

Silicon Carbide MOSFET

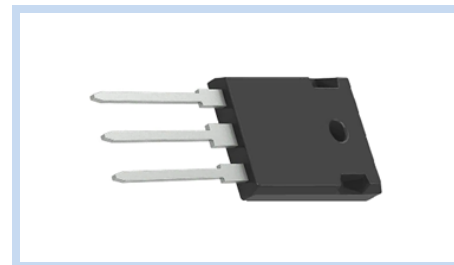
N-Channel 650V 32A TO-247

MFTC650N32T247

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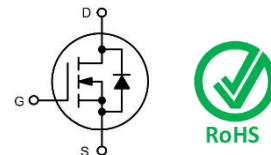
FEATURE

- $R_{DS(ON)} < 150m\Omega$ at $V_{GS}=18V$, $I_D=10A$
- Low On-Resistance with High Blocking Voltage
- Low Capacitances with High-Speed Switching
- Low Reverse Recovery
- Applications: High Voltage DC/DC Converters, Switching Mode Power Supplier, Renewable Energy, Motor Drives



MECHANICAL DATA

- Case: TO-247 Package
- Terminals: Solderable per MIL-STD-750, Method 2026



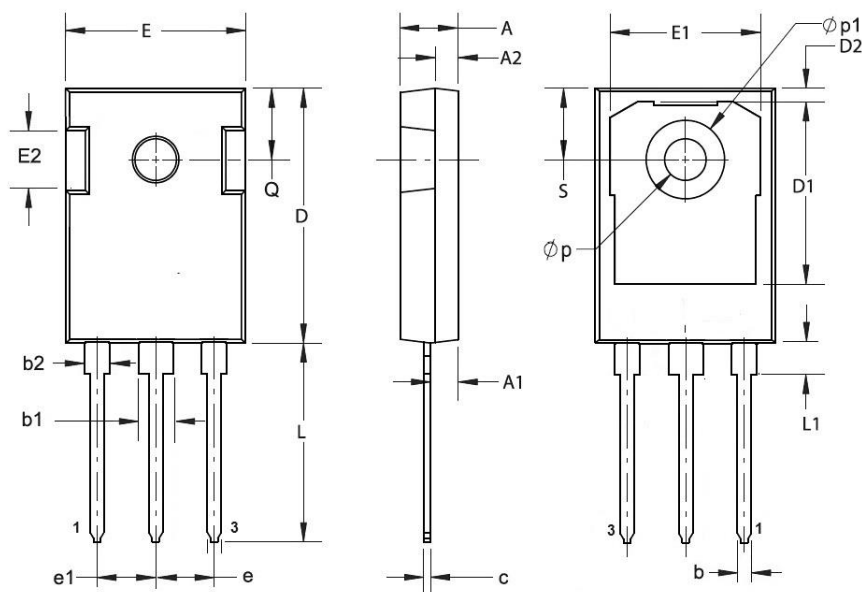
MAXIMUM RATINGS

Parameter		Symbol	Value	Unit
Drain-Source Voltage	$V_{GS}=0V$, $I_D=100\mu A$	V_{DS}	650	V
Gate-Source Voltage	Dynamic ($f > 1Hz$)	V_{GS}	-10/+25	V
	Static		-4/+18	
Drain Current – Continuous	$V_{GS}=20V$, $T_C=25^\circ C$	I_D	32	A
	$V_{GS}=20V$, $T_C=100^\circ C$		23	
Drain Current – Pulse with t_p Limited by T_{jmax}	at 1ms	I_{DM}	50	A
	at 100μs		94	
Power Dissipation		P_D	142	W
Thermal Resistance, Junction to Case		$R_{\theta JC}$	1.06	$^\circ C / W$
Operating Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 175	$^\circ C$

DIMENSIONS

DIMENSION	Min	Max
A	4.80	5.20
A1	2.21	2.59
A2	1.85	2.15
b	1.11	1.36
b1	2.91	3.21
b2	1.91	2.21
c	0.51	0.75
D	20.70	21.30
D1	16.25	16.85
e	5.44 BSC	
e1	5.44 BSC	
E	15.50	16.10
L	19.62	20.22
L1	--	4.30
p	3.40	3.80
p1	--	7.30
Q	6.15 BSC	

