

HMZ60N028E7

N-Channel eMOS E7 Power MOSFET

600 V, 75 A, 28 mΩ

Description

The 600V eMOS E7 is an advanced Power Master Semiconductor's Super Junction MOSFET family by utilizing charge balance technology for excellent low on-resistance and gate charge. This technology combines the benefits of a fast switching performance with ease of usage and robustness. Consequently, the eMOS E7 family is suitable for application requiring high power density and superior efficiency.

TO-247-4L Kelvin source configuration package offers excellent switching performance thanks to separated power and drive sources for high efficiency and high switching frequency applications.

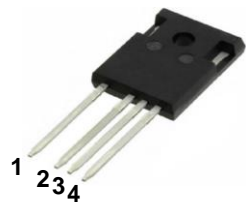
Applications

- PFC, Hard & Soft Switching Topologies
- Industrial & Consumer Power Supplies

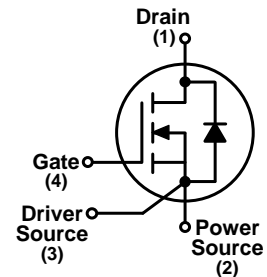
Features

$BV_{DSS} @ T_{J,max}$	I_D	$R_{DS(on),max}$	$Q_{g,typ}$
650 V	75 A	28 mΩ	186 nC

- Reduced Switching & Conduction Losses
- Lower Gate Resistance
- 100% Avalanche Tested
- Pb-free, Halogen Free, and RoHS Compliant



TO-247-4L



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

Symbol	Parameter	Value	Unit
V_{DSS}	Drain to Source Voltage	600	V
V_{GSS}	Gate to Source Voltage	± 30	V
I_D	Drain Current	Continuous ($T_C = 25^\circ\text{C}$)	75
		Continuous ($T_C = 100^\circ\text{C}$)	57
I_{DM}	Drain Current	Pulsed (Note1)	270
E_{AS}	Single Pulsed Avalanche Energy	(Note2)	702
I_{AS}	Avalanche Current	(Note2)	10.5
E_{AR}	Repetitive Avalanche Energy	(Note1)	5.68
dv/dt	MOSFET dv/dt	100	V/ns
	Peak Diode Recovery dv/dt	(Note3)	
P_D	Power Dissipation	($T_C = 25^\circ\text{C}$)	568
		Derate Above 25°C	4.55
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to 150	$^\circ\text{C}$
T_L	Maximum Lead Temperature for Soldering, 1/8" from Case for 10 Seconds	260	$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.22	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	40	

Package Marking and Ordering Information

Part Number	Top Marking	Package	Packing Method	Quantity
HMZ60N028E7	HMZ60N028E7	TO-247-4L	Tube	30 units

Electrical Characteristics ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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Off Characteristics

BV_{DSS}	Drain to Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	600			V
		$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}, T_J = 150^\circ\text{C}$	650			
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$			1	μA
		$V_{DS} = 480\text{ V}, V_{GS} = 0\text{ V}, T_J = 125^\circ\text{C}$		2.1		
I_{GSS}	Gate-Source Leakage Current	$V_{GS} = \pm 30\text{ V}, V_{DS} = 0\text{ V}$			± 100	nA

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 5.0\text{ mA}$	2.5		4.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}, I_D = 37.5\text{ A}$		24	28	m Ω

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V},$ $f = 250\text{ kHz}$		8100		pF
C_{oss}	Output Capacitance			201		pF
$C_{o(tr)}$	Time Related Output Capacitance	$V_{DS} = 0\text{ V to } 400\text{ V}, V_{GS} = 0\text{ V}$		2150		pF
$C_{o(er)}$	Energy Related Output Capacitance			327		pF
$Q_{g(tot)}$	Total Gate Charge at 10 V	$V_{DS} = 400\text{ V}, I_D = 37.5\text{ A},$ $V_{GS} = 10\text{ V}$		186		nC
Q_{gs}	Gate to Source Charge			38		nC
Q_{gd}	Gate to Drain "Miller" Charge			87		nC
R_G	Gate Resistance	$f = 1\text{ MHz}$		1		Ω

