



CAS300M12BM2

1.2kV, 5.0 mΩ All-Silicon Carbide Half-Bridge Module

Z-FET™ MOSFET and Z-Rec™ Diode

V_{DS}	= 1.2 kV
$E_{sw,Total@300A}$	= 12.0 mJ
$R_{DS(on)}$	= 5.0 mΩ

Module Features

- Ultra Low Loss
- High-Frequency Operation
- Zero Reverse Recovery Current from Diode
- Zero Turn-off Tail Current from MOSFET
- Normally-off, fail-safe device operation
- Ease of paralleling
- Copper baseplate and aluminum nitride insulator

System Benefits

- Enables compact and lightweight systems
- High efficiency operation
- Mitigates over-voltage protection
- Reduces thermal requirements
- Enables simplified topologies

Applications

- Induction Heating
- Motor Drives
- Solar and Wind Inverters
- UPS and SMPS
- Traction

Package 62 mm x 106 mm x 30 mm



Part Number	Package	Marking
CAS300M12BM2	Half Bridge Module	CAS300M12BM2

Maximum Ratings ($T_C = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions	Note
V_{DSmax}	Drain – Source Voltage	1.2	kV		
V_{GSmax}	Gate – Source Voltage	-10/+25	V	Absolute maximum values	
V_{GSop}	Gate – Source Voltage	-5/+20	V	Recommended operational values	
I_D	Continuous Drain Current	404	A	$V_{GS} = 20\text{ V}, T_C = 25^\circ\text{C}$	Fig 20
		285	A	$V_{GS} = 20\text{ V}, T_C = 90^\circ\text{C}$	
I_{Dpulse}	Pulsed Drain Current	1500	A	Pulse width $t_P = 200\text{ }\mu\text{s}$ repetition rate limited by $T_{J(max)}$, $T_C = 25^\circ\text{C}$	
T_{Jmax}	Junction Temperature	150	$^\circ\text{C}$		
T_C T_{stg}	Case and Storage Temperature Range	-40 to +125	$^\circ\text{C}$		
P_{tot}	Maximum Power Dissipation	1660	W	$T_C = 25^\circ\text{C}, T_J = 150^\circ\text{C}$	
V_{isol}	Case Isolation Voltage	4.0	kV	AC, 50 Hz, 1 min	
L_{stray}	Stray Inductance	14	nH	Measured between terminals 2 and 3	
M	Mounting Torque	5	Nm	To heatsink and terminals	
G	Weight	300	g		
	Clearance Distance	12	mm	Terminal to terminal	
	Creepage Distance	30	mm	Terminal to terminal	
		40	mm	Terminal to baseplate	



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

Symbol	Parameter	Value			Unit	Test Conditions	Notes
		Min	Typ	Max			
V _{(BR)DSS}	Drain – Source Breakdown Voltage	1.2			kV	V _{GS} = 0 V, I _{DS} = 1 mA	
V _{GS(th)}	Gate Threshold Voltage	2.0	2.3		V	V _{DS} = 10 V, I _{DS} = 15 mA	Fig 11
I _{DSS}	Zero Gate Voltage Drain Current		500	2000	μA	V _{DS} = 1.2 kV, V _{GS} = 0 V	
			1000			V _{DS} = 1.2 kV, V _{GS} = 0 V T _J = 150 °C	
I _{GSS}	Gate-Source Leakage Current		1	100	nA	V _{GS} = 20 V, V _{DS} = 0 V	
R _{DS(on)}	Drain-Source On-State Resistance		5.0	5.7	mΩ	V _{GS} = 20 V, I _{DS} = 300 A	Fig 4, 5 and 6
			8.6	9.8		V _{GS} = 20 V, I _{DS} = 300 A, T _J = 150 °C	
g _{fs}	Transconductance		94.8		S	V _{DS} = 20 V, I _{DS} = 300 A	Fig 7
			93.3			V _{DS} = 20 V, I _{DS} = 300 A, T _J = 150 °C	
C _{ISS}	Input Capacitance		11.7		nF	V _{DS} = 600 V f = 200 kHz, V _{AC} = 25 mV	Fig 17, 18
C _{OSS}	Output Capacitance		2.55				
C _{RSS}	Reverse Transfer Capacitance		0.07				
t _{d(on)}	Turn-On Delay Time		76			V _{DD} = 600 V, V _{GS} = -5/20 V I _D = 300 A, R _{G(ext)} = 2.5 Ω, Timing relative to V _{DS} Per IEC60747-8-4 pg 83 Inductive Load	Fig 24
t _r	Rise Time		68				
t _{d(off)}	Turn-Off Delay Time		168				
t _f	Fall Time		43				
E _{ON}	Turn-On Switching Energy		6.05		mJ	V _{DS} = 600 V, V _{GS} = -5 / 20 V I _{DS} = 300 A, R _G = 2.5 Ω, Inductive Load	Fig 25
E _{OFF}	Turn-Off Switching Energy		5.95				

