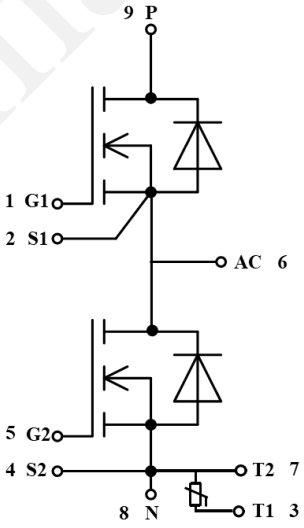
SiC Half-Bridge Module
PAAA12036FM

Features

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



Applications

- Automotive Application
- EV/HEV

Standards Benefits

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

Order Information

Part Number	Package	Marking
PAAA12036FM	IPM-MSOP9	PAAA12036FM

Contents

1. Maximum Ratings

At T_J= 25℃, unless specified otherwise

Parameter	Symbol	Value	Unit	Test Conditions
Drain - Source Voltage	V_{DSmax}	1200	V	
Gate - Source Voltage (Dynamic)	V_{GSmax}	-10 / +22	V	AC (f >1Hz)
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	36	A	V_{GS} =18V T_C = 25℃ T_J = 175℃
		26		V_{GS} =18V T_C = 100℃ T_J = 175℃
		21		V_{GS} =18V T_C = 125℃ T_J = 175℃
Power Dissipation	P_D	180	W	
Operating Junction Temperature	T_J	-55 To +175	℃	
Storage Temperature	T_{stg}	-55 To +175	℃	

2. Electrical Characteristics

At T_J= 25℃, unless specified otherwise

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	1200	/	/	V	V_{GS}=-3V I_{DS}=1mA
Gate Threshold Voltage	$V_{GS(th)}$	/	3.1	/	V	V_{DS}= V_{GS} I_D= 5mA
Reverse Bias Drain Current	I_{DSS}	/	1	100	μA	V_{GS}= -3V V_{DS}= 1200V T_J= 25℃
Gate-Source Leakage Current	I_{GSS}	/	5	30	nA	V_{GS}= 18V V_{DS}= 0V T_J= 25℃
Drain-Source On-State Resistance	$R_{DS(on)}$	/	55	70	mΩ	V_{GS}= 18V I_D= 20A T_J= 25℃
		/	58	/		V_{GS}= 18V I_D= 20A T_J= 125℃
		/	75	/		V_{GS}= 18V I_D= 20A T_J= 175℃
Turn-on Energy	E_{on}	/	208	/	μJ	V_{DS}= 800V V_{GS}= -3/18V I_D= 20A R_G= 1Ω L = 200uH T_J=25℃
Turn-off Energy	E_{off}	/	62.8	/		
Turn-On Delay Time	$t_{d(on)}$	/	17.3	/	ns	
Rise Time	t_r	/	9.1	/		
Turn-Off Delay Time	$t_{d(off)}$	/	24.2	/		
Fall Time	t_f	/	13.4	/		

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
Transconductance	g_{fs}	/	6.7	/	S	V_{DS}= 20V I_{DS}= 10A T_J = 25℃
		/	6.9	/		V_{DS}= 20V I_{DS}= 10A T_J= 175℃
Internal Gate Resistance	$R_{G(int)}$	/	1.9	/	Ω	f= 1MHz V_{AC}= 25mV
Coss Stored Energy	E_{oss}	/	49.8	/	μJ	V_{DS}= 800V f= 1MHz
Input Capacitance	C_{iss}	/	2228	/	pF	V_{GS}= 0V V_{DS}= 800V f= 1MHz V_{AC}= 25mV
Output Capacitance	C_{oss}	/	138	/	pF	
Reverse Transfer Capacitance	C_{rss}	/	18	/	pF	
Gate to Source Charge	Q_{gs}	/	23.3	/	nC	V_{DS}= 800V I_{DS}= 10A I_{GS}= 20mA V_{GS}= -3 to 18V
Gate to Drain Charge	Q_{gd}	/	24.7	/		
Total Gate Charge	Q_g	/	63.6	/		

