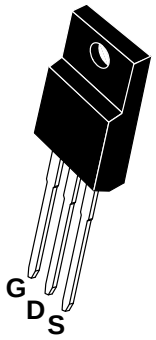
Advanced N-Ch Power MOSFET

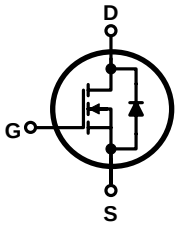
PIN Connection TO-220F



Switchng Regulator Application

Features

- High Voltage: BV_{DSS}=600V(Min.)
- Low C_{rss} : C_{rss}=3.4F(Typ.)
- Low gate charge : Qg= 7.0nC(Typ.)
- Low $R_{DS(on)}$:$R_{DS(on)}$=7.0Ω(Max.)



Marking Diagram

Y = Year
A = Assembly Location
WW = Work Week
FIR2N60F = Specific Device Code

Absolute maximum ratings (T_C=25°C unless otherwise noted) Advanced N-Ch Power MOSFET

Characteristic Symbol			Rating	Unit
Drain-source voltage	V_{DSS} 600			V
Gate-source voltage	V_{GSS}		±20	V
Drain current (DC) *	I_D	(Tc=25℃)	1.5	A
		(Tc=100℃)	1	A
Drain current (Pulsed) *	I_{DM} 6.0			A
Power dissipation	P_D19.1			W
Avalanche current (Single) ②	I_{AS} 2.0			A
Single pulsed avalanche energy ②	E_{AS} 88			mJ
Avalanche current (Repetitive) ①	I_{AR} 2.0			A
Repetitive avalanche energy ①	E_{AR} 8			mJ
Junction temperature	T_J		150	°C
Storage temperature range	T_{stg}		-55~150	

* Limited by maximum junction temperature

Characteristic Symbol			Typ.	Max.	Unit
Thermal resistance	Junction-case R	$_{th(J-C)}$ -		5.6	°C/W
	Junction-ambient R	$_{th(J-A)}$ -		100	

Electrical Characteristics (T_C=25°C unless otherwise noted)

Characteristic Symbol		Test Condition	Min.	Typ.	Max.	Unit
Drain-source breakdown voltage	BV_{DSS}	I_D=250uA, V_{GS}=0 600		-	-	V
Gate threshold voltage	$V_{GS(th)}$	I_D=250uA, V_{DS}=V_{GS}	2.0	3.0	4.0	
Drain-source cut-off current	I_{DSS}	V_{DS}=600V, V_{GS}=0V -		-	25	uA
Gate leakage current	I_{GSS}	V_{DS}=0V, V_{GS}=±30V	- -		±100	nA
Drain-source on-resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=1.0A -		7.0	8.0	Ω
Forward transfer conductance	g_{fs}	V_{DS}=10V, I_D=1.0A	-	5	-	S
Input capacitance	Ciss -	V_{GS}=0V, V_{DS}=25V, f=1MHz		170	-	pF
Output capacitance	Coss		-	27	-	
Reverse transfer capacitance	Crss		-	5	-	
Turn-on delay time	$t_{d(on)}$	V_{DD}=300V, I_D=1.5A R_G=4.7Ω	-	8	-	ns
Rise time	t_r -			30	-	
Turn-off delay time	$t_{d(off)}$		-	22	-	
Fall time	t_f		- 55		-	
Total gate charge	Q_g -	- V_{DS}=480V, V_{GS}=10V I_D=1.5A		7.5		nC
Gate-source charge	Q_{gs} -			1.7	-	
Gate-drain charge	Q_{gd}		- 4.	0	-	

Source-Drain Diode Ratings and Characteristics (T_C=25°C unless otherwise noted)

Characteristic Symbol		Test Condition	Min.	Typ.	Max.	Unit
Source current (DC)	I_S	Integral reverse diode in the MOSFET	-	-	1.5	A
Source current (Pulsed)	I_{SM}		- -		6.0	
Forward voltage	V_{SD}	V_{GS}=0V, I_S=1.5A -		-	1.5	V
Reverse recovery time	t_{rr}	I_S=1.5A, V_{GS}=0V dI_F/dt=100A/us	-	250	-	ns
Reverse recovery charge	Q_{rr}		-	550 -		nC

Note ;

