

650V N-Channel MOSFET
Description

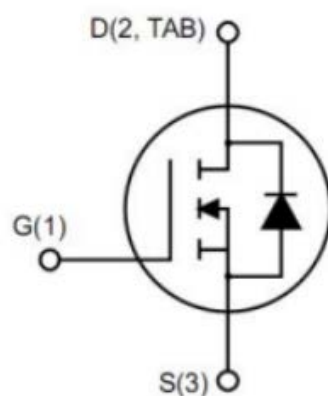
Silicon Carbide (SiC) MOSFET use a completely new technology that provide superior switching performance and higher reliability compared to Silicon. In addition, the low ON resistance and compact chip size ensure low capacitance and gate charge. Consequently, system benefits include highest efficiency, faster operating frequency, increased power density, reduced EMI, and reduced system size.

Features

- High Speed Switching with Low Capacitances
- High Blocking Voltage with Low RDS(on)
- Optimized package with separate driver source pin
- Easy to parallel and simple to drive
- ROHS Compliant, Halogen free


Application

- EV motor drive
- High Voltage DC/DC Converters
- Switch Mode Power Supplies
- Solar inverters
- EV charging


Ordering Information

Part Number	Marking	Package	Packaging
ASR90N650MD88PB	ASR90N650MD88	TDFN8*8	Reel

Absolute Maximum Ratings(Tc=25℃)

Symbol	Parameter	Value	Unit
V _{DS}	Drain-Source Voltage	650	V
I _D	Drain Current(continuous)at Tc=25℃	25	A
I _D	Drain Current(continuous)at Tc=100℃	18	A
I _{DM}	Drain Current (pulsed)	100	A
V _{GS}	Gate-Source Voltage	-5/+15	V
P _D	Power Dissipation T _C = 25℃	102	W
T _J , Tstg	Junction and Storage Temperature Range	-55 to +175	℃

Electrical Characteristics(T_J = 25℃ unless otherwise specified)
Typical Performance-Static

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
BV _{DS}	Drain-source Breakdown Voltage	I _D =250uA, V _{GS} =0V	650			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =650V, V _{GS} =0V, T _J =25℃		5	100	uA
I _{GSS}	Gate-body Leakage Current	V _{DS} =0V ; V _{GS} =-5 to 15V		10	250	nA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D =2mA	1.2	1.8	2.5	V
V _{GS(on)}	Recommended turn-on Voltage	Static		12		V
V _{GS(off)}	Recommended turn-off Voltage			-3		V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} =12V, I _D =5A		72	90	mΩ
		V _{GS} =12V, I _D =5A T _J =175℃		108		mΩ

Typical Performance-Dynamic

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input Capacitance	$V_{DS}=600V, f=1MHz,$ $V_{AC}=25mV$		1450		pF
C_{oss}	Output Capacitance			110		pF
C_{rss}	Reverse Transfer Capacitance			4.6		pF
g_{fs}	Transconductance	$V_{DS}=20V, I_D=15A$		3.5		S
E_{oss}	Coss Stored Energy	$V_{DS}=600V, f=1MHz$		18		μJ
E_{ON}	Turn-On Energy (Body Diode)	$V_{DS}=400V,$ $V_{GS}=-3/12V, I_D=15A,$ $L=150\mu H, T_J=175^\circ C$		72		μJ
E_{OFF}	Turn-Off Energy (Body Diode)			8		μJ
Q_g	Total Gate Charge	$V_{DS}=400V,$ $V_{GS}=-3V/12V, I_D=15A,$		75		nC
Q_{gs}	Gate-source Charge			19		nC
Q_{gd}	Gate-Drain Charge			26		nC
$R_{G(int)}$	Internal Gate Resistance	$f=1MHz, V_{AC}=25mV$		5.5		Ω
$t_{d(on)}$	Turn-on Delay Time	$V_{DS}=400V,$ $V_{GS}=-3V/12V,$ $I_D=15A, L=150\mu H$ $R_{ext}=2.5\Omega$		9.5		ns
t_r	Rise Time			20		ns
$t_{d(off)}$	Turn-off Delay Time			17		ns
t_f	Fall Time			7		ns

Typical Performance-Reverse Diode($T_J = 25^\circ C$ unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{FSD}	Forward Voltage	$V_{GS}=0V, I_F=5A, T_J=25^\circ C$		4.5	6	V
		$V_{GS}=0V, I_F=5A, T_J=175^\circ C$		4.2	6	V
I_S	Continuous Diode Forward Current	$V_{GS}=0V, T_C=25^\circ C$		20		A
t_{rr}	Reverse Recovery Time	$V_{GS}=-3V, I_F=15A,$ $V_R=400V, di/dt=2400A/\mu s,$ $T_J=175^\circ C$		12		nS
Q_{rr}	Reverse Recovery Charge			80		nC
I_{rrm}	Peak Reverse Recovery Current			10		A

