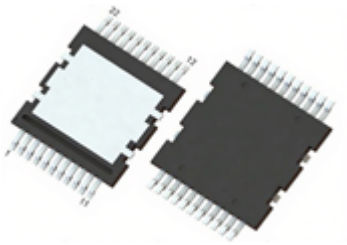
Technical Data
Data Sheet N3030, Rev. -

S1M0032065Q Silicon Carbide Power MOSFET

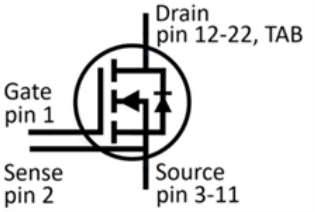


Q-DPAK

Features

- Positive temperature characteristics, easy to parallel.
- Low on-resistance typ. RDS(on) = 32 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	650			V	
Gate - Source Voltage (dynamic)	V_{GSmax}	AC (f > 1 Hz)	-10		+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 V_{GS} = 18 V, T_C = 100 ˚C			78 55	A	
Pulsed Drain Current	$I_{D(pulse)}$	Pulse width t_P limited by T_{jmax}			250	A	
Power Dissipation	P_D	T_C = 25 ˚C			384	W	

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

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Electrical Characteristics:

Characteristics	Symbol	Conditions	Min.	Typ.	Max.	Units
Drain Source Breakdown Voltage	$V_{(BR)DSS}$	VGS = 0 V, ID = 100 μA	650			V
Gate Threshold Voltage	$V_{GS(th)}$	VDS = VGS, ID = 9.4 mA	2	3.2	4	V
		VDS = VGS, ID = 9.4 mA, TJ = 175 °C		2.4		V
Zero Gate Voltage Drain Current	IDSS	VDS = 650 V, VGS = 0 V			100	μA
Gate Source Leakage Current	IGSS	VGS = 18 V, VDS = 0 V			250	nA
Drain Source On-State Resistance	$R_{DS(on)}$	VGS = 18 V, ID = 90 A		32	42	mΩ
		VGS = 18 V, ID = 90 A, TJ = 175 °C		40		mΩ
Transconductance	gfs	VDS = 20 V, IDS = 90 A		1.7		S
		VDS = 20 V, IDS = 90 A, TJ = 175 °C		1.8		S
Input Capacitance	C_{ISS}	VGS = 0 V		3110		pF
Output Capacitance	C_{OSS}	VDS = 650 V		243		
Reverse Transfer Capacitance	C_{RSS}	VAC = 25 mV		14		
COSS Stored Energy	E_{OSS}	f = 1 MHz		55		μJ
Turn-On Switching Energy	E_{ON}	VDS = 400 V, VGS = -4 / 18 V		1754		μJ
Turn-Off Switching Energy	E_{OFF}	ID = 90 A, RG(ext) = 5.6Ω, L = 99 uH		448		
Turn-On Delay Time	$t_{d(on)}$	VDS = 400 V, VGS = -4 / 18 V		53		ns
Rise Time	t_r	ID = 90 A, RG(ext) = 5.6Ω		52		
Turn-Off Delay Time	$t_{d(off)}$	Inductive Load Timing relative to		23		
Fall Time	t_f	VDS Per IEC60747-8-4 pg 83		8		
Internal Gate Resistance	$R_{G(int)}$	f = 1 MHz, AC = 25 mV		1		Ω
Gate to Source Charge	Qg_s	VDS = 400 V, VGS = -4 / 18 V		70		nC
Gate to Drain Charge	Q_{gd}	ID = 90 A		40		
Total Gate Charge	Q_g	Per IEC60747-8-4 pg 21		121		

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

Characteristics	Symbol	Conditions	Typ.	Max.	Units
Diode Forward Voltage	V_{SD}	V_{GS} = -4 V, I_{SD} = 45 A	5.5		V
	V_{SD}	V_{GS} = -4 V, I_{SD} = 45 A, T_J = 175°C	5.0		V
Reverse Recovery Time	t_{rr}	V_{GS} = -4 V, I_{SD} = 90 A, T_J = 25 °C	34		ns
Reverse Recovery Charge	Q_{rr}	V_R = 400 V	208		nC
Peak Reverse Recovery Current	I_{mm}	dif / dt = 2000 A / µs	21		A

