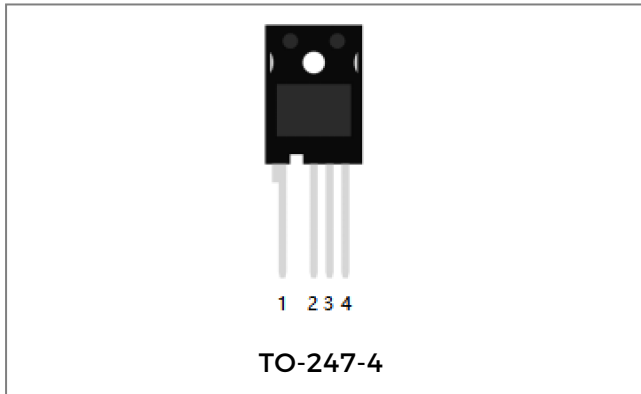


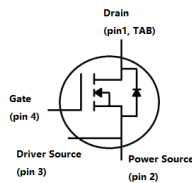
S4M0010075K Silicon Carbide Power MOSFET



Features

- Positive temperature characteristics, easy to parallel.
- Low on-resistance typ. $R_{DS(on)} = 10 \text{ m}\Omega$.
- Fast switching speed and low switching losses.
- Very fast and robust intrinsic body diode.
- Process of non-bright tin electroplatin.
- “-A” is an AEC-Q101 qualified device.

Circuit Diagram



Applications

- EV Fast Charging Modules
- EV On Board Chargers
- Solar Inverters
- Online UPS/Industrial UPS
- SMPS (Switch Mode Power Supplies)
- DC-DC Converters
- ESS (Energy Storage Systems)

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

Characteristics	Symbol	Conditions	Min.	Typ.	Max.	Units	Note
Drain - Source Voltage	V_{DSmax}	$V_{GS} = 0 \text{ V}$, $I_D = 100 \mu\text{A}$			750	V	
Gate - Source Voltage (dynamic)	V_{GSmax}	AC ($f > 1 \text{ Hz}$)	-8		+22	V	
Gate - Source Voltage (static)	V_{GSop}	Static		-4 / +18		V	[1]
Continuous Drain Current	I_D	$V_{GS} = 18 \text{ V}$, $T_c = 25^\circ\text{C}$			208	A	
		$V_{GS} = 18 \text{ V}$, $T_c = 100^\circ\text{C}$			147	A	
Pulsed Drain Current	$I_{D(pulse)}$	Pulse width t_p limited by T_{jmax}			419	A	
Power Dissipation	P_D	$T_c = 25^\circ\text{C}$			789	W	

[1] Recommended turn off gate voltage is -4 V. Recommended turn on gate voltage is 18 V. Do not use with $V_{GSON} < 12 \text{ V}$.

Electrical Characteristics:

Characteristics	Symbol	Conditions	Min.	Typ.	Max.	Units
Drain Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 100\text{ }\mu\text{A}$	750			V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 30\text{ mA}$	2	2.3	4	V
		$V_{DS} = V_{GS}, I_D = 40\text{ mA}$	2	2.4	4	V
		$V_{DS} = V_{GS}, I_D = 50\text{ mA}$	2	2.5	4	V
		$V_{DS} = V_{GS}, I_D = 30\text{ mA}, T_J = 175\text{ }^\circ\text{C}$		1.55		V
		$V_{DS} = V_{GS}, I_D = 40\text{ mA}, T_J = 175\text{ }^\circ\text{C}$		1.6		V
		$V_{DS} = V_{GS}, I_D = 50\text{ mA}, T_J = 175\text{ }^\circ\text{C}$		1.65		V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 750\text{ V}, V_{GS} = 0\text{ V}$			100	μA
Gate Source Leakage Current	I_{GSS}	$V_{GS} = 18\text{ V}, V_{DS} = 0\text{ V}$			250	nA
Drain Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 18\text{ V}, I_D = 100\text{ A}$		10	12	m Ω
		$V_{GS} = 18\text{ V}, I_D = 100\text{ A}, T_J = 175\text{ }^\circ\text{C}$		11.7		m Ω
Transconductance	gfs	$V_{DS} = 20\text{ V}, I_{DS} = 100\text{ A}$		26		S
		$V_{DS} = 20\text{ V}, I_{DS} = 100\text{ A}, T_J = 175\text{ }^\circ\text{C}$		28		S
Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}$		5150		pF
Output Capacitance	C_{OSS}	$V_{DS} = 750\text{ V}$		432		
Reverse Transfer Capacitance	C_{RSS}	$V_{AC} = 25\text{ mV}$		9		
COSS Stored Energy	E_{OSS}	$f = 1\text{ MHz}$		137		
Turn-On Switching Energy	E_{ON}	$V_{DS} = 500\text{ V}, V_{GS} = -4 / 18\text{ V}$		300		μJ
Turn-Off Switching Energy	E_{OFF}	$I_D = 100\text{ A}, R_{G(ext)} = 2.5\text{ }\Omega, L = 99\text{ }\mu\text{H}$		355		
Turn-On Delay Time	$t_{d(on)}$	$V_{DS} = 500\text{ V}, V_{GS} = -4 / 18\text{ V}$		15		ns
Rise Time	t_r	$I_D = 100\text{ A}, R_{G(ext)} = 2.5\text{ }\Omega$		25		
Turn-Off Delay Time	$t_{d(off)}$	Inductive Load Timing relative to		43		
Fall Time	t_f	v_{DS} Per IEC60747-8-4 pg 83		10		
Internal Gate Resistance	$R_{G(int)}$	$f = 1\text{ MHz}, AC = 25\text{ mV}$		1.85		Ω
Gate to Source Charge	Q_{gs}	$V_{DS} = 500\text{ V}, V_{GS} = -4 / 18\text{ V}$		8		nC
Gate to Drain Charge	Q_{gd}	$I_D = 100\text{ A}$		117		
Total Gate Charge	Q_g	Per IEC60747-8-4 pg 21		132		

Reverse Diode Characteristics ($T_A = 25^\circ\text{C}$, unless otherwise specified)

Characteristics	Symbol	Conditions	Typ.	Max.	Units
Diode Forward Voltage	V_{SD}	$V_{GS} = -4\text{ V}$, $I_{SD} = 50\text{ A}$	3.7		V
	V_{SD}	$V_{GS} = -4\text{ V}$, $I_{SD} = 50\text{ A}$, $T_J = 175^\circ\text{C}$	3.1		V
Reverse Recovery Time	t_{rr}	$V_{GS} = -4\text{ V}$, $I_{SD} = 100\text{ A}$, $T_J = 25^\circ\text{C}$ $V_R = 500\text{ V}$ $di/dt = 2000\text{ A}/\mu\text{s}$	25		ns
Reverse Recovery Charge	Q_{rr}		545		nC
Peak Reverse Recovery Current	I_{rm}		35		A

Thermal-Mechanical Specifications

Characteristics	Symbol	Condition	Specification	Units
Junction Temperature	T_J	-	-55 to +175	$^\circ\text{C}$
Storage Temperature	T_{stg}	-	-55 to +175	$^\circ\text{C}$
Typical Thermal Resistance Junction to Case	$R_{\theta JC}$		0.19	$^\circ\text{C}/\text{W}$

Ordering Information

Device	Package	Shipping
S4M0010075K	TO-247-4	30 pcs/tube

Marking Diagram



Where XXXXX is YYWWL

S4M = Device Type
 0010 = RDS(on)
 075 = Reverse Voltage (750V)
 K = Package
 SSG = SSG
 YY = Year
 WW = Week
 L = Lot Number

