



**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 $t_P = 200\ \mu\text{s}$ 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		
	Creepage Distance	12	mm	Terminal to terminal	
		30	mm	Terminal to terminal	
		40	mm	Terminal to baseplate	



## Electrical Characteristics (T<sub>C</sub> = 25°C unless otherwise specified)

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

## Free-Wheeling Diode Characteristics

Symbol	Parameter	Value			Unit	Test Conditions	Notes
		Min	Typ	Max			
V <sub>SD</sub>	Diode Forward Voltage		1.7	2.0	V	I <sub>SD</sub> = 300 A, T <sub>J</sub> = 25°C, V <sub>GS</sub> = 0 V	Fig 8, 9 and 10
			2.2	2.5			
Q <sub>C</sub>	Total Capacitive Charge		3.2		μC		

Note: The reverse recovery is purely capacitive.

## Gate Charge Characteristics

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

## Thermal Characteristics

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



## Typical Performance

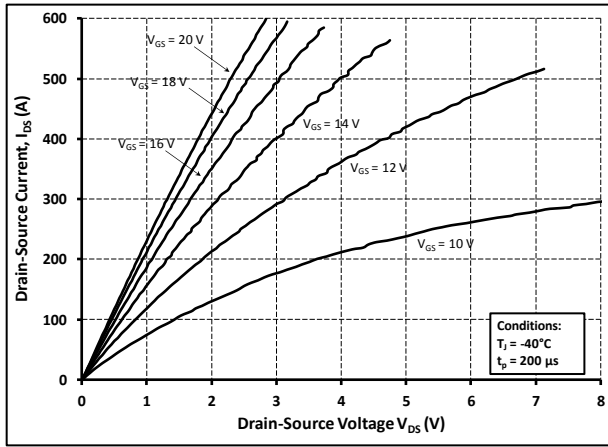


Fig 1. Typical Output Characteristics  $T_J = -40\text{ }^\circ\text{C}$

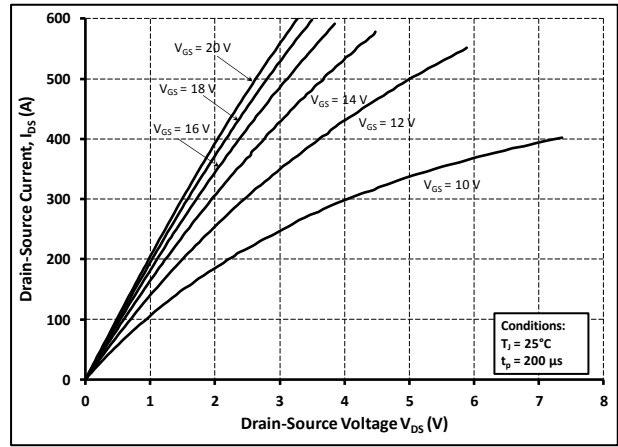


Fig 2. Typical Output Characteristics  $T_J = 25\text{ }^\circ\text{C}$

