

# HCA60R150T

## 600V N-Channel Super Junction MOSFET

### Features

- Very Low FOM ( $R_{DS(on)} \times Q_g$ )
- Extremely low switching loss
- Excellent stability and uniformity
- 100% Avalanche Tested

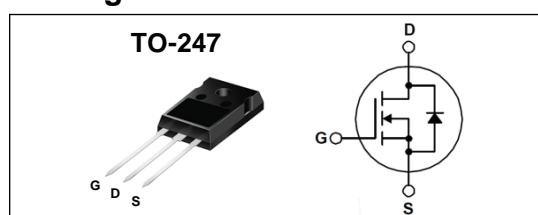
### Application

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)
- TV power & LED Lighting Power

### Key Parameters

Parameter	Value	Unit
$BV_{DSS} @ T_{j,max}$	650	V
$I_D$	22	A
$R_{DS(on), max}$	0.15	$\Omega$
$Q_g, Typ$	41	nC

### Package & Internal Circuit



### Absolute Maximum Ratings $T_C=25^\circ\text{C}$ unless otherwise specified

Symbol	Parameter	Value	Units
$V_{DSS}$	Drain-Source Voltage	600	V
$V_{GS}$	Gate-Source Voltage	$\pm 30$	V
$I_D$	Drain Current – Continuous ( $T_C = 25^\circ\text{C}$ )	22.0	A
	Drain Current – Continuous ( $T_C = 100^\circ\text{C}$ )	13.9	A
$I_{DM}$	Drain Current – Pulsed (Note 1)	60.0	A
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	650	mJ
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ )	192	W
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$
$T_L$	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	260	$^\circ\text{C}$

### Thermal Resistance Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	--	0.65	$^\circ\text{C/W}$
$R_{\theta JA}$	Junction-to-Ambient	--	40	

**Electrical Characteristics**  $T_J=25^\circ\text{C}$  unless otherwise specified

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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**On Characteristics**

$V_{GS}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250 \mu\text{A}$	2.0	--	4.0	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS} = 10 \text{ V}, I_D = 11 \text{ A}$	--	0.13	0.15	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 10, I_D = 11 \text{ A}$	--	18.8	--	S

**Off Characteristics**

$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$	600	--	--	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 600 \text{ V}, V_{GS} = 0 \text{ V}$	--	--	10	$\mu\text{A}$
		$V_{DS} = 480 \text{ V}, T_J = 125^\circ\text{C}$	--	--	100	$\mu\text{A}$
$I_{GSS}$	Gate-Body Leakage Current	$V_{GS} = \pm 30 \text{ V}, V_{DS} = 0 \text{ V}$	--	--	$\pm 100$	nA

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 50 \text{ V}, V_{GS} = 0 \text{ V}, f = 1.0 \text{ MHz}$	--	1600	2100	pF
$C_{oss}$	Output Capacitance		--	225	295	pF
$C_{riss}$	Reverse Transfer Capacitance		--	14	18.5	pF

**Switching Characteristics**

$t_{d(on)}$	Turn-On Time	$V_{DS} = 300 \text{ V}, I_D = 22 \text{ A}, R_G = 25 \Omega$	--	48	104	ns
$t_r$	Turn-On Rise Time		--	108	220	ns
$t_{d(off)}$	Turn-Off Delay Time		--	176	360	ns
$t_f$	Turn-Off Fall Time		--	50	108	ns
$Q_g$	Total Gate Charge	$V_{DS} = 480 \text{ V}, I_D = 22 \text{ A}, V_{GS} = 10 \text{ V}$	--	41	53	nC
$Q_{gs}$	Gate-Source Charge		--	8	--	nC
$Q_{gd}$	Gate-Drain Charge		--	15	--	nC

