

General Description

These N-channel enhancement mode power mosfets Used advanced trench technology design, provided excellent $R_{DS(on)}$ and low gate charge. Which accords with the RoHS standard.

Features

- Fast switching
- Low on-resistance
- Low gate charge and input capacitance
- 100% avalanche tested

Mechanical Data

- Case:TO-220,TO-263, TO-220C, TO-252 Package

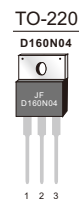
Application

- AC-DC switching power supply
- UPS power supply
- Power tool

Ordering Information

Part No.	Package Type	Package	Quality(box)
D160N04	TO-220	Tube	1000
D160N04	TO-220C	Tube	1000
D160N04D	TO-263	Tape & Reel	800
D160N04M	TO-252	Tape & Reel	3000

Product Summary			
V_{DS}	$R_{DS(on)}$ (m Ω) Typ	I_D (A)	Q_g (Typ)
40V	2.4 @ 10V,70A	160	148nc



Block Diagram

Pin Definition:

1. Gate
2. Drain
3. Source

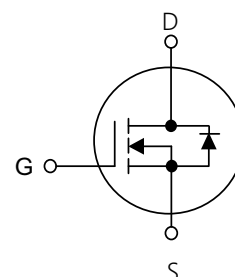


Table1 Absolute Maximum Ratings ($T_c=25^\circ\text{C}$, unless otherwise specified)

Parameter	Symbol	D160N04/D160N04D/ D160N04M	Unit
Drain-Source Voltage	V_{DS}	40	V
Gate-Source Voltage	V_{GS}	± 20	V
Continuous Drain Current	$T_c=25^\circ\text{C}$	I_D 160	A
	$T_c=100^\circ\text{C}$	101	
Pulsed Drain Current (Note 1)	I_{DM}	640	A
Single Pulse Avalanche Energy(Note 2)	E_{AS}	870	mJ
Avalanche Current(Note 1)	I_{AR}	75	A
Power Dissipation $T_c=25^\circ\text{C}$	P_D	125	W
Operating Junction and Storage Temperature	T_J/T_{STG}	-55~+150	$^\circ\text{C}$

Table 2. Thermal Characteristics

Parameter	Symbol	D160N04/D160N04D/ D160N04M	Unit
Thermal resistance Junction to Ambient	$R_{\theta JA}$	75	$^{\circ}\text{C}/\text{W}$
Thermal resistance Junction to Case	$R_{\theta JC}$	1.0	$^{\circ}\text{C}/\text{W}$

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

Parameter		Symbol	Test Conditions	Min	Typ	Max	Unit
Off Characteristics							
Drain-Source Breakdown Voltage		BV _{DSS}	V _{GS} =0V,I _D =250μA	40	-	-	V
Drain-Source Leakage Current		I _{DSS}	V _{DS} =40V,V _{GS} =0V	-	-	1	μA
Gate- Source Leakage Current	Forward	I _{GSS}	V _{GS} =25V,V _{DS} =0V	-	-	100	nA
	Reverse		V _{GS} =-25V,V _{DS} =0V	-	-	-100	nA
On Characteristics(Note 3)							
Gate Threshold Voltage		V _{GS(TH)}	V _{DS} =V _{GS} ,I _D =250μA	1.3	-	2.3	V
Static Drain-Source On-State Resistance		R _{DS(ON)}	V _{GS} =10V,I _D =70A	-	2.4	2.8	mΩ
			V _{GS} =4.5V,I _D =70A	-	3.0	3.5	
Dynamic Characteristics(Note 4)							
Input Capacitance	C _{ISS}	V _{DS} =20V,V _{GS} =0V,f=1MHz	-	8400	-	pF	
Output Capacitance	C _{OSS}		-	610	-	pF	
Reverse Transfer Capacitance	C _{RSS}		-	506	-	pF	
Gate Resitance	R _G	V _{DD} =0V,V _{GS} =0V,f=1MHz	-	-	-	Ω	
Switching Characteristics (Note 4)							
Turn-On Delay Time	t _{d(on)}	V _{DD} =20V,I _D =70A V _{GS} =10V,R _G =3Ω,	-	13	-	ns	
Turn-On Rise Time	t _r		-	37	-	ns	
Turn-Off Delay Time	t _{d(off)}		-	114	-	ns	
Turn-Off Fall Time	t _f		-	90	-	ns	
Total Gate Charge	Q _G	V _{DD} =20V,I _D =70A, V _{GS} =10V	-	148	-	nC	
Gate-Source Charge	Q _{GS}		-	27	-	nC	
Gate-Drain Charge	Q _{GD}		-	21	-	nC	
Drain-Source Diode Characteristics and Maximum Ratings							
Drain-Source Diode Forward Voltage	V _{SD}	V _{GS} =0V, I _S =70A	-	-	1.2	V	
Maximum Continuous Drain-Source Diode Forward Current	I _S		-	-	160	A	
Reverse Recovery Time	t _{rr}	V _{GS} =0V, I _F =20A	-	34	-	ns	
Reverse Recovery Charge	Q _{RR}	dI _F /dt= 100A/μs (Note 1)	-	29	-	nC	

