



1. Description

LH85N33X2PW1 is obtained by advanced Trench Field Stop (T-FS) technology which is characteristic with low $V_{CE(sat)}$, optimized switching performance and low gate charge Q_g . The IGBT is suitable device for Photovoltaic, UPS, Boost and high switching frequency applications.

KEY CHARACTERISTICS

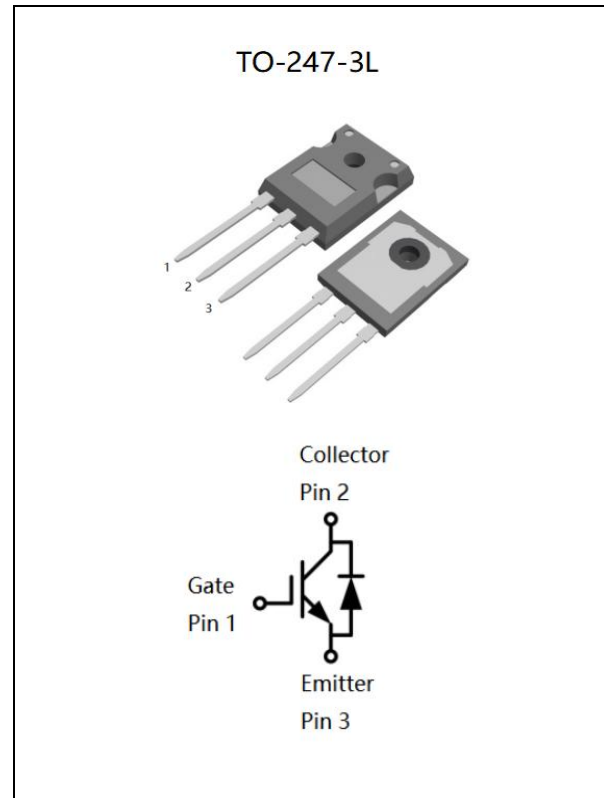
Parameter	Value	Unit
V_{CES}	650	V
I_C	60	A
$V_{CE(sat).typ}$	1.6	V

FEATURES

- Fast Switching
- Low $V_{CE(sat)}$
- Positive temperature coefficient
- Fast recovery anti-parallel diode
- RoHS product

APPLICATIONS

- Photovoltaic converters
- UPS
- Boost



ORDERING INFORMATION

Device Marking	Ordering Codes	Package	Product Code	Packing
LH85N33X2PW1	LH85N33X2PW1	TO-247-3L	LH85N33X2PW1	Tube

**2. ABSOLUTE RATINGS**

Symbol	Parameter	Values	Units
V_{CES}	Collector-Emitter Voltage	650	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$	120	A
	Collector Current @ $T_C=100^{\circ}\text{C}$	60	A
I_{CM}	Pulsed Collector Current, tp limited by T_{Jmax}	240	A
I_F	Diode Continuous Forward Current @ $T_C=25^{\circ}\text{C}$	120	A
	Diode Continuous Forward Current @ $T_C=100^{\circ}\text{C}$	60	A
I_{FM}	Diode Maximum Forward Current, limited by T_{Jmax}	240	A
V_{GES}	Gate-Emitter Voltage	± 30	V
t_{SC}	Short circuit withstand time $V_{GE}=15\text{V}$, $V_{CC}\leq 400\text{V}$, Allowed number of short circuits <1000 , Times between short circuits: $\geq 1.0\text{s}$, $T_J \leq 175^{\circ}\text{C}$	10	μs
P_D	Power Dissipation @ $T_C=25^{\circ}\text{C}$	375	W
T_{Jmax} , T_{stg}	Operating Junction and Storage Temperature Range	175, -55 to 175	$^{\circ}\text{C}$
T_L	Maximum Temperature for Soldering	260	$^{\circ}\text{C}$

3. Thermal characteristics

Symbol	Parameter	TO-247	Units
$R_{\theta JC}$	Junction-to-Case (IGBT)	0.40	$^{\circ}\text{C/W}$
$R_{\theta JC}$	Junction-to-Case (Diode)	0.70	$^{\circ}\text{C/W}$
$R_{\theta JA}$	Junction-to-Ambient	40	$^{\circ}\text{C/W}$

4. Electrical Characteristicsat $T_C = 25^{\circ}\text{C}$, unless otherwise specified**Static Characteristics**

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
V_{CES}	Collector-Emitter Breakdown Voltage	$V_{GE} = 0\text{V}$, $I_C = 250\mu\text{A}$	650	--	--	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE} = 15\text{V}$, $I_C = 60\text{A}$ $T_J=25^{\circ}\text{C}$	--	1.60	2.00	V
		$T_J=125^{\circ}\text{C}$	--	1.95	--	
		$T_J=175^{\circ}\text{C}$	--	2.10	--	



$V_{GE(TH)}$	Gate Threshold Voltage	$V_{CE} = V_{GE}, I_C = 1mA$	4.7	5.5	6.2	V
V_F	Diode Forward Voltage	$I_F = 60A$ $T_J = 25^\circ C$ $T_J = 125^\circ C$ $T_J = 175^\circ C$	--	1.41 1.29 1.18	--	V
I_{CES}	Collector-Emitter Leakage Current	$V_{CE} = 650V$, $V_{GE} = 0V$	--	--	25	μA
$I_{GES(F)}$	Gate-Emitter Forward Leakage Current	$V_{GE} = +30V$	--	--	200	nA
$I_{GES(R)}$	Gate-Emitter Reverse Leakage Current	$V_{GE} = -30V$	--	--	-200	nA
Pulse width $tp \leq 300\mu s$, $\delta \leq 2\%$						