Cautions: Molding resin
 Epoxy resin UL94V-0

Ratings and Characteristics Curves

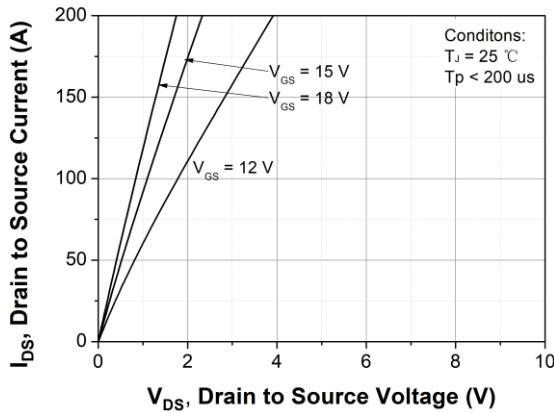


Figure 1. Output Characteristics $T_J = 25^\circ\text{C}$

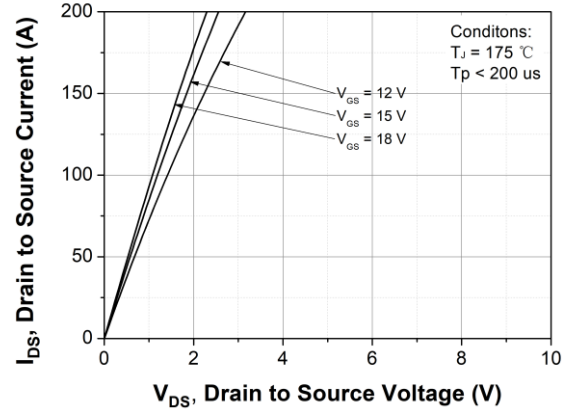


Figure 2. Output Characteristics $T_J = 175^\circ\text{C}$

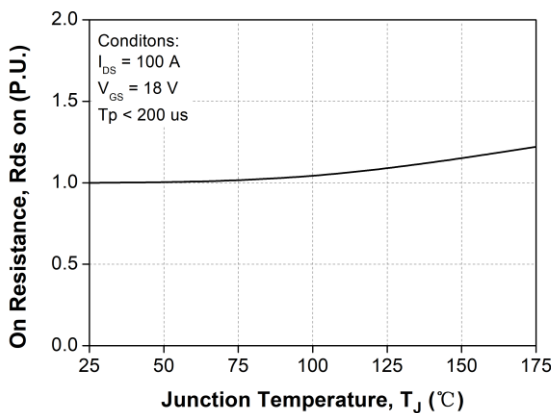


Figure 3. Normalized On-Resistance vs. Temperature

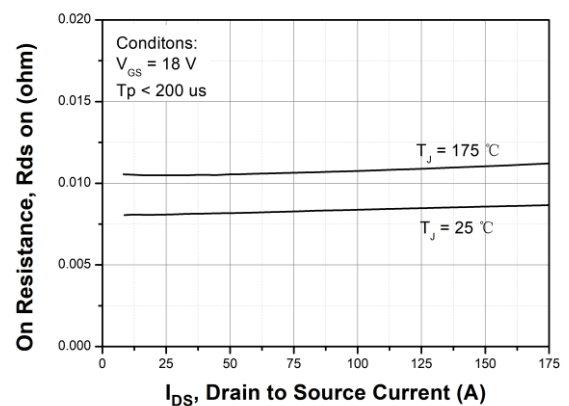


Figure 4. On-Resistance vs. Drain Current For Various Temperatures

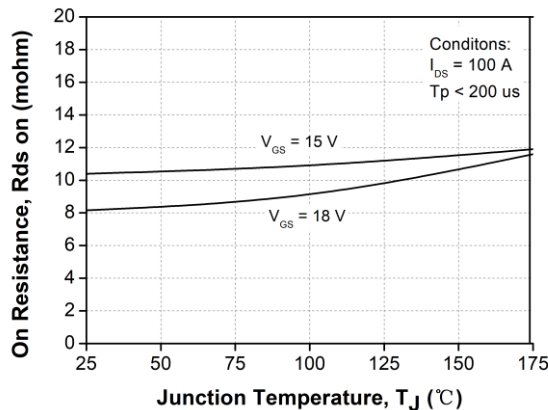


Figure 5. On-Resistance vs. Temperature For Various Gate Voltage

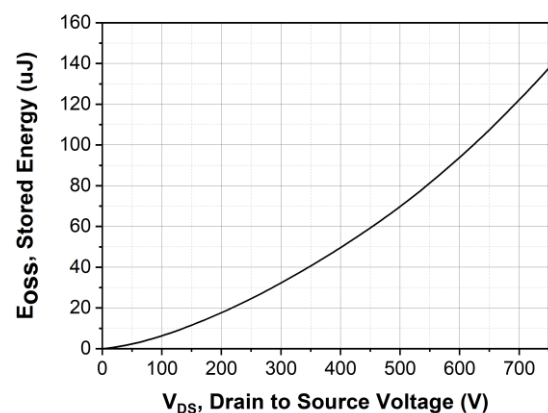


Figure 6. Output Capacitor Stored Energy

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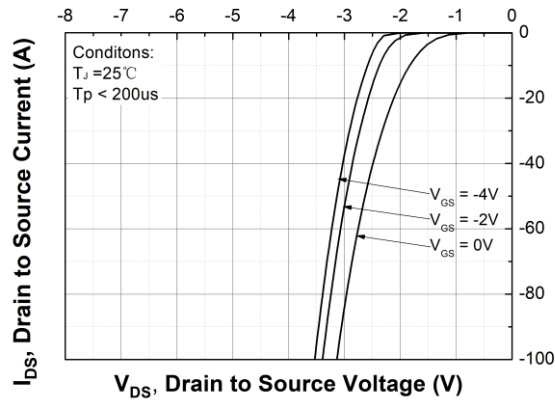


