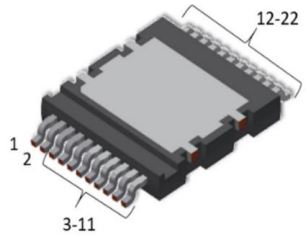
Technical Data
Data Sheet N3203, Rev. -

S3M0080120Q Silicon Carbide Power MOSFET

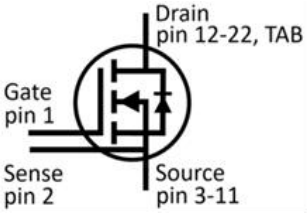


HV-Q-DPAK

Features

- Positive temperature characteristics, easy to parallel.
- Low on-resistance typ. RDS(on) = 80 mΩ.
- 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˚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		+22	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 V_{GS} = 18 V, T_C = 100 ˚C			31 22	A	
Pulsed Drain Current	$I_{D(pulse)}$	Pulse width t_P limited by T_{jmax}			123	A	
Power Dissipation	P_D	T_C = 25 ˚C			192	W	
Avalanche energy	E_{AS}	Single, V_{DD}=50V, L=1mH			21	A	
Short - circuit withstand time	t_{sc}	V_{DD} = 500 V, V_{GS} = -4 / 22 V, R_G = 20 Ω, T_J = 25 ˚C		3		us	

[1] Recommended turn off gate voltage is -4 V. Recommended turn on gate voltage is 18 V. Do not use with VGSON < 12 V.

Electrical Characteristics:

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} = VGS, I_D = 6 mA	2	2.6	4	V
		V_{DS} = VGS, I_D = 6 mA, T_J = 175 °C		1.7		V
Zero Gate Voltage Drain Current	IDSS	V_{DS} = 1200 V, V_{GS} = 0 V		1	100	µA
Gate Source Leakage Current	IGSS	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 = 15 A		80	104	mΩ
		V_{GS} = 18 V, I_D = 15 A, T_J = 175 °C		119		mΩ
Transconductance	gfs	V_{DS} = 20 V, I_{DS} = 15 A		8		S
		V_{DS} = 20 V, I_{DS} = 15 A, T_J = 175 °C		9		S
Input Capacitance	C_{ISS}	V_{GS} = 0 V		984		pF
Output Capacitance	C_{OSS}	V_{DS} = 1000 V		55		
Reverse Transfer Capacitance	C_{RSS}	V_{AC} = 25 mV		10		
COSS Stored Energy	E_{OSS}	f = 100 KHz		45		µJ
Turn-On Switching Energy	E_{ON}	V_{DS} = 800 V, V_{GS} = -4 / 18 V		114		µJ
Turn-Off Switching Energy	E_{OFF}	I_D = 15 A, $R_{G(ext)}$ = 0 Ω, L = 99 uH		2		
Turn-On Delay Time	$t_{d(on)}$	V_{DS} = 800 V, V_{GS} = -4 / 18 V		7		ns
Rise Time	t_r	I_D = 15 A, $R_{G(ext)}$ = 0 Ω		7		
Turn-Off Delay Time	$t_{d(off)}$	Inductive Load Timing relative to		14		
Fall Time	t_f	V_{DS} Per IEC60747-8-4 pg 83		12		
Internal Gate Resistance	$R_{G(int)}$	f = 1 MHz, AC = 25 mV		2.1		Ω
Gate to Source Charge	Qg_s	V_{DS} = 800 V, V_{GS} = -4 / 18 V		11		nC
Gate to Drain Charge	Q_{gd}	I_D = 15 A		5		
Total Gate Charge	Q_g	Per IEC60747-8-4 pg 21		53		

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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} = 7.5 A	4.3		V
	V_{SD}	V_{GS} = -4 V, I_{SD} = 7.5 A, T_J = 175°C	3.8		V
Continuous Diode Forward Current	I_S	V_{GS} = -4 V, T_C = 25 °C	26		A
Reverse Recovery Time	t_{rr}	V_{GS} = -4 V, I_{SD} = 15 A, T_J = 25 °C	14		ns
Reverse Recovery Charge	Q_{rr}	V_R = 800 V	190		nC
Peak Reverse Recovery Current	I_{mm}	dif / dt = 2000 A / µs	17		A

