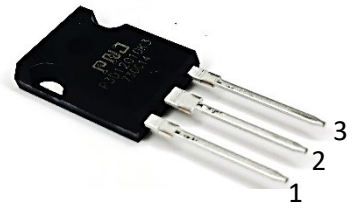
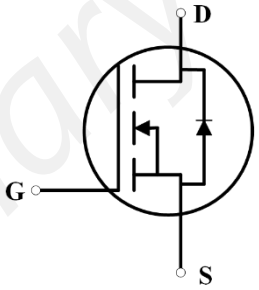
SiC MOSFET P3M06040K3

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



TO-247-3

Gate	1
Drain	2
Source	3

Benefits

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

Application

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

RoHS

Halogen

Order Information

Part Number	Package	Marking
P3M06040K3	TO-247-3	P3M06040K3

Contents

1. Maximum Ratings

At T_J= 25℃, unless specified otherwise

Parameter	Symbol	Value	Unit	Test Conditions
Drain - Source Voltage	V_{DSmax}	650	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	58	A	V_{GS} = 18V T_C = 25℃
		41		V_{GS} = 18V T_C = 100℃
		56		V_{GS} = 15V T_C = 25℃
		39		V_{GS} = 15V T_C = 100℃
Pulsed Drain Current	$I_{D(pulse)}$	120	A	PW≤ 10us， Duty cycle ≤ 1%
Power Dissipation	P_D	211	W	
Operating Junction Temperature	T_J	-55 To +175	℃	
Storage Temperature	T_{stg}	-55 To +150	℃	
Solder Temperature	T_L	260	℃	
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	$V_{(BR)DSS}$	650	/	/	V	V_{GS}= 0V I_D= 0.8mA
Gate Threshold Voltage	$V_{GS(th)}$	2.0	2.8	/	V	V_{DS}= V_{GS} I_D= 20mA T_J = 25℃
		/	2.0	/	V	V_{DS}= V_{GS} I_D= 20mA T_J = 175℃
Zero Gate Voltage Drain Current	I_{DSS}	/	1	100	μA	V_{GS}=0V V_{DS}=650V
Gate-Source Leakage Current	I_{GSS}	/	2	250	nA	V_{GS}= -5 to 18V V_{DS}= 0V
Drain-Source On-State Resistance	$R_{DS(on)}$	/	40	52	mΩ	V_{GS}= 18V I_D= 40A T_J = 25℃
		/	44	/		V_{GS}= 18V I_D= 40A T_J = 175℃
		/	46	/		V_{GS}= 15V I_D= 40A T_J = 25℃
		/	49	/		V_{GS}= 15V I_D= 40A T_J = 175℃
Transconductance	g_{fs}	/	24	/	S	V_{DS}= 20V I_{DS}= 40A T_J = 25℃
		/	22	/		V_{DS}= 20V I_{DS}= 40A T_J= 175℃

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
Input Capacitance	C_{iss}	/	1870	/	pF	V_{GS}= 0V V_{DS}= 400V f= 1MHz V_{AC}= 25mV
Output Capacitance	C_{oss}	/	120	/		
Reverse Transfer Capacitance	C_{rss}	/	15	/		
Coss Stored Energy	E_{oss}	/	14	/	μJ	
Turn-on Energy	E_{on}	/	117	/	μJ	V_{DS}= 400V V_{GS}= -3/15V I_{DS}=40A R_G= 1Ω
Turn-off Energy	E_{off}	/	48	/		
Turn-On Delay Time	$T_{d(on)}$	/	32	/	ns	
Rise Time	T_r	/	20	/		
Turn-Off Delay Time	$T_{d(off)}$	/	30	/		
Fall Time	T_f	/	6	/		
Turn-on Energy	E_{on}	/	91	/	μJ	V_{DS}= 400V V_{GS}= -4/18V I_{DS}=40A R_G= 1Ω
Turn-off Energy	E_{off}	/	26	/		
Turn-On Delay Time	$T_{d(on)}$	/	28	/	ns	
Rise Time	T_r	/	17	/		
Turn-Off Delay Time	$T_{d(off)}$	/	33	/		
Fall Time	T_f	/	5.9	/		
Internal Gate Resistance	$R_{G(int)}$	/	2.2	/	Ω	f= 1MHz V_{AC}= 25mV

Parameter	Symbol	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
Gate to Source Charge	Q_{gs}	/	18	/	nC	V_{DS}= 400V I_{DS}= 40A V_{GS}= -3 to 15V I_G= 10mA
Gate to Drain Charge	Q_{gd}	/	16.6	/		
Total Gate Charge	Q_g	/	52	/		
Gate to Source Charge	Q_{gs}	/	18	/	nC	V_{DS}= 400V I_{DS}= 40A V_{GS}= -4 to 18V I_G= 10mA
Gate to Drain Charge	Q_{gd}	/	17.6	/		
Total Gate Charge	Q_g	/	61	/		

