PowerCubeSemi, Inc.
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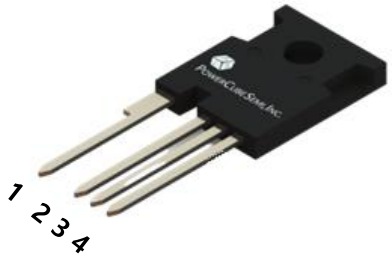
PCM014R120EU

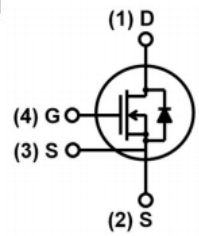
1,200V 110A 14mΩ Silicon Carbide MOSFET

Features

- High Blocking Voltage with low $R_{DS(ON)}$
- High Frequency operation with low Capacitance
- Simple to drive with -4/+15V Gate
- Robust body diode with low Qrr
- 100% Avalanche Tested

Package Outline





Applications

- EV Motor Drives
- EV/HEV Charging Station
- Energy storage and Battery Charging
- High Voltage DC-DC Converters
- Solar / Wind Inverters
- UPS and PFC

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

Halogen-Free

RoHS

Absolute Maximum Ratings

T_C = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{DSS}	Drain-Source Voltage	1200	V
I_D	Drain Current - Continuous (V_{GS}=15V, T_C = 25℃)	110	A
	- Continuous (V_{GS}=15V, T_C = 100℃)	75	A
I_{DM}	Drain Current - Pulsed	313	A
$V_{GSS\ Max}$	Gate-Source Voltage	-8 / +19	V
V_{GSS}	Gate-Source Voltage (Recommended operational)	-4 / +15	V
P_D	Power Dissipation (T_C = 25℃)	652	W
E_{AS}	Avalanche Capability, Single Pulse **	3025	mJ
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +175	℃

EAS Test Condition : V_{DD}=100V, V_{GS}=15V, L=2mH
** 100% Tested in 36% Rating

Thermal Characteristics

Symbol	Parameter	Value			Units
		Min	Typ	Max	
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	-	0.21	0.23	℃/W

Electrical Characteristics

Static Electrical Characteristics

T_C = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0V, I_D = 100uA	1200	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 1200V, V_{GS} = 0V		0.5	60	μA
		V_{DS} = 1200V, V_{GS} = 0V, T_J=175℃	0	5	200	
I_{GSS} (+)	Gate-Source Leakage Current	V_{GS} = 15V, V_{DS} = 0V	-	-	±100	nA
I_{GSS} (-)		V_{GS} = -4V, V_{DS} = 0V	-	-		
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 30mA	1.8	2.5	3.2	V
$R_{DS(on)}$	Drain-Source On-Resistance	V_{GS} = 15V, I_D = 75A	-	14.5	19	mΩ
R_G	Gate Resistance	V_{GS}=0V, f=1MHz	-	3.0	-	Ω

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
C_{iss}	Input Capacitance	V_{DS} = 1,000V, V_{GS} = 0V, f = 100kHz	-	6550	-	pF
C_{oss}	Output Capacitance		-	202	-	
C_{rss}	Reverse Transfer Capacitance		-	10	-	

Switching Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 800V, V_{GS} = -4 / 15V, I_D = 75A, L = 200uH, R_G = 2Ω	-	16	-	ns
t_r	Turn-On Rise Time		-	37	-	
$t_{d(off)}$	Turn-Off Delay Time		-	67	-	
t_f	Turn-Off Fall Time		-	13	-	
E_{on}	Turn-On Switching loss	V_{DD} = 800V, V_{GS} = -4 / 15V I_D= 75A, L = 200uH, R_G = 2Ω	-	1050	-	uJ
E_{off}	Turn-Off Switching loss		-	350	-	
Q_g	Total Gate Charge	V_{DS} = 800V, I_D = 75A, V_{GS} = -4 / 15V	-	235	-	nC
Q_{gs}	Gate-Source Charge		-	74	-	
Q_{gd}	Gate-Drain Charge		-	73	-	

