

650V, 30A N-Channel MOSFET

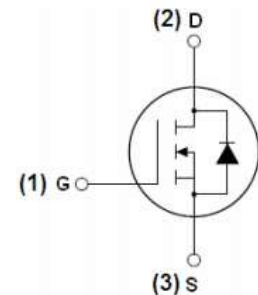
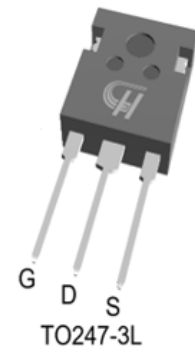
Features

- * $V_{DS} = 650V$, $I_D = 30A$
- * $R_{DS(ON)} = 250m\Omega$ (Typ.) @ $V_{GS} = 10V$
- * Low on-resistance and low C_{rss} (Typical 19pF)
- * Fast switching characteristics
- * Good stability and improved dv/dt capability
- * Low gate charge ($Q_g = 82nC$)
- * Lead free available (RoHS compliant)
- * TO247-3L package for good heat dissipation

Applications

- Power Management for Inverter Systems
- Switch Mode Power Supply
- Motor Drive

Pin Description and Schematic



N-Channel MOSFET

Package Marking And Ordering Information

Device	Marking ^[1]	Device Package	Quantity
HCR30N65GT247BP	HCR30N65G xx	TO247-3L	1800pcs, / Box

Note 1. "HCR30N65G" identifies the product; "xx" is the date code.

650V, 30A N-Channel MOSFET

Absolute Maximum Ratings

 $T_C = 25^{\circ}\text{C}$, unless otherwise noted

Parameter	Symbol	HCR30N65G	Unit
Drain-source voltage ($V_{GS} = 0\text{V}$)	V_{DS}	650	V
Gate-source voltage ($V_{DS} = 0\text{V}$), AC ($f > 1\text{Hz}$)	V_{GS}	± 30	V
Continuous drain current, $T_J = 25^{\circ}\text{C}$	I_D	30	A
Continuous drain current, $T_J = 100^{\circ}\text{C}$	$I_{D(100^{\circ}\text{C})}$	15	A
Pulsed drain current (Note 1)	I_{DM}	100	A
Maximum power dissipation	P_D	300	W
Derate above 25°C	P_D	2.4	W/ $^{\circ}\text{C}$
Single pulsed avalanche energy (Note 2)	E_{AS}	1125	mJ
Avalanche current (Note 2)	I_{AR}	15	A
Repetitive avalanche current (Note 2)	E_{AR}	18	mJ
Peak diode recovery dv/dt (Note 3)	dv/dt	5.0	V/ns
Maximum lead temperature for soldering	T_L	300	$^{\circ}\text{C}$
Operating junction and storage temperature range	T_J, T_{stg}	150, -55 to 150	$^{\circ}\text{C}$

Note 1. Pulse width is limited by maximum junction temperature.

Note 2. $L = 10\text{mH}$, $V_{DD} = 50\text{V}$, $R_G = 25\Omega$; starting $T_J = 25^{\circ}\text{C}$.

Note 3. $I_{SD} \leq 20\text{A}$, $di/dt \leq 100\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$; starting $T_J = 25^{\circ}\text{C}$.

Thermal Characteristics

Parameter	Symbol	HCR30N65G	Unit
Thermal resistance, junction to case (maximum)	$R_{\theta JC}$	0.42	$^{\circ}\text{C}/\text{W}$
Thermal resistance, junction to ambient (maximum)	$R_{\theta JA}$	40	$^{\circ}\text{C}/\text{W}$

650V, 30A N-Channel MOSFET
Electrical Characteristics
 $T_A = 25^\circ\text{C}$, unless otherwise noted

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
On/Off States						
Drain-source breakdown voltage	BV_{DSS}	$V_{GS} = 0V, I_D = 250\mu A$	650	-	-	V
Breakdown voltage temperature coefficient	$\Delta BV_{DSS}/\Delta T_J$	$I_D = 250\mu A$, referenced to 25°C	-	0.65	-	V/ $^\circ\text{C}$
Zero gate voltage drain current	I_{DSS}	$V_{DS} = 650V, V_{GS} = 0V$, $T_C = 25^\circ\text{C}$	-	-	10	μA
Zero gate voltage drain current	I_{DSS}	$V_{DS} = 520V, V_{GS} = 0V$, $T_C = 125^\circ\text{C}$	-	-	100	μA
Gate-body leakage current	I_{GSS}	$V_{DS} = 0V, V_{GS} = \pm 30V$	-	-	± 100	nA
Gate-threshold voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\mu A$	2.0	3.0	4.0	V
Drain-source on-resistance	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 15A$	-	250	300	m Ω
Forward transconductance	g_{fs}	$V_{DS} = 15V, I_D = 15A$	-	24	-	S

Dynamic Characteristics

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Gate resistance	R_g	$f = 1.0\text{MHz}, V_{DS}$ open	-	1.3	-	Ω
Input capacitance	C_{iss}	$V_{DS} = 25V, V_{GS} = 0V$, $f = 1\text{MHz}$	-	4611	-	pF
Output capacitance	C_{oss}		-	389	-	pF
Reverse transfer capacitance	C_{rss}		-	19	-	pF

Gate Charge Characteristics

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Total gate charge	Q_g	$V_{DS} = 400V, I_D = 30A$, $V_{GS} = 10V$ (Notes 4, 5)	-	82	-	nC
Gate-source charge	Q_{gs}		-	22	-	nC
Gate-drain charge	Q_{gd}		-	56	-	nC

Notes 4 and 5: see the following page.

