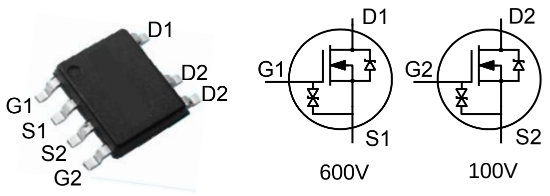
N-Channel Depletion Mode Combo MOSFET Module

General Description

DME6010D integrates a 600V depletion mode MOSFET as a startup device and a 100V depletion mode MOSFET with patented UltraVt®,which will provide stable and safe voltage for load as a non-isolated high voltage regulator. DME6010D is used in PD charger or QC charger for the cost down and space saving purpose.

No.	BV_{DSS}	$R_{DS(ON)\ (Max.)}$	$I_{DSS(Min)}$
1	600V	700 Ω	5mA
2	100V	30 Ω	100mA

SOP-7



General Features

- Proprietary Advanced Planar Technology
- Rugged Polysilicon Gate Cell Structure
- Proprietary Advanced High Vth Technology
- RoHS Compliant
- Halogen-free available

Applications

- PD / Quick Charger
- SMPS Start-up Circuit

Ordering Information

Part Number	Package	Marking	Remark
DME6010D	SOP-7	6010D	Halogen Free

Absolute Maximum Ratings

T_A=25℃ unless otherwise specified

Symbol	Parameter	600V MOSFET	100V MOSFET	Unit
V_{DSX}	Drain-to-Source Voltage[1]	600	100	V
I_D	Continuous Drain Current	0.02	0.1	A
I_{DM}	Pulsed Drain Current[2]	0.08	0.4	
V_{GS}	Gate-to-Source Voltage	±20	±30	V
V_{ESD}	Gate to Source ESD[3]	1000	700	V
	Source to Gate ESD[3]	1000	700	V
P_D	Power Dissipation	1.5		W
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	DME6010D	Unit
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	83.3	K/W

Electrical Characteristics

600V N-Channel Depletion MOSFET

OFF Characteristics

T_A =25℃ unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
BV_{DSX}	Drain-to-Source Breakdown Voltage	600	--	--	V	V_{GS}=-5V, I_D=250μA
$I_{D(OFF)}$	Drain-to-Source Leakage Current	--	--	0.1	μA	V_{DS}=600V, V_{GS}= -5V
		--	--	10	μA	V_{DS}=600V, V_{GS}= -5V T_J=125℃
I_{GSS}	Gate-to-Source Leakage Current	--	--	20	μA	V_{GS}=+20V, V_{DS}=0V
		--	--	-20		V_{GS}=-20V, 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	5	--	25	mA	V_{GS}=0V, V_{DS}=25V
$R_{DS(ON)}$	Static Drain-to-Source On-Resistance	--	500	700	Ω	V_{GS}=0V, I_D=3mA [4]
$V_{GS(OFF)}$	Gate-to-Source Cut-off Voltage	-1.5	--	-3.3	V	V_{DS} =3V, I_D=8μA
gfs	Forward Transconductance	--	15.4	--	mS	V_{DS} =10V, I_D=5mA

Dynamic Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
C_{ISS}	Input Capacitance	--	12.3	--	pF	V_{GS}=-5V V_{DS}=25V f=1.0MHz
C_{OSS}	Output Capacitance	--	2.6	--		
C_{RSS}	Reverse Transfer Capacitance	--	1.8	--		
Q_G	Total Gate Charge	--	1.55	--	nC	V_{GS}=-5V~5V V_{DS}=300V, I_D=7mA
Q_{GS}	Gate-to-Source Charge	--	0.12	--		
Q_{GD}	Gate-to-Drain (Miller) Charge	--	0.56	--		

Resistive Switching Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$t_{d(on)}$	Turn-on Delay Time	--	4	--	ns	V_{GS} = -5V~5V V_{DD} = 300V, I_D=7mA R_G = 20 Ω
t_{rise}	Rise Time	--	9	--		
$t_{d(off)}$	Turn-off Delay Time	--	14	--		
t_{fall}	Fall Time	--	84	--		