3. Reverse Diode Characteristics

At T_J= 25℃, unless specified otherwise

Parameter	Symbol	Value		Unit	Test Conditions
		Typ.	Max.		
Diode Forward Voltage	V_{SD}	5.5	/	V	V_{GS}= -3V I_{SD}= 12A T_J= 25℃
		5.2	/	V	V_{GS}= -3V I_{SD}= 12A T_J= 175℃
Reverse Recover Time	t_{rr}	19.2	/	ns	V_{DS}= 800V I_{SD}= 20A d_{if}/d_t= 1900A/μs V_{GS} = -3V T_J= 25℃
Reverse Recovery Charge	Q_{rr}	272.6	/	nC	
Peak Reverse Recovery Current	I_{rrm}	22.5	/	A	

4. Thermal Characteristics

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
Thermal Resistance from Junction to Cooling Fluid	$R_{\theta JF}$	/	0.98	/	℃/W	

5. NTC Thermistor Characteristics

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ	Max.		
Rated Resistance	R_{NTC}	/	10	/	kΩ	T_{NTC}= 25℃
Resistance Tolerance	△R/R	-5	/	5	%	T_{NTC}= 25℃
B-value	$B_{25/85}$	3170	/	4100	K	T_2= 80℃
Power Dissipation	P_{NTC}	/	/	125	mW	T_{NTC}= 25℃