650V, 30A N-Channel MOSFET
Electrical Characteristics (Continued)
 $T_A = 25^\circ\text{C}$, unless otherwise noted

Switching Characteristics

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Turn-on delay time	$t_{d(on)}$	$V_{DS} = 300\text{V}$, $I_D = 30\text{A}$, $R_G = 20\Omega$, $V_{GS} = 10\text{V}$ (Notes 4, 5)	-	43	-	ns
Rise time	t_r		-	82	-	ns
Turn-off delay time	$t_{d(off)}$		-	116	-	ns
Fall time	t_f		-	87	-	ns

Drain-Source Diode Characteristics

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Source-drain current (body diode)	I_{SD}	$T_C = 25^\circ\text{C}$	-	-	30	A
Pulsed source-drain current (body diode)	I_{SDM}		-	-	100	A
Forward on voltage	V_{SD}	$T_J = 25^\circ\text{C}$, $V_{GS} = 0\text{V}$, $I_{SD} = 30\text{A}$	-	-	1.2	V
Reverse recovery time	t_{rr}	$V_{GS} = 0\text{V}$, $I_S = 30\text{A}$, $di/dt = 100\text{A}/\mu\text{s}$ (Note 4)	-	591	-	ns
Reverse recovery charge	Q_{rr}		-	8.36	-	μC

Note 4. Pulse test: pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$.

Note 5. Essentially independent of operating temperature.

