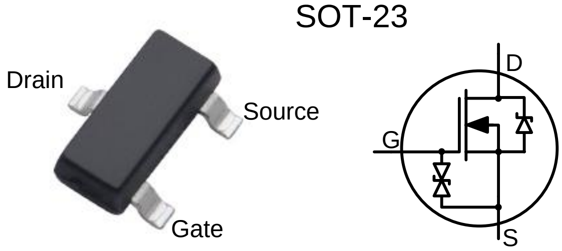
Ultrahigh Threshold Voltage Depletion-Mode Power MOSFET

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}	$V_{GS(off),max}$	$I_{DSS,min}$
70V	**-21V**	**120mA**

SOT-23



Applications

- Quick Charger
- Current Source
- Voltage Source
- Normally-on Switches

General Description

This novel depletion mode MOSFET, developed and manufactured by ARK proprietary ultrahigh threshold voltage technology. 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
DMZ0615E	SOT-23	0615	Halogen Free

Absolute Maximum Ratings

T_A=25℃ unless otherwise specified

Symbol	Parameter	DMZ0615E	Unit
V_{DSX}	Drain-to-Source Voltage[1]	70	V
V_{DGX}	Drain-to-Gate Voltage[1]	70	V
I_D	Continuous Drain Current	0.1	A
I_{DM}	Pulsed Drain Current[2]	0.4	A
P_D	Power Dissipation	0.50	W
V_{GS}	Gate-to-Source Voltage	±30	V
$V_{ESD(G-S)}$	Gate Source ESD IEC, C=150pF, R=330Ω	400	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	DMZ0615E	Unit
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	250	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	70	--	--	V	V_{GS}=-30V, I_D=250μA
$I_{D(OFF)}$	Drain-to-Source Leakage Current	--	--	10	μA	V_{DS}=70V， V_{GS}= -30V
		--	--	1.0	mA	V_{DS}=70V， V_{GS}= -30V T_J=125℃
I_{GSS}	Gate-to-Source Leakage Current	--	--	20	uA	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	120	--	--	mA	V_{GS}=0V, V_{DS}=25V
$R_{DS(ON)}$	Static Drain-to-Source On-Resistance	--	10	15	Ω	V_{GS}=0V， I_D=100mA [3]
$V_{GS(OFF)}$	Gate-to-Source Cut-off Voltage	-13	-17	-21	V	V_{DS} =20V, I_D=8μA
gfs	Forward Transconductance	--	130	--	mS	V_{DS} =20V, I_D=5mA

Dynamic Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
C_{ISS}	Input Capacitance	--	--	--	pF	V_{GS}=-30V V_{DS}=25V f=1.0MHz
C_{OSS}	Oput Capacitance	--	--	--		
C_{RSS}	Reverse Transfer Capacitance	--	--	--		
Q_G	Total Gate Charge	--	--	--	nC	V_{GS}= -10V~0V V_{DS}=30V, I_D=100mA
Q_{GS}	Gate-to-Source Charge	--	--	--		
Q_{GD}	Gate-to-Drain (Miller) Charge	--	--	--		

Resistive Switching Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$t_{d(ON)}$	Turn-on Delay Time	--	--	--	ns	V_{GS} = -30V~-20V V_{DD} = 35V, I_D=100mA R_G = 20Ohm
t_{rise}	Rise Time	--	--	--		
$t_{d(OFF)}$	Turn-off Delay Time	--	--	--		
t_{fall}	Fall Time	--	--	--		

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} =100 mA, V_{GS} = -30 V

NOTE：

[1] T_J=+25℃ to +150℃

[2] Repetitive rating, pulse width limited by maximum junction temperature.

[3] Pulse width≤380μs; duty cycle≤2%.

Figure 1. Maximum Power Dissipation vs. Case Temperature

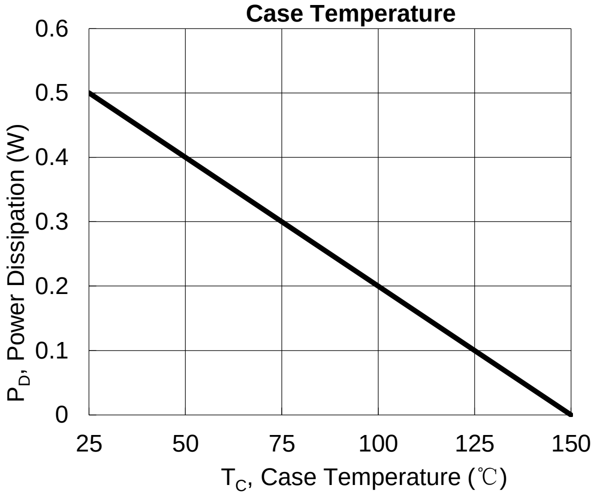
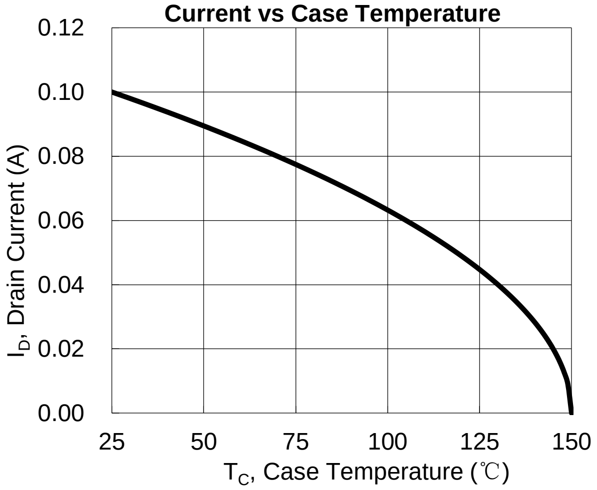


