

## 20V(D-S) Dual N-Channel Enhancement Mode Power MOS FET

**General Features**

- $V_{DS} = 20V, I_D = 11A$
- $R_{DS(ON)} < 7m\Omega @ V_{GS}=2.5V$
- $R_{DS(ON)} < 9m\Omega @ V_{GS}=4.5V$
- ESD Rating: 2000V HBM
- High power and current handing capability
- Lead free product is acquired
- Surface mount package
- ESD protected



Lead Free

**Application**

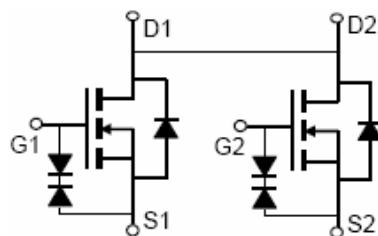
- PWM application
- Load switch



Marking and pin assignment

**PIN Configuration**

TSSOP-8 top view



Schematic diagram

**Package Marking and Ordering Information**

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
MSC0211GE	MSC0211GE	TSSOP-8	Ø330mm	12mm	3000 units

**Absolute Maximum Ratings ( $T_A=25^\circ C$  unless otherwise noted)**

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	20	V
Gate-Source Voltage	$V_{GS}$	$\pm 10$	V
Drain Current-Continuous	$I_D$	11	A
Drain Current-Pulsed <sup>(Note 1)</sup>	$I_{DM}$	44	A
Maximum Power Dissipation	$P_D$	1.6	W
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 150	°C

**Thermal Characteristic**

Thermal Resistance, Junction-to-Ambient <sup>(Note 2)</sup>	$R_{\theta JA}$	78	°C/W
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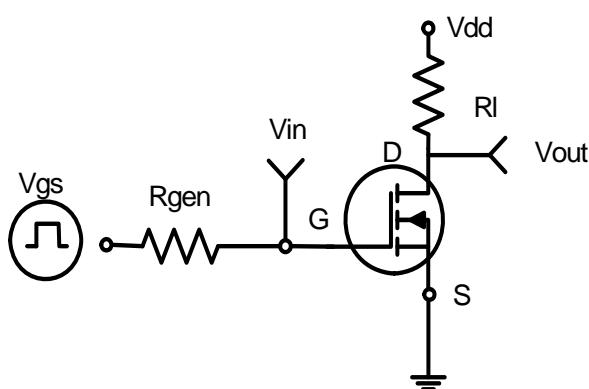
**Electrical Characteristics ( $T_A=25^\circ\text{C}$  unless otherwise noted)**

<b>Parameter</b>	<b>Symbol</b>	<b>Condition</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>	<b>Unit</b>
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$\text{BV}_{\text{DSS}}$	$V_{\text{GS}}=0\text{V}, I_{\text{D}}=250\mu\text{A}$	20		-	V
Zero Gate Voltage Drain Current	$I_{\text{DSS}}$	$V_{\text{DS}}=20\text{V}, V_{\text{GS}}=0\text{V}$	-	-	1	$\mu\text{A}$
<b>Parameter</b>						
Gate-Body Leakage Current	$I_{\text{GSS}}$	$V_{\text{GS}}=\pm 10\text{V}, V_{\text{DS}}=0\text{V}$	-	-	$\pm 10$	$\mu\text{A}$
<b>On Characteristics</b> <sup>(Note 3)</sup>						
Gate Threshold Voltage	$V_{\text{GS}(\text{th})}$	$V_{\text{DS}}=V_{\text{GS}}, I_{\text{D}}=250\mu\text{A}$	0.6	0.8	1.2	V
Drain-Source On-State Resistance	$R_{\text{DS}(\text{ON})}$	$V_{\text{GS}}=4.5\text{V}, I_{\text{D}}=10\text{A}$	-	5.5	7	$\text{m}\Omega$
		$V_{\text{GS}}=2.5\text{V}, I_{\text{D}}=5.5\text{A}$	-	7	9	$\text{m}\Omega$
Forward Transconductance	$g_{\text{FS}}$	$V_{\text{DS}}=5\text{V}, I_{\text{D}}=11\text{A}$	25	-	-	S
<b>Dynamic Characteristics</b> <sup>(Note 4)</sup>						
Input Capacitance	$C_{\text{iss}}$	$V_{\text{DS}}=10\text{V}, V_{\text{GS}}=0\text{V}, F=1.0\text{MHz}$	-	1710	-	PF
Output Capacitance	$C_{\text{oss}}$		-	232	-	PF
Reverse Transfer Capacitance	$C_{\text{rss}}$		-	200	-	PF
<b>Switching Characteristics</b> <sup>(Note 4)</sup>						
Turn-on Delay Time	$t_{\text{d}(\text{on})}$	$V_{\text{DD}}=10\text{V}, R_{\text{L}}=1\Omega$ $V_{\text{GS}}=10\text{V}, R_{\text{GEN}}=3\Omega$	-	2.5		nS
Turn-on Rise Time	$t_{\text{r}}$		-	7.2		nS
Turn-Off Delay Time	$t_{\text{d}(\text{off})}$		-	49		nS
Turn-Off Fall Time	$t_{\text{f}}$		-	10.8		nS
Total Gate Charge	$Q_{\text{g}}$	$V_{\text{DS}}=10\text{V}, I_{\text{D}}=10\text{A}, V_{\text{GS}}=4.5\text{V}$	-	17.5		nC
Gate-Source Charge	$Q_{\text{gs}}$		-	1.5	-	nC
Gate-Drain Charge	$Q_{\text{gd}}$		-	4.5	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage <sup>(Note 3)</sup>	$V_{\text{SD}}$	$V_{\text{GS}}=0\text{V}, I_{\text{s}}=1\text{A}$	-	-	1.2	V
Diode Forward Current <sup>(Note 2)</sup>	$I_{\text{s}}$		-	-	11	A