Thermal Characteristics

Symbol	Parameter	Value.	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1.46	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	40	$^\circ C/W$

The values are based on the junction-to case thermal impedance which is measured with the device mounted to a large heat sink assuming maximum junction temperature of $T_J(max)=175^\circ C$

Electrical Characteristics

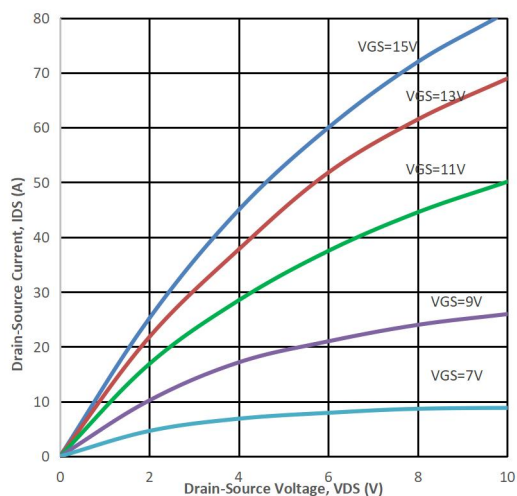
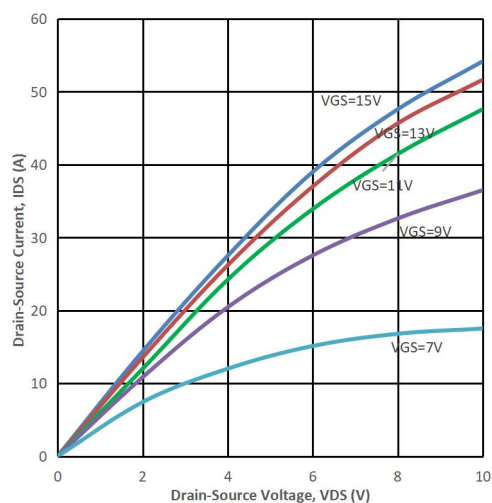
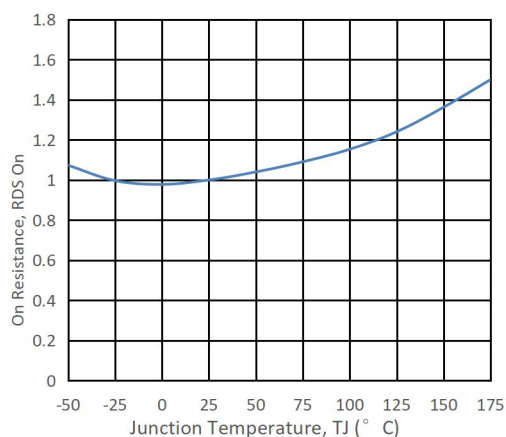
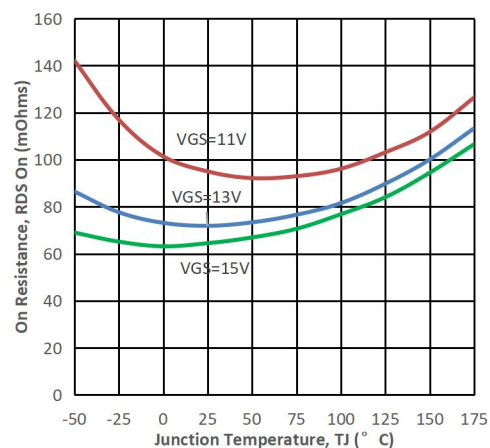
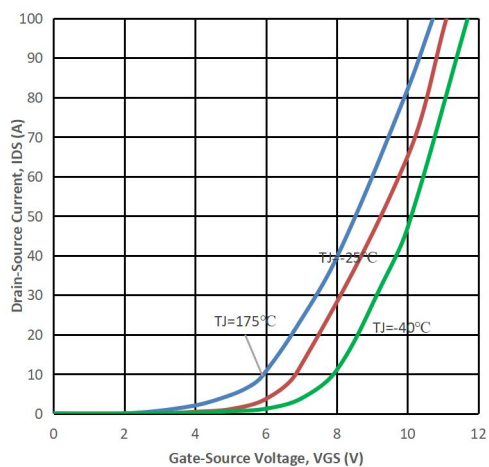
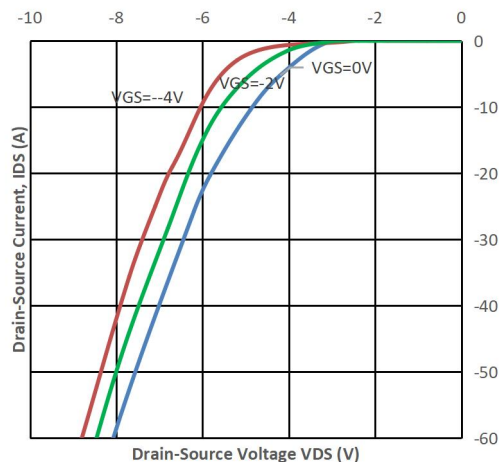
Fig1. Output characteristics ($T_J = 25^\circ\text{C}$)

