

# IMW65R083M1H-VB Datasheet

## N-Channel 650V (D-S) SiC Power MOSFET

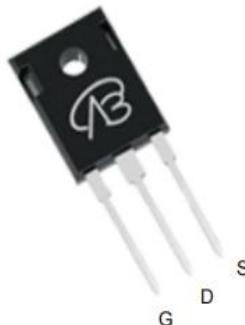
PRODUCT SUMMARY		
$V_{DS}$ (V)		650
$R_{DS(on)}$ at 25 °C (Ω)	$V_{GS} = 18$ V	0.07
$Q_g$ (nC)		90

### FEATURES

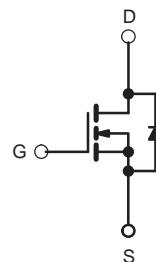
- Low figure-of-merit (FOM)  $R_{on} \times Q_g$
- Low input capacitance ( $C_{iss}$ )
- Reduced switching and conduction losses
- Ultra low gate charge ( $Q_g$ )
- Avalanche energy rated (UIS)



TO-247



Top View



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS ( $T_C = 25$ °C, unless otherwise noted)					
PARAMETER		SYMBOL	LIMIT	UNIT	
Drain-Source Voltage		$V_{DS}$	650	V	
		$V_{GS}$	-10 / +22		
Continuous Drain Current ( $T_J = 150$ °C)	$V_{GS}$ at 18 V	$I_D$	30	A	
			24		
Pulsed Drain Current <sup>a</sup>		$I_{DM}$	90		
Linear Derating Factor			2.1	W/°C	
Single Pulse Avalanche Energy <sup>b</sup>		$E_{AS}$	225	mJ	
Maximum Power Dissipation		$P_D$	187	W	
Operating Junction and Storage Temperature Range		$T_J, T_{stg}$	-55 to +175	°C	
Drain-Source Voltage Slope	$T_J = 125$ °C	$dV/dt$	50	V/ns	
Reverse Diode $dV/dt$ <sup>d</sup>			15		
Soldering Recommendations (Peak Temperature) <sup>c</sup>			260	°C	

