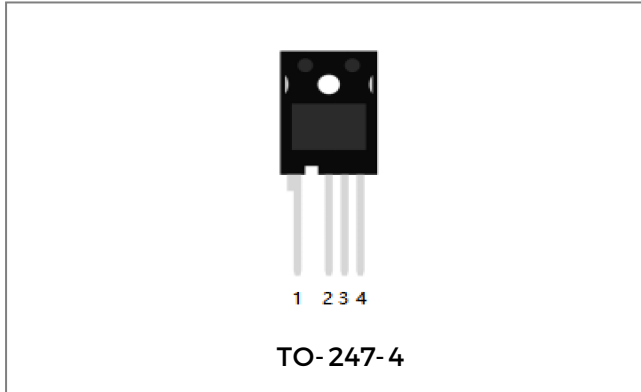


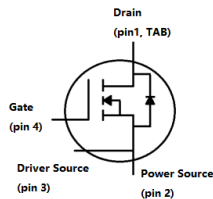
S4M0055150K Silicon Carbide Power MOSFET



Features

- Positive temperature characteristics, easy to parallel.
- Low on-resistance typ. $R_{DS(on)} = 55 \text{ m}\Omega$.
- Fast switching speed and low switching losses.
- Very fast and robust intrinsic body diode.
- Process of non-bright tin electroplating.
- “-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}	$V_{GS} = 0 \text{ V}$, $I_D = 100 \mu\text{A}$			1500	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	$V_{GS} = 18 \text{ V}$, $T_C = 25^\circ\text{C}$ $V_{GS} = 18 \text{ V}$, $T_C = 100^\circ\text{C}$			43 30	A	
Pulsed Drain Current	$I_{D(pulse)}$	Pulse width t_p limited by T_{jmax}			105	A	
Power Dissipation	P_D	$T_C = 25^\circ\text{C}$			276	W	

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

Electrical Characteristics:

Characteristics	Symbol	Conditions	Min.	Typ.	Max.	Units
Drain Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 100\text{ }\mu\text{A}$	1500			V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 7.2\text{ mA}$	2	2.8	4	V
		$V_{DS} = V_{GS}, I_D = 7.2\text{ mA}, T_J = 175\text{ }^\circ\text{C}$		1.9		V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 1500\text{ V}, V_{GS} = 0\text{ V}$		1	100	μA
Gate Source Leakage Current	I_{GSS}	$V_{GS} = 18\text{ V}, V_{DS} = 0\text{ V}$		10	250	nA
Drain Source On- State Resistance	$R_{DS(on)}$	$V_{GS} = 18\text{ V}, I_D = 21.6\text{ A}$	38	55	72	m Ω
		$V_{GS} = 18\text{ V}, I_D = 21.6\text{ A}, T_J = 175\text{ }^\circ\text{C}$		97		m Ω
Transconductance	g_{fs}	$V_{DS} = 20\text{ V}, I_{DS} = 21.6\text{ A}$		21		S
		$V_{DS} = 20\text{ V}, I_{DS} = 21.6\text{ A}, T_J = 175\text{ }^\circ\text{C}$		12		S
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}$		1300		pF
Output Capacitance	C_{oss}	$V_{DS} = 1500\text{ V}$		62		
Reverse Transfer Capacitance	C_{rss}	$V_{AC} = 25\text{ mV}$		1.4		
COSS Stored Energy	E_{oss}	$f = 100\text{ kHz}$		77		μJ
Turn-On Switching Energy	E_{ON}	$V_{DS} = 1000\text{ V}, V_{GS} = -4 / 18\text{ V}$		123		μJ
Turn-Off Switching Energy	E_{OFF}	$I_D = 21.6\text{ A}, R_{G(ext)} = 2.5\text{ }\Omega, L = 99\text{ }\mu\text{H}$		54		
Turn-On Delay Time	$t_{d(on)}$	$V_{DS} = 1000\text{ V}, V_{GS} = -4 / 18\text{ V}$		7.3		ns
Rise Time	t_r	$I_D = 21.6\text{ A}, R_{G(ext)} = 2.5\text{ }\Omega$		8		
Turn-Off Delay Time	$t_{d(off)}$	Inductive Load Timing relative to		15		
Fall Time	t_f	V_{DS} Per IEC60747-8-4 pg 83		11		
Internal Gate Resistance	$R_{G(int)}$	$f = 1\text{ MHz}, AC = 25\text{ mV}$		2		Ω
Gate to Source Charge	Q_{gs}	$V_{DS} = 1000\text{ V}, V_{GS} = -4 / 18\text{ V}$		13		nC
Gate to Drain Charge	Q_{gd}	$I_D = 21.6\text{ A}$		11		
Total Gate Charge	Q_g	Per IEC60747-8-4 pg 21		52		

