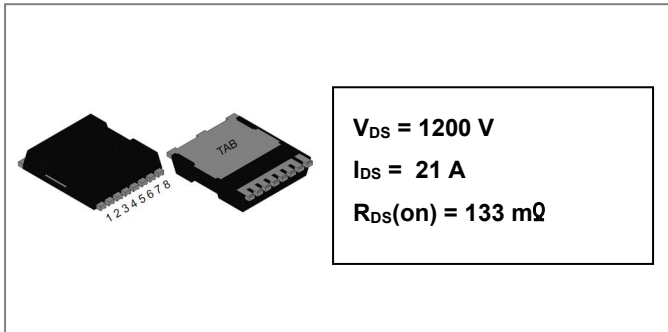


S2M0120120T

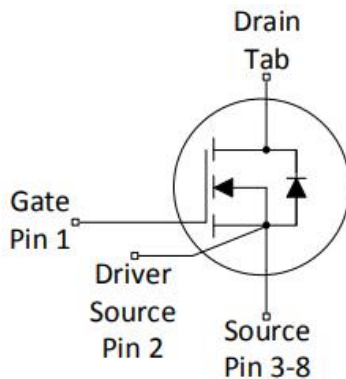
1200V SiC POWER MOSFET



Description

S2M0120120T is single SiC Power MOSFET packaged in TOLL 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 S2M0120120T is ideal for energy sensitive, high frequency applications in challenging environments.

Circuit Diagram



Features

- Positive temperature characteristics, easy to parallel.
- Low on-resistance Typ. $R_{DS(on)} = 133\text{ m}\Omega$.
- 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=25°C unless otherwise specified)

Characteristics	Symbol	Condition	Max.	Units
Drain Source Voltage	V_{DSS}	$V_{GS} = 0V, I_{DS} = 100\mu A, T_C = 25^\circ C$	1200	V
Gate Source Voltage	V_{GSS}	$T_C = 25^\circ C$, Absolute maximum values, AC ($f > 1\text{Hz}$)	-10 to +25	V
Gate Source Voltage	V_{GSOP}	$T_C = 25^\circ C$, Recommended Operational Values	-5 to +20	V
Continuous Drain Current	I_D	$V_{GS} = 20V, T_C = 25^\circ C$	21	A
	I_D	$V_{GS} = 20V, T_C = 100^\circ C$	15	A
Pulsed Drain Current	$I_{D,pulse}$	Pulse width t_P limited by T_{jmax}	66	A
Power Dissipation	P_D	$T_C = 25^\circ C, T_J = 175^\circ C$	156	W

Electrical Characteristics(T=25°C unless otherwise specified)

Characteristics	Symbol	Condition	Min.	Typ.	Max.	Units
Drain Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 100\text{ }\mu\text{A}$	1200			V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 3.3\text{ mA}$	2.0	2.9	4	V
		$V_{DS} = V_{GS}, I_D = 3.3\text{ mA}, T_J = 175\text{ }^\circ\text{C}$		1.9		V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}$		1	100	μA
Gate Source Leakage Current	I_{GSS}	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$			250	nA
Drain Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 20\text{ V}, I_D = 13.3\text{ A}$		133	150	m Ω
		$V_{GS} = 20\text{ V}, I_D = 13.3\text{ A}, T_J = 175\text{ }^\circ\text{C}$		212		m Ω
Transconductance	gfs	$V_{DS} = 20\text{ V}, I_D = 13.3\text{ A}$		5		S
		$V_{DS} = 20\text{ V}, I_D = 13.3\text{ A}, T_J = 175\text{ }^\circ\text{C}$		2		S
Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V},$ $V_{DS} = 1000\text{ V}$ $V_{AC} = 25\text{ mV}$ $f = 100\text{ kHz}$		652		pF
Output Capacitance	C_{OSS}			47.6		
Reverse Transfer Capacitance	C_{RSS}			3.47		
C_{OSS} Stored Energy	E_{OSS}			28		
Turn-On Switching Energy	E_{ON}	$V_{DS} = 800\text{ V}, V_{GS} = -5/+20\text{ V}$ $I_D = 13.3\text{ A}, R_{G(ext)} = 2.5\text{ }\Omega$		62.3		μJ
Turn-Off Switching Energy	E_{OFF}			62.7		
Turn-On Delay Time	$t_{d(on)}$	$V_{DS} = 800\text{ V}, V_{GS} = -5/20\text{ V}$ $I_D = 13.3\text{ A}, R_{G(ext)} = 2.5\text{ }\Omega, R_L = 80\text{ }\Omega$		3.5		ns
Rise Time	t_r			6.7		
Turn-Off Delay Time	$t_{d(off)}$			8.3		
Fall Time	t_f			10.6		
Internal Gate Resistance	$R_{G(int)}$	$f = 1\text{ MHz}, V_{AC} = 25\text{ mV}, \text{D-S short}$		6.4		Ω
Gate to Source Charge	Q_{gs}	$V_{DS} = 800\text{ V}, V_{GS} = -5/20\text{ V}$ $I_D = 13.3\text{ A}$		12.8		nC
Gate to Drain Charge	Q_{gd}			6.0		
Total Gate Charge	Q_g			29.6		

