



PCMQ040R120EQ

1,200V 63A 40mΩ Silicon Carbide MOSFET

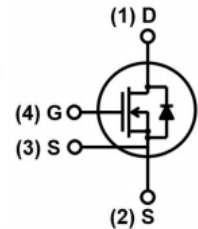
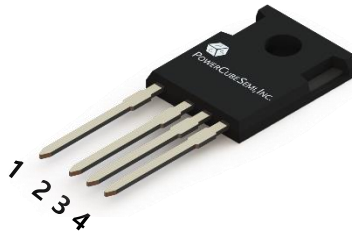
Features

- High-Speed Switching
- Reliable Body Diode
- All parts tested to greater than 1,400V
- Avalanche tested to 400mJ
- Driver Source Pin for Gate Driving
- Higher System Efficiency
- Lower Switching Loss
- AEC-Q101 Qualified

Applications

- Switch Mode Power Supplies, UPS
- Solar Inverters
- High Voltage DC/DC Converters
- EV Charging stations
- Motor Drives
- Induction Heating and Welding

Package Outline



- (1) D (Drain)
- (2) S (Source)
- (3) S (Driver Source)
- (4) G (Gate)



Absolute Maximum Ratings

T_j = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V _{DSS}	Drain-Source Voltage	1200	V
I _D	Drain Current - Continuous (T _j = 25°C) - Continuous (T _j = 100°C)	63	A
		47	A
I _{DM}	Drain Current - Pulsed	160	A
V _{GSS Max}	Gate-Source Voltage	-10 / +25	V
V _{GSS}	Gate-Source Voltage (Recommended operational)	-5 / +20	V
P _D	Power Dissipation (T _j = 25°C)	322	W
T _J , T _{STG}	Operating and Storage Temperature Range	-55 to +175	°C

Thermal Characteristics

Symbol	Parameter	Value			Units
		Min	Typ	Max	
R _{θJC}	Thermal Resistance, Junction-to-Case	-	0.38	0.47	°C/W
R _{θJA}	Thermal Resistance, Junction-to-Ambient	-	-	40.0	

Electrical Characteristics

Static Electrical Characteristics $T_j = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	1200	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}$	-	0.1	1.0	μA
		$V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}, T_j = 175^\circ\text{C}$	-	1	-	
$I_{GSS}(+)$	Gate-Source Leakage Current	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$	-	-	± 100	nA
$I_{GSS}(-)$		$V_{GS} = -5\text{ V}, V_{DS} = 0\text{ V}$	-	-		
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 10\text{ mA}$	2	3.5	4	V
		$V_{DS} = V_{GS}, I_D = 15\text{ mA}$	2	3.6	4	
$R_{DS(on)}$	Drain-Source On-Resistance	$V_{GS} = 20\text{ V}, I_D = 40\text{ A}$	-	40	52	m Ω
		$V_{GS} = 20\text{ V}, I_D = 20\text{ A}$	-	38	50	
R_G	Gate Resistance	$f = 1\text{ MHz}, V_{AC} = 25\text{ mV}$	-	2.5	-	Ω

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
C_{iss}	Input Capacitance	$V_{DS} = 1,000\text{ V}, V_{GS} = 0\text{ V}, f = 200\text{ kHz}$	-	3200	-	pF
C_{oss}	Output Capacitance		-	135	-	
C_{rss}	Reverse Transfer Capacitance		-	9	-	

Switching Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 800\text{ V}, V_{GS} = -5 / 20\text{ V}, I_D = 40\text{ A}, L = 273\text{ uH}, R_G = 2.5\text{ }\Omega$	-	14	-	ns
t_r	Turn-On Rise Time		-	5	-	
$t_{d(off)}$	Turn-Off Delay Time		-	23	-	
t_f	Turn-Off Fall Time		-	14	-	
E_{on}	Turn-On Switching loss	$V_{DD} = 800\text{ V}, V_{GS} = -5 / 20\text{ V}, I_D = 40\text{ A}, L = 273\text{ uH}, R_G = 2.5\text{ }\Omega$	-	339	-	μJ
E_{off}	Turn-Off Switching loss		-	70	-	
Q_g	Total Gate Charge	$V_{DS} = 800\text{ V}, I_D = 20\text{ A}, V_{GS} = -5 / 20\text{ V}$	-	118	-	nC
Q_{gs}	Gate-Source Charge		-	51	-	
Q_{gd}	Gate-Drain Charge		-	10	-	