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

2 $L=0.5\text{mH}$, $I_D=41A$, Starting $T_J=25^{\circ}\text{C}$

3 Pulse Test: Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$

4 Guaranteed by design, not subject to production

Typical Characteristics Diagrams

Figure 1. Output Characteristics

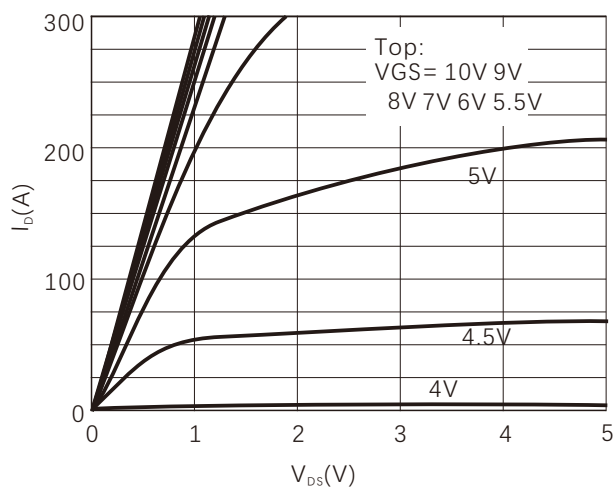


Figure 2. Normalized $R_{DS(ON)}$ vs Temperature

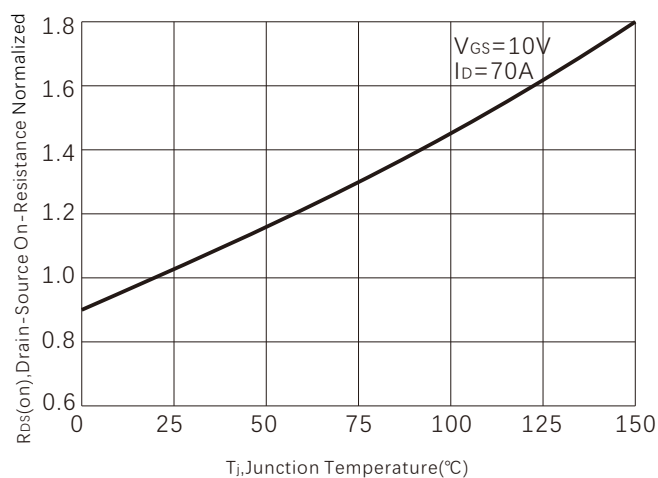


