

60V N&P-Channel Trench Power MOSFET

General Description

The EJP60NP930 uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as $\pm 4.5V$. This device is suitable for use as a wide variety of applications.

Features

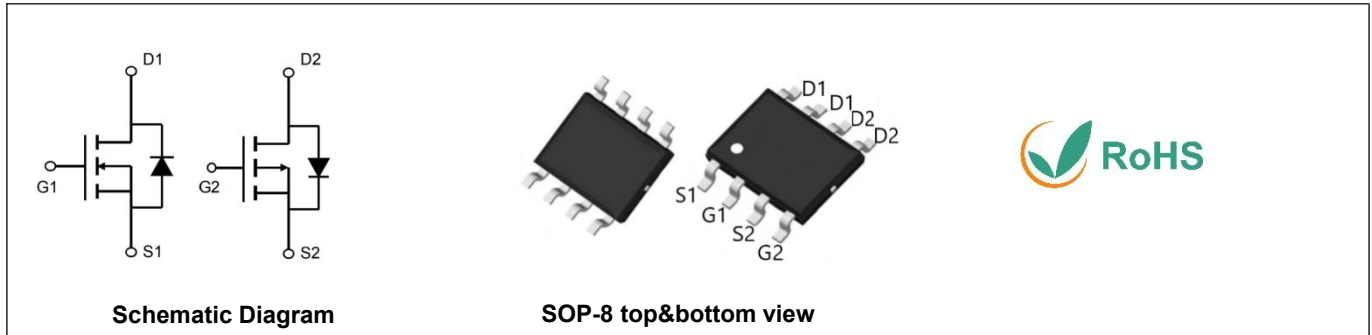
- Low Gate Charge
- High Power and current handling capability
- Lead free product is acquired

Application

- Battery Protection
- Power Management
- Load Switch

Key Performance Parameters

Parameter	Value	Value	Unit
V_{DS}	60	-60	V
$R_{DS(ON_TYP)}$	24	69	m Ω
I_D	5.7	-3.6	A
Q_G	23	16	nC



Package Marking and Ordering Information

Device/Ordering Code	Package	Packing	Reel Size	Tape width	Quantity
EJP60NP930	SOP-8	Tape	\	\	4000 Pcs

Table 1. Absolute Maximum Ratings ($T_A=25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	N Limit	P Limit	Unit
V_{DS}	Drain-Source Voltage ($V_{GS}=0V$)	60	-60	V
V_{GS}	Gate-Source Voltage ($V_{DS}=0V$)	± 20	± 20	V
I_D	Drain Current-Continuous($T_A=25^\circ\text{C}$)	5.7	-3.6	A
	Drain Current-Continuous($T_A=100^\circ\text{C}$)	3.6	-2.3	A
$I_{DM(pulse)}$	Drain Current-Continuous@ Current-Pulsed (Note 1)	22.8	-14.4	A
P_D	Maximum Power Dissipation($T_A=25^\circ\text{C}$)	2.1	1.95	W
	Maximum Power Dissipation($T_A=100^\circ\text{C}$)	0.8	0.78	W
E_{AS}	Avalanche energy (Note 2)	56	49	mJ
T_J, T_{STG}	Operating Junction and Storage Temperature Range	-55 To 150		$^\circ\text{C}$

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Table 2. Thermal Characteristic

Symbol	Parameter	N Max	P Max	Unit
$R_{\theta JA}$	Thermal Resistance, Junction-to- Ambient	60.5	64	°C/W

