

## 650V 20A 0.37Ω N-ch Power MOSFET

### Description

DT2 MOS is DIN-TEK 2<sup>nd</sup> generation VDMOS family that is dramatic reduction in on-resistance and ultra-low gate charge for applications requiring high power density and high efficiency. And it is very robust and RoHS compliant.

TO-220F



TO-220



TO-247



TO-263

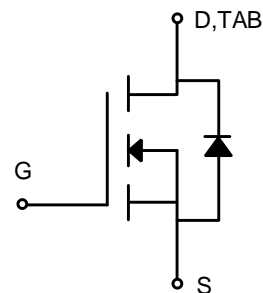


### Features

- Typ. $R_{DS(on)}=0.37\Omega@V_{GS}=10V$
- 100% avalanche tested
- RoHS Compliant

### Applications

- SMPS
- Charger
- DC-DC



### Absolute Maximum Ratings ( $T_c=25^\circ\text{C}$ )

Parameter	Symbol	DTP20N65F	DTP20N65/DTK20N65	DTN20N65	Unit
Drain-source voltage	$V_{DSS}$	650			V
Gate-source voltage	$V_{GS}$	$\pm 30$			V
Continuous drain current	$I_D$	20			A
Pulsed drain current <sup>1</sup>	$I_{DM}$	80			A
Avalanche energy, single pulse <sup>2</sup>	$E_{AS}$	980			mJ
Power dissipation	$P_D$	74	250	313	W
Derate above 25°C		0.6	2	2.5	W/°C
Operating junction temperature	$T_j$	-55~150			°C
Storage temperature	$T_{stg}$	-55~150			°C
Continuous diode forward current	$I_S$	20			A
Diode pulse current <sup>1</sup>	$I_{Spulse}$	80			A

### Thermal Characteristic

Thermal resistance, junction-to-case	$R_{\theta JC}$	1.7	0.5	0.4	°C/W
Thermal resistance, junction-to-ambient	$R_{\theta JA}$	62.5	62.5	40	°C/W

**Electrical Characteristics of MOSFET**

				Min.	Typ.	Max.	
Drain-source break down voltage	$BV_{DSS}$	$I_D=250\mu A, V_{GS}=0V$	$T_C=25^\circ C$	650	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$I_D=250\mu A, V_{DS}=V_{GS}$	$T_J=25^\circ C$	2.0	-	4.0	V
Drain-source leakage current	$I_{DSS}$	$V_{DS}=650V, V_{GS}=0V$	$T_J=25^\circ C$	-	-	1	$\mu A$
		$V_{DS}=520V, V_{GS}=0V$	$T_J=125^\circ C$	-	-	100	$\mu A$
Gate-source leakage current,forward	$I_{GSSF}$	$V_{DS}=0V, V_{GS}=30V$	$T_J=25^\circ C$	-	-	100	nA
Gate-source leakage current,reverse	$I_{GSSR}$	$V_{DS}=0V, V_{GS}=-30V$	$T_J=25^\circ C$	-	-	-100	nA
Drain-source on-state resistance <sup>3</sup>	$R_{DS(ON)}$	$V_{GS}=10V, I_D=10A$	$T_J=25^\circ C$	-	0.37	0.44	$\Omega$
Transconductance <sup>3</sup>	$G_{fs}$	$V_{DS}=20V$	$T_J=25^\circ C$	-	22	-	S

**Dynamic Characteristics of MOSFET** ( $T_C=25^\circ C$ )

				Min.	Typ.	Max.	
Input capacitance	$C_{iss}$	$f=1MHz,$ $V_{DS}=25V, V_{GS}=0V$		-	3280	-	pF
Output capacitance	$C_{oss}$			-	244	-	pF
Reverse transfer capacitance	$C_{rss}$			-	26	-	pF
Gate to source charge	$Q_{gs}$	$V_{DD}=320V$		-	17	-	nC
Gate to drain charge	$Q_{gd}$	$I_D=20A$		-	26	-	nC
Total gate charge	$Q_g$	$V_{GS}=0$ to 10V		-	73	-	nC

