

MOSFET

160A,60V,3.5mΩ N-CHANNEL MOSFET

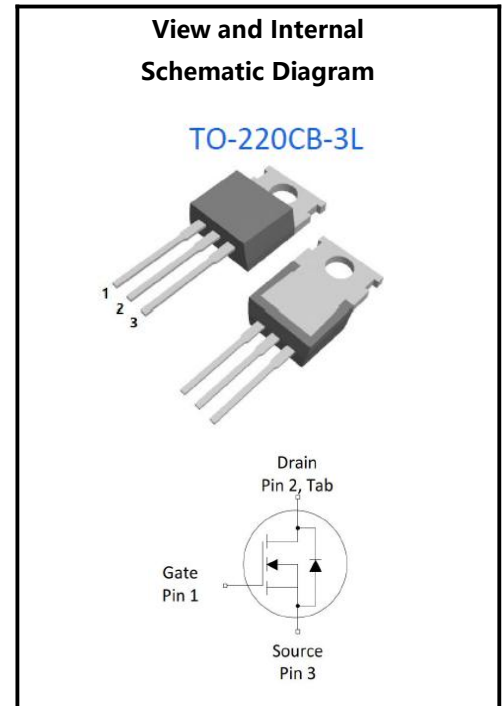
Features

- ◆ Extremely low on-resistance $R_{DS(on)}$
- ◆ Excellent $Q_g \times R_{DS(on)}$ product(FOM)
- ◆ Excellent Low Ciss
- ◆ High robustness and reliability
- ◆ Increases maximum current capability
- ◆ Low power loss, high power density
- ◆ Easy paralleling

Application

- ◆ Synchronous Rectification for AC/DC Quick Charger
- ◆ Battery management
- ◆ UPS(Uninterruptible Power Supplies)

Parameter	Values	Unit
BV_{DSS}	60	V
I_D	160	A
$R_{DS(on)}$ (max)	3.5	mΩ
$V_{GS(th)}$ (Typ)	1.75	V



Ordering Code	Marking	Package	Packaging
X3P5N060GLP3	X3P5N060GLP3	TO-220CB-3L	Tube

Absolute Maximum Ratings($T_C=25^{\circ}\text{C}$, unless otherwise noted)

Parameter	Symbol	Values	Unit	Note/Test Conditions
Drain-Source Voltage	V_{DSS}	60	V	-
Gate-Source Voltage	V_{GS}	± 20	V	-
Continuous Drain Current(Note 1)	I_D	160	A	$T_C=25^{\circ}\text{C}$
		101		$T_C=100^{\circ}\text{C}$
Pulsed Drain Current(Note 2)	I_{DM}	640	A	-
Single Pulse Avalanche Energy	E_{AS}	127	mJ	$L=0.5\text{mH}, V_D=48\text{V}, T_C=25^{\circ}\text{C}$
Power Dissipation	P_D	125	W	$T_C=25^{\circ}\text{C}$
		1.6		$T_a=25^{\circ}\text{C}$
Operating Junction and Storage Temperature Range	T_{j}, T_{STG}	-55~150	$^{\circ}\text{C}$	-

Thermal Characteristics

Parameter	Symbol	Values			Unit	Note/Test Conditions
		Min	Typ	Max		
Thermal resistance , junction – case	R_{thJC}	-	-	1.0	$^{\circ}\text{C/W}$	-
Thermal resistance junction - ambient	R_{thJA}	-	-	77		-

Electrical Characteristics (T_j=25°C, unless otherwise noted)

Static characteristics

Parameter	Symbol	Values			Unit	Note/Test Conditions
		Min	Typ	Max		
Drain-Source Breakdown Voltage	BV _{DSS}	60	-	-	V	V _{GS} =0V, I _D =250μA
Zero Gate Voltage Drain Current	I _{DSS}	-	0.03	1	μA	V _{DS} =60V, V _{GS} =0V, T _j =25°C
		-	-	100		V _{DS} =60V, V _{GS} =0V, T _j =150°C
Gate-Body Leakage Current	I _{GSS}	-	±10	±100	nA	V _{GS} =±20V, V _{DS} =0V
Gate-Source Threshold Voltage	V _{GS(th)}	1.0	-	2.5	V	V _{DS} =V _{GS} , I _D =250μA
Drain-Source On-State Resistance	R _{DS(on)}	-	2.55	3.5	mΩ	V _{GS} =10V, I _D =20A
		-	3.7	4.8		V _{GS} =4.5V, I _D =20A
Gate Resistance	R _g	-	2	-	Ω	V _{GS} =0V, V _{DS} =0V, f=1MHz
Forward Transconductance	g _{fs}	-	55	-	S	V _{DS} =5V, I _D =20A

