

## Silicon Carbide Enhancement Mode MOSFET

### Features

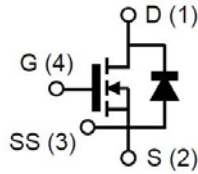
- High blocking voltage with low  $R_{DS(on)}$
- High frequency operation with low Capacitance
- Simple to drive with -4V/+15V gate
- Robust body diode with low  $Q_{rr}$
- 100% Avalanche Tested

### Benefits

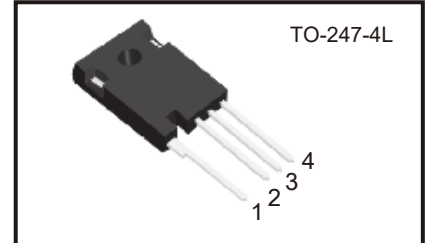
- Superior robustness and system reliability
- Higher system efficiency
- Easier paralleling without thermal runaway
- Capable of high temperature application
- Faster and more efficient switching

### Applications

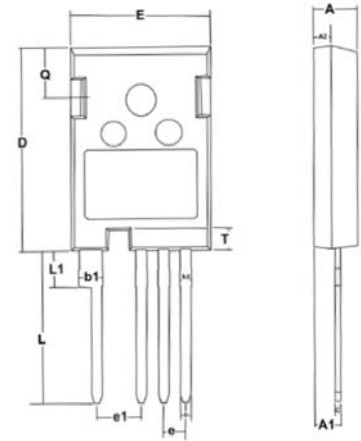
- EV motor drives
- EV/HEV charging station
- Energy storage and Battery charging
- High voltage DC-DC converters
- Solar / Wind Inverters
- UPS and PFC



$V_{DSS}$	1200V
$I_D(@25^{\circ}C)$	67A
$R_{DS(ON)}$ typ.	38m $\Omega$



Package Dimensions



### Absolute Maximum Ratings

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

Parameter	Symbol	Ratings	Unit
Drain-Source Voltage $V_{GS}=0V$ $I_D=100\mu A$	$V_{DS}$	1200	V
Gate-Source Voltage (dynamic) AC ( $f>1$ Hz, duty cycle<1%, pulse width<200ns)	$V_{GS}$	-8/+19	V
Gate-Source Voltage (static)	$V_{GS(op)}$	-4/+15	V
Drain Current-Continuous @ $T_c=25^{\circ}C$ @ $T_c=100^{\circ}C$	$I_D$	67 47	A
Pulse Drain Current	$I_{D,pulse}$	134	A
Power Dissipation	$P_D$	312	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 * $V_{DD}=100V$ $V_{GS}=10V$ $L=2mH$	$I_{AV}$	35	A
Avalanche Capability, single pulse** $V_{DD}=100V$ $V_{GS}=10V$ $L=2mH$	$E_{AV}$	1225	mJ

\* 100% tested in 60% rating

\*\* 100% tested in 36% rating

Symbol	Dimensions in millimeters		
	Min.	Avg.	Max.
A	4.80	5.00	5.20
A1	2.21	2.41	2.61
A2	1.80	2.00	2.20
b	1.06	1.21	1.36
b1	2.33	2.63	2.93
b2	1.07	1.30	1.60
C	0.51	0.61	0.75
D	23.30	23.45	23.60
E	15.74	15.94	16.14
e	2.54 BSC		
e1	5.08 BSC		
L	17.27	17.57	17.87
L1	3.99	4.19	4.39
Q	5.49	5.79	6.09
T	2.35	2.50	2.65

