

# 650V, 15A, 156mΩ N-channel Power Super Junction MOSFET

## JMH65R190PCFD

### Features

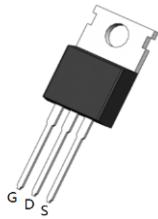
- Excellent  $R_{DS(ON)}$  and Low Gate Charge
- 100% UIS Tested
- 100%  $\Delta V_{ds}$  Tested
- Halogen-free; RoHS-compliant

### Applications

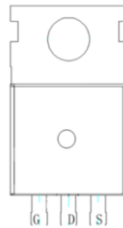
- SMPS with PFC
- Flyback and LLC topologies
- Silver ATX, adapter, TV, lighting, Telecom

### Product Summary

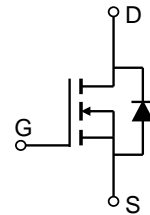
Parameters	Value	Unit
$V_{DSS}$	650	V
$V_{GS(th\_Typ)}$	3.4	V
$I_D(@V_{GS}=10V)$	15	A
$R_{DS(ON)\_Typ}(@V_{GS}=10V)$	156	mΩ



TO-220-3L Top View



Pin Assignment



Schematic Diagram

### Ordering Information

Device	Marking	MSL	Form	Package	Tube(pcs)	Per Carton (pcs)
JMH65R190PCFD-U	H65R190PF	N/A	Tube	TO-220-3L	50	5000

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

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-to-Source Voltage	650	V
$V_{GS}$	Gate-to-Source Voltage	$\pm 30$	V
$I_D$	Continuous Drain Current	$T_C = 25^\circ\text{C}$	15
		$T_C = 100^\circ\text{C}$	10
$I_{DM}$	Pulsed Drain Current <sup>(1)</sup>	Refer to Fig.4	A
$E_{AS}$	Single Pulsed Avalanche Energy <sup>(2)</sup>	65	mJ
$P_D$	Power Dissipation	$T_C = 25^\circ\text{C}$	114
		$T_C = 100^\circ\text{C}$	45
$T_J, T_{STG}$	Junction & Storage Temperature Range	-55 to 150	$^\circ\text{C}$

### Thermal Characteristics

Symbol	Parameter	Max	Unit
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient <sup>(3)</sup>	68	$^\circ\text{C}/\text{W}$
$R_{\theta JC}$	Thermal Resistance, Junction to Case	1.1	