Body Diode Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
I_S	Maximum Continuous Diode Forward Current	V_{GS} = - 4V, T_j=25℃	-	-	128	A
V_{SD}	Diode Forward Voltage	V_{GS} = - 4V, I_S = 40A	-	4.2	-	V
T_{rr}	Reverse Recovery Time	V_R = 800V, V_{GS} = -4V, I_S = 75A, dI_F/dt = 2400A/us	-	25	-	ns
Q_{rr}	Reverse Recovery Charge		-	670	-	nC
I_{rr}	Reverse Recovery Current		-	45	-	A

Typical Characteristics

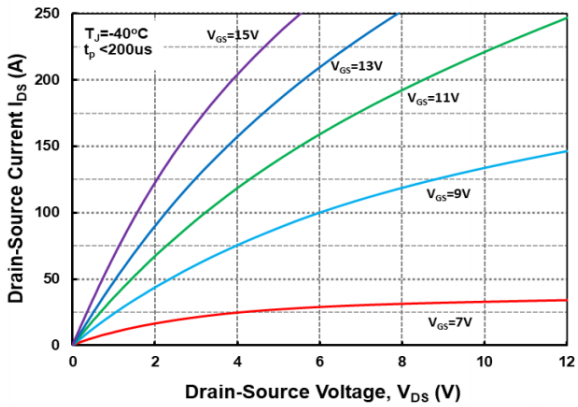


Figure 1. Output Characteristics at T_J=-40 ℃

