

Silicon Carbide Enhancement Mode MOSFET

Features

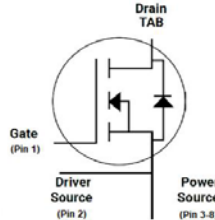
- High blocking voltage with low Rds(on)
- High frequency operation with low Capacitance
- Simple to drive with -4V/+18V gate
- Robust body diode with low Qrr
- 100% Avalanche tested

Benefits

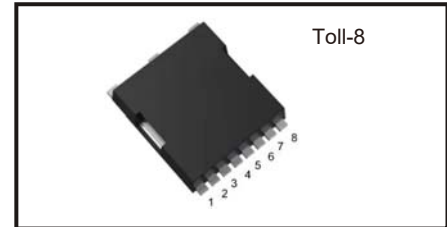
- Superior robustness and system reliability
- Higher system efficiency
- Easier paralleling without thermal runaway
- Capable of high temperature application
- Faster and more efficient switching

Applications

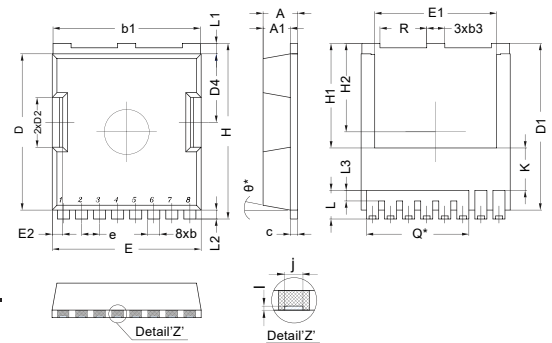
- Server power
- EV/HEV charging station
- Energy storage systems
- High performance DC-DC converters
- On-board charger
- Battery management systems



V_{DSS}	650V
$I_D(@25^{\circ}C)$	96A
$R_{DS(ON)}$ typ.	22.5m Ω



Package Dimensions



Absolute Maximum Ratings

(Tc = 25°C unless otherwise specified)

Parameter	Symbol	Ratings	Unit
Drain-Source Voltage $V_{GS}=0V$ $I_D=100\mu A$	V_{DS}	650	V
Gate-Source Voltage (dynamic) AC (f>1 Hz, duty cycle<1%, pulse width<200ns)	V_{GS}	-9/+23	V
Gate-Source Voltage (static)	$V_{GS(op)}$	-4/+18	V
Drain Current-Continuous @ Tc = 25°C @ Tc = 100°C	I_D	96 66	A
Pulse Drain Current	$I_{D,pulse}$	220	A
Power Dissipation	P_D	325	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}	36	A
Avalanche Capability, single pulse** $V_{DD}=100V$ $V_{GS}=10V$ $L=2mH$	E_{AV}	1200	mJ

* 100% tested in 60% rating

** 100% tested in 36% rating

SYMBOL	DIMENSIONS		
	MIN.	NOM.	MAX.
A	2.20	2.30	2.40
A1	1.70	1.80	1.90
b	0.70	0.80	0.90
b1	9.70	9.80	9.90
b3	1.10	1.20	1.30
c	0.40	0.50	0.60
D	10.28	10.38	10.48
D1	10.98	11.08	11.18
D2	3.20	3.30	3.40
D4	4.45	4.55	4.65
E	9.80	9.90	10.00
E1	8.00	8.10	8.20
E2	0.60	0.70	0.80
e	1.20 BSC		
H	11.58	11.68	11.78
H1	6.95 BSC		
H2	5.89 BSC		
I	0.10 REF.		
j	0.46 REF.		
K	2.80 REF.		
L	1.40	1.90	2.10
L1	0.60	0.70	0.80
L2	0.50	0.60	0.70
L3	0.30	0.70	0.80
N	8		
Q	6.80 REF.		
R	3.00	3.10	3.20
θ	10° REF.		

