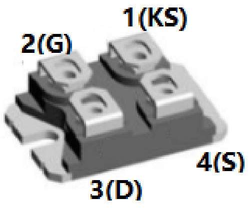
RoHS

S3M0040120N
1200V SIC POWER MOSFET



V_{DS} = 1200 V

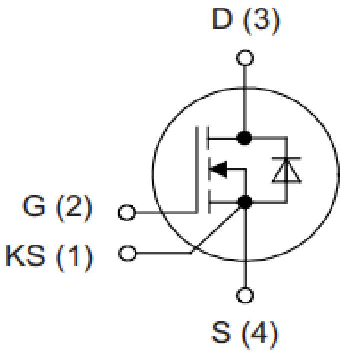
I_{DS}@ 25℃ = 65 A

R_{DS}(on) = 40 mΩ

Description

S3M0040120N is single SiC Power MOSFET packaged in SOT-227 case. The device is a high voltage n-channel Enhancement mode MOSFET that has very low total conduction losses and very stable switching characteristics over temperature extremes. The S3M0040120N is ideal for energy sensitive, high frequency applications in challenging environments.

Circuit Diagram



Features

- Positive temperature characteristics, easy to parallel.
- Low on-resistance Typ. RDS(on) = 40mΩ.
- Fast switching speed and low switching losses.
- Very fast and robust intrinsic body diode.
- Process of non-bright Tin electroplatin

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_A = 25 °C, unless otherwise specified)

Characteristics	Symbol	Conditions	Min.	Typ.	Max.	Units	Note
Drain - Source Voltage	V_{DSmax}	V_{GS} = 0 V, I_D = 100 µA			1200	V	
Gate - Source Voltage (dynamic)	V_{GSmax}	AC (f > 1 Hz)	-8		+20	V	
Gate - Source Voltage (static)	V_{GSop}	Static		-4 / +18		V	[1]
Continuous Drain Current	I_D	V_{GS} = 18 V, T_C = 25 ˚C			65	A	
		V_{GS} = 18 V, T_C = 100 ˚C			46		
Pulsed Drain Current	$I_{D(pulse)}$	Pulse width t_P limited by T_{jmax}			223	A	
Power Dissipation	P_D	T_C = 25 ˚C			483	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 V.

Electrical Characteristics (T_A = 25 °C, unless otherwise specified)

Characteristics	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Units**
Drain Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = 100 µA	1200			V
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 16 mA	2	2.5	4	V
		V_{DS} = V_{GS}, I_D = 16 mA, T_J = 175 °C		1.7		V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 1200 V, V_{GS} = 0 V		1	100	µA
Gate Source Leakage Current	I_{GSS}	V_{GS} = 18 V, V_{DS} = 0 V		10	250	nA
Drain Source On-State Resistance	$R_{DS(on)}$	V_{GS} = 18 V, I_D = 40 A		40	52	mΩ
		V_{GS} = 18 V, I_D = 40 A, T_J = 175 °C		50		mΩ
Transconductance	gfs	V_{DS} = 20 V, I_{DS} = 40 A		18		S
		V_{DS} = 20 V, I_{DS} = 40 A, T_J = 175 °C		19		S
Input Capacitance	C_{ISS}	V_{GS} = 0 V		2844		pF
Output Capacitance	C_{OSS}	V_{DS} = 1000 V		134		
Reverse Transfer Capacitance	C_{RSS}	V_{AC} = 25 mV		17		
C_{OSS} Stored Energy	E_{OSS}	f = 1 MHz		78		µJ
Turn-On Switching Energy	E_{ON}	V_{DS} = 800 V, V_{GS} = -4 / 18 V		212		µJ
Turn-Off Switching Energy	E_{OFF}	I_D = 40 A, $R_{G(ext)}$ = 2.5 Ω, L = 99 uH		198		
Turn-On Delay Time	$t_{d(on)}$	V_{DS} = 800 V, V_{GS} = -4 / 18 V		12.5		ns
Rise Time	t_r	I_D = 40 A, $R_{G(ext)}$ = 2.5 Ω		14.7		

Turn-Off Delay Time	$t_{d(off)}$	Inductive Load Timing relative to		27.5		
Fall Time	t_f	VDS Per IEC60747-8-4 pg 83		7.0		
Internal Gate Resistance	$R_{G(int)}$	f = 1 MHz, AC = 25 mV		1.3		Ω
Gate to Source Charge	Q_{gs}	V_{DS} = 800 V, V_{GS} = -4 / 18 V		66		nC
Gate to Drain Charge	Q_{gd}	I_D = 40 A		49		
Total Gate Charge	Q_g	Per IEC60747-8-4 pg 21		143		

