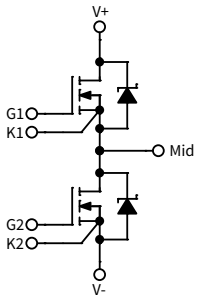
YX300B170F46

1700 V, 8.0 mΩ, Silicon Carbide, Half-Bridge Module

V_{DS}	**1700 V**
I_{DS}	**300 A**



Technical Features

- Industry Standard 62mm Footprint
- Ultra Low Loss, High-Frequency Operation
- Zero Reverse Recovery from Diodes
- Zero Turn-off Tail Current from MOSFET
- Normally-off, Fail-safe Device Operation
- Copper Baseplate and Aluminum Nitride Insulator

Applications

- HF Resonant Converters/Inverters
- Solar and Wind Inverters
- UPS and SMPS
- Motor Drive
- Traction

System Benefits

- Enables Compact and Lightweight Systems
- High Efficiency Operation
- Mitigates Over-voltage Protection
- Reduced Thermal Requirements
- Reduced System Cost

Maximum Parameters (Verified by Design)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions	Note
Drain-Source Voltage	V_{DS}			1700	V		
Gate-Source Voltage, Maximum Values	$V_{GS\,max}$	-10		+25			
Gate-Source Voltage, Recommended Values	$V_{GS\,op}$	-5		+20			
DC Continuous Drain Current	I_D		325		A	V_{GS} = 20 V, T_C = 25 °C	Fig. 26
			225			V_{GS} = 20 V, T_C = 90 °C	
DC Source-Drain Current (Body Diode)	$I_{SD\,BD}$		556			V_{GS} = -5 V, T_C = 25 °C	
			353			V_{GS} = -5 V, T_C = 90 °C	
Maximum Pulsed Drain-Source Current	$I_{D\,(pulsed)}$			900		Pulse width limited by $T_{VJ(max)}$	
Maximum Virtual Junction Temperature under Switching Conditions	$T_{VJ\,op}$	-40		150	°C		

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MOSFET Characteristics (Per Position) (T_{VJ} = 25 °C unless otherwise specified)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions	Note
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	1700			V	V_{GS} = 0 V, I_{DS} = 2 mA	Fig. 29
Gate Threshold Voltage	$V_{GS(th)}$	1.8	2.5			V_{DS} = V_{GS}, I_{DS} = 104 mA	Fig. 7
Zero Gate Voltage Drain Current	I_{DSS}		0.7	2	mA	V_{GS} = 0 V, V_{DS} = 1700 V	
			1.5	4		V_{GS} = 0 V, V_{DS} = 1700 V, T_{VJ} = 150°C	
Gate-Source Leakage Current	I_{GSS}		1	600	nA	V_{GS} = 25 V, V_{DS} = 0 V	
Drain-Source On-State Resistance (MOSFET Only)	$R_{DS(on)}$		8.0	10.0	mΩ	V_{GS} = 20 V, I_D = 300 A	Fig. 4 Fig. 5 Fig. 6
			16.2	20.0		V_{GS} = 20 V, I_D = 300 A, T_{VJ} = 150 °C	
Transconductance	g_{fs}		133		S	V_{DS} = 20 V, I_D = 300 A	Fig. 8
			131			V_{DS} = 20 V, I_D = 300 A, T_{VJ} = 150 °C	
Turn-On Switching Energy	E_{On}		13.0		mJ	V_{DD} = 900 V, I_D = 300 A, V_{GS} = -5 V/+20 V, $R_{G(ON)}$ = 2.5 Ω, $R_{G(OFF)}$ = 2.5 Ω, L = 77 µH, T_{VJ} = 150 °C, Note: IEC 60747-8-4 Definitions	Fig. 22
Turn-Off Switching Energy	E_{Off}		10.0				
Internal Gate Resistance	$R_{G(int)}$		3.7		Ω	f = 1 MHz, V_{AC} = 25 mV	
Input Capacitance	C_{iss}		20		nF	V_{DS} = 1000 V, V_{AC} = 25 mV, f = 200 kHz	Fig. 16 Fig. 17
Output Capacitance	C_{oss}		2.5				
Reverse Transfer Capacitance	C_{rss}		80		pF		
Gate to Source Charge	Q_{GS}		273		nC	V_{DS} = 900 V, V_{GS} = -5 V/+20 V, I_D = 300 A, Per JEDED24 pg 27	Fig. 15
Gate to Drain Charge	Q_{GD}		324				
Total Gate Charge	Q_G		1076				
Turn-on Delay Time	$t_{d(on)}$		105		ns	V_{DD} = 900V, V_{GS} = -5/+20V, I_D = 300 A, $R_{G(ext)}$ = 2.5 Ω, Timing relative to V_{DS}, Note: IEC 60747-8-4, pg 83, Inductive load	Fig. 23
Rise Time	t_r		72				
Turn-off Delay Time	$t_{d(off)}$		211				
Fall Time	t_f		56				
MOSFET Thermal Resistance, Junction to Case	R_{th-JCM}		0.067	0.071	°C/W		Fig. 27

