

Lonten N-channel 650V, 20A, 0.15Ω LonFET™ Power MOSFET

Description LonFET™ Power MOSFET is fabricated using advanced super junction technology. The resulting device has extremely low on resistance, making it especially suitable for applications which require superior power density and outstanding efficiency. Features ♦ Ultra low $R_{DS(on)}$ ♦ Ultra low gate charge (typ. $Q_g = 65\text{nC}$) ♦ 100% UIS tested ♦ RoHS compliant	Product Summary <table> <tr> <td>$V_{DS} @ T_{j,max}$</td><td>700V</td></tr> <tr> <td>$R_{DS(on),max}$</td><td>0.15Ω</td></tr> <tr> <td>I_{DM}</td><td>60A</td></tr> <tr> <td>$Q_{g,typ}$</td><td>65nC</td></tr> </table> N-Channel MOSFET	$V_{DS} @ T_{j,max}$	700V	$R_{DS(on),max}$	0.15Ω	I_{DM}	60A	$Q_{g,typ}$	65nC
$V_{DS} @ T_{j,max}$	700V								
$R_{DS(on),max}$	0.15Ω								
I_{DM}	60A								
$Q_{g,typ}$	65nC								

Absolute Maximum Ratings

Parameter	Symbol	LSD20N65	Unit
Drain-Source Voltage	V_{DSS}	650	V
Continuous drain current ($T_C = 25^\circ\text{C}$)	I_D	20	A
($T_C = 100^\circ\text{C}$)		13	A
Pulsed drain current ¹⁾	I_{DM}	60	A
Gate-Source voltage	V_{GSS}	± 30	V
Avalanche energy, single pulse ²⁾	E_{AS}	700	mJ
Avalanche energy, repetitive ¹⁾	E_{AR}	20.5	mJ
Avalanche current, repetitive ¹⁾	I_{AR}	20	A
Power Dissipation ($T_C = 25^\circ\text{C}$)	P_D	34	W
- Derate above 25°C		0.28	W/ $^\circ\text{C}$
Operating and Storage Temperature Range	T_J, T_{STG}	-55 to +150	$^\circ\text{C}$
Continuous diode forward current	I_S	20	A
Diode pulse current	$I_{S,pulse}$	60	A

Thermal Characteristics

Parameter	Symbol	LSD20N65	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	3.6	$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	80	$^\circ\text{C/W}$

Package Marking and Ordering Information

Device	Device Package	Marking
LSD20N65	TO-220F	LSD20N65

Electrical Characteristics

 $T_c = 25^{\circ}\text{C}$ unless otherwise noted

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Static characteristics						
Drain-source breakdown voltage	BV _{DSS}	V _{GS} =0 V, I _D =0.25 mA	650	-	-	V
Gate threshold voltage	V _{GS(th)}	V _{DS} =V _{GS} , I _D =0.25mA	2		5	V
Drain cut-off current	I _{DSS}	V _{DS} =600 V, V _{GS} =0 V,	-	-	1	μA
Gate leakage current, Forward	I _{GSSF}	V _{GS} =30 V, V _{DS} =0 V	-	-	100	nA
Gate leakage current, Reverse	I _{GSSR}	V _{GS} =-30 V, V _{DS} =0 V	-	-	-100	nA
Drain-source on-state resistance	R _{DS(on)}	V _{GS} =10 V, I _D =10 A	-			
		T _J = 25°C	-	0.13	0.15	Ω
		T _J = 150°C	-	0.39	-	
Gate resistance	R _G	f=1 MHz, open drain	-	1.8	-	Ω
Dynamic characteristics						
Input capacitance	C _{iss}	V _{DS} = 25 V, V _{GS} = 0 V, f = 1 MHz	-	2100	-	pF
Output capacitance	C _{oss}		-	1700	-	
Reverse transfer capacitance	C _{rss}		-	17	-	
Turn-on delay time	t _{d(on)}	V _{DD} = 380V, I _D = 10A R _G = 4.7Ω, V _{GS} =10V	-	25	-	ns
Rise time	t _r		-	21	-	
Turn-off delay time	t _{d(off)}		-	60	-	
Fall time	t _f		-	4	-	
Gate charge characteristics						
Gate to source charge	Q _{gs}	V _{DD} =480 V, I _D =10A, V _{GS} =0 to 10 V	-	12	-	nC
Gate to drain charge	Q _{gd}		-	31	-	
Gate charge total	Q _g		-	65	-	
Gate plateau voltage	V _{plateau}		-	5.7	-	V
Reverse diode characteristics						
Diode forward voltage	V _{SD}	V _{GS} =0 V, I _F =10A	-	-	1.4	V
Reverse recovery time	t _{rr}	V _R =50 V, I _F =20A, dI _F /dt=100 A/μs	-	520	-	ns
Reverse recovery charge	Q _{rr}		-	5.7	-	μC
Peak reverse recovery current	I _{rrm}		-	19	-	A