Dynamic characteristics

Parameter	Symbol	Values			Unit	Note/Test Conditions
		Min	Typ	Max		
Input Capacitance	C _{iss}	-	3942	-	pF	V _{DS} =30V, V _{GS} =0V, f=1.0MHz
Output Capacitance	C _{oss}	-	3105	-		
Reverse Transfer Capacitance	C _{rss}	-	344	-		
Turn-On Delay Time	t _{d(on)}	-	18	-	ns	V _{DD} =30V, I _D =30A, V _{GS} =10V, R _G =10Ω
Turn-On Rise Time	t _r	-	4	-		
Turn-Off Delay Time	t _{d(off)}	-	90	-		
Turn-Off Fall Time	t _f	-	127	-		

Gate charge characteristics

Parameter	Symbol	Values			Unit	Note/Test Conditions
		Min	Typ	Max		
Total Gate Charge	Q _g	-	73	-	nC	V _{DS} =30V, I _D =20A, V _{GS} =10V
Gate-Source Charge	Q _{gs}	-	14	-		
Gate-Drain Charge	Q _{gd}	-	15	-		

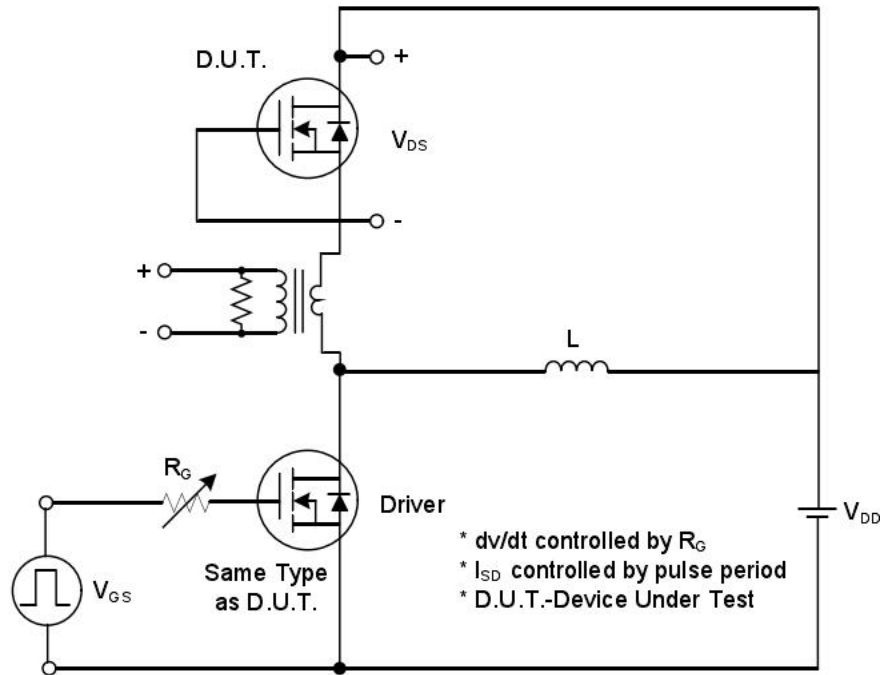
Diode Characteristic

Parameter	Symbol	Values			Unit	Note/Test Conditions
		Min	Typ	Max		
Continuous Diode Forward Current	I _S	-	-	160	A	-
Pulsed Diode Forward Current	I _{SM}	-	-	640	A	-
Diode Forward Voltage	V _{SD}	-	0.8	1.2	V	I _S =20A, V _{GS} =0V
Reverse Recovery Time	t _{rr}	-	96	-	ns	V _{GS} =0V, I _S =30A
Reverse Recovery Charge	Q _{rr}	-	242	-	nC	di/dt=100A/μs