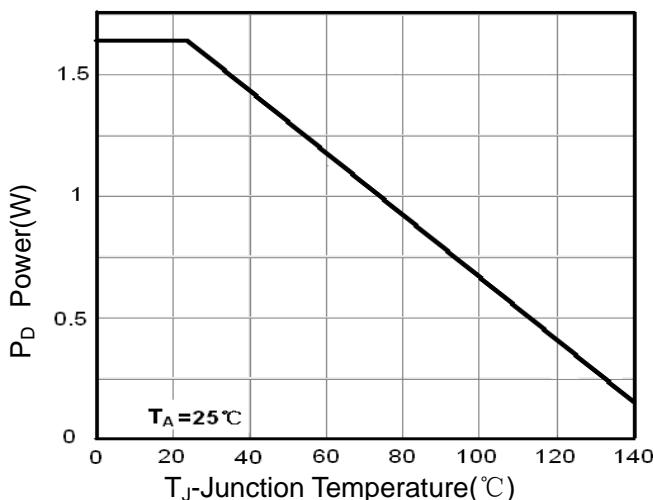
**Notes:**

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production

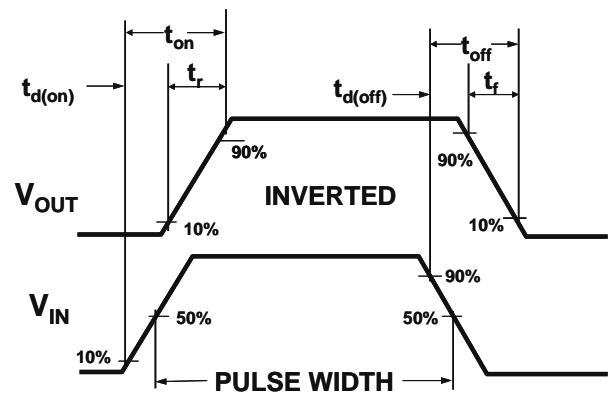
### Typical Electrical and Thermal Characteristics



