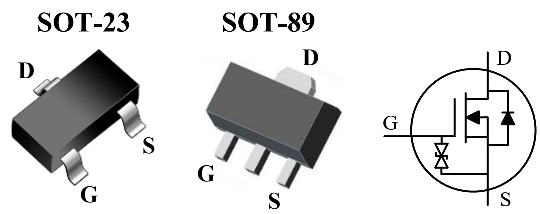
UltraVt® Depletion-Mode Power MOSFET

General Features

- ESD Improved Capability
- Depletion Mode (Normally On)
- Proprietary Advanced Planar Technology
- Proprietary Advanced Ultrahigh Vth Technology
- Optimized for SiC MOSFET Gate Drive
- High-Voltage LDO Functionality
- RoHS Compliant
- Halogen-free Available

BV_{DSX}	$V_{GS(off)}$	$I_{DSS(Min.)}$
130V	**-26V to -18V**	**100mA**



Applications

- Sic MOSFET Gate Drive Supply
- High-Voltage Auxiliary Power Supplies
- Industrial and Consumer High-Voltage LDO Applications
- Primary-Side Auxiliary Winding Regulation for Type-C / PD Fast Chargers
- Current Source
- Voltage Source

General Description

This novel depletion mode MOSFET is developed and manufactured using ARK's proprietary UltraVt® technology. It has a high threshold voltage. By using the sub threshold characteristics, the depletion mode MOSFET can provide stably power to the load, and the voltage can be clamped to protect the load without Zener diode, and the circuit consumption is reduced. It is also optimized for SiC MOSFET gate drive, providing 18V~20V output for fast chargers.

Ordering Information

Part Number	Package	Marking	Remark
DMZ1318E	SOT-23	1318	Halogen Free
DMX1318E	SOT-89	1318	Halogen Free

Absolute Maximum Ratings

T_A = 25°C unless otherwise specified

Symbol	Parameter	DMZ1318E	DMX1318E	Unit
V_{DSX}	Drain-to-Source Voltage [1]	130		V
V_{DGX}	Drain-to-Gate Voltage [1]	130		V
V_{GS}	Gate-to-Source Voltage	±32		V
I_D	Continuous Drain Current [2]	0.1		A
I_{DM}	Pulsed Drain Current [3]	0.4		A
P_D	Power Dissipation [4]	0.5	1.0	W
T_L	Soldering Temperature Distance of 1.6mm from case for 10 seconds	300		℃
T_J & T_{STG}	Operating and Storage Temperature Range	-55 to 150		℃

Caution: Stresses beyond those listed in the "Absolute Maximum Ratings" may cause permanent damage to the device.

Thermal Characteristics

Symbol	Parameter	DMZ1318E	DMX1318E	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	250	125	°C/W

Electrical Characteristics

OFF Characteristics

T_A = 25°C unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
BV_{DSX}	Drain-to-Source Breakdown Voltage	130	--	--	V	V_{GS} = -32V, I_D = 250μA
$I_{D(off)}$	Drain-to-Source Leakage Current	--	--	20	μA	V_{DS} = 130V, V_{GS} = -32V
I_{GSS}	Gate-to-Source Leakage Current	--	--	20	μA	V_{GS} = 32V, V_{DS} = 0V
		--	--	-20		V_{GS} = -32V, V_{DS} = 0V

ON Characteristics

T_A = 25°C unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
I_{DSS}	Saturated Drain-to-Source Current	100	--	--	mA	V_{DS}=25V, V_{GS}=0V [5]
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	--	--	30	Ω	V_{GS} = 0V, I_D = 50mA [5]
$V_{GS(off)}$	Gate-to-Source Cut-off Voltage	-26	--	-18	V	V_{DS} = 35V, I_D = 100μA

Source-Drain Diode Characteristics

T_A = 25°C unless otherwise specified

Symbol	Parameter	Min	Typ.	Max.	Unit	Test Conditions
V_{SD}	Diode Forward Voltage	--	--	1.2	V	I_{SD} = 100mA, V_{GS} = -32V

NOTE：

[1] T_J = +25°C to +150°C.
[2] T_C = +25°C.
[3] Repetitive rating, pulse width limited by maximum junction temperature.
[4] T_C = +25°C.
[5] Pulse width ≤ 380μs, duty cycle ≤ 2%.