Figure 3. On-Resistance vs. Drain Current

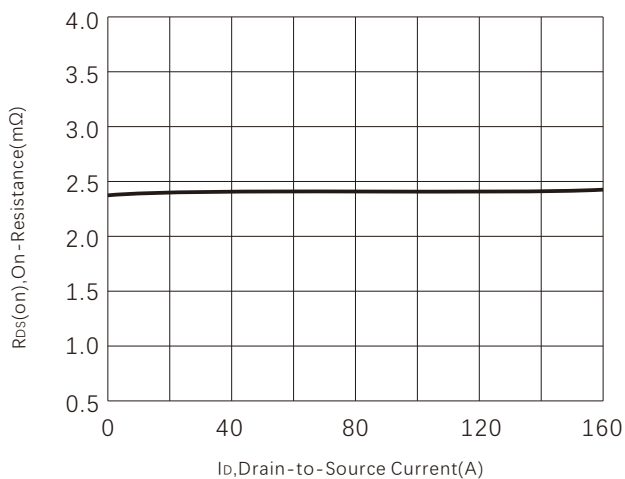


Figure 4. Capacitance

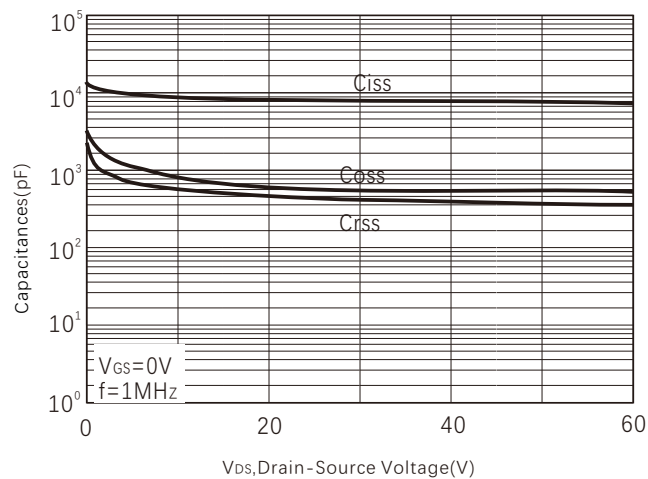


Figure 5. Gate charge

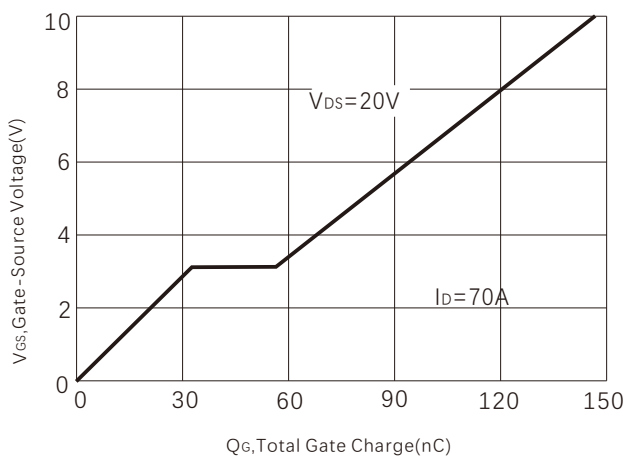


Figure 6. Source-Drain Diode Forward Voltage

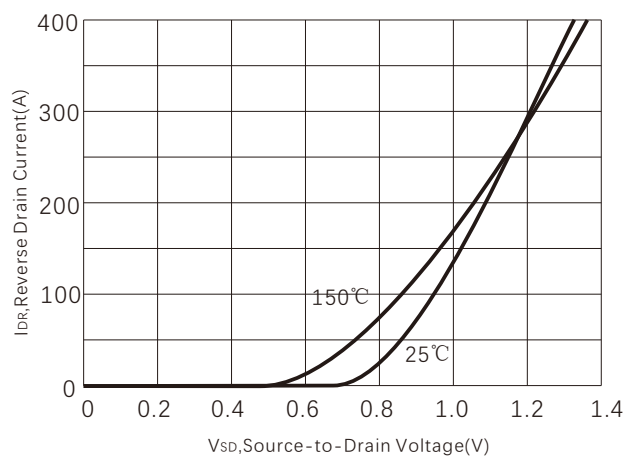


Figure 7. Maximum Drain Current vs Temperature

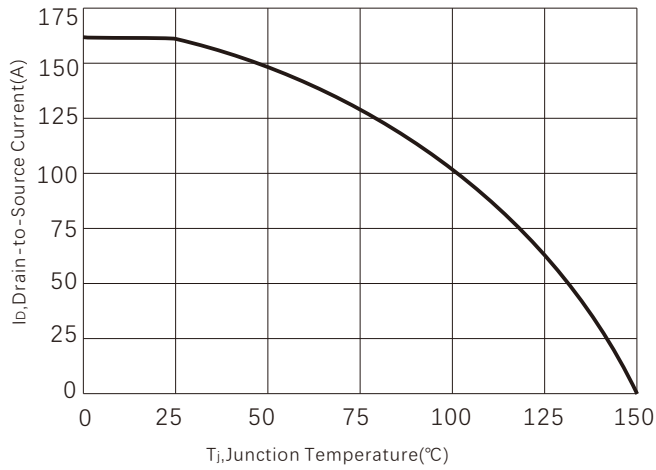


Figure 8. Transfer Characteristics

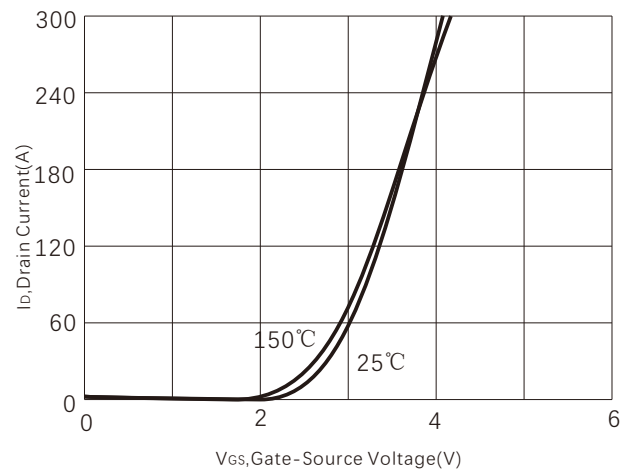


Figure 9.

