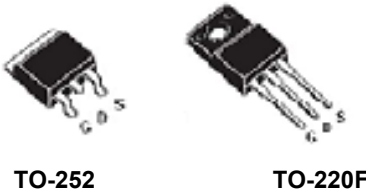







N-channel 650V, 4A Power MOSFET

<p>Description The Power MOSFET is fabricated using the advanced planar VDMOS technology. The resulting device has low conduction resistance, superior switching performance and high avalanche energy.</p> <p>Features</p> <ul style="list-style-type: none"> ◆ Low $R_{DS(on)}$ ◆ Low gate charge (typ. $Q_g = 12$ nC) ◆ 100% UIS tested ◆ RoHS compliant <p>Applications</p> <ul style="list-style-type: none"> ◆ Power factor correction. ◆ Switched mode power supplies. ◆ LED driver. 	<p>Product Summary</p> <table> <tr> <td>V_{DSS}</td> <td>650V</td> </tr> <tr> <td>I_D</td> <td>4A</td> </tr> <tr> <td>$R_{DS(on),max}$</td> <td>2.70Ω</td> </tr> <tr> <td>$Q_{g,typ}$</td> <td>12 nC</td> </tr> </table> <div style="text-align: center;">   <p>TO-252 TO-220F</p>  <p>N-Channel MOSFET</p>  </div>	V_{DSS}	650V	I_D	4A	$R_{DS(on),max}$	2.70 Ω	$Q_{g,typ}$	12 nC
V_{DSS}	650V								
I_D	4A								
$R_{DS(on),max}$	2.70 Ω								
$Q_{g,typ}$	12 nC								

Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	650	V
Continuous drain current ($T_C = 25^\circ\text{C}$)	I_D	4	A
($T_C = 100^\circ\text{C}$)		2.5	A
Pulsed drain current ¹⁾	I_{DM}	16	A
Gate-Source voltage	V_{GSS}	± 30	V
Avalanche energy, single pulse ²⁾	E_{AS}	198	mJ
Peak diode recovery dv/dt ³⁾	dv/dt	5	V/ns
Power Dissipation TO-220F ($T_C = 25^\circ\text{C}$)	P_D	32	W
Derate above 25°C		0.26	W/ $^\circ\text{C}$
Power Dissipation TO-252 ($T_C = 25^\circ\text{C}$)		77	W
Derate above 25°C		0.61	W/ $^\circ\text{C}$
Operating junction and storage temperature range	T_J, T_{STG}	-55 to +150	$^\circ\text{C}$
Continuous diode forward current	I_S	4	A
Diode pulse current	$I_{S,pulse}$	16	A

Thermal Characteristics

Parameter	Symbol	Value		Unit
		TO-220F	TO-252	
Thermal resistance, Junction-to-case	$R_{\theta JC}$	3.8	1.62	$^\circ\text{C/W}$
Thermal resistance, Junction-to-ambient	$R_{\theta JA}$	62.5	110	$^\circ\text{C/W}$



Package Marking and Ordering Information

Device	Device Package	Marking	Units/Tube	Units/Real
BCT4N65	TO-220F	BCT4N65	50	
BCD4N65	TO-252	BCD4N65		2500

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}	$V_{GS}=0\text{ V}, I_D=0.25\text{ mA}$	650	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=0.25\text{ mA}$	2	-	4	V
Drain cut-off current	I_{DSS}	$V_{DS}=650\text{ V}, V_{GS}=0\text{ V},$ $T_j = 25^\circ\text{C}$ $T_j = 125^\circ\text{C}$	-	-	1	μA
Gate leakage current, Forward	I_{GSSF}	$V_{GS}=30\text{ V}, V_{DS}=0\text{ V}$	-	-	100	nA
Gate leakage current, Reverse	I_{GSSR}	$V_{GS}=-30\text{ V}, V_{DS}=0\text{ V}$	-	-	-100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10\text{ V}, I_D=2\text{ A}$	-	2.50	2.70	Ω
Dynamic characteristics						
Input capacitance	C_{iss}	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1\text{ MHz}$	-	600	-	pF
Output capacitance	C_{oss}		-	55	-	
Reverse transfer capacitance	C_{rss}		-	3.2	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 325\text{ V}, I_D = 4\text{ A}$ $R_G = 10\ \Omega, V_{GS}=15\text{ V}$	-	12	-	ns
Rise time	t_r		-	31	-	
Turn-off delay time	$t_{d(off)}$		-	42	-	
Fall time	t_f		-	15	-	
Gate charge characteristics						
Gate to source charge	Q_{gs}	$V_{DD}=520\text{ V}, I_D=4\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	-	3.2	-	nC
Gate to drain charge	Q_{gd}		-	5.1	-	
Gate charge total	Q_g		-	12	-	
Gate plateau voltage	$V_{plateau}$		-	6	-	V
Reverse diode characteristics						
Diode forward voltage	V_{SD}	$V_{GS}=0\text{ V}, I_F=4\text{ A}$	-	-	1.5	V
Reverse recovery time	t_{rr}	$V_R=400\text{ V}, I_F=4\text{ A},$ $di_F/dt=100\text{ A}/\mu\text{s}$	-	282	-	ns
Reverse recovery charge	Q_{rr}		-	1.4	-	μC
Peak reverse recovery current	I_{rrm}		-	10	-	A

