DAC020N120QD3

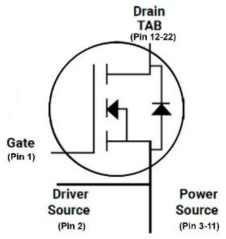
Silicon Carbide Enhancement Mode MOSFET

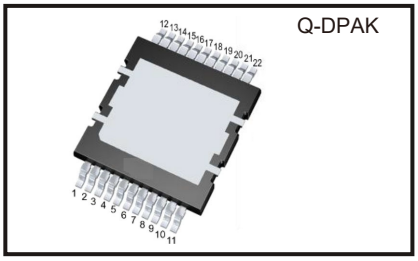
Preliminary

V_{DSS}	1200V
$I_{D(@25℃)}$	105A
$R_{DS(ON)\ typ.}$	20mΩ

Features

- High blocking voltage with low Rds(on)
- High frequency operation with low Capacitance
- Simple to drive with 0V/+18V gate
- Robust body diode with low Qrr
- 100% Avalanche Tested





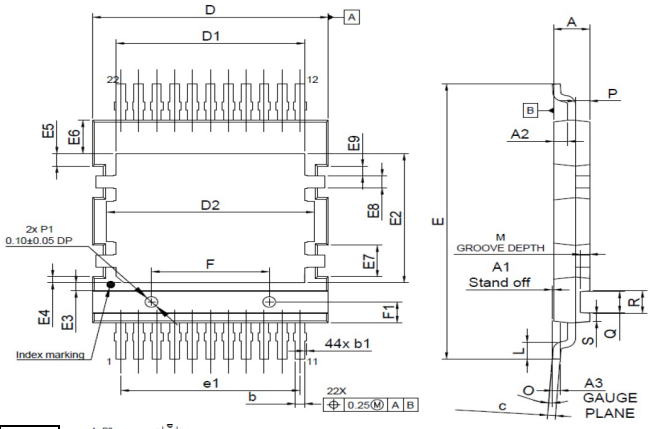
Benefits

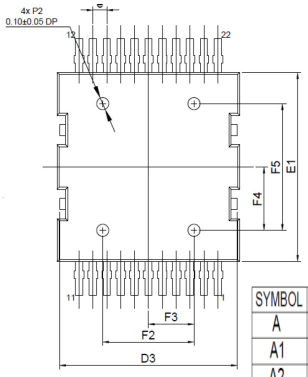
- Superior robustness and system reliability
- Higher system efficiency
- Easier paralleling without thermal runaway
- Capable of high temperature application
- Faster and more efficient switching

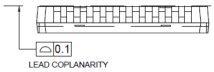
Applications

- EV/HEV charging station
- Energy storage and Battery charging
- High voltage DC-DC converters
- Solar / Wind Inverters
- UPS and PFC

Package Dimensions







Absolute Maximum Ratings

(Tc = 25℃ unless otherwise specified)

Parameter		Symbol	Ratings	Unit
Drain-Source Voltage	V_{GS}=0V I_D=100μA	V_{DS}	1200	V
Gate-Source Voltage (dynamic)	AC (f>1 Hz, duty cycle<1%, pulse width<200ns)	V_{GS}	-9/+23	V
Gate-Source Voltage (static)		$V_{GS(op)}$	-4...0/+18	V
Drain Current-Continuous	V_{GS}=18V@ T_C=25°C V_{GS}=18V@ T_C=100°C	I_D	105 75	A
Pulse Drain Current		$I_{D,pulse}$	315	A
Power Dissipation		P_D	416	W
Storage Temperature Range		T_{STG}	-55 to +175	°C
Operating Junction Temperature Range		T_J	-55 to +175	°C
Soldering Temperature		T_L	260	°C
Avalanche Capability, single pulse *	V_{DD}=100V V_{GS}=10V L=2mH	I_{AV}	40	A
Avalanche Capability, single pulse**	V_{DD}=100V V_{GS}=10V L=2mH	E_{AV}	1600	mJ

