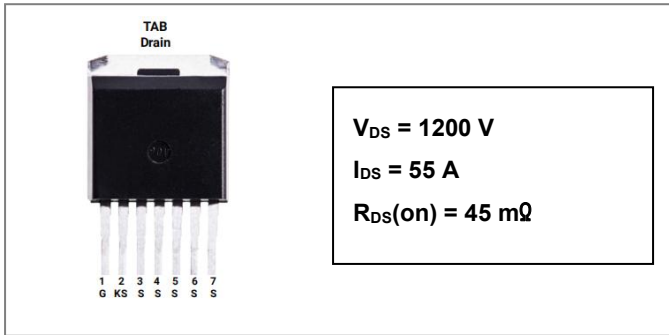


S2M0040120J-1

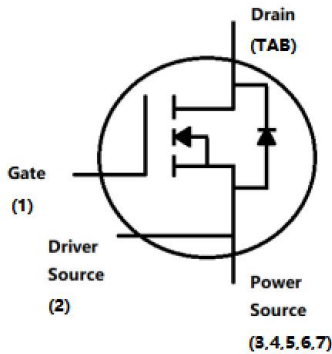
1200V SiC POWER MOSFET



Description

S2M0040120J-1 is single SiC Power MOSFET packaged in TO-263-7 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 S2M0040120J-1 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) = 45mΩ .
- 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} = 100uA, T _J = 25°C	1200	V
Gate Source Voltage	V _{GSS}	T _J = 25°C, Absolute maximum values, AC (f>1Hz)	-10 to 25	V
Gate Source Voltage	V _{GSOP}	T _J = 25°C Recommended Operational Values	-5 to 20	V
Continuous Drain Current	I _D	V _{GS} = 20V, T _J = 25°C	55	A
	I _D	V _{GS} = 20V, T _J = 100°C	39	A
Pulsed Drain Current	I _{D,pulse}	Pulse width t _P limited by T _{Jmax}	160	A
Power Dissipation	P _D	T _C =25°C, T _J = 175 °C	348	W
Solder Temperature	TL	1.6mm (0.063") from case for 10s	260	°C

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

Characteristics	Symbol	Condition	Min.	Typ.	Max.	Units
Drain Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 100\mu A$	1200			V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 10mA$	1.8	2.4	4	V
		$V_{DS} = V_{GS}, I_D = 10mA, T_J = 175^\circ C$		1.55		V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 1200V, V_{GS} = 0V$		1	100	μA
Gate Source Leakage Current	I_{GSS}	$V_{GS} = 20V, V_{DS} = 0V$			250	nA
Drain Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 20V, I_D = 40A$		45	52	m Ω
		$V_{GS} = 20V, I_D = 40A, T_J = 175^\circ C$		73		m Ω
Transconductance	gfs	$V_{DS} = 20V, I_{DS} = 40A$		10		S
		$V_{DS} = 20V, I_{DS} = 40A, T_J = 175^\circ C$		12		S
Input Capacitance	C_{ISS}	$V_{GS} = 0V,$		1904		pF
Output Capacitance	C_{OSS}	$V_{DS} = 1000V$		108		
Reverse Transfer Capacitance	C_{RSS}	$V_{AC} = 25mV$ $f = 1MHz$		6		
C_{OSS} Stored Energy	E_{OSS}			72.9		μJ
Turn-On Switching Energy	E_{ON}	$V_{DS} = 800V, V_{GS} = -5/20V$		0.25		mJ
Turn-Off Switching Energy	E_{OFF}	$I_D = 40A, R_{G(ext)} = 2.5\Omega, L = 99\mu H$		0.05		
Turn-On Delay Time	$t_{d(on)}$	$V_{DS} = 800V, V_{GS} = -5/20V$		12		ns
Rise Time	t_r	$I_D = 40A, R_{G(ext)} = 2.5\Omega$		14		
Turn-Off Delay Time	$t_{d(off)}$	Inductive Load Timing relative to VDS Per IEC60747-8-4 pg 83		22		
Fall Time	t_f			4		
Internal Gate Resistance	$R_{G(int)}$	$f = 1MHz, V_{AC} = 25mV$		2.6		Ω
Gate to Source Charge	Q_{gs}	$V_{DS} = 800V, V_{GS} = -5/20V$		34.3		nC
Gate to Drain Charge	Q_{gd}	$I_D = 40A$		32.1		
Total Gate Charge	Q_g	Per IEC60747-8-4 pg 21		92.1		