**Switching Characteristics of MOSFET** ( $T_C=25^\circ C$ )

				Min.	Typ.	Max.	
Turn-on delay time	$t_{d on}$	$V_{DS}=320V,$ $I_D=20A, R_G=25\Omega,$ $V_{GS}=0$ to 10V		-	18	-	ns
Rise time	$t_r$			-	33	-	ns
Turn-off delay time	$t_{d off}$			-	104	-	ns
Fall time	$t_f$			-	50	-	ns

**Characteristics of Body Diode** ( $T_C=25^\circ C$ )

				Min.	Typ.	Max.	
Forward voltage	$V_{SD}$	$I_{SD}=20A, V_{GS}=0V$		-	-	1.5	V
Reverse recovery time	$t_{rr}$	$V_{DS}=320V,$		-	420	-	ns
Reverse recovery current	$I_{rr}$	$I_S=20A, V_{GS}=10V$		-	20	-	A
Recovery charge	$Q_{rr}$	$-di/dt=100A/\mu s$		-	4.2	-	$\mu C$

**Notes:**

1. Repetitive rating, pulse width limited by junction temperature  $T_{J(MAX)}=150^\circ C$ .
2. The  $E_{AS}$  data shows Max. rating . The test condition is  $V_{DD}=80V, V_{GS}=10V, L=10mH, I_{AS}=14A, T_C=25^\circ C$ .
3. The data tested by pulsed , pulse width  $\leq 300\mu s$  , duty cycle  $\leq 2\%$ .