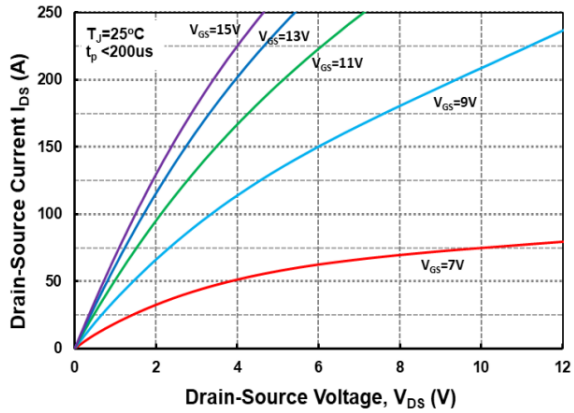


Figure 2. Output Characteristics at T_J=25 ℃

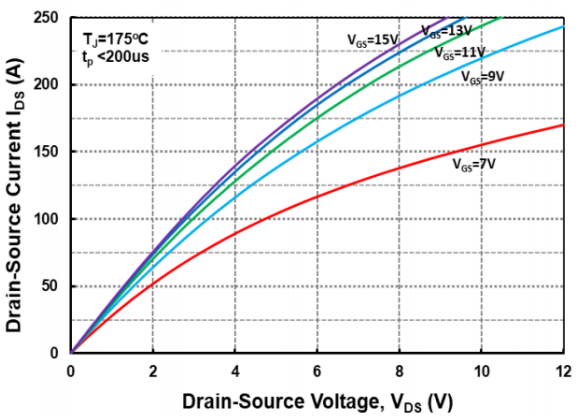


Figure 3. Output Characteristics at T_J=175 ℃

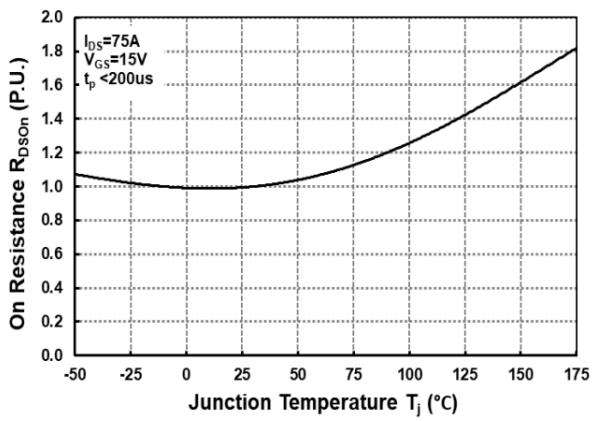


Figure 4. Normalized On-Resistance vs. Temperature

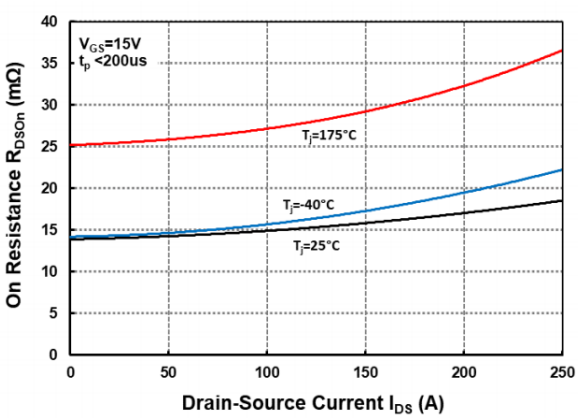


Figure 5. On Resistance vs. Drain Current for various Temperatures

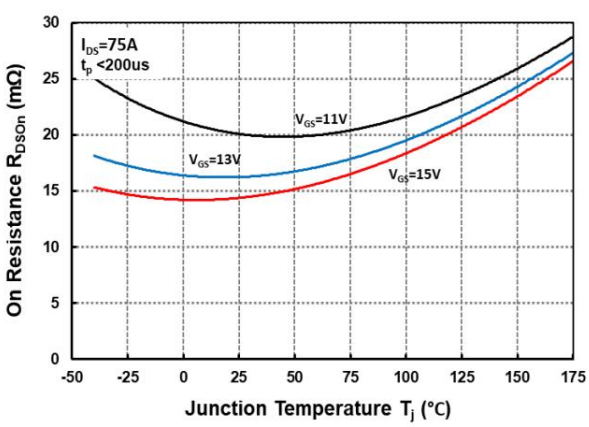


Figure 6. On Resistance vs. Temperature for various gate voltage

Typical Characteristics

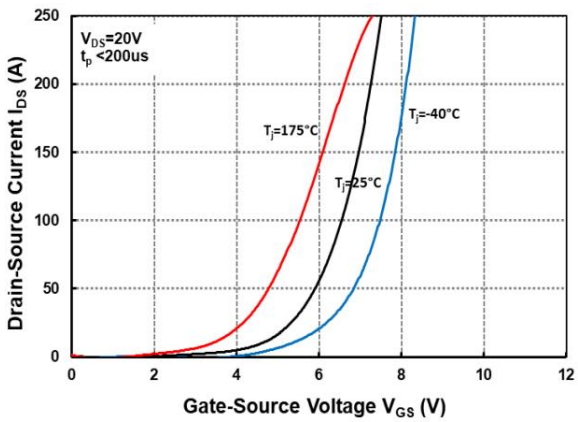