Note: Pin Layout: 1:Gate(G), 2:Drain(D), 3:Source(S)



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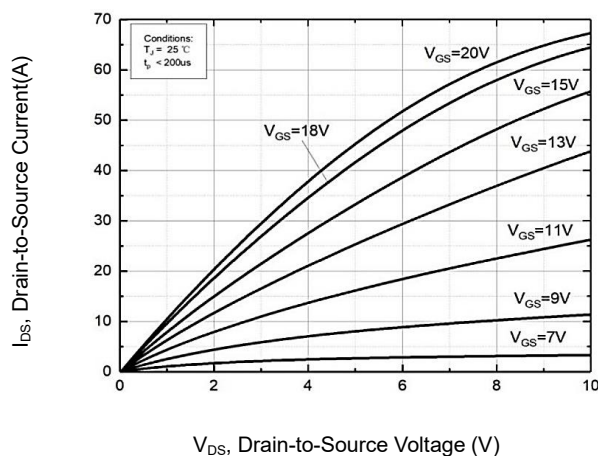
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ELECTRICAL CHARACTERISTICS

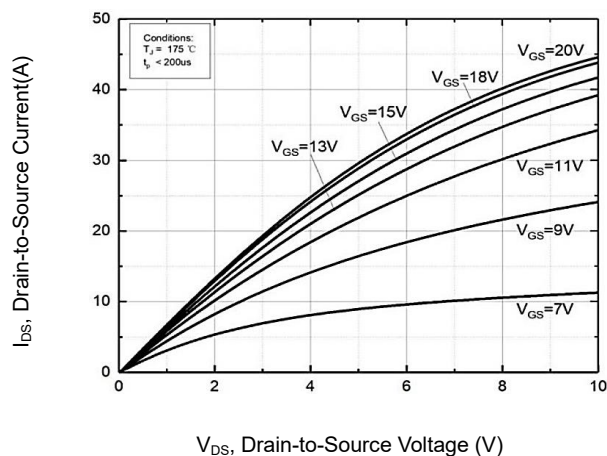
Off Characteristics	Conditions	Symbol	Min	Typ.	Max	Unit
Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=100\mu A$	BV_{DSS}	650	--	--	V
Zero Gate Voltage Drain Current	$V_{DS}=650V, V_{GS}=0V$	I_{DSS}	--	1	50	μA
Gate-Body Leakage Current	$V_{GS}=18V, V_{DS}=0V$	I_{GSS}	--	--	250	nA
On Characteristics	Conditions	Symbol	Min	Typ.	Max	Unit
Static Drain-Source On-Resistance	$V_{GS}=18V, I_D=10A$	$R_{DS(ON)}$	--	105	150	m Ω
	$V_{GS}=20V, I_D=10A$		--	94	--	
	$V_{GS}=18V, I_D=10A, T_J=175^\circ C$		--	140	--	
	$V_{GS}=20V, I_D=10A, T_J=175^\circ C$		--	130	--	
Gate Threshold Voltage	$V_{GS}=V_{DS}, I_D=5mA$	$V_{GS(th)}$	--	2.7	--	V
	$V_{GS}=V_{DS}, I_D=5mA, T_J=175^\circ C$		--	1.8	--	
Transconductance	$V_{GS}=18V, I_D=10A$	g_{FS}	--	13	--	S
	$V_{GS}=18V, I_D=10A, T_J=175^\circ C$		--	9	--	
Dynamic Characteristics	Conditions	Symbol	Min	Typ.	Max	Unit
Total Gate Charge	$V_{DS}=400V, I_D=10A, V_{GS}= -4/+18V$	Q_g	--	35.8	--	nC
Gate-Source Charge		Q_{gs}	--	8.3	--	
Gate-Drain Charge		Q_{gd}	--	12.1	--	
Turn-On Delay Time	$V_{DS}=400V, I_D=20A, L=293\mu H$ $V_{GS}= -4/+18V, R_{GEN}=2.4\Omega$	$T_{d(on)}$	--	2.6	--	nS
Rise Time		T_r	--	10	--	
Turn-Off Delay Time		$T_{d(off)}$	--	11	--	
Fall Time		T_f	--	5	--	
Turn-On Switching Loss		E_{ON}	--	16	--	μJ
Turn-Off Switching Loss		E_{OFF}	--	12	--	
Total Switching Loss		E_{TOT}	--	28	--	
Input Capacitance	$V_{DS}=600V, V_{GS}=0V, V_{AC}=25mV$ $f=1MHz$	C_{iss}	--	767	--	pF
Output Capacitance		C_{oss}	--	55	--	
Reverse Transfer Capacitance		C_{rss}	--	7	--	
Internal Gate Resistance	$V_{AC}=25mV, f=1MHz$	$R_{G(int)}$	--	2.8	--	Ω
Drain-Source Body Diode	Conditions	Symbol	Min	Typ.	Max	Unit
Diode Forward Current	$V_{GS}= -5V, T_C=25^\circ C$	I_S	--	28	--	A
Diode Forward Current - Pulse with tp Limited by Tjmax	$V_{GS}= -5V$	$I_{S,Pulse}$	--	50	--	A
Drain-Source Diode Forward Voltage	$V_{GS}= -5V, I_{SD}=7.5A$	V_{SD}	--	4.0	--	V
	$V_{GS}= -5V, I_{SD}=7.5A, T_J=175^\circ C$		--	3.5	--	
Peak Reverse Recovery Current	$V_{GS}= -5V, V_R=400V, I_{SD}=12A,$ $dif/dt=1050A/\mu s$	I_{rm}	--	6	--	A
Reverse Recovery Time		T_{rr}	--	14.2	--	nS
Reverse Recovery Charge		Q_{rr}	--	63	--	nC