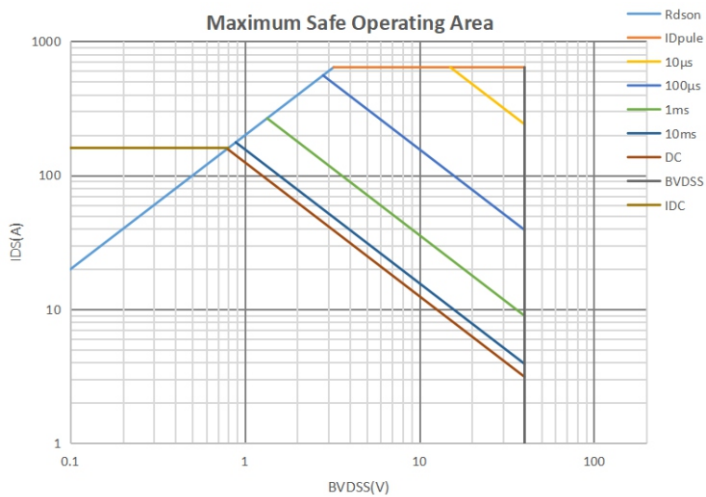


Figure 10. Power dissipation

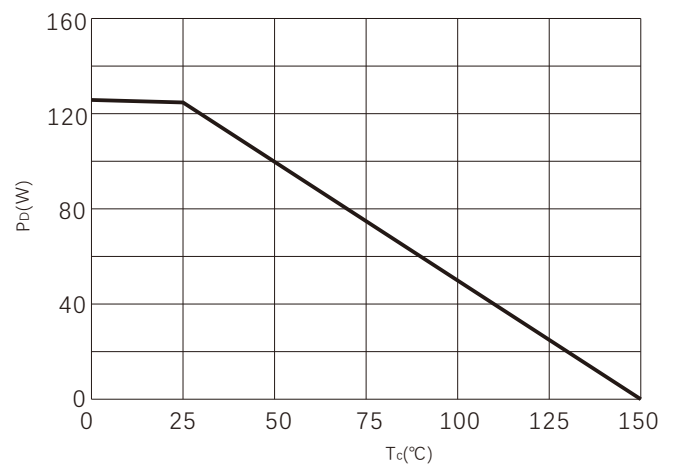
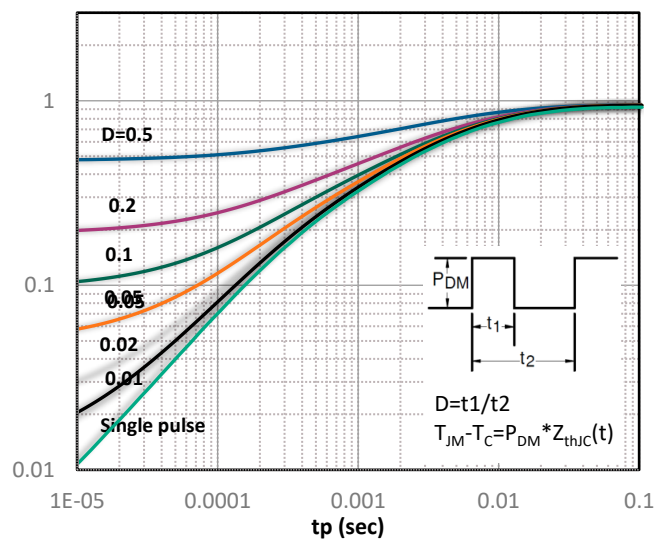
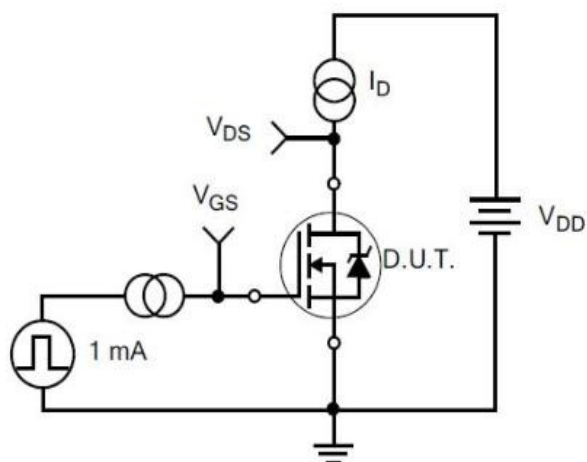


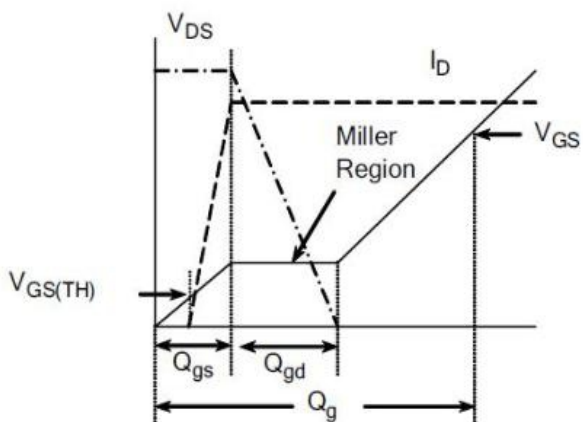
Figure 11. Maximum Transient Thermal Impedance