Body Diode Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
I_S	Maximum Continuous Diode Forward Current	$V_{GS} = -5\text{ V}, T_j = 25^\circ\text{C}$	-	-	74	A
I_{SM}	Maximum Pulsed Diode Forward Current		-	-	160	A
V_{SD}	Diode Forward Voltage	$V_{GS} = -5\text{ V}, I_S = 20\text{ A}$	-	3.9	-	V
t_{rr}	Reverse Recovery Time	$V_R = 800\text{ V}, V_{GS} = -5\text{ V}, I_S = 40\text{ A}, di_F / dt = 9.6\text{ A/ns}$	-	11	-	ns
Q_{rr}	Reverse Recovery Charge		-	316	-	nC
I_{rr}	Reverse Recovery Current		-	46	-	A

Typical Characteristics

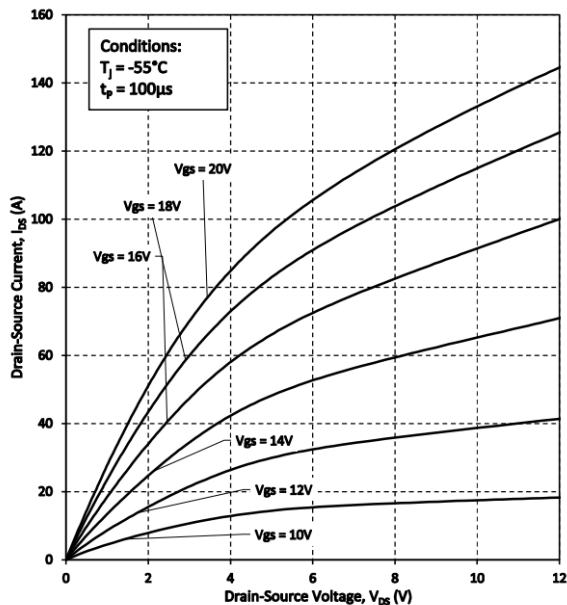


Figure 1. Output Characteristics at $T_j = -55^\circ\text{C}$

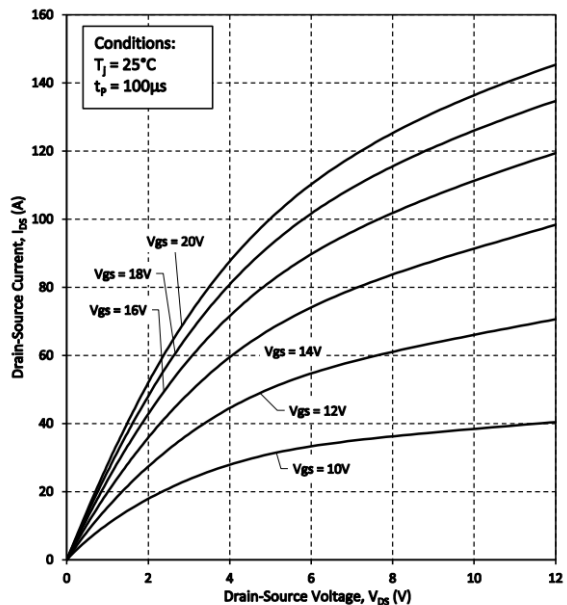


Figure 2. Output Characteristics at $T_j = 25^\circ\text{C}$

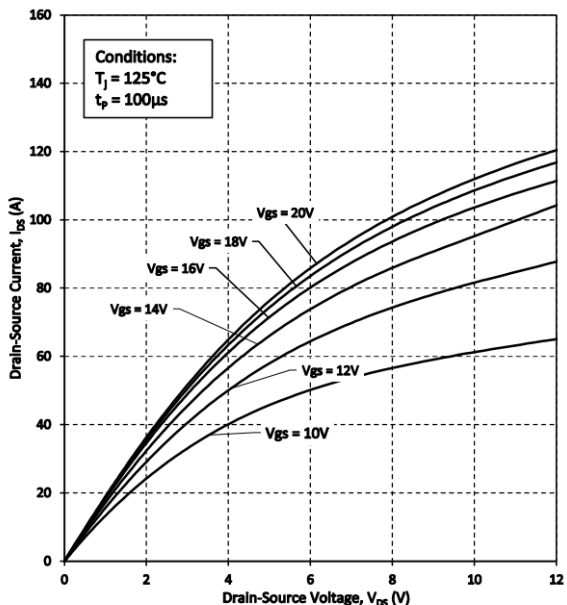


Figure 3. Output Characteristics at $T_j = 125^\circ\text{C}$

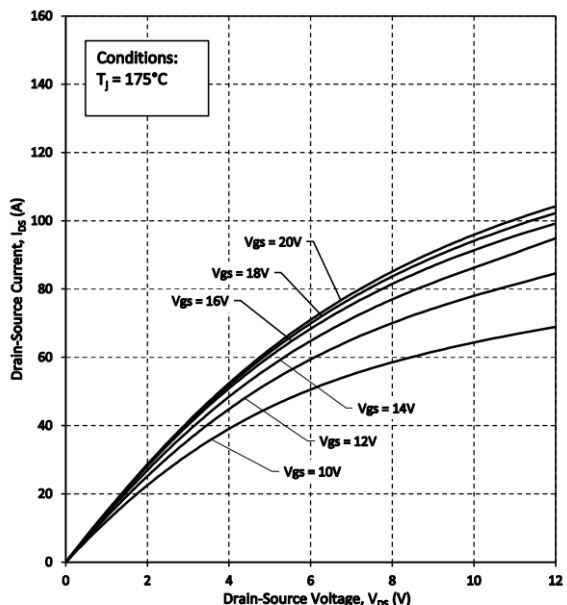


