

SiC Half-Bridge Module PAAA12017FM

Features

- High Blocking Voltage with Low $R_{DS(on)}$
- Automotive Module
- High Temperature Operation
- Low Stray Inductance
- Silver Sintering Technology

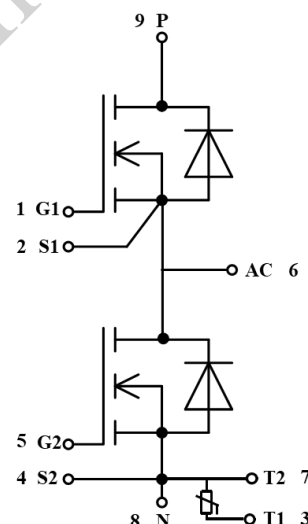


Applications

- Automotive Application
- EV/HEV

Standards Benefits

- Improve System Efficiency
- Improve Power Density
- Reduce System Size



Order Information

Part Number	Package	Marking
PAAA12017FM	IPM-MSOP9	PAAA12017FM



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1. Maximum Ratings

At $T_J = 25^\circ\text{C}$, unless specified otherwise

Parameter	Symbol	Value	Unit	Test Conditions
Drain - Source Voltage	V_{DSmax}	1200	V	
Gate - Source Voltage (Dynamic)	V_{GSmax}	-10 / +25	V	AC ($f > 1\text{Hz}$)
Gate - Source Voltage(static) turn-on gate voltage turn-off gate voltage	$V_{GS,on}$ $V_{GS,off}$	+15/+18 -3	V	Static
Continuous Drain Current	I_D	20	A	$V_{GS} = 18\text{V}$ $T_C = 25^\circ\text{C}$ $T_J = 175^\circ\text{C}$
		17		$V_{GS} = 18\text{V}$ $T_C = 65^\circ\text{C}$ $T_J = 175^\circ\text{C}$
		12		$V_{GS} = 18\text{V}$ $T_C = 125^\circ\text{C}$ $T_J = 175^\circ\text{C}$
Power Dissipation	P_D	110	W	
Operating Junction Temperature	T_J	-55 To +175	$^\circ\text{C}$	
Storage Temperature	T_{stg}	-55 To +175	$^\circ\text{C}$	

2. Electrical Characteristics

At $T_J = 25^\circ\text{C}$, unless specified otherwise

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	1200	/	/	V	$V_{GS}=0V$ $I_{DS}=100\mu A$
Gate Threshold Voltage	$V_{GS(th)}$	/	2.55	/	V	$V_{DS}=V_{GS}$ $I_D=2.5mA$
Reverse Bias Drain Current	I_{DSS}	/	1	100	μA	$V_{GS}=0V$ $V_{DS}=1200V$
Gate-Source Leakage Current	I_{GSS}	/	3	30	nA	$V_{GS}=18V$ $V_{DS}=0V$
Drain-Source On-State Resistance	$R_{DS(on)}$	/	110	160	m Ω	$V_{GS}=18V$ $I_D=10A$ $T_J=25^{\circ}C$
		/	125	/		$V_{GS}=18V$ $I_D=10A$ $T_J=125^{\circ}C$
		/	160	/		$V_{GS}=18V$ $I_D=10A$ $T_J=175^{\circ}C$
Turn-on Energy	E_{on}	/	43.3	/	μJ	$V_{DS}=800V$ $V_{GS}=-3/18V$ $I_D=10A$ $R_G=3\Omega$ $L=500\mu H$ $T_J=25^{\circ}C$
Turn-off Energy	E_{off}	/	43	/		
Turn-On Delay Time	$t_{d(on)}$	/	14.4	/	ns	
Rise Time	t_r	/	10	/		
Turn-Off Delay Time	$t_{d(off)}$	/	21.3	/		
Fall Time	t_f	/	28.8	/		