Reverse Diode Characteristics (T_A = 25 °C, unless otherwise specified)

Characteristics	**Symbol**	**Conditions**	**Typ.**	**Max.**	**Units**
Diode Forward Voltage	V_{SD}	V_{GS} = -4 V, I_{SD} = 20 A	4.3		V
	V_{SD}	V_{GS} = -4 V, I_{SD} = 20 A, T_J = 175°C	3.6		V
Continuous Diode Forward Current	I_S	V_{GS}= -4 V, T_C= 25 ℃	48		A
Reverse Recovery Time	t_{rr}	V_{GS} = -4 V, I_{SD} = 40 A, T_J = 25 °C	16		ns
Reverse Recovery Charge	Q_{rr}	V_R = 800V	221		nC
Peak Reverse Recovery Current	I_{mm}	dif / dt = 3000 A / µs	23		A

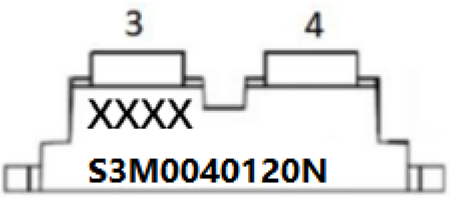
Thermal-Mechanical Specifications

Characteristics	Symbol	Condition	Specification	Units
Junction Temperature	T_J	-	-55 to +175	°C
Storage Temperature	T_{stg}	-	-55 to +175	°C
Typical Thermal Resistance Junction to Case	$R_{\theta JC}$	DC operation	0.31	°C/W

Ordering Information

Device	Package	Shipping
S3M0040120N	SOT-227	36pcs/box

Marking Diagram



Where XXXXX is YYWW

S3M = Device Type
0040 = R_{DS}(on)
120 = Reverse Voltage (1200V)
N = Package
SSG = SSG
YY = Year
WW = Week