**TYPICAL CHARACTERISTICS**

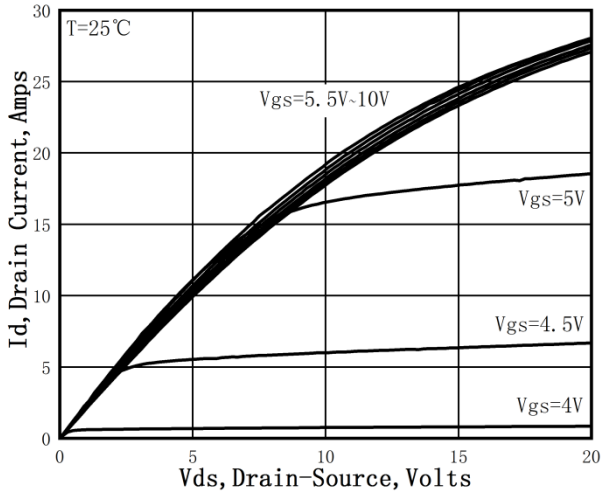


Figure 1. On-Region Characteristics

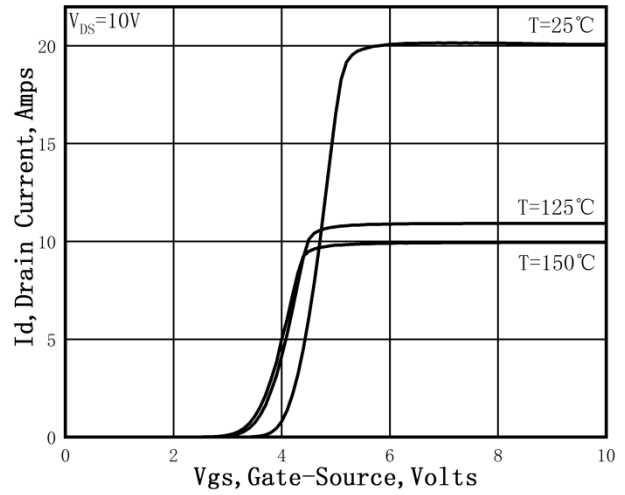


Figure 2. Transfer Characteristics

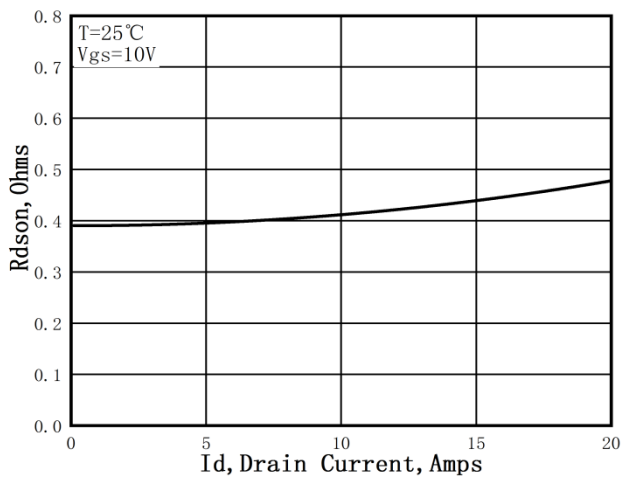


Figure 3. Static Drain-Source On Resistance

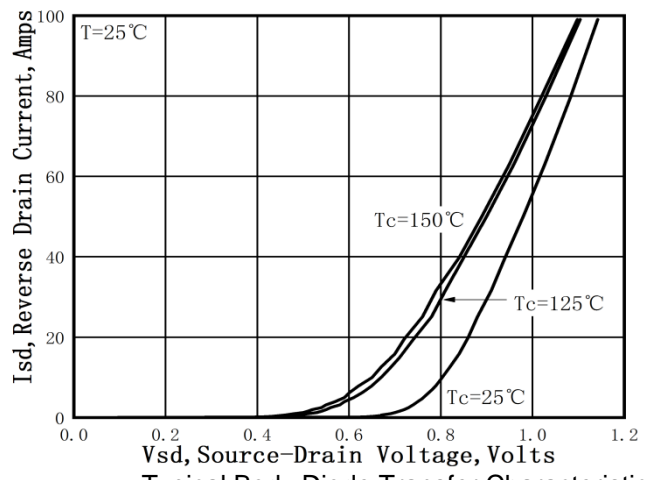


Figure 4.