Reverse Diode Characteristics:

Characteristics	Symbol	Condition	Typ.	Max.	Units
Diode Forward Voltage	V _{SD}	V _{GS} = -5 V, I _{SD} = 6.7 A	3.7		V
	V _{SD}	V _{GS} = -5 V, I _{SD} = 6.7 A, T _J = 175 °C	3.3		V
Continuous Diode Forward Current	I _S	V _{GS} = -5 V, T _C = 25 °C	20		A
Reverse Recovery Time	t _{rr}	V _{GS} = -5 V, I _{SD} = 13.3 A, T _J = 25 °C V _R = 800 V dif/dt= 3030 A/μs	7.3		ns
Reverse Recovery Charge	Q _{rr}		0.05		uC
Peak Reverse Recovery Current	I _{mm}		11.9		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 _{θJC}	DC operation	0.96	°C/W

Ordering Information:

Device	Package	Shipping
S2M0120120T	TOLL	1800pcs/Reel

Marking Diagram



Where XXXXX is YYWWL

- S2M = Device Type
- 0120 = R_{DS(on)}
- 120 = Reverse Voltage (1200V)
- T = Package
- SSG = SSG
- YY = Year
- WW = Week
- L = Lot Number

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

Ratings and Characteristics Curves

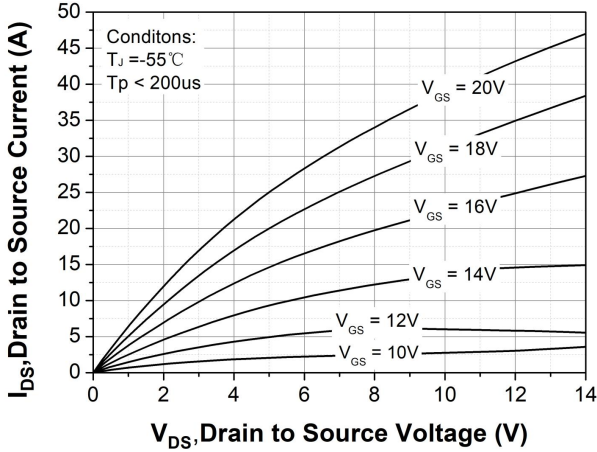


Figure 1. Output Characteristics $T_J = -55^\circ\text{C}$

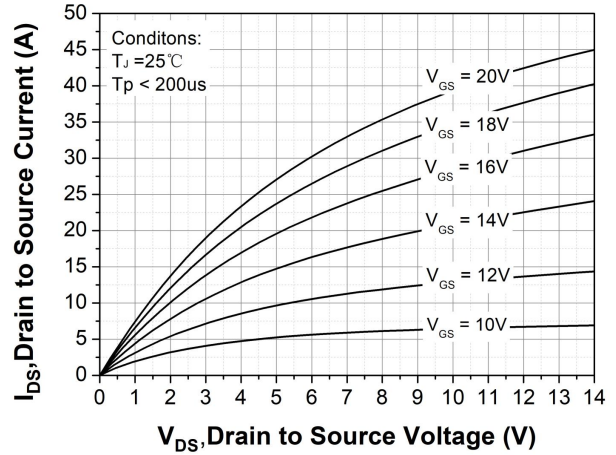


Figure 2. Output Characteristics $T_J = 25^\circ\text{C}$

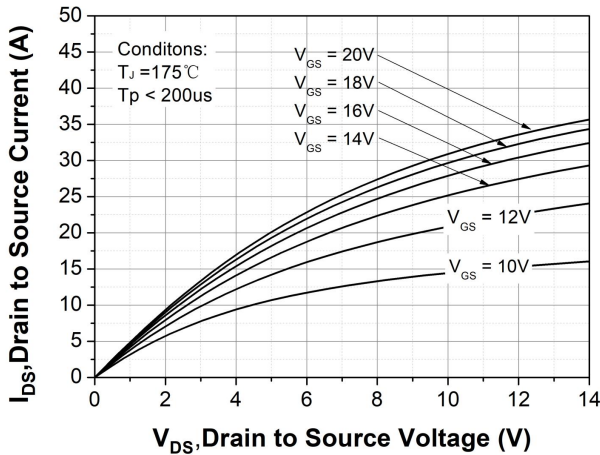


Figure 3. Output Characteristics $T_J = 175^\circ\text{C}$

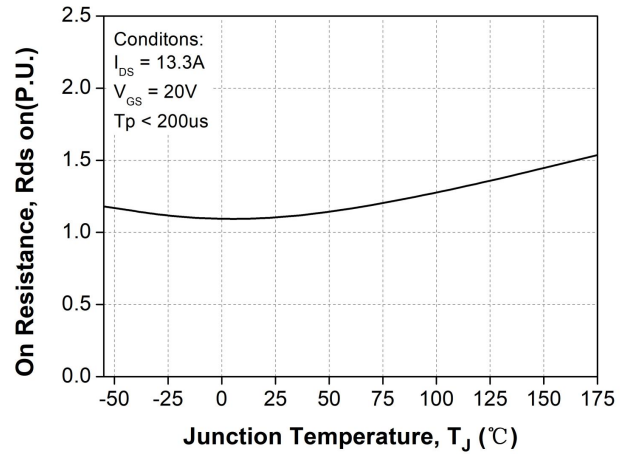