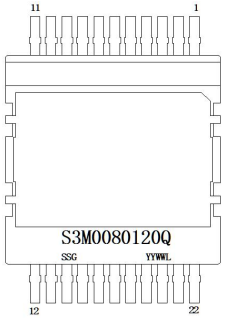
Thermal-Mechanical Specifications

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	0.78	°C /W

Ordering Information

Device	Package	Shipping
S3M0080120Q	HV-Q-DPAK	1000pcs/reel

Marking Diagram



S3M = Device Type
0080 = RDS(on)
120 = Reverse Voltage (1200V)
Q = Package
SSG = SSG
YY = Year
WW = Week
L = Lot Number

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

Ratings and Characteristics Curves

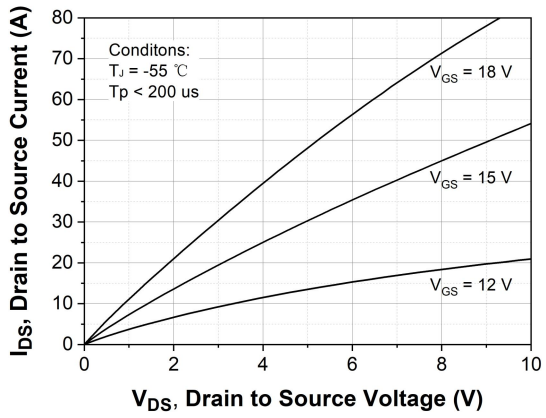


Figure 1. Output Characteristics T_J = -55 °C