Fig2. Output characteristics ($T_J = 175^\circ\text{C}$)

Fig3. Normalized On-Resistance vs. Temperature

Fig4. On-Resistance vs. Temperature

Fig5. Transfer Characteristic

Fig6. Body Diode Characteristic at 25°C


Fig7. Threshold Voltage vs. Temperature

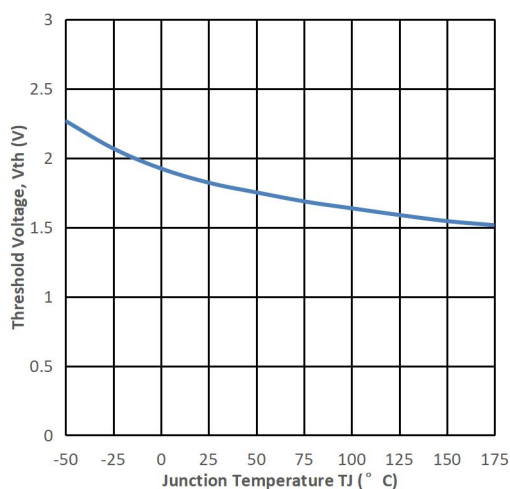


Fig8. Gate Charge Characteristics

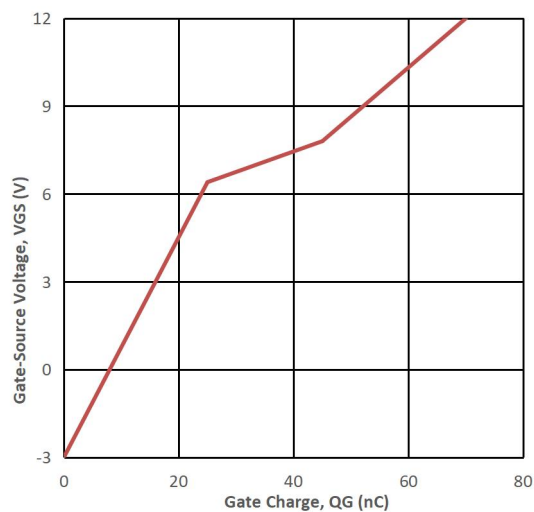


Fig9. 3rd Quadrant Characteristic at 25 °C

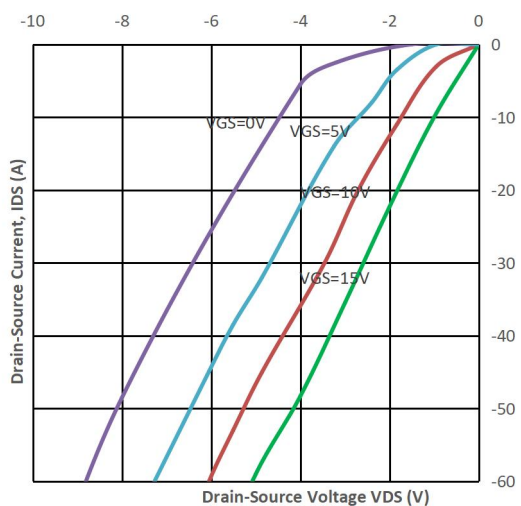


Fig10. Output Capacitor Stored Energy

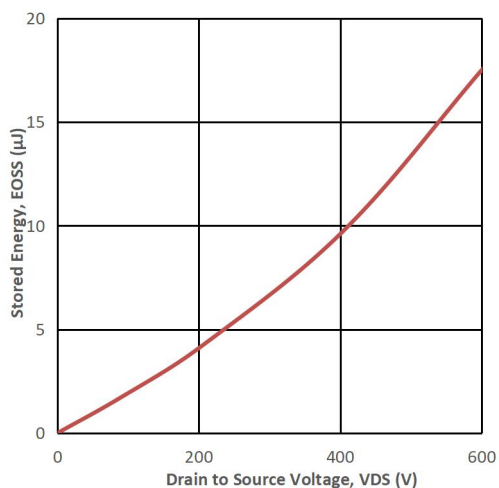


