

**SuperMOS – TO-263 -60V  $BV_{DSS}$ , 27m $\Omega$   $R_{DS(on)}$ , -33A  $I_D$  P-channel MOSFET**

**1. Description**

The ESB409L is P-Channel enhancement MOS Field Effect Transistor. Uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. Device is suitable for use in DC-DC conversion, power switch and charging circuit. Standard Product ESB409L is Pb-free.

**2. Features**

- -60V,  $R_{DS(ON)}=27m\Omega(Typ)$ ,  $V_{GS}=-10V$   
 $R_{DS(ON)}=31m\Omega(Typ)$ ,  $V_{GS}=-4.5V$
- Fast Switching
- High density cell design for low  $R_{DS(on)}$
- Material: Halogen free
- Reliable and rugged
- Avalanche Rated
- Low leakage current

**3. Applications**

- PWM applications
- Load switch
- Power management in portable/desktop PCs
- DC/DC conversion

**100% UIS TESTED**

**4. Ordering Information**

Part Number	Package	Marking	Material	Packing	Quantity per reel	Flammability Rating	Reel Size
ESB409L	TO-263	ESB409L/lot	Halogen free	Tape & Reel	800 PCS	UL 94V-0	13 inches

Table-1 Ordering information

**5. Pin Configuration and Functions**

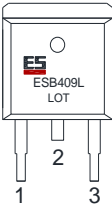
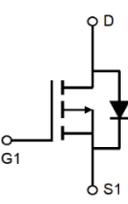
Pin	Function	Outline	Circuit Diagram
3	Source		
1	Gate		
2	Drain		

Table-2 Pin configuration

## 6. Specification

### Absolute Maximum Rating & Thermal Characteristics

Ratings at 25 °C ambient temperature unless otherwise specified.

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$BV_{DSS}$	-60	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current	$I_D$	$T_C=25^\circ\text{C}$	-33
		$T_C=75^\circ\text{C}$	-26
Maximum Power Dissipation	$P_D$	$T_C=25^\circ\text{C}$	69
		$T_C=75^\circ\text{C}$	42
Pulsed Drain Current	$I_{DM}$	-132	A
Operating Junction Temperature	$T_J$	150	$^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	-55 to +150	$^\circ\text{C}$

### Thermal resistance ratings

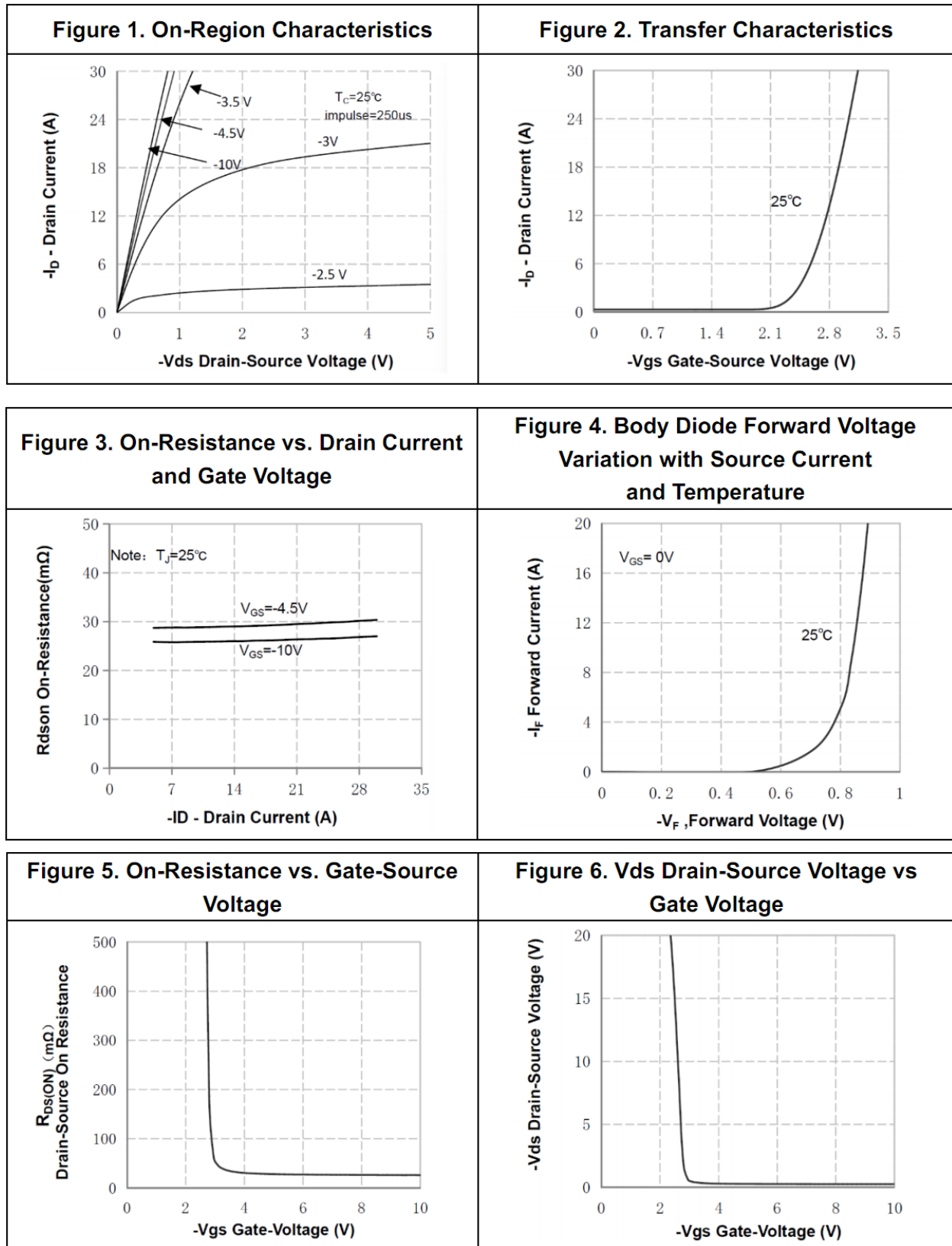
Single Operation				
Parameter	Symbol	Typical	Maximum	Unit
Junction-to- Case Thermal Resistance( $t \leq 10\text{s}$ )	$R_{\theta JC}$	1.5	1.8	$^\circ\text{C/W}$