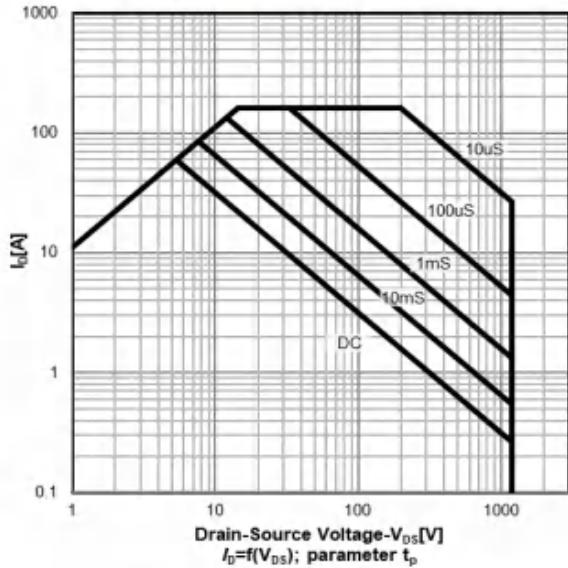
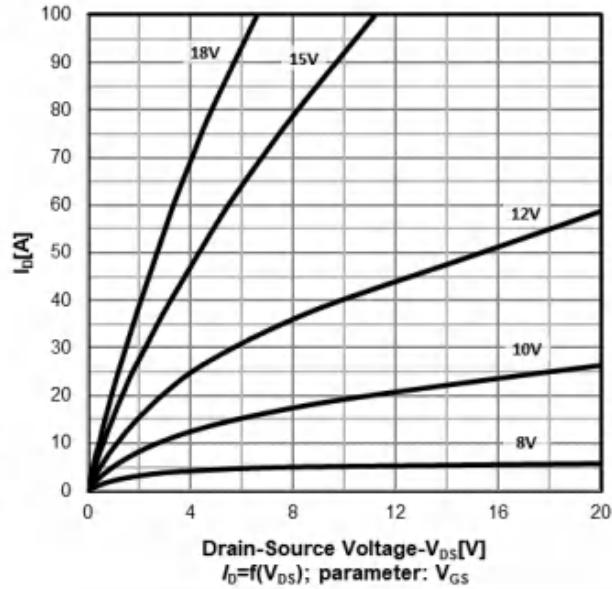
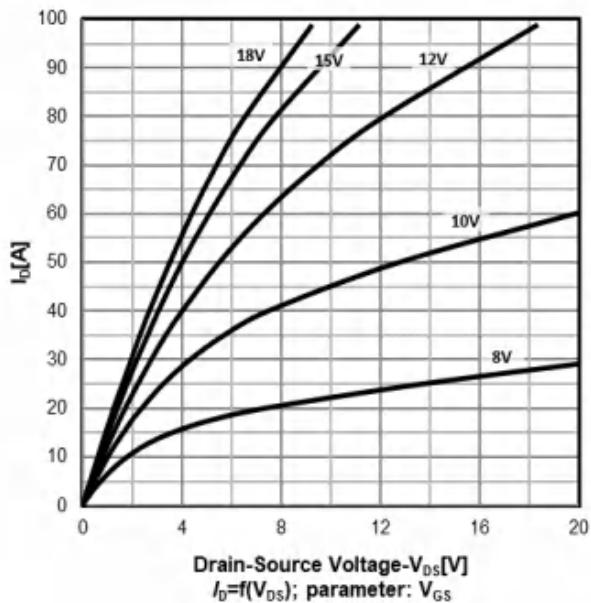
### Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- $V_{DD} = 100$  V, starting  $T_J = 25$  °C,  $L = 0.5\text{mH}$ ,  $R_g = 25$  Ω,  $I_{AS} = 30\text{A}$ .
- 1.6 mm from case.
- $I_{SD} \leq I_D$ ,  $dI/dt = 100$  A/μs, starting  $T_J = 25$  °C.