* 100% tested in 60% rating
** 100% tested in 36% rating

SYMBOL	MIN	MAX	SYMBOL	MIN	MAX
A	2.25	2.35	E9	0.75	
A1	0.00	0.15	e	1.14	
A2	0.90		e1	11.4	
A3	0.50		F	7.40	7.60
b	0.50	0.70	F1	1.47	1.67
b1	-	0.15	F2	7.40	7.60
c	0.46	0.58	F3	3.65	3.85
D	14.90	15.10	F4	5.07	5.27
D1	12.00		F5	10.24	10.44
D2	13.20		L	1.30	
D3	14.50	14.70	M	0.60	
E	20.81	21.11	N	22	
E1	15.30	15.50	O	0°	8°
E2	9.83		P	0.90	
E3	0.625		P1	0.70	0.90
E4	0.45		P2	0.90	1.10
E5	0.95		Q	1.60	
E6	2.53		R	1.70	
E7	2.40		S	0.631	
E8	0.90				

Electrical Characteristics @ T_C =25°C (unless otherwise specified)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
OFF Characteristics							
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS} =0V，I_D =0.1mA		1200	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} =1200V V_{GS} =0V	T_J =25℃	-	0.5	60	μA
			T_J =175℃	-	5	200	
Gate-Source Leakage Current	I_{GSS}	V_{GS} =18V，V_{DS} =0V		-	5	100	nA
		V_{GS} =-4V，V_{DS} =0V		-100	-5	-	
ON Characteristics							
Gate Threshold Voltage ***	$V_{GS(th)}$	V_{DS} = V_{GS}，I_D =25mA	T_J =25℃	3.2	3.8	4.8	V
			T_J =175℃	-	2.8	-	
Drain-Source On-State Resistance	$R_{DS(on)}$	V_{GS} =18V，I_D =40A	T_J =25℃	-	20	27	mΩ
			T_J =175℃	-	35	-	
Transconductance	g_{fs}	V_{DS} =20V，I_D =40A	T_J =25℃	-	34	-	S
			T_J =175℃	-	31	-	
Internal Gate Resistance	$R_{G(int.)}$	f =1MHz，I_D =0A		-	1	-	Ω
Dynamic Characteristics							
Input Capacitance	C_{iss}	V_{DS} =1000V V_{GS} =0V f =100kHz V_{AC} =25mV		-	3600	-	pF
Output Capacitance	C_{oss}			-	126	-	
Reverse Transfer Capacitance	C_{rss}			-	11	-	
Coss Stored Energy	E_{oss}			-	72	-	μJ
Turn-On Switching Energy	E_{on}	V_{DS} =800V，V_{GS} =0/+18V I_D =40A，$R_{G(ext)}$ =2.0Ω L=200μH		-	290	-	μJ
Turn-Off Switching Energy	E_{off}			-	85	-	
Switching Characteristics							
Turn-On Delay Time	$t_{d(on)}$	V_{DS} =800V，V_{GS} =0/+18V I_D =40A，$R_{G(ext)}$ =2.0Ω L=200μH		-	18	-	ns
Rise Time	t_r			-	9	-	
Turn-Off Delay Time	$t_{d(off)}$			-	38	-	
Fall Time	t_f			-	7	-	
Total Gate Charge	Q_g	V_{DS} =800V V_{GS} =0/+18V I_D =40A		-	140	-	nC
Gate to Source Charge	Q_{gs}			-	30	-	
Gate to Drain Charge	Q_{gd}			-	38	-	
Body Diode Characteristics							
Inverse Diode Forward Voltage	V_{SD}	V_{GS}=0V，I_{SD}=30A	T_J =25℃	-	3.5	-	V
Inverse Diode Forward Voltage			T_J =175℃	-	3.2	-	V
Continuous Diode Forward Current	I_S	V_{GS}=-4V，T_J =25°C		-	81	-	A
Reverse Recovery Time	T_{rr}	I_{SD}=40A，V_{GS}=0V V_R=800V，$R_{G(ext)}$ =10Ω dif/dt=1953A/μs L=200μH		-	25	-	ns
Reverse Recovery Charge	Q_{rr}			-	460	-	nC
Peak Reverse Recovery Current	I_{rrm}			-	36	-	A
Thermal Resistance							
Thermal Resistance, Junction-to-Case	$R\theta_{JC}$			-	0.36	0.42	°C/W