① Repetitive rating : Pulse width limited by maximum junction temperature

② L=10.0mH, I_{AS}=1.5A, V_{DD}=50V, R_G=25Ω, Starting T_J=25℃

③ Pulse Test : Pulse width≤300us, Duty cycle≤2%

④ Essentially independent of operating temperature

Electrical Characteristic Curves

Fig. 1 I_D - V_{DS}

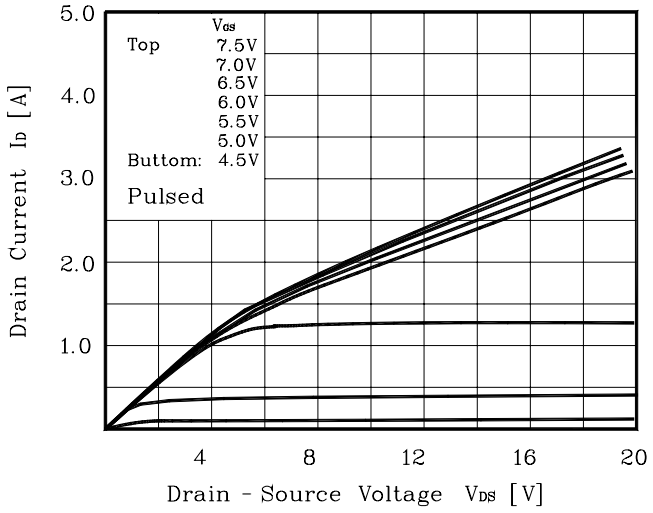