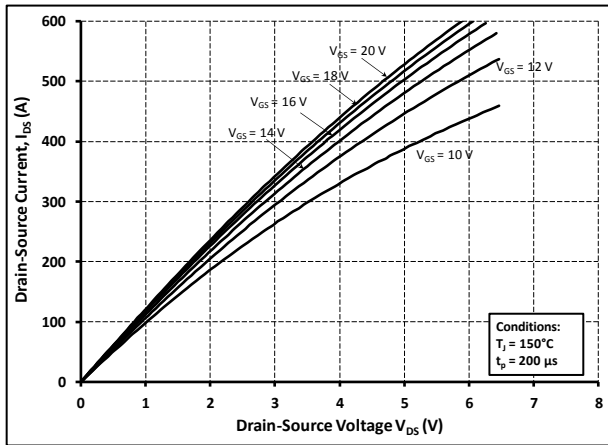


Fig 3. Typical Output Characteristics  $T_J = 150\text{ }^\circ\text{C}$

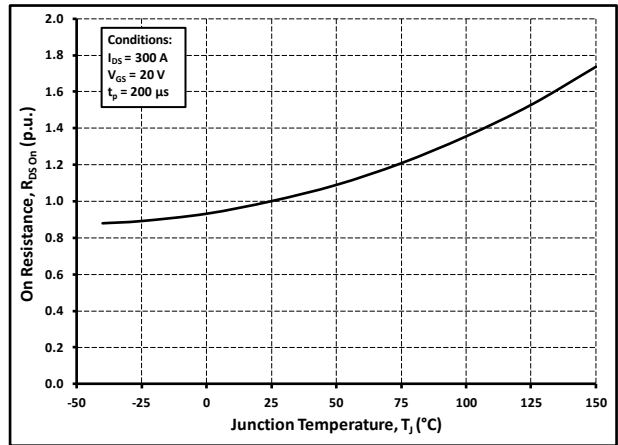


Fig 4. Normalized On-Resistance vs. Temperature

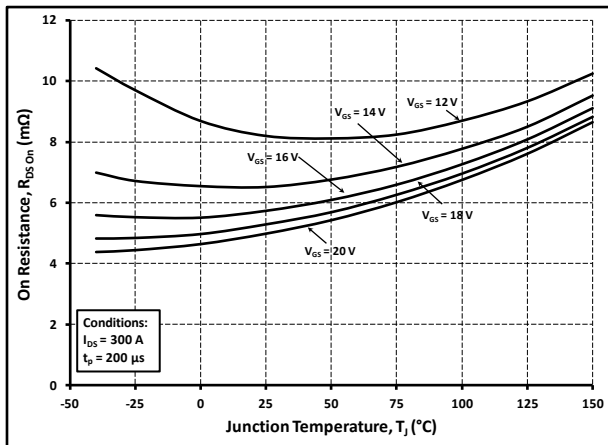


Fig 5. Typical On-Resistance vs. Temperature and Gate Voltage

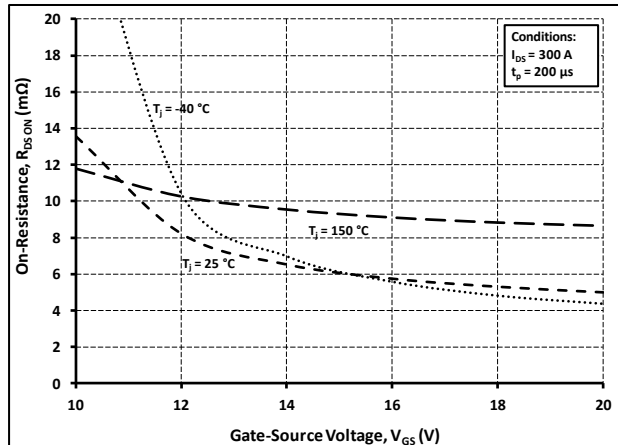
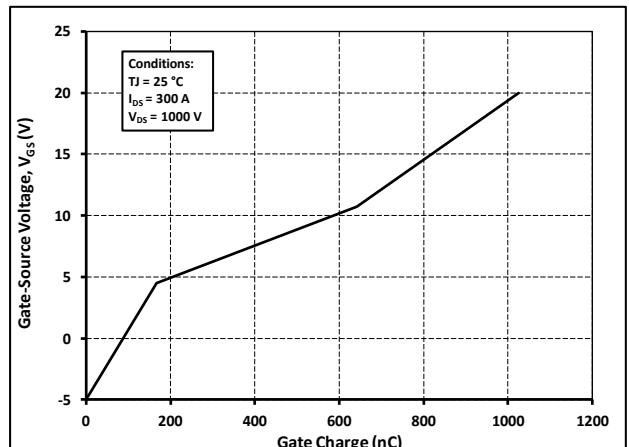
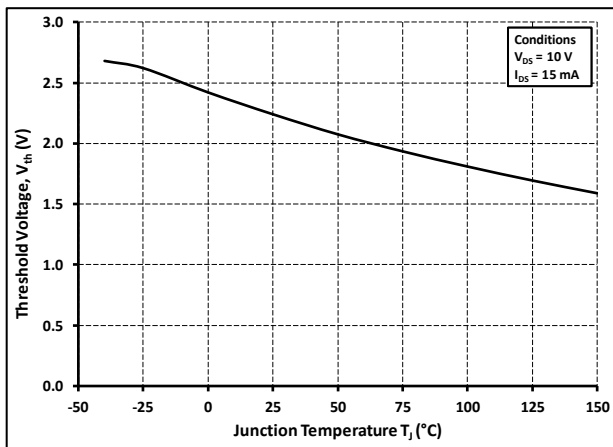
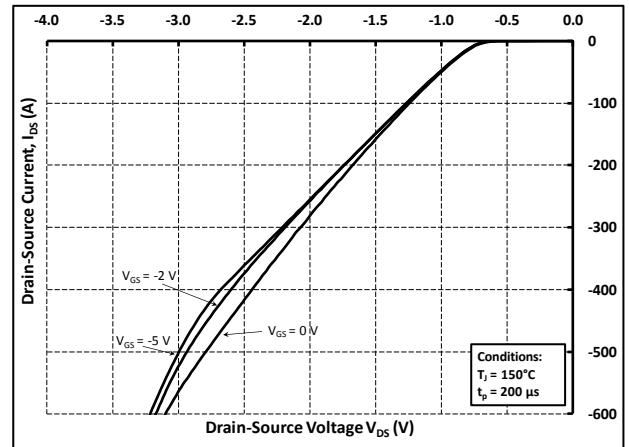
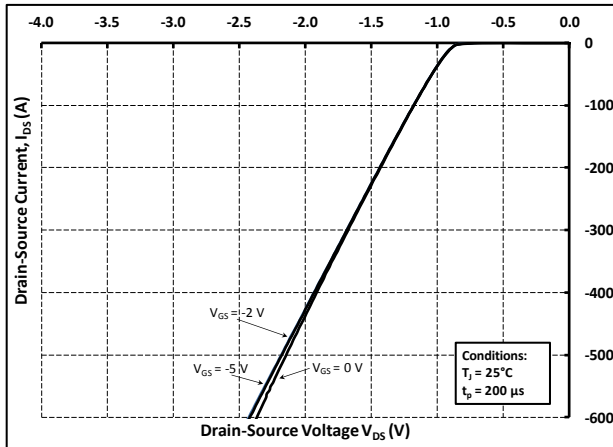
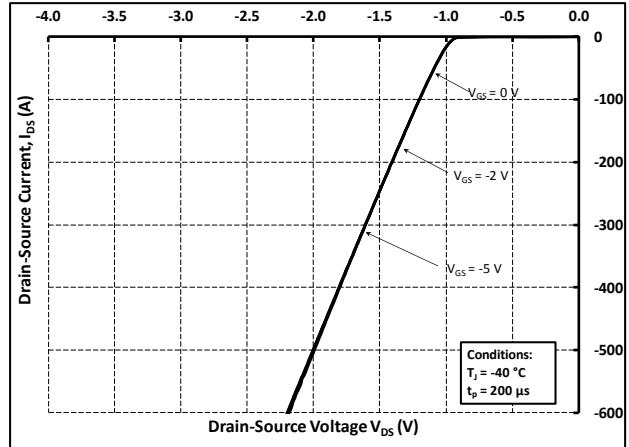
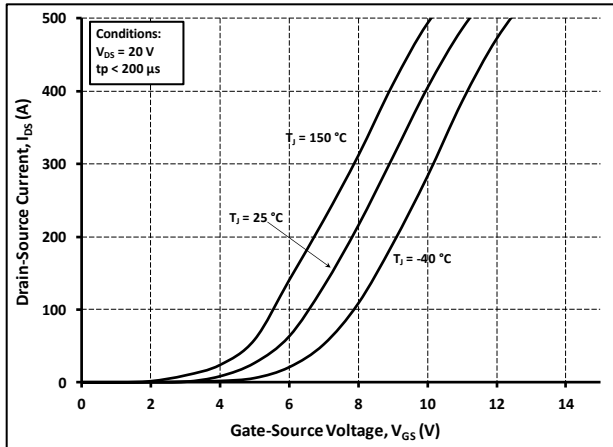