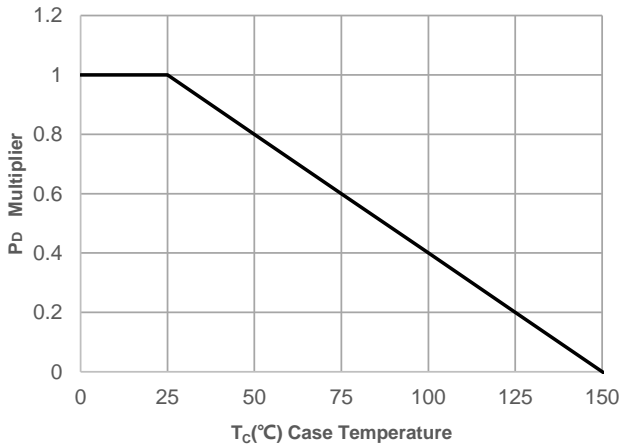
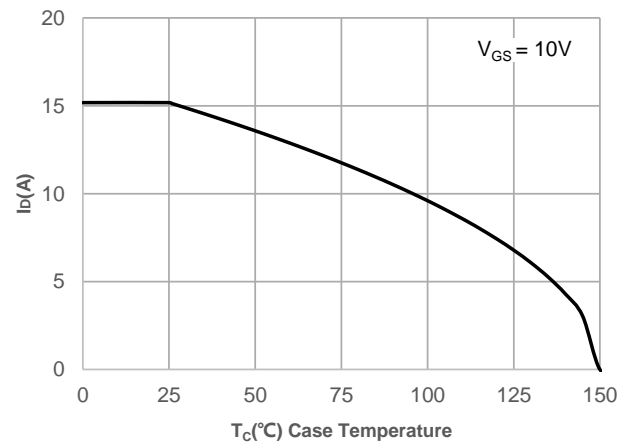
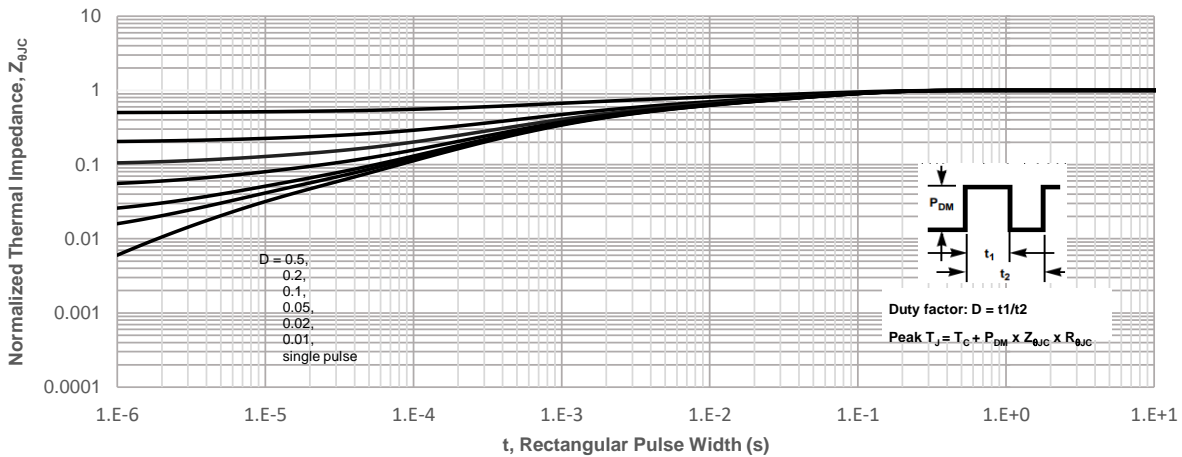
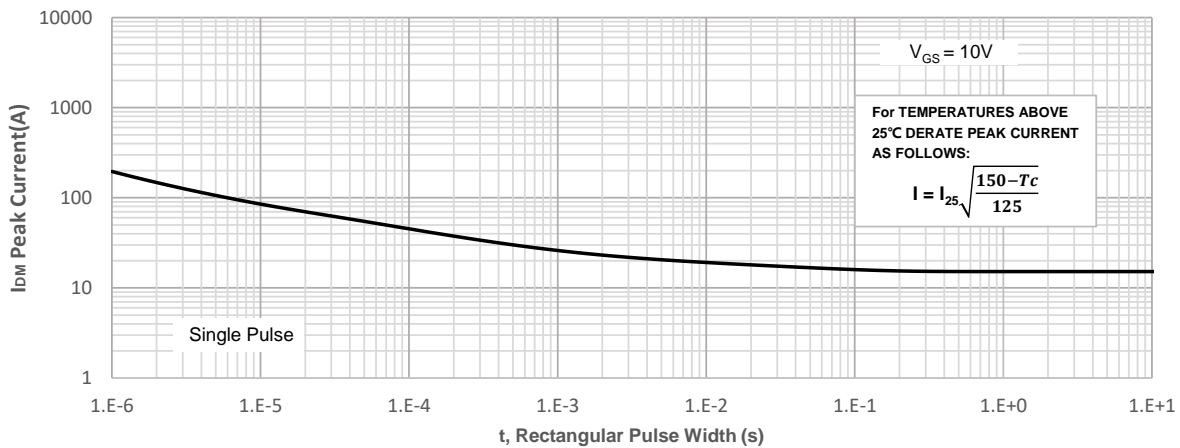
**Electrical Characteristics** ( $T_J = 25^\circ\text{C}$  unless otherwise specified)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
<b>Off Characteristics</b>						
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$I_D = 250\mu\text{A}$ , $V_{GS} = 0\text{V}$	650	-	-	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 650\text{V}$ , $V_{GS} = 0\text{V}$	-	-	10.0	$\mu\text{A}$
$I_{GSS}$	Gate-Body Leakage Current	$V_{DS} = 0\text{V}$ , $V_{GS} = \pm 30\text{V}$	-	-	$\pm 100$	nA
<b>On Characteristics</b>						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ , $I_D = 250\mu\text{A}$	2.4	3.4	4.5	V
$R_{DS(ON)}$	Static Drain-Source ON-Resistance <sup>(4)</sup>	$V_{GS} = 10\text{V}$ , $I_D = 10\text{A}$	-	156	190	m $\Omega$
<b>Dynamic Characteristics</b>						
$R_g$	Gate Resistance	$f = 1\text{MHz}$	-	4.9	-	$\Omega$