*** Turn-off with -4V gate bias is highly recommended

Typical Performance

Fig 1. Output Characteristics, T_J = -40°C

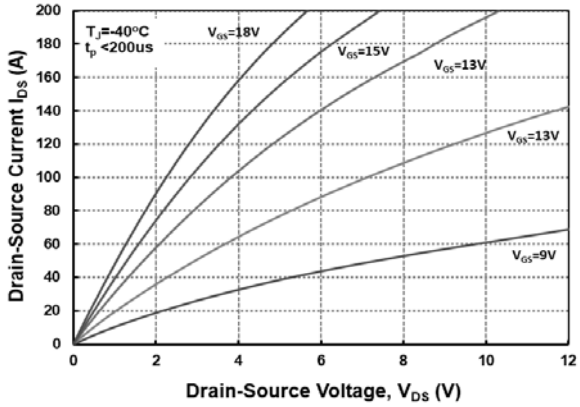


Fig 2. Output Characteristics, T_J = 25°C

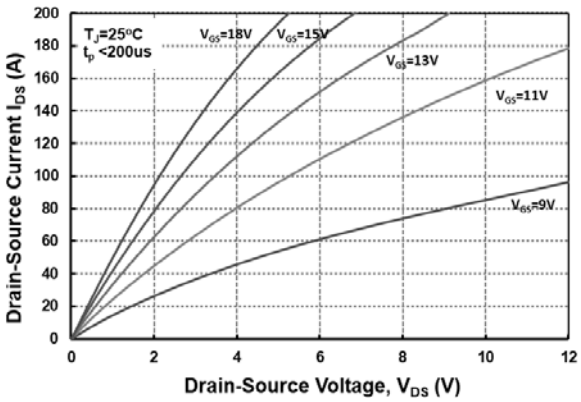


Fig 3. Output Characteristics, T_J = 175°C

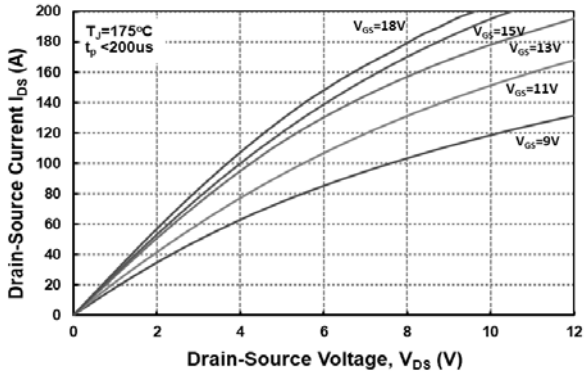


Fig 4. Normalized On-Resistance vs. Temperature

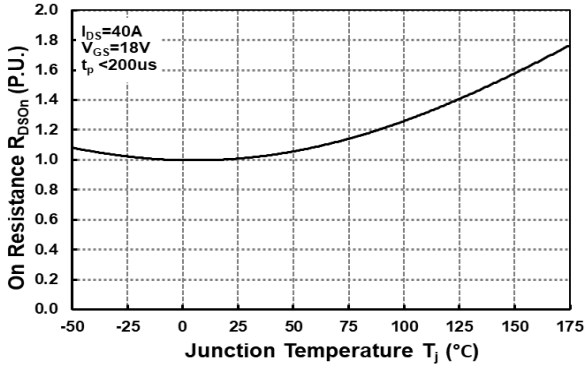


Fig 5. On-Resistance vs. Drain Current for Various Temperatures

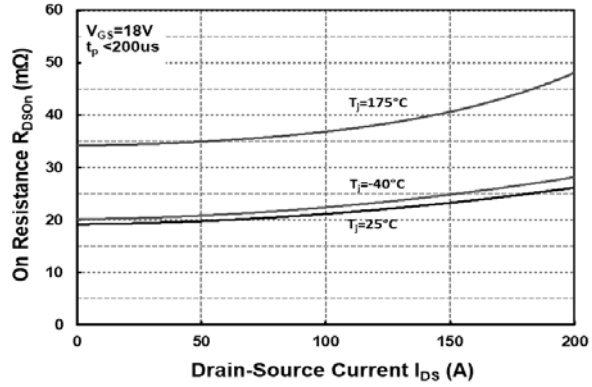
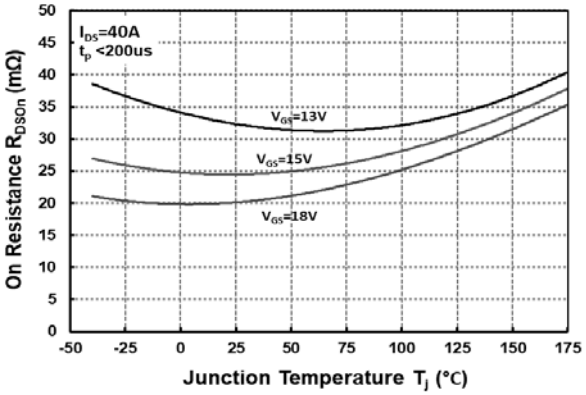