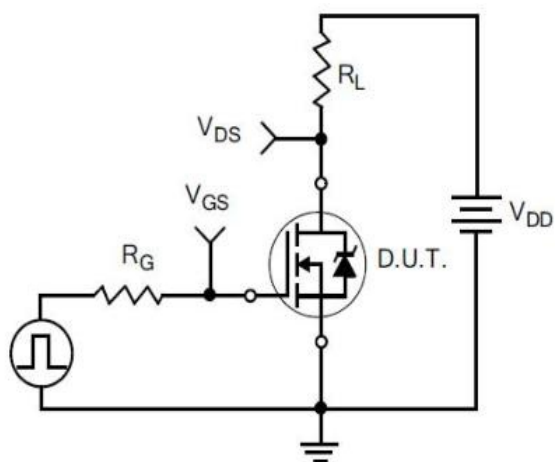
Typical Test Circuit



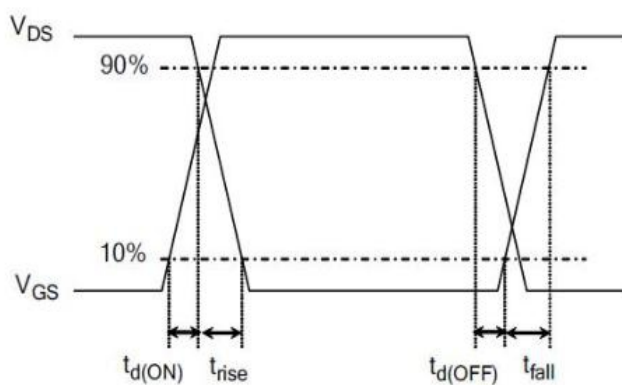
1) Gate Charge Test Circuit



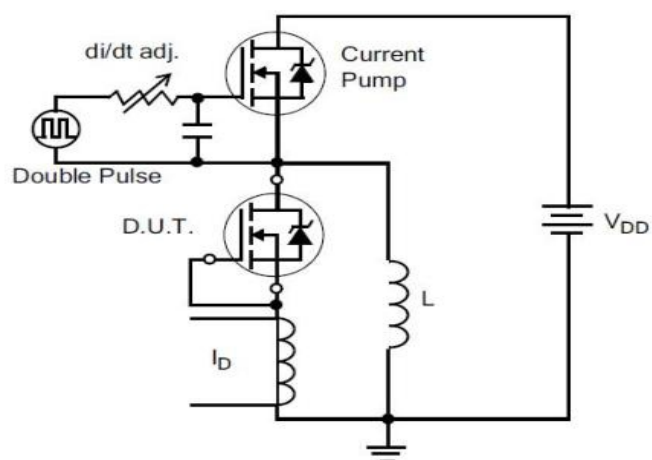
2) Gate Charge Waveform



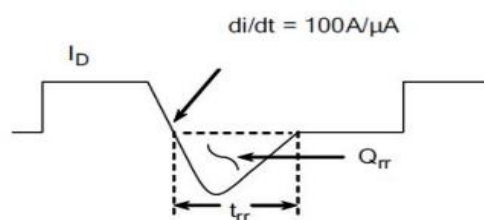
3) Resistive Switching Test Circuit



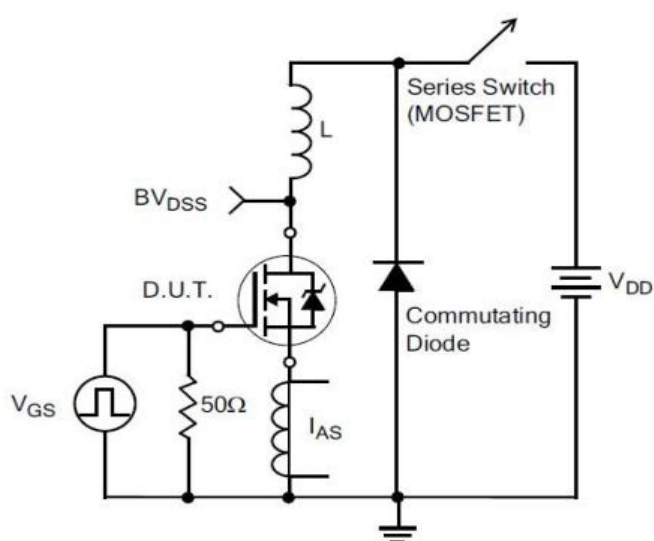
4) Resistive Switching Waveforms



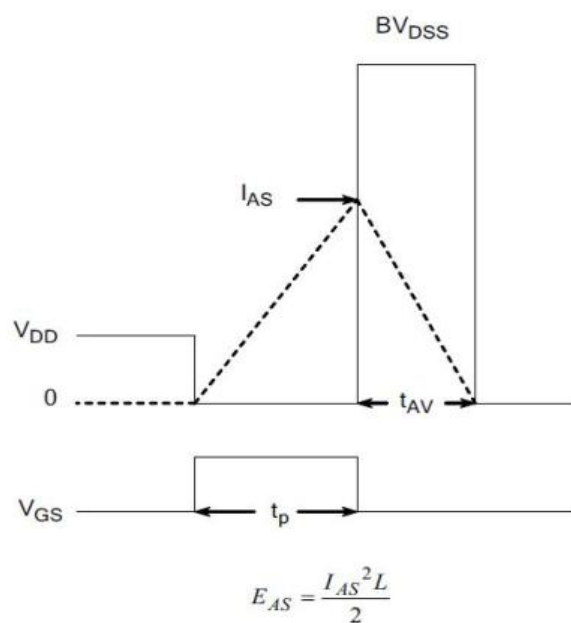
5) Diode Reverse Recovery Test Circuit



6) Diode Reverse Recovery Waveform



7) . Unclamped Inductive Switching Test Circuit