Typical Application

For the deployment of SiC MOSFETs in fast charging solutions, their specific gate drive requirements must first be addressed. Unlike GaN devices, which typically operate with a gate drive voltage of 6 V to 12 V, mainstream 650 V / 1200 V SiC MOSFETs require a gate drive voltage of +18 V to +20 V. Insufficient gate drive voltage significantly increases the on-resistance of the device, leading to higher conduction losses and reduced efficiency, thereby preventing the full utilization of SiC's low on-resistance characteristics.

To meet this drive voltage requirement in practical designs, careful consideration must be given to the power supply architecture. In a typical primary-side PD fast charger, the PWM controller is usually powered by an auxiliary winding through an LDO regulator. When adopting a SiC-based solution, this LDO must satisfy two basic requirements: first, it must have sufficient voltage margin (typically above 100 V); second, its output voltage must be stably regulated above 18 V to ensure adequate driving of the SiC MOSFET.

The typical application circuit is shown in Figure 1.

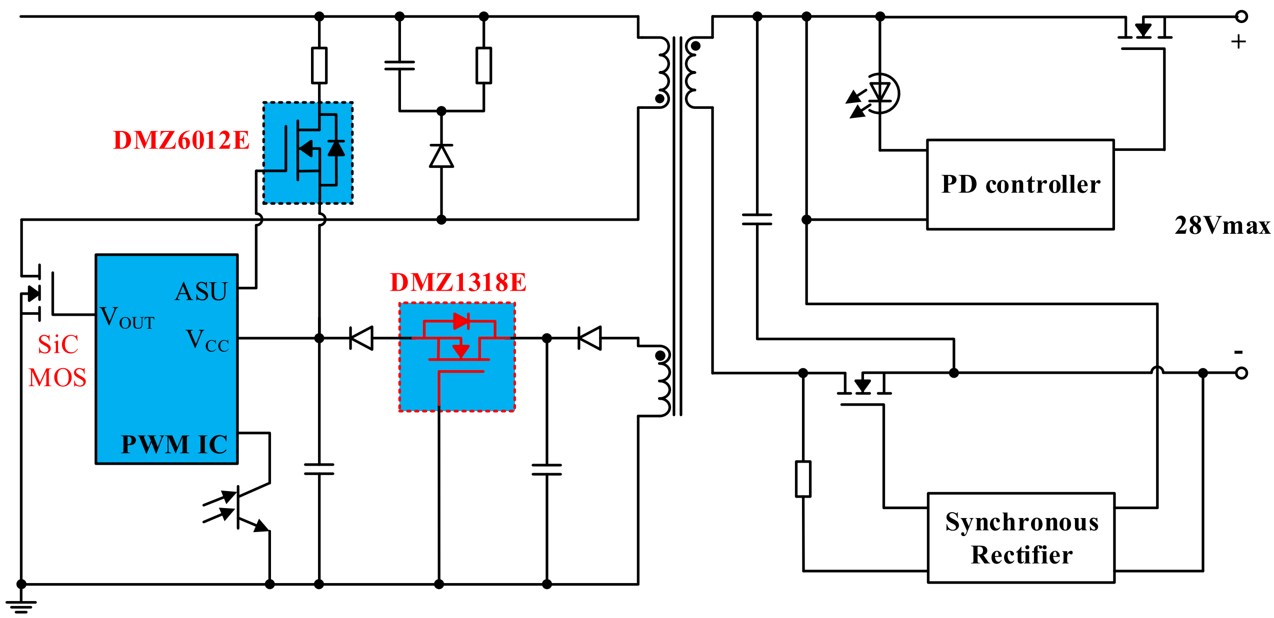


Figure 1. Type-C / PD Charger Circuit with DMZ1318E

The DMZ1318E is ideally suited for this application, providing:

Output Voltage Precisely Matches SiC Drive Window

The DMZ1318E delivers a typical output voltage of 20 V at a 5 mA load condition, with guaranteed output above 18 V. This voltage range covers the recommended gate drive voltage window (18 V to 20 V) for mainstream SiC MOSFETs, enabling full turn-on of the SiC power device and fully utilizing its low on-resistance characteristics.