Notes:

1. Pulse width limited by maximum junction temperature.
2. $L=10\text{mH}, I_{AS} = 6.3\text{A},$ Starting $T_j= 25^\circ\text{C}.$
3. $I_{SD} = 4\text{A}, di/dt \leq 100\text{A}/\mu\text{s}, V_{DD} \leq BV_{DS},$ Starting $T_j= 25^\circ\text{C}.$



Electrical Characteristics Diagrams

Figure 1. Typical Output Characteristics

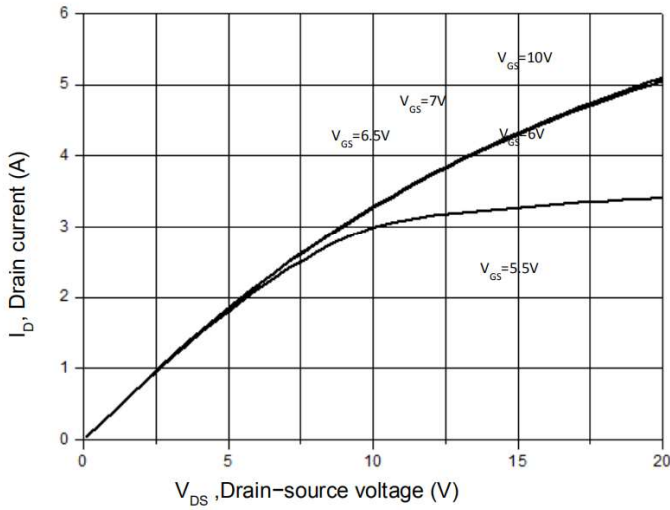


Figure 3. On-Resistance Variation vs. Drain Current

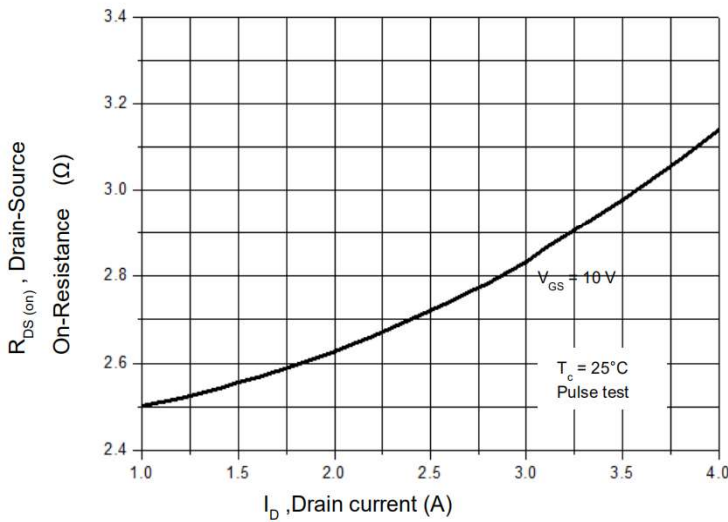


Figure 5. Breakdown Voltage vs. Temperature

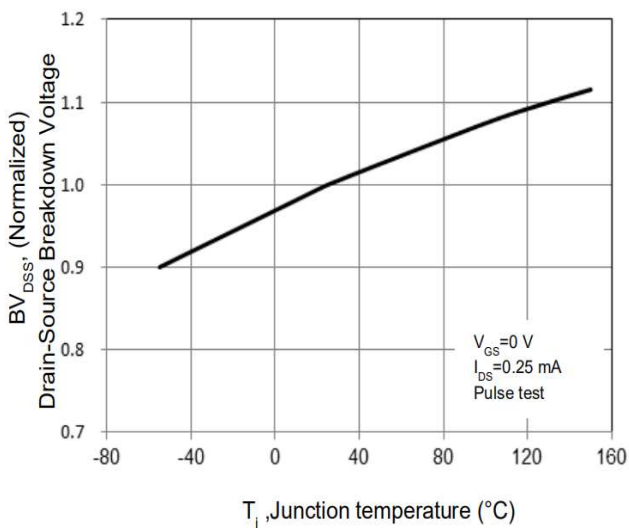


Figure 2. Transfer Characteristics

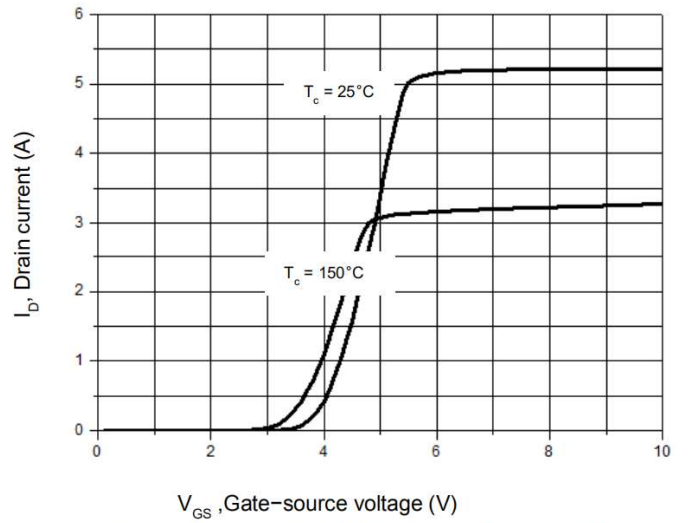


Figure 4. Threshold Voltage vs. Temperature

