

GaN Power Device

Features

- Easy to use, compatible with standard gate drivers
- Low Q_{rr} , no free-wheeling diode required
- Excellent $Q_g \times R_{DS(on)}$ product (FOM)
- Low switching loss
- RoHS compliant and Halogen-free

Product Summary		
V_{DSS}	650	V
$R_{DS(on), typ}$	240	m Ω
$Q_{G, typ}$	9	nC
$Q_{RR, typ}$	23	nC

Applications

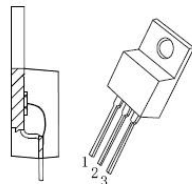
- Switching Mode Power Supply
- Power Factor Correction
- Portable Adaptor

Main Characteristics

V_{DS}	650 V
$R_{DS(ON)}$	240 m Ω
Current	6.5 A

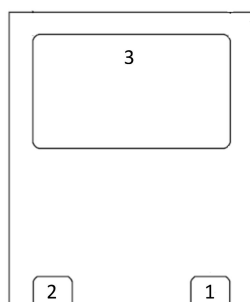
Product Information

(1) TO-220-3L



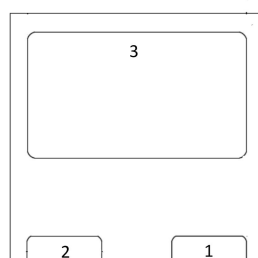
Pin No.	Name	Function
1	G	Gate
2	S	Source
3	D	Drain

(2) DFN 5X6-Dual Punch



Pin No.	Name	Function
1	G	Gate
2	D	Drain
3	S	Source

(3) DFN 8X8



Pin No.	Name	Function
1	G	Gate
2	D	Drain
3	S	Source

Device Information

Part Number	package	packing
GN2065T4ZG	DFN5*6	Tape 4K/reel
GN2065T5ZG	DFN8*8	Tape 3K/reel
GN2065TGG	TO-252	Tape 2.5K/reel
GN2065TLG	TO-220	Tape 1K/reel

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

Drain-to-Source Voltage	650 (V)
Drain-to-Source Current	6.5(A)
Drain-Source On-Resistance	300 (m Ω)
Gate-to-Source Voltage	-18 ~ 18(V)
Storage Temperature	-50 ~ 150($^{\circ}\text{C}$)
Soldering Temperature	-50 ~ 150 ($^{\circ}\text{C}$)

Electrical Characteristics (T_J = 25°C)

Symbol	Parameter	Test Conditions	Min	Typical	Max	Unit
Forward Device Characteristics						
V _{DSS(BL)}	Maximum drain-source voltage	V _{GS} =0V	650	—	—	V
V _{GS(th)}	Gate threshold voltage	V _{DS} =V _{GS} , I _D =0.5mA	1.6	2.1	2.6	V
R _{DS(on)eff}	Drain-source on-resistance ^a	V _{GS} =8V, I _D =5A	—	240	312	mΩ
		V _{GS} =8V, I _D =5A, T _J =150°C	—	492	—	
I _{DSS}	Drain-to-source leakage current	V _{DS} =650V, V _{GS} =0V	—	1.2	12	μA
		V _{DS} =650V, V _{GS} =0V, T _J =150°C	—	8	—	
I _{GSS}	Gate-to-source forward leakage current	V _{GS} =20V	—	—	100	nA
	Gate-to-source reverse leakage current	V _{GS} =-20V	—	—	-100	
C _{ISS}	Input capacitance	V _{GS} =0V, V _{DS} =400V, f=1MHz	—	760	—	pF
C _{OSS}	Output capacitance		—	16	—	
C _{RSS}	Reverse transfer capacitance		—	2	—	
C _{O(er)}	Output capacitance, energy related ^b	V _{GS} =0V, V _{DS} =0 to 400V	—	24	—	pF
C _{O(tr)}	Output capacitance, time related ^c		—	47	—	
Q _G	Total gate charge	V _{DS} =400V, V _{GS} =0V to 8V, I _D =4A	—	9.6	—	nC
Q _{GS}	Gate-source charge		—	2.6	—	
Q _{GD}	Gate-drain charge		—	2.6	—	
Q _{OSS}	Output charge	V _{GS} =0V, V _{DS} =0V to 400V	—	19	—	nC
t _{D(on)}	Turn-on delay	V _{DS} =400V, V _{GS} =0V to 8V, I _D =4A, R _G =30Ω, 4A driver	—	19.4	—	nS
t _R	Rise time		—	3.4	—	
t _{D(off)}	Turn-off delay		—	53	—	
t _F	Fall time		—	10	—	