Fig 6. Typical On-Resistance vs. Gate Voltage



## Typical Performance





## Typical Performance

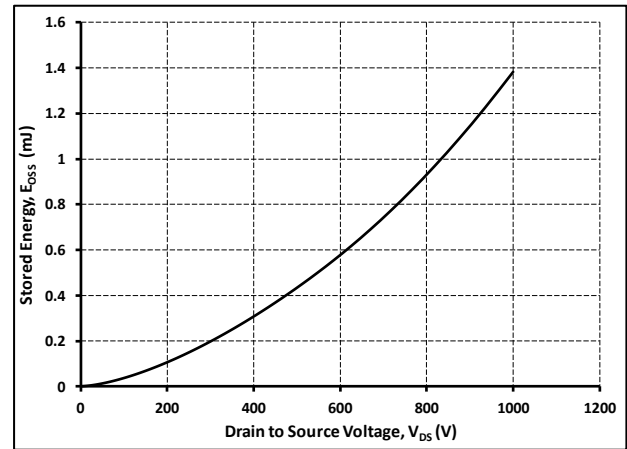
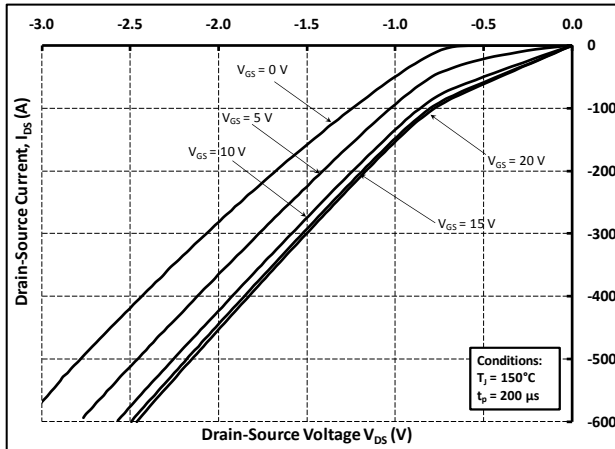
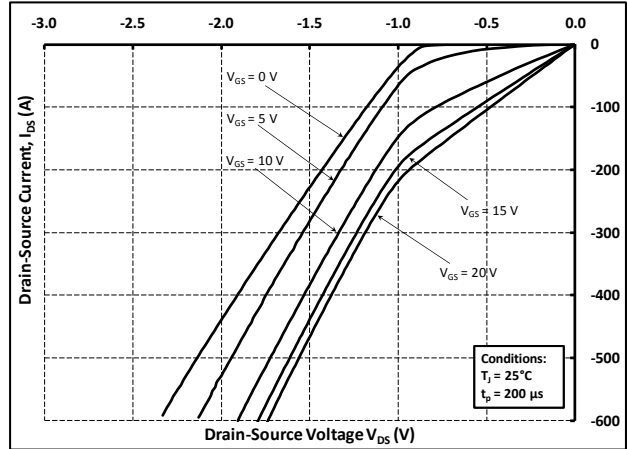
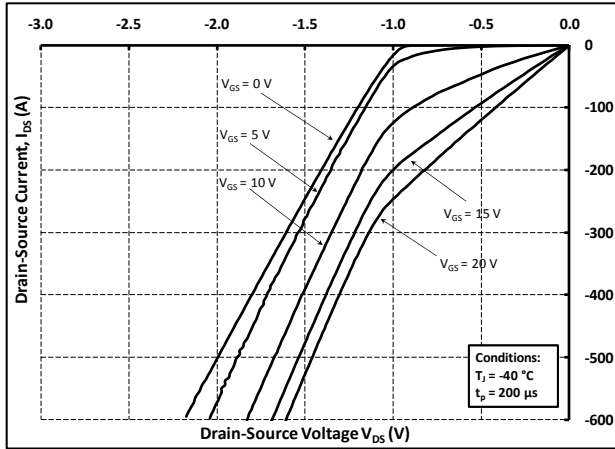


Fig 15. Typical 3<sup>rd</sup> Quadrant Behavior  $T_j = 150\text{ }^\circ\text{C}$

