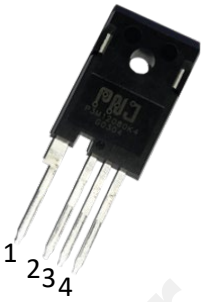
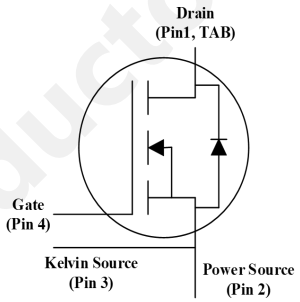
SiC MOSFET I3M12045K4

N-Channel Enhancement Mode



Features

- Qualified to AEC-Q101
- High Blocking Voltage with Low On-Resistance
- High-Frequency Operation
- Ultra-Small Q_{gd}
- 100% UIS tested



Benefits

- Improve System Efficiency
- Increase Power Density
- Reduce Heat Sink Requirements
- Reduction of System Cost

TO-247-4

Drain	1
Power Source	2
Kelvin Source	3
Gate	4

Applications

- Solar Inverters
- EV Battery Chargers
- High Voltage DC/DC Converters
- Switch Mode Power Supplies

RoHS

Halogen

Order Information

Part Number	Package	Marking
I3M12045K4	TO-247-4	I3M12045K4

Contents

1. Maximum Ratings

At T_J= 25℃, unless specified otherwise

Parameter	Symbol	Value	Unit	Test Conditions
Drain - Source Voltage	V_{DSmax}	1200	V	V_{GS} = 0V I_D = 100μA
Gate - Source Voltage (dynamic)	V_{GSmax}	-8 / +22	V	Duty cycle ≤ 1%
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	45	A	V_{GS} = 18V T_C = 25℃
		32		V_{GS} = 18V T_C = 100℃
		41		V_{GS} = 15V T_C = 25℃
		29		V_{GS} = 15V T_C = 100℃
Pulsed Drain Current	$I_{D(pulse)}$	120	A	PW≤ 10us， Duty cycle ≤ 1%
Power Dissipation	P_D	220	W	
Operating Junction	T_J	-55 To +175	˚C	
Storage Temperature	T_{stg}	-55 To +175	˚C	
Solder Temperature	T_L	260	˚C	
Mounting Torque	M_d	1 8.8	Nm lbf-in	M3 or 6-32 screw

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}= 0V I_D= 0.8mA
Gate Threshold Voltage	$V_{GS(th)}$	1.8	2.5	/	V	V_{DS}= V_{GS} I_D= 10mA T_J = 25℃
		/	1.8	/	V	V_{DS}= V_{GS} I_D= 10mA T_J = 175℃
Reverse Bias Drain Current	I_{DSS}	/	1	100	μA	V_{GS}=0V V_{DS}=1200V
Gate-Source Leakage Current	I_{GSS}	/	1	250	nA	V_{GS}= -5~18V V_{DS}= 0V
Drain-Source On-State Resistance	$R_{DS(on)}$	/	45	59	mΩ	V_{GS}= 18V I_D= 20A T_J = 25℃
		/	76	/		V_{GS}= 18V ID= 20A T_J = 175℃
		/	60	/		V_{GS}= 15V ID= 20A T_J = 25℃
		/	84	/		V_{GS}= 15V ID= 20A T_J = 175℃
Transconductance	g_{fs}	/	12	/	S	V_{DS}= 20V I_{DS}= 20A T_J = 25℃
		/	10	/		V_{DS}= 20V I_{DS}= 20A T_J= 175℃

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
Input Capacitance	C_{iss}	/	2070	/	pF	V_{GS}= 0V V_{DS}= 800V f= 1MHz V_{AC}= 25mV
Output Capacitance	C_{oss}	/	96	/		
Reverse Transfer Capacitance	C_{rss}	/	11	/		
Coss Stored Energy	E_{oss}	/	37	/	μJ	
Turn-on Energy	E_{on}	/	130	/	μJ	V_{DS}= 800V V_{GS}= -4/15V I_D= 20A R_G= 1Ω
Turn-off Energy	E_{off}	/	45	/		
Turn-On Delay Time	$T_{d(on)}$	/	22.7	/	ns	
Rise Time	T_r	/	12.5	/		
Turn-Off Delay Time	$T_{d(off)}$	/	25.6	/		
Fall Time	T_f	/	8	/		
Turn-on Energy	E_{on}	/	116	/	μJ	V_{DS}= 800V V_{GS}= -4/18V I_D= 30A R_G= 1Ω
Turn-off Energy	E_{off}	/	40	/		
Turn-On Delay Time	$T_{d(on)}$	/	20.8	/	ns	
Rise Time	T_r	/	11	/		
Turn-Off Delay Time	$T_{d(off)}$	/	27.2	/		
Fall Time	T_f	/	8	/		
Internal Gate Resistance	$R_{G(int)}$	/	2.0	/	Ω	f= 1MHz V_{AC}= 25mV