8) Unclamped Inductive Switching Waveforms

Product Names Rules

X X X N E X X X-X X X

Process Type:
VDMOS:default
Super junction:SJ
Low Voltage trench:D

Rdson Code
2Ω :2D0
9.5mΩ :9M5

Rated Current Code
With 1-2 Digital,
For Ex ample:
4A:4,
10A:10,
0.8A:08

Package Code
TO-220:Default
ITO-220:F
TO-262:E
TO-263:D
TO-252:M
TO-251:N
TO-263-7L:D7

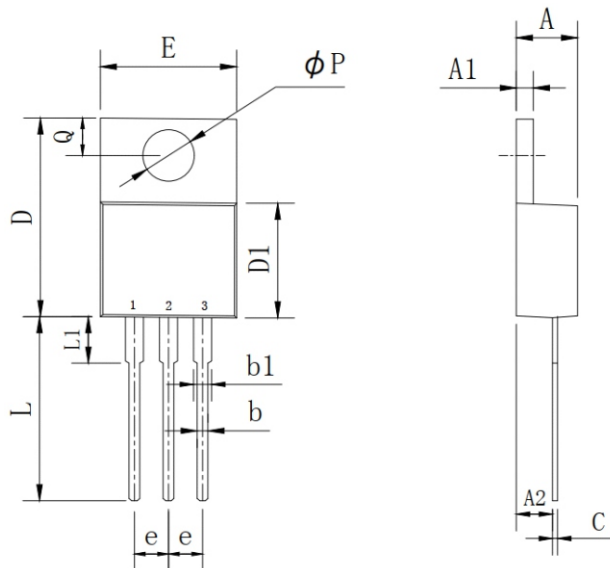
Channel Code
N channel:N
P channel:P

Rated Voltage Code
With 2 Digital,For Example:
600V:60
60V:06

