

N-Channel Super Junction Power MOSFET IV

General Description

The series of devices use advanced trench gate super junction technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. This super junction MOSFET fits the industry's AC-DC SMPS requirements for PFC, AC/DC power conversion, and industrial power applications.

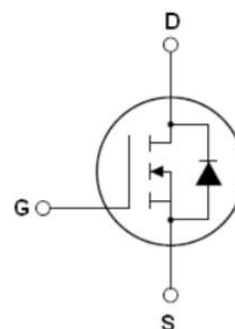
Features

- New technology for high voltage device
- Low on-resistance and low conduction losses
- Small package
- Ultra Low Gate Charge cause lower driving requirements
- 100% Avalanche Tested
- ROHS compliant

Application

- Power factor correction (PFC)
- Switched mode power supplies(SMPS)
- Uninterruptible Power Supply (UPS)
- LLC Half-bridge

$V_{DS \min @ T_{jmax}}$	550	V
$R_{DS(ON)TYP.}$	680	m Ω
I_D	4.6	A
Q_g	9.6	nC



Schematic diagram

✧ Intrinsic fast-recovery body diode

Package Marking And Ordering Information

Device	Device Package	Marking
NCE50NF800D	TO-263-2L	NCE50NF800D

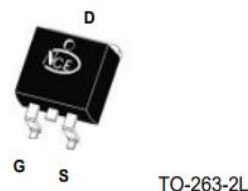


Table 1. Absolute Maximum Ratings ($T_J=25^\circ\text{C}$)

Parameter	Symbol	Value	Unit
Drain-Source Voltage ($V_{GS}=0V$)	V_{DS}	500	V
Gate-Source Voltage ($V_{DS}=0V$), AC ($f>1\text{ Hz}$)	V_{GS}	± 30	V
Gate-Source Voltage ($V_{DS}=0V$), DC	V_{GS}	± 20	V
Continuous Drain Current at $T_c=25^\circ\text{C}$	$I_D(DC)$	4.6	A
Continuous Drain Current at $T_c=100^\circ\text{C}$	$I_D(DC)$	3.22	A
Pulsed drain current (Note 1)	$I_{DM}(\text{pulse})$	13.8	A
Maximum Power Dissipation($T_c=25^\circ\text{C}$)	P_D	47	W
Derate above 25°C		0.31	W/ $^\circ\text{C}$
Single pulse avalanche current (Note 2)	I_{AS}	1.5	A
Reverse diode dv/dt, $V_{DS} \leq 480\text{ V}, I_{SD} < I_D$	dv/dt	50	V/ns
Drain Source voltage slope, $V_{DS} \leq 480\text{ V}$	dv/dt	50	V/ns
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55...+175	$^\circ\text{C}$

Table 2. Thermal Characteristic

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case (Maximum)	R_{thJC}	3.19	$^{\circ}\text{C}/\text{W}$
Thermal Resistance, Junction-to-Ambient (Maximum)	R_{thJA}	62	$^{\circ}\text{C}/\text{W}$

