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

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
$R_{\theta JA}$	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:

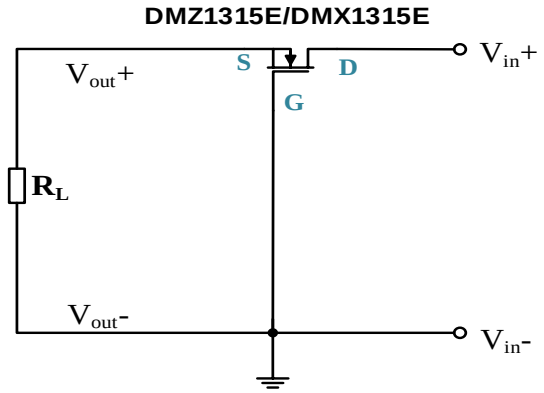


Figure1. Drain Current I_D is decided by Load Resistance

Figure 2. Clamp Voltage vs. Input Voltage

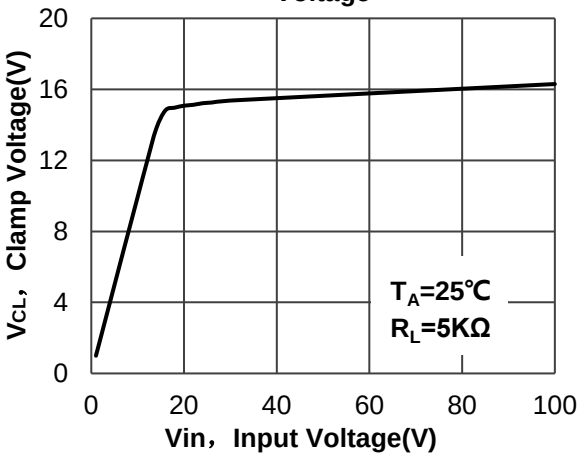


Figure 3. Clamp Voltage vs. Drain Current

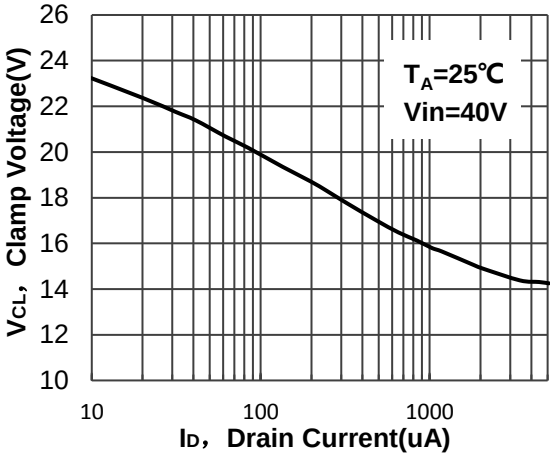
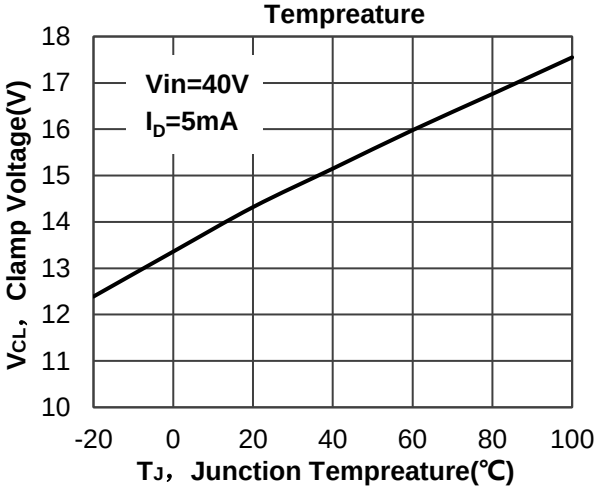


Figure 4. Clamp Voltage vs. Junction Tempreature



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.

