# PCM020R065BY
650V 107A 20mΩ Silicon Carbide MOSFET

Features

- High-Speed Switching
- Essentially no switching losses
- Reduction of heat sink requirements
- maximum working temperature at 175℃
- High blocking voltage
- Fast Intrinsic diode with low recovery current
- High-frequency operation

Applications

- Power factor correction, PFC
- Solar inverter
- Uninterruptible power supply, UPS
- Motor drives
- Photovoltaic inverter
- Electric car and charger

Package Outline
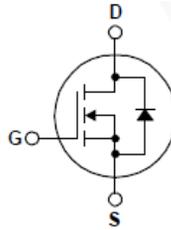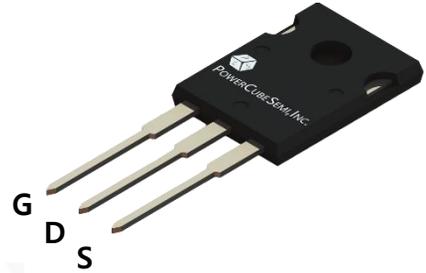
Absolute Maximum Ratings Tj = 25°C unless otherwise noted

Symbol	Parameter		Value	Units
V_{DSS}	Drain-Source Voltage		650	V
I_D	Drain Current	- Continuous (T_j = 25℃)	107	A
		- Continuous (T_j = 110℃)	72	A
I_{DM}	Drain Current	- Pulsed	305	A
$V_{GSS\ Max}$	Gate-Source Voltage		-10 / +25	V
V_{GSS}	Gate-Source Voltage (Recommended operational)		-5 / +20	V
E_{AS}	Avalanche energy, Single pulse		3.2	J
P_D	Power Dissipation (T_j = 25℃)		375	W
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +175	℃

Thermal Characteristics

Symbol	Parameter	Value			Units
		Min	Typ	Max	
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	-	0.4	-	℃/W

Electrical Characteristics

Static Electrical Characteristics $T_j = 25°C$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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	100	μA
		$V_{DS} = 650$ V, $V_{GS} = 0$ V, T_J=175 ℃	-	10	500	
I_{GSS}	Gate-Source Leakage Current	$V_{GS} = 20$ V, $V_{DS} = 0$ V	-	-	250	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 50$ mA	-	3.1	-	V
$R_{DS(on)}$	Drain-Source On-Resistance	$V_{GS} = 20$ V, $I_D = 50$ A	-	20	26	$m\Omega$
		$V_{GS} = 20$ V, $I_D = 50$ A, T_J=175 ℃	-	30	-	
g_{fs}	Transconductance	V_{DS}=10 V, I_D=60 A	-	18.2	-	S

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
C_{iss}	Input Capacitance	$V_{DS} = 400$ V, $V_{GS} = 0$ V, f = 1 MHz	-	4838	-	pF
C_{oss}	Output Capacitance		-	359	-	
C_{rss}	Reverse Transfer Capacitance		-	47	-	
E_{OSS}	Coss stored energy		-	34	-	uJ
Q_g	Total Gate Charge	$V_{DS} = 400$ V, $I_D = 50$ A, $V_{GS} = -5 / 20$ V	-	80	-	nC
Q_{gs}	Gate-Source Charge		-	75	-	
Q_{gd}	Gate-Drain Charge		-	287	-	
R_G	Internal Gate Resistance	f=1㎒, V_{AC}=25mV	-	0.5	-	Ω

Electrical Characteristics

Switching Characteristics $T_j = 25°C$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 400V, V_{GS} = -4/20V, I_D = 35A, R_L = 11.4Ω, R_G = 2.7Ω	-	29	-	ns
t_r	Turn-On Rise Time		-	51	-	
$t_{d(off)}$	Turn-Off Delay Time		-	30	-	
t_f	Turn-Off Fall Time		-	16	-	
E_{on}	Turn-On Switching loss	V_{DD} = 400V, V_{GS} = 0/20V, I_D= 50A, R_G = 2.7Ω	-	61.7	-	uJ
E_{off}	Turn-Off Switching loss		-	101	-	

Body Diode Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
I_S	Maximum Continuous Diode Forward Current	V_{GS} = 0 V, T_j=25 ℃	-	61.5	-	A
I_{SM}	Maximum Pulsed Diode Forward Current		-	305	-	
V_{SD}	Diode Forward Voltage	V_{GS} = 0 V, I_{SD} = 10 A	-	2.9	-	V
T_{rr}	Reverse Recovery Time	V_R = 400 V, V_{GS} = 0 V, I_S = 30 A, dI_F / dt = 300 A/us	-	77	-	ns
Q_{rr}	Reverse Recovery Charge		-	301	-	nC
I_{rr}	Reverse Recovery Current		-	6.9	-	A