Figure 4. Output Characteristics at $T_j = 175^\circ\text{C}$

Typical Characteristics

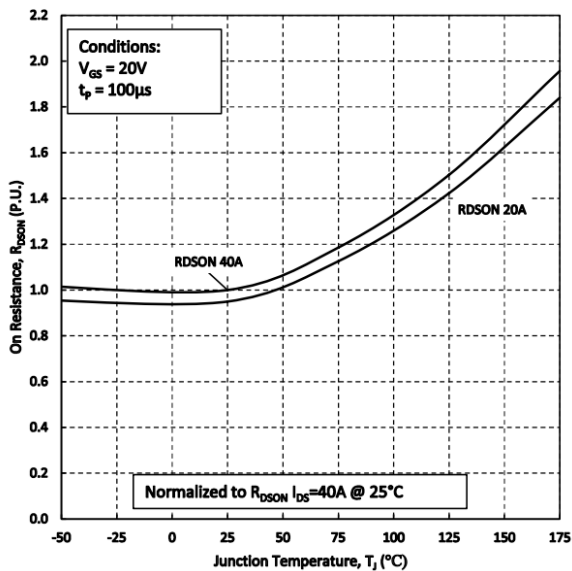


Figure 5. Normalized On-Resistance vs. Temperature

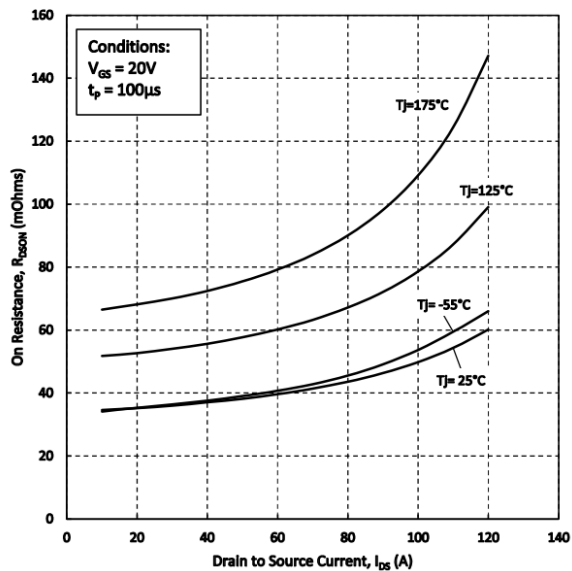


Figure 6. On-Resistance vs. Drain Current for Various Temperature

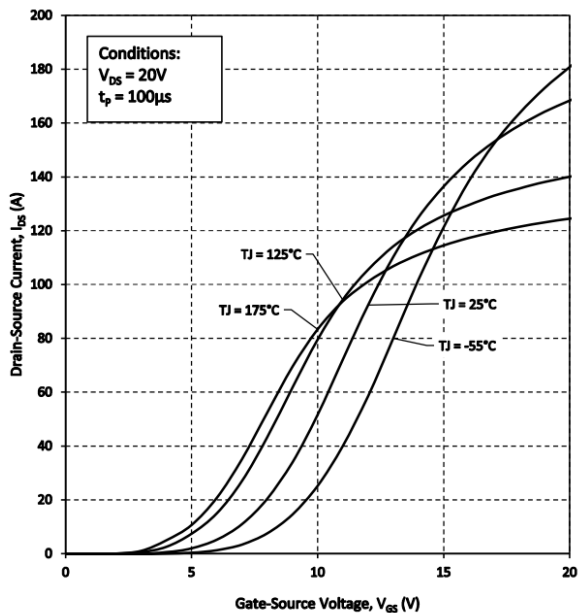


Figure 7. Transfer Characteristics for Various Junction Temperature

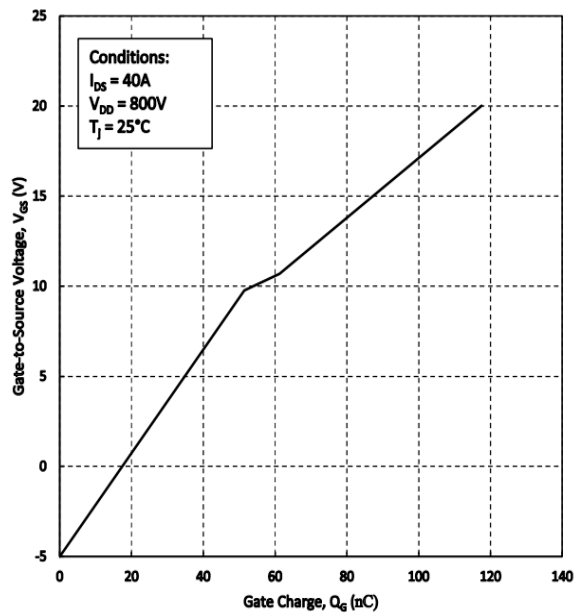