**Source-Drain Diode Maximum Ratings and Characteristics**

$I_S$	Continuous Source-Drain Diode Forward Current	--	--	22	A	
$I_{SM}$	Pulsed Source-Drain Diode Forward Current	--	--	60		
$V_{SD}$	Source-Drain Diode Forward Voltage	$I_S = 22 \text{ A}, V_{GS} = 0 \text{ V}$	--	--	1.2	V
$t_{rr}$	Reverse Recovery Time	$I_S = 22 \text{ A}, V_{GS} = 0 \text{ V}, di_F/dt = 100 \text{ A}/\mu\text{s}$	--	440	--	ns
$Q_{rr}$	Reverse Recovery Charge		--	5	--	$\mu\text{C}$

**Notes ;**

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $I_{AS}=6\text{A}, V_{DD}=50\text{V}, R_G=25\Omega$ , Starting  $T_J=25^\circ\text{C}$
3. Pulse Test : Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$

Typical Characteristics

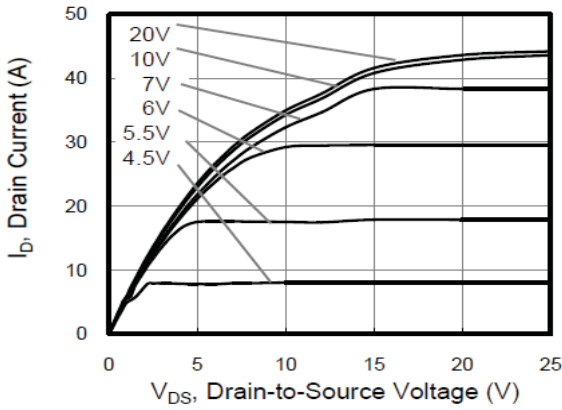


Figure 1. On Region Characteristics

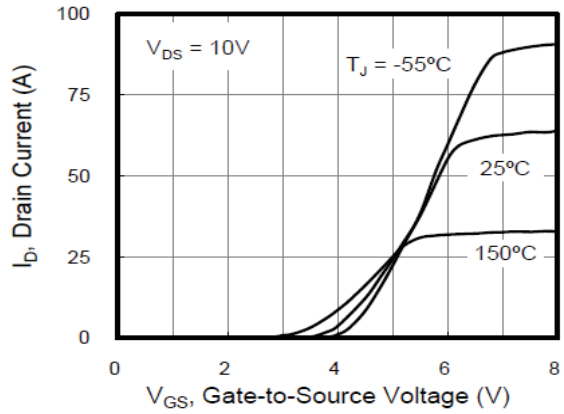


Figure 2. Transfer Characteristics

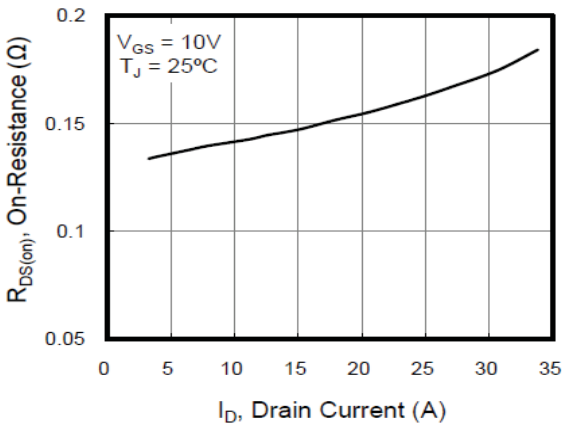


Figure 3. On Resistance Variation vs Drain Current and Gate Voltage

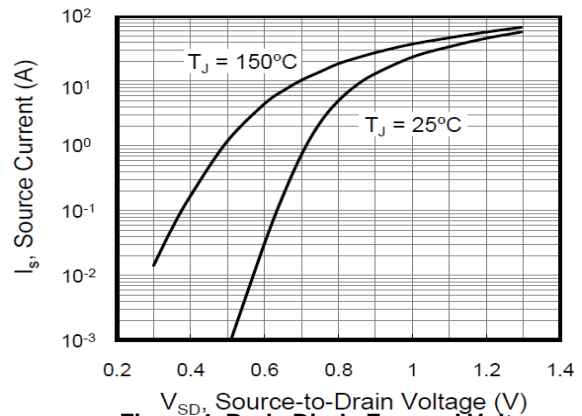


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

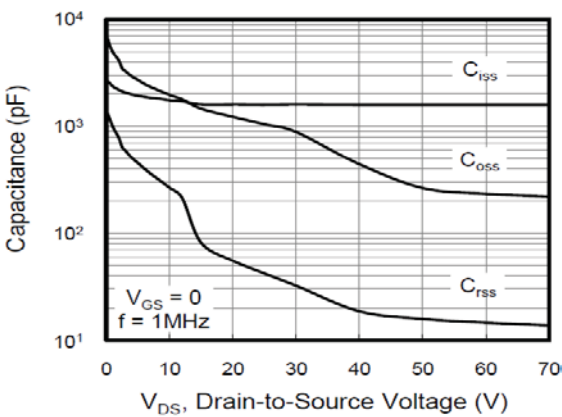


Figure 5. Capacitance Characteristics

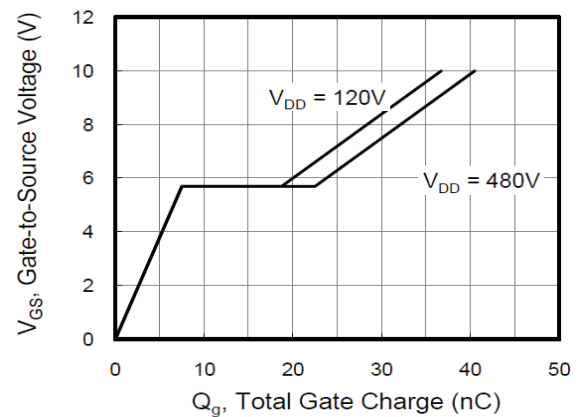


Figure 6. Gate Charge Characteristics

Typical Characteristics (continued)

