

Ultrahigh Threshold Voltage Depletion-Mode Power MOSFET

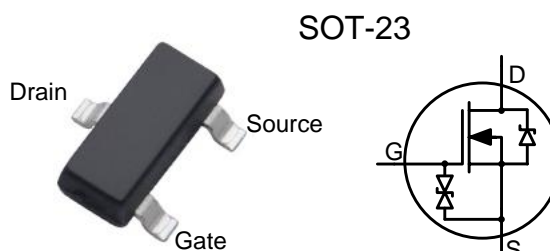
General Features

- ESD improved Capability
- Depletion Mode (Normally On)
- Proprietary Advanced Planar Technology
- Proprietary Advanced Ultrahigh V_{th} Technology
- RoHS Compliant
- Halogen-free available

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

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°C 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	
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	°C
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 _{θJA}	Thermal Resistance, Junction-to-Ambient	250	K/W

Electrical Characteristics

OFF Characteristics

 $T_A = 25^\circ\text{C}$ unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
BV_{DSX}	Drain-to-Source Breakdown Voltage	70	--	--	V	$V_{GS} = -30\text{V}$, $I_D = 250\mu\text{A}$
$I_{D(OFF)}$	Drain-to-Source Leakage Current	--	--	10	μA	$V_{DS} = 70\text{V}$, $V_{GS} = -30\text{V}$
		--	--	1.0	mA	$V_{DS} = 70\text{V}$, $V_{GS} = -30\text{V}$ $T_J = 125^\circ\text{C}$
I_{GSS}	Gate-to-Source Leakage Current	--	--	20	μA	$V_{GS} = +30\text{V}$, $V_{DS} = 0\text{V}$
		--	--	20		$V_{GS} = -30\text{V}$, $V_{DS} = 0\text{V}$

ON Characteristics

 $T_A = 25^\circ\text{C}$ unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
I_{DSS}	Saturated Drain-to-Source Current	120	--	--	mA	$V_{GS} = 0\text{V}$, $V_{DS} = 25\text{V}$
$R_{DS(ON)}$	Static Drain-to-Source On-Resistance	--	10	15	Ω	$V_{GS} = 0\text{V}$, $I_D = 100\text{mA}$ [3]
$V_{GS(OFF)}$	Gate-to-Source Cut-off Voltage	-13	-17	-21	V	$V_{DS} = 20\text{V}$, $I_D = 8\mu\text{A}$
gfs	Forward Transconductance	--	130	--	mS	$V_{DS} = 20\text{V}$, $I_D = 5\text{mA}$

Dynamic Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
C_{ISS}	Input Capacitance	--	--	--	pF	$V_{GS} = -30\text{V}$ $V_{DS} = 25\text{V}$ $f = 1.0\text{MHz}$
C_{OSS}	Output Capacitance	--	--	--		
C_{RSS}	Reverse Transfer Capacitance	--	--	--		
Q_G	Total Gate Charge	--	--	--	nC	$V_{GS} = -10\text{V} \sim 0\text{V}$ $V_{DS} = 30\text{V}$, $I_D = 100\text{mA}$
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	$V_{GS} = -30\text{V} \sim 20\text{V}$ $V_{DD} = 35\text{V}$, $I_D = 100\text{mA}$ $R_G = 20\Omega$
t_{rise}	Rise Time	--	--	--		
$t_{d(OFF)}$	Turn-off Delay Time	--	--	--		
t_{fall}	Fall Time	--	--	--		

Source-Drain Diode Characteristics

 $T_A = 25^\circ\text{C}$ unless otherwise specified

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

NOTE:

[1] $T_J = +25^\circ\text{C}$ to $+150^\circ\text{C}$

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

[3] Pulse width $\leq 380\mu\text{s}$; duty cycle $\leq 2\%$.