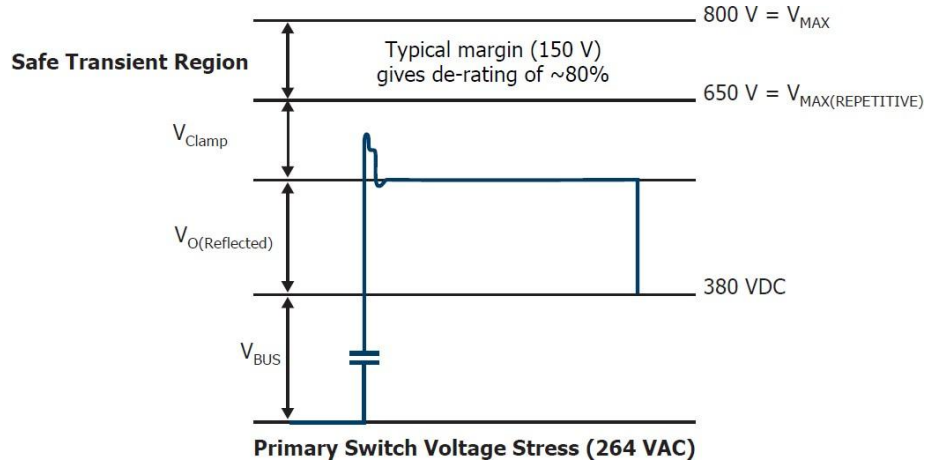
Symbol	Parameter	Test Conditions	Min	Typical	Max	Unit
Reverse Device Characteristics						
I _S	Reverse current	V _{GS} =0V, T _C =100°C, ≤25% duty cycle	—	—	3.7	A
V _{SD}	Reverse voltage	V _{GS} =0V, I _S =5A	—	1.7	—	V
		V _{GS} =0V, I _S =2A	—	1.2	—	
t _{RR}	Reverse recovery time	I _S =5A, V _{DD} =400V,	—	16	—	ns
Q _{RR}	Reverse recovery charge	di/dt=1000A/us	—	23	—	nC

Maximum ratings, at TC=25 °C, unless otherwise specified

Symbol	Parameter	Limit Value	Unit	
V _{DSS}	Drain to source voltage (T _J = -55°C to 150°C)	650	V	
V _{DSS (TR)}	Transient drain to source voltage ^a	800		
V _{GSS}	Gate to source voltage	±18		
P _D	Maximum power dissipation @T _C =25°C	21	W	
I _D	Continuous drain current @T _C =25°C ^b	6.5	A	
	Continuous drain current @T _C =100°C ^b	4.1	A	
I _{DM}	Pulsed drain current (pulse width: 10µs)	30	A	
T _C	Operating temperature	Case	-55 to +150	°C
T _J		Junction	-55 to +150	°C
T _S	Storage temperature	-55 to +150	°C	
T _{SOLD}	Reflow soldering temperature ^c	260	°C	