Figure 2. Maximum Continuous Drain Current vs Case Temperature



Application Highlight

Depletion mode MOSFET has the function of providing power for IC in circuit, as shown in Figure 3.

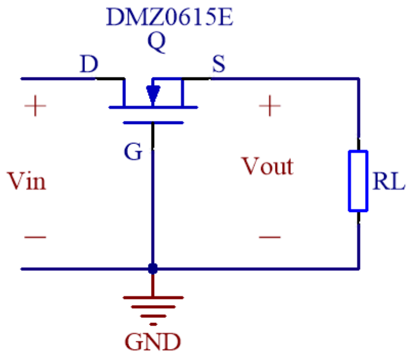


Figure 3

The parameters of the depletion mode MOSFET and the resistance (R_L) of the IC are jointly determined the voltage(V_{out}) and current(I_D) supplied to the IC.

$$I_D = I_{DSS}(1+I_D R_L/V_{GS(OFF)})^2$$

$$V_{out} = -V_{GS} = I_D R_L$$

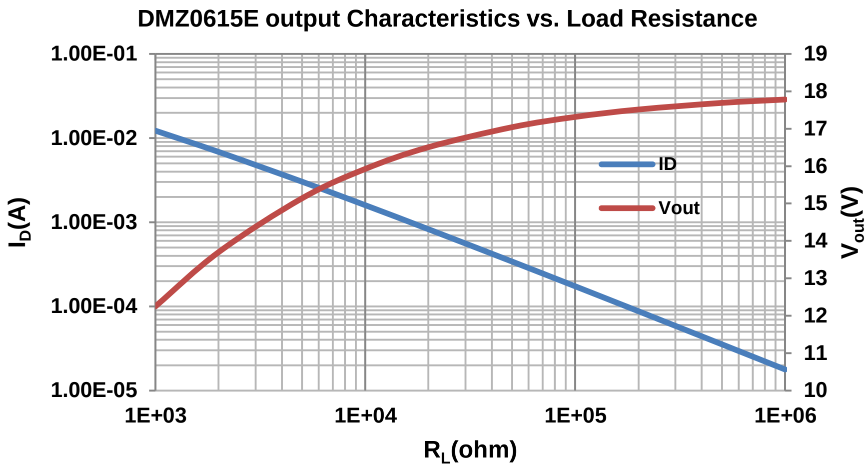


Figure 4

By this way, the depletion mode MOSFET operate in sub-threshold region, the gate voltage(V_{GS}) is always at or below threshold voltage($V_{GS(OFF)}$), even when the input voltage(V_{in}) is increased or the peak voltage occurs also so. Therefore, in addition to provide power for IC, the device can clamp voltage, the IC is protected. The V_{out} and V_{in} have the following formula:

If $V_{in} < |V_{GS(OFF)}|$ ***, then*** $V_{out} \approx V_{in}$

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

The **Ultrahigh Threshold Voltage Depletion-Mode Power MOSFET--DMZ0615E**, was developed by ***ARK Microelectronics*** using proprietary technology. The threshold voltage of DMZ0615E exceeds -16V, can provide sufficient voltage for IC.

Typical applications:

In the QC2.0/3.0 and Type-C charger circuits, using the depletion mode MOSFET can make the PWM IC power supply circuit more simplified, as shown below:

In Figure 5, the transistor Q3 is used to provide power, and the zener diode ZD is used to clamp voltage, the power supply circuit of IC is composed of several components.