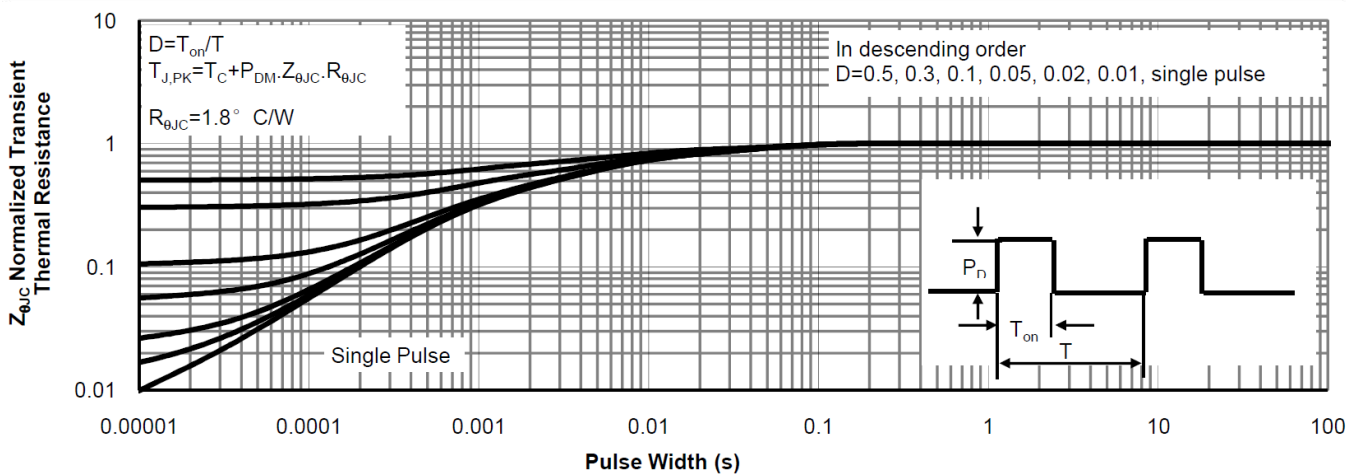
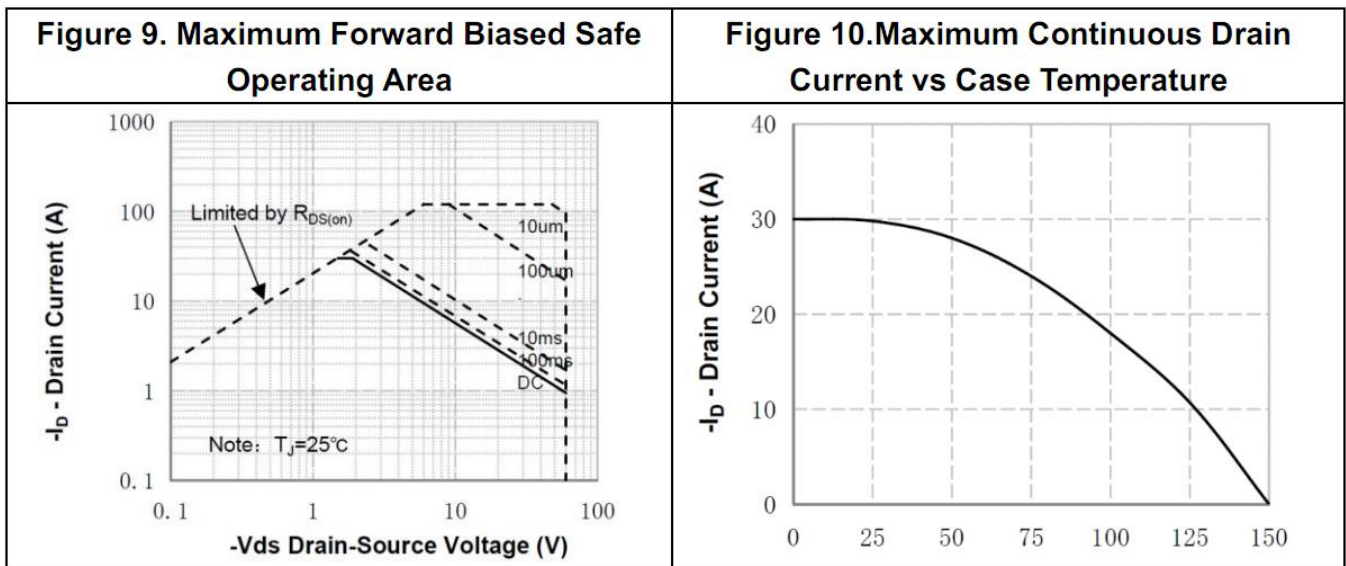