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

Characteristics	Symbol	Conditions	Typ.	Max.	Units
Diode Forward Voltage	V_{SD}	$V_{GS} = -4\text{ V}$, $I_{SD} = 10.8\text{ A}$	3.6		V
	V_{SD}	$V_{GS} = -4\text{ V}$, $I_{SD} = 10.8\text{ A}$, $T_J = 175^\circ\text{C}$	3.2		V
Reverse Recovery Time	t_{rr}	$V_{GS} = -4\text{ V}$, $I_{SD} = 21.6\text{ A}$, $T_J = 25^\circ\text{C}$	13		ns
Reverse Recovery Charge	Q_{rr}	$V_R = 1000\text{ V}$	220		nC
Peak Reverse Recovery Current	I_{RRM}	$di/dt = 2000\text{ A}/\mu\text{s}$	19		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	$R_{\theta JC}$	DC operation	0.54	$^\circ\text{C}/\text{W}$

Ordering Information

Device	Package	Shipping
S4M0055150K	TO-247-4	30 pcs/ tube

Marking Diagram



Where XXXXX is YYWWL

S4M = Device Type
 0055 = RDS(on)
 150 = Reverse Voltage (1500V)
 K = Package
 SSG = SSG
 YY = Year
 WW = Week
 L = Lot Number