Figure 7. Body Diode Characteristic at $T_J = 25\text{ }^{\circ}\text{C}$

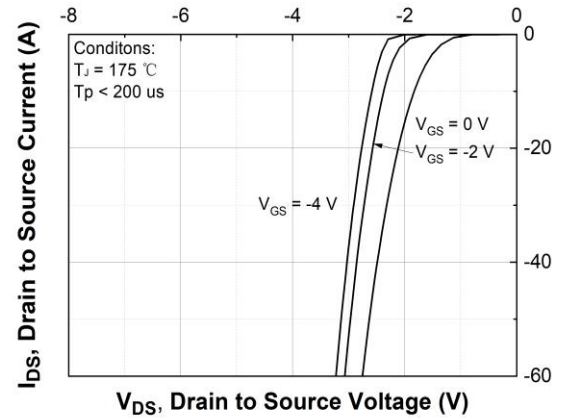


Figure 8. Body Diode Characteristic at $T_J = 175\text{ }^{\circ}\text{C}$

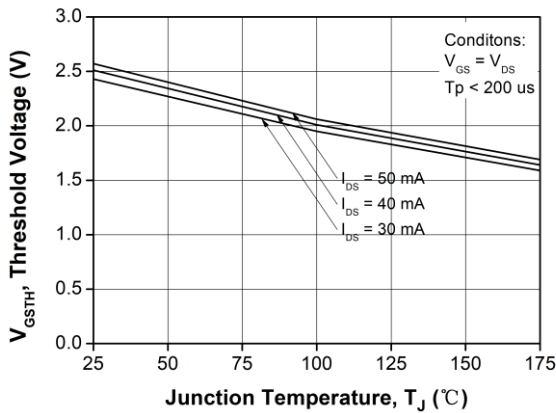


Figure 9. Threshold Voltage vs. Temperature

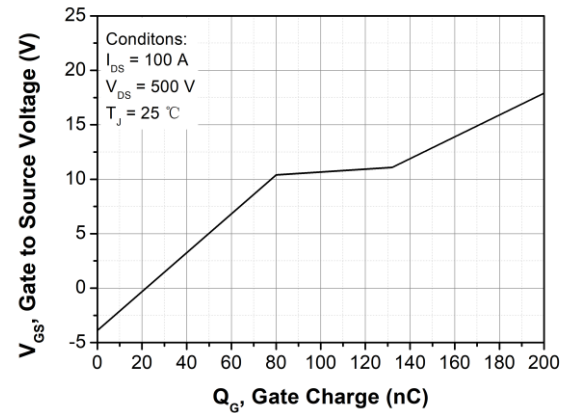


Figure 10. Gate Charge Characteristic

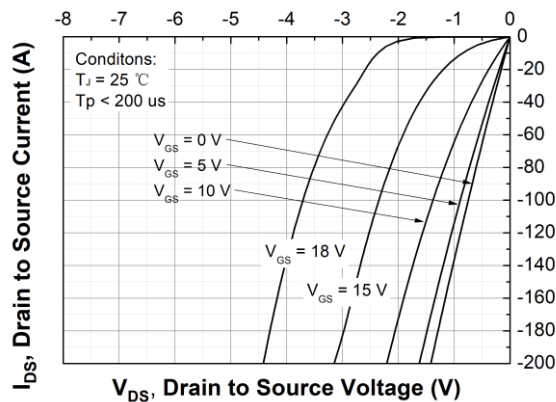


Figure 11. 3rd Quadrant Characteristic at $T_J = 25\text{ }^{\circ}\text{C}$

