

## DC-DC CONVERTER APPLICATION

## HIGH VOLTAGE SWITCHING APPLICATIONS

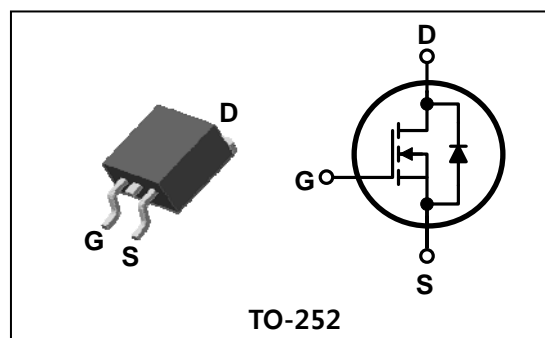
### Features

- High Voltage :  $BV_{DSS}=200V(\text{Min.})$
- Low  $C_{RSS}$  :  $C_{RSS}=17pF(\text{Typ.})$
- Low gate charge :  $Qg=9nC(\text{Typ.})$
- Low  $R_{DS(on)}$  :  $R_{DS(on)}=0.4\Omega(\text{Max.})$

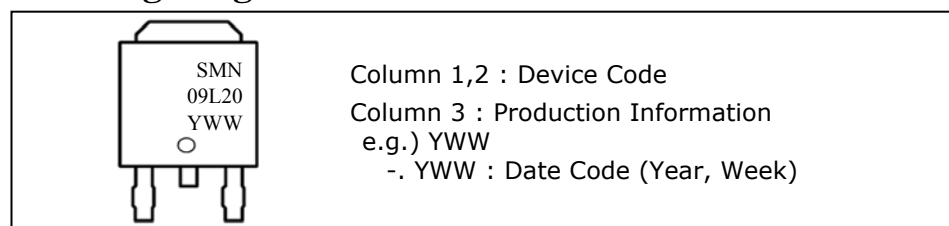
### Ordering Information

Type No.	Marking	Package Code
SMN09L20D	SMN09L20	TO-252

### PIN Connection



### Marking Diagram



### Absolute maximum ratings ( $T_C=25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Rating	Unit	
Drain-source voltage	$V_{DSS}$	200	V	
Gate-source voltage	$V_{GSS}$	$\pm 30$	V	
Drain current (DC) *	$I_D$	$T_C=25^\circ\text{C}$	9	A
		$T_C=100^\circ\text{C}$	5.7	A
Drain current (Pulsed) *	$I_{DM}$	36	A	
Power dissipation	$P_D$	45	W	
Avalanche current (Single) ②	$I_{AS}$	9	A	
Single pulsed avalanche energy ②	$E_{AS}$	232	mJ	
Avalanche current (Repetitive) ①	$I_{AR}$	9	A	
Repetitive avalanche energy ①	$E_{AR}$	9.5	mJ	
Junction temperature	$T_J$	150	$^\circ\text{C}$	
Storage temperature range	$T_{stg}$	-55~150		

\* Limited by maximum junction temperature

Characteristic	Symbol	Typ.	Max.	Unit	
Thermal resistance	Junction-case	$R_{th(J-C)}$	-	2.77	$^\circ\text{C/W}$
	Junction-ambient **	$R_{th(J-A)}$	-	50	

\*\* When mounted on the minimum pad size recommended (PCB Mount)

## Electrical Characteristics (T<sub>C</sub>=25°C unless otherwise noted)

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit	
Drain-source breakdown voltage	BV <sub>DSS</sub>	I <sub>D</sub> =250μA, V <sub>GS</sub> =0	200	-	-	V	
Gate threshold voltage	V <sub>GS(th)</sub>	I <sub>D</sub> =250μA, V <sub>DS</sub> =V <sub>GS</sub>	1.0	-	2.25	V	
Drain-source cut-off current	I <sub>DSS</sub>	V <sub>DS</sub> =200V, V <sub>GS</sub> =0V	-	-	1	μA	
Gate leakage current	I <sub>GSS</sub>	V <sub>DS</sub> =0V, V <sub>GS</sub> =±30V	-	-	±100	nA	
Drain-source on-resistance ④	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =4.5A	-	0.34	0.40	Ω	
Forward transfer conductance ④	g <sub>fs</sub>	V <sub>DS</sub> =10V, I <sub>D</sub> =4.5A	-	5.5	-	S	
Input capacitance	C <sub>iss</sub>	V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1MHz	-	556	600	pF	
Output capacitance	C <sub>oss</sub>		-	100	150		
Reverse transfer capacitance	C <sub>rss</sub>		-	17	30		
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> =100V, I <sub>D</sub> =9A R <sub>G</sub> =25Ω	-	18	-	ns	
Rise time	t <sub>r</sub>		-	36	-		
Turn-off delay time	t <sub>d(off)</sub>		③④	-	133		-
Fall time	t <sub>f</sub>		-	45	-		
Total gate charge	Q <sub>g</sub>	V <sub>DS</sub> =160V, V <sub>GS</sub> =5V I <sub>D</sub> =9A	-	9	15	nC	
Gate-source charge	Q <sub>gs</sub>		-	4	-		
Gate-drain charge	Q <sub>gd</sub>		③④	-	3		-