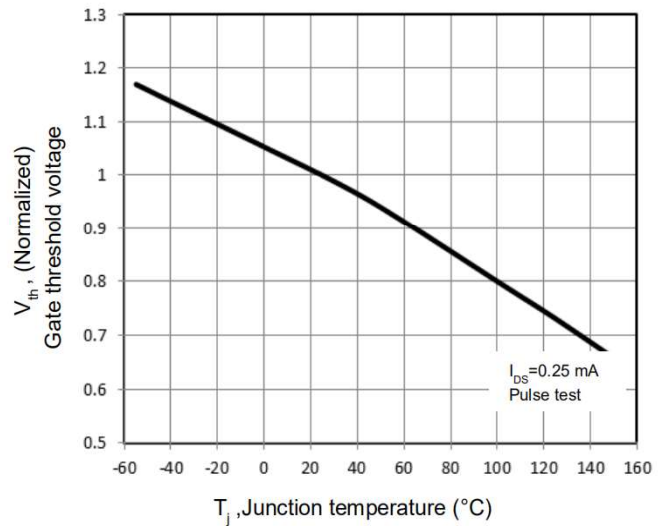


Figure 6. On-Resistance vs. Temperature

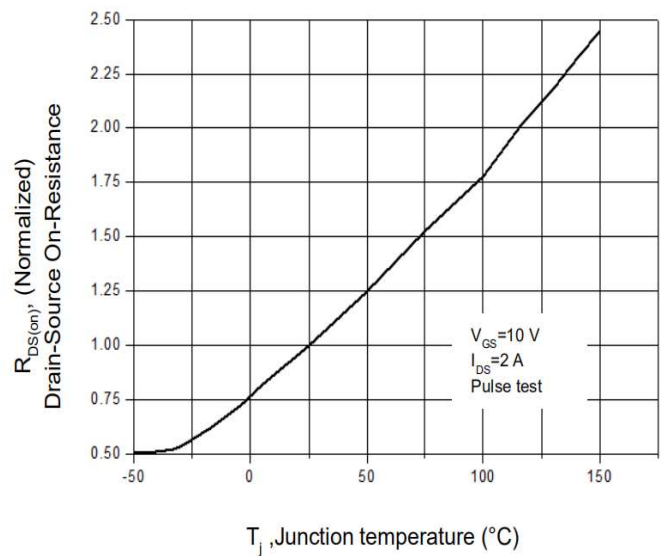




Figure 7. Capacitance Characteristics

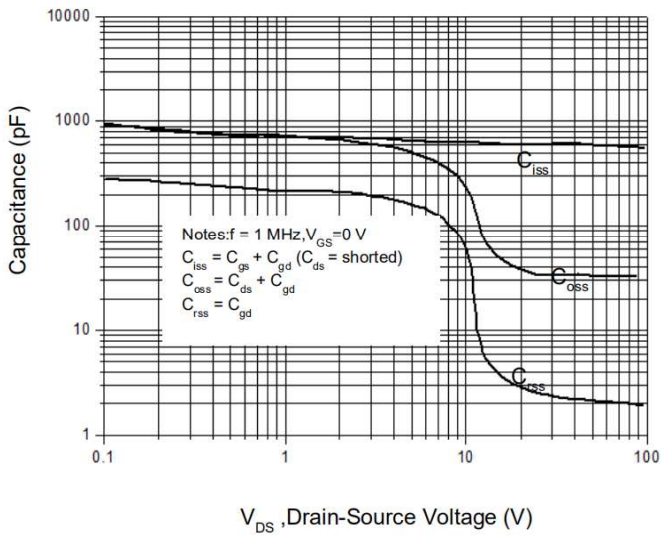


Figure 8. Gate Charge Characterist

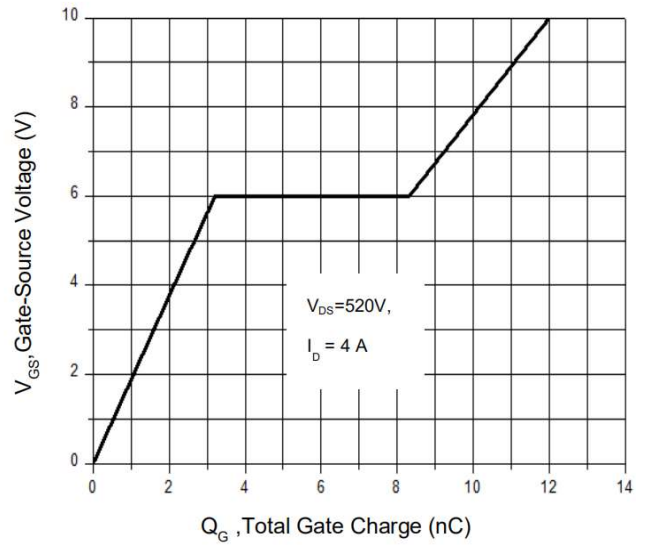


Figure 9. Maximum Safe Operating Area
TO-220F