NOTE:

1. REFER TO JEDEC MO-299B.

2. ALL DIMENSIONS ARE IN MM, ANGLES IN DEGREES.

3. DIMENSIONS DO NOT INCLUSIVE BURRS AND MOLD FLASH.

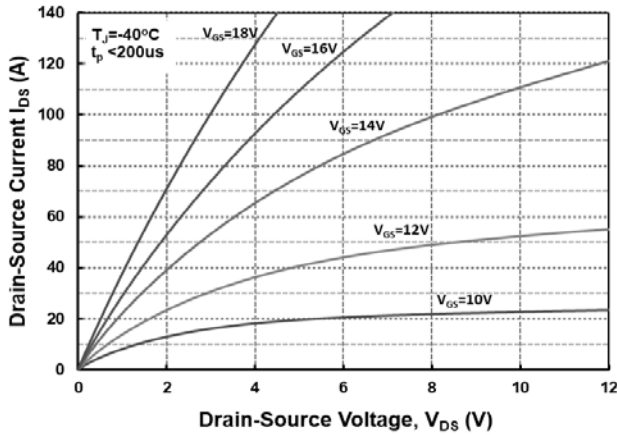
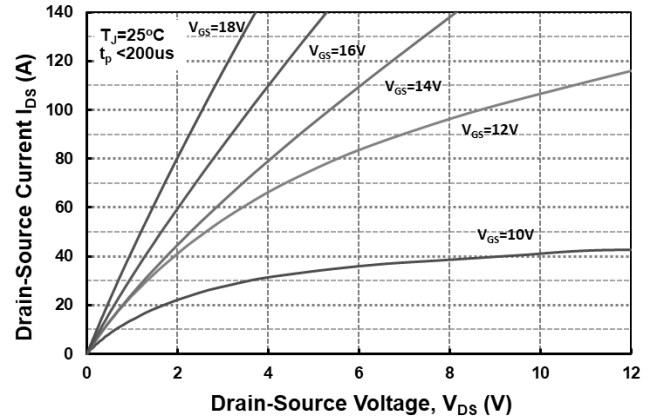
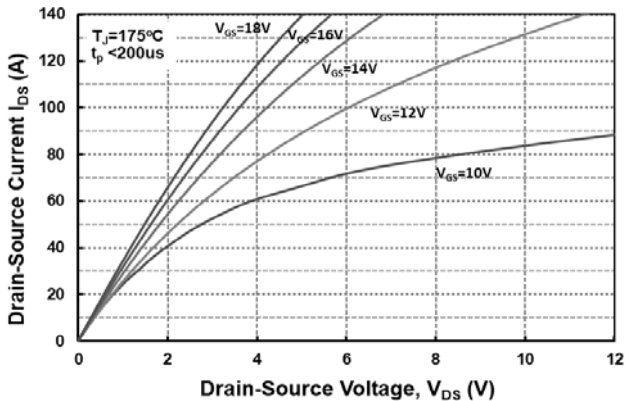
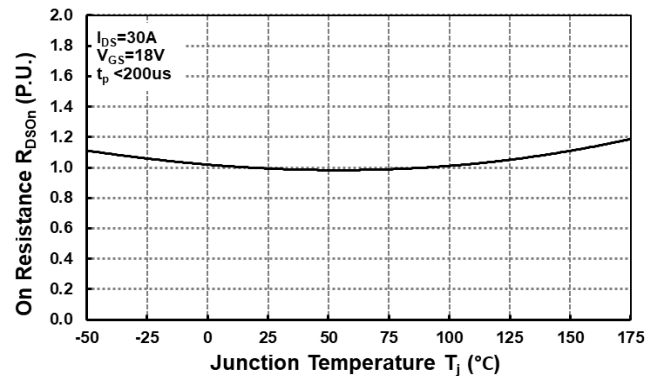
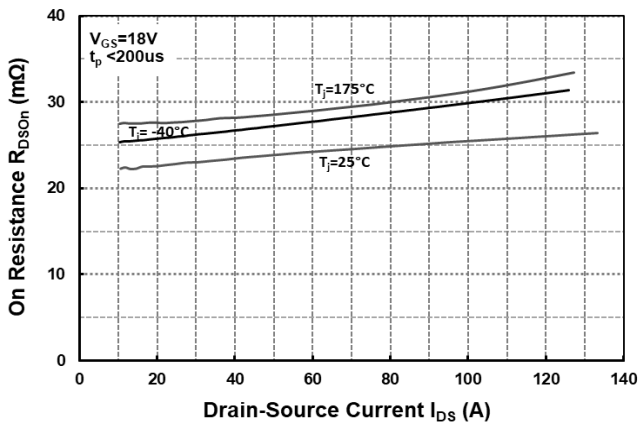
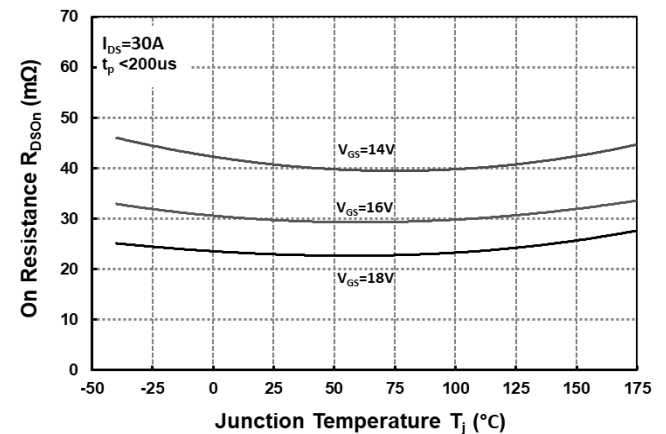
4. *** IS FOR REFERENCE.