Fig. 2 I_D - V_{GS}

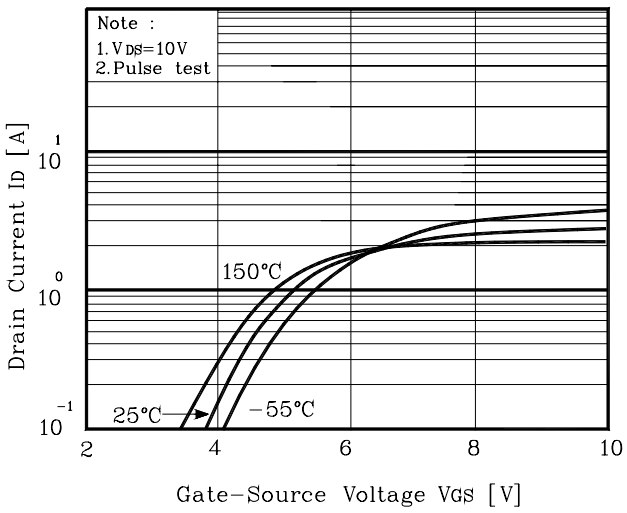


Fig. 3 $R_{DS(on)}$ - I_D

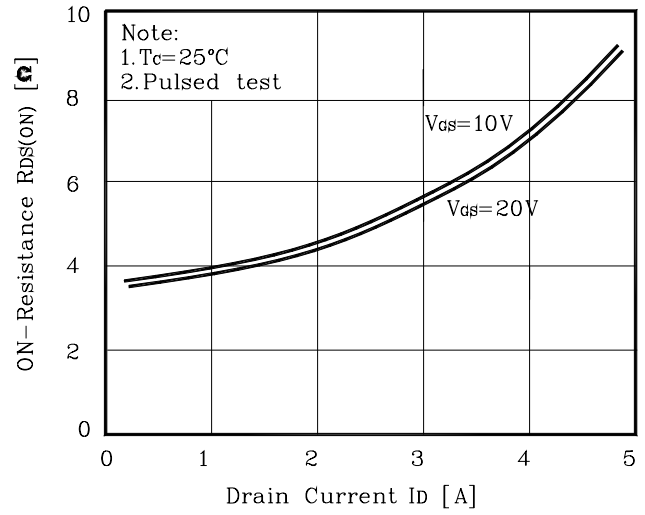


Fig. 4 I_S - V_{SD}

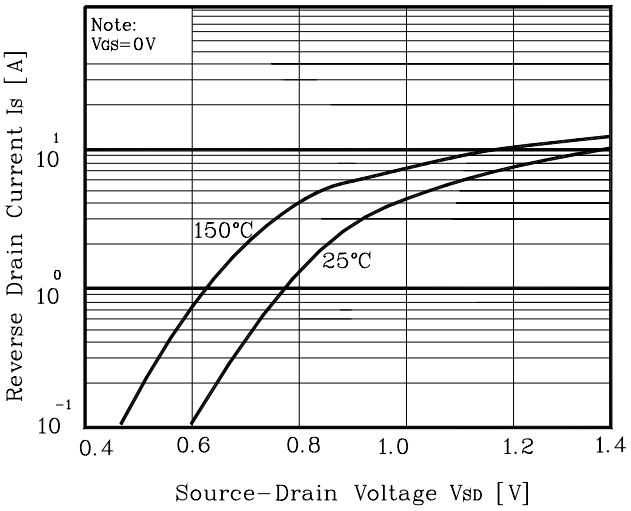


Fig. 5 Capacitance - V_{DS}

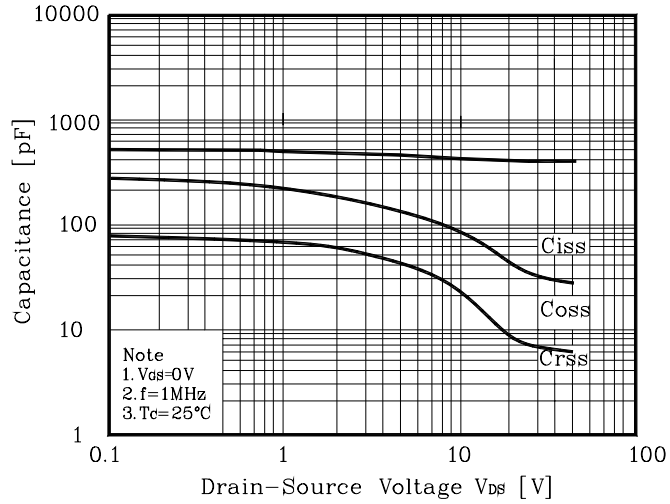
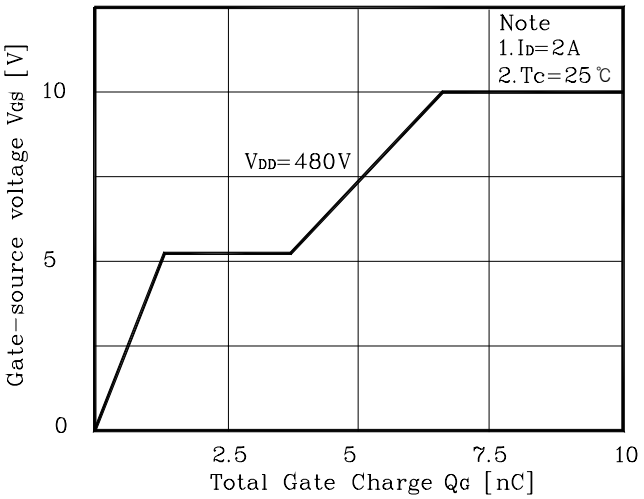