Figure 4. Normalized On-Resistance vs. Temperature

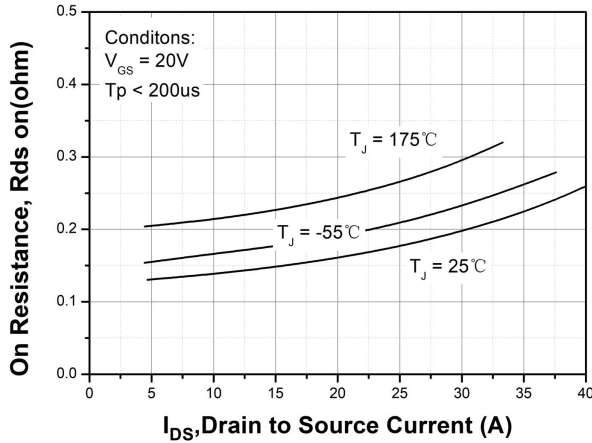


Figure 5. On-Resistance vs. Drain Current For Various Temperatures

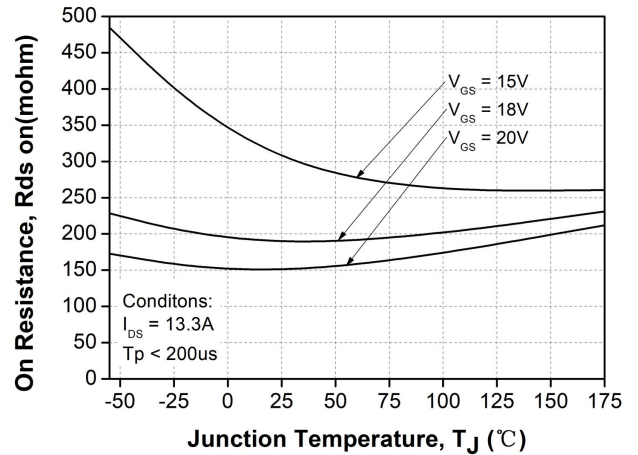


Figure 6. On-Resistance vs. Temperature For Various Gate Voltage

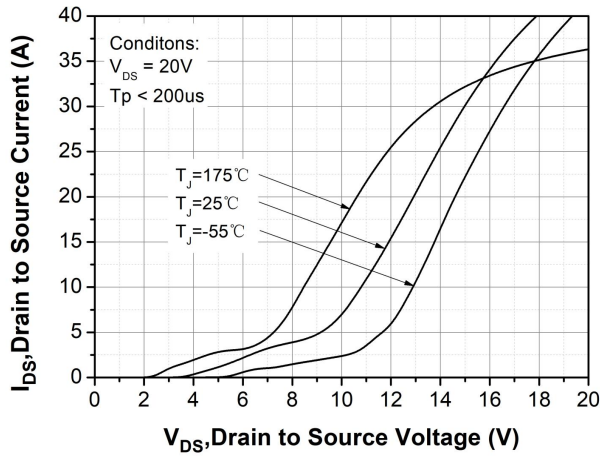


Figure 7. Transfer Characteristic for Various Junction Temperatures

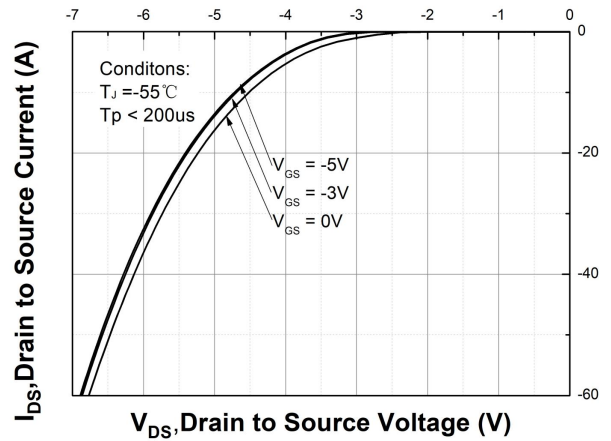


Figure 8. Body Diode Characteristic at $T_J = -55^\circ\text{C}$

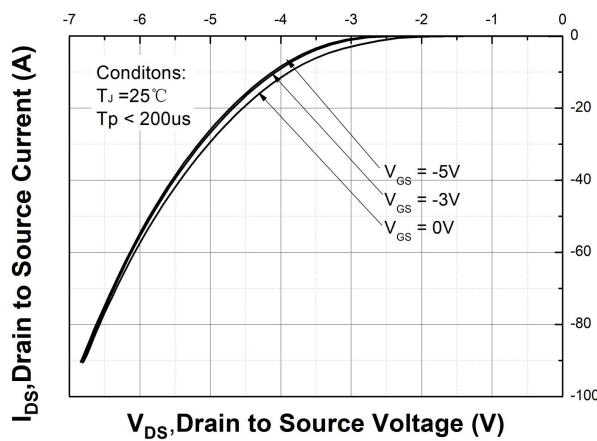


Figure 9. Body Diode Characteristic at $T_J = 25^\circ\text{C}$

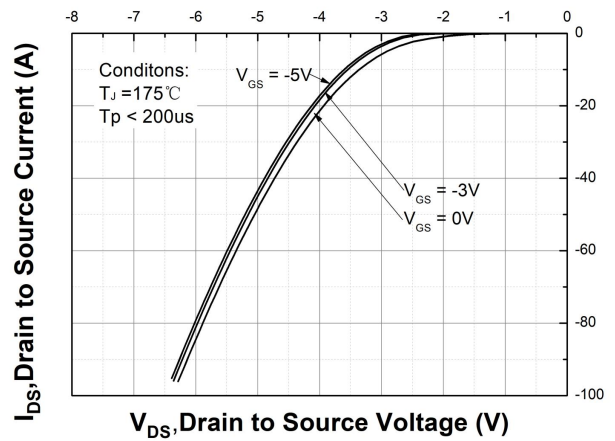


