SHANGHAI SINO-IC
MICROELECTRONICS CO., LTD.

SE12N50FRA
N-Channel Enhancement-Mode MOSFET with FR

Revision: A

General Description

Thigh Density Cell Design For Ultra Low On-Resistance Fully Characterized Avalanche Voltage and Current Improved Shoot-Through FOM

- Simple Drive Requirement
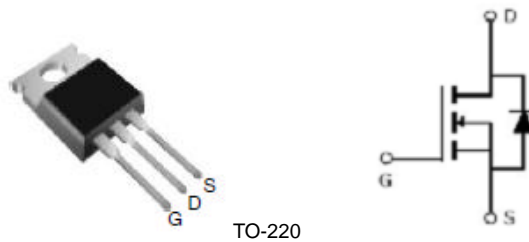- Small Package Outline
- Surface Mount Device

Features

For a single MOSFET

- V_{DS} = 500V
- $R_{DS(ON)}$ = 0.58Ω @ V_{GS}=10V

Pin configurations

See Diagram below

TO-220

Absolute Maximum Ratings

Parameter		Symbol	Rating	Units
Drain-Source Voltage		V_{DS}	500	V
Gate-Source Voltage		V_{GS}	±30	V
Drain Current	Continuous	I_D	12	A
	Pulsed		48	
Avalanche Energy, Single Pulse		E_{AS}	140	mJ
Avalanche Energy, Repetitive		E_{AR}	0.3	mJ
Continuous Diode Forward Current		I_S	8.7	A
Diode Pulse Current		$I_{S, Pulse}$	26.1	A
Total Power Dissipation @TC=25℃		P_D	83	W
Operating Junction Temperature Range		T_J	-55 to 150	℃

Thermal Resistance

Symbol	Parameter	Min	Max	Units
$R_{θJC}$	Junction to Case		4.0	℃/W
$R_{θJA}$	Junction to Ambient (t ≦ 10s)		80	℃/W

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Electrical Characteristics (TJ=25℃ unless otherwise noted)						
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
OFF CHARACTERISTICS						
BV_{DSS}	Drain-Source Breakdown Voltage	$I_D=250\mu A$, $V_{GS}=0V$	500			V
I_{DSS}	Drain to Source Leakage Current	$V_{DS}=500V$, $V_{GS}=0V$			1	nA
I_{GSS}	Gate-Body Leakage Current	$V_{GS}=20V$			100	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$, $I_D=250\mu A$	3.0	3.5	4.0	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=10V$, $I_D=7.5A$		0.58	0.70	Ω
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	$V_{GS}=0V$, $V_{DS}=25V$, f=1MHz		739		pF
C_{oss}	Output Capacitance			58		pF
C_{rss}	Reverse Transfer Capacitance			40		pF
SWITCHING PARAMETERS						
Q_g	Total Gate Charge [2]	$V_{GS}=10V$, $V_{DS}=15V$, $I_D=12A$		20		nC
Q_{gs}	Gate Source Charge			4.3		nC
Q_{gd}	Gate Drain Charge			7.6		nC
$t_{d(on)}$	Turn-On Delay Time	$V_{GS}=10V$, $V_{DS}=50V$, $R_{GEN}=18Ω$, $I_D=8A$		11		ns
$t_{d(off)}$	Turn-Off Delay Time			29		ns
$t_{d(r)}$	Turn-On Rise Time			31		ns
$t_{d(f)}$	Turn-Off Fall Time			28		ns
Source-Drain Ratings and Characteristics						
V_{SD}	Diode Forward Voltage	$V_{GS}=0V$, $I_S=12A$		0.89	1.1	V
trr	Reverse Recovery Time	VR=400V, IF=15A, DIF/dt=100A/μs		63		ns
Qrr	Reverse Recovery Charge			390		nC
I_{rrm}	Peak Reverse Recovery Current			7.7		A