Special Function Code
G-S ESD Protection:E
No Protection:Default

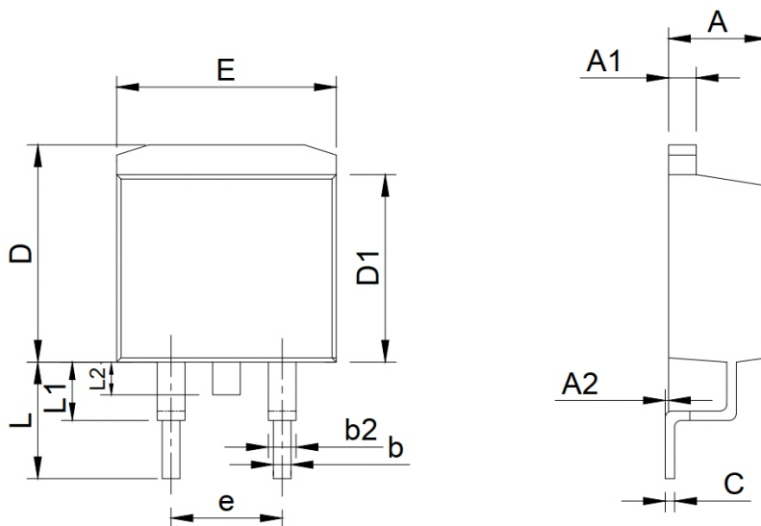
Dimensions

TO-220 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	4.25	4.87	0.167	0.192
A1	1.07	1.47	0.042	0.058
A2	2.03	2.92	0.080	0.115
b	0.51	1.11	0.020	0.044
b1	0.97	1.6	0.038	0.063
C	0.3	0.7	0.012	0.028
D	14.6	15.9	0.575	0.626
D1	8.04	9.3	0.317	0.366
E	9.57	10.57	0.377	0.416
e	2.34	2.74	0.092	0.108
L	12.58	14.3	0.495	0.563
L1	2.8	4.2	0.110	0.165
P	3.4	4.14	0.134	0.163
Q	2.45	3	0.096	0.118