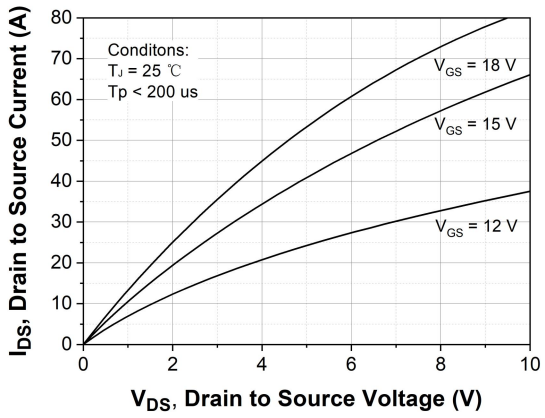


Figure 2. Output Characteristics T_J = 25 °C

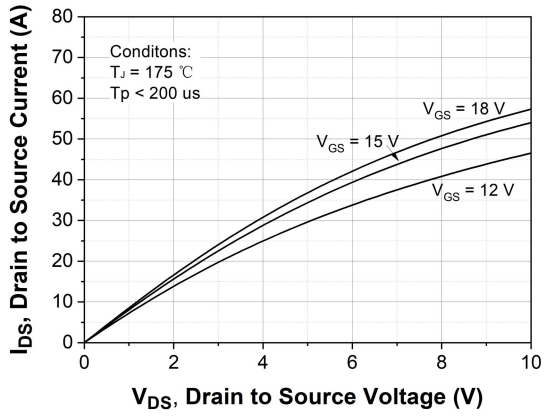


Figure 3. Output Characteristics T_J = 175 °C

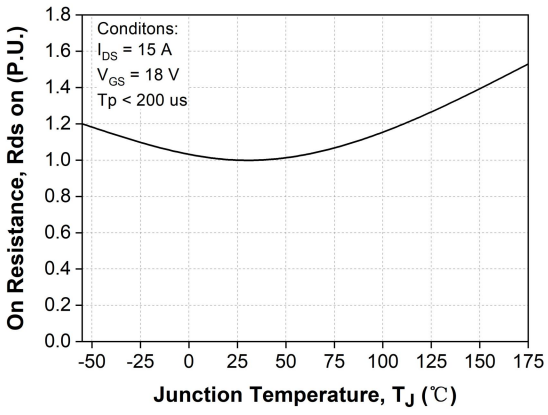


Figure 4. Normalized On-Resistance vs. Temperature

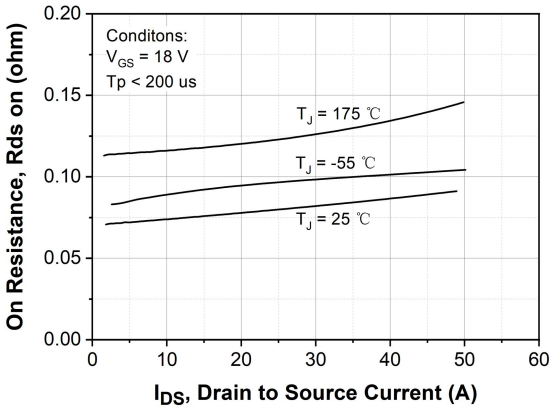


Figure 5. On-Resistance vs. Drain Current For Various Temperatures

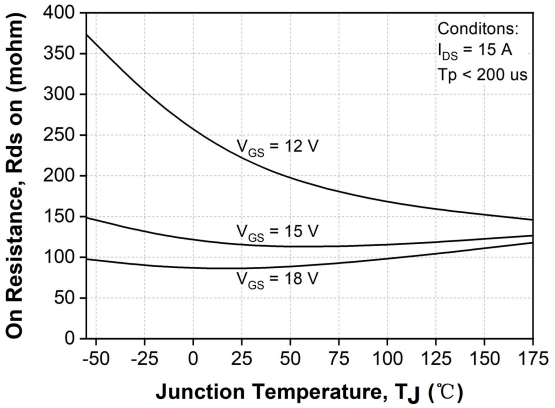


Figure 6. On-Resistance vs. Temperature For Various Gate Voltage

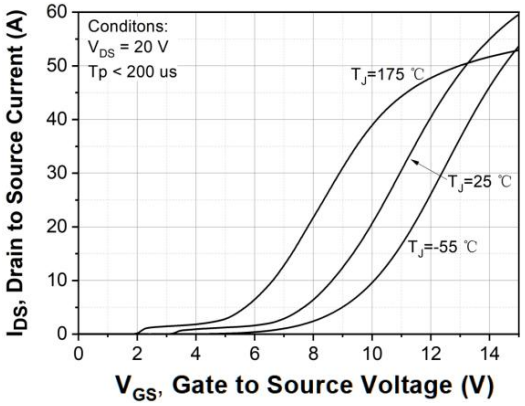