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
Transconductance	g_{fs}	/	2.4	/	S	$V_{DS} = 20V$ $I_{DS} = 10A$ $T_J = 25^{\circ}C$
		/	3.6	/		$V_{DS} = 20V$ $I_{DS} = 10A$ $T_J = 175^{\circ}C$
Internal Gate Resistance	$R_{G(int)}$	/	2.7	/	Ω	$f = 1MHz$ $V_{AC} = 25mV$
Coss Stored Energy	E_{oss}	/	39.8	/	μJ	$V_{DS} = 800V$ $f = 1MHz$
Input Capacitance	C_{iss}	/	1120	/	pF	$V_{GS} = 0V$ $V_{DS} = 800V$ $f = 1MHz$ $V_{AC} = 25mV$
Output Capacitance	C_{oss}	/	115	/	pF	
Reverse Transfer Capacitance	C_{rss}	/	28	/	pF	
Gate to Source Charge	Q_{gs}	/	13	/	nC	$V_{DS} = 800V$ $I_{DS} = 10A$ $I_{GS} = 20mA$ $V_{GS} = -3 \text{ to } 18V$
Gate to Drain Charge	Q_{gd}	/	7	/		
Total Gate Charge	Q_g	/	30	/		

3. Reverse Diode Characteristics

At $T_J = 25^\circ\text{C}$, unless specified otherwise

Parameter	Symbol	Value		Unit	Test Conditions
		Typ.	Max.		
Diode Forward Voltage	V_{SD}	5.5	/	V	$V_{GS} = -3\text{V}$ $I_{SD} = 5\text{A}$ $T_J = 25^\circ\text{C}$
		4.8	/	V	$V_{GS} = -3\text{V}$ $I_{SD} = 5\text{A}$ $T_J = 175^\circ\text{C}$
Reverse Recover Time	t_{rr}	12.4	/	ns	$V_{DS} = 800\text{V}$ $I_{SD} = 10\text{A}$ $dI/dt = 4500\text{A}/\mu\text{s}$ $V_{GS} = -3\text{V}$ $T_J = 25^\circ\text{C}$
Reverse Recovery Charge	Q_{rr}	165.6	/	nC	
Peak Reverse Recovery Current	I_{rrm}	21.2	/	A	
Continuous Diode Forward Current	I_S	15	/	A	$V_{GS} = -3\text{V}$

4. Thermal Characteristics

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
Thermal Resistance from Junction to Cooling Fluid	$R_{\theta JF}$	/	1.36	/	$^\circ\text{C}/\text{W}$	

5. NTC Thermistor Characteristics

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ	Max.		
Rated Resistance	R_{NTC}	/	10	/	k Ω	$T_{NTC} = 25^{\circ}\text{C}$
Resistance Tolerance	$\Delta R/R$	-5	/	5	%	$T_{NTC} = 25^{\circ}\text{C}$
B-value	$B_{25/85}$	3170	/	4100	K	$T_2 = 80^{\circ}\text{C}$
Power Dissipation	P_{NTC}	/	/	125	mW	$T_{NTC} = 25^{\circ}\text{C}$