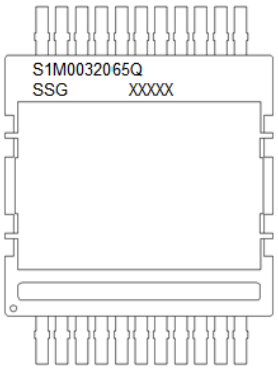
Thermal-Mechanical Specifications

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	$R_{\theta JC}$		0.39	°C / W

Ordering Information

Device	Package	Shipping
S1M0032065Q	Q-DPAK	1000 pcs/ reel

Marking Diagram



Where XXXXX is YYWWL

S1M = Device Type
0032 = RDS(on)
065 = Reverse Voltage (650V)
Q = Package
SSG = SSG
YY = Year
WW = Week
L = Lot Number

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

Ratings and Characteristics Curves

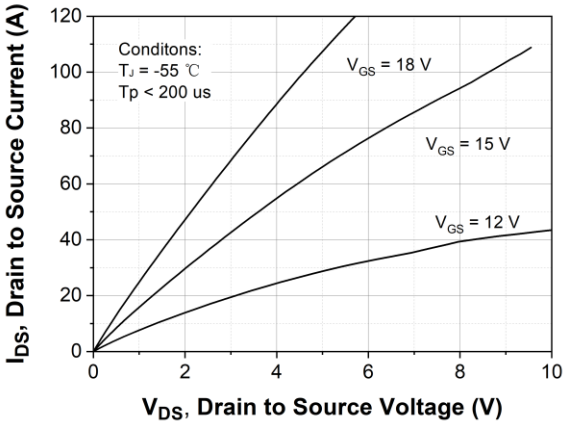


Figure 1. Output Characteristics T_J = -55 °C