Free-Wheeling Diode Characteristics

Symbol	Parameter	Value			Unit	Test Conditions	Notes
		Min	Typ	Max			
V _{SD}	Diode Forward Voltage		1.7	2.0	V	I _{SD} = 300 A, T _J = 25°C, V _{GS} = 0 V	Fig 8, 9 and 10
Q _C	Total Capacitive Charge		2.2	2.5	V	I _{SD} = 300 A, T _J = 150°C, V _{GS} = 0 V	
			3.2		μC		

Note: The reverse recovery is purely capacitive.

Gate Charge Characteristics

Symbol	Parameter	Value			Unit	Test Conditions	Notes
		Min	Typ	Max			
Q _{GS}	Gate to Source Charge		166		nC	V _{DS} = 800 V, V _{GS} = -5 /+ 20 V I _{DS} = 300 Amps Per JEDEC24 pg 27	Fig 12
Q _{GD}	Gate to Drain Charge		475				
Q _G	Total Gate Charge		1025				
R _G	Internal Gate Resistance		3.0		Ω	f = 200 kHz, V _{AC} = 25 mV	

Thermal Characteristics

Symbol	Parameter	Value			Unit	Test Conditions	Notes
		Min	Typ	Max			
R _{θJCM}	Thermal Resistance Junction to Case for MOSFET		0.070	0.075	°C/W	T _C = 90 °C, T _J = 150 °C P _{dis} = P _{max}	Fig 17
R _{θJCD}	Thermal Resistance Junction to Case for Diode		0.073	0.076			Fig 18

