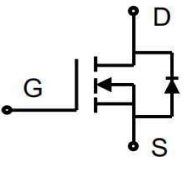




N-channel 650V, 4A Power MOSFET

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. Features ◆ Low $R_{DS(on)}$ ◆ Low gate charge (typ. $Q_g = 12 \text{ nC}$) ◆ 100% UIS tested ◆ RoHS compliant Applications ◆ Power factor correction. ◆ Switched mode power supplies. ◆ LED driver.	Product Summary <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>   TO-252 TO-220F  N-Channel MOSFET 	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 V, I _D =0.25 mA	650	-	-	V
Gate threshold voltage	V _{GS(th)}	V _{DS} =V _{GS} , I _D =0.25 mA	2	-	4	V
Drain cut-off current	I _{DSS}	V _{DS} =650 V, V _{GS} =0 V, T _j = 25°C T _j = 125°C	- -	-	1 100	μA
Gate leakage current, Forward	I _{GSSF}	V _{GS} =30 V, V _{DS} =0 V	-	-	100	nA
Gate leakage current, Reverse	I _{GSSR}	V _{GS} =-30 V, V _{DS} =0 V	-	-	-100	nA
Drain-source on-state resistance	R _{DS(on)}	V _{GS} =10 V, I _D =2 A	-	2.50	2.70	Ω
Dynamic characteristics						
Input capacitance	C _{iss}	V _{DS} = 25 V, V _{GS} = 0 V, f = 1 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 V, I _D = 4 A R _G = 10 Ω, V _{GS} =15 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 V, I _D =4 A, V _{GS} =0 to 10 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 V, I _F =4 A	-	-	1.5	V
Reverse recovery time	t _{rr}	V _R =400 V, I _F =4 A, dI _F /dt=100 A/μs	-	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