Reverse Diode Characteristics:

Characteristics	Symbol	Condition	Typ.	Max.	Units
Diode Forward Voltage	V_{SD}	$V_{GS} = -5V, I_{SD} = 20A$	3.6		V
		$V_{GS} = -5V, I_{SD} = 20A, T_J = 175^\circ C$	3.2		V
Continuous Diode Forward Current	I_S	$T_C = 25^\circ C$	44		
Reverse Recovery Time	t_{rr}	$V_{GS} = -5V, I_{SD} = 40A, T_J = 25^\circ C$	43.4		ns
Reverse Recovery Charge	Q_{rr}	$V_R = 800V$	162		nC
Peak Reverse Recovery Current	I_{mm}	$df/dt = 1047A/\mu s$	8.1		A

Thermal-Mechanical Specifications:

Characteristics	Symbol	Condition	Specification	Units
Junction Temperature	T_J	-	-55 to +175	$^\circ C$
Storage Temperature	T_{stg}	-	-55 to +175	$^\circ C$
Typical Thermal Resistance Junction to Case	$R_{\theta JC}$	DC operation	0.44	$^\circ C/W$
Typical Thermal Resistance Junction to Ambient	$R_{\theta JA}$		32.6	$^\circ C/W$

Ordering Information:

Device	Package	Shipping
S2M0040120J-1	TO-263-7	800pcs/reel

Marking Diagram


Where XXXXX is YYWWL

S2M = Device Type
 0040 = $R_{DS(on)}$
 120 = Reverse Voltage (1200V)
 J = Package
 SSG = SSG
 YY = Year
 WW = Week
 L = Lot Number