Typical Performance

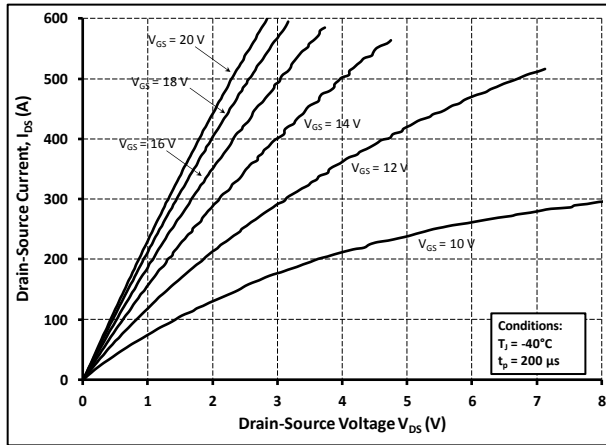


Fig 1. Typical Output Characteristics $T_J = -40\text{ }^{\circ}\text{C}$

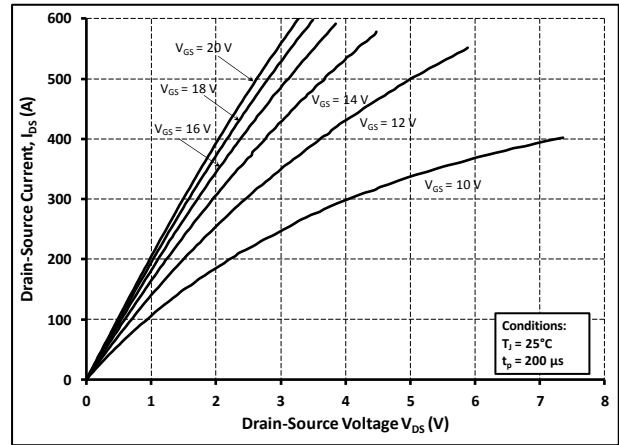


Fig 2. Typical Output Characteristics $T_J = 25\text{ }^{\circ}\text{C}$

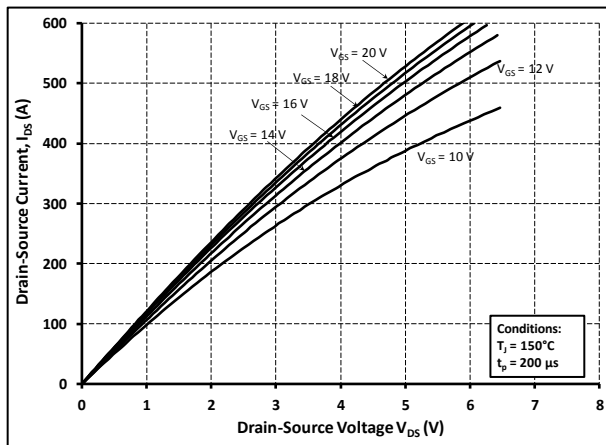


Fig 3. Typical Output Characteristics $T_J = 150\text{ }^{\circ}\text{C}$