Typical Characteristics
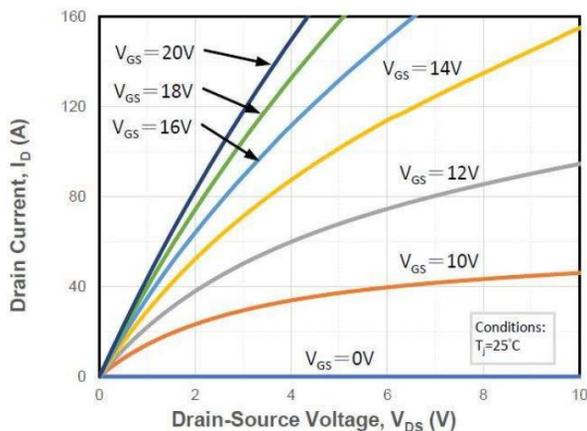
Figure 1. Output Characteristics at T$_J$=25 ℃
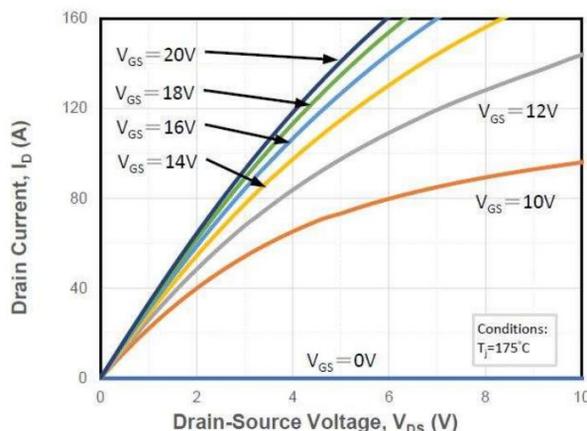
Figure 2. Output Characteristics at T$_J$=175 ℃
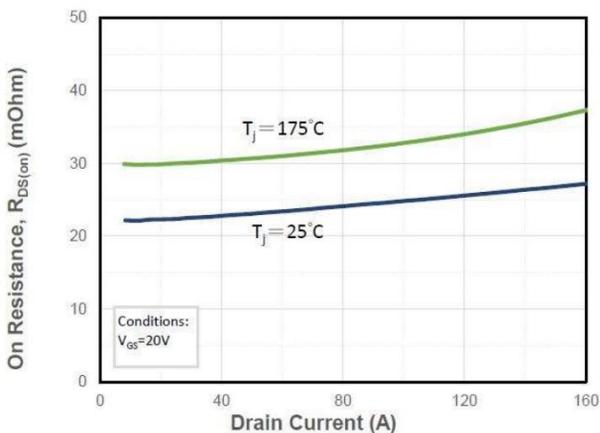

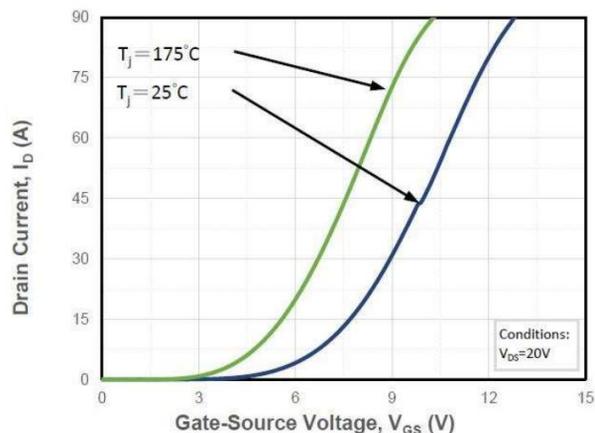**Figure 3. On Resistance vs. Drain Current**

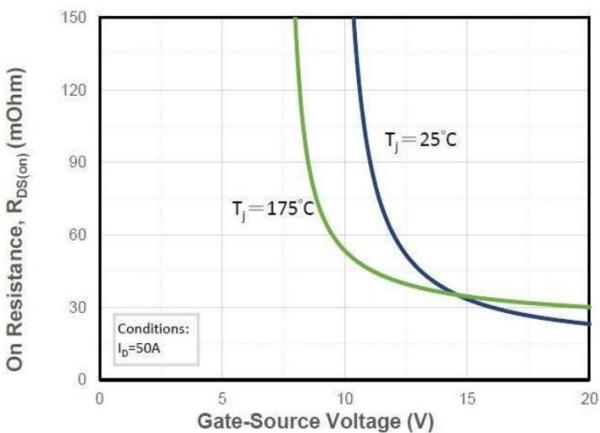**Figure 4. Transfer Characteristics for various T$_J$**