CHARACTERISTIC CURVES

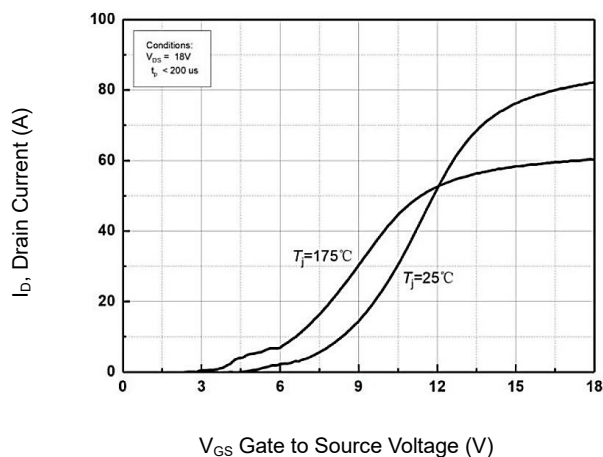
Output Characteristics



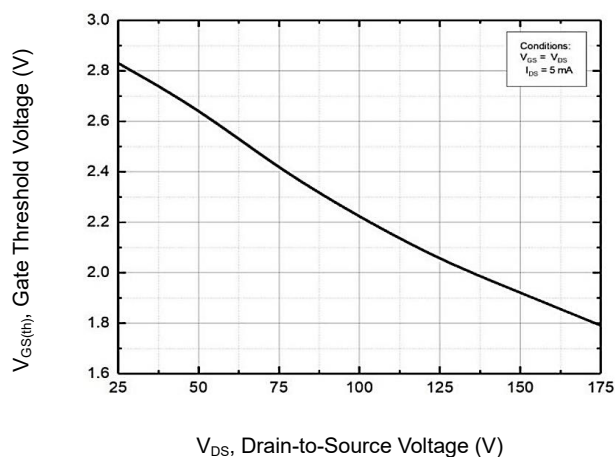
Output Characteristics



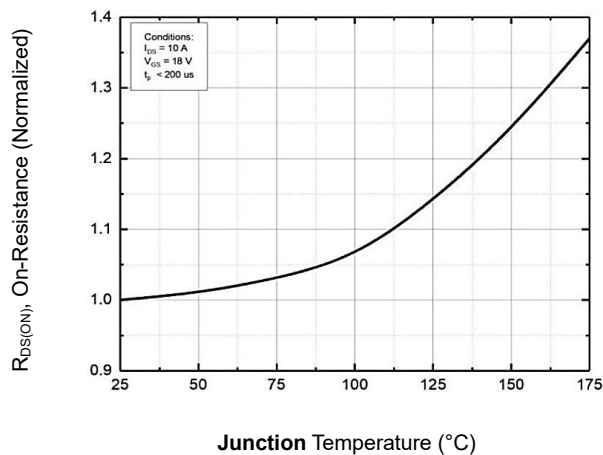
Transfer Characteristic



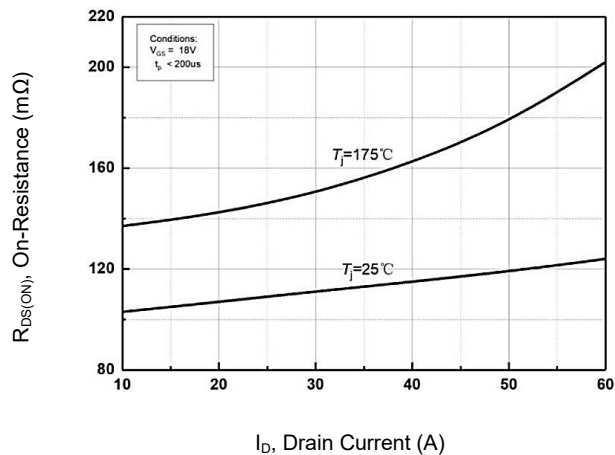
Threshold Voltage vs. Junction temperature



Normalized On-Resistance vs. Junction temperature