Typical Characteristics

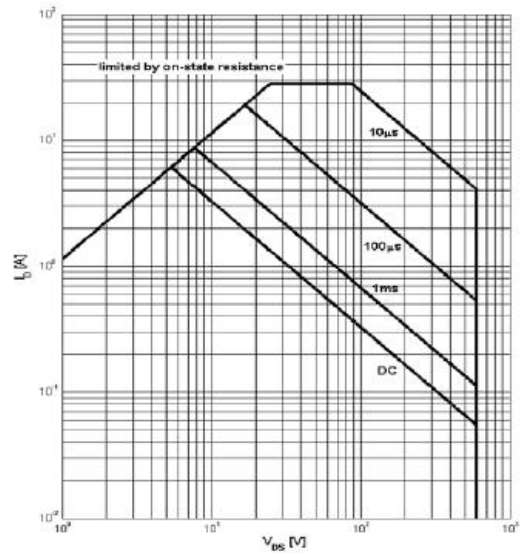| Figure 3: Power Dissipation	Figure 4: Max. Transient Thermal Impedance
$P_{tot} = f(T_c)$	$Z_{(thJC)} = f(t_p)$; parameter: $D = t_p/T$
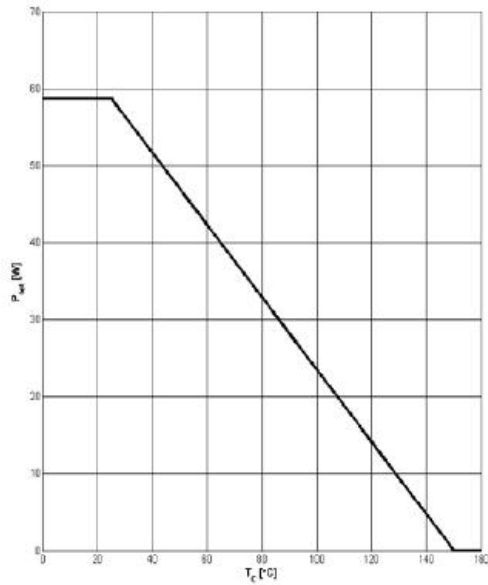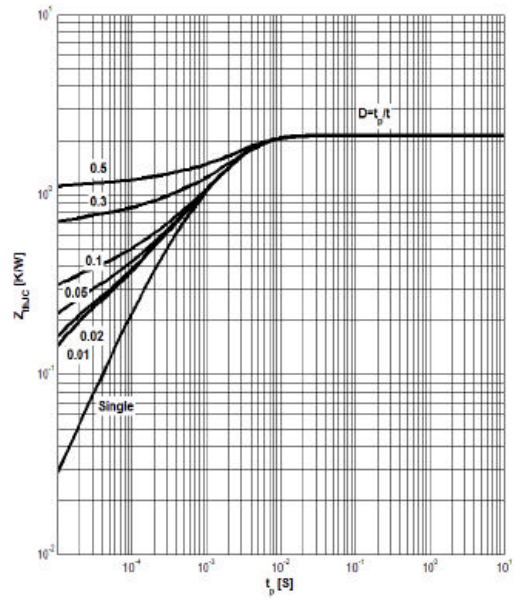
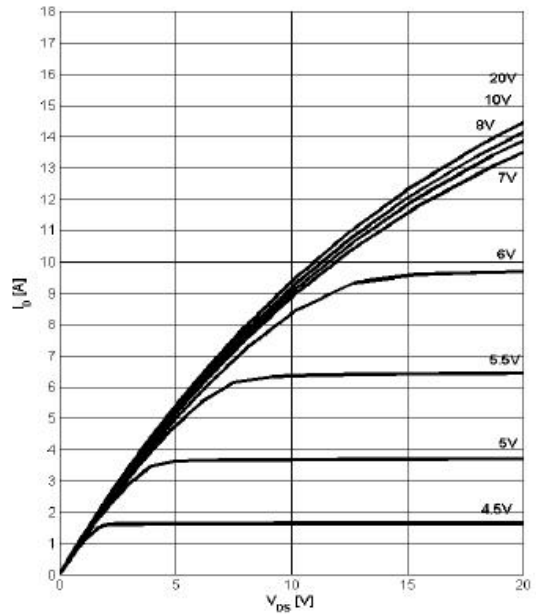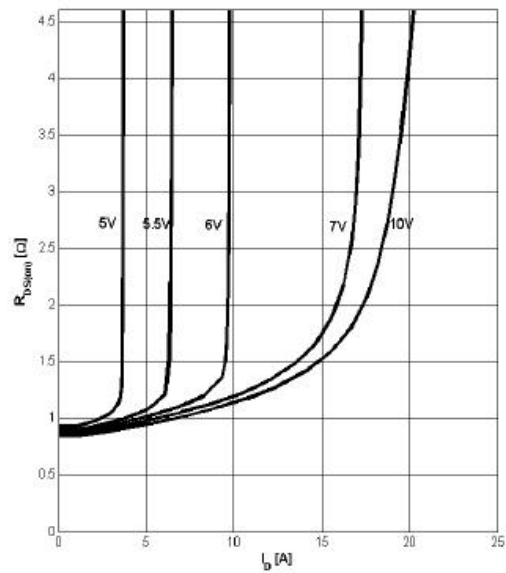| Figure 5: Safe Operating Area	Figure 6: Safe Operating Area
$I_D = f(V_{DS})$; $T_c = 25°C$; $V_{GS} > 7V$; parameter t_p	$I_D = f(V_{DS})$; $T_c = 80°C$; $V_{GS} > 7V$; parameter t_p
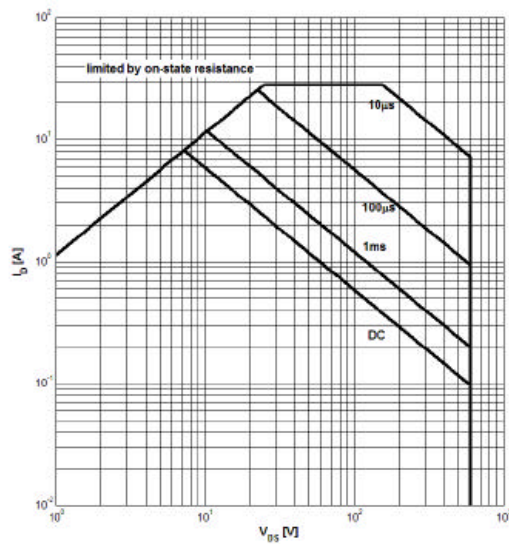
Figure 7: Typ. Output Characteristics
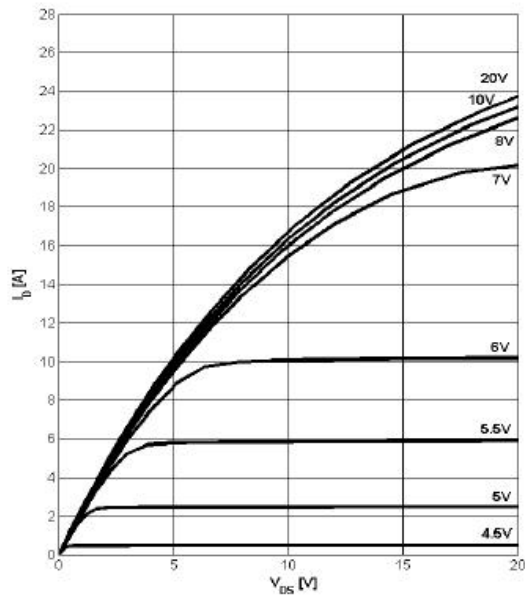
$I_D = f(V_{DS})$; $T_j = 25°C$; parameter: V_{GS}