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6. Typical Performance

At $T_J = 25^\circ\text{C}$, unless specified otherwise

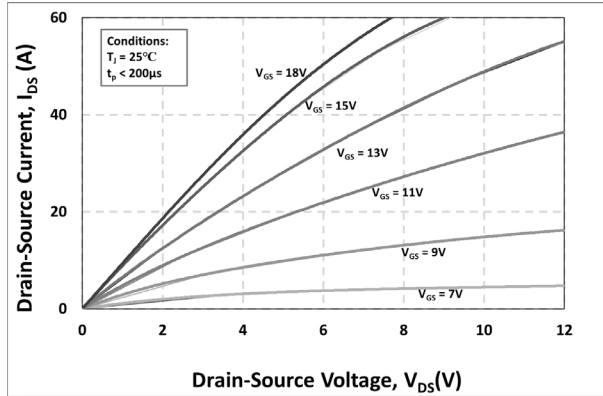


Figure 1. Output Characteristics $T_J = 25^\circ\text{C}$

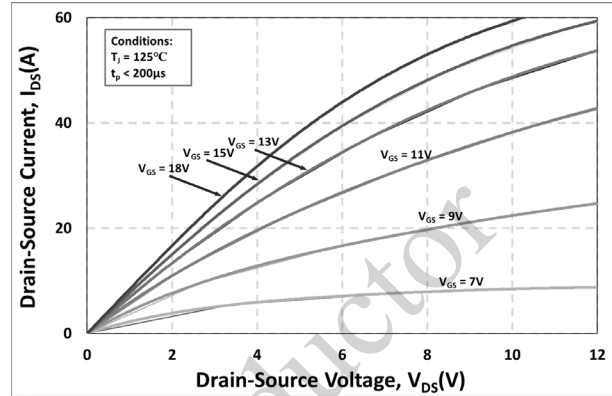


Figure 2. Output Characteristics $T_J = 125^\circ\text{C}$

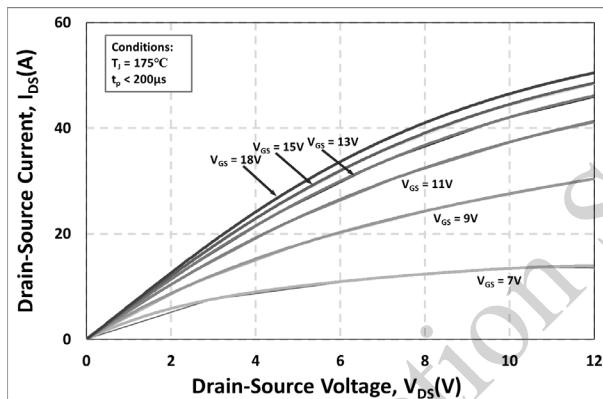


Figure 3. Output Characteristics $T_J = 175^\circ\text{C}$

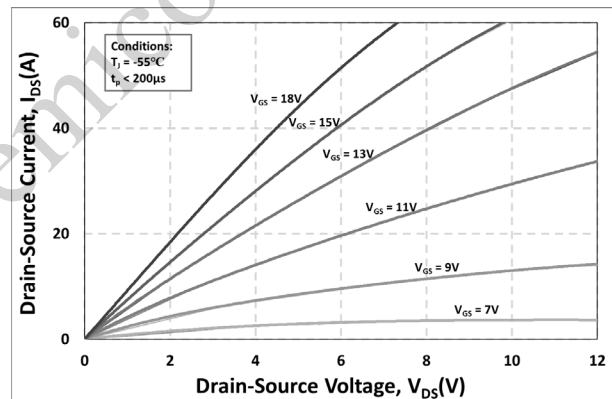