$C_{iss}$	Input Capacitance	$V_{GS} = 0\text{V}$ , $V_{DS} = 325\text{V}$ , $f = 1\text{MHz}$	1084	1517	2049	pF
$C_{oss}$	Output Capacitance		28	39	52	pF
$C_{rss}$	Reverse Transfer Capacitance		-	5.9	-	pF
$Q_g$	Total Gate Charge	$V_{GS} = 0$ to $10\text{V}$ $V_{DS} = 325\text{V}$ , $I_D = 10\text{A}$	23	32	43	nC
$Q_{gs}$	Gate Source Charge		-	10	-	nC
$Q_{gd}$	Gate Drain ("Miller") Charge		-	11	-	nC
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Delay Time	$V_{GS} = 10\text{V}$ , $V_{DD} = 310\text{V}$ $I_D = 10\text{A}$ , $R_{GEN} = 24\Omega$	-	36	-	ns
$t_r$	Turn-On Rise Time		-	38	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	100	-	ns
$t_f$	Turn-Off Fall Time		-	30	-	ns
<b>Body Diode Characteristics</b>						
$I_S$	Maximum Continuous Body Diode Forward Current		-	-	15	A
$I_{SM}$	Maximum Pulsed Body Diode Forward Current		-	-	61	A
$V_{SD}$	Body Diode Forward Voltage	$V_{GS} = 0\text{V}$ , $I_S = 10\text{A}$	-	-	1.2	V
$t_{rr}$	Body Diode Reverse Recovery Time	$I_F = 10\text{A}$ , $di/dt = 100\text{A}/\mu\text{s}$	94	131	177	ns
$Q_{rr}$	Body Diode Reverse Recovery Charge		-	851	-	nC