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

Ratings and Characteristics Curves

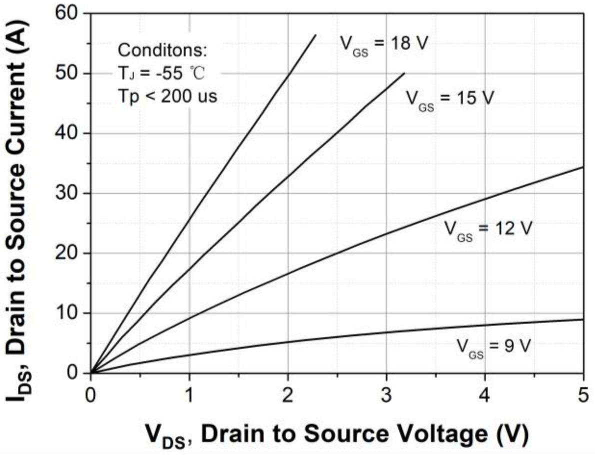


Figure 1. Output Characteristics T_J = -55 °C

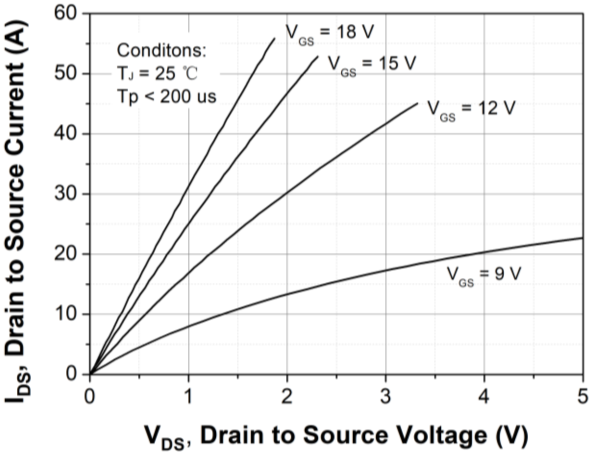


Figure 2. Output Characteristics T_J = 25 °C

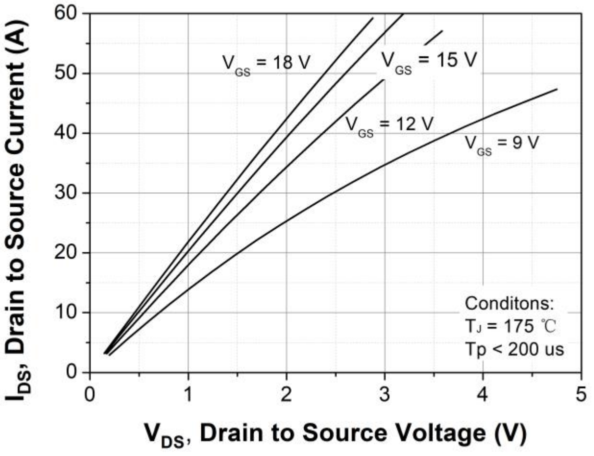


Figure 3. Output Characteristics T_J = 175 °C

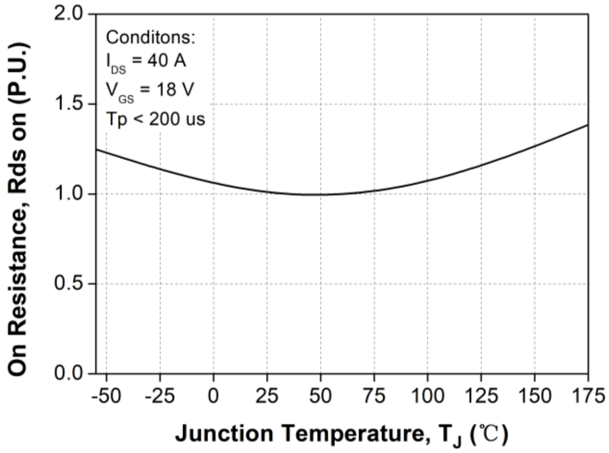


Figure 4. Normalized On-Resistance vs. Temperature

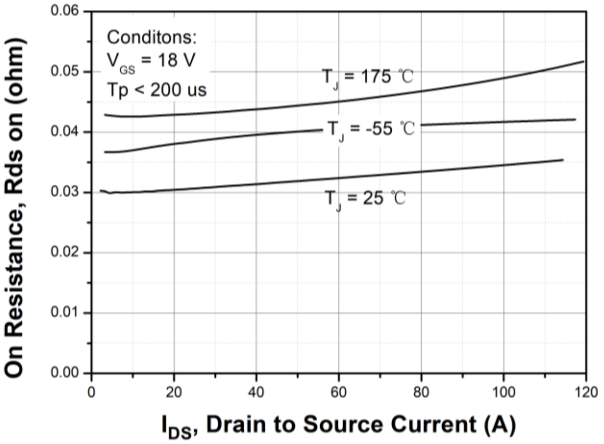