650V, 30A N-Channel MOSFET

Typical Characteristics

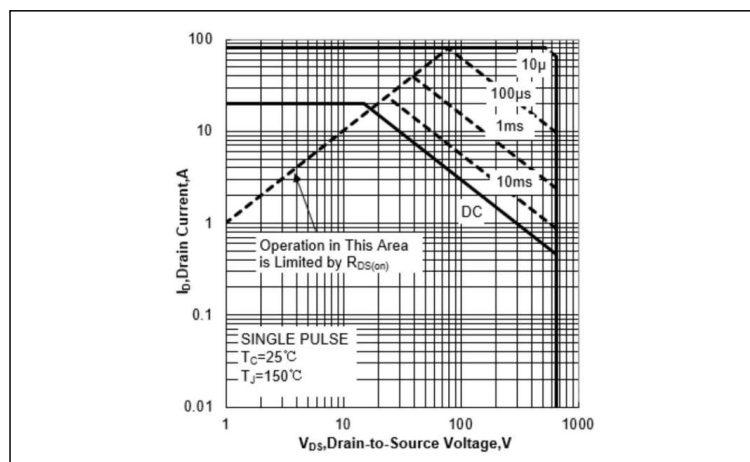


Figure 1. Safe Operating Area

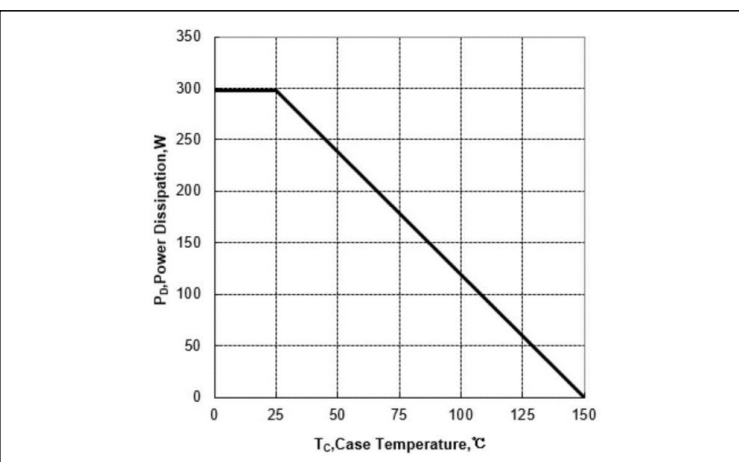


Figure 2. Power Dissipation

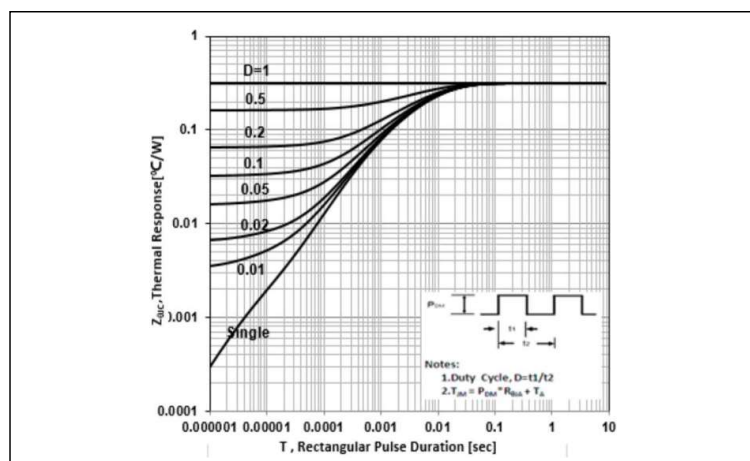


Figure 3. Maximum Thermal Impedance

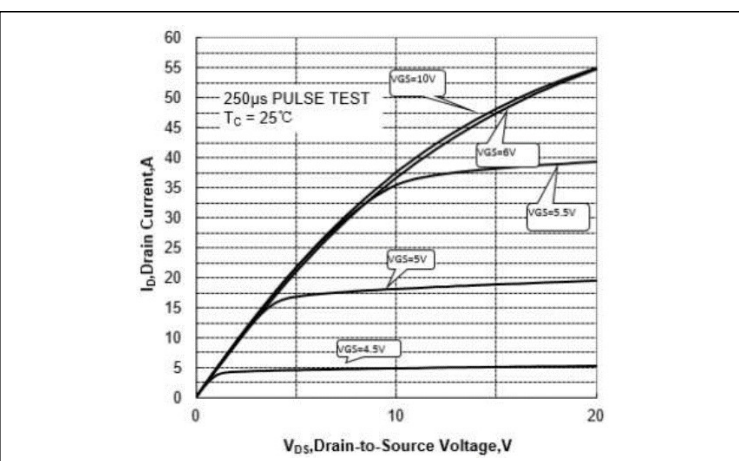


Figure 4. Typical Output Characteristics

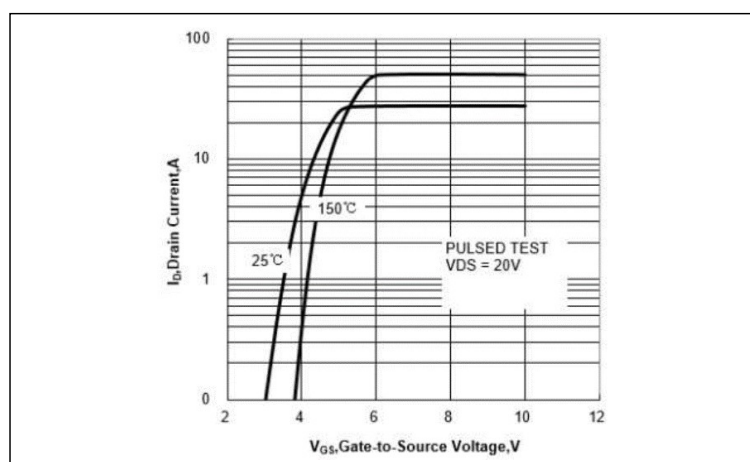


Figure 5. Typical Transfer Characteristics

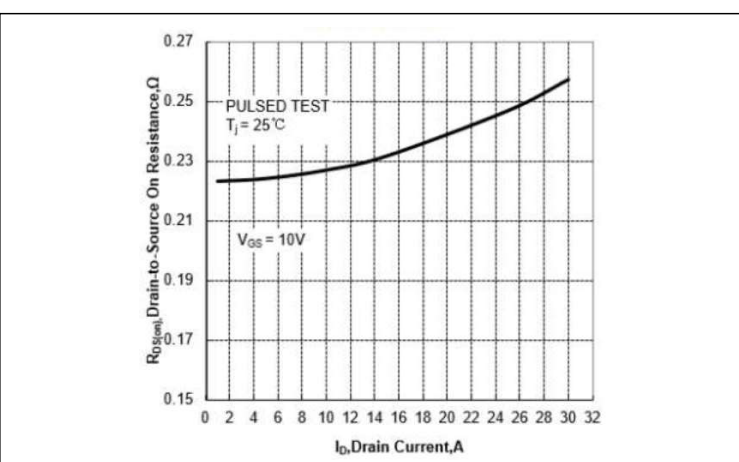


Figure 6. Typical Drain-to-Source On-Resistance vs. Drain Current

Typical Characteristics (Continued)