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $I_{AS} = 7\text{ A}$, $V_{DD} = 60\text{ V}$, $R_G = 25\Omega$, Starting $T_J = 25^{\circ}\text{C}$

Electrical Characteristics Diagrams

Figure 1. On-Region Characteristics

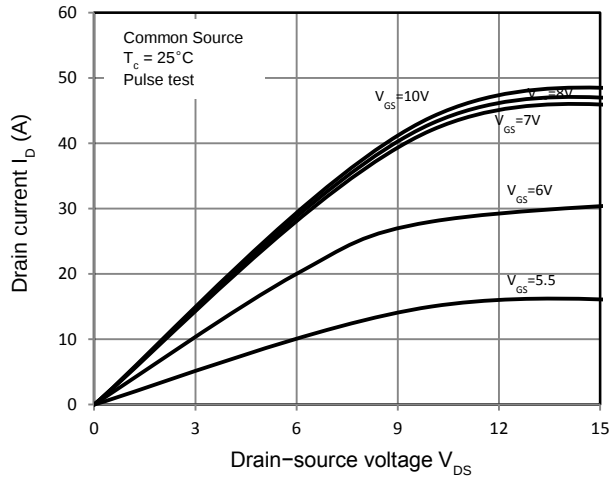


Figure 2. Transfer Characteristics

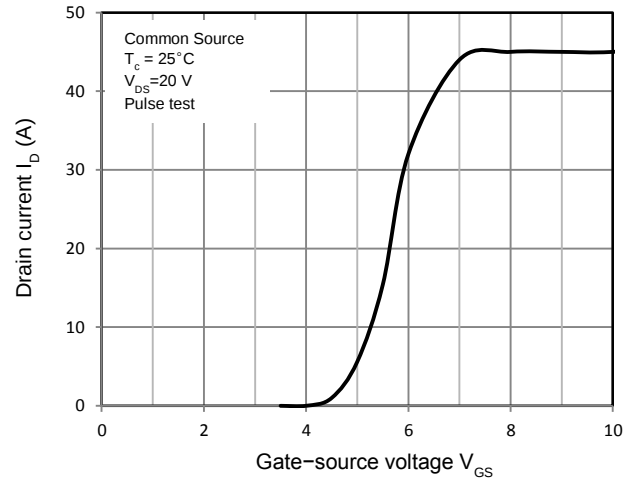