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
C_{iss}	Input Capacitance	$V_{GE} = 0V$ $V_{CE} = 25V$ $f = 1.0MHz$	--	3146	--	pF
C_{oss}	Output Capacitance		--	121	--	
C_{rss}	Reverse Transfer Capacitance		--	31	--	
Q_G	Gate charge	$V_{CC} = 520V$ $I_{CE} = 60A$ $V_{GE} = 15V$	--	118	--	nC
Q_{GC}	Gate-emitter charge		--	46	--	
Q_{GE}	Gate-collector charge		--	33	--	
$I_{C(SC)}$	Short circuit collector current Max.1000 short circuits, Times between short circuits: $\geq 1.0s$	$V_{GE} = 15.0V, V_{CC} \leq 400V$, $t_{sc} \leq 10\mu s, T_J \leq 175^\circ C$		250		A

IGBT Switching Characteristics, at $T_J = 25^\circ C$

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
$t_{d(on)}$	Turn-on Delay Time	$I_C = 60A$ $V_{CE} = 400V$ $V_{GE} = 15V$ $R_G = 5\Omega$ $T_J = 25^\circ C$ Inductive Load	--	40	--	ns
t_r	Rise Time		--	47	--	
$t_{d(off)}$	Turn-Off Delay Time		--	123	--	
t_f	Fall Time		--	90	--	
E_{on}	Turn-On Switching Loss		--	1.2	--	mJ
E_{off}	Turn-Off Switching Loss		--	1.5	--	
E_{ts}	Total Switching Loss		--	2.70	--	



IGBT Switching Characteristics, at $T_J=175^\circ\text{C}$

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
$t_{d(on)}$	Turn-on Delay Time	$I_C = 60\text{A}$ $V_{CE} = 400\text{V}$ $V_{GE} = 15\text{V}$ $R_G = 5\Omega$ $T_J = 175^\circ\text{C}$ Inductive Load	--	36	--	ns
t_r	Rise Time		--	46	--	
$t_{d(off)}$	Turn-Off Delay Time		--	140	--	
t_f	Fall Time		--	150	--	
E_{on}	Turn-On Switching Loss		--	1.30	--	mJ
E_{off}	Turn-Off Switching Loss		--	2.34	--	
E_{ts}	Total Switching Loss		--	3.64	--	

Diode Characteristics, at $T_J=25^\circ\text{C}$

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
T_{rr}	Reverse Recovery Time	$I_F = 0.5\text{A}, I_R = 1\text{A}, I_{RR} = 0.25\text{A}, T_J = 25^\circ\text{C}$	--	31	--	ns