**Electrical Characteristics @ T<sub>c</sub> =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	$I_{DSS}$	$V_{GS}=0V, V_{DS}=1200V$	-	0.5	60	$\mu A$
Gate-Source Leakage Current	$I_{GSS}$	$V_{GS}=15V, V_{DS}=0V$	-	5	100	nA
ON Characteristics						
Gate Threshold Voltage ***	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=10mA$	2.0	2.7	3.6	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=15V, I_D=30A$	-	38	48	m $\Omega$
Transconductance	$g_{fs}$	$V_{DS}=20V, I_D=30A$	-	27	-	S
Internal Gate Resistance	$R_{G(int.)}$		1.0	1.4	3.0	$\Omega$
Dynamic Characteristics						
Input Capacitance	$C_{iss}$	$V_{DS}=1000V$ $V_{GS}=0V$ Freq.=100kHz $V_{AC}=25mV$	-	2550	-	pF
Output Capacitance	$C_{oss}$		-	84	-	
Reverse Transfer Capacitance	$C_{rss}$		-	6	-	
C <sub>oss</sub> Stored Energy	$E_{oss}$		-	51	-	$\mu J$
Turn-On Switching Energy	$E_{on}$	$V_{DS}=800V, V_{GS}=-4/+15V$ $I_D=30A, R_{G(ext)}=2.0\Omega$ $L=200\mu H$	-	156	-	$\mu J$
Turn-Off Switching Energy	$E_{off}$		-	45	-	
Switching Characteristics						
Turn-On Delay Time	$t_{d(on)}$	$V_{DS}=800V$ $V_{GS}=-4/+15V$ $I_D=30A$ $R_{G(ext)}=2.0\Omega$ $L=200\mu H$	-	13	-	ns
Rise Time	$t_r$		-	13	-	
Turn-Off Delay Time	$t_{d(off)}$		-	25	-	
Fall Time	$t_f$		-	10	-	
Total Gate Charge	$Q_g$	$V_{DS}=800V$ $V_{GS}=-4/+15V$ $I_D=30A$	-	101	-	nC
Gate to Source Charge	$Q_{gs}$		-	29	-	
Gate to Drain Charge	$Q_{gd}$		-	37	-	
Body Diode Characteristics						
Inverse Diode Forward Voltage	$V_{SD}$	$V_{GS}=-4V, I_{SD}=20A$	-	4.5	-	V
Continuous Diode Forward Current	$I_S$	$V_{GS}=-4V, T_J=25^{\circ}C$	-	-	46	A
Reverse Recovery Time	$T_{rr}$	$I_{SD}=30A, V_{GS}=-4V$ $V_R=800V, T_J=25^{\circ}C$ $di/dt=3100A/\mu s$	-	17	-	ns
Reverse Recovery Charge	$Q_{rr}$		-	360	-	nC
Peak Reverse Recovery Current	$I_{rrm}$		-	37	-	A
Thermal Resistance						
Thermal Resistance, Junction-to-Case	$R\theta_{JC}$		-	0.48	0.60	$^{\circ}C/W$