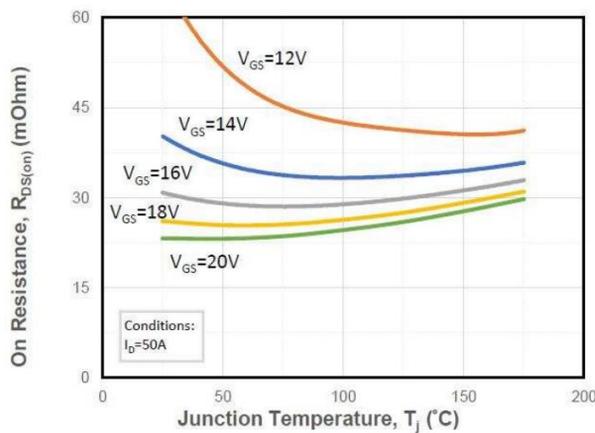**Figure 5. On Resistance vs. gate voltage for various T$_J$**

Figure 6. On Resistance vs. Temperature for various gate voltage
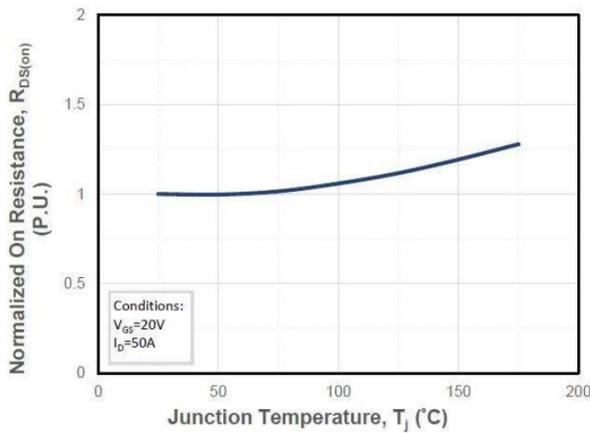
Typical Characteristics
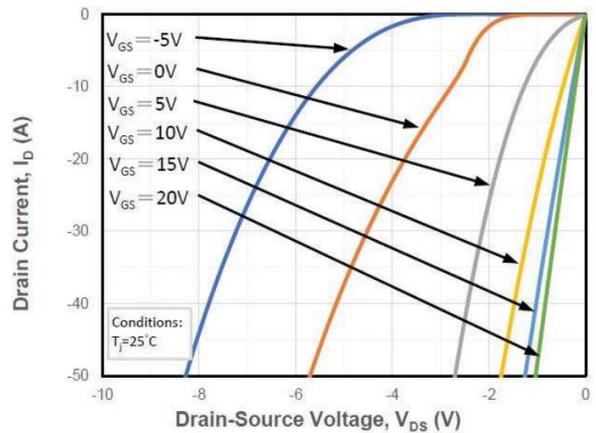