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

Ratings and Characteristics Curves

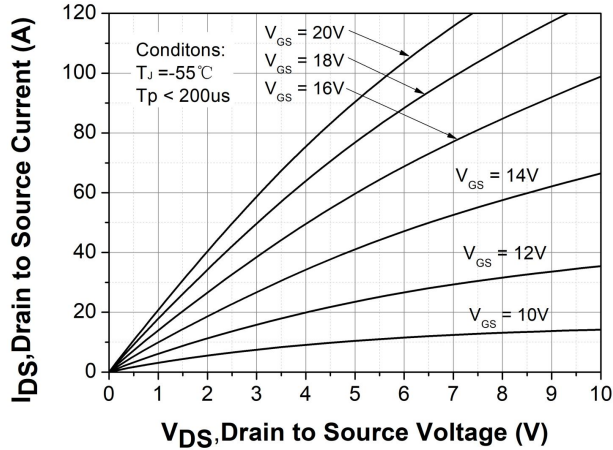


Figure 1. Output Characteristics $T_J = -55^\circ\text{C}$

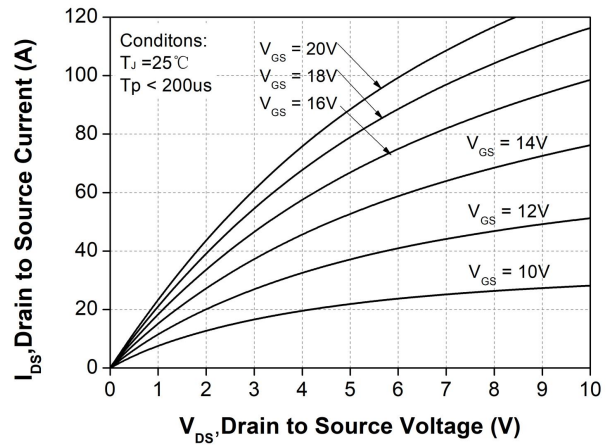


Figure 2. Output Characteristics $T_J = 25^\circ\text{C}$

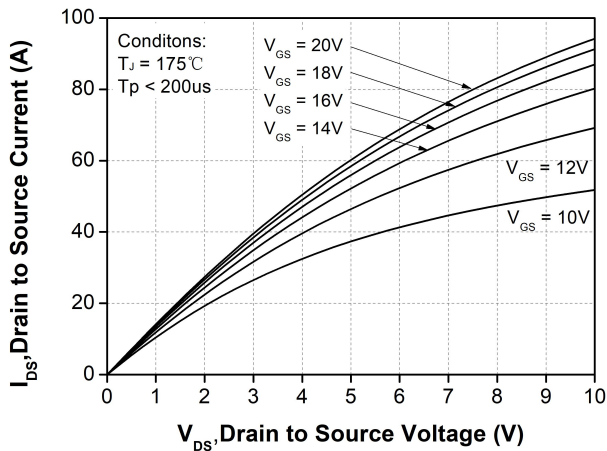


Figure 3. Output Characteristics $T_J = 175^\circ\text{C}$

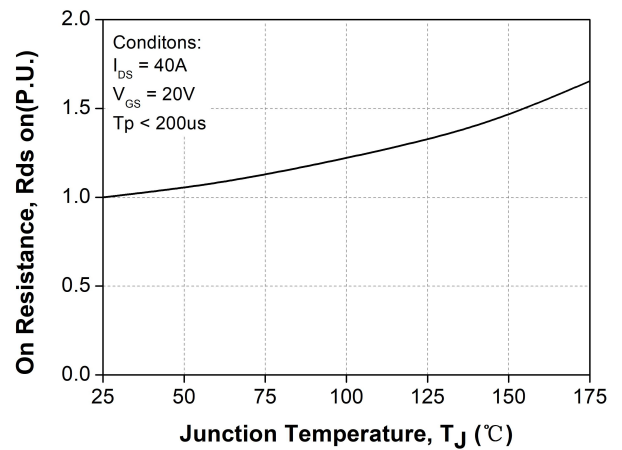


Figure 4. Normalized On-Resistance vs. Temperature

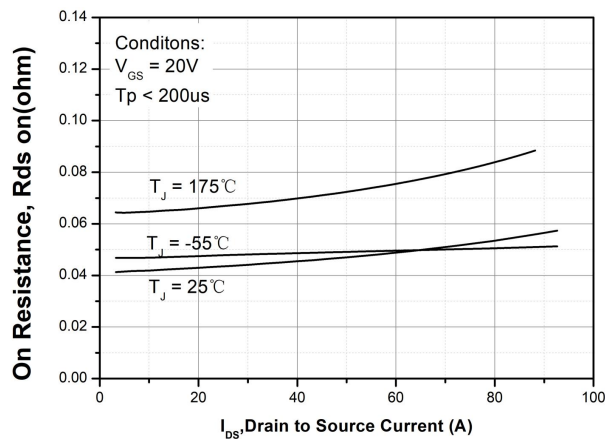


Figure 5. On-Resistance vs. Drain Current For Various Temperatures

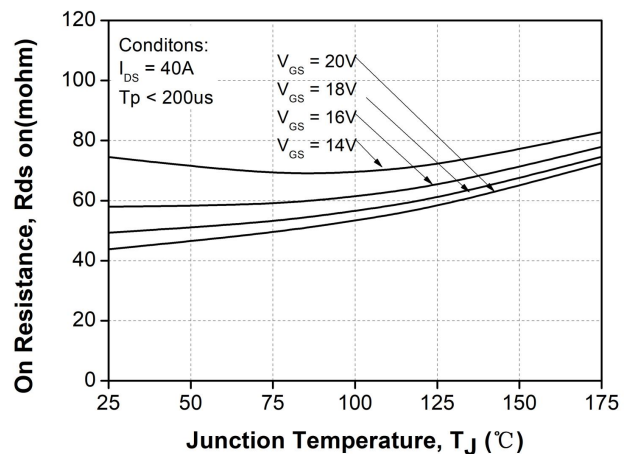


Figure 6. On-Resistance vs. Temperature For Various Gate Voltage

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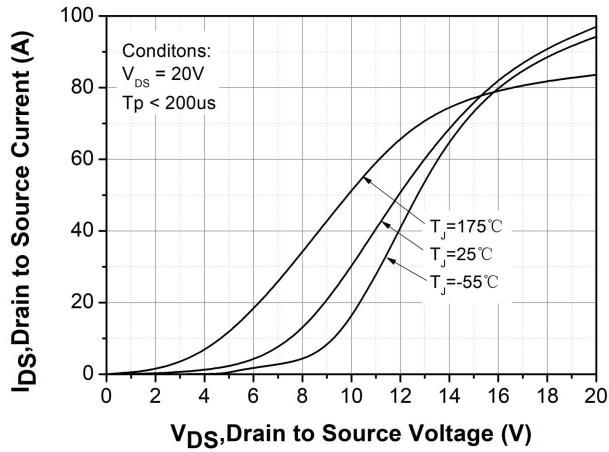