Figure 7. Transfer Characteristics for Various Junction Temperatures

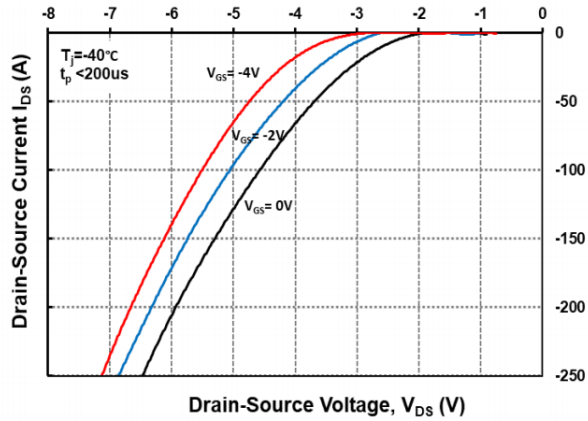


Figure 8. Body Diode Characteristics at T_J=-40℃

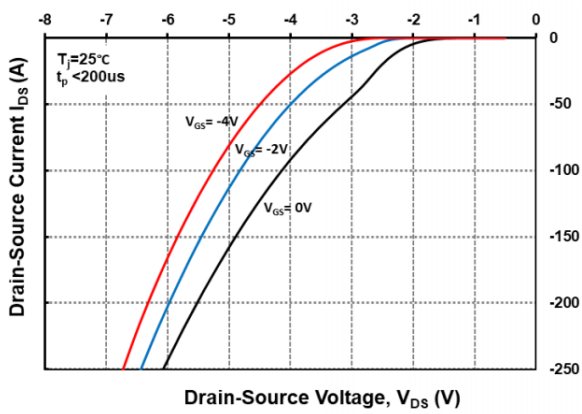


Figure 9. Body Diode Characteristics at T_J=25℃

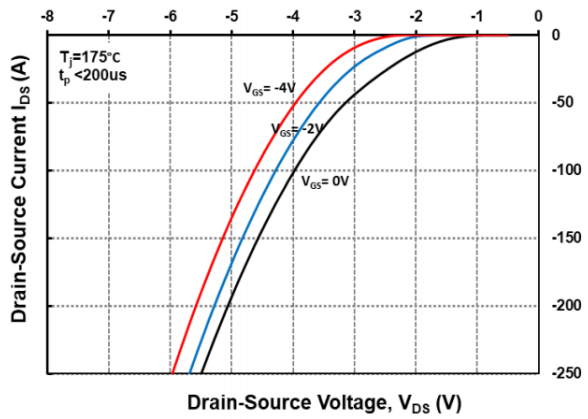


Figure 10. Body Diode Characteristics at T_J=175℃

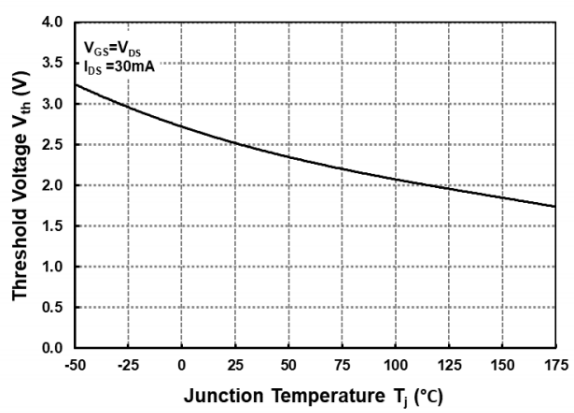


Figure 11. Threshold Voltage vs. Temperature

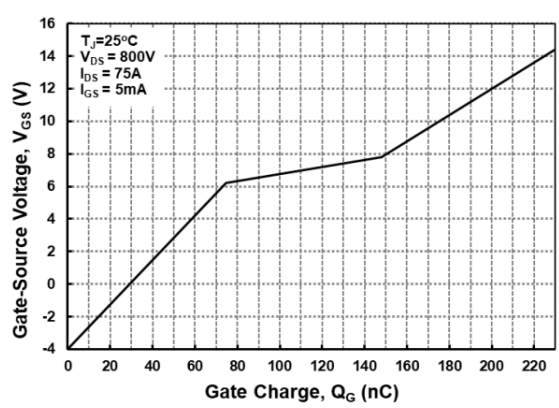


Figure 12. Gate Charge Characteristics