Figure 1. Maximum Power Dissipation vs. Case Temperature

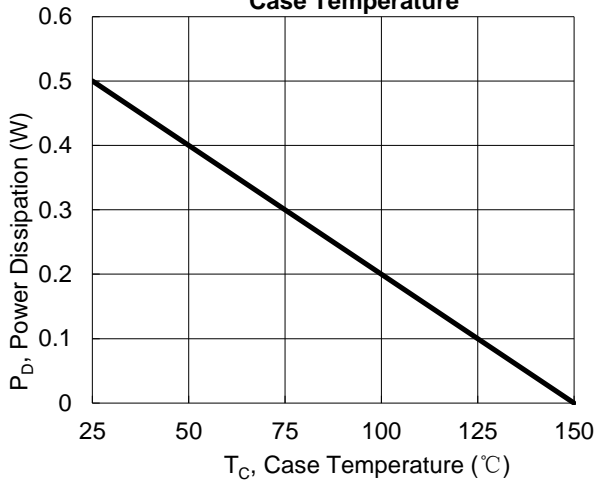
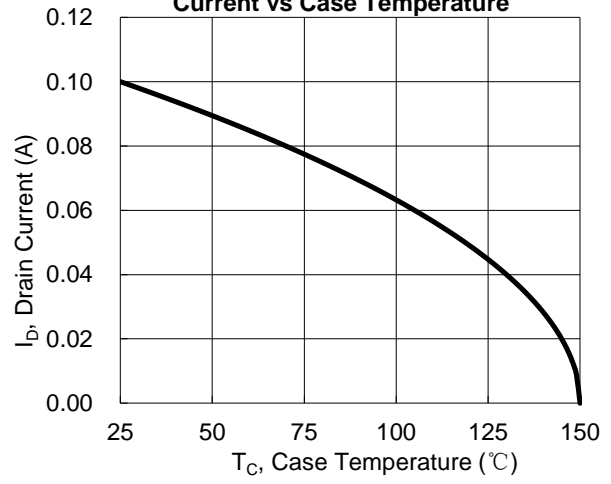


Figure 2. Maximum Continuous Drain Current vs Case Temperature



Application Highlight

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

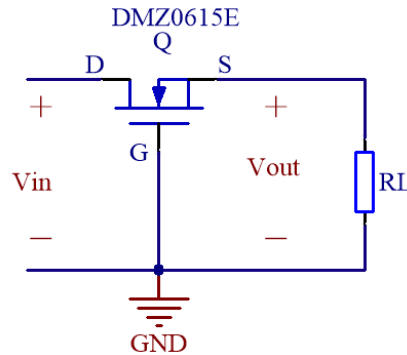


Figure 3

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.