Cautions: Molding resin
 Epoxy resin UL:94V-0

Ratings and Characteristics Curves

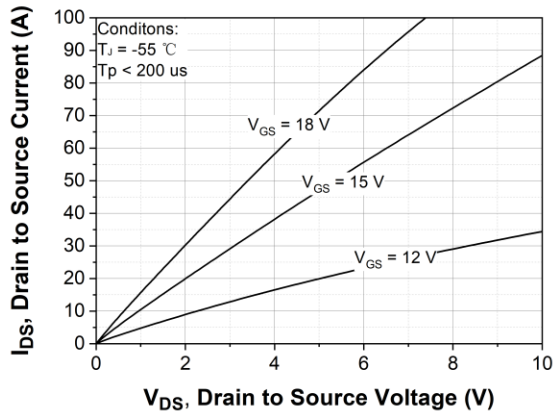


Figure 1. Output Characteristics $T_J = -55^\circ\text{C}$

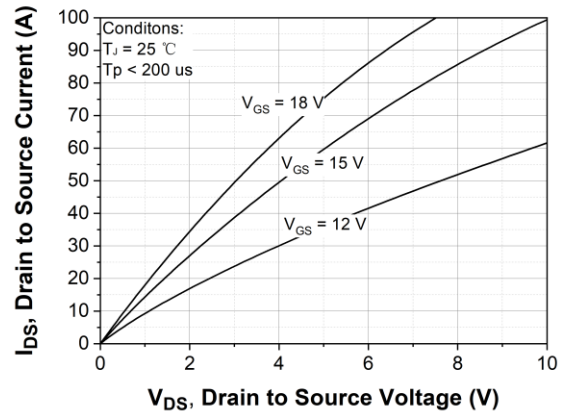


Figure 2. Output Characteristics $T_J = 25^\circ\text{C}$

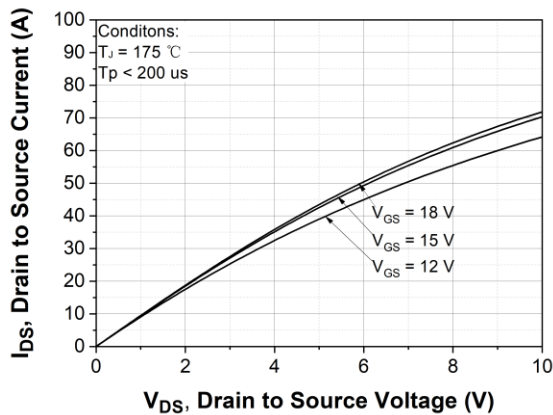


Figure 3. Output Characteristics $T_J = 175^\circ\text{C}$

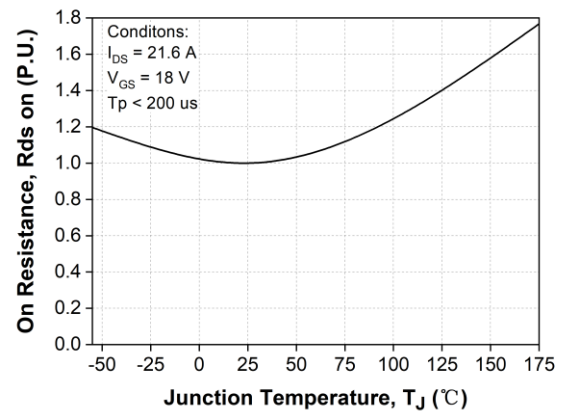


Figure 4. Normalized On-Resistance vs. Temperature

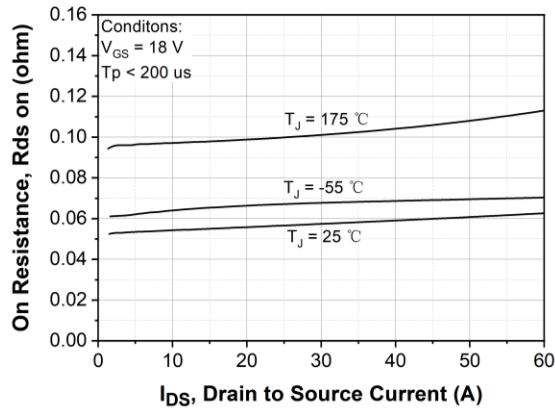


Figure 5. On-Resistance vs. Drain Current For Various Temperatures

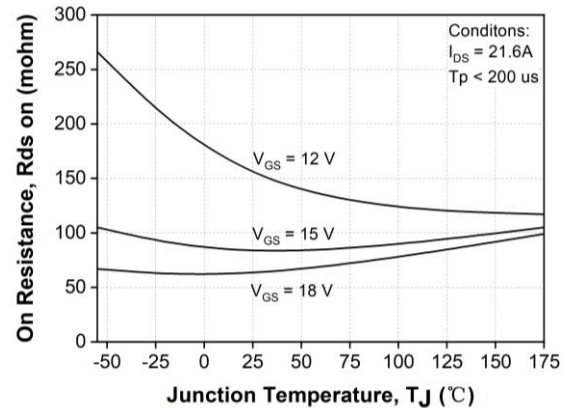