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	650	-	-	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =650V, V _{GS} =0V	-	0.5	60	μA
		V _{DS} =650V, V _{GS} =0V, 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 =10mA	2.6	3.1	4.2	V
		V _{DS} =V _{GS} , I _D =10mA, T _J =150°C	-	2.2	-	
		V _{DS} =V _{GS} , I _D =10mA, T _J =175°C	-	2.1	-	
Drain-Source On-State Resistance	R _{DS(on)}	V _{GS} =18V, I _D =30A	-	22.5	28.5	mΩ
		V _{GS} =18V, I _D =30A, T _J =175°C	-	27	-	
Transconductance	g _{fs}	V _{DS} =20V, I _D =30A	-	23	-	S
		V _{DS} =20V, I _D =30A, T _J =175°C	-	21	-	
Internal Gate Resistance	R _{G(int.)}	f=1MHz, I _D =0A	-	1.2	-	Ω
Dynamic Characteristics						
Input Capacitance	C _{iss}	V _{DS} =400V V _{GS} =0V Freq.=1MHz V _{AC} =25mV	-	2400	-	pF
Output Capacitance	C _{oss}		-	190	-	
Reverse Transfer Capacitance	C _{rss}		-	8	-	
C _{oss} Stored Energy	E _{oss}		-	19	-	μJ
Turn-On Switching Energy	E _{on}	V _{DS} =400V, V _{GS} =-4/+18V I _D =30A, R _{G(ext)} =2.0Ω	-	29	-	μJ
Turn-Off Switching Energy	E _{off}	L=200μH	-	26	-	
Switching Characteristics						
Turn-On Delay Time	t _{d(on)}	V _{DS} =400V, V _{GS} =-4/+18V I _D =30A, R _{G(ext)} =2.0Ω L=200μH	-	15	-	ns
Rise Time	t _r		-	11	-	
Turn-Off Delay Time	t _{d(off)}		-	29	-	
Fall Time	t _f		-	6	-	
Total Gate Charge	Q _g	V _{DS} =400V V _{GS} =-4/+18V I _D =30A	-	112	-	nC
Gate to Source Charge	Q _{gs}		-	30	-	
Gate to Drain Charge	Q _{gd}		-	45	-	
Body Diode Characteristics						
Diode Forward Voltage	V _{SD}	V _{GS} =-4V, I _{SD} =20A, T _J =25°C	-	3.3	-	V
		V _{GS} =-4V, I _{SD} =20A, T _J =175°C	-	3.0	-	
Continuous Diode Forward Current	I _S	V _{GS} =-4V, T _J =25°C	-	62	-	A
Reverse Recovery Time	T _{rr}	I _{SD} =30A, V _{GS} =-4V V _R =400V, R _{G(ext)} =20Ω L=200μH, dif/dt=1420A/μs	-	22	-	ns
Reverse Recovery Charge	Q _{rr}		-	240	-	nC
Peak Reverse Recovery Current	I _{rrm}		-	21	-	A
Thermal Resistance						
Thermal Resistance, Junction-to-Case	Rθ _{JC}		-	0.46	0.55	°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 at $T_J = 175^\circ\text{C}$