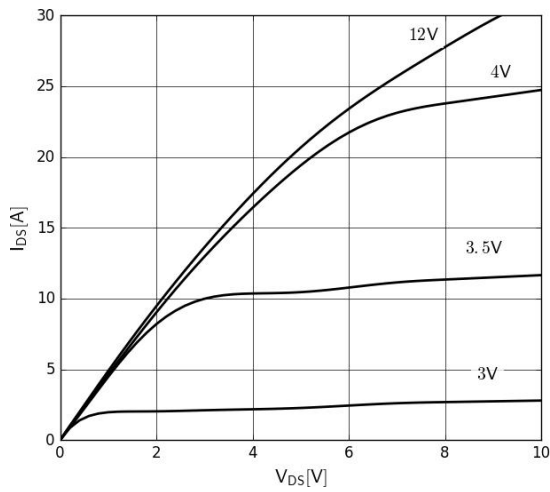
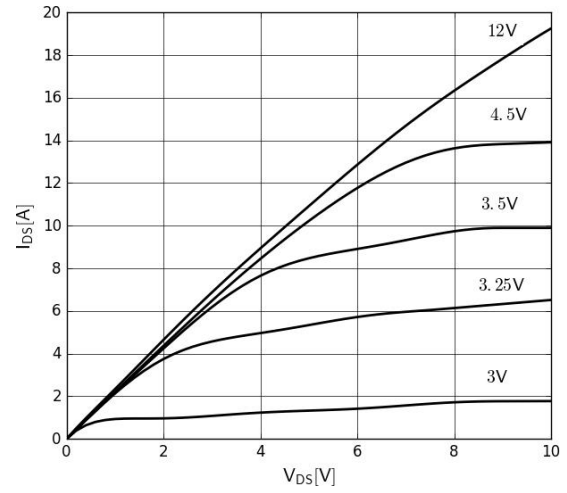
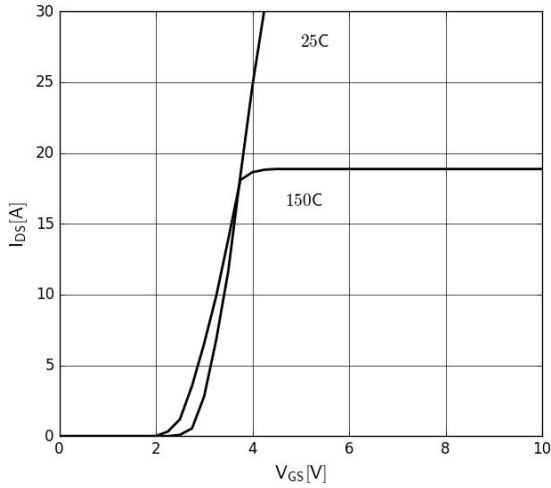
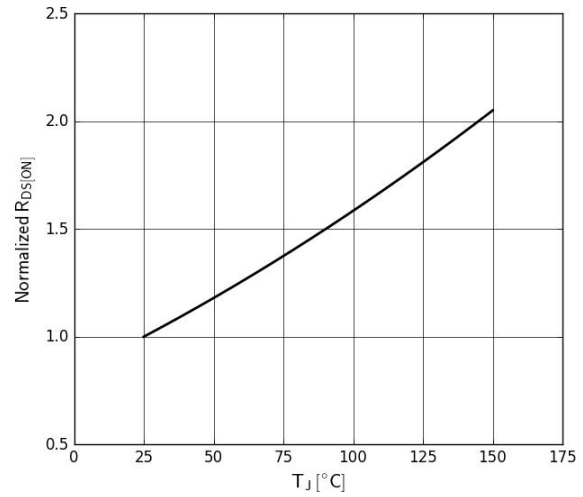
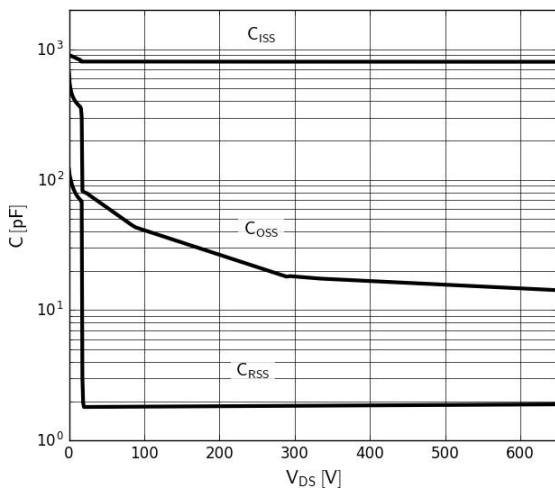
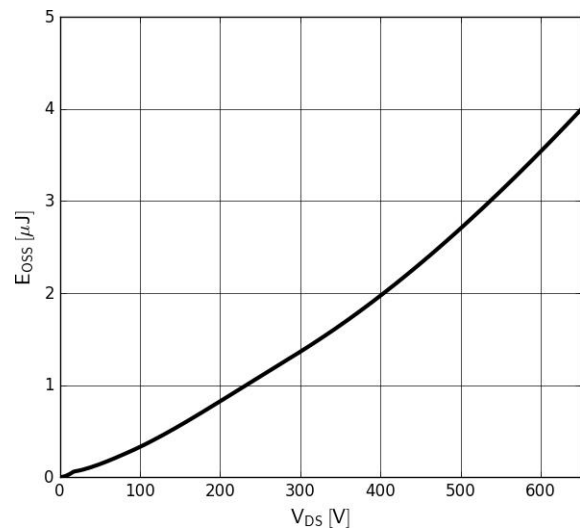
Notes:

- a. In off-state, spike duty cycle D<0.01, spike duration <30µs.
- b. For increased stability at high current operation, see Circuit Implementation on page 3
- c. Reflow MSL3



Thermal Resistance

Symbol	Parameter	Typical	Unit
$R_{\theta JC}$	Junction-to-case	5.5	°C/W
$R_{\theta JA}$	Junction-to-ambient ^d	50	°C/W


 Figure 1. Typical output characteristics $T_j=25\text{ }^\circ\text{C}$.

 Figure 2. Typical output characteristics $T_j=150\text{ }^\circ\text{C}$.

 Figure 3. Typical Transfer Characteristics at $V_{DS} = 10\text{V}$.

 Figure 4. Normalized On-resistance at $I_D = 16\text{A}$, $V_{GS} = 10\text{V}$.

