

Features

- CRM(CQ) Super_Junction technology
- Much lower R_{on}^*A performance for On-state efficiency
- Better efficiency due to very low FOM
- Optimized switching performance to meet stringent EMI standards
- Integrated ESD protection diode
- Qualified for industrial grade applications according to JEDEC

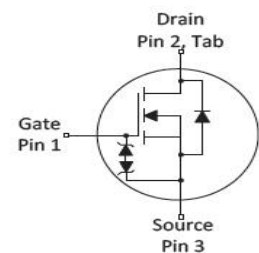
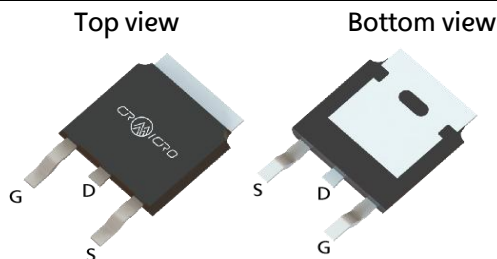
Applications

- Lighting
- Adapter/PC Power
- Solar/UPS
- Server/Telecom

Product Summary

V_{DS}	600V
$R_{DS(on),typ}$	275mΩ
I_D	10A

100% DVDS Tested
100% Avalanche Tested



Package Marking and Ordering Information

Part #	Marking	Package	Packing	Reel Size	Tape Width	Qty
CRJD290N60G4EM	J290N60G4EM	TO-252	Tape&Reel	N/A	N/A	2500pcs

Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-source voltage	V_{DS}	600	V
Continuous drain current ¹⁾	I_D	10 6	A
$T_C = 25^\circ\text{C}$			
$T_C = 100^\circ\text{C}$			
Pulsed drain current ²⁾ ($T_C = 25^\circ\text{C}$, t_p limited by $T_{j,max}$)	$I_{D,pulse}$	20	A
Avalanche energy, single pulse ($L=30\text{mH}$)	E_{AS}	32	mJ
MOSFET dv/dt ruggedness	dv/dt	50	V/ns
Gate-Source voltage	V_{GS}	± 30	V
Power dissipation ($T_C = 25^\circ\text{C}$)	P_{tot}	67	W
Continuous diode forward current ($T_C = 25^\circ\text{C}$)	I_S	10	A
Diode pulse current ²⁾ ($T_C = 25^\circ\text{C}$)	$I_{S,pulse}$	20	A
Recovery diode dv/dt ³⁾	dv/dt	15	V/ns
Operating junction and storage temperature	T_j, T_{stg}	-55...+150	$^\circ\text{C}$

1) Limited by $T_{j,max}$. Maximum Duty Cycle $D = 0.50$

2) Pulse width t_p limited by $T_{j,max}$

3) Identical low side and high side switch with identical R_g

Thermal Resistance

Parameter	Symbol	Value			Unit	Test Condition
		min.	typ.	max.		
Thermal resistance, junction – case	R_{thJC}	-	1.34	1.87	°C/W	
Thermal resistance, junction – ambient	R_{thJA}	-	-	127	°C/W	

Electrical Characteristic (at $T_j = 25^\circ\text{C}$, unless otherwise specified)

Parameter	Symbol	Value			Unit	Test Condition
		min.	typ.	max.		

Static Characteristic

Drain-source breakdown voltage	BV_{DSS}	600	-	-	V	$V_{GS}=0V, I_D=1mA$
Gate threshold voltage	$V_{GS(th)}$	3	-	5	V	$V_{DS}=V_{GS}, I_D=250\mu A$
Zero gate voltage drain current	I_{DSS}	-	-	1	μA	$V_{DS}=600V, V_{GS}=0V$
Gate-source leakage current	I_{GSS}	-	-	± 10	μA	$V_{GS}=\pm 30V, V_{DS}=0V$
Drain-source on-state resistance	$R_{DS(on)}$	-	275	310	mΩ	$V_{GS}=10V, I_D=2.7A,$ $T_j=25^\circ\text{C}$
		-	595	-		$T_j=150^\circ\text{C}$
Transconductance	g_{fs}	-	7.1	-	S	$V_{DS}=20V, I_D=2.7A$

