

» Applications

- Industrial UPS
- Welding machine
- Solar converters
- Energy Storage

» Product Summary

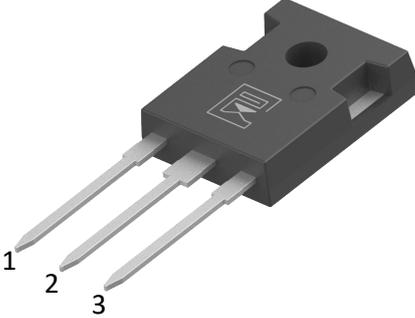
V_{CES}	350	V
I_C	60	A
$V_{CE(sat), Typ@15V}$	1.4	V

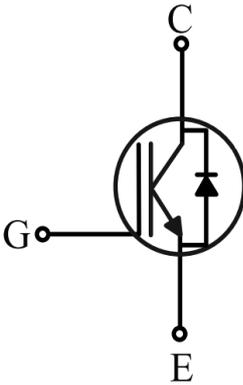
» Features

- Low switching power loss
- Low switching surge and noise
- Short circuit withstand time – 10 μ S
- Advanced Fieldstop technology
- Qualified according to JEDEC for target applications



TO-247L





Gate: 1
Collector: 2
Emitter: 3

» Package Marking and Ordering Information

Ordering code	Marking	Package	Packaging	Min. package quantity
MSLB60N035T7EF	MSLB60N035T7EF	TO-247L	Tube	450

➤➤ Absolute Maximum Ratings (Tc=25°C unless otherwise noted)

Parameter	Symbol	Ratings	Unit
Collector-emitter Voltage	V_{CES}	350	V
DC collector current, limited by T_{jmax} TC=25°C TC=100°C	I_C	120 60	A
Pulsed collector current, tp limited by T_{jmax}	$I_{C\ Pulse}$	240	A
Diode forward current, limited by T_{jmax} TC=25°C TC=100°C	I_F	120 60	A
Diode Pulsed current, tp limited by T_{jmax}	$I_{F\ Pulse}$	240	A
Continuous Gate-emitter voltage	V_{GE}	±20	V
Short circuit withstand time $V_{GE}=15V, V_{CC} \leq 400V, T_j \leq 150^\circ C$	t_{SC}	10	μs
Power Dissipation (TC=25°C)	P_D	300	W
Junction Temperature	T_j	175	°C
Storage Temperature	T_{STG}	-55-175	°C

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.

➤➤ Thermal Characteristics

Parameter	Symbol	Max	Unit
IGBT Maximum Junction-to-Case	$R_{\theta JC}$	0.5	°C/W
Diode Maximum Junction-to-Case	$R_{\theta JC}$	0.6	°C/W
Maximum Junction-to-Ambient	$R_{\theta JA}$	40	°C/W

Note: This transistor is sensitive to electrostatic discharge and should be handled with care.

Electrical Characteristics (Tc=25°C unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Static Characteristics						
Collector-emitter Breakdown Voltage	BV_{CES}	$V_{GE}=0V, I_C=0.5mA$	350	-	-	V
Zero gate voltage collector current	I_{CES}	$V_{CE}=350V, V_{GE}=0V$	-	-	100	μA
Gate-emitter leakage current	I_{GES}	$V_{GE}=\pm 20V, V_{CE}=0V$	-	-	± 200	nA
Gate-emitter threshold voltage	$V_{GE(TH)}$	$V_{CE}=V_{GE}, I_C=250\mu A$	4.0	5.3	6.0	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	$V_{GE}=15V, I_C=60A$	-	1.4	1.9	V
		$T_j=175^\circ C$	-	1.8	-	V
Diode forward voltage	V_F	$I_F=60A$	-	1.3	1.9	V
		$T_j=175^\circ C$	-	1	-	V
Dynamic Characteristics						
Input Capacitance	C_{ies}	$V_{CE}=25V, V_{GE}=0V, f=1.0MHz$	-	3850	-	pF
Output Capacitance	C_{oes}		-	243	-	pF
Reverse Transfer Capacitance	C_{res}		-	31	-	pF
Integrated gate resistor	R_{Gint}		-	2	-	Ω
Total Gate Charge	Q_g	$V_{CC}=50V, I_C=10A, V_{GE}=15V$	-	88	-	nC
Gate-to-emitter charge	Q_{ge}		-	29	-	nC
Gate-to-collector charge	Q_{gc}		-	25	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E		-	13	-	nH