 Figure 5. Typical Capacitance at $V_{GS} = 0\text{V}$, $f=1\text{MHz}$.

 Figure 6. Typical C_{OSS} Stored Energy.

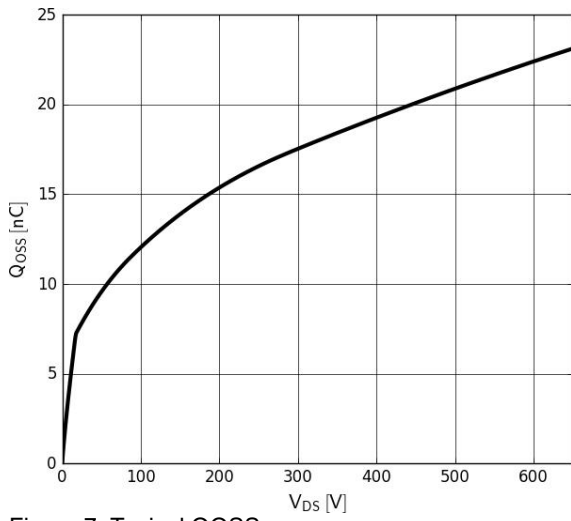


Figure 7. Typical QOSS.

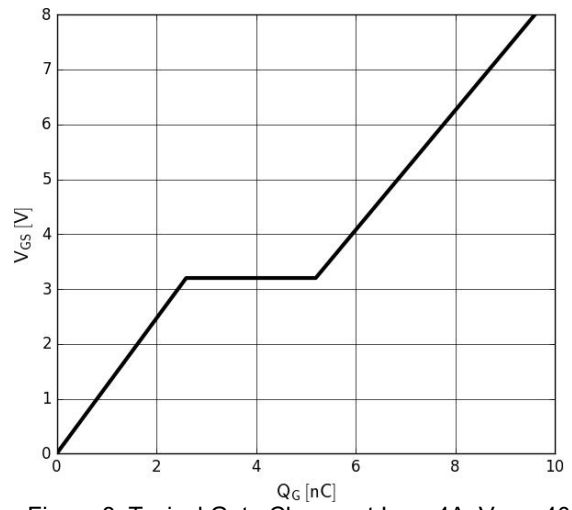
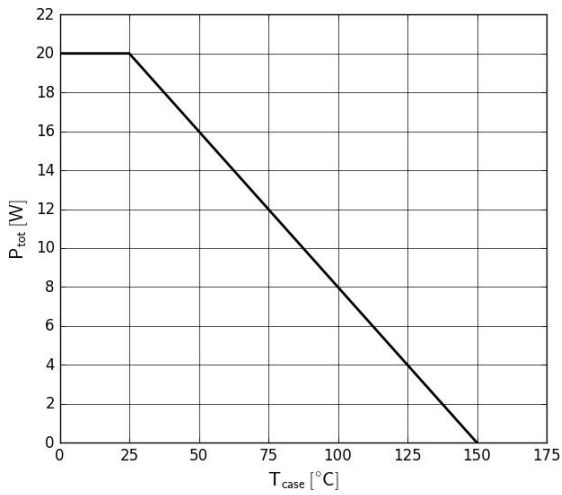

 Figure 8. Typical Gate Charge at $I_{DS} = 4A$, $V_{DS} = 400V$.


Figure 9. Power Dissipation.