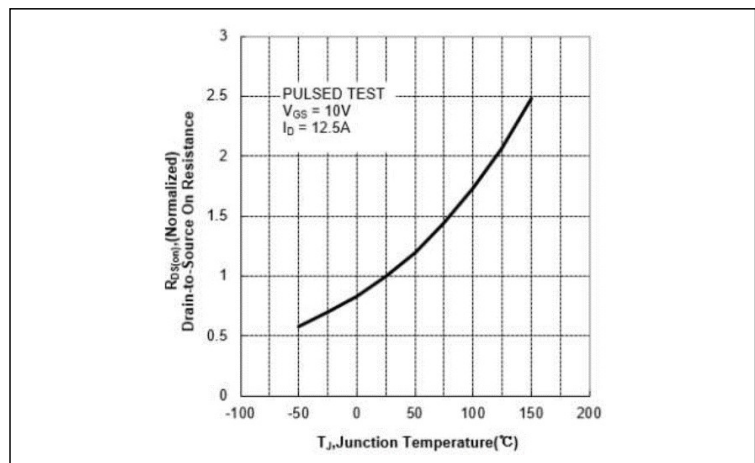


Figure 7. Typical Drain-to-Source On-Resistance vs. Junction Temperature

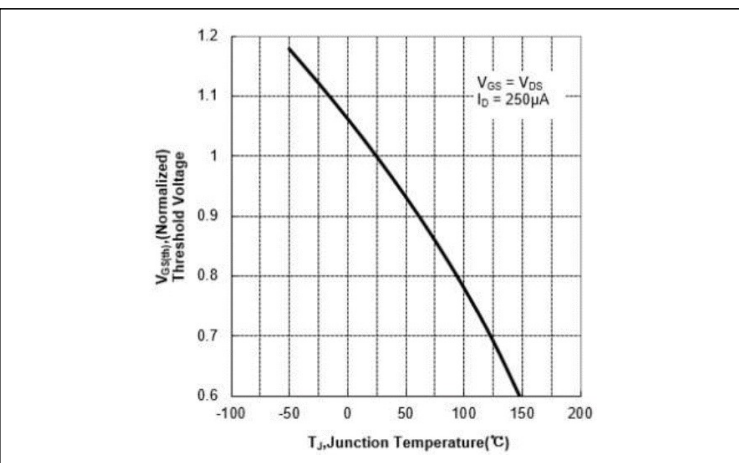


Figure 8. Typical Threshold Voltage vs. Junction Temperature

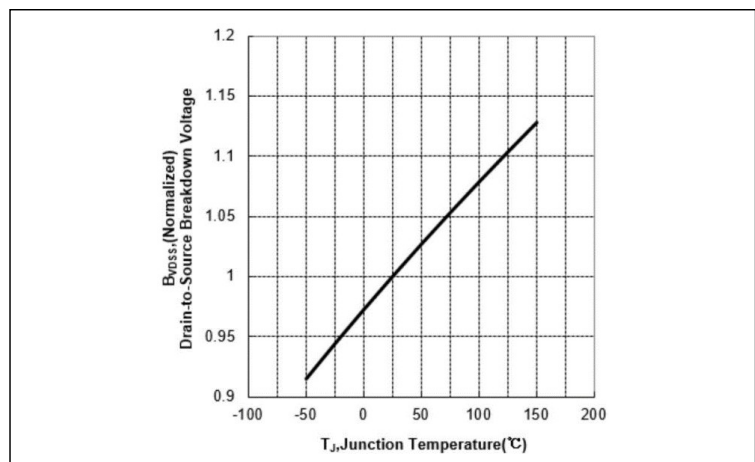


Figure 9. Typical Breakdown Voltage vs. Junction Temperature

