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	-13V to -20V	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
DMZ1315EL	SOT-23	1315L	Halogen Free
DMX1315EL	SOT-89	1315L	Halogen Free

Absolute Maximum Ratings

T_A=25℃ unless otherwise specified

Symbol	Parameter	DMZ1315EL	DMX1315EL	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	DMZ1315EL	DMX1315EL	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=1mA
$I_{D(OFF)}$	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	--	15	30	Ω	V_{GS}=0V， I_D=50mA[4]
$V_{GS(OFF)}$	Gate-to-Source Cut-off Voltage	-13	--	-20	V	V_{DS}=9V, I_D=8μA

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

DMZ1315EL/DMX1315EL 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:

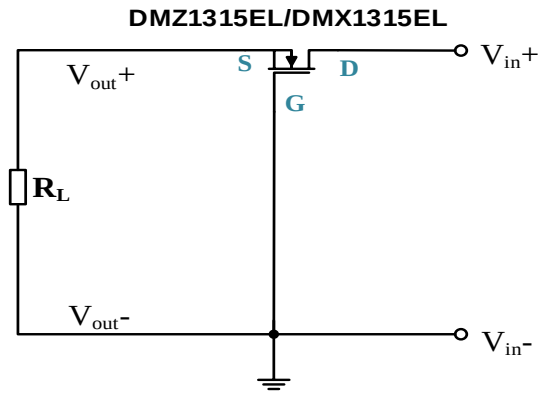


Figure1. Drain Current I_D is decided by Load Resistance

Figure 2. Clamp Voltage vs. Input Voltage

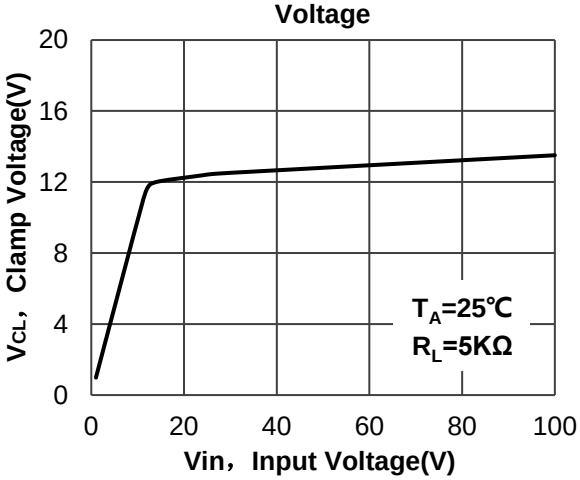


Figure 3. Clamp Voltage vs. Drain Current

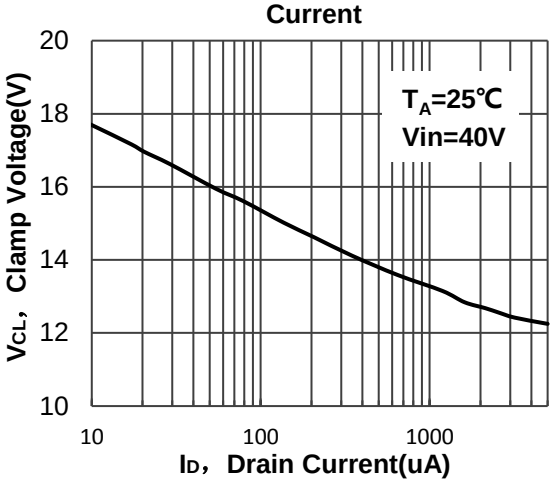
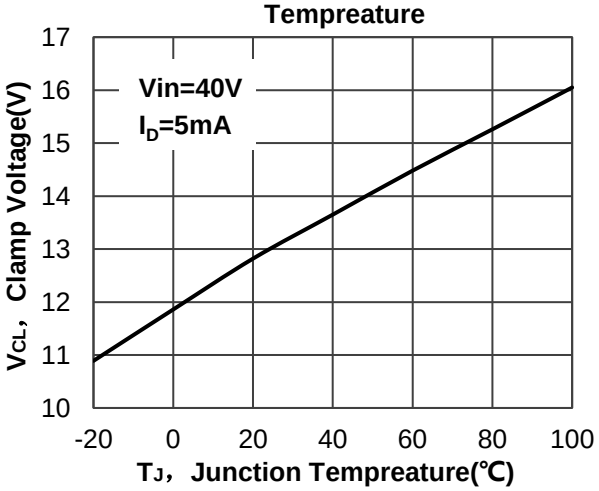


Figure 4. Clamp Voltage vs. Junction Tempreature



Typical Application

In the QC2.0/3.0 and Type-C/PD charger circuits, using DMZ1315EL/DMX1315EL 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.