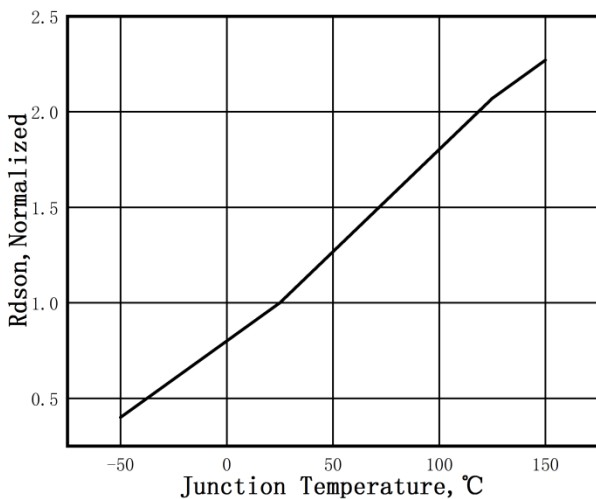


Figure 5. Normalized  $R_{DS(on)}$  vs. Temperature

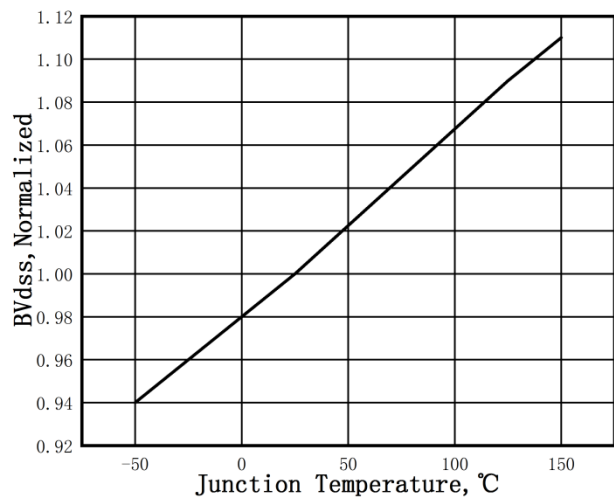


Figure 6. Normalized  $BV_{DSS}$  vs. Temperature

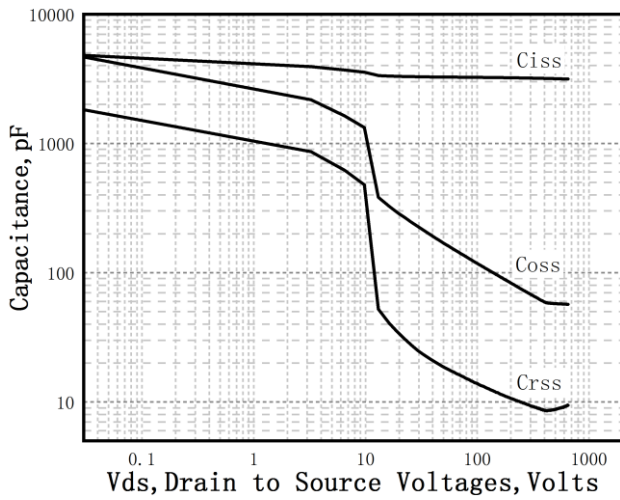


Figure 7. Capacitance Characteristics

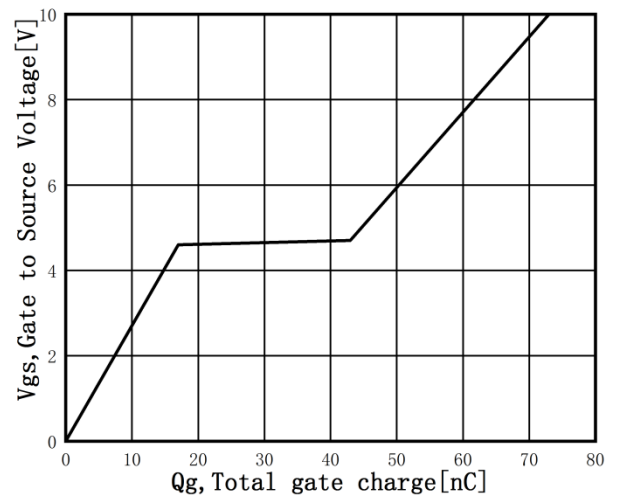


Figure 8. Gate Charge Characteristics

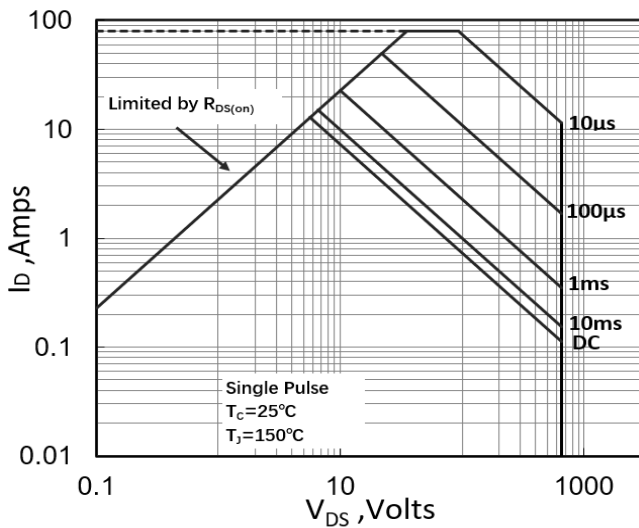


Figure 9. Maximum Safe Operating Area (TO-220F)

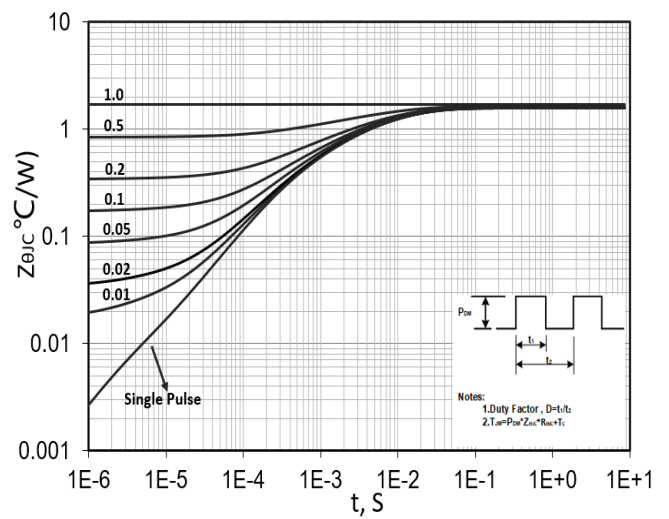


Figure 10. Transient Thermal Response Curve (TO-220F)