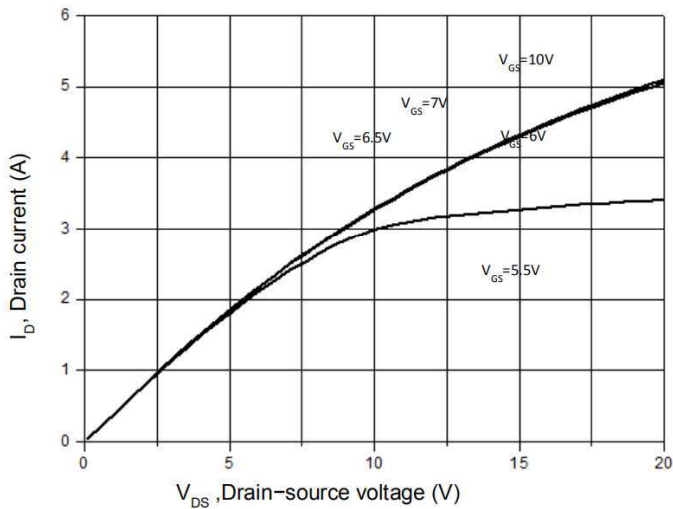


Figure 2. Transfer Characteristics

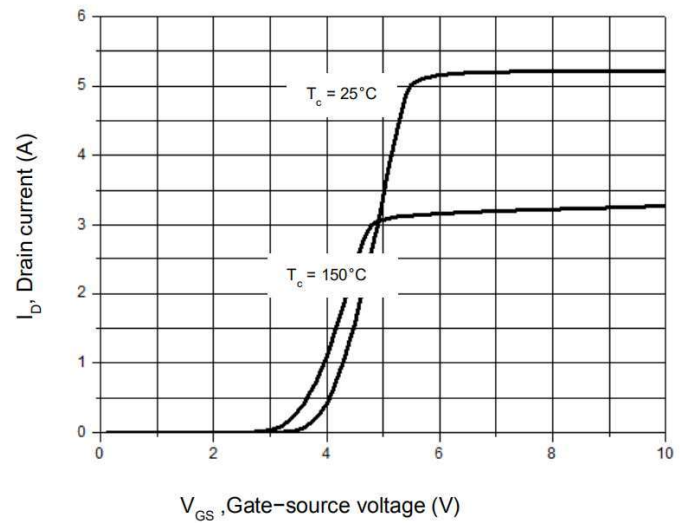


Figure 3. On-Resistance Variation vs. Drain Current

Figure 4. Threshold Voltage vs. Temperature

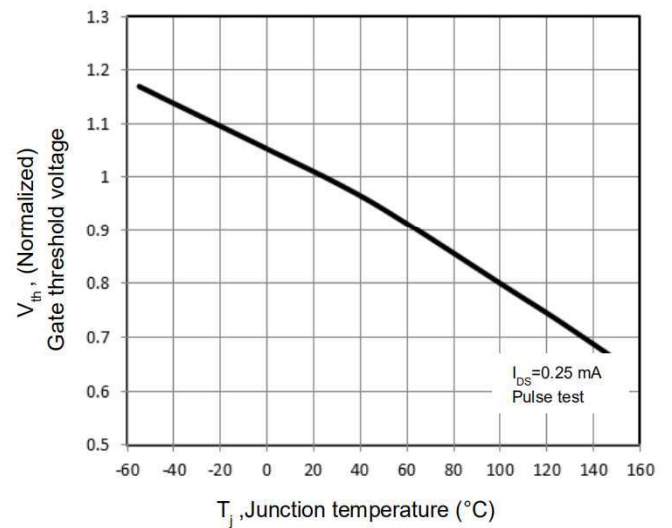
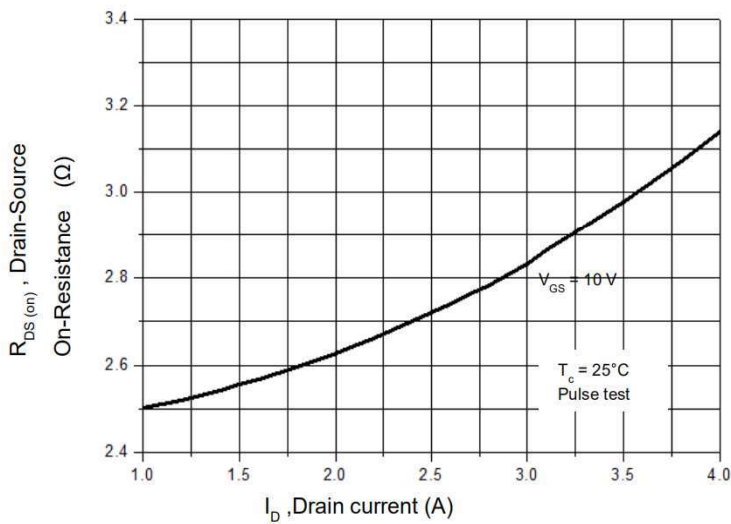