On-Resistance vs. Drain Current



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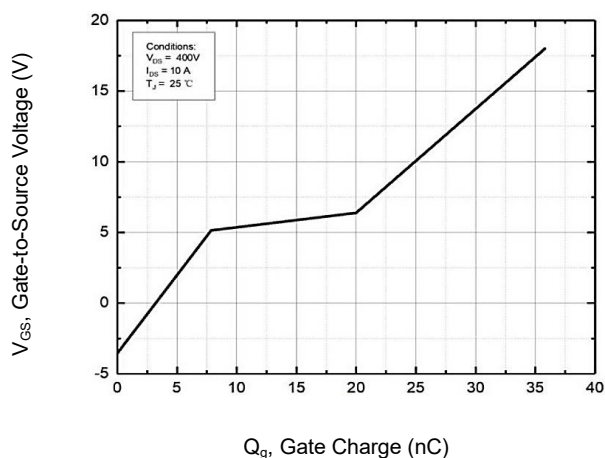
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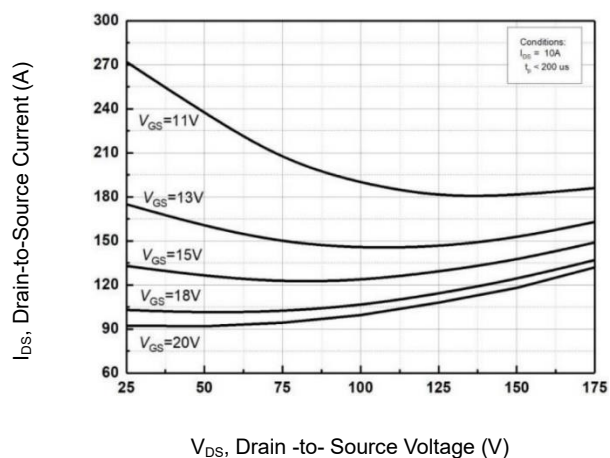
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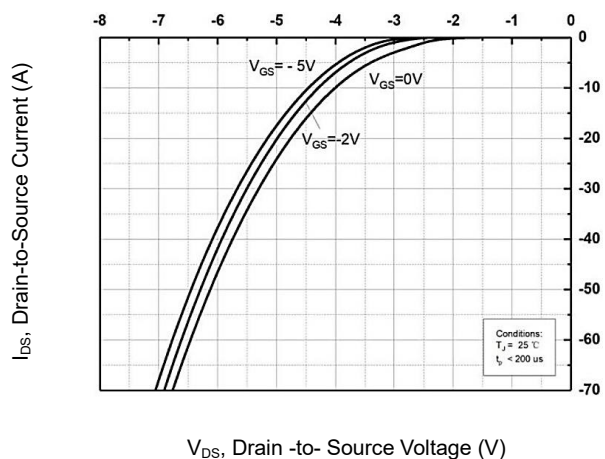
Gate-Charge Characteristics