Dynamic Characteristic

Input Capacitance	C_{iss}	-	600	-	pF	$V_{GS}=0V, V_{DS}=400V,$ $f=250KHz$
Output Capacitance	C_{oss}	-	14	-		
Reverse Transfer Capacitance	C_{rss}	-	1.8	-		
Gate Total Charge	Q_g	-	12	-	nC	$V_{GS}=10V, V_{DS}=400V, I_D=2.7A$
Gate-Source charge	Q_{gs}	-	4	-		
Gate-Drain charge	Q_{gd}	-	3	-		
Gate plateau voltage	$V_{plateau}$	-	6	-	V	
Turn-on delay time	$t_{d(on)}$	-	8	-	ns	$V_{GS}=13V, I_D=2.7A, V_{DS}=400V,$ $R_g=3.4\Omega$
Rise time	t_r	-	7	-		
Turn-off delay time	$t_{d(off)}$	-	38	-		
Fall time	t_f	-	40	-		
Gate resistance	$R_{g,int}$	-	10	-	Ω	$f=1MHz$

Body Diode Characteristic

Parameter	Symbol	Value			Unit	Test Condition
		min.	typ.	max.		
Body Diode Forward Voltage	V_{SD}	0.6	0.85	1.1	V	$V_{GS}=0V, I_{SD}=2.7A$
Body Diode Reverse Recovery Time	t_{rr}	-	160	-	ns	$I_{SD}=2.7A$ $di_f/dt=100A/\mu s$ $V_{DS}=400V$
Body Diode Reverse Recovery Charge	Q_{rr}	-	1	-	μC	
Body Diode Reverse Recovery Peak Current	I_{rrm}	-	13	-	A	