Table 3. N-Channel Electrical Characteristics ($T_J=25^{\circ}\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
On/Off States						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V I _D =250μA	60			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =60V, V _{GS} =0V T _J =25℃			1	μA
		V _{DS} =60V, V _{GS} =0V T _J =125℃			100	μA
I _{GSS}	Gate-Body Leakage Current	V _{GS} =±20V, V _{DS} =0V			±100	nA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _D =250μA	1.0		2.5	V
g _{FS}	Forward Transconductance	V _{DS} =5V, I _D =10A		15		S
R _{DS(ON)}	Drain-Source On-State Resistance	V _{GS} =10V, I _D =10A T _J =25℃		24	30	mΩ
R _{DS(ON)}	Drain-Source On-State Resistance	V _{GS} =4.5V, I _D =8A T _J =25℃		29	38.6	mΩ
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} =30V, V _{GS} =0V, f=1.0MHz		1000		pF
C _{oss}	Output Capacitance			58		pF
C _{rss}	Reverse Transfer Capacitance			50		pF
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1.0MHz		1		Ω
Switching Parameters						
t _{d(on)}	Turn-on Delay Time	V _{GS} =10V, V _{DS} =30V, R _L =3Ω, R _{GEN} =3Ω		4		ns
t _r	Turn-on Rise Time			3.5		ns
t _{d(off)}	Turn-Off Delay Time			15.8		ns
t _f	Turn-Off Fall Time			2		ns
Q _g	Total Gate Charge	V _{GS} =10V, V _{DS} =30V, I _D =10A		23		nC
Q _{gs}	Gate-Source Charge			3.5		nC
Q _{gd}	Gate-Drain Charge			5.4		nC
Source-Drain Diode Characteristics						
I _{SD}	Source-Drain Current (Body Diode)				5.7	A
V _{SD}	Forward on Voltage (Note 3)	V _{GS} =0V, I _S =10A			1.2	V
t _{rr}	Reverse Recovery Time	I _F =10A, dI/dt=100A/μs		27		ns
Q _{rr}	Reverse Recovery Charge	I _F =10A, dI/dt=100A/μs		30		nC