Figure 7. Normalized On Resistance vs. Temperature

Figure 8. Reverse Output Characteristics at T_J=25℃
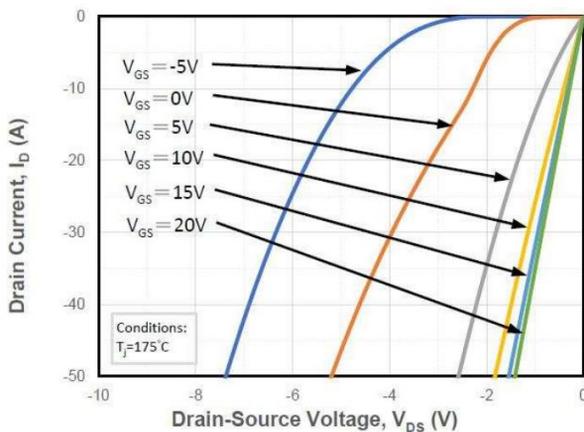
Figure 9. Reverse Output Characteristics at T_J=175℃
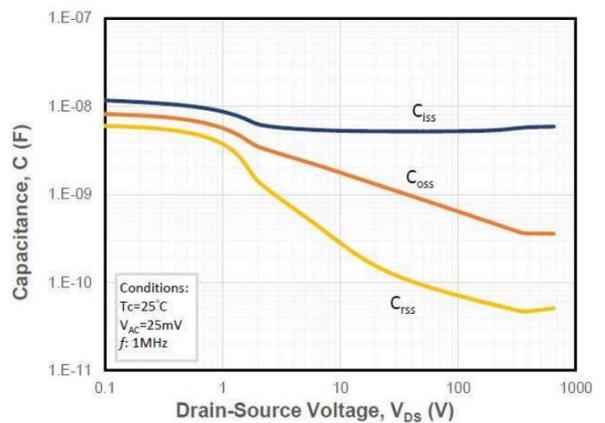
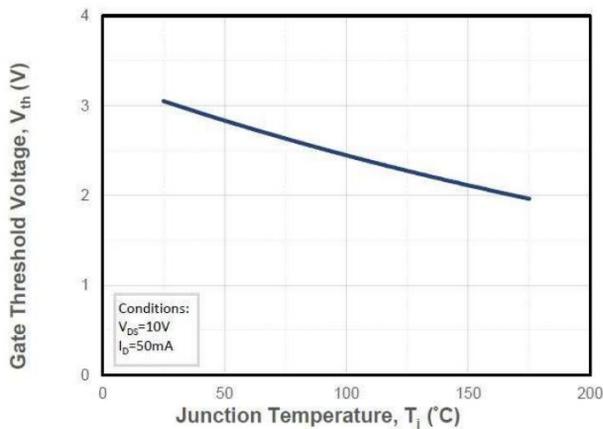Figure 10. Capacitances vs. Drain to Source Voltage
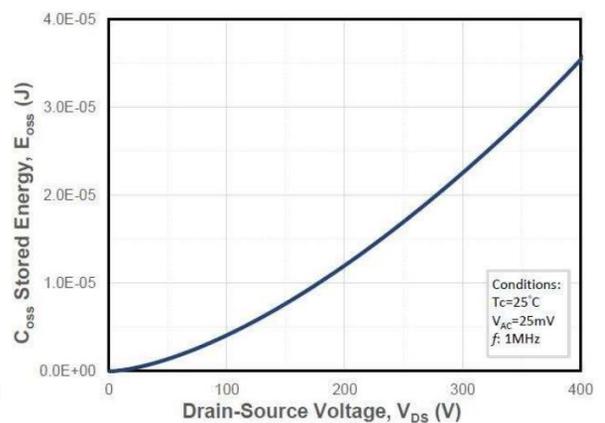

Figure 11. Threshold Voltage vs. Temperature

Figure 12. Output Capacitor Stored Energy
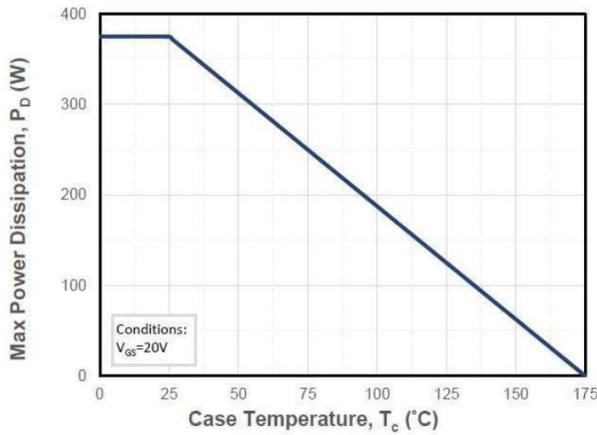
Typical Characteristics

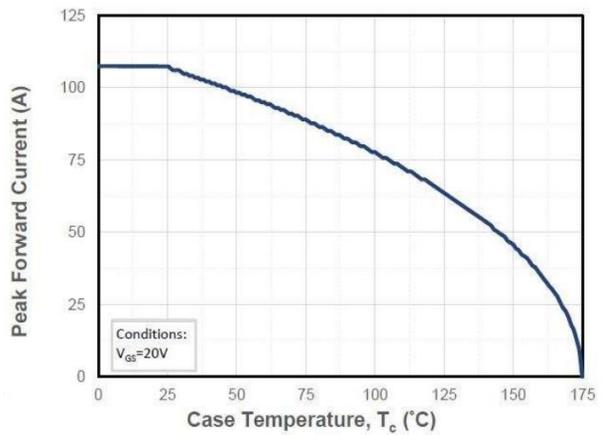**Figure 13. Maximum Power Dissipation Derating vs. Case Temperature**