Typical Performance Characteristics

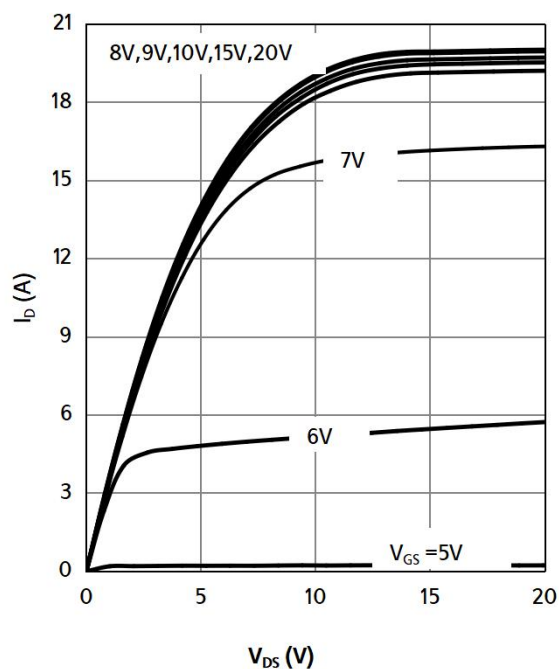
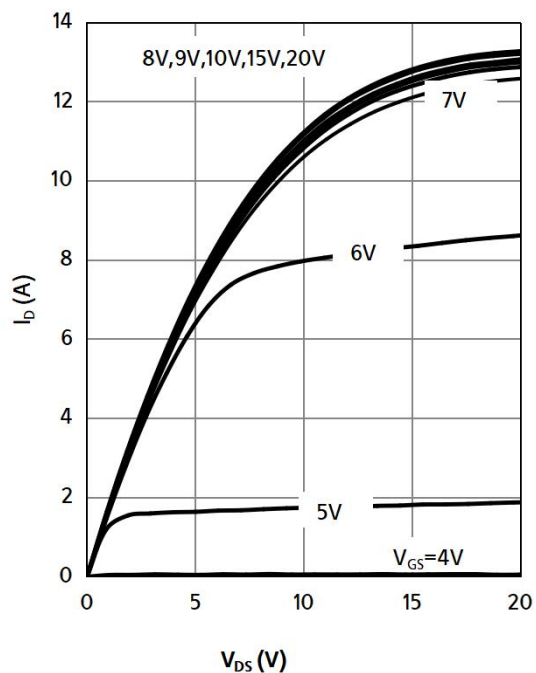
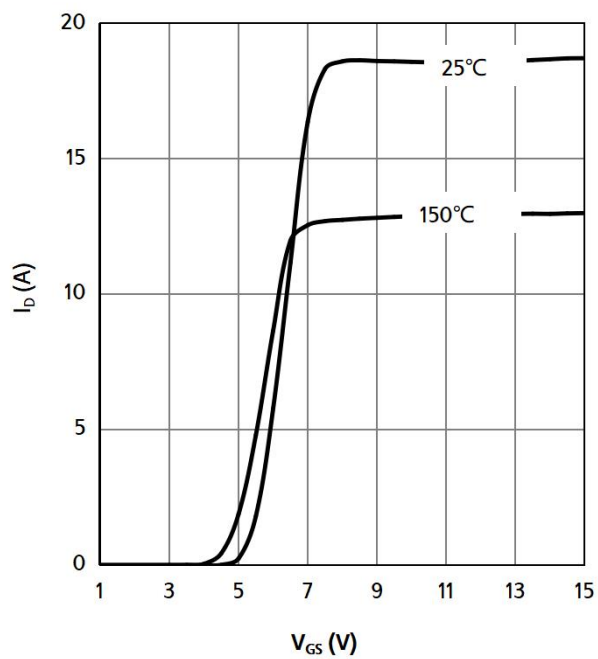
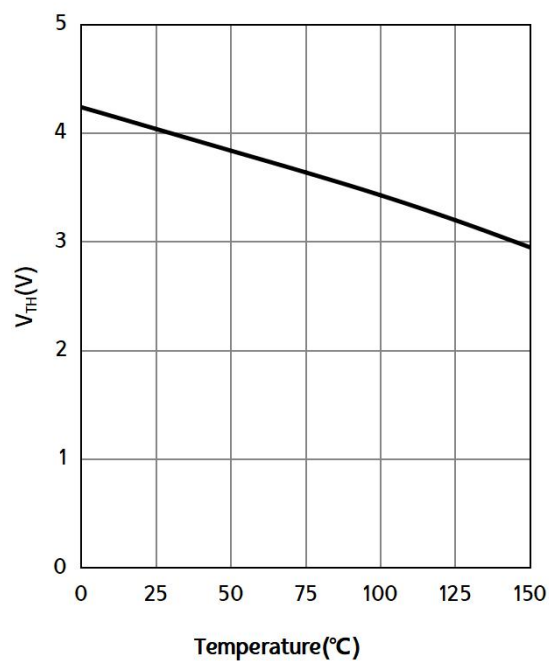
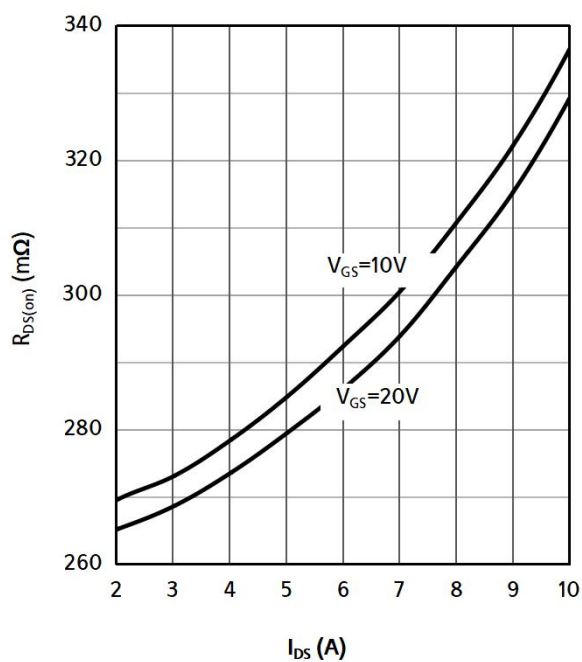
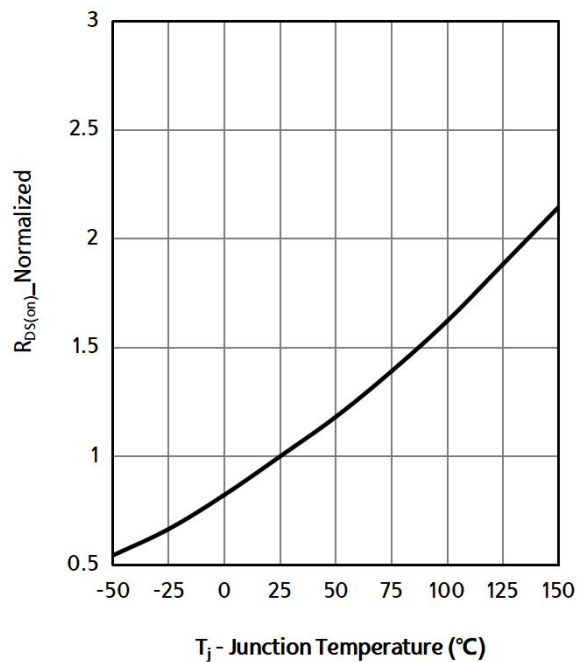
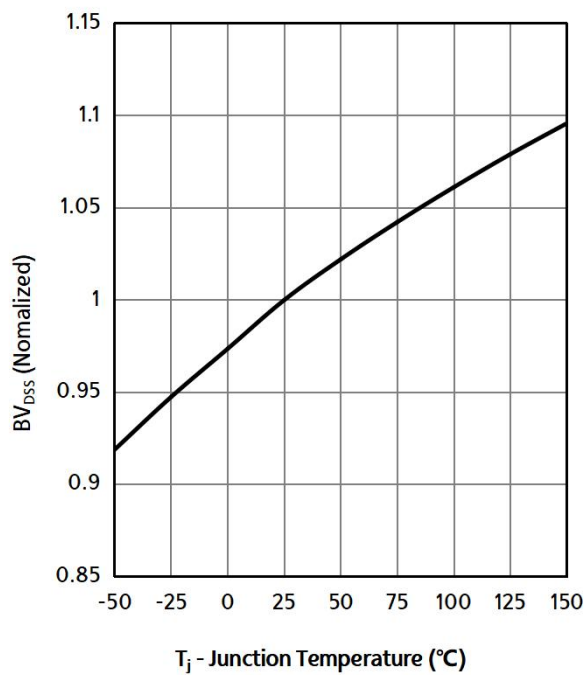
Fig 1. Output Characteristics ($T_j=25^\circ\text{C}$)