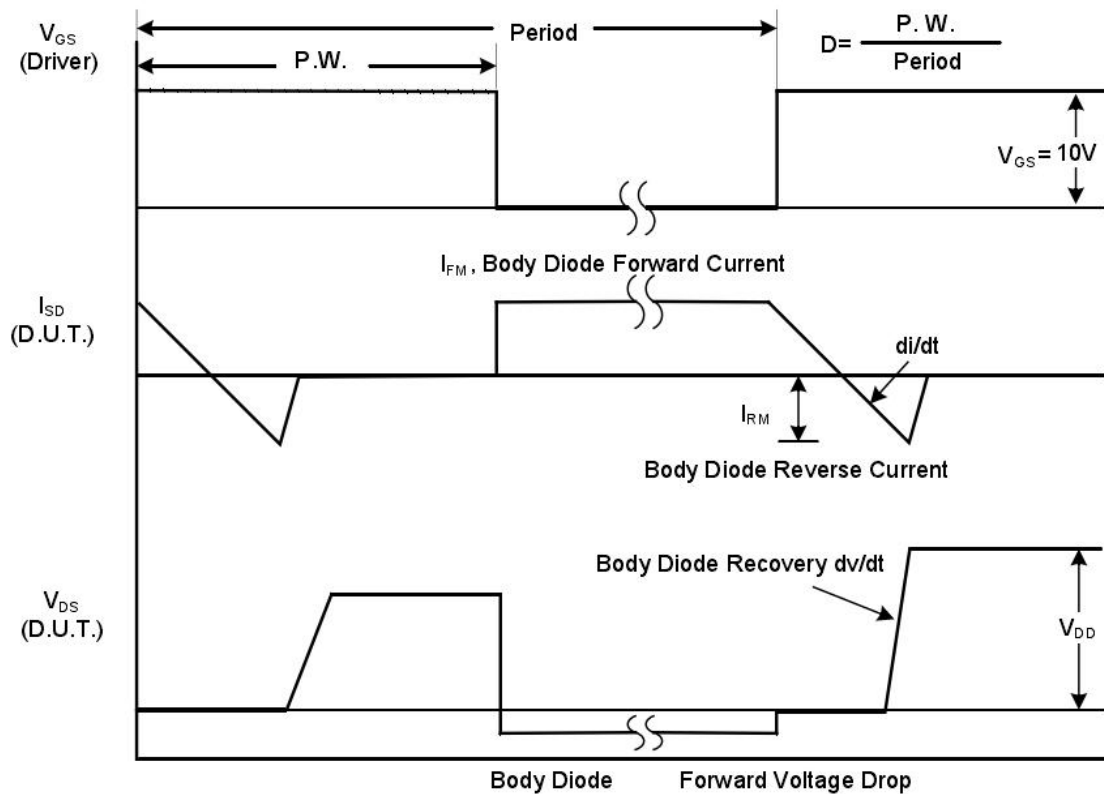
Notes

1. Computed continuous current assumes the condition of T_{j,Max} while the actual continuous current depends on the thermal & electro-mechanical application board design.
2. This single-pulse measurement was taken under T_{j,Max} = 150°C.