Figure 4. Output Characteristics $T_J = -55^\circ\text{C}$

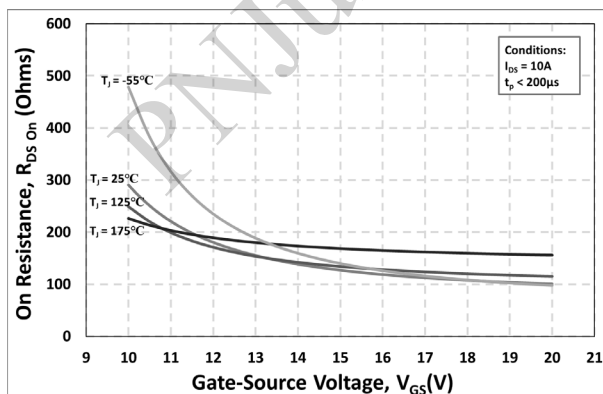


Figure 5. On-Resistance vs. Gate-Source Voltage

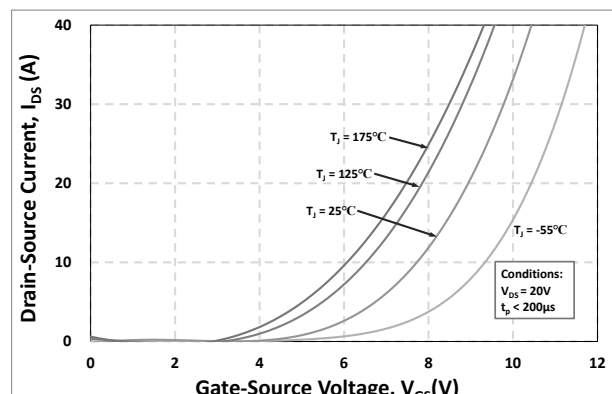


Figure 6. Transfer Characteristic for Various Junction Temperatures

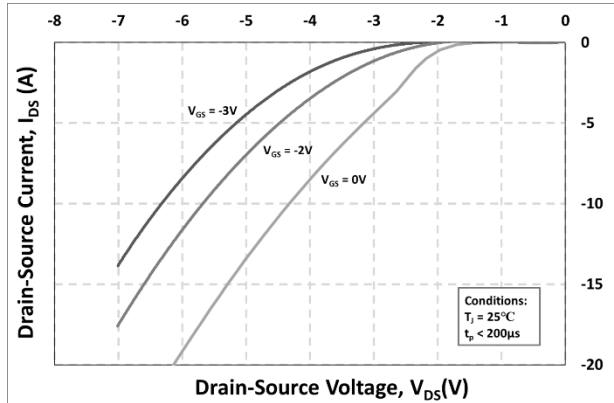


Figure 7. Body Diode Characteristic at 25°C

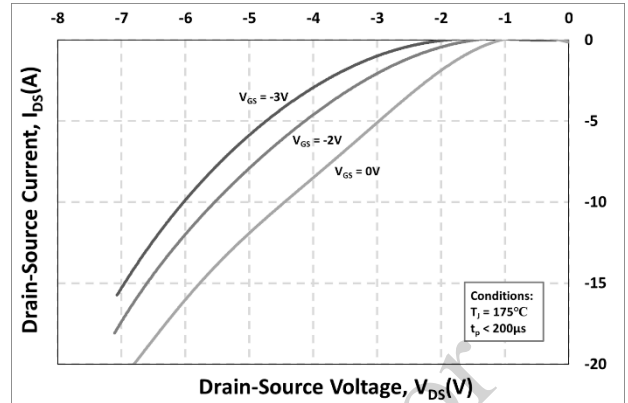


Figure 8. Body Diode Characteristic at 175°C

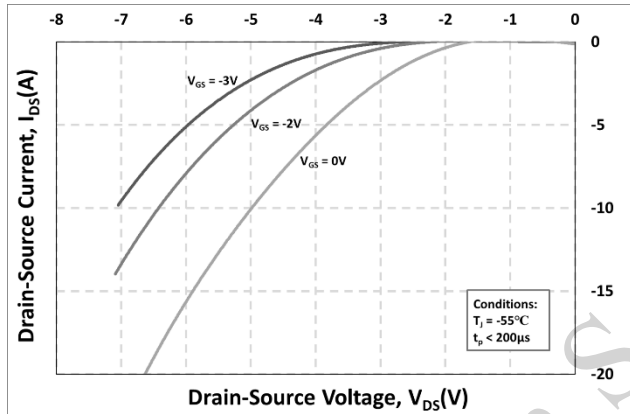


Figure 9. Body Diode Characteristic at -55°C