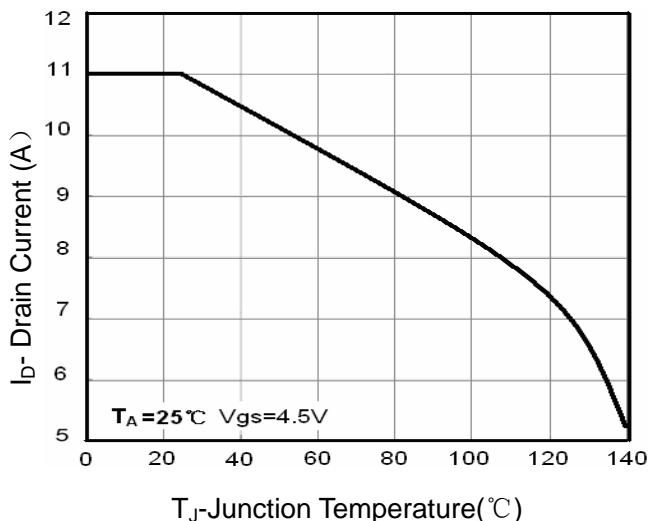
**Figure 1:Switching Test Circuit**



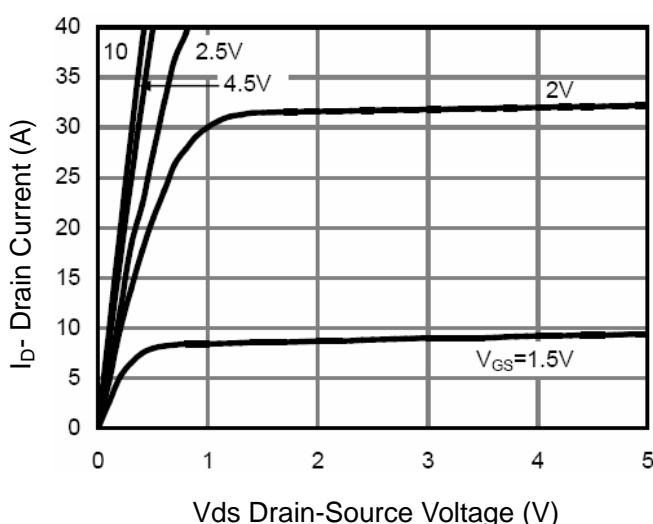
**Figure 3 Power Dissipation**



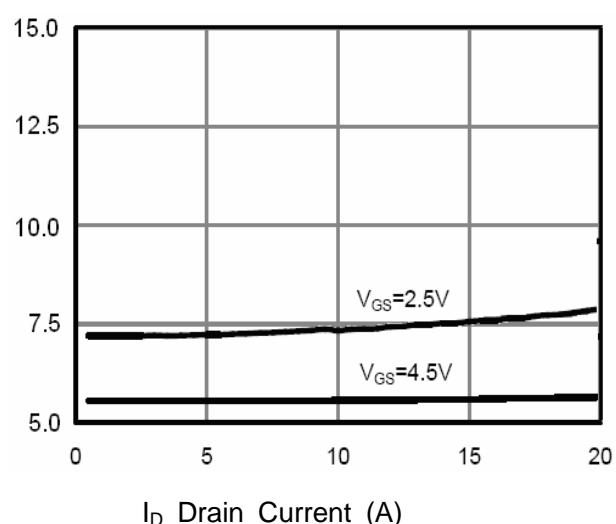
**Figure 2:Switching Waveforms**



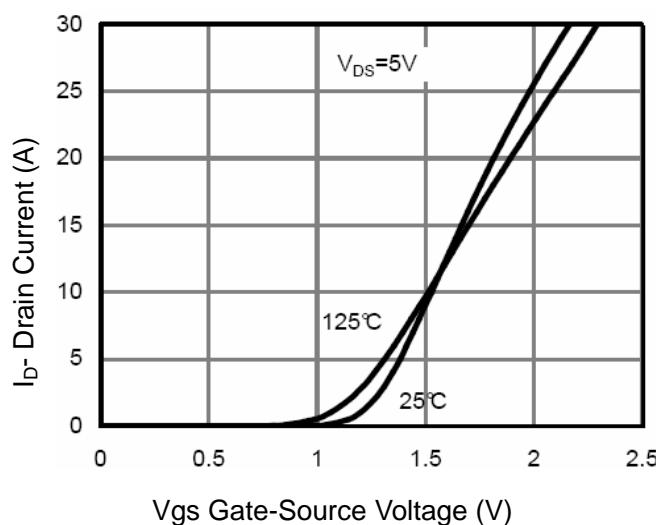