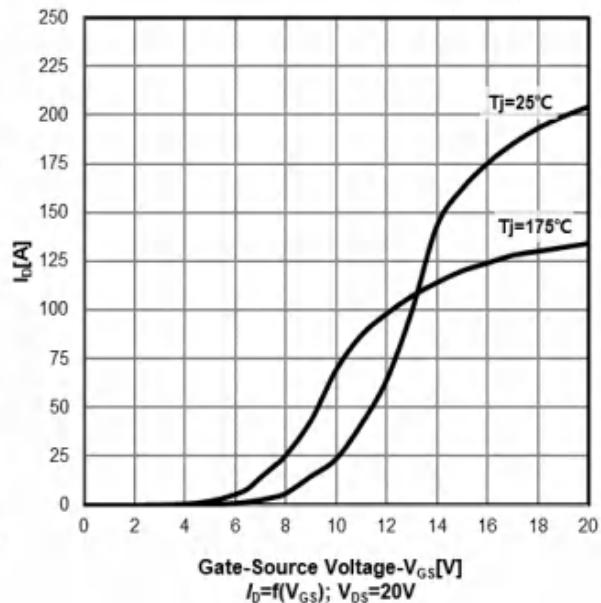
THERMAL RESISTANCE RATINGS							
PARAMETER	SYMBOL	TYP.	MAX.	UNIT			
Maximum Junction-to-Ambient	$R_{thJA}$	-	40	$^{\circ}\text{C}/\text{W}$			
Maximum Junction-to-Case (Drain)	$R_{thJC}$	-	0.8				
SPECIFICATIONS ( $T_J = 25^{\circ}\text{C}$ , unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	
Static							
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0 \text{ V}$ , $I_D = 1 \text{ mA}$		650	-	-	
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25^{\circ}\text{C}$ , $I_D = 1 \text{ mA}$		-	0.70	-	
Gate-Source Threshold Voltage (N)	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = 10 \text{ mA}$		2	-	5	
Gate-Source Leakage	$I_{GSS}$	$V_{GS} = +22 \text{ V}$		-	-	100	
		$V_{GS} = -10 \text{ V}$		-	-	100	
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 650 \text{ V}$ , $V_{GS} = 0 \text{ V}$		-	10	-	
		$V_{DS} = 650 \text{ V}$ , $V_{GS} = 0 \text{ V}$ , $T_J = 125^{\circ}\text{C}$		-	-	100	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 18 \text{ V}$	$I_D = 20 \text{ A}$	-	0.07	-	
Forward Transconductance	$g_{fs}$	$V_{DS} = 0 \text{ V}$ , $I_D = 30 \text{ A}$		-	12	-	
Dynamic							
Input Capacitance	$C_{iss}$	$V_{GS} = 0 \text{ V}$ , $V_{DS} = 600 \text{ V}$ , $f = 1 \text{ MHz}$		-	1600	-	
Output Capacitance	$C_{oss}$			-	175	-	
Reverse Transfer Capacitance	$C_{rss}$			-	9	-	
Effective Output Capacitance, Energy Related <sup>a</sup>	$C_{o(er)}$	$V_{DS} = 0 \text{ V}$ to $400 \text{ V}$ , $V_{GS} = 0 \text{ V}$		-	156	-	
Effective Output Capacitance, Time Related <sup>b</sup>	$C_{o(tr)}$			-	268	-	
Total Gate Charge	$Q_g$			-	70	-	
Gate-Source Charge	$Q_{gs}$	$V_{GS} = -5/18 \text{ V}$	$I_D = 20 \text{ A}$ , $V_{DS} = 400 \text{ V}$	-	20	-	
Gate-Drain Charge	$Q_{gd}$			-	23	-	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 400 \text{ V}$ , $I_D = 20 \text{ A}$ , $V_{GS} = -5/18 \text{ V}$ , $R_g = 2 \Omega$		-	12	15	
Rise Time	$t_r$			-	10	13	
Turn-Off Delay Time	$t_{d(off)}$			-	20	-	
Fall Time	$t_f$			-	10	-	
Gate Input Resistance	$R_g$	$f = 1 \text{ MHz}$ , open drain		-	2.2	-	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	$I_S$	MOSFET symbol showing the integral reverse p - n junction diode		-	-	30	
Pulsed Diode Forward Current	$I_{SM}$			-	-	90	
Diode Forward Voltage	$V_{SD}$	$T_J = 25^{\circ}\text{C}$ , $I_S = 20 \text{ A}$ , $V_{GS} = 0$		-	-	4.1	
Reverse Recovery Time	$t_{rr}$	$T_J = 25^{\circ}\text{C}$ , $I_F = I_S = 20 \text{ A}$ , $dl/dt = 1000 \text{ A}/\mu\text{s}$ , $V_R = 400 \text{ V}$		-	20	-	
Reverse Recovery Charge	$Q_{rr}$			-	60	-	
Reverse Recovery Current	$I_{RRM}$			-	10	-	

**Notes**

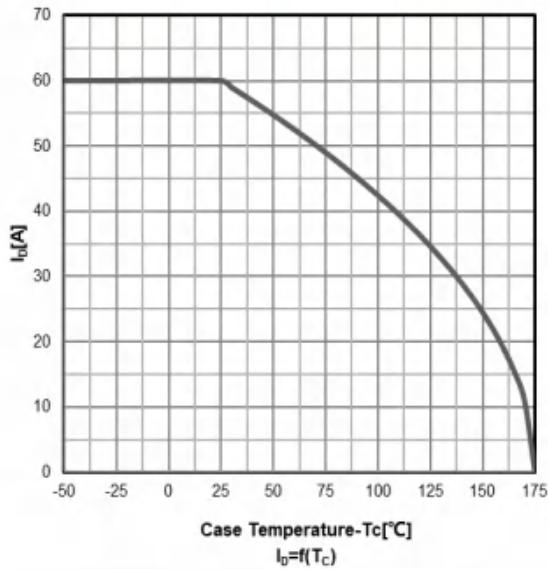
a.  $C_{oss(er)}$  is a fixed capacitance that gives the same energy as  $C_{oss}$  while  $V_{DS}$  is rising from 0 % to 60 %  $V_{DSS}$ .  
 b.  $C_{oss(tr)}$  is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 % to 60 %  $V_{DSS}$ .