Switching Characteristic, Inductive Load, at $T_j=25^\circ\text{C}$

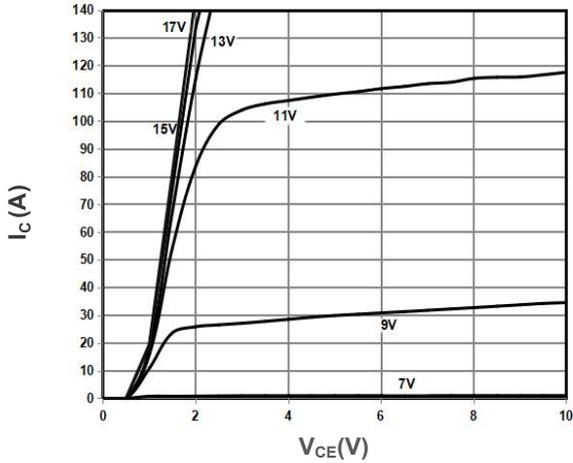
Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
IGBT Switching Characteristics						
Turn-On Delay Time	$t_{d(on)}$	$V_{CC}= 200V$ $I_C= 60A$ $V_{GE}= 15V$ $R_G= 10\Omega$ Inductive load	-	71	-	ns
Turn-On Rise Time	t_r		-	124	-	ns
Turn-Off Delay Time	$t_{d(off)}$		-	132	-	ns
Turn-Off Fall Time	t_f		-	93	-	ns
Turn-on energy	E_{on}		-	0.15	-	mJ
Turn-off energy	E_{off}		-	0.67	-	mJ
Diode Characteristics						
Reverse Recovery Time	t_{rr}	$V_R=200V, I_F=30A,$ $di/dt=200A/us$	-	56	-	ns
Reverse Recovery Charge	Q_{rr}		-	0.23	-	μC
Peak Reverse Recovery Current	I_{rrm}		-	8.2	-	A

Switching Characteristic, Inductive Load, at $T_j=150^\circ\text{C}$

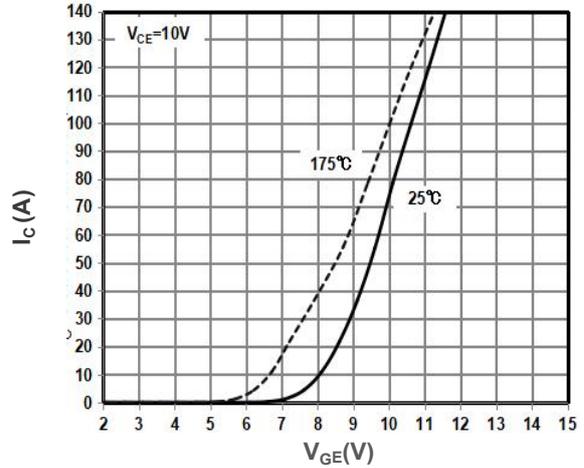
Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
IGBT Switching Characteristics						
Turn-On Delay Time	$t_{d(on)}$	$V_{CC}= 200V$ $I_C= 60A$ $V_{GE}= 15V$ $R_G= 10\Omega$ Inductive load	-	84	-	ns
Turn-On Rise Time	t_r		-	147	-	ns
Turn-Off Delay Time	$t_{d(off)}$		-	142	-	ns
Turn-Off Fall Time	t_f		-	99	-	ns
Turn-on energy	E_{on}		-	0.26	-	mJ
Turn-off energy	E_{off}		-	0.75	-	mJ
Diode Characteristics						
Reverse Recovery Time	t_{rr}	$V_R=200V, I_F=30A,$ $di/dt=200A/us$	-	89	-	ns
Reverse Recovery Charge	Q_{rr}		-	0.6	-	μC
Peak Reverse Recovery Current	I_{rrm}		-	13.4	-	A