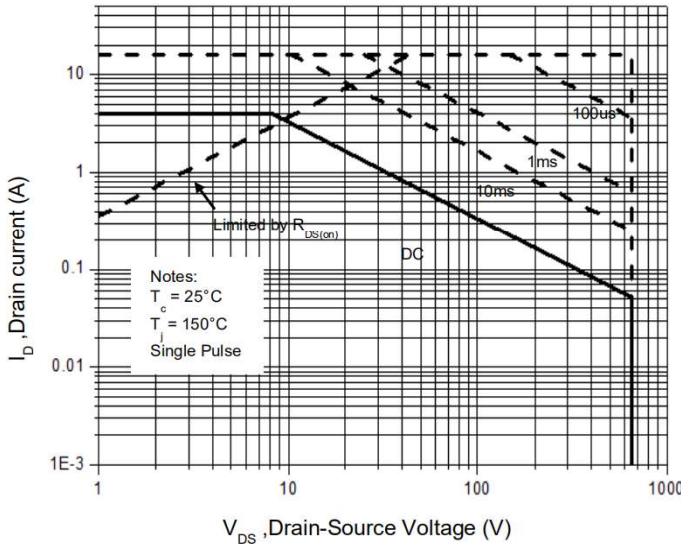


Figure 10. Maximum Safe Operating Area
TO-252

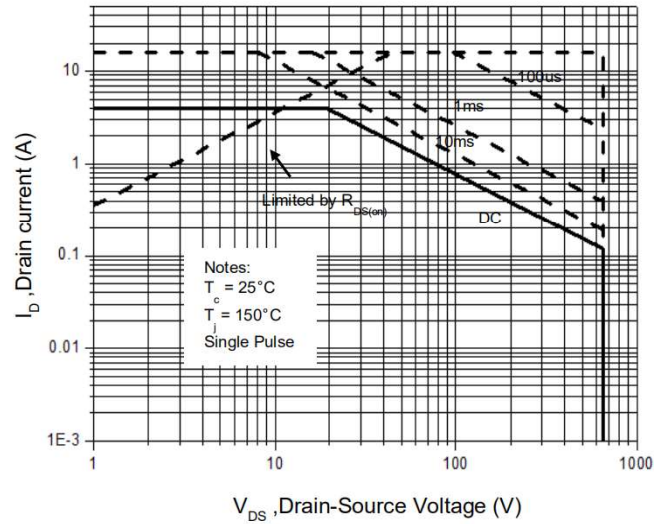


Figure 11. Power Dissipation vs. Temperature
TO-220F

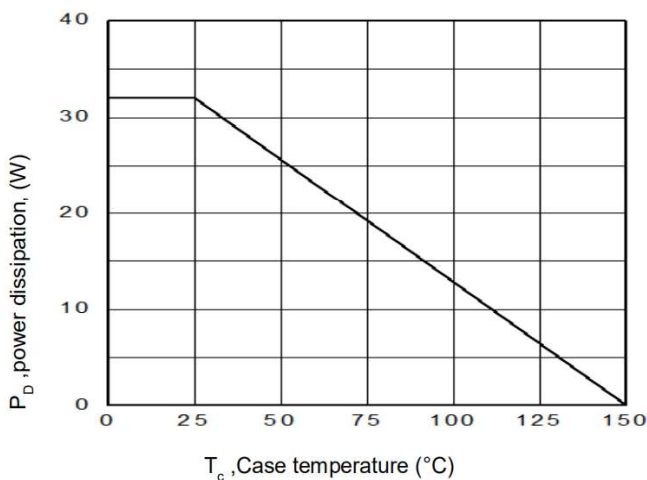


Figure 12. Power Dissipation vs. Temperature
TO-252

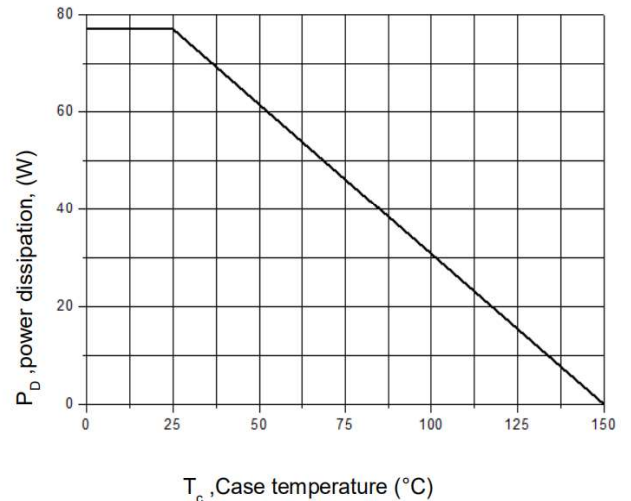




Figure 13. Continuous Drain Current vs. Temperature