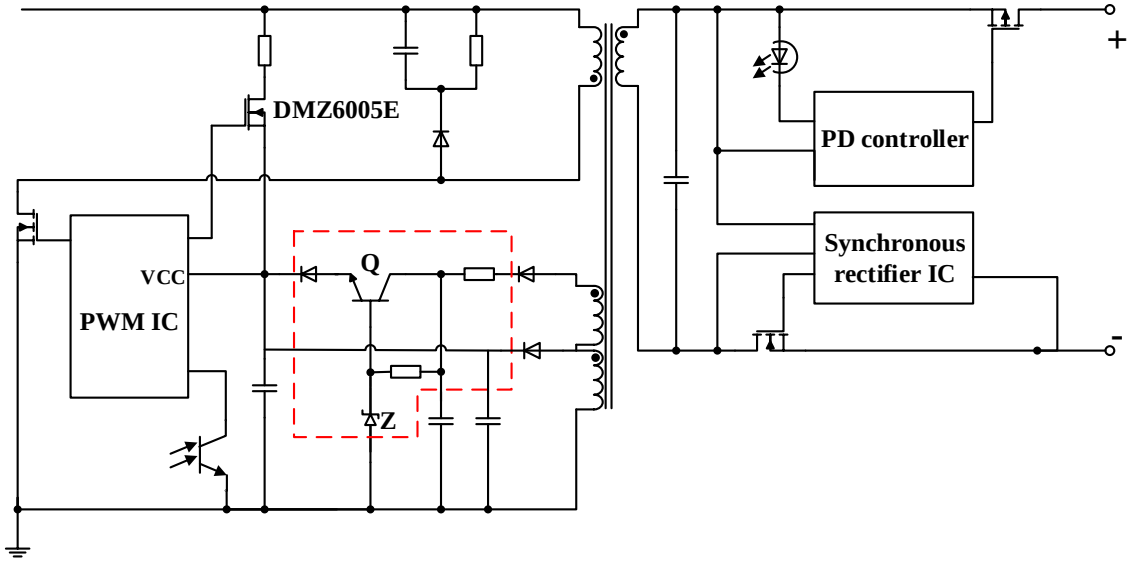


Figure 5. Normal Circuit with Transistor and Diode

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

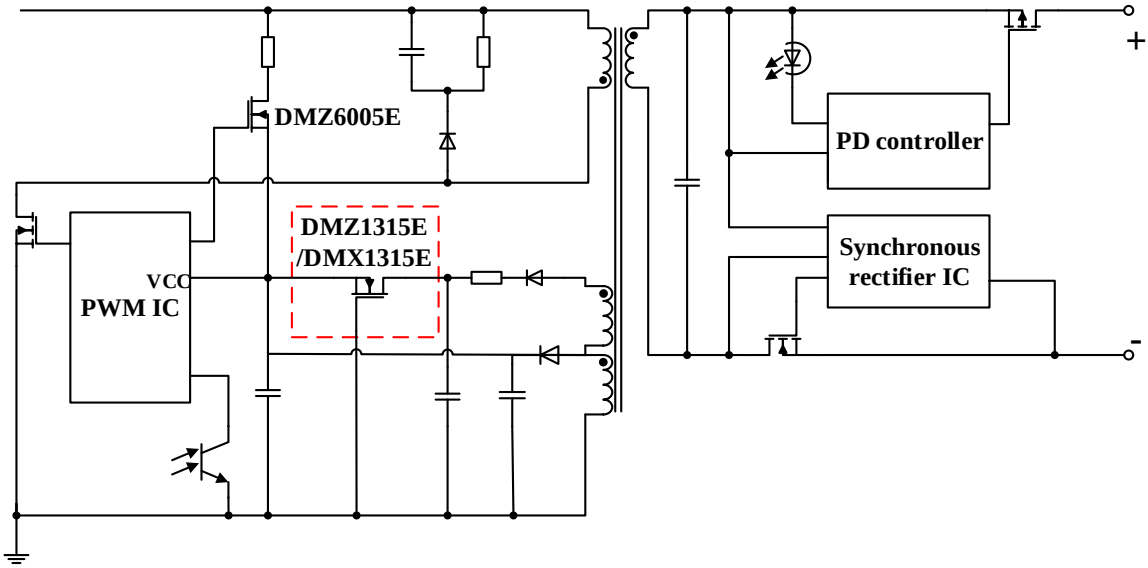


Figure 6. Circuit with DMZ1315E/DMX1315E

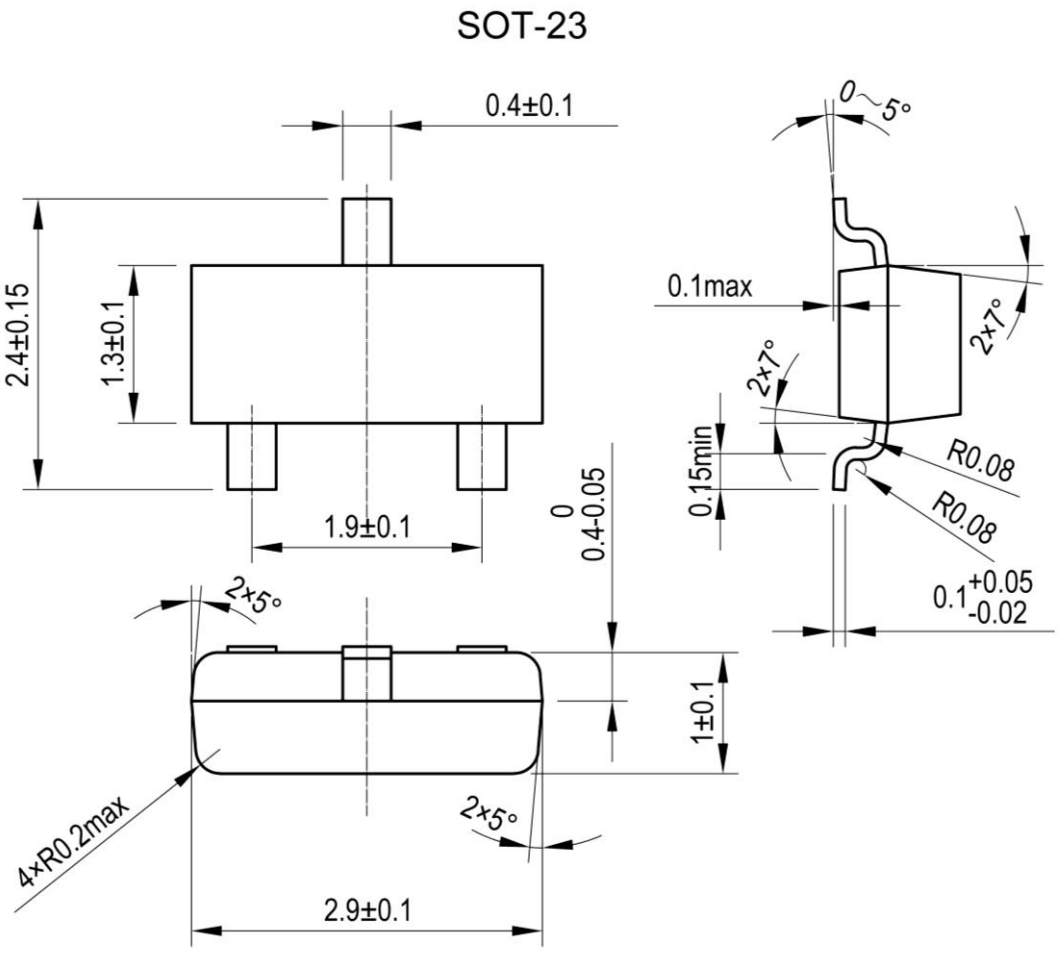
From the above function, we can see the depletion mode MOSFET operate in sub-threshold region, the Vout is always below or closed to the threshold voltage or Gate-to-Source Cut-off Voltage $V_{GS(OFF)}$, no matter how the input voltage Vin changes. Therefore, in addition to provide power for load like 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*** $Vout \approx Vin$