Figure 5. On-Resistance vs. Drain Current
For Various Temperatures

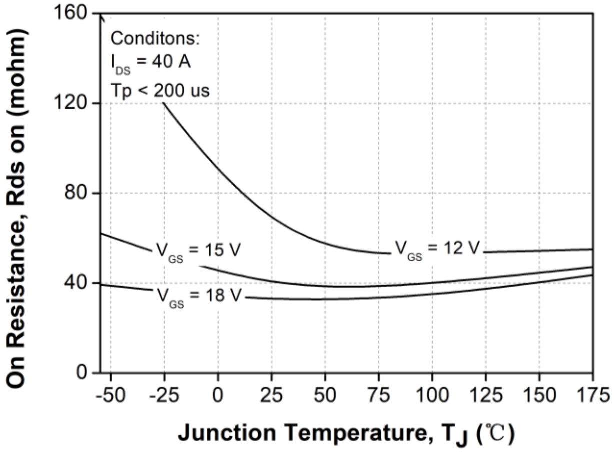


Figure 6. On-Resistance vs. Temperature
For Various Gate Voltage

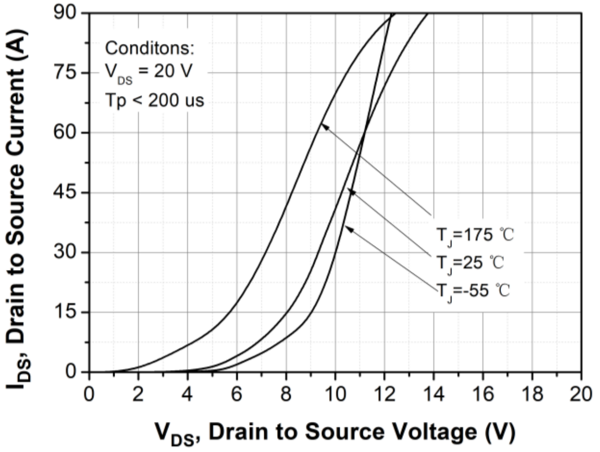


Figure 7. Transfer Characteristic for Various Junction Temperatures

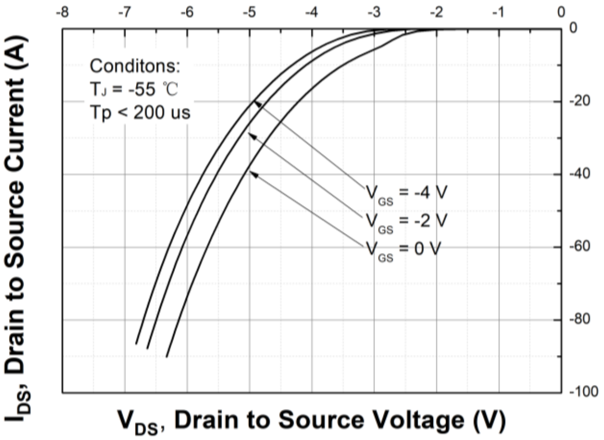


Figure 8. Body Diode Characteristic at T_J = -55 °C

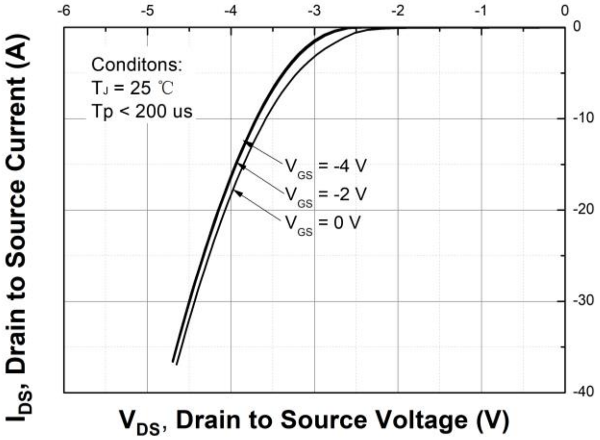


Figure 9. Body Diode Characteristic at T_J = 25 °C

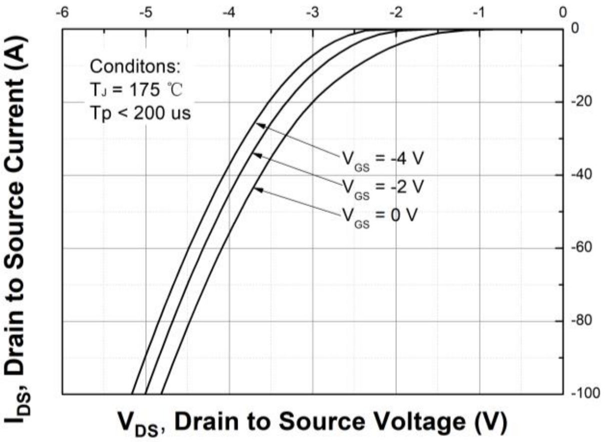