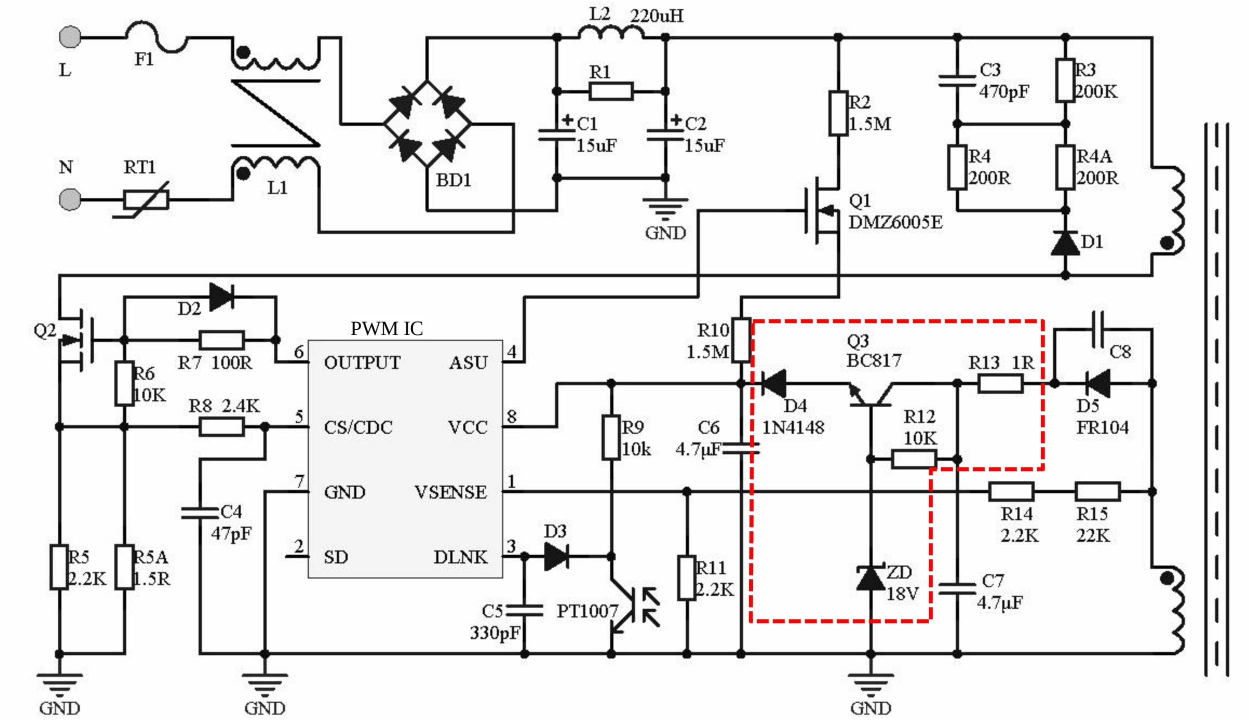


Figure 5

In figure 6, providing power and clamp voltage use only one device-DMZ0615E, the circuit is simplified.