Figure 8. Gate Charge Characteristics

Typical Characteristics

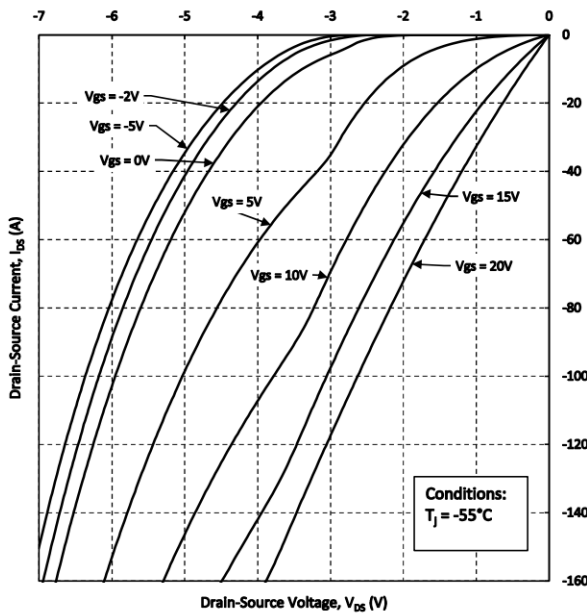


Figure 9. Body Diode Characteristics at $T_j = -55^\circ\text{C}$

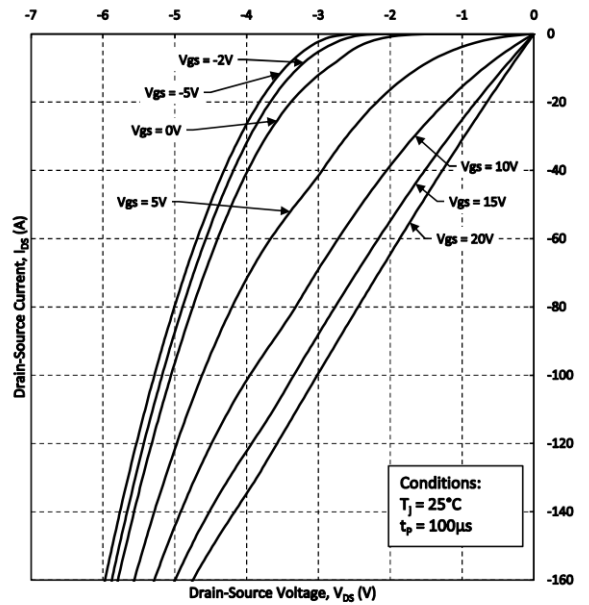


Figure 10. Body Diode Characteristics at $T_j = 25^\circ\text{C}$

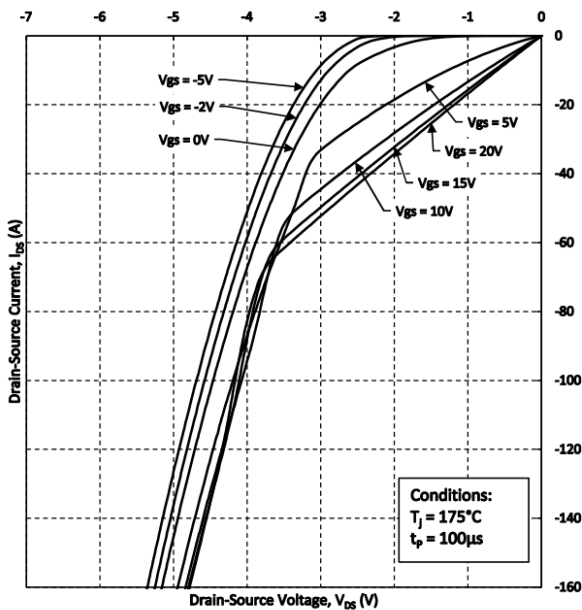


Figure 11. Body Diode Characteristics at $T_j = 175^\circ\text{C}$

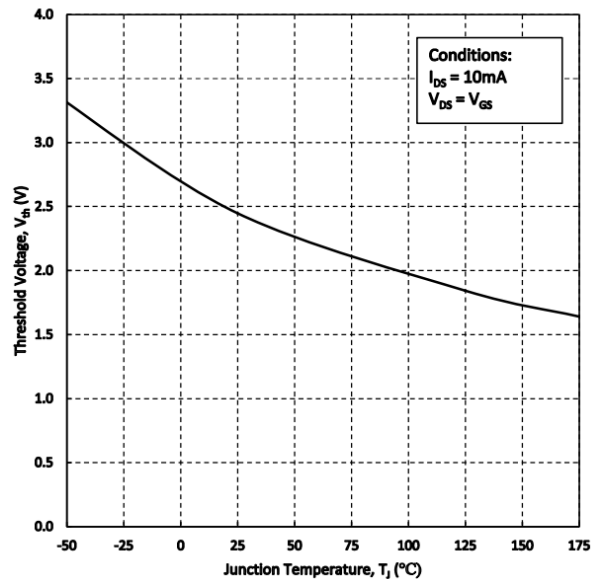