Figure 7. Transfer Characteristic for Various Junction Temperatures

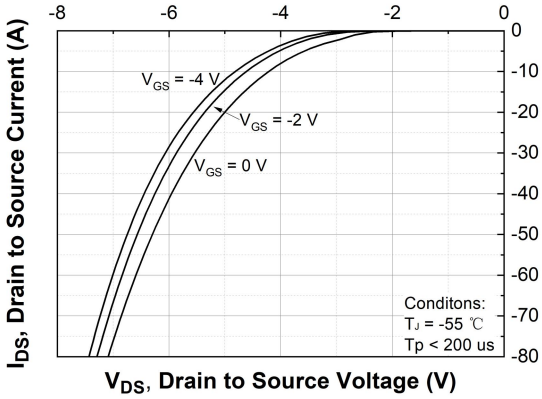


Figure 8. Body Diode Characteristic at T_J = -55 °C

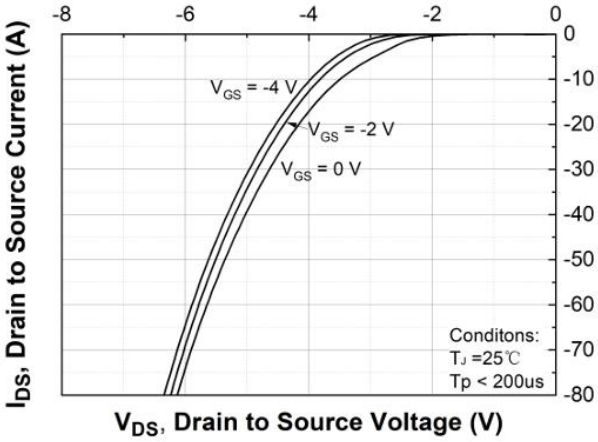


Figure 9. Body Diode Characteristic at T_J = 25 °C

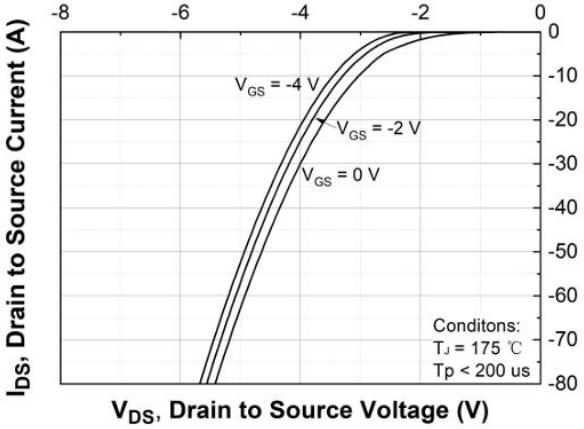


Figure 10. Body Diode Characteristic at T_J = 175

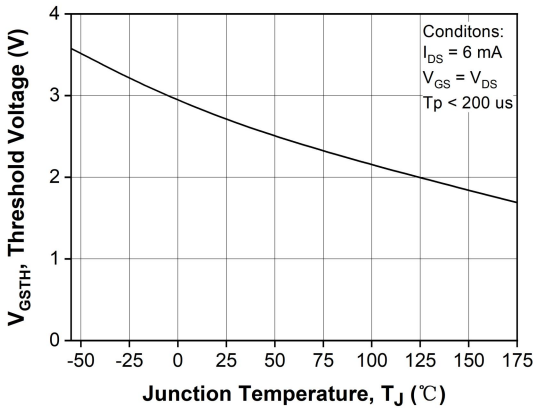


Figure 11. Threshold Voltage vs. Temperature

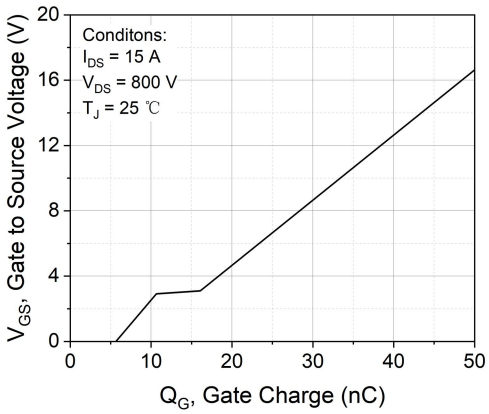


Figure 12. Gate Charge Characteristic

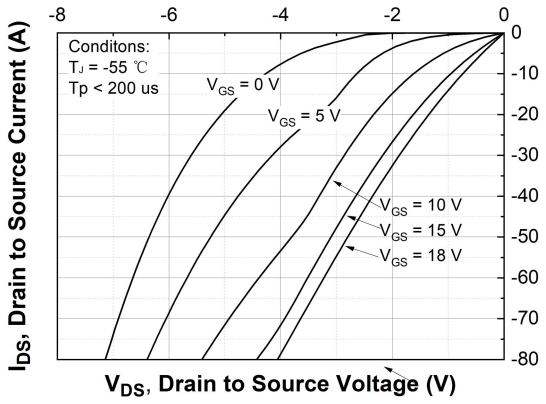