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

Parameter	Symbol	Condition	Min	Typ	Max	Unit
On/off states						
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V I _D =250uA	500			V
Zero Gate Voltage Drain Current(T _j =25℃)	I _{DSS}	V _{DS} =500V,V _{GS} =0V			10	μA
Zero Gate Voltage Drain Current(T _j =125℃)	I _{DSS}	V _{DS} =500V,V _{GS} =0V			300	μA
Gate-Body Leakage Current	I _{GSS}	V _{GS} =±20V,V _{DS} =0V			±200	nA
Gate Threshold Voltage	V _{GS(th)}	V _{DS} =V _{GS} ,I _D =250uA	3.5	4.2	5.0	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =10V, I _D =2.3A		680	800	mΩ
Dynamic Characteristics						
Gate Resistance	R _g	F=1MHZ, D-S short		29		Ω
Input Capacitance	C _{iss}	V _{DS} =50V,V _{GS} =0V, F=1MHz		309	350	pF
Output Capacitance	C _{oss}			14		pF
Reverse Transfer Capacitance	C _{rss}			2		pF
Total Gate Charge	Q _g	V _{DS} =350V,I _D =2.3A, V _{GS} =10V		9.6		nC
Gate-Source Charge	Q _{gs}			4.2		nC
Gate-Drain Charge	Q _{gd}			3.0		nC
Gate plateau voltage	V _{gp}			6.9		V
Switching times						
Turn-on Delay Time	t _{d(on)}	V _{DD} =380V,I _D =2.3A, R _G =4Ω,V _{GS} =10V		7		nS
Turn-on Rise Time	t _r			8		nS
Turn-Off Delay Time	t _{d(off)}			38		nS
Turn-Off Fall Time	t _f			8		nS
Source- Drain Diode Characteristics						
Source-drain current(Body Diode)	I _{SD}	T _C =25℃			4.6	A
Pulsed-Source-drain current(Body Diode)	I _{SDM}				13.8	A
Forward on voltage	V _{SD}	T _j =25℃,I _{SD} =4.6A,V _{GS} =0V		1.0	1.2	V
Reverse Recovery Time	t _{rr}	T _j =25℃,I _F =2.3A, di/dt=100A/μs		90		nS
Reverse Recovery Charge	Q _{rr}			0.29		uC
Peak reverse recovery current	I _{rrm}			6.5		A

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

2. $T_J=25^{\circ}\text{C}, V_{DD}=50V, V_G=10V, R_G=25\Omega$

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)