Diode Characteristics (Per Position) (T_{VJ} = 25 °C unless otherwise specified)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions	Notes
Body Diode Forward Voltage	V_{SD}		1.7	2.0	V	V_{GS} = 0 V, I_{SD} = 300 A	Fig. 10 Fig. 11
			2.2	2.5		V_{GS} = 0 V, I_{SD} = 300 A, T_{VJ} = 150 °C	
Total Capacitive Charge	Q_C		4.4		µC	I_{SD} = 300 A, V_{DS} = 900 V, T_{VJ} = 25°C, di_{SD}/dt = 9 kA/µs, V_{GS} = -5 V	
DIODE Thermal Resistance, Junction to Case	R_{th-JCD}		0.060	0.065	°C/W		Fig. 28

Module Physical Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions
Stray Inductance	L_{Stray}		15		nH	Between terminals 2 & 3
Case Temperature	T_C	-40		125	°C	
Mounting Torque	M_S		5.0		N-m	To heatsink and terminals
Weight	W		300		g	
Case Isolation Voltage	V_{Isol}	5.0			kV	AC, 50 Hz, 1 minute
Clearance Distance		9			mm	Terminal to terminal
Creepage Distance		30				Terminal to terminal
		40				Terminal to baseplate

Typical Performance

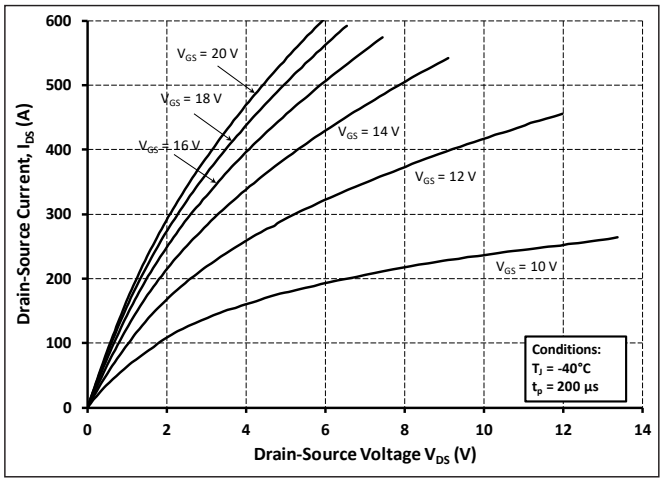


Figure 1. Output Characteristics for T_{VJ} = 40 °C

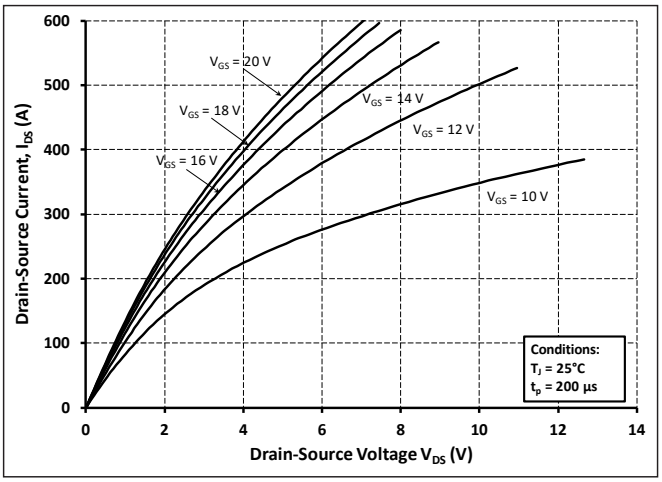


Figure 2. Output Characteristics for T_{VJ} = 25 °C

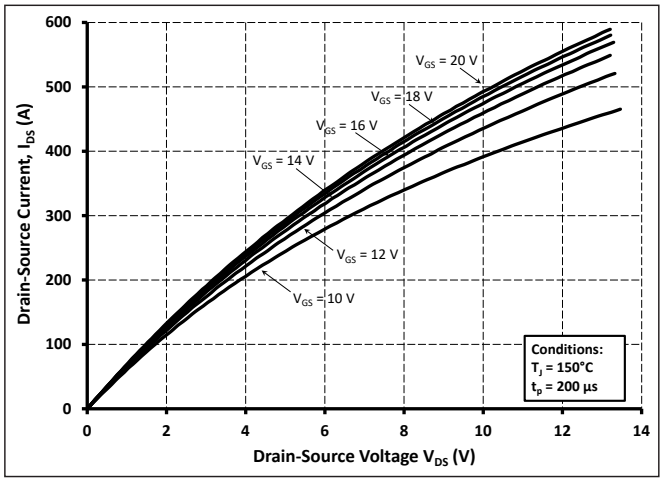


Figure 3. Output Characteristics for T_{VJ} = 150 °C

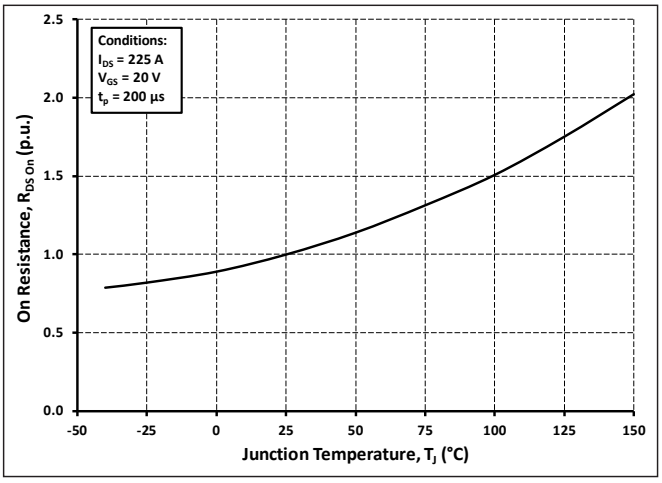