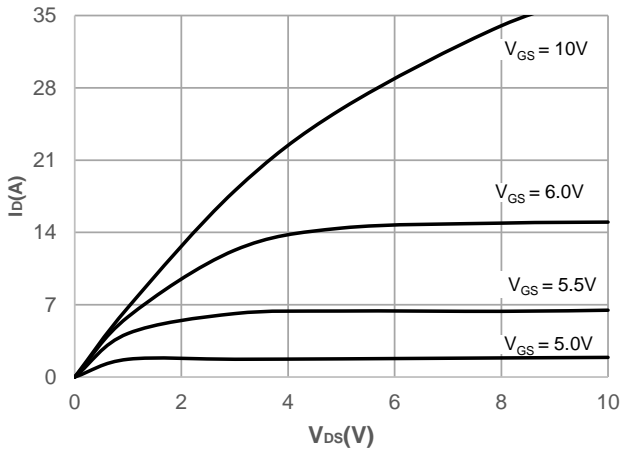
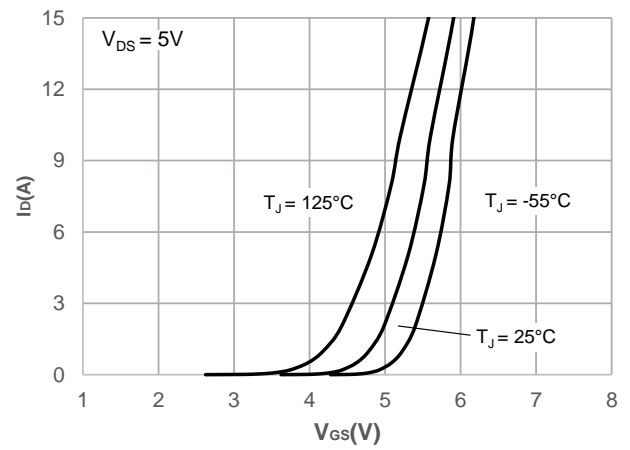
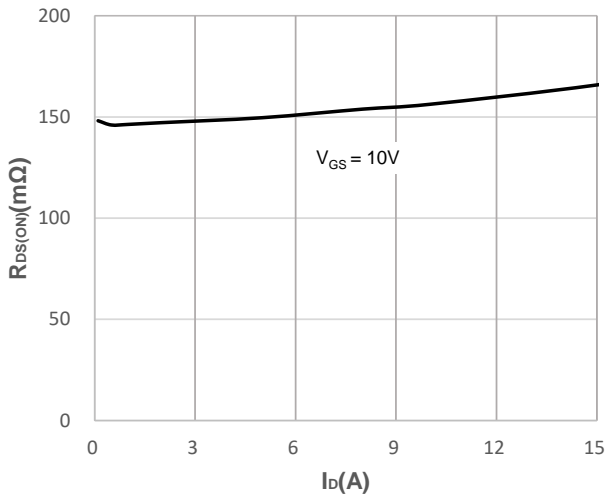
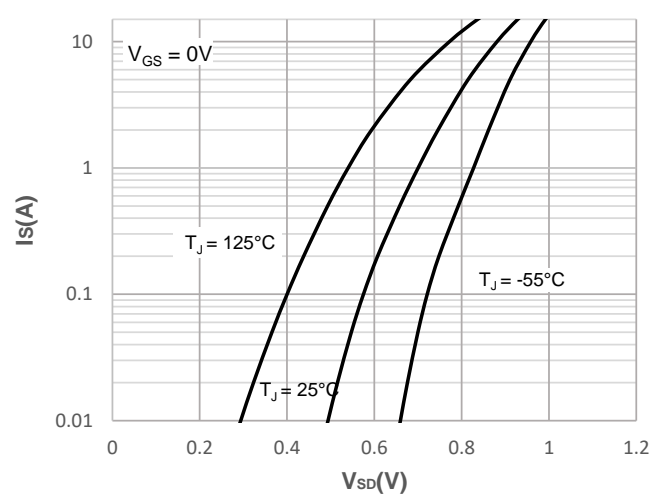
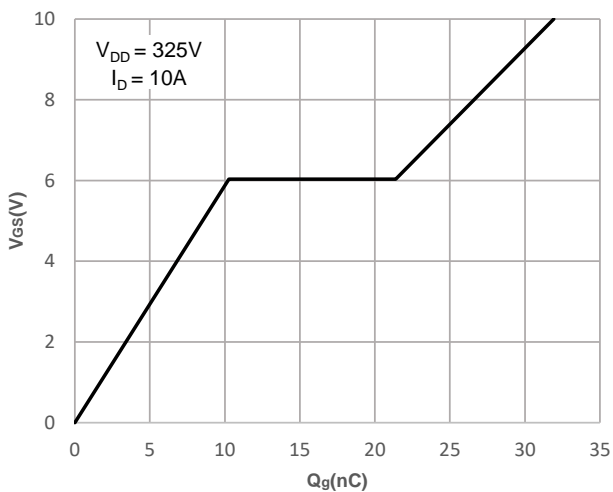
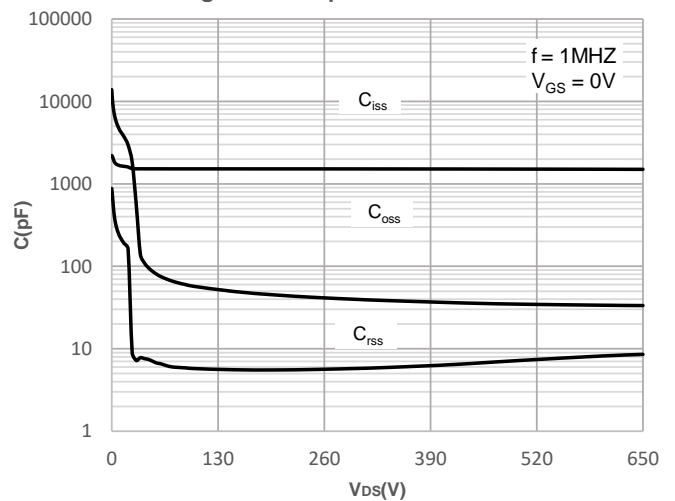
- Notes:
1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature.
  2.  $E_{AS}$  condition: Starting  $T_J = 25^\circ\text{C}$ ,  $V_{DD} = 50\text{V}$ ,  $V_{GS} = 10\text{V}$ ,  $R_G = 25\text{ohm}$ ,  $L = 10\text{mH}$ ,  $I_{AS} = 3.6\text{A}$ ,  $V_{DD} = 0\text{V}$  during time in avalanche.
  3.  $R_{\theta JA}$  is measured with the device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.
  4. Pulse Test: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 0.5\%$ .



