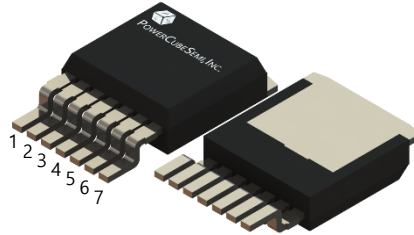# PCMQ050R065D7Y
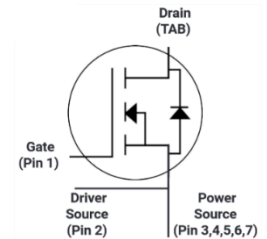# 650V 57A 50mΩ Silicon Carbide MOSFET

Features

- High speed switching
- Essentially no switching losses
- Reduction of heat sink requirements
- Maximum working temperature at 175 °C
- High blocking voltage
- Fast Intrinsic diode with low recovery current
- High-frequency operation
- Halogen free, RoHS compliant
- AEC-Q101 qualified

Applications

- Power Factor Correction (PFC)
- Solar Inverters
- Uninterruptible power supply
- Motor Drives
- Photovoltaic inverter
- Electric car
- EV Charging System
- On-Board Charger (OBC)

Package Outline

Absolute Maximum Ratings $T_C = 25°C$ unless otherwise noted

Symbol	Parameter		Value	Units
V_{DSS}	Drain-Source Voltage		650	V
I_D	Drain Current	- Continuous ($T_C = 25℃$)	57	A
		- Continuous ($T_C = 110℃$)	38	A
I_{DM}	Drain Current	- Pulsed	127	A
$V_{GS, max}$	Gate-Source Voltage (AC f > 1Hz, duty cycle < 1%)		-10 / +25	V
$V_{GS, op}$	Gate-Source Voltage		-5 / +20	V
P_D	Power Dissipation ($T_C = 25℃$)		223	W
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +175	℃
T_L	Maximum lead temperature for soldering purposes, 1.6 mm from case for 10 seconds		260	℃
E_{AS}	Avalanche energy, Single Pulse (V_{DD}=100V, I_D=10A)		1600	mJ

Thermal Characteristics

Symbol	Parameter	Value	Units
$R_{θJC}$	Thermal Resistance, Junction-to-Case	0.67	℃/W
$R_{θJA}$	Thermal Resistance, Junction-to-Ambient	-	℃/W

Electrical Characteristics $T_C = 25°C$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0$ V, $I_D = 100$ uA	650	--	--	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 650$ V, $V_{GS} = 0$ V	--	<1	50	uA
I_{GSS}	Gate-Body Leakage Current	$V_{GS} = 20$ V, $V_{DS} = 0$ V	--	--	250	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 20$ mA	--	2.6	--	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 20$ V, $I_D = 20$ A	--	50	65	mΩ
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = 400$ V, $V_{GS} = 0$ V, f = 1.0 MHz	--	1850	--	pF
C_{oss}	Output Capacitance		--	208	--	pF
C_{rss}	Reverse Transfer Capacitance		--	33	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 400$ V, $V_{GS} = -4 / 20$ V, $I_D = 20$ A, $R_L = 20$ Ω, $R_G = 2.7$ Ω	--	16	--	ns
t_r	Turn-On Rise Time		--	17	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	20	--	ns
t_f	Turn-Off Fall Time		--	10	--	ns
E_{on}	Turn-On Switching loss	$V_{DD} = 400$ V, $V_{GS} = 0 / 20$ V $R_G = 2.7$ Ω	--	21	--	uJ
E_{off}	Turn-Off Switching loss		--	28	--	uJ
Q_g	Total Gate Charge	$V_{DS} = 400$ V, $I_D = 30$ A, $V_{GS} = -5 / 20$ V	--	121	--	nC
Q_{gs}	Gate-Source Charge		--	30	--	nC
Q_{gd}	Gate-Drain Charge		--	43	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	39	--	A
V_{SD}	Diode Forward Voltage	$V_{GS} = 0$ V, $I_S = 5$ A	--	3.0	--	V
t_{rr}	Reverse Recovery Time	$V_R = 400$ V, $V_{GS} = 0$ V, $I_S = 30$ A, $dI_F / dt = 300$ A/us	--	58	--	ns
Q_{rr}	Reverse Recovery Charge		--	122	--	nC
I_{rrm}	Peak Reverse Recovery Current		--	3.75	--	A