Figure 4. Normalized On-Resistance vs. Temperature

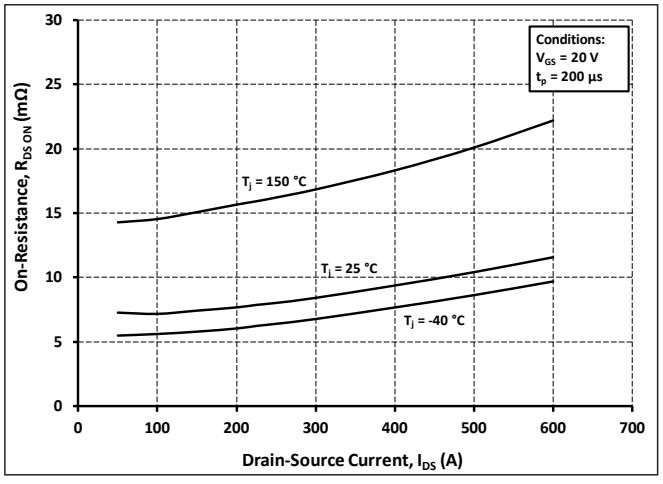


Figure 5. On-Resistance vs. Drain Current For Various Temperatures

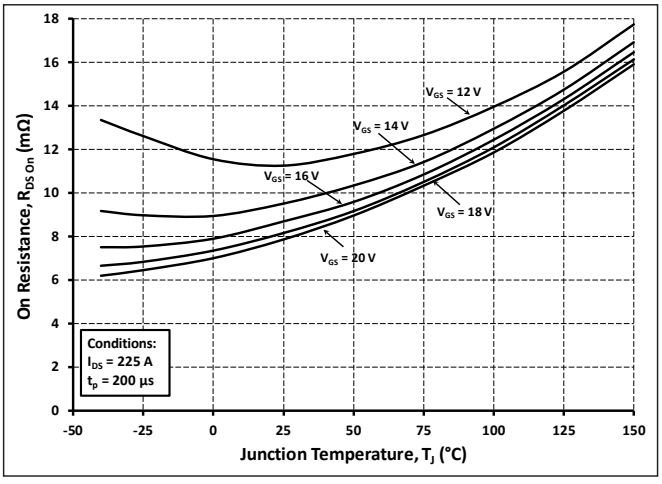


Figure 6. On-Resistance vs. Temperature for Various Gate-Source Voltage

Typical Performance

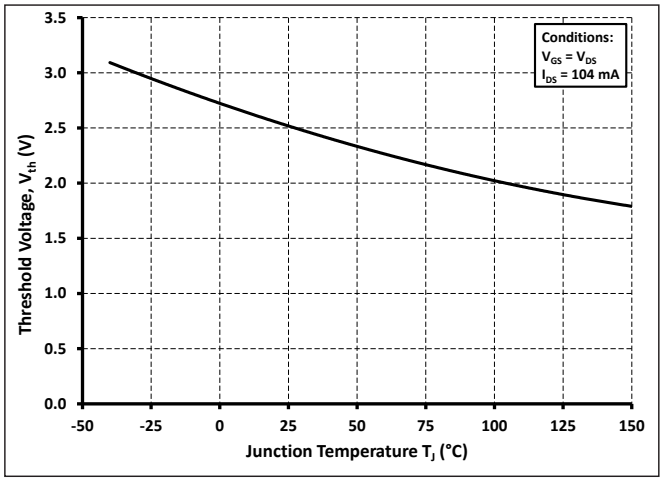


Figure 7. Threshold Voltage vs. Temperature

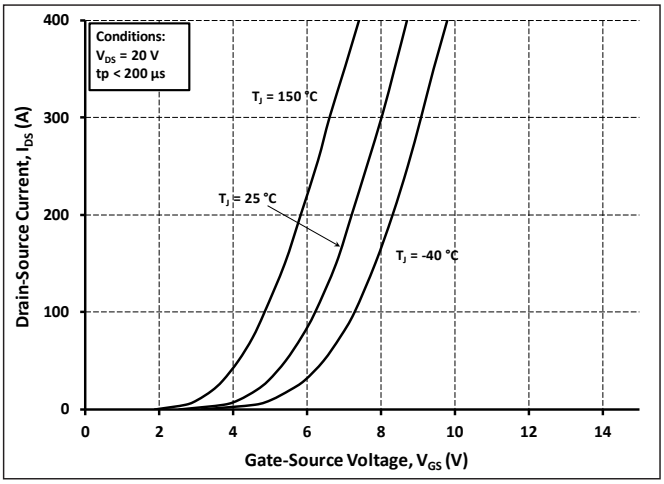


Figure 8. Transfer Characteristic for Various Junction Temperatures

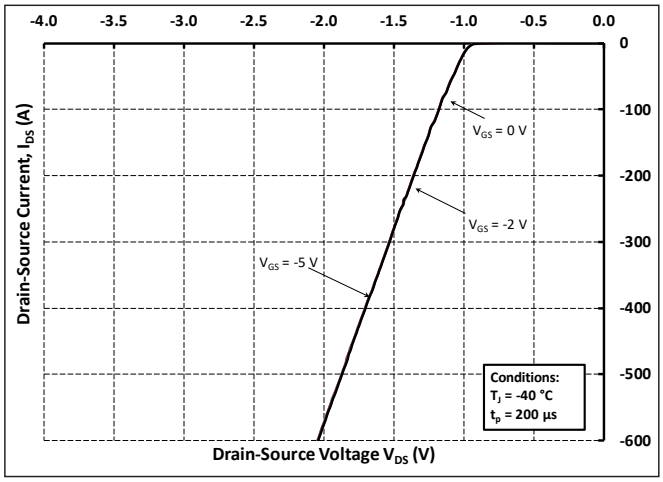


Figure 9. Diode Characteristic at T_{VJ} = -40 °C

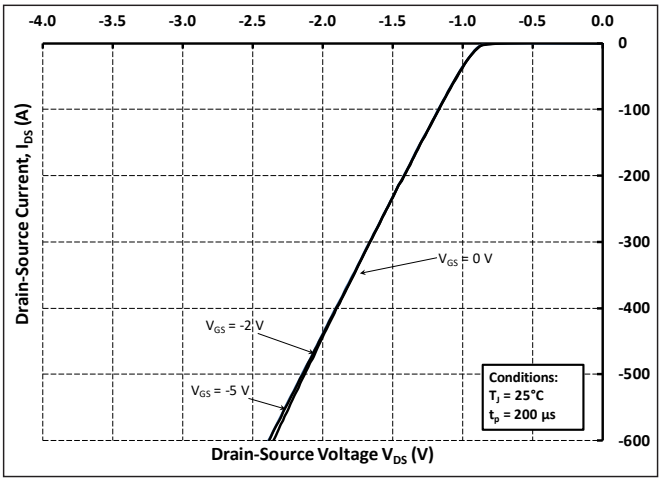