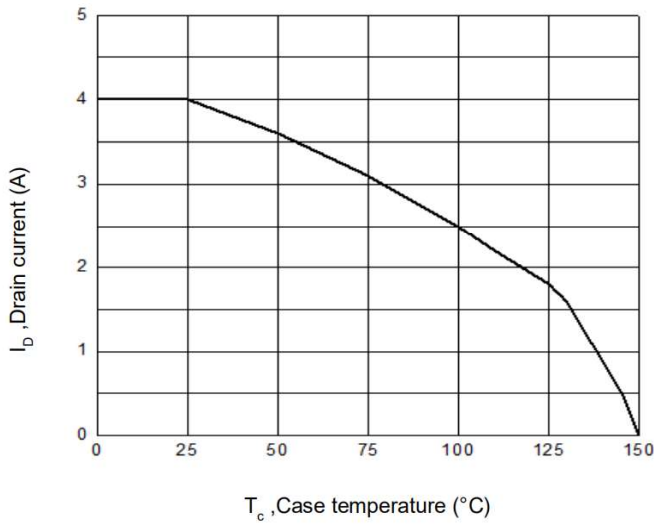


Figure 14. Body Diode Transfer Characteristics

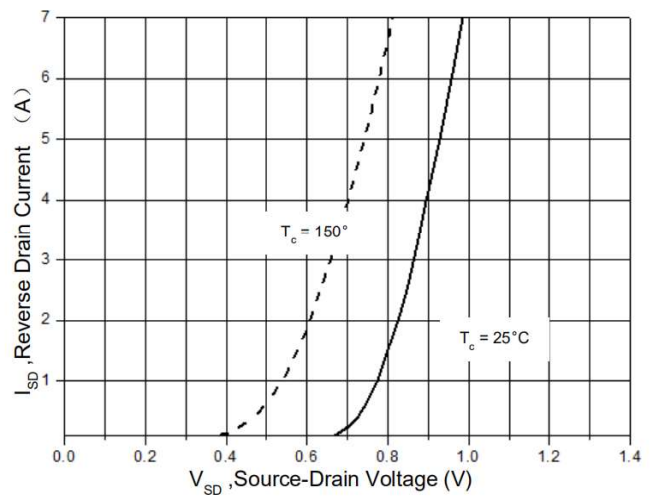


Figure 15 Transient Thermal Impedance, Junction to Case, TO-220F

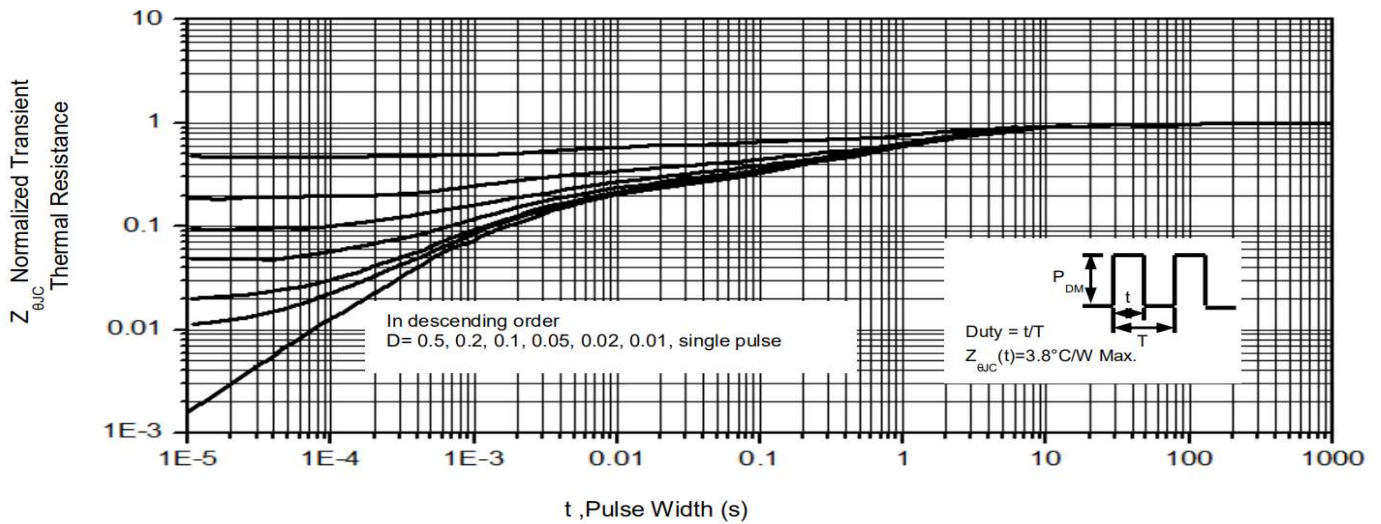
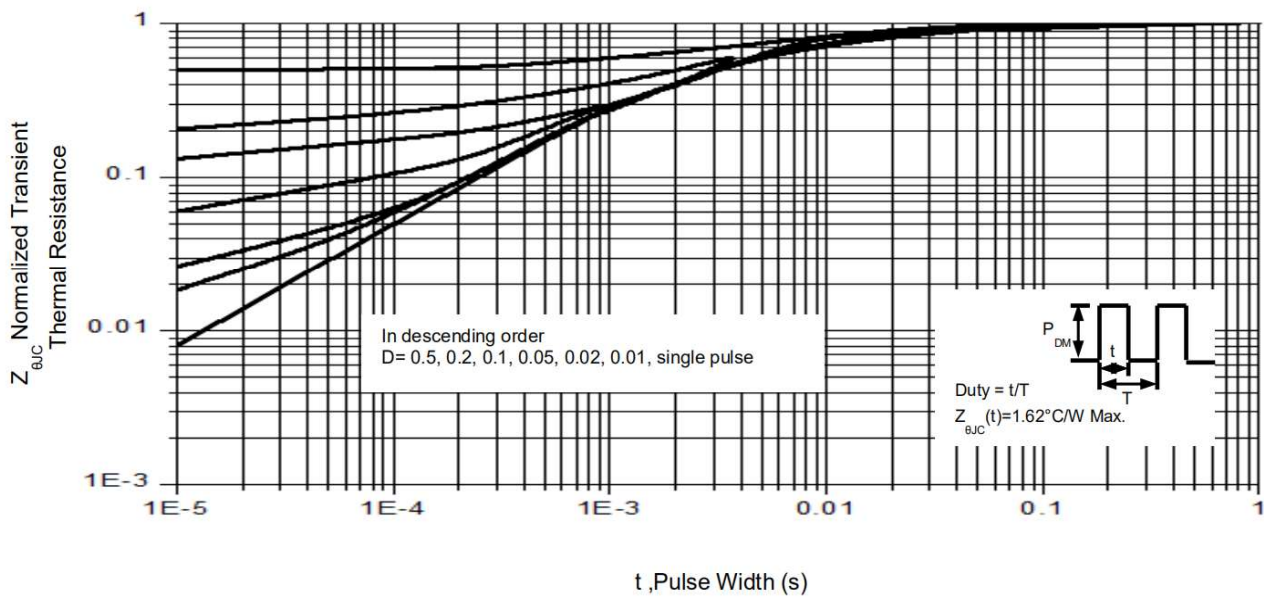
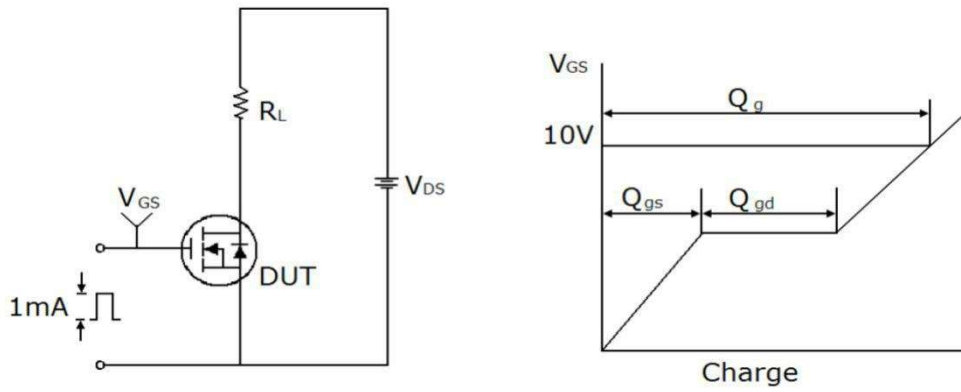