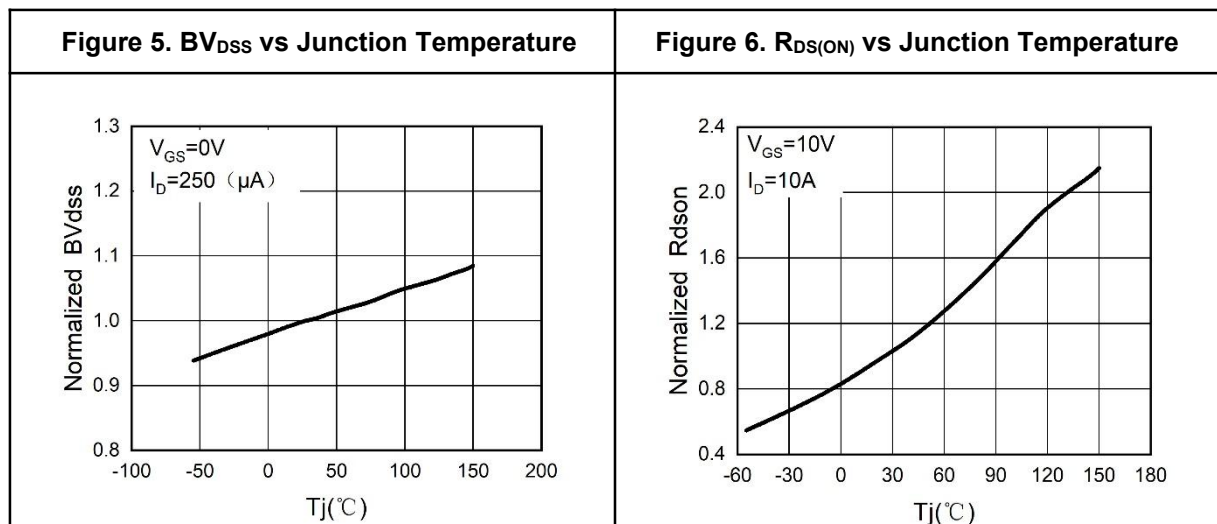
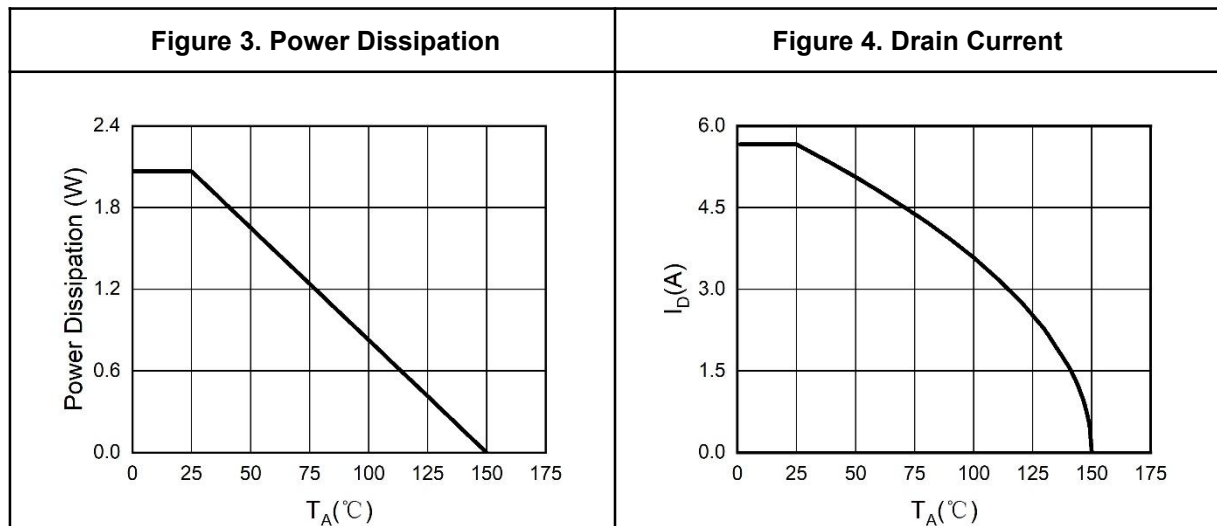
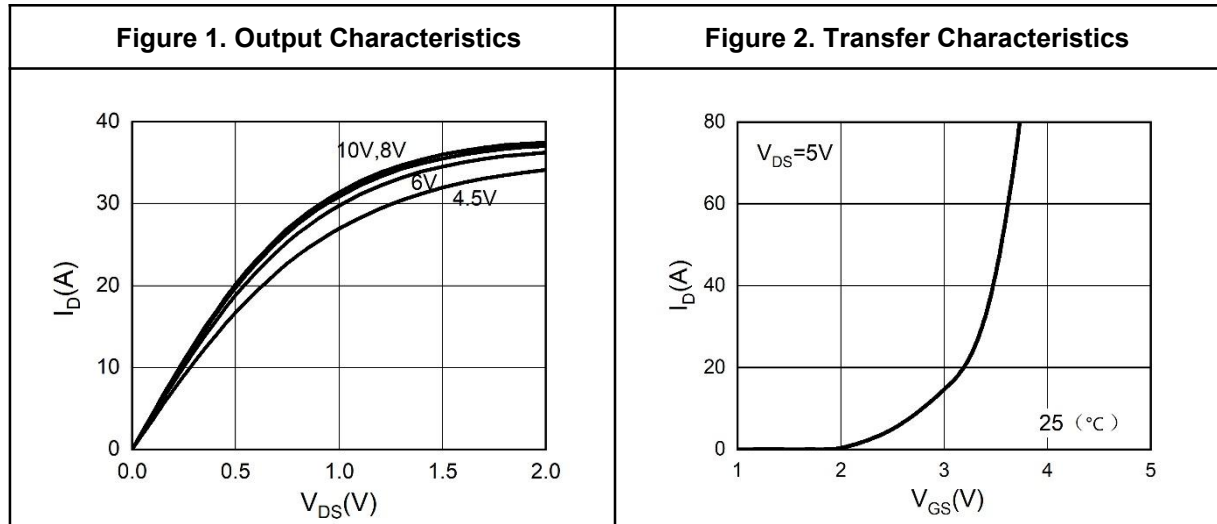
Notes 1.Repetitive Rating: Pulse width limited by maximum junction temperature.

Notes 2.EAS condition: $T_J=25^{\circ}\text{C}, V_{DD}=40V, V_G=10V, R_g=25\Omega, L=0.5\text{mH}$.

Notes 3.Repetitive Rating: Pulse width limited by maximum junction temperature.