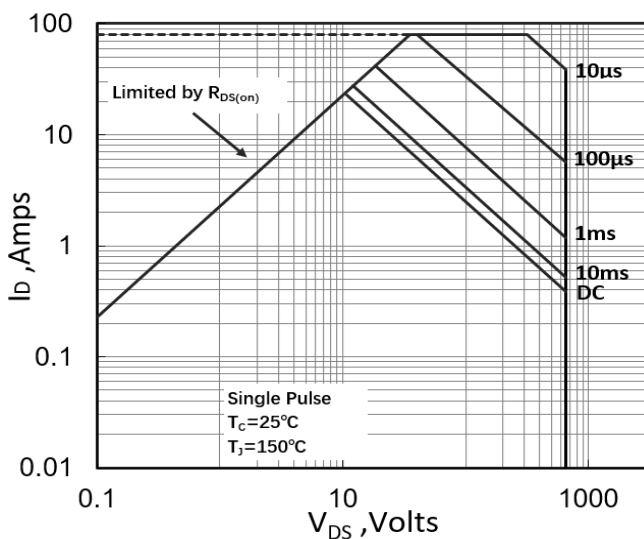


Figure 11. Maximum Safe Operating Area (TO-220/TO-263)

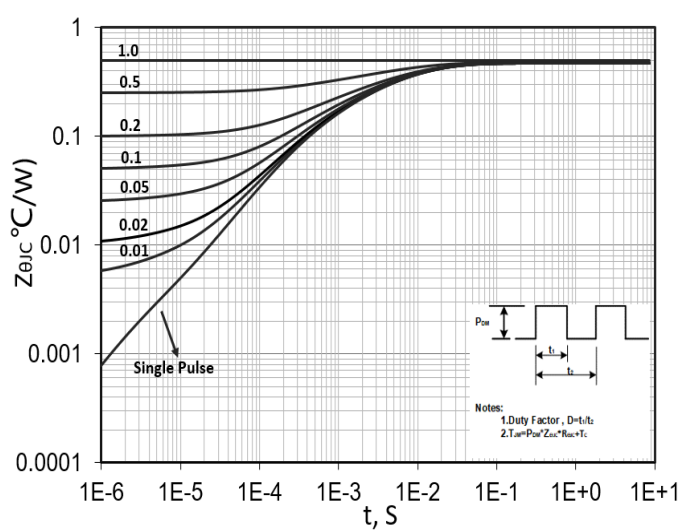


Figure 12. Transient Thermal Response Curve (TO-220/TO-263)

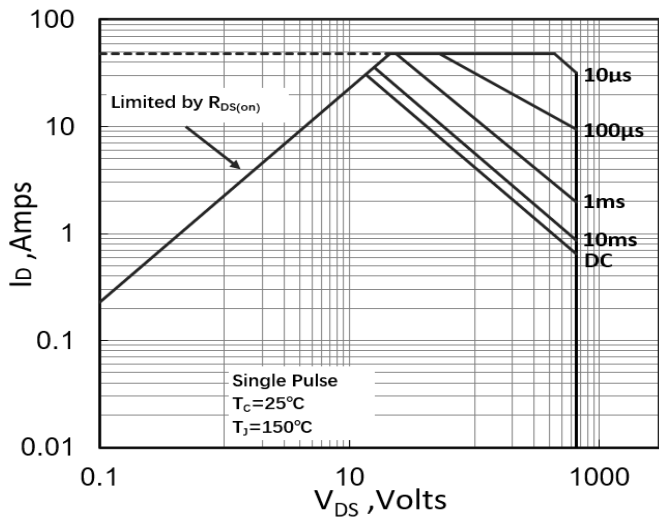


Figure 13. Maximum Safe Operating Area (TO-247)