Figure 10. Body Diode Characteristic at T_J = 175 °C

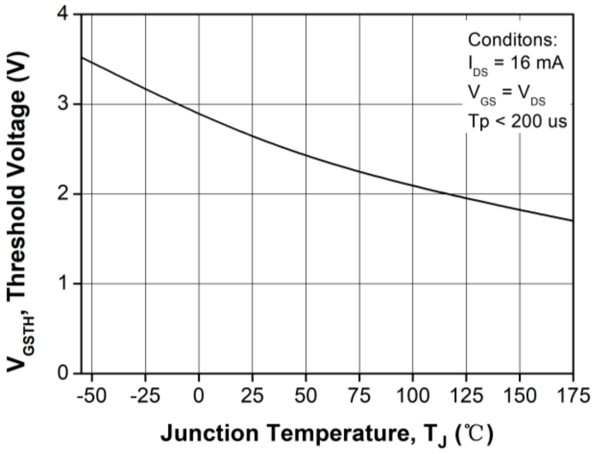


Figure 11. Threshold Voltage vs. Temperature

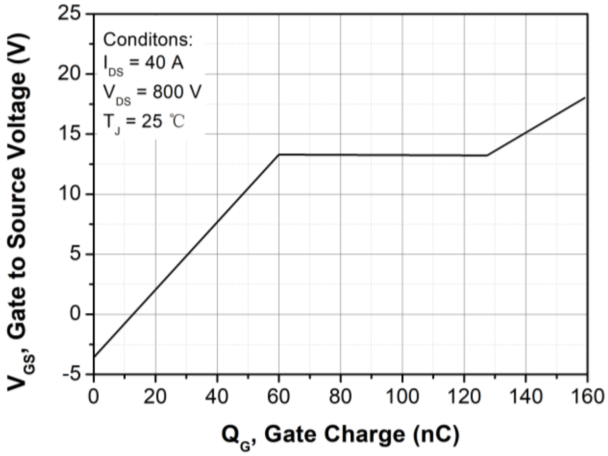


Figure 12. Gate Charge Characteristic

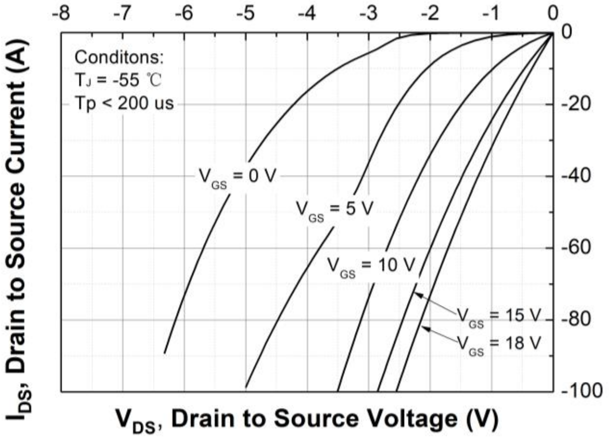


Figure 13. 3rd Quadrant Characteristic at T_J = -55 °C

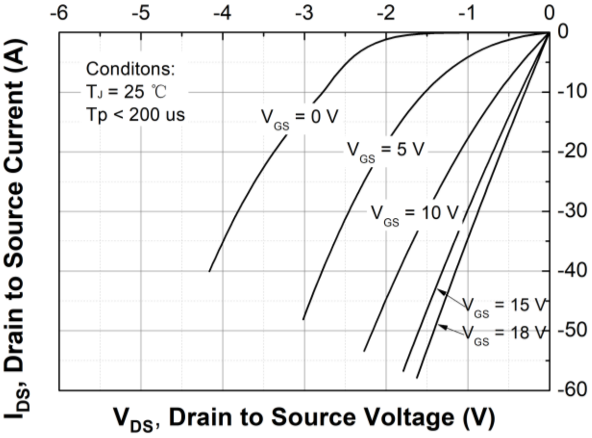


Figure 14. 3rd Quadrant Characteristic at T_J = 25 °C

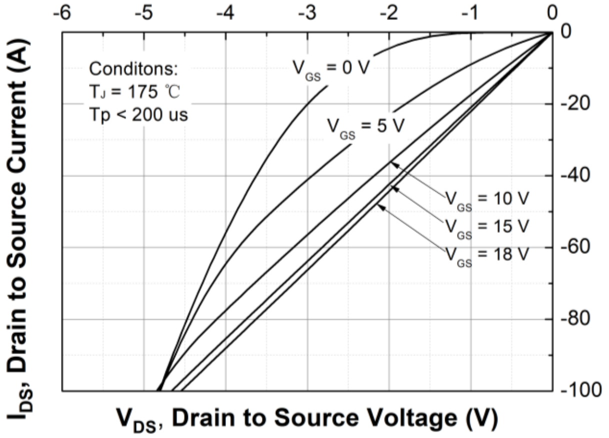


Figure 15. 3rd Quadrant Characteristic at T_J = 175 °C