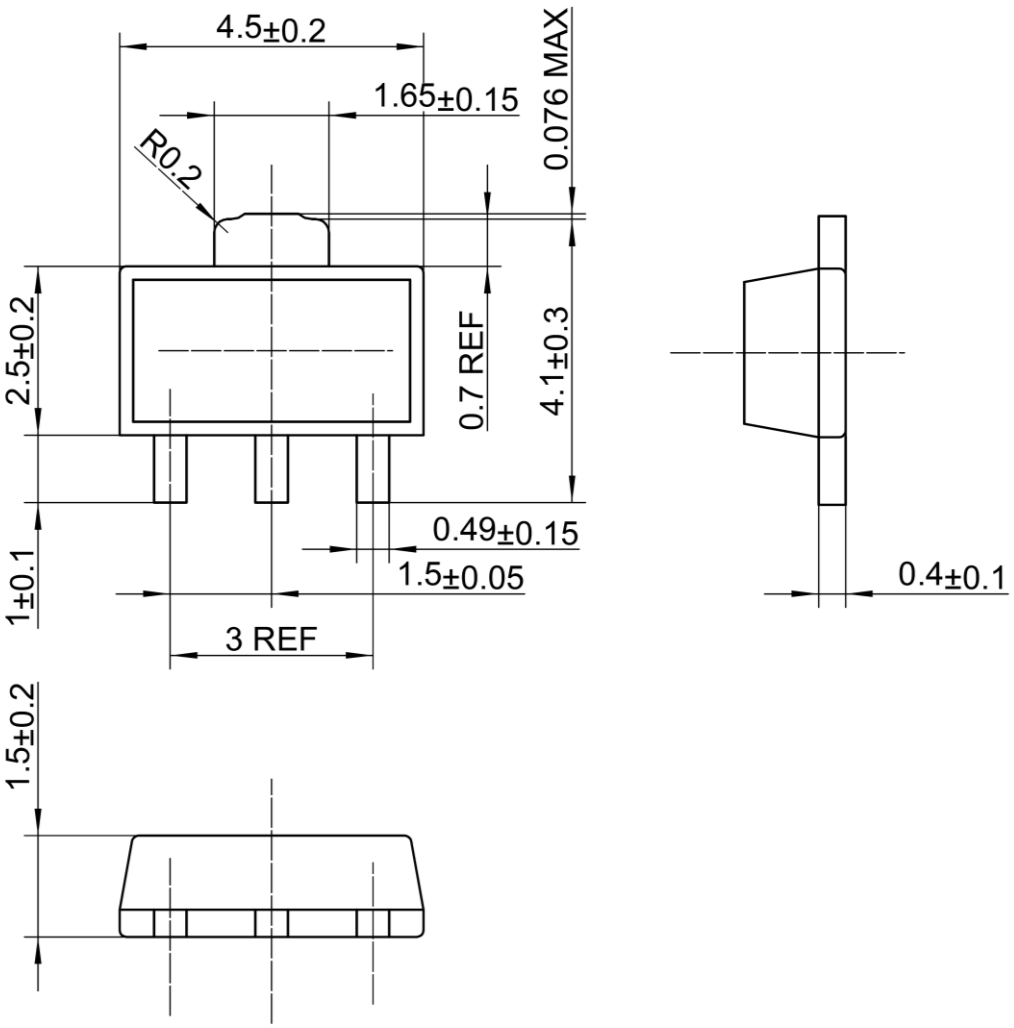
If $Vin \geq |V_{GS(OFF)}|$ ***, then*** $Vout \leq V_{GS(OFF)}$

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-89


4.5±0.2
1.65±0.15
0.076 MAX
R0.2
2.5±0.2
0.7 REF
4.1±0.3
0.49±0.15
1.5±0.05
1±0.1
3 REF
0.4±0.1
1.5±0.2

Published by
ARK Microelectronics Co., Ltd.
ADD: D26,UESTC National Science Park No. 1 Shuangxing Avenue, Chengdu, Sichuan.

Disclaimers

ARK Microelectronics Co., Ltd. reserves the right to make change without notice in order to improve reliability, function or design and to discontinue any product or service without notice. Customers should obtain the latest relevant information before orders and should verify that such information is current and complete. All products are sold subject to ARK Microelectronics Co., Ltd's terms and conditions supplied at the time of order acknowledgement.

ARK Microelectronics Co., Ltd. warrants performance of its hardware products to the specifications at the time of sale, Testing, reliability and quality control are used to the extent ARK Microelectronics Co., Ltd deems necessary to support this warrantee. Except where agreed upon by contractual agreement, testing of all parameters of each product is not necessary performed.

ARK Microelectronics Co., Ltd. does not assume any liability arising from the use of any product or circuit designs described herein. Customers are responsible for their products and applications using ARK Microelectronics Co., Ltd's components. To minimize risk, customers must provide adequate design and operating safeguards.

ARK Microelectronics Co., Ltd. does not warrant or convey any license either expressed or implied under its patent rights, nor the rights of others. Reproduction of information in ARK Microelectronics Co., Ltd's data sheets or data books is permissible only if reproduction is without modification or alteration. Reproduction of this information with any alteration is an unfair and deceptive business practice. ARK Microelectronics Co., Ltd is not responsible or liable for such altered documentation.

Resale of ARK Microelectronics Co., Ltd's products with statements different from or beyond the parameters stated by ARK Microelectronics Co., Ltd. for the product or service voids all express or implied warrantees for the associated ARK Microelectronics Co., Ltd's product or service and is unfair and deceptive business practice. ARK Microelectronics Co., Ltd is not responsible or liable for any such statements.

Life Support Policy:

ARK Microelectronics Co., Ltd's products are not authorized for use as critical components in life devices or systems without the expressed written approval of ARK Microelectronics Co., Ltd.

As used herein:

1. Life support devices or systems are devices or systems which:
   a. are intended for surgical implant into the human body,
   b. support or sustain life,
   c. whose failure to perform when properly used in accordance with instructions for used provided in the labeling, can be reasonably expected to result in significant injury to the user.
2. A critical component is any component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.