Sufficient Voltage Margin

With a device voltage rating of 130 V, the DMZ1318E provides adequate margin to cope with power line fluctuations and start-up transients in PD fast charger primary-side applications, delivering stable power to the subsequent PWM IC.

Simple External Circuitry and Low Quiescent Current

As a member of the DMZ1015E/DMZ1315E series, the DMZ1318E inherits the same simple external circuit design, reliable voltage regulation characteristics, and low quiescent current. For engineers already familiar with DMZ1015E and similar devices, this minimizes repetitive design efforts when developing SiC-based solutions.

Flexible Package Options

Available in SOT-23 (ideal for compact fast charger designs) and SOT-89 (suitable for applications requiring enhanced heat dissipation) packages, the DMZ1318E accommodates the mechanical and thermal requirements of PD products across different power levels.

In addition, the DMZ1318E can also be used in power supplies employing a PFC + LLC resonant converter topology. A typical application is shown in Figure 2. The DMZ1318E provides a stable supply voltage for the AC/DC controller and half-bridge driver. Under a 5 mA load condition, the typical output voltage is 20 V, with guaranteed output above 18 V.

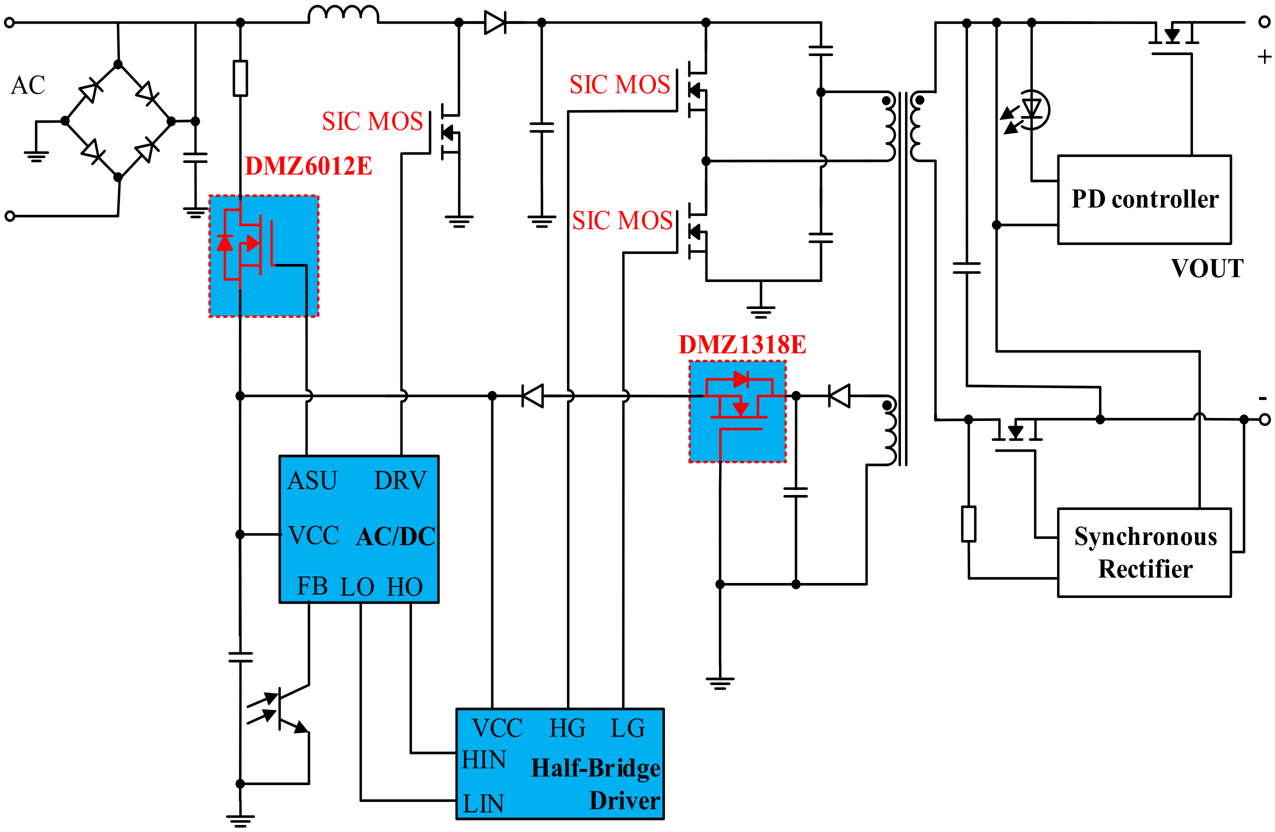


Figure 2. PFC + LCC Resonant Converter Circuit with DMZ1318E

Typical and highlight Characteristics

Figure3. Maximum Power Dissipation vs. Ambient Temperature

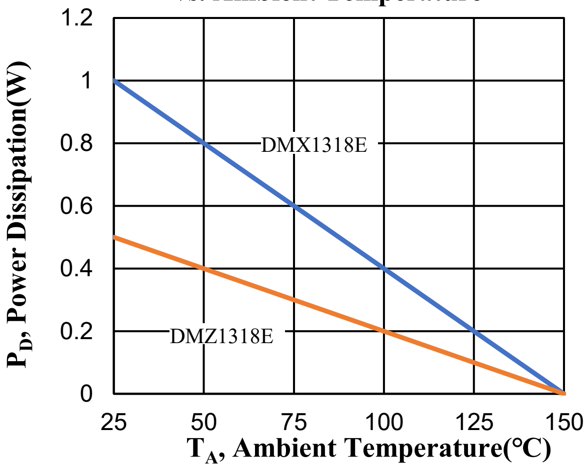
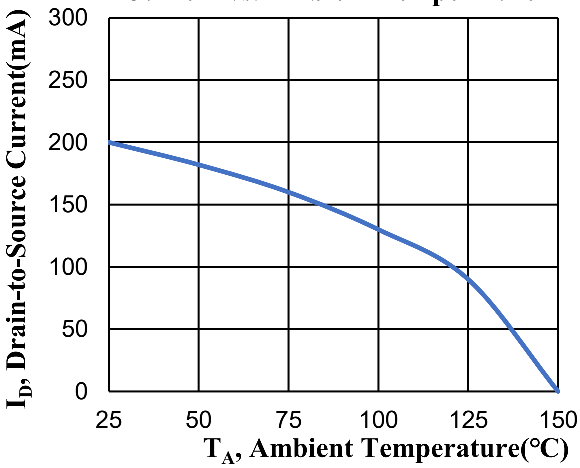


Figure4. Maximum Continuous Drain Current vs. Ambient Temperature



DMZ1318E/DMX1318E is an UltraVt® depletion mode MOS device. A stable output voltage source or current source is implemented by using the sub-threshold characteristics of the device. Its basic application is shown as Figure 5:

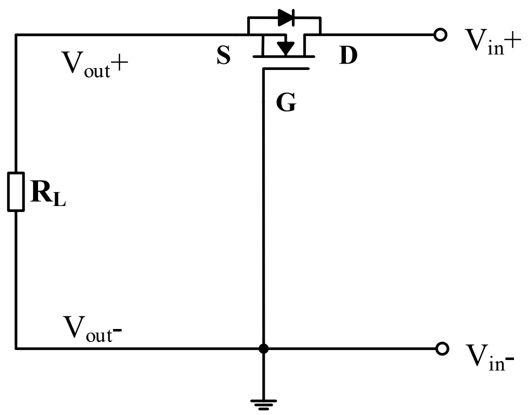


Figure5. Drain Current ID is decided by Load Resistance

Figure 6. Clamp Voltage vs. Drain Current

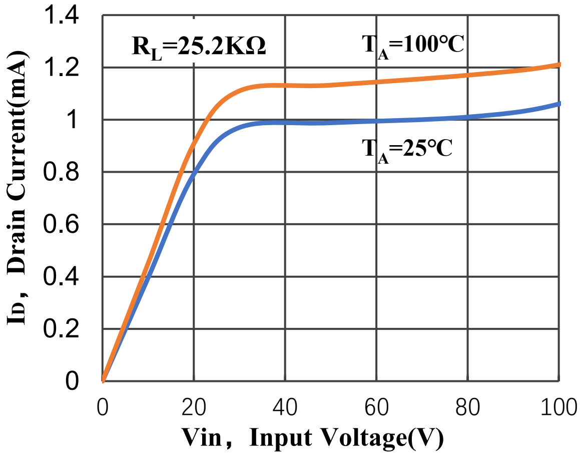
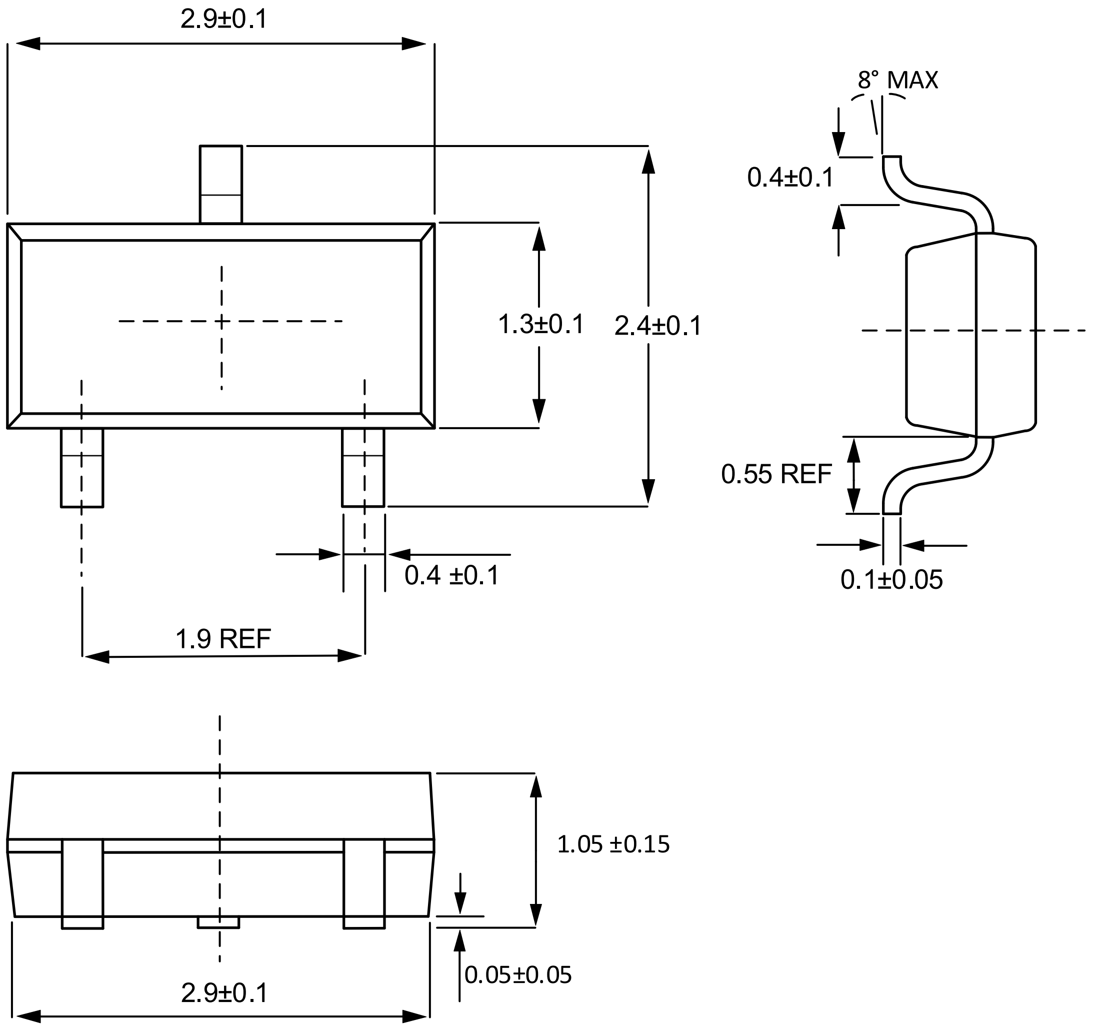