## Source-Drain Diode Ratings and Characteristics (T<sub>C</sub>=25°C unless otherwise noted)

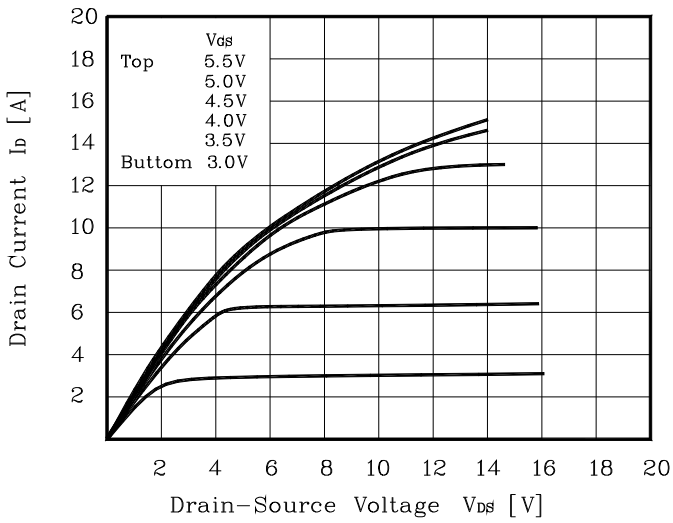
Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Source current (DC)	I <sub>S</sub>	Integral reverse diode in the MOSFET	-	-	9	A
Source current (Pulsed) ①	I <sub>SM</sub>		-	-	36	
Forward voltage ④	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =9A	-	-	1.5	V
Reverse recovery time	t <sub>rr</sub>	I <sub>S</sub> =9A, V <sub>GS</sub> =0V dI <sub>F</sub> /dt=100A/μs	-	158	-	ns
Reverse recovery charge	Q <sub>rr</sub>		-	0.97	-	μC

Note ;

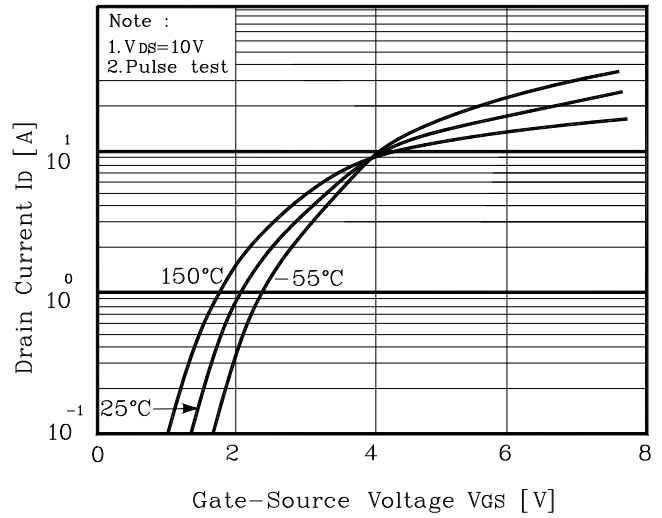
- ① Repetitive rating : Pulse width limited by maximum junction temperature
- ② L=4.3mH, I<sub>AS</sub>=9A, V<sub>DD</sub>=50V, R<sub>G</sub>=25Ω, Starting T<sub>J</sub>=25°C
- ③ Pulse Test : Pulse width≤300μs, Duty cycle≤2%
- ④ Essentially independent of operating temperature