Safe operating area  $T_c=25\text{ }^\circ\text{C}$   
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On-Region characteristics  $T_j=25\text{ }^\circ\text{C}$ On-Region characteristics  $T_j=175\text{ }^\circ\text{C}$ 

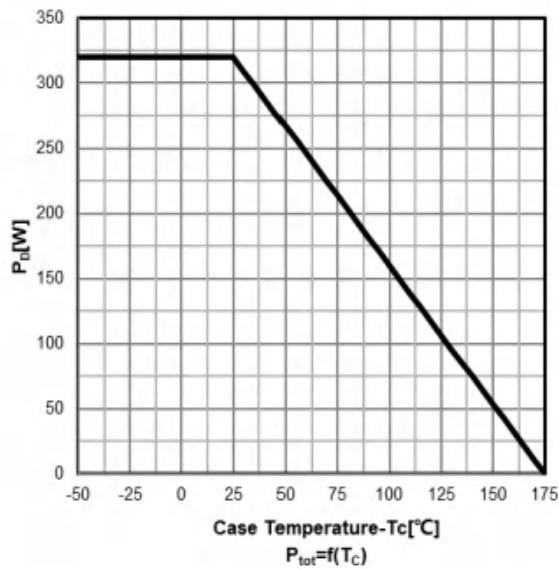
Transfer characteristics



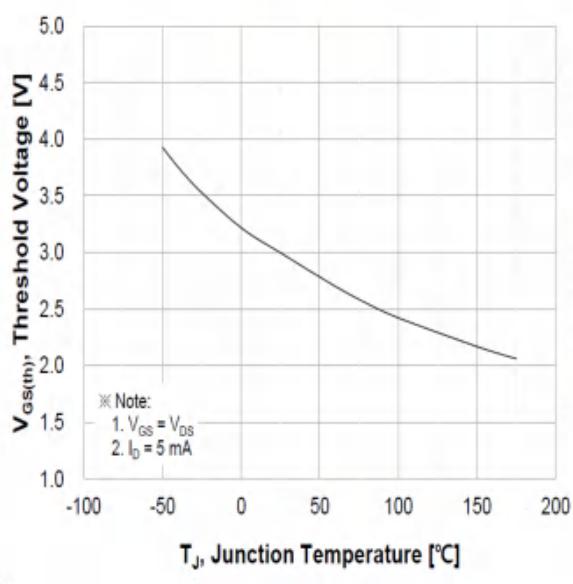