Typical Characteristics

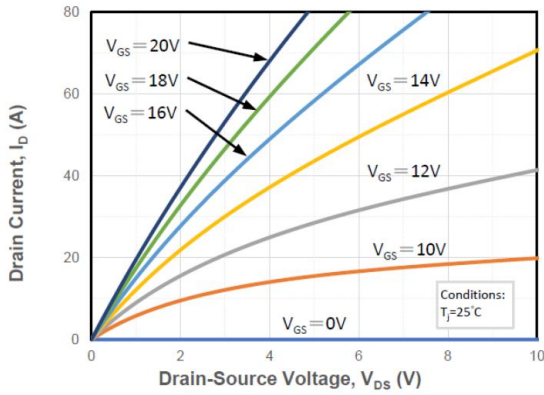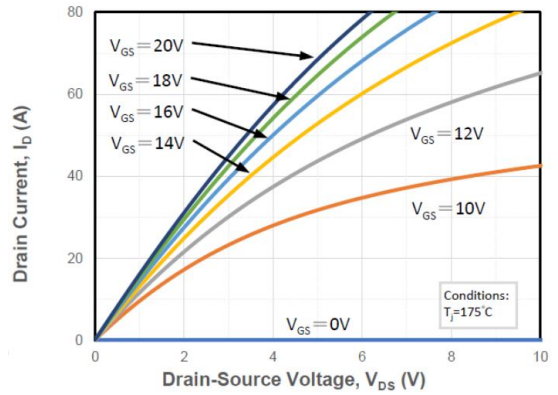Figure 1. Output Characteristics $T_J=25℃$

Figure 2. Output Characteristics $T_J=175℃$
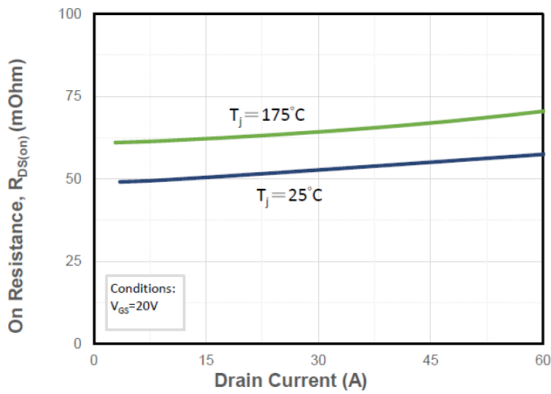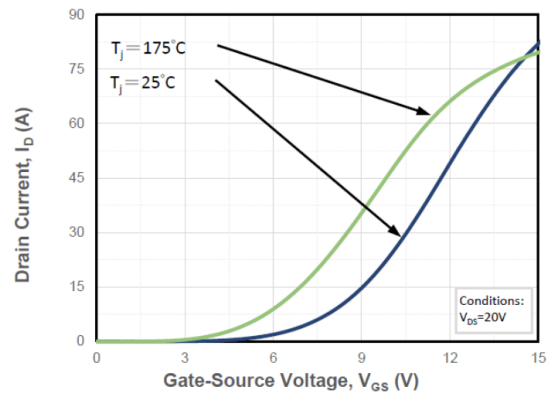

Figure 3. On-resistance vs. Drain Current

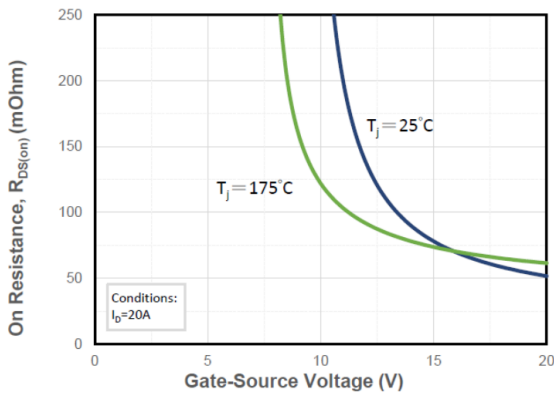Figure 4. Transfer Characteristics for various T_J