Figure 12. Output Capacitor Stored Energy

Typical Characteristics

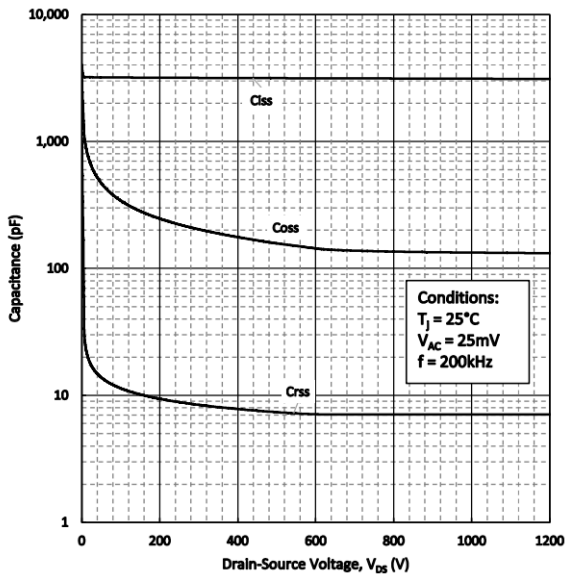


Figure 13. Capacitance vs Drain-Source Voltage

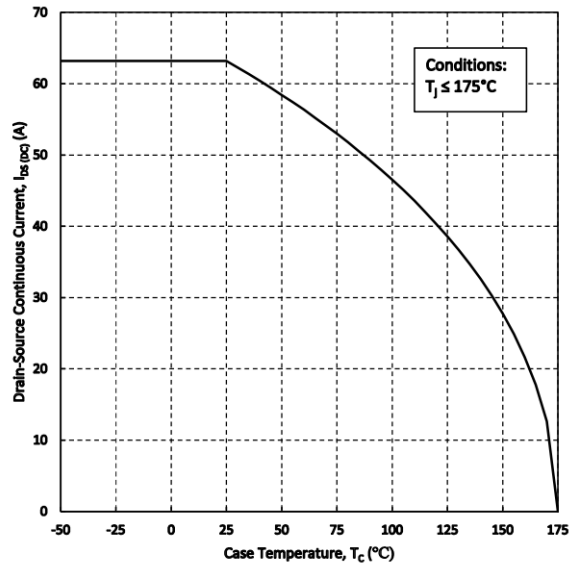


Figure 14. Continuous Drain Current Derating vs. Case Temperature

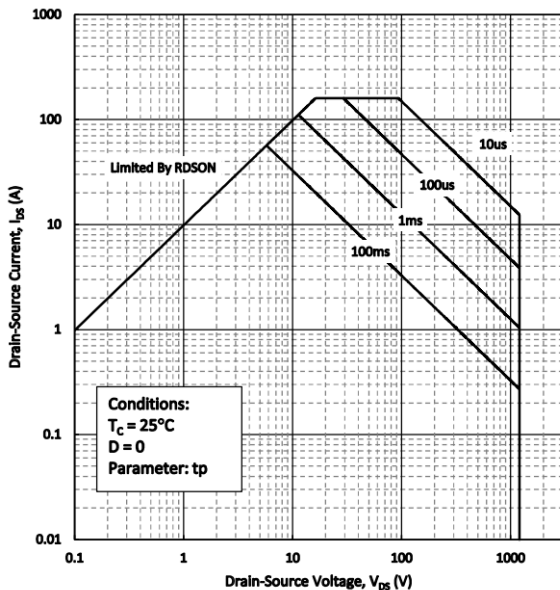


Figure 15. Safe Operating Area

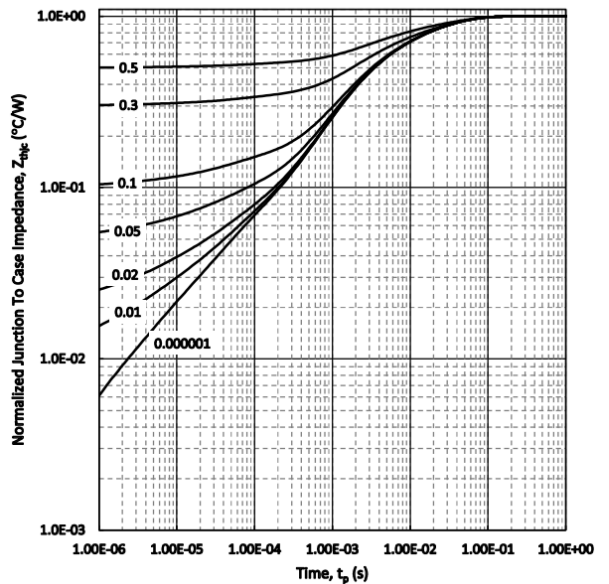


Figure 16. Transient Thermal Impedance (Junction to Case)

