
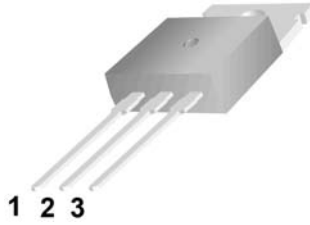
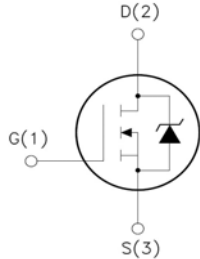


<p><b>Features:</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Low Intrinsic Capacitances.</li> <li><input type="checkbox"/> Excellent Switching Characteristics.</li> <li><input type="checkbox"/> Extended Safe Operating Area.</li> <li><input type="checkbox"/> Unrivalled Gate Charge :Qg= 50nC (Typ.).</li> <li><input type="checkbox"/> BVDSS=60V, I<sub>D</sub>=53A</li> <li><input type="checkbox"/> R<sub>DS(on)</sub> : 0.015 Ω (Max) @ V<sub>G</sub>=10V</li> <li><input type="checkbox"/> 100% Avalanche Tested</li> </ul>	<div style="text-align: right;">  </div> <p style="text-align: center;">TO-220</p>  <div style="text-align: center;">  </div> <div style="text-align: right; margin-top: 10px;"> <p>1.Gate (G)</p> <p>2.Drain (D)</p> <p>3.Source (S)</p> </div>
--	---

**Absolute Maximum Ratings\*** (T<sub>c</sub>=25°C Unless otherwise noted)

Symbol	PARAMETER	Value	Unit
V <sub>DSS</sub>	Drain-Source Voltage	60	V
I <sub>D</sub>	Drain Current	T <sub>C</sub> =25°C	53
		T <sub>C</sub> =100°C	35.4
V <sub>GSS</sub>	Gate Threshold Voltage	±20	V
E <sub>AS</sub>	Single Pulse Avalanche Energy (note1)	300	mJ
I <sub>AR</sub>	Avalanche Current (note2)	50	A
P <sub>D</sub>	Power Dissipation (T <sub>c</sub> =25°C)	85	W
T <sub>j</sub>	Junction Temperature(MAX)	175	°C
T <sub>stg</sub>	Storage Temperature	-55~+175	°C
TL	Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds	300	°C

**Thermal Characteristics**

Symbol	PARAMETER	Typ.	MAX.	Unit
R <sub>θJC</sub>	Thermal Resistance, Junction to Case	-	1.8	°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction to Ambient	-	-	°C/W
R <sub>θCS</sub>	Thermal Resistance, Case to Sink	-	110	°C/W