Figure 3. On-Resistance Variation vs. Drain Current

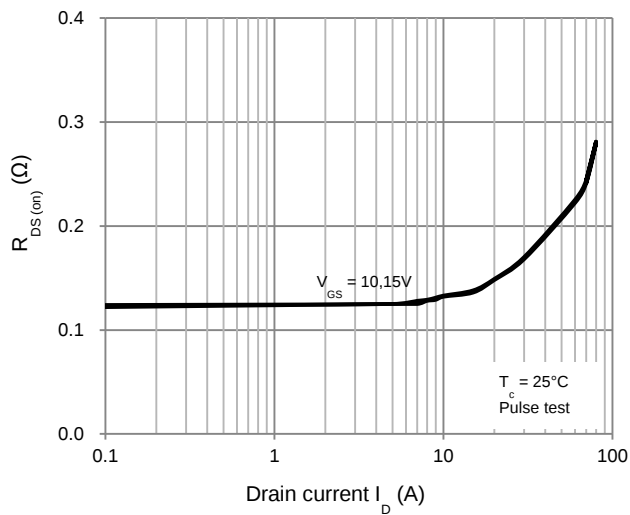


Figure 4. Threshold Voltage vs. Temperature

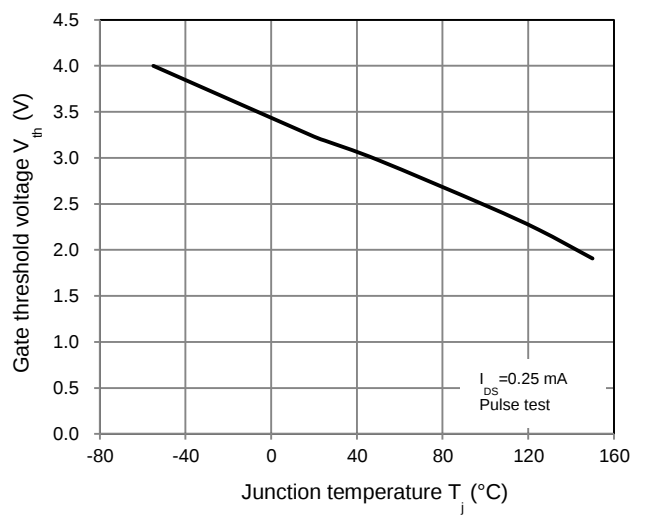


Figure 5. Breakdown Voltage vs. Temperature

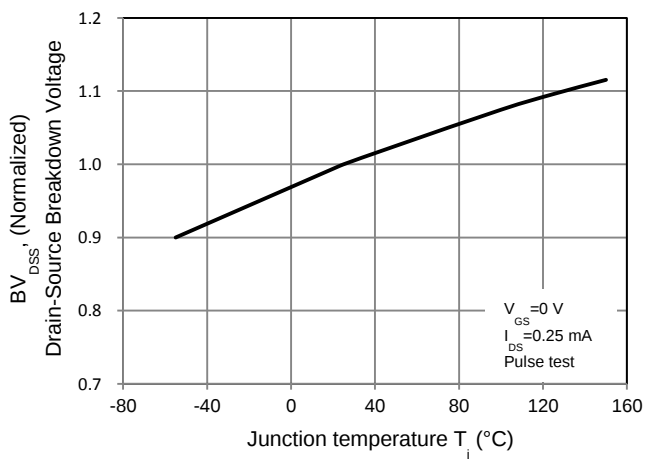


Figure 6. On-Resistance vs. Temperature

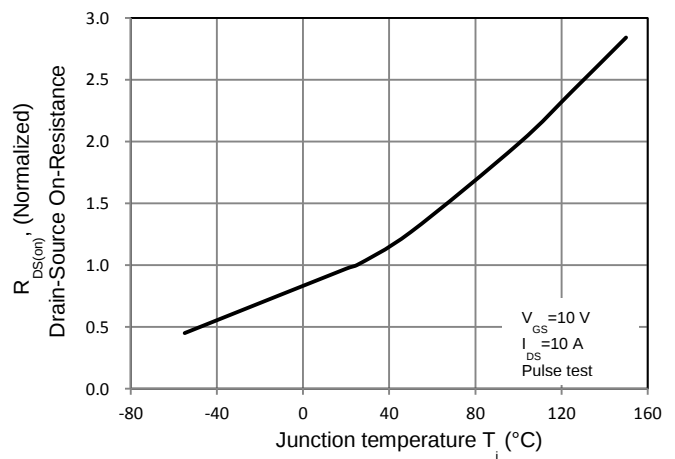


Figure 7. Capacitance Characteristics