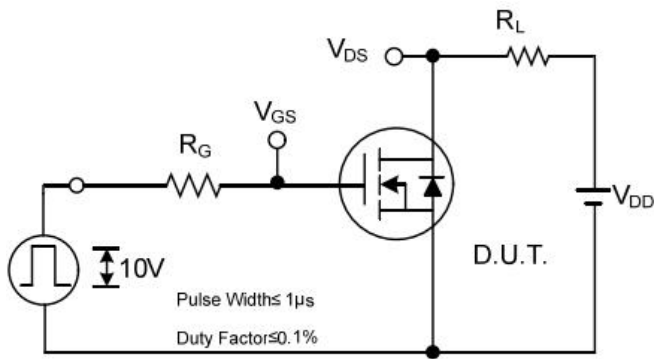
RATING AND CHARACTERISTIC CURVES



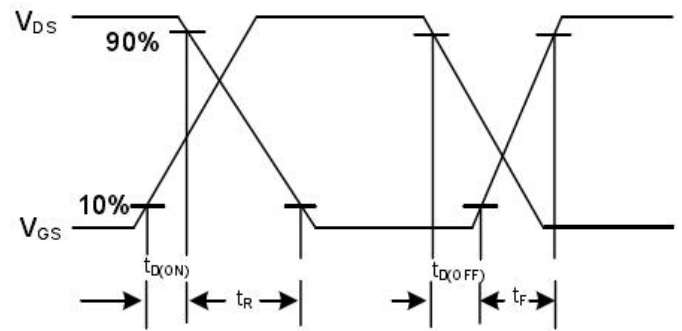
Peak Diode Recovery dv/dt Test Circuit



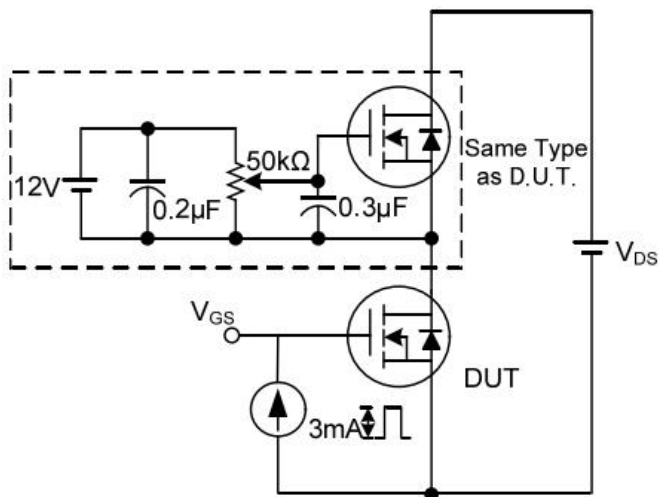
Peak Diode Recovery dv/dt Waveforms



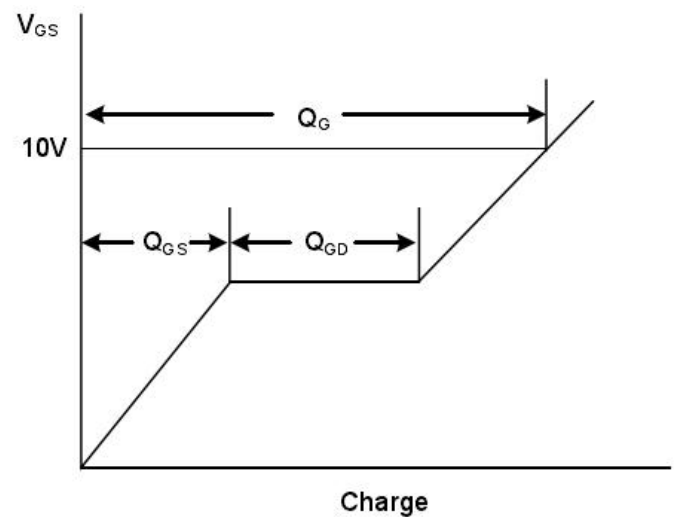
Switching Test Circuit



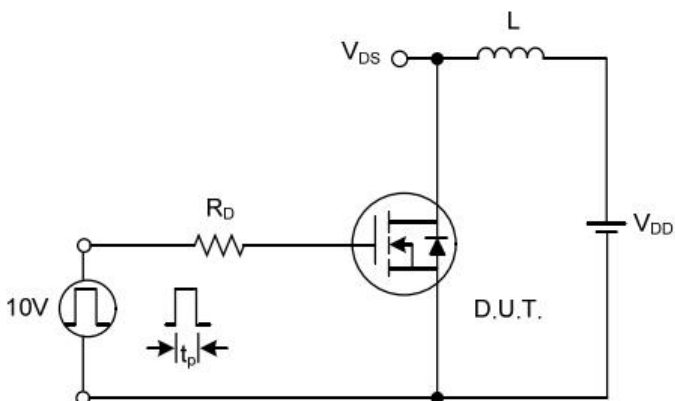
Switching Waveforms



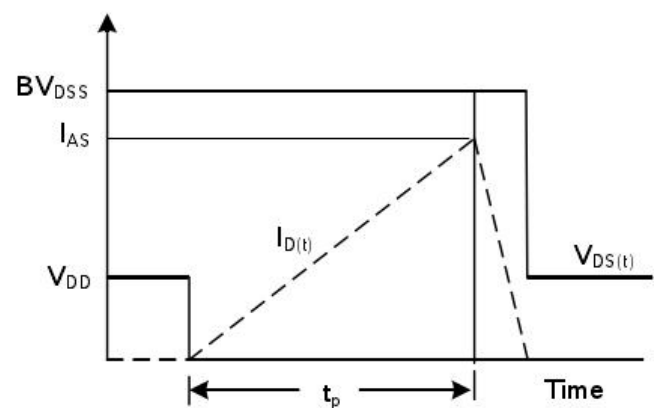
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

