

### Features

- Uses advanced SGT technology
- Extremely low on-resistance  $R_{DS(on)}$
- Excellent gate charge x  $R_{DS(on)}$  product(FOM)

Product Summary			
$V_{DS}$	$R_{DS(on)}$ (m $\Omega$ ) Typ	$I_D$ (A)	$Q_g$ (Typ)
120V	1.23 @ 10V 40A	362	203nc

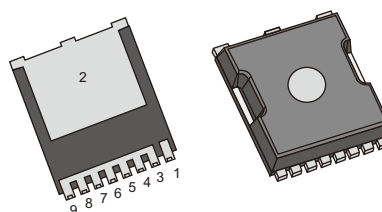
### Mechanical Data

- Case:TOLL Package

TOLL  
DS016N12T

### Application

- Motor control and drives
- Battery management
- DC/DC converter
- General purpose applications



### Ordering Information

Part No.	Package Type	Package	Quality(box)
DS016N12T	TOLL	Tape & Reel	2000

### Block Diagram

Pin Definition:

- 1. Gate
- 2. Drain
- 3/4/5/6/7/8/9. Source

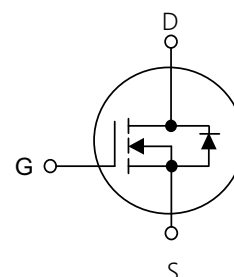


Table1 Absolute Maximum Ratings ( $T_c=25^\circ\text{C}$ , unless otherwise specified)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	$V_{DS}$	120	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current	$I_D$	$T_c=25^\circ\text{C}$	A
		$T_c=100^\circ\text{C}$	
Pulsed Drain Current (Note 1)	$I_{DM}$	1540	A
Single Pulse Avalanche Energy(Note 2)	$E_{AS}$	2209	mJ
Power Dissipation $T_c=25^\circ\text{C}$	$P_D$	329	W
Operating Junction and Storage Temperature	$T_J/T_{STG}$	-55~+150	$^\circ\text{C}$

Table 2. Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal resistance Junction to Ambient. Max	$R_{\theta JA}$	54.0	$^{\circ}\text{C}/\text{W}$
Thermal resistance Junction to Case. Max	$R_{\theta JC}$	0.38	$^{\circ}\text{C}/\text{W}$

Table 3. Electrical Characteristics ( $T_J=25^{\circ}\text{C}$ , unless otherwise specified)

Parameter		Symbol	Test Conditions	Min	Typ	Max	Unit
Off Characteristics							
Drain-Source Breakdown Voltage		BV <sub>DSS</sub>	V <sub>GS</sub> =0V,I <sub>D</sub> =250μA	120	-	-	V
Drain-Source Leakage Current		I <sub>DSS</sub>	V <sub>DS</sub> =120V,V <sub>GS</sub> =0V	-	-	1	μA
Gate- Source Leakage Current	Forward	I <sub>GSS</sub>	V <sub>GS</sub> =20V,V <sub>DS</sub> =0V	-	-	100	nA
	Reverse		V <sub>GS</sub> =-20V,V <sub>DS</sub> =0V	-	-	-100	nA
On Characteristics(Note 3)							
Gate Threshold Voltage		V <sub>GS(TH)</sub>	V <sub>DS</sub> =V <sub>GS</sub> ,I <sub>D</sub> =250μA	2.0	-	4.0	V
Static Drain-Source On-State Resistance		R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V,I <sub>D</sub> =40A	-	1.23	1.6	mΩ
Dynamic Characteristics(Note 4)							
Input Capacitance		C <sub>ISS</sub>	V <sub>DS</sub> =40V,V <sub>GS</sub> =0V,f=1MHz	-	10900	-	pF
Output Capacitance		C <sub>OSS</sub>		-	3039	-	pF
Reverse Transfer Capacitance		C <sub>RSS</sub>		-	111	-	pF
Switching Characteristics (Note 4)							
Turn-On Delay Time		t <sub>d(on)</sub>	V <sub>DS</sub> =40V,I <sub>D</sub> =40A, V <sub>GS</sub> =10V,R <sub>G</sub> =1.8Ω,	-	38	-	ns
Turn-On Rise Time		t <sub>R</sub>		-	64	-	ns
Turn-Off Delay Time		t <sub>d(off)</sub>		-	84	-	ns
Turn-Off Fall Time		t <sub>f</sub>		-	39	-	ns
Total Gate Charge		Q <sub>G</sub>	V <sub>DS</sub> =60V,I <sub>D</sub> =100A, V <sub>GS</sub> =10V	-	203	-	nC
Gate-Source Charge		Q <sub>GS</sub>		-	92.9	-	nC
Gate-Drain Charge		Q <sub>GD</sub>		-	35	-	nC
Drain-Source Diode Characteristics and Maximum Ratings							
Drain-Source Diode Forward Voltage		V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =50A	-	-	1.2	V
Reverse Recovery Time		t <sub>rr</sub>	I <sub>F</sub> =50A,dI <sub>F</sub> /dt=100A/μs	-	113	-	ns
Reverse Recovery Charge		Q <sub>RR</sub>	I <sub>F</sub> =50A,dI <sub>F</sub> /dt=100A/μs	-	270	-	nC