3. Reverse Diode Characteristics

At T_J= 25℃, unless specified otherwise

Parameter	Symbol	Value		Unit	Test Conditions
		Typ.	Max.		
Diode Forward Voltage	V_{SD}	5.3	/	V	V_{GS}= -3V I_{SD}= 20A T_J= 25℃
		4.8	/	V	V_{GS}= -3V I_{SD}= 20A T_J= 175℃
Continuous Diode Forward Current	I_S	/	38	A	V_{GS}= -3V
Reverse Recover Time	t_{rr}	12	/	ns	V_{GS}= -3/15V I_{SD}= 40A V_R= 400V d_{if}/d_t= 3600A/μs T_J= 25℃
Reverse Recovery Charge	Q_{rr}	80	/	nC	
Peak Reverse Recovery Current	I_{rrm}	10	/	A	
Reverse Recover Time	t_{rr}	11	/	ns	V_{GS}= -4/18V I_{SD}= 40A V_R= 400V d_{if}/d_t= 3900A/μs T_J= 25℃
Reverse Recovery Charge	Q_{rr}	73	/	nC	
Peak Reverse Recovery Current	I_{rrm}	11	/	A	

4. Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal Resistance from Junction to Case	$R_{\theta JC}$	0.70	℃/W

5. Typical Performance

At T_J= 25℃, unless specified otherwise

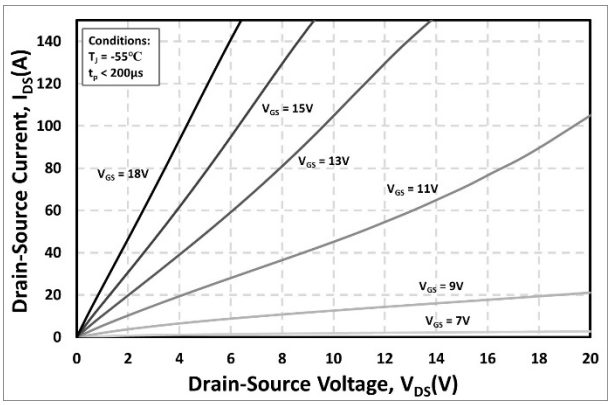


Figure 1. Output Characteristics T_J = -55℃

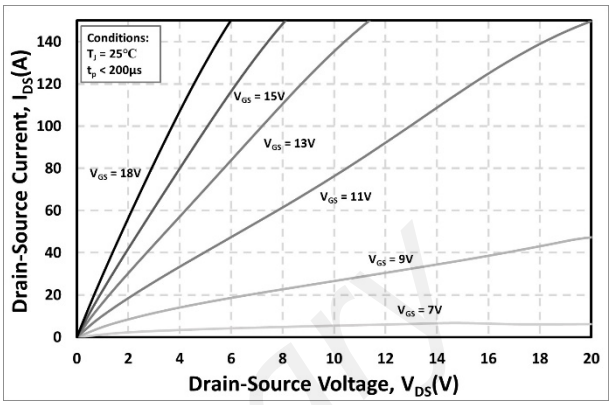


Figure 2. Output Characteristics T_J = 25℃

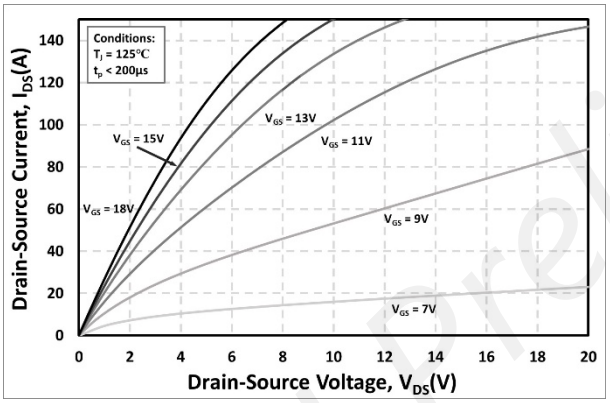


Figure 3. Output Characteristics T_J = 125℃

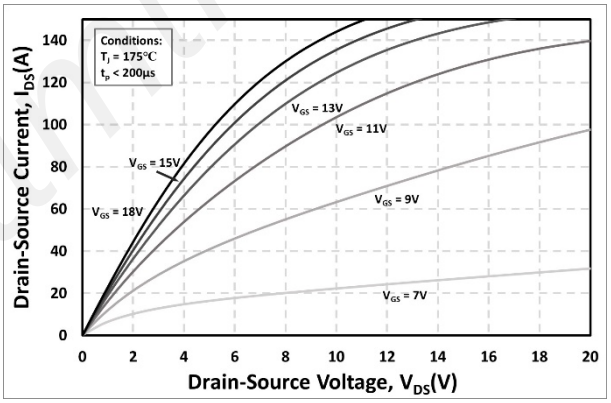


Figure 4. Output Characteristics T_J = 175℃

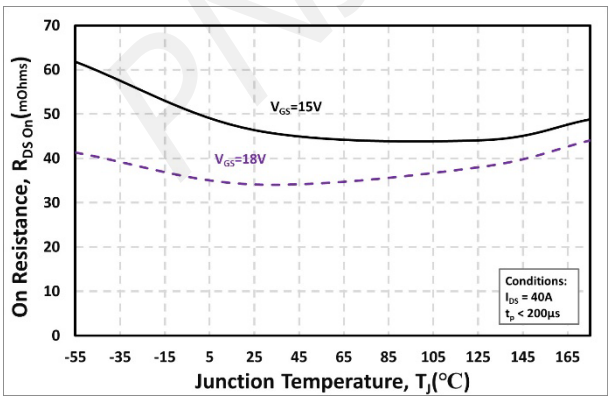


Figure 5. Normalized On-Resistance vs. Temperature