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
Gate to Source Charge	Q_{gs}	/	22	/	nC	V_{DS} =800V I_{DS}= 20A V_{GS}= -3/15V I_G= 20mA
Gate to Drain Charge	Q_{gd}	/	14	/		
Total Gate Charge	Q_g	/	54	/		
Gate to Source Charge	Q_{gs}	/	24	/	nC	V_{DS} =800V I_{DS}= 20A V_{GS}= -4/18V I_G= 20mA
Gate to Drain Charge	Q_{gd}	/	15	/		
Total Gate Charge	Q_g	/	66	/		

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}= 10A T_J= 25℃
		5.3	/	V	V_{GS}= -3V I_{SD}= 10A T_J= 175℃
Continuous Diode Forward Current	I_S	/	38	A	V_{GS}= -3V
Reverse Recover Time	t_{rr}	32.5	/	ns	V_{GS}= -4/15V I_{SD}= 20A V_R= 800V d_{if}/d_t= 2800A/μs T_J= 25℃
Reverse Recovery Charge	Q_{rr}	159	/	nC	
Peak Reverse Recovery Current	I_{rrm}	19.2	/	A	
Reverse Recover Time	t_{rr}	28.5	/	ns	V_{GS}= -4/18V I_{SD}= 20A V_R= 800V d_{if}/d_t= 2900A/μs T_J= 25℃
Reverse Recovery Charge	Q_{rr}	155	/	nC	
Peak Reverse Recovery Current	I_{rrm}	15.6	/	A	

4. Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal Resistance from Junction to Case	$R_{\theta JC}$	0.68	℃/W