Fig11. Capacitances vs. Drain-Source

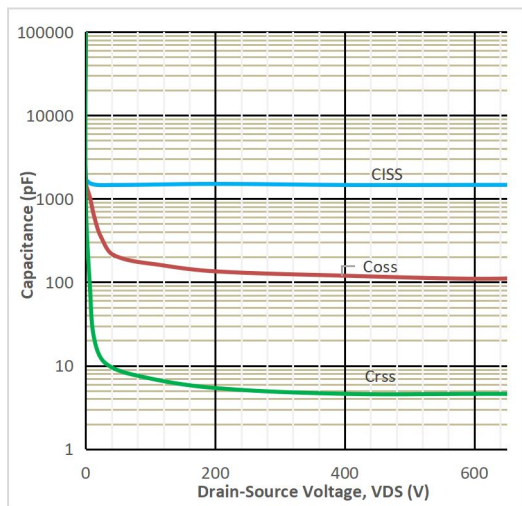


Fig12. Max Power Dissipation Derating Vs Tc

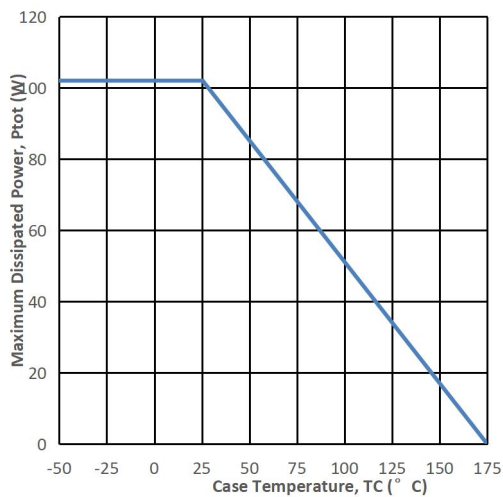
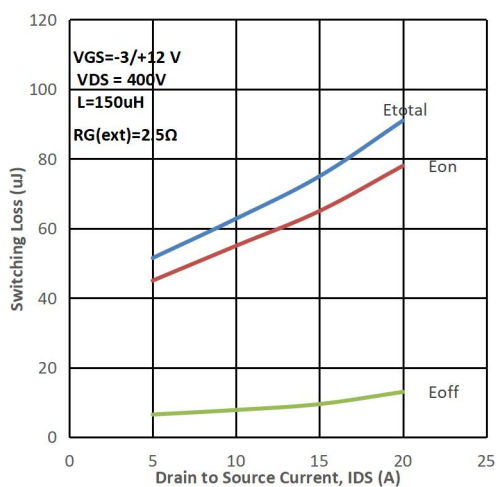
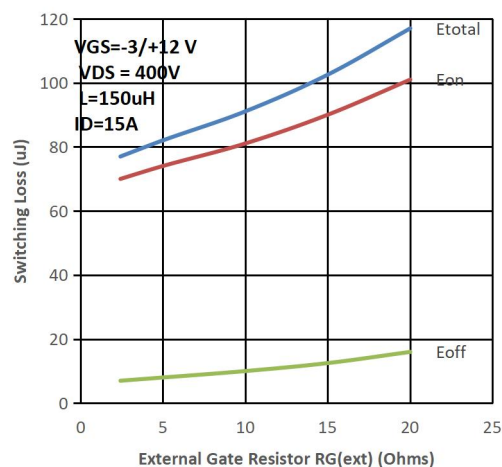
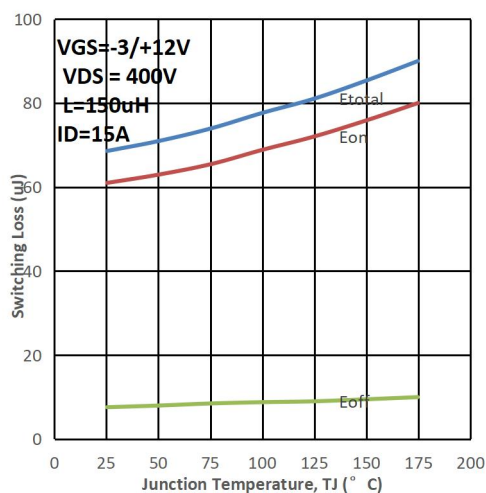
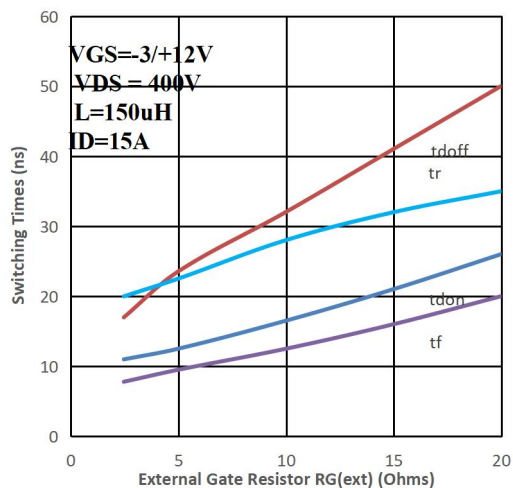
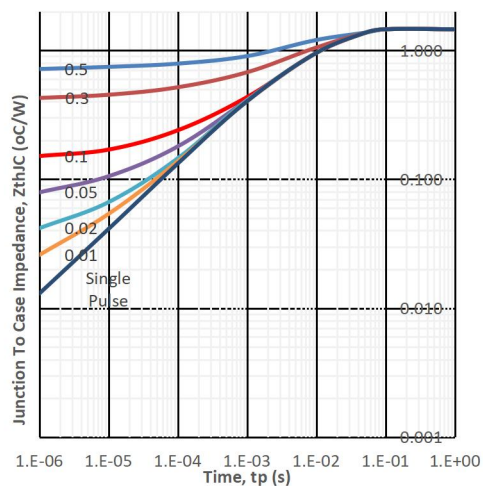
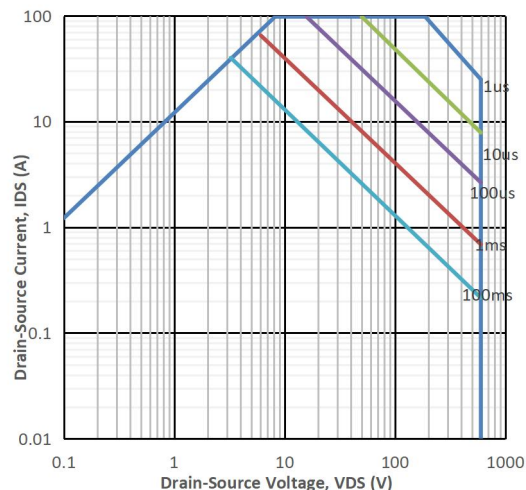
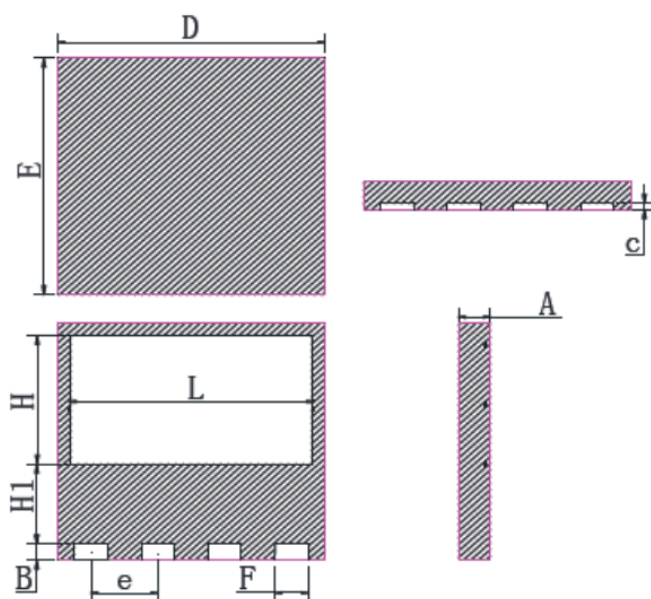


Fig13. Switching Energy vs. Drain Current

Fig14. Switching Energy vs. $R_{G(ext)}$

Fig15. Switching Energy vs. Temperature

Fig16. Switching Times vs. $R_{G(ext)}$

Fig17. Transient Thermal Impedance

Fig18. Safe Operating Area


Package Drawing:

Dimensions (UNIT: mm)

Symbol	Min	Typ	Max
A	0.90	0.95	1.00
B	0.45	0.55	0.65
C	0.153	0.203	0.253
D	7.90	8.00	8.10
E	7.90	8.00	8.10
e	1.90	2.00	2.10
F	0.90	1.00	1.10
H	4.20	4.35	4.45
H1	2.60	2.70	2.80
L	7.10	7.20	7.3

Notes:

- The information in this document is subject to change without notice.
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