5. Characteristics Curves

Figure 1. Forward Bias Safe Operating Area for TO247

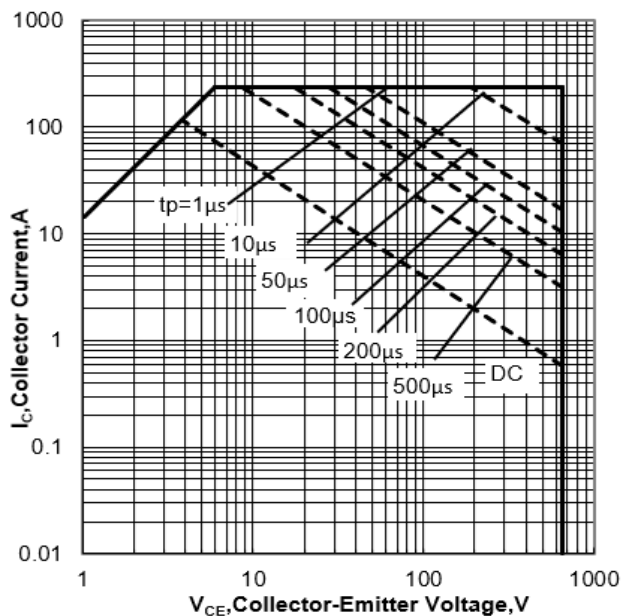


Figure 2. Power Dissipation vs Case Temperature for TO247

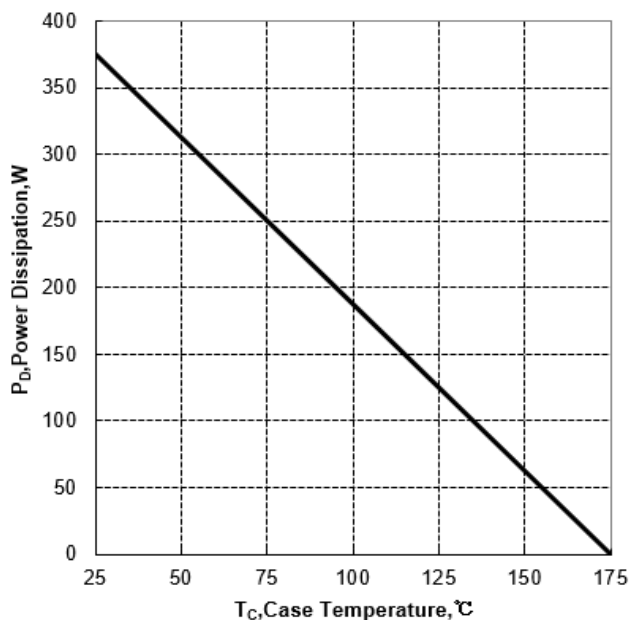


Figure 3. Collector Current vs Case Temperature for TO247

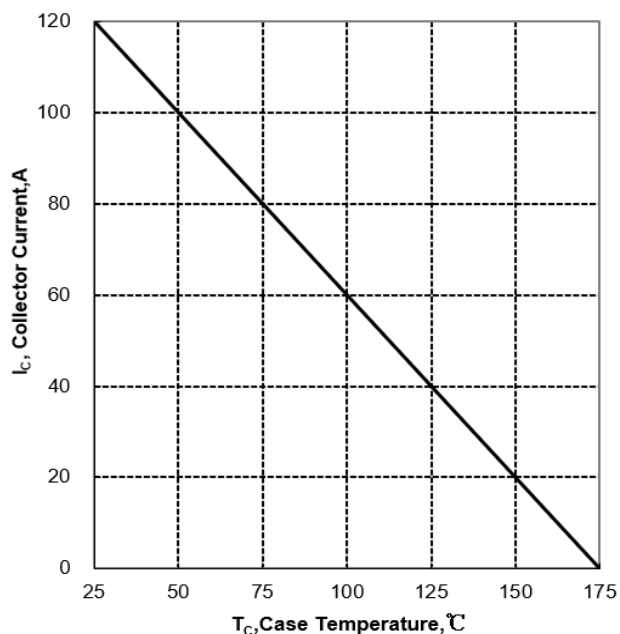


Figure 4. Typical Output Characteristics (Tj=25°C)

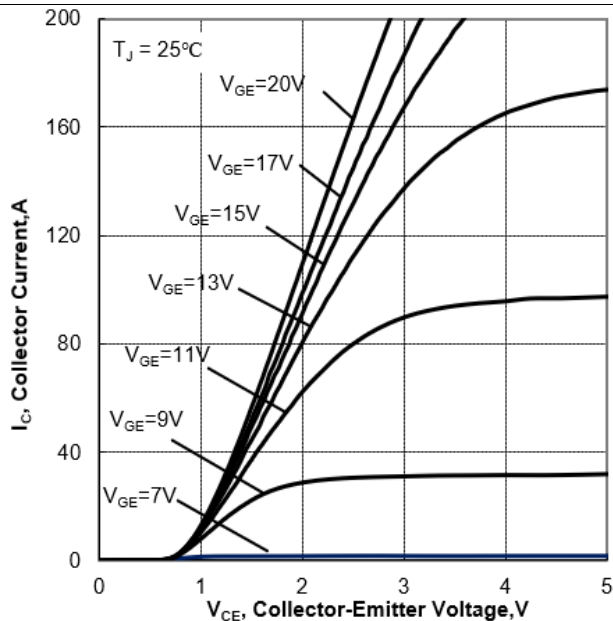




Figure 5. Typical Output Characteristics
($T_J=175^\circ\text{C}$)