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

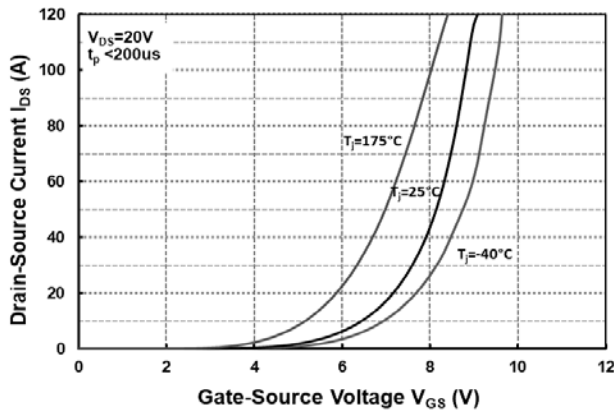


Fig 8. Body Diode Characteristics @ -40°C

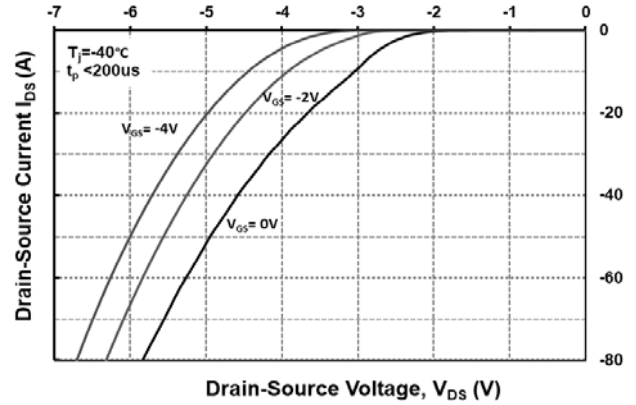


Fig 9. Body Diode Characteristics @ 25°C

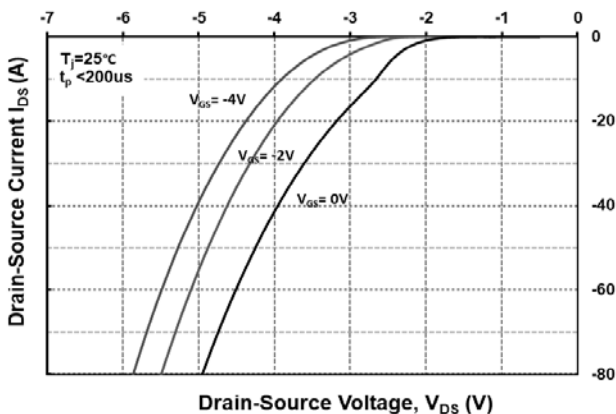