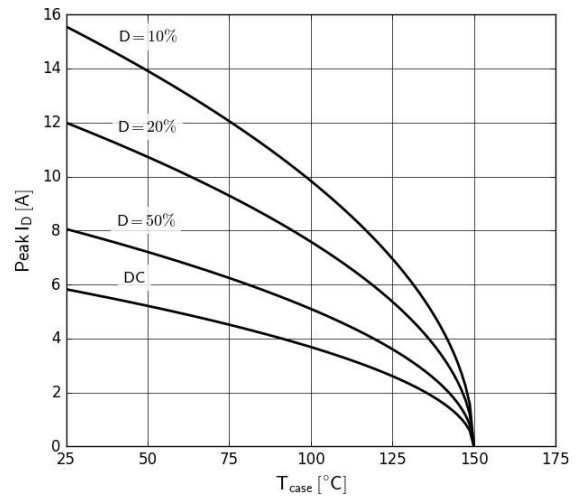
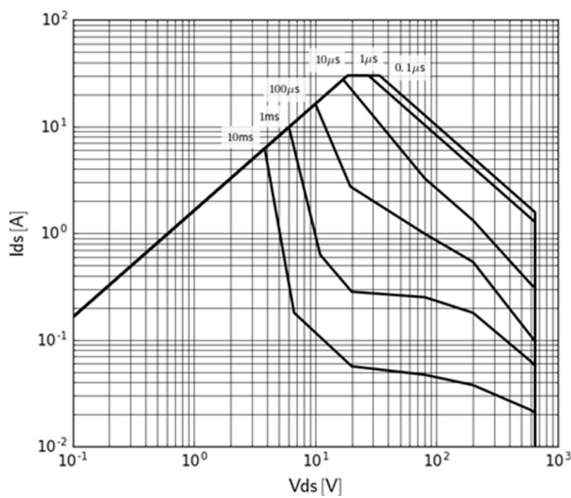
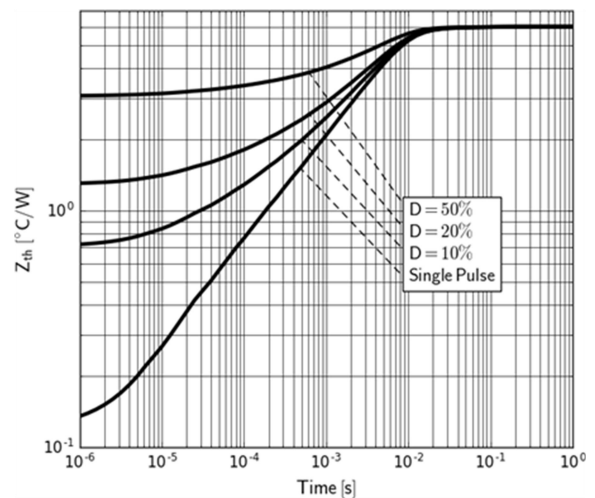

 Figure 10. Current Derating at Pulse width $\leq 10\mu s$, $V_{GS} \geq 10V$.

 Figure 11. Safe Operating Area $TC=25^{\circ}C$.


Figure 12. Transient Thermal Resistance.

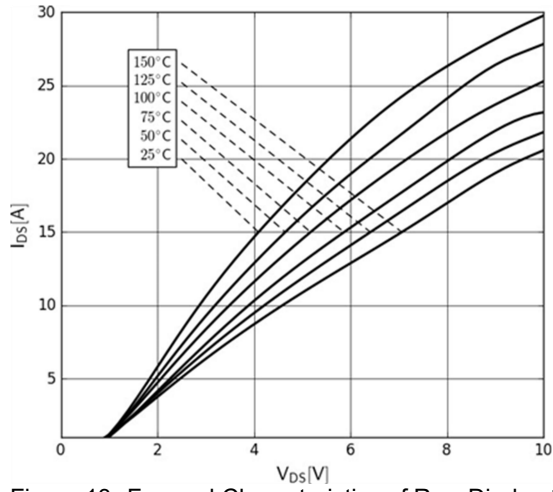


Figure 13. Forward Characteristics of Rev. Diode at $I_S=f(V_{SD})$.

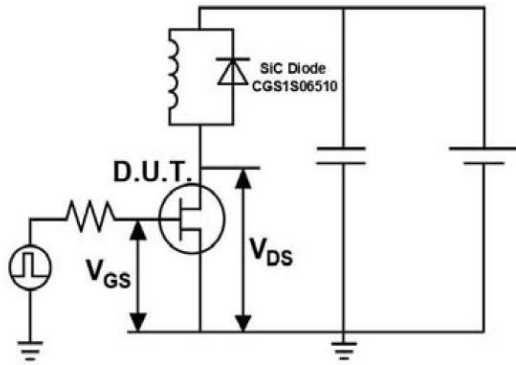
Test Circuits and Waveforms:


Figure A. Switching Time Test Circuits.

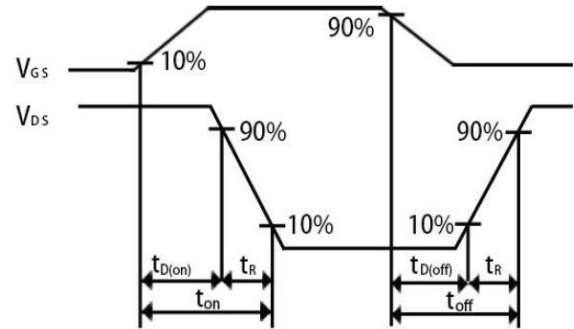


Figure B. Switching Time Waveform.