Fig 6. On-Resistance vs. Temperature for Various Gate Voltage



Typical Performance

Fig 7. Transfer Characteristic for Various Junction Temperatures

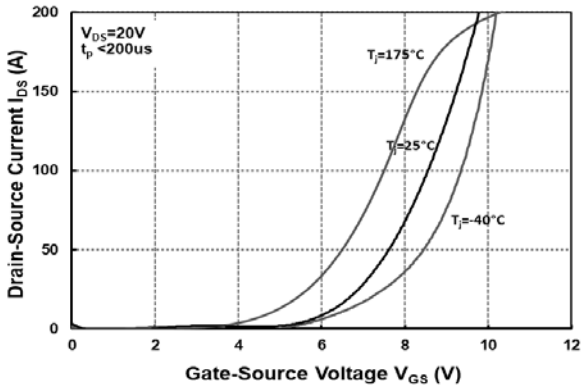


Fig 8.Body Diode Characteristics @ -40°C

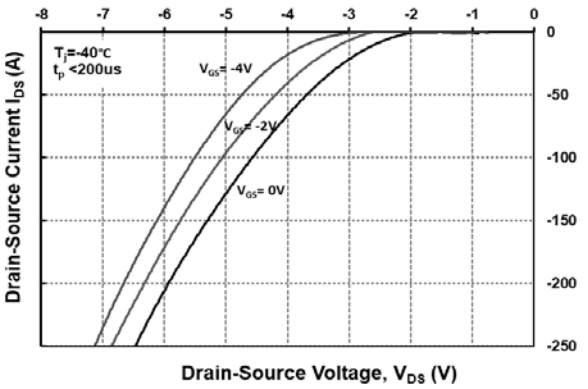