5. Typical Performance

At T_J= 25℃, unless specified otherwise

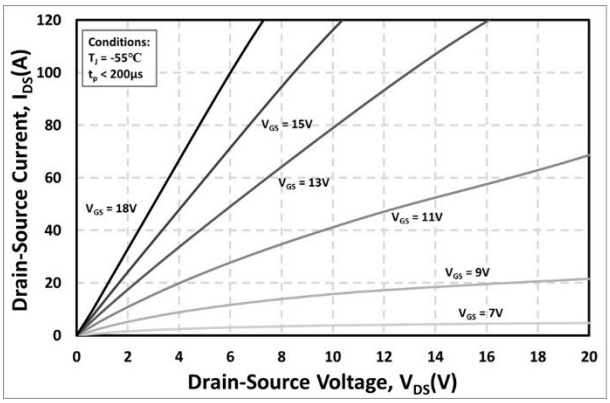


Figure 1. Output Characteristics T_J = -55℃

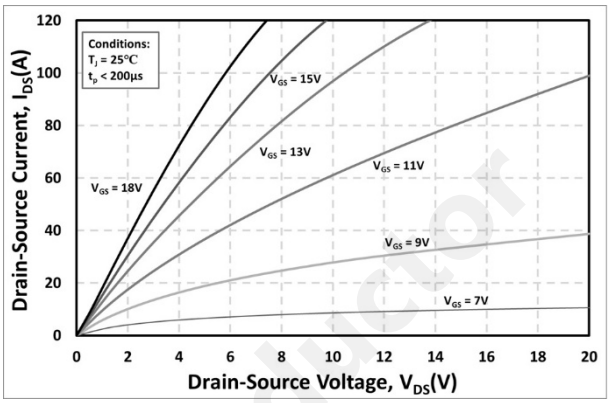


Figure 2. Output Characteristics T_J = 25℃

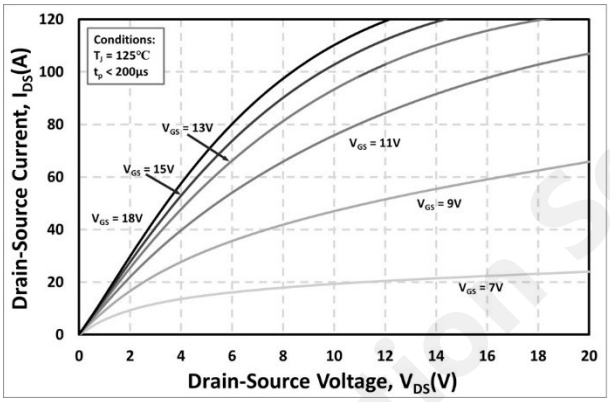


Figure 3. Output Characteristics T_J = 125℃

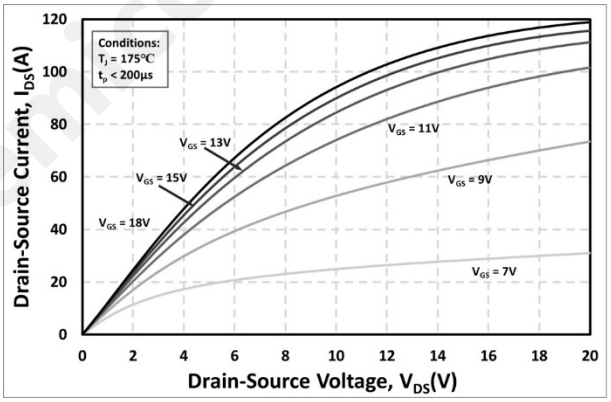


Figure 4. Output Characteristics T_J = 175℃

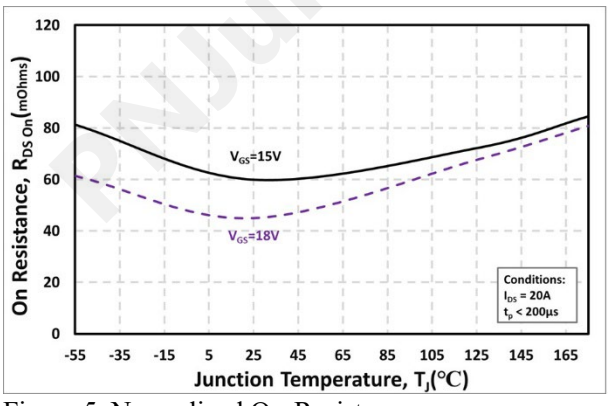


Figure 5. Normalized On-Resistance vs. Temperature

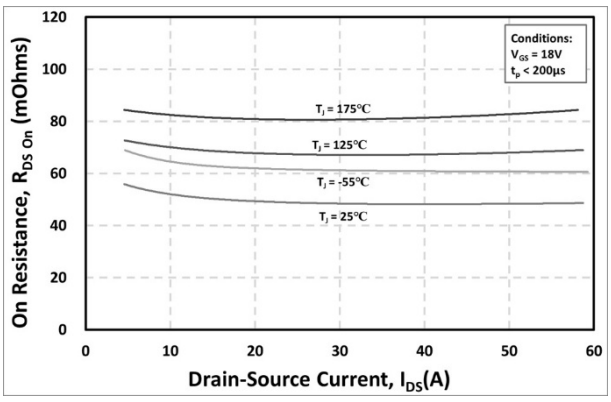


Figure 6. On-Resistance vs. Drain Current Various Temperatures