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N-Channel Typical Electrical And Thermal Characteristics (Curves)



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N-Channel Typical Electrical And Thermal Characteristics (Curves)

Figure 7. Gate Charge Waveforms

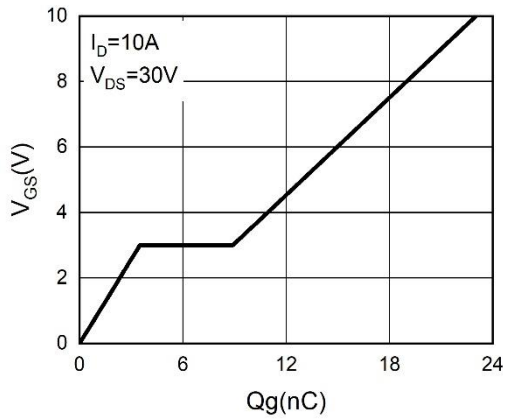


Figure 8. Capacitance

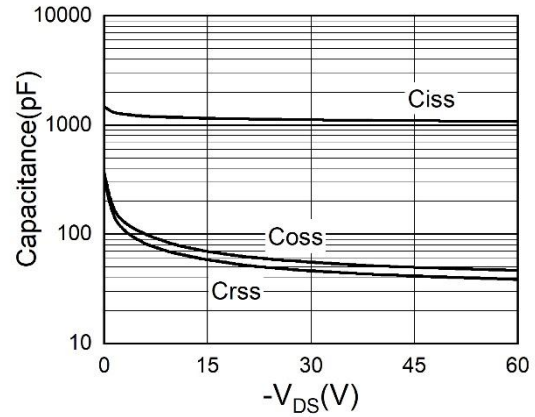


Figure 9. Body-Diode Characteristics

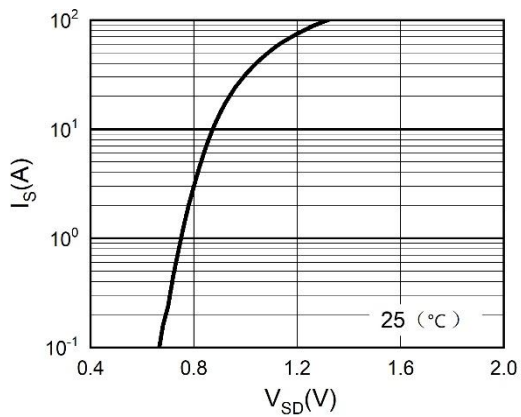
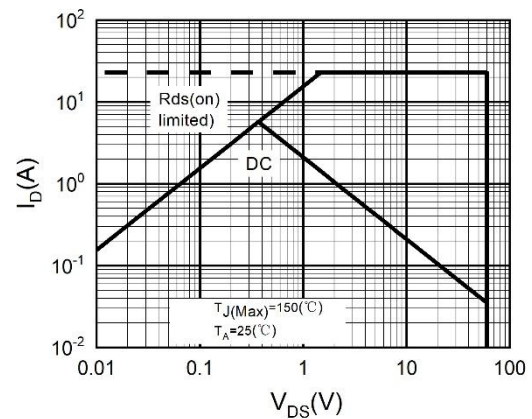


Figure 10. Maximum Safe Operating Area



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Table 4. P-Channel Electrical Characteristics (T_J=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
On/Off States						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V I _D =-250μA	-60			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =-60V, V _{GS} =0V T _J =25°C			-1	μA
		V _{DS} =-60V, V _{GS} =0V T _J =125°C			-100	μA
I _{GSS}	Gate-Body Leakage Current	V _{GS} =±20V, V _{DS} =0V			±100	nA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _D =-250μA	-1		-2.5	V
g _{FS}	Forward Transconductance	V _{DS} =-5V, I _D =-7A		12		S
R _{DS(ON)}	Drain-Source On-State Resistance	V _{GS} =-10V, I _D =-7A T _J =25°C		69	89	mΩ
R _{DS(ON)}	Drain-Source On-State Resistance	V _{GS} =-4.5V, I _D =-5A T _J =25°C		85	113	mΩ
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} =-30V,V _{GS} =0V, f=1.0MHz		1120		pF
C _{oss}	Output Capacitance			57		pF
C _{rss}	Reverse Transfer Capacitance			46		pF
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1.0MHz		6.4		Ω
Switching Parameters						
t _{d(on)}	Turn-on Delay Time	V _{GS} =-10V, V _{DS} =-30V, R _L =4Ω, R _{GEN} =3Ω		8		ns
t _r	Turn-on Rise Time			10		ns
t _{d(off)}	Turn-Off Delay Time			26		ns
t _f	Turn-Off Fall Time			10		ns
Q _g	Total Gate Charge	V _{GS} =-10V, V _{DS} =-30V, I _D =-7A		16		nC
Q _{gs}	Gate-Source Charge			3		nC
Q _{gd}	Gate-Drain Charge			3.5		nC
Source-Drain Diode Characteristics						
I _{SD}	Source-Drain Current (Body Diode)				-3.6	A
V _{SD}	Forward on Voltage ^(Note 3)	V _{GS} =0V, I _S =-7A			-1.2	V
t _{rr}	Reverse Recovery Time	I _F =-7A, dI/dt=100A/μs		27.5		ns
Q _{rr}	Reverse Recovery Charge	I _F =-7A, dI/dt=100A/μs		30		nC