RATING AND CHARACTERISTIC CURVES

Figure.1 Typical Output Characteristics

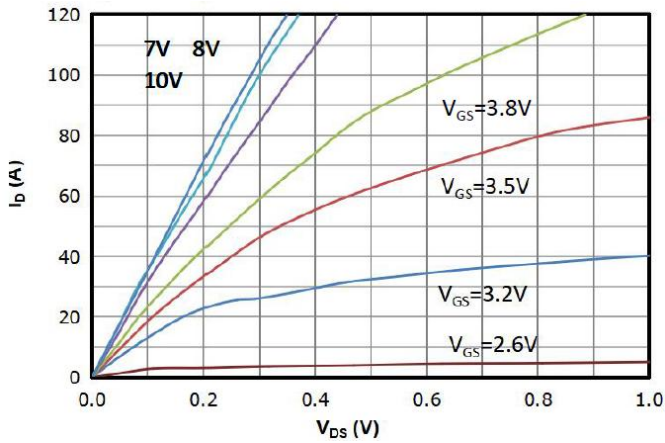


Figure.2 Transfer Characteristics

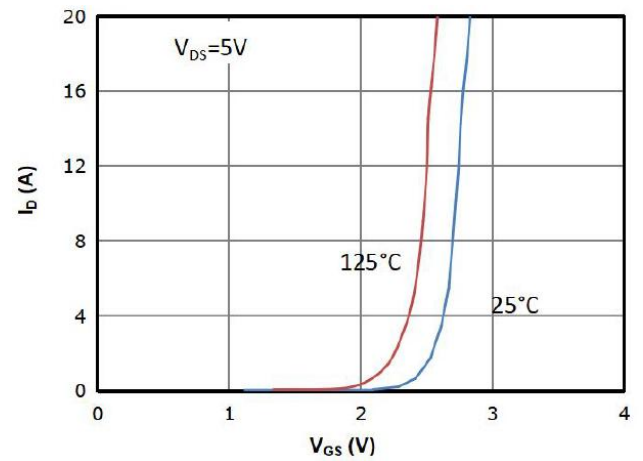
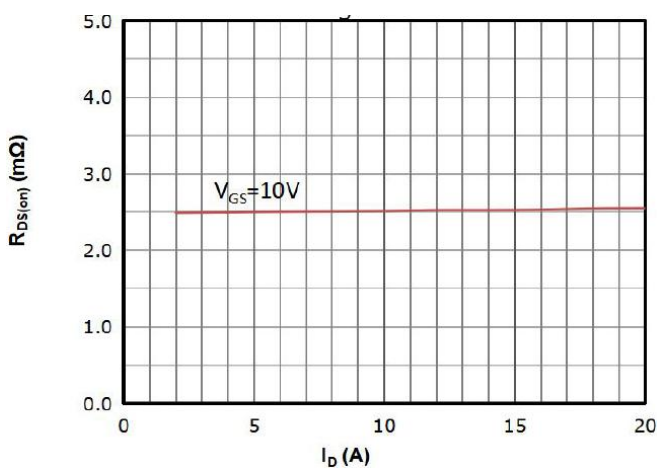
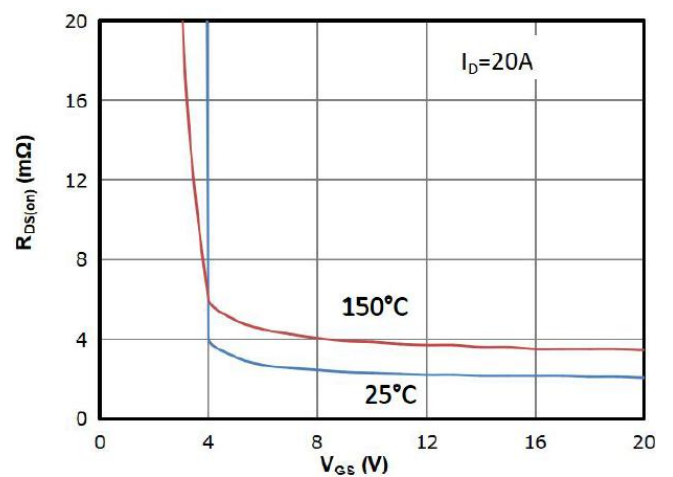