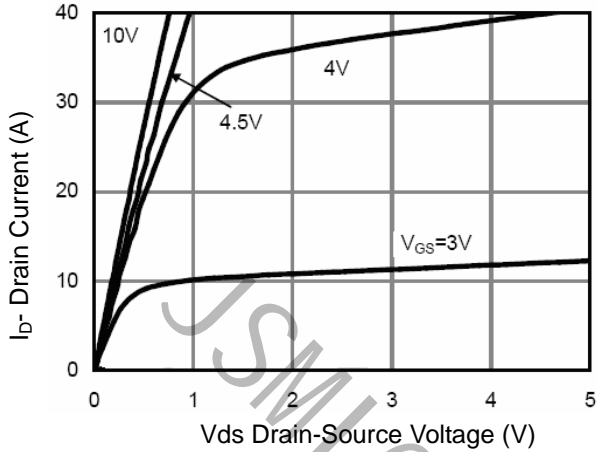
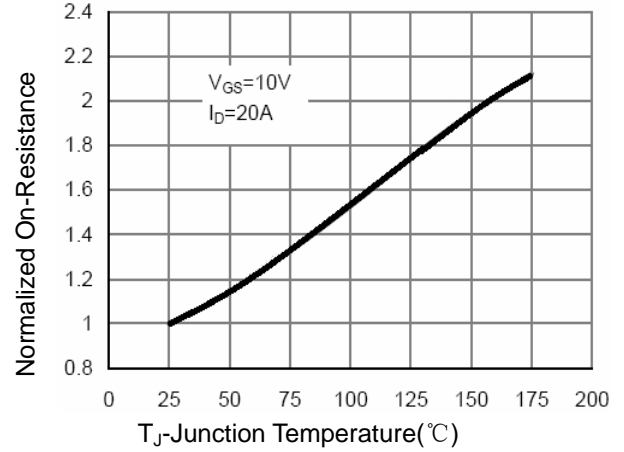
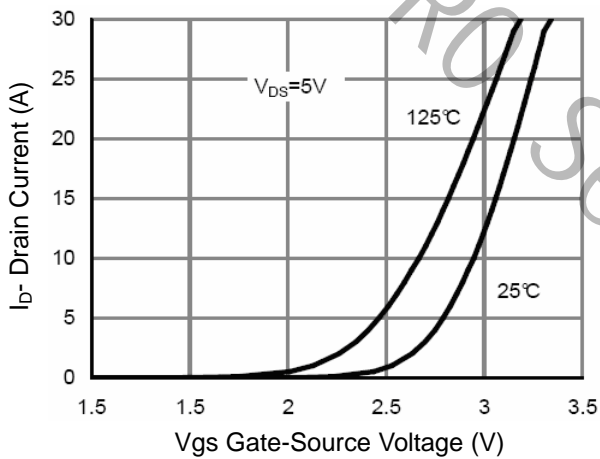
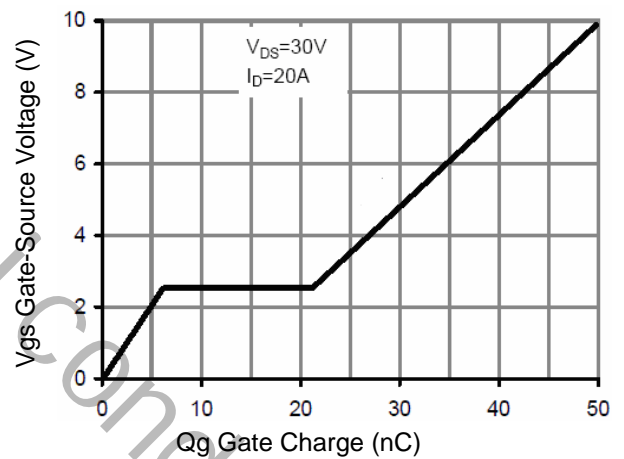
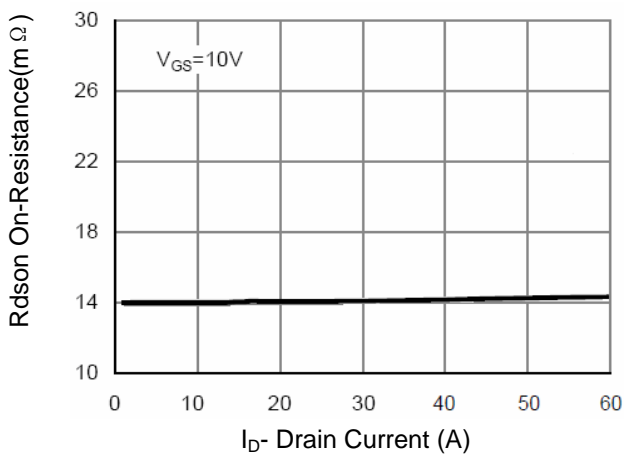
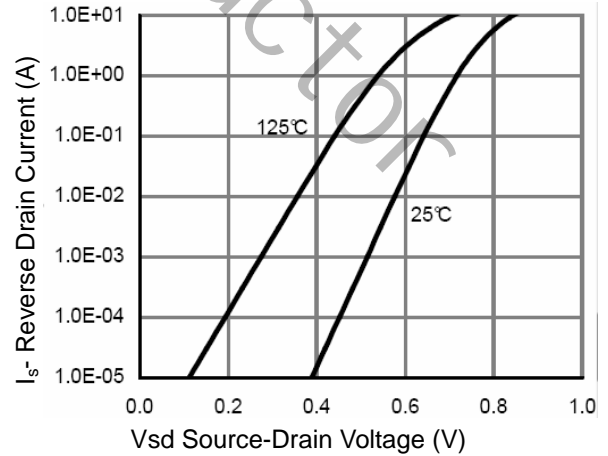
**Electrical Characteristics ( $T_C=25^\circ\text{C}$  unless otherwise noted)**