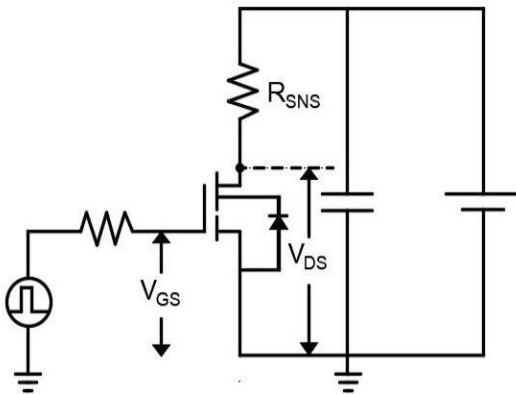
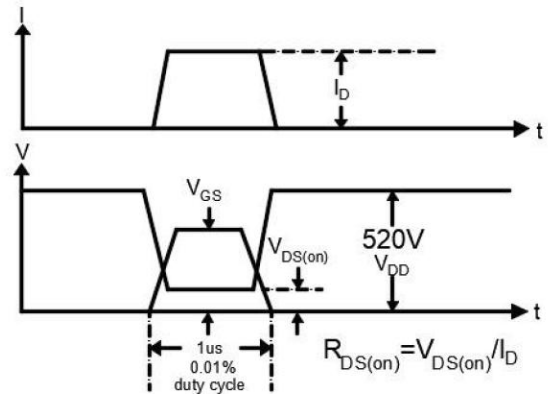
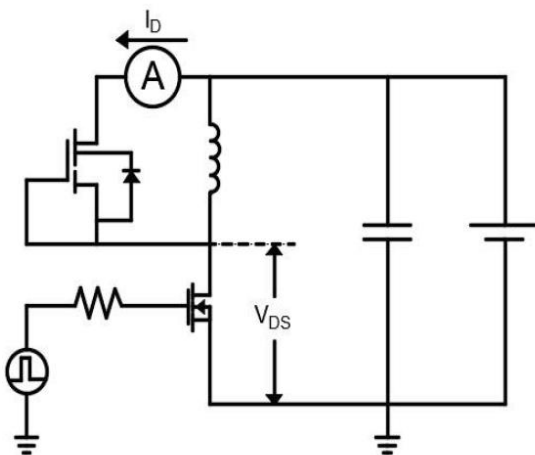

 Figure C. Dynamic $R_{DS(on)}$ Test Circuits.

 Figure D. Dynamic $R_{DS(on)}$ Waveform.


Figure E. Diode Characteristics Test Circuits.

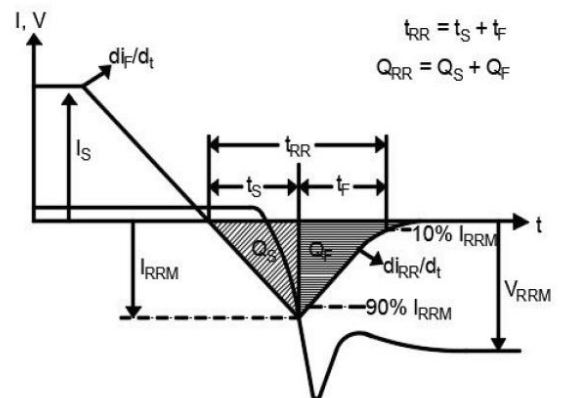
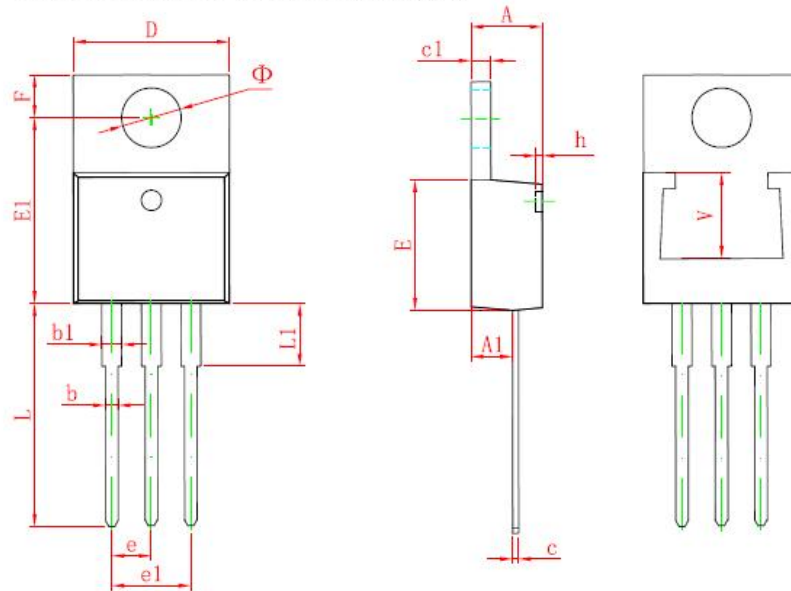
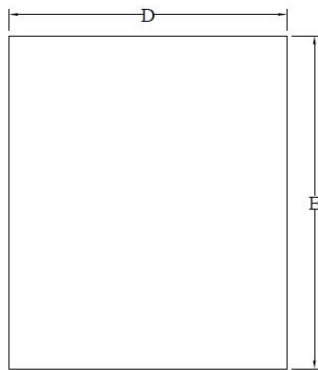