Figure 10. Diode Characteristic at T_{VJ} = 25 °C

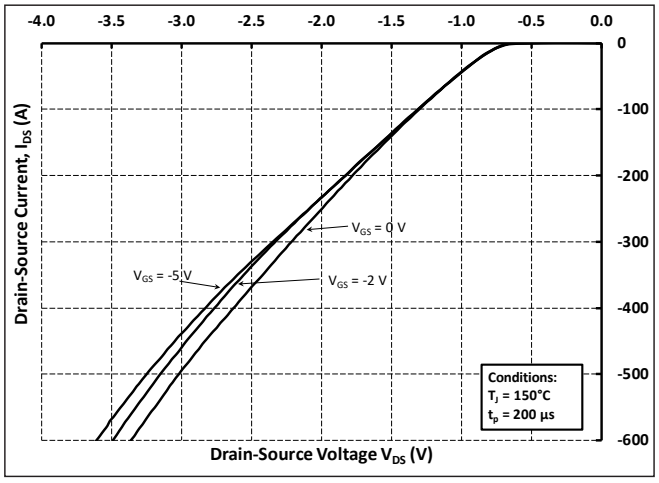


Figure 11. Diode Characteristic at T_{VJ} = 150 °C

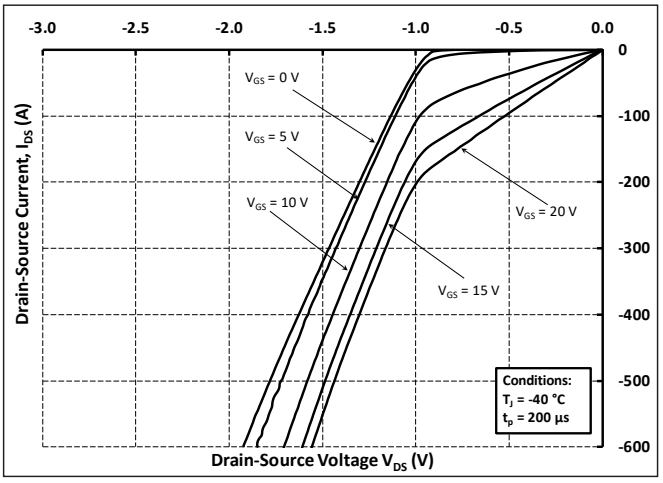


Figure 12. 3rd Quadrant Characteristic at T_{VJ} = -40 °C

Typical Performance

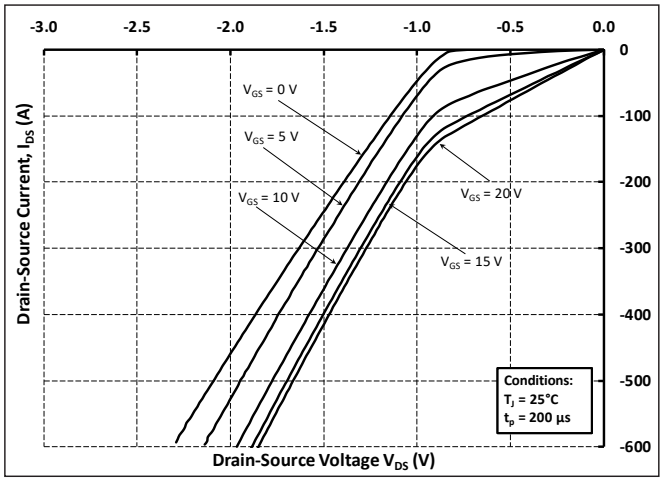


Figure 13. 3rd Quadrant Characteristic at T_{VJ} = 25 °C

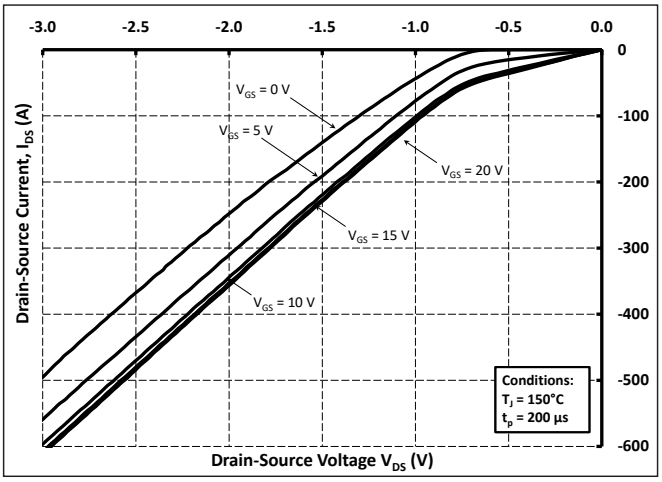


Figure 14. 3rd Quadrant Characteristic at T_{VJ} = 150 °C

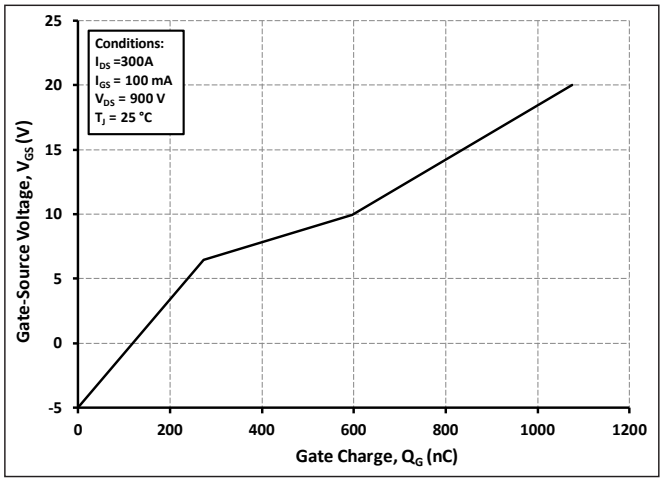


Figure 15. Gate Charge Characteristics

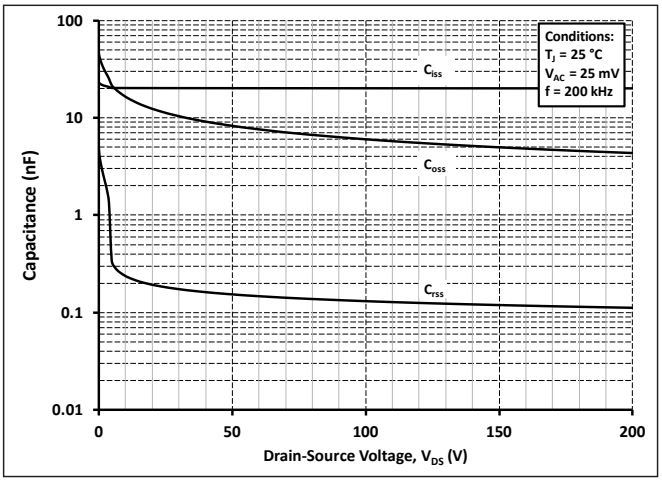


Figure 16. Capacitances vs. Drain-Source Voltage (0 - 200 V)