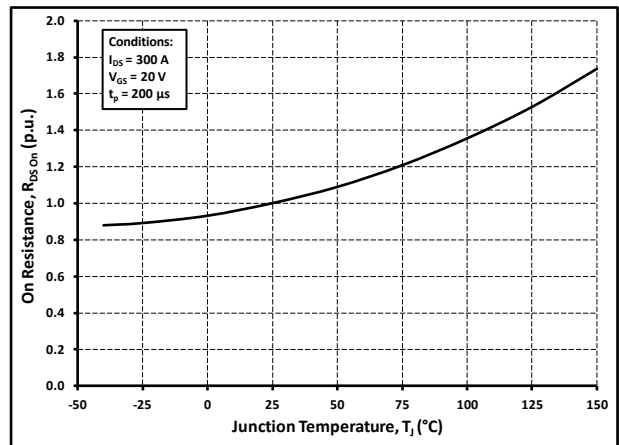


Fig 4. Normalized On-Resistance vs. Temperature

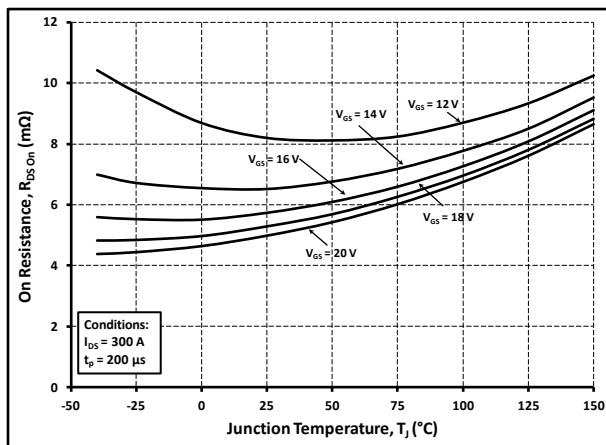


Fig 5. Typical On-Resistance vs. Temperature and Gate Voltage

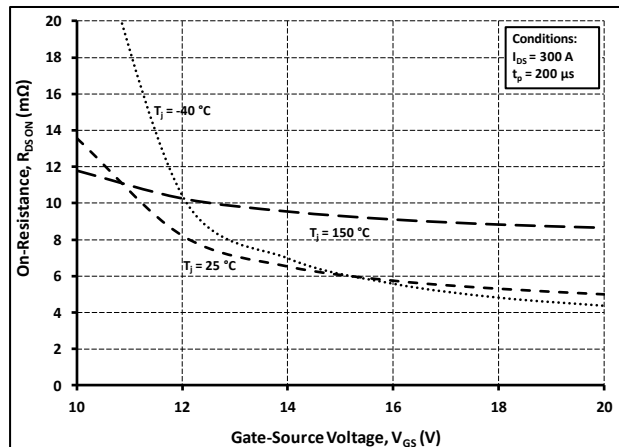


Fig 6. Typical On-Resistance vs. Gate Voltage

Typical Performance

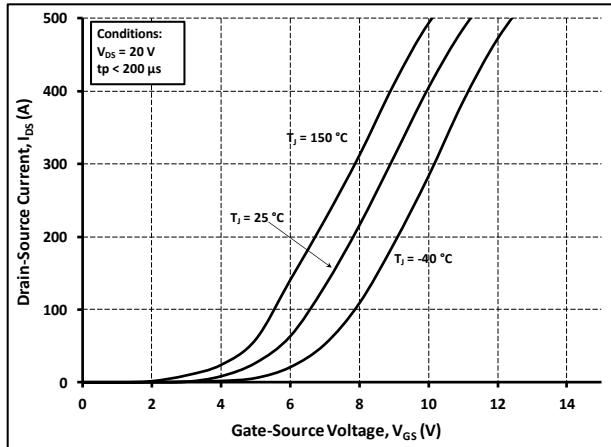