Fig 9. Body Diode Characteristics @ 25°C

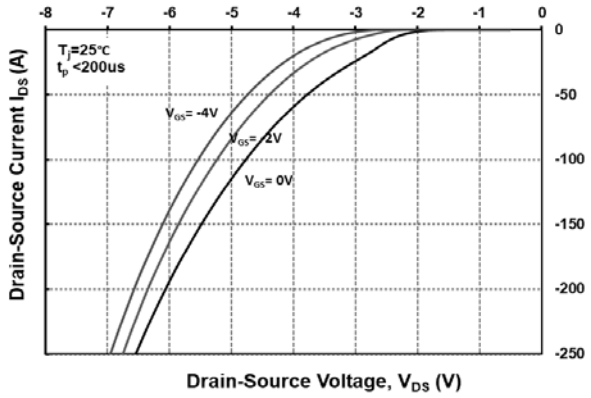


Fig 10. Body Diode Characteristics @ 175°C

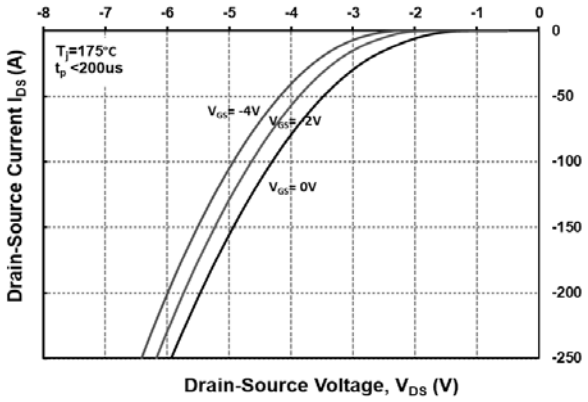


Fig 11. Threshold Voltage vs. Temperature

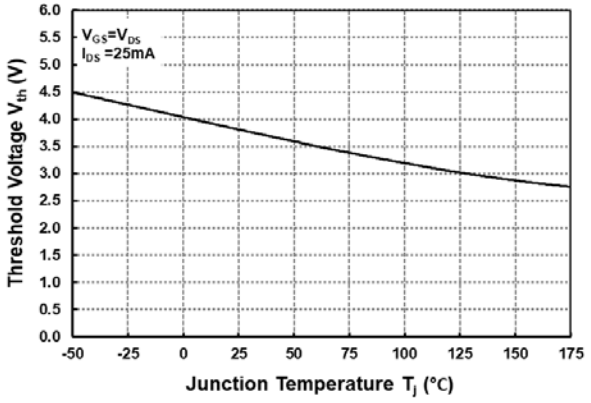
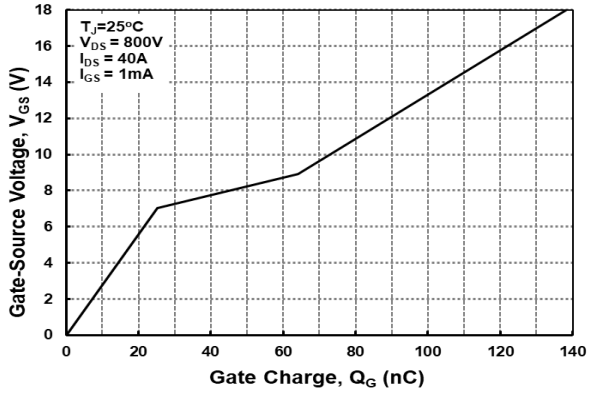