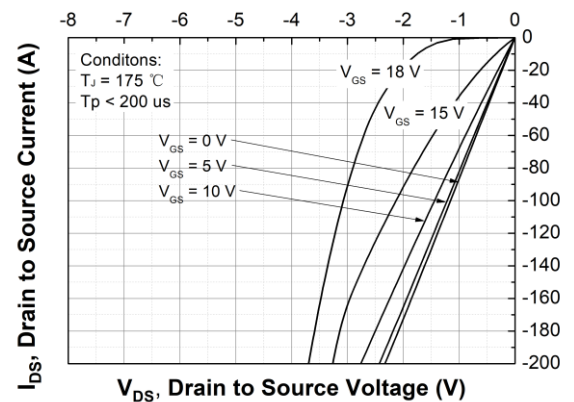


Figure 12. 3rd Quadrant Characteristic at $T_J = 175\text{ }^{\circ}\text{C}$

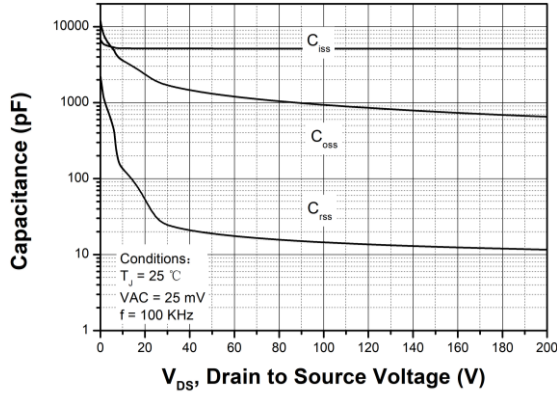


Figure 13. Capacitances vs. Drain-Source

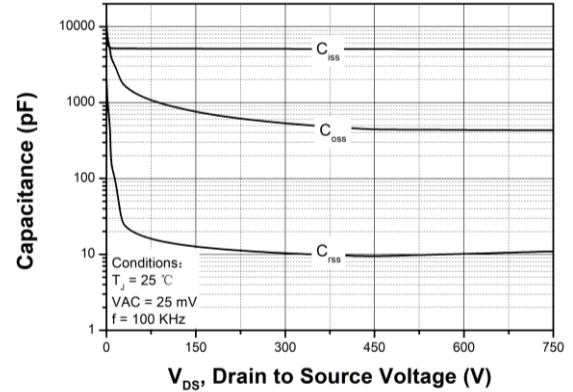


Figure 14. Capacitances vs. Drain-Source

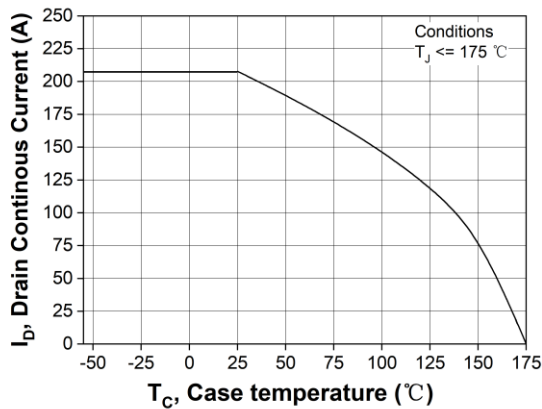


Figure 15. Continuous Drain Current Derating vs. Case Temperature