Figure 13. 3rd Quadrant Characteristic at T_J = -55 °C

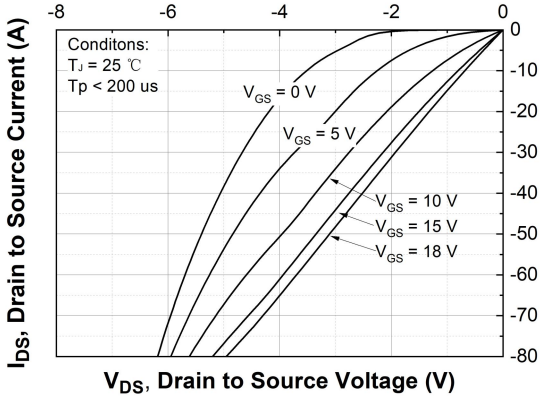


Figure 14. 3rd Quadrant Characteristic at T_J = 25 °C

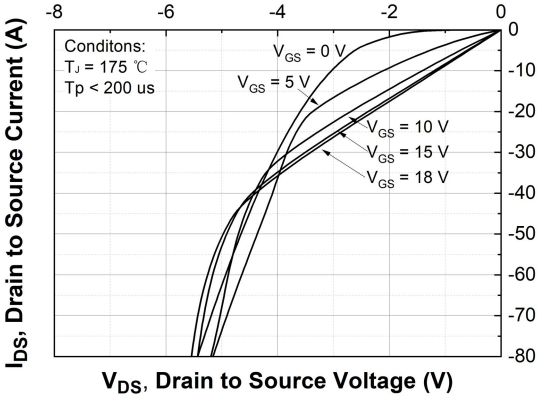


Figure 15. 3rd Quadrant Characteristic at T_J = 175 °C

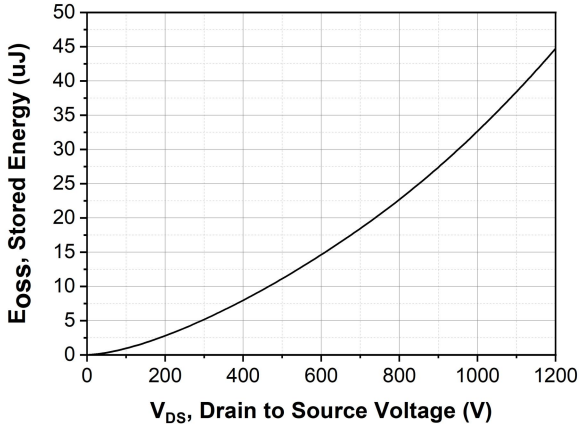


Figure 16. Output Capacitor Stored Energy

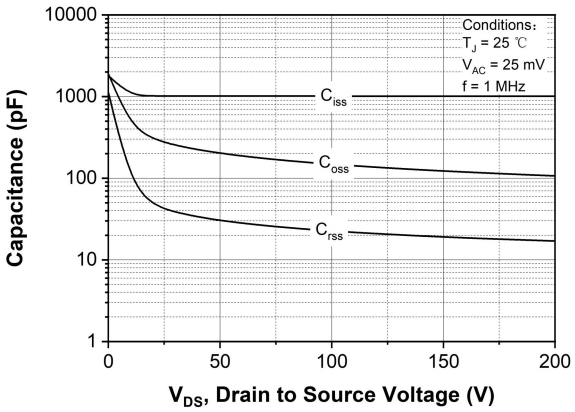


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200 V)

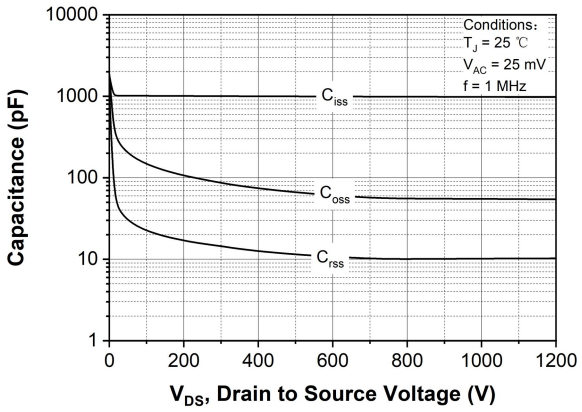


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 1200 V)