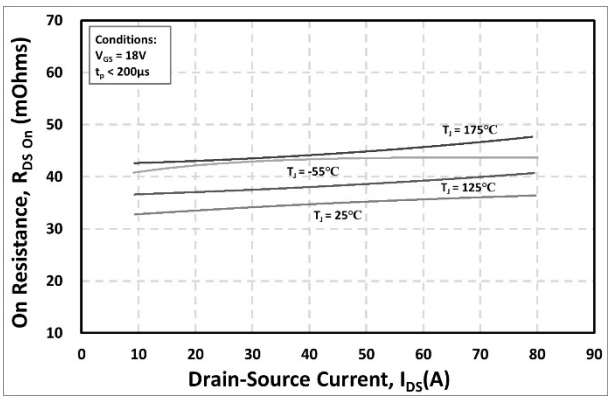


Figure 6. On-Resistance vs. Drain Current Various Temperatures

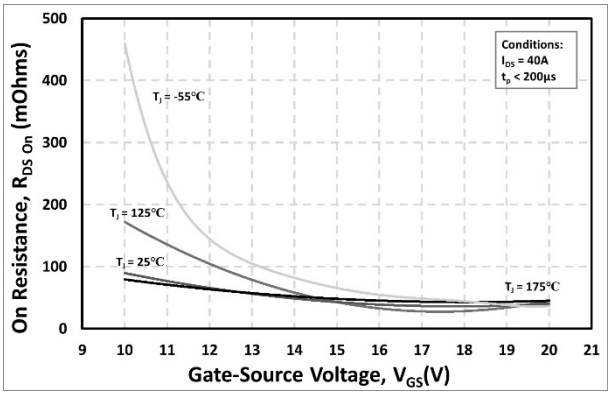


Figure 7. On-Resistance vs. Gate-Source Voltage

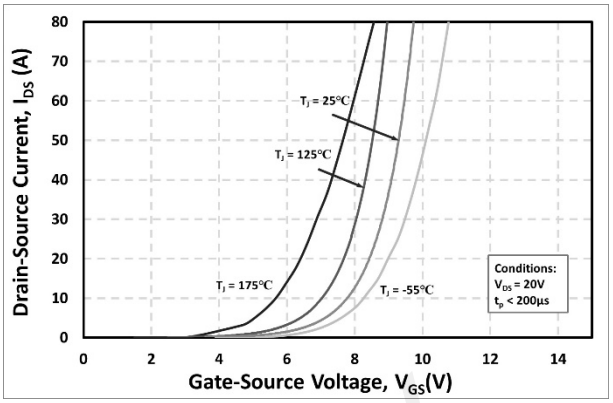


Figure 8. Transfer Characteristic for Various Junction Temperatures

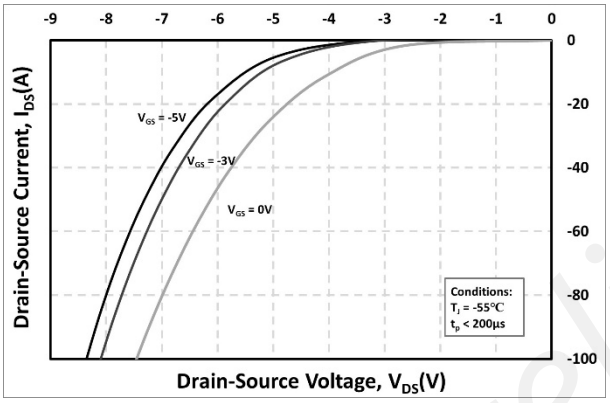


Figure 9. Body Diode Characteristic at -55°C

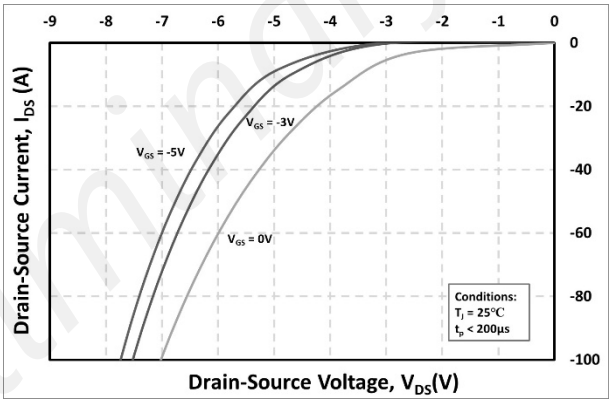


Figure 10. Body Diode Characteristic at 25°C

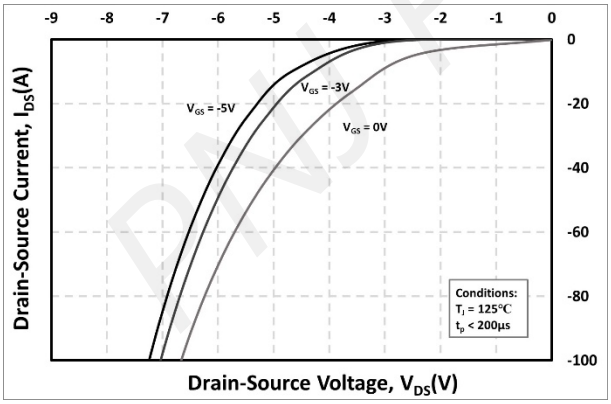


Figure 11. Body Diode Characteristic at 125°C

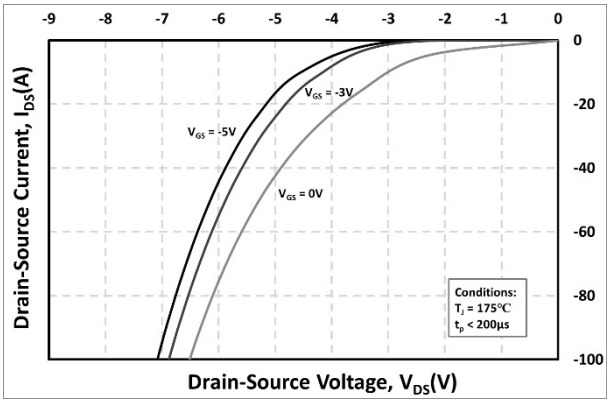


Figure 12. Body Diode Characteristic at 175°C