Figure 8: Typ. Output Characteristics

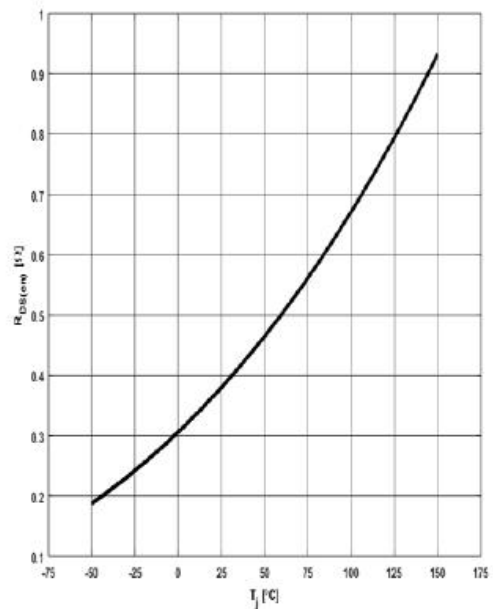
$I_D = f(V_{DS})$; $T_j = 125°C$; parameter: V_{GS}
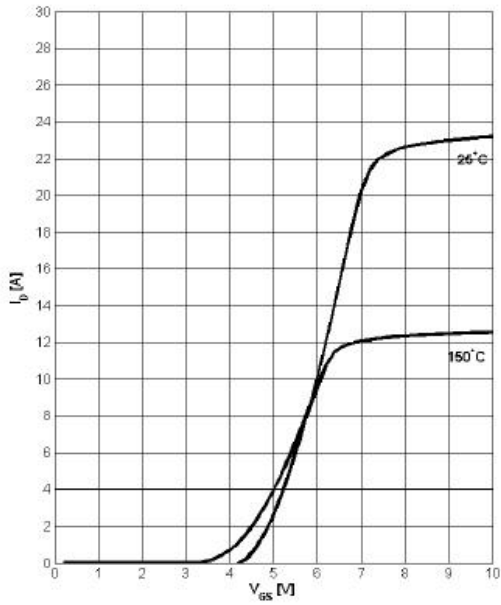
Figure 9: Typ. Drain-Source On-State Resistance

