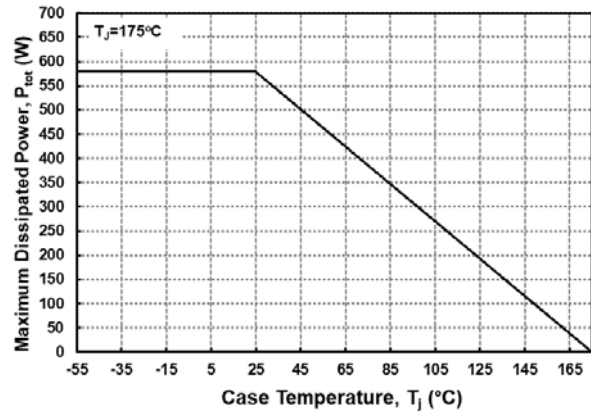


Fig 21. Transient Thermal Impedance (Junction – Case)

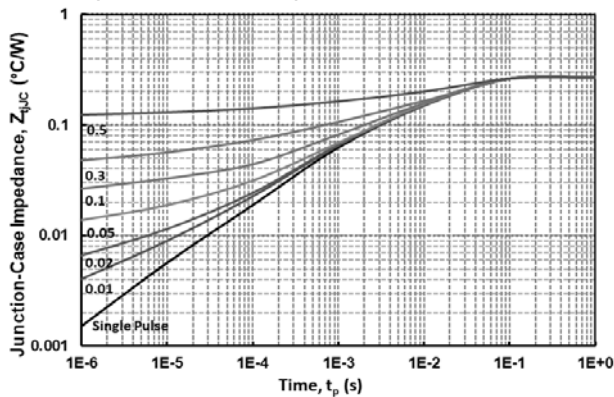


Fig 22. Safe Operating Area

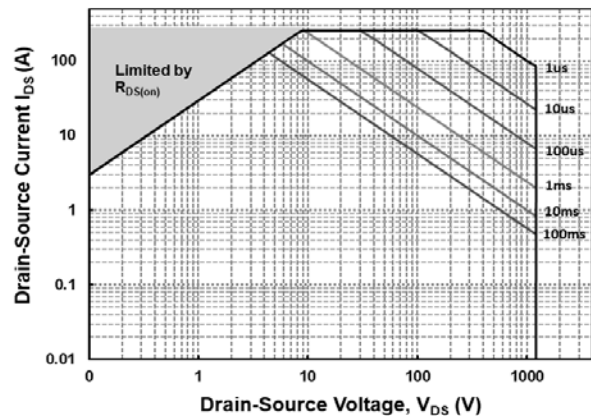


Fig 23. Clamped Inductive Switching Energy vs Drain Current ($V_{DD} = 800V$)

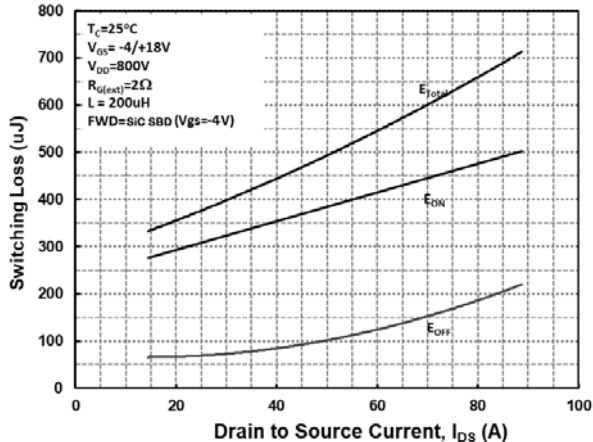
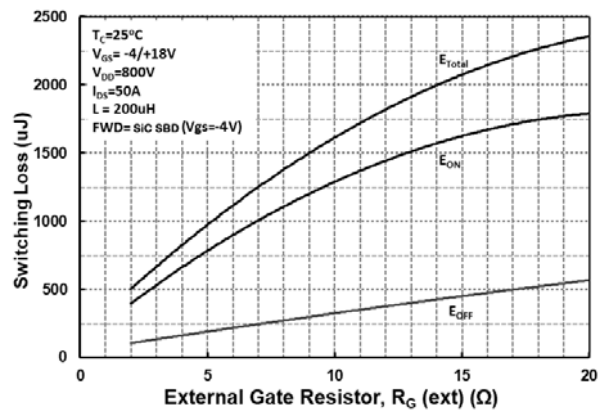
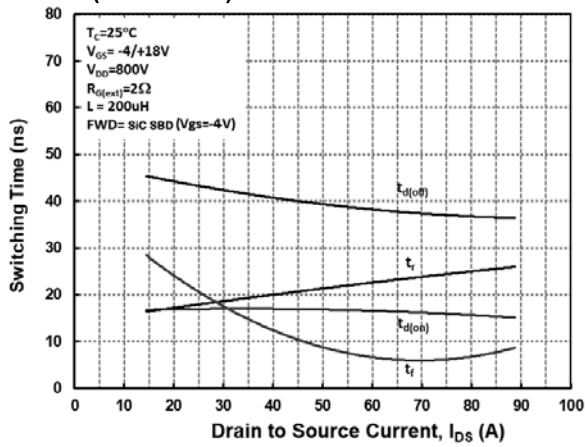
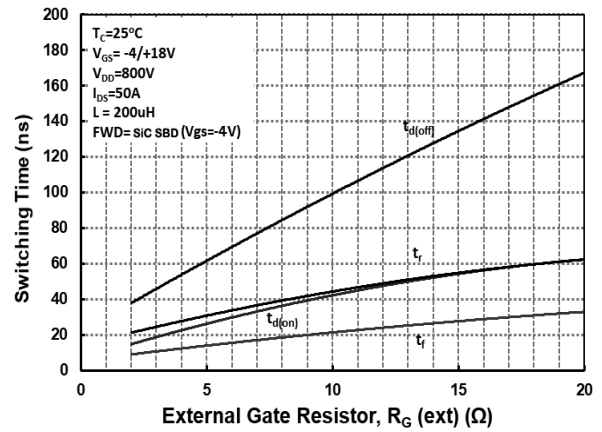


Fig 24. Clamped Inductive Switching Energy vs External Gate Resistor $R_{G(ext)}$



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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