Figure1. Safe operating area

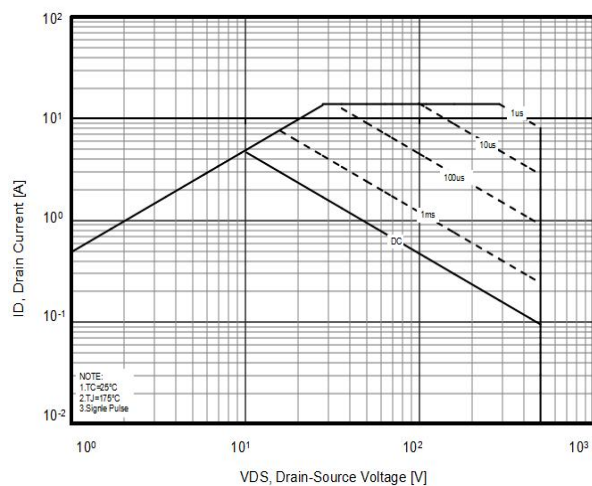


Figure2. Source-Drain Diode Forward Voltage

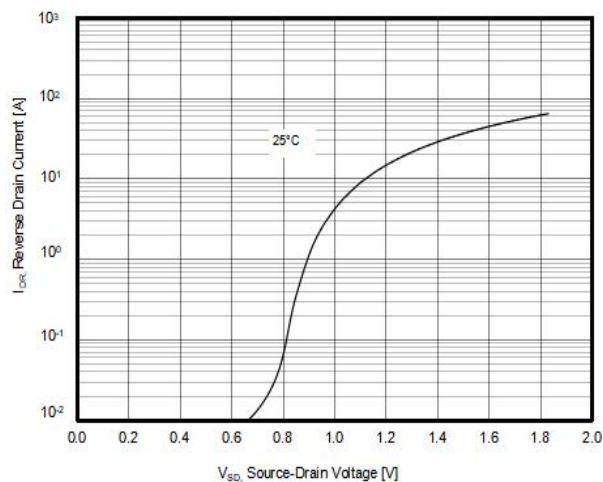


Figure3. $R_{DS(ON)}$ vs Junction Temperature

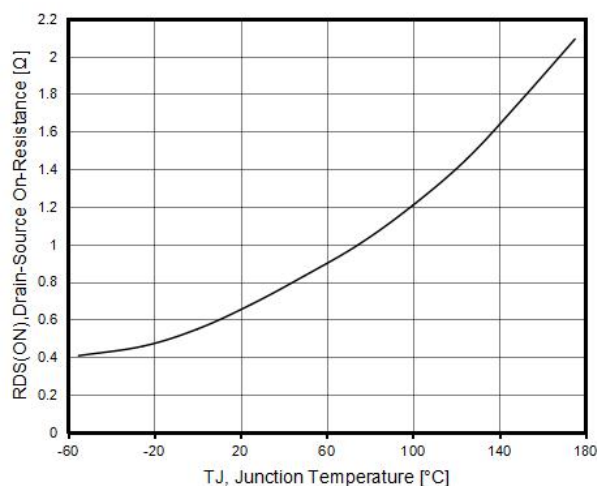


Figure4. BV_{DSS} vs Junction Temperature

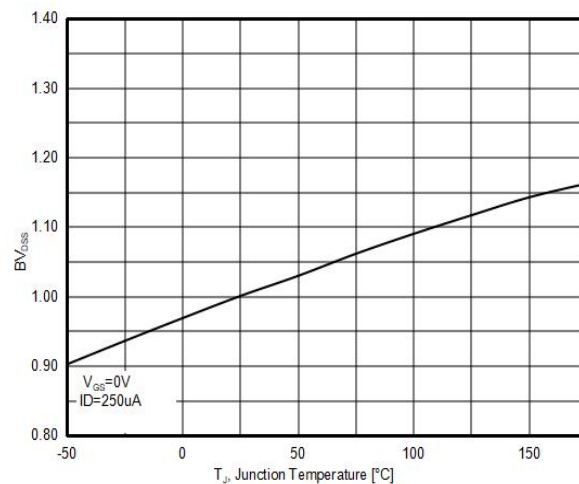


Figure5. Maximum I_D vs Junction Temperature

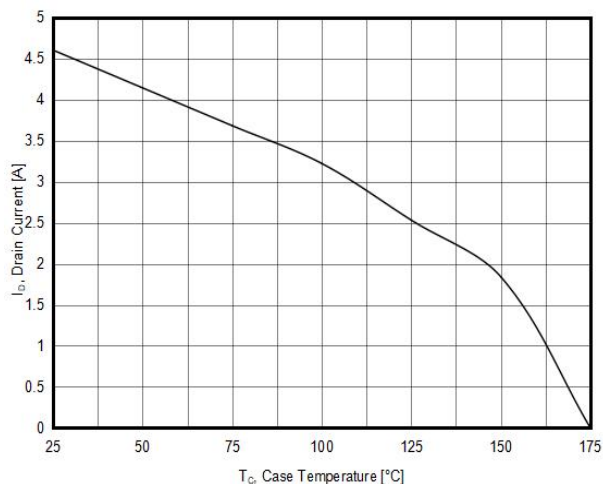