Figure 6. On-Resistance vs. Temperature For Various Gate Voltage

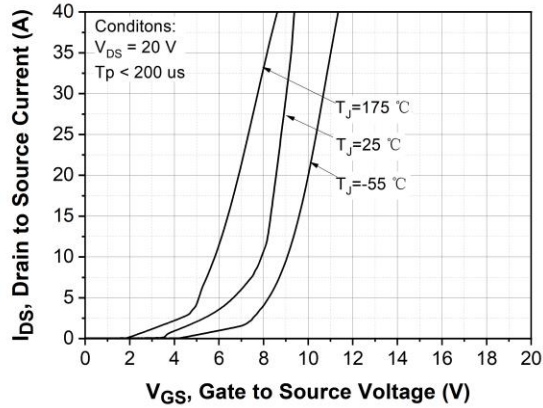


Figure 7. Transfer Characteristic for Various Junction Temperatures

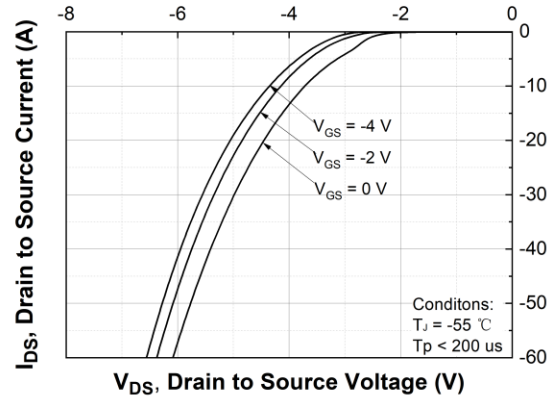


Figure 8. Body Diode Characteristic at $T_J = -55\text{ }^{\circ}\text{C}$

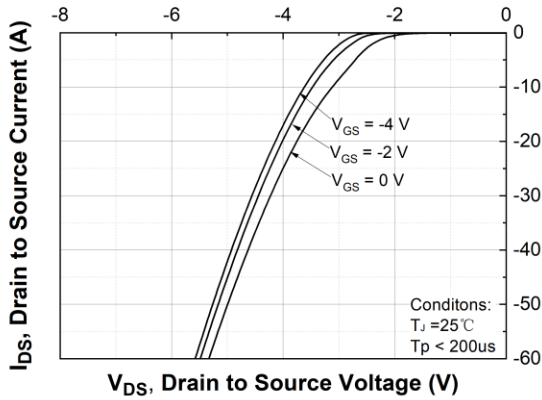


Figure 9. Body Diode Characteristic at $T_J = 25\text{ }^{\circ}\text{C}$

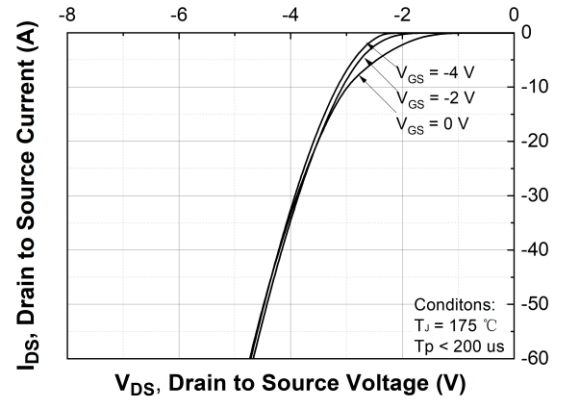


Figure 10. Body Diode Characteristic at $T_J = 175\text{ }^{\circ}\text{C}$

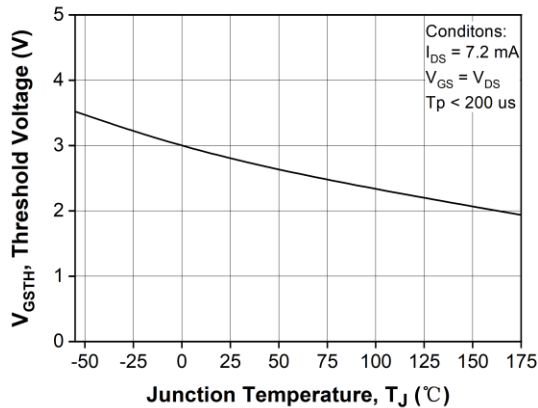


Figure 11. Threshold Voltage vs. Temperature

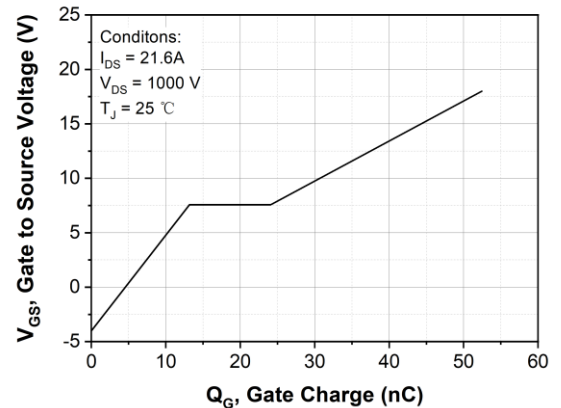


Figure 12. Gate Charge Characteristic