Figure 16. Transient Thermal Impedance, Junction to Case, TO-252

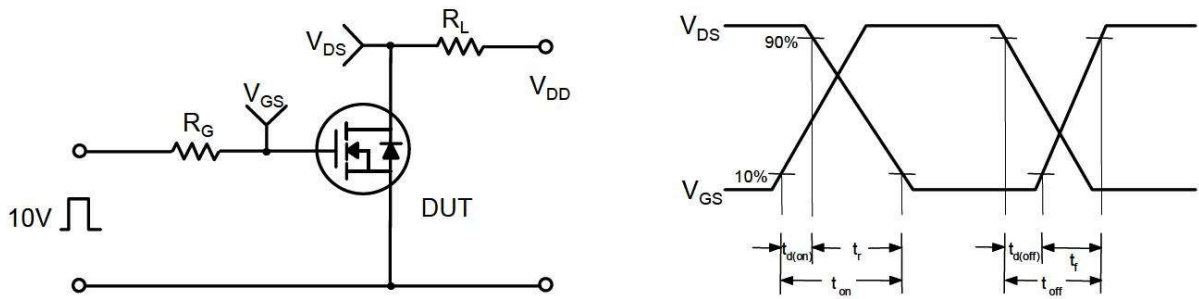




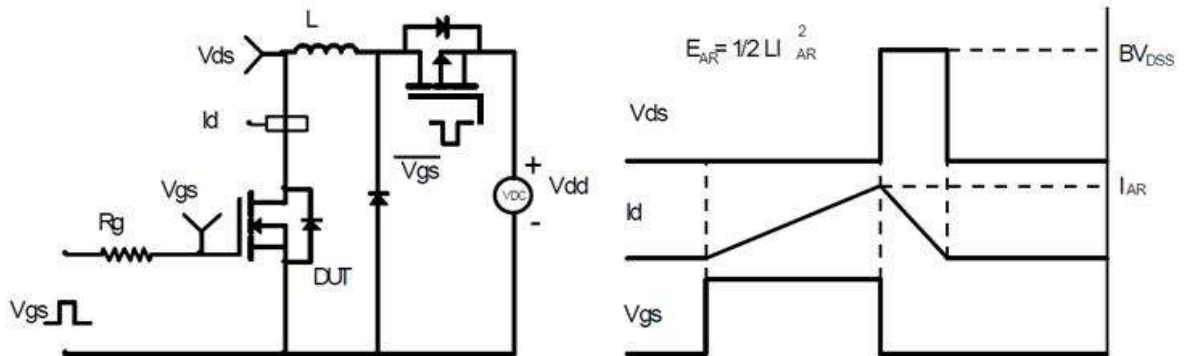
Gate Charge Test Circuit & Waveform



Switching Test Circuit & Waveforms



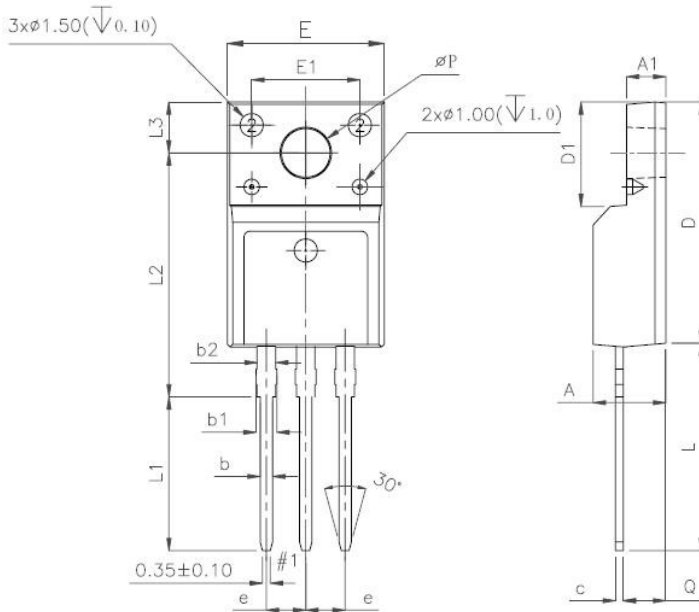
Unclamped Inductive Switching Test Circuit & Waveforms





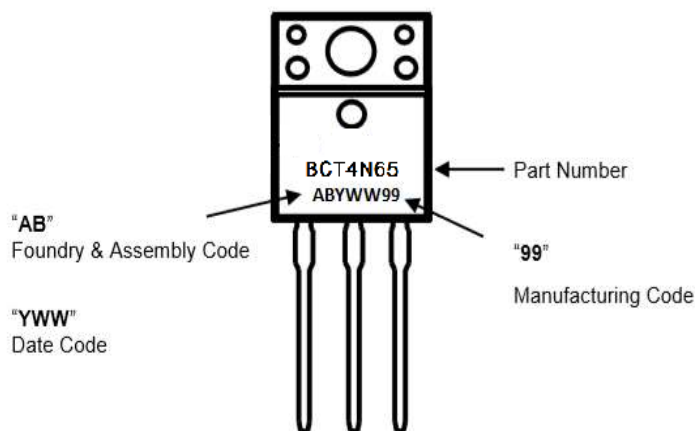
Mechanical Dimensions for TO-220F

UNIT:mm



SYMBOL	MIN	NOM	MAX
A	4.5		4.9
A1	2.3		2.9
b	0.65		0.9
b1	1.1		1.7
b2	1.2		1.4
c	0.35		0.65
D	14.5		16.5