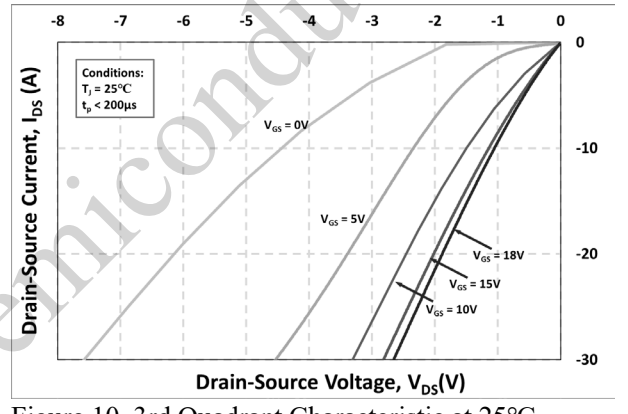


Figure 10. 3rd Quadrant Characteristic at 25°C

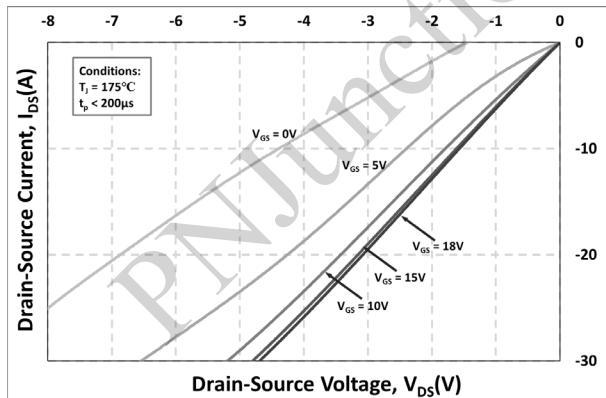


Figure 11. 3rd Quadrant Characteristic at 175°C

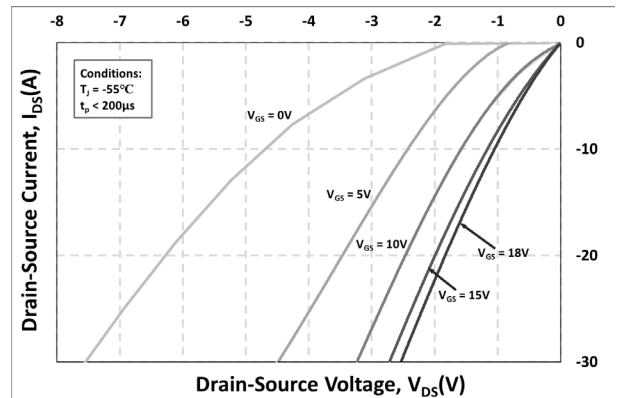


Figure 12. 3rd Quadrant Characteristic at -55°C

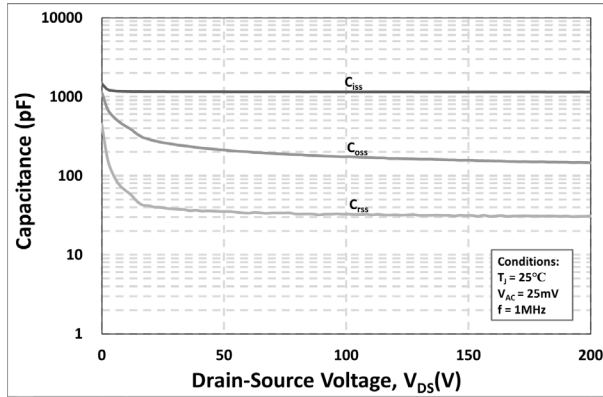


Figure 13. Capacitances vs. Drain-Source Voltage (0 - 200V)

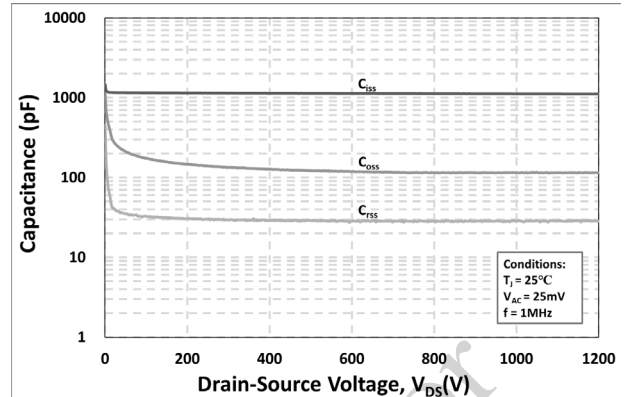


Figure 14. Capacitances vs. Drain-Source Voltage (0 - 1200V)