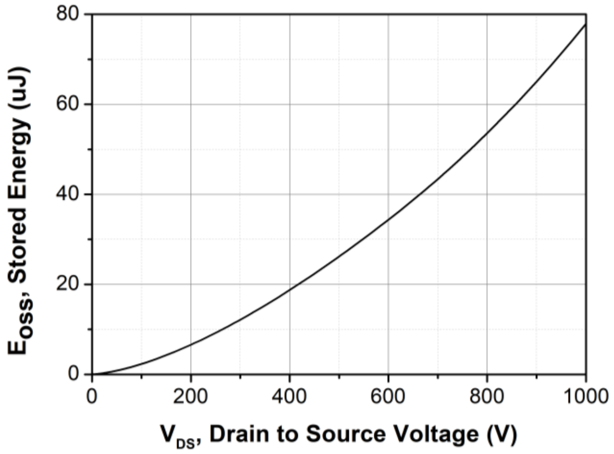


Figure 16. Output Capacitor Stored Energy

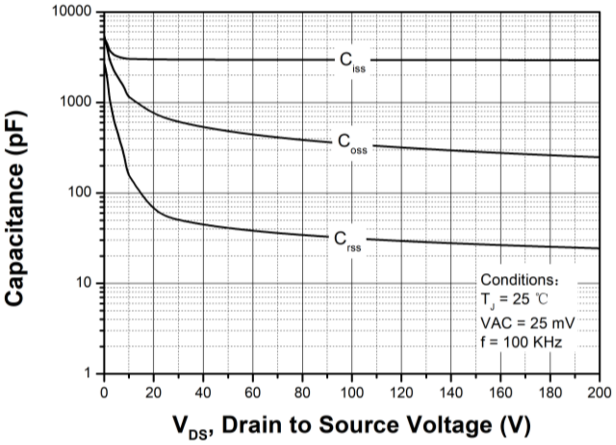


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200 V)

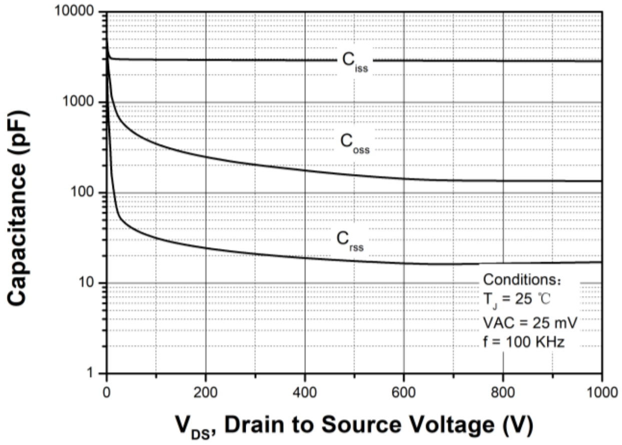


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 1000 V)

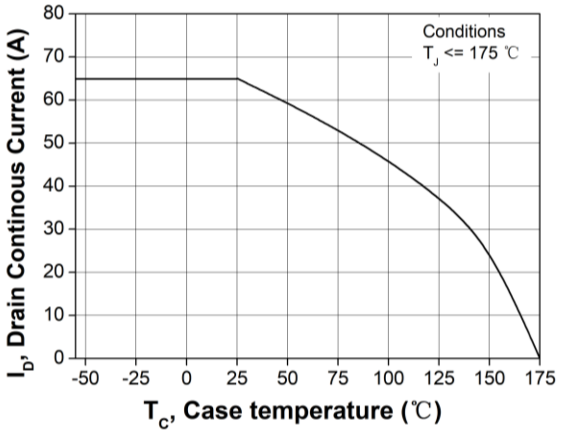


Figure 19. Continuous Drain Current Derating vs. Case Temperature

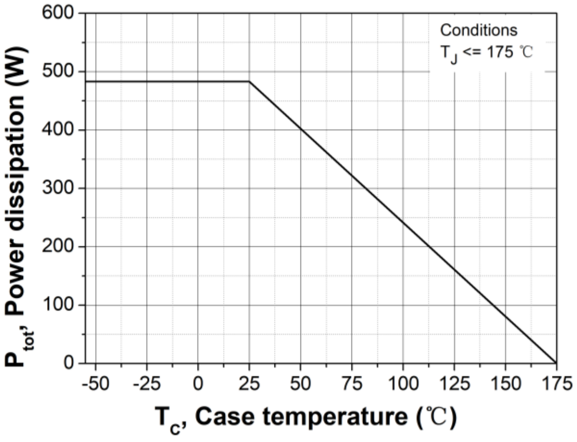
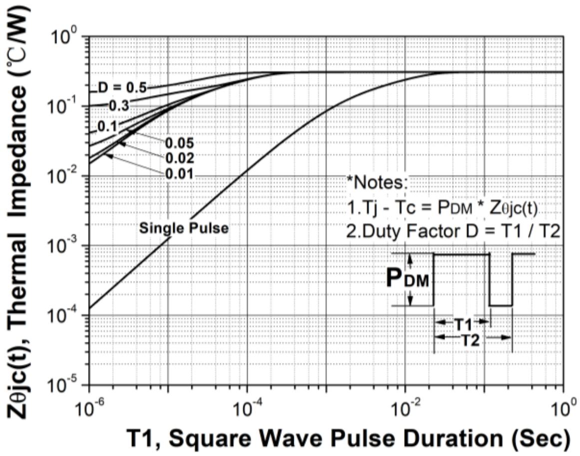


