UltraVt® Depletion-Mode Power MOSFET

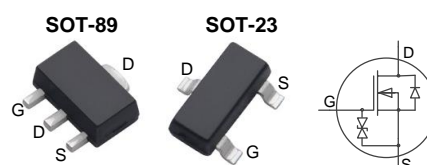## General Features

➢ ESD Improved Capability
➢ Depletion Mode (Normally On)
➢ Proprietary Advanced Planar Technology
➢ Proprietary Advanced Ultrahigh Vth Technology
➢ RoHS Compliant
➢ Halogen-free Available

BV_{DSX}	$V_{GS(off)}$	$I_{DSS,min}$
130V	-17V to -27V	100mA

Applications

➢ Quick Charger
➢ Current Source
➢ Voltage Source
➢ Type-C/PD charger

SOT-89   SOT-23

General Description

This novel depletion mode MOSFET, developed and manufactured by ARK 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.

Ordering Information

Part Number	Package	Marking	Remark
DMZ1315E	SOT-23	1315	Halogen Free
DMX1315E	SOT-89	1315	Halogen Free

Absolute Maximum Ratings

$T_A=25℃$ unless otherwise specified

Symbol	Parameter	DMZ1315E	DMX1315E	Unit
V_{DSX}	Drain-to-Source Voltage[1]	130		V
I_D	Continuous Drain Current	0.1		A
I_{DM}	Pulsed Drain Current[2]	0.4		
P_D	Power Dissipation	0.5	1.0	W
V_{GS}	Gate-to-Source Voltage	±30		V
V_{ESD}	Gate to Source ESD[3]	700		V
	Source to Gate ESD[3]	700		V
T_L	Soldering Temperature Distance of 1.6mm from case for 10 seconds	300		℃
T_J and T_{STG}	Operating and Storage Temperature Range	-55 to 150		

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

Thermal Characteristics

Symbol	Parameter	DMZ1315E	DMX1315E	Unit
$R_{θJA}$	Thermal Resistance, Junction-to-Ambient	250	125	K/W

Electrical Characteristics

OFF Characteristics

T_A =25℃ unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
BV_{DSX}	Drain-to-Source Breakdown Voltage	130	--	--	V	V_{GS}=-30V, I_D=250uA
$I_{D(OFF)}$	Drain-to-Source Leakage Current	--	--	10	µA	V_{DS}=130V，V_{GS}= -30V
I_{GSS}	Gate-to-Source Leakage Current	--	--	20	µA	V_{GS}=+30V, V_{DS}=0V
		--	--	-20		V_{GS}=-30V, V_{DS}=0V

ON Characteristics

T_A =25℃ unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
I_{DSS}	Saturated Drain-to-Source Current	100	--	--	mA	V_{GS}=0V, V_{DS}=25V
$R_{DS(ON)}$	Static Drain-to-Source On-Resistance	--	11	30	Ω	V_{GS}=0V，I_D=50mA[4]
$V_{GS(OFF)}$	Gate-to-Source Cut-off Voltage	-17	--	-27	V	V_{DS}=9V, I_D=8µA
V_{CL}	Source-to-Gate Clamp Voltage	-11.5	--	--	V	V_{DS}=9V, I_D=5mA

Source-Drain Diode Characteristics

T_A=25℃ unless otherwise specified

Symbol	Parameter	Min	Typ.	Max.	Units	Test Conditions
V_{SD}	Diode Forward Voltage	--	--	1.2	V	I_{SD}=100mA, V_{GS}=-30V

NOTE：

[1] T_J=+25℃ to +150℃
[2] Repetitive rating, pulse width limited by maximum junction temperature.
[3] The test is based on JEDEC EIA/JESD22-A114 (HBM).
[4] Pulse width≤380µs; duty cycle≤2%.