Figure.3 R_{DS(on)} vs Drain Current and Gate Voltage

Figure.4 R_{DS(on)} vs Gate Voltage


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

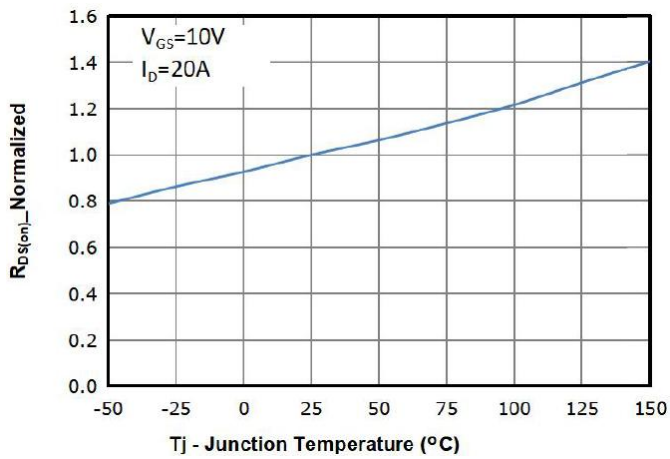


Figure.6 $V_{gs(th)}$ vs Temperature

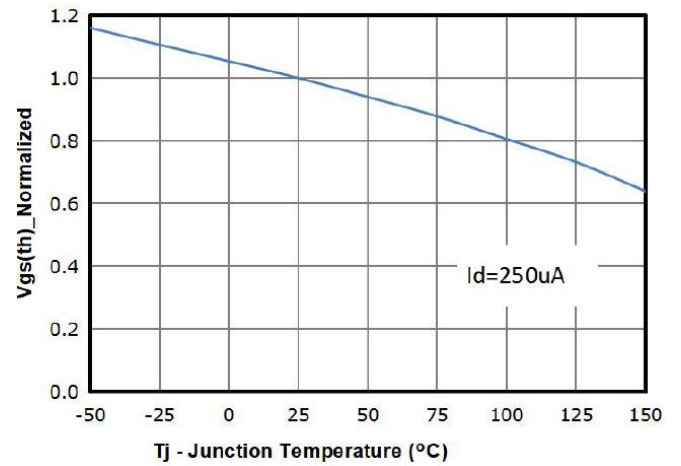


Figure.7 BV_{dss} vs Temperature

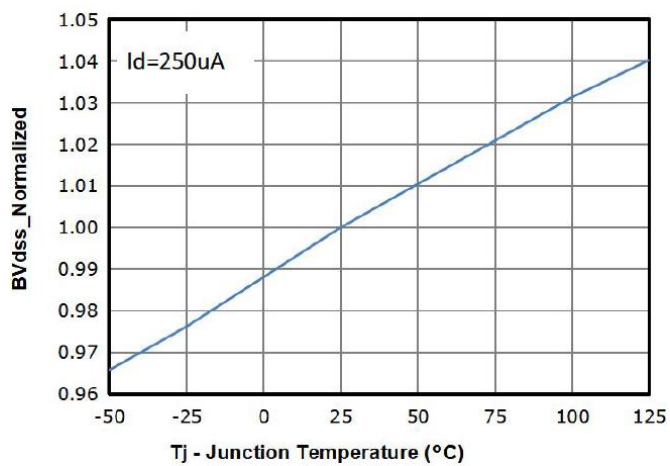


Figure.8 Capacitance Characteristics

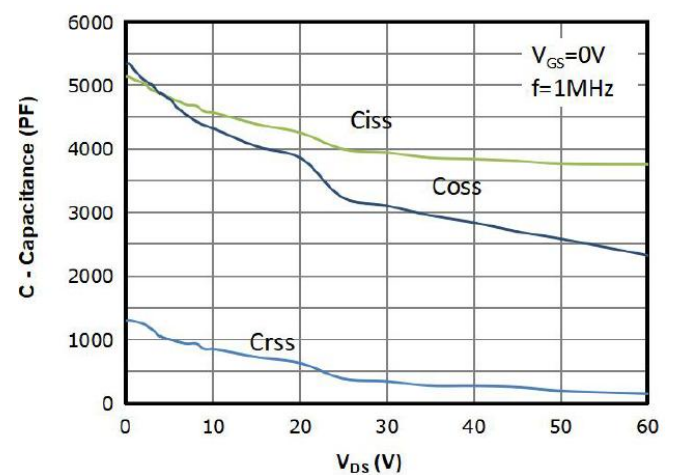


Figure.9 Gate Charge characteristics

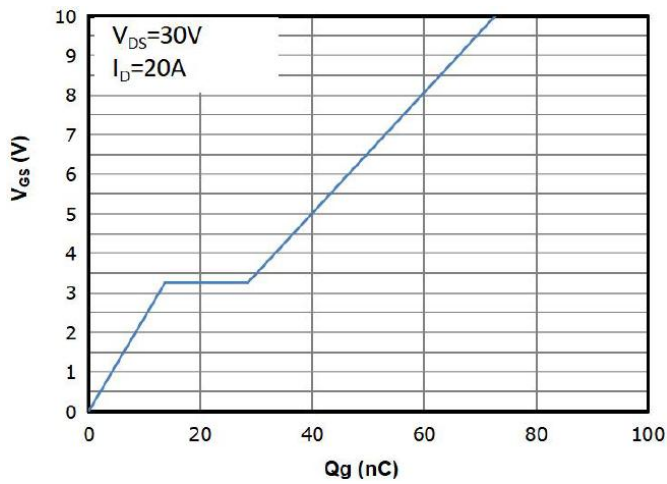


Figure.10 Body-Diode Forward Characteristics