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

2  $L = 0.5\text{mH}$ ,  $R_G = 25\Omega$ , Starting  $T_J=25^{\circ}\text{C}$

3 Pulse Test: Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$

4 Guaranteed by design, not subject to production

## Typical Characteristics Diagrams

Figure 1. Output Characteristics

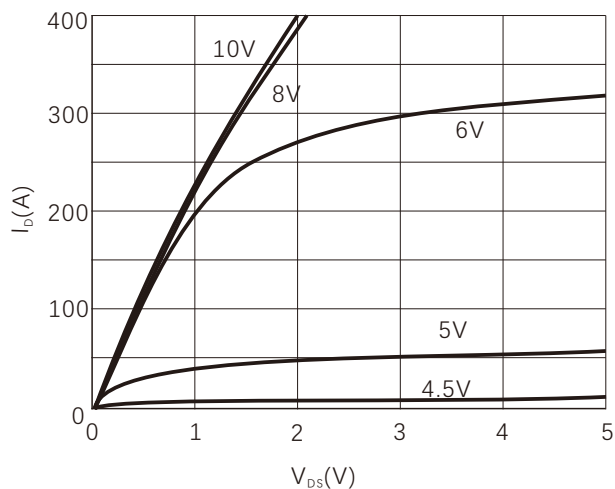