Fig 12. Gate Charge Characteristics



Typical Performance

Fig 13. 3rd Quadrant Characteristics @ -40°C

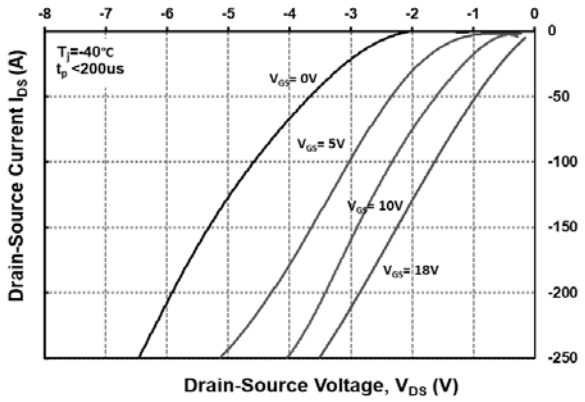


Fig 14. 3rd Quadrant Characteristics @ 25°C

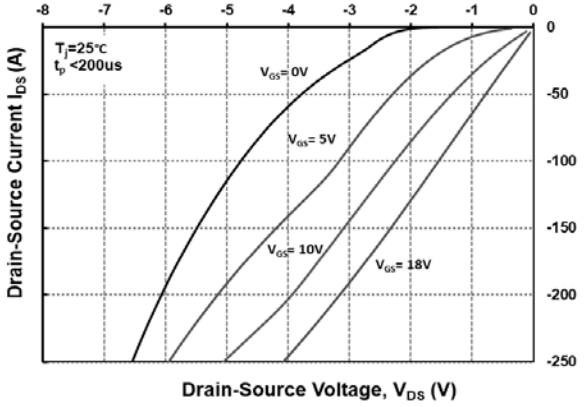


Fig 15. 3rd Quadrant Characteristics @ 175°C

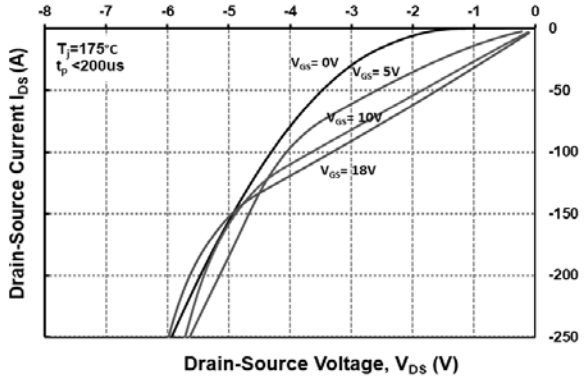


Fig 16. Output Capacitor Stored Energy

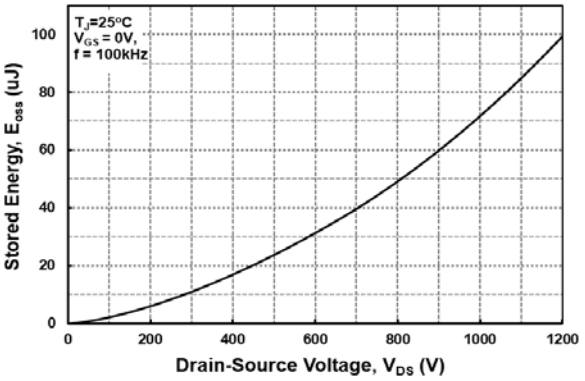


Fig 17. Capacitances vs. Drain-Source Voltage (0-200V)

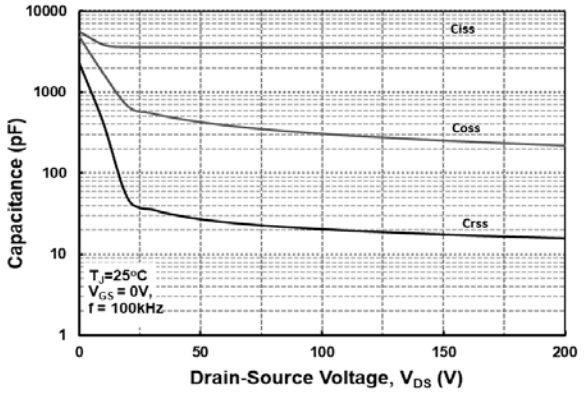
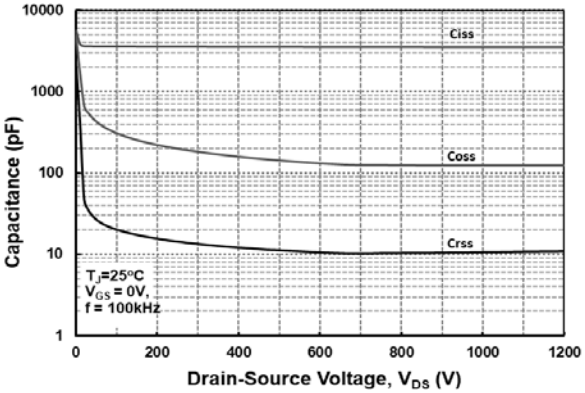


Fig 18. Capacitances vs. Drain-Source Voltage (0-1200V)