Fig 10. Body Diode Characteristics @ 175°C

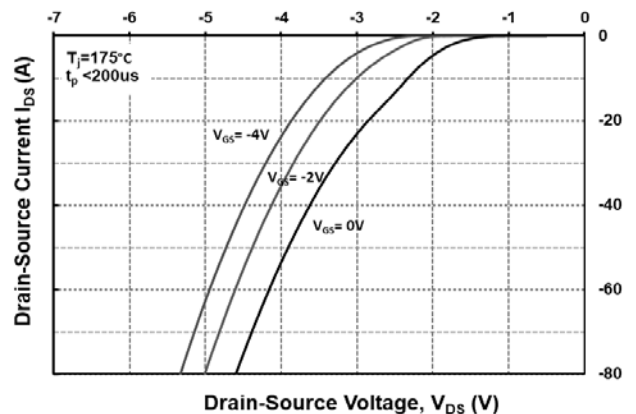


Fig 11. Threshold Voltage vs. Temperature

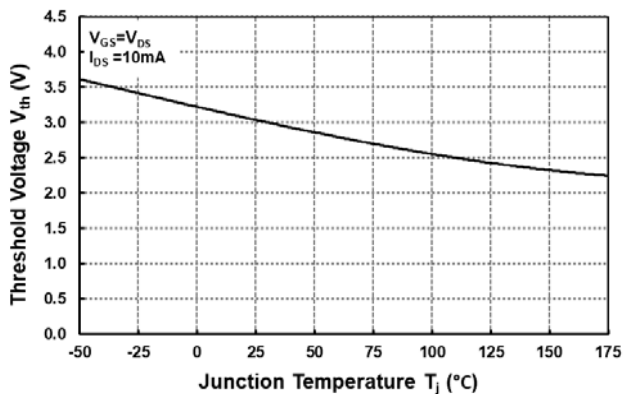
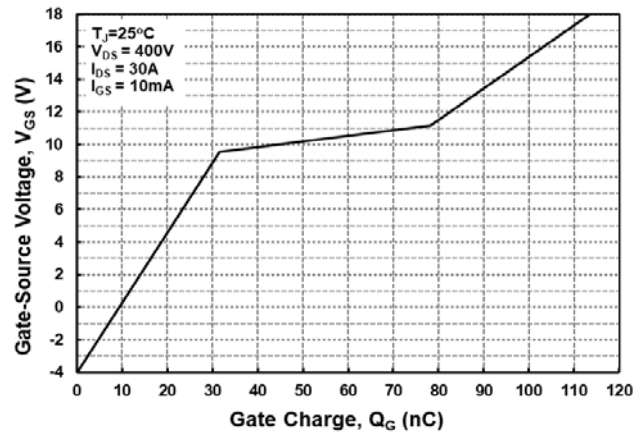
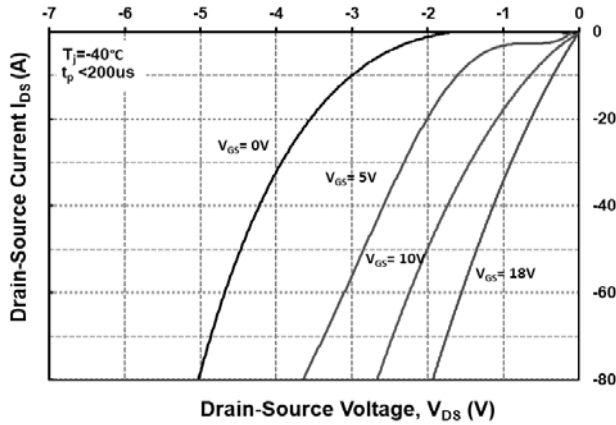
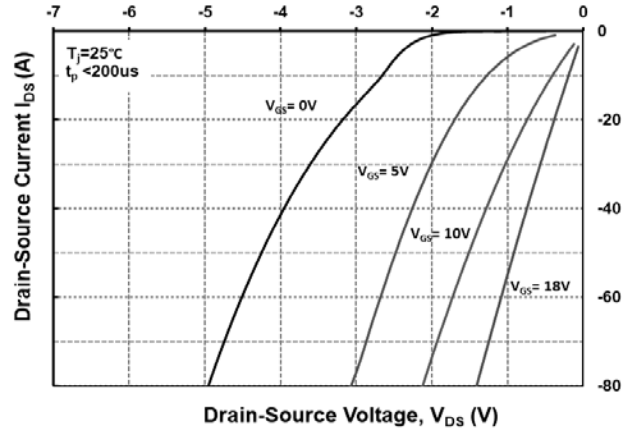