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DS} = 400\text{ V}, I_D = 37.5\text{ A},$ $V_{GS} = 10\text{ V}, R_G = 2.7\text{ }\Omega$ See Figure 13		28.8		ns
t_r	Turn-On Rise Time			10.7		ns
$t_{d(off)}$	Turn-Off Delay Time			131.3		ns
t_f	Turn-Off Fall Time			9.9		ns

Source-Drain Diode Characteristics

I_S	Maximum Continuous Diode Forward Current			75	A
I_{SM}	Maximum Pulsed Diode Forward Current			270	A
V_{SD}	Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_{SD} = 37.5\text{ A}$		1.2	V
t_{rr}	Reverse Recovery Time	$V_{DD} = 400\text{ V}, I_{SD} = 37.5\text{ A},$ $di_F/dt = 100\text{ A}/\mu\text{s}$		547	ns
Q_{rr}	Reverse Recovery Charge			13.6	μC

※Notes:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. $I_{AS} = 10.5\text{ A}, R_G = 25\text{ }\Omega$, starting $T_J = 25^\circ\text{C}$.
3. $I_{SD} \leq 37.5\text{ A}, di/dt \leq 100\text{ A}/\mu\text{s}, V_{DD} \leq 400\text{ V}$, starting $T_J = 25^\circ\text{C}$.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