 $I_D = f(V_{DS}); T_j = 25^\circ\text{C}; \text{parameter: } V_{GS}$
Fig 2. Output Characteristics ($T_j=150^\circ\text{C}$)

 $I_D = f(V_{DS}); T_j = 150^\circ\text{C}; \text{parameter: } V_{GS}$
Fig 3: Transfer Characteristics

 $I_D = f(V_{GS}); V_{DS} = 20\text{V}; \text{parameter: } T_j$
Fig 4: V_{TH} vs. T_j Temperature Characteristics

 $V_{TH} = f(T_j); I_D = 250\mu\text{A}$

Fig 5: $R_{DS(on)}$ vs. I_{DS} Characteristics ($T_j=25^\circ\text{C}$)


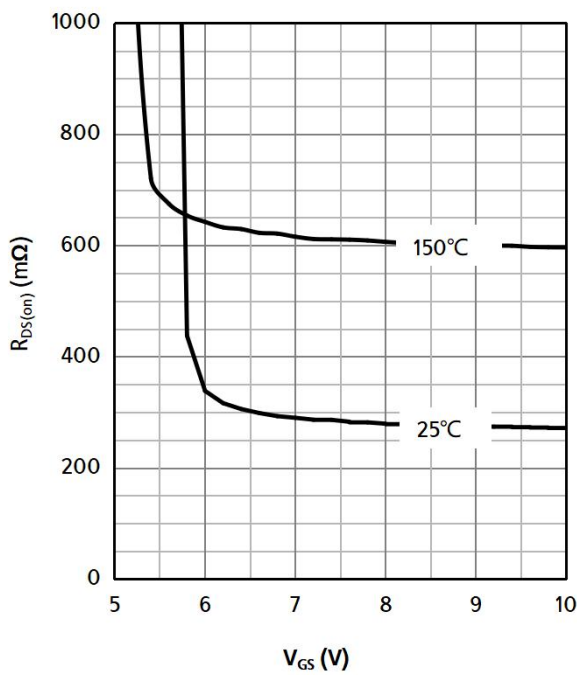
$$R_{DS(on)} = f(I_D); T_j = 25^\circ\text{C}; \text{parameter: } V_{GS}$$

Fig 6: $R_{DS(on)}$ vs. Temperature


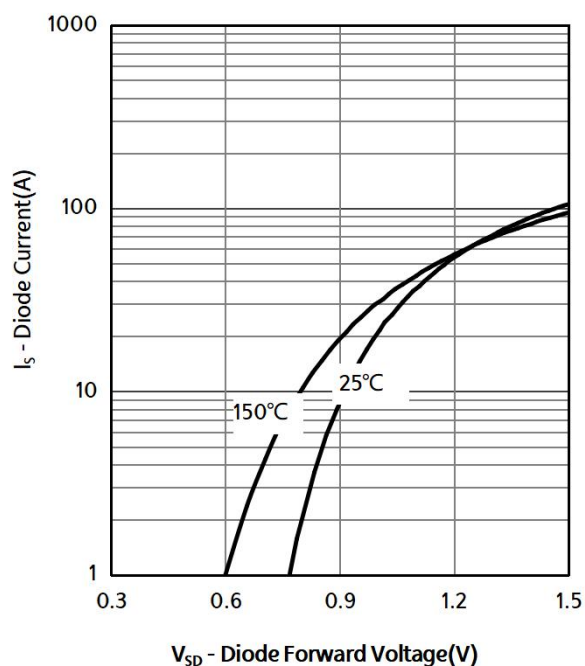
$$R_{DS(on)} = f(T_j); I_D = 2.7\text{A}; V_{GS} = 10\text{V}$$