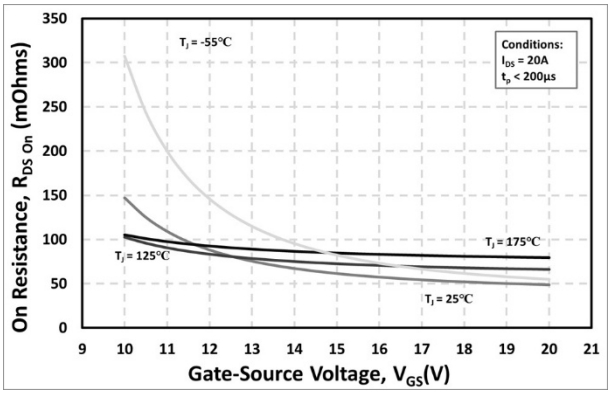


Figure 7. On-Resistance vs. Gate-Source Voltage

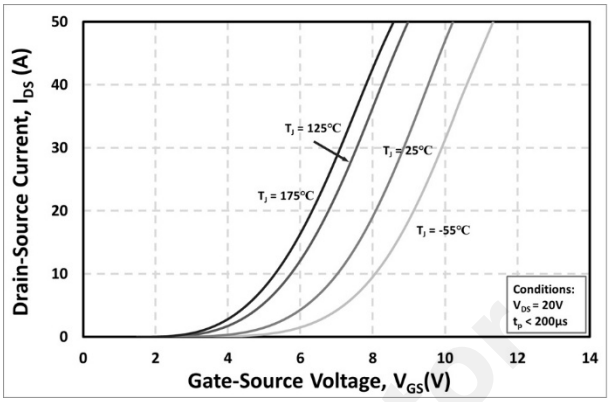


Figure 8. Transfer Characteristic for Various Junction Temperatures

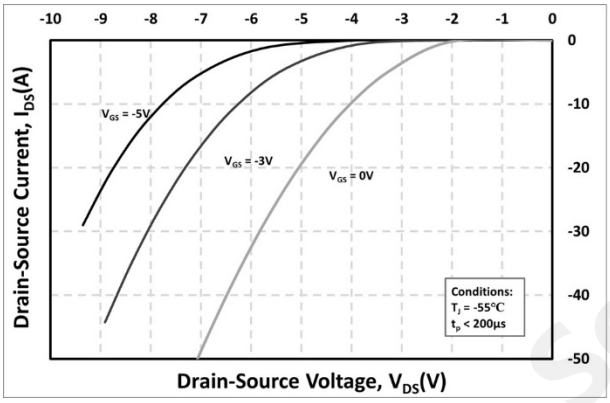


Figure 9. Body Diode Characteristic at -55°C

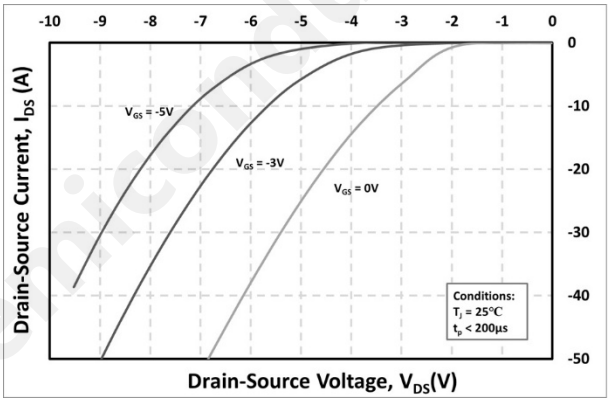


Figure 10. Body Diode Characteristic at 25°C

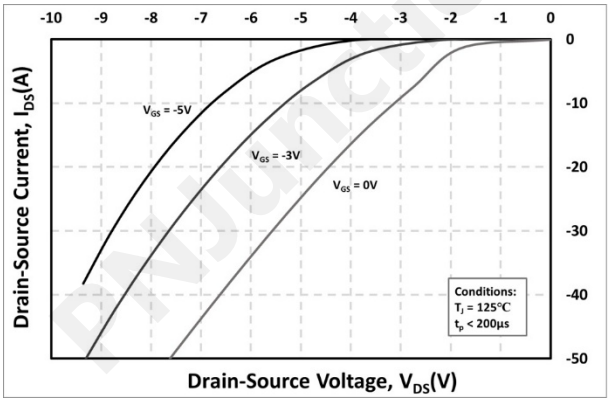


Figure 11. Body Diode Characteristic at 125°C

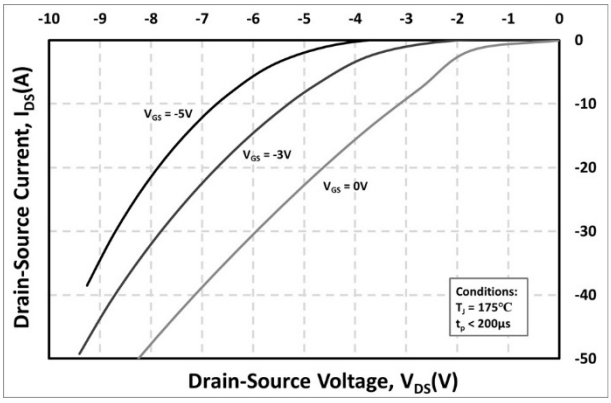


Figure 12. Body Diode Characteristic at 175°C

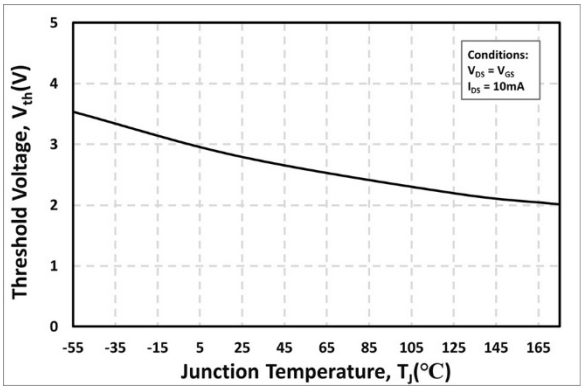