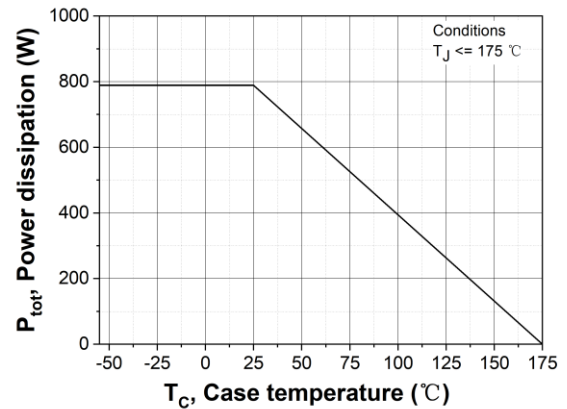


Figure 16. Maximum Power Dissipation Derating vs. Case Temperature

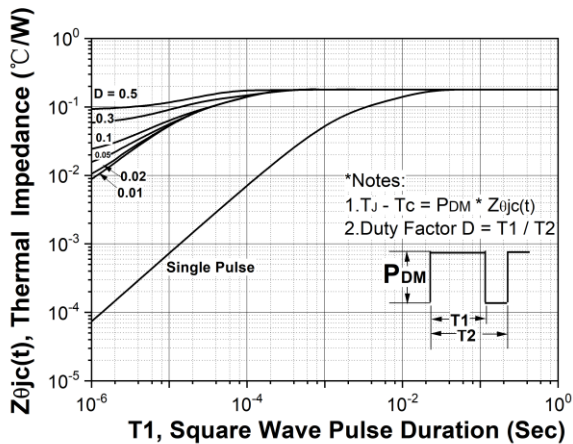


Figure 17. Transient Thermal Impedance (Junction - Case)

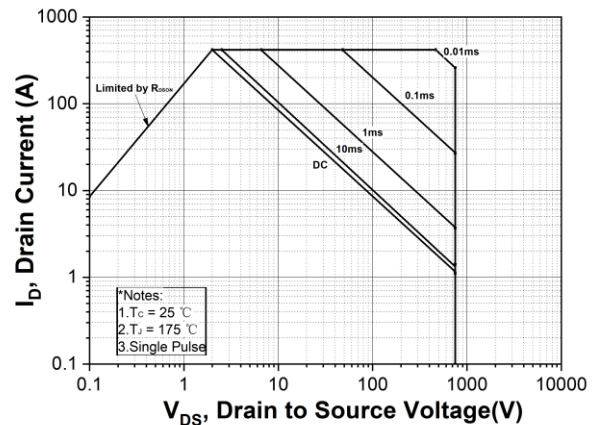


Figure 18. Safe Operating Area

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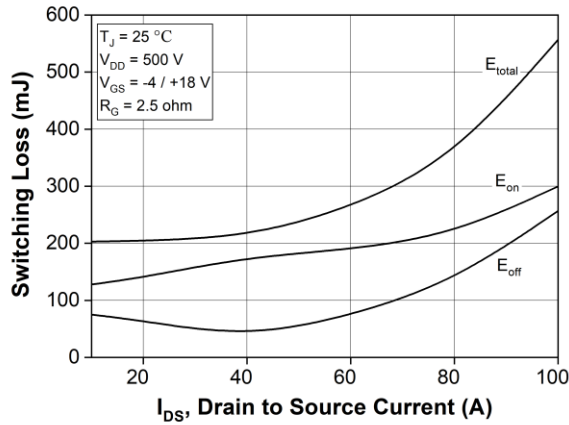


Figure 19. Clamped Inductive Switching Energy vs. Drain Current ($V_{DD} = 500V$)