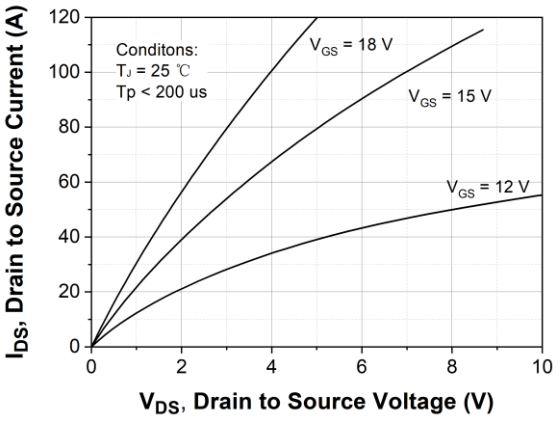


Figure 2. Output Characteristics T_J = 25 °C

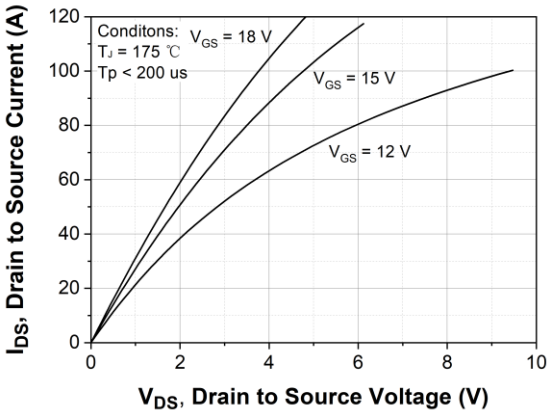


Figure 3. Output Characteristics T_J = 175 °C

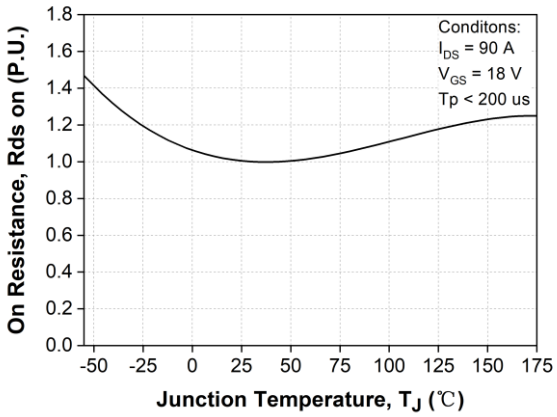


Figure 4. Normalized On-Resistance vs. Temperature

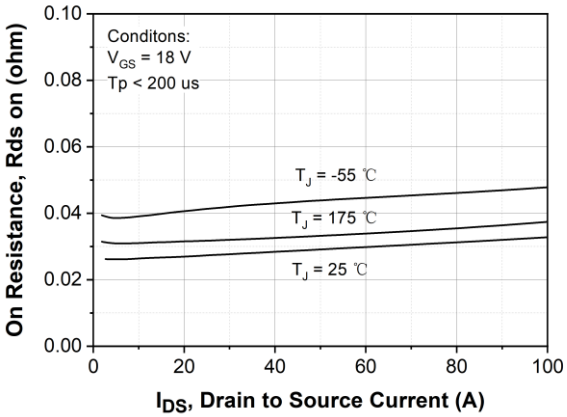


Figure 5. On-Resistance vs. Drain Current For Various Temperatures

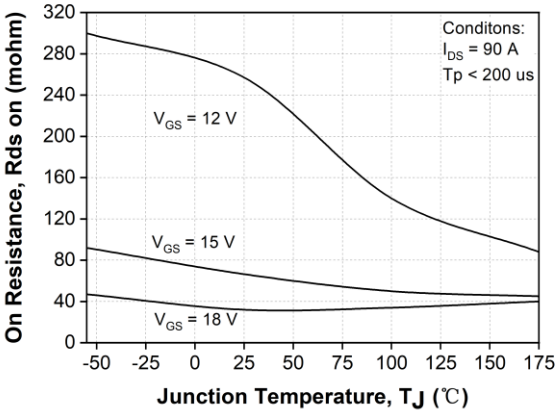


Figure 6. On-Resistance vs. Temperature For Various Gate Voltage

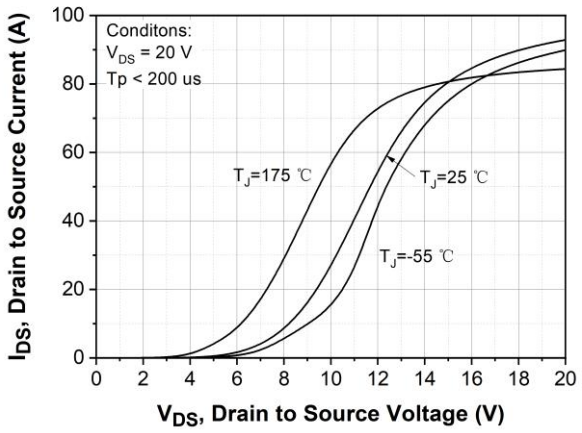