Figure 7. Transfer Characteristic for Various Junction Temperatures

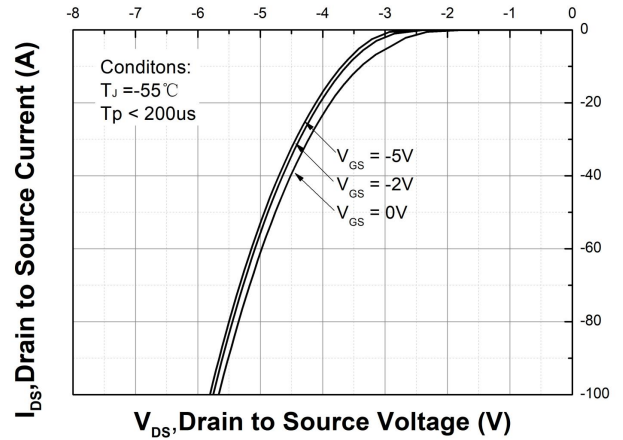


Figure 8. Body Diode Characteristic at $T_J = -55^\circ C$

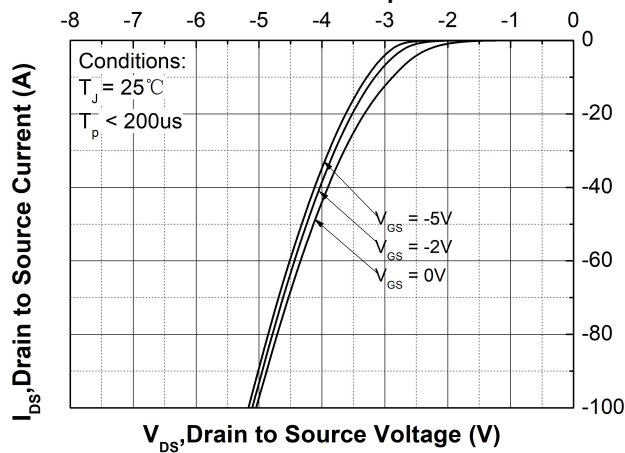


Figure 9. Body Diode Characteristic at $T_J = 25^\circ C$

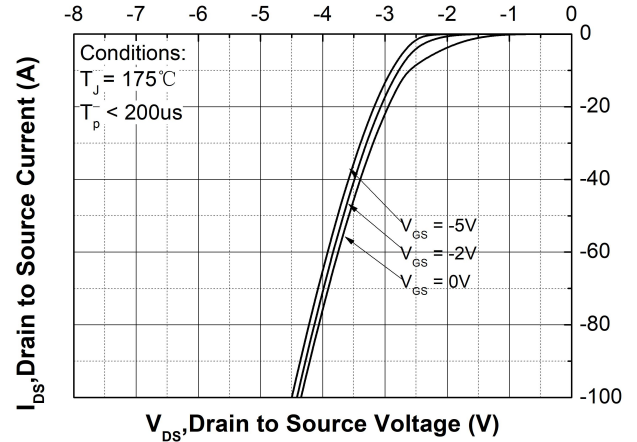


Figure 10. Body Diode Characteristic at $T_J = 175^\circ C$

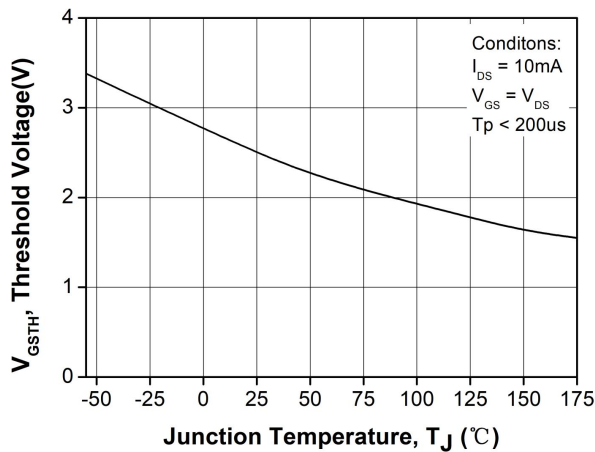


Figure 11. Threshold Voltage vs. Temperature

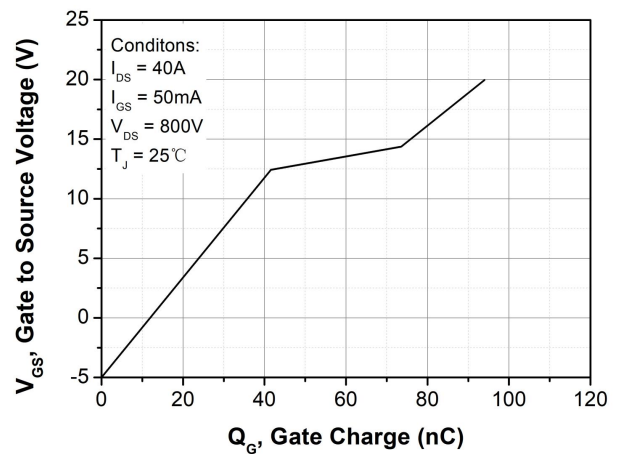