Notes 1.Repetitive Rating: Pulse width limited by maximum junction temperature.

Notes 2.EAS condition: T_J=25°C, V_{DD}=-40V, V_G=-10V, R_g=25Ω, L=0.5mH.

Notes 3.Repetitive Rating: Pulse width limited by maximum junction temperature.

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P-Channel Typical Electrical And Thermal Characteristics (Curves)

Figure 1. Output Characteristics

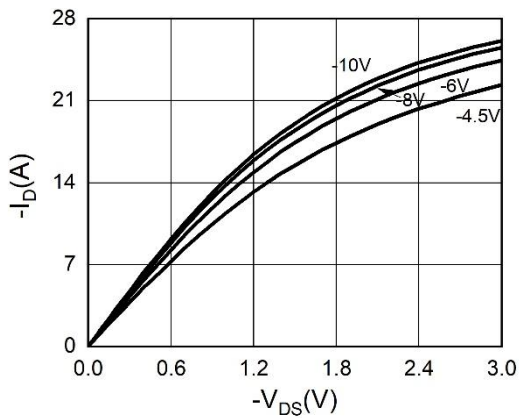


Figure 2. Transfer Characteristics

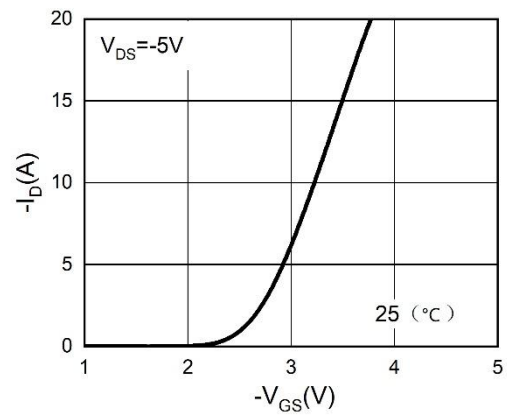


Figure 3. Power Dissipation

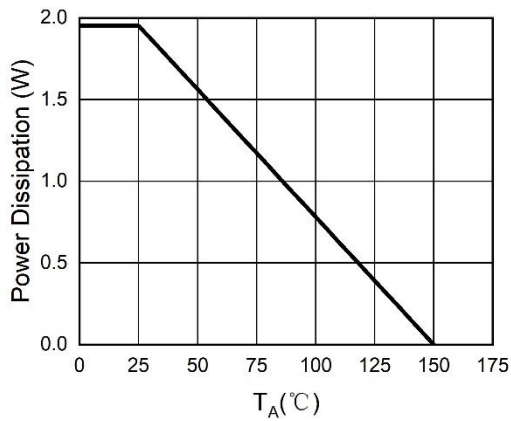


Figure 4. Drain Current

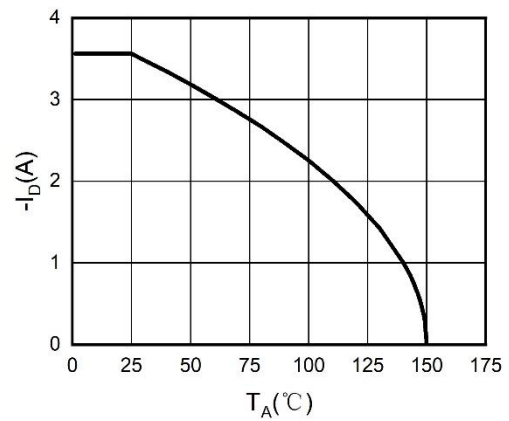


Figure 5. BV_{DSS} vs Junction Temperature

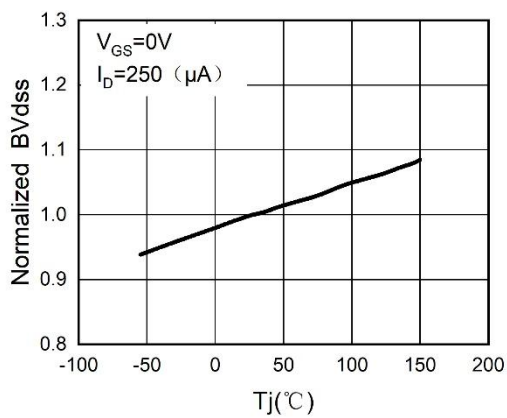
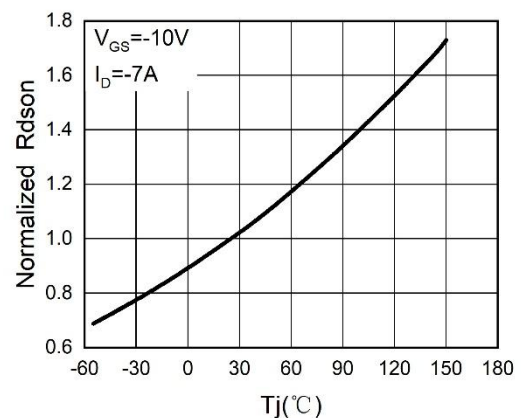


Figure 6. $R_{DS(ON)}$ vs Junction Temperature



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P-Channel Typical Electrical And Thermal Characteristics (Curves)