Fig 7: BV_{DSS} vs. Temperature


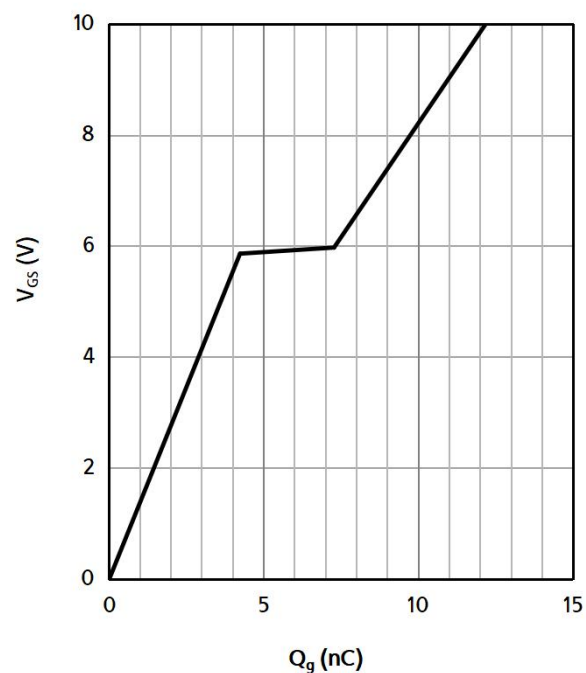
$$BV_{DSS} = f(T_j)$$

Fig 8: $R_{DS(on)}$ vs. Gate Voltage


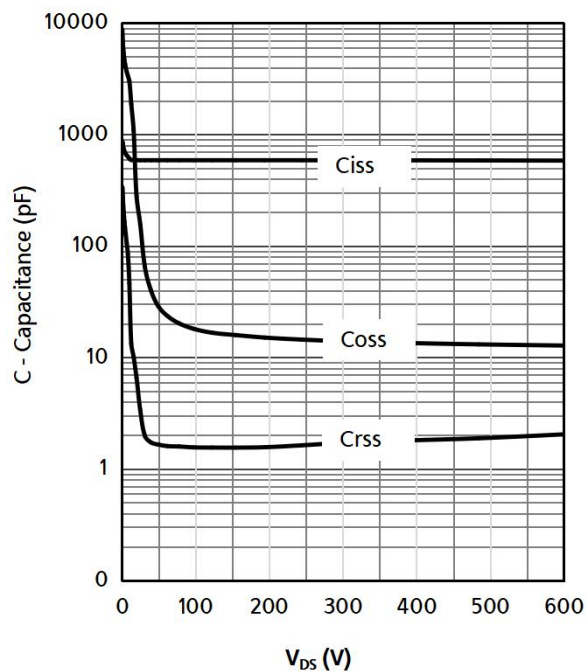
$$R_{DS(on)} = f(V_{GS}); I_D = 2.7\text{A}; \text{parameter: } T_j$$

Fig 9: Body-diode Forward Characteristics


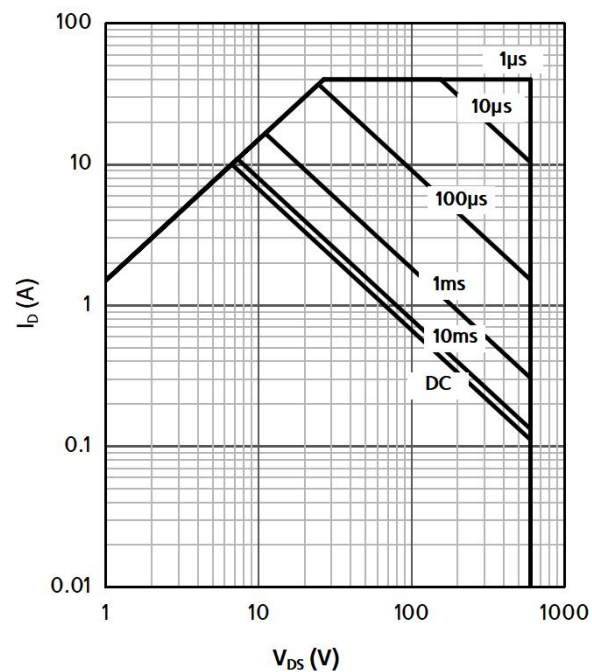
$$I_F = f(V_{SD}); \text{parameter: } T_j$$