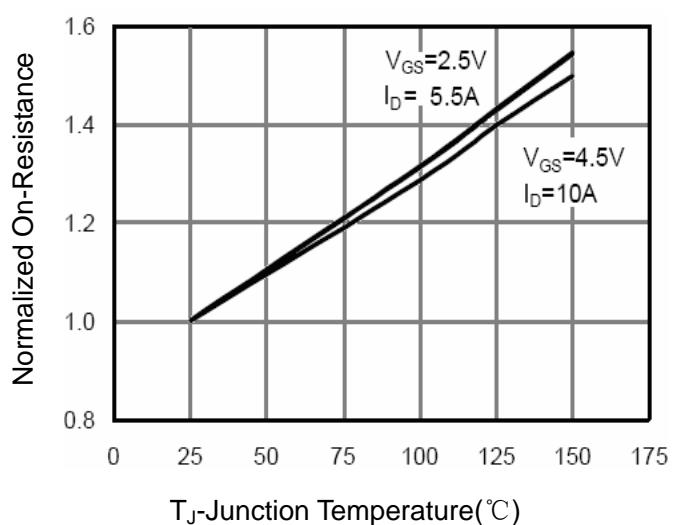
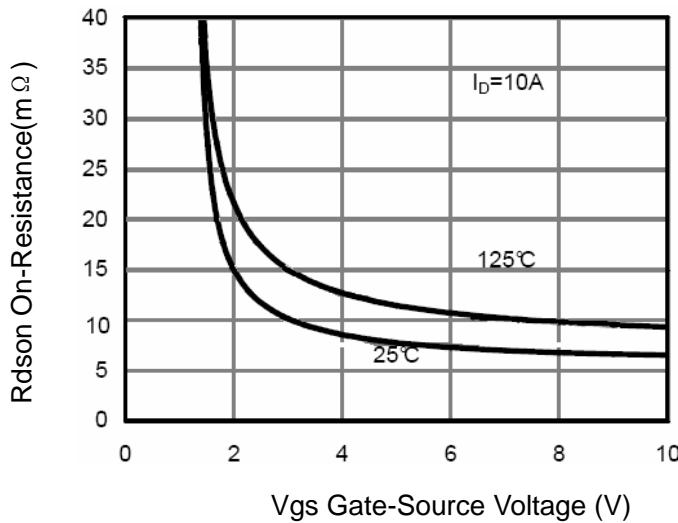
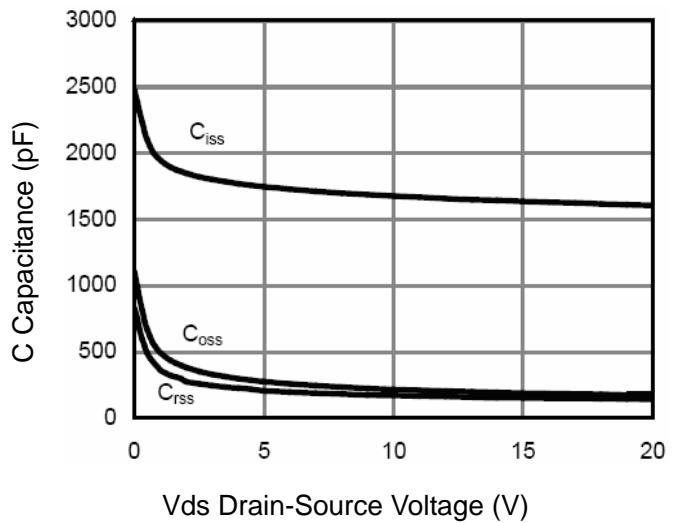
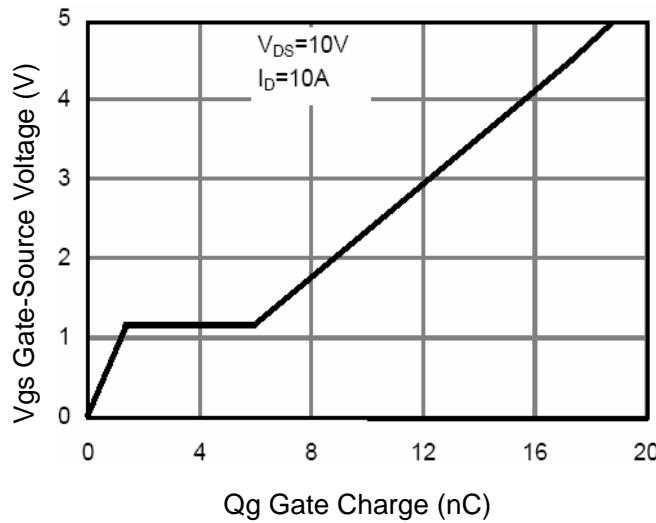
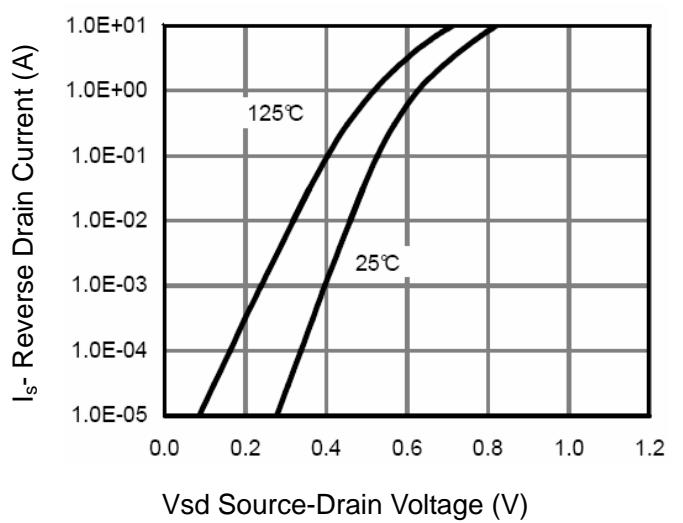
**Figure 4 Drain Current**