Figure 13. Threshold Voltage vs. Temperature

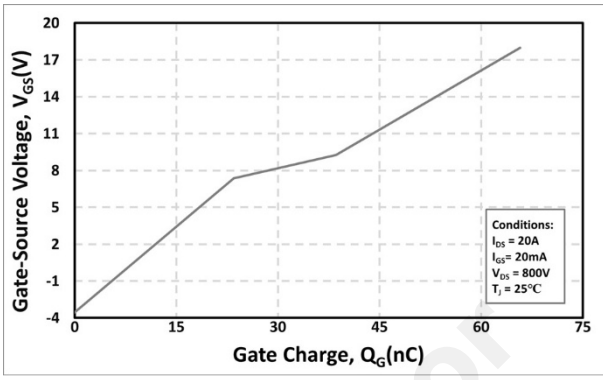


Figure 14. Gate Charge Characteristics

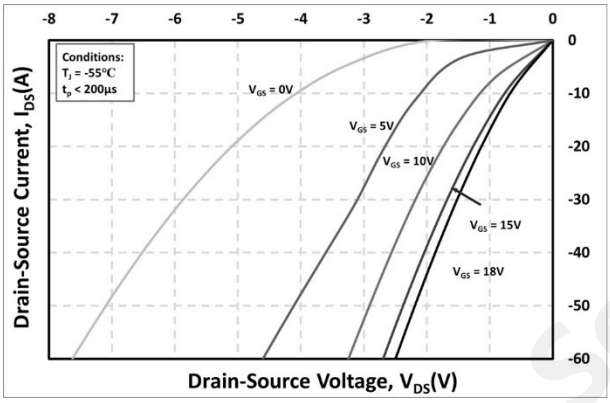


Figure 15. 3rd Quadrant Characteristic at -55°C

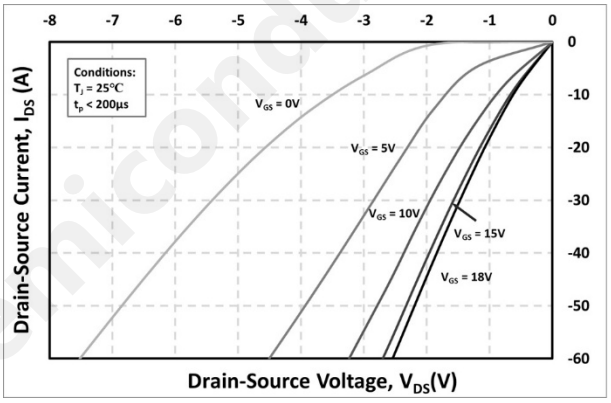


Figure 16. 3rd Quadrant Characteristic at 25°C

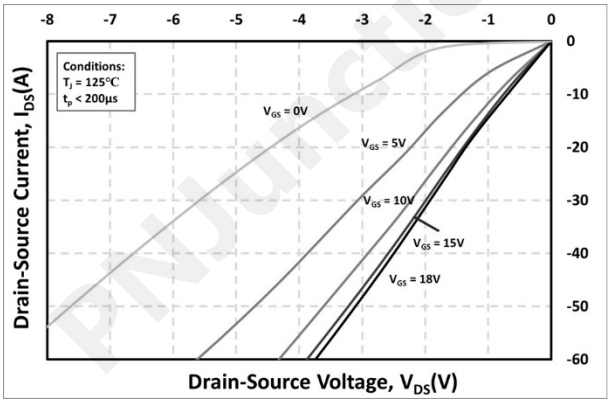


Figure 17. 3rd Quadrant Characteristic at 125°C

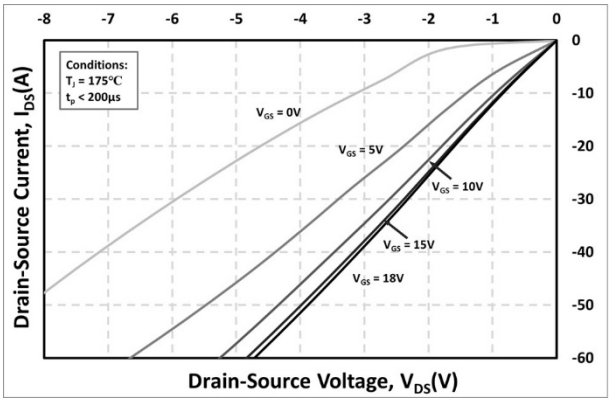


Figure 18. 3rd Quadrant Characteristic at 175°C

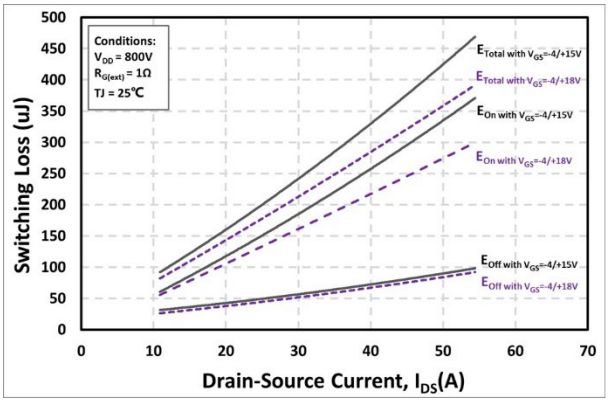


Figure 19. Clamped Inductive Switching Energy vs. Drain Current (V_{DD}= 800V)