Figure 10. Body Diode Characteristic at $T_J = 175^\circ\text{C}$

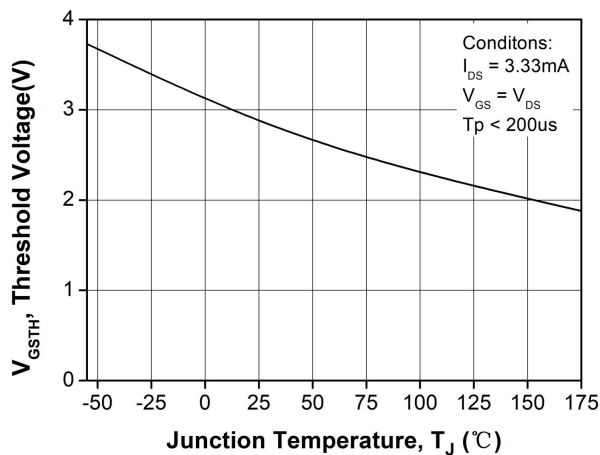


Figure 11. Threshold Voltage vs. Temperature

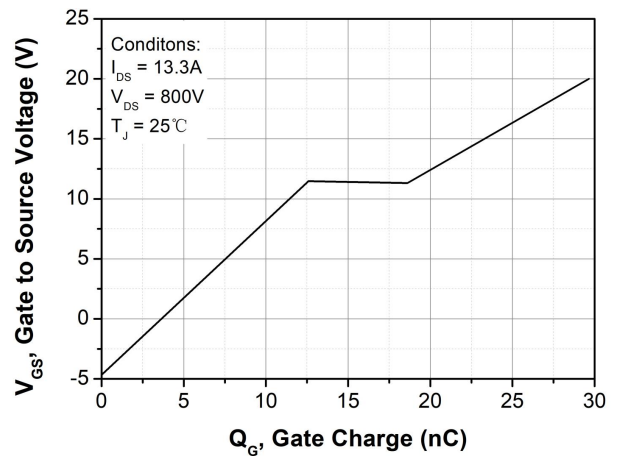


Figure 12. Gate Charge Characteristic

Technical Data
Data Sheet N2751, REV.-

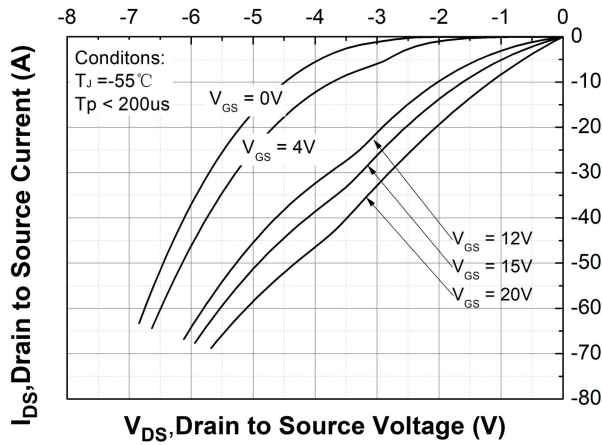


Figure 13. 3rd Quadrant Characteristic at $T_J = -55^\circ\text{C}$

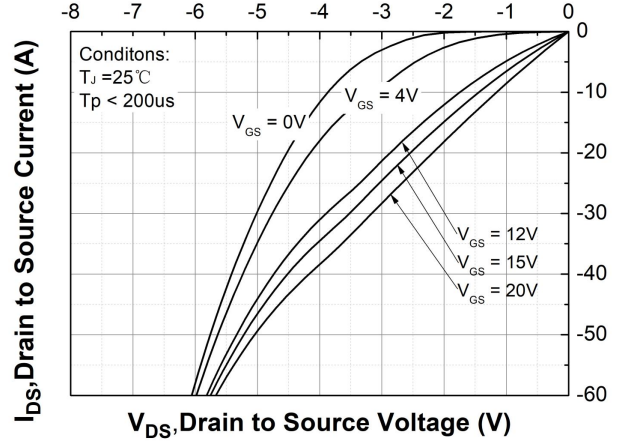


Figure 14. 3rd Quadrant Characteristic at $T_J = 25^\circ\text{C}$

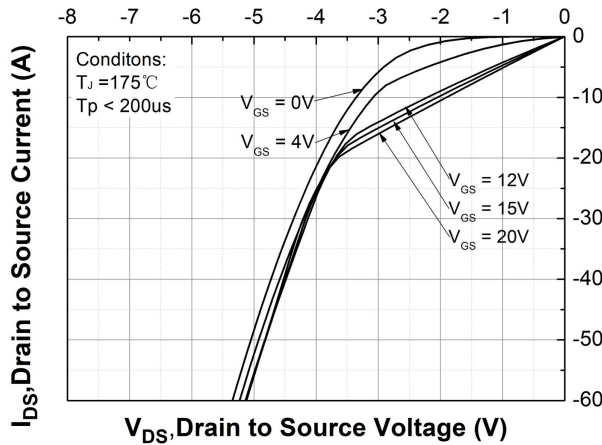


Figure 15. 3rd Quadrant Characteristic at $T_J = 175^\circ\text{C}$