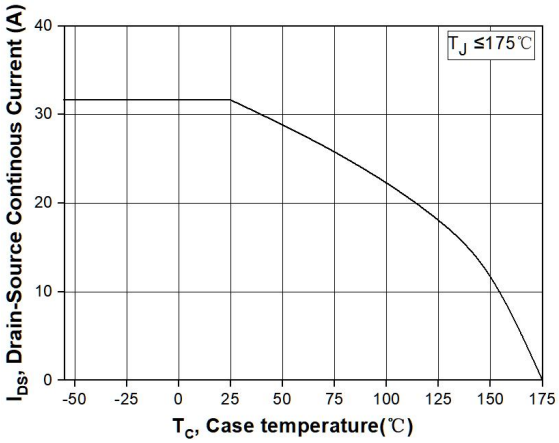


Figure 19. Continuous Drain Current Derating vs. Case Temperature

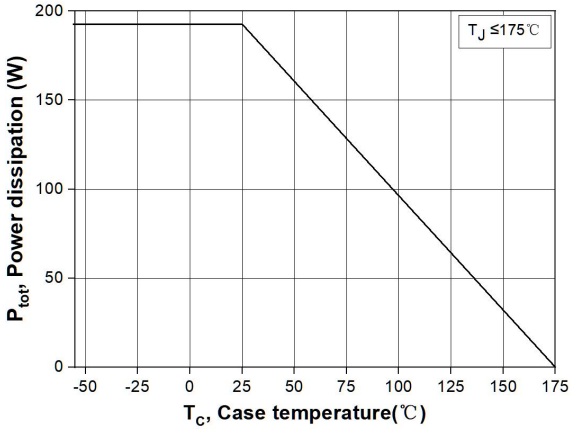


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

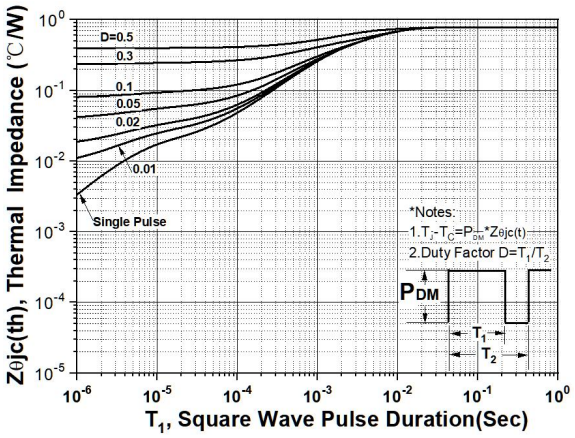


Figure 21. Transient Thermal Impedance (Junction - Case)

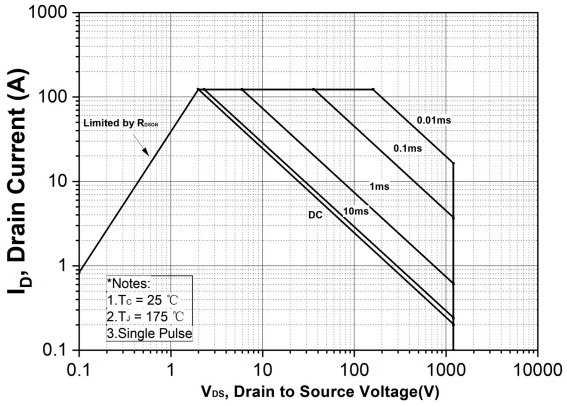


Figure 22. Safe Operating Area

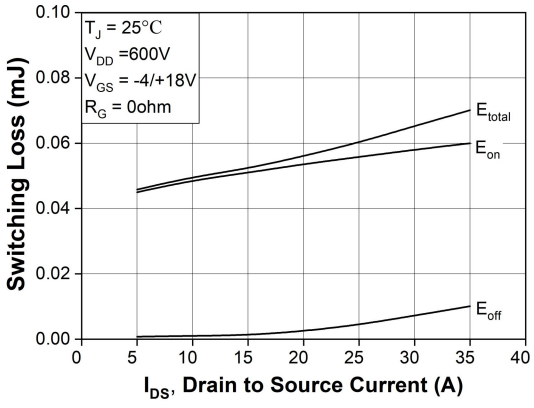


Figure 23. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 600V)

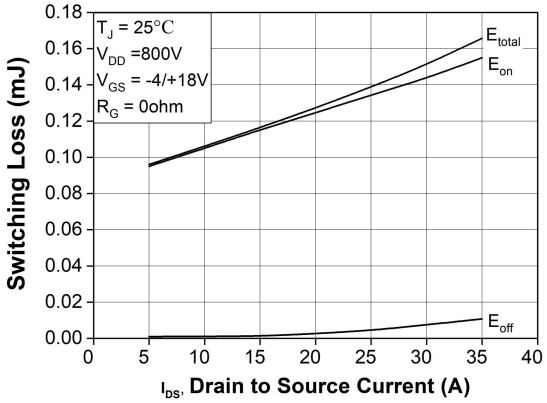


Figure 24. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 800V)