Figure 7. Transfer Characteristic for Various Junction Temperatures

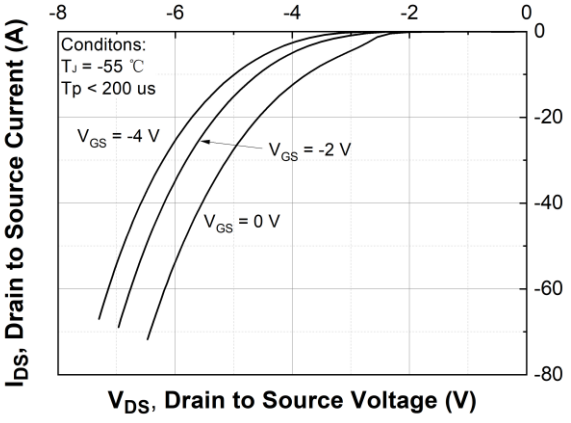


Figure 8. Body Diode Characteristic at T_J = -55 °C

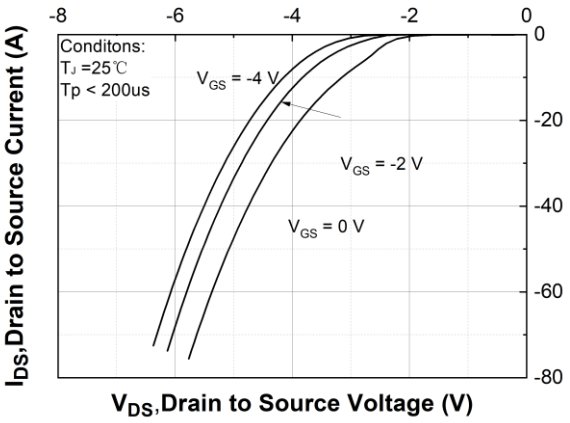


Figure 9. Body Diode Characteristic at T_J = 25 °C

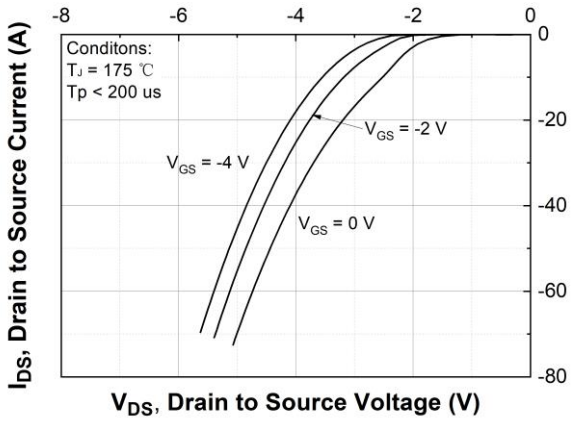


Figure 10. Body Diode Characteristic at T_J = 175 °C

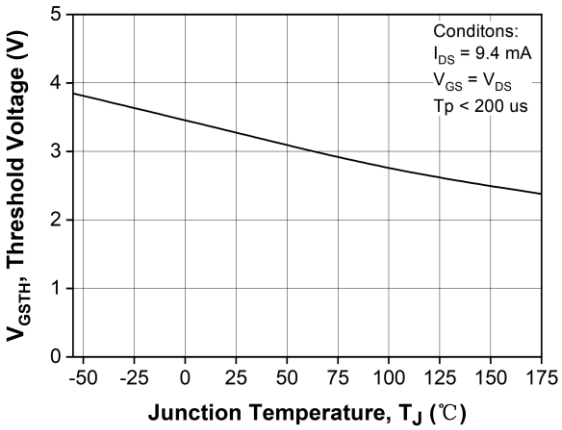


Figure 11. Threshold Voltage vs. Temperature

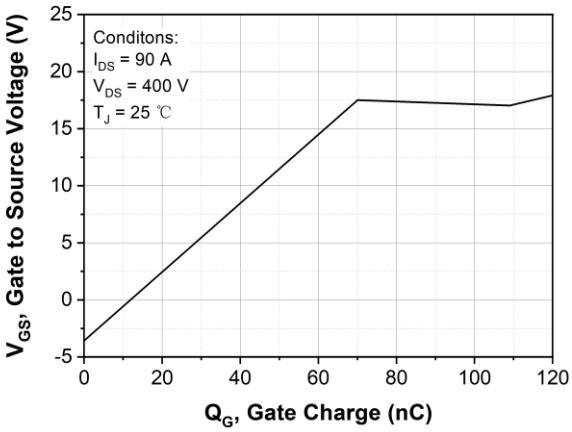


Figure 12. Gate Charge Characteristic

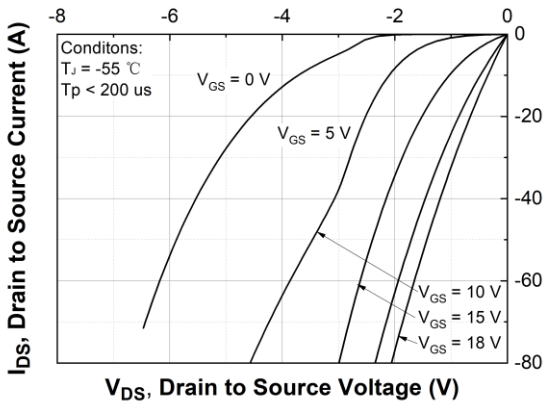