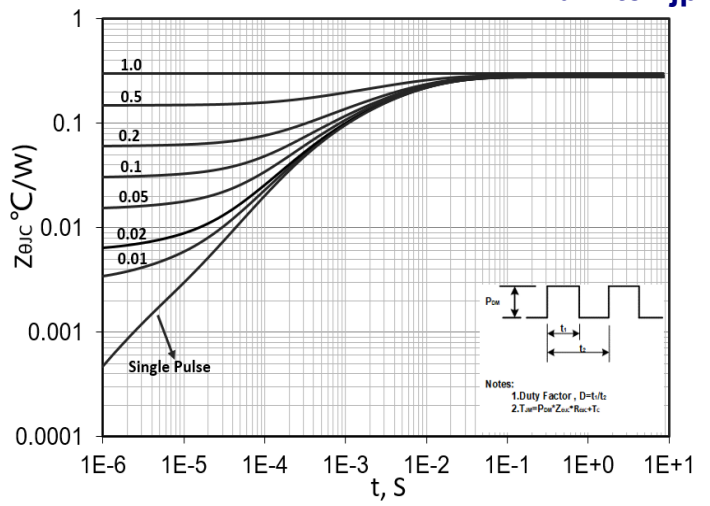
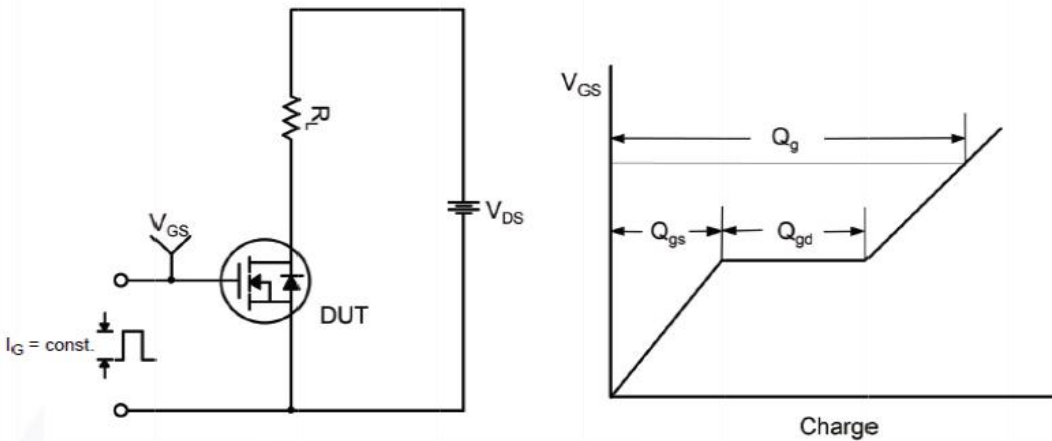


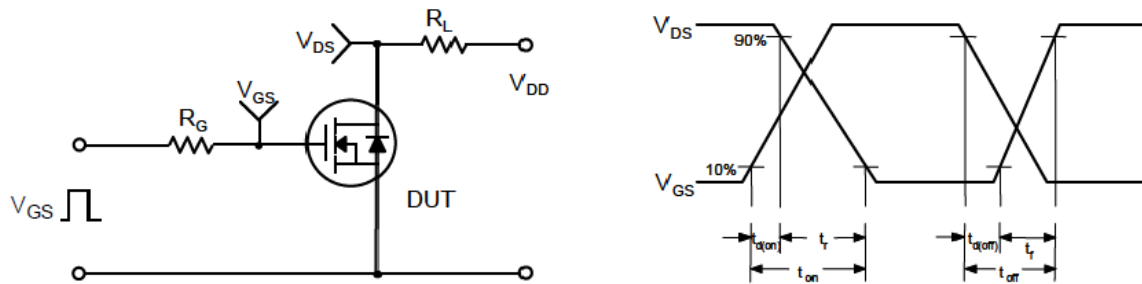
Figure 14. Transient Thermal Response Curve (TO-247)