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-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-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
<b>On Characteristics</b> (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2.0	-	4.0	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=20A$	-	12	15	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=5V, I_D=20A$	18	-	-	S
<b>Dynamic Characteristics</b> (Note 4)						
Input Capacitance	$C_{iss}$	$V_{DS}=30V, V_{GS}=0V,$ $F=1.0MHz$	-	2050	-	PF
Output Capacitance	$C_{oss}$		-	158	-	PF
Reverse Transfer Capacitance	$C_{riss}$		-	120	-	PF
<b>Switching Characteristics</b> (Note 4)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=30V, R_L=6.7\Omega$ $V_{GS}=10V, R_G=3\Omega$	-	7.4	-	nS
Turn-on Rise Time	$t_r$		-	5.1	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	28.2	-	nS
Turn-Off Fall Time	$t_f$		-	5.5	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=30V, I_D=20A,$ $V_{GS}=10V$	-	50	-	nC
Gate-Source Charge	$Q_{gs}$		-	6	-	nC
Gate-Drain Charge	$Q_{gd}$		-	15	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage (Note 3)	$V_{SD}$	$V_{GS}=0V, I_S=20A$	-	-	1.2	V
Diode Forward Current (Note 2)	$I_S$		-	-	53	A
Reverse Recovery Time	$t_{rr}$	$T_J = 25^\circ\text{C}, I_F = 20A$ $di/dt = 100A/\mu s$ (Note 3)	-	28	-	nS
Reverse Recovery Charge	$Q_{rr}$		-	40	-	nC
Forward Turn-On Time	$t_{on}$	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

**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  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS condition :  $T_J=25^\circ\text{C}, V_{DD}=30V, V_G=10V, L=0.5mH, R_g=25\Omega$

## Typical Characteristics


**Figure 1 Output Characteristics**

**Figure 4 Rdson-Junction Temperature**

**Figure 2 Transfer Characteristics**

**Figure 5 Gate Charge**

**Figure 3 Rdson- Drain Current**

**Figure 6 Source- Drain Diode Forward**

Typical Characteristics (Continued)