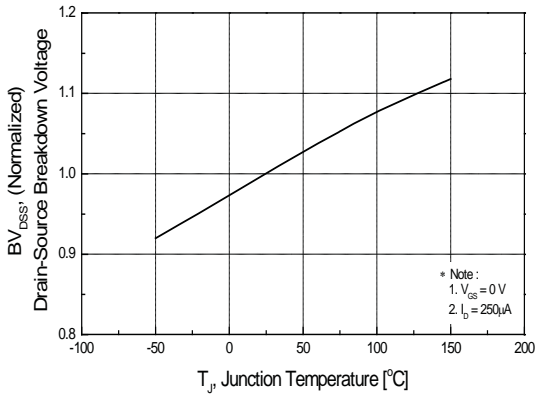


Figure 7. Breakdown Voltage Variation vs Temperature

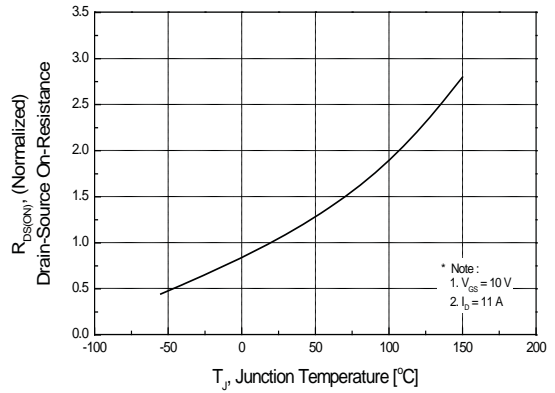


Figure 8. On-Resistance Variation vs Temperature

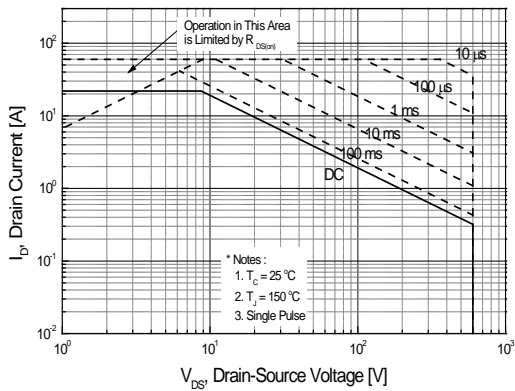