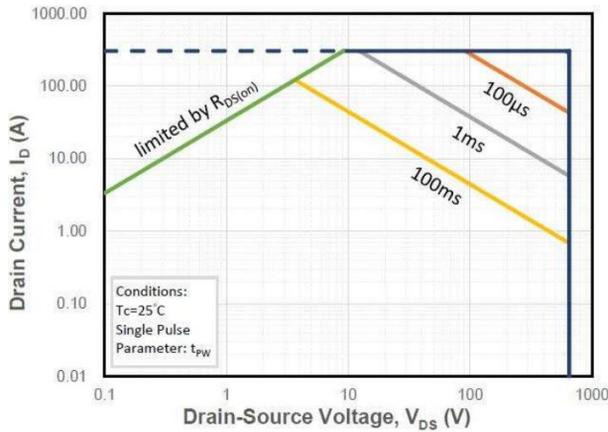**Figure 14. Drain Current Derating vs. Case Temperature**

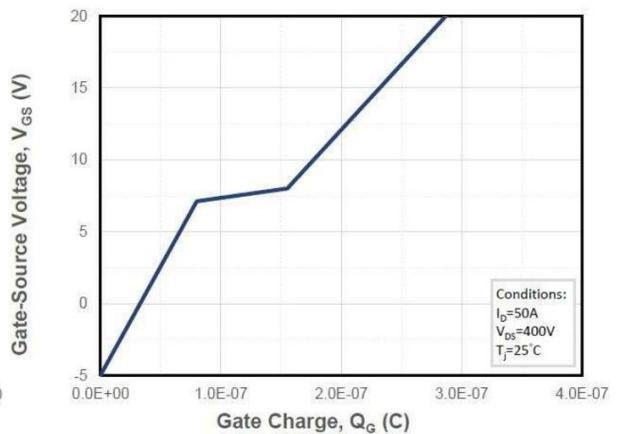**Figure 15. Safe Operating Area**
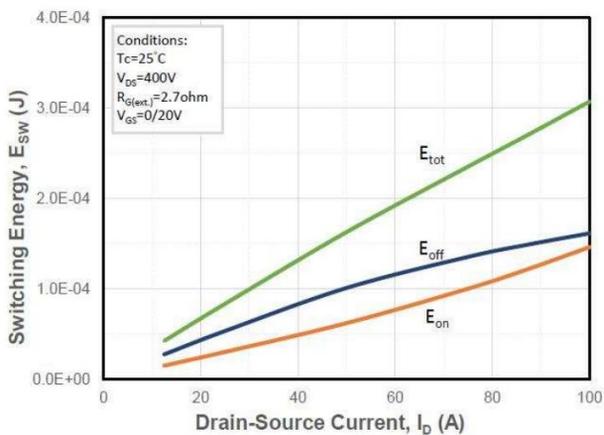

Figure 16. Gate Charge Characteristics

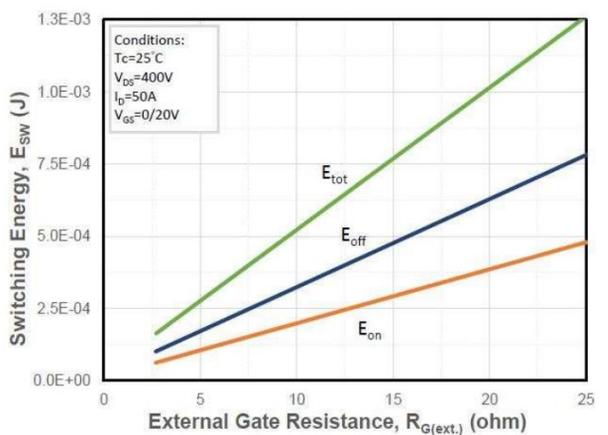**Figure 17. Clamped Inductive Switching Energy vs. Drain Current**