Drain current vs temperature



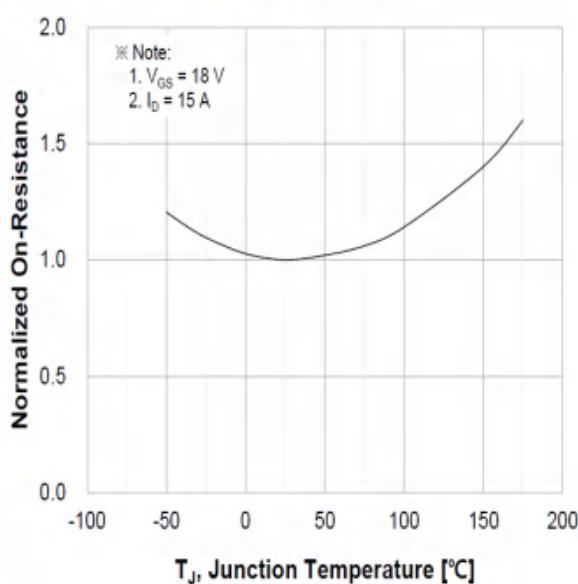
Power dissipation



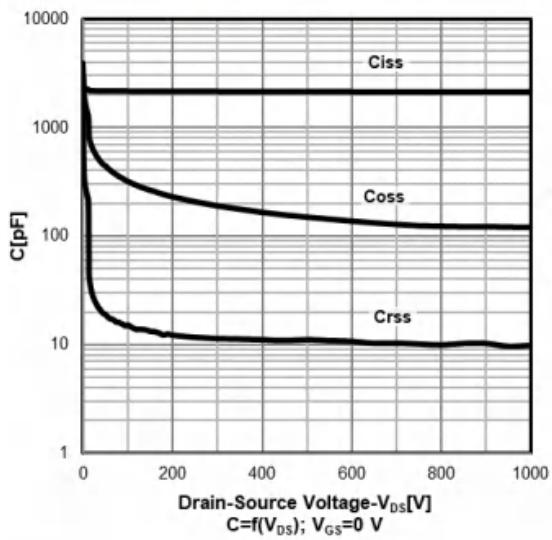
Threshold voltage vs temperature



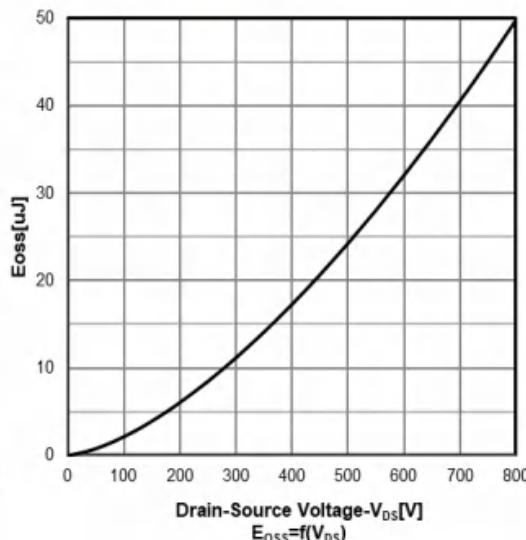
Normalized On-resistance vs temperature



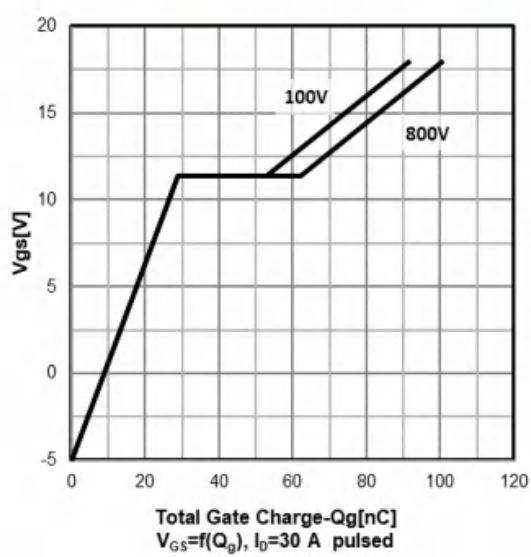
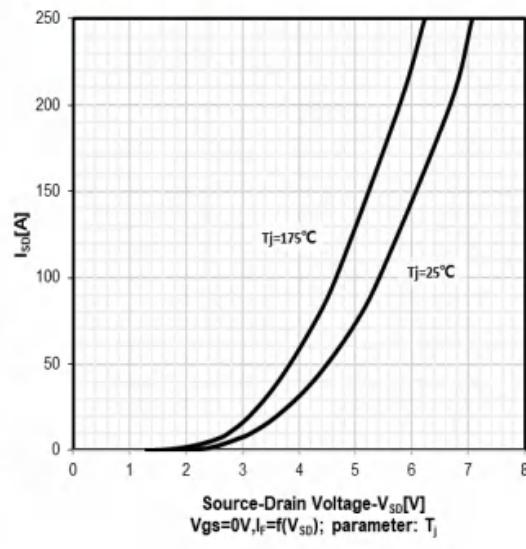
Typ. capacitances