Figure 5. Breakdown Voltage vs. Temperature

Figure 6. On-Resistance vs. Temperature

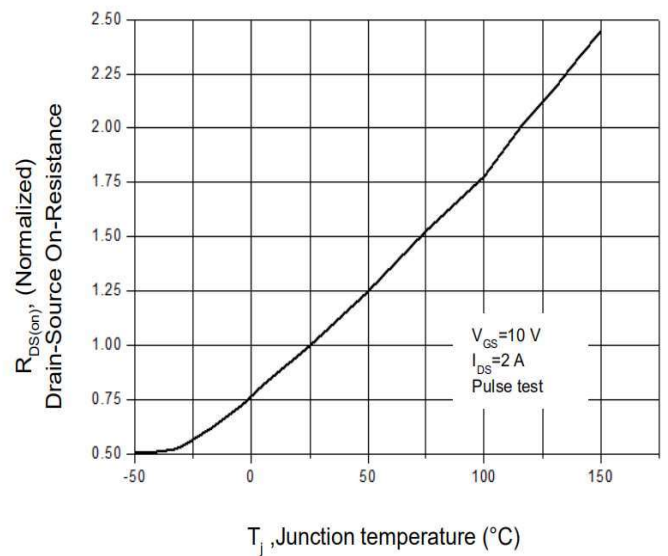
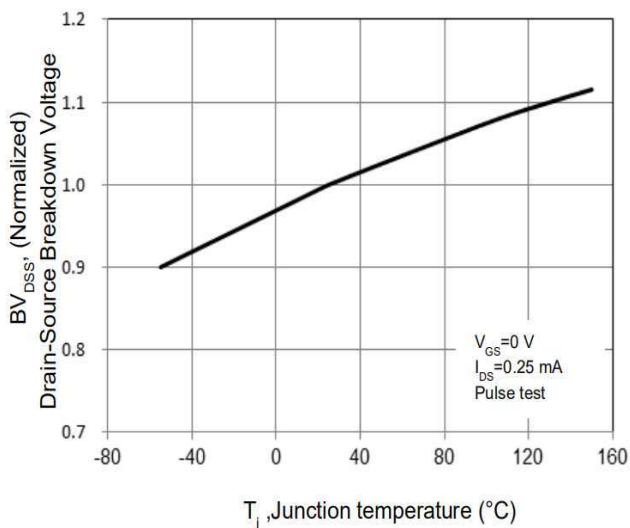