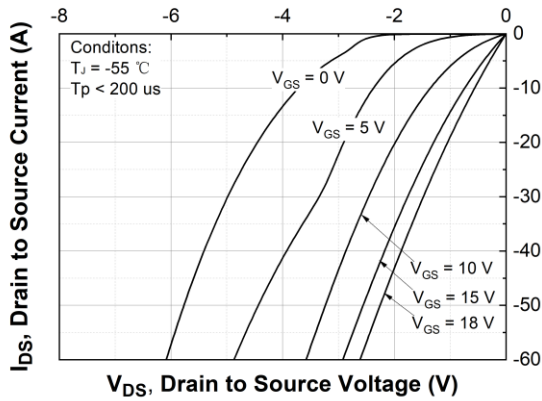


Figure 13. 3rd Quadrant Characteristic at $T_J = -55\text{ }^{\circ}\text{C}$

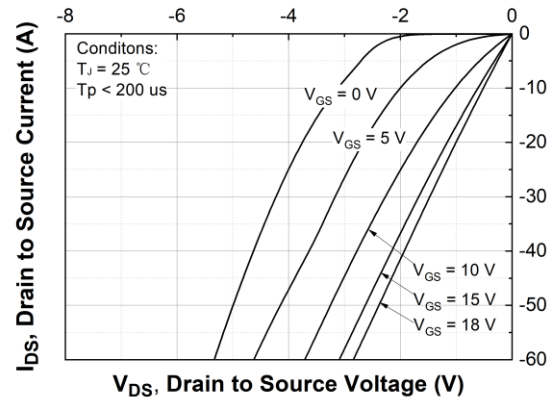


Figure 14. 3rd Quadrant Characteristic at $T_J = 25\text{ }^{\circ}\text{C}$

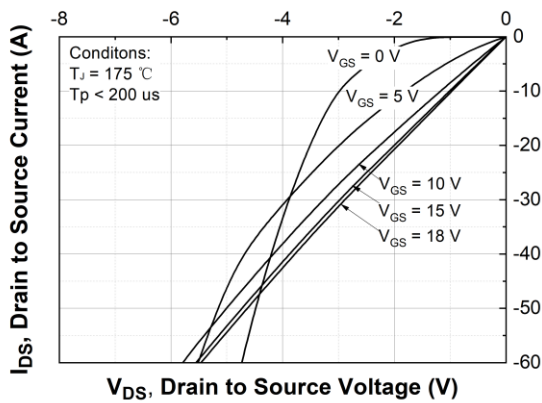


Figure 15. 3rd Quadrant Characteristic at $T_J = 175\text{ }^{\circ}\text{C}$

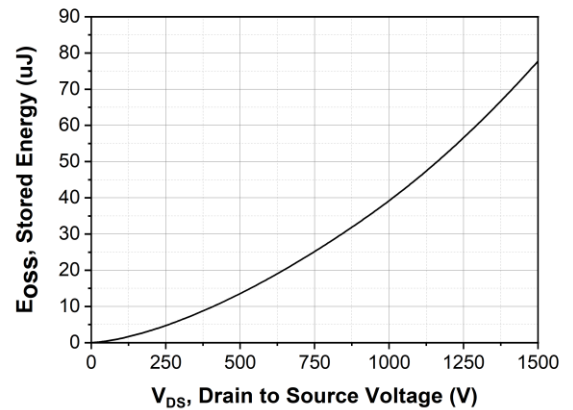


Figure 16. Output Capacitor Stored Energy

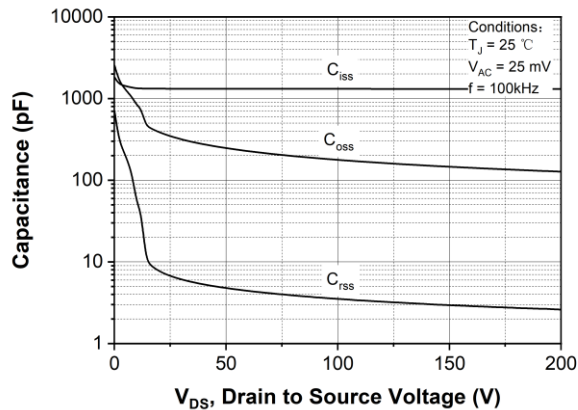


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200 V)

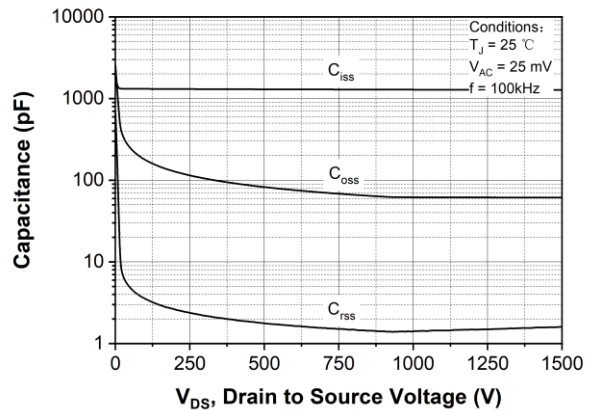


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 1500 V)