Fig 7. Typical Transfer Characteristic For Various Temperatures

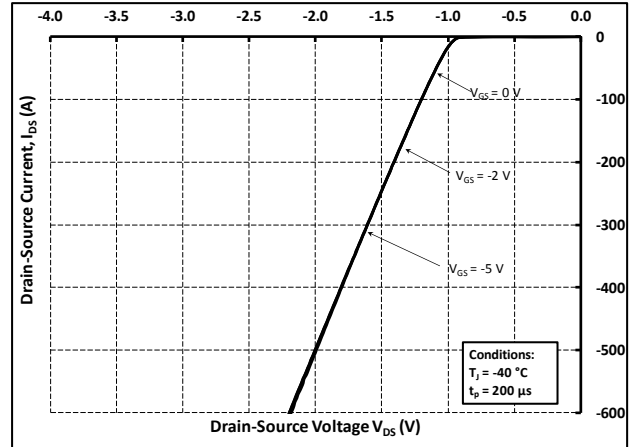


Fig 8. Typical Diode Behavior $T_J = -40$ $^{\circ}$ C

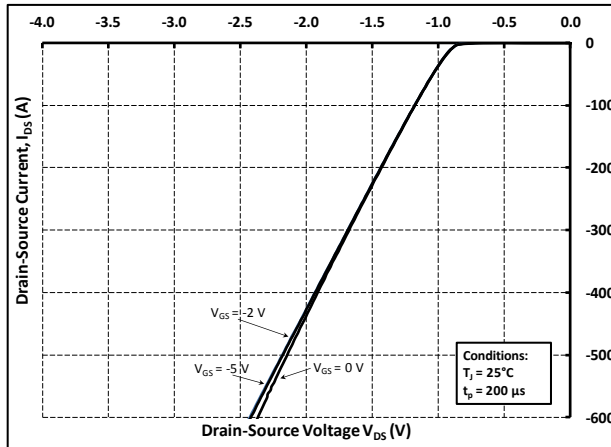


Fig 9. Typical Diode Behavior $T_J = 25$ $^{\circ}$ C

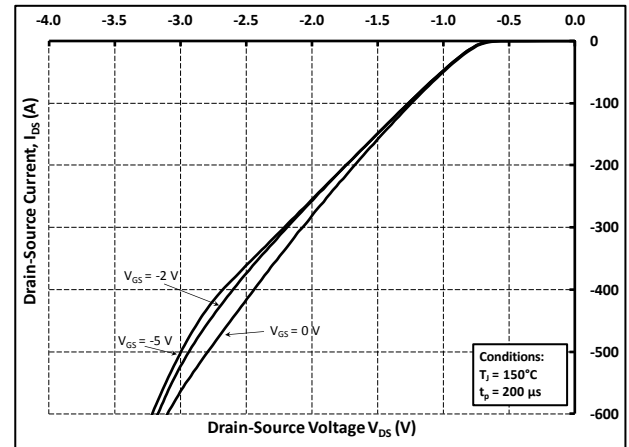


Fig 10. Typical Diode Behavior $T_J = 150$ $^{\circ}$ C