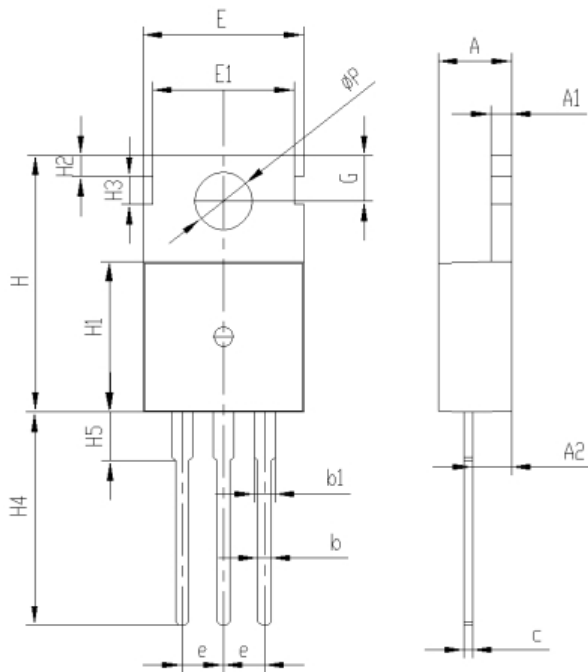
TO-263 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	4.25	4.87	0.167	0.192
A1	1.07	1.47	0.042	0.058
A2	0	0.25	0.000	0.010
b	0.61	1.01	0.024	0.040
b1	1.2	1.34	0.047	0.053
C	0.3	0.6	0.012	0.024
D	9.48	10.84	0.373	0.427
D1	8.49	9.3	0.334	0.366
E	9.7	10.31	0.382	0.406
e	4.88	5.28	0.192	0.208
L	4.46	5.85	0.176	0.230
L1	1.33	2.33	0.052	0.092
L2	0	2.2	0.000	0.087

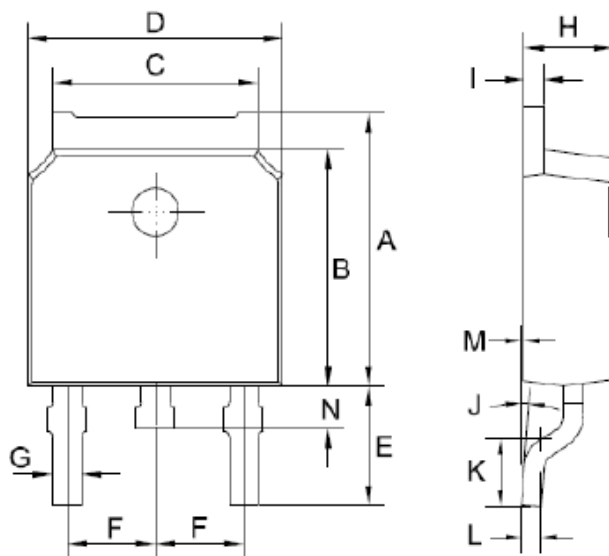
Dimensions

TO-220C PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions(millimeters)	
	Min.	Max.
A	4.30	4.70
A1	1.17	1.37
A2	2.20	2.60
b	0.60	1.00
b1	1.17	1.37
b2	1.90	2.30
c	0.30	0.70
e	2.34	2.74
E	9.70	10.1
E1	8.50	8.90
H	15.5	15.9
H1	9.00	9.40
H2	1.10	1.50
H3	1.50	1.90
H4	12.58	13.58
H5	2.80	3.20
G	2.60	3.00
ΦP	3.40	3.80

TO-252 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	6.85	7.25	0.270	0.285
B	5.8	6.3	0.228	0.248
C	5	5.53	0.197	0.218
D	6.3	6.8	0.248	0.268
E	2.6	3.3	0.102	0.130
F	2.19	2.39	0.086	0.094
G	0.45	0.85	0.018	0.033
H	2.2	2.4	0.087	0.094
I	0.41	0.61	0.016	0.024
J	0°	8°	0°	8°
K	1.45	1.85	0.057	0.073
L	0.41	0.61	0.016	0.024
M	0	0.12	0.000	0.005
N	0.6	1	0.024	0.039

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