D1	6.1		6.9
E	9.6		10.3
E1	6.5	7	7.5
e	2.44	2.54	2.64
L	12.5		14.3
L1	9.45		10.05
L2	15		16
L3	3.2		4.4
ΦP	3		3.3
Q	2.5		2.9

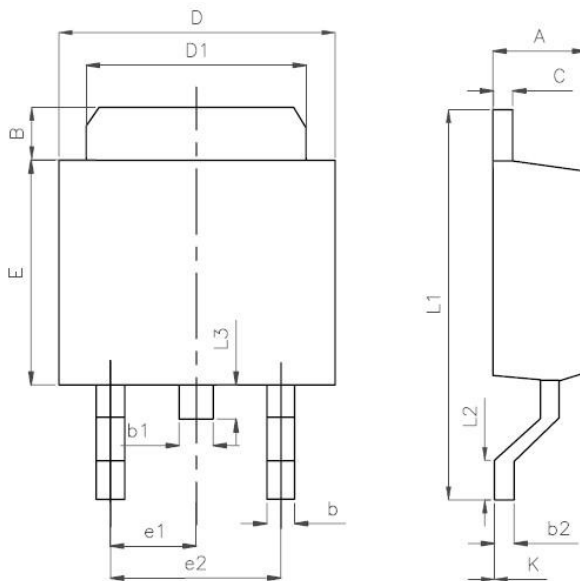
TO-220F Part Marking Information





Mechanical Dimensions for TO-252

UNIT:mm



SYMBOL	MIN	NOM	MAX
A	2.10		2.50
B	0.80		1.25
b	0.50		0.85
b1	0.50		0.90
b2	0.45		0.60
C	0.45		0.60
D	6.35		6.75
D1	5.10		5.50
E	5.80		6.30
e1	2.25	2.30	2.35
e2	4.45		4.75
L1	9.50		10.20
L2	0.90		1.45
L3	0.60		1.10
K	-0.1		0.10

TO-252 Part Marking Information