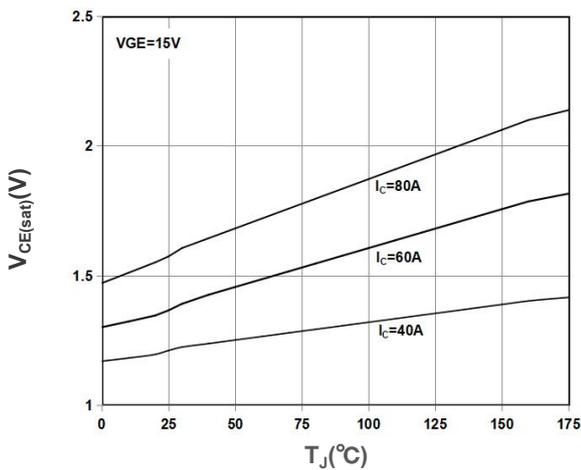
Characteristics Curves



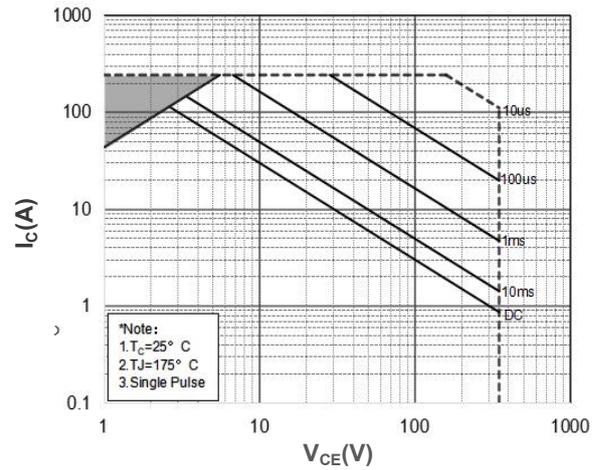
Output Characteristics



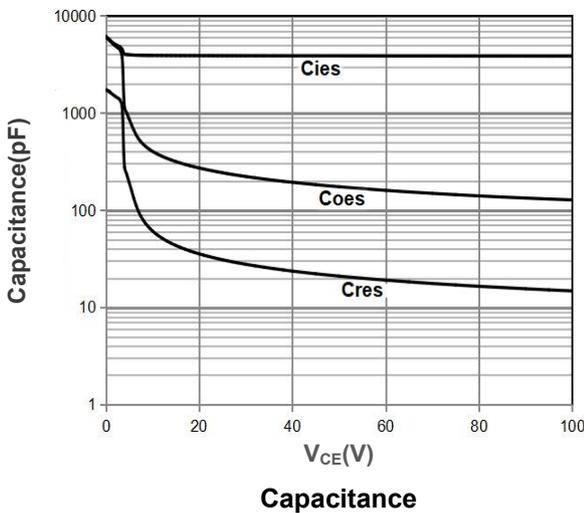
Transfer Characteristics



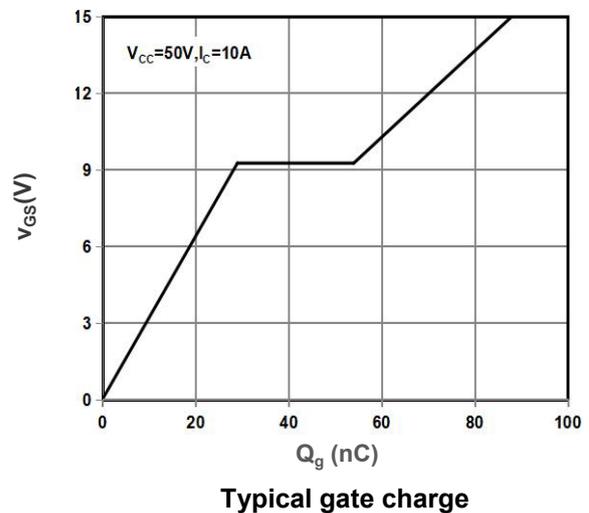
"Typical collector-emitter saturation voltage as a function of junction temperature"



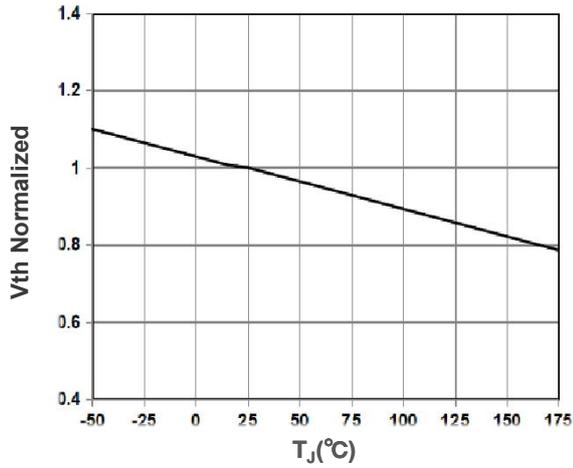
Maximum Safe Operating Area



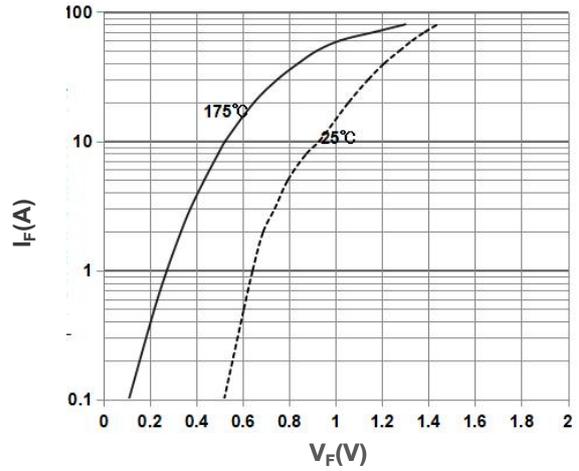
Capacitance



Typical gate charge



Gate-emitter threshold voltage as a function of junction temperature



Typ. diode forward current as a function of forward voltage

Note : The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.



TO-247L Package Dimensions

Unit: mm

Symbol	Min	Nom	Max	Symbol	Min	Nom	Max
A	4.80		5.20	E1	13.00		13.60
A1	2.20	2.40	2.60	E2	5.00		5.50
A2	1.85		2.15	E3	1.90		2.60
b	1.07		1.33	e		5.44	
b2	1.90		2.16	L	19.30		19.90
b4	2.90		3.20	L1	3.95	4.15	4.35
c	0.52		0.68	ΦP	3.40		3.80
D	20.70	20.80	21.30	ΦP1	7.00		7.40
D1	16.15		16.95	S	6.04	6.15	6.30
E	15.50	15.60	16.10				