Figure 9. Maximum Safe Operating Area

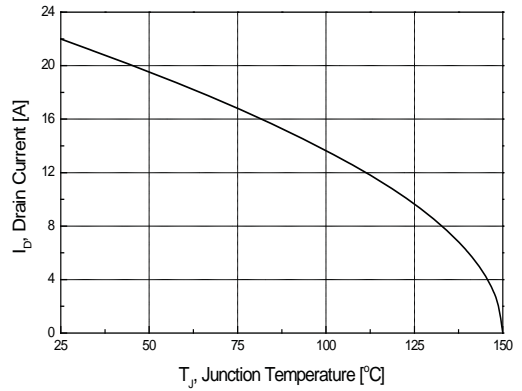


Figure 10. Maximum Drain Current vs Case Temperature

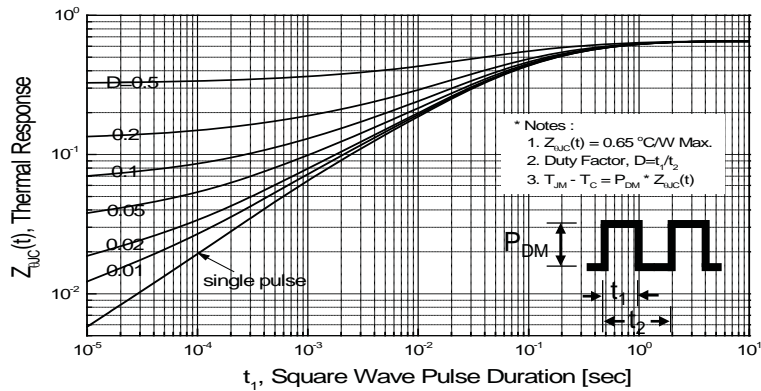
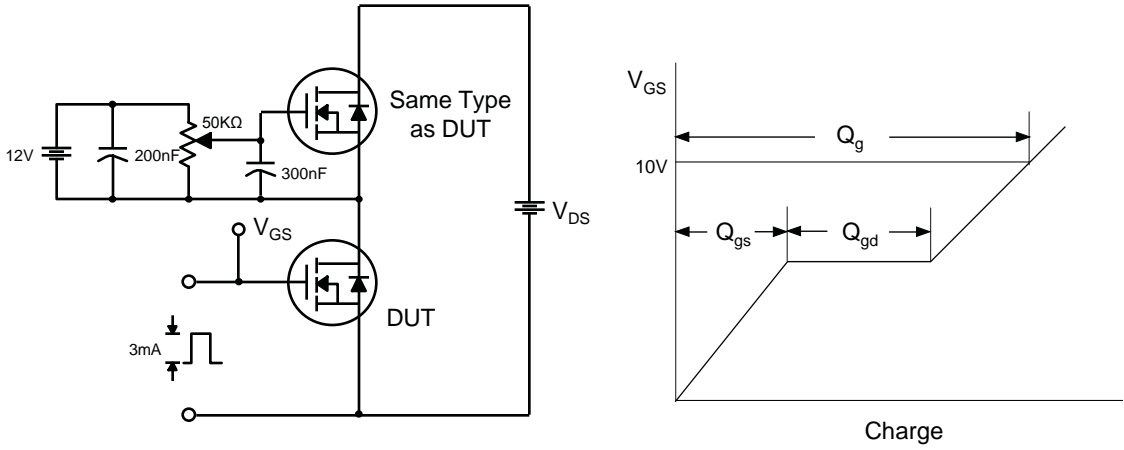
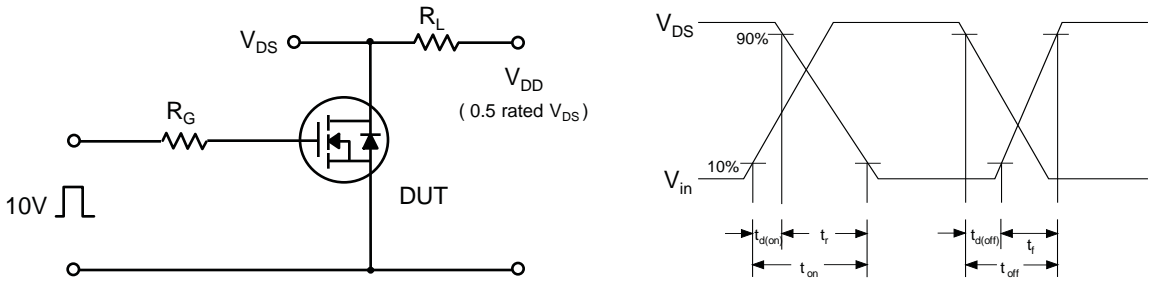