Figure 7. Capacitance Characteristics

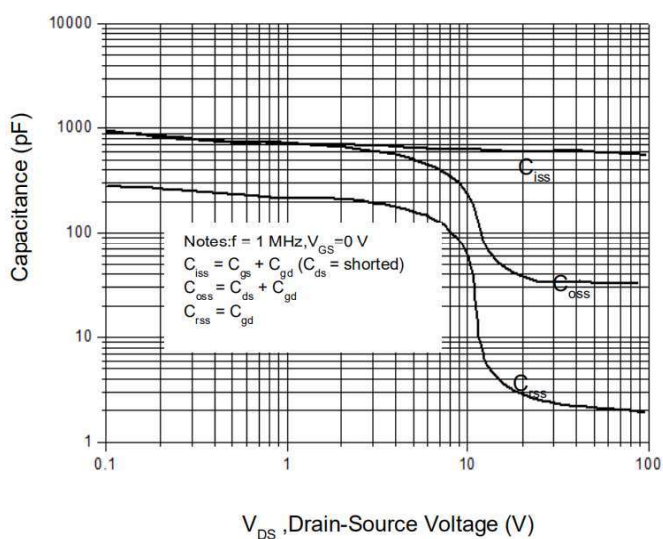


Figure 8. Gate Charge Characterist

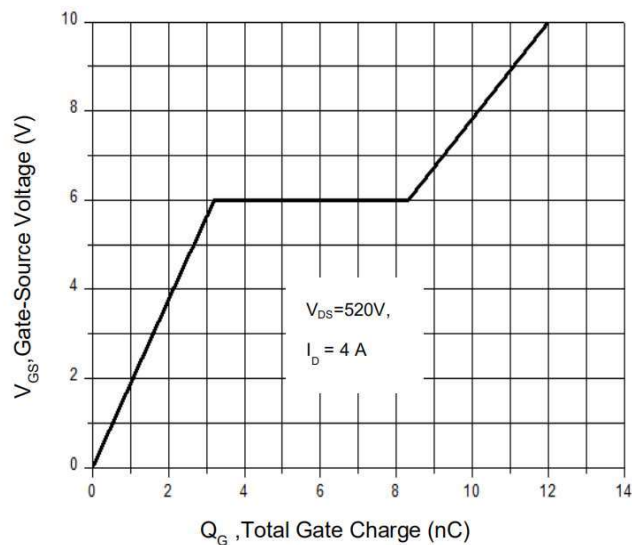


Figure 9. Maximum Safe Operating Area
TO-220F