## Electrical Characteristic Curves

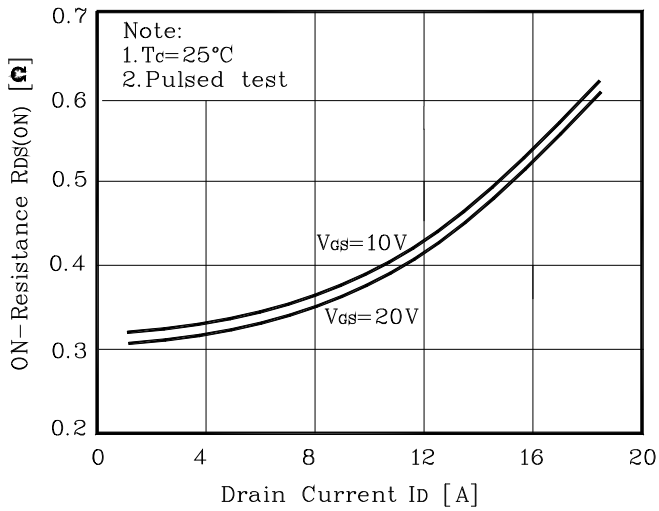
**Fig. 1  $I_D - V_{DS}$**



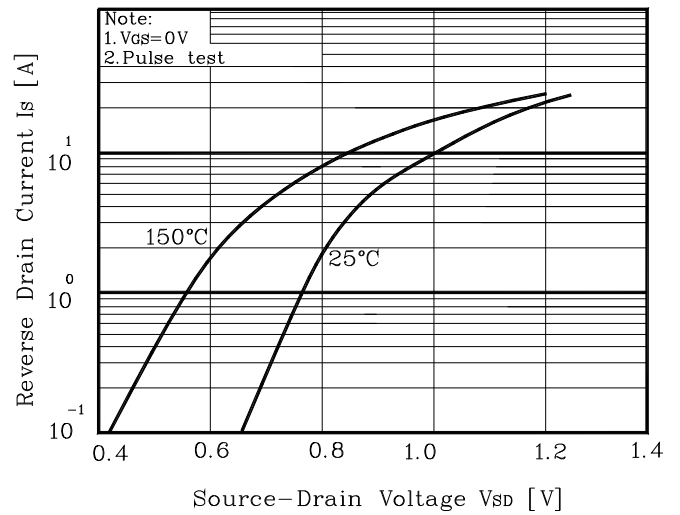
**Fig. 2  $I_D - V_{GS}$**



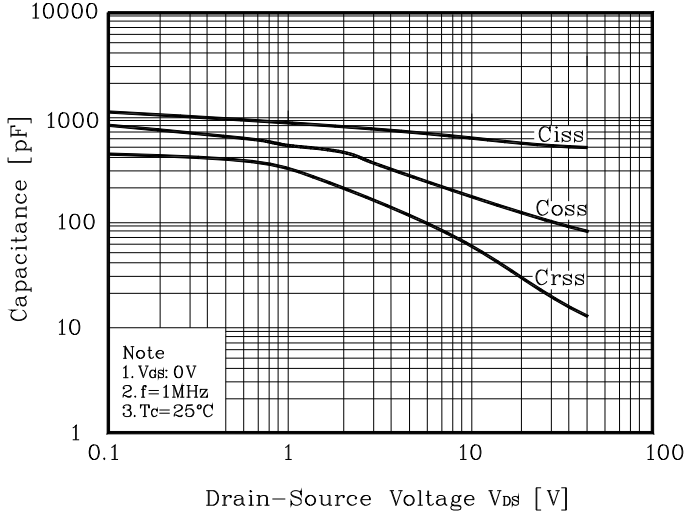
**Fig. 3  $R_{DS(on)} - I_D$**



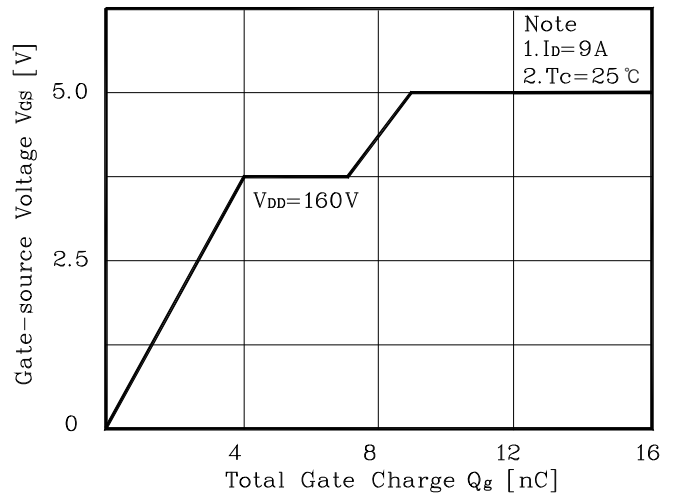
**Fig. 4  $I_S - V_{SD}$**



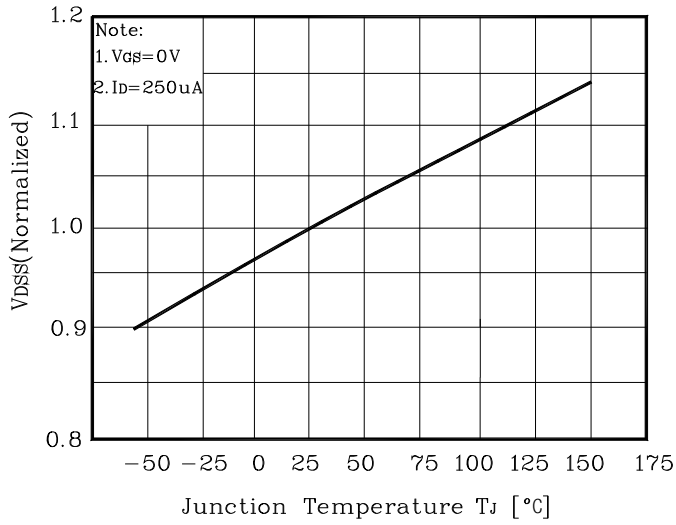