Figure 18. Clamped Inductive Switching Energy vs. External Gate Resistor
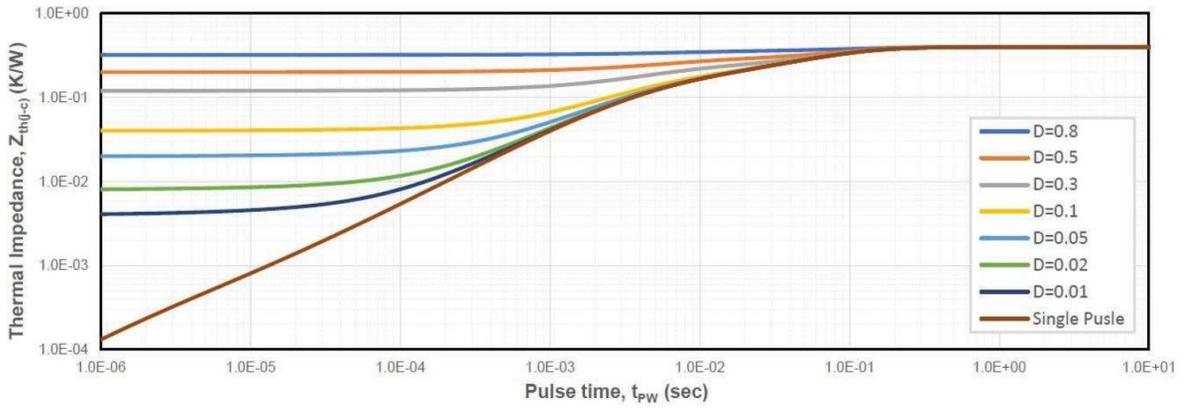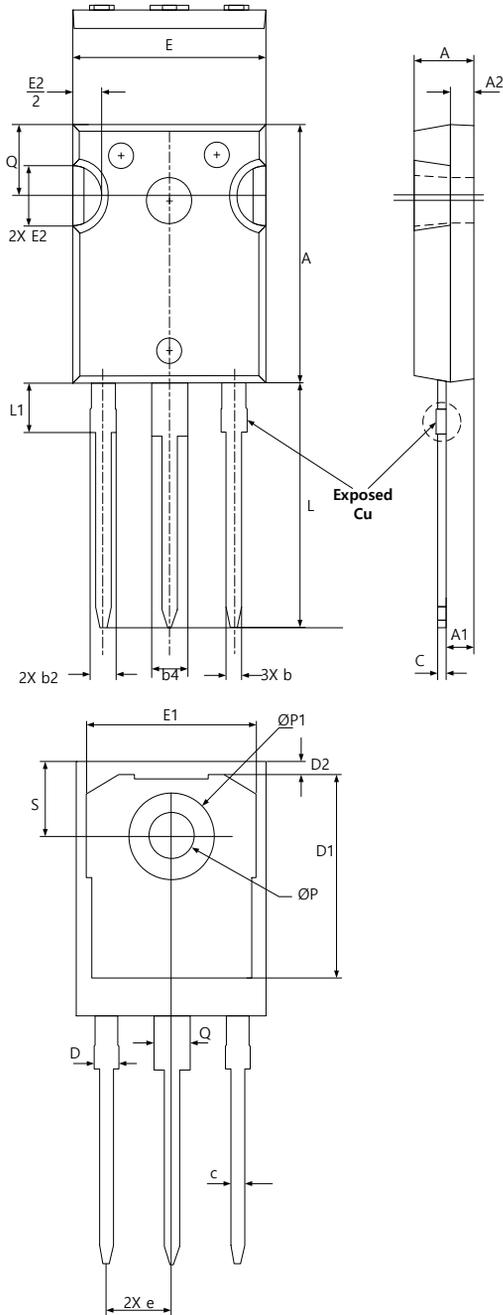
Typical Characteristics

Figure 19. Transient Junction to Case Thermal Impedance

Package Outline

SYMBOL	DIMENSIONS			NOTES
	MIN	NOM	MAX	
A	4.83	5.02	5.21	
A1	2.29	2.41	2.55	
A2	1.50	2.00	2.49	
b	1.12	1.20	1.33	
b1	1.12	1.20	1.28	
b2	1.91	2.00	2.39	6
b3	1.91	2.00	2.34	
b4	2.87	3.00	3.22	6, 8
b5	2.87	3.00	3.18	
c	0.55	0.60	0.69	6
c1	0.55	6.00	0.65	
D	20.80	20.95	21.10	4
D1	16.25	16.55	17.65	5
D2	0.51	1.19	1.35	
E	15.75	15.94	16.13	4
E1	13.46	14.02	14.16	5
E2	4.32	4.91	5.49	3
e	5.44 BSC			
L	19.81	20.07	20.32	
L1	4.10	4.19	4.40	6
φP	3.56	3.61	3.65	7
φP1	7.19 REF			
Q	5.39	5.79	6.20	
S	6.04	6.17	6.30	