Fig 16. Typical Output Capacitor Stored Energy

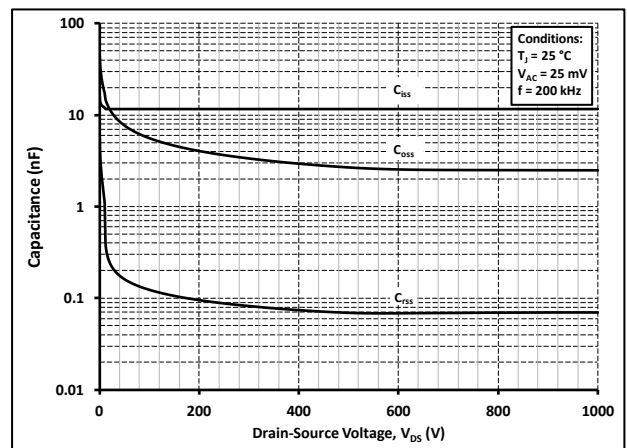
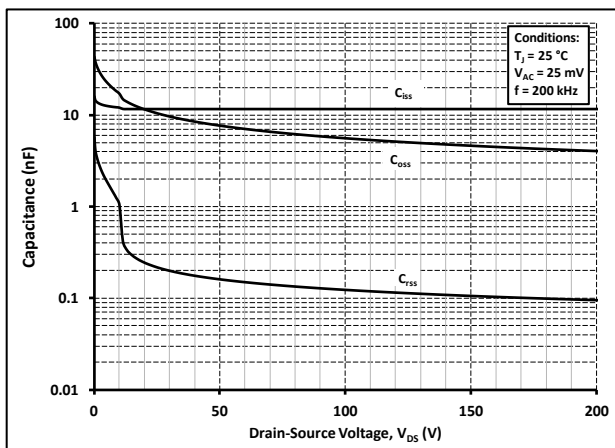


Fig 17. Typical Capacitances vs. Drain-Source Voltage. (0-200V)

Fig 18. Typical Capacitances vs. Drain-Source Voltage. (0-1000V)



## Typical Performance

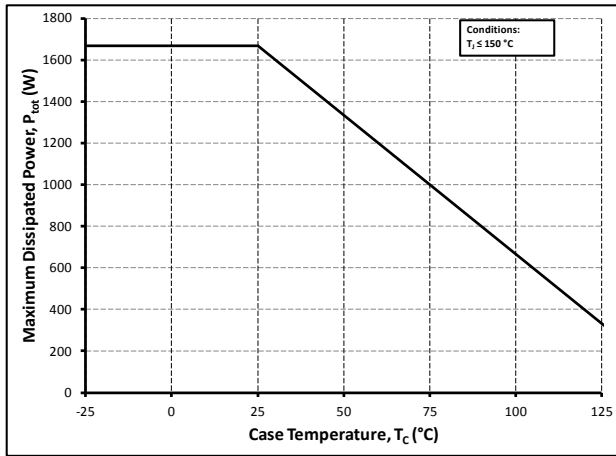


Fig 19. Max. Continuous Power Derating Curve vs. Case Temperature.