Figure 13. 3rd Quadrant Characteristic at T_J = -55 °C

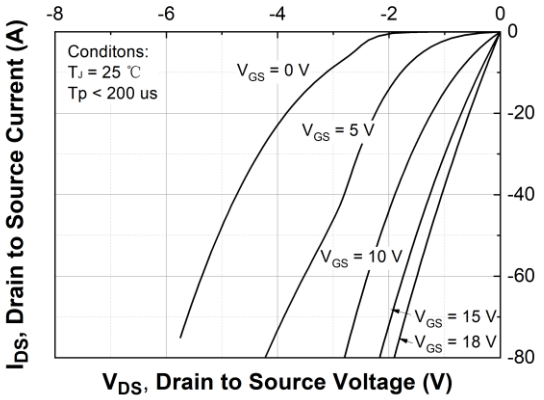


Figure 14. 3rd Quadrant Characteristic at T_J = 25 °C

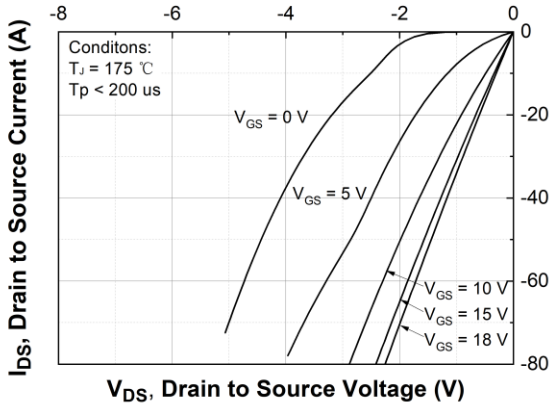


Figure 15. 3rd Quadrant Characteristic at T_J = 175 °C

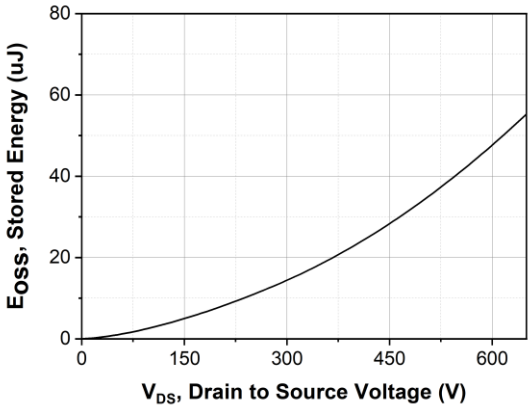


Figure 16. Output Capacitor Stored Energy

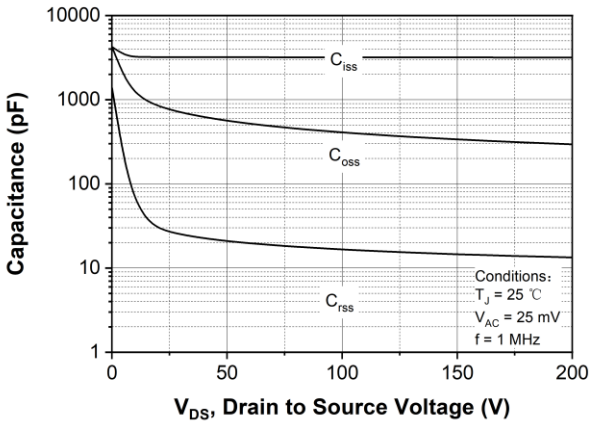


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200 V)

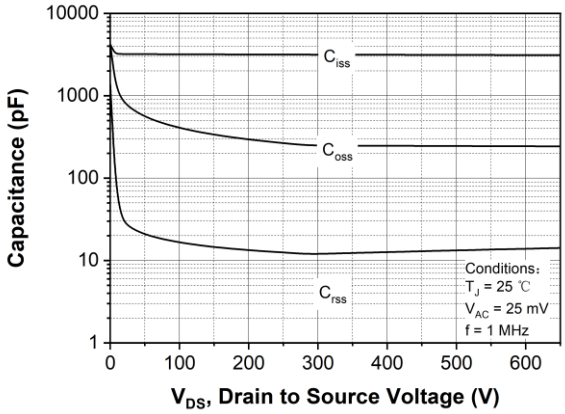


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 650 V)