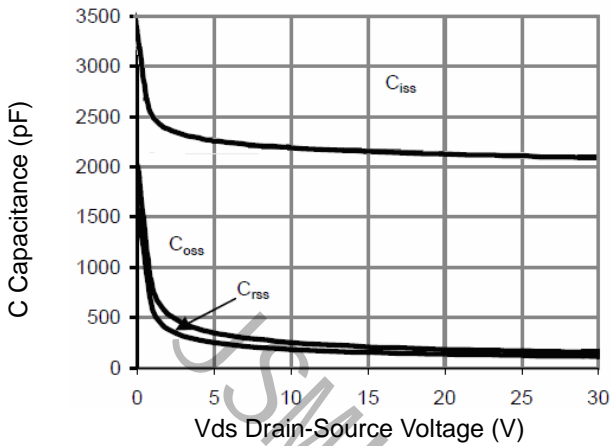


Figure 7 Capacitance vs Vds

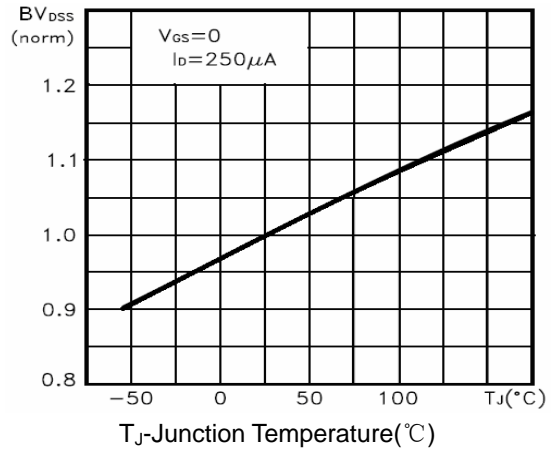


Figure 9  $BV_{DSS}$  vs Junction Temperature

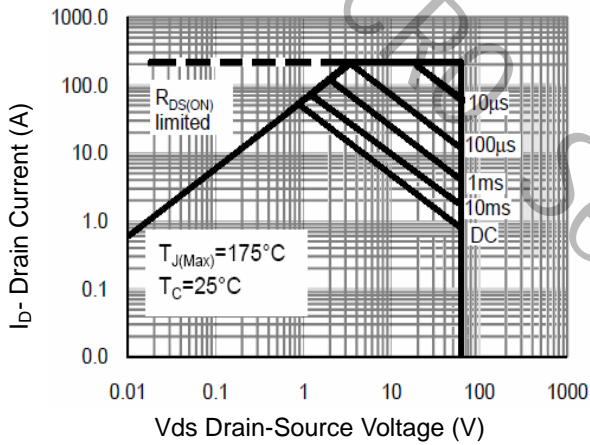


Figure 8 Safe Operation Area

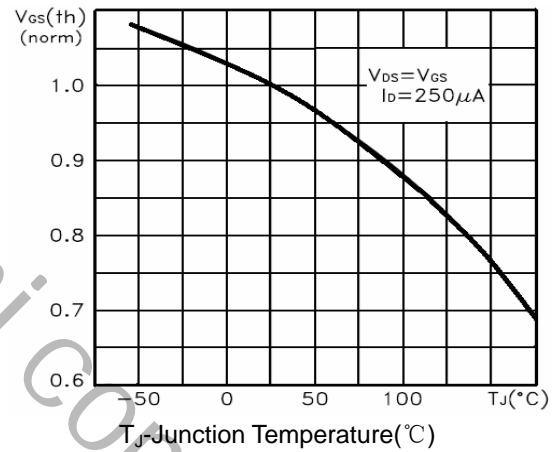


Figure 10  $V_{GS(th)}$  vs Junction Temperature

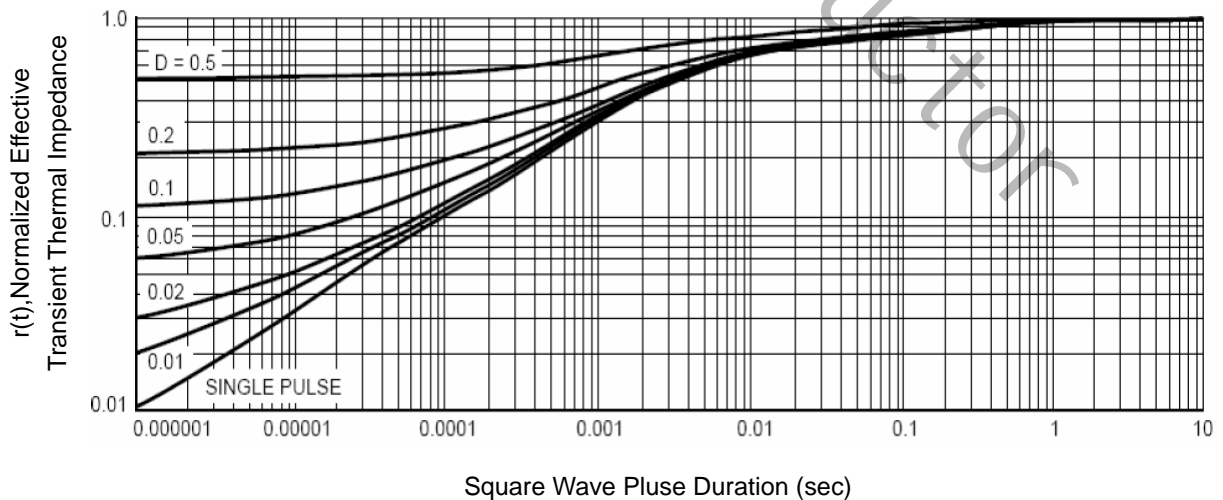
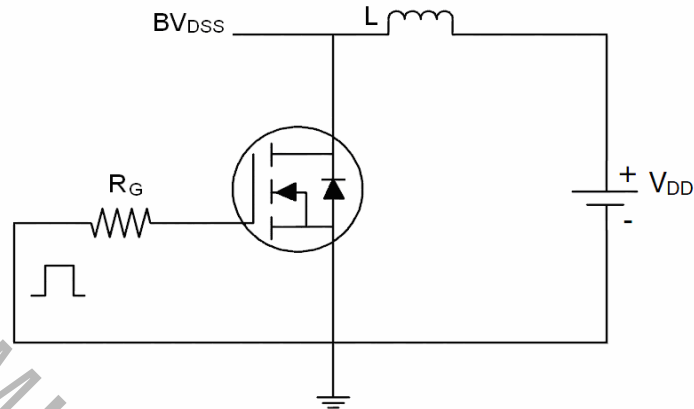