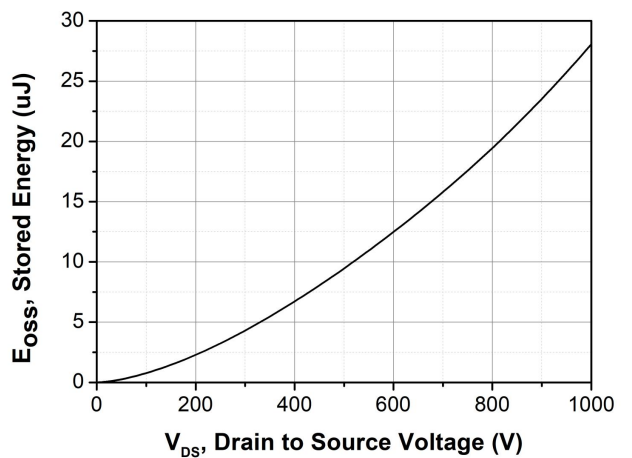


Figure 16. Output Capacitor Stored Energy

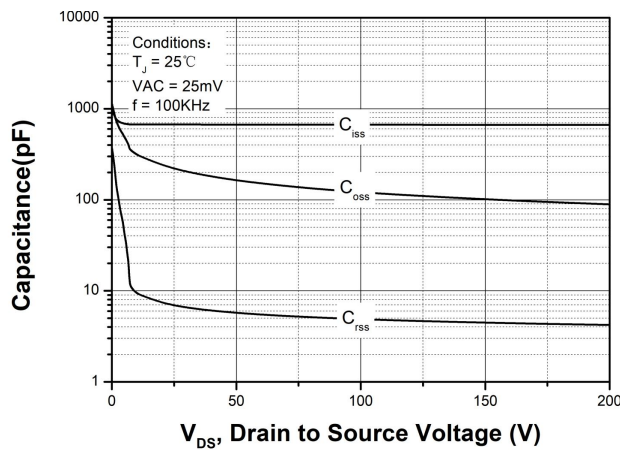


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200V)

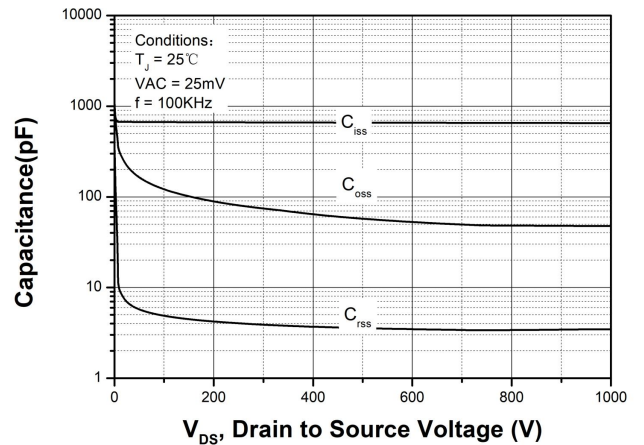


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 1000V)

Technical Data
Data Sheet N2751, REV.-

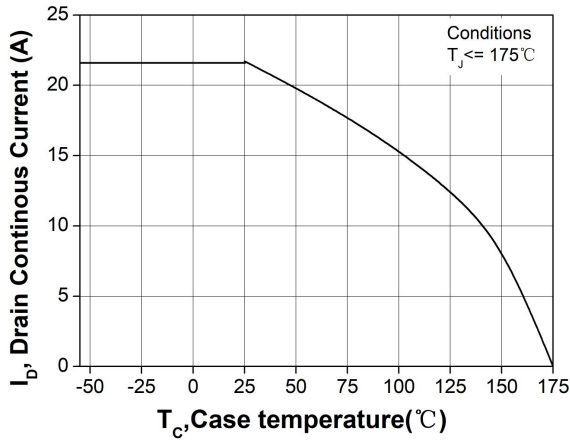


Figure 19. Continuous Drain Current Derating vs. Case Temperature

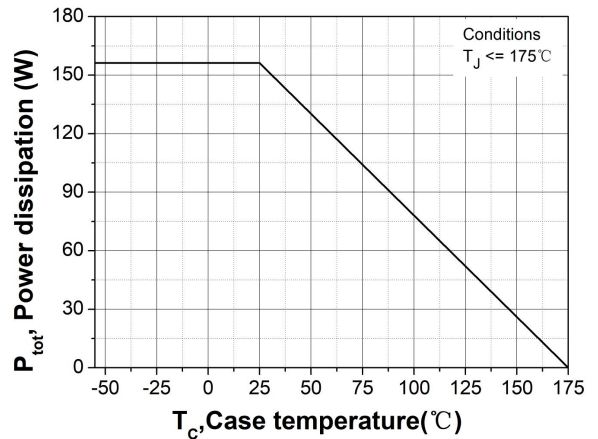


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

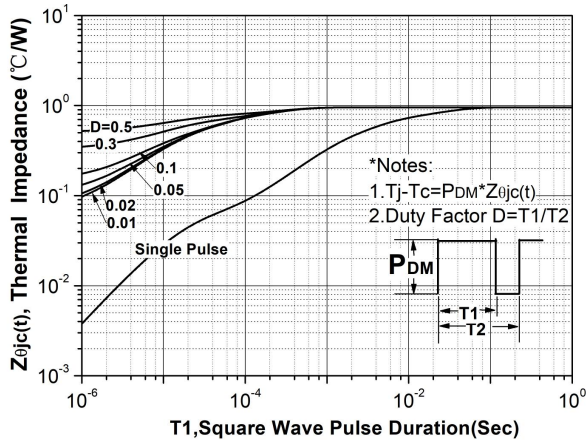


Figure 21. Transient Thermal Impedance (Junction - Case)