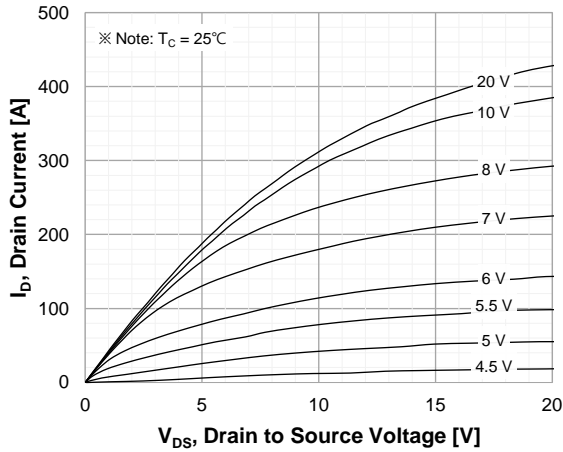


Figure 2. Transfer Characteristics

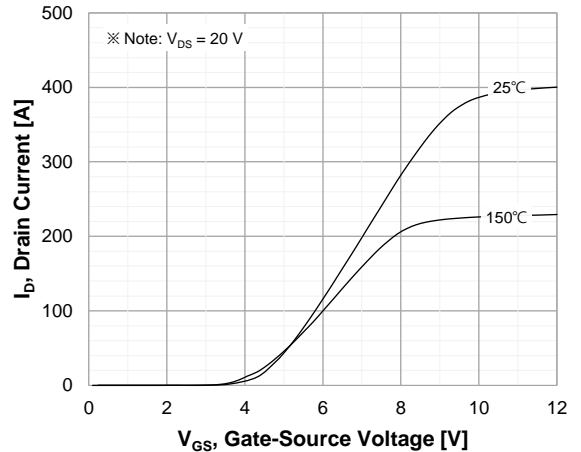


Figure 3. On-Resistance Characteristics vs. Drain Current and Gate Voltage

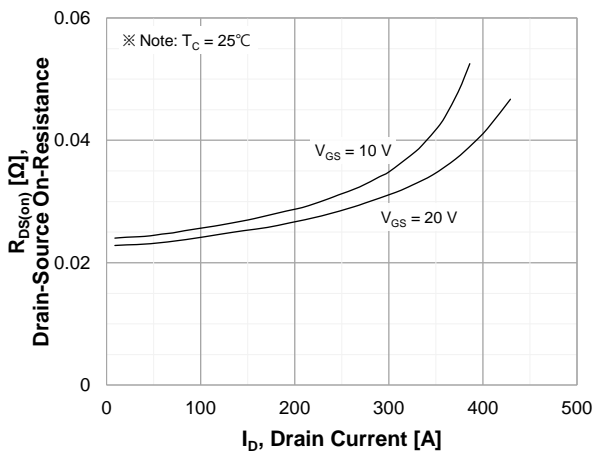


Figure 4. Diode Forward Voltage Characteristics vs. Source-Drain Current and Temperature

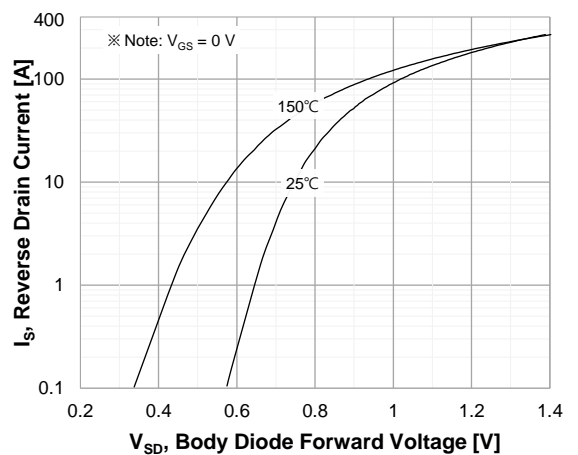


Figure 5. Capacitance Characteristics

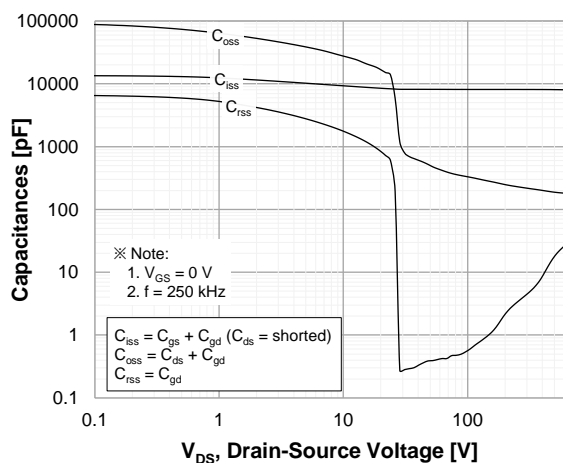
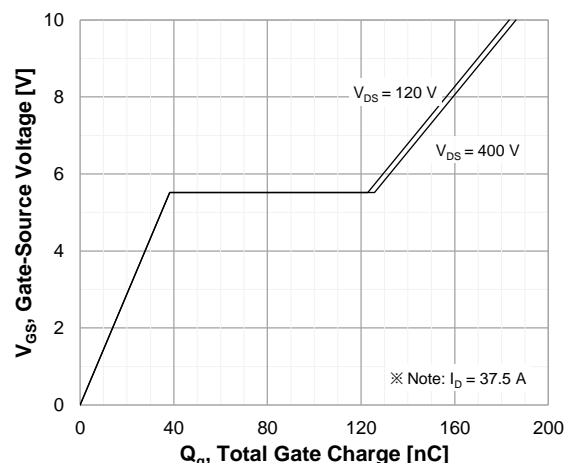