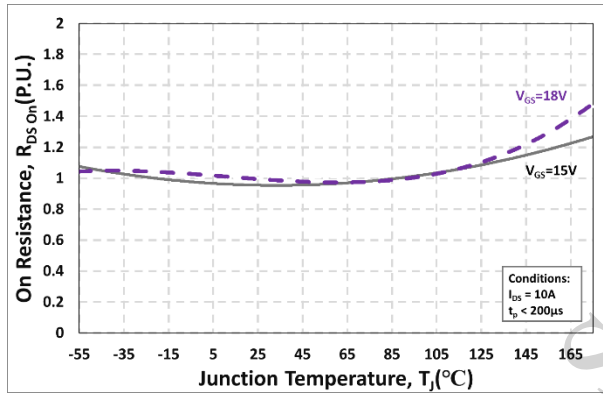


Figure 15. Normalized On-Resistance vs. Temperature

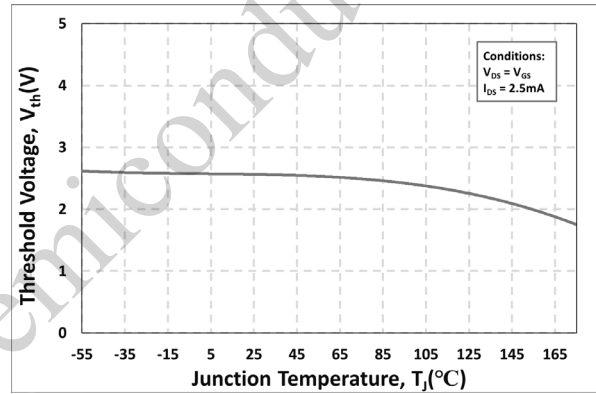


Figure 16. Threshold Voltage vs. Temperature

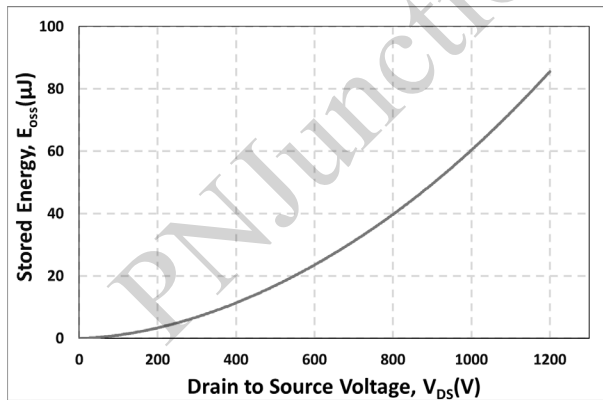


Figure 17. Output Capacitor Stored Energy

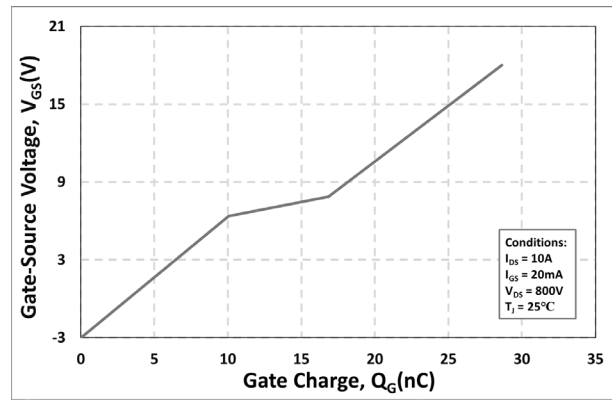


Figure 18. Gate Charge Characteristics

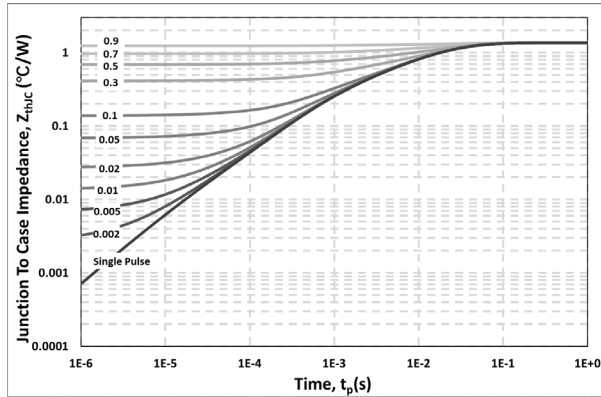


Figure 19. Transient Thermal Impedance (Junction - Case)