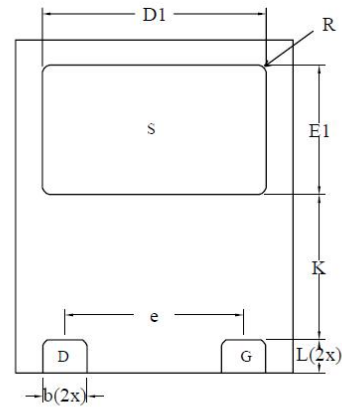
Figure F. Diode Recovery Waveform.

Package Outlines:
(1) TO-220-3L
TO-220-3L PACKAGE OUTLINE DIMENSIONS


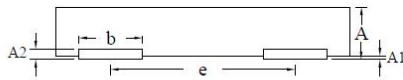
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.470	4.670	0.176	0.184
A1	2.520	2.820	0.099	0.111
b	0.710	0.910	0.028	0.036
b1	1.170	1.370	0.046	0.054
c	0.310	0.530	0.012	0.021
c1	1.170	1.370	0.046	0.054
D	10.010	10.310	0.394	0.406
E	8.500	8.900	0.335	0.350
E1	12.060	12.460	0.475	0.491
e	2.540 TYP.		0.100 TYP.	
e1	4.980	5.180	0.196	0.204
F	2.590	2.890	0.102	0.114
h	0.000	0.300	0.000	0.012
L	13.400	13.800	0.528	0.543
L1	3.560	3.960	0.140	0.156
Φ	3.735	3.935	0.147	0.155
V	5.600 REF.		0.220 REF.	

(2) DFN 5X6: (GN2065T4)


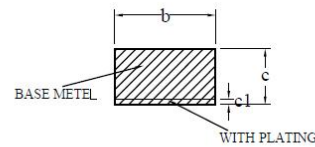
Top View



Bottom View

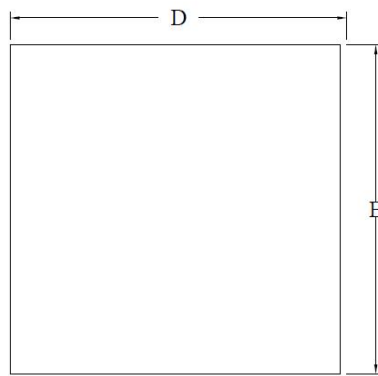


Side View

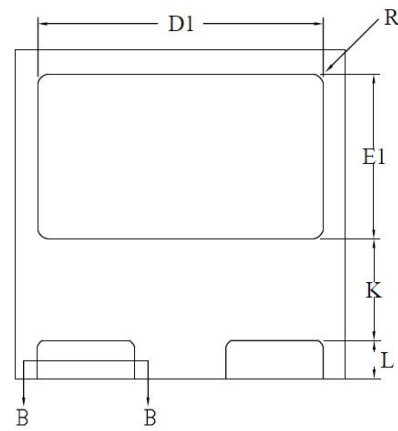


SECTION B-B

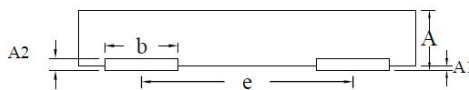
SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	1.05	1.10	1.15
A1	0.00	—	0.05
A2	—	0.20	0.22
b	0.82	0.87	0.92
c	—	0.20	—
c1	0.01	—	0.02
D	4.90	5.00	5.10
D1	4.09	4.24	4.39
E	5.90	6.00	6.10
E1	2.15	2.30	2.45
e	3.37BSC		
K	2.50	—	—
L	0.71	0.81	0.91
R	—	0.13	—

(3) DFN 8X8: (GN2065T5)