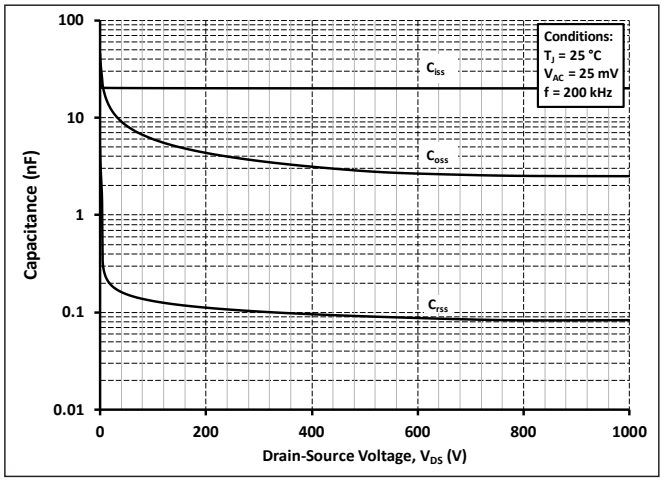


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 1 kV)

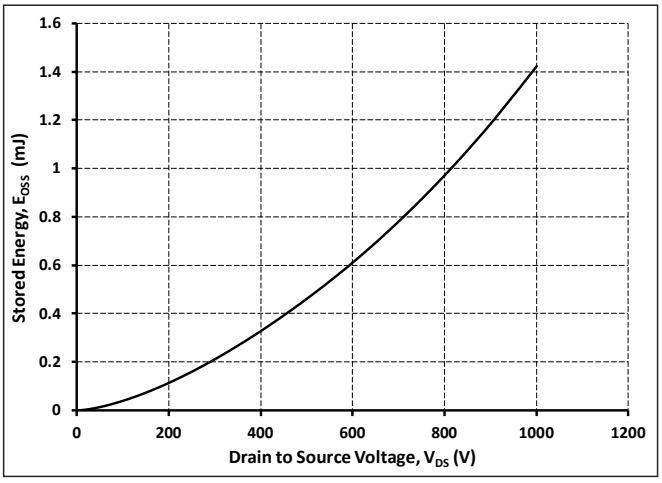


Figure 18. Output Capacitor Stored Energy

Typical Performance

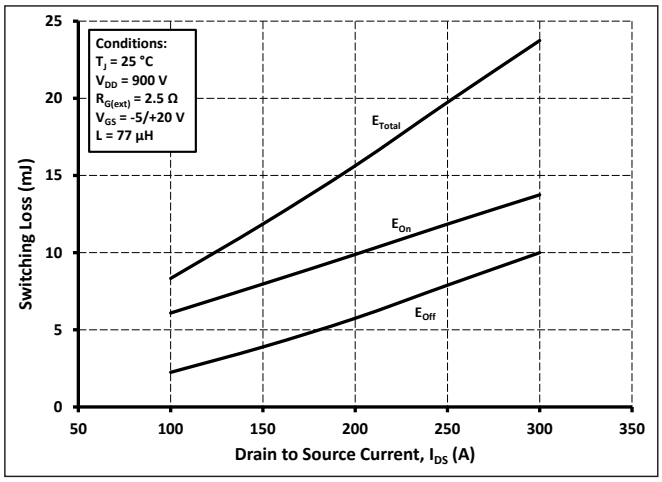


Figure 19. Inductive Switching Energy vs. Drain Current For V_{DS} = 900 V, R_G = 2.5 Ω

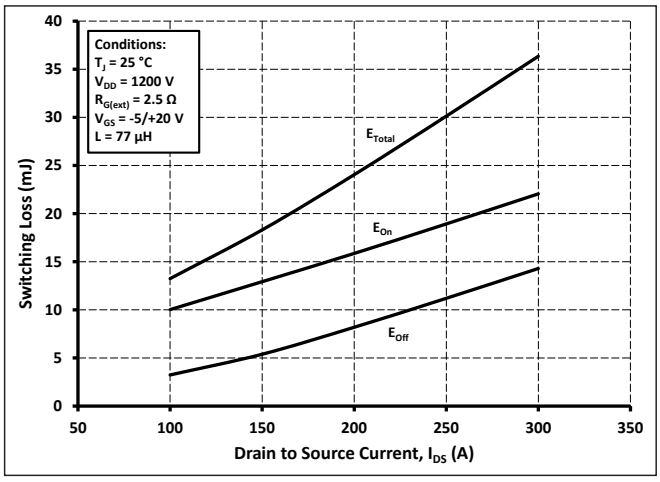


Figure 20. Inductive Switching Energy vs. Drain Current For V_{DS} = 1200 V, R_G = 2.5 Ω