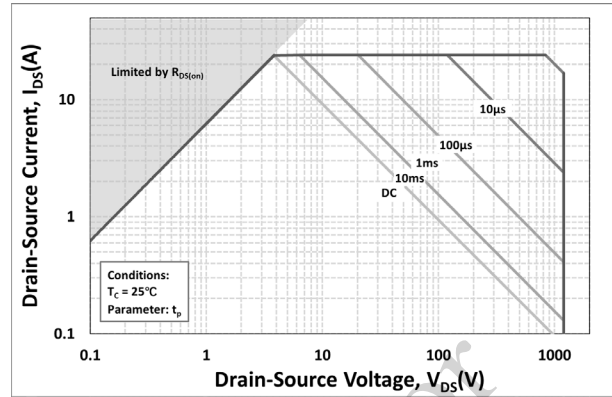


Figure 20. Forward Bias Safe Operating Area (FBSOA)

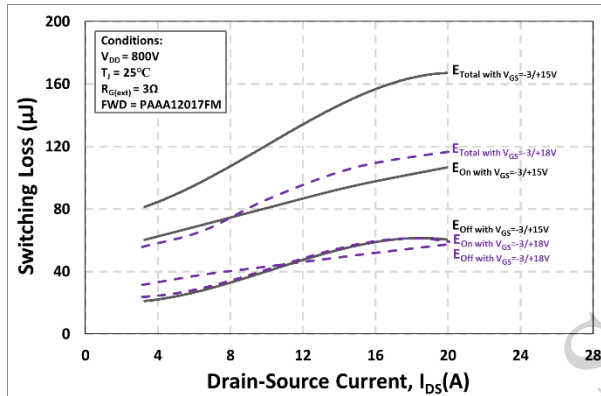


Figure 21. Switching Loss vs. Drain-Source Current ($V_{DS} = 800\text{ V}$)

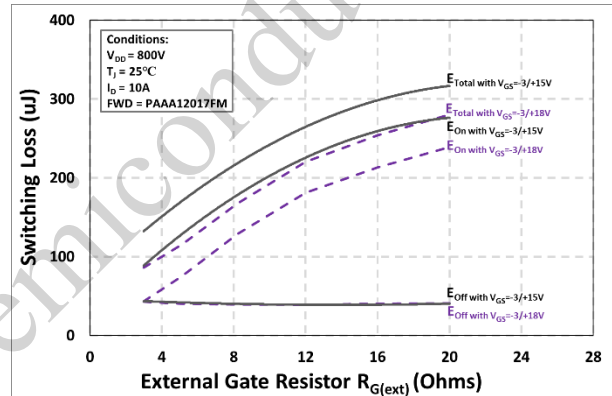


Figure 22. Switching Loss vs. External Gate Resistance

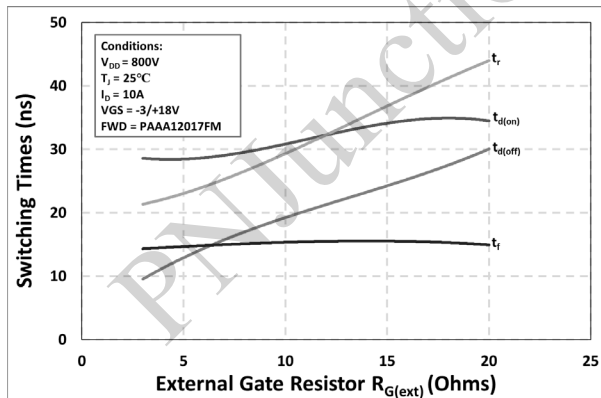


Figure 23. Switching Times vs. External Gate Resistance

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