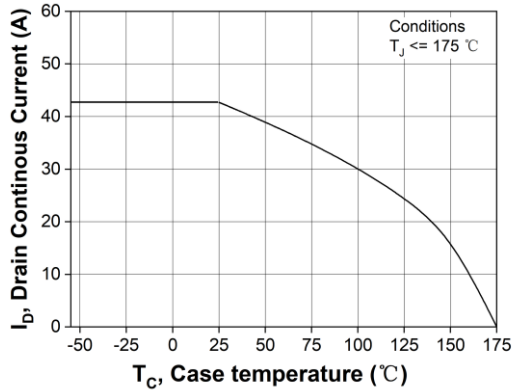


Figure 19. Continuous Drain Current Derating vs. Case Temperature

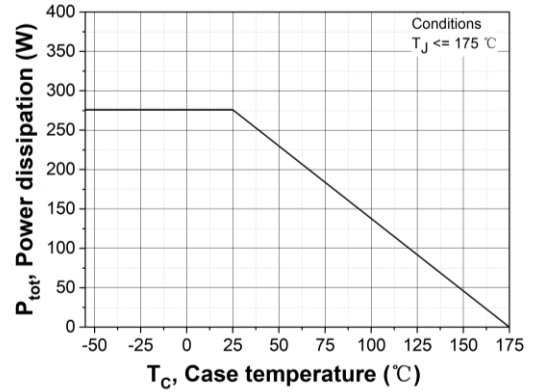


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

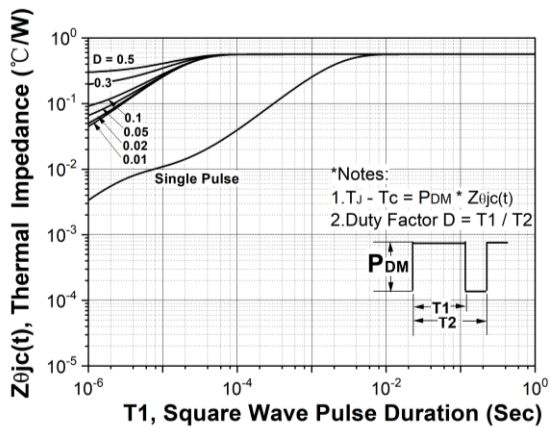


Figure 21. Transient Thermal Impedance (Junction - Case)

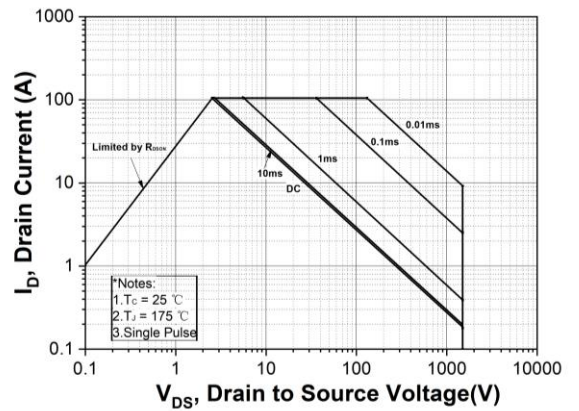


Figure 22. Safe Operating Area

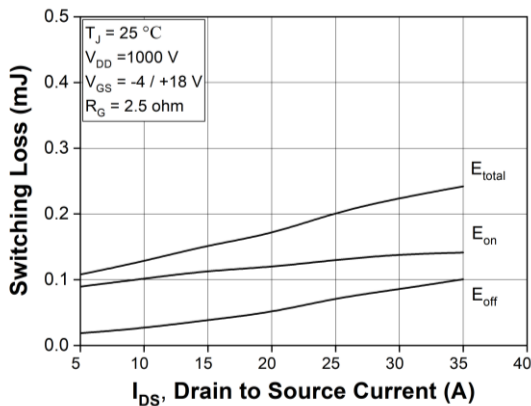


Figure 23. Clamped Inductive Switching Energy vs. Drain Current ($V_{DD} = 1000V$)