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature



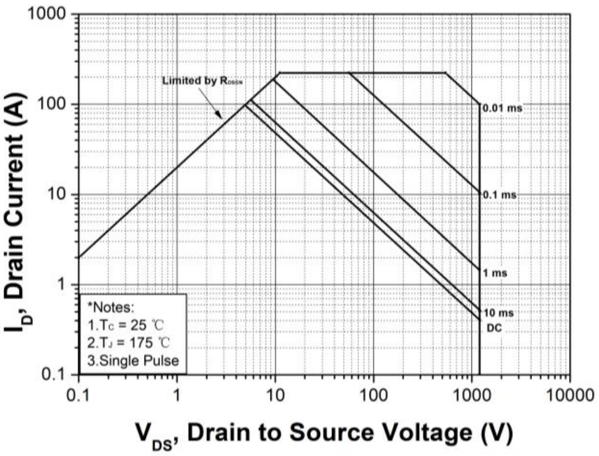
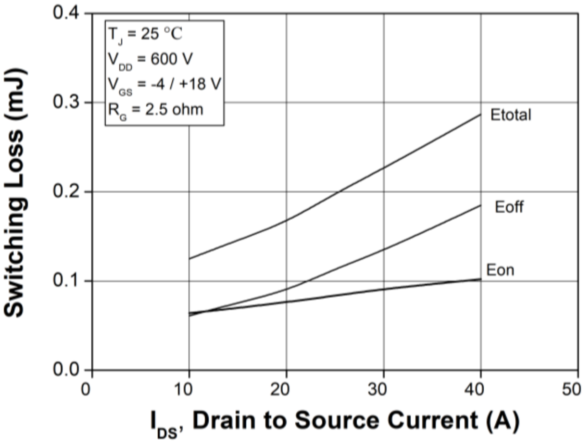


Figure 21. Transient Thermal Impedance (Junction - Case)

Figure 22. Safe Operating Area



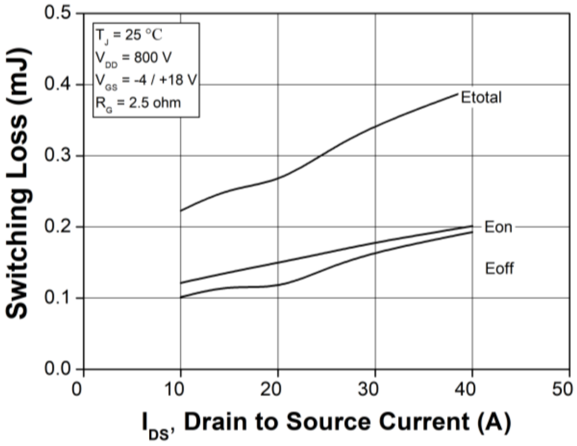


Figure 23. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 600V)

Figure 24. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 800V)