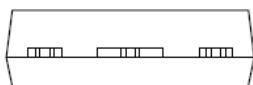
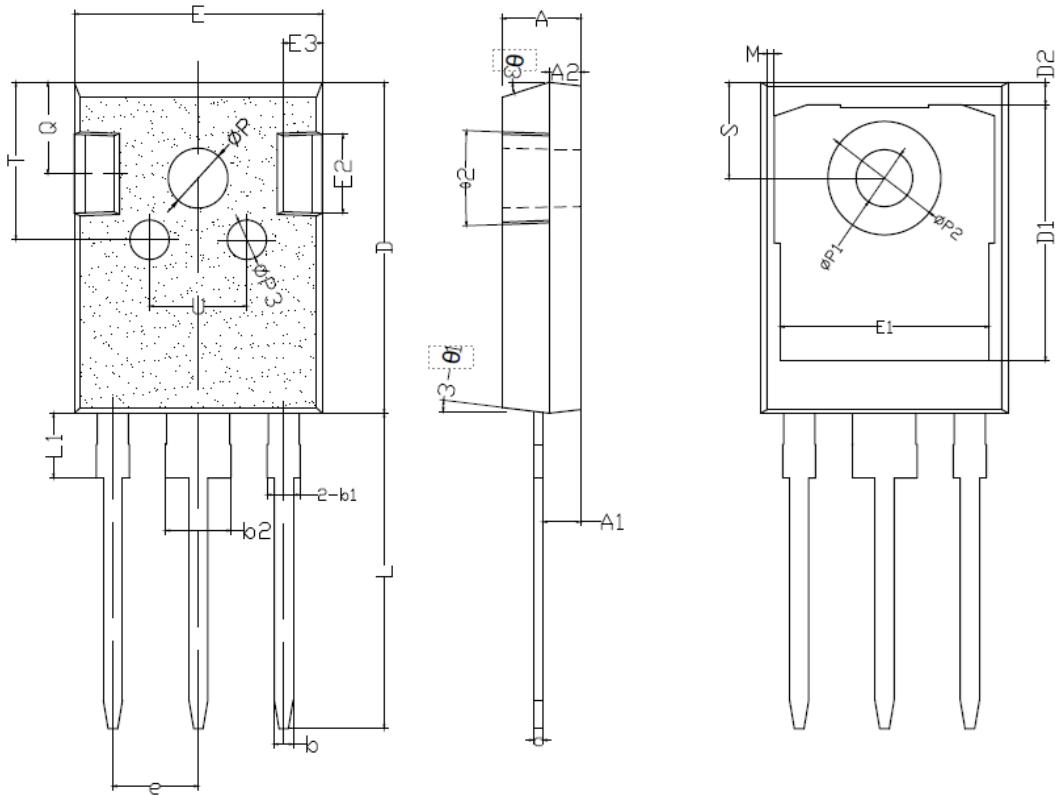
Coss stored energy



Typ. gate charge characteristics

Diode forward voltage characteristics  
 $T_j=25$  °C/175 °C

## TO-247 PACKAGE OUTLINE DIMENSIONS



SYMBOL	mm		
	MIN	NOM	MAX
*A	4.90	5.00	5.10
*A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
*b	1.15	1.20	1.25
*b1	1.95	2.10	2.25
*b2	2.95	3.10	3.25
*c	0.55	0.60	0.65
*D	20.90	21.00	21.10
D1	16.35	16.55	16.75
D2	1.05	1.20	1.35

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