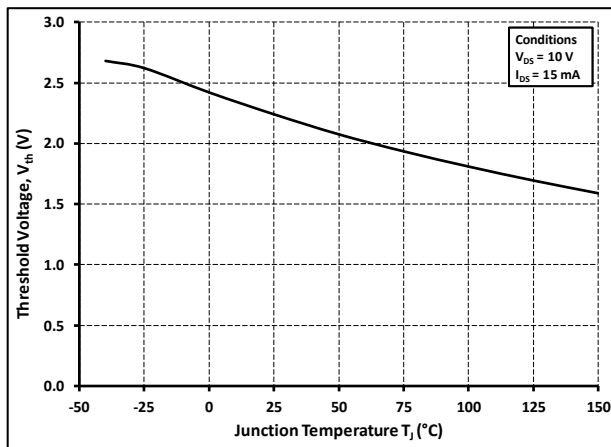


Fig 11. Typical Threshold Voltage vs. Temperature

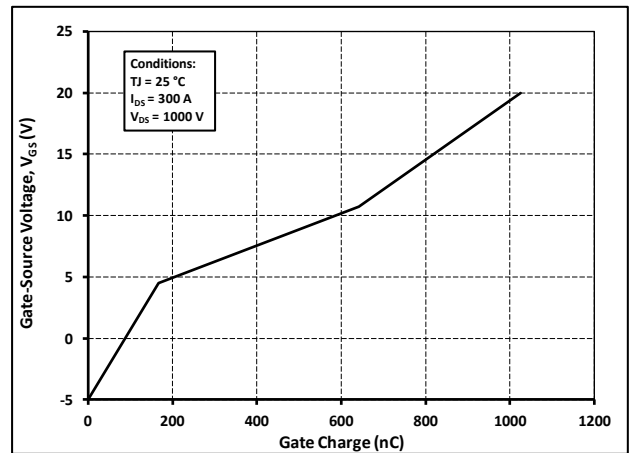
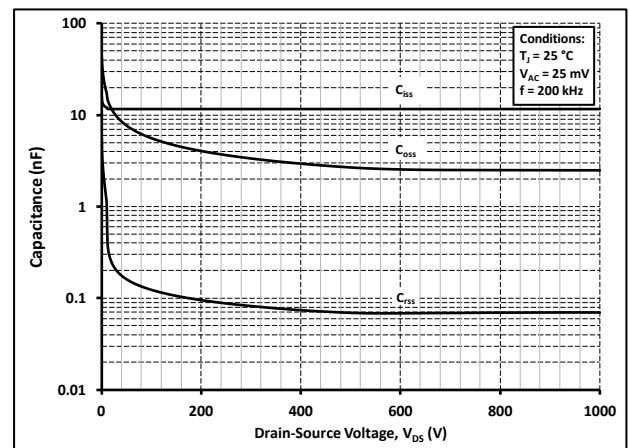
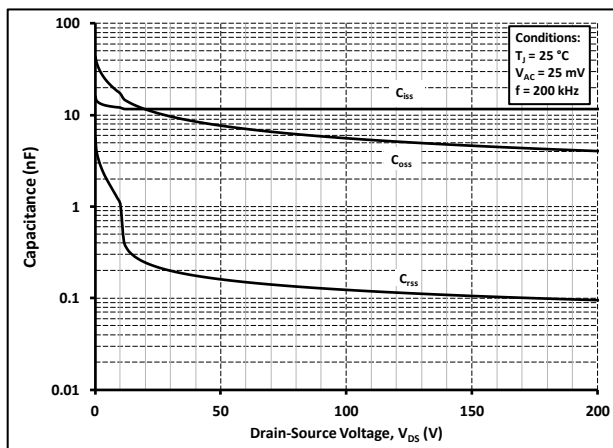
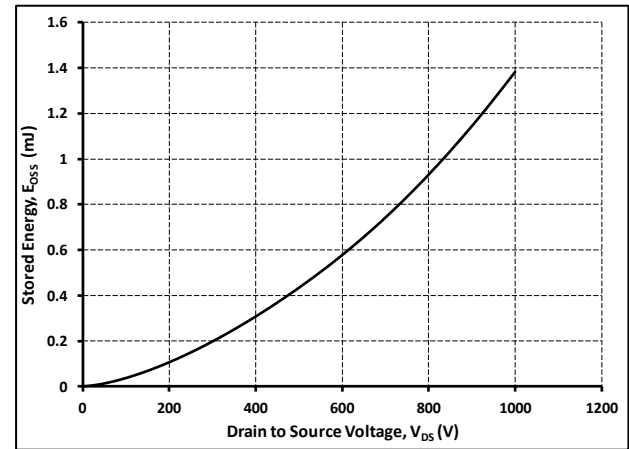
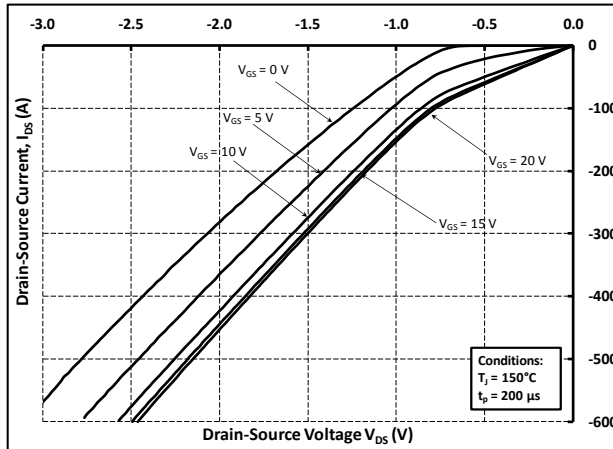
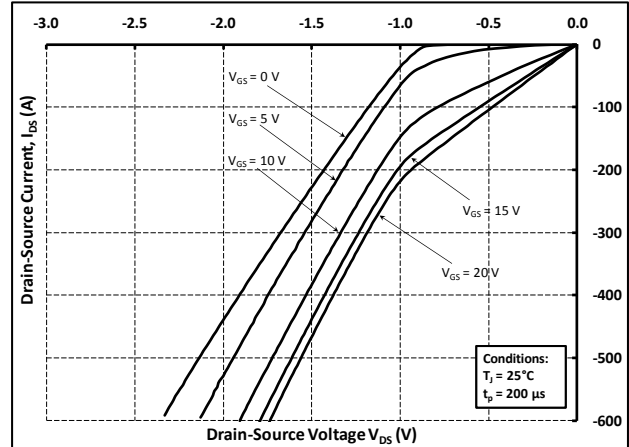
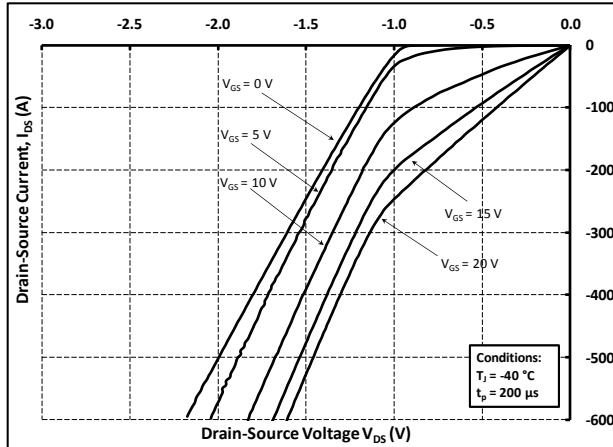