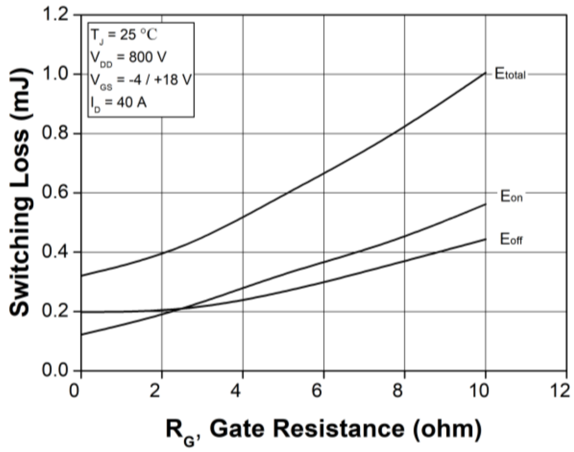


Figure 25. Clamped Inductive Switching Energy vs. R$_{G(ext)}$

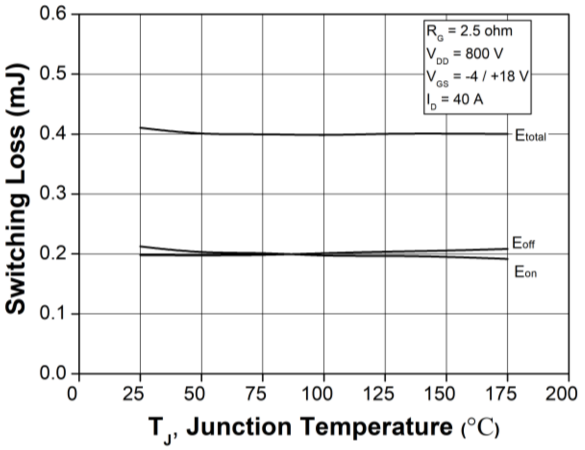


Figure 26. Clamped Inductive Switching Energy vs. Temperature

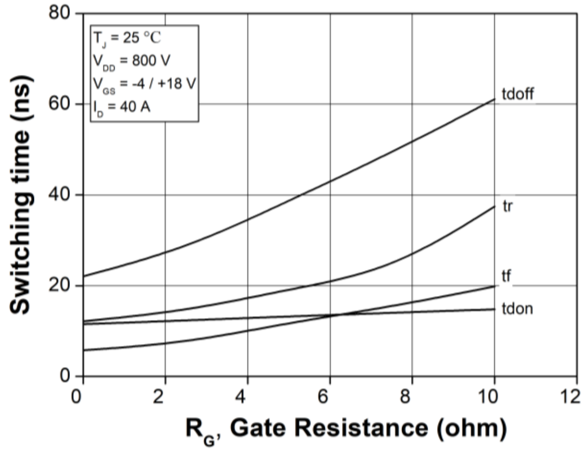


Figure 27. Switching Times vs. R$_{G(ext)}$

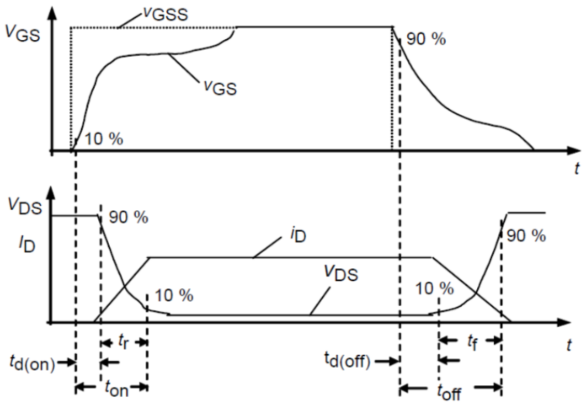
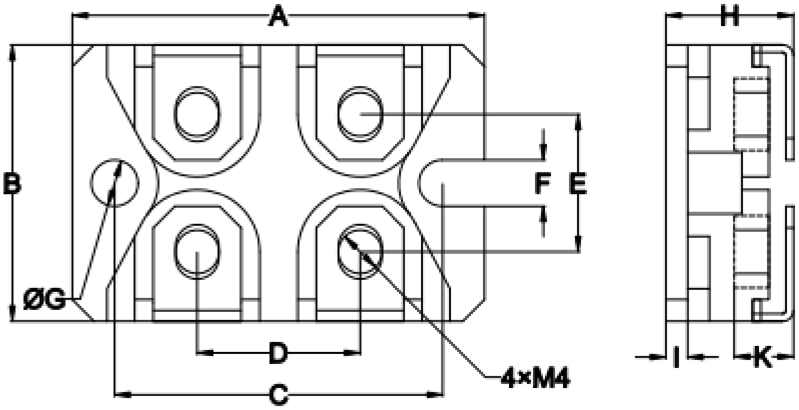


Figure 28. Switching Times Definition

Mechanical Dimensions SOT-227



SYMBOL	Dimensions in millimeters	
	Min.	**Max.**
A	37.8	38.2
B	24.8	25.21
C	29.9	30.55
D	14.5	15.5
E	12.2	13.45
F	4.1	4.31
G	φ4.1	φ4.31
H	11	12.5
I	1.9	2.1
K	4.3	6.5

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