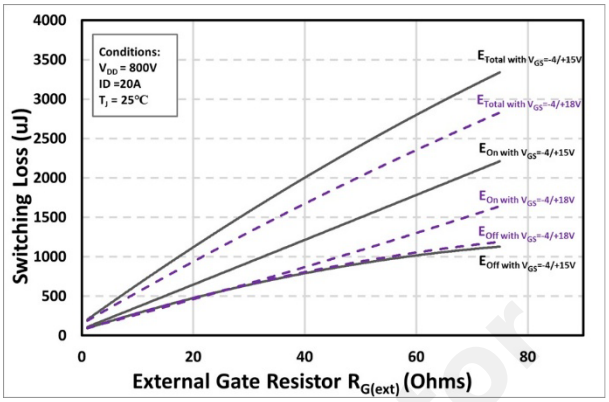


Figure 20. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

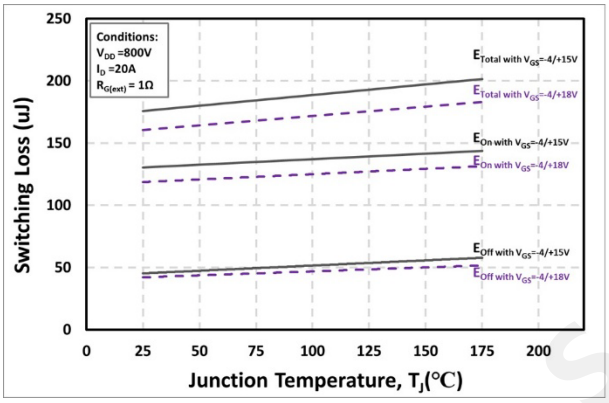


Figure 21. Clamped Inductive Switching Energy vs. Temperature

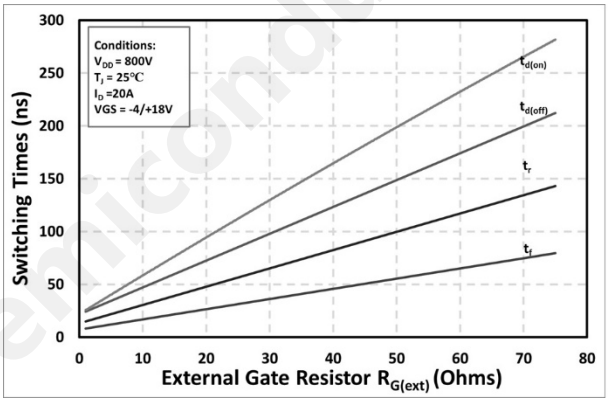


Figure 22. Switching Times vs. $R_{G(ext)}$

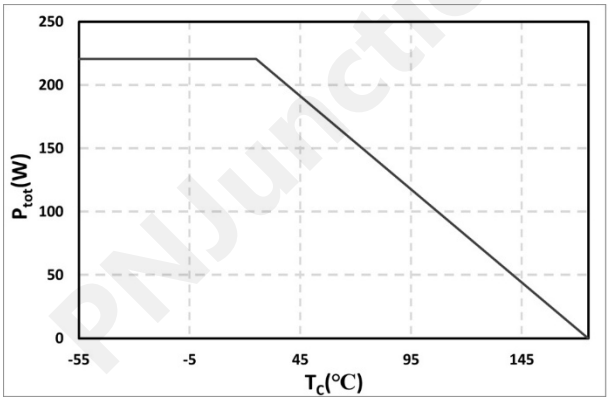


Figure 23. Maximum Power Dissipation Derating vs. Case Temperature

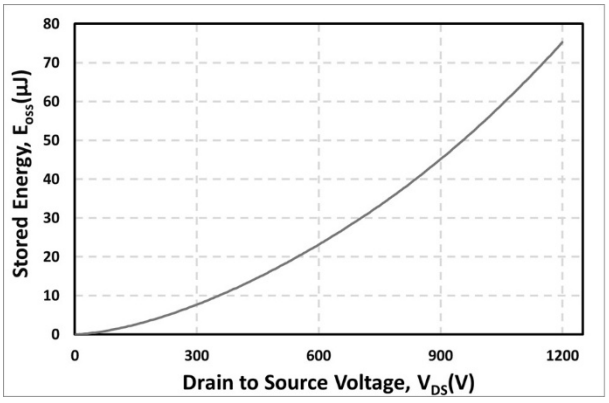


Figure 24. Output Capacitor Stored Energy

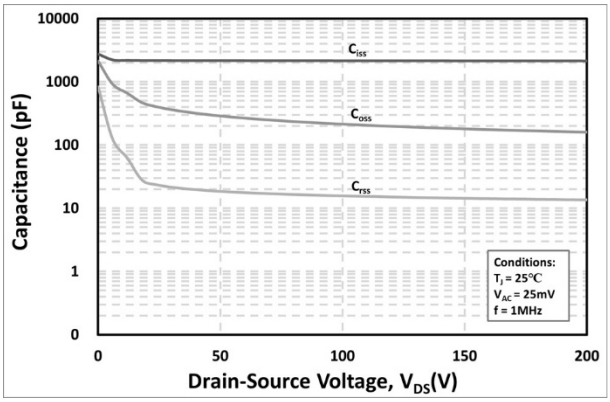


Figure 25. Capacitances vs. Drain-Source Voltage (0 - 200V)