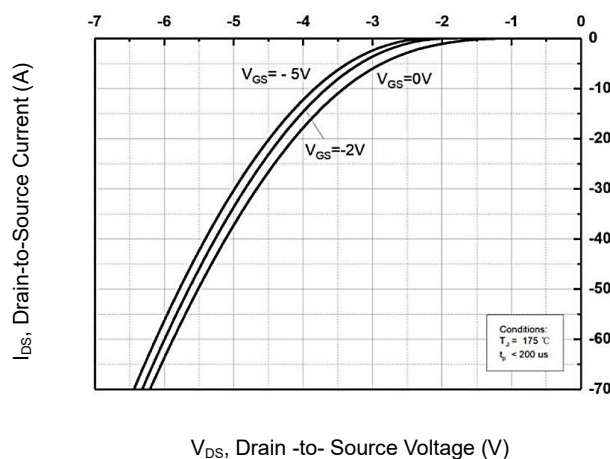
On-Resistance vs. Junction temperature for V_{GS}



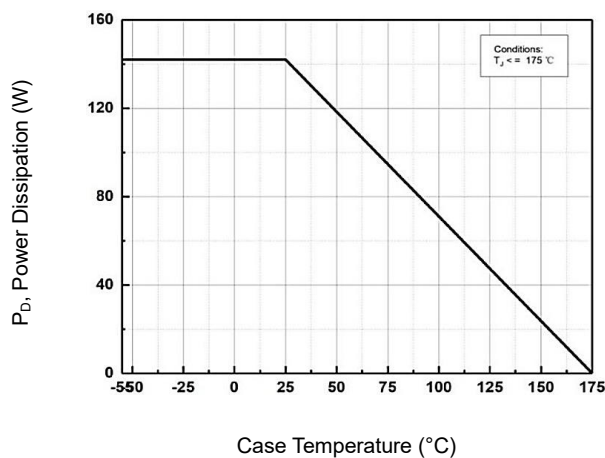
Body Diode Characteristics



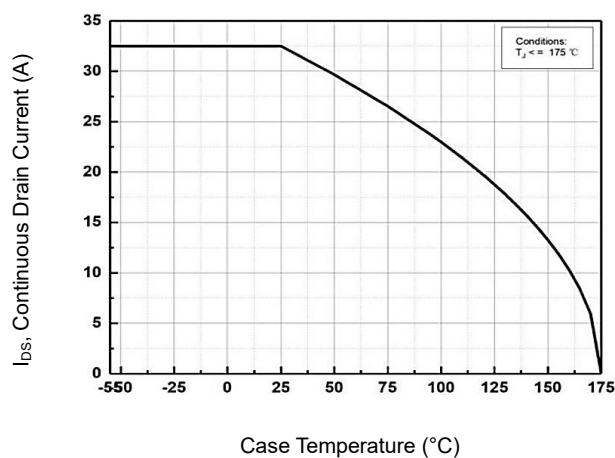
Body Diode Characteristics



Maximum Power Dissipation Derating