Fig. 6 V_{GS} - Q_G



Electrical Characteristic Curves

Fig. 7 V_{DSS} - T_J

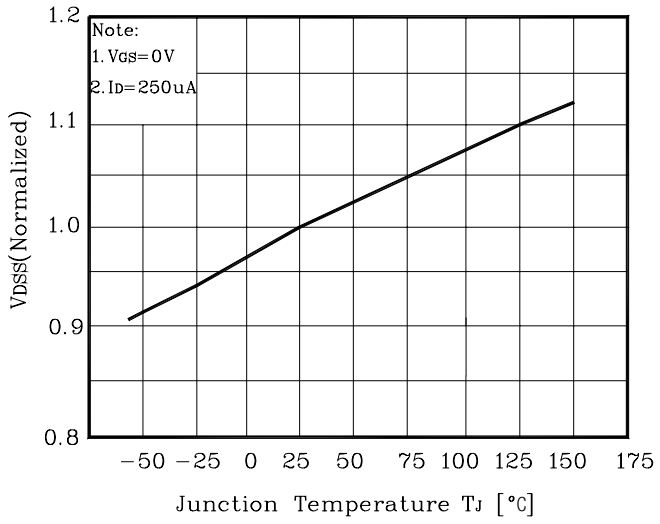


Fig. 8 $R_{DS(on)}$ - T_J

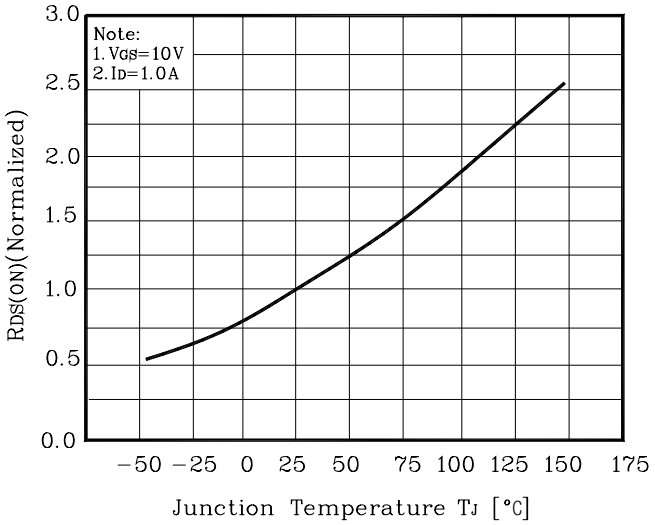
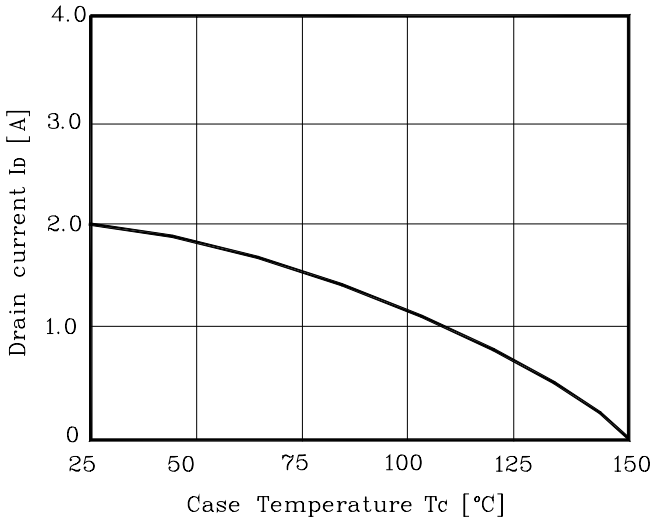


Fig. 9 I_D - T_C



Fi g. 10 Safe Operating Area

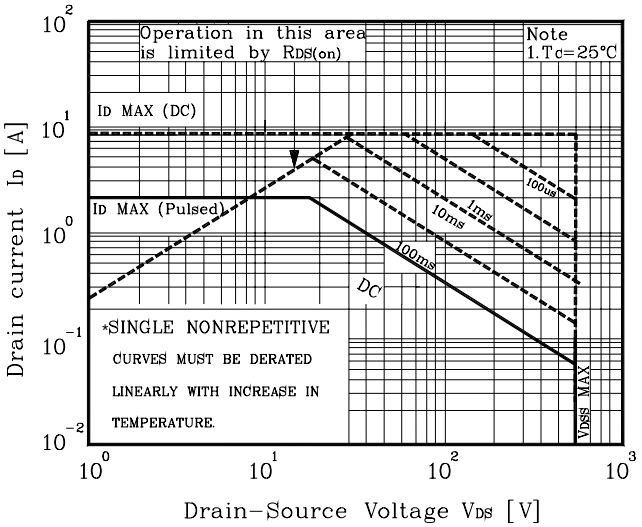
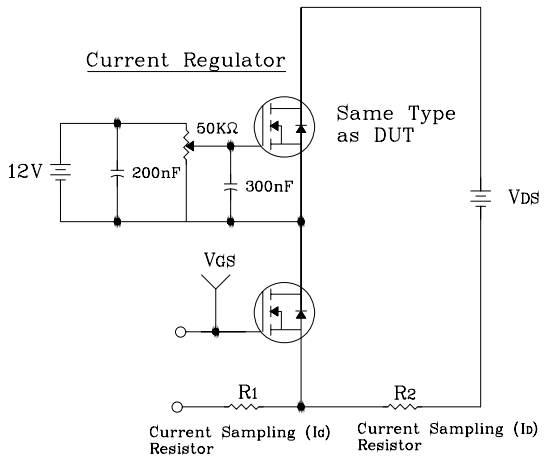