Figure 12. Gate Charge Characteristic

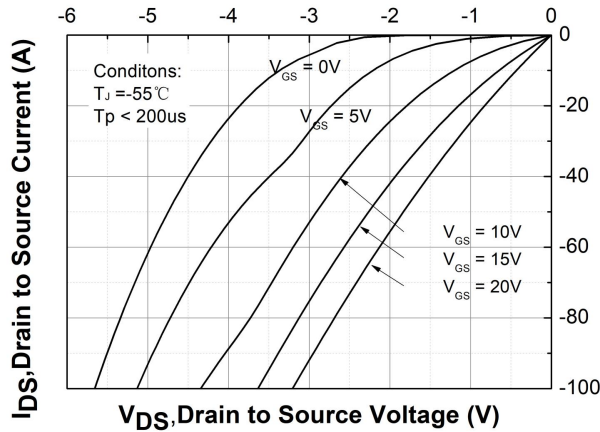


Figure 13. 3rd Quadrant Characteristic at $T_J = -55^\circ\text{C}$

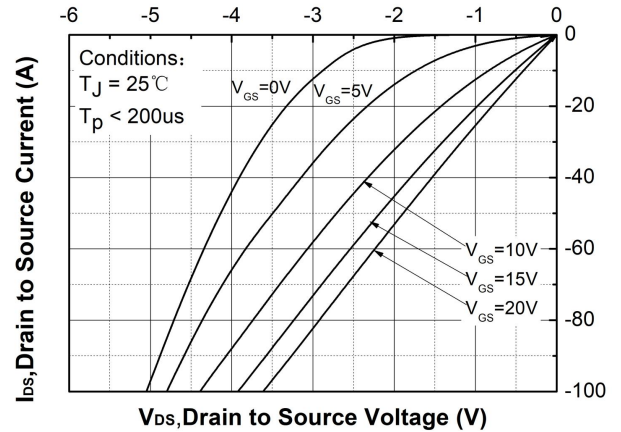


Figure 14. 3rd Quadrant Characteristic at $T_J = 25^\circ\text{C}$

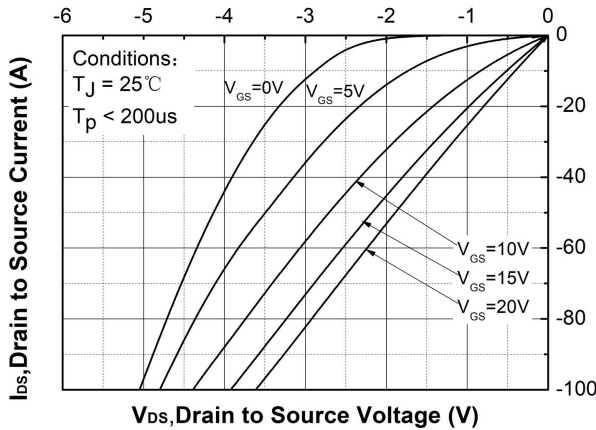


Figure 15. 3rd Quadrant Characteristic at $T_J = 175^\circ\text{C}$

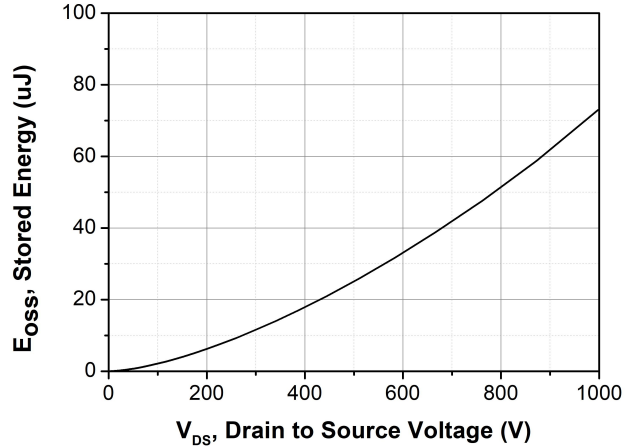


Figure 16. Output Capacitor Stored Energy

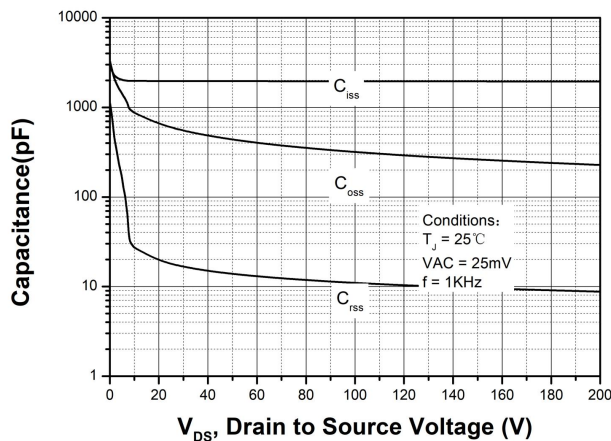