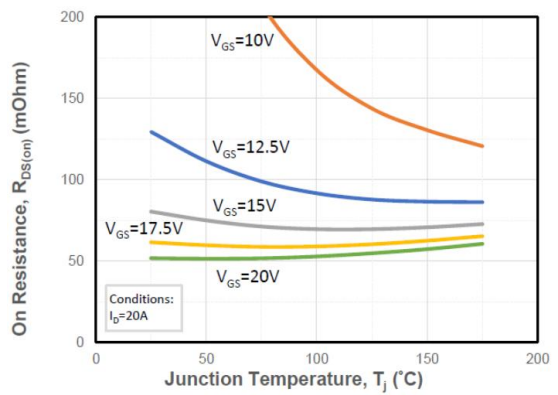Figure 5. On-resistance vs. gate voltage for various T_J

Figure 6. On-resistance vs. Temperature for various Gate Voltage
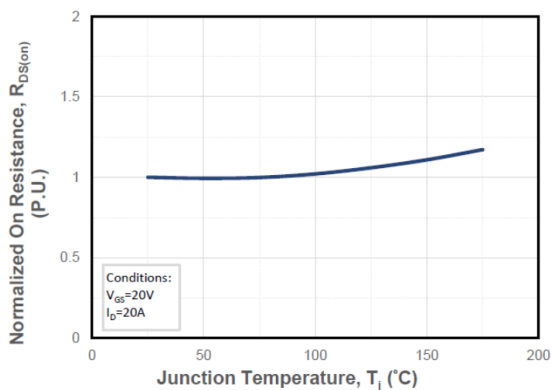
Typical Characteristics

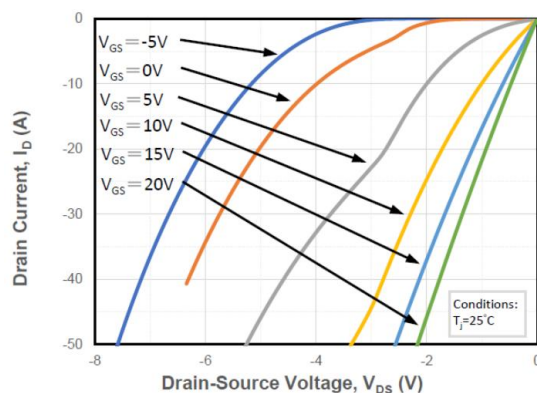Figure 7. Normalized On-resistance vs. Temperature
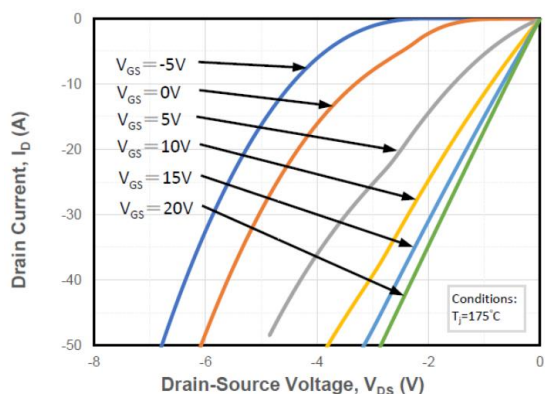