$R_{DS(ON)} = f(I_D)$; $T_j = 125°C$; parameter: V_{GS}
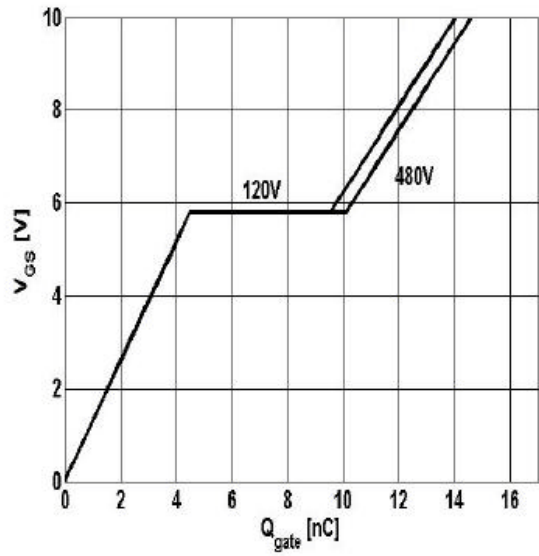
Figure 10: Typ. Drain-Source On-State Resistance

$R_{DS(ON)} = f(T_j)$; $I_D = 4.5A$; $V_{GS} = 10V$

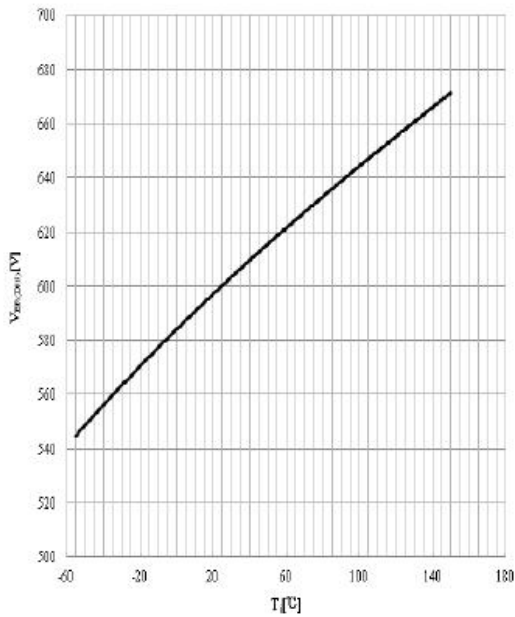Figure 11: Typ. Transfer Characteristics

I_D = f(V_{GS}); V_{DS} = 20V
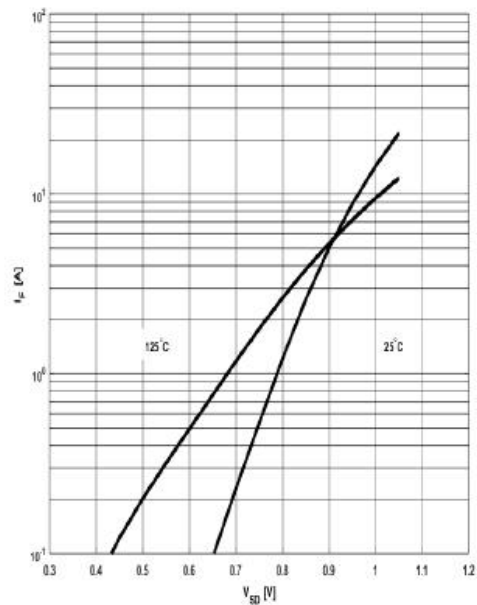
Figure 12: Typ. Gate Charge