Figure 2. Normalized  $R_{DS(ON)}$  vs Temperature

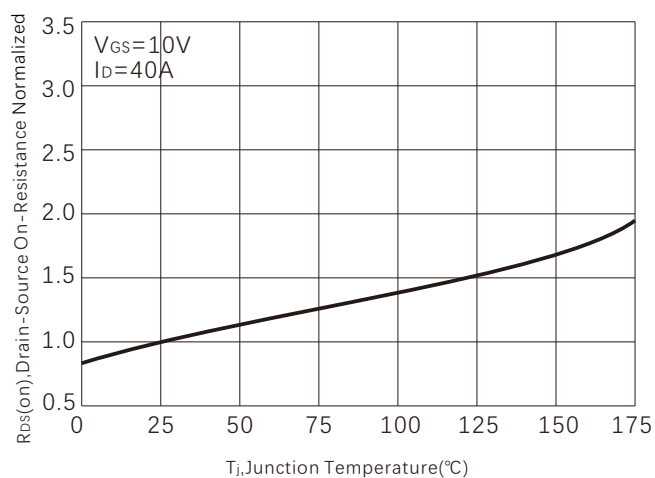


Figure 3. On-Resistance vs. Drain Current

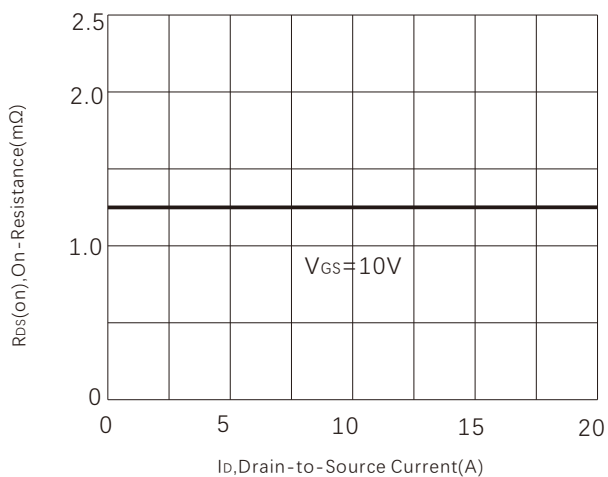


Figure 4. Capacitance

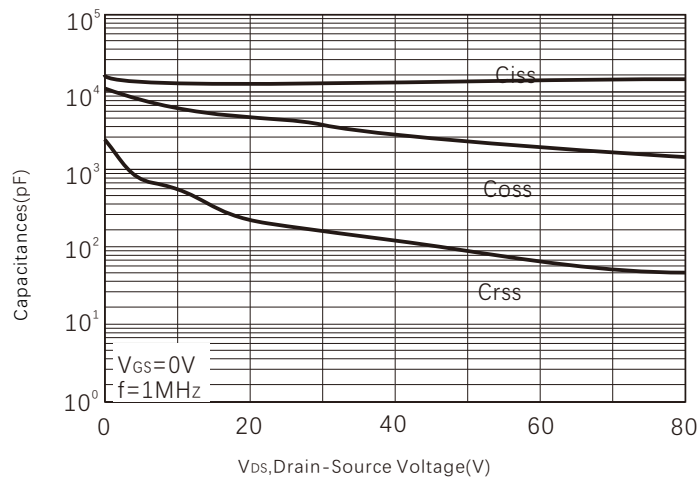


Figure 5. Gate charge

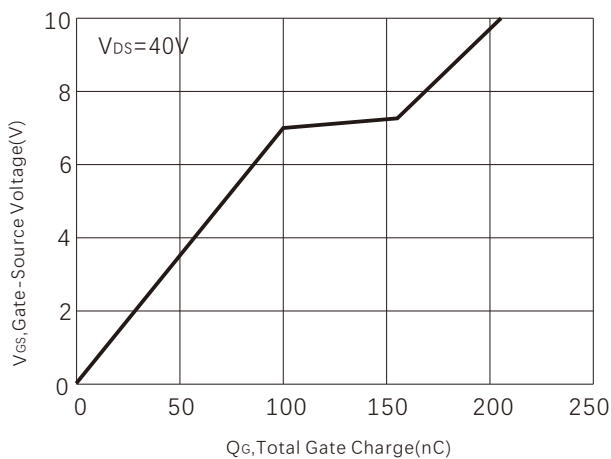


Figure 6. Source-Drain Diode Forward Voltage