Typical Performance

Fig 19. Continuous Drain Current Derating vs. Case Temperature

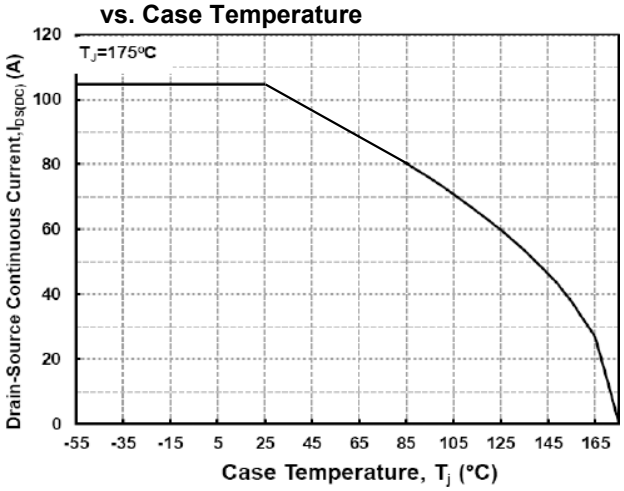


Fig 20. Maximum Power Dissipation Derating vs. Case Temperature

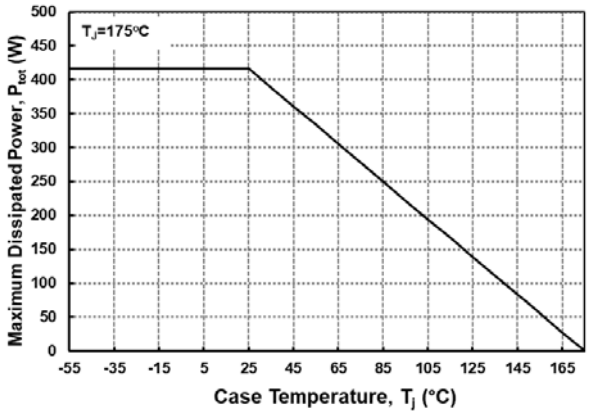


Fig 21. Transient Thermal Impedance (Junction – Case)

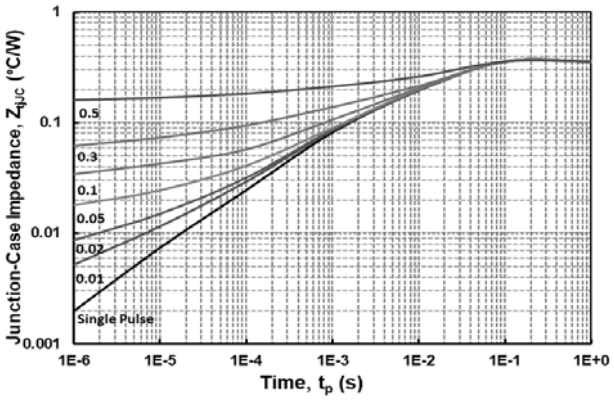


Fig 22. Safe Operating Area

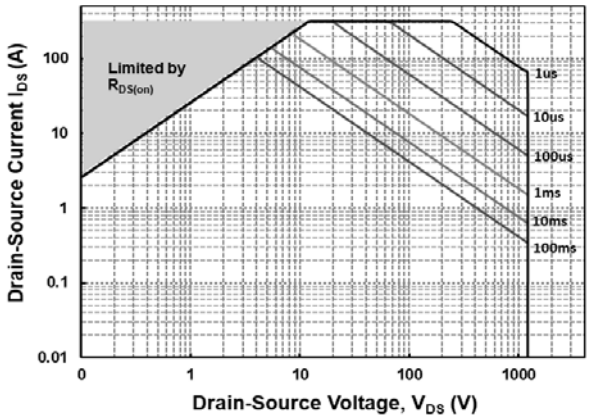


Fig 23. Clamped Inductive Switching Energy vs Drain Current (V_{DD} = 800V)