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200V)

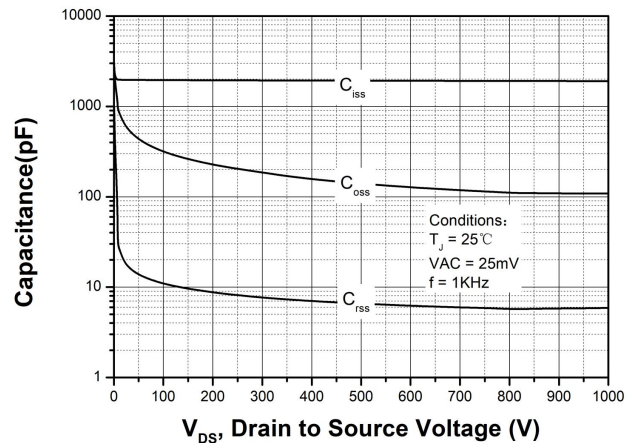


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 1000V)

Technical Data
Data Sheet N2699, REV.-

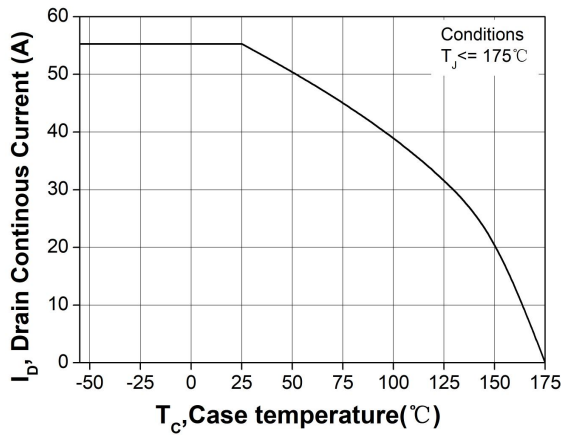


Figure 19. Continuous Drain Current Derating vs. Case Temperature

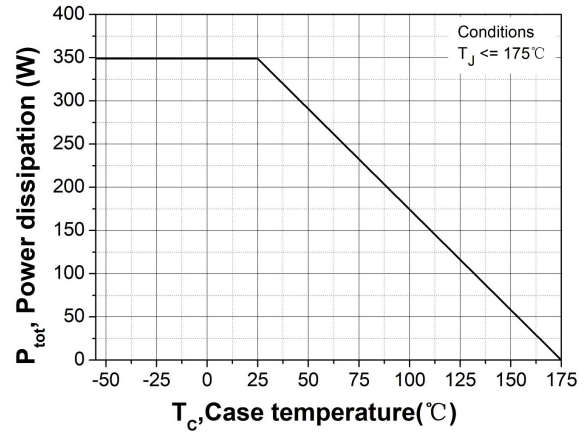


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

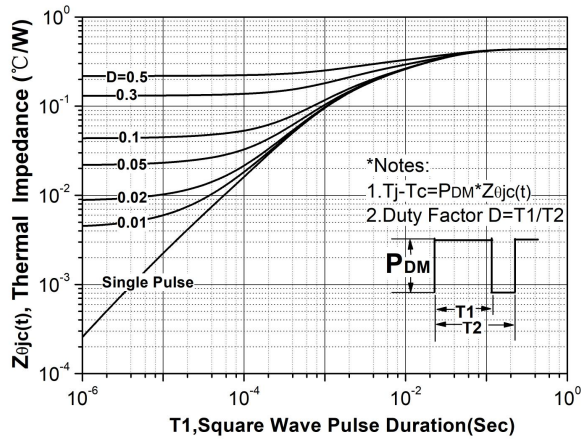


Figure 21. Transient Thermal Impedance (Junction - Case)