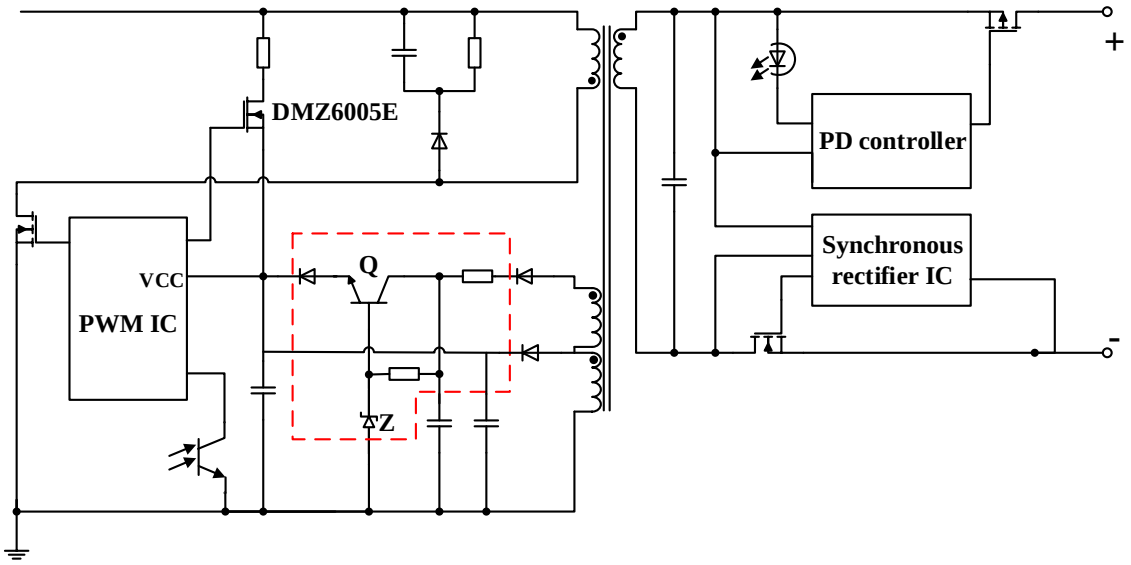


Figure 5. Normal Circuit with Transistor and Diode

In Figure 6, providing power and clamp voltage use only one device—DMZ1315EL/DMX1315EL, the circuit is simplified.