**Test Circuit**

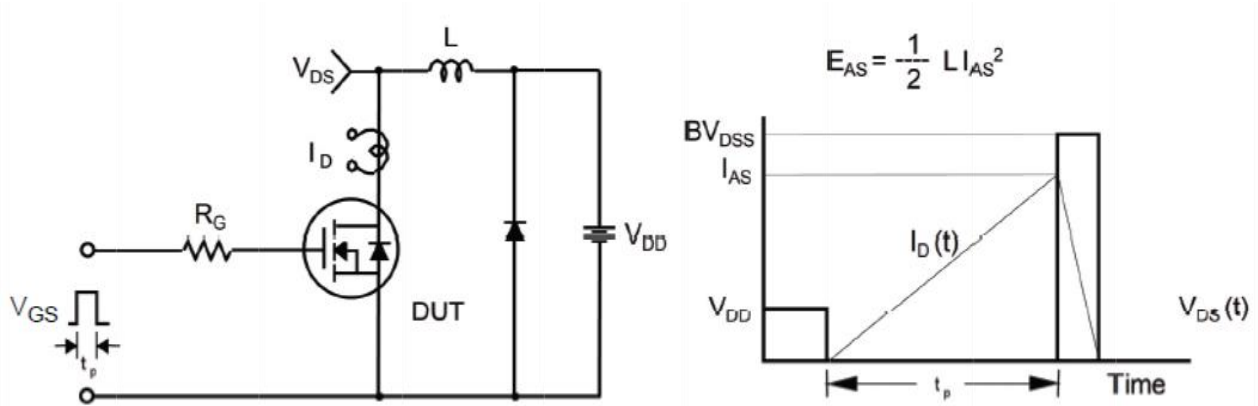
Gate Charge Test Circuit & Waveform



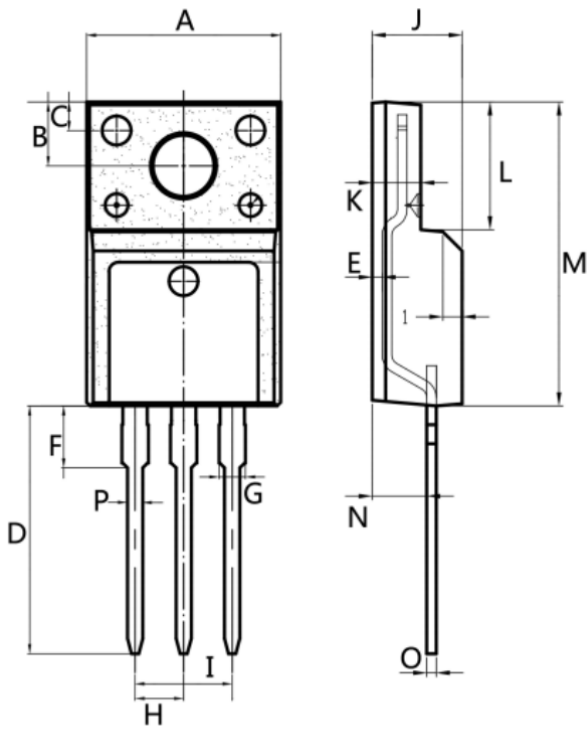
Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms



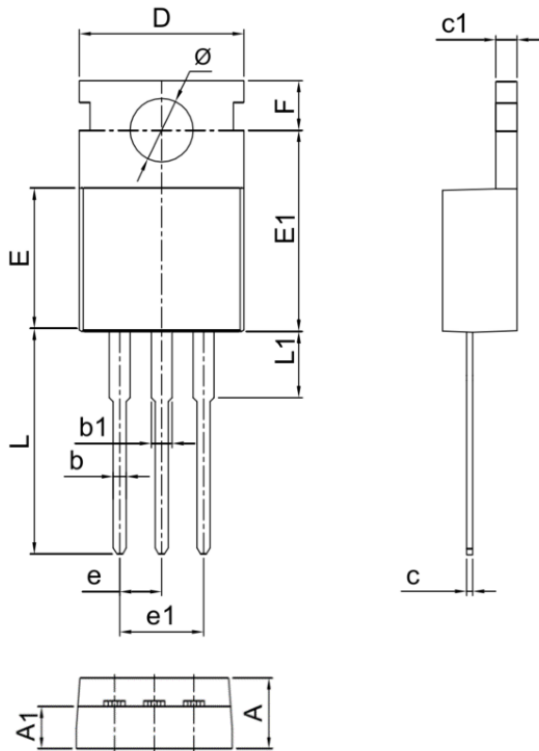
**Mechanical Dimensions for TO-220F**



**COMMON DIMENSIONS**

SYMBOL	MM	
	MIN	MAX
A	9.95	10.36
B	2.95	3.55
C	1.25	1.6
D	12.64	13.5
E	0.40	0.60
F	2.80	3.80
G	1.14	1.58
H	2.44	2.64
I	4.88	5.26
J	4.50	4.90
K	2.34	2.80
L	6.48	6.90
M	15.40	16.07
N	2.66	3.50
O	0.40	0.64
P	0.70	0.94