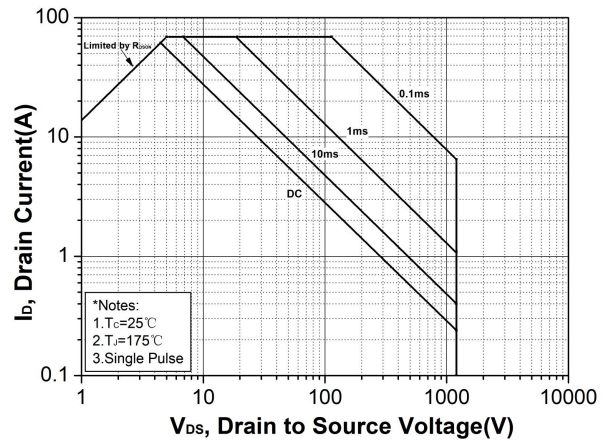


Figure 22. Safe Operating Area

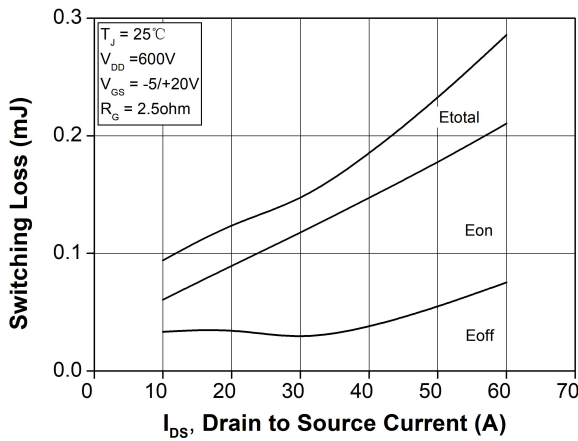


Figure 23. Clamped Inductive Switching Energy vs. Drain Current ($V_{DD} = 600V$)

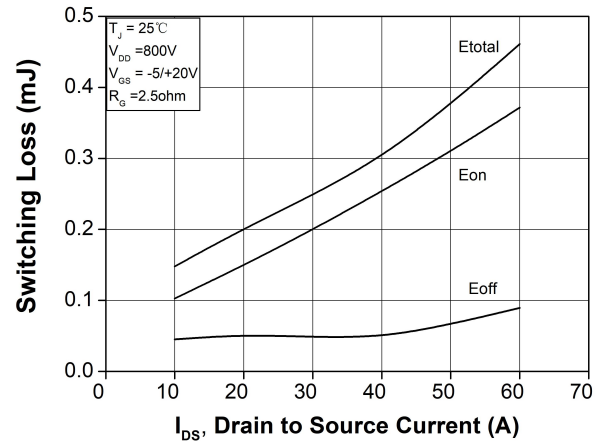


Figure 24. Clamped Inductive Switching Energy vs. Drain Current ($V_{DD} = 800V$)

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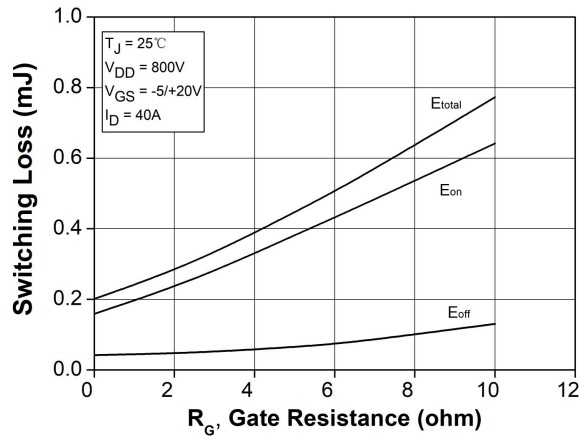