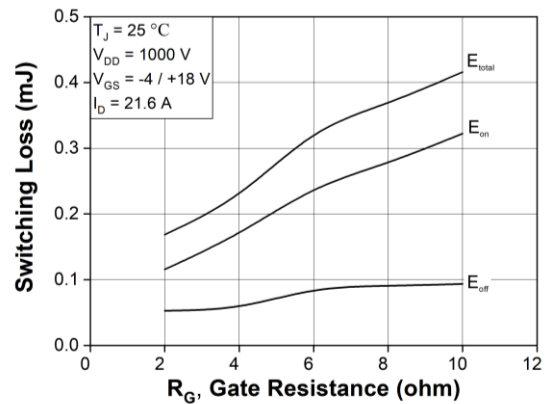


Figure 24. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

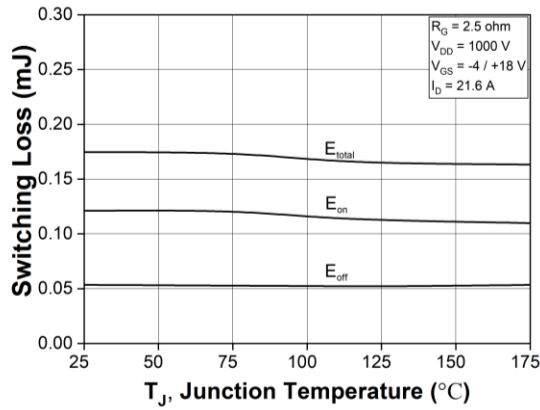


Figure 25. Clamped Inductive Switching Energy vs. Temperature

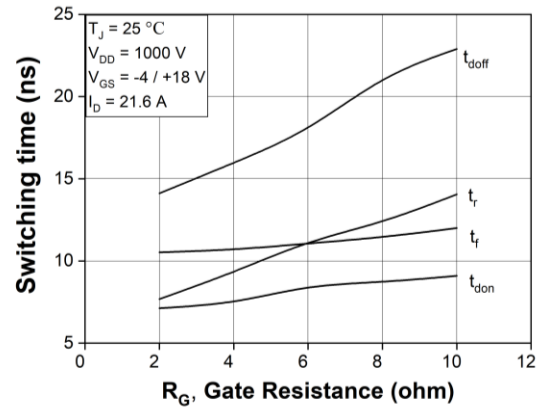
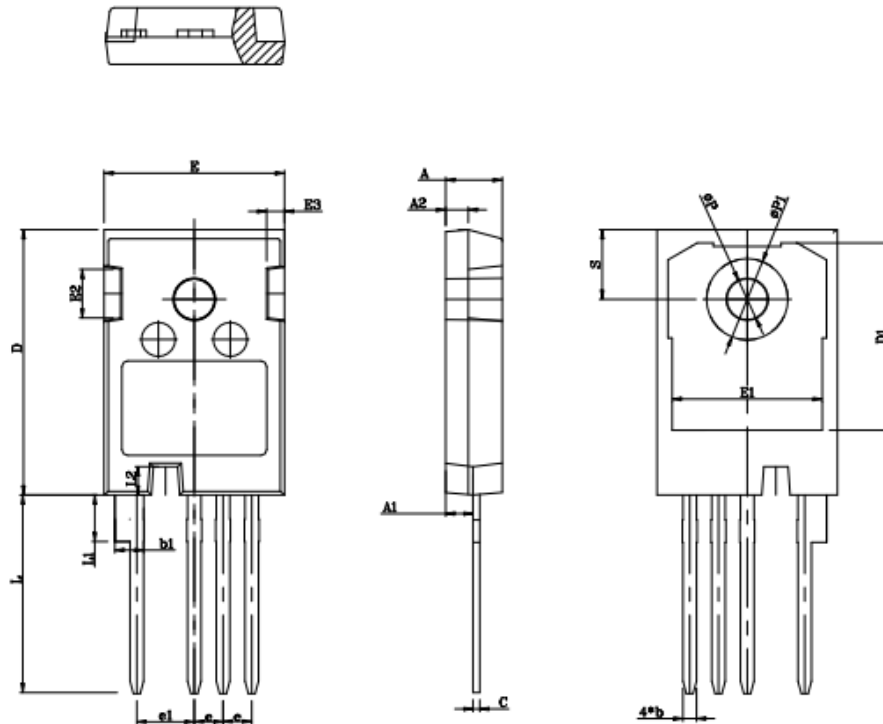


Figure 26. Switching Times vs. $R_{G(\text{ext})}$

Mechanical Dimensions TO-247-4



COMMON DIMENSIONS

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	4.12	4.30
L2	2.35	2.5	2.65
ØP	3.55	3.65	3.75
ØP1	7.08	7.19	7.30
S	6.15BSC		

The outline from different package houses may have slight differences. So the outline above is just schematic. The dimensions are controlled per specifications.

Technical Data

Data Sheet N3247, REV. -



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