6. Typical Performance

At T_J= 25℃, unless specified otherwise

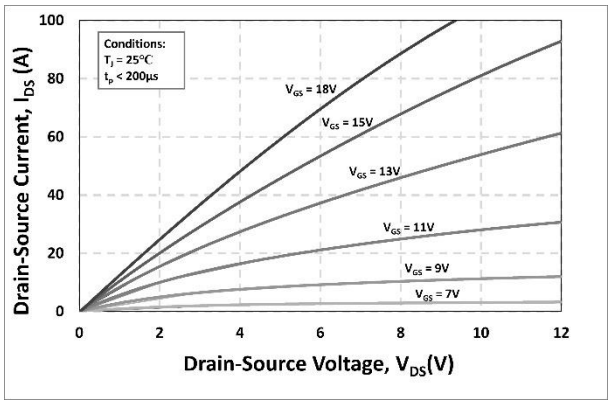


Figure 1. Output Characteristics T_J = 25℃

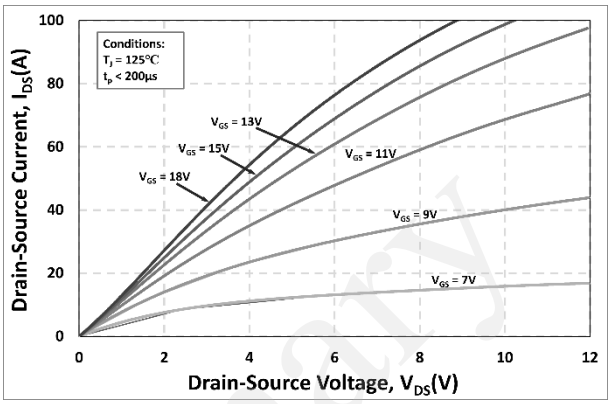


Figure 2. Output Characteristics T_J = 125℃

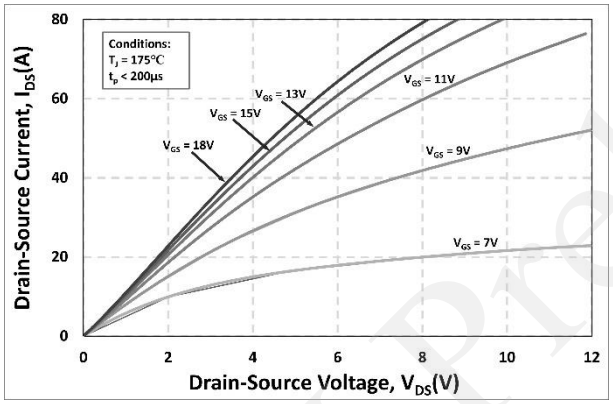


Figure 3. Output Characteristics T_J = 175℃

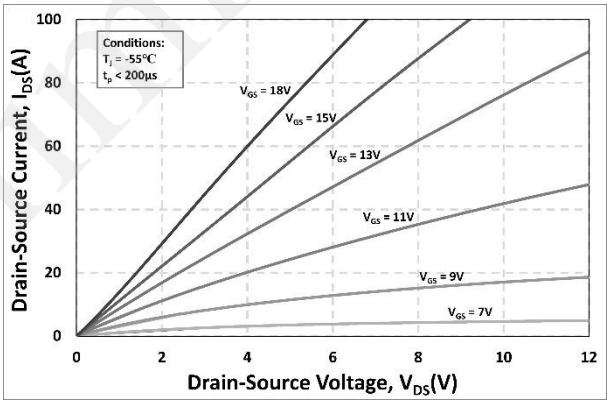


Figure 4. Output Characteristics T_J = -55℃

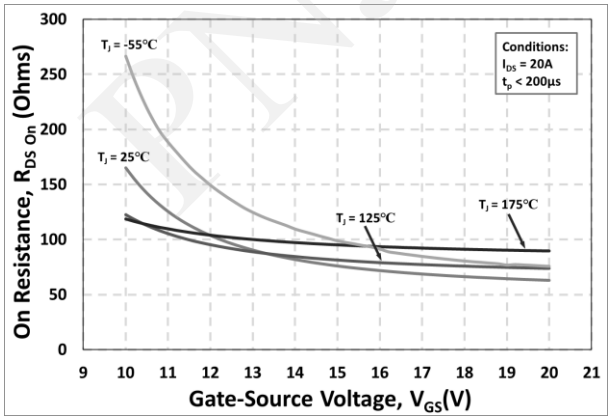


Figure 5. On-Resistance vs. Gate-Source Voltage

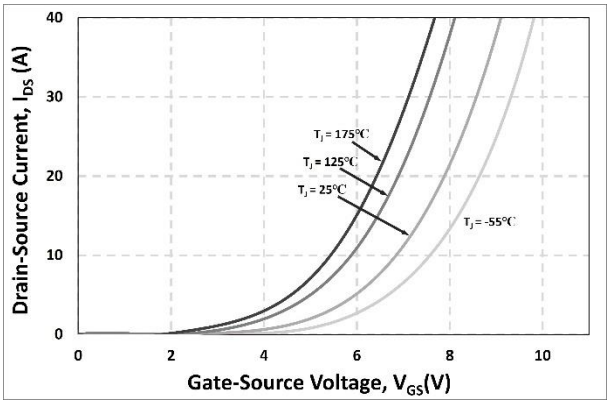


Figure 6. Transfer Characteristic for Various Junction Temperatures