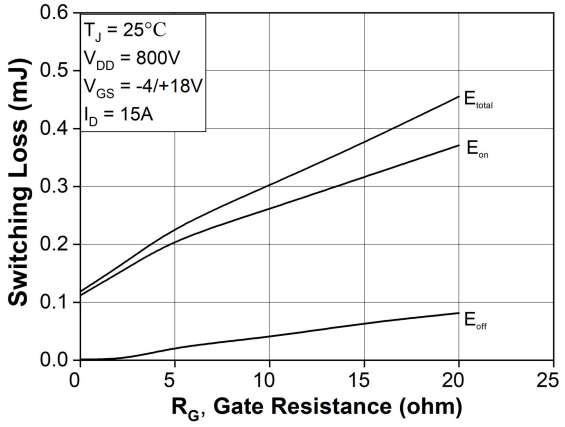


Figure 25. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

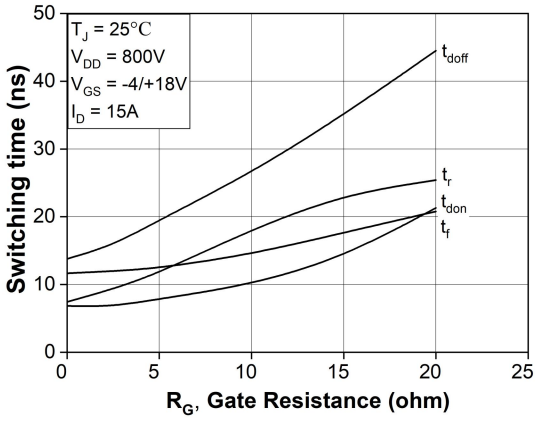


Figure 26. Switching Times vs. $R_{G(ext)}$

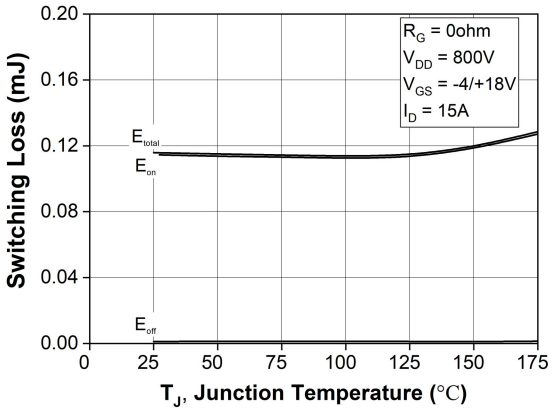


Figure 27. Clamped Inductive Switching Energy vs. Temperature

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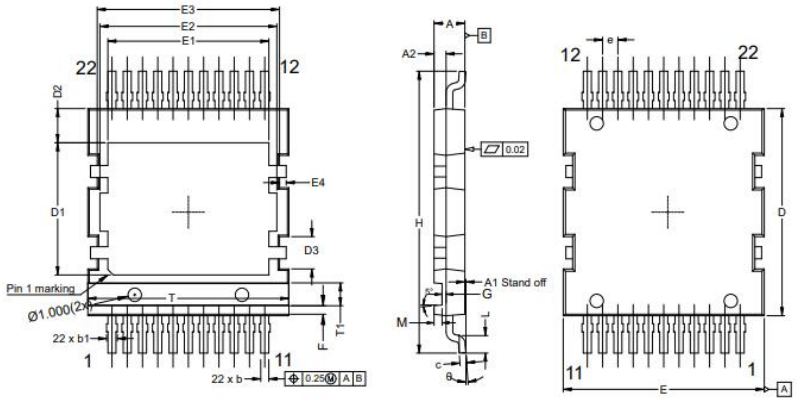
Mechanical Dimensions HV-Q-DPAK



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

COMMON DIMENSIONS		
SYMBOL	mm	
	Min	Max
A	2.20	2.35
A1	0.00	0.15
A2	0.80	1.00
b	0.50	0.70
b1	0.50	0.90
c	0.46	0.58
e	1.14	
D	15.30	15.50
D1	9.74	9.94
D2	2.54	
D3	2.40	
E	14.90	15.10
E1	11.91	12.11
E2	13.20	
E3	13.60	
E4	0.50	
H	20.81	21.11
L	1.20	1.40
T	14.90	15.10
T1	1.65	1.75
M	0.60	
F	0.631	
G	0.30	

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