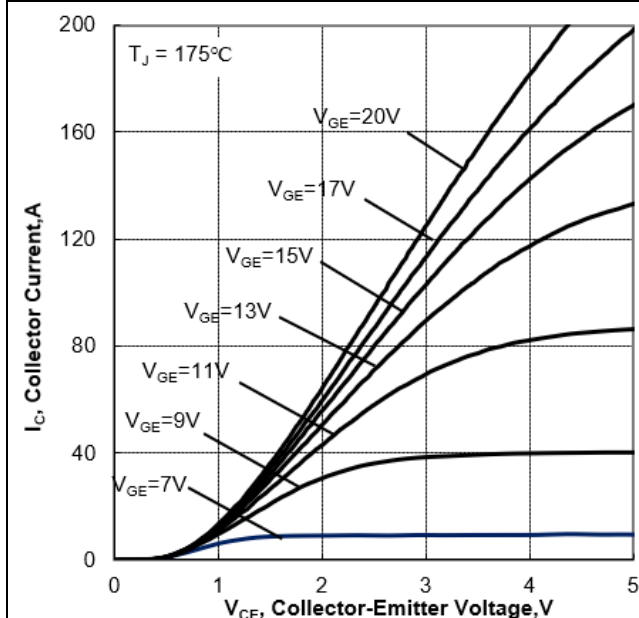


Figure 6. Typical Transfer Characteristics

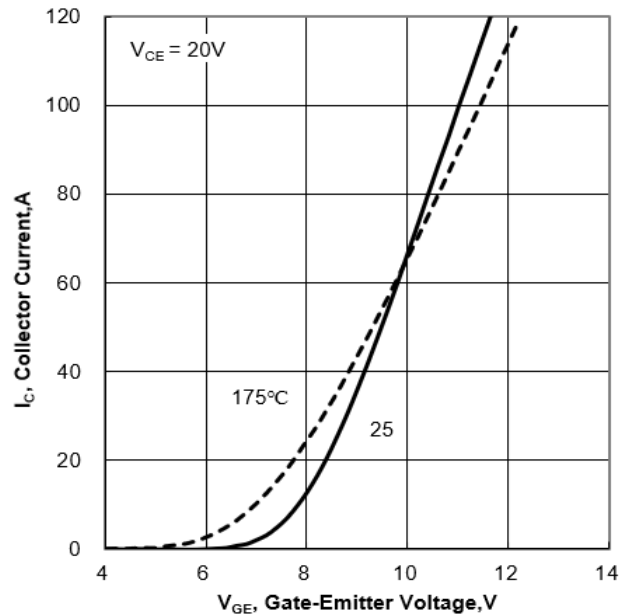


Figure 7. Typical Gate-Emitter Threshold Voltage vs Junction Temperature

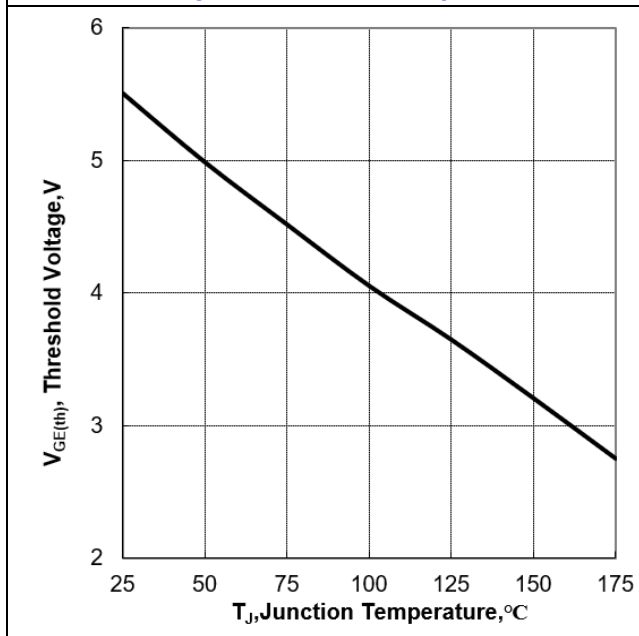


Figure 8. Typical Collector-Emitter Saturation Voltage vs Junction Temperature

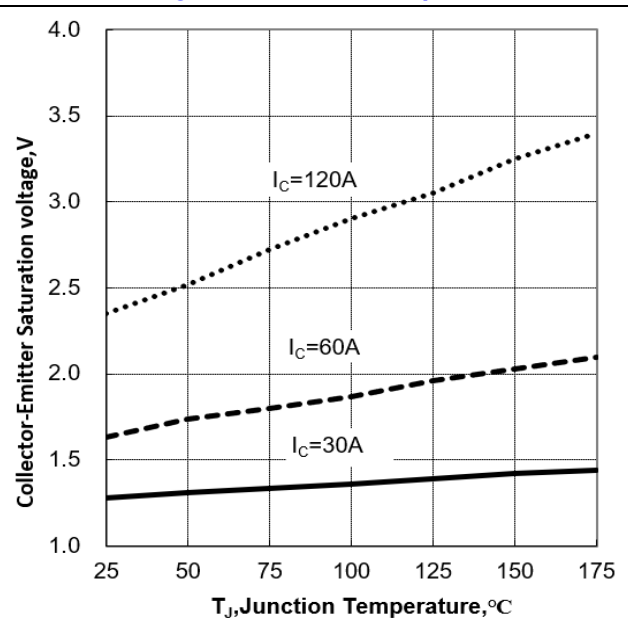




Figure 9. Typical Diode Forward Current vs Forward Voltage

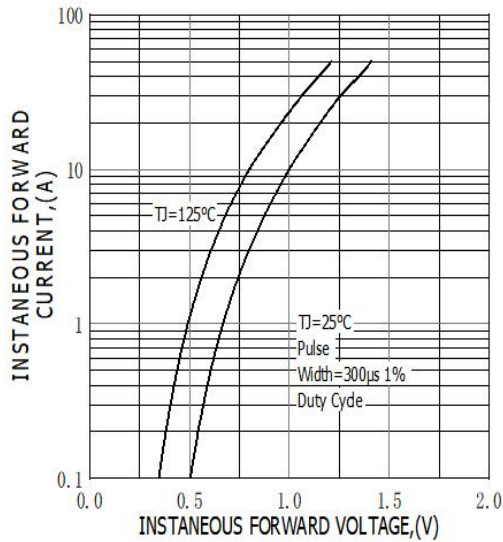


Figure 10. Typical Gate Charge

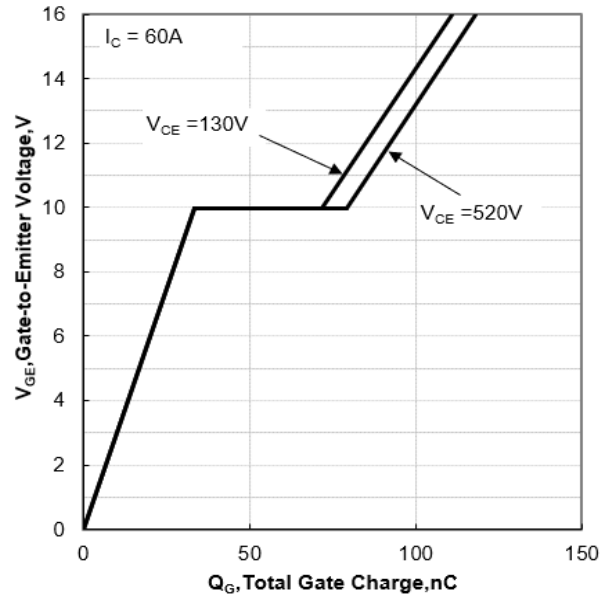


Figure 11. Typical Capacitance vs Collector-Emitter Voltage

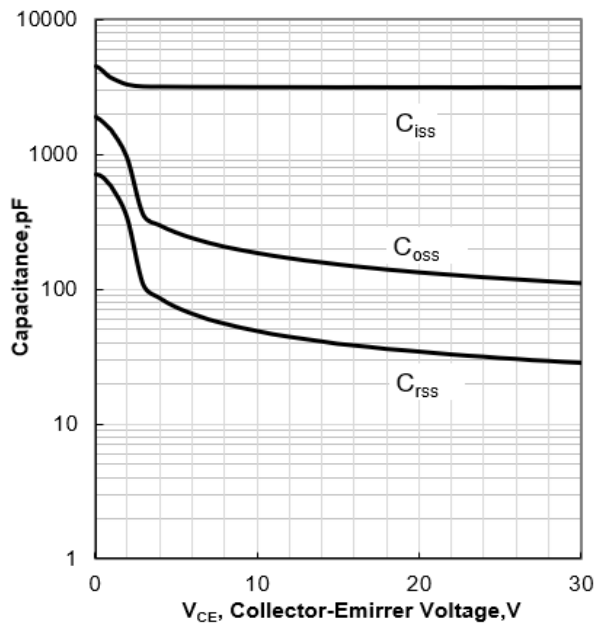