Typical and highlight Characteristics

DMZ1315E/DMX1315E 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 1:
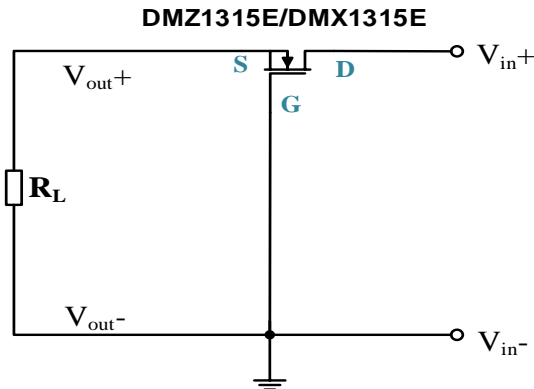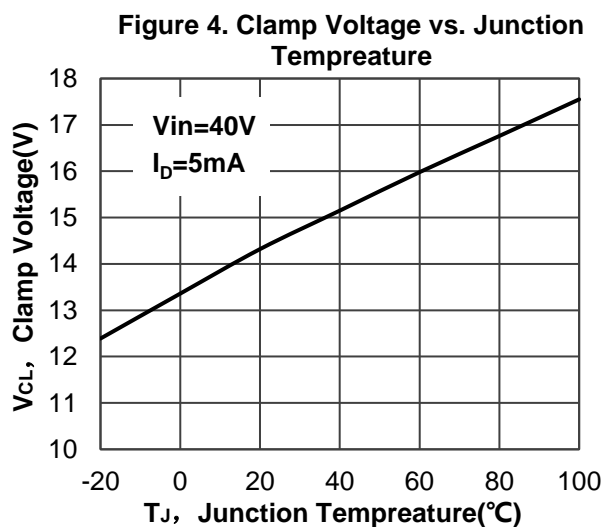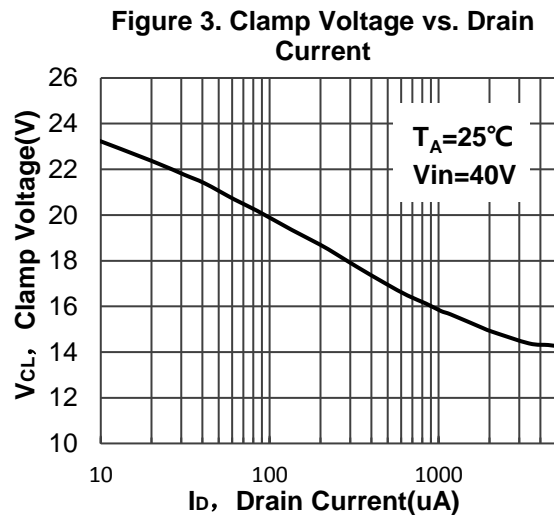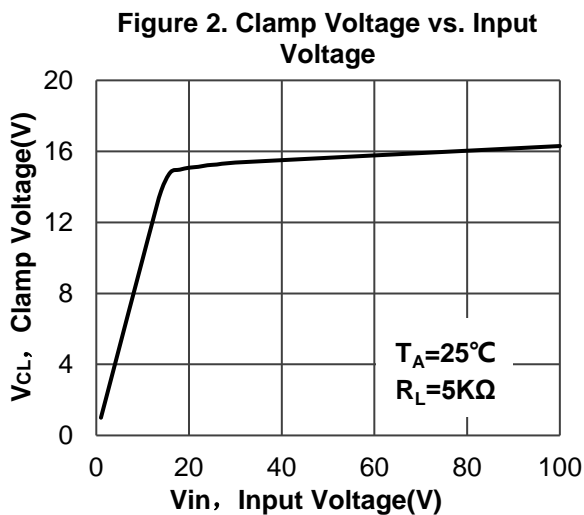
DMZ1315E/DMX1315E

Figure1. Drain Current I_D is decided by Load Resistance

Figure 2. Clamp Voltage vs. Input Voltage

$T_A=25℃$
$R_L=5KΩ$

V_{CL}, Clamp Voltage(V) vs. Vin，Input Voltage(V)

Figure 3. Clamp Voltage vs. Drain Current

$T_A=25℃$
$V_{in}=40V$

V_{CL}, Clamp Voltage(V) vs. I_D, Drain Current(uA)

Figure 4. Clamp Voltage vs. Junction Tempreature

$V_{in}=40V$
$I_D=5mA$

V_{CL}, Clamp Voltage(V) vs. T_J, Junction Tempreature(℃)