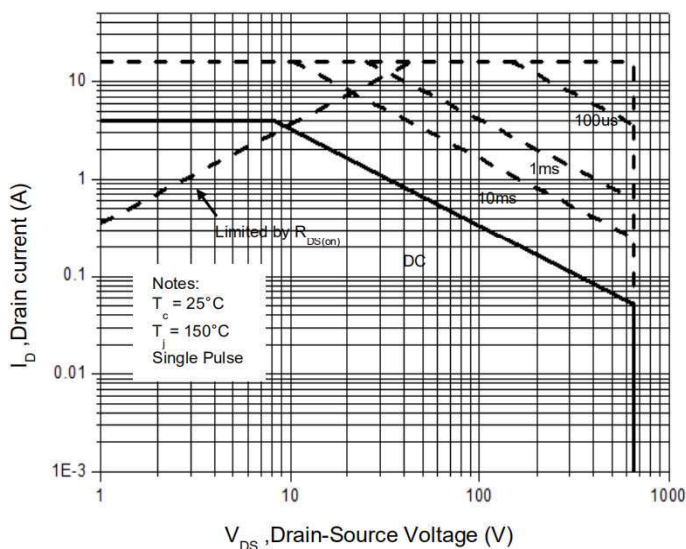


Figure 10. Maximum Safe Operating Area
TO-252

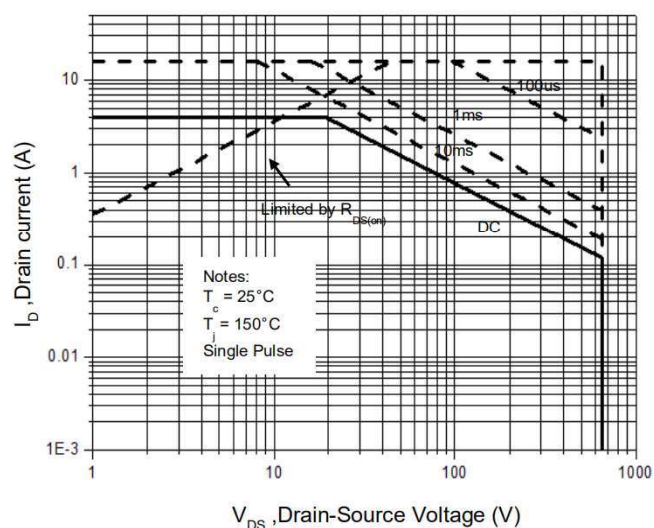


Figure 11. Power Dissipation vs. Temperature
TO-220F

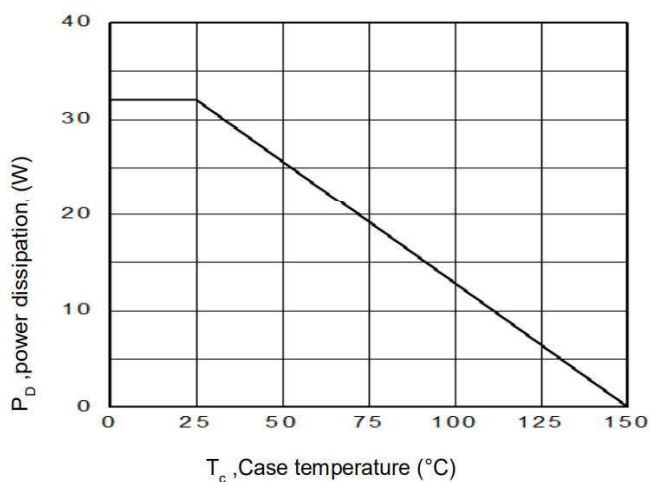