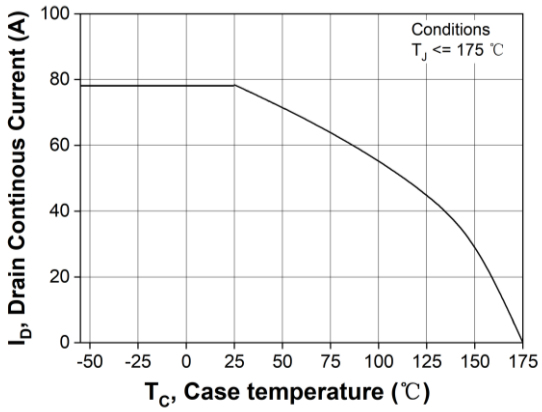


Figure 19. Continuous Drain Current Derating vs. Case Temperature

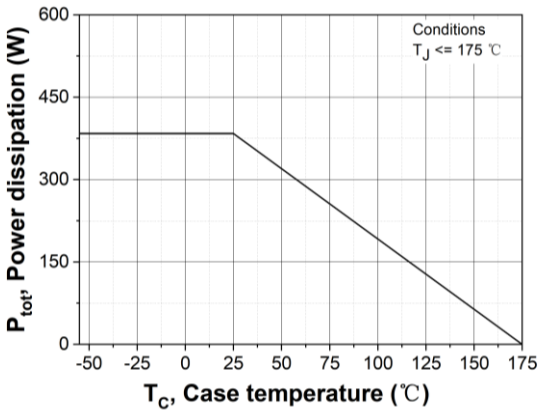


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

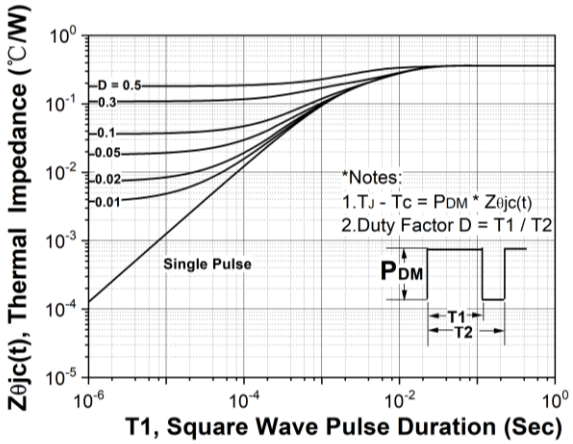


Figure 21. Transient Thermal Impedance (Junction - Case)

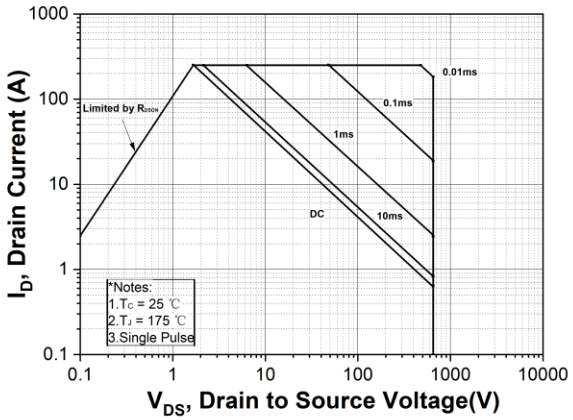


Figure 22. Safe Operating Area

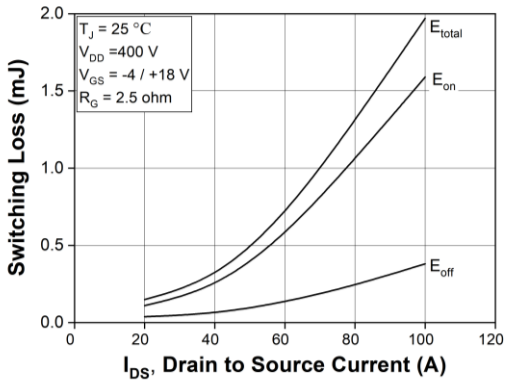


Figure 23. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 400V)