Typical Application

In the QC2.0/3.0 and Type-C/PD charger circuits, using DMZ1315E/DMX1315E as a high voltage linear regulators can make the PWM IC power supply circuit more simplified, as shown below:

In Figure 5, the transistor Q is used to provide power, and the zener diode Z is used to clamp voltage, the power supply circuit of IC is composed of several components.
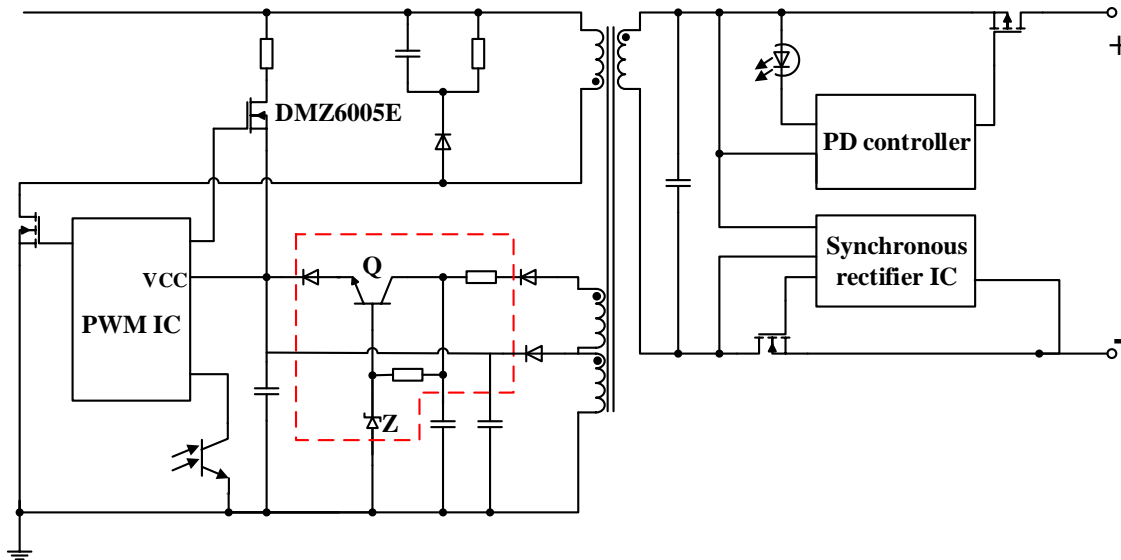

Figure 5. Normal Circuit with Transistor and Diode

In Figure 6, providing power and clamp voltage use only one device—DMZ1315E/DMX1315E, the circuit is simplified.
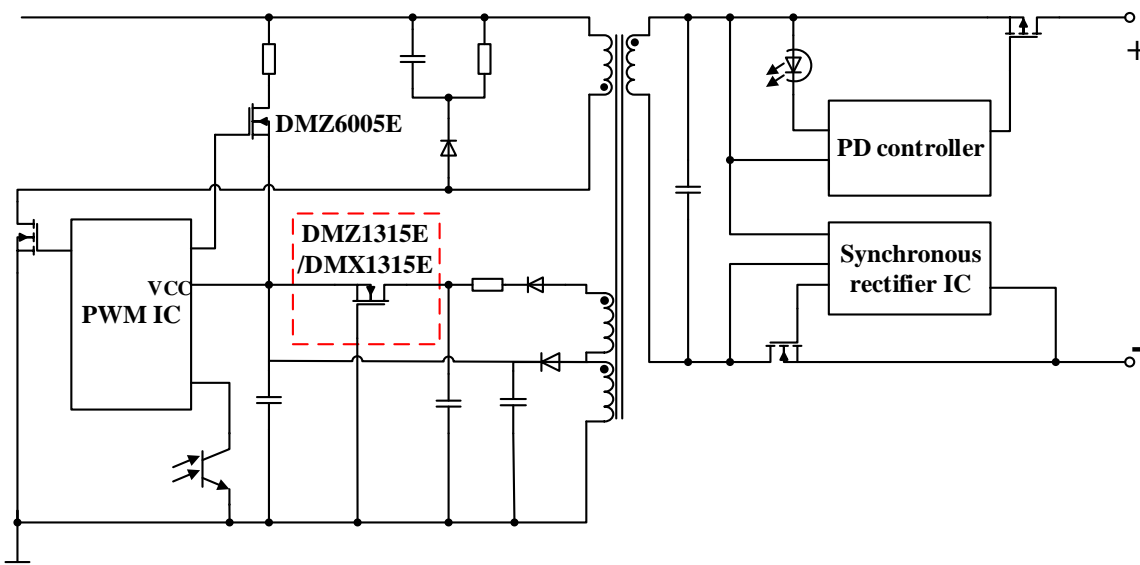