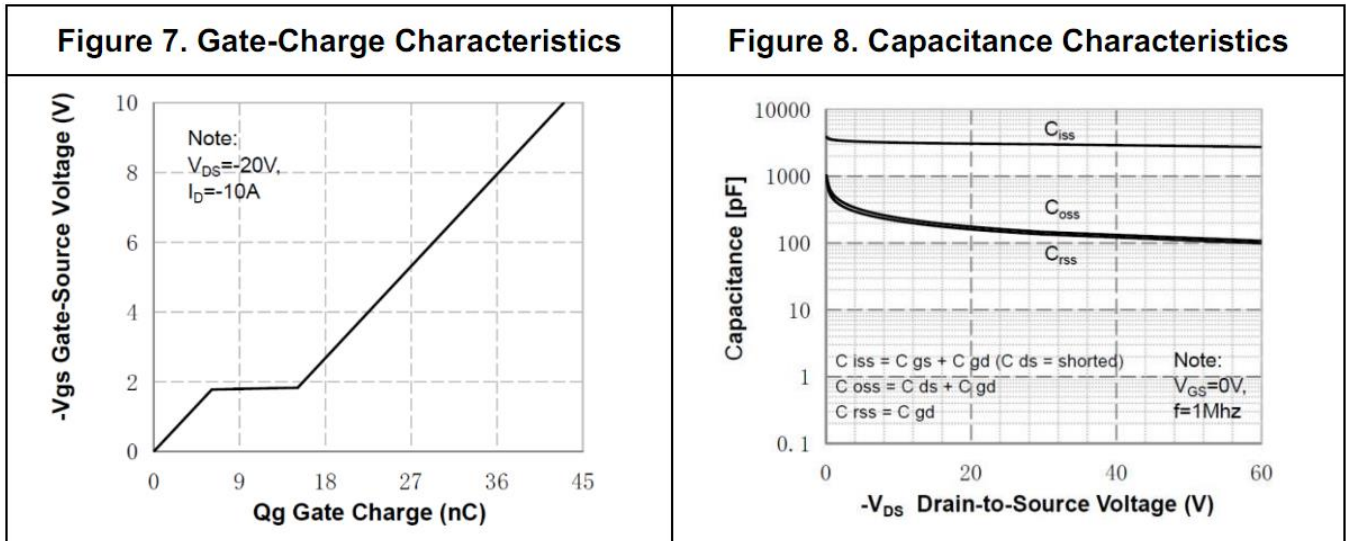
## Electrical Characteristics