V_{GS}= f(Q_{gate}), I_D= 4.5A pulsed

Figure 13: Drain-Source Breakdown Voltage

$V_{BR(DSS)}$=f(T_j); I_D=1mA
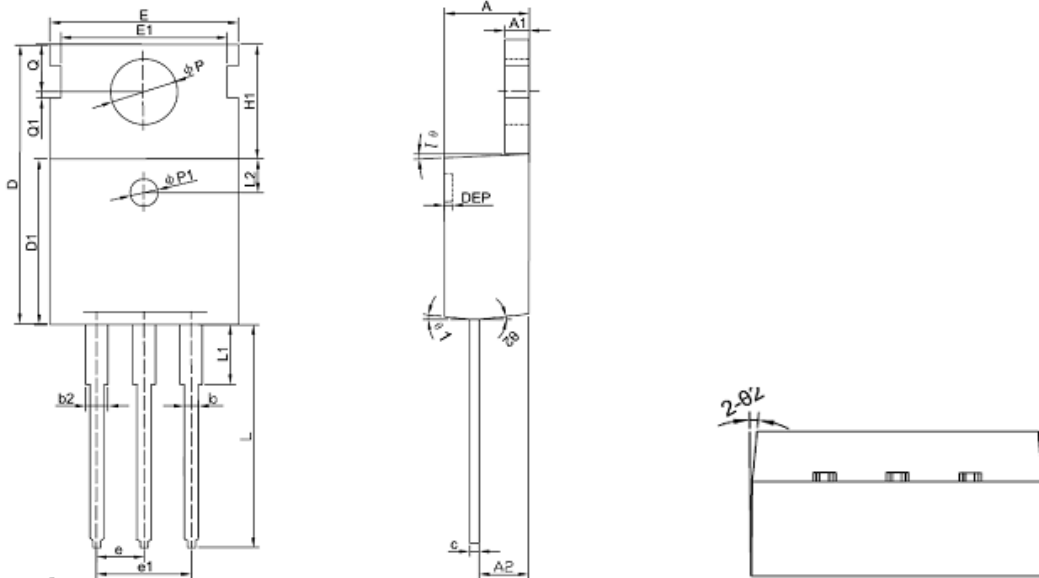
Figure 14: Forward Characteristics of Reverse Diode

I_F=f(V_{SD}); parameter: T_j

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Package Outline Dimension

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Symbol	Dimension In Millimeters			Dimension In Inches		
	Min	Nom	Max	Min	Nom	Max
A	4.400	4.550	4.700	0.173	0.179	0.185
A1	1.270	1.300	1.330	0.050	0.051	0.052
A2	2.590	2.690	2.790	0.102	0.106	0.110
b	0.770	-	0.900	0.030	-	0.035
b2	1.230	-	1.360	0.048	-	0.054
c	0.480	0.500	0.520	0.019	0.020	0.020
D	15.100	15.400	15.700	-	0.606	-
D1	9.000	9.100	9.200	0.354	0.358	0.362
DEP	0.050	0.285	0.520	0.002	0.011	0.020
E	10.060	10.160	10.260	0.396	0.400	0.404
E1	-	8.700	-	-	0.343	-
ΦP1	1.400	1.500	1.600	0.055	0.059	0.063
e	2.54BSC			0.1BSC		
e1	5.08BSC			0.2BSC		
H1	6.100	6.300	6.500	0.240	0.248	0.256
L	12.750	12.960	13.170	0.502	0.510	0.519
L1	-	-	3.950	-	-	0.156
L2	1.85REF			0.073REF		
ΦP	3.570	3.600	3.630	0.141	0.142	0.143
Q	2.730	2.800	2.870	0.107	0.110	0.113
Q1	-	0.200	-	-	0.008	-
Θ1	5^0	7^0	9^0	5^0	7^0	9^0
Θ2	1^0	3^0	5^0	1^0	3^0	5^0