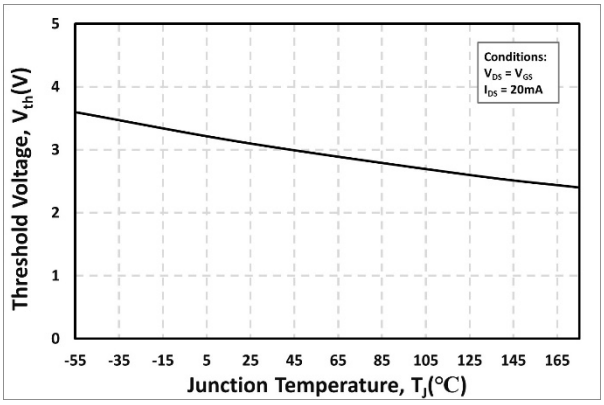


Figure 13. Threshold Voltage vs. Temperature

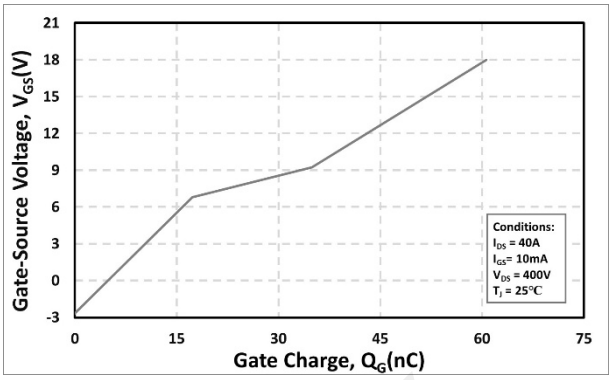


Figure 14. Gate Charge Characteristics

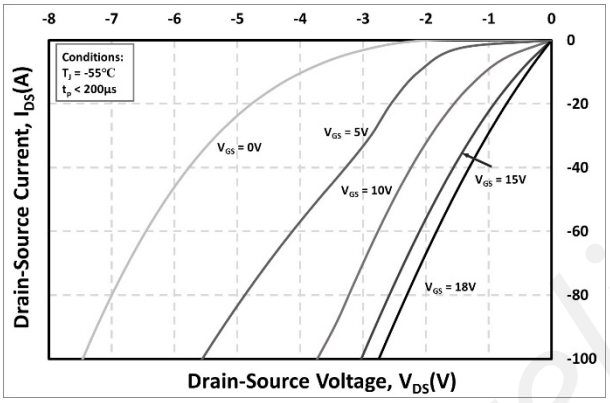


Figure 15. 3rd Quadrant Characteristic at -55°C

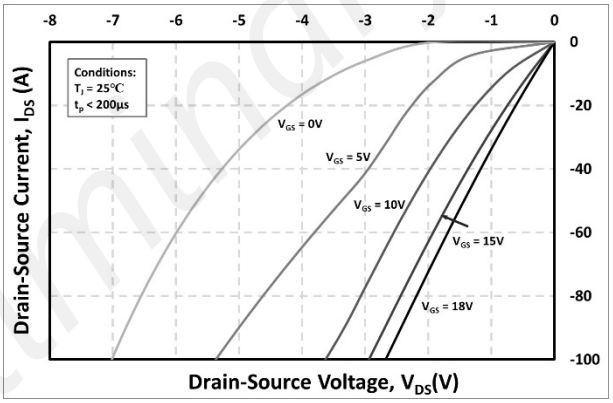


Figure 16. 3rd Quadrant Characteristic at 25°C

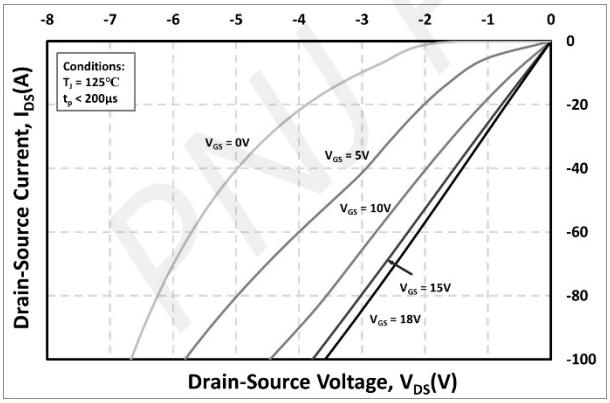


Figure 17. 3rd Quadrant Characteristic at 125°C

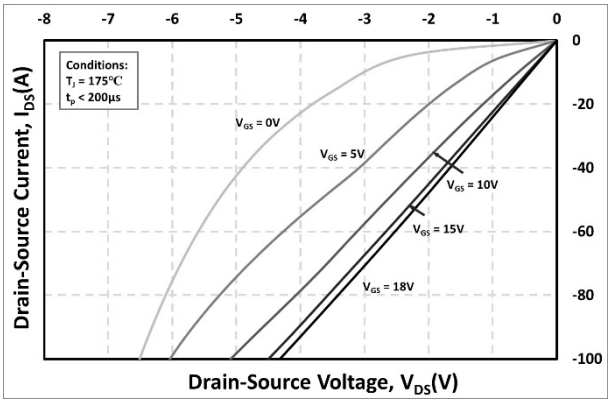


Figure 18. 3rd Quadrant Characteristic at 175°C

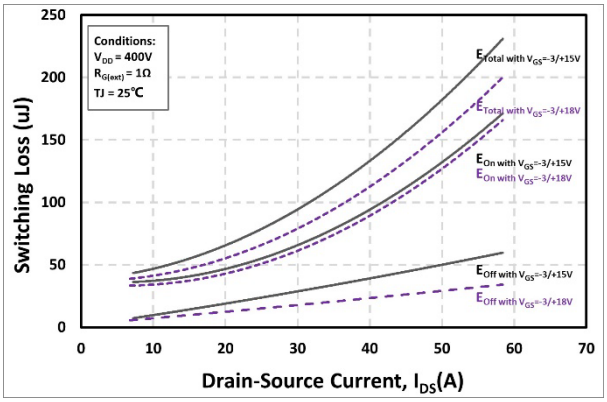


Figure 19. Clamped Inductive Switching Energy vs. Drain Current (V_{DD}= 400V)