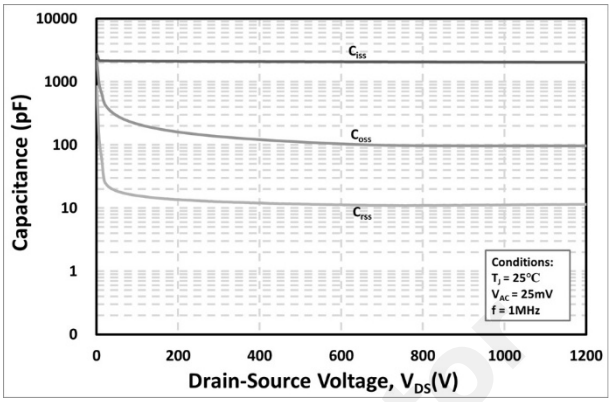


Figure 26. Capacitances vs. Drain-Source Voltage (0 - 1000V)

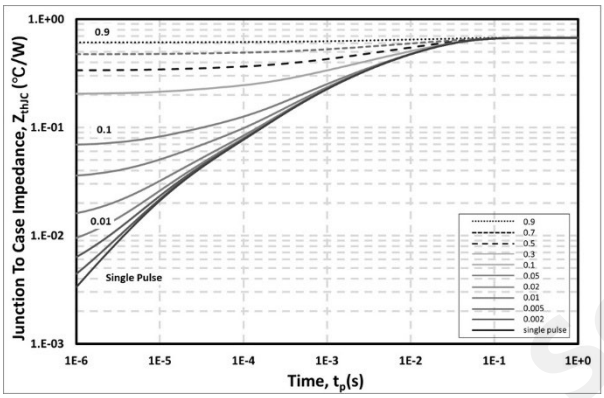


Figure 27. Transient Thermal Impedance (Junction - Case)