Figure 11. Transient Thermal Response Curve

**Fig 12. Gate Charge Test Circuit & Waveform**



**Fig 13. Resistive Switching Test Circuit & Waveforms**



**Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms**

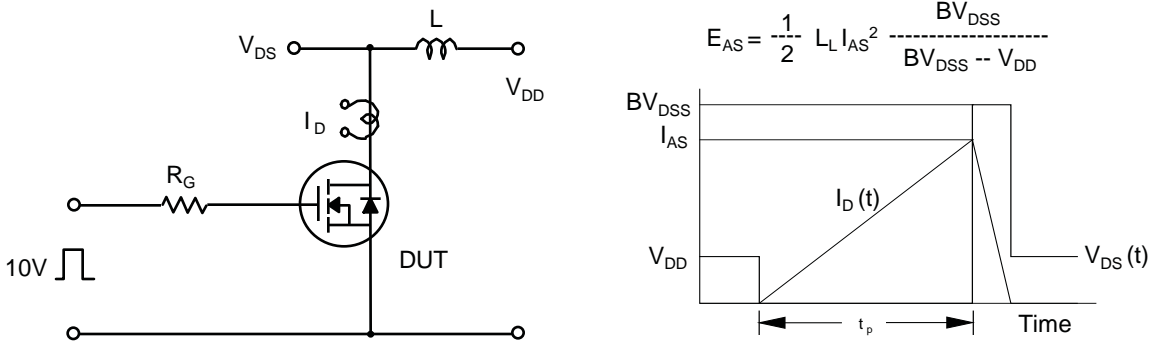
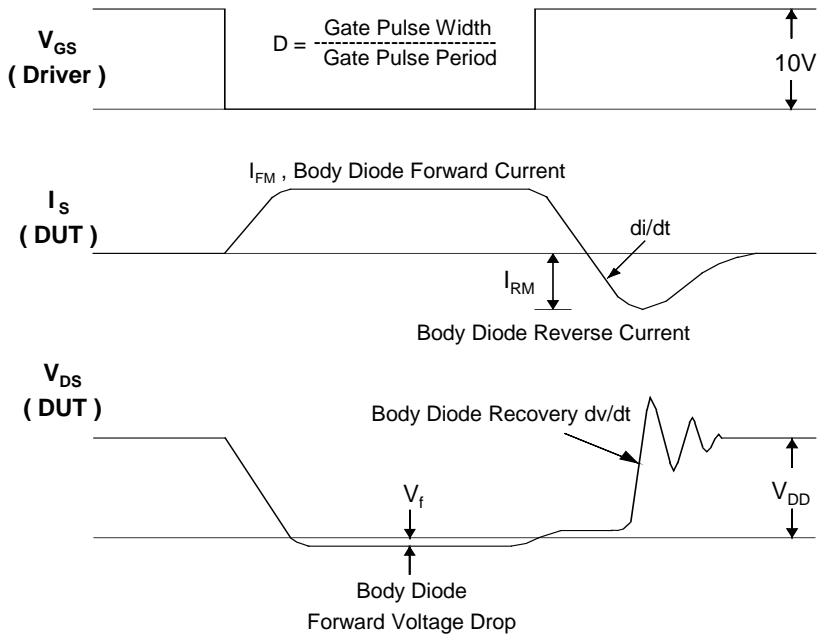
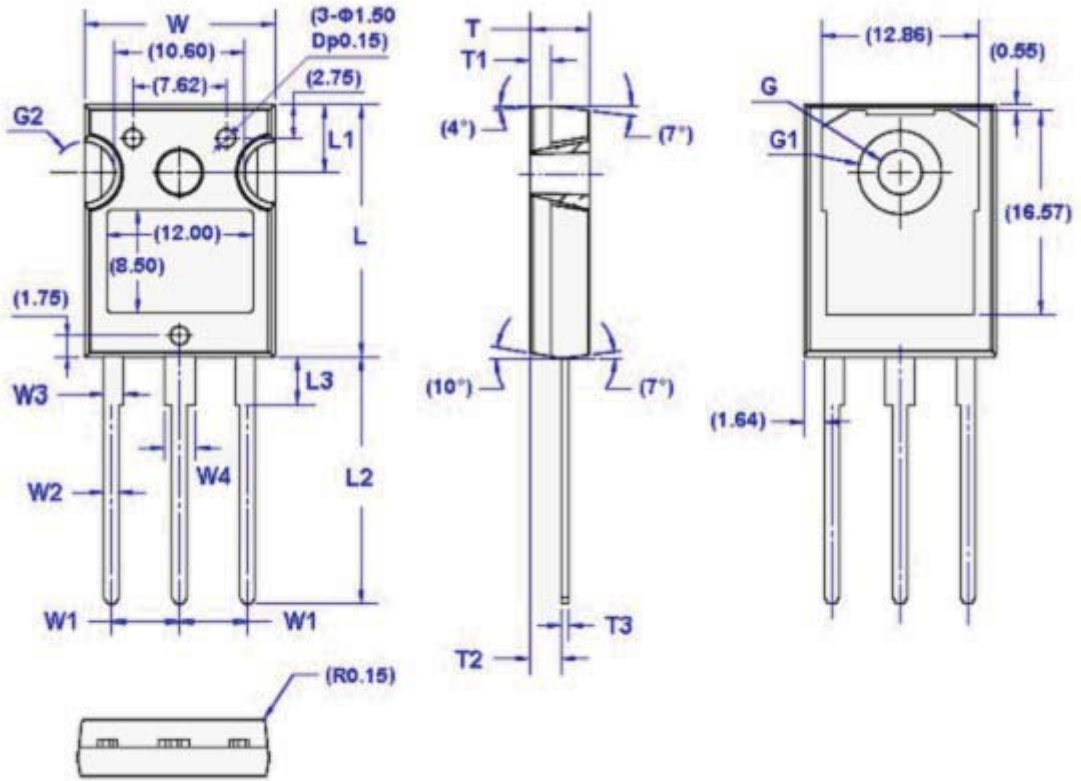


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



Package Dimension

TO-247



( Unit : mm )

Symbol	Size		Symbol	Size	
	Min	Max		Min	Max
W	15.4	15.8	W4	2.44	2.64
W1	5.56 (TYP)		L	20.4	20.8
W2	1.17	1.35	L1	5.36	5.56
W3	1.55	1.75	L2	19.8	20.2
L3	3.69	3.93	T3	0.51	0.69
T	4.6	4.8	G(Φ)	3.51	3.65
T1	1.4	1.6	G1(Φ)	6.61	6.85
T2	2.3	2.5	G2(Φ)	4.96	5.2