Figure6. Output characteristics

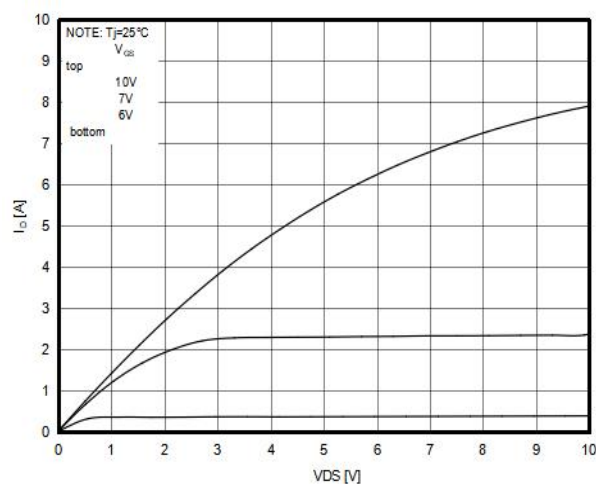


Figure7. Transfer characteristics

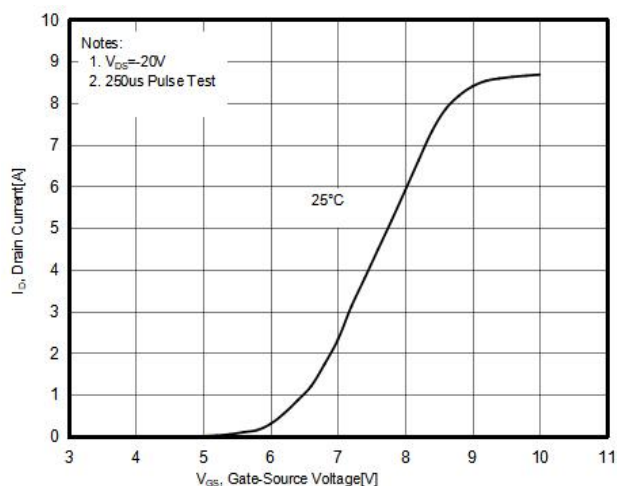


Figure8. Static drain-source on resistance

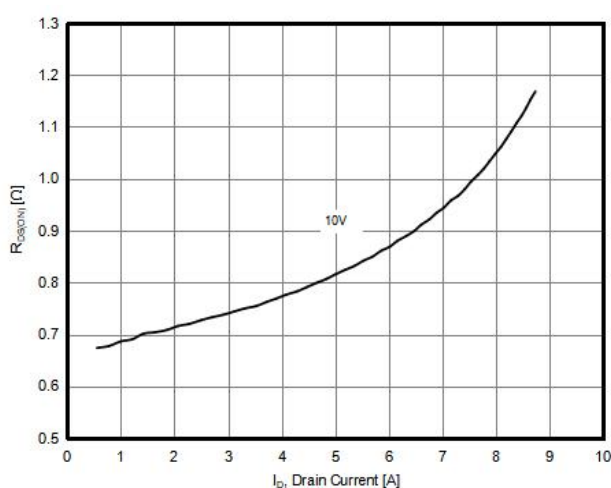


Figure9. Gate charge waveforms

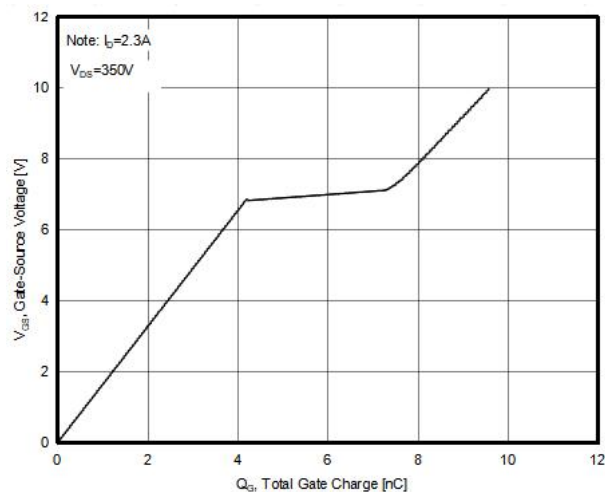
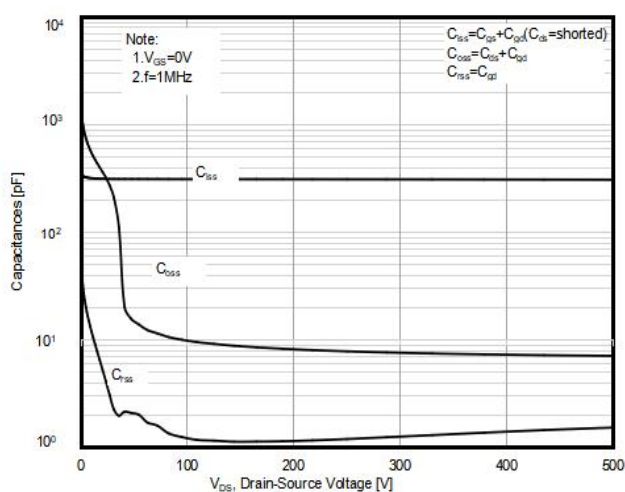
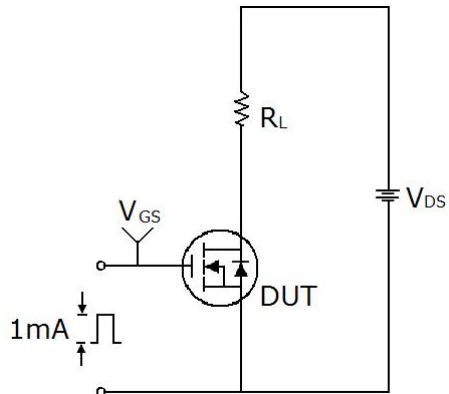
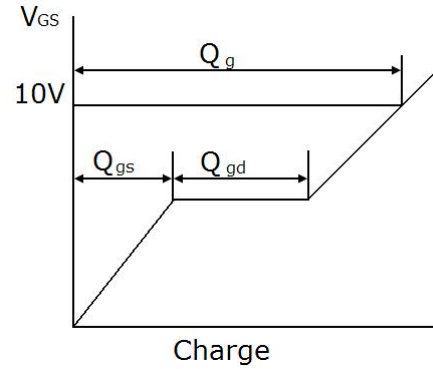