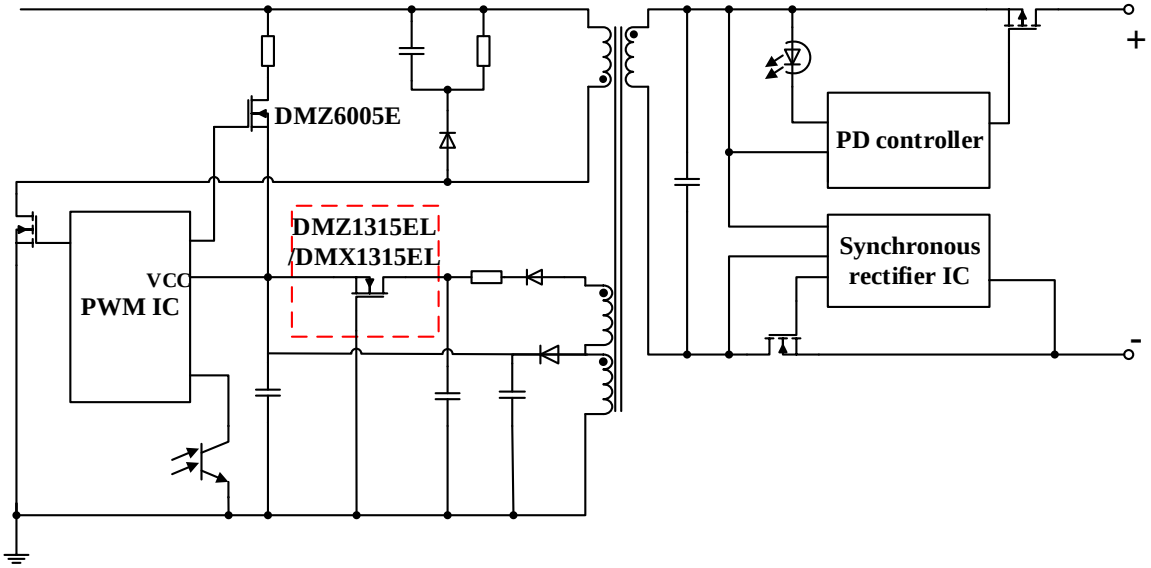


Figure 6. Circuit with DMZ1315EL/DMX1315EL

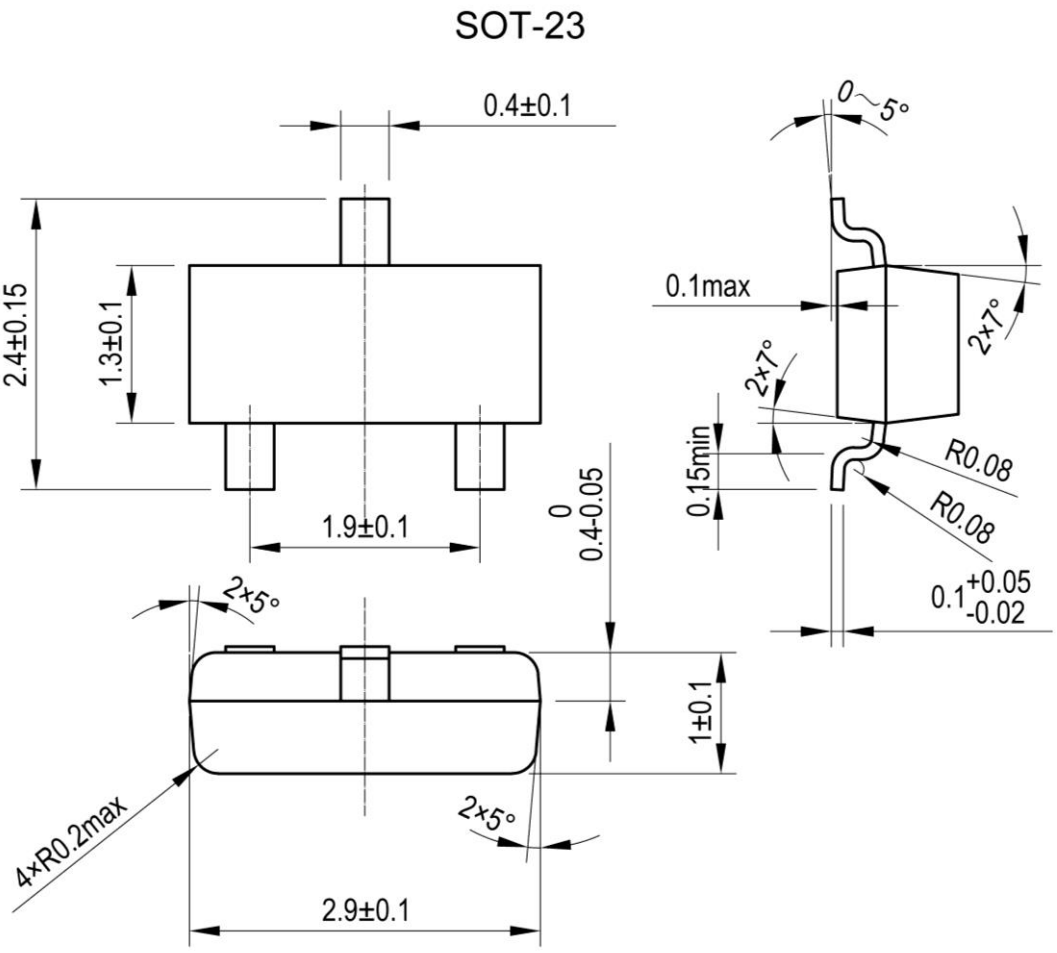
From the above function, we can see the depletion mode MOSFET operate in sub-threshold region, the Vout is always below or closed to the threshold voltage or Gate-to-Source Cut-off Voltage $V_{GS(OFF)}$, no matter how the input voltage Vin changes. Therefore, in addition to provide power for load like IC, the output voltage Vout can be clamped to the $V_{GS(OFF)}$, the IC is then protected from variable voltage or current. DMZ1315EL/DMX1315EL can support up to 130V input voltage. Vout and Vin have relations following the formulas:

If Vin < \| $V_{GS(OFF)}$ \|, then Vout ≈ Vin

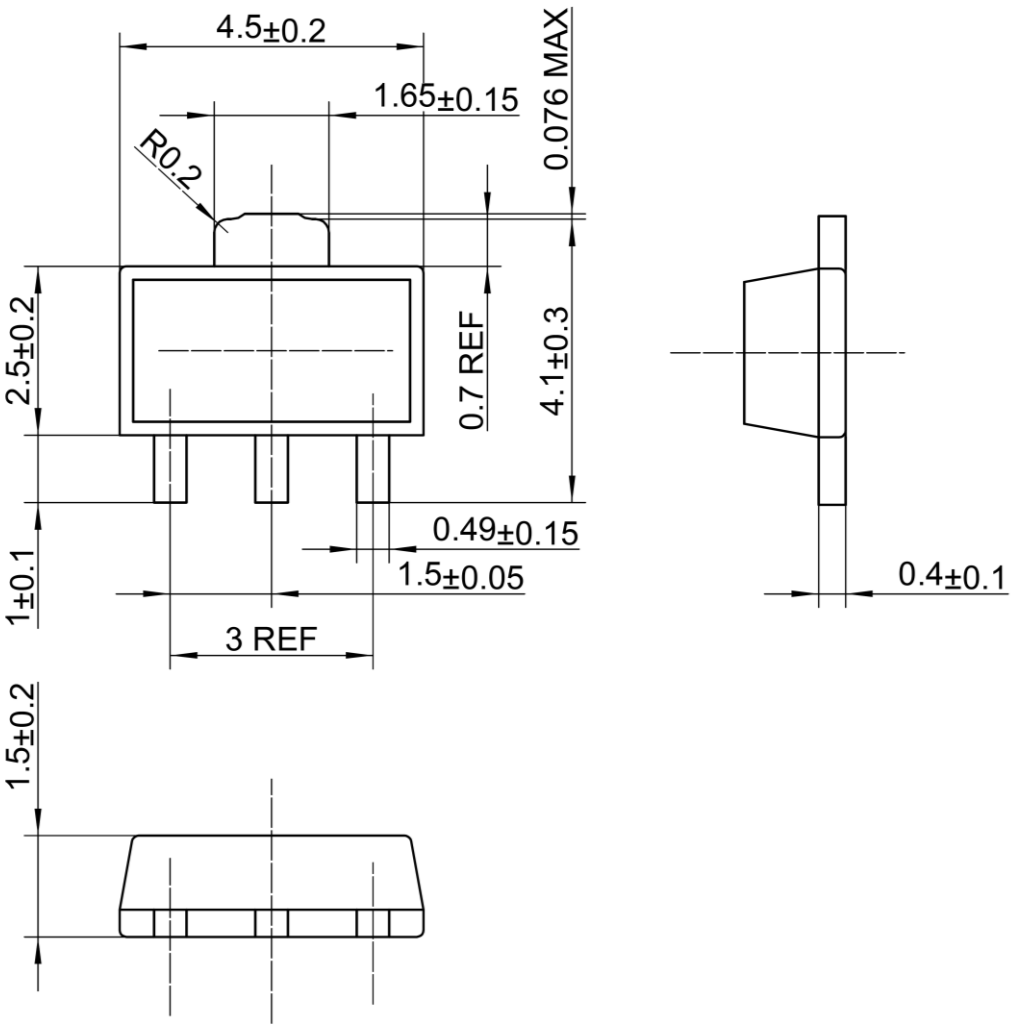
If Vin ≥ \| $V_{GS(OFF)}$ \|, then Vout ≤ $V_{GS(OFF)}$

The Ultrahigh Vth Depletion Mode Power MOSFET--DMZ1315EL/DMX1315EL, was developed by ARK Microelectronics proprietary and patent technology. The threshold voltage $V_{GS(OFF)}$ of DMZ1315EL/ DMX1315EL is between -13V and -20V, 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

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