Figure 12. Power Dissipation vs. Temperature
TO-252

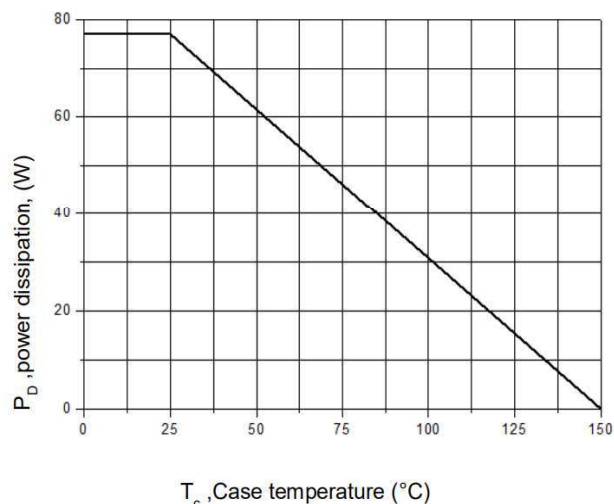




Figure 13. Continuous Drain Current vs. Temperature

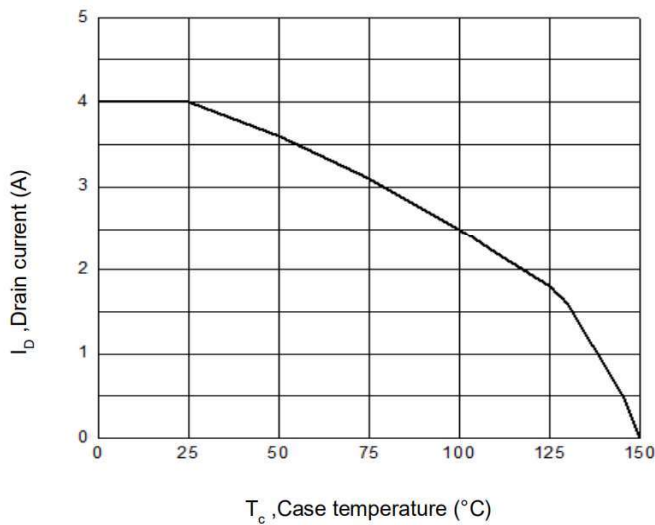


Figure 14. Body Diode Transfer Characteristics