At TA = 25°C unless otherwise specified

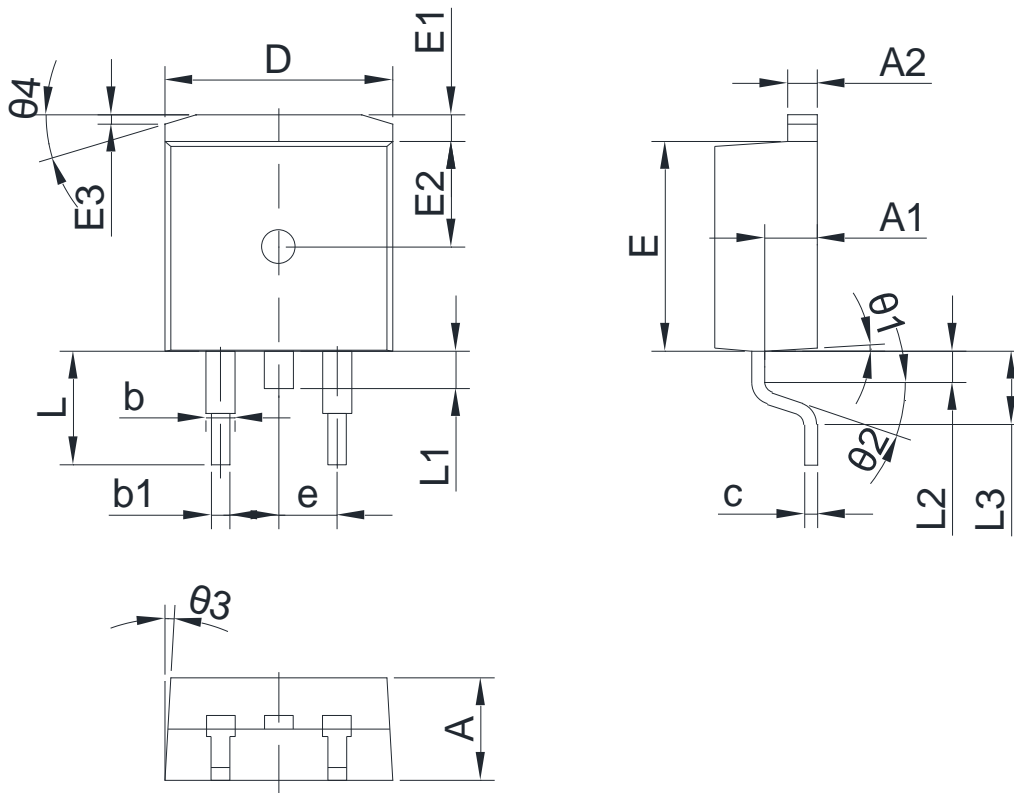
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>OFF CHARACTERISTICS</b>						
Drain-to-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=-250\mu A$	-60			V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=-60V, V_{GS}=0V$			-1	$\mu A$
Gate-to-source Leakage Current	$I_{GSS}$	$V_{DS}=0V, V_{GS}=\pm 20V$			$\pm 100$	nA
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS}=V_{DS}, I_D=-250\mu A$	-1.1	-1.6	-2.1	V
Drain-to-source On-resistance	$R_{DS(on)}$	$V_{GS}=-10V, I_D=-20A$		27	34	m $\Omega$
		$V_{GS}=-4.5V, I_D=-20A$		31	38	
Forward Transconductance	$g_{FS}$	$V_{DS}=-5V, I_D=-20A$			60	S
<b>CHARGES, CAPACITANCES AND GATE RESISTANCE</b>						
Input Capacitance	$C_{ISS}$	$V_{GS}=0V$ $V_{DS}=-20V$ $f=1MHz$		3020		pF
Output Capacitance	$C_{OSS}$			180		
Reverse Transfer Capacitance	$C_{RSS}$			160		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS}=-10V$ $V_{DS}=-20V$ $I_D=-10A$		46.6		nC
Gate-to-Source Charge	$Q_{GS}$			9.1		
Gate-to-Drain Charge	$Q_{GD}$			6.2		
<b>SWITCHING CHARACTERISTICS</b>						
Turn-On Delay Time	$t_{d(ON)}$	$V_{GS}=-10V, V_{DS}=-15V,$ $I_D=-1A, R_G=3\Omega$		45		ns
Rise Time	$t_r$			28		
Turn-Off Delay Time	$t_{d(OFF)}$			80		
Fall Time	$t_f$			6.6		
<b>BODY DIODE CHARACTERISTICS</b>						
Forward Voltage	$V_{SD}$	$V_{GS}=0V, I_S=-1.0A$			-1.2	V

7. Typical Characteristic





8. Dimension (TO-263)



REF	Millimeters		REF	Millimeters	
	Min	Max		Min	Max
A	4.42	4.58	E3	0.2	0.4
A1	2.23	2.43	e	2.49	2.59
A2	1.325 BSC		L	4.725	5.125
b	1.3 BSC		L1	1.47	1.67
b1	0.81 BSC		L2	1.125	1.325
c	0.49	0.59	L3	3.125	3.325
D	9.90	10.06	θ 1	3° REF	
E	9.11	9.27	θ 2	17° REF	
E1	1.15	1.25	θ 3	3° REF	
E2	4.59	4.61	θ 4	15° REF	

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