Figure 12. IGBT Transient Thermal Impedance vs Pulse Width TO247

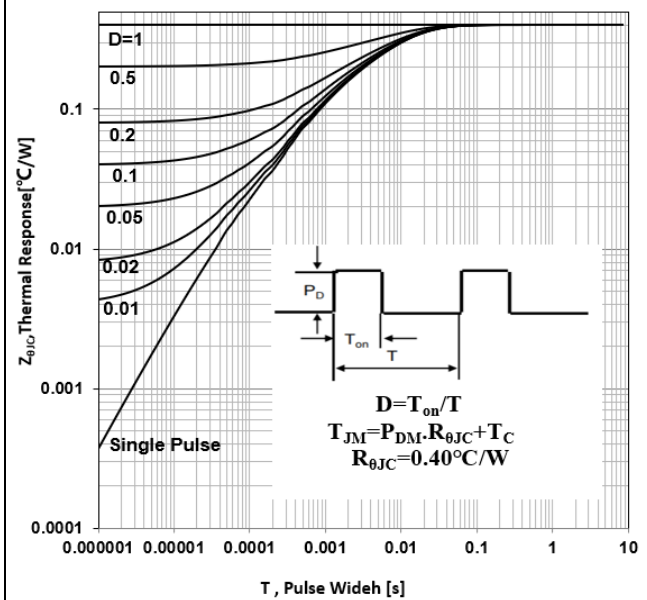




Figure 13. Typical Switching Times vs Gate Resistor ($T_J=25^{\circ}\text{C}$, $V_{CE}=400\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=60\text{A}$)

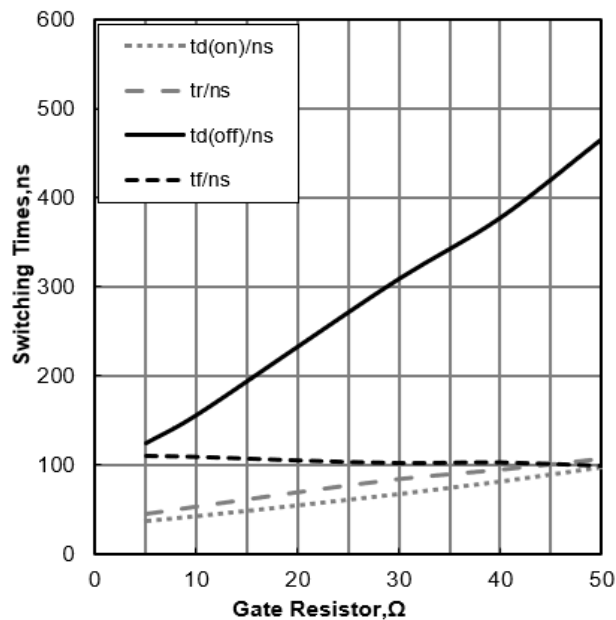


Figure 14. Typical Switching Energy vs Gate Resistor ($T_J=25^{\circ}\text{C}$, $V_{CE}=400\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=60\text{A}$)

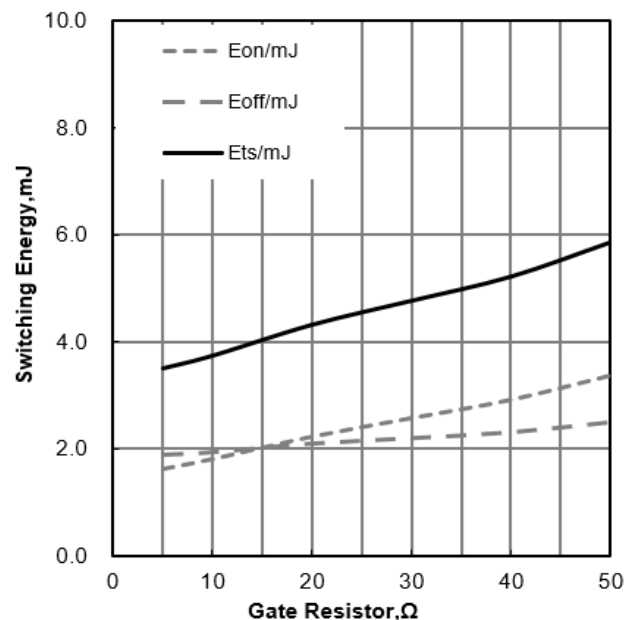


Figure 15. Typical Switching Times vs Junction Temperature ($V_{CE}=400\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=60\text{A}$)