Fig 12. Typical Gate Charge



Typical Performance



Typical Performance

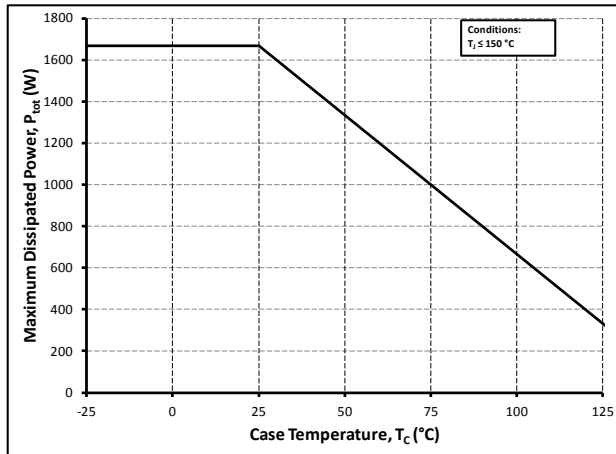


Fig 19. Max. Continuous Power Derating Curve vs. Case Temperature.

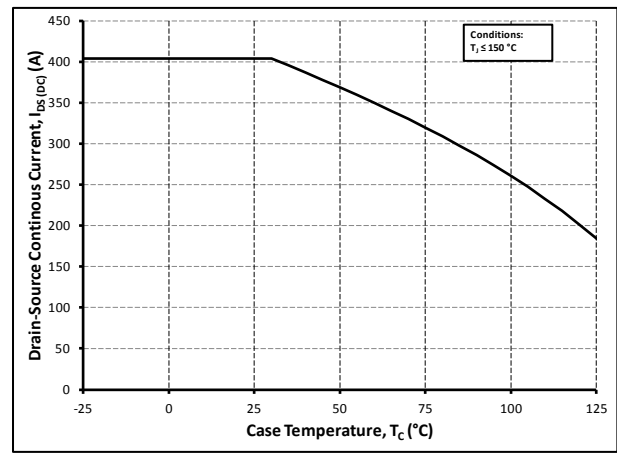


Fig 20. Max. Continuous Current Derating Curve vs. Case Temperature

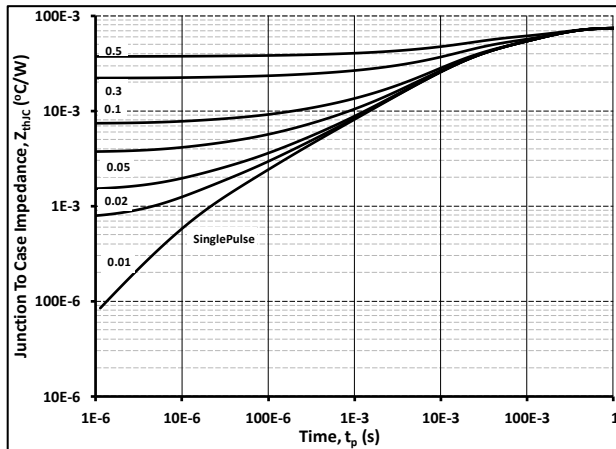


Fig 21. Typical Transient Thermal Impedance - MOSFET

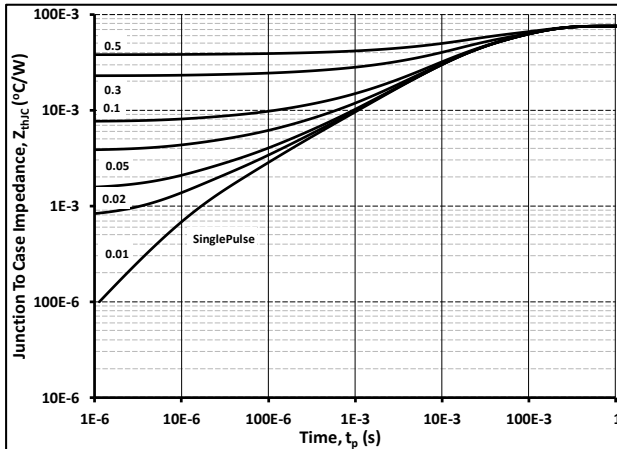


Fig 22. Typical Transient Thermal Impedance - DIODE

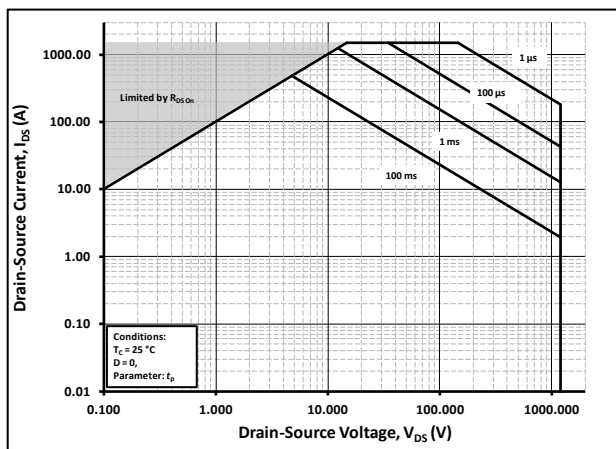


Fig 23. MOSFET Safe Operating Area

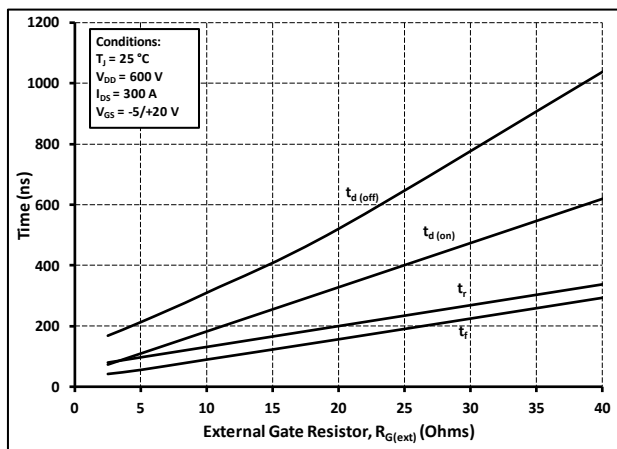


Fig 24. Typical Inductive Switching Time vs Gate Resistance ($V_{\text{DD}} = 600\text{V}$, $I_{\text{D}} = 300\text{A}$)