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics

Figure 7. Breakdown Voltage Characteristics vs. Temperature

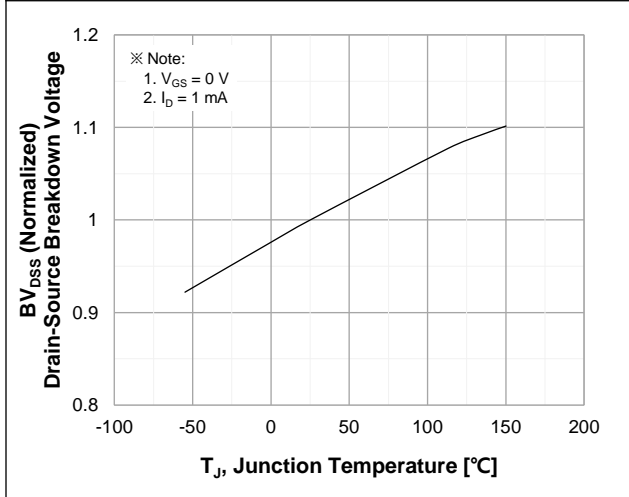


Figure 8. On-Resistance Characteristics vs. Temperature

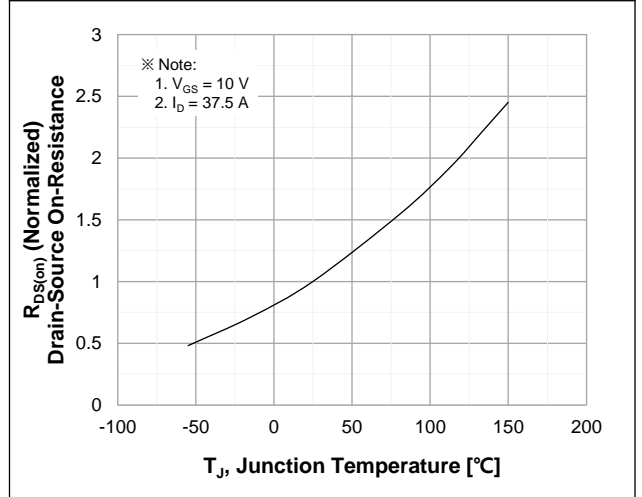


Figure 9. Maximum Safe Operating Area