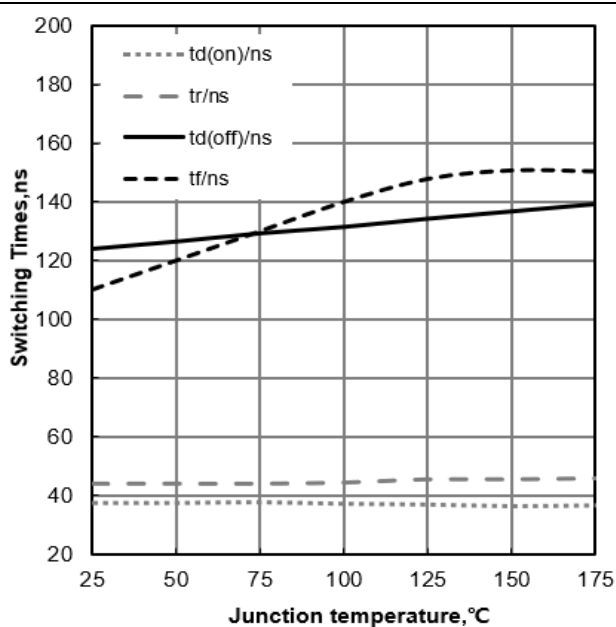


Figure 16. Typical Switching Energy vs Junction Temperature ($V_{CE}=400\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=60\text{A}$)

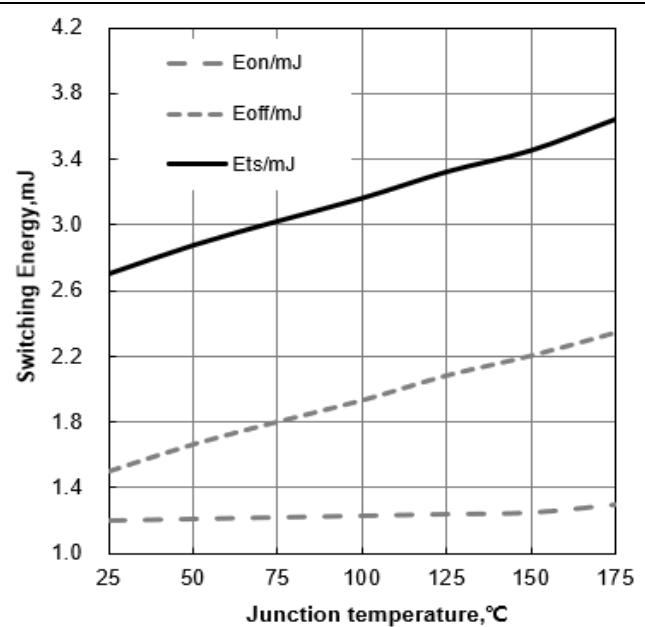




Figure 17. Typical Switching Times vs Collector Current ($T_J=25^\circ\text{C}$, $V_{CE}=400\text{V}$, $V_{GE}=15/0\text{V}$)

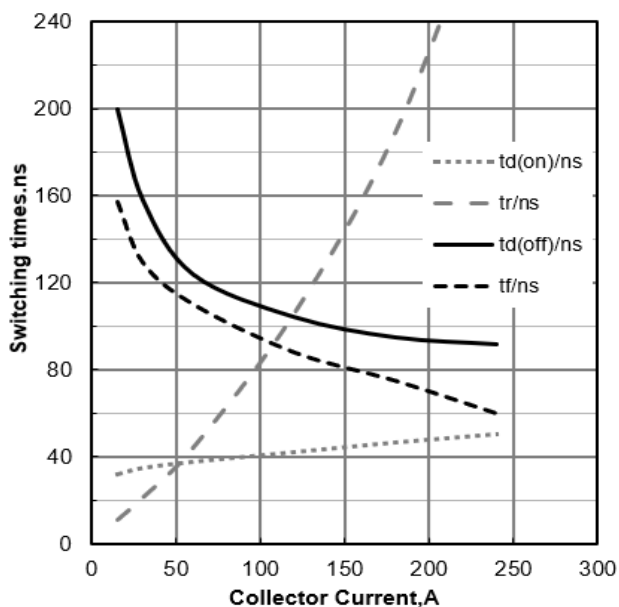


Figure 18. Typical Switching Energy vs Collector Current ($T_J=25^\circ\text{C}$, $V_{CE}=400\text{V}$, $V_{GE}=15/0\text{V}$)