Figure 7. Gate Charge Waveforms

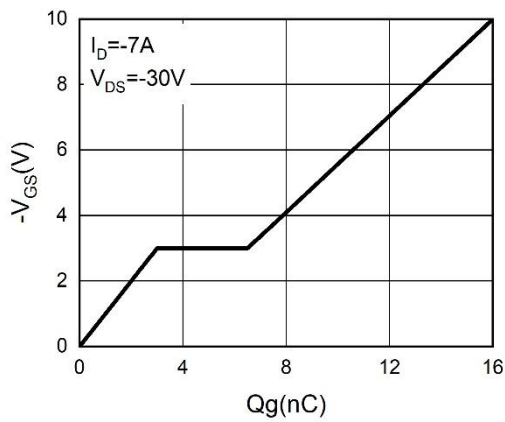


Figure 8. Capacitance

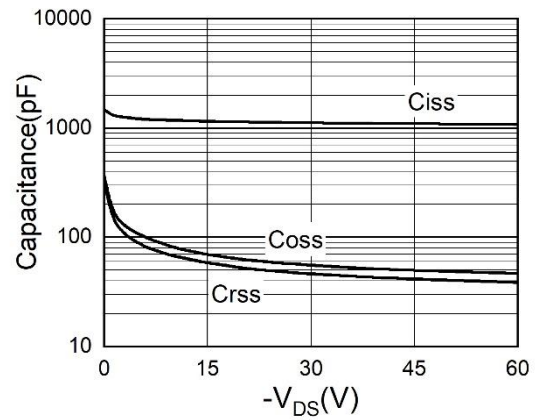


Figure 9. Body-Diode Characteristics

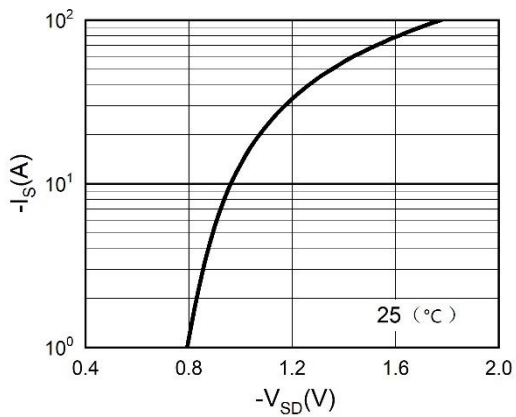
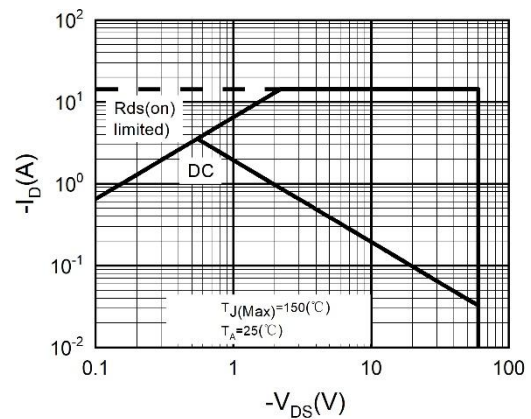
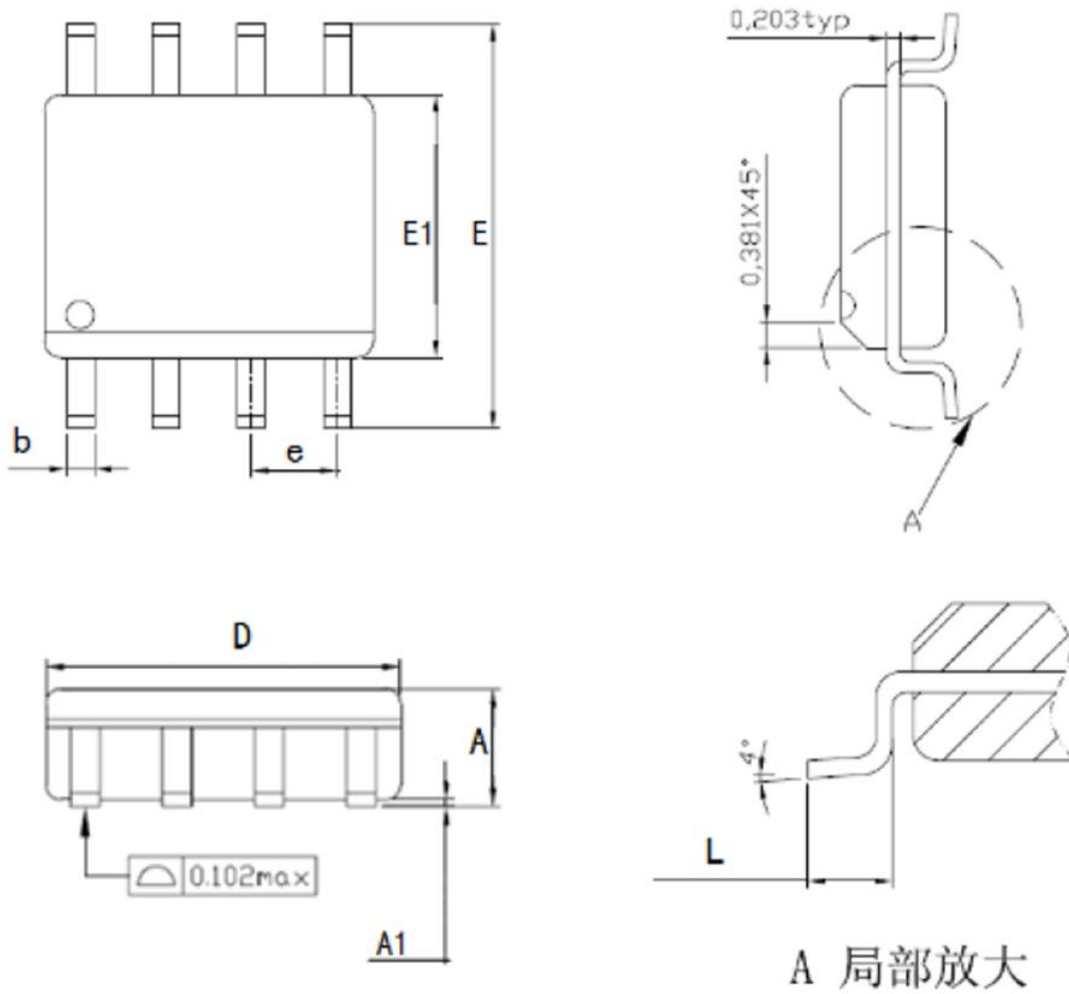


Figure 10. Maximum Safe Operating Area



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SOP-8 Package Information



Symbol	Dimensions In Millimeters		
	Min.	Nom.	Max.
A	1.35	1.55	1.75
A1	0.1	0.15	0.2
b	0.346	0.406	0.466
D	4.8	4.89	4.98
E	5.75	6.00	6.25
E1	3.81	3.90	3.99
e	1.27 TYP		
L	0.406	0.838	1.27