**Fig. 5 Capacitance -  $V_{DS}$**



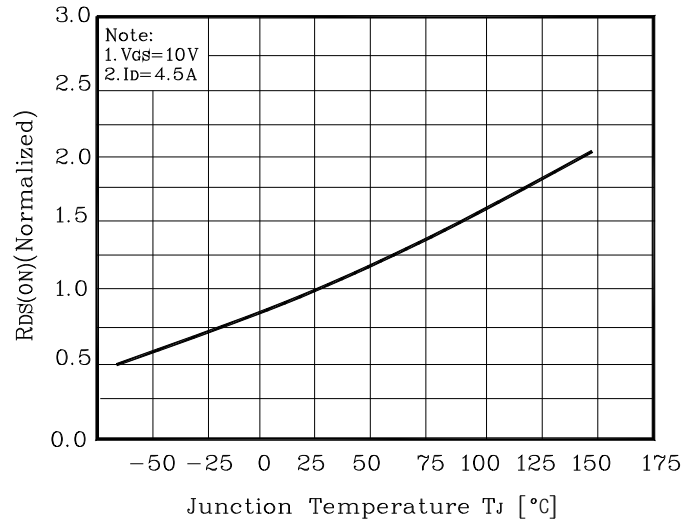
**Fig. 6  $V_{GS} - Q_g$**



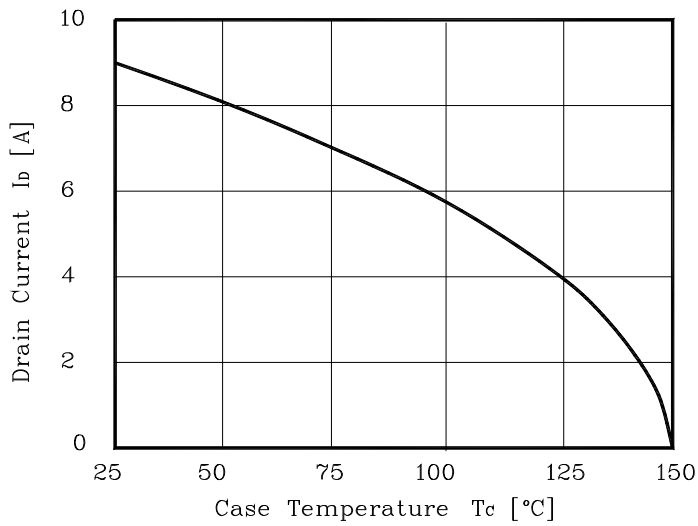
**Fig. 7  $V_{DSS} - T_J$**



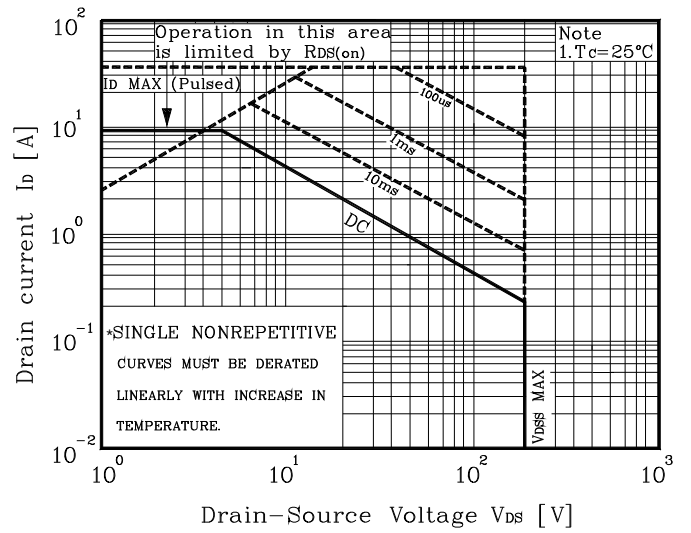
**Fig. 8  $R_{DS(on)} - T_J$**



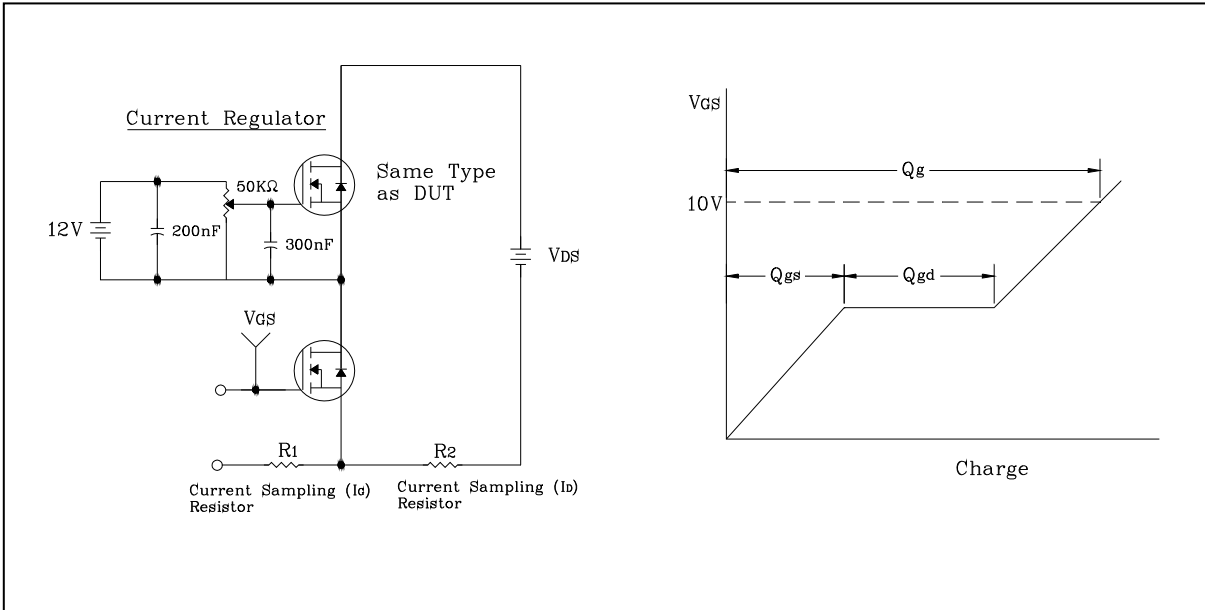
**Fig. 9  $I_D - T_C$**



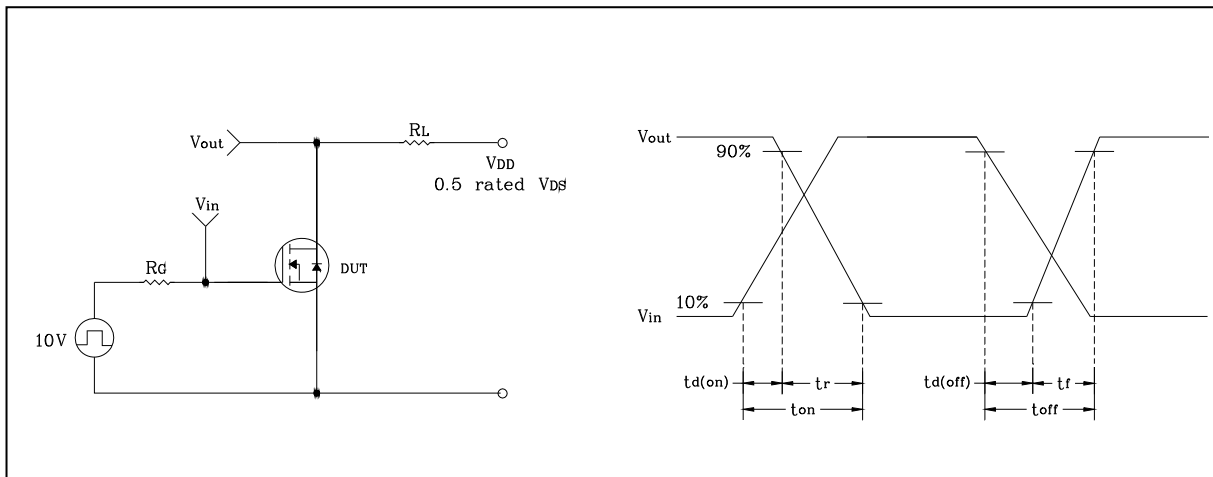