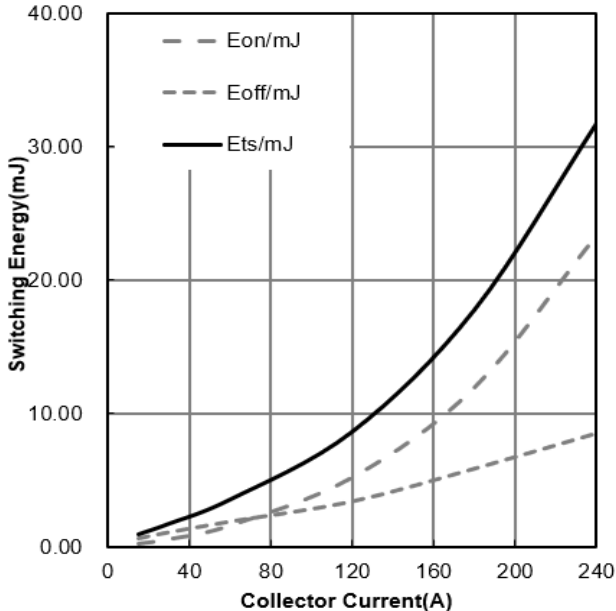


Figure 19. Typical Switching Times vs V_{CE} ($T_J=25^\circ\text{C}$, $V_{GE}=15/0\text{V}$, $I_C=60\text{A}$)

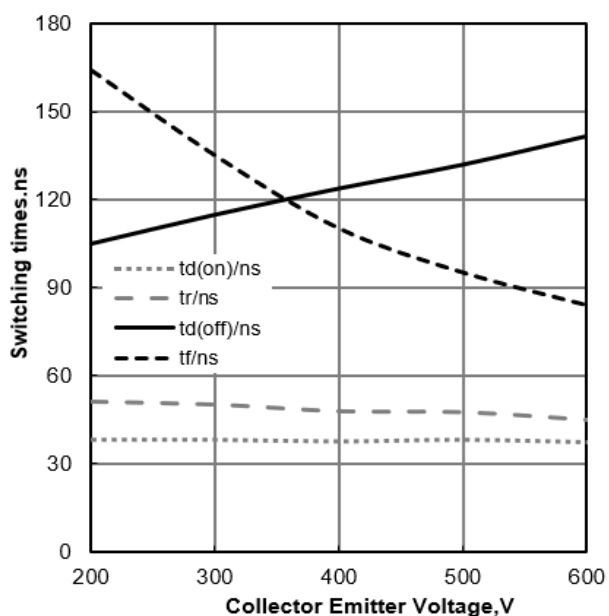
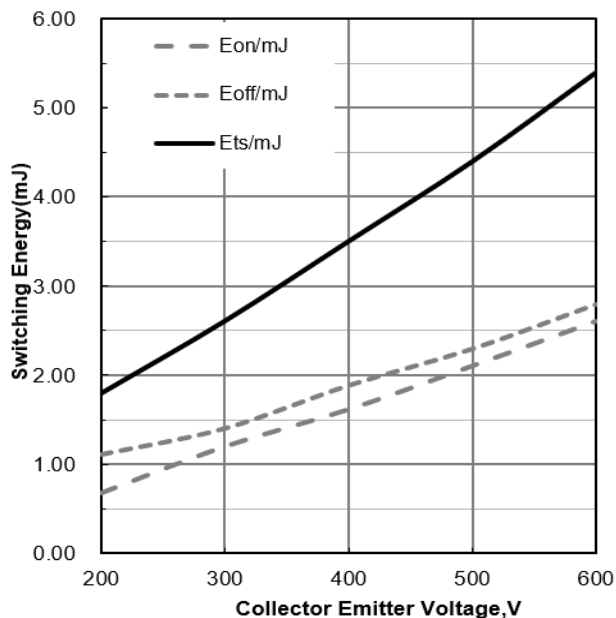


Figure 20. Typical Switching Energy vs V_{CE} ($T_J=25^\circ\text{C}$, $V_{GE}=15/0\text{V}$, $I_C=60\text{A}$)