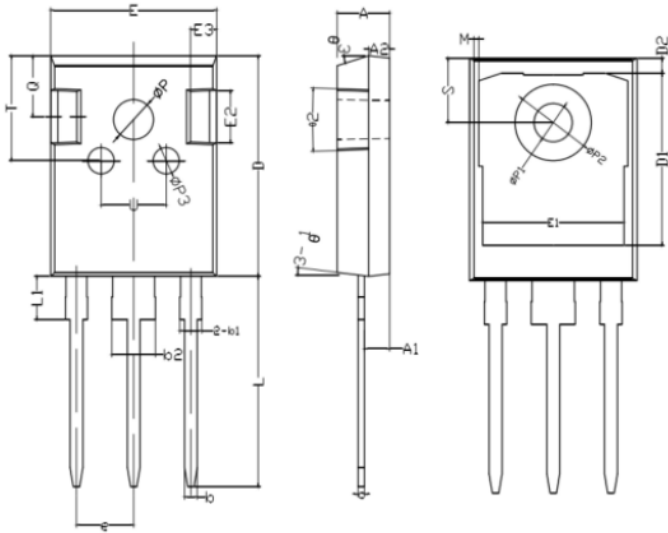
**Mechanical Dimensions for TO-220**



**COMMON DIMENSIONS**

SYMBOL	MM	
	MIN	MAX
A	4.30	4.70
A1	2.30	2.82
b	0.70	0.94
b1	1.17	1.41
c	0.30	0.64
c1	1.17	1.44
D	9.70	10.20
E	8.50	9.30
E1	12.00	12.50
e	2.44	2.64
e1	4.88	5.26
F	2.60	2.94
L	13.00	14.00
L1	3.385	4.20
Ø	3.74	3.95

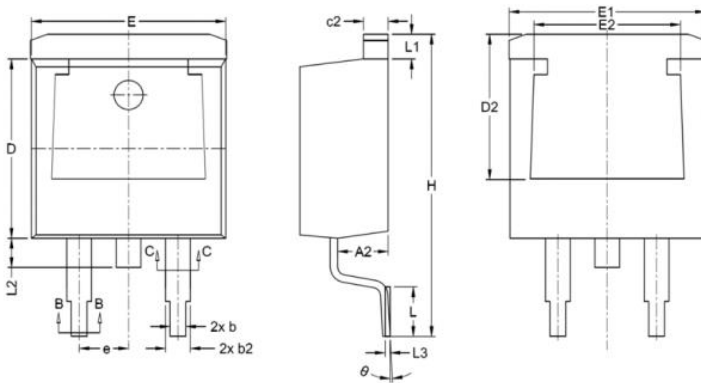
COMMON DIMENSIONS



SYMBOL	MM	
	MIN	MAX
A	4.80	5.20
A1	2.21	2.59
A2	1.85	2.15
b	1.11	1.36
b1	1.91	2.25
b2	2.91	3.25
c	0.51	0.75
D	20.70	21.30
D1	16.25	16.85
E	15.50	16.10
E1	13.00	13.60
E2	4.80	5.20
E3	2.30	2.70
e	5.40	5.48
L	19.62	20.22
L1	-	4.30
ØP	3.40	3.80
ØP2	6.90	7.30
S	6.05	6.25

**Mechanical Dimensions for TO-263**

COMMON DIMENSIONS



SYMBOL	MM	
	MIN	MAX
A	4.45	4.65
A1	0	0.15
A2	2.50	2.70
b	0.75	0.96
b1	0.71	0.92
b2	1.21	1.41
b3	1.17	1.37
c	0.33	0.52
c1	0.28	0.48
c2	1.21	1.41
D	9.10	9.30
D2	7.21	7.62
E	9.90	10.10
E1	9.90	10.30
E2	7.34	7.74
e	2.50	2.60
H	15.30	15.70
L	2.34	2.74
L1	1.06	1.47
L2	1.40	1.60
L3	0.25	0.26



<b>Part</b>	<b>Package</b>	<b>Packing method</b>
DTP20N65F	TO-220F	Tube
DTP20N65	TO-220	Tube
DTN20N65	TO-247	Tube
DTK20N65	TO-263	Tape and reel

## Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Din-Tek Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Din-Tek"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Din-Tek makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Din-Tek disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Din-Tek's knowledge of typical requirements that are often placed on Din-Tek products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Din-Tek's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Din-Tek products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Din-Tek product could result in personal injury or death. Customers using or selling Din-Tek products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Din-Tek personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Din-Tek. Product names and markings noted herein may be trademarks of their respective owners.

## Material Category Policy

**Din-Tek Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.**

**Please note that some Din-Tek documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

**Din-Tek Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Din-Tek documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.**