Figure6. Clamp Voltage vs. Drain Current

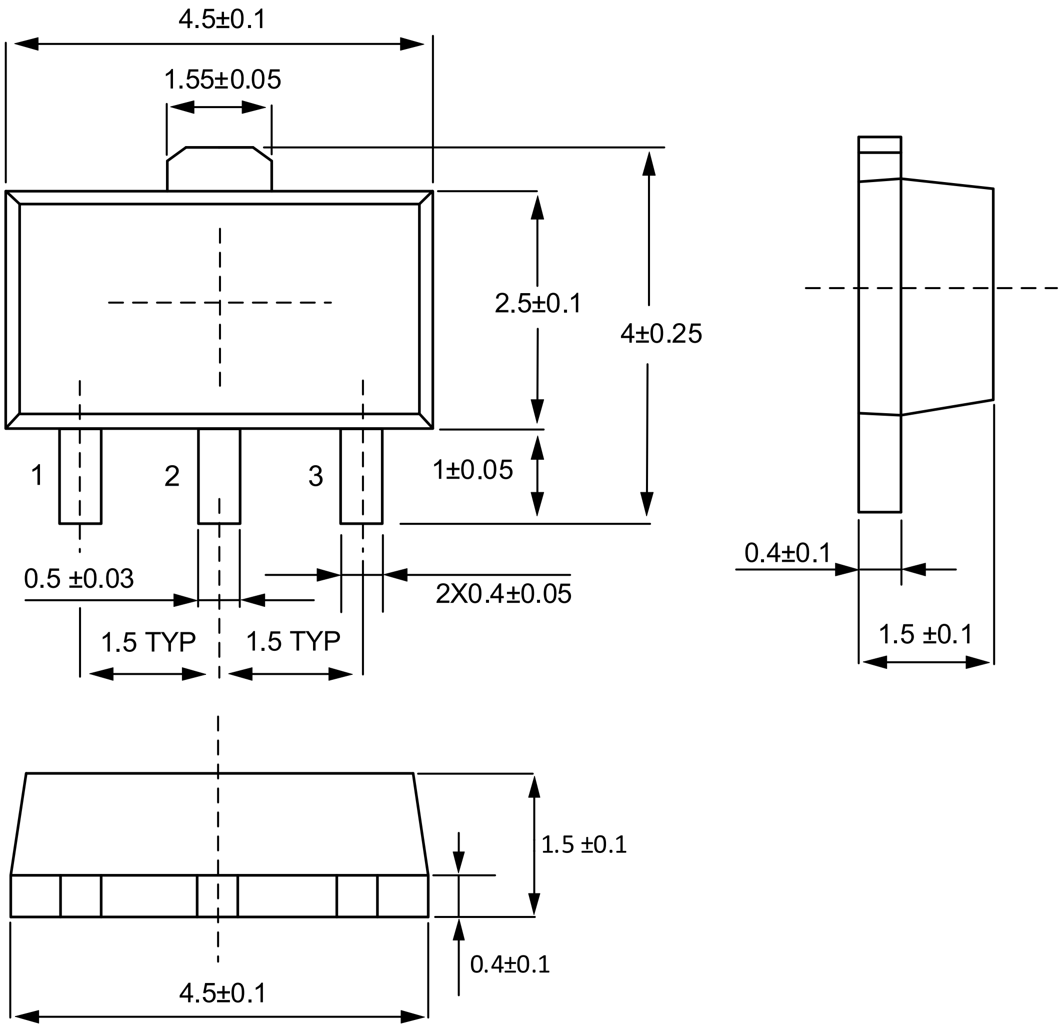
Package Dimensions

SOT-23



Unit：mm

SOT-89



Unit：mm

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