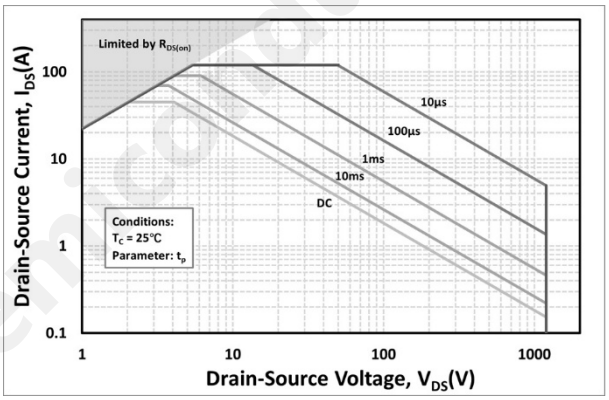


Figure 28. Safe Operating Area

6. Definitions

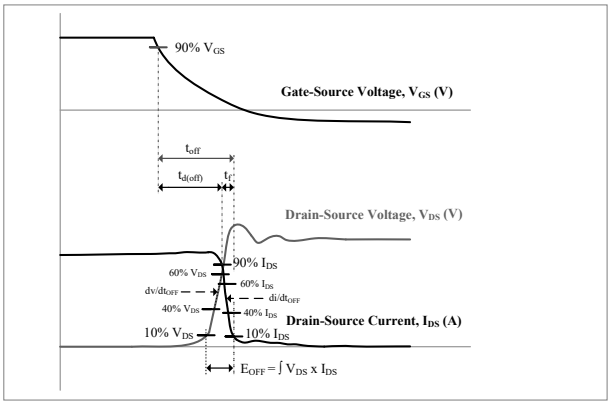


Figure 29. Turn-off Transient Definitions

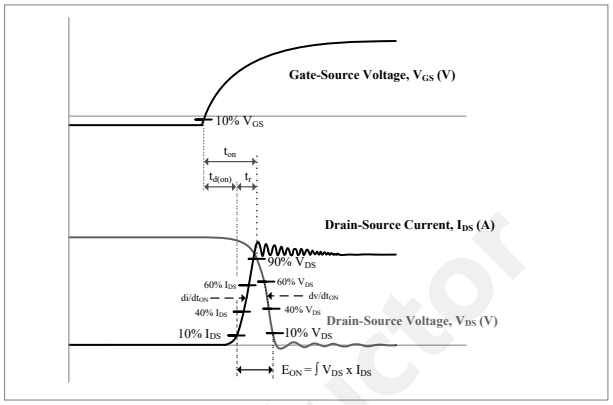


Figure 30. Turn-on Transient Definitions

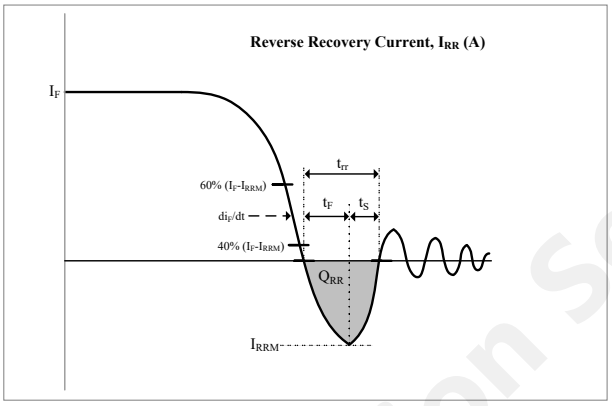


Figure 31. Reverse Recovery Definitions

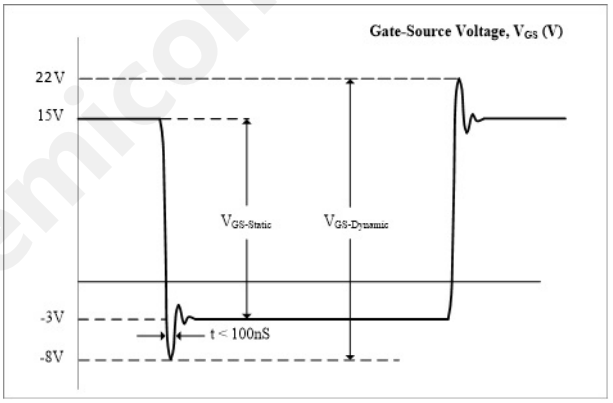
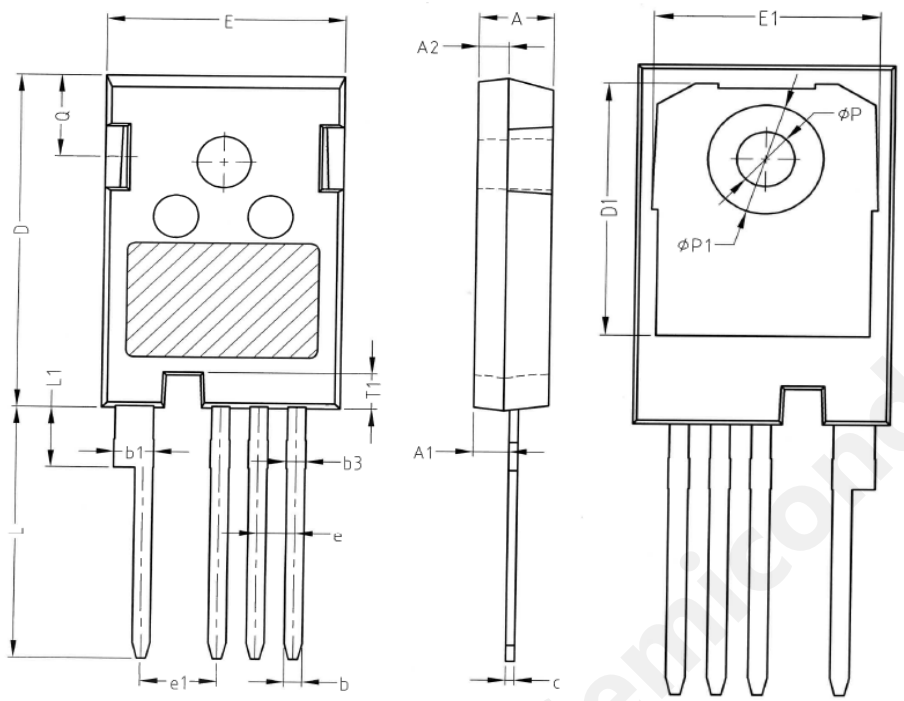


Figure 32. Vgs Transient Definitions

7. Package Outlines



SYMBOL	MM		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.61
A2	1.80	2.00	2.20
b	1.06	1.21	1.36
b1	2.33	2.63	2.93
b3	1.07	1.30	1.60
c	0.51	0.61	0.75
D	23.30	23.45	23.60
D1	16.25	16.55	16.85
E	15.74	15.94	16.14
E1	13.72	14.02	14.32
T1	2.35	2.50	2.65
e	2.54 BSC		
e1	5.08 BSC		
Q	5.49	5.79	6.09
L	17.27	17.57	17.87
L1	3.99	4.19	4.39
Φp	3.40	3.60	3.80
Φp1	7.19 REF		

Drawing and Dimensions

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