## Typical Performance Characteristics

**Figure 1: Power De-rating**

**Figure 2: Current De-rating**

**Figure 3: Normalized Maximum Transient Thermal Impedance**

**Figure 4: Peak Current Capacity**


## Typical Performance Characteristics

**Figure 5: Output Characteristics**

**Figure 6: Typical Transfer Characteristics**

**Figure 7: On-resistance vs. Drain Current**

**Figure 8: Body Diode Characteristics**

**Figure 9: Gate Charge Characteristics**

**Figure 10: Capacitance Characteristics**


## Typical Performance Characteristics

Figure 11: Normalized Breakdown voltage vs. Junction Temperature

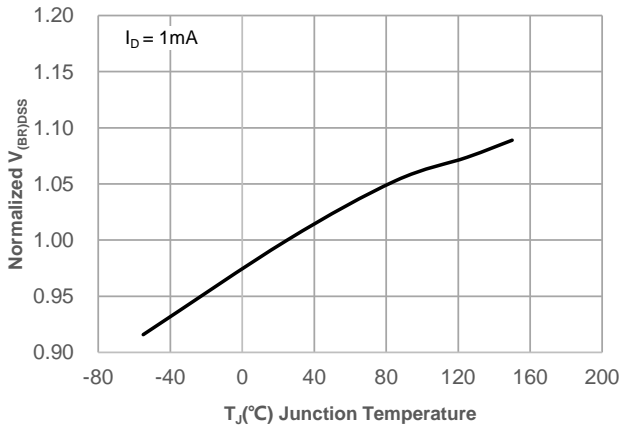


Figure 12: Normalized on Resistance vs. Junction Temperature

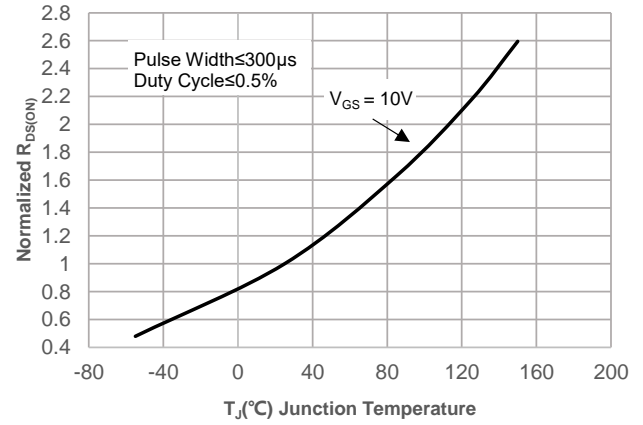


Figure 13: Normalized Threshold Voltage vs. Junction Temperature

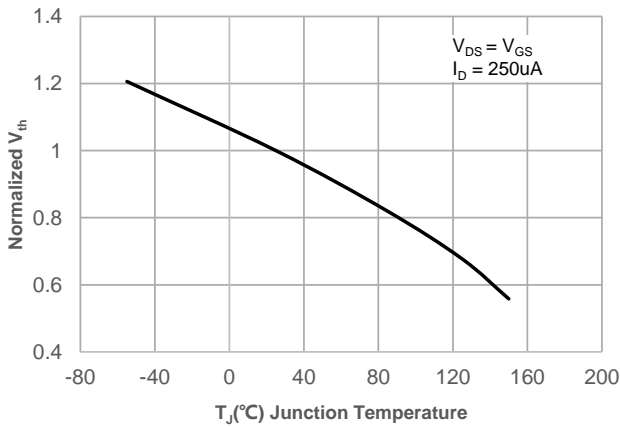


Figure 14:  $R_{DS(ON)}$  vs.  $V_{GS}$

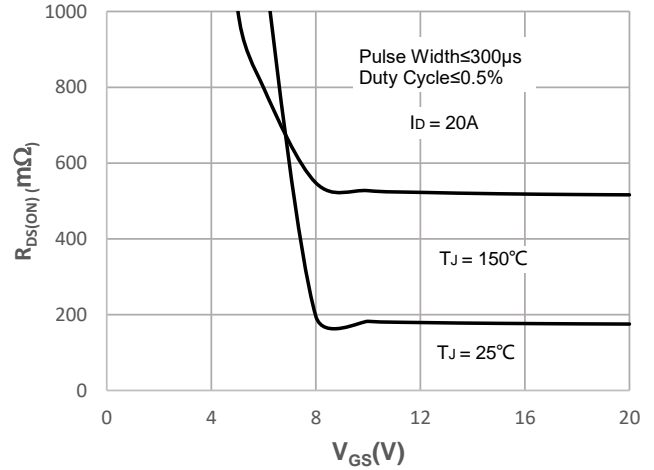
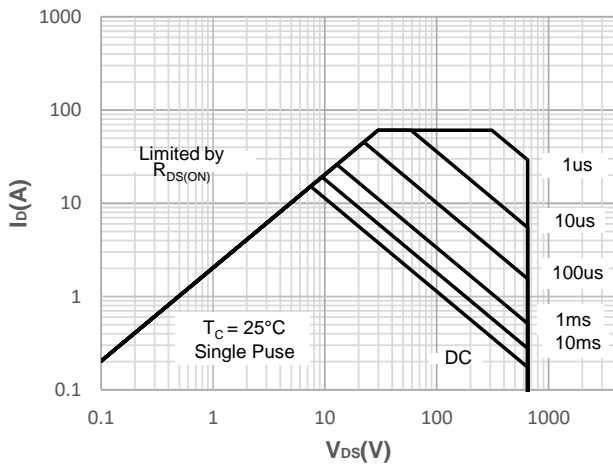
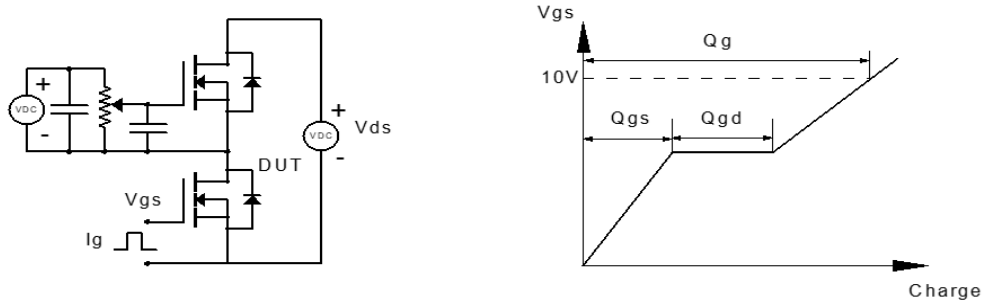
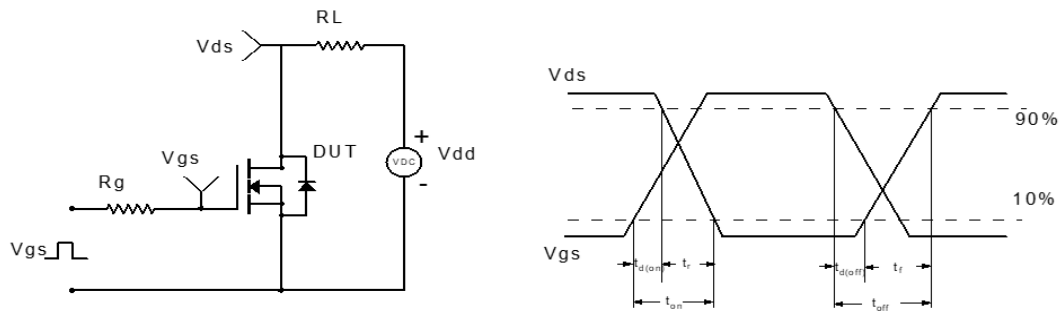
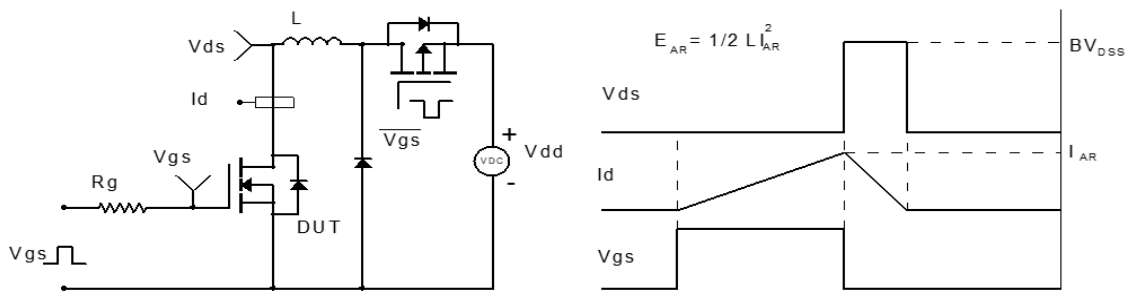
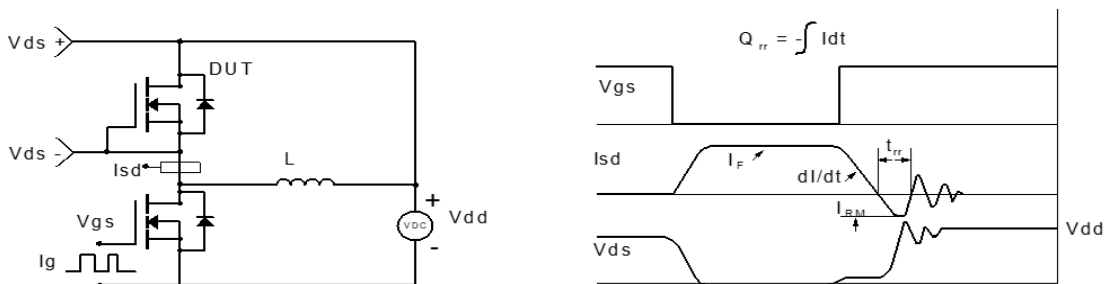