\*\*\* Turn-off with -4V gate bias is highly recommended

## Typical Performance

Fig 1. Output Characteristics,  $T_J = -40^\circ\text{C}$

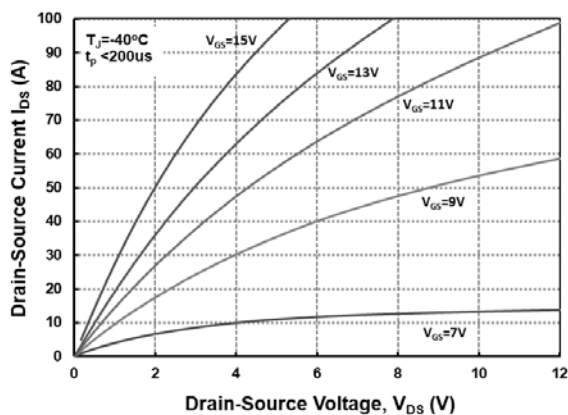


Fig 2. Output Characteristics,  $T_J = 25^\circ\text{C}$

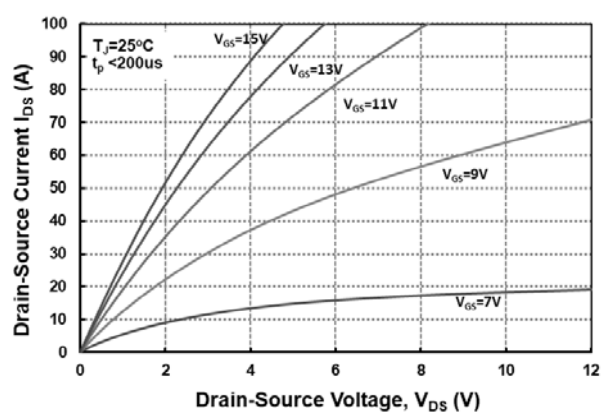


Fig 3. Output Characteristics,  $T_J = 175^\circ\text{C}$

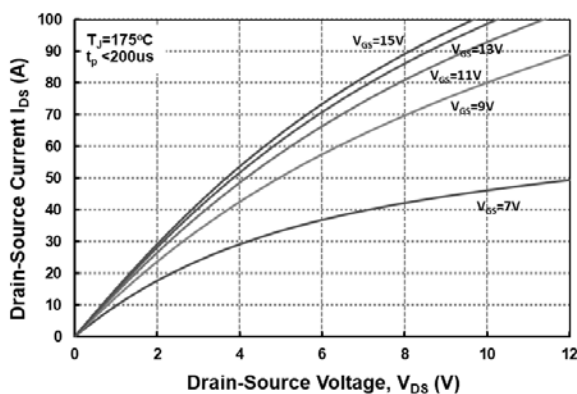


Fig 4. Normalized On-Resistance vs. Temperature

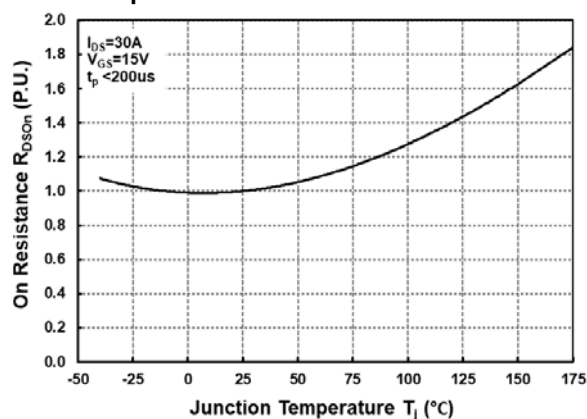


Fig 5. On-Resistance vs. Drain Current for Various Temperatures

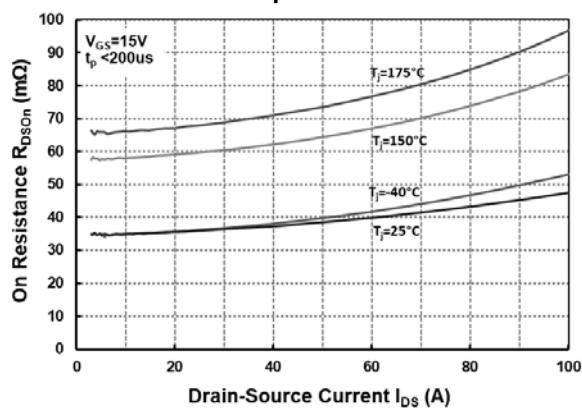
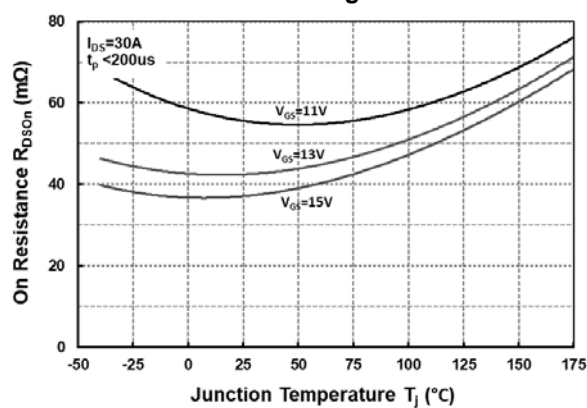
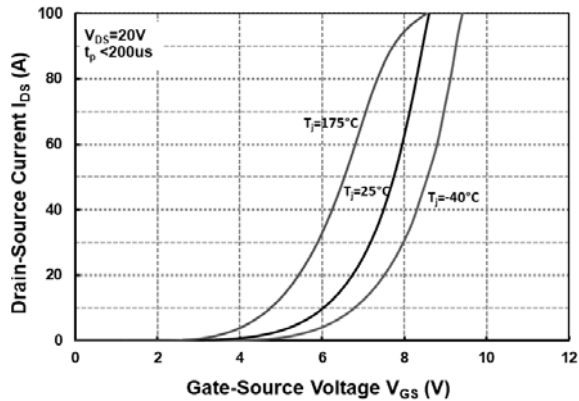