Fig. 11 Gate Charge Test Circuit & Waveform



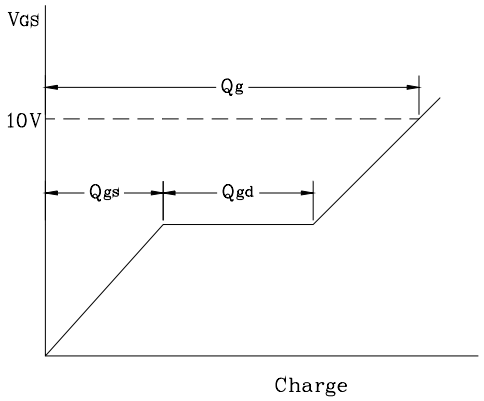
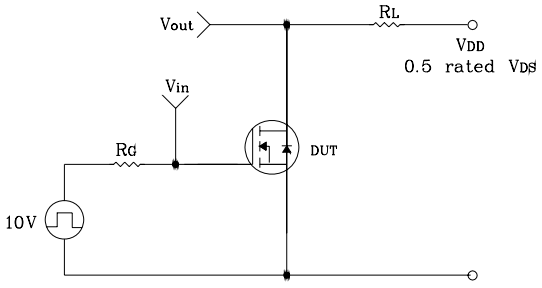


Fig. 12 Resistive Switching Test Circuit & Waveform



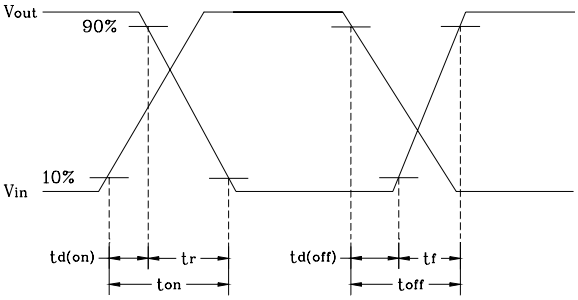
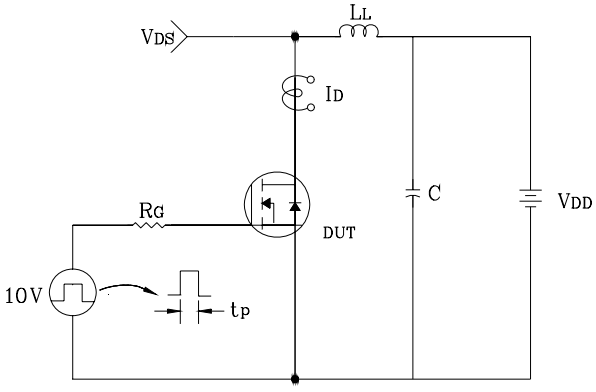


Fig. 13 E_{AS} Test Circuit & Waveform



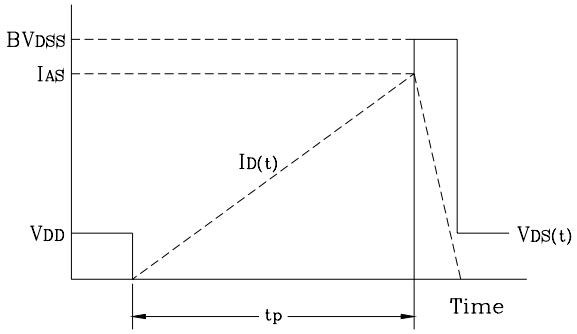
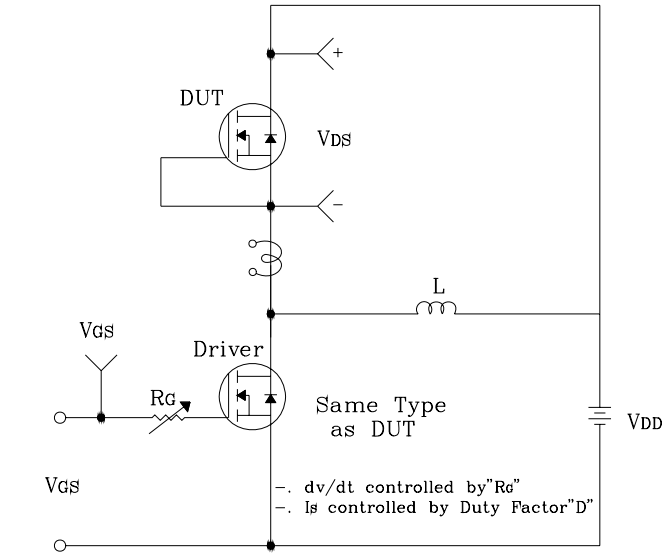
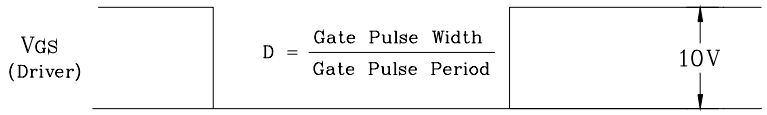
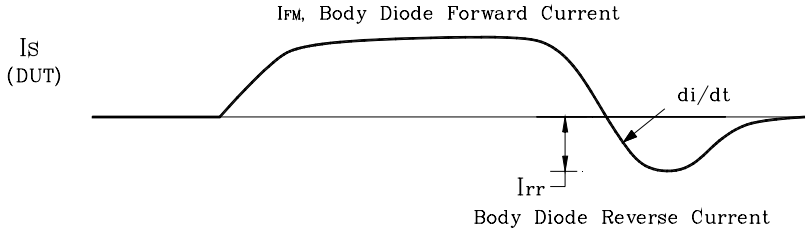
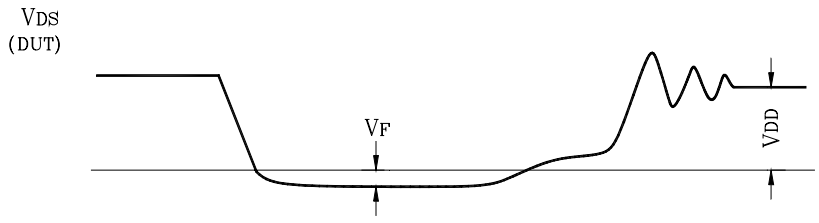