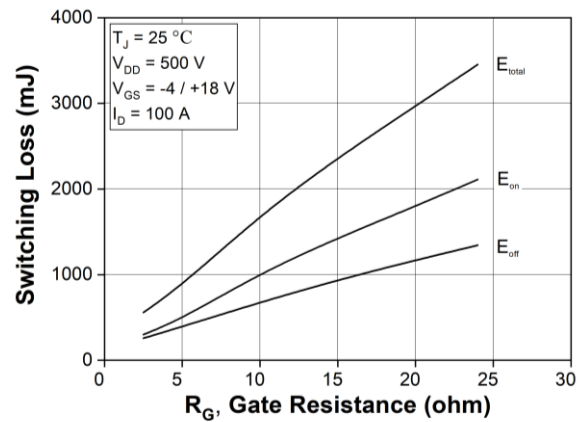


Figure 20. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

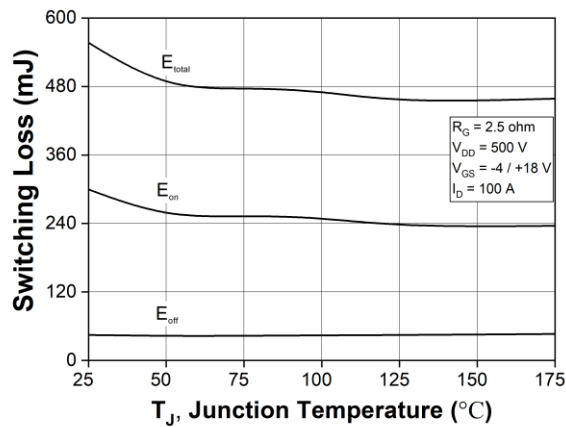


Figure 21. Clamped Inductive Switching Energy vs. Temperature

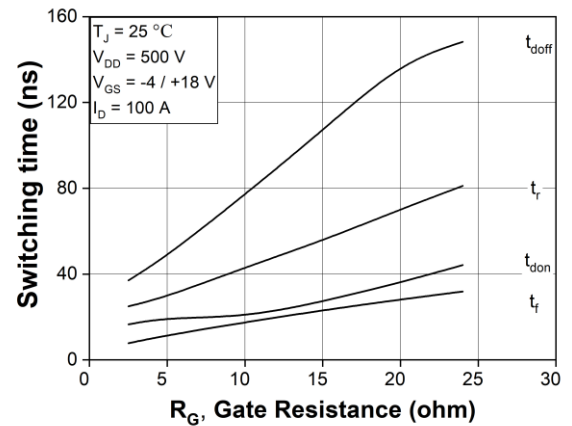
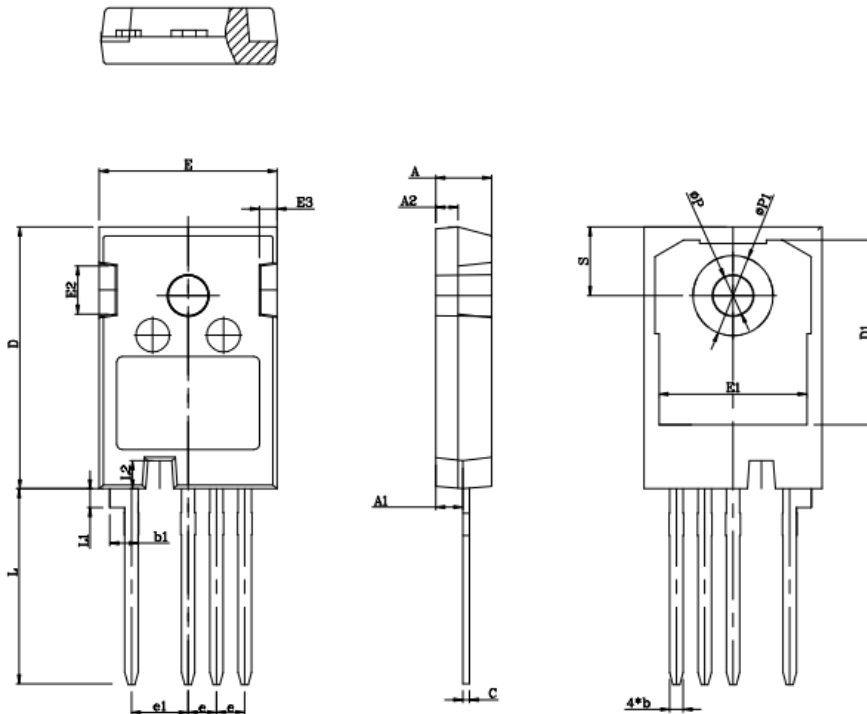


Figure 22. Switching Times vs. $R_{G(ext)}$

Mechanical Dimensions TO-247-4



SYMBOL	mm		
	Min	Nom	Max
A	4.80	5.00	5.20
A1	2.23	2.41	2.59
A2	1.85	2.00	2.15
b	1.11	1.21	1.36
b1	2.35	2.55	2.75
c	0.51	0.61	0.75
D	23.30	23.45	23.60
D1	16.25	16.55	16.85
E	15.75	15.94	16.10
E1	13.00	13.26	13.43
E2	4.00	4.30	4.60
E3	1.15	1.45	1.75
e	2.54BSC		
e1	5.08BSC		
L	17.31	17.47	17.82
L1	1.50	1.70	1.90
ØP	3.51	3.60	3.65
ØP1	7.08	7.19	7.30
S	6.15BSC		

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