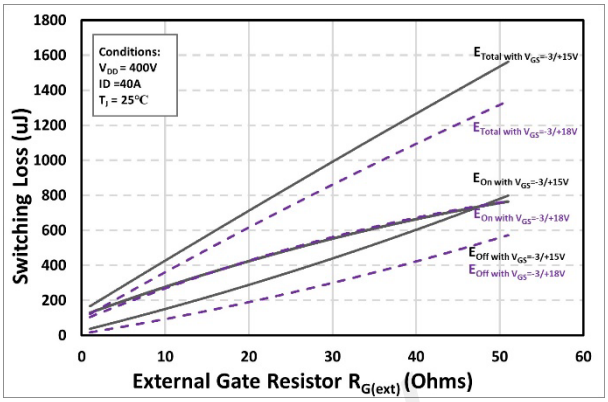


Figure 20. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

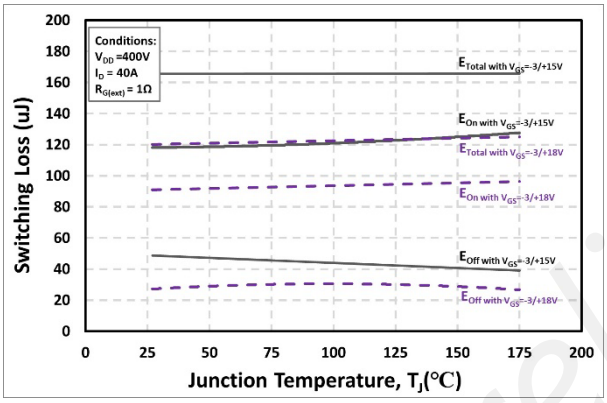


Figure 21. Clamped Inductive Switching Energy vs. Temperature

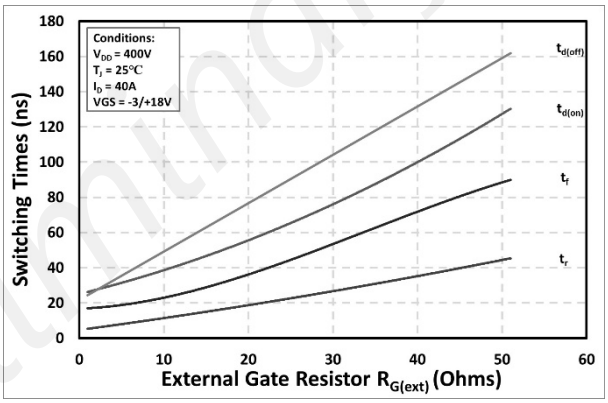


Figure 22. Switching Times vs. $R_{G(ext)}$

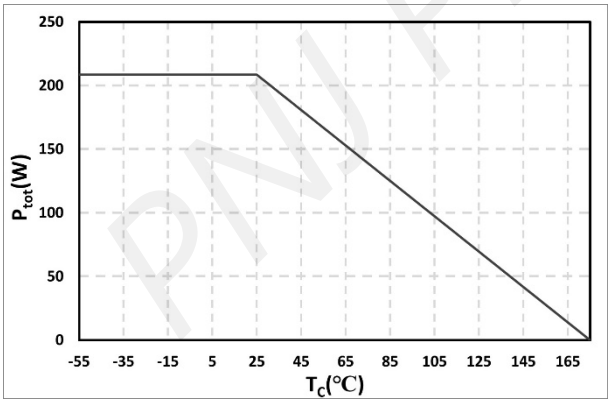


Figure 23. Maximum Power Dissipation Derating vs. Case Temperature

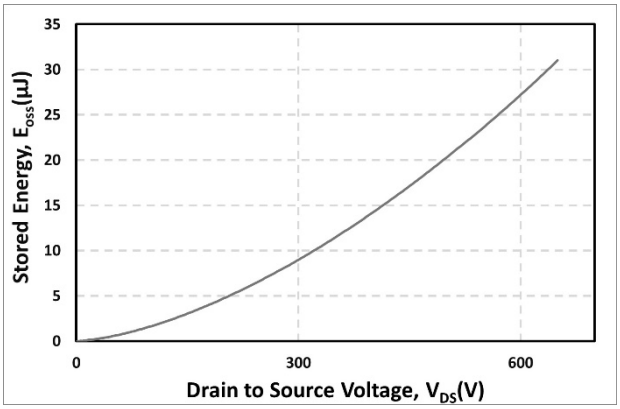


Figure 24. Output Capacitor Stored Energy

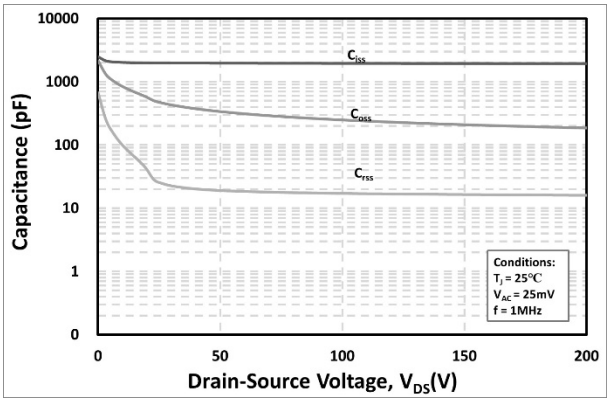


Figure 25. Capacitances vs. Drain-Source Voltage (0 - 200V)