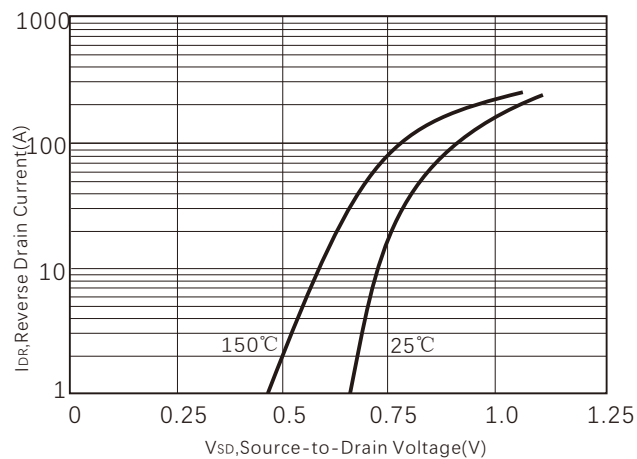


Figure7.Maximum Drain Current vs Temperature

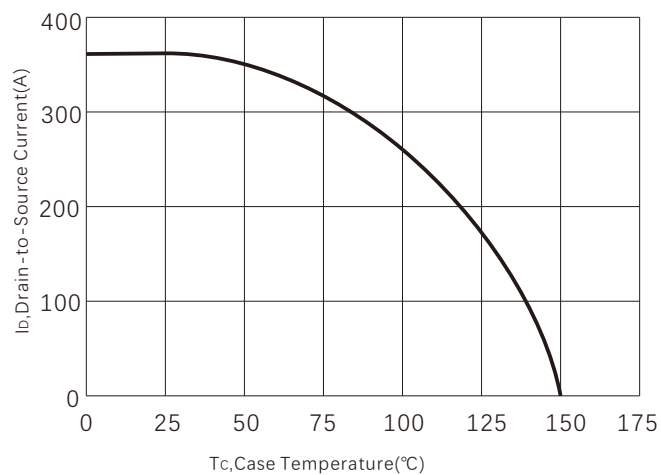


Figure 8. Power dissipation

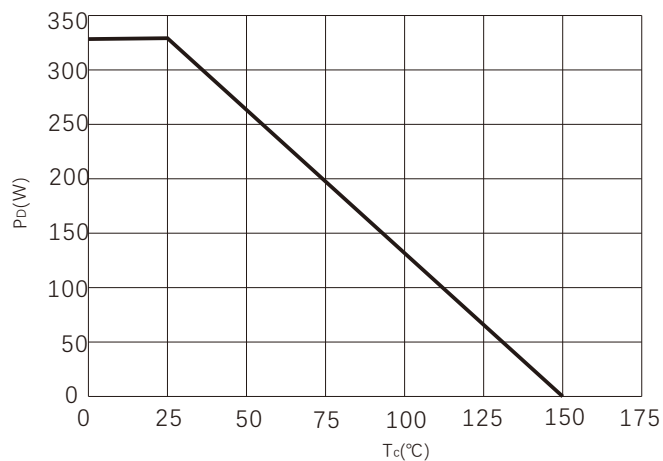


Figure 9. Safe operating area

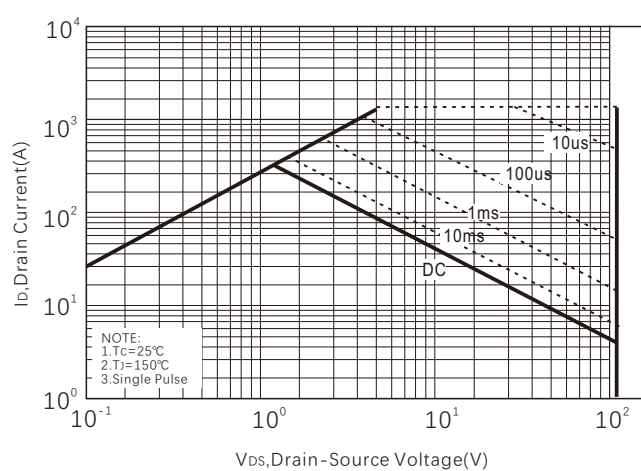
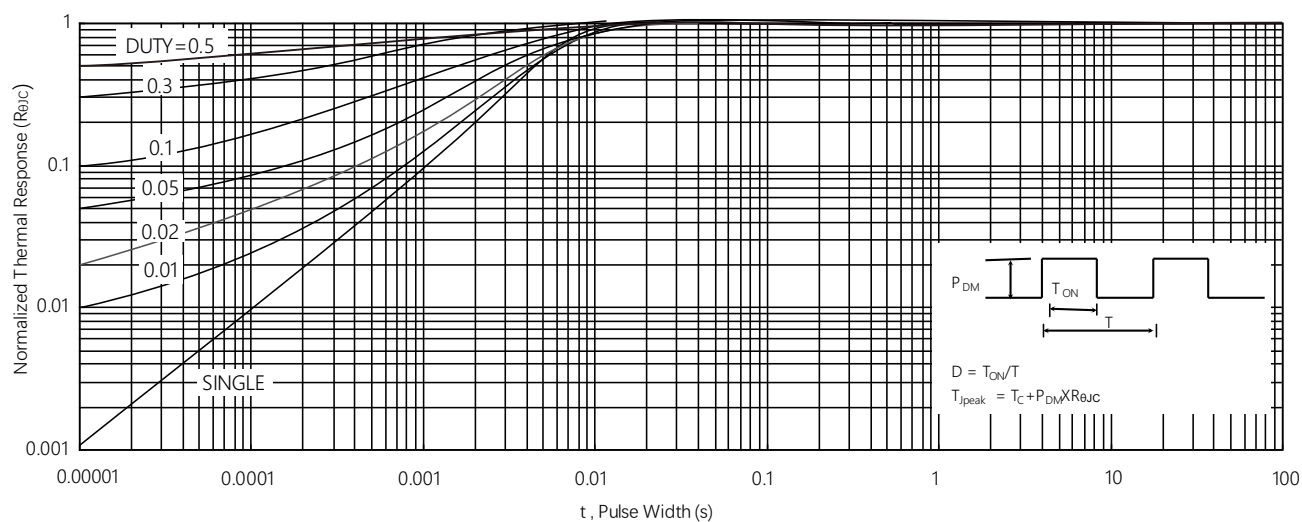
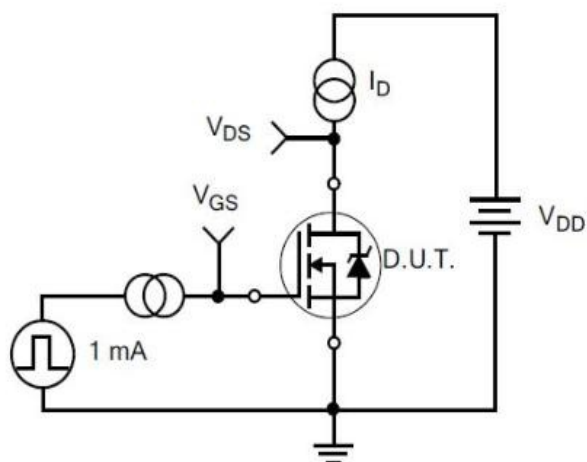