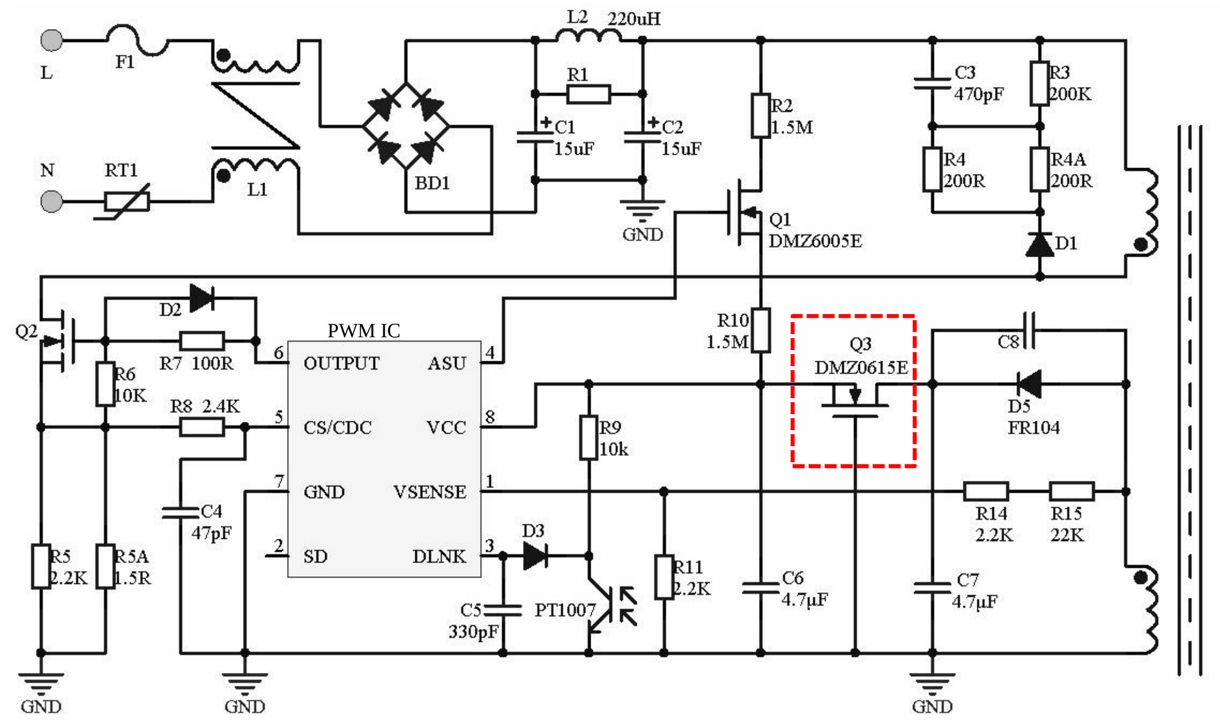
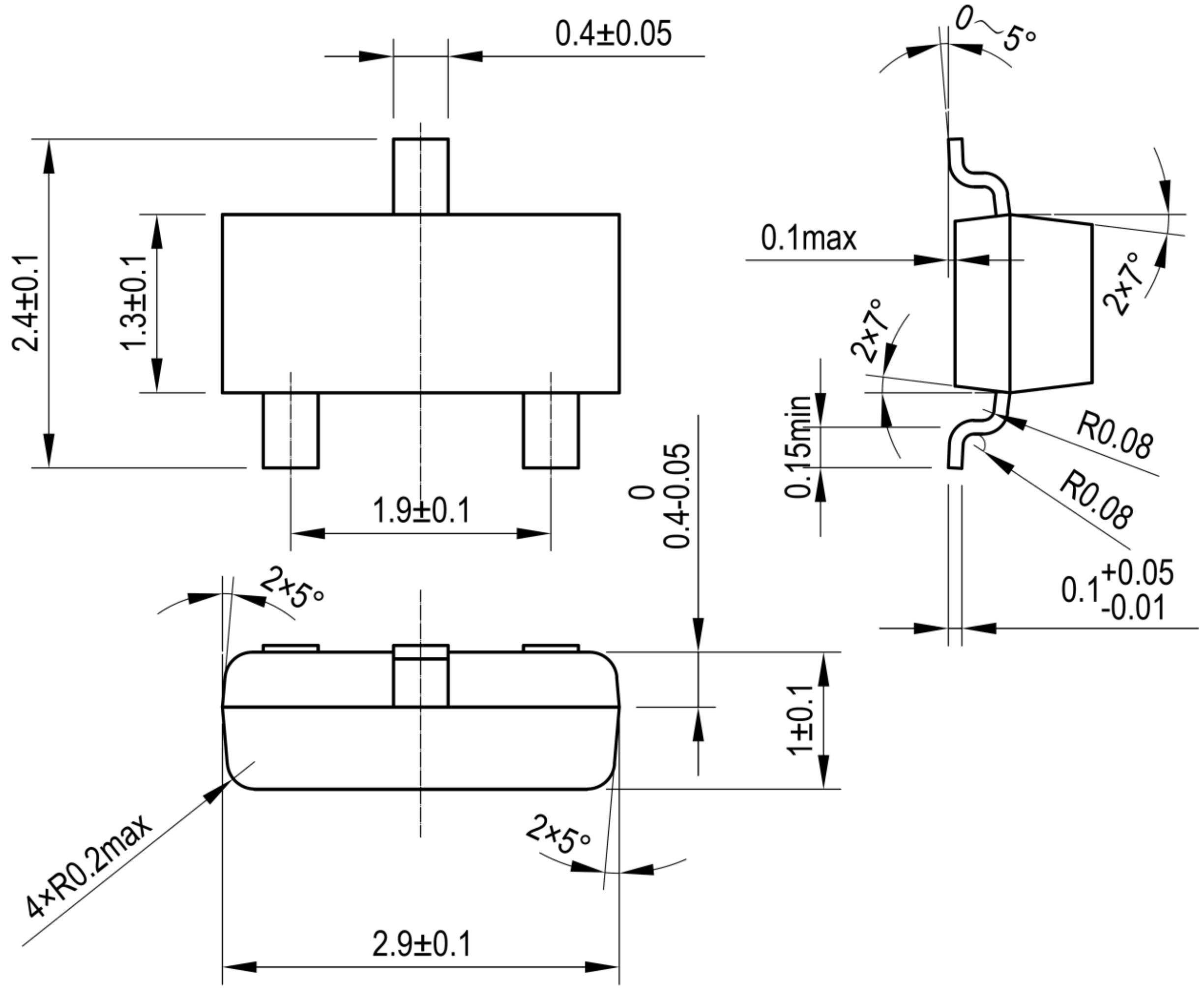


Figure 6

Package Dimensions

SOT-23



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