**Fig. 10 Safe Operating Area**



**Fig. 11 Gate Charge Test Circuit & Waveform**



**Fig. 12 Resistive Switching Test Circuit & Waveform**



**Fig. 13  $E_{AS}$  Test Circuit & Waveform**

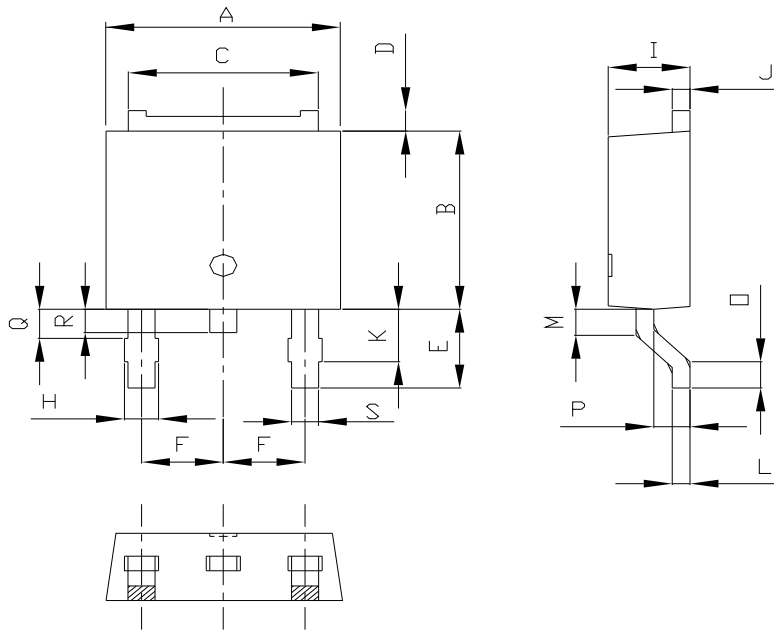


Fig. 14 Diode Reverse Recovery Time Test Circuit & Waveform



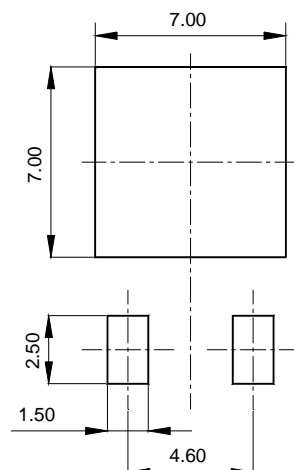
## Outline Dimension

unit: mm



SYMBOL	MILLIMETERS			NOTE
	MINIMUM	NOMINAL	MAXIMUM	
A	6.40	6.60	6.80	
B	5.90	6.10	6.30	
C	5.04	5.34	5.64	
D	0.50	0.70	0.90	
E	2.50	2.70	2.90	
F	2.10	2.30	2.50	
H	0.96 MAX			
I	2.20	2.30	2.40	
J	0.40	0.50	0.60	
K	1.60	1.80	2.00	
L	0.40	0.50	0.60	
M	0.81	0.91	1.01	
Q	0.80	0.90	1.00	
P	0.90	1.00	1.10	
Q	0.95 MAX			
R	0.60	0.80	1.00	
S	0.66	0.76	0.86	

### ※ Recommended Land Pattern [unit: mm]



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