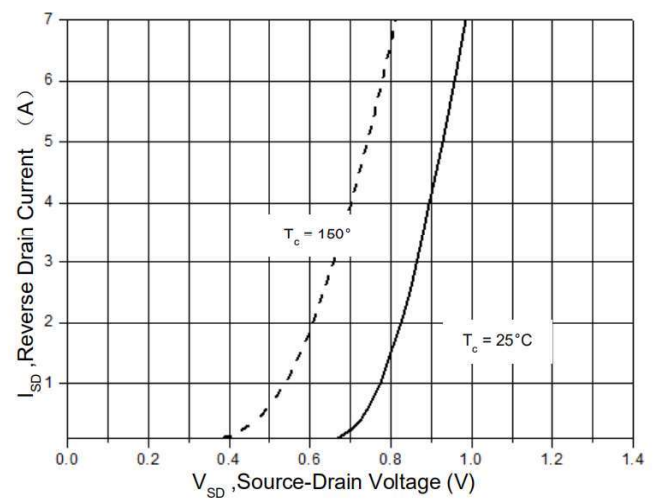


Figure 15 Transient Thermal Impedance, Junction to Case, TO-220F

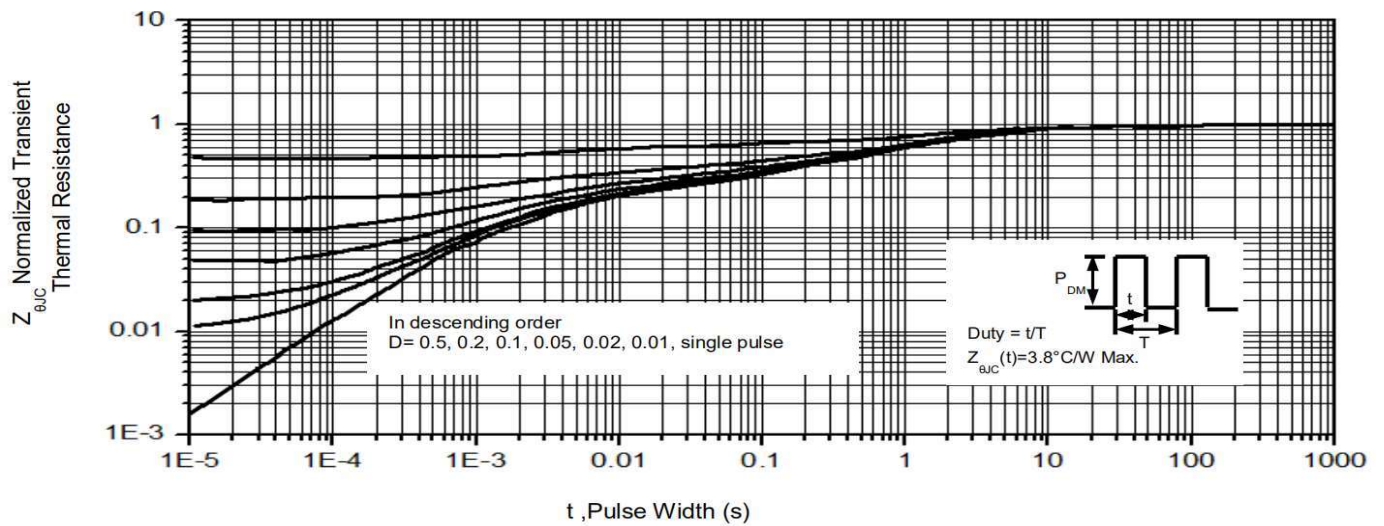
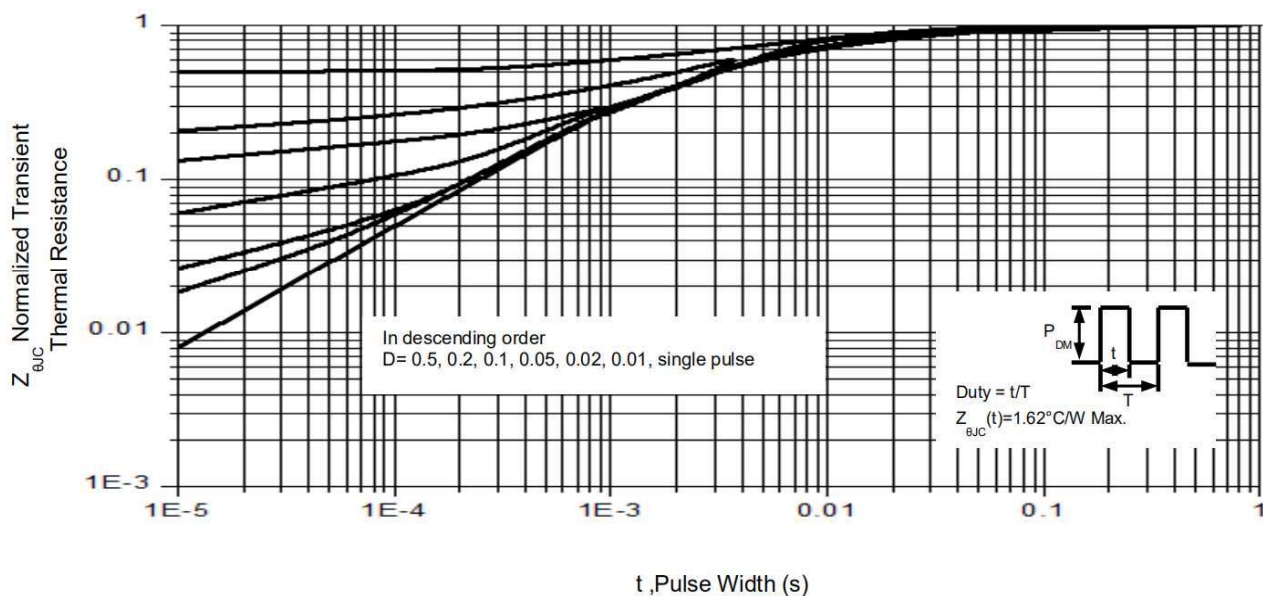
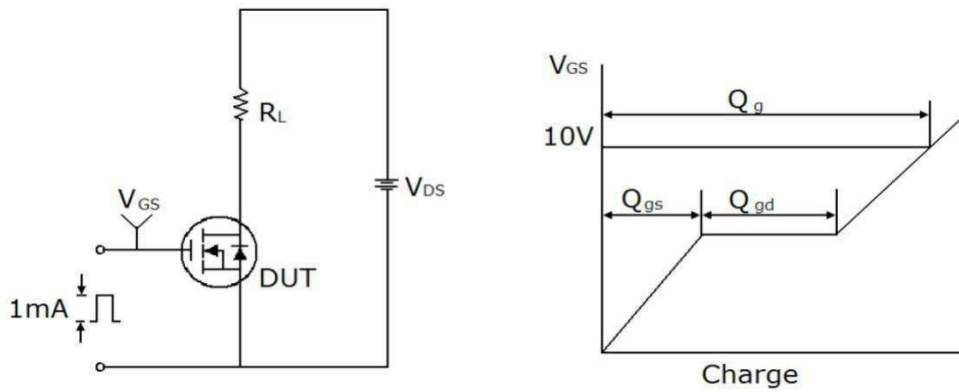