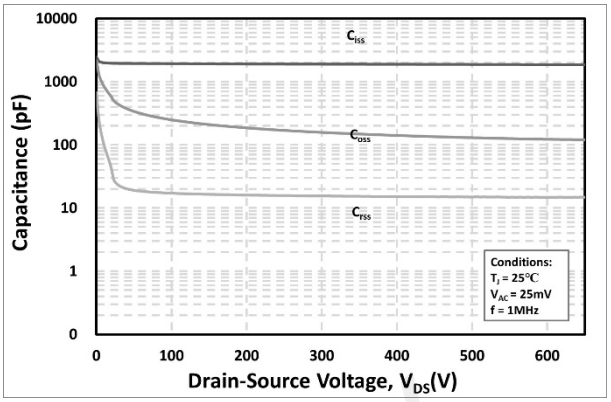


Figure 26. Capacitances vs. Drain-Source Voltage (0 - 650V)

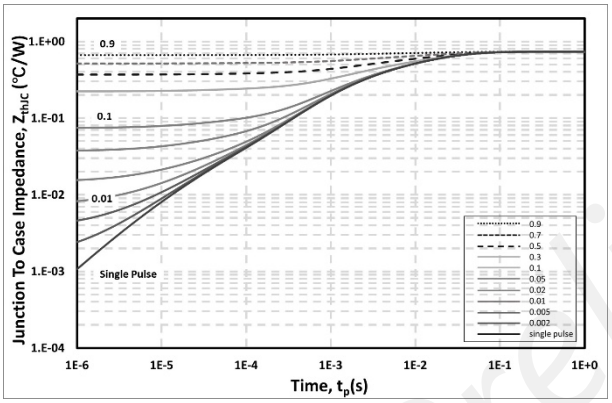


Figure 27. Transient Thermal Impedance (Junction - Case)