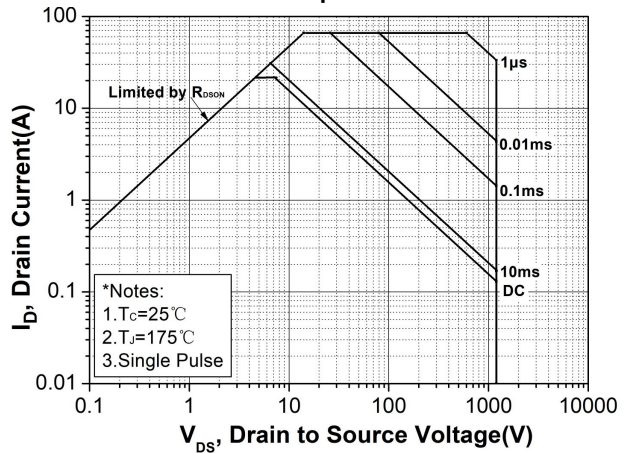


Figure 22. Safe Operating Area

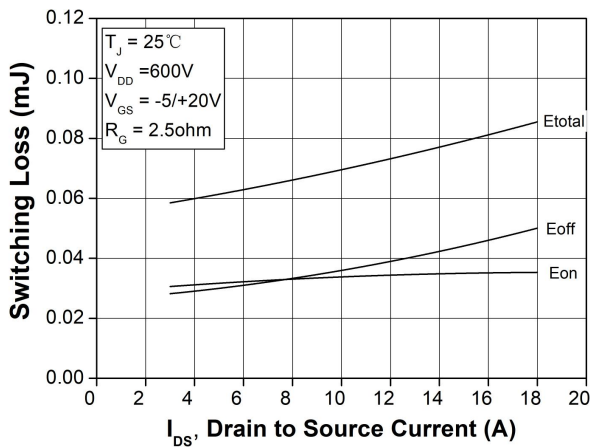


Figure 23. Clamped Inductive Switching Energy vs. Drain Current ($V_{DD} = 600V$)

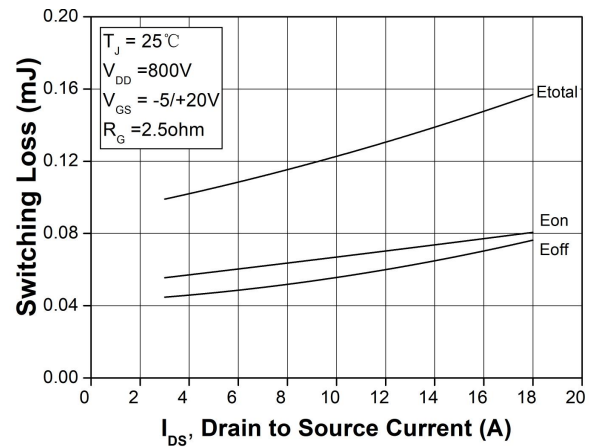


Figure 24. Clamped Inductive Switching Energy vs. Drain Current ($V_{DD} = 800V$)