Fig 6. On-Resistance vs. Temperature for Various Gate Voltage

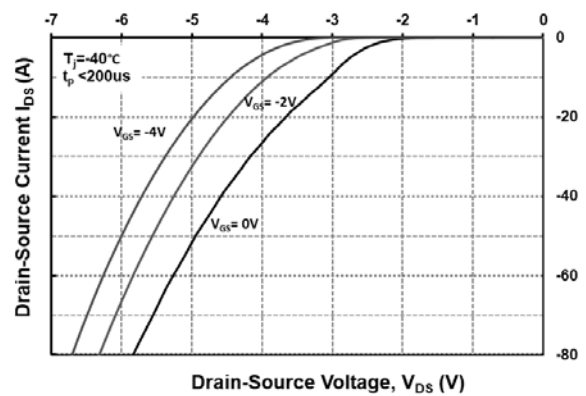


## Typical Performance

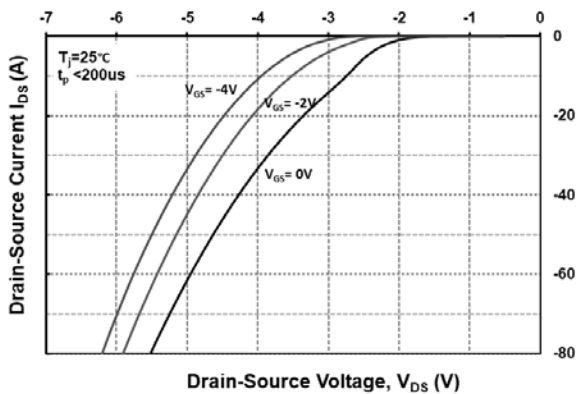
**Fig 7. Transfer Characteristic for Various Junction Temperatures**



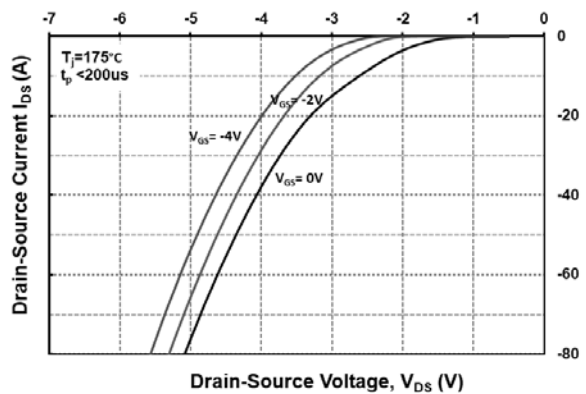
**Fig 8. Body Diode Characteristics @  $-40^\circ C$**



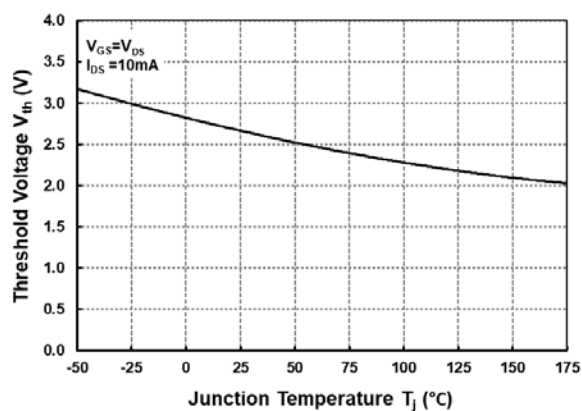
**Fig 9. Body Diode Characteristics @  $25^\circ C$**



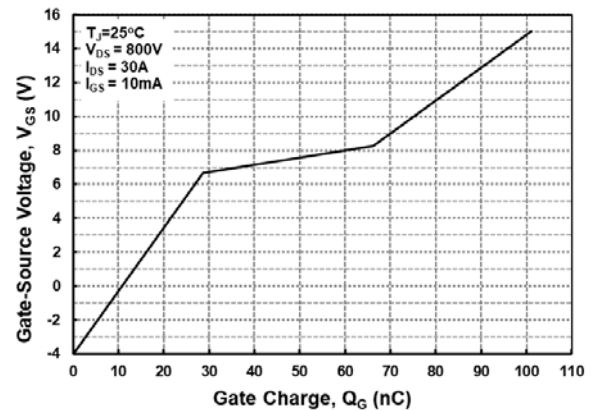
**Fig 10. Body Diode Characteristics @  $175^\circ C$**