Figure 16. Transient Thermal Impedance, Junction to Case, TO-252

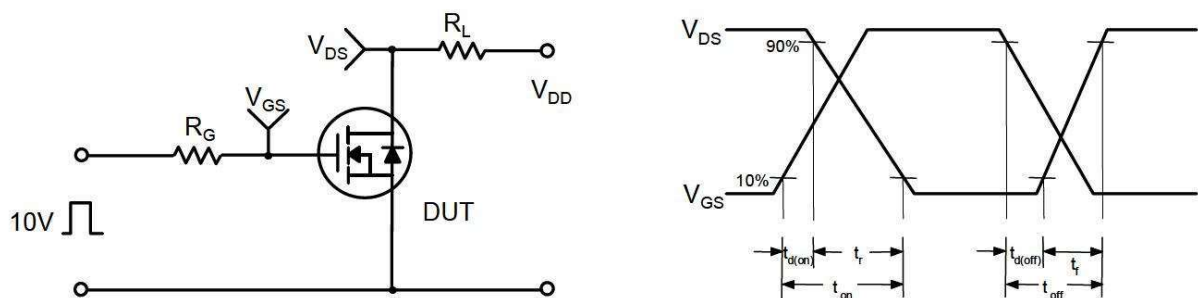




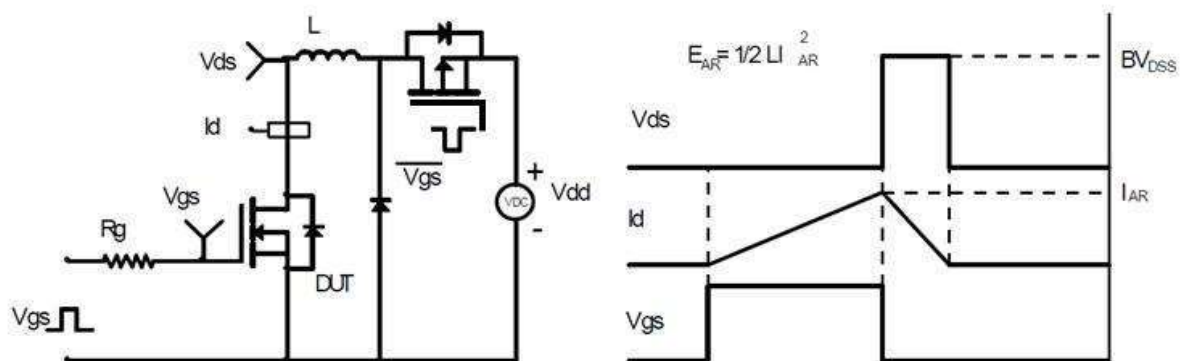
Gate Charge Test Circuit & Waveform



Switching Test Circuit & Waveforms



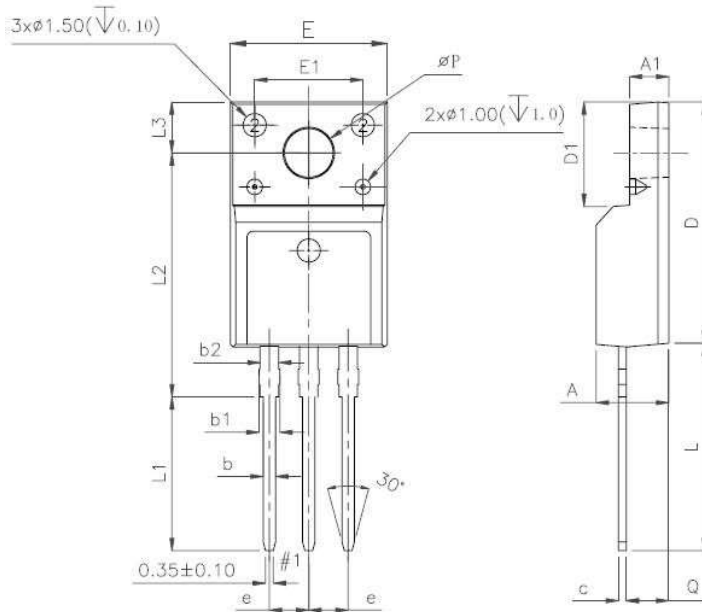
Unclamped Inductive Switching Test Circuit & Waveforms





BCT4N65\BCD4N65

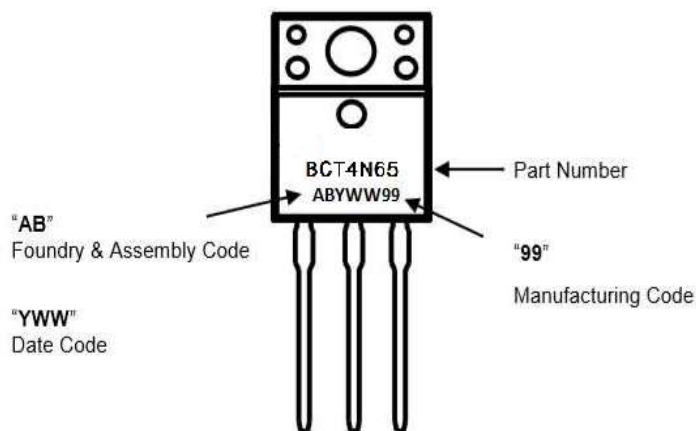
Mechanical Dimensions for TO-220F



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

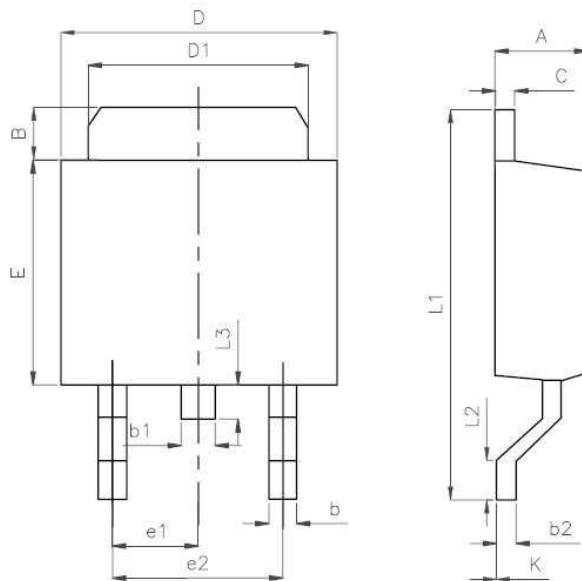
TO-220F Part Marking Information





BCT4N65\BCD4N65

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