Source-Drain Diode Characteristics

TA =25℃ unless otherwise specified

Symbol	Parameter	Min	Typ.	Max.	Units	Test Conditions
V_{SD}	Diode Forward Voltage	--	--	1.2	V	I_{SD} =3.0 mA, V_{GS} = -10 V

100V N-Channel MOSFET

OFF Characteristics

T_A =25℃ unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
BV_{DSX}	Drain-to-Source Breakdown Voltage	100	--	--	V	V_{GS}=-30V, I_D=250uA
$I_{D(OFF)}$	Drain-to-Source Leakage Current	--	--	10	µA	V_{DS}=100V, 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	--	--	30	Ω	V_{GS}=0V, I_D=100mA[4]
$V_{GS(OFF)}$	Gate-to-Source Cut-off Voltage	--	--	-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 Characteristics

600V N-Channel Depletion MOSFET

Figure 1. Maximum Power Dissipation vs. Case Temperature

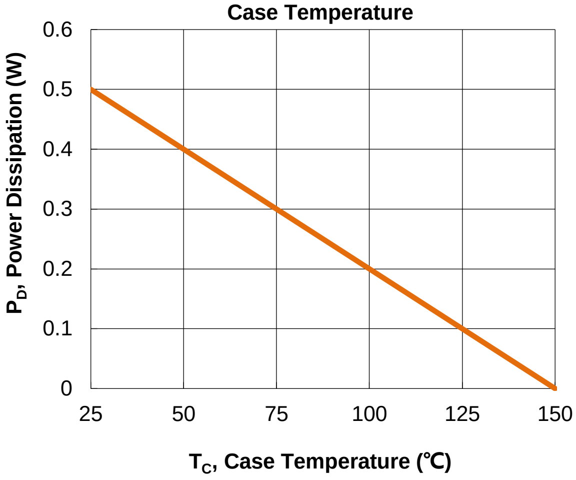


Figure 2. Maximum Continuous Drain Current vs Case Temperature

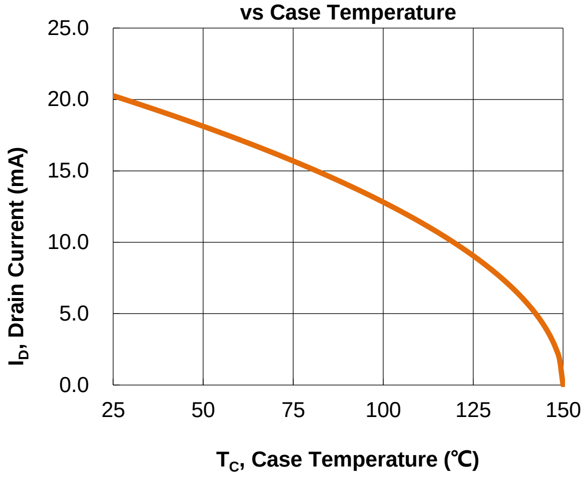


Figure 3. Typical Output Characteristics

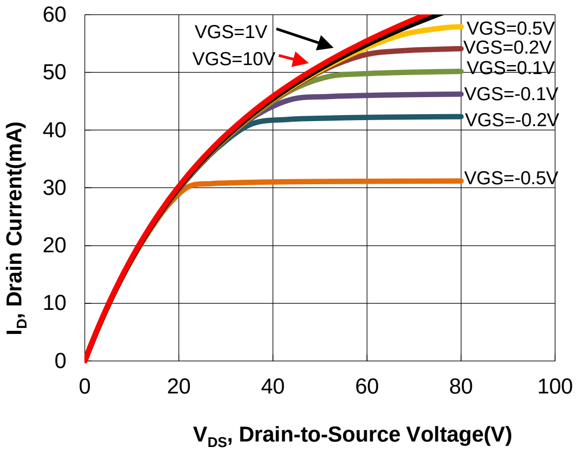


Figure 4. Typical Transfer Characteristics

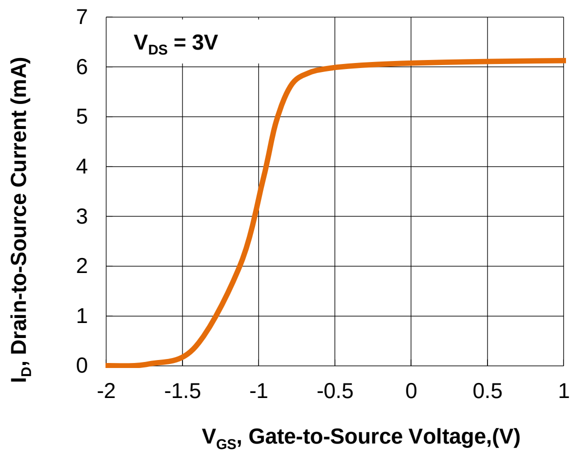


Figure 5. Typical Capacitance vs. Drain-to-Source Voltage

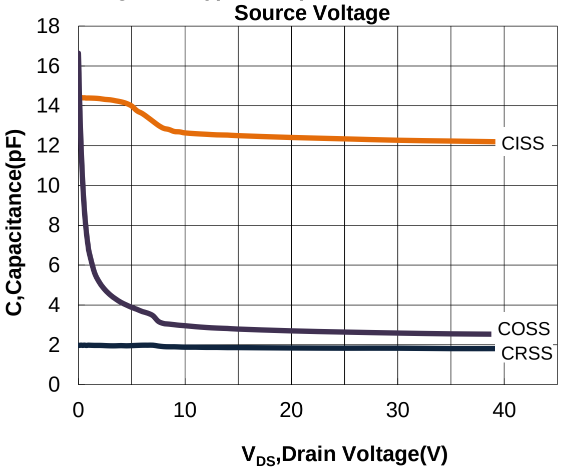
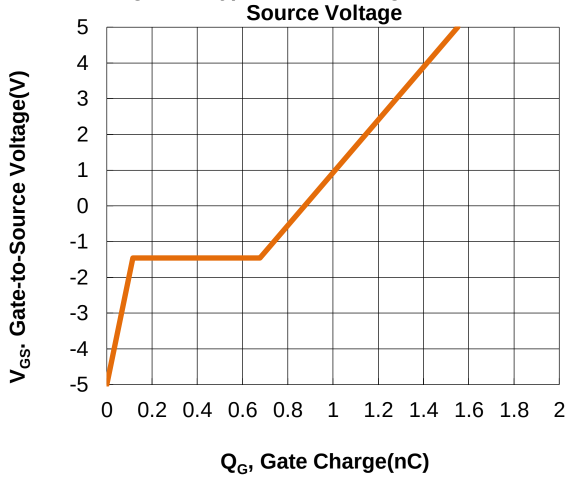


Figure 6. Typical Gate Charge vs. Gate-to-Source Voltage



100V N-Channel MOSFET

100V N-Channel MOSFET is an ultra-high threshold voltage 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 7:

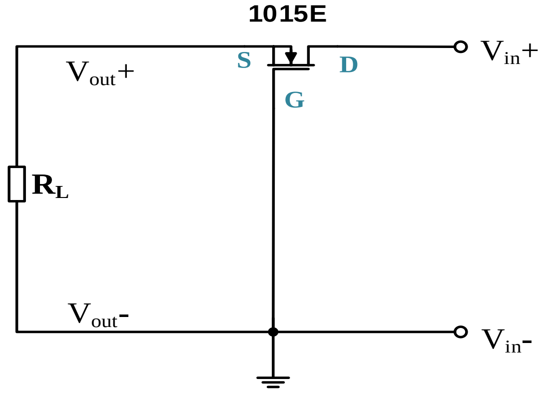


Figure7. Drain Current I_D is decided by Load Resistance

Figure 8. Clamp Voltage vs. Input Voltage

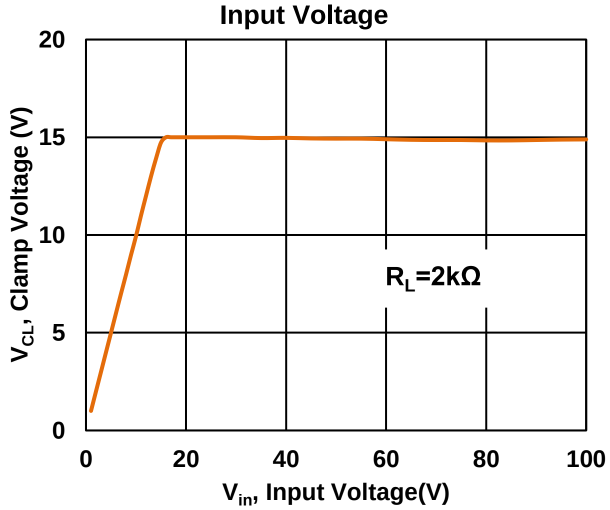


Figure 9. Clamp Voltage vs. Drain Current

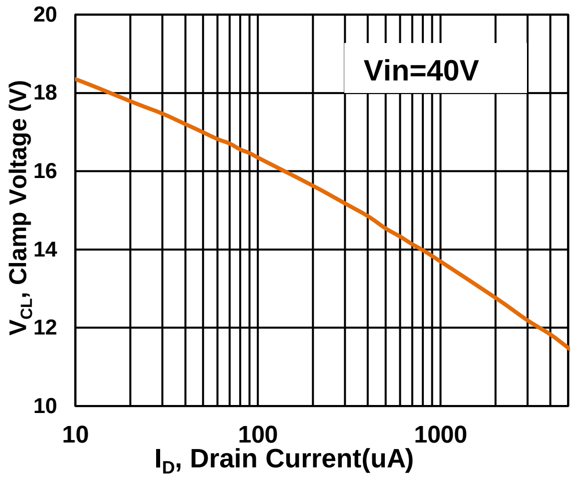
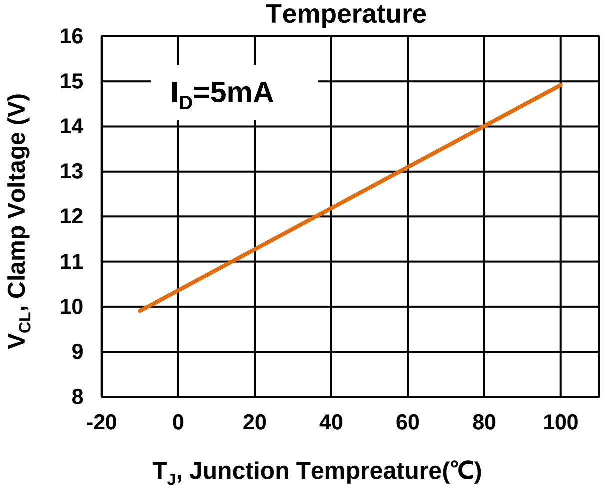


Figure 10. Clamp Voltage vs. Junction Temperature



Typical Application

DME6010D integrates a 600V depletion mode MOSFET as a startup device, and a 100V depletion mode MOSFET with patented UltraVt®,which will provide stable and safe voltage for load as a non-isolated high voltage regulator. DME6010D is used in PD charger or QC charger for the cost down and space saving purpose. The circuit is as follows：