Figure 8. Reverse output characteristics at $T_J=25℃$

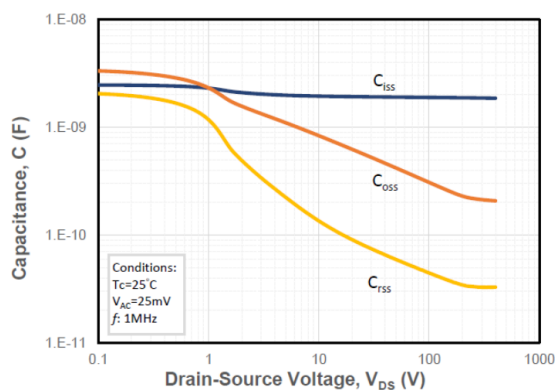Figure 9. Reverse output characteristics at $T_J=175℃$

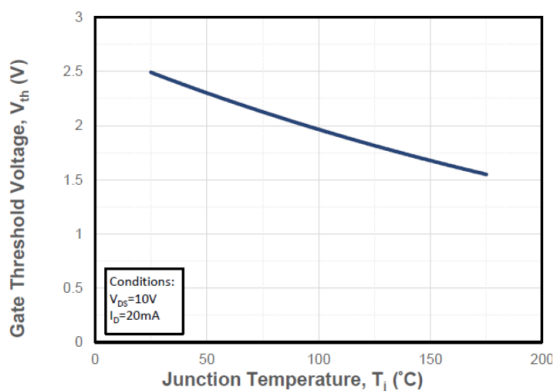Figure 10. Capacitance vs. Drain to Source Voltage

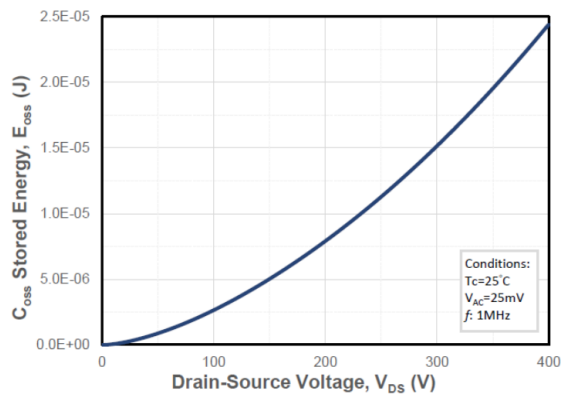Figure 11. Threshold Voltage vs. Temperature

Figure 12. Output capacitor stored energy
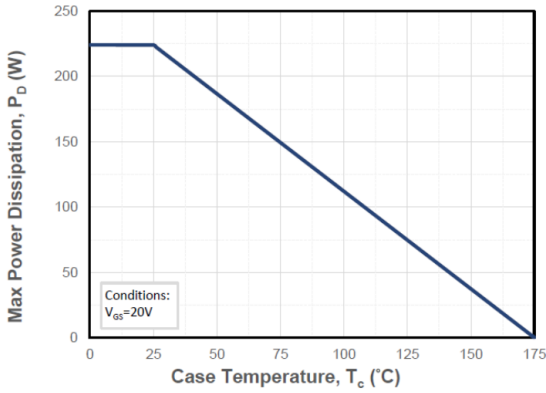
Typical Characteristics

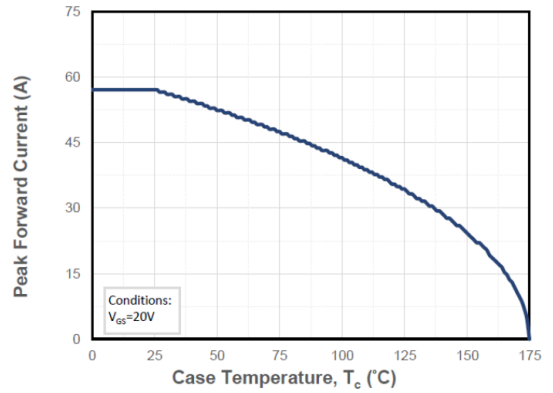Figure 13. Maximum Power dissipation derating vs. Case temperature