Fig 10: Gate Charge Characteristics


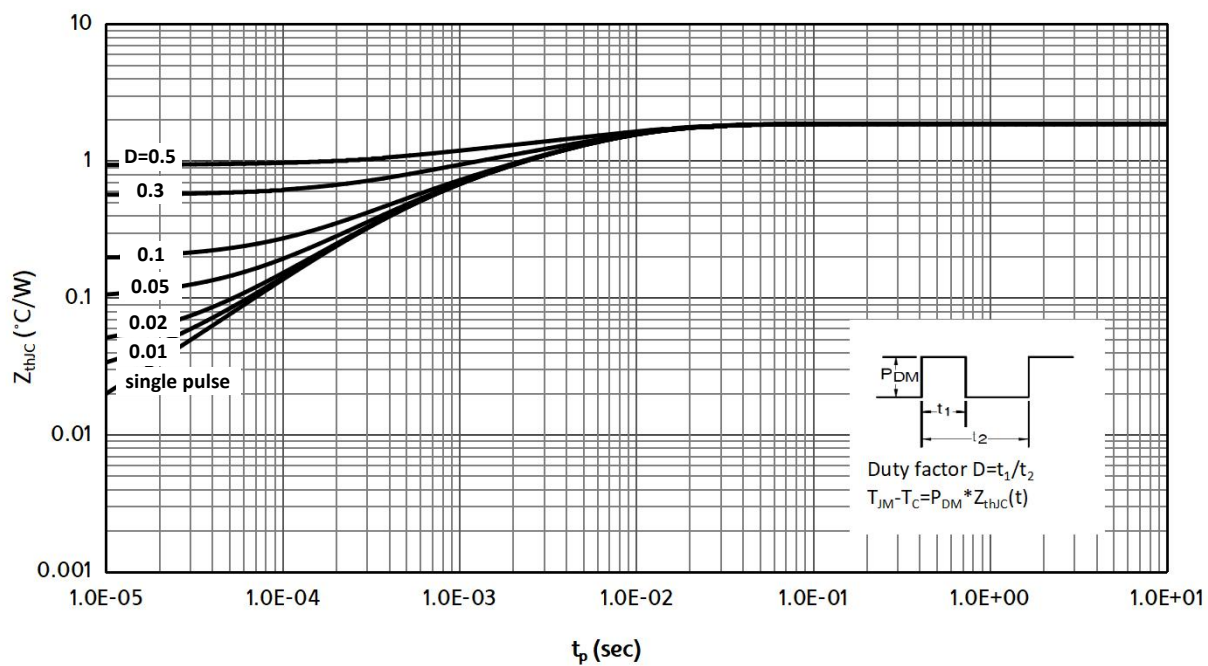
$$V_{GS} = f(Q_g); V_{DD} = 400V; I_D = 2.7A$$

Fig 11: Capacitance Characteristics


$$C = f(V_{DS}); V_{GS} = 0V; f = 250kHz$$

Fig 12: Safe Operating Area


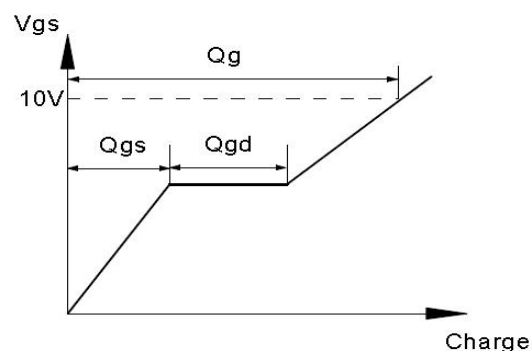
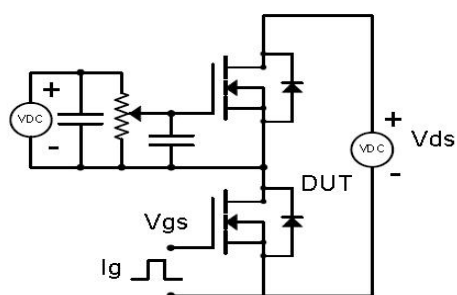
$$I_D = f(V_{DS}); T_C = 25^\circ C; D = 0; \text{parameter: } t_p$$