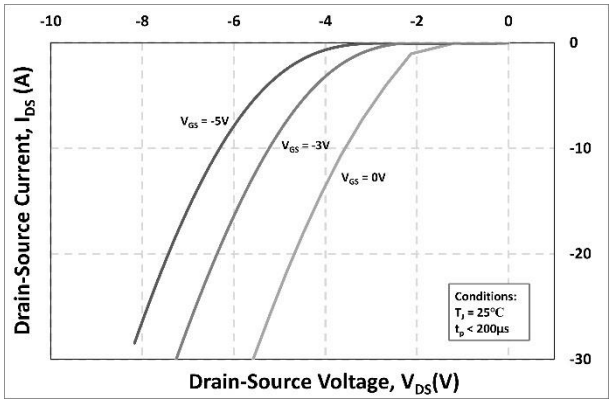


Figure 7. Body Diode Characteristic at 25°C

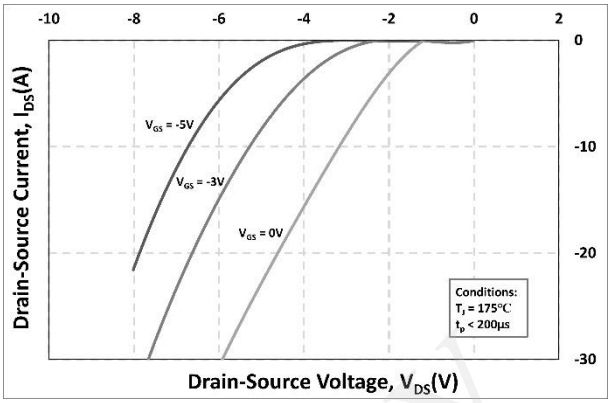


Figure 8. Body Diode Characteristic at 175°C

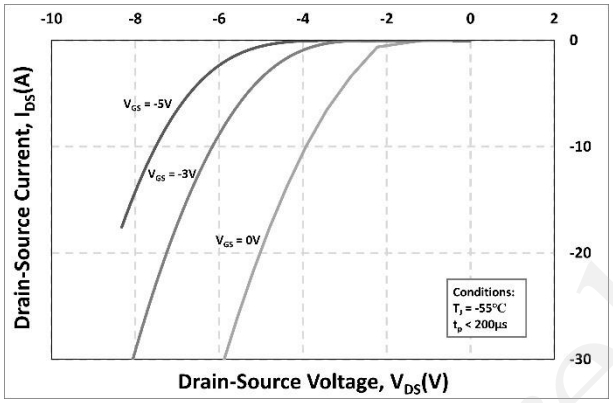


Figure 9. Body Diode Characteristic at -55°C

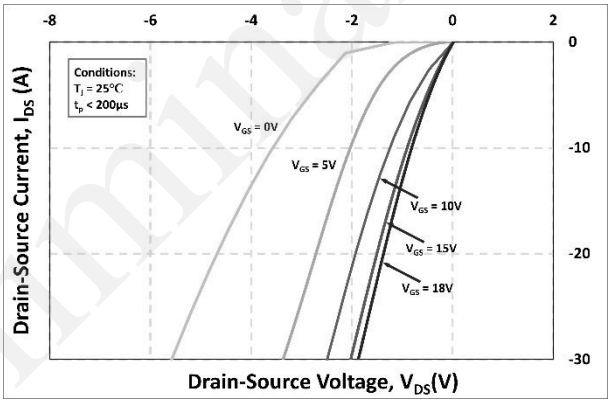


Figure 10. 3rd Quadrant Characteristic at 25°C

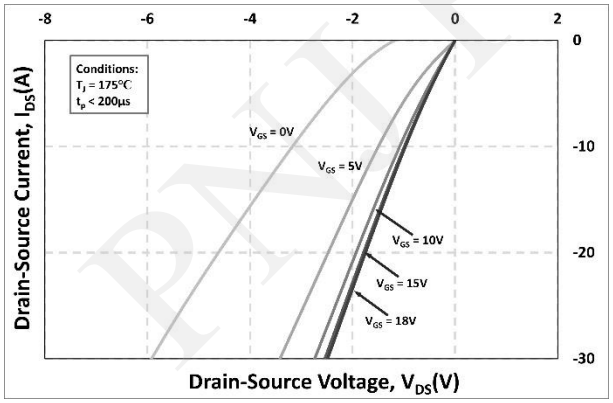


Figure 11. 3rd Quadrant Characteristic at 175°C

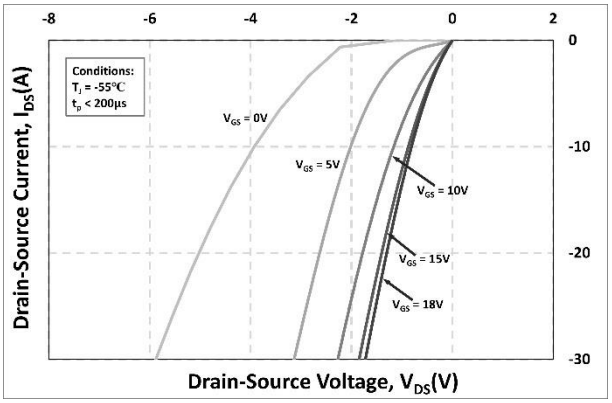


Figure 12. 3rd Quadrant Characteristic at -55°C

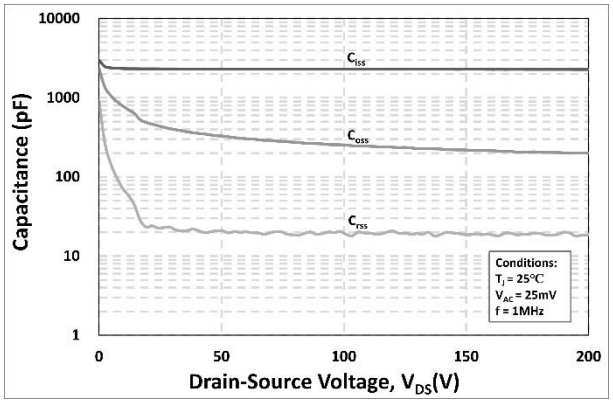


Figure 13. Capacitances vs. Drain-Source Voltage (0 - 200V)