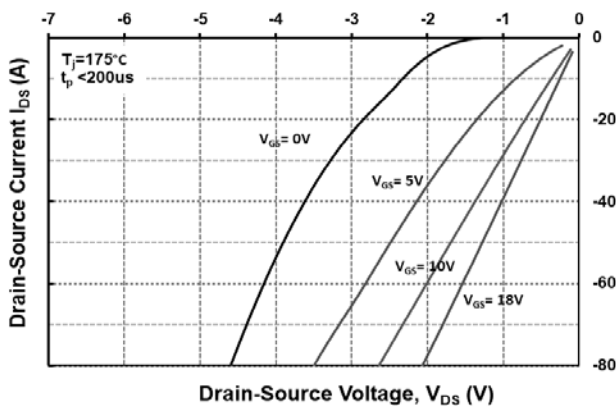
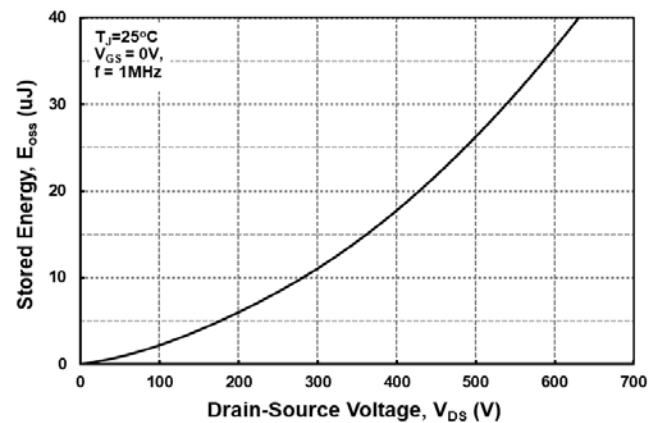
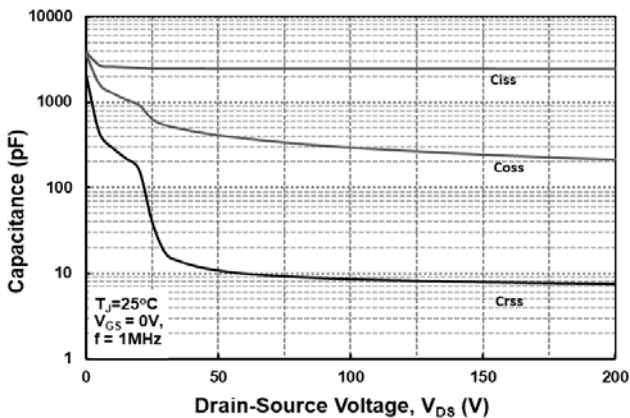
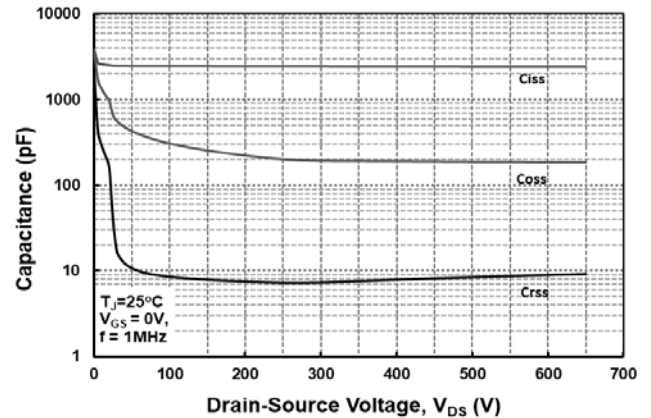


Fig 12. Gate Charge Characteristics



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 (0-650V)