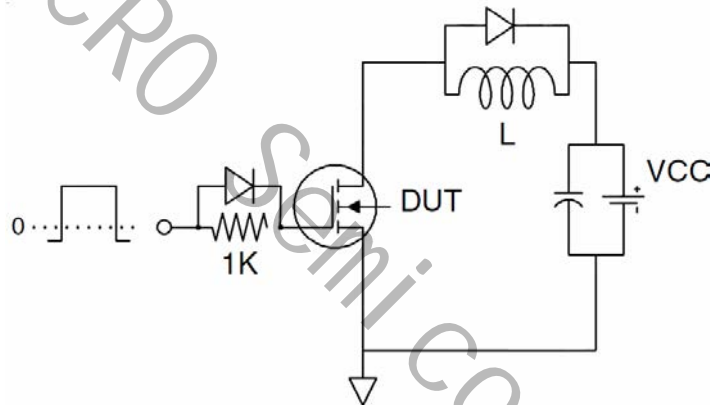
Figure 11 Normalized Maximum Transient Thermal Impedance

**Test Circuit**

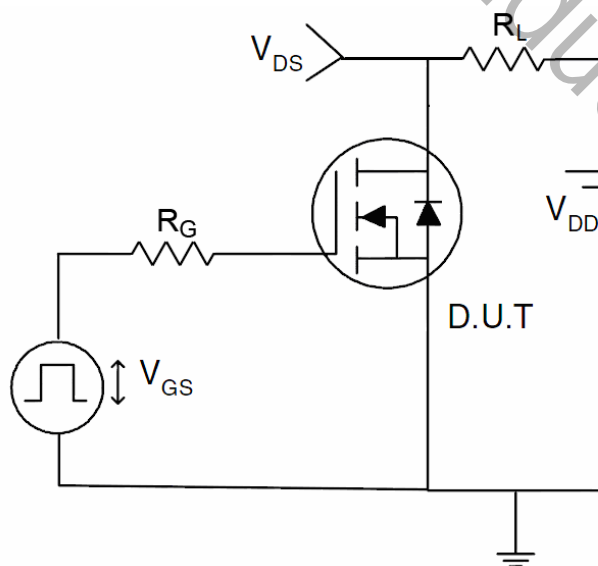
1)  $A_S$  test Circuit



2) Gate charge test Circuit



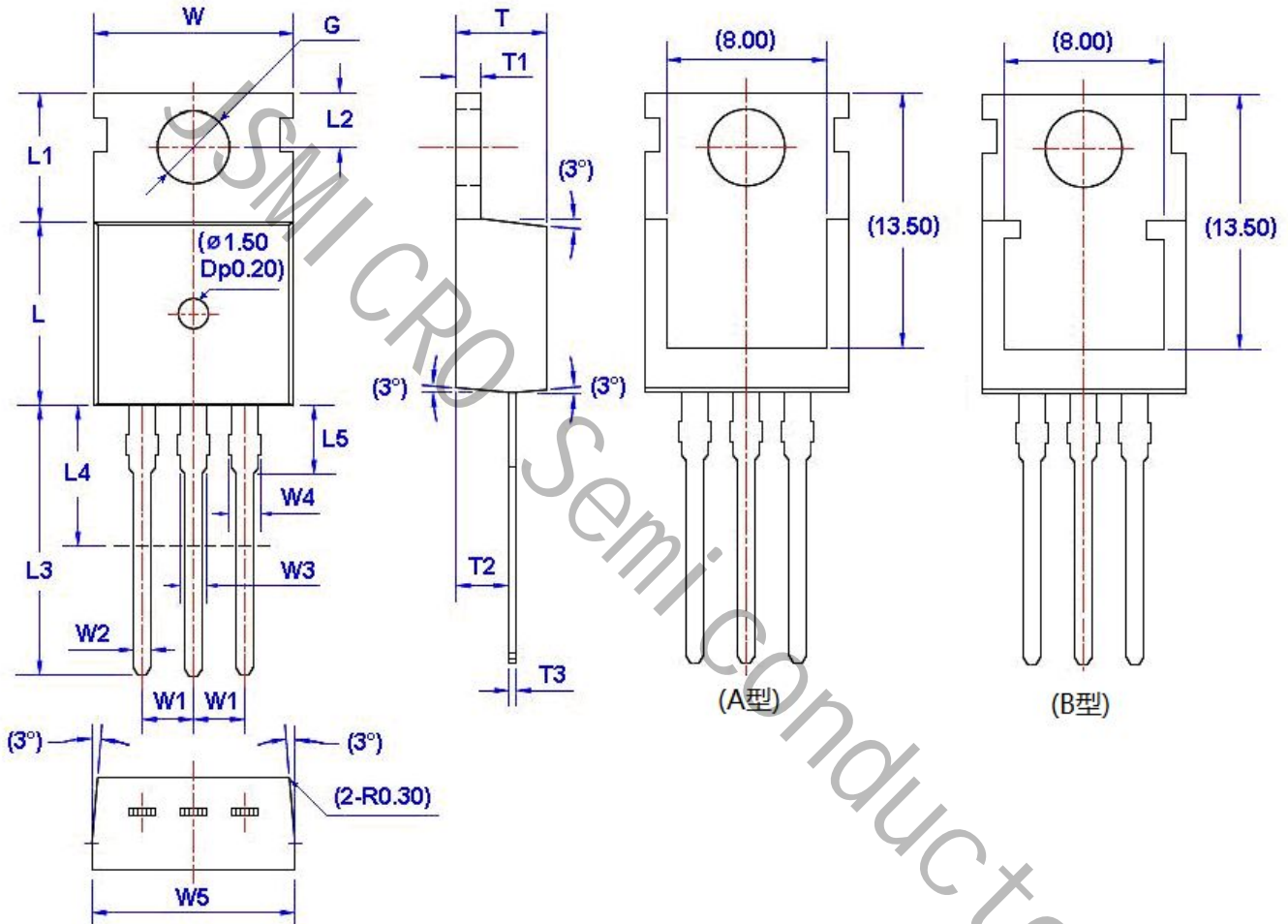
3) Switch Time Test Circuit



## Package Dimension

TO-220

Unit:mm



Symbol	Size		Symbol	Size		Symbol	Size		Symbol	Size	
	Min	Max		Min	Max		Min	Max		Min	Max
W	9.66	10.28	W5	9.80	10.20	L4**	6.20	6.60	T3	0.45	0.60
W1	2.54 (TYP)		L	9.00	9.40	L5	2.79	3.30	G( $\Phi$ )	3.50	3.70
W2	0.70	0.95	L1	6.40	6.80	T	4.30	4.70			
W3	1.17	1.37	L2	2.70	2.90	T1	1.15	1.40			
W4*	1.32	1.72	L3	12.70	14.27	T2	2.20	2.60			