Typical Characteristics

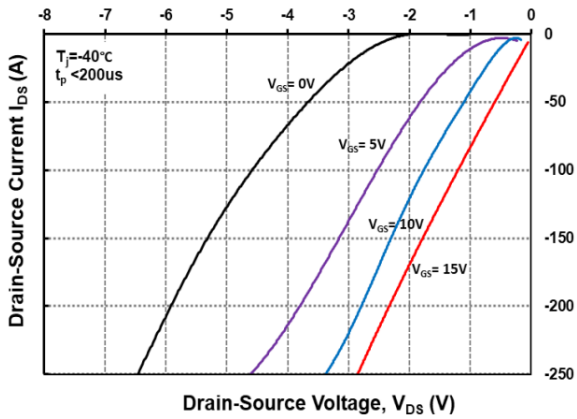


Figure 13. Third Quadrant Characteristics at T_J=-40℃

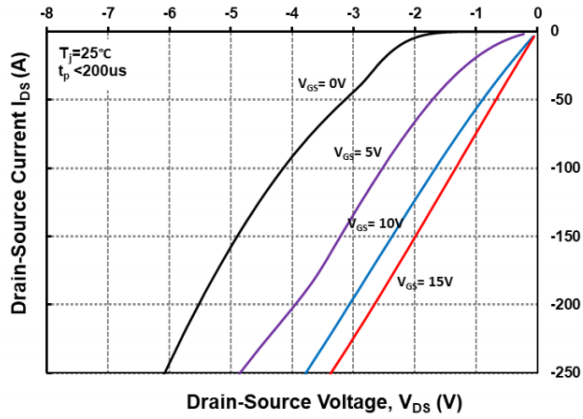


Figure 14. Third Quadrant Characteristics at T_J=25℃

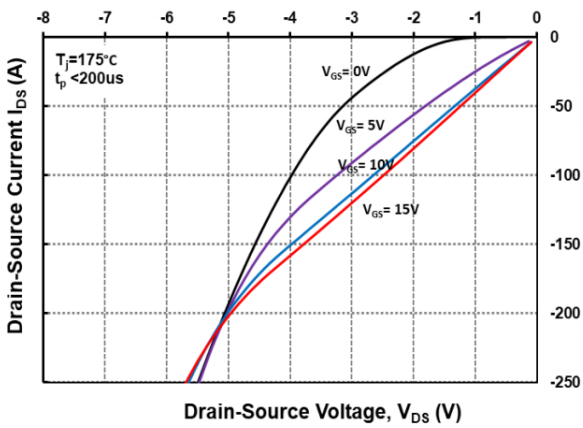


Figure 15. Third Quadrant Characteristics at T_J=175℃

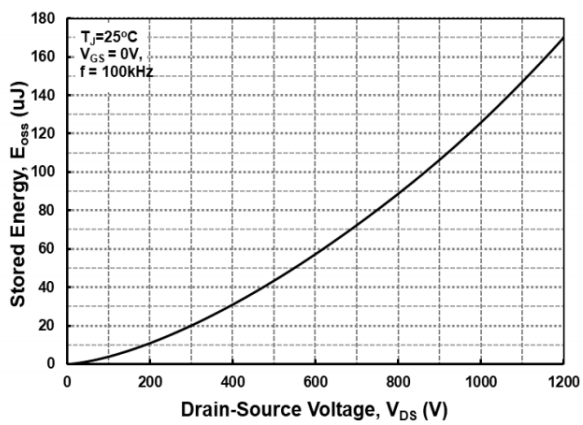


Figure 16. Output Capacitor Stored Energy

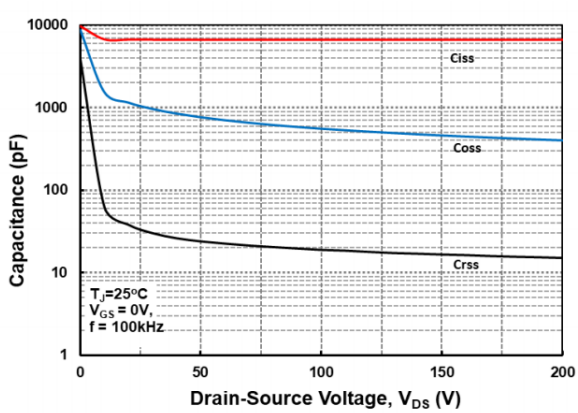


Figure 17. Capacitances vs. Drain to Source Voltage (0-200V)