Figure 6. Circuit with DMZ1315E/DMX1315E

From the above function, we can see the depletion mode MOSFET operate in sub-threshold region, the Vout is always below or closed to the threshold voltage or Gate-to-Source Cut-off Voltage $V_{GS(OFF)}$, no matter how the input voltage Vin changes. Therefore, in addition to provide power for load like IC, the output voltage Vout can be clamped to the $V_{GS(OFF)}$, the IC is then protected from variable voltage or current. DMZ1315E/DMX1315E can support up to 130V input voltage. Vout and Vin have relations following the formulas:

If   Vin < / V$_{GS(OFF)}$ / , then   Vout ≈ Vin

If   Vin ≥ / V$_{GS(OFF)}$ / , then   Vout ≤ V$_{GS(OFF)}$

The Ultrahigh Vth Depletion Mode Power MOSFET--DMZ1315E/DMX1315E, was developed by ARK Microelectronics proprietary and patent technology. The threshold voltage V$_{GS(OFF)}$ of DMZ1315E/ DMX1315E is between -17V and -27V, can provide sufficient voltage for load such like a PWM IC in the primary side of a Flyback converter.

Package Dimensions

SOT-23
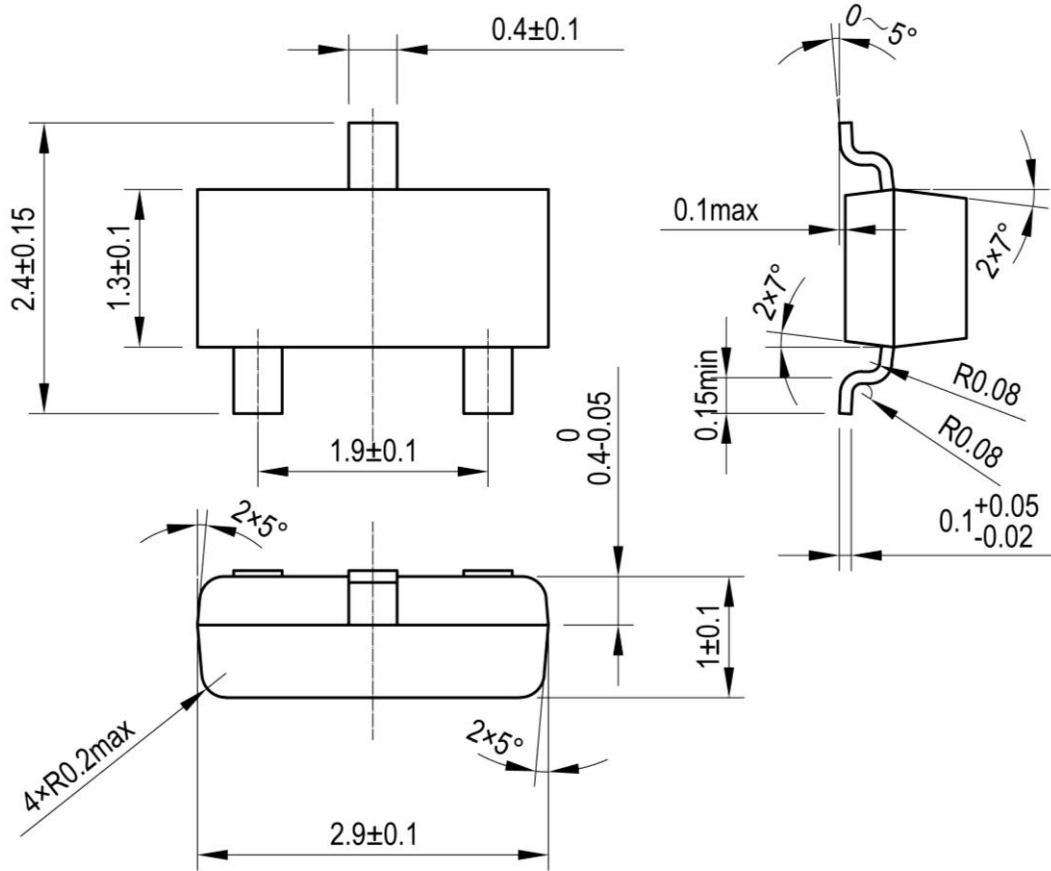
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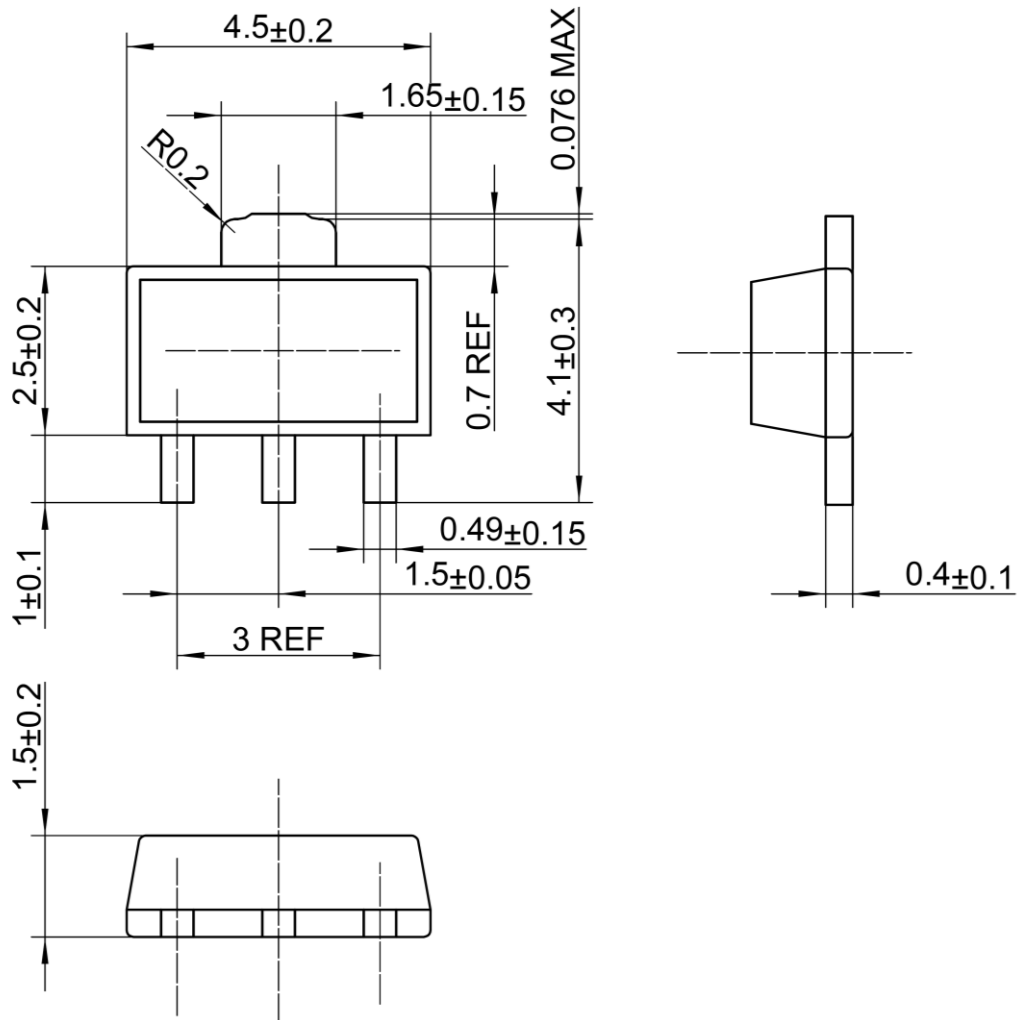
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