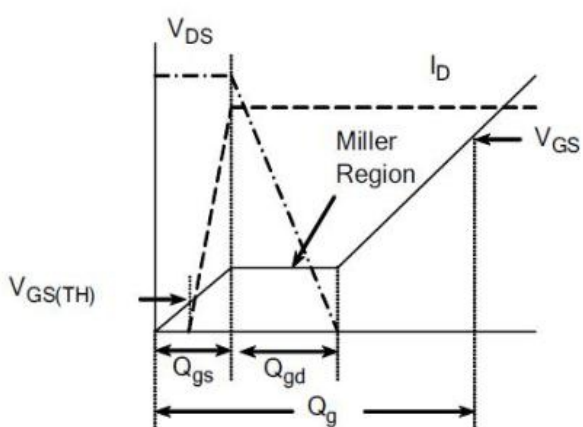
Figure 10.Normalized Maximum Transient Thermal Impedance



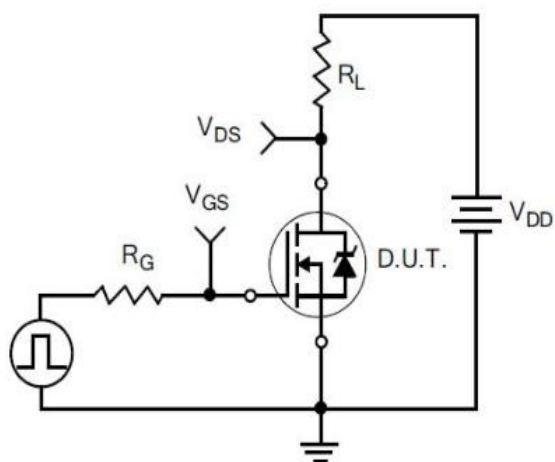
## Typical Test Circuit



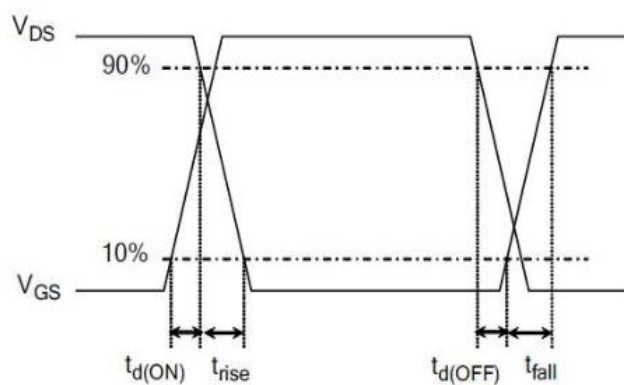
1) Gate Charge Test Circuit



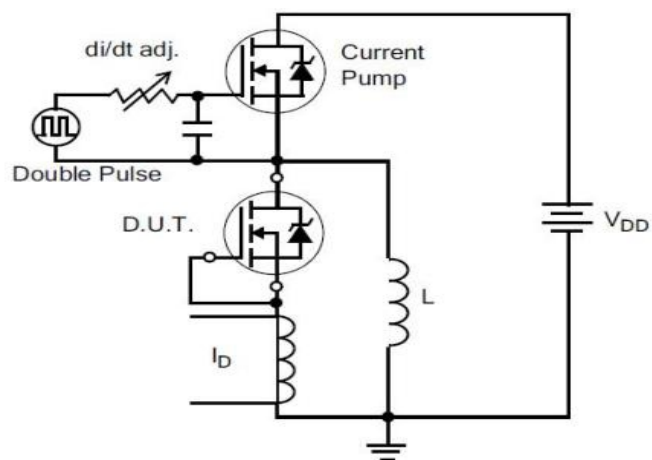
2) . Gate Charge Waveform



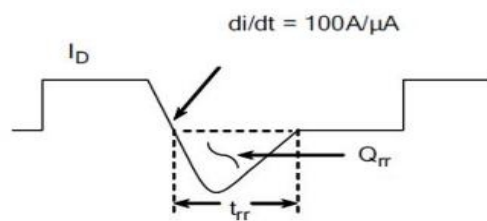
3) Resistive Switching Test Circuit



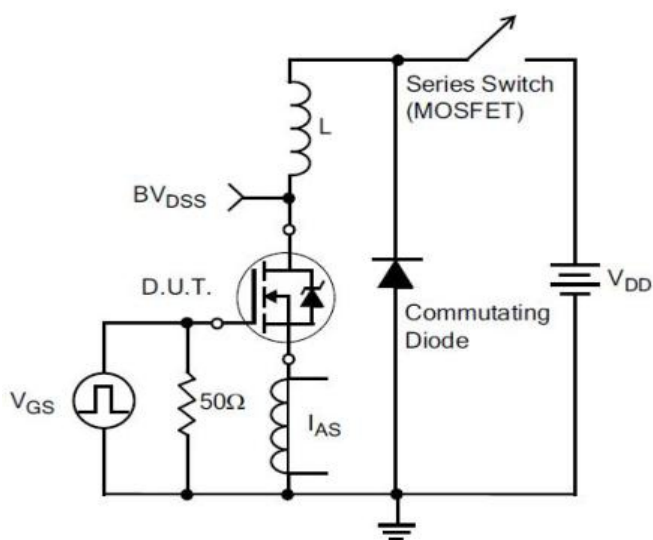
4) Resistive Switching Waveforms



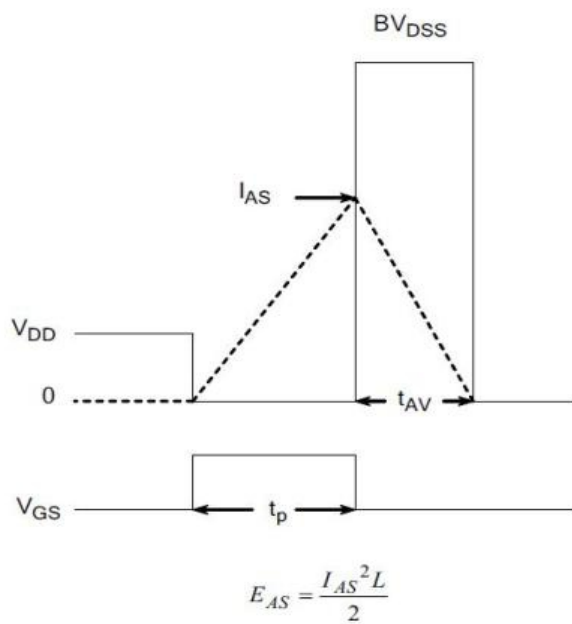
5) Diode Reverse Recovery Test Circuit



6) Diode Reverse Recovery Waveform



7) . Unclamped Inductive Switching Test Circuit



8) Unclamped Inductive Switching Waveforms

# Product Names Rules

X X X N E X X X-X X X

Process Type:  
VDMOS:default  
Super junction:SJ  
Low Voltage trench:D  
Low Voltage SGT:DS

Rdson Code  
2 Ω :2D0  
9.5m Ω :9M5

Rated Current Code  
With 3 Digital,  
For Example:  
6.7mΩ:067,  
10mΩ:100,

Package Code  
TO-220:Default  
ITO-220:F  
TO-262:E  
TO-263:D  
TO-252:M  
TO-251:N  
TO-263-7L:D7  
TOLL:T