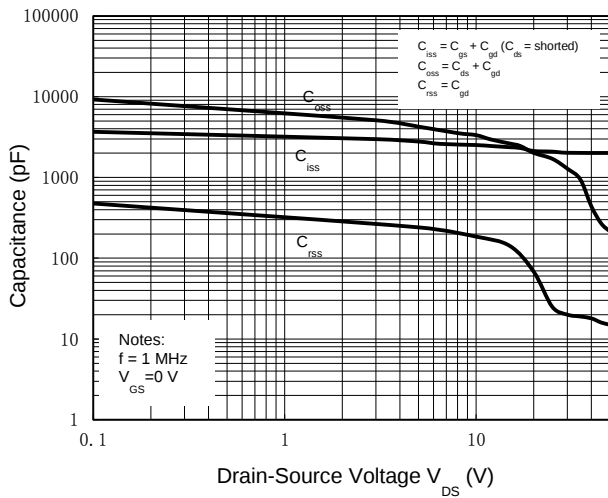


Figure 8. Gate Charge Characteristics

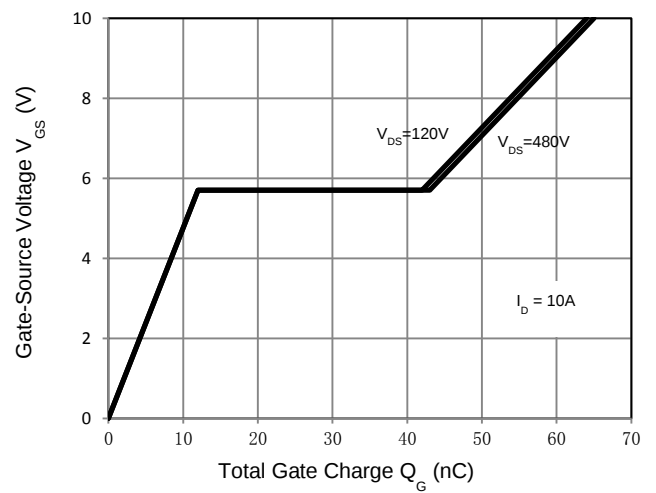


Figure 9. Maximum Safe Operating Area

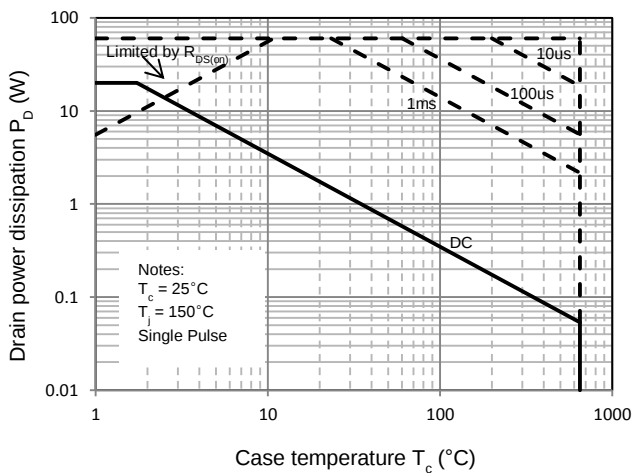


Figure 10. Power Dissipation vs. Temperature

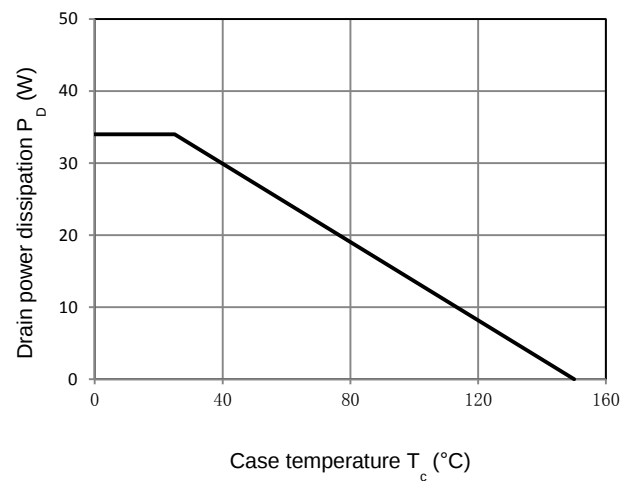
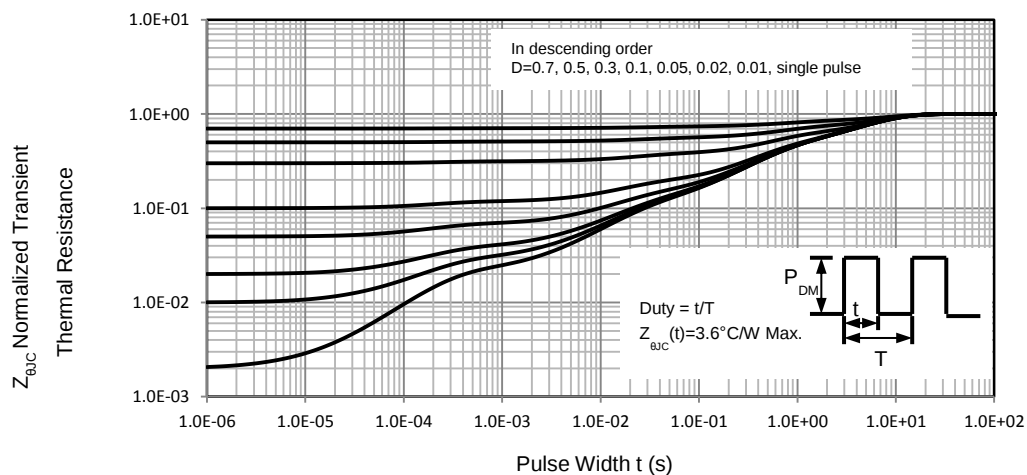
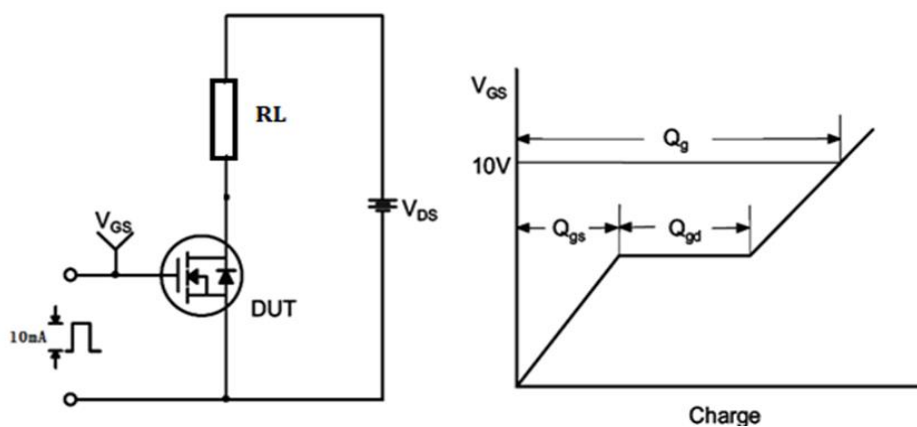