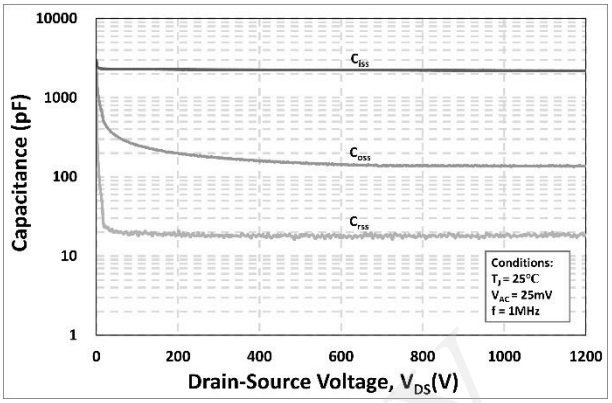


Figure 14. Capacitances vs. Drain-Source Voltage (0 - 1200V)

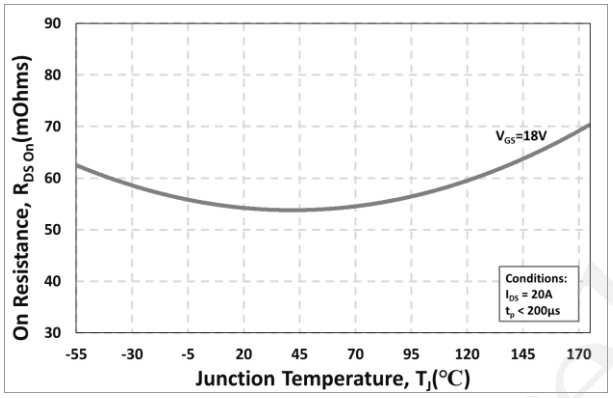


Figure 15. On-Resistance vs. Temperature

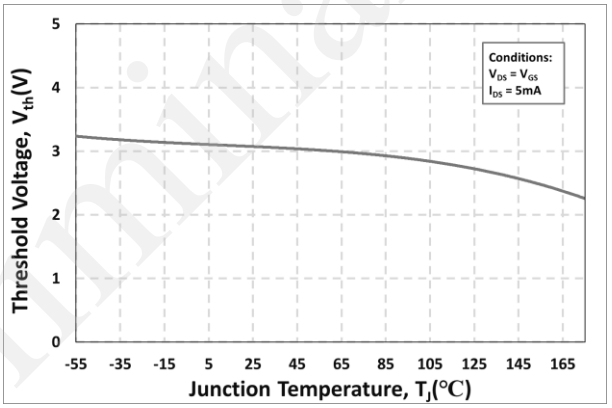


Figure 16. Threshold Voltage vs. Temperature

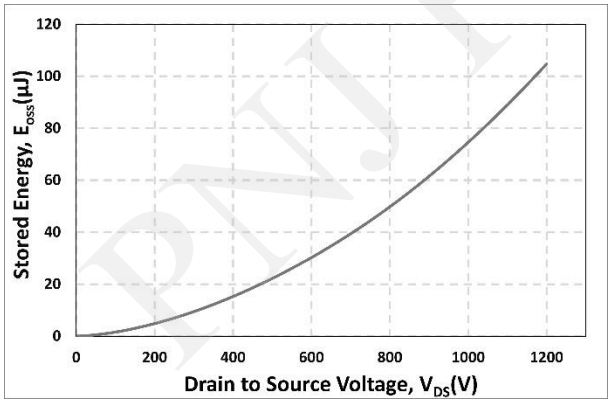


Figure 17. Output Capacitor Stored Energy

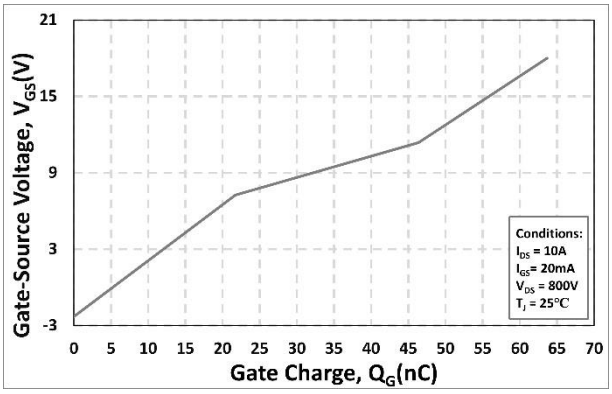


Figure 18. Gate Charge Characteristics

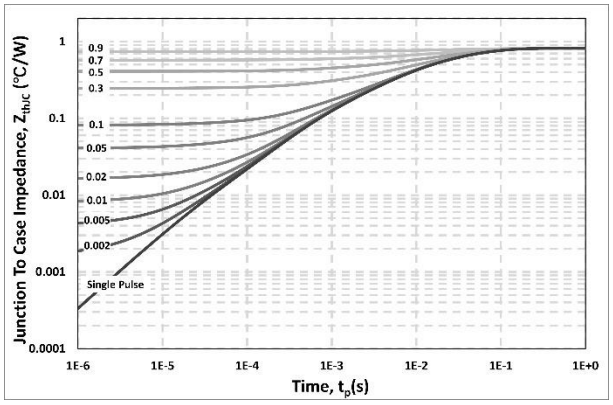