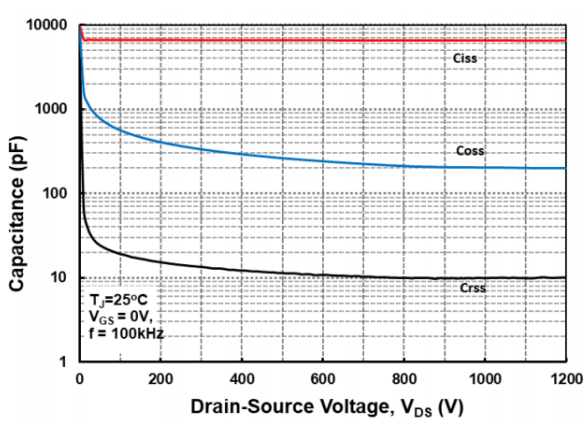


Figure 18. Capacitances vs. Drain to Source Voltage (0-1200V)

Typical Characteristics

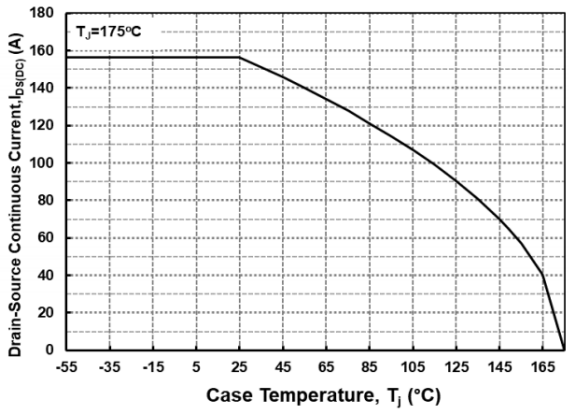


Figure 19. Continuous Drain Current Derating vs. Case Temperature

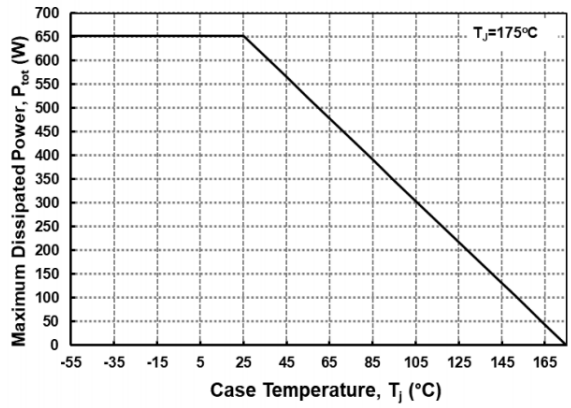


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

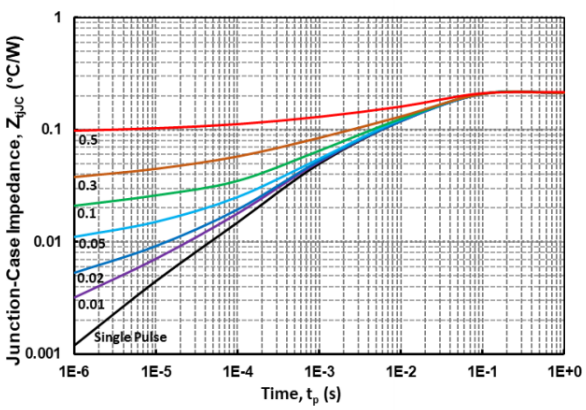


Figure 21. Transient Thermal Impedance (Junction to Case)