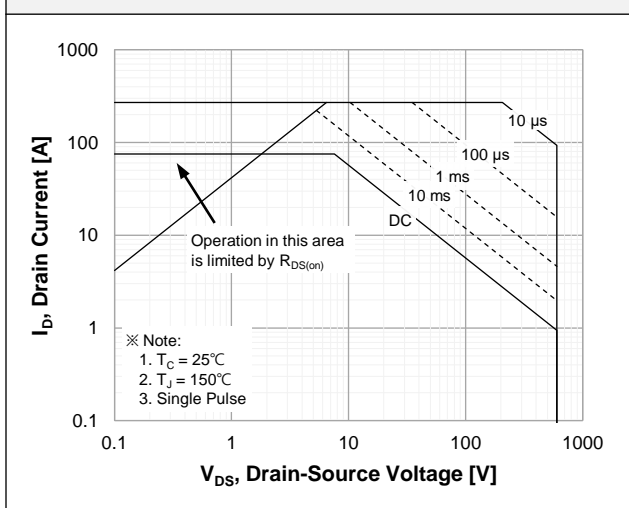


Figure 10. Maximum Drain Current vs. Case Temperature

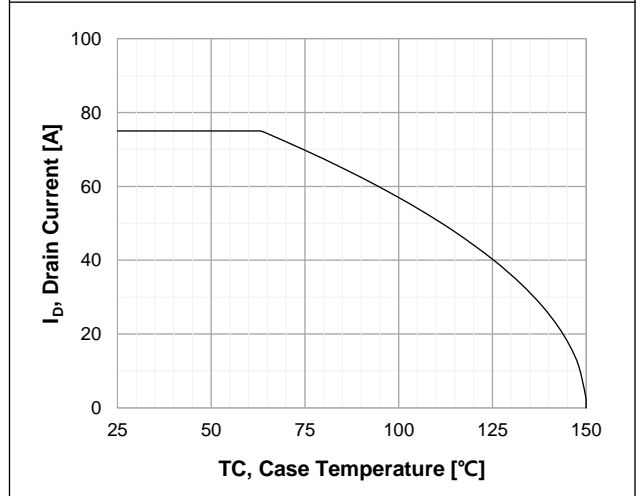


Figure 11. E_oss vs. Drain to Source Voltage

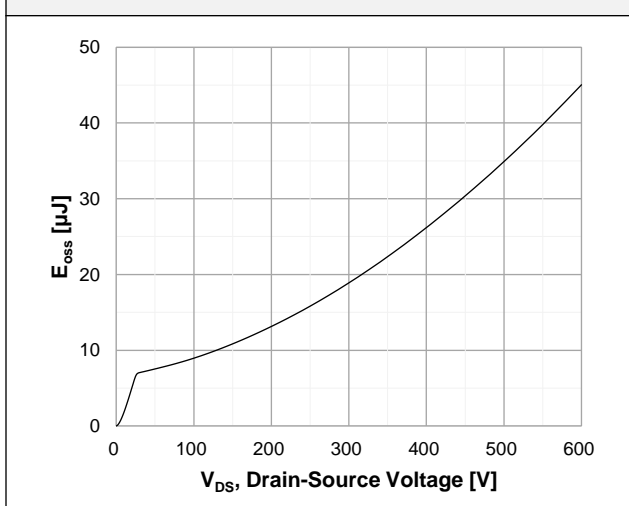
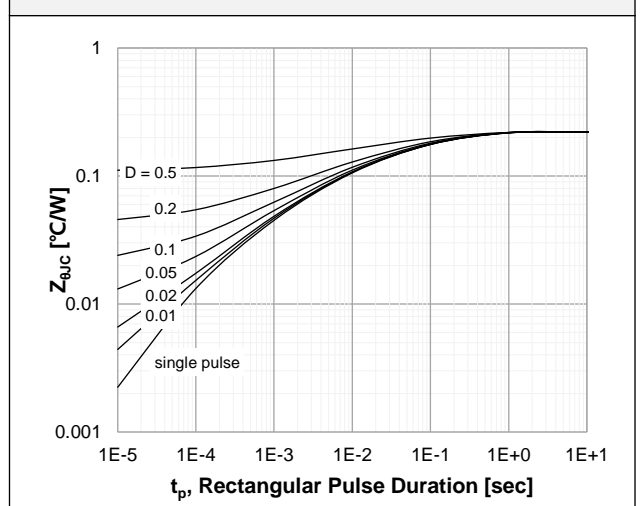