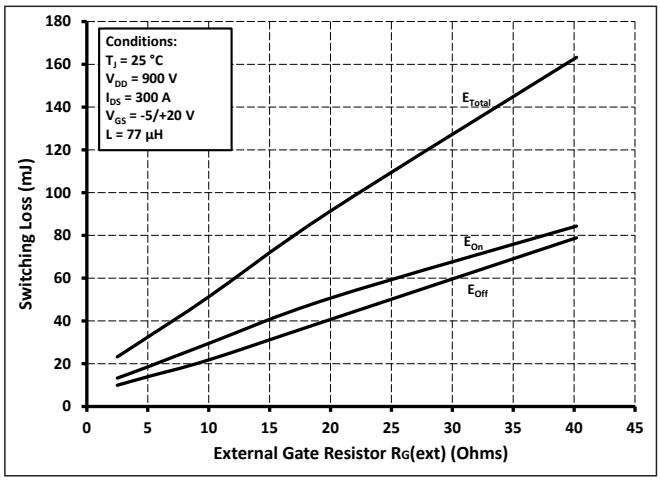


Figure 21. Inductive Switching Energy vs. $R_{G(ext)}$

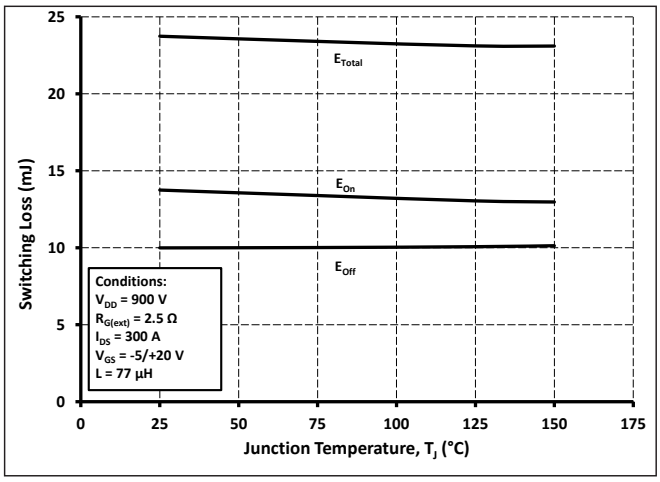


Figure 22. Inductive Switching Energy vs. Temperature

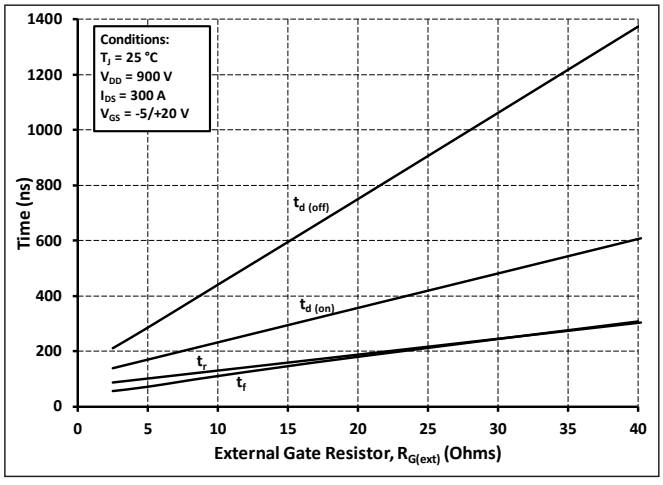


Figure 23. Timing vs. $R_{G(ext)}$

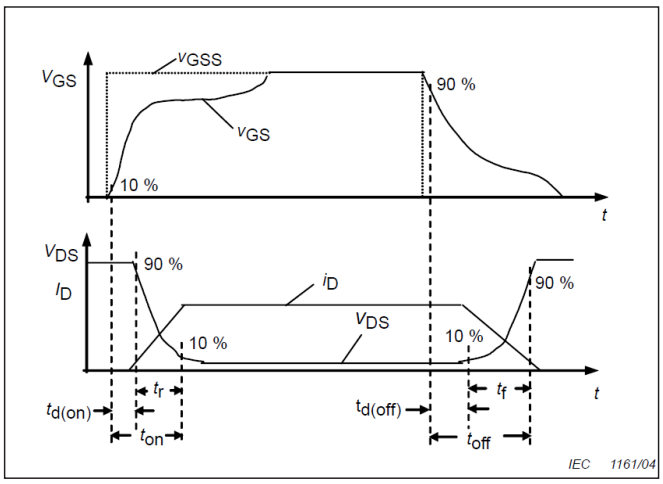


Figure 24. Resistive Switching Time Description

Timing Characteristics

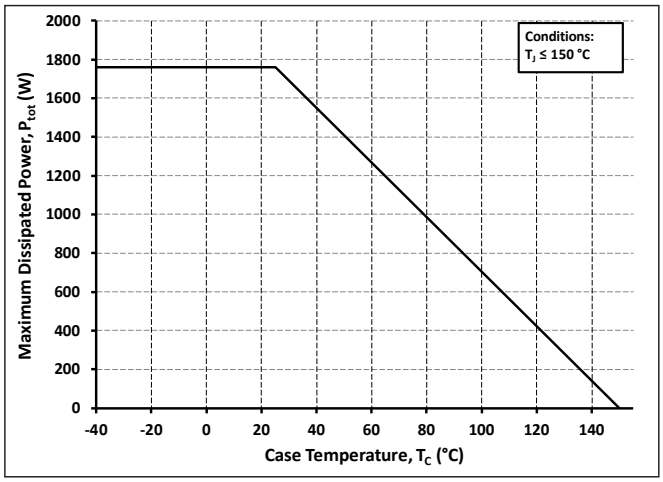


Figure 25. Maximum Power Dissipation (MOSFET) Derating vs. Case Temperature