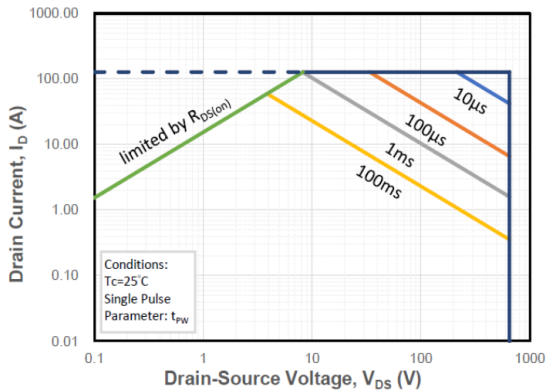Figure 14. Drain current derating vs. case temperature
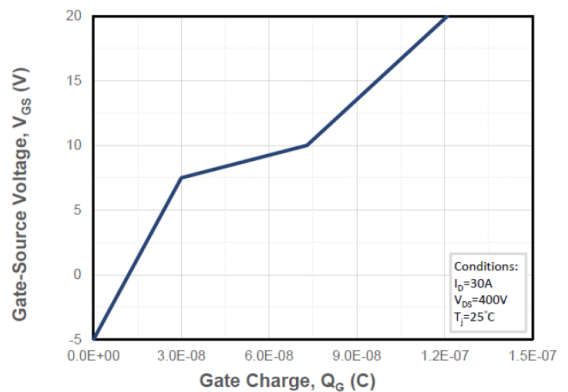

Figure 15. Safe Operating Area

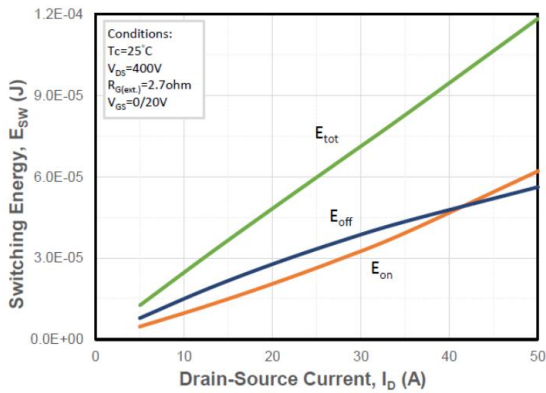Figure 16. Gate charge characteristics

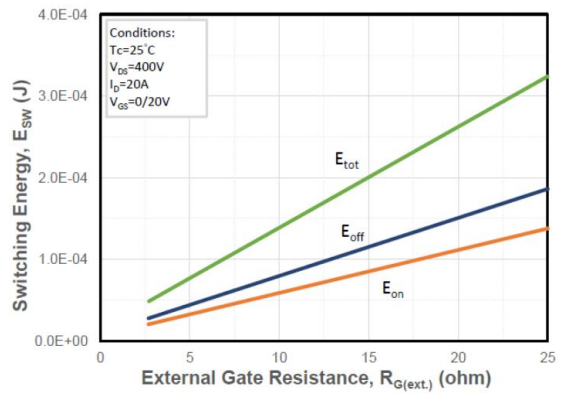Figure 17. Clamped inductive switching energy vs. Drain current