Fig. 14 Diode Reverse Recovery Time Test Circuit & Waveform



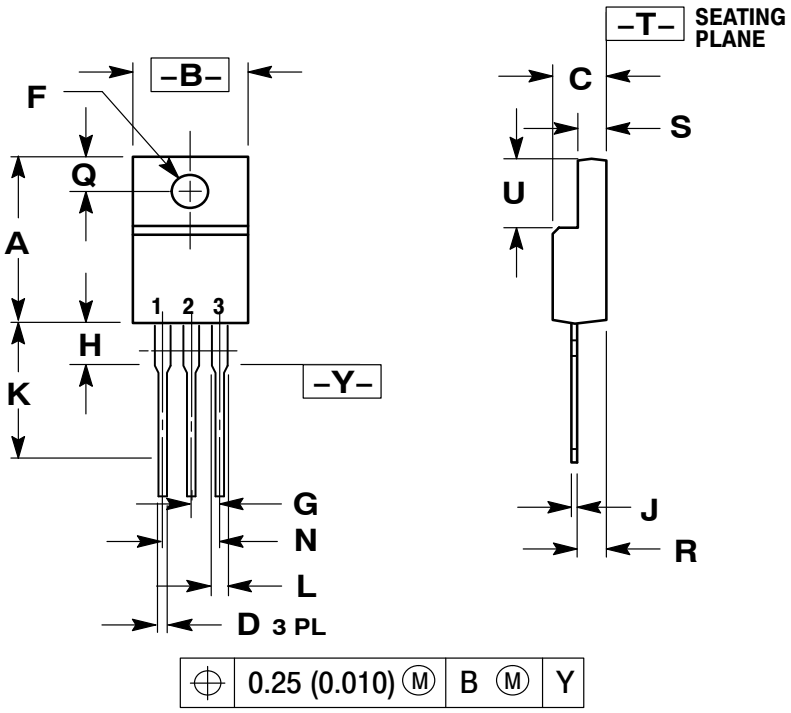






Package Dimensions

TO-220F



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH
3. 221D-01 THRU 221D-02 OBSOLETE, NEW STANDARD 221D-03.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.617	0.635	15.67	16.12
B	0.392	0.419	9.96	10.63
C	0.177	0.193	4.50	4.90
D	0.024	0.039	0.60	1.00
F	0.116	0.129	2.95	3.28
G	0.100 BSC		2.54 BSC	
H	0.118	0.135	3.00	3.43
J	0.018	0.025	0.45	0.63
K	0.503	0.541	12.78	13.73
L	0.048	0.058	1.23	1.47
N	0.200 BSC		5.08 BSC	
Q	0.122	0.138	3.10	3.50
R	0.099	0.117	2.51	2.96
S	0.092	0.113	2.34	2.87
U	0.239	0.271	6.06	6.88