**Fig 11. Threshold Voltage vs. Temperature**



**Fig 12. Gate Charge Characteristics**



## Typical Performance

Fig 13. 3<sup>rd</sup> Quadrant Characteristics @ -40°C

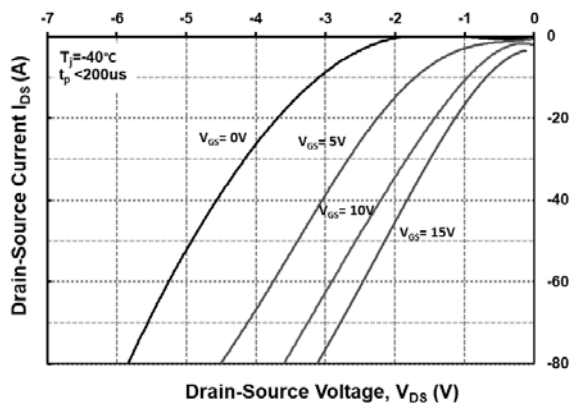


Fig 14. 3<sup>rd</sup> Quadrant Characteristics @ 25°C

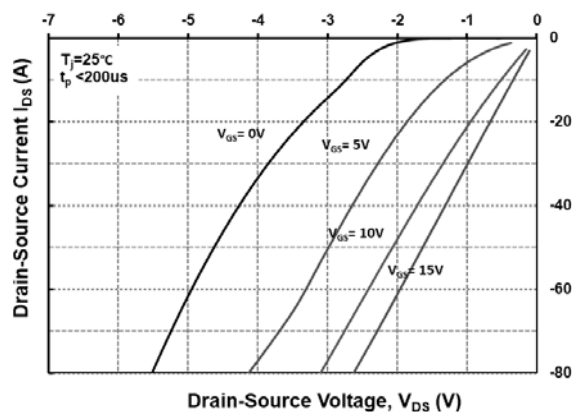


Fig 15. 3<sup>rd</sup> Quadrant Characteristics @ 175°C

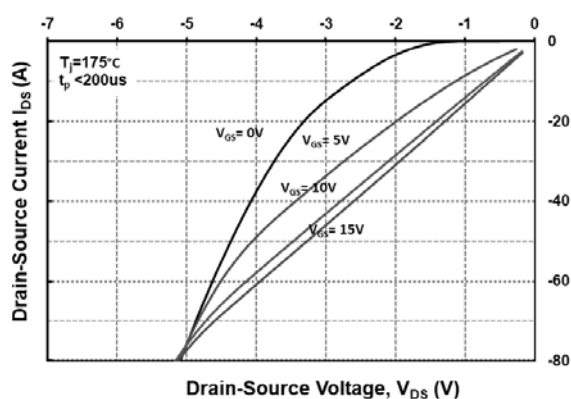


Fig 16. Output Capacitor Stored Energy

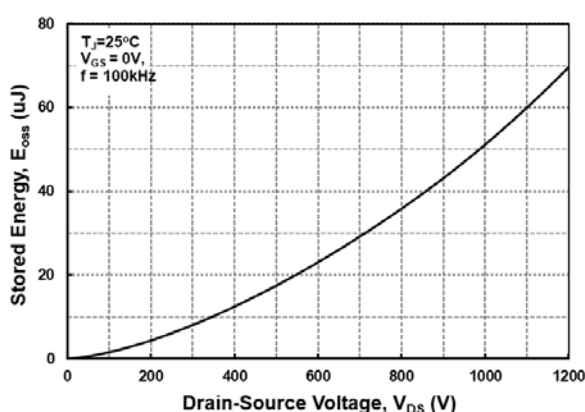


Fig 17. Capacitances vs. Drain-Source Voltage (0-200V)