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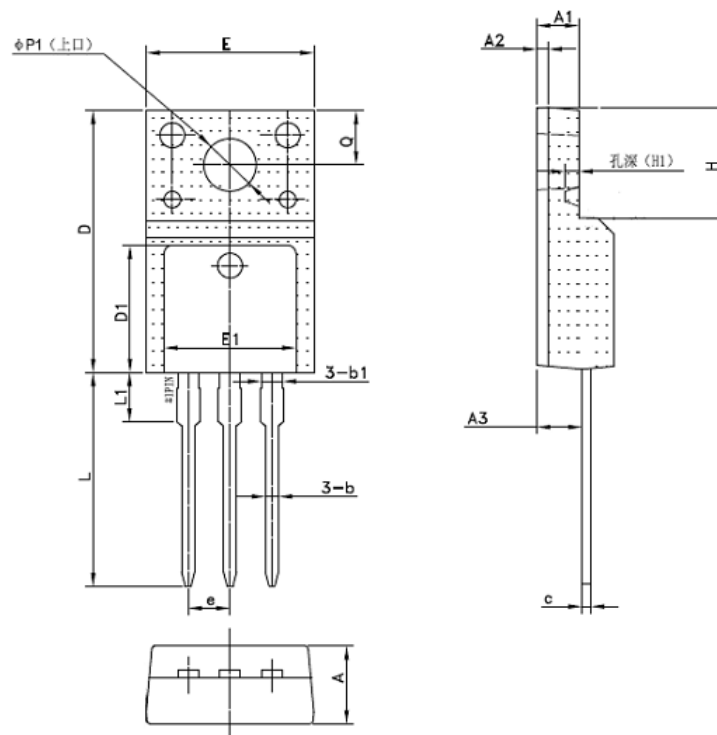
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.50	4.70	4.90
A1	2.44	2.54	2.64
A2	0.60	0.70	0.80
A3	2.56	2.76	2.96
b	0.70	0.80	0.95
b1	-	1.28	-
c	0.45	0.50	0.65
D	15.67	15.87	16.07
D1	-	7.70	-
E	9.96	10.16	10.36
E1	-	8.00	-
e	2.54(BSC)		
H	6.50	6.70	6.90
(H1)	-	(0.81)	-
L	12.48	12.98	13.20
L1	-	2.93	-
ΦP1	2.98	3.18	3.38
Q	3.10	3.30	3.50

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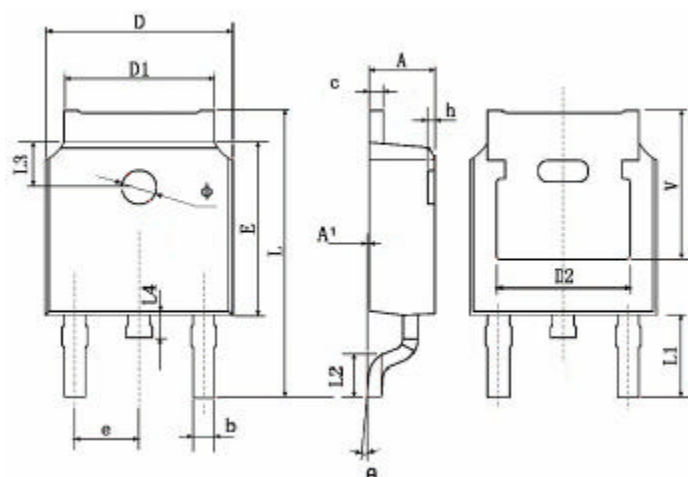
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.200	2.400	0.087	0.094
A1	0.000	0.127	0.000	0.005
b	0.660	0.860	0.026	0.034
c	0.460	0.580	0.018	0.023
D	6.500	6.700	0.256	0.264
D1	5.100	5.460	0.201	0.215
D2	0.483 TYP.		0.190 TYP.	
E	6.000	6.200	0.236	0.244
e	2.186	2.386	0.086	0.094
L	9.800	10.400	0.386	0.409
L1	2.900 TYP.		0.114 TYP.	
L2	1.400	1.700	0.055	0.067
L3	1.600 TYP.		0.063 TYP.	
L4	0.600	1.000	0.024	0.039
Φ	1.100	1.300	0.043	0.051
θ	0°	8°	0°	8°
h	0.000	0.300	0.000	0.012
V	5.350 TYP.		0.211 TYP.	

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