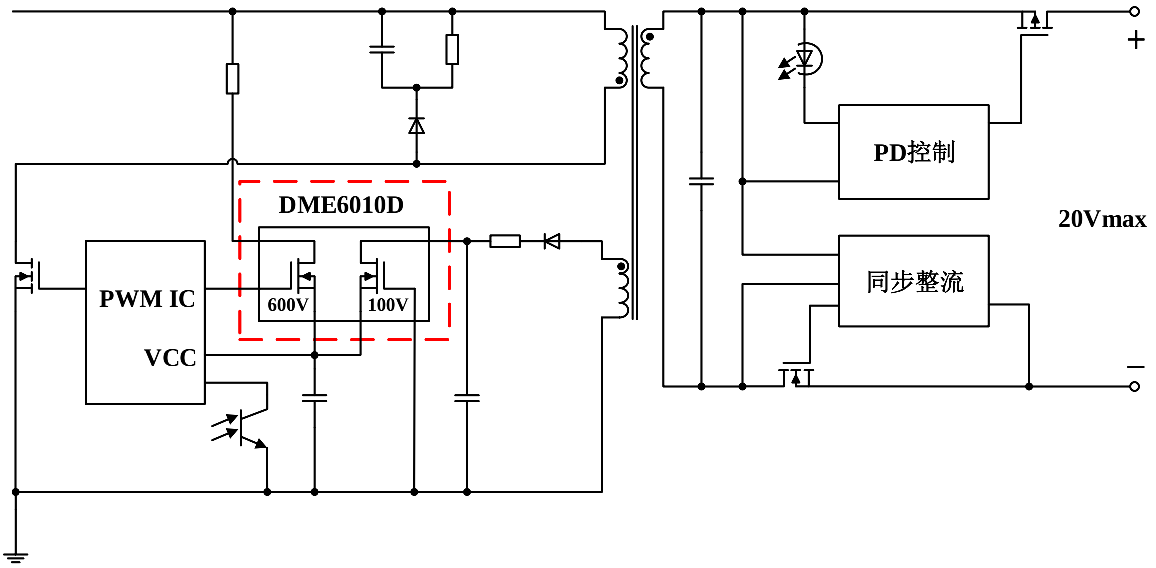


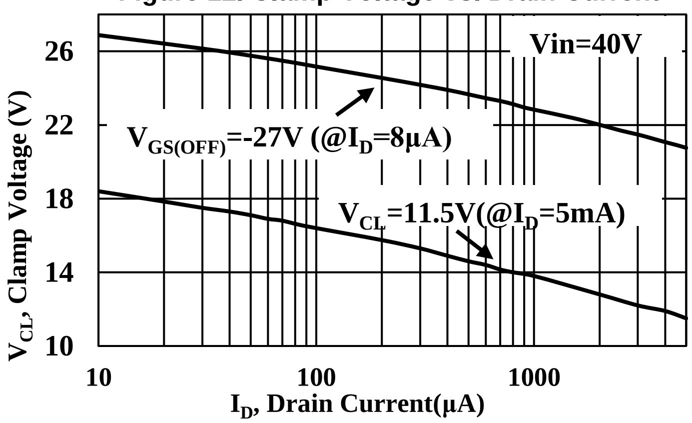
Figure 11. The circuit with DME6010D

In Figure 11,600V MOSFET is used for PWM IC startup and 100V MOSFET is used as a high voltage linear regulator to make the PWM IC power supply circuit more simplified.

At room temperature and under 2~4mA working current (most IC's working current), the output voltage of 100V MOSFET is between 12~22V.