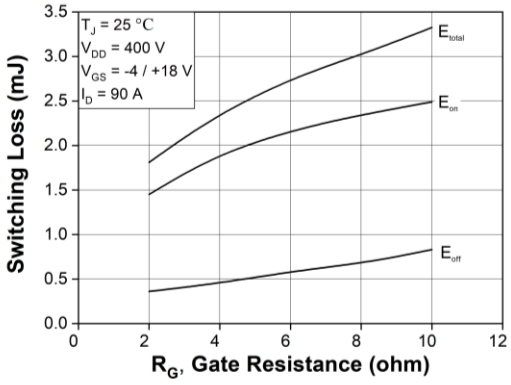


Figure 24. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

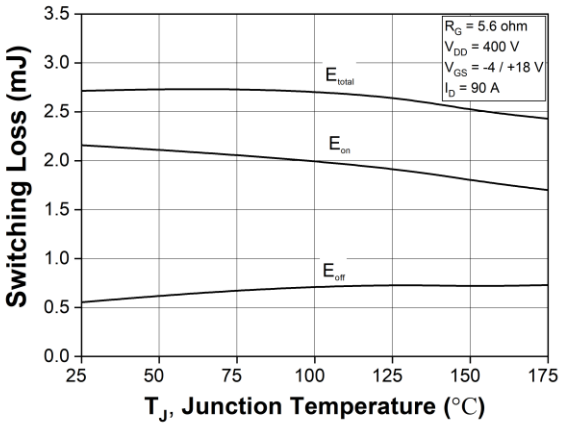


Figure 25. Clamped Inductive Switching Energy vs. Temperature

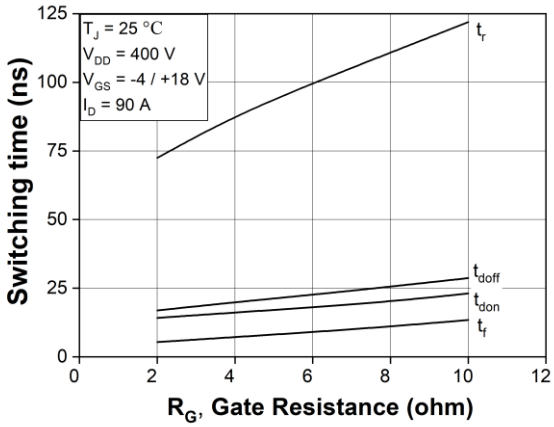


Figure 26. Switching Times vs. $R_{G(ext)}$

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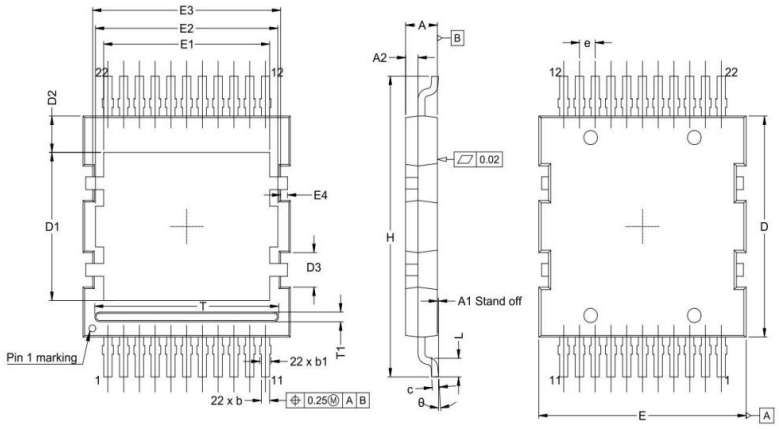
Mechanical Dimensions Q-DPAK



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	2.40
A1	0.00	0.15
A2	0.80	1.00
b	0.50	0.70
b1	0.50	0.95
c	0.40	0.60
e	1.14	
D	15.20	15.60
D1	10.20	10.45
D2	2.54	
D3	2.40	
E	14.80	15.20
E1	11.85	12.15
E2	13.20	
E3	13.60	
E4	0.50	
H	20.70	21.20
L	1.15	1.45
T	13.15	13.45
T1	0.50	0.80

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