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

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

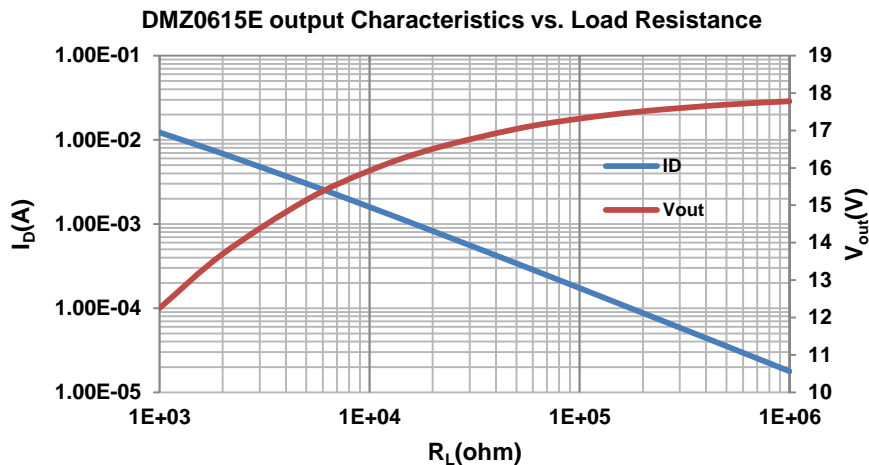


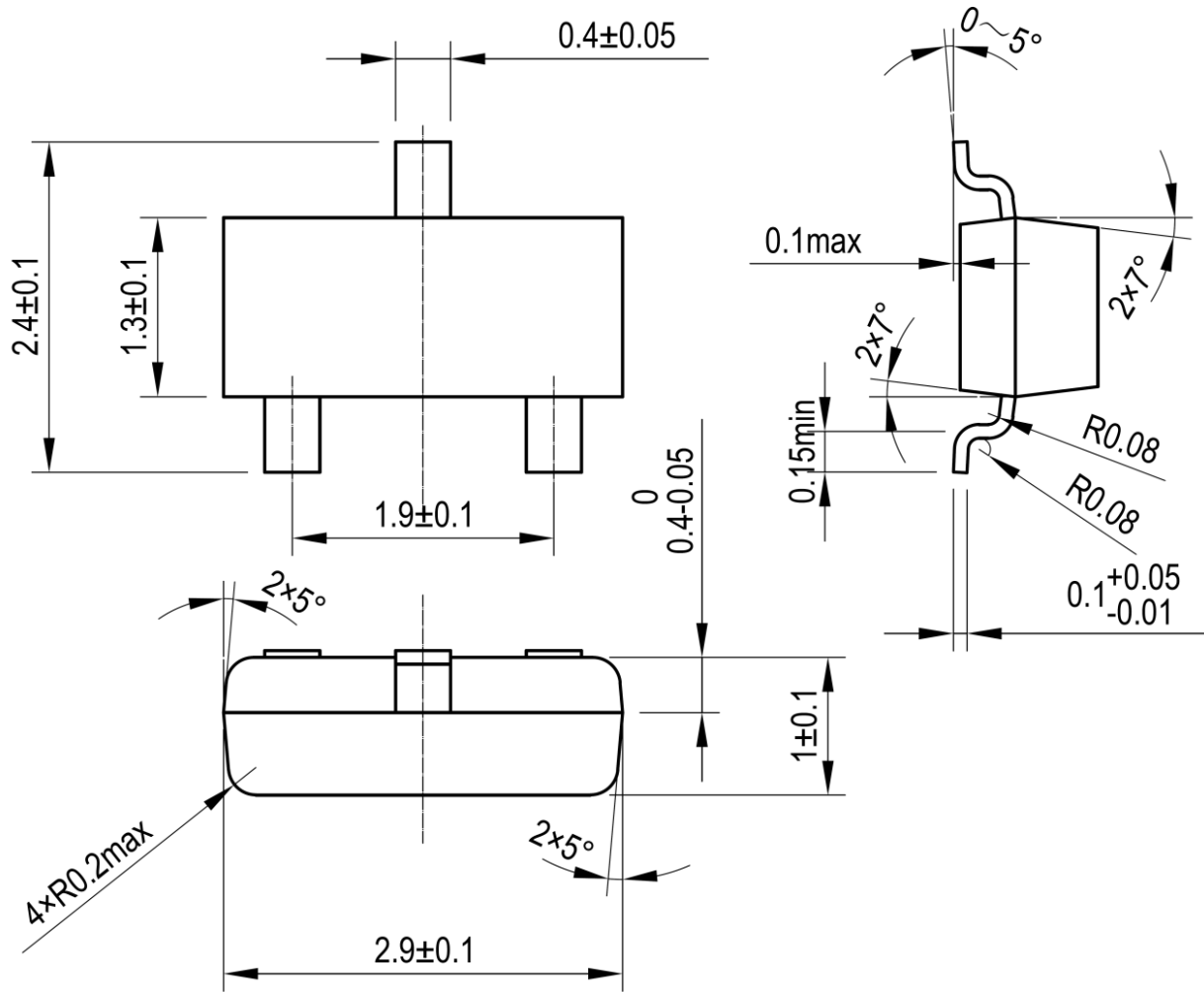
Figure 4

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:

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

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

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.

Package Dimensions
SOT-23




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