Figure10. Capacitance

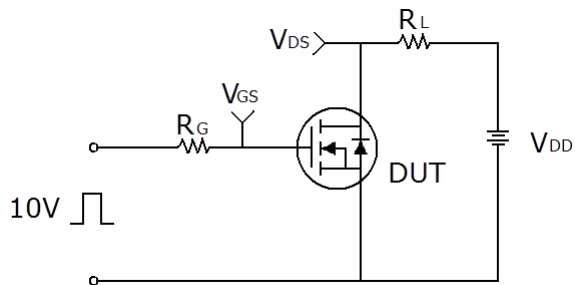
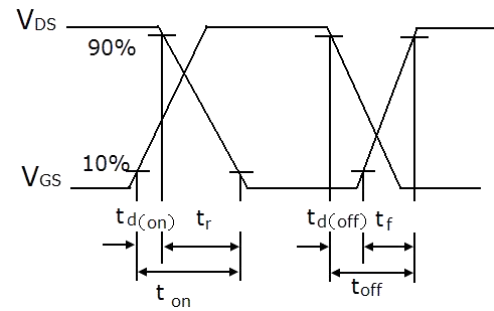


Test circuit

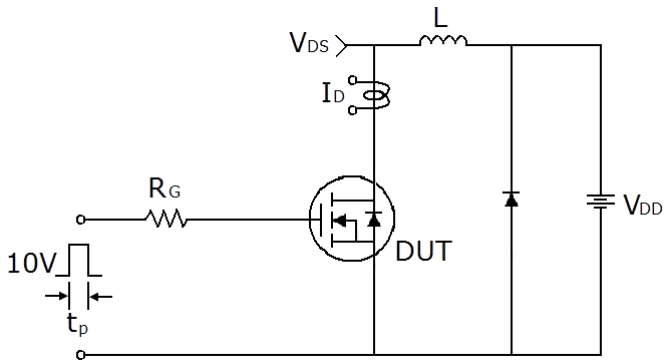
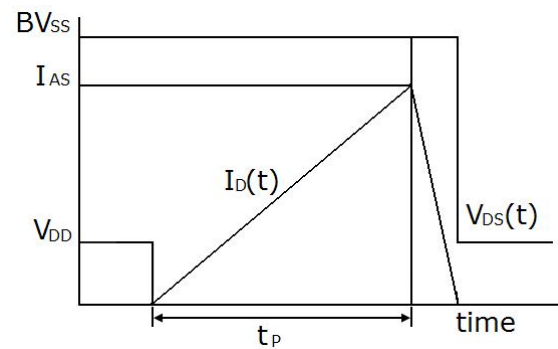
1) Gate charge test circuit & Waveform