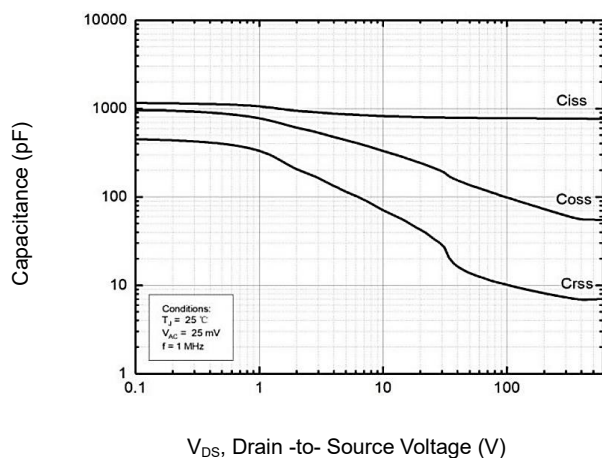


Continuous Drain Current vs. Case Temperature

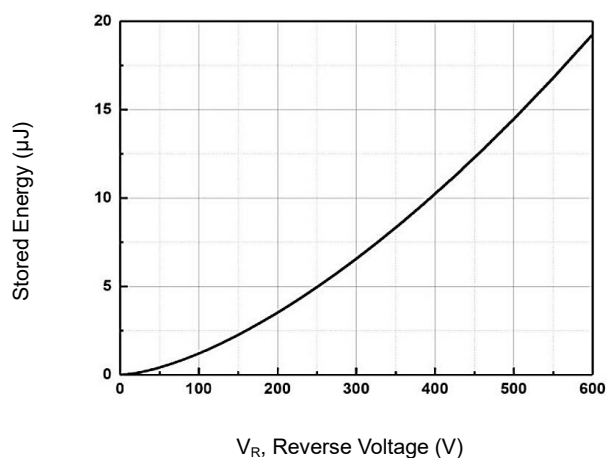


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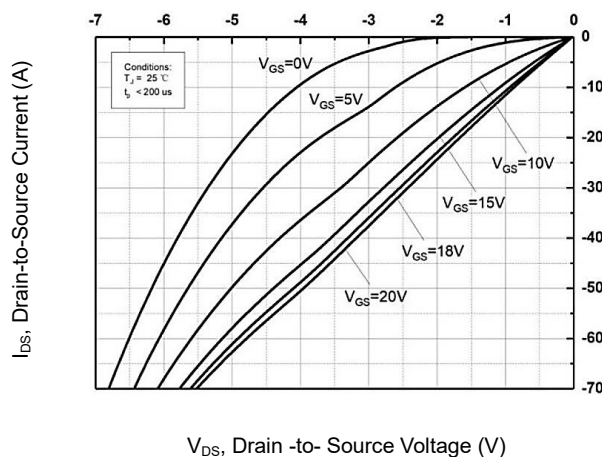
Capacitance vs. Drain-Source Voltage