Figure 18. Clamped inductive switching energy vs. External gate resistor ($R_{G(ext.)}$)
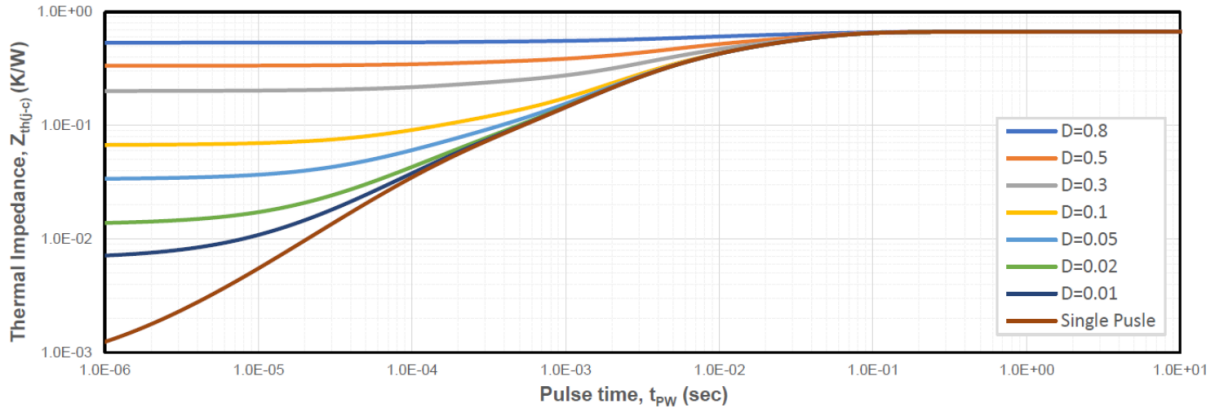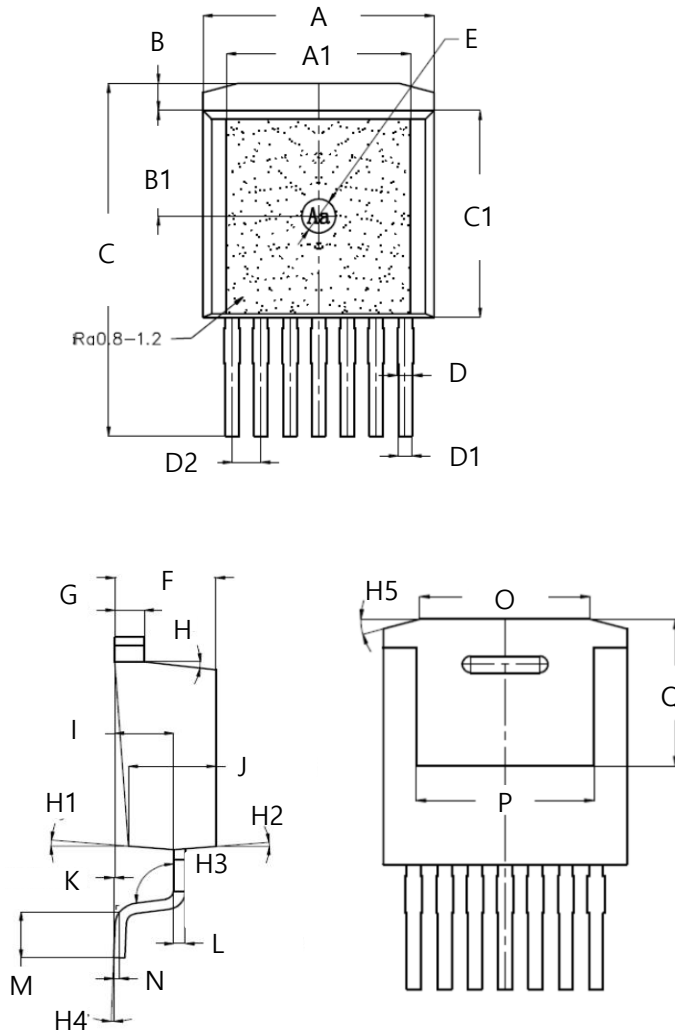
Typical Characteristics

Figure 19. Transient Junction to Case Thermal Impedance

Package Outline

Unit : mm

SYMBOL	DIMENSIONS		
	MIN	NOM	MAX
A	10.08	10.18	10.28
A1	8.08	8.10	8.12
B	1.10	1.20	1.3
B1	4.53	4.63	4.73
C	15.30	15.50	15.70
C1	8.98	9.08	9.18
D	0.60	0.70	0.80
D1	0.59	0.60	0.61
D2	-	1.27	-
E	0.05	0.10	0.15
F	4.40	4.45	4.50
G	1.29	1.30	1.31
H	-	7°	-
H1	-	5°	-
H2	-	5°	-
H3	93°	98°	103°
H4	0°	-	5°
H5	-	15°	-
I	2.55	2.60	2.65
J	4.35	4.40	4.45
K	0	0.05	0.10
L	0.49	0.50	0.51
M	2.0	2.2	2.4
N	-	0.25	-
O	6.92	7.12	7.32
P	-	7.45	-
Q	-	6.15	-