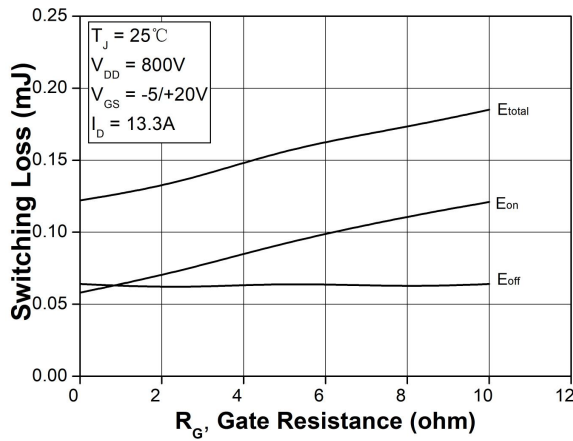


Figure 25. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

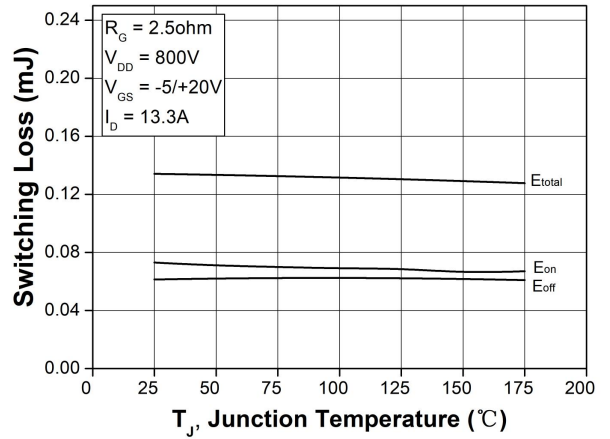


Figure 26. Clamped Inductive Switching Energy vs. Temperature

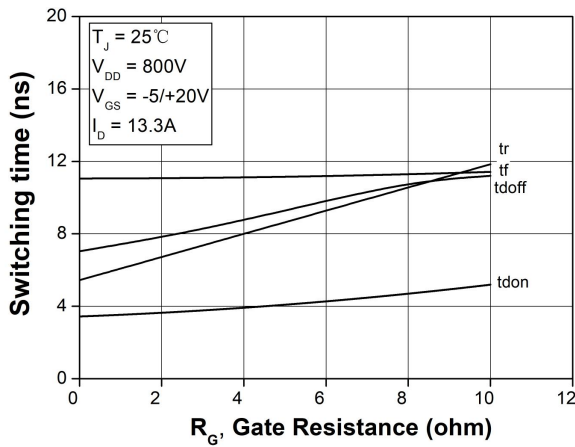


Figure 27. Switching Times vs. $R_{G(ext)}$

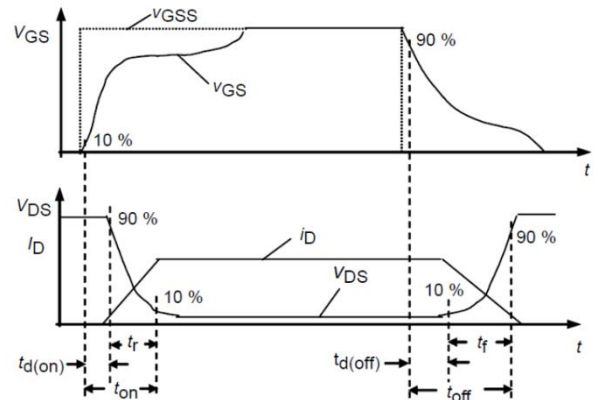
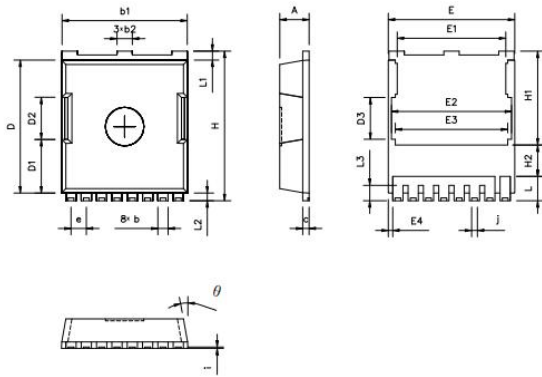


Figure 28. Switching Times Definition

Mechanical Dimensions TOLL



SYMBOL	Dimensions in Millimeters		
	Min.	NOM.	Max.
A	2.20	2.30	2.40
b	0.70	0.80	0.90
b1	9.70	9.80	9.90
b2	1.20 REF.		
c	0.40	0.50	0.60
D	10.28	10.38	10.48
D1	4.08	4.18	4.28
D2	3.20	3.30	3.40
D3	3.16	3.26	3.36
E	9.80	9.90	10.00
E1	8.40	8.50	8.60
E2	9.30	9.40	9.50
E3	8.8 REF.		
E4	0.25	0.35	0.45
e	1.20 BASIC		
H	11.58	11.68	11.78
H1	7.23	7.33	7.43
H2	2.45 REF.		
i	0.10	-	-
j	0.45 REF.		
L	1.60	1.90	2.10
L1	0.60	0.70	0.80
L2	0.50	0.60	0.70
L3	1.05	1.20	1.30
e	10° REF.		

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