Figure 25. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

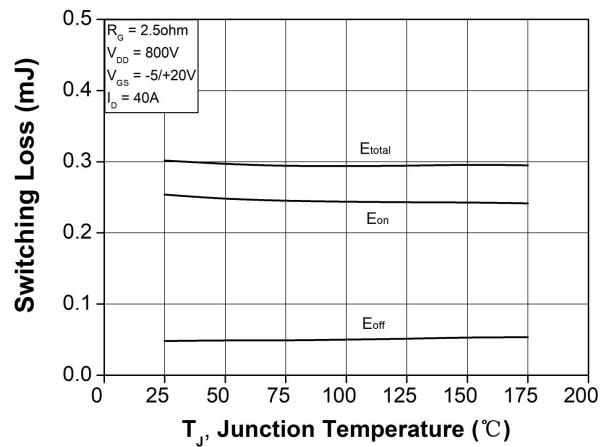


Figure 26. Clamped Inductive Switching Energy vs. Temperature

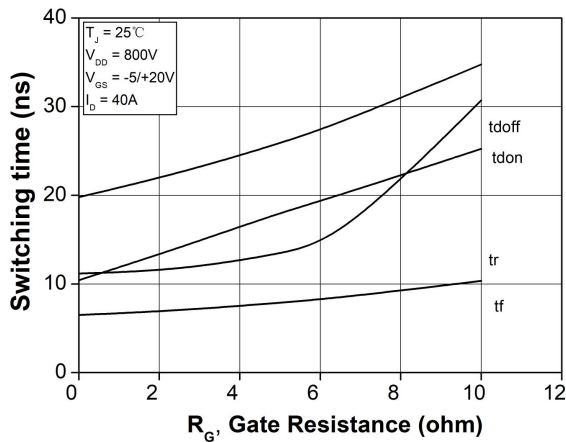


Figure 27. Switching Times vs. $R_{G(ext)}$

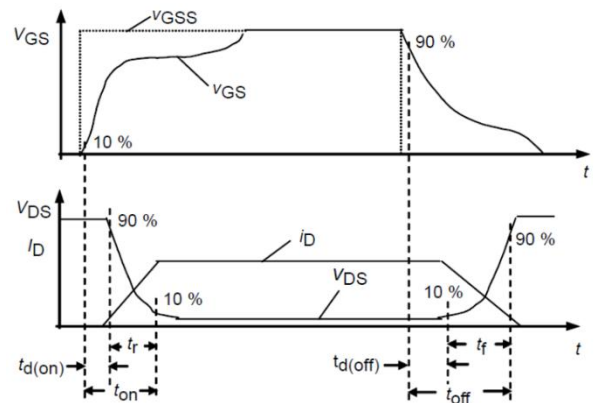
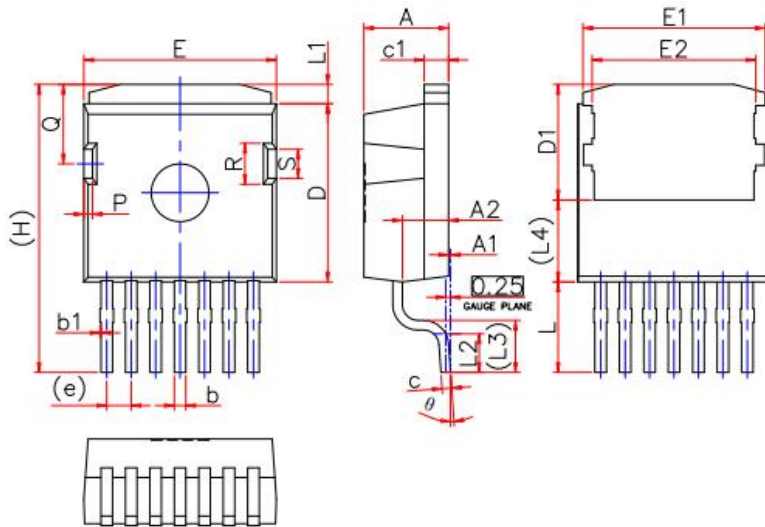


Figure 28. Switching Times Definition

Mechanical Dimensions TO-263-7



SYMBOL	Millimeters		
	MIN.	TYP.	MAX.
A	4.300		4.400
A1	0.000		0.100
A2	2.300		2.400
b	0.500		0.600
b1	0.000		0.075
c	0.400		0.500
c1	1.170		1.270
D	9.050		9.250
D1	5.900		6.000
E	9.800		10.000
E1	9.360		9.460
E2	8.400		8.500
e	1.270 REF		
H	15.000 REF		
L	4.200	2.512	4.700
L1	0.700	0.60	1.000
L2	1.700	1.418	2.000
L3	2.700 REF		
L4	4.250 REF		
P	0.350		0.450
Q	4.020		4.120
R	2.030		2.130
S	1.400		1.500
θ	0°		4°

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RoHS

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