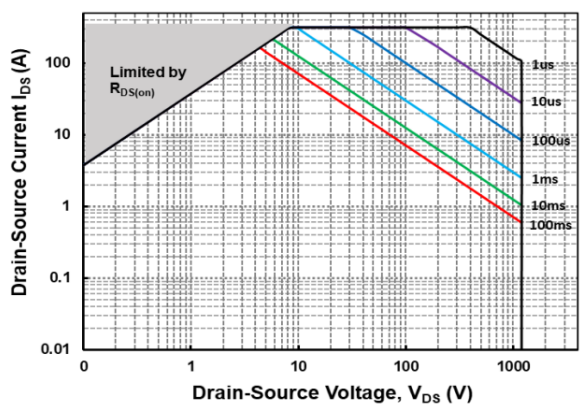


Figure 22. Safe Operating Area

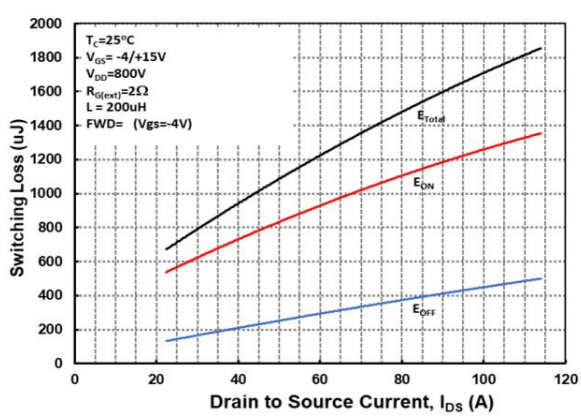


Figure 23. Clamped Inductive Switching Energy vs. Drain Current (V_{DD}=800V)

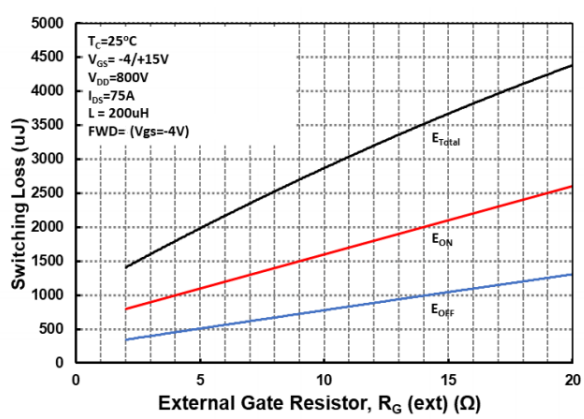


Figure 24. Clamped Inductive Switching Energy vs. External Gate Resistor $R_{G(ext)}$

Typical Characteristics

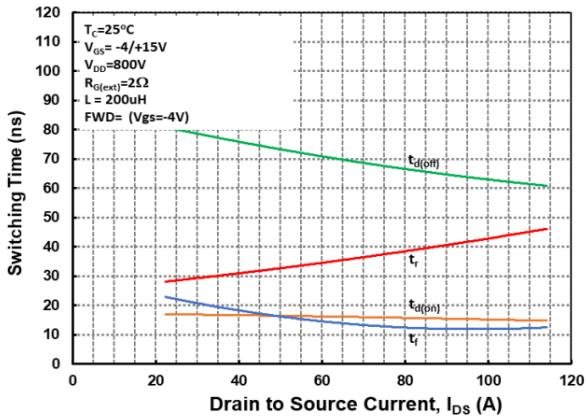


Figure 25. Switching Times vs. Drain Current (V_{DD}=800V)