Typical Performance

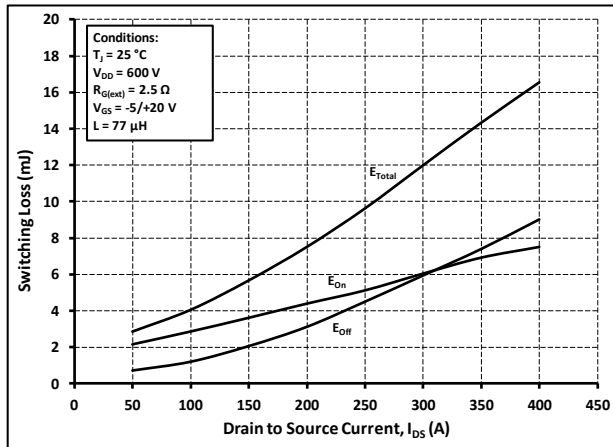


Fig 25. Typical Clamped Inductive Switching Energy vs Drain Current ($V_{DD} = 600\text{V}$)

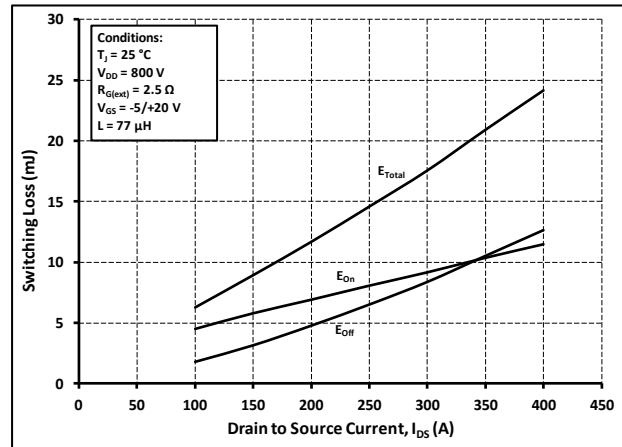


Fig 26. Typical Clamped Inductive Switching Energy vs Drain Current ($V_{DD} = 800\text{V}$)

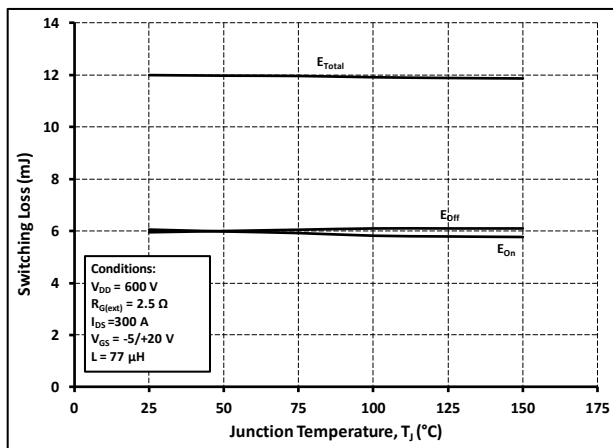


Fig 27. Typical Switching Loss vs. Temperature

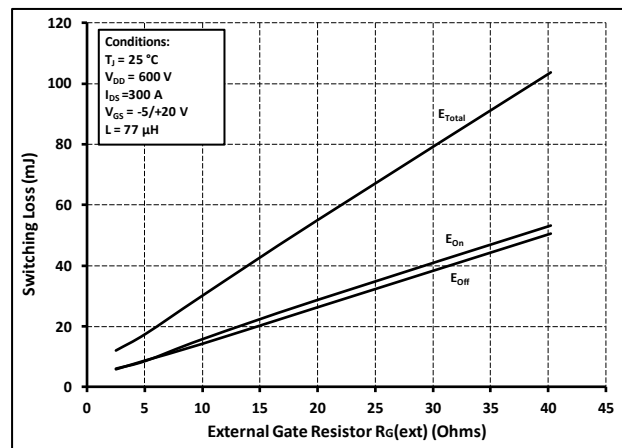
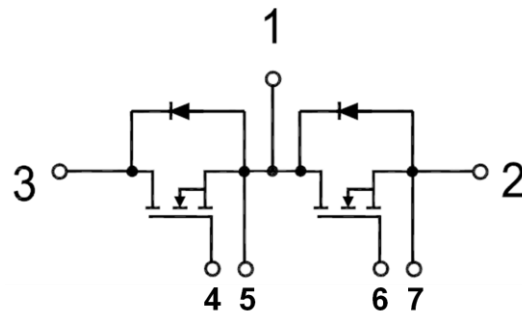


Fig 28. Typical Switching Loss vs. Gate Resistance

Schematic



Mechanical Characteristics (in mm)