重庆平伟实业股份有限公司

LH85N33X2PW1

Test Circuit and Waveform

Figure 2 1. Inductive Switching Test Circuit

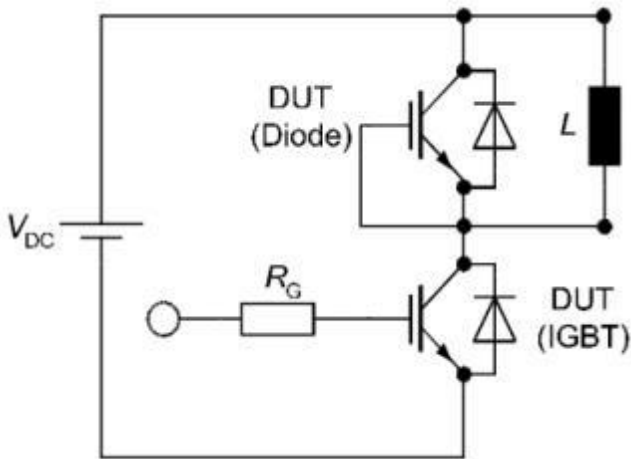


Figure 2 2. Definition of switching times

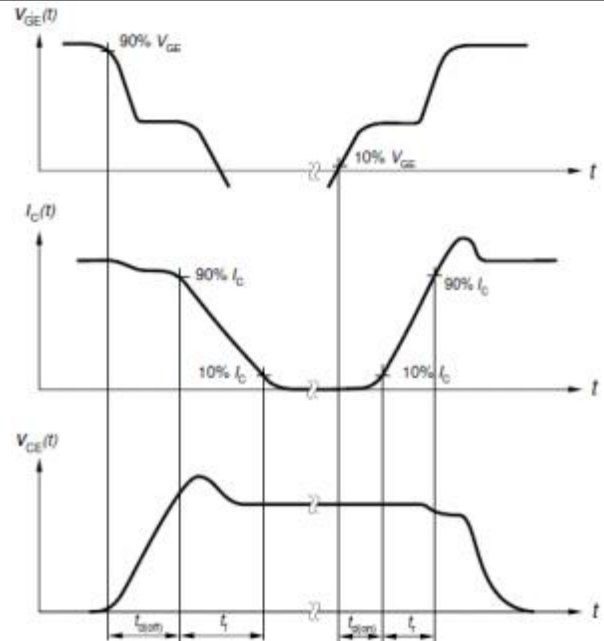


Figure 2 3. Definition of switching losses

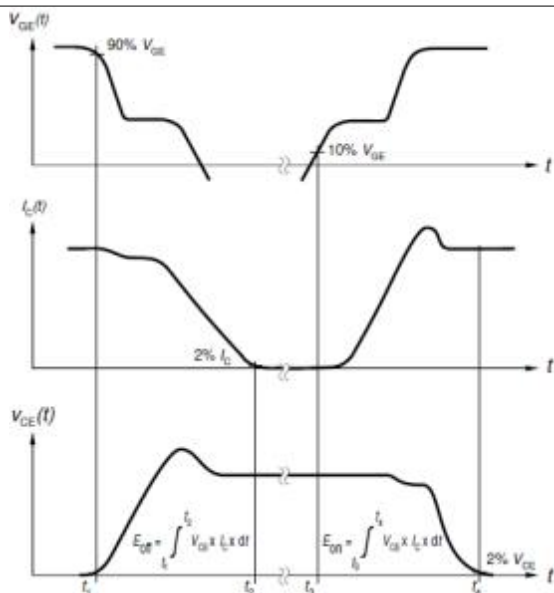
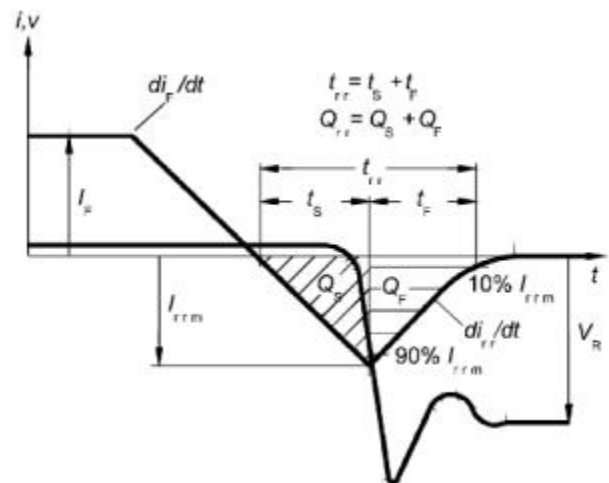


Figure 2 4. Definition of diode switching characteristics

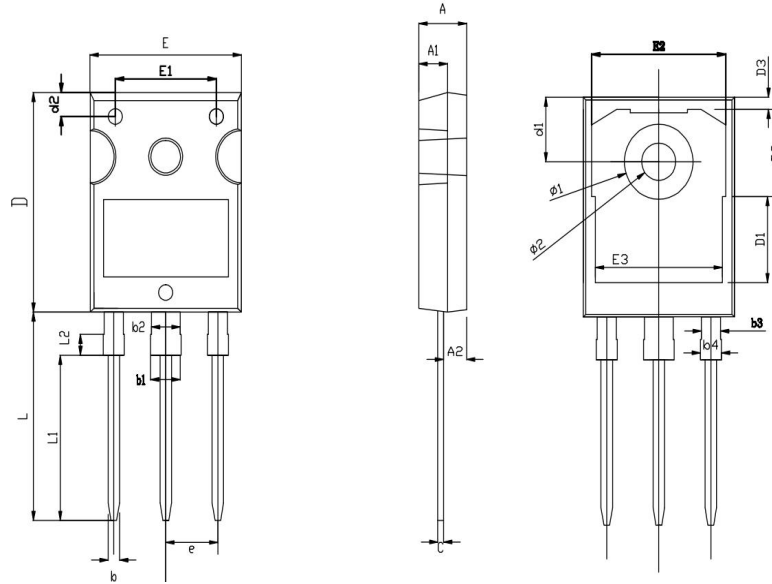




重庆平伟实业股份有限公司

LH85N33X2PW1

Package Description



SYMBOL	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.80	5.20	0.189	0.205
A1	2.80	3.20	0.110	0.126
A2	2.26	2.56	0.089	0.101
b	1.10	1.30	0.043	0.051
b1	2.90	3.20	0.114	0.126
b2	2.90	3.10	0.114	0.122
b3	1.90	2.10	0.075	0.083
b4	2.00	2.20	0.079	0.087
c	0.50	0.70	0.020	0.028
D	20.80	21.20	0.819	0.835
D1	8.23		0.324	
D2	8.32		0.328	
D3	1.17		0.046	
d1	6.00	6.30	0.236	0.248



d2	2.20	2.40	0.087	0.094
E	15.60	16.00	0.614	0.630
E1	10.50		0.413	
E2	14.02		0.552	
E3	13.50		0.531	
e	5.34	5.54	0.210	0.218
L	19.72	20.12	0.776	0.792
L1	15.79		0.622	
L2	1.98		0.078	
φ1	7.10	7.30	0.280	0.287
φ2	3.50	3.70	0.138	0.146