Typical Characteristics

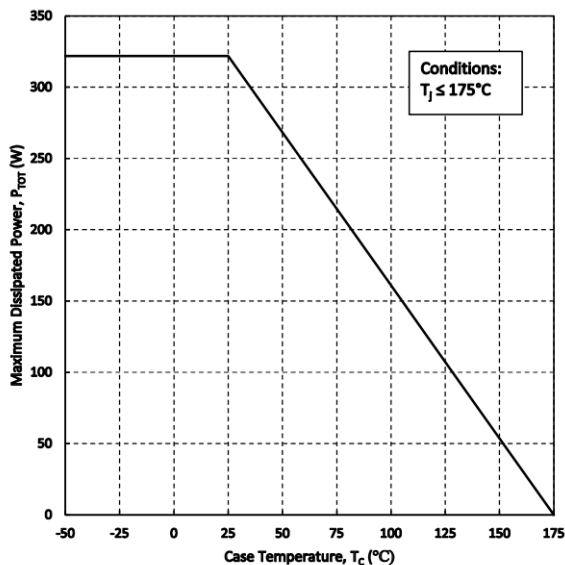


Figure 17. Maximum Power Dissipation Derating vs Case Temperature

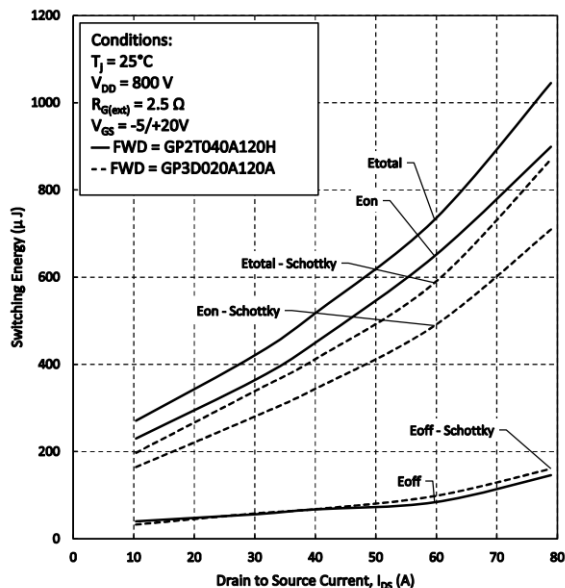


Figure 18. Clamped Inductive Switching Energy vs. Drain Current

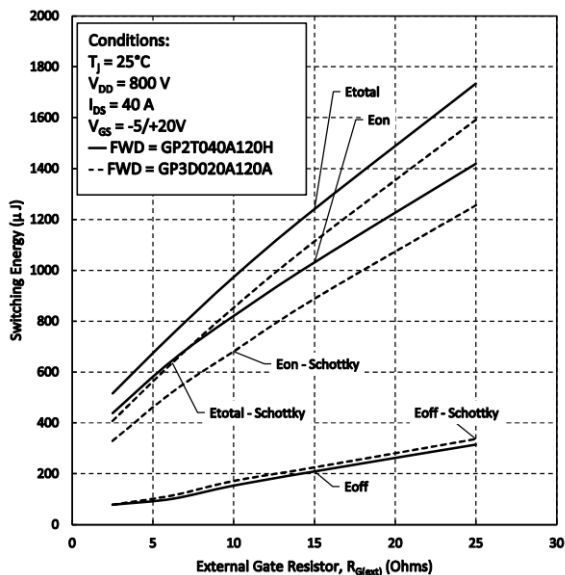


Figure 19. Clamped Inductive Switching Energy vs. R_G

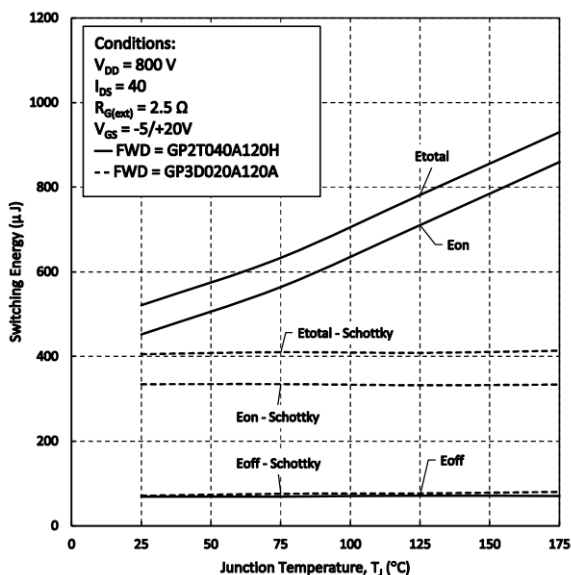
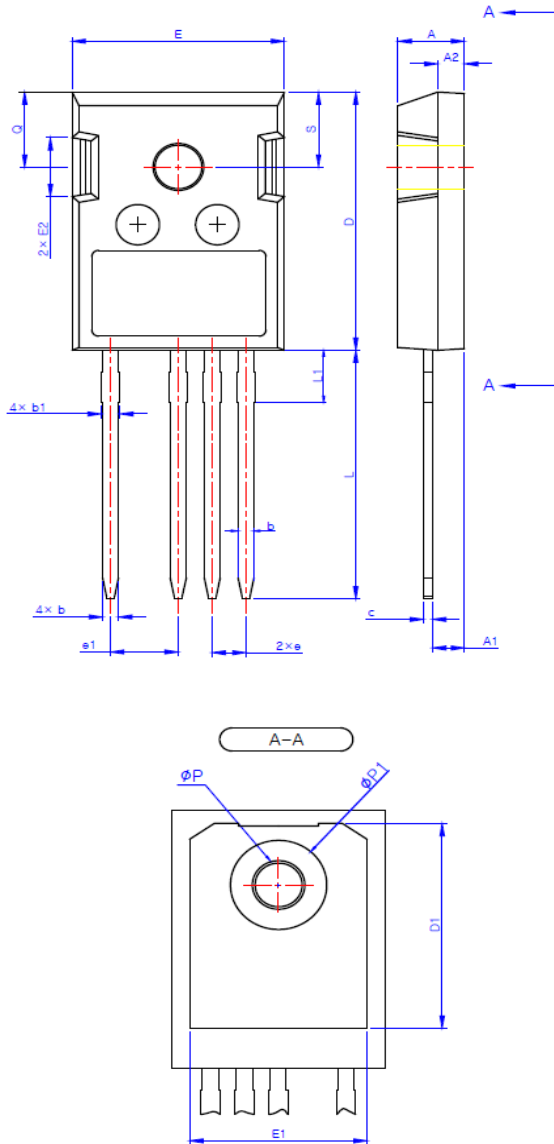


Figure 20. Clamped Inductive Switching Energy vs. Temperature

Package Information

Package Outline

Unit : mm



SYMBOL	DIMENSIONS			NOTES
	MIN	NOM	MAX	
A	4.80	-	5.20	
A1	2.29	-	2.54	
A2	1.90	-	2.10	
b	1.10	-	1.30	
b1	1.30	-	1.50	
c	0.50	-	0.70	
D	20.80	-	21.34	
D1	17.43	-	17.83	
E	15.75	-	16.13	
E1	13.06	-	13.46	
E2	4.32	-	4.83	
e	2.54 BSC			
e1	5.08 BSC			
L	19.85	-	20.25	
L1	-	-	4.49	
$\varnothing P$	3.55	-	3.65	
$\varnothing P1$	7.00	-	7.40	
Q	5.59	-	6.19	
S	6.15 BSC			