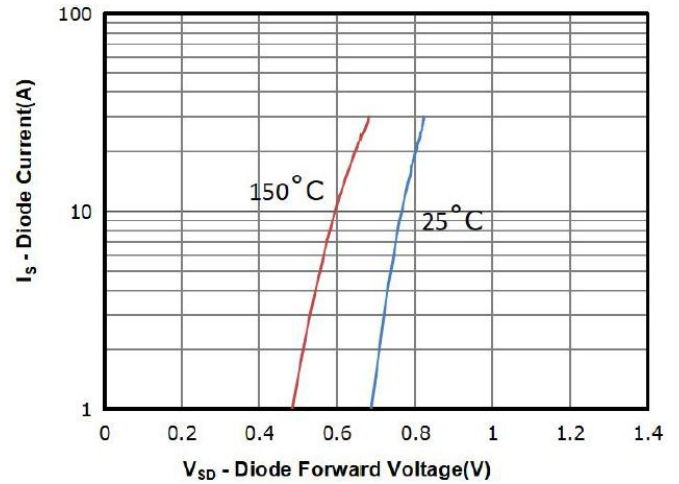


Figure.11 Power Dissipation

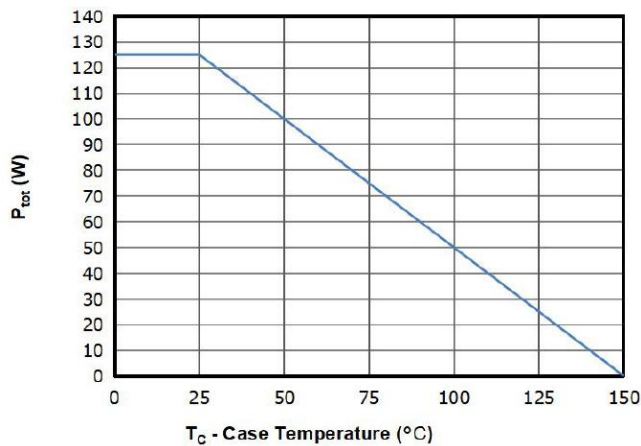


Figure.12 Drain Current Derating

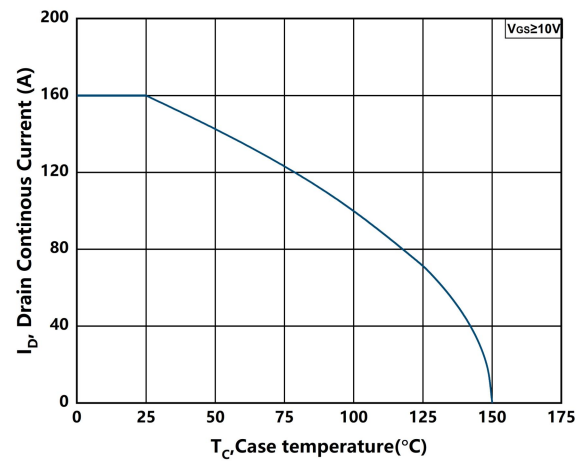


Figure.13 Safe Operating Area

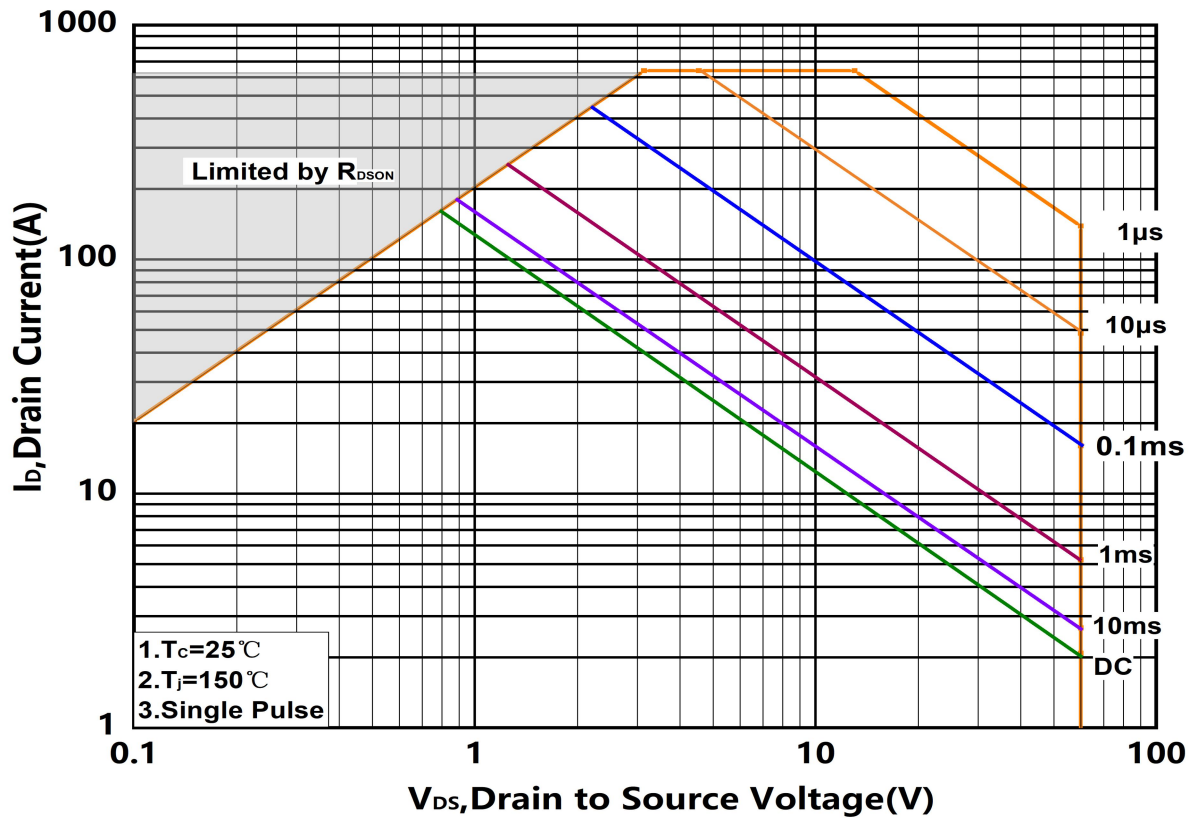
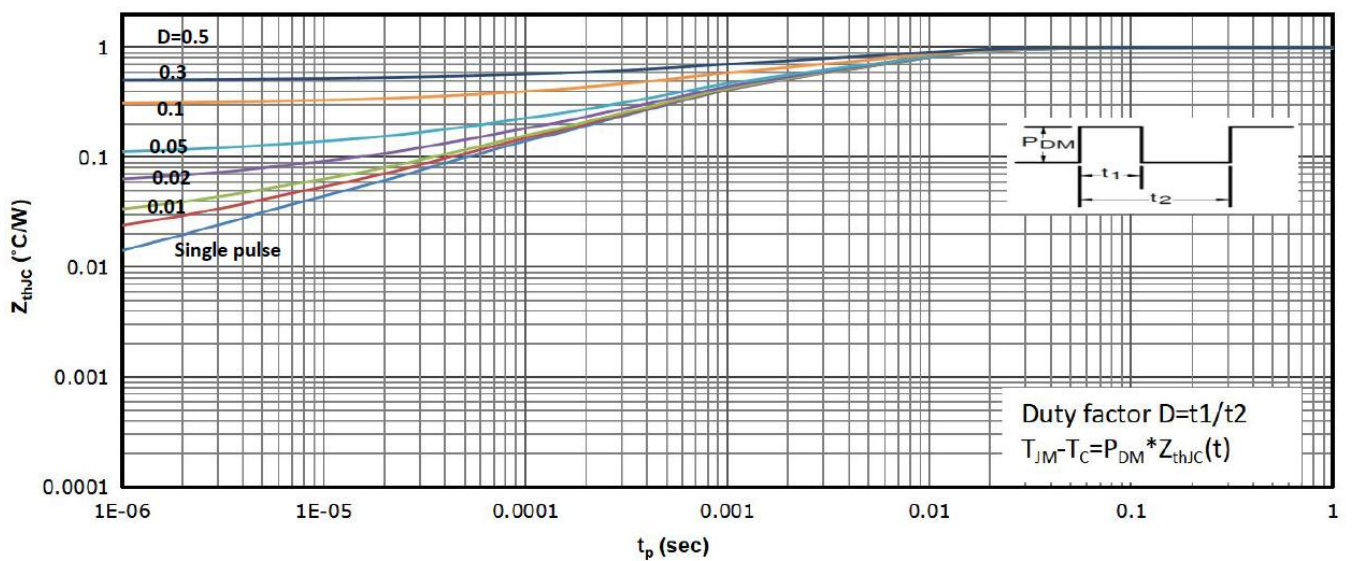
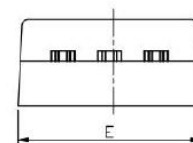
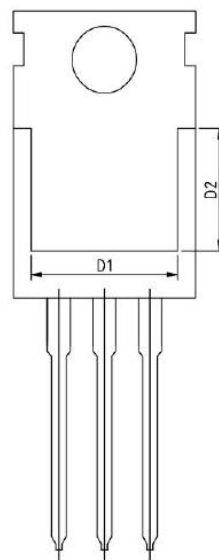
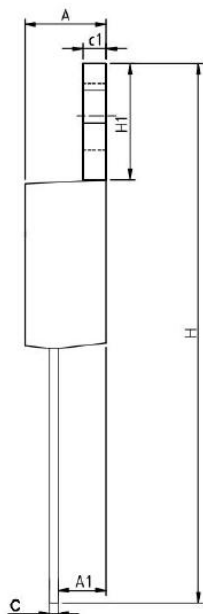
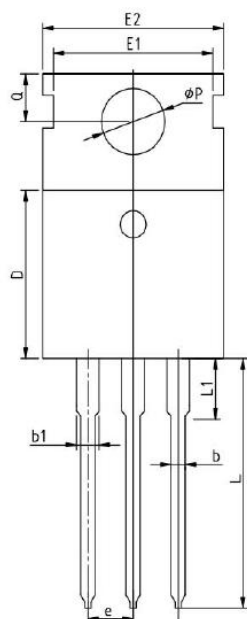


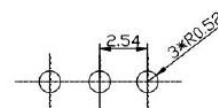
Figure.14 Max .Transient Thermal Impedance



Package Outline: TO-220CB-3L



RECOMMENDED LAND PATTERN



UNIT:mm

SYMBOL	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.40	4.80	0.173	0.189
A1	2.25	2.55	0.089	0.100
b	0.72	0.92	0.028	0.036
b1	1.12	1.42	0.044	0.056
c	0.40	0.60	0.016	0.024
c1	1.20	1.40	0.047	0.055
D	8.80	9.40	0.346	0.370
D1	7.75	8.15	0.305	0.321
D2	6.55	6.95	0.258	0.274
e	2.54		0.100	
E	9.65	10.35	0.380	0.407
E1	8.70		0.343	
E2	9.70	10.30	0.382	0.406
H	28.70	29.70	1.130	1.169
H1	6.25	6.85	0.246	0.270
L	13.20	13.80	0.520	0.543
L1	2.80	3.40	0.110	0.134
Q	2.60	3.00	0.102	0.118
φP	3.45	3.75	0.136	0.148