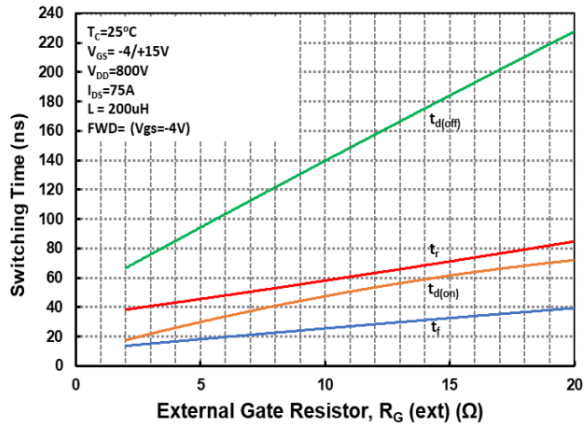
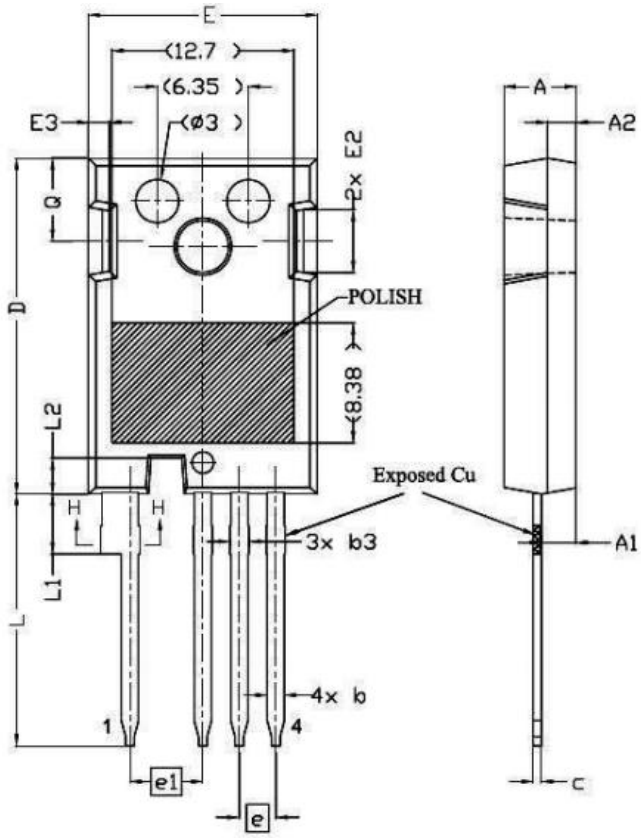
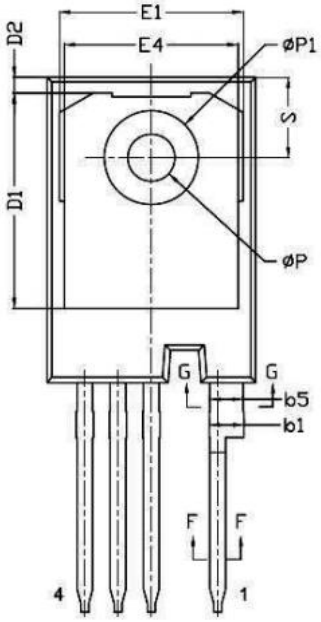


Figure 26. Switching Times vs. External Gate Resistor $R_{G(ext)}$

Package Information

Package Outline





Unit : mm

SYMBOL	DIMENSIONS		
	MIN	NOM	MAX
A	4.83	5.02	5.21
A1	2.29	2.41	2.54
A2	1.91	2.00	2.16
b	1.07	1.20	1.28
b1	2.39	2.67	2.94
b2	2.39	2.67	2.84
b3	1.07	1.30	1.60
b4	1.07	1.30	1.50
b5	2.39	2.53	2.69
b6	2.39	2.53	2.64
c	0.55	0.60	0.68
c1	0.55	0.60	0.65
D	23.30	23.45	23.60
D1	16.25	16.55	17.65
D2	0.95	1.19	1.25
E	15.75	15.94	16.13
E1	13.10	14.02	14.15
E2	3.68	4.40	5.10
E3	1.00	1.45	1.90
E4	12.38	13.26	13.43
e	2.54 BSC		
e1	5.08 BSC		
L	17.31	17.57	17.82
L1	3.97	4.19	4.37
L2	2.35	2.50	2.65
ØP	3.51	3.61	3.65
ØP1	7.19 REF		
Q	5.49	5.79	6.00
S	6.04	6.17	6.30