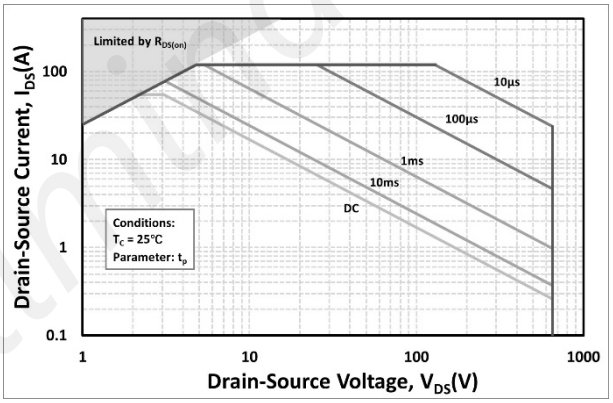


Figure 28. Safe Operating Area

6. Definitions

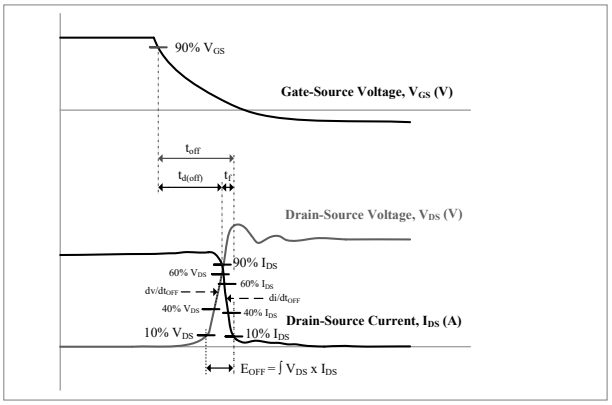


Figure 29. Turn-off Transient Definitions

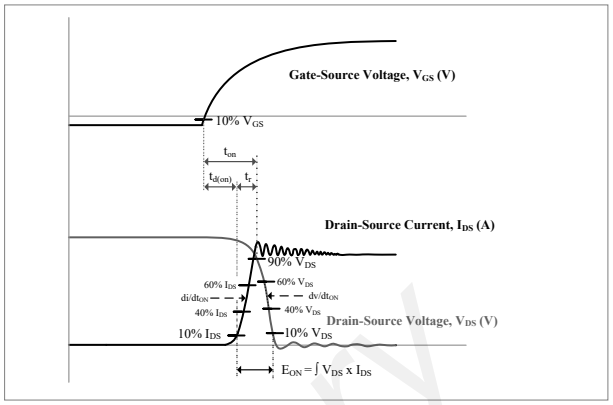


Figure 30. Turn-on Transient Definitions

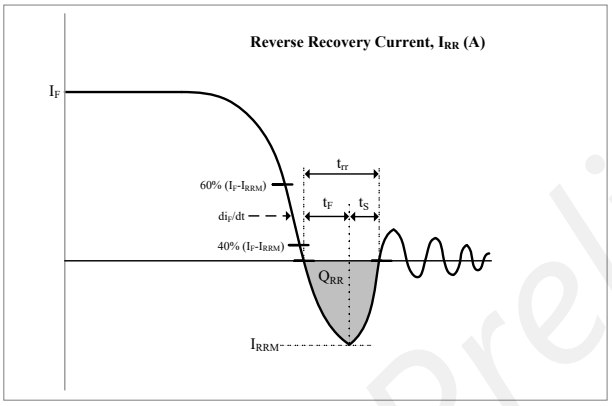


Figure 31. Reverse Recovery Definitions

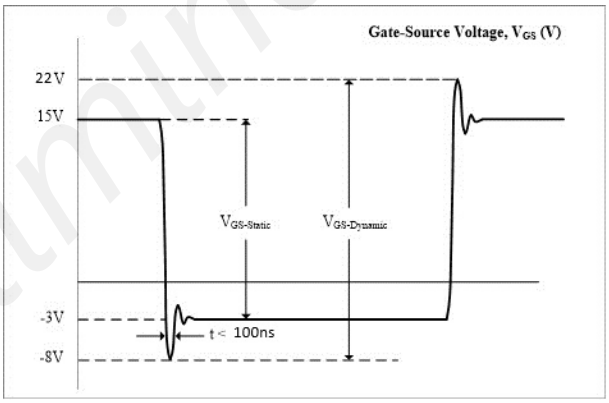
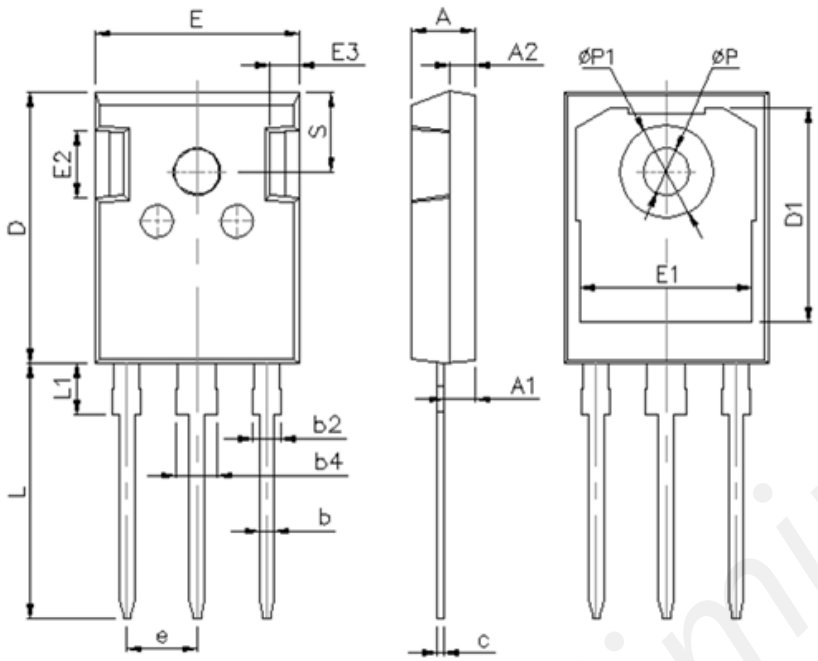


Figure 32. Vgs Transient Definitions

7. Package Outlines



SYMBOL	DIMENSIONS		
	MIN	NOM	MAX
A	4.80		5.20
A1	2.20	2.40	2.60
A2	1.85		2.15
b	1.07		1.33
b2	1.90		2.16
b4	2.90		3.20
c	0.52		0.68
D	20.70		21.30
D1	16.15		16.95
E	15.50		16.10
E1	13.00		13.60
E2	5.00		5.50
E3	1.90		2.60
e		5.44	
L	19.30		19.90
L1	3.75	3.95	4.15
ΦP	3.40		3.80
ΦP1	7.00		7.40
S	6.04	6.15	6.30

Drawing and Dimensions

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