Typical Performance

Fig 19. Continuous Drain Current Derating vs. Case Temperature

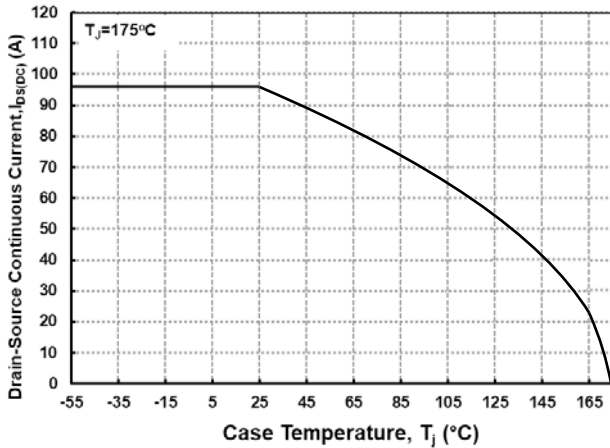


Fig 20. Maximum Power Dissipation Derating vs. Case Temperature

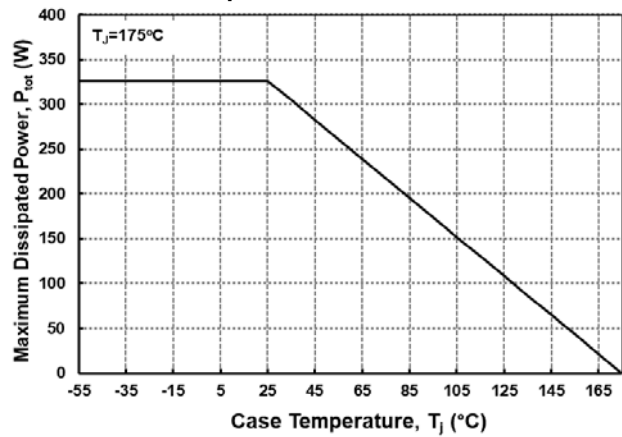


Fig 21. Transient Thermal Impedance (Junction – Case)

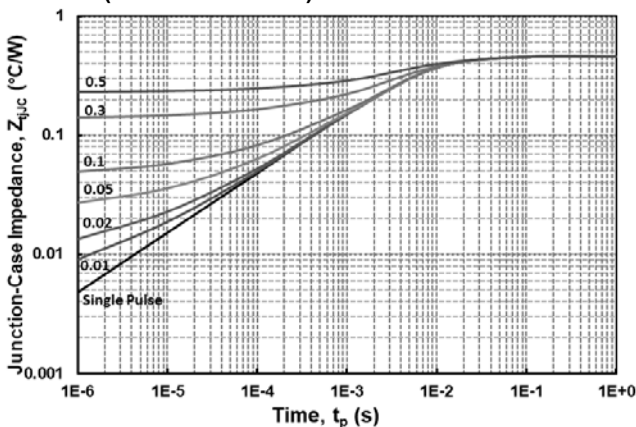


Fig 22. Safe Operating Area

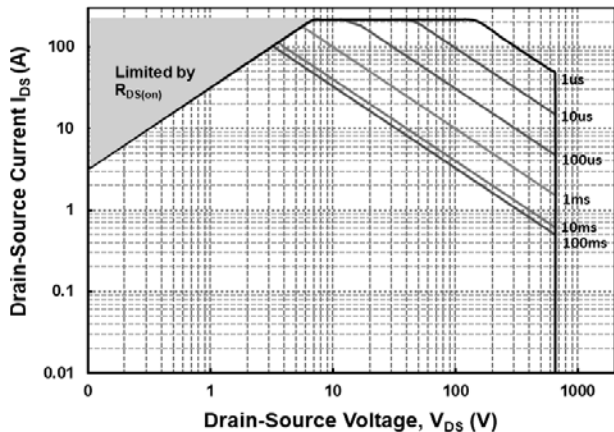


Fig 23. Clamped Inductive Switching Energy vs Drain Current ($V_{DD} = 400V$)