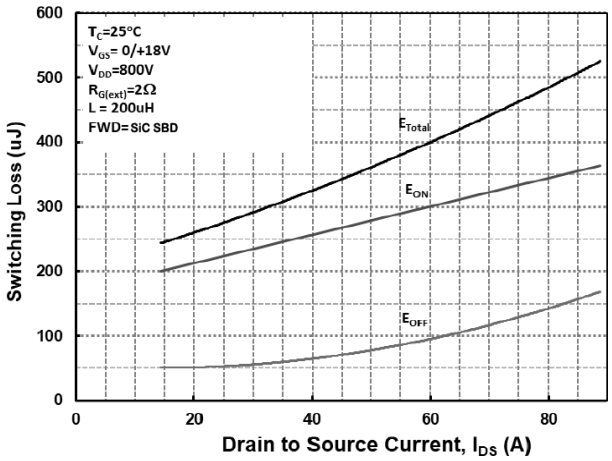
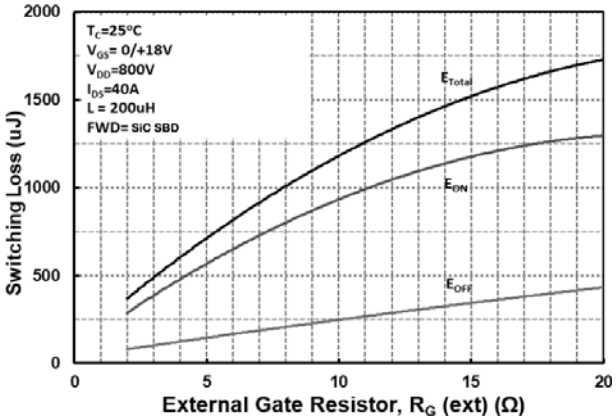


Fig 24. Clamped Inductive Switching Energy vs External Gate Resistor $R_{G(ext)}$



Typical Performance

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

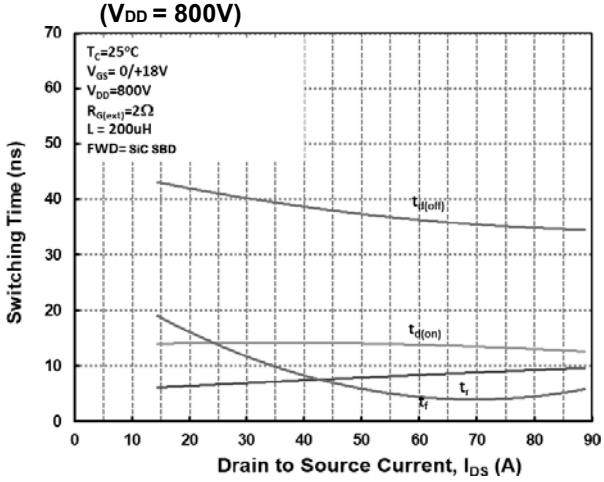
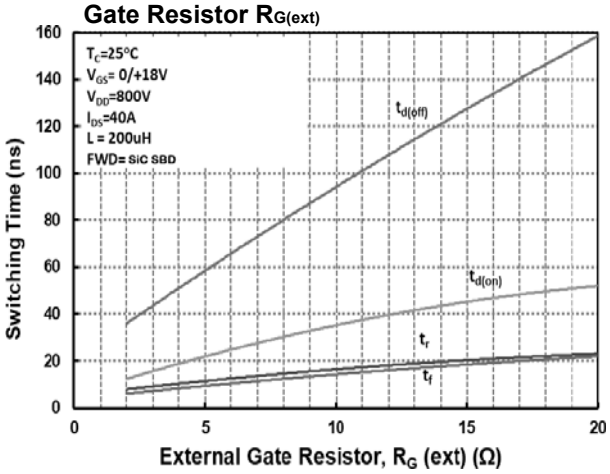


Fig 26. Switching Times vs External Gate Resistor $R_{G(ext)}$



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