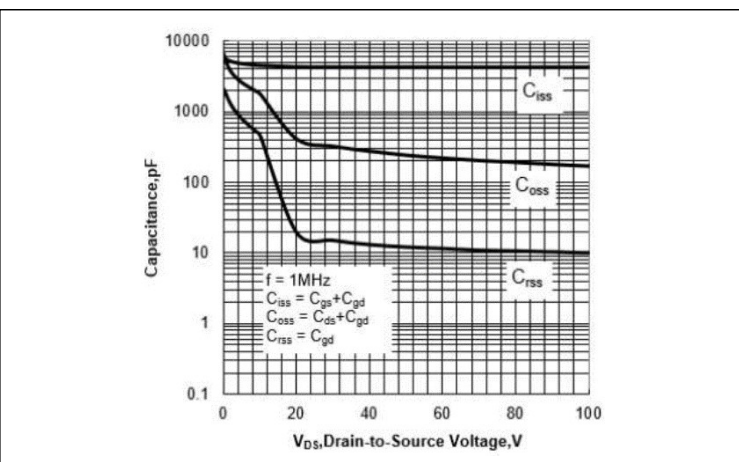


Figure 10. Typical Capacitance vs. Drain-to-Source Voltage

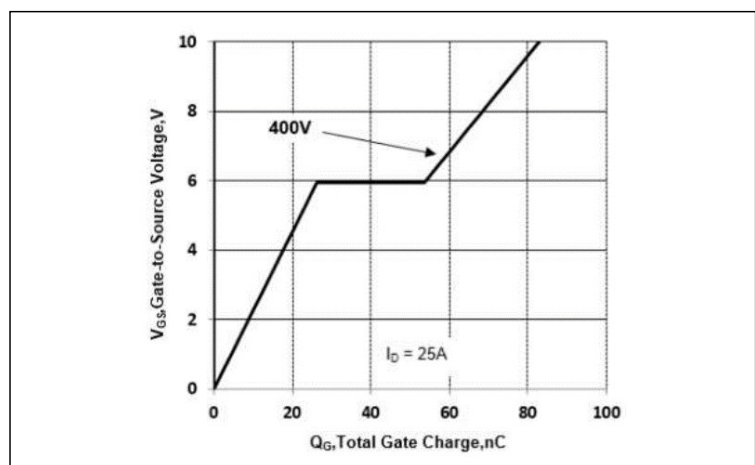


Figure 11. Typical Gate Charge vs. Gate-to-Source Voltage

Test Circuits and Waveforms

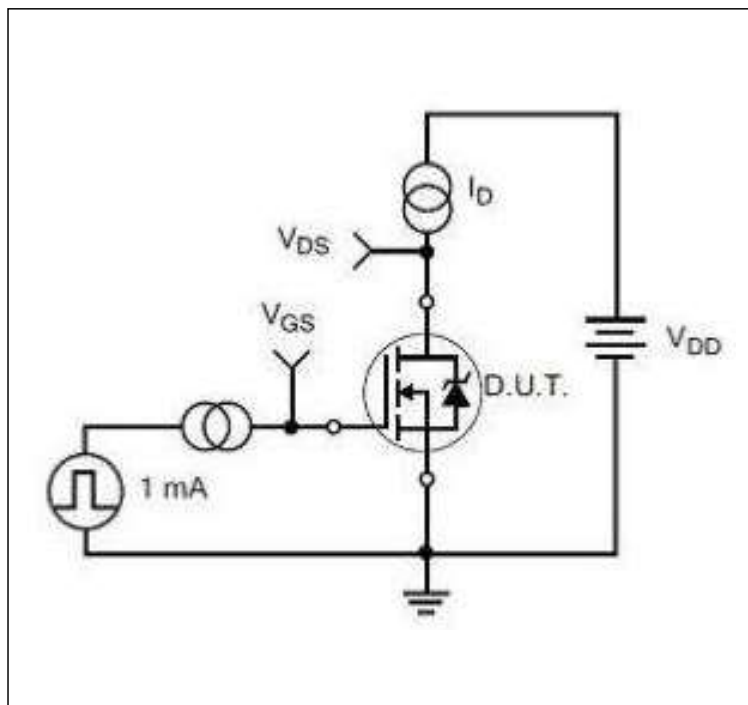


Figure 12. Gate Charge Test Circuit