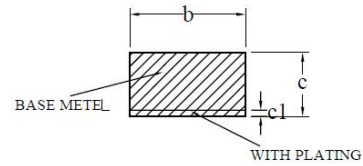
Top View



Bottom View



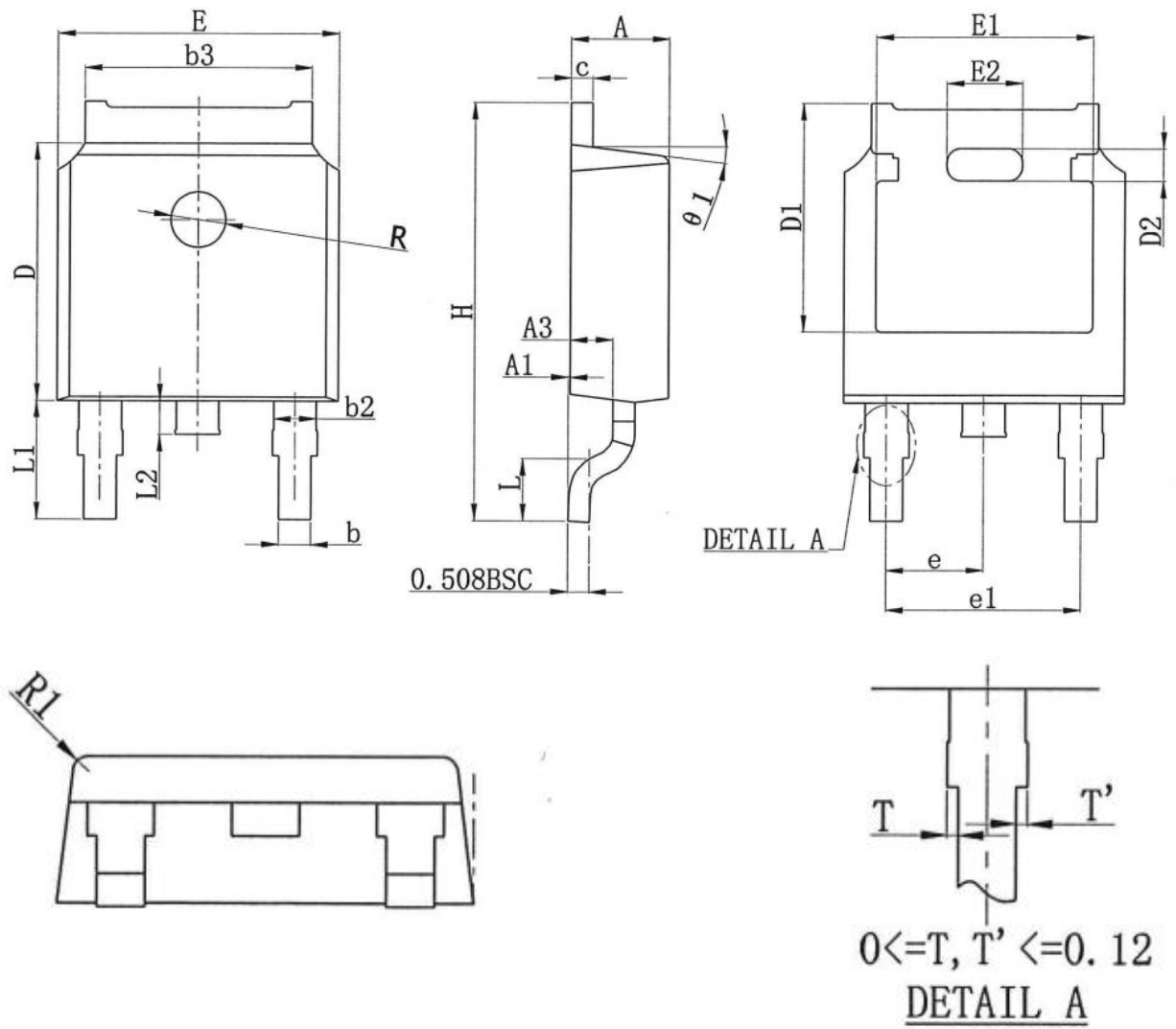
Side View



SECTION B-B

SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	1.05	1.10	1.15
A1	0.00	—	0.05
A2	—	0.20	0.22
b	2.20	2.25	2.30
c	—	0.20	—
c1	0.01	—	0.02
D	7.90	8.00	8.10
D1	6.85	7.00	7.15
E	7.90	8.00	8.10
E1	4.03	4.18	4.33
e	4.75BSC		
K	2.50	—	—
L	0.70	0.80	0.90
R	—	0.13	—

(4) TO-252



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	2.250	2.300	2.350
A1	0.000	0.050	0.100
A3	0.960	1.010	1.060
b	0.660	0.760	0.860
b2	1.000REF.		
b3	5.220	5.320	5.420
C	0.508REF.		
D	6.050	6.100	6.150
D1	5.414REF.		
D2	0.762REF.		
E	6.550	6.600	6.650
E1	5.092REF.		
E2	1.778REF,		
e	2.286BSC.		
e1	4.572BSC.		
H	9.700	9.900	10.100
L	1.400	1.500	1.700
L1	2.650	2.800	2.950
L2	0.650	0.800	0.950
O1	7° REF.		
R	1.300REF.		
R1	0.250REF.		

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