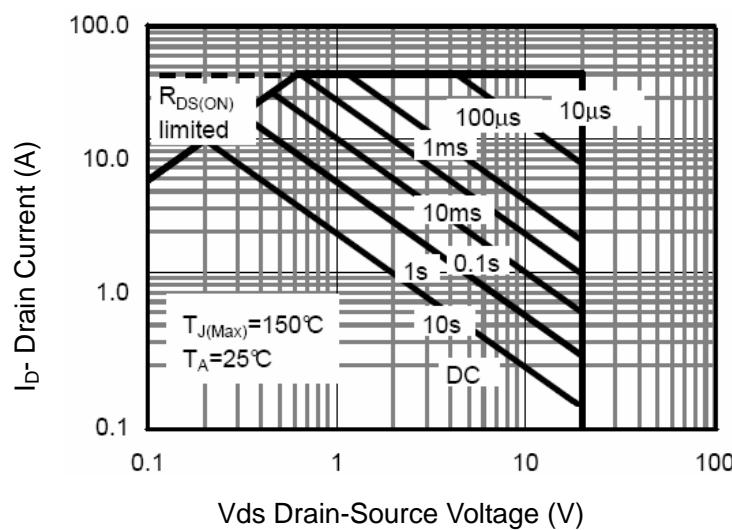
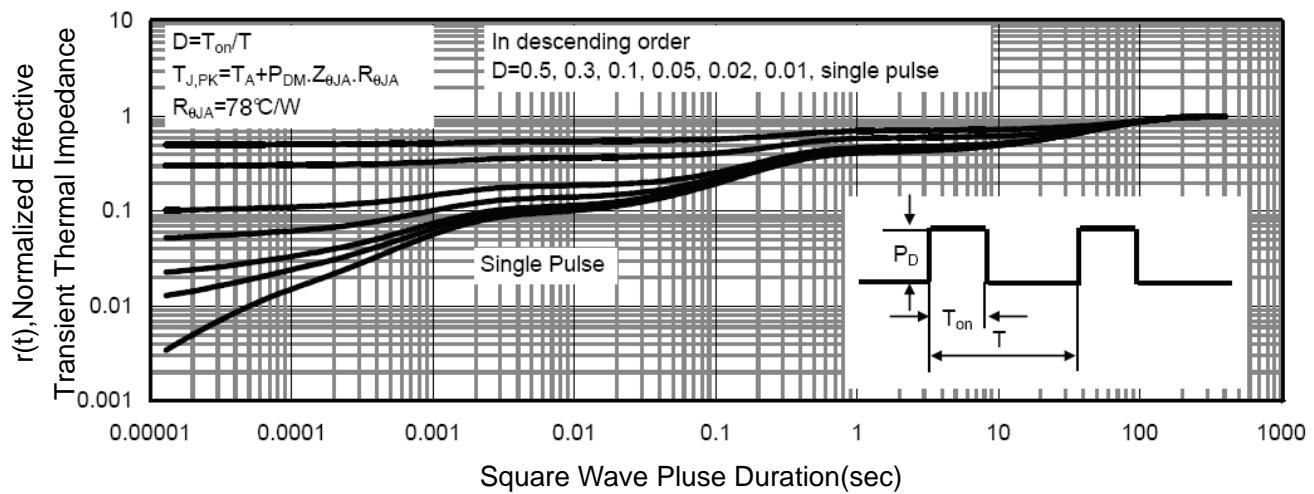