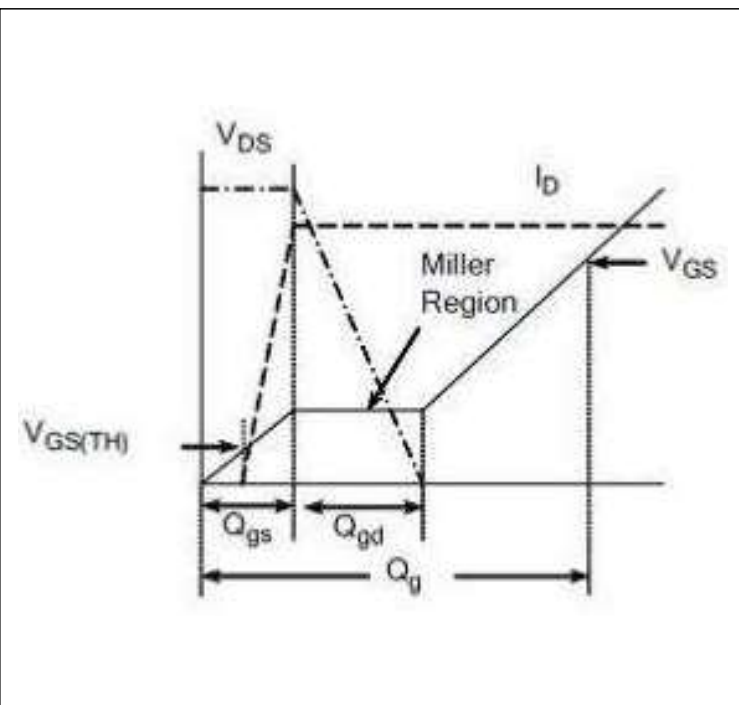


Figure 13. Gate Charge Waveforms

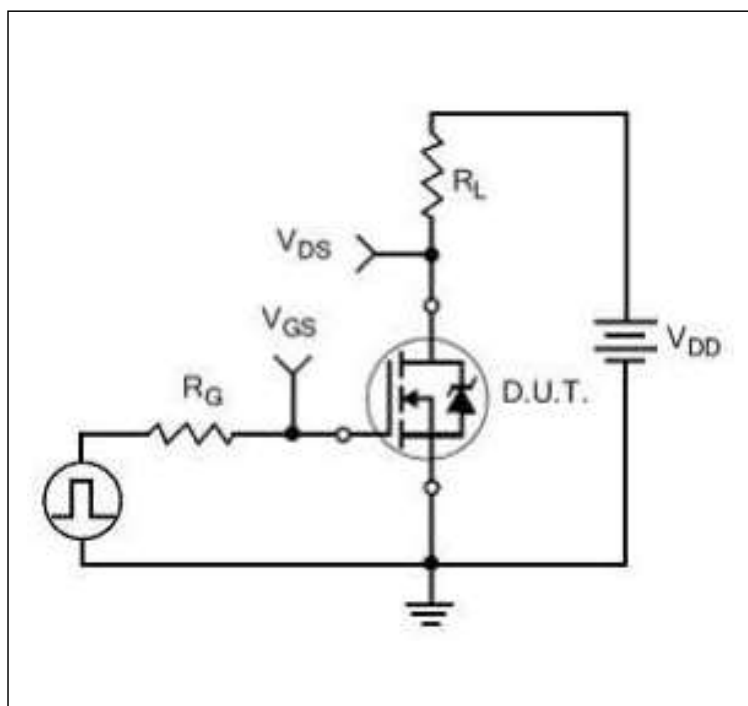


Figure 14. Resistive Switching Test Circuit

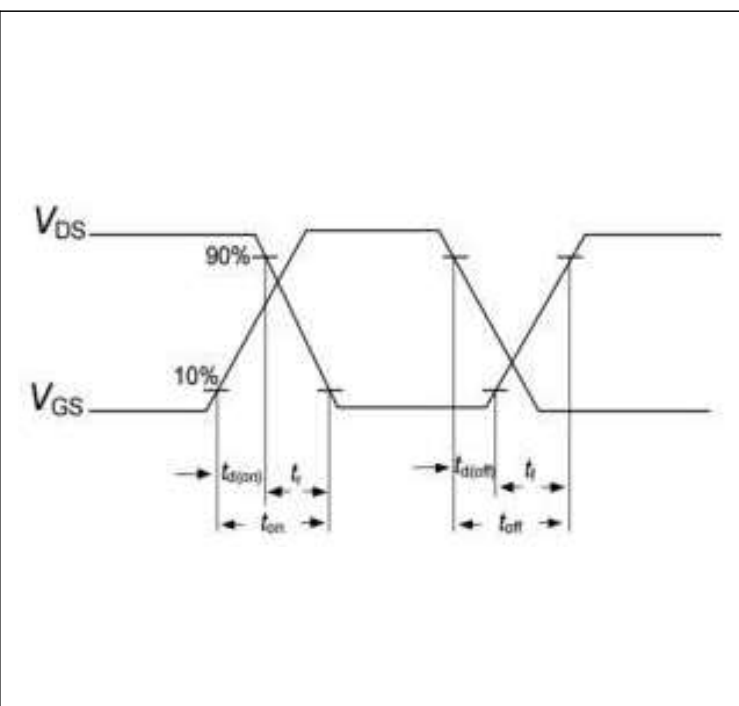


Figure 15. Resistive Switching Waveforms

Test Circuits and Waveforms

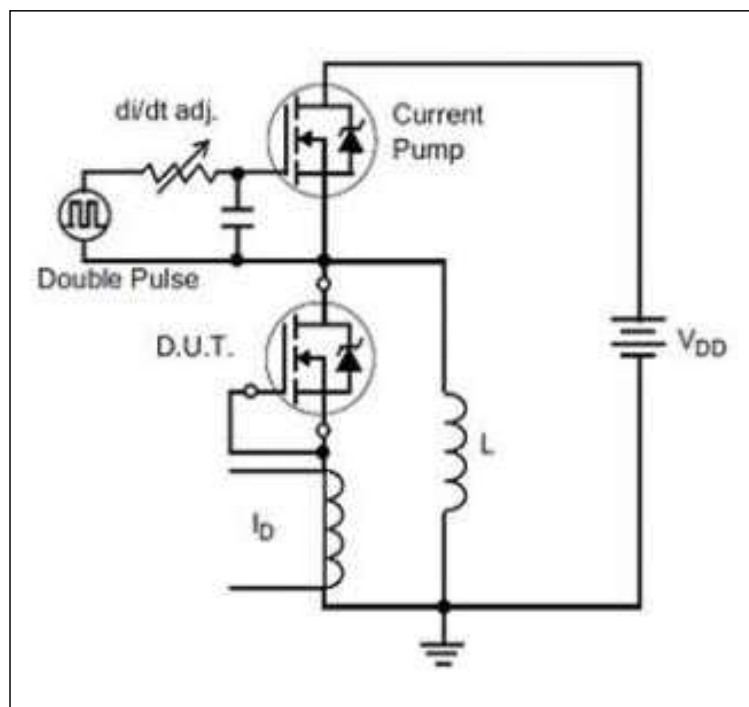