Fig 13: Max. Transient Thermal Impedance


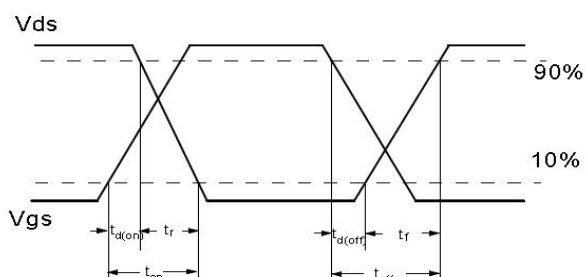
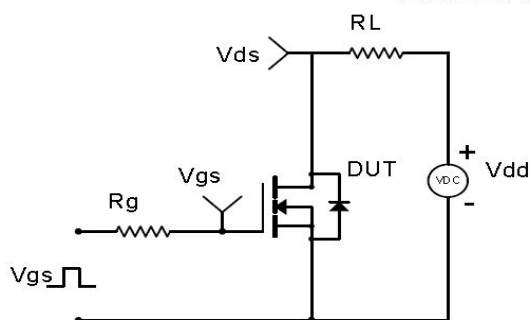
$$Z_{thJC}=f(t_p); \text{parameter: } D=t_1/t_2$$

Test Circuit & Waveform

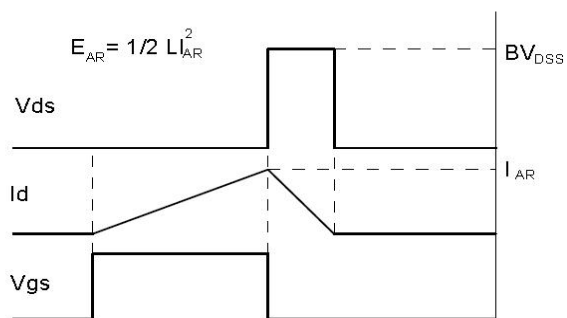
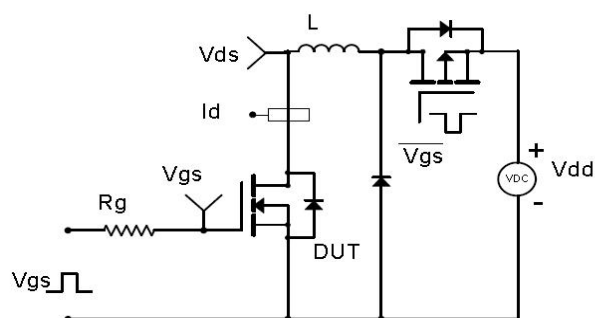
Gate Charge Test Circuit & Waveform



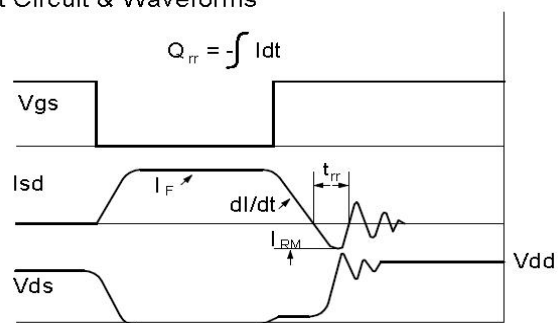
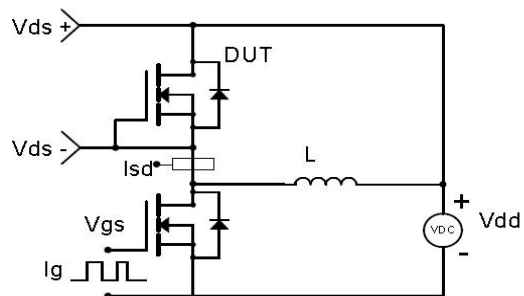
Resistive Switching Test Circuit & Waveforms