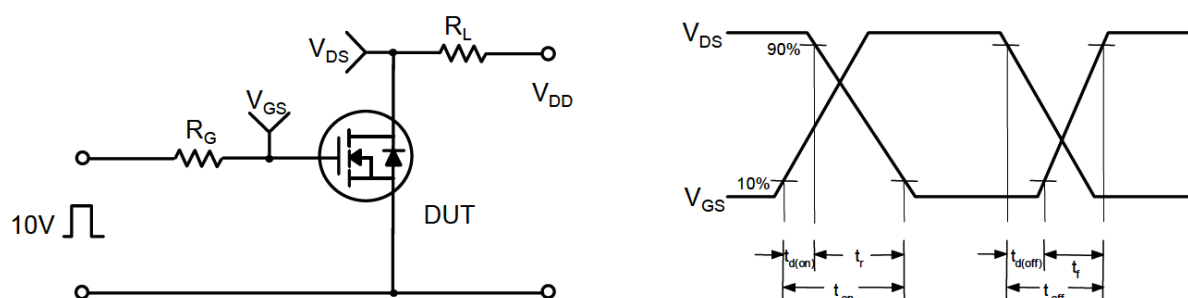
Figure 11. Transient Thermal Response Curve



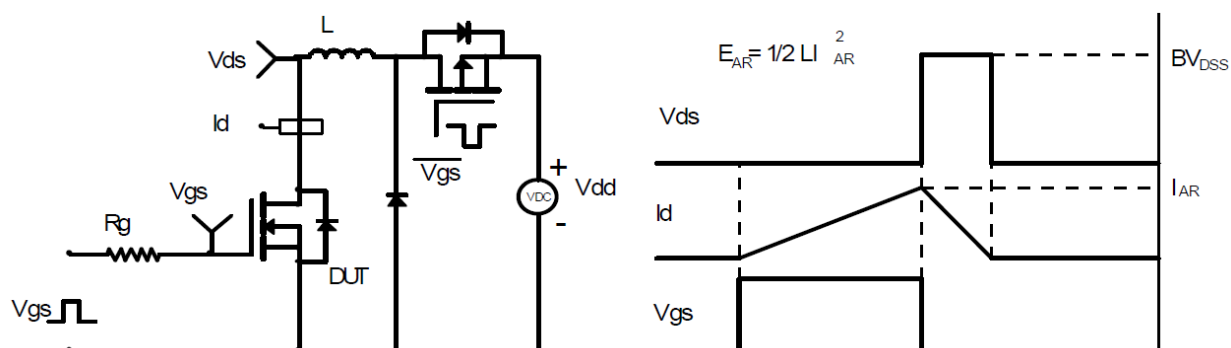
Gate Charge Test Circuit & Waveform



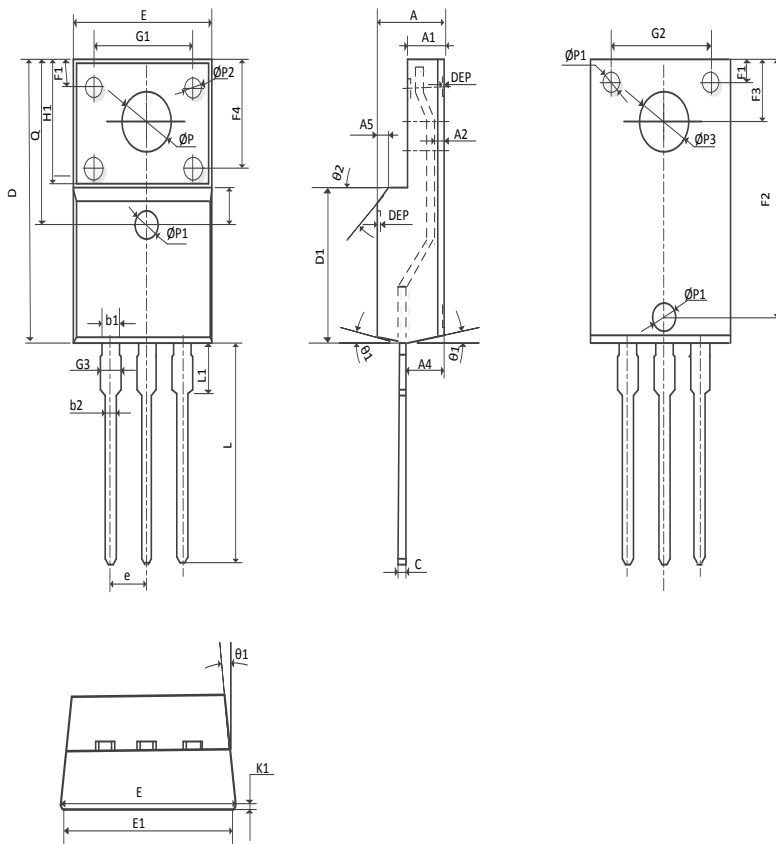
Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms



Mechanical Dimensions for TO-220F



SYMBOL	COMMON DIMENSIONS					
	MM			INCH		
	MIN	NOM	MAX	MIN	NOM	MAX
E	10.04	10.20	10.36	0.395	0.402	0.408
A	4.50	4.70	4.90	0.177	0.185	0.193
A1	2.34	2.54	2.74	0.092	0.100	0.108
A2	0.70	0.85	1.00	0.028	0.033	0.039
A4	2.65	2.75	2.85	0.104	0.108	0.112
A5	1.00REF			0.039REF		
C	0.42	0.50	0.58	0.017	0.020	0.023
D	15.67	15.87	16.07	0.617	0.625	0.633
Q	9.20REF			0.362REF		
H1	6.70REF			0.264REF		
e	2.54BSC			0.1BSC		