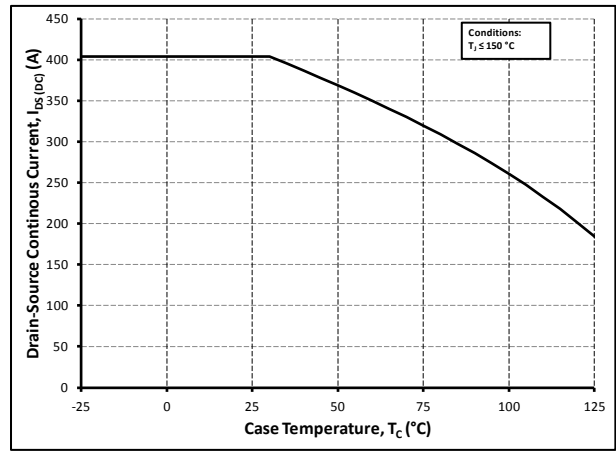


Fig 20. Max. Continuous Current Derating Curve vs. Case Temperature

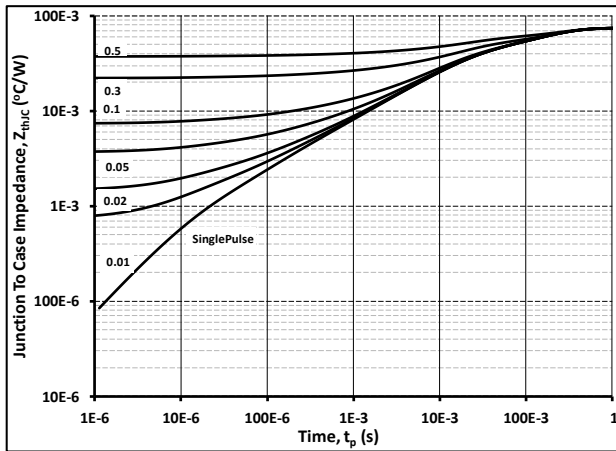


Fig 21. Typical Transient Thermal Impedance - MOSFET

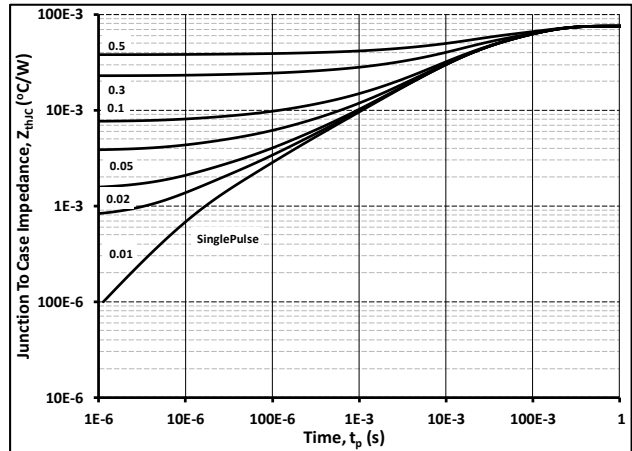


Fig 22. Typical Transient Thermal Impedance - DIODE

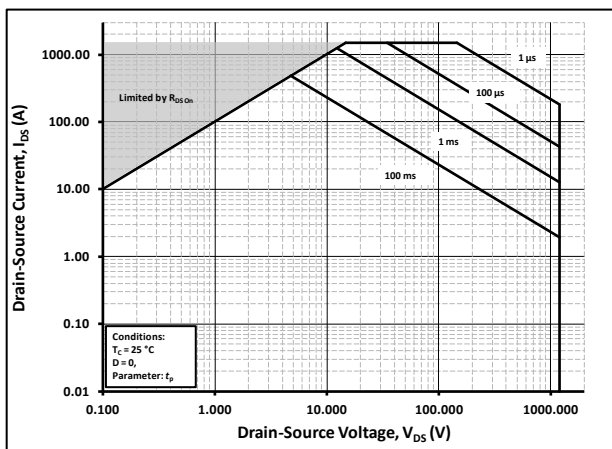


Fig 23. MOSFET Safe Operating Area

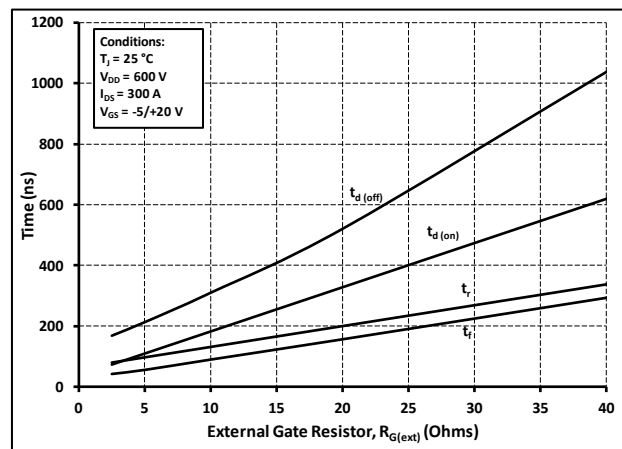


Fig 24. Typical Inductive Switching Time vs Gate Resistance ( $V_{DD} = 600V$ ,  $I_D = 300A$ )