Figure 12. Transient Thermal Response Curve



Test Circuits

Figure 13. Inductive Load Switching Test Circuit and Waveforms

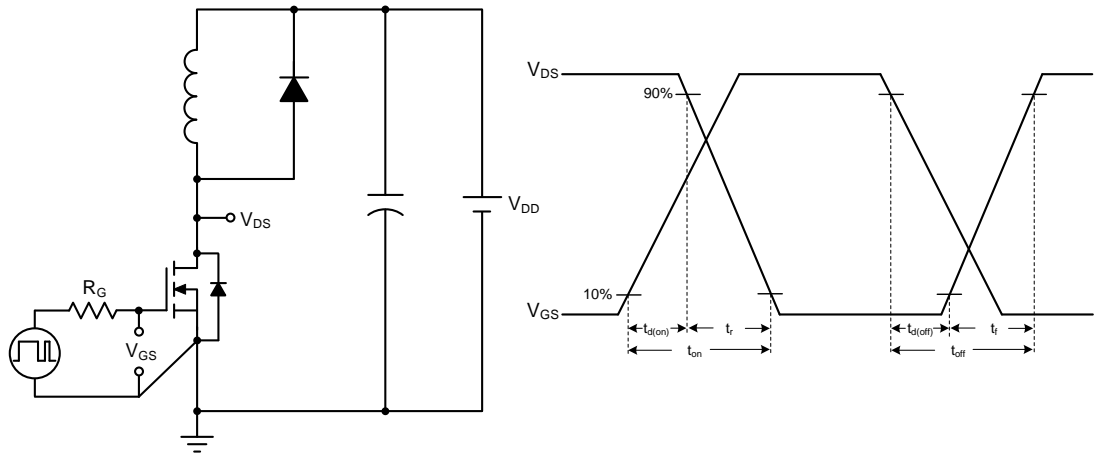


Figure 14. Unclamped Inductive Switching Test Circuit and Waveforms

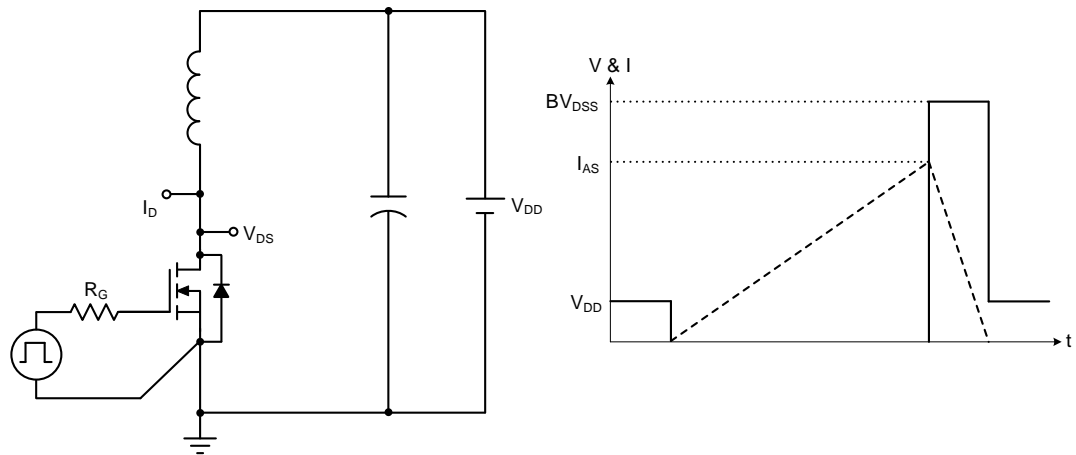
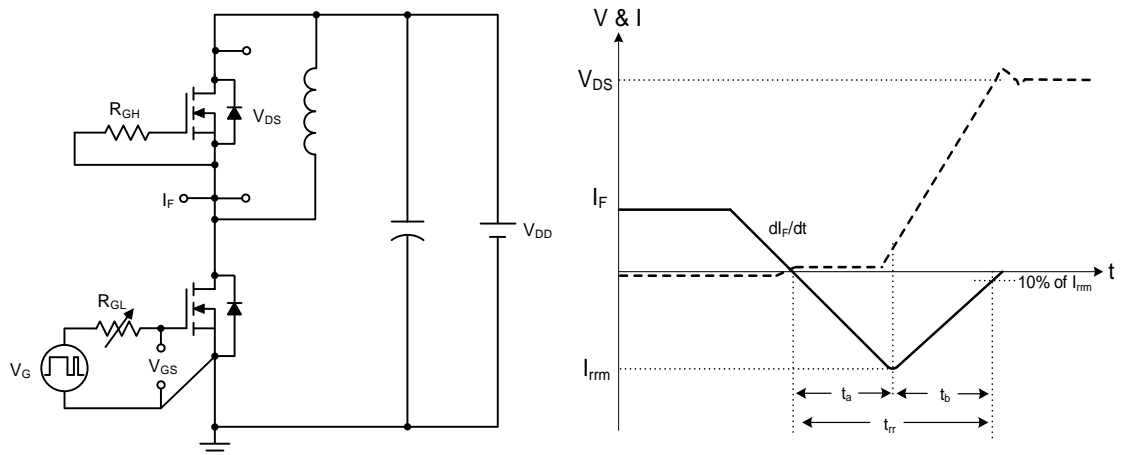
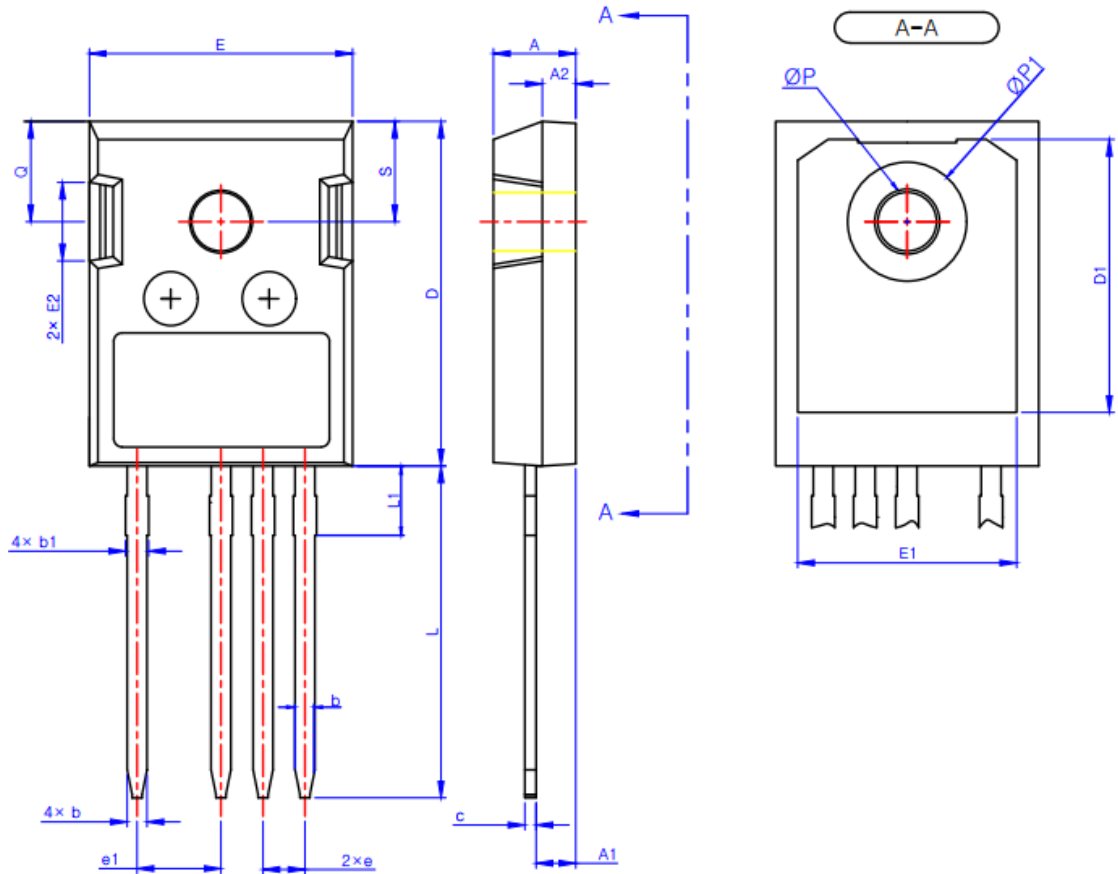


Figure 15. Peak Diode Recovery dv/dt Test Circuit and Waveforms



Package Outlines TO-247-4L



SYMBOL	MIN	MAX
A	4.80	5.20
A1	2.29	2.54
A2	1.90	2.10
b	1.10	1.30
b1	1.30	1.50
c	0.50	0.70
D	20.80	21.10
D1	17.43	17.83
E	15.75	16.13
E1	13.06	13.46
E2	4.32	4.83
e	2.54 BSC	
e1	5.08 BSC	
L	19.85	20.25
L1	-	4.49
$\varnothing P$	3.55	3.65
$\varnothing P1$	7.00	7.40
Q	5.59	6.19
S	6.15 BSC	

* Dimensions in millimeters