ØP	3.183REF			0.125REF		
L	12.78	12.98	13.18	0.503	0.511	0.519
L1	3.25	3.45	3.65	0.128	0.136	0.144
D1	9.17REF			0.362REF		
ØP1	1.40	1.50	1.60	0.055	0.059	0.063
ØP2	1.15	1.20	1.25	0.045	0.047	0.049
ØP3	3.45REF			0.136REF		
Ø1	5°	7°	9°	5°	7°	9°
Ø2	-	45°	-	-	45°	-
DEP	0.05	0.10	0.15	0.002	0.004	0.006
F1	1.90	2.00	2.10	0.075	0.079	0.083
F2	13.80	13.90	14.00	0.543	0.547	0.551
F3	3.20	3.30	3.40	0.126	0.130	0.134
F4	5.30	5.40	5.50	0.209	0.213	0.217
G1	6.60	6.70	6.80	0.260	0.264	0.268
G2	6.90	7.00	7.10	0.272	0.276	0.280
G3	1.10	1.30	1.50	0.043	0.051	0.059
b1	1.05	1.20	1.35	0.041	0.047	0.053
b2	0.70	0.80	0.85	0.028	0.031	0.033
E1	9.90	10.00	10.10	0.390	0.394	0.398
K1	0.65	0.70	0.75	0.026	0.028	0.030

TO-220F Part Marking Information