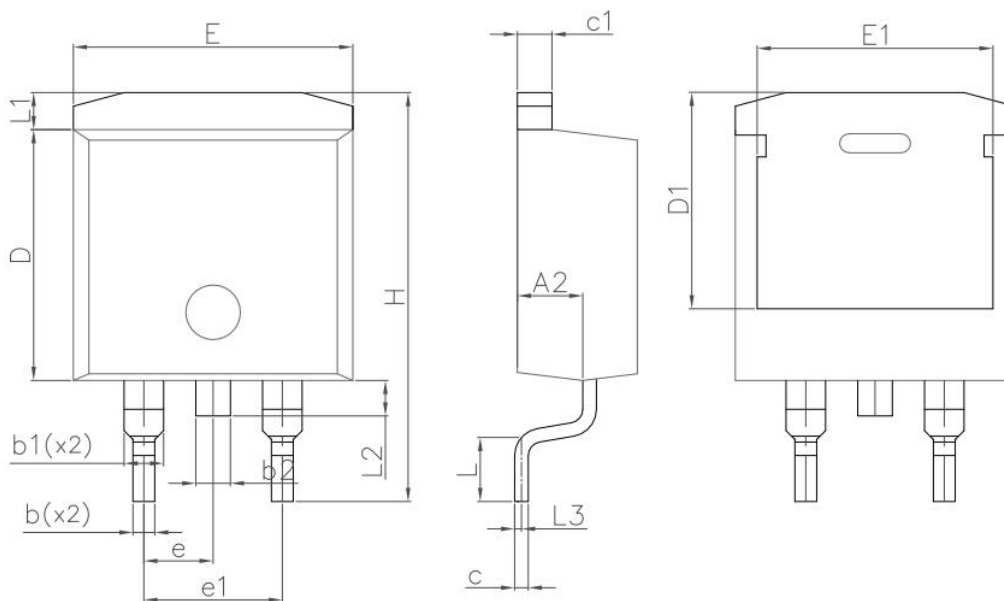
2) Switch Time Test Circuit:



3) Unclamped Inductive Switching Test Circuit & Waveforms

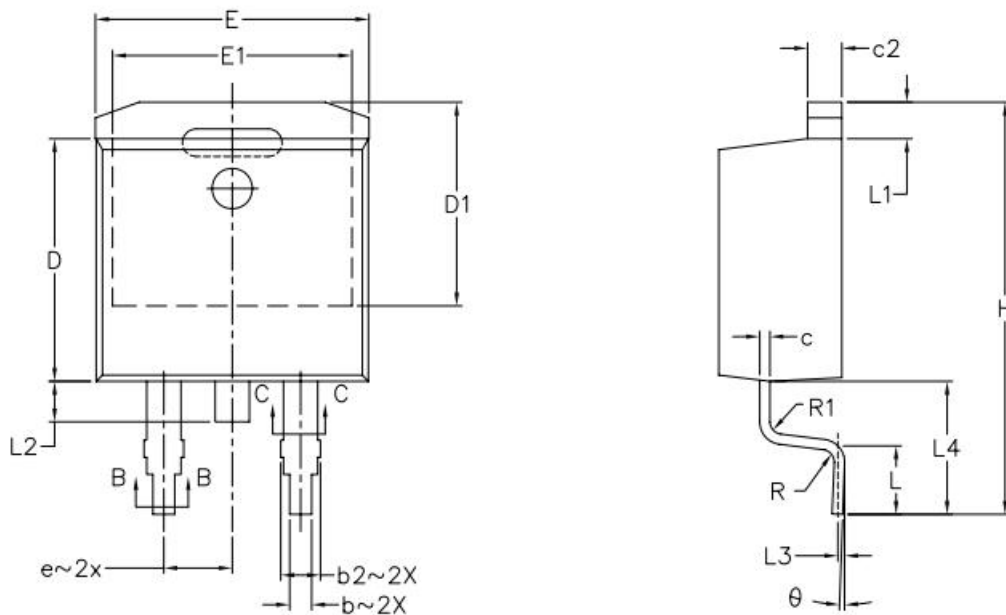


TO-263-E Package Information



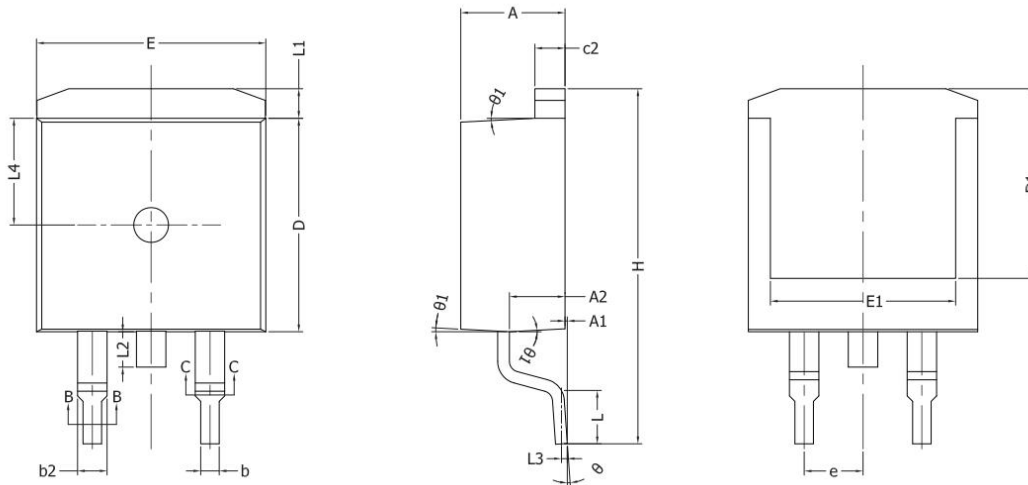
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.20	4.60	0.165	0.181
A1	0	0.25	0	0.01
A2	2.20	2.60	0.087	0.102
b	0.70	0.90	0.028	0.035
b1	1.20	1.75	0.047	0.069
b2	1.17	1.37	0.046	0.054
c	0.40	0.60	0.016	0.024
c1	1.15	1.40	0.045	0.055
D	9.10	9.30	0.358	0.366
D1	7.63	8.23	0.300	0.324
E	10.05	10.45	0.396	0.411
E1	8.35	8.95	0.329	0.352
e	2.54BSC		0.100BSC	
e1	5.08BSC		0.200BSC	
H	14.61	15.88	0.575	0.625
L	1.78	2.79	0.070	0.110
L1	1.36REF		0.054REF	
L2	1.30REF		0.051REF	
L3	0.25REF		0.010REF	

TO-263-J Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.06	4.83	0.160	0.190
A1	0.00	0.25	0.000	0.010
b	0.51	0.99	0.020	0.039
b1	0.51	0.89	0.020	0.035
b2	1.14	1.78	0.045	0.070
b3	1.14	1.73	0.045	0.068
c	0.38	0.74	0.015	0.029
c1	0.38	0.58	0.015	0.023
c2	1.14	1.65	0.045	0.065
D	8.38	9.65	0.330	0.380
D1	6.86		0.270	
E	9.65	10.00	0.380	0.394
E1	6.22		0.245	
e	2.54BSC		0.100BSC	
H	14.61	15.88	0.575	0.625
L	1.78	2.79	0.070	0.110
L1		1.68		0.066
L2		1.78		0.070
L3	0.25BSC		0.101BSC	
L4	4.78	5.28	0.188	0.208

TO-263-P Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.173	0.181
A1	0.00	0.25	0.000	0.010
A2	2.20	2.60	0.087	0.102
b	0.76	0.89	0.030	0.035
b1	0.75	0.85	0.030	0.033
b2	1.23	1.37	0.048	0.054
b3	1.22	1.32	0.048	0.052
c	0.47	0.60	0.019	0.024
c1	0.46	0.56	0.018	0.022
c2	1.25	1.35	0.049	0.053
D	9.10	9.30	0.358	0.366
D1	8.00		0.315	
E	9.80	10.00	0.386	0.394
E1	7.80		0.307	
e	2.54BSC		0.100BSC	
H	14.90	15.70	0.587	0.618
L	2.00	2.60	0.079	0.102
L1	1.17	1.40	0.046	0.055
L2		1.75		0.069
L3	0.25BSC		0.101BSC	
L4	4.60REF		0.181REF	

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