Figure 19. Transient Thermal Impedance (Junction - Case)

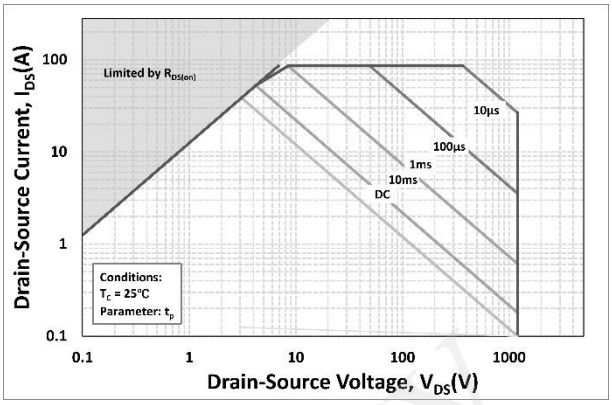


Figure 20. Forward Bias Safe Operating Area (FBSOA)

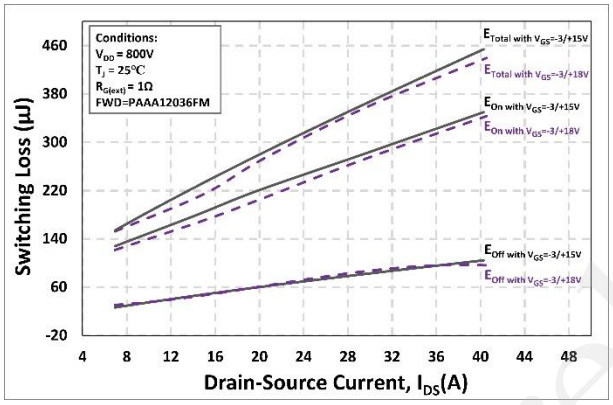


Figure 21. Switching Loss vs. Drain-Source Current (V_{DS} = 800 V)

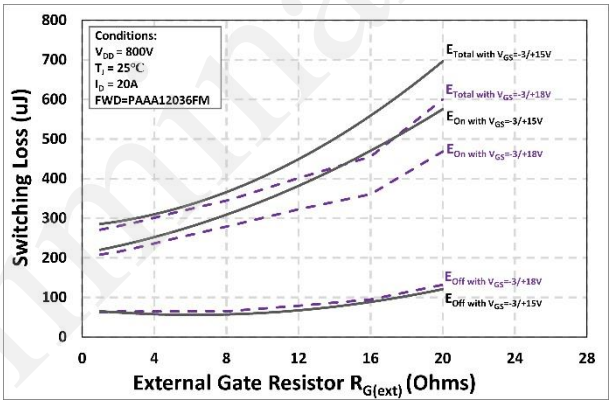


Figure 22. Switching Loss vs. External Gate Resistance

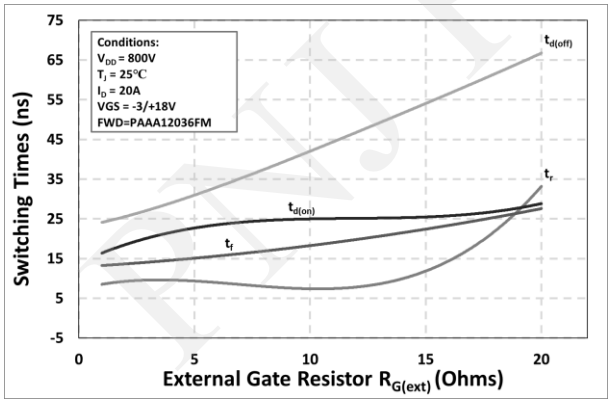


Figure 23. Switching Times vs. External Gate Resistance

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