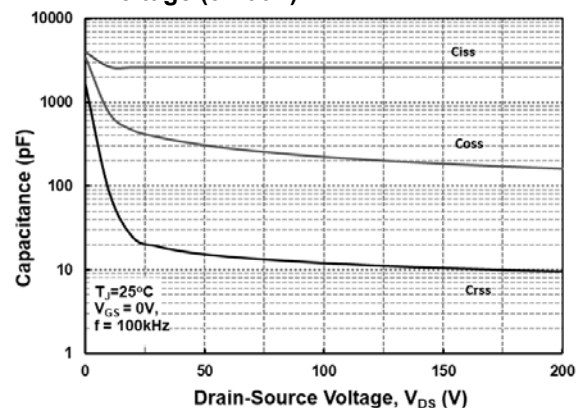
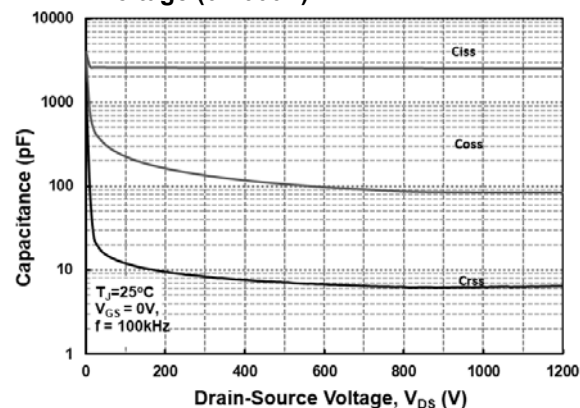


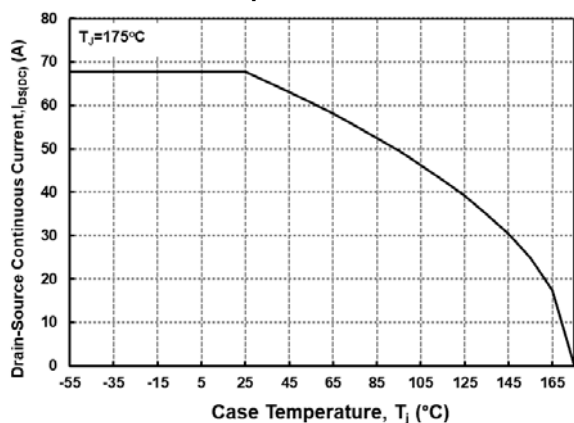
Fig 18. Capacitances vs. Drain-Source Voltage (0-1000V)



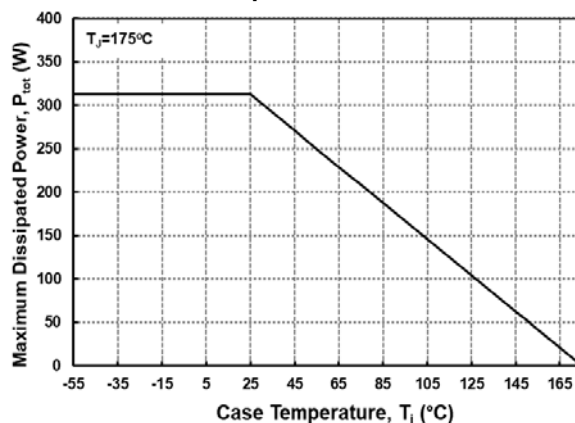


## Typical Performance

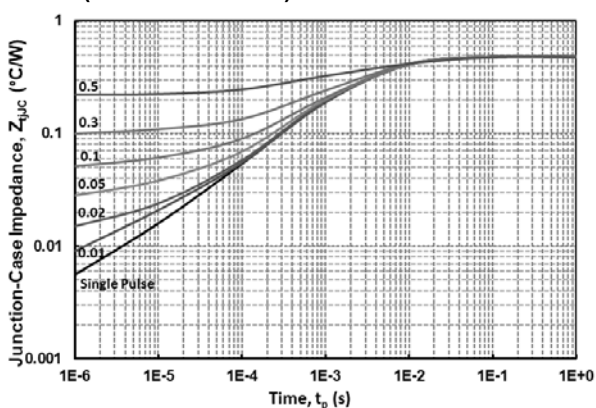
**Fig 19. Continuous Drain Current Derating vs. Case Temperature**