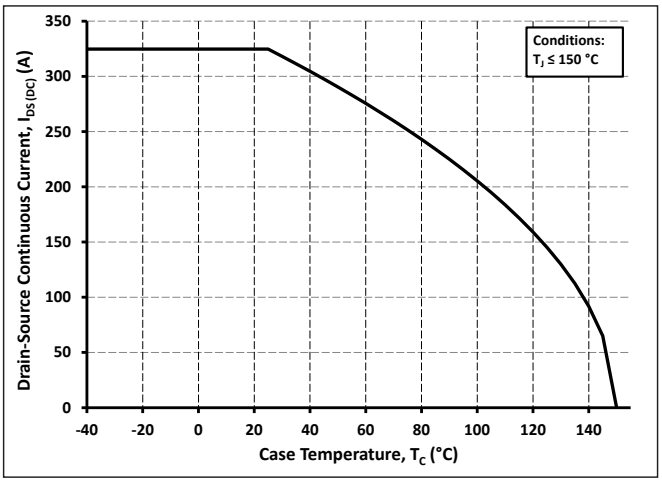


Figure 26. Continuous Drain Current Derating vs Case Temperature

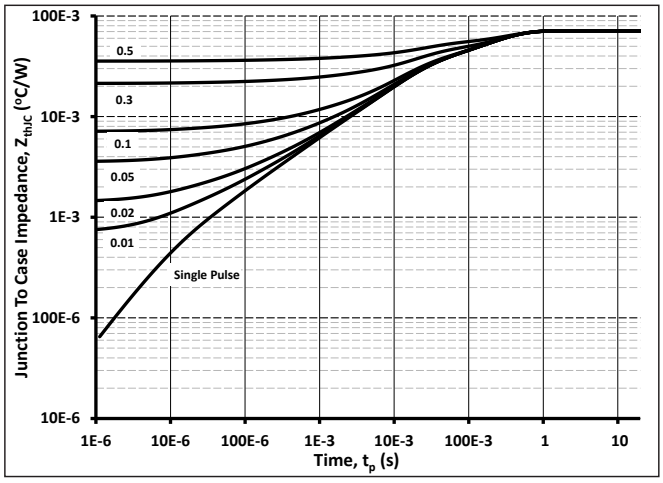


Figure 27. MOSFET Junction to Case Thermal Impedance

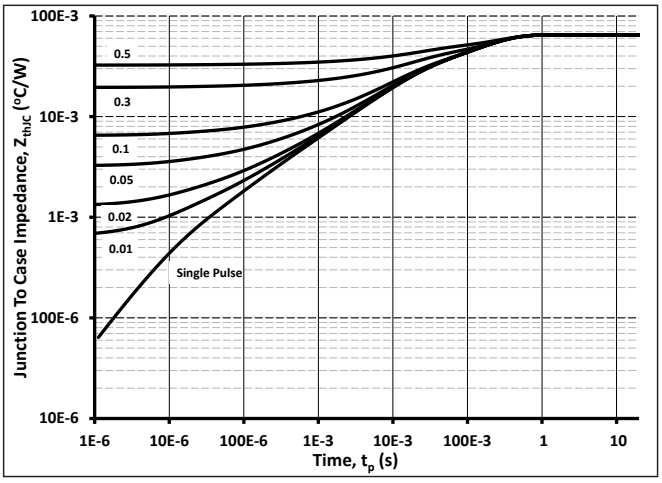


Figure 28. Diode Junction to Case Thermal Impedance

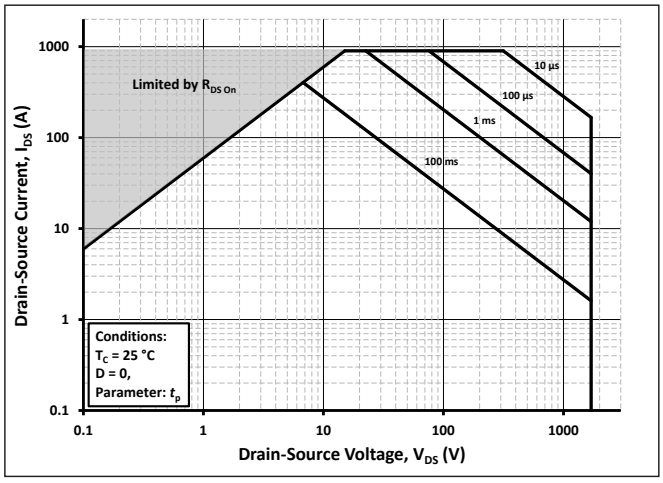
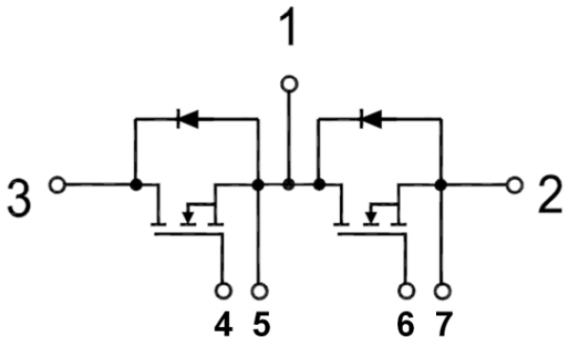


Figure 29. Safe Operating Area

Schematic



Package Dimension (mm)