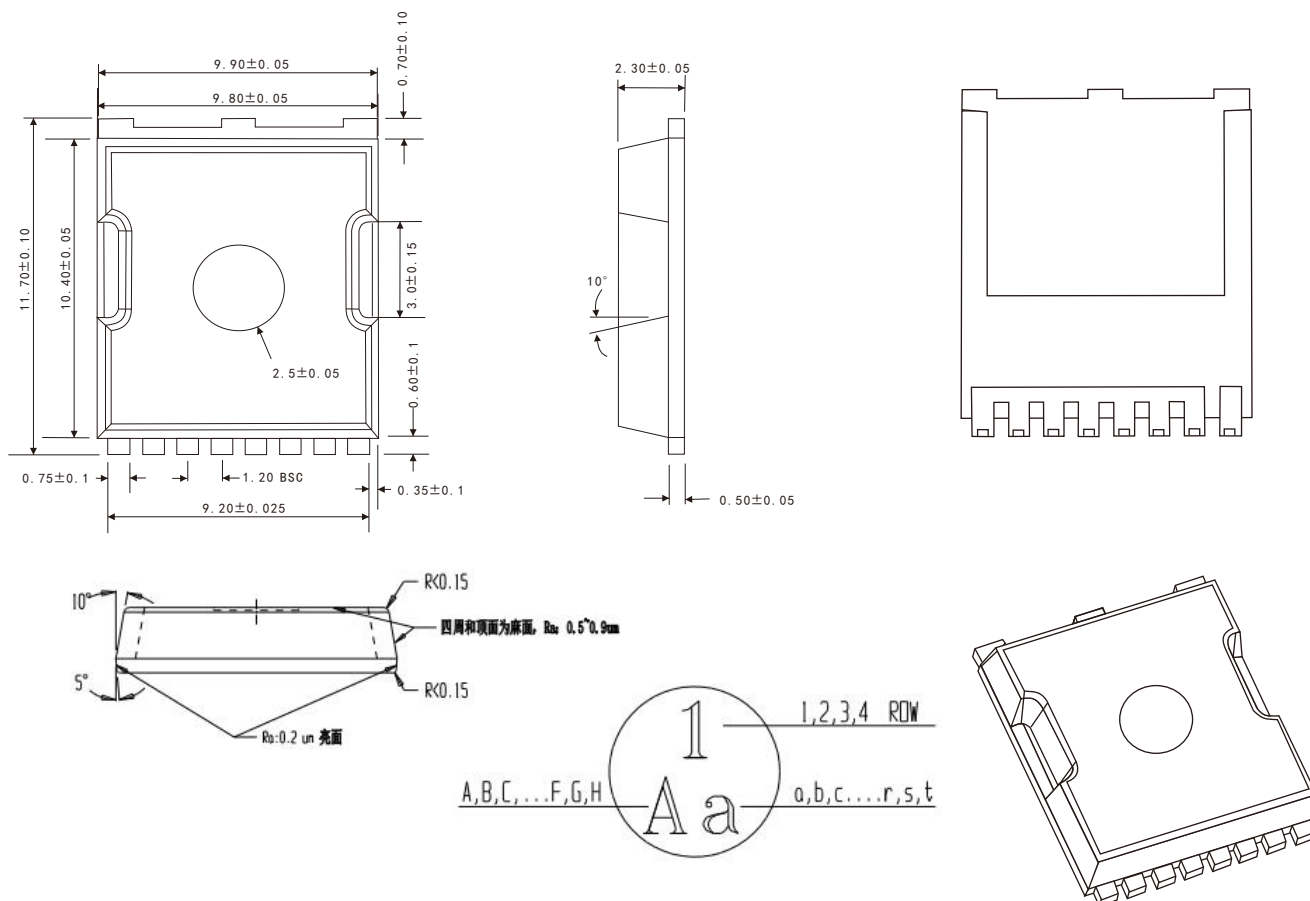
Channel Code  
N channel:N  
P channel:P

Rated Voltage Code  
With 2 Digital,For Example:  
600V:60  
60V:06

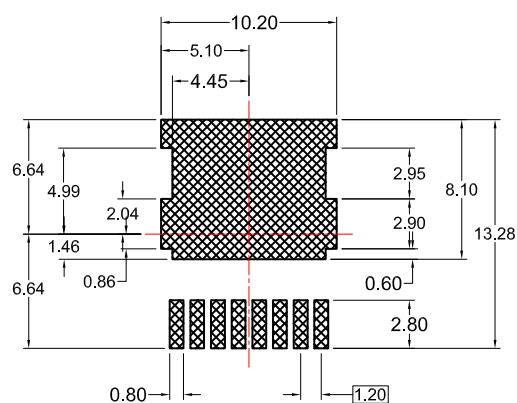
Special Function Code  
G-S ESD Protection:E  
No Protection:Default

## Dimensions

## TOLL PACKAGE OUTLINE DIMENSIONS



## Suggested Pad Layout





## Friendship Reminder

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