Figure 16. Diode Reverse Recovery Test Circuit

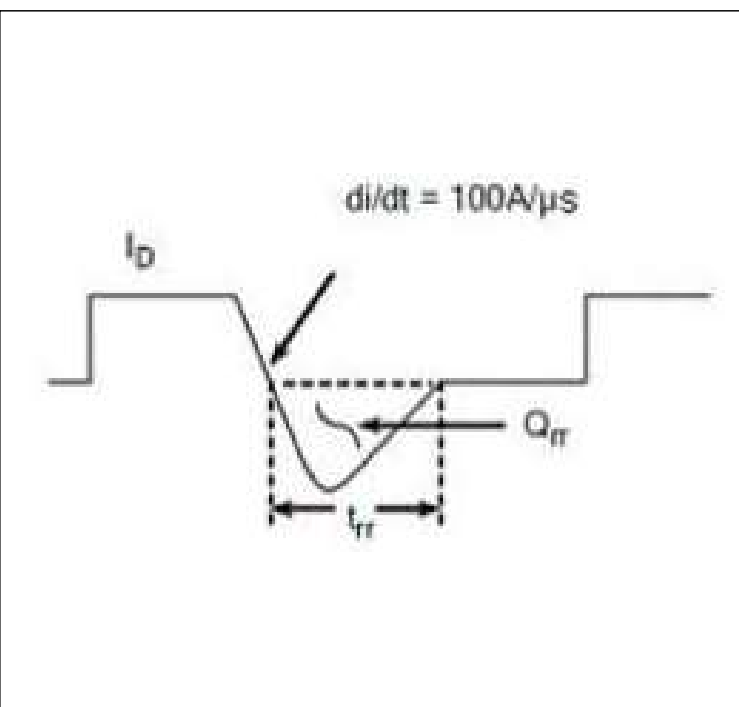


Figure 17. Diode Reverse Recovery Waveform

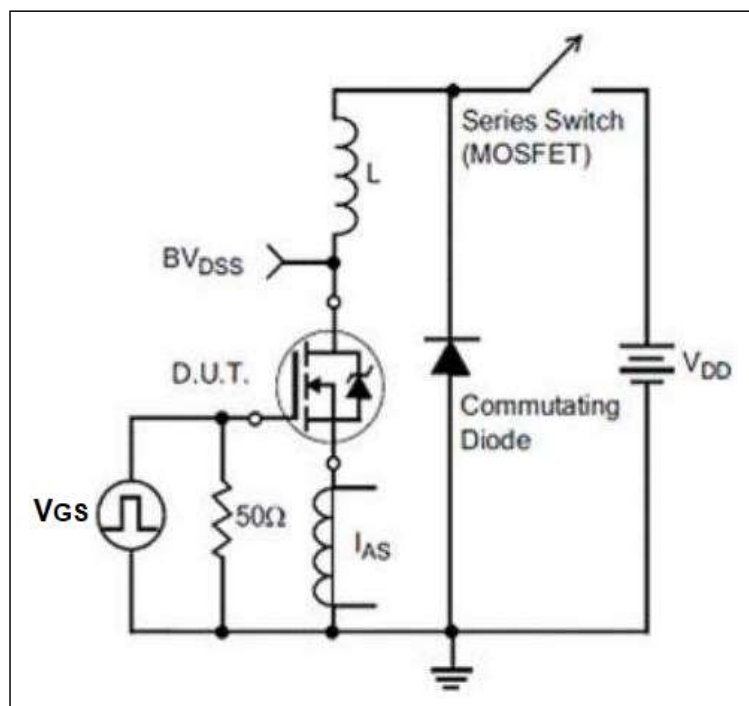


Figure 18. Unclamped Inductive Switching Test Circuit

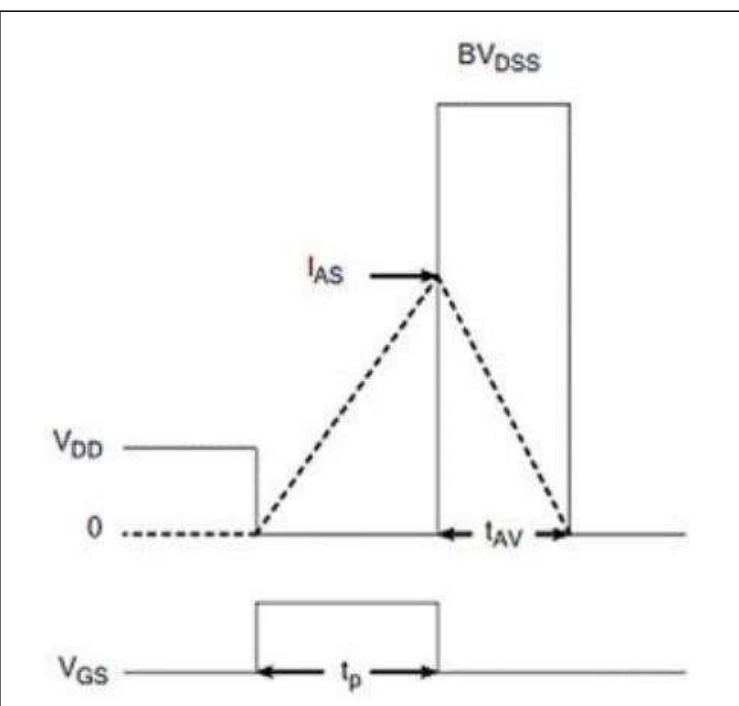
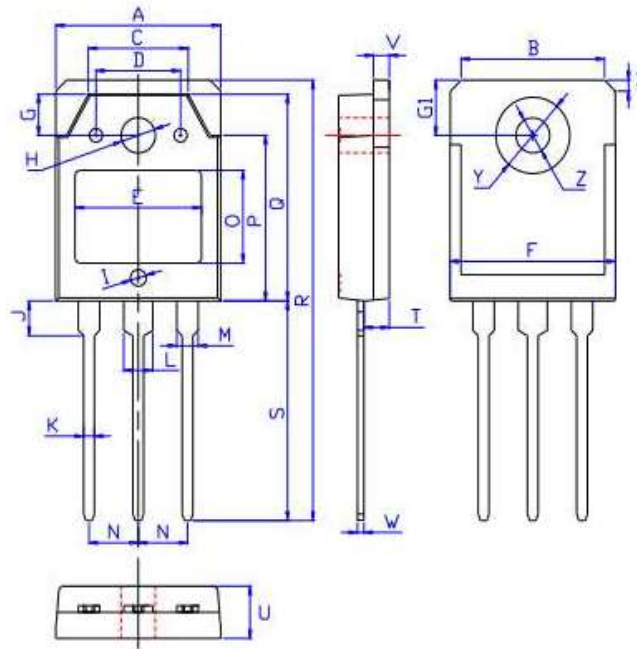