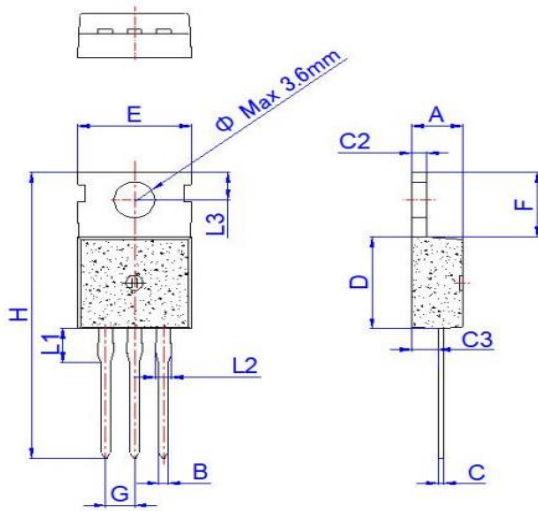
Figure 15: Maximum Safe Operating Area



**Test Circuit**

**Figure 1: Gate Charge Test Circuit & Waveform**

**Figure 2: Resistive Switching Test Circuit & Waveform**

**Figure 3: Unclamped Inductive Switching Test Circuit & Waveform**

**Figure 4: Diode Recovery Test Circuit & Waveform**

## Package Mechanical Data(TO-220-3L)

### Package Outline



Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.40		4.60	0.173		0.181
B	0.70		0.90	0.028		0.035
C	0.45		0.60	0.018		0.024
C2	1.23		1.32	0.048		0.052
C3	2.20		2.60	0.087		0.102
D	8.90		9.90	0.350		0.390
E	9.90		10.3	0.390		0.406
F	6.30		6.90	0.248		0.272
G		2.54			0.1	
H	28.0		29.8	1.102		1.173
L1		3.39			0.133	
L2	1.14		1.70	0.045		0.067
L3	2.65		2.95	0.104		0.116
Φ		3.6			0.142	

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