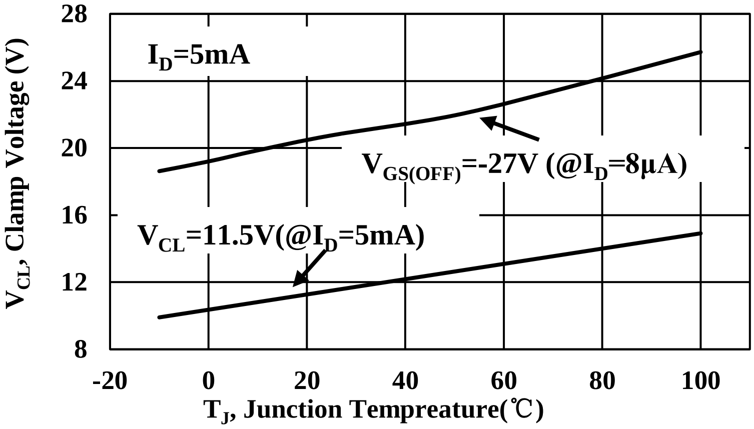
Due to strict design and process control,the parameters of 100V MOSFET have good consistency, but there are still some $V_{GS(OFF)}$ parameter distribution range, so we strictly control the final testing standard, the upper limit is｜$V_{GS(OFF)}$｜=27V (under normal temperature I_D=8μA), the lower limit is V_{CL}=11.5V of clamping voltage (under room temperature I_D =5mA), so as to ensure under normal working condition and the working current 8μA≤I_D≤5mA, the clamping voltage: 11.5V≤V_{CL}≤27V. Figure 13 shows the clamping voltage V_{CL} lower limit of 11.5V and the threshold voltage $V_{GS(OFF)}$ upper limit of $V_{GS(OFF)}$ =-27V, and the clamping working voltage distribution when the working current does not exceed 5mA.

Figure 12. Clamp Voltage vs. Drain Current



The clamping voltage will also change with the temperature. When the working temperature increases, the clamping voltage will increase; when the working temperature decreases, the clamping voltage will also decrease. The relationship between clamping voltage and junction temperature is shown in Figure 13:

Figure 13. Clamp Voltage vs. Junction Temperature



Package Dimensions

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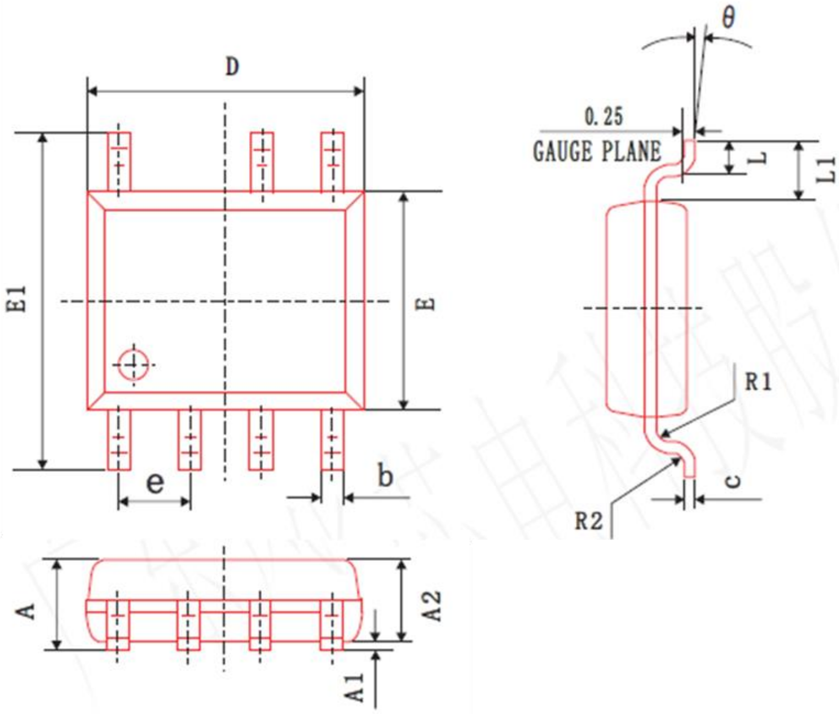

SYMBOL	MIN	NOM	MAX
A	1.40	1.60	1.80
A 1	0.05	0.15	0.25
A 2	1.35	1.45	1.55
b	0.30	0.40	0.50
C	0.153	0.203	0.253
D	4.80	4.90	5.00
E	3.80	3.90	4.00
E 1	5.80	6.00	6.20
L	0.45	0.70	1.00
θ	2°	4°	6°
L 1	1.04 REF		
e	1.27 BSC		
R 1	0.07 TYP		
R 2	0.07 TYP		

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