Figure 19. Unclamped Inductive Switching Waveform

Package Dimensions

HCR30N65G - TO247-3L Package

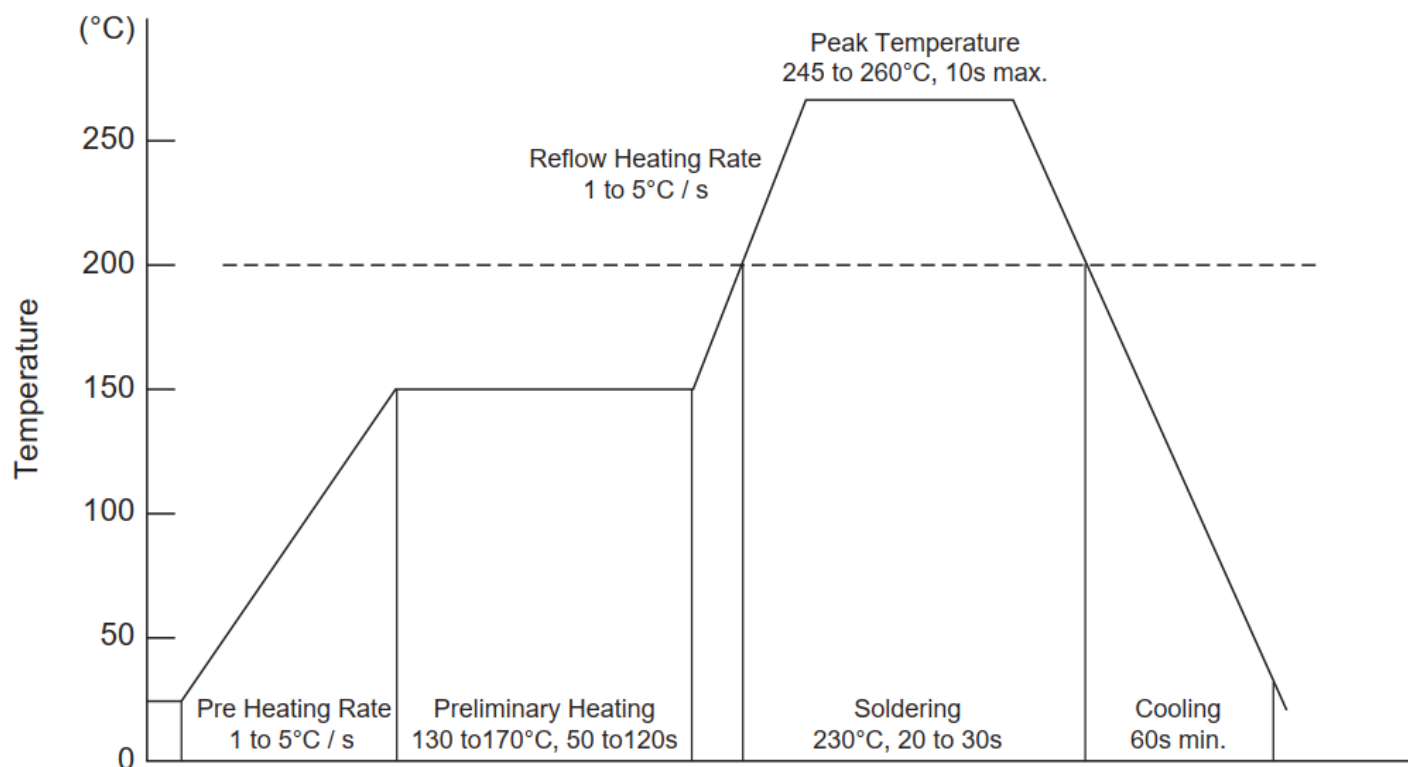


Symbol	Dimensions (mm)	Symbol	Dimensions (mm)
A	15.60±0.30	N	5.45±0.30
B	13.60±0.30	O	8.40±0.30
C	9.50±0.30	P	13.90±0.30
D	8.00±0.30	Q	18.70±0.30
E	11.85±0.30	R	40.00±0.60
F	15.65±0.30	S	20.00±0.40
G	3.80±0.30	T	2.40±0.30
G1	5.00±0.30	U	4.80±0.30
H	Φ3.50±0.30	V	1.50±0.15
I	Φ1.50±0.30 Depth 0.15±0.15	W	0.60±0.15
J	3.20±0.30	X	1.80±0.40
K	1.00±0.15	Y	7.00±0.30
L	3.10±0.15	Z	3.20±0.30
M	2.10±0.15		-

650V, 30A N-Channel MOSFET

Conditions of Soldering and Storage

Recommended condition of reflow soldering



Recommended peak temperature is over 245°C. If peak temperature is below 245°C, you may adjust the following parameters:

- Time length of peak temperature (longer)
- Time length of soldering (longer)
- Thickness of solder paste (thicker)

Conditions of hand soldering

- Temperature: 300°C
- Time: 3s max
- Times: one time

Storage conditions

- Temperature: 5 to 40°C
- Humidity: 30 to 80% RH
- Recommended period: One year after manufacturing