## Typical Performance

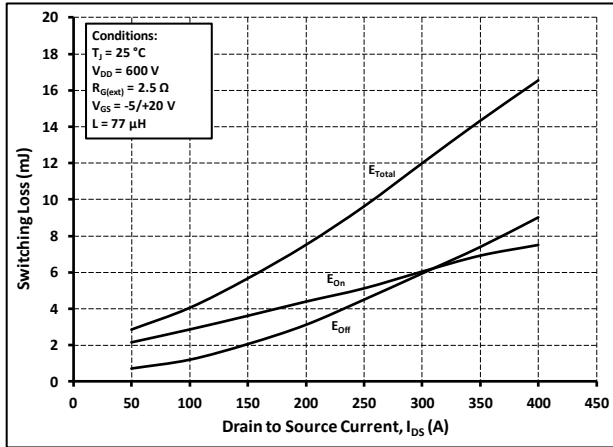


Fig 25. Typical Clamped Inductive Switching Energy vs Drain Current ( $V_{DD} = 600\text{V}$ )

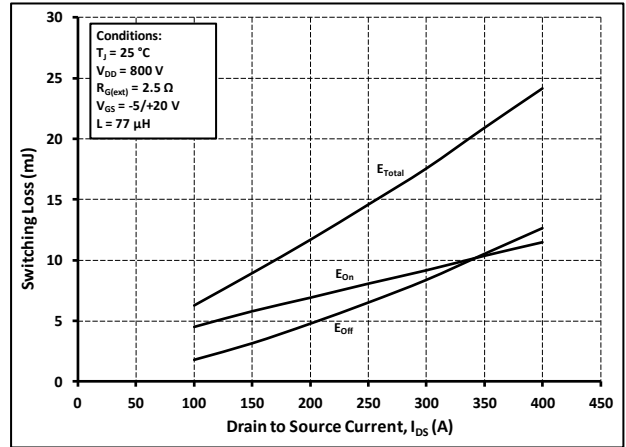


Fig 26. Typical Clamped Inductive Switching Energy vs Drain Current ( $V_{DD} = 800\text{V}$ )

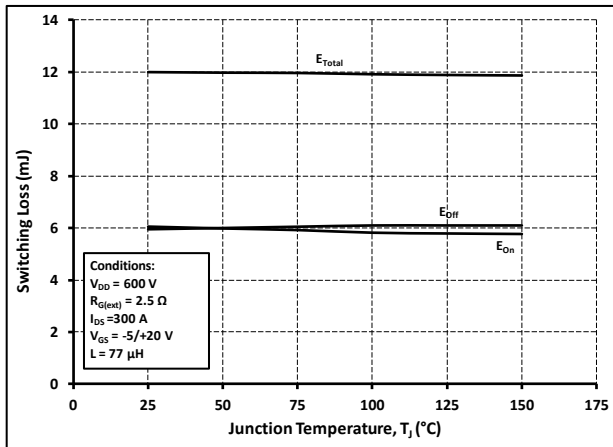


Fig 27. Typical Switching Loss vs. Temperature

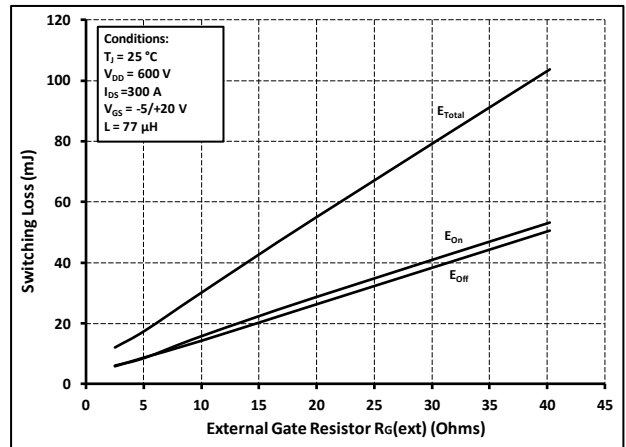
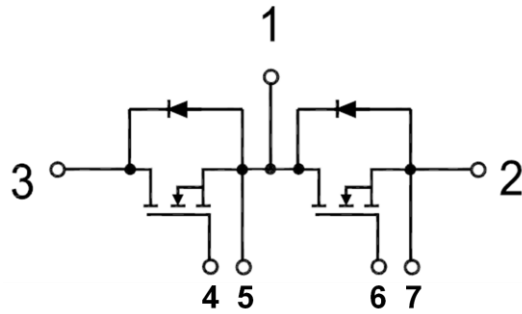


Fig 28. Typical Switching Loss vs. Gate Resistance

**Schematic**



**Mechanical Characteristics (in mm)**