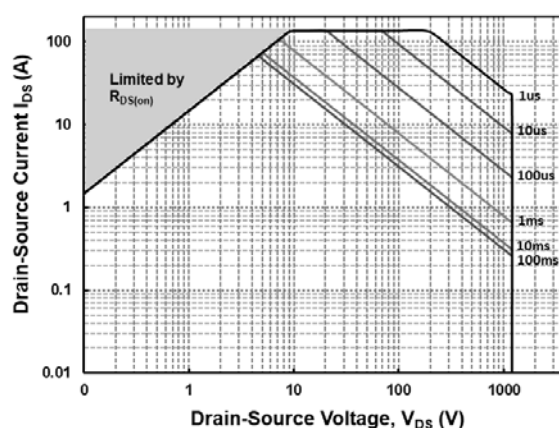
**Fig 20. Maximum Power Dissipation Derating vs. Case Temperature**



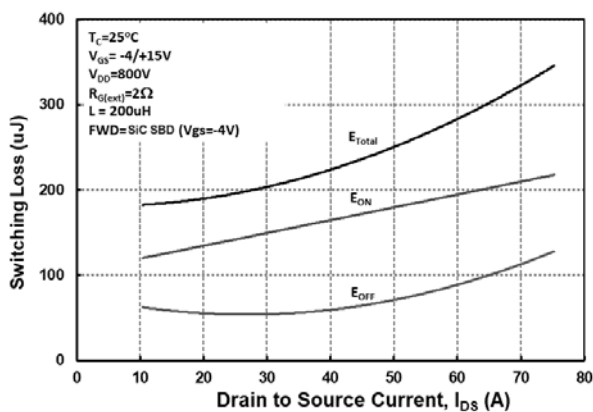
**Fig 21. Transient Thermal Impedance (Junction – Case)**



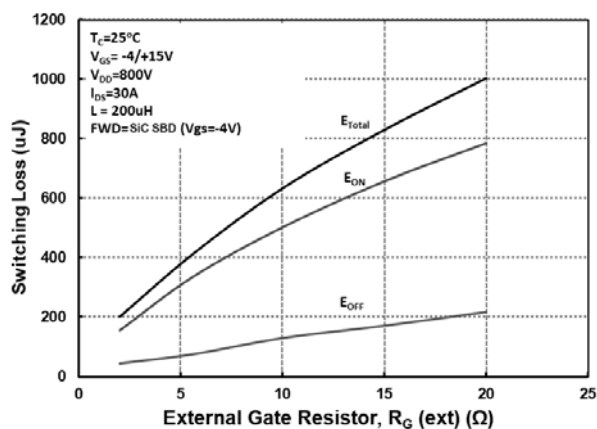
**Fig 22. Safe Operating Area**



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

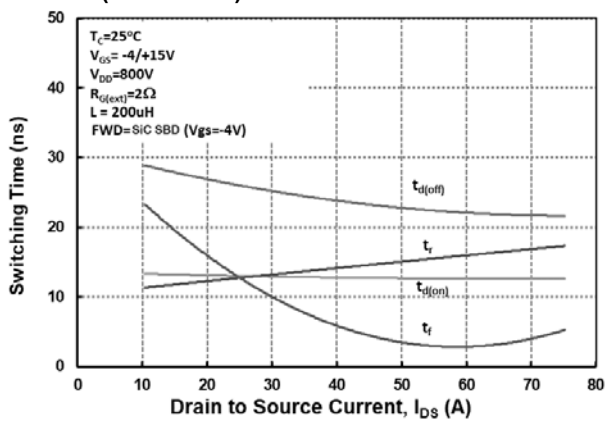


**Fig 24. Clamped Inductive Switching Energy vs External Gate Resistor  $R_{G(ext)}$**

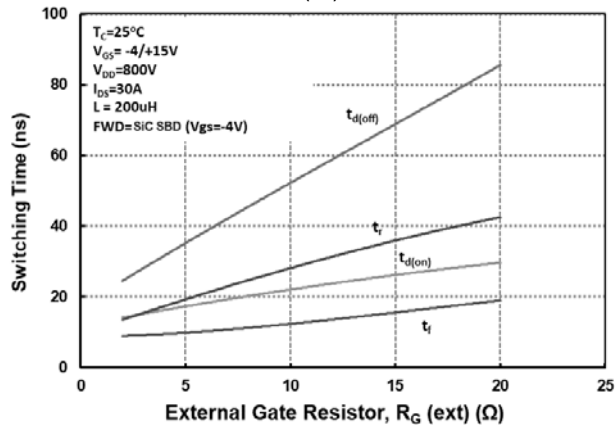


## Typical Performance

**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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