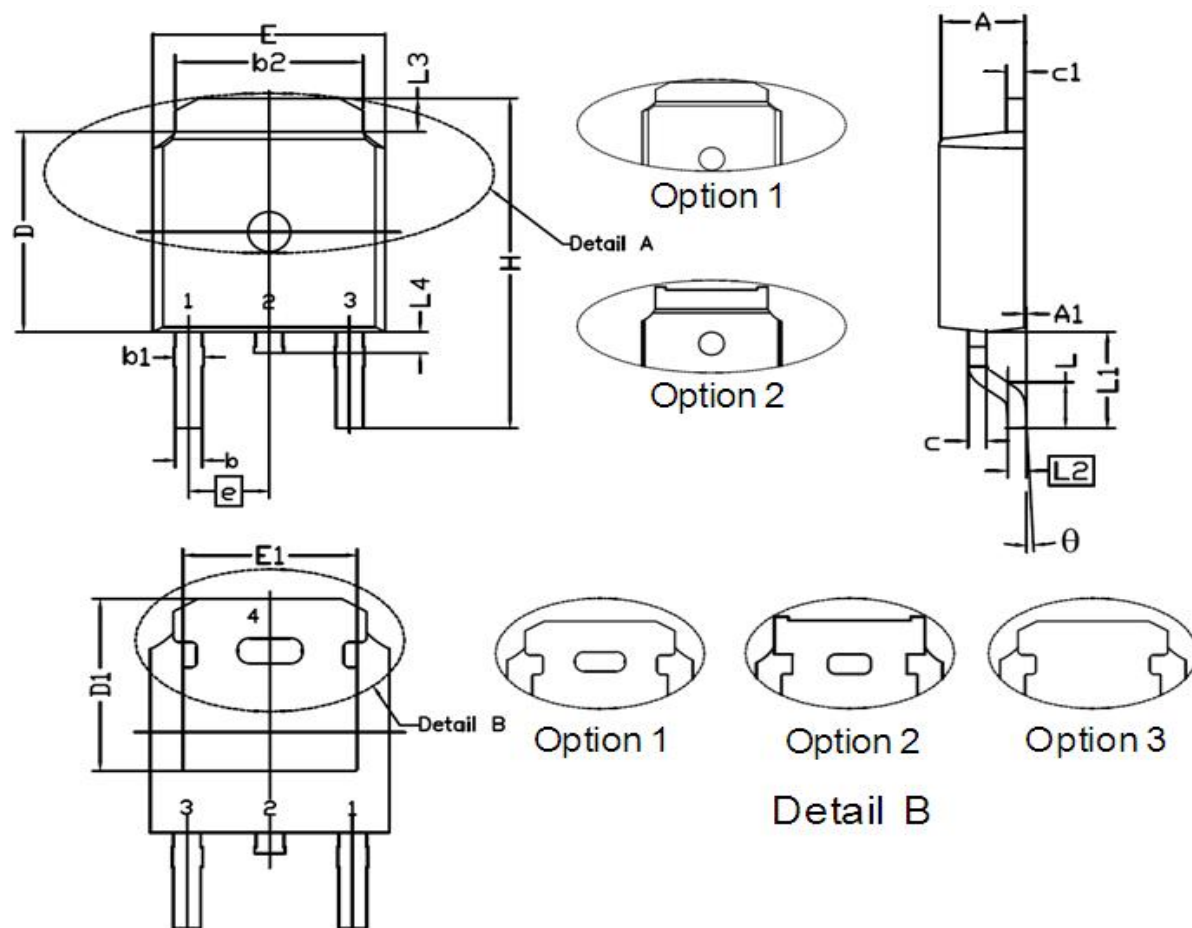


Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



Package Outline: TO-252


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.15	2.45	0.085	0.096
A1	0.00	0.15	0.000	0.006
b	0.60	0.91	0.024	0.036
b1	0.65	1.15	0.026	0.045
b2	5.00	5.64	0.197	0.222
c	0.45	0.61	0.018	0.024
c1	0.36	0.66	0.014	0.026
D	5.80	6.30	0.228	0.248
D1	5.21	--	0.205	--
e	2.29 BSC.		0.090 BSC.	
E	6.30	6.90	0.248	0.272
E1	4.40	--	0.173	--
H	9.40	10.48	0.370	0.413
L	1.38	1.78	0.054	0.070
L1	2.92 REF		0.115 REF	
L2	0.508 BSC.		0.020 BSC.	
L3	0.72	1.35	0.028	0.053
L4	0.60	1.20	0.024	0.047
θ	0°	10°	0°	10°

Marking**NOTE:**

NXBBAAAA-Y

N	—WB code (Usually omitted)
X	—Assembly location code
BB	—Fab code
AAAA	—Lot code
Y	—Bin code (Usually omitted)

Revision History

Revision	Major changes
1.0	First version
2.0	Final version

Disclaimer

Unless otherwise specified in the datasheet, the product is designed and qualified as a standard commercial product and is not intended for use in applications that require extraordinary levels of quality and reliability, such as automotive, aviation/aerospace and life-support devices or systems.

Any and all semiconductor products have certain probability to fail or malfunction, which may result in personal injury, death or property damage. Customers are solely responsible for providing adequate safety measures when designing their systems.

CRM(CQ) reserves the right to improve product design, function and reliability without notice.