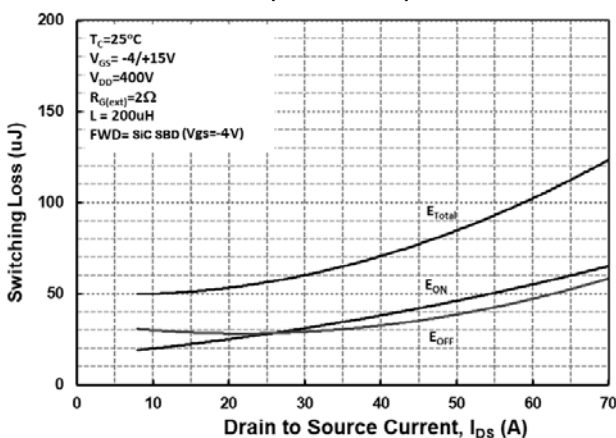
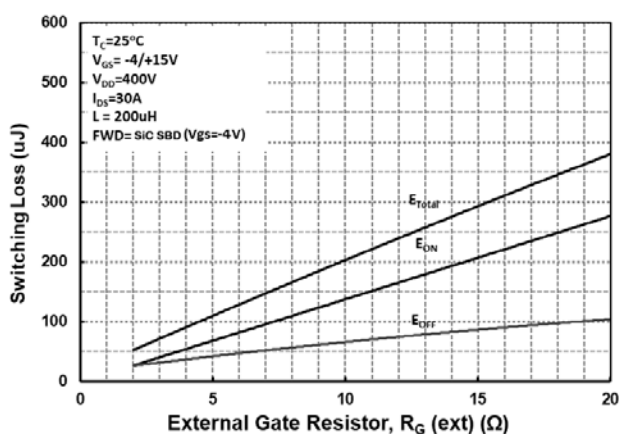
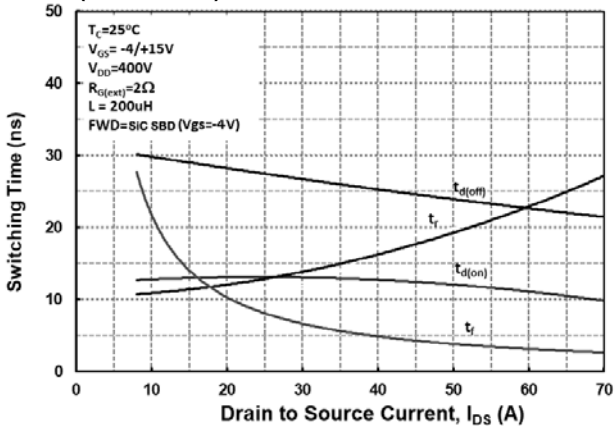
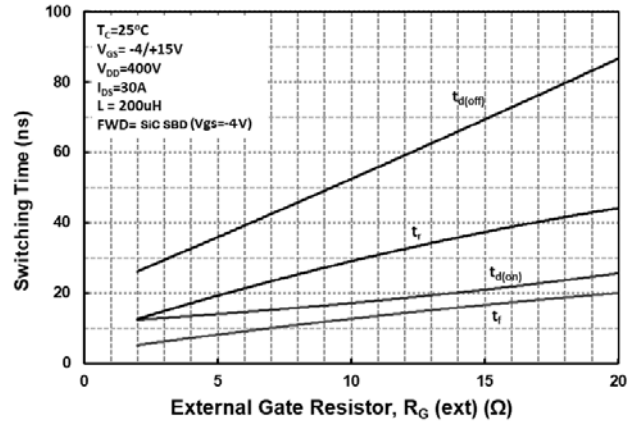


Fig 24. Clamped Inductive Switching Energy vs External Gate Resistor $R_{G(ext)}$



Typical Performance
Fig 25. Switching Times vs Drain Current
($V_{DD} = 400V$)

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


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