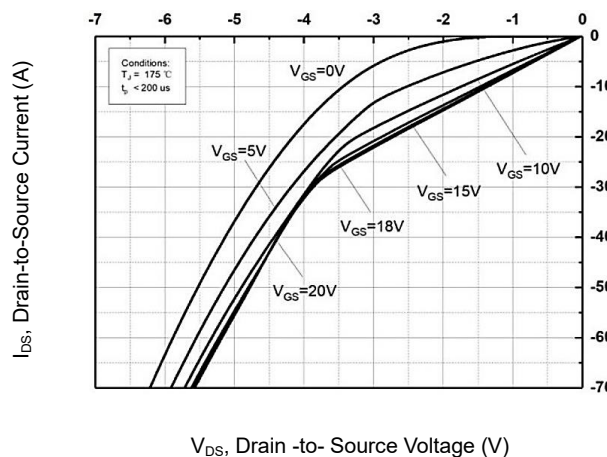
Output Capacitor Stored Energy



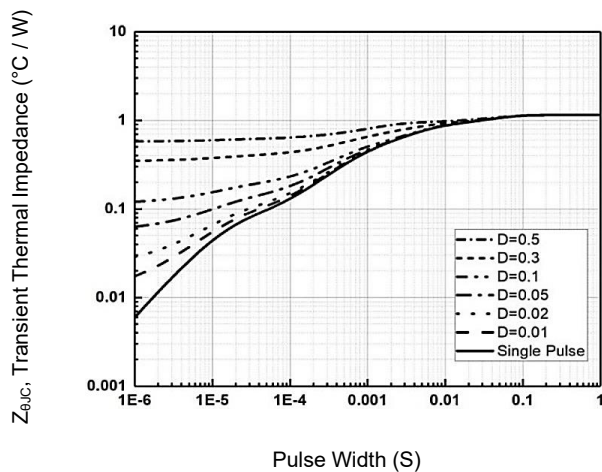
3rd Quadrant Characteristics



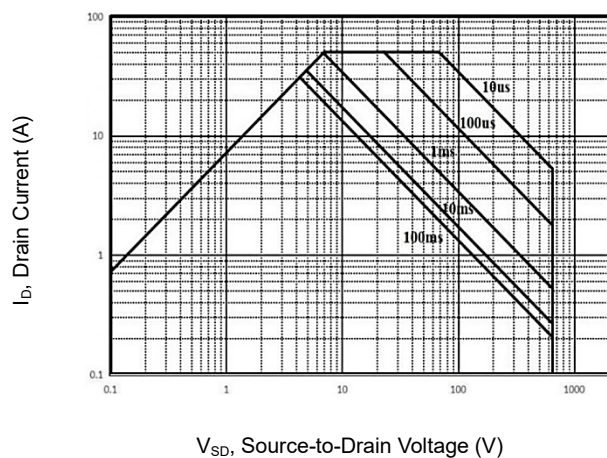
3rd Quadrant Characteristics



Transient Thermal Impedance

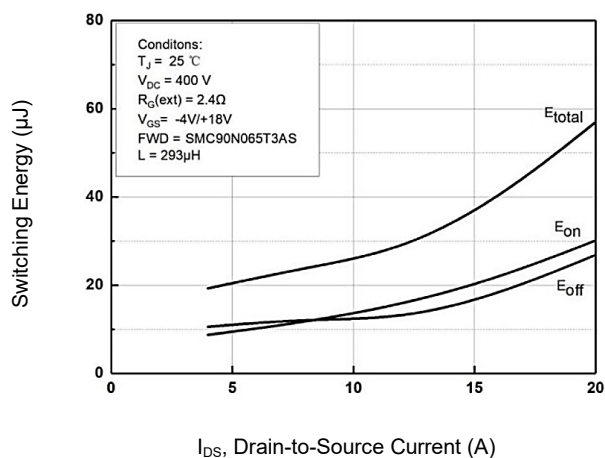


Safe Operating Area

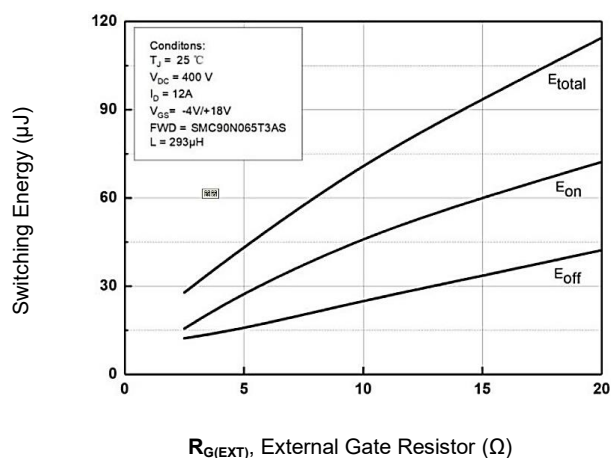


CHARACTERISTIC CURVES

Clamped Inductive Switching Energy vs Drain current



Clamped Inductive Switching Energy vs $R_{G(EXT)}$



Switching Time vs $R_{G(EXT)}$