**Figure 5 Output Characteristics**

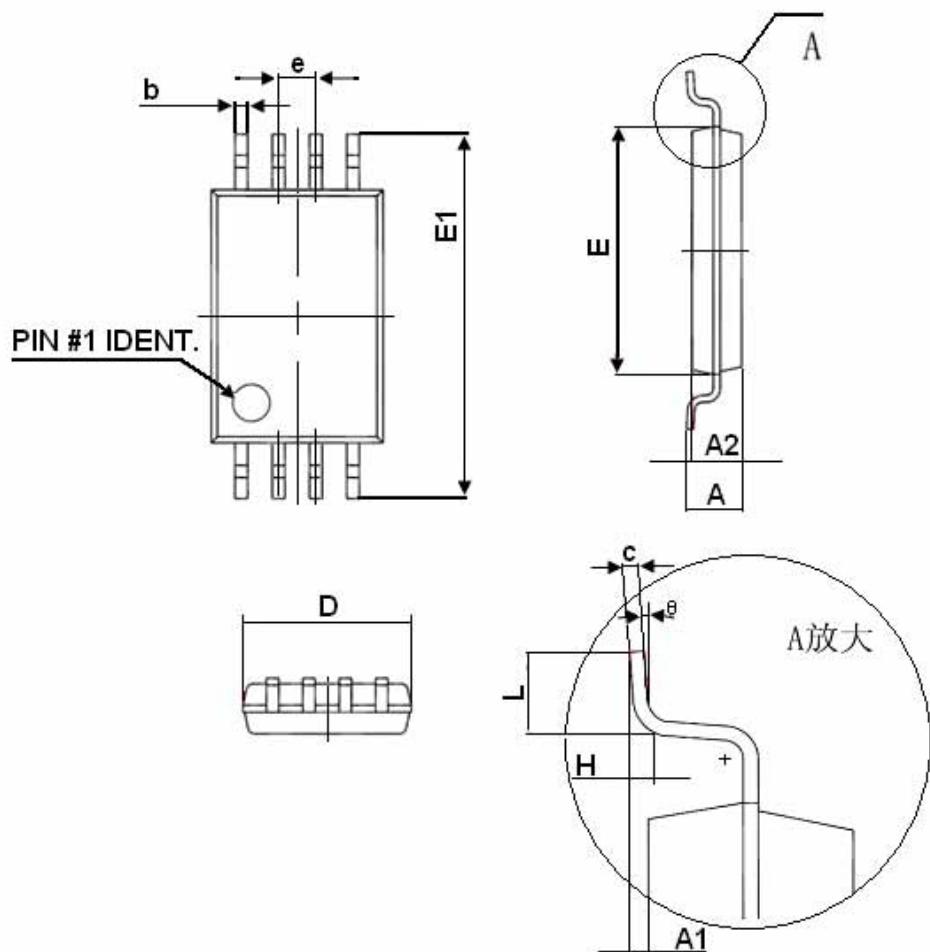


**Figure 6 Drain-Source On-Resistance**

**Figure 7 Transfer Characteristics****Figure 8 Drain-Source On-Resistance****Figure 9  $R_{DS(on)}$  vs  $V_{GS}$** **Figure 10 Capacitance vs  $V_{DS}$** **Figure 11 Gate Charge****Figure 12 Source- Drain Diode Forward**

**Figure 13 Safe Operation Area****Figure 14 Normalized Maximum Transient Thermal Impedance**

## TSSOP-8 Package Information



Symbol	Dimensions In Millimeters	
	Min	Max
D	2.900	3.100
E	4.300	4.500
b	0.190	0.300
c	0.090	0.200
E1	6.250	6.550
A		1.100
A2	0.800	1.000
A1	0.020	